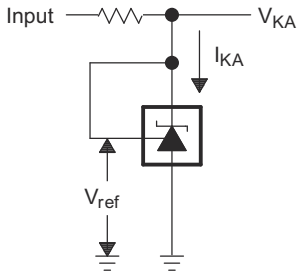
TL431, TL432 Precision Programmable Reference

1 Features

- Reference voltage tolerance at 25°C
  - 0.5% (B grade)
  - 1% (A grade)
  - 2% (Standard grade)
- Adjustable output voltage: V_{ref} to 36V
- Operation from −40°C to 125°C
- Typical temperature drift (TL43xB)
  - 6mV (C temp)
  - 14mV (I temp, Q temp)
- Low Output Noise
- 0.2Ω Typical output impedance
- Sink-current capability: 1mA to 100mA

2 Applications

- Rack server power
- Industrial AC/DC
- AC inverter & VF drives
- Servo drive control module
- Notebook PC power adapter design



Simplified Schematic

3 Description

The TL431 and TL432 devices are three-terminal adjustable shunt regulators, with specified thermal stability over applicable automotive, commercial, and military temperature ranges. The output voltage can be set to any value between V_{ref} (approximately 2.5V) and 36V, with two external resistors. These devices have a typical output impedance of 0.2Ω. Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as on-board regulation, adjustable power supplies, and switching power supplies. The TL432 device has exactly the same functionality and electrical specifications as the TL431 device, but has different pinouts for the DBV, DBZ, and PK packages.

Both the TL431 and TL432 devices are offered in three grades, with initial tolerances (at 25°C) of 0.5%, 1%, and 2%, for the B, A, and standard grade, respectively. In addition, low output drift versus temperature verifies good stability over the entire temperature range.

The TL43xxC devices are characterized for operation from 0°C to 70°C, the TL43xxI devices are characterized for operation from –40°C to 85°C, and the TL43xxQ devices are characterized for operation from –40°C to 125°C.

Device Information

PART NUMBER	PACKAGE (PIN) (1)	BODY SIZE (NOM) (2)
TL43x	SOT-23-3 (3)	2.90mm × 1.30mm
	SOT-23-5 (5)	2.90mm × 1.60mm
	SOIC (8)	4.90mm × 3.90mm
	PDIP (8)	9.50mm × 6.35mm
	SOP (8)	6.20mm × 5.30mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.

An IMPORTANT NOTICE at the end of this data sheet addresses availability, warranty, changes, use in safety-critical applications, intellectual property matters and other important disclaimers. PRODUCTION DATA.

Table of Contents

1 Features....1
2 Applications....1
3 Description....1
4 Device Comparison Table....3
5 Pin Configuration and Functions....4
6 Specifications....5
6.1 Absolute Maximum Ratings....5
6.2 ESD Ratings....5
6.3 Thermal Information....5
6.4 Recommended Operating Conditions....5
6.5 Electrical Characteristics, TL431C, TL432C....6
6.6 Electrical Characteristics, TL431I, TL432I....7
6.7 Electrical Characteristics, TL431Q, TL432Q....8
6.8 Electrical Characteristics, TL431AC, TL432AC....9
6.9 Electrical Characteristics, TL431AI, TL432AI....10
6.10 Electrical Characteristics, TL431AQ, TL432AQ....11
6.11 Electrical Characteristics, TL431BC, TL432BC....12
6.12 Electrical Characteristics, TL431BI, TL432BI....13
6.13 Electrical Characteristics, TL431BQ, TL432BQ....14
6.14 Typical Characteristics....15
7 Parameter Measurement Information....19
7.1 Temperature Coefficient....19
7.2 Dynamic Impedance....20
8 Detailed Description....21
8.1 Overview....21
8.2 Functional Block Diagram....21
8.3 Feature Description....22
8.4 Device Functional Modes....22
9 Applications and Implementation....23
9.1 Application Information....23
9.2 Typical Applications....23
9.3 System Examples....28
9.4 Power Supply Recommendations....31
9.5 Layout....31
10 Device and Documentation Support....32
10.1 Device Nomenclature....32
10.2 Related Links....32
10.3 Receiving Notification of Documentation Updates....32
10.4 Support Resources....32
10.5 Trademarks....32
10.6 Electrostatic Discharge Caution....33
10.7 Glossary....33
11 Revision History....33
12 Mechanical, Packaging, and Orderable Information....33

Copyright © 2024 Texas Instruments Incorporated

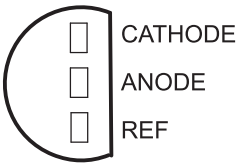
4 Device Comparison Table

DEVICE PINOUT	INITIAL ACCURACY	OPERATING FREE-AIR TEMPERATURE (T_A)
TL431 TL432	B: 0.5% A: 1% (Blank): 2%	C: 0°C to 70°C I: -40°C to 85°C Q: -40°C to 125°C

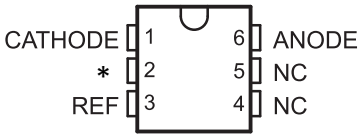
Copyright © 2024 Texas Instruments Incorporated

5 Pin Configuration and Functions

TL431, TL431A, TL431B . . . LP (TO-92/TO-226) PACKAGE
(TOP VIEW)

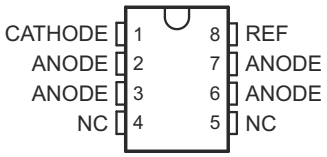


TL431A, TL431B . . . DCK (SC-70) PACKAGE
(TOP VIEW)



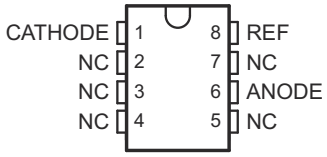
NC − No internal connection
∗ - Must be connected to ANODE or left open

TL431, TL431A, TL431B . . . D (SOIC) PACKAGE
(TOP VIEW)



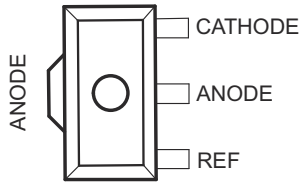
NC − No internal connection

TL431, TL431A, TL431B . . . P (PDIP), PS (SOP),
OR PW (TSSOP) PACKAGE
(TOP VIEW)

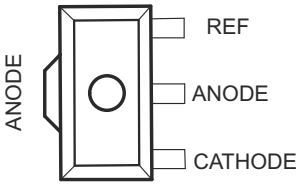


NC − No internal connection

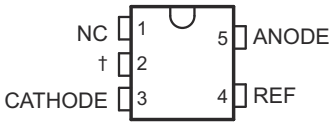
TL431, TL431A, TL431B . . . PK (SOT-89) PACKAGE
(TOP VIEW)



TL432, TL432A, TL432B . . . PK (SOT-89) PACKAGE
(TOP VIEW)

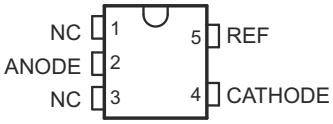


TL431, TL431A, TL431B . . . DBV (SOT-23-5) PACKAGE
(TOP VIEW)



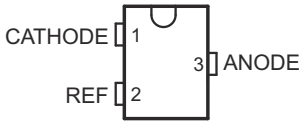
NC − No internal connection
† Pin 2 is attached to Substrate and must be connected to ANODE or left open.

TL432, TL432A, TL432B . . . DBV (SOT-23-5) PACKAGE
(TOP VIEW)



NC − No internal connection

TL431, TL431A, TL431B . . . DBZ (SOT-23-3) PACKAGE
(TOP VIEW)



TL432, TL432A, TL432B . . . DBZ (SOT-23-3) PACKAGE
(TOP VIEW)

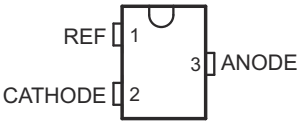


Table 5-1. Pin Functions

PIN											TYPE	DESCRIPTION
NAME	TL431x							TL432x				
	DBZ	DBV	PK	D	P, PS PW	LP	DCK	DBZ	DBV	PK		
CATHODE	1	3	3	1	1	1	1	2	4	1	I/O	Shunt Current/Voltage input
REF	2	4	1	8	8	3	3	1	5	3	I	Threshold relative to common anode
ANODE	3	5	2	2, 3, 6, 7	6	2	6	3	2	2	O	Common pin, normally connected to ground

Copyright © 2024 Texas Instruments Incorporated

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
V_{KA}	Cathode Voltage(2)			37	V
I_{KA}	Continuos Cathode Current Range		–100	150	mA
$I_{I(ref)}$	Reference Input Current		–0.05	10	mA
T_J	Operating Junction Temperature Range			150	°C
T_{stg}	Storage Temperature Range		–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
(2) All voltage values are with respect to ANODE, unless otherwise noted.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001pins(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101 (2)	±1000	

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 500V HBM is possible with the necessary precautions.
(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process. Manufacturing with less than 250V CDM is possible with the necessary precautions.

6.3 Thermal Information

THERMAL METRIC(1)		TL43xx									UNIT
		P	PW	D	PS	DCK	DBV	DBZ	LP	PK	
		8 PINS				6 PINS	5 PINS	3 PINS			
$R_{\theta JA}$	Junction-to-ambient thermal resistance	85	149	97	95	259	206	206	140	52	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	57	65	39	46	87	131	76	55	9	°C/W

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report (SPRA953)

6.4 Recommended Operating Conditions

See (1)

			MIN	MAX	UNIT
V_{KA}	Cathode Voltage		V_{ref}	36	V
I_{KA}	Continuous Cathode Current Range		1	100	mA
T_A	Operating Free-Air Temperature	TL43xxC	0	70	°C
		TL43xxI	–40	85	
		TL43xxQ	–40	125	

(1) Maximum power dissipation is a function of $T_{J(max)}$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_{J(max)} – T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.

Copyright © 2024 Texas Instruments Incorporated

6.5 Electrical Characteristics, TL431C, TL432C

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2440	2495	2550	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA	SOT23-3 and TL432 devices		6	16	mV
				All other devices		4	25	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.4	1.2	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	1	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	1	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.6 Electrical Characteristics, TL431I, TL432I

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2440	2495	2550	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA	SOT23-3 and TL432 devices		14	34	mV
				All other devices		5	50	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	2.5	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	1	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	1	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.7 Electrical Characteristics, TL431Q, TL432Q

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2440	2495	2550	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA			14	34	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	2.5	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	1	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	1	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.8 Electrical Characteristics, TL431AC, TL432AC

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2470	2495	2520	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA	SOT23-3 and TL432 devices		6	16	mV
				All other devices		4	25	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	1.2	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	0.6	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	0.5	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.9 Electrical Characteristics, TL431AI, TL432AI

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2470	2495	2520	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA	SOT23-3 and TL432 devices		14	34	mV
				All other devices		5	50	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	2.5	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	0.7	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	0.5	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.10 Electrical Characteristics, TL431AQ, TL432AQ

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2470	2495	2520	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA			14	34	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	2.5	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	0.7	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	0.5	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.11 Electrical Characteristics, TL431BC, TL432BC

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2483	2495	2507	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA			6	16	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	1.2	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	0.6	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	0.5	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.12 Electrical Characteristics, TL431BI, TL432BI

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2483	2495	2507	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA			14	34	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	2.5	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	0.7	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	0.5	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.13 Electrical Characteristics, TL431BQ, TL432BQ

over recommended operating conditions, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CIRCUIT	TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{ref}	Reference Voltage	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA		2483	2495	2507	mV
$V_{I(dev)}$	Deviation of reference input voltage over full temperature range (1)	See Figure 7-1	V_{KA} = V_{ref}, I_{KA} = 10mA			14	34	mV
ΔV_{ref} / ΔV_{KA}	Ratio of change in reference voltage to the change in cathode voltage	See Figure 7-2	I_{KA} = 10mA	ΔV_{KA} = 10V- V_{ref}		–1.4	–2.7	mV/V
				ΔV_{KA} = 36V- 10V		–1	–2	mV/V
I_{ref}	Reference Input Current	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			2	4	µA
$I_{I(dev)}$	Deviation of reference input current over full temperature range (1)	See Figure 7-2	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞			0.8	2.5	µA
I_{min}	Minimum cathode current for regulation	See Figure 7-1	V_{KA} = V_{ref}			0.4	0.7	mA
I_{off}	Off-state cathode current	See Figure 7-3	V_{KA} = 36V, V_{ref} = 0			0.1	0.5	µA
$\|Z_{KA}\|$	Dynamic Impedance (2)	See Figure 7-1	V_{KA} = V_{ref}, f ≤ 1kHz, I_{KA} = 1mA to 100mA			0.2	0.5	Ω

(1) The deviation parameters $V_{I(dev)}$ and $I_{I(dev)}$ are defined as the differences between the maximum and minimum values obtained over the rated temperature range. For more details on $V_{I(dev)}$ and how it relates to the average temperature coefficient, see Temperature Coefficient.

(2) The dynamic impedance is defined by $|Z_{KA}| = \Delta V_{KA}/\Delta I_{KA}$. For more details on $|Z_{KA}|$ and how it relates to V_{KA}, see Dynamic Impedance.

Copyright © 2024 Texas Instruments Incorporated

6.14 Typical Characteristics

Data at high and low temperatures are applicable only within the recommended operating free-air temperature ranges of the various devices.

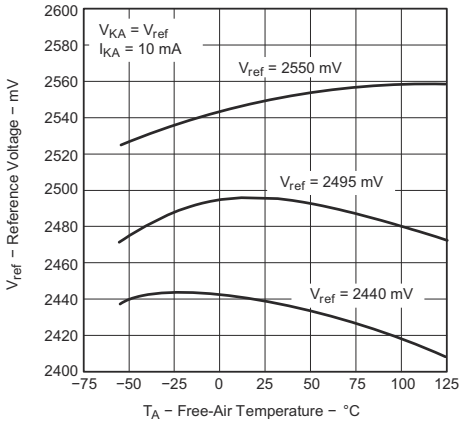


Figure 6-1. Reference Voltage vs Free-Air Temperature

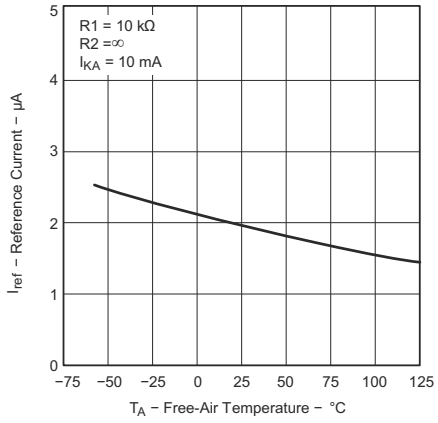


Figure 6-2. Reference Current vs Free-Air Temperature

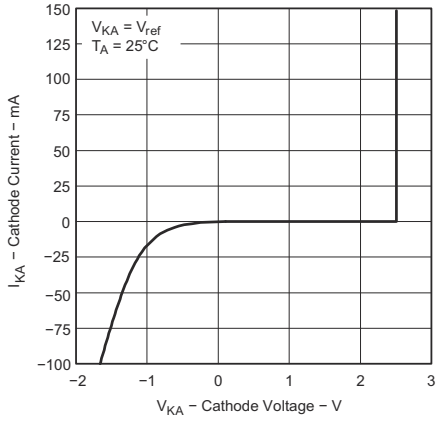


Figure 6-3. Cathode Current vs Cathode Voltage

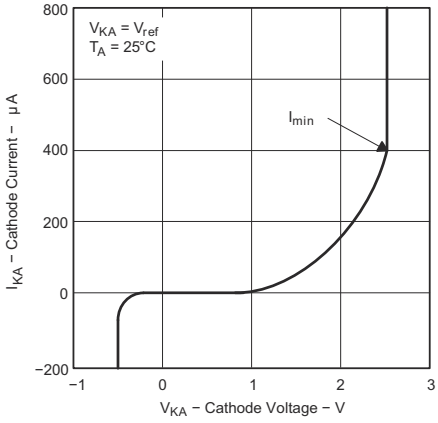


Figure 6-4. Cathode Current vs Cathode Voltage

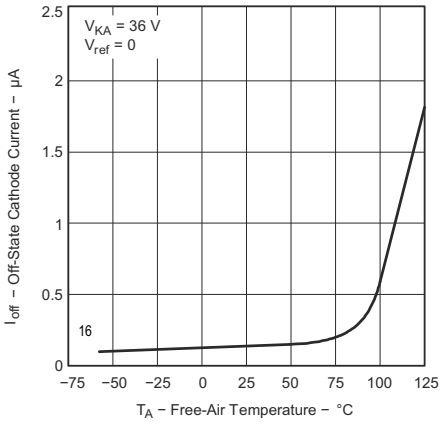


Figure 6-5. Off-State Cathode Current vs Free-Air Temperature

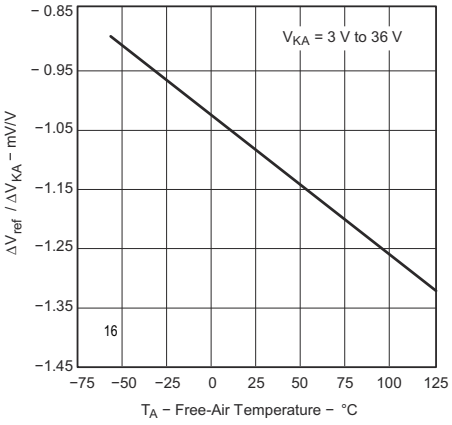


Figure 6-6. Ratio of Delta Reference Voltage to Delta Cathode Voltage vs Free-Air Temperature

Copyright © 2024 Texas Instruments Incorporated

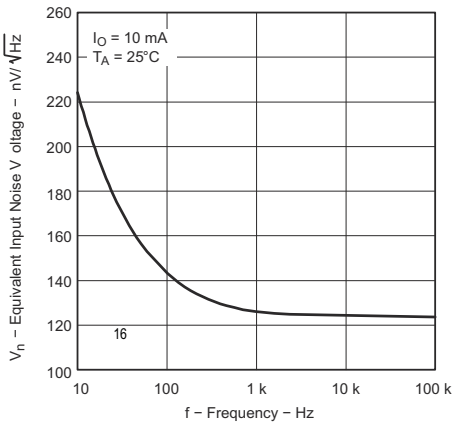


Figure 6-7. Equivalent Input Noise Voltage vs Frequency

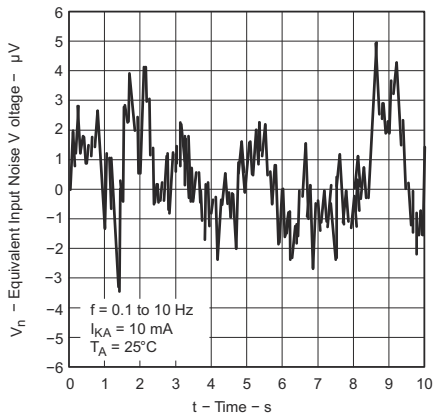


Figure 6-8. Equivalent Input Noise Voltage Over a 10S Period

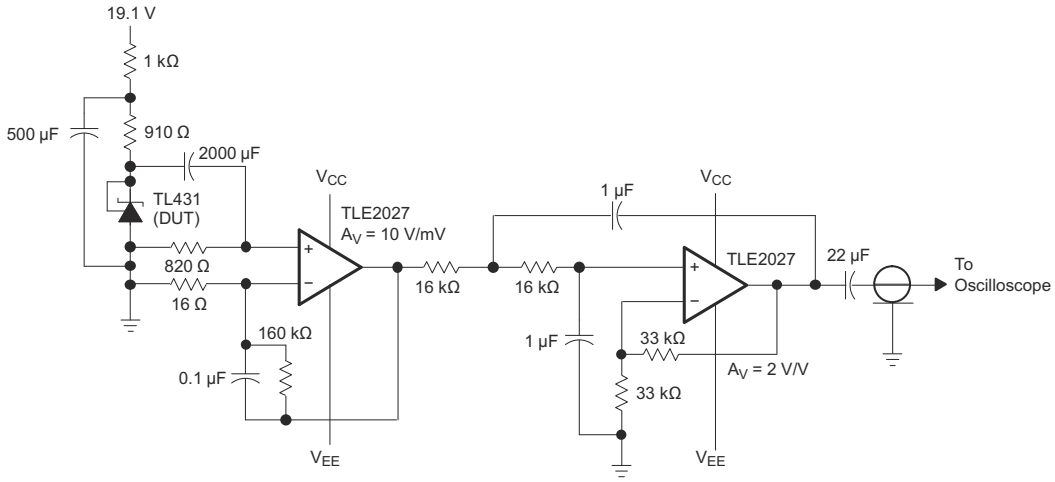


Figure 6-9. Test Circuit for Equivalent Input Noise Voltage Over a 10S Period

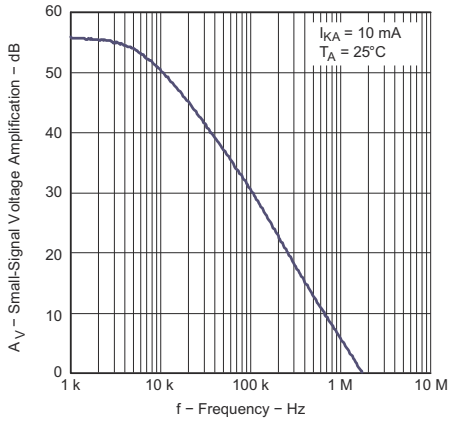


Figure 6-10. Small-Signal Voltage Amplification vs Frequency

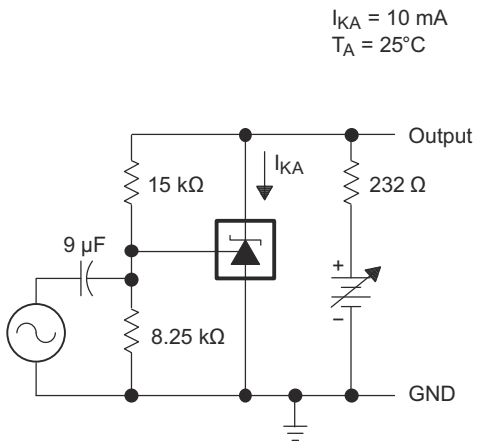


Figure 6-11. Test Circuit for Voltage Amplification

Copyright © 2024 Texas Instruments Incorporated

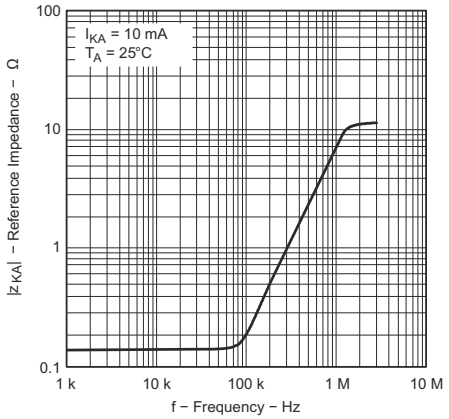


Figure 6-12. Reference Impedance vs Frequency

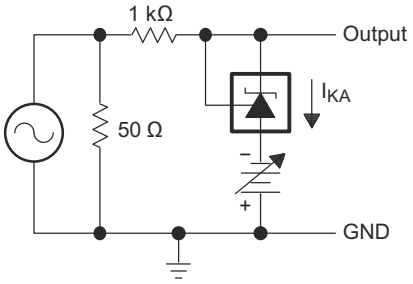


Figure 6-13. Test Circuit for Reference Impedance

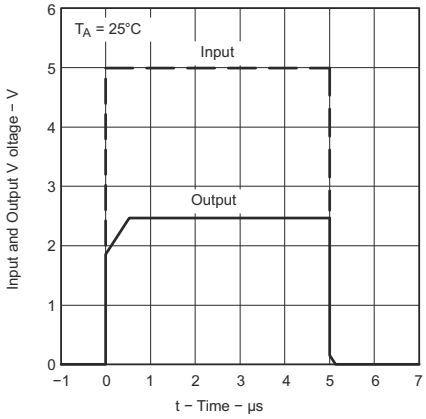


Figure 6-14. Pulse Response

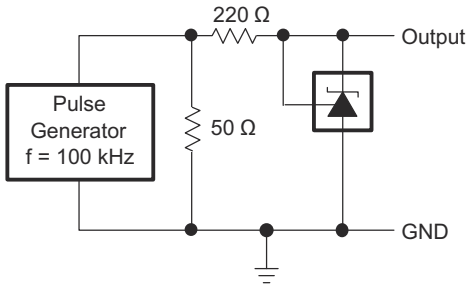
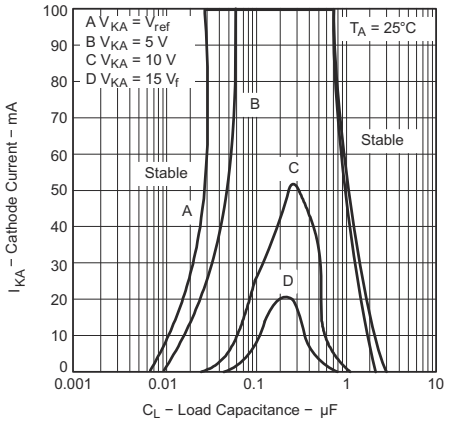
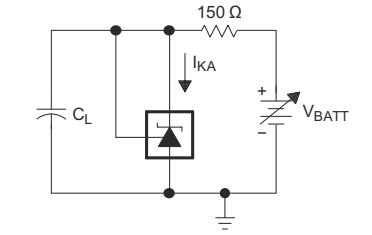


Figure 6-15. Test Circuit for Pulse Response

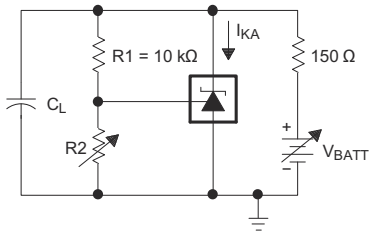


The areas under the curves represent conditions that can cause the device to oscillate. For curves B, C, and D, R2 and V+ are adjusted to establish the initial V_{KA} and I_{KA} conditions, with C_L = 0. VBATT and C_L then are adjusted to determine the ranges of stability.

Figure 6-16. Stability Boundary Conditions for All TL431 and TL431A Devices (Except for SOT23-3, SC-70, and Q-Temp Devices)

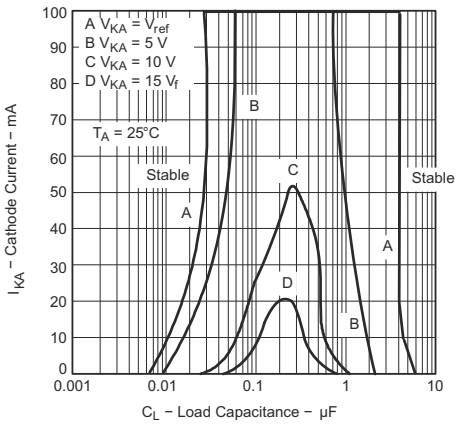


TEST CIRCUIT FOR CURVE A



TEST CIRCUIT FOR CURVES B, C, AND D

Figure 6-17. Test Circuits for Stability Boundary Conditions



The areas under the curves represent conditions that can cause the device to oscillate. For curves B, C, and D, R2 and V+ are adjusted to establish the initial V_{KA} and I_{KA} conditions, with C_L = 0. VBATT and C_L then are adjusted to determine the ranges of stability.

Figure 6-18. Stability Boundary Conditions for All TL431B, TL432, SOT-23, SC-70, and Q-Temp Devices

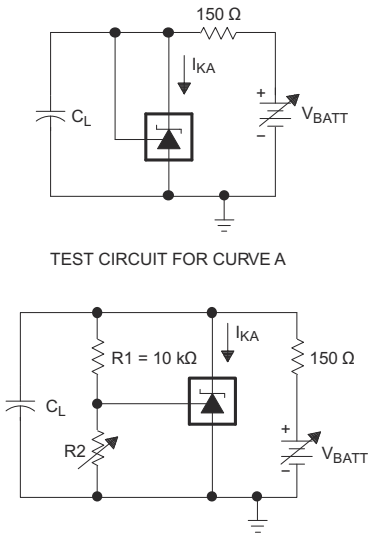


Figure 6-19. Test Circuit for Stability Boundary Conditions

Copyright © 2024 Texas Instruments Incorporated

7 Parameter Measurement Information

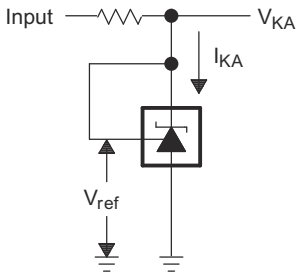


Figure 7-1. Test Circuit for $V_{KA} = V_{ref}$

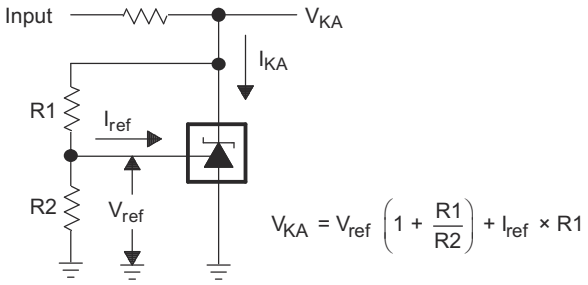


Figure 7-2. Test Circuit for $V_{KA} > V_{ref}$

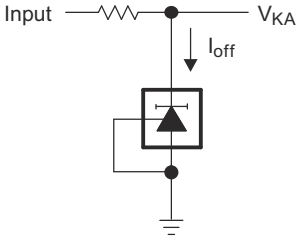


Figure 7-3. Test Circuit for I_{off}

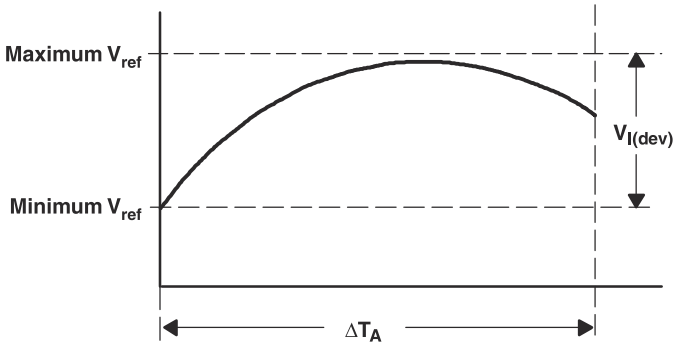
7.1 Temperature Coefficient

The deviation of the reference voltage, V_{ref}, over the full temperature range is known as $V_{I(dev)}$. The parameter of $V_{I(dev)}$ can be used to find the temperature coefficient of the device. The average full-range temperature coefficient of the reference input voltage, α_{Vref}, is defined as:

$$\left|\alpha_{vref}\right| \left(\frac{ppm}{°C}\right) = \frac{\left(\frac{V_{I(dev)}}{V_{ref\ at\ 25°C}}\right) \times 10^6}{\Delta T_A}$$

where:

ΔT_A is the rated operating temperature range of the device.



α_{Vref} is positive or negative, depending on whether minimum V_{ref} or maximum V_{ref}, respectively, occurs at the lower temperature. The full-range temperature coefficient is an average and therefore any subsection of the rated operating temperature range can yield a value that is greater or less than the average. For more details on temperature coefficient, refer to the *Voltage Reference Selection Basics White Paper*.

Copyright © 2024 Texas Instruments Incorporated

7.2 Dynamic Impedance

The dynamic impedance is defined as $|Z_{KA}| = \frac{\Delta V_{KA}}{\Delta I_{KA}}$. When the device is operating with two external resistors (see Figure 6-13), the total dynamic impedance of the circuit is given by $|z'| = \frac{\Delta V}{\Delta I}$, which is approximately equal to $|Z_{KA}|\left(1 + \frac{R1}{R2}\right)$.

The V_{KA} of the device can be affected by the dynamic impedance. The device test current I_{test} for V_{KA} is specified in the *Electrical Characteristics*. Any deviation from I_{test} can cause deviation on the output V_{KA}. Figure 7-4 shows the effect of the dynamic impedance on the V_{KA}.

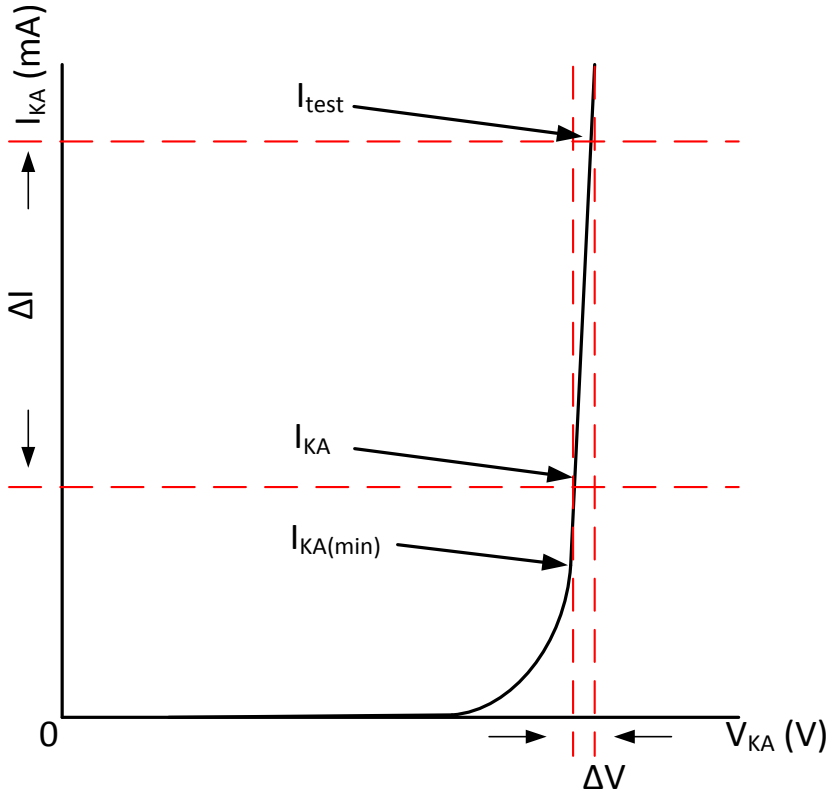


Figure 7-4. Dynamic Impedance

Copyright © 2024 Texas Instruments Incorporated

8 Detailed Description

8.1 Overview

This standard device has proven ubiquity and versatility across a wide range of applications, ranging from power to signal path. This is due to its key components containing an accurate voltage reference & opamp, which are very fundamental analog building blocks. TL43xx is used in conjunction with its key components to behave as a single voltage reference, error amplifier, voltage clamp or comparator with integrated reference.

TL43xx can be operated and adjusted to cathode voltages from 2.5V to 36V, making this part optimum for a wide range of end equipments in industrial, auto, telecom & computing. In order for this device to behave as a shunt regulator or error amplifier, >1mA (I_{min}(max)) must be supplied in to the cathode pin. Under this condition, feedback can be applied from the Cathode and Ref pins to create a replica of the internal reference voltage.

Various reference voltage options can be purchased with initial tolerances (at 25°C) of 0.5%, 1%, and 2%. These reference options are denoted by B (0.5%), A (1.0%) and blank (2.0%) after the TL431 or TL432. TL431 & TL432 are both functionaly, but have separate pinout options.

The TL43xxC devices are characterized for operation from 0°C to 70°C, the TL43xxI devices are characterized for operation from –40°C to 85°C, and the TL43xxQ devices are characterized for operation from –40°C to 125°C.

8.2 Functional Block Diagram

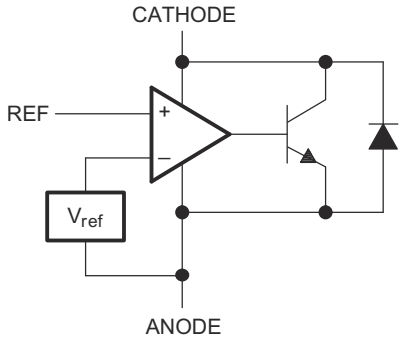


Figure 8-1. Equivalent Schematic

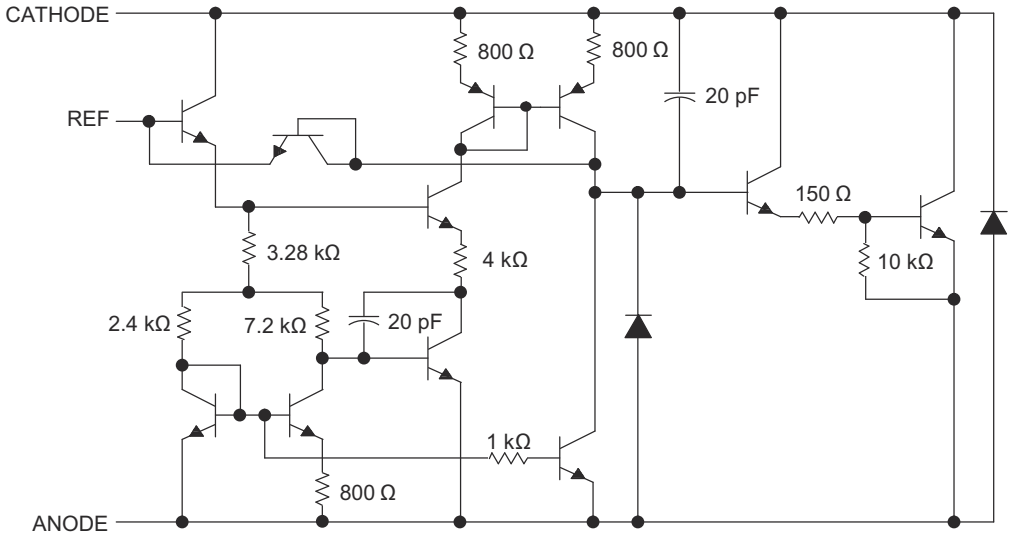


Figure 8-2. Detailed Schematic

Copyright © 2024 Texas Instruments Incorporated

8.3 Feature Description

TL43xx consists of an internal reference and amplifier that outputs a sink current base on the difference between the reference pin and the virtual internal pin. The sink current is produced by the internal Darlington pair, shown in the above schematic (Figure 8-2). A Darlington pair is used for this device to be able to sink a maximum current of 100mA.

When operated with enough voltage headroom (≥ 2.5V) and cathode current (I_{KA}), TL431 forces the reference pin to 2.5V. However, the reference pin can not be left floating, as it needs I_{REF} ≥ 4µA (please see *Electrical Characteristics, TL431C, TL432C*). This is because the reference pin is driven into an npn, which needs base current in order operate properly.

When feedback is applied from the Cathode and Reference pins, TL43xx behaves as a Zener diode, regulating to a constant voltage dependent on current being supplied into the cathode. This is due to the internal amplifier and reference entering the proper operating regions. The same amount of current needed in the above feedback situation must be applied to this device in open loop, servo or error amplifying implementations for it to be in the proper linear region giving TL43xx enough gain.

Unlike many linear regulators, TL43xx is internally compensated to be stable without an output capacitor between the cathode and anode. However, if it is desired to use an output capacitor Figure 6-18 can be used as a guide to assist in choosing the correct capacitor to maintain stability.

8.4 Device Functional Modes

8.4.1 Open Loop (Comparator)

When the cathode/output voltage or current of TL43xx is not being fed back to the reference/input pin in any form, this device is operating in open loop. With proper cathode current (Ika) applied to this device, TL43xx will have the characteristics shown in Figure 9-2. With such high gain in this configuration, TL43xx is typically used as a comparator. With the reference integrated makes TL43xx the prefered choice when users are trying to monitor a certain level of a single signal.

8.4.2 Closed Loop

When the cathode/output voltage or current of TL43xx is being fed back to the reference/input pin in any form, this device is operating in closed loop. The majority of applications involving TL43xx use it in this manner to regulate a fixed voltage or current. The feedback enables this device to behave as an error amplifier, computing a portion of the output voltage and adjusting it to maintain the desired regulation. This is done by relating the output voltage back to the reference pin in a manner to make it equal to the internal reference voltage, which can be accomplished via resistive or direct feedback.

Copyright © 2024 Texas Instruments Incorporated

9 Applications and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

As this device has many applications and setups, there are many situations that this datasheet can not characterize in detail. The linked application notes will help the designer make the best choices when using this part.

Application note *Understanding Stability Boundary Conditions Charts in TL431, TL432 Data Sheet* (SLVA482) will provide a deeper understanding of this devices stability characteristics and aid the user in making the right choices when choosing a load capacitor. Application note *Setting the Shunt Voltage on an Adjustable Shunt Regulator* (SLVA445) assists designers in setting the shunt voltage to achieve optimum accuracy for this device.

9.2 Typical Applications

9.2.1 Comparator With Integrated Reference

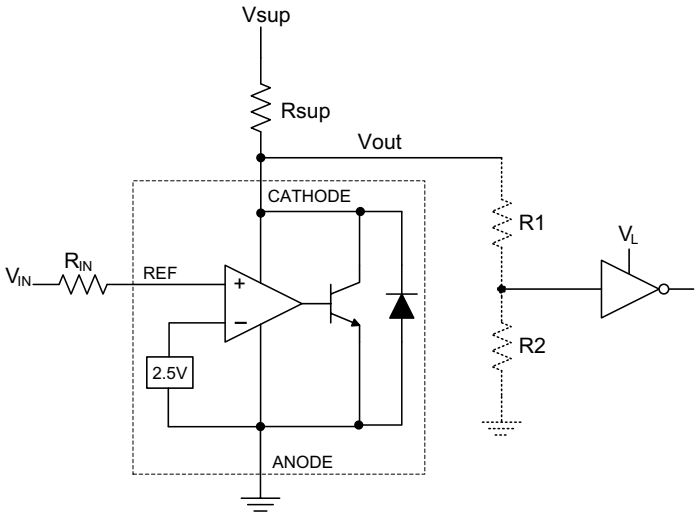


Figure 9-1. Comparator Application Schematic

9.2.1.1 Design Requirements

For this design example, use the parameters listed in *Table 9-1* as the input parameters.

Table 9-1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Input Voltage Range	0Vto 5V
Input Resistance	10kΩ
Supply Voltage	24V
Cathode Current (Ik)	5mA
Output Voltage Level	~2V– V_{SUP}
Logic Input Thresholds VIH/VIL	V_L

9.2.1.2 Detailed Design Procedure

When using TL431 as a comparator with reference, determine the following:

- Input Voltage Range
- Reference Voltage Accuracy
- Output logic input high and low level thresholds
- Current Source resistance

9.2.1.2.1 Basic Operation

In the configuration shown in Figure 9-1 TL431 will behave as a comparator, comparing the V_{REF} pin voltage to the internal virtual reference voltage. When provided a proper cathode current (I_K), TL43xx will have enough open loop gain to provide a quick response. This can be seen in Figure 9-2, where the R_{SUP}=10 kΩ (I_{KA}=500 µA) situation responds much slower than R_{SUP}=1 kΩ (I_{KA}=5mA). Operation near and below I_{min} could result in low gain, leading to a slow response.

9.2.1.2.1.1 Overdrive

Slow or inaccurate responses can also occur when the reference pin is not provided enough overdrive voltage. This is the amount of voltage that is higher than the internal virtual reference. The internal virtual reference voltage will be within the range of 2.5V±(0.5%, 1.0% or 1.5%) depending on which version is being used. The more overdrive voltage provided, the faster the TL431 will respond.

For applications where TL431 is being used as a comparator, it is best to set the trip point to greater than the positive expected error (i.e. +1.0% for the A version). For fast response, setting the trip point to >10% of the internal V_{REF} should suffice.

For minimal voltage drop or difference from Vin to the ref pin, it is recommended to use an input resistor <10kΩ to provide Iref.

Copyright © 2024 Texas Instruments Incorporated

9.2.1.2.2 Output Voltage and Logic Input Level

For TL431 to properly be used as a comparator, the logic output must be readable by the receiving logic device. This is accomplished by knowing the input high and low level threshold voltage levels, typically denoted by V_{IH} & V_{IL}.

As seen in Figure 9-2, TL431's output low level voltage in open-loop/comparator mode is ~2 V, which is typically sufficient for 5V supplied logic. However, would not work for 3.3V& 1.8Vsupplied logic. To accommodate this a resistive divider can be tied to the output to attenuate the output voltage to a voltage legible to the receiving low voltage logic device.

TL431's output high voltage is equal to V_{SUP} due to TL431 being open-collector. If V_{SUP} is much higher than the receiving logic's maximum input voltage tolerance, the output must be attenuated to accommodate the outgoing logic's reliability.

When using a resistive divider on the output, be sure to make the sum of the resistive divider (R1 & R2 in Figure 9-1) is much greater than R_{SUP} to not interfere with TL431's ability to pull close to V_{SUP} when turning off.

9.2.1.2.2.1 Input Resistance

TL431 requires an input resistance in this application to source the reference current (I_{REF}) needed from this device to be in the proper operating regions while turning on. The actual voltage seen at the ref pin will be $V_{REF}=V_{IN}-I_{REF}*R_{IN}$. Since I_{REF} can be as high as 4µA it is recommended to use a resistance small enough that will mitigate the error that I_{REF} creates from V_{IN}.

9.2.1.3 Application Curve

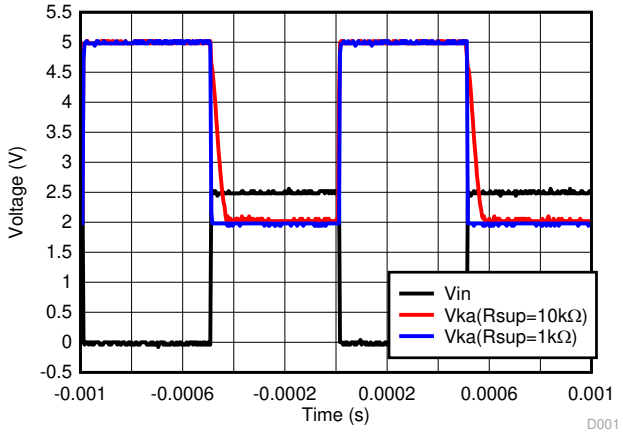


Figure 9-2. Output Response With Various Cathode Currents

Copyright © 2024 Texas Instruments Incorporated

9.2.2 Shunt Regulator/Reference

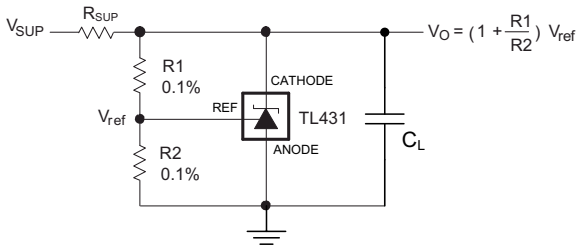


Figure 9-3. Shunt Regulator Schematic

9.2.2.1 Design Requirements

For this design example, use the parameters listed in Table 9-1 as the input parameters.

Table 9-2. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Reference Initial Accuracy	1.0 %
Supply Voltage	24V
Cathode Current (Ik)	5mA
Output Voltage Level	2.5V- 36V
Load Capacitance	10µF
Feedback Resistor Values and Accuracy (R1 & R2)	10kΩ

9.2.2.2 Detailed Design Procedure

When using TL431 as a Shunt Regulator, determine the following:

- Input Voltage Range
- Temperature Range
- Total Accuracy
- Cathode Current
- Reference Initial Accuracy
- Output Capacitance

9.2.2.2.1 Programming Output/Cathode Voltage

In order to program the cathode voltage to a regulated voltage a resistive bridge must be shunted between the cathode and anode pins with the mid point tied to the reference pin. This can be seen in Figure 9-3, with R1 & R2 being the resistive bridge. The cathode/output voltage in the shunt regulator configuration can be approximated by the equation shown in Figure 9-3. The cathode voltage can be more accuratel determined by taking in to account the cathode current:

$Vo=(1+R1/R2)*V_{REF}-I_{REF}*R1$

In order for this equation to be valid, TL43xx must be fully biased so that it has enough open loop gain to mitigate any gain error. This can be done by meeting the Imin spec denoted in *Electrical Characteristics, TL431C, TL432C*.

Copyright © 2024 Texas Instruments Incorporated

9.2.2.2.2 Total Accuracy

When programming the output above unity gain (V_{KA}=V_{REF}), TL43xx is susceptible to other errors that may effect the overall accuracy beyond V_{REF}. These errors include:

- R1 and R2 accuracies
- $V_{I(dev)}$ - Change in reference voltage over temperature
- ΔV_{REF} / ΔV_{KA} - Change in reference voltage to the change in cathode voltage
- $|z_{KA}|$ - Dynamic impedance, causing a change in cathode voltage with cathode current

Worst case cathode voltage can be determined taking all of the variables in to account. Application note *Setting the Shunt Voltage on an Adjustable Shunt Regulator* (SLVA445) assists designers in setting the shunt voltage to achieve optimum accuracy for this device.

9.2.2.2.3 Stability

Though TL43xx is stable with no capacitive load, the device that receives the shunt regulator's output voltage could present a capacitive load that is within the TL43xx region of stability, shown in Figure 6-16 and Figure 6-18. Also, designers may use capacitive loads to improve the transient response or for power supply decoupling. When using additional capacitance between Cathode and Anode, refer to Figure 6-16 and Figure 6-18. Also, application note *Understanding Stability Boundary Conditions Charts in TL431, TL432 Data Sheet* (SLVA482) will provide a deeper understanding of this devices stability characteristics and aid the user in making the right choices when choosing a load capacitor.

9.2.2.2.4 Start-Up Time

As shown in Figure 9-4, TL43xx has a fast response up to ~2Vand then slowly charges to its programmed value. This is due to the compensation capacitance (shown in Figure 6-18) the TL43xx has to meet its stability criteria. Despite the secondary delay, TL43xx still has a fast response suitable for many clamp applications.

9.2.2.3 Application Curve

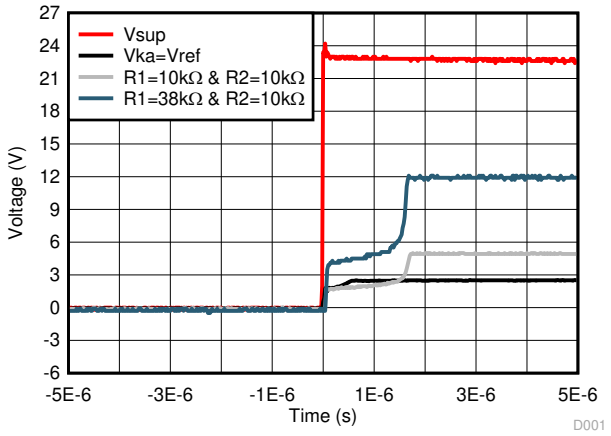
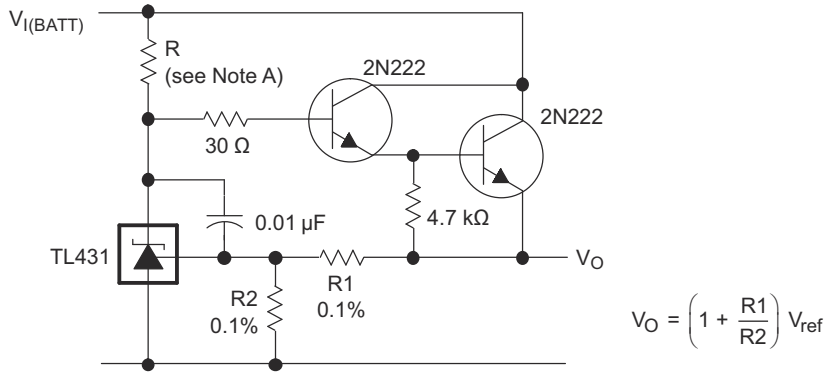


Figure 9-4. TL43xx Start-Up Response

Copyright © 2024 Texas Instruments Incorporated

9.3 System Examples



A. R should provide cathode current ≥1mA to the TL431 at minimum $V_{(BATT)}$.

Figure 9-5. Precision High-Current Series Regulator

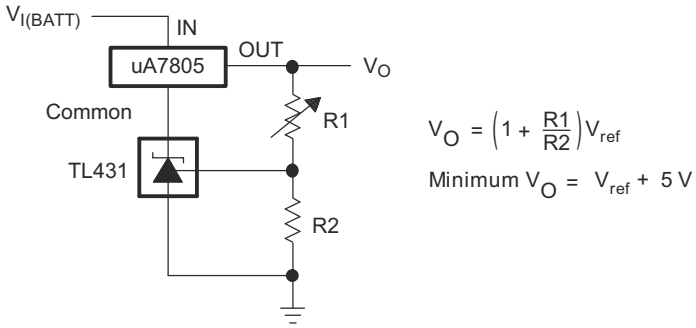


Figure 9-6. Output Control of a Three-Terminal Fixed Regulator

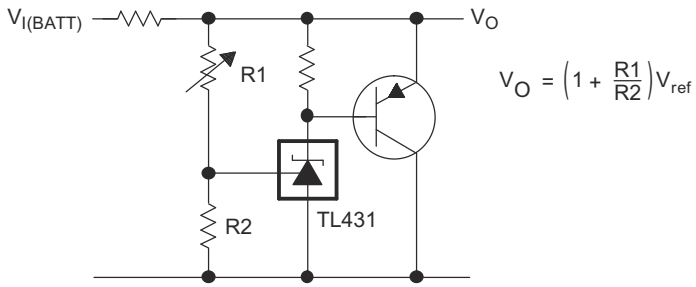
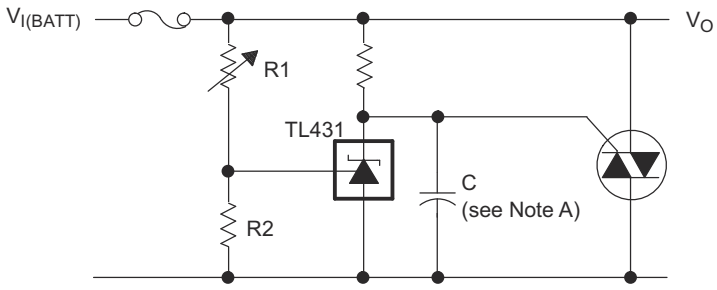


Figure 9-7. High-Current Shunt Regulator



A. Refer to the stability boundary conditions in Figure 6-16 and Figure 6-18 to determine allowable values for C.

Figure 9-8. Crowbar Circuit

Copyright © 2024 Texas Instruments Incorporated

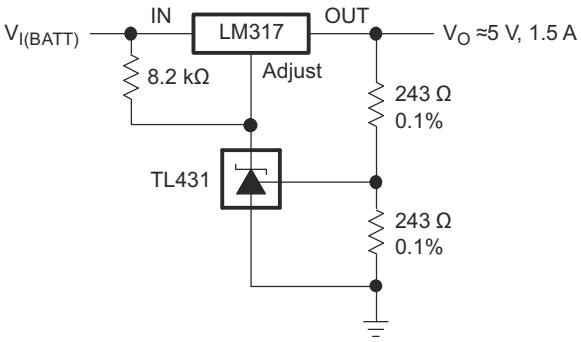
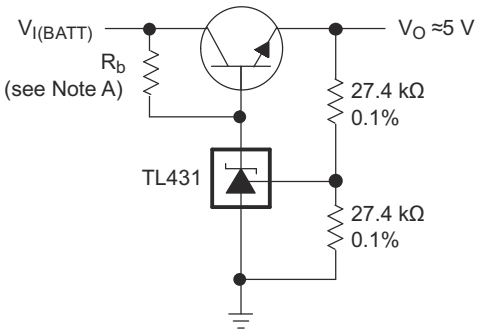


Figure 9-9. Precision 5V, 1.5A Regulator



A. R_b should provide cathode current ≥1mA to the TL431.

Figure 9-10. Efficient 5V Precision Regulator

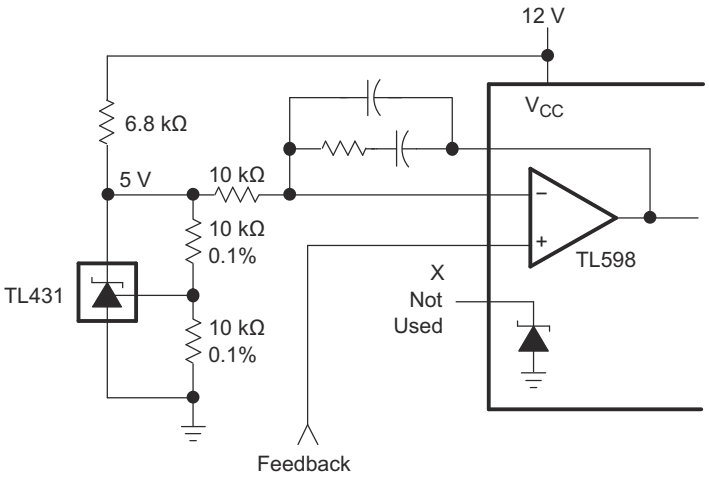
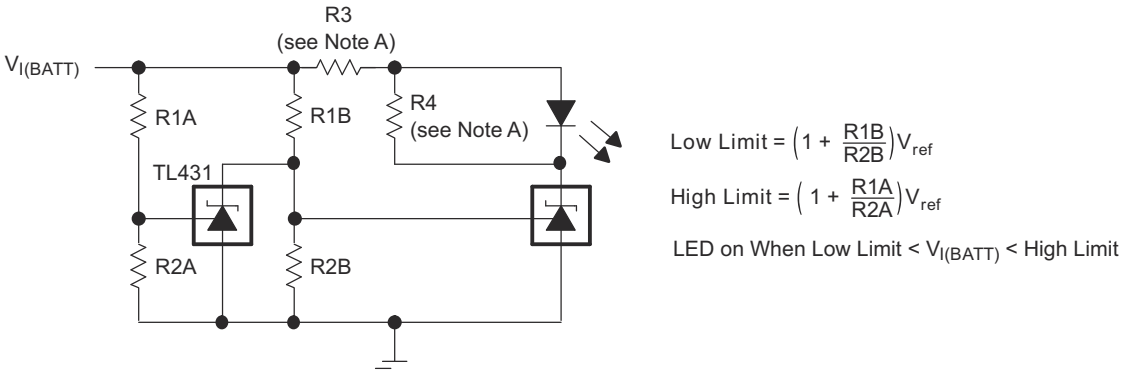


Figure 9-11. PWM Converter With Reference



A. Select R3 and R4 to provide the desired LED intensity and cathode current ≥1mA to the TL431 at the available $V_{I(BATT)}$.

Figure 9-12. Voltage Monitor

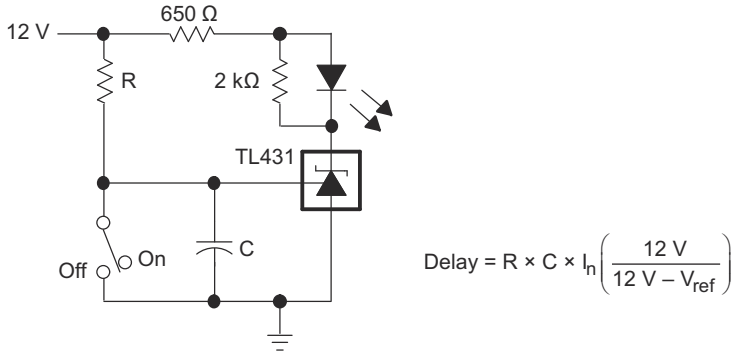


Figure 9-13. Delay Timer

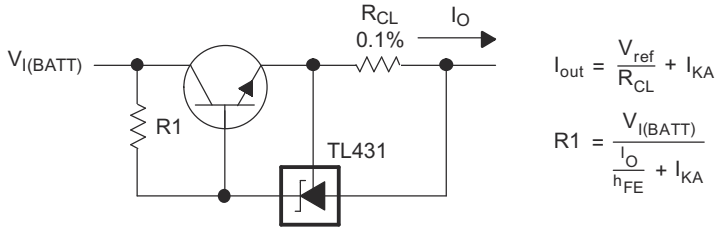


Figure 9-14. Precision Current Limiter

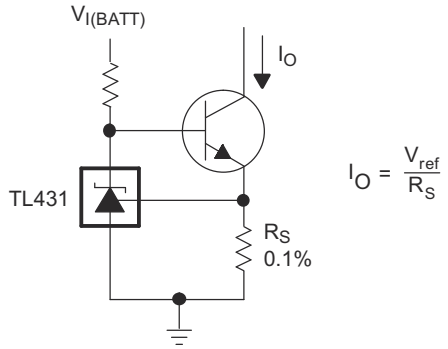


Figure 9-15. Precision Constant-Current Sink

Copyright © 2024 Texas Instruments Incorporated

9.4 Power Supply Recommendations

When using TL43xx as a Linear Regulator to supply a load, designers will typically use a bypass capacitor on the output/cathode pin. When doing this, be sure that the capacitance is within the stability criteria shown in Figure 6-16 and Figure 6-18.

In order to not exceed the maximum cathode current, be sure that the supply voltage is current limited. Also, be sure to limit the current being driven into the Ref pin, as not to exceed its absolute maximum rating.

For applications shunting high currents, pay attention to the cathode and anode trace lengths, adjusting the width of the traces to have the proper current density.

9.5 Layout

9.5.1 Layout Guidelines

Bypass capacitors should be placed as close to the part as possible. Current-carrying traces need to have widths appropriate for the amount of current they are carrying; in the case of the TL43xx, these currents will be low.

9.5.2 Layout Example

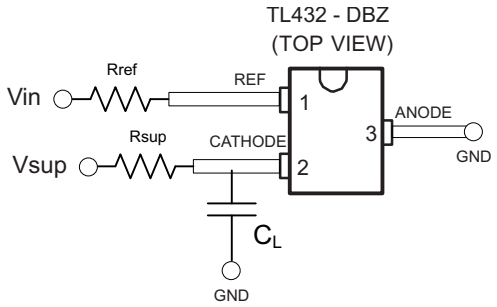
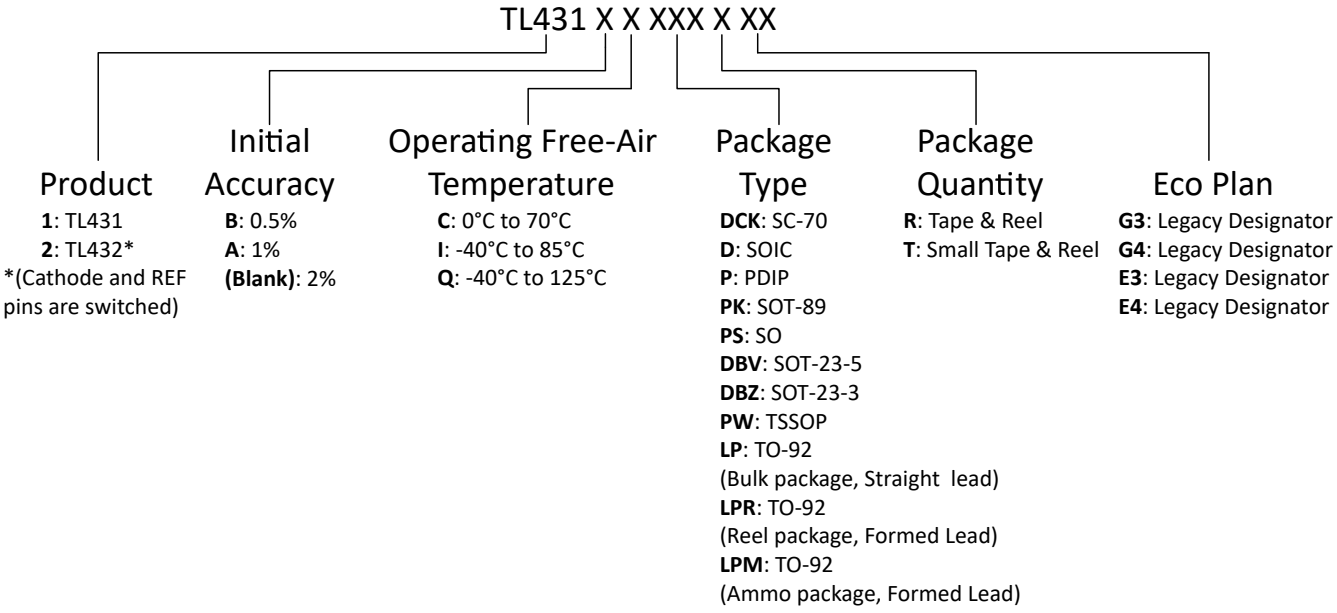


Figure 9-16. DBZ Layout Example

10 Device and Documentation Support

10.1 Device Nomenclature

TI assigns suffixes and prefixes to differentiate all the combinations of the TL43x family. The Eco Plan designator is a legacy designator that was used to differentiate Pb-free and Green devices. More details and possible orderable combinations are located on the Package Option Addendum in Mechanical, Packaging, and Orderable Information.



10.2 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 10-1. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
TL431	Click here	Click here	Click here	Click here	Click here
TL432	Click here	Click here	Click here	Click here	Click here

10.3 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

10.4 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

10.5 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

Copyright © 2024 Texas Instruments Incorporated

10.6 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

10.7 Glossary

TI Glossary — This glossary lists and explains terms, acronyms, and definitions.

11 Revision History

Changes from Revision R (August 2023) to Revision S (May 2024)	Page
• Updated pinout diagrams	4

Changes from Revision Q (July 2022) to Revision R (August 2023)	Page
• Updated *Applications* section links	1
• Updated *Description* section	1
• Removed KTP package	4
• Added detailed *Temperature Coefficient* and *Dynamic Impedance* sections	19
• Updated *Applications* section	26
• Updated LP package in *Device Nomenclature* figure	32

Changes from Revision P (November 2018) to Revision Q (July 2022)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document	1
• Corrected the device names in the *Pin Functions* table	4

Changes from Revision O (January 2015) to Revision P (November 2018)	Page
• Added text to the *Description* section	1
• Added *TL43x Device Comparison Table*	3
• Added *TL43x Device Nomenclature* section	32

Changes from Revision N (January 2014) to Revision O (January 2015)	Page
• Added *Applications*, *Device Information* table, *Pin Functions* table, *ESD Ratings* table, *Thermal Information* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section	1
• Added Applications	1

12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical packaging and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser based versions of this data sheet, refer to the left hand navigation.

Copyright © 2024 Texas Instruments Incorporated

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431ACD	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	431AC
TL431ACD.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	431AC
TL431ACDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(TACG, TACJ, TACS)
TL431ACDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(TACG, TACJ, TACS)
TL431ACDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(TACG, TACJ, TACU)
TL431ACDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(TACG, TACJ, TACU)
TL431ACDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(TAC3, TACG, TACS, TACU)
TL431ACDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(TAC3, TACG, TACS, TACU)
TL431ACDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TAC3
TL431ACDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TAC3
TL431ACDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(TAC3, TACG, TACS, TACU)
TL431ACDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(TAC3, TACG, TACS, TACU)
TL431ACDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TAC3
TL431ACDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TAC3
TL431ACDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T4S, T4U)
TL431ACDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T4S, T4U)
TL431ACDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	431AC
TL431ACDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	431AC
TL431ACDRG4	Obsolete	Production	SOIC (D) | 8	-	-	Call TI	Call TI	0 to 70	431AC
TL431ACLP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	TL431AC
TL431ACLP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	TL431AC
TL431ACLPM	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	0 to 70	TL431AC
TL431ACLPM.A	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	0 to 70	TL431AC

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431ACLPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	TL431AC
TL431ACLPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	TL431AC
TL431ACP	Active	Production	PDIP (P) | 8	50 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL431ACP
TL431ACP.A	Active	Production	PDIP (P) | 8	50 | TUBE	Yes	NIPDAU	N/A for Pkg Type	0 to 70	TL431ACP
TL431ACPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	4A
TL431ACPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	4A
TL431ACPSR	Active	Production	SO (PS) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431A
TL431ACPSR.A	Active	Production	SO (PS) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431A
TL431ACPWR	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431A
TL431ACPWR.A	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431A
TL431AID	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	431AI
TL431AID.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	431AI
TL431AIDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(TAIG, TAIJ, TAIS)
TL431AIDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(TAIG, TAIJ, TAIS)
TL431AIDBVRG4	Obsolete	Production	SOT-23 (DBV) | 5	-	-	Call TI	Call TI	-40 to 85	TAIG
TL431AIDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(TAIG, TAIJ, TAIU)
TL431AIDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(TAIG, TAIJ, TAIU)
TL431AIDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3AG, TAI3, TAIS, TAIU)
TL431AIDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T3AG, TAI3, TAIS, TAIU)
TL431AIDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TAI3
TL431AIDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TAI3
TL431AIDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3AG, TAI3, TAIS, TAIU)
TL431AIDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T3AG, TAI3, TAIS, TAIU)
TL431AIDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TAI3
TL431AIDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TAI3

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431AIDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	T5U
TL431AIDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	T5U
TL431AIDCKRE4	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	-	Call TI	Call TI	-40 to 85	
TL431AIDCKRG4	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T5U
TL431AIDCKRG4.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T5U
TL431AIDCKT	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	T5U
TL431AIDCKT.A	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	T5U
TL431AIDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	431AI
TL431AIDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	431AI
TL431AIDRG4	Obsolete	Production	SOIC (D) | 8	-	-	Call TI	Call TI	-40 to 85	431AI
TL431AILP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 85	TL431AI
TL431AILP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 85	TL431AI
TL431AILPM	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	-40 to 85	TL431AI
TL431AILPM.A	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	-40 to 85	TL431AI
TL431AILPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	TL431AI
TL431AILPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	TL431AI
TL431AIPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	4B
TL431AIPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	4B
TL431AQDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(TAQG, TAQJ, TAQU)
TL431AQDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(TAQG, TAQJ, TAQU)
TL431AQDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(TAQG, TAQJ, TAQU)
TL431AQDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(TAQG, TAQJ, TAQU)
TL431AQDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(TAQ3, TAQG, TAQS, TAQU)
TL431AQDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(TAQ3, TAQG, TAQS, TAQU)
TL431AQDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	TAQS
TL431AQDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	TAQS

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431AQDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(TAQG, TAQS, TAQU)
TL431AQDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(TAQG, TAQS, TAQU)
TL431AQDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	TAQS
TL431AQDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	TAQS
TL431AQDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	T7U
TL431AQDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	T7U
TL431AQDCKT	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	T7U
TL431AQDCKT.A	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	T7U
TL431AQPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	4D
TL431AQPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	4D
TL431BCD	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431B
TL431BCD.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431B
TL431BCDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3GG, T3GJ, T3GU)
TL431BCDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T3GG, T3GJ, T3GU)
TL431BCDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3GG, T3GJ, T3GU)
TL431BCDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T3GG, T3GJ, T3GU)
TL431BCDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3G3, T3GG, T3GS, T3GU)
TL431BCDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T3G3, T3GG, T3GS, T3GU)
TL431BCDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3G3
TL431BCDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3G3
TL431BCDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3G3, T3GG, T3GS, T3GU)
TL431BCDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T3G3, T3GG, T3GS, T3GU)
TL431BCDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3G3

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431BCDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3G3
TL431BCDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	T2U
TL431BCDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	T2U
TL431BCDCKT	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	T2U
TL431BCDCKT.A	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	T2U
TL431BCDE4	Active	Production	SOIC (D) | 8	75 | TUBE	-	Call TI	Call TI	0 to 70	
TL431BCDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431B
TL431BCDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T431B
TL431BCLP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	T431B
TL431BCLP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	T431B
TL431BCLPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	T431B
TL431BCLPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	T431B
TL431BCPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	4C
TL431BCPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	4C
TL431BID	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	Z431B
TL431BID.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	Z431B
TL431BIDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3FG, T3FJ, T3FU)
TL431BIDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(T3FG, T3FJ, T3FU)
TL431BIDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3FG, T3FJ, T3FU)
TL431BIDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(T3FG, T3FJ, T3FU)
TL431BIDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3F3, T3FG, T3FS, T3FU)
TL431BIDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T3F3, T3FG, T3FS, T3FU)
TL431BIDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T3F3
TL431BIDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T3F3
TL431BIDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3F3, T3FG, T3FS, T3FU)

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431BIDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T3F3, T3FG, T3FS, T3FU)
TL431BIDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T3F3
TL431BIDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T3F3
TL431BIDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	T3U
TL431BIDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	T3U
TL431BIDCKT	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	T3U
TL431BIDCKT.A	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	T3U
TL431BIDE4	Active	Production	SOIC (D) | 8	75 | TUBE	-	Call TI	Call TI	-40 to 85	
TL431BIDG4	Active	Production	SOIC (D) | 8	75 | TUBE	-	Call TI	Call TI	-40 to 85	
TL431BIDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	Z431B
TL431BIDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	Z431B
TL431BIDRG4	Obsolete	Production	SOIC (D) | 8	-	-	Call TI	Call TI	-40 to 85	Z431B
TL431BILP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 85	Z431B
TL431BILP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 85	Z431B
TL431BILPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	Z431B
TL431BILPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	Z431B
TL431BIP	Obsolete	Production	PDIP (P) | 8	-	-	Call TI	Call TI	-40 to 85	TL431BIP
TL431BIPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	4I
TL431BIPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	4I
TL431BQD	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431BQ
TL431BQD.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431BQ
TL431BQDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(T3HJ, T3HU)
TL431BQDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(T3HJ, T3HU)
TL431BQDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(T3HJ, T3HU)
TL431BQDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(T3HJ, T3HU)
TL431BQDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T3H3, T3HG, T3HS, T3HU)
TL431BQDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T3H3, T3HG, T3HS, T3HU)
TL431BQDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T3HS

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431BQDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T3HS
TL431BQDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T3HG, T3HS, T3HU)
TL431BQDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T3HG, T3HS, T3HU)
TL431BQDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T3HS
TL431BQDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T3HS
TL431BQDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	T8U
TL431BQDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	T8U
TL431BQDCKT	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	T8U
TL431BQDCKT.A	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	T8U
TL431BQDE4	Active	Production	SOIC (D) | 8	75 | TUBE	-	Call TI	Call TI	-40 to 125	
TL431BQDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431BQ
TL431BQDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431BQ
TL431BQDRG4	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	-	Call TI	Call TI	-40 to 125	
TL431BQLP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 125	T431BQ
TL431BQLP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 125	T431BQ
TL431BQLPM	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	-40 to 125	T431BQ
TL431BQLPM.A	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	-40 to 125	T431BQ
TL431BQLPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 125	T431BQ
TL431BQLPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 125	T431BQ
TL431BQPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	3H
TL431BQPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	3H
TL431CD	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL431C
TL431CD.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL431C
TL431CDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3CG, T3CJ, T3CS)
TL431CDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T3CG, T3CJ, T3CS)
TL431CDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3CG, T3CJ, T3CS)

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431CDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T3CG, T3CJ, T3CS)
TL431CDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3C3, T3CG, T3CS, T3CU)
TL431CDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T3C3, T3CG, T3CS, T3CU)
TL431CDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3C3
TL431CDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3C3
TL431CDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T3CG, T3CS, T3CU)
TL431CDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T3CG, T3CS, T3CU)
TL431CDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	T3CS
TL431CDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T3CS
TL431CDG4	Active	Production	SOIC (D) | 8	75 | TUBE	-	Call TI	Call TI	0 to 70	
TL431CDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL431C
TL431CDR-J	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL431C
TL431CDR-J.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL431C
TL431CDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TL431C
TL431CDRG4	Obsolete	Production	SOIC (D) | 8	-	-	Call TI	Call TI	0 to 70	TL431C
TL431CLP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	TL431C
TL431CLP-Z	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	-	TL431C
TL431CLP-Z.A	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	See TL431CLP-Z	TL431C
TL431CLP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	0 to 70	TL431C
TL431CLPM	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	0 to 70	TL431C
TL431CLPM.A	Active	Production	TO-92 (LP) | 3	2000 | AMMO	Yes	SN	N/A for Pkg Type	0 to 70	TL431C
TL431CLPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	TL431C
TL431CLPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	0 to 70	TL431C
TL431CPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	43
TL431CPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	43
TL431CPKE6	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SNBI	Level-1-260C-UNLIM	0 to 70	43
TL431CPKE6.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SNBI	Level-1-260C-UNLIM	0 to 70	43

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431CPSR	Obsolete	Production	SO (PS) | 8	-	-	Call TI	Call TI	0 to 70	T431
TL431ID	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL431I
TL431ID.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL431I
TL431IDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3IG, T3IJ, T3IS)
TL431IDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(T3IG, T3IJ, T3IS)
TL431IDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T3IG, T3IJ, T3IU)
TL431IDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(T3IG, T3IJ, T3IU)
TL431IDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(T3I3, T3IG, T3IS, T3IU)
TL431IDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T3I3, T3IG, T3IS, T3IU)
TL431IDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	T3IS
TL431IDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T3IS
TL431IDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(T3IG, T3IS, T3IU)
TL431IDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T3IG, T3IS, T3IU)
TL431IDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	T3IS
TL431IDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T3IS
TL431IDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL431I
TL431IDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	TL431I
TL431IDRG4	Obsolete	Production	SOIC (D) | 8	-	-	Call TI	Call TI	-40 to 85	TL431I
TL431ILP	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 85	TL431I
TL431ILP.A	Active	Production	TO-92 (LP) | 3	1000 | BULK	Yes	SN	N/A for Pkg Type	-40 to 85	TL431I
TL431ILPR	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	TL431I
TL431ILPR.A	Active	Production	TO-92 (LP) | 3	2000 | LARGE T&R	Yes	SN	N/A for Pkg Type	-40 to 85	TL431I
TL431IP	Obsolete	Production	PDIP (P) | 8	-	-	Call TI	Call TI	-40 to 85	TL431IP
TL431IPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	3I
TL431IPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	3I

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL431IPK3	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SNBI	Level-1-260C-UNLIM	-40 to 85	3I
TL431IPK3.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SNBI	Level-1-260C-UNLIM	-40 to 85	3I
TL431QD	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431Q
TL431QD.A	Active	Production	SOIC (D) | 8	75 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431Q
TL431QDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(T3QG, T3QJ, T3QU)
TL431QDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(T3QG, T3QJ, T3QU)
TL431QDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(T3QG, T3QJ, T3QU)
TL431QDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(T3QG, T3QJ, T3QU)
TL431QDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T3Q3, T3QG, T3QS, T3QU)
TL431QDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T3Q3, T3QG, T3QS, T3QU)
TL431QDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T3QS
TL431QDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T3QS
TL431QDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T3QG, T3QS, T3QU)
TL431QDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T3QG, T3QS, T3QU)
TL431QDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T3QS
TL431QDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T3QS
TL431QDCKR	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	T6U
TL431QDCKR.A	Active	Production	SC70 (DCK) | 6	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	T6U
TL431QDCKT	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	T6U
TL431QDCKT.A	Active	Production	SC70 (DCK) | 6	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	T6U
TL431QDR	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431Q
TL431QDR.A	Active	Production	SOIC (D) | 8	2500 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T431Q
TL431QPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	3Q
TL431QPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	3Q

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL432ACDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T4BG, T4BJ, T4BU)
TL432ACDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T4BG, T4BJ, T4BU)
TL432ACDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	(T4B3, T4BG, T4BS, T4BU)
TL432ACDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T4B3, T4BG, T4BS, T4BU)
TL432ACDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	T4BS
TL432ACDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T4BS
TL432ACDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	(T4BG, T4BS, T4BU)
TL432ACDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T4BG, T4BS, T4BU)
TL432ACDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	T4BS
TL432ACDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T4BS
TL432AIDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T4AG, T4AJ, T4AU)
TL432AIDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(T4AG, T4AJ, T4AU)
TL432AIDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T4A3, T4AG, T4AS, T4AU)
TL432AIDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T4A3, T4AG, T4AS, T4AU)
TL432AIDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4A3
TL432AIDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4A3
TL432AIDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T4A3, T4AG, T4AS, T4AU)
TL432AIDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T4A3, T4AG, T4AS, T4AU)
TL432AIDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4A3
TL432AIDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4A3
TL432AIPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	2E
TL432AIPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	2E

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL432AQDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(T4DJ, T4DU)
TL432AQDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(T4DJ, T4DU)
TL432AQDBVT	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 125	(T4DJ, T4DU)
TL432AQDBVT.A	Active	Production	SOT-23 (DBV) | 5	250 | SMALL T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 125	(T4DJ, T4DU)
TL432AQDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T4D3, T4DG, T4DS, T4DU)
TL432AQDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T4D3, T4DG, T4DS, T4DU)
TL432AQDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T4DS
TL432AQDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T4DS
TL432AQDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T4DG, T4DS, T4DU)
TL432AQDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T4DG, T4DS, T4DU)
TL432AQDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T4DS
TL432AQDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T4DS
TL432AQPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	2F
TL432AQPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	2F
TL432BCDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(TBCJ, TBCU)
TL432BCDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(TBCJ, TBCU)
TL432BCDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	(TBCG, TBCS, TBCU)
TL432BCDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(TBCG, TBCS, TBCU)
TL432BCDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	TBCS
TL432BCDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TBCS
TL432BCDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(TBCG, TBCS, TBCU)
TL432BCDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(TBCG, TBCS, TBCU)
TL432BCDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	TBCS
TL432BCDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	TBCS
TL432BCPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	2G

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL432BCPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	2G
TL432BIDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T4F3, T4FG, T4FS, T4FU)
TL432BIDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T4F3, T4FG, T4FS, T4FU)
TL432BIDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4F3
TL432BIDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4F3
TL432BIDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T4F3, T4FG, T4FS, T4FU)
TL432BIDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T4F3, T4FG, T4FS, T4FU)
TL432BIDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4F3
TL432BIDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4F3
TL432BIPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	2H
TL432BIPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	2H
TL432BQDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T4H3, T4HS, T4HU)
TL432BQDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T4H3, T4HS, T4HU)
TL432BQDBZR1G4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T4H3
TL432BQDBZR1G4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T4H3
TL432BQPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	2J
TL432BQPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	2J
TL432CDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	0 to 70	(T4CG, T4CJ, T4CU)
TL432CDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	0 to 70	(T4CG, T4CJ, T4CU)
TL432CDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	(T4CG, T4CS, T4CU)
TL432CDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	(T4CG, T4CS, T4CU)
TL432CDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	0 to 70	T4CS
TL432CDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	0 to 70	T4CS

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TL432CPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	2A
TL432CPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	0 to 70	2A
TL432IDBVR	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	NIPDAU | SN	Level-1-260C-UNLIM	-40 to 85	(T4IG, T4IJ, T4IU)
TL432IDBVR.A	Active	Production	SOT-23 (DBV) | 5	3000 | LARGE T&R	Yes	SN	Level-1-260C-UNLIM	-40 to 85	(T4IG, T4IJ, T4IU)
TL432IDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(T4IG, T4IS, T4IU)
TL432IDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T4IG, T4IS, T4IU)
TL432IDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	T4IS
TL432IDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4IS
TL432IDBZT	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	(T4IG, T4IS, T4IU)
TL432IDBZT.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	(T4IG, T4IS, T4IU)
TL432IDBZTG4	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 85	T4IS
TL432IDBZTG4.A	Active	Production	SOT-23 (DBZ) | 3	250 | SMALL T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	T4IS
TL432IPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	2B
TL432IPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 85	2B
TL432QDBZR	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | SN | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	(T4QG, T4QS, T4QU)
TL432QDBZR.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	(T4QG, T4QS, T4QU)
TL432QDBZRG4	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU | NIPDAUAG	Level-1-260C-UNLIM	-40 to 125	T4QS
TL432QDBZRG4.A	Active	Production	SOT-23 (DBZ) | 3	3000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	T4QS
TL432QPK	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	2C
TL432QPK.A	Active	Production	SOT-89 (PK) | 3	1000 | LARGE T&R	Yes	SN	Level-2-260C-1 YEAR	-40 to 125	2C

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF TL431, TL432 :

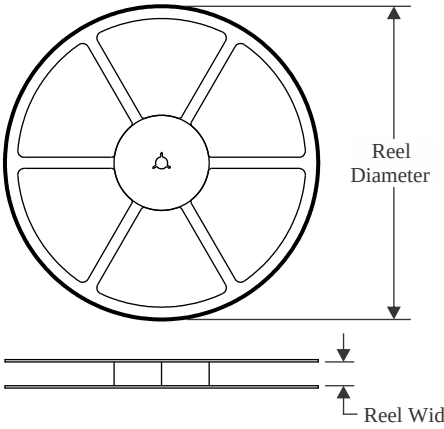
- Automotive : TL431-Q1, TL432-Q1

NOTE: Qualified Version Definitions:

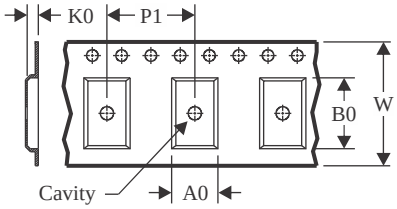
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS

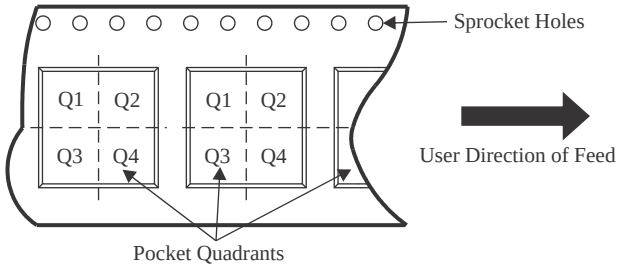


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL431ACDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431ACDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431ACDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431ACDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431ACDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431ACDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431ACDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431ACDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431ACDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431ACDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431ACDCKR	SC70	DCK	6	3000	180.0	8.4	2.41	2.41	1.2	4.0	8.0	Q3
TL431ACDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431ACPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431ACPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431ACPSR	SO	PS	8	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
TL431ACPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL431AIDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431AIDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431AIDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431AIDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AIDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431AIDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AIDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431AIDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AIDCKR	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431AIDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431AIDCKRG4	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431AIDCKT	SC70	DCK	6	250	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431AIDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431AIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431AIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431AIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431AQDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431AQDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431AQDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431AQDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431AQDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AQDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431AQDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AQDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431AQDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431AQDCKR	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431AQDCKT	SC70	DCK	6	250	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431AQDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431AQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431AQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431BCDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BCDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BCDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BCDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BCDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431BCDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BCDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431BCDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BCDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BCDCKR	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3

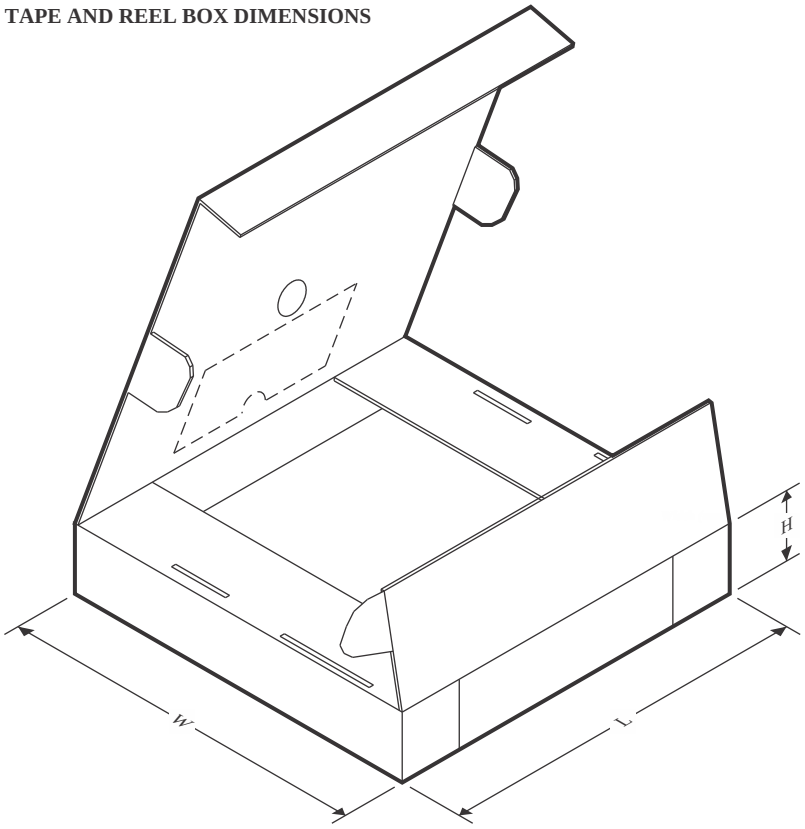
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL431BCDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431BCDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431BCDCKT	SC70	DCK	6	250	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431BCDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431BCDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431BCPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431BCPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431BIDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BIDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BIDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BIDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431BIDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BIDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431BIDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BIDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431BIDCKR	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431BIDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431BIDCKT	SC70	DCK	6	250	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431BIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431BIDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431BIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431BIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431BQDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BQDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BQDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BQDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431BQDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BQDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BQDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BQDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431BQDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431BQDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431BQDCKR	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431BQDCKT	SC70	DCK	6	250	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431BQDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431BQDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431BQDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431BQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431CDBVR	SOT-23	DBV	5	3000	178.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431CDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL431CDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431CDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431CDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431CDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431CDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431CDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431CDR-J	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431CPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431CPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431CPKE6	SOT-89	PK	3	1000	180.0	13.0	4.91	4.52	1.9	8.0	12.0	Q3
TL431IDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431IDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431IDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431IDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431IDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431IDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431IDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431IPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431IPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431QDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431QDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431QDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL431QDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431QDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431QDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL431QDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL431QDCKR	SC70	DCK	6	3000	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431QDCKR	SC70	DCK	6	3000	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431QDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431QDCKT	SC70	DCK	6	250	180.0	8.4	2.3	2.5	1.2	4.0	8.0	Q3
TL431QDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431QDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TL431QPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432ACDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432ACDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432ACDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432ACDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL432ACDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432ACDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432ACDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432ACDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AIDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AIDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AIDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL432AIDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AIDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432AIDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AIDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432AIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432AQDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AQDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AQDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AQDBVT	SOT-23	DBV	5	250	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AQDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AQDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL432AQDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AQDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432AQDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AQDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432AQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432AQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432BCDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432BCDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432BCDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BCDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432BCDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BCDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BCDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432BCDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BCPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432BCPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432BIDBZR	SOT-23	DBZ	3	3000	178.0	9.0	3.15	2.77	1.22	4.0	8.0	Q3
TL432BIDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BIDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BIDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432BIDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TL432BIDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432BIPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432BQDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BQDBZR1G4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432BQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432BQPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432CDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432CDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432CDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432CDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432CPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432CPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432IDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432IDBVR	SOT-23	DBV	5	3000	180.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432IDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432IDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432IDBZT	SOT-23	DBZ	3	250	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432IDBZT	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432IDBZTG4	SOT-23	DBZ	3	250	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432IPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432IPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	3.2	2.85	1.3	4.0	8.0	Q3
TL432QDBZR	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432QDBZRG4	SOT-23	DBZ	3	3000	180.0	8.4	2.9	3.35	1.35	4.0	8.0	Q3
TL432QPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432QPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL431ACDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431ACDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431ACDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431ACDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431ACDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431ACDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431ACDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431ACDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431ACDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431ACDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431ACDCKR	SC70	DCK	6	3000	183.0	183.0	20.0
TL431ACDR	SOIC	D	8	2500	340.5	336.1	25.0
TL431ACPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431ACPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431ACPSR	SO	PS	8	2000	353.0	353.0	32.0
TL431ACPWR	TSSOP	PW	8	2000	353.0	353.0	32.0
TL431AIDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431AIDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL431AIDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431AIDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431AIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431AIDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431AIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431AIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431AIDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431AIDCKR	SC70	DCK	6	3000	200.0	183.0	25.0
TL431AIDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431AIDCKRG4	SC70	DCK	6	3000	200.0	183.0	25.0
TL431AIDCKT	SC70	DCK	6	250	210.0	185.0	35.0
TL431AIDCKT	SC70	DCK	6	250	200.0	183.0	25.0
TL431AIDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431AIPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431AIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431AQDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431AQDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431AQDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431AQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431AQDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431AQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431AQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431AQDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431AQDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431AQDCKR	SC70	DCK	6	3000	200.0	183.0	25.0
TL431AQDCKT	SC70	DCK	6	250	210.0	185.0	35.0
TL431AQDCKT	SC70	DCK	6	250	200.0	183.0	25.0
TL431AQPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431AQPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431BCDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431BCDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431BCDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431BCDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431BCDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431BCDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431BCDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BCDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BCDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BCDCKR	SC70	DCK	6	3000	200.0	183.0	25.0
TL431BCDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431BCDCKT	SC70	DCK	6	250	200.0	183.0	25.0
TL431BCDCKT	SC70	DCK	6	250	210.0	185.0	35.0
TL431BCDR	SOIC	D	8	2500	353.0	353.0	32.0

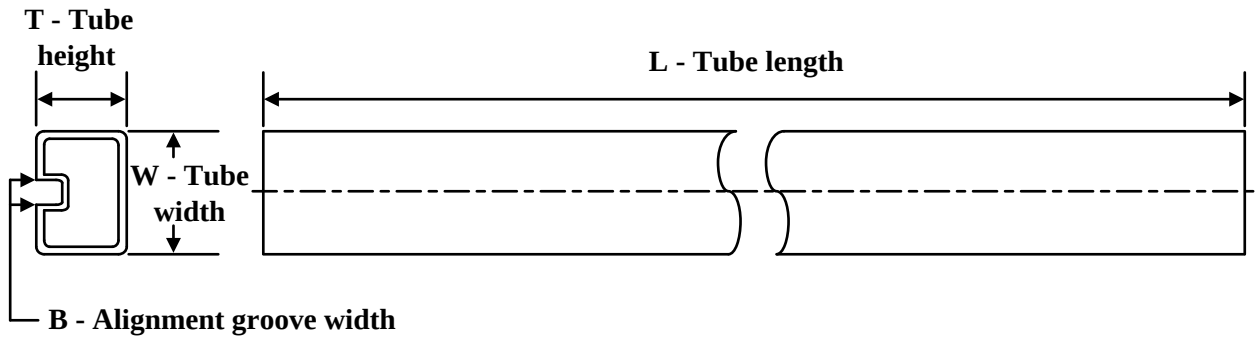
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL431BCDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431BCPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431BCPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431BIDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TL431BIDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431BIDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431BIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431BIDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431BIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BIDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BIDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431BIDCKR	SC70	DCK	6	3000	200.0	183.0	25.0
TL431BIDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431BIDCKT	SC70	DCK	6	250	210.0	185.0	35.0
TL431BIDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431BIDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431BIPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431BIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431BQDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431BQDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431BQDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431BQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431BQDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431BQDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431BQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BQDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431BQDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431BQDCKR	SC70	DCK	6	3000	200.0	183.0	25.0
TL431BQDCKT	SC70	DCK	6	250	210.0	185.0	35.0
TL431BQDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431BQDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431BQDR	SOIC	D	8	2500	340.5	336.1	25.0
TL431BQPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431CDBVR	SOT-23	DBV	5	3000	208.0	191.0	35.0
TL431CDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431CDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431CDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431CDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431CDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431CDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431CDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL431CDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431CDR-J	SOIC	D	8	2500	340.5	338.1	20.6
TL431CPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431CPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431CPKE6	SOT-89	PK	3	1000	182.0	182.0	20.0
TL431IDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431IDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431IDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431IDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431IDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431IDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431IPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431IPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL431QDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL431QDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL431QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431QDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL431QDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL431QDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431QDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431QDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL431QDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431QDCKR	SC70	DCK	6	3000	210.0	185.0	35.0
TL431QDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431QDCKT	SC70	DCK	6	250	210.0	185.0	35.0
TL431QDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431QDR	SOIC	D	8	2500	353.0	353.0	32.0
TL431QPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432ACDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432ACDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432ACDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432ACDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432ACDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432ACDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432ACDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432ACDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AIDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432AIDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432AIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL432AIDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL432AIDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432AIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AIDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432AIPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432AQDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432AQDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432AQDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL432AQDBVT	SOT-23	DBV	5	250	210.0	185.0	35.0
TL432AQDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432AQDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL432AQDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432AQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AQDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AQDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432AQPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432AQPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432BCDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432BCDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432BCDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BCDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BCDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BCDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432BCDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432BCDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432BCPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432BCPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432BIDBZR	SOT-23	DBZ	3	3000	180.0	180.0	18.0
TL432BIDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BIDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432BIDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432BIDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432BIPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432BIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432BQDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BQDBZR1G4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432BQPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432BQPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432CDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432CDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432CDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL432CDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432CPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432CPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432IDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432IDBVR	SOT-23	DBV	5	3000	210.0	185.0	35.0
TL432IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432IDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432IDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432IDBZT	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432IDBZTG4	SOT-23	DBZ	3	250	210.0	185.0	35.0
TL432IPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432IPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432QDBZR	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432QDBZRG4	SOT-23	DBZ	3	3000	210.0	185.0	35.0
TL432QPK	SOT-89	PK	3	1000	190.0	190.0	30.0
TL432QPK	SOT-89	PK	3	1000	340.0	340.0	38.0

TUBE



*All dimensions are nominal

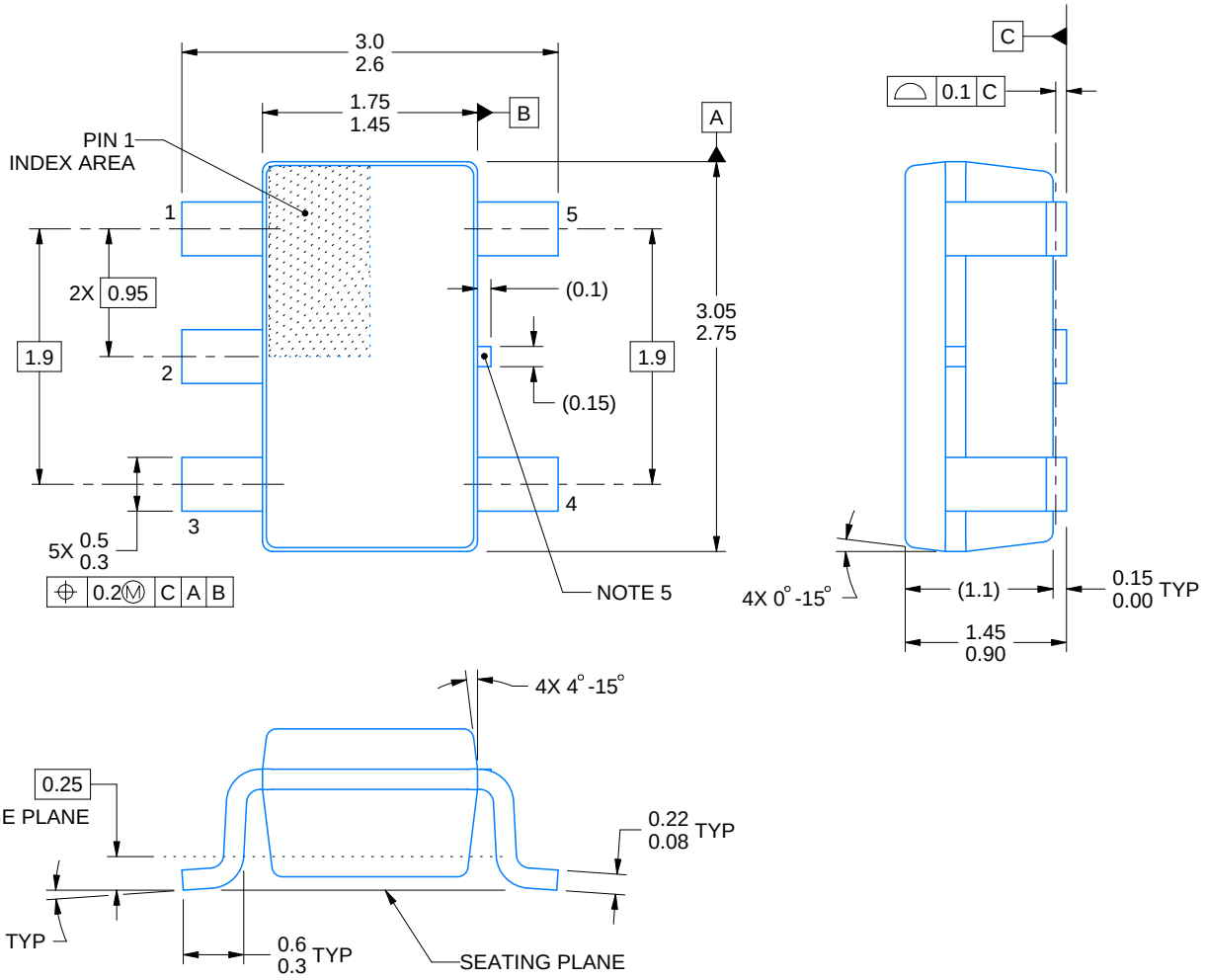
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
TL431ACD	D	SOIC	8	75	507	8	3940	4.32
TL431ACD.A	D	SOIC	8	75	507	8	3940	4.32
TL431ACP	P	PDIP	8	50	506	13.97	11230	4.32
TL431ACP.A	P	PDIP	8	50	506	13.97	11230	4.32
TL431AID	D	SOIC	8	75	507	8	3940	4.32
TL431AID.A	D	SOIC	8	75	507	8	3940	4.32
TL431BCD	D	SOIC	8	75	507	8	3940	4.32
TL431BCD.A	D	SOIC	8	75	507	8	3940	4.32
TL431BID	D	SOIC	8	75	507	8	3940	4.32
TL431BID.A	D	SOIC	8	75	507	8	3940	4.32
TL431BQD	D	SOIC	8	75	507	8	3940	4.32
TL431BQD.A	D	SOIC	8	75	507	8	3940	4.32
TL431CD	D	SOIC	8	75	507	8	3940	4.32
TL431CD.A	D	SOIC	8	75	507	8	3940	4.32
TL431ID	D	SOIC	8	75	507	8	3940	4.32
TL431ID.A	D	SOIC	8	75	507	8	3940	4.32
TL431QD	D	SOIC	8	75	507	8	3940	4.32
TL431QD.A	D	SOIC	8	75	507	8	3940	4.32

PACKAGE OUTLINE

DBV0005A

SOT-23 - 1.45 mm max height

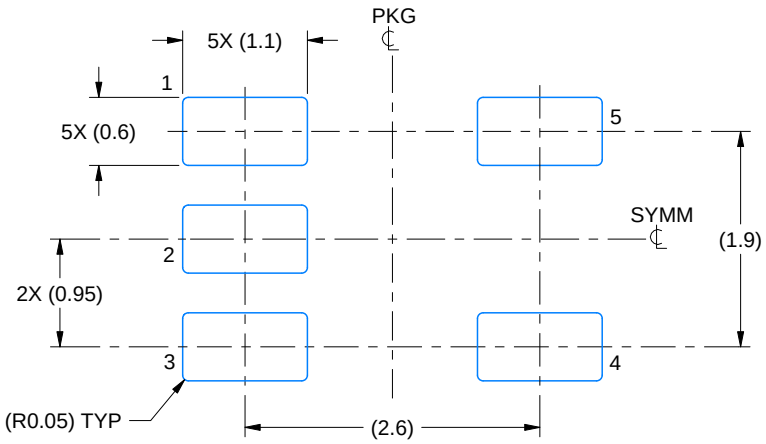
SMALL OUTLINE TRANSISTOR



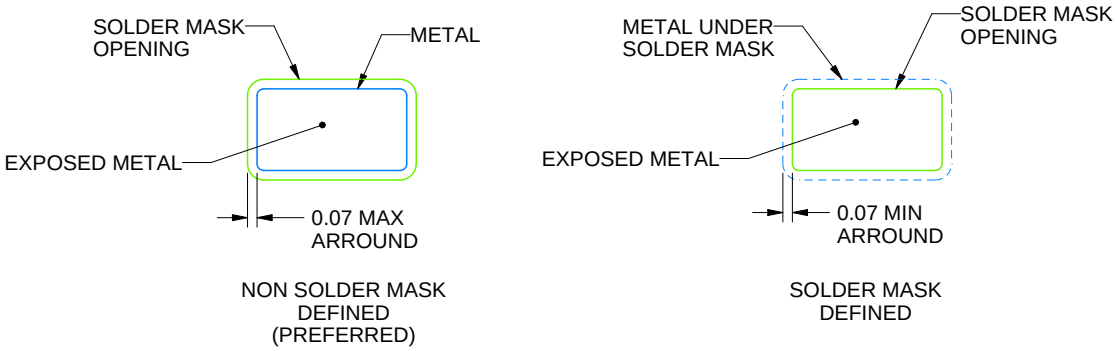
4214839/K 08/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Refernce JEDEC MO-178.
4. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25 mm per side.
5. Support pin may differ or may not be present.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:15X

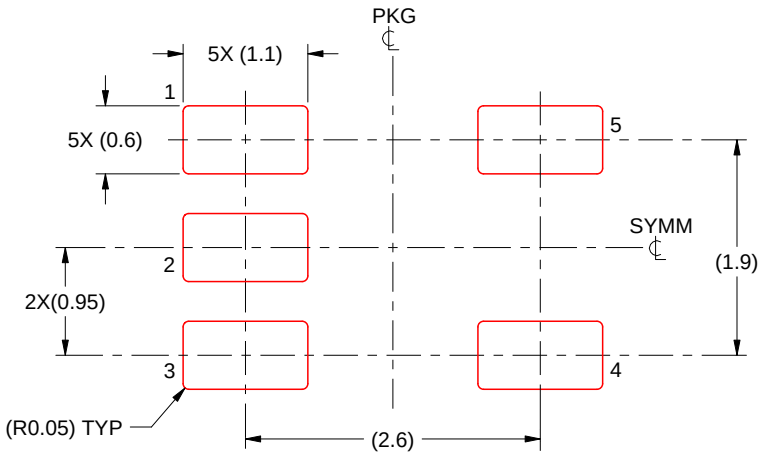


SOLDER MASK DETAILS

4214839/K 08/2024

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:15X

4214839/K 08/2024

NOTES: (continued)

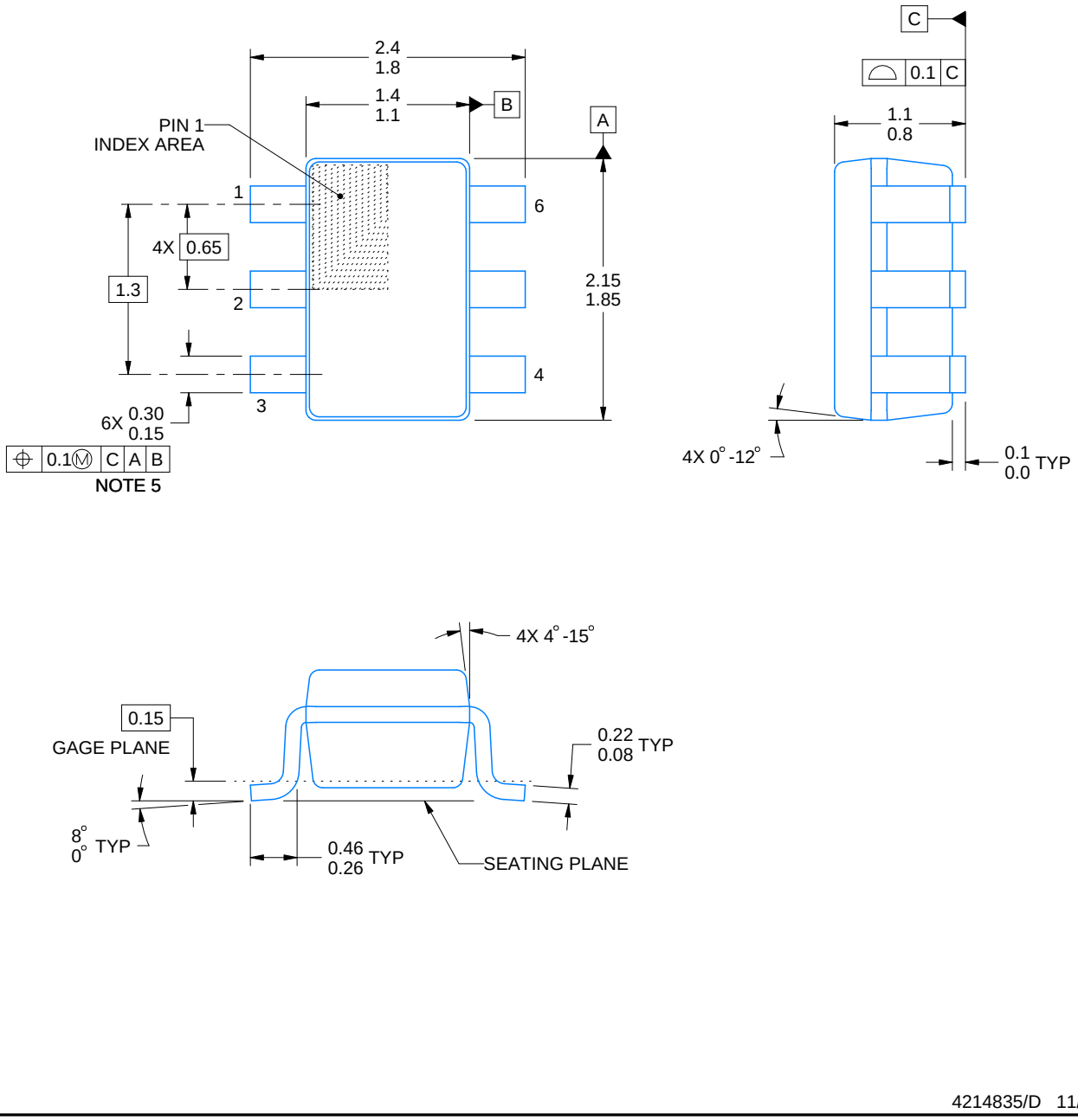
8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PACKAGE OUTLINE

DCK0006A

SOT - 1.1 max height

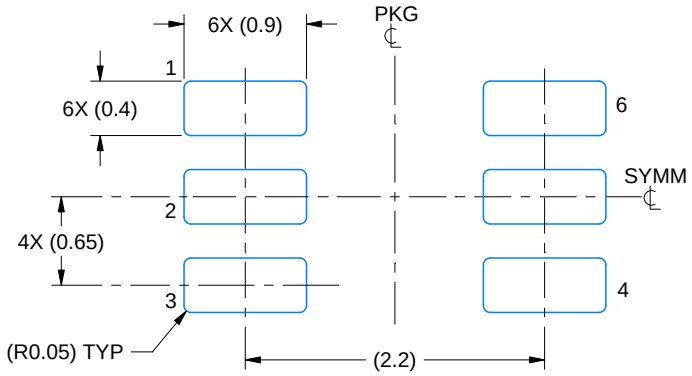
SMALL OUTLINE TRANSISTOR



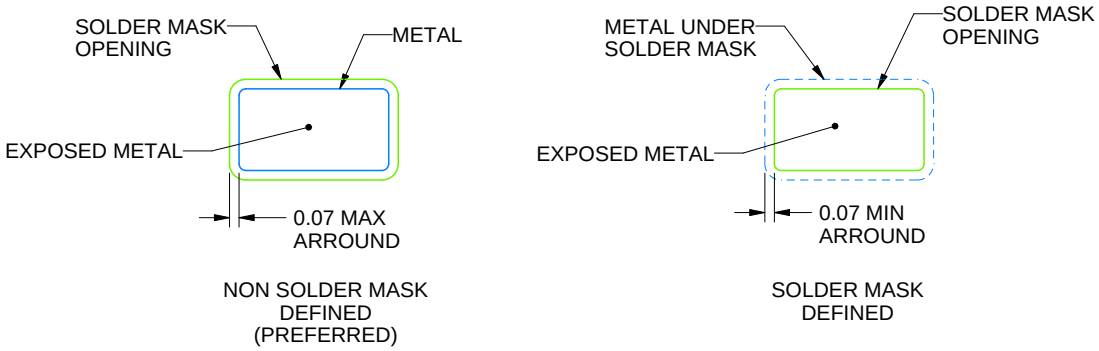
4214835/D 11/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
4. Falls within JEDEC MO-203 variation AB.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:18X

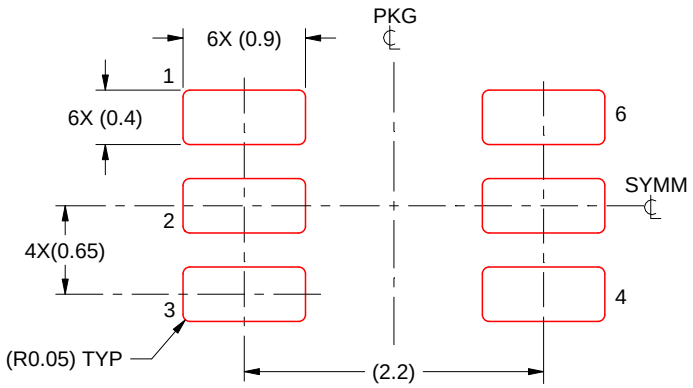


SOLDER MASK DETAILS

4214835/D 11/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:18X

4214835/D 11/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

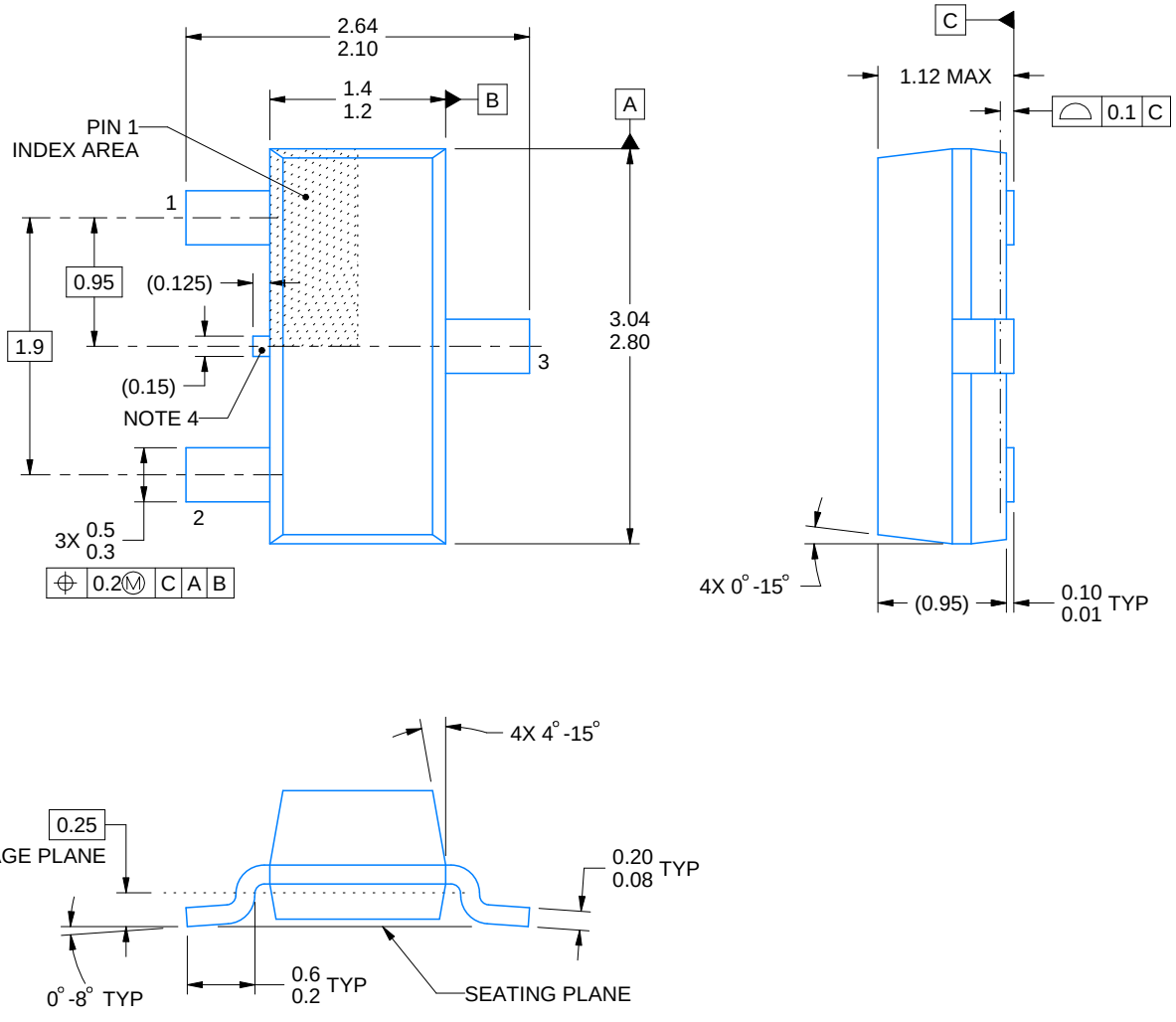
PACKAGE OUTLINE

DBZ0003A



SOT-23 - 1.12 mm max height

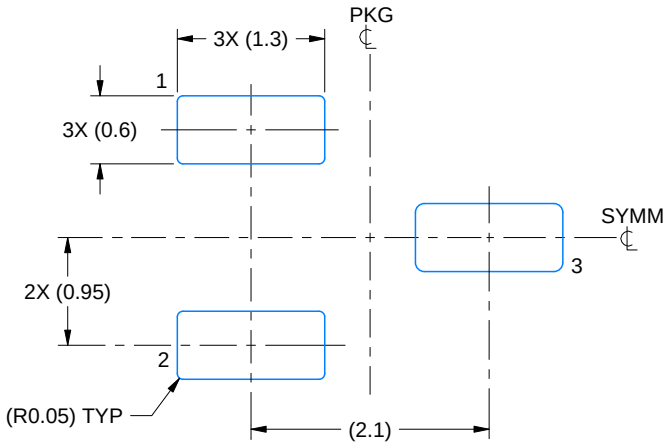
SMALL OUTLINE TRANSISTOR



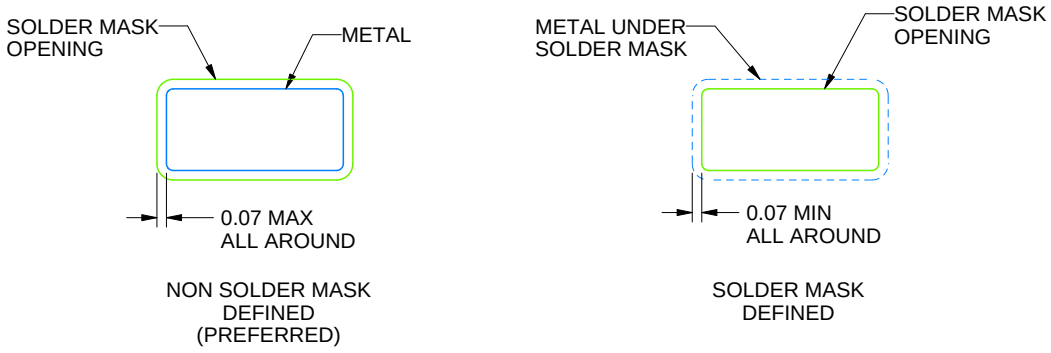
4214838/F 08/2024

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.
4. Support pin may differ or may not be present.
5. Body dimensions do not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.25mm per side



LAND PATTERN EXAMPLE
SCALE:15X

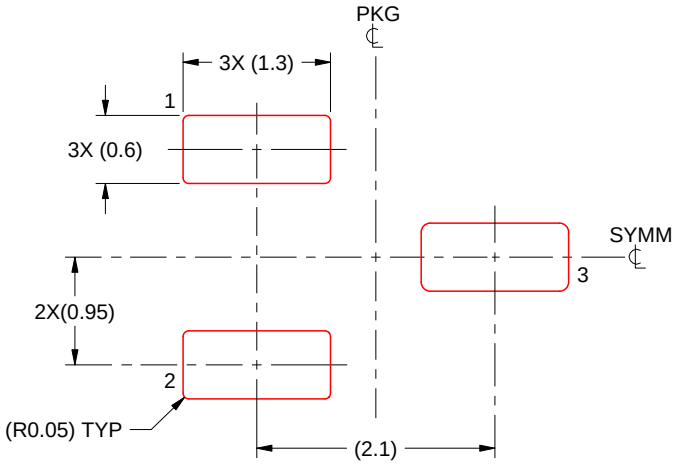


SOLDER MASK DETAILS

4214838/F 08/2024

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



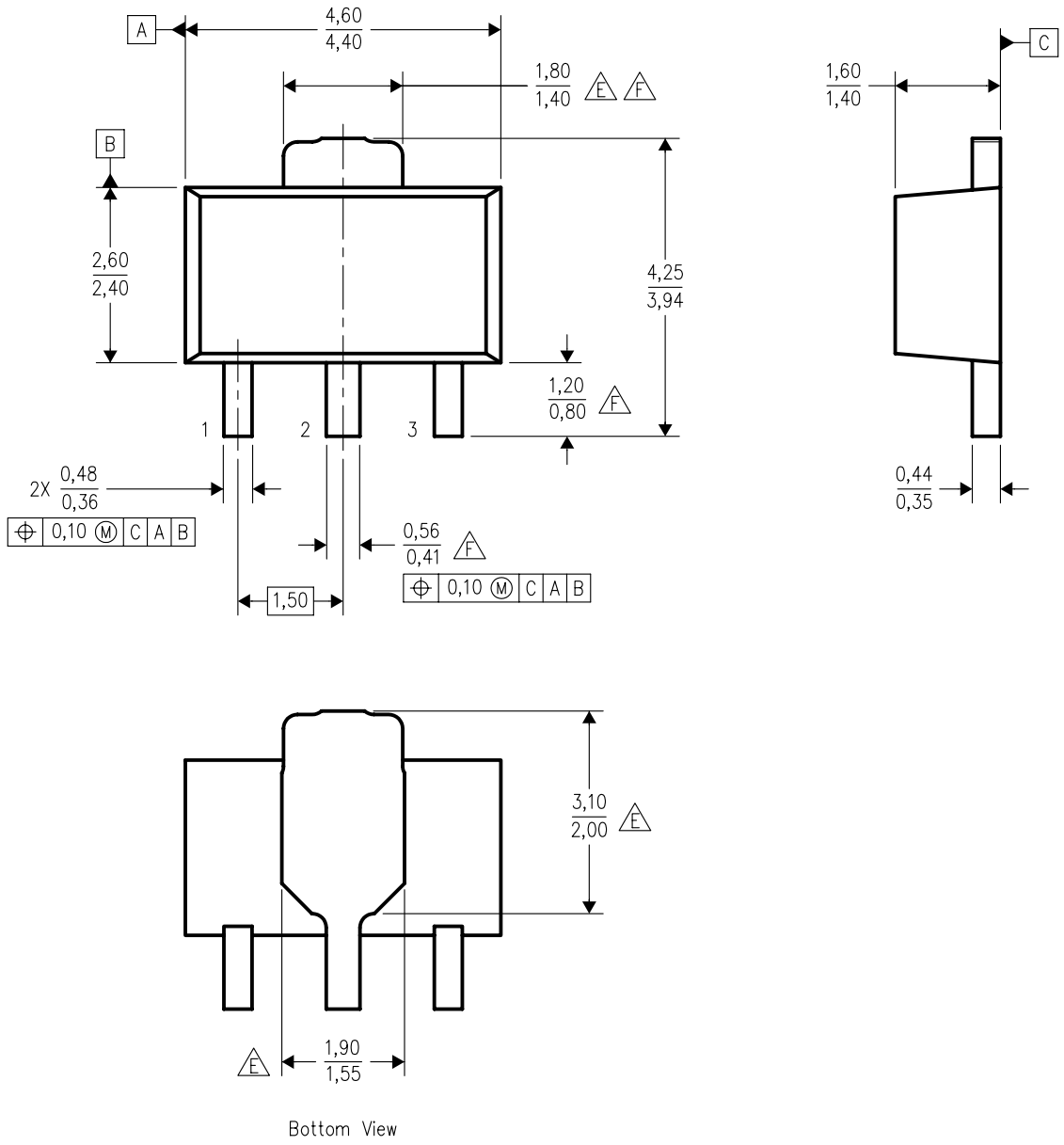
SOLDER PASTE EXAMPLE
BASED ON 0.125 THICK STENCIL
SCALE:15X

4214838/F 08/2024

NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

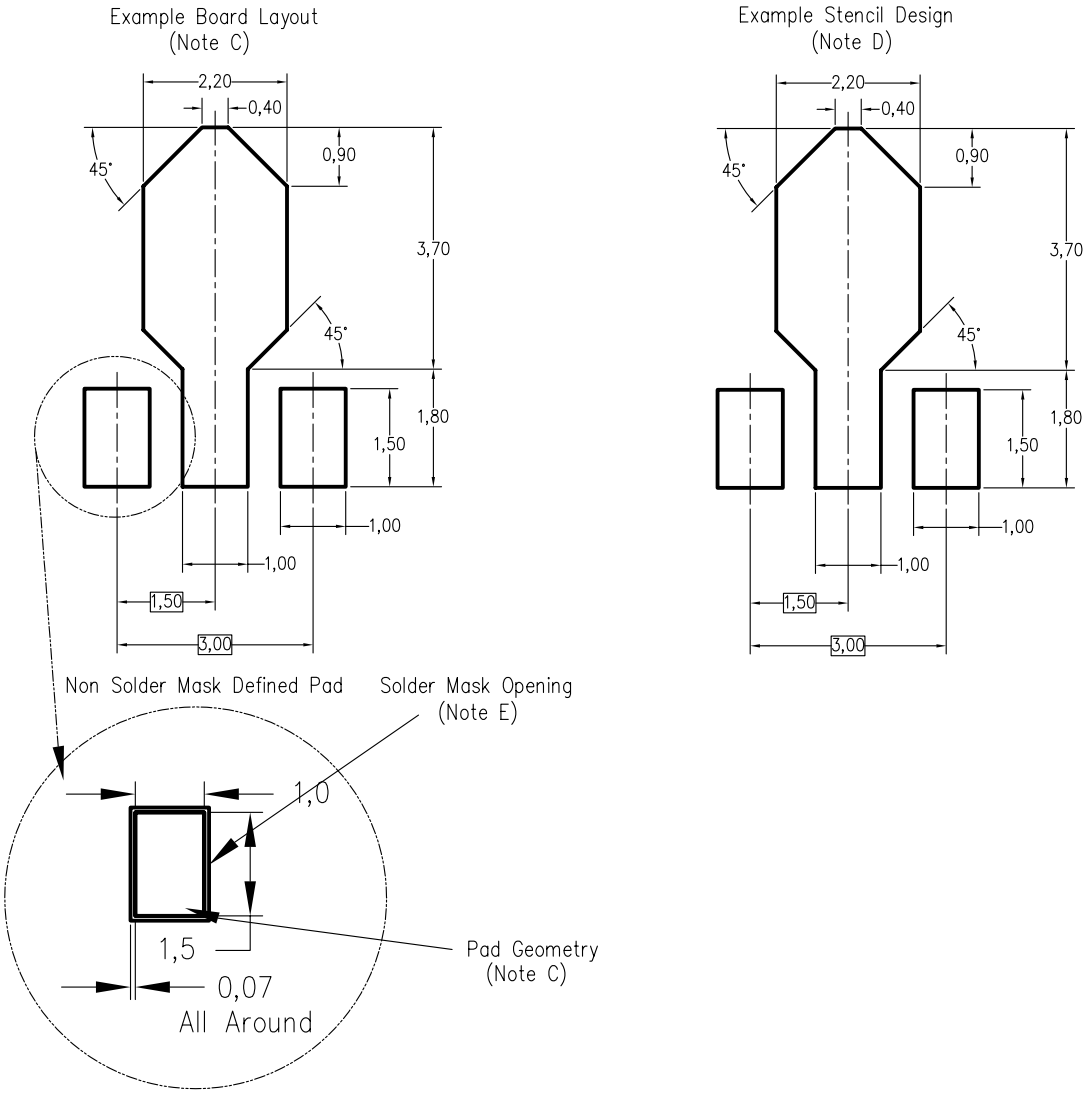
PK (R–PSSO–F3) PLASTIC SINGLE–IN–LINE PACKAGE



4040234/D 02/2006

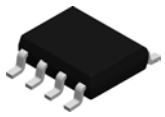
NOTES:
A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the tab.
D. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion not to exceed 0.15 per side.
E. Thermal pad contour optional within these dimensions.
F. Falls within JEDEC TO–243 variation AA, except minimum lead length, pin 2 minimum lead width, minimum tab width.

PK (R–PDSO–G3)



4208221/A 09/06

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

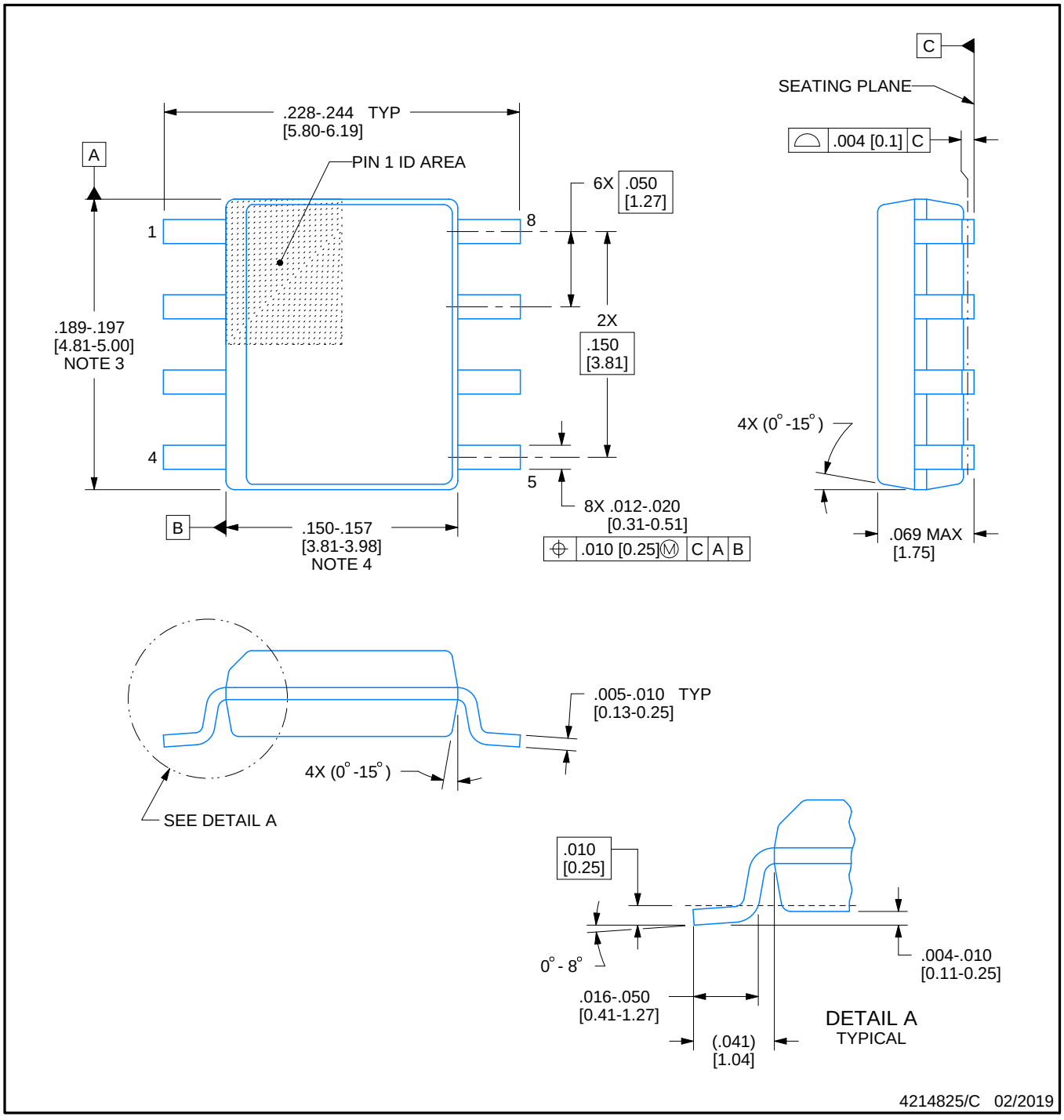


PACKAGE OUTLINE

D0008A

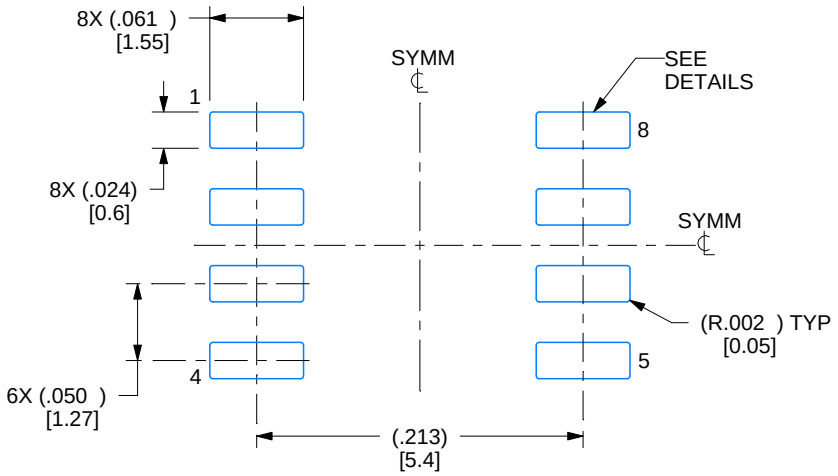
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

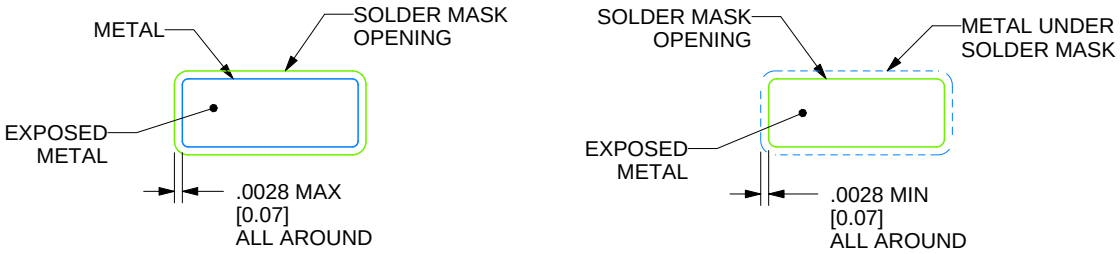


NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

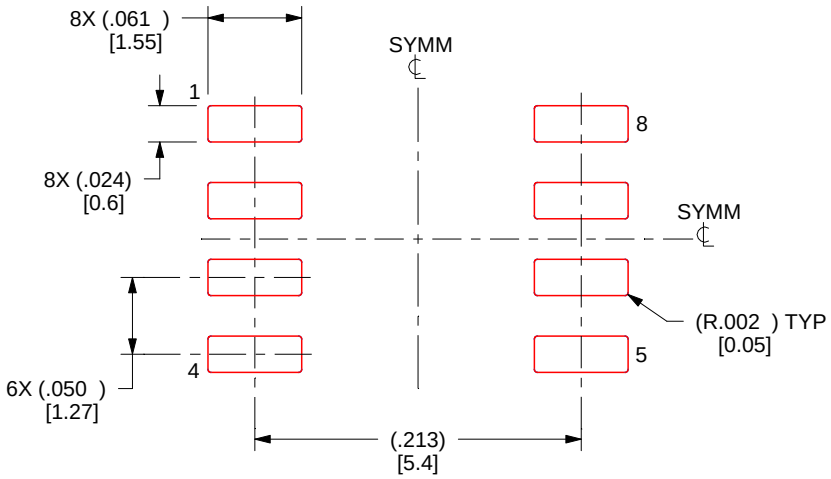
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

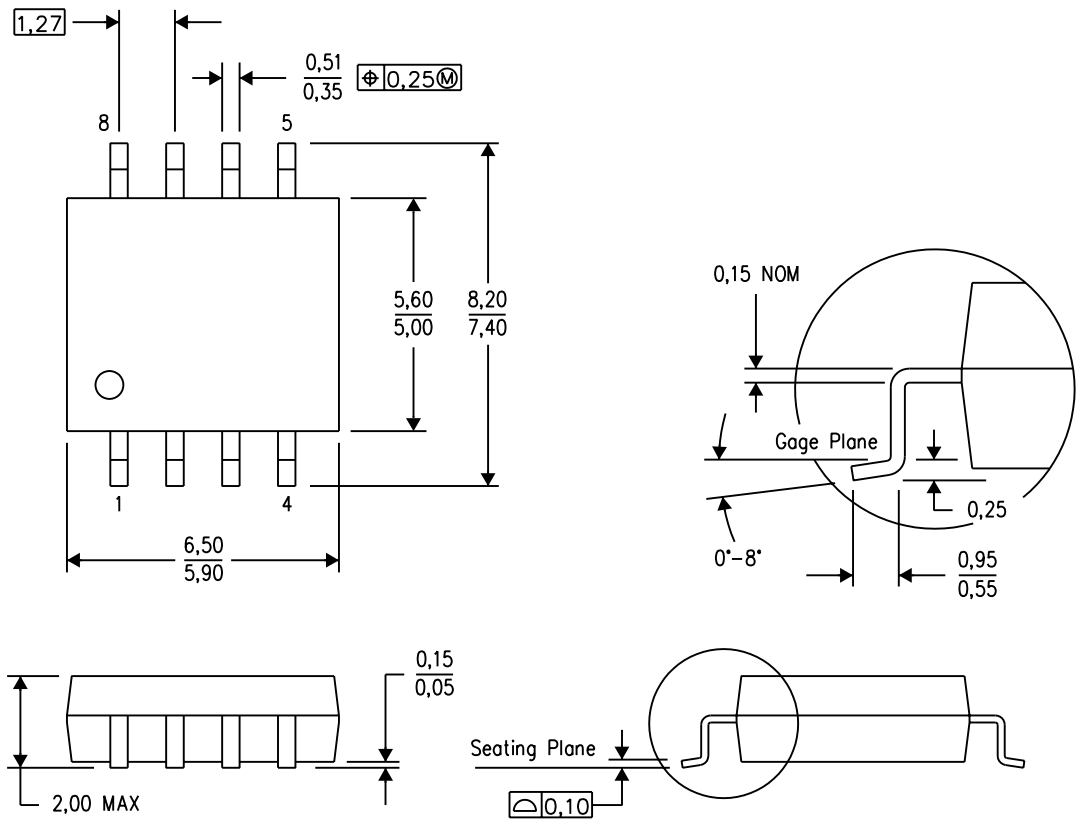
4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

MECHANICAL DATA

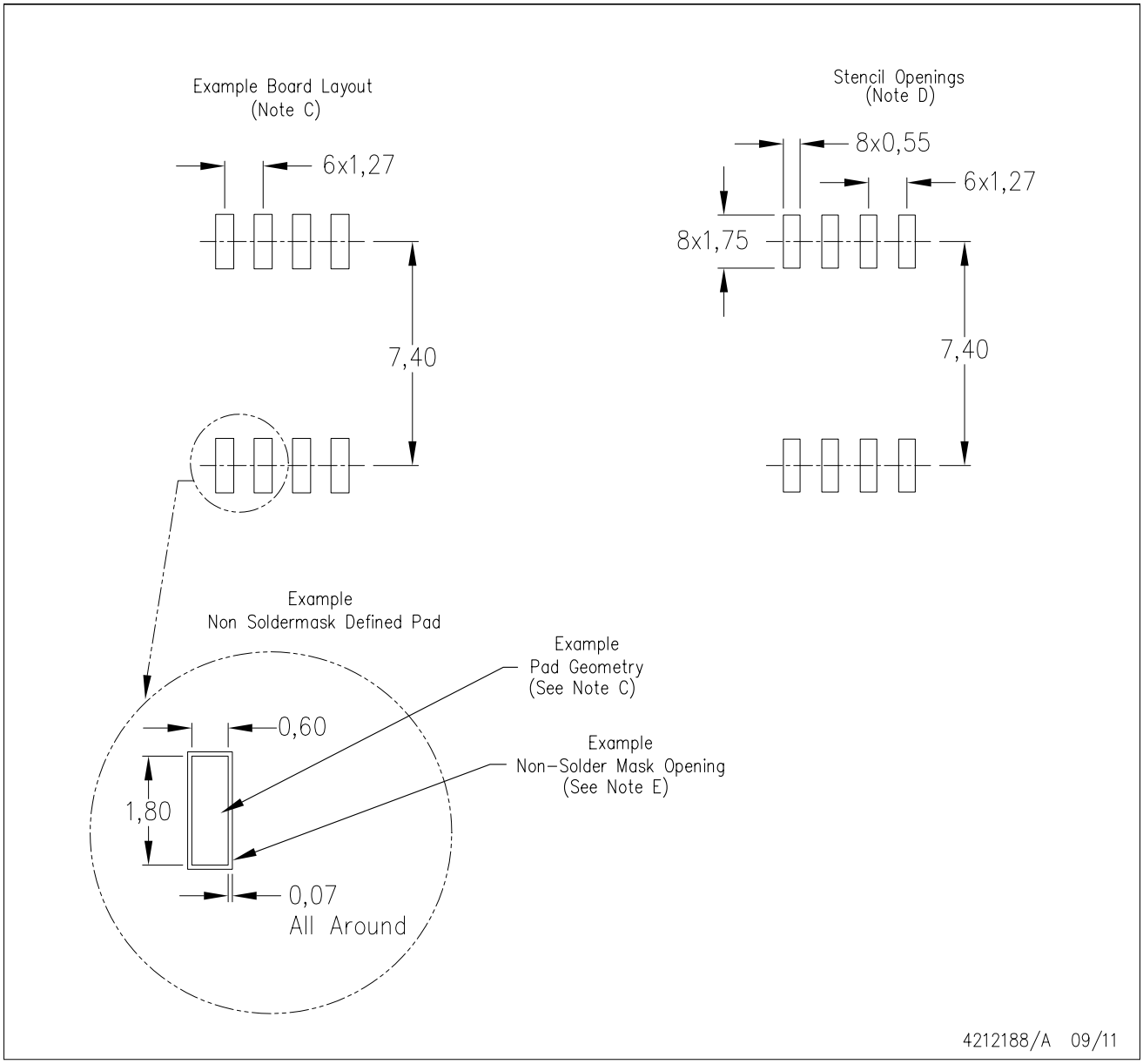
PS (R-PDSO-G8) **PLASTIC SMALL-OUTLINE PACKAGE**



4040063/C 03/03

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

PS (R–PDSO–G8) PLASTIC SMALL OUTLINE



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

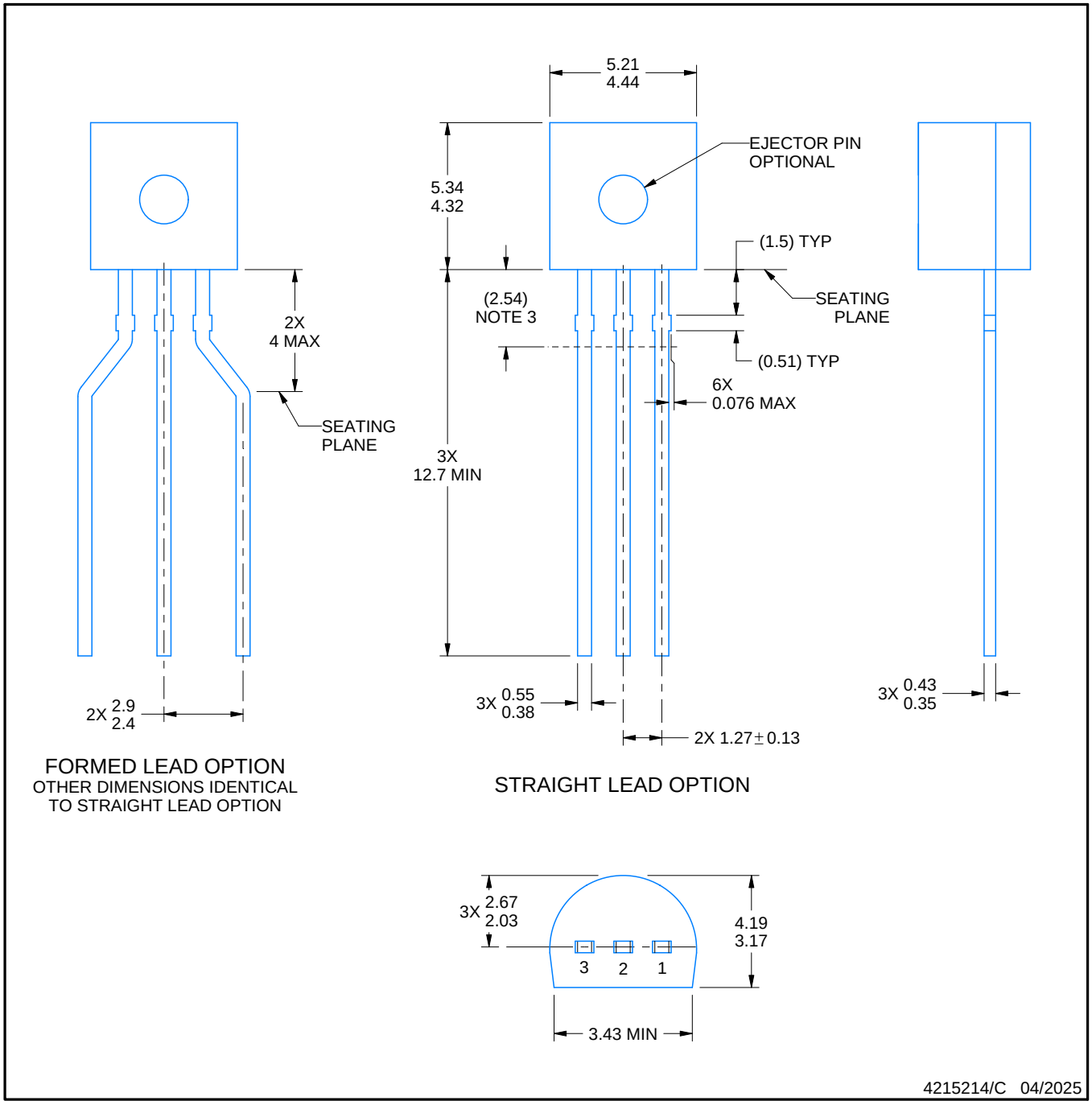
LP0003A



PACKAGE OUTLINE

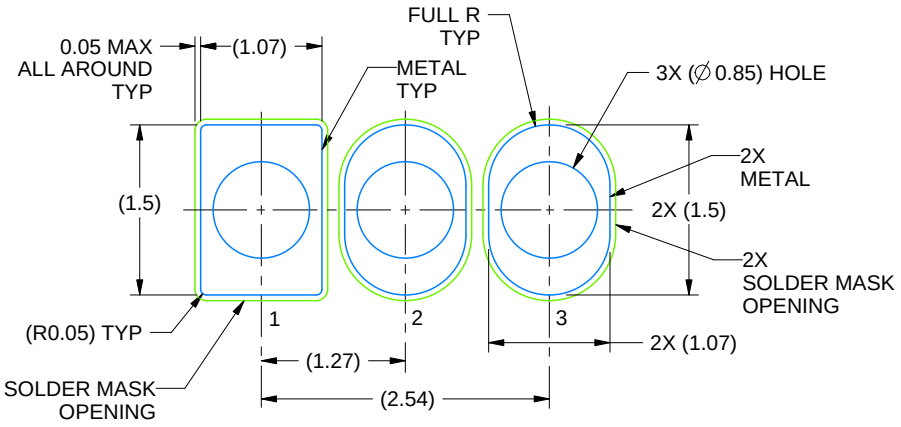
TO-92 - 5.34 mm max height

TO-92

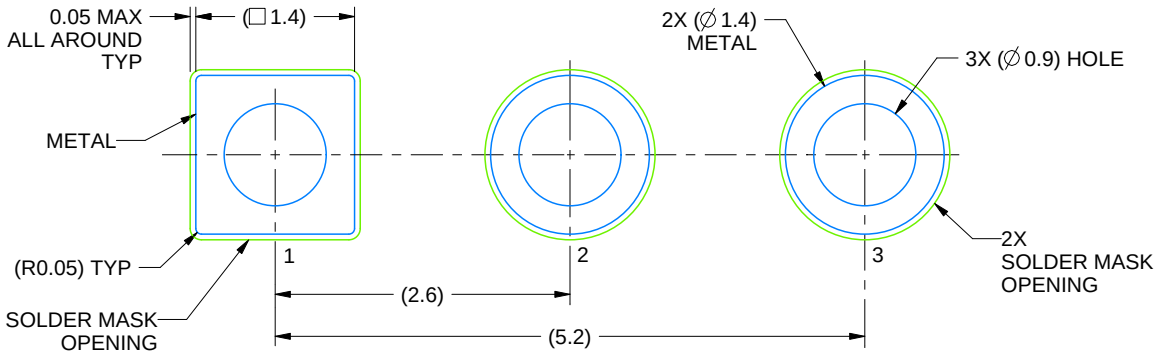


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Lead dimensions are not controlled within this area.
4. Reference JEDEC TO-226, variation AA.
5. Shipping method:
   a. Straight lead option available in bulk pack only.
   b. Formed lead option available in tape and reel or ammo pack.
   c. Specific products can be offered in limited combinations of shipping medium and lead options.
   d. Consult product folder for more information on available options.



LAND PATTERN EXAMPLE
STRAIGHT LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X



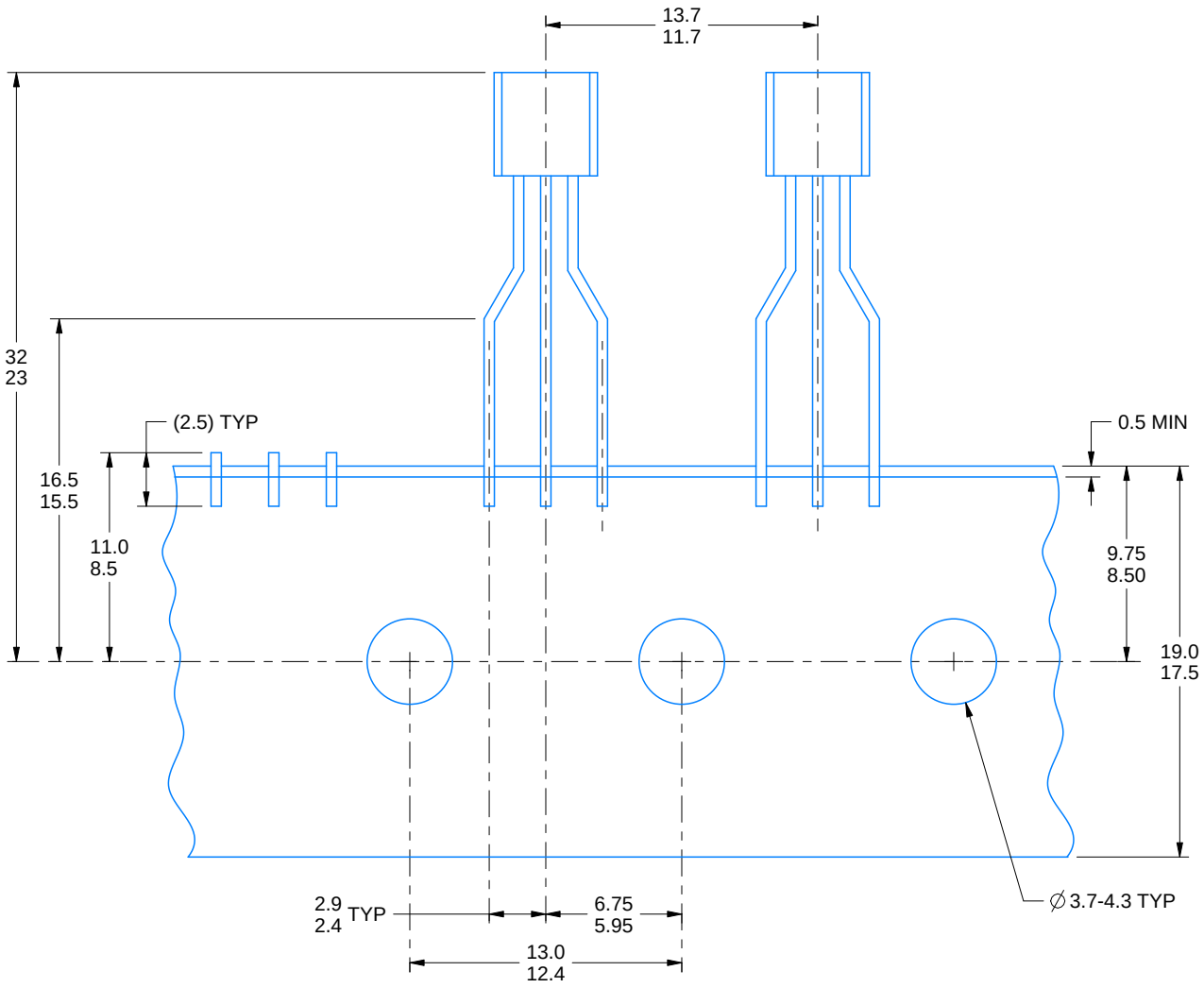
LAND PATTERN EXAMPLE
FORMED LEAD OPTION
NON-SOLDER MASK DEFINED
SCALE:15X

4215214/C 04/2025

LP0003A

TO-92 - 5.34 mm max height

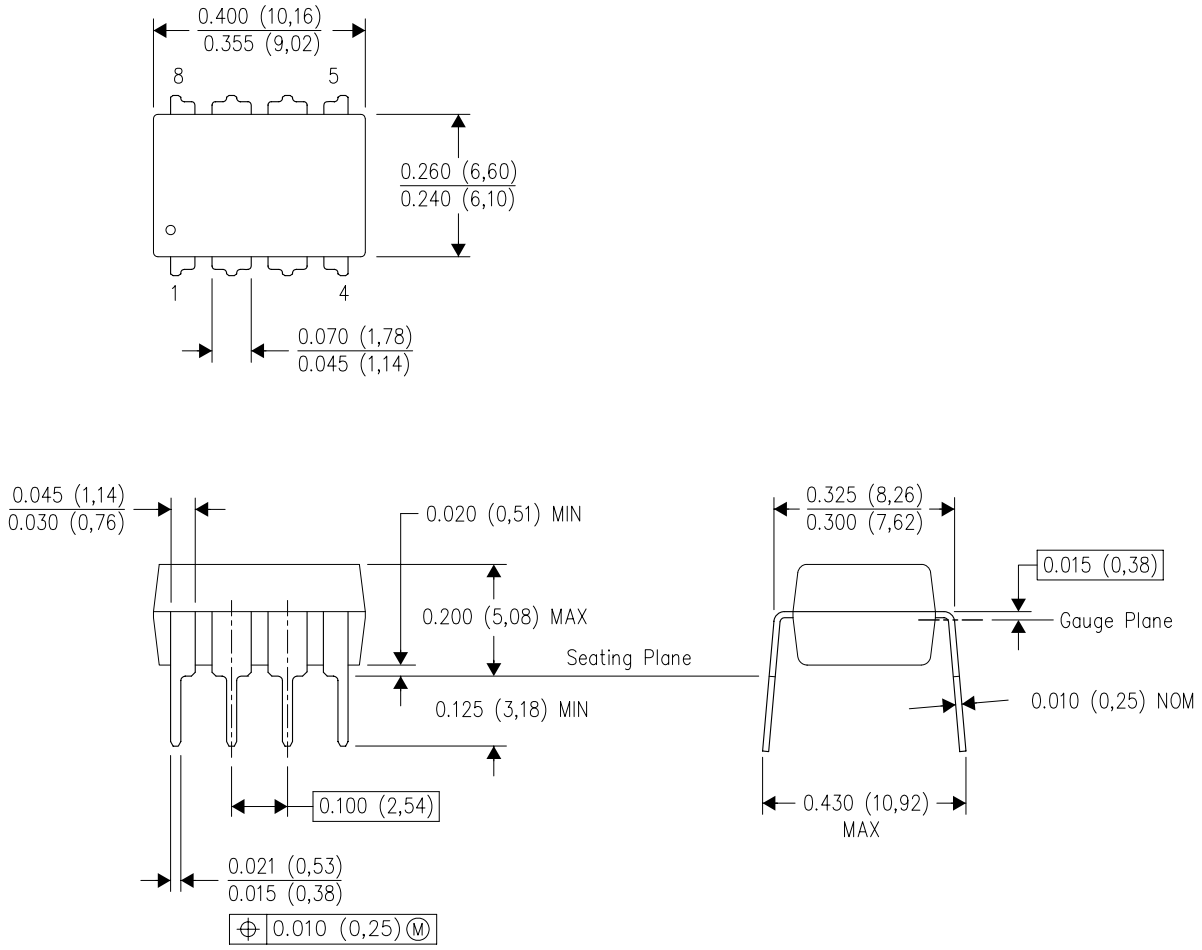
TO-92



FOR FORMED LEAD OPTION PACKAGE

4215214/C 04/2025

P (R–PDIP–T8) PLASTIC DUAL–IN–LINE PACKAGE



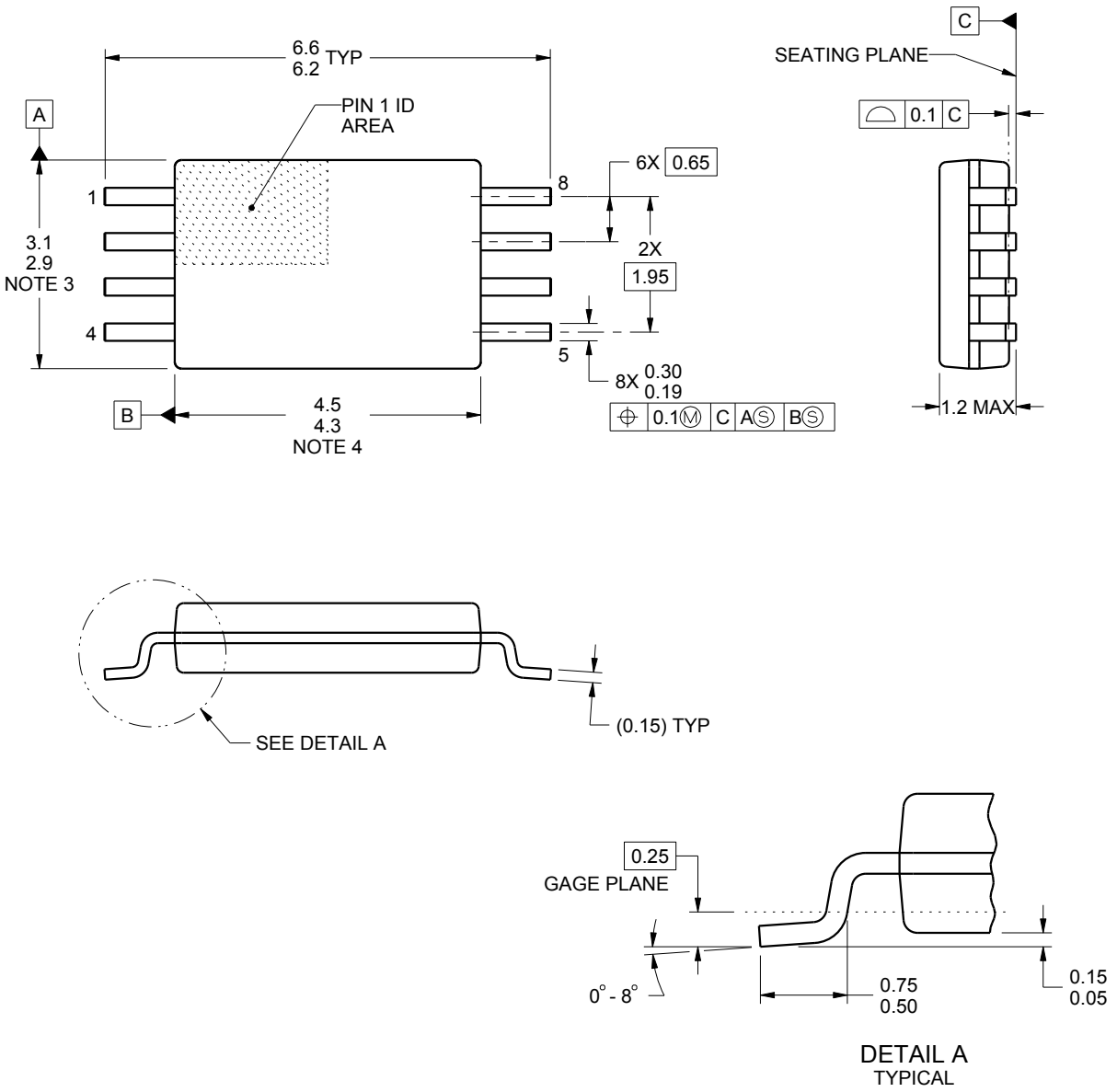
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001 variation BA.

PACKAGE OUTLINE

PW0008A

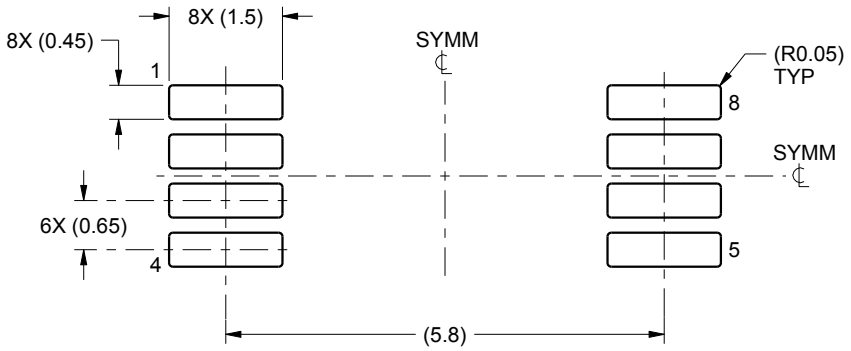
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

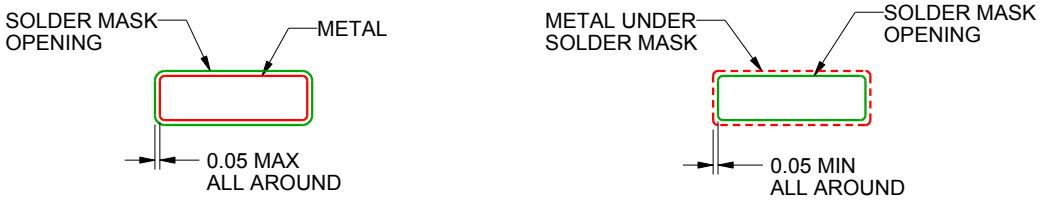


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153, variation AA.



LAND PATTERN EXAMPLE
SCALE:10X

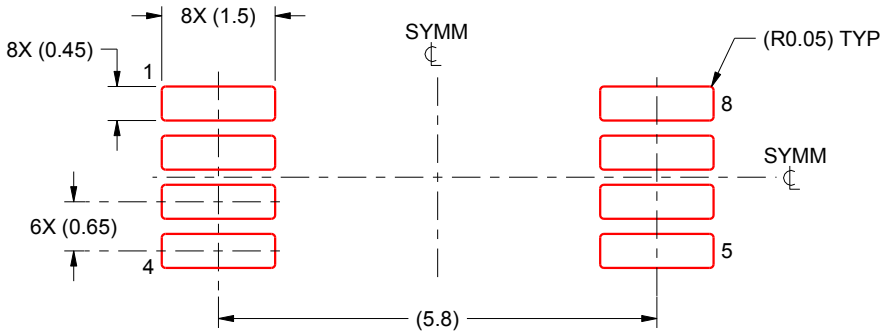


SOLDER MASK DETAILS
NOT TO SCALE

4221848/A 02/2015

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:10X

4221848/A 02/2015

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATASHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you fully indemnify TI and its representatives against any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale, TI’s General Quality Guidelines, or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products. Unless TI explicitly designates a product as custom or customer-specified, TI products are standard, catalog, general purpose devices.

TI objects to and rejects any additional or different terms you may propose.

Copyright © 2025, Texas Instruments Incorporated

Last updated 10/2025