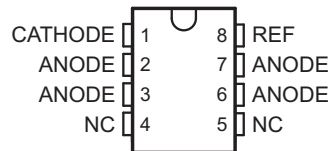


## PRECISION PROGRAMMABLE REFERENCE

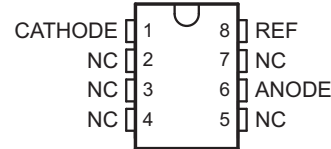
Check for Samples: [TL431](#), [TL431A](#), [TL431B](#), [TL432](#), [TL432A](#), [TL432B](#)

### FEATURES

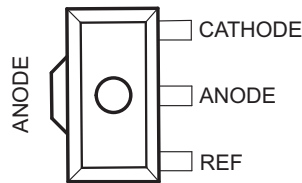
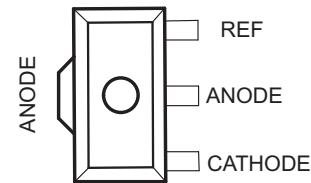
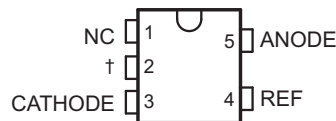
- Operation From  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- Reference Voltage Tolerance at  $25^{\circ}\text{C}$ 
  - 0.5% . . . B Grade
  - 1% . . . A Grade
  - 2% . . . Standard Grade
- Typical Temperature Drift (TL431B)
  - 6 mV (C Temp)
  - 14 mV (I Temp, Q Temp)
- Low Output Noise
- 0.2- $\Omega$  Typical Output Impedance
- Sink-Current Capability . . . 1 mA to 100 mA
- Adjustable Output Voltage . . . Vref to 36 V

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


NC – No internal connection

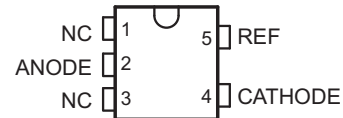
TL431, TL431A, TL431B . . . P (PDIP), PS (SOP),  
OR PW (TSSOP) PACKAGE  
(TOP VIEW)


NC – No internal connection

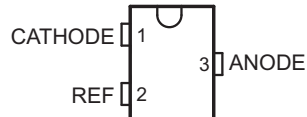
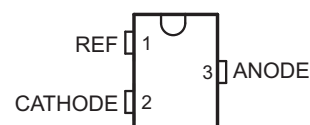
TL431, TL431A, TL431B . . . PK (SOT-89) PACKAGE  
(TOP VIEW)

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.

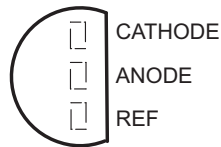
TL432, TL432A, TL432B . . . DBV (SOT-23-5) PACKAGE  
(TOP VIEW)


NC – No internal connection

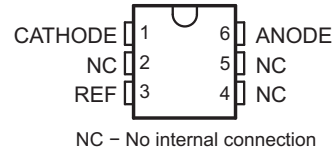
TL431, TL431A, TL431B . . . DBZ (SOT-23-3) PACKAGE  
(TOP VIEW)

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


Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

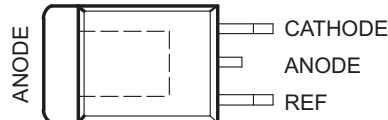
TL431, TL431A, TL431B . . . LP (TO-92/TO-226) PACKAGE  
(TOP VIEW)



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



TL431 . . . KTP (PowerFLEX /TO-252) PACKAGE  
(TOP VIEW)



## DESCRIPTION/ORDERING INFORMATION

The TL431 and TL432 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 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2  $\Omega$ . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacements for Zener diodes in many applications, such as onboard regulation, adjustable power supplies, and switching power supplies. The TL432 has exactly the same functionality and electrical specifications as the TL431, 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 vs temperature ensures 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.

**V<sub>ref</sub> TOLERANCE (25°C) = 2%**  
**TL431, TL432 ORDERING INFORMATION<sup>(1)</sup>**

T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
0°C to 70°C	PDIP (P)	Tube of 50	TL431CP	TL431CP
		SOIC (D)	Tube of 75	TL431CD
		Reel of 2500	TL431CDR	
	SOP (PS)	Reel of 2000	TL431CPSR	T431
	SOT-23-5 (DBV)	Reel of 3000	TL431CDBVR	T3C_
		Reel of 250	TL431CDBVT	
		Reel of 3000	TL432CDBVR	T4C_
		Reel of 250	TL432CDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431CDBZR	T3C_
		Reel of 250	TL431CDBZT	
		Reel of 3000	TL432CDBZR	T4C_
		Reel of 250	TL432CDBZT	
	SOT-89 (PK)	Reel of 1000	TL431CPK	43
			TL432CPK	2A
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431CLP	TL431C
		Ammo of 2000, formed lead	TL431CLPM	
Reel of 2000, formed lead		TL431CLPR		
TSSOP (PW)	Tube of 150	TL431CPW	T431	
	Reel of 2000	TL431CPWR		
-40°C to 85°C	PDIP (P)	Tube of 50	TL431IP	TL431IP
		SOIC (D)	Tube of 75	TL431ID
		Reel of 2500	TL431IDR	
	SOT-23-5 (DBV)	Reel of 3000	TL431IDBVR	T3I_
		Reel of 250	TL431IDBVT	
		Reel of 3000	TL432IDBVR	T4I_
		Reel of 250	TL432IDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431IDBZR	T3I_
		Reel of 250	TL431IDBZT	
		Reel of 3000	TL432IDBZR	T4I_
		Reel of 250	TL432IDBZT	
	SOT-89 (PK)	Reel of 1000	TL431IPK	3I
			TL432IPK	2B
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431ILP	TL431I
		Ammo of 2000, formed lead	TL431ILPM	
		Reel of 2000, formed lead	TL431ILPR	

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).
- (3) DBV/DBZ/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

$V_{ref}$  TOLERANCE (25°C) = 2%  
 TL431, TL432 ORDERING INFORMATION <sup>(1)</sup> (continued)

T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
-40°C to 125°C	SOT-23-5 (DBV)	Reel of 3000	TL431QDBVR	T3Q_
		Reel of 250	TL431QDBVT	
		Reel of 3000	TL432QDBVR	T4Q_
		Reel of 250	TL432QDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431QDBZR	T3Q_
		Reel of 250	TL431QDBZT	
		Reel of 3000	TL432QDBZR	T4Q_
		Reel of 250	TL432QDBZT	
	SOT-89 (PK)	Reel of 1000	TL431QPK	3Q
			TL432QPK	2C
	SC-70 (DCK)	Reel of 1000	TL431QDCKR	T6_
		Reel of 250	TL431QDCKT	

**V<sub>ref</sub> TOLERANCE (25°C) = 1%**  
**TL431A, TL432A ORDERING INFORMATION<sup>(1)</sup>**

T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
0°C to 70°C	PDIP (P)	Tube of 50	TL431ACP	TL431ACP
		SC-70 (DCK)	Reel of 3000	TL431ACDCKR
		Reel of 250	TL431ACDCKT	
	SOIC (D)	Tube of 75	TL431ACD	431AC
		Reel of 2500	TL431ACDR	
	SOP (PS)	Reel of 2000	TL431ACPSR	T431A
	SOT-23-5 (DBV)	Reel of 3000	TL431ACDBVR	TAC_
		Reel of 250	TL431ACDBVT	
		Reel of 3000	TL432ACDBVR	T4B_
		Reel of 250	TL432ACDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431ACDBZR	TAC_
		Reel of 250	TL431ACDBZT	
		Reel of 3000	TL432ACDBZR	T4B_
		Reel of 250	TL432ACDBZT	
	SOT-89 (PK)	Reel of 1000	TL431ACPK	4A
			TL432ACPK	2D
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431ACL	TL431AC
		Ammo of 2000, formed lead	TL431ACLPM	
Reel of 2000, formed lead		TL431ACLPR		
Reel of 2000, formed lead		TL431ACLPRE3		
TSSOP (PW)	Tube of 150	TL431ACPW	T431A	
	Reel of 2000	TL431ACPWR		
-40°C to 85°C	PDIP (P)	Tube of 50	TL431AIP	TL431AIP
		SC-70 (DCK)	Reel of 3000	TL431AIDCKR
		Reel of 250	TL431AIDCKT	
	SOIC (D)	Tube of 75	TL431AID	431AI
		Reel of 2500	TL431AIDR	
	SOT-23-5 (DBV)	Reel of 3000	TL431AIDBVR	TAI_
		Reel of 250	TL431AIDBVT	
		Reel of 3000	TL432AIDBVR	T4A_
		Reel of 250	TL432AIDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431AIDBZR	TAI_
		Reel of 250	TL431AIDBZT	
		Reel of 3000	TL432AIDBZR	T4A_
		Reel of 250	TL432AIDBZT	
	SOT-89 (PK)	Reel of 1000	TL431AIPK	4B
			TL432AIPK	2E
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431AILP	TL431AI
		Ammo of 2000, formed lead	TL431AILPM	
		Reel of 2000, formed lead	TL431AILPR	

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).

(2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).

(3) DBV/DBZ/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

$V_{ref}$  TOLERANCE (25°C) = 1%  
 TL431A, TL432A ORDERING INFORMATION <sup>(1)</sup> (continued)

$T_A$	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
-40°C to 125°C	SOT-23-5 (DBV)	Reel of 3000	TL431AQDBVR	TAQ_
		Reel of 250	TL431AQDBVT	
		Reel of 3000	TL432AQDBVR	T4D_
		Reel of 250	TL432AQDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431AQDBZR	TAQ_
		Reel of 250	TL431AQDBZT	
		Reel of 3000	TL432AQDBZR	T4D_
		Reel of 250	TL432AQDBZT	
	SOT-89 (PK)	Reel of 1000	TL431AQP	4D
			TL432AQP	2F
	SC-70 (PK)	Reel of 1000	TL431AQDCKR	T7_
		Reel of 250	TL431AQDCKT	

**V<sub>ref</sub> TOLERANCE (25°C) = 0.5%**  
**TL431B, TL432B ORDERING INFORMATION<sup>(1)</sup>**

T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
0°C to 70°C	PDIP (P)	Tube of 50	TL431BCP	TL431BCP
	SC-70 (DCK)	Reel of 3000	TL431BCDCKR	T2_
		Reel of 250	TL431BCDCKT	
	SOIC (D)	Tube of 75	TL431BCD	T431B
		Reel of 2500	TL431BCDR	
	SOP (PS)	Reel of 2000	TL431BCPSR	TL431B
	SOT-23-5 (DBV)	Reel of 3000	TL431BCDBVR	T3G_
		Reel of 250	TL431BCDBVT	
		Reel of 3000	TL432BCDBVR	TBC_
		Reel of 250	TL432BCDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431BCDBZR	T3G_
		Reel of 250	TL431BCDBZT	
		Reel of 3000	TL432BCDBZR	TBC_
		Reel of 250	TL432BCDBZT	
	SOT-89 (PK)	Reel of 1000	TL431BCPK	4C
			TL432BCPK	2G
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431BCLP	TL431B
		Ammo of 2000, formed lead	TL431BCLPM	
		Reel of 2000, formed lead	TL431BCLPR	
	TSSOP (PW)	Tube of 150	TL431BCPW	T431B
Reel of 2000		TL431BCPWR		
-40°C to 85°C	PDIP (P)	Tube of 50	TL431BIP	TL431BIP
	SC-70 (DCK)	Reel of 3000	TL431BIDCKR	T3_
		Reel of 250	TL431BIDCKT	
	SOIC (D)	Tube of 75	TL431BID	Z431B
		Reel of 2500	TL431BIDR	
	SOT-23-5 (DBV)	Reel of 3000	TL431BIDBVR	T3F_
		Reel of 250	TL431BIDBVT	
		Reel of 3000	TL432BIDBVR	T4F_
		Reel of 250	TL432BIDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431BIDBZR	T3F_
		Reel of 250	TL431BIDBZT	
		Reel of 3000	TL432BIDBZR	T4F_
		Reel of 250	TL432BIDBZT	
	SOT-89 (PK)	Reel of 1000	TL431BIPK	4I
			TL432BIPK	2H
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431BILP	Z431B
Ammo of 2000, formed lead		TL431BILPM		
Reel of 2000, formed lead		TL431BILPR		

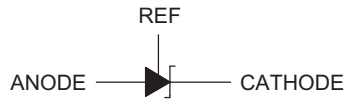
- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at [www.ti.com](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://www.ti.com/packaging).
- (3) DBV/DBZ/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

**V<sub>ref</sub> TOLERANCE (25°C) = 0.5%**  
**TL431B, TL432B ORDERING INFORMATION <sup>(1)</sup> (continued)**

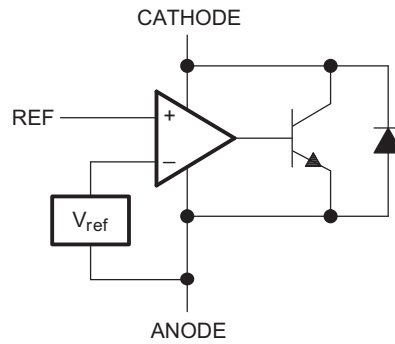
T <sub>A</sub>	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
-40°C to 125°C	SOIC (D)	Tube of 75	TL431BQD	T431BQ
		Reel of 2500	TL431BQDR	
	SOT-23-5 (DBV)	Reel of 3000	TL431BQDBVR	T3H_
		Reel of 250	TL431BQDBVT	
		Reel of 3000	TL432BQDBVR	T4H_
		Reel of 250	TL432BQDBVT	
	SOT-23-3 (DBZ)	Reel of 3000	TL431BQDBZR	T3H_
		Reel of 250	TL431BQDBZT	
		Reel of 3000	TL432BQDBZR	T4H_
		Reel of 250	TL432BQDBZT	
	SOT-89 (PK)	Reel of 1000	TL431BQPK	3H
			TL432BQPK	2J
	TO-226/TO-92 (LP)	Bulk of 1000, straight lead	TL431BQLP	T431BQ
		Ammo of 2000, formed lead	TL431BQLPM	
		Reel of 2000, formed lead	TL431BQLPR	
	SC-70 (DCK)	Reel of 1000	TL431BQDCKR	T8_
Reel of 250		TL431BQDCKT		



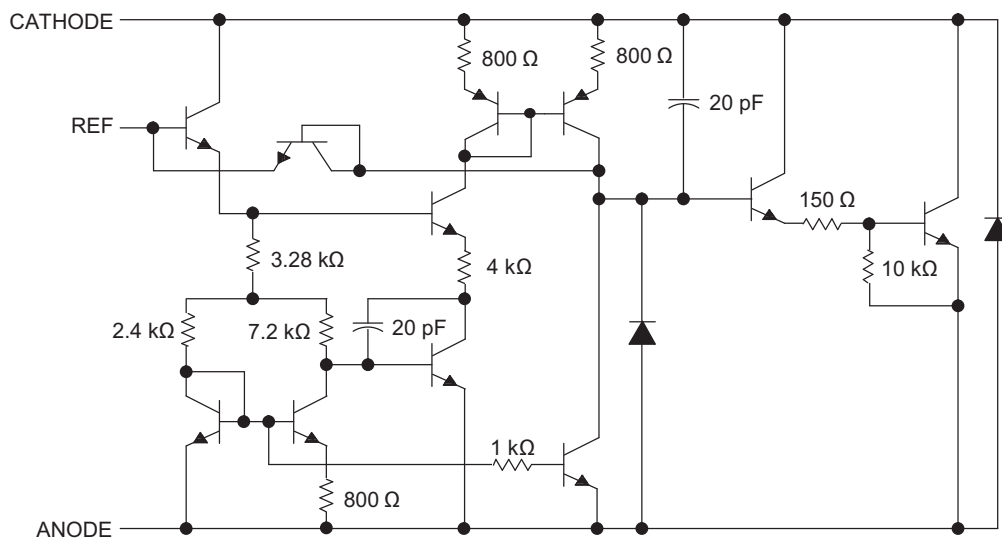
**SYMBOL**



**FUNCTIONAL BLOCK DIAGRAM**



**EQUIVALENT SCHEMATIC**



NOTE: All component values are nominal.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

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

		MIN	MAX	UNIT
$V_{KA}$	Cathode voltage <sup>(2)</sup>		37	V
$I_{KA}$	Continuous cathode current range	-100	150	mA
$I_{I(ref)}$	Reference input current range	-0.05	10	mA
$T_J$	Operating virtual junction temperature		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, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. 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.

## PACKAGE THERMAL DATA<sup>(1)</sup>

PACKAGE	BOARD	$\theta_{JC}$	$\theta_{JA}$
PDIP (P)	High K, JESD 51-7	57°C/W	85°C/W
SC-70 (DCK)	High K, JESD 51-7	259°C/W	87°C/W
SOIC (D)	High K, JESD 51-7	39°C/W	97°C/W
SOP (PS)	High K, JESD 51-7	46°C/W	95°C/W
SOT-89 (PK)	High K, JESD 51-7	9°C/W	52°C/W
SOT-23-5 (DBV)	High K, JESD 51-7	131°C/W	206°C/W
SOT-23-3 (DBZ)	High K, JESD 51-7	76°C/W	206°C/W
TO-92 (LP)	High K, JESD 51-7	55°C/W	140°C/W
TSSOP (PW)	High K, JESD 51-7	65°C/W	149°C/W

- (1) Maximum power dissipation is a function of  $T_{J(max)}$ ,  $\theta_{JA}$ , 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.

## RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
$V_{KA}$	Cathode voltage	$V_{ref}$	36	V
$I_{KA}$	Cathode current	1	100	mA
$T_A$	Operating free-air temperature	TL43xxC	0	70
		TL43xxI	-40	85
		TL43xxQ	-40	125

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

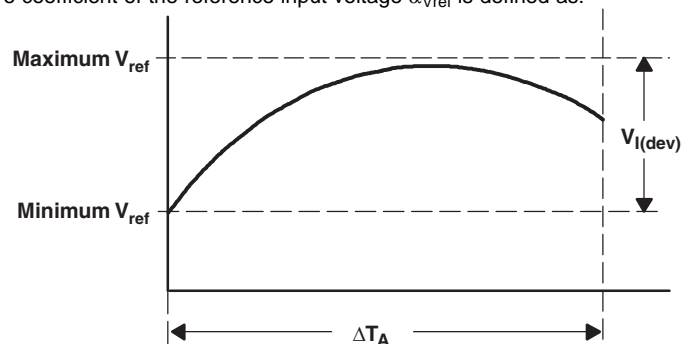
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431C, TL432C			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C to } 70^\circ\text{C}$	SOT23-3 and TL432 devices	6	16	mV
				All other devices	4	25	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

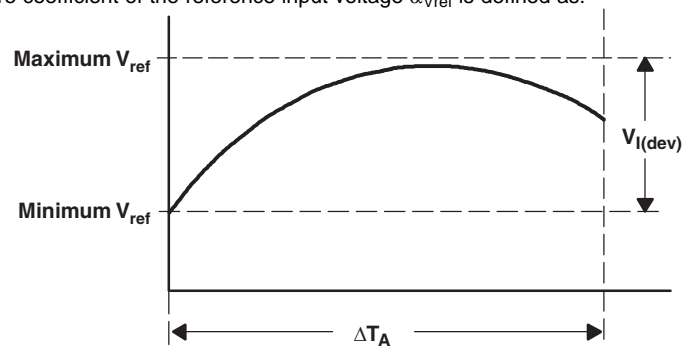
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431, TL432I			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}},$ $I_{\text{KA}} = 10 \text{ mA},$ $T_A = 0^\circ\text{C to } 70^\circ\text{C}$	SOT23-3 and TL432 devices	14	34	mV
				All other devices	5	50	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty,$ $T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$   
which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

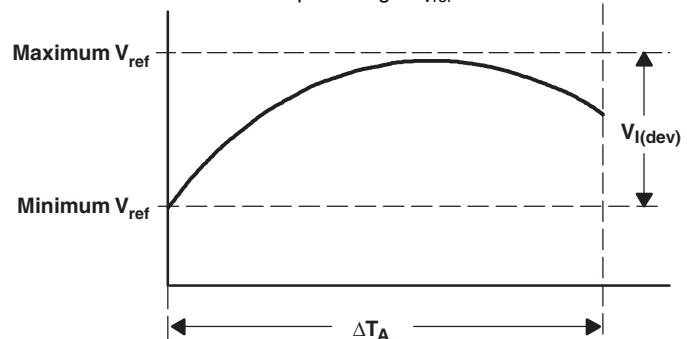
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431Q, TL432Q			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			mV	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

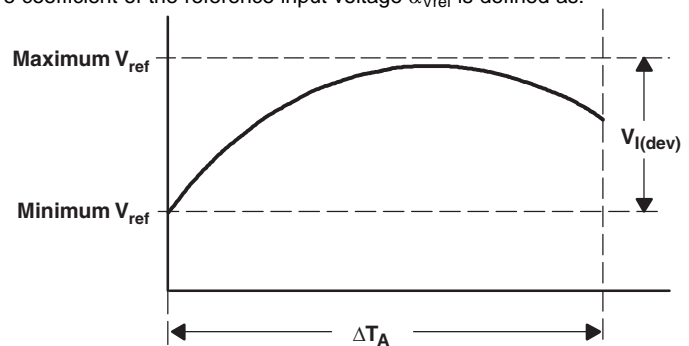
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431AC, TL432AC			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}},$ $I_{\text{KA}} = 10 \text{ mA},$ $T_A = 0^\circ\text{C to } 70^\circ\text{C}$	SOT23-3 and TL432 devices	6	16	mV
				All other devices	4	25	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty,$ $T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$   
which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

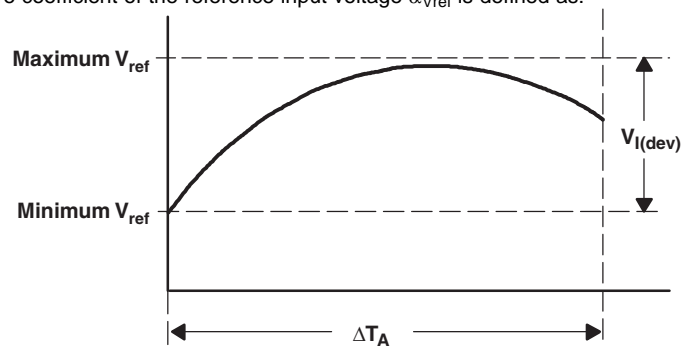
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431AI, TL432AI			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C to } 70^\circ\text{C}$	SOT23-3 and TL432 devices	14	34	mV
				All other devices	5	50	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

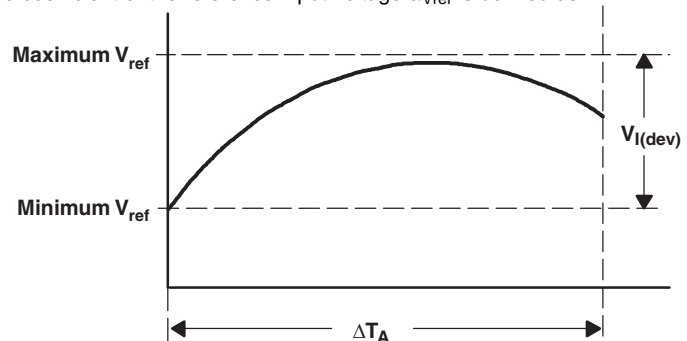
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431AQ, TL432AQ			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			mV	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .



## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

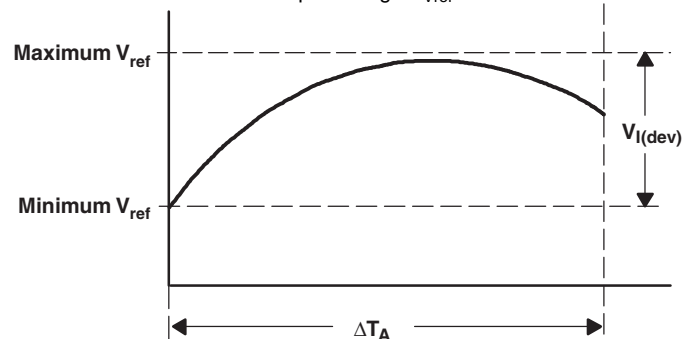
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431BC, TL432BC			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			mV	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

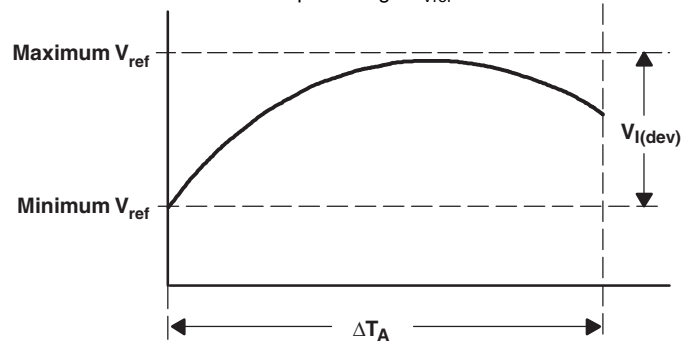
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431BI, TL432BI			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			mV	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

## ELECTRICAL CHARACTERISTICS

over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

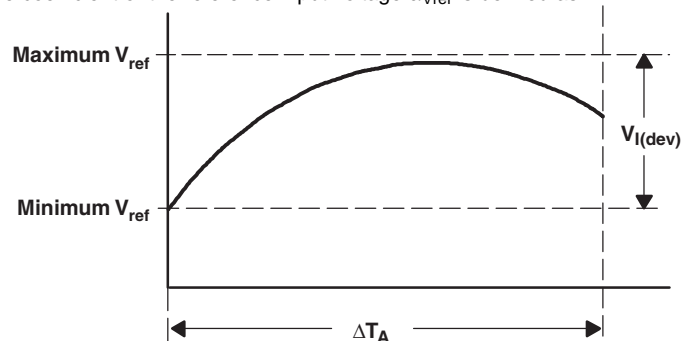
PARAMETER	TEST CIRCUIT	TEST CONDITIONS	TL431BQ, TL432BQ			UNIT	
			MIN	TYP	MAX		
$V_{\text{ref}}$	Reference voltage	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}$			mV	
$V_{\text{I(dev)}}$	Deviation of reference input voltage over full temperature range <sup>(1)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, I_{\text{KA}} = 10 \text{ mA}, T_A = 0^\circ\text{C} \text{ to } 70^\circ\text{C}$			mV	
$\frac{\Delta V_{\text{ref}}}{\Delta V_{\text{KA}}}$	Ratio of change in reference voltage to the change in cathode voltage	Figure 2	$I_{\text{KA}} = 10 \text{ mA}$	$\Delta V_{\text{KA}} = 10 \text{ V} - V_{\text{ref}}$	-1.4	-2.7	mV/V
				$\Delta V_{\text{KA}} = 36 \text{ V} - 10 \text{ V}$	-1	-2	
$I_{\text{ref}}$	Reference input current	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty$			$\mu\text{A}$	
$I_{\text{I(dev)}}$	Deviation of reference input current over full temperature range <sup>(1)</sup>	Figure 2	$I_{\text{KA}} = 10 \text{ mA}, R_1 = 10 \text{ k}\Omega, R_2 = \infty, T_A = 0^\circ\text{C} \text{ to } 70^\circ\text{C}$			$\mu\text{A}$	
$I_{\text{min}}$	Minimum cathode current for regulation	Figure 1	$V_{\text{KA}} = V_{\text{ref}}$			mA	
$I_{\text{off}}$	Off-state cathode current	Figure 3	$V_{\text{KA}} = 36 \text{ V}, V_{\text{ref}} = 0$			$\mu\text{A}$	
$ z_{\text{KA}} $	Dynamic impedance <sup>(2)</sup>	Figure 1	$V_{\text{KA}} = V_{\text{ref}}, f \leq 1 \text{ kHz}, I_{\text{KA}} = 1 \text{ mA} \text{ to } 100 \text{ mA}$			$\Omega$	

- (1) The deviation parameters  $V_{\text{ref(dev)}}$  and  $I_{\text{ref(dev)}}$  are defined as the differences between the maximum and minimum values obtained over the rated temperature range. The average full-range temperature coefficient of the reference input voltage  $\alpha_{V_{\text{ref}}}$  is defined as:

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

where:

$\Delta T_A$  is the rated operating temperature range of the device.



$\alpha_{V_{\text{ref}}}$  is positive or negative, depending on whether minimum  $V_{\text{ref}}$  or maximum  $V_{\text{ref}}$ , respectively, occurs at the lower temperature.

- (2) The dynamic impedance is defined as:  $|z_{\text{KA}}| = \frac{\Delta V_{\text{KA}}}{\Delta I_{\text{KA}}}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by:  $|z'| = \frac{\Delta V}{\Delta I}$  which is approximately equal to  $|z_{\text{KA}}| \left( 1 + \frac{R_1}{R_2} \right)$ .

PARAMETER MEASUREMENT INFORMATION

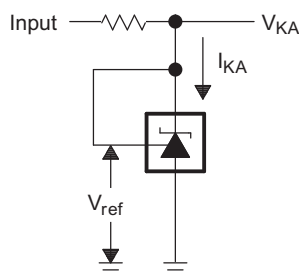


Figure 1. Test Circuit for  $V_{KA} = V_{ref}$

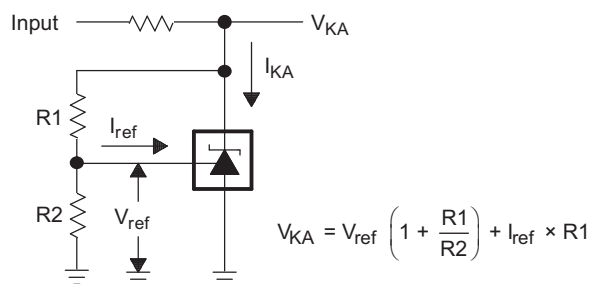


Figure 2. Test Circuit for  $V_{KA} > V_{ref}$

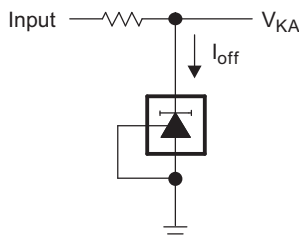


Figure 3. Test Circuit for  $I_{off}$

## TYPICAL CHARACTERISTICS

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

**Table 1. Table of Graphs**

GRAPH	FIGURE
Reference voltage vs Free-air temperature	<a href="#">Figure 4</a>
Reference current vs Free-air temperature	<a href="#">Figure 5</a>
Cathode current vs Cathode voltage	<a href="#">Figure 6</a>
Off-state cathode current vs Free-air temperature	<a href="#">Figure 7, Figure 8</a>
Ratio of delta reference voltage to delta cathode voltage vs Free-air temperature	<a href="#">Figure 9</a>
Equivalent input-noise voltage vs Frequency	<a href="#">Figure 10</a>
Equivalent input-noise voltage over a 10-second period	<a href="#">Figure 11</a>
Small-signal voltage amplification vs Frequency	<a href="#">Figure 12</a>
Reference impedance vs Frequency	<a href="#">Figure 13</a>
Pulse response	<a href="#">Figure 14</a>
Stability boundary conditions	<a href="#">Figure 15, Figure 16</a>

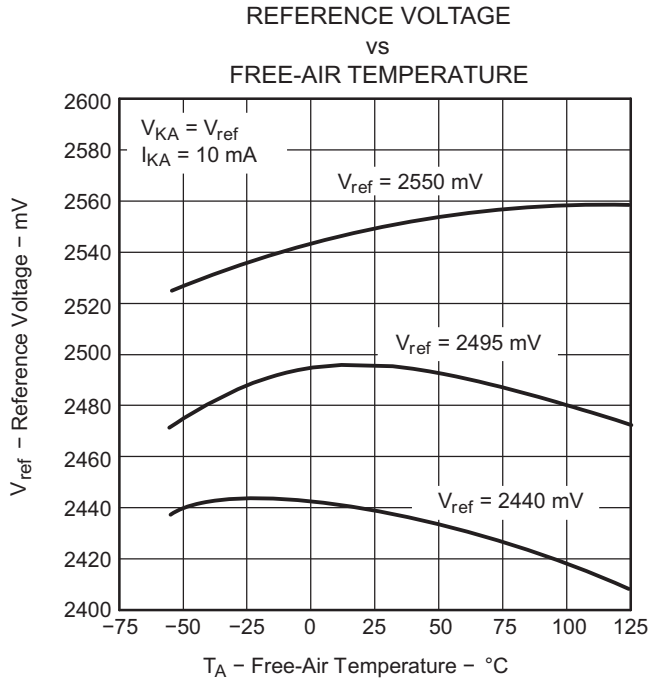


Figure 4.

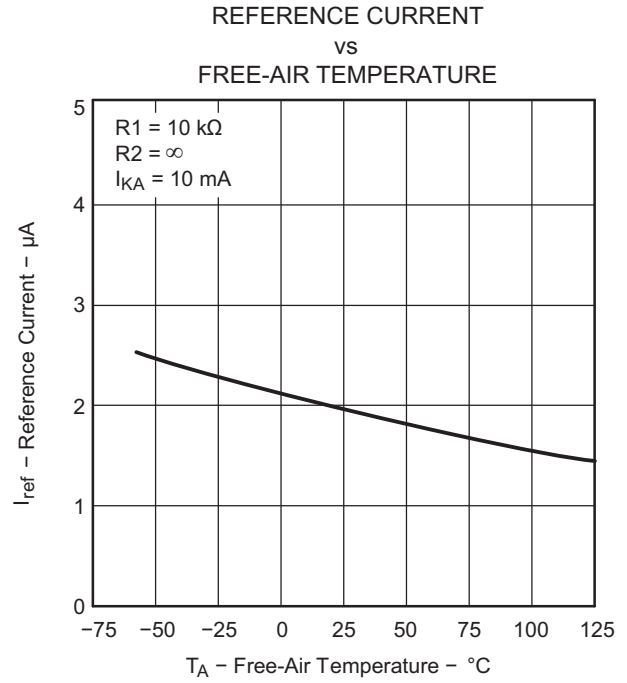


Figure 5.

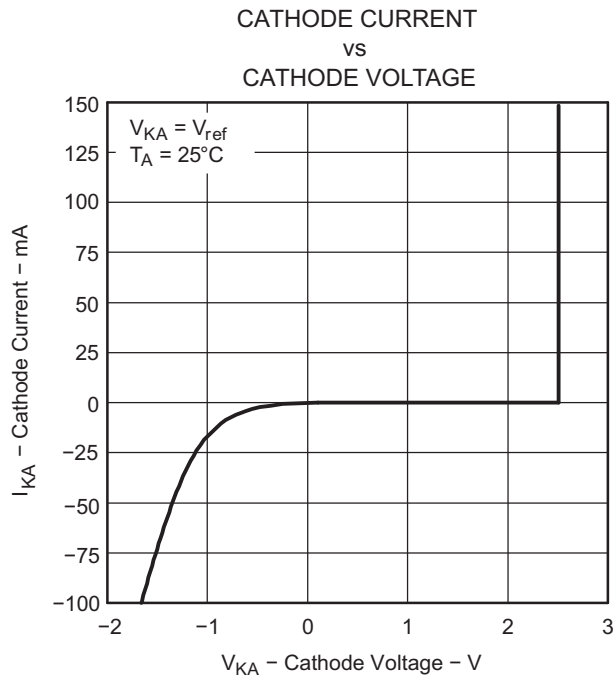


Figure 6.

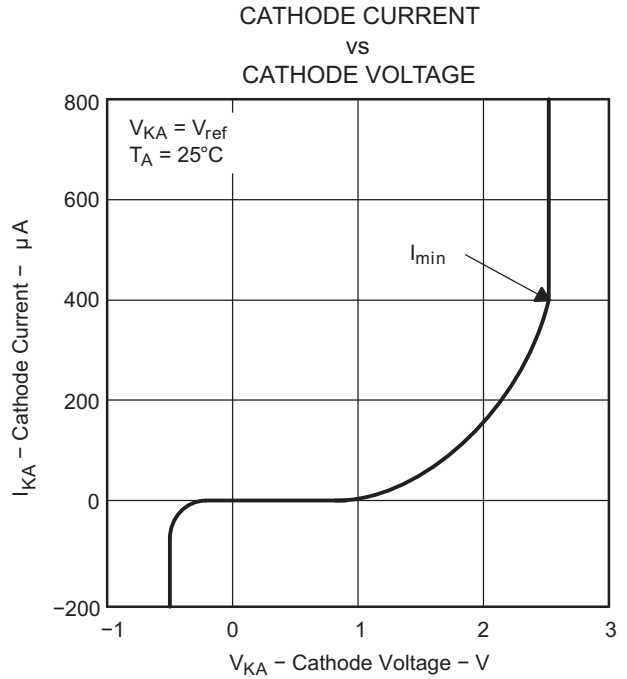


Figure 7.

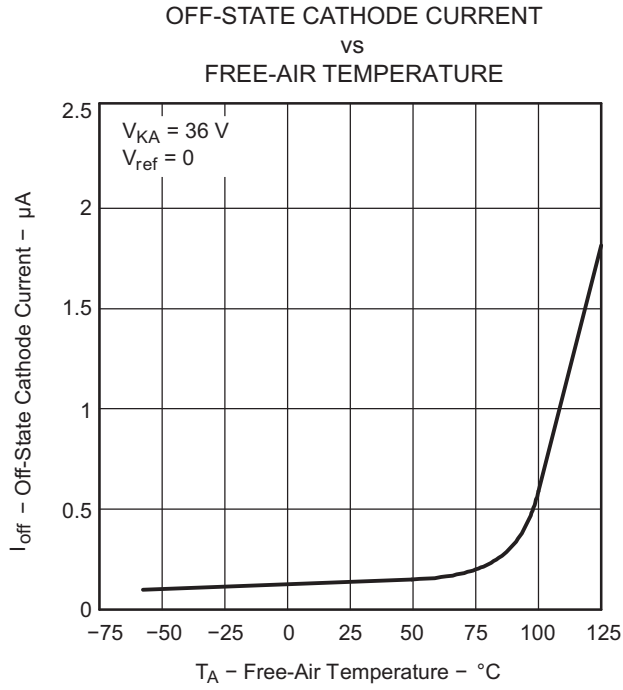


Figure 8.

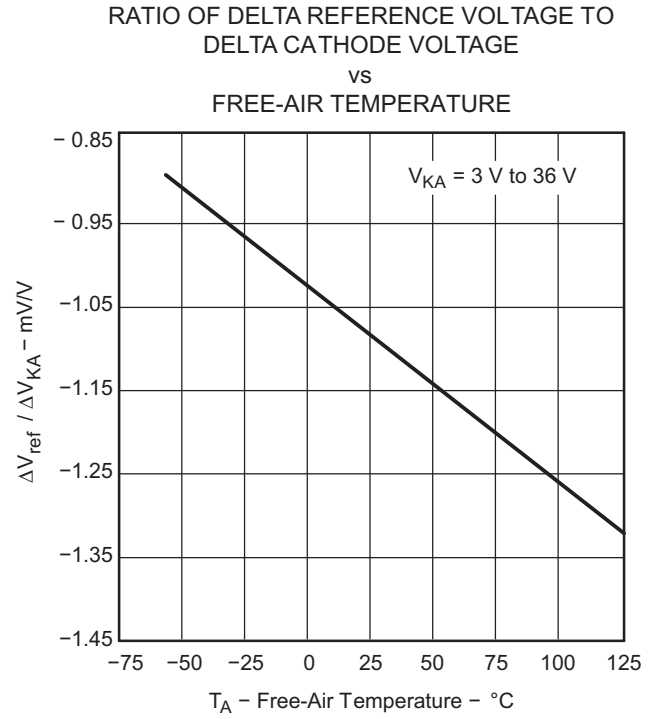


Figure 9.

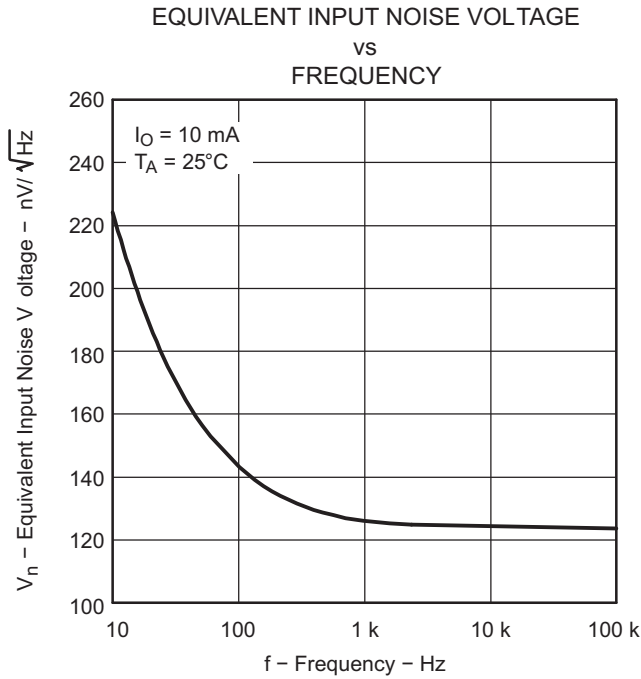


Figure 10.

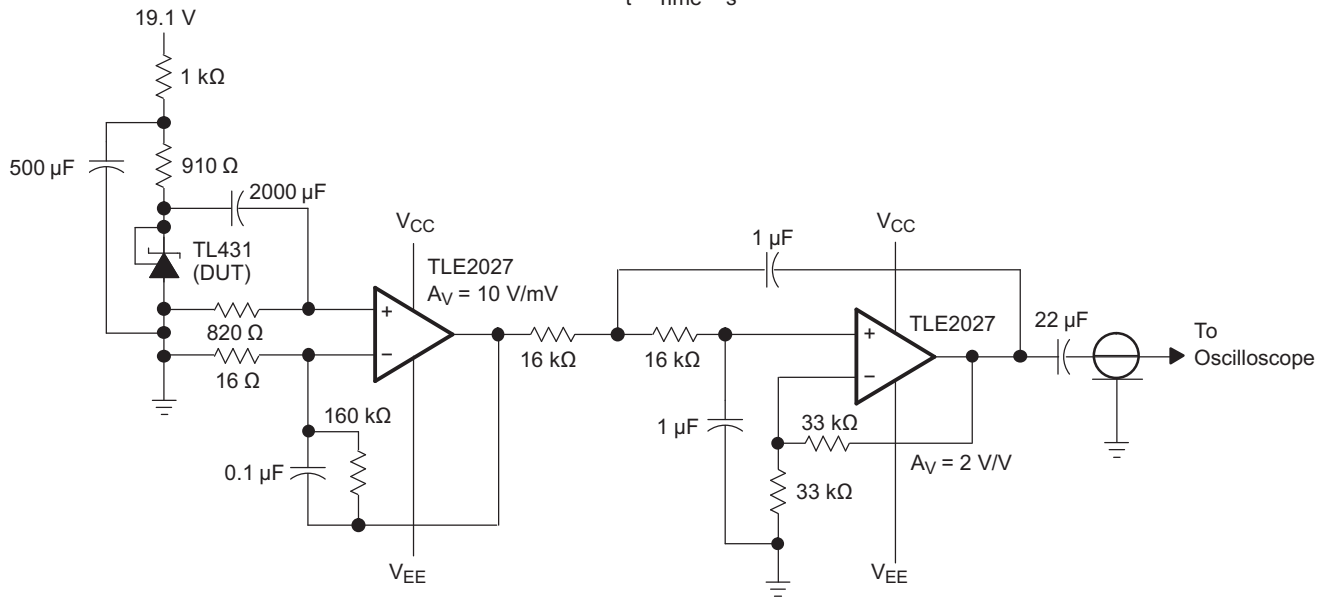
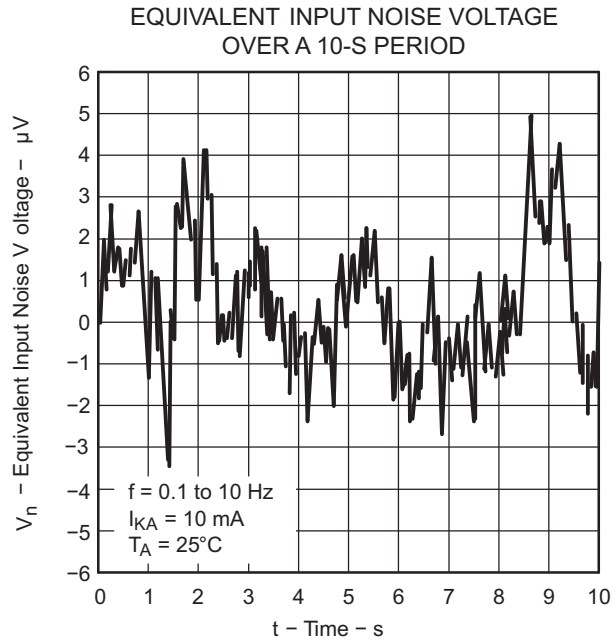


Figure 11.



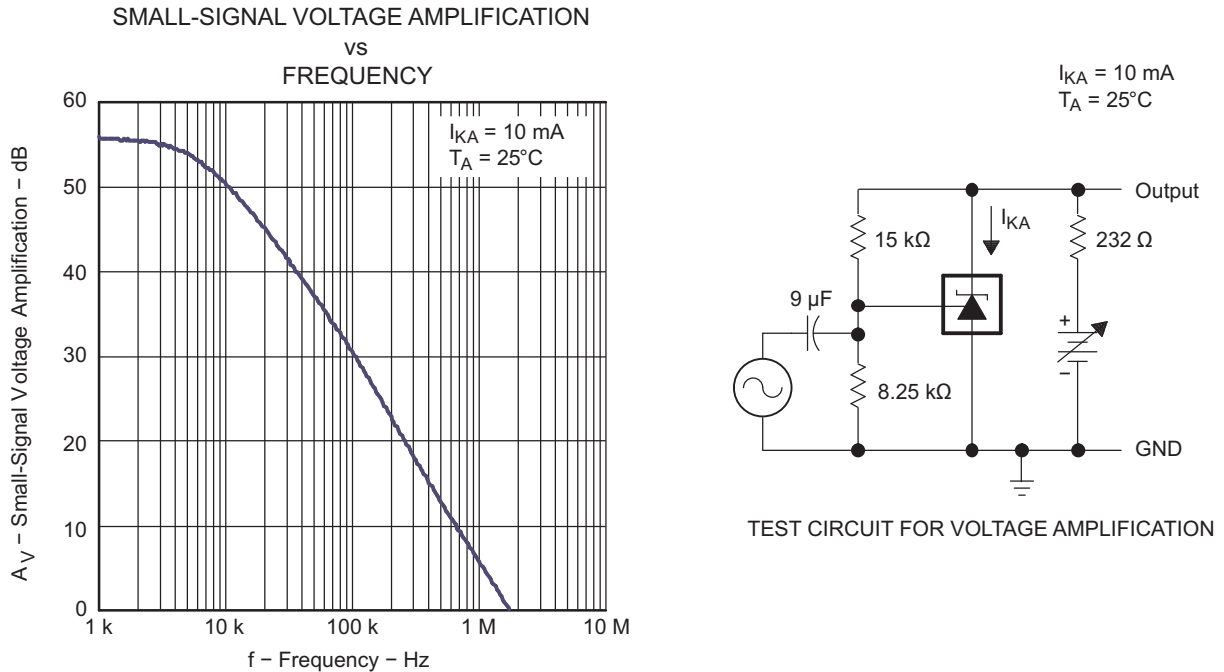


Figure 12.

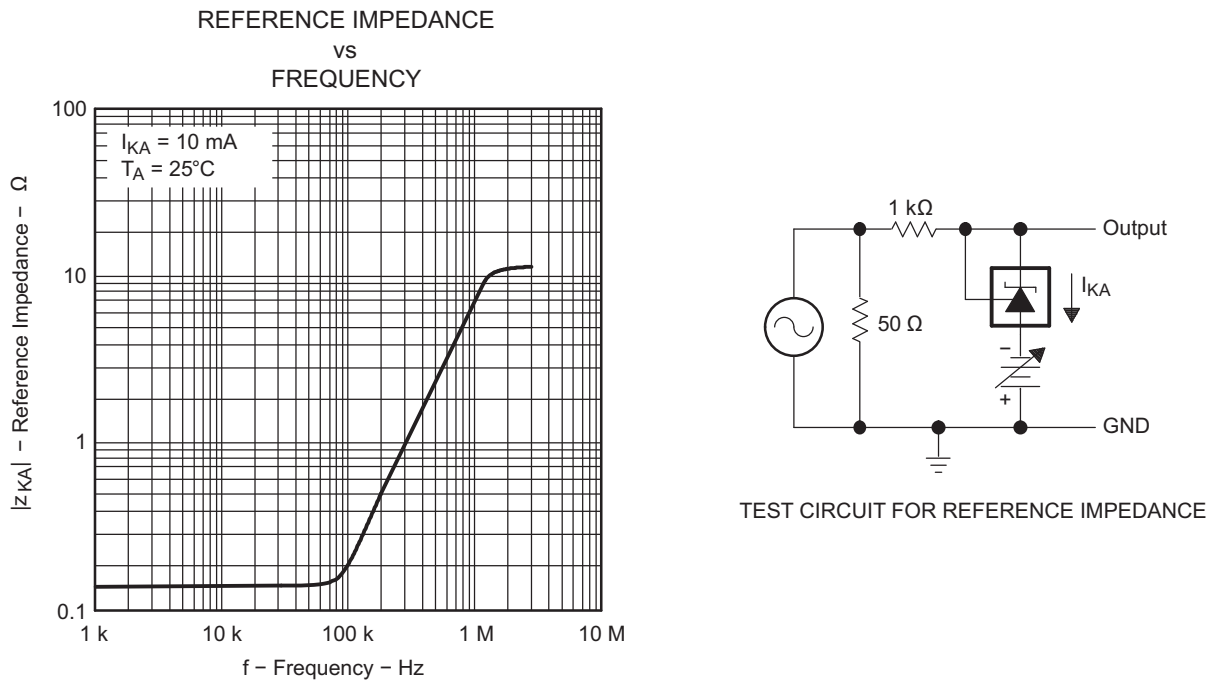


Figure 13.

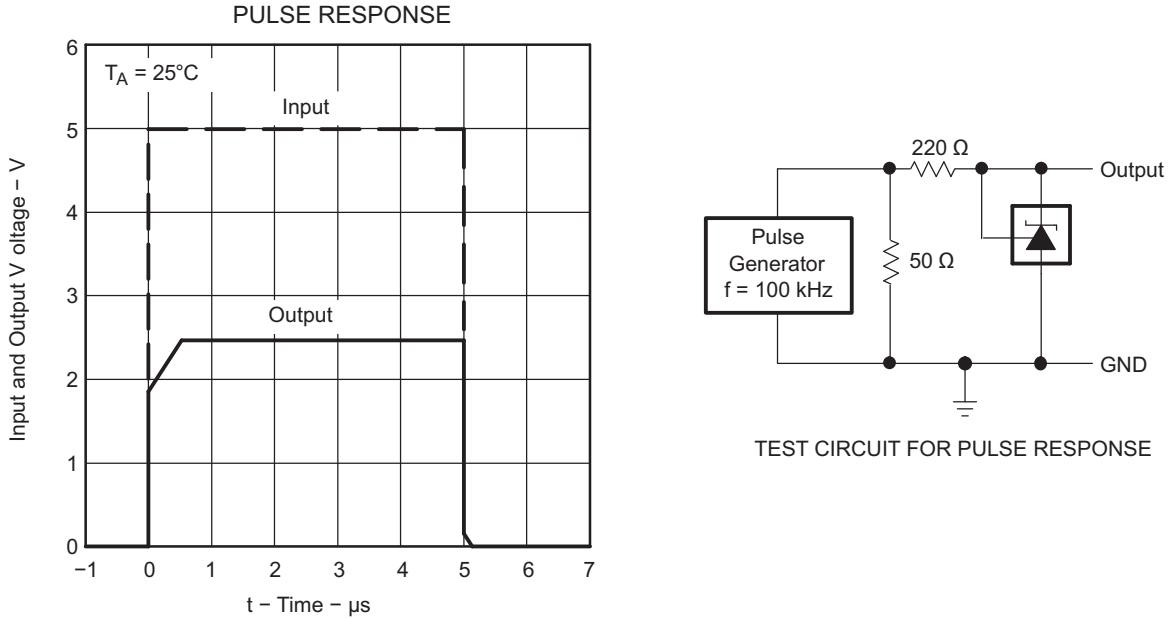
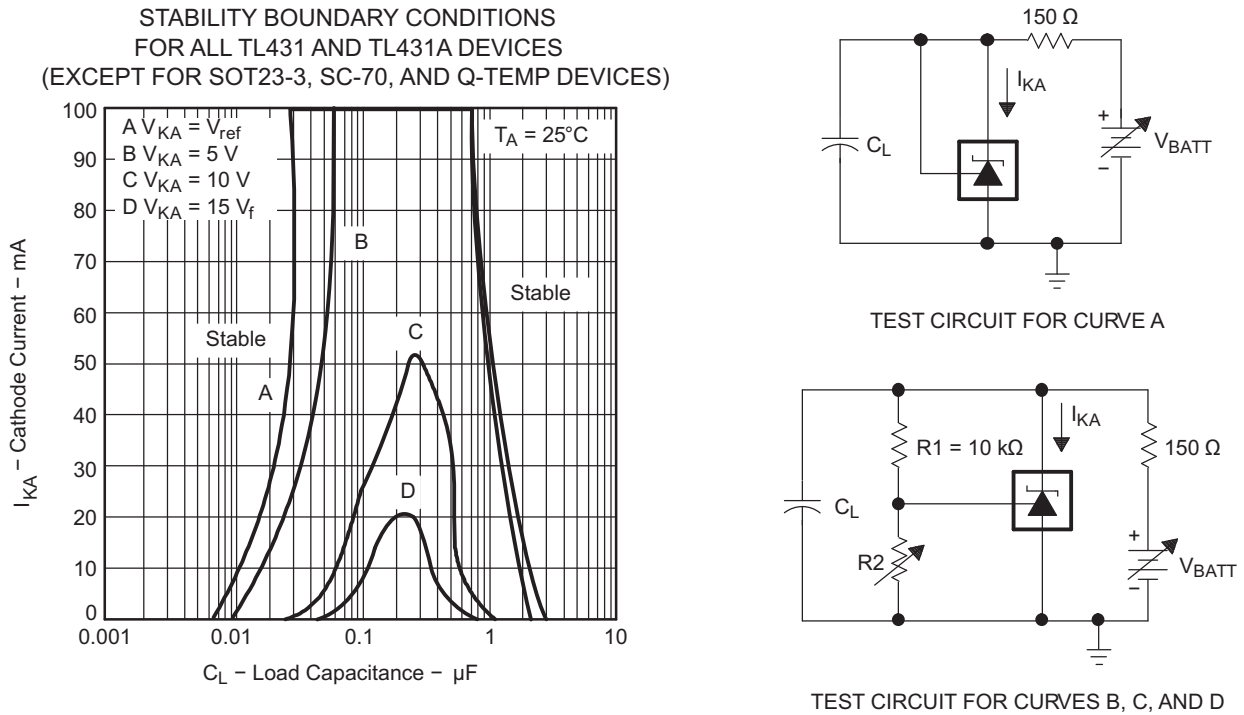


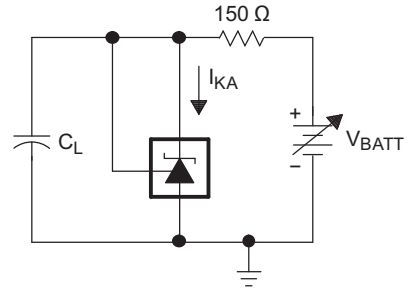
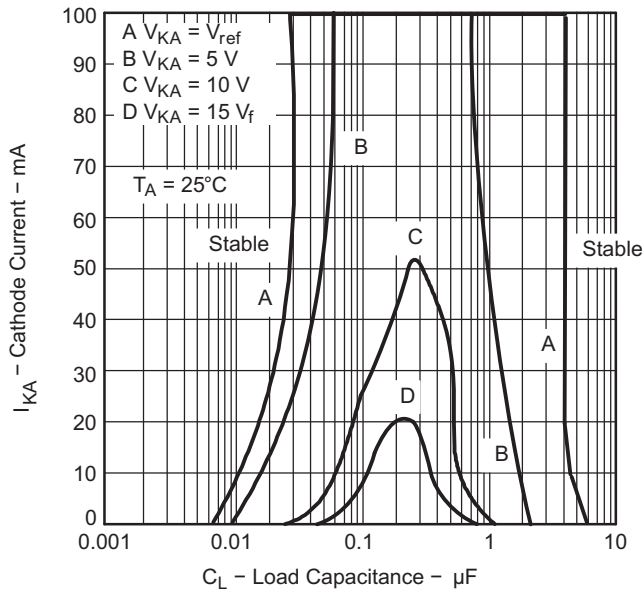
Figure 14.



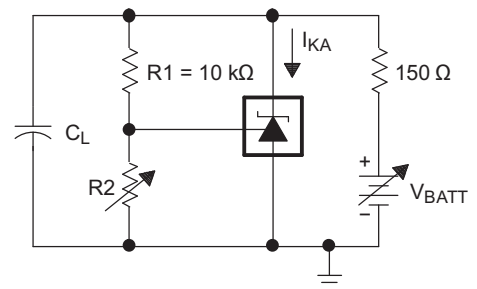
A. The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 and V+ are adjusted to establish the initial VKA and IKA conditions, with CL = 0. VBATT and CL then are adjusted to determine the ranges of stability.

Figure 15.

STABILITY BOUNDARY CONDITIONS  
FOR ALL TL431B, TL432, SOT-23, SC-70, AND Q-TEMP DEVICES



TEST CIRCUIT FOR CURVE A



TEST CIRCUIT FOR CURVES B, C, AND D

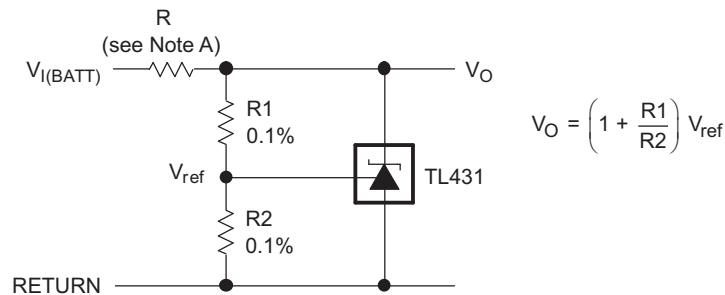
A. The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 and V+ are adjusted to establish the initial V<sub>KA</sub> and I<sub>KA</sub> conditions, with C<sub>L</sub> = 0. V<sub>BATT</sub> and C<sub>L</sub> then are adjusted to determine the ranges of stability.

Figure 16.

**APPLICATION INFORMATION**

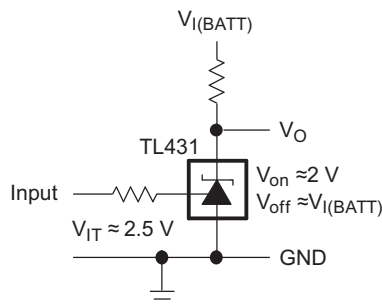
**Table 2. Table of Application Circuits**

APPLICATION	FIGURE
Shunt regulator	Figure 17
Single-supply comparator with temperature-compensated threshold	Figure 18
Precision high-current series regulator	Figure 19
Output control of a three-terminal fixed regulator	Figure 20
High-current shunt regulator	Figure 21
Crowbar Circuit	Figure 22
Precision 5-V, 1.5-A regulator	Figure 23
Efficient 5-V precision regulator	Figure 24
PWM converter with reference	Figure 25
Voltage monitor	Figure 26
Delay timer	Figure 27
Precision current limiter	Figure 28
Precision constant-current sink	Figure 29

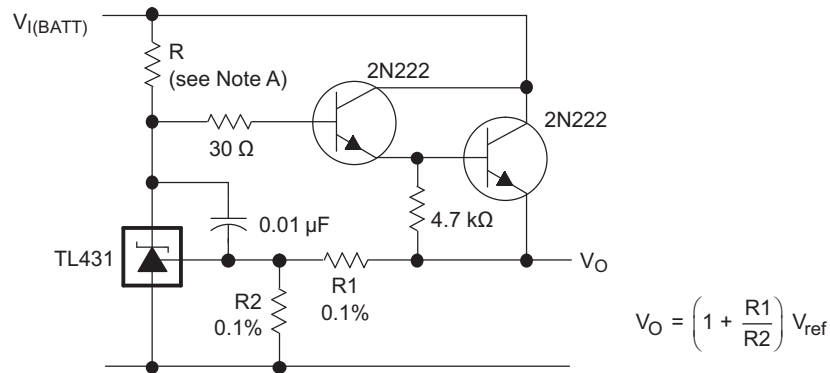


A. R should provide cathode current  $\geq 1$  mA to the TL431 at minimum  $V_{(BATT)}$ .

**Figure 17. Shunt Regulator**

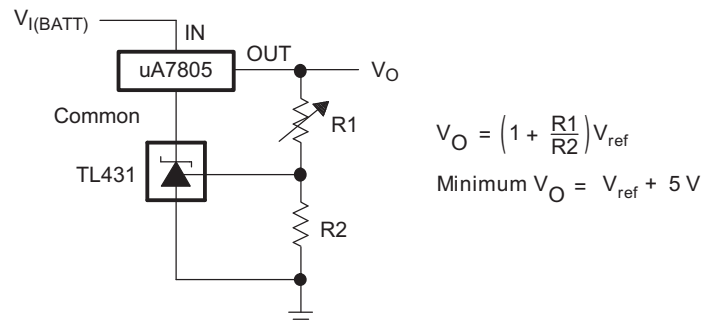


**Figure 18. Single-Supply Comparator With Temperature-Compensated Threshold**

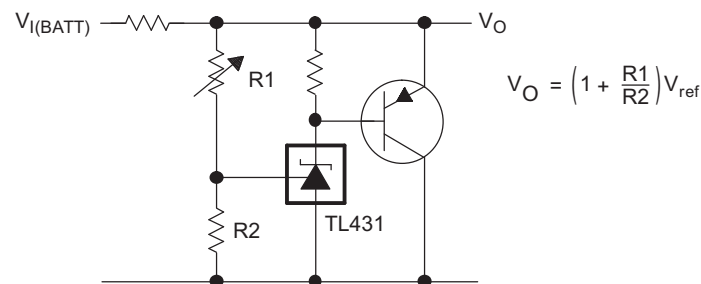


A. R should provide cathode current  $\geq 1$  mA to the TL431 at minimum  $V_{(BATT)}$ .

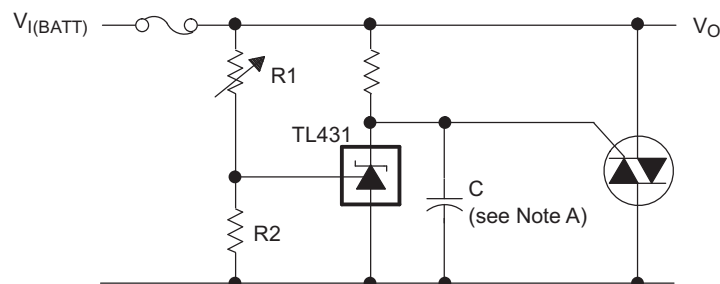
**Figure 19. Precision High-Current Series Regulator**



**Figure 20. Output Control of a Three-Terminal Fixed Regulator**



**Figure 21. High-Current Shunt Regulator**



A. Refer to the stability boundary conditions in [Figure 15](#) and [Figure 16](#) to determine allowable values for C.

**Figure 22. Crowbar Circuit**

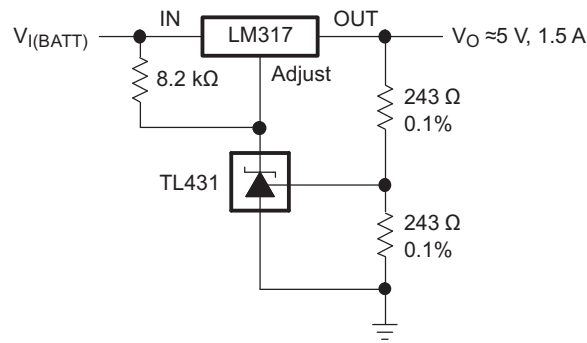
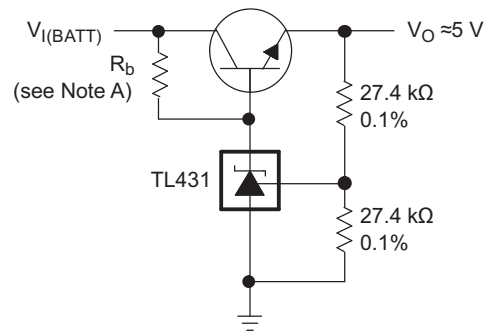


Figure 23. Precision 5-V, 1.5-A Regulator



A.  $R_b$  should provide cathode current  $\geq 1$  mA to the TL431.

Figure 24. Efficient 5-V Precision Regulator

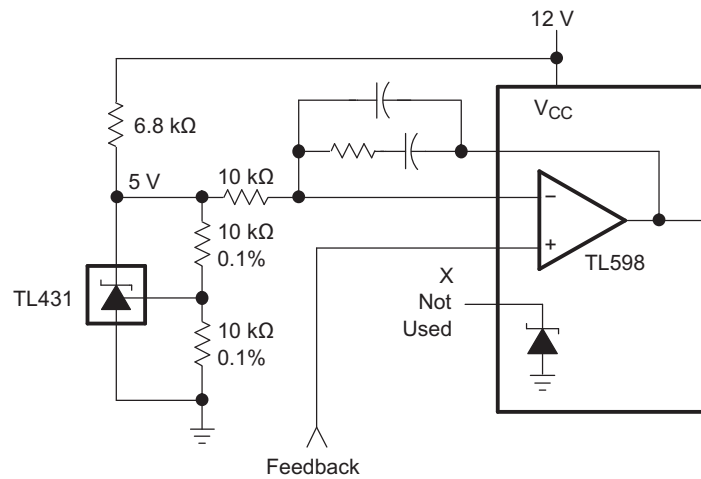
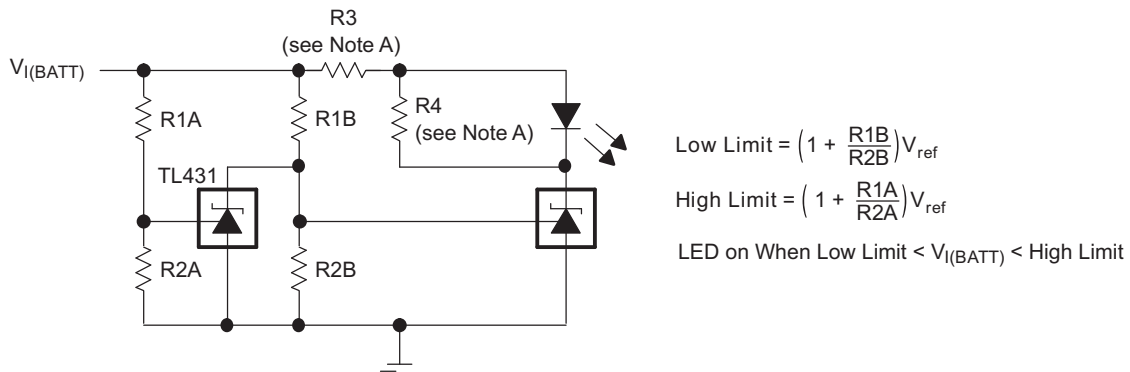


Figure 25. PWM Converter With Reference



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

Figure 26. Voltage Monitor

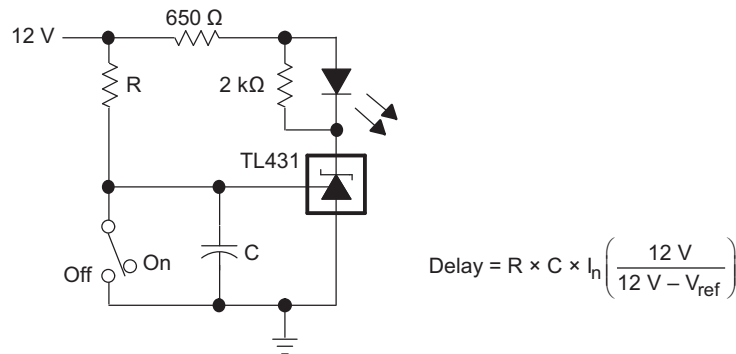


Figure 27. Delay Timer

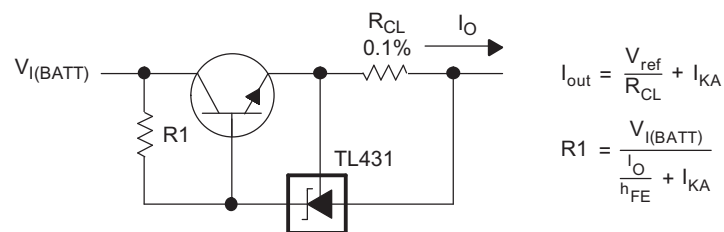


Figure 28. Precision Current Limiter

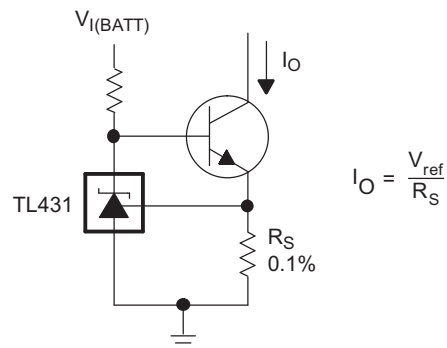


Figure 29. Precision Constant-Current Sink

**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431ACD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431ACDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431ACDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431ACDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431ACDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>



Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431ACDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACDRG3	PREVIEW	SOIC	D	8	2500	TBD	Call TI	Call TI	Samples Not Available
TL431ACDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431ACLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431ACLPM	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431ACLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431ACP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431ACPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431ACPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431ACPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431ACPSR	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACPSRE4	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACPSRG4	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACPWE4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACPWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431ACPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431ACPWRE4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ACPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AIDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AIDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431AIDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431AIDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431AIDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431AIDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AIDRG3	PREVIEW	SOIC	D	8	2500	TBD	Call TI	Call TI	Samples Not Available
TL431AIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431AILPM	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431AILPME3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431AILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431AIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431AIPe4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431AIPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431AIPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431AQDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AQDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AQDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431AQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431AQDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431AQDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431AQDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431AQDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AQDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AQDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431AQPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431AQPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BCD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BCDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431BCDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BCDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BCDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BCDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431BCLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431BCLPM	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431BCLPME3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431BCLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BCLPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BCP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BCPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BCPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BCPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BCPSR	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCPSRE4	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCPSRG4	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCPWE4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCPWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BCPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCPWRE4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BCPWG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431BIDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BIDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BIDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BIDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431BIDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431BILPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431BILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BILPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BIP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BIPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BIPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BIPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BQD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office



Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431BQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431BQDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431BQDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431BQLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431BQLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431BQLPM	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431BQLPME3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431BQLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BQLPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Request Free Samples</a>
TL431BQPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BQPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431BQPSR	PREVIEW	SO	PS	8	2000	TBD	Call TI	Call TI	Samples Not Available

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CKTPR	OBSOLETE	PFM	KTP	2		TBD	Call TI	Call TI	Samples Not Available
TL431CLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431CLPB-TDJ	OBSOLETE	TO-92	LP	3		TBD	Call TI	Call TI	Samples Not Available
TL431CLPM	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	<a href="#">Purchase Samples</a>
TL431CLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431CPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431CPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431CPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431CPSLE	OBSOLETE	SO	PS	8		TBD	Call TI	Call TI	Replaced by TL431CPSR
TL431CPSR	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CPSRG4	ACTIVE	SO	PS	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CPW	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CPWE4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CPWG4	ACTIVE	TSSOP	PW	8	150	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431CPWLE	OBSOLETE	TSSOP	PW	8		TBD	Call TI	Call TI	Replaced by TL431CPWR
TL431CPWR	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CPWRE4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431CPWRG4	ACTIVE	TSSOP	PW	8	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431IDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431IDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431ILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431ILPM	OBSOLETE	TO-92	LP	3		TBD	Call TI	Call TI	Samples Not Available
TL431ILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431IPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	Contact TI Distributor or Sales Office
TL431IPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431IPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	Contact TI Distributor or Sales Office
TL431MFKB	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	Samples Not Available
TL431MJG	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	Samples Not Available
TL431MJGB	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	Samples Not Available

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431QD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431QDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431QDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431QDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431QDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL431QDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431QDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431QDCKRG4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431QDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDCKTG4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL431QDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL431QDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431QDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431QDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Request Free Samples</a>
TL431QPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL431QPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432ACDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432ACPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432ACPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432AIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AIDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AIDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL432AIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AIPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432AIPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432AQDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AQDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AQDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AQDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AQDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AQDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432AQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432AQPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432AQPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL432BCDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BCDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BCDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BCDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BCDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BCDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BCDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BCPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432BCPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432BIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BIDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BIDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BIPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432BIPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>



Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL432BQDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BQDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BQDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BQDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BQDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BQDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432BQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432BQDBZT	PREVIEW	SOT-23	DBZ	3	250	TBD	Call TI	Call TI	Samples Not Available
TL432BQPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432BQPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432CDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432CDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432CDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432CDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432CDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432CDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432CDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL432CPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432CPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432IDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432IDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432IDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432IPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432IPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432QDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432QDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432QDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432QDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432QDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432QDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	<a href="#">Purchase Samples</a>
TL432QDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/ Ball Finish	MSL Peak Temp <sup>(3)</sup>	Samples (Requires Login)
TL432QDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432QDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432QDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	Contact TI Distributor or Sales Office
TL432QPK	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>
TL432QPKG3	ACTIVE	SOT-89	PK	3	1000	Green (RoHS & no Sb/Br)	CU SN	Level-2-260C-1 YEAR	<a href="#">Request Free Samples</a>

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

**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 TL431A, TL431B, TL432A, TL432B :**

- Automotive: [TL431A-Q1](#), [TL431B-Q1](#), [TL432A-Q1](#), [TL432B-Q1](#)

NOTE: Qualified Version Definitions:

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

**TAPE AND REEL INFORMATION**

**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	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431ACDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431ACDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431ACDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431ACDCKR	SC70	DCK	6	3000	180.0	8.4	2.24	2.34	1.22	4.0	8.0	Q3
TL431ACDCKT	SC70	DCK	6	250	179.0	8.4	2.2	2.5	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
TL431ACPSR	SO	PS	8	2000	330.0	16.4	8.2	6.6	2.5	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
TL431AIDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431AIDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431AIDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431AIDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
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

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
TL431AQDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431AQDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431AQDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431AQDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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	179.0	8.4	2.2	2.5	1.2	4.0	8.0	Q3
TL431BCDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431BCDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431BCDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431BCDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL431BCDCKT	SC70	DCK	6	250	179.0	8.4	2.2	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
TL431BCPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431BCPSR	SO	PS	8	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
TL431BCPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
TL431BIDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431BIDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431BIDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431BIDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
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
TL431BQDBVR	SOT-23	DBV	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BQDBVT	SOT-23	DBV	5	250	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL431BQDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431BQDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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	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
TL431CDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431CDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431CDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431CDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL431CPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL431CPSR	SO	PS	8	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
TL431CPWR	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1
TL431IDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431IDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431IDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431IDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
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
TL431QDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431QDBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL431QDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL431QDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL431QDCKT	SC70	DCK	6	250	179.0	8.4	2.2	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
TL432ACDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL432ACDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432ACDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432ACPK	SOT-89	PK	3	1000	180.0	12.4	4.91	4.52	1.9	8.0	12.0	Q3
TL432AIDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL432AIDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432AIDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL432AQDBVR	SOT-23	DBV	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AQDBVT	SOT-23	DBV	5	250	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432AQDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432AQDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432AQPCK	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	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432BCDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432BCDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL432BIDBVR	SOT-23	DBV	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432BIDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432BIDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL432BQDBVR	SOT-23	DBV	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432BQDBVT	SOT-23	DBV	5	250	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432BQDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432BQPCK	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	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL432CDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432CDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL432IDBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
TL432IDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432IDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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
TL432QDBVR	SOT-23	DBV	5	3000	179.0	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
TL432QDBVT	SOT-23	DBV	5	250	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
TL432QDBZR	SOT-23	DBZ	3	3000	180.0	9.2	3.18	3.28	1.32	4.0	8.0	Q3
TL432QDBZT	SOT-23	DBZ	3	250	180.0	9.2	3.18	3.28	1.32	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

**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	180.0	180.0	18.0
TL431ACDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431ACDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431ACDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431ACDCKR	SC70	DCK	6	3000	202.0	201.0	28.0
TL431ACDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431ACDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431ACPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431ACPSR	SO	PS	8	2000	346.0	346.0	33.0
TL431ACPWR	TSSOP	PW	8	2000	346.0	346.0	29.0
TL431AIDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431AIDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431AIDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0



Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL431AIDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431AIDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431AIDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431AIDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431AIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431AQDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431AQDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431AQDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431AQDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431AQDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431AQDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431BCDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431BCDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431BCDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431BCDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431BCDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431BCDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431BCDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431BCPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431BCPSR	SO	PS	8	2000	346.0	346.0	33.0
TL431BCPWR	TSSOP	PW	8	2000	346.0	346.0	29.0
TL431BIDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431BIDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431BIDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431BIDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431BIDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431BIDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431BIDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431BIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431BQDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
TL431BQDBVT	SOT-23	DBV	5	250	203.0	203.0	35.0
TL431BQDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431BQDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431BQDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431BQDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431BQDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431CDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431CDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431CDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431CDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431CDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431CPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431CPSR	SO	PS	8	2000	346.0	346.0	33.0
TL431CPWR	TSSOP	PW	8	2000	346.0	346.0	29.0

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL431IDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431IDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431IDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431IDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431IDR	SOIC	D	8	2500	340.5	338.1	20.6
TL431IPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL431QDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL431QDBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
TL431QDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL431QDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL431QDCKR	SC70	DCK	6	3000	203.0	203.0	35.0
TL431QDCKT	SC70	DCK	6	250	203.0	203.0	35.0
TL431QDR	SOIC	D	8	2500	340.5	338.1	20.6
TL432ACDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL432ACDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432ACDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432ACPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432AIDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL432AIDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432AIDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432AIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432AQDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
TL432AQDBVT	SOT-23	DBV	5	250	203.0	203.0	35.0
TL432AQDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432AQDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432AQPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432BCDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
TL432BCDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432BCDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432BCPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432BIDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
TL432BIDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432BIDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432BIPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432BQDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
TL432BQDBVT	SOT-23	DBV	5	250	203.0	203.0	35.0
TL432BQDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432BQPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432CDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL432CDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432CDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432CPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432IDBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
TL432IDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TL432IDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432IPK	SOT-89	PK	3	1000	340.0	340.0	38.0
TL432QDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
TL432QDBVT	SOT-23	DBV	5	250	203.0	203.0	35.0
TL432QDBZR	SOT-23	DBZ	3	3000	202.0	201.0	28.0
TL432QDBZT	SOT-23	DBZ	3	250	202.0	201.0	28.0
TL432QPK	SOT-89	PK	3	1000	340.0	340.0	38.0

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification.  
 E. Falls within MIL STD 1835 GDIP1-T8

PK (R-PSS0-F3)

PLASTIC SINGLE-IN-LINE PACKAGE



4040234/D 02/2006

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

PK (R-PDSO-G3)



- 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.

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a metal lid.
  - D. The terminals are gold plated.
  - E. Falls within JEDEC MS-004

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.



DBV (R-PDSO-G5)

PLASTIC SMALL-OUTLINE PACKAGE




- 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. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-178 Variation AA.

DBZ (R-PDSO-G3)

PLASTIC SMALL-OUTLINE



- 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. Lead dimensions are inclusive of plating.
  - D. Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
-  Falls within JEDEC TO-236 variation AB, except minimum foot length.

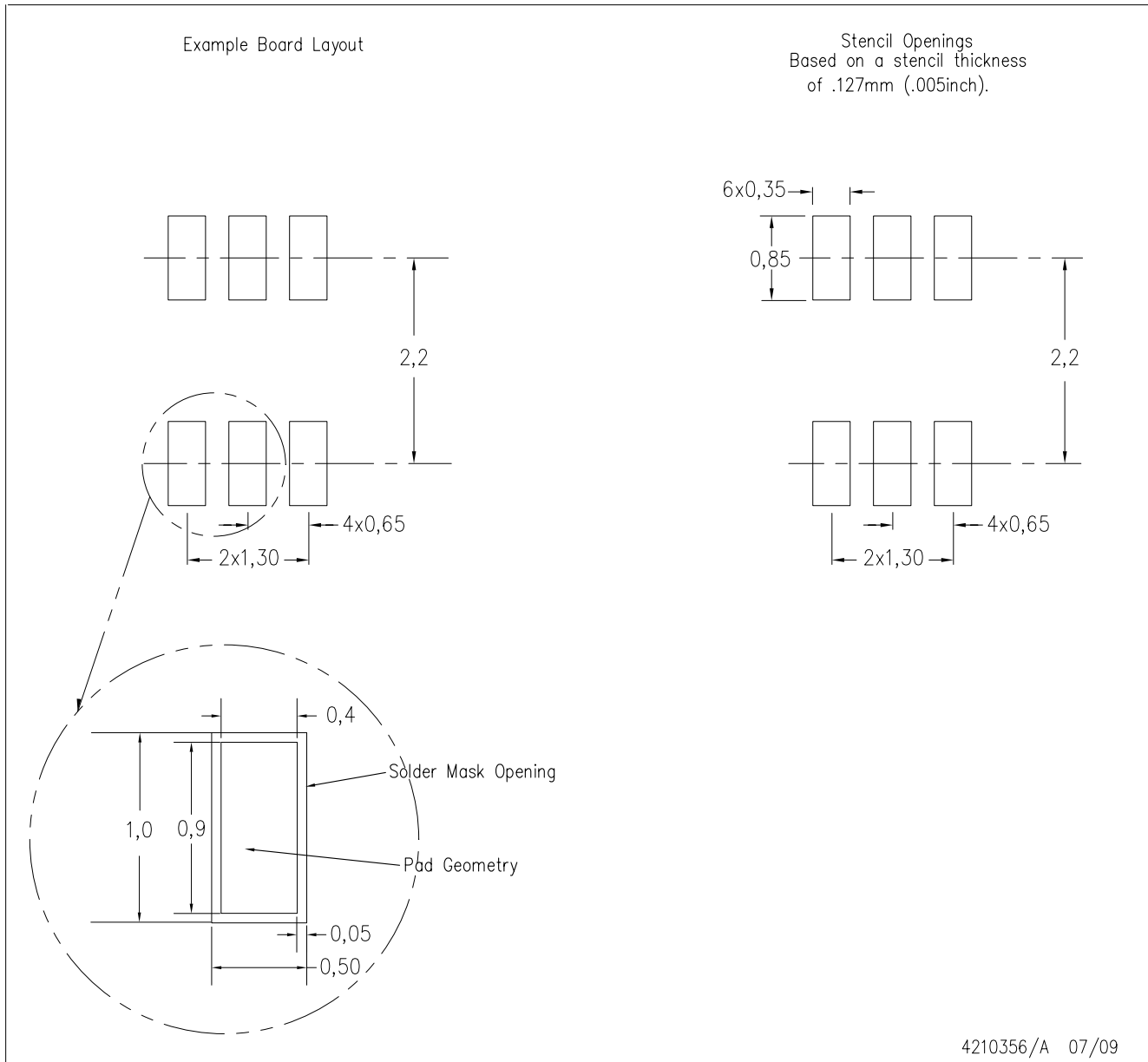
DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



- 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. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-203 variation AB.

## DCK (R-PDSO-G6)



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

KTP (R-PSFM-G2)

PowerFLEX™ PLASTIC FLANGE-MOUNT PACKAGE

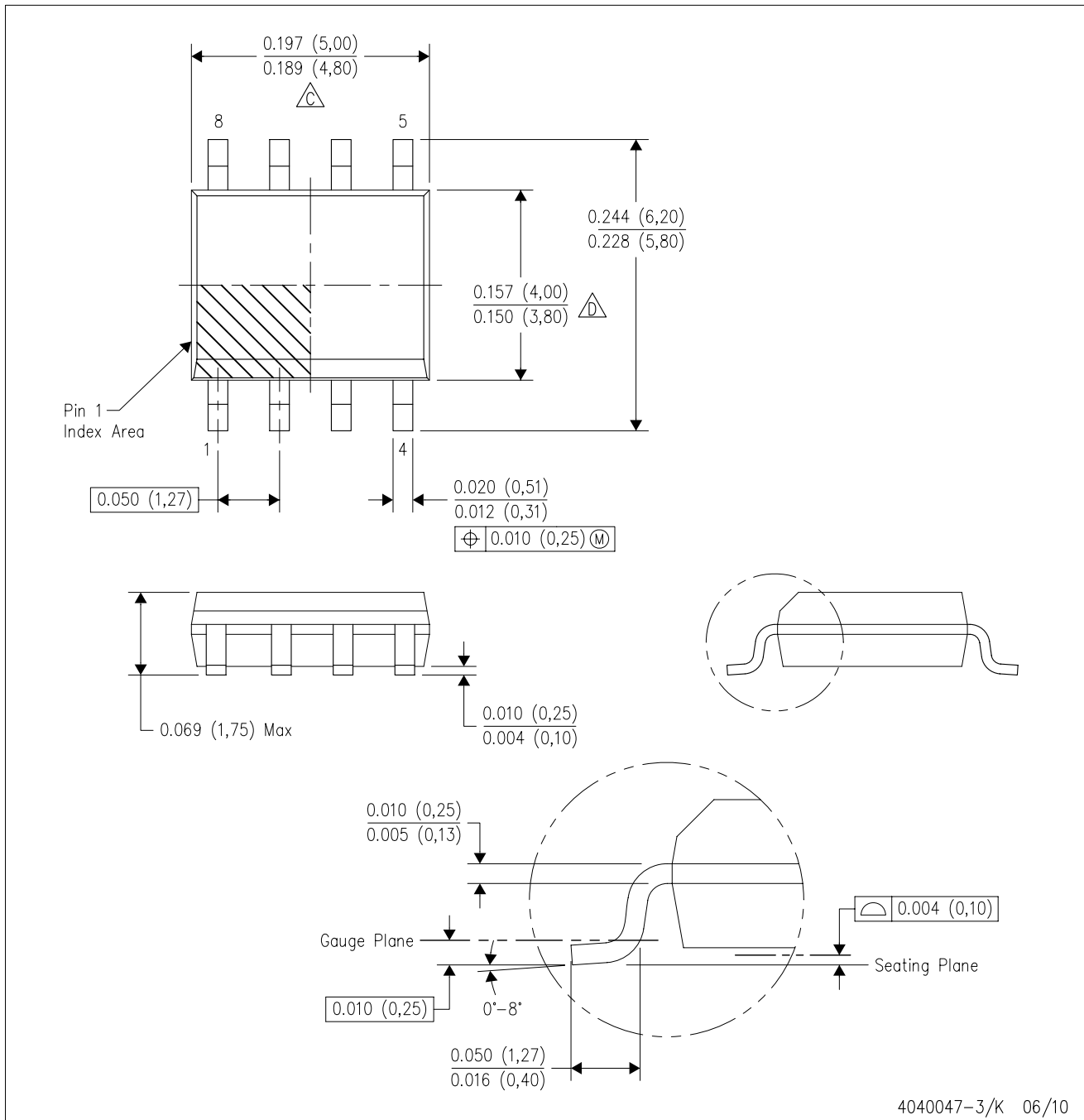




- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. The center lead is in electrical contact with the thermal tab.  
 D. Dimensions do not include mold protrusions, not to exceed 0.006 (0,15).  
 E. Falls within JEDEC TO-252 variation AC.

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D (R-PDSO-G8)

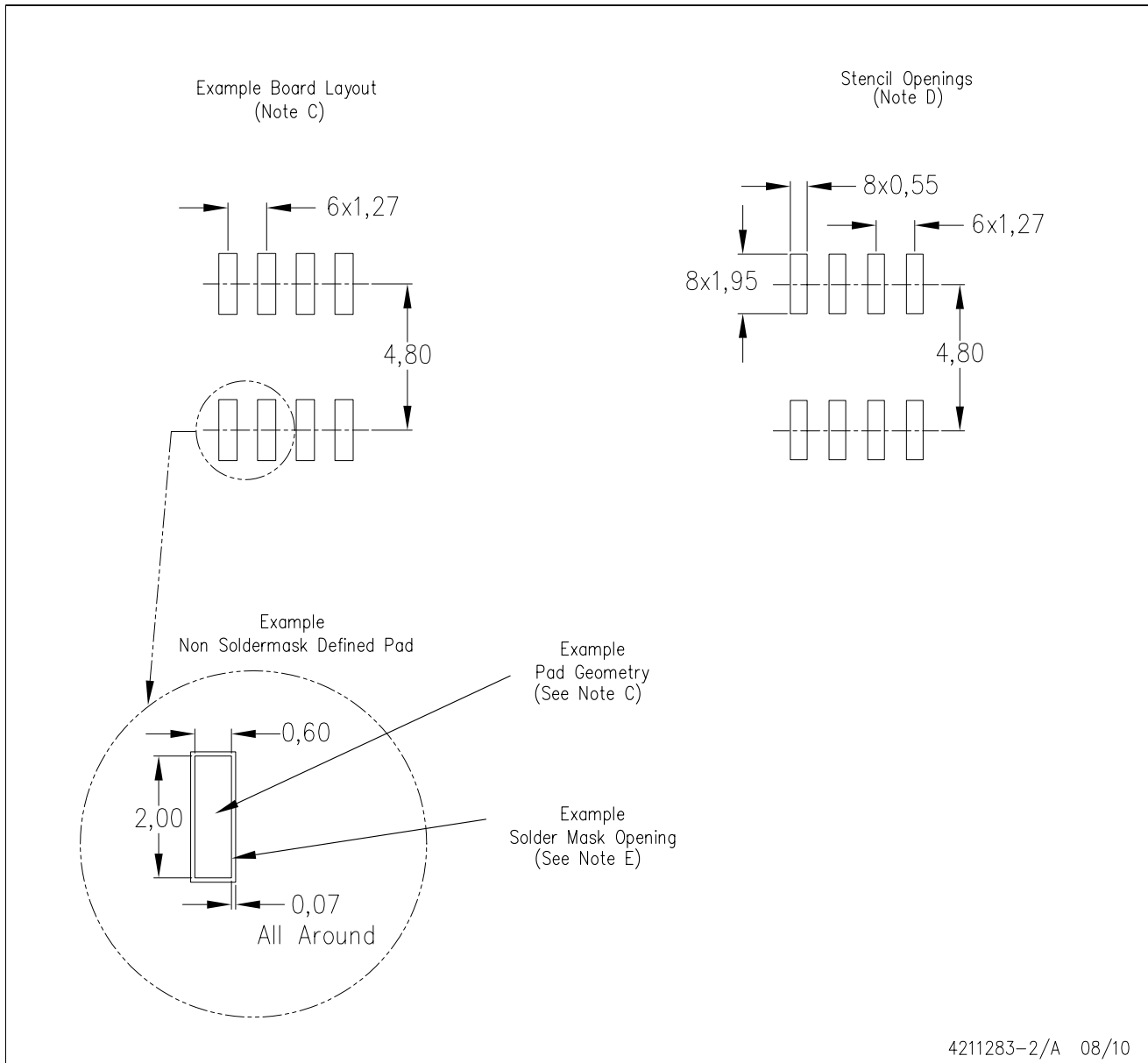
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  -  Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

## MECHANICAL DATA

PS (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

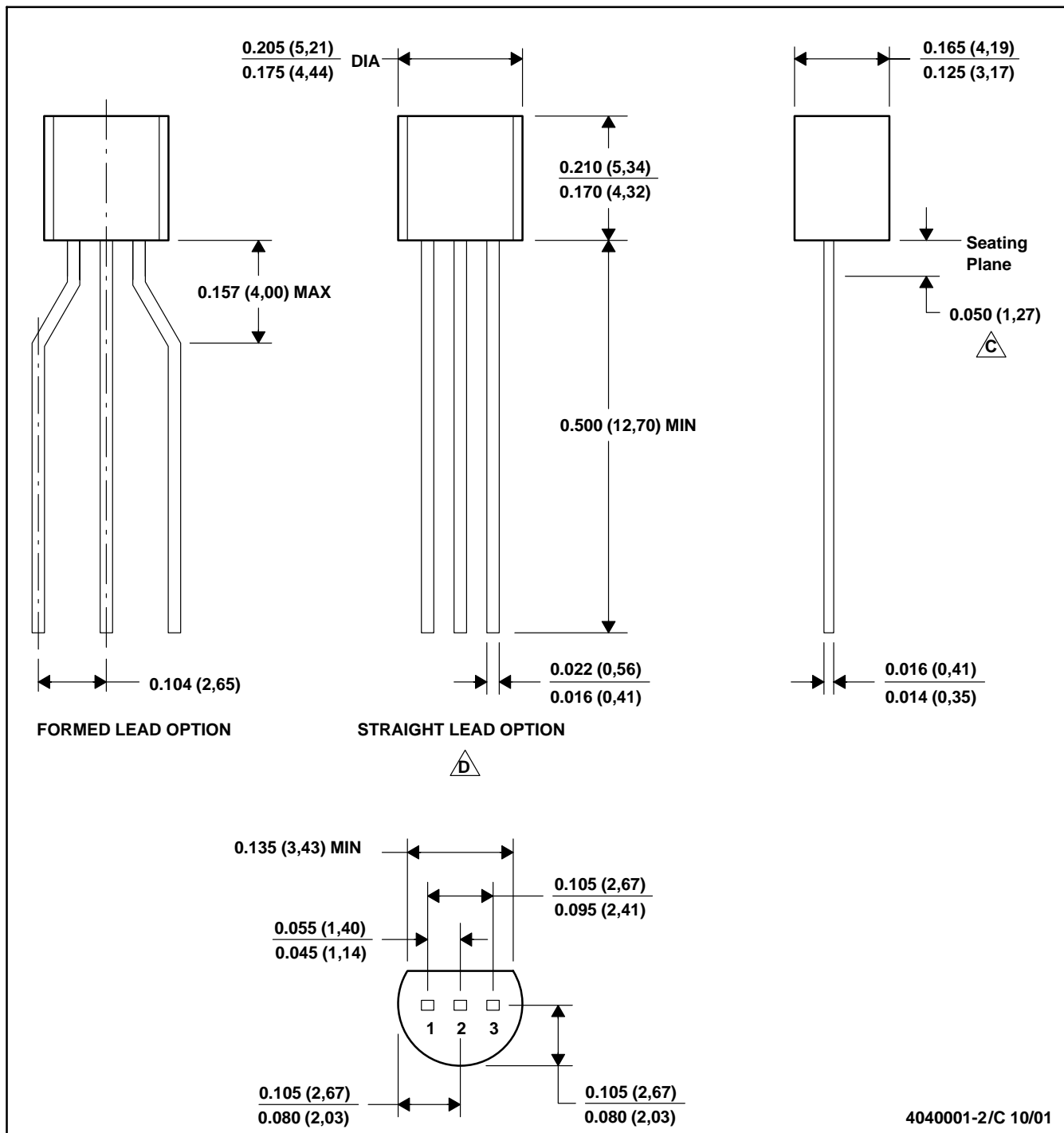


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



4040001-2/C 10/01

# MECHANICAL DATA

MSOT002A – OCTOBER 1994 – REVISED NOVEMBER 2001

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Tape and Reel information for the Format Lead Option package.

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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.  
 D. Falls within JEDEC MO-153

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DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>	Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>	Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Energy	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>	Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>

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