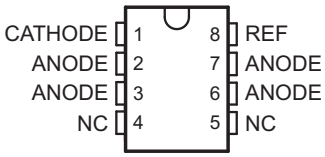
# PRECISION PROGRAMMABLE REFERENCE

**Check for Samples: TL431, TL431A, TL431B, TL432, TL432A, TL432B**

## FEATURES

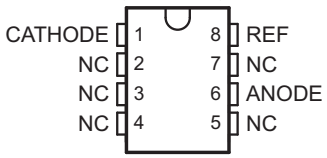
- **Operation From −40°C to 125°C**
- **Reference Voltage Tolerance at 25°C**
  - **0.5% . . . B Grade**
  - **1%. . . A Grade**
  - **2% . . . Standard Grade**
- **Typical Temperature Drift (TL431B)**
  - **6 mV (C Temp)**
  - **14 mV (I Temp, Q Temp)**
- **Low Output Noise**
- **0.2-Ω Typical Output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

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



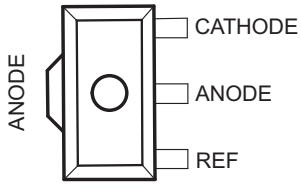

NC − No internal connection

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

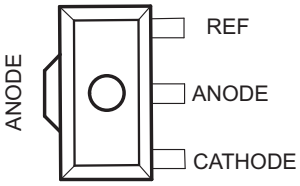



NC − No internal connection

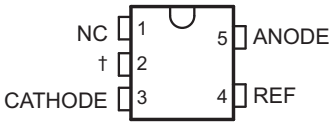
TL431, TL431A, TL431B . . . PK (SOT-89) PACKAGE
(TOP VIEW)




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

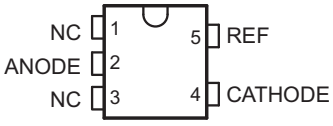



TL431, TL431A, TL431B . . . DBV (SOT-23-5) PACKAGE
(TOP VIEW)



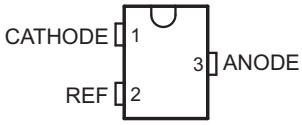

NC − No internal connection
† Pin 2 is attached to Substrate and must be connected to ANODE or left open.

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

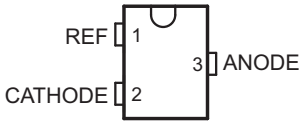



NC − No internal connection

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




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

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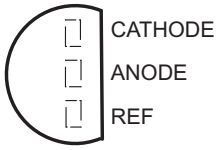
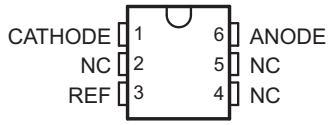
TL431, TL431A, TL431B . . . LP (TO-92/TO-226) PACKAGE
(TOP VIEW)

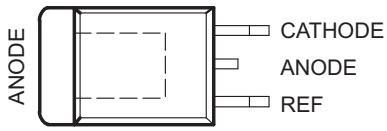



TL431A, TL431B . . . DCK (SC-70) PACKAGE
(TOP VIEW)




NC − No internal connection

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 Vref (approximately 2.5 V) and 36 V, with two external resistors (see Figure 17). These devices have a typical output impedance of 0.2 Ω. 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.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## $V_{ref}$ TOLERANCE (25°C) = 2%
## TL431, TL432 ORDERING INFORMATION(1)

| $T_A$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|
| 0°C to 70°C | PDIP (P) | Tube of 50 | TL431CP | TL431CP |
| | SOIC (D) | Tube of 75 | TL431CD | TL431C |
| | | 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 | TL431I |
| | | 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.
(2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(3) DBV/DBZ/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

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

| $T_A$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|
| -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 | |


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## $V_{ref}$ TOLERANCE (25°C) = 1%
## TL431A, TL432A ORDERING INFORMATION(1)

| $T_A$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|
| 0°C to 70°C | PDIP (P) | Tube of 50 | TL431ACP | TL431ACP |
| | SC-70 (DCK) | Reel of 3000 | TL431ACDCKR | T4_ |
| | | 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 | TL431ACLP | 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 | T5_ |
| | | 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.
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(3) DBV/DBZ/DCK: The actual top-side marking has one additional character that designates the wafer fab/assembly site.

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

| $T_A$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|
| -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 | TL431AQPK | 4D |
| | | | TL432AQPK | 2F |
| | SC-70 (PK) | Reel of 1000 | TL431AQDCKR | T7_ |
| | | Reel of 250 | TL431AQDCKT | |


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## $V_{ref}$ TOLERANCE (25°C) = 0.5%
## TL431B, TL432B ORDERING INFORMATION(1)

| $T_A$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|
| 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 | TL432IBDBZT | |
| | 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 | |

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

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### $V_{ref}$ TOLERANCE (25°C) = 0.5%
### TL431B, TL432B ORDERING INFORMATION(1) (continued)

| $T_A$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|
| -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 | |


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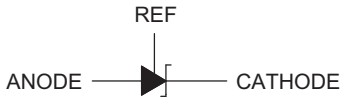
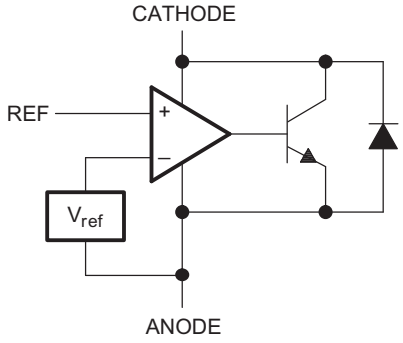
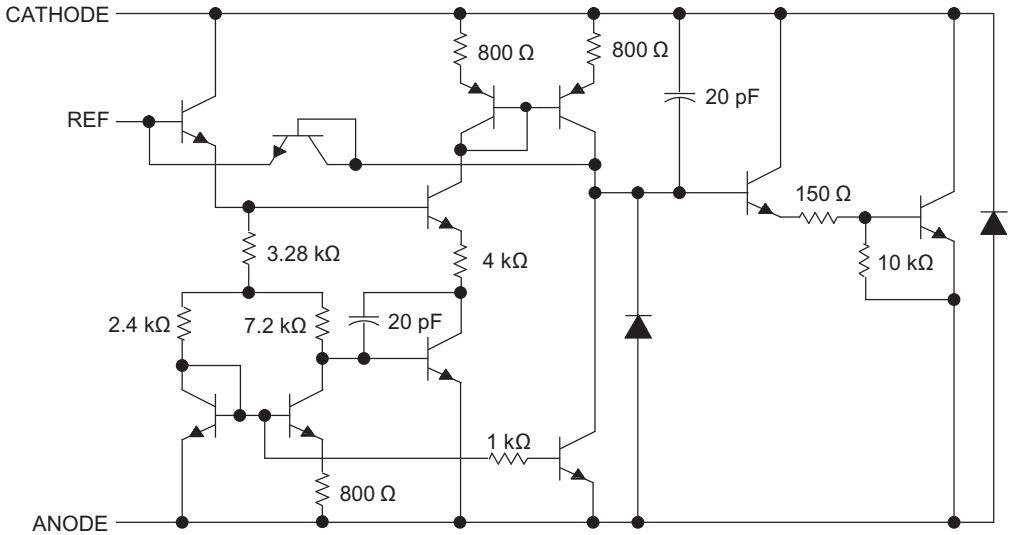
## SYMBOL




## FUNCTIONAL BLOCK DIAGRAM




## EQUIVALENT SCHEMATIC




NOTE: All component values are nominal.

## ABSOLUTE MAXIMUM RATINGS(1)

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

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| $V_{KA}$ | Cathode voltage(2) | | 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(1)

| 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 | °C |
| | | TL43xxI | –40 | 85 | |
| | | TL43xxQ | –40 | 125 | |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## ELECTRICAL CHARACTERISTICS

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

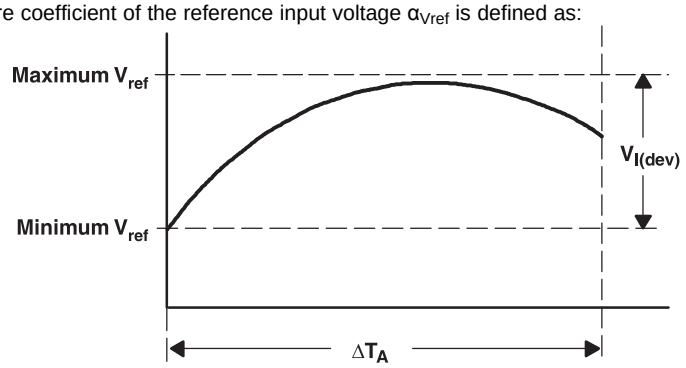
| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431C, TL432C | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2440 | 2495 | 2550 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA, | SOT23-3 and TL432 devices | | 6 | 16 | mV |
| | | | | All other devices | | 4 | 25 | |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.4 | 1.2 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 1 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 1 | µA |
| $\lvert z_{KA} \rvert$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

where:

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$ which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .

## ELECTRICAL CHARACTERISTICS

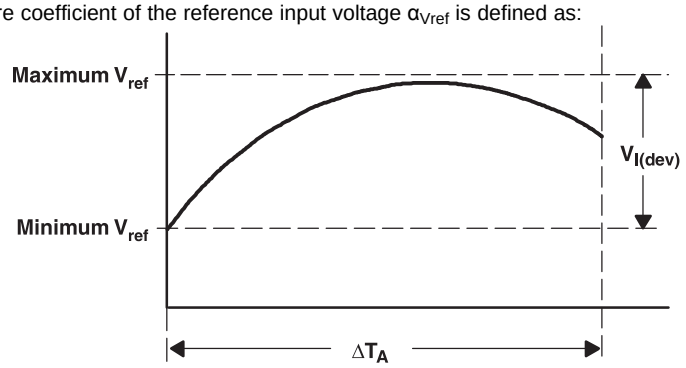
over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431I, TL432I | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2440 | 2495 | 2550 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | SOT23-3 and TL432 devices | | 14 | 34 | mV |
| | | | | All other devices | | 5 | 50 | |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 1 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 1 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$ which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .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## ELECTRICAL CHARACTERISTICS

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

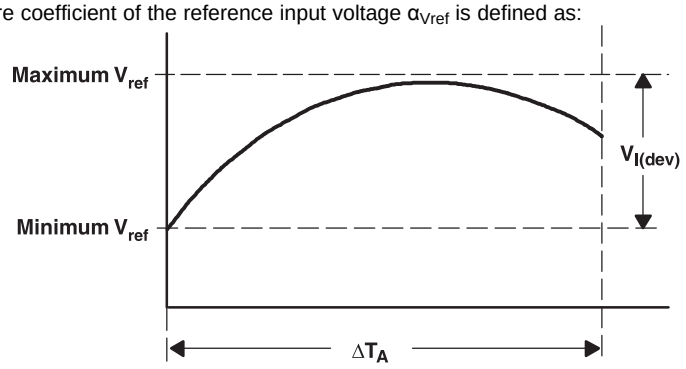
| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431Q, TL432Q | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2440 | 2495 | 2550 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | | 14 | 34 | mV |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 1 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 1 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

where:

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$

which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .

## ELECTRICAL CHARACTERISTICS

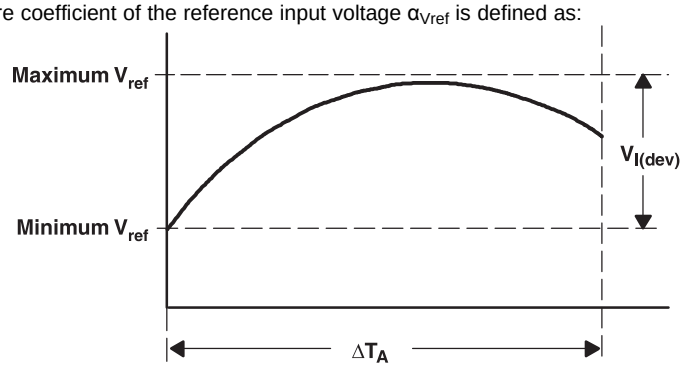
over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431AC, TL432AC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2470 | 2495 | 2520 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | SOT23-3 and TL432 devices | | 6 | 16 | mV |
| | | | | All other devices | | 4 | 25 | |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 1.2 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 0.6 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$ which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .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## ELECTRICAL CHARACTERISTICS

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

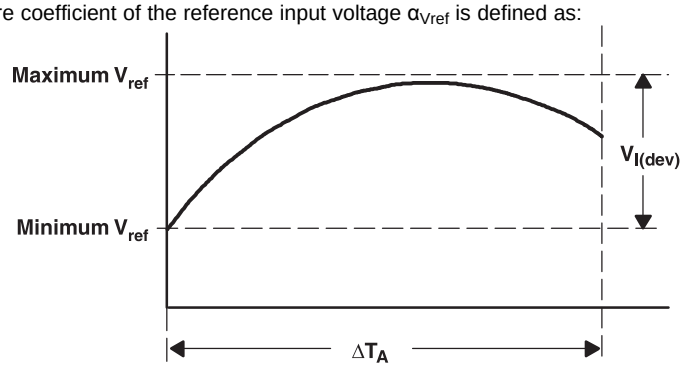
| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431AI, TL432AI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2470 | 2495 | 2520 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | SOT23-3 and TL432 devices | | 14 | 34 | mV |
| | | | | All other devices | | 5 | 50 | |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 0.7 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

where:

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$

which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .

## ELECTRICAL CHARACTERISTICS

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

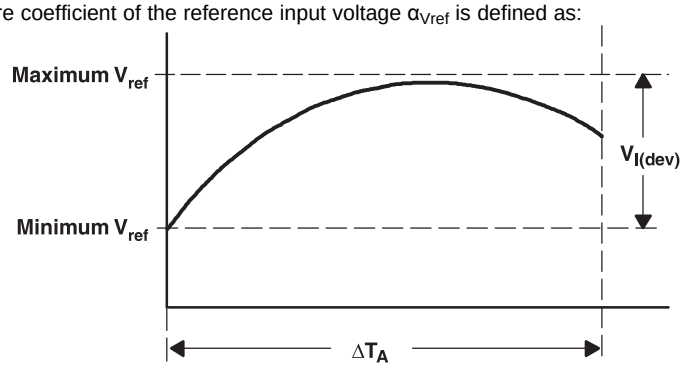
| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431AQ, TL432AQ | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2470 | 2495 | 2520 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | | 14 | 34 | mV |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 0.7 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

where:

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$

which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .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## ELECTRICAL CHARACTERISTICS

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

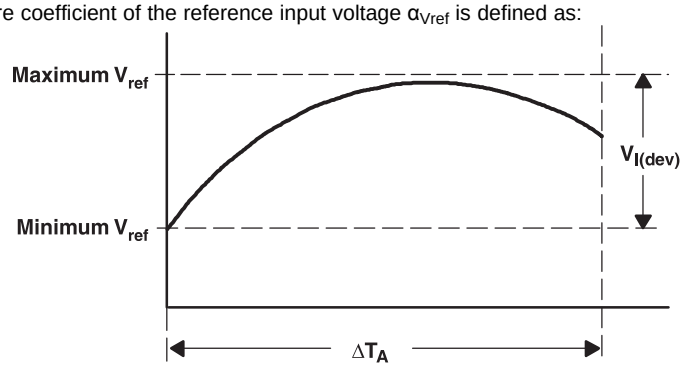
| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431BC, TL432BC | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2483 | 2495 | 2507 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | | 6 | 16 | mV |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 1.2 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 0.6 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

where:

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$

which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .

## ELECTRICAL CHARACTERISTICS

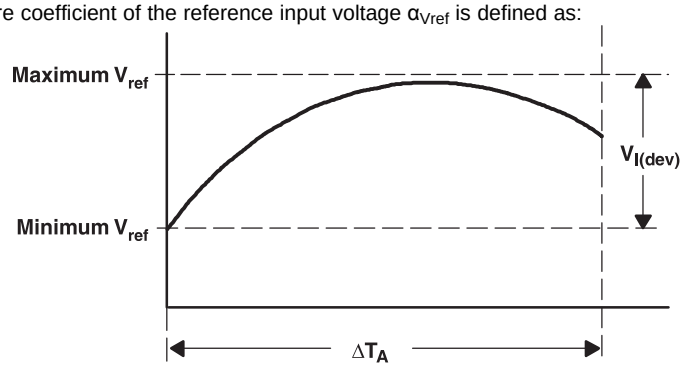
over recommended operating conditions, $T_A$ = 25°C (unless otherwise noted)

| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431BI, TL432BI | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2483 | 2495 | 2507 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | | 14 | 34 | mV |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 0.7 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$

which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .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## ELECTRICAL CHARACTERISTICS

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

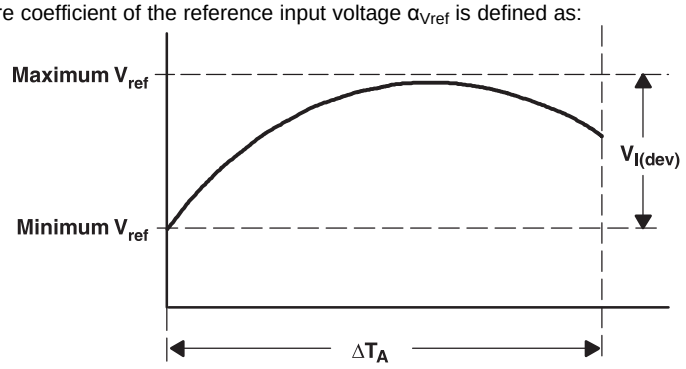
| PARAMETER | | TEST CIRCUIT | TEST CONDITIONS | | TL431BQ, TL432BQ | | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | MIN | TYP | MAX | |
| $V_{ref}$ | Reference voltage | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | 2483 | 2495 | 2507 | mV |
| $V_{I(dev)}$ | Deviation of reference input voltage over full temperature range(1) | Figure 1 | $V_{KA}$ = $V_{ref}$, $I_{KA}$ = 10 mA | | | 14 | 34 | mV |
| $\Delta V_{ref}$ / $\Delta V_{KA}$ | Ratio of change in reference voltage to the change in cathode voltage | Figure 2 | $I_{KA}$ = 10 mA | $\Delta V_{KA}$ = 10 V − $V_{ref}$ | | -1.4 | -2.7 | mV/V |
| | | | | $\Delta V_{KA}$ = 36 V − 10 V | | -1 | -2 | |
| $I_{ref}$ | Reference input current | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 2 | 4 | µA |
| $I_{I(dev)}$ | Deviation of reference input current over full temperature range(1) | Figure 2 | $I_{KA}$ = 10 mA, R1 = 10 kΩ, R2 = ∞ | | | 0.8 | 2.5 | µA |
| $I_{min}$ | Minimum cathode current for regulation | Figure 1 | $V_{KA}$ = $V_{ref}$ | | | 0.4 | 0.7 | mA |
| $I_{off}$ | Off-state cathode current | Figure 3 | $V_{KA}$ = 36 V, $V_{ref}$ = 0 | | | 0.1 | 0.5 | µA |
| $\|z_{KA}\|$ | Dynamic impedance(2) | Figure 1 | $V_{KA}$ = $V_{ref}$, f ≤ 1 kHz, $I_{KA}$ = 1 mA to 100 mA | | | 0.2 | 0.5 | Ω |

(1) The deviation parameters $V_{ref(dev)}$ and $I_{ref(dev)}$ 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 $\alpha_{Vref}$ is defined as:

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

where:

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




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

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

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is given by: $|z'| = \frac{\Delta V}{\Delta I}$

which is approximately equal to $|z_{KA}|\left(1 + \frac{R1}{R2}\right)$ .

## PARAMETER MEASUREMENT INFORMATION

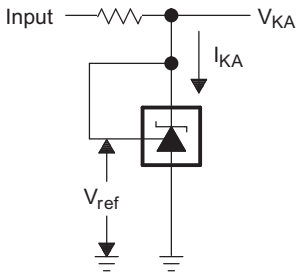



**Figure 1. Test Circuit for $V_{KA} = V_{ref}$**

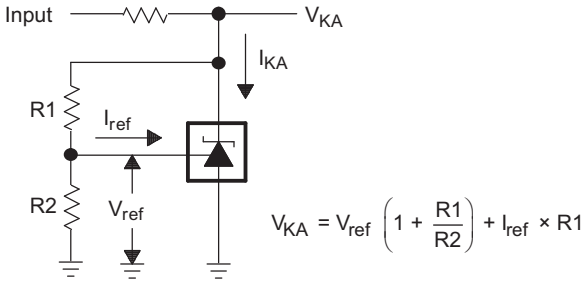



**Figure 2. Test Circuit for $V_{KA} > V_{ref}$**

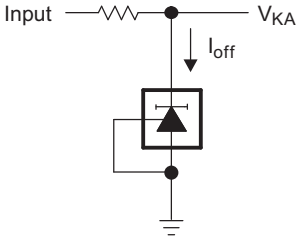



**Figure 3. Test Circuit for $I_{off}$**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## TYPICAL CHARACTERISTICS

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

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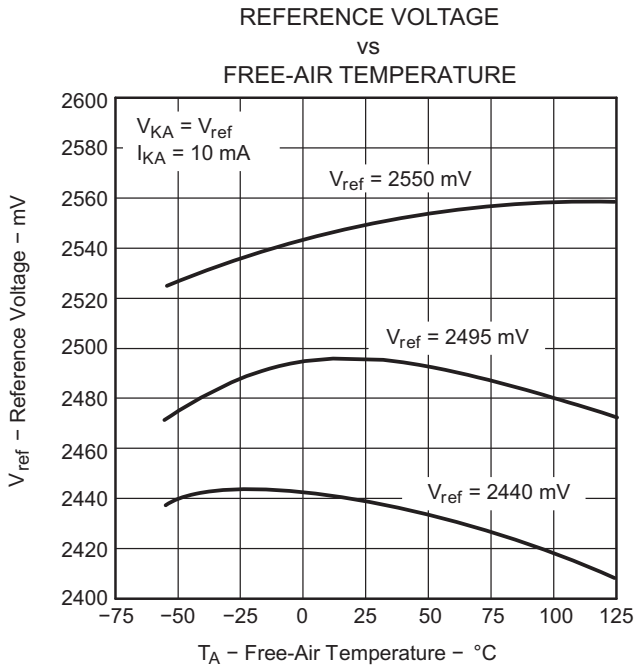


**Figure 4.**

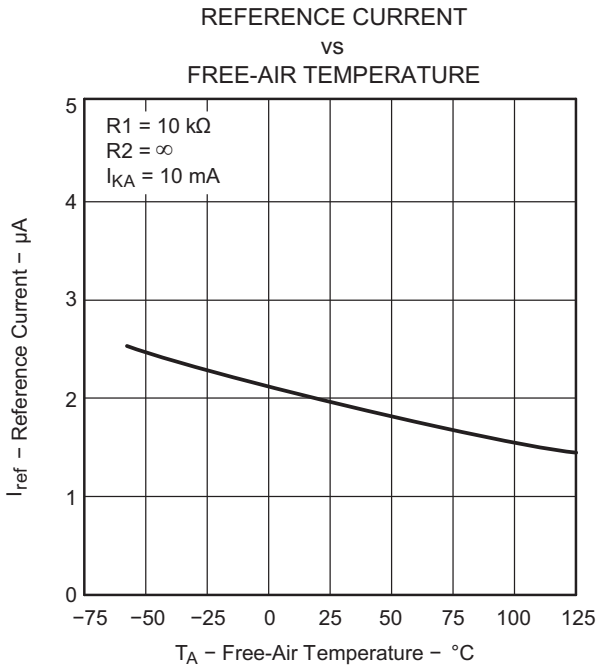


**Figure 5.**

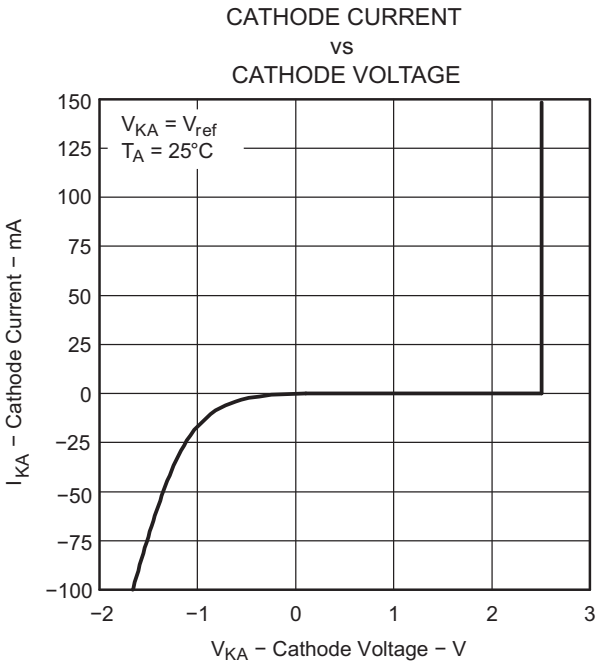


**Figure 6.**

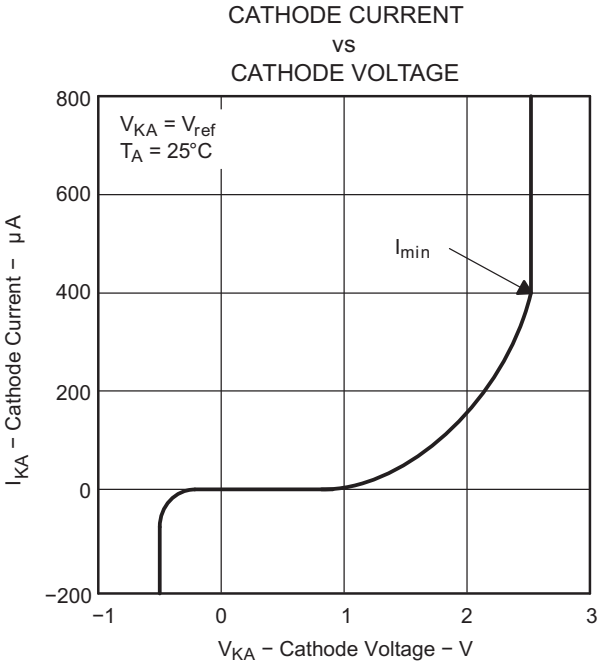


**Figure 7.**


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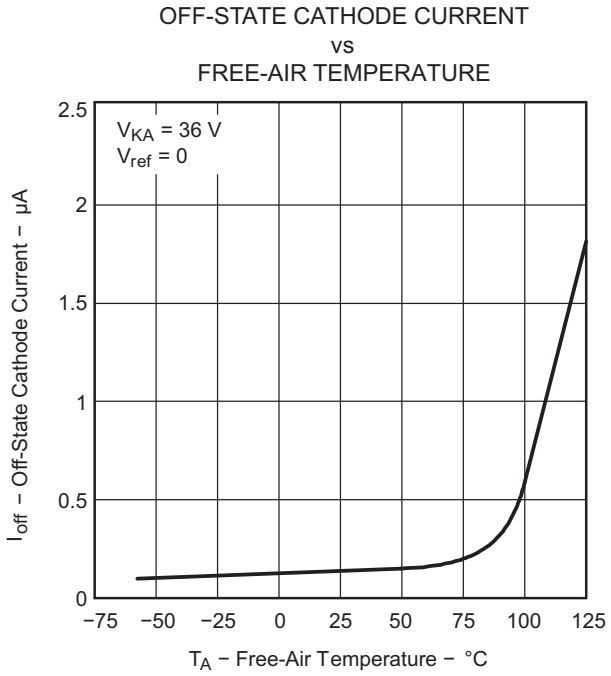


**Figure 8.**

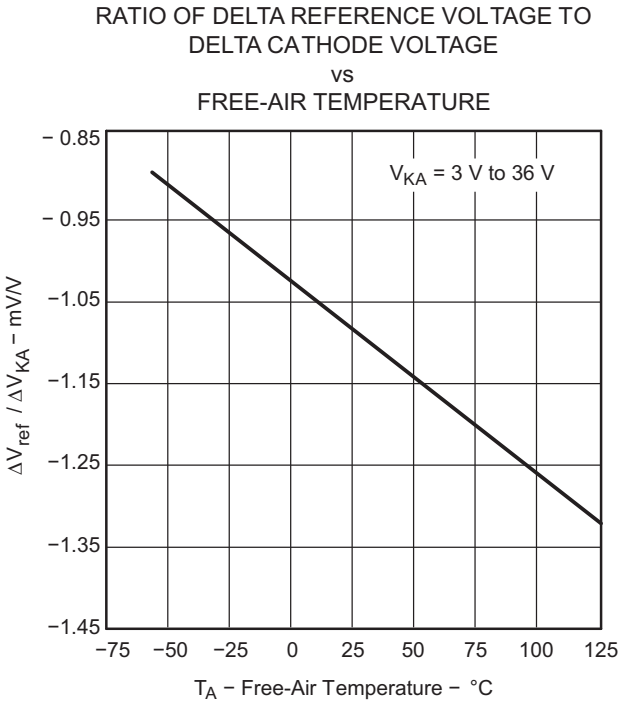


**Figure 9.**

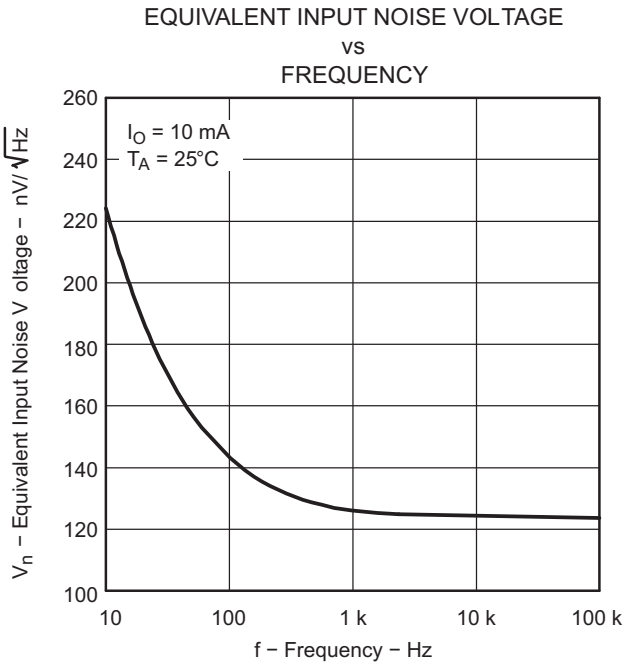


**Figure 10.**

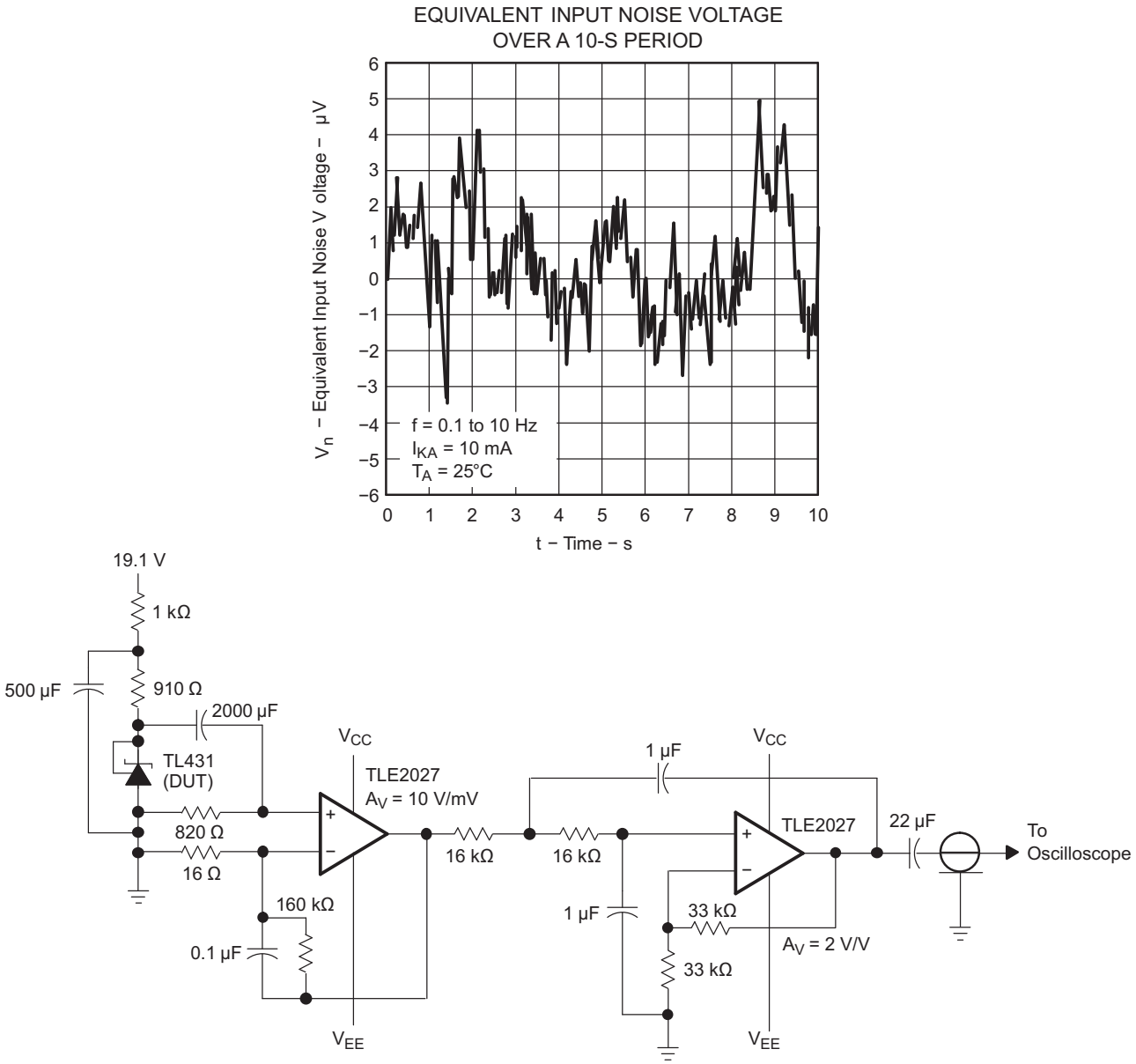


**Figure 11.**


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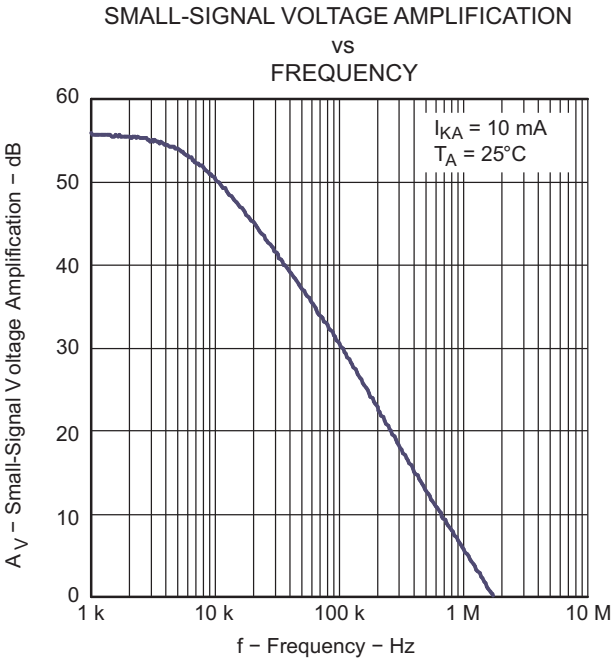
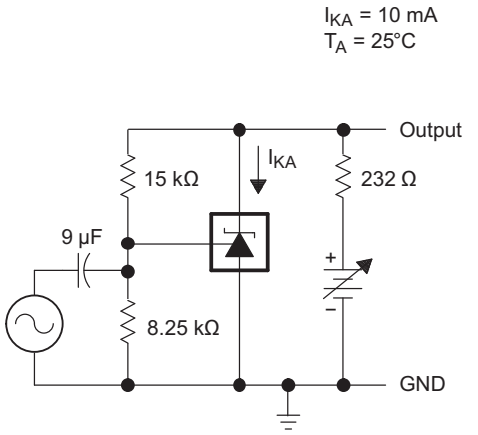
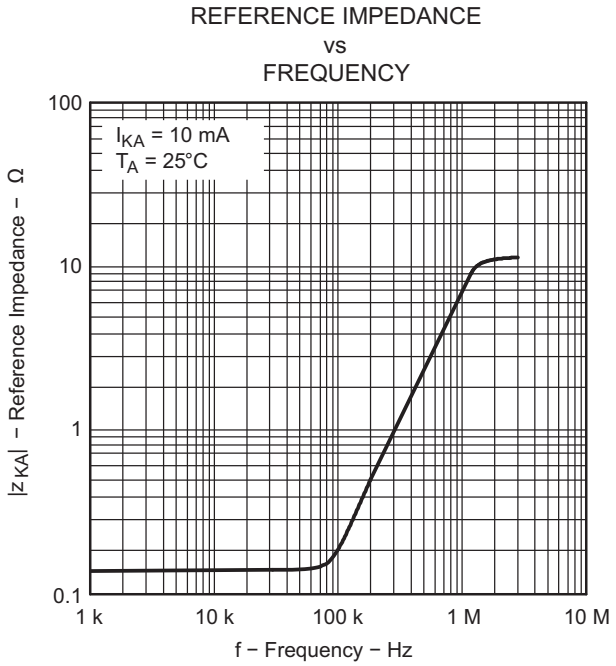
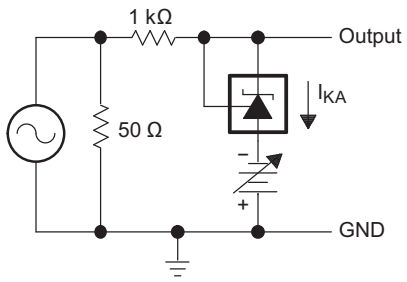



TEST CIRCUIT FOR VOLTAGE AMPLIFICATION

**Figure 12.**




TEST CIRCUIT FOR REFERENCE IMPEDANCE

**Figure 13.**

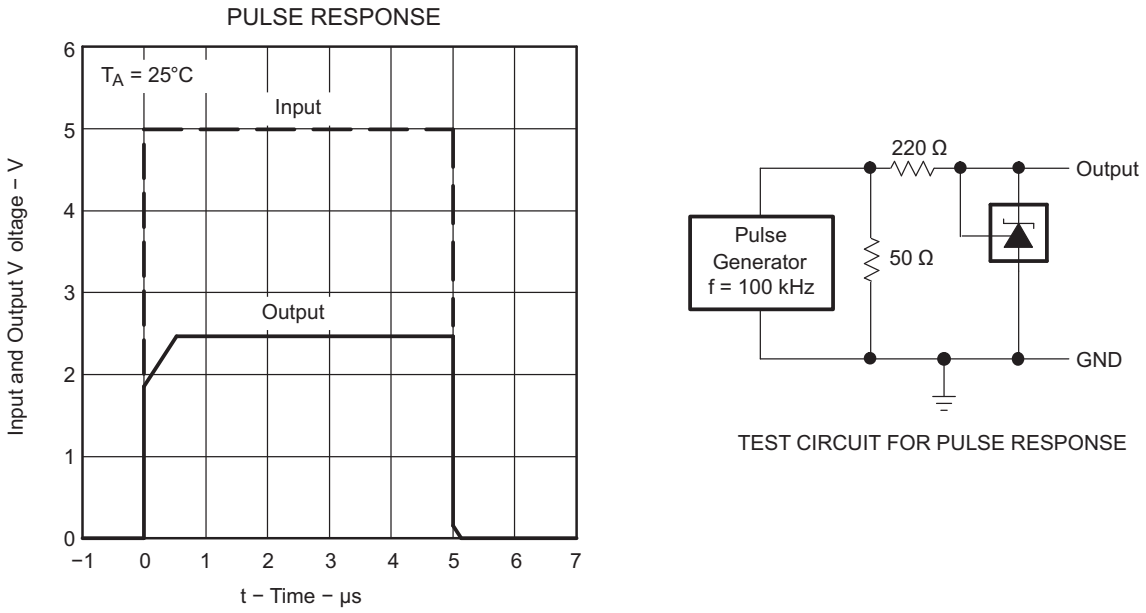
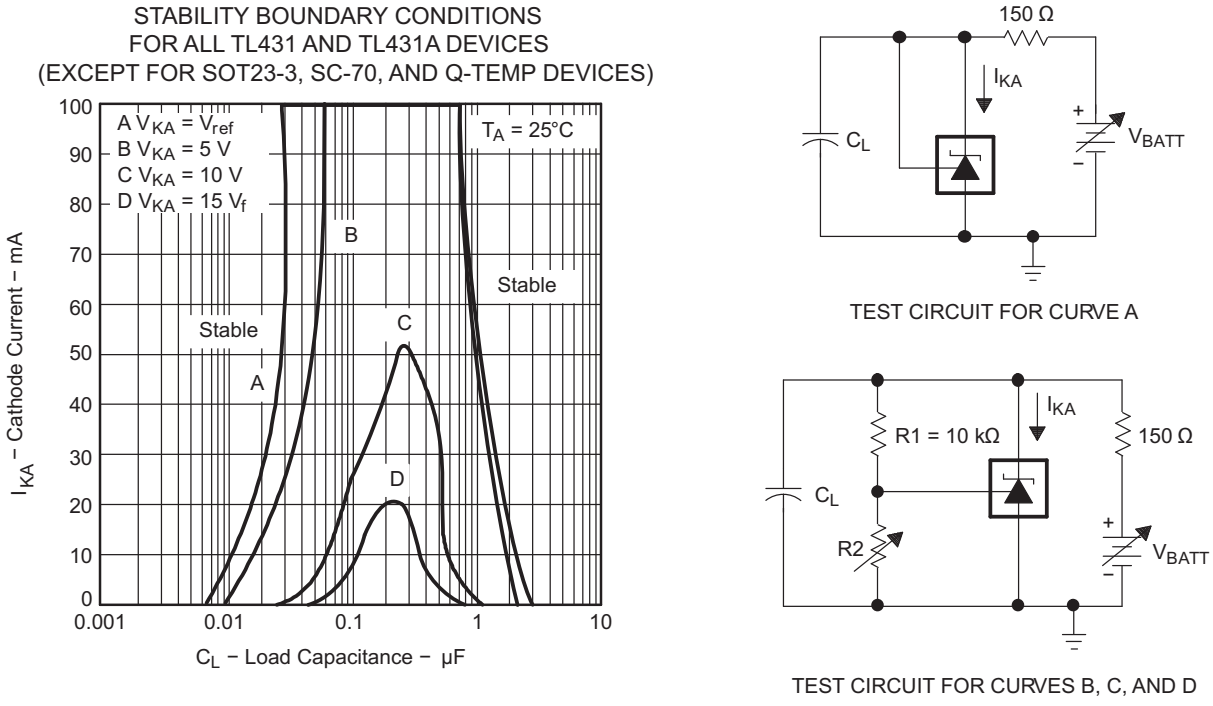



**Figure 14.**




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 $V_{KA}$ and $I_{KA}$ conditions, with $C_L$ = 0. $V_{BATT}$ and $C_L$ then are adjusted to determine the ranges of stability.

**Figure 15.**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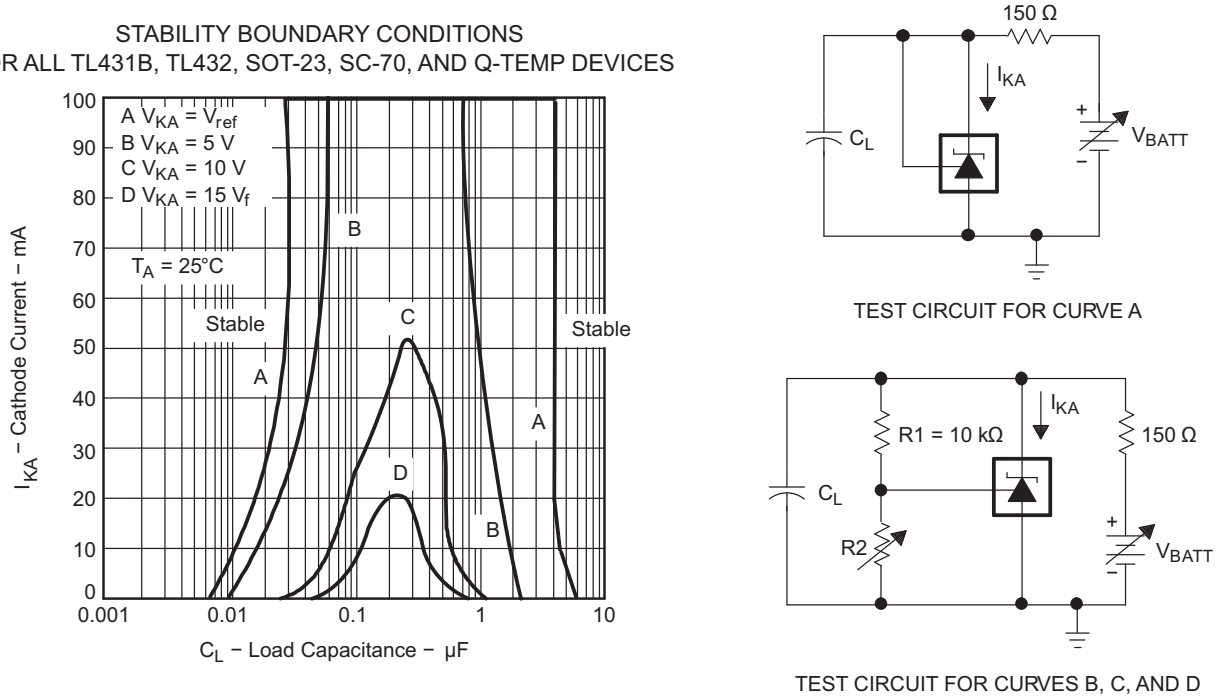


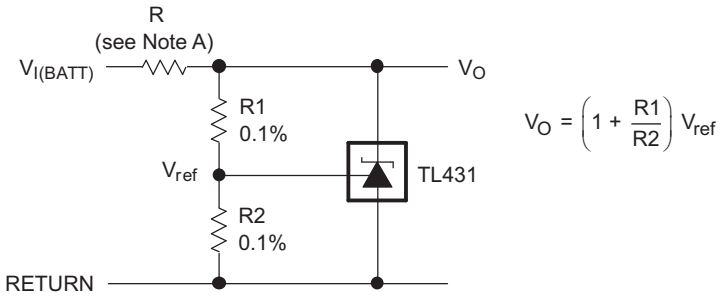

A. The areas under the curves represent conditions that may cause the device to oscillate. For curves B, C, and D, R2 and V+ are adjusted to establish the initial $V_{KA}$ and $I_{KA}$ conditions, with $C_L$ = 0. $V_{BATT}$ and $C_L$ then are adjusted to determine the ranges of stability.

**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 ≥1 mA to the TL431 at minimum $V_{(BATT)}$.

**Figure 17. Shunt Regulator**

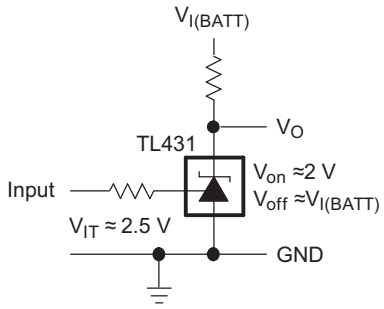



**Figure 18. Single-Supply Comparator With Temperature-Compensated Threshold**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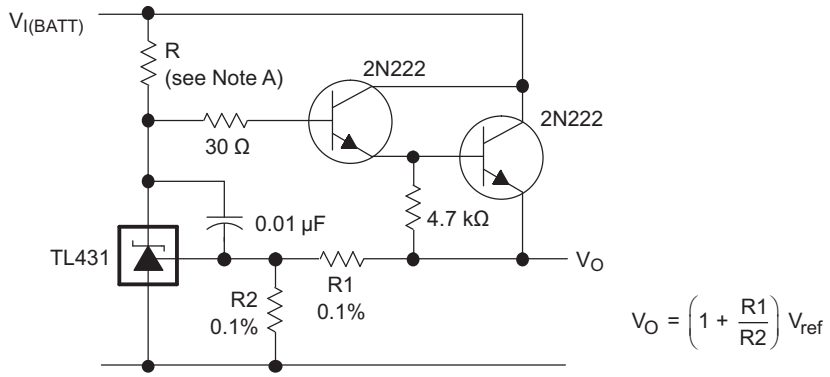



A. R should provide cathode current ≥1 mA to the TL431 at minimum $V_{(BATT)}$.

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

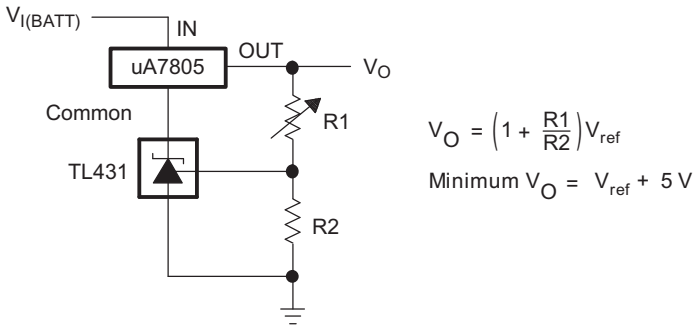



**Figure 20. Output Control of a Three-Terminal Fixed Regulator**

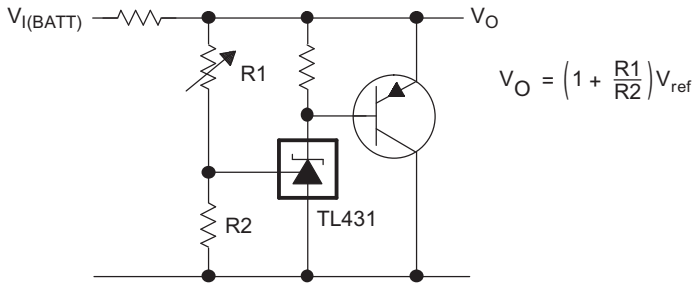
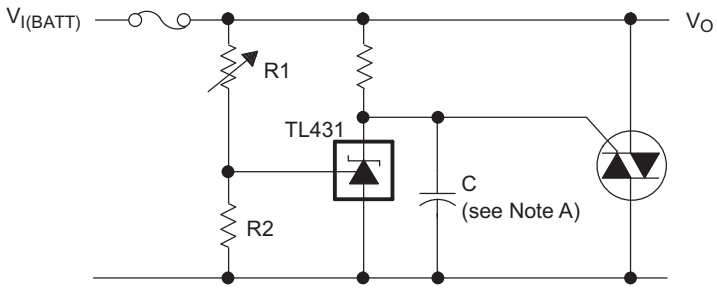



**Figure 21. High-Current Shunt Regulator**




A. Refer to the stability boundary conditions in Figure 15 and Figure 16 to determine allowable values for C.

**Figure 22. Crowbar Circuit**

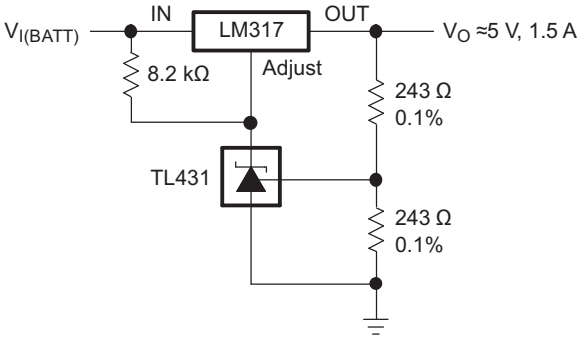
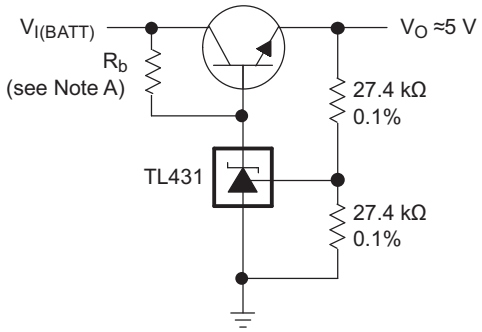



**Figure 23. Precision 5-V, 1.5-A Regulator**




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

**Figure 24. Efficient 5-V Precision Regulator**

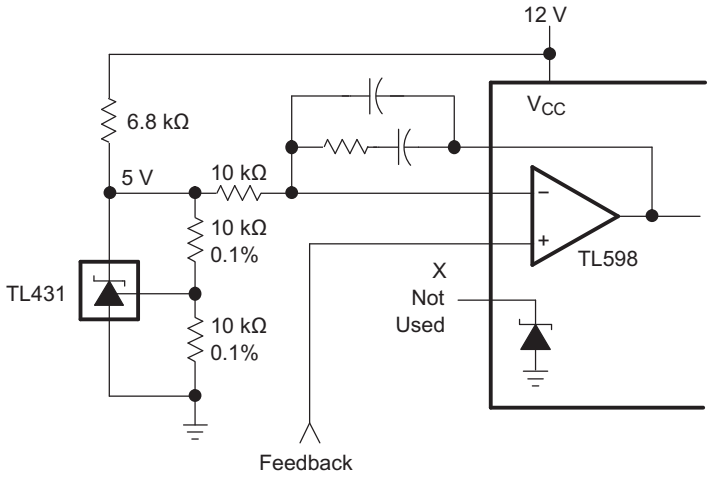



**Figure 25. PWM Converter With Reference**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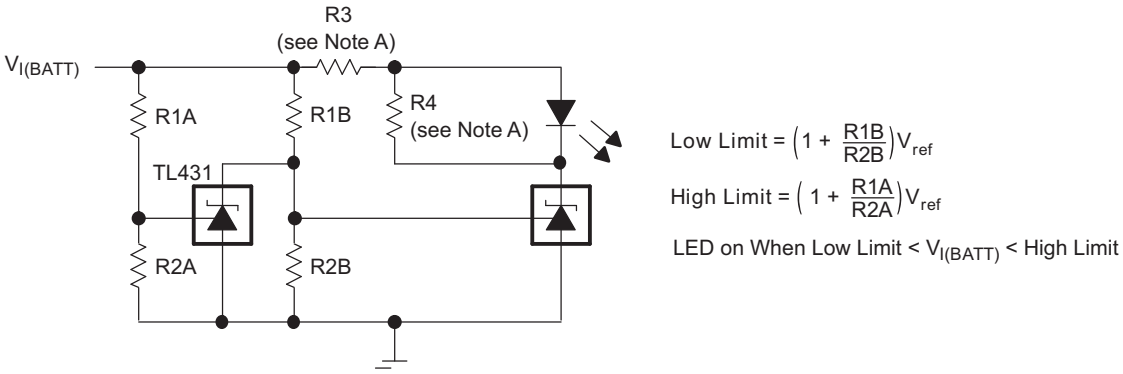


A. Select R3 and R4 to provide the desired LED intensity and cathode current ≥1 mA to the TL431 at the available $V_{I(BATT)}$.

**Figure 26. Voltage Monitor**

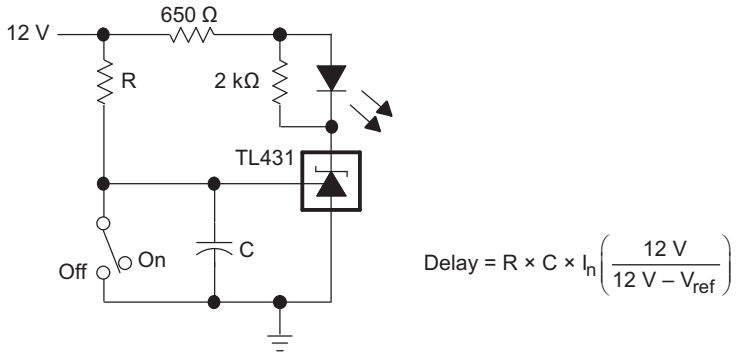


**Figure 27. Delay Timer**

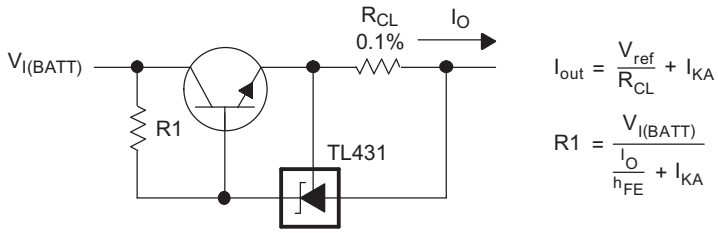


**Figure 28. Precision Current Limiter**

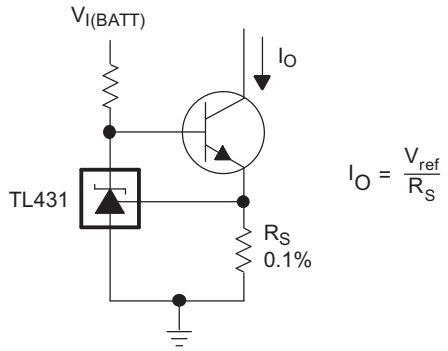


**Figure 29. Precision Constant-Current Sink**

## REVISION HISTORY

**Changes from Revision K (June 2010) to Revision L** **Page**

- Deleted $T_A$ values under TEST CONDITIONS for $V_{I(dev)}$ and $I_{I(dev)}$ PARAMTERS in the ELECTRICAL CHRACTERISTICS table. ..... 11


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## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431ACD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431ACDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACDRG3 | PREVIEW | SOIC | D | 8 | 2500 | TBD | Call TI | Call TI | |
| TL431ACDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACLP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431ACLPE3 | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431ACLPM | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431ACLPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431ACP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431ACPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431ACPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431ACPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431ACPSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPSRE4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPW | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPWE4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPWG4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ACPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431AID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431AIDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AIDRG3 | PREVIEW | SOIC | D | 8 | 2500 | TBD | Call TI | Call TI | |
| TL431AIDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AILP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431AILPM | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431AILPME3 | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431AILPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431AIP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431AIPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431AIPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431AIPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431AQDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431AQDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431AQPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431AQPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431BCD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431BCDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCLP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BCLPE3 | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BCLPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BCLPRE3 | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BCP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431BCPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431BCPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431BCPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431BCPSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCPSRE4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCPSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCPWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BCPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431BIDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BIDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BILP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BILPE3 | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BILPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BILPRE3 | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BIP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431BIPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431BIPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431BIPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431BQD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431BQDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431BQDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431BQLP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BQLPE3 | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BQLPM | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BQLPME3 | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BQLPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BQLPRE3 | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431BQPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431BQPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431BQPSR | PREVIEW | SO | PS | 8 | 2000 | TBD | Call TI | Call TI | |
| TL431CD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431CDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CKTPR | OBSOLETE | PFM | KTP | 2 | | TBD | Call TI | Call TI | |
| TL431CLP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431CLPB-TDJ | OBSOLETE | TO-92 | LP | 3 | | TBD | Call TI | Call TI | |
| TL431CLPM | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431CLPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431CP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431CPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431CPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431CPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431CPSLE | OBSOLETE | SO | PS | 8 | | TBD | Call TI | Call TI | |
| TL431CPSR | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CPSRG4 | ACTIVE | SO | PS | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CPW | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CPWE4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CPWG4 | ACTIVE | TSSOP | PW | 8 | 150 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CPWLE | OBSOLETE | TSSOP | PW | 8 | | TBD | Call TI | Call TI | |
| TL431CPWR | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431CPWRE4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431CPWRG4 | ACTIVE | TSSOP | PW | 8 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ID | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431IDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431ILP | ACTIVE | TO-92 | LP | 3 | 1000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431ILPM | OBSOLETE | TO-92 | LP | 3 | | TBD | Call TI | Call TI | |
| TL431ILPR | ACTIVE | TO-92 | LP | 3 | 2000 | Pb-Free (RoHS) | CU SN | N / A for Pkg Type | |
| TL431IP | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |
| TL431IPE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431IPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431IPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431MFKB | OBSOLETE | LCCC | FK | 20 | | TBD | Call TI | Call TI | |
| TL431MJG | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI | |
| TL431MJGB | OBSOLETE | CDIP | JG | 8 | | TBD | Call TI | Call TI | |
| TL431QD | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDCKR | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDCKRE4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDCKRG4 | ACTIVE | SC70 | DCK | 6 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL431QDCKT | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDCKTE4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDCKTG4 | ACTIVE | SC70 | DCK | 6 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDE4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDRE4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QDRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL431QPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL431QPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432ACDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432ACDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432ACDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432ACDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432ACDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432ACDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432ACDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL432AIDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AIPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432AIPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432AQDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBVT | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBVTE4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBVTG4 | ACTIVE | SOT-23 | DBV | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432AQDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL432AQPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432AQPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432BCDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BCPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432BCPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432BIDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BIDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BIDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BIDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BIPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432BIPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432BQDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL432BQDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432BQDBZT | PREVIEW | SOT-23 | DBZ | 3 | 250 | TBD | Call TI | Call TI | |
| TL432BQPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432BQPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432CDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432CPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432CPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432IDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432IDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432IDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432IDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/ Ball Finish | MSL Peak Temp (3) | Samples (Requires Login) |
|---|---|---|---|---|---|---|---|---|---|
| TL432IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432IDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432IPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432IPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432QDBVR | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432QDBVRE4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432QDBVRG4 | ACTIVE | SOT-23 | DBV | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432QDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | |
| TL432QPK | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |
| TL432QPKG3 | ACTIVE | SOT-89 | PK | 3 | 1000 | Green (RoHS & no Sb/Br) | CU SN | Level-2-260C-1 YEAR | |

(1) 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.

(2) 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)

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

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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 :**

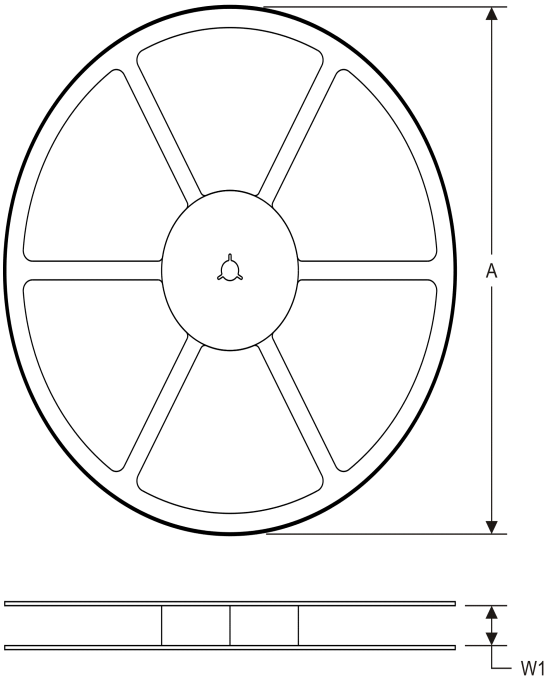
- Automotive: TL431A-Q1, TL431B-Q1, TL432A-Q1, TL432B-Q1

NOTE: Qualified Version Definitions:

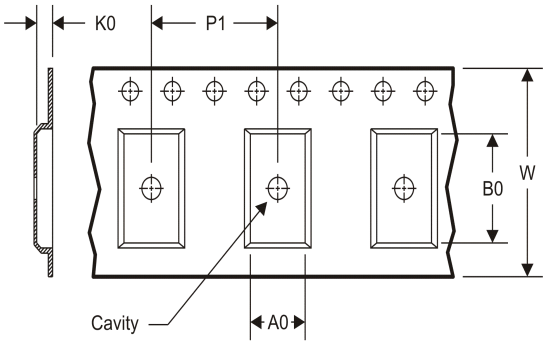
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**




**TAPE DIMENSIONS**




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

**TAPE AND REEL INFORMATION**

*All dimensions are nominal

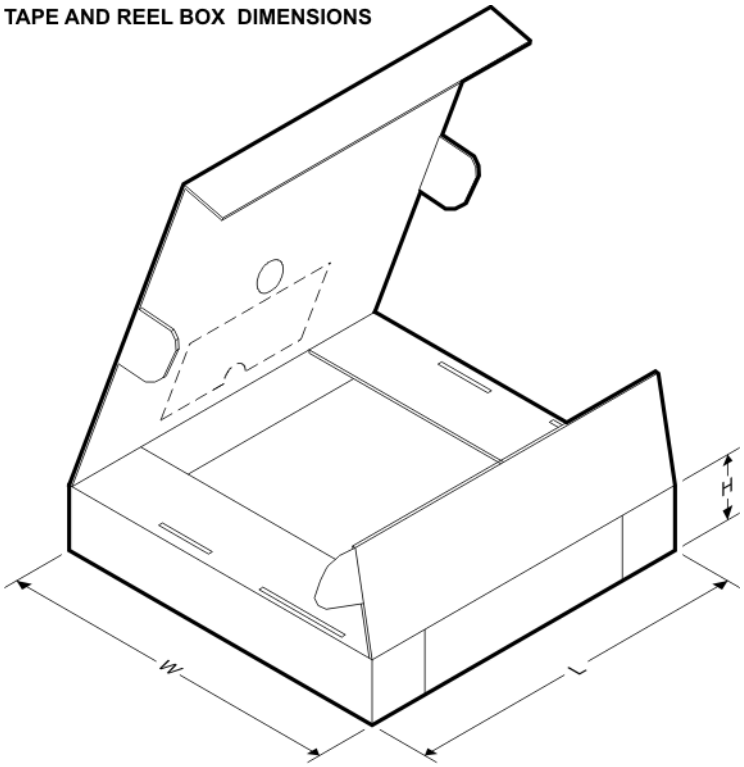
| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL431ACDBVR | SOT-23 | DBV | 5 | 3000 | 178.0 | 9.0 | 3.23 | 3.17 | 1.37 | 4.0 | 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431ACDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL431ACDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL431ACDCKR | SC70 | DCK | 6 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431AIDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 8.4 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431AIDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL431AIDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 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 |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 | 8.4 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431AQDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431AQDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL431BCDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431BCDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 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 |
| TL431BIDBVR | SOT-23 | DBV | 5 | 3000 | 179.0 | 8.4 | 3.2 | 3.2 | 1.4 | 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 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL431BIDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431BQDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 | 8.4 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431CDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431CDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 |

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431IDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 8.4 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431IDR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| TL431IPK | SOT-89 | PK | 3 | 1000 | 180.0 | 12.4 | 4.91 | 4.52 | 1.9 | 8.0 | 12.0 | Q3 |
| 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL431QDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432ACDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | 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 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL432AIDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432AIDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 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 | 8.4 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432AQDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432AQDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432AQPK | SOT-89 | PK | 3 | 1000 | 180.0 | 12.4 | 4.91 | 4.52 | 1.9 | 8.0 | 12.0 | Q3 |
| 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432BCDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 |
| TL432BIDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL432BIDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432BIDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 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 |
| TL432BQDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.08 | 2.8 | 1.27 | 4.0 | 8.0 | Q3 |
| TL432BQPK | SOT-89 | PK | 3 | 1000 | 180.0 | 12.4 | 4.91 | 4.52 | 1.9 | 8.0 | 12.0 | Q3 |
| 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL432CDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL432IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 |
| TL432QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 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 | 203.0 | 203.0 | 35.0 |
| TL431ACDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL431ACDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL431ACDCKR | SC70 | DCK | 6 | 3000 | 203.0 | 203.0 | 35.0 |
| TL431ACDCKT | SC70 | DCK | 6 | 250 | 203.0 | 203.0 | 35.0 |
| TL431ACDR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |

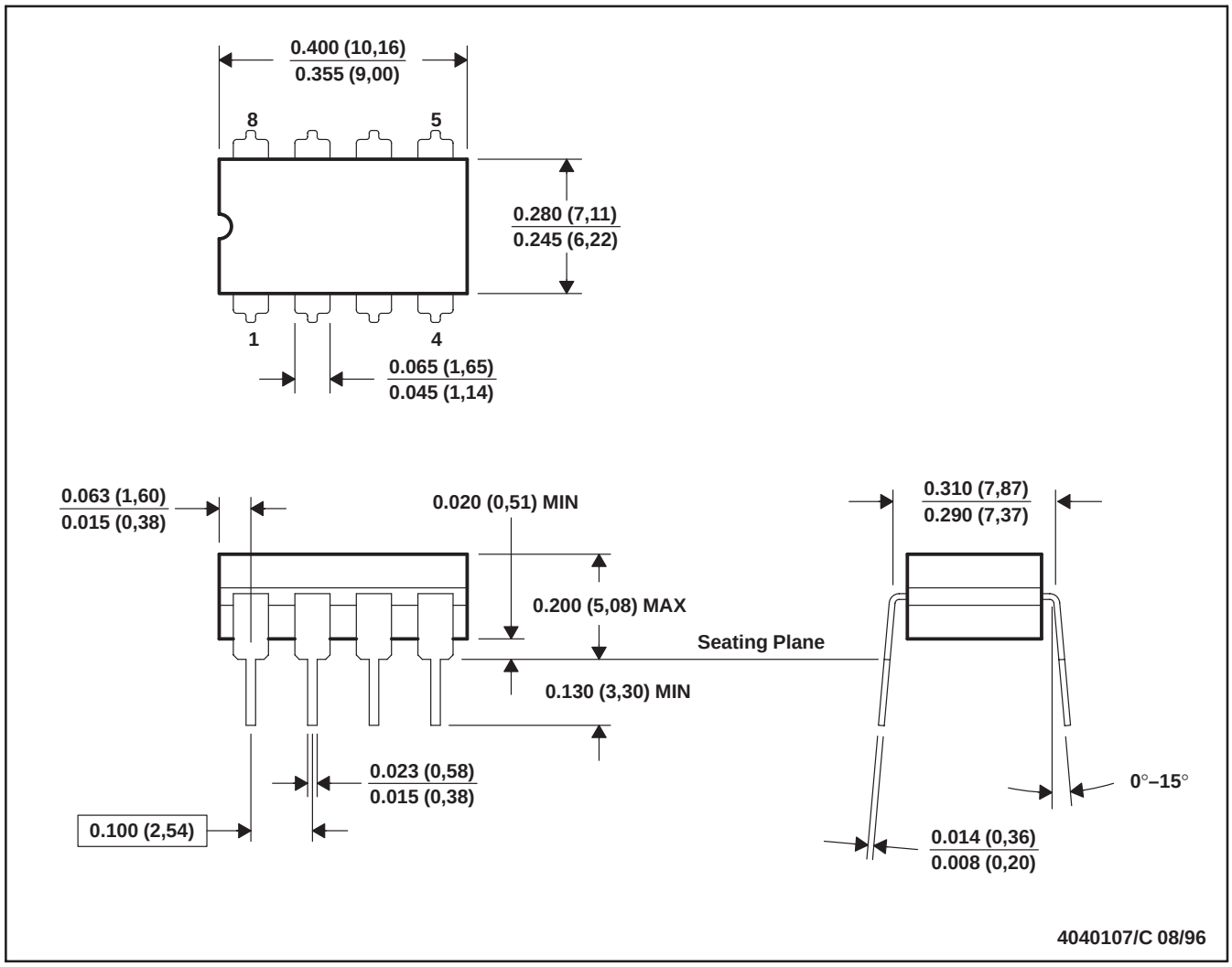
| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TL431ACPK | SOT-89 | PK | 3 | 1000 | 340.0 | 340.0 | 38.0 |
| TL431ACPSR | SO | PS | 8 | 2000 | 346.0 | 346.0 | 33.0 |
| TL431ACPWR | TSSOP | PW | 8 | 2000 | 346.0 | 346.0 | 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 | 203.0 | 203.0 | 35.0 |
| TL431AIDBZR | SOT-23 | DBZ | 3 | 3000 | 202.0 | 201.0 | 28.0 |
| TL431AIDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL431AIDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| 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 |
| TL431AQDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL431AQDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| 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 | 180.0 | 180.0 | 18.0 |
| TL431BCDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL431BCDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| 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 |
| TL431BIDBVR | SOT-23 | DBV | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL431BIDBVT | SOT-23 | DBV | 5 | 250 | 180.0 | 180.0 | 18.0 |
| TL431BIDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL431BIDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL431BQDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| 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 |
| TL431CDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL431CDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| 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 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL431IDBZR | SOT-23 | DBZ | 3 | 3000 | 202.0 | 201.0 | 28.0 |
| TL431IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL431QDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL432ACDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL432AIDBVR | SOT-23 | DBV | 5 | 3000 | 180.0 | 180.0 | 18.0 |
| TL432AIDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL432AIDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL432AIDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| 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 |
| TL432AQDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL432AQDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL432BCDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL432BCPK | SOT-89 | PK | 3 | 1000 | 340.0 | 340.0 | 38.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TL432BIDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL432BIDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL432BIDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL432BIPK | SOT-89 | PK | 3 | 1000 | 340.0 | 340.0 | 38.0 |
| TL432BQDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL432CDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| 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 | 203.0 | 203.0 | 35.0 |
| TL432IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL432IPK | SOT-89 | PK | 3 | 1000 | 340.0 | 340.0 | 38.0 |
| TL432QDBVR | SOT-23 | DBV | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL432QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL432QPK | SOT-89 | PK | 3 | 1000 | 340.0 | 340.0 | 38.0 |

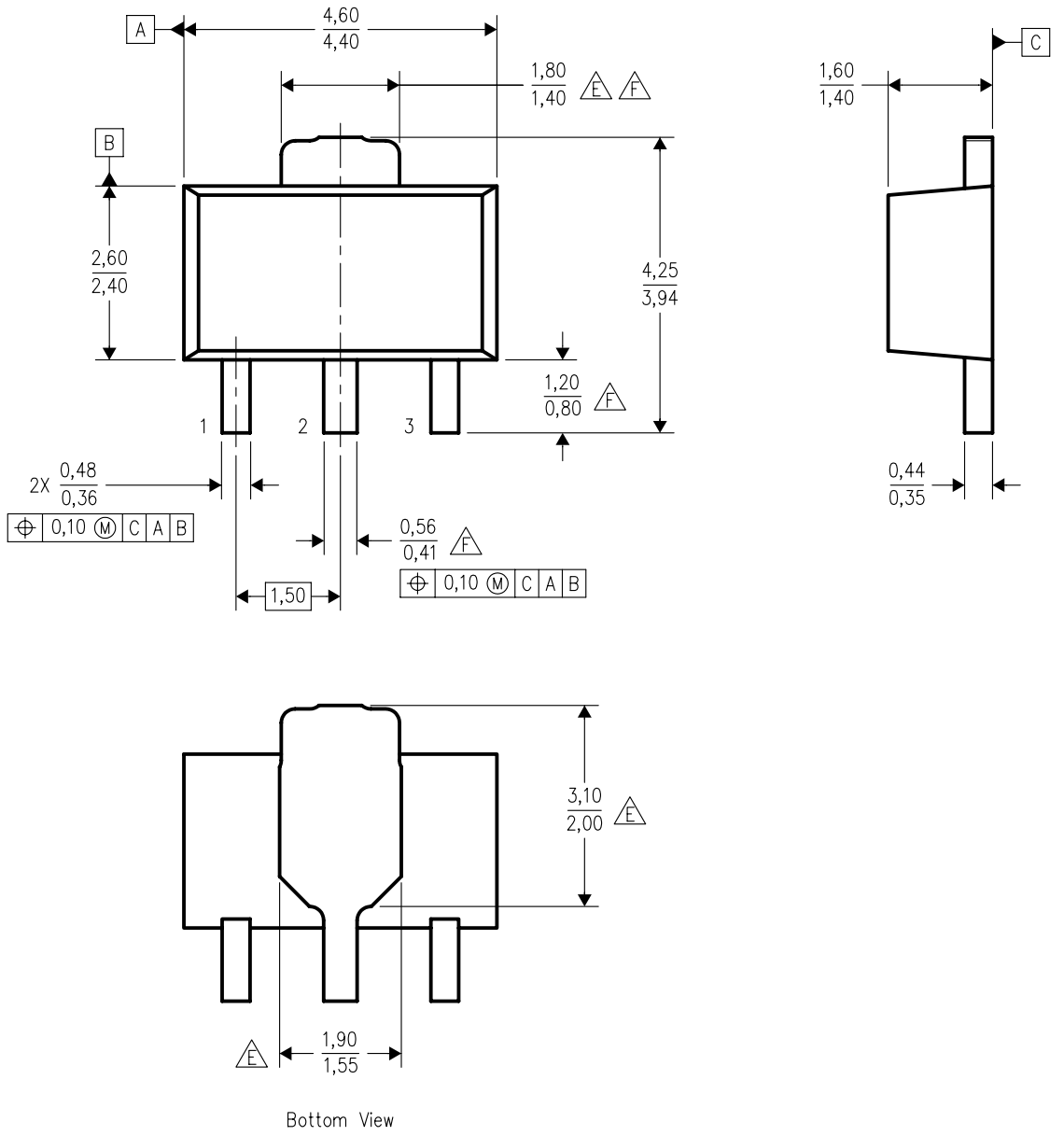
MCER001A – JANUARY 1995 – REVISED JANUARY 1997

**JG (R-GDIP-T8)** **CERAMIC DUAL-IN-LINE**



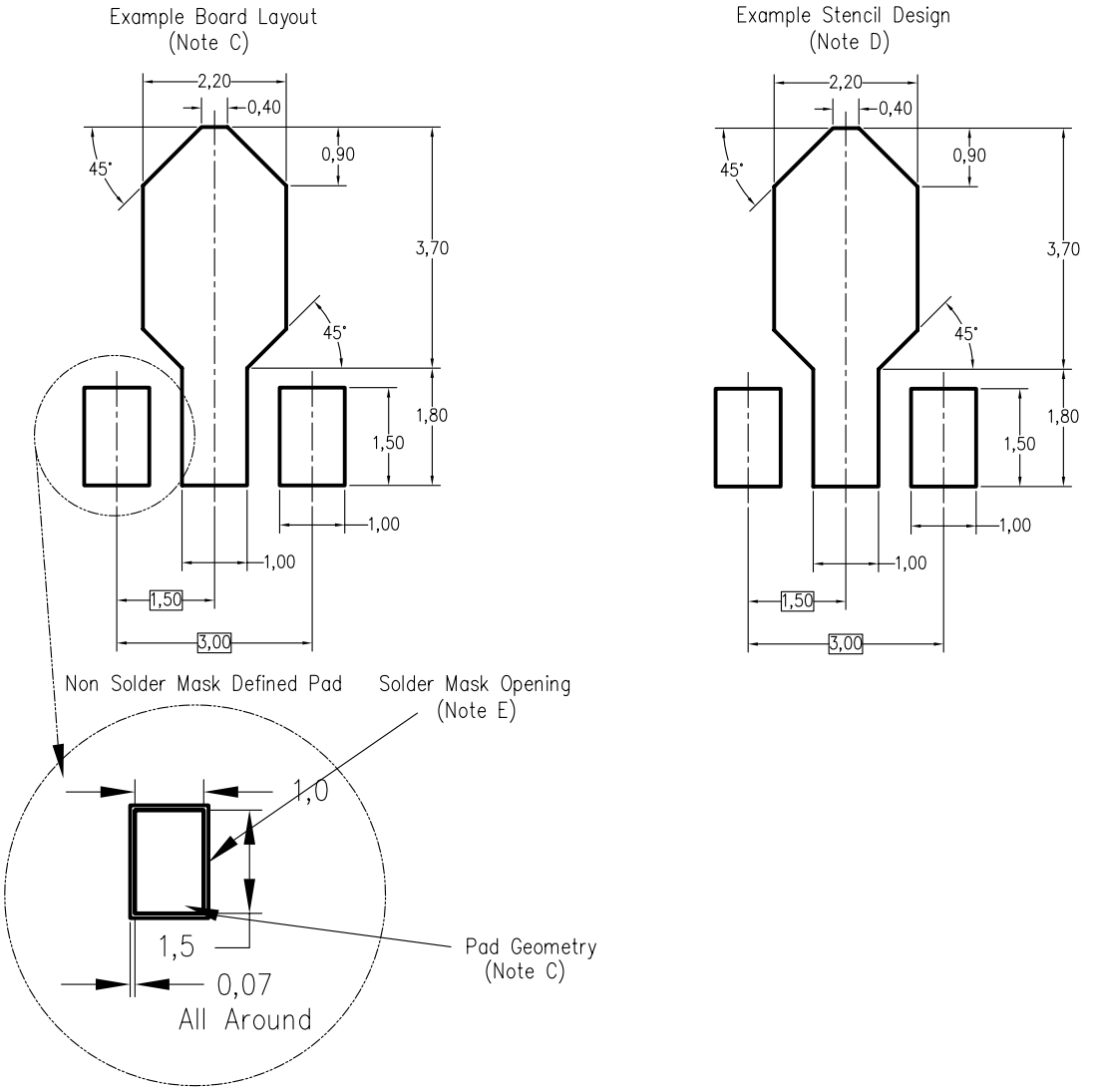

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification.
E. Falls within MIL STD 1835 GDIP1-T8

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




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

# PK (R–PDSO–G3)

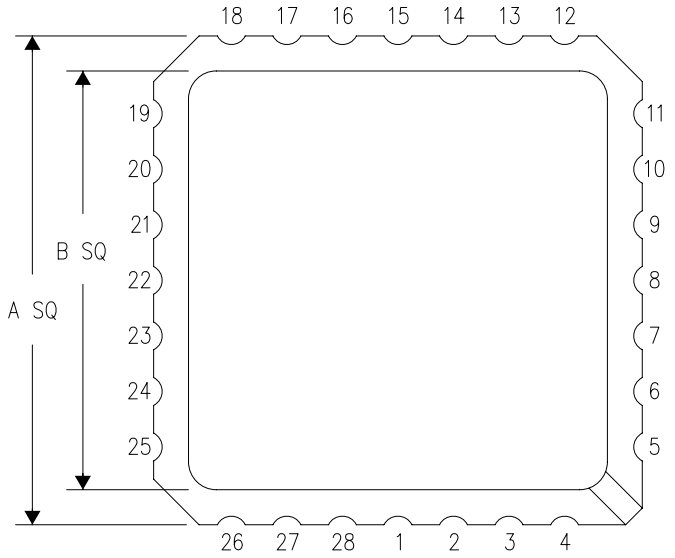



4208221/A 09/06

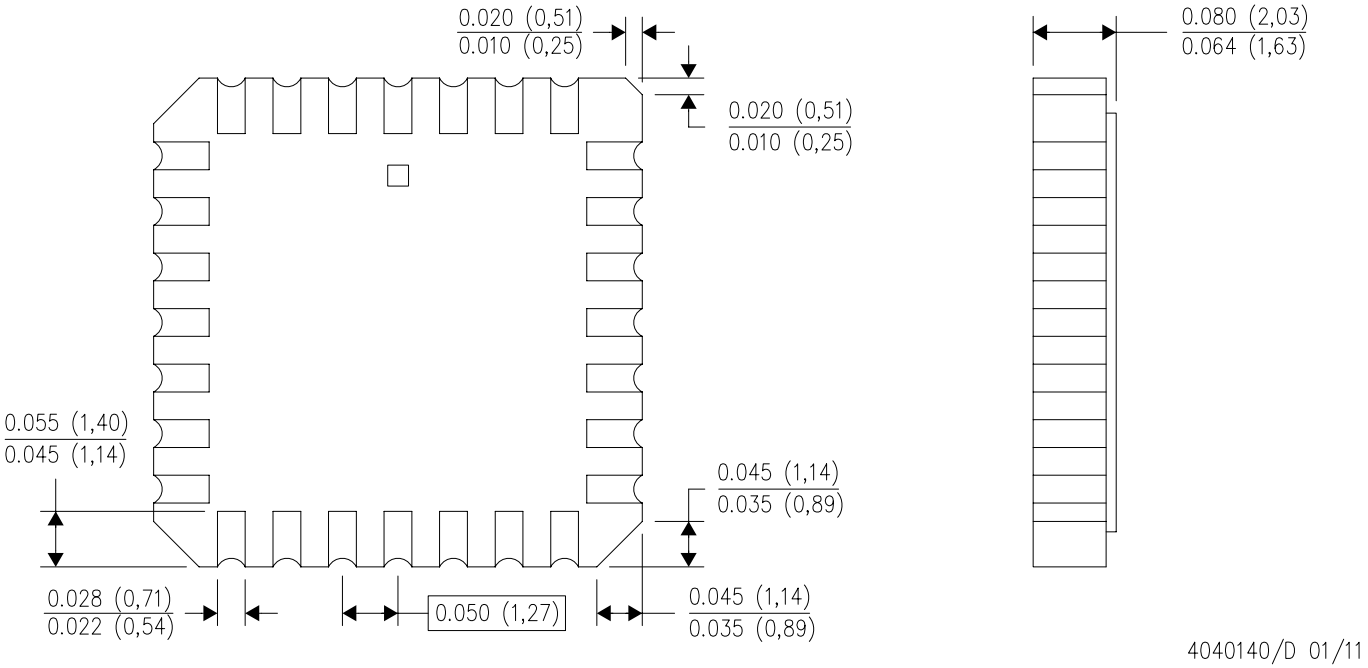
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact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

FK (S–CQCC–N**) LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



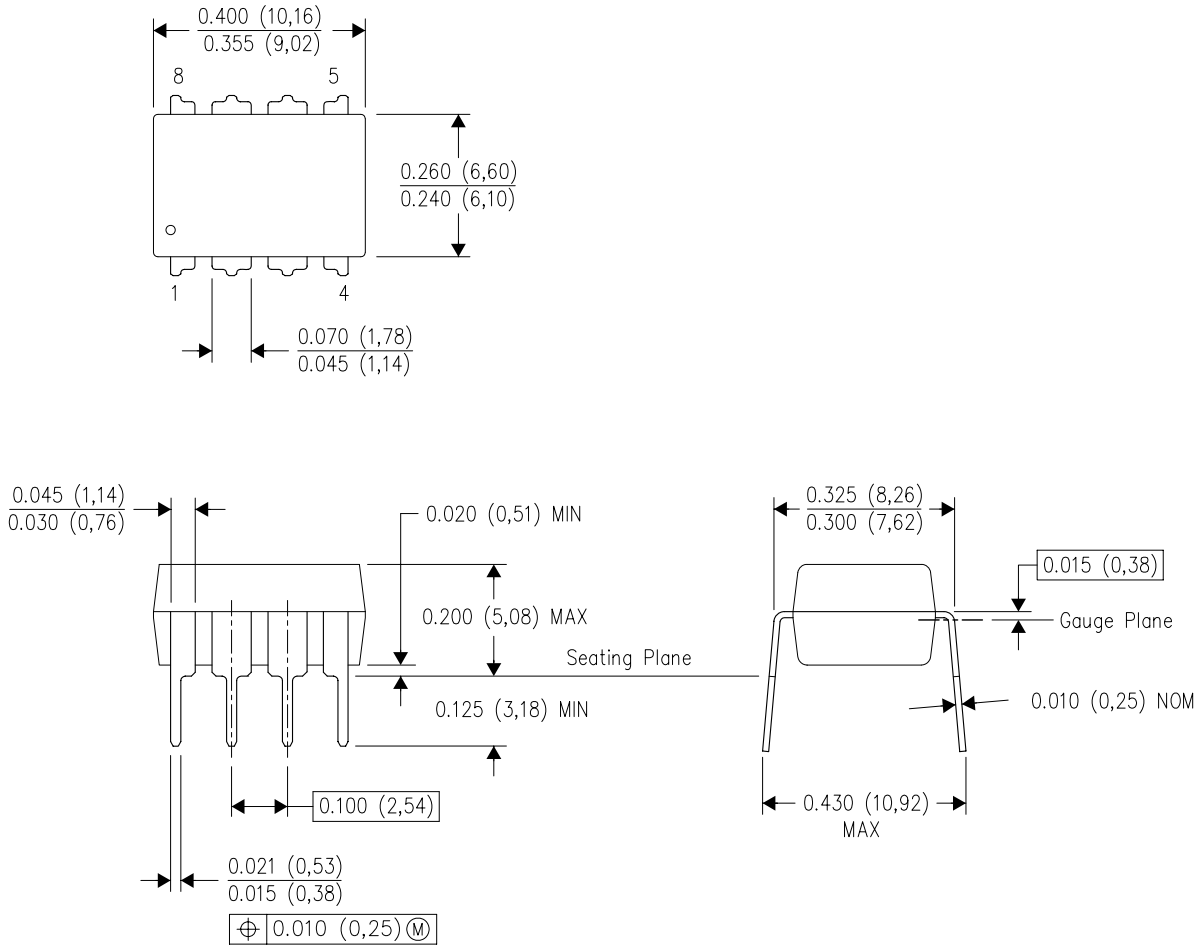

| NO. OF TERMINALS ** | A | | B | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| 20 | 0.342 (8,69) | 0.358 (9,09) | 0.307 (7,80) | 0.358 (9,09) |
| 28 | 0.442 (11,23) | 0.458 (11,63) | 0.406 (10,31) | 0.458 (11,63) |
| 44 | 0.640 (16,26) | 0.660 (16,76) | 0.495 (12,58) | 0.560 (14,22) |
| 52 | 0.740 (18,78) | 0.761 (19,32) | 0.495 (12,58) | 0.560 (14,22) |
| 68 | 0.938 (23,83) | 0.962 (24,43) | 0.850 (21,6) | 0.858 (21,8) |
| 84 | 1.141 (28,99) | 1.165 (29,59) | 1.047 (26,6) | 1.063 (27,0) |




4040140/D 01/11

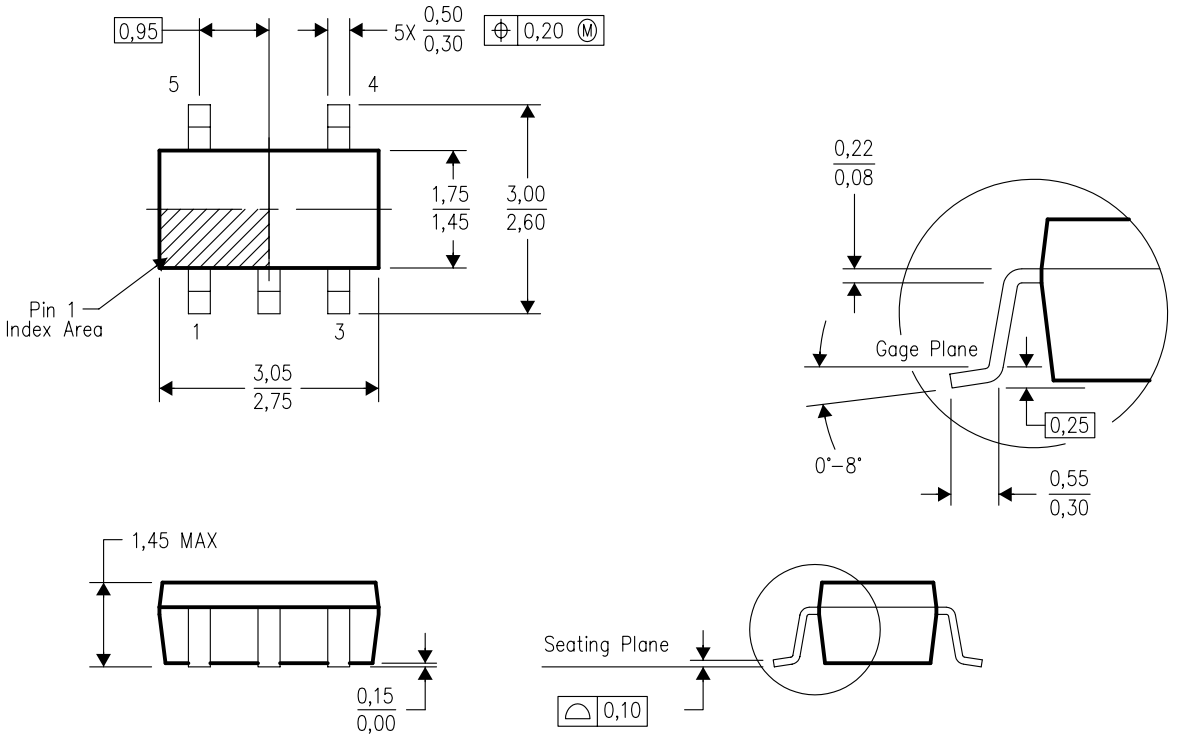
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. Falls within JEDEC MS–004

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.

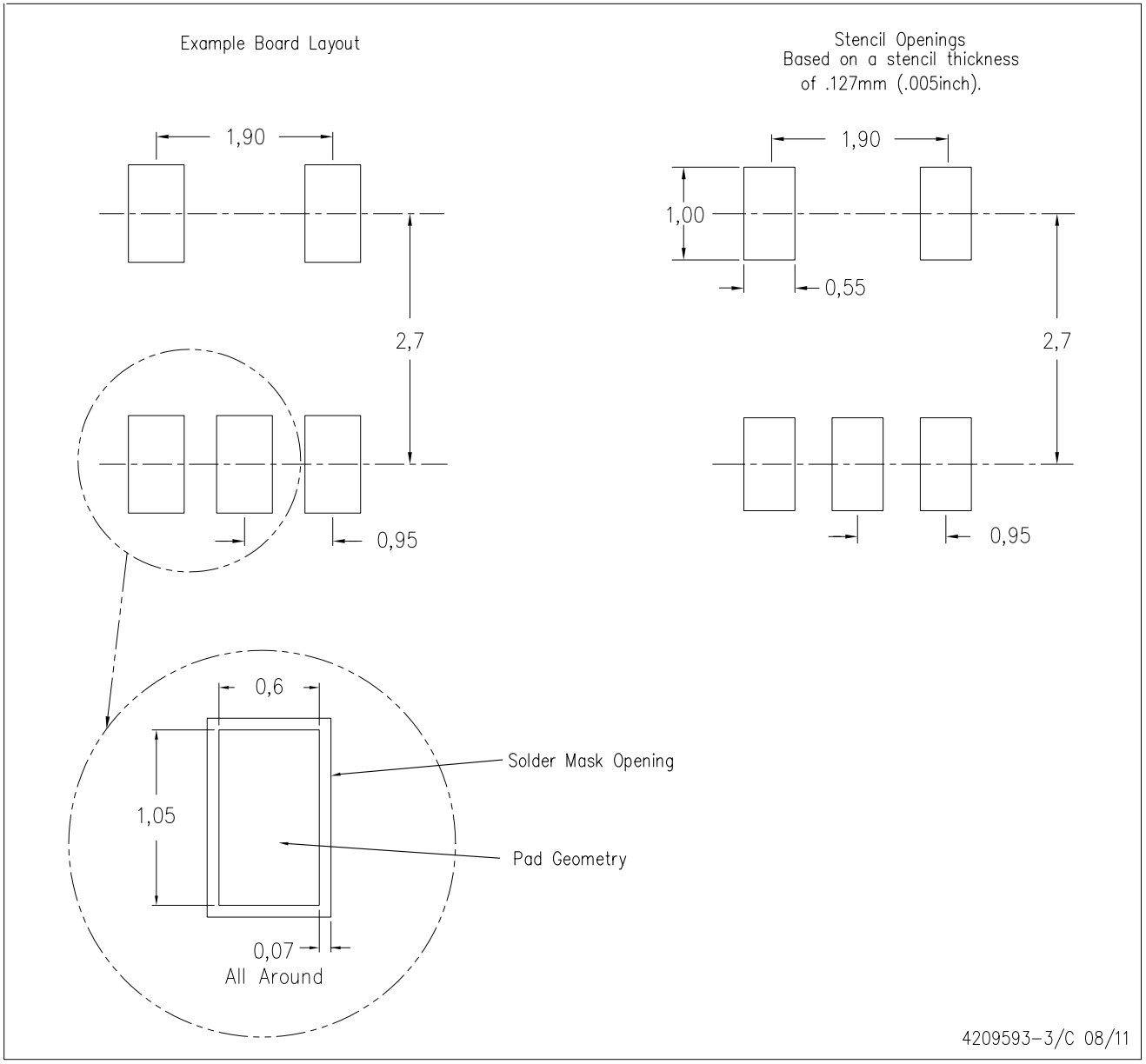
## DBV (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE




4073253–4/K 03/2006

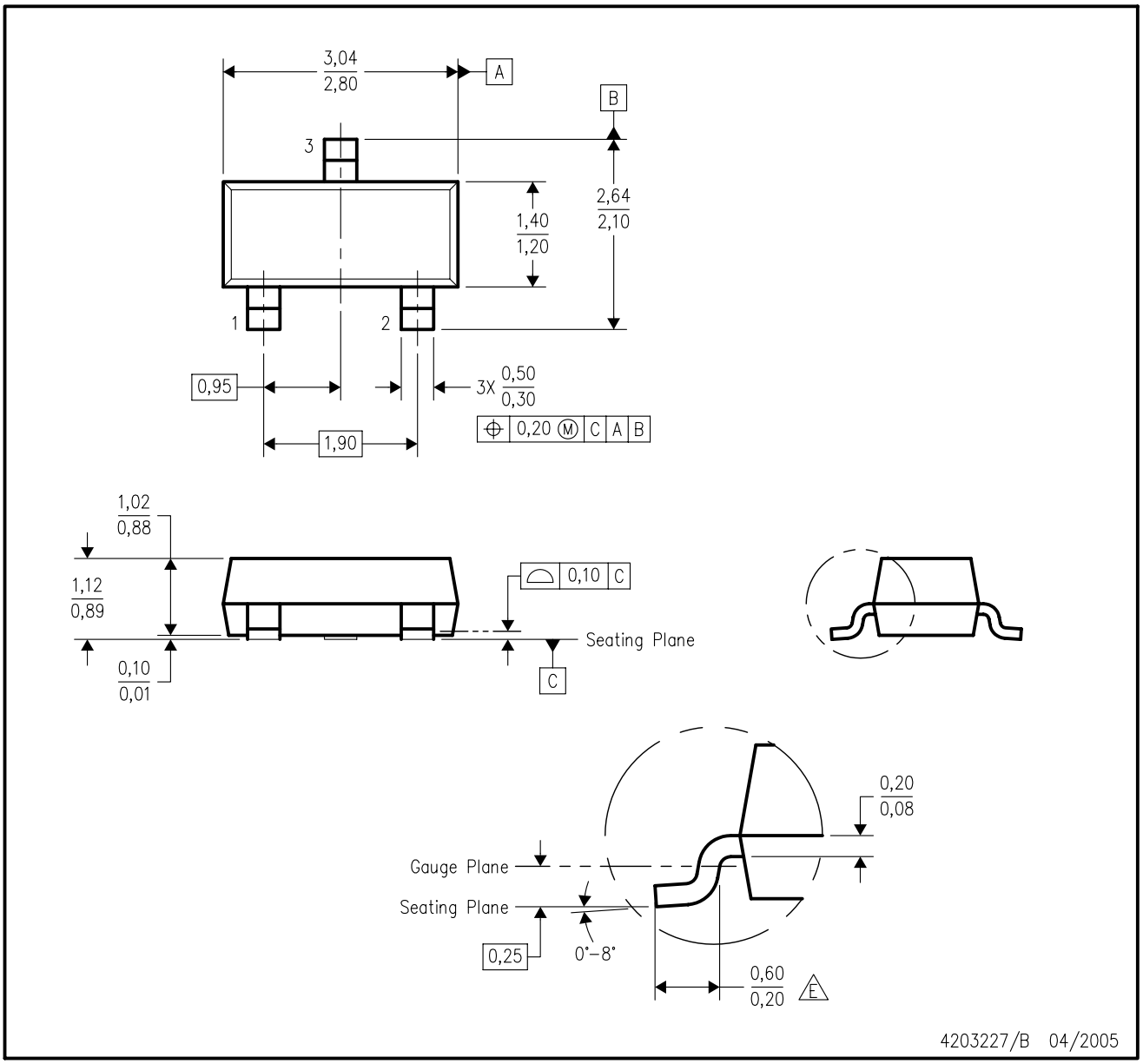
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–178 Variation AA.

DBV (R–PDSO–G5) PLASTIC SMALL OUTLINE



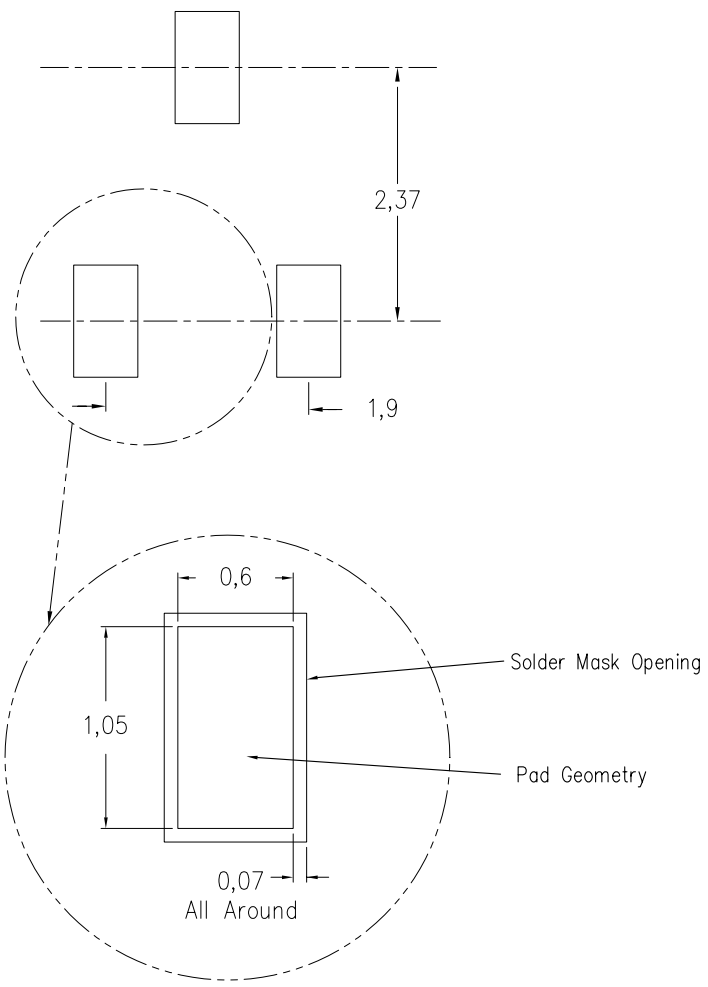

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting 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.

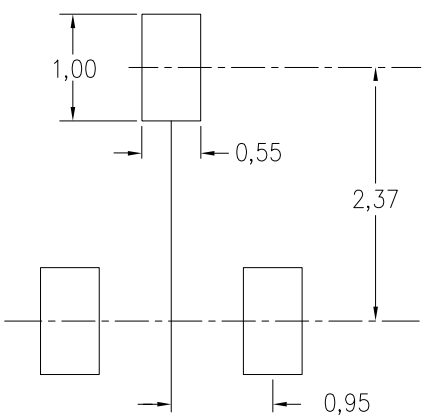
DBZ (R–PDSO–G3) PLASTIC SMALL–OUTLINE




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.
E. Falls within JEDEC TO–236 variation AB, except minimum foot length.

DBZ (R–PDSO–G3) PLASTIC SMALL OUTLINE

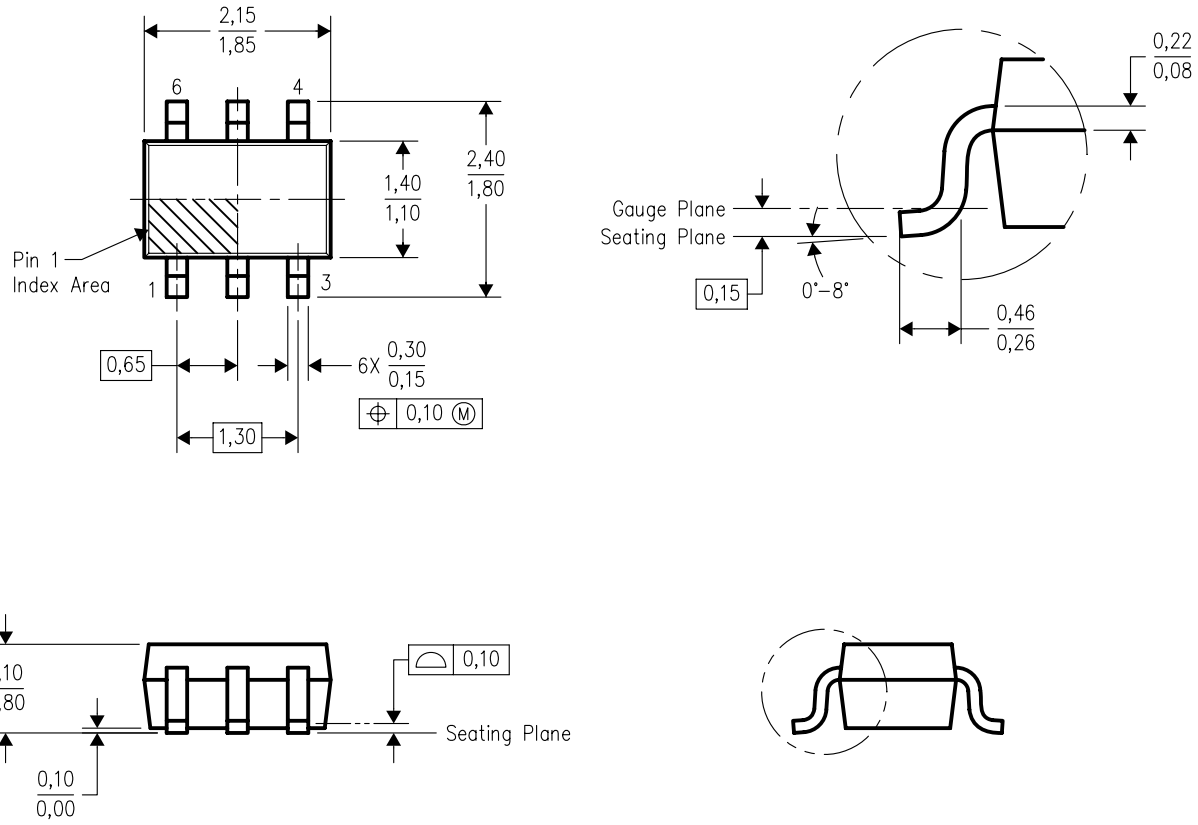



4212057/A 08/11

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. 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.

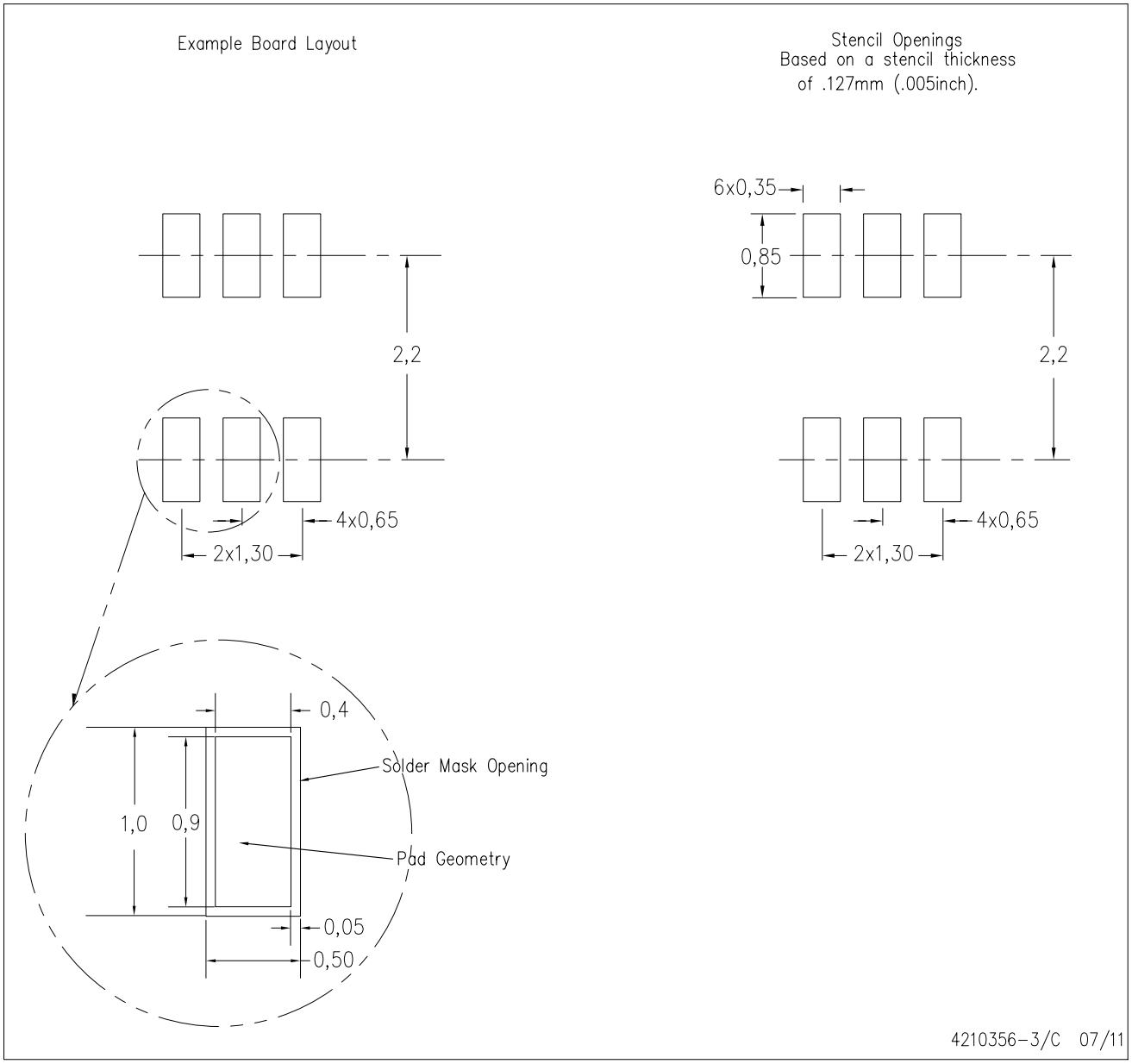
## DCK (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE




4093553–4/G 01/2007

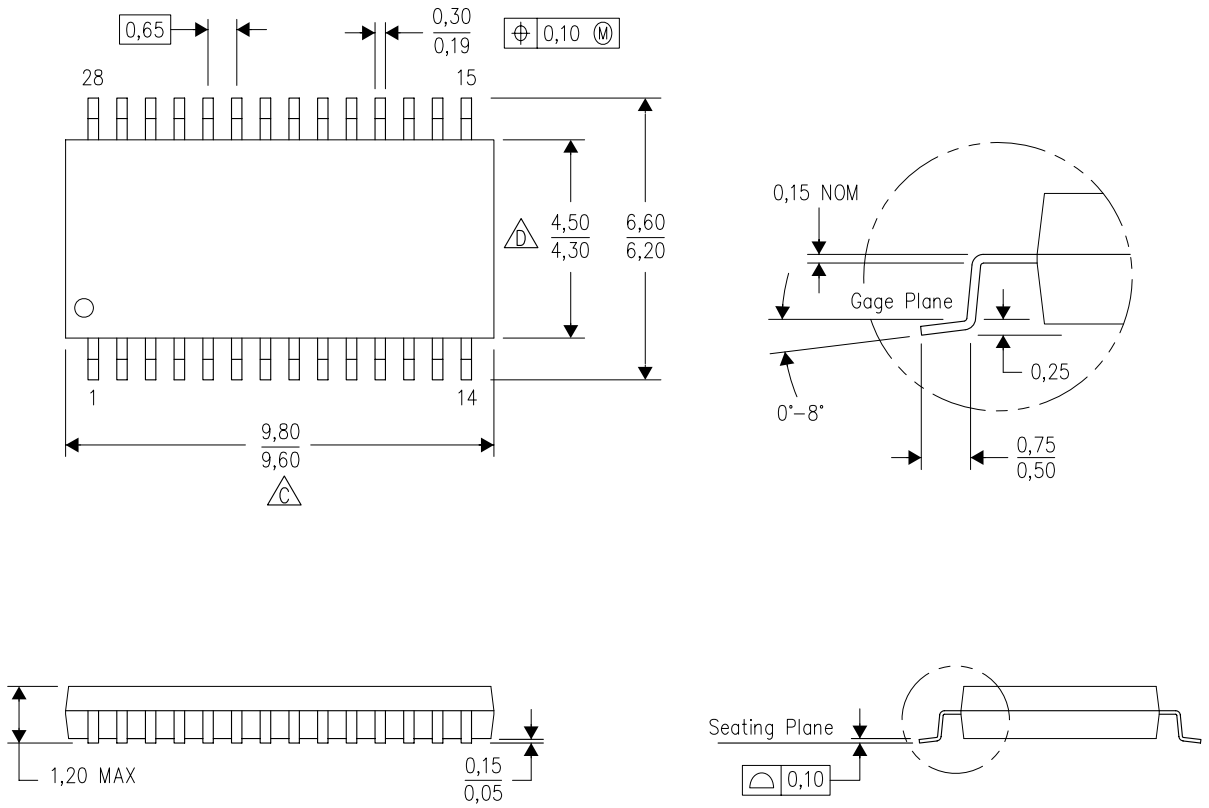
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AB.

DCK (R–PDSO–G6) PLASTIC SMALL OUTLINE




NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. 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.

PW (R–PDSO–G28) PLASTIC SMALL OUTLINE

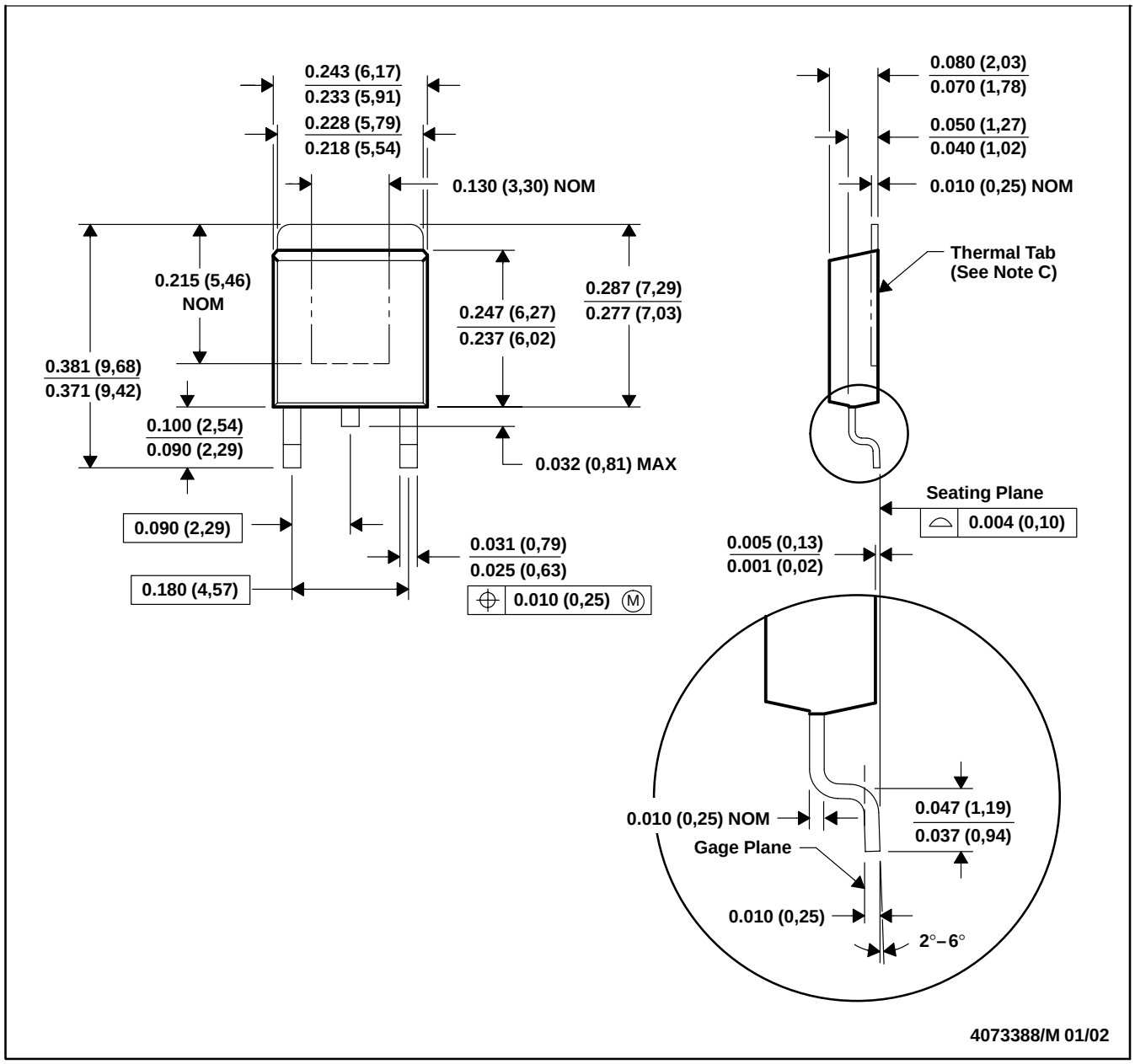



4040064–7/G 02/11

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. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

MPSF001F – JANUARY 1996 – REVISED JANUARY 2002

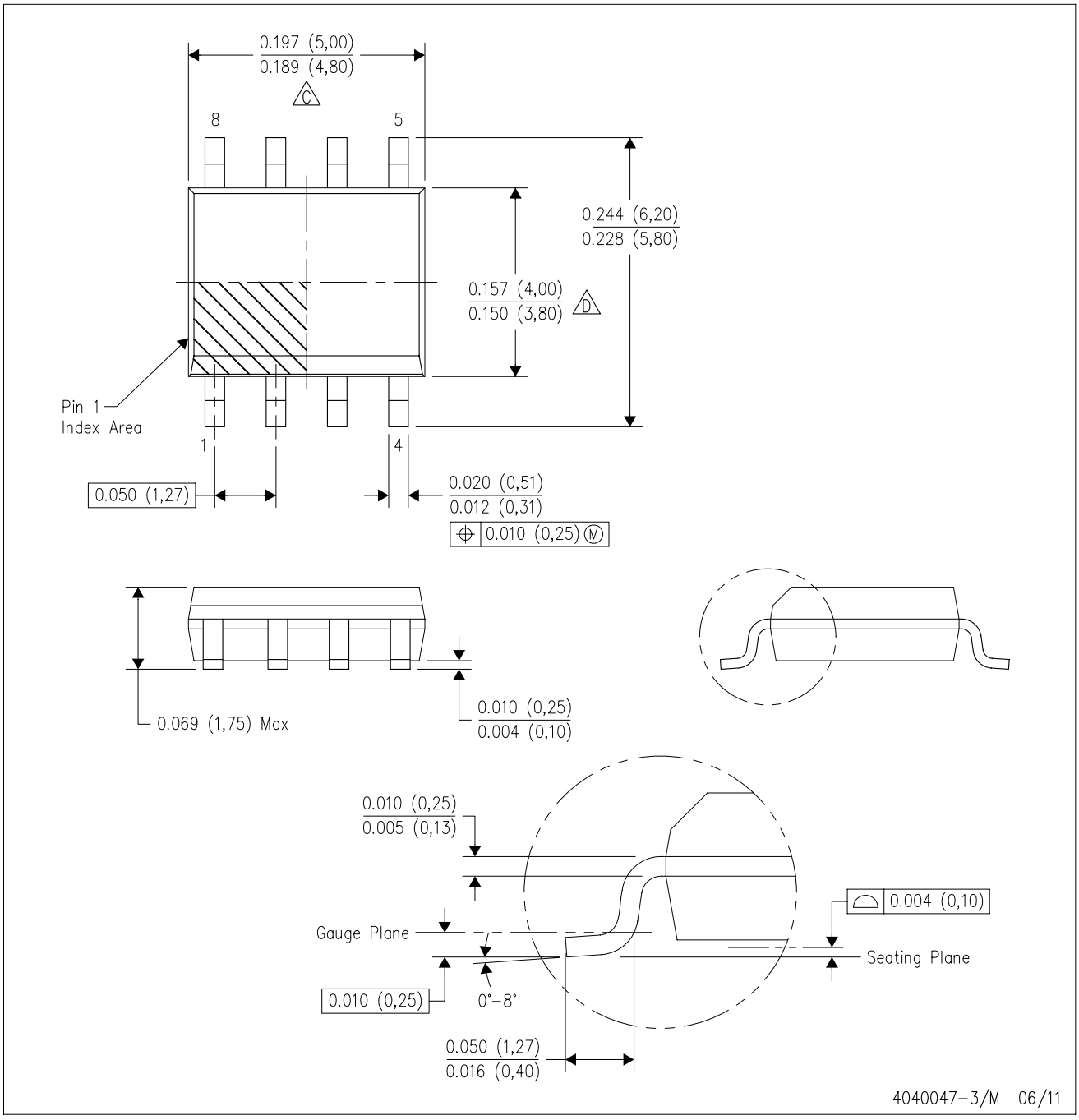
**KTP (R-PSFM-G2)** **PowerFLEX™ PLASTIC FLANGE-MOUNT PACKAGE**




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.

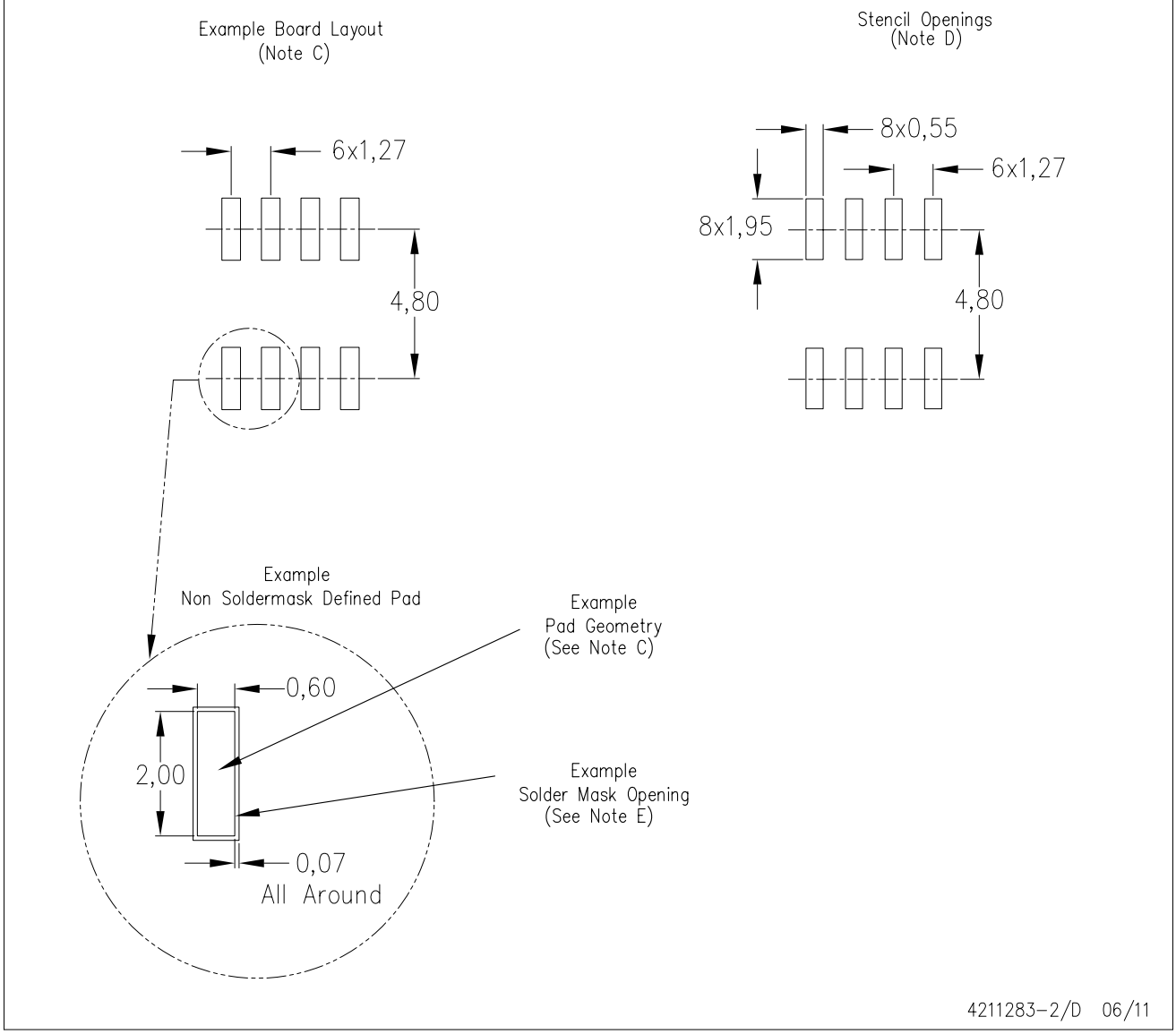
PowerFLEX is a trademark of Texas Instruments.

D (R–PDSO–G8) PLASTIC SMALL OUTLINE




NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AA.

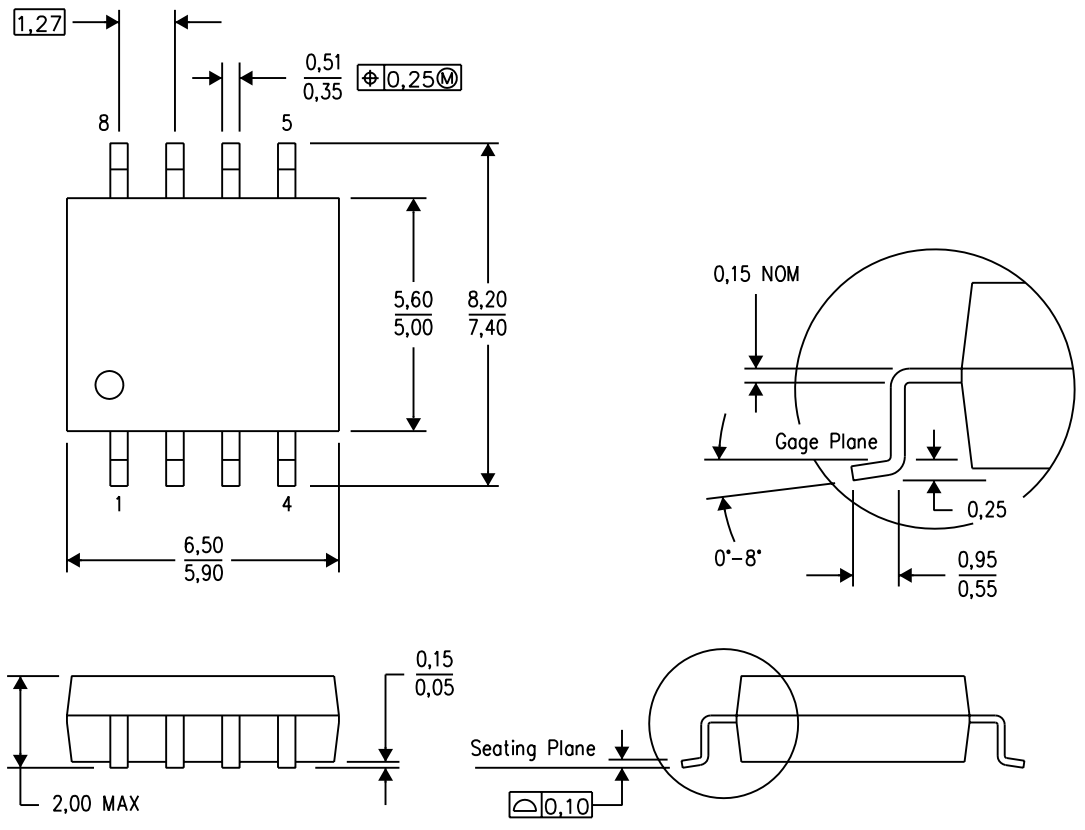
D (R–PDSO–G8) PLASTIC SMALL OUTLINE




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

## MECHANICAL DATA

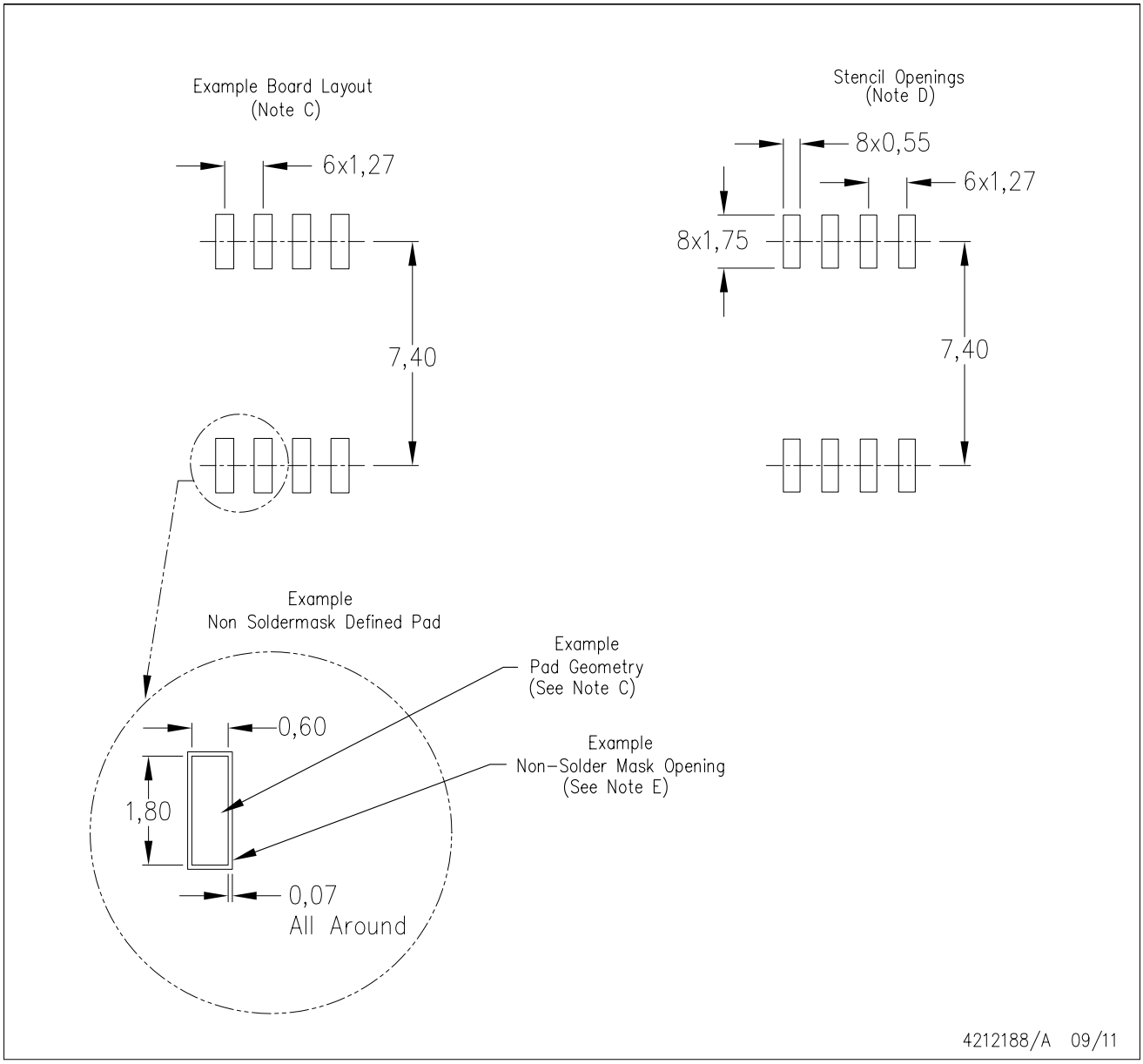
**PS (R-PDSO-G8)** **PLASTIC SMALL-OUTLINE PACKAGE**




4040063/C 03/03

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

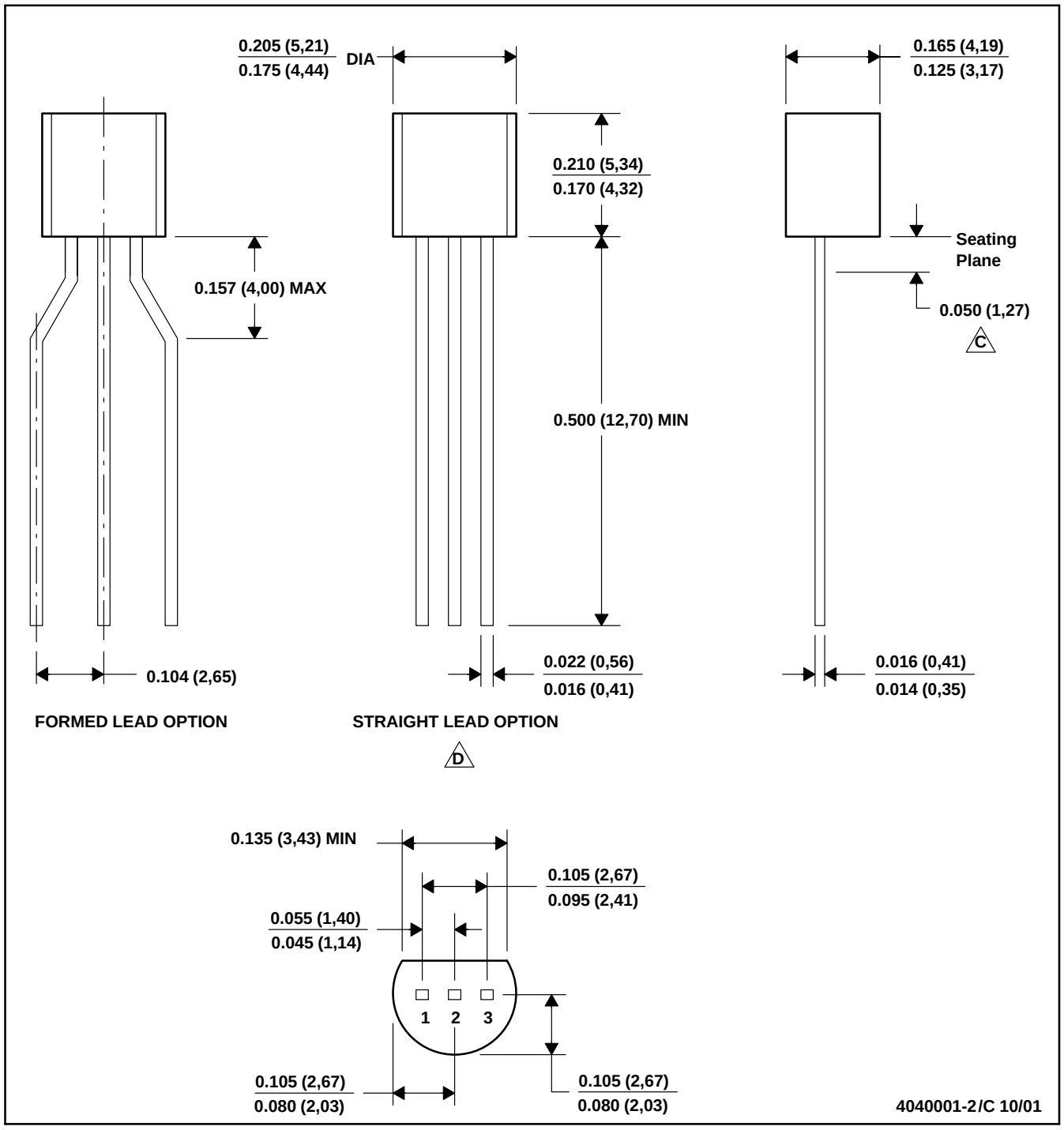
PS (R–PDSO–G8) PLASTIC SMALL OUTLINE




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

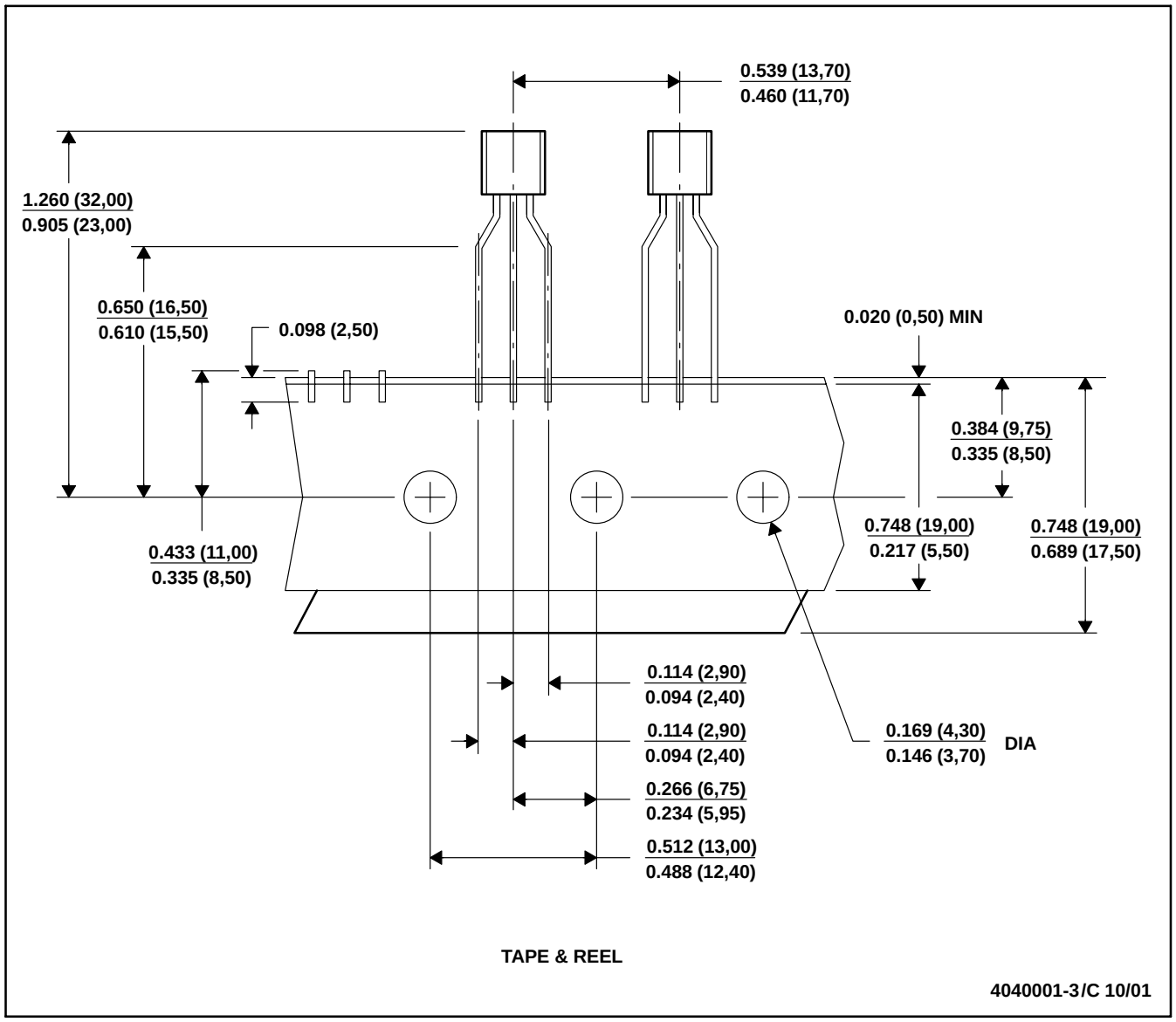
MSOT002A – OCTOBER 1994 – REVISED NOVEMBER 2001

**LP (O-PBCY-W3)** **PLASTIC CYLINDRICAL PACKAGE**



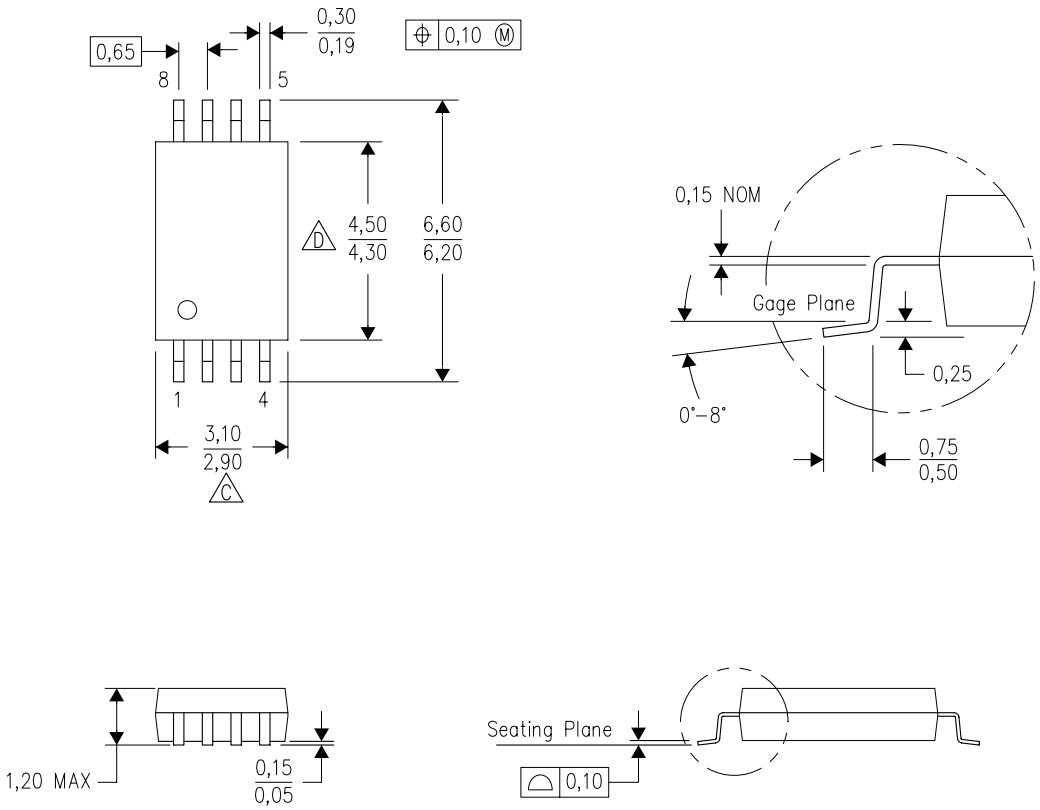

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area
D. FAlls within JEDEC TO -226 Variation AA (TO-226 replaces TO-92)
E. Shipping Method:
Straight lead option available in bulk pack only.
Formed lead option available in tape & reel or ammo pack.

**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–G8) PLASTIC SMALL OUTLINE




4040064–2/G 02/11

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. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
E. Falls within JEDEC MO–153

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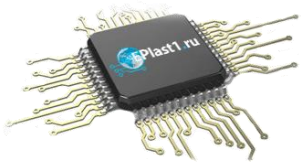


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