# THE DATASHEET OF

# TL4050A25IDBZR

# PRECISION MICROPOWER SHUNT VOLTAGE REFERENCE

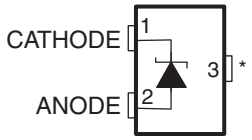
## FEATURES

- **Fixed Output Voltages of 2.5 V, 4.096 V, 5 V, and 10 V**
- **Tight Output Tolerances and Low Temperature Coefficient**
  - **Max 0.1%, 50 ppm/°C – A Grade**
  - **Max 0.2%, 50 ppm/°C – B Grade**
  - **Max 0.5%, 50 ppm/°C – C Grade**
- **Low Output Noise: 41 $\mu V_{RMS}$ Typ**
- **Wide Operating Current Range: 60 μA Typ to 15 mA**
- **Stable With All Capacitive Loads; No Output Capacitor Required**
- **Available in Extended Temperature Range: –40°C to 125°C**

## APPLICATIONS

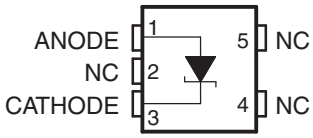
- **Data-Acquisition Systems**
- **Power Supplies and Power-Supply Monitors**
- **Instrumentation and Test Equipment**
- **Process Controls**
- **Precision Audio**
- **Automotive Electronics**
- **Energy Management**
- **Battery-Powered Equipment**

**DBZ (SOT-23-3) PACKAGE**
**(TOP VIEW)**




*Pin 3 is attached to Substrate and must be connected to ANODE or left open.

**DCK (SC-70) PACKAGE**
**(TOP VIEW)**




NC – No internal connection

## DESCRIPTION/ORDERING INFORMATION

The TL4050 series of shunt voltage references are versatile easy-to-use references suitable for a wide array of applications. The two-terminal fixed-output device requires no external capacitors for operation and is stable with all capacitive loads. Additionally, the reference offers low dynamic impedance, low noise, and low temperature coefficient to ensure a stable output voltage over a wide range of operating currents and temperatures.

The TL4050 is offered in three initial tolerances, ranging from 0.1% (max) for the A grade to 0.5% (max) for the C grade. Thus, a great deal of flexibility is offered to designers in choosing the best cost-to-performance ratio for their applications. Packaged in the space-saving SOT-23-3 and SC-70 packages and requiring a minimum current of 45 μA (typ), the TL4050 also is ideal for portable applications.

The TL4050xI is characterized for operation over an ambient temperature range of –40°C to 85°C. The TL4050xQ is characterized for operation over an ambient temperature range of –40°C to 125°C.

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

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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## ORDERING INFORMATION(1)

| $T_A$ | DEVICE GRADE | $V_{KA}$ | PACKAGE(2) | | ORDERABLE PART NUMBER | TOP-SIDE MARKING(3) |
|---|---|---|---|---|---|---|
| –40°C to 85°C | A grade: 0.1% initial accuracy and 50 ppm/°C temperature coefficient | 2.5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A25IDBZR | TKE_ |
| | | | | Reel of 250 | TL4050A25IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A25IDCKR | 82_ |
| | | | | Reel of 250 | TL4050A25IDCKT | |
| | | 4.096 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A41IDBZR | TKL_ |
| | | | | Reel of 250 | TL4050A41IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A41IDCKR | 8E_ |
| | | | | Reel of 250 | TL4050A41IDCKT | |
| | | 5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A50IDBZR | TKS_ |
| | | | | Reel of 250 | TL4050A50IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A50IDCKR | 8L_ |
| | | | | Reel of 250 | TL4050A50IDCKT | |
| | | 10 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A10IDBZR | TK2_ |
| | | | | Reel of 250 | TL4050A10IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A10IDCKR | 8Z_ |
| | | | | Reel of 250 | TL4050A10IDCKT | |
| | B grade: 0.2% initial accuracy and 50 ppm/°C temperature coefficient | 2.5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B25IDBZR | TKF_ |
| | | | | Reel of 250 | TL4050B25IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B25IDCKR | 83_ |
| | | | | Reel of 250 | TL4050B25IDCKT | |
| | | 4.096 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B41IDBZR | TKM_ |
| | | | | Reel of 250 | TL4050B41IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B41IDCKR | 8F_ |
| | | | | Reel of 250 | TL4050B41IDCKT | |
| | | 5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B50IDBZR | TKT_ |
| | | | | Reel of 250 | TL4050B50IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B50IDCKR | 8M_ |
| | | | | Reel of 250 | TL4050B50IDCKT | |
| | | 10 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B10IDBZR | TK3_ |
| | | | | Reel of 250 | TL4050B10IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B10IDCKR | 92_ |
| | | | | Reel of 250 | TL4050B10IDCKT | |

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


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## ORDERING INFORMATION (continued)

| $T_A$ | DEVICE GRADE | $V_{KA}$ | PACKAGE[2] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING[3] |
|---|---|---|---|---|---|---|
| –40°C to 85°C | C grade: 0.5% initial accuracy and 50 ppm/°C temperature coefficient | 2.5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C25IDBZR | TKG_ |
| | | | | Reel of 250 | TL4050C25IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C25IDCKR | 84_ |
| | | | | Reel of 250 | TL4050C25IDCKT | |
| | | 4.096 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C41IDBZR | TKN_ |
| | | | | Reel of 250 | TL4050C41IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C41IDCKR | 8G_ |
| | | | | Reel of 250 | TL4050C41IDCKT | |
| | | 5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C50IDBZR | TKU_ |
| | | | | Reel of 250 | TL4050C50IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C50IDCKR | 8N_ |
| | | | | Reel of 250 | TL4050C50IDCKT | |
| | | 10 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C10IDBZR | TK4_ |
| | | | | Reel of 250 | TL4050C10IDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C10IDCKR | 93_ |
| | | | | Reel of 250 | TL4050C10IDCKT | |
| –40°C to 125°C | A grade: 0.1% initial accuracy and 50 ppm/°C temperature coefficient | 2.5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A25QDBZR | TKH_ |
| | | | | Reel of 250 | TL4050A25QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A25QDCKR | 85_ |
| | | | | Reel of 250 | TL4050A25QDCKT | |
| | | 4.096 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A41QDBZR | TKP_ |
| | | | | Reel of 250 | TL4050A41QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A41QDCKR | 8H_ |
| | | | | Reel of 250 | TL4050A41QDCKT | |
| | | 5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A50QDBZR | TKV_ |
| | | | | Reel of 250 | TL4050A50QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A50QDCKR | 8P_ |
| | | | | Reel of 250 | TL4050A50QDCKT | |
| | | 10 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050A10QDBZR | TK5_ |
| | | | | Reel of 250 | TL4050A10QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050A10QDCKR | 94_ |
| | | | | Reel of 250 | TL4050A10QDCKT | |

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## ORDERING INFORMATION (continued)

| $T_A$ | DEVICE GRADE | $V_{KA}$ | PACKAGE[2] | | ORDERABLE PART NUMBER | TOP-SIDE MARKING[3] |
|---|---|---|---|---|---|---|
| –40°C to 125°C | B grade: 0.2% initial accuracy and 50 ppm/°C temperature coefficient | 2.5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B25QDBZR | TKJ_ |
| | | | | Reel of 250 | TL4050B25QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B25QDCKR | 86_ |
| | | | | Reel of 250 | TL4050B25QDCKT | |
| | | 4.096 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B41QDBZR | TKQ_ |
| | | | | Reel of 250 | TL4050B41QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B41QDCKR | 8J_ |
| | | | | Reel of 250 | TL4050B41QDCKT | |
| | | 5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B50QDBZR | TKW_ |
| | | | | Reel of 250 | TL4050B50QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B50QDCKR | 8R_ |
| | | | | Reel of 250 | TL4050B50QDCKT | |
| | | 10 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050B10QDBZR | TK6_ |
| | | | | Reel of 250 | TL4050B10QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050B10QDCKR | 95_ |
| | | | | Reel of 250 | TL4050B10QDCKT | |
| | C grade: 0.5% initial accuracy and 50 ppm/°C temperature coefficient | 2.5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C25QDBZR | TKK_ |
| | | | | Reel of 250 | TL4050C25QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C25QDCKR | 87_ |
| | | | | Reel of 250 | TL4050C25QDCKT | |
| | | 4.096 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C41QDBZR | TKR_ |
| | | | | Reel of 250 | TL4050C41QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C41QDCKR | 8K_ |
| | | | | Reel of 250 | TL4050C41QDCKT | |
| | | 5 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C50QDBZR | TKY_ |
| | | | | Reel of 250 | TL4050C50QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C50QDCKR | 8S_ |
| | | | | Reel of 250 | TL4050C50QDCKT | |
| | | 10 V | SOT-23-3 – DBZ | Reel of 3000 | TL4050C10QDBZR | TK7_ |
| | | | | Reel of 250 | TL4050C10QDBZT | |
| | | | SC-70 – DCK | Reel of 3000 | TL4050C10QDCKR | 96_ |
| | | | | Reel of 250 | TL4050C10QDCKT | |


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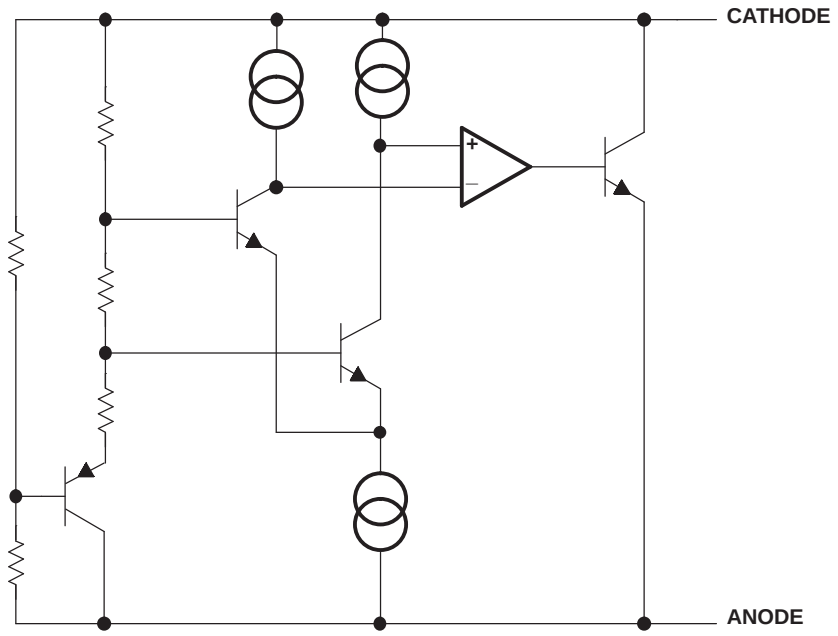
## FUNCTIONAL BLOCK DIAGRAM




## ABSOLUTE MAXIMUM RATINGS(1)

over free-air temperature range (unless otherwise noted)

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $I_Z$ | Continuous cathode current | | –10 | 20 | mA |
| $\theta_{JA}$ | Package thermal impedance(2)(3) | DBV package | | 206 | °C/W |
| | | DCK package | | 252 | |
| $T_J$ | 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) 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.
(3) The package thermal impedance is calculated in accordance with JESD 51-7.

## RECOMMENDED OPERATING CONDITIONS

| | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| $I_Z$ | Cathode current | | (1) | 15 | mA |
| $T_A$ | Free-air temperature | I temperature | –40 | 85 | °C |
| | | Q temperature | –40 | 125 | |

(1) See parametric tables

## TL4050x25I ELECTRICAL CHARACTERISTICS

at industrial temperature range, full range $T_A$ = –40°C to 85°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A25I | | | TL4050B25I | | | TL4050C25I | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 2.5 | | | 2.5 | | | 2.5 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –2.5 | | 2.5 | –5 | | 5 | –13 | | 13 | mV |
| | | | Full range | –11 | | 11 | –14 | | 14 | –21 | | 21 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 41 | 60 | | 41 | 60 | | 41 | 60 | µA |
| | | | Full range | | | 65 | | | 65 | | | 65 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±15 | | | ±15 | | | ±15 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±15 | | | ±15 | | | ±15 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.3 | 0.8 | | 0.3 | 0.8 | | 0.3 | 0.8 | mV |
| | | | Full range | | | 1.2 | | | 1.2 | | | 1.2 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 2.3 | 6 | | 2.3 | 6 | | 2.3 | 6 | |
| | | | Full range | | | 8 | | | 8 | | | 8 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.3 | | | 0.3 | | | 0.3 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 41 | | | 41 | | | 41 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 0.7 | | | 0.7 | | | 0.7 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).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## TL4050x25Q ELECTRICAL CHARACTERISTICS

at extended temperature range, full range $T_A$ = –40°C to 125°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A25Q | | | TL4050B25Q | | | TL4050C25Q | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 2.5 | | | 2.5 | | | 2.5 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –2.5 | | 2.5 | –5 | | 5 | –13 | | 13 | mV |
| | | | Full range | –15 | | 15 | –18 | | 18 | –25 | | 25 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 41 | 60 | | 41 | 60 | | 41 | 60 | µA |
| | | | Full range | | | 65 | | | 65 | | | 65 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±15 | | | ±15 | | | ±15 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±15 | | | ±15 | | | ±15 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.3 | 0.8 | | 0.3 | 0.8 | | 0.3 | 0.8 | mV |
| | | | Full range | | | 1.2 | | | 1.2 | | | 1.2 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 2.3 | 6 | | 2.3 | 6 | | 2.3 | 6 | |
| | | | Full range | | | 8 | | | 8 | | | 8 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.3 | | | 0.3 | | | 0.3 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 41 | | | 41 | | | 41 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 0.7 | | | 0.7 | | | 0.7 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).

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## TL4050x41I ELECTRICAL CHARACTERISTICS

at industrial temperature range, full range $T_A$ = –40°C to 85°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A41I | | | TL4050B41I | | | TL4050C41I | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 4.096 | | | 4.096 | | | 4.096 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –4.1 | | 4.1 | –8.2 | | 8.2 | –21 | | 21 | mV |
| | | | Full range | –18 | | 18 | –22 | | 22 | –34 | | 34 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 52 | 68 | | 52 | 68 | | 52 | 68 | µA |
| | | | Full range | | | 73 | | | 73 | | | 73 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±30 | | | ±30 | | | ±30 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.2 | 0.9 | | 0.2 | 0.9 | | 0.2 | 0.9 | mV |
| | | | Full range | | | 1.2 | | | 1.2 | | | 1.2 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 2 | 7 | | 2 | 7 | | 2 | 7 | |
| | | | Full range | | | 10 | | | 10 | | | 10 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.5 | | | 0.5 | | | 0.5 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 93 | | | 93 | | | 93 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 1.148 | | | 1.148 | | | 1.148 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).


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## TL4050x41Q ELECTRICAL CHARACTERISTICS

at extended temperature range, full range $T_A$ = –40°C to 125°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A41Q | | | TL4050B41Q | | | TL4050C41Q | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 4.096 | | | 4.096 | | | 4.096 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –4.1 | | 4.1 | –8.2 | | 8.2 | –21 | | 21 | mV |
| | | | Full range | –25 | | 25 | –29 | | 29 | –41 | | 41 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 52 | 68 | | 52 | 68 | | 52 | 68 | µA |
| | | | Full range | | | 78 | | | 78 | | | 78 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±30 | | | ±30 | | | ±30 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.2 | 0.9 | | 0.2 | 0.9 | | 0.2 | 0.9 | mV |
| | | | Full range | | | 1.2 | | | 1.2 | | | 1.2 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 2 | 7 | | 2 | 7 | | 2 | 7 | |
| | | | Full range | | | 10 | | | 10 | | | 10 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.5 | | | 0.5 | | | 0.5 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 93 | | | 93 | | | 93 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 1.148 | | | 1.148 | | | 1.148 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).

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## TL4050x50I ELECTRICAL CHARACTERISTICS

at industrial temperature range, full range $T_A$ = –40°C to 85°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A50I | | | TL4050B50I | | | TL4050C50I | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 5 | | | 5 | | | 5 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –5 | | 5 | –10 | | 10 | –25 | | 25 | mV |
| | | | Full range | –22 | | 22 | –27 | | 27 | –42 | | 42 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 56 | 74 | | 56 | 74 | | 56 | 74 | µA |
| | | | Full range | | | 80 | | | 80 | | | 80 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±30 | | | ±30 | | | ±30 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.2 | 1 | | 0.2 | 1 | | 0.2 | 1 | mV |
| | | | Full range | | | 1.4 | | | 1.4 | | | 1.4 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 2 | 8 | | 2 | 8 | | 2 | 8 | |
| | | | Full range | | | 12 | | | 12 | | | 12 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.5 | | | 0.5 | | | 0.5 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 93 | | | 93 | | | 93 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 1.4 | | | 1.4 | | | 1.4 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).


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## TL4050x50Q ELECTRICAL CHARACTERISTICS

at extended temperature range, full range $T_A$ = –40°C to 125°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A50Q | | | TL4050B50Q | | | TL4050C50Q | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 5 | | | 5 | | | 5 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –5 | | 5 | –10 | | 10 | –25 | | 25 | mV |
| | | | Full range | –30 | | 30 | –35 | | 35 | –50 | | 50 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 56 | 74 | | 56 | 74 | | 56 | 74 | µA |
| | | | Full range | | | 90 | | | 90 | | | 90 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±30 | | | ±30 | | | ±30 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.2 | 1 | | 0.2 | 1 | | 0.2 | 1 | mV |
| | | | Full range | | | 1.4 | | | 1.4 | | | 1.4 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 2 | 8 | | 2 | 8 | | 2 | 8 | |
| | | | Full range | | | 12 | | | 12 | | | 12 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.5 | | | 0.5 | | | 0.5 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 93 | | | 93 | | | 93 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 1.4 | | | 1.4 | | | 1.4 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).

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## TL4050x10I ELECTRICAL CHARACTERISTICS

at industrial temperature range, full range $T_A$ = –40°C to 85°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A10I | | | TL4050B10I | | | TL4050C10I | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 10 | | | 10 | | | 10 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –10 | | 10 | –20 | | 20 | –50 | | 50 | mV |
| | | | Full range | –43 | | 43 | –53 | | 53 | –83 | | 83 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 80 | 100 | | 80 | 100 | | 80 | 100 | µA |
| | | | Full range | | | 103 | | | 103 | | | 103 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±40 | | | ±40 | | | ±40 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.8 | 1.5 | | 0.8 | 1.5 | | 0.8 | 1.5 | mV |
| | | | Full range | | | 3.5 | | | 3.5 | | | 3.5 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 8 | 12 | | 8 | 12 | | 8 | 12 | |
| | | | Full range | | | 23 | | | 23 | | | 23 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.7 | | | 0.7 | | | 0.7 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 150 | | | 150 | | | 150 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 2.8 | | | 2.8 | | | 2.8 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).


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## TL4050x10Q ELECTRICAL CHARACTERISTICS

at extended temperature range, full range $T_A$ = –40°C to 125°C (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | $T_A$ | TL4050A10Q | | | TL4050B10Q | | | TL4050C10Q | | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | TYP | MAX | MIN | TYP | MAX | MIN | TYP | MAX | |
| $V_Z$ | Reverse breakdown voltage | $I_Z$ = 100 µA | 25°C | | 10 | | | 10 | | | 10 | | V |
| $\Delta V_Z$ | Reverse breakdown voltage tolerance | $I_Z$ = 100 µA | 25°C | –10 | | 10 | –20 | | 20 | –50 | | 50 | mV |
| | | | Full range | –60 | | 60 | –70 | | 70 | –100 | | 100 | |
| $I_{Z,min}$ | Minimum cathode current | | 25°C | | 80 | 100 | | 80 | 100 | | 80 | 100 | µA |
| | | | Full range | | | 110 | | | 110 | | | 110 | |
| $\alpha_{VZ}$ | Average temperature coefficient of reverse breakdown voltage | $I_Z$ = 10 mA | 25°C | | ±40 | | | ±40 | | | ±40 | | ppm/°C |
| | | $I_Z$ = 1 mA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | $I_Z$ = 100 µA | 25°C | | ±20 | | | ±20 | | | ±20 | | |
| | | | Full range | | | ±50 | | | ±50 | | | ±50 | |
| $\frac{\Delta V_Z}{\Delta I_Z}$ | Reverse breakdown voltage change with cathode current change | $I_{Z,min} < I_Z < 1$ mA | 25°C | | 0.8 | 1.5 | | 0.8 | 1.5 | | 0.8 | 1.5 | mV |
| | | | Full range | | | 3.5 | | | 3.5 | | | 3.5 | |
| | | 1 mA < $I_Z$ < 15 mA | 25°C | | 8 | 12 | | 8 | 12 | | 8 | 12 | |
| | | | Full range | | | 23 | | | 23 | | | 23 | |
| $Z_Z$ | Reverse dynamic impedance | $I_Z$ = 1 mA, f = 120 Hz, $I_{AC}$ = 0.1 $I_Z$ | 25°C | | 0.7 | | | 0.7 | | | 0.7 | | Ω |
| $e_N$ | Wideband noise | $I_Z$ = 100 µA, 10 Hz ≤ f ≤ 10 kHz | 25°C | | 150 | | | 150 | | | 150 | | $\mu V_{RMS}$ |
| | Long-term stability of reverse breakdown voltage | t = 1000 h, $T_A$ = 25°C ± 0.1°C, $I_Z$ = 100 µA | | | 120 | | | 120 | | | 120 | | ppm |
| $V_{HYST}$ | Thermal hysteresis(1) | $\Delta T_A$ = –40°C to 125°C | | | 2.8 | | | 2.8 | | | 2.8 | | mV |

(1) Thermal hysteresis is defined as $V_{Z,25°C}$ (after cycling to –40°C) – $V_{Z,25°C}$ (after cycling to 125°C).

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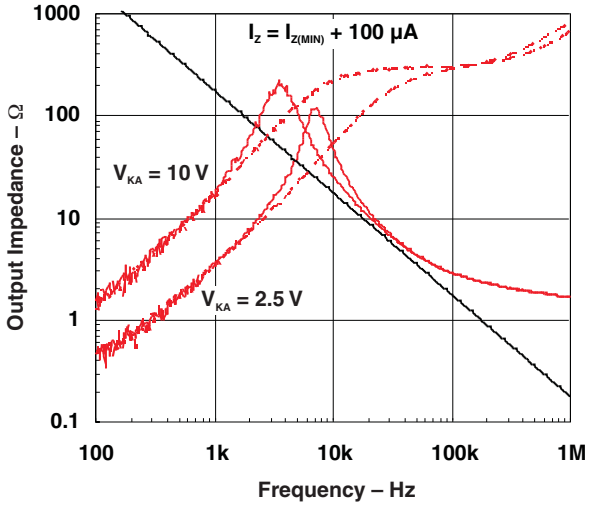
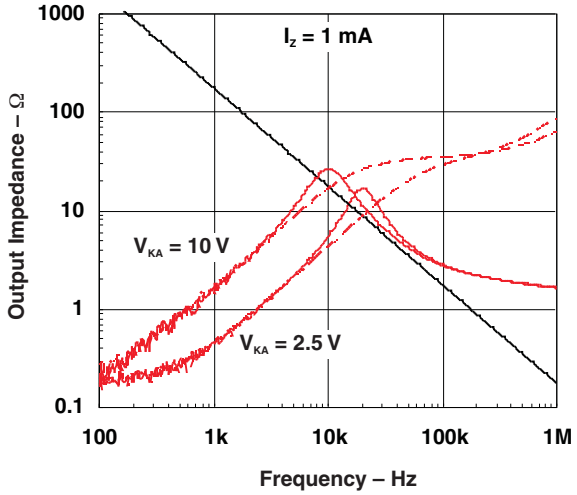
## TYPICAL CHARACTERISTICS

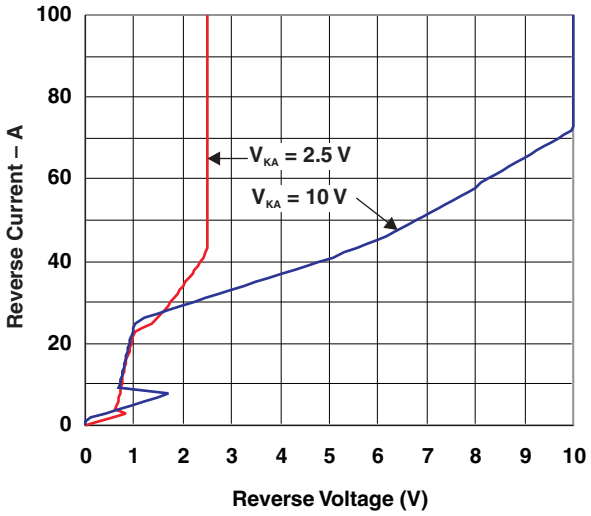
**OUTPUT IMPEDANCE vs FREQUENCY**



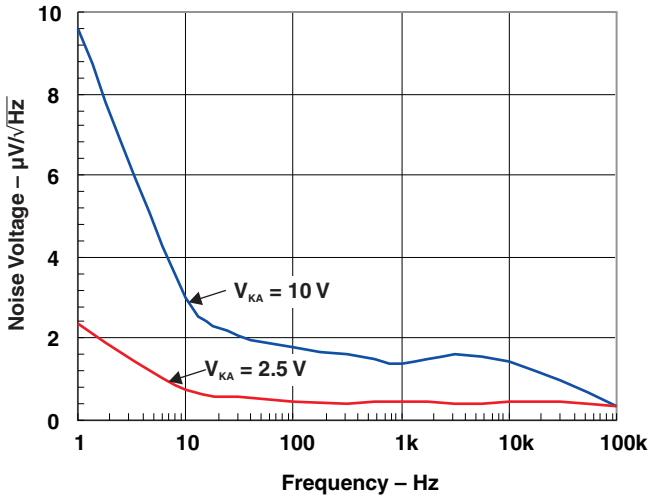

**OUTPUT IMPEDANCE vs FREQUENCY**




**REVERSE CHARACTERISTICS AND MINIMUM OPERATING CURRENT**




**NOISE VOLTAGE vs FREQUENCY**





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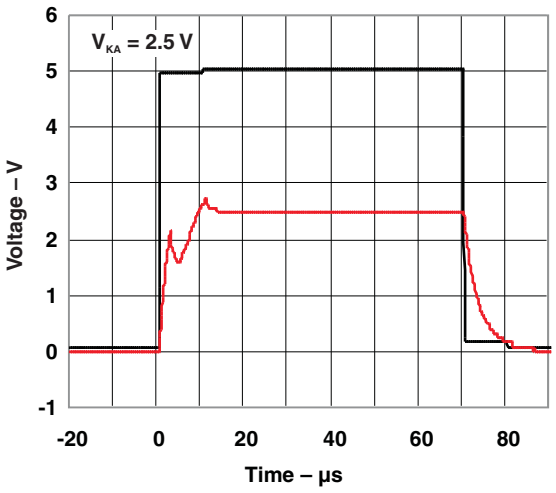
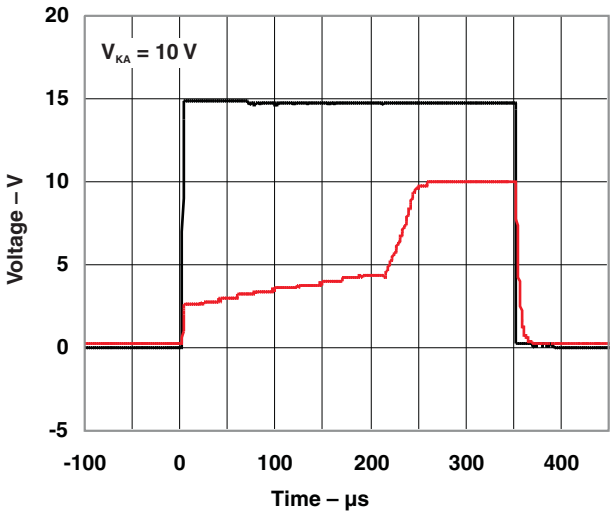
## TYPICAL CHARACTERISTICS (continued)

LARGE SIGNAL PULSE RESPONSE




LARGE SIGNAL PULSE RESPONSE



## APPLICATION INFORMATION

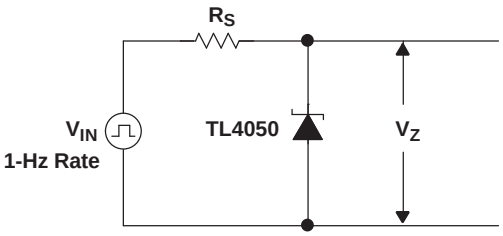



**Figure 1. Start-Up Test Circuit**

### Output Capacitor

The TL4050 does not require an output capacitor across cathode and anode for stability. However, if an output bypass capacitor is desired, the TL4050 is designed to be stable with all capacitive loads.

### SOT-23 Pin Connections

There is a parasitic Schottky diode connected between pins 2 and 3 of the SOT-23 packaged device. Thus, pin 3 of the SOT-23 package must be left floating or connected to pin 2.

### Use With ADCs or DACs

The TL4050x-41 is designed to be a cost-effective voltage reference as required in 12-bit data-acquisition systems. For 12-bit systems operating from 5-V supplies, such as the ADS7842 (see Figure 2), the TL4050x-41 (4.096 V) permits operation with an LSB of 1 mV.

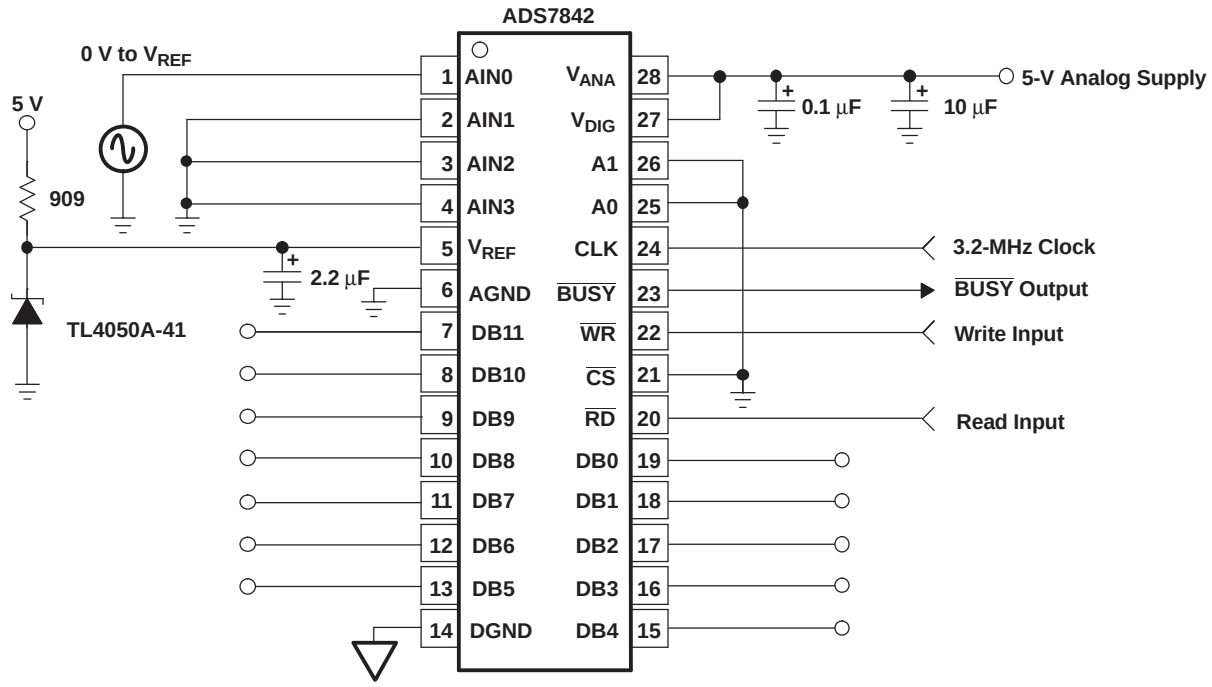



**Figure 2. Data-Acquisition Circuit With TL4050x-41**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## Cathode and Load Currents

In a typical shunt-regulator configuration (see Figure 3), an external resistor, $R_S$, is connected between the supply and the cathode of the TL4050. $R_S$ must be set properly, as it sets the total current available to supply the load ($I_L$) and bias the TL4050 ($I_Z$). In all cases, $I_Z$ must stay within a specified range for proper operation of the reference. Taking into consideration one extreme in the variation of the load and supply voltage (maximum $I_L$ and minimum $V_S$), $R_S$ must be small enough to supply the minimum $I_Z$ required for operation of the regulator, as given by data-sheet parameters. At the other extreme, maximum $V_S$ and minimum $I_L$, $R_S$ must be large enough to limit $I_Z$ to less than its maximum-rated value of 15 mA.

$R_S$ is calculated according to Equation 1:

$$R_S = \frac{(V_S - V_Z)}{(I_L + I_Z)} \quad (1)$$

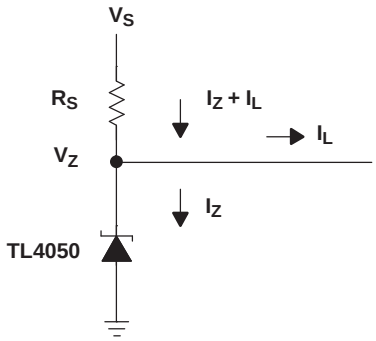


**Figure 3. Shunt Regulator**

## PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050A10IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TK2U | Samples |
| TL4050A10IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TK2U | Samples |
| TL4050A10IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8ZU | Samples |
| TL4050A10IDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8ZU | Samples |
| TL4050A10QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TK5U | Samples |
| TL4050A10QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 94U | Samples |
| TL4050A25IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKEU | Samples |
| TL4050A25IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKEU | Samples |
| TL4050A25IDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKEU | Samples |
| TL4050A25IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 82U | Samples |
| TL4050A25IDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 82U | Samples |
| TL4050A25QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TKHU | Samples |
| TL4050A25QDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TKHU | Samples |
| TL4050A25QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 85U | Samples |
| TL4050A41IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKL3, TKLU) | Samples |
| TL4050A41IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKL3, TKLU) | Samples |
| TL4050A41QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKP3, TKPU) | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050A41QDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKP3, TKPU) | Samples |
| TL4050A41QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 8HU | Samples |
| TL4050A50IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKS3, TKSU) | Samples |
| TL4050A50IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKS3, TKSU) | Samples |
| TL4050A50IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8LU | Samples |
| TL4050A50IDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8LU | Samples |
| TL4050A50QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKV3, TKVU) | Samples |
| TL4050A50QDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKV3, TKVU) | Samples |
| TL4050A50QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 8PU | Samples |
| TL4050B10IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TK3U | Samples |
| TL4050B10IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TK3U | Samples |
| TL4050B10QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TK6U | Samples |
| TL4050B10QDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TK6U | Samples |
| TL4050B10QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 95U | Samples |
| TL4050B25IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKFU | Samples |
| TL4050B25IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKFU | Samples |
| TL4050B25IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 83U | Samples |
| TL4050B25QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TKJU | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050B25QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 86U | Samples |
| TL4050B41IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKMU | Samples |
| TL4050B41IDBZRG4 | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKMU | Samples |
| TL4050B41IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKMU | Samples |
| TL4050B41IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8FU | Samples |
| TL4050B41IDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8FU | Samples |
| TL4050B41QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKQ3, TKQU) | Samples |
| TL4050B41QDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKQ3, TKQU) | Samples |
| TL4050B41QDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKQ3, TKQU) | Samples |
| TL4050B50IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKT3, TKTU) | Samples |
| TL4050B50IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKT3, TKTU) | Samples |
| TL4050B50IDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKT3, TKTU) | Samples |
| TL4050B50IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8MU | Samples |
| TL4050B50QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKW3, TKWU) | Samples |
| TL4050B50QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 8RU | Samples |
| TL4050C10IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TK43, TK4U) | Samples |
| TL4050C10IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TK43, TK4U) | Samples |
| TL4050C10QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TK73, TK7U) | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050C25IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKGU | Samples |
| TL4050C25IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKGU | Samples |
| TL4050C25IDBZTG4 | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKGU | Samples |
| TL4050C25IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 84U | Samples |
| TL4050C25IDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 84U | Samples |
| TL4050C25QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TKKU | Samples |
| TL4050C25QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 87U | Samples |
| TL4050C41IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKNU | Samples |
| TL4050C41IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | TKNU | Samples |
| TL4050C41IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8GU | Samples |
| TL4050C41QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | TKRU | Samples |
| TL4050C41QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 8KU | Samples |
| TL4050C41QDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 8KU | Samples |
| TL4050C50IDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKU3, TKUU) | Samples |
| TL4050C50IDBZT | ACTIVE | SOT-23 | DBZ | 3 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | (TKU3, TKUU) | Samples |
| TL4050C50IDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8NU | Samples |
| TL4050C50IDCKT | ACTIVE | SC70 | DCK | 5 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 85 | 8NU | Samples |
| TL4050C50QDBZR | ACTIVE | SOT-23 | DBZ | 3 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | (TKY3, TKYU) | Samples |

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050C50QDCKR | ACTIVE | SC70 | DCK | 5 | 3000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | 8SU | Samples |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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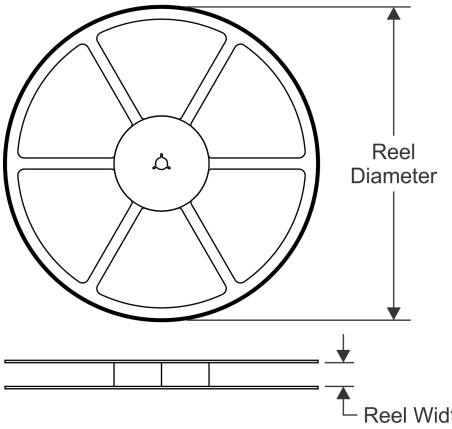
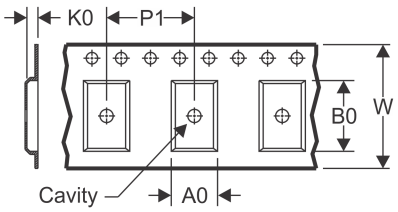
## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

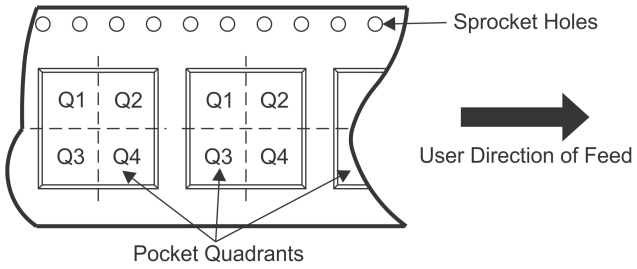



**TAPE DIMENSIONS**




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

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



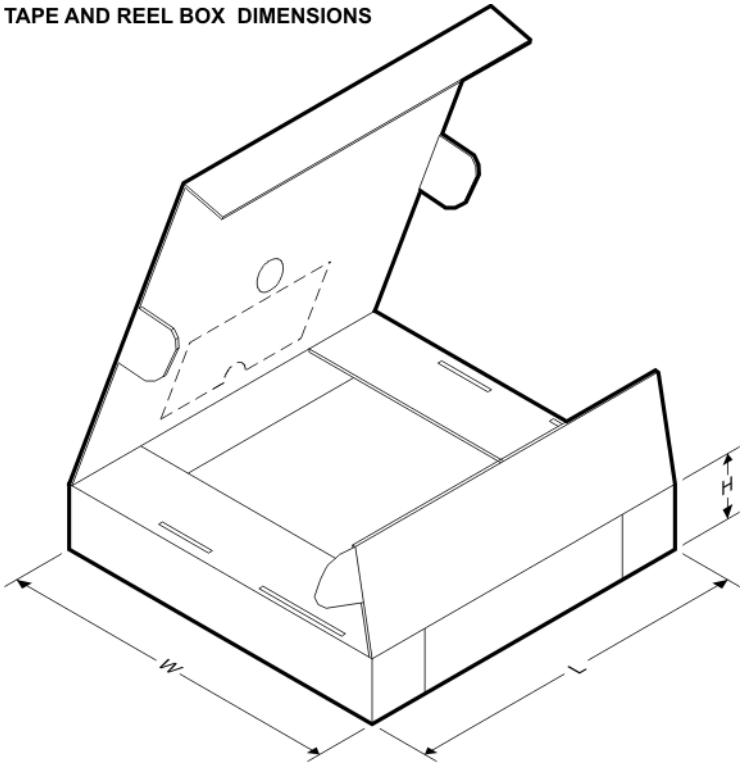

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050A10IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A10IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A10IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A10IDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A10QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A10QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A25IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A25IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A25IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A25IDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A25QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A25QDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A25QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A41IDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A41IDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A41IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A41QDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A41QDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050A41QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A50IDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A50IDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A50IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A50IDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050A50QDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A50QDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050A50QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B10IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B10IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B10QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B10QDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B10QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B25IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B25IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B25IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B25QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B25QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B41IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B41IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B41IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B41IDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B41QDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B41QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B41QDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B50IDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B50IDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B50IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050B50QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B50QDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050B50QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C10IDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C10IDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C10IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C10QDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C25IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C25IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C25IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C25IDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C25QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C25QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C41IDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C41IDBZT | SOT-23 | DBZ | 3 | 250 | 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TL4050C41IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C41QDBZR | SOT-23 | DBZ | 3 | 3000 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C41QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C41QDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C50IDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C50IDBZT | SOT-23 | DBZ | 3 | 250 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C50IDBZT | SOT-23 | DBZ | 3 | 250 | 179.0 | 8.4 | 3.15 | 2.95 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C50IDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C50IDCKT | SC70 | DCK | 5 | 250 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |
| TL4050C50QDBZR | SOT-23 | DBZ | 3 | 3000 | 178.0 | 9.2 | 3.15 | 2.77 | 1.22 | 4.0 | 8.0 | Q3 |
| TL4050C50QDCKR | SC70 | DCK | 5 | 3000 | 179.0 | 8.4 | 2.2 | 2.5 | 1.2 | 4.0 | 8.0 | Q3 |

**TAPE AND REEL BOX DIMENSIONS**



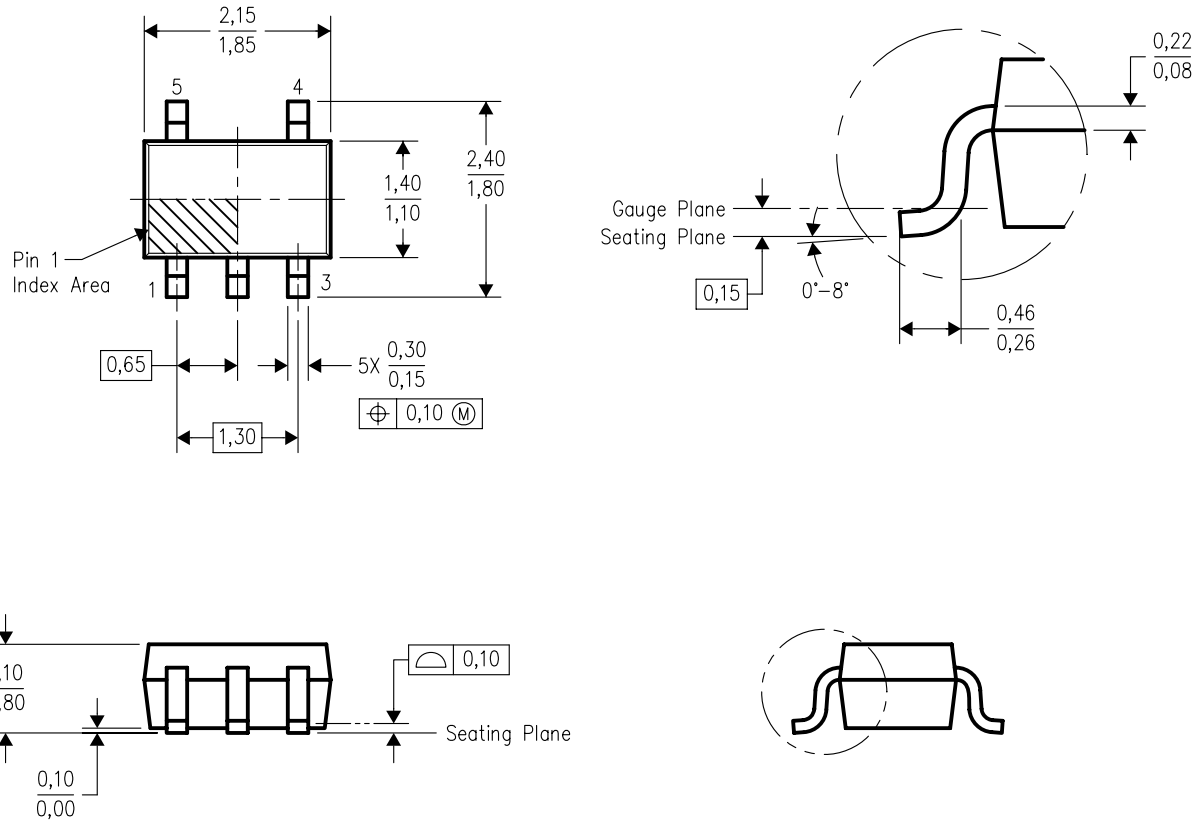

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TL4050A10IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A10IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A10IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A10IDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A10QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A10QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TL4050A25IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A25IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A25IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A25IDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A25QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A25QDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A25QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A41IDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050A41IDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050A41IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A41QDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050A41QDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050A41QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A50IDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050A50IDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050A50IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050A50IDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050A50QDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050A50QDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050A50QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B10IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B10IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050B10QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B10QDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050B10QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B25IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B25IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050B25IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B25QDBZR | SOT-23 | DBZ | 3 | 3000 | 195.0 | 200.0 | 45.0 |
| TL4050B25QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B41IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B41IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050B41IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B41IDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050B41QDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050B41QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B41QDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050B50IDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050B50IDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050B50IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B50QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050B50QDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050B50QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C10IDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|---|---|---|---|---|---|---|---|
| TL4050C10IDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050C10IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C10QDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050C25IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C25IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C25IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C25IDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C25QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C25QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C41IDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C41IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C41IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C41QDBZR | SOT-23 | DBZ | 3 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C41QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C41QDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C50IDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050C50IDBZT | SOT-23 | DBZ | 3 | 250 | 180.0 | 180.0 | 18.0 |
| TL4050C50IDBZT | SOT-23 | DBZ | 3 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C50IDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |
| TL4050C50IDCKT | SC70 | DCK | 5 | 250 | 203.0 | 203.0 | 35.0 |
| TL4050C50QDBZR | SOT-23 | DBZ | 3 | 3000 | 180.0 | 180.0 | 18.0 |
| TL4050C50QDCKR | SC70 | DCK | 5 | 3000 | 203.0 | 203.0 | 35.0 |

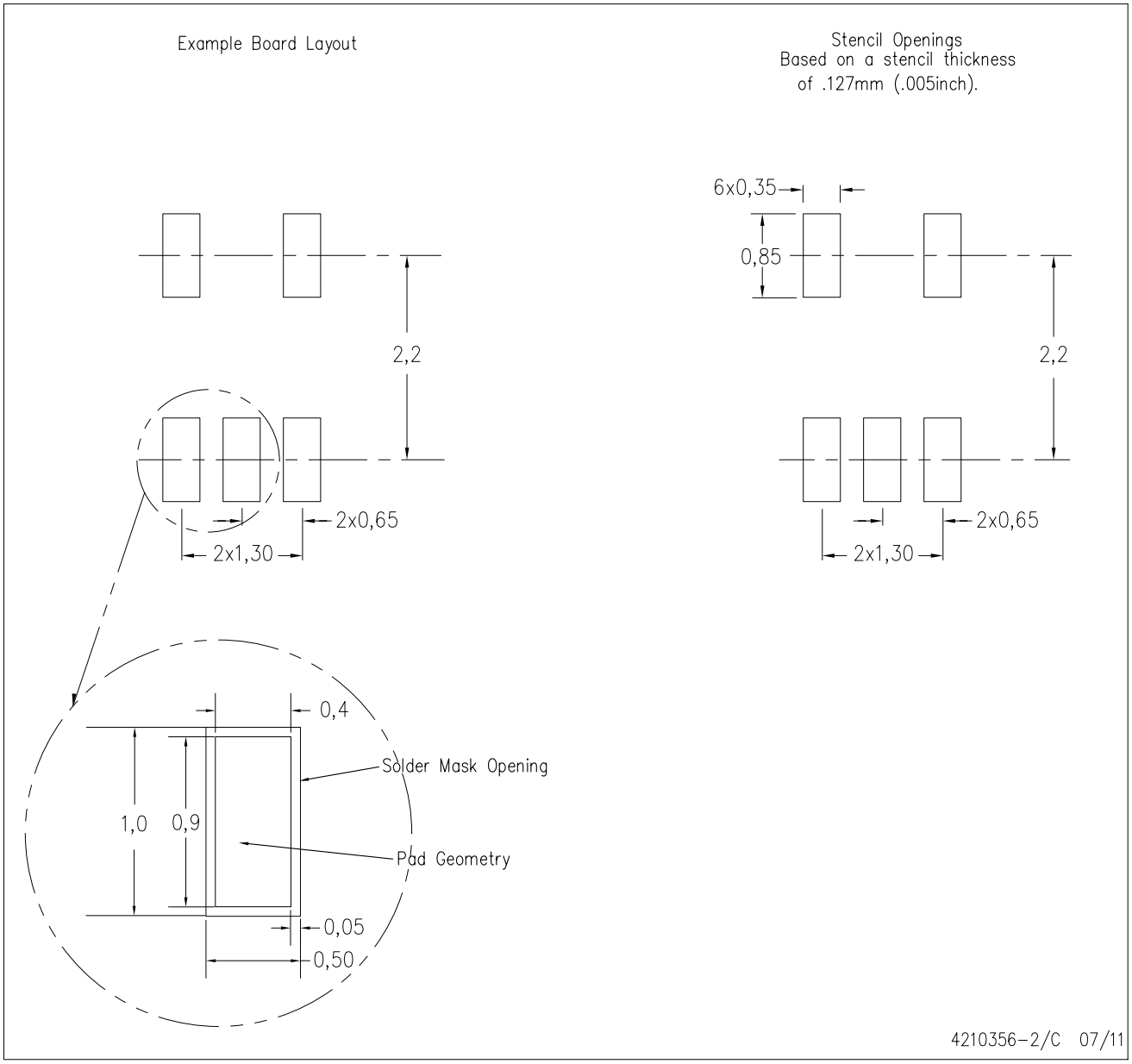
## DCK (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE




4093553–3/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 AA.

DCK (R–PDSO–G5) PLASTIC SMALL OUTLINE

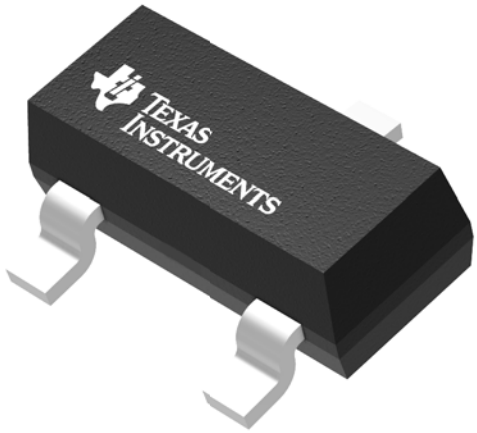



NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
D. Publication IPC–7351 is recommended for alternate designs.
E. Laser cutting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

# GENERIC PACKAGE VIEW

## DBZ 3 SOT-23 - 1.12 mm max height

SMALL OUTLINE TRANSISTOR



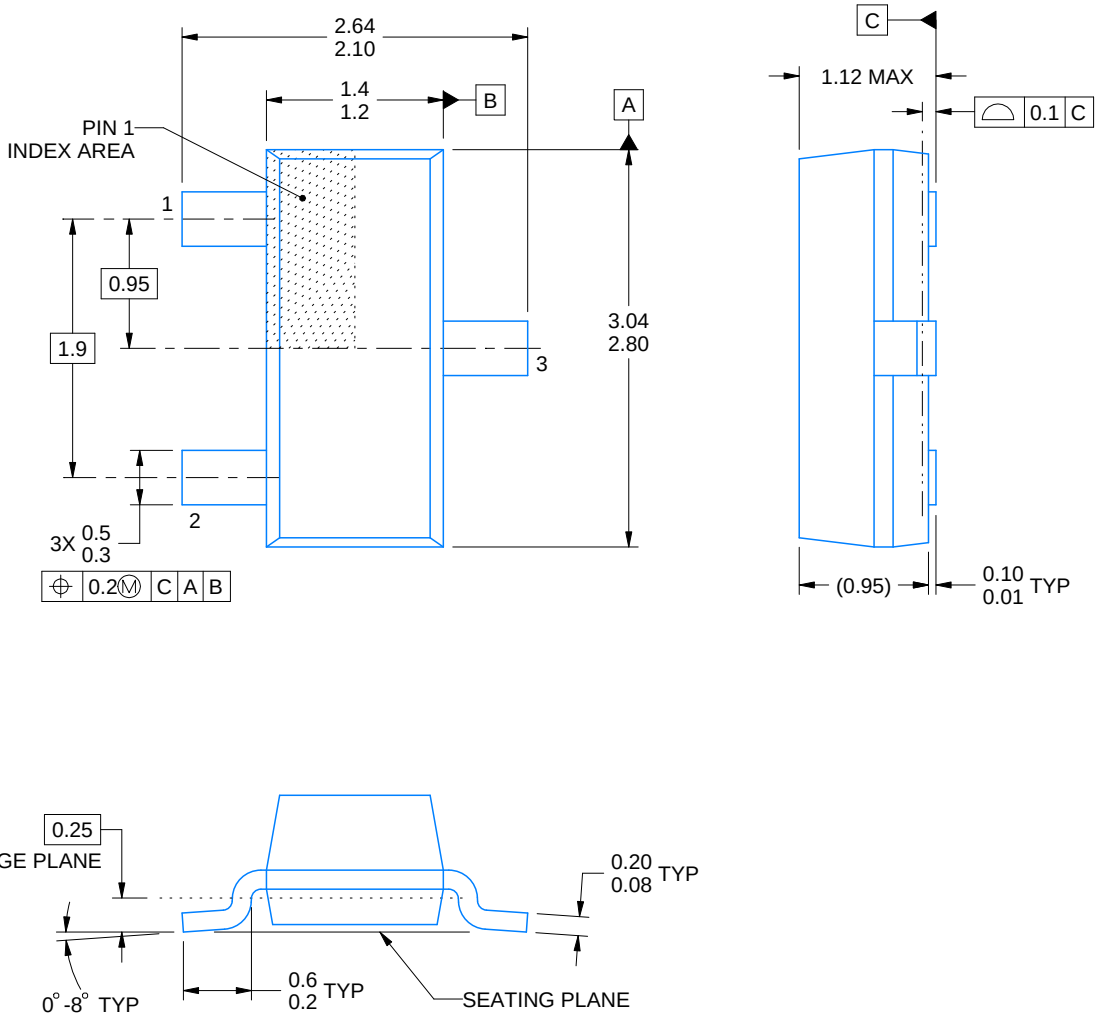

Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

# PACKAGE OUTLINE

## DBZ0003A

## SOT-23 - 1.12 mm max height

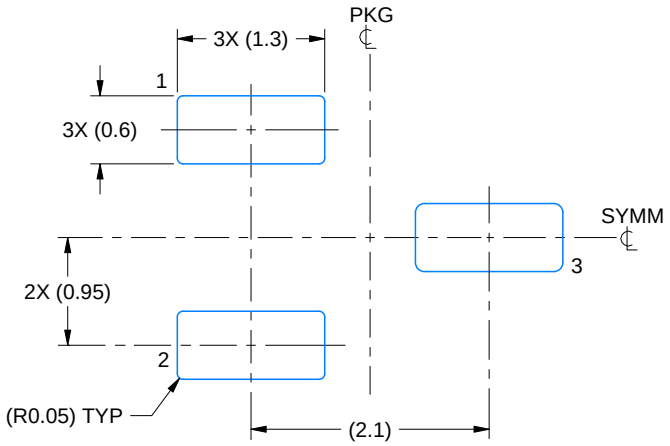
SMALL OUTLINE TRANSISTOR



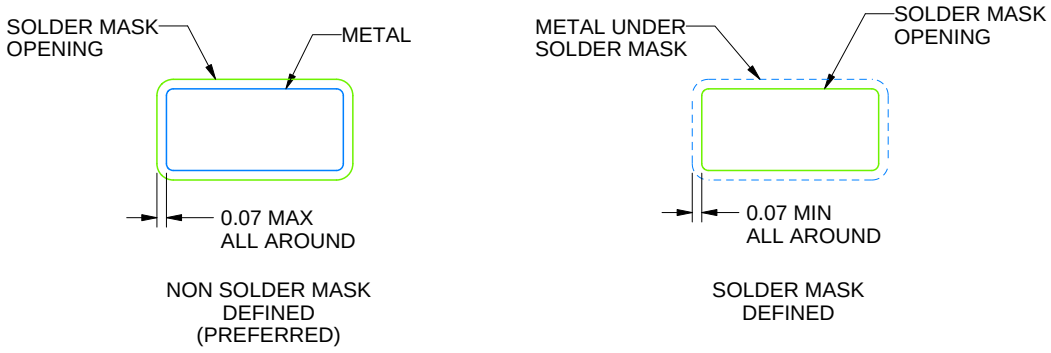

4214838/C 04/2017

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Reference JEDEC registration TO-236, except minimum foot length.




LAND PATTERN EXAMPLE
SCALE:15X

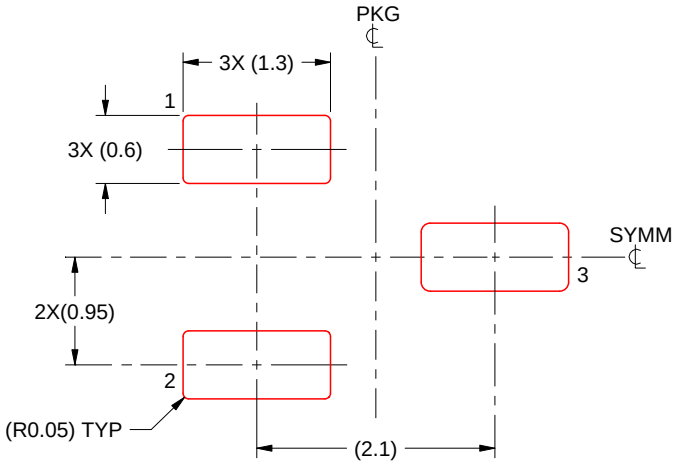



SOLDER MASK DETAILS

4214838/C 04/2017

NOTES: (continued)

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




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

4214838/C 04/2017

NOTES: (continued)

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

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