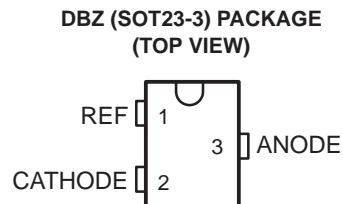
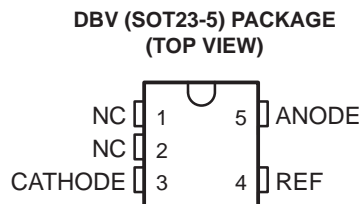
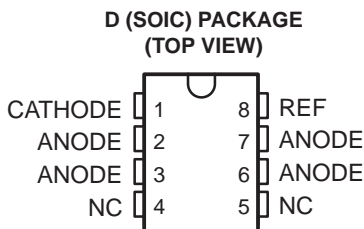


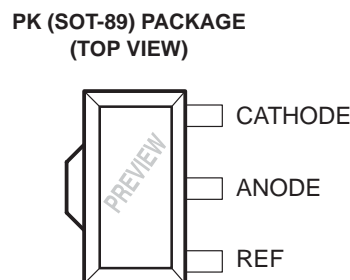
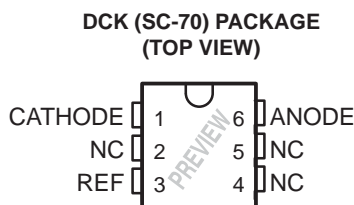
TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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- Low-Voltage Operation . . . Down to 1.24 V
- Reference Voltage Tolerances are:
0.5% for TLV431B,
1% for TLV431A, and
1.5% for TLV431
- Adjustable Output Voltage, $V_O = V_{REF}$ to 6 V
- Low Operational Cathode Current . . . 80 μ A Typ
- 0.25 Ω Typical Output Impedance
- -40°C to 125°C Specifications



NC - No internal connection



description/ordering information

The TLV431, TLV431A, and TLV431B are low-voltage 3-terminal adjustable voltage references with specified thermal stability over applicable industrial and commercial temperature ranges. Output voltage can be set to any value between V_{REF} (1.24 V) and 6 V with two external resistors (see Figure 2). These devices operate from a lower voltage (1.24 V) than the widely used TL431 and TL1431 shunt-regulator references.

When used with an optocoupler, the TLV431, TLV431A, and TLV431B are ideal voltage references in isolated feedback circuits for 3-V to 3.3-V switching-mode power supplies. These devices have a typical output impedance of 0.25 Ω . Active output circuitry provides a very sharp turn-on characteristic, making the TLV431, TLV431A, and TLV431B excellent replacements for low-voltage Zener diodes in many applications, including on-board regulation and adjustable power supplies.



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 Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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description/ordering information (continued)

ORDERING INFORMATION

T _J	V _{REF} TOLERANCE	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING		
0°C to 70°C	0.5%	SC-70 (DCK)	Reel of 3000	TLV431BCDCKR	PREVIEW	
			Reel of 250	TLV431BCDCKT		
		SOT-23-5 (DBV)	Reel of 3000	TLV431BCDBVR	PREVIEW	
			Reel of 250	TLV431BCDBVT		
		SOT-23-3 (DBZ)	Reel of 3000	TLV431BCDBZR	PREVIEW	
			Reel of 250	TLV431BCDBZT		
		SOT-89 (PK)	Reel of 1000	TLV431BCPK	PREVIEW	
		TO-92 (LP)	Bulk of 1000	TLV431BCLP	PREVIEW	
			Reel of 2000	TLV431BCLPR		
		1%	SC-70 (DCK)	Reel of 3000	TLV431ACDCKR	PREVIEW
				Reel of 250	TLV431ACDCKT	
			SOT-23-5 (DBV)	Reel of 3000	TLV431ACDBVR	VAHC‡, YAC_§
	Reel of 250			TLV431ACDBVT		
	SOT-23-3 (DBZ)		Reel of 3000	TLV431ACDBZR	YAC_§	
	SOT-89 (PK)		Reel of 1000	TLV431ACPK	PREVIEW	
	TO-92 (LP)		Bulk of 1000	TLV431ACL	V431AC	
			Reel of 2000	TLV431ACLPR		
	1.5%		SC-70 (DCK)	Reel of 3000	TLV431CDCKR	PREVIEW
				Reel of 250	TLV431CDCKT	
			SOT-23-5 (DBV)	Reel of 3000	TLV431CDBVR	VAII‡, Y3I_§
				Reel of 250	TLV431CDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLV431CDBZR	Y3I_§	
		SOT-89 (PK)	Reel of 1000	TLV431CPK	PREVIEW	
		TO-92 (LP)	Bulk of 1000	TLV431CLP	V431C	
Reel of 2000			TLV431CLPR			

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

‡ Possible top-side marking on units prior to August 16, 2004.

§ DBV/DBZ: The actual top-side marking has one additional character that designates the assembly/test site.

TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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description/ordering information (continued)

ORDERING INFORMATION (continued)

T _J	V _{REF} TOLERANCE	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING	
–40°C to 85°C	0.5%	SC-70 (DCK)	Reel of 3000	TLV431BIDCKR	PREVIEW	
			Reel of 250	TLV431BIDCKT		
		SOT-23-5 (DBV)	Reel of 3000	TLV431BIDBVR	PREVIEW	
			Reel of 250	TLV431BIDBVT		
		SOT-23-3 (DBZ)	Reel of 3000	TLV431BIDBZR	PREVIEW	
			Reel of 250	TLV431BIDBZT		
		SOT-89 (PK)	Reel of 1000	TLV431BIPK	PREVIEW	
		TO-92 (LP)	Bulk of 1000	TLV431BILP	PREVIEW	
			Reel of 2000	TLV431BILPR		
		1%	SC-70 (DCK)	Reel of 3000	TLV431AIDCKR	PREVIEW
				Reel of 250	TLV431AIDCKT	
			SOIC (D)	Tube of 75	TLV431AID	TY431A
	Reel of 2500			TLV431AIDR		
	SOT-23-5 (DBV)		Reel of 3000	TLV431AIDBVR	VAH†, YAI_§	
			Reel of 250	TLV431AIDBVT		
	SOT-23-3 (DBZ)		Reel of 3000	TLV431AIDBZR	YAI_§	
	SOT-89 (PK)		Reel of 1000	TLV431AIPK	PREVIEW	
	TO-92 (LP)		Bulk of 1000	TLV431AILP	V431AI	
			Ammo of 2000	TLV431AILPM		
			Reel of 2000	TLV431AILPR		
	1.5%		SC-70 (DCK)	Reel of 3000	TLV431IDCKR	PREVIEW
		Reel of 250		TLV431IDCKT		
		SOT-23-5 (DBV)	Reel of 3000	TLV431IDBVR	VAH†, Y3I_§	
			Reel of 250	TLV431IDBVT		
SOT-23-3 (DBZ)		Reel of 3000	TLV431IDBZR	Y3I_§		
SOT-89 (PK)		Reel of 1000	TLV431IPK	PREVIEW		
TO-92 (LP)		Bulk of 1000	TLV431ILP	V431I		
		Reel of 2000	TLV431ILPR			

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TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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description/ordering information (continued)

ORDERING INFORMATION (continued)

T _J	V _{REF} TOLERANCE	PACKAGE†	ORDERABLE PART NUMBER	TOP-SIDE MARKING	
–40°C to 125°C	0.5%	SC-70 (DCK)	Reel of 3000	TLV431BQDCKR	PREVIEW
			Reel of 250	TLV431BQDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLV431BQDBVR	PREVIEW
			Reel of 250	TLV431BQDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLV431BQDBZR	PREVIEW
			Reel of 250	TLV431BQDBZT	
		SOT-89 (PK)	Reel of 1000	TLV431BQPK	PREVIEW
		TO-92 (LP)	Bulk of 1000	TLV431BQLP	PREVIEW
			Reel of 2000	TLV431BQLPR	
		1%	SC-70 (DCK)	Reel of 3000	TLV431AQDCKR
	Reel of 250			TLV431AQDCKT	
	SOIC (D)		Tube of 75	TLV431AQD	PREVIEW
			Reel of 2500	TLV431AQDR	
	SOT-23-5 (DBV)		Reel of 3000	TLV431AQDBVR	PREVIEW
			Reel of 250	TLV431AQDBVT	
	SOT-23-3 (DBZ)		Reel of 3000	TLV431AQDBZR	PREVIEW
			Reel of 250	TLV431AQDBZT	
	SOT-89 (PK)		Reel of 1000	TLV431AQPK	PREVIEW
	TO-92 (LP)		Bulk of 1000	TLV431AQLP	PREVIEW
		Reel of 2000	TLV431AQLPR		
	1.5%	SC-70 (DCK)	Reel of 3000	TLV431QDCKR	PREVIEW
			Reel of 250	TLV431QDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLV431QDBVR	PREVIEW
			Reel of 250	TLV431QDBVT	
SOT-23-3 (DBZ)		Reel of 3000	TLV431QDBZR	PREVIEW	
		Reel of 250	TLV431QDBZT		
SOT-89 (PK)		Reel of 1000	TLV431QPK	PREVIEW	
TO-92 (LP)		Bulk of 1000	TLV431QLP	PREVIEW	
		Reel of 2000	TLV431QLPR		

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

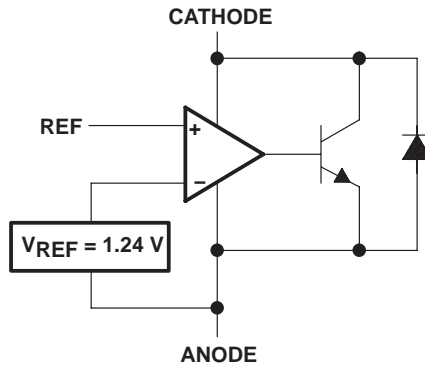


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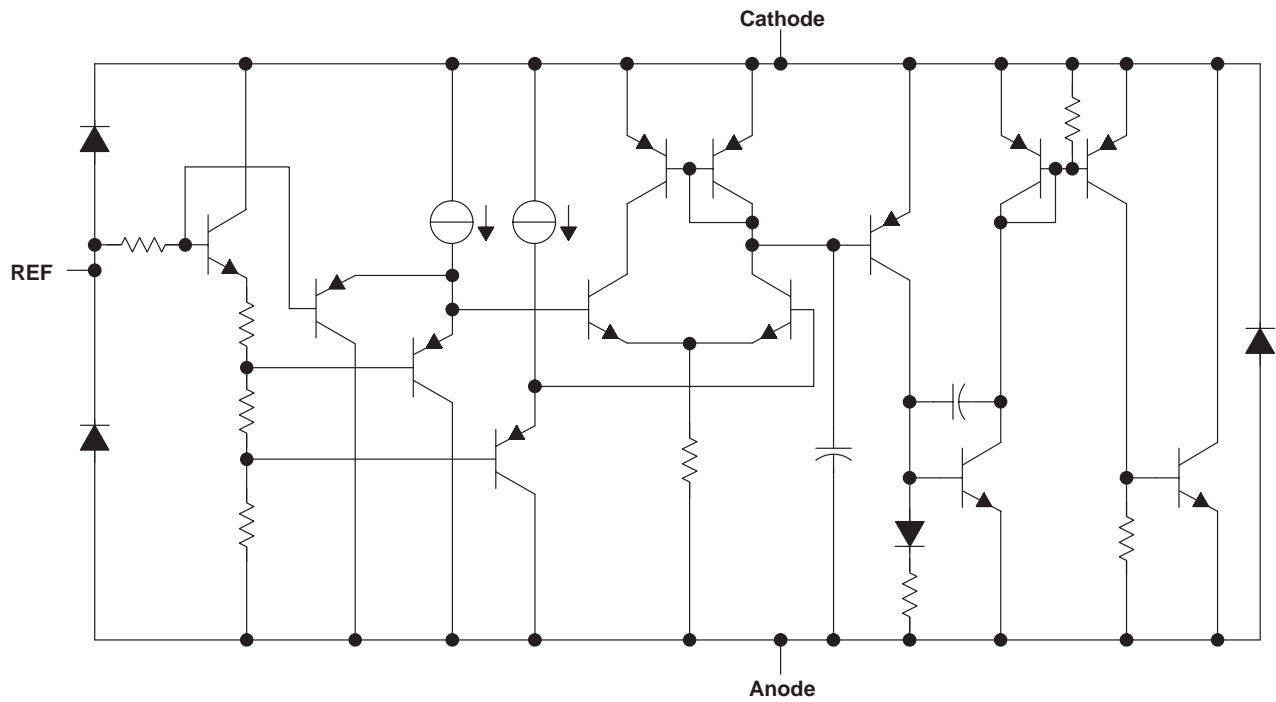
TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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logic block diagram



equivalent schematic



TLV431, TLV431A, TLV431B

LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Cathode voltage, V_{KA} (see Note 1)	7 V
Continuous cathode current range, I_K	-20 mA to 20 mA
Reference current range, I_{ref}	-0.05 mA to 3 mA
Package thermal impedance, θ_{JA} (see Notes 2 and 3):	
D package	97°C/W
DBV package	206°C/W
DBZ package	TBD°C/W
DCK package	252°C/W
LP package	140°C/W
PK package	52°C/W
Operating virtual junction temperature	150°C
Storage temperature range, T_{stg}	-65°C to 150°C

† 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.

- NOTES:
1. Voltage values are with respect to the anode terminal unless otherwise noted.
 2. Maximum power dissipation is a function of $T_J(max)$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions

		MIN	MAX	UNIT	
V_{KA}	Cathode voltage	V_{REF}	6	V	
I_K	Cathode current	0.1	15	mA	
T_A	Operating free-air temperature range	TLV431_C	0	70	°C
		TLV431_I	-40	85	
		TLV431_Q	-40	125	



TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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TLV431 electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLV431			UNIT	
		MIN	TYP	MAX		
V_{REF} Reference voltage	$V_{KA} = V_{REF}$ $I_K = 10\text{ mA}$	$T_A = 25^\circ\text{C}$	1.222	1.24	1.258	V
		$T_A = \text{full range}$ (see Note 4 and Figure 1)	TLV431C	1.21	1.27	
		TLV431I	1.202	1.278		
		TLV431Q				
$V_{REF(\text{dev})}$ V_{REF} deviation over full temperature range (see Note 4)	$V_{KA} = V_{REF}$, $I_K = 10\text{ mA}$ (see Note 4 and Figure 1)	TLV431C	4	12	mV	
		TLV431I	6	20		
		TLV431Q				
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$ Ratio of V_{REF} change in cathode voltage change	$I_K = 10\text{ mA}$ (see Figure 2)	$V_{KA} = V_{REF}$ to 6 V		-1.5	-2.7	mV/V
I_{ref} Reference terminal current	$I_K = 10\text{ mA}$, $R_1 = 10\text{ k}\Omega$, $R_2 = \text{open}$ (see Figure 2)			0.15	0.5	μA
$I_{ref(\text{dev})}$ I_{ref} deviation over full temperature range (see Note 4)	$I_K = 10\text{ mA}$, $R_1 = 10\text{ k}\Omega$, $R_2 = \text{open}$ (see Note 4 and Figure 2)	TLV431C	0.05	0.3	μA	
		TLV431I	0.1	0.4		
		TLV431Q				
$I_{K(\text{min})}$ Minimum cathode current for regulation	$V_{KA} = V_{REF}$ (see Figure 1)			55	80	μA
$I_{K(\text{off})}$ Off-state cathode current	$V_{REF} = 0$, $V_{KA} = 6\text{ V}$ (see Figure 3)			0.001	0.1	μA
$ z_{KA} $ Dynamic impedance (see Note 5)	$V_{KA} = V_{REF}$, $f \leq 1\text{ kHz}$, $I_K = 0.1\text{ mA}$ to 15 mA (see Figure 1)			0.25	0.4	Ω

- NOTES: 4. Full temperature ranges are: -40°C to 125°C for TLV431Q, -40°C to 85°C for TLV431I, and 0°C to 70°C for the TLV431C.
5. The deviation parameters $V_{REF(\text{dev})}$ and $I_{ref(\text{dev})}$ 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, αV_{REF} , is defined as:

$$|\alpha V_{REF}| \left(\frac{\text{ppm}}{^\circ\text{C}} \right) = \frac{\left(\frac{V_{REF(\text{dev})}}{V_{REF}(T_A = 25^\circ\text{C})} \right) \times 10^6}{\Delta T_A}$$

where ΔT_A is the rated operating free-air temperature range of the device.

αV_{REF} can be positive or negative, depending on whether minimum V_{REF} or maximum V_{REF} , respectively, occurs at the lower temperature.

6. The dynamic impedance is defined as: $|z_{ka}| = \frac{\Delta V_{KA}}{\Delta I_K}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is defined as:

$$|z_{ka}'| = \frac{\Delta V}{\Delta I} \approx |z_{ka}| \times \left(1 + \frac{R_1}{R_2} \right)$$

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TLV431A electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLV431A			UNIT		
		MIN	TYP	MAX			
V _{REF} Reference voltage	V _{KA} = V _{REF} , I _K = 10 mA	T _A = 25°C	1.228	1.24	1.252	V	
		T _A = full range (see Note 3 and Figure 1)	TLV431AC	1.221	1.259		
			TLV431AI	1.215	1.265		
			TLV431AQ				
V _{REF(dev)} V _{REF} deviation over full temperature range (see Note 4)	V _{KA} = V _{REF} , I _K = 10 mA (see Note 3 and Figure 1)	TLV431AC	4	12	mV		
		TLV431AI	6	20			
		TLV431AQ					
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$ Ratio of V _{REF} change in cathode voltage change	I _K = 10 mA (see Figure 2)	V _{KA} = V _{REF} to 6 V	-1.5	-2.7	mV/V		
I _{ref} Reference terminal current	I _K = 10 mA, R1 = 10 kΩ, R2 = open (see Figure 2)		0.15	0.5	μA		
I _{ref(dev)} I _{ref} deviation over full temperature range (see Note 4)	I _K = 10 mA, R1 = 10 kΩ, R2 = open (see Note 3 and Figure 2)	TLV431AC	0.05	0.3	μA		
		TLV431AI	0.1	0.4			
		TLV431AQ					
I _{K(min)} Minimum cathode current for regulation	V _{KA} = V _{REF} (see Figure 1)		55	80	μA		
I _{K(off)} Off-state cathode current	V _{REF} = 0, V _{KA} = 6 V (see Figure 3)		0.001	0.1	μA		
z _{KA} Dynamic impedance (see Note 5)	V _{KA} = V _{REF} , f ≤ 1 kHz, I _K = 0.1 mA to 15 mA (see Figure 1)		0.25	0.4	Ω		

- NOTES: 3. Full temperature ranges are: -40°C to 125°C for TLV431AQ, -40°C to 85°C for TLV431AI, and 0°C to 70°C for the TLV431AC.
 4. 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, αV_{REF}, is defined as:

$$|\alpha V_{REF}| \left(\frac{\text{ppm}}{^{\circ}\text{C}} \right) = \frac{\left(\frac{V_{REF(\text{dev})}}{V_{REF}(T_A=25^{\circ}\text{C})} \right) \times 10^6}{\Delta T_A}$$

where ΔT_A is the rated operating free-air temperature range of the device.

αV_{REF} can be positive or negative, depending on whether minimum V_{REF} or maximum V_{REF}, respectively, occurs at the lower temperature.

5. The dynamic impedance is defined as: $|z_{ka}| = \frac{\Delta V_{KA}}{\Delta I_K}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is defined as:

$$|z_{ka}'| = \frac{\Delta V}{\Delta I} \approx |z_{ka}| \times \left(1 + \frac{R1}{R2} \right)$$

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TLV431B electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLV431B			UNIT	
		MIN	TYP	MAX		
V_{REF} Reference voltage	$V_{KA} = V_{REF}$ $I_K = 10\text{ mA}$	$T_A = 25^\circ\text{C}$	1.234	1.24	1.246	V
		$T_A = \text{full range}$ (see Note 3 and Figure 1)	TLV431BC	1.227		
	TLV431BI		1.224		1.259	
	TLV431BQ					
$V_{REF(\text{dev})}$ V_{REF} deviation over full temperature range (see Note 4)	$V_{KA} = V_{REF}$, $I_K = 10\text{ mA}$ (see Note 3 and Figure 1)	TLV431BC		4	12	mV
		TLV431BI		6	20	
		TLV431BQ				
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$ Ratio of V_{REF} change in cathode voltage change	$I_K = 10\text{ mA}$ (see Figure 2)	$V_{KA} = V_{REF}$ to 6 V		-1.5	-2.7	mV/V
I_{ref} Reference terminal current	$I_K = 10\text{ mA}$, $R1 = 10\text{ k}\Omega$, $R2 = \text{open}$ (see Figure 2)			0.15	0.5	μA
$I_{ref(\text{dev})}$ I_{ref} deviation over full temperature range (see Note 4)	$I_K = 10\text{ mA}$, $R1 = 10\text{ k}\Omega$, $R2 = \text{open}$ (see Note 3 and Figure 2)	TLV431BC		0.05	0.3	μA
		TLV431BI		0.1	0.4	
		TLV431BQ				
$I_{K(\text{min})}$ Minimum cathode current for regulation	$V_{KA} = V_{REF}$ (see Figure 1)			55	80	μA
$I_{K(\text{off})}$ Off-state cathode current	$V_{REF} = 0$, $V_{KA} = 6\text{ V}$ (see Figure 3)			0.001	0.1	μA
$ z_{KA} $ Dynamic impedance (see Note 5)	$V_{KA} = V_{REF}$, $f \leq 1\text{ kHz}$, $I_K = 0.1\text{ mA}$ to 15 mA (see Figure 1)			0.25	0.4	Ω

- NOTES: 3. Full temperature ranges are: -40°C to 125°C for TLV431BQ, -40°C to 85°C for TLV431BI, and 0°C to 70°C for the TLV431BC.
4. The deviation parameters $V_{REF(\text{dev})}$ and $I_{ref(\text{dev})}$ 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, αV_{REF} , is defined as:

$$|\alpha V_{REF}| \left(\frac{\text{ppm}}{^\circ\text{C}} \right) = \frac{\left(\frac{V_{REF(\text{dev})}}{V_{REF}(T_A = 25^\circ\text{C})} \right) \times 10^6}{\Delta T_A}$$

where ΔT_A is the rated operating free-air temperature range of the device.

αV_{REF} can be positive or negative, depending on whether minimum V_{REF} or maximum V_{REF} , respectively, occurs at the lower temperature.

5. The dynamic impedance is defined as: $|z_{ka}| = \frac{\Delta V_{KA}}{\Delta I_K}$

When the device is operating with two external resistors (see Figure 2), the total dynamic impedance of the circuit is defined as:

$$|z_{ka}|' = \frac{\Delta V}{\Delta I} \approx |z_{ka}| \times \left(1 + \frac{R1}{R2} \right)$$

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LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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PARAMETER MEASUREMENT INFORMATION

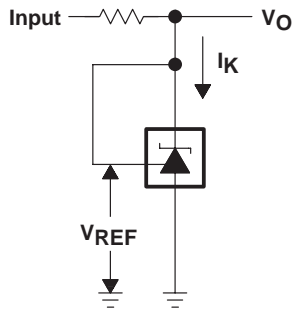


Figure 1. Test Circuit for $V_{KA} = V_{REF}$
 $V_O = V_{KA} = V_{REF}$

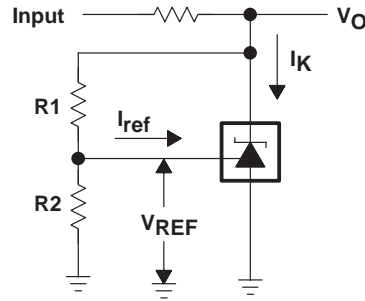


Figure 2. Test Circuit for $V_{KA} > V_{REF}$
 $V_O = V_{KA} = V_{REF} \times (1 + R1/R2) + I_{ref} \times R1$

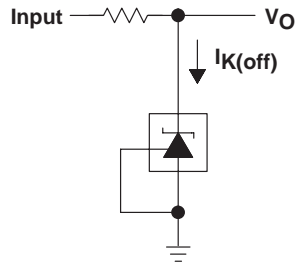
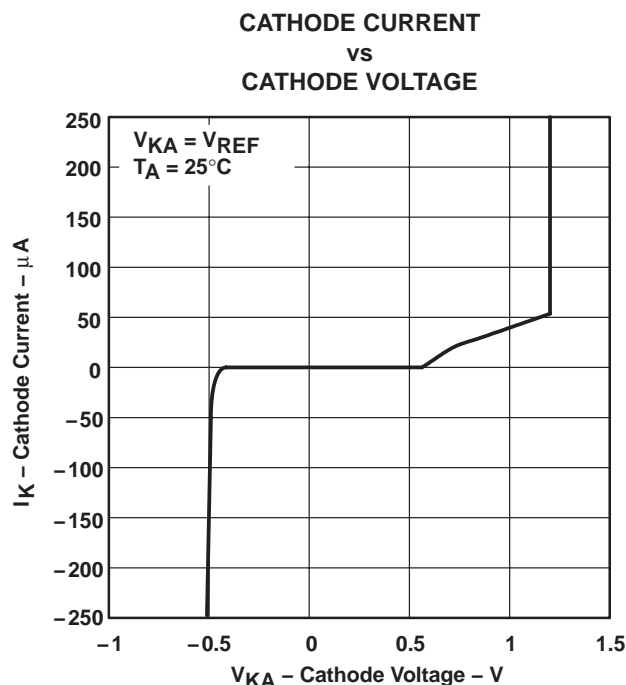
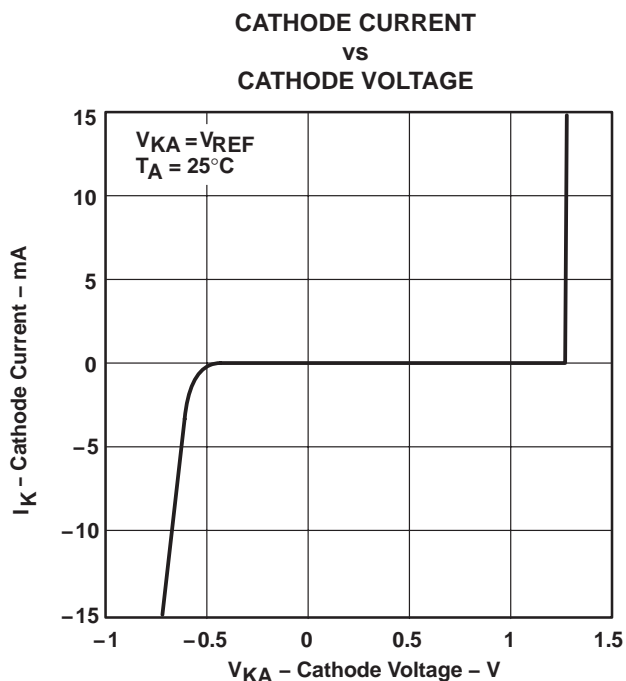
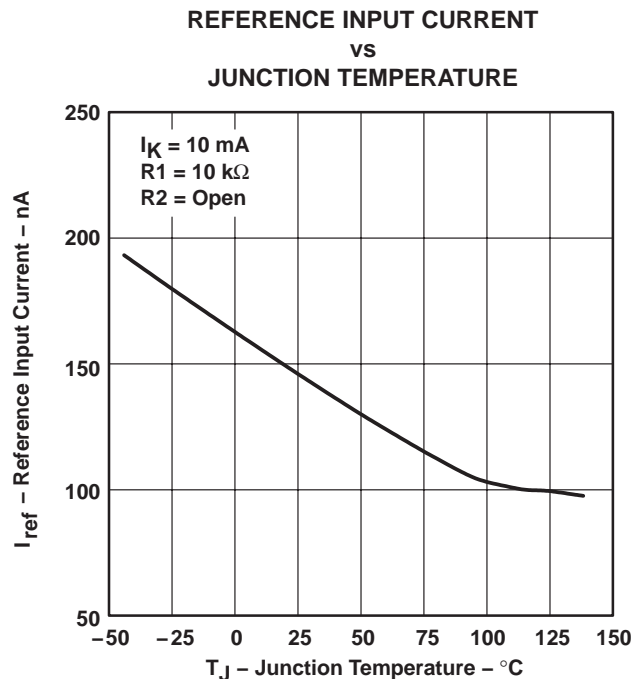
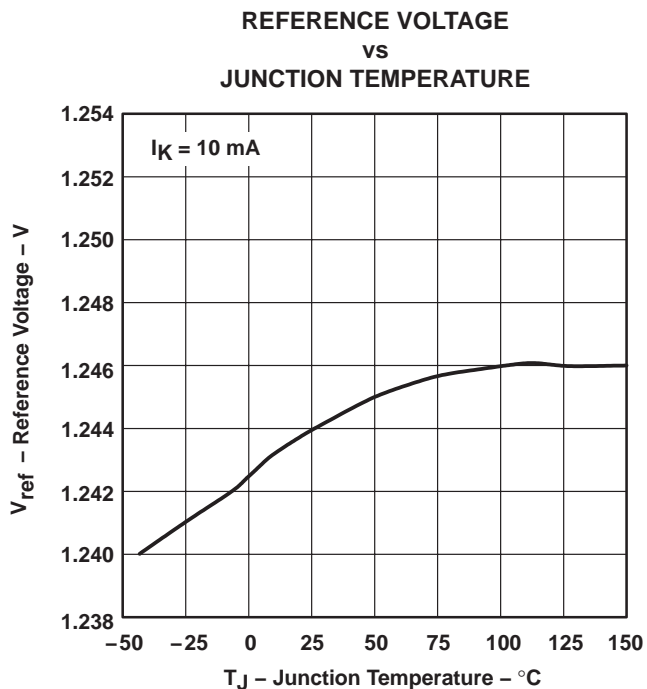


Figure 3. Test Circuit for $I_{K(off)}$

TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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PARAMETER MEASUREMENT INFORMATION†



† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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PARAMETER MEASUREMENT INFORMATION†

OFF-STATE CATHODE CURRENT
vs
JUNCTION TEMPERATURE

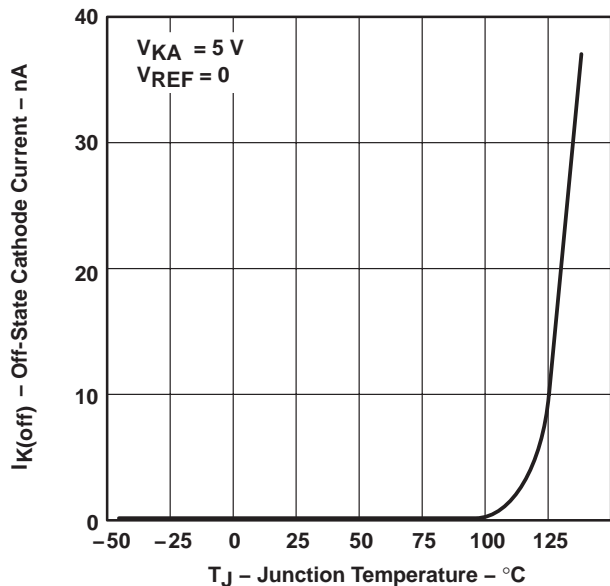


Figure 8

RATIO OF DELTA REFERENCE VOLTAGE
TO DELTA CATHODE VOLTAGE
vs
JUNCTION TEMPERATURE

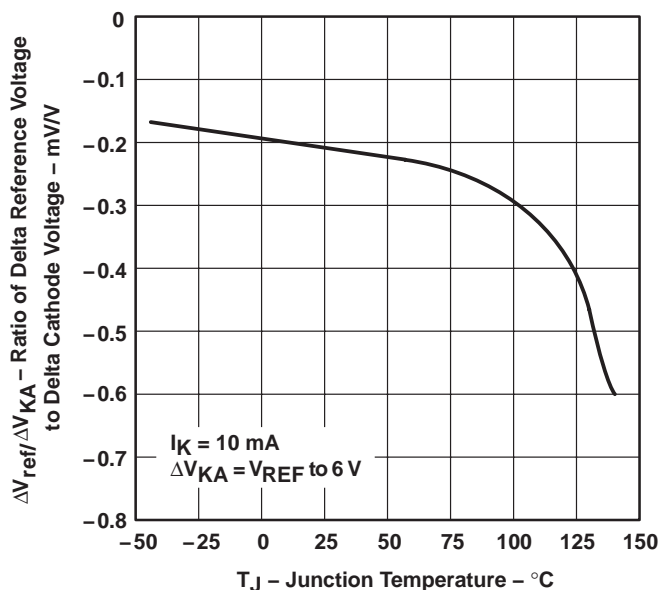
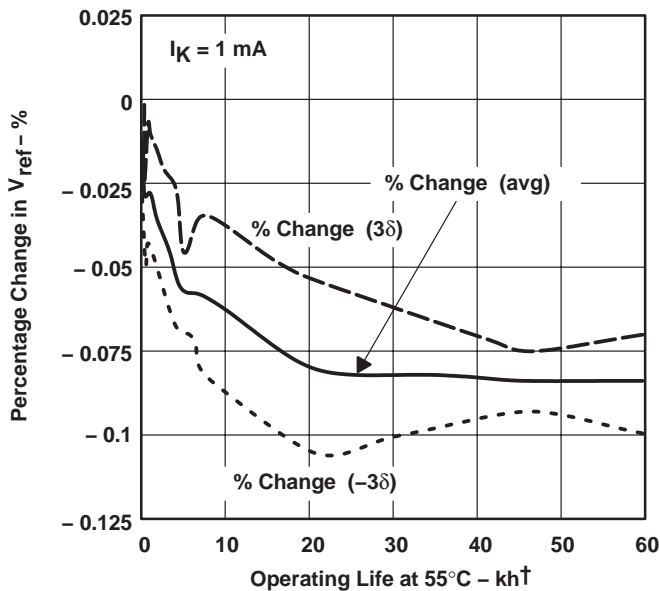


Figure 9

† Operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied.

PERCENTAGE CHANGE IN V_{REF}
vs
OPERATING LIFE AT 55°C



† Extrapolated from life-test data taken at 125°C; the activation energy assumed is 0.7 eV.

Figure 10



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PARAMETER MEASUREMENT INFORMATION

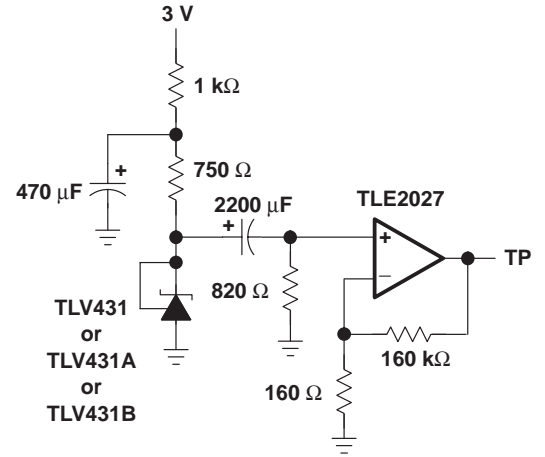
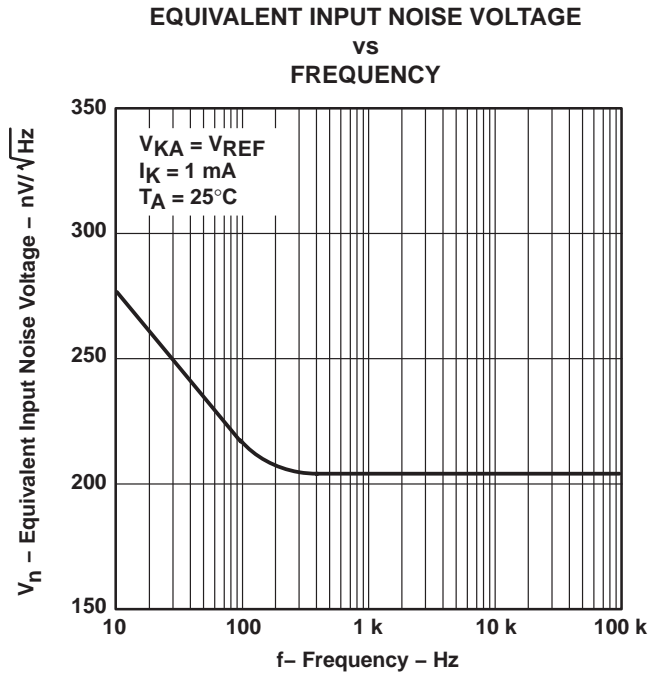
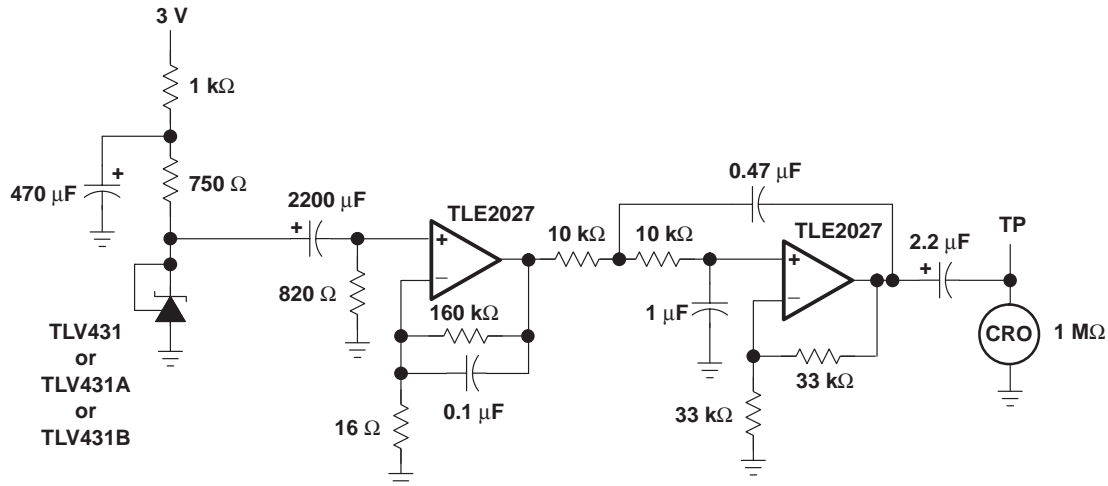
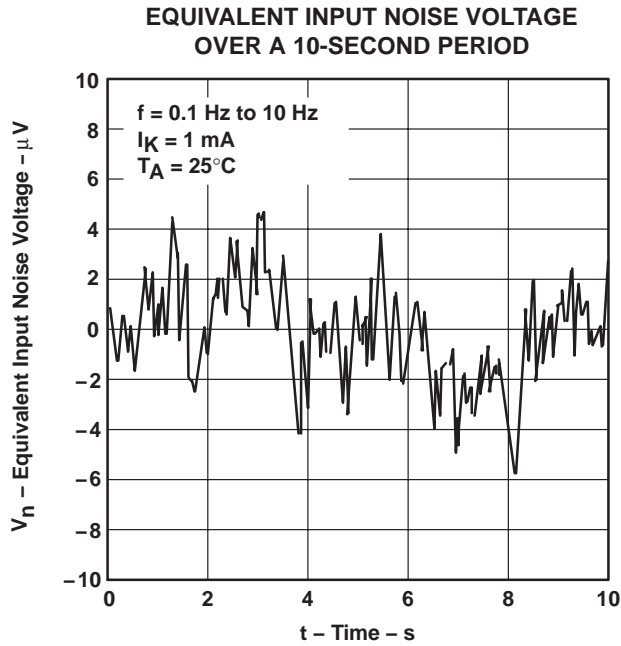


Figure 11

TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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PARAMETER MEASUREMENT INFORMATION



TEST CIRCUIT FOR 0.1-Hz TO 10-Hz EQUIVALENT NOISE VOLTAGE

Figure 12

PARAMETER MEASUREMENT INFORMATION

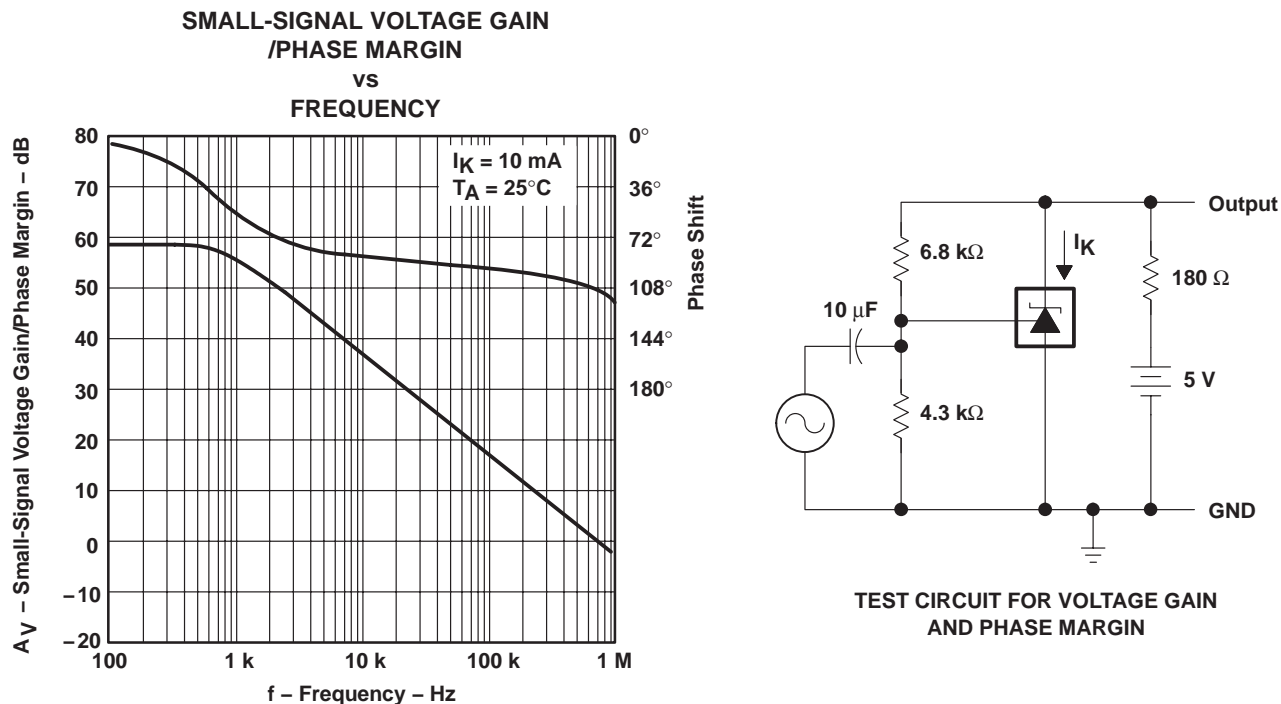


Figure 13

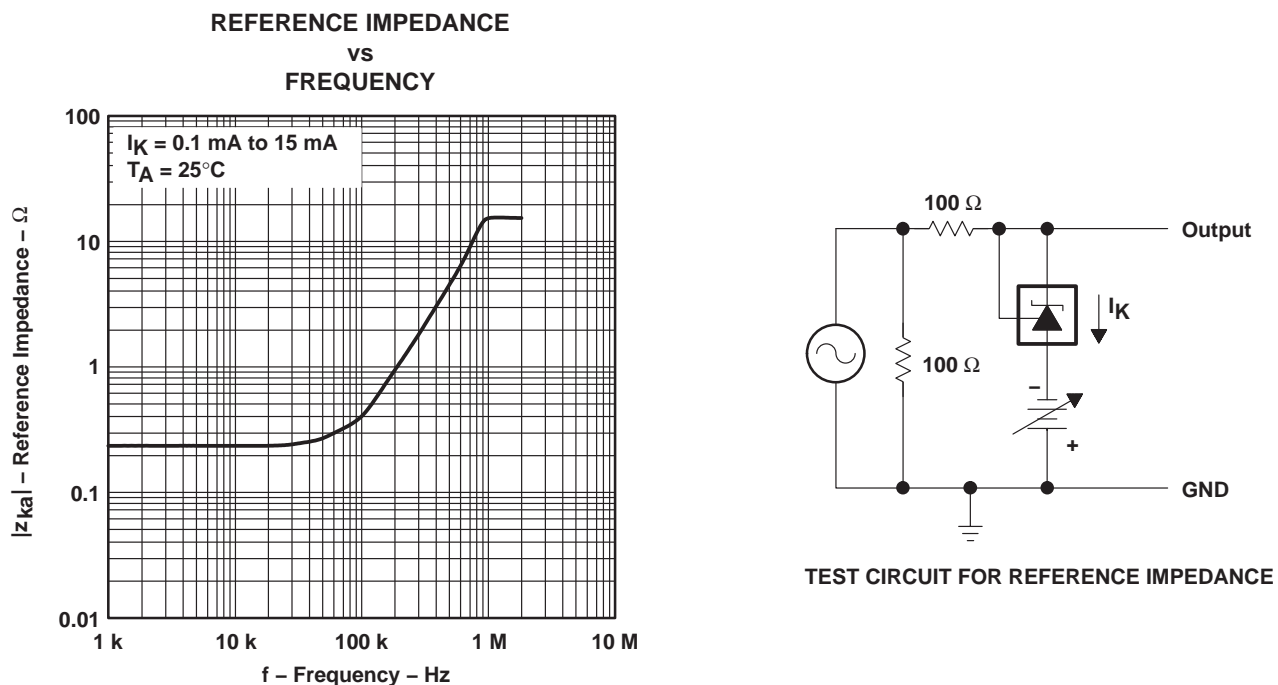


Figure 14

TLV431, TLV431A, TLV431B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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PARAMETER MEASUREMENT INFORMATION

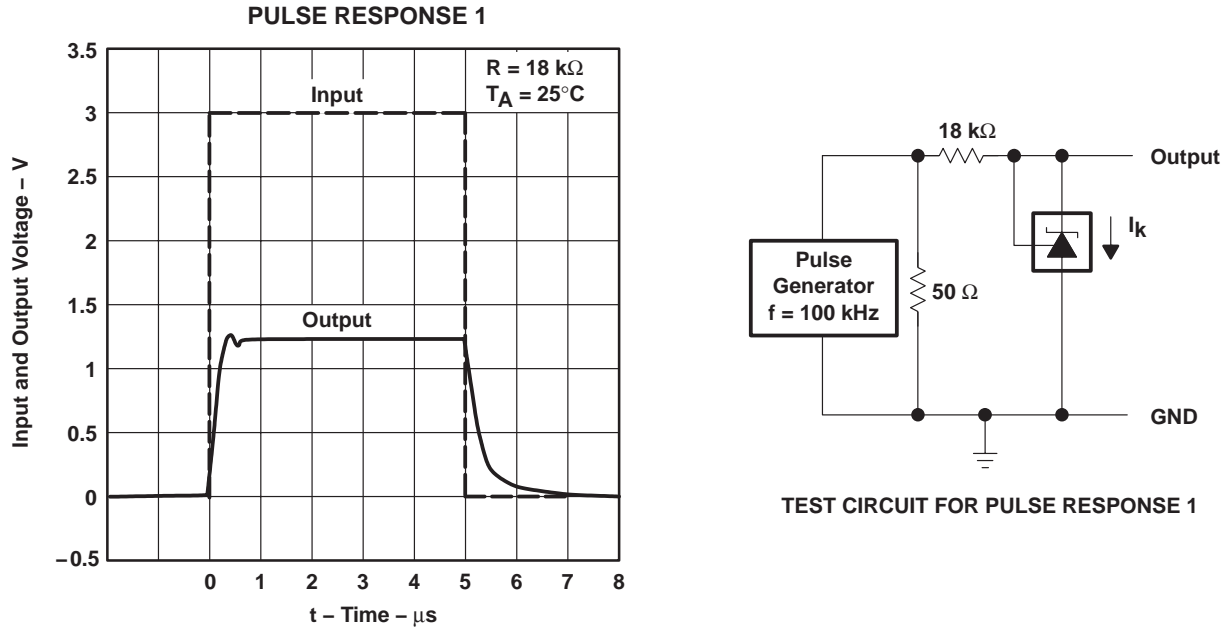


Figure 15

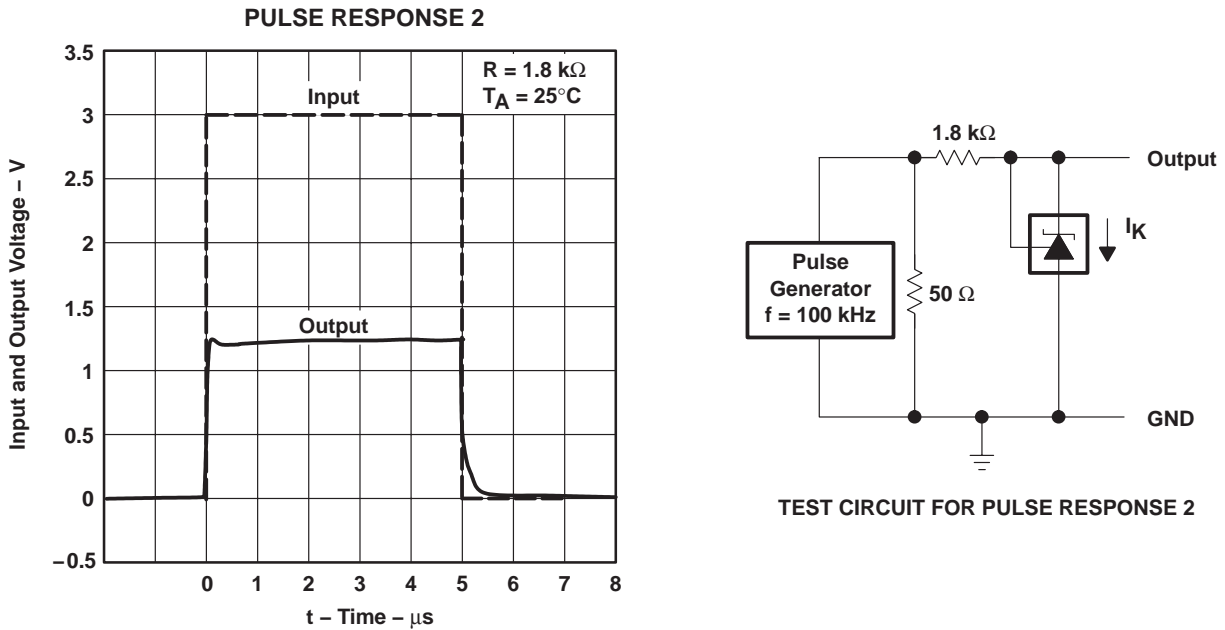
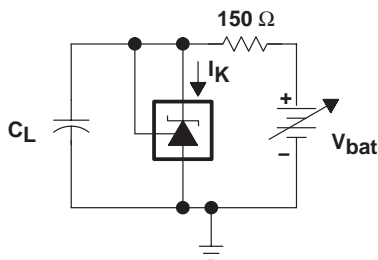
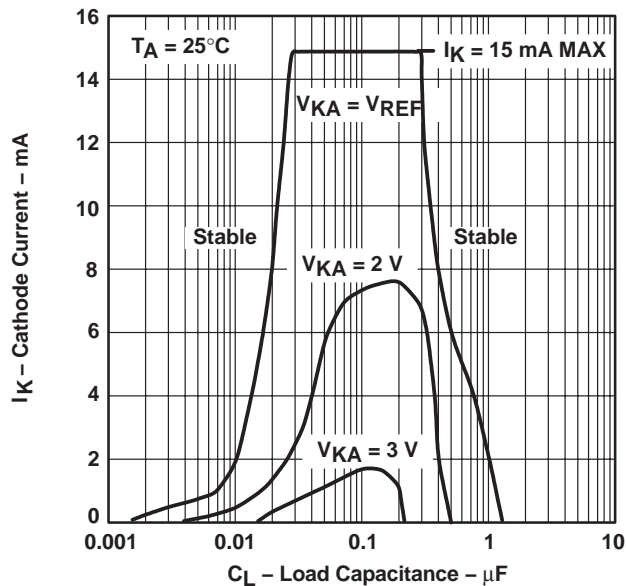


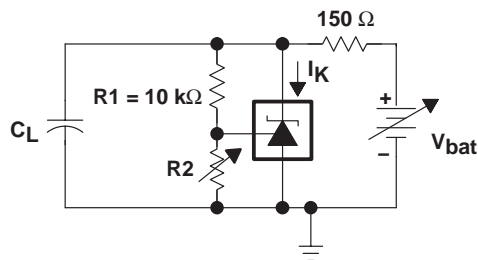
Figure 16

PARAMETER MEASUREMENT INFORMATION†

STABILITY BOUNDARY CONDITION‡



TEST CIRCUIT FOR $V_{KA} = V_{REF}$



TEST CIRCUIT FOR $V_{KA} = 2\text{ V}, 3\text{ V}$

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

‡ The areas under the curves represent conditions that may cause the device to oscillate. For $V_{KA} = 2\text{ V}$ and 3 V curves, $R2$ and V_{bat} were adjusted to establish the initial V_{KA} and I_K conditions with $C_L = 0$. V_{bat} and C_L then were adjusted to determine the ranges of stability.

Figure 17

TLV431, TLV431A, TLV431B

LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATORS

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APPLICATION INFORMATION

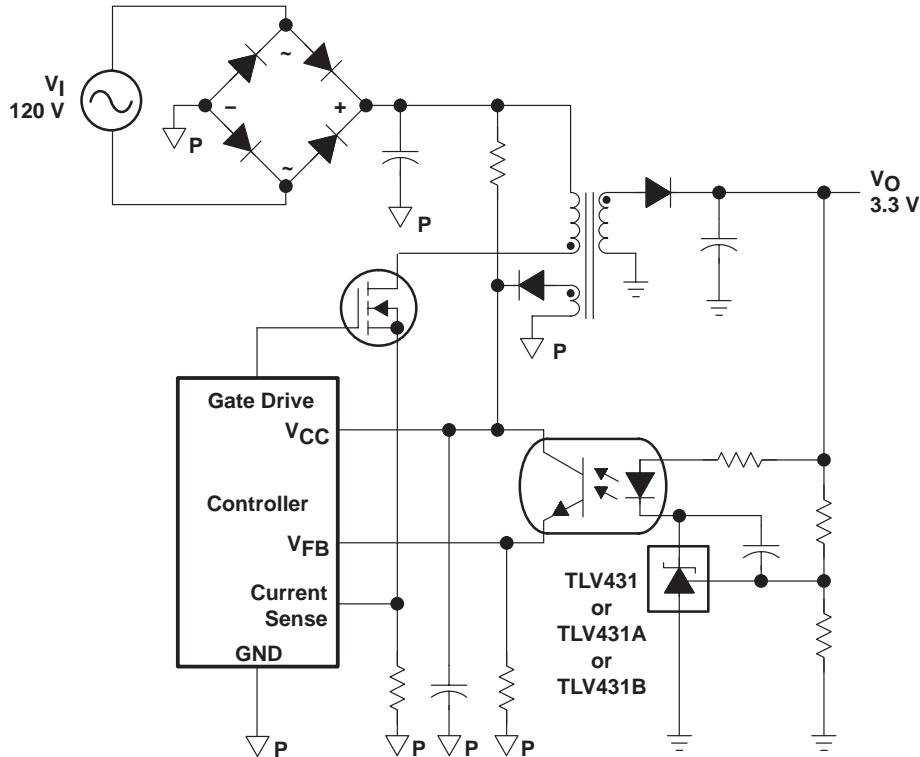
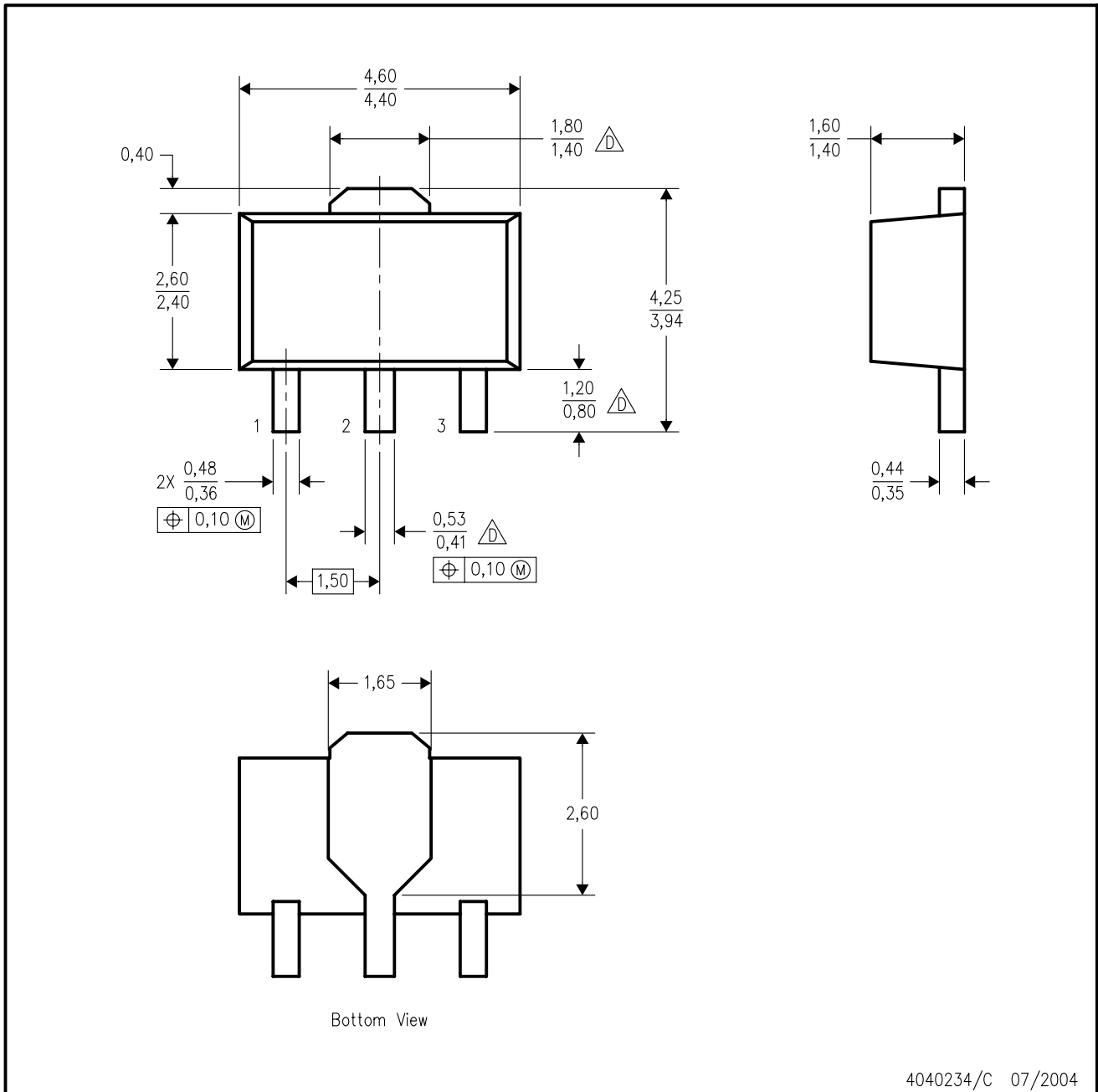


Figure 18. Flyback With Isolation Using TLV431, TLV431A, or TLV431B as Voltage Reference and Error Amplifier


Figure 18 shows the TLV431, TLV431A, or TLV431B used in a 3.3-V isolated flyback supply. Output voltage V_O can be as low as reference voltage V_{REF} ($1.24 \text{ V} \pm 1\%$). The output of the regulator, plus the forward voltage drop of the optocoupler LED ($1.24 + 1.4 = 2.64 \text{ V}$), determine the minimum voltage that can be regulated in an isolated supply configuration. Regulated voltage as low as 2.7 Vdc is possible in the above topology.

PK (R-PSSO-F3)

PLASTIC SINGLE-IN-LINE PACKAGE

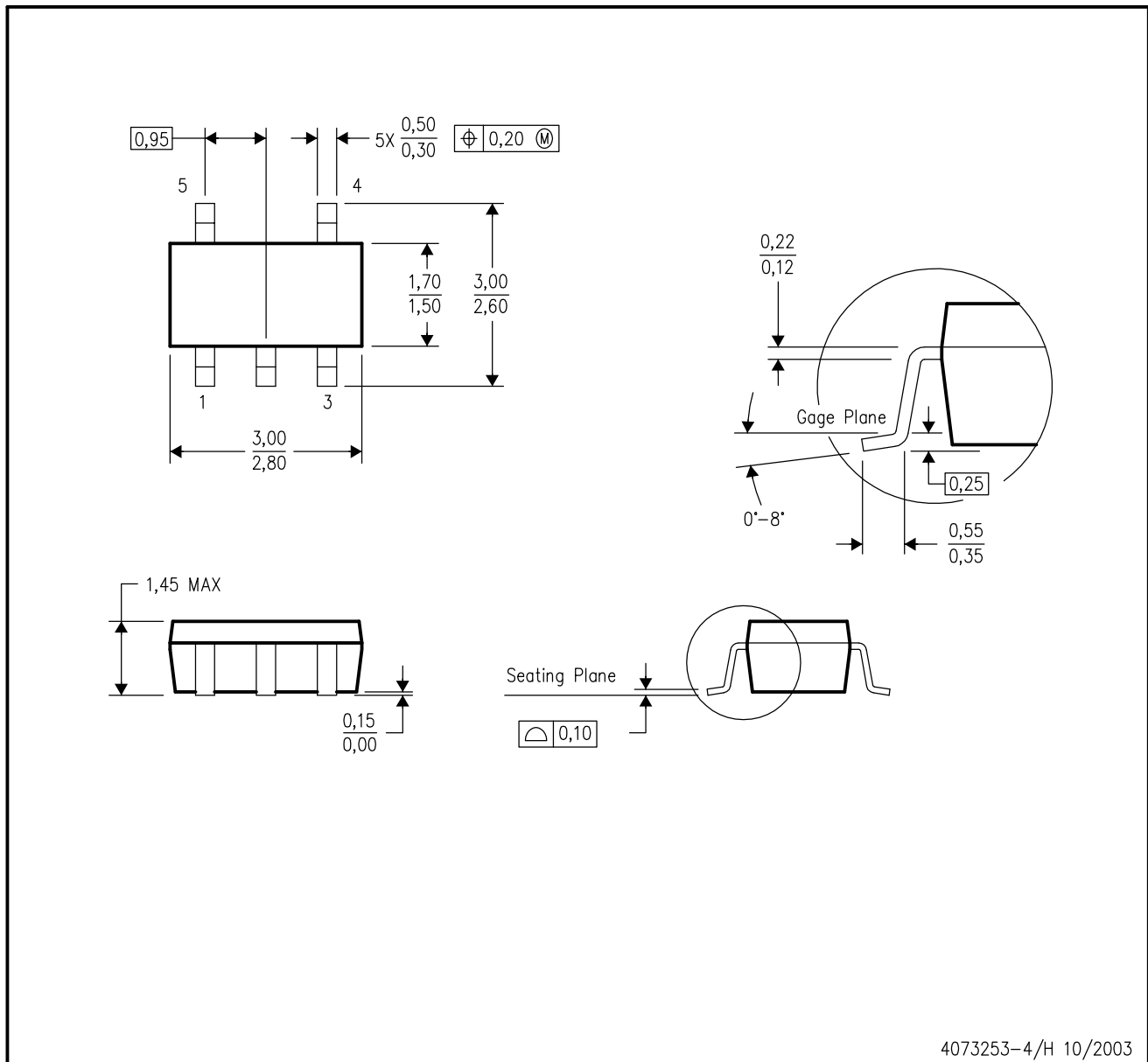


4040234/C 07/2004

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5-1994.
 - B. This drawing is subject to change without notice.
 - C. The center lead is in electrical contact with the tab.
-  Falls within JEDEC TO-243 variation AA, except minimum lead length, pin 2 minimum lead width, and minimum tab width.

DBV (R-PDSO-G5)

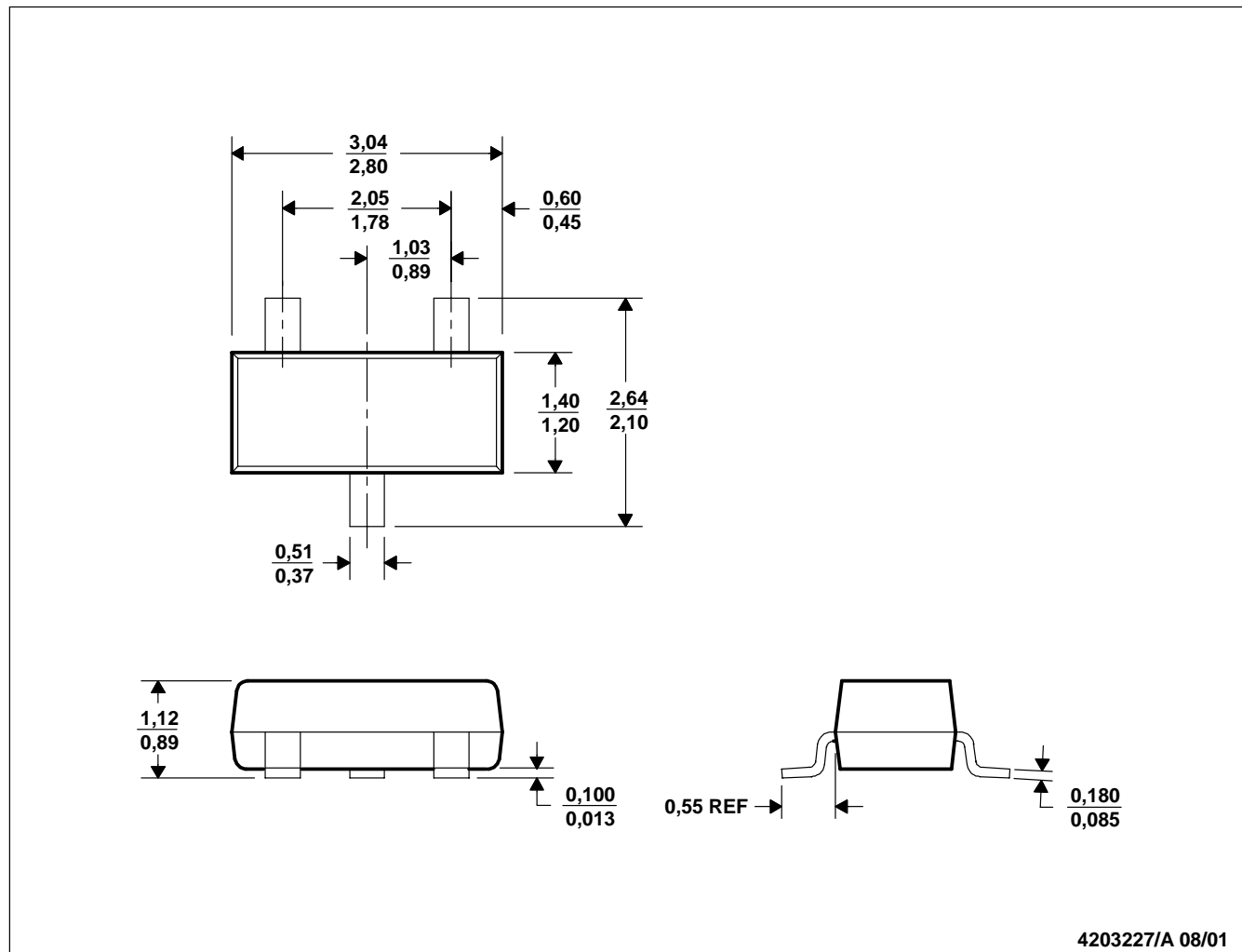
PLASTIC SMALL-OUTLINE PACKAGE



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

DBZ (R-PDSO-G3)

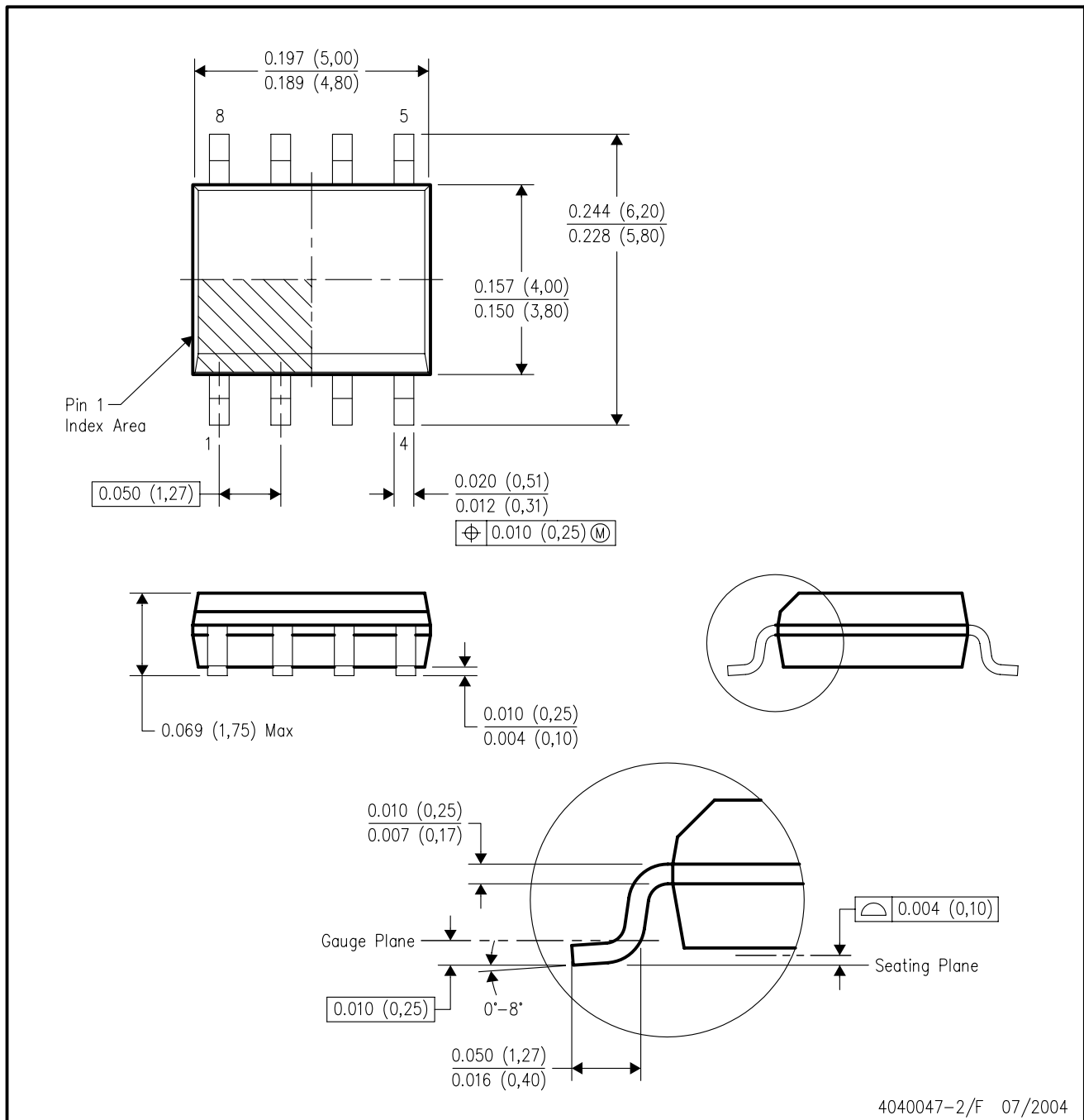
PLASTIC SMALL-OUTLINE



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Dimensions are inclusive of plating.
 D. Dimensions are exclusive of mold flash and metal burr.

D (R-PDSO-G8)

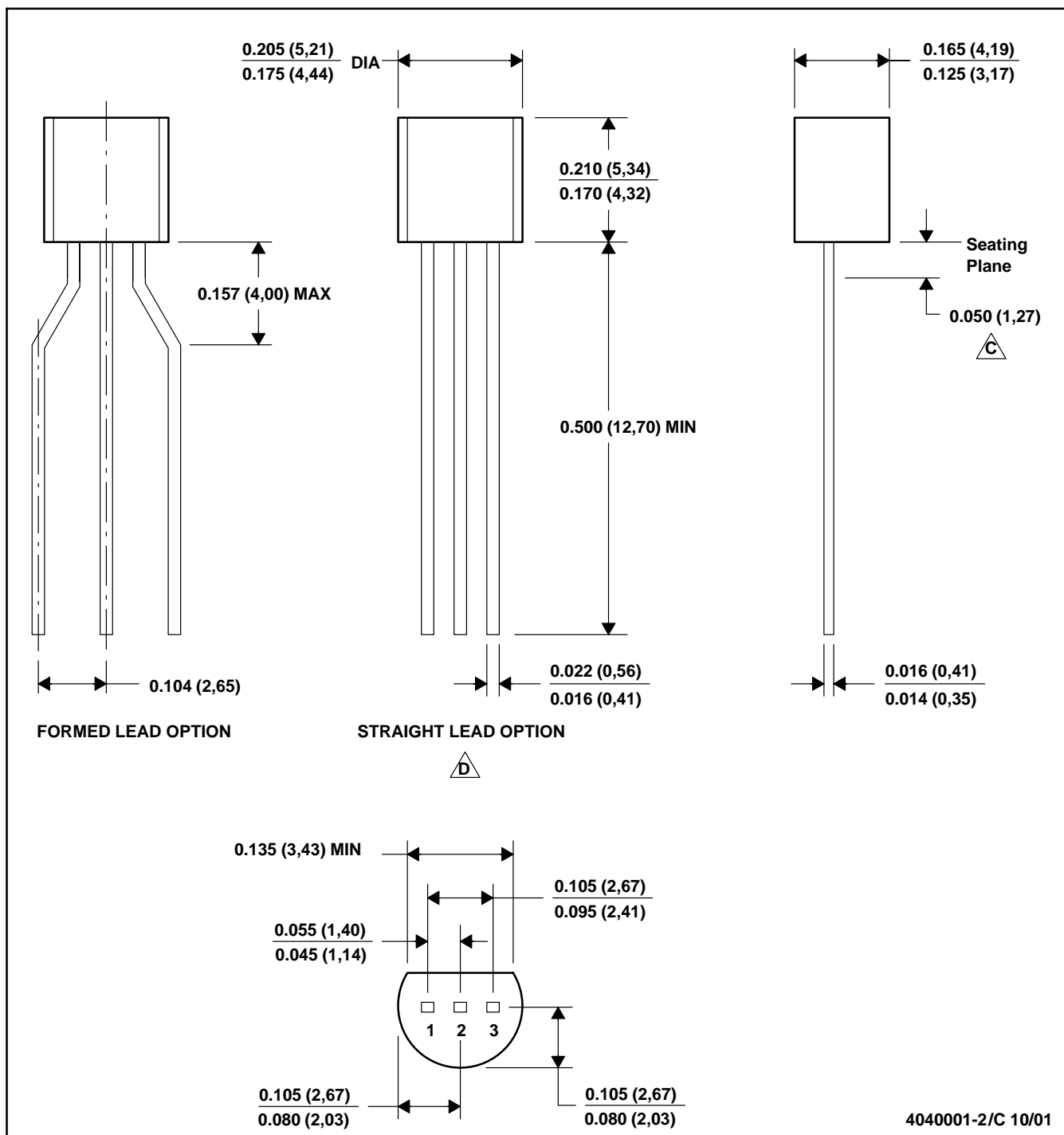
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-012 variation AA.

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



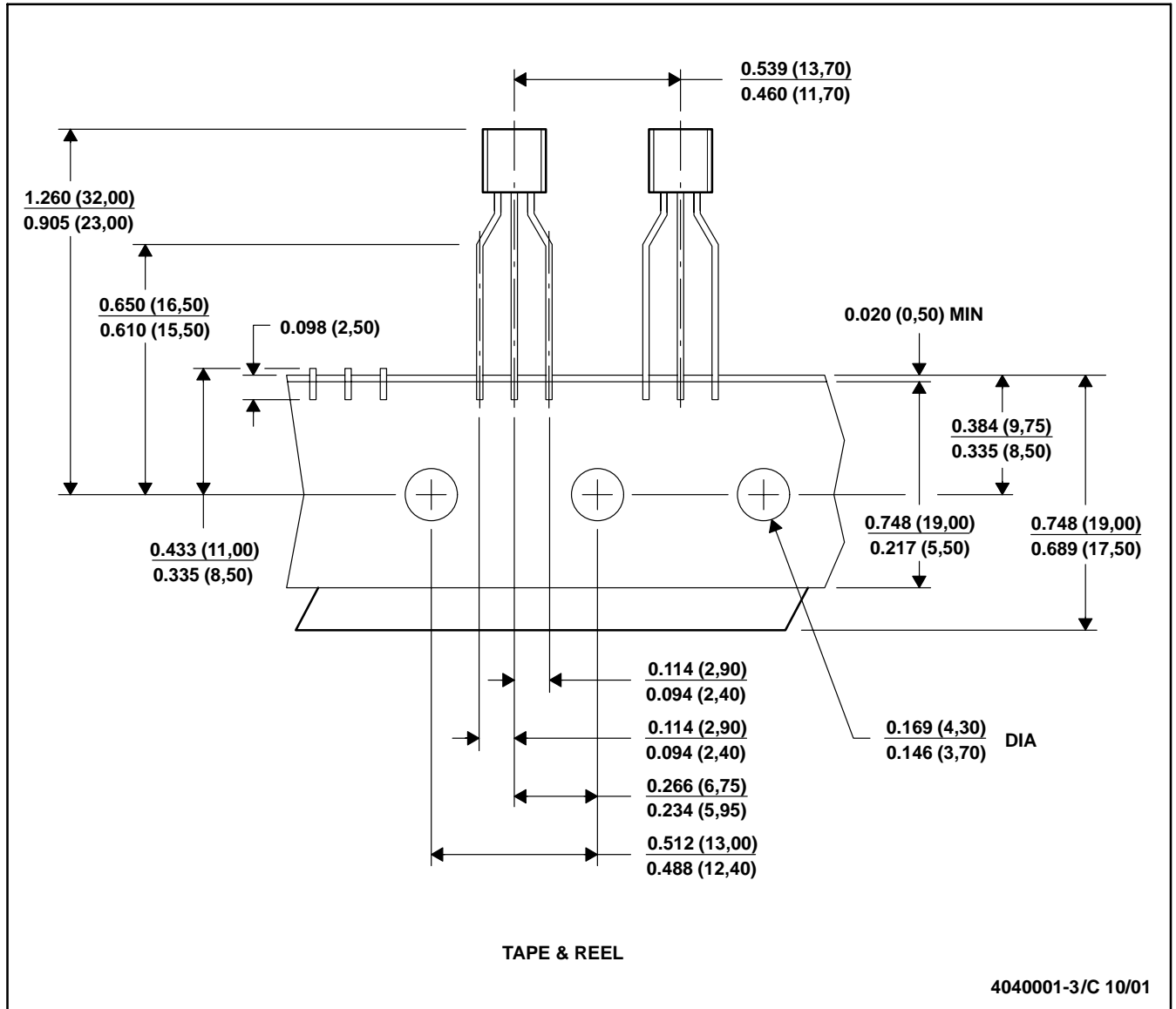
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Lead dimensions are not controlled within this area
 D. Falls within JEDEC TO -226 Variation AA (TO-226 replaces TO-92)
 E. Shipping Method:
 Straight lead option available in bulk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

MECHANICAL DATA

MSOT002A – OCTOBER 1994 – REVISED NOVEMBER 2001

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



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

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