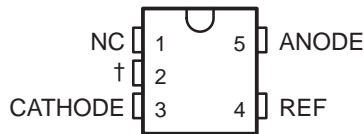


TLVH431, TLVH431A, TLVH431B TLVH432, TLVH432A, TLVH432B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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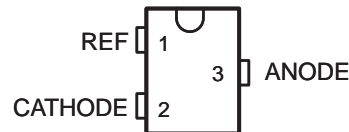
- Low-Voltage Operation . . . Down to 1.24 V
- Reference Voltage Tolerances at 25°C
 - 0.5% for B Grade
 - 1% for A Grade
 - 1.5% for Standard Grade
- Adjustable Output Voltage, $V_O = V_{REF}$ to 18 V
- Wide Operating Cathode Current Range . . . 55 μ A to 80 mA
- 0.25- Ω Typical Output Impedance
- –40°C to 125°C Specifications
- TLVH432 Provides Alternative Pinouts for SOT-23-3 and SOT-89 Packages
- Ultra-Small SC-70 Package Offers 40% Smaller Footprint Than SOT-23-3

TLVH431
DBV (SOT-23-5) PACKAGE
(TOP VIEW)

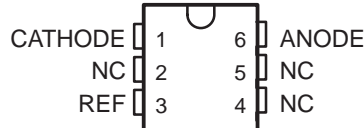


NC - No internal connection
† Pin 2 must be connected to ANODE or left open.

TLVH431
DBZ (SOT-23-3) PACKAGE
(TOP VIEW)



TLVH431
DCK (SC-70) PACKAGE
(TOP VIEW)

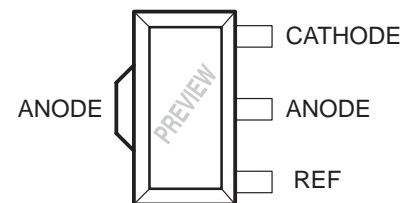


NC - No internal connection

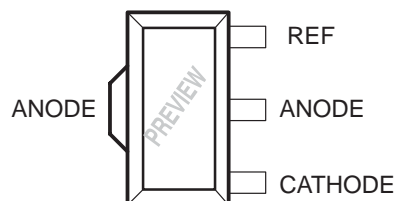
TLVH431
LP (TO-92/TO-226) PACKAGE
(TOP VIEW)



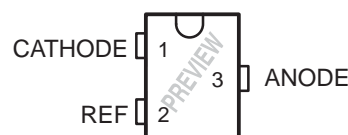
TLVH431
PK (SOT-89) PACKAGE
(TOP VIEW)



TLVH432
PK (SOT-89) PACKAGE
(TOP VIEW)



TLVH432
DBZ (SOT-23-3) PACKAGE
(TOP VIEW)



description/ordering information

The TLVH431 and TLVH432 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 18 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.



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.

**TEXAS
INSTRUMENTS**

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TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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description/ordering information (continued)

When used with an optocoupler, the TLVH431 and TLVH432 are ideal voltage references in isolated feedback circuits for 3-V to 3.3-V switching-mode power supplies. They have a typical output impedance of 0.25 Ω . Active output circuitry provides a very sharp turn-on characteristic, making the TLVH431 and TLVH432 excellent replacements for low-voltage Zener diodes in many applications, including on-board regulation and adjustable power supplies.

The TLVH432 is identical to the TLVH431, but is offered with different pinouts for the SOT-23-3 and SOT-89 packages.



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TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
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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	TLVH431BCDCKR	YH_
			Reel of 250	TLVH431BCDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431BCDBVR	Y3J_
			Reel of 250	TLVH431BCDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431BCDBZR	Y3J_
				TLVH432BCDBZR	Y2H_
			Reel of 250	TLVH431BCDBZT	Y3J_
				TLVH432BCDBZT	Y2H_
		SOT-89 (PK)	Reel of 1000	TLVH431BCPK	PREVIEW
				TLVH432BCPK	
		TO-92 (LP)	Bulk of 1000	TLVH431BCLP	ZA431B
				Reel of 2000	
	1%	SC-70 (DCK)	Reel of 3000	TLVH431ACDCKR	YP_
			Reel of 250	TLVH431ACDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431ACDBVR	Y3P_
			Reel of 250	TLVH431ACDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431ACDBZR	Y3P_
				TLVH432ACDBZR	Y2E_
			Reel of 250	TLVH431ACDBZT	Y3P_
				TLVH432ACDBZT	Y2E_
		SOT-89 (PK)	Reel of 1000	TLVH431ACPK	PREVIEW
				TLVH432ACPK	
		TO-92 (LP)	Bulk of 1000	TLVH431ACLP	PREVIEW
				Reel of 2000	
1.5%	SC-70 (DCK)	Reel of 3000	TLVH431CDCKR	YU_	
		Reel of 250	TLVH431CDCKT		
	SOT-23-5 (DBV)	Reel of 3000	TLVH431CDBVR	Y3U_	
		Reel of 250	TLVH431CDBVT		
	SOT-23-3 (DBZ)	Reel of 3000	TLVH431CDBZR	Y3U_	
			TLVH432CDBZR	Y2A_	
		Reel of 250	TLVH431CDBZT	Y3U_	
			TLVH432CDBZT	Y2A_	
	SOT-89 (PK)	Reel of 1000	TLVH431CPK	PREVIEW	
			TLVH432CPK		
	TO-92 (LP)	Bulk of 1000	TLVH431CLP	PREVIEW	
			Reel of 2000		TLVH431CLPR

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

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



TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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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	TLVH431BIDCKR	YJ_
			Reel of 250	TLVH431BIDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431BIDBVR	Y3K_
			Reel of 250	TLVH431BIDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431BIDBZR	Y3K_
				TLVH432BIDBZR	Y2J_
			Reel of 250	TLVH431BIDBZT	Y3K_
				TLVH432BIDBZT	Y2J_
		SOT-89 (PK)	Reel of 1000	TLVH431BIPK	PREVIEW
				TLVH432BIPK	
		TO-92 (LP)	Bulk of 1000	TLVH431BILP	ZB431B
				Reel of 2000	
	1%	SC-70 (DCK)	Reel of 3000	TLVH431AIDCKR	YT_
			Reel of 250	TLVH431AIDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431AIDBVR	Y3T_
			Reel of 250	TLVH431AIDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431AIDBZR	Y3T_
				TLVH432AIDBZR	Y2F_
			Reel of 250	TLVH431AIDBZT	Y3T_
				TLVH432AIDBZT	Y2F_
		SOT-89 (PK)	Reel of 1000	TLVH431AQPK	PREVIEW
				TLVH432AQPK	
		TO-92 (LP)	Bulk of 1000	TLVH431AILP	PREVIEW
				Reel of 2000	
	1.5%	SC-70 (DCK)	Reel of 3000	TLVH431IDCKR	YV_
			Reel of 250	TLVH431IDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431IDBVR	Y3V_
			Reel of 250	TLVH431IDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431IDBZR	Y3V_
				TLVH432IDBZR	Y2B_
Reel of 250			TLVH431IDBZT	Y3V_	
			TLVH432IDBZT	Y2B_	
SOT-89 (PK)		Reel of 1000	TLVH431IPK	PREVIEW	
			TLVH432IPK		
TO-92 (LP)		Bulk of 1000	TLVH431ILP	PREVIEW	
			Reel of 2000		TLVH431ILPR

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

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



TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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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	TLVH431BQDCKR	YK_
			Reel of 250	TLVH431BQDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431BQDBVR	Y3L_
			Reel of 250	TLVH431BQDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431BQDBZR	Y3L_
				TLVH432BQDBZR	Y2K_
			Reel of 250	TLVH431BQDBZT	Y3L_
				TLVH432BQDBZT	Y2K_
		SOT-89 (PK)	Reel of 1000	TLVH431BQPK	PREVIEW
				TLVH432BQPK	
		TO-92 (LP)	Bulk of 1000	TLVH431BQLP	ZD431B
			Reel of 2000	TLVH431BQLPR	
	1%	SC-70 (DCK)	Reel of 3000	TLVH431AQDCKR	YN_
			Reel of 250	TLVH431AQDCKT	
		SOT-23-5 (DBV)	Reel of 3000	TLVH431AQDBVR	Y3N_
			Reel of 250	TLVH431AQDBVT	
		SOT-23-3 (DBZ)	Reel of 3000	TLVH431AQDBZR	Y3N_
				TLVH432AQDBZR	Y2G_
			Reel of 250	TLVH431AQDBZT	Y3N_
				TLVH432AQDBZT	Y2G_
		SOT-89 (PK)	Reel of 1000	TLVH431AQPK	PREVIEW
				TLVH432AQPK	
		TO-92 (LP)	Bulk of 1000	TLVH431AQLP	PREVIEW
			Reel of 2000	TLVH431AQLPR	
1.5%	SC-70 (DCK)	Reel of 3000	TLVH431QDCKR	YM_	
		Reel of 250	TLVH431QDCKT		
	SOT-23-5 (DBV)	Reel of 3000	TLVH431QDBVR	Y3M_	
		Reel of 250	TLVH431QDBVT		
	SOT-23-3 (DBZ)	Reel of 3000	TLVH431QDBZR	Y3M_	
			TLVH432QDBZR	Y2D_	
		Reel of 250	TLVH431QDBZT	Y3M_	
			TLVH432QDBZT	Y2D_	
	SOT-89 (PK)	Reel of 1000	TLVH431QPK	PREVIEW	
			TLVH432QPK		
	TO-92 (LP)	Bulk of 1000	TLVH431QLP	PREVIEW	
		Reel of 2000	TLVH431QLPR		

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

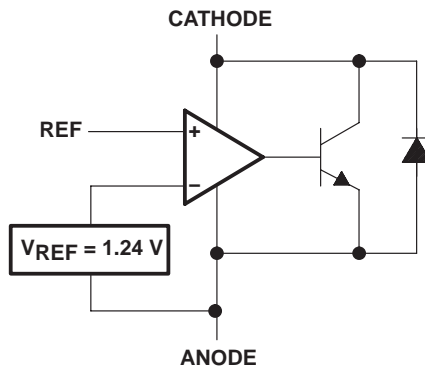
‡ DBV/DBZ/DCK: The actual top-side marking has one additional character that designates the assembly/test site.



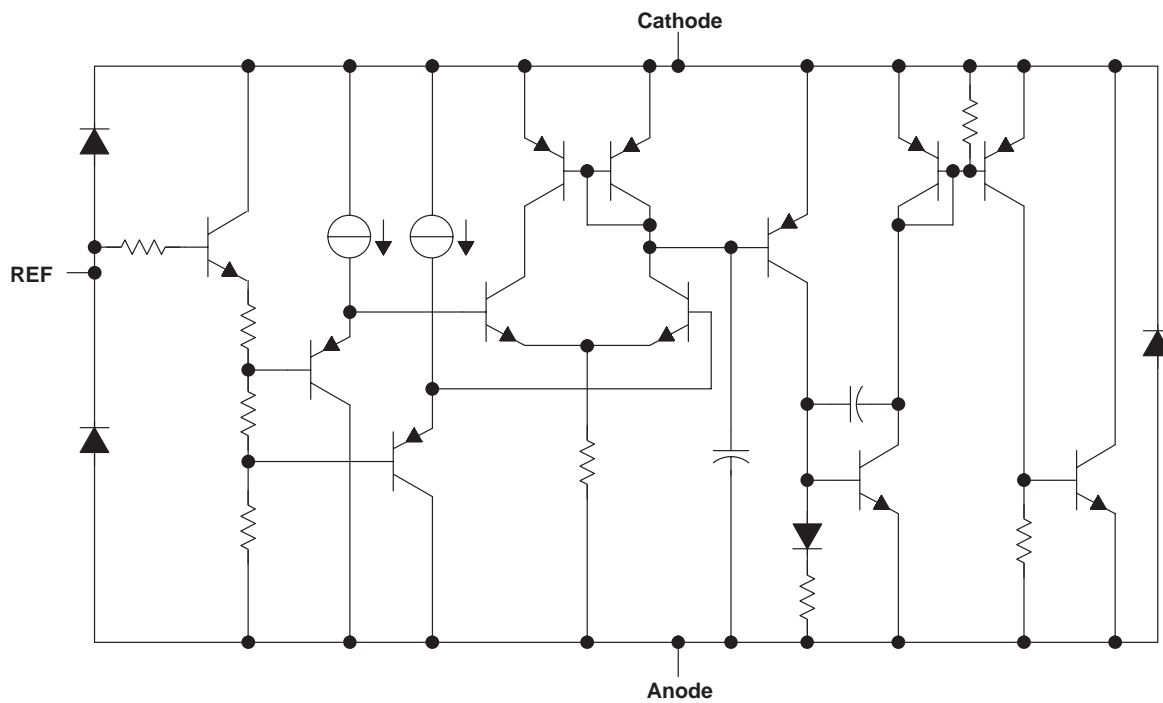
TLVH431, TLVH431A, TLVH431B TLVH432, TLVH432A, TLVH432B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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logic block diagram



equivalent schematic



TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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

Cathode voltage, V_{KA} (see Note 1)	20 V
Cathode current range, I_K	–25 mA to 80 mA
Reference current range, I_{ref}	–0.05 mA to 3 mA
Package thermal impedance, θ_{JA} (see Notes 2 and 3):	
DBV package	206°C/W
DBZ package	206°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}	18	V	
I_K	Cathode current (continuous)	0.1	80	mA	
T_A	Operating free-air temperature range	TLVH43X_C	0	70	°C
		TLVH43X_I	–40	85	
		TLVH43X_Q	–40	125	



TLVH431, TLVH431A, TLVH431B TLVH432, TLVH432A, TLVH432B LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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TLVH431 electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLVH431, TLVH432			UNIT		
		MIN	TYP	MAX			
V _{REF} Reference voltage	V _{KA} = V _{REF} , I _K = 10 mA	T _A = 25°C	1.222	1.24	1.258	V	
		T _A = full range (see Note 4 and Figure 1)	TLVH431C	1.21	1.27		
			TLVH431I	1.202	1.278		
			TLVH431Q	1.194	1.286		
V _{REF(dev)} V _{REF} deviation over full temperature range (see Note 5)	V _{KA} = V _{REF} , I _K = 10 mA (see Note 4 and Figure 1)	TLVH431C		4	12	mV	
		TLVH431I		6	20		
		TLVH431Q		11	31		
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$ Ratio of V _{REF} change to cathode voltage change	I _K = 10 mA (see Figure 2)	V _{KA} = V _{REF} to 18 V		-1.5	-2.7	mV/V	
I _{ref} Reference terminal current	I _K = 10 mA, R1 = 10 kΩ, R2 = open (see Figure 2)			0.1	0.5	μA	
I _{ref(dev)} I _{ref} deviation over full temperature range (see Note 5)	I _K = 10 mA, R1 = 10 kΩ, R2 = open (see Note 4 and Figure 2)	TLVH431C		0.05	0.3	μA	
		TLVH431I		0.1	0.4		
		TLVH431Q		0.15	0.5		
I _{K(min)} Minimum cathode current for regulation	V _{KA} = V _{REF} (see Figure 1)			60	100	μA	
I _{K(off)} Off-state cathode current	V _{REF} = 0, V _{KA} = 18 V (see Figure 3)			0.02	0.1	μA	
z _{KA} Dynamic impedance (see Note 6)	V _{KA} = V _{REF} , f ≤ 1 kHz, I _K = 0.1 mA to 80 mA (see Figure 1)			0.25	0.4	Ω	

- NOTES: 4. Full temperature ranges are: -40°C to 125°C for TLVH431Q, -40°C to 85°C for TLVH431I, and 0°C to 70°C for the TLVH431C.
5. 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:

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

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:

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

TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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TLVH431A electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLVH431A, TLVH432A			UNIT	
		MIN	TYP	MAX		
V_{REF} Reference voltage	$V_{KA} = V_{REF}$, $I_K = 10$ mA	$T_A = 25^\circ\text{C}$	1.228	1.24	1.252	V
		$T_A = \text{full range}$ (see Note 4 and Figure 1)	TLVH431AC	1.221		
	TLVH431AI		1.215		1.265	
	TLVH431AQ		1.209		1.271	
$V_{REF(\text{dev})}$ V_{REF} deviation over full temperature range (see Note 5)	$V_{KA} = V_{REF}$, $I_K = 10$ mA (see Note 4 and Figure 1)	TLVH431AC		4	12	mV
		TLVH431AI		6	20	
		TLVH431AQ		11	31	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$ Ratio of V_{REF} change to cathode voltage change	$I_K = 10$ mA (see Figure 2)	$V_{KA} = V_{REF}$ to 18 V		-1.5	-2.7	mV/V
I_{ref} Reference terminal current	$I_K = 10$ mA, $R1 = 10$ k Ω , $R2 = \text{open}$ (see Figure 2)			0.1	0.5	μA
$I_{ref(\text{dev})}$ I_{ref} deviation over full temperature range (see Note 5)	$I_K = 10$ mA, $R1 = 10$ k Ω , $R2 = \text{open}$ (see Note 4 and Figure 2)	TLVH431AC		0.05	0.3	μA
		TLVH431AI		0.1	0.4	
		TLVH431AQ		0.15	0.5	
$I_{K(\text{min})}$ Minimum cathode current for regulation	$V_{KA} = V_{REF}$ (see Figure 1)			60	100	μA
$I_{K(\text{off})}$ Off-state cathode current	$V_{REF} = 0$, $V_{KA} = 18$ V (see Figure 3)			0.02	0.1	μA
$ z_{KA} $ Dynamic impedance (see Note 6)	$V_{KA} = V_{REF}$, $f \leq 1$ kHz, $I_K = 0.1$ mA to 80 mA (see Figure 1)			0.25	0.4	Ω

- NOTES: 4. Full temperature ranges are: -40°C to 125°C for TLVH431AQ, -40°C to 85°C for TLVH431AI, and 0°C to 70°C for the TLVH431AC.
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:

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

TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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TLVH431B electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLVH431B, TLVH432B			UNIT	
		MIN	TYP	MAX		
V _{REF} Reference voltage	V _{KA} = V _{REF} , I _K = 10 mA	T _A = 25°C	1.234	1.24	1.246	V
		T _A = full range (see Note 4 and Figure 1)	TLVH431BC	1.227		
	TLVH431BI		1.224		1.259	
	TLVH431BQ		1.221		1.265	
V _{REF(dev)} V _{REF} deviation over full temperature range (see Note 5)	V _{KA} = V _{REF} , I _K = 10 mA (see Note 4 and Figure 1)	TLVH431BC		4	12	mV
		TLVH431BI		6	20	
		TLVH431BQ		11	31	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$ Ratio of V _{REF} change to cathode voltage change	I _K = 10 mA (see Figure 2)	V _{KA} = V _{REF} to 18 V		-1.5	-2.7	mV/V
I _{ref} Reference terminal current	I _K = 10 mA, R ₁ = 10 kΩ (see Figure 2)			0.1	0.5	μA
I _{ref(dev)} I _{ref} deviation over full temperature range (see Note 5)	I _K = 10 mA, R ₁ = 10 kΩ, R ₂ = open (see Note 4 and Figure 2)	TLVH431BC		0.05	0.3	μA
		TLVH431BI		0.1	0.4	
		TLVH431BQ		0.15	0.5	
I _{K(min)} Minimum cathode current for regulation	V _{KA} = V _{REF} (see Figure 1)			60	100	μA
I _{K(off)} Off-state cathode current	V _{REF} = 0, V _{KA} = 18 V (see Figure 3)			0.02	0.1	μA
z _{KA} Dynamic impedance (see Note 6)	V _{KA} = V _{REF} , f ≤ 1 kHz, I _K = 0.1 mA to 80 mA (see Figure 1)			0.25	0.4	Ω

- NOTES: 4. Full temperature ranges are: -40°C to 125°C for TLVH431BQ, -40°C to 85°C for TLVH431BI, and 0°C to 70°C for the TLVH431BC.
5. 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:

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

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:

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



PARAMETER MEASUREMENT INFORMATION

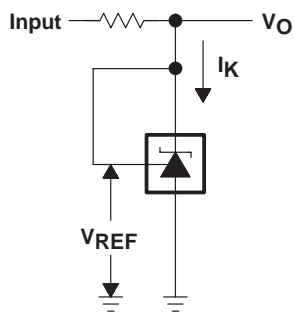


Figure 1. Test Circuit for $V_{KA} = V_{REF}$
 $V_O = V_{KA} = V_{REF}$

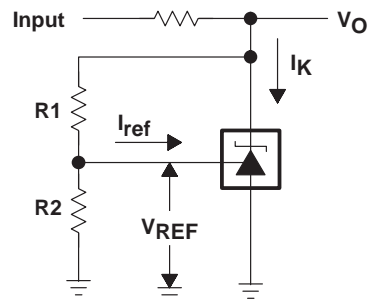


Figure 2. Test Circuit for $V_{KA} > V_{REF}$
 $V_O = V_{KA} = V_{REF} \times (1 + R1/R2) + I_{ref} \times R1$

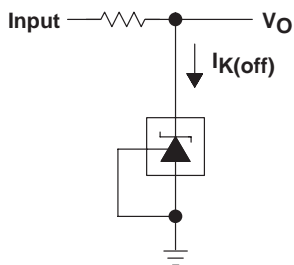


Figure 3. Test Circuit for $I_{K(off)}$

PARAMETER MEASUREMENT INFORMATION

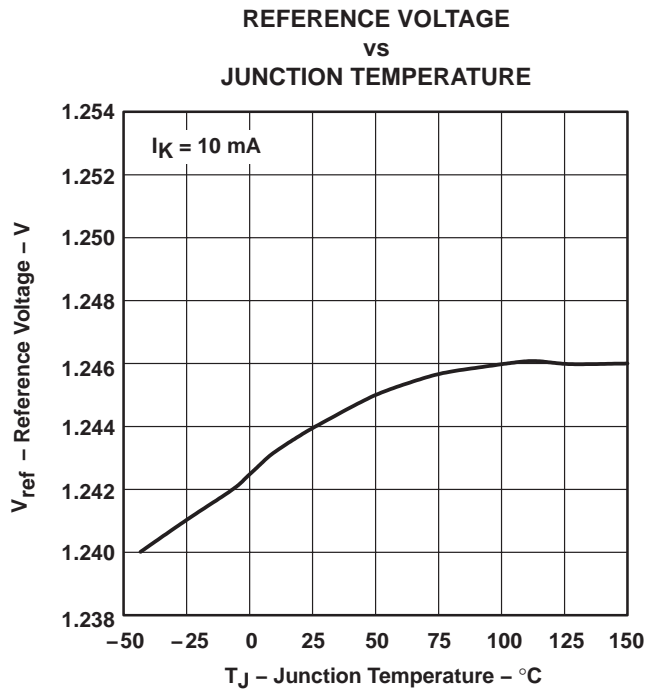


Figure 4

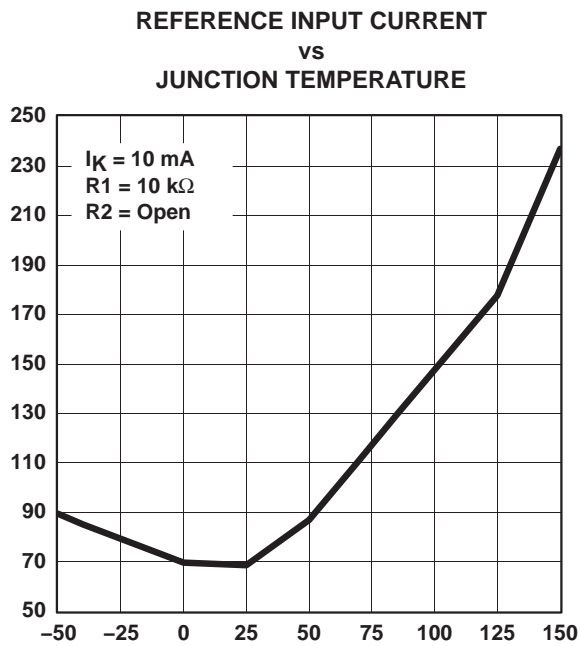


Figure 5

PARAMETER MEASUREMENT INFORMATION

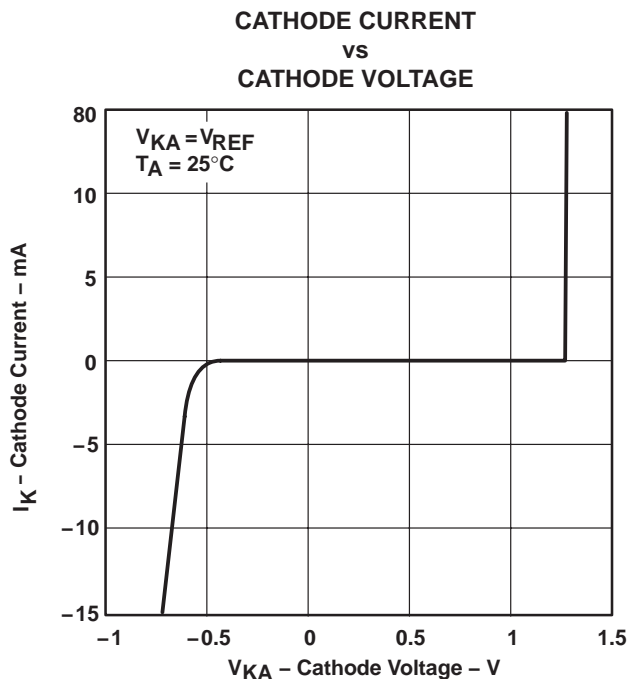


Figure 6

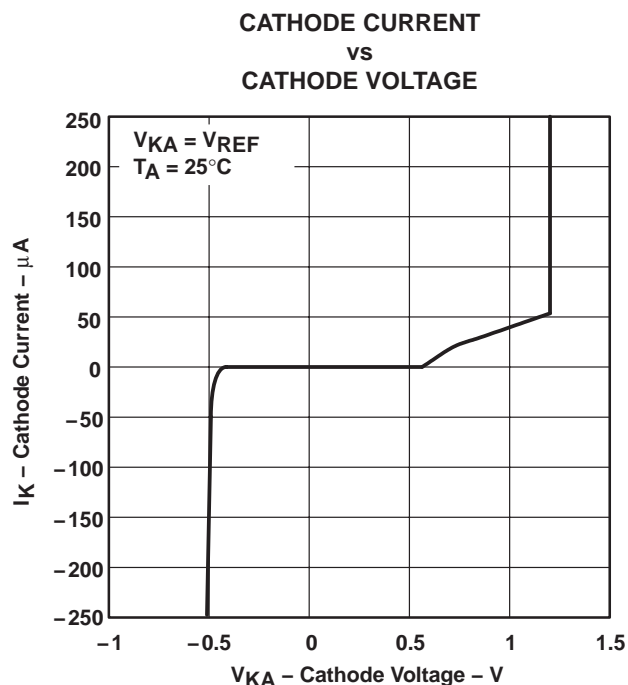


Figure 7

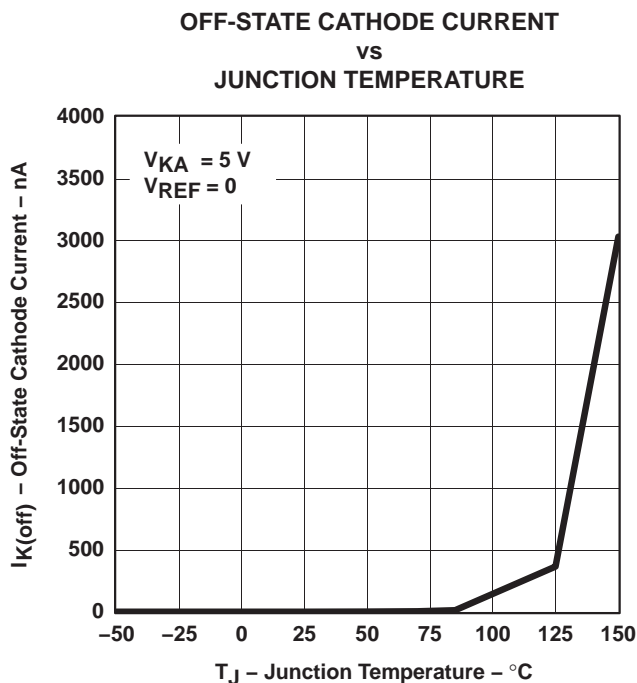
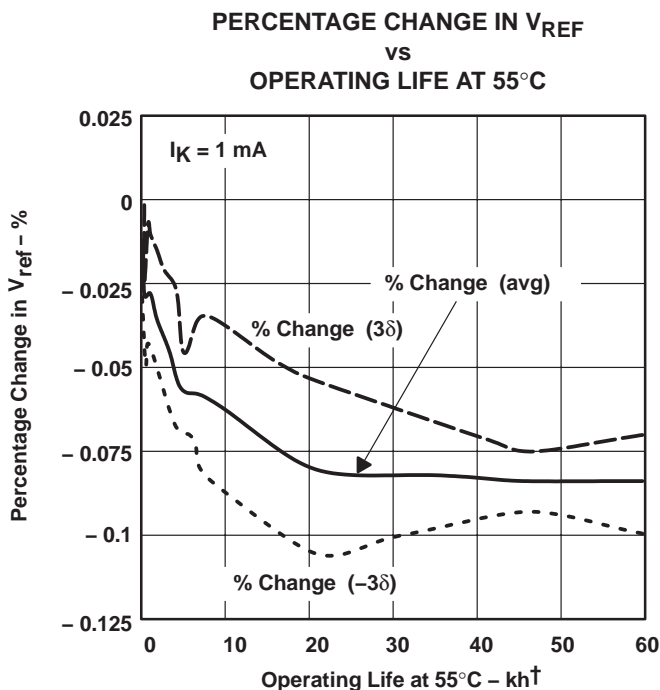
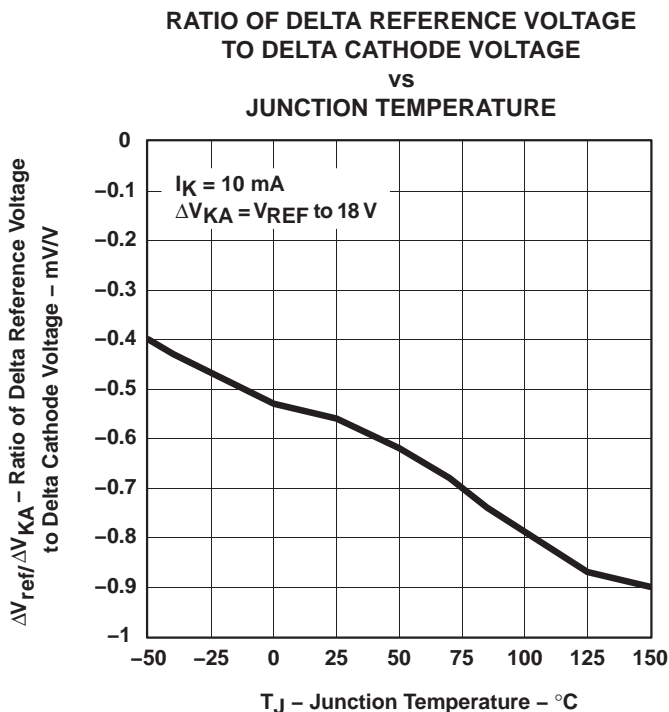


Figure 8

**TLVH431, TLVH431A, TLVH431B
 TLVH432, TLVH432A, TLVH432B
 LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR**

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PARAMETER MEASUREMENT INFORMATION†



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

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



PARAMETER MEASUREMENT INFORMATION

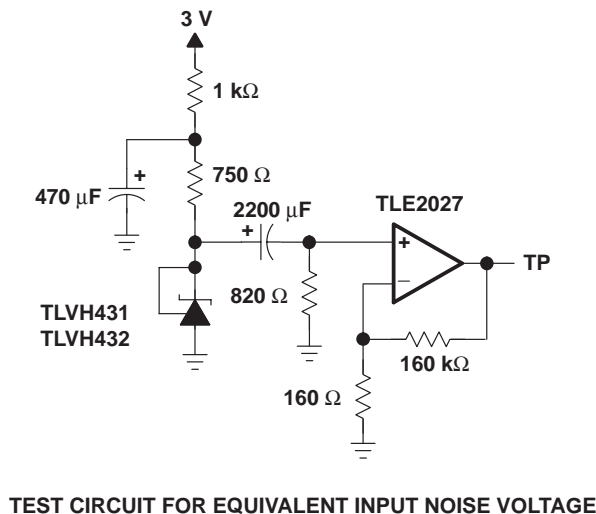
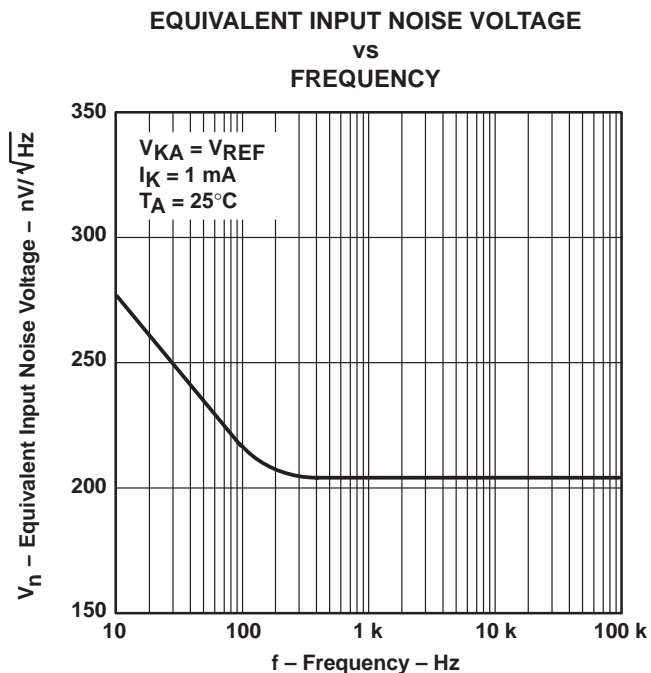


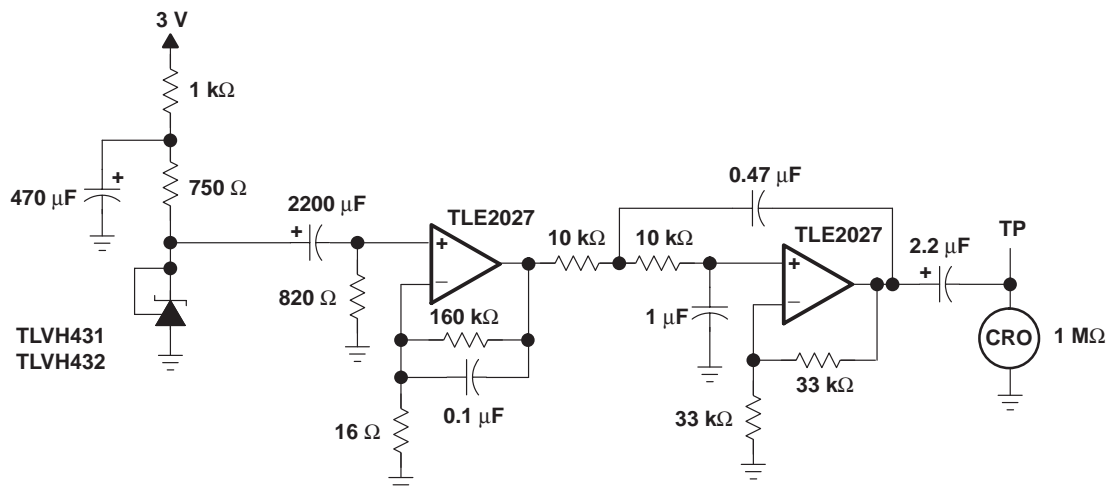
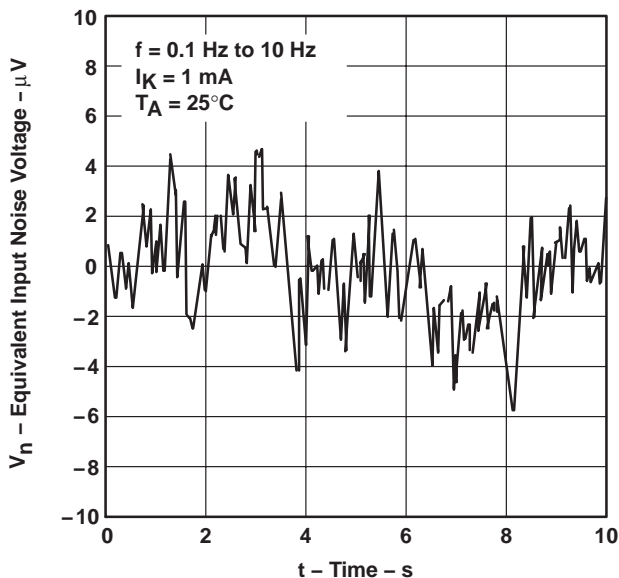
Figure 11

**TLVH431, TLVH431A, TLVH431B
 TLVH432, TLVH432A, TLVH432B
 LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR**

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PARAMETER MEASUREMENT INFORMATION

**EQUIVALENT INPUT NOISE VOLTAGE
 OVER A 10-SECOND PERIOD**



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

Figure 12

TLVH431, TLVH431A, TLVH431B
 TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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PARAMETER MEASUREMENT INFORMATION

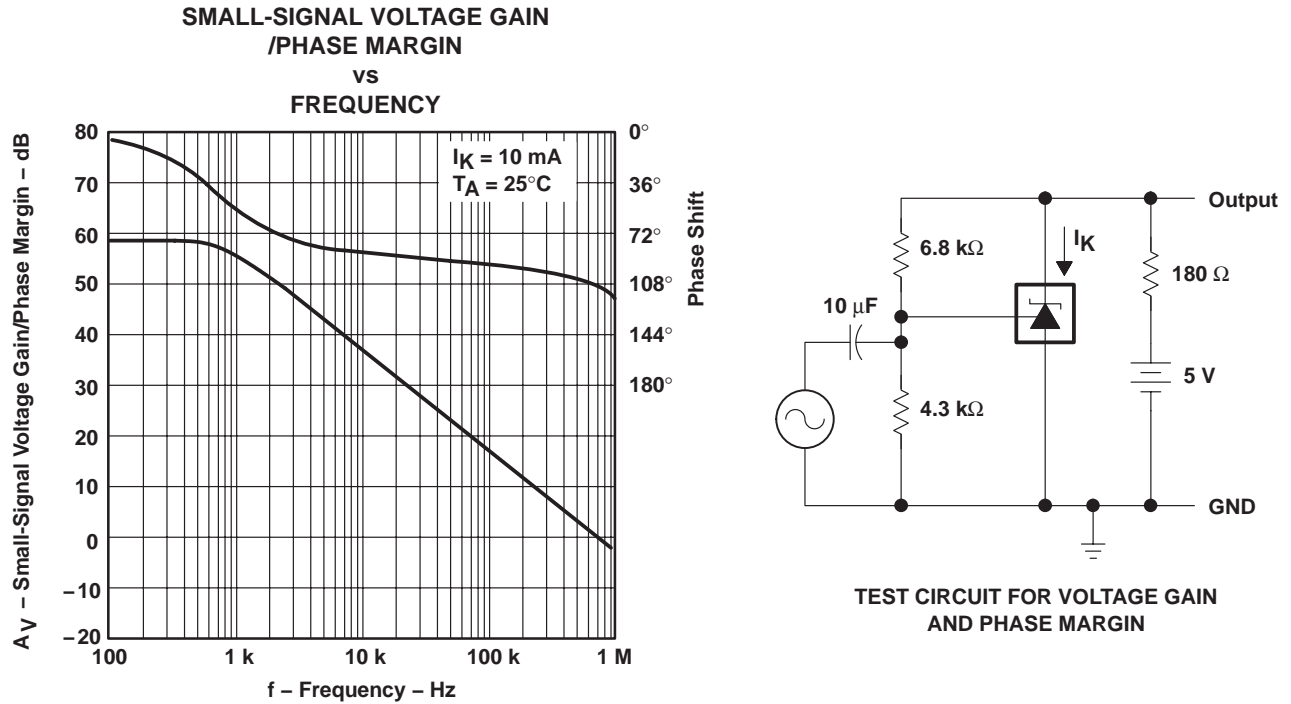


Figure 13

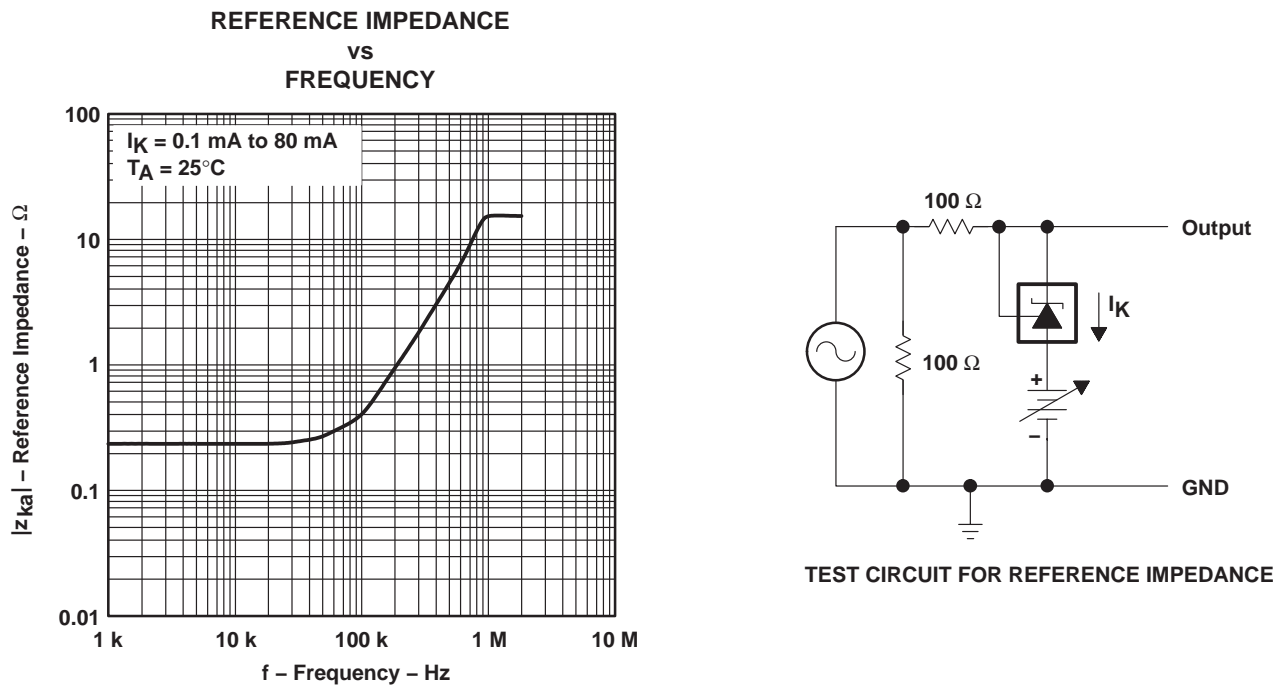


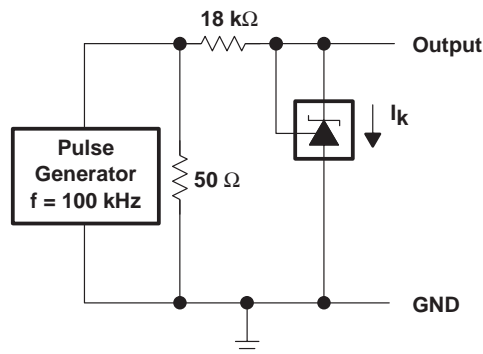
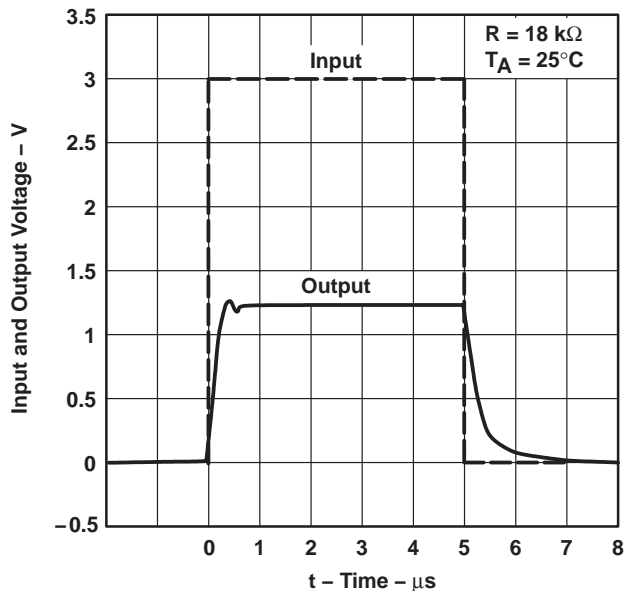
Figure 14

TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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PARAMETER MEASUREMENT INFORMATION

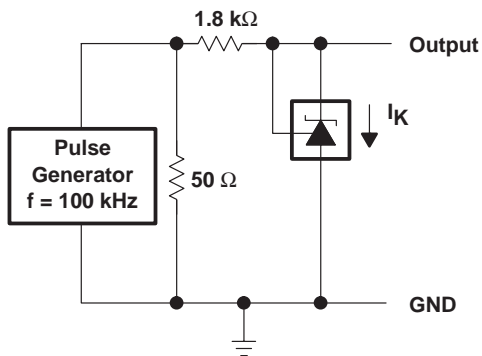
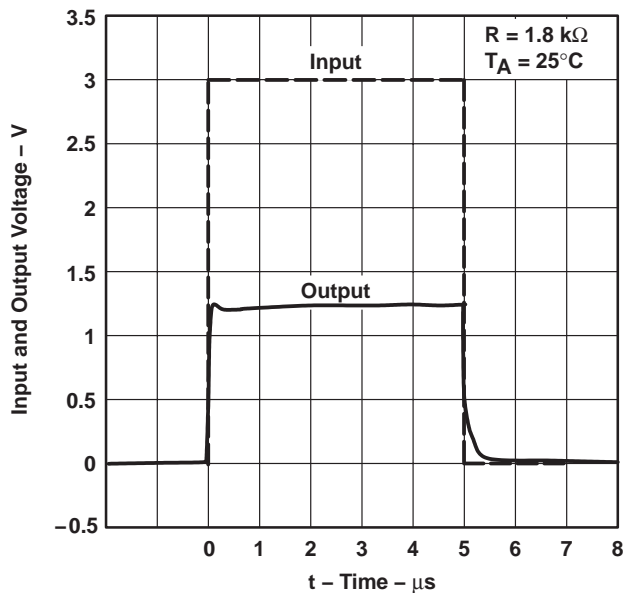
PULSE RESPONSE 1



TEST CIRCUIT FOR PULSE RESPONSE 1

Figure 15

PULSE RESPONSE 2



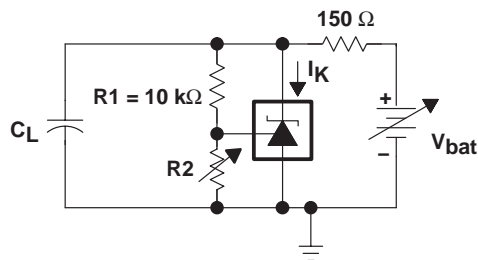
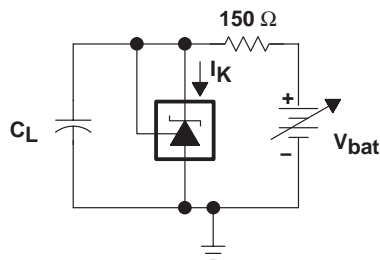
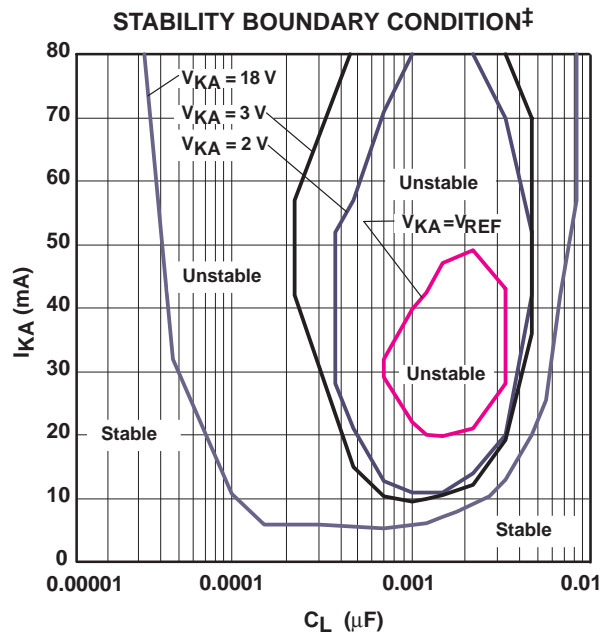
TEST CIRCUIT FOR PULSE RESPONSE 2

Figure 16

TLVH431, TLVH431A, TLVH431B
 TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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PARAMETER MEASUREMENT INFORMATION†



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 enclosed by the curves represent conditions that may cause the device to oscillate. For $V_{KA} = 2\text{-V}, 3\text{-V}$, and 18-V curves, R_2 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

TLVH431, TLVH431A, TLVH431B
TLVH432, TLVH432A, TLVH432B
LOW-VOLTAGE ADJUSTABLE PRECISION SHUNT REGULATOR

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APPLICATION INFORMATION

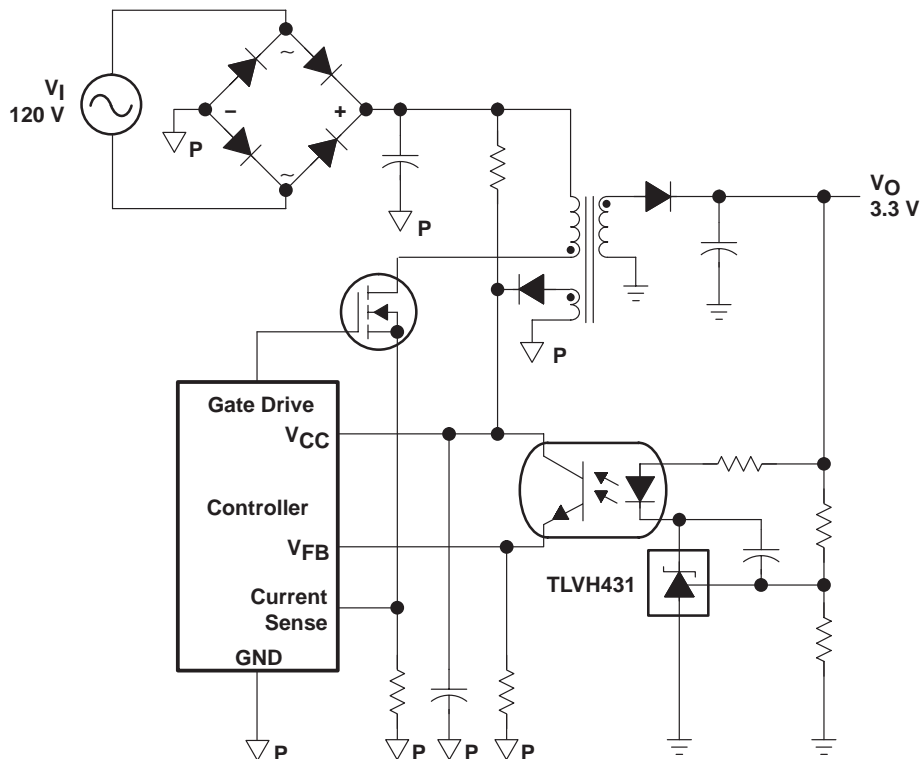


Figure 18. Flyback With Isolation Using TLVH431 and TLVH432 as Voltage Reference and Error Amplifier

Figure 18 shows the TLVH431 used in a 3.3-V isolated flyback supply. Output voltage V_O can be as low as reference voltage V_{REF} (1.24 V). The output of the regulator plus the forward voltage drop of the optocoupler LED ($1.24 + 1.4 = 2.64$ 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 topology shown in Figure 18.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLVH431ACDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ACLCP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431ACLPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431ACPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431AIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLVH431AIDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AIDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AILP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431AILPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431AIPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431AQDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431AQLP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431AQLPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431AQP	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431BCDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLVH431BCDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BCLP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431BCLPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431BCPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431BIDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BIDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BILP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431BILPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431BIPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431BQDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLVH431BQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431BQLP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431BQLPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431BQPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431CDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431CLP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431CLPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431CPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431IBQDBZR	PREVIEW	SOT-23	DBZ	3		TBD	Call TI	Call TI
TLVH431IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
						no Sb/Br)		
TLVH431IDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431IDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431ILP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431ILPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431IPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH431QDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDCKR	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDCKRE4	ACTIVE	SC70	DCK	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDCKT	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QDCKTE4	ACTIVE	SC70	DCK	6	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH431QLP	ACTIVE	TO-92	LP	3	1000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431QLPR	ACTIVE	TO-92	LP	3	2000	TBD	CU SNPB	Level-NC-NC-NC
TLVH431QPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432ACDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
						no Sb/Br)		
TLVH432ACDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432ACDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432ACDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432ACPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432AIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AIPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432AQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432AQPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432BCDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BCDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BCDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BCDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BCPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432BIDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BIDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BIDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BIDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BIPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432BQDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BQDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BQDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
TLVH432BQDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432BQPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432CDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432CDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432CDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432CDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432CPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432IDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432IDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432IDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432IDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432IPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM
TLVH432QDBZR	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432QDBZRG4	ACTIVE	SOT-23	DBZ	3	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432QDBZT	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432QDBZTG4	ACTIVE	SOT-23	DBZ	3	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLVH432QPK	ACTIVE	SOT-89	PK	3	1000	TBD	CU SNPB	Level-1-220C-UNLIM

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

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

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

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

OBSOLETE: TI has discontinued the production of the device.

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

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

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

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

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

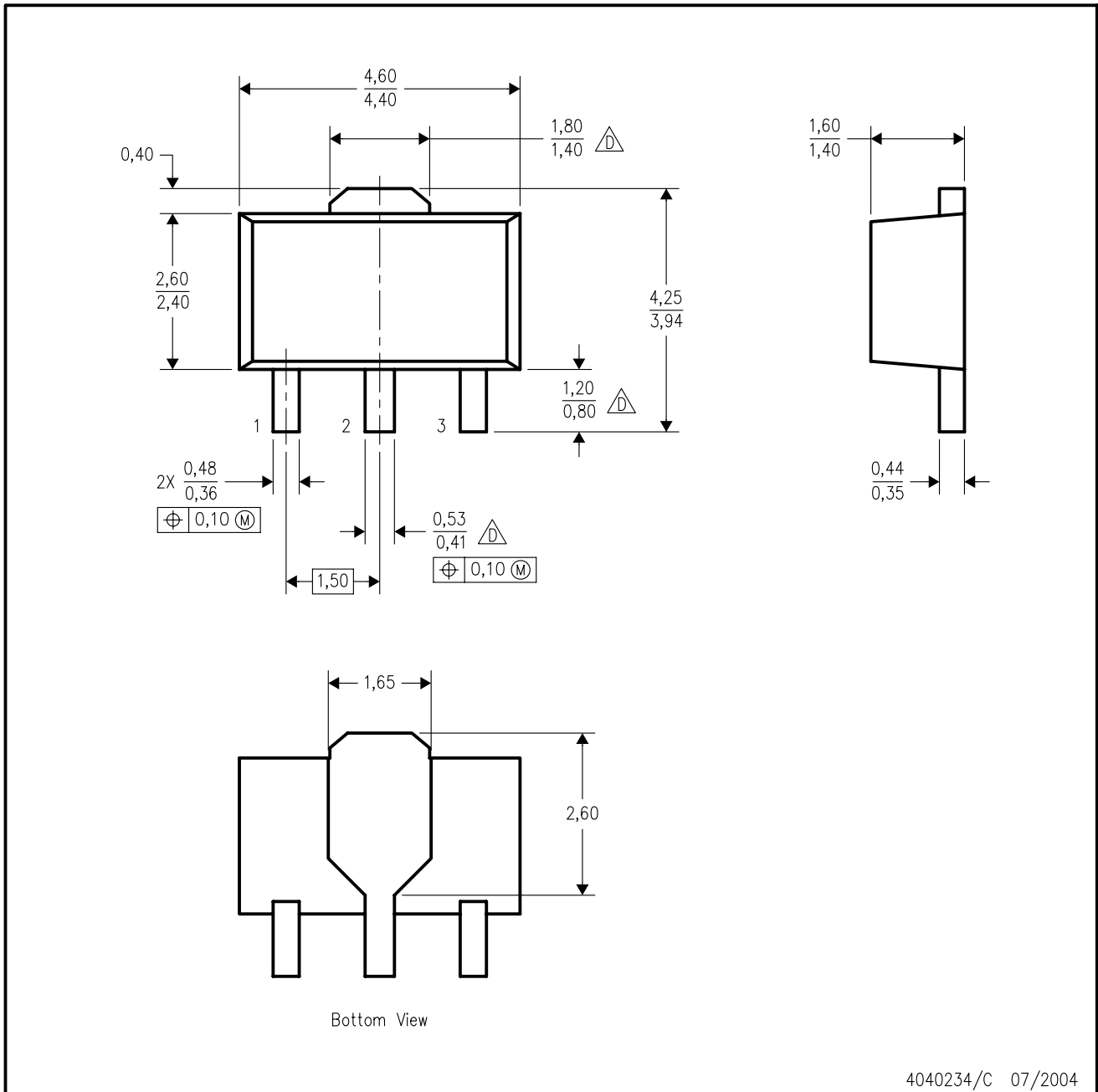
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PK (R-PSSO-F3)

PLASTIC SINGLE-IN-LINE PACKAGE



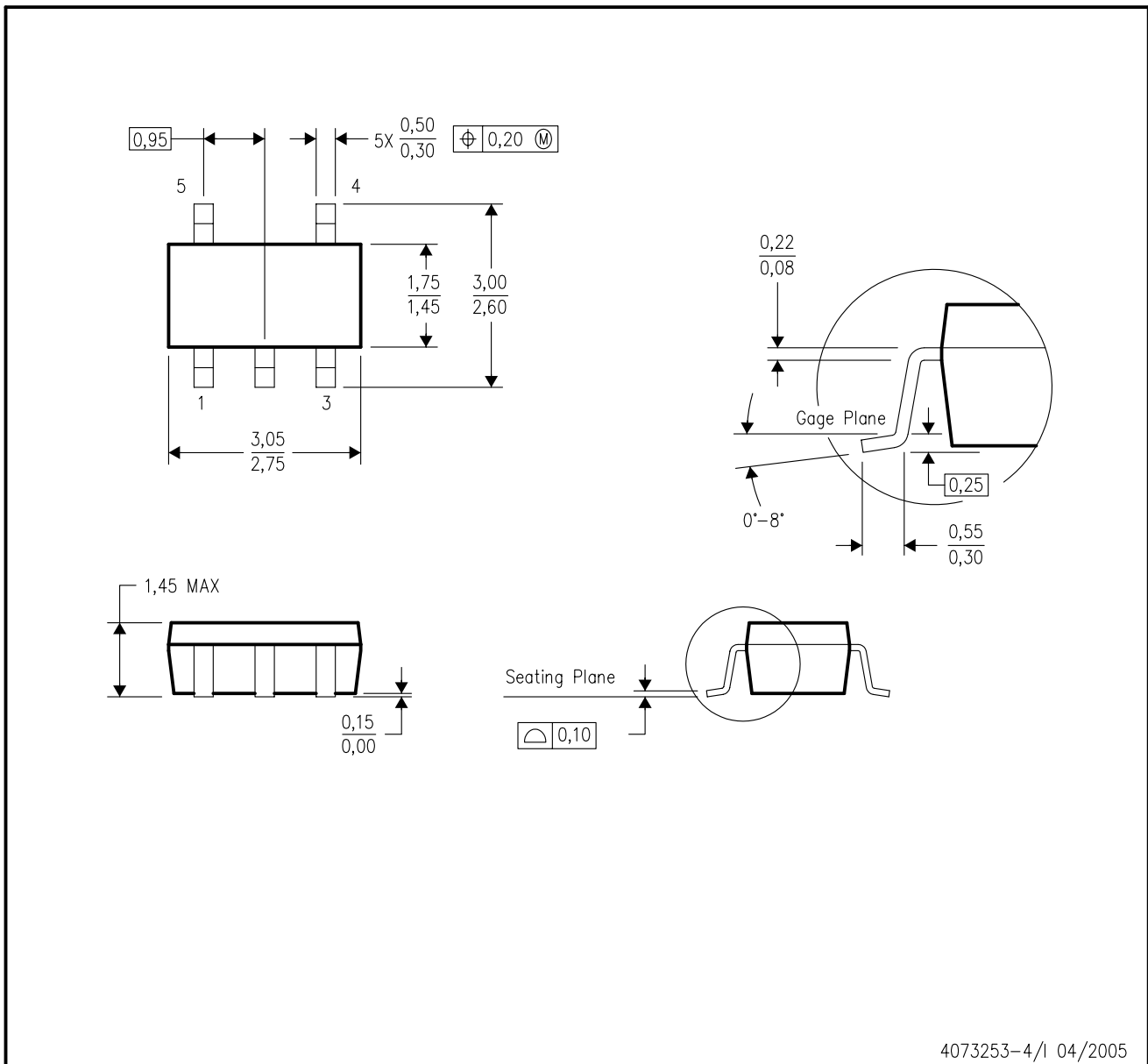
4040234/C 07/2004

- 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.

Δ 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)

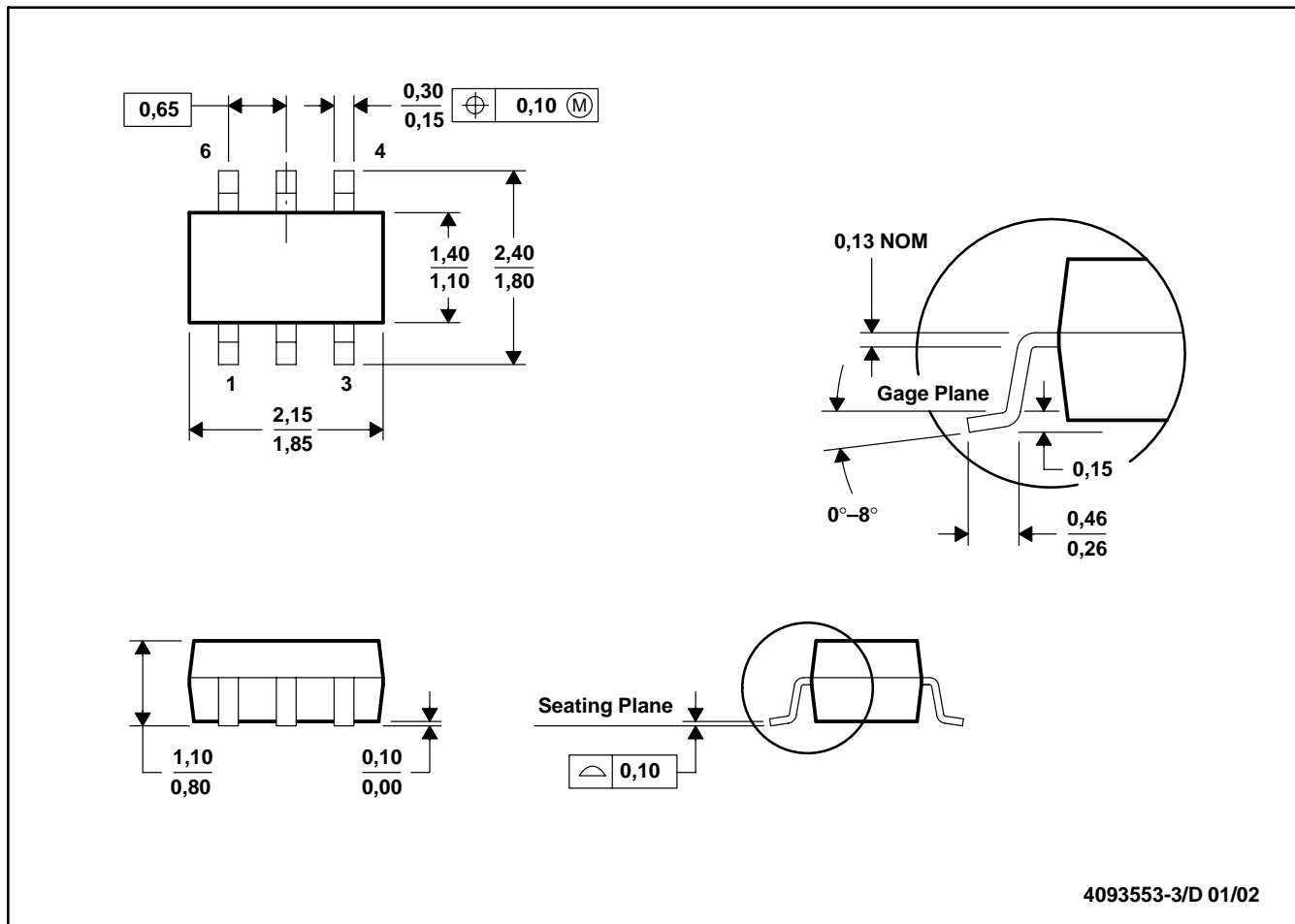
PLASTIC SMALL-OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. Lead dimensions are inclusive of plating.
 - D. Body dimensions are exclusive of mold flash and protrusion. Mold flash and protrusion not to exceed 0.25 per side.
 - $\triangle E$ Falls within JEDEC TO-236 variation AB, except minimum foot length.

DCK (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE



4093553-3/D 01/02

- 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-203

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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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265