

- **1/2 V_I Virtual Ground for Analog Systems**
- **Self-Contained 3-terminal TO-226AA Package**
- **Micropower Operation . . . 170 μ A Typ, $V_I = 5$ V**
- **Wide V_I Range . . . 4 V to 40 V**
- **High Output-Current Capability**
 - Source . . . 20 mA Typ
 - Sink . . . 20 mA Typ

- **Excellent Output Regulation**
 - -45μ V Typ at $I_O = 0$ to -10 mA
 - $+15 \mu$ V Typ at $I_O = 0$ to $+10$ mA
- **Low-Impedance Output . . . 0.0075Ω Typ**
- **Noise Reduction Pin (D, JG, and P Packages Only)**

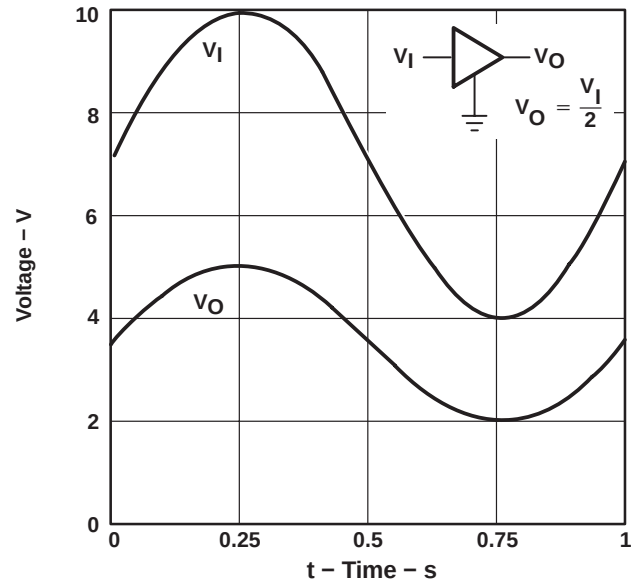
description

In signal-conditioning applications utilizing a single power source, a reference voltage equal to one-half the supply voltage is required for termination of all analog signal grounds. Texas Instruments presents a precision virtual ground whose output voltage is always equal to one-half the input voltage, the TLE2426 "rail splitter."

The unique combination of a high-performance, micropower operational amplifier and a precision-trimmed divider on a single silicon chip results in a precise V_O/V_I ratio of 0.5 while sinking and sourcing current. The TLE2426 provides a low-impedance output with 20 mA of sink and source capability while drawing less than 280 μ A of supply current over the full input range of 4 V to 40 V. A designer need not pay the price in terms of board space for a conventional signal ground consisting of resistors, capacitors, operational amplifiers, and voltage references. The performance and precision of the TLE2426 is available in an easy-to-use, space saving, 3-terminal LP package. For increased performance, the optional 8-pin packages provide a noise-reduction pin. With the addition of an external capacitor (C_{NR}), peak-to-peak noise is reduced while line ripple rejection is improved.

Initial output tolerance for a single 5-V or 12-V system is better than 1% with 3.6% over the full 40-V input range. Ripple rejection exceeds 12 bits of accuracy. Whether the application is for a data acquisition front end, analog signal termination, or simply a precision voltage reference, the TLE2426 eliminates a major source of system error.

INPUT/OUTPUT TRANSFER CHARACTERISTICS



AVAILABLE OPTIONS

PACKAGED DEVICES					CHIP FORM (Y)
T_A	SMALL OUTLINE (D)	CERAMIC DIP (JG)	PLASTIC (LP)	PLASTIC DIP (P)	
0°C to 70°C	TLE2426CD	—	TLE2426CLP	TLE2426CP	



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.

TLE2426, TLE2426Y THE “RAIL SPLITTER” PRECISION VIRTUAL GROUND

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–40°C to 85°C	TLE2426ID	—	TLE2426ILP	TLE2426IP	TLE2426Y
–55°C to 125°C	TLE2426MD	TLE2426MJG	TLE2426MLP	TLE2426MP	

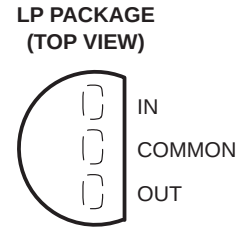
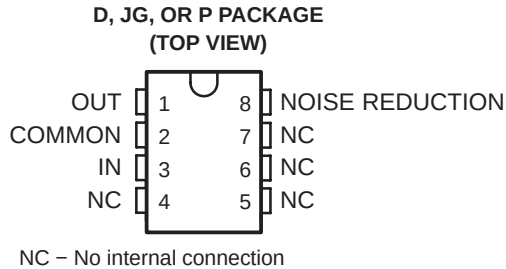
The D and LP packages are available taped and reeled in the commercial temperature range only. Add R suffix to the device type (e. g., TLC2426CDR). Chips are tested at 25°C.



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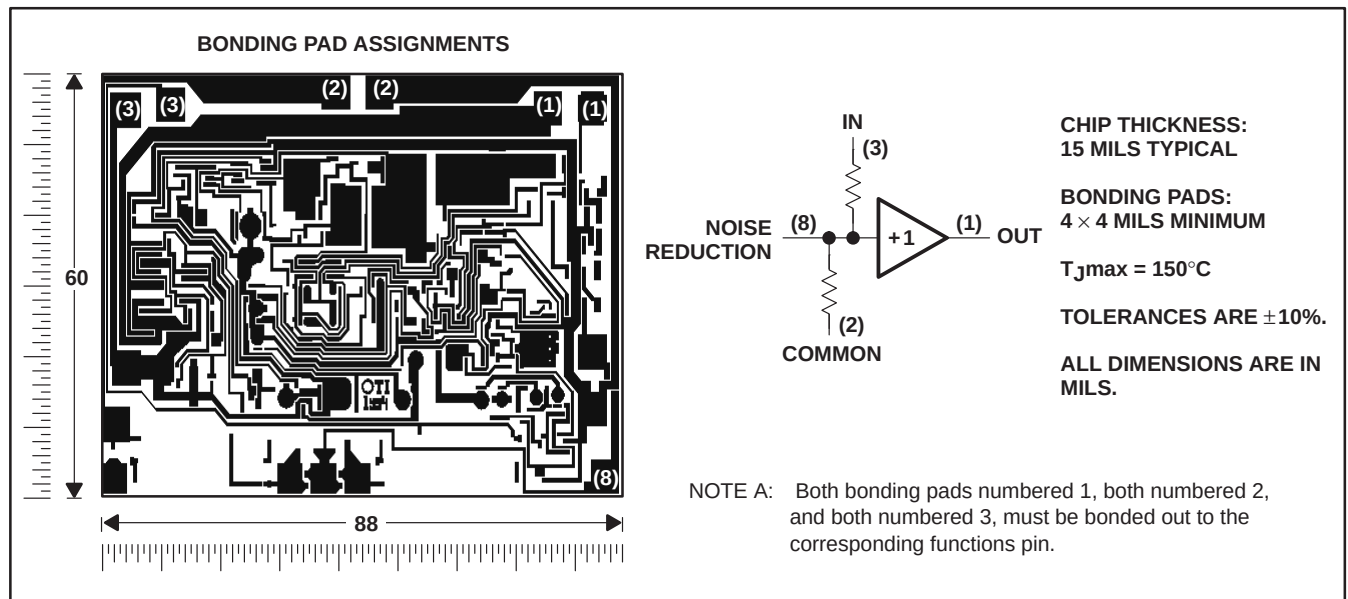
description (continued)

The C-suffix devices are characterized for operation from 0°C to 70°C. The I suffix devices are characterized for operation from –40°C to 85°C. The M suffix devices are characterized over the full military temperature range of –55°C to 125°C.



TLE2426Y chip information

This chip, properly assembled, displays characteristics similar to the TLE2426C. Thermal compression or ultrasonic bonding may be used on the doped aluminum bonding pads. The chips may be mounted with conductive epoxy or a gold-silicon preform.



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

Continuous input voltage, V_I	40 V
Continuous filter trap voltage	40 V
Output current, I_O	±80 mA
Duration of short-circuit current at (or below) 25°C (see Note 1)	unlimited
Continuous total power dissipation	See Dissipation Rating Table
Operating free-air temperature range, T_A : C suffix	0°C to 70°C
I suffix	–40°C to 85°C
M suffix	–55°C to 125°C
Storage temperature range, T_{stg}	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: JG or LP package	300°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.

NOTE 1: The output may be shorted to either supply. Temperature and/or supply voltages must be limited to ensure that the maximum dissipation rating is not exceeded.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 85^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW	377 mW	145 mW
JG	1050 mW	8.4 mW/°C	672 mW	546 mW	210 mW
LP	775 mW	6.2 mW/°C	496 mW	403 mW	155 mW
P	1000 mW	8.0 mW/°C	640 mW	520 mW	200 mW

recommended operating conditions

	C SUFFIX		I SUFFIX		M SUFFIX		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	
Input voltage, V_I	4	40	4	40	4	40	V
Operating free-air temperature, T_A	0	70	–40	85	–55	125	°C



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electrical characteristics at specified free-air temperature, $V_I = 5\text{ V}$, $I_O = 0$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T _A [†]	TLE2426C			UNIT
				MIN	TYP	MAX	
Output voltage	V _I = 4 V		25°C	1.98	2	2.02	V
	V _I = 5 V			2.48	2.5	2.52	
	V _I = 40 V			19.8	20	20.2	
	V _I = 5 V		Full range		2.475	2.525	
Temperature coefficient of output voltage			Full range	25			ppm/°C
Supply current	No load	V _I = 5 V	25°C	170 300			μA
		V _I = 4 to 40 V	Full range	400			
Output voltage regulation (sourcing current) [‡]	I _O = 0 to −10 mA		25°C	−45 ±160			μV
			Full range	±250			
	I _O = 0 to −20 mA		25°C	−150 ±450			
Output voltage regulation (sinking current) [‡]	I _O = 0 to 10 mA		25°C	15 ±160			μV
			Full range	±250			
	I _O = 0 to 20 mA		25°C	65 ±235			
Output impedance			25°C	7.5 22.5			mΩ
Noise-reduction impedance			25°C	110			kΩ
Short-circuit current	Sinking current, V _O = 5 V		25°C	26			mA
	Sourcing current, V _O = 0			−47			
Output noise voltage, rms	f = 10 Hz to 10 kHz	CNR = 0	25°C	120			μV
		CNR = 1 μF		30			
Output voltage current step response	V _O to 0.1%, I _O = ±10 mA	C _L = 0	25°C	290			μs
		C _L = 100 pF		275			
	V _O to 0.01%, I _O = ±10 mA	C _L = 0	25°C	400			
		C _L = 100 pF		390			
Step response	V _I = 0 to 5 V, V _O to 0.1%		25°C	20			μs
	V _I = 0 to 5 V, V _O to 0.01%			160			

† Full range is 0°C to 70°C .

‡ The listed values are not production tested.

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electrical characteristics at specified free-air temperature, $V_I = 12\text{ V}$, $I_O = 0$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T _A [†]	TLE2426C			UNIT
				MIN	TYP	MAX	
Output voltage	V _I = 4 V		25°C	1.98	2	2.02	V
	V _I = 12 V			5.95	6	6.05	
	V _I = 40 V			19.8	20	20.2	
	V _I = 12 V		Full range		5.945	6.055	
Temperature coefficient of output voltage			Full range	35			ppm/°C
Supply current	No load	V _I = 12 V	25°C	195 300			μA
		V _I = 4 to 40 V	Full range	400			
Output voltage regulation (sourcing current) [‡]	I _O = 0 to −10 mA		25°C	−45 ±160			μV
			Full range	±250			
	I _O = 0 to −20 mA		25°C	−150 ±450			
Output voltage regulation (sinking current) [‡]	I _O = 0 to 10 mA		25°C	15 ±160			μV
			Full range	±250			
	I _O = 0 to 20 mA		25°C	65 ±235			
Output impedance			25°C	7.5 22.5			mΩ
Noise-reduction impedance			25°C	110			kΩ
Short-circuit current	Sinking current, V _O = 12 V		25°C	31			mA
	Sourcing current, V _O = 0			−70			
Output noise voltage, rms	f = 10 Hz to 10 kHz	C _{NR} = 0	25°C	120			μV
		C _{NR} = 1 μF		30			
Output voltage current step response	V _O to 0.1%, I _O = ±10 mA	C _L = 0	25°C	290			μs
		C _L = 100 pF		275			
	V _O to 0.01%, I _O = ±10 mA	C _L = 0	25°C	400			
		C _L = 100 pF		390			
Step response	V _I = 0 to 12 V, V _O to 0.1%	C _L = 100 pF	25°C	20			μs
	V _I = 0 to 12 V, V _O to 0.01%			120			

[†] Full range is 0°C to 70°C.

[‡] The listed values are not production tested.

electrical characteristics at specified free-air temperature, $V_I = 5\text{ V}$, $I_O = 0$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$T_A^\dagger$	TLE2426I			UNIT
				MIN	TYP	MAX	
Output voltage	$V_I = 4\text{ V}$		25°C	1.98	2	2.02	V
	$V_I = 5\text{ V}$			2.48	2.5	2.52	
	$V_I = 40\text{ V}$			19.8	20	20.2	
	$V_I = 5\text{ V}$		Full range	2.47		2.53	
Temperature coefficient of output voltage			Full range		25		ppm/°C
Supply current	No load	$V_I = 5\text{ V}$	25°C		170	300	µA
		$V_I = 4\text{ to }40\text{ V}$	Full range			400	
Output voltage regulation (sourcing current) ‡	$I_O = 0\text{ to }-10\text{ mA}$		25°C		-45	±160	µV
			Full range			±250	
	$I_O = 0\text{ to }-20\text{ mA}$		25°C		-150	±450	
Output voltage regulation (sinking current) ‡	$I_O = 0\text{ to }10\text{ mA}$		25°C		15	±160	µV
	$I_O = 0\text{ to }8\text{ mA}$		Full range			±250	
	$I_O = 0\text{ to }20\text{ mA}$		25°C		65	±235	
Output impedance			25°C		7.5	22.5	mΩ
Noise-reduction impedance			25°C		110		kΩ
Short-circuit current	Sinking current,	$V_O = 5\text{ V}$	25°C		26		mA
	Sourcing current,	$V_O = 0$			-47		
Output noise voltage, rms	$f = 10\text{ Hz to }10\text{ kHz}$	$C_{NR} = 0$	25°C		120		µV
		$C_{NR} = 1\text{ µF}$			30		
Output voltage current step response	$V_O\text{ to }0.1\%, I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		290		µs
		$C_L = 100\text{ pF}$			275		
	$V_O\text{ to }0.01\%, I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		400		
		$C_L = 100\text{ pF}$			390		
Step response	$V_I = 0\text{ to }5\text{ V}, V_O\text{ to }0.1\%$	$C_L = 100\text{ pF}$	25°C		20		µs
	$V_I = 0\text{ to }5\text{ V}, V_O\text{ to }0.01\%$				160		

† Full range is -40°C to 85°C.

‡ The listed values are not production tested.

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electrical characteristics at specified free-air temperature, $V_I = 12\text{ V}$, $I_O = 0$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$T_A^\dagger$	TLE2426I			UNIT
				MIN	TYP	MAX	
Output voltage	$V_I = 4\text{ V}$		25°C	1.98	2	2.02	V
	$V_I = 12\text{ V}$			5.95	6	6.05	
	$V_I = 40\text{ V}$			19.8	20	20.2	
	$V_I = 12\text{ V}$		Full range	5.935		6.065	
Temperature coefficient of output voltage			Full range		35		ppm/°C
Supply current	No load	$V_I = 12\text{ V}$	25°C		195	300	μA
		$V_I = 4\text{ to }40\text{ V}$	Full range			400	
Output voltage regulation (sourcing current) [‡]	$I_O = 0\text{ to }-10\text{ mA}$		25°C		-45	±160	μV
			Full range			±250	
	$I_O = 0\text{ to }-20\text{ mA}$		25°C		-150	±450	
Output voltage regulation (sinking current) [‡]	$I_O = 0\text{ to }10\text{ mA}$		25°C		15	±160	μV
	$I_O = 0\text{ to }8\text{ mA}$		Full range			±250	
	$I_O = 0\text{ to }20\text{ mA}$		25°C		65	±235	
Output impedance			25°C		7.5	22.5	mΩ
Noise-reduction impedance			25°C		110		kΩ
Short-circuit current	Sinking current,	$V_O = 12\text{ V}$	25°C		31		mA
	Sourcing current,	$V_O = 0$			-70		
Output noise voltage, rms	$f = 10\text{ Hz to }10\text{ kHz}$	$C_{NR} = 0$	25°C		120		μV
		$C_{NR} = 1\text{ μF}$			30		
Output voltage current step response	$V_O\text{ to }0.1\%, I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		290		μs
		$C_L = 100\text{ pF}$			275		
	$V_O\text{ to }0.01\%, I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		400		
		$C_L = 100\text{ pF}$			390		
Step response	$V_I = 0\text{ to }12\text{ V}, V_O\text{ to }0.1\%$	$C_L = 100\text{ pF}$	25°C		20		μs
	$V_I = 0\text{ to }12\text{ V}, V_O\text{ to }0.01\%$				120		

[†] Full range is -40°C to 85°C.

[‡] The listed values are not production tested.

electrical characteristics at specified free-air temperature, $V_I = 5\text{ V}$, $I_O = 0$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$T_A^\dagger$	TLE2426M			UNIT
				MIN	TYP	MAX	
Output voltage	$V_I = 4\text{ V}$		25°C	1.98	2	2.02	V
	$V_I = 5\text{ V}$			2.48	2.5	2.52	
	$V_I = 40\text{ V}$			19.8	20	20.2	
	$V_I = 5\text{ V}$		Full range	2.465		2.535	
Temperature coefficient of output voltage			Full range		25		ppm/ $^\circ\text{C}$
Supply current	No load	$V_I = 5\text{ V}$	25°C		170	300	μA
		$V_I = 4\text{ to }40\text{ V}$	Full range			400	
Output voltage regulation (sourcing current) ‡	$I_O = 0\text{ to }-10\text{ mA}$		25°C		-45	± 160	μV
			Full range			± 250	
	$I_O = 0\text{ to }-20\text{ mA}$		25°C		-150	± 450	
Output voltage regulation (sinking current) ‡	$I_O = 0\text{ to }10\text{ mA}$		25°C		15	± 160	μV
	$I_O = 0\text{ to }3\text{ mA}$		Full range			± 250	
	$I_O = 0\text{ to }20\text{ mA}$		25°C		65	± 235	
Output impedance			25°C		7.5	22.5	$\text{m}\Omega$
Noise-reduction impedance			25°C		110		$\text{k}\Omega$
Short-circuit current	Sinking current,	$V_O = 5\text{ V}$	25°C		26		mA
	Sourcing current,	$V_O = 0$			-47		
Output noise voltage, rms	$f = 10\text{ Hz to }10\text{ kHz}$	$C_{NR} = 0$	25°C		120		μV
		$C_{NR} = 1\text{ }\mu\text{F}$			30		
Output voltage current step response	$V_O\text{ to }0.1\%,\ I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		290		μs
		$C_L = 100\text{ pF}$			275		
	$V_O\text{ to }0.01\%,\ I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		400		
		$C_L = 100\text{ pF}$			390		
Step response	$V_I = 0\text{ to }5\text{ V},\ V_O\text{ to }0.1\%$	$C_L = 100\text{ pF}$	25°C		20		μs
	$V_I = 0\text{ to }5\text{ V},\ V_O\text{ to }0.01\%$				120		

† Full range is -55°C to 125°C .

‡ The listed values are not production tested.

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electrical characteristics at specified free-air temperature, $V_I = 12\text{ V}$, $I_O = 0$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$T_A^\dagger$	TLE2426M			UNIT
				MIN	TYP	MAX	
Output voltage	$V_I = 4\text{ V}$		25°C	1.98	2	2.02	V
	$V_I = 12\text{ V}$			5.95	6	6.05	
	$V_I = 40\text{ V}$			19.8	20	20.2	
	$V_I = 12\text{ V}$		Full range	5.925		6.075	
Temperature coefficient of output voltage			Full range		35		ppm/°C
Supply current	No load	$V_I = 12\text{ V}$	25°C		195	250	μA
		$V_I = 4\text{ to }40\text{ V}$	Full range			350	
Output voltage regulation (sourcing current) [‡]	$I_O = 0\text{ to }-10\text{ mA}$		25°C		-45	±160	μV
			Full range			±250	
	$I_O = 0\text{ to }-20\text{ mA}$		25°C		-150	±450	
Output voltage regulation (sinking current) [‡]	$I_O = 0\text{ to }10\text{ mA}$		25°C		15	±160	μV
	$I_O = 0\text{ to }8\text{ mA}$		Full range			±250	
	$I_O = 0\text{ to }20\text{ mA}$		25°C		65	±235	
Output impedance			25°C		7.5	22.5	mΩ
Noise-reduction impedance			25°C		110		kΩ
Short-circuit current	Sinking current,	$V_O = 12\text{ V}$	25°C		31		mA
	Sourcing current,	$V_O = 0$			-70		
Output noise voltage, rms	$f = 10\text{ Hz to }10\text{ kHz}$	$C_{NR} = 0$	25°C		120		μV
		$C_{NR} = 1\text{ μF}$			30		
Output voltage current step response	$V_O\text{ to }0.1\%, I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		290		μs
		$C_L = 100\text{ pF}$			275		
	$V_O\text{ to }0.01\%, I_O = \pm 10\text{ mA}$	$C_L = 0$	25°C		400		
		$C_L = 100\text{ pF}$			390		
Step response	$V_I = 0\text{ to }12\text{ V}, V_O\text{ to }0.1\%$	$C_L = 100\text{ pF}$	25°C		12		μs
	$V_I = 0\text{ to }12\text{ V}, V_O\text{ to }0.01\%$				120		

[†] Full range is -55°C to 125°C.

[‡] The listed values are not production tested.

electrical characteristics at specified free-air temperature, $V_I = 5\text{ V}$, $I_O = 0$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLE2426Y			UNIT
		MIN	TYP	MAX	
Output voltage	$V_I = 5\text{ V}$		2.5		V
Supply current	No load		170		μA
Output voltage regulation (sourcing current) [†]	$I_O = 0$ to -10 mA		-45		μV
	$I_O = 0$ to -20 mA		-150		
Output voltage regulation (sinking current) [†]	$I_O = 0$ to 10 mA		15		μV
	$I_O = 0$ to 20 mA		65		
Output impedance			7.5		$\text{m}\Omega$
Noise-reduction impedance			110		$\text{k}\Omega$
Short-circuit current	Sinking current, $V_O = 5\text{ V}$		26		mA
	Sourcing current, $V_O = 0$		-47		
Output noise voltage, rms	$f = 10\text{ Hz}$ to 10 kHz	$\text{CNR} = 0$	120		μV
		$\text{CNR} = 1\text{ }\mu\text{F}$	30		
Output voltage current step response	V_O to 0.1%, $I_O = \pm 10\text{ mA}$	$C_L = 0$	290		μs
		$C_L = 100\text{ pF}$	275		
	V_O to 0.01%, $I_O = \pm 10\text{ mA}$	$C_L = 0$	400		
		$C_L = 100\text{ pF}$	390		
Step response	$V_I = 0$ to 5 V , V_O to 0.1%	$C_L = 100\text{ pF}$	20		μs
	$V_I = 0$ to 5 V , V_O to 0.01%		160		

[†] The listed values are not production tested.

electrical characteristics at specified free-air temperature, $V_I = 12\text{ V}$, $I_O = 0$, $T_A = 25^\circ\text{C}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	TLE2426Y			UNIT
		MIN	TYP	MAX	
Output voltage	$V_I = 12\text{ V}$		6		V
Supply current	No load		195		μA
Output voltage regulation (sourcing current) [†]	$I_O = 0$ to -10 mA		-45		μV
	$I_O = 0$ to -20 mA		-150		
Output voltage regulation (sinking current) [†]	$I_O = 0$ to 3 mA		15		μV
	$I_O = 0$ to 20 mA		65		
Output impedance			7.5		$\text{m}\Omega$
Noise-reduction impedance			110		$\text{k}\Omega$
Short-circuit current	Sinking current, $V_O = 12\text{ V}$		31		mA
	Sourcing current, $V_O = 0$		-70		
Output noise voltage, rms	$f = 10\text{ Hz}$ to 10 kHz	$\text{CNR} = 0$	120		μV
		$\text{CNR} = 1\text{ }\mu\text{F}$	30		
Output voltage current, step response	V_O to 0.1%, $I_O = \pm 10\text{ mA}$	$C_L = 0$	290		μs
		$C_L = 100\text{ pF}$	275		
	V_O to 0.01%, $I_O = \pm 10\text{ mA}$	$C_L = 0$	400		
		$C_L = 100\text{ pF}$	390		
Step response	$V_I = 0$ to 12 V , V_O to 0.1%	$C_L = 100\text{ pF}$	12		μs
	$V_I = 0$ to 12 V , V_O to 0.01%		120		

[†] The listed values are not production tested.

TYPICAL CHARACTERISTICS

Table Of Graphs

		FIGURE
Output voltage	Distribution	1,2
Output voltage change	vs Free-air temperature	3
Output voltage error	vs Input voltage	4
Input bias current	vs Input voltage	5
	vs Free-air temperature	6
Output voltage regulation	vs Output current	7
Output impedance	vs Frequency	8
Short-circuit output current	vs Input voltage	9,10
	vs Free-air temperature	11,12
Ripple rejection	vs Frequency	13
Spectral noise voltage density	vs Frequency	14
Output voltage response to output current step	vs Time	15
Output voltage power-up response	vs Time	16
Output current	vs Load capacitance	17

TYPICAL CHARACTERISTICS†

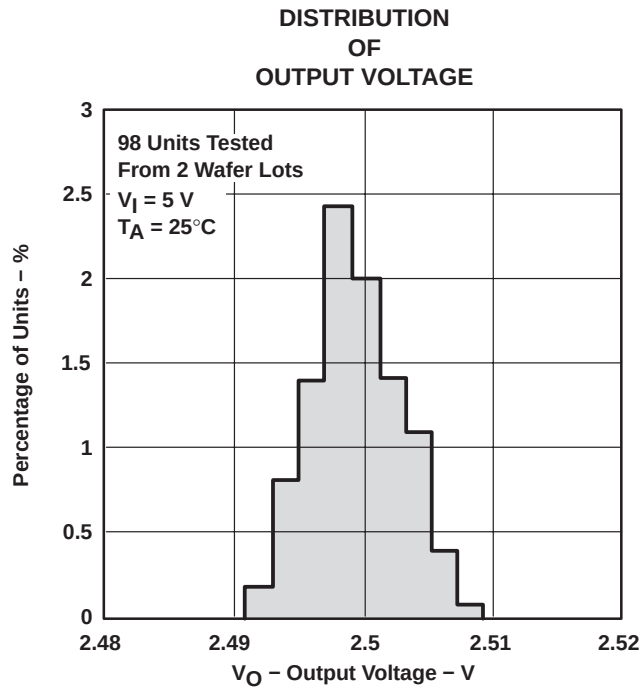


Figure 1

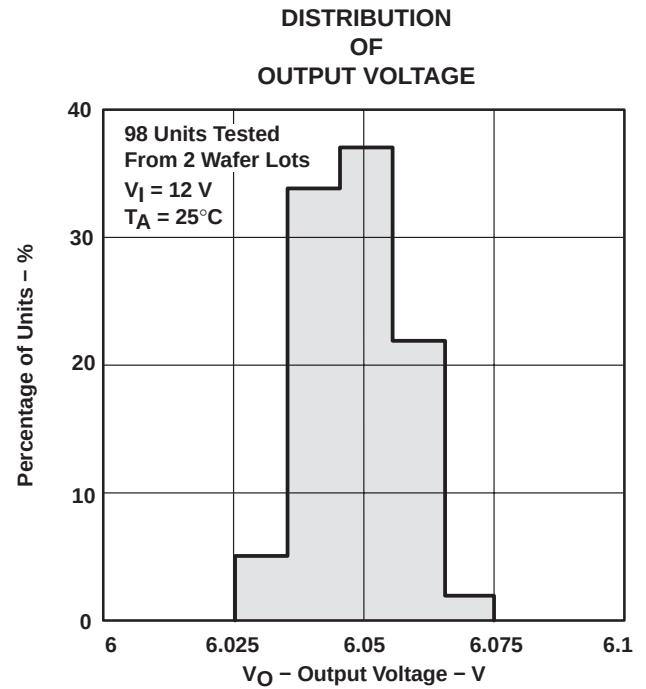


Figure 2

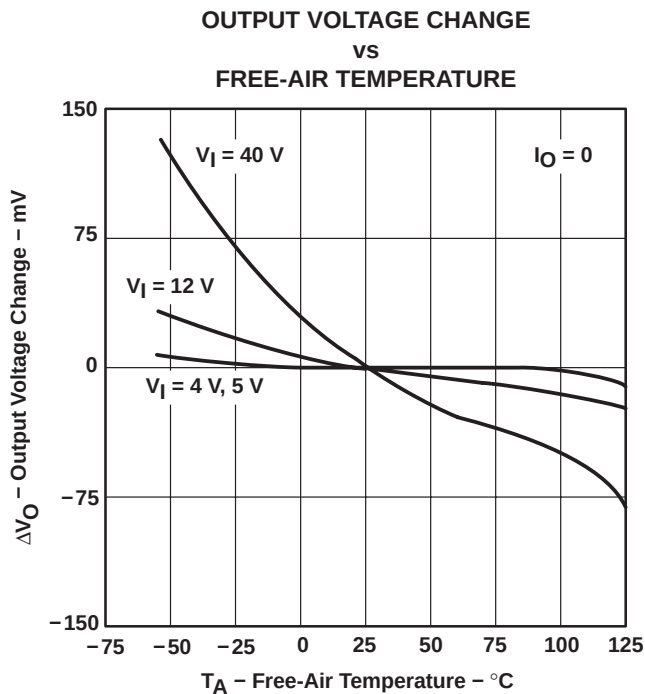


Figure 3

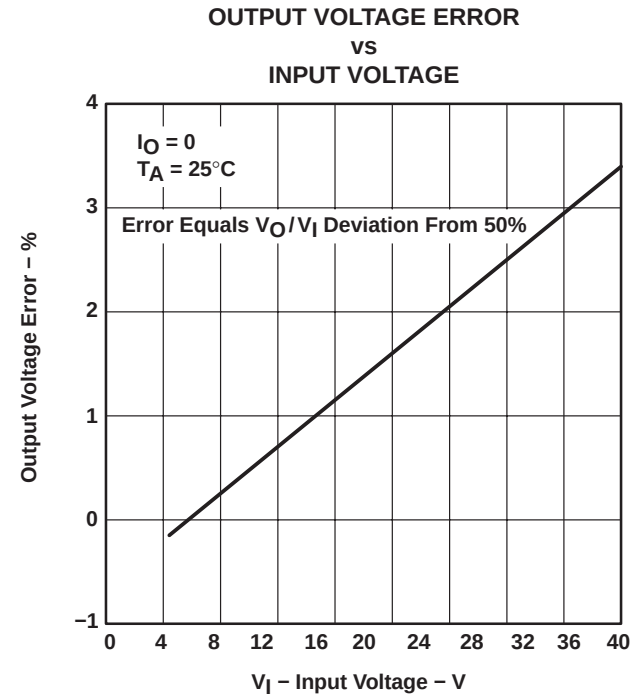
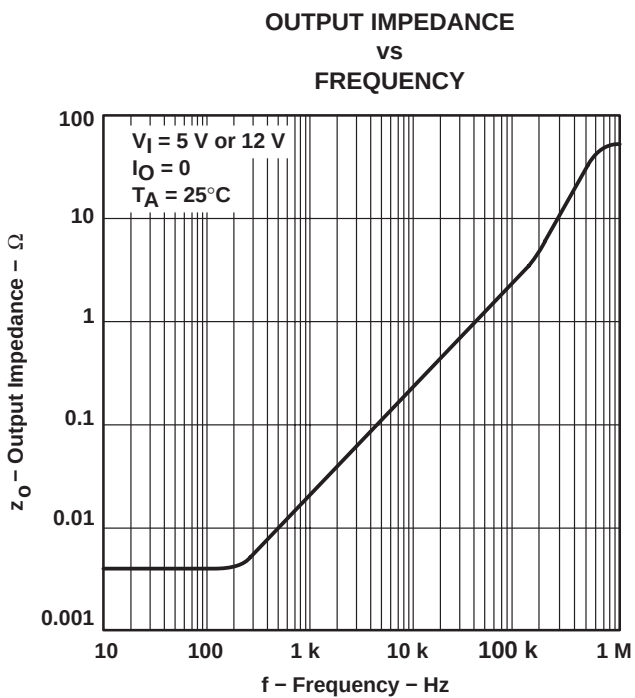
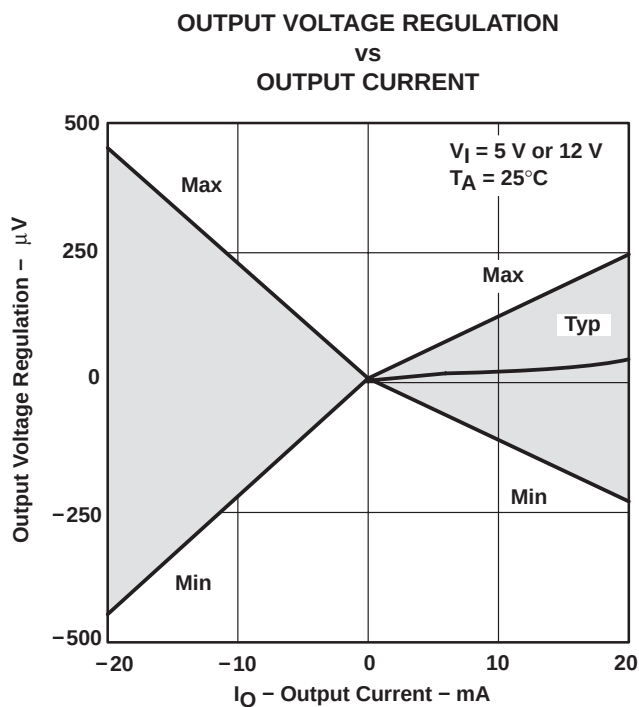
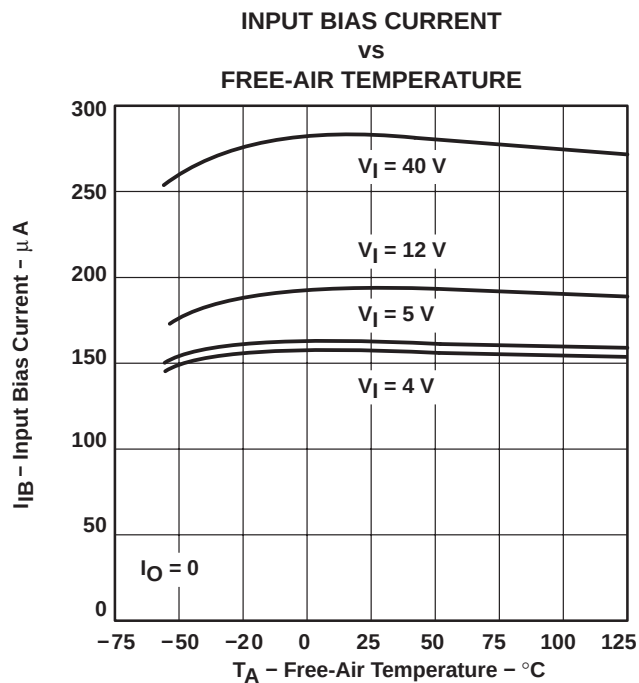
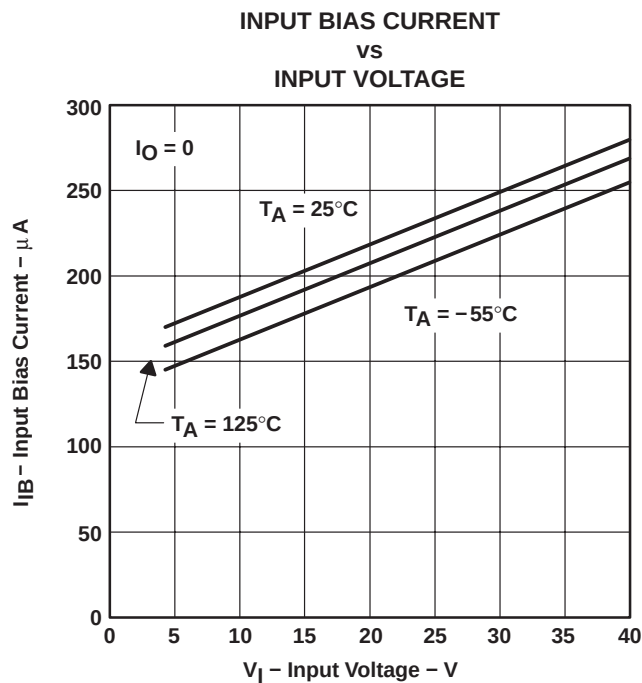


Figure 4

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

TYPICAL CHARACTERISTICS†



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

TYPICAL CHARACTERISTICS†

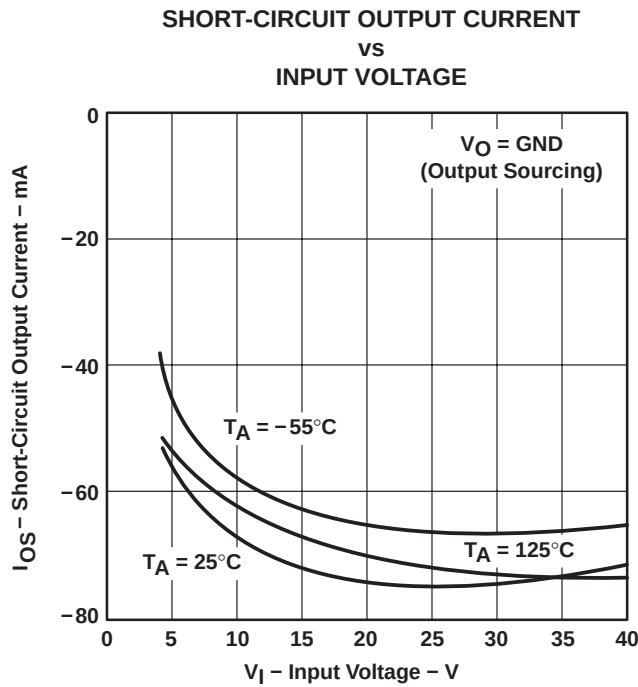


Figure 9

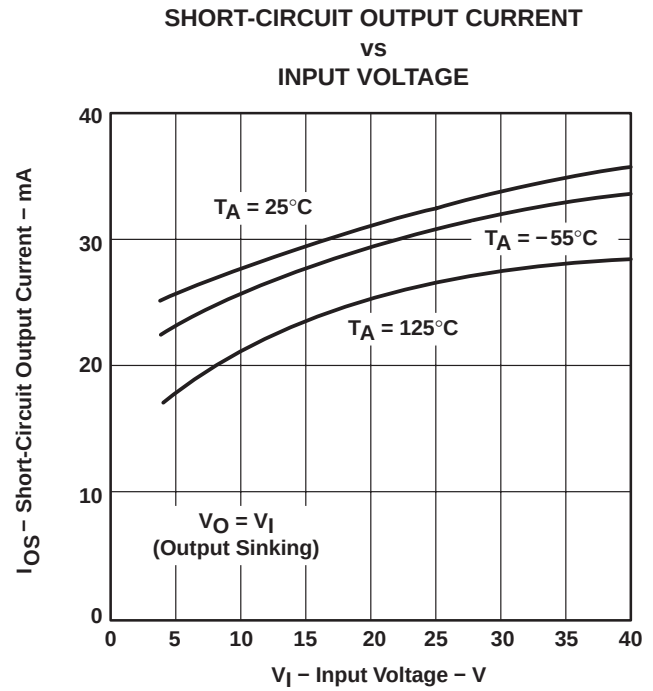


Figure 10

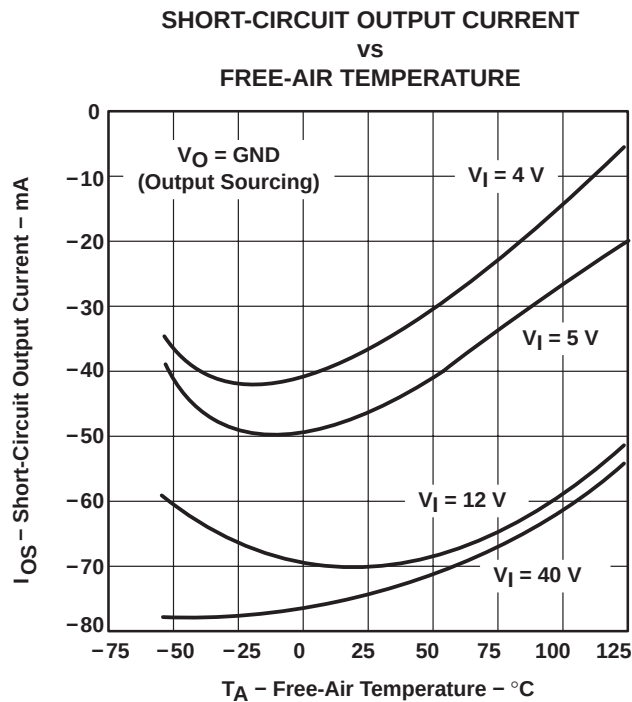


Figure 11

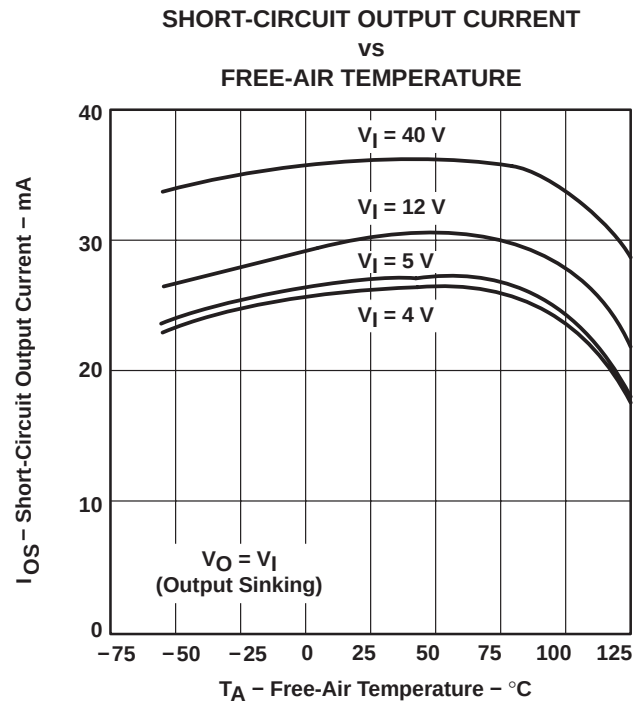


Figure 12

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

TLE2426, TLE2426Y

THE "RAIL SPLITTER"

PRECISION VIRTUAL GROUND

SLOS098D – AUGUST 1991 – REVISED MAY 1998

TYPICAL CHARACTERISTICS

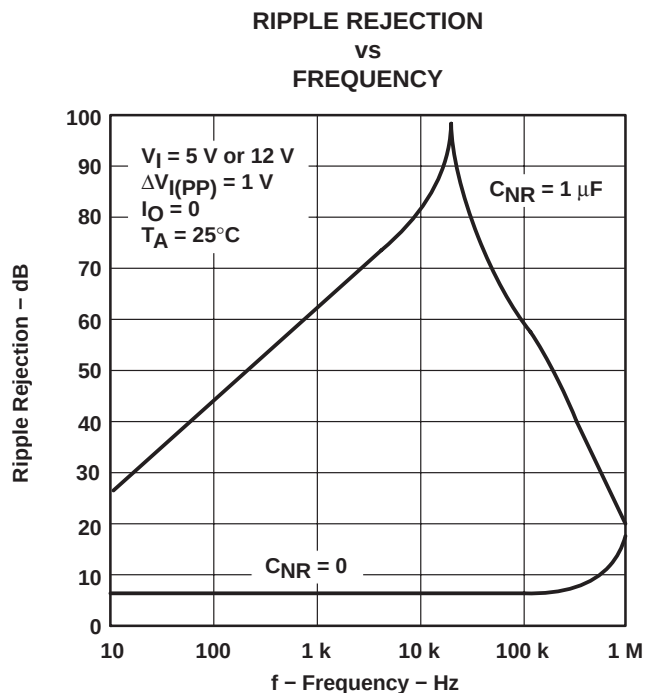


Figure 13

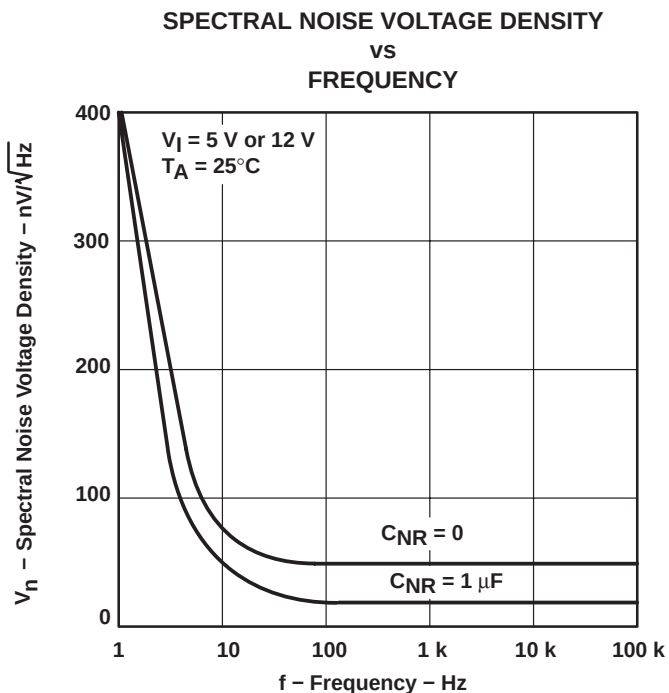


Figure 14

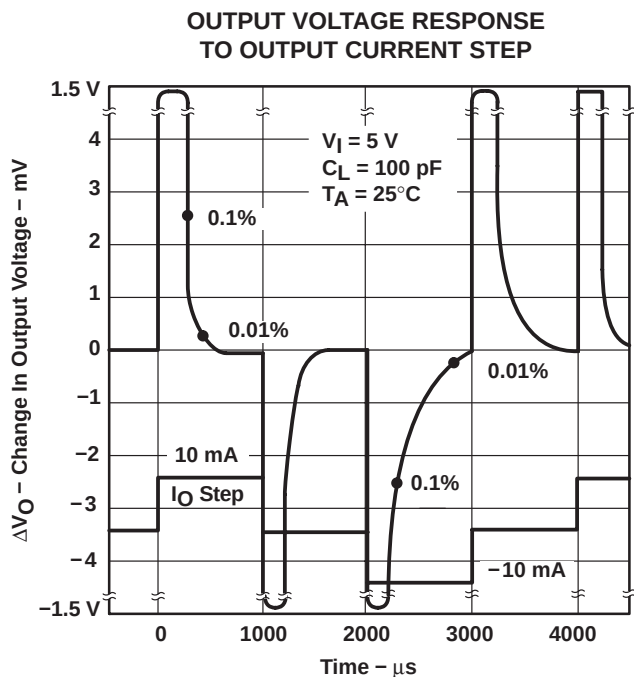


Figure 15

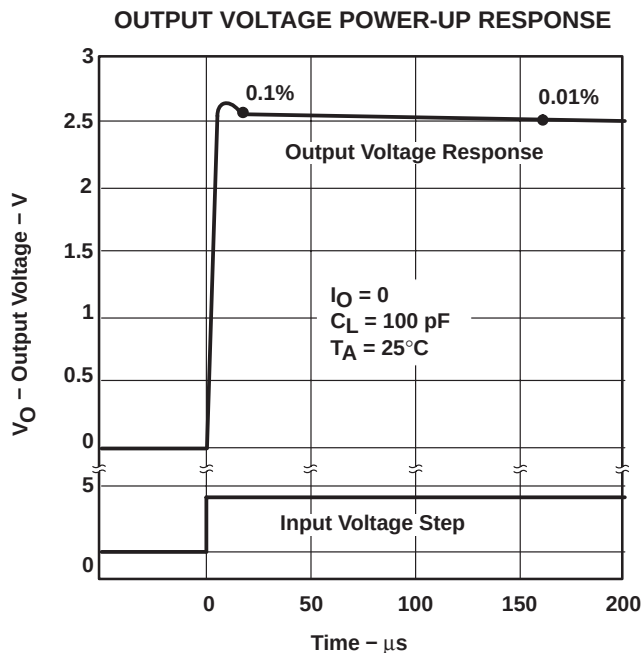


Figure 16

TYPICAL CHARACTERISTICS

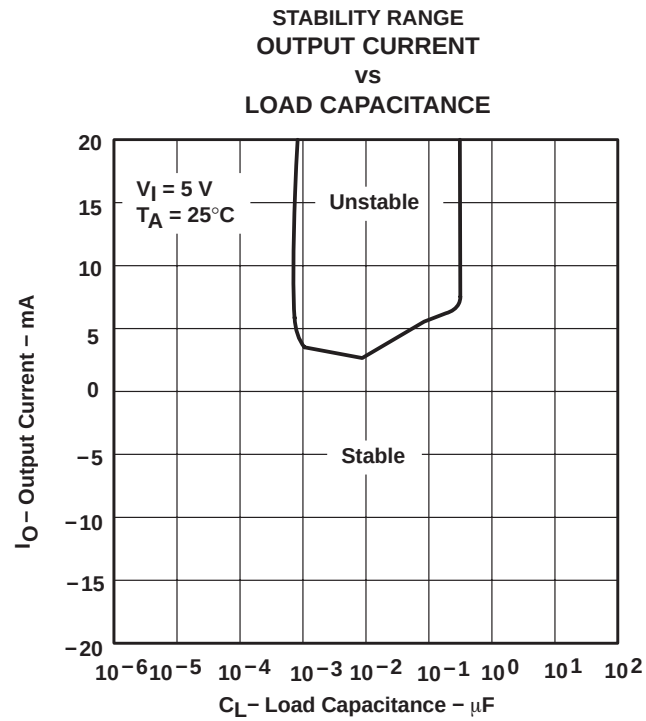


Figure 17

SLOS098D – AUGUST 1991 – REVISED MAY 1998

```
* TLE2426 OPERATIONAL AMPLIFIER "MACROMODEL" SUBCIRCUIT
* CREATED USING PARTS RELEASE 4.03 ON 08/21/90 AT 13:51
* REV (N/A) SUPPLY VOLTAGE: 5 V
* CONNECTIONS: FILTER
```

.SUBCKT TLE2426

```

C1      11 12 21.66E-12
C2      6 7 30.00E-12
C3      87 0 10.64E-9
CPSR    85 86 15.9E-9
DCM+    81 82 DX
DCM-    83 81 DX
DC       5 53 DX
DE      54 5 DX
DLP     90 91 DX
DLN     92 90 DX
DP       4 3 DX
ECMR    84 99 (2,99) 1
EGND    99 0 POLY(2) (3,0) (4,0) 0 .5 .5
EPSR    85 0 POLY(1) (3,4) -16.22E-6 3.24E-6
ENSE    89 2 POLY(1) (88,0) 120E-6 1
FB       7 99 POLY(6) VB VC VE VLP VLN VPSR 0 74.8E6 -10E6 10E6 10E6 -10E6 74E6
GA       6 0 11 12 320.4E-6
GCM      0 6 10 99 1.013E-9
GPSR    85 86 (85,86) 100E-6
GRC1     4 11 (4,11) 3.204E-4
GRC2     4 12 (4,12) 3.204E-4
GRE1    13 10 (13,10) 1.038E-3
GRE2    14 10 (14,10) 1.038E-3
HLIM    90 0 VLIM 1K
HCMR    80 1 POLY(2) VCM+ VCM- 0 1E2 1E2
IRP      3 4 146E-6
IEE      3 10 DC 24.05E-6
IIO      2 0 .2E-9
I1      88 0 1E-21
Q1      11 89 13 QX
Q2      12 80 14 QX
R2       6 9 100.0E3
RCM     84 81 1K
REE     10 99 8.316E6
RN1     87 0 2.55E8
RN2     87 88 11.67E3
RO1      8 5 63
RO2      7 99 62
VCM+    82 99 1.0
VCM-    83 99 -2.3
VB       9 0 DC 0
VC       3 53 DC 1.400
VE      54 4 DC 1.400
VLIM     7 8 DC 0
VLP     91 0 DC 30
VLN      0 92 DC 30
VPSR     0 86 DC 0
RFB      5 2 1K
RIN1     3 1 220K
RIN2     1 4 220K
.MODEL DX D(IS=800.OE-18)
.MODEL QX PNP(IS=800.OE-18 BF=480)
.ENDS

```

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
5962-9555602Q2A	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	
5962-9555602QPA	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	
TLE2426CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426CLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426CLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426CLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426CLPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
TLE2426CPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
TLE2426ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426ILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426ILPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426ILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426ILPRE3	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type	
TLE2426IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
TLE2426IPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
TLE2426MD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
TLE2426MDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
TLE2426MFKB	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	
TLE2426MJGB	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	
TLE2426MLP	OBSOLETE	TO-92	LP	3		TBD	Call TI	Call TI	
TLE2426MP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI	

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

ACTIVE: Product device recommended for new designs.

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

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

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

OBSOLETE: TI has discontinued the production of the device.

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

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

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

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

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

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

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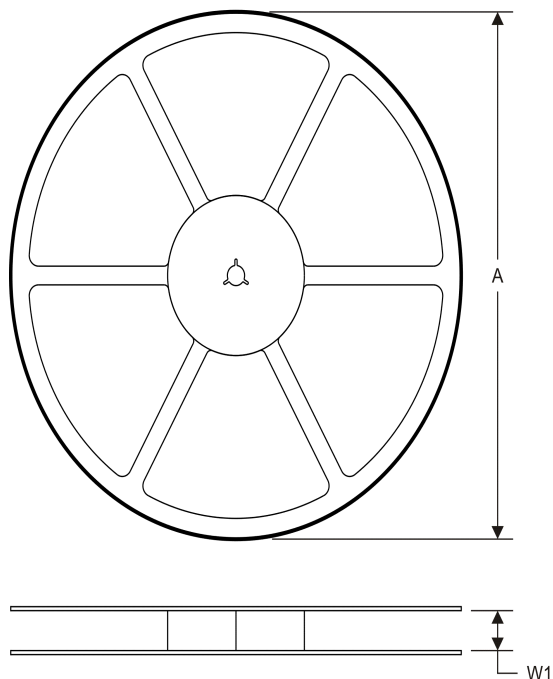
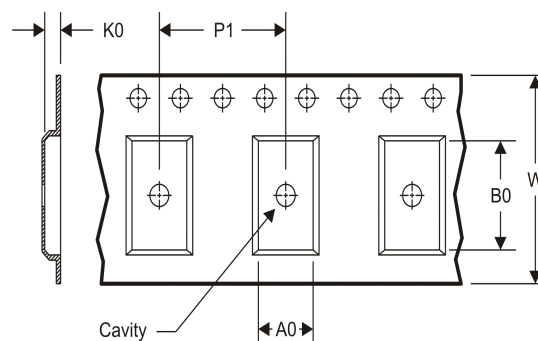
OTHER QUALIFIED VERSIONS OF TLE2426 :

- Automotive: [TLE2426-Q1](#)

- Enhanced Product: [TLE2426-EP](#)

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

TAPE AND REEL INFORMATION
REEL DIMENSIONS

TAPE DIMENSIONS


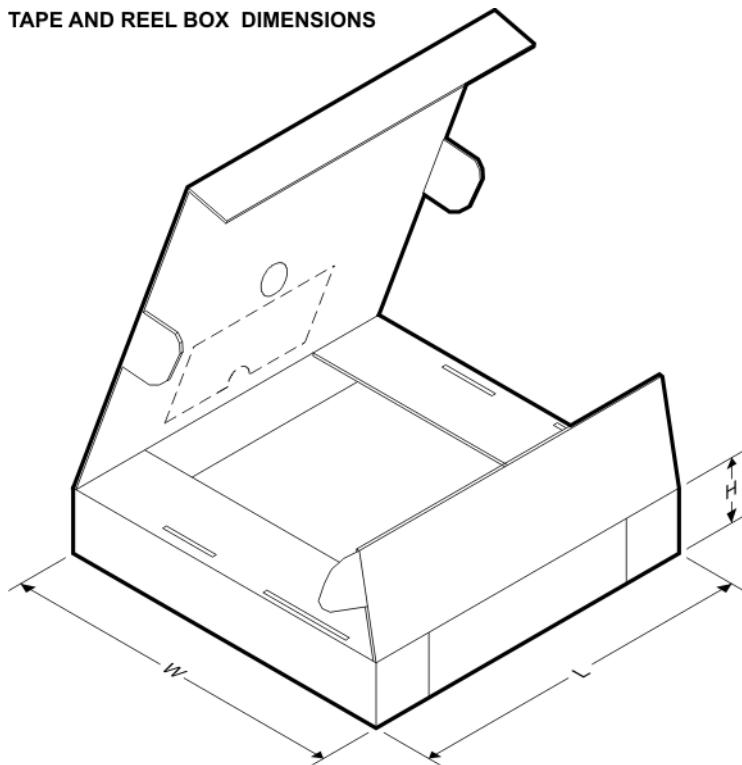
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TLE2426CDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLE2426IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

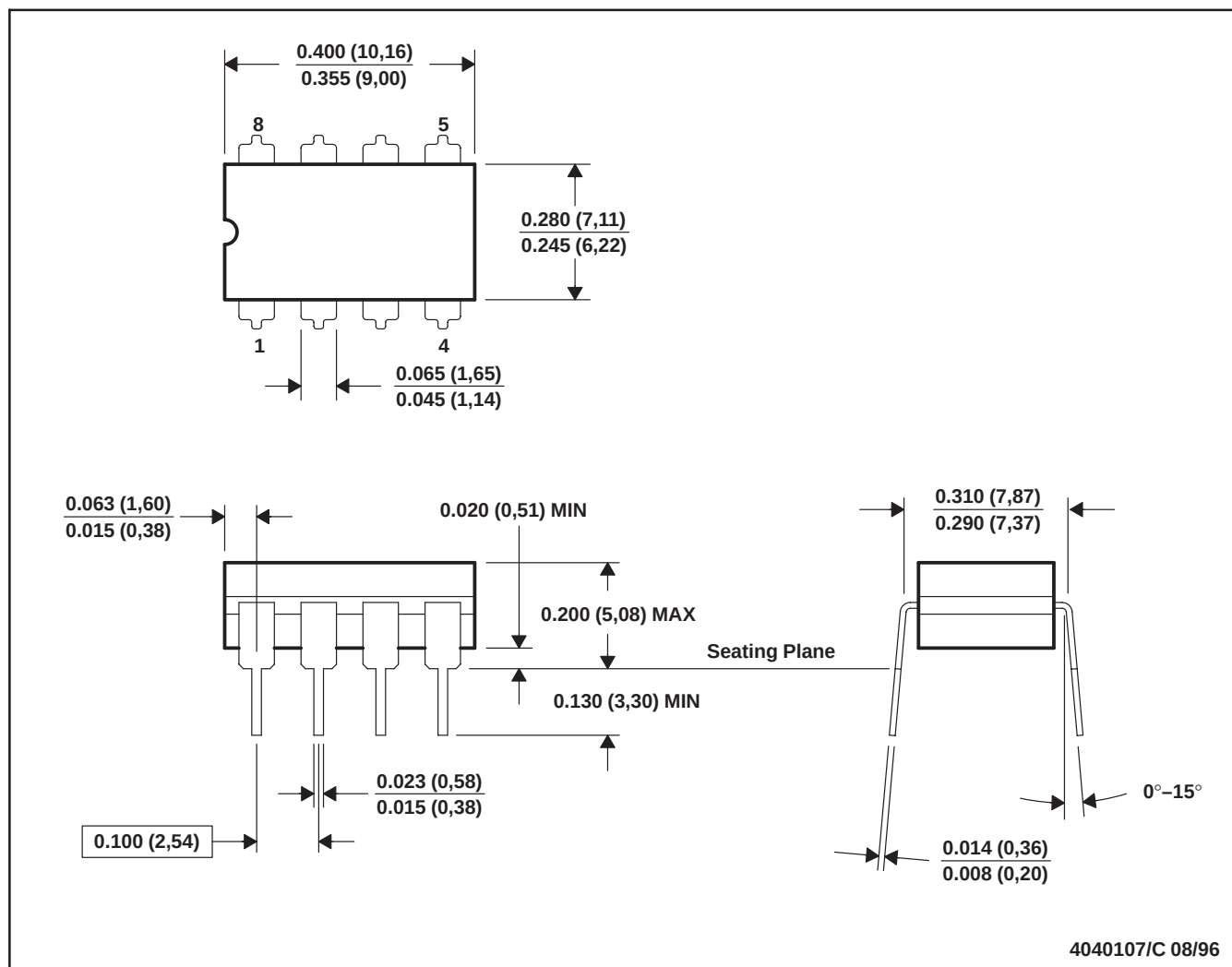


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLE2426CDR	SOIC	D	8	2500	367.0	367.0	35.0
TLE2426IDR	SOIC	D	8	2500	367.0	367.0	35.0

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE

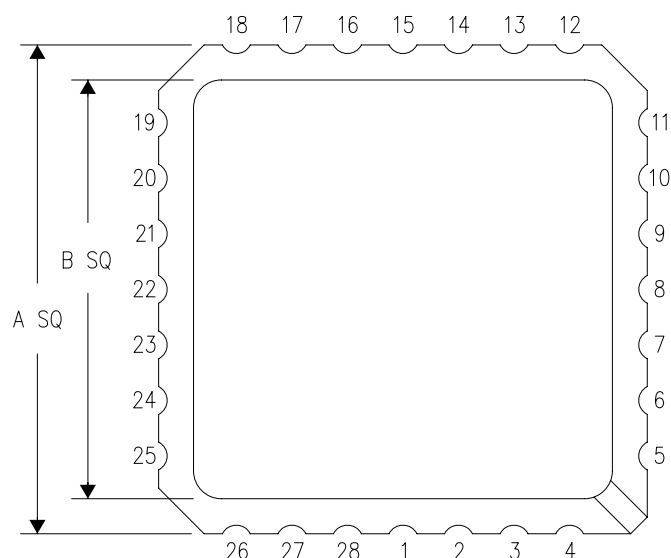


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package can be hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification.
 - E. Falls within MIL STD 1835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

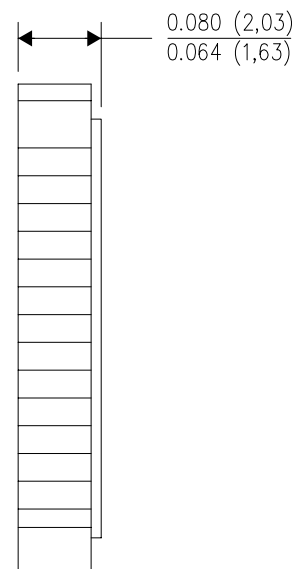
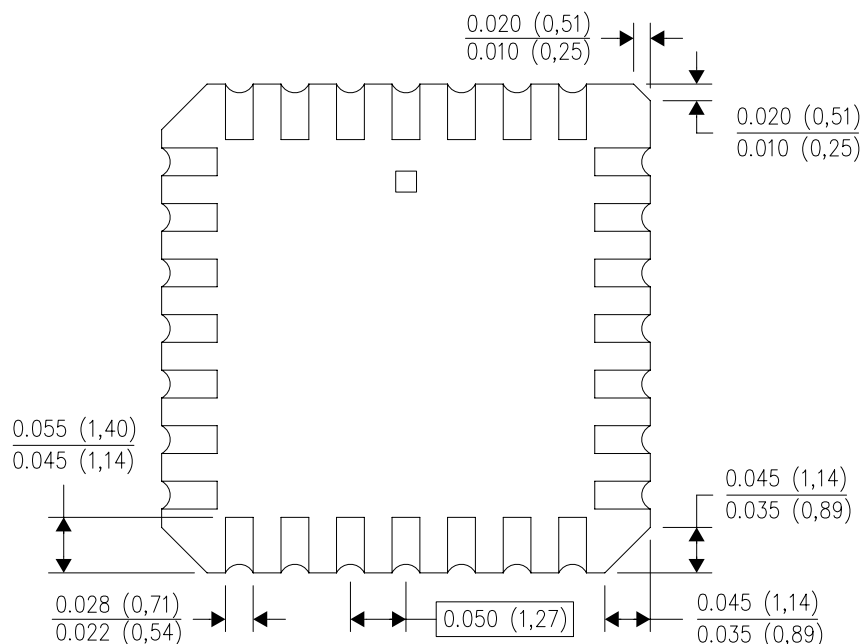
FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



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

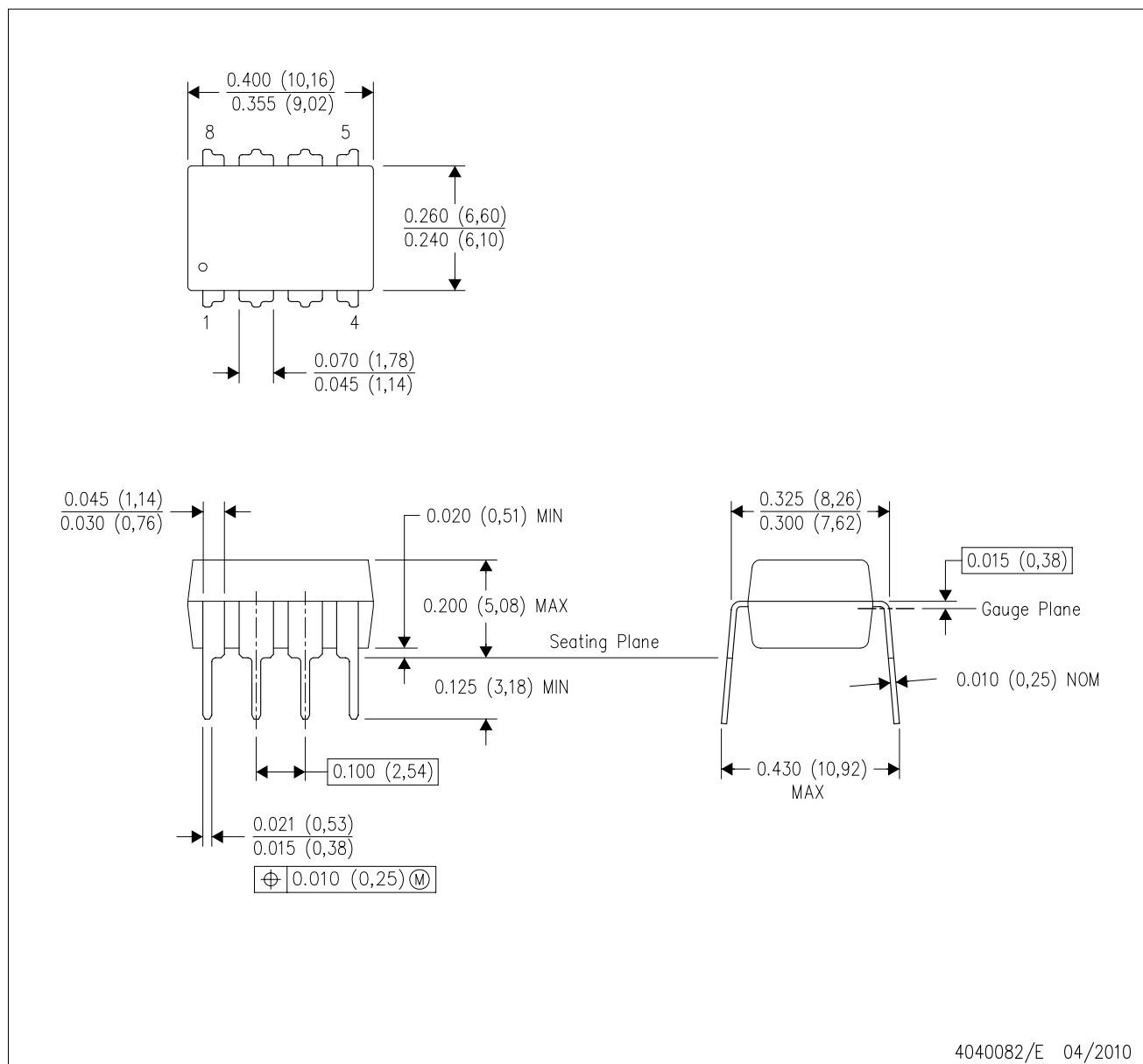


4040140/D 01/11

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

P (R-PDIP-T8)

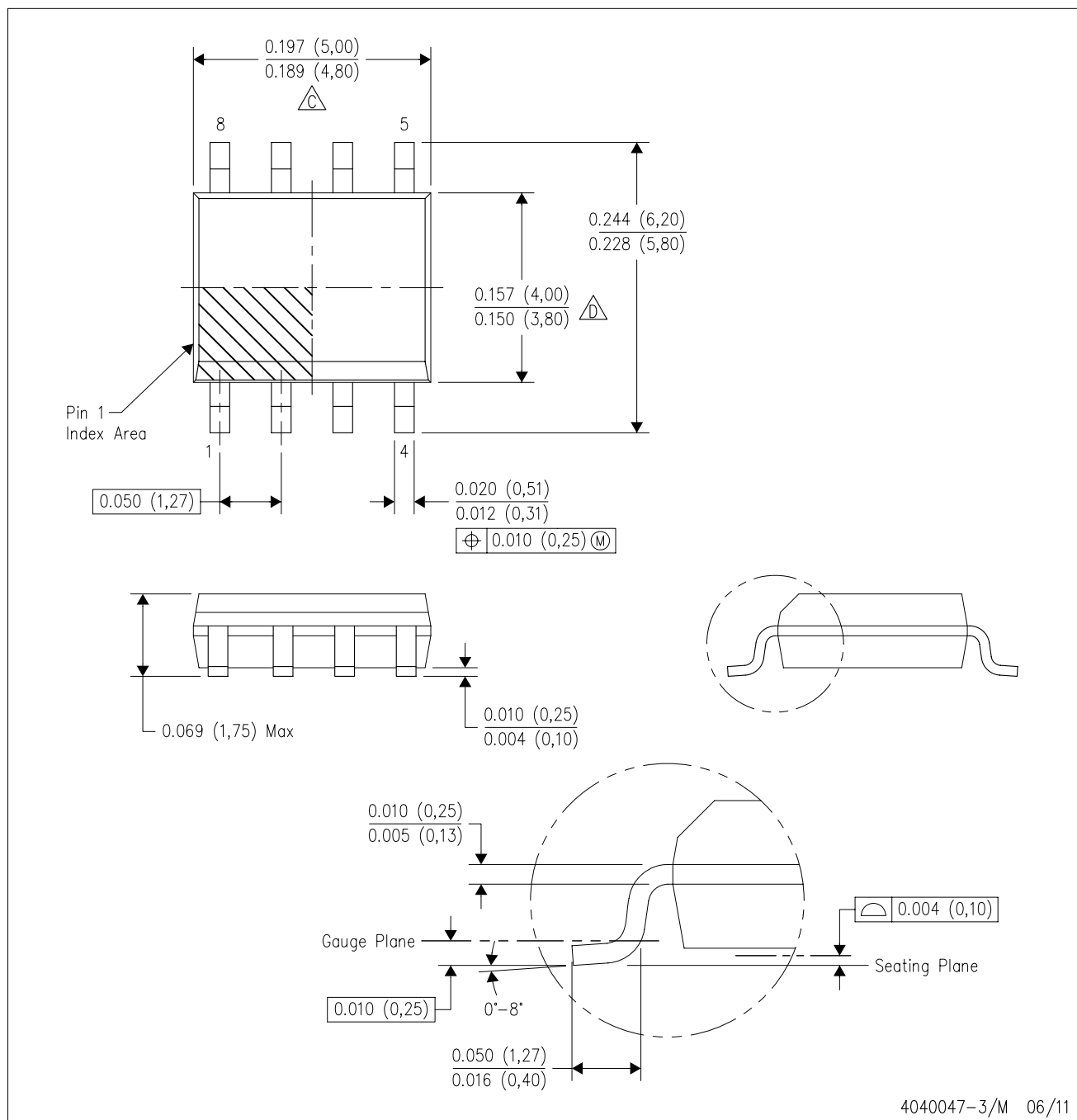
PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Falls within JEDEC MS-001 variation BA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE

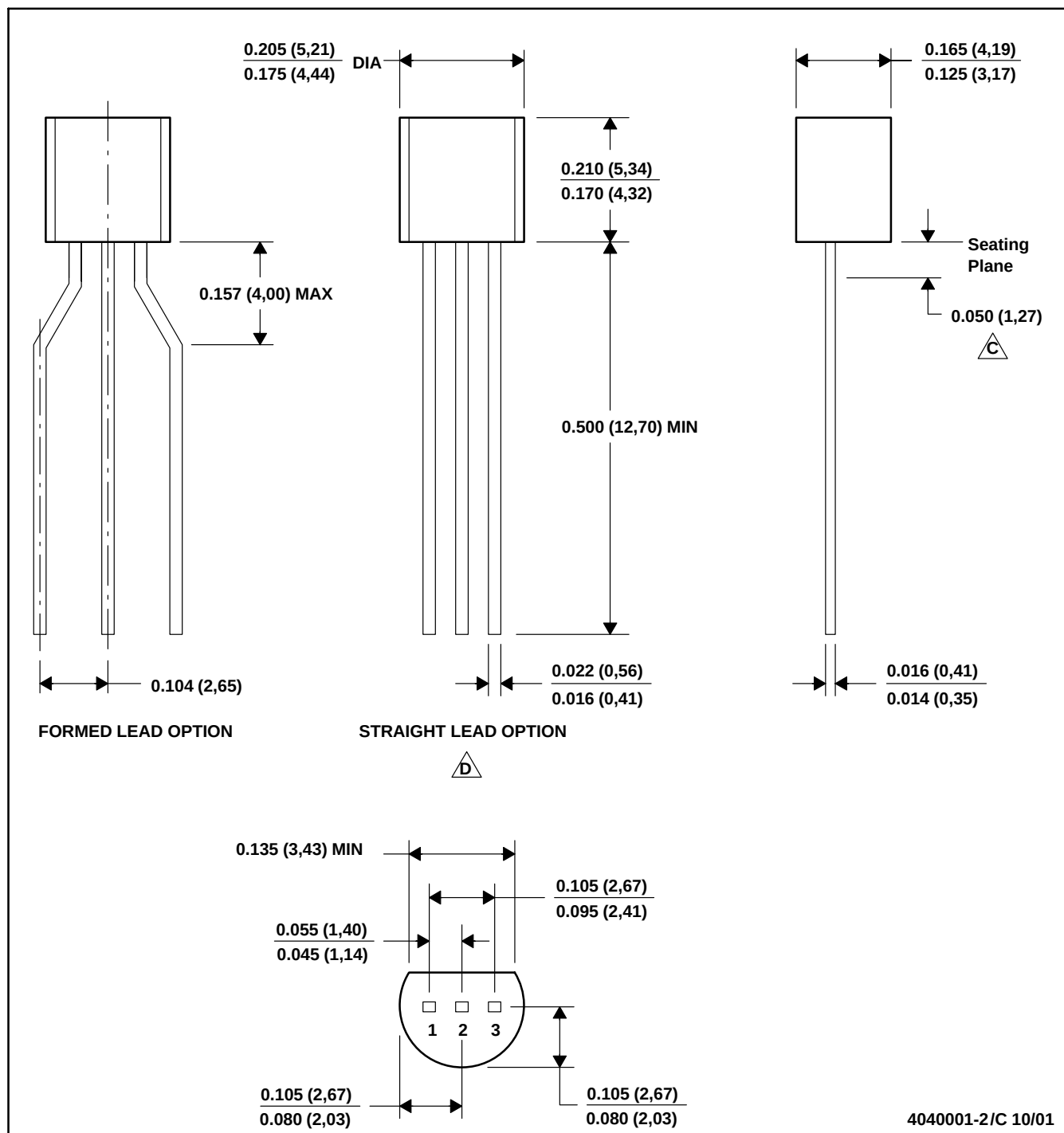


NOTES:

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

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



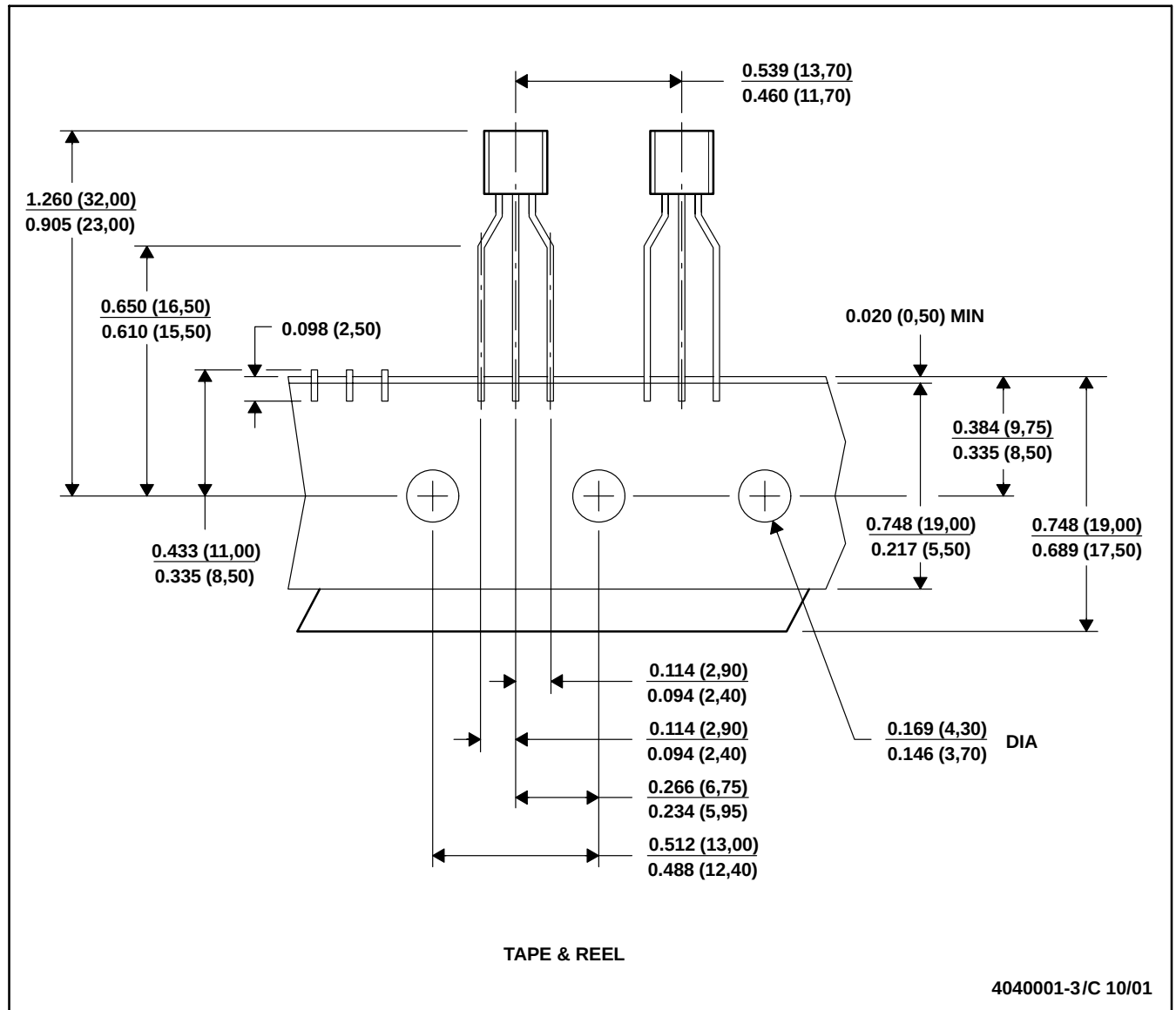
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 $\triangle C$ Lead dimensions are not controlled within this area
 $\triangle D$ Falls within JEDEC TO -226 Variation AA (TO-226 replaces TO-92)
 E. Shipping Method:
 Straight lead option 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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