

TLE2426, TLE2426Y THE "RAIL SPLITTER" PRECISION VIRTUAL GROUND

SLOS098D – AUGUST 1991 – REVISED MAY 1998

- 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 . . . 0.0075 Ω Typ
- Noise Reduction Pin (D, JG, and P Packages Only)

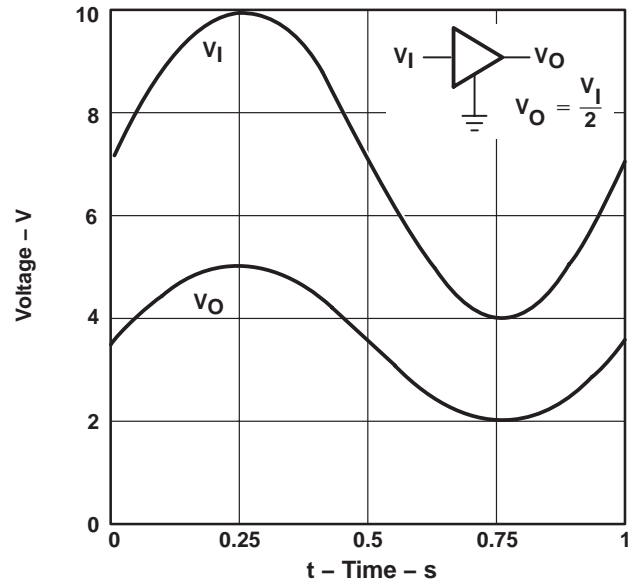
description

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.

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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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	

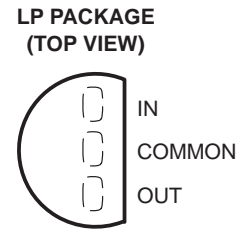
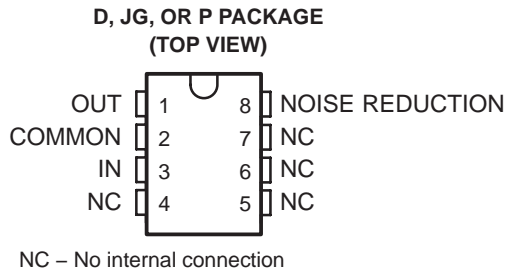
The D and LP packages are available taped and reeled in the commercial temperature range only. Add R suffix to the device type (e. g., TLC2426CDR). Chips are tested at 25°C.



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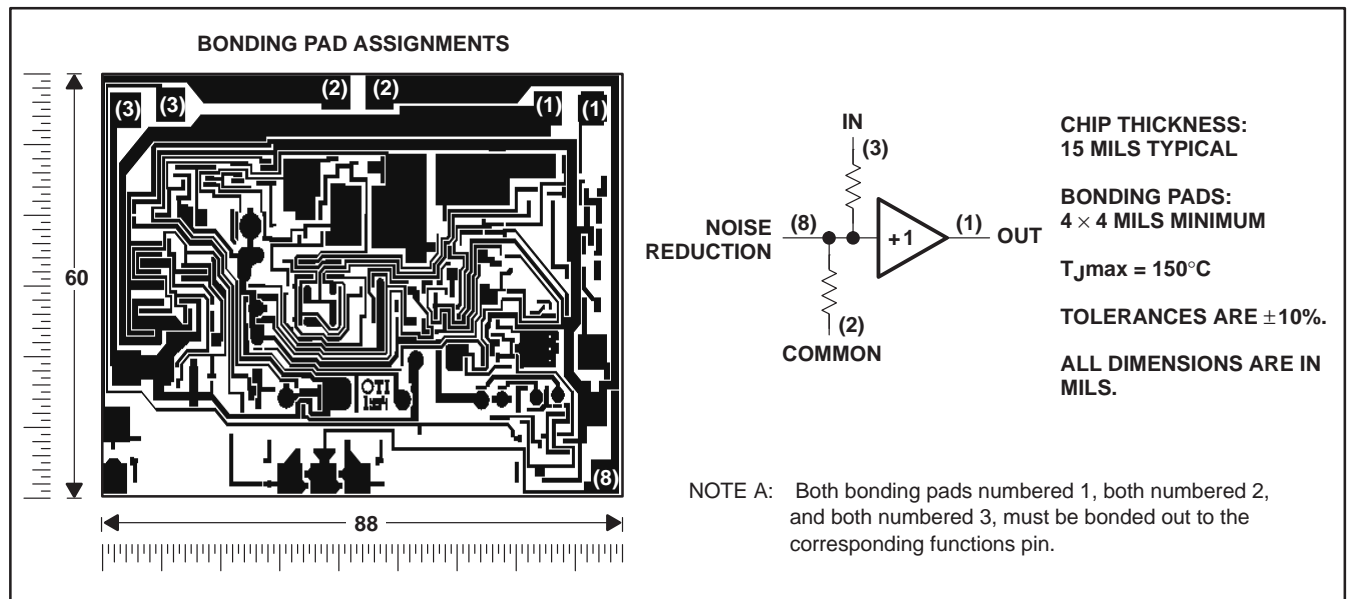
description (continued)

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.



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	$V_I = 4\text{ V}$		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	2.475		2.525	
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			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-150	±450	µV	
			Full range	±250			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }10\text{ mA}$		25°C	15	±160	µV	
			Full range	±250			
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	$V_I = 0\text{ to }5\text{ V}, V_O\text{ to }0.1\%$		25°C	20		µs	
	$V_I = 0\text{ to }5\text{ V}, V_O\text{ to }0.01\%$			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	$V_I = 4\text{ V}$		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	5.945 6.055			
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			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-150	±450	μV	
			Full range	±250			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }10\text{ mA}$		25°C	15	±160	μV	
			Full range	±250			
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	$V_I = 0\text{ to }12\text{ V}$, $V_O\text{ to }0.1\%$		25°C	20		μs	
	$V_I = 0\text{ to }12\text{ V}$, $V_O\text{ to }0.01\%$			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 †	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			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-150	±450	µV	
			Full range	±250			
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	$V_I = 0\text{ to }5\text{ V}$, $V_O\text{ to }0.1\%$		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 †	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			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-150	±450	µV	
			Full range	±250			
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	$V_I = 0\text{ to }12\text{ V}$, $V_O\text{ to }0.1\%$		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 †	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/°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			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-150	±450	µV	
			Full range	±250			
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	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	$V_I = 0\text{ to }5\text{ V}$, $V_O\text{ to }0.1\%$		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.

TLE2426, TLE2426Y
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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 †	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			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-150	±450	μV	
			Full range	±250			
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	$V_I = 0\text{ to }12\text{ V}$, $V_O\text{ to }0.1\%$		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	$C_{NR} = 0$	120		μV
		$C_{NR} = 1\ \mu\text{F}$	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	$C_{NR} = 0$	120		μV
		$C_{NR} = 1\ \mu\text{F}$	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

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Output current	vs Load capacitance	17

TYPICAL CHARACTERISTICS†

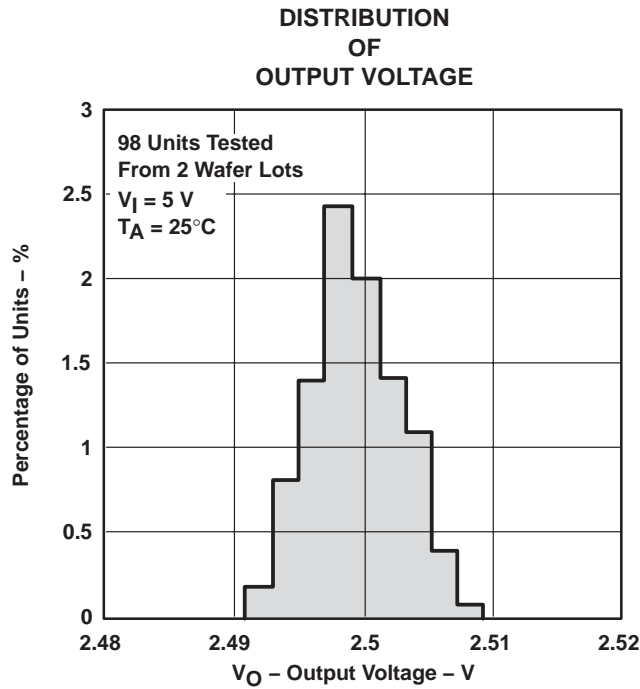


Figure 1

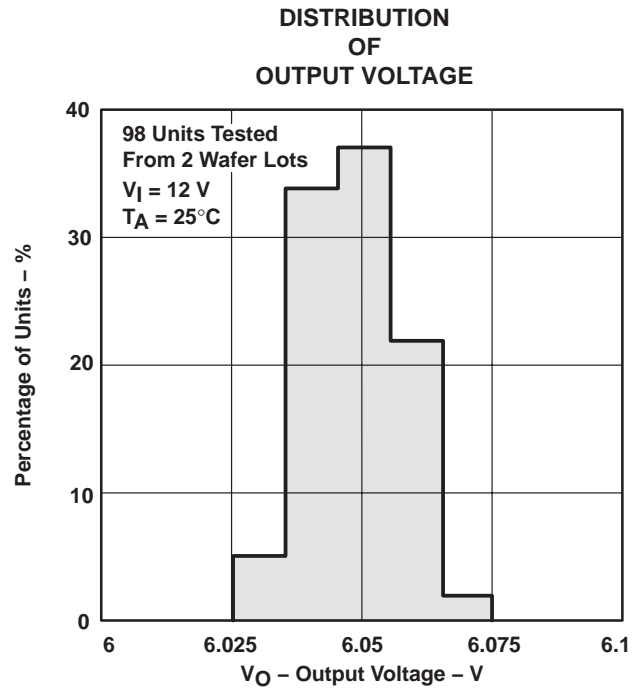


Figure 2

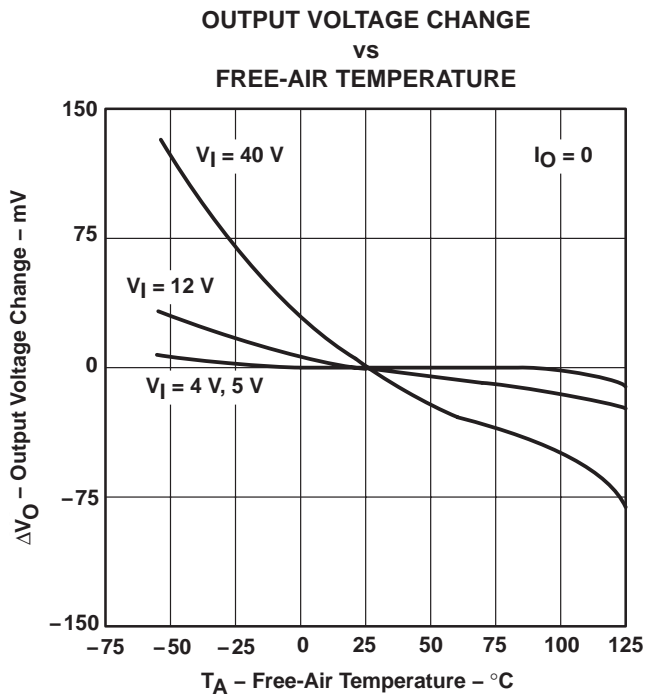


Figure 3

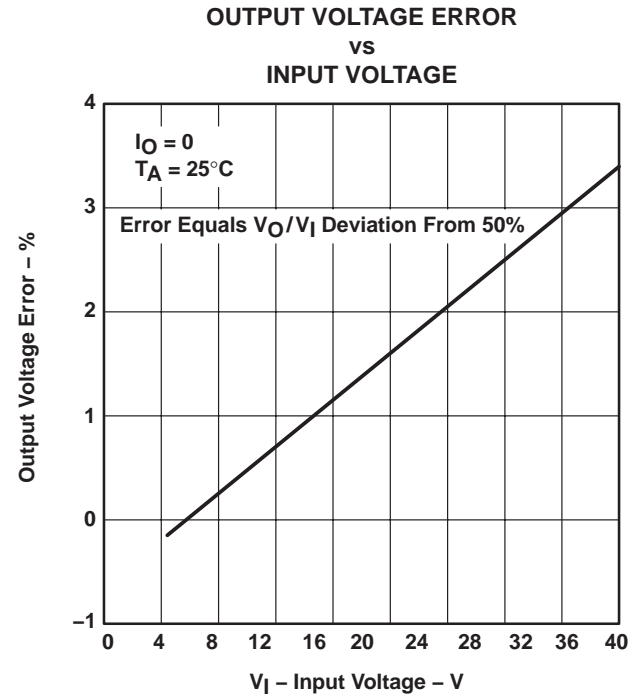


Figure 4

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

TLE2426, TLE2426Y
THE "RAIL SPLITTER"
PRECISION VIRTUAL GROUND

SLOS098D – AUGUST 1991 – REVISED MAY 1998

TYPICAL CHARACTERISTICS†

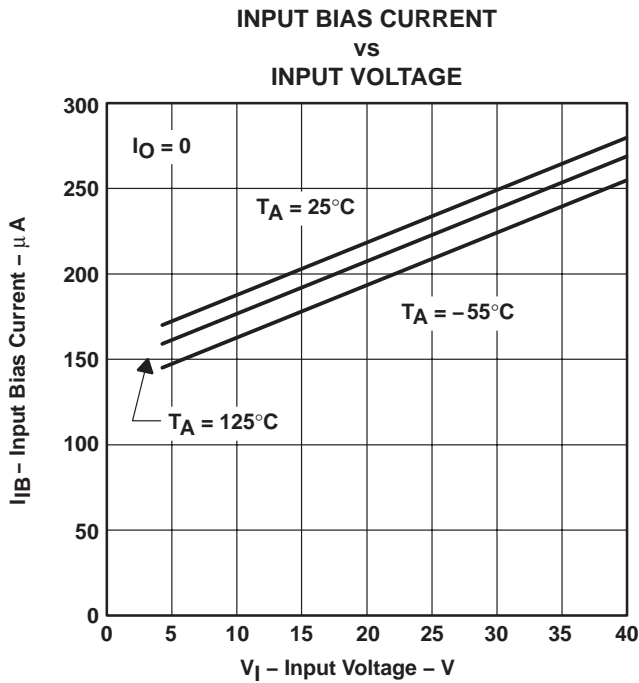


Figure 5

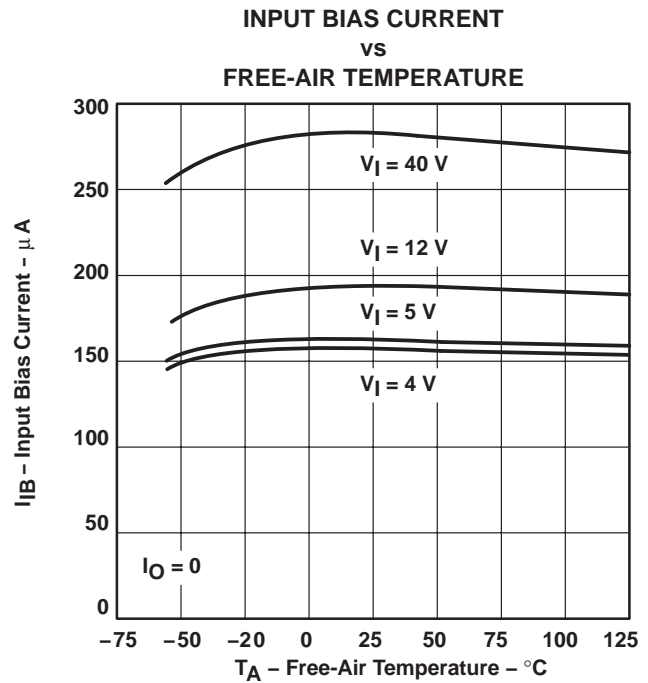


Figure 6

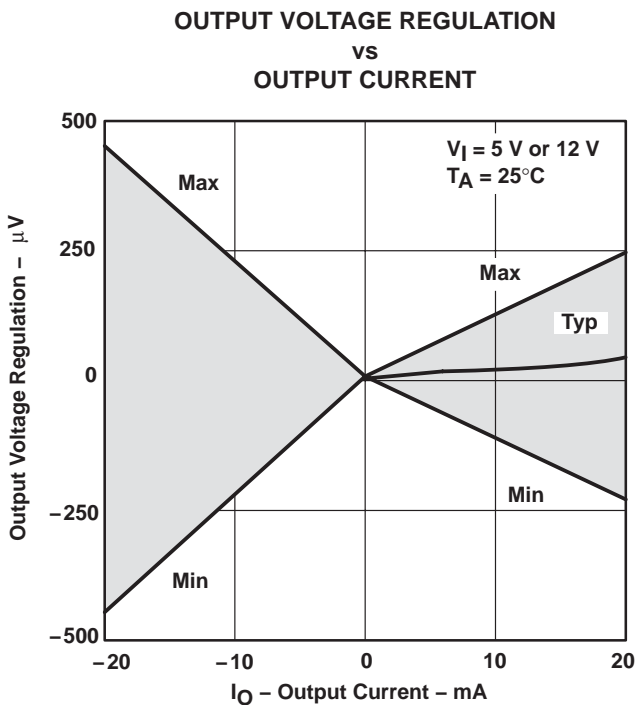


Figure 7

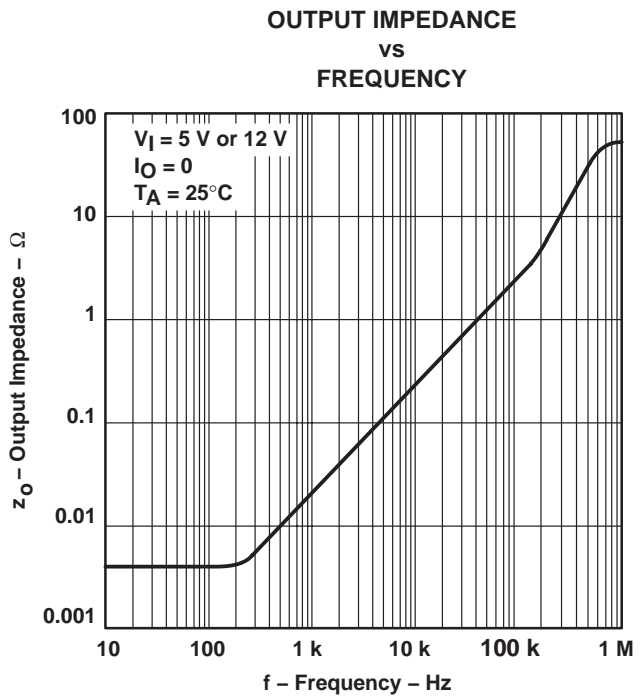


Figure 8

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

TYPICAL CHARACTERISTICS†

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 INPUT VOLTAGE

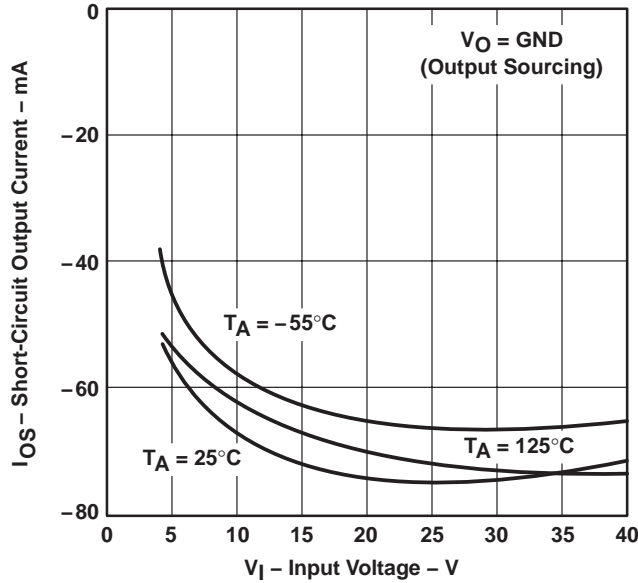


Figure 9

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 INPUT VOLTAGE

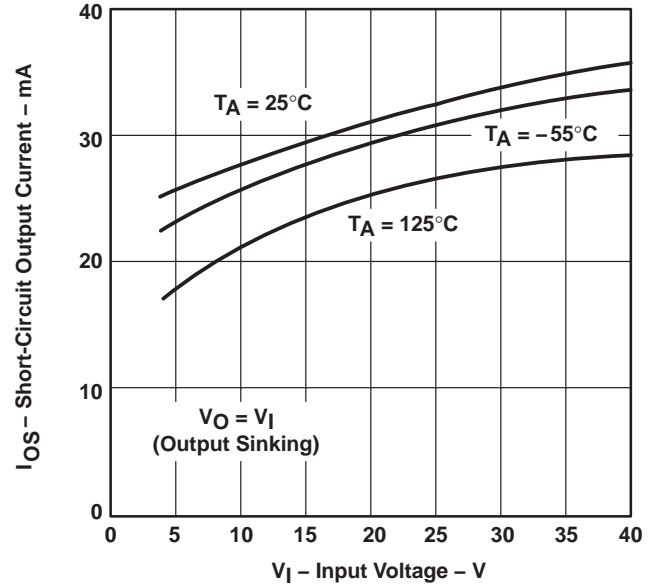


Figure 10

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 FREE-AIR TEMPERATURE

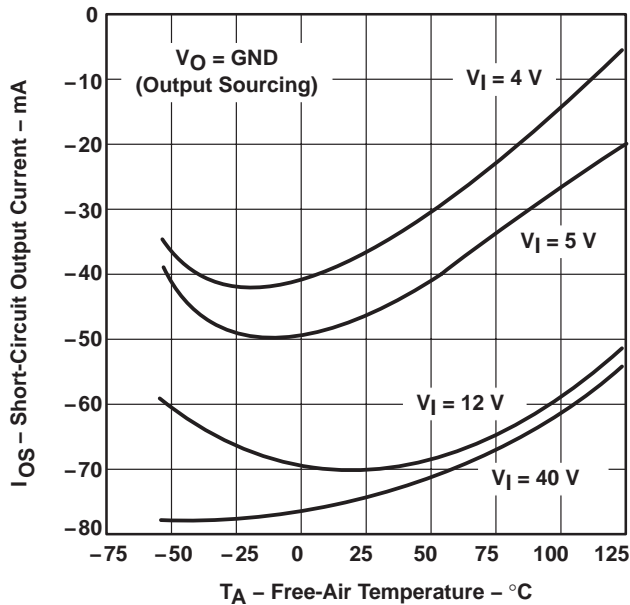


Figure 11

SHORT-CIRCUIT OUTPUT CURRENT
 vs
 FREE-AIR TEMPERATURE

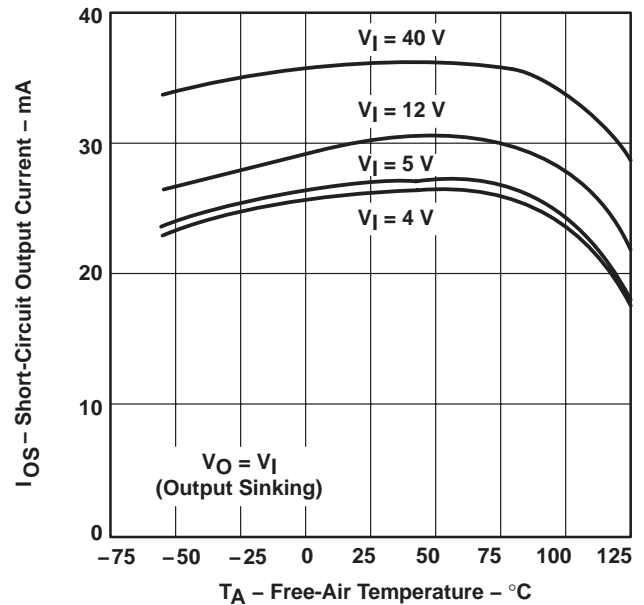


Figure 12

† 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

**RIPPLE REJECTION
 vs
 FREQUENCY**

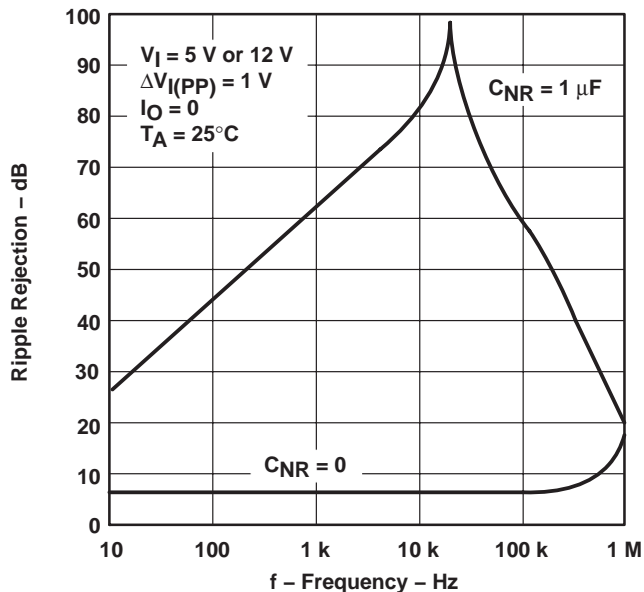


Figure 13

**SPECTRAL NOISE VOLTAGE DENSITY
 vs
 FREQUENCY**

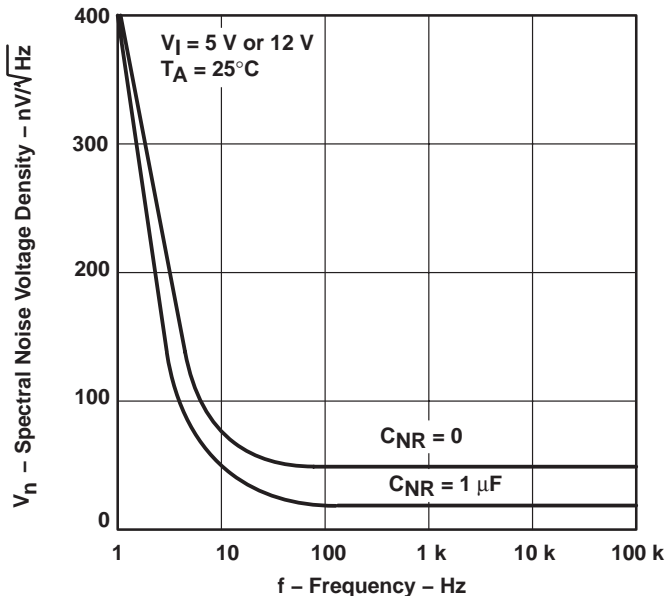


Figure 14

**OUTPUT VOLTAGE RESPONSE
 TO OUTPUT CURRENT STEP**

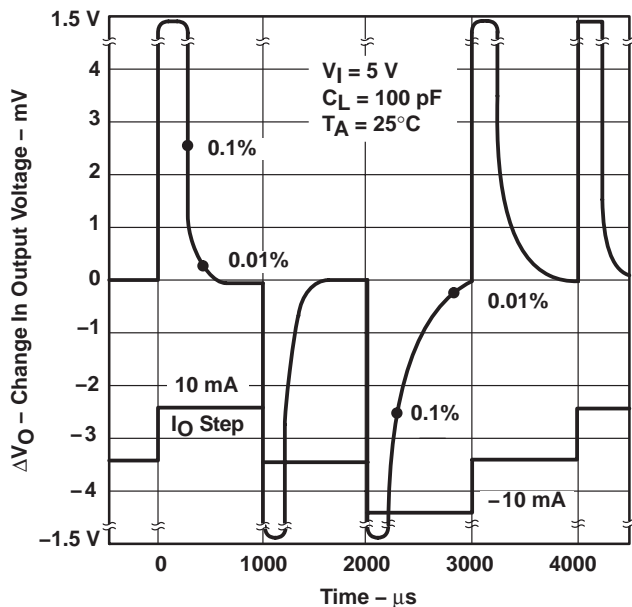


Figure 15

OUTPUT VOLTAGE POWER-UP RESPONSE

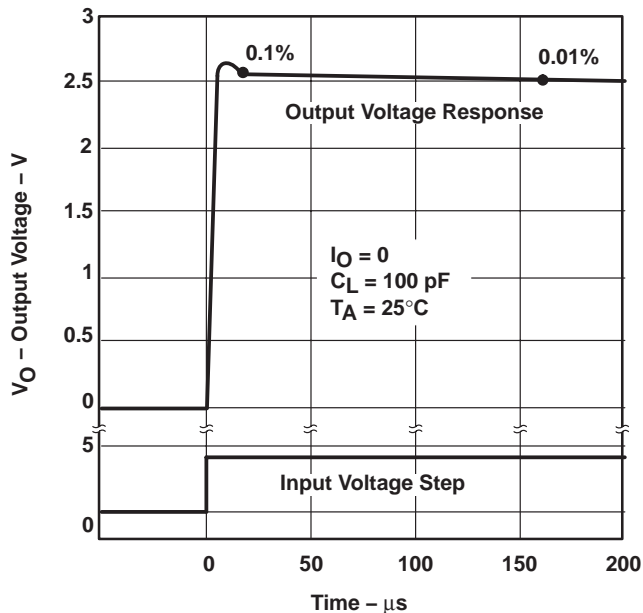


Figure 16



TYPICAL CHARACTERISTICS

STABILITY RANGE
OUTPUT CURRENT
VS
LOAD CAPACITANCE

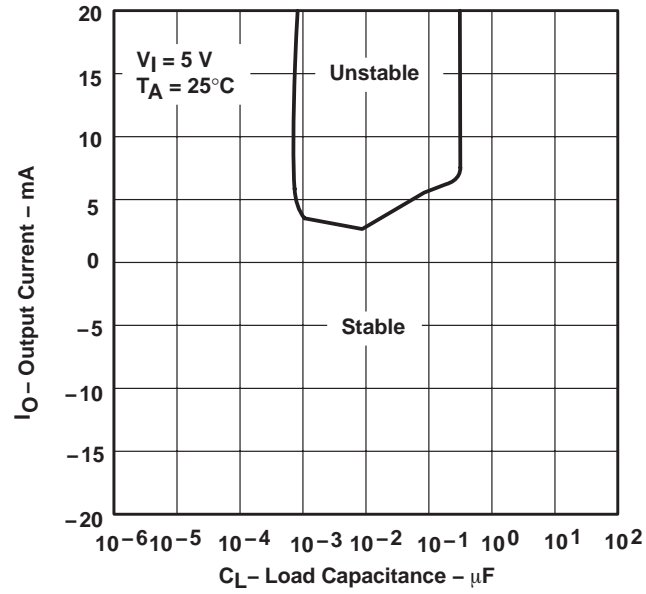


Figure 17

TLE2426, TLE2426Y
THE "RAIL SPLITTER"
PRECISION VIRTUAL GROUND

SLOS098D - AUGUST 1991 - REVISED MAY 1998

MACROMODEL INFORMATION

```

* 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
      INPUT
      COMMON
      OUTPUT
*
*
*
.SUBCKT TLE2426      1      3      4      5

```

```

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



```



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-9555602Q2A	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	-55 to 125		
5962-9555602QPA	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	-55 to 125		
TLE2426CD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426C	Samples
TLE2426CDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426C	Samples
TLE2426CDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426C	Samples
TLE2426CDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426C	Samples
TLE2426CLP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type		2426C	Samples
TLE2426CLPE3	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type		2426C	Samples
TLE2426CLPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type		2426C	Samples
TLE2426CP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2426CP	Samples
TLE2426ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426I	Samples
TLE2426IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426I	Samples
TLE2426IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426I	Samples
TLE2426IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		2426I	Samples
TLE2426ILP	ACTIVE	TO-92	LP	3	1000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type		2426I	Samples
TLE2426ILPR	ACTIVE	TO-92	LP	3	2000	Pb-Free (RoHS)	CU SN	N / A for Pkg Type		2426I	Samples
TLE2426IP	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2426IP	Samples
TLE2426IPE4	ACTIVE	PDIP	P	8	50	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type		TLE2426IP	Samples

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLE2426MD	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	2426M	
TLE2426MDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-55 to 125	2426M	
TLE2426MFKB	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI	-55 to 125		
TLE2426MJGB	OBSOLETE	CDIP	JG	8		TBD	Call TI	Call TI	-55 to 125		
TLE2426MLP	OBSOLETE	TO-92	LP	3		TBD	Call TI	Call TI	-55 to 125		
TLE2426MP	OBSOLETE	PDIP	P	8		TBD	Call TI	Call TI	-55 to 125		

(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.

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

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

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

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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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
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

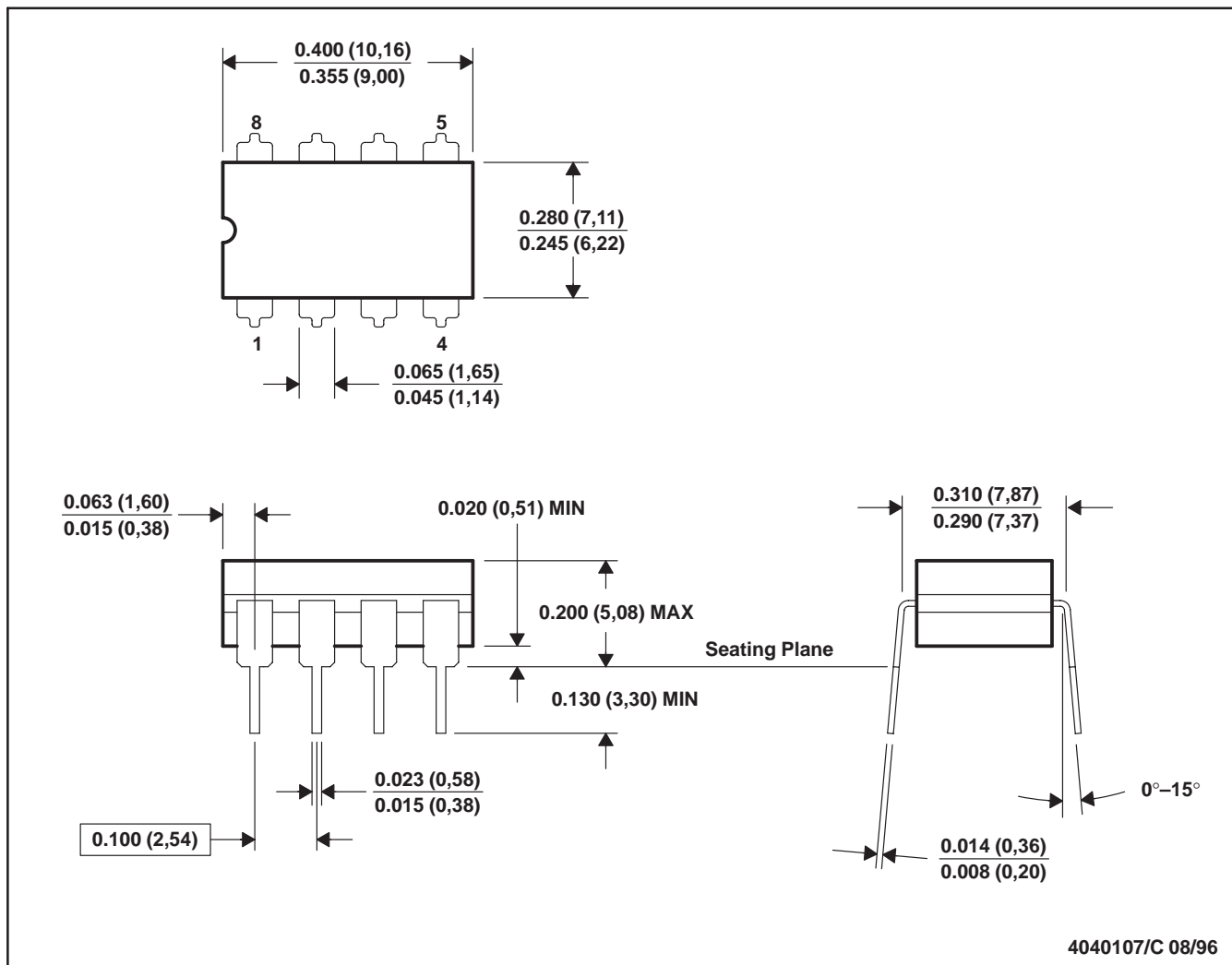
TAPE AND REEL BOX DIMENSIONS


*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

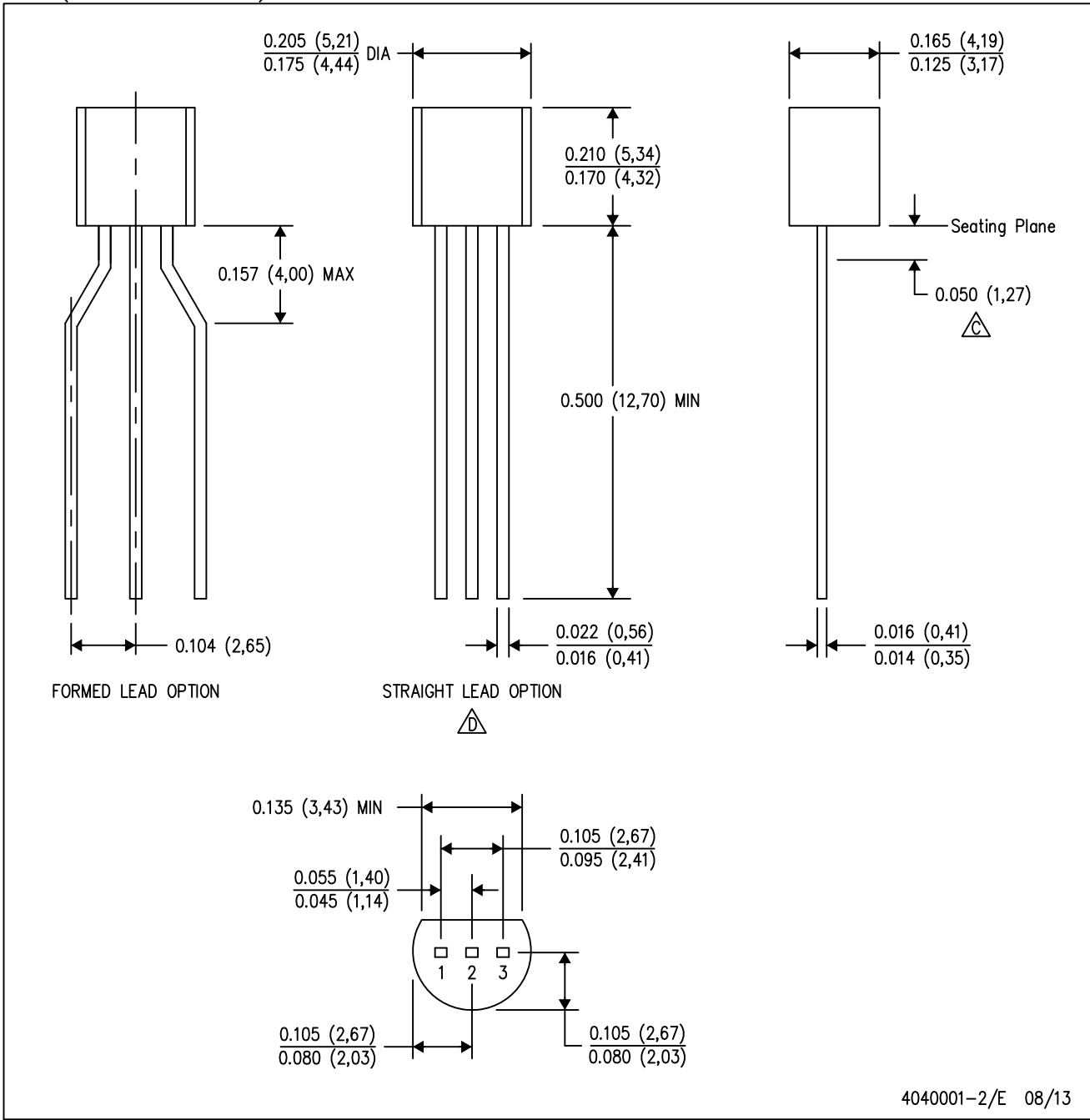


NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
 D. Body width does not include interlead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



MECHANICAL DATA

LP (O-PBCY-W3)

PLASTIC CYLINDRICAL PACKAGE



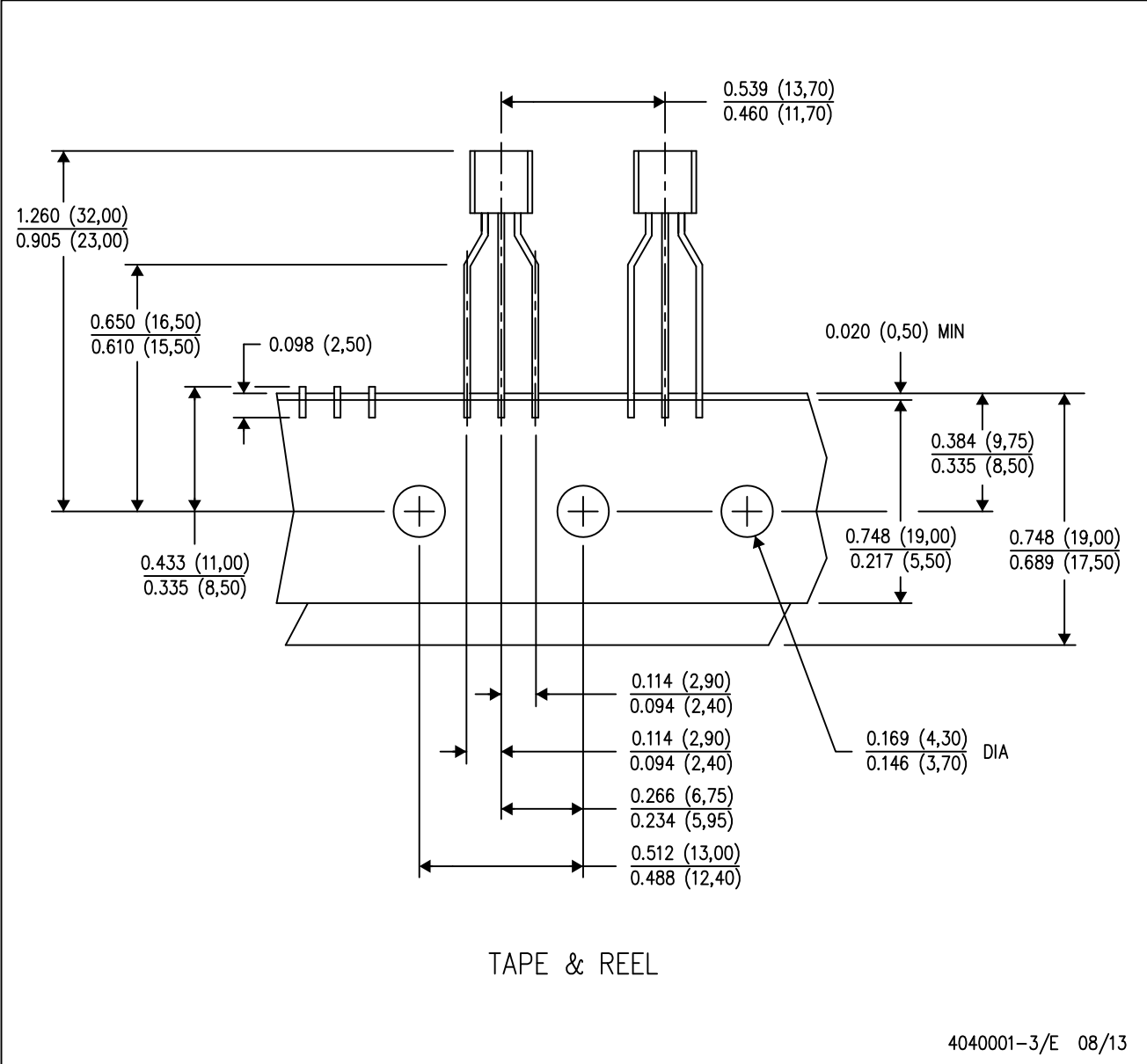
4040001-2/E 08/13

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  Lead dimensions are not controlled within this area.
 -  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.
 Specific products can be offered in limited combinations of shipping mediums and lead options.
 Consult product folder for more information on available options.

MECHANICAL DATA

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 Formed Lead Option package.

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Электрон
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