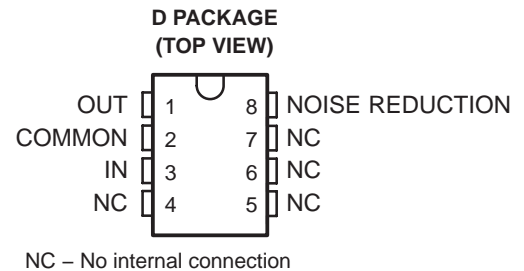


- **Controlled Baseline**
 - One Assembly/Test Site, One Fabrication Site
- **Extended Temperature Performance of –55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **One-Half V_I Virtual Ground for Analog Systems**
- **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**
 - –102 μ V Typ at $I_O = 0$ mA to –10 mA
 - 49 μ V Typ at $I_O = 0$ mA to 10 mA
- **Low-Impedance Output . . . 0.0075 Ω Typ**
- **Noise Reduction Pin**

† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life. Such qualification testing should not be viewed as justifying use of this component beyond specified performance and environmental limits.

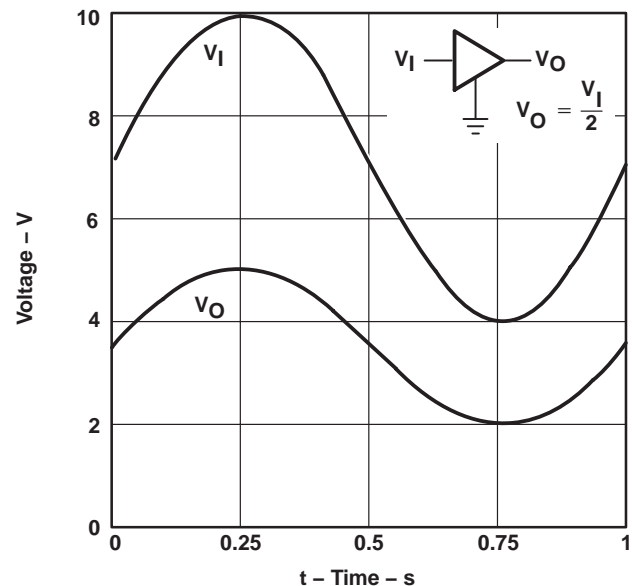


description/ordering information

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. TI 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. For increased performance, the 8-pin package provides 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.

INPUT/OUTPUT TRANSFER CHARACTERISTICS



Initial output tolerance for a single 5-V or 12-V system is better than 1% 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.



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**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

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TLE2426-EP
RAIL SPLITTER
PRECISION VIRTUAL GROUND

SGLS345 – JUNE 2006

ORDERING INFORMATION

T _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-55°C to 125°C	SOIC (D)	Tape and reel	TLE2426MDREP	2426EP

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

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	-55°C to 125°C
Operating junction temperature, T _J (see Note 2)	150°C
Storage temperature range, T _{stg} (see Note 2)	150°C
Lead temperature 1,6 mm (1/16 in) from case for 10 s	260°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. 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.
2. Long-term high-temperature storage and/or usage at the absolute maximum ratings may result in a reduction of overall device life. See http://www.ti.com/ep_quality for additional information on enhanced plastic packaging.

DISSIPATION RATING TABLE

PACKAGE	T _A ≤ 25°C POWER RATING	DERATING FACTOR ABOVE T _A = 25°C	T _A = 70°C POWER RATING	T _A = 85°C POWER RATING	T _A = 125°C POWER RATING
D	1102 mW	10.3 mW/°C	638.5 mW	484 mW	72.1 mW

recommended operating conditions

	MIN	MAX	UNIT
Input voltage, V _I	4	40	V
Operating free-air temperature, T _A	-55	125	°C



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

PARAMETER	TEST CONDITIONS		T_A^\dagger	MIN	TYP	MAX	UNIT
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
		$V_I = 4\text{ to }40\text{ V}$	25°C	350			
			Full range	400			
Output voltage regulation (sourcing current) \ddagger	$I_O = 0\text{ to }-10\text{ mA}$		25°C	-0.102	± 0.7		mV
			Full range	± 10			
	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-0.121	± 1.4		
Output voltage regulation (sinking current) \ddagger	$I_O = 0\text{ to }10\text{ mA}$		25°C	0.049	± 0.5		mV
	$I_O = 0\text{ to }8\text{ mA}$		Full range	± 10			
	$I_O = 0\text{ to }20\text{ mA}$		25°C	0.175	± 1.4		
Output impedance \ddagger			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
		$C_{NR} = 1\ \mu\text{F}$		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	$V_I = 0\text{ to }5\text{ V}, V_O\text{ to }0.1\%$		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.

\ddagger The listed values are not production tested.

TLE2426-EP
RAIL SPLITTER
PRECISION VIRTUAL GROUND

SGLS345 – JUNE 2006

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

PARAMETER	TEST CONDITIONS		T_A †	MIN	TYP	MAX	UNIT
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	300		µA
		$V_I = 4\text{ to }40\text{ V}$	25°C	350			
			Full range	400			
Output voltage regulation (sourcing current)‡	$I_O = 0\text{ to }-10\text{ mA}$		25°C	-1.48	±10		mV
			Full range	±10			
Output voltage regulation (sinking current)‡	$I_O = 0\text{ to }-20\text{ mA}$		25°C	-3.9	±10		mV
	$I_O = 0\text{ to }10\text{ mA}$		25°C	2.27	±10		
	$I_O = 0\text{ to }8\text{ mA}$		Full range	±10			
Output impedance‡	$I_O = 0\text{ to }20\text{ mA}$		25°C	4.3	±10		mΩ
			25°C	7.5	22.5		
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.



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†

DISTRIBUTION OF OUTPUT VOLTAGE

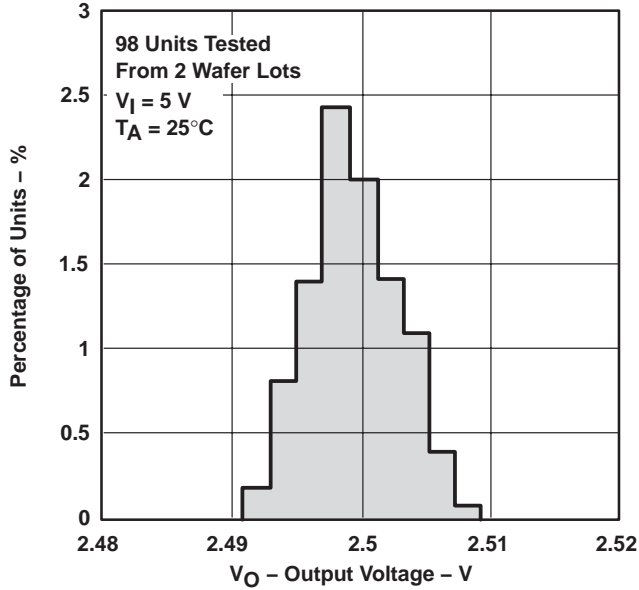


Figure 1

DISTRIBUTION OF OUTPUT VOLTAGE

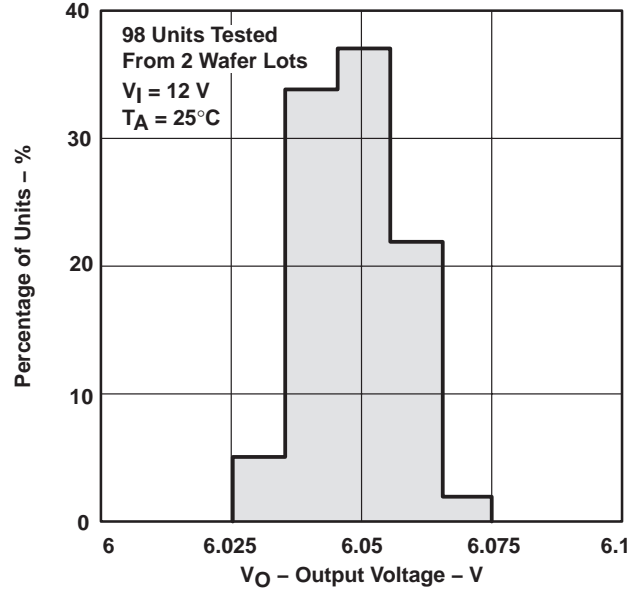


Figure 2

OUTPUT VOLTAGE CHANGE vs FREE-AIR TEMPERATURE

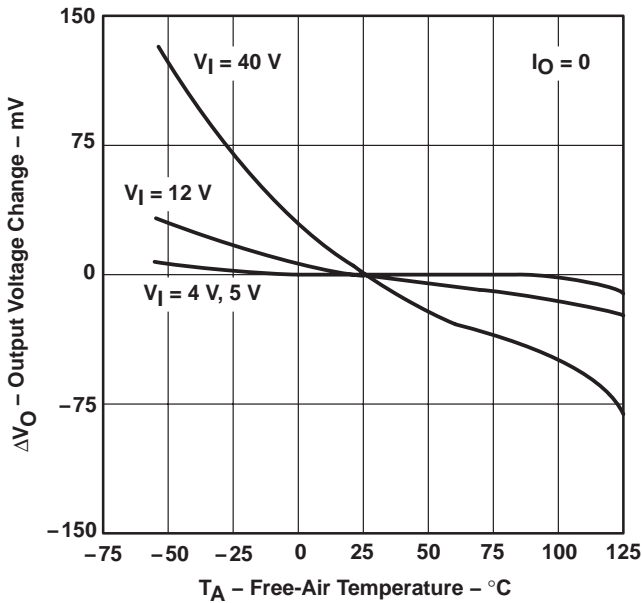


Figure 3

OUTPUT VOLTAGE ERROR vs INPUT VOLTAGE

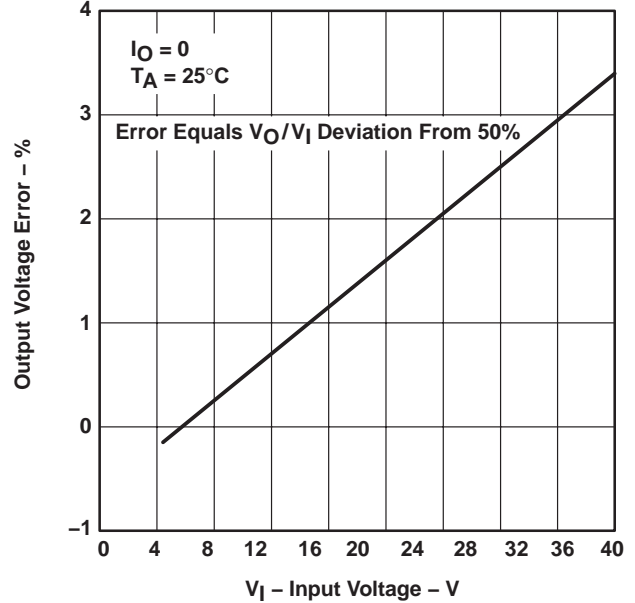


Figure 4

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

TYPICAL CHARACTERISTICS†

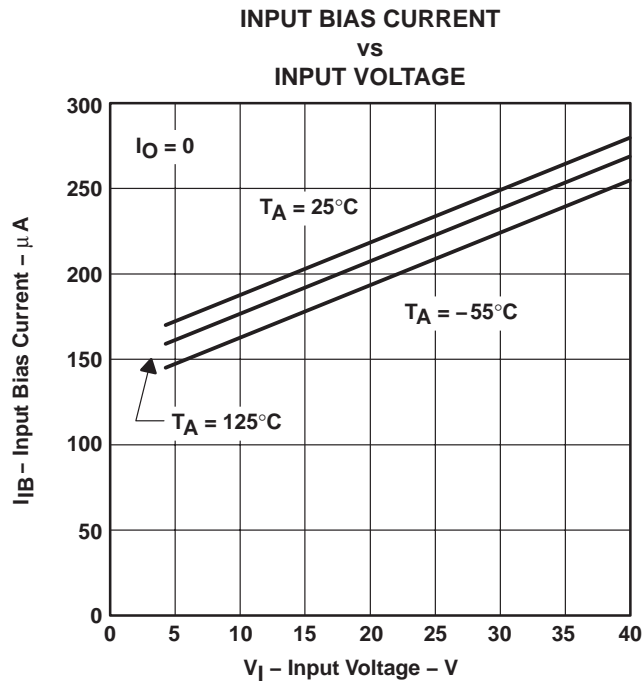


Figure 5

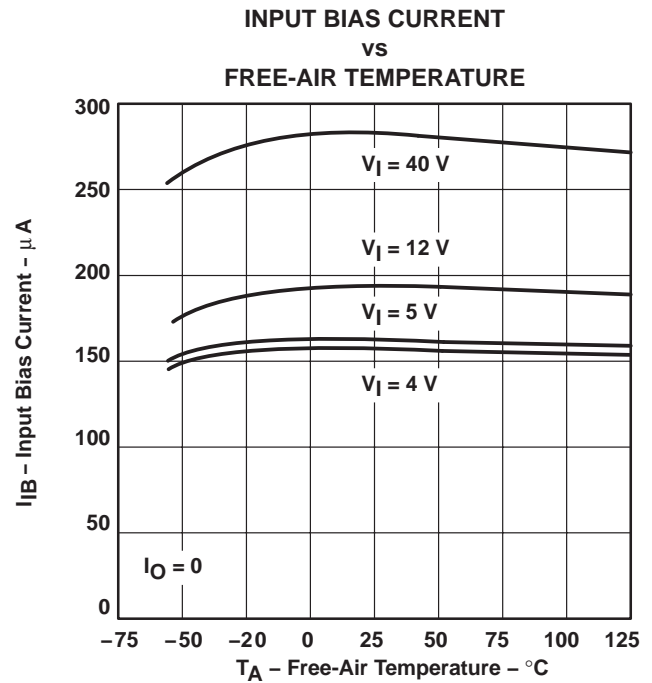


Figure 6

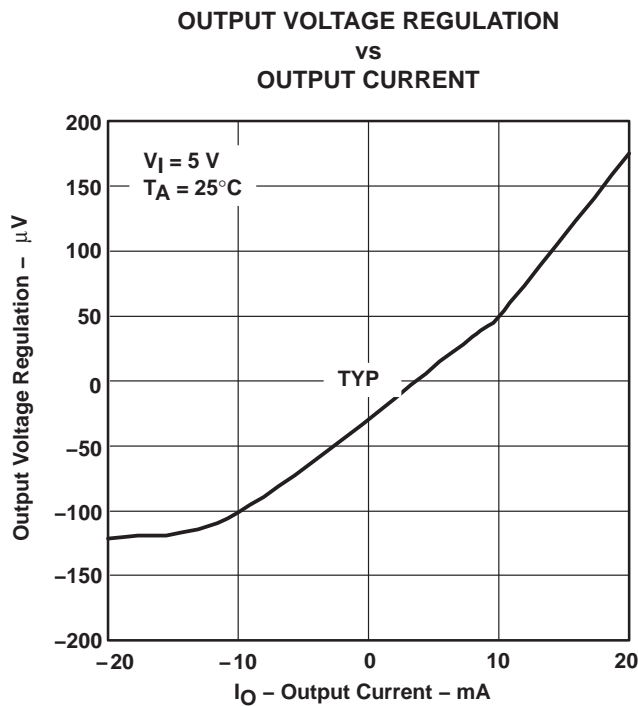


Figure 7

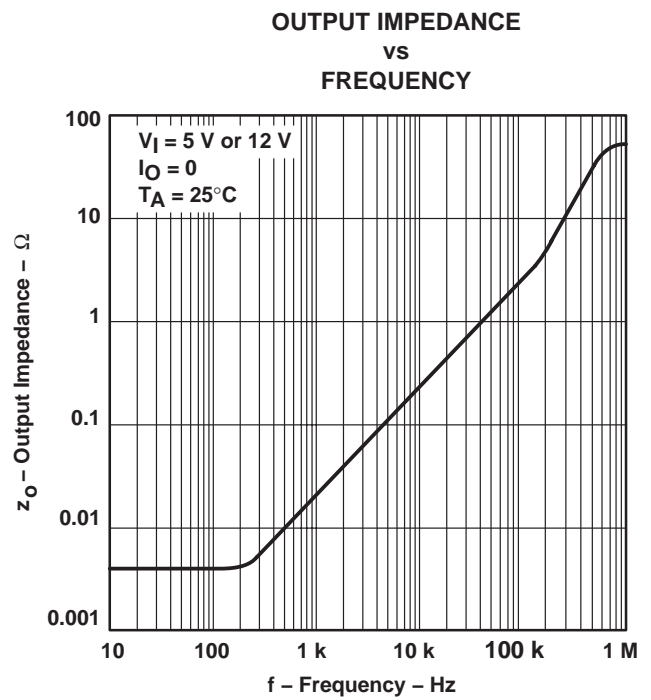


Figure 8

† 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**

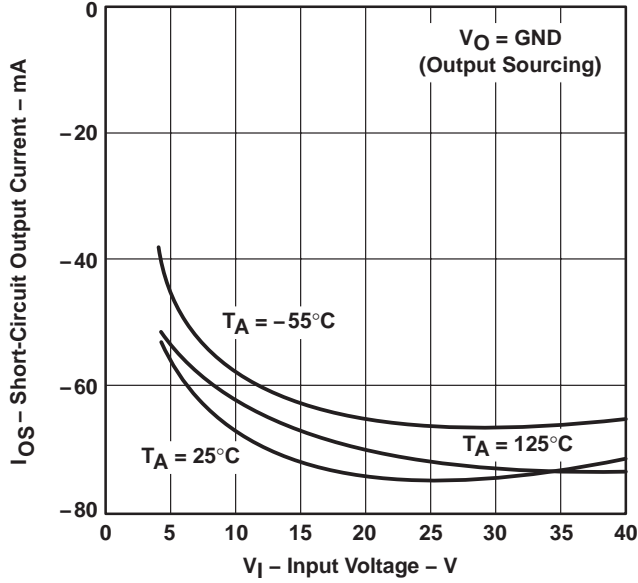


Figure 9

**SHORT-CIRCUIT OUTPUT CURRENT
 VS
 INPUT VOLTAGE**

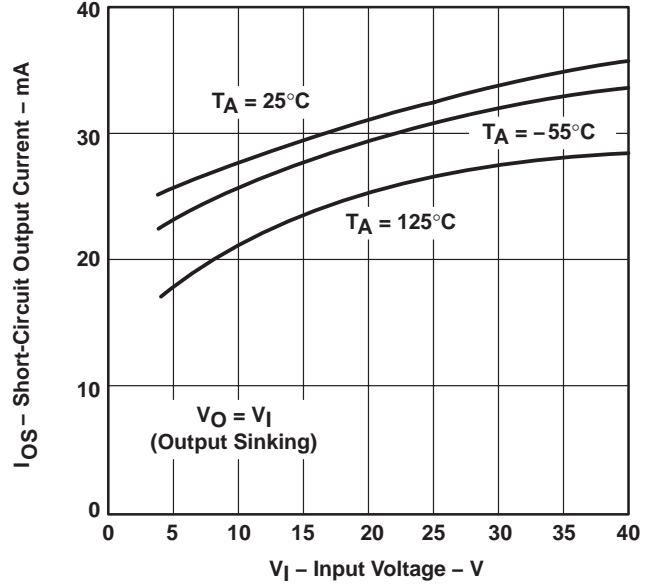


Figure 10

**SHORT-CIRCUIT OUTPUT CURRENT
 VS
 FREE-AIR TEMPERATURE**

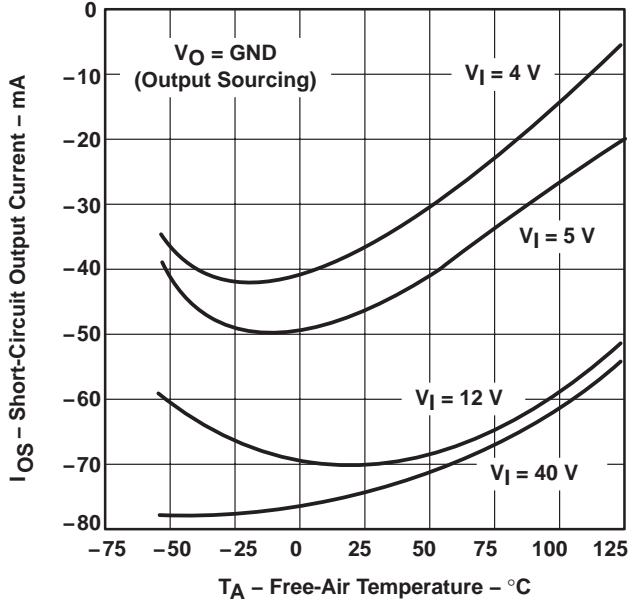


Figure 11

**SHORT-CIRCUIT OUTPUT CURRENT
 VS
 FREE-AIR TEMPERATURE**

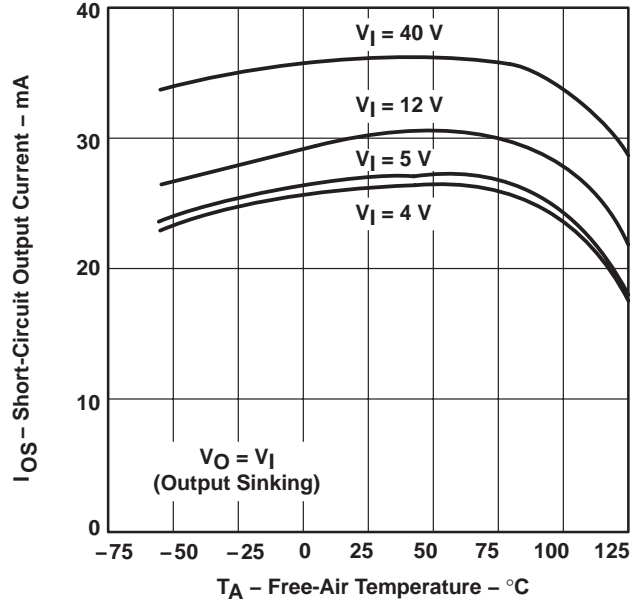


Figure 12

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

TYPICAL CHARACTERISTICS

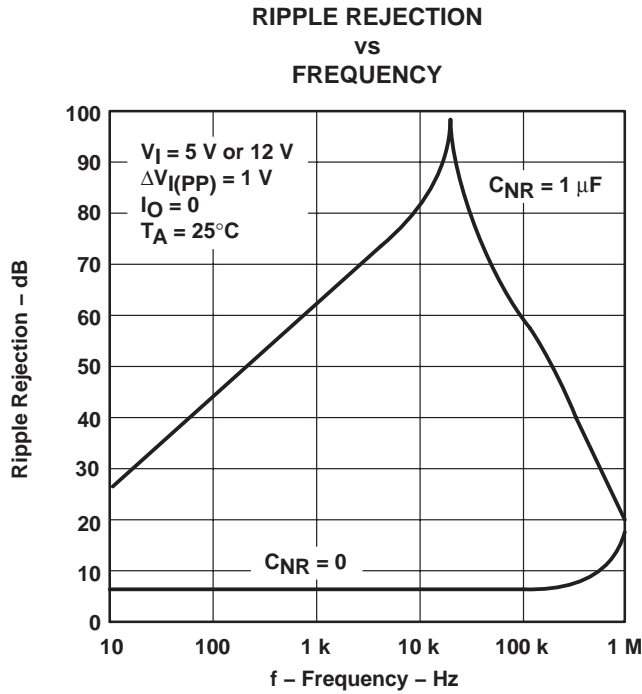


Figure 13

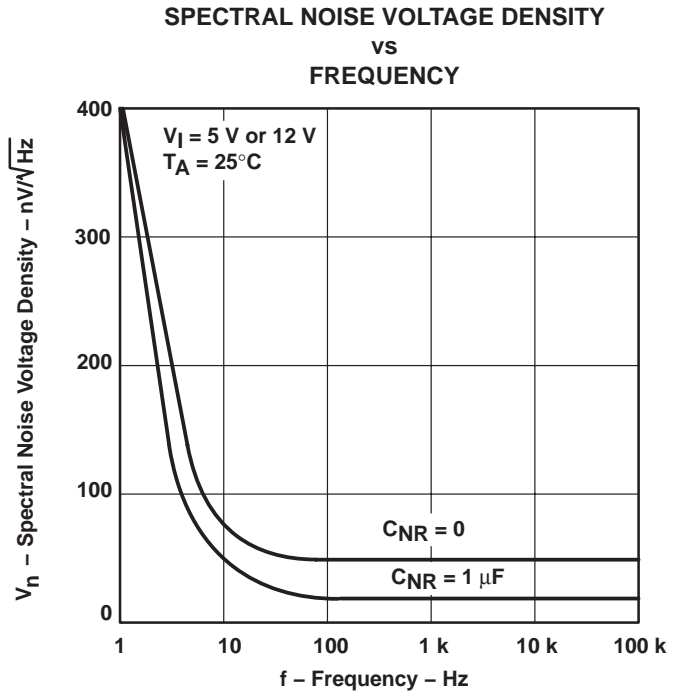


Figure 14

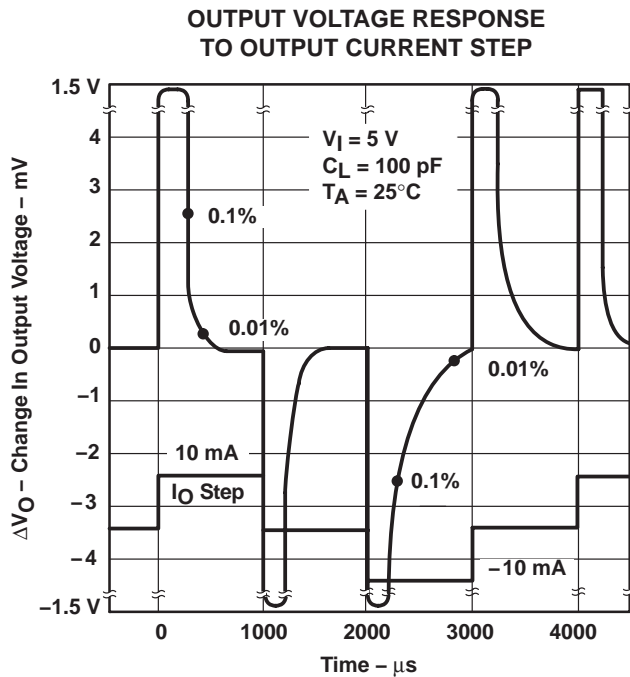


Figure 15

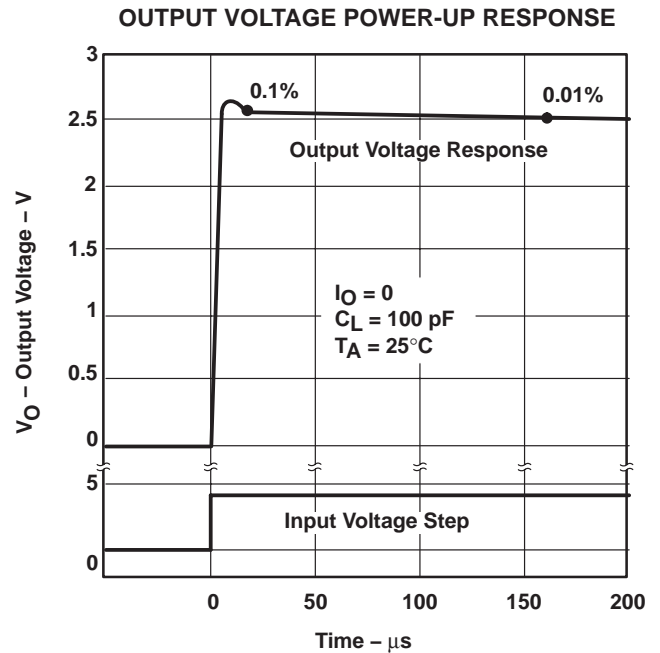


Figure 16

TYPICAL CHARACTERISTICS

**STABILITY RANGE
OUTPUT CURRENT
vs
LOAD CAPACITANCE**

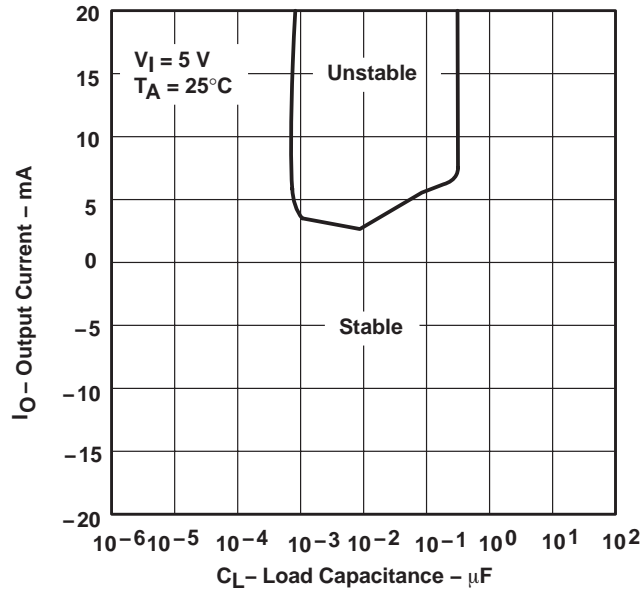
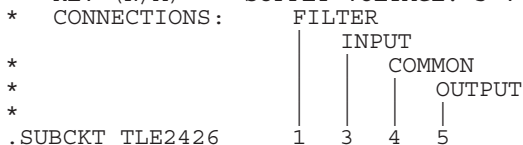


Figure 17

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



```

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

```

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
TLE2426MDREP	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)
TLE2426MDREP	SOIC	D	8	2500	350.0	350.0	43.0



D0008A

PACKAGE OUTLINE

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed $.006$ [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE:8X



SOLDER MASK DETAILS

4214825/C 02/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.125 MM] THICK STENCIL
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

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

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