- **Output Swing Includes Both Supply Rails**
- **Extended Common-Mode Input Voltage Range . . . 0 V to 4.5 V (Min) with 5-V Single Supply**
- **No Phase Inversion**
- **Low Noise . . . 18 nV/√Hz Typ at f = 1 kHz**
- **Low Input Offset Voltage**
  950 μV Max at T_A = 25°C (TLV243xA)
- **Low Input Bias Current . . . 1 pA Typ**
- **Very Low Supply Current . . . 125 μA Per Channel Max**
- **600-Ω Output Drive**
- **Macromodel Included**
- **Available in Q-Temp Automotive**
  HighRel Automotive Applications
  Configuration Control / Print Support
  Qualification to Automotive Standards

description

The TLV243x and TLV243xA are low-voltage operational amplifier from Texas Instruments. The common-mode input voltage range for each device is extended over the typical CMOS amplifiers making them suitable for a wide range of applications. In addition, these devices do not phase invert when the common-mode input is driven to the supply rails. This satisfies most design requirements without paying a premium for rail-to-rail input performance. They also exhibit rail-to-rail output performance for increased dynamic range in single- or split-supply applications. This family is fully characterized at 3-V and 5-V supplies and is optimized for low-voltage operation. The TLV243x only requires 100 μA (typ) of supply current per channel, making it ideal for battery-powered applications. The TLV243x also has increased output drive over previous rail-to-rail operational amplifiers and can drive 600-Ω loads for telecom applications.

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

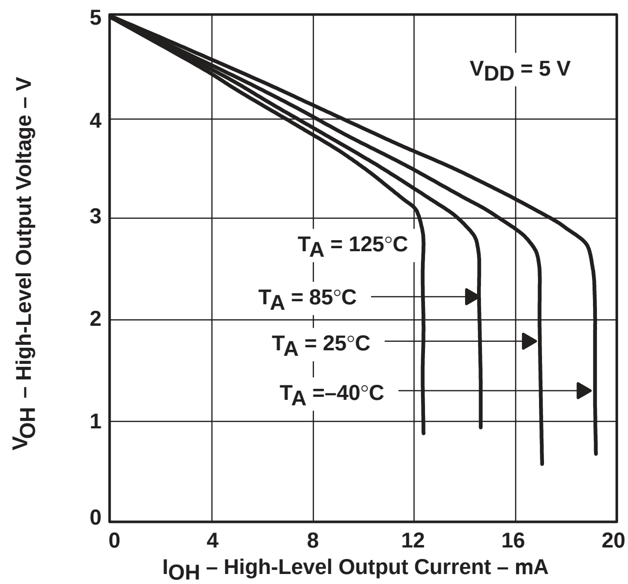


Figure 1

The other members in the TLV243x family are the high-power, TLV244x, and micro-power, TLV2422, versions.

The TLV243x, exhibiting high input impedance and low noise, is excellent for small-signal conditioning for high-impedance sources, such as piezoelectric transducers. Because of the micropower dissipation levels and low-voltage operation, these devices work well in hand-held monitoring and remote-sensing applications. In addition, the rail-to-rail output feature with single- or split-supplies makes this family a great choice when interfacing with analog-to-digital converters (ADCs). For precision applications, the TLV243xA is available and has a maximum input offset voltage of 950 μV.

If the design requires single operational amplifiers, see the TI TLV2211/21/31. This is a family of rail-to-rail output operational amplifiers in the SOT-23 package. Their small size and low power consumption, make them ideal for high density, battery-powered equipment.

TLV2432 and TLV2432A AVAILABLE OPTIONS

T_A	V_{IO}max AT 25°C	PACKAGED DEVICES				
		SMALL OUTLINE (D)	CHIP CARRIER (FK)	CERAMIC DIP (JG)	TSSOP (PW)	CERAMIC FLAT PACK (U)
0°C to 70°C	2.5 mV	TLV2432CD	—	—	TLV2432CPW	—
–40°C to 85°C	950 µV 2.5 mV	TLV2432AID TLV2432ID	— —	— —	TLV2432AIPW —	— —
–40°C to 125°C	950 µV 2.5 mV	TLV2432AQD TLV2432QD	— —	— —	— —	— —
–55°C to 125°C	950 µV 2.5 mV	— —	TLV2432AMFK TLV2432MFK	TLV2432AMJG TLV2432MJG	— —	TLV2432AMU TLV2432MU

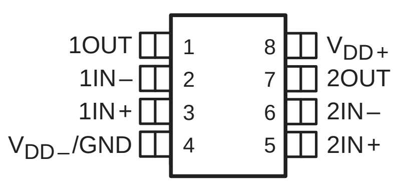
The D packages are available taped and reeled. Add R suffix to device type (e.g., TLV2432CDR). The PW package is available only left-end taped and reeled.

TLV2434 AVAILABLE OPTIONS

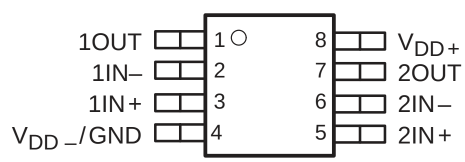
T_A	V_{IO}max AT 25°C	PACKAGED DEVICES	
		SMALL OUTLINE (D)	TSSOP (PW)
0°C to 70°C	2.5 mV	TLV2434CD	TLV2434CPW
–40°C to 125°C	950 µV 2.5 mV	TLV2434AID TLV2434ID	TLV2434AIPW TLV2434IPW

The D packages are available taped and reeled. Add R suffix to device type (e.g., TLV2434CDR). The PW package is available only left-end taped and reeled.

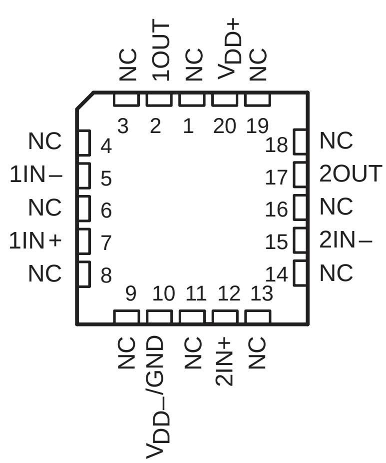
TLV2432
D OR JG PACKAGE
(TOP VIEW)



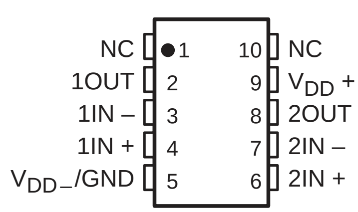
TLV2432
PW PACKAGE
(TOP VIEW)



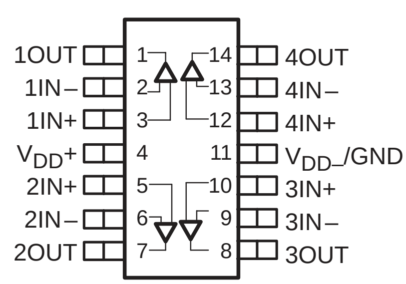
TLV2432
FK PACKAGE
(TOP VIEW)



TLV2432
U PACKAGE
(TOP VIEW)

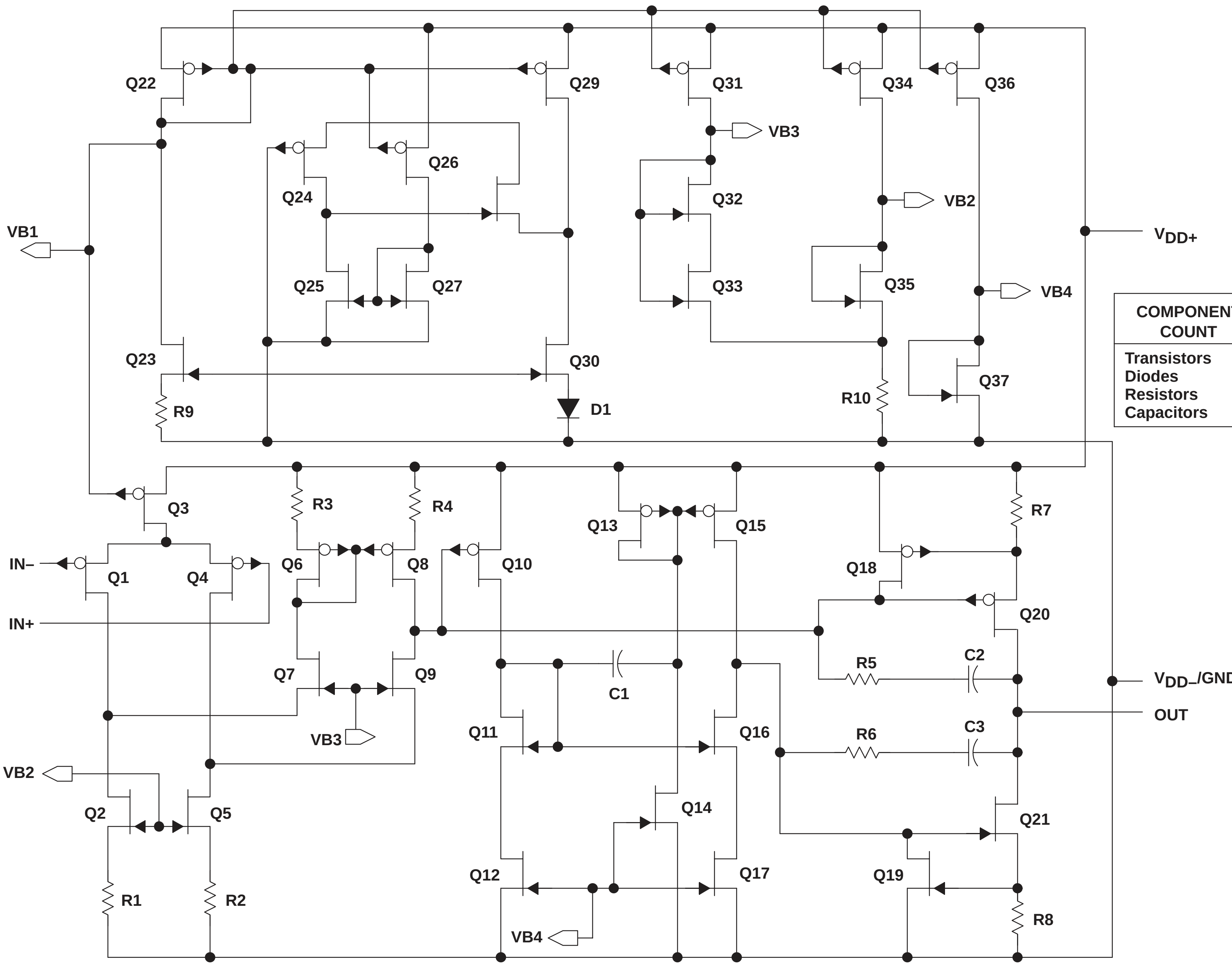


TLV2434
D OR PW PACKAGE
(TOP VIEW)



NC – No internal connection

equivalent schematic (each amplifier)



COMPONENT COUNT	
Transistors	69
Diodes	5
Resistors	26
Capacitors	6

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

Supply voltage, V_{DD} (see Note 1) . . . . 12 V
Differential input voltage, V_{ID} (see Note 2) . . . . $\pm V_{DD}$
Input voltage, V_I (any input, see Note 1): C and I suffix . . . . –0.3 V to V_{DD}
Input current, I_I (each input) . . . . ±5 mA
Output current, I_O . . . . ±50 mA
Total current into V_{DD+} . . . . ±50 mA
Total current out of V_{DD-} . . . . ±50 mA
Duration of short-circuit current at (or below) 25°C (see Note 3) . . . . unlimited
Continuous total dissipation . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A: C suffix . . . . 0°C to 70°C
I suffix (dual) . . . . –40°C to 85°C
I suffix (quad) . . . . –40°C to 125°C
Q suffix . . . . –40°C to 125°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 . . . . 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. All voltage values, except differential voltages, are with respect to the midpoint between V_{DD+} and V_{DD-}.
2. Differential voltages are at IN+ with respect to IN–. Excessive current flows if input is brought below V_{DD-} – 0.3 V.
3. 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	$T_A \le 25°C$ 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 (8)	725 mW	5.8 mW/°C	464 mW	377 mW	145 mW
D (14)	1022 mW	7.6 mW/°C	900 mW	777 mW	450 mW
FK	1375 mW	11.0 mW/°C	880 mW	715 mW	275 mW
JG	1050 mW	8.4 mW/°C	672 mW	546 mW	210 mW
PW (8)	525 mW	4.2 mW/°C	336 mW	273 mW	105 mW
PW (14)	720 mW	5.6 mW/°C	634 mW	547 mW	317 mW
U	675 mW	5.4 mW/°C	432 mW	350 mW	135 mW

recommended operating conditions

	C SUFFIX		I SUFFIX		Q SUFFIX		M SUFFIX		UNIT
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
Supply voltage, V_{DD}	2.7	10	2.7	10	2.7	10	2.7	10	V
Input voltage range, V_I	V_{DD-}	$V_{DD+}-0.8$	V_{DD-}	$V_{DD+}-0.8$	V_{DD-}	$V_{DD+}-0.8$	V_{DD-}	$V_{DD+}-0.8$	V
Common-mode input voltage, V_{IC}	V_{DD-}	$V_{DD+}-1.3$	V_{DD-}	$V_{DD+}-1.3$	V_{DD-}	$V_{DD+}-1.3$	V_{DD-}	$V_{DD+}-1.3$	V
Operating free-air temperature, T_A	0	70	–40	125	–40	125	–55	125	°C

electrical characteristics at specified free-air temperature, V_{DD} = 3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLV243x MIN	TLV243x TYP	TLV243x MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, V_{DD}± = ±1.5 V, R_S = 50 Ω	TLV243xC, TLV243xI	25°C		300	2000	µV
				Full range			2500	
			TLV243xAI	25°C		300	950	
				Full range			1500	
α_{VIO}	Temperature coefficient of input offset voltage	V_{IC} = 0, V_O = 0,	V_{DD}± = ±1.5 V, R_S = 50 Ω	25°C to 70°C		2		µV/°C
	Input offset voltage long-term drift (see Note 4)			25°C		0.003		µV/mo
I_{IO}	Input offset current			25°C		0.5		pA
				Full range			150	
I_{IB}	Input bias current			25°C		1		pA
				Full range			150	
V_{ICR}	Common-mode input voltage range	$\|V_{IO}\|$ ≤ 5 mV,	R_S = 50 Ω	25°C	0 to 2.5	–0.25 to 2.75		V
				Full range	0 to 2.2			
V_{OH}	High-level output voltage	I_{OH} = –100 µA		25°C		2.98		V
		I_{OH} = –3 mA		25°C		2.5		
				Full range	2.25			
V_{OL}	Low-level output voltage	V_{IC} = 1.5 V,	I_{OL} = 100 µA	25°C		0.02		V
		V_{IC} = 1.5 V,	I_{OL} = 3 mA	25°C		0.83		
				Full range			1	
A_{VD}	Large-signal differential voltage amplification	V_{IC} = 2.5 V, V_O = 1 V to 2 V	R_L = 2 kΩ‡	25°C	1.5	2.5		V/mV
				Full range	1			
			R_L = 1 MΩ‡	25°C		750		
$r_{i(d)}$	Differential input resistance			25°C		1000		GΩ
$r_{i(c)}$	Common-mode input resistance			25°C		1000		GΩ
$c_{i(c)}$	Common-mode input capacitance	f = 10 kHz		25°C		8		pF
z_o	Closed-loop output impedance	f = 100 kHz,	A_V = 10	25°C		130		Ω
CMRR	Common-mode rejection ratio	V_{IC} = 0 to 2.5 V, R_S = 50 Ω	V_O = 1.5 V,	25°C	70	83		dB
				Full range	70			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	V_{DD} = 2.7 V to 8 V, V_{IC} = V_{DD}/2,	No load	25°C	80	95		dB
				Full range	80			
I_{DD}	Supply current (per channel)	V_O = 1.5 V,	No load	25°C		98	125	µA
				Full range			125	

† Full range for the C suffix is 0°C to 70°C. Full range for the dual I suffix is – 40°C to 85°C. Full range for the quad I suffix is – 40°C to 125°C.
‡ Referenced to 2.5 V
NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 3 V

PARAMETER		TEST CONDITIONS		T_A†	TLV243x MIN	TLV243x TYP	TLV243x MAX	UNIT
SR	Slew rate at unity gain	V_O = 1 V to 2 V, C_L = 100 pF‡	R_L = 2 kΩ‡,	25°C	0.15	0.25		V/µs
				Full range	0.1			
V_n	Equivalent input noise voltage	f = 10 Hz		25°C		120		nV/√Hz
		f = 1 kHz		25°C		22		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		25°C		2.7		µV
		f = 0.1 Hz to 10 Hz		25°C		4		
I_n	Equivalent input noise current			25°C		0.6		fA/√Hz
THD + N	Total harmonic distortion plus noise	V_O = 0.5 V to 2.5 V, f = 1 kHz, R_L = 2 kΩ‡	A_V = 1	25°C		0.065%		
			A_V = 10			0.5%		
	Gain-bandwidth product	f = 10 kHz, C_L = 100 pF‡	R_L = 2 kΩ‡,	25°C		0.5		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 1 V, R_L = 2 kΩ‡,	A_V = 1, C_L = 100 pF‡	25°C		220		kHz
t_s	Settling time	A_V = –1, Step = 0.5 V to 2.5 V, R_L = 2 kΩ‡, C_L = 100 pF‡	To 0.1%	25°C		6.4		µs
			To 0.01%			14.1		
ϕ_m	Phase margin at unity gain	R_L = 2 kΩ‡,	C_L = 100 pF‡	25°C		62°		
	Gain margin			25°C		11		dB

† Full range for the C suffix is 0°C to 70°C. Full range for the dual I suffix is – 40°C to 85°C. Full range for the quad I suffix is – 40°C to 125°C.
‡ Referenced to 2.5 V

electrical characteristics at specified free-air temperature, V_{DD} = 3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLV243xQ, TLV243xM MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, V_{DD}± = ±1.5 V, R_S = 50 Ω	TLV243xQ, TLV243xM	25°C		300	2000	μV
				Full range			2500	
			TLV243xAQ, TLV243xAM	25°C		300	950	
				Full range			2000	
α_{VIO}	Temperature coefficient of input offset voltage	V_{IC} = 0, V_O = 0,	V_{DD}± = ±1.5 V, R_S = 50 Ω	25°C to 70°C		2		μV/°C
	Input offset voltage long-term drift (see Note 4)			25°C		0.003		μV/mo
I_{IO}	Input offset current			25°C		0.5		pA
				Full range			150	
I_{IB}	Input bias current			25°C		1		pA
				Full range			300	
V_{ICR}	Common-mode input voltage range	$\|V_{IO}\| \leq 5$ mV,	R_S = 50 Ω	25°C	0 to 2.5	–0.25 to 2.75		V
				Full range	0 to 2.2			
V_{OH}	High-level output voltage	I_{OH} = –100 μA		25°C		2.98		V
		I_{OH} = –3 mA		25°C		2.5		
				Full range	2.25			
V_{OL}	Low-level output voltage	V_{IC} = 1.5 V,	I_{OL} = 100 μA	25°C		0.02		V
		V_{IC} = 1.5 V,	I_{OL} = 3 mA	25°C		0.83		
				Full range			1	
A_{VD}	Large-signal differential voltage amplification	V_{IC} = 2.5 V, V_O = 1 V to 2 V	R_L = 2 kΩ‡	25°C	1.5	2.5		V/mV
				Full range	0.5			
			R_L = 1 MΩ‡	25°C		750		
$r_{i(d)}$	Differential input resistance			25°C		1000		GΩ
$r_{i(c)}$	Common-mode input resistance			25°C		1000		GΩ
$c_{i(c)}$	Common-mode input capacitance	f = 10 kHz		25°C		8		pF
z_o	Closed-loop output impedance	f = 100 kHz,	A_V = 10	25°C		130		Ω
CMRR	Common-mode rejection ratio	V_{IC} = 0 to 2.5 V, R_S = 50 Ω	V_O = 1.5 V,	25°C	70	83		dB
				Full range	70			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	V_{DD} = 2.7 V to 8 V, V_{IC} = V_{DD}/2,	No load	25°C	80	95		dB
				Full range	80			
I_{DD}	Supply current	V_O = 1.5 V,	No load	25°C		195	250	μA
				Full range			260	

† Full range is –40°C to 125°C for Q level part, –55°C to 125°C for M level part.
‡ Referenced to 2.5 V
NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 3 V

PARAMETER		TEST CONDITIONS		T_A†	TLV243xQ, TLV243xM, TLV243xAQ, TLV243xAM MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	V_O = 1 V to 2 V, C_L = 100 pF‡	R_L = 2 kΩ‡,	25°C	0.15	0.25		V/µs
				Full range	0.1			
V_n	Equivalent input noise voltage	f = 10 Hz		25°C		120		nV/√Hz
		f = 1 kHz		25°C		22		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		25°C		2.7		µV
		f = 0.1 Hz to 10 Hz		25°C		4		
I_n	Equivalent input noise current			25°C		0.6		fA√Hz
THD + N	Total harmonic distortion plus noise	V_O = 0.5 V to 2.5 V, f = 1 kHz, R_L = 2 kΩ‡	A_V = 1	25°C		0.065%		
			A_V = 10			0.5%		
	Gain-bandwidth product	f = 10 kHz, C_L = 100 pF‡	R_L = 2 kΩ‡,	25°C		0.5		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 1 V, R_L = 2 kΩ‡,	A_V = 1, C_L = 100 pF‡	25°C		220		kHz
t_s	Settling time	A_V = –1, Step = 0.5 V to 2.5 V, R_L = 2 kΩ‡, C_L = 100 pF‡	To 0.1%	25°C		6.4		µs
			To 0.01%			14.1		
ϕ_m	Phase margin at unity gain	R_L = 2 kΩ‡,	C_L = 100 pF‡	25°C		62°		
	Gain margin			25°C		11		dB

† Full range is –40°C to 125°C for Q level part, –55°C to 125°C for M level part.
‡ Referenced to 2.5 V

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLV243x MIN	TLV243x TYP	TLV243x MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, $V_{DD}\pm$ = ±2.5 V, R_S = 50 Ω	TLV243x	25°C		300	2000	µV
				Full range			2500	
			TLV243xA	25°C		300	950	
				Full range			1500	
α_{VIO}	Temperature coefficient of input offset voltage	V_{IC} = 0, V_O = 0,	$V_{DD}\pm$ = ±2.5 V, R_S = 50 Ω	25°C to 70°C		2		µV/°C
	Input offset voltage long-term drift (see Note 4)			25°C		0.003		µV/mo
I_{IO}	Input offset current			25°C		0.5		pA
				Full range			150	
I_{IB}	Input bias current			25°C		1		pA
				Full range			150	
V_{ICR}	Common-mode input voltage range	$\|V_{IO}\| \le$ 5 mV,	R_S = 50 Ω	25°C	0 to 4.5	–0.25 to 4.75		V
				Full range	0 to 4.2			
V_{OH}	High-level output voltage	I_{OH} = –100 µA		25°C		4.97		V
		I_{OH} = –5 mA		25°C	4	4.35		
				Full range	4			
V_{OL}	Low-level output voltage	V_{IC} = 2.5 V,	I_{OL} = 100 µA	25°C		0.01		V
		V_{IC} = 2.5 V,	I_{OL} = 5 mA	25°C		0.8		
				Full range			1.25	
A_{VD}	Large-signal differential voltage amplification	V_{IC} = 2.5 V, V_O = 1 V to 4 V	R_L = 2 kΩ‡	25°C	2.5	3.8		V/mV
				Full range	1.5			
			R_L = 1 MΩ‡	25°C		950		
$r_{i(d)}$	Differential input resistance			25°C		1000		GΩ
$r_{i(c)}$	Common-mode input resistance			25°C		1000		GΩ
$c_{i(c)}$	Common-mode input capacitance	f = 10 kHz		25°C		8		pF
z_o	Closed-loop output impedance	f = 100 kHz,	A_V = 10	25°C		130		Ω
CMRR	Common-mode rejection ratio	V_{IC} = 0 to 4.5 V, R_S = 50 Ω	V_O = 2.5 V,	25°C	70	90		dB
				Full range	70			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	V_{DD} = 4.4 V to 8 V, V_{IC} = V_{DD}/2,	No load	25°C	80	95		dB
				Full range	80			
I_{DD}	Supply current (per channel)	V_O = 2.5 V,	No load	25°C		100	125	µA
				Full range			125	

† Full range for the C suffix is 0°C to 70°C. Full range for the dual I suffix is – 40°C to 85°C. Full range for the quad I suffix is – 40°C to 125°C.
‡ Referenced to 2.5 V

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS		T_A†	TLV243x MIN	TLV243x TYP	TLV243x MAX	UNIT
SR	Slew rate at unity gain	V_O = 1.5 V to 3.5 V, C_L = 100 pF‡	R_L = 2 kΩ‡,	25°C	0.15	0.25		V/µs
				Full range	0.1			
V_n	Equivalent input noise voltage	f = 10 Hz		25°C		100		nV/√Hz
		f = 1 kHz		25°C		18		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		25°C		1.9		µV
		f = 0.1 Hz to 10 Hz		25°C		2.8		
I_n	Equivalent input noise current			25°C		0.6		fA√Hz
THD + N	Total harmonic distortion plus noise	V_O = 1.5 V to 3.5 V, f = 1 kHz, R_L = 2 kΩ‡	A_V = 1	25°C		0.045%		
			A_V = 10			0.4%		
	Gain-bandwidth product	f = 10 kHz, C_L = 100 pF‡	R_L =2 kΩ‡,	25°C		0.55		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 2 V, R_L = 2 kΩ‡,	A_V = 1, C_L = 100 pF‡	25°C		100		kHz
t_s	Settling time	A_V = –1, Step = 1.5 V to 3.5 V, R_L = 2 kΩ‡, C_L = 100 pF‡	To 0.1%	25°C		6.4		µs
			To 0.01%			13.1		
ϕ_m	Phase margin at unity gain	R_L = 2 kΩ‡,	C_L = 100 pF‡	25°C		66°		
	Gain margin			25°C		11		dB

† Full range for the C suffix is 0°C to 70°C. Full range for the dual I suffix is – 40°C to 85°C. Full range for the quad I suffix is – 40°C to 125°C.
‡ Referenced to 2.5 V

electrical characteristics at specified free-air temperature, V_{DD} = 5 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A†	TLV243xQ, TLV243xM			UNIT
					MIN	TYP	MAX	
V_{IO}	Input offset voltage	V_{IC} = 0, V_O = 0, $V_{DD}\pm$ = ±2.5 V, R_S = 50 Ω	TLV2453x	25°C		300	2000	µV
				Full range			2500	
			TLV2453xA	25°C		300	950	
				Full range			2000	
α_{VIO}	Temperature coefficient of input offset voltage	V_{IC} = 0, V_O = 0,	$V_{DD}\pm$ = ±2.5 V, R_S = 50 Ω	25°C to 70°C		2		µV/°C
	Input offset voltage long-term drift (see Note 4)			25°C		0.003		µV/mo
I_{IO}	Input offset current			25°C		0.5		pA
				Full range			150	
I_{IB}	Input bias current			25°C		1		pA
				Full range			300	
V_{ICR}	Common-mode input voltage range	$\|V_{IO}\| \leq$ 5 mV,	R_S = 50 Ω	25°C	0 to 4.5	–0.25 to 4.75		V
				Full range	0 to 4.2			
V_{OH}	High-level output voltage	I_{OH} = –100 µA		25°C		4.97		V
		I_{OH} = –5 mA		25°C	4	4.35		
				Full range	4			
V_{OL}	Low-level output voltage	V_{IC} = 2.5 V,	I_{OL} = 100 µA	25°C		0.01		V
		V_{IC} = 2.5 V,	I_{OL} = 5 mA	25°C		0.8		
				Full range			1.25	
A_{VD}	Large-signal differential voltage amplification	V_{IC} = 2.5 V, V_O = 1 V to 4 V	R_L = 2 kΩ‡	25°C	2.5	3.8		V/mV
				Full range	0.5			
			R_L = 1 MΩ‡	25°C		950		
$r_{i(d)}$	Differential input resistance			25°C		1000		GΩ
$r_{i(c)}$	Common-mode input resistance			25°C		1000		GΩ
$c_{i(c)}$	Common-mode input capacitance	f = 10 kHz		25°C		8		pF
z_o	Closed-loop output impedance	f = 100 kHz,	A_V = 10	25°C		130		Ω
CMRR	Common-mode rejection ratio	V_{IC} = 0 to 4.5 V, R_S = 50 Ω	V_O = 2.5 V,	25°C	70	90		dB
				Full range	70			
k_{SVR}	Supply-voltage rejection ratio ($\Delta V_{DD}/\Delta V_{IO}$)	V_{DD} = 4.4 V to 8 V, $V_{IC} = V_{DD}/2$,	No load	25°C	80	95		dB
				Full range	80			
I_{DD}	Supply current	V_O = 2.5 V,	No load	25°C		200	250	µA
				Full range			270	

† Full range is –40°C to 125°C for Q level part, –55°C to 125°C for M level part.
‡ Referenced to 2.5 V

NOTE 4: Typical values are based on the input offset voltage shift observed through 500 hours of operating life test at T_A = 150°C extrapolated to T_A = 25°C using the Arrhenius equation and assuming an activation energy of 0.96 eV.

operating characteristics at specified free-air temperature, V_{DD} = 5 V

PARAMETER		TEST CONDITIONS		T_A†	TLV243xQ, TLV243xM, TLV243xAQ, TLV243xAM MIN	TYP	MAX	UNIT
SR	Slew rate at unity gain	V_O = 1.5 V to 3.5 V, C_L = 100 pF‡	R_L = 2 kΩ‡,	25°C	0.15	0.25		V/µs
				Full range	0.1			
V_n	Equivalent input noise voltage	f = 10 Hz		25°C		100		nV/√Hz
		f = 1 kHz		25°C		18		
$V_{N(PP)}$	Peak-to-peak equivalent input noise voltage	f = 0.1 Hz to 1 Hz		25°C		1.9		µV
		f = 0.1 Hz to 10 Hz		25°C		2.8		
I_n	Equivalent input noise current			25°C		0.6		fA√Hz
THD + N	Total harmonic distortion plus noise	V_O = 1.5 V to 3.5 V, f = 1 kHz, R_L = 2 kΩ‡	A_V = 1	25°C		0.045%		
			A_V = 10			0.4%		
	Gain-bandwidth product	f = 10 kHz, C_L = 100 pF‡	R_L =2 kΩ‡,	25°C		0.55		MHz
B_{OM}	Maximum output-swing bandwidth	$V_{O(PP)}$ = 2 V, R_L = 2 kΩ‡,	A_V = 1, C_L = 100 pF‡	25°C		100		kHz
t_s	Settling time	A_V = –1, Step = 1.5 V to 3.5 V, R_L = 2 kΩ‡, C_L = 100 pF‡	To 0.1%	25°C		6.4		µs
			To 0.01%			13.1		
ϕ_m	Phase margin at unity gain	R_L = 2 kΩ‡,	C_L = 100 pF‡	25°C		66°		
	Gain margin			25°C		11		dB

† Full range is –40°C to 125°C for Q level part, –55°C to 125°C for M level part.
‡ Referenced to 2.5 V

TYPICAL CHARACTERISTICS

Table of Graphs

			FIGURE
V_{IO}	Input offset voltage	Distribution vs Common-mode input voltage	2,3 4,5
α_{VIO}	Temperature coefficient	Distribution	6,7
I_{IB}/I_{IO}	Input bias and input offset currents	vs Free-air temperature	8
V_{OH}	High-level output voltage	vs High-level output current	9,11
V_{OL}	Low-level output voltage	vs Low-level output current	10,12
$V_{O(PP)}$	Maximum peak-to-peak output voltage	vs Frequency	13
I_{OS}	Short-circuit output current	vs Supply voltage vs Free-air temperature	14 15
V_{ID}	Differential input voltage	vs Output voltage	16,17
	Differential gain	vs Load resistance	18
A_{VD}	Large-signal differential voltage amplification	vs Frequency	19,20
A_{VD}	Differential voltage amplification	vs Free-air temperature	21,22
z_o	Output impedance	vs Frequency	23,24
CMRR	Common-mode rejection ratio	vs Frequency vs Free-air temperature	25 26
k_{SVR}	Supply-voltage rejection ratio	vs Frequency vs Free-air temperature	27,28 29
I_{DD}	Supply current	vs Supply voltage	30
SR	Slew rate	vs Load capacitance vs Free-air temperature	31 32
V_O	Inverting large-signal pulse response		33,34
V_O	Voltage-follower large-signal pulse response		35,36
V_O	Inverting small-signal pulse response		37,38
V_O	Voltage-follower small-signal pulse response		39,40
V_n	Equivalent input noise voltage	vs Frequency	41, 42
	Noise voltage (referred to input)	Over a 10-second period	43
THD + N	Total harmonic distortion plus noise	vs Frequency	44,45
	Gain-bandwidth product	vs Free-air temperature vs Supply voltage	46 47
ϕ_m	Phase margin	vs Frequency vs Load capacitance	19,20 48
	Gain margin	vs Load capacitance	49
B_1	Unity-gain bandwidth	vs Load capacitance	50

TYPICAL CHARACTERISTICS

DISTRIBUTION OF TLV2432
INPUT OFFSET VOLTAGE

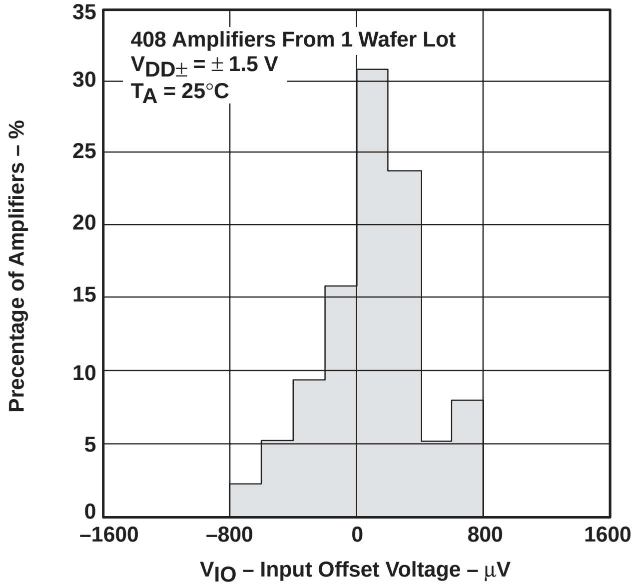


Figure 2

DISTRIBUTION OF TLV2432
INPUT OFFSET VOLTAGE

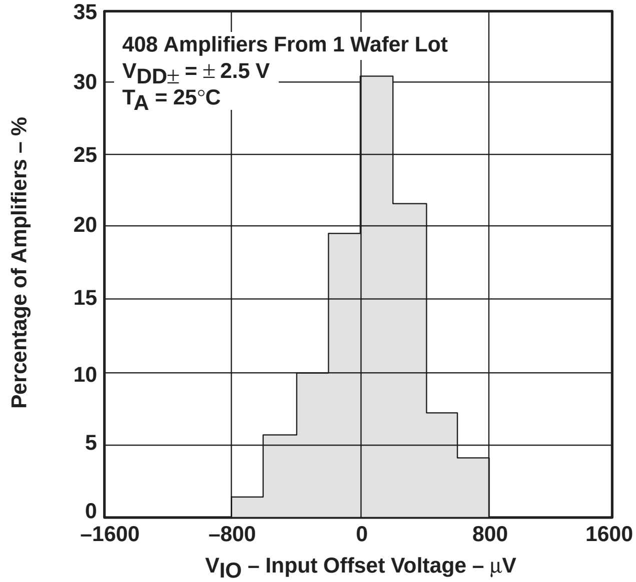


Figure 3

INPUT OFFSET VOLTAGE
vs
COMMON-MODE INPUT VOLTAGE

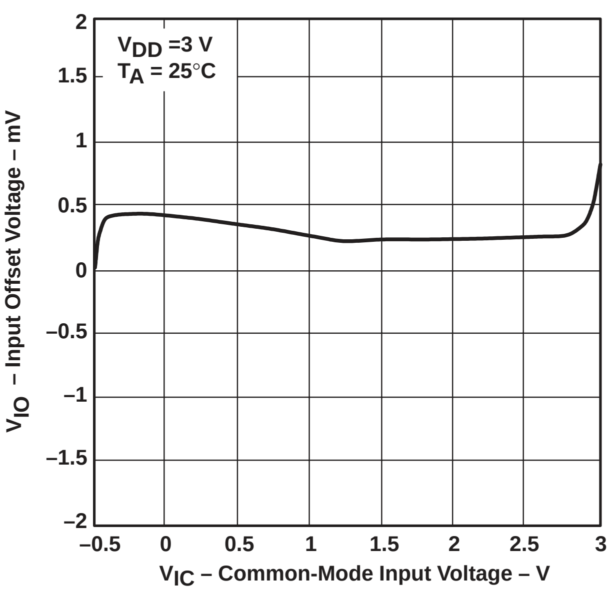


Figure 4

INPUT OFFSET VOLTAGE
vs
COMMON-MODE INPUT VOLTAGE

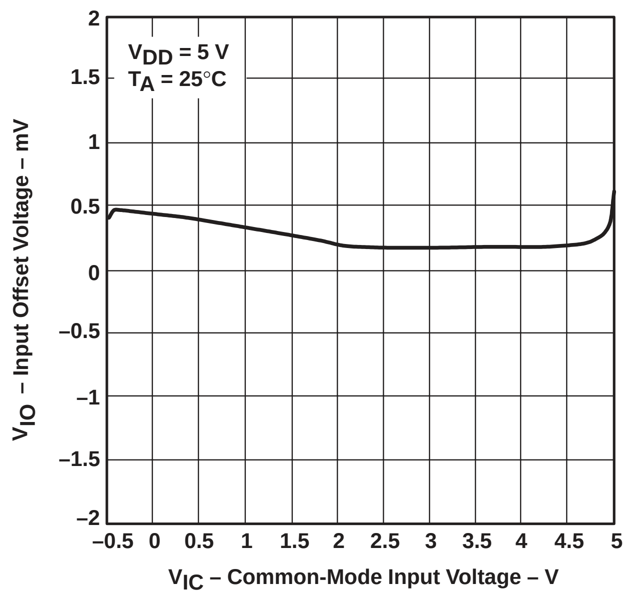


Figure 5

TYPICAL CHARACTERISTICS

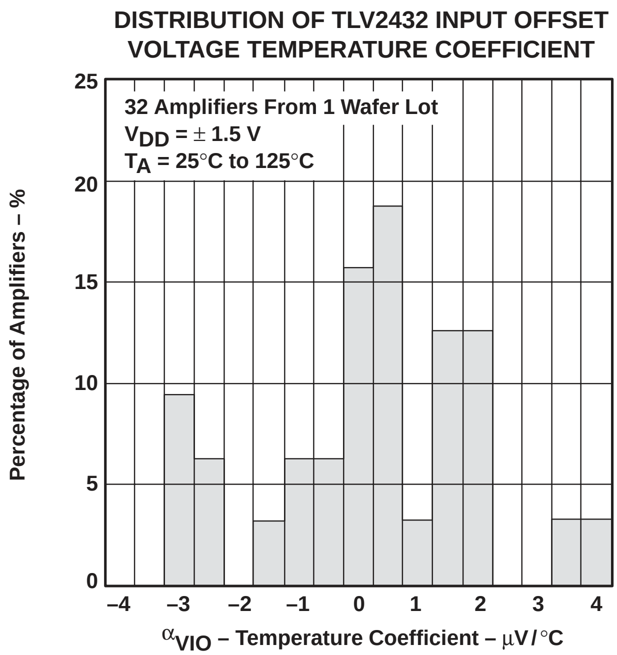


Figure 6

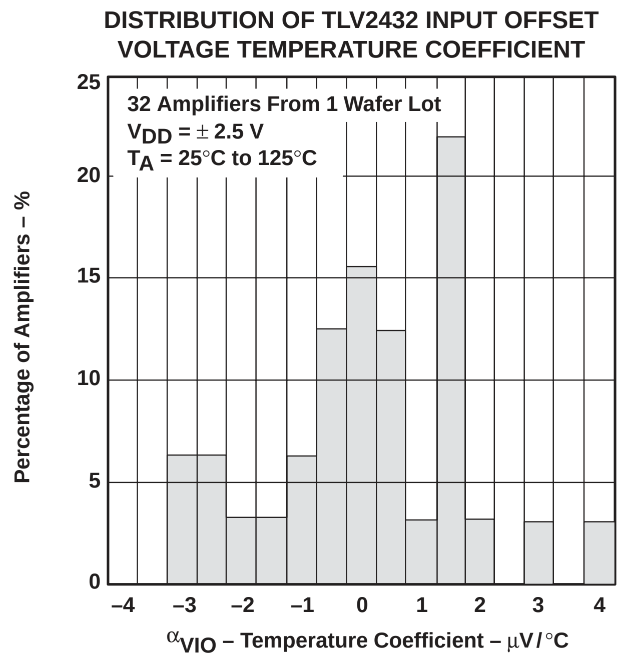


Figure 7

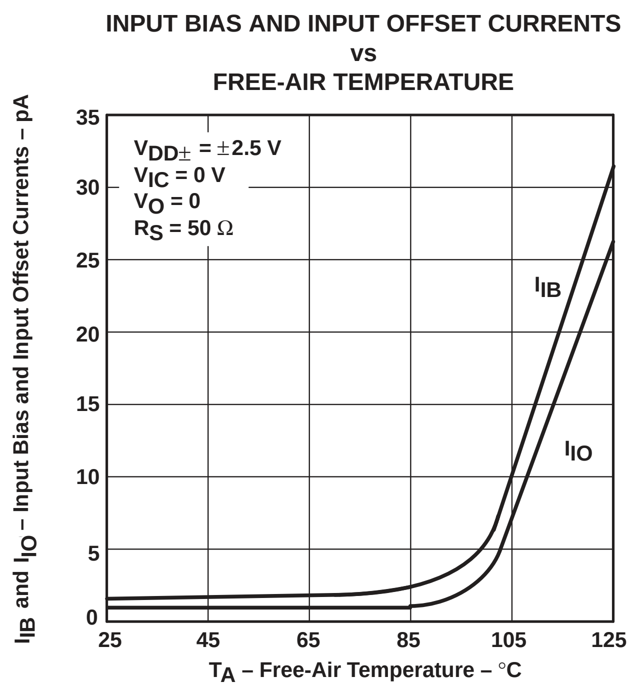


Figure 8

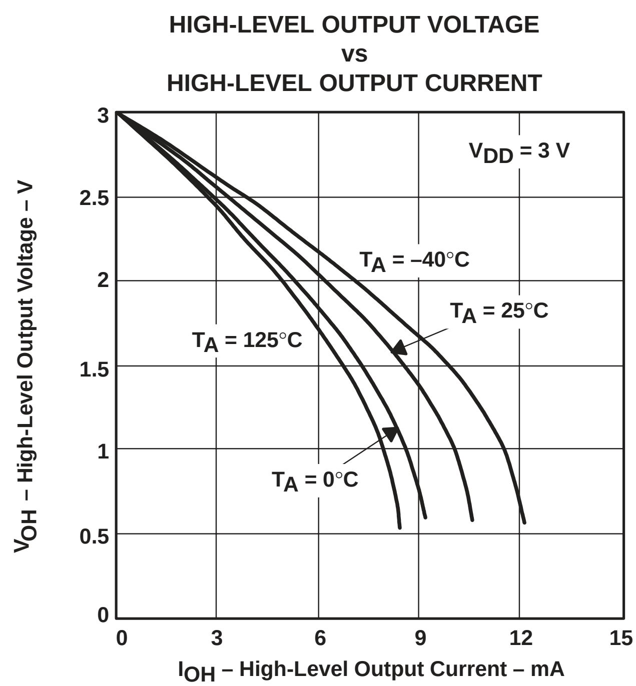


Figure 9

TYPICAL CHARACTERISTICS

LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

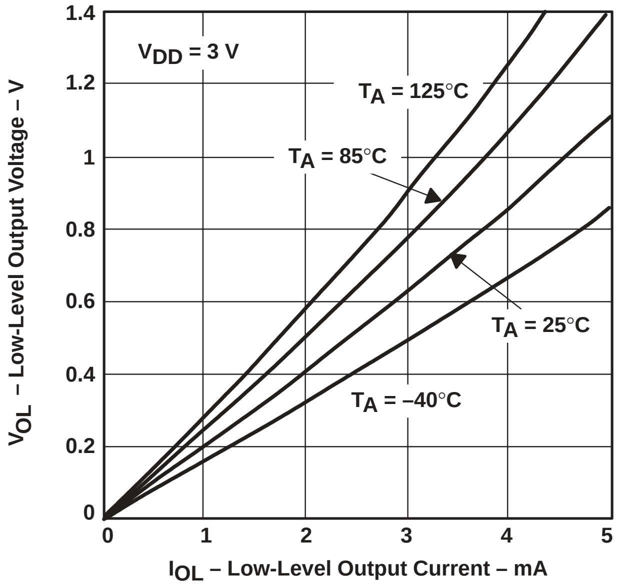


Figure 10

HIGH-LEVEL OUTPUT VOLTAGE vs HIGH-LEVEL OUTPUT CURRENT

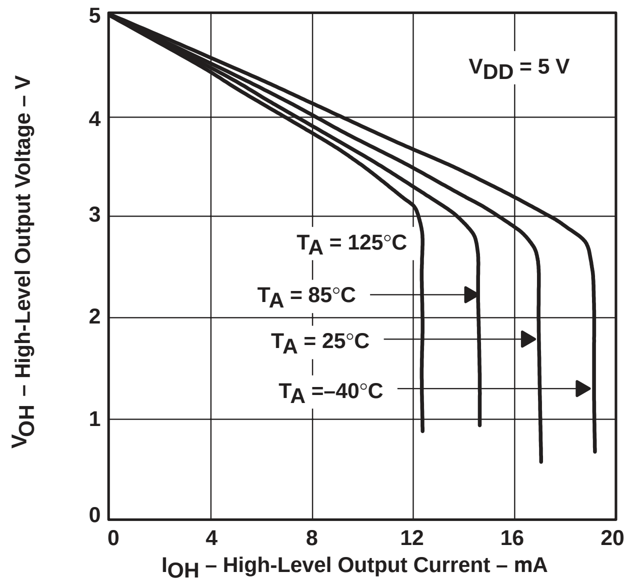


Figure 11

LOW-LEVEL OUTPUT VOLTAGE vs LOW-LEVEL OUTPUT CURRENT

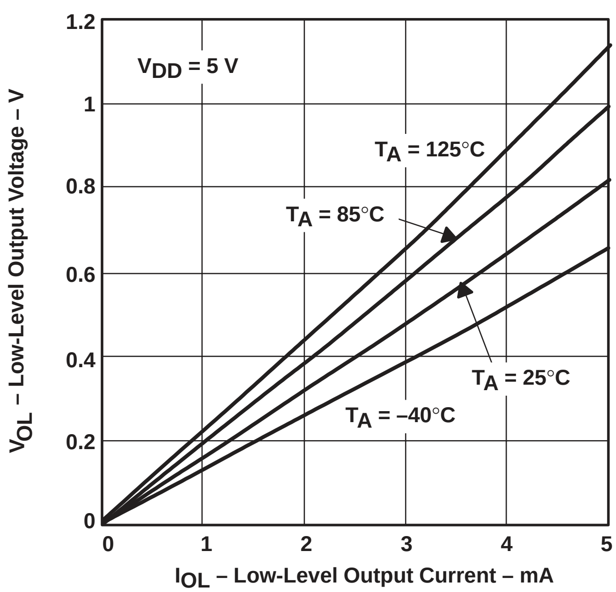


Figure 12

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs FREQUENCY

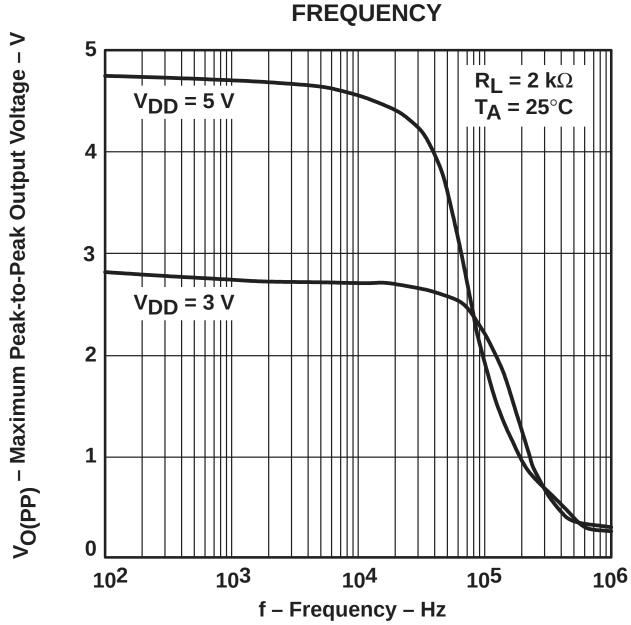


Figure 13

TYPICAL CHARACTERISTICS

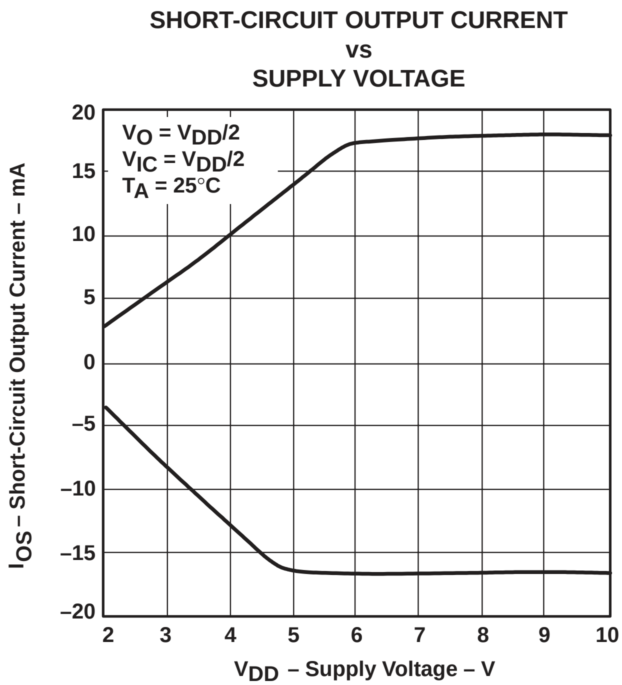


Figure 14

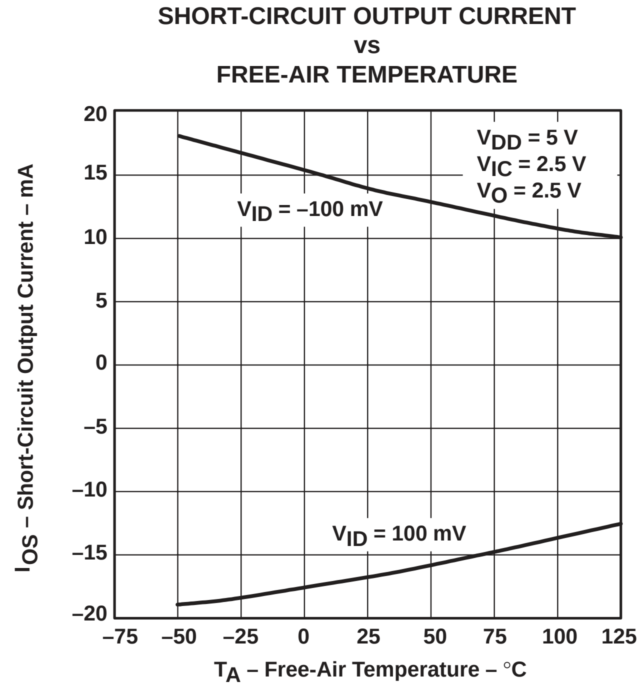


Figure 15

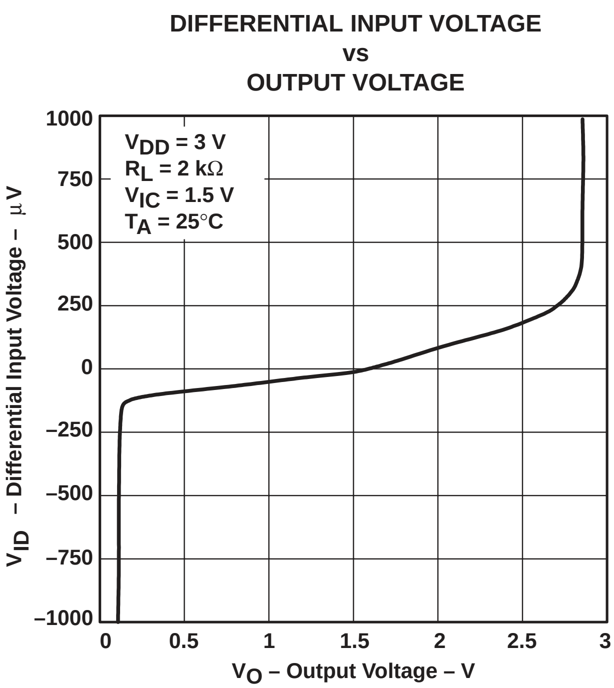


Figure 16

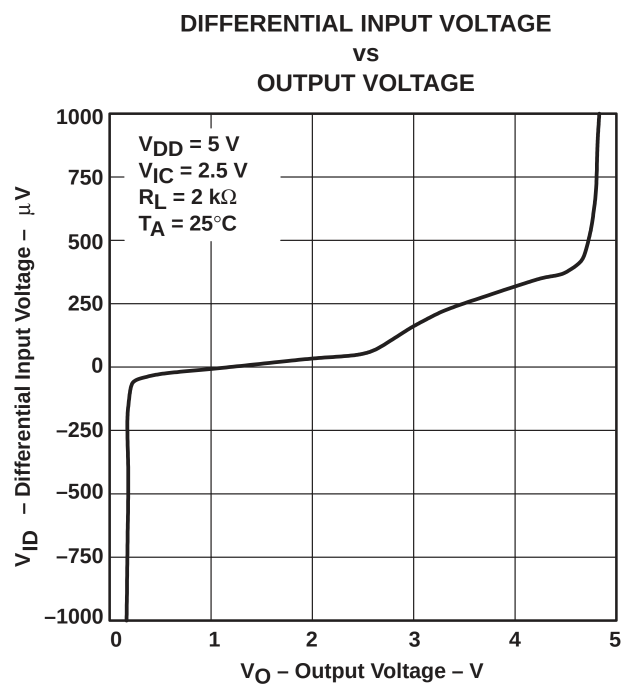


Figure 17

TYPICAL CHARACTERISTICS

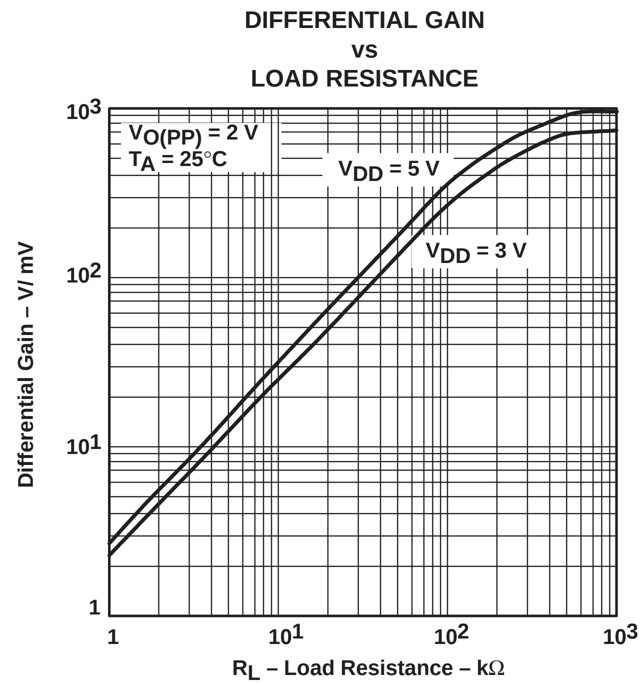


Figure 18

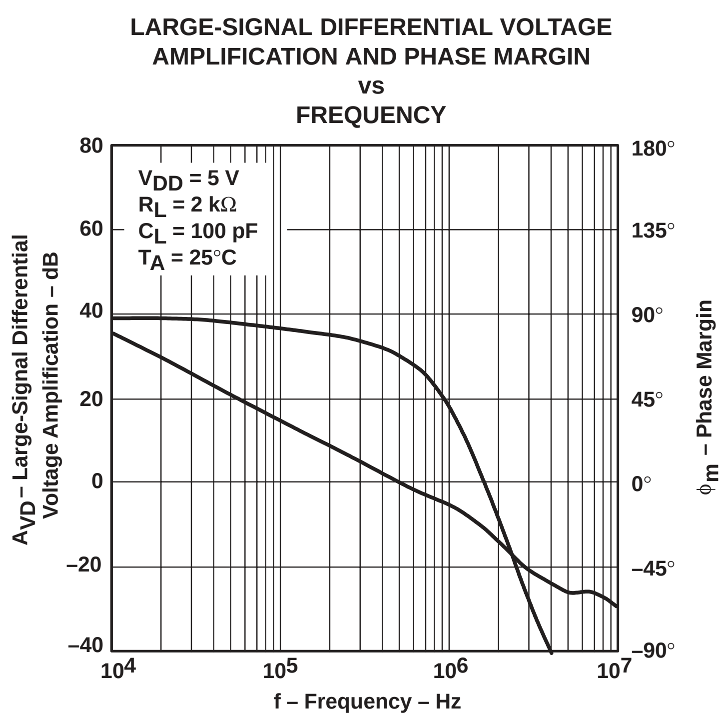


Figure 19

TYPICAL CHARACTERISTICS

LARGE-SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE MARGIN vs FREQUENCY

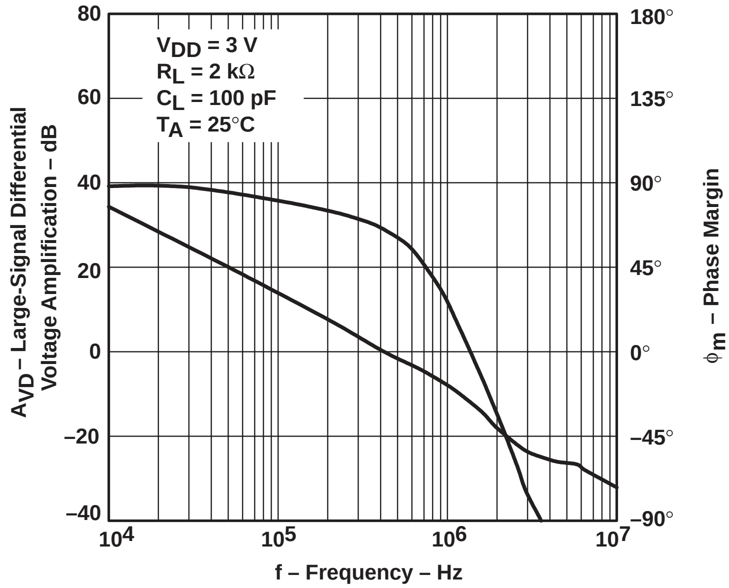


Figure 20

DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

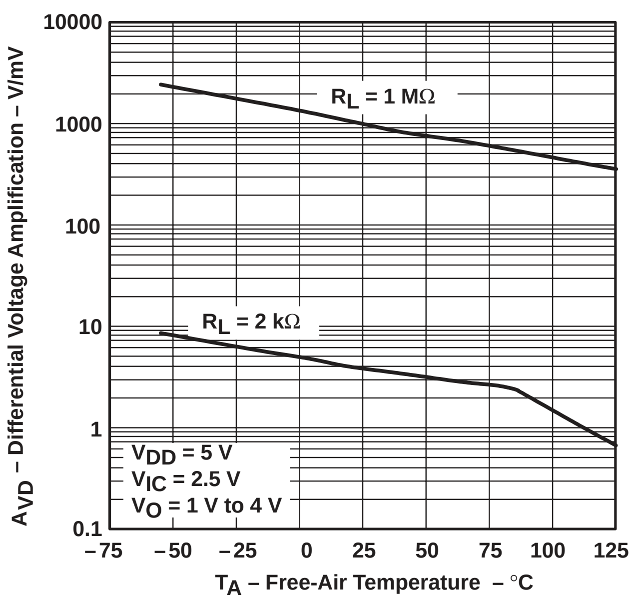


Figure 21

DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE

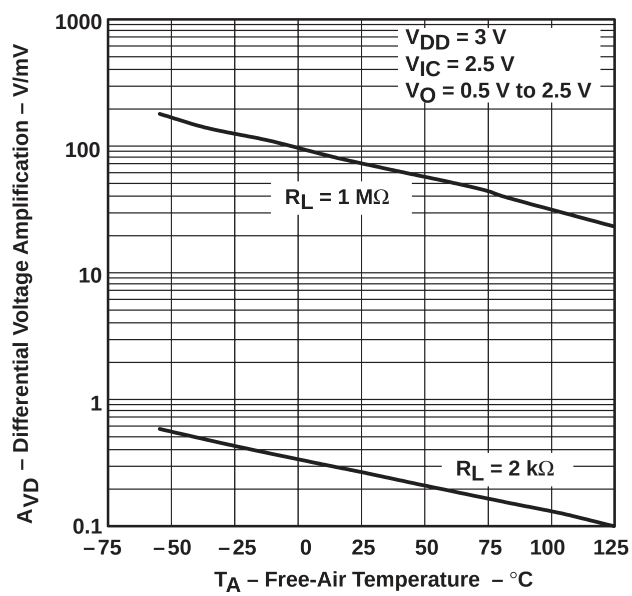


Figure 22

TYPICAL CHARACTERISTICS

OUTPUT IMPEDANCE vs FREQUENCY

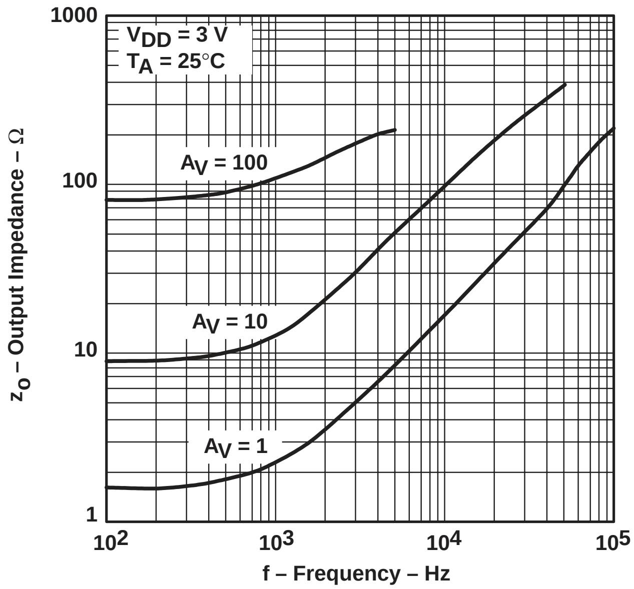


Figure 23

OUTPUT IMPEDANCE vs FREQUENCY

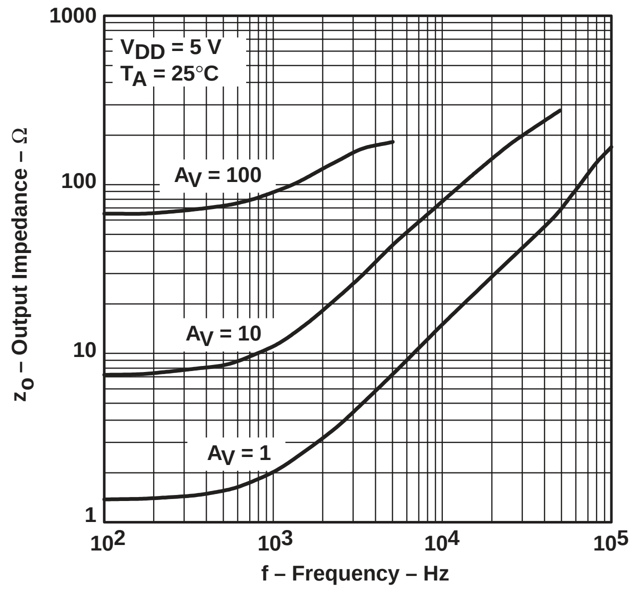


Figure 24

COMMON-MODE REJECTION RATIO vs FREQUENCY

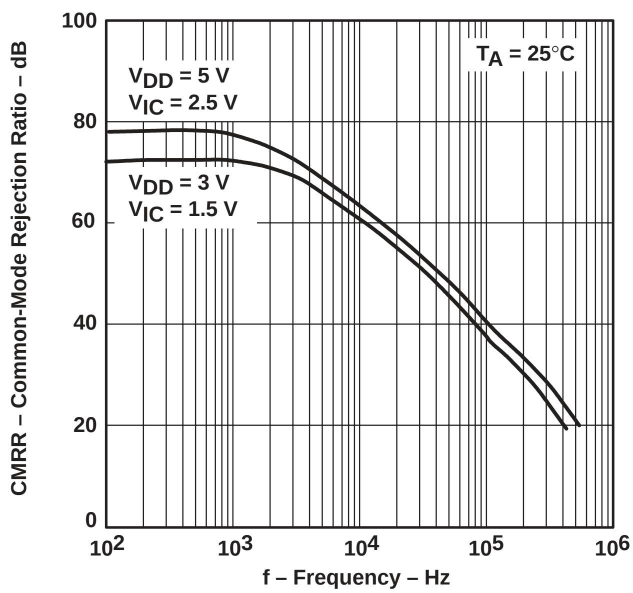


Figure 25

COMMON-MODE REJECTION RATIO vs FREE-AIR TEMPERATURE

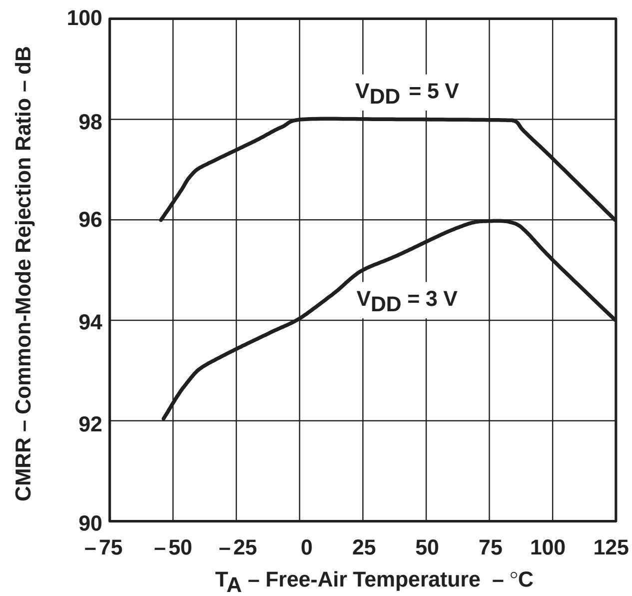


Figure 26

TYPICAL CHARACTERISTICS

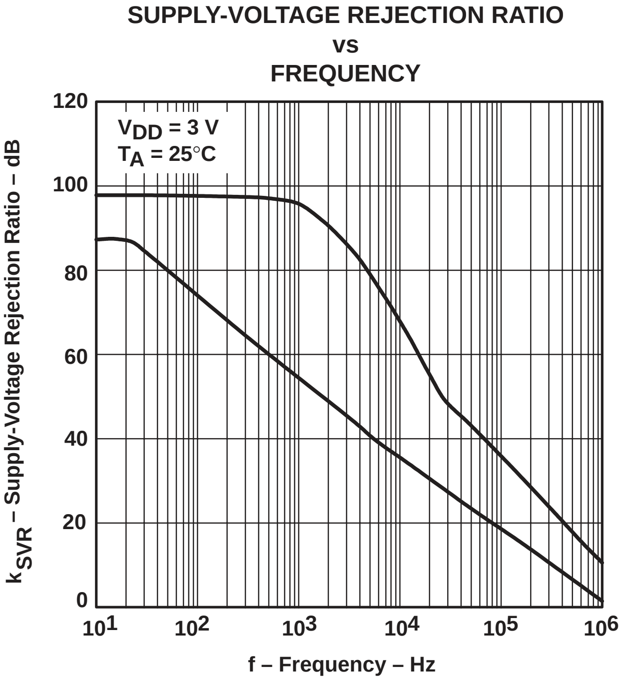


Figure 27

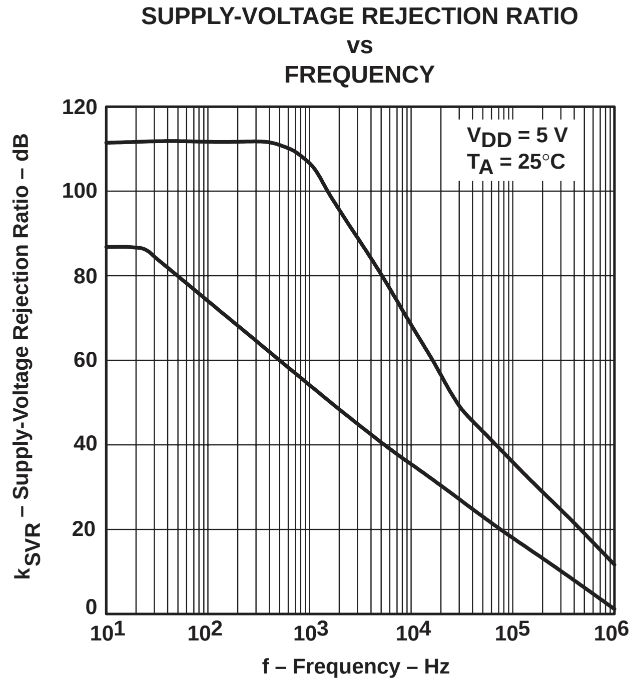


Figure 28

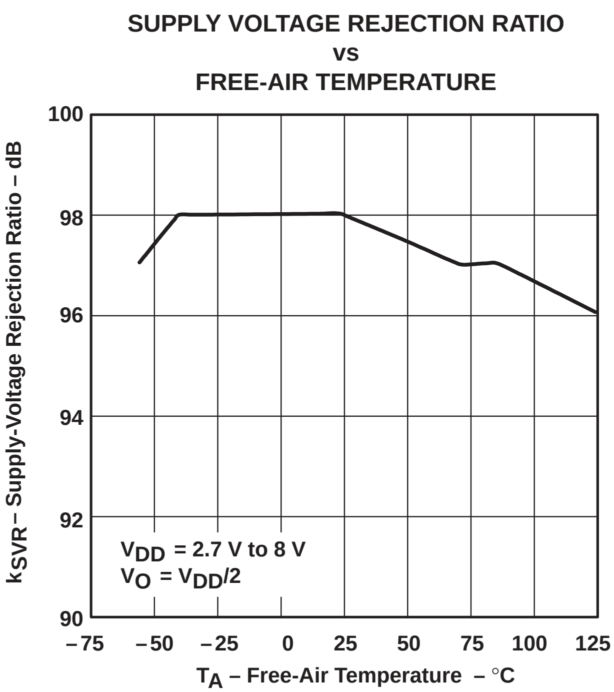


Figure 29

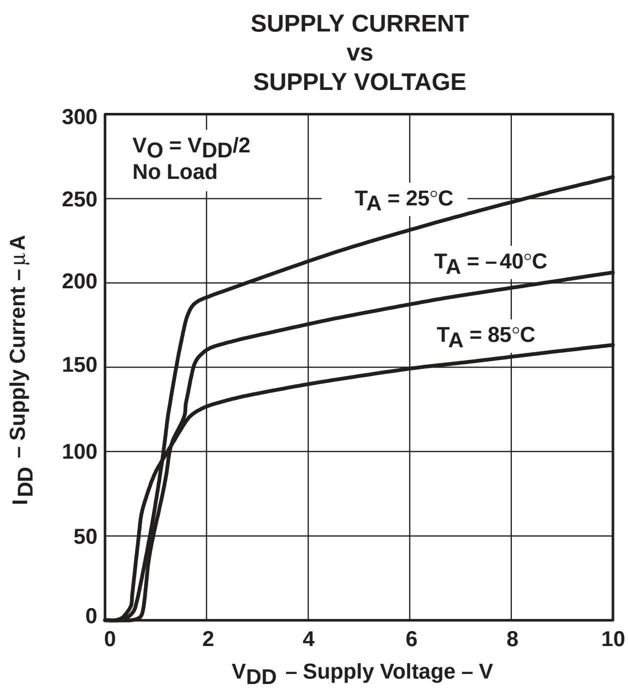


Figure 30

TYPICAL CHARACTERISTICS

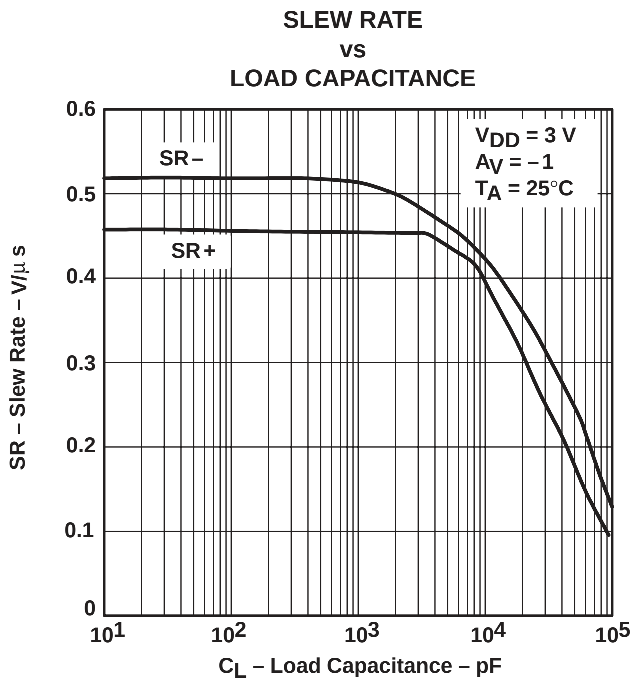


Figure 31

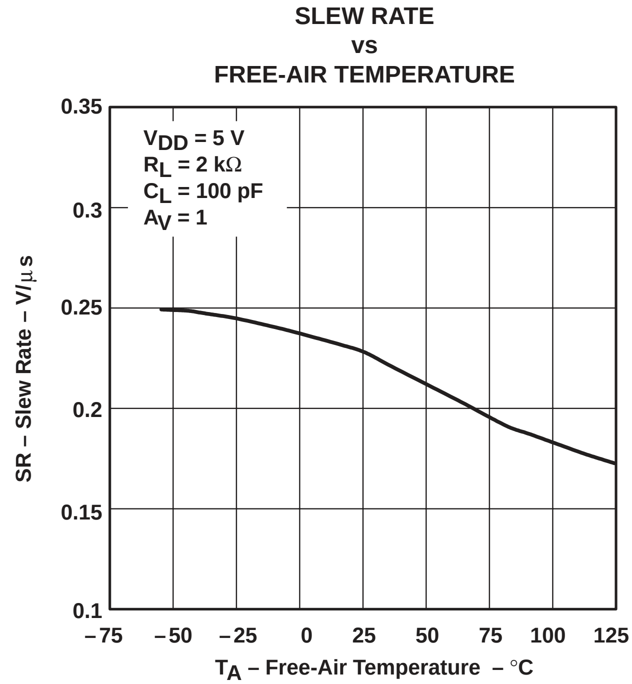


Figure 32

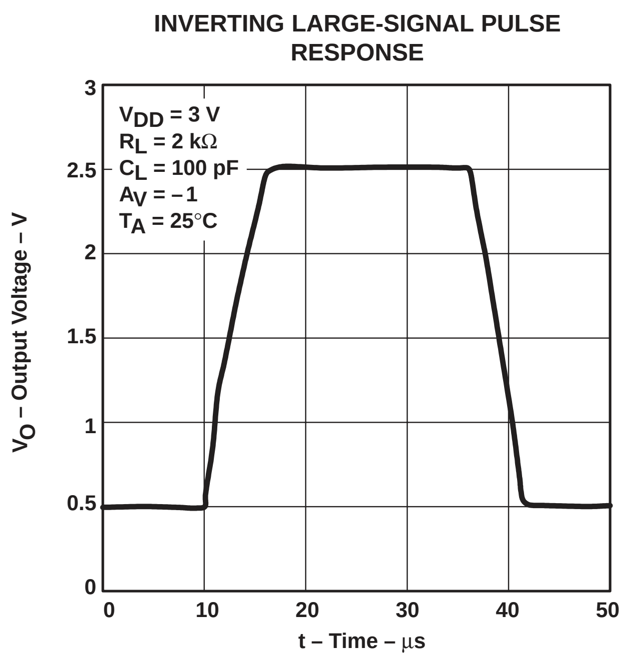


Figure 33

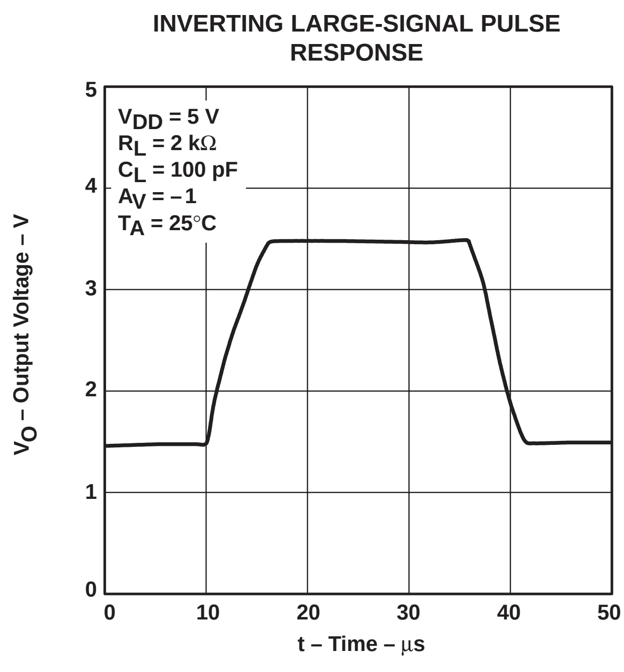


Figure 34

TYPICAL CHARACTERISTICS

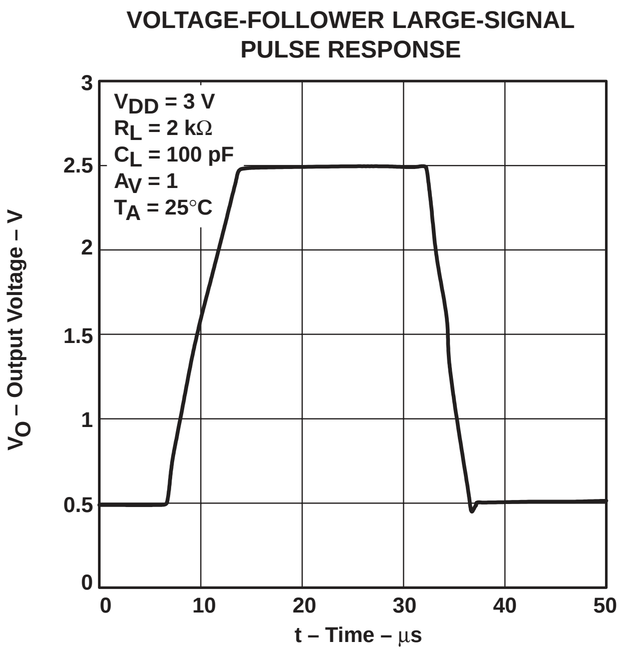


Figure 35

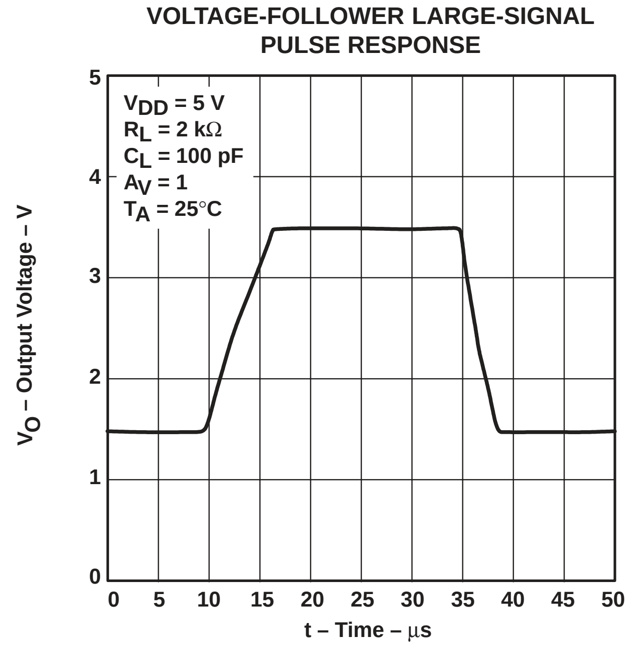


Figure 36

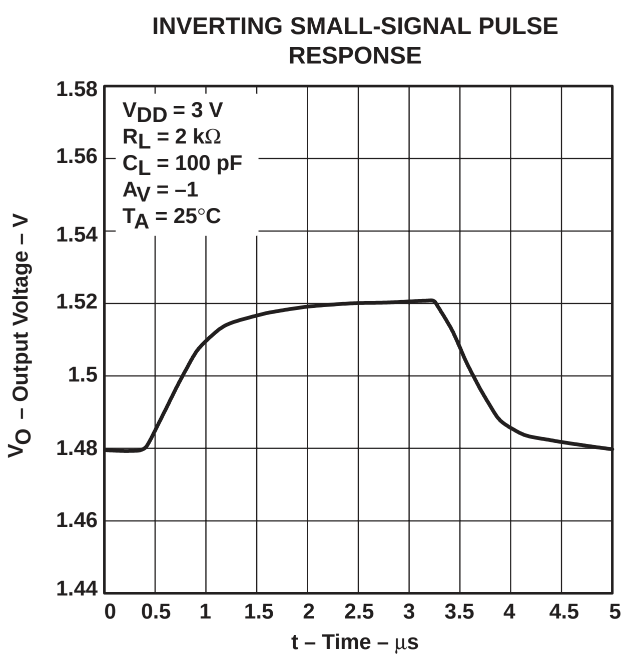


Figure 37

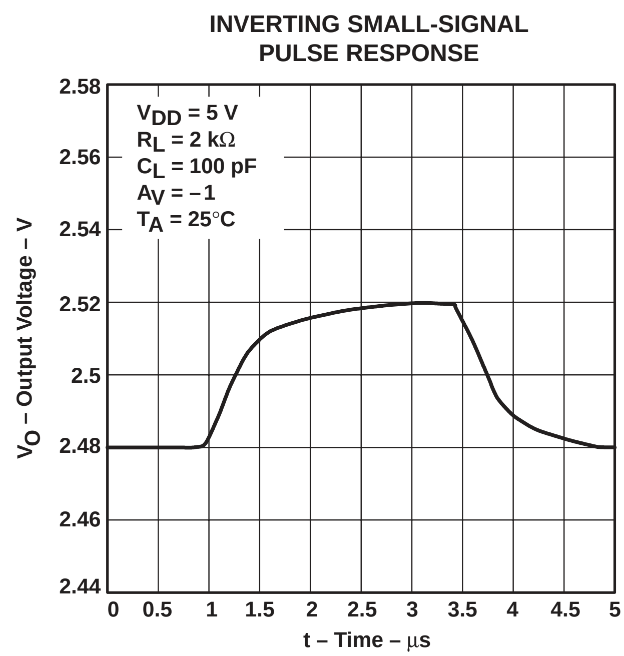


Figure 38

TYPICAL CHARACTERISTICS

VOLTAGE-FOLLOWER SMALL-SIGNAL PULSE RESPONSE

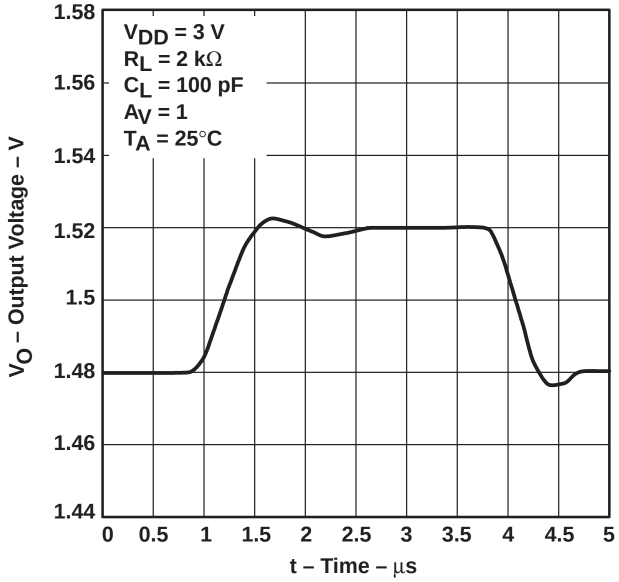


Figure 39

VOLTAGE-FOLLOWER SMALL-SIGNAL PULSE RESPONSE

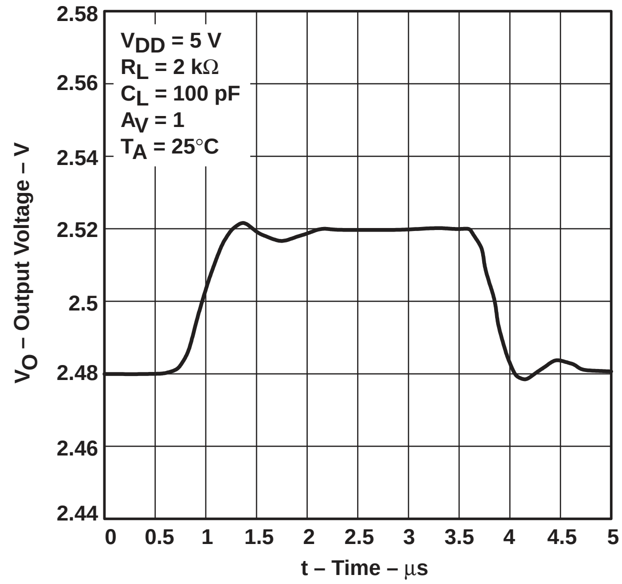


Figure 40

EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY

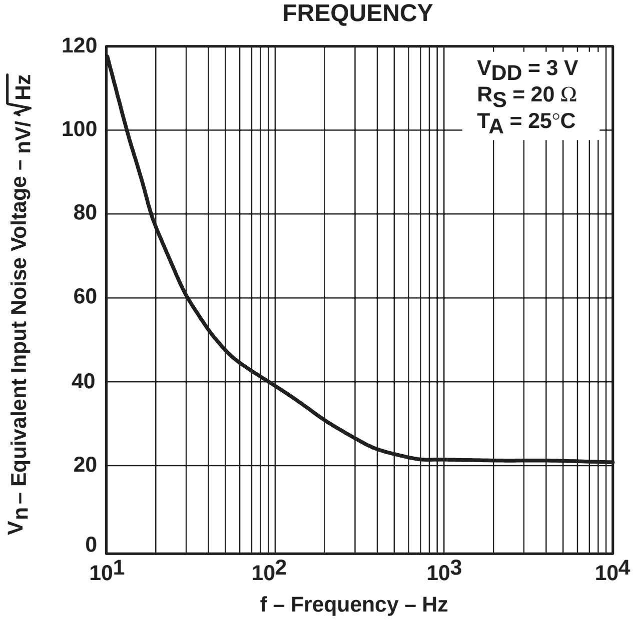


Figure 41

EQUIVALENT INPUT NOISE VOLTAGE vs FREQUENCY

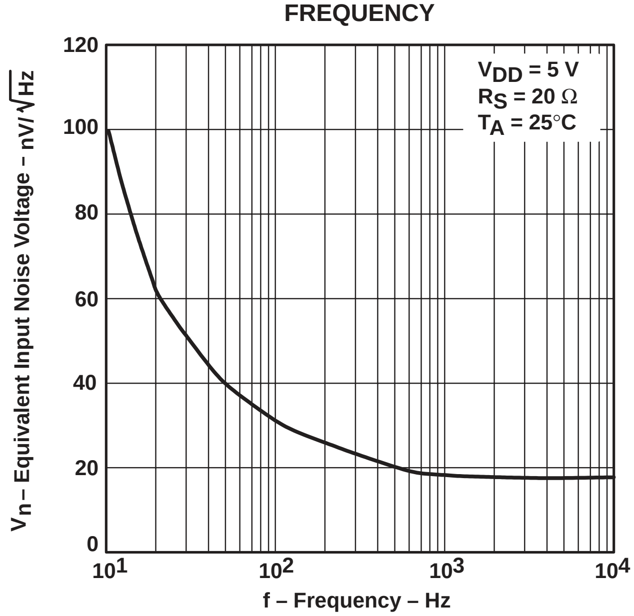


Figure 42

TYPICAL CHARACTERISTICS

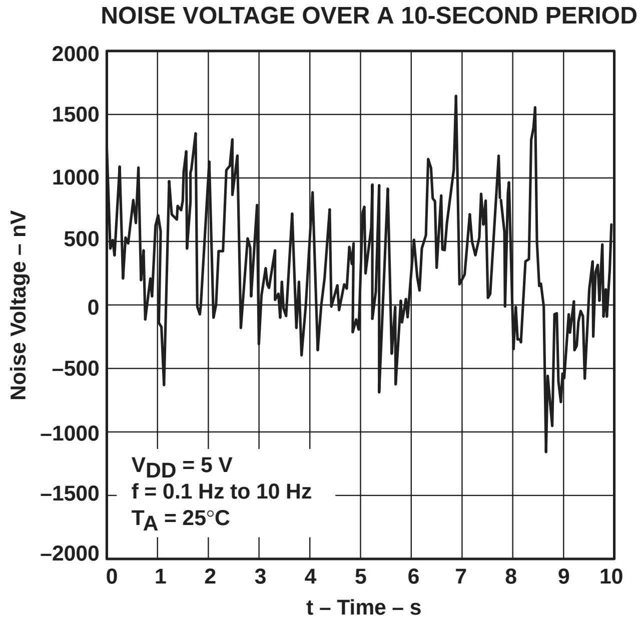


Figure 43

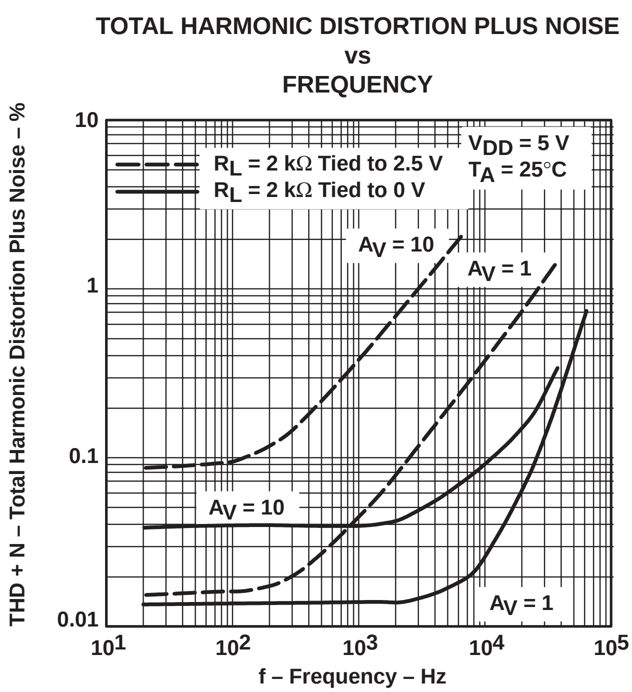


Figure 44

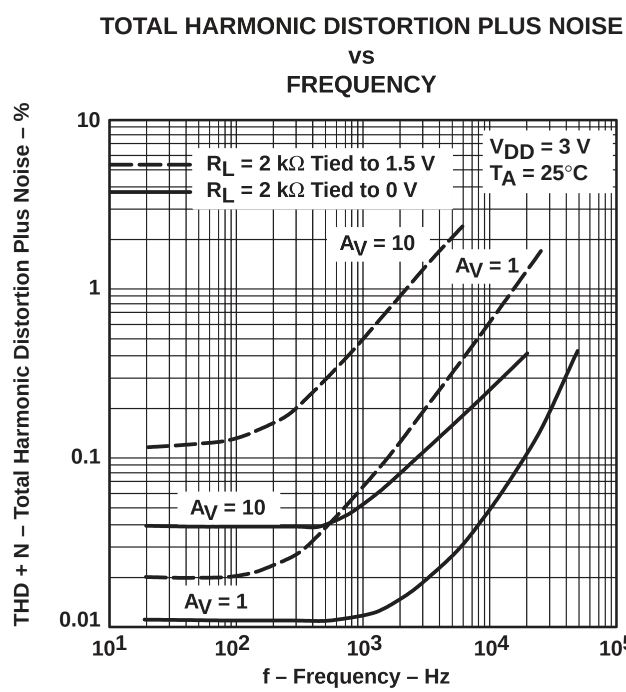


Figure 45

TYPICAL CHARACTERISTICS

GAIN-BANDWIDTH PRODUCT vs FREE-AIR TEMPERATURE

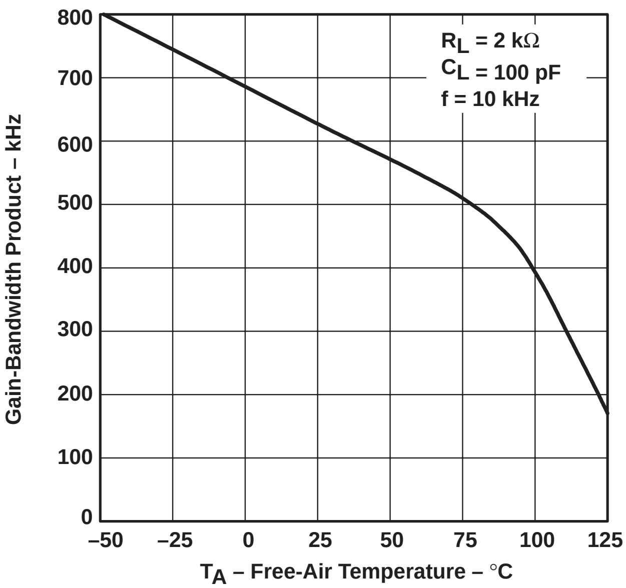


Figure 46

GAIN-BANDWIDTH PRODUCT vs SUPPLY VOLTAGE

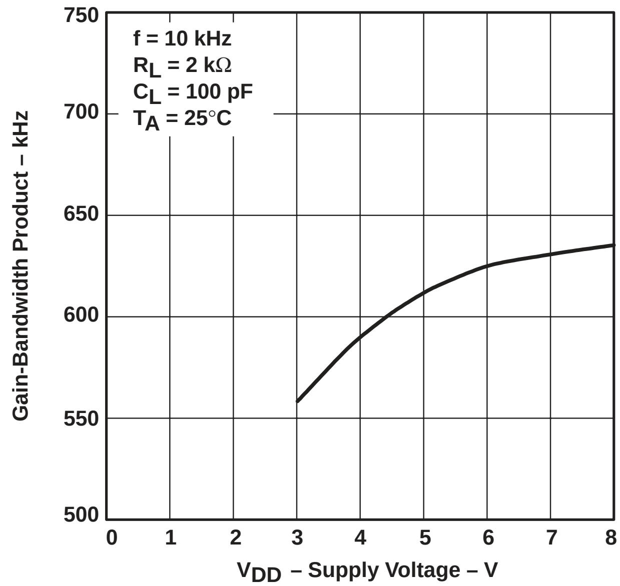


Figure 47

PHASE MARGIN vs LOAD CAPACITANCE

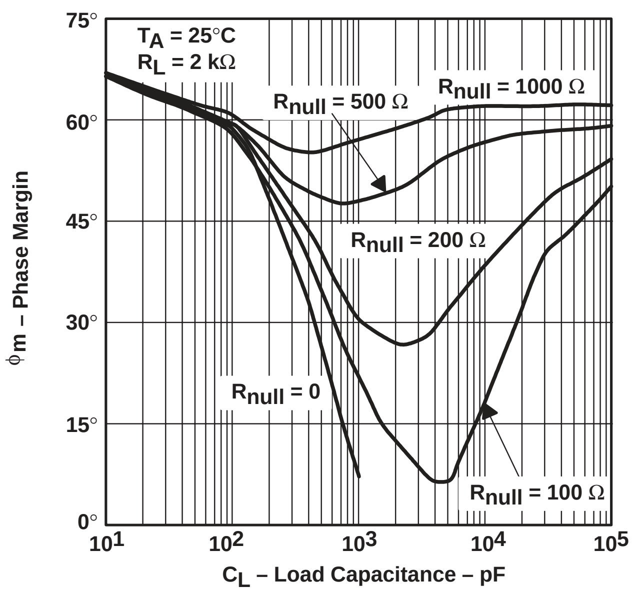


Figure 48

GAIN MARGIN vs LOAD CAPACITANCE

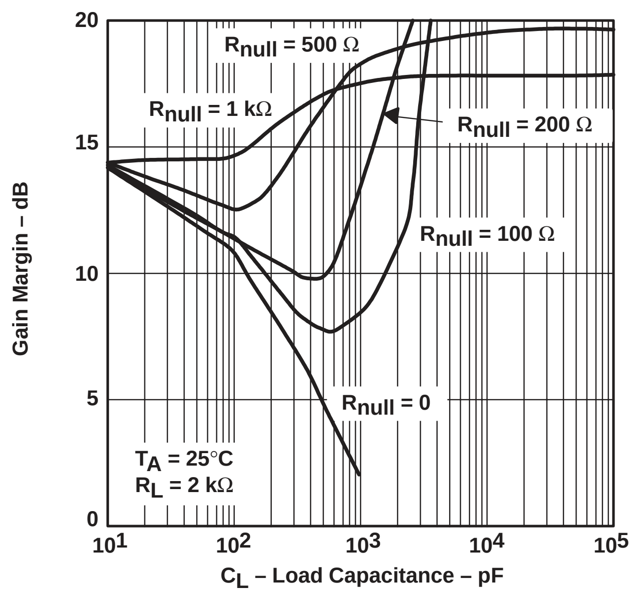


Figure 49

TYPICAL CHARACTERISTICS

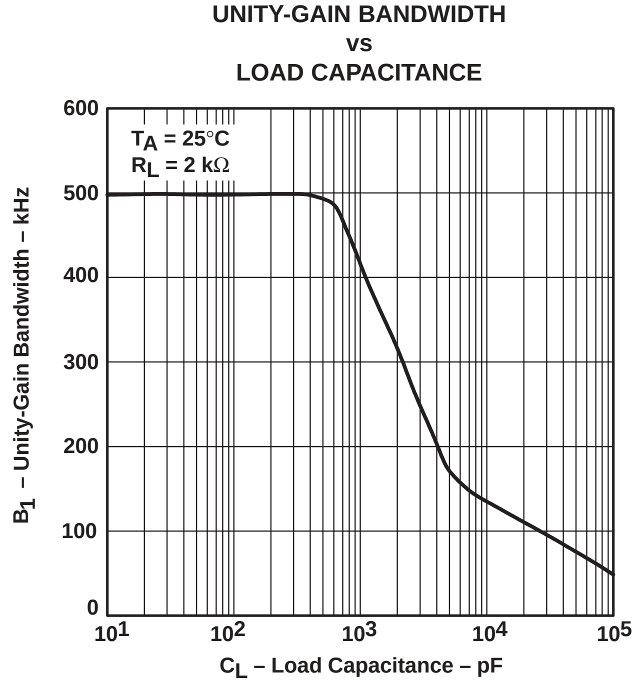


Figure 50

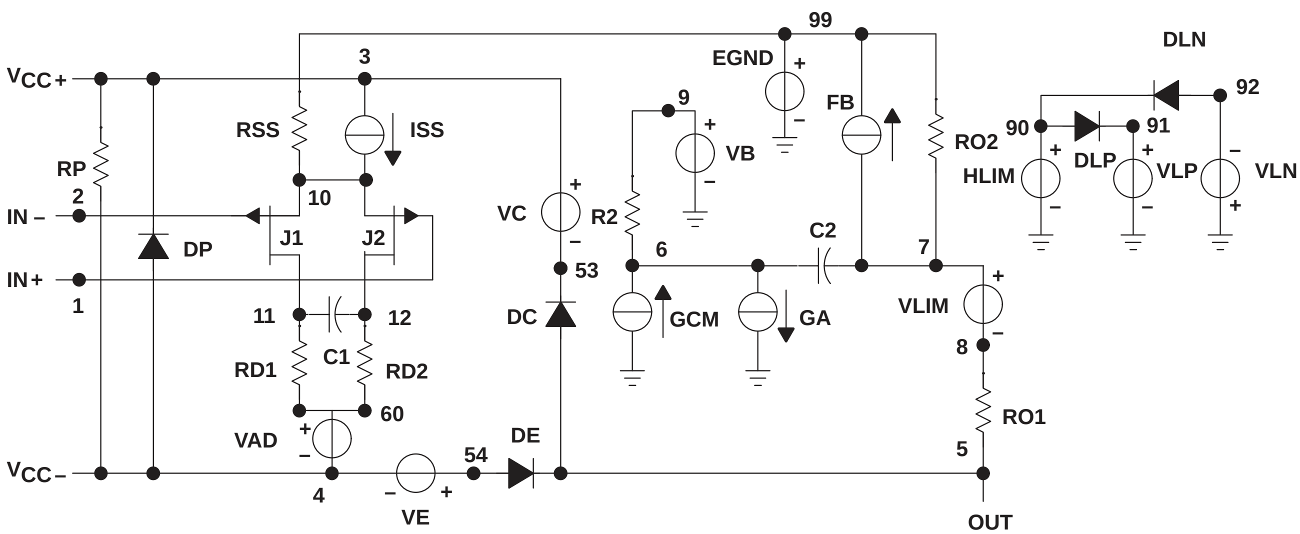
APPLICATION INFORMATION

macromodel information

Macromodel information provided was derived using Microsim *Parts*™, the model generation software used with Microsim *PSpice*™. The Boyle macromodel (see Note 5) and subcircuit in Figure 51 are generated using the TLV243x typical electrical and operating characteristics at T_A = 25°C. Using this information, output simulations of the following key parameters can be generated to a tolerance of 20% (in most cases):

- Maximum positive output voltage swing
- Maximum negative output voltage swing
- Slew rate
- Quiescent power dissipation
- Input bias current
- Open-loop voltage amplification
- Unity-gain frequency
- Common-mode rejection ratio
- Phase margin
- DC output resistance
- AC output resistance
- Short-circuit output current limit

NOTE 4: G. R. Boyle, B. M. Cohn, D. O. Pederson, and J. E. Solomon, “Macromodeling of Intergrated Circuit Operational Amplifiers”, *IEEE Journal of Solid-State Circuits,* SC-9, 353 (1974).




```
.SUBCKT TLV2432 1 2 3 4 5
        C1      11      12      3.560E–12
        C2      6       7       15.00E–12
        DC      5       53      DX
        DE      54      5       DX
        DLP     90      91      DX
        DLN     92      90      DX
        DP      4       3       DX
        EGND    99      0       POLY (2) (3,0) (4,0) 0 .5 .5
        FB      7       99      POLY (5) VB VC VE VLP
        + VLN 0 21.04E6 –30E6 30E6 30E6 –30E6
        GA      6       0       11      12 47.12E–6
        GCM     0       6       10      99 4.9E–9
        ISS     3       10      DC 8.250E–6
        HLIM    90      0       VLIM 1K
        J1      11      2       10 JX
        J2      12      1       10 JX
        R2      6       9       100.0E3
RD1     60      11      21.22E3
RD2     60      12      21.22E3
R01     8       5       120
R02     7       99      120
RP      3       4       26.04E3
RSS     10      99      24.24E6
VAD     60      4       –.6
VB      9       0       DC 0
VC      3       53      DC .65
VE      54      4       DC .65
VLIM    7       8       DC 0
VLP     91      0       DC 1.4
VLN     0       92      DC 9.4
.MODEL DX D (IS=800.0E–18)
.MODEL JX PJF (IS=500.0E–15 BETA=281E–6
+ VTO=–.065)
.ENDS
```

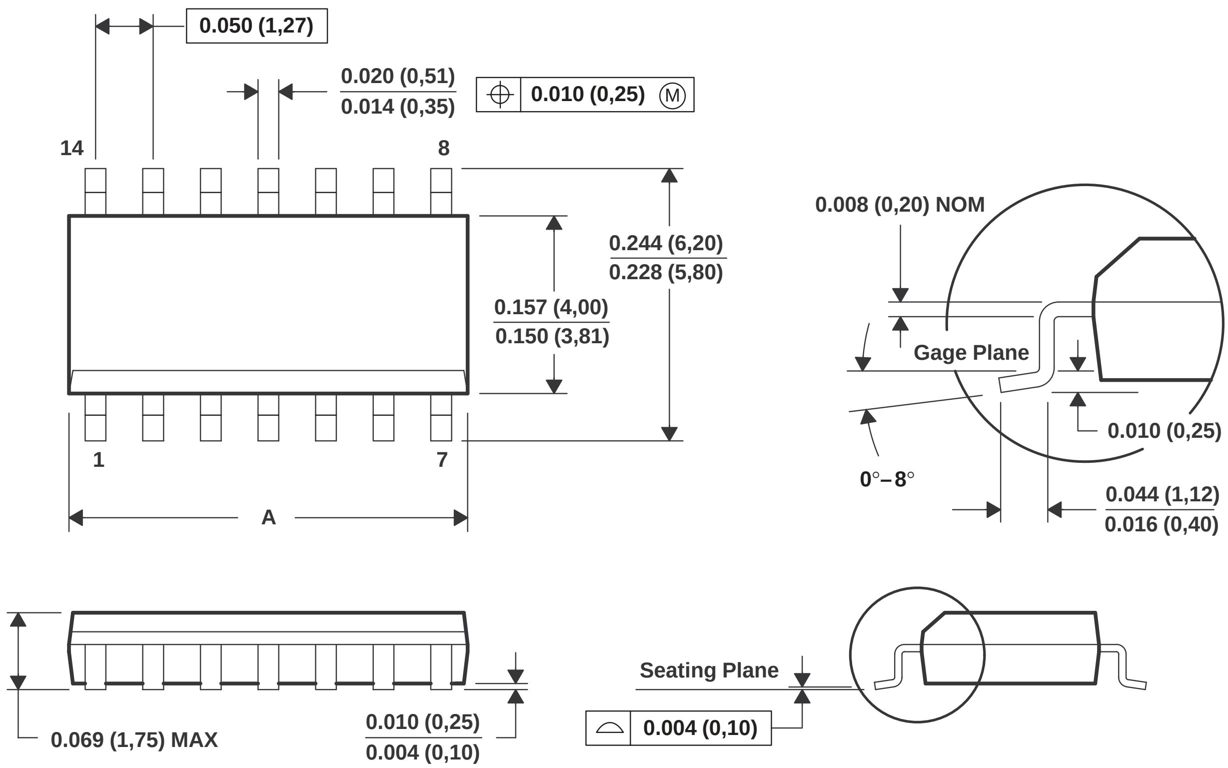
Figure 51. Boyle Macromodel and Subcircuit

PSpice and *Parts* are trademarks of MicroSim Corporation.

MECHANICAL DATA

D (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PIN SHOWN



DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

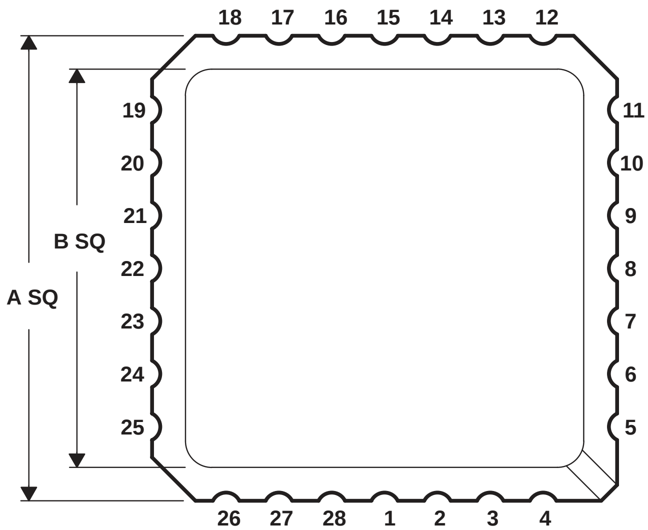
4040047 / D 10/96

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

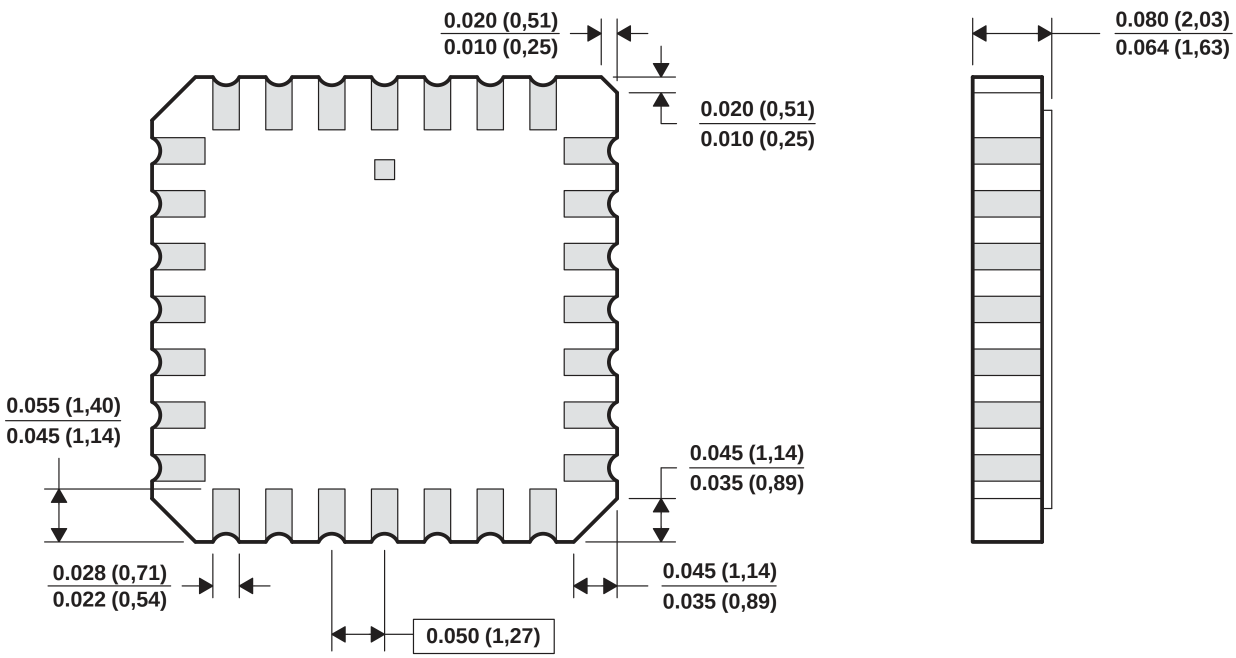
MECHANICAL DATA

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	0.739 (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)

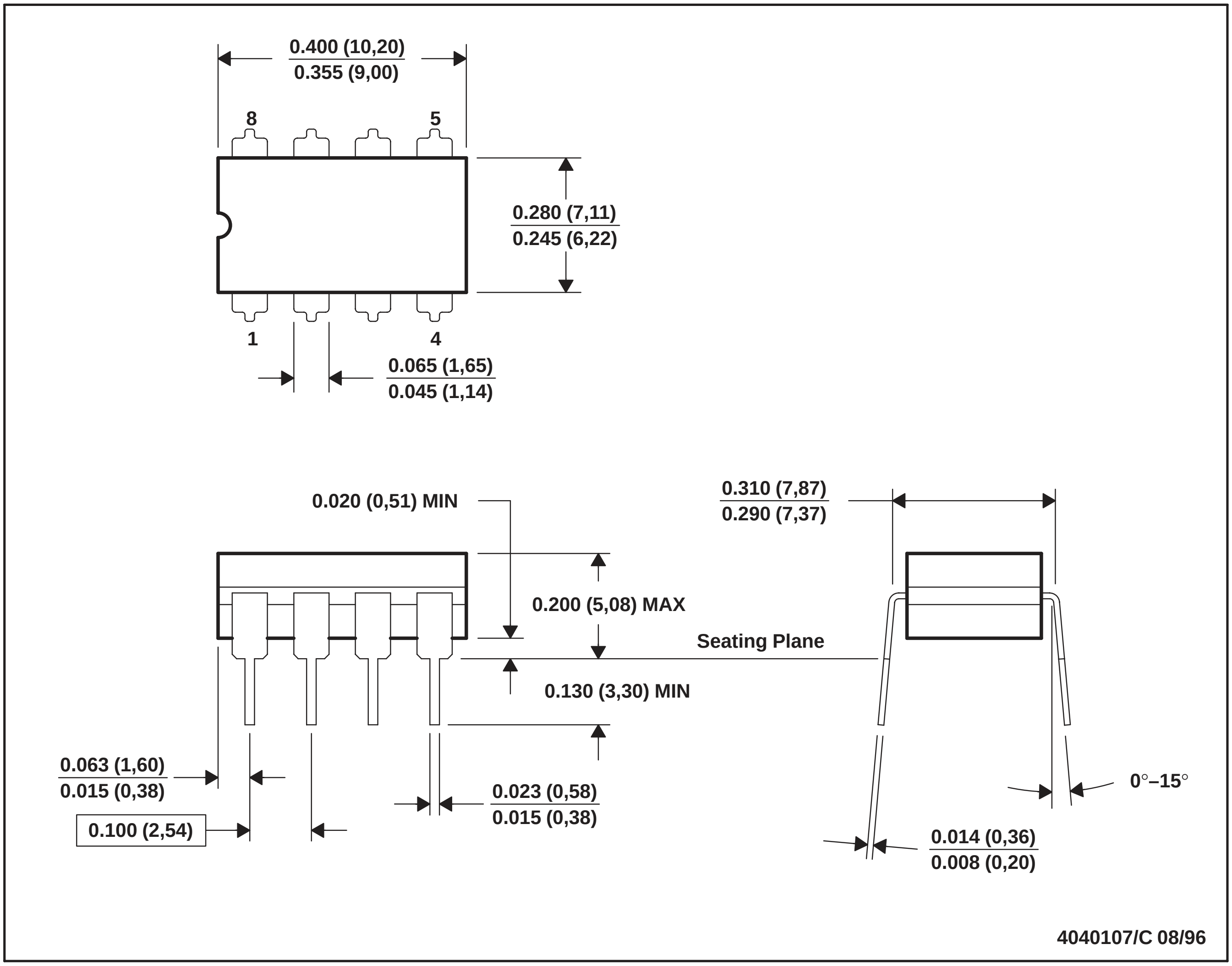


4040140 / D 10/96

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 metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

MECHANICAL DATA

JG (R-GDIP-T8) **CERAMIC DUAL-IN-LINE PACKAGE**

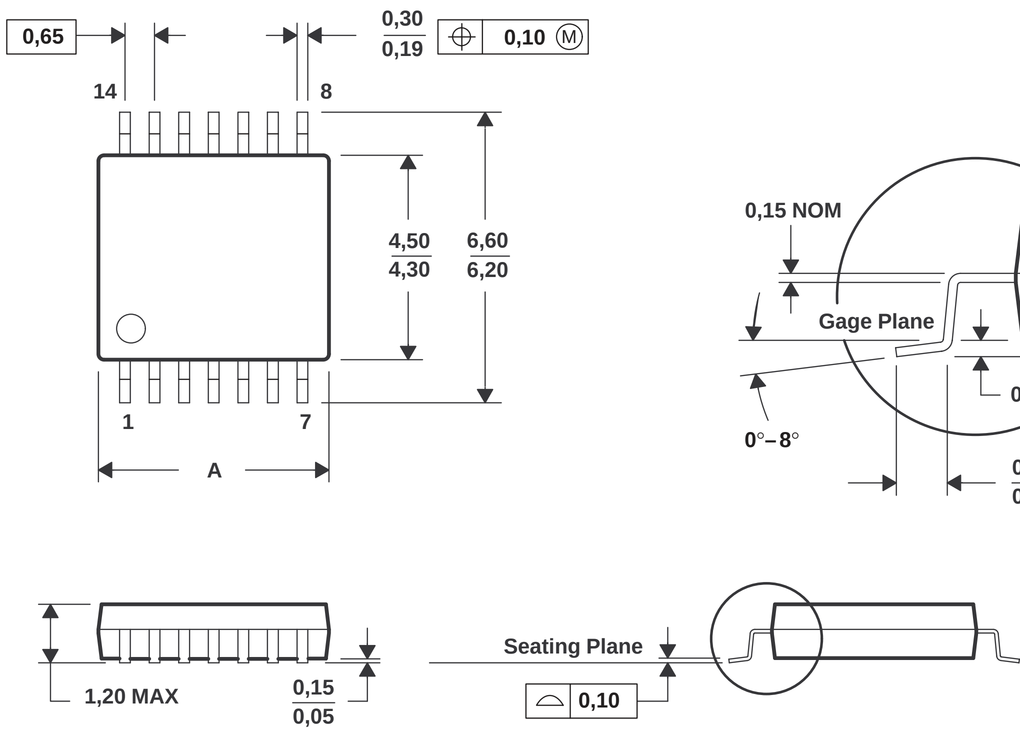


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E.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

MECHANICAL DATA

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PIN SHOWN



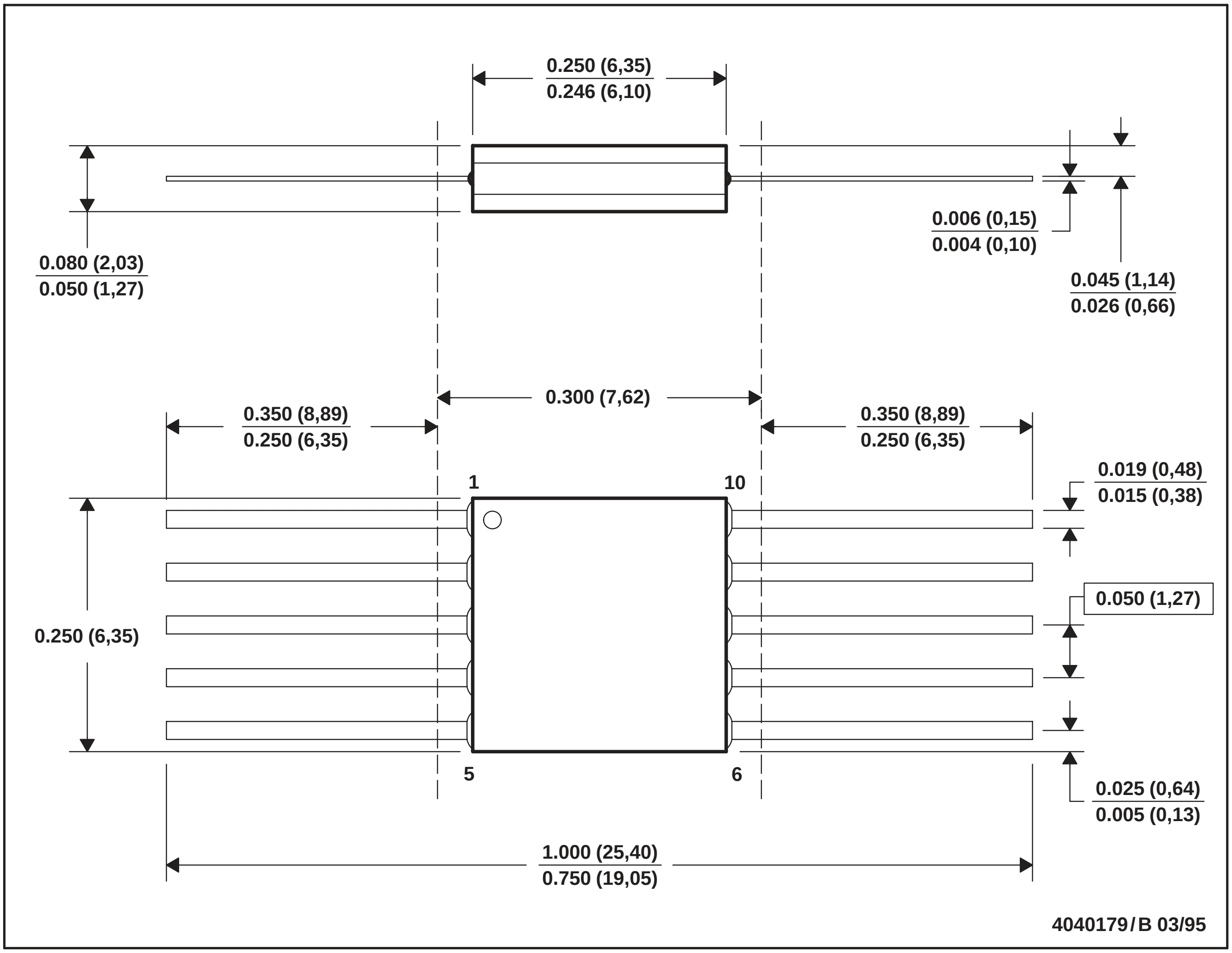
PINS ** / DIM	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064 / E 08/96

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 not to exceed 0,15.
D. Falls within JEDEC MO-153

MECHANICAL DATA

U (S-GDFP-F10) **CERAMIC DUAL FLATPACK**



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 only.
E. Falls within MIL STD 1835 GDFP1-F10 and JEDEC MO-092AA

IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.

TLV2432, Advanced LinCMOS(TM) Rail-To-Rail Output Wide-Input-Voltage Dual Operational Amplifier

DEVICE STATUS: ACTIVE

PARAMETER NAME	TLV2432
Vs (max) (V)	10
Vs (min) (V)	2.7
IQ per channel (max) (mA)	0.125
IQ per channel (typ) (mA)	0.098
GBW (typ) (MHz)	0.5
Slew Rate (typ) (V/us)	0.25
VIO (Full Range) (max) (mV)	2.5
VIO (25 deg C) (max) (mV)	2
IIB (max) (pA)	150
CMRR (min) (dB)	70
Vn at 1kHz (typ) (nV/rtHz)	18
Number of Channels	2
Spec'd at Vs (V)	5
Open Loop Gain (min) (dB)	68
Offset Drift (typ) (uV/C)	2

FEATURES

Back to Top

- Output Swing Includes Both Supply Rails
- Extended Common-Mode Input Voltage Range...0 V to 4.5 V (Min) with 5-V Single Supply
- No Phase Inversion
- Low Noise...18 nV/√Hz\ Typ at f = 1 kHz
- Low Input Offset Voltage
  950 uV Max at T_A = 25°C (TLV243xA)
- Low Input Bias Current...1 pA Typ
- Very Low Supply Current...125 uA Per Channel Max

- 600-Ω Output Drive
- Macromodel Included
- Available in Q-Temp Automotive
  HighRel Automotive Applications
  Configuration Control / Print Support
  Qualification to Automotive Standards

DESCRIPTION

Back to Top

The TLV243x and TLV243xA are low-voltage operational amplifier from Texas Instruments. The common-mode input voltage range for each device is extended over the typical CMOS amplifiers making them suitable for a wide range of applications. In addition, these devices do not phase invert when the common-mode input is driven to the supply rails. This satisfies most design requirements without paying a premium for rail-to-rail input performance. They also exhibit rail-to-rail output performance for increased dynamic range in single- or split-supply applications. This family is fully characterized at 3-V and 5-V supplies and is optimized for low-voltage operation. The TLV243x only requires 100 uA (typ) of supply current per channel, making it ideal for battery-powered applications. The TLV243x also has increased output drive over previous rail-to-rail operational amplifiers and can drive 600-Ω loads for telecom applications.

The other members in the TLV243x family are the high-power, TLV244x, and micro-power, TLV2422, versions.

The TLV243x, exhibiting high input impedance and low noise, is excellent for small-signal conditioning for high-impedance sources, such as piezoelectric transducers. Because of the micropower dissipation levels and low-voltage operation, these devices work well in hand-held monitoring and remote-sensing applications. In addition, the rail-to-rail output feature with single- or split-supplies makes this family a great choice when interfacing with analog-to-digital converters (ADCs). For precision applications, the TLV243xA is available and has a maximum input offset voltage of 950 uV.

If the design requires single operational amplifiers, see the TI TLV2211/21/31. This is a family of rail-to-rail output operational amplifiers in the SOT-23 package. Their small size and low power consumption, make them ideal for high density, battery-powered equipment.

TECHNICAL DOCUMENTS

Back to Top

To view the following documents, Acrobat Reader 3.x is required.
To download a document to your hard drive, right-click on the link and choose 'Save'.

DATASHEET

Back to Top

Full datasheet in Acrobat PDF: slos168e.pdf (623 KB) (Updated: 11/30/1999)
Full datasheet in Zipped PostScript: slos168e.psz (568 KB)

APPLICATION NOTES

Back to Top

View Application Reports for Signal Amplifiers (Less than equal to 100MHz)

- Analog Applications Journal May 2000 (SLYT015 - Updated: 04/20/2000)

- Analog Applications Journal, September 1999 edition (SLYT005 - Updated: 07/15/1999)
- Analysis Of The Sallen-Key Architecture (SLOA024A - Updated: 07/27/1999)
- Current Feedback Amplifiers: Review, Stability Analysis, and Applications (SBOA081 - Updated: 11/20/2000)
- Use of Rail-to-Rail Operational Amplifiers (SLOA039A - Updated: 12/22/1999)

USER MANUALS Back to Top

- Universal Op Amp Single, Dual, Quad (SOIC) Evaluation Module With Shutdown (SLOU061, 1160 KB - Updated: 10/22/1999)
- Universal Operational Amplifier EVM (SLVU006A, 387 KB - Updated: 03/22/1999)
- Universal Operational Amplifier Evaluation Module Selection Guide (SLOU060A, 16 KB - Updated: 09/28/2000)
- Universal Operational Amplifier Single, Dual, Quad (MSOP/TSSOP) (SLOU055, 1196 KB - Updated: 10/22/1999)
- Universal Operational Amplifier Single, Dual, Quad (PDIP) (SLOU062, 1211 KB - Updated: 10/22/1999)

BLOCK DIAGRAMS Back to Top

- Digital Cellphone
- Electro-Optics
- Point of Sale System with Card Reader
- Point of Sale System with Image Recognition
- Radar
- Target Detection Recognition

SAMPLES Back to Top

ORDERABLE DEVICE	PACKAGE	PINS	TEMP (º C)	STATUS	DSCC NUMBER	SAMPLES
TLV2432CD	D	8		ACTIVE		Request Samples
TLV2432CDR	D	8		ACTIVE		Request Samples
TLV2432ID	D	8		ACTIVE		Request Samples
TLV2432IDR	D	8		ACTIVE		Request Samples

PRICING/AVAILABILITY Back to Top

ORDERABLE DEVICE	PACKAGE	PINS	TEMP (º C)	STATUS	BUDGETARY PRICE US$/UNIT QTY=1000+	PACK QTY	DSCC NUMBER	PRICING/AVAILABILITY
TLV2432CD	D	8		ACTIVE	0.71	75		Check stock or order
TLV2432CDR	D	8		ACTIVE	0.71	2500		Check stock or order
TLV2432CPW	PW	8		ACTIVE	0.71	150		Check stock or order
TLV2432CPWR	PW	8		ACTIVE	0.71	2000		Check stock or order
TLV2432ID	D	8		ACTIVE	0.73	75		Check stock or order
TLV2432IDR	D	8		ACTIVE	0.73	2500		Check stock or order
TLV2432MFKB	FK	20	-55 TO	ACTIVE	14.27	1	5962-9751001Q2A	Check stock or order

			125					
TLV2432MJGB	JG	8	-55 TO 125	ACTIVE	6.48	1	5962-9751001QPA	Check stock or order
TLV2432MUB	U	10	-55 TO 125	ACTIVE	11.80	1	5962-9751001QHA	Check stock or order
TLV2432QD	D	8	-40 TO 125	ACTIVE	0.83	75		Check stock or order
TLV2432QDR	D	8	-40 TO 125	ACTIVE	0.83	2500		Check stock or order

DEVELOPMENT TOOLS

Back to Top

Tool Part Number	Tool Title	Tool Type
UNIV-OPAMP-1B	Universal EVM for Single/Dual OpAmps without Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-2B	Universal EVM for Single/Dual OpAmps with Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-3B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in MSOP/TSSOP packages	Evaluation Modules (EVM)
UNIV-OPAMP-4B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in SOIC packages	Evaluation Modules (EVM)
UNIV-OPAMP-5B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in PDIP packages	Evaluation Modules (EVM)

MODELS

Back to Top

- TLV243xA Macromodel for 5V Supply Voltage (SLOJ015, 0 KB, ZIP - Updated: 05/02/2000)

Table Data Updated on: 11/29/2000

TLV2432A, Advanced LinCMOS(TM) Rail-To-Rail Output Wide-Input-Voltage Dual Operational Amplifier

DEVICE STATUS: ACTIVE

PARAMETER NAME	TLV2432A
Vs (max) (V)	10
Vs (min) (V)	2.7
IQ per channel (max) (mA)	0.125
IQ per channel (typ) (mA)	0.098
GBW (typ) (MHz)	0.5
Slew Rate (typ) (V/us)	0.25
VIO (Full Range) (max) (mV)	1.5
VIO (25 deg C) (max) (mV)	0.95
IIB (max) (pA)	150
CMRR (min) (dB)	70
Vn at 1kHz (typ) (nV/rtHz)	18
Number of Channels	2
Spec'd at Vs (V)	5
Open Loop Gain (min) (dB)	68
Offset Drift (typ) (uV/C)	2

FEATURES

Back to Top

- Output Swing Includes Both Supply Rails
- Extended Common-Mode Input Voltage Range...0 V to 4.5 V (Min) with 5-V Single Supply
- No Phase Inversion
- Low Noise...18 nV/√Hz\ Typ at f = 1 kHz
- Low Input Offset Voltage
  950 uV Max at T_A = 25°C (TLV243xA)
- Low Input Bias Current...1 pA Typ
- Very Low Supply Current...125 uA Per Channel Max
- 600-Ω Output Drive

- Macromodel Included
- Available in Q-Temp Automotive
  HighRel Automotive Applications
  Configuration Control / Print Support
  Qualification to Automotive Standards

Advanced LinCMOS is a trademark of Texas Instruments Incorporated.

DESCRIPTION

Back to Top

The TLV243x and TLV243xA are low-voltage operational amplifier from Texas Instruments. The common-mode input voltage range for each device is extended over the typical CMOS amplifiers making them suitable for a wide range of applications. In addition, these devices do not phase invert when the common-mode input is driven to the supply rails. This satisfies most design requirements without paying a premium for rail-to-rail input performance. They also exhibit rail-to-rail output performance for increased dynamic range in single- or split-supply applications. This family is fully characterized at 3-V and 5-V supplies and is optimized for low-voltage operation. The TLV243x only requires 100 uA (typ) of supply current per channel, making it ideal for battery-powered applications. The TLV243x also has increased output drive over previous rail-to-rail operational amplifiers and can drive 600-Ω loads for telecom applications.

The other members in the TLV243x family are the high-power, TLV244x, and micro-power, TLV2422, versions.

The TLV243x, exhibiting high input impedance and low noise, is excellent for small-signal conditioning for high-impedance sources, such as piezoelectric transducers. Because of the micropower dissipation levels and low-voltage operation, these devices work well in hand-held monitoring and remote-sensing applications. In addition, the rail-to-rail output feature with single- or split-supplies makes this family a great choice when interfacing with analog-to-digital converters (ADCs). For precision applications, the TLV243xA is available and has a maximum input offset voltage of 950 uV.

If the design requires single operational amplifiers, see the TI TLV2211/21/31. This is a family of rail-to-rail output operational amplifiers in the SOT-23 package. Their small size and low power consumption, make them ideal for high density, battery-powered equipment.

TECHNICAL DOCUMENTS

Back to Top

To view the following documents, Acrobat Reader 3.x is required.
To download a document to your hard drive, right-click on the link and choose 'Save'.

DATASHEET

Back to Top

Full datasheet in Acrobat PDF: slos168e.pdf (623 KB) (Updated: 11/30/1999)
Full datasheet in Zipped PostScript: slos168e.psz (568 KB)

APPLICATION NOTES

Back to Top

View Application Reports for Signal Amplifiers (Less than equal to 100MHz)

- Analog Applications Journal May 2000 (SLYT015 - Updated: 04/20/2000)
- Analog Applications Journal, September 1999 edition (SLYT005 - Updated: 07/15/1999)

- Analysis Of The Sallen-Key Architecture (SLOA024A - Updated: 07/27/1999)
- Current Feedback Amplifiers: Review, Stability Analysis, and Applications (SBOA081 - Updated: 11/20/2000)
- Use of Rail-to-Rail Operational Amplifiers (SLOA039A - Updated: 12/22/1999)

USER MANUALS Back to Top

- Universal Op Amp Single, Dual, Quad (SOIC) Evaluation Module With Shutdown (SLOU061, 1160 KB - Updated: 10/22/1999)
- Universal Operational Amplifier EVM (SLVU006A, 387 KB - Updated: 03/22/1999)
- Universal Operational Amplifier Evaluation Module Selection Guide (SLOU060A, 16 KB - Updated: 09/28/2000)
- Universal Operational Amplifier Single, Dual, Quad (MSOP/TSSOP) (SLOU055, 1196 KB - Updated: 10/22/1999)
- Universal Operational Amplifier Single, Dual, Quad (PDIP) (SLOU062, 1211 KB - Updated: 10/22/1999)

SAMPLES Back to Top

ORDERABLE DEVICE	PACKAGE	PINS	TEMP (º C)	STATUS	DSCC NUMBER	SAMPLES
TLV2432AID	D	8		ACTIVE		Request Samples
TLV2432AIDR	D	8		ACTIVE		Request Samples
TLV2432AIPWR	PW	8		ACTIVE		Request Samples

PRICING/AVAILABILITY Back to Top

ORDERABLE DEVICE	PACKAGE	PINS	TEMP (º C)	STATUS	BUDGETARY PRICE US$/UNIT QTY=1000+	PACK QTY	DSCC NUMBER	PRICING/AVAILABILITY
TLV2432AID	D	8		ACTIVE	0.77	75		Check stock or order
TLV2432AIDR	D	8		ACTIVE	0.77	2500		Check stock or order
TLV2432AIPW	PW	8		ACTIVE	0.77	150		Check stock or order
TLV2432AIPWLE	PW	8		OBSOLETE				
TLV2432AIPWR	PW	8		ACTIVE	0.77	2000		Check stock or order
TLV2432AMFKB	FK	20	-55 TO 125	ACTIVE	16.45	1	5962-9751002Q2A	Check stock or order
TLV2432AMJGB	JG	8	-55 TO 125	ACTIVE	8.41	1	5962-9751002QPA	Check stock or order
TLV2432AMUB	U	10	-55 TO 125	ACTIVE	13.94	1	5962-9751002QHA	Check stock or order
TLV2432AQD	D	8	-40 TO 125	ACTIVE	0.87	75		Check stock or order
TLV2432AQDR	D	8	-40 TO 125	ACTIVE	0.87	2500		Check stock or order

DEVELOPMENT TOOLS Back to Top

Tool Part Number	Tool Title	Tool Type
UNIV-OPAMP-1B	Universal EVM for Single/Dual OpAmps without Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-2B	Universal EVM for Single/Dual OpAmps with Shutdown in MSOP/SOIC/SOT-23 packages	Evaluation Modules (EVM)
UNIV-OPAMP-3B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in MSOP/TSSOP packages	Evaluation Modules (EVM)
UNIV-OPAMP-4B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in SOIC packages	Evaluation Modules (EVM)
UNIV-OPAMP-5B	Universal EVM for Single/Dual/Quad OpAmps with/without Shutdown in PDIP packages	Evaluation Modules (EVM)

MODELS Back to Top

- TLV243xA Macromodel for 5V Supply Voltage (SLOJ015, 0 KB, ZIP - Updated: 05/02/2000)

Table Data Updated on: 11/29/2000