

1. DESCRIPTION

The XLV324DR are CMOS quad low voltage operational amplifiers with rail-to-rail output swing. These amplifiers are a cost-effective solution for applications where low power consumption and space saving packages are critical. Specification tables are provided for operation from power supply voltages at 2.7 V and 5 V. Rail-to-Rail operation provides improved signal-to-noise performance. Ultra low quiescent current makes this series of amplifiers ideal for portable, battery operated equipment. The common mode input range includes ground making the device useful for low-side current-shunt measurements. The ultra small packages allow for placement on the PCB in close proximity to the signal source thereby reducing noise pickup.

2. FEATURES

- Operation from 2.7 V to 5.0 V Single-Sided Power Supply
- No Output Crossover Distortion
- Industrial temperature Range: -40°C to +85°C
- Rail-to-Rail Output
- No Output Phase-Reversal from Overdriven Input
- These are Pb-Free Devices

3. TYPICAL APPLICATION

- Notebook Computers and PDA's
- Portable Battery-Operated Instruments
- Active Filters

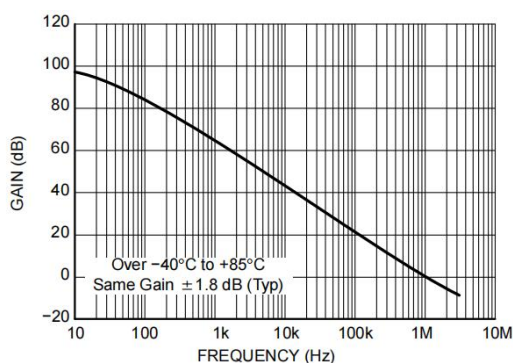


Figure 1. Open Loop Frequency Response
(RL = 2 k, TA = 25 C, VS = 5 V)

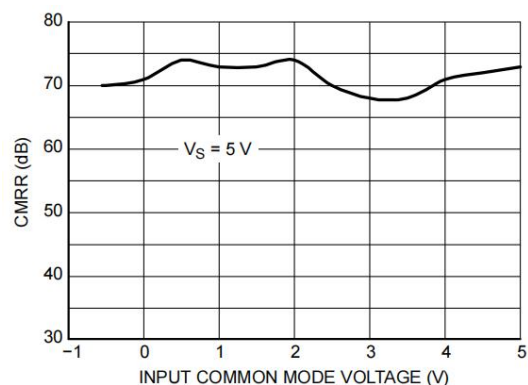
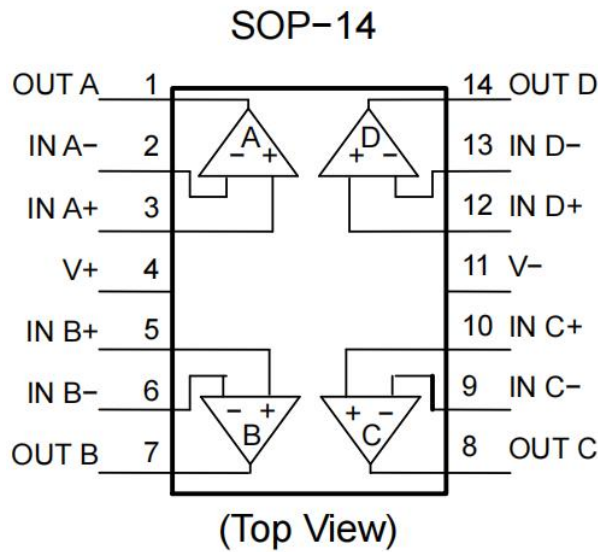


Figure 2. CMRR vs. Input Common Mode

4. PIN CONNECTIONS



5. MAXIMUM RATINGS

Symbol	Rating	Value	Unit
V_S	Supply Voltage (Operating Range $V_S = 2.7\text{ V to }5.5\text{ V}$)	5.5	V
V_{IDR}	Input Differential Voltage	\pm Supply Voltage	V
V_{ICR}	Input Common Mode Voltage Range	$-0.5\text{ to }(V+) + 0.5$	V
	Maximum Input Current	10	mA
t_{SO}	Output Short Circuit (Note 1)	Continuous	
T_J	Maximum Junction Temperature (Operating Range $-40^\circ\text{C to }^\circ\text{C}$)	150	$^\circ\text{C}$
θ_{JA}	Thermal Resistance:		$^\circ\text{C/W}$
	SOP-14	156	
T_{stg}	Storage Temperature	$-65\text{ to }150$	$^\circ\text{C}$
	Mounting Temperature (Infrared or Convection -20 sec)	260	$^\circ\text{C}$
V_{ESD}	ESD Tolerance		
	Machine Model	100	V
	Human Body Mode	2000	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Continuous short-circuit operation to ground at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C . Output currents in excess of 45 mA over long term may adversely affect reliability. Shorting output to either $V+$ or $V-$ will adversely affect reliability

6. 2.7 V DC ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, all limits are guaranteed for $T_A = 25^\circ\text{C}$, $V^+ = 2.7\text{ V}$, $R_L = 1\text{ M}\Omega$, $V^- = 0\text{ V}$, $V_O = V^+/2$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		1.7	9	mV
Input Offset Voltage Average Drift	ICV_{OS}	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		5		$\mu\text{V}/^\circ\text{C}$
Input Bias Current	I_B	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		<1		nA
Input Offset Current	I_{IO}	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		<1		nA
Common Mode Rejection Ratio	CMRR	$0\text{ V} \leq V_{CM} \leq 1.7\text{ V}$	50	63		dB
Power Supply Rejection Ratio	PSRR	$2.7\text{ V} \leq V^+ \leq 5\text{ V}$, $V_O = 1\text{ V}$	50	60		dB
Input Common-Mode Voltage Range	V_{CM}	For CMRR $\geq 50\text{ dB}$	0 to 1.7	-0.2 to 1.9		V
Output Swing	V_{OH}	$R_L = 10\text{ k}\Omega$ to 1.35 V	$V_{CC} - 100$	$V_{CC} - 10$		mV
	V_{OL}	$R_L = 10\text{ k}\Omega$ to 1.35 V (Note 2)		60	180	mV
Supply Current XLV324DR (4 Amplifiers)	I_{CC}			260	680	μA

7. 2.7 V AC ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, all limits are guaranteed for $T_A = 25^\circ\text{C}$, $V^+ = 2.7\text{ V}$, $R_L = 1\text{ M}\Omega$, $V^- = 0\text{ V}$, $V_O = V^+/2$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Gain Bandwidth Product	GBWP	$CL = 200\text{ pF}$		1		MHz
Phase Margin	Θ_m			60		°
Gain Margin	G_m			10		dB
Input-Referred Voltage Noise	e_n	$f = 50\text{ kHz}$		50		$\text{nV}/\sqrt{\text{Hz}}$

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted.

Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Guaranteed by design and/or characterization.

8. 5.0 V DC ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, all limits are guaranteed for $T_A = 25^\circ\text{C}$, $V^+ = 5.0\text{ V}$, $R_L = 1\text{ M}\Omega$, $V^- = 0\text{ V}$, $V_O = V^+/2$)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		1.7	9	mV
Input Offset Voltage Average Drift	TCV_{IO}	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		5		$\mu\text{V}/^\circ\text{C}$
Input Bias Current (Note 3)	I_B	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		< 1		nA
Input Offset Current (Note 3)	I_{IO}	$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		< 1		nA
Common Mode Rejection Ratio	CMRR	$0\text{ V} \leq V_{CM} \leq 4\text{ V}$	50	65		dB
Power Supply Rejection Ratio	PSRR	$2.7\text{ V} \leq V^+ \leq 5\text{ V}$, $V_O = 1\text{ V}$, $V_{CM} = 1\text{ V}$	50	60		dB
Input Common-Mode Voltage Range	VCM	For CMRR $\geq 50\text{ dB}$	0 to 4	-0.2 to 4.2		V
Large Signal Voltage Gain (Note 3)	A_V	$R_L = 2\text{ k}\Omega$	15	100		V/mV
		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	10			
Output Swing	V_{OH}	$R_L = 2\text{ k}\Omega$ to 2.5 V $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	$V_{CC} - 300$ $V_{CC} - 400$	$V_{CC} - 40$		mV
	V_{OL}	$R_L = 2\text{ k}\Omega$ to 2.5 V (Note 3) $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		120	300 400	mV
	V_{OH}	$R_L = 10\text{ k}\Omega$ to 2.5 V (Note 3) $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$	$V_{CC} - 100$ $V_{CC} - 200$			mV
	V_{OL}	$R_L = 10\text{ k}\Omega$ to 2.5 V $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		65	180 280	mV
Output Short Circuit Current	I_O	Sourcing = $V_O = 0\text{ V}$ (Note 3)	10	60		mA
		Sinking = $V_O = 5\text{ V}$ (Note 3)	10	160		
Supply Current	I_{CC}	XLV324 All Four Amplifiers $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$		410	830 1160	μA

9. 5.0 V AC ELECTRICAL CHARACTERISTICS

(Unless otherwise specified, all limits are guaranteed for $T_A = 25^\circ\text{C}$, $V^+ = 5.0\text{ V}$, $R_L = 1\text{ M}\Omega$, $V^- = 0\text{ V}$, $V_O = V^+/2$)

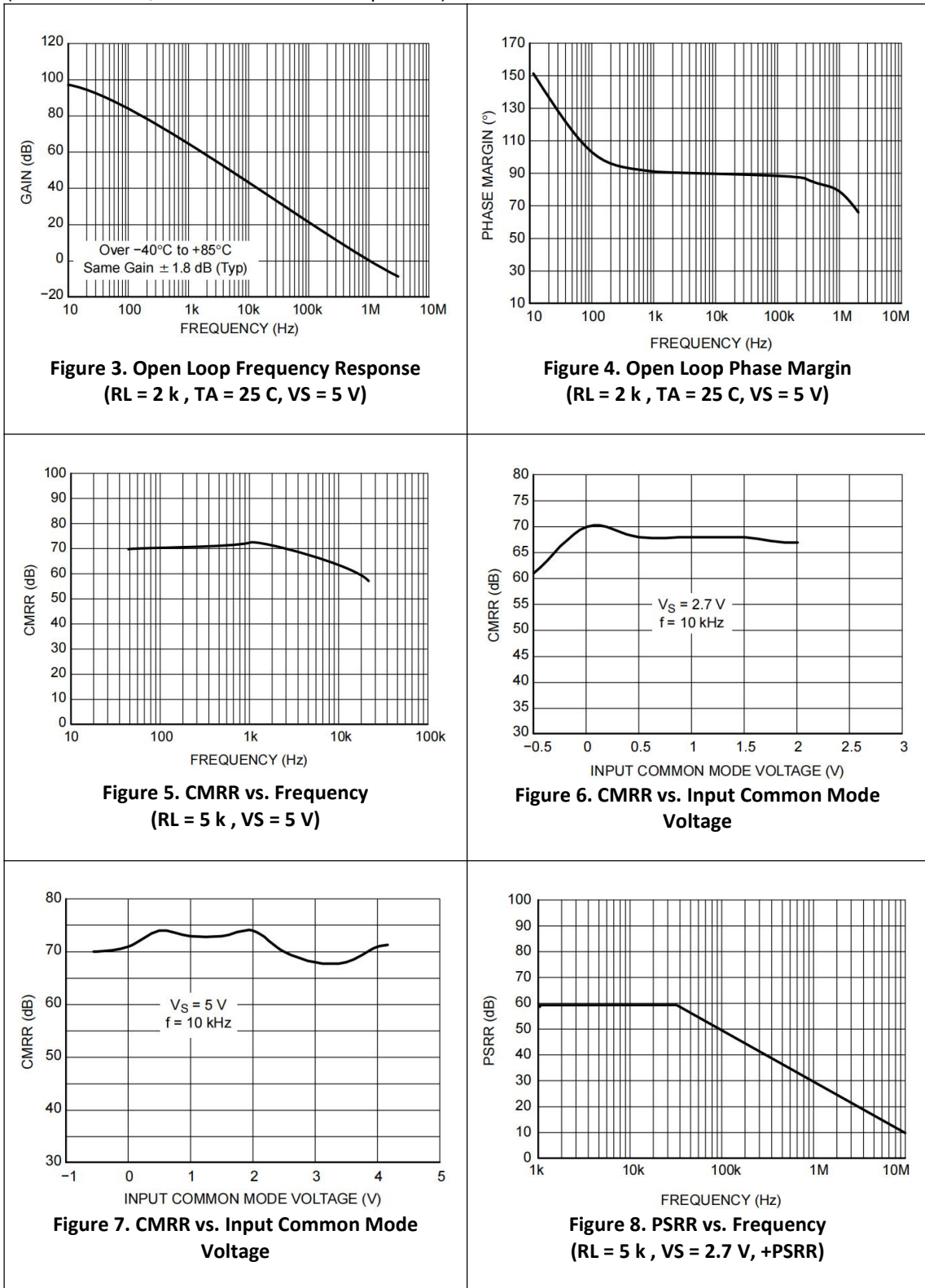
Parameter	Symbol	Condition	Min	Typ	Max	Unit
Slew Rate	S_R			1		V/ μs
Gain Bandwidth Product	GBWP	$C_L = 200\text{ pF}$		1		MHz
Phase Margin	Θ_m			60		°
Gain Margin	G_m			10		dB
Input-Referred Voltage Noise	e_n	$f = 50\text{ kHz}$		50		$\text{nV}/\sqrt{\text{Hz}}$

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

3. Guaranteed by design and/or characterization.

10. TYPICAL CHARACTERISTICS

($T_A = 25^\circ\text{C}$ and $V_S = 5\text{ V}$ unless otherwise specified)



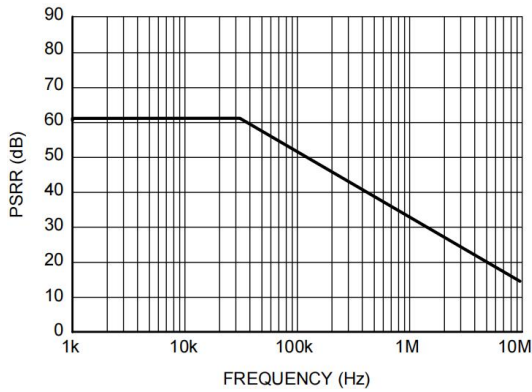


Figure 9. PSRR vs. Frequency
(RL = 5 k, VS = 2.7 V, -PSRR)

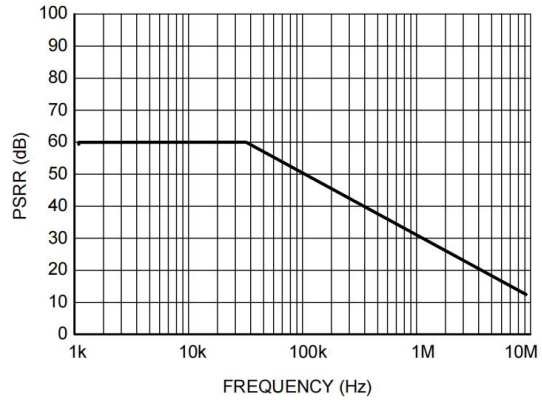


Figure 10. PSRR vs. Frequency
(RL = 5 k, VS = 5 V, +PSRR)

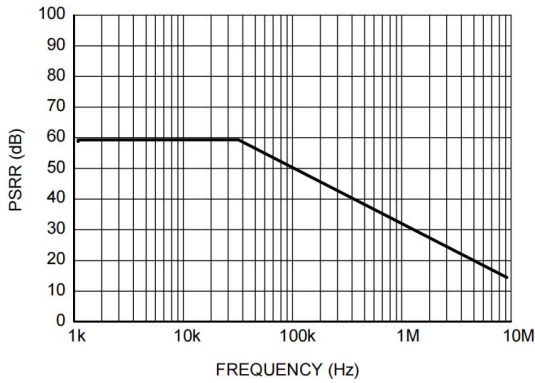


Figure 11. PSRR vs. Frequency
(RL = 5 k, VS = 5 V, -PSRR)

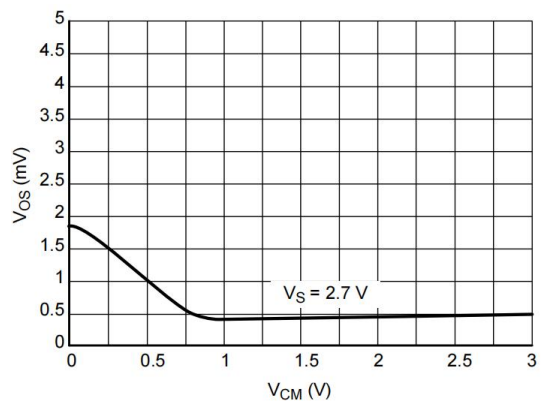


Figure 12. VOS vs. CMR

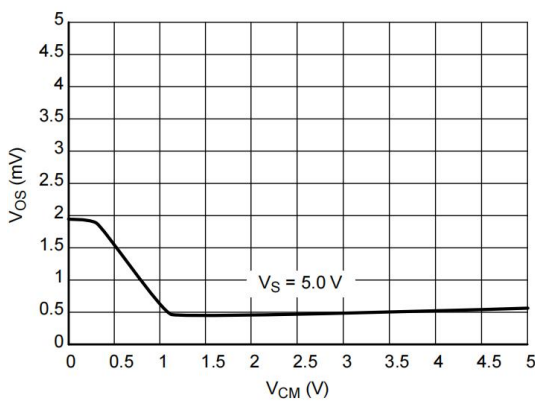


Figure 13. VOS vs. CMR

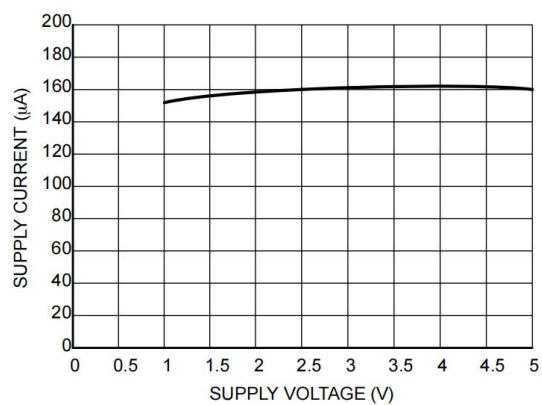
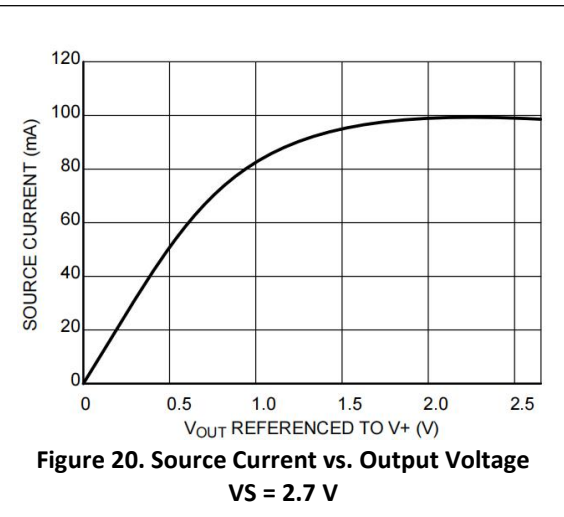
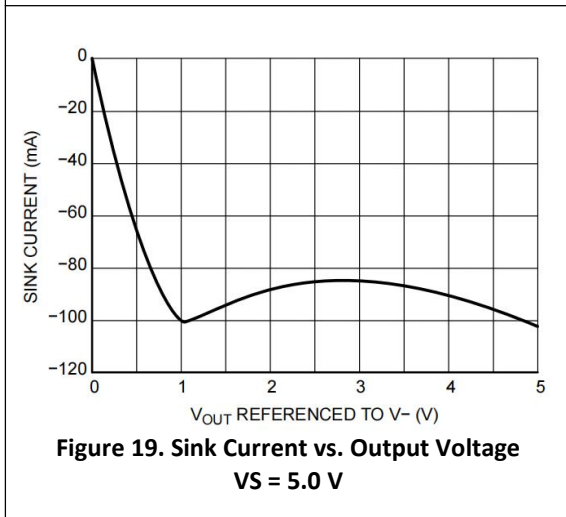
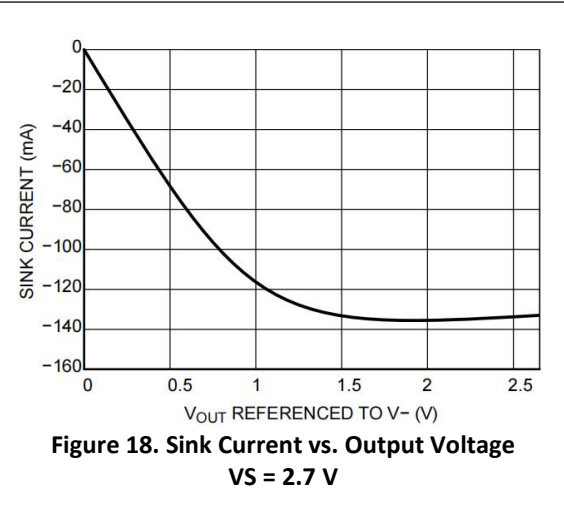
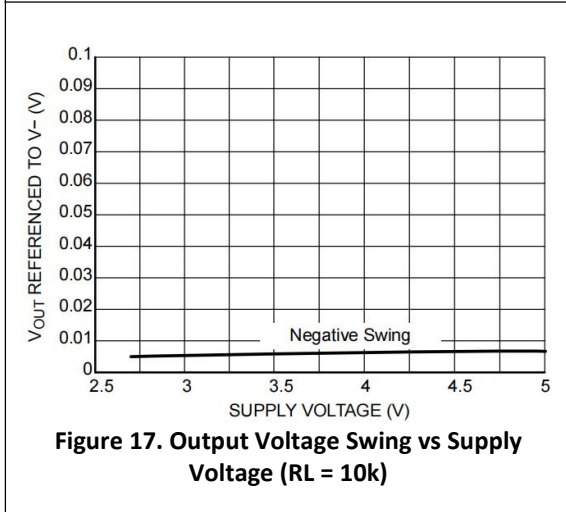
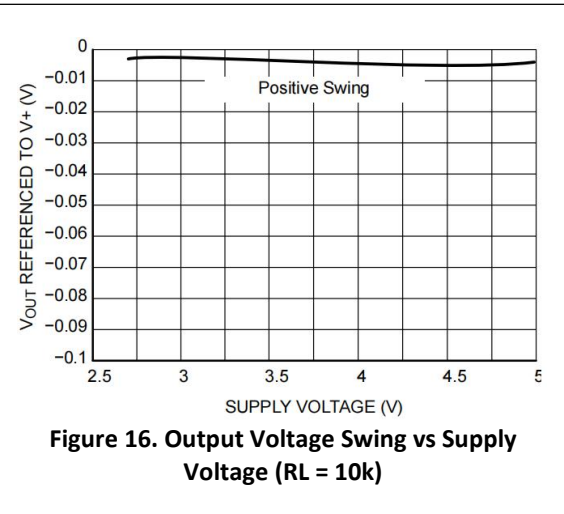
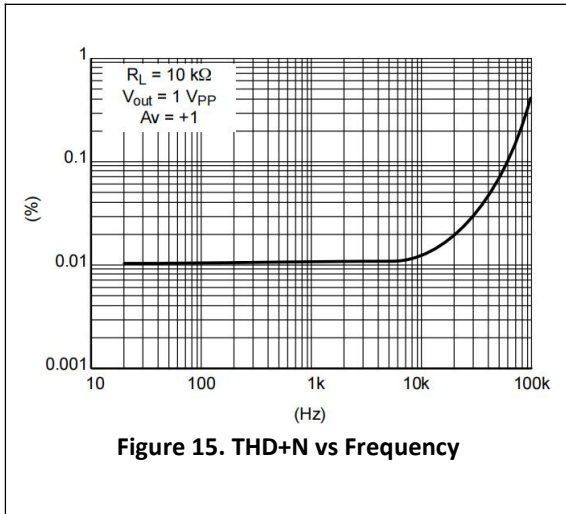


Figure 14. Supply Current vs. Supply Voltage



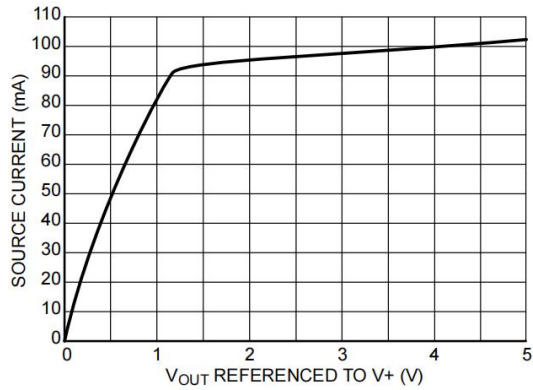


Figure 21. Source Current vs. Output Voltage
VS = 5.0 V

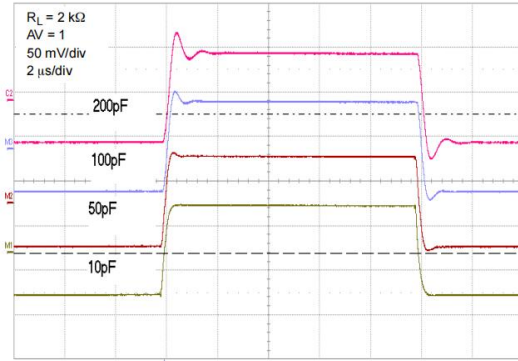


Figure 22. Settling Time vs. Capacitive Load

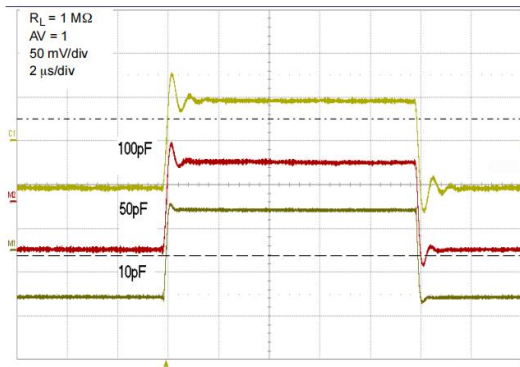


Figure 23. Settling Time vs. Capacitive Load

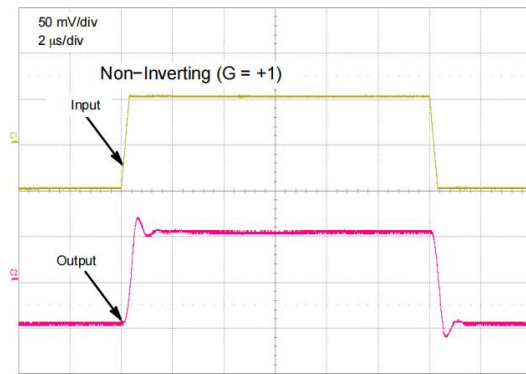


Figure 24. Step Response – Small Signal

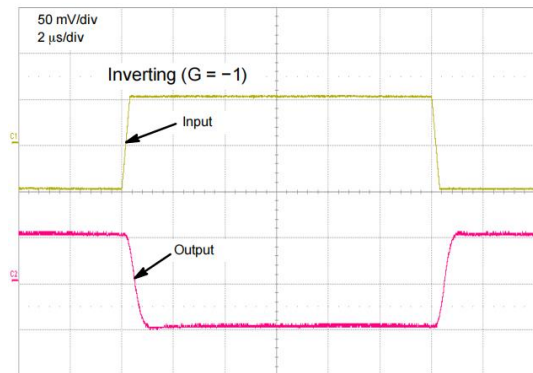


Figure 25. Step Response – Small Signal

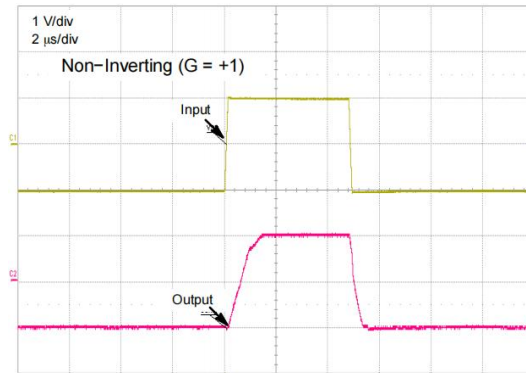
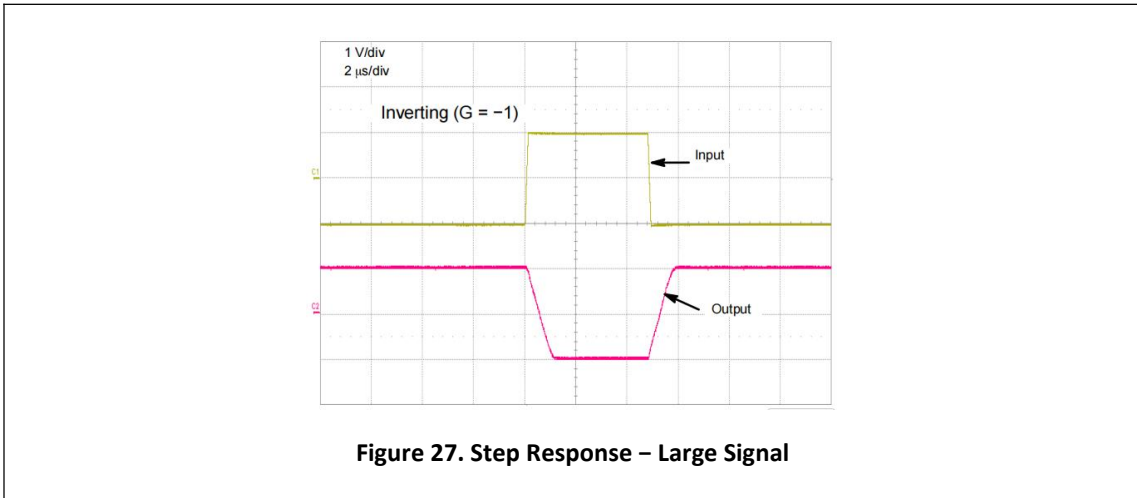


Figure 26. Step Response – Large Signal



11. APPLICATIONS

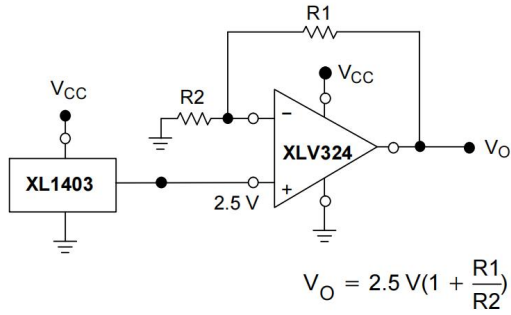


Figure 28. Voltage Reference

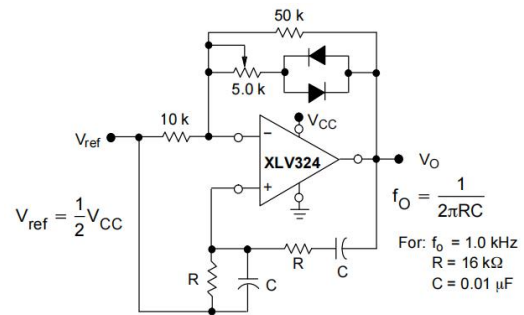


Figure 29. Wien Bridge Oscillator

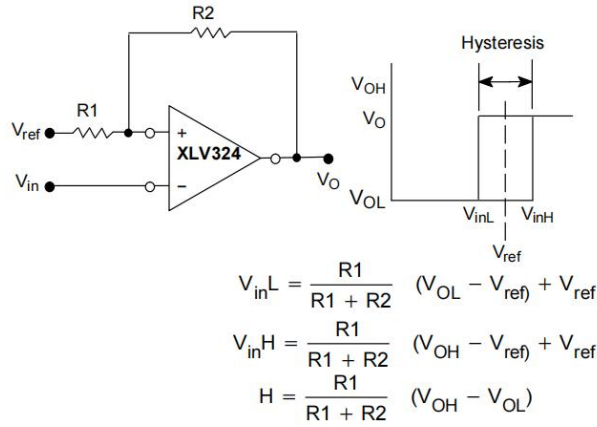
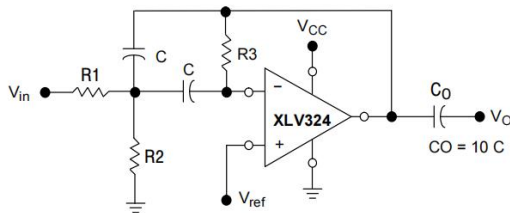


Figure 30. Comparator with Hysteresis



Given: f_o = center frequency
 $A(f_o)$ = gain at center frequency

Choose value f_o, C, Q
Then: $R_3 = \frac{C}{\pi f_o Q}$
 $R_1 = \frac{R_3}{2 A(f_o)}$
 $R_2 = \frac{R_1 R_3}{4Q^2 R_1 - R_3}$

For less than 10% error from operational amplifier,
 $((Qo f_o)/BW) < 0.1$ where f_o and BW are expressed in Hz.
If source impedance varies, filter may be preceded with voltage follower buffer to stabilize filter parameters.

Figure 31. Multiple Feedback Bandpass Filter

12. ORDERING INFORMATION

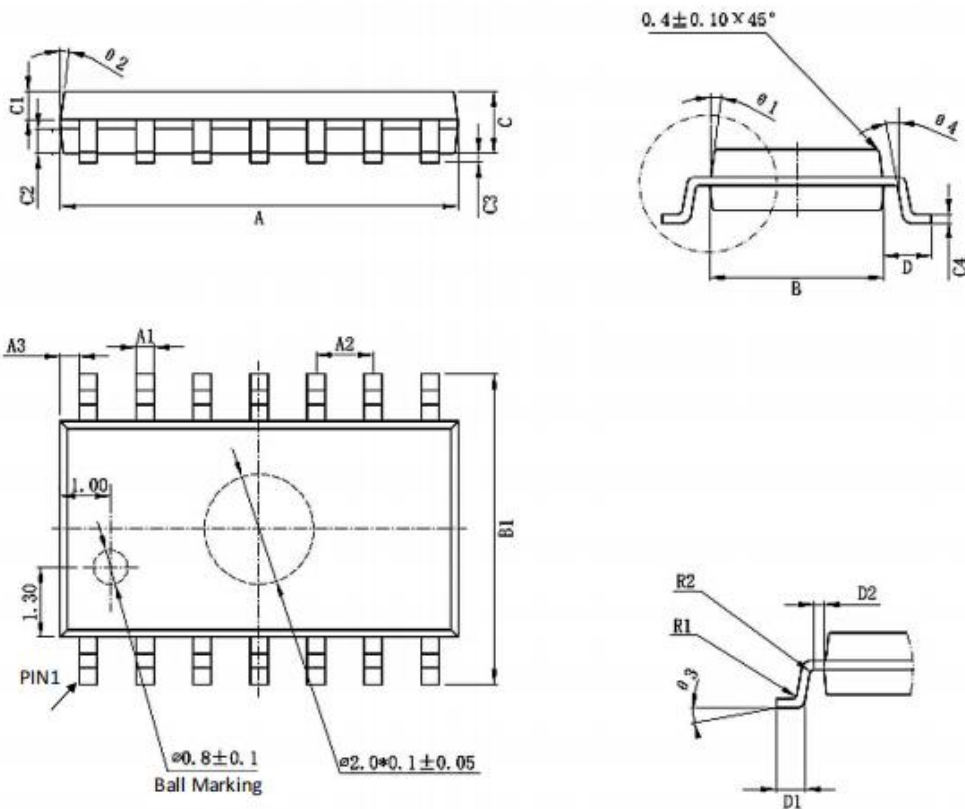
Ordering Information

Part Number	Device Making	Package type	Body size (mm)	Temperate (°C)	MSL	Transpo Rt	Package Quantit
XLV324DR	XLV324D	SOP14	8.75*4.00	-40 to +85	MSL3	T&R	2500

13. DIMENSIONAL DRAWINGS

SOP14

Mark	Size	Min (mm)	Max (mm)	Mark	Size	Min (mm)	Max (mm)
A		8.55	8.75	C4		0.193	0.213
A1		0.356	0.456	D		0.96	1.15
A2		1.27TYP		D1		0.40	0.70
A3		0.312TYP		D2		0.20TYP	
B		3.80	4.00	R1		0.20TYP	
B1		5.80	6.20	R2		0.20TYP	
C		1.40	1.60	θ 1		8° ~ 12° TYP4	
C1		0.60	0.70	θ 2		8° ~ 12° TYP4	
C2		0.55	0.65	θ 3		0° ~ 8°	
C3		0.05	0.25	θ 4		4° ~ 12°	



[if you need help contact us. Xinluda reserves the right to change the above information without prior notice.]