

1. DESCRIPTION

The XLV358-MS and XLV358D are dual,CMOS,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.

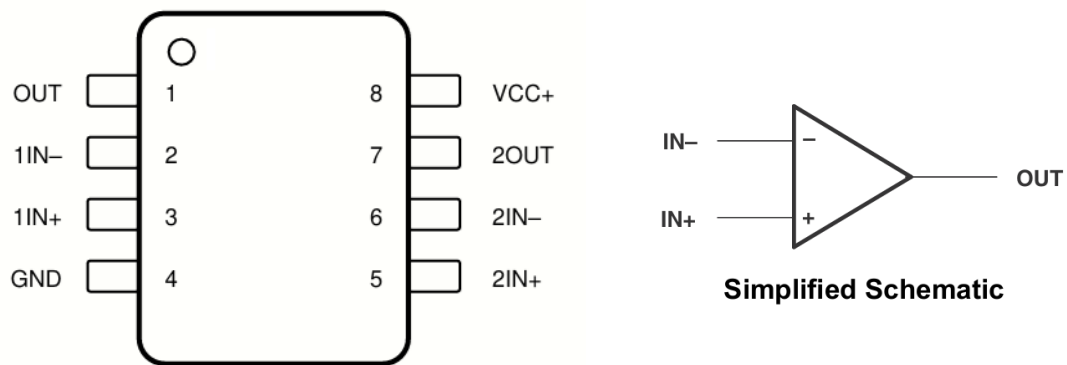
2. FEATURES

- Operation from 2.7 V to 5.0 V Single-Sided Power Supply
- Rail-to-Rail Output swing
- No Output Crossover Distortion
- Low Quiescent Current: 100 μ A @VCC=5V (typical) per Channel
- No Output Phase-Reversal from Overdriven Input

3. TYPICAL APPLICATIONS

- Active filters
- Personal electronics
- HVAC: heating, ventilating, and air conditioning
- Motor control: AC induction
- Portable media players
- Washing machines: high-end and low-end

4. PIN CONFIGURATION AND FUNCTIONS



XLV358-MS,XLV358D (Top View)

Pin Functions

PIN		TYPE ⁽¹⁾	DESCRIPTION
NAME	NO.		
1IN+	3	I	Noninverting input
1IN-	2	I	Inverting input
2IN+	5	I	Noninverting input
2IN-	6	I	Inverting input
2OUT	7	O	Output
GND	4	—	Negative supply
OUT	1	O	Output
VCC+	8	—	Positive supply

(1) I = input, O = output

5. MAXIMUM RATINGS

Symbol	Rating	Value	Unit
VCC	Supply Voltage ($V_S = V_{CC+} - GND$, Note 2)	5.5	V
V_{IDR}	Input Differential Voltage($IN+$ with respect to $IN-$)	± 5.5	V
V_{ICR}	Input Common Mode Voltage Range	-0.2 to $(V_{CC}) + 0.2$	V
t_{SO}	Output Short Circuit (Note 3)	Continuous	
T_J	Maximum Junction Temperature	150	°C
T_A	Operating Ambient Temperature Range	-40 to 85	°C
θ_{JA}	Junction-to-ambient thermal resistance		°C/W
	MSOP8	220	
	SOP-8	212	
T_{stg}	Storage Temperature	-65 to 150	°C
	Mounting Temperature (Infrared or Convection –20 sec)	260	°C
V_{ESD}	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins (Note 4)	2000	V
	Charged device model (CDM), per JEDEC specification JESD22-C101, all pins (Note 5)	1000	

NOTE:

- (1) 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.
- (2) All voltage values (except differential voltages and VCC specified for the measurement of IOS) are with respect to the network GND.
- (3) Short circuits from outputs to VCC can cause excessive heating and eventual destruction.
- (4) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (5) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$T_A = 25^\circ\text{C}$		1.8	9	mV
Input Offset Voltage Average Drift	ICV_{OS}	$T_A = 25^\circ\text{C}$		7		$\mu\text{V}/^\circ\text{C}$
Input Bias Current	I_B	$T_A = 25^\circ\text{C}$		20	300	nA
Input Offset Current	I_{IO}	$T_A = 25^\circ\text{C}$		9	60	nA
Common Mode Rejection Ratio	CMRR	$0\text{V} \leq V_{CM} \leq 1.7\text{V}$	48	62		dB
Power Supply Rejection Ratio	PSRR	$2.7\text{V} \leq V_{+} \leq 5\text{V}$, $V_O = 1\text{V}$	48	60		dB
Input Common-Mode Voltage Range	V_{CM}	For CMRR $\geq 50\text{dB}$	0		1.9	V
Output Swing	V_{OH}	$R_L = 10\text{k}\Omega$ to 1.35V	$V_{CC} - 100$	$V_{CC} - 20$		mV
	V_{OL}	$R_L = 10\text{k}\Omega$ to 1.35V (Note 5)		60	200	mV
Supply Current (both amplifiers)	I_{CC}	Static operating current		90	270	μA

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

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

Note:

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.

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		2	10	mV
Input Offset Voltage Average Drift	$T_C V_{IO}$	$T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		10		$\mu\text{V}/^\circ\text{C}$
Input Bias Current (Note 7)	I_B	$T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		30	600	nA
Input Offset Current (Note 7)	I_{IO}	$T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		18	200	nA
Common Mode Rejection Ratio	CMRR	$0\text{ V} \leq V_{CM} \leq 4\text{ V}$	50	62		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	58		dB
Input Common-Mode Voltage Range	V_{CM}	For CMRR $\geq 50\text{ dB}$	0		4.2	V
Large Signal Voltage Gain (Note 7)	A_v	$R_L = 2\text{ k}\Omega$ (25°C)	15	100		V/mV
		$T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)	10			
Output Swing	V_{OH}	$R_L = 2\text{ k}\Omega$ to 2.5 V $T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)	$V_{CC} - 300$ $V_{CC} - 400$	$V_{CC} - 40$		mV
	V_{OL}	$R_L = 2\text{ k}\Omega$ to 2.5 V (25°C) $T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		120	300 400	mV
	V_{OH}	$R_L = 10\text{ k}\Omega$ to 2.5 V (25°C) $T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)	$V_{CC} - 100$ $V_{CC} - 200$			mV
	V_{OL}	$R_L = 10\text{ k}\Omega$ to 2.5 V (25°C) $T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		75	180 300	mV
Output Short Circuit Current	I_O	Sourcing, $V_O = 0\text{ V}$ Sinking, $V_O = 5\text{ V}$	5 10	30 35		mA
Supply Current (both amplifiers)	I_{CC}	Static operating current $T_A = 25^\circ\text{C}$ $T_A = T_{\text{Low}} \text{ to } T_{\text{High}}$ (Note1)		100	360 500	μA

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Slew Rate	S_R			1		$\text{V}/\mu\text{s}$
Gain Bandwidth Product	GBWP	$C_L = 200\text{ pF}$		1		MHz
Phase Margin	$\angle I_m$			60		$^\circ$
Gain Margin	G_m			10		dB
Input-Referred Voltage Noise	e_n	$f = 1\text{ kHz}$		65		$\text{nV}/\sqrt{\text{Hz}}$

Note1: $T_{\text{Low}} = -40^\circ\text{C}$, $T_{\text{High}} = +85^\circ\text{C}$

Note2: 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.

6. TYPICAL CHARACTERISTICS

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

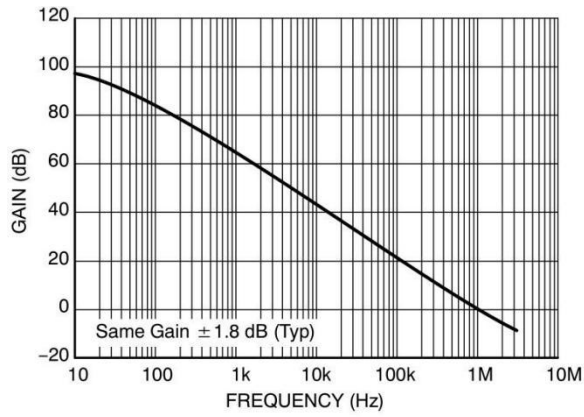


Figure 1. Open Loop Frequency Response
($R_L = 2\text{ k}\Omega$, $T_A = 25^\circ\text{C}$, $V_S = 5\text{ V}$)

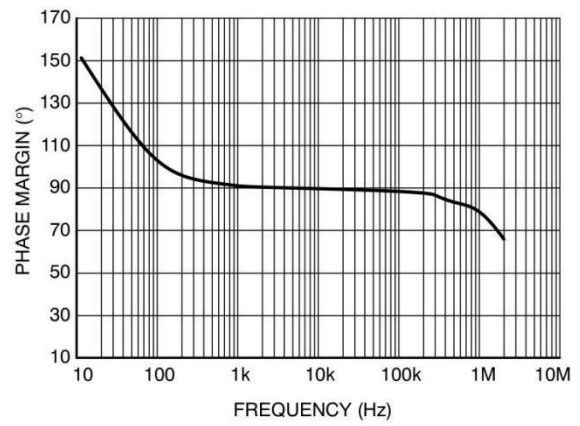


Figure 2. Open Loop Phase Margin
($R_L = 2\text{ k}\Omega$, $T_A = 25^\circ\text{C}$, $V_S = 5\text{ V}$)

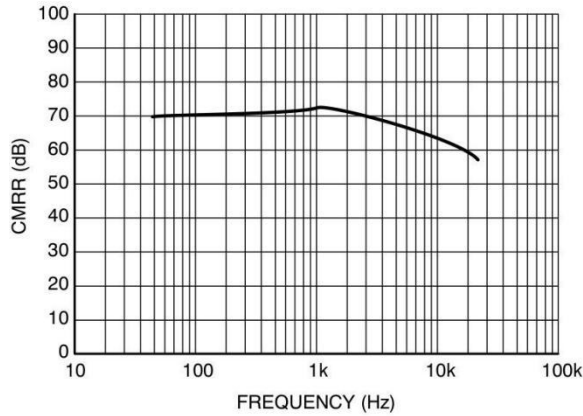


Figure 3. CMRR vs. Frequency
($R_L = 5\text{ k}\Omega$, $V_S = 5\text{ V}$)

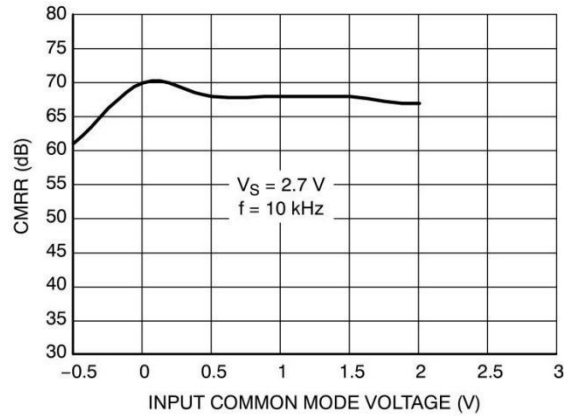


Figure 4. CMRR vs. Input Common Mode Voltage

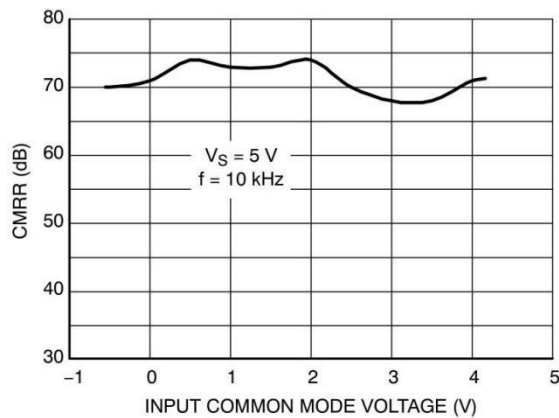


Figure 5. CMRR vs. Input Common Mode Voltage

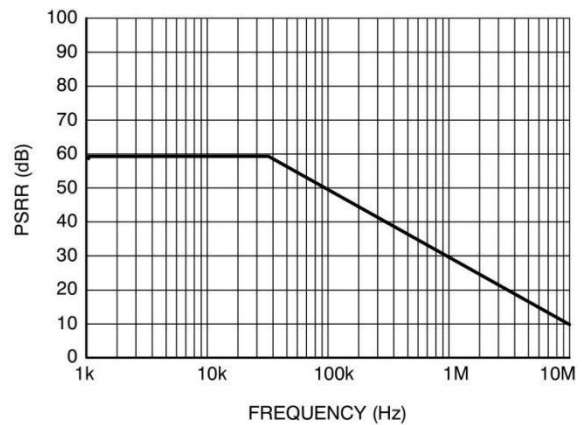


Figure 6. PSRR vs. Frequency
($R_L = 5\text{ k}\Omega$, $V_S = 2.7\text{ V}$, +PSRR)

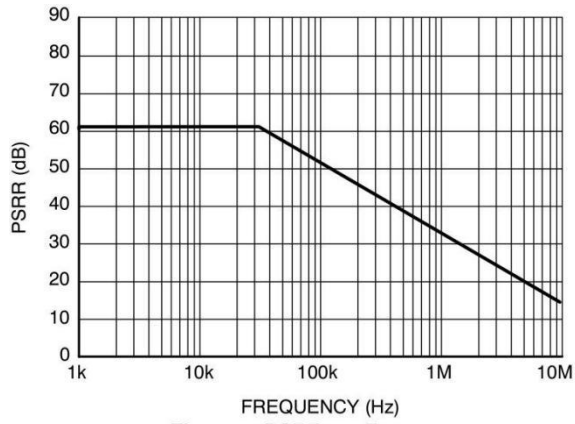


Figure 7. PSRR vs. Frequency
($R_L = 5\text{ k}\Omega$, $V_S = 2.7\text{ V}$, -PSRR)

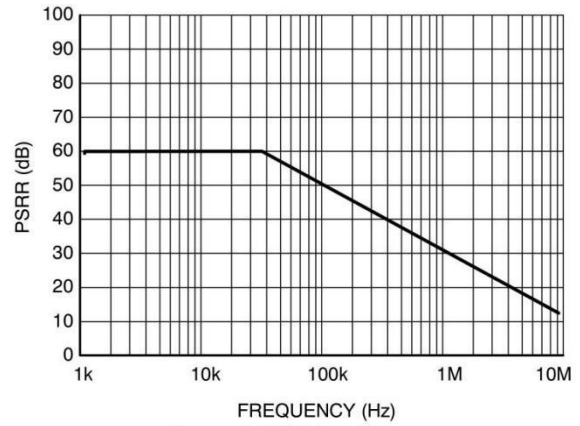


Figure 8. PSRR vs. Frequency
($R_L = 5\text{ k}\Omega$, $V_S = 5\text{ V}$, +PSRR)

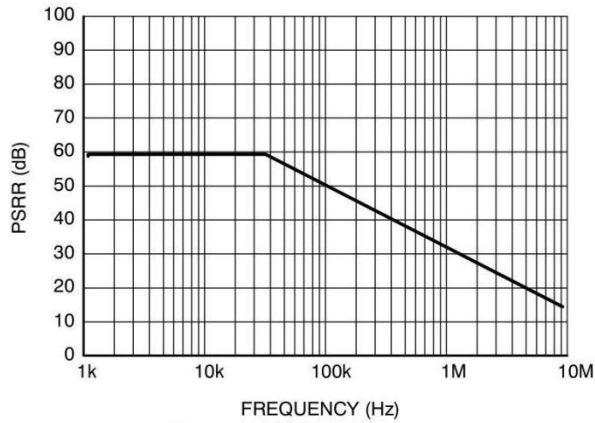


Figure 9. PSRR vs. Frequency
($R_L = 5\text{ k}\Omega$, $V_S = 5\text{ V}$, -PSRR)

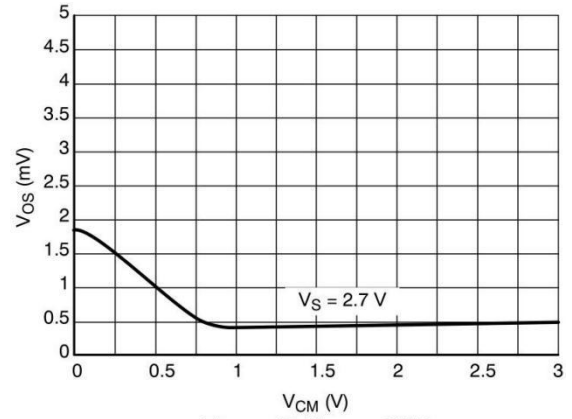


Figure 10. V_{OS} vs CMR

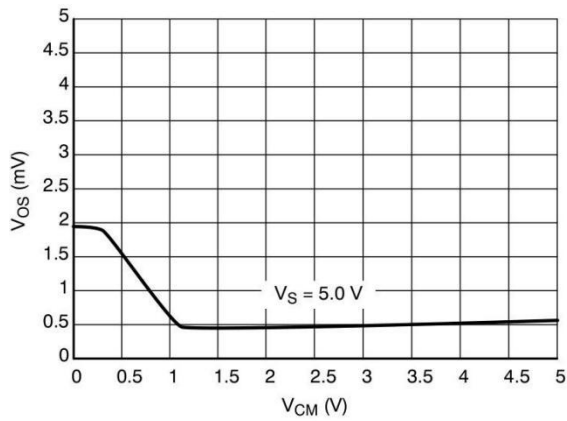


Figure 11. V_{OS} vs CMR

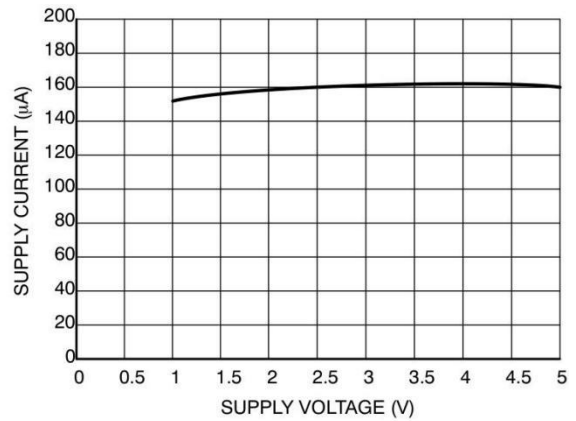


Figure 12. Supply Current vs. Supply Voltage

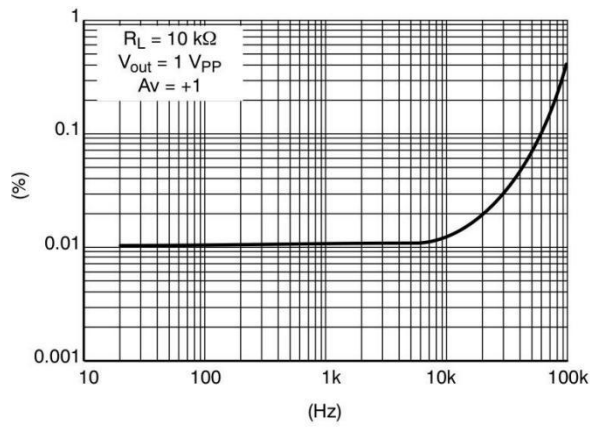


Figure 13. THD+N vs Frequency

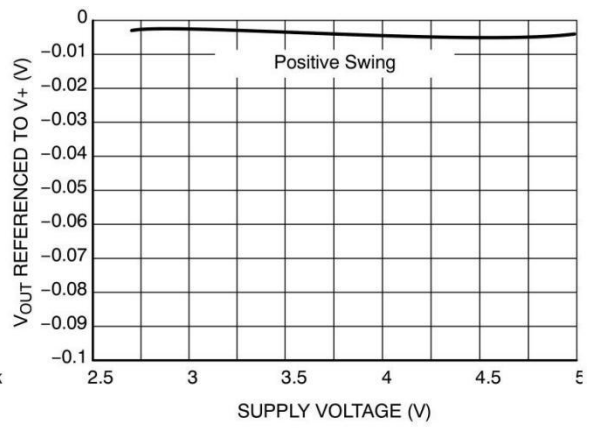


Figure 14. Output Voltage Swing vs Supply Voltage ($R_L = 10\text{ k}\Omega$)

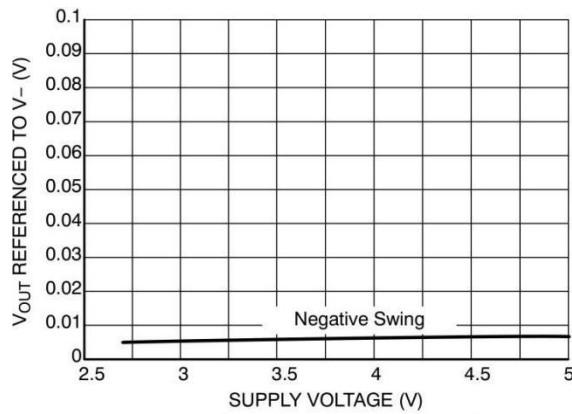


Figure 15. Output Voltage Swing vs Supply Voltage ($R_L = 10\text{ k}\Omega$)

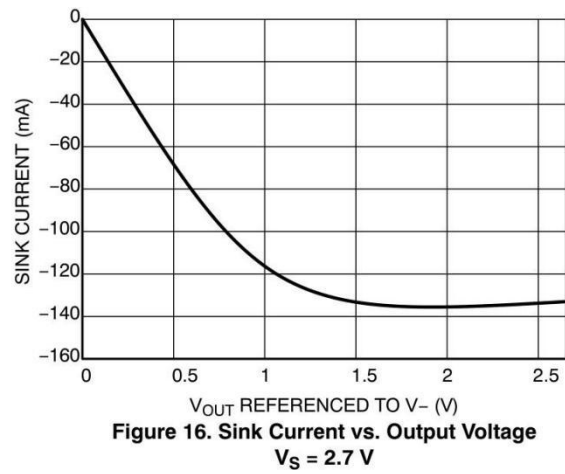


Figure 16. Sink Current vs. Output Voltage $V_S = 2.7\text{ V}$

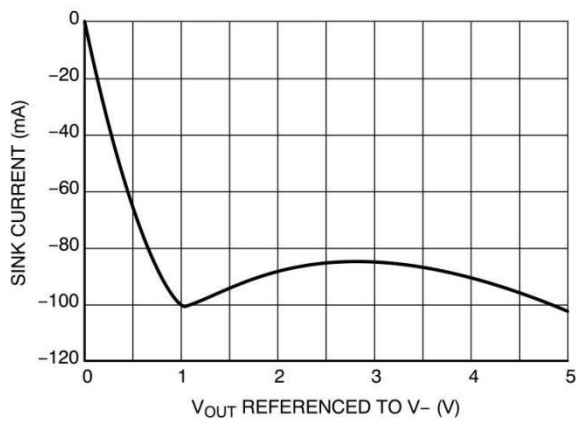


Figure 17. Sink Current vs. Output Voltage $V_S = 5.0\text{ V}$

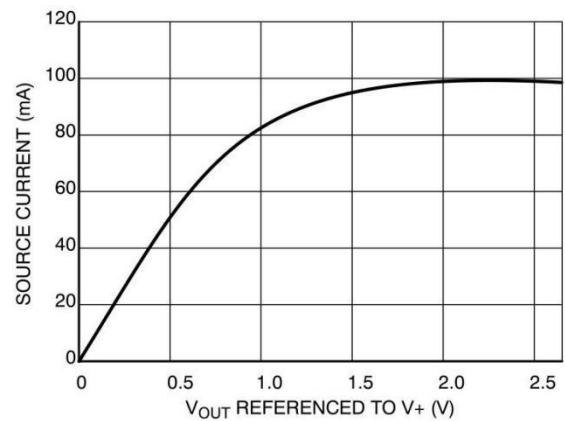


Figure 18. Source Current vs. Output Voltage $V_S = 2.7\text{ V}$

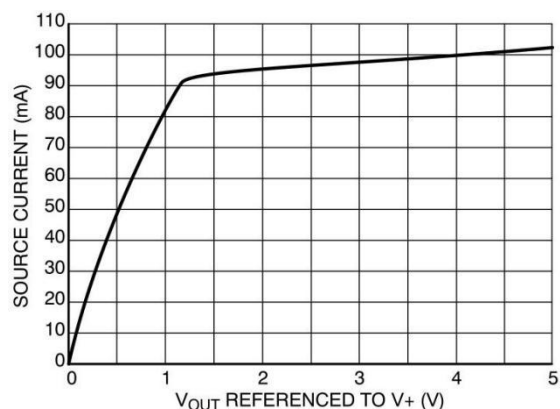


Figure 19. Source Current vs. Output Voltage
 $V_S = 5.0\text{ V}$

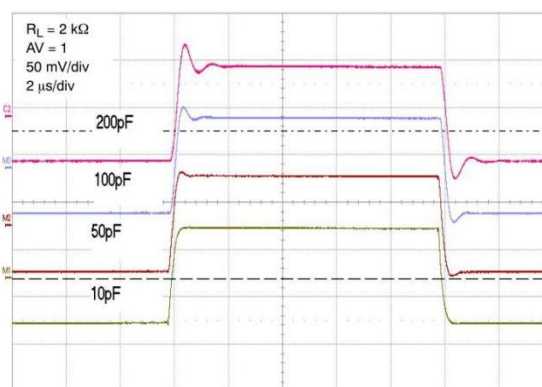


Figure 20. Settling Time vs. Capacitive Load

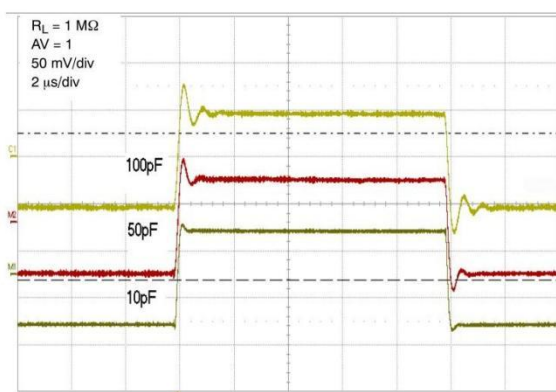


Figure 21. Settling Time vs. Capacitive Load

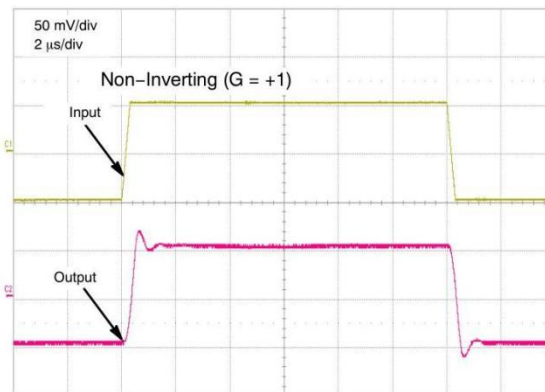


Figure 22. Step Response - Small Signal

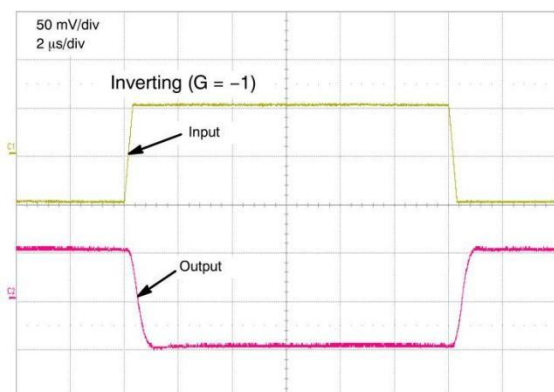


Figure 23. Step Response - Small Signal

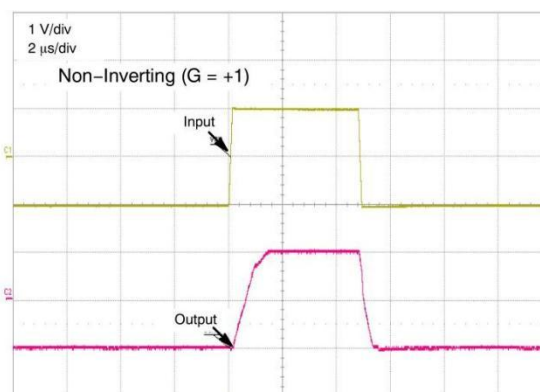


Figure 24. Step Response - Large Signal

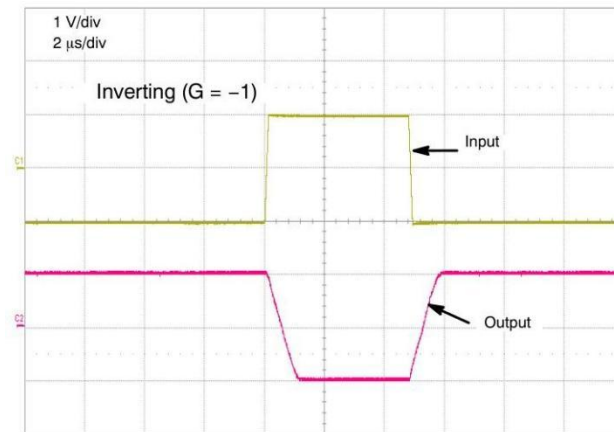


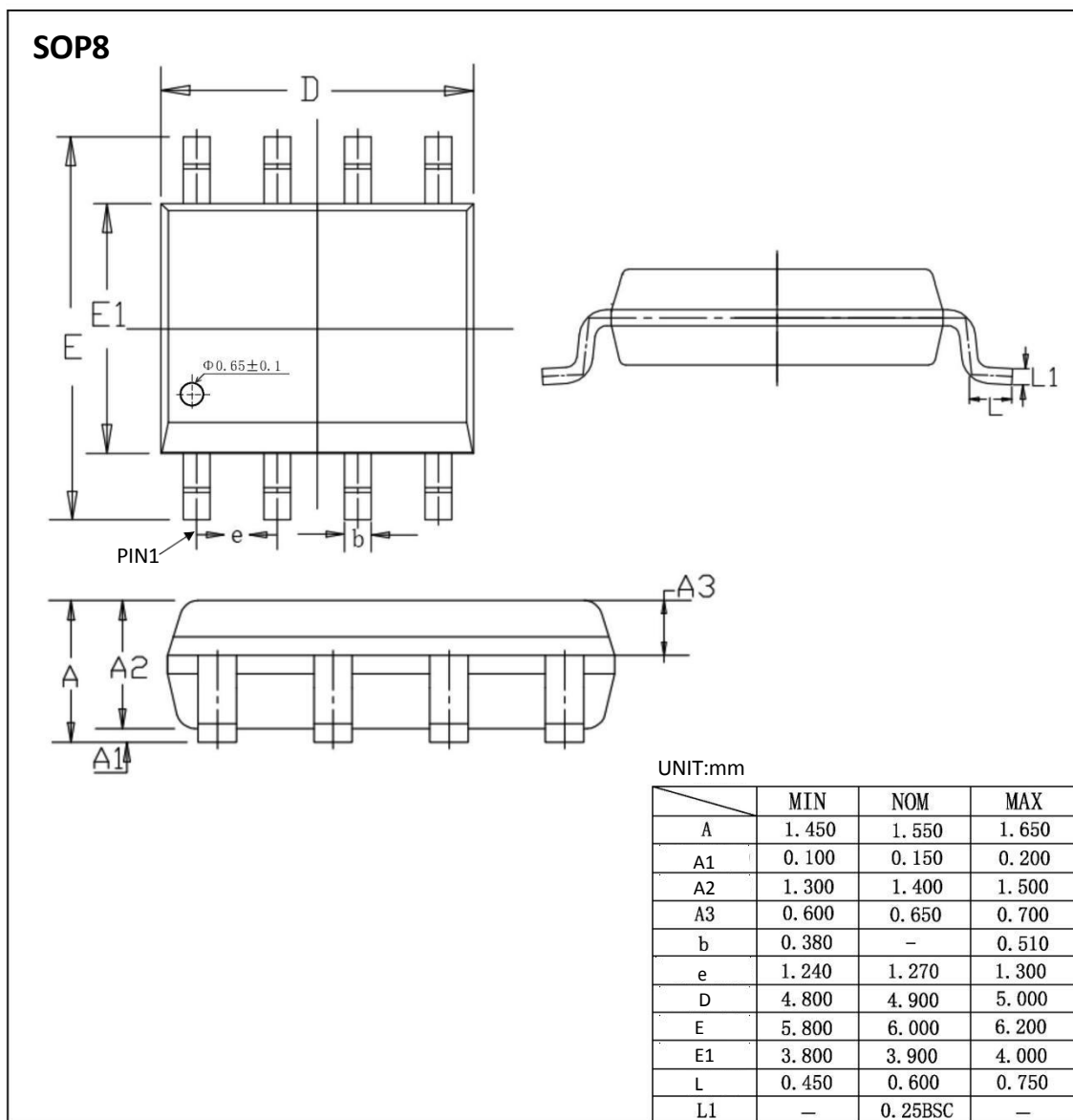
Figure 25. Step Response – Large Signal

7. ORDERING INFORMATION

Ordering Information

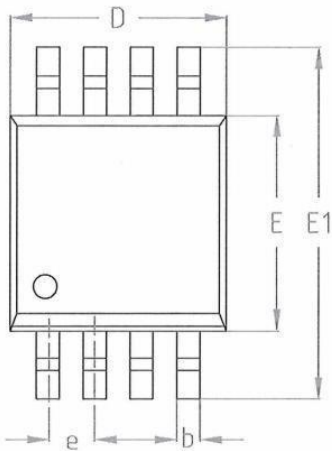
Part Number	Device Marking	Package Type	Body size (mm)	Temperature (°C)	MSL	Transport Media	Package Quantity
XLV358D	XLV358D	SOP8	4.90 * 3.90	- 40 to 85	MSL3	T&R	2500
XLV358-MS	V358	MSOP8	3.00 * 3.00	- 40 to 85	MSL3	T&R	3500

7. DIMENSIONAL DRAWINGS

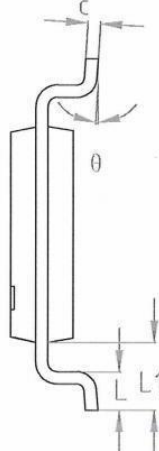


MSOP8

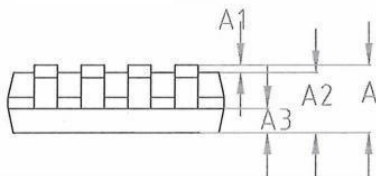
TOP VIEW



SIDE VIEW



SIDE VIEW



Dimensions

SYMBOL	MIN	NOMINAL	MAX
A	—	—	1.10
A1	0.05	—	0.15
A2	0.75	0.85	0.95
A3	0.30	0.35	0.40
b	0.28	—	0.36
c	0.15	—	0.19
D	2.90	3.00	3.10
E	2.90	3.00	3.10
E1	4.70	4.90	5.10
e	0.65 BSC		
L1	0.95 REF		
L	0.40	—	0.70
θ	0°	—	8°

Unit: mm