1. DESCRIPTION

The XLV358-MS and XLV358D are CMOS single, dual, and 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 preformance. 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
- Rail−to−Rail Output
- Low Quiescent Current: XLV358 Dual − 220 µA, Max per Channel
- No Output Phase−Reversal from Overdriven Input

3. TYPICAL APPLICATIONS

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

4. MAXIMUM RATINGS

Symbol	Rating	Value	Unit
V_S	Supply Voltage (Operating Range V_S = 2.7 V to 5.5 V)	5.5	V
V_{IDR}	Input Differential Voltage	±Supply Voltage	V
V_{ICR}	Input Common Mode Voltage Range	−0.5 to (V+) + 0.5	V
	Maximum Input Current	10	mA
t_{So}	Output Short Circuit (Note 1)	Continuous	
T_J	Maximum Junction Temperature	150	°C
T_A	Operating Ambient Temperature Range XLV358	−40 to 85	°C
θ_{JA}	Thermal Resistance:		°C/W
	MSOP8	238	
	SOP−8	212	
T_{stg}	Storage Temperature	−65 to 150	°C
	Mounting Temperature (Infrared or Convection −20 sec)	260	°C
V_{ESD}	ESD Tolerance Machine Model Human Body Model XLV358 Machine Model Human Body Mode	100 1000 100 2000	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functional- ity 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.
2 . Human Body Model, applicable std. MIL−STD−883, Method 3015.7 Machine Model, applicable std. JESD22−A115−A (ESD MM std. of JEDEC)
Field−Induced Charge−Device Model, applicable std. JESD22−C101−C (ESD FICDM std. of JEDEC).

2.7 V DC ELECTRICAL CHARACTERISTICS (Unless otherwise specified, all limits are guaranteed for T_A = 25°C, V^+ = 2.7 V, R_L = 1 MΩ, V^- = 0 V, V_O = V+/2)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$T_A = T_{Low}$ to T_{High} (Note 4)		1.7	9	mV
Input Offset Voltage Average Drift	ICV_{OS}	$T_A = T_{Low}$ to T_{High} (Note 4)		5		μV/°C
Input Bias Current	I_B	$T_A = T_{Low}$ to T_{High} (Note 4)		<1		nA
Input Offset Current	I_{IO}	$T_A = T_{Low}$ to T_{High} (Note 4)		<1		nA
Common Mode Rejection Ratio	CMRR	0 V ≤ V_{CM} ≤ 1.7 V	50	63		dB
Power Supply Rejection Ratio	PSRR	2.7 V ≤ V+ ≤ 5 V, V_O = 1 V	50	60		dB
Input Common−Mode Voltage Range	V_{CM}	For CMRR ≥ 50 dB	0 to 1.7	−0.2 to 1.9		V
Output Swing	V_{OH}	R_L = 10 kΩ to 1.35 V	V_{CC} − 100	V_{CC} − 10		mV
	V_{OL}	R_L = 10 kΩ to 1.35 V (Note 5)		60	180	mV
Supply Current XLV358	I_{CC}			80 140 260	185 340 680	μA

2.7 V AC ELECTRICAL CHARACTERISTICS (Unless otherwise specified, all limits are guaranteed for T_A = 25°C, V^+ = 2.7 V, R_L = 1 MΩ, V^- = 0 V, V_O = V+/2)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Gain Bandwidth Product	GBWP	C_L = 200 pF		1		MHz
Phase Margin	①m			60		°
Gain Margin	G_m			10		dB
Input−Referred Voltage Noise	e_n	f = 50 kHz		50		nV/√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 . For XLV358: TA = −40℃ to +85℃
4 . Guaranteed by design and/
or characterization.

5.0 V DC ELECTRICAL CHARACTERISTICS (Unless otherwise specified, all limits are guaranteed for T_A = 25°C, V^+ = 5.0 V, R_L = 1 MΩ, V^- = 0 V, V_O = V+/2)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Offset Voltage	V_{IO}	$T_A = T_{Low}$ to T_{High} (Note 6)		1.7	9	mV
Input Offset Voltage Average Drift	T_CV_{IO}	$T_A = T_{Low}$ to T_{High} (Note 6)		5		μV/°C
Input Bias Current (Note 7)	I_B	$T_A = T_{Low}$ to T_{High} (Note 6)		< 1		nA
Input Offset Current (Note 7)	I_{IO}	$T_A = T_{Low}$ to T_{High} (Note 6)		< 1		nA
Common Mode Rejection Ratio	CMRR	0 V ≤ V_{CM} ≤ 4 V	50	65		dB
Power Supply Rejection Ratio	PSRR	2.7 V ≤ V+ ≤ 5 V, V_O = 1 V, V_{CM} = 1 V	50	60		dB
Input Common−Mode Voltage Range	V_{CM}	For CMRR ≥ 50 dB	0 to 4	−0.2 to 4.2		V
Large Signal Voltage Gain (Note 7)	Av	R_L = 2 kΩ	15	100		V/mV
		$T_A = T_{Low}$ to T_{High} (Note 6)	10			
Output Swing	V_{OH}	R_L = 2 kΩ to 2.5 V $T_A = T_{Low}$ to T_{High} (Note 6)	V_{CC} − 300 V_{CC} − 400	V_{CC} − 40		mV
	V_{OL}	R_L = 2 kΩ to 2.5 V (Note 7) $T_A = T_{Low}$ to T_{High} (Note 6)		120	300 400	mV
	V_{OH}	R_L = 10 kΩ to 2.5 V (Note 7) $T_A = T_{Low}$ to T_{High} (Note 6)	V_{CC} − 100 V_{CC} − 200			mV
	V_{OL}	R_L = 10 kΩ to 2.5 V $T_A = T_{Low}$ to T_{High} (Note 6)		65	180 280	mV
Output Short Circuit Current	Io	Sourcing = V_O = 0 V (Note 7) Sinking = V_O = 5 V (Note 7)	10 10	60 160		mA
Supply Current	I_{CC}	XLV358 Amplifiers T_A = T_{Low} to T_{High} (Note 6)		210	440 615	μA

5.0 V AC ELECTRICAL CHARACTERISTICS (Unless otherwise specified, all limits are guaranteed for T_A = 25°C, V^+ = 5.0 V, R_L = 1 MΩ, V^- = 0 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 pF		1		MHz
Phase Margin	①m			60		°
Gain Margin	G_m			10		dB
Input−Referred Voltage Noise	e_n	f = 50 kHz		50		nV/√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.

5 . For XLV358: TA = −40℃ to +85℃
6 . Guaranteed by design and/or characterization.

5. TYPICAL CHARACTERISTICS

(T_A = 25°C and V_S = 5 V unless otherwise specified)

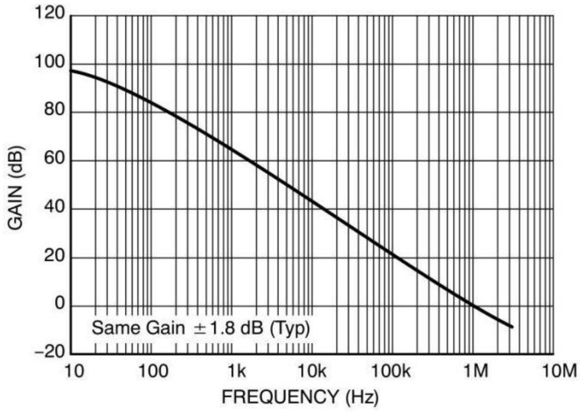


Figure 1. Open Loop Frequency Response (R_L = 2 kΩ, T_A = 25°C, V_S = 5 V)

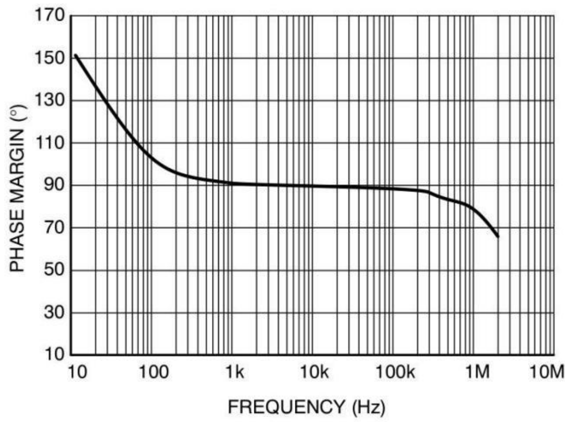


Figure 2. Open Loop Phase Margin (R_L = 2 kΩ, T_A = 25°C, V_S = 5 V)

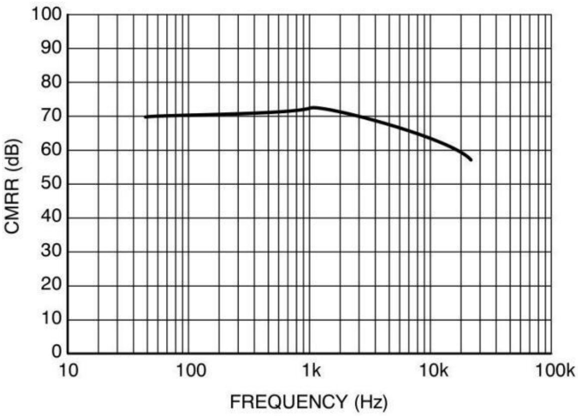


Figure 3. CMRR vs. Frequency (R_L = 5 kΩ, V_S = 5 V)

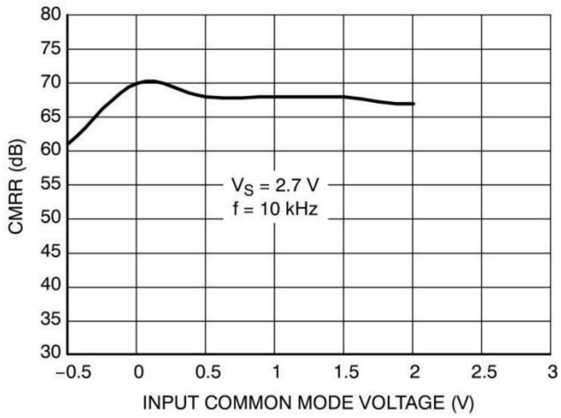


Figure 4. CMRR vs. Input Common Mode Voltage

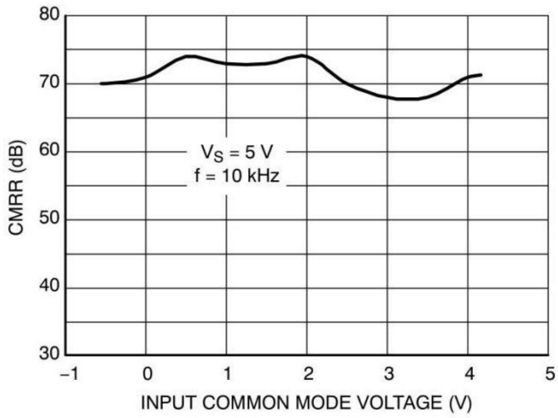


Figure 5. CMRR vs. Input Common Mode Voltage

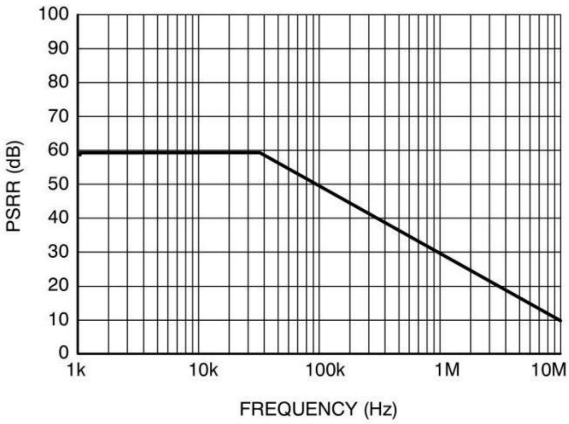


Figure 6. PSRR vs. Frequency (R_L = 5 kΩ, V_S = 2.7 V, +PSRR)

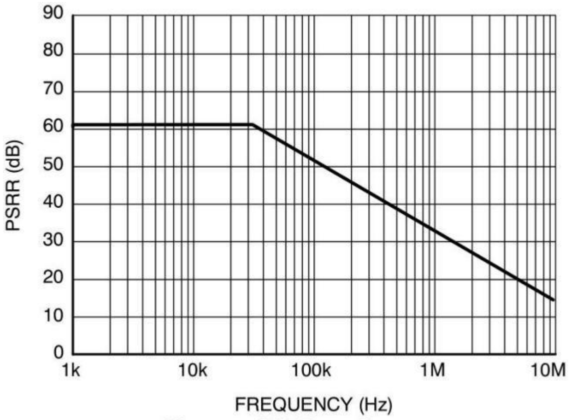


Figure 7. PSRR vs. Frequency (R_L = 5 kΩ, V_S = 2.7 V, −PSRR)

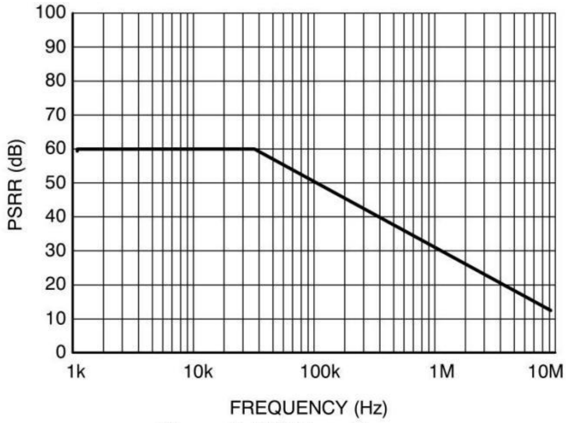


Figure 8. PSRR vs. Frequency (R_L = 5 kΩ, V_S = 5 V, +PSRR)

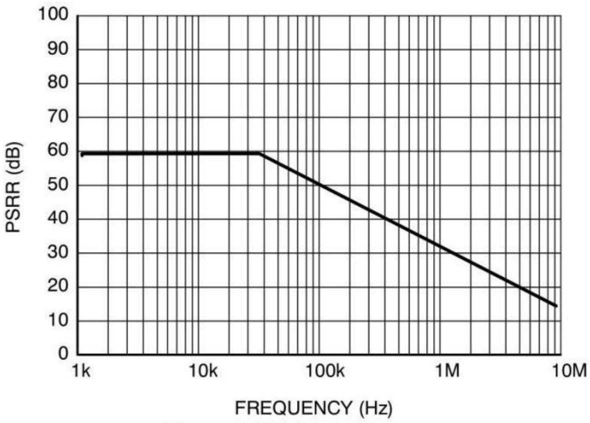


Figure 9. PSRR vs. Frequency (R_L = 5 kΩ, V_S = 5 V, −PSRR)

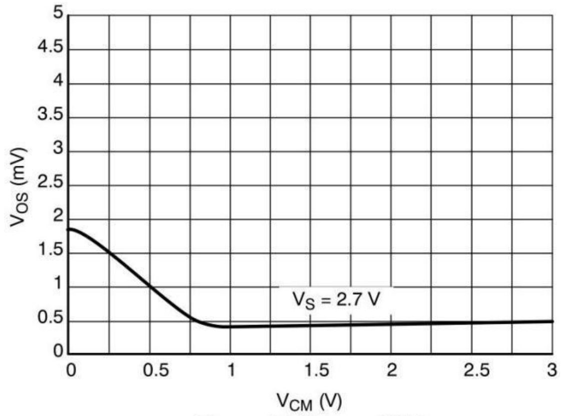


Figure 10. V_{OS} vs CMR

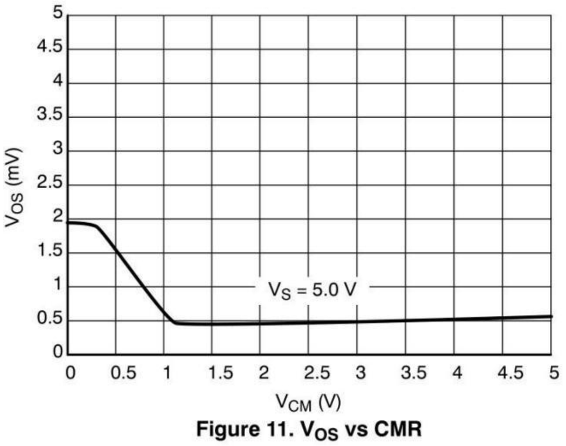


Figure 11. V_{OS} vs CMR

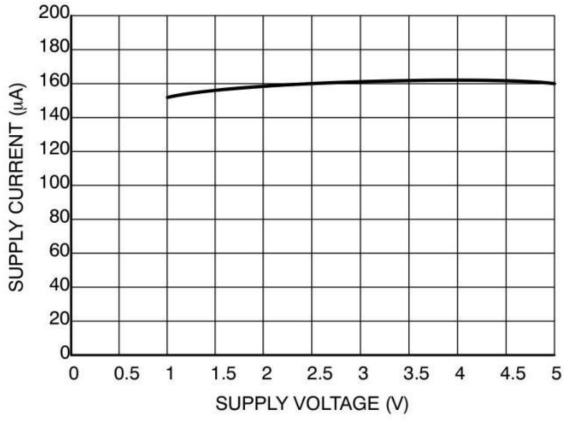


Figure 12. Supply Current vs. Supply Voltage

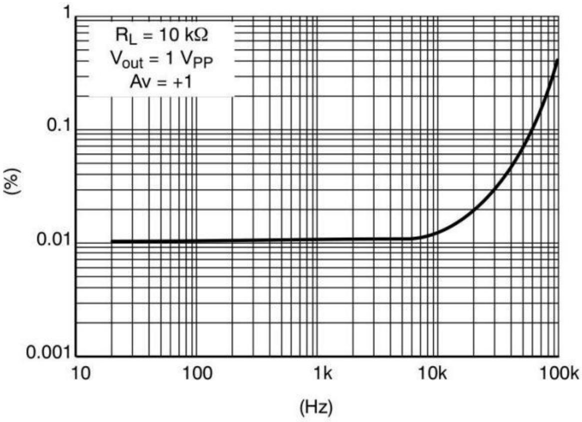


Figure 13. THD+N vs Frequency

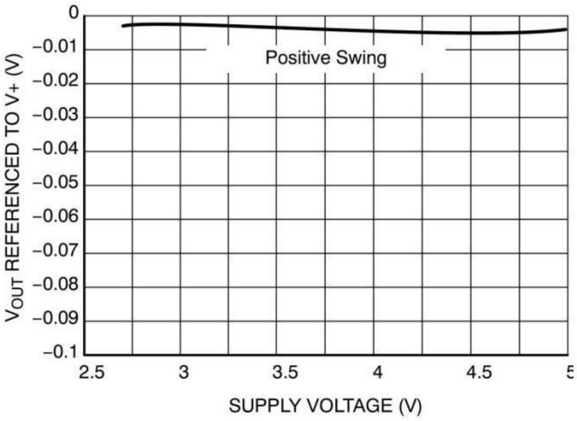


Figure 14. Output Voltage Swing vs Supply Voltage (R_L = 10k)

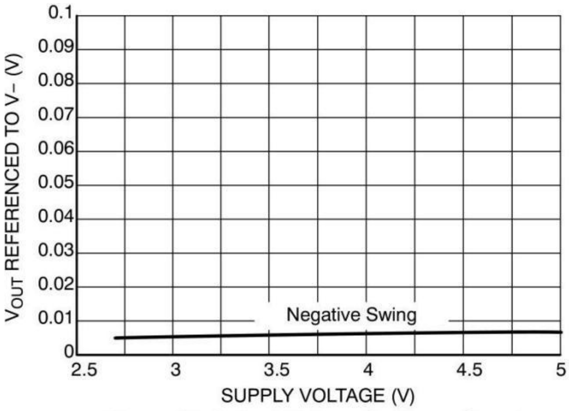


Figure 15. Output Voltage Swing vs Supply Voltage (R_L = 10k)

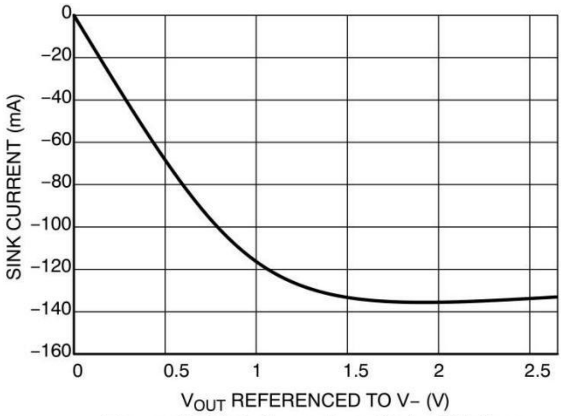


Figure 16. Sink Current vs. Output Voltage V_S = 2.7 V

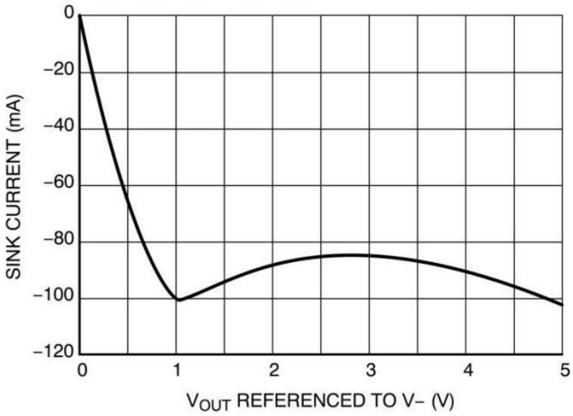


Figure 17. Sink Current vs. Output Voltage V_S = 5.0 V

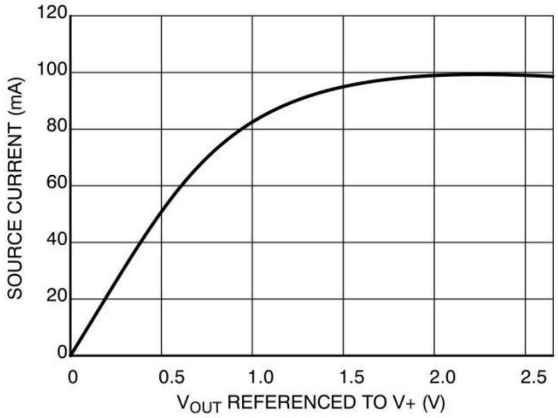


Figure 18. Source Current vs. Output Voltage V_S = 2.7 V

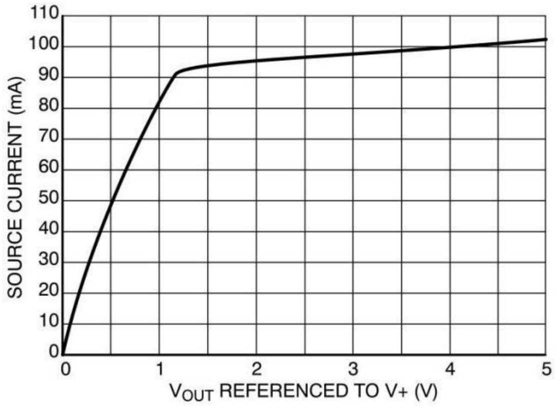


Figure 19. Source Current vs. Output Voltage V_S = 5.0 V

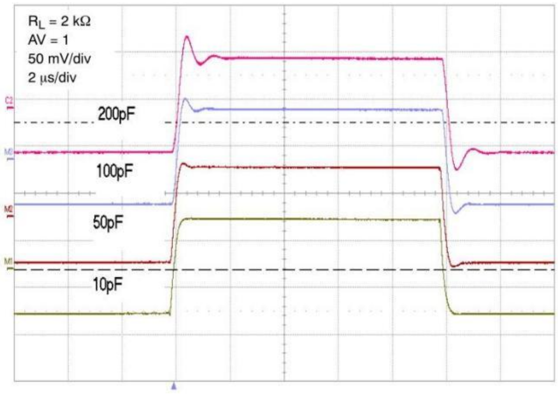


Figure 20. Settling Time vs. Capacitive Load

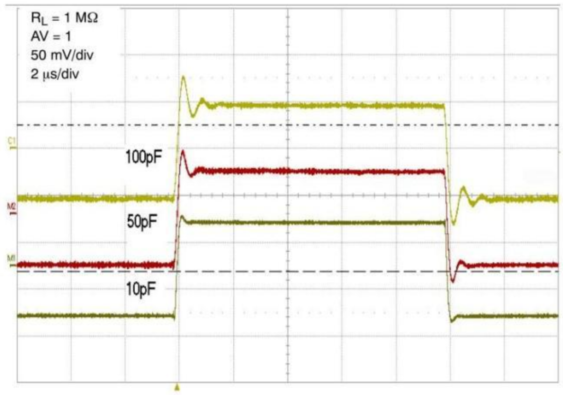


Figure 21. Settling Time vs. Capacitive Load

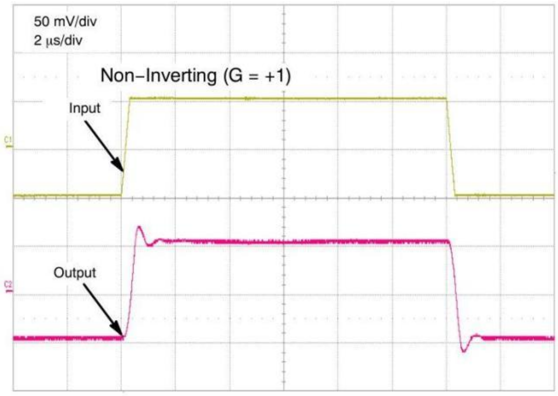


Figure 22. Step Response − Small Signal

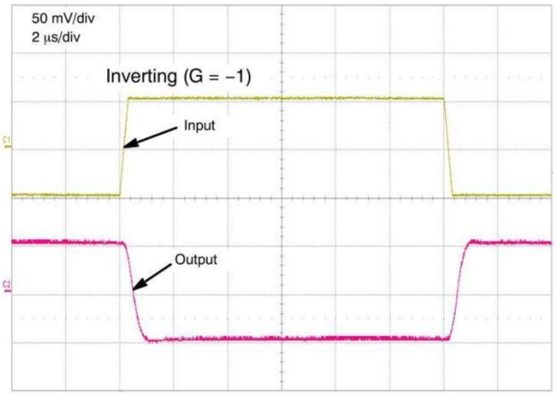


Figure 23. Step Response − Small Signal

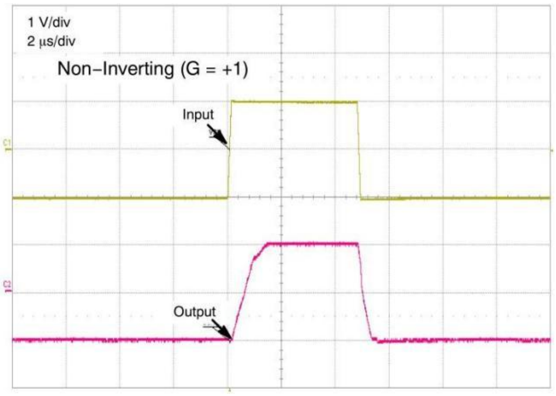


Figure 24. Step Response − Large Signal

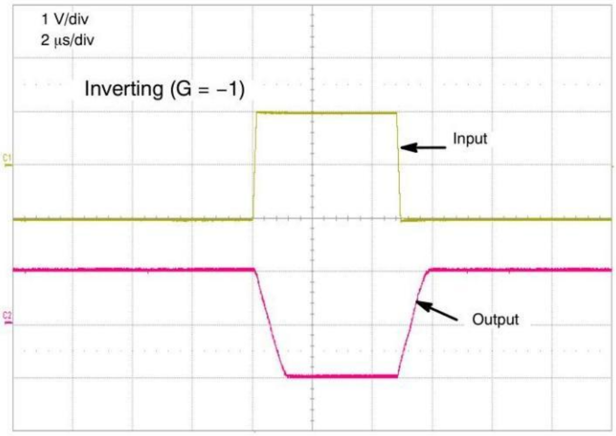


Figure 25. Step Response − Large Signal

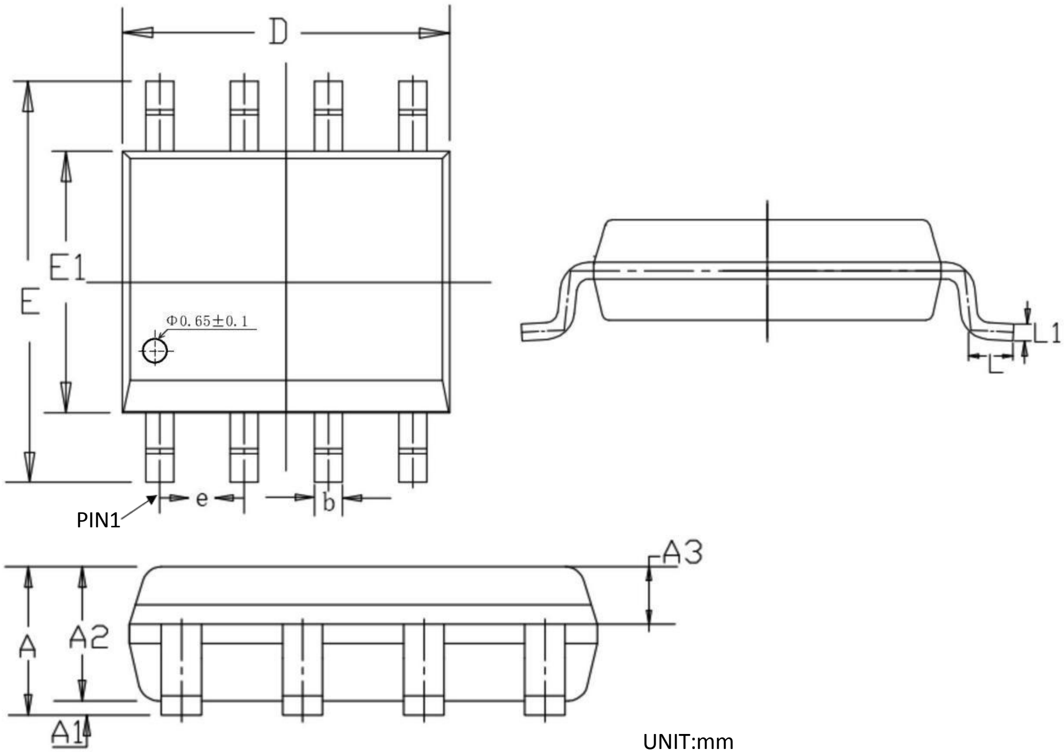
6. ORDERING INFORMATION

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

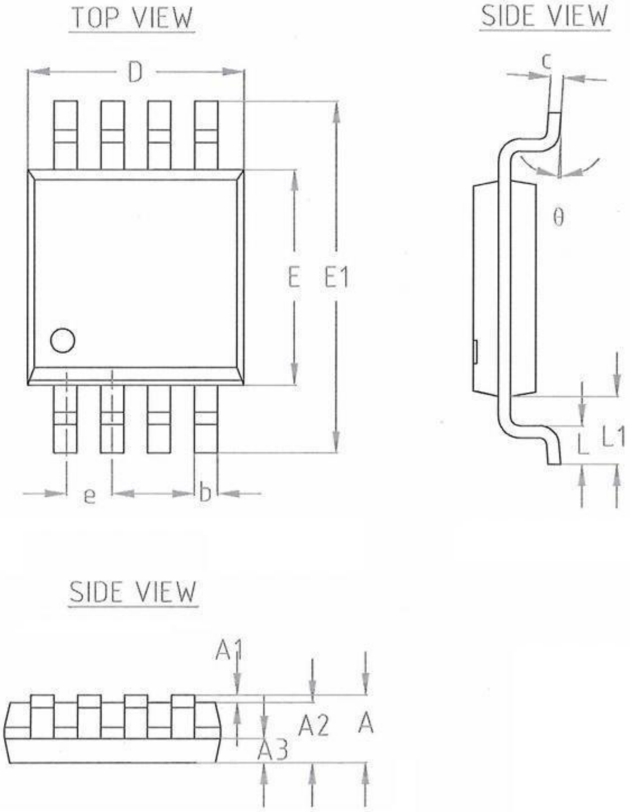
SOP8



UNIT:mm

	MIN	NOM	MAX
A	1.450	1.550	1.650
A1	0.100	0.150	0.200
A2	1.300	1.400	1.500
A3	0.600	0.650	0.700
b	0.380	–	0.510
e	1.240	1.270	1.300
D	4.800	4.900	5.000
E	5.800	6.000	6.200
E1	3.800	3.900	4.000
L	0.450	0.600	0.750
L1	—	0.25BSC	—

MSOP8



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