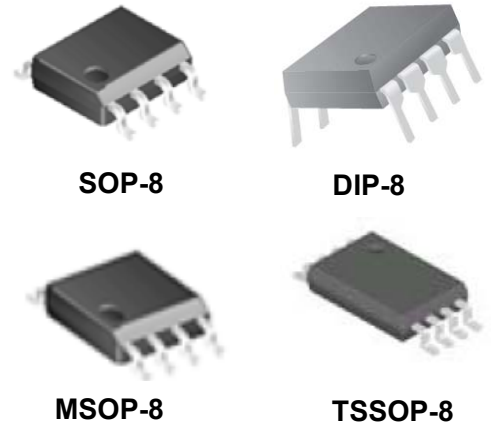


Dual Low Voltage Operational Amplifier

General Description

- The LMV358 are low voltage (2.7-5.5V) versions of the dual and quad commodity op amps.
- The LMV358 are the most cost effective solutions for the applications where low voltage operation, space saving and low price are needed.
- The LMV358 have rail-to-rail output swing capability and the input common-mode voltage range includes ground. They all exhibit excellent speed-power ratio, achieving 1MHz of bandwidth and 1V/ μ s of slew rate with low supply current.
- The LMV358 have bipolar input and output stages for improved noise performance and higher output current drive.
- The LMV358 is available in SOP-8, DIP-8, TSSOP-8 and MSOP-8 packages



Features

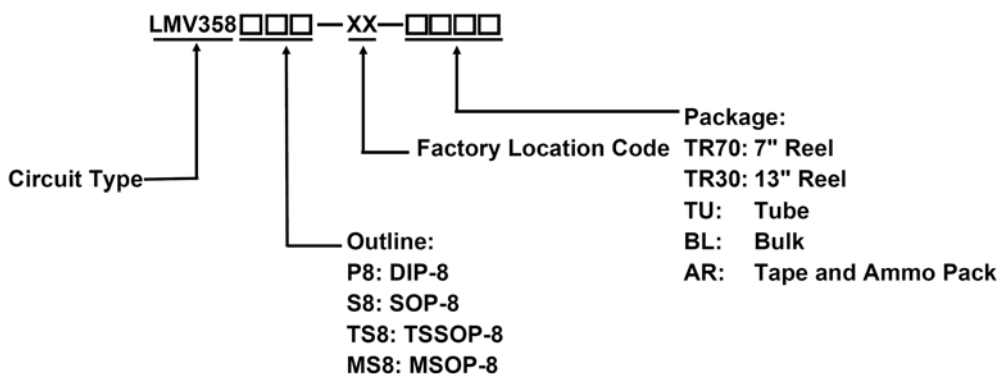
(For $V^- = 5V$ and $V^+ = 0V$. Typical Unless Otherwise Noted)

- Guaranteed 2.7V and 5V performance
- No crossover distortion, space saving package
- Industrial temp. range, $V_{CM} -0.2V$ to $V^- -0.8V$
- Gain-Bandwidth product; Low supply current: 210 μ A
- Rail-to-Rail output swing @10K Ω load (V^- 10mV, V^+ 65mV)
- RoHS Compliance

Applications

- Battery Charger
- Cordless Telephone
- Switching Power Supply

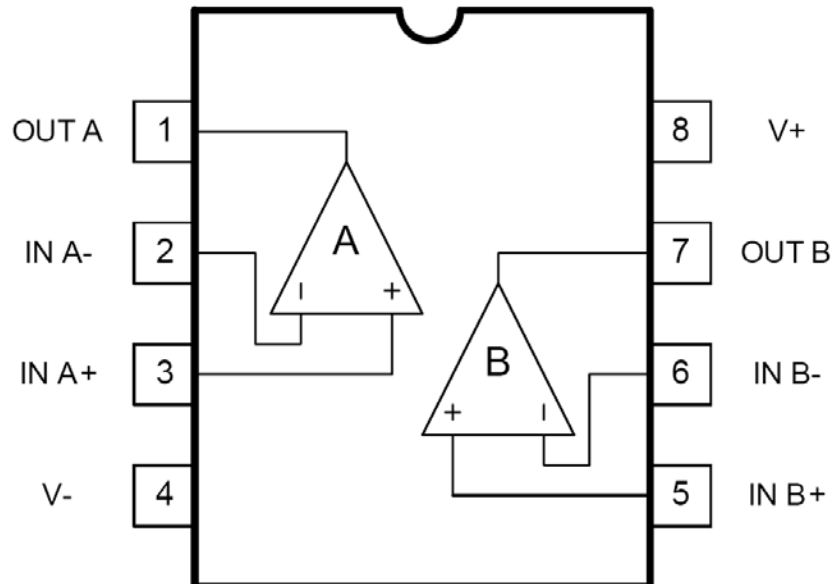
Ordering Information



Dual Low Voltage Operational Amplifier

LMV358

Internal Block Diagram



Absolute Maximum Ratings

Symbol	Description	Ratings	Unit
V _{CC}	Supply Voltage	2.7 to 5.5	V
V _{I(DIFF)}	Differential Input Voltage	±Supply Voltage	V
V _{IO}	Max. Input Offset Voltage	7	mV
-	Output Short Circuit to V ⁻	Note1	
-	Output Short Circuit to V ⁺	Note2	
R _{thJA}	Typical Thermal Resistance (Note3)	235	° C/W
-	Infrared (15 sec)	-	-
T _J	Junction Temperature (Note4)	150	° C
T _{OPR}	Operating Temperature Range	-40 ~ +85	° C
T _{STG}	Storage Temperature Range	-65~ +150	° C

- Note:**
1. Shorting output to V⁻ will adversely affect reliability.
 2. Shorting output to V⁺ will adversely affect reliability.
 3. All numbers are typical, and apply for packages soldered directly onto a PC board in still air.
 4. The max. power dissipation is a function of T_{J(max)}, θ_{JA} and T_A. The max. allowable power dissipation at any ambient temperature is PD=(T_{J(max)} – T_A)/ θ_{JA}. All numbers apply for packages soldered directly into a PC board.

Dual Low Voltage Operational Amplifier

LMV358

2.7V DC Electrical Characteristics

($V=2.7V$, $V_+=0V$, $V_{CM}=1.0V$, $V_{OUT}=V/2$ and $R_L=1M\Omega$, $T_J=25^\circ C$ unless otherwise specified)

Symbol	Description	LMV358			Unit	Conditions
		Min.	Typ.	Max.		
V_{io}	Input Offset Voltage	-	1.7	7	mV	
TCV_{os}	Input Offset Current Average Drift	-	5	-	$\mu V/^\circ C$	-
I_{BIAS}	Input Bias Current	-	11	250	nA	-
I_{io}	Input Offset Current	-	5	30	nA	-
CMRR	Common Mode Rejection Ratio	50	63	-	dB	$0V \leq V_{CM} \leq 1.7V$
PSRR	Power Supply Rejection Ratio	50	60	-	dB	$2.7V \leq V^- \leq 5V$, $V_{OUT}=1V$
V_{CM}	Input Common Mode Voltage	0	-0.2	-	V	For $CMRR \geq 50dB$
		-	1.9	1.7	V	
V_{out}	Output Voltage Swing	$V^- - 100$	$V^- - 100$	-	mV	$R_L=10K\Omega$ to 1.35V
		-	60	180	mV	
I_{cc}	Power Supply Current	-	140	340	μA	Both amplifiers

2.7V AC Electrical Characteristics

($V=2.7V$, $V_+=0V$, $V_{CM}=1.0V$, $V_{OUT}=V/2$ and $R_L > 1M\Omega$, $T_J=25^\circ C$ unless otherwise specified)

Symbol	Description	LMV358			Unit	Conditions
		Min.	Typ.	Max.		
GBWP	Gain-Bandwidth Product	-	1	-	MHz	$C_L=200pF$
$\Phi(T)$	Phase Margin	-	60	-	Deg	-
G	Gain Margin	-	10	-	dB	-
θ_{r1}	Input-Referred Voltage Noise	-	46	-	$nV/sq(Hz)$	$f=1KHz$
I_{r1}	Input-Referred Current Noise	-	0.17	-	$nV/sq(Hz)$	$f=1KHz$

Dual Low Voltage Operational Amplifier

LMV358

5V DC Electrical Characteristics

($V=5V$, $V+=0V$, $V_{CM}=2.0V$, $V_{OUT}=V/2$ and $R_L>1M\Omega$, $T_J=25^\circ C$ unless otherwise specified)

Symbol	Description	LMV358			Unit	Conditions
		Min.	Typ.	Max.		
V_{IO}	Input Offset Voltage	7	1.7	9	mV	-
TCV_{OS}	Input Offset Current Average Drift	-	5	-	$\mu V/^\circ C$	-
I_{BIAS}	Input Bias Current	250	15	500	nA	-
I_{IO}	Input Offset Current	50	5	150	nA	-
$CMRR$	Common Mode Rejection Ratio	50	65	-	dB	$0V \leq V_{CM} \leq 4V$
$PSRR$	Power Supply Rejection Ratio	50	60	-	dB	$2.7V \leq V^- \leq 5V$, $V_{OUT}=1V$, $V_{CM}=1V$
V_{CM}	Input Common Mode Voltage	0	-0.2	-	V	For $CMRR \geq 50dB$
		-	4.2	4	V	
A_v	Large Signal Voltage Gain	10	100	15	V/mV	$R_L=2K\Omega$ (Note5)
V_{OUT}	Output Voltage Swing	V^+-400	$V^- -40$	$V^- -300$	mV	$R_L=2K\Omega$ to 2.5V
		300	120	400		
		V^+-200	$V^- -10$	$V^- -10$		$R_L=10K\Omega$ to 1.35V
		180	65	280		
I_{OUT}	Output Short Circuit Current	5	60	-	mA	Sourcing, $V_{OUT}=0V$
		10	160	-	mA	Sinking, $V_{OUT}=5V$
I_{CC}	Power Supply Current	440	210	615	μA	Both amplifiers

5V AC Electrical Characteristics

($V=5V$, $V+=0V$, $V_{CM}=2.0V$, $V_{OUT}=V/2$ and $R_L>1M\Omega$, $T_J=25^\circ C$ unless otherwise specified)

Symbol	Description	LMV358			Unit	Conditions
		Min.	Typ.	Max.		
SR	Slew Rate	-	1	-	V/ μs	
$GBWP$	Gain-Bandwidth Product	-	1	-	MHz	$C_L=200pF$
$\Phi(T)$	Phase Margin	-	60	-	Deg	-
G°	Gain Margin	-	10	-	dB	-
θ_{r1}	Input-Referred Voltage Noise	-	39	-	nV/sq(Hz)	$f=1KHz$
I_{r1}	Input-Referred Current Noise	-	0.21	-	nV/sq(Hz)	$f=1KHz$

Note: 5. R_L is connected to V^- . The output voltage is $0.5V \leq V_{OUT} \leq 4.5V$

Dual Low Voltage Operational Amplifier

LMV358

Typical Characteristics Curves

(VE= +5V, single supply. TA=25° C, unless otherwise specified)

Fig.1- Input Current vs. Temperature

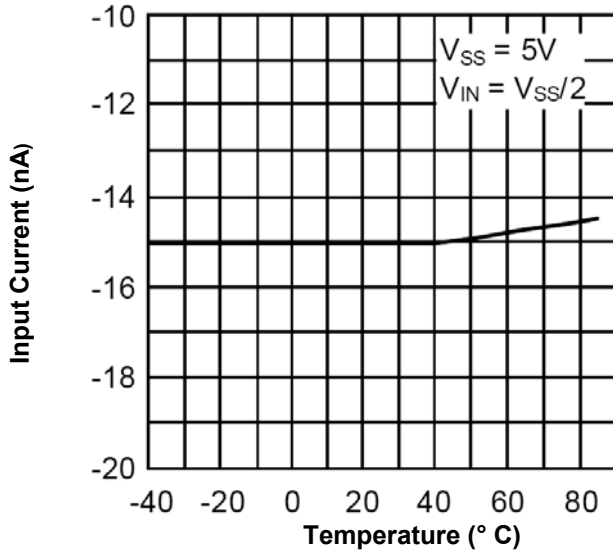


Fig.2- Sourcing Current vs Output Voltage

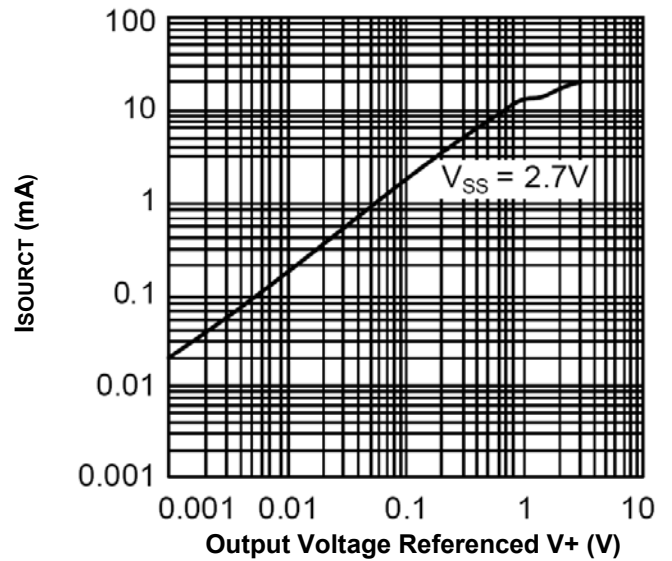


Fig.3- Sourcing Current vs Output Voltage

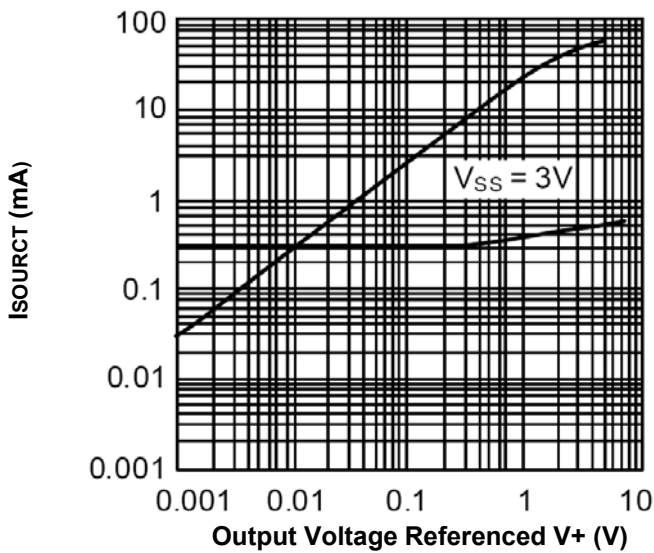
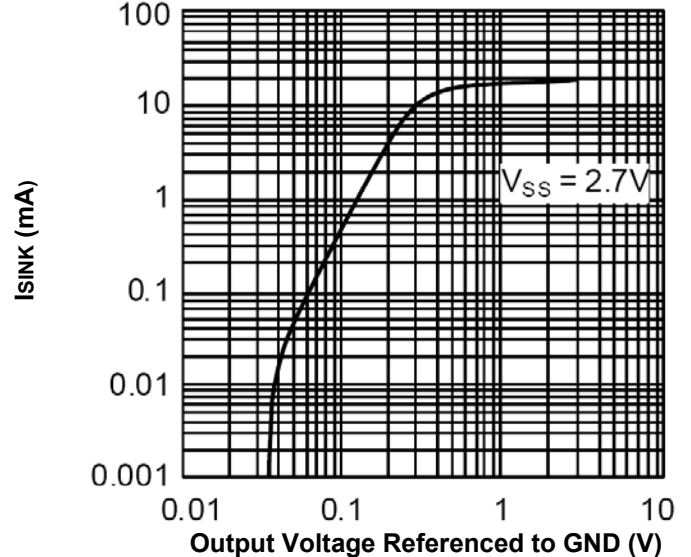


Fig.4- Sinking Current vs Output Voltage



Dual Low Voltage Operational Amplifier

LMV358

Typical Characteristics (Continued)

Fig.5- Sinking Current vs Output Voltage

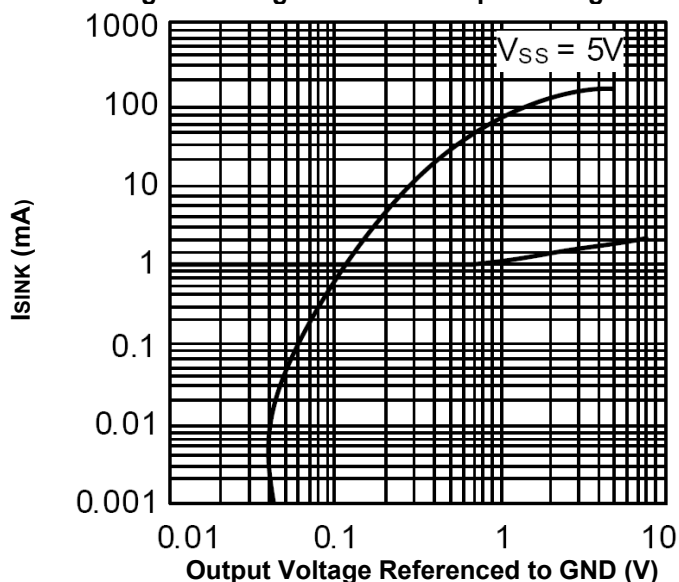


Fig.6- Open Loop Output Impedance vs Frequency

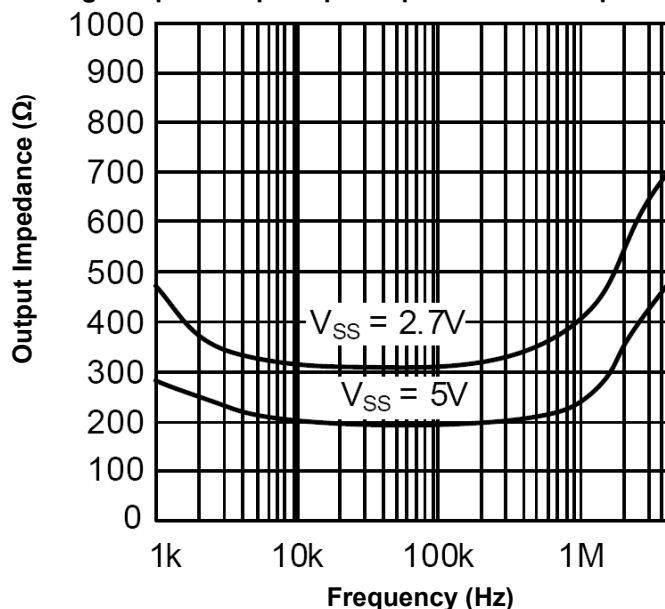


Fig.7- Short Circuit Current vs Temperature (Sinking)

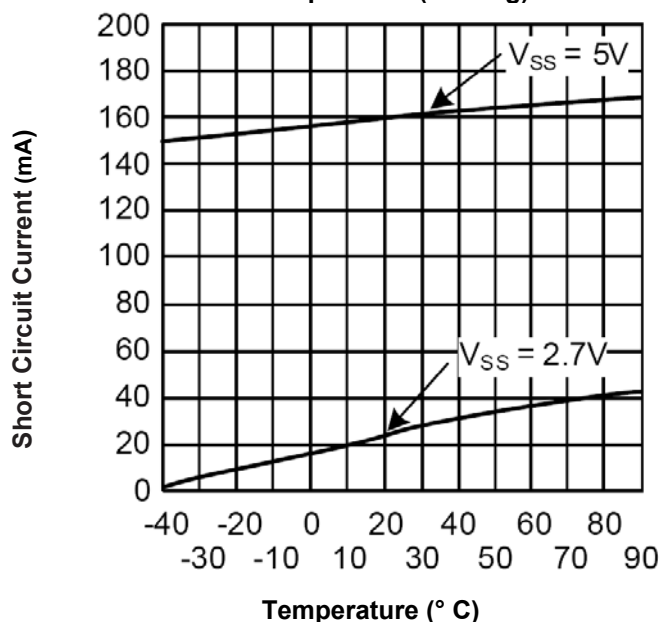
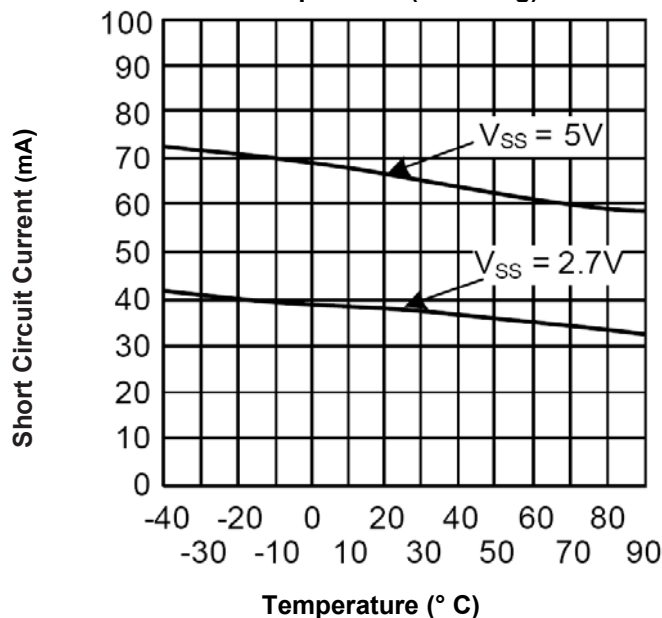


Fig.8- Short Circuit Current vs Temperature (Sourcing)



Typical Characteristics (Continued)

Fig.9- Output Voltage Swing vs Supply Voltage

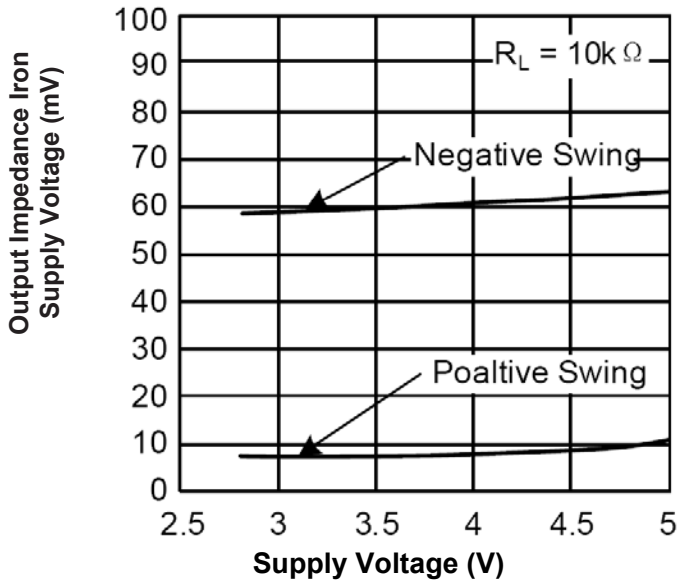


Fig.10- Input Voltage Noise vs Frequency

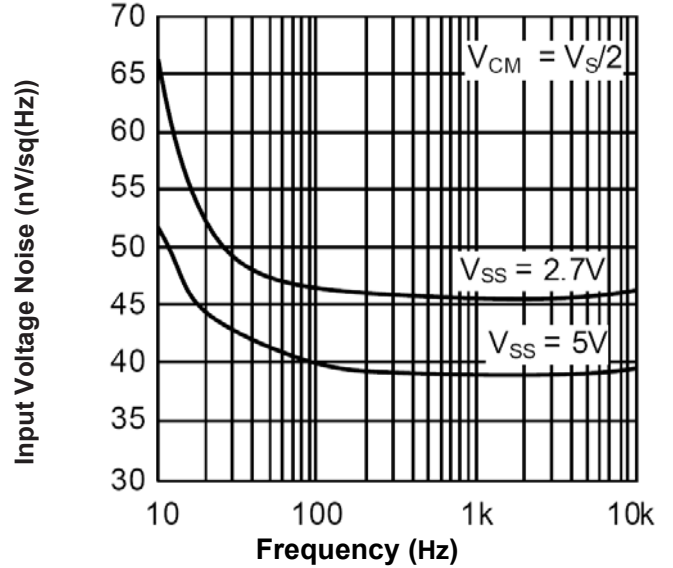


Fig.11- Input Current Noise vs Frequency

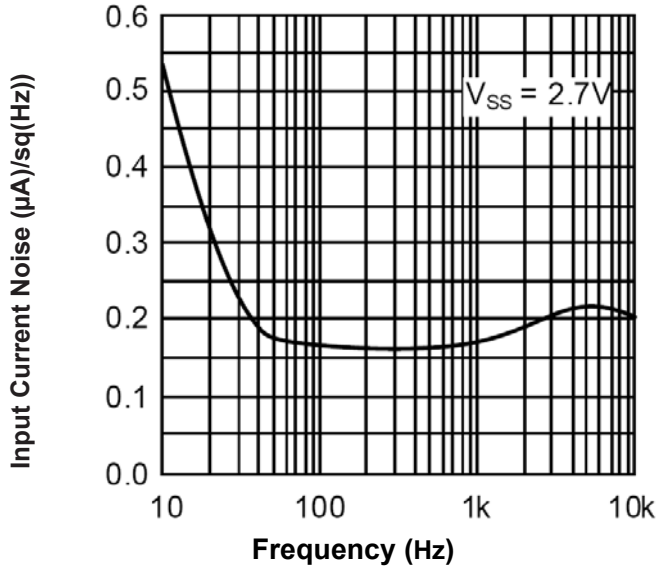
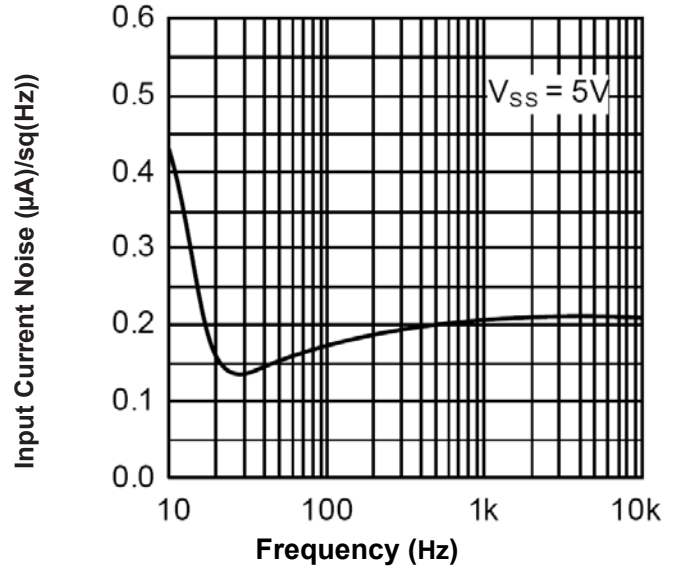


Fig.12- Input Current Noise vs Frequency



Typical Characteristics (Continued)

Fig.13- Crosstalk Rejection vs Frequency

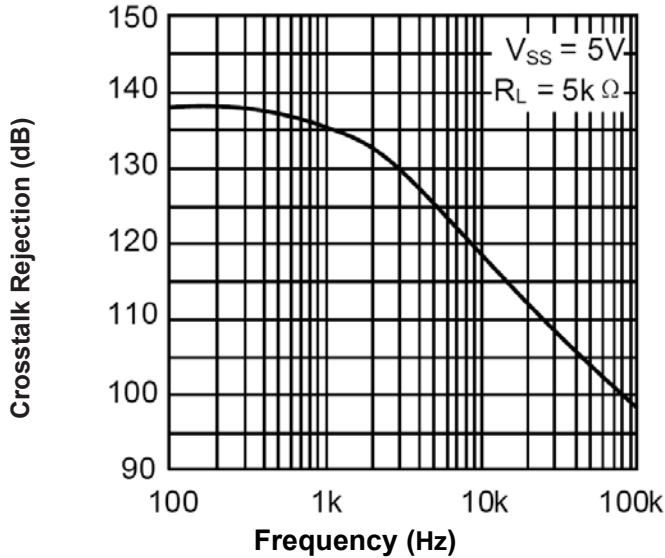


Fig.14- PSRR vs Frequency

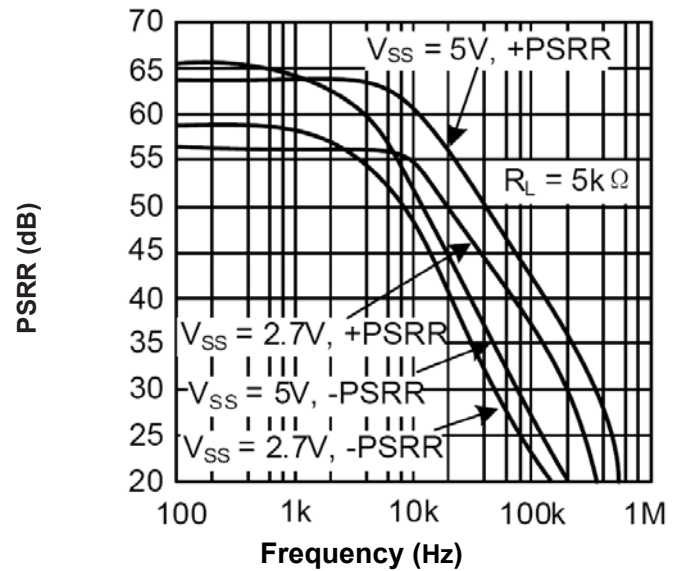


Fig.15- CMRR vs Frequency

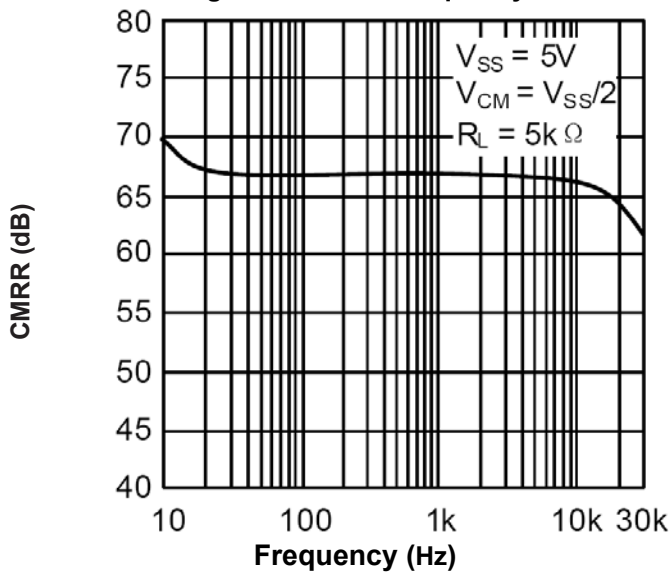
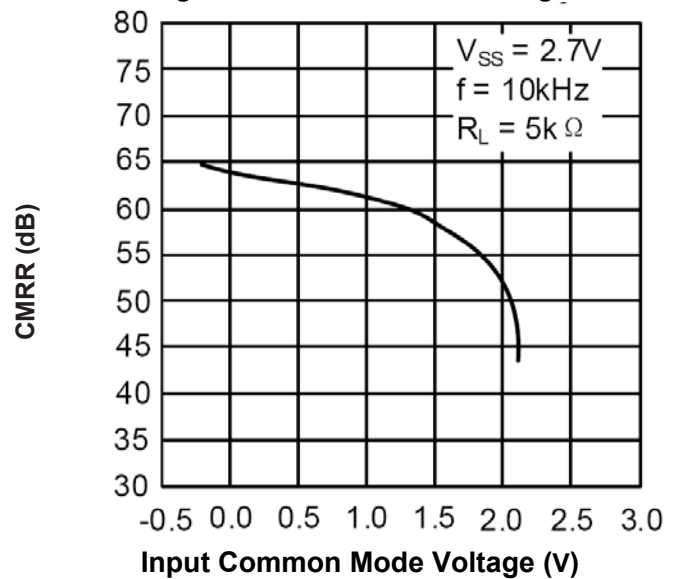


Fig.16- Common Mode vs Voltage



Dual Low Voltage Operational Amplifier

LMV358

Typical Characteristics (Continued)

Fig.17- CMRR vs Input Common Mode Voltage

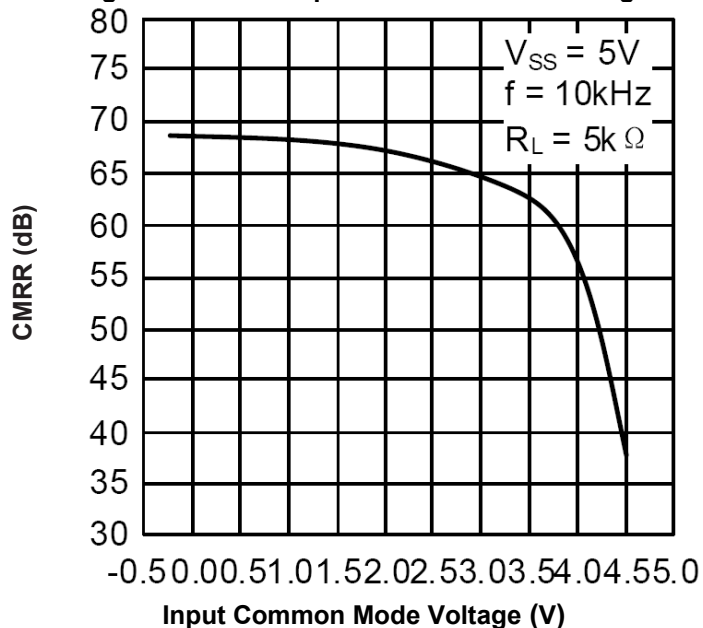


Fig.18- ΔV_{os} vs CMR

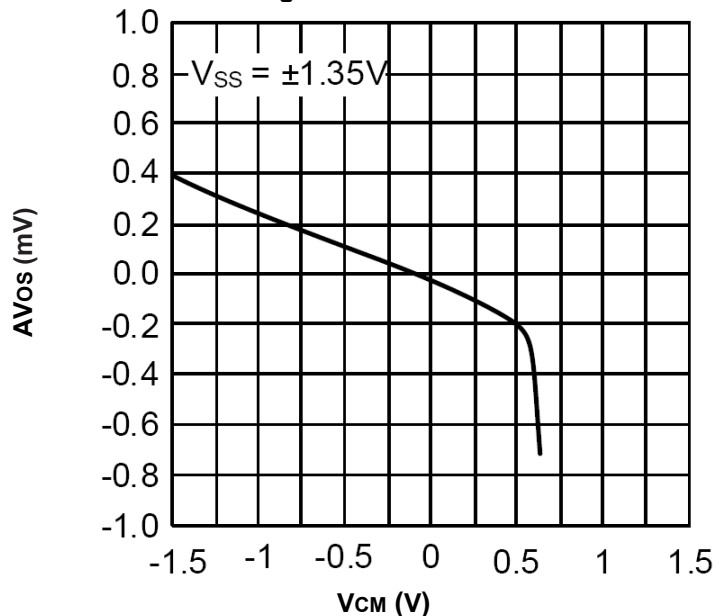


Fig.19- ΔV_{os} vs CMR

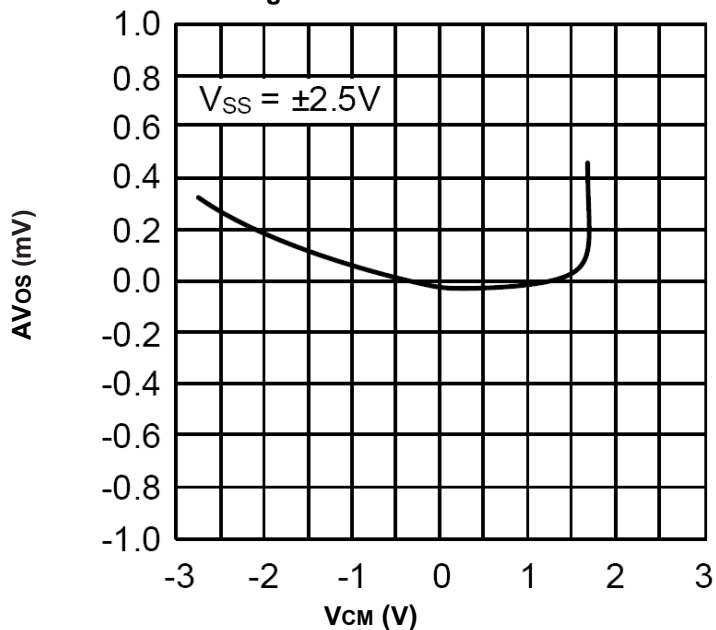
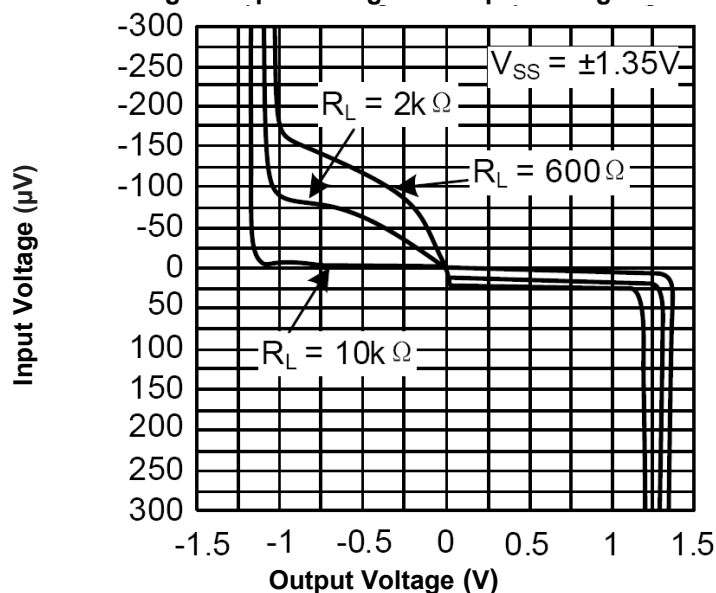


Fig.20- Input Voltage vs Output Voltage



Dual Low Voltage Operational Amplifier

LMV358

Typical Characteristics (Continued)

Fig.21- Input Voltage vs Output Voltage

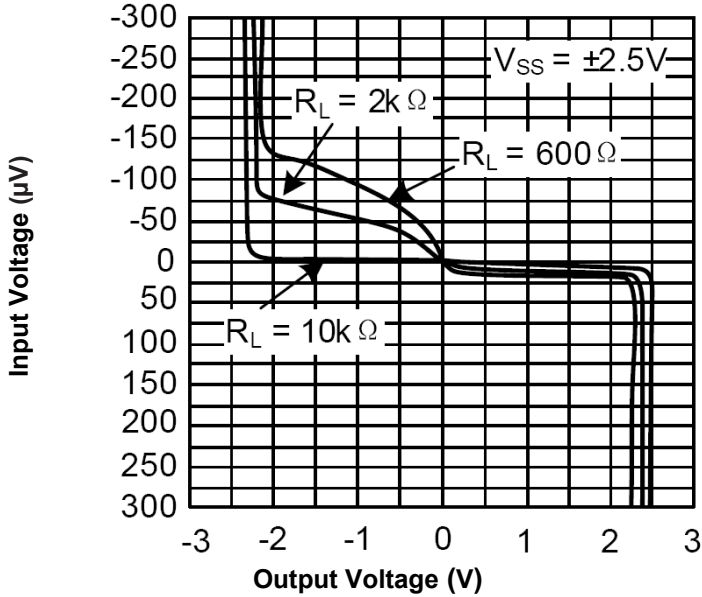


Fig.22- Open Loop Frequency Response

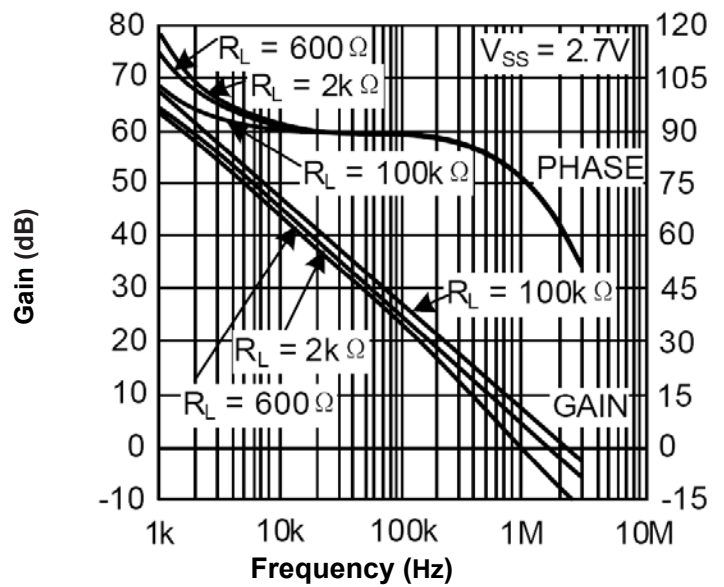


Fig.23- Open Loop Frequency Response

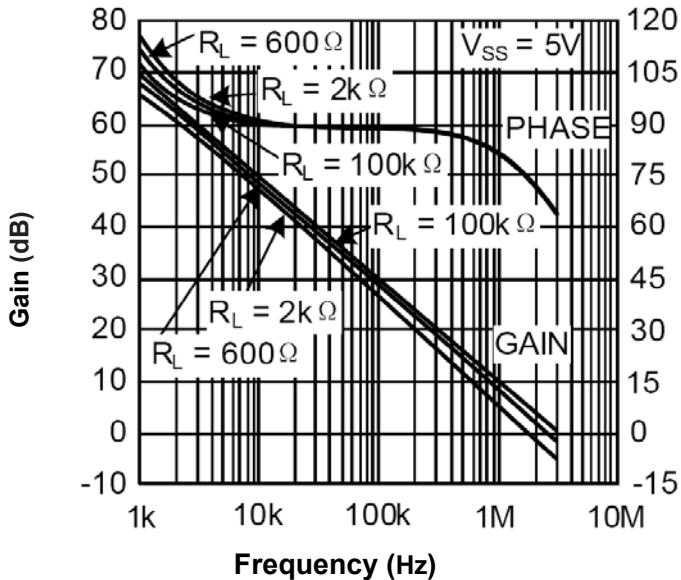
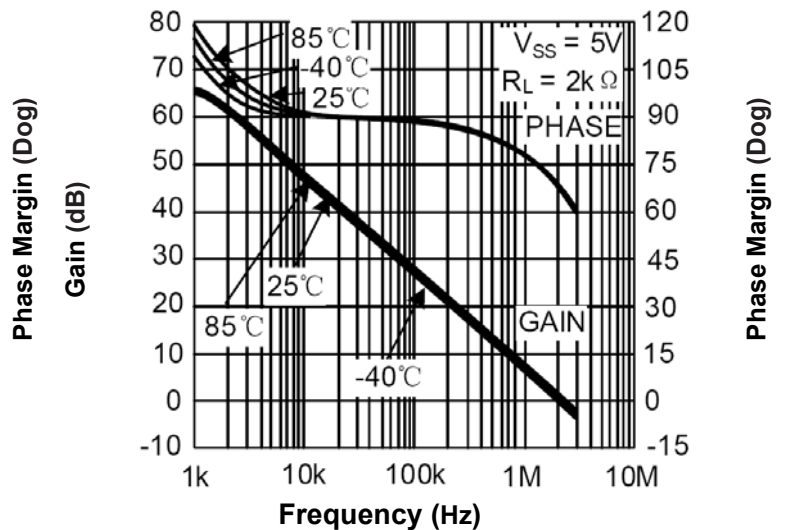


Fig.24- Open Loop Frequency Response vs Temperature



Typical Characteristics (Continued)

Fig.25- Gain and Phase vs Capacitive Load

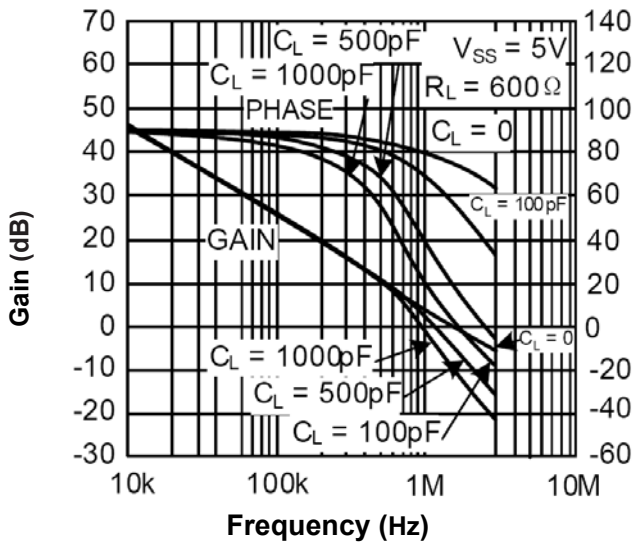


Fig.26- Gain and Phase vs Capacitive Load

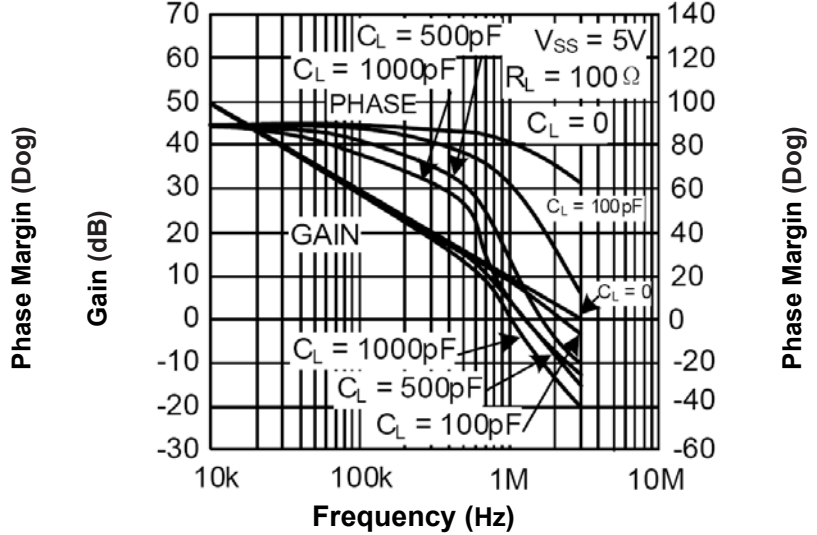


Fig.27- Slew Rate vs Supply Voltage

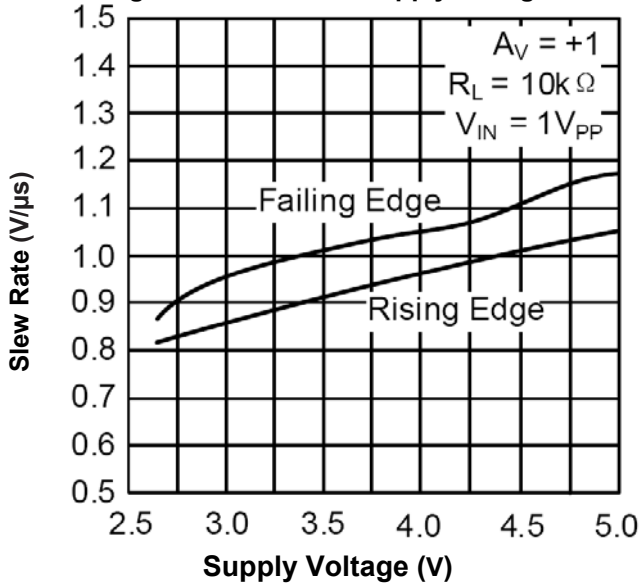
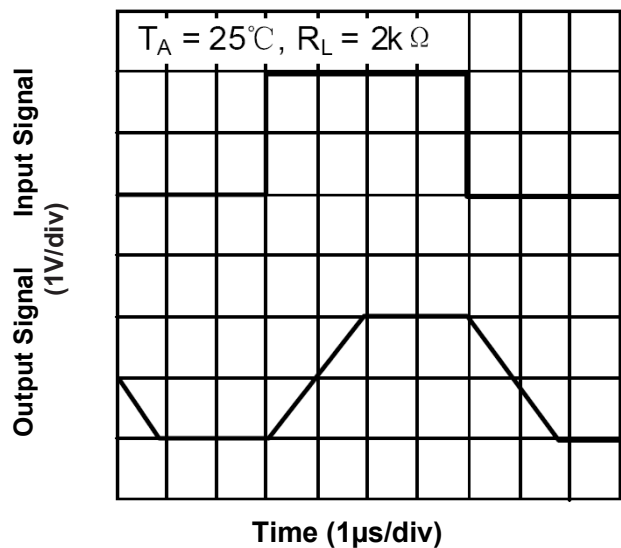


Fig.28- Non-Inverting Large Signal Pulse Response



Typical Characteristics (Continued)

Fig.29- Non-Inverting Large Signal Pulse Response

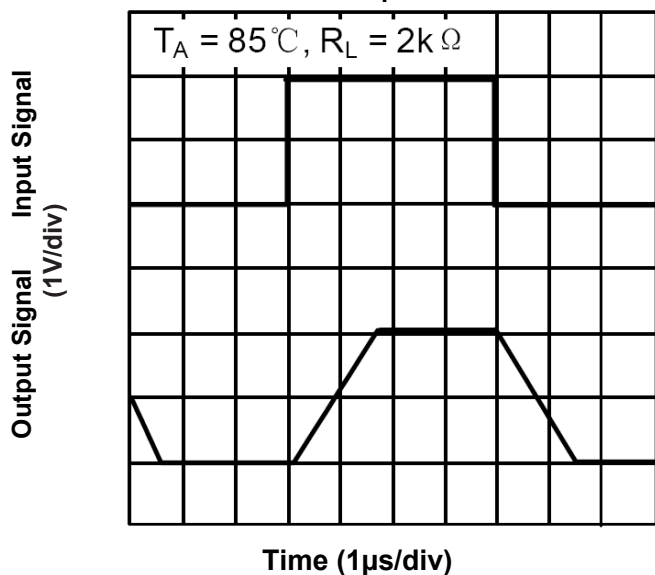


Fig.30- Non-Inverting Large Signal Pulse Response

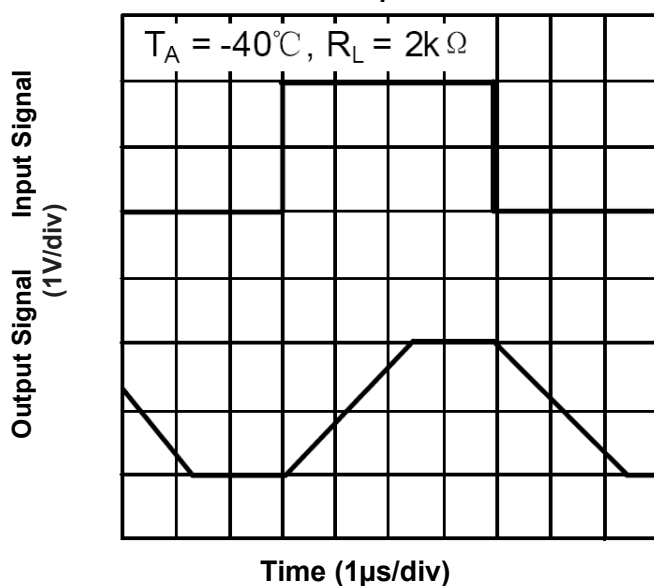


Fig.31- Non-Inverting Large Signal Pulse Response

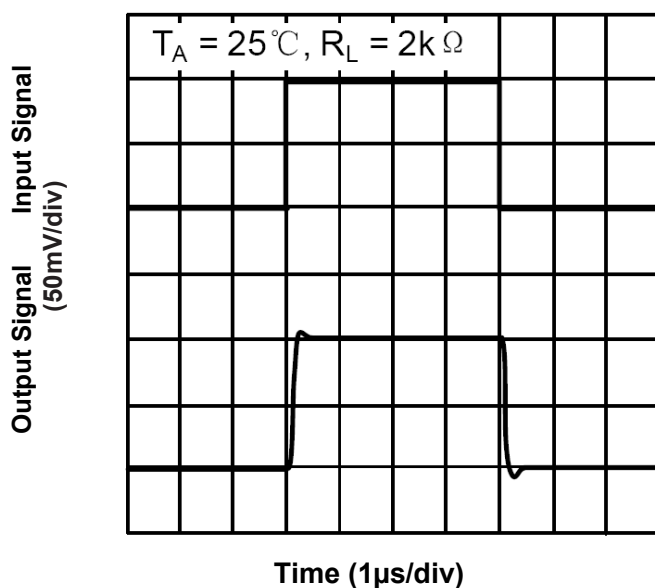
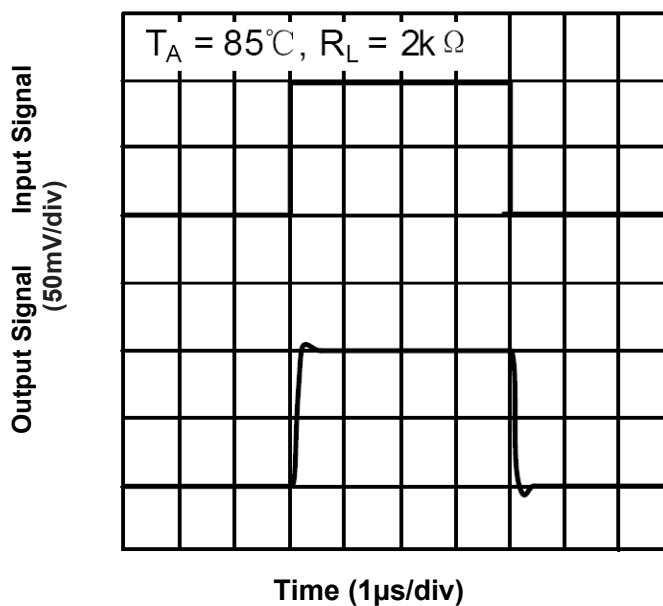


Fig.32- Non-Inverting Large Signal Pulse Response



Typical Characteristics (Continued)

Fig.33- Non-Inverting Large Signal Pulse Response

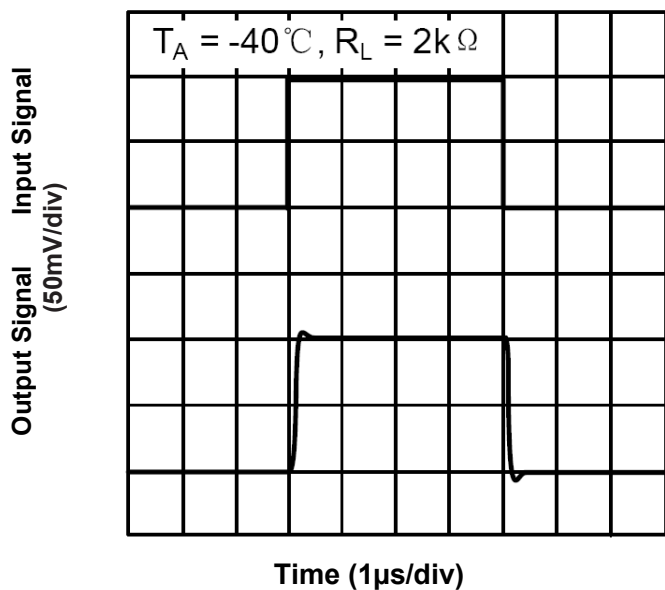


Fig.34- Non-Inverting Large Signal Pulse Response

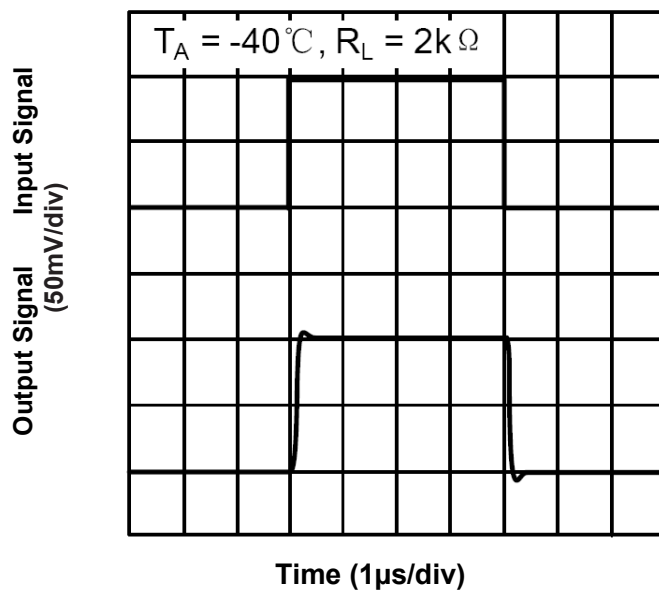


Fig.35- Non-Inverting Large Signal Pulse Response

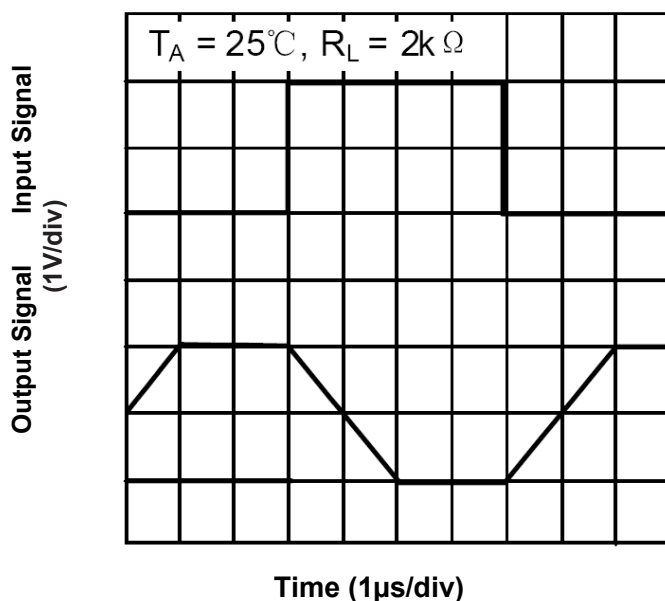
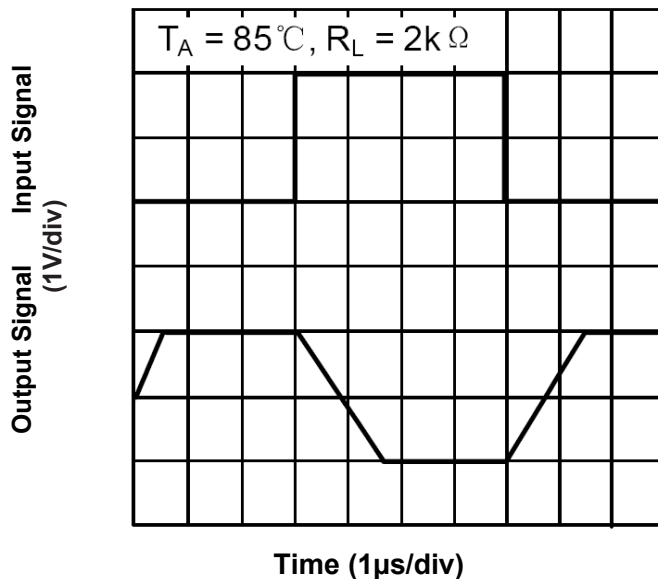


Fig.36- Non-Inverting Large Signal Pulse Response



Typical Characteristics (Continued)

Fig.37- Non-Inverting Large Signal Pulse Response

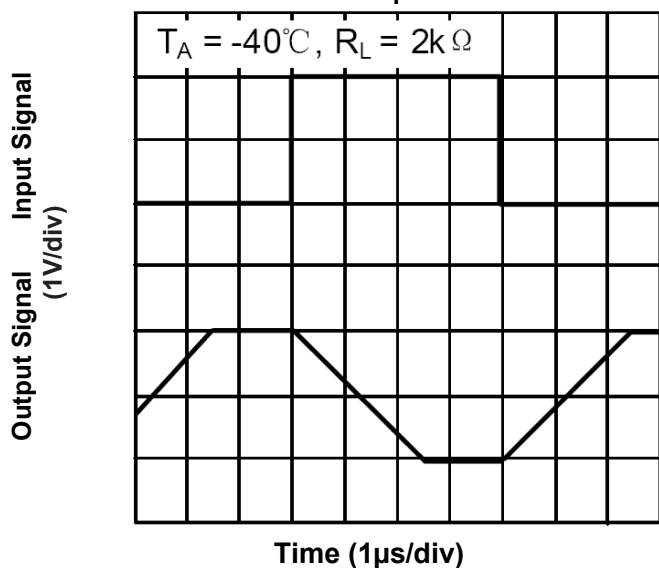


Fig.38- Non-Inverting Small Signal Pulse Response

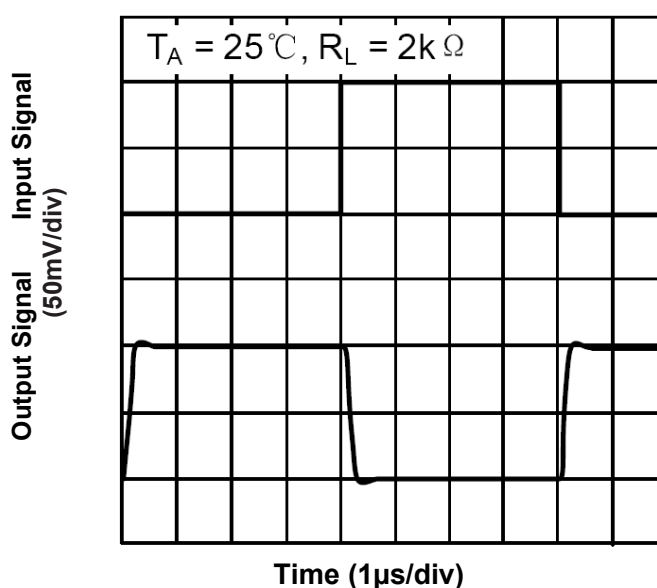


Fig.39- Non-Inverting Small Signal Pulse Response

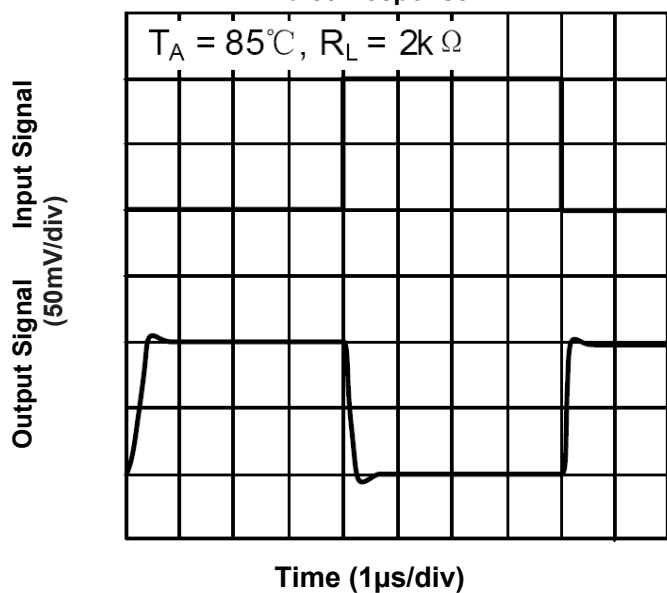
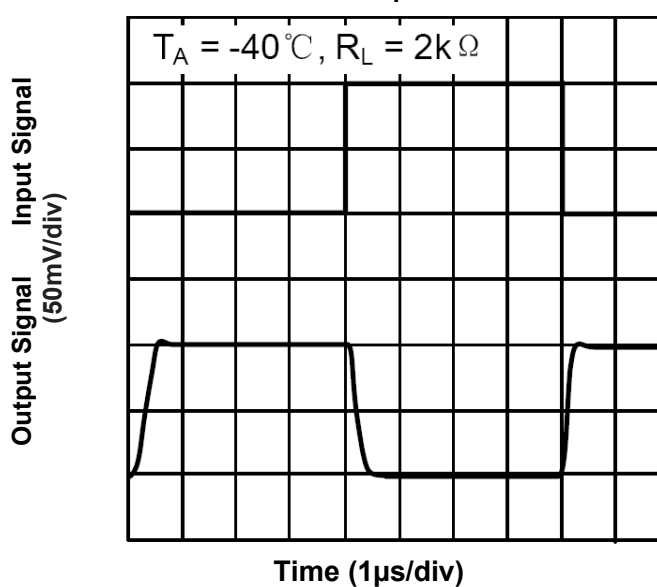


Fig.40- Non-Inverting Small Signal Pulse Response



Typical Characteristics (Continued)

Fig.41- Stability vs Capacitive Load

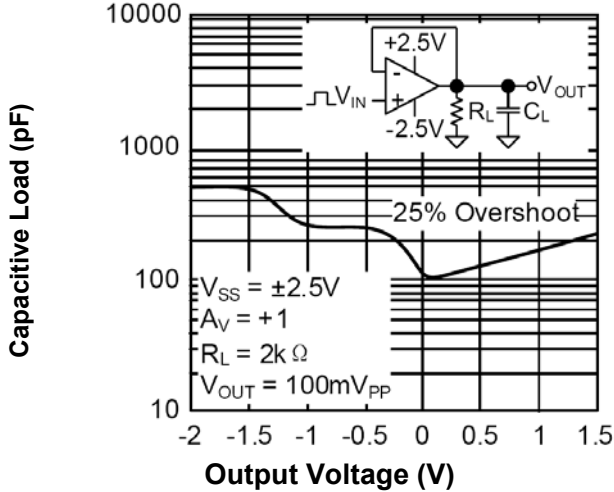


Fig.42- Stability vs Capacitive Load

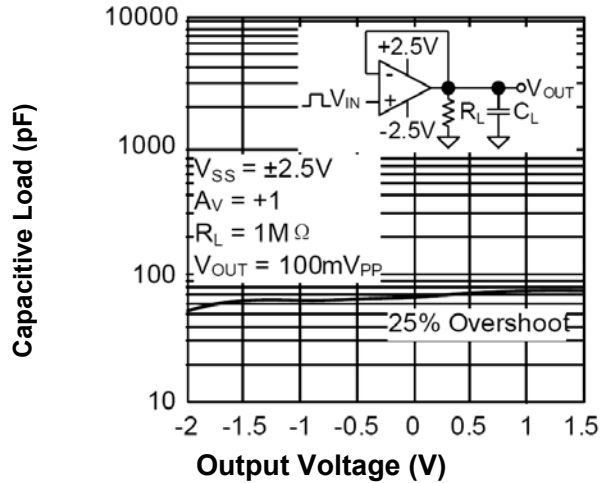


Fig.43- Stability vs Capacitive Load

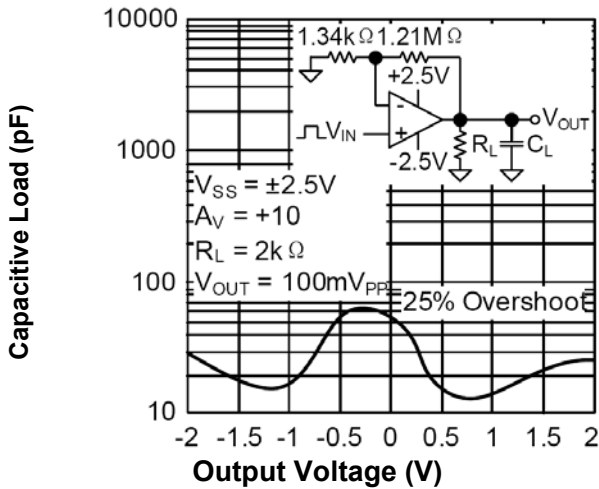


Fig.44- Stability vs Capacitive Load

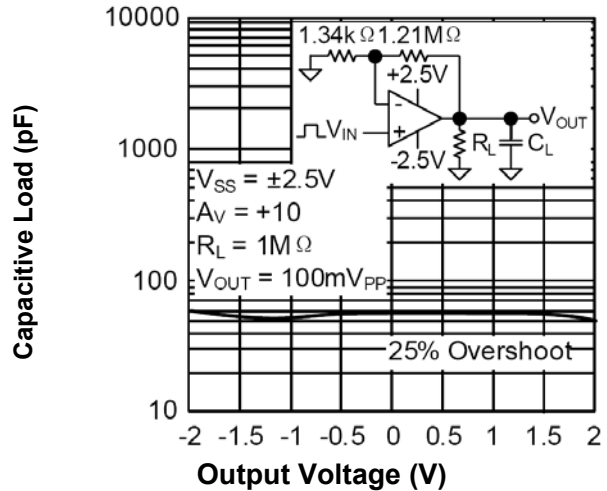
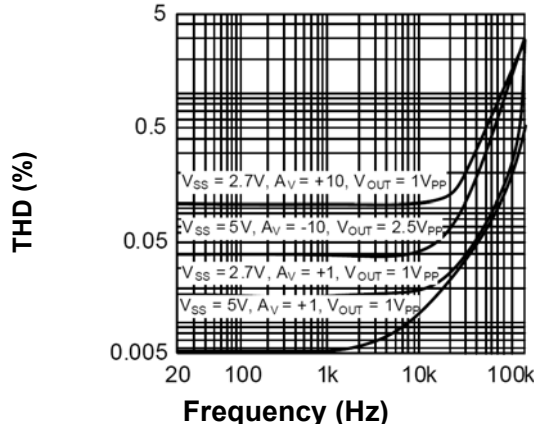


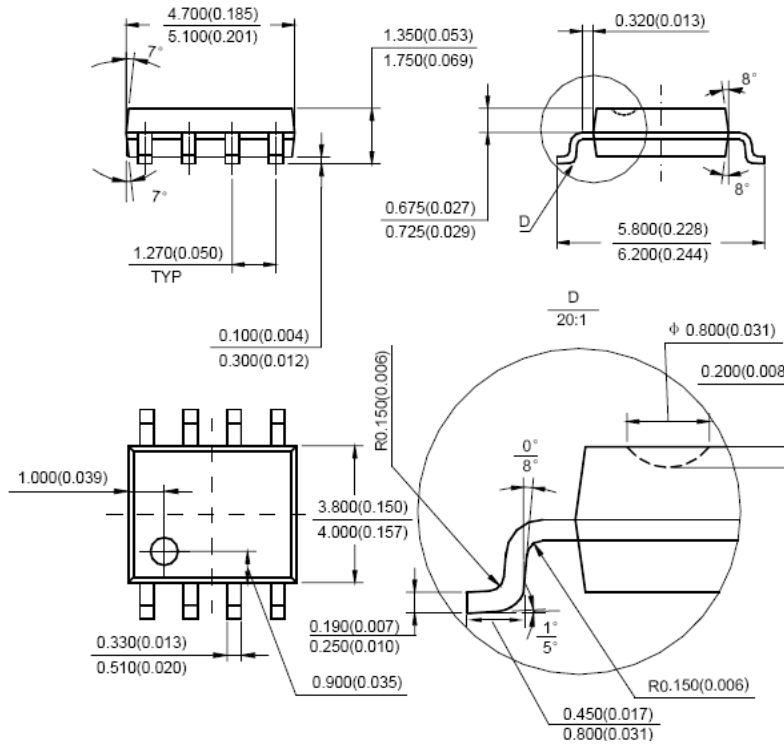
Fig.45- THD vs Frequency



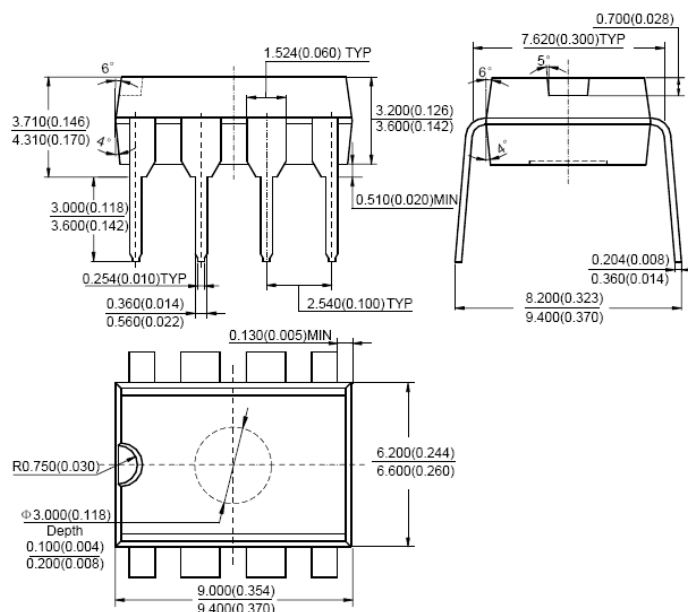
Dual Low Voltage Operational Amplifier

LMV358

Dimensions in inches (mm)



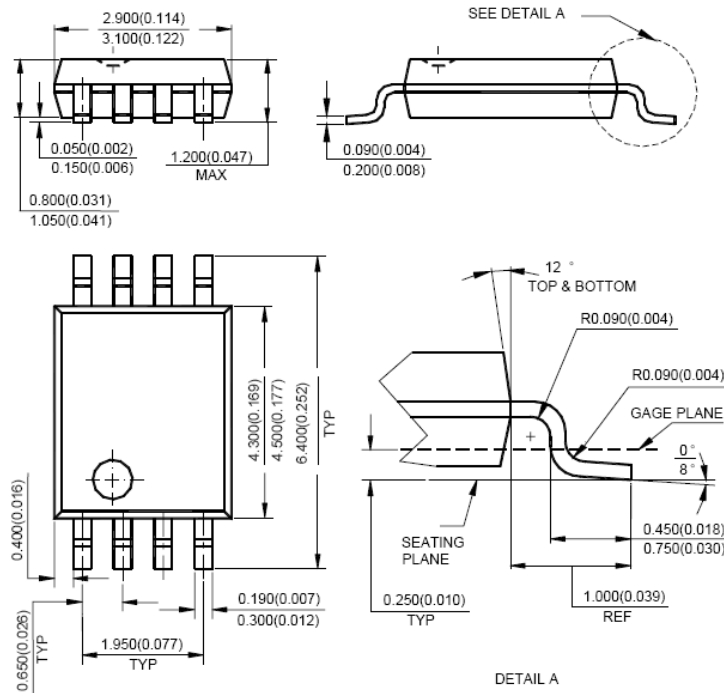
SOP-8



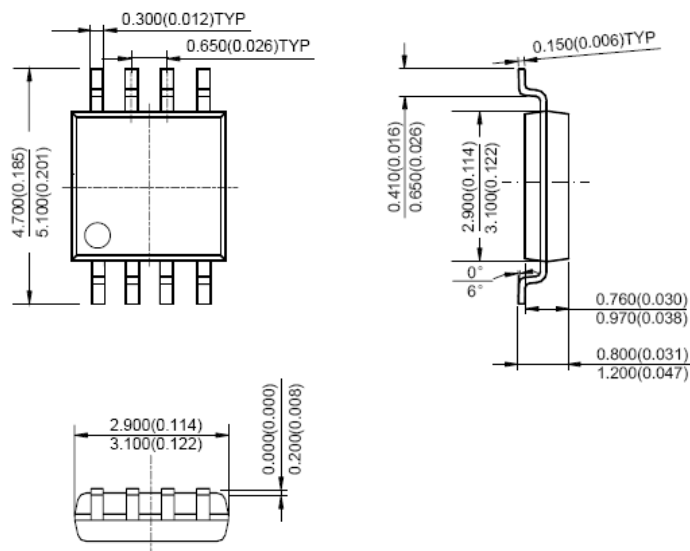
DIP-8

Dual Low Voltage Operational Amplifier

LMV358



TSSOP-8



MSOP-8

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