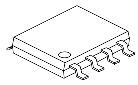
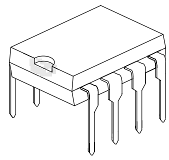
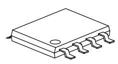
GENERAL PURPOSE, LOW VOLTAGE, RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS



SOP-8



DIP-8



TSSOP-8

*Pb-free plating product number: LMV358L

■ DESCRIPTION

The UTC **LMV358** are low voltage (2.7-5.5V) versions of the dual and quad commodity op amps, LM358, which currently operate at 5-30V. The UTC **LMV358** are the most cost effective solutions for the applications where low voltage operation, space saving and low price are needed. They offer specifications that meet or exceed the familiar LM358. The UTC **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/μs of slew rate with low supply current.

The chips are built with National's advanced submicron silicon-gate BiCMOS process. The UTC **LMV358** have bipolar input and output stages for improved noise performance and higher output current drive.

■ FEATURES

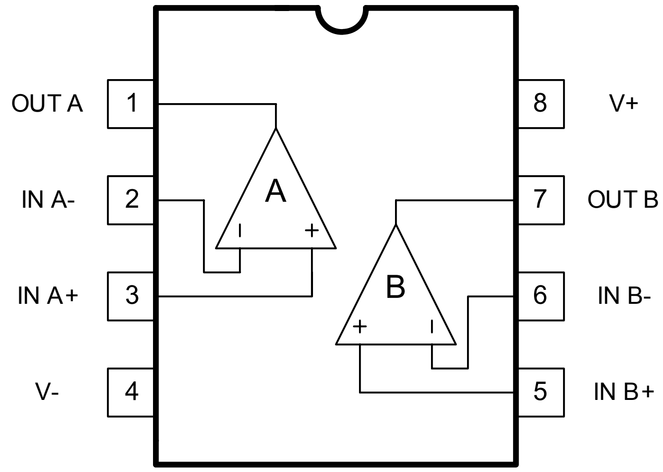
(For V^1 =5V and V=0V. Typical Unless Otherwise Noted)
*Guaranteed 2.7V and 5V Performance
*No Crossover Distortion
*Space Saving Package
*Industrial Temp. Range
*Gain-Bandwidth Product
*Low Supply Current: 210μA
*Rail-to-Rail Output Swing
@10kΩ Load V^1-10mV
V +65mV
*V_{CM} -0.2V to V^1 –0.8V

■ ORDERING INFORMATION

Order Number		Package	Packing
Normal	Lead Free Plating		
LMV358-D08-T	LMV358L-D08-T	DIP-8	Tube
LMV358-P08-R	LMV358L-P08-R	TSSOP-8	Tape Reel
LMV358-P08-T	LMV358L-P08-T	TSSOP-8	Tube
LMV358-S08-R	LMV358L-S08-R	SOP-8	Tape Reel
LMV358-S08-T	LMV358L-S08-T	SOP-8	Tube

LMV358L-D08-T (1)Packing Type (2)Package Type (3)Lead Plating	(1) R: Tape Reel, T: Tube (2) D08: DIP-8, S08: SOP-8, P08: TSSOP-8 (3) L: Lead Free Plating, Blank: Pb/Sn

■ PIN CONFIGURATIONS



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	RATINGS	UNIT
ESD Tolerance(Note 2)			
Machine Model		100	V
Human Body Model		2000	V
Differential Input Voltage	$V_{I(DIFF)}$	±Supply Voltage	
Supply Voltage (V^1-V)	V_{SS}	5.5	V
Output Short Circuit to V^1		(Note 3)	
Output Short Circuit to V		(Note 4)	
Infrared (15 sec)		215	°C
Junction Temp. (Tj, max) (Note 5)	T_J	+150	°C
Storage Temp. Range	T_{STG}	-65 to 150	°C

Note Absolute maximum ratings are those values beyond which the device could be permanently damaged.
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

■ OPERATING RATINGS (NOTE 1)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V_{SS}	2.7 to 5.5	V
Temperature Range		$-40 \leqq T_J \leqq 85$	°C

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Thermal Resistance (Note 8)	θ_{JA}	235	°C/W

■ 2.7V DC ELECTRICAL CHARACTERISTICS

Unless otherwise specified, all limits guaranteed for T_J =25°C, V^1=2.7V, V=0V, V_{CM}=1.0V, V_{OUT} =V^1/2 and R_L=1MΩ

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{OS}			1.7	7	mV
Input Offset Voltage Average Drift	TCVos			5		μV/°C
Input Bias Current	$I_{I(BIAS)}$			11	250	nA
Input Offset Current	$I_{I(OFF)}$			5	50	nA
Common Mode Rejection Ratio	CMRR	$0V \leqq V_{CM} \leqq 1.7V$	50	63		dB
Power Supply Rejection Ratio	PSRR	$2.7V \leqq V^1 \leqq 5V$ V_{OUT} =1V	50	60		dB
Input Common-Mode Voltage Range	V_{CM}	For CMRR≧50dB	0	-0.2		V
				1.9	1.7	V
Output Swing	V_{OUT}	R_L=10kΩ to 1.35V	V^1-100	V^1-10		mV
				60	180	mV
Supply Current	I_{SS}	Both amplifiers		140	340	μA

■ 2.7V AC ELECTRICAL CHARACTERISTICS

Unless otherwise specified, all limits guaranteed for T_J =25°C, V^1=2.7V, V=0V, V_{CM}=1.0V, V_{OUT} =V^1/2 and R_L>1MΩ

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Gain-Bandwidth Product	GBWP	C_L=200pF		1		MHz
Phase Margin	Φ(T)			60		Deg
Gain Margin	G(r)			10		dB
Input-Referred Voltage Noise	θr1	F=1kHz		46		$\frac{nV}{\sqrt{Hz}}$
Input-referred Current Noise	Ir1	F=1kHz		0.17		$\frac{pA}{\sqrt{Hz}}$

■ 5V DC ELECTRICAL CHARACTERISTICS

Unless otherwise specified, all limits guaranteed for T_J =25°C, V^1=5V, V=0V, V_{CM}=2.0V, V_{OUT}=V^1/2 and R_L>1MΩ. Boldface limits apply at the temperature extremes.

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Input Offset Voltage	V_{OS}		7	1.7	9	mV
Input Offset Voltage Average Drift	TCVos			5		μV/°C
Input Bias Current	$I_{I(BIAS)}$		250	15	500	nA
Input Offset Current	$I_{I(OFF)}$		50	5	150	nA
Common Mode Rejection Ratio	CMRR	0V≦V_{CM}≦4V	50	65		dB
Power Supply Rejection Ratio	PSRR	2.7V≦V^1≦5V V_{OUT}=1V V_{CM}=1V	50	60		dB
Input Common-Mode Voltage Range	V_{CM}	For CMRR≧50dB	0	-0.2		V
				4.2	4	V
Large Signal Voltage Gain(Note 6)	Av	R_L=2kΩ	10	100	15	V/mV
Output Swing	V_{OUT}	R_L=2kΩ to 2.5V	V^+-400	V^1-40	V^1-300	mV
			300	120	400	mV
		R_L=10kΩ to 2.5V	V^+-200	V^1-10	V^1-100	mV
			180	65	280	mV
Output Short Circuit Current	I_{OUT}	Sourcing, V_{OUT} =0V	5	60		mA
		Sinking, V_{OUT} =5V	10	160		mA
Supply Current	I_{SS}	Both amplifiers	440	210	615	μA

■ 2.5V AC ELECTRICAL CHARACTERISTICS

Unless otherwise specified, all limits guaranteed for T_J =25°C, V^1=2.7V, V=0V, V_{CM}=2.0V, V_{OUT}=V1/2 and R_L>1MΩ

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Slew Rate	SR			1		V/μs
Gain-Bandwidth Product	GBWP	C_L=200pF		1		MHz
Phase Margin	Φ(T)			60		Deg
Gain Margin	G(r)			10		dB
Input-Referred Voltage Noise	θr1	f=1kHz		39		$\frac{nV}{\sqrt{Hz}}$
Input-referred Current Noise	Ir1	f=1kHz		0.21		$\frac{pA}{\sqrt{Hz}}$

Note1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but specific performances is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characteristics.

Note2: Human body model 1.5kΩ in series with 100pF. Machine model, 0Ω in series with 200pF.

Note3: Shorting output to V^1 will adversely after reliability.

Note4: Shorting output to V^+ will adversely affect reliability.

Note5: The maximum power dissipation is a function of T_J(max) θ_{JA} and T_A. The maximum allowable power dissipation at any ambient temperature is P_D=(T_J(max)-T_A)/θ_{JA}. All numbers apply for packages soldered directly into a PC board.

Note6: R_L is connected to V. The output voltage is 0.5V≦V_{OUT}≦4.5V.

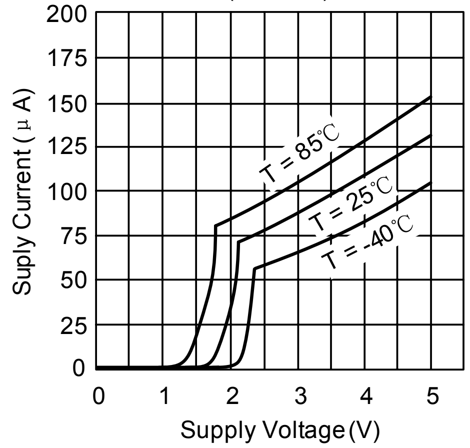
Note7: Connected as voltage follower with 3V step input. Number specified is these lower of the positive and negative slew rates.

Note8: all numbers are typical, and apply for packages soldered directly note a PC board is still air.

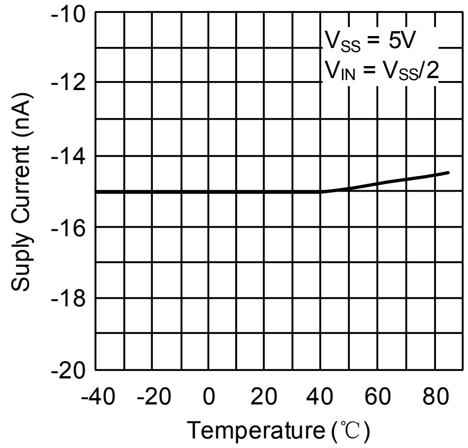
■ TYPICAL CHARACTERISTICS

(Unless otherwise specified, V_E=+5V, single supply. T_A=25°C)

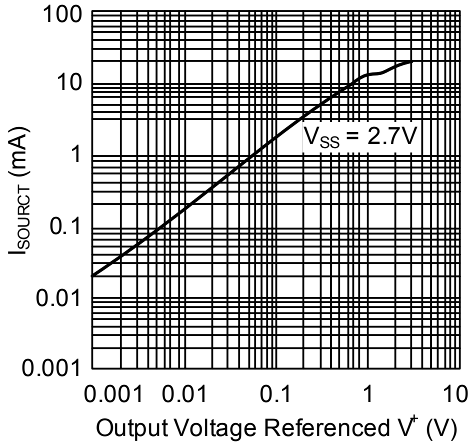
Supply Current vs Supply Voltage (LMV321)



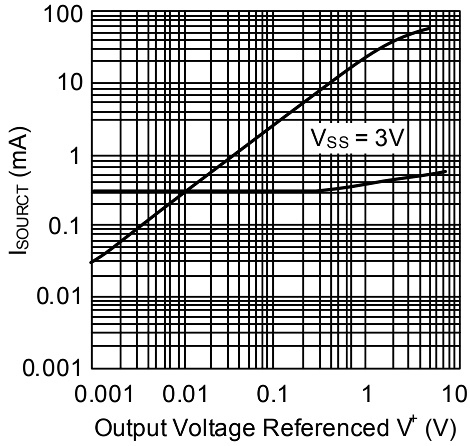
Input Current vs Temperature



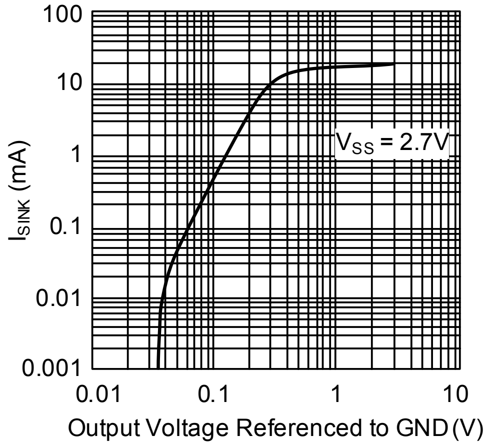
Sourcing Current vs Output Voltage



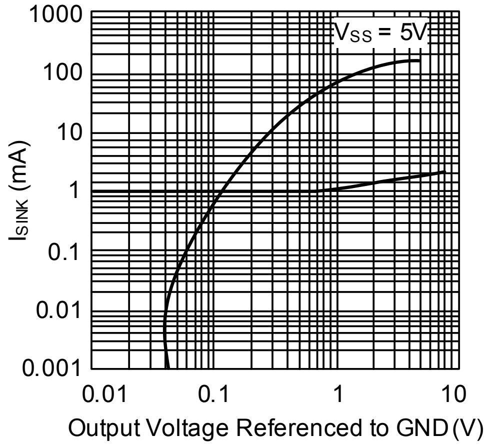
Sourcing Current vs Output Voltage



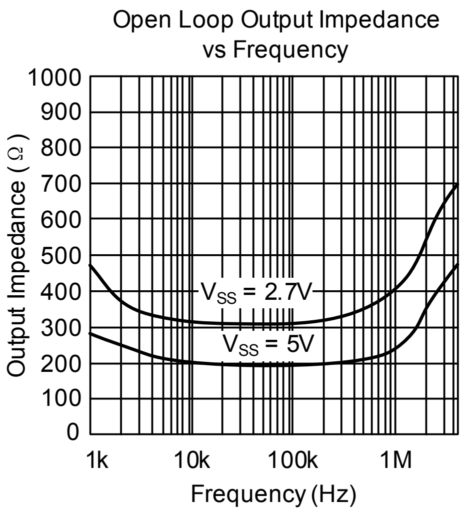
Sinking Current vs Output Voltage

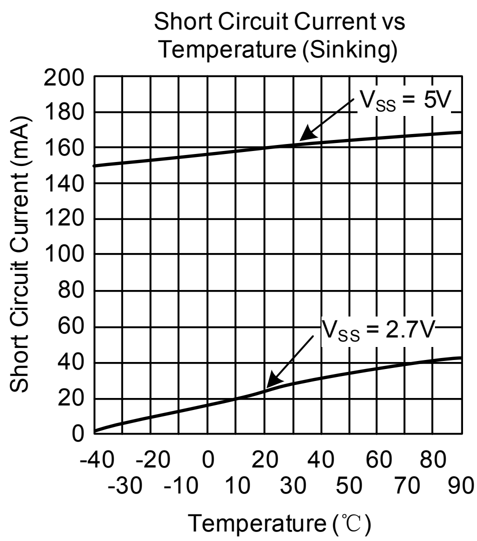


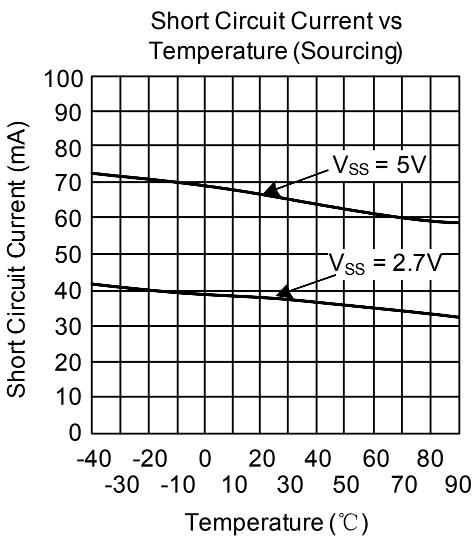
Sinking Current vs Output Voltage

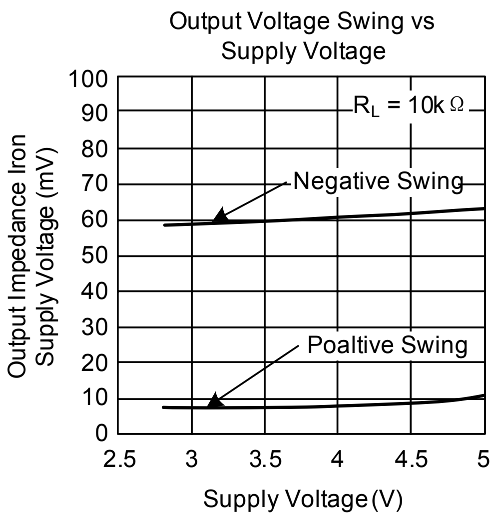


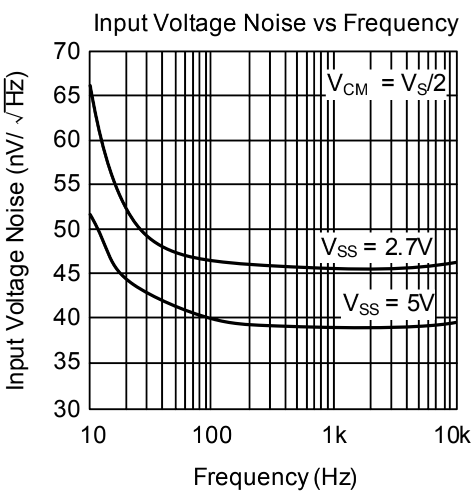
■ TYPICAL CHARACTERISTICS(Cont.)

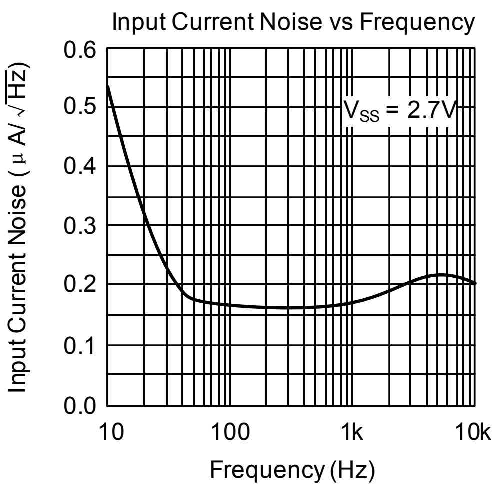






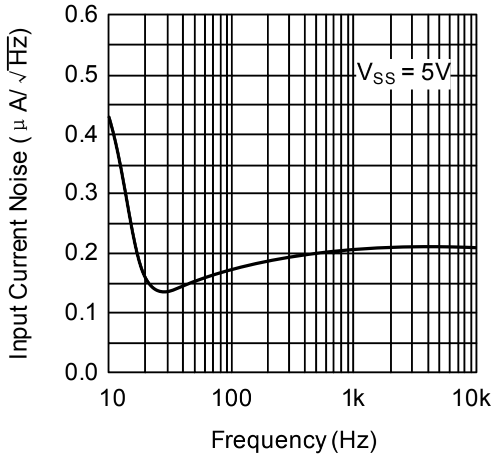




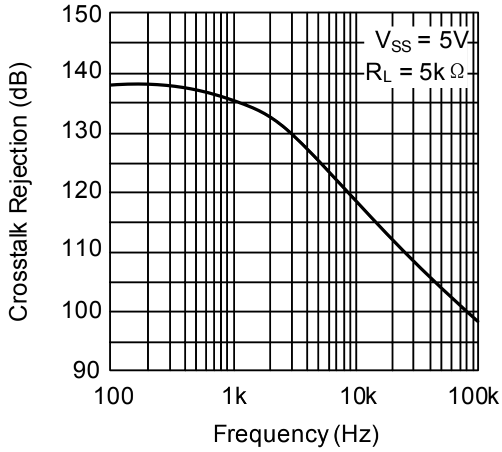


■ TYPICAL CHARACTERISTICS(Cont.)

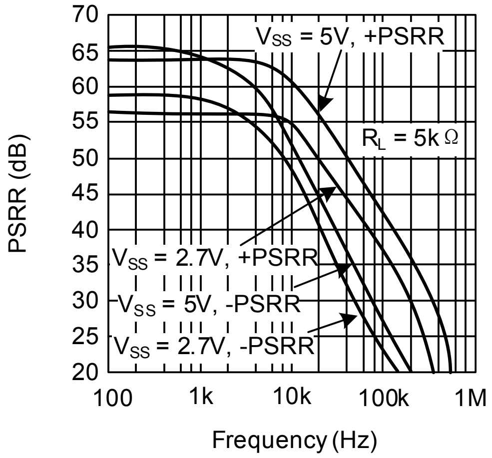
Input Current Noise vs Frequency



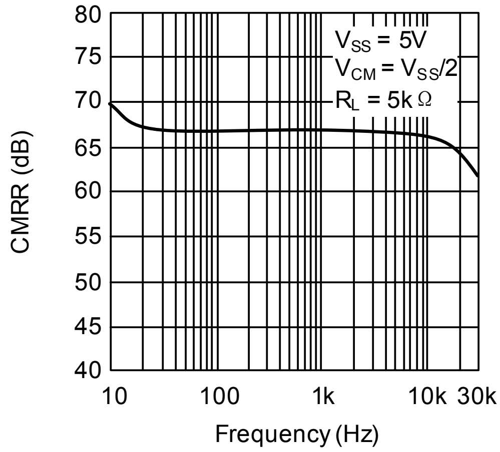
Crosstalk Rejection vs Frequency



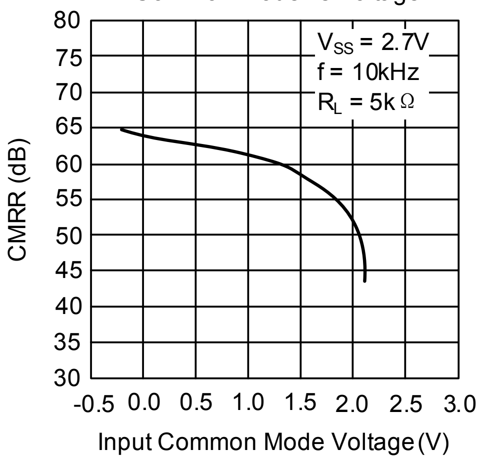
PSRR vs Frequency



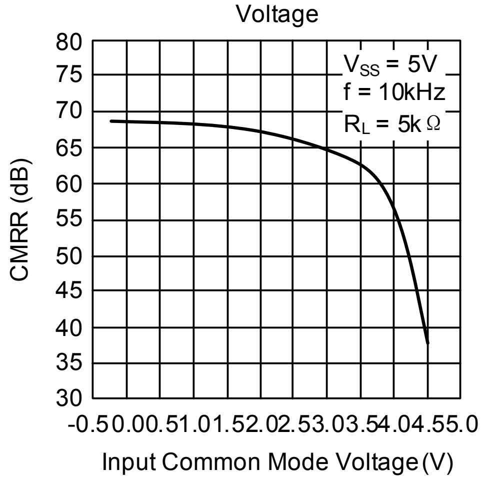
CMRR vs Frequency



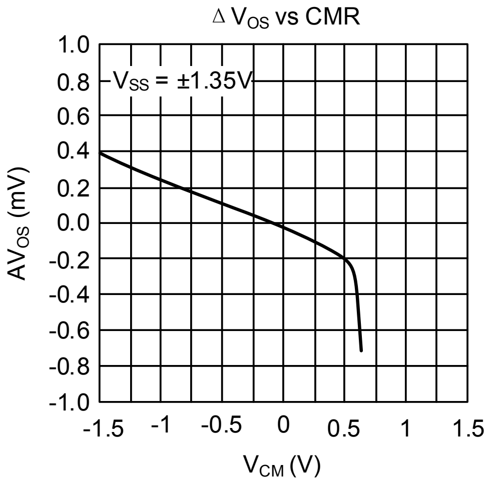
Common Mode vs Voltage

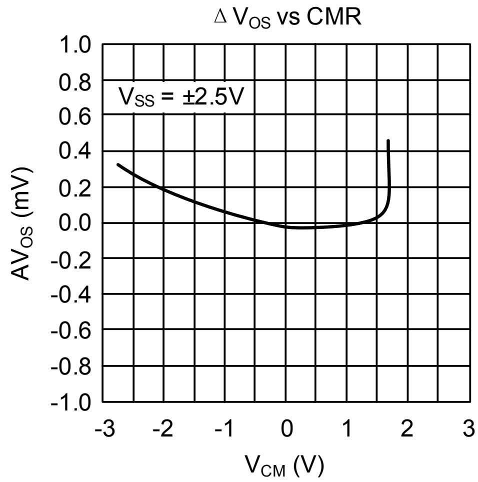


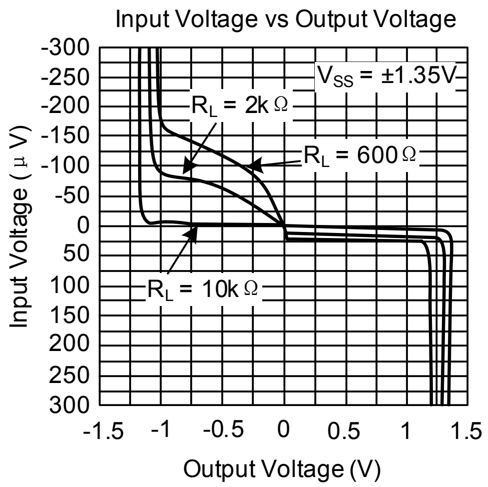
CMRR vs Input Common Mode Voltage

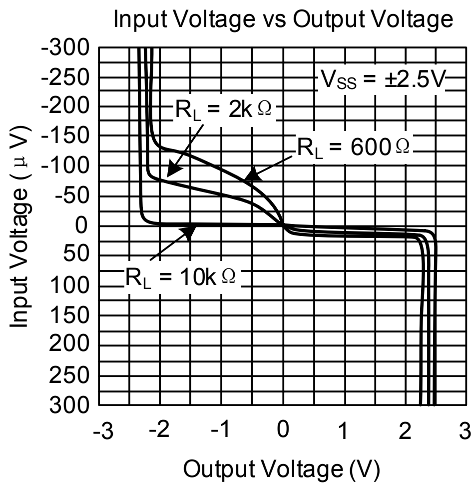


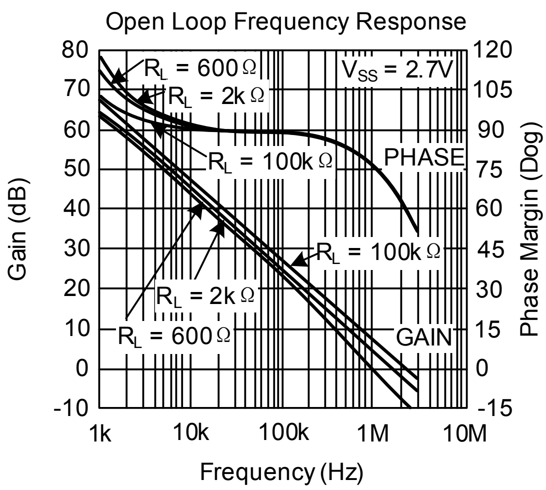
■ TYPICAL CHARACTERISTICS(Cont.)

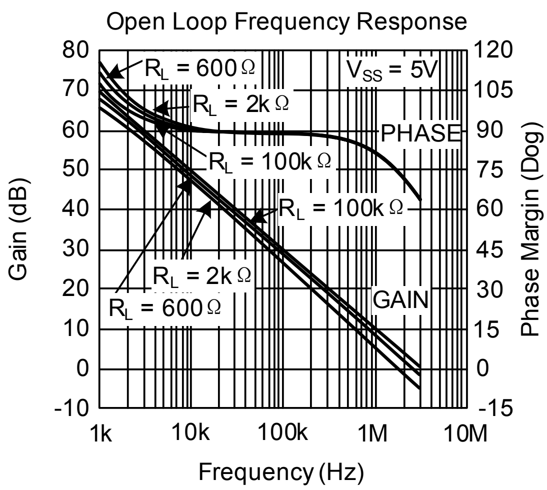






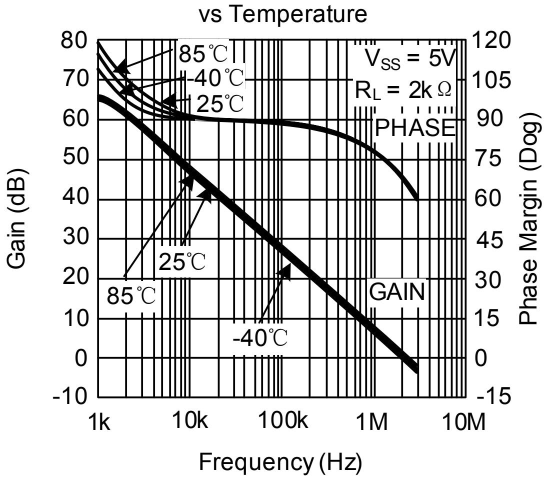




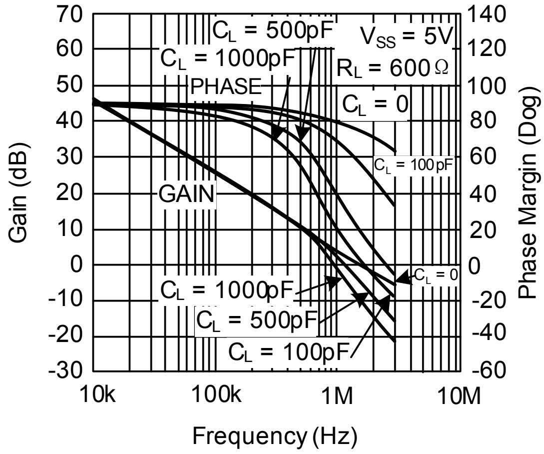


■ TYPICAL CHARACTERISTICS(Cont.)

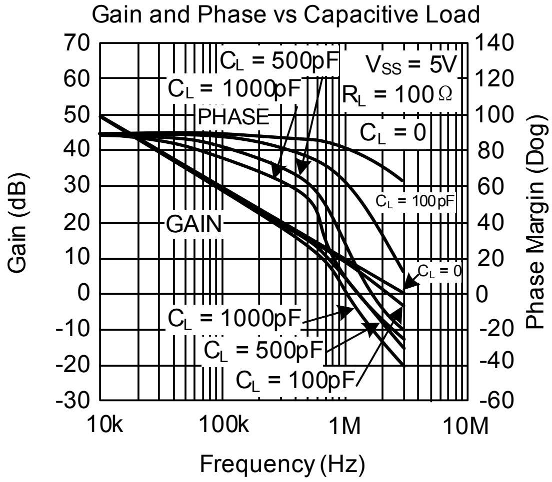
Open Loop Frequency Response vs Temperature



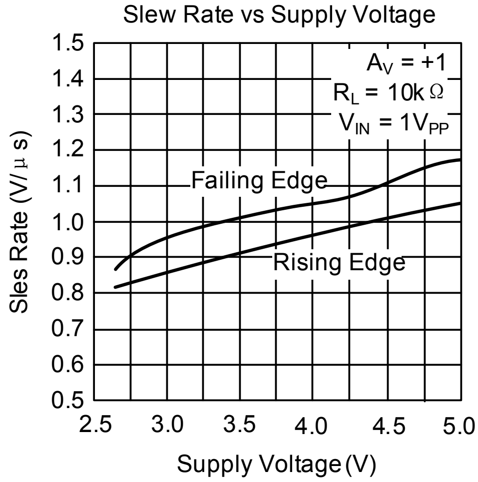
Gain and Phase vs Capacitive Load



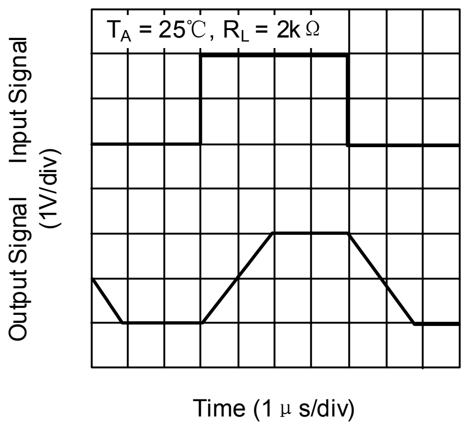
Gain and Phase vs Capacitive Load



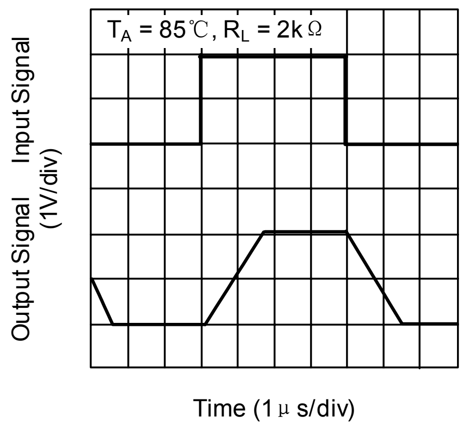
Slew Rate vs Supply Voltage



Non-Inverting Large Signal Pulse Response

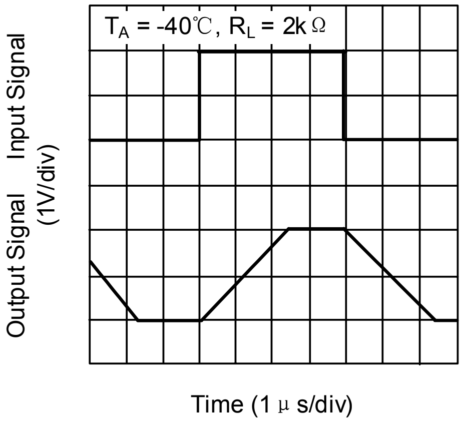


Non-Inverting Large Signal Pulse Response

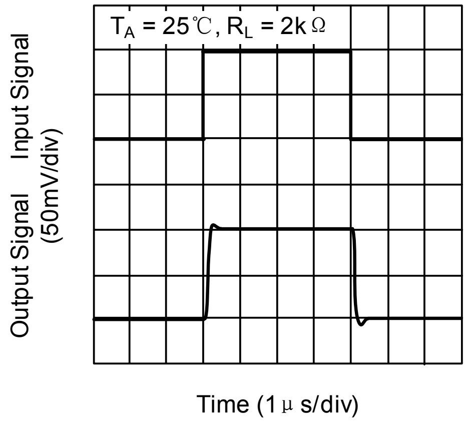


■ TYPICAL CHARACTERISTICS(Cont.)

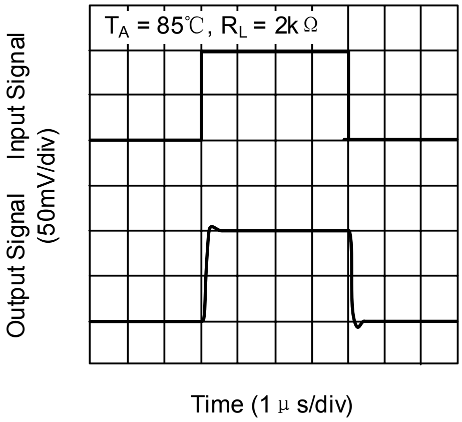
Non-Inverting Large Signal
Pulse Response



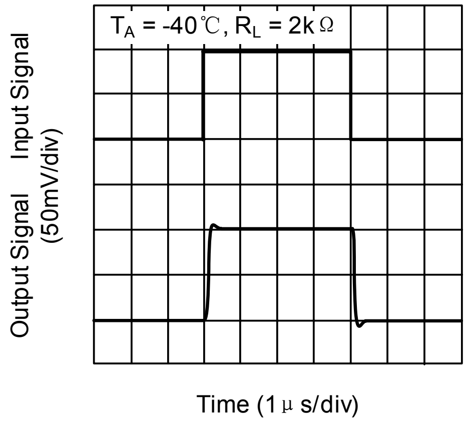
Non-Inverting Small Signal
Pulse Response



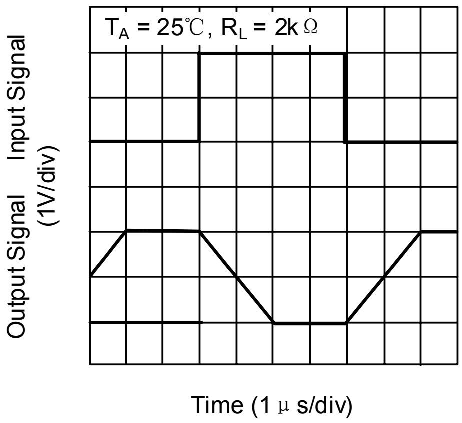
Non-Inverting Small Signal
Pulse Response



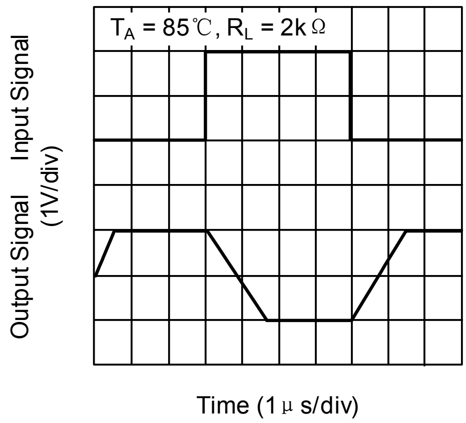
Non-Inverting Small Signal
Pulse Response



Non-Inverting Large Signal
Pulse Response

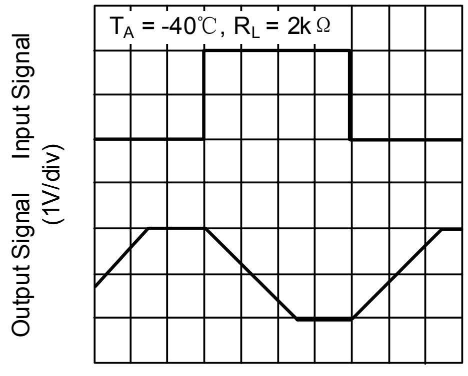


Non-Inverting Large Signal
Pulse Response

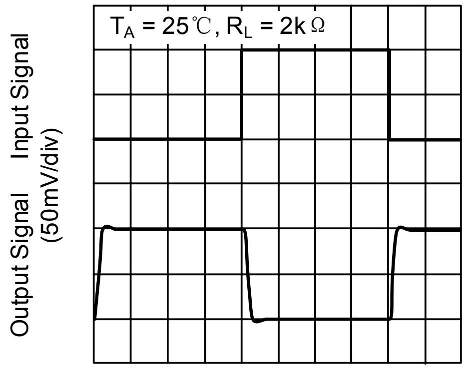


■ TYPICAL CHARACTERISTICS(Cont.)

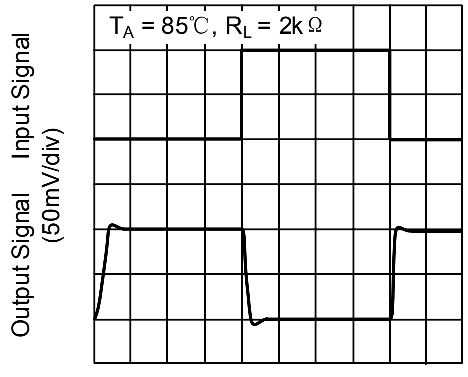
Non-Inverting Large Signal Pulse Response



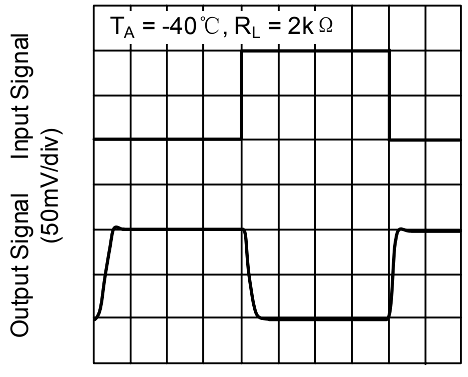
Non-Inverting Small Signal Pulse Response



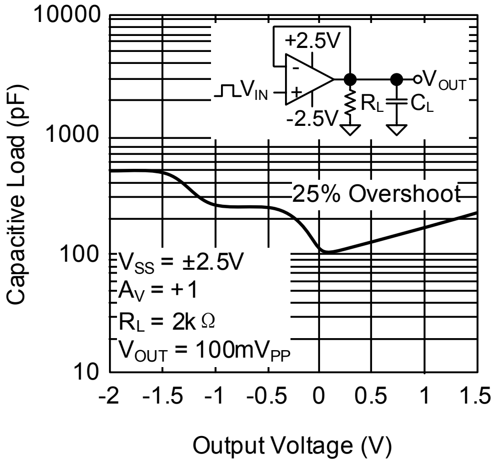
Non-Inverting Small Signal Pulse Response



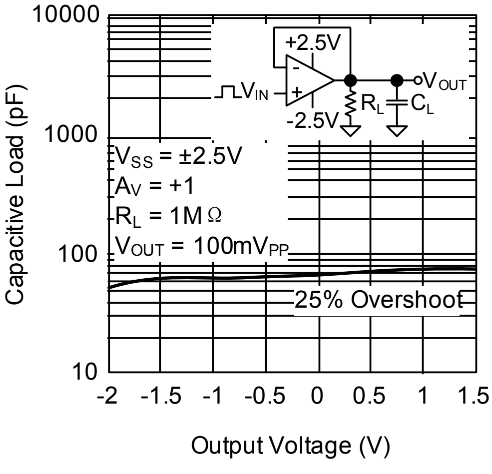
Non-Inverting Small Signal Pulse Response



Stability vs Capacitive Load



Stability vs Capacitive Load



■ TYPICAL CHARACTERISTICS(Cont.)