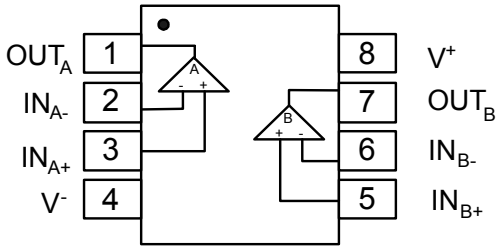
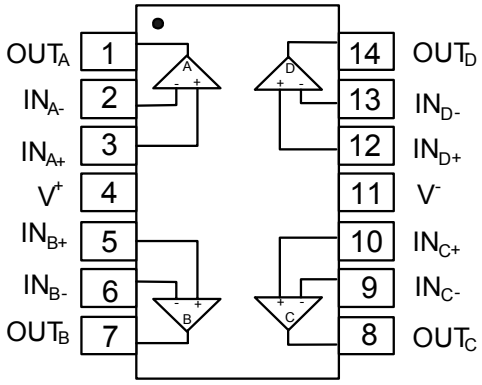
Pin Assignments

(Top View)



MSOP-8L / SOP-8L

(Top View)



TSSOP-14L

Absolute Maximum Ratings (Note 5)

Symbol	Description	Rating	Unit
ESD HBM	Human Body Model ESD Protection	2000	V
ESD MM	Machine Model ESD Protection	200	V
	Differential Input Voltage	±Supply Voltage	V
V^+ -V^-	Supply Voltage	5.5	V
	Output Short Circuit to V^+	(Note 6)	
	Output Short Circuit to V^-	(Note 7)	
T_{ST}	Storage Temperature	-65 to 150	°C
T_J	Maximum Junction Temperature	150	°C

Operating Ratings (Note 5)

Symbol	Description	Rating	Unit
V^+ -V^-	Supply Voltage	2.5 to 5.5	V
T_A	Operating Ambient Temperature Range	-40 to +85	°C

Note: 5. 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 performance is not guaranteed. For guaranteed specifications and the test conditions, see the Electrical Characteristics.

Electrical Characteristics

2.7V DC Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min (Note 9)	Typ (Note 8)	Max (Note 9)	Unit
V_{OS}	Input Offset Voltage			1.7	7	mV
TCV_{OS}	Input Offset Voltage Average Drift			5		µV/°C
I_B	Input Bias Current			10		nA
I_{OS}	Input Offset Current			5	50	nA
CMRR	Common Mode Rejection Ratio	0.3V ≤ V_{CM} ≤ 2.4V	50	63		dB
PSRR	Power Supply Rejection Ratio	2.7V ≤ V^+ ≤ 5V V_O = 1V	50	60		dB
V_{CM}	Input Common-Mode Voltage	For CMRR ≥ 50dB	0.2		V^+ - 0.2	V
V_O	Output Swing	R_L = 10 kΩ to 1.35V	V^+ -100	V^+ -20		mV
				20	100	
I_S	Supply Current	APX358 Both amplifiers		190	340	µA
		APX324 All four amplifiers		340	680	µA

2.7V AC Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min (Note 9)	Typ (Note 8)	Max (Note 9)	Unit
GBWP	Gain-Bandwidth Product	C_L = 200 pF		1		MHz
Φm	Phase Margin			60		Deg
Gm	Gain Margin			10		dB
e_n	Input-Referred Voltage Noise	f = 1 KHz		60		$\frac{nV}{\sqrt{Hz}}$

Electrical Characteristics (Continued)

5V DC Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min (Note 9)	Typ (Note 8)	Max (Note 9)	Unit
V_{OS}	Input Offset Voltage			1.7	7 **9**	mV
TCV_{OS}	Input Offset Voltage Average Drift			5		µV/°C
I_B	Input Bias Current			15	250 **500**	nA
I_{OS}	Input Offset Current			5	50 **150**	nA
CMRR	Common Mode Rejection Ratio	0.3V ≤ V_{CM} ≤ 4.7V	50	65		dB
PSRR	Power Supply Rejection Ratio	2.7V ≤ V^+ ≤ 5V V_O = 1V, V_{CM} = 1V	50	60		dB
V_{CM}	Input Common-Mode Voltage	For CMRR ≥ 50dB	0.2		V^+-0.2	V
A_V	Large Signal Voltage Gain (Note 10)	R_L = 2 kΩ	15 **10**	100		V/mV
V_O	Output Swing	R_L = 2 kΩ to 2.5V	V^+ -300 **V^+ -400**	V^+ -50		mV
				50	300 **400**	mV
		R_L = 10 kΩ to 2.5V	V^+ -100 **V^+ -200**	V^+ -10		mV
				10	180 **280**	mV
I_O	Output Short Circuit Current	Sourcing, V_O = 0V	5	60		mA
		Sinking, V_O = 5V	10	90		mA
I_S	Supply Current	APX358 Both amplifiers		190	340 **600**	µA
		APX324 All four amplifiers		340	680 **1100**	µA
θ_{JA}	Thermal Resistance Junction-to-Ambient	MSOP-8L (Note 12)		203		°C/W
		SOP-8L (Note 12)		150		°C/W
		TSSOP-14L (Note 12)		100		°C/W

Electrical Characteristics (Continued)

5V AC Electrical Characteristics

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

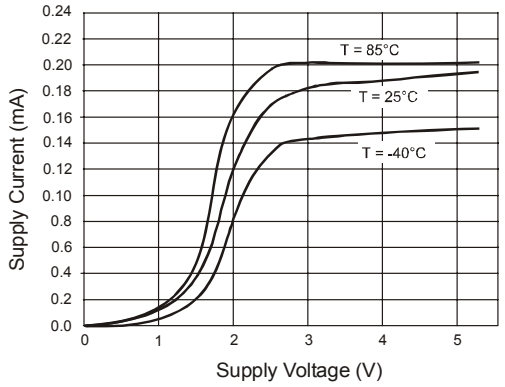
Symbol	Parameter	Test Conditions	Min (Note 9)	Typ (Note 8)	Max (Note 9)	Unit
SR	Slew Rate	(Note 11)		1		V/μs
GBWP	Gain-Bandwidth Product	C_L = 200 pF		1		MHz
Φ_m	Phase Margin			60		Deg
G_m	Gain Margin			10		dB
e_n	Input-Referred Voltage Noise	f = 1 KHz		55		$\frac{nV}{\sqrt{Hz}}$

Note:
6. Shorting output to V+ will adversely affect reliability.
7. Shorting output to V- will adversely affect reliability.
8. Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration. The typical values are not tested and are not guaranteed on shipped production material.
9. All limits are guaranteed by testing or statistical analysis.
10. RL is connected to V-. The output voltage is 0.5V ≤ VO ≤ 4.5V.
11. Connected as voltage follower with 3V step input. Number specified is the slower of the positive and negative slew rates.
12. All numbers are typical, and apply for packages soldered directly onto a PC board in still air.

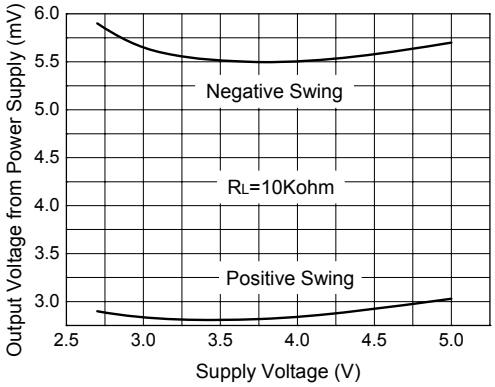
Typical Performance Characteristics

Unless otherwise specified, Vs=+5V, single supply, T_A=25°C

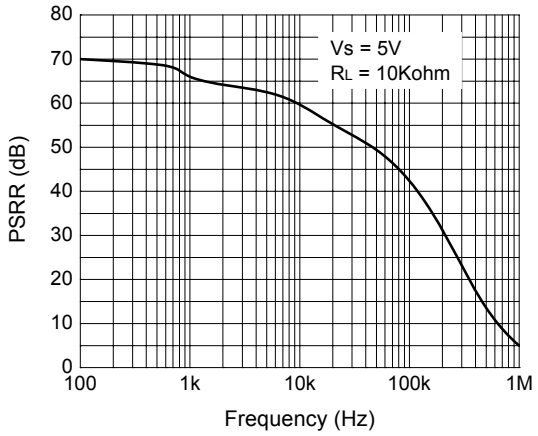
Supply Current vs. Supply Voltage



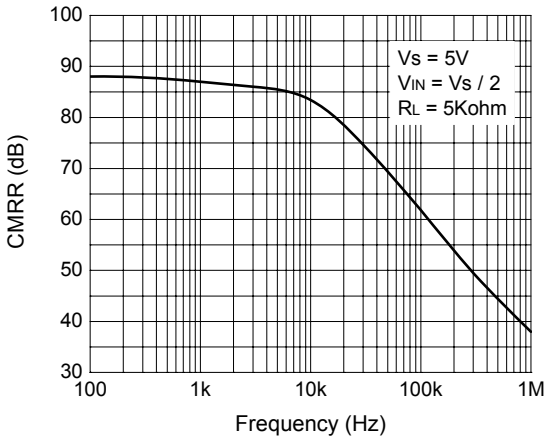
Output Voltage Swing vs. Supply Voltage



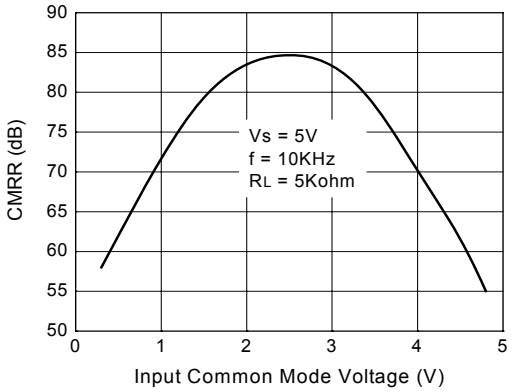
PSRR vs. Frequency



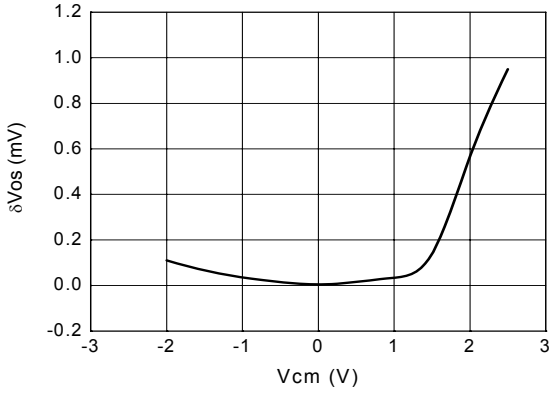
CMRR vs. Frequency



CMRR vs. Input Common Mode Voltage

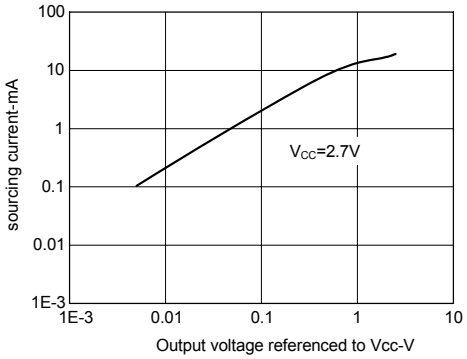


ΔVos vs. CMR

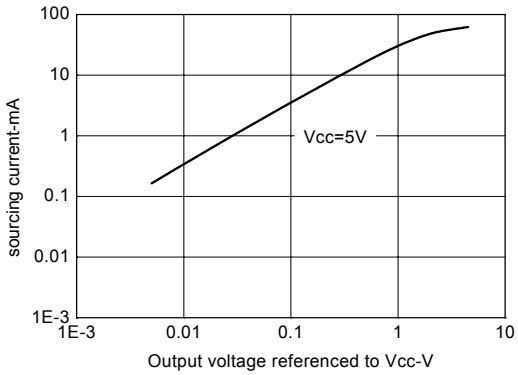


Typical Performance Characteristics (Continued)

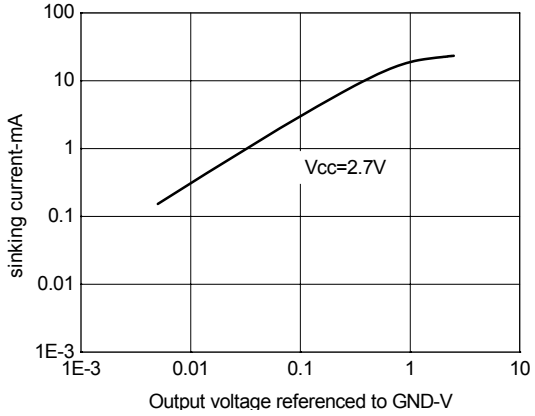
Sourcing Current vs. Output Voltage (2.7V)



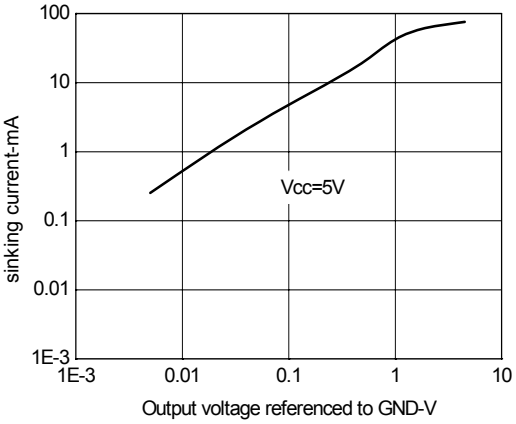
Sourcing Current vs. Output Voltage (5V)



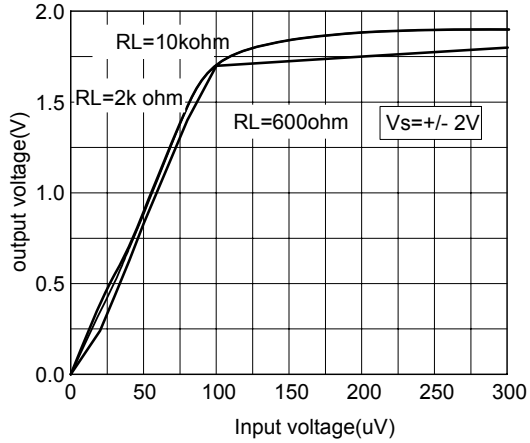
Sinking Current vs. Output Voltage (2.7V)



Sinking Current vs. Output Voltage (5V)

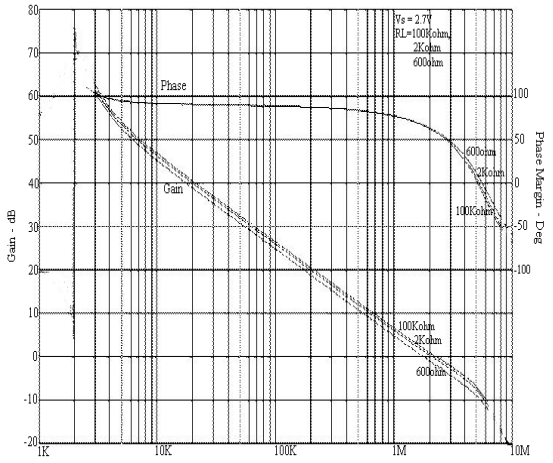


Input Voltage vs. Output Voltage

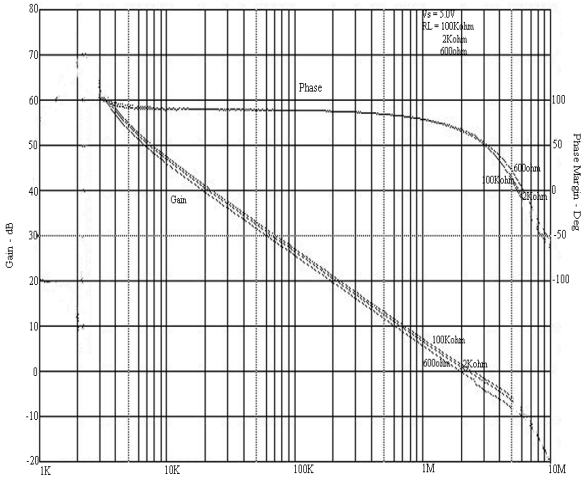


Typical Performance Characteristics (continued)

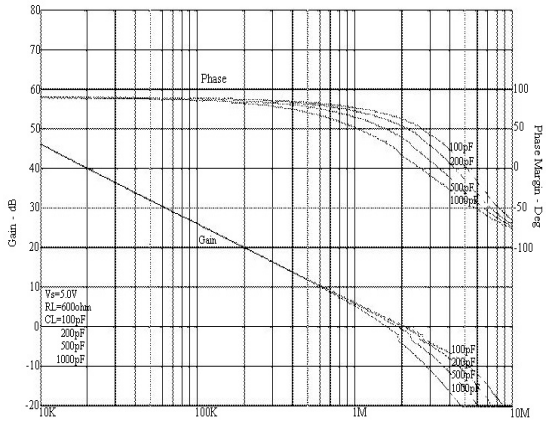
Frequency Response vs. Resistive Load (2.7V)



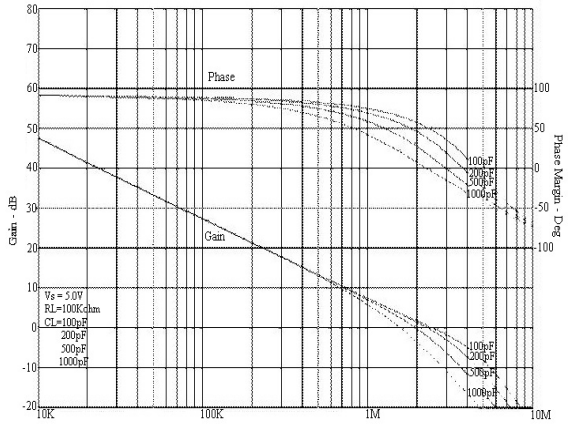
Frequency Response vs. Resistive Load (5V)



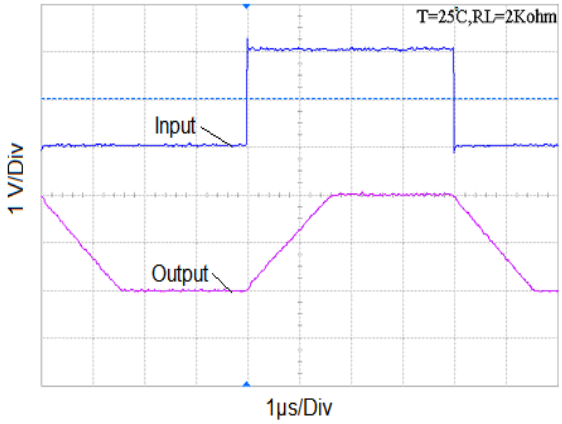
Frequency Response vs. Capacitive Load (2.7V)



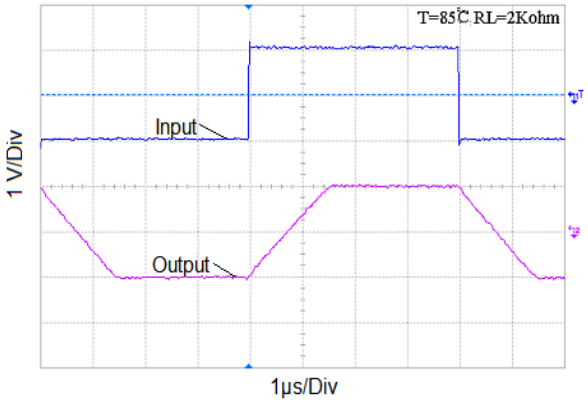
Frequency Response vs. Capacitive Load (5V)



Non-Inverting Large Signal Pulse Response

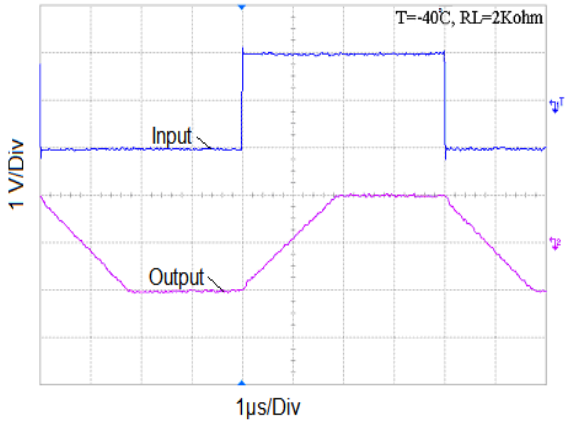


Non-Inverting Large Signal Pulse Response

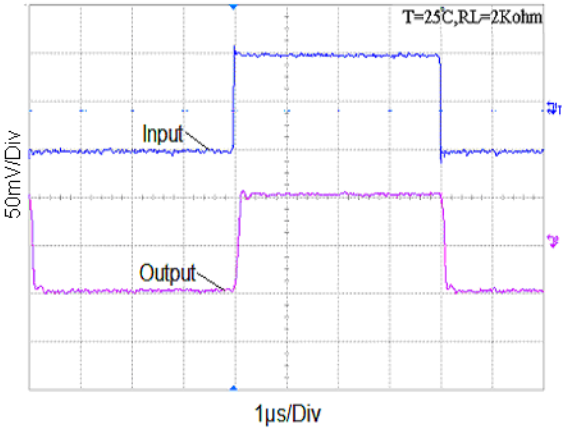


Typical Performance Characteristics (continued)

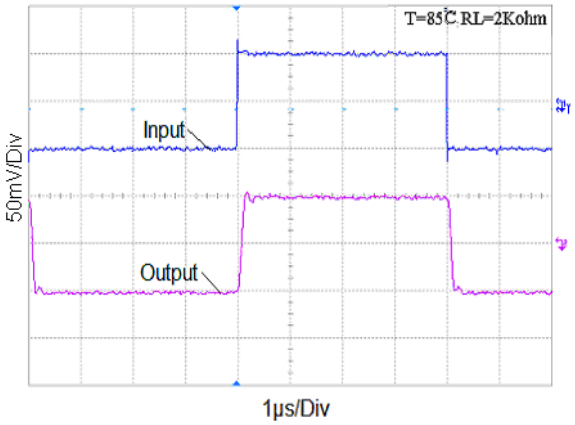
Non-Inverting Large Signal Pulse Response



Non-Inverting Small Signal Pulse Response



Non-Inverting Small Signal Pulse Response



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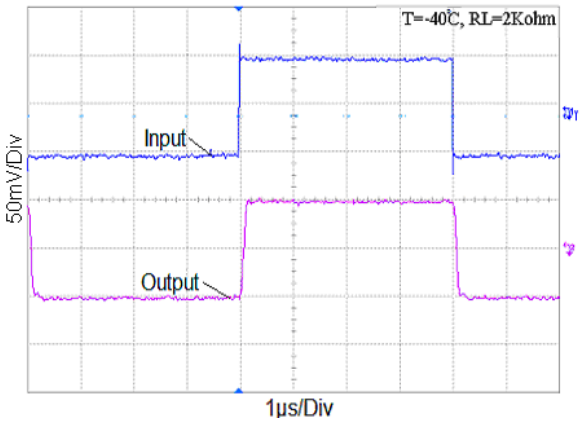
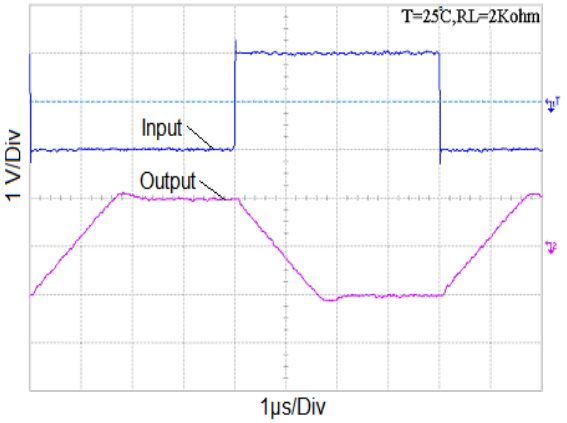


Inverting Large Signal Pulse Response



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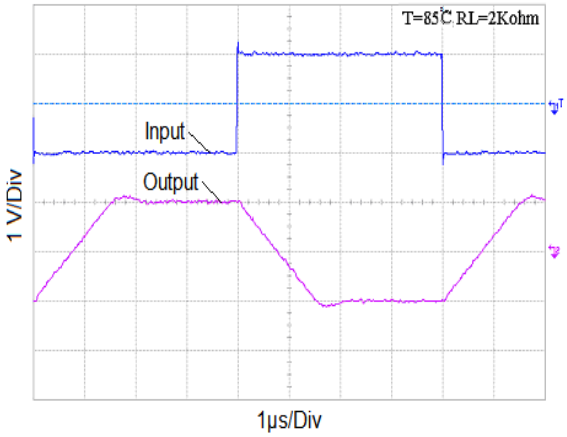
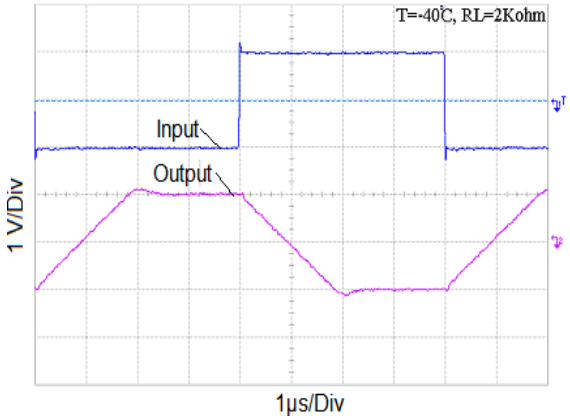
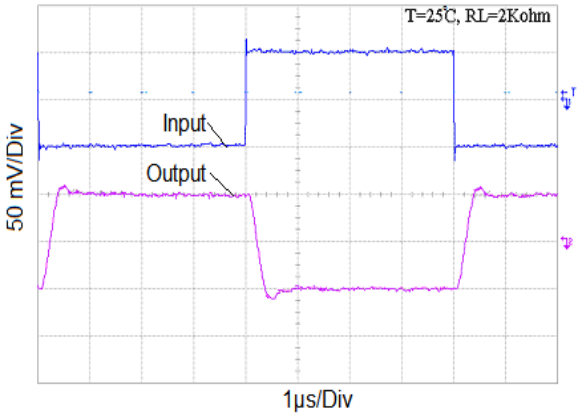


Typical Performance Characteristics (Continued)

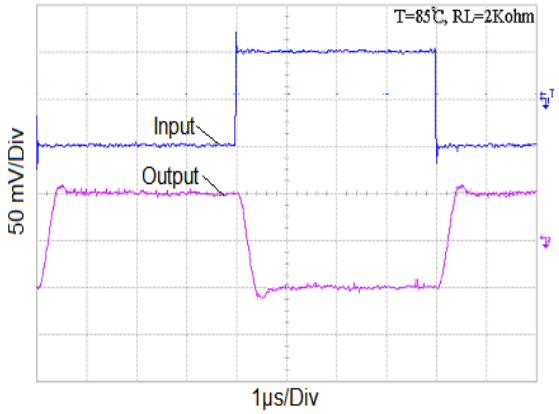
Inverting Large Signal Pulse Response



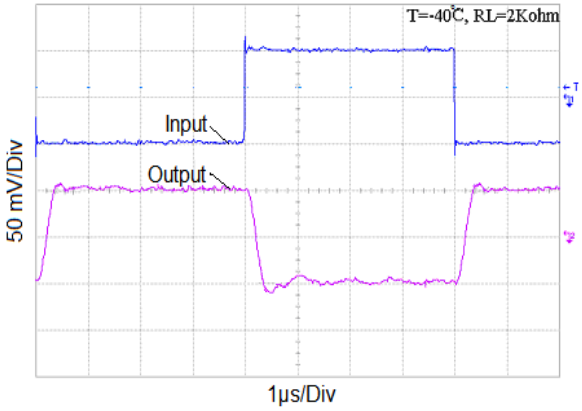
Inverting Small Signal Pulse Response



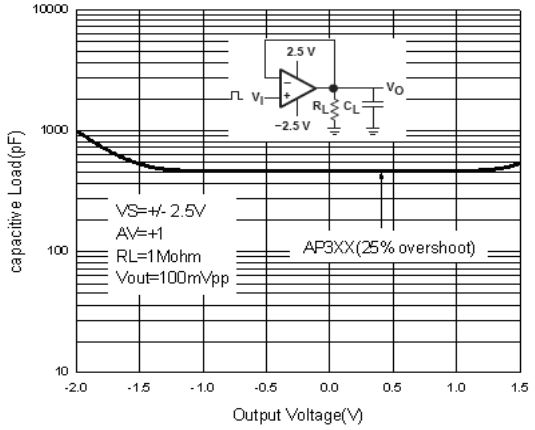
Inverting Small Signal Pulse Response



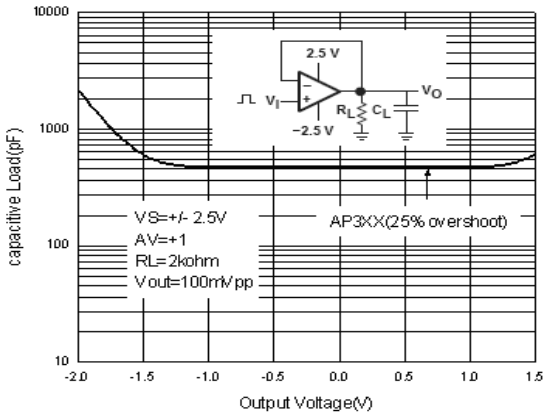
Inverting Small Signal Pulse Response



Stability vs. Capacitive Load

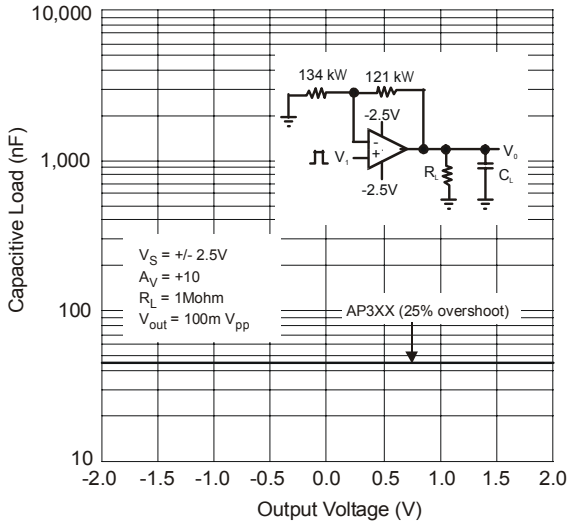


Stability vs. Capacitive Load

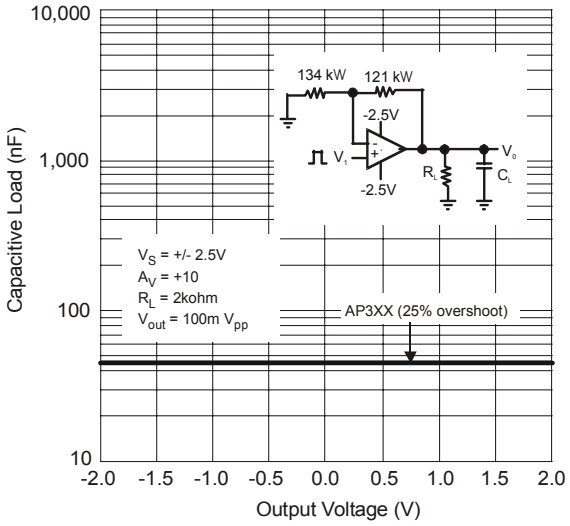


Typical Performance Characteristics (Continued)

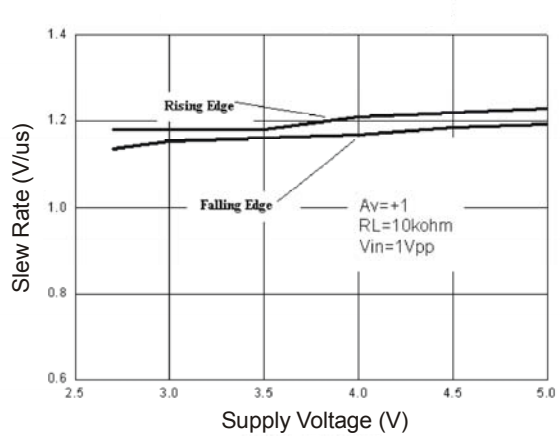
Stability vs. Capacitive Load



Stability vs. Capacitive Load

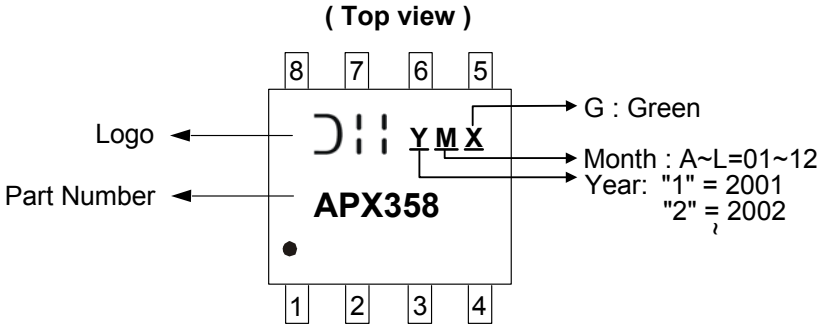


Slew Rate vs. Supply Voltage

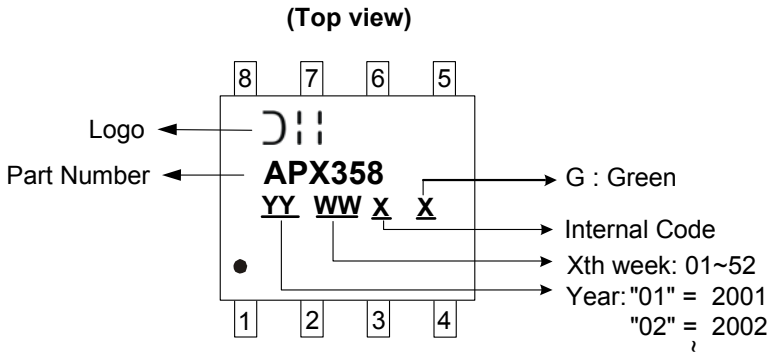


Marking Information

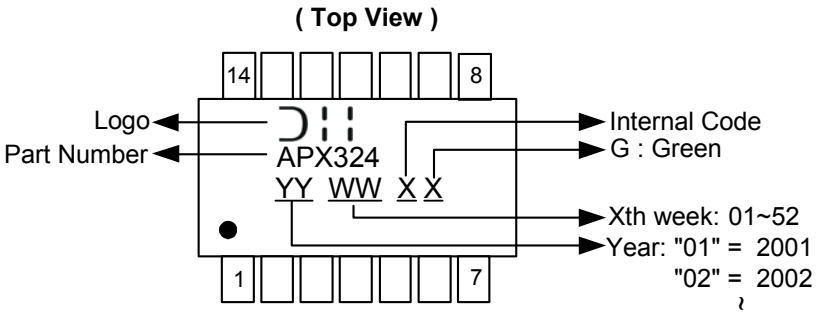
(1) MSOP-8L



(2) SOP-8L

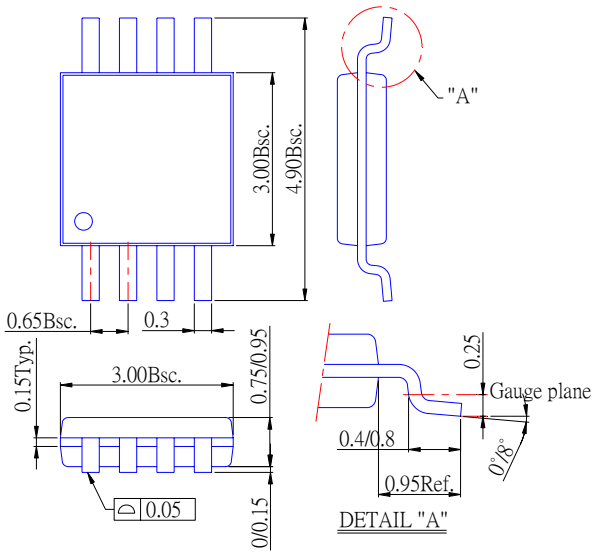


(3) TSSOP-14L

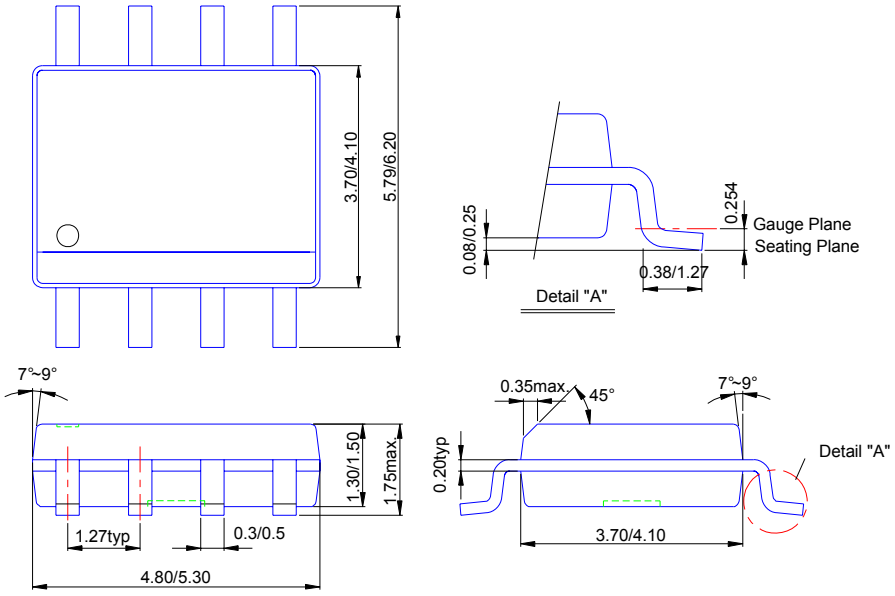


Package Information (All Dimensions in mm)

(1) MSOP-8L



(2) SOP-8L



Package Information (Continued)

(3) TSSOP-14L