

Description

TP321/358 are general purpose single, dual and quad CMOS op-amps with low offset, high frequency response, low power, low supply voltage, and rail-to-rail inputs and outputs.

The TP321/358 are unity gain stable with a constant 1MHz gain-bandwidth product, 1V/μs slew rate while consuming only 45μA of supply current per amplifier. The rail-to-rail input and output characteristics allow the full power-supply voltage to be used for signal range.

This combination of features makes the TP321/358 superior and cost-effective among RRIO CMOS op-amps. The TP321/358 are ideal choices for battery-powered applications because they minimize errors due to power supply voltage variations over the lifetime of the battery and maintain high CMRR even for a rail-to-rail input op-amp.

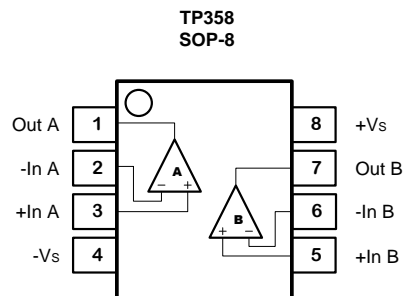
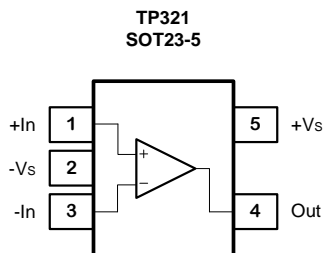
Features

- General Purpose, Low Cost
- Gain Bandwidth Product: 1MHz
- Low Quiescent Current: 45μA/Amplifier
- Offset Voltage: 5.0mV Maximum
- Offset Voltage Temperature Drift: 2uV/°C
- Input Bias Current: 10pA
- CMRR/PSRR: 90dB
- Unity Gain Stable
- Rail-to-Rail Input and Output
- No Phase Reversal for Overdriven Inputs
- Supply Voltage Range: 2.1V to 6.0V
- Operation Range: -40°C to 125°C
- ESD Rating :
8kV – HBM, 2kV – CDM and 500V – MM
- Popular Type Package

Applications

- Audio Output
- Battery and Power Supply Control
- Smoke/Gas/Environment Sensors
- Medical Equipment
- Portable Instruments and Mobile Device
- Active Filters
- Piezo Electrical Transducer Amplifier
- Sensor Interface
- ASIC Input or Output Amplifier

Pin Configuration (Top View)



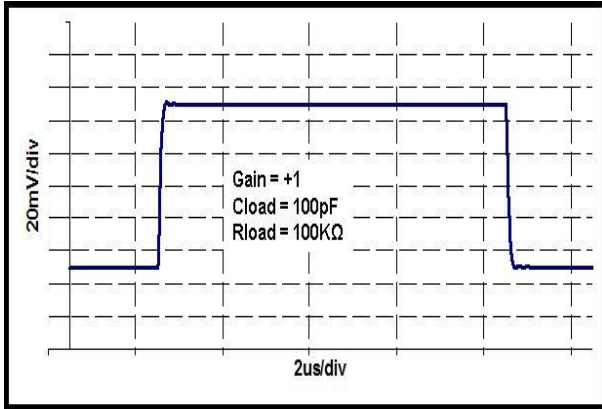
5V Electrical Characteristics

The denotes the specifications which apply over the full operating temperature range, otherwise specifications are at $T_A = 27^\circ \text{C}$. $V_{\text{SUPPLY}} = 5\text{V}$, $V_{\text{CM}} = V_{\text{OUT}} = V_{\text{SUPPLY}}/2$, $R_L = 100\text{k}\Omega$, $C_L = 100\text{pF}$

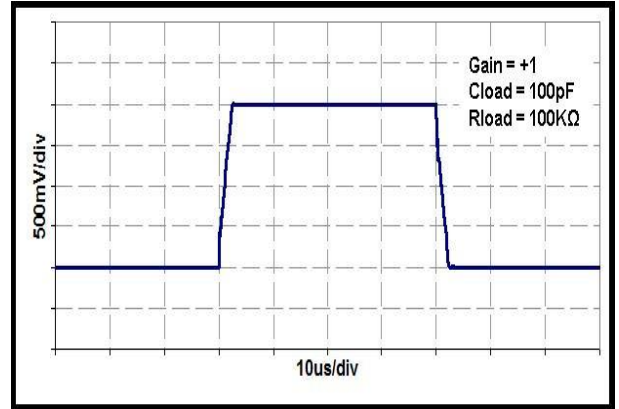
SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{OS}	Input Offset Voltage	$V_{\text{CM}} = V_{\text{SUPPLY}}/2$	-5.0	± 0.8	+5.0	mV
$V_{\text{OS TC}}$	Input Offset Voltage Drift			2		$\mu\text{V}/^\circ\text{C}$
I_{B}	Input Bias Current			10		pA
I_{OS}	Input Offset Current			1.0		pA
e_n	Input Voltage Noise Density	$f = 1\text{kHz}$ $f = 10\text{kHz}$		45 29		$\text{nV}/\sqrt{\text{Hz}}$
R_{IN}	Input Resistance		>100			$\text{G}\Omega$
C_{IN}	Input Capacitance	Differential Common Mode		1.5 3.0		pF
CMRR	Common Mode Rejection Ratio	$V_{\text{CM}} = 0.1\text{V}$ to 4.9V	80	90		dB
V_{CM}	Common-mode Input Voltage Range		-0.1		5.1	V
PSRR	Power Supply Rejection Ratio		80	90		dB
A_{VOL}	Open-Loop Large Signal Gain	$V_{\text{OUT}} = 2.5\text{V}$, $R_{\text{LOAD}} = 100\text{k}\Omega$	80	97		dB
		$V_{\text{OUT}} = 0.1\text{V}$ to 4.9V, $R_{\text{LOAD}} = 100\text{k}\Omega$	72	95		
V_{OL}	Output Swing from Supply Rail	$R_{\text{LOAD}} = 100\text{k}\Omega$		5		mV
I_{SC}	Output Short-Circuit Current	Sink or source current		40		mA
I_{Q}	Quiescent Current per Amplifier			45	87	μA
PM	Phase Margin	$R_{\text{LOAD}} = 100\text{k}\Omega$, $C_{\text{LOAD}} = 100\text{pF}$		63		$^\circ$
GM	Gain Margin	$R_{\text{LOAD}} = 100\text{k}\Omega$, $C_{\text{LOAD}} = 100\text{pF}$		-15		dB
GBWP	Gain-Bandwidth Product	$f = 1\text{kHz}$		1.0		MHz
t_s	Settling Time, 1.5V to 3.5V, Unity Gain Settling Time, 2.45V to 2.55V, Unity Gain	0.1%		2.3		μs
		0.01%		2.8		
		0.1%		0.33		
		0.01%		0.38		
SR	Slew Rate	$A_v = 1$, $V_{\text{OUT}} = 1.5\text{V}$ to 3.5V, $C_{\text{LOAD}} = 100\text{pF}$, $R_{\text{LOAD}} = 100\text{k}\Omega$		1.0		$\text{V}/\mu\text{s}$
THD+N	Total Harmonic Distortion and Noise	$f=1\text{kHz}$, $A_v=1$, $R_L=100\text{k}\Omega$, $V_{\text{OUT}} = 2V_{\text{PP}}$		-105		dB
		$f=10\text{kHz}$, $A_v=1$, $R_L=100\text{k}\Omega$, $V_{\text{OUT}} = 2V_{\text{PP}}$		-90		

Typical Performance Characteristics

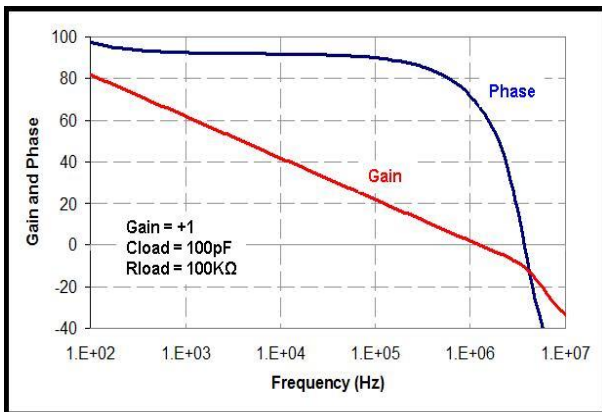
Small-Signal Step Response, 100mV Step



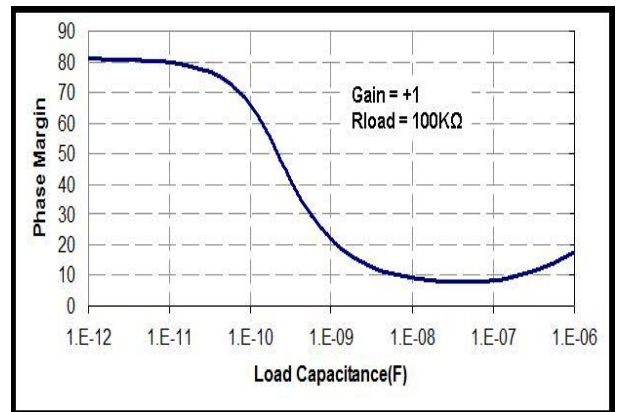
Large-Signal Step Response, 2V Step



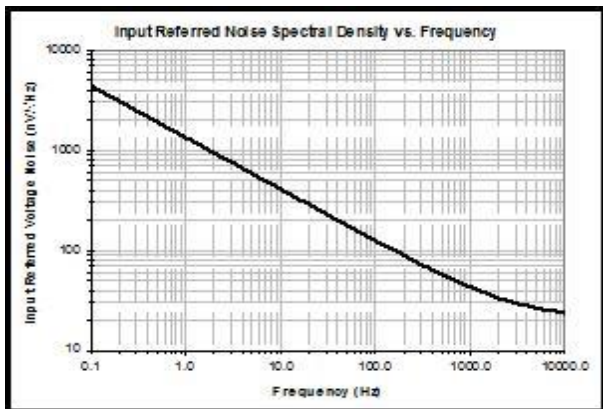
Open-Loop Gain and Phase



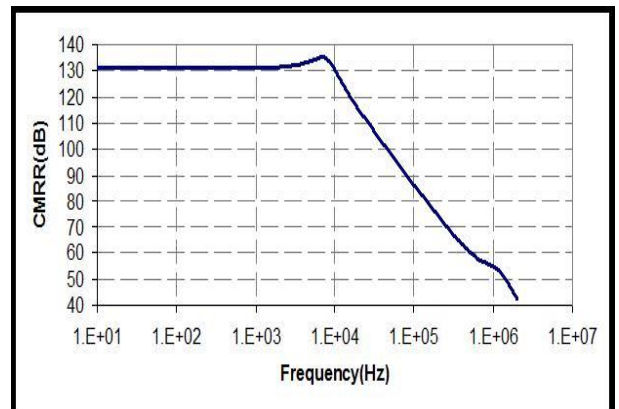
Phase Margin vs. C_{LOAD} (Stable for Any C_{LOAD})



Input Voltage Noise Spectral Density

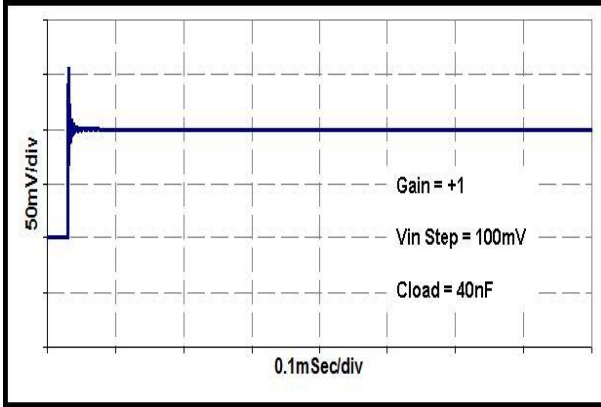


Common-Mode Rejection Ratio

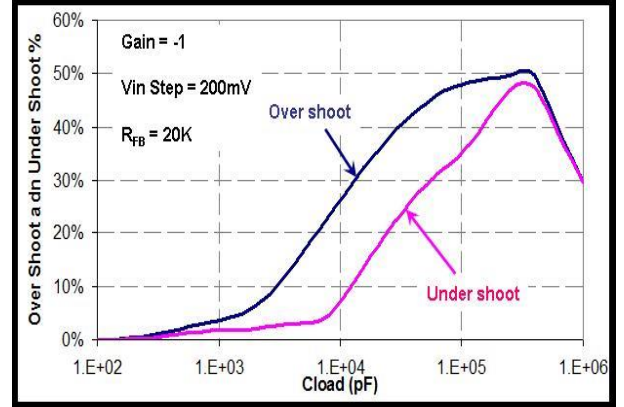


Typical Performance Characteristics

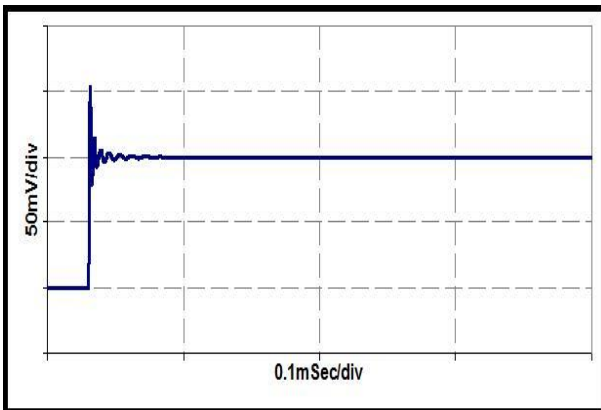
Over-Shoot Voltage, $C_{LOAD} = 40nF$, Gain = +1



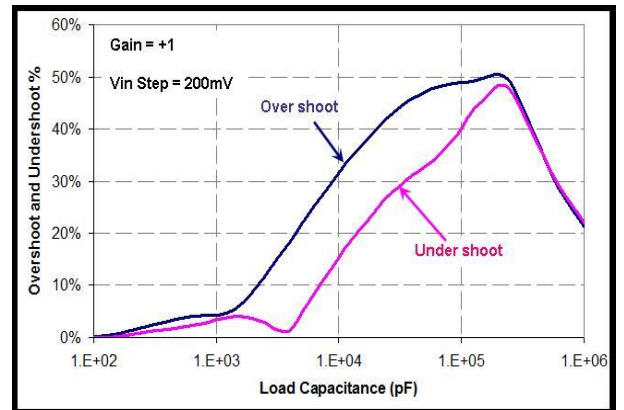
Over-Shoot % vs. C_{LOAD} , Gain = -1, $R_{FB} = 20k\Omega$



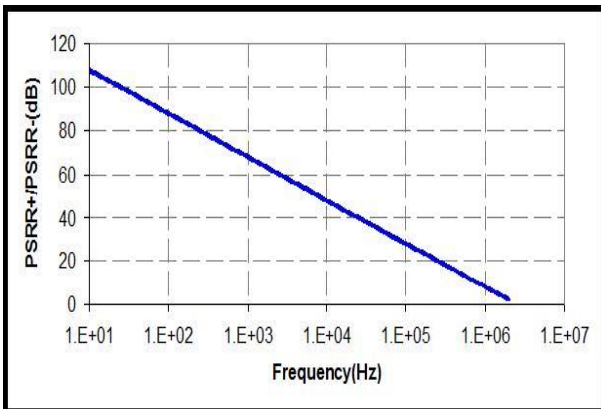
Over-Shoot Voltage, $C_{LOAD}=40nF$, Gain= -1, $R_{FB}=100k\Omega$



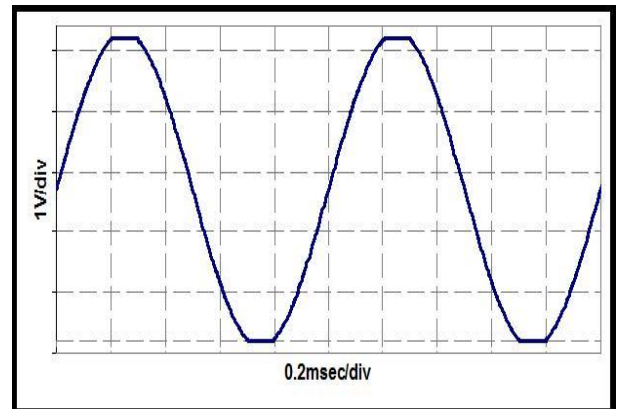
Small-Signal Over-Shoot % vs. C_{LOAD} , Gain = +1



Power-Supply Rejection Ratio

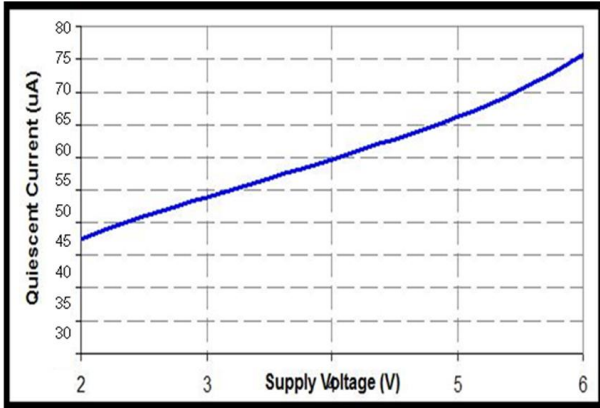


$V_{IN} = -0.2V$ to $5.7V$, No Phase Reversal

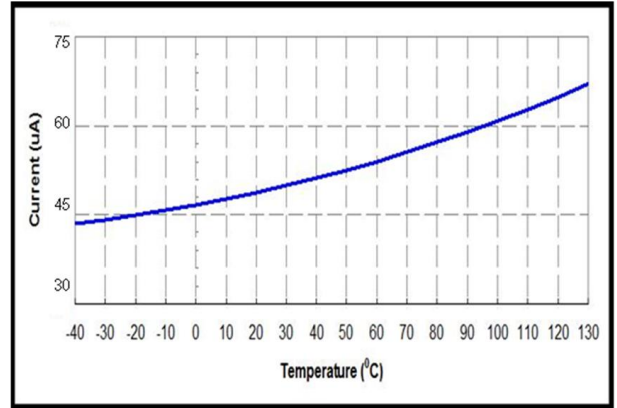


Typical Performance Characteristics

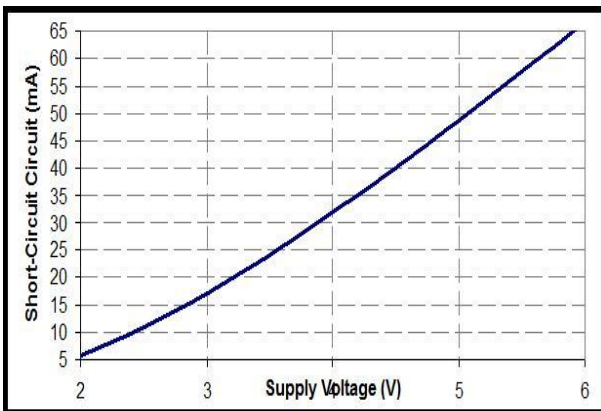
Quiescent Supply Current vs. Supply Voltage



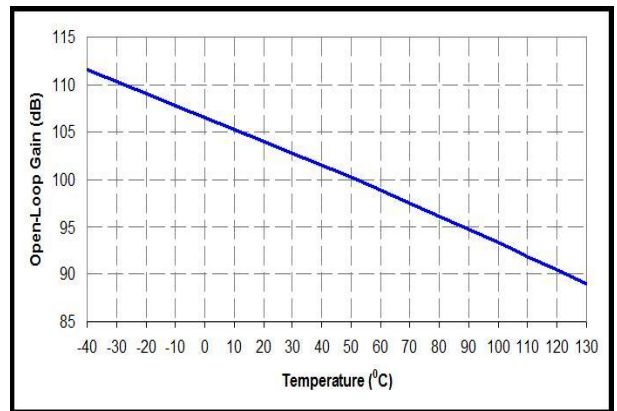
Quiescent Supply Current vs. Temperature



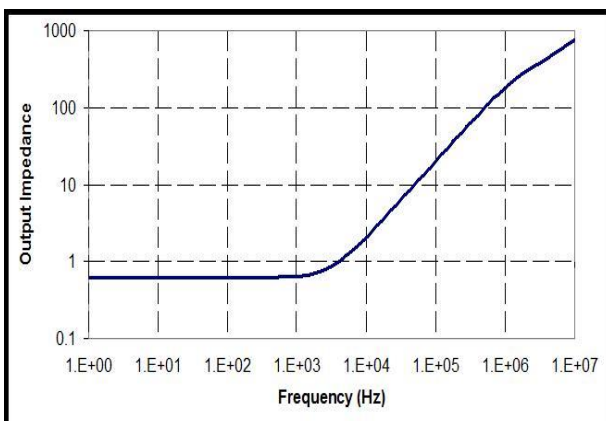
Short-Circuit Current vs. Supply Voltage



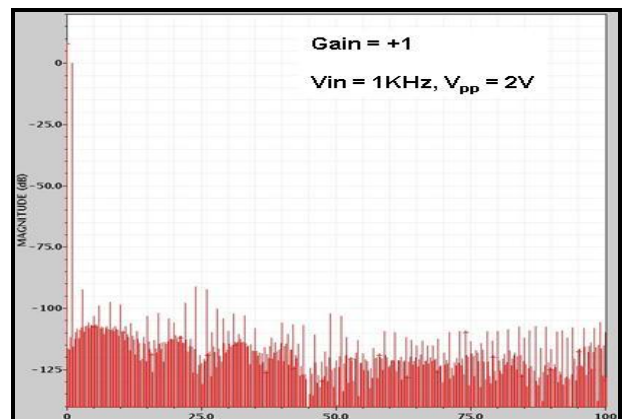
Open-Loop Gain vs. Temperature



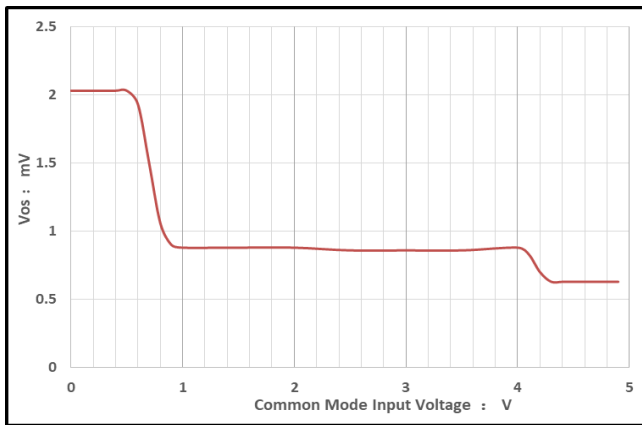
Closed-Loop Output Impedance vs. Frequency



THD+Noise, Gain = +1, V_{IN} = 1kHz, V_{PP} = 2V

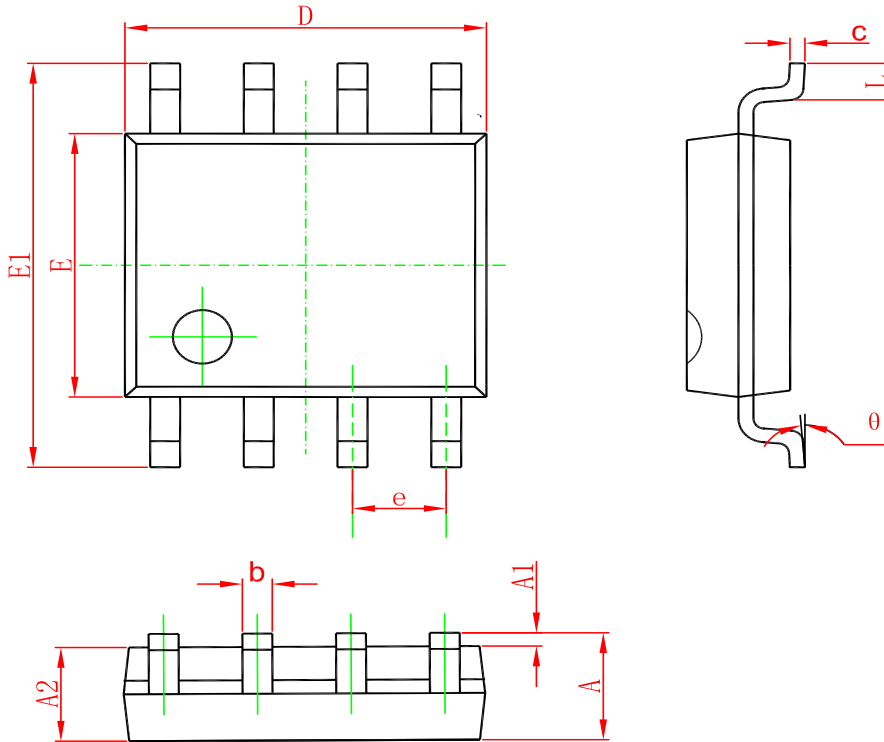


Vos vs. Common Mode Input Voltage



Package Dimension

SOP-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Ordering information

Order code	Package	Baseqty	Deliverymode	Marking
UMW TP358-SR	SOP-8	2500	Tape and reel	TP358
UMW TP321-TR	SOT23-5	3000	Tape and reel	AT4YW U

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