



**THE DATASHEET OF
AZV358MTR-G1**



DUAL LOW VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

Description

The AZV358 is dual low voltage (2.7V to 5.5V) operational amplifiers which have rail-to-rail output swing capability. The input common-mode voltage range includes ground. The chip exhibits excellent speed-power ratio, achieving 1MHz of bandwidth and 1V/μs of slew rate with low supply current.

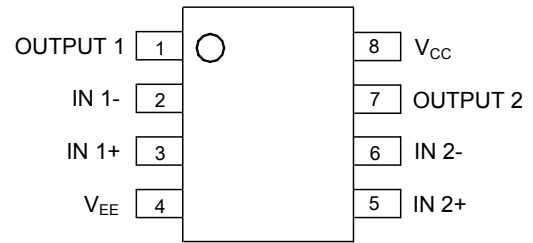
The AZV358 is built with BiCMOS process. It has bipolar input and output stages for improved noise performance, low input offset voltage and higher output current drive.

AZV358 is available in the package of TSSOP-8 and MSOP-8. The small packages save space on pc boards, and enable the design of small portable electronic devices. It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

AZV358 is also available in standard SOIC-8 package.

Pin Assignments

M/G/MM Package
(SOIC-8/TSSOP-8/MSOP-8)



Features

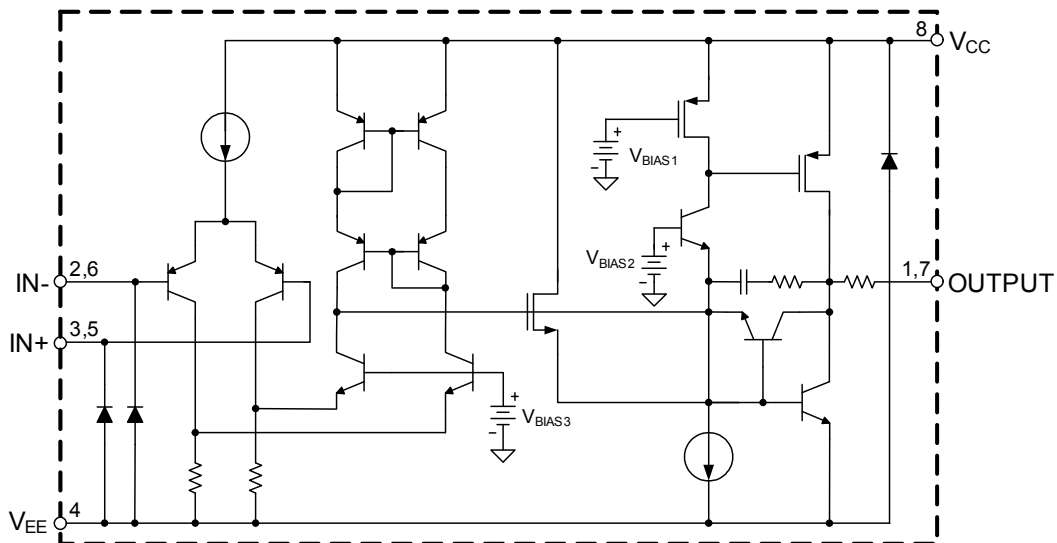
(For $V_{CC}=5V$ and $V_{EE}=0V$, typical unless otherwise noted)

- Guaranteed 2.7V to 5.5V Performance
- No Crossover Distortion
- Gain-Bandwidth Product 1MHz
- Industrial Temperature Range: -40°C to +85°C
- Low Supply Current: 210μA
- Rail-to-Rail Output Swing under 10kΩ Load:
 - V_{OH} up to $V_{CC} - 10mV$
 - V_{OL} near to $V_{EE} + 65mV$
- V_{CM} : -0.1V to $V_{CC} - 0.8V$

Applications

- Active Filters
- Low Power, Low Voltage Applications
- General Purpose Portable Devices
- Cellular Phone, Cordless Phone
- Battery-Powered Systems

Functional Block Diagram



Absolute Maximum Ratings (@ $T_A=25^{\circ}\text{C}$, unless otherwise specified. Note 1)

Symbol	Parameter	Rating	Unit
V_{CC}	Power Supply Voltage	6	V
T_J	Operation Junction Temperature	150	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-65 to 150	$^{\circ}\text{C}$
T_{LEAD}	Lead Temperature (Soldering, 10 seconds)	260	$^{\circ}\text{C}$
—	ESD (Machine Model)	200	V
—	ESD (Human Body Model)	2000	V

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{CC}	Supply Voltage	2.7	5.5	V
T_A	Ambient Operating Temperature Range	-40	85	$^{\circ}\text{C}$

2.7V Electrical Characteristics (@ $T_A=25^{\circ}\text{C}$, **bold** typeface applies over $T_A=-40^{\circ}\text{C}$ to 85°C , $V_{CC}=2.7\text{V}$, $V_{EE}=0\text{V}$, $V_{CM}=1.0\text{V}$, $V_O=V_{CC}/2$ and $R_L>1\text{M}\Omega$, unless otherwise specified. Note 2)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage	—	—	1.7	7	mV
		—	—	—	9	
I_B	Input Bias Current	—	—	11	250	nA
		—	—	—	500	
I_{IO}	Input Offset Current	—	—	5	50	nA
		—	—	—	150	
V_{CM}	Input Common Mode Voltage Range	for $CMRR \geq 50\text{dB}$	-0.1	—	1.9	V
I_{CC}	Supply Current	$V_O=V_{CC}/2$, $A_{VCL}=1$, No load	—	140	340	μA
			—	—	420	
CMRR	Common Mode Rejection Ratio	$0 \leq V_{CM} \leq 1.7\text{V}$	50	63	—	dB
PSRR	Power Supply Rejection Ratio	$2.7\text{V} \leq V_{CC} \leq 5\text{V}$, $V_O=1\text{V}$	50	60	—	dB
I_{SOURCE}	Output Short Circuit Current	$V_O=0\text{V}$	5	20	—	mA
I_{SINK}		$V_O=2.7\text{V}$	10	30	—	mA
V_{OH}	Output Voltage Swing	$R_L=10\text{k}\Omega$ to 1.35V	2.60	2.69	—	V
V_{OL}			—	60	180	mV
GBWP	Gain Bandwidth Product	$C_L=200\text{pF}$	—	1	—	MHz
ϕ_M	Phase Margin	—	—	60	—	deg
G_M	Gain Margin	—	—	10	—	dB

Note 2: Limits over the full temperature are guaranteed by design, but not tested in production.

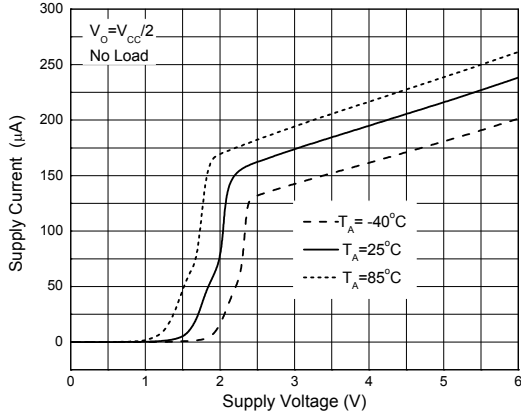
5V Electrical Characteristics (@ $T_A=25^\circ\text{C}$, **bold** typeface applies over $T_A=-40^\circ\text{C}$ to 85°C , $V_{CC}=5\text{V}$, $V_{EE}=0\text{V}$, $V_{CM}=2.0\text{V}$, $V_O=V_{CC}/2$ and $R_L>1\text{M}\Omega$, unless otherwise specified. Note 2)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IO}	Input Offset Voltage	—	—	1.7	7	mV
		—	—	—	9	
I_B	Input Bias Current	—	—	15	250	nA
		—	—	—	500	
I_{IO}	Input Offset Current	—	—	5	50	nA
		—	—	—	150	
V_{CM}	Input Common Mode Voltage Range	for $CMRR \geq 50\text{dB}$	-0.1	—	4.2	V
I_{CC}	Supply Current	$V_O=V_{CC}/2$, $A_{VCL}=1$, No load	—	210	440	μA
			—	—	615	
G_V	Large Signal Voltage Gain	$R_L=2\text{k}\Omega$	84	100	—	dB
			80	—	—	
CMRR	Common Mode Rejection Ratio	$0 \leq V_{CM} \leq 4\text{V}$	50	63	—	dB
PSRR	Power Supply Rejection Ratio	$2.7\text{V} \leq V_{CC} \leq 5\text{V}$, $V_O=1\text{V}$, $V_{CM}=1\text{V}$	50	60	—	dB
I_{SOURCE}	Output Short Circuit Current	$V_O=0\text{V}$	5	60	—	mA
I_{SINK}		$V_O=5\text{V}$	10	160	—	mA
V_{OH}	Output Voltage Swing	$R_L=2\text{k}\Omega$ to 2.5V	4.7	4.96	—	V
			4.6	—	—	
		$R_L=10\text{k}\Omega$ to 2.5V	4.9	4.99	—	
			4.8	—	—	
V_{OL}	Output Voltage Swing	$R_L=2\text{k}\Omega$ to 2.5V	—	120	300	mV
			—	—	400	
		$R_L=10\text{k}\Omega$ to 2.5V	—	65	180	
			—	—	280	
SR	Slew Rate	—	—	1	—	V/ μs
GBWP	Gain Bandwidth Product	$C_L=200\text{pF}$	—	1	—	MHz
ϕ_M	Phase Margin	—	—	60	—	deg
G_M	Gain Margin	—	—	10	—	dB

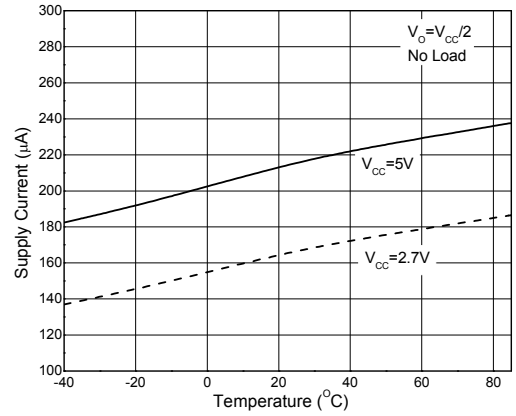
Note 2: Limits over the full temperature are guaranteed by design, but not tested in production.

Performance Characteristics

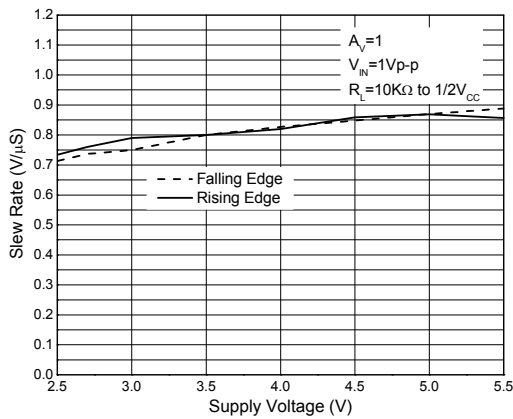
Supply Current vs. Supply Voltage



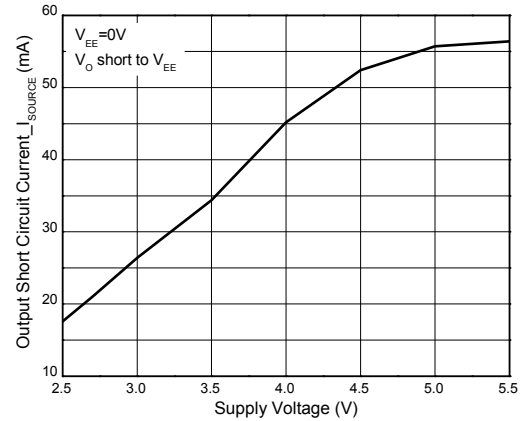
Supply Current vs. Temperature



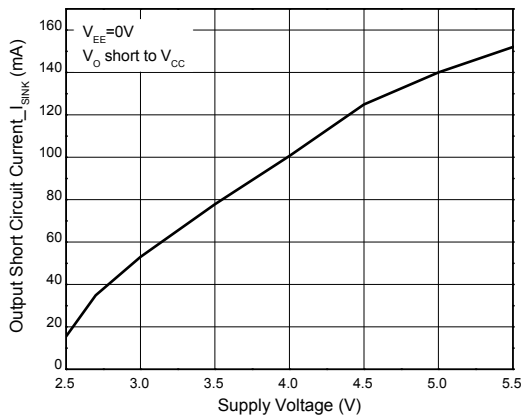
Slew Rate vs. Supply Voltage



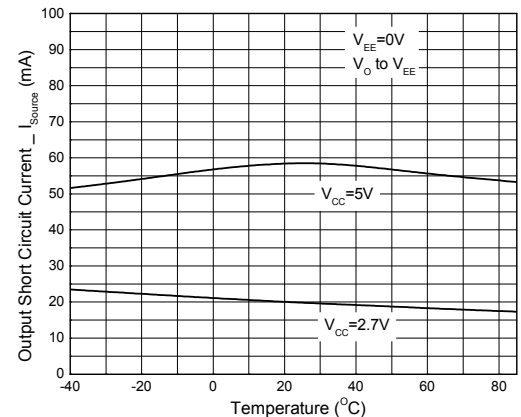
Output Short Circuit Current vs. Supply Voltage



Output Short Circuit Current vs. Supply Voltage

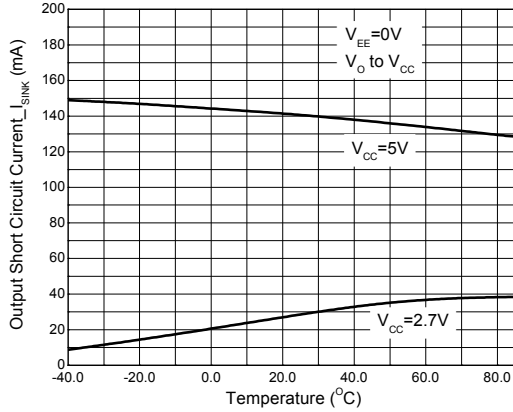


Output Short Circuit Current vs. Temperature

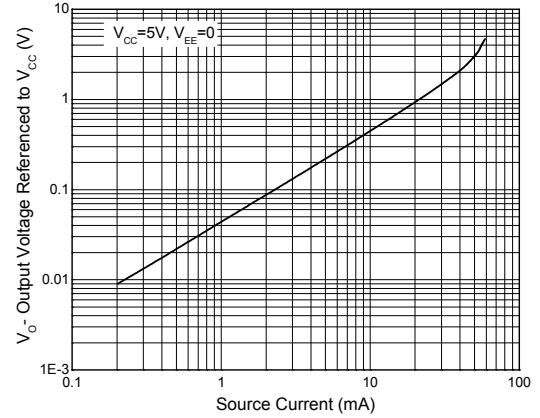


Performance Characteristics (Cont.)

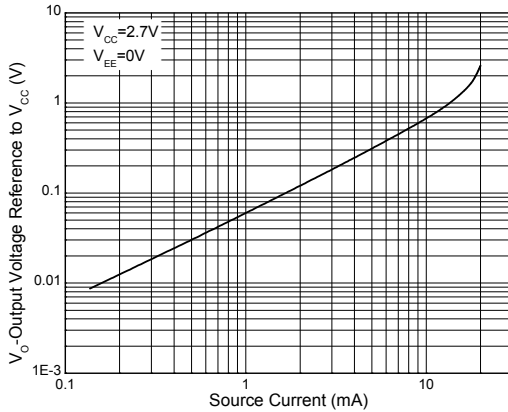
Output Short Circuit Current vs. Temperature



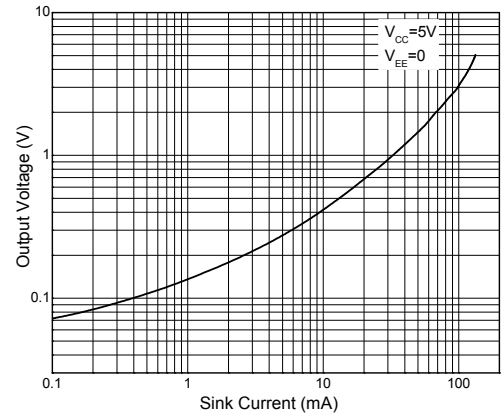
Output Voltage vs. Output Source Current



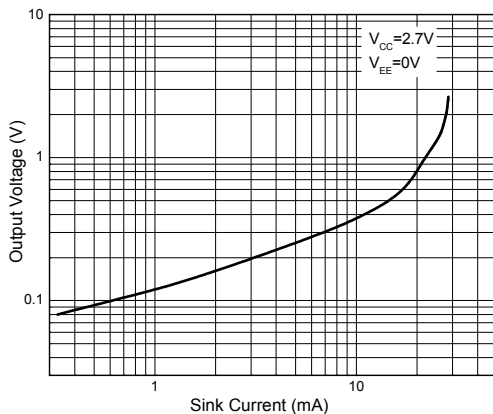
Output Voltage vs. Output Source Current



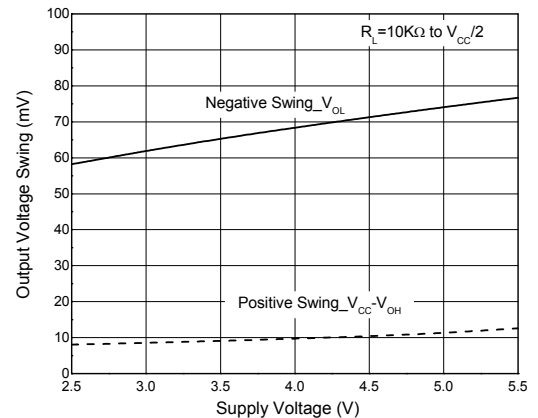
Output Voltage vs. Output Sink Current



Output Voltage vs. Output Sink Current

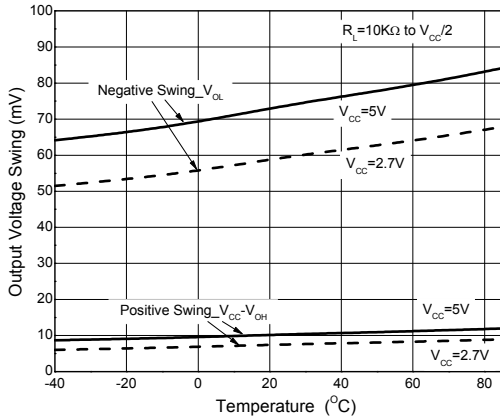


Output Voltage Swing vs. Supply Voltage

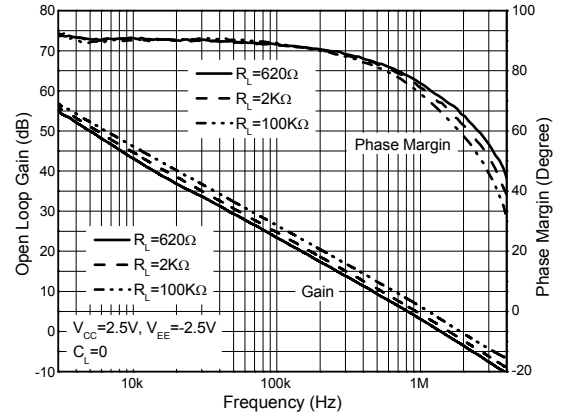


Performance Characteristics (Cont.)

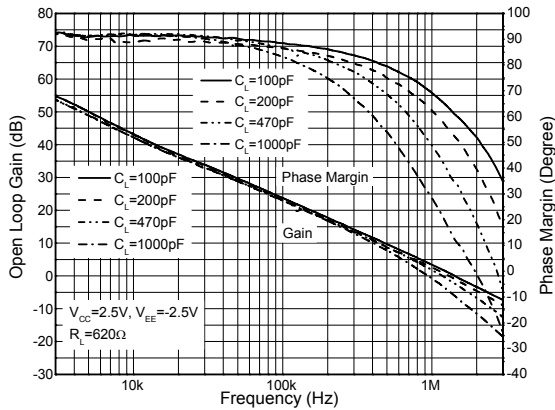
Output Voltage Swing vs. Temperature



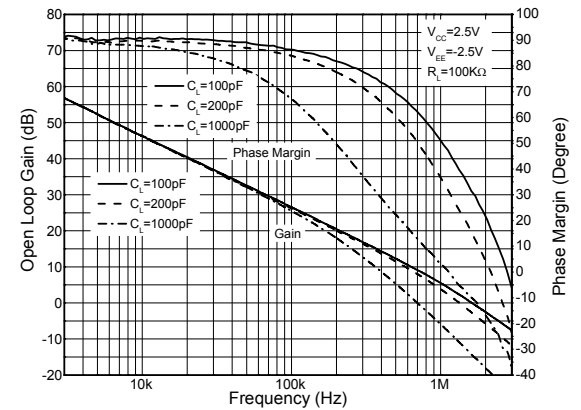
Gain and Phase vs. Frequency and Resistive Load



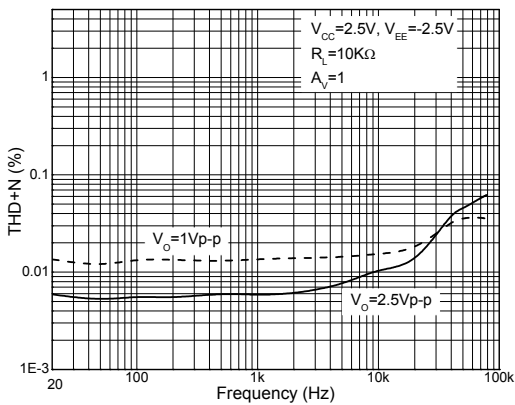
Gain and Phase vs. Frequency and Capacitive Load



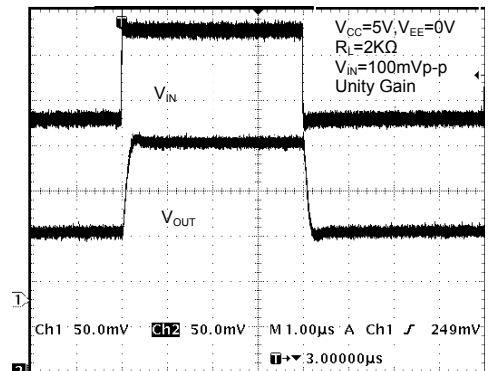
Gain and Phase vs. Frequency and Capacitive Load



THD+N vs. Frequency

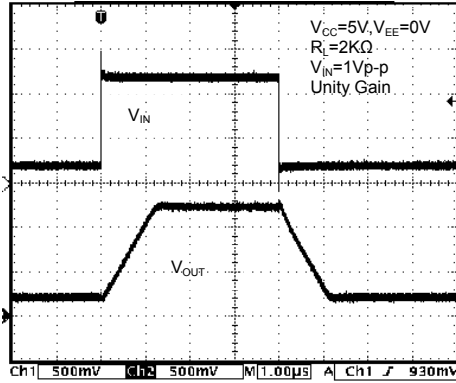


Non-Inverting Input Small Signal Pulse Response

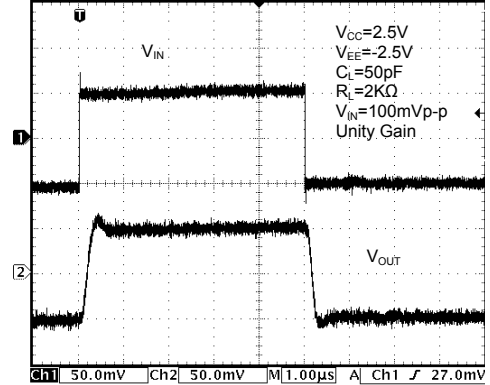


Performance Characteristics (Cont.)

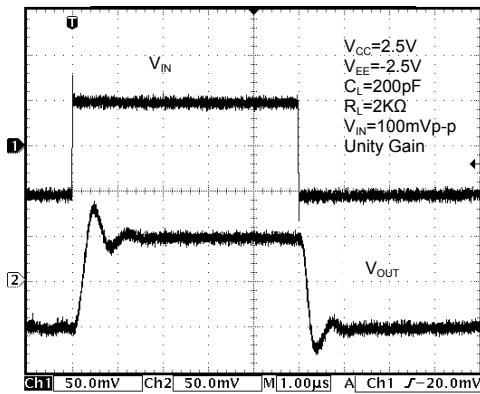
Non-Inverting Input Large Signal Pulse Response



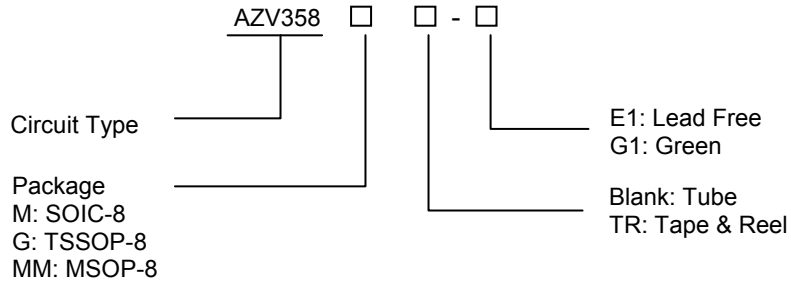
Non-Inverting Input Small Signal Response



Non-Inverting Input Small Signal Response



Ordering Information

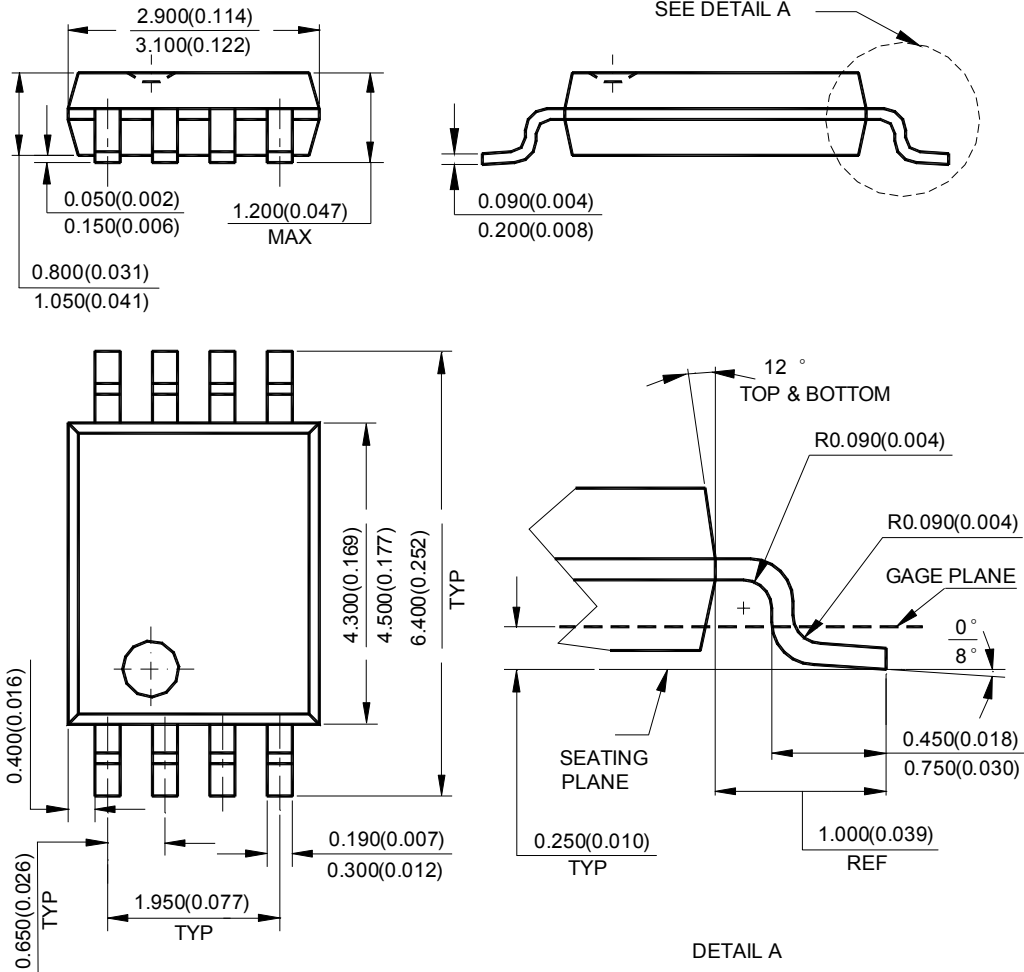


Package	Temperature Range	Part Number		Marking ID		Packing Type
		Lead Free	Green	Lead Free	Green	
SOIC-8	-40 to 85°C	AZV358M-E1	AZV358M-G1	AZV358M-E1	AZV358M-G1	Tube
		AZV358MTR-E1	AZV358MTR-G1	AZV358M-E1	AZV358M-G1	Tape & Reel
TSSOP-8	-40 to 85°C	AZV358G-E1	AZV358G-G1	EG3E	GG3E	Tube
		AZV358GTR-E1	AZV358GTR-G1	EG3E	GG3E	Tape & Reel
MSOP-8	-40 to 85°C	AZV358MM-E1	AZV358MM-G1	AZV358MM-E1	AZV358MM-G1	Tube
		AZV358MMTR-E1	AZV358MMTR-G1	AZV358MM-E1	AZV358MM-G1	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

Package Outline Dimensions (Cont.) (All dimensions in mm(inch).)

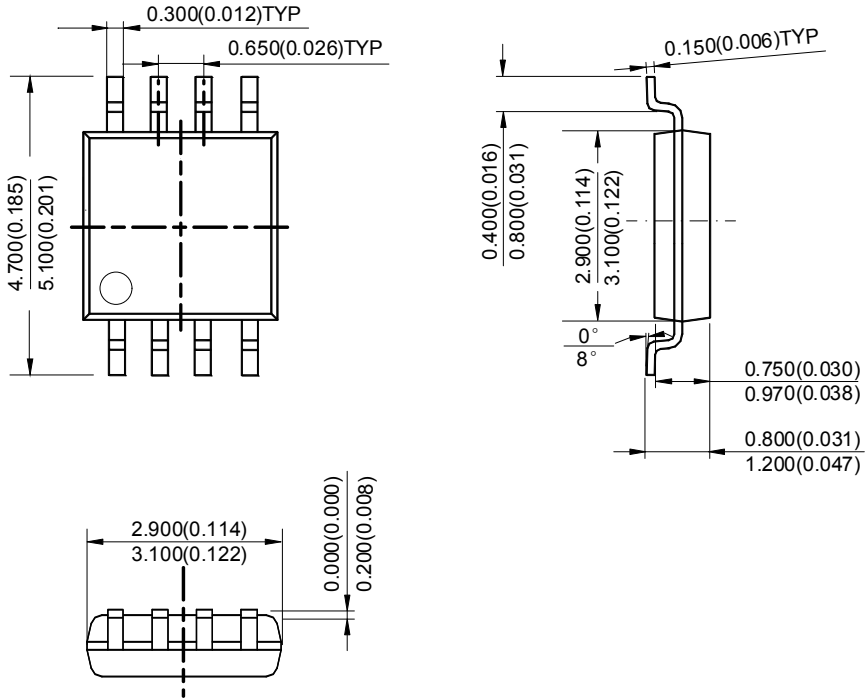
TSSOP-8



Note: Eject hole, oriented hole and mold mark is optional

Package Outline Dimensions (Cont.) (All dimensions in mm(inch).)

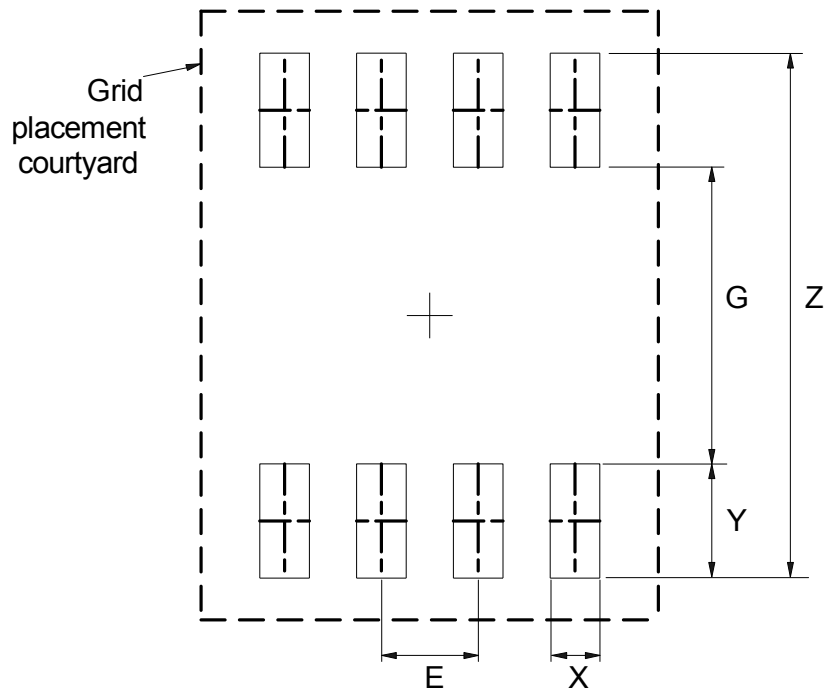
MSOP-8



Note: Eject hole, oriented hole and mold mark is optional

Suggested Pad Layout

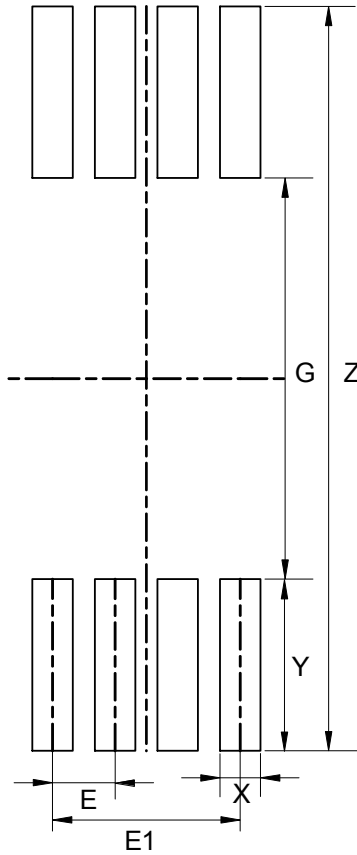
SOIC-8



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	1.270/0.050

Suggested Pad Layout (Cont.)

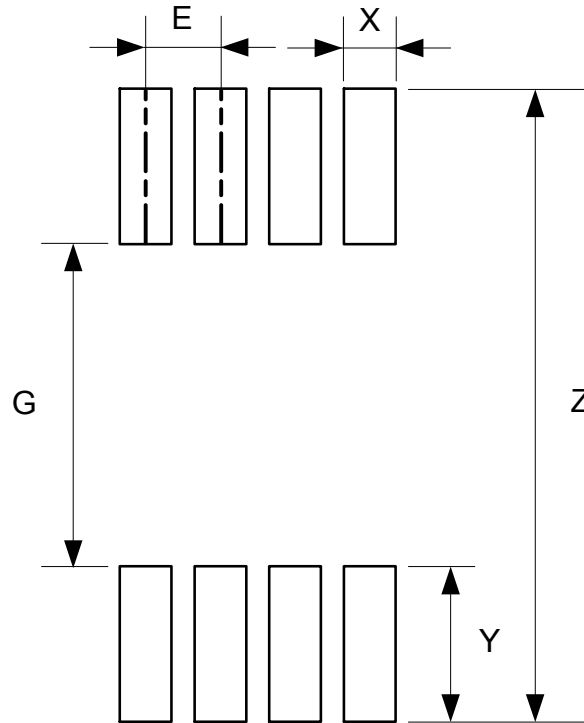
TSSOP-8



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)	E1 (mm)/(inch)
Value	7.720/0.304	4.160/0.164	0.420/0.017	1.780/0.070	0.650/0.026	1.950/0.077

Suggested Pad Layout (Cont.)

MSOP-8



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	5.500/0.217	2.800/0.110	0.450/0.018	1.350/0.053	0.650/0.026

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