1MHz, 45μA, CMOS, Rail-to-Rail OPERATIONAL AMPLIFIERS

DESCRIPTION

The OPA348 series amplifiers are single supply, low-power, CMOS op amps in micro packaging. Featuring an extended bandwidth of 1MHz, and a supply current of 45μA, the OPA348 series is useful for low-power applications on single supplies of 2.1V to 5.5V.

Low supply current of 45μA, and an input bias current of 0.5pA, make the OPA348 series an optimal candidate for low-power, high-impedance applications such as smoke detectors and other sensors.

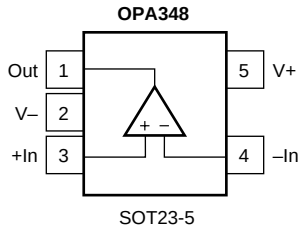
The OPA348 is available in the miniature SC70-5, SOT23-5 and SO-8 packages. The OPA2348 is available in SOT23-8 and SO-8 packages, and the OPA4348 is offered in space-saving TSSOP-14 and SO-14 packages. The extended temperature range of –40°C to +125°C over all supply voltages offers additional design flexibility.

FEATURES

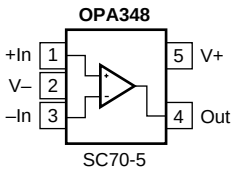
- LOW I_Q: 45∝A typical
- LOW COST
- RAIL-TO-RAIL INPUT AND OUTPUT
- SINGLE SUPPLY: +2.1V to +5.5V
- INPUT BIAS CURRENT: 0.5pA
- Micro SIZE PACKAGES: SC70-5, SOP-8 and TSSOP-14
- HIGH SPEED:POWER WITH BANDWIDTH: 1MHz

APPLICATIONS

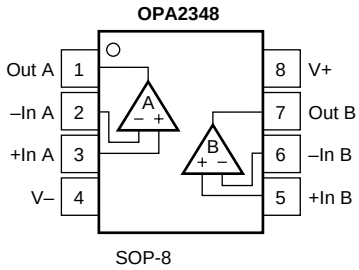
- PORTABLE EQUIPMENT
- BATTERY-POWERED EQUIPMENT
- SMOKE ALARMS
- CO DETECTORS
- MEDICAL INSTRUMENTATION



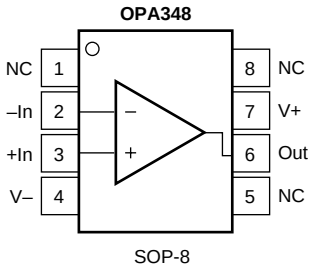
SOT23-5



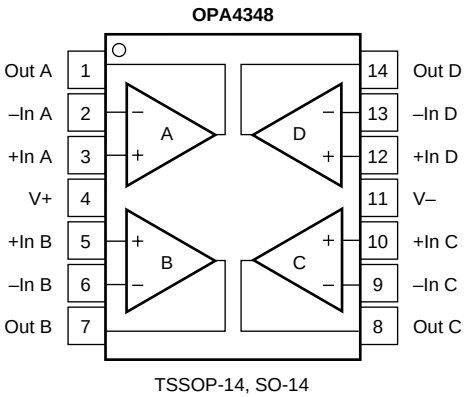
SC70-5



SOP-8



SOP-8



TSSOP-14, SO-14

ELECTRICAL CHARACTERISTICS: V_S = 2.5V to 5.5V

Boldface limits apply over the specified temperature range, T_A = –40°C to +125°C

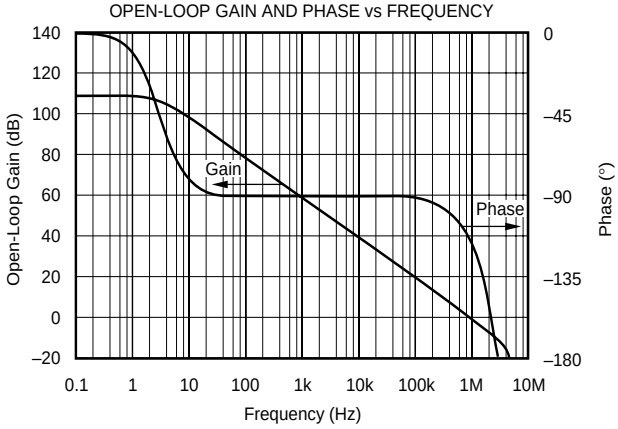
At T_A = +25°C, R_L = 100kΩ connected to V_S / 2 and V_{OUT} = V_S / 2, unless otherwise noted.

PARAMETER		CONDITION	OPA348 OPA2348 OPA4348 MIN	TYP	MAX	UNITS
OFFSET VOLTAGE						
Input Offset Voltage	V_{OS}	V_S = 5V, V_{CM} = (V–) + 0.8V		1	5	mV
Over Temperature					**6**	**mV**
Drift	**dV_{OS}/dT**			**4**		**µV/°C**
vs Power Supply	PSRR	V_S = 2.5V to 5.5V, V_{CM} < (V+) – 1.7V		60	175	µV/V
Over Temperature		**V_S = 2.5V to 5.5V, V_{CM} < (V+) – 1.7V**			**300**	**µV/V**
Channel Separation, dc				0.2		µV/V
f = 1kHz				134		dB
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}		(V–) – 0.2		(V+) + 0.2	V
Common-Mode Rejection Ratio	CMRR	(V–) – 0.2V < V_{CM} < (V+) – 1.7V	70	82		dB
over Temperature		**(V–) < V_{CM} < (V+) – 1.7V**	**66**			**dB**
		V_S = 5.5V, (V–) – 0.2V < V_{CM} < (V+) + 0.2V	60	71		dB
over Temperature		**V_S = 5.5V, (V–) < V_{CM} < (V+)**	**56**			**dB**
INPUT BIAS CURRENT						
Input Bias Current	I_B			±0.5	±10	pA
Input Offset Current	I_{OS}			±0.5	±10	pA
INPUT IMPEDANCE						
Differential				10^{13} || 3		Ω || pF
Common-Mode				10^{13} || 6		Ω || pF
NOISE		V_{CM} < (V+) – 1.7V				
Input Voltage Noise, f = 0.1Hz to 10Hz				10		µVp-p
Input Voltage Noise Density, f = 1kHz	e_n			35		nV/√Hz
Input Current Noise Density, f = 1kHz	i_n			4		fA/√Hz
OPEN-LOOP GAIN						
Open-Loop Voltage Gain	A_{OL}	V_S = 5V, R_L = 100kΩ, 0.025V < V_O < 4.975V	94	108		dB
over Temperature		**V_S = 5V, R_L = 100kΩ, 0.025V < V_O < 4.975V**	**90**			**dB**
		V_S = 5V, R_L = 5kΩ, 0.125V < V_O < 4.875V	90	98		dB
over Temperature		**V_S = 5V, R_L = 5kΩ, 0.125V < V_O < 4.875V**	**88**			**dB**
OUTPUT						
Voltage Output Swing from Rail		R_L = 100kΩ, A_{OL} > 94dB		18	25	mV
over Temperature		**R_L = 100kΩ, A_{OL} > 90dB**			**25**	**mV**
		R_L = 5kΩ, A_{OL} > 90dB		100	125	mV
over Temperature		**R_L = 5kΩ, A_{OL} > 88dB**			**125**	**mV**
Short-Circuit Current	I_{SC}			±10		mA
Capacitive Load Drive	C_{LOAD}		See Typical Characteristics			
FREQUENCY RESPONSE		C_L = 100pF				
Gain-Bandwidth Product	GBW			1		MHz
Slew Rate	SR	G = +1		0.5		V/µs
Settling Time, 0.1%	t_S	V_S = 5.5V, 2V Step, G = +1		5		µs
0.01%		V_S = 5.5V, 2V Step, G = +1		7		µs
Overload Recovery Time		V_{IN} • Gain > V_S		1.6		µs
Total Harmonic Distortion + Noise	THD+N	V_S = 5.5V, V_O = 3Vp-p, G = +1, f = 1kHz		0.0023		%
POWER SUPPLY						
Specified Voltage Range	V_S		2.5		5.5	V
Minimum Operating Voltage				2.1 to 5.5		V
Quiescent Current (per amplifier)	I_Q	I_O = 0		45	65	µA
over Temperature					**75**	**µA**
TEMPERATURE RANGE						
Specified Range			–40		125	°C
Operating Range			–65		150	°C
Storage Range			–65		150	°C
Thermal Resistance	θ_{JA}					
SOT23-5 Surface-Mount				200		°C/W
SOT23-8 Surface-Mount				150		°C/W
MSOP-8 Surface-Mount				150		°C/W
SOP-8 Surface-Mount				150		°C/W
SOP-14 Surface-Mount				100		°C/W
TSSOP-14 Surface-Mount				100		°C/W
SC70-5 Surface-Mount				250		°C/W

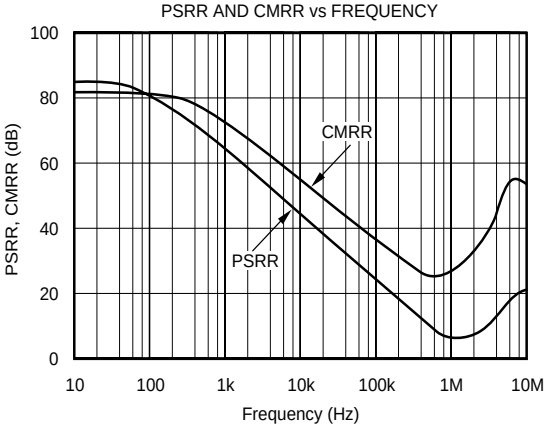
TYPICAL CHARACTERISTICS

At T_A = +25°C, R_L = 100kΩ connected to V_S / 2 and V_{OUT} = V_S / 2, unless otherwise noted.

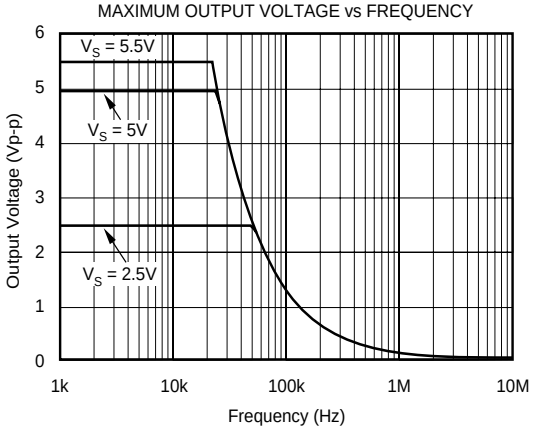
OPEN-LOOP GAIN AND PHASE vs FREQUENCY



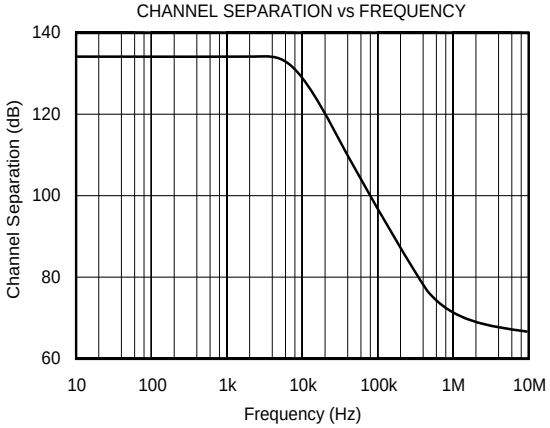
PSRR AND CMRR vs FREQUENCY



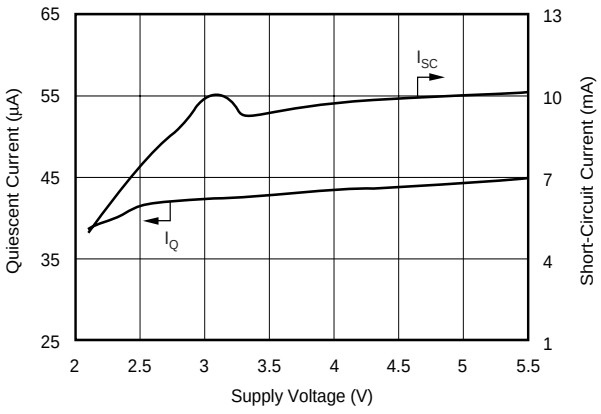
MAXIMUM OUTPUT VOLTAGE vs FREQUENCY



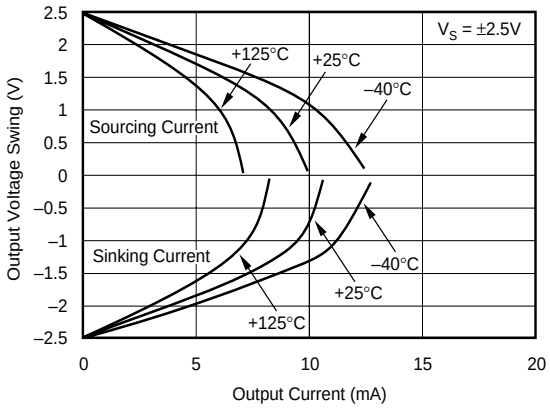
CHANNEL SEPARATION vs FREQUENCY



QUIESCENT AND SHORT-CIRCUIT CURRENT vs SUPPLY VOLTAGE



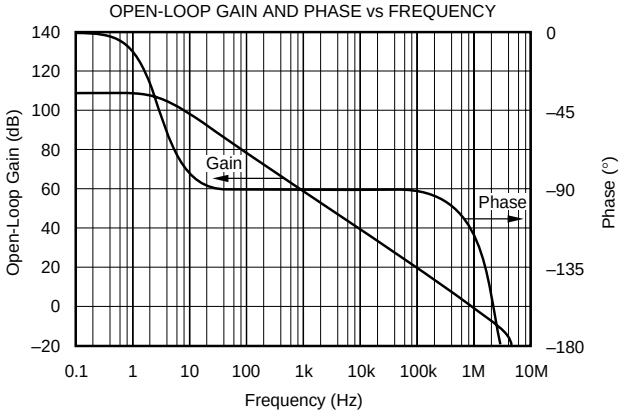
OUTPUT VOLTAGE SWING vs OUTPUT CURRENT



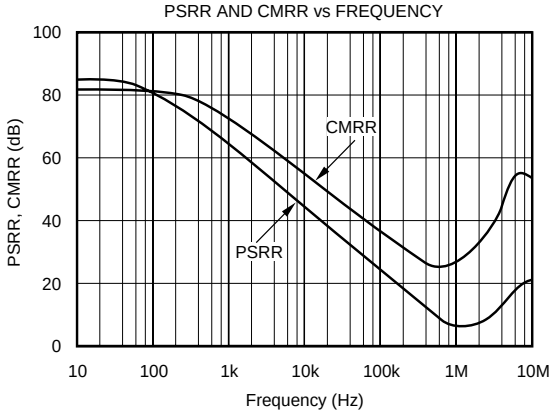
TYPICAL CHARACTERISTICS (Cont.)

At T_A = +25°C, R_L = 100kΩ connected to V_S / 2 and V_{OUT} = V_S / 2, unless otherwise noted.

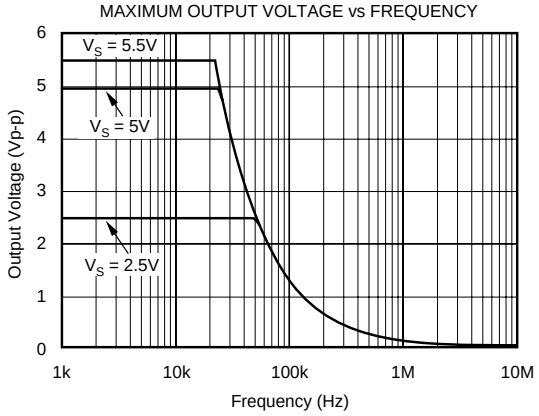
OPEN-LOOP GAIN AND PHASE vs FREQUENCY



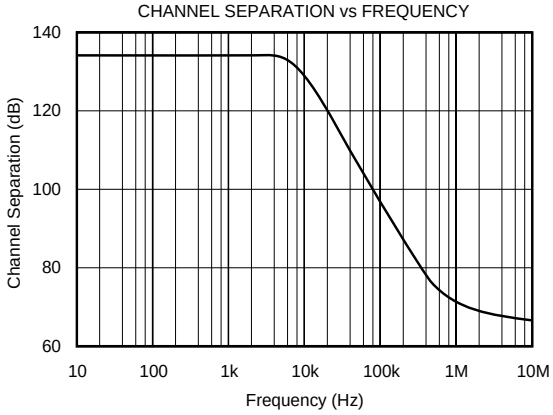
PSRR AND CMRR vs FREQUENCY



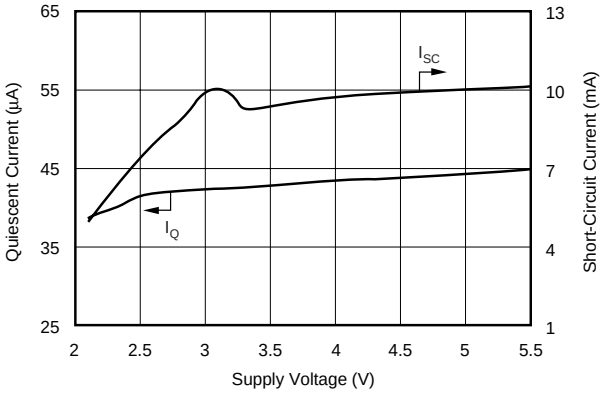
MAXIMUM OUTPUT VOLTAGE vs FREQUENCY



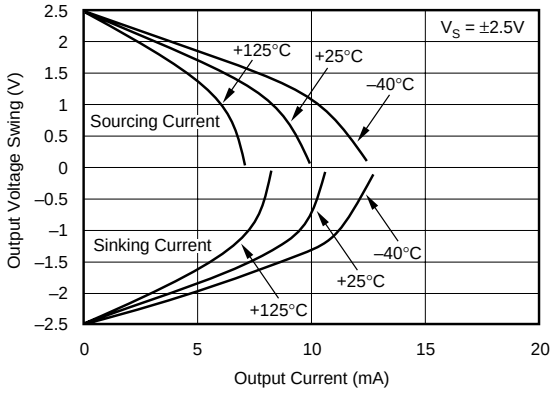
CHANNEL SEPARATION vs FREQUENCY



QUIESCENT AND SHORT-CIRCUIT CURRENT vs SUPPLY VOLTAGE



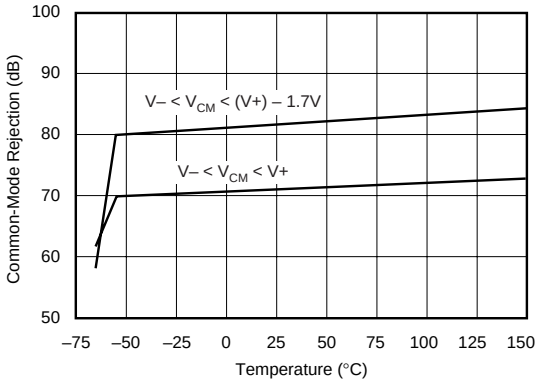
OUTPUT VOLTAGE SWING vs OUTPUT CURRENT



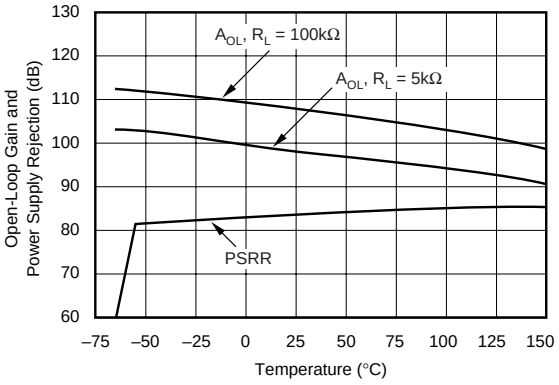
TYPICAL CHARACTERISTICS (Cont.)

At T_A = +25°C, R_L = 100kΩ connected to V_S / 2 and V_{OUT} = V_S / 2, unless otherwise noted.

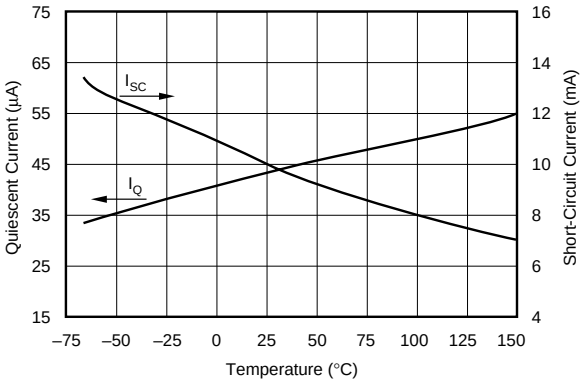
COMMON-MODE REJECTION vs TEMPERATURE



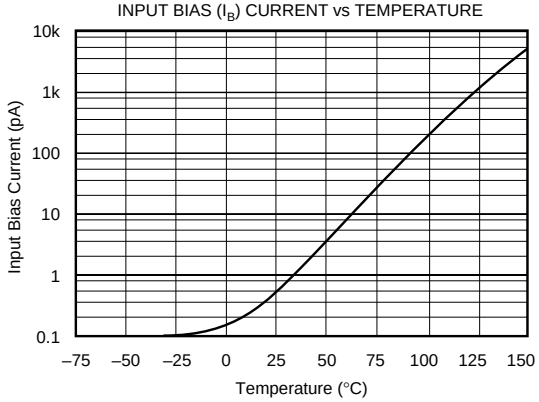
OPEN-LOOP GAIN AND PSRR vs TEMPERATURE



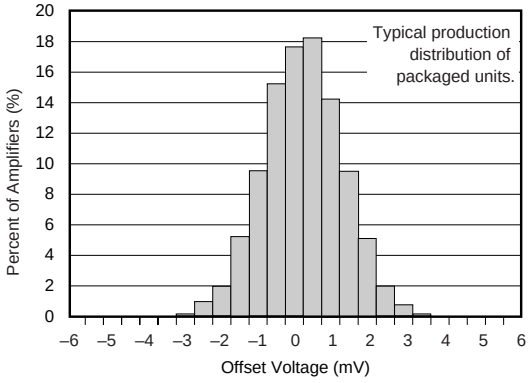
QUIESCENT AND SHORT-CIRCUIT CURRENT vs TEMPERATURE



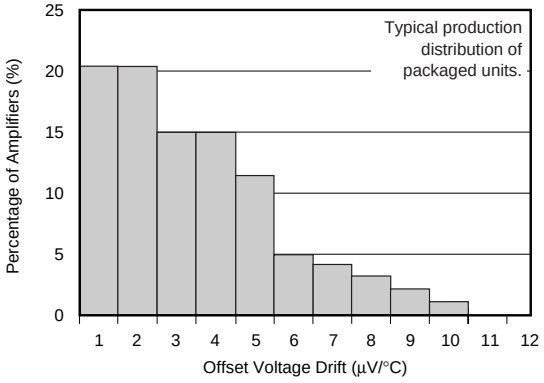
INPUT BIAS (I_B) CURRENT vs TEMPERATURE



OFFSET VOLTAGE PRODUCTION DISTRIBUTION

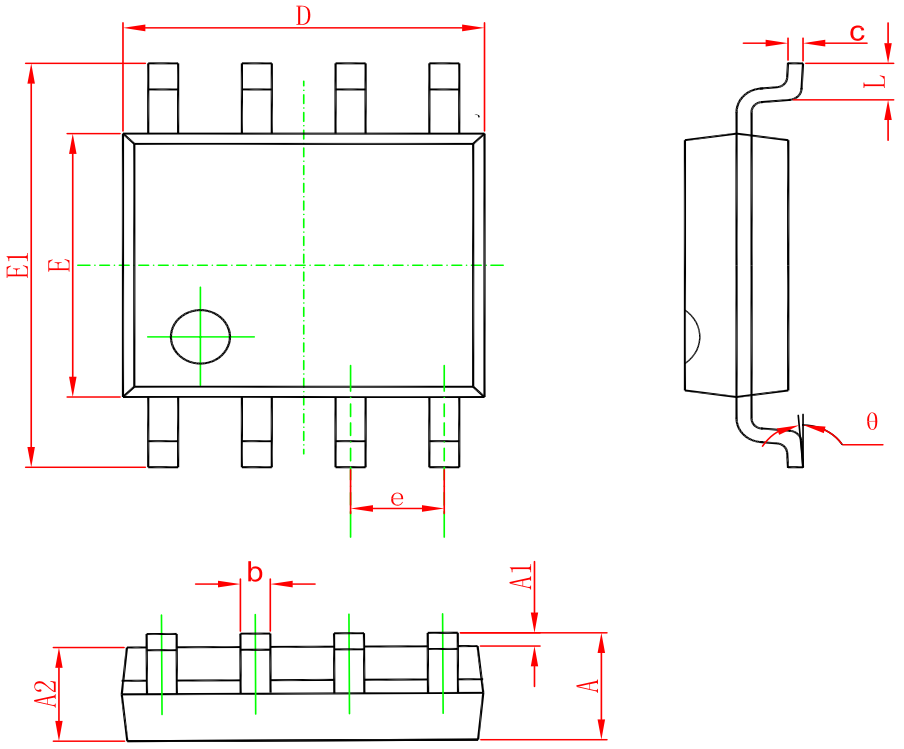


OFFSET VOLTAGE DRIFT MAGNITUDE PRODUCTION DISTRIBUTION



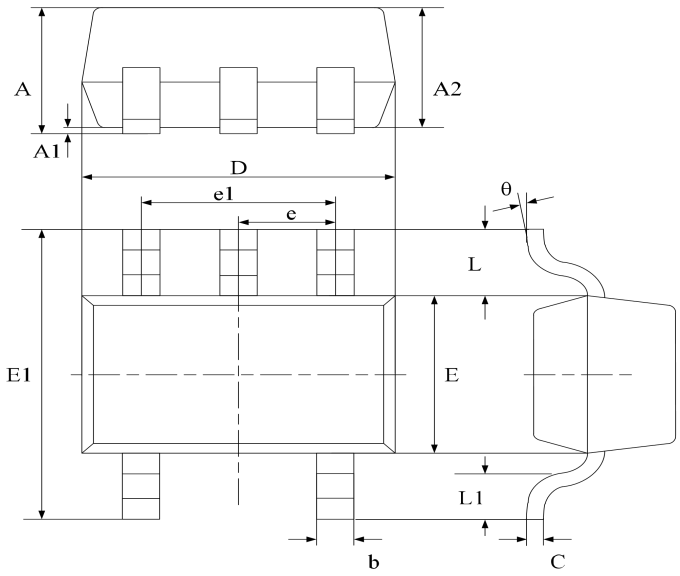
Package Dimension

SOP-8



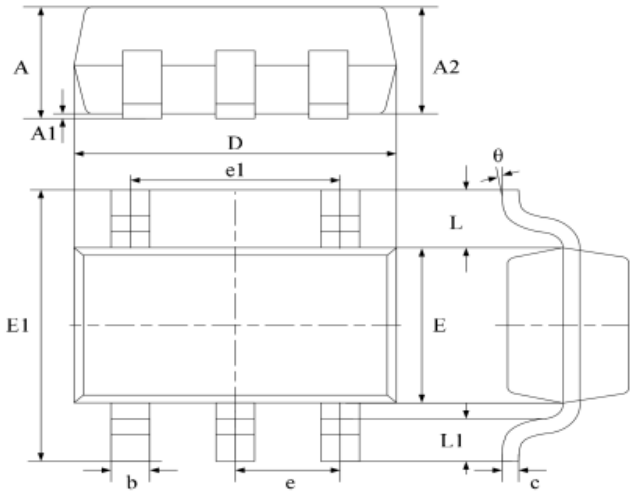
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)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

SC70-5（SOT353）



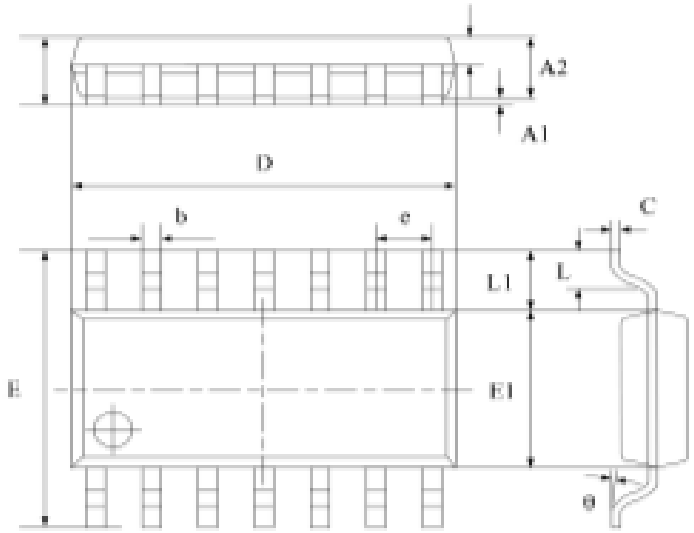
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.800	0.900	0.035	0.039
b	0.150	0.350	0.006	0.014
C	0.080	0.150	0.003	0.006
D	1.8500	2.150	0.079	0.087
E	1.100	1.400	0.045	0.053
E1	1.950	2.200	0.085	0.096
e	0.850 typ.		0.026 typ.	
e1	1.200	1.400	0.047	0.055
L	0.42 ref.		0.021 ref.	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

SOT23-5



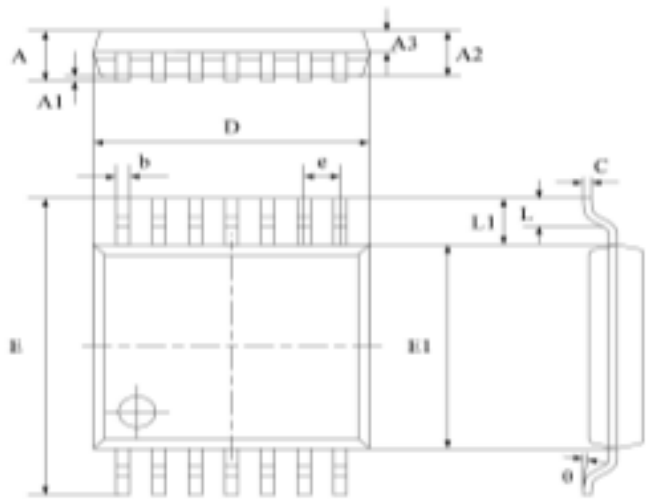
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.040	1.350	0.042	0.055
A1	0.040	0.150	0.002	0.006
A2	1.000	1.200	0.041	0.049
b	0.380	0.480	0.015	0.020
c	0.110	0.210	0.004	0.009
D	2.720	3.120	0.111	0.127
E	1.400	1.800	0.057	0.073
E1	2.600	3.000	0.106	0.122
e	0.950 typ.		0.037 typ.	
e1	1.900 typ.		0.078 typ.	
L	0.700 ref.		0.028 ref.	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

SOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.450	1.850	0.059	0.076
A1	0.100	0.300	0.004	0.012
A2	1.350	1.550	0.055	0.063
A3	0.550	0.750	0.022	0.031
b	0.406typ.		0.017typ.	
C	0.203typ.		0.008typ.	
D	8.630	8.830	0.352	0.360
E	5.840	6.240	0.238	0.255
E1	3.850	4.050	0.157	0.165
e	1.270 typ.		0.050 typ.	
L1	1.040 ref.		0.041 ref.	
L	0.350	0.750	0.014	0.031
θ	2°	8°	2°	8°

TSSOP-14



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	-	1.200	-	0.0472
A1	0.050	0.150	0.002	0.006
A2	0.900	1.050	0.037	0.043
A3	0.390	0.490	0.016	0.020
b	0.200	0.290	0.008	0.012
C	0.130	0.180	0.005	0.007
D	4.860	5.060	0.198	0.207
E	6.200	6.600	0.253	0.269
E1	4.300	4.500	0.176	0.184
e	0.650 typ.		0.0256 typ.	
L1	1.000 ref.		0.0393 ref.	
L	0.450	0.750	0.018	0.031
θ	0°	8°	0°	8°

Ordering information

Order code	Package	Baseqty	Deliverymode	Marking
UMW OPA348AIDCKR	SC70-5	3000	Tape and reel	S48 U
UMW OPA348AIDBVR	SOT23-5	3000	Tape and reel	A48 U
UMW OPA348AIDR	SOP-8	2500	Tape and reel	OPA348A
UMW OPA2348AID	SOP-8	2500	Tape and reel	OPA2348A
UMW OPA2348AIDR	SOP-8	2500	Tape and reel	OPA2348A
UMW OPA4348AIDR	SOP-14	2500	Tape and reel	OPA4348A
UMW OPA4348AIPWR	TSSOP-14	4000	Tape and reel	OPA4348A
UMW OPA4348AIPWT	TSSOP-14	4000	Tape and reel	OPA4348A