UMW OPAx348

1MHz, 45μA, CMOS, Rail-to-Rail Operational Amplifiers

1.Description

The UMW 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 UMW 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.

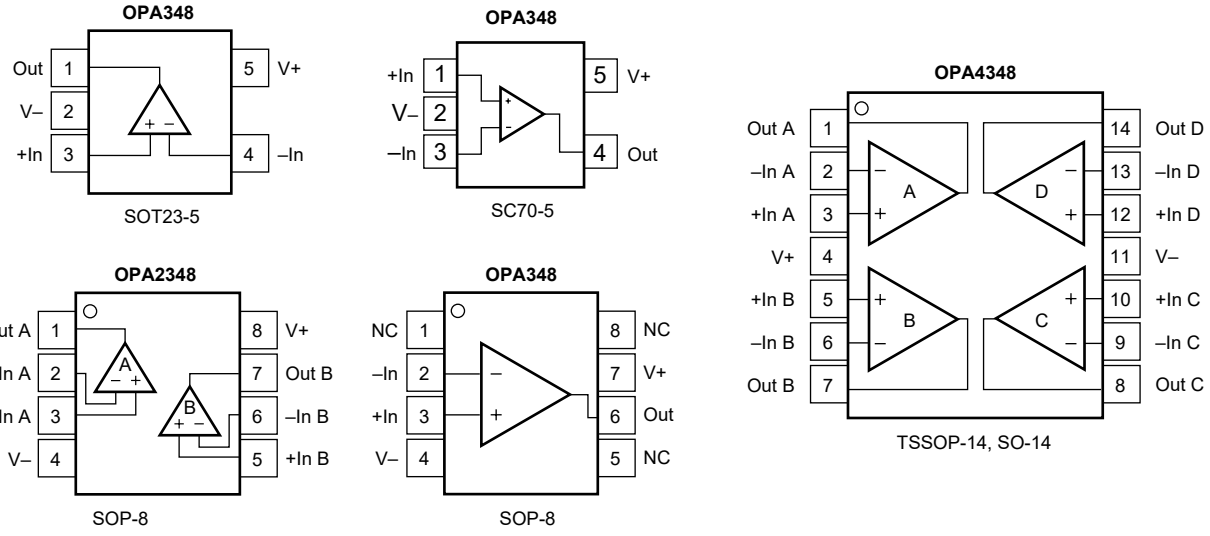
2.Features

- LOW IQ: 45μA 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

3.Applications

- Portable Equipment
- Battery-powered Equipment
- Smoke Alarms
- Co Detectors
- Medical Instrumentation

4.Pinning information



5.Absolute Maximum Rating

Measured in the range of natural ventilation temperatures (unless otherwise stated) (1)

Parameter		Min	Max	Units
Voltage	Power Supply Voltage		7.5	V
	Signal Input Terminal, Voltage (2)	(V–) – 0.5	(V+) + 0.5	V
Current	Signal Input Terminal, Current (2)		10	mA
	Short-circuit Output (3)	Continues		
Temperature	Junction Temperature, T_J		150	°C
	Working Temperature, T_A	-65	150	°C
	Storage Temperature, T_{STG}	-65	150	°C

(1) Stresses beyond these ratings can cause permanent damage to the device. Reliability is reduced when the device is operated continuously at the absolute maximum. These are stress ratings only. Functional operation of the device at these or other conditions beyond those indicated under the conditions of this specification is not implied.

(2) The terminals are not clamped to the power rails with diodes. For input signals that may exceed the power rails by 0.5V, the current must be limited to 0mA or less.

(3) Short circuit to ground, one amplifier per package.

6.ESD Ratings

Parameter		Value	Units
Electrostatic Discharge, $V_{(ESD)}$	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
	Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±500	V

(1) JEDEC document JEP155 states: 500V HBM can be produced safely under standard ESD control procedures.

(2) JEDEC document JEP157 states: 250V CDM can be produced safely under standard ESD control procedures

7.Suggested Operating Conditions

Measured in the range of natural ventilation temperatures (unless otherwise stated)

Parameter	Min	Max	Units
Power Supply Voltage	2.1	5.5	V
Rated Temperature Range	-40	125	°C

8.DC Electrical Characteristics (V_S=2.5V to 5.5V)

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

Parameter	Symbol	Conditions	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
		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						
Input Voltage Noise,f=0.1Hz to 10Hz		V_{CM}<(V+) - 1.7V		10		$μV_{p-p}$
Input Voltage Noise Density,f=1kHz	e_n			35		nV/√Hz
Input Current Noise Density,f=1kHz	i_n			4		fA/√Hz

Parameter	Symbol	Conditions	Min	Typ	Max	Units
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
		V_S=5V,R_L=5kΩ,0.125V<V_O<4.875V	88			dB
OUTPUT						
Voltage output swing with respect to the power rail		V_S=5V,R_L=100kΩ,0.025V<V_O<4.975V		18	25	mV
		V_S=5V,R_L=100kΩ,0.025V<V_O<4.975V T_A=-40°C to 125°C			25	mV
		V_S=5V,R_L=5kΩ,0.125V<V_O<4.875V		100	125	mV
		V_S=5V,R_L=5kΩ,0.125V<V_O<4.875V T_A=-40°C to 125°C			125	mV
Short-Circuit Current	I_{SC}			±10		mA
Capacitive Load Drive	C_{LOAD}					mA
FREQUENCY RESPONSE						
Gain-Bandwidth Product	GBW	C_L=100pF		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%				7		μs
Overload Recovery Time		V_{IN} • Gain>V_S	2.5	1.6		μs
Total Harmonic Distortion + Noise	THD+N	V_S=5.5V, V_O=3V_{p-p}, G=+1, f=1kHz		0.0023		%
POWER SUPPLY						
Specified Voltage Range	V_S	I_O=0			5.5	V
Minimum Operating Voltage				2.1	5.5	V
Quiescent Current (per amplifier)	I_Q			45	65	μA
over Temperature					75	μA

Parameter	Symbol	Conditions	Min	Typ	Max	Units
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

9.1 Typical Characteristic

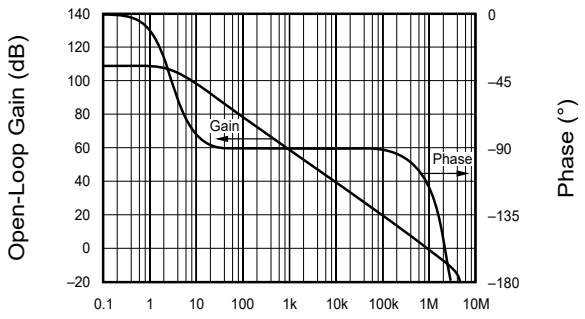


Figure 1: Open-loop Gain And Phase vs Frequency

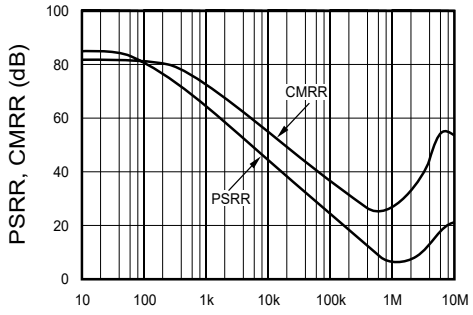


Figure 2: PSRR and CMRR vs Frequency

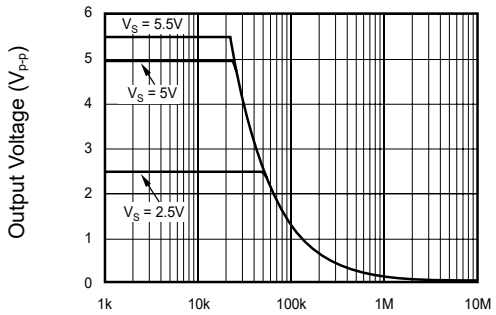


Figure 3: Maximum Output Voltage vs Frequency

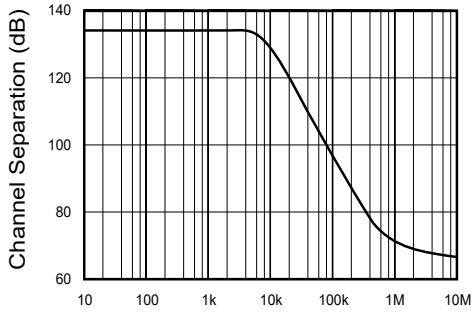


Figure 4: Channel Separation vs Frequency

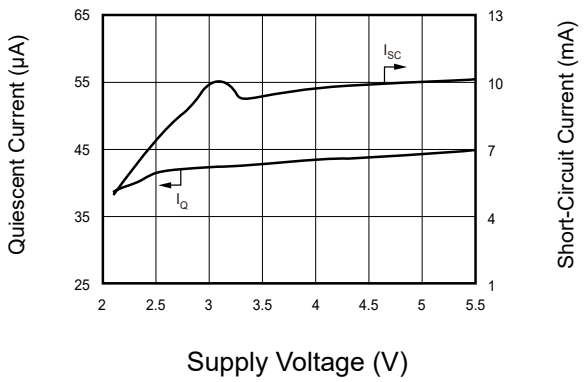


Figure 5: Quiescent and Short-circuit Current vs Supply Voltage

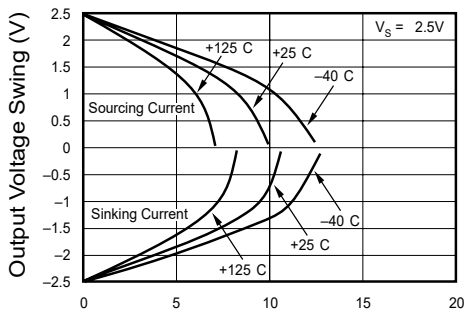
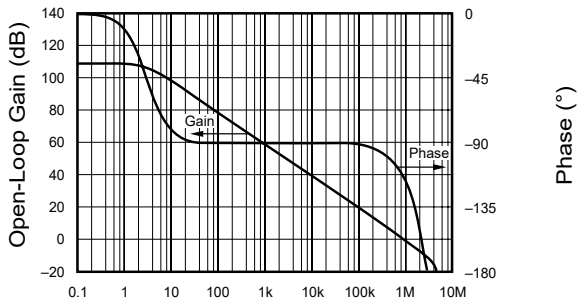


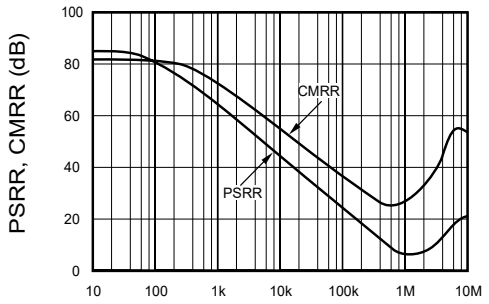
Figure 6: Output Voltage Swing vs Output Current

9.2 Typical Characteristic



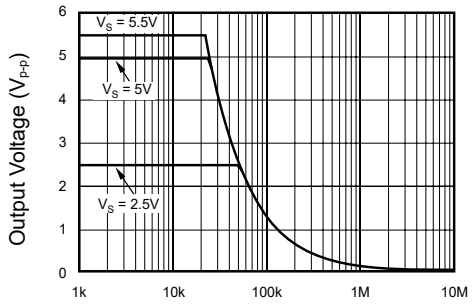
Input Bias Current (pA)

Figure 7: Input Bias Current at +85°C.



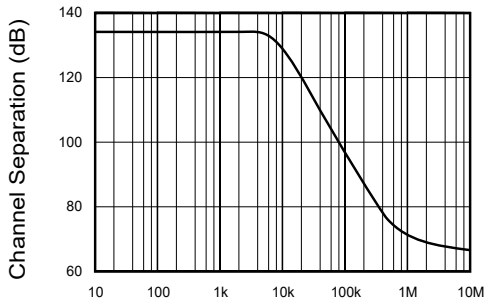
Frequency (Hz)

Figure 8: PSRR, CMRR vs. Frequency.



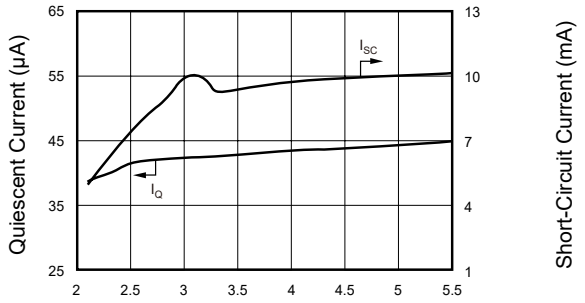
Frequency (Hz)

Figure 9: Maximum Output Voltage vs Frequency



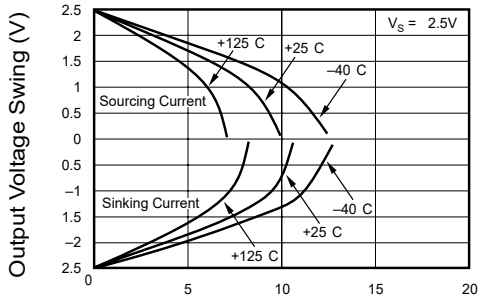
Frequency (Hz)

Figure 10: Channel Separation vs Frequency



Ambient Temperature (°C)

Figure 11: Quiescent and Short-circuit Current vs Supply Voltage



Output Current (mA)

Figure 12: Output Voltage Swing vs Output Current

9.3 Typical Characteristic

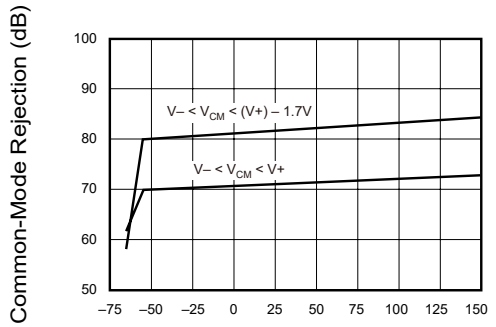


Figure 13: Common-mode Rejection vs Temperature

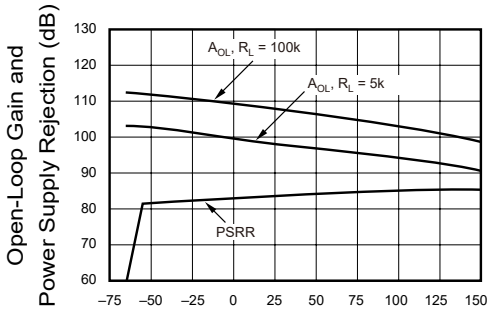


Figure 14: Open-loop Gain and PSRR vs Temperature

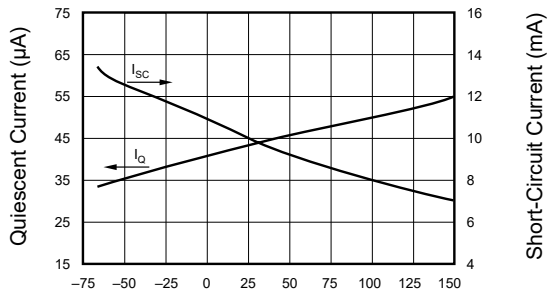


Figure 15: Quiescent and Short-circuit Current vs Temperature

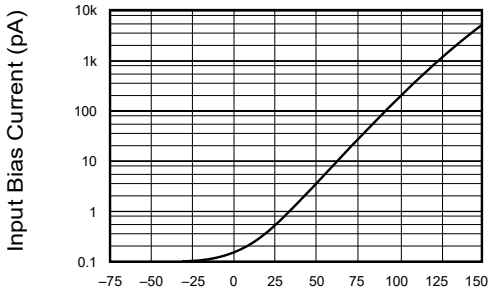


Figure 16: Input Bias (I_B) Current vs Temperature

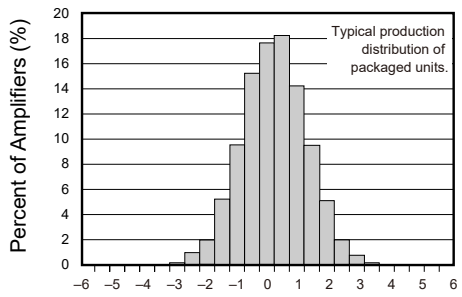


Figure 17: Offset Voltage Production Distribution

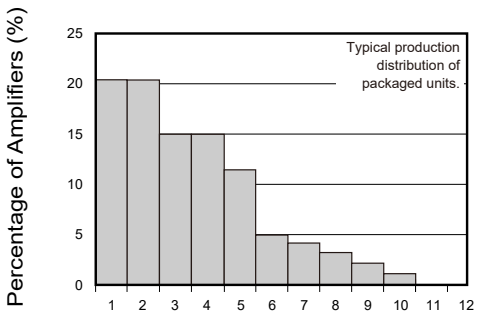
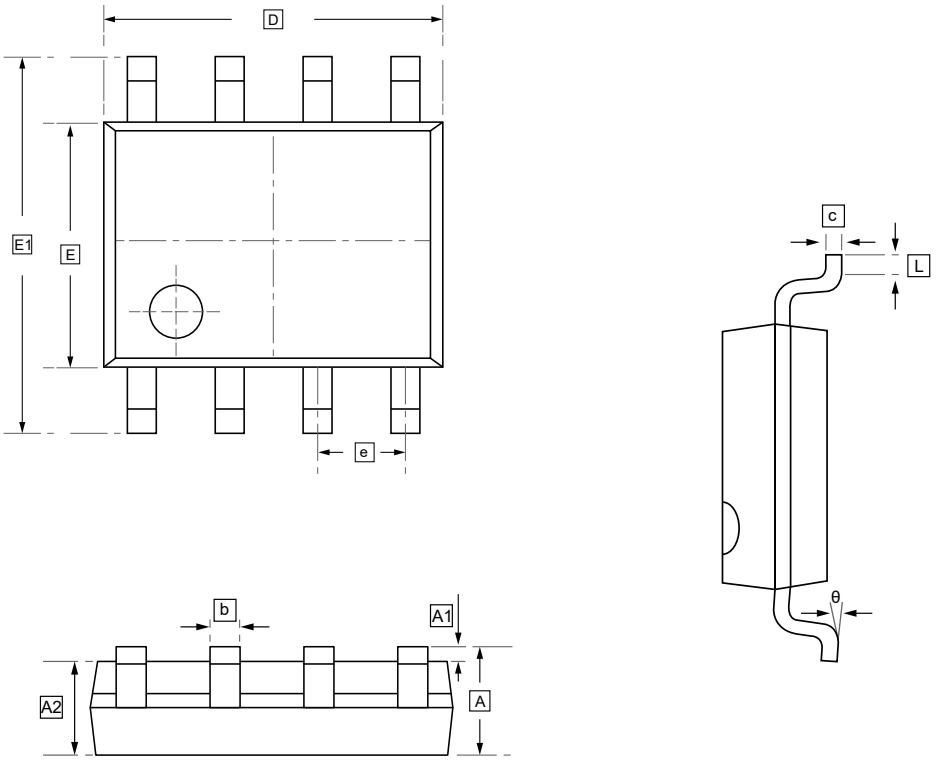


Figure 18: Offset Voltage Drift Magnitude Production Distribution

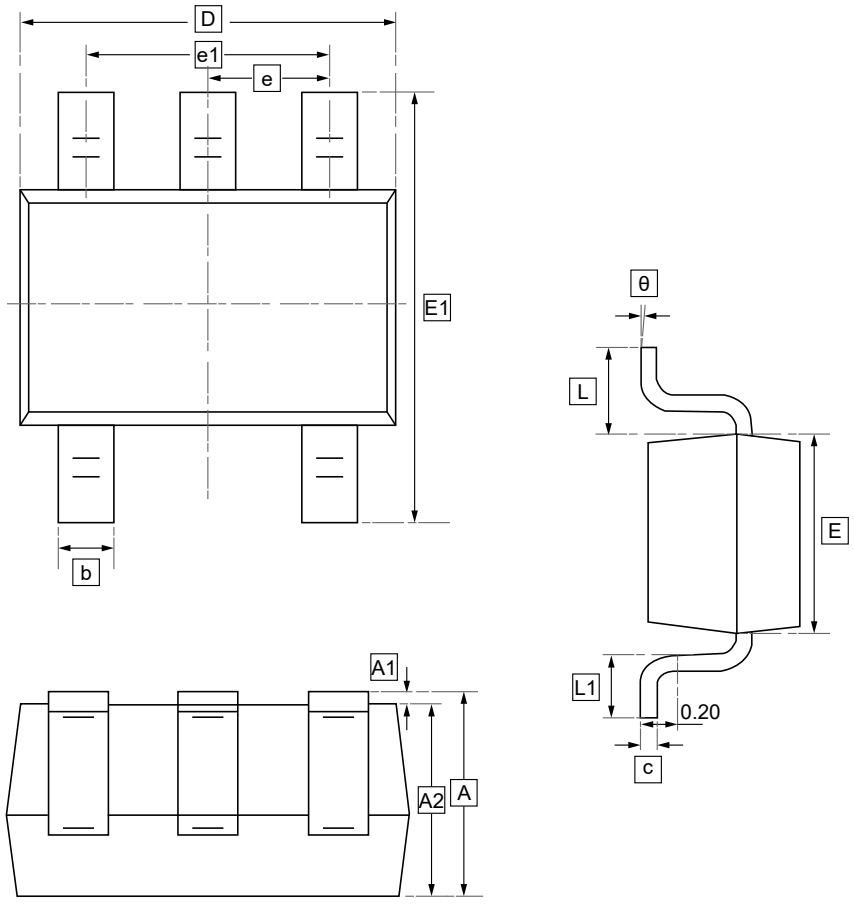
10.1 SOP-8 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°

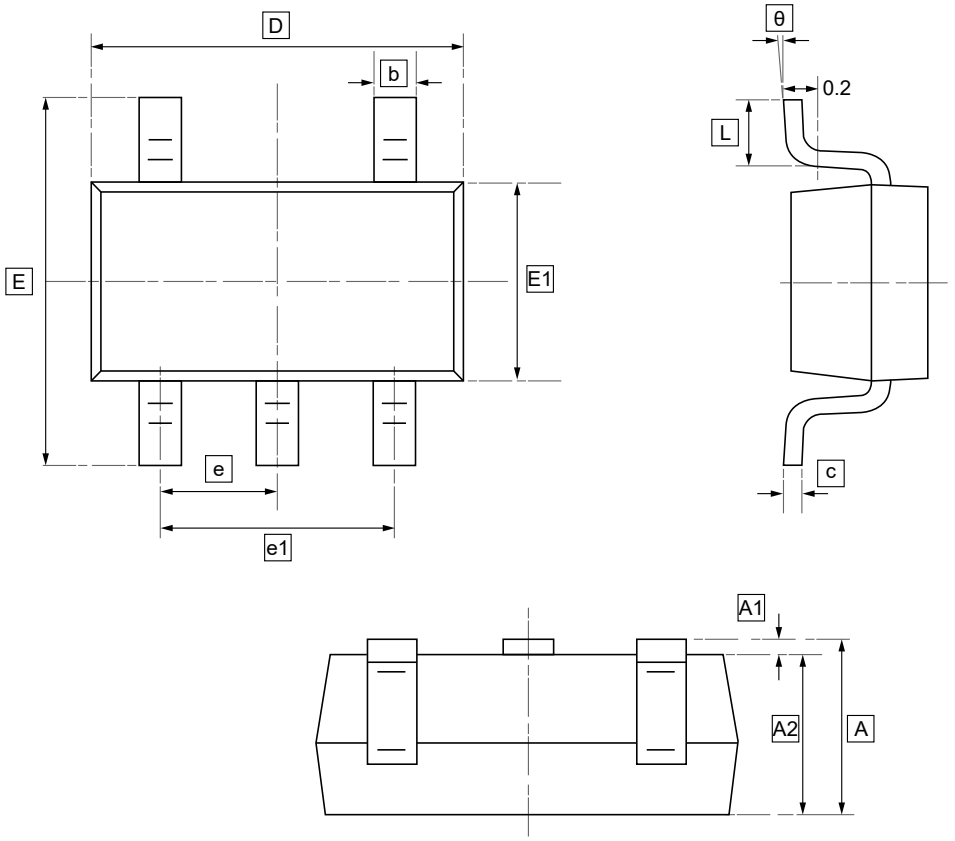
10.2 SC70-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	e1	L	θ
Min	0.90	0.00	0.90	0.15	0.08	1.80	1.15	2.15	0.65	1.20	0.26	7°
Max	1.10	0.10	1.00	0.35	0.15	2.25	1.35	2.45	TYP	1.40	0.46	REF.

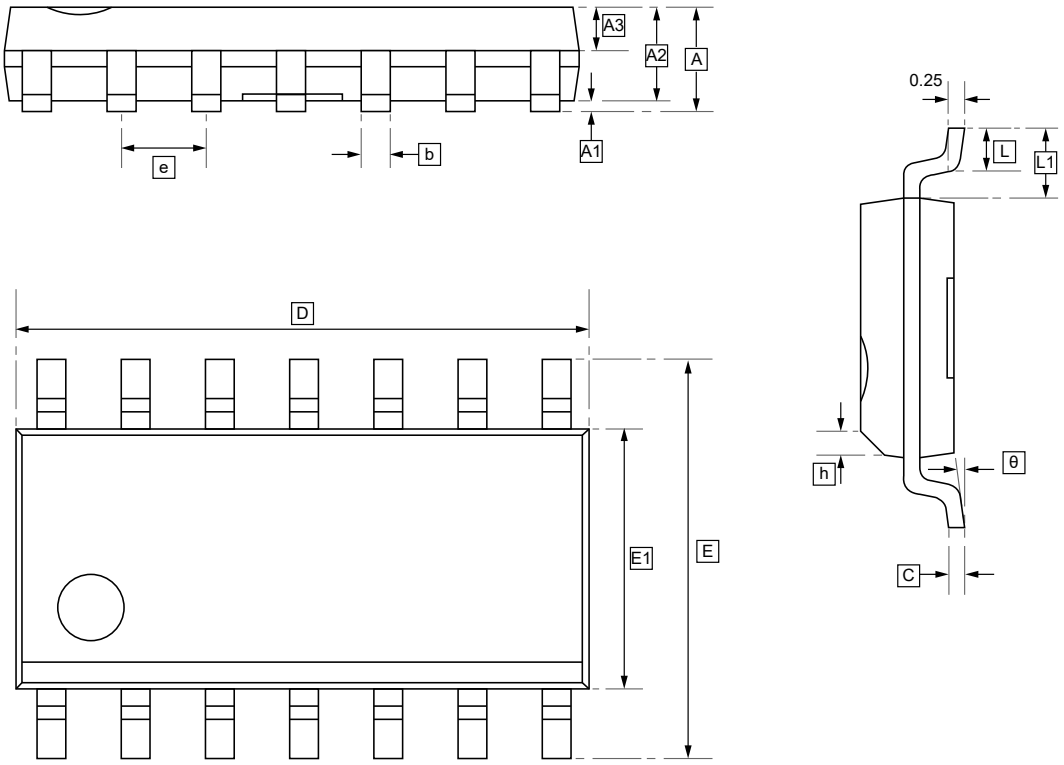
10.3 SOT23-5 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E1	E	e	e1	L	θ
Min	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950	1.800	0.300	0°
Max	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950	BSC	2.000	0.600	8°

10.4 SOP-14 Package Outline Dimensions

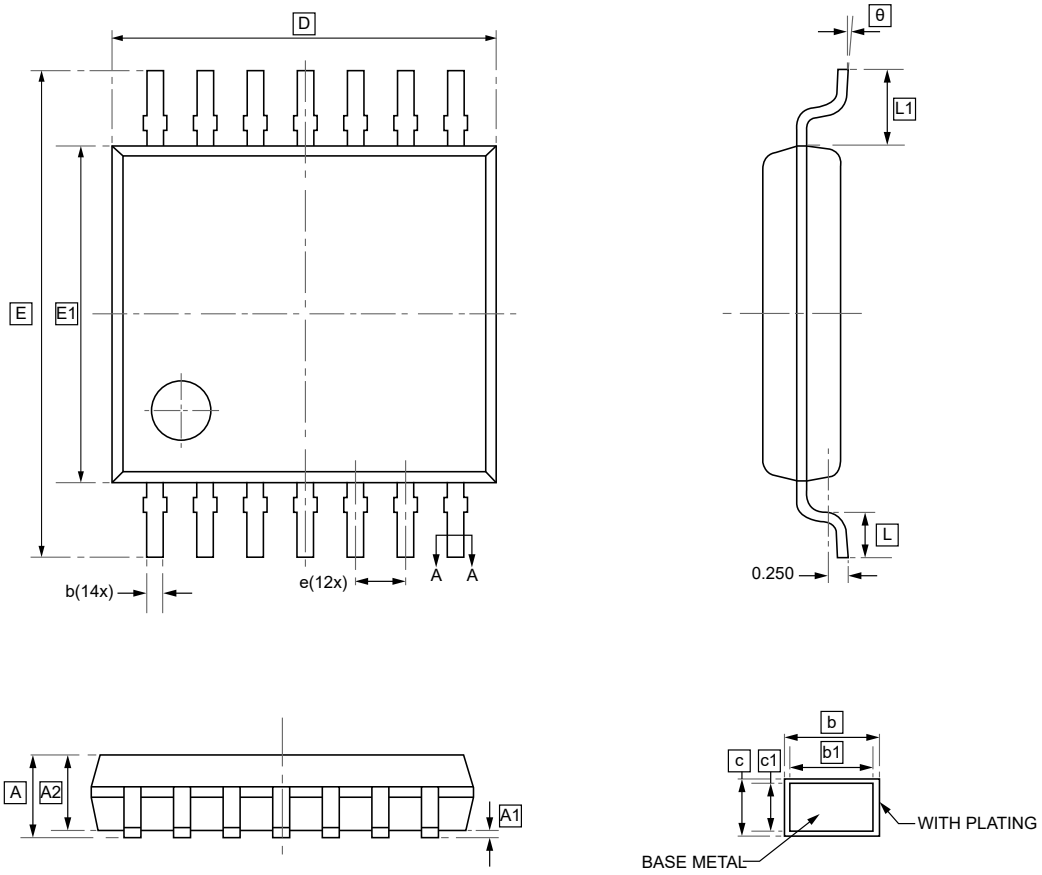


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	A3	b	C	D	E	E1	e	h	L
Min	-	0.05	1.35	0.65	0.203	0.17	8.45	5.80	3.80	1.24	0.25	0.40
Max	1.75	0.25	1.55	0.75	0.305	0.25	8.85	6.20	4.00	1.30	0.50	0.80

Symbol	L1	θ
Min	1.00	0°
Max	1.10	8°

10.5 TSSOP-14 Package Outline Dimensions



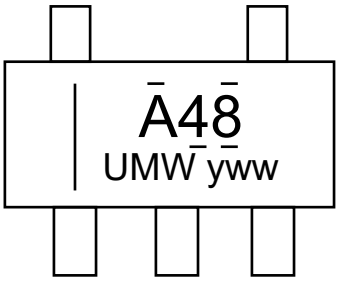
DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	b1	c	c1	D	E	E1	e	L1
Min	-	0.05	0.90	0.20	0.19	0.13	0.120	4.90	6.20	4.30	0.65	0.85
Max	1.20	0.15	1.05	0.28	0.25	0.17	0.14	5.10	6.60	4.50	BSC	1.15

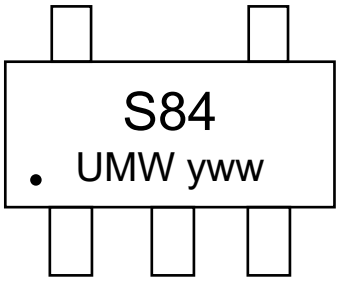
Symbol	L	θ
Min	0.45	0°
Max	0.75	8°

11.Ordering Information

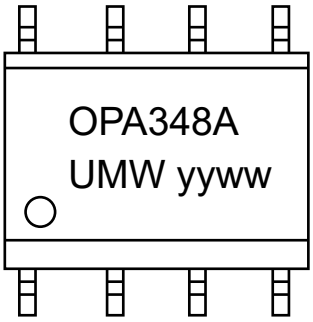
SOT23-5



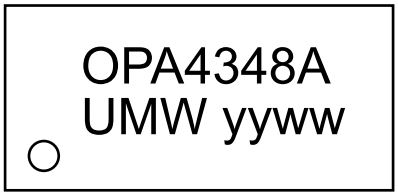
SC70-5



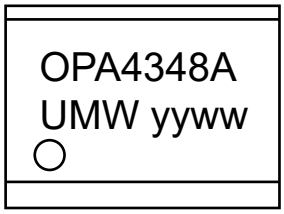
SOP-8



SOP-14



TSSOP-14



y: Year Code
yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW OPA348AIDCKR	S48	SC70-5	3000	Tape and reel
UMW OPA348AIDBVR	A48	SOT23-5	3000	Tape and reel
UMW OPA348AIDR	OPA348A	SOP-8	2500	Tape and reel
UMW OPA2348AID	OPA2348A	SOP-8	2500	Tape and reel
UMW OPA2348AIDR	OPA2348A	SOP-8	2500	Tape and reel
UMW OPA4348AIDR	OPA4348A	SOP-14	2500	Tape and reel
UMW OPA4348AIPWR	OPA4348A	TSSOP-14	4000	Tape and reel
UMW OPA4348AIPWT	OPA4348A	TSSOP-14	4000	Tape and reel

12.Disclaimer

UMW reserves the right to make changes to all products, specifications. Customers should obtain the latest version of product documentation and verify the completeness and currency of the information before placing an order.

When applying our products, please do not exceed the maximum rated values, as this may affect the reliability of the entire system. Under certain conditions, any semiconductor product may experience faults or failures. Buyers are responsible for adhering to safety standards and implementing safety measures during system design, prototyping, and manufacturing when using our products to prevent potential failure risks that could lead to personal injury or property damage.

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