UMW OPA338/OPA2338

MicroSIZE, Single-Supply CMOS OPERATIONAL AMPLIFIERS
MicroAmplifier Series

1.Description

The UMW OPA338 series rail-to-rail output CMOS operational amplifiers are designed for low cost and miniature applications.UMW OPA338 op amps provide low bias current, highspeed operation, high open-loop gain, and rail-to-rail output swing. They operate on a single supply with operation as low as 2.5V while drawing only 525μA quiescent current. In addition, the input common-mode voltage range includes ground—ideal for single-supply operation. The UMW OPA338 series is optimized for gains greater than or equal to 5. They are easy-to-use and free from phase inversion and overload problems found in some other op amps. Excellent performance is maintained as the amplifiers swing to their specified limits. The dual versions feature completely independent circuitry for lowest crosstalk and freedom from interaction, even when overdriven or overloaded.

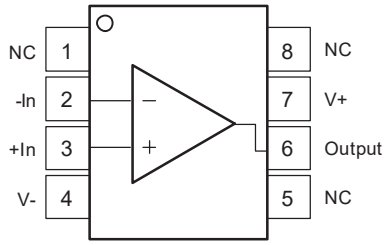
2.Features

- Single-supply Operation
- Rail-to-rail Output Swing
- FET-input: I_B=10pA max
- High Speed:
- OPA337: 3MHz, 1.2V/μs (G = 1)
- OPA338: 12.5MHz, 4.6V/μs (G = 5)
- Operation From 2.5V to 5.5V
- High Open-loop Gain: 120dB
- Low Quiescent Current: 525μA/amp
- Single And Dual Versions

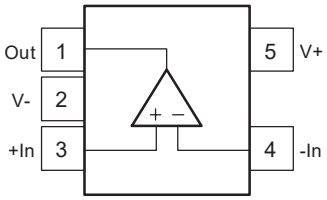
3.Applications

- Battery-powered Instruments
- Photodiode Pre-amps
- Medical Instruments
- Test Equipment
- Audio Systems
- DRIVING ADCs
- Consumer Products

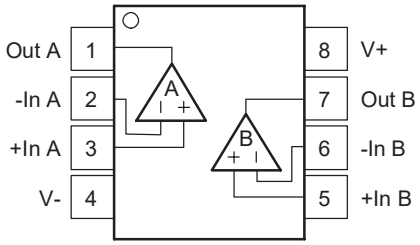
4.Pinning Information



OPA338
SOP-8



OPA338
SOT23−5



OPA2338
SOP−8

5.Absolute Maximum Ratings (1)

Description	Rating
Supply Voltage	7.5V
Input Voltage (2)	(V−) − 0.5V to (V+) + 0.5V
Input Current (2)	10mA
Output Short Circuit (3)	Continuous
Operating Temperature	-55°C to +125°C
Storage Temperature	-55°C to +125°C
Junction Temperature	150°C
Lead Temperature (soldering, 10s)	300°C

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not supported.

(2) Input signal voltage is limited by internal diodes connected to power supplies. See text.

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

6.Electrical Characteristics:V_S=2.7V to 5.5V

Boldface limits apply over the specified temperature range, −40°C to +85°C, V_S=5V.
At T_A=+25°C and R_L=25kΩ connected to V_S/2, unless otherwise noted.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Offset Voltage						
Input Offset Voltage	V_{OS}			±0.5	±3	mV
T_A=−40°C to +85°C					±3.5	mV
vs Temperature	dV_{OS}/dT			±2		μV/°C
vs Power-Supply Rejection Ratio	PSRR	V_S=2.7V to 5.5V		25	125	μV/V
T_A=−40°C to +85°C		V_S=2.7V to 5.5V			125	μV/V
Channel Separation (dual versions)		dc		0.3		μV/V
Input Bias Current						
Input Bias Current	I_B			±0.2	±10	pA
T_A=−40°C to +85°C			See Typical Curve			
Input Offset Current	I_{OS}			±0.2	±10	pA
Noise						
Input Voltage Noise, f=0.1Hz to 10Hz				6		μV_{PP}
Input Voltage Noise Density, f=1kHz	e_n			26		nV/√Hz
Current Noise Density, f= 1kHz	i_n			0.6		fA/√Hz
Input Voltage Range						
Common-Mode Voltage Range	V_{CM}	T_A=-40°C to +125°C	-0.2		(V+)-1.2	V
Common-Mode Rejection Ratio	CMRR	−0.2V<V_{CM}< (V+)−1.2V	74	90		dB
T_A=−40°C to +85°C		−0.2V<V_{CM}< (V+)−1.2V	74			dB
Input Impedance						
Differential				10^{13}II2		ΩIIpF
Common-Mode				10^{13}II4		ΩIIpF

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Open-loop Gain						
Open-Loop Voltage Gain	A_{OL}	R_L=25kΩ,125mV<V_O< (V+)−125mV	100	120		dB
T_A=−40°C to +85°C		R_L=25kΩ,125mV<V_O< (V+)−125mV	100			dB
		R_L=5kΩ,500mV<V_O< (V+)−500mV	100	114		dB
T_A=−40°C to +85°C		R_L=5kΩ,500mV<V_O< (V+)−500mV	100			dB
OPA338 Frequency Response						
Gain-Bandwidth Product	GBW	V_S=5V, G=5		12.5		MHz
Slew Rate	SR	V_S=5V, G=5		4.6		V/μs
Settling TIme: 0.1%		V_S=5V,2V Step,C_L=100pF,G=5		1.4		μs
0.01%		V_S=5V,2V Step,C_L=100pF,G=5		1.9		μs
Overload Recovery Time		V_{IN} × G=V_S		0.5		μs
Total Harmonic Distortion + Noise	THD+N	V_S=5V, V_O=3V_{PP}, G=5, f=1kHz		0.0035		%
Output						
Voltage Output Swing from Rail (2)		R_L=25kΩ, A_{OL}≥100dB		40	125	mV
T_A=−40°C to +85°C		R_L=25kΩ, A_{OL}≥100dB			125	mV
		R_L=5kΩ, A_{OL}≥100dB		150	500	mV
T_A=−40°C to +85°C		R_L=5kΩ, A_{OL}≥100dB			500	mV
Short-Circuit Current				±9		mA
Capacitive Load Drive			See Typical Curve			
Power Supply						
Specified Voltage Range	V_S	T_A=−40°C to +85°C	2.7		5.5	V
Minimum Operating Voltage				2.5		V
Quiescent Curent (per amplifier)	I_Q	I_O=0		0.525	1	mA
T_A=−40°C to +85°C		I_O=0			1.2	mA

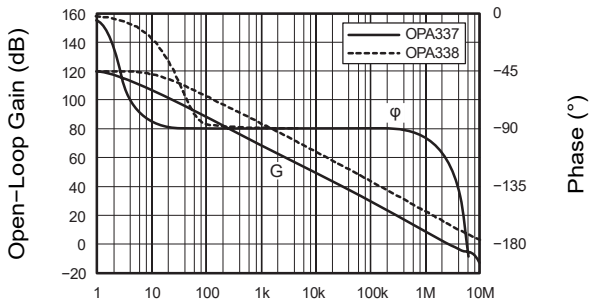
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Temperature Range						
Specified Range					+85	°C
Operating Range			-40		+125	°C
Storage Range			-55		+125	°C
Thermal Resistance	θ_{JA}		-55			
SOP-8 Surface-Mount				150		°C/W

Notes:

(1) V_S=5V.

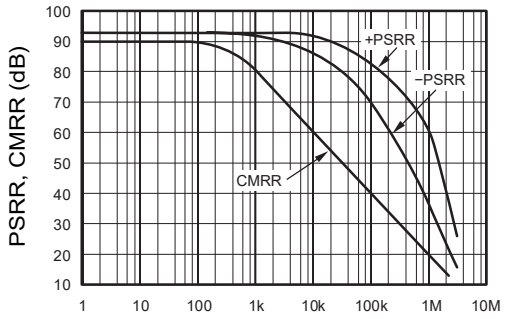
(2) Output voltage swings are measured between the output and negative and positive power-supply rails.

7.1 Typical Characteristic



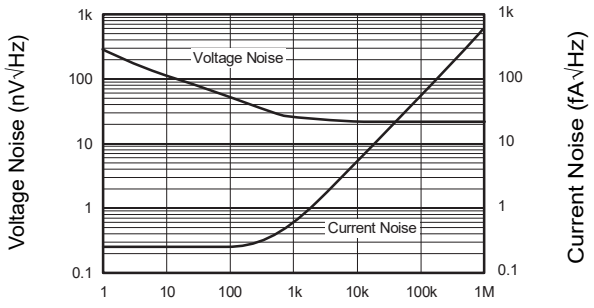
Frequency (Hz)

Figure 1: Open−loop Gain/phase vs Frequency



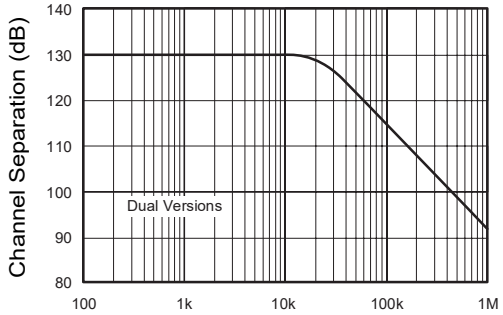
Frequency (Hz)

Figure 2: Power−supply Rejection Ratio And Common−mode Rejection Ratio Vs Frequency



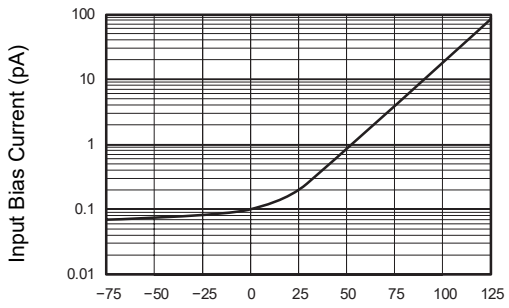
Frequency (Hz)

Figure 3: Input Voltage And Current Noise Spectral Density vs Frequency



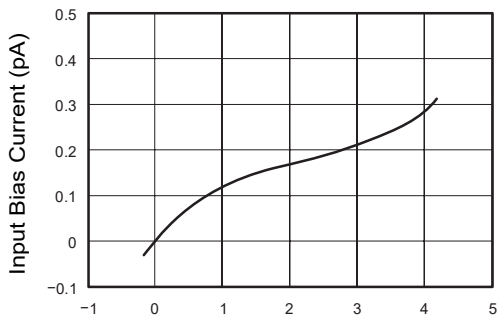
Frequency (Hz)

Figure 4: Channel Separation vs Frequency



Temperature (°C)

Figure 5: Input Bias Current vs Temperature



Common−Mode Voltage (V)

Figure 6: Input Bias Current vs Input Common−mode Voltage

7.2 Typical Characteristic

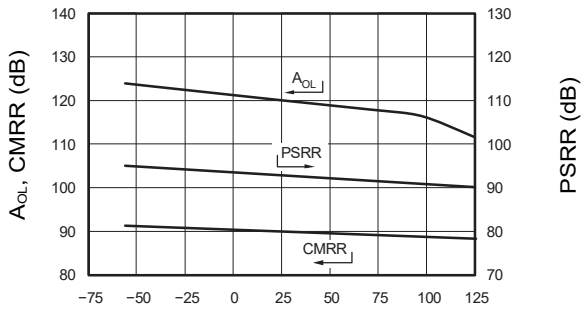


Figure 7: A_{OL}, CMRR, PSRR vs Temperature

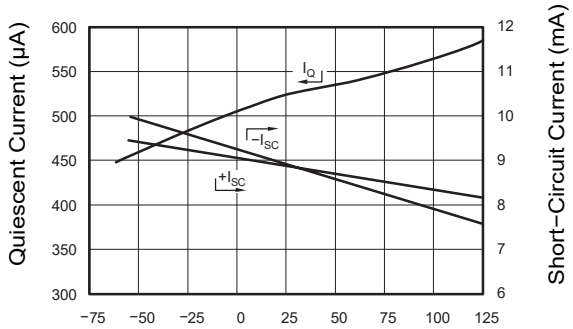


Figure 8: Quiescent Current And Short−circuit Current vs Temperature

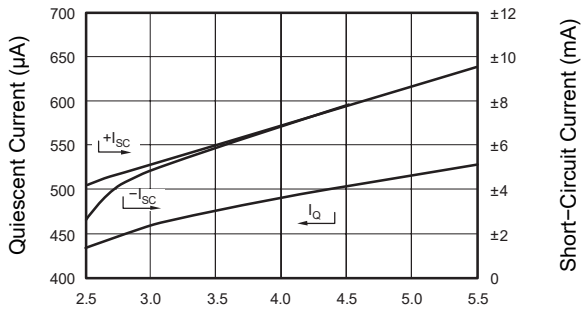


Figure 9: Quiescent And Short−circuit Current vs Supply Voltage

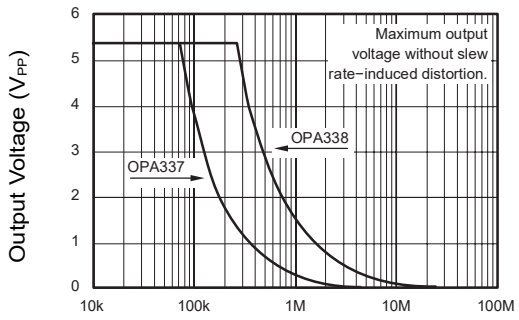


Figure 10: Maximum Output Voltage vs Frequency

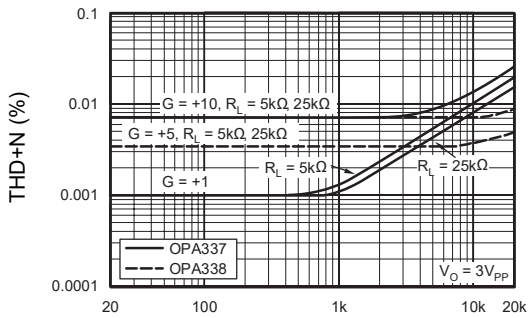


Figure 11: Total Harmonic Distortion + Noise vs Frequency

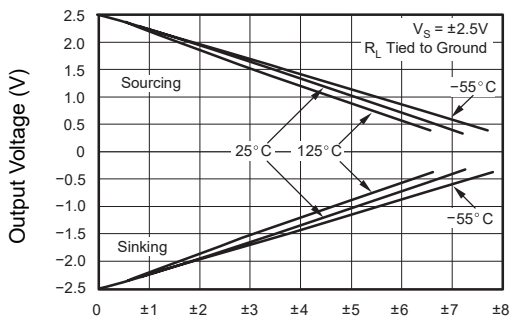


Figure 12: Output Voltage Swing vs Output Current

7.3 Typical Characteristic

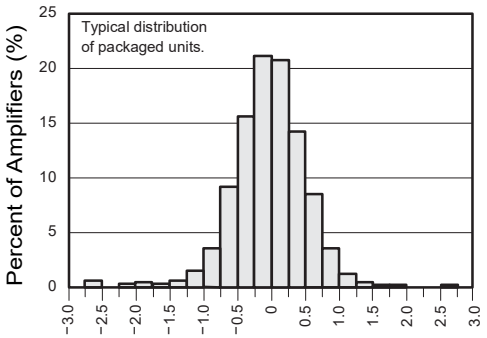


Figure 13: Offset Voltage Production Distribution

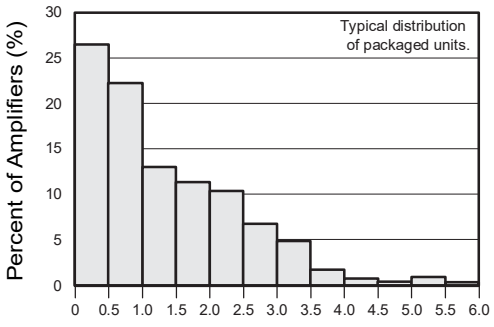


Figure 14: Offset Voltage Drift Production Distribution

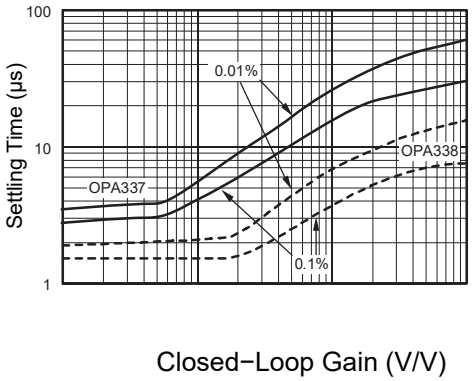


Figure 15: Settling Time vs Closed−loop Gain

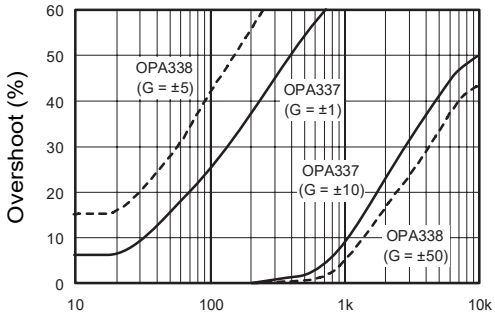


Figure 16: Small−signal Overshoot vs Load Capacitance

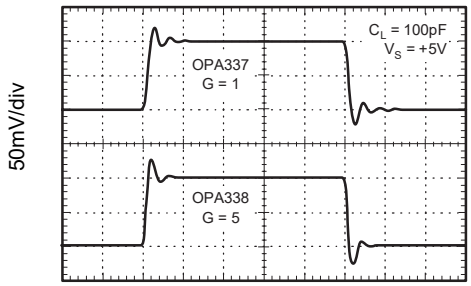


Figure 17: Small−signal Step Response

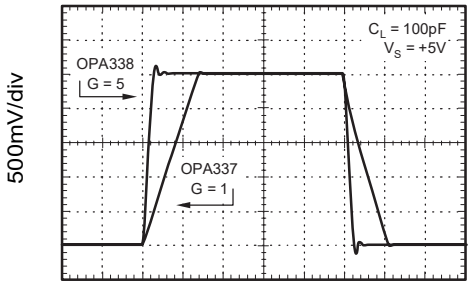
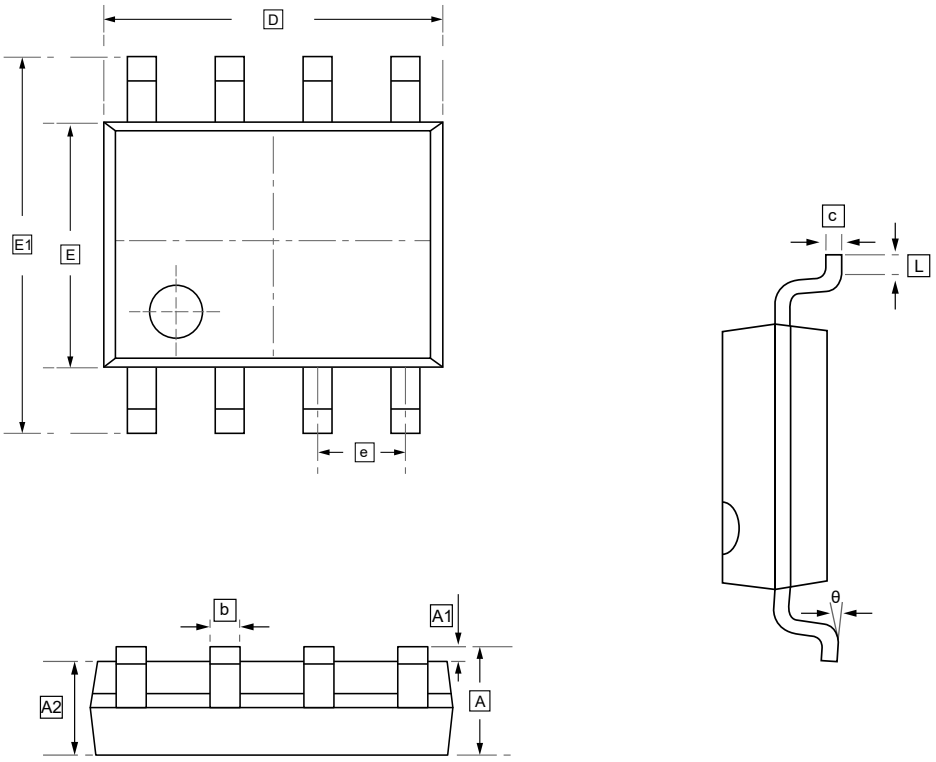


Figure 18: Large−signal Step Response

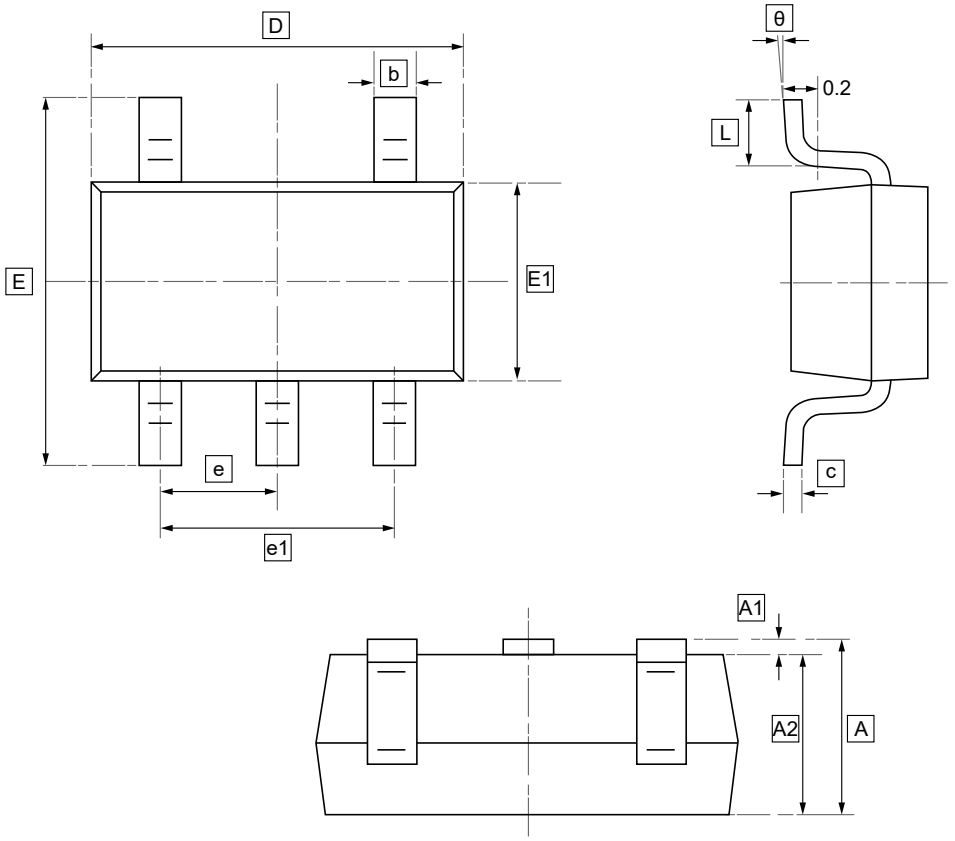
8.1 SOP-8 Package Outline Dimensions



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°

8.2 SOT-23-5 Package Outline Dimensions

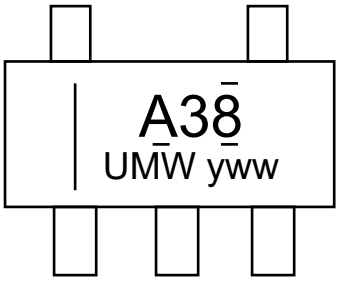


DIMENSIONS (mm are the original dimensions)

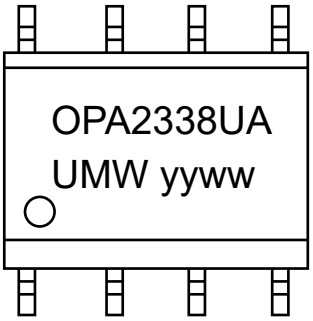
Symbol	A	A1	A2	b	c	D	E1	E	e	e1	L	θ
Min	1.050	0.000	1.050	0.300	0.100	2.820	1.500	2.650	0.950	1.800	0.300	0°
Max	1.250	0.100	1.150	0.500	0.200	3.020	1.700	2.950	BSC	2.000	0.600	8°

9.Ordering Information

SOT23-5



SOP-8



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

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW OPA338NA	A38	SOT23-5	3000	Tape and reel
UMW OPA2338UA	OPA2338UA	SOP-8	2500	Tape and reel
UMW OPA338UA	OPA338UA	SOP-8	2500	Tape and reel

10.Disclaimer

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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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