MicroSIZE, Single-Supply CMOS OPERATIONAL AMPLIFIERS MicroAmplifier Series

DESCRIPTION

The OPA338 series rail-to-rail output CMOS operational amplifiers are designed for low cost and miniature applications.

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.

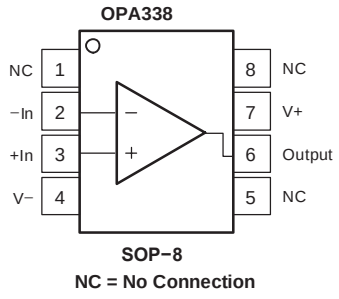
The OPA338 series is optimized for gains greater than or equal to 5. They are easy-to-use and free from phase inversion and overload problems found in some other op amps. Excellent performance is maintained as the amplifiers swing to their specified limits. The dual versions feature completely independent circuitry for lowest crosstalk and freedom from interaction, even when overdriven or overloaded.

FEATURES

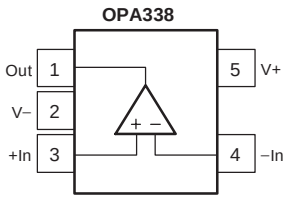
- SINGLE-SUPPLY OPERATION
- RAIL-TO-RAIL OUTPUT SWING
- FET-INPUT: I_B = 10pA max
- HIGH SPEED:
  OPA337: 3MHz, 1.2V/µs (G = 1)
  OPA338: 12.5MHz, 4.6V/µs (G = 5)
- OPERATION FROM 2.5V to 5.5V
- HIGH OPEN-LOOP GAIN: 120dB
- LOW QUIESCENT CURRENT: 525µA/amp
- SINGLE AND DUAL VERSIONS

APPLICATIONS

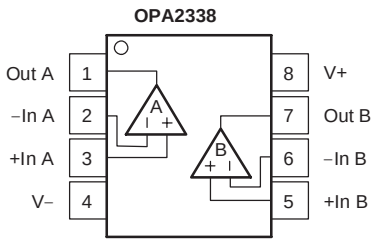
- BATTERY-POWERED INSTRUMENTS
- PHOTODIODE PRE-AMPS
- MEDICAL INSTRUMENTS
- TEST EQUIPMENT
- AUDIO SYSTEMS
- DRIVING ADCs
- CONSUMER PRODUCTS



SOP−8
NC = No Connection



SOT23−5



SOP−8

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		CONDITION	OPA338, OPA2338 MIN	TYP(1)	MAX	UNIT
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		$nV/\sqrt{Hz}$
Current Noise Density, f = 1kHz	i_n			0.6		$fA/\sqrt{Hz}$
INPUT VOLTAGE RANGE						
Common-Mode Voltage Range	V_{CM}	T_A = −40°C to +85°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} ||2		Ω ||pF
Common-Mode				10^{13} ||4		Ω ||pF
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		$V_{IN} \times G = V_S$		0.5		µs
Total Harmonic Distortion + Noise	THD+N	V_S = 5V, V_O = $3V_{PP}$, G = 5, f = 1kHz		0.0035		%

(1) V_S = 5V.

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

ELECTRICAL CHARACTERISTICS: V_S = 2.7V to 5.5V (continued)

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.

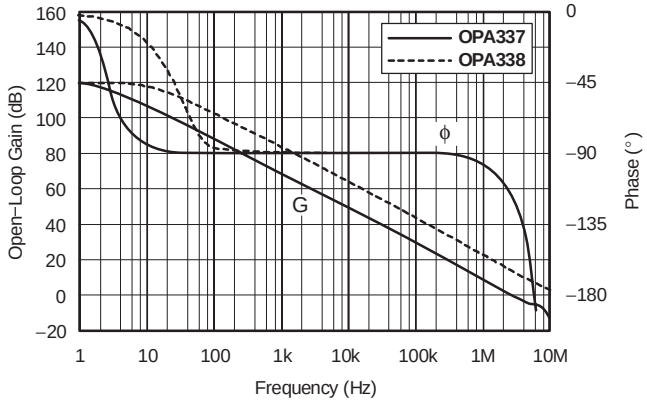
PARAMETER		CONDITION	OPA338, OPA2338			UNIT
			MIN	TYP(1)	MAX	
OUTPUT						
Voltage Output Swing from Rail(2)		R_L = 25kΩ, A_{OL} ≥ 100dB		40	125	mV
T_A = −40°C to +85°C		R_L = 25kΩ, A_{OL} ≥ 100dB			125	mV
		R_L = 5kΩ, A_{OL} ≥ 100dB		150	500	mV
T_A = −40°C to +85°C		R_L = 5kΩ, A_{OL} ≥ 100dB			500	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 Current (per amplifier)	I_Q	I_O = 0		0.525	1	mA
T_A = −40°C to +85°C		I_O = 0			1.2	mA
TEMPERATURE RANGE						
Specified Range			−40		+85	°C
Operating Range			−55		+125	°C
Storage Range			−55		+125	°C
Thermal Resistance	θ_{JA}					
SO-8 Surface-Mount				150		°C/W

(1) V_S = 5V.
(2) Output voltage swings are measured between the output and negative and positive power-supply rails.

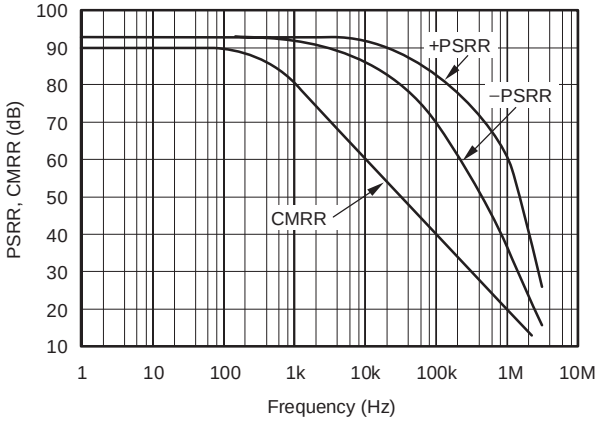
TYPICAL CHARACTERISTICS

At T_A = +25°C, V_S = +5V, and R_L = 25kΩ connected to V_S/2, unless otherwise noted.

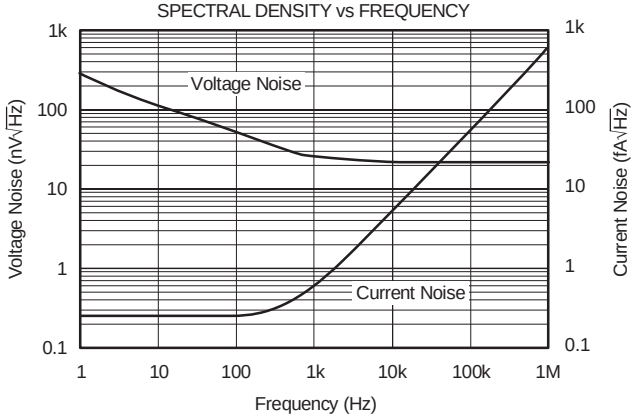
OPEN−LOOP GAIN/PHASE vs FREQUENCY



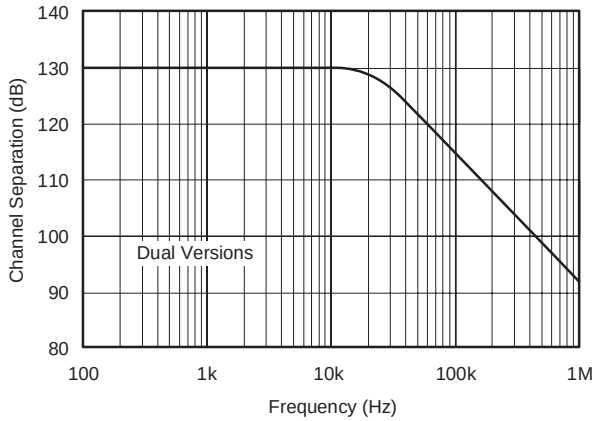
POWER−SUPPLY REJECTION RATIO AND COMMON−MODE REJECTION RATIO vs FREQUENCY



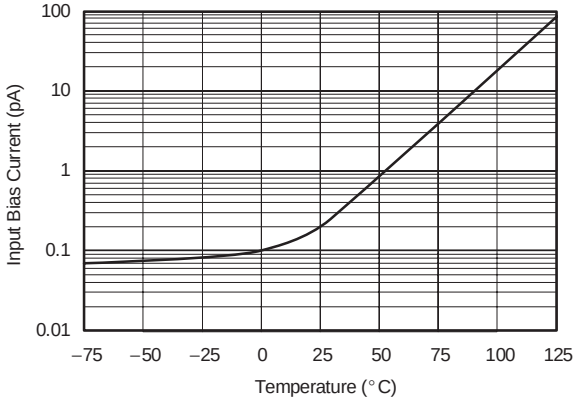
INPUT VOLTAGE AND CURRENT NOISE SPECTRAL DENSITY vs FREQUENCY



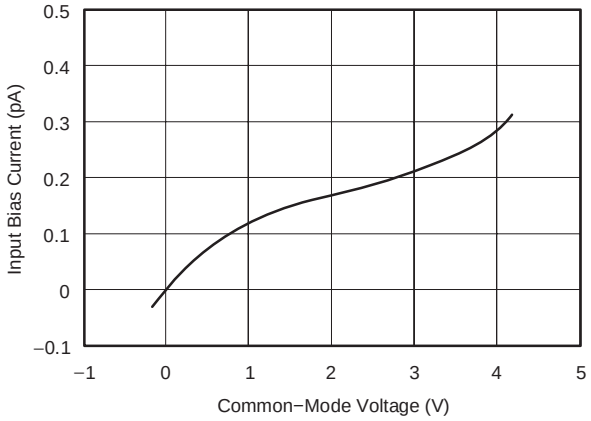
CHANNEL SEPARATION vs FREQUENCY



INPUT BIAS CURRENT vs TEMPERATURE



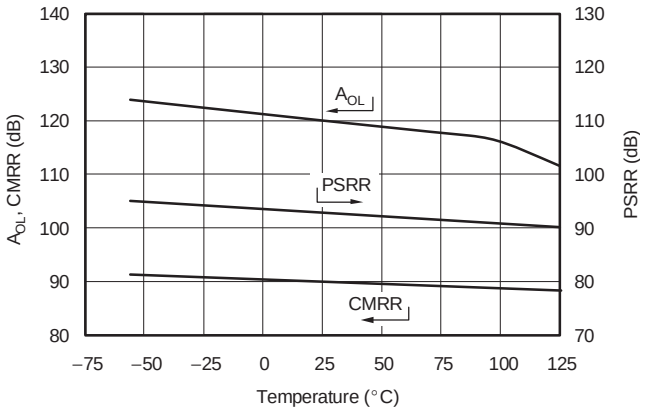
INPUT BIAS CURRENT vs INPUT COMMON−MODE VOLTAGE



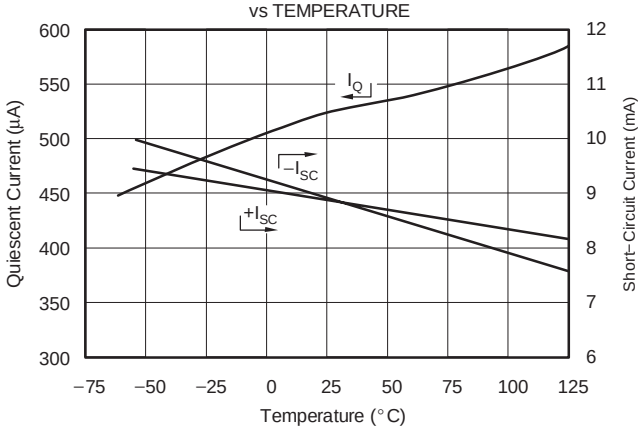
TYPICAL CHARACTERISTICS (continued)

At T_A = +25°C, V_S = +5V, and R_L = 25kΩ connected to V_S/2, unless otherwise noted.

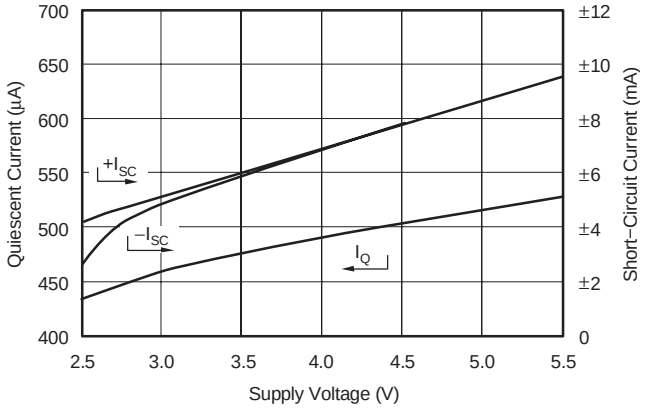
A_{OL}, CMRR, PSRR vs TEMPERATURE



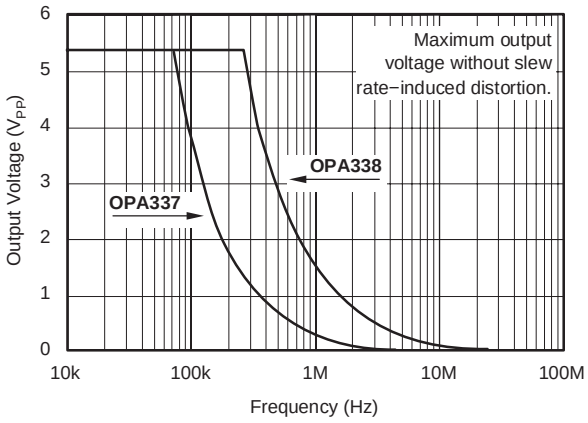
QUIESCENT CURRENT AND SHORT−CIRCUIT CURRENT vs TEMPERATURE



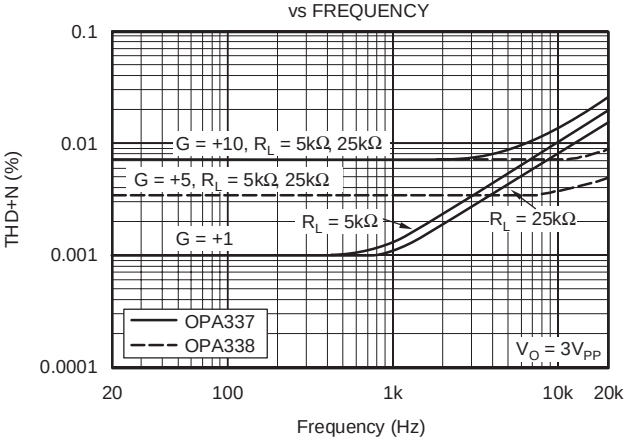
QUIESCENT AND SHORT−CIRCUIT CURRENT vs SUPPLY VOLTAGE



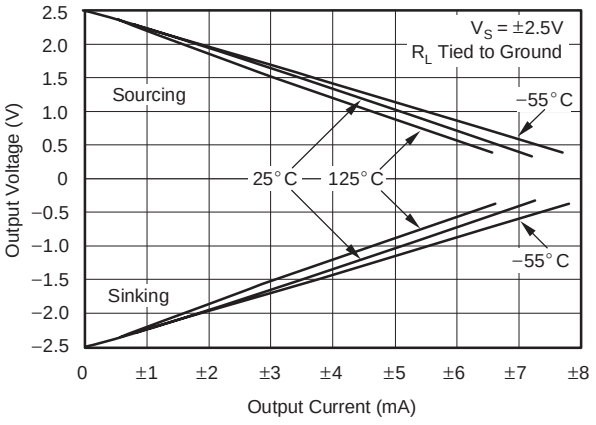
MAXIMUM OUTPUT VOLTAGE vs FREQUENCY



TOTAL HARMONIC DISTORTION + NOISE vs FREQUENCY



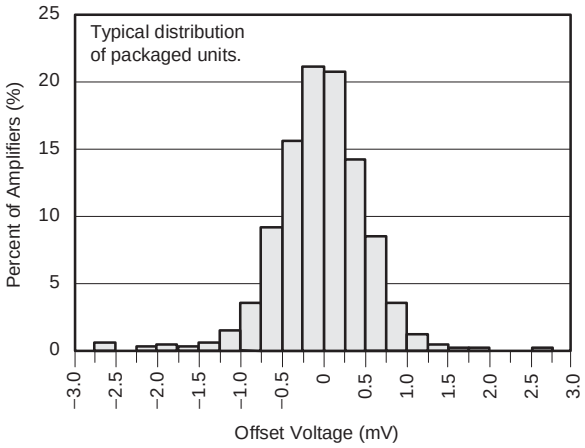
OUTPUT VOLTAGE SWING vs OUTPUT CURRENT



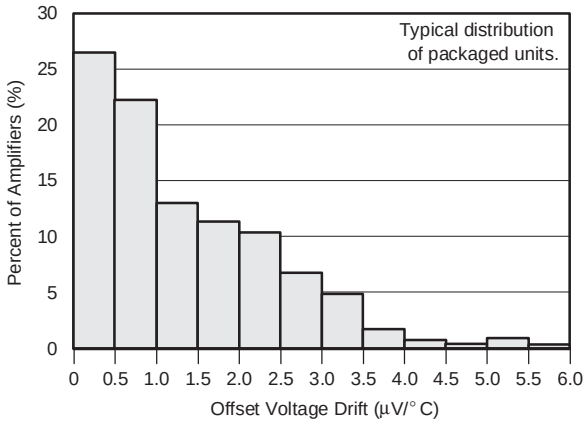
TYPICAL CHARACTERISTICS (continued)

At T_A = +25°C, V_S = +5V, and R_L = 25kΩ connected to V_S/2, unless otherwise noted.

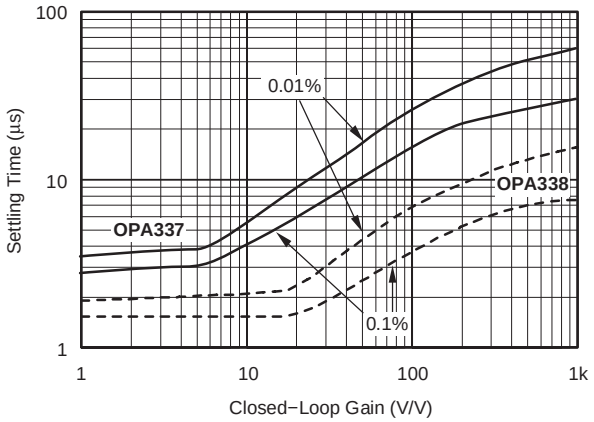
OFFSET VOLTAGE
PRODUCTION DISTRIBUTION



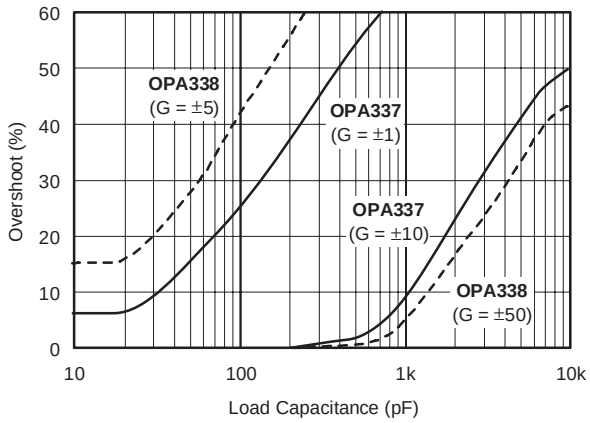
OFFSET VOLTAGE DRIFT
PRODUCTION DISTRIBUTION



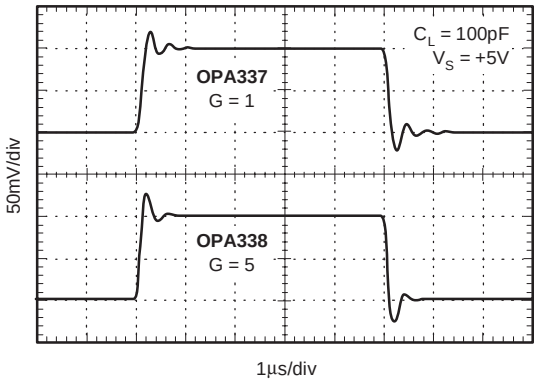
SETTLING TIME vs CLOSED−LOOP GAIN



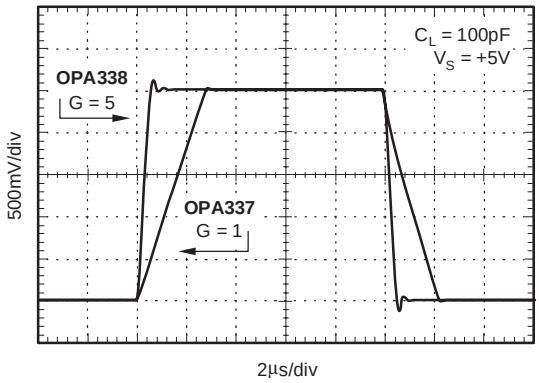
SMALL−SIGNAL OVERSHOOT vs LOAD CAPACITANCE



SMALL−SIGNAL STEP RESPONSE

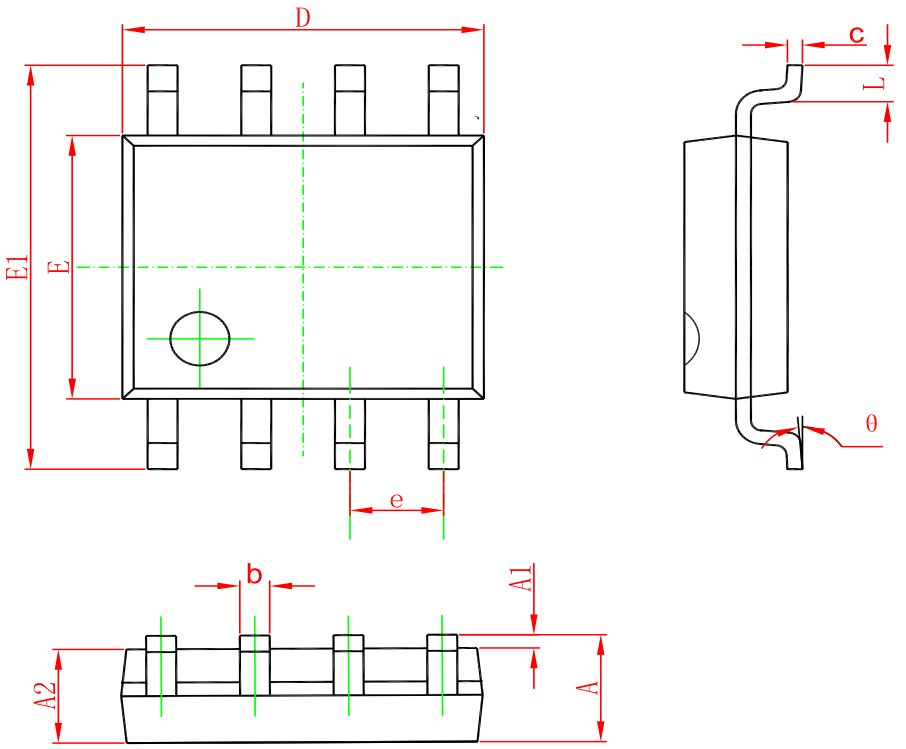


LARGE−SIGNAL STEP RESPONSE



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 OPA338NA	SOT23-5	3000	Tape and reel	A38 U
UMW OPA2338UA	SOP-8	2500	Tape and reel	OPA2338UA
UMW OPA338UA	SOP-8	2500	Tape and reel	OPA338UA

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