SGM8555/6
Single-Supply, Single Rail-to-Rail I/O Precision Operational Amplifiers

PRODUCT DESCRIPTION

The SGM8555/6 are rail-to-rail input and output precision operational amplifiers which have low input offset voltage, and bias current. They are guaranteed to operate from 2.5V to 5.5V single supply.

The rail-to-rail input and output swings provided by the SGM8555/6 make both high-side and low-side sensing easy. The combination of characteristics makes the SGM8555/6 good choices for temperature, position and pressure sensors, medical equipment and strain gauge amplifiers, or any other 2.5V to 5.5V application requiring precision and long term stability.

The single SGM8555 is available in the Green SOT-23-5, SOIC-8 and MSOP-8 packages. The dual SGM8556 is available in the Green SOIC-8 and MSOP-8 packages. They are specified for the extended industrial/automotive (-40℃ to +125℃) temperature range.

FEATURES

- **Low Offset Voltage: 90μV (MAX)**
- **Low Noise density: 21nV/$\sqrt{Hz}$ at 1kHz**
- **Low Voltage Noise: 0.6μV_{P-P} at 0.1Hz to 10Hz**
- **3.5MHz GBP**
- **Slew Rate is 3V/μs**
- **Rail-to-Rail Input and Output Swing**
- **2.5V to 5.5V Single Supply Operation**
- **Voltage Gain: 133dB (TYP) at +5V**
- **High PSRR: 96dB (TYP)**
- **High CMRR: 98dB (TYP)**
- **Ultra Low Input Bias Current: 30pA**
- **Low Supply Current: 950μA/Amplifier (TYP)**
- **Overload Recovery Time: 40μs (at V_S = +5V)**
- **No External Capacitors Required**
- **-40℃ to +125℃ Operating Temperature Range**
- **Small Packaging:**
  SGM8555 Available in Green SOT-23-5, SOIC-8 and MSOP-8
  SGM8556 Available in Green SOIC-8 and MSOP-8

APPLICATIONS

Temperature Measurements
Pressure Sensors
Precision Current Sensing
Electronic Scales
Strain Gauge Amplifiers
Medical Instrumentation
Thermocouple Amplifiers
Handheld Test Equipment

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8555	SOT-23-5	-40℃ to +125℃	SGM8555XN5G/TR	S05XX	Tape and Reel, 3000
	MSOP-8	-40℃ to +125℃	SGM8555XMS8G/TR	SGM8555 XMS8 XXXXX	Tape and Reel, 4000
	SOIC-8	-40℃ to +125℃	SGM8555XS8G/TR	SGM8555XS8 XXXXX	Tape and Reel, 2500
SGM8556	MSOP-8	-40℃ to +125℃	SGM8556XMS8G/TR	SGM8556 XMS8 XXXXX	Tape and Reel, 4000
	SOIC-8	-40℃ to +125℃	SGM8556XS8G/TR	SGM8556XS8 XXXXX	Tape and Reel, 2500

NOTE: **XX** = Date Code. **XXXXX** = Date Code and Vendor Code.

MARKING INFORMATION

S05 X X

- Date code - Month ("A" = Jan. "B" = Feb. ⋯ "L" = Dec.)
- Date code - Year ("A" = 2010, "B" = 2011 ⋯)
- Chip I.D.

For example: S05CA (2012, January)

Green (RoHS & HSF)

SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage 6V
Input Voltage ..... $-V_S$ to $(+V_S)$ + 0.1V
Differential Input Voltage ..... -5V to 5V
Storage Temperature Range ..... -65℃ to +150℃
Junction Temperature ..... 150℃
Lead Temperature (Soldering 10 sec) ..... 260℃
ESD Susceptibility
HBM 8000V
MM 400V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range ..... 2.5V to 5.5V
Operating Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ESD SENSITIVITY CAUTION

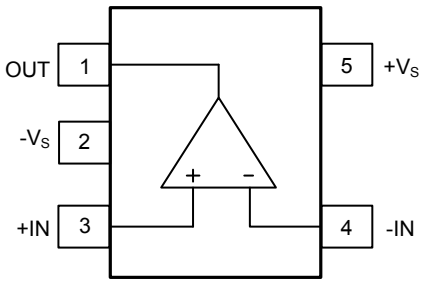
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

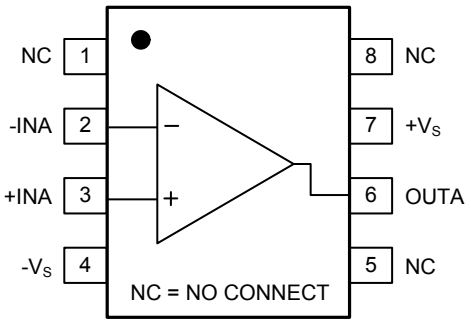
PIN CONFIGURATIONS

SGM8555 (TOP VIEW)



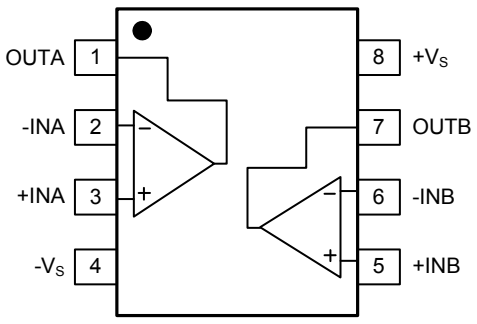
SOT-23-5

SGM8555 (TOP VIEW)



SOIC-8/MSOP-8

SGM8556 (TOP VIEW)



SOIC-8/MSOP-8

ELECTRICAL CHARACTERISTICS

(V_S = +5V, V_{CM} = +2.5V, V_O = +2.5V, T_A = +25℃, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		32	90	μV
		-40℃ ≤ T_A ≤ +125℃			150	
Input Bias Current (I_B)				30		pA
Input Offset Current (I_{OS})				30		pA
Input Voltage Range			0		5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to V_S	90	98		dB
		-40℃ ≤ T_A ≤ +125℃	79			
Open-Loop Voltage Gain (A_{OL})		V_{CM} = V_S/2, R_L = 10kΩ	109	133		dB
		-40℃ ≤ T_A ≤ +125℃	106			
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta_T$)		-40℃ ≤ T_A ≤ +125℃		50		nV/℃
OUTPUT CHARACTERISTICS						
Output Voltage High (V_{OH})		V_{CM} = V_S/2, R_L = 10kΩ to GND		13	19	mV
		-40℃ ≤ T_A ≤ +125℃			26	
Output Voltage Low (V_{OL})		V_{CM} = V_S/2, R_L = 10kΩ to V_S		11	19	mV
		-40℃ ≤ T_A ≤ +125℃			26	
Short Circuit Current	I_{SOURCE}	V_{CM} = V_S/2, R_L =10Ω to V_S/2	31	50		mA
		-40℃ ≤ T_A ≤ +125℃	22			
	I_{SINK}	V_{CM} = V_S/2, R_L =10Ω to V_S/2	38	61		mA
		-40℃ ≤ T_A ≤ +125℃	22			
POWER SUPPLY						
Power Supply Rejection Ratio (1) (PSRR)		V_S = 2.5V to 5.5V, V_{CM} = V_S/2	87	96		dB
		-40℃ ≤ T_A ≤ +125℃	84			
Quiescent Current/Amplifier (I_Q)		V_{CM} = 0.5V, I_O = 0mA		950	1300	μA
		-40℃ ≤ T_A ≤ +125℃			1650	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		A_V = +100, R_F = 10kΩ, R_G = 100Ω, V_{CM} = V_S/2		3.5		MHz
Phase Margin		A_V = +100, R_F = 10kΩ, R_G = 100Ω, V_{CM} = V_S/2		64		°
Gain Margin		A_V = +100, R_F = 10kΩ, R_G = 100Ω, V_{CM} = V_S/2		-13		dB
Slew Rate (SR)	UP	A_V = +1, R_L = 10kΩ, C_L = 100pF, 2V Output Step		3		V/μs
	DOWN			3.5		
Overload Recovery Time	UP	V_{IN} × Gain = V_S, R_F = 10kΩ, R_G = 100Ω, R_L = 10kΩ, A_V = -100, V_{IN} = 200mV		40		μs
	DOWN			36		
NOISE PERFORMANCE						
Voltage Noise (e_n p-p)		0.1Hz to 10Hz		0.6		μV_{P-P}
Voltage Noise Density (e_n)		f = 1kHz, V_{CM} = V_S/2		21		$nV/\sqrt{Hz}$
		f = 12kHz, V_{CM} = V_S/2		10		

NOTE 1: PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

ELECTRICAL CHARACTERISTICS

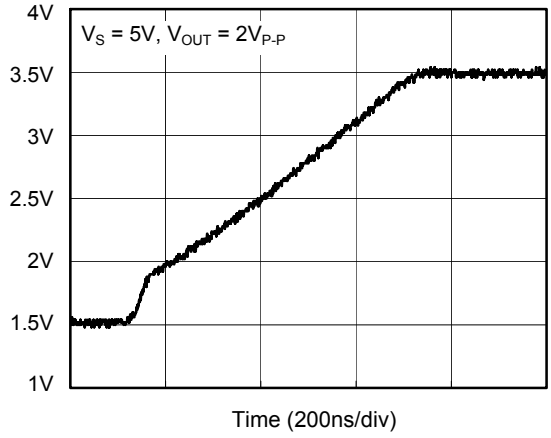
(V_S = +2.5V, V_{CM} = +1.25V, V_O = +1.25V, T_A = +25℃, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		5	30	μV
		-40℃ ≤ T_A ≤ +125℃			110	
Input Bias Current (I_B)				30		pA
Input Offset Current (I_{OS})				30		pA
Input Voltage Range			0		2.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to V_S	86	94		dB
		-40℃ ≤ T_A ≤ +125℃	73			
Open-Loop Voltage Gain (A_{OL})		V_{CM} = V_S/2, R_L = 10kΩ	108	130		dB
		-40℃ ≤ T_A ≤ +125℃	105			
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta_T$)		-40℃ ≤ T_A ≤ +125℃		50		nV/℃
OUTPUT CHARACTERISTICS						
Output Voltage High (V_{OH})		V_{CM} = V_S/2, R_L = 10kΩ to GND		6.5	12	mV
		-40℃ ≤ T_A ≤ +125℃			15	
Output Voltage Low (V_{OL})		V_{CM} = V_S/2, R_L = 10kΩ to V_S		6.5	13	mV
		-40℃ ≤ T_A ≤ +125℃			16	
Short Circuit Current	I_{SOURCE}	V_{CM} = V_S/2, R_L =10Ω to V_S/2	20	30		mA
		-40℃ ≤ T_A ≤ +125℃	15			
	I_{SINK}	V_{CM} = V_S/2, R_L =10Ω to V_S/2	28	39		mA
		-40℃ ≤ T_A ≤ +125℃	17			
POWER SUPPLY						
Power Supply Rejection Ratio (1) (PSRR)		V_S = 2.5V to 5.5V, V_{CM} = V_S/2	87	96		dB
		-40℃ ≤ T_A ≤ +125℃	84			
Quiescent Current/Amplifier (I_Q)		V_{CM} = 0.5V, I_O = 0mA		950	1300	μA
		-40℃ ≤ T_A ≤ +125℃			1650	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		A_V = +100, R_F = 10kΩ, R_G = 100Ω, V_{CM} = V_S/2		4.5		MHz
Phase Margin		A_V = +100, R_F = 10kΩ, R_G = 100Ω, V_{CM} = V_S/2		59		°
Gain Margin		A_V = +100, R_F = 10kΩ, R_G = 100Ω, V_{CM} = V_S/2		-11		dB
Slew Rate (SR)	UP	A_V = +1, R_L = 10kΩ, C_L = 100pF, 2V Output Step		3		V/μs
	DOWN			3.5		
Overload Recovery Time	UP	V_{IN} × Gain = V_S, R_F = 10kΩ, R_G = 100Ω, R_L = 10kΩ, A_V = -100, V_{IN} = 200mV		12		μs
	DOWN			12		
NOISE PERFORMANCE						
Voltage Noise (e_n p-p)		0.1Hz to 10Hz		0.75		μV_{P-P}
Voltage Noise Density (e_n)		f = 1kHz, V_{CM} = V_S/2		32		$nV/\sqrt{Hz}$
		f = 12kHz, V_{CM} = V_S/2		15		

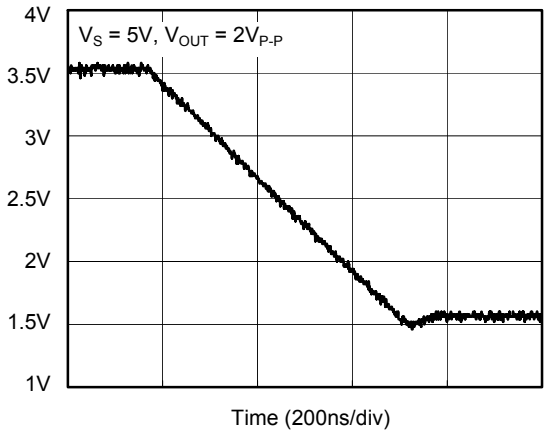
NOTE 1: PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

TYPICAL PERFORMANCE CHARACTERISTICS

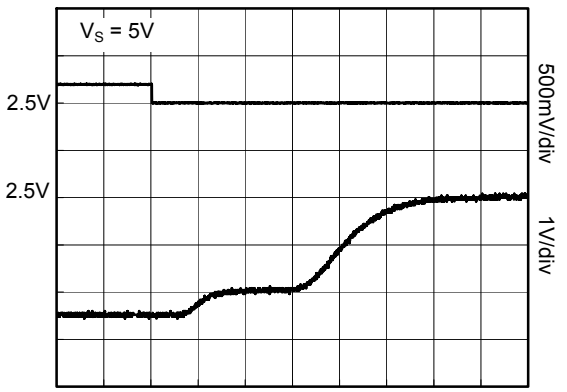
Slew Rate (UP)



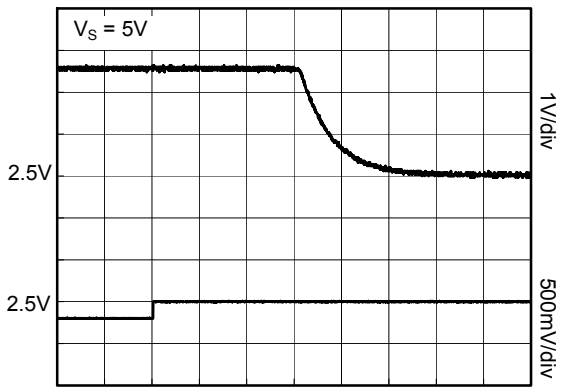
Slew Rate (DOWN)



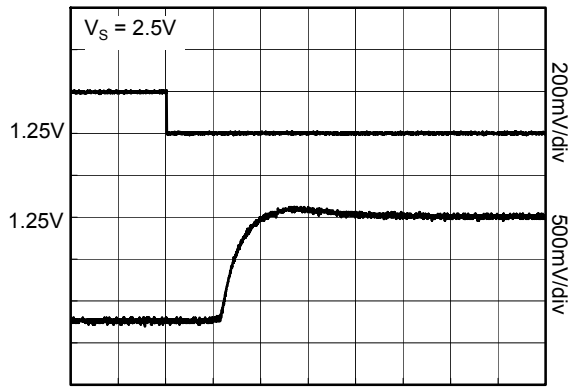
Overload Recovery Time (UP)



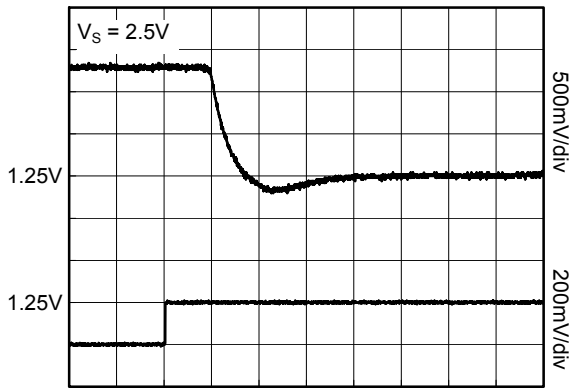
Overload Recovery Time (DOWN)



Overload Recovery Time (UP)

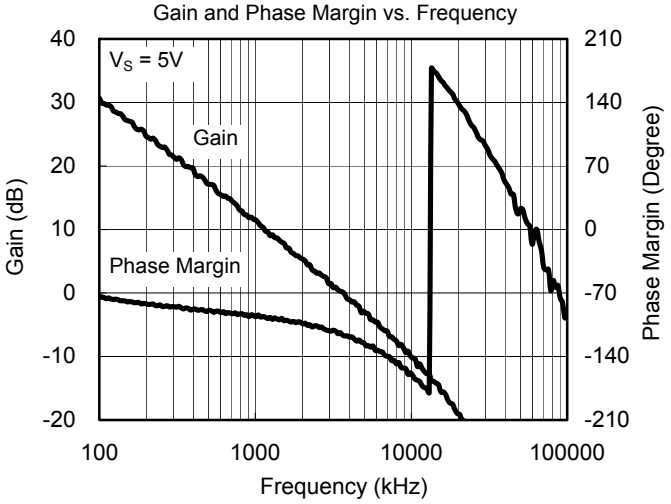


Overload Recovery Time (DOWN)

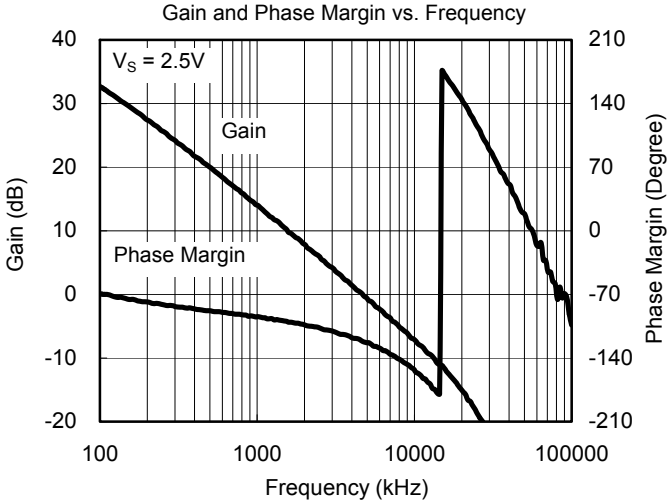


TYPICAL PERFORMANCE CHARACTERISTICS

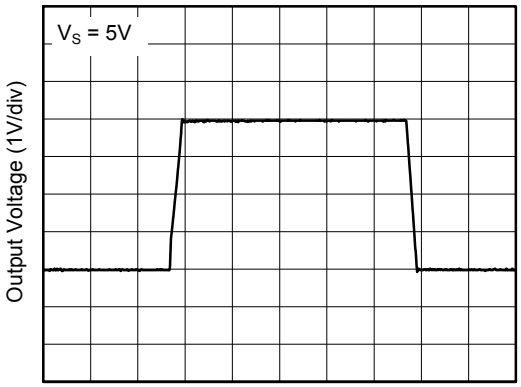
Gain and Phase Margin vs. Frequency



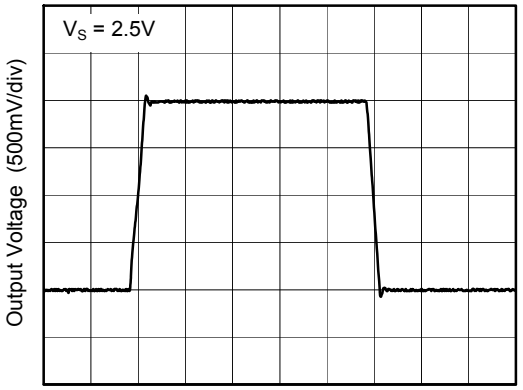
Gain and Phase Margin vs. Frequency



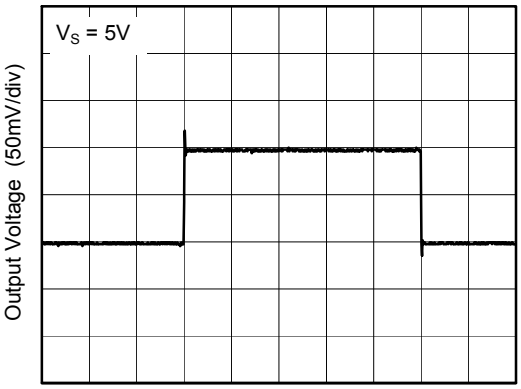
Large Signal Transient Response



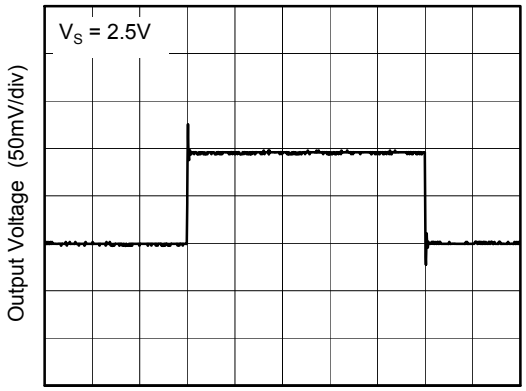
Large Signal Transient Response



Small Signal Transient Response

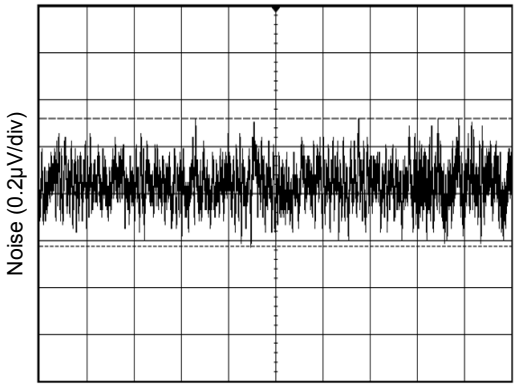


Small Signal Transient Response

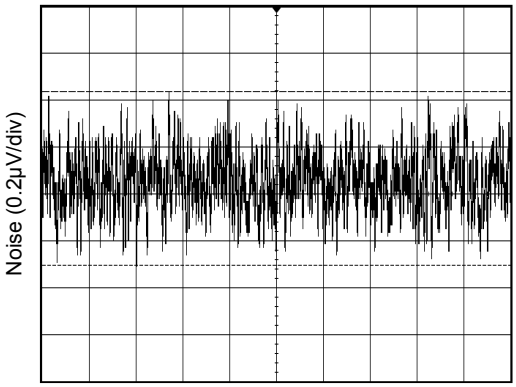


TYPICAL PERFORMANCE CHARACTERISTICS

0.1Hz to 10Hz Noise at 5V

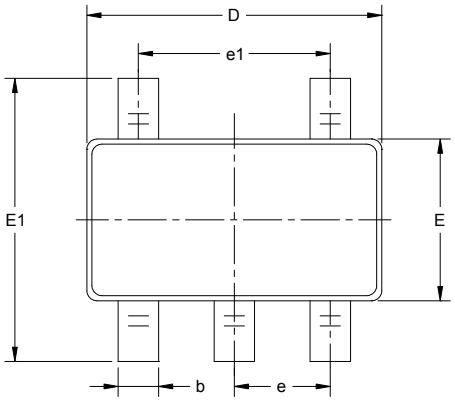


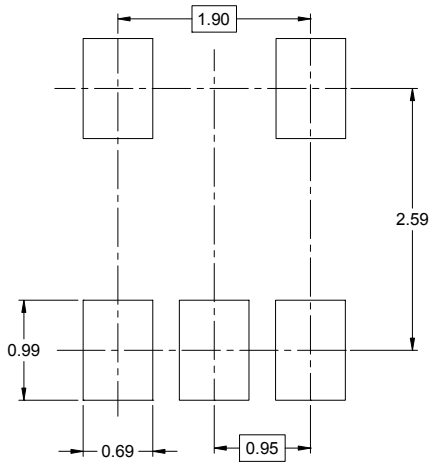
0.1Hz to 10Hz Noise at 2.5V



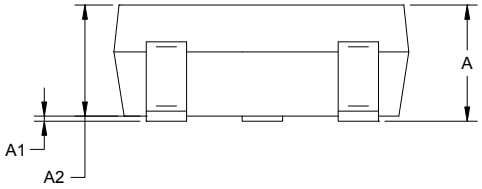
PACKAGE OUTLINE DIMENSIONS

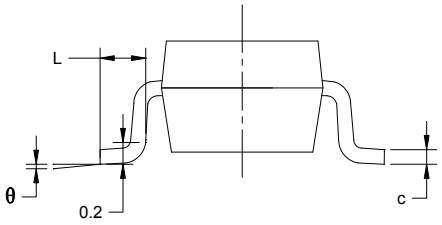
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)

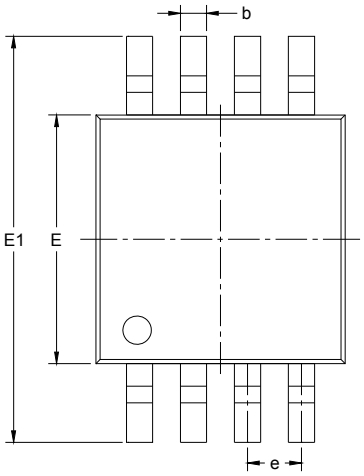


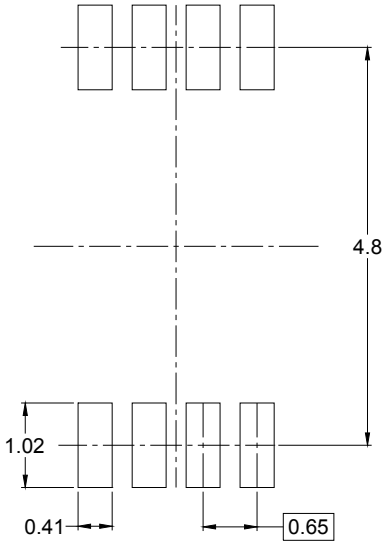


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

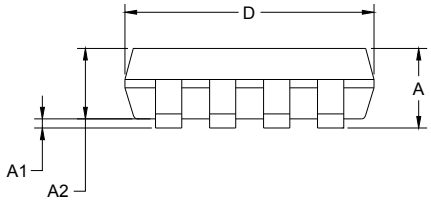
PACKAGE OUTLINE DIMENSIONS

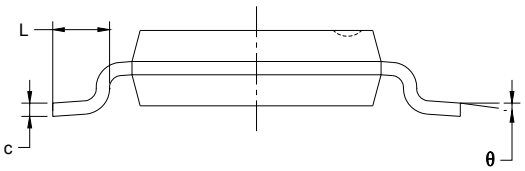
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

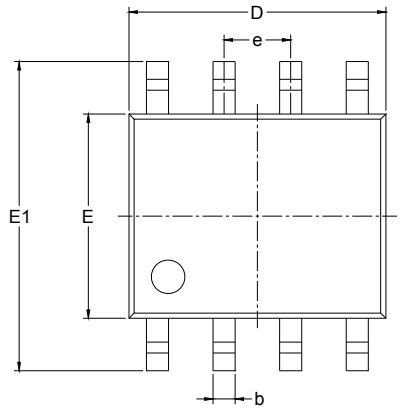


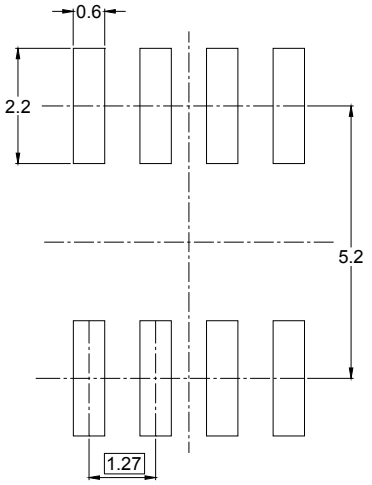


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

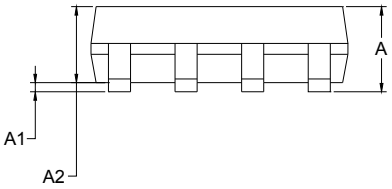
PACKAGE OUTLINE DIMENSIONS

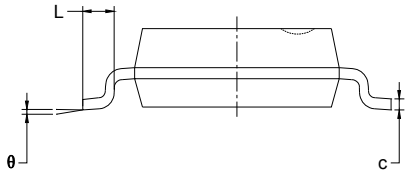
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)

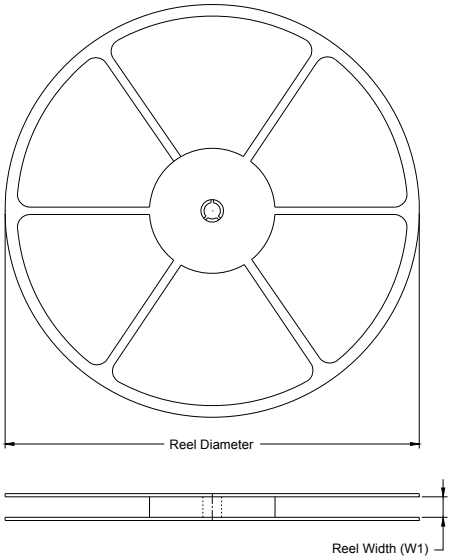




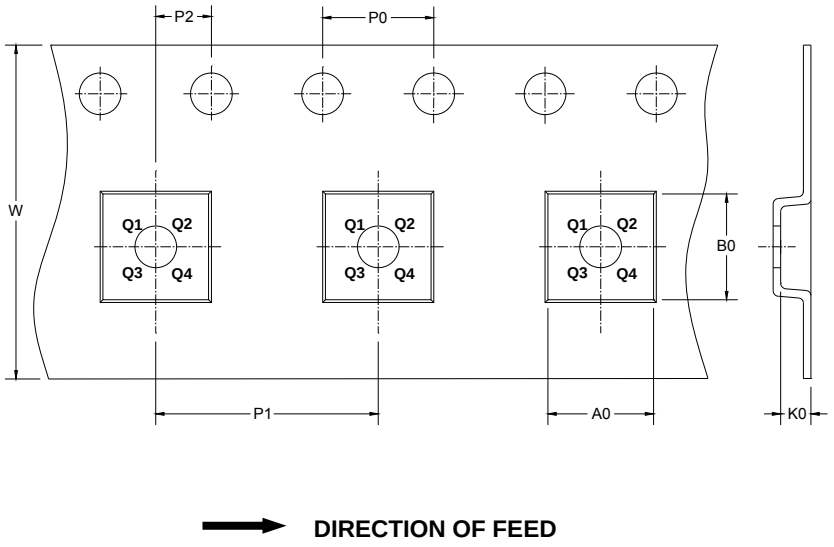
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



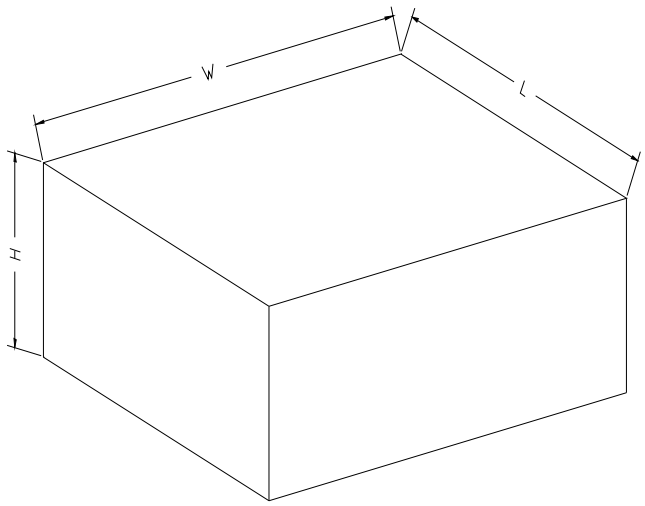
NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-23-5	7″	9.5	3.2	3.2	1.4	4.0	4.0	2.0	8.0	Q3
MSOP-8	13″	12.4	5.2	3.3	1.5	4.0	8.0	2.0	12.0	Q1
SOIC-8	13″	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1

DD0001

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18
13″	386	280	370	5

DD0002