SGMOP17C
1.5MHz, High Voltage, High Precision, Low Noise Rail-to-Rail Output Operational Amplifier

GENERAL DESCRIPTION

The SGMOP17C is a single, low noise and high precision operational amplifier optimized for high voltage operation from 4.5V to 36V single supply. The device provides rail-to-rail output operation.

The SGMOP17C offers a low offset voltage less than 120μV and a low bias current. The combination of characteristics makes the SGMOP17C a good choice for temperature measurements, pressure and position sensors, strain gauge amplifiers and medical instrumentation, or any other 4.5V to 36V applications requiring precision and long-term stability.

The single SGMOP17C is available in a Green SOIC-8 package. It is specified over the extended -40℃ to +125℃ temperature range.

FEATURES

- **Low Offset Voltage: 120μV (MAX)**
- **Open-Loop Voltage Gain: 135dB (TYP)**
- **PSRR: 145dB (TYP)**
- **CMRR: 125dB (TYP)**
- **0.1Hz to 10Hz Noise: 1μV_{P-P}**
- **Input Voltage Noise Density: 56nV/$\sqrt{Hz}$ at 1kHz**
- **Gain-Bandwidth Product: 1.5MHz**
- **Overload Recovery Time: 3μs (TYP)**
- **Rail-to-Rail Output Swing**
- **Supply Voltage Range: 4.5V to 36V**
- **Low Supply Current: 480μA (TYP)**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SOIC-8 Package**

APPLICATIONS

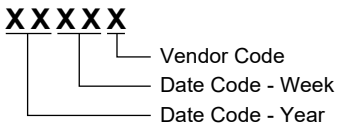
Pressure Sensors
Temperature Measurements
Precision Current Sensing
Electronic Scales
Strain Gauge Amplifiers
Handheld Test Equipment
Thermocouple Amplifiers
Medical Instrumentation

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGMOP17C	SOIC-8	-40℃ to +125℃	SGMOP17CXS8G/TR	SGM OP17CXS8 XXXXX	Tape and Reel, 2500

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.



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 40V
Input Voltage Range ..... ($-V_S$) - 0.3V to ($+V_S$) + 0.3V
Differential Input Voltage Range ..... -15V to 15V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
MM 300V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Voltage Range ..... 4.5V to 36V
Operating Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

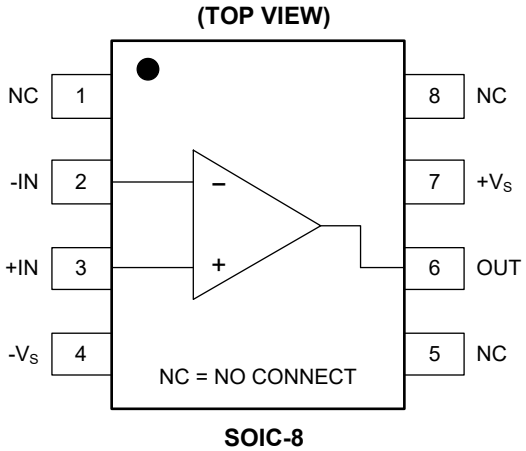
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. 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 even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATION



SOIC-8

ELECTRICAL CHARACTERISTICS

(At T_A = +25℃, V_S = 5V, V_{CM} = 2.5V, V_{OUT} = 2.5V, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage (V_{OS})			+25℃		25	120	μV
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			Full		0.3		μV/℃
Input Bias Current (I_B)			+25℃		100		pA
Input Offset Current (I_{OS})			+25℃		100		pA
Input Voltage Range			Full	0		3.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0.1V to 3.5V	+25℃	99	125		dB
			Full	97			
Large-Signal Voltage Gain (A_{VO})		R_L = 10kΩ, V_{OUT} = 0.3V to 4.7V	+25℃	110	135		dB
			Full	108			
Output Characteristics							
Output Voltage High (V_{OH})		R_L = 10kΩ to 0V	+25℃		75	95	mV
			Full			100	
Output Voltage Low (V_{OL})		R_L = 10kΩ to 5V	+25℃		60	75	mV
			Full			80	
Short-Circuit Limit	I_{SOURCE}	V_{OUT} = 2.5V, R_L =10Ω to 0V	+25℃	4.6	8.5		mA
			Full	3.5			
	I_{SINK}	V_{OUT} = 2.5V, R_L =10Ω to 5V	+25℃	3.9	10		
			Full	2.9			
Power Supply							
Quiescent Current (I_Q)		V_{OUT} = 2.5V	+25℃		450	600	μA
			Full			790	
Power Supply Rejection Ratio (1) (PSRR)		V_S = 4.5V to 36V	+25℃	117	145		dB
			Full	115			
Dynamic Performance							
Gain-Bandwidth Product (GBP)		A_V = +100	+25℃		1.5		MHz
Slew Rate (SR)		A_V = +1, R_L = 10kΩ, 2V output step	+25℃		1.7		V/μs
Overload Recovery Time		A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to 0V)	+25℃		3		μs
Total Harmonic Distortion + Noise (THD+N)		f = 1kHz, A_V = +1, V_{OUT} = $2V_{p-p}$	+25℃		0.0006		%
Noise							
Input Voltage Noise		f = 0.1Hz to 10Hz	+25℃		1		μV_{P-P}
Input Voltage Noise Density (e_n)		f = 0.1kHz	+25℃		56		$nV/\sqrt{Hz}$
		f = 1kHz	+25℃		56		
		f = 12kHz	+25℃		22		

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

ELECTRICAL CHARACTERISTICS (continued)

(At T_A = +25℃, V_S = 30V, V_{CM} = 15V, V_{OUT} = 15V, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage (V_{OS})			+25℃		25	120	μV
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			Full		0.3		μV/℃
Input Bias Current (I_B)			+25℃		100		pA
Input Offset Current (I_{OS})			+25℃		100		pA
Input Voltage Range			Full	0		28.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0.1V to 28.5V	+25℃	112	140		dB
			Full	106			
Large-Signal Voltage Gain (A_{VO})		R_L = 10kΩ, V_{OUT} = 0.3V to 29.7V	+25℃	119	145		dB
			Full	117			
Output Characteristics							
Output Voltage High (V_{OH})		R_L = 10kΩ to 0V	+25℃		425	505	mV
			Full			555	
Output Voltage Low (V_{OL})		R_L = 10kΩ to 30V	+25℃		360	430	mV
			Full			455	
Short-Circuit Limit	I_{SOURCE}	V_{OUT} = 15V, R_L =10Ω to 0V	+25℃	23	43		mA
	I_{SINK}	V_{OUT} = 15V, R_L =10Ω to 30V	+25℃	25	48		
Power Supply							
Quiescent Current (I_Q)		V_{OUT} = 15V	+25℃		465	620	μA
			Full			800	
Power Supply Rejection Ratio (1) (PSRR)		V_S = 4.5V to 36V	+25℃	117	145		dB
			Full	115			
Dynamic Performance							
Gain-Bandwidth Product (GBP)		A_V = +100	+25℃		1.5		MHz
Slew Rate (SR)		A_V = +1, R_L = 10kΩ, 2V output step	+25℃		1.8		V/μs
Overload Recovery Time		A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to 0V)	+25℃		2		μs
Total Harmonic Distortion + Noise (THD+N)		f = 1kHz, A_V = +1, V_{OUT} = $2V_{p-p}$	+25℃		0.0006		%
Noise							
Input Voltage Noise		f = 0.1Hz to 10Hz	+25℃		1		μV_{P-P}
Input Voltage Noise Density (e_n)		f = 0.1kHz	+25℃		60		$nV/\sqrt{Hz}$
		f = 1kHz	+25℃		60		
		f = 12kHz	+25℃		22		

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

ELECTRICAL CHARACTERISTICS (continued)

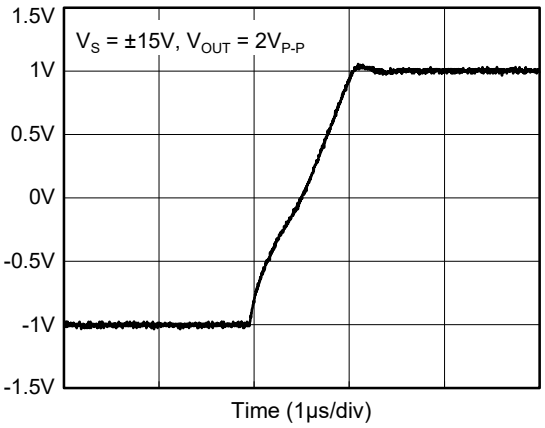
(At T_A = +25℃, V_S = 36V, V_{CM} = 18V, V_{OUT} = 18V, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage (V_{OS})			+25℃		25	120	μV
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			Full		0.3		μV/℃
Input Bias Current (I_B)			+25℃		100		pA
Input Offset Current (I_{OS})			+25℃		100		pA
Input Voltage Range			Full	0		34.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0.1V to 34.5V	+25℃	105	130		dB
			Full	96			
Large-Signal Voltage Gain (A_{VO})		R_L = 10kΩ, V_{OUT} = 0.3V to 35.7V	+25℃	116	150		dB
			Full	114			
Output Characteristics							
Output Voltage High (V_{OH})		R_L = 10kΩ to 0V	+25℃		515	610	mV
			Full			675	
Output Voltage Low (V_{OL})		R_L = 10kΩ to 36V	+25℃		435	515	mV
			Full			545	
Short-Circuit Limit	I_{SOURCE}	V_{OUT} = 15V, R_L =10Ω to 0V	+25℃	25	47		mA
	I_{SINK}	V_{OUT} = 15V, R_L =10Ω to 36V	+25℃	26	51		
Power Supply							
Quiescent Current (I_Q)		V_{OUT} = 18V	+25℃		480	640	μA
			Full			820	
Power Supply Rejection Ratio (1) (PSRR)		V_S = 4.5V to 36V	+25℃	117	145		dB
			Full	115			
Dynamic Performance							
Gain-Bandwidth Product (GBP)		A_V = +100	+25℃		1.5		MHz
Slew Rate (SR)		A_V = +1, R_L = 10kΩ, 2V output step	+25℃		1.7		V/μs
Overload Recovery Time		A_V = -100, R_L = 10kΩ, V_{IN} = 200mV (RET to 0V)	+25℃		2		μs
Total Harmonic Distortion + Noise (THD+N)		f = 1kHz, A_V = +1, V_{OUT} = $2V_{p-p}$	+25℃		0.0006		%
Noise							
Input Voltage Noise		f = 0.1Hz to 10Hz	+25℃		1		μV_{P-P}
Input Voltage Noise Density (e_n)		f = 0.1kHz	+25℃		60		$nV/\sqrt{Hz}$
		f = 1kHz	+25℃		60		
		f = 12kHz	+25℃		22		

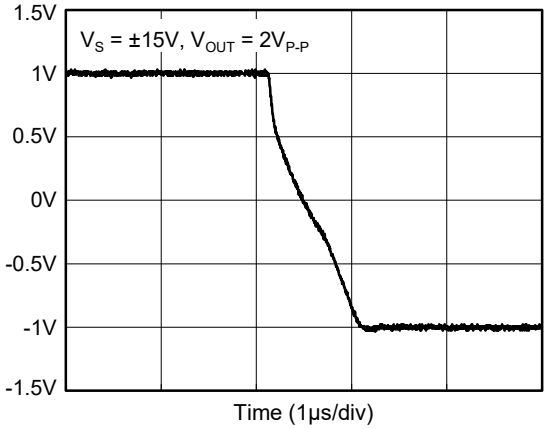
NOTE: 1. PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

TYPICAL PERFORMANCE CHARACTERISTICS

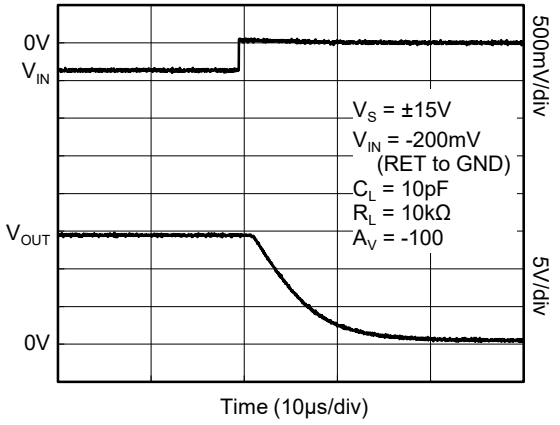
Slew Rate (Up)



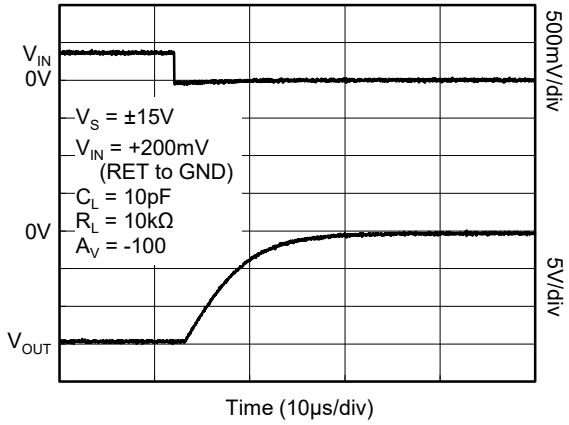
Slew Rate (Down)



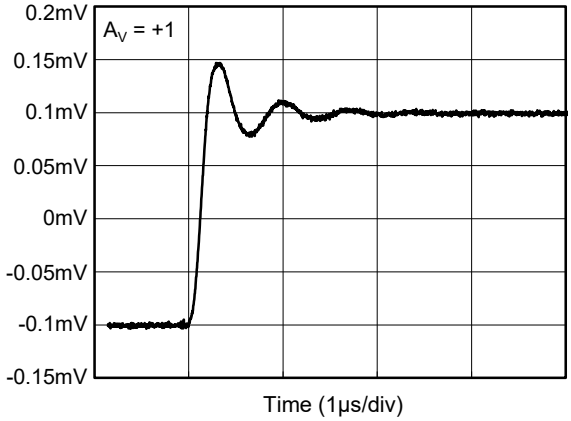
Positive Overload Recovery Time



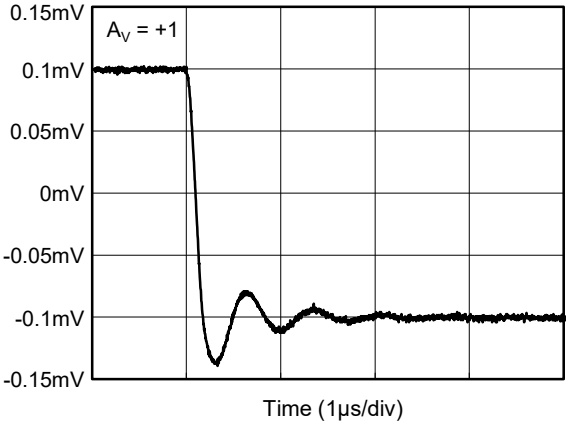
Negative Overload Recovery Time



Positive Settling Time

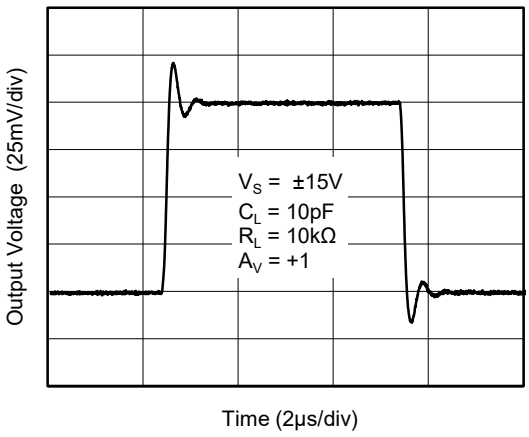


Negative Settling Time

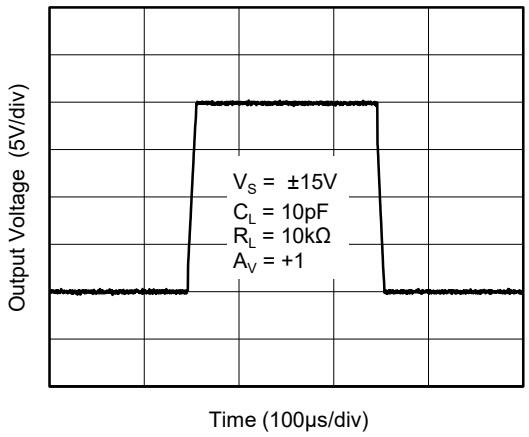


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

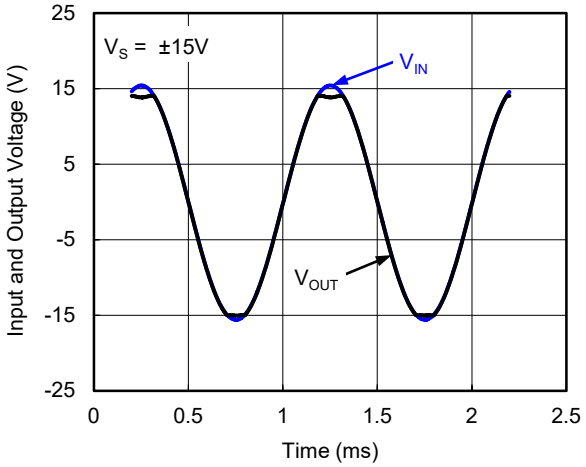
Small-Signal Step Response



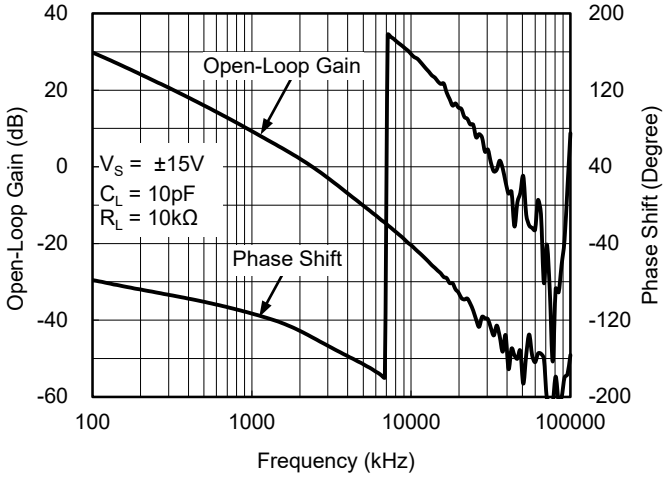
Large-Signal Step Response



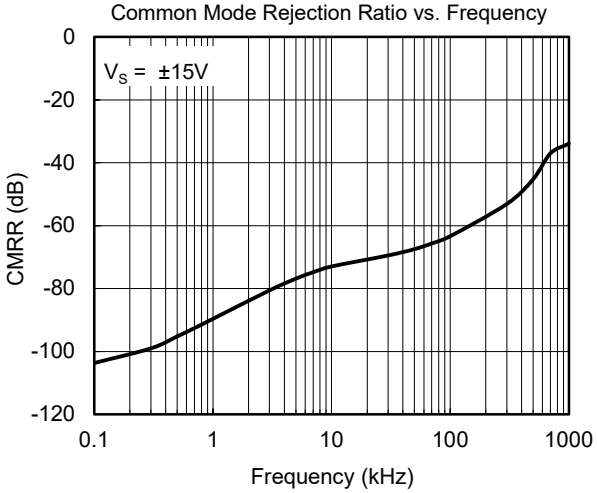
No Phase Reversal



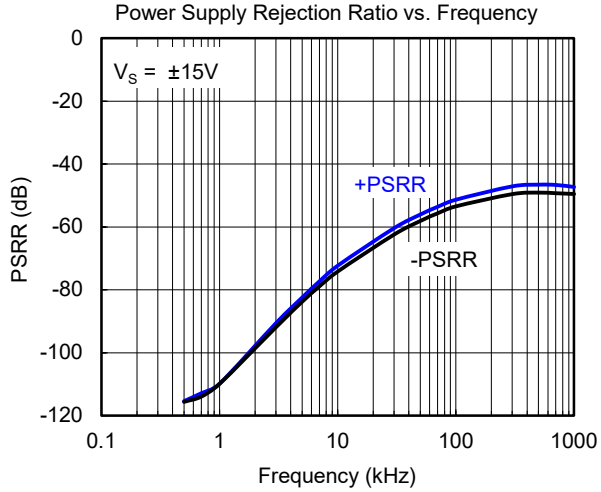
Open-Loop Gain and Phase Shift vs. Frequency



Common Mode Rejection Ratio vs. Frequency

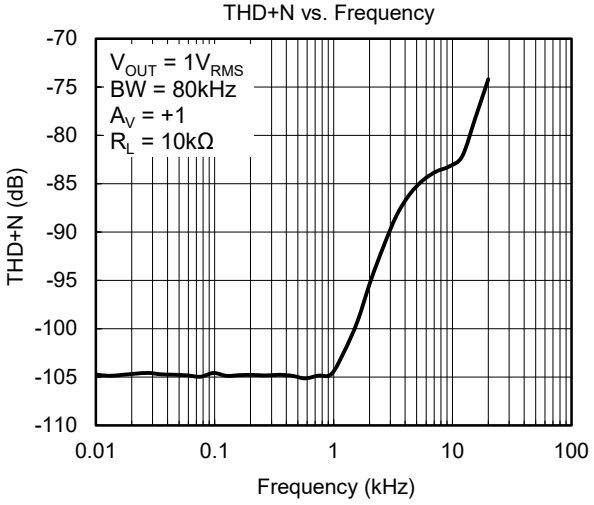


Power Supply Rejection Ratio vs. Frequency

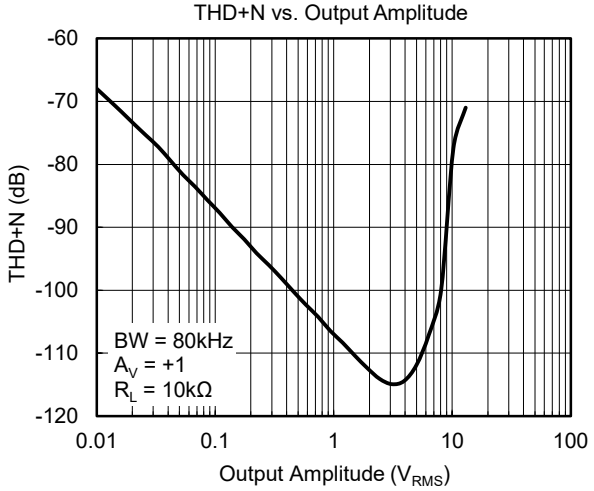


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

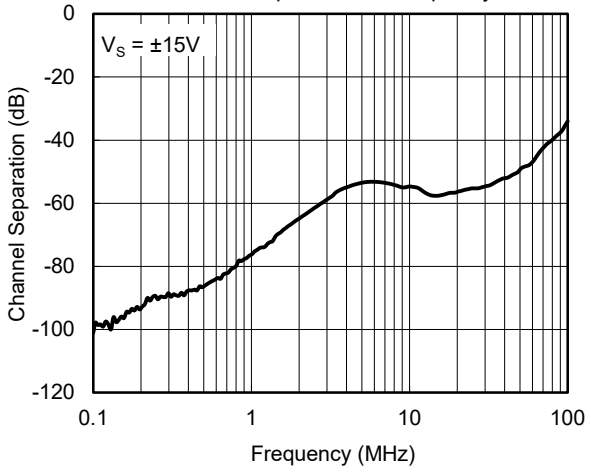
THD+N vs. Frequency



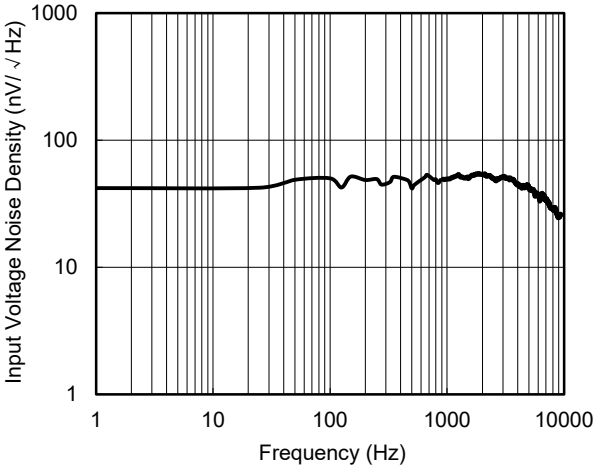
THD+N vs. Output Amplitude



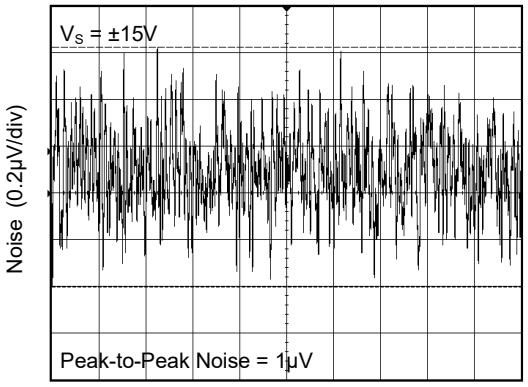
Channel Separation vs. Frequency



Input Voltage Noise Density vs. Frequency



0.1Hz to 10Hz Noise



REVISION HISTORY

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

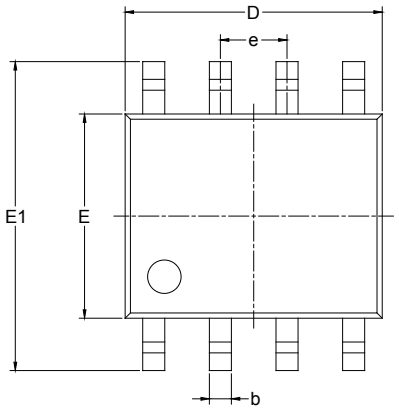
SEPTEMBER 2019 – REV.A.1 to REV.A.2	Page
Changed Electrical Characteristics section	5

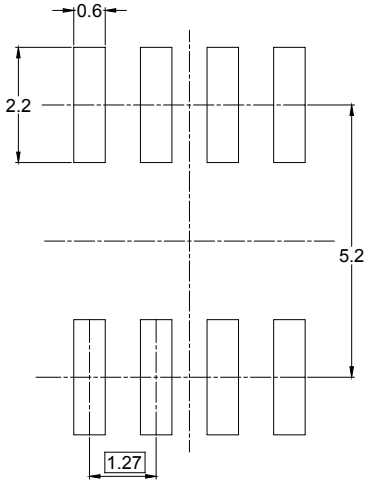
JULY 2016 – REV.A to REV.A.1	Page
Changed V_{OS}	3~5

Changes from Original (MARCH 2016) to REV.A	Page
Changed from product preview to production data	All

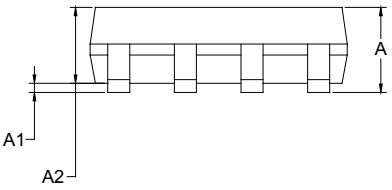
PACKAGE OUTLINE DIMENSIONS

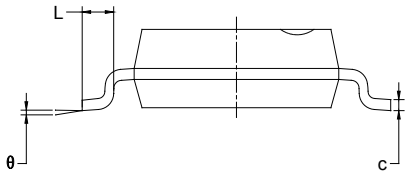
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)

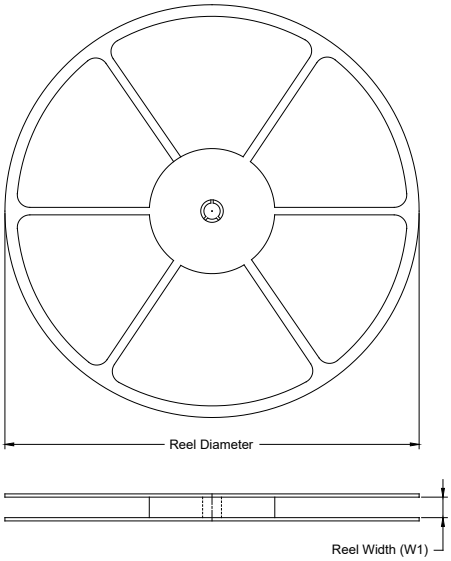




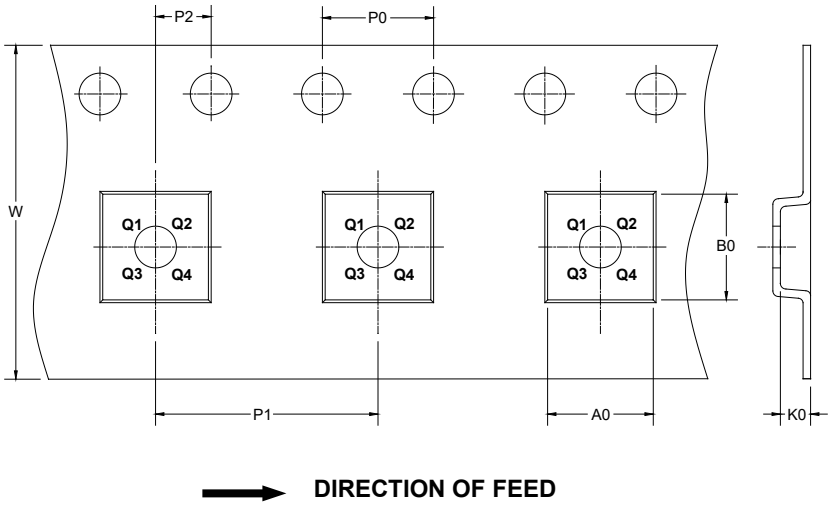
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

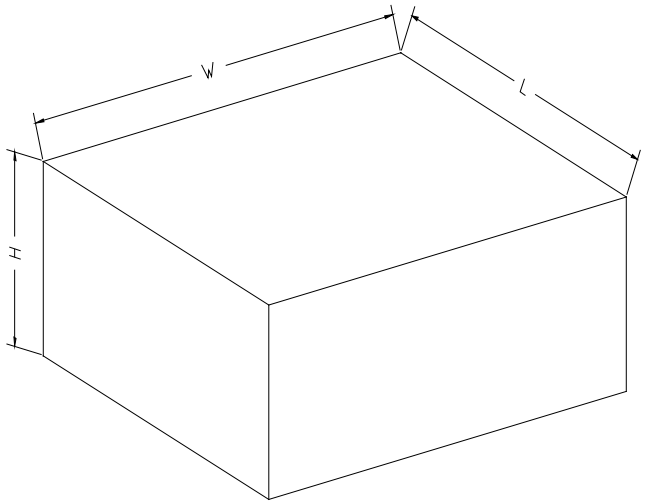
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOIC-8	13″	12.4	6.40	5.40	2.10	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
13″	386	280	370	5

DD0002