

SGM8551XN

Single-Supply, Single Rail-to-Rail I/O Precision Operational Amplifier

GENERAL DESCRIPTION

The SGM8551XN is a single, precision operational amplifier which can operate from 2.5V to 5.5V single supply. The device provides rail-to-rail input and output operation.

The SGM8551XN offers a low offset voltage of 12 μ V and an ultra-low bias current of 19pA. The combination of characteristics makes the SGM8551XN a good choice for temperature measurements, pressure and position sensors, strain gauge amplifiers and medical instrumentation, or any other 2.5V to 5.5V applications requiring precision and long-term stability.

The SGM8551XN is available in a Green SOT-23-5 package. It is specified over the extended industrial temperature range (-40°C to +125°C).

FEATURES

- **Low Offset Voltage:** 12 μ V (TYP) at 5V
- **Ultra-Low Input Bias Current:** 19pA
- **Large-Signal Voltage Gain:** 145dB (TYP) at 5V
- **PSRR:** 110dB (TYP)
- **CMRR:** 105dB (TYP)
- **Overload Recovery Time:** 0.1ms (at $V_S = 5V$)
- **Rail-to-Rail Input and Output**
- **Supply Voltage Range:** 2.5V to 5.5V
- **Low Supply Current:** 465 μ A (TYP)
- **No External Capacitors Required**
- **-40°C to +125°C Operating Temperature Range**
- **Available in a Green SOT-23-5 Package**

APPLICATIONS

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

SGM8551XN

Single-Supply, Single Rail-to-Rail I/O Precision Operational Amplifier

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8551XN	SOT-23-5	-40°C to +125°C	SGM8551XN5G/TR	S06XX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X

— Date Code - Month
— Date Code - Year
— Serial Number

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 Range	$-V_S$ to $(+V_S) + 0.1V$
Differential Input Voltage Range	-5V to 5V
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM.....	4000V
MM.....	400V

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.

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range-40°C to +125°C

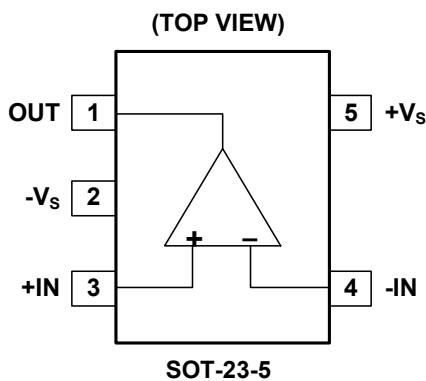
OVERSTRESS CAUTION

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

PIN CONFIGURATION



ELECTRICAL CHARACTERISTICS

(At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $V_{CM} = 2.5\text{V}$, $V_{OUT} = 2.5\text{V}$, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Characteristics					
Input Offset Voltage (V _{OS})			12	20	μV
	-40°C ≤ T _A ≤ +125°C			28	
Input Bias Current (I _B)			19		pA
Input Offset Current (I _{OS})			3		pA
Input Voltage Range		0		5	V
Common Mode Rejection Ratio ⁽¹⁾ (CMRR)	V _{CM} = 0V to 5V	90	105		dB
	-40°C ≤ T _A ≤ +125°C	86			
Large Signal Voltage Gain (A _{VO})	R _L = 10kΩ, V _{OUT} = 0.3V to 4.7V	100	145		dB
	-40°C ≤ T _A ≤ +125°C	90			
Input Offset Voltage Drift (ΔV _{OS} /ΔT)	-40°C ≤ T _A ≤ +125°C		20		nV/°C
Output Characteristics					
Output Voltage High (V _{OH})	R _L = 100kΩ to -V _S	4.99	4.998		V
	-40°C ≤ T _A ≤ +125°C	4.987			
	R _L = 10kΩ to -V _S	4.985	4.996		
	-40°C ≤ T _A ≤ +125°C	4.98			
Output Voltage Low (V _{OL})	R _L = 100kΩ to +V _S		2	10	mV
	-40°C ≤ T _A ≤ +125°C			13	
	R _L = 10kΩ to +V _S		6	15	
	-40°C ≤ T _A ≤ +125°C			20	
Short Circuit Limit (I _{SC})	V _{OUT} = 2.5V, R _L =10Ω to GND	40	48		mA
	-40°C ≤ T _A ≤ +125°C	24			
Power Supply					
Power Supply Rejection Ratio ⁽¹⁾ (PSRR)	V _S = 2.5V to 5.5V	90	110		dB
	-40°C ≤ T _A ≤ +125°C	85			
Quiescent Current (I _Q)	V _{OUT} = +V _S /2		465	553	μA
	-40°C ≤ T _A ≤ +125°C			800	
Dynamic Performance					
Gain-Bandwidth Product (GBP)	A _V = +100		1.48		MHz
Slew Rate (SR)	A _V = +1, R _L = 10kΩ, 2V output step		0.84		V/μs
Overload Recovery Time	A _V = -100, R _L = 10kΩ, V _{IN} = 200mV (RET to GND)		0.10		ms
Noise Performance					
Voltage Noise (e _n p-p)	0.1Hz to 10Hz		0.90		μV _{P-P}
Voltage Noise Density (e _n)	f = 1kHz		53		nV/√Hz

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

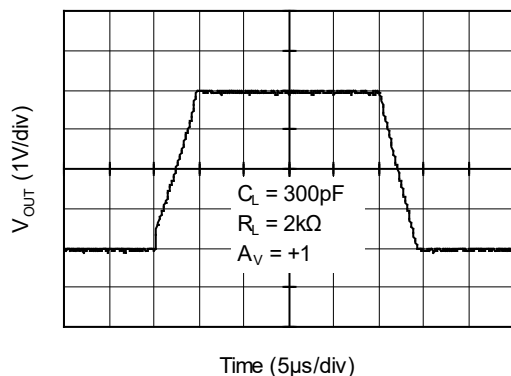
ELECTRICAL CHARACTERISTICS (continued)(At $T_A = +25^\circ\text{C}$, $V_S = 2.5\text{V}$, $V_{CM} = 1.25\text{V}$, $V_{OUT} = 1.25\text{V}$, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Characteristics					
Input Offset Voltage (V _{OS})			9	20	μV
	-40°C ≤ T _A ≤ +125°C			27	
Input Bias Current (I _B)			13		pA
Input Offset Current (I _{OS})			5		pA
Input Voltage Range		0		2.5	V
Common Mode Rejection Ratio ⁽¹⁾ (CMRR)	V _{CM} = 0V to 2.5V	90	105		dB
	-40°C ≤ T _A ≤ +125°C	86			
Large Signal Voltage Gain (A _{VO})	R _L = 10kΩ, V _{OUT} = 0.3V to 2.4V	100	135		dB
	-40°C ≤ T _A ≤ +125°C	90			
Input Offset Voltage Drift (ΔV _{OS} /ΔT)	-40°C ≤ T _A ≤ +125°C		20		nV/°C
Output Characteristics					
Output Voltage High (V _{OH})	R _L = 100kΩ to -V _S	2.49	2.499		V
	-40°C ≤ T _A ≤ +125°C	2.489			
	R _L = 10kΩ to -V _S	2.485	2.498		
	-40°C ≤ T _A ≤ +125°C	2.483			
Output Voltage Low (V _{OL})	R _L = 100kΩ to +V _S		1	10	mV
	-40°C ≤ T _A ≤ +125°C			11	
	R _L = 10kΩ to +V _S		3	15	
	-40°C ≤ T _A ≤ +125°C			17	
Short Circuit Limit (I _{SC})	V _{OUT} = 1.25V, R _L =10Ω to GND	20	28		mA
	-40°C ≤ T _A ≤ +125°C	16			
Power Supply					
Power Supply Rejection Ratio ⁽¹⁾ (PSRR)	V _S = 2.5V to 5.5V	90	110		dB
	-40°C ≤ T _A ≤ +125°C	85			
Quiescent Current (I _Q)	V _{OUT} = +V _S /2		498	553	μA
	-40°C ≤ T _A ≤ +125°C			800	
Dynamic Performance					
Gain-Bandwidth Product (GBP)	A _V = +100		1.46		MHz
Slew Rate (SR)	A _V = +1, R _L = 10kΩ, 2V output step		0.83		V/μs
Overload Recovery Time	A _V = -100, R _L = 10kΩ, V _{IN} = 200mV (RET to GND)		0.86		ms
Noise Performance					
Voltage Noise (e _n p-p)	0.1Hz to 10Hz		0.90		μV _{P-P}
Voltage Noise Density (e _n)	f = 1kHz		55		nV/√Hz

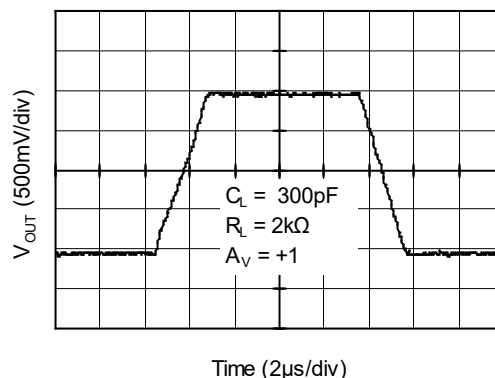
NOTE: 1. PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

TYPICAL PERFORMANCE CHARACTERISTICS

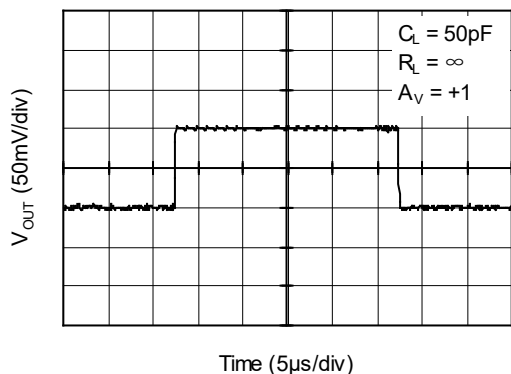
Large Signal Transient Response at +5V



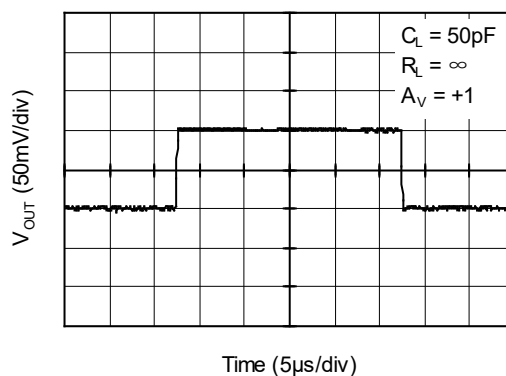
Large Signal Transient Response at +2.5V



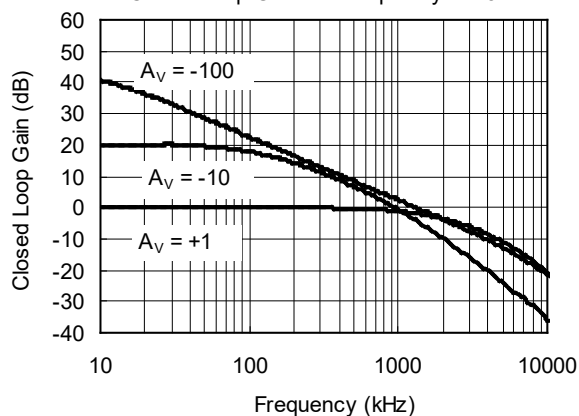
Small Signal Transient Response at +5V



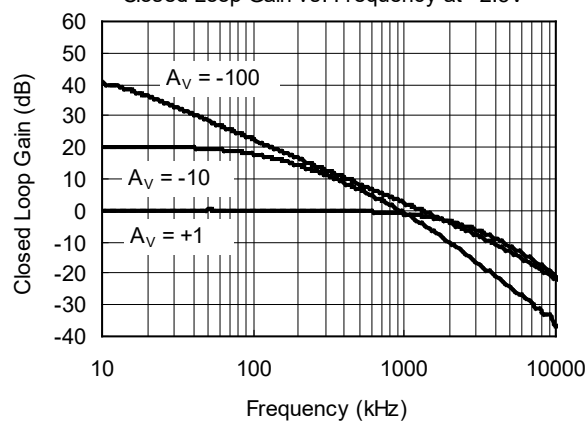
Small Signal Transient Response at +2.5V



Closed Loop Gain vs. Frequency at +5V

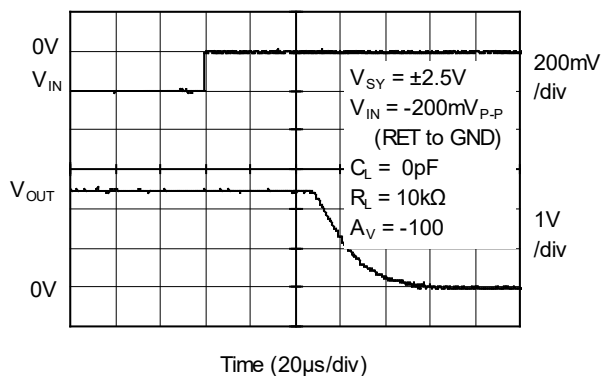


Closed Loop Gain vs. Frequency at +2.5V

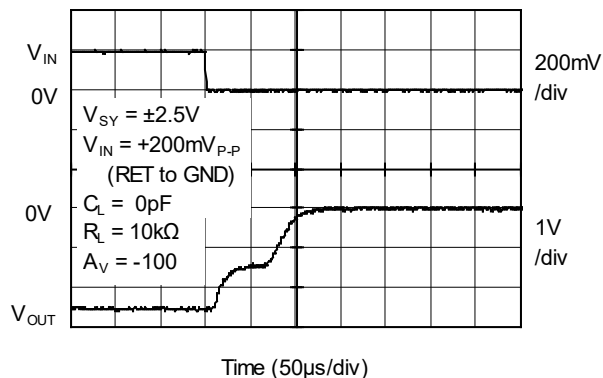
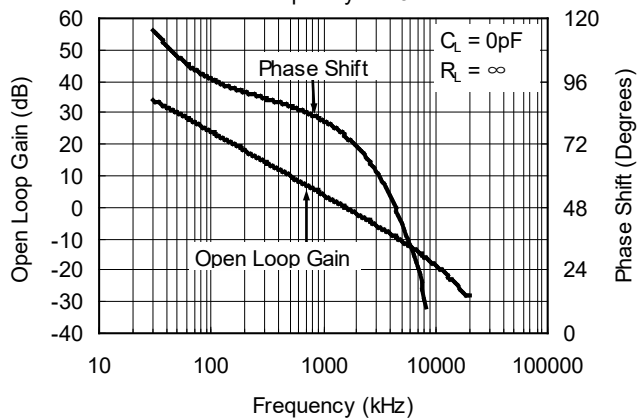
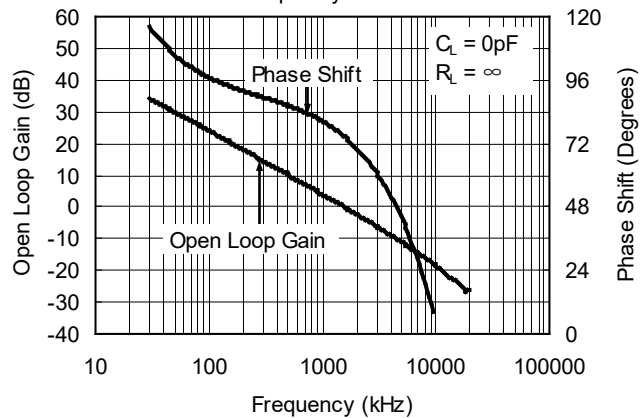


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

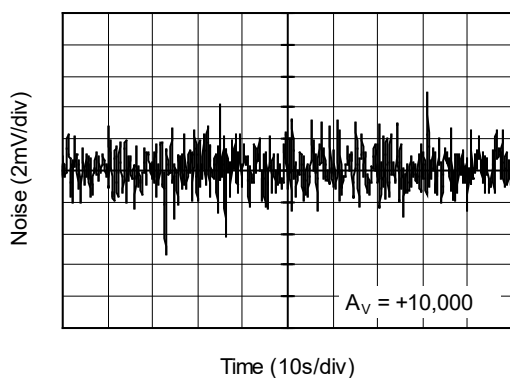
Positive Overvoltage Recovery



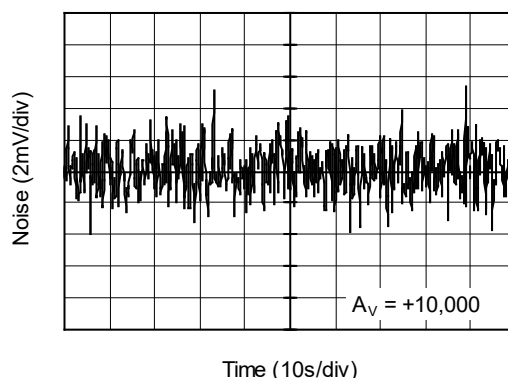
Negative Overvoltage Recovery

Open Loop Gain, Phase Shift
vs. Frequency at +5VOpen Loop Gain, Phase Shift
vs. Frequency at +2.5V

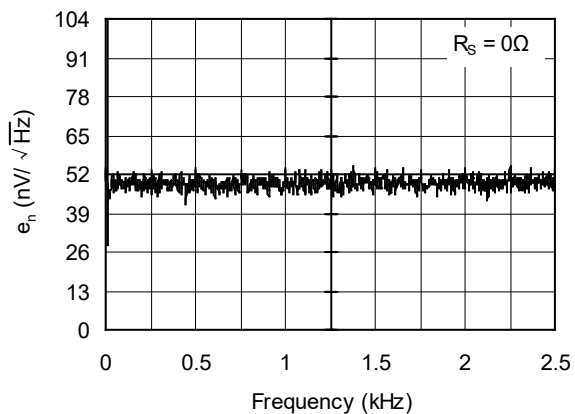
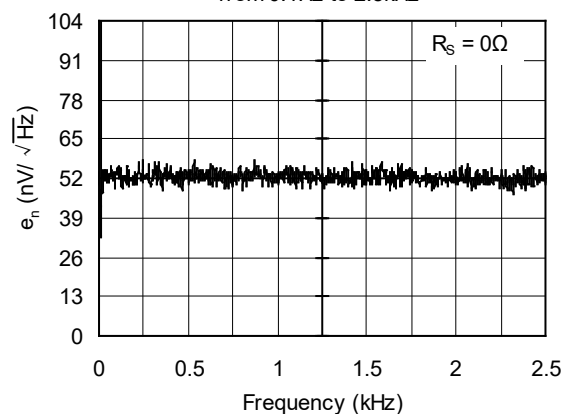
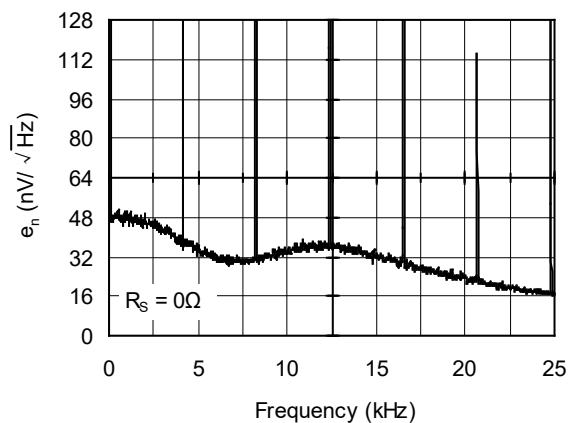
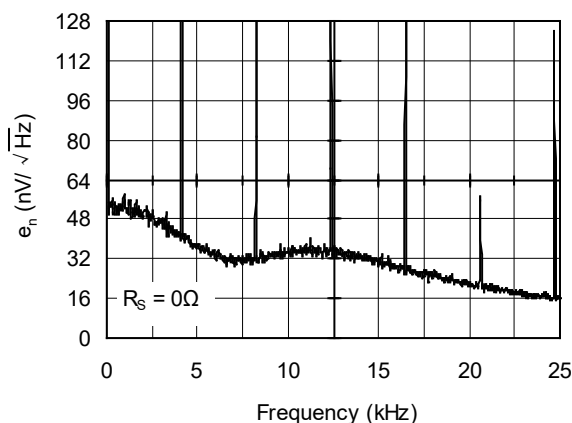
0.1Hz to 10Hz Noise at +5V



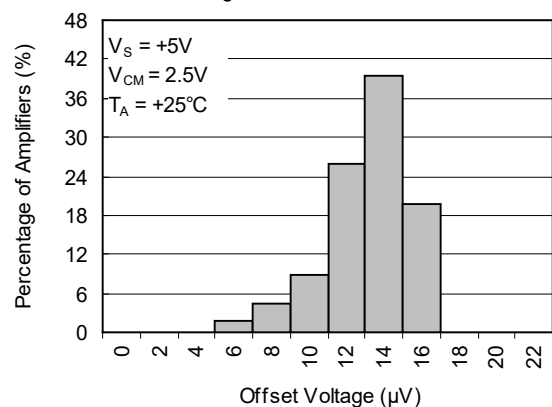
0.1Hz to 10Hz Noise at +2.5V



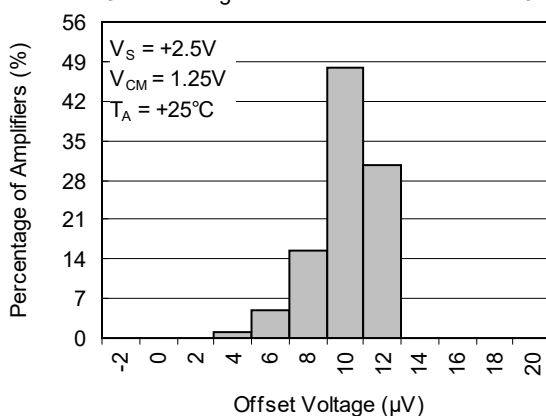
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Voltage Noise Density at +5V
from 0.1Hz to 2.5kHzVoltage Noise Density at +2.5V
from 0.1Hz to 2.5kHzVoltage Noise Density at +5V
from 0.1Hz to 25kHzVoltage Noise Density at +2.5V
from 0.1Hz to 25kHz

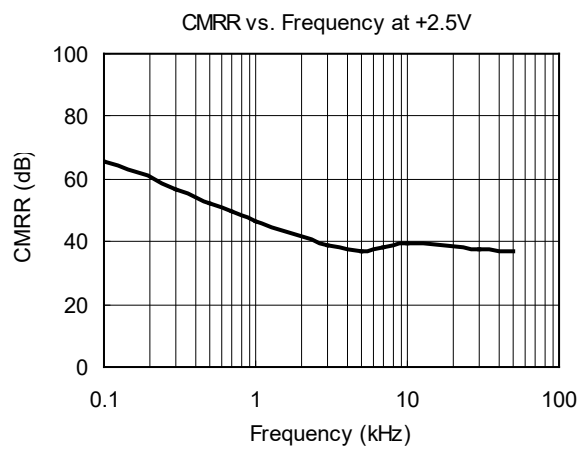
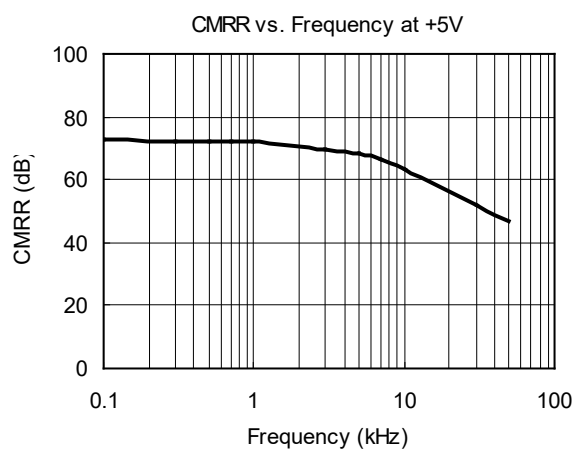
Offset Voltage Production Distribution at +5V



Offset Voltage Production Distribution at +2.5V

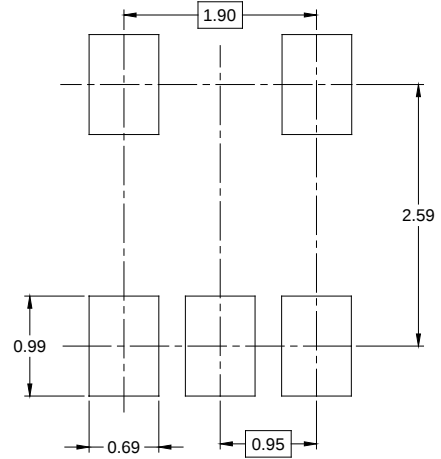
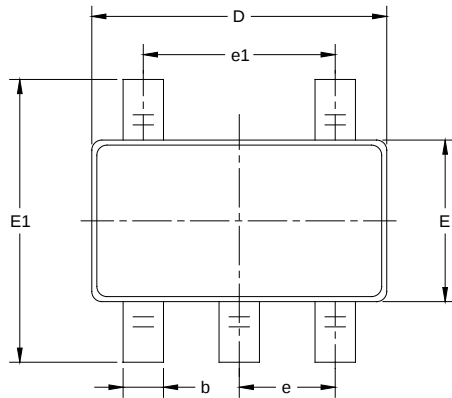


TYPICAL PERFORMANCE CHARACTERISTICS (continued)

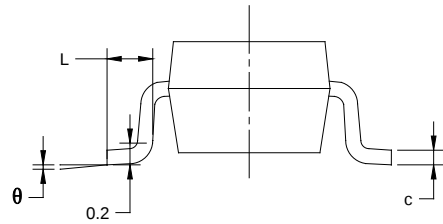
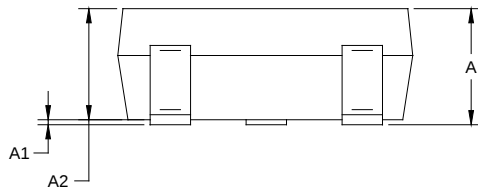


PACKAGE OUTLINE DIMENSIONS

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°

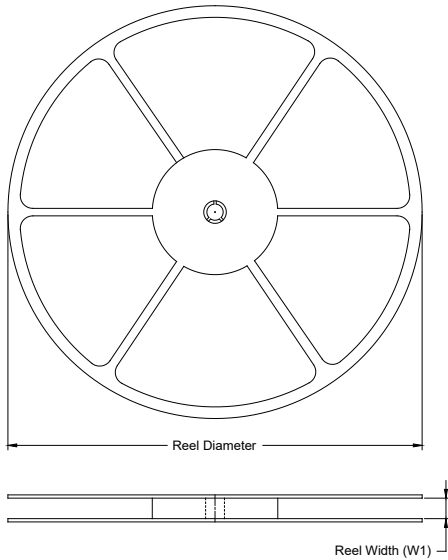
NOTES:

1. Body dimensions do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

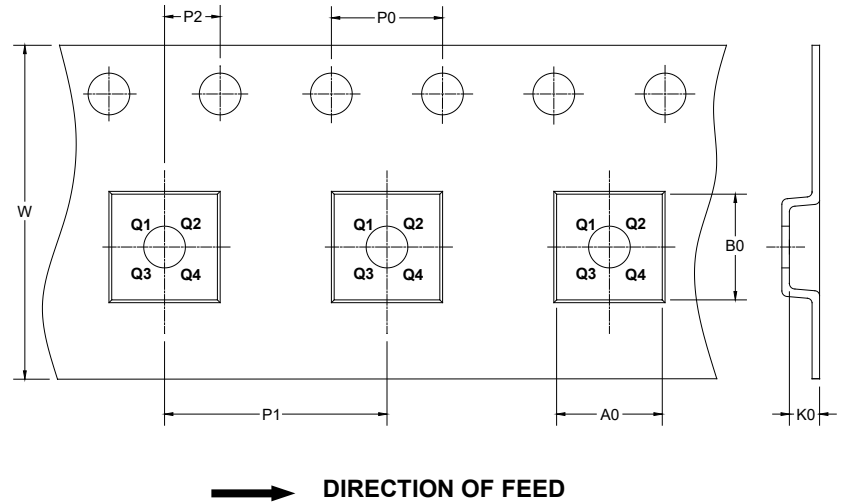
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

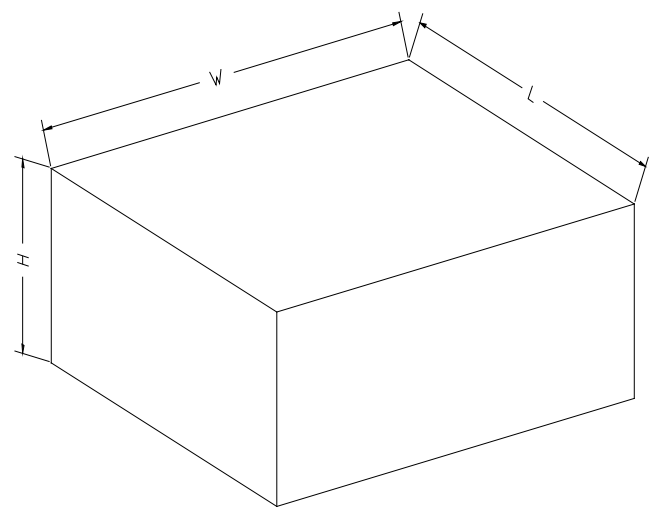
KEY PARAMETER LIST OF TAPE AND REEL

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	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

DD00001

PACKAGE INFORMATION

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

DD0002