SGM8480-2
15V Single-Supply, Dual Operational Amplifier with ±10V Output Range

GENERAL DESCRIPTION

The SGM8480-2 is a dual, low noise, high precision operational amplifier with ±10V output range. The device consists of an internal charge pump and external capacitors. They produce a V_{SS} rail, which enables the device to operate from 4.5V to 18V single supply. It can be equivalently regarded as operate from ± 4.5V to ± 18V dual power supplies due to the V_{SS} generated by charge pump. This design enables the operational amplifier to be powered by a positive power supply. It also does not require a negative power rail, thereby saving device space.

The SGM8480-2 provides a wide input common mode voltage range from $(-V_S)$ + 3V to $(+V_S)$ - 1.5V. The output voltage can be lower than 0V. It supports a wide dynamic range and improved resolution for analog-to-digital converters.

The SGM8480-2 has a 7.5MHz gain-bandwidth product and is unity-gain stable. It exhibits maximum offset voltage of 25µV and low offset drift. The 0.1Hz to 10Hz voltage noise is 200nV$_{P-P}$. The noise of charge pump can be minimized by adjusting external capacitors of charge pump. These specifications, as well as wide input common mode voltage range, make the operational amplifier a good choice for applications such as sensor interfaces and transmitters.

The SGM8480-2 is available in a Green TSSOP-14 package. It is specified over the -40℃ to +125℃ temperature range.

FEATURES

- **Output Voltage Range: Greater than ±10V**
- **Powered from a Single Positive Power Supply**
- **Integrated Negative LDO to Cancel Charge Pump Noise**
- **Low Input Voltage Noise: 10nV/$\sqrt{Hz}$ at 1kHz**
- **Low Offset Voltage: 25µV (MAX)**
- **Gain-Bandwidth Product: 7.5MHz**
- **Slew Rate: 6V/µs (TYP)**
- **Quiescent Current: 4.2mA (TYP)**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green TSSOP-14 Package**

APPLICATIONS

Sensor Interface
Pressure Sensor
Bridge Sensor
PLC Analog Input/Output Module
Analog Level Conditioning
Analog Level Shifting

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8480-2	TSSOP-14	-40℃ to +125℃	SGM8480-2XTS14G/TR	SGM84802 XTS14 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

X X X X X
— Vendor Code
— Date Code - Week
— Date Code - Year
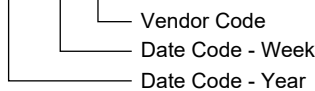
Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

V_{DD} to GND .... -0.3V to 20V
CPVDD to GND .... -0.3V to 20V
CP, CN, CPVSS, V_{SS} Input Current............................±20mA
Input Common Mode Voltage Range.......................................
....................................(-V_{DD}) - 0.3V to (+V_{DD}) + 0.3V
Differential Input Current..±20mA
Differential Input Voltage....................................±1V
OUTA, OUTB to GND ....(-V_{DD}) - 0.3V to (+V_{DD}) + 0.3V
Short-Circuit Duration, OUTA, OUTB to either Supply Rail
....1s
Junction Temperature ....+150℃
Storage Temperature Range........................-65℃ to +150℃
Lead Temperature (Soldering, 10s) ....+260℃
ESD Susceptibility
HBM..8000V
MM..300V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range ....4.5V to 18V
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.
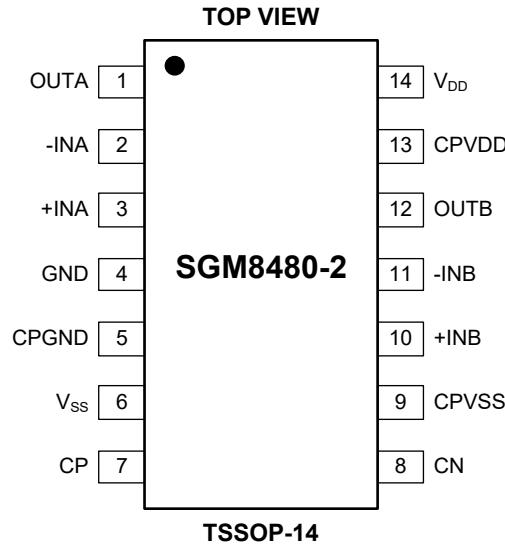
ESD SENSITIVITY CAUTION

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

TOP VIEW

Pin	Name		Pin	Name
1	OUTA	●	14	V_{DD}
2	-INA		13	CPVDD
3	+INA		12	OUTB
4	GND	**SGM8480-2**	11	-INB
5	CPGND		10	+INB
6	V_{SS}		9	CPVSS
7	CP		8	CN

TSSOP-14

PIN DESCRIPTION

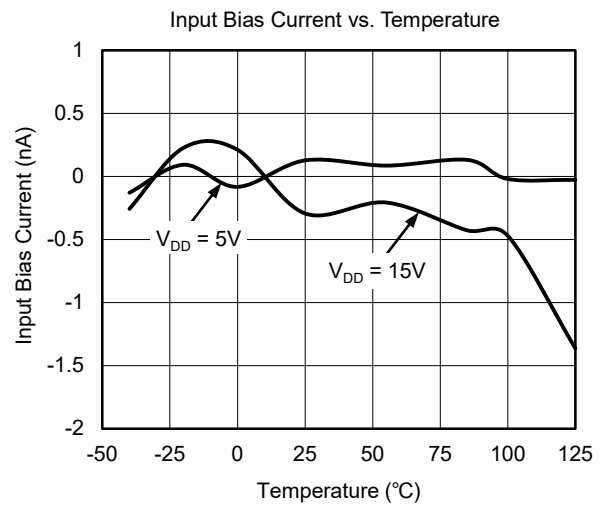| PIN	NAME	FUNCTION
1	OUTA	Output Pin of Amplifier A.
2	-INA	Inverting Input Pin of Amplifier A.
3	+INA	Non-Inverting Input Pin of Amplifier A.
4	GND	Ground Pin.
5	CPGND	Charge Pump Ground Pin. Connect CPGND pin to GND pin.
6	V_{SS}	Filtered Negative Supply Output Pin. Bypass with a 1µF, low-ESR capacitor to GND.
7	CP	Positive Terminal of the Flying Capacitor. Only connect flying capacitor to CN. Voltage connection on CN or CP is prohibited. Connect a 1µF, low-ESR flying capacitor between CP and CN.
8	CN	Negative Terminal of the Flying Capacitor. Only connect flying capacitor to CP. Voltage connection on CN or CP is prohibited. Connect a 1µF, low-ESR flying capacitor between CP and CN.
9	CPVSS	Negative Supply Output Pin of Charge Pump. Bypass with a 1µF capacitor to CPGND.
10	+INB	Non-Inverting Input Pin of Amplifier B.
11	-INB	Inverting Input Pin of Amplifier B.
12	OUTB	Output of Pin Amplifier B.
13	CPVDD	Supply Voltage Input Pin of Charge Pump. Connect CPVDD to V_{DD}. Bypass with a 0.1µF capacitor to GND.
14	V_{DD}	Supply Voltage Input Pin of SGM8480-2. Bypass with a 0.1µF capacitor to GND.

ELECTRICAL CHARACTERISTICS
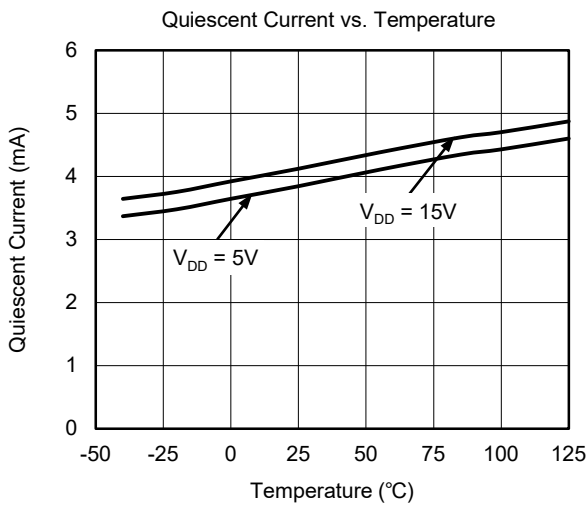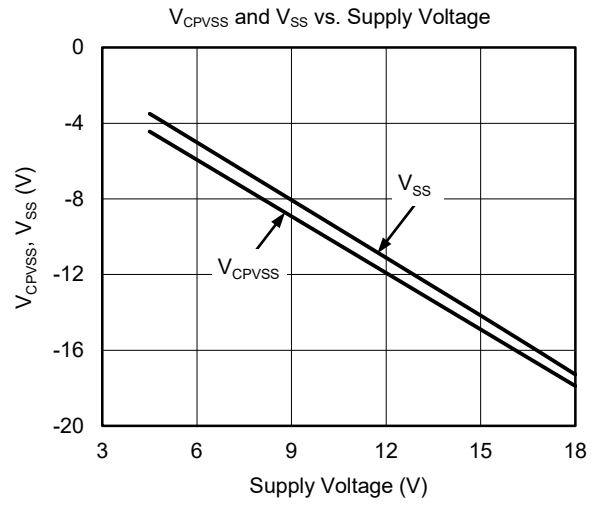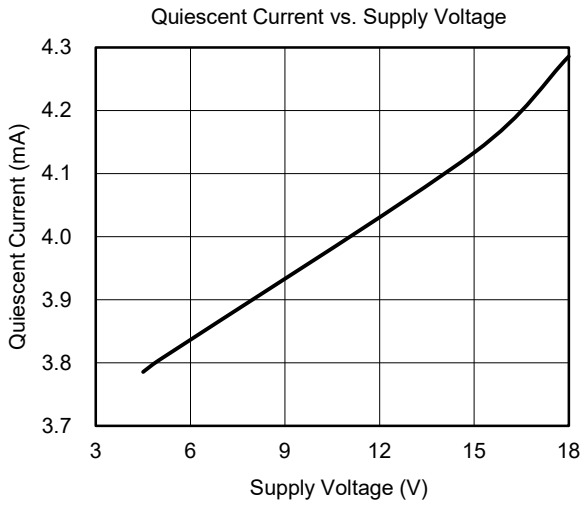
(V_{DD} = V_{CPVDD} = 5V to 15V, V_{GND} = 0V, V_{CM} = GND, R_L = 5kΩ to GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, Full = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage	V_{OS}		+25℃		5	25	µV
			Full			45	
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$		Full		0.2		µV/℃
Input Bias Current	I_B		+25℃		0.5	5	nA
			Full			6	
Input Offset Current	I_{OS}		+25℃		1	6	nA
			Full			9	
Input Common Mode Voltage Range	V_{CM}		Full	$(-V_S)$ + 3		$(+V_S)$ - 1.5	V
Common Mode Rejection Ratio	CMRR	V_{DD} = 15V, V_{CM} = -12V to 13.5V	+25℃	126	140		dB
			Full	123			
		V_{DD} = 5V, V_{CM} = -2V to 3.5V	+25℃	118	140		
			Full	115			
Open-Loop Voltage Gain	A_{OL}	V_{DD} = 15V, V_{OUT} = -12V to 13.5V	+25℃	122	145		dB
			Full	119			
		V_{DD} = 5V, V_{OUT} = -1.3V to 3.5V	+25℃	114	140		
			Full	111			
Output Characteristics							
Output Voltage Swing High	V_{OH}	V_{DD} = 15V	+25℃		220	300	mV
			Full			385	
		V_{DD} = 5V	+25℃		72	100	
			Full			135	
Output Voltage Swing Low	V_{OL}	V_{DD} = 15V	+25℃		100	130	mV
			Full			185	
		V_{DD} = 5V	+25℃		28	38	
			Full			55	
Output Short-Circuit Current	I_{SC}	V_{DD} = 15V	+25℃	±58	±85		mA
		V_{DD} = 5V	+25℃	±45	±66		

ELECTRICAL CHARACTERISTICS (continued)

(V_{DD} = V_{CPVDD} = 5V to 15V, V_{GND} = 0V, V_{CM} = GND, R_L = 5kΩ to GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, Full = -40℃ to +125℃, unless otherwise noted.)

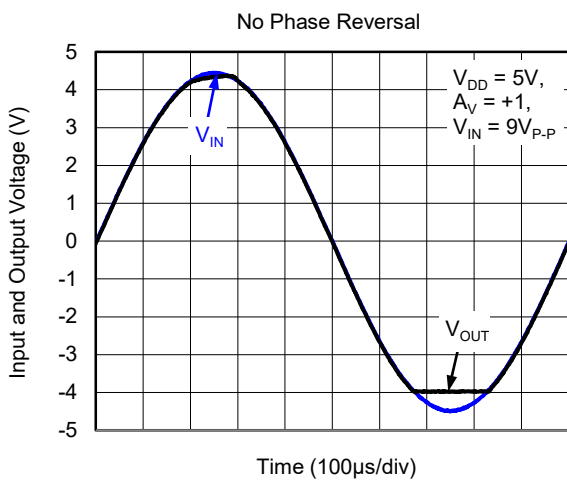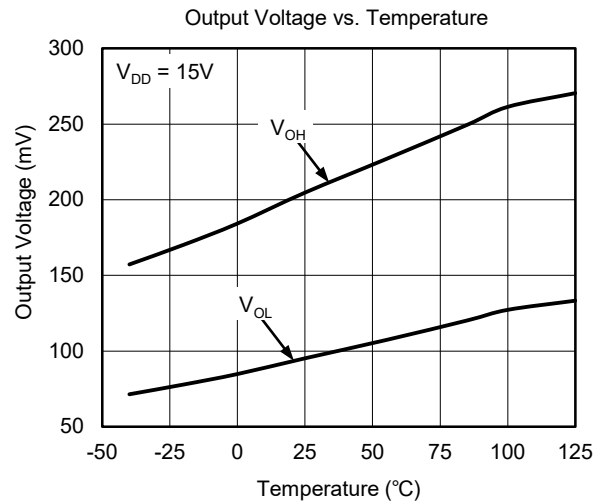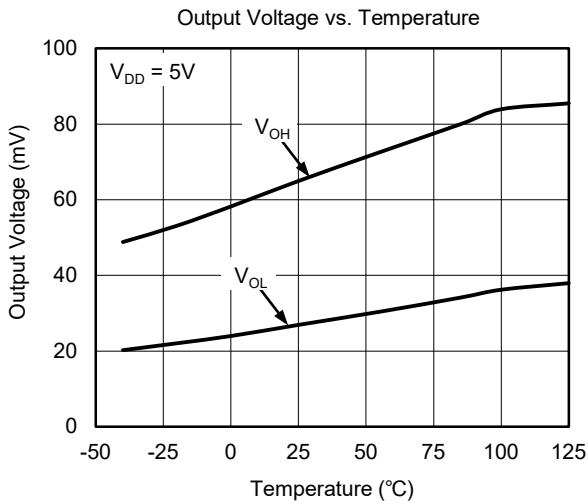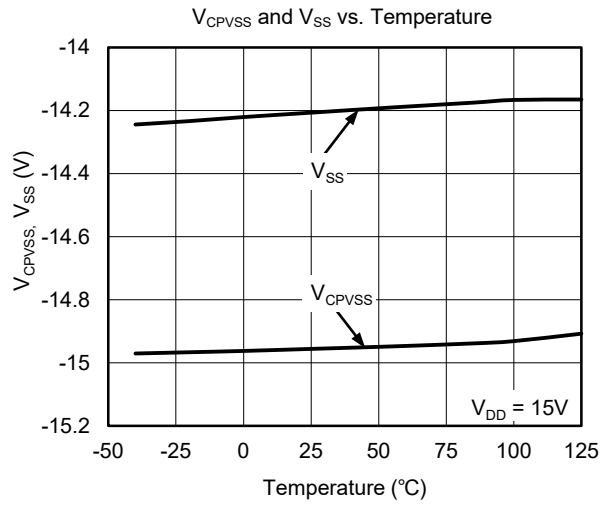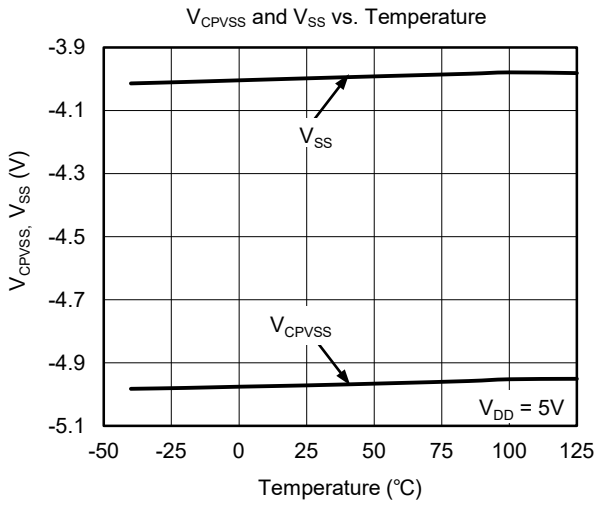| PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power Supply							
Power Supply Voltage Input Range	V_{DD}	Guaranteed by PSRR	Full	4.5		18	V
Charge Pump Supply Voltage Input Range [1]	V_{CPVDD}		Full	4.5		18	V
Charge Pump Negative Supply Output	V_{CPVSS}	V_{DD} = 15V	+25℃		-14.95		V
		V_{DD} = 5V	+25℃		-4.95		
Filtered Negative Supply Output	V_{SS}	V_{DD} = 15V	+25℃		-14		V
		V_{DD} = 5V	+25℃		-4		
Total Quiescent Current	I_{DD}	V_{DD} = 15V, I_{OUT} = 0	+25℃		4.2	5.5	mA
			Full			6.7	
		V_{DD} = 5V, I_{OUT} = 0	+25℃		3.8	5	
			Full			6.2	
Power Supply Rejection Ratio	PSRR	V_{DD} = 4.5V to 18V	+25℃	114	134		dB
			Full	111			
Dynamic Performance							
Gain-Bandwidth Product	GBP	C_L = 10pF	+25℃		7.5		MHz
Slew Rate	SR		+25℃		6		V/µs
Settling Time	t_S	V_{IN} = 1V Step, A_V = +1	+25℃		0.7		µs
Charge Pump Frequency	f_{OSC}		+25℃		440		kHz
Total Harmonic Distortion + Noise	THD+N	f = 1kHz, V_{IN} = 2V_{P-P}, A_V = +1	+25℃		-110		dB
Crosstalk	X_{talk}	f = 1kHz	+25℃		-95		dB
Noise							
Input Voltage Noise		f = 0.1Hz to 10Hz	+25℃		200		nV_{P-P}
Input Voltage Noise Density	e_n	f = 1kHz	+25℃		10		nV/$\sqrt{Hz}$
Input Current Noise Density	i_n	f = 1kHz	+25℃		280		pA/$\sqrt{Hz}$

NOTE: 1. Connect CPVDD to V_{DD}. V_{CPVDD} = V_{DD}.

TYPICAL PERFORMANCE CHARACTERISTICS

At T_A = +25℃, V_{DD} = V_{CPVDD} = 15V, V_{GND} = 0V, V_{CM} = GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, R_L = 5kΩ and C_L = 10pF to GND, unless otherwise noted.
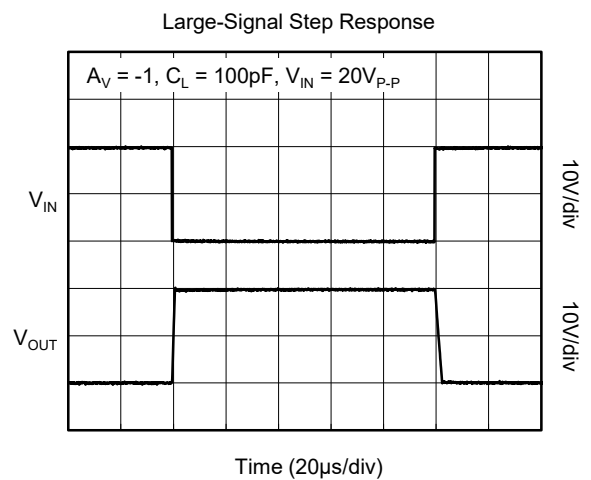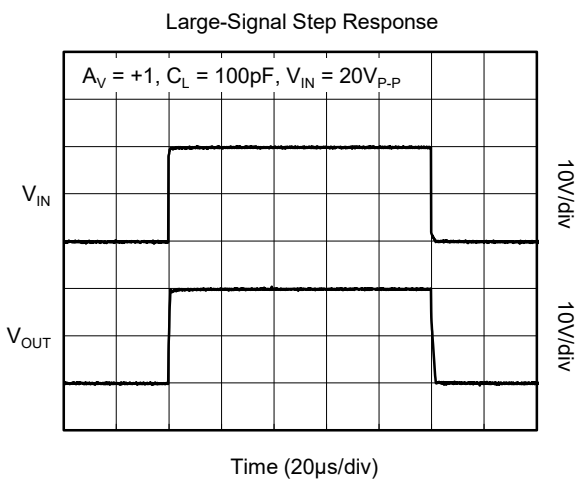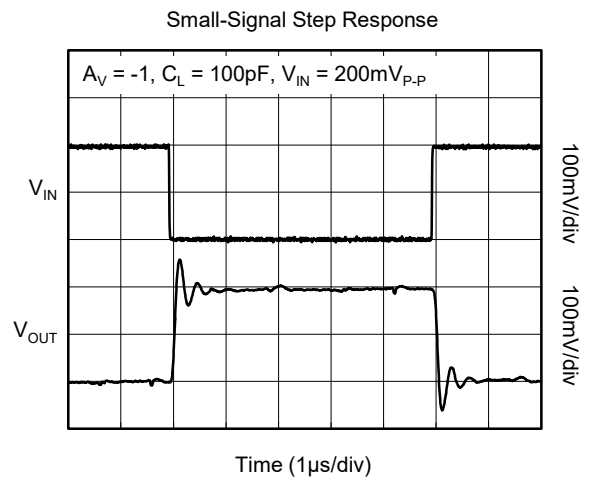
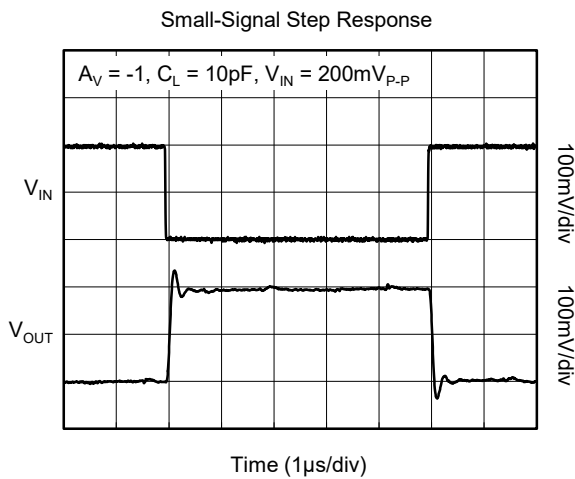Quiescent Current vs. Supply Voltage

V_{CPVSS} and V_{SS} vs. Supply Voltage

Quiescent Current vs. Temperature

Input Bias Current vs. Temperature

Input Offset Current vs. Temperature

Input Offset Voltage vs. Temperature

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_{DD} = V_{CPVDD} = 15V, V_{GND} = 0V, V_{CM} = GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, R_L = 5kΩ and C_L = 10pF to GND, unless otherwise noted.

V_{CPVSS} and V_{SS} vs. Temperature

V_{CPVSS} and V_{SS} vs. Temperature

Output Voltage vs. Temperature

Output Voltage vs. Temperature

No Phase Reversal

No Phase Reversal

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_{DD} = V_{CPVDD} = 15V, V_{GND} = 0V, V_{CM} = GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, R_L = 5kΩ and C_L = 10pF to GND, unless otherwise noted.

Small-Signal Step Response

A_V = +1, C_L = 10pF, V_{IN} = 200mV$_{P-P}$

Small-Signal Step Response

A_V = +1, C_L = 100pF, V_{IN} = 200mV$_{P-P}$

Small-Signal Step Response

A_V = -1, C_L = 10pF, V_{IN} = 200mV$_{P-P}$

Small-Signal Step Response

A_V = -1, C_L = 100pF, V_{IN} = 200mV$_{P-P}$

Large-Signal Step Response

A_V = +1, C_L = 100pF, V_{IN} = 20V$_{P-P}$

Large-Signal Step Response

A_V = -1, C_L = 100pF, V_{IN} = 20V$_{P-P}$

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25°C, V_{DD} = V_{CPVDD} = 15V, V_{GND} = 0V, V_{CM} = GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, R_L = 5kΩ and C_L = 10pF to GND, unless otherwise noted.
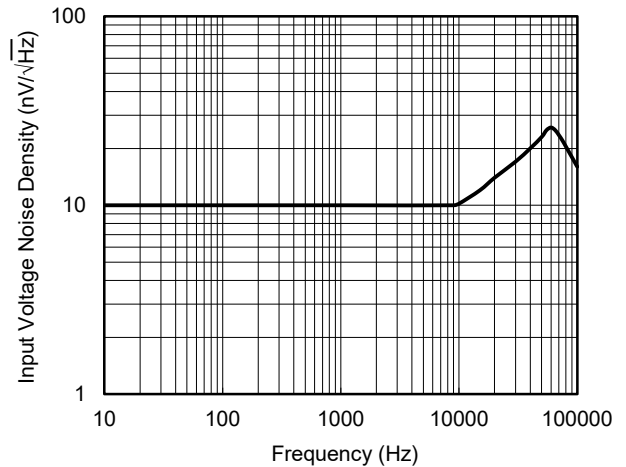

Positive Overload Recovery
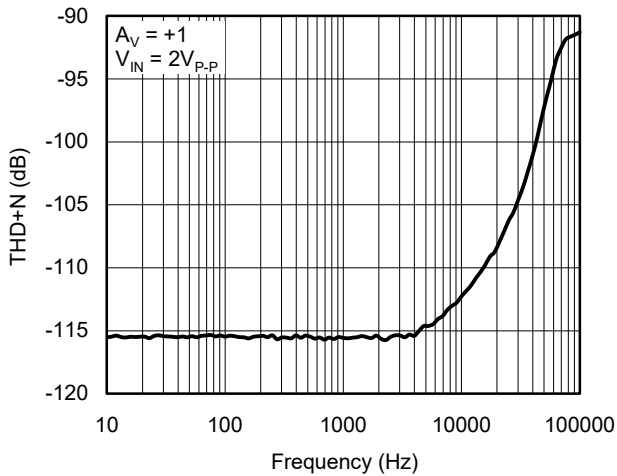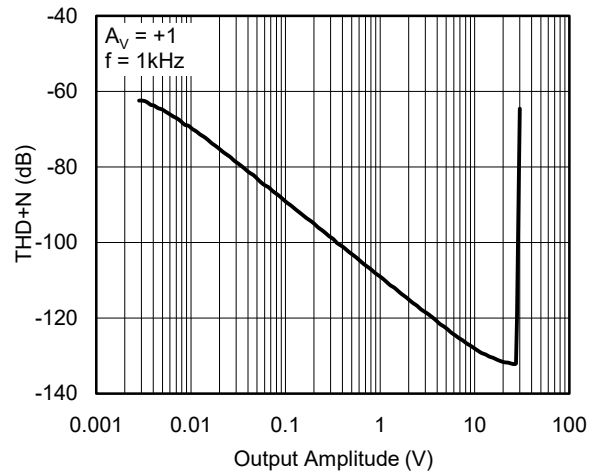

Negative Overload Recovery
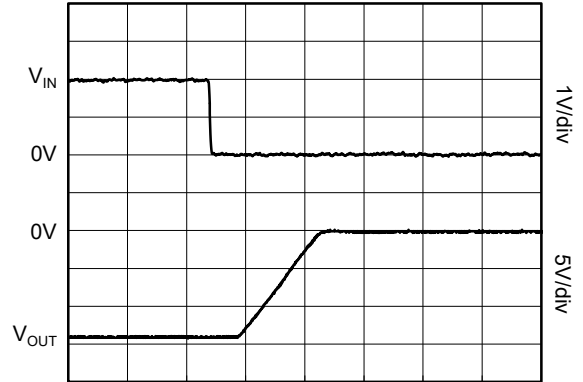
0.1Hz to 10Hz Input Voltage Noise
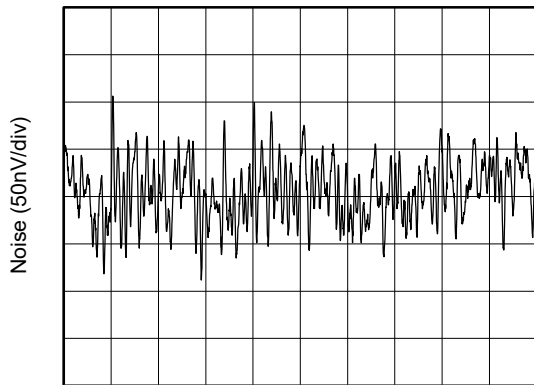
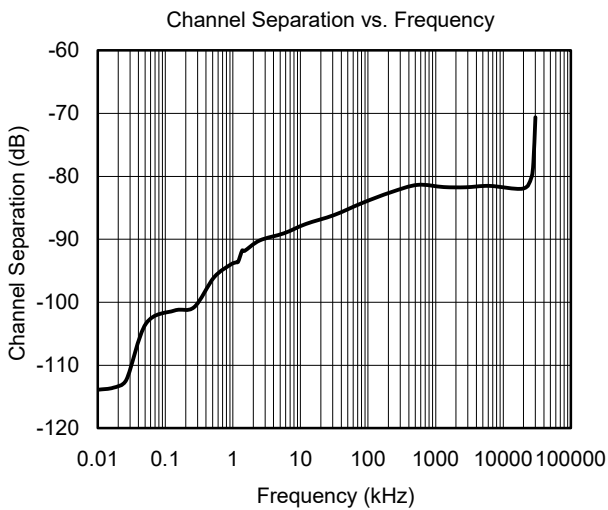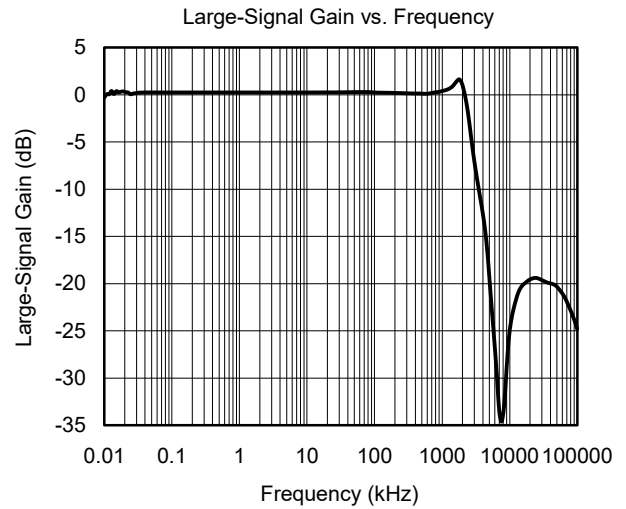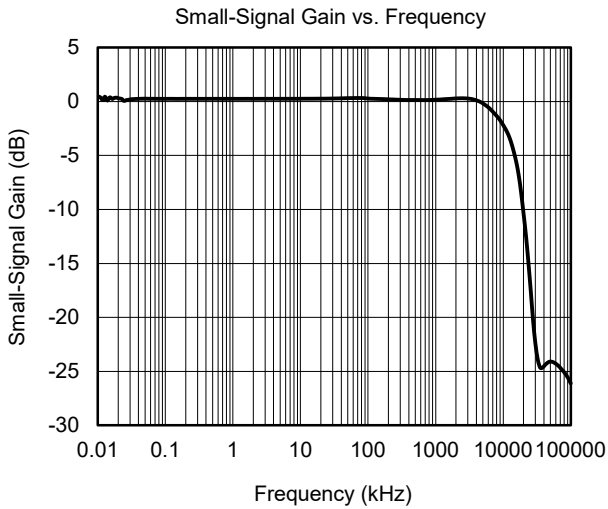Input Voltage Noise Density vs. Frequency

THD+N vs. Frequency

THD+N vs. Output Amplitude

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_{DD} = V_{CPVDD} = 15V, V_{GND} = 0V, V_{CM} = GND, C_{FLY} = 1µF, C_{HOLD} = 1µF, C_{FILT} = 1µF, R_L = 5kΩ and C_L = 10pF to GND, unless otherwise noted.

Small-Signal Gain vs. Frequency

Large-Signal Gain vs. Frequency

Channel Separation vs. Frequency

Input Offset Voltage Production Distribution

REVISION HISTORY

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

Changes from Original (DECEMBER 2017) to REV.A   **Page**
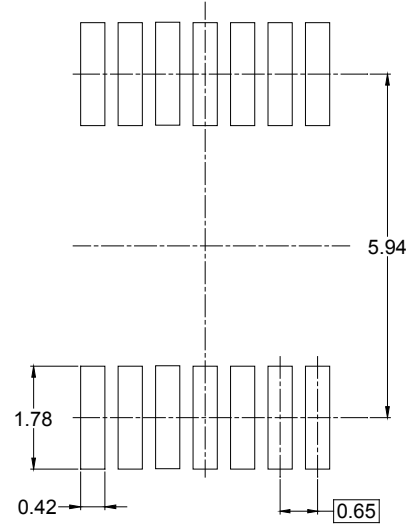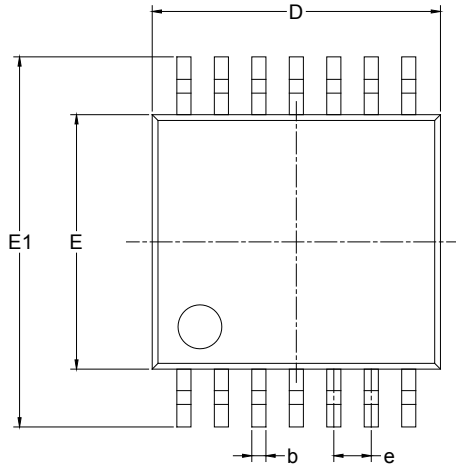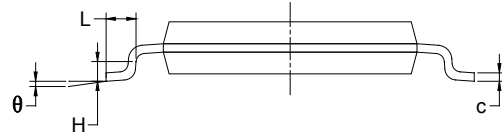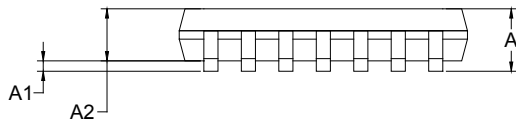
Changed from product preview to production data ....All

PACKAGE OUTLINE DIMENSIONS

TSSOP-14

RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION

REEL DIMENSIONS
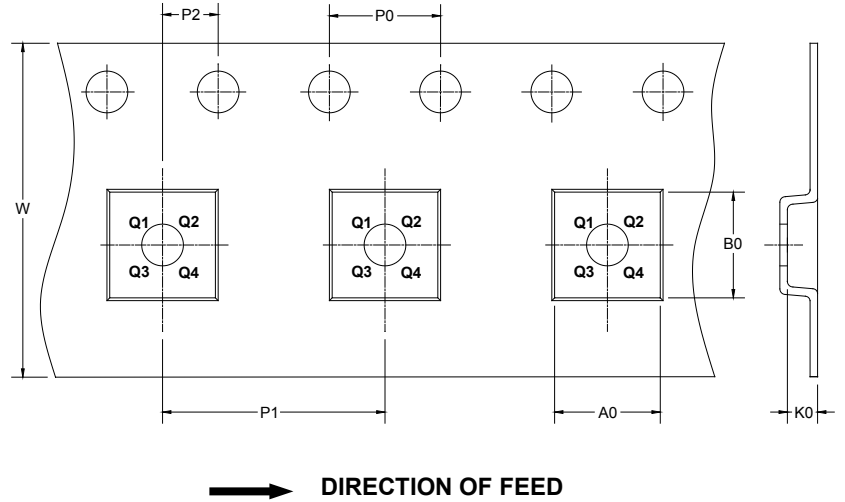
Reel Diameter

Reel Width (W1)

TAPE DIMENSIONS

DIRECTION OF FEED

NOTE: The picture is only for reference. Please make the object as the standard.
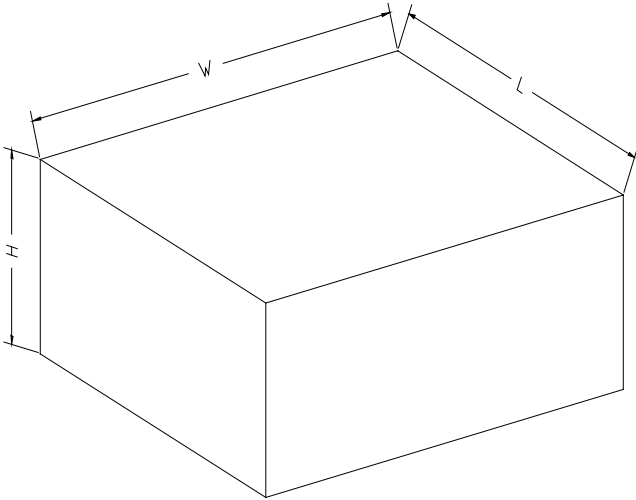
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TSSOP-14	13″	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1

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