



SGM8480-2

15V Single-Supply, Dual Operational Amplifier with $\pm 10V$ Output Range

GENERAL DESCRIPTION

The SGM8480-2 is a dual, low noise, high precision operational amplifier with $\pm 10V$ 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 $\pm 4.5V$ to $\pm 18V$ 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 25 μV 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°C to +125°C temperature range.

FEATURES

- **Output Voltage Range:** Greater than $\pm 10V$
- **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:** 25 μV (MAX)
- **Gain-Bandwidth Product:** 7.5MHz
- **Slew Rate:** 6V/ μs (TYP)
- **Quiescent Current:** 4.2mA (TYP)
- **-40°C to +125°C 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

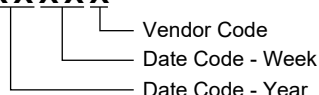
PACKAGE/ORDERING INFORMATION

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

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

XXXXX



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.....	$\pm 20mA$
Input Common Mode Voltage Range.....	
.....(- V_{DD}) - 0.3V to (+ V_{DD}) + 0.3V	
Differential Input Current.....	$\pm 20mA$
Differential Input Voltage.....	$\pm 1V$
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°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM.....	8000V
MM.....	300V
CDM	1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range	4.5V to 18V
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.

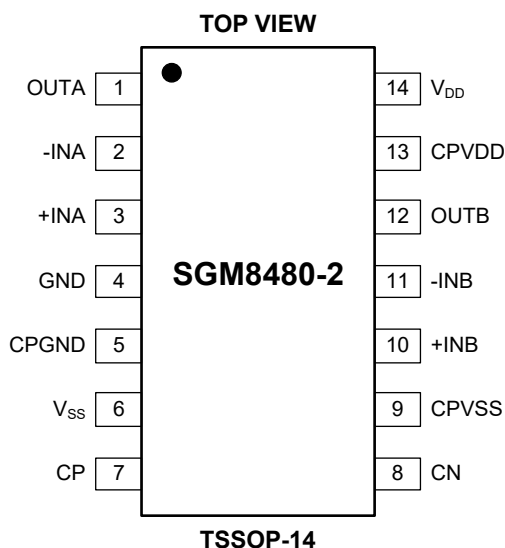
ESD SENSITIVITY CAUTION

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 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



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 1 μ F, 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 1 μ F, 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 1 μ F, low-ESR flying capacitor between CP and CN.
9	CPVSS	Negative Supply Output Pin of Charge Pump. Bypass with a 1 μ F 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 0.1 μ F capacitor to GND.
14	V _{DD}	Supply Voltage Input Pin of SGM8480-2. Bypass with a 0.1 μ F capacitor to GND.

ELECTRICAL CHARACTERISTICS

($V_{DD} = V_{CPVDD} = 5V$ to $15V$, $V_{GND} = 0V$, $V_{CM} = GND$, $R_L = 5k\Omega$ to GND , $C_{FLY} = 1\mu F$, $C_{HOLD} = 1\mu F$, $C_{FILT} = 1\mu F$, Full = $-40^\circ C$ to $+125^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage	V _{OS}		+25°C		5	25	μV
			Full			45	
Input Offset Voltage Drift	ΔV _{OS} /ΔT		Full		0.2		μV/°C
Input Bias Current	I _B		+25°C		0.5	5	nA
			Full			6	
Input Offset Current	I _{OS}		+25°C		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°C	126	140		dB
			Full	123			
		V _{DD} = 5V, V _{CM} = -2V to 3.5V	+25°C	118	140		
			Full	115			
Open-Loop Voltage Gain	A _{OL}	V _{DD} = 15V, V _{OUT} = -12V to 13.5V	+25°C	122	145		dB
			Full	119			
		V _{DD} = 5V, V _{OUT} = -1.3V to 3.5V	+25°C	114	140		
			Full	111			
Output Characteristics							
Output Voltage Swing High	V _{OH}	V _{DD} = 15V	+25°C		220	300	mV
			Full			385	
		V _{DD} = 5V	+25°C		72	100	
			Full			135	
Output Voltage Swing Low	V _{OL}	V _{DD} = 15V	+25°C		100	130	mV
			Full			185	
		V _{DD} = 5V	+25°C		28	38	
			Full			55	
Output Short-Circuit Current	I _{SC}	V _{DD} = 15V	+25°C	±58	±85		mA
		V _{DD} = 5V	+25°C	±45	±66		

ELECTRICAL CHARACTERISTICS (continued)

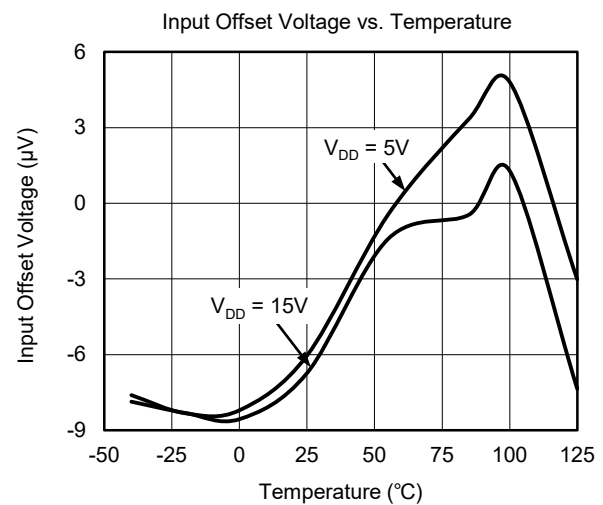
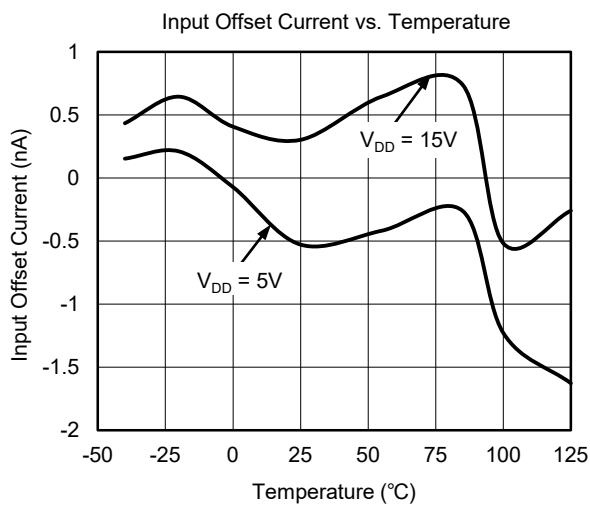
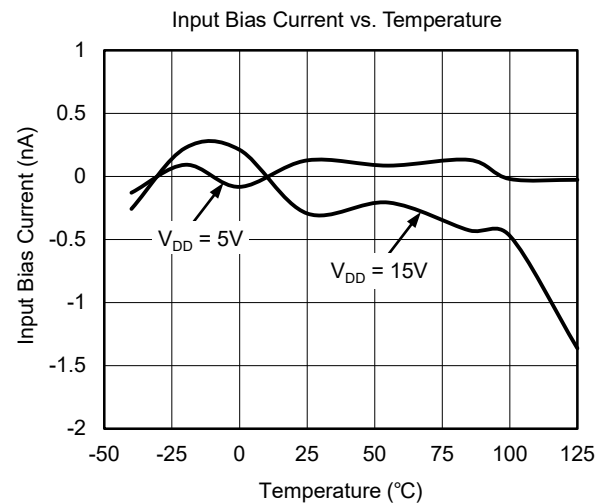
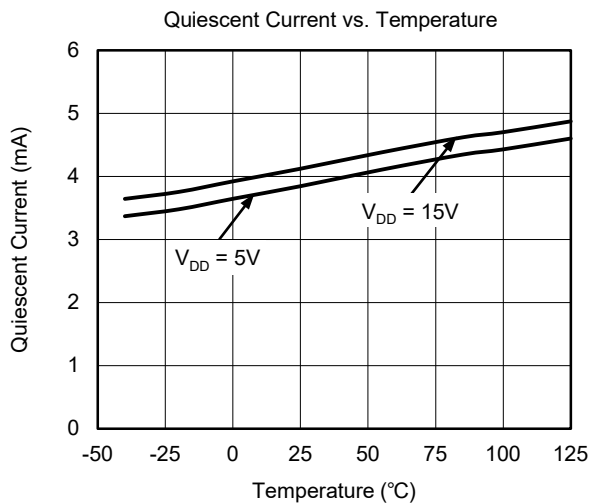
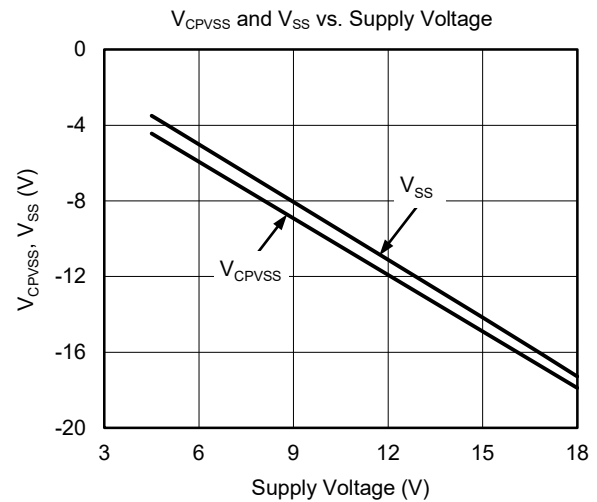
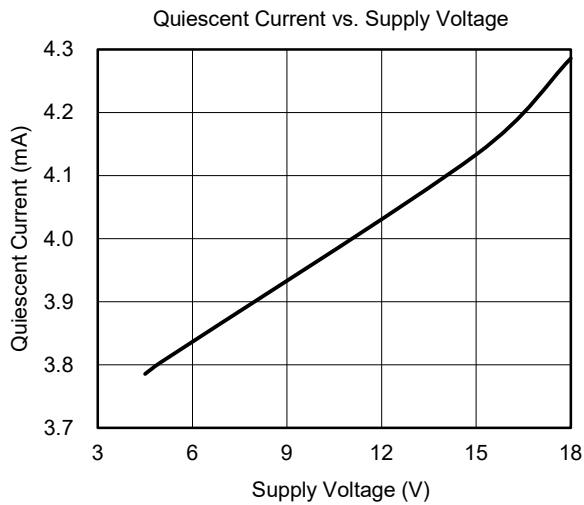
($V_{DD} = V_{CPVDD} = 5V$ to $15V$, $V_{GND} = 0V$, $V_{CM} = GND$, $R_L = 5k\Omega$ to GND , $C_{FLY} = 1\mu F$, $C_{HOLD} = 1\mu F$, $C_{FILT} = 1\mu F$, Full = $-40^\circ C$ to $+125^\circ C$, unless otherwise noted.)

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°C		-14.95		V
		V _{DD} = 5V	+25°C		-4.95		
Filtered Negative Supply Output	V _{SS}	V _{DD} = 15V	+25°C		-14		V
		V _{DD} = 5V	+25°C		-4		
Total Quiescent Current	I _{DD}	V _{DD} = 15V, I _{OUT} = 0	+25°C		4.2	5.5	mA
			Full			6.7	
		V _{DD} = 5V, I _{OUT} = 0	+25°C		3.8	5	
			Full			6.2	
Power Supply Rejection Ratio	PSRR	V _{DD} = 4.5V to 18V	+25°C	114	134		dB
			Full	111			
Dynamic Performance							
Gain-Bandwidth Product	GBP	C _L = 10pF	+25°C		7.5		MHz
Slew Rate	SR		+25°C		6		V/μs
Settling Time	t _s	V _{IN} = 1V Step, A _V = +1	+25°C		0.7		μs
Charge Pump Frequency	f _{OSC}		+25°C		440		kHz
Total Harmonic Distortion + Noise	THD+N	f = 1kHz, V _{IN} = 2V _{P-P} , A _V = +1	+25°C		-110		dB
Crosstalk	X _{talk}	f = 1kHz	+25°C		-95		dB
Noise							
Input Voltage Noise		f = 0.1Hz to 10Hz	+25°C		200		nV _{P-P}
Input Voltage Noise Density	e _n	f = 1kHz	+25°C		10		nV/√Hz
Input Current Noise Density	i _n	f = 1kHz	+25°C		280		pA/√Hz

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

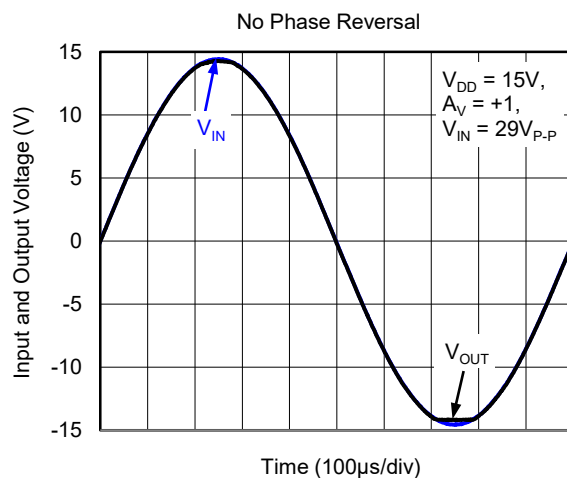
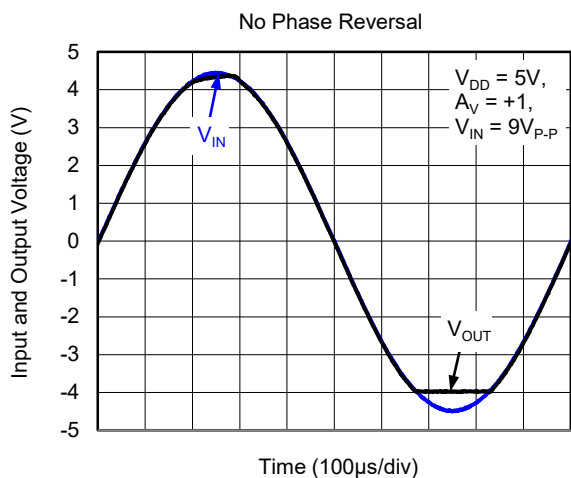
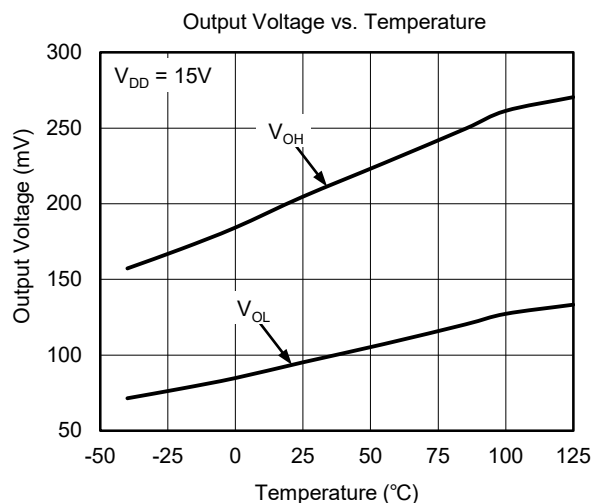
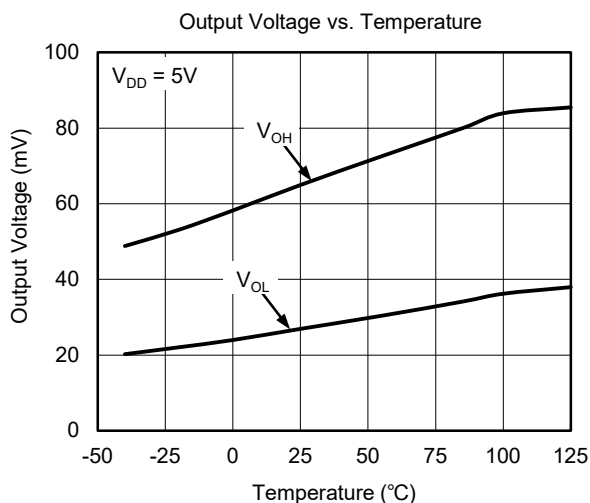
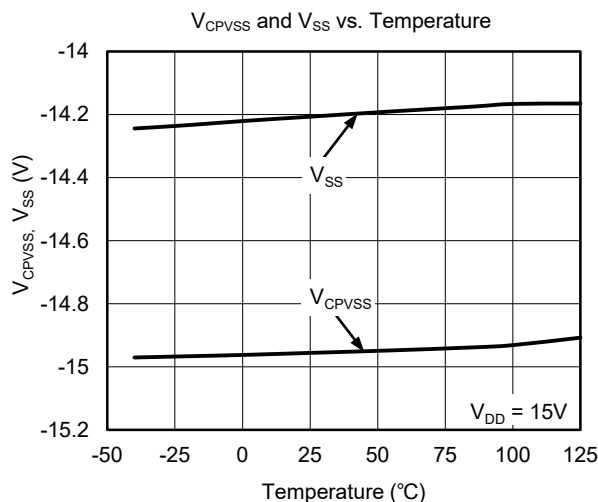
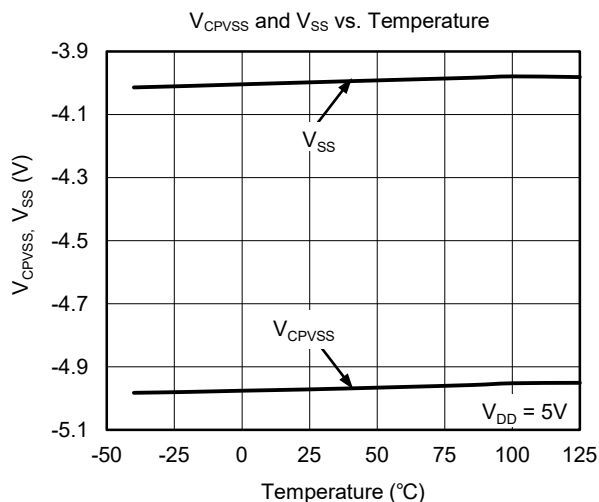
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_{DD} = V_{CPVDD} = 15V$, $V_{GND} = 0V$, $V_{CM} = GND$, $C_{FLY} = 1\mu F$, $C_{HOLD} = 1\mu F$, $C_{FILT} = 1\mu F$, $R_L = 5k\Omega$ and $C_L = 10pF$ to GND, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

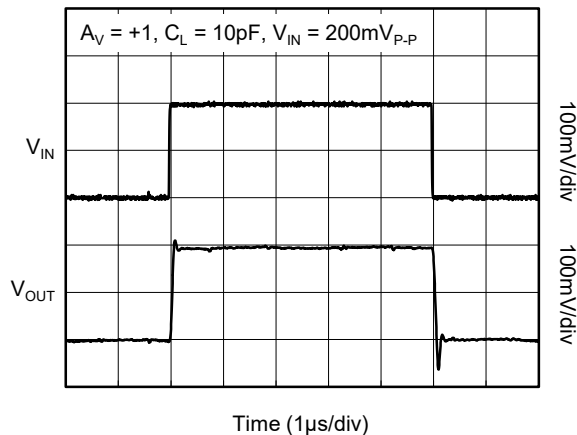
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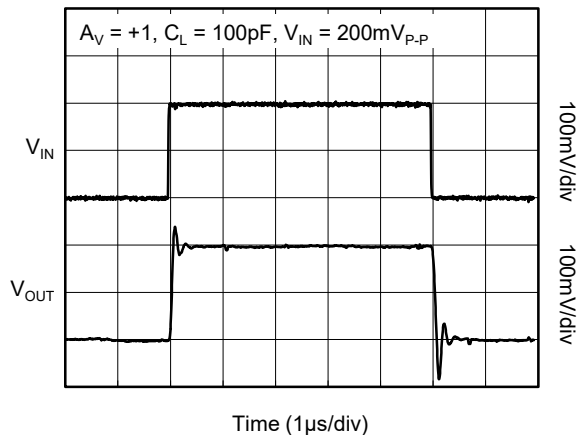
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_{DD} = V_{CPVDD} = 15V$, $V_{GND} = 0V$, $V_{CM} = GND$, $C_{FLY} = 1\mu F$, $C_{HOLD} = 1\mu F$, $C_{FILT} = 1\mu F$, $R_L = 5k\Omega$ and $C_L = 10pF$ to GND , unless otherwise noted.

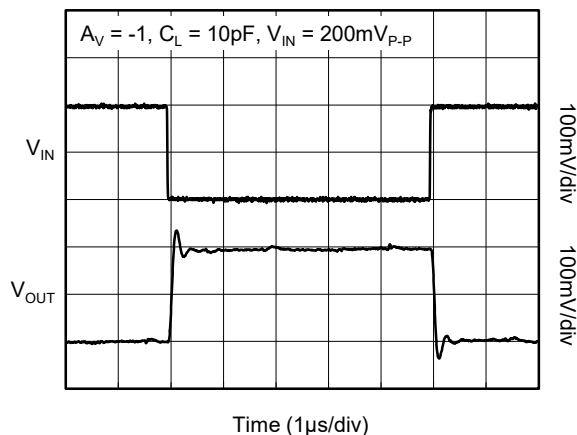
Small-Signal Step Response



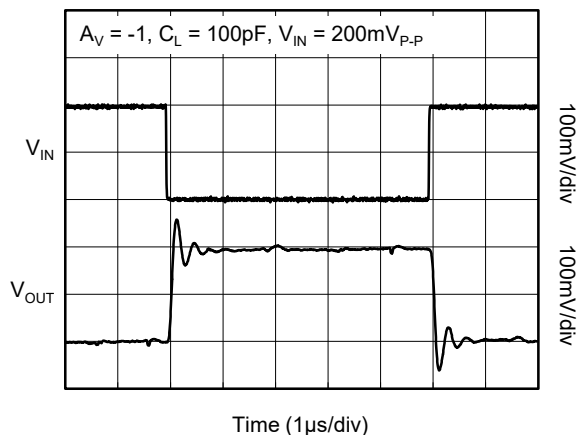
Small-Signal Step Response



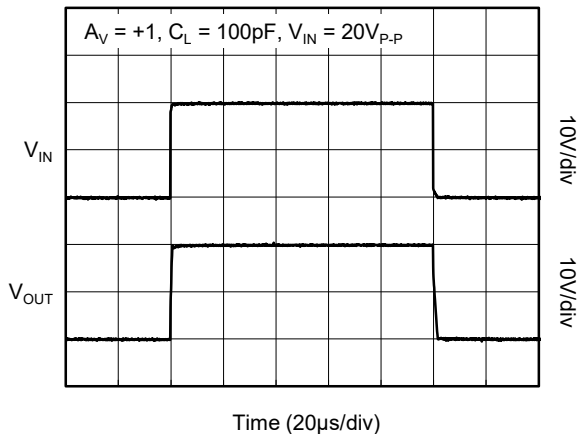
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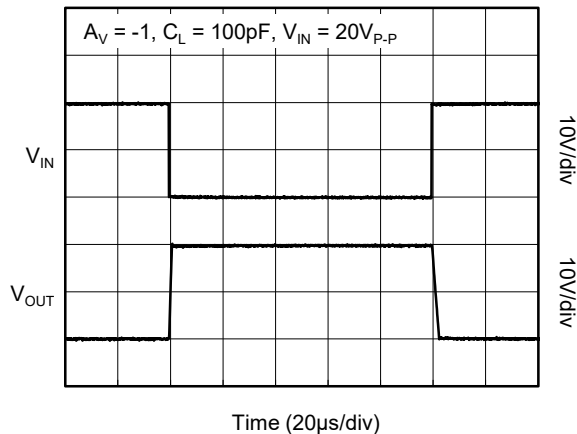
Small-Signal Step Response



Large-Signal Step Response



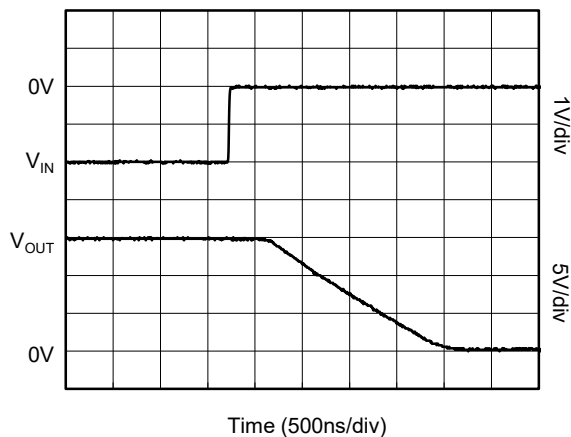
Large-Signal Step Response



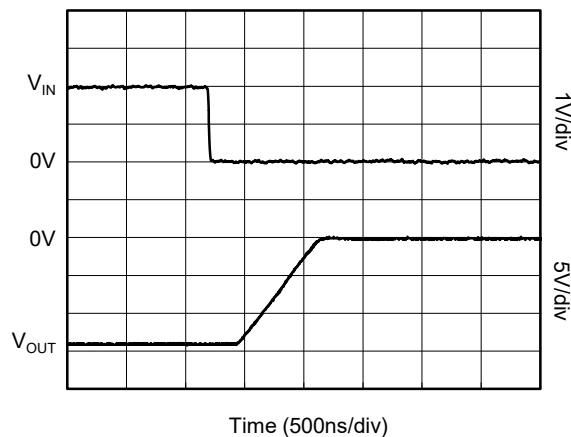
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_{DD} = V_{CPVDD} = 15V$, $V_{GND} = 0V$, $V_{CM} = GND$, $C_{FLY} = 1\mu F$, $C_{HOLD} = 1\mu F$, $C_{FILT} = 1\mu F$, $R_L = 5k\Omega$ and $C_L = 10pF$ to GND, unless otherwise noted.

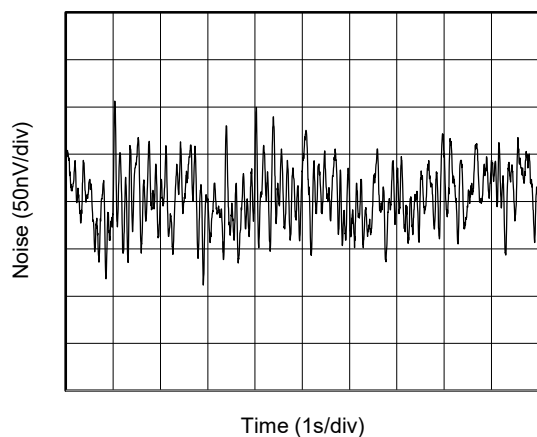
Positive Overload Recovery



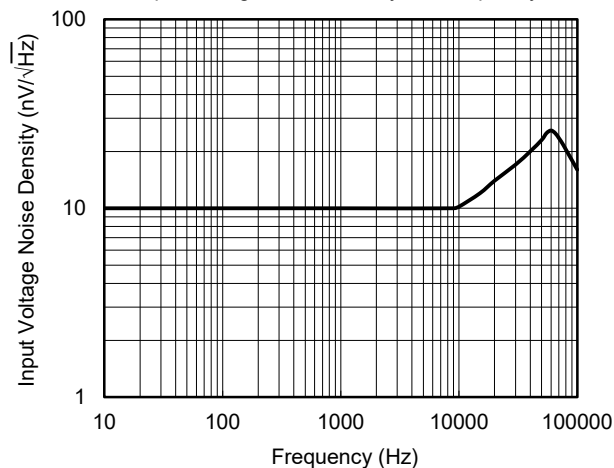
Negative Overload Recovery



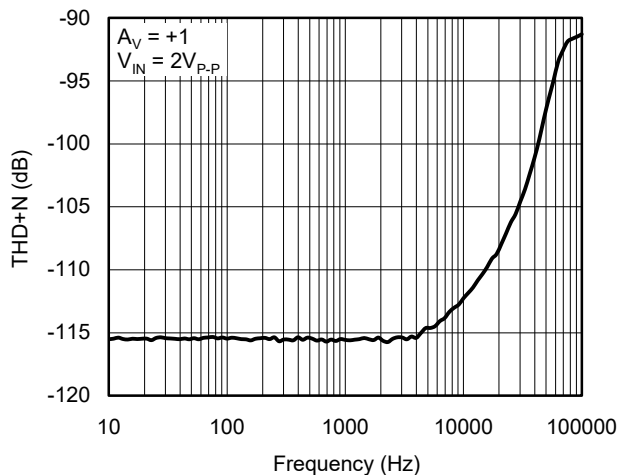
0.1Hz to 10Hz Input Voltage Noise



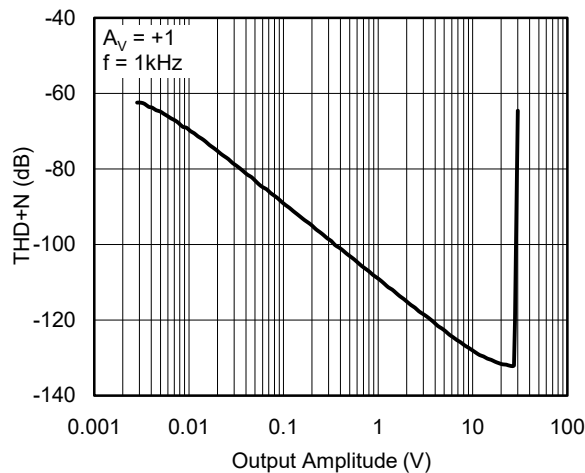
Input Voltage Noise Density vs. Frequency



THD+N vs. Frequency

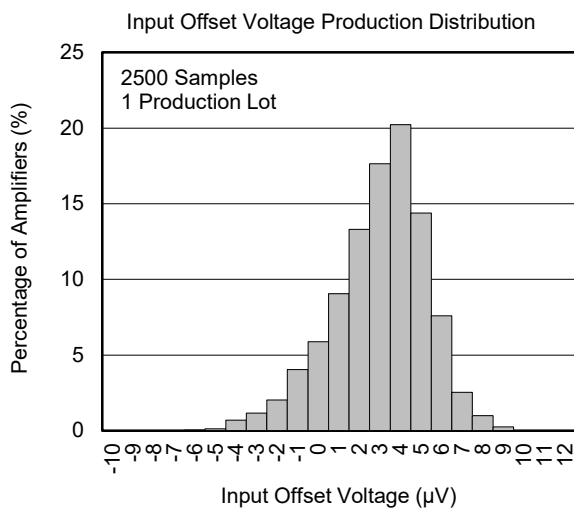
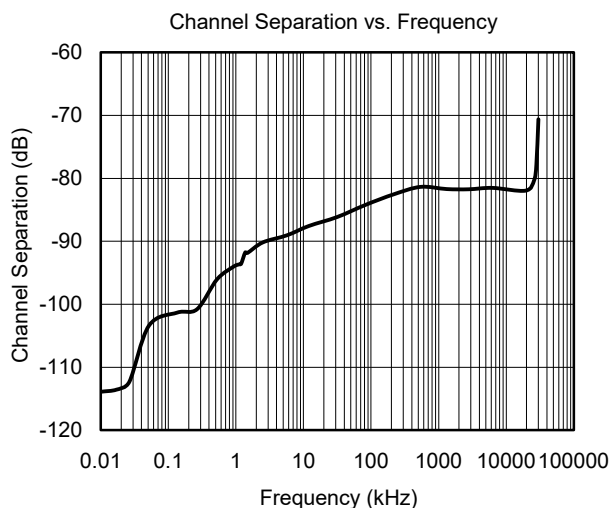
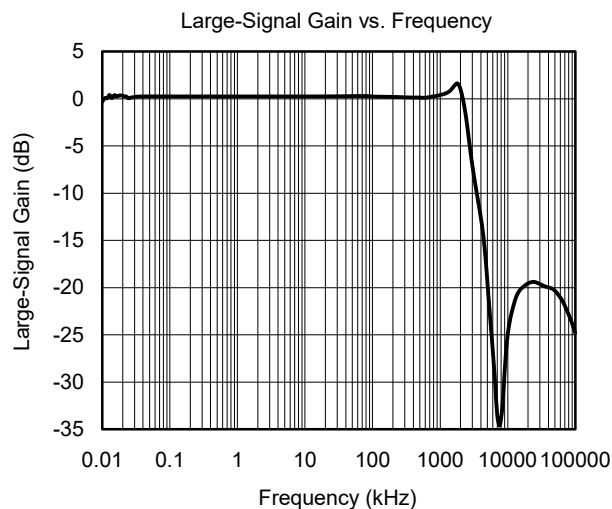
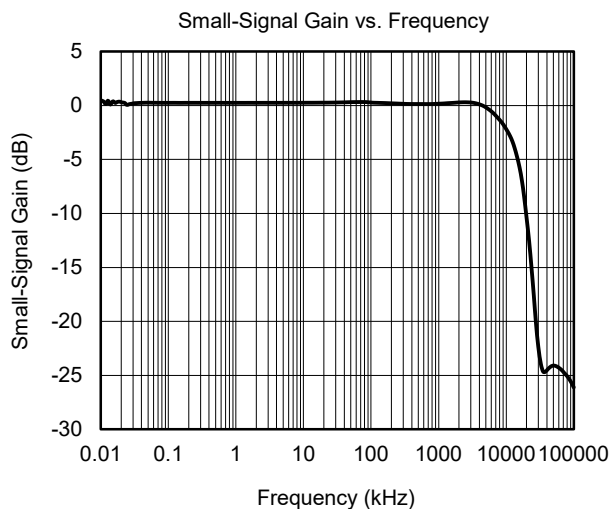


THD+N vs. Output Amplitude



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_{DD} = V_{CPVDD} = 15\text{V}$, $V_{GND} = 0\text{V}$, $V_{CM} = \text{GND}$, $C_{FLY} = 1\mu\text{F}$, $C_{HOLD} = 1\mu\text{F}$, $C_{FILT} = 1\mu\text{F}$, $R_L = 5\text{k}\Omega$ and $C_L = 10\text{pF}$ to GND, unless otherwise noted.



REVISION HISTORY

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

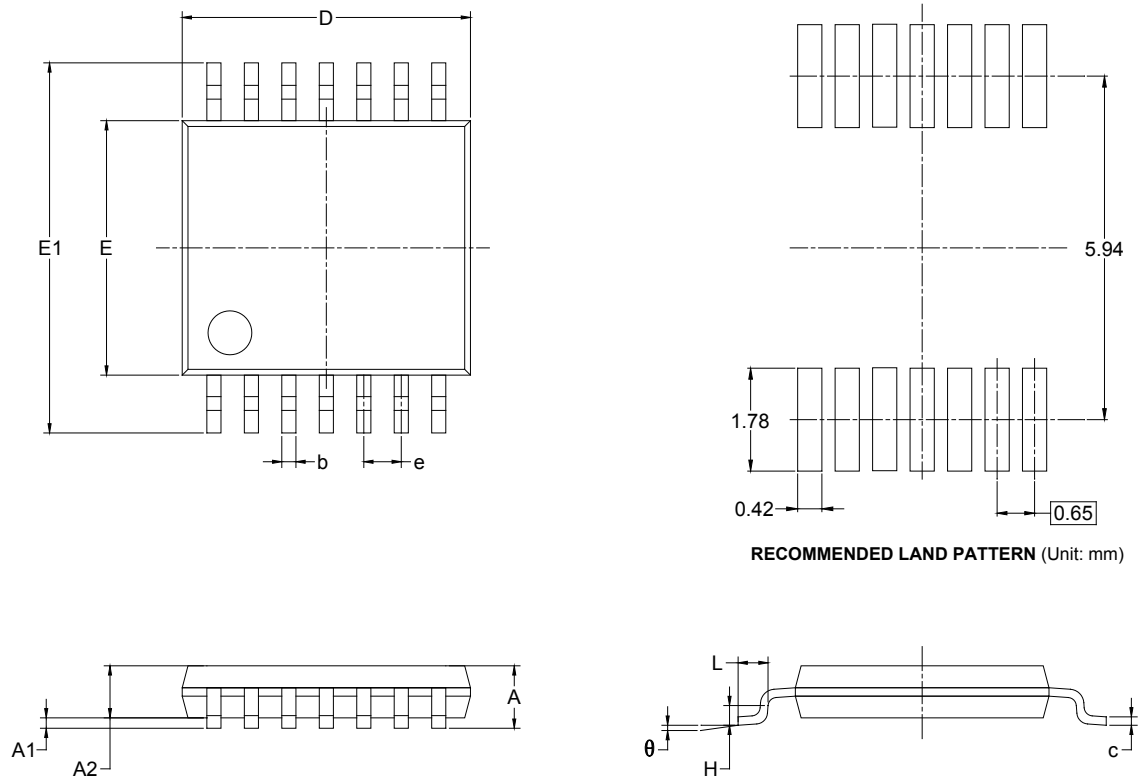
Changes from Original (DECEMBER 2017) to REV.A

Page

Changed from product preview to production data.....	All
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PACKAGE OUTLINE DIMENSIONS

TSSOP-14

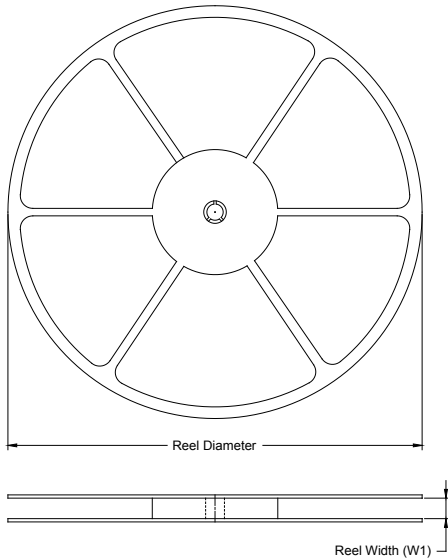


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500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

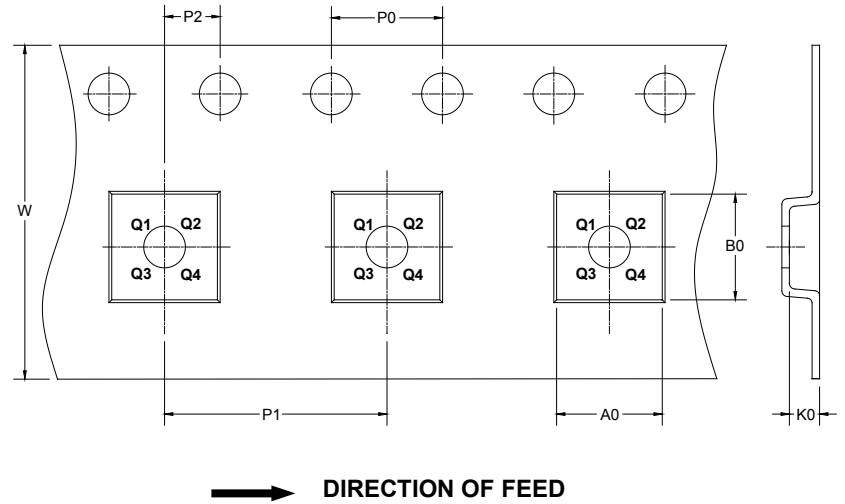
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

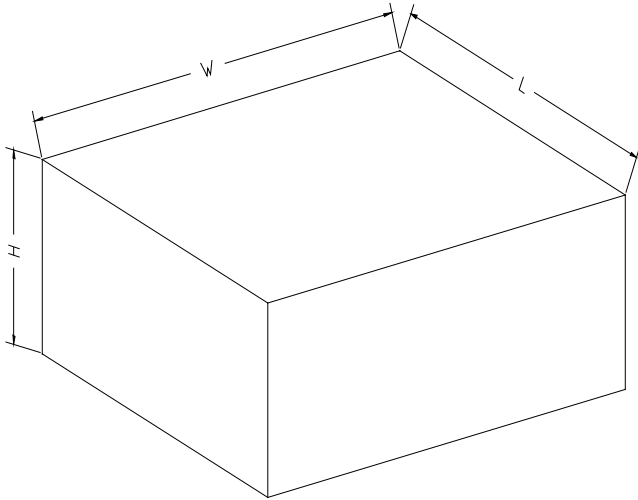
KEY PARAMETER LIST OF TAPE AND REEL

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

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
13"	386	280	370	5

DD0002