



+3V/+5V, 250MHz, SOT23 ADC Buffer Amplifiers with High-Speed Disable

MAX4285-MAX4288/MAX4387/MAX4388

General Description

The MAX4285/MAX4286 single and MAX4287/MAX4288/MAX4387/MAX4388 dual ADC buffer amplifiers feature high-speed performance and single +3V supply operation. The MAX4285/MAX4286/MAX4288 and MAX4388 offer a disable feature that reduces power-supply current and places the outputs in a high-impedance state. All six devices operate from a +2.85V to +6.5V single supply or from $\pm 1.425V$ to $\pm 3.25V$ dual supplies. The common-mode input voltage range extends to the negative power-supply rail (ground in single-supply applications).

These devices require 20mA of quiescent supply current per amplifier while achieving a 250MHz -3dB bandwidth and a 350V/ μ s slew rate. The combination of an 8ns (to 0.1%) settling time, 88dBc (f = 5MHz) of SFDR, and up to 100mA output drive makes these amplifiers ideal for high-speed ADC drivers for communications and instrumentation applications. In addition, when disabled, their high output impedance makes them ideal for multiplexing applications.

The MAX4285/MAX4286 are available in space-saving 6-pin SOT23 and 8-pin SO packages. The MAX4287/MAX4387 come in 8-pin μ MAX and 8-pin SO packages, while the MAX4288/MAX4388 come in 10-pin μ MAX and 14-pin SO packages.

Applications

- High-Speed ADC Drivers
- Communications Equipment
- Instrumentation
- CCD Imaging Systems
- Ultrasound

Typical Operating Circuit appears at end of data sheet.

Pin Configurations appear at end of data sheet.

Features

- High Speed at 3V
 - 250MHz -3dB Bandwidth (MAX4285/87/88)
 - 150MHz -3dB Bandwidth (MAX4286, MAX4387/88)
 - 350V/ μ s Slew Rate
- +2.85V to +6.5V Single-Supply Operation
- Input Common-Mode Range Extends to V_{EE}
- Low Distortion at 5MHz
 - 88dBc SFDR
- High Output Current Drive: -106mA to +77mA
- 6ns Settling Time to 0.1%
- High-Speed Enable/Disable
 - 40ns Enable Time
 - 50ns Disable Time
 - High Output Impedance
- Space-Saving SOT23 and μ MAX Packages

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE	SOT TOP MARK
MAX4285EUT-T	-40°C to +85°C	6 SOT23-6	AABQ
MAX4285ESA	-40°C to +85°C	8 SO	—
MAX4286EUT-T	-40°C to +85°C	6 SOT23-6	AABR
MAX4286ESA	-40°C to +85°C	8 SO	—
MAX4287EUA	-40°C to +85°C	8 μ MAX	—
MAX4287ESA	-40°C to +85°C	8 SO	—

Ordering Information continued at end of data sheet.

Selector Guide

PART	OP AMPS PER PKG	MIN GAIN	-3dB BANDWIDTH (AT MIN GAIN)	HIGH-SPEED DISABLE	PIN-PACKAGE
MAX4285	1	1	250MHz	Yes	6-pin SOT23, 8-pin SO
MAX4286	1	5	150MHz	Yes	6-pin SOT23, 8-pin SO
MAX4287	2	1	250MHz	No	8-pin μ MAX/SO
MAX4288	2	1	250MHz	Yes	10-pin μ MAX/14-pin SO
MAX4387	2	5	150MHz	No	8-pin μ MAX/SO
MAX4388	2	5	150MHz	Yes	10-pin μ MAX, 14-pin SO

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ABSOLUTE MAXIMUM RATINGS

Supply Voltage ($V_{CC} - V_{EE}$)	-0.3V to +7.5V	8-Pin μ MAX (derate 4.1mW/°C above +70°C)	330mW
Input Voltage Range ($IN+$, $IN-$)	($V_{EE} - 0.3V$) to ($V_{CC} + 0.3V$)	10-Pin μ MAX (derate 5.6mW/°C above +70°C)	444mW
Differential Input Voltage	-0.3V to +7.5V	8-Pin SO (derate 5.88mW/°C above +70°C)	471mW
Voltage at $\overline{DISABLE}$	($V_{EE} - 0.3V$) to ($V_{CC} + 0.3V$)	14-Pin SO (derate 8.3mW/°C above +70°C)	667mW
Current into $IN+$, $IN-$, $\overline{DISABLE}$	$\pm 20mA$	Operating Temperature Range	-40°C to +85°C
Output Short-Circuit Duration	Indefinite	Junction Temperature	+150°C
Continuous Power Dissipation ($T_A = +70^\circ C$)		Storage Temperature Range	-65°C to +150°C
6-Pin SOT23 (derate 7.1mW/°C above +70°C)	571mW	Lead Temperature (soldering, 10s)	+300°C

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC ELECTRICAL CHARACTERISTICS

($V_{CC} = +3V$, $V_{EE} = 0$, $\overline{DISABLE} = 3V$, $R_L = \infty$, $V_{CM} = 1V$, and $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^\circ C$.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Operating Supply Voltage Range		Guaranteed by PSRR test	2.85		6.5	V	
Input Common-Mode Voltage Range	V_{CM}	Guaranteed by CMRR test	V_{EE}		$V_{CC} - 1.25$	V	
Input Offset Voltage	V_{OS}	MAX4_87EU_/MAX4_88EU_/MAX4_8_ES_		± 0.1	± 8	mV	
		MAX4285EUT-T/MAX4286EUT-T		± 1.5	± 12		
Input Offset-Voltage Temperature Coefficient	TC_{VOS}			26		$\mu V/^\circ C$	
Input Offset-Voltage Matching	ΔV_{OS}	MAX4287/88 and MAX4387/88		± 0.2		mV	
Input Bias Current	I_B			13	35	μA	
Input Offset Current	I_{OS}			0.2	8	μA	
Input Resistance	R_{IN}	Differential ($-10mV \leq V_{IN} \leq +10mV$)		38		k Ω	
		Common mode ($V_{EE} \leq V_{CM} \leq V_{CC} - 1.25V$)		600			
Common-Mode Rejection Ratio	CMRR	$V_{EE} \leq V_{CM} \leq V_{CC} - 1.25V$	MAX4_87EU_/MAX4_88EU_/MAX4_8_ES_		50	73	dB
			MAX4285EUT-T/MAX4286EUT-T		45	68	
Open-Loop Gain	A_{VOL}	$V_{EE} + 0.4V \leq V_{OUT} \leq V_{CC} - 0.4V$	$R_L = 2k\Omega$	75	94	dB	
			$R_L = 300\Omega$	65	94		
			$R_L = 100\Omega$	60	85		

DC ELECTRICAL CHARACTERISTICS (continued)

($V_{CC} = +3V$, $V_{EE} = 0$, $\overline{DISABLE} = 3V$, $R_L = \infty$, $V_{CM} = 1V$, and $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted. Typical values are at $T_A = +25^\circ C$.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Current Drive	I_{OUT}	$R_L = 20\Omega$ to V_{EE}		77		mA
		$R_L = 20\Omega$ to V_{CC}		106		
Power-Supply Rejection Ratio	PSRR	$V_{CC} = 2.85V$ to $6.5V$	40	50		dB
Disabled Output Leakage Current	I_{LEAK}	$\overline{DISABLE} = V_{EE}$, $V_{EE} \leq V_{OUT} \leq V_{CC}$		700		nA
$\overline{DISABLE}$ Logic Low Threshold	V_{IL}				$V_{CC} - 2$	V
$\overline{DISABLE}$ Logic High Threshold	V_{IH}		$V_{CC} - 1$			V
$\overline{DISABLE}$ Logic Input Low Current	I_{IL}	$\overline{DISABLE} = V_{EE}$		± 3	± 22	μA
$\overline{DISABLE}$ Logic Input High Current	I_{IH}	$\overline{DISABLE} = V_{CC}$		± 3	± 22	μA
Quiescent Supply Current (per Amplifier)	I_{SY}	$V_{CC} = 3V$	Normal mode	20	24	mA
			Disabled mode, $\overline{DISABLE} = V_{EE}$	1	3	
		$V_{CC} = 5V$	Normal mode	23	28	
			Disabled mode, $\overline{DISABLE} = V_{EE}$	1	3	

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MAX4285-MAX4288/MAX4387/MAX4388

AC ELECTRICAL CHARACTERISTICS

($V_{CC} = +3V$, $V_{EE} = 0$, $\overline{DISABLE} = 3V$, $R_L = 300\Omega$ to $V_{CC}/2$, $V_{CM} = 1V$, $A_{VCL} = +1V/V$ for MAX4285/MAX4287/MAX4288, $A_{VCL} = +5V/V$ for MAX4286 and MAX4387/MAX4388, $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal -3dB Bandwidth	BW _{SS}	V _{OUT} = 100mVp-p	MAX4285/87/88	250		MHz
			MAX4286 and MAX4387/88	150		
Large-Signal -3dB Bandwidth	BW _{LS}	V _{OUT} = 1Vp-p		200		MHz
Bandwidth for 0.1dB Flatness	BW _{0.1dB}	V _{OUT} = 100mVp-p	MAX4285/87/88	100		MHz
			MAX4286 and MAX4387/88	50		
Slew Rate	SR	V _{OUT} = 1V step, 10% to 90%		350		V/ μ s
Rise Time	t _R	V _{OUT} = 1V step, 10% to 90%		2.2		ns
Fall Time	t _F	V _{OUT} = 1V step, 90% to 10%		2.8		ns
Settling Time (0.1%)	t _{S 0.1%}	V _{OUT} = 1V step	MAX4285/87/88	6		ns
			MAX4286 and MAX4387/88	14		
Overload Recovery Time		10% overdrive		25		ns
Spurious-Free Dynamic Range	SFDR	V _{OUT} = 0.5Vp-p	f _c = 100kHz	88		dBc
			f _c = 1MHz	88		
			f _c = 5MHz	87		
			f _c = 10MHz	79		
			f _c = 20MHz	70		
			f _c = 60MHz	50		
Two-Tone Third-Order Intercept	IP ₃	f _c = 20MHz		34		dBm
Input Noise Voltage Density	e _n	f = 1MHz		10		nV/ \sqrt{Hz}
Input Noise Current Density	i _n	f = 1MHz		2.1		pA/ \sqrt{Hz}
Input Capacitance	C _{IN}			2		pF
Output Impedance	Z _{OUT}	f = 10MHz		0.5		Ω
Enable Time	t _{ON}	V _{OUT} = 1V, to within 0.1%		40		ns
Disable Time	t _{OFF}	V _{OUT} = 1V, to within 0.1%		50		
Crosstalk	X _{TALK}	MAX4287/88 and MAX4387/88, f = 10MHz, V _{OUT} = 1Vp-p		85		dBc

AC ELECTRICAL CHARACTERISTICS (continued)

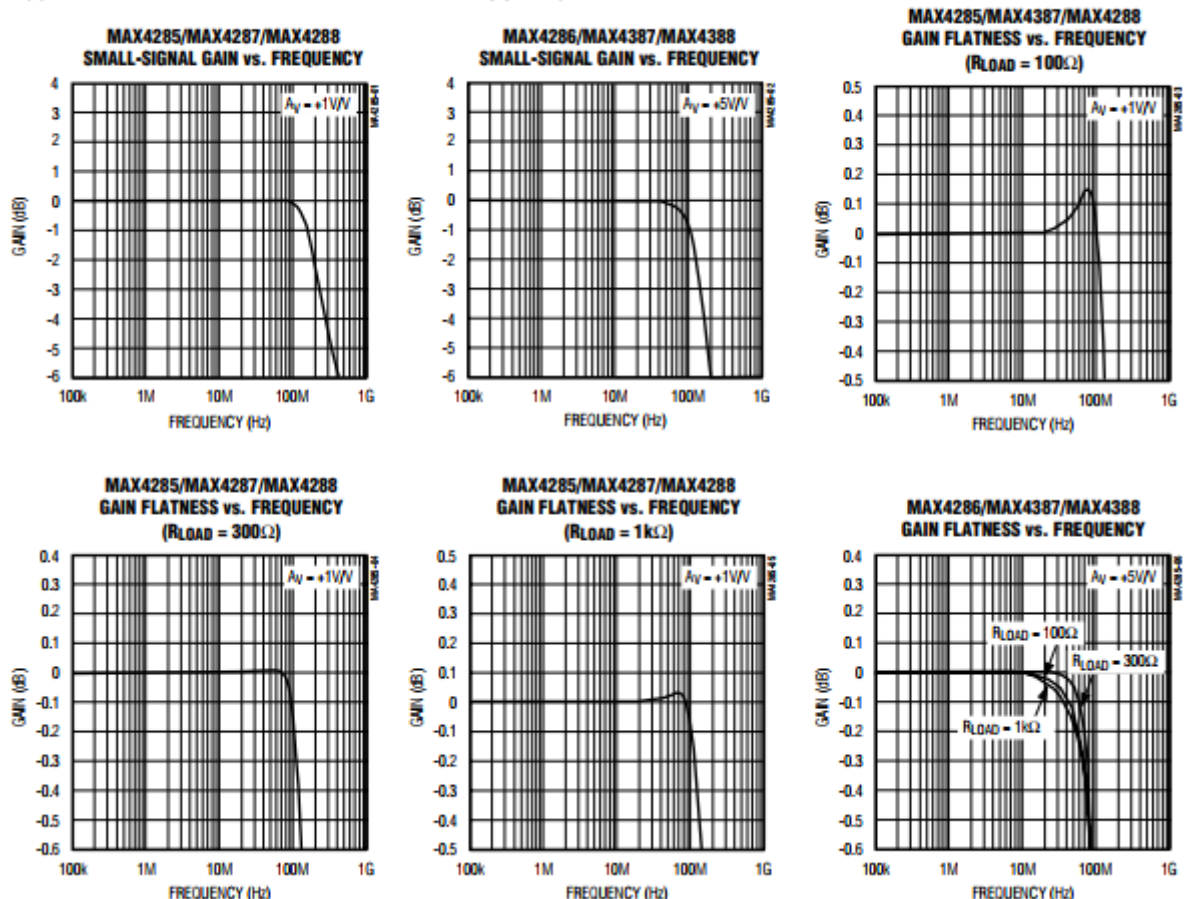
($V_{CC} = +5V$, $V_{EE} = 0$, $\overline{DISABLE}_- = 5V$, $R_L = 300\Omega$ to $V_{CC}/2$, $V_{CM} = 2.5V$, $A_{VCL} = +1V/V$ for MAX4285/MAX4287/MAX4288, $A_{VCL} = +5V/V$ for MAX4286 and MAX4387/MAX4388, $T_A = +25^\circ C$, unless otherwise noted.)

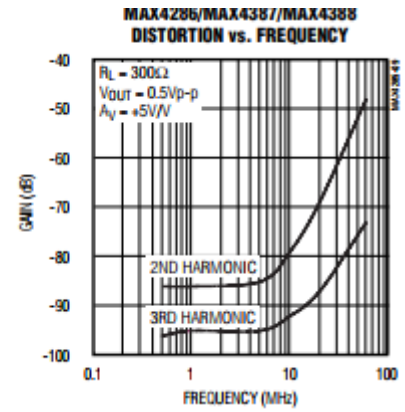
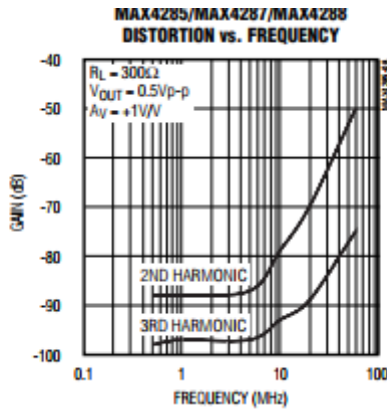
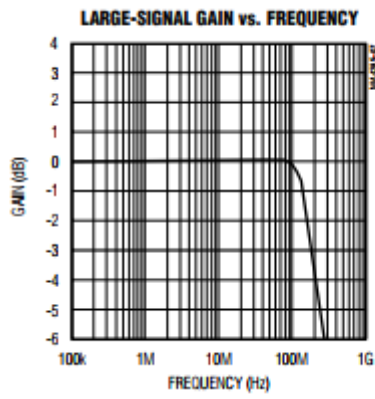
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Small-Signal -3dB Bandwidth	BW _{SS}	$V_{OUT} = 100mVp-p$	MAX4285/87/88	220		MHz
			MAX4286 and MAX4387/88	130		
Large-Signal -3dB Bandwidth	BW _{LS}	$V_{OUT} = 1Vp-p$		195		MHz
Bandwidth for 0.1dB Flatness	BW _{0.1dB}	$V_{OUT} = 100mVp-p$	MAX4285/87/88	75		MHz
			MAX4286 and MAX4387/88	40		
Slew Rate	SR	$V_{OUT} = 2V$ step, 10% to 90%		385		V/ μs
Rise Time	t_R	$V_{OUT} = 2V$ step, 10% to 90%		4.2		ns
Fall Time	t_F	$V_{OUT} = 2V$ step, 90% to 10%		2.9		ns
Settling Time (0.1%)	t_S 0.1%	$V_{OUT} = 2V$ step	MAX4285/87/88	8		ns
			MAX4286 and MAX4387/88	10		
Spurious-Free Dynamic Range	SFDR	$V_{OUT} = 1Vp-p$	$f_C = 100kHz$	86		dBc
			$f_C = 1MHz$	86		
			$f_C = 5MHz$	86		
			$f_C = 10MHz$	77		
			$f_C = 20MHz$	64		
			$f_C = 60MHz$	45		
Two-Tone Third-Order Intercept	IP3	$f_C = 20MHz$		40		dBm
Input Noise Voltage Density	e_n	$f = 1MHz$		6.5		nV/ \sqrt{Hz}
Input Noise Current Density	i_n	$f = 1MHz$		1.9		pA/ \sqrt{Hz}
Input Capacitance	C_{IN}			2		pF
Output Impedance	Z_{OUT}	$f = 10MHz$		0.5		Ω
Enable Time	t_{ON}	$V_{OUT} = 1V$, to within 0.1%		40		ns
Disable Time	t_{OFF}	$V_{OUT} = 1V$, to within 0.1%		35		
Crosstalk	XTALK	MAX4287/88 and MAX4387/88, $f = 10MHz$, $V_{OUT} = 2Vp-p$		85		dBc

Note 1: The MAX428_EUT (SOT23) are 100% production tested at $T_A = +25^\circ C$. Specifications over temperature limits are guaranteed by design.

Typical Operating Characteristics

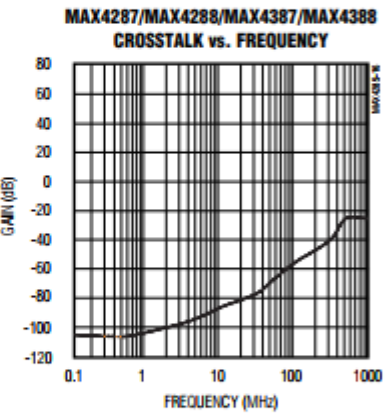
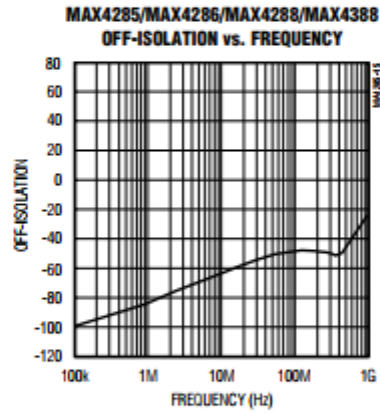
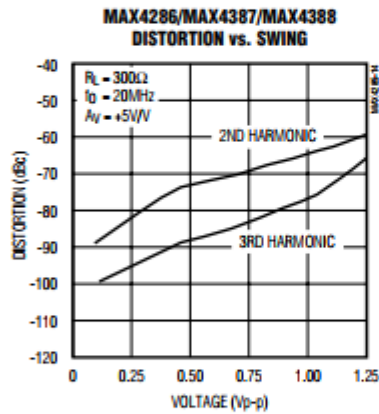
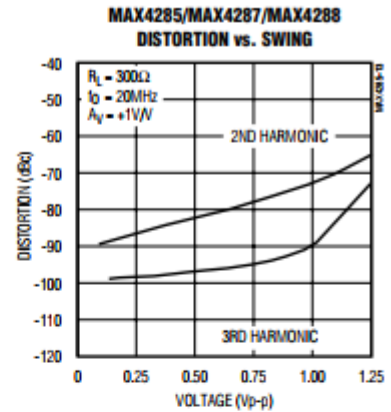
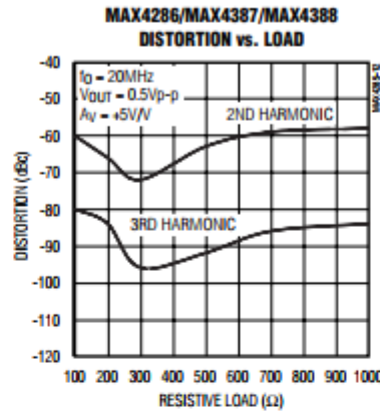
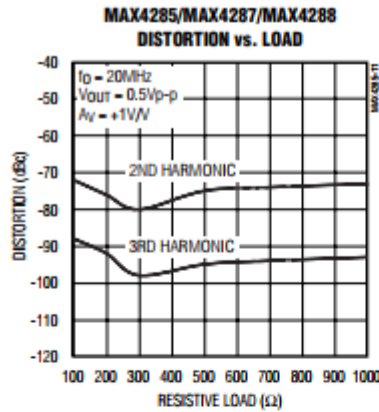
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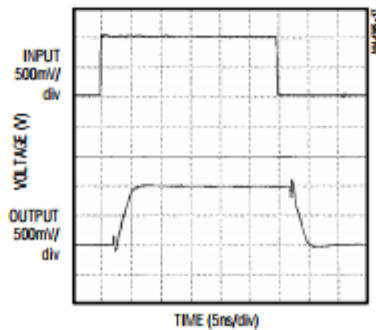


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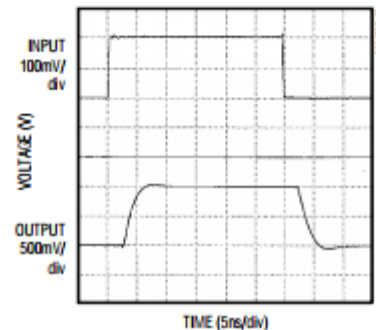
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**MAX4285/MAX4287/MAX4288
LARGE-SIGNAL PULSE RESPONSE
($A_V = +1V/V$)**



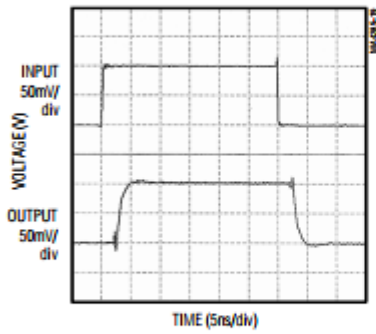
**MAX4286/MAX4387/MAX4388
LARGE-SIGNAL PULSE RESPONSE
($A_V = +5V/V$)**



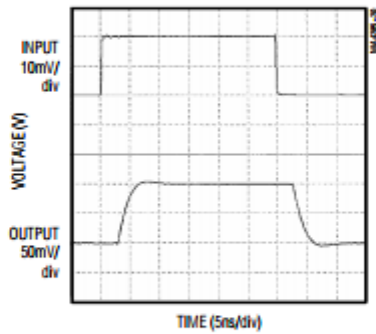
Typical Operating Characteristics (continued)

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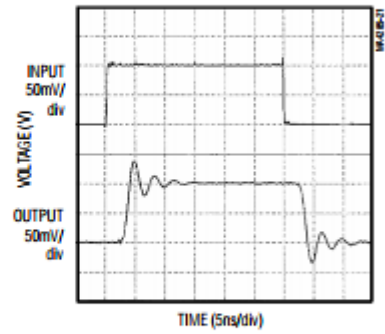
**MAX4285/MAX4287/MAX4288
SMALL-SIGNAL PULSE RESPONSE
($A_V = +1V/V$)**



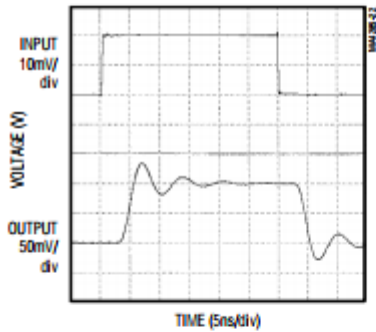
**MAX4286/MAX4387/MAX4388
SMALL-SIGNAL PULSE RESPONSE
($A_V = +5V/V$)**



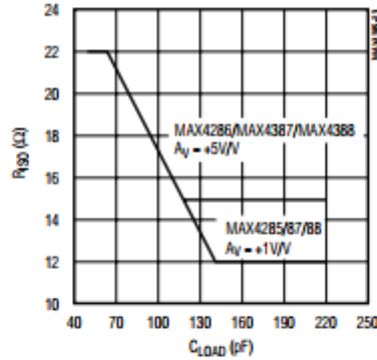
**MAX4285/MAX4287/MAX4288
SMALL-SIGNAL PULSE RESPONSE
($C_{LOAD} = 22pF$, $A_V = +1V/V$)**



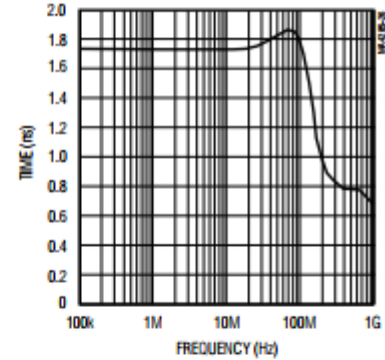
**MAX4286/MAX4387/MAX4388
SMALL-SIGNAL PULSE RESPONSE
($C_{LOAD} = 47pF$, $A_V = +5V/V$)**



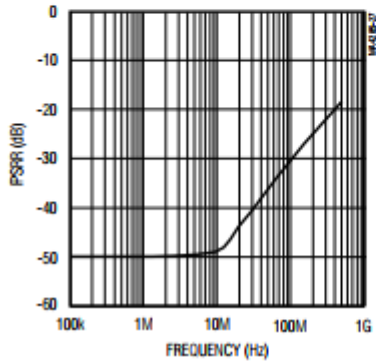
**ISOLATION RESISTANCE
vs. LOAD CAPACITANCE**



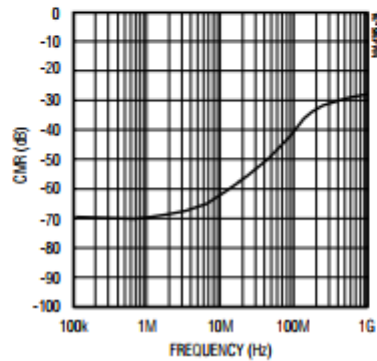
GROUP DELAY vs. FREQUENCY



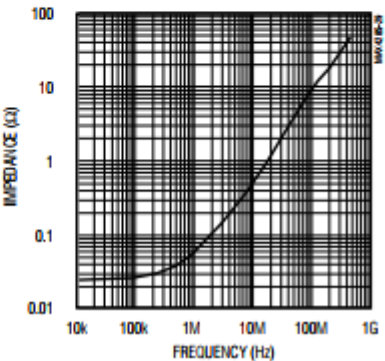
**POWER-SUPPLY REJECTION RATIO
vs. FREQUENCY**



**COMMON-MODE REJECTION
vs. FREQUENCY**



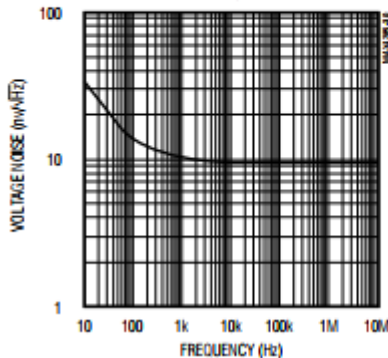
OUTPUT IMPEDANCE vs. FREQUENCY



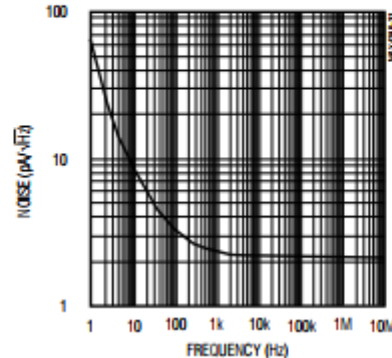
Typical Operating Characteristics (continued)

($V_{CC} = +3V$, $V_{EE} = 0$, $\overline{DISABLE}_n \geq 2V$, $R_L = 300\Omega$ to $V_{CC}/2$, $V_{CM} = +1.0V$, $T_A = +25^\circ C$, unless otherwise noted.)

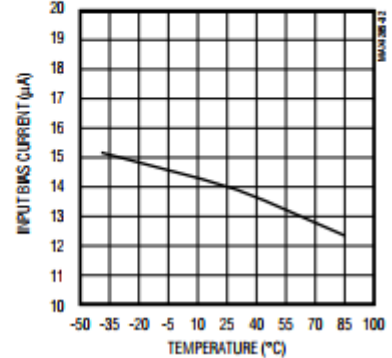
**VOLTAGE NOISE DENSITY
vs. FREQUENCY**

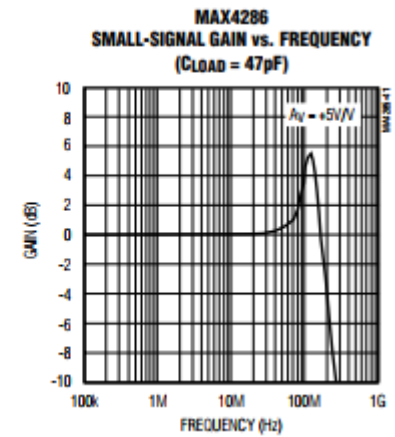
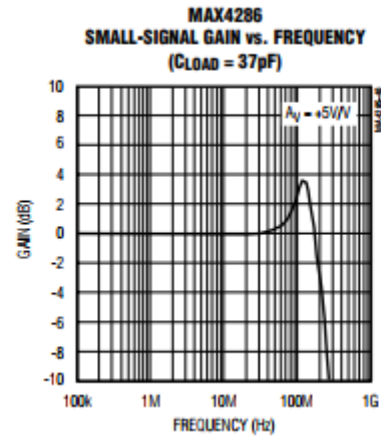
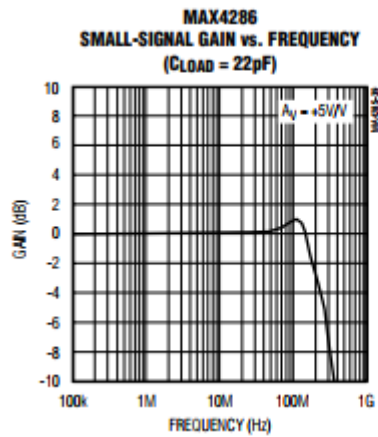
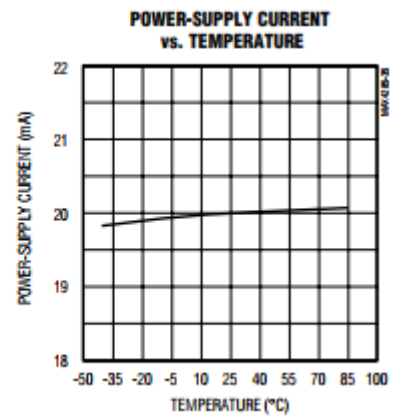
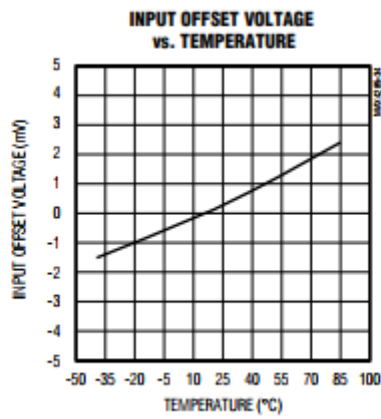
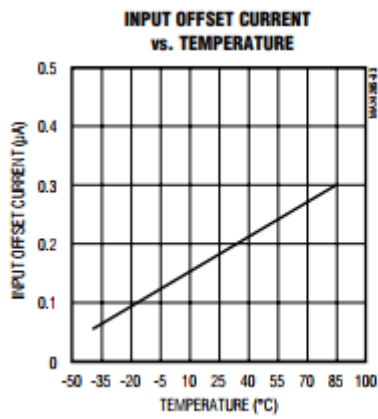


**CURRENT NOISE DENSITY
vs. FREQUENCY**



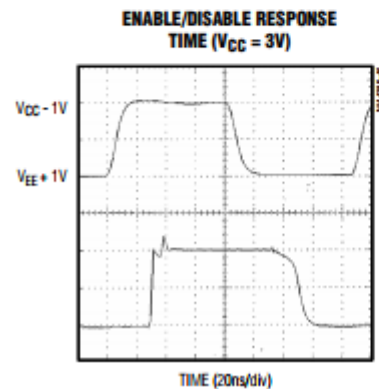
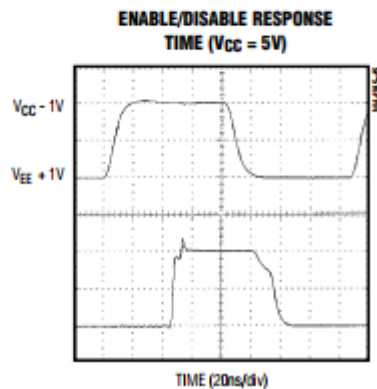
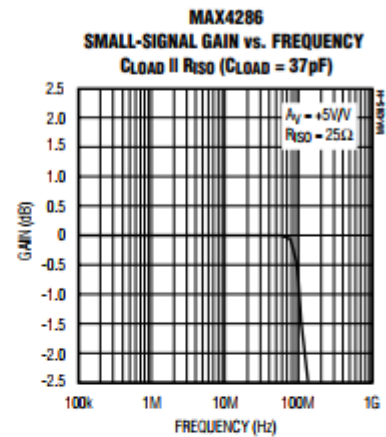
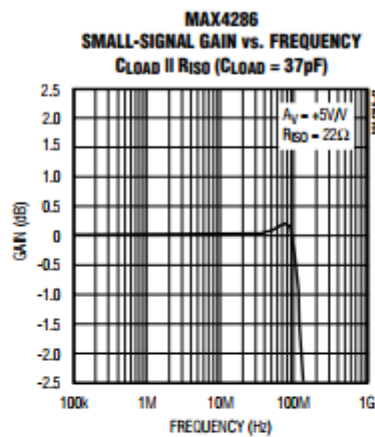
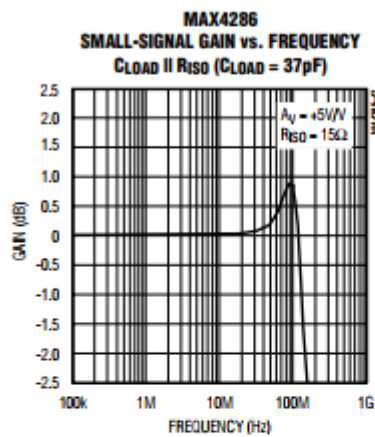
**INPUT BIAS CURRENT
vs. TEMPERATURE**





Typical Operating Characteristics (continued)

($V_{CC} = +3V$, $V_{EE} = 0$, $\overline{DISABLE} \geq 2V$, $R_L = 300\Omega$ to $V_{CC}/2$, $V_{CM} = +1.0V$, $T_A = +25^\circ C$, unless otherwise noted.)



TOP VIEW

