

MAX44280

1.8V、50MHz、低失调、 低功耗、满摆幅I/O运算放大器

概述

MAX44280具有高速、高精度、低噪声和低压工作特性，可理想用于众多信号处理系统，例如：便携式设备和工业设备中的信号滤波、放大电路。

放大器在1.8V供电时，具有小于50 μ V的输入失调电压和50MHz的高增益带宽积。器件内部针对5V/V或更高增益进行补偿，满摆幅输入/输出和低噪声特性确保提供最大的动态范围，满足12至16位SAR ADC驱动器的应用要求。与传统的满摆幅输入架构不同，经过优化的输入级采用超低噪声的电荷泵，输入没有交越失真。

MAX44280包括快速上电关断模式，进一步节省功耗。

MAX44280在-40°C至+125°C温度范围内，可以工作在1.8V至5.5V电源电压；在0°C至+70°C温度范围内，工作电压可低至1.7V。MAX44280提供小尺寸、6引脚SC70封装和1mm x 1.5mm薄型 μ DFN (超薄LGA)封装。

订购信息在数据资料的最后给出。

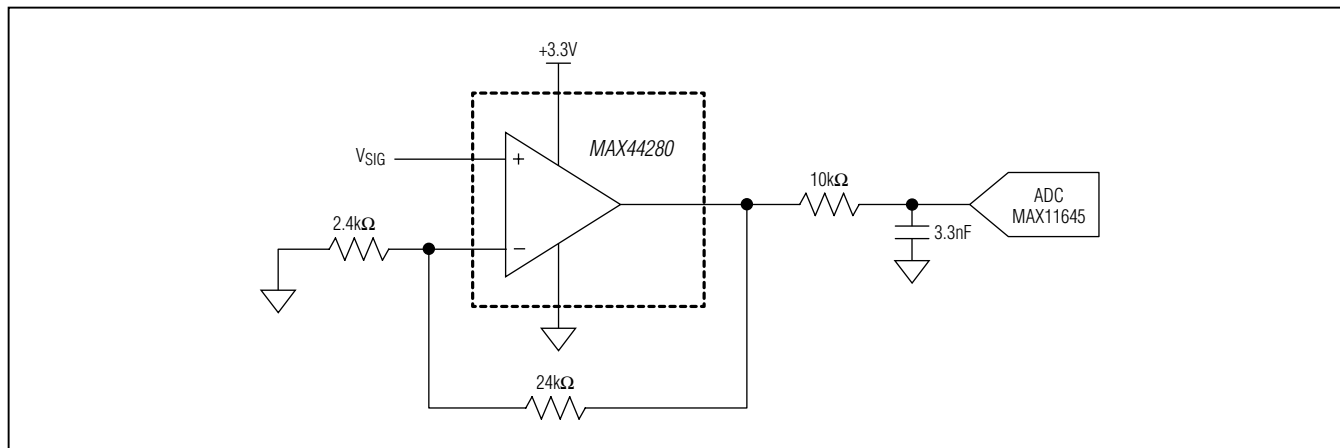
特性

- ◆ -40°C至+125°C温度范围内，工作电压低至1.8V
- ◆ 0°C至+70°C温度范围内，工作电压低至1.7V
- ◆ 50MHz带宽
- ◆ 12.7nV/ $\sqrt{\text{Hz}}$ 低输入电压噪声密度
- ◆ 1.2fA/ $\sqrt{\text{Hz}}$ 低输入电流噪声密度
- ◆ +25°C下，具有50 μ V (最大值)超低 V_{OS}
- ◆ 500fA低输入偏置电流
- ◆ 每路运放消耗750 μ A静态电流
- ◆ 关断模式下，电源电流小于1 μ A
- ◆ 小尺寸、2mm x 2mm SC70封装和1mm x 1.5mm μ DFN超薄封装
- ◆ 总谐波失真低至-110dB
- ◆ 5V/V最小稳定增益

应用

笔记本电脑
3G/4G手机
便携式媒体播放器
便携式医疗设备
电池供电设备
模/数转换器缓冲器
互阻放大器
通用信号处理

典型应用电路



相关型号以及配合该器件使用的推荐产品，请参见：china.maxim-ic.com/MAX44280.related。

本文是英文数据资料的译文，文中可能存在翻译上的不准确或错误。如需进一步确认，请在您的设计中参考英文资料。
有关价格、供货及订购信息，请联络Maxim亚洲销售中心：10800 852 1249 (北中国区)，10800 152 1249 (南中国区)，或访问Maxim的中文网站：china.maximintegrated.com。

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ABSOLUTE MAXIMUM RATINGS

IN+, IN-, OUT($V_{SS} - 0.3V$) to ($V_{DD} + 0.3V$)
 V_{DD} to V_{SS}-0.3V to +6V
SHDN.....-0.3V to +6V
Output to Short-Circuit Ground Duration 10s
Continuous Input Current into Any Pin..... $\pm 20mA$
Continuous Power Dissipation ($T_A = +70^\circ C$)
SC70 (derate 3.1mW/ $^\circ C$ above $+70^\circ C$) 245mW

Thin μ DFN (Ultra-Thin LGA)
(derate 2.1mW/ $^\circ C$ above $+70^\circ C$) 110.2mW
Operating Temperature Range $-40^\circ C$ to $+125^\circ C$
Junction Temperature $+150^\circ C$
Lead Temperature (soldering, 10s) $+300^\circ C$
Soldering Temperature (reflow) $+260^\circ C$

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.

PACKAGE THERMAL CHARACTERISTICS (Note 1)

SC70

Junction-to-Ambient Thermal Resistance (θ_{JA}) 326.5 $^\circ C/W$
Junction-to-Case Thermal Resistance (θ_{JC}) 115 $^\circ C/W$

Thin μ DFN (Ultra-Thin LGA)

Junction-to-Ambient Thermal Resistance (θ_{JA}) 470 $^\circ C/W$
Junction-to-Case Thermal Resistance (θ_{JC}) 120 $^\circ C/W$

Note 1: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to china.maxim-ic.com/thermal-tutorial.

ELECTRICAL CHARACTERISTICS

($V_{DD} = 3.3V$, $V_{SS} = 0V$, $V_{IN+} = V_{IN-} = V_{DD}/2$, $R_L = 10k\Omega$ to $V_{DD}/2$, $V_{SHDN} = V_{DD}$, $T_A = -40^\circ C$ to $+125^\circ C$. Typical values are at $T_A = +25^\circ C$, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DC CHARACTERISTICS						
Input Voltage Range	V_{IN+} V_{IN-}	Guaranteed by CMRR test	-0.1		$V_{DD} + 0.1$	V
Input Offset Voltage	V_{OS}	$T_A = +25^\circ C$		10	50	μV
		$T_A = -40^\circ C$ to $+125^\circ C$ after calibration			100	
		$T_A = -40^\circ C$ to $+125^\circ C$			500	
Input Offset Voltage Drift	$V_{OS} - TC$			0.8	5	$\mu V/^\circ C$
Input Bias Current	I_B	$T_A = +25^\circ C$		0.01	0.5	pA
		$T_A = -40^\circ C$ to $+85^\circ C$			10	
		$T_A = -40^\circ C$ to $+125^\circ C$			100	
Input Capacitance	C_{IN}			0.4		pF
Common-Mode Rejection Ratio	CMRR	$V_{CM} = -0.1V$ to $(V_{DD} + 0.1V)$	75	90		dB
Open-Loop Gain	A_{OL}	$0.4V \leq V_{OUT} \leq V_{DD} - 0.4V$, $R_{OUT} = 10k\Omega$	100	115		dB
		$0.4V \leq V_{OUT} \leq V_{DD} - 0.4V$, $R_{OUT} = 600\Omega$	91	100		
		$0.4V \leq V_{OUT} \leq V_{DD} - 0.4V$, $R_{OUT} = 32\Omega$		80		
Output Short-Circuit Current	I_{SC}	To V_{DD} or V_{SS}		85		mA

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ELECTRICAL CHARACTERISTICS (continued)

($V_{DD} = 3.3V$, $V_{SS} = 0V$, $V_{IN+} = V_{IN-} = V_{DD}/2$, $R_L = 10k\Omega$ to $V_{DD}/2$, $V_{SHDN} = V_{DD}$, $T_A = -40^{\circ}C$ to $+125^{\circ}C$. Typical values are at $T_A = +25^{\circ}C$, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage Swing	V _{OL} - V _{SS}	R _{OUT} = 10kΩ			20	mV
		R _{OUT} = 600Ω			50	
		R _{OUT} = 32Ω		400	700	
	V _{DD} - V _{OH}	R _{OUT} = 10kΩ			10	
		R _{OUT} = 600Ω			40	
		R _{OUT} = 32Ω		400	800	
AC CHARACTERISTICS						
Input Voltage-Noise Density	e _n	f = 10kHz		12.7		nV/√Hz
Input Current-Noise Density	i _n	f = 10kHz		1.2		fA/√Hz
Gain-Bandwidth Product	GBWP			50		MHz
Minimum Stable Gain	A _{MIN}			5		V/V
Slew Rate	SR			30		V/μs
Settling Time		V _{OUT} = 2V _{P-P} , V _{DD} = 3.3V, A _V = 5V/V, C _L = 30pF (load), settle to 0.01%		0.6		μs
Capacitive Load	C _{LOAD}	No sustained oscillation, 5V/V		80		pF
		No sustained oscillation, 10V/V		500		
Total Harmonic Distortion	THD	f = 10kHz, V _O = 2V _{P-P} , A _V = 5V/V, R _{OUT} = 10kΩ		-110		dB
Output Transient Recovery Time		ΔV _{OUT} = 0.2V, V _{DD} = 3.3V, A _V = 5V/V; R _S = 20Ω, C _L = 1nF (load)		1		μs
POWER-SUPPLY CHARACTERISTICS						
Power-Supply Range	V _{DD}	Guaranteed by PSRR	1.8		5.5	V
		T _A = 0°C to +70°C	1.7		5.5	
Power-Supply Rejection Ratio	PSRR	V _{CM} = V _{DD} /2	82	95		dB
Quiescent Current	I _{DD}			750	1200	μA
Shutdown Supply Current	I _{SHDN}				1	μA
Shutdown Input Low	V _{IL}				0.7	V
Shutdown Input High	V _{IH}		1.3			V
Output Leakage Current in Shutdown	I _{SHDN}			100		pA
Shutdown Input Bias Current	I _{IL} /I _{IH}				1	μA
Shutdown Turn-On Time	t _{SHDN}			15		μs
Turn-On Time	t _{ON}			10		ms

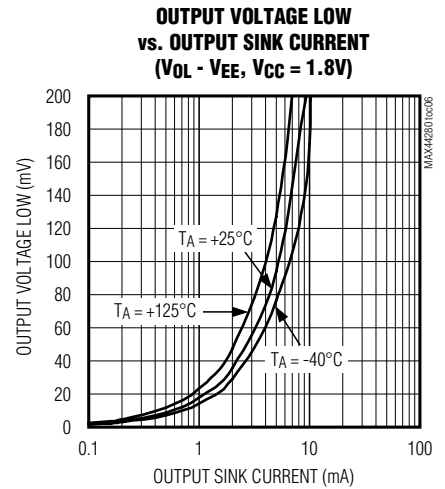
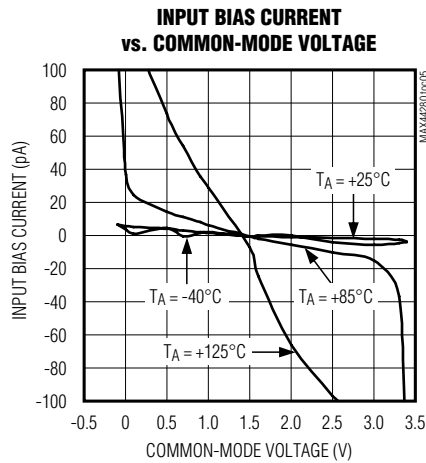
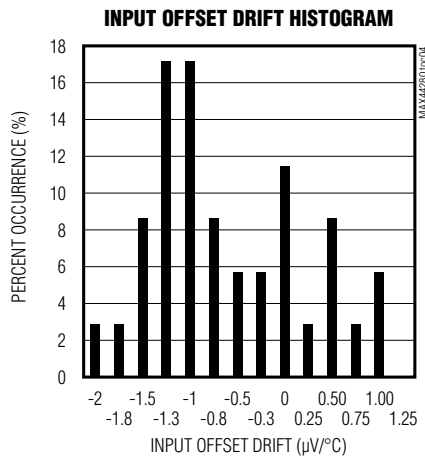
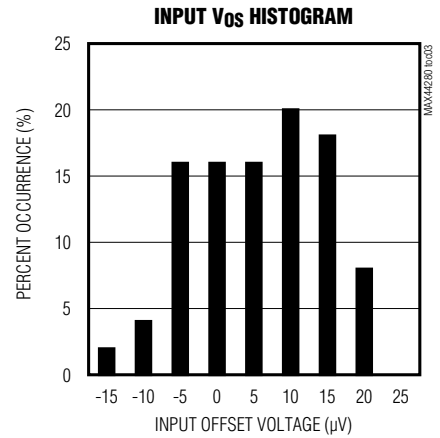
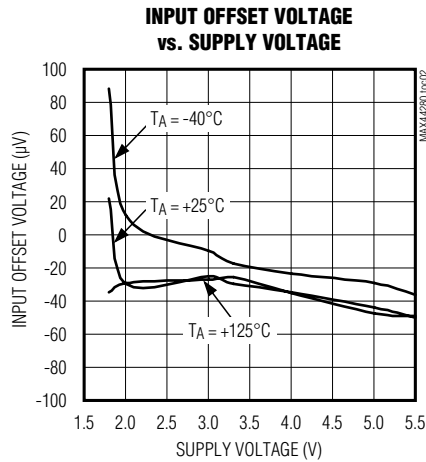
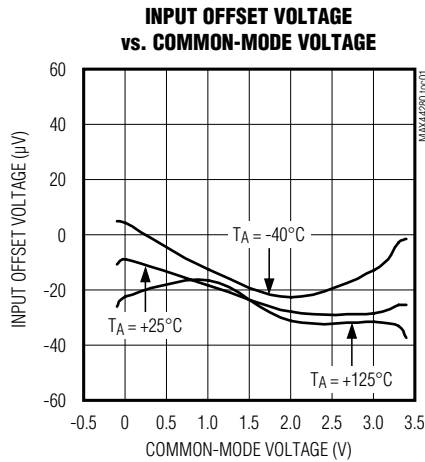
Note 2: All devices are 100% production tested at $T_A = +25^{\circ}C$. Temperature limits are guaranteed by design.

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典型工作特性

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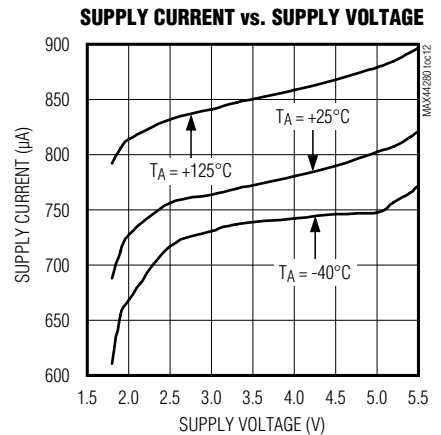
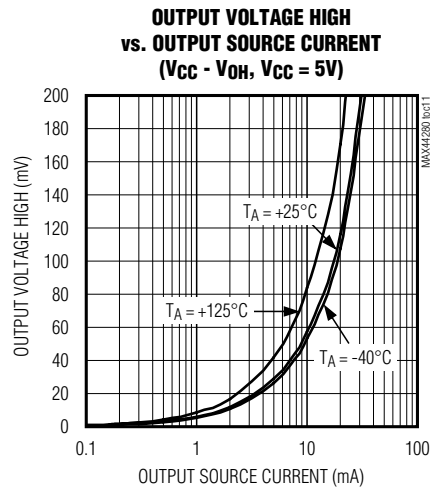
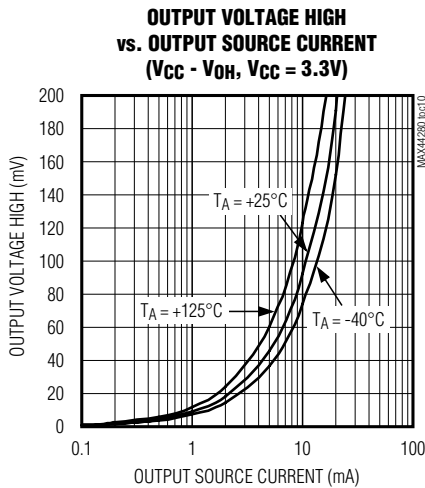
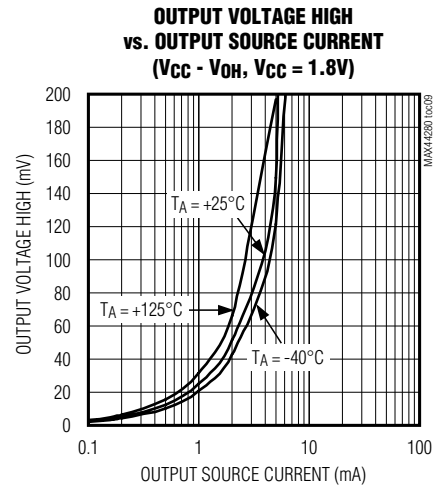
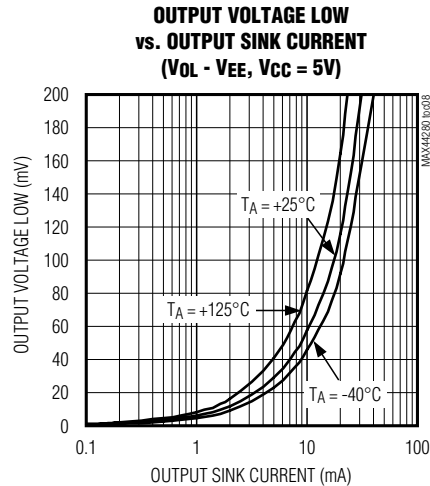
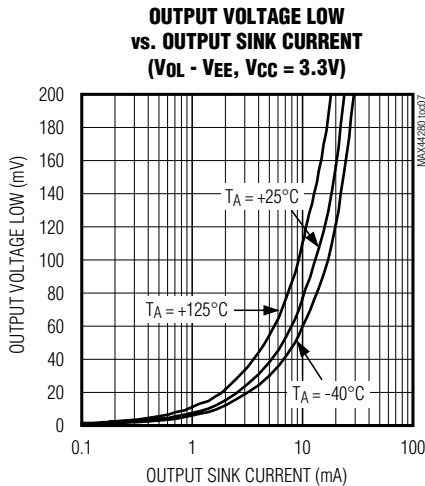


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典型工作特性(续)

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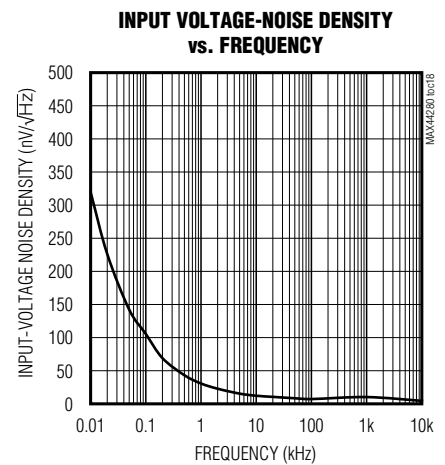
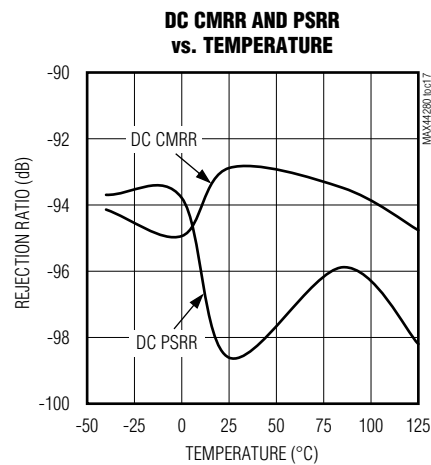
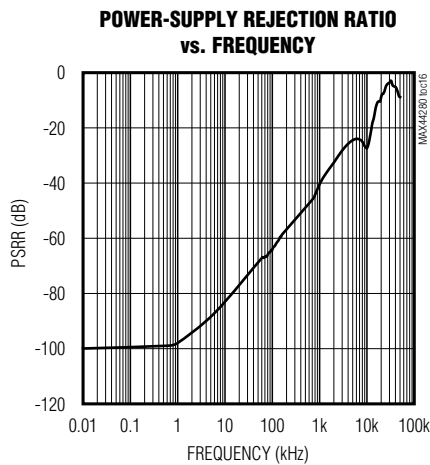
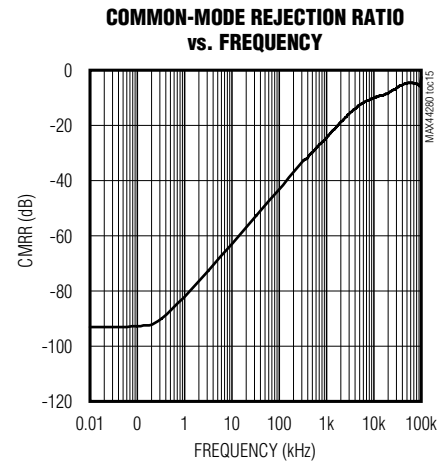
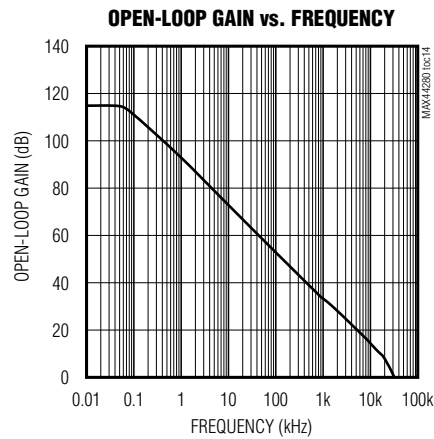
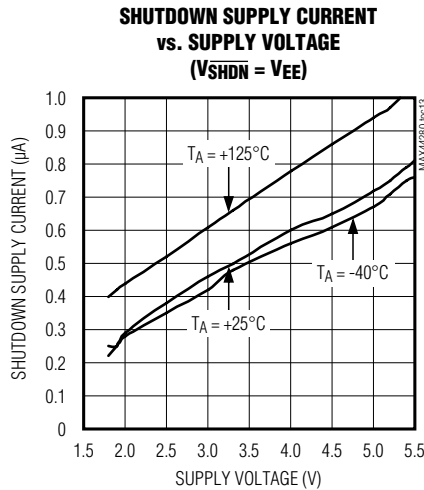


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典型工作特性(续)

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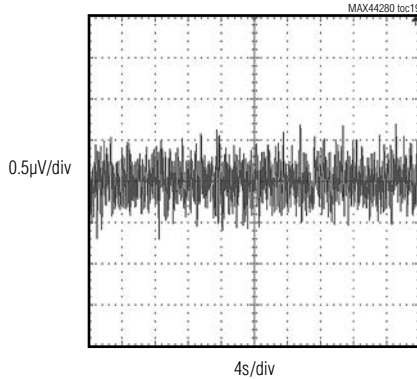
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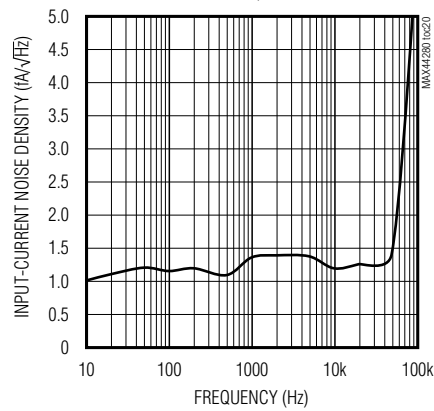
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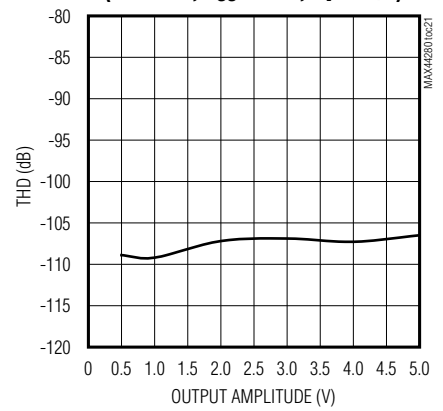
0.1Hz TO 10Hz OUTPUT-VOLTAGE NOISE



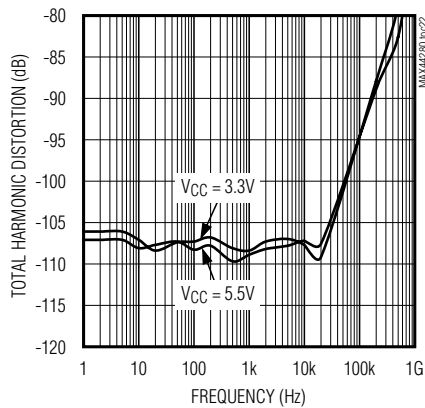
INPUT CURRENT-NOISE DENSITY
vs. FREQUENCY



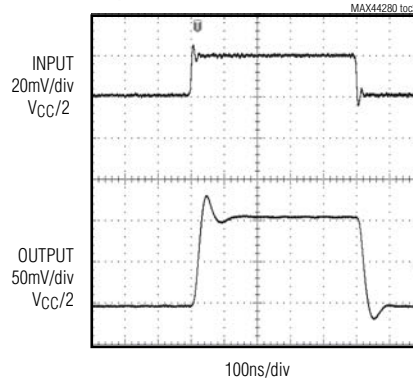
TOTAL HARMONIC DISTORTION vs. INPUT AMPLITUDE
($f = 10kHz$, $V_{CC} = 5.5V$, $A_V = 5V/V$)



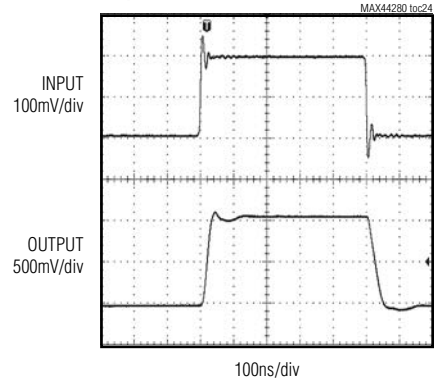
TOTAL HARMONIC DISTORTION vs. FREQUENCY
($V_{OUT} = 2V_{P-P}$)



SMALL-SIGNAL TRANSIENT RESPONSE
($A_V = 5V/V$, $R_F = 4k\Omega$, $R_G = 1k\Omega$)



LARGE-SIGNAL TRANSIENT RESPONSE
($A_V = 5V/V$, $R_F = 4k\Omega$, $R_G = 1k\Omega$)

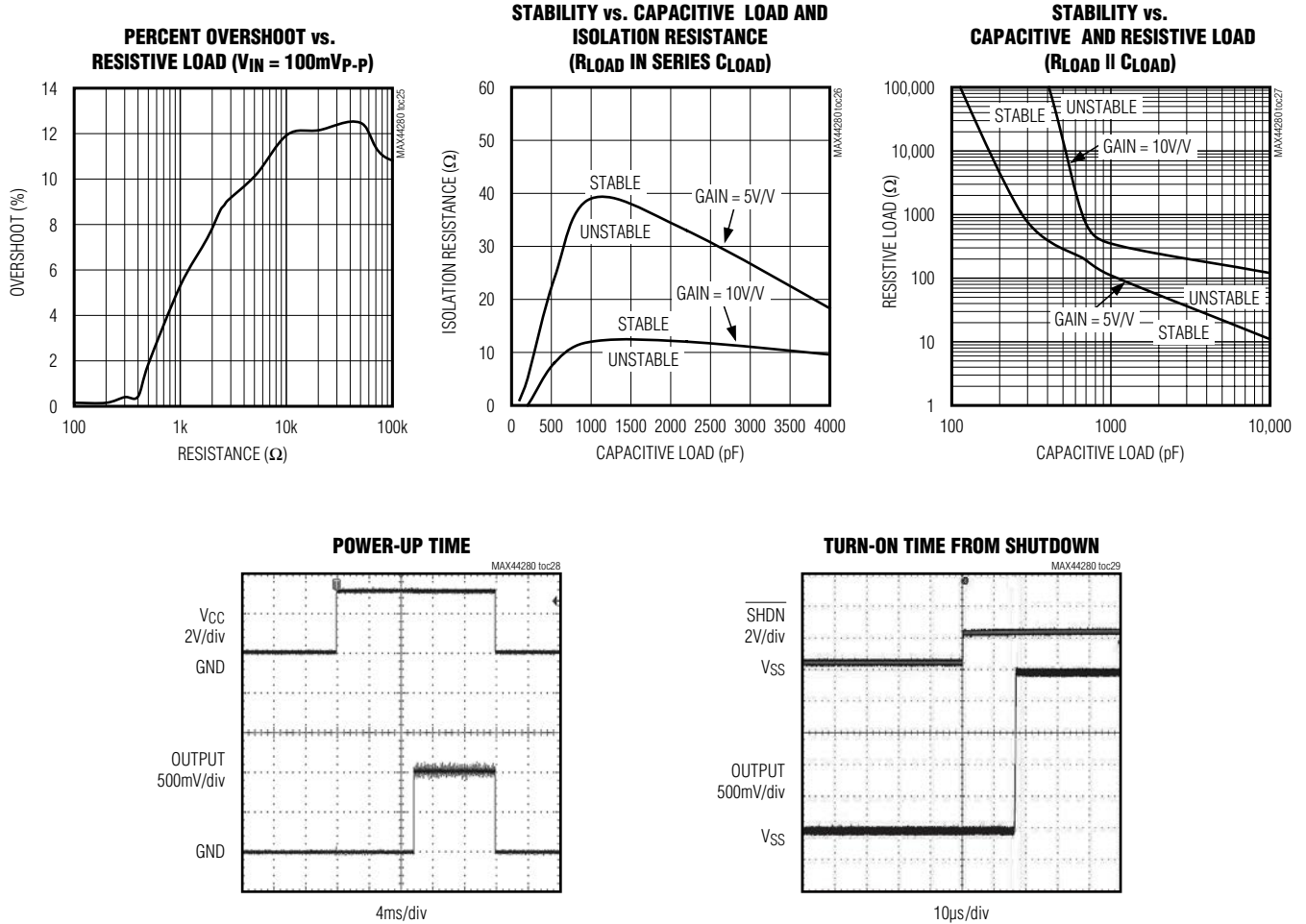


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典型工作特性(续)

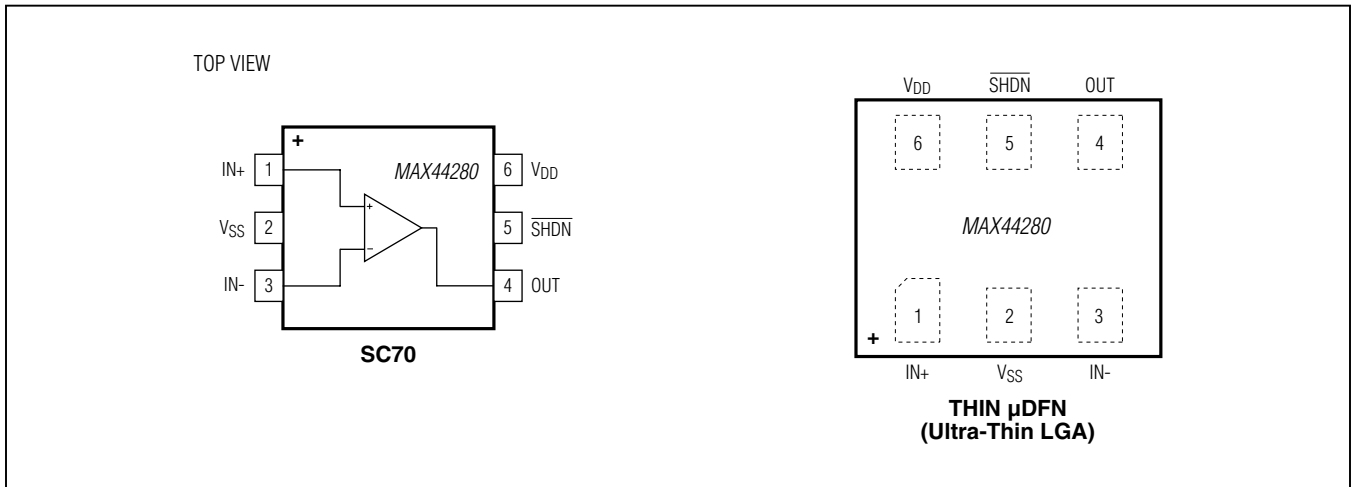
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引脚配置



引脚说明

引脚	名称	功能
1	IN+	同相输入端。
2	VSS	负电源，通过0.1 μ F电容旁路至地。
3	IN-	反相输入端。
4	OUT	输出端。
5	SHDN	低电平有效关断控制。
6	VDD	正电源，通过0.1 μ F电容旁路至地。

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详细说明

MAX44280为高速、低功耗运算放大器，由于器件具有高精度、低噪声CMOS输入，非常适合信号处理应用。器件的上电自校准功能消除了温度和电源变化的影响。

MAX44280具有低功耗关断模式，器件不工作时可进入关断模式，有效降低静态电流。可在30 μ s之内从关断模式恢复工作。

交越失真

运算放大器内部集成低噪声电荷泵，在内部产生比 V_{DD} 高出1V的电压，用于pMOS晶体管输入差分对供电，如图1所示。这种独特架构消除了传统CMOS输入架构中常见的交越失真(图2)，特别是在同相配置时，例如Sallen-Key滤波器。

电荷泵的工作频率远远高于放大器的单位增益带宽。高频工作及超低噪声电路设计，有效抑制了电荷泵噪声，无需使用外部元件，用户端完全透明。

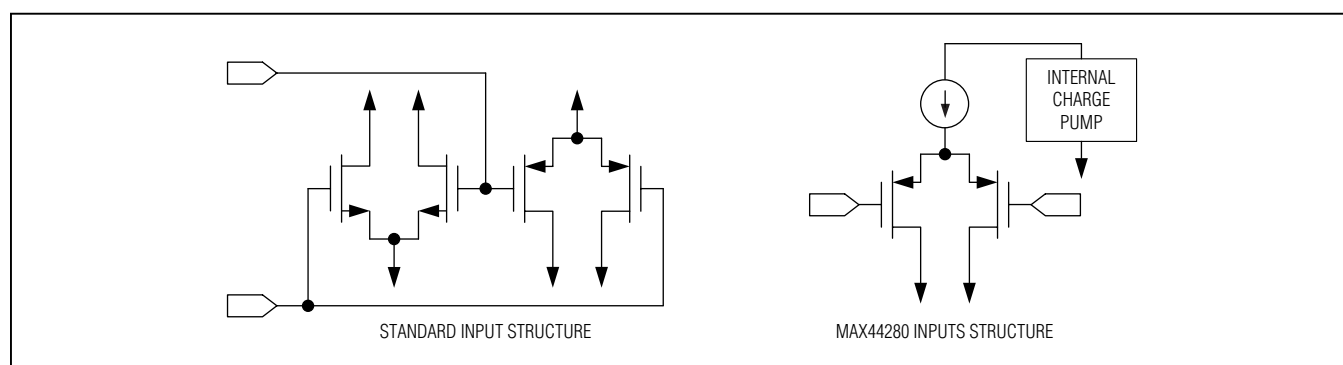


图1. MAX44280输入架构与标准运放输入的比较

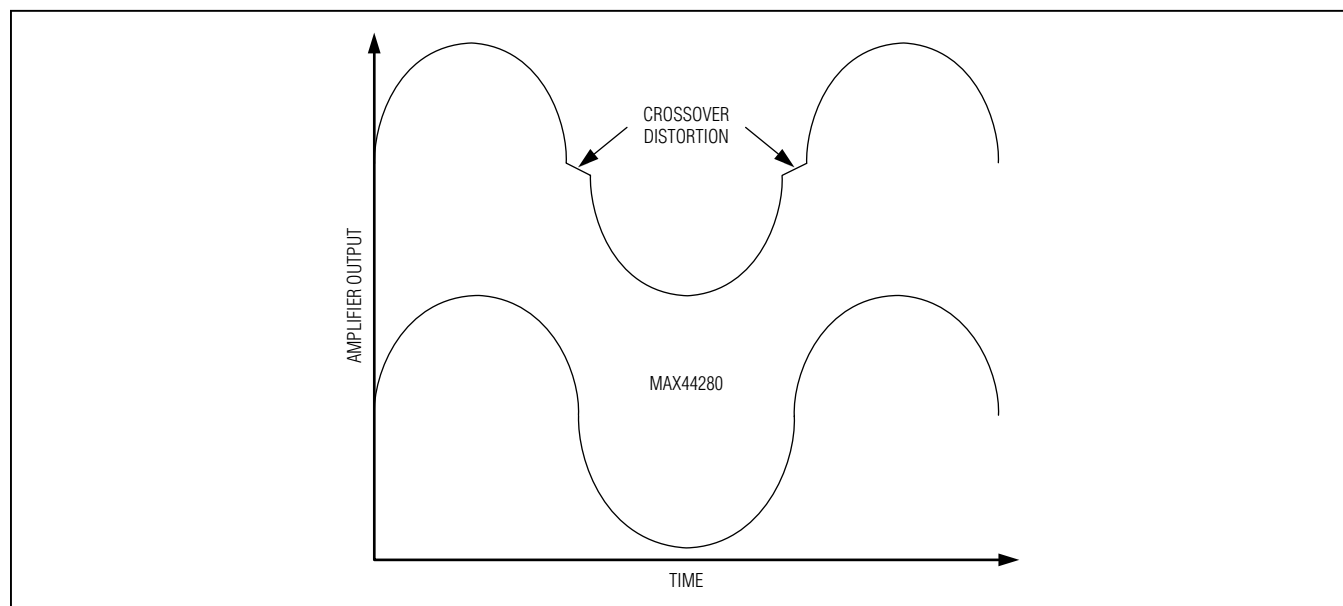


图2. 典型放大器的交越失真

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应用信息

上电自动微调

IC具有自动微调功能，上电时将器件的输入失调电压 V_{os} 自校准至50 μ V以下。通过重新上电，自校准功能可以消除由于电源、工作温度变化产生的输入失调电压。完成自动微调需要大约10ms，由内部上电复位(POR)电路触发操作。在此期间，输入和输出置于高阻态，保持浮空。

关断模式

MAX44280具有低电平有效关断控制，关断时输入和输出置于高阻态，静态电流降低至1 μ A以内。将输出置于高阻态时，允许多路输出复用到一条输出线，无需额外的外部缓冲器。退出关断模式时，器件不进行自校准，保持其上电微调设置。器件在30 μ s内从关断模式恢复。

器件的关断逻辑电平独立于电源电压，采用1.8V或3.3V微控制器都可以控制器件进入关断模式，与电源电压无关。

满摆幅输入/输出

IC的输入电压范围可扩展至 V_{DD} 以上及 V_{SS} 以下100mV，较宽的共模输入电压范围允许运放在各种信号处理应用中用作缓冲器和差分放大器。输出电压的上限/下限设计为高于 V_{SS} 、低于 V_{DD} 50mV，使器件在单电源应用中具有最大动态范围。器件具有大输出电流和大电容驱动能力，可理想用作ADC驱动器和线驱动器。

输入偏置电流

IC采用高阻CMOS输入级和专有的ESD结构，允许在低输入以及共模输入下提供极低的输入偏置电流。连接高电阻传感器时，低输入偏置电流特性非常关键。器件还非常适合在光电二极管传感器应用中作为互阻放大器使用，理想用于以地为参考的医疗、工业传感器。

有源滤波器

MAX44280可用于构建各种有源滤波器电路，充分利用其宽带、满摆幅输入/输出和高阻CMOS输入等优势。

MAX11645 ADC驱动器

IC的微小尺寸和低噪声特性使其非常适合驱动空间受限应用中的12至16位分辨率ADC。[典型应用电路](#)中，MAX44280放大器输出连接到低通滤波器，驱动MAX11645 ADC。MAX11645是3V/5V供电、12位/10位、双通道ADC系列产品中的一款。

MAX11645采样率高达94ksps，测量两路单端输入或一路差分输入。ADC在最大采样率时消耗电流670 μ A，1ksps时仅消耗6 μ A电流，关断时电流损耗0.5 μ A。MAX11645 ADC采用超小尺寸、1.9mm x 2.2mm WLP和 μ MAX-8封装，非常适合在便携应用中与MAX44280放大器配合使用。需要较高分辨率时，请参考MAX1069 (14位)和MAX1169 (16位) ADC系列。

MAX44280

1.8V、50MHz、低失调、
低功耗、满摆幅I/O运算放大器

芯片信息

订购信息

PROCESS: BiCMOS

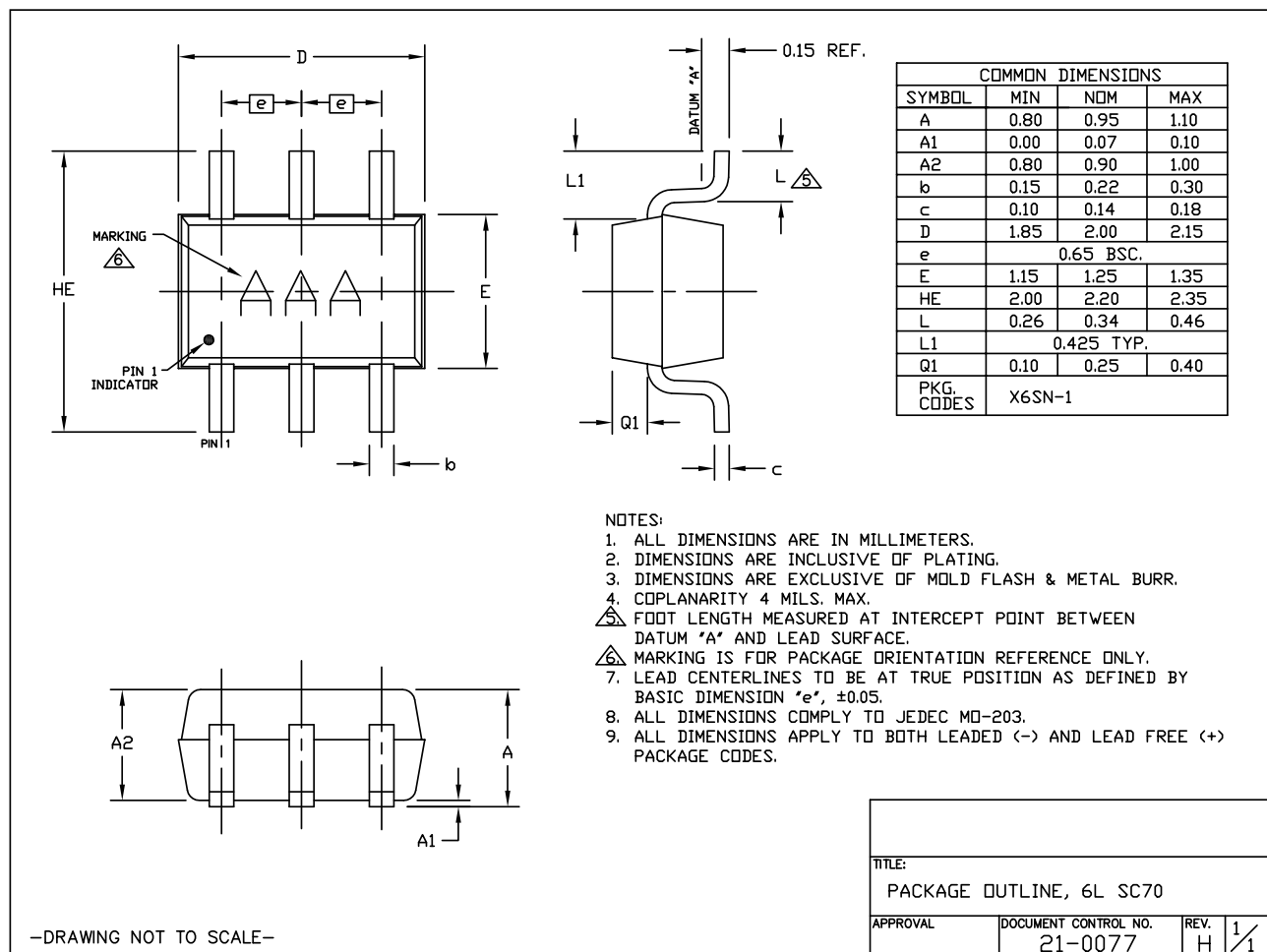
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX44280AXT+	-40°C to +125°C	6 SC70	+AED
MAX44280AYT+	-40°C to +125°C	6 Thin µDFN (Ultra-Thin LGA)	+AZ

+表示无铅(Pb)/符合RoHS标准的封装。

1.8V、50MHz、低失调、低功耗、满摆幅I/O运算放大器

如需最近的封装外形信息和焊盘布局(占位面积), 请查询china.maxim-ic.com/packages。请注意, 封装编码中的“+”、“#”或“-”仅表示RoHS状态。封装图中可能包含不同的尾缀字符, 但封装图只与封装有关, 与RoHS状态无关。

封装类型	封装编码	外形编号	焊盘布局编号
6 SC70	X6SN+1	21-0077	90-0189
6引脚薄型 μDFN (超薄LGA)封装	Y61A1+1	21-0190	90-0233

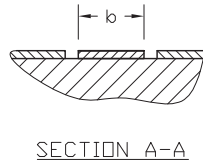
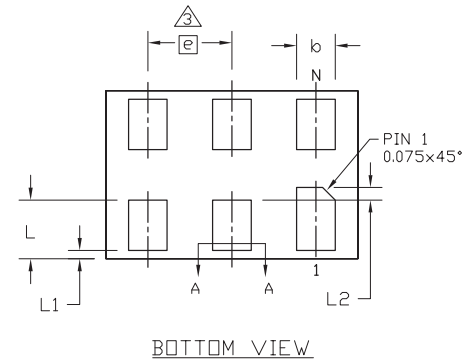
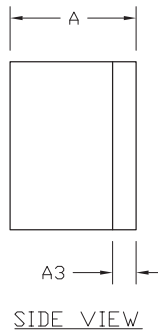
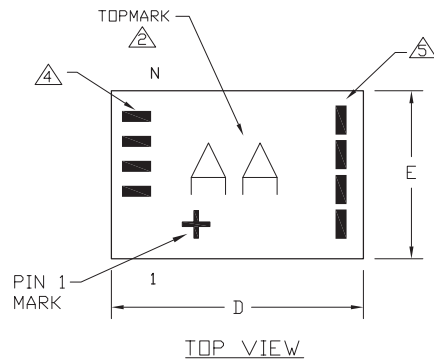


MAX44280

1.8V、50MHz、低失调、 低功耗、满摆幅I/O运算放大器

封装信息(续)

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NOTES:

1. DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
2. MARKING SHOWN IS FOR PACKAGE ORIENTATION REFERENCE ONLY. PACKAGE USES 2 CHARACTER PRODUCT CODE.
3. LEAD CENTERLINES TO BE AT TRUE POSITION AS DEFINED BY BASIC DIMENSION "e", ± 0.05 .
4. CALENDAR YEAR BINARY DATE CODE (REFER TO PG. 2 TABLE 1 FOR TRANSLATION).
5. 6 WEEKLY DATE BINARY CODE (REFER TO PG. 2 TABLE 2 FOR TRANSLATION).
6. MEETS JEDEC MO-252 VARIATION WAAD.
7. MATERIAL MUST COMPLY WITH BANNED AND RESTRICTED SUBSTANCES SPEC# 10-0131.
8. ALL DIMENSIONS APPLY TO BOTH LEADED (-) AND PbFREE (+) PKG. CODES.

-DRAWING NOT TO SCALE-

SYMBOL	COMMON DIMENSIONS		
	MIN.	NOM.	MAX.
A	0.45	0.50	0.55
A3	0.15 REF		
D	1.45	1.50	1.55
E	0.95	1.00	1.05
L	0.30	0.35	0.40
L1	0.00	--	0.08
L2	0.05	--	0.10
b	0.15	0.20	0.25
e	0.50 BSC.		
Pkg. Code	Y61A1-1, Y61A1-2		

TITLE: PACKAGE OUTLINE 6L ULTRA THIN LGA, 1.5x1.0x0.5mm			
APPROVAL	DOCUMENT CONTROL NO. 21-0190	REV. C	1/2

MAX44280

1.8V、50MHz、低失调、 低功耗、满摆幅I/O运算放大器

封装信息(续)

如需最近的封装外形信息和焊盘布局(占位面积), 请查询china.maxim-ic.com/packages。请注意, 封装编码中的“+”、“#”或“-”仅表示RoHS状态。封装图中可能包含不同的尾缀字符, 但封装图只与封装有关, 与RoHS状态无关。

TABLE 1 Translation Table for Calendar Year Code

Calendar Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014

Legend: Marked with bar Blank space - no bar required

TABLE 2 Translation Table for Payweek Binary Coding

Payweek	06-11	12-17	18-23	24-29	30-35	36-41	42-47	48-51	52-05

Legend: Marked with bar Blank space - no bar required

—DRAWING NOT TO SCALE—

TITLE:			
PACKAGE OUTLINE 6L ULTRA THIN LGA, 1.5x1.0x0.5mm			
APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0190	C	2/2

MAX44280

1.8V、50MHz、低失调、 低功耗、满摆幅I/O运算放大器

修订历史

修订号	修订日期	说明	修改页
0	12/11	最初版本。	—
1	4/12	更新了封装热特性、电气特性和订购信息。	2, 3, 12

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