19-6784; Rev 0; 9/13

备有评估板

MAX14689

超小尺寸、低R_{ON}、Beyond-the-Rails™ DPDT模拟开关

概述

MAX14689超小尺寸、低导通电阻(R_{ON})、双刀双掷(DPDT)模拟开关具有超摆幅(Beyond-the-Rails™)处理能力，允许开关通过-5.5V至+5.5V信号，即使信号范围超出电源也不会发生失真。低导通电阻(0.25Ω)使器件非常适合低失真开关应用，例如音频或视频信号切换。

MAX14689可以工作在+1.6V至+5.5V单电源。由于所需供电电流非常小，V_{CC}可由GPIO提供。未加电时，开关为高阻模式，所有模拟输入端口可承受-5.5V至+5.5V信号。开关由单个引脚CB控制。

MAX14689采用1.2mm x 1.2mm、0.4mm焊球间距、9焊球、晶片级封装(WLP)，工作在-40°C至+85°C扩展级温度范围。

应用

- 智能手机
- 平板电脑
- 便携式音频/视频设备
- 低失真信号开关

Beyond-the-Rails™是Maxim Integrated Products, Inc.的商标。

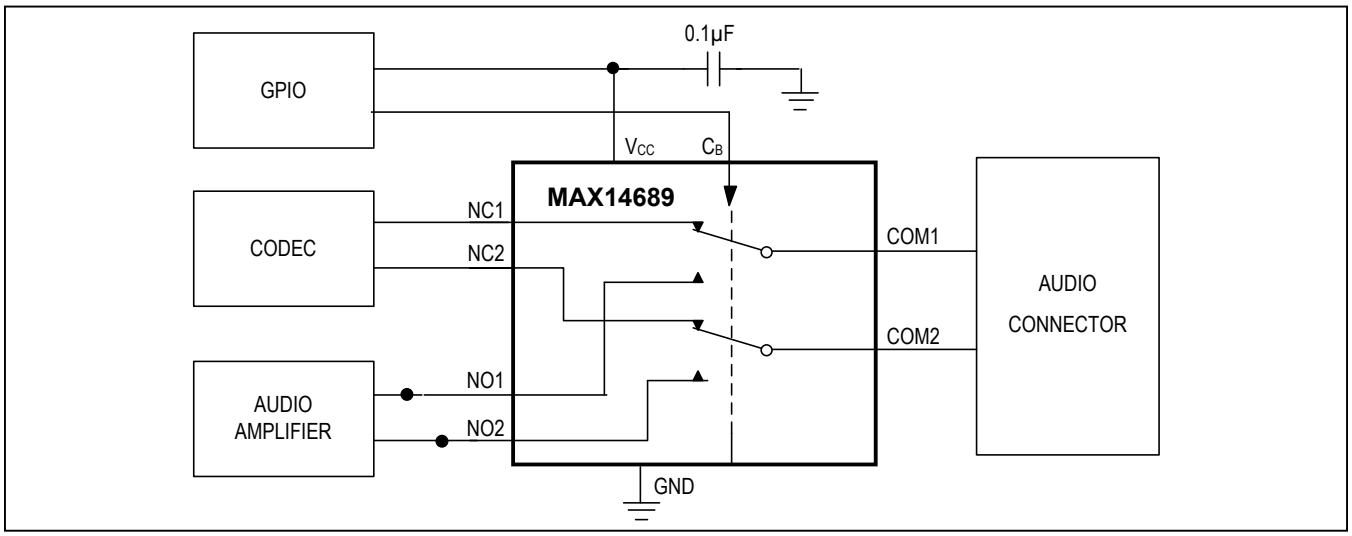
优势和特性

- 无失真连接超摆幅信号
  - 支持负压音、视频信号
  - -5.5V至+5.5V模拟信号范围，独立于V_{CC}
  - 0.25Ω (典型值)导通电阻
  - +1.6V至+5.5V单电源供电
  - 0.001% (典型值)总谐波失真+噪声
  - 0.001Ω (典型值)导通电阻平坦度
- 低电源电流：40µA (典型值) @ 1.6V
  - 可由GPIO供电
  - V_{CC}未加电时开关为高阻模式
- COM_具有ESD保护
  - ±15kV人体模式
  - ±10kV IEC 61000-4-2气隙放电
  - ±8kV IEC 61000-4-2接触放电
- NC_和NO_具有ESD保护
  - ±15kV人体模式
- 设计灵活
  - 先开后合
  - 9焊球、WLP封装(1.2mm x 1.2mm)
  - -40°C至+85°C工作温度范围

定购信息在数据资料的最后给出。

相关型号以及配合该器件使用的推荐产品，请参见：china.maximintegrated.com/MAX14689.related。

典型应用电路/功能框图



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。

Absolute Maximum Ratings

(All voltages referenced to GND.)
V_{CC}, CB.....-0.3V to +6V
NC_, NO_, COM_.....-6V to +6V
Continuous Current NC_, NO_, COM_.....±500mA
Peak Current NC_, NO_, COM_ (50% duty cycle).....±850mA

Continuous Power Dissipation (T_A = +70°C)
9-Bump WLP (derate 12mW/°C above +70°C).....963.8mW
Operating Temperature Range..... -40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature Range..... -65°C to +150°C
Soldering Temperature (reflow).....+260°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)

WLP
Junction-to-Ambient Thermal Resistance (θ_{JA}).....83°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.maximintegrated.com/thermal-tutorial.

Electrical Characteristics

(V_{CC} = +1.6V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +2.5V, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
POWER SUPPLY							
Power-Supply Range	V_{CC}			1.6		5.5	V
Power-Supply Rejection Ratio	PSRR	$R_{COM\_}$ = 32Ω, f = 20kHz			80		dB
Supply Current	I_{CC}	V_{CC} = +1.6V, V_{CB} = 0V or V_{CC}			40	65	µA
		V_{CC} = +4.2V, V_{CB} = 0V or V_{CC}			70	125	
ANALOG SWITCH							
Analog Signal Range	$V_{NC\_}$, $V_{NO\_}$, $V_{COM\_}$			-5.5		+5.5	V
On-Resistance	R_{ON}	$V_{COM\_}$ = 0V, $I_{COM\_}$ = 100mA (Note 3)	V_{CC} = 2.5V		0.25	0.45	Ω
			V_{CC} = 1.8V		0.325	0.55	
On-Resistance Match Between Channels	ΔR_{ON}	V_{CC} = 2.5V, $V_{NC\_}$ = 0V, $I_{COM\_}$ = 100mA, between same NC_ and NO_ channel (Note 4)			0.005	0.05	Ω
On-Resistance Flatness	R_{FLAT}	V_{CC} = 2.5V, $I_{COM\_}$ = 100mA, $V_{COM\_}$ = -5.5V to +5.5V (Notes 5, 6)			0.001	0.01	Ω
NC_ or NO_ Off-Leakage Current	$I_{NC\_(OFF)}$, $I_{NO\_(OFF)}$	V_{CC} = 2.5V, switch open, $V_{NO\_}$ or $V_{NC\_}$ = -5.5 or +5.5V $V_{COM\_}$ = +5.5V, -5.5V, unconnected		-100		+100	nA

Electrical Characteristics (continued)

(V_{CC} = +1.6V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +2.5V, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
COM_ Off-Leakage Current	$I_{COM\_(OFF)}$	V_{CC} = 0V, $V_{COM\_}$ = -5.5V, 0V, +5.5V $V_{NO\_}$ or $V_{NC\_}$ = -5.5V, +5.5V, unconnected		-100		+100	nA
COM_ On Leakage-Current	$I_{COM\_(ON)}$	V_{CC} = 2.5V, switch closed, $V_{COM\_}$ = +5.5V, -5.5V $V_{NO\_}$ or $V_{NC\_}$ = +5.5V, -5.5V, unconnected		-100		+100	nA
DYNAMIC TIMING							
Turn-Off Time	t_{OFF}	$V_{NO\_}$ or $V_{NC\_}$ = 0V, R_L = 50Ω, Figure 1 (Note 6)			5	30	µs
Break-Before-Make Time	t_{BBM}	R_L = 50Ω. Time that both NC_/NO_ switches are open during transition, Figure 2 (Note 6)	V_{CC} = 2.5V	0	80	150	µs
			V_{CC} = 1.8V	0		250	
Turn-On Time	t_{ON}	$V_{NO\_}$ or $V_{NC\_}$ = 0V, Figure 1 (Note 6)	V_{CC} = 2.5V		85	200	µs
			V_{CC} = 1.8V			250	
AUDIO PERFORMANCE							
Total Harmonic Distortion Plus Noise	THD+N	f = 20Hz to 20kHz, $V_{COM\_}$ = 0.5V_{P-P}, R_S = R_L = 50Ω; DC bias = 0V			0.001		%
Off-Isolation	V_{ISO}	R_S = R_L = 50Ω; $V_{COM\_}$ = 0.5V_{P-P}, f = 100kHz, V_{CC} = 0V, DC bias = 0.25V, Figure 3			-60		dB
Crosstalk	V_{CT}	R_S = R_L = 50Ω; $V_{COM\_}$ = 0.5V_{P-P}, f = 100kHz (Note 7), Figure 3			-100		dB
-3dB Bandwidth	BW	R_S = R_L = 50Ω			110		MHz
NC_ or NO_ Off-Capacitance	$C_{NC\_(OFF)}$, $C_{NO\_(OFF)}$	$V_{NC\_}$ / $V_{NO\_}$ = 0.5V_{P-P}, f = 1MHz			25		pF
COM_ On-Capacitance	$C_{COM\_(ON)}$	$V_{NC\_}$ / $V_{NO\_}$ = 0.5V_{P-P}, f = 1MHz			50		pF
DIGITAL I/O							
Input Logic High Voltage	V_{IH}			1.4			V
Input Logic Low Voltage	V_{IN}					0.325	V
Input Leakage Current	I_{IN}	V_{IN} = 0V to V_{CC}		-1		+1	µA

Electrical Characteristics (continued)

(V_{CC} = +1.6V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +2.5V, T_A = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
THERMAL PROTECTION						
Thermal Shutdown				+150		°C
Thermal-Shutdown Hysteresis				25		°C
ESD PROTECTION						
COM_		Human Body Model		±15		kV
		IEC 61000-4-2 Air-Gap Discharge		±10		
		IEC 61000-4-2 Contact Discharge		±8		
NC_, NO_		Human Body Model		±15		kV
All Other Pins		Human Body Model		±2		kV

Note 2: All specifications are 100% production tested at T_A = +25°C, unless otherwise noted. Specifications over T_A = -40°C to +85°C are guaranteed by design.
Note 3: The same limits apply for $V_{COM\_}$ = -5.5V to +5.5V and are guaranteed by design.
Note 4: $\Delta R_{ON} = |R_{ON(CH1)} - R_{ON(CH2)}|$.
Note 5: Flatness is defined as the difference between the maximum and minimum value of on-resistance, as measured over specified analog signal ranges.
Note 6: Guaranteed by design; not production tested.
Note 7: Between two switches.

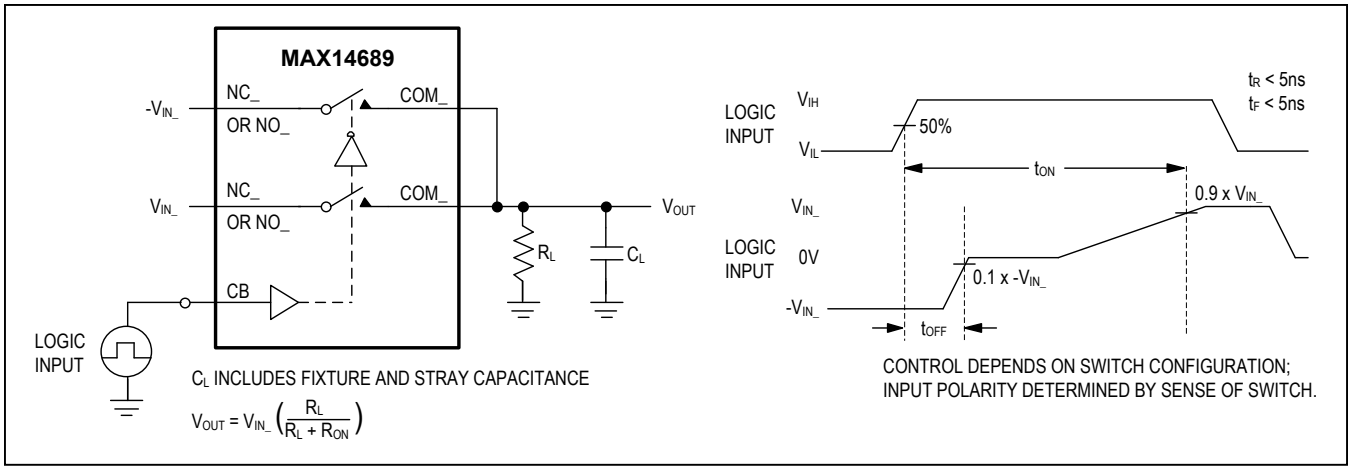


图1. 开关时间

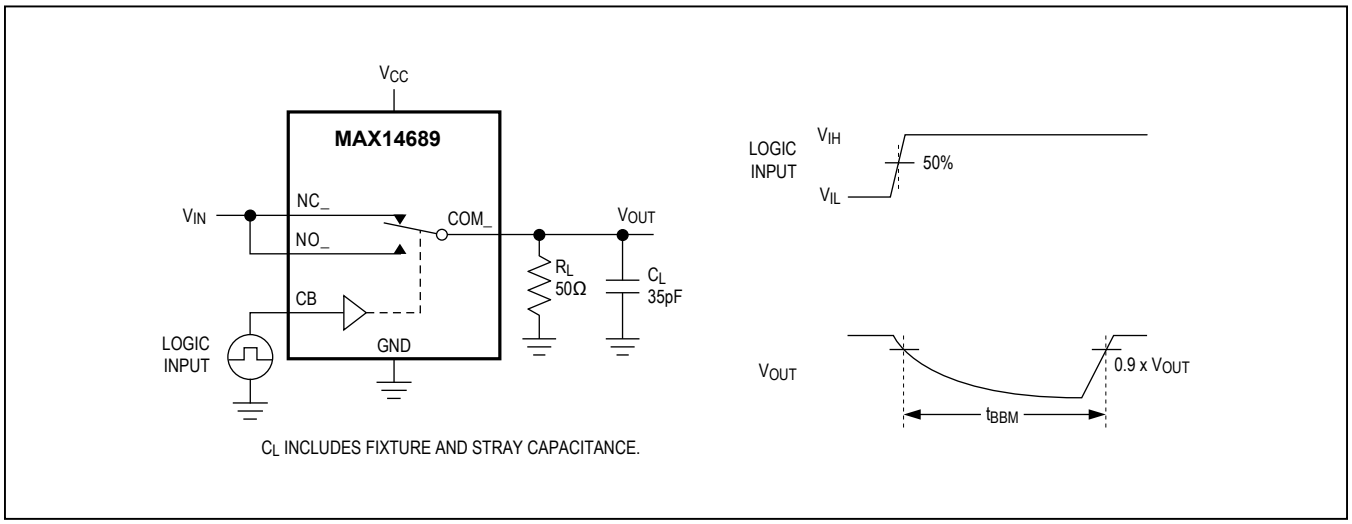


图2. 先开后合间隔

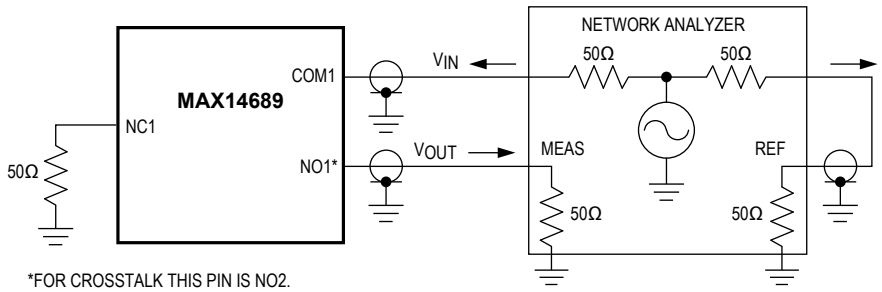
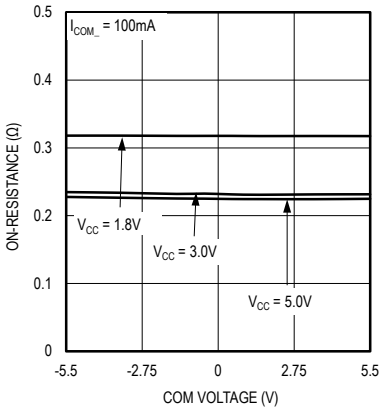


图3. 3dB带宽、关断隔离及串扰

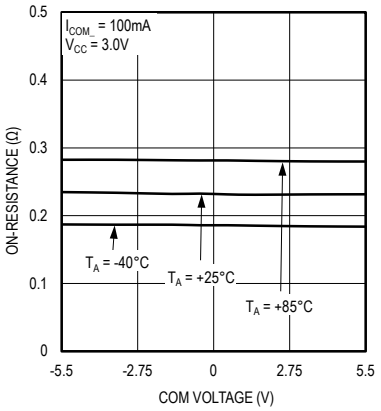
典型工作特性

(V_{CC} = 2.5V, T_A = +25°C, unless otherwise noted.)

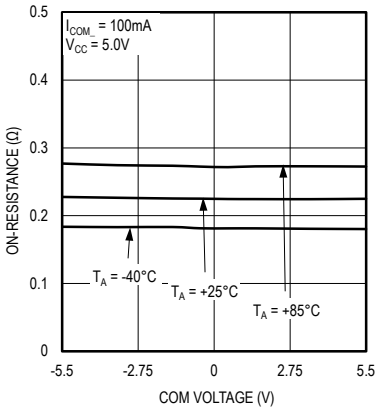
TOC1



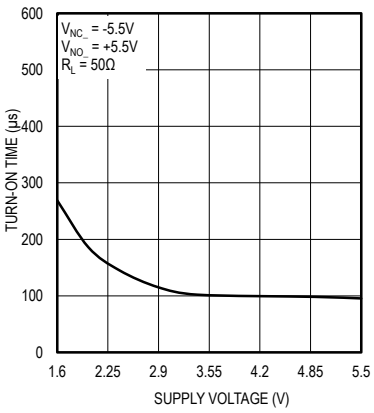
TOC2



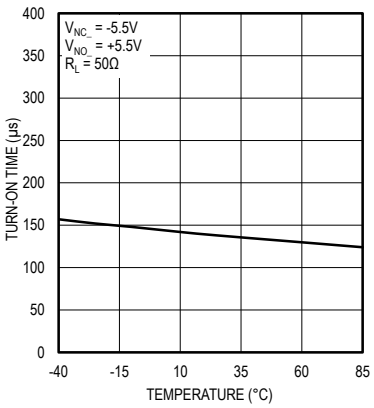
TOC3



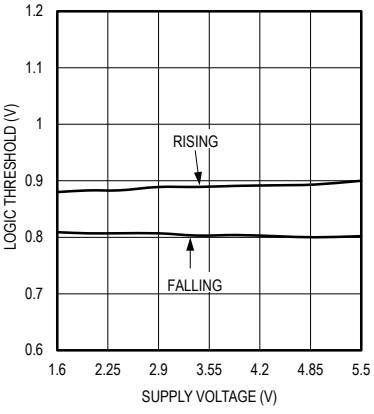
TOC4



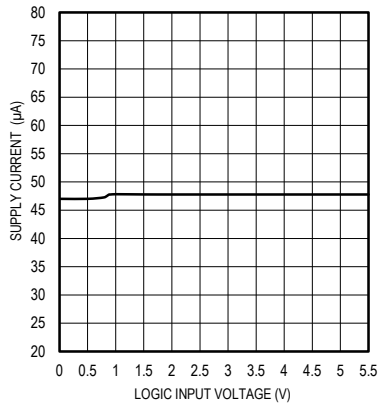
TOC5



TOC6



TOC7

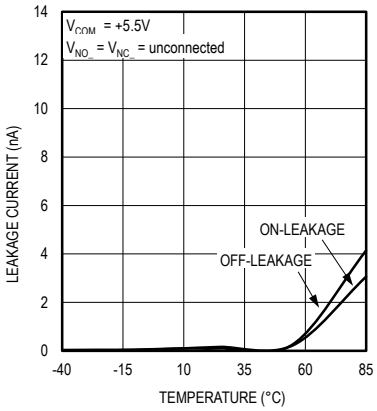


典型工作特性(续)

(VCC = 2.5V, TA = +25°C, unless otherwise noted.)

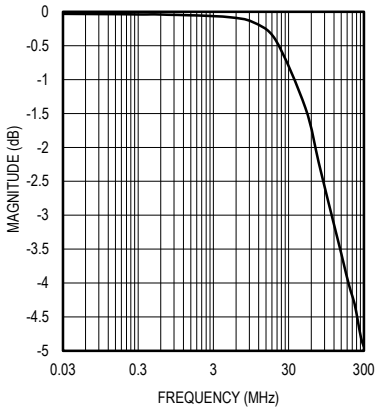
TOC8

COM_ LEAKAGE CURRENT vs. TEMPERATURE



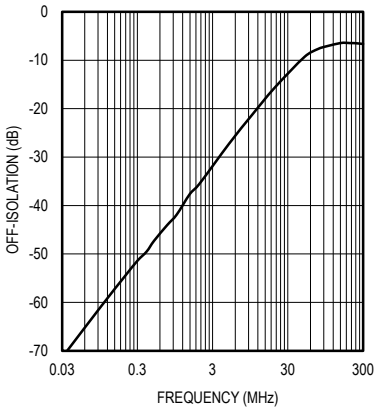
TOC9

FREQUENCY RESPONSE



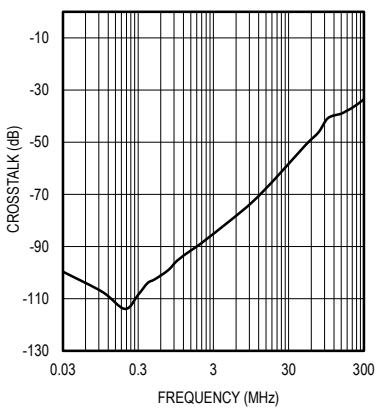
TOC10

OFF-ISOLATION vs. FREQUENCY



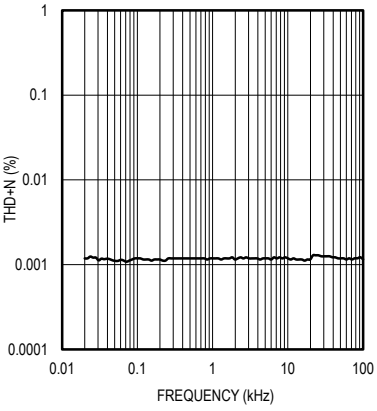
TOC11

CROSSTALK vs FREQUENCY



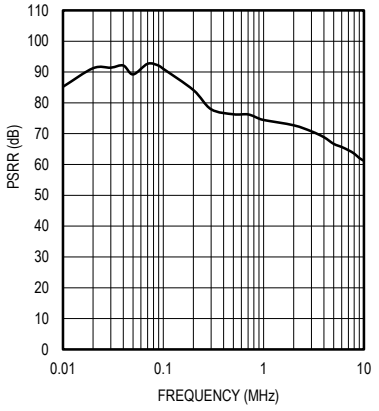
TOC12

THD+N vs. FREQUENCY



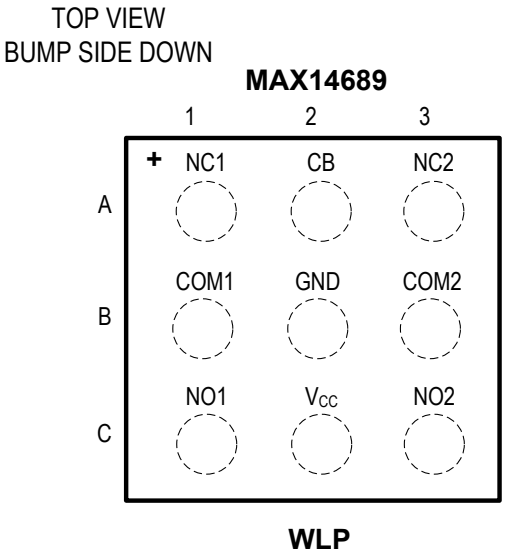
TOC13

PSRR vs. FREQUENCY



超小尺寸、低R_{ON}、Beyond-the-Rails™ DPDT模拟开关

引脚配置



引脚说明

引脚	名称	功能
A1	NC1	常闭端子，用于开关1。
A2	CB	数字控制输入。将CB驱动为低电平时，COM_连接至NC_；将CB驱动为高电平时，COM_连接至NO_。
A3	NC2	常闭端子，用于开关2。
B1	COM1	公共端，用于开关1。
B2	GND	地。
B3	COM2	公共端，用于开关2。
C1	NO1	常开端子，用于开关1。
C2	V_{CC}	电源电压输入，利用0.1µF陶瓷电容将V_{CC}旁路至GND，电容尽量靠近器件放置。
C3	NO2	常开端子，用于开关2。

详细说明

MAX14689为超小尺寸、低导通电阻、高ESD保护DPDT开关，采用+1.6V至+5.5V单电源供电，设计用于连接模拟信号，例如交流偏置或直流偏置的音、视频信号。这些开关具有高性能开关应用中所要求的低导通电阻(R_{ON})。MAX14689的超摆幅信号能力允许低于地或高于V_{CC}的信号无失真通过。

模拟信号电平

MAX14689支持双向工作，允许NO_、NC_和COM_配置为输入或输出。开关拓扑允许信号下降到地电平以下，无需外部负电源。注：器件未上电时，也可承受-5.5V至+5.5V的模拟信号电平。

数字控制输入

MAX14689具有一路控制逻辑输入CB。CB控制开关的位置，如*典型应用电路/功能框图*所示。

应用信息

增强ESD保护

所有引脚具有ESD保护架构，在器件工作与装配期间可承受高达±2kV (HBM)的静电放电冲击。COM1和COM2提供增强ESD保护，可承受高达±15kV (HBM)、±10kV (气隙放电)和±8kV (接触放电)的静电冲击。NO_和NC_提供增强型ESD保护，可承受高达±15kV (HBM)的静电冲击。ESD架构在正常工作和器件关断情况下均可承受较高的ESD冲击。发生ESD冲击后，器件可继续工作，不会闭锁。

ESD测试条件

ESD测试性能与各种测试条件有关。关于测试配置、测试方法及测试结果的可靠性报告，请联系Maxim。

人体模式

图4所示为人体模式测试模型，图5所示为对低阻放电时产生的电流波形。该模型包括一个100pF电容，先充电至所要求的ESD电压，然后通过1.5kΩ电阻向被测器件放电。

IEC 61000-4-2

IEC 61000-4-2标准涵盖了最终产品的ESD测试和性能，并非针对集成电路。采用HBM和IEC 61000-4-2测试的主要区别是IEC 61000-4-2的峰值电流较高，这是因为IEC 61000-4-2模型中的串联电阻较低。所以，按照IEC 61000-4-2标准测得的ESD承受电压通常低于采用HBM测得的电压。图6所示为IEC 61000-4-2模型，图7所示为±8kV、IEC 61000-4-2、4级、ESD接触放电模式的电流波形。

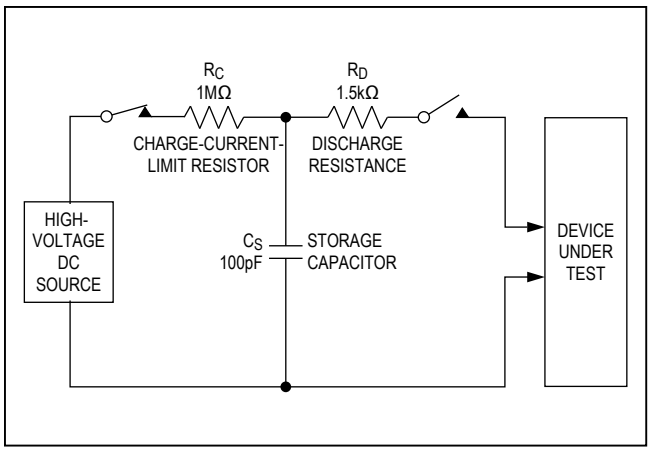


图4. 人体模式ESD测试模型

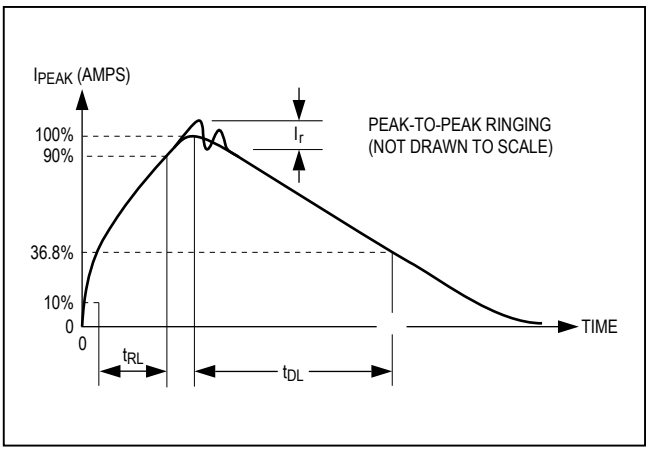


图5. 人体测试电流波形

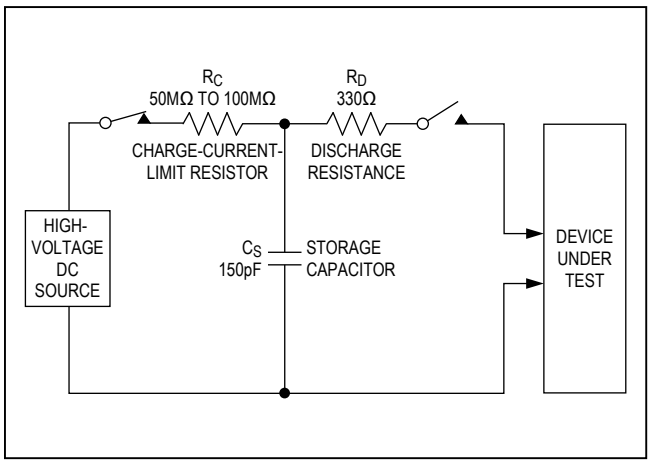


图6. IEC 61000-4-2 ESD测试模型

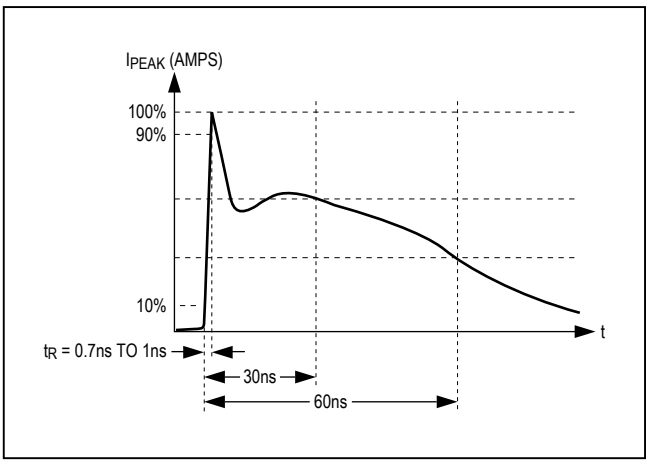


图7. IEC 61000-4-2 ESD发生器电流波形

定购信息

器件	引脚–封装	顶标
MAX14689EWL+T	9 WLP	AKL

+表示无铅(Pb)/符合RoHS标准的封装。

T =卷带包装。

芯片信息

PROCESS: BiCMOS

封装信息

如需最近的封装外形信息和焊盘布局(占位面积)，请查询china.maximintegrated.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
9 WLP	W91B1+7	21-0459	参见应用笔记1891

超小尺寸、低R_{ON}、Beyond-the-Rails™ DPDT模拟开关

修订历史

修订号	修订日期	说明	修改页
0	9/13	最初版本。	—

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