19-5720; Rev 0; 12/10

MAXIM

四通道、+70V SPST模拟开关

概述

MAX14756/MAX14757/MAX14758为具有10Ω（最大值）低导通电阻的模拟开关，适合于双向传输。所有器件均具有满摆幅模拟信号范围。单极性应用中，采用+10V至+70V单电源供电；双极性应用中，采用±35V双电源供电。双极性电源可以有偏差，不一定对称。

MAX14756为四通道常闭(NC)单刀/单掷(SPST)开关；MAX14757为四通道常开(NO) SPST开关；MAX14758为两路NO、两路NC SPST开关。这些开关具有5Ω（典型值）导通电阻和0.01nA（典型值)导通漏电流，导通电阻平坦度为0.004Ω（典型值)。

器件适用于绝大多数模拟信号的路由和切换，确保工作在-40°C至+85°C扩展级温度范围。但在允许增大漏电流的前提下，也可以工作在+125°C。

应用

工业控制系统

仪表

电池管理

环境控制系统

医疗系统

ATE系统

音频信号路由/切换

汽车

特性

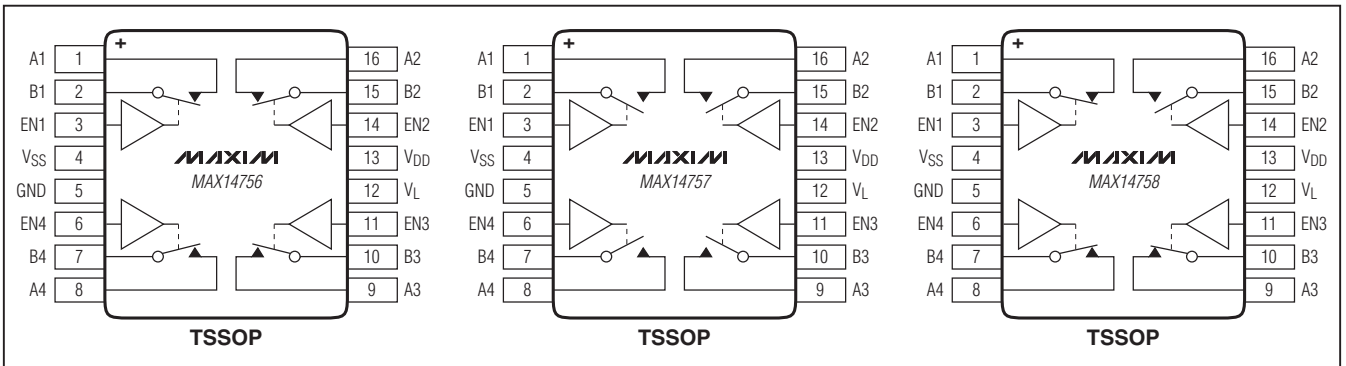
- 采用+10V至+70V单电源供电
- 工作在高达±35V的双电源电压
- 10Ω (最大值)导通电阻
- 0.004Ω (典型值) R_{ON}平坦度
- +85°C时，具有2.5nA (最大)关断漏电流
- 通过保护二极管实现过压/欠压箝位
- 500µA (典型值)电源电流
- TSSOP 16引脚封装
- -40°C至+85°C环境温度范围
- 与DG411、DG412和DG413功能兼容
- 高达+125°C时，确保正常工作

定购信息

PART	FUNCTION	TEMP RANGE	PIN-PACKAGE
MAX14756EUE+	Quad NC SPST	-40°C to +85°C	16 TSSOP
MAX14757EUE+	Quad NO SPST	-40°C to +85°C	16 TSSOP
MAX14758EUE+	Dual NO + NC SPST	-40°C to +85°C	16 TSSOP

+表示无铅(Pb)/符合RoHS标准的封装。

功能框图



TSSOP TSSOP TSSOP

MAX14756	
EN_ LOGIC	SWITCHES
0	CLOSED
1	OPEN

MAX14757	
EN_ LOGIC	SWITCHES
0	OPEN
1	CLOSED

MAX14758		
EN_ LOGIC	SWITCHES 1, 4	SWITCHES 2, 3
0	CLOSED	OPEN
1	OPEN	CLOSED

四通道、+70V SPST模拟开关

ABSOLUTE MAXIMUM RATINGS

V_{DD} to V_{SS} .....-0.3V to +72V
V_{SS} to GND .....-36V to +0.3V
V_L, EN_ to GND .....-0.3V to the lesser of (+12V, V_{DD} + 0.3V)
A_, B_ to V_{SS} .....-0.3V to (V_{DD} + 2V) or 100mA (whichever occurs first)
Continuous Current into A_, B_ ..... ±100mA

Continuous Power Dissipation (T_A = +70°C)
TSSOP (derate 11.1mW/°C above +70°C) 889mW
Operating Temperature Range ..... -40°C to +85°C
Storage Temperature Range..... -65°C to +150°C
Junction Temperature ..... +150°C
Lead Temperature (soldering, 10s) .....+300°C
Soldering Temperature (reflow) .....+260°C

PACKAGE THERMAL CHARACTERISTICS (Note 1)

TSSOP
Junction-to-Ambient Thermal Resistance (θ_{JA}).....90°C/W
Junction-to-Case Thermal Resistance (θ_{JC}).....27°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**.

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.

ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES

(V_{DD} = +35V, V_{SS} = -35V, V_{GND} = 0V, V_L = +3.3V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
V_{DD} Supply-Voltage Range	V_{DD}		+10		+35	V
V_{SS} Supply-Voltage Range	V_{SS}		-10		-35	V
V_L Logic Supply-Voltage Range	V_L		+1.6		+11	V
V_{DD} Supply Current	$I_{DD(OFF)}$	$V_{EN\_}$ to switch off state, $V_{A\_}$, $V_{B\_}$ = +20V		200	450	µA
	$I_{DD(ON)}$	$V_{EN\_}$ to switch on state, $V_{A\_}$, $V_{B\_}$ = +20V		500	800	
V_{SS} Supply Current	$I_{SS(OFF)}$	$V_{EN\_}$ to switch off state, $V_{A\_}$, $V_{B\_}$ = +20V		200	450	µA
	$I_{SS(ON)}$	$V_{EN\_}$ to switch on state, $V_{A\_}$, $V_{B\_}$ = +20V		500	800	
V_L Current	I_L	V_L = +11V, V_{EN1} = V_{EN2} = V_{EN3} = V_{EN4} = (0.25 x V_L) or (0.75 x V_L)			0.4	mA
SWITCH						
Analog-Signal Range	$V_{A\_}$, $V_{B\_}$	Figure 1	V_{SS}		V_{DD}	V
Current Through Switch	$I_{A\_}$, $I_{B\_}$	$V_{A\_}$, $V_{B\_}$ = +20V	-50		+50	mA
On-Resistance	R_{ON}	$I_{A\_}$, $I_{B\_}$ = 10mA, $V_{A\_}$, $V_{B\_}$ = ±20V, Figure 1		5	10	Ω
On-Resistance Matching Between Channels	ΔR_{ON}	$I_{A\_}$, $I_{B\_}$ = 10mA, $V_{A\_}$, $V_{B\_}$ = ±20V, 0V (Note 2)		0.3	0.5	Ω
On-Resistance Flatness	$R_{FLAT(ON)}$	$I_{A\_}$, $I_{B\_}$ = 10mA, $V_{A\_}$, $V_{B\_}$ = ±20V		0.004		Ω
On-Leakage Current	$I_{A/B\_(ON)}$	$V_{B\_}$ = ±20V, $V_{A\_}$= unconnected, Figure 2	-5		+5	nA
		$V_{B\_}$ = ±20V, $V_{A\_}$ = unconnected, T_A = +25°C, Figure 2		0.01		
Off-Leakage Current	$I_{A/B\_(OFF)}$	$V_{B\_}$ = ±20V, $V_{A\_}$ = -20V, Figure 3	-2.5		+2.5	nA
		$V_{B\_}$ = ±20V, $V_{A\_}$ = -20V, T_A = +25°C, Figure 3		0.01		

ELECTRICAL CHARACTERISTICS—DUAL SUPPLIES (continued)

(V_{DD} = +35V, V_{SS} = -35V, V_{GND} = 0V, V_L = +3.3V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
LOGIC (EN1, EN2, EN3, EN4)						
Input-Voltage Low	V_{IL}				0.25 x V_L	V
Input-Voltage High	V_{IH}		0.75 x V_L			V
Input Leakage Current		$V_{EN\_}$ = 0V or V_L	-1		+1	µA
DYNAMIC CHARACTERISTICS						
V_{DD}/V_{SS} Power-On Time		R_L = 10kΩ		1		µs
Enable Turn-On Time	t_{ON}	$V_{A\_}$, $V_{B\_}$ = ±10V, R_L = 10kΩ, Figure 4		35	60	µs
Enable Turn-Off Time	t_{OFF}	$V_{A\_}$, $V_{B\_}$ = ±10V, R_L = 10kΩ, Figure 4		2	3	µs
Off-Isolation	V_{ISO}	$V_{A\_}$, $V_{B\_}$ = 1V RMS, f = 100kHz, R_L = 1kΩ, C_L = 15pF, Figure 5		65		dB
Crosstalk	V_{CT}	R_S = R_L = 1kΩ, Figure 6		96		dB
-3dB Bandwidth	BW	R_S = 50Ω, R_L = 1kΩ, Figure 7		145		MHz
Total Harmonic Distortion Plus Noise	THD+N	R_S = R_L = 1kΩ, f = 20Hz to 20kHz		0.001		%
Charge Injection	Q	A_, B_ = GND, C_L = 1nF, Figure 8		580		pC
Switch-On Capacitance	C_{IN}	V_{DD} = +50V, V_{SS} = 0V, $V_{A\_}$, $V_{B\_}$ = +4V, f = 1MHz		40		pF
Switch-Off Capacitance	C_{IN}	V_{DD} = +50V, V_{SS} = 0V, $V_{A\_}$, $V_{B\_}$ = +4V, f = 1MHz		35		pF

DC ELECTRICAL CHARACTERISTICS—SINGLE SUPPLY

(V_{DD} = +70V, V_{SS} = V_{GND} = 0V, V_L = +3.3V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
POWER SUPPLY						
V_{DD} Supply-Voltage Range	V_{DD}		+10		+70	V
SWITCH						
On-Resistance	R_{ON}	$I_{A\_}$ = 10mA, $V_{A\_}$, $V_{B\_}$ = +20V, Figure 1		5	10	Ω
On-Resistance Matching Between Channels	ΔR_{ON}	$I_{A\_}$, $I_{B\_}$ = 10mA, $V_{A\_}$, $V_{B\_}$ = +70V, 0V (Note 2)		0.3	0.5	Ω
Off-Leakage Current	$I_{A/B\_(OFF)}$	$V_{B\_}$ = +40V, $V_{A\_}$ = +10V, Figure 3	-2.5		+2.5	nA

Note 2: Guaranteed by design; not production tested.
Note 3: All parameters in single-supply operation are expected to be the same as in dual-supply operation.

四通道、+70V SPST模拟开关

测试电路/时序图

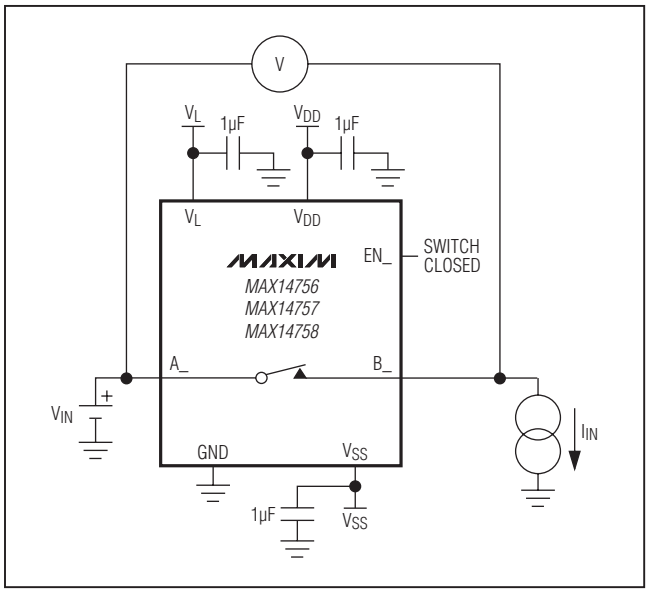


图1. 导通电阻测量

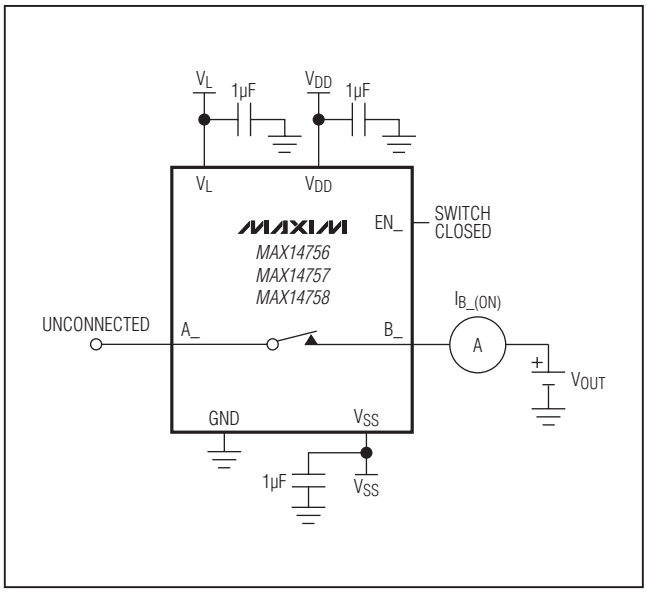


图2. 导通漏电流

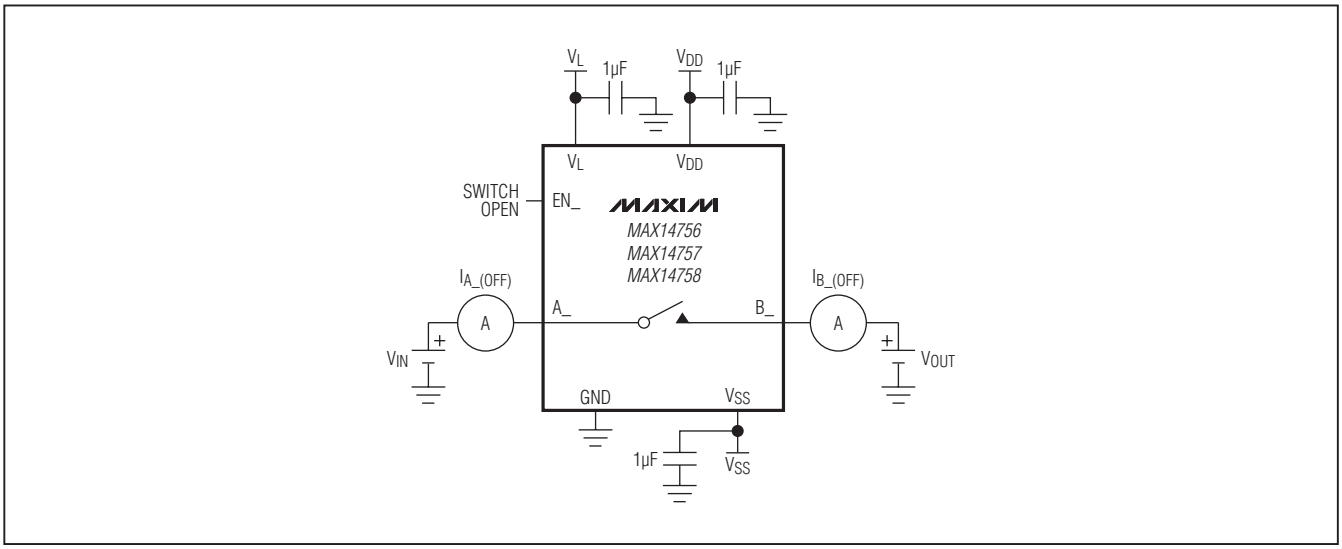


图3. 关断漏电流

测试电路/时序图(续)

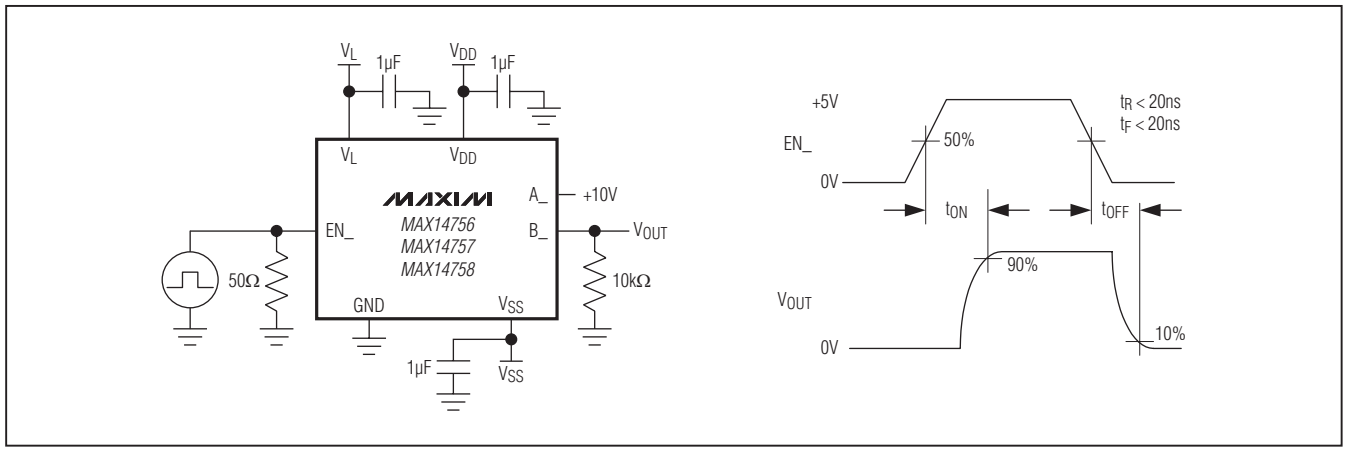


图4. 使能开关时间

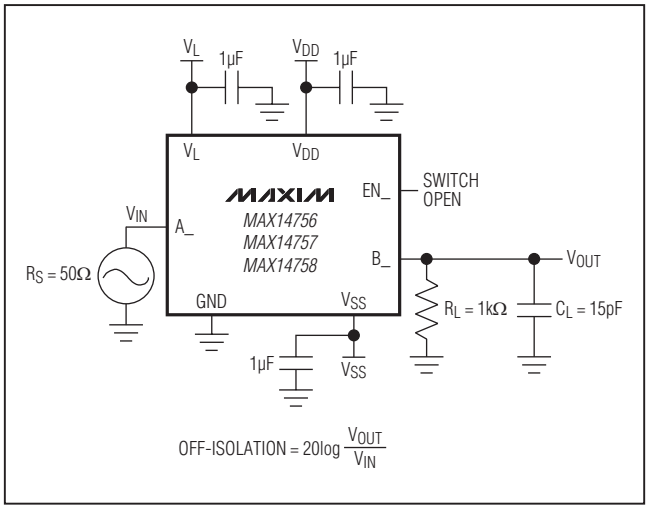


图5. 关断隔离

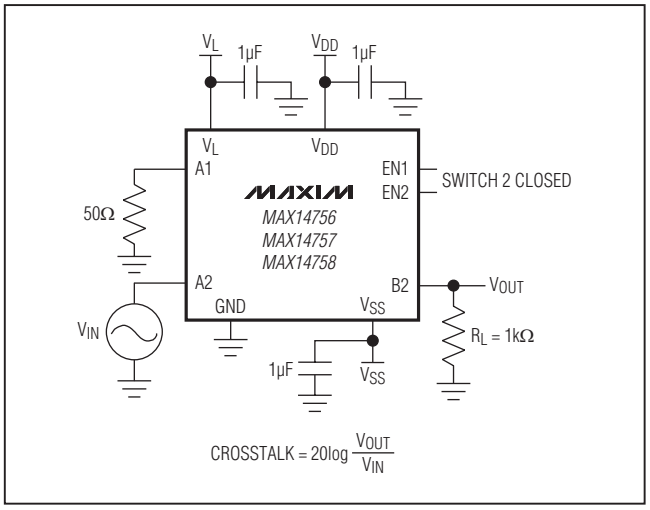


图6. 串扰

四通道、+70V SPST模拟开关

测试电路/时序图(续)

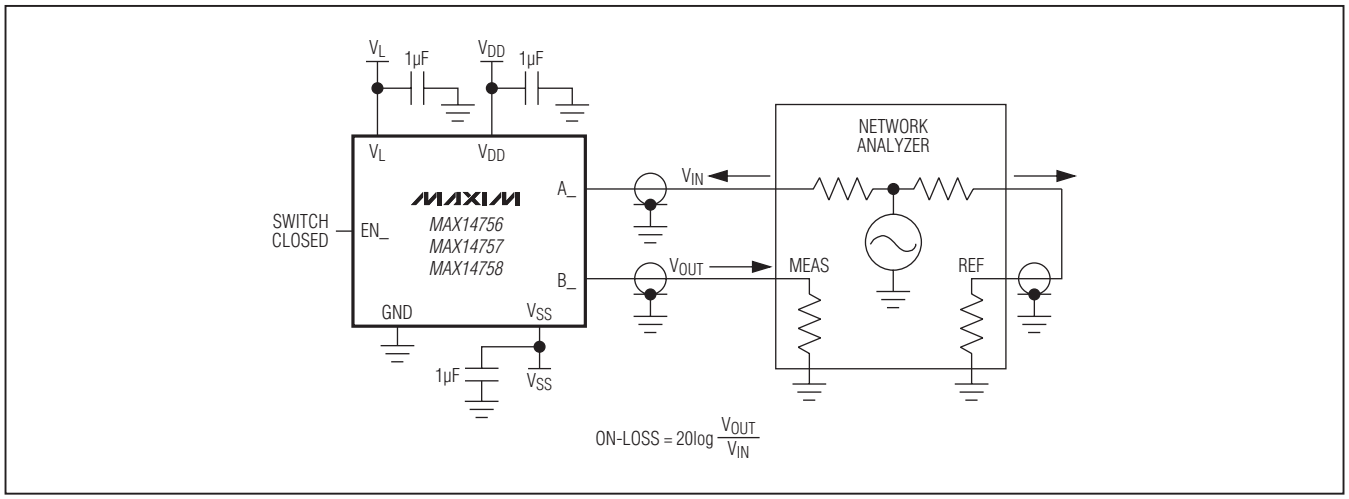


图7. 频率响应

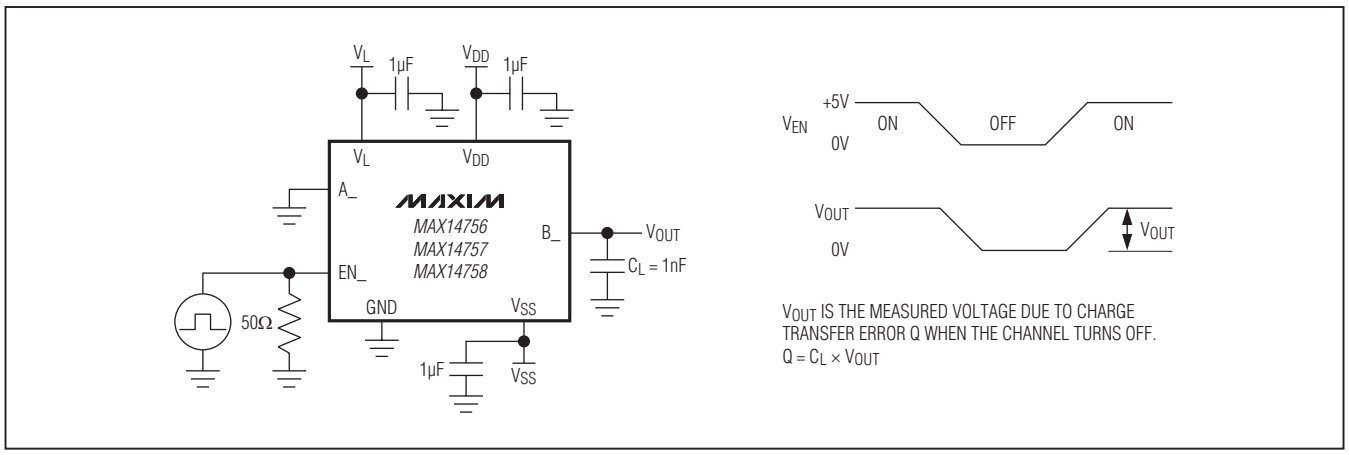
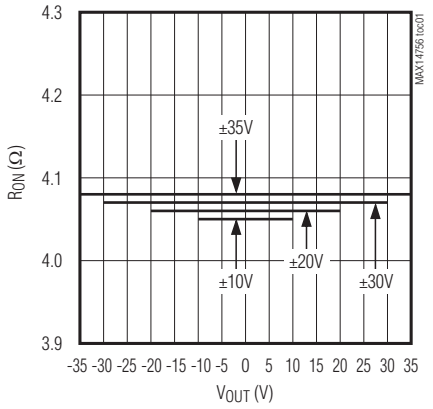


图8. 电荷注入

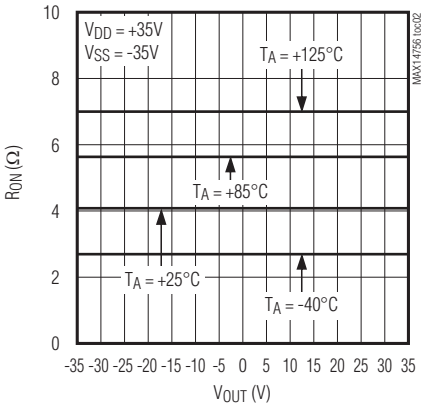
典型工作特性

(T_A = +25°C, V_L = +3.3V, unless otherwise noted.)

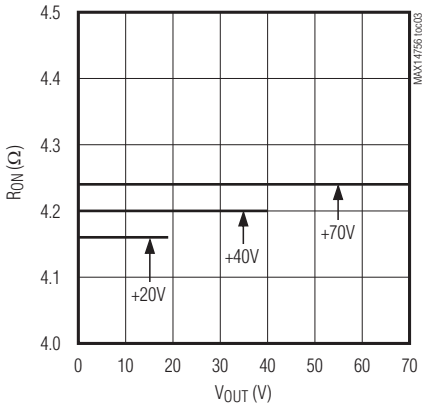
ON-RESISTANCE vs. $V_{B\_}$ (DUAL SUPPLIES)



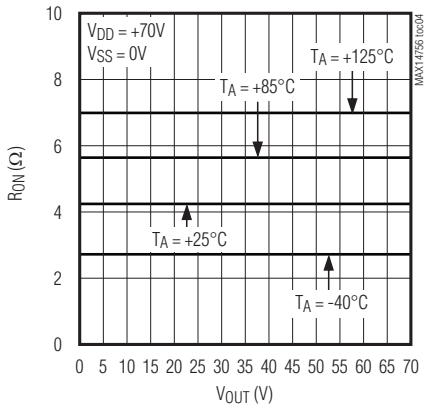
ON-RESISTANCE vs. $V_{B\_}$ AND TEMPERATURE (DUAL SUPPLIES)



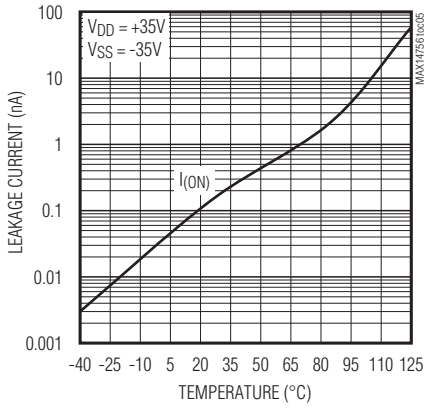
ON-RESISTANCE vs. $V_{B\_}$ (SINGLE SUPPLY)



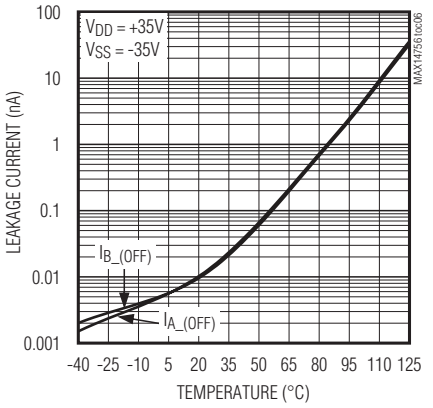
ON-RESISTANCE vs. $V_{B\_}$ AND TEMPERATURE (SINGLE SUPPLY)



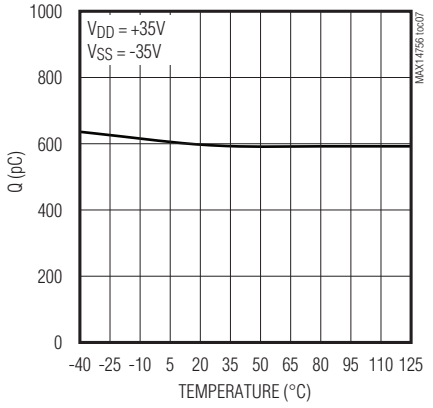
ON-LEAKAGE vs. TEMPERATURE



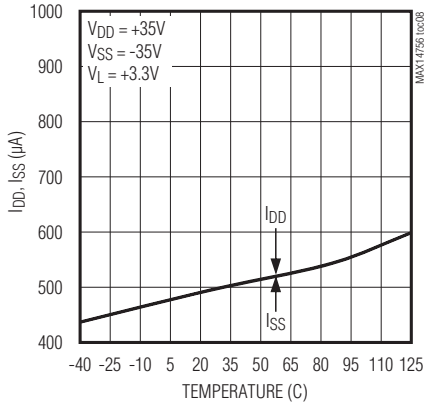
ON-LEAKAGE vs. TEMPERATURE



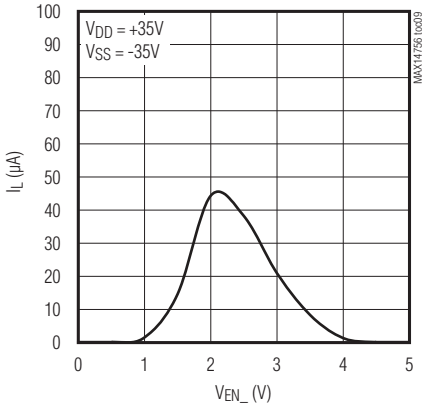
CHARGE INJECTION vs. TEMPERATURE



SUPPLY CURRENT vs. TEMPERATURE



V_L INPUT CURRENT vs. $V_{EN\_}$

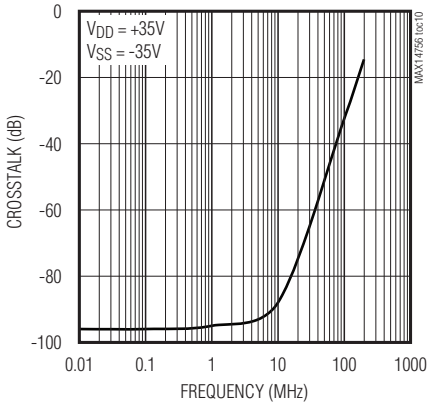


四通道、+70V SPST模拟开关

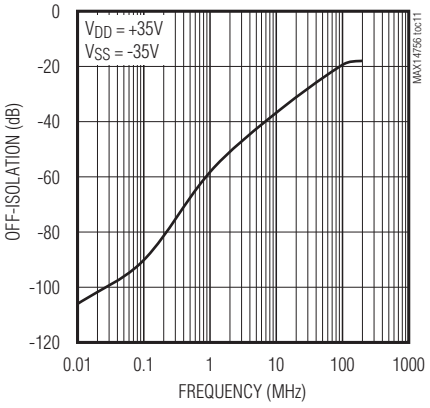
典型工作特性(续)

(T_A = +25°C, V_L = +3.3V, unless otherwise noted.)

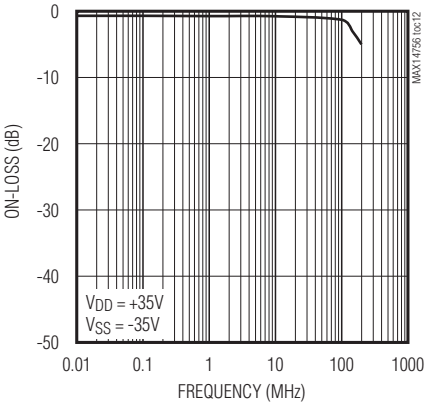
CROSSTALK vs. FREQUENCY



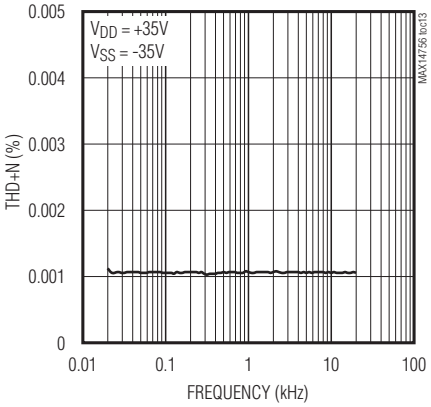
OFF-ISOLATION vs. FREQUENCY



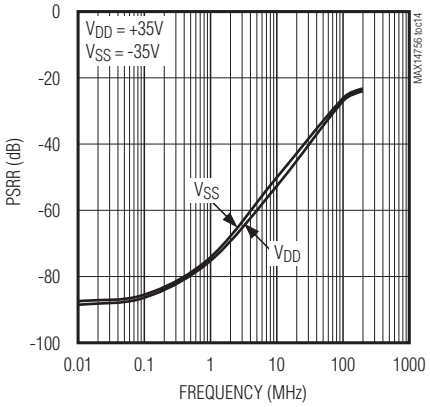
ON-LOSS vs. FREQUENCY



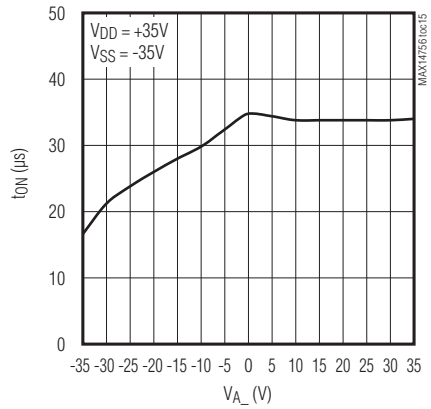
TOTAL HARMONIC DISTORTION PLUS NOISE vs. FREQUENCY



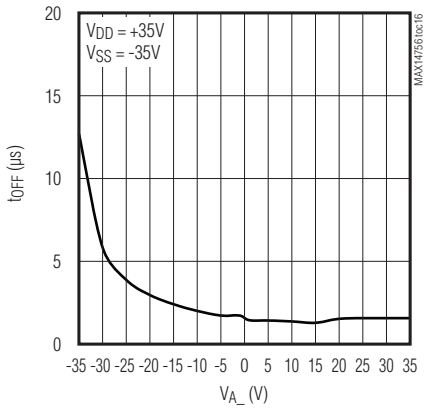
PSRR vs. FREQUENCY



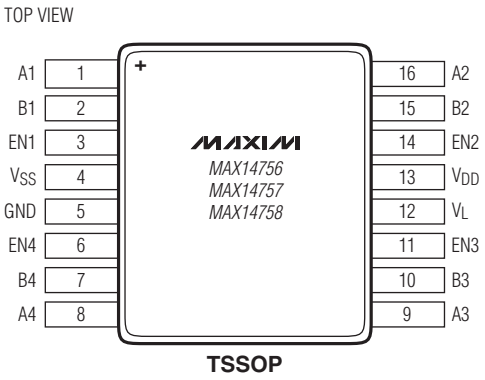
TURN-ON TIME vs. INPUT VOLTAGE



TURN-OFF TIME vs. INPUT VOLTAGE



引脚配置



引脚说明

引脚	名称	功能
1	A1	开关1的端口A。
2	B1	开关1的端口B。
3	EN1	开关1的使能输入。EN1驱动为高电平时，开关的状态(NO/NC)改变(见表1、表2和表3)。
4	V_{SS}	负电源电压。利用1µF陶瓷电容(额定100V)将V_{SS}旁路至GND，尽量靠近引脚放置。
5	GND	地。
6	EN4	开关4的使能输入。EN4驱动为高电平时，开关的状态(NO/NC)改变(见表1、表2和表3)。
7	B4	开关4的端口B。
8	A4	开关4的端口A。
9	A3	开关3的端口A。
10	B3	开关3的端口B。
11	EN3	开关3的使能输入。EN3驱动为高电平时，开关的状态(NO/NC)变化(见表1、表2和表3)。
12	V_L	逻辑电源电压。利用1µF陶瓷电容将V_L旁路至GND，尽量靠近引脚放置。
13	V_{DD}	正电源电压。利用1µF陶瓷电容(额定100V)将V_{DD}旁路至GND，尽量靠近引脚放置。
14	EN2	开关2的使能输入。EN2驱动为高电平时，开关的状态(NO/NC)改变(见表1、表2和表3)。
15	B2	开关2的端口B。
16	A2	开关2的端口A。

四通道、+70V SPST模拟开关

详细说明

MAX14756/MAX14757/MAX14758为具有10Ω（最大值）低导通电阻的模拟开关，适合于双向传输。所有器件均具有满摆幅模拟信号范围。器件在单极性应用中采用+70V单电源供电，在双极性应用中采用±35V双电源供电。双极性电源可偏移，不一定对称。

MAX14756为四通道NC SPST开关，MAX14757是一款四通道NO SPST开关，MAX14758为两路NO和两路NC SPST开关。这些开关具有5Ω（典型值）导通电阻和5nA（最大值）低导通漏电流。导通电阻平坦度为0.004Ω（典型值）。器件适用于绝大多数模拟信号的路由和切换，允许增大漏电流的情况下，确保在高达+125°C环境下正常工作。

应用信息

低失真音频

MAX14756/MAX14757/MAX14758开关具有低R_{ON}，信号幅值变化时，R_{ON}波动极低，非常适合于低失真音频应用。*典型工作特性*部分给出了几种信号幅值下总谐波失真(THD)与频率的关系曲线。

通过开关的电流

通过每个开关的电流必须限制在±50mA以内才能正常工作。如果电流超过限值，就会有内部漏电流从开关流向V_{SS}。只要不超过*Absolute Maximum Ratings*规定的极限值，较大的输入电流不会损坏器件。

输入电压箝位

对于输入电压超过电源轨的应用，连接V_{DD}和V_{SS}的内部输入二极管可以限制输入电压。如图9所示，可在输入端采用串联电阻来限制欠压和过压期间流入二极管的电流。选择适当的的限流电阻将输入电流限制至$I_{IN_(MAX)}$ = 100mA，取R_{LIM+}和R_{LIM-}中的较大值作为限流电阻。

$$R_{LIM+} = \frac{V_{IN}(MAX) - V_{DD}}{I_{IN\_}(MAX)}$$

$$R_{LIM-} = \frac{V_{SS} - V_{IN}(MIN)}{I_{IN\_}(MAX)}$$

欠压或过压条件下，输入阻抗等于R_{LIM}。需要计算由于故障电流造成的额外功耗。一路开关输入上发生过压或欠压故障时，MAX14756/MAX14757/MAX14758的其他开关正常工作。

表1. MAX14756真值表

LOGIC		SWITCH	
EN1	0	A1/B1	Closed
EN2	0	A2/B2	Closed
EN3	0	A3/B3	Closed
EN4	0	A4/B4	Closed
EN1	1	A1/B1	Open
EN2	1	A2/B2	Open
EN3	1	A3/B3	Open
EN4	1	A4/B4	Open

表2. MAX14757真值表

LOGIC		SWITCH	
EN1	0	A1/B1	Open
EN2	0	A2/B2	Open
EN3	0	A3/B3	Open
EN4	0	A4/B4	Open
EN1	1	A1/B1	Closed
EN2	1	A2/B2	Closed
EN3	1	A3/B3	Closed
EN4	1	A4/B4	Closed

表3. MAX14758真值表

LOGIC		SWITCH	
EN1	0	A1/B1	Closed
EN2	0	A2/B2	Open
EN3	0	A3/B3	Open
EN4	0	A4/B4	Closed
EN1	1	A1/B1	Open
EN2	1	A2/B2	Closed
EN3	1	A3/B3	Closed
EN4	1	A4/B4	Open

超摆幅输入

如果预期输入电压超过电源电压，但是仍然在MAX14756/MAX14757/MAX14758的绝对最大电源电压之内，则增加两个与电源串联的二极管，如图10所示。

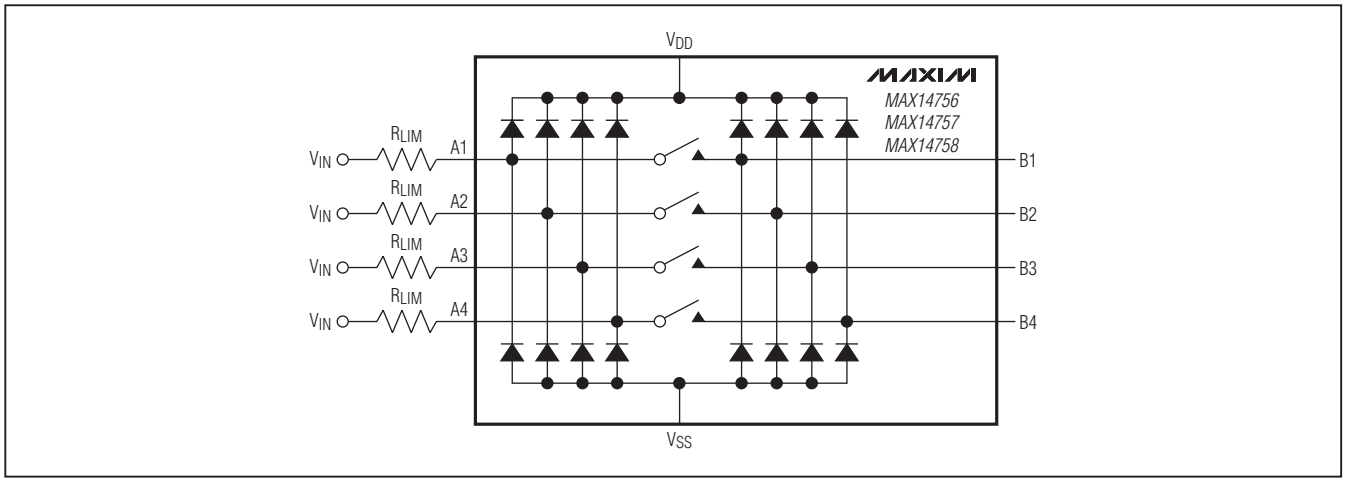


图9. 输入过压和欠压箝位

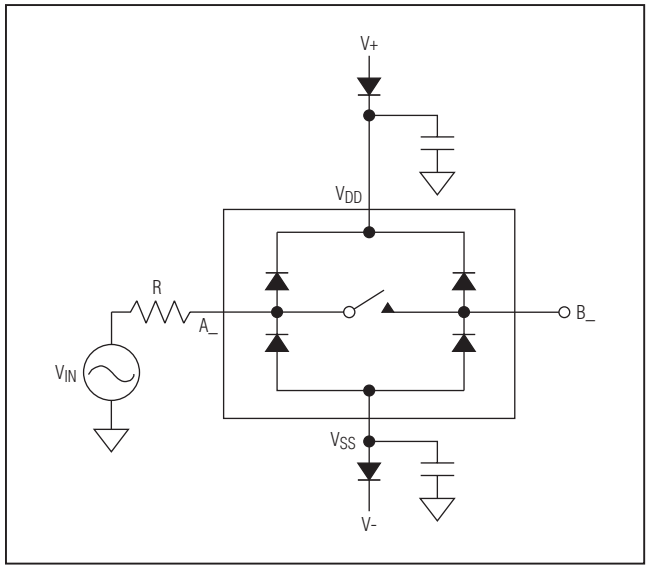


图10. 超摆幅应用

发生欠压和过压事件期间，内部二极管将V_{DD}/V_{SS}拉高/低。这种方法的优势是在过压和欠压期间的输入阻抗较高，电流不会流过MAX14756/MAX14757/MAX14758。输入电压必须限制在*Absolute Maximum Ratings*部分规定的电压范围内。

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，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
16 TSSOP	U16+1	**21-0066**	**90-0117**

四通道、+70V SPST模拟开关

修订历史

修订号	修订日期	说明	修改页
0	12/10	最初版本。	—

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