



## 7Ω、四路 SPST 开关， 可处理超摆幅信号

MAX4854

### 概述

MAX4854 四路、单刀/单掷 (SPST) 开关采用 +2V 至 +5.5V 单电源供电，能够处理大于电源摆幅的信号。该开关具有 7Ω 的低导通电阻和 30pF 导通电容，可理想用于数据信号切换。

对于超摆幅应用，超过正电源的信号 (高达 +5.5V) 仍可以无失真地通过开关。

MAX4854 采用节省空间的、16 引脚、3mm x 3mm 薄型 QFN 封装，工作在 -40°C 至 +85°C 的扩展级温度范围。

### 特性

- ◆ USB 2.0 全速 (12Mbps) 和 USB 1.1 信号开关
- ◆ 可切换大于  $V_{CC}$  的信号
- ◆ 7Ω 导通电阻
- ◆ 30pF 导通电容
- ◆ -3dB 带宽: 150MHz
- ◆ 兼容 1.8V 逻辑电平
- ◆ +2V 至 +5.5V 电源范围
- ◆ 0.01μA 低电源电流
- ◆ 采用节省空间的、3mm x 3mm、16 引脚 TQFN 封装

### 应用

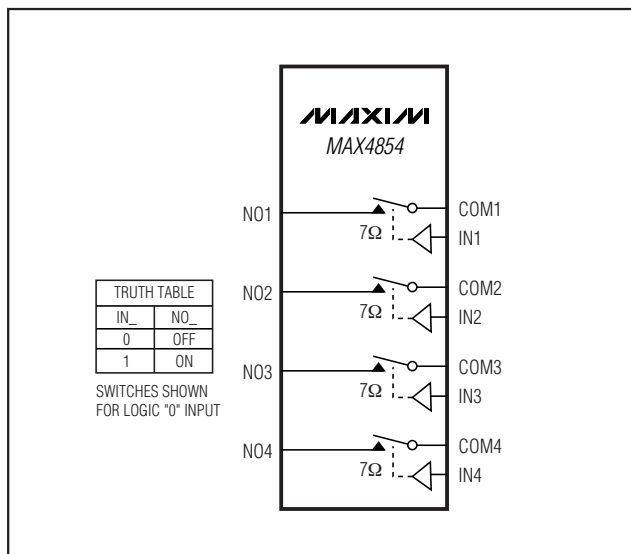
USB 开关  
蜂窝电话  
笔记本电脑  
PDA 及其它手持式设备

### 订购信息

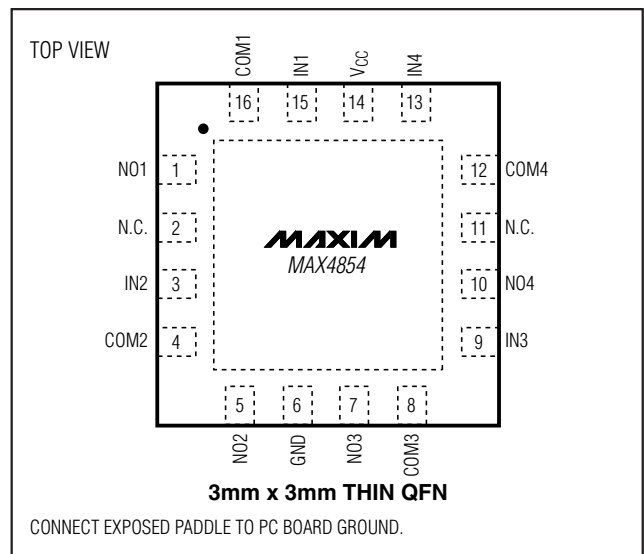
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4854ETE	-40°C to +85°C	16 TQFN-EP*	ACE

\* EP = 裸露焊盘。

### 方框图/真值表



### 引脚配置



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## ABSOLUTE MAXIMUM RATINGS

V<sub>CC</sub>, IN<sub>-</sub>, COM<sub>-</sub>, NO<sub>-</sub> to GND (Note 1) .....-0.3V to +6.0V  
 Closed-Switch Continuous Current COM<sub>-</sub>, NO<sub>-</sub>, NC<sub>-</sub>.....±50mA  
 Peak Current COM<sub>-</sub>, NO<sub>-</sub>  
 (pulsed at 1ms, 50% duty cycle).....±100mA  
 Peak Current COM<sub>-</sub>, NO<sub>-</sub>  
 (pulsed at 1ms, 10% duty cycle).....±120mA

Continuous Power Dissipation (T<sub>A</sub> = +70°C)  
 16-Pin Thin QFN (derate 20.8mW/°C above +70°C) ....1667mW  
 Operating Temperature Range .....-40°C to +85°C  
 Junction Temperature .....+150°C  
 Storage Temperature Range .....-65°C to +150°C  
 Lead Temperature (soldering, 10s) .....+300°C

**Note 1:** Signals on IN<sub>-</sub>, NO<sub>-</sub>, or COM<sub>-</sub> below GND are clamped by internal diodes. Limit forward-diode current to maximum current rating.

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

(V<sub>CC</sub> = +2.7V to +5.5V, T<sub>A</sub> = -40°C to +85°C, unless otherwise noted. Typical values are at V<sub>CC</sub> = +3.0V, T<sub>A</sub> = +25°C, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V <sub>CC</sub>		2.0		5.5	V
Supply Current	I <sub>CC</sub>	V <sub>CC</sub> = +5.5V, V <sub>IN-</sub> = 0 or V <sub>CC</sub>		0.01	1	μA
<b>ANALOG SWITCH</b>						
Analog Signal Range	V <sub>NO-</sub> , V <sub>COM-</sub>		0		5.5	V
On-Resistance	R <sub>ON</sub>	V <sub>CC</sub> = +3V, I <sub>COM-</sub> = 10mA, V <sub>NO-</sub> = 0 to +5.5V	T <sub>A</sub> = +25°C	7	9	Ω
			T <sub>A</sub> = -40°C to +85°C		10	
On-Resistance Match Between Channels (Notes 3, 4)	ΔR <sub>ON</sub>	V <sub>CC</sub> = +3V, I <sub>COM-</sub> = 10mA, V <sub>NO-</sub> = +1.5V	T <sub>A</sub> = +25°C	0.2	0.4	Ω
			T <sub>A</sub> = -40°C to +85°C		0.5	
On-Resistance Flatness (Note 5)	R <sub>FLAT</sub>	V <sub>CC</sub> = +3V; I <sub>COM-</sub> = 10mA; V <sub>NO-</sub> = +1V, +2V, +3V	T <sub>A</sub> = +25°C	2.5	3.75	Ω
			T <sub>A</sub> = -40°C to +85°C		4.0	
NO <sub>-</sub> Off-Leakage Current	I <sub>OFF</sub>	V <sub>CC</sub> = +5.5V, V <sub>NO-</sub> = +1V or +4.5V, V <sub>COM-</sub> = +4.5V or +1V	T <sub>A</sub> = +25°C	-2	+2	nA
			T <sub>A</sub> = -40°C to +85°C		-10	
COM <sub>-</sub> On-Leakage Current	I <sub>ON</sub>	V <sub>CC</sub> = +5.5V; V <sub>NO-</sub> = +1V, +4.5V, or floating; V <sub>COM-</sub> = +1V, +4.5V, or floating	T <sub>A</sub> = +25°C	-2	+2	nA
			T <sub>A</sub> = -40°C to +85°C		-12.5	
<b>DYNAMIC CHARACTERISTICS</b>						
Skew (Note 3)	t <sub>SKEW</sub>	R <sub>S</sub> = 39Ω, C <sub>L</sub> = 50pF, Figure 2		0.1	1	ns
Propagation Delay (Note 3)	t <sub>PD</sub>	R <sub>S</sub> = 39Ω, C <sub>L</sub> = 50pF, Figure 2		0.9	2	ns
Turn-On Time	t <sub>ON</sub>	V <sub>CC</sub> = +3V, V <sub>NO-</sub> = +1.5V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 50pF, Figure 1	T <sub>A</sub> = +25°C	40	60	ns
			T <sub>A</sub> = -40°C to +85°C		100	
Turn-Off Time	t <sub>OFF</sub>	V <sub>CC</sub> = +3V, V <sub>NO-</sub> = +1.5V, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 50pF, Figure 1	T <sub>A</sub> = +25°C	30	40	ns
			T <sub>A</sub> = -40°C to +85°C		60	
Charge Injection	Q	V <sub>COM-</sub> = +1.5V, R <sub>S</sub> = 0Ω, C <sub>L</sub> = 1nF, Figure 3		8		pC
Off-Isolation (Note 6)		f = 100kHz, V <sub>COM-</sub> = 1V <sub>RMS</sub> , R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Figure 4		-80		dB
Crosstalk		f = 1MHz, V <sub>COM-</sub> = 1V <sub>RMS</sub> , R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Figure 4		-95		dB
-3dB Bandwidth	BW	Signal = 0dBm, R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, Figure 4		150		MHz

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## ELECTRICAL CHARACTERISTICS (continued)

( $V_{CC} = +2.7V$  to  $+5.5V$ ,  $T_A = -40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted. Typical values are at  $V_{CC} = +3.0V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
NO_ Off-Capacitance	$C_{OFF}$	$f = 1MHz$ , Figure 5		13		pF
COM On-Capacitance	$C_{ON}$	$f = 1MHz$ , Figure 5		30		pF
Total Harmonic Distortion	THD	$f = 20Hz$ to $20kHz$ , $V_{COM\_} = 1V + 2V_{P-P}$ , $R_L = 600\Omega$		0.04		%
<b>DIGITAL I/O (IN_)</b>						
Input Logic High Voltage	$V_{IH}$	$V_{CC} = +2V$ to $+3.6V$	1.4			V
		$V_{CC} = +3.6V$ to $+5.5V$	1.8			
Input Logic Low Voltage	$V_{IL}$	$V_{CC} = +2V$ to $+3.6V$			0.5	V
		$V_{CC} = +3.6V$ to $+5.5V$			0.8	
Input Leakage	$I_{IN}$	$V_{IN\_} = 0$ or $+5.5V$	-0.5		+0.5	$\mu A$

**Note 2:** Specifications are 100% tested at  $T_A = +85^{\circ}C$  only, and guaranteed by design and characterization over the specified temperature range.

**Note 3:** Guaranteed by design and characterization; not production tested.

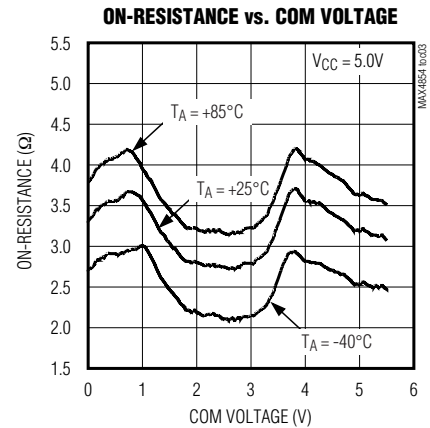
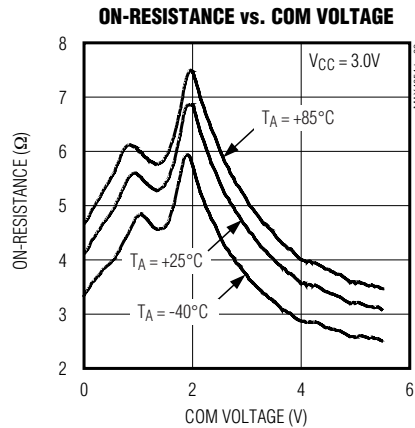
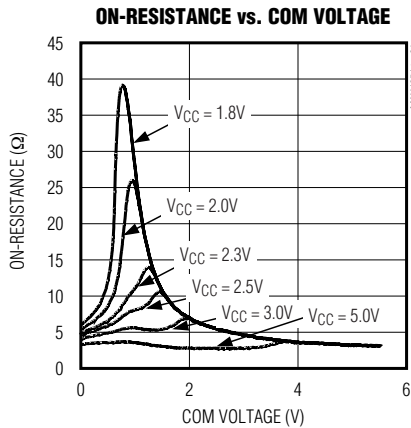
**Note 4:**  $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ .

**Note 5:** Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

**Note 6:** Off-isolation =  $20\log_{10}(V_{COM\_} / V_{NO\_})$ ,  $V_{COM\_}$  = output,  $V_{NO\_}$  = input to off switch.

### 典型工作特性

( $V_{CC} = 3.0V$ ,  $T_A = +25^{\circ}C$ , unless otherwise noted.)

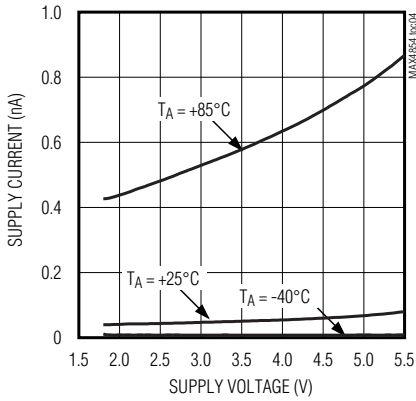


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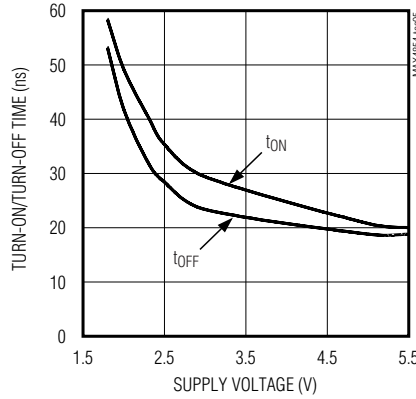
典型工作特性 (续)

( $V_{CC} = 3.0V$ ,  $T_A = +25^\circ C$ , unless otherwise noted.)

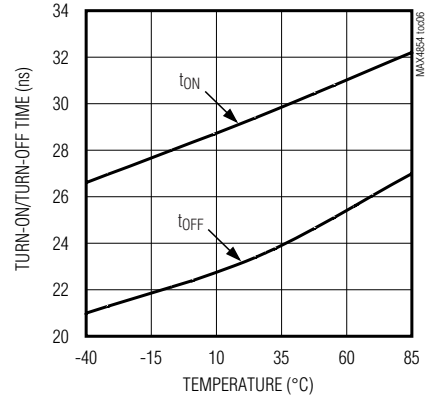
**SUPPLY CURRENT vs. SUPPLY VOLTAGE**



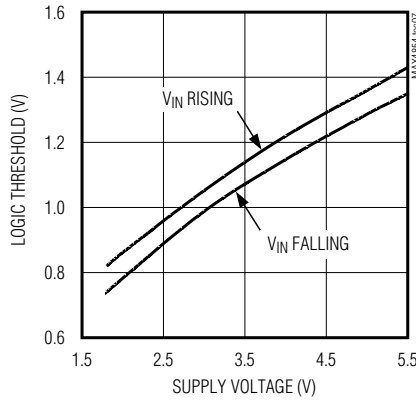
**TURN-ON/TURN-OFF TIME vs. SUPPLY VOLTAGE**



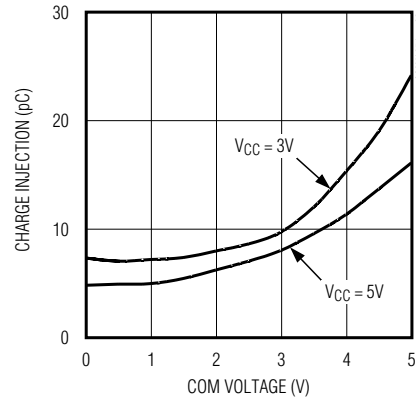
**TURN-ON/TURN-OFF TIME vs. TEMPERATURE**



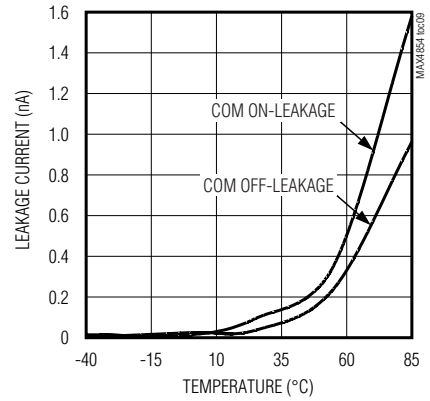
**LOGIC THRESHOLD vs. SUPPLY VOLTAGE**



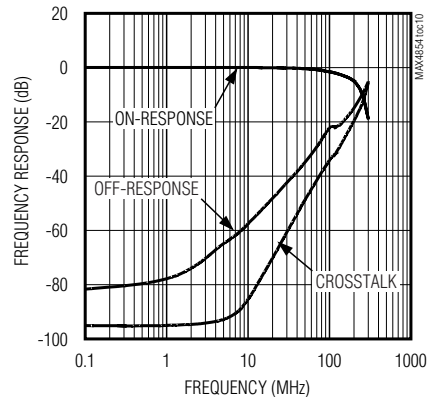
**CHARGE INJECTION vs. COM VOLTAGE**



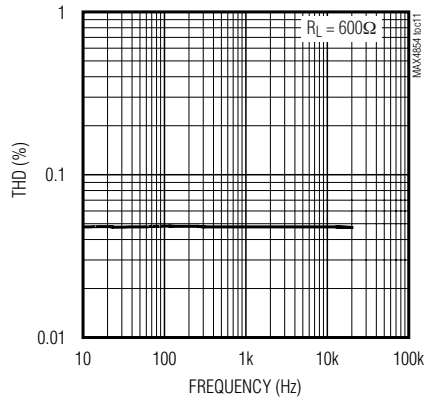
**LEAKAGE CURRENT vs. TEMPERATURE**



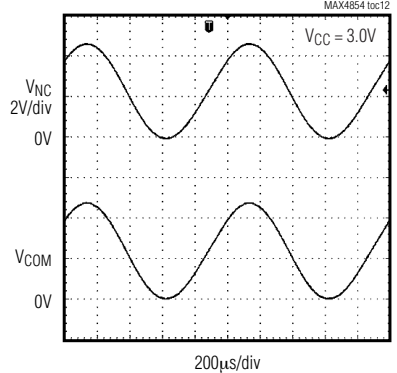
**FREQUENCY RESPONSE**



**TOTAL HARMONIC DISTORTION vs. FREQUENCY**



**SWITCH PASSING SIGNALS ABOVE SUPPLY VOLTAGE**



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引脚说明

MAX4854

引脚	名称	功能
1	NO1	模拟开关 1 的常开端
2, 11	N.C.	未接。内部无连接。
3	IN2	模拟开关 2 的数字控制输入。IN2 为逻辑低时关断 COM2 和 NO2；IN2 为逻辑高时接通 COM2 和 NO2。
4	COM2	模拟开关 2 的公共端
5	NO2	模拟开关 2 的常开端
6	GND	地
7	NO3	模拟开关 3 的常开端
8	COM3	模拟开关 3 的公共端
9	IN3	模拟开关 3 的数字控制输入。IN3 为逻辑低时关断 COM3 和 NO3；IN3 为逻辑高时接通 COM3 和 NO3。
10	NO4	模拟开关 4 的常开端
12	COM4	模拟开关 4 的公共端
13	IN4	模拟开关 4 的数字控制输入。IN4 为逻辑低时关断 COM4 和 NO4；IN4 为逻辑高时接通 COM4 和 NO4。
14	VCC	电源电压。用一个尽可能靠近该引脚的 0.01μF 电容旁路至 GND。
15	IN1	模拟开关 1 的数字控制输入。IN1 为逻辑低时关断 COM1 和 NO1；IN1 为逻辑高时接通 COM1 和 NO1。
16	COM1	模拟开关 1 的公共端
EP	GND	裸露焊盘。接地。

# 7Ω、四路 SPST 开关， 可处理超摆幅信号

## 详细说明

MAX4854 是低导通电阻、低电压模拟开关，设计工作在 +2V 至 +5.5V 单电源，并且完全规范于电源标称值为 +3.0V 的应用。该器件具有超摆幅信号处理能力，在电源电压降至 +2.0V 时，仍然允许高达 +5.5V 的信号无失真地通过。

该四路 SPST 开关具有低导通电容，能够切换 USB 2.0/1.1 应用中 (12Mbps) 的数据信号。它设计用来切换 USB 的 D+ 和 D- 信号，并能保证在输入信号的 50% 和输出信号的 50% 处测量的偏差小于 1ns (见图 2)。

## 应用信息

### 数字控制输入

逻辑输入 (IN<sub>n</sub>) 可接受高达 +5.5V 的电压，即使电源电压低于该电平。例如，V<sub>CC</sub> 电源为 +3.3V 时，IN<sub>n</sub> 可以低至 GND，也可以高达 +5.5V，这样就允许多种逻辑电平共存于同一系统中。满摆幅驱动 IN<sub>n</sub> 可使功耗降至最低。对于 +2V 电源电压，逻辑门限值为 +0.5V (低) 和 +1.4V (高)；对于 +5V 电源电压，逻辑门限值为 +0.8V (低) 和 +1.8V (高)。

## 模拟信号电平

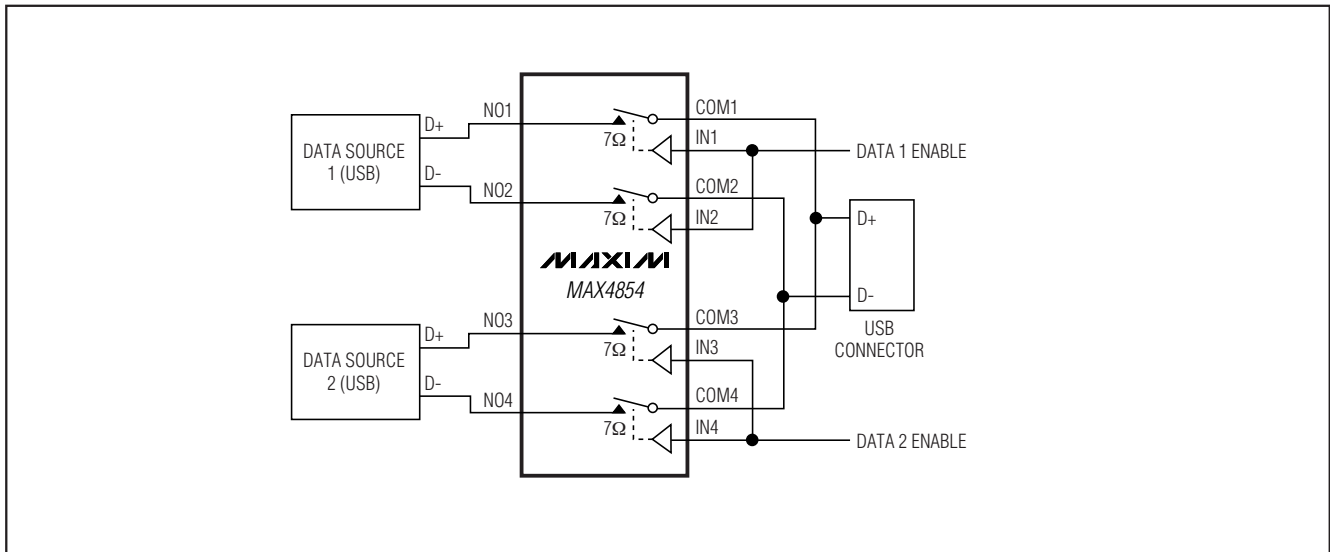
当模拟输入信号在整个电源电压范围内变化时，这些开关的导通电阻变化极小 (见典型工作特性)。这些开关都是双向的，因此 NO<sub>n</sub> 和 COM<sub>n</sub> 既能做输入也能做输出。

## 供电顺序

**警告：** 加载电压不要超过极限参数，因为超过列出的极限参数可能引起器件永久损坏。

对于所有 CMOS 器件，推荐使用正确的供电顺序。总是在加模拟信号之前先加 V<sub>CC</sub>，特别是在模拟信号没有限流的情况下。

## 典型工作电路



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测试电路/时序图

MAX4854

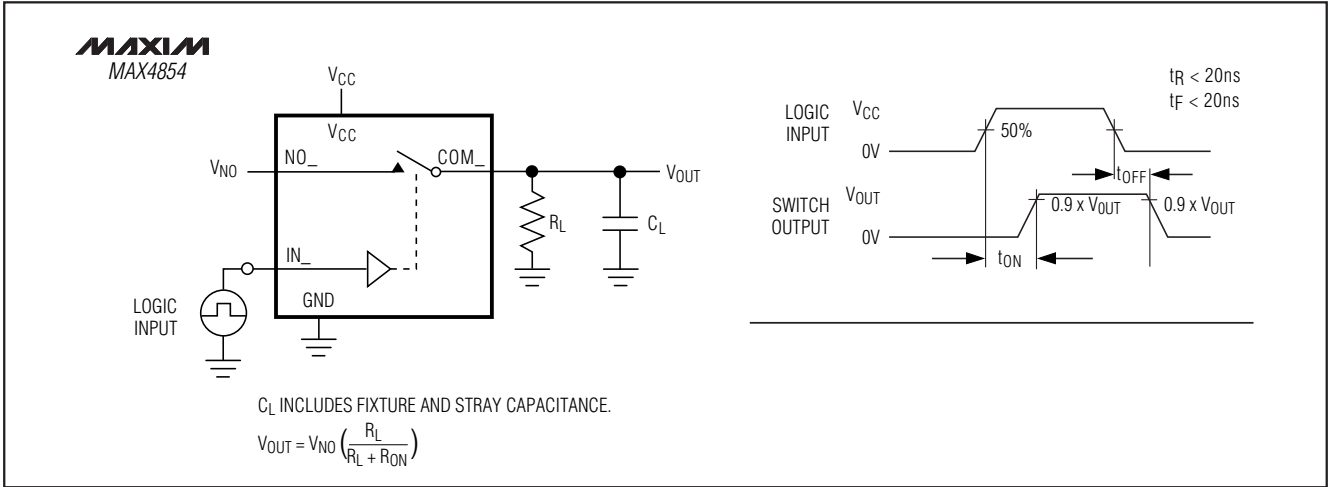


图 1. 开关时间

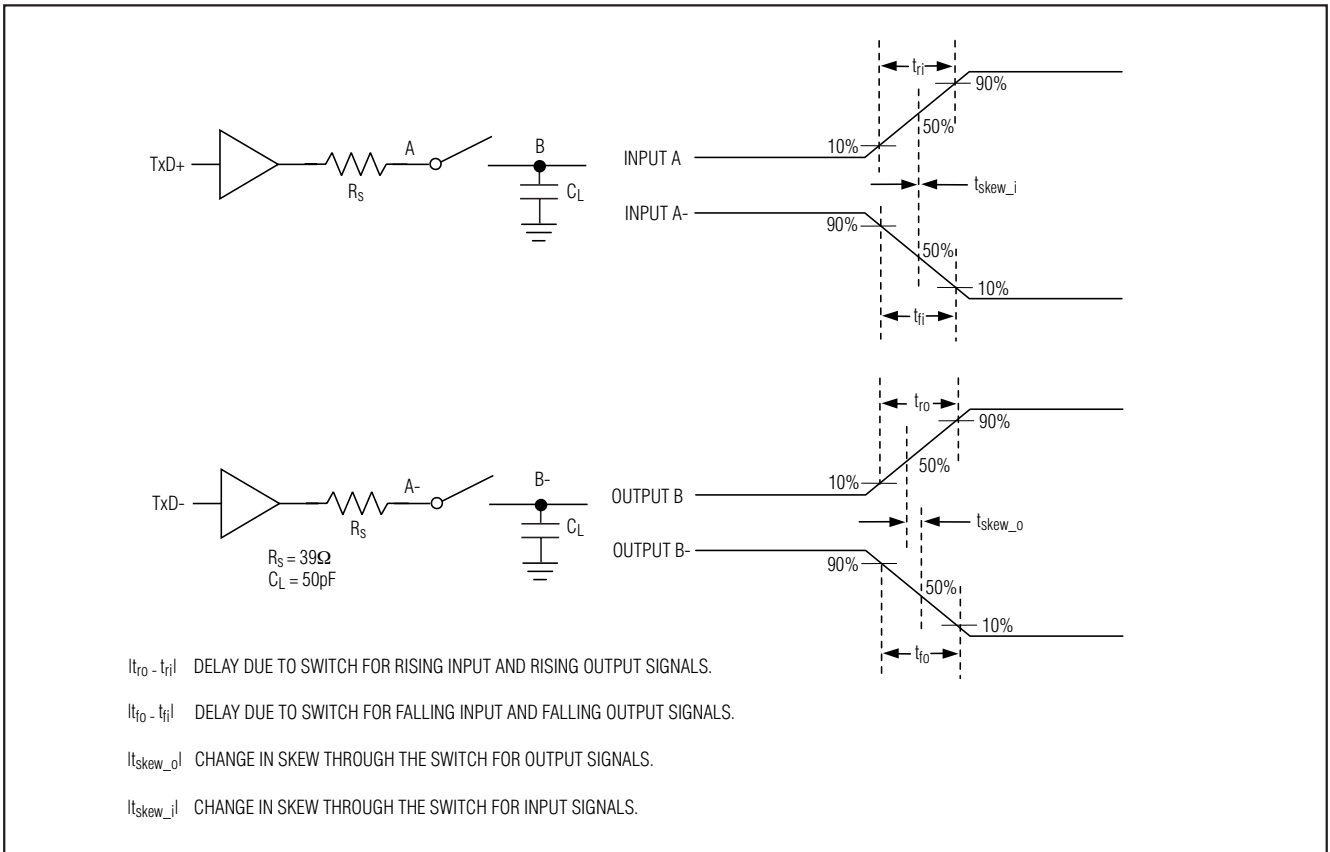


图 2. 输入/输出偏差时序图

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测试电路/时序图 (续)

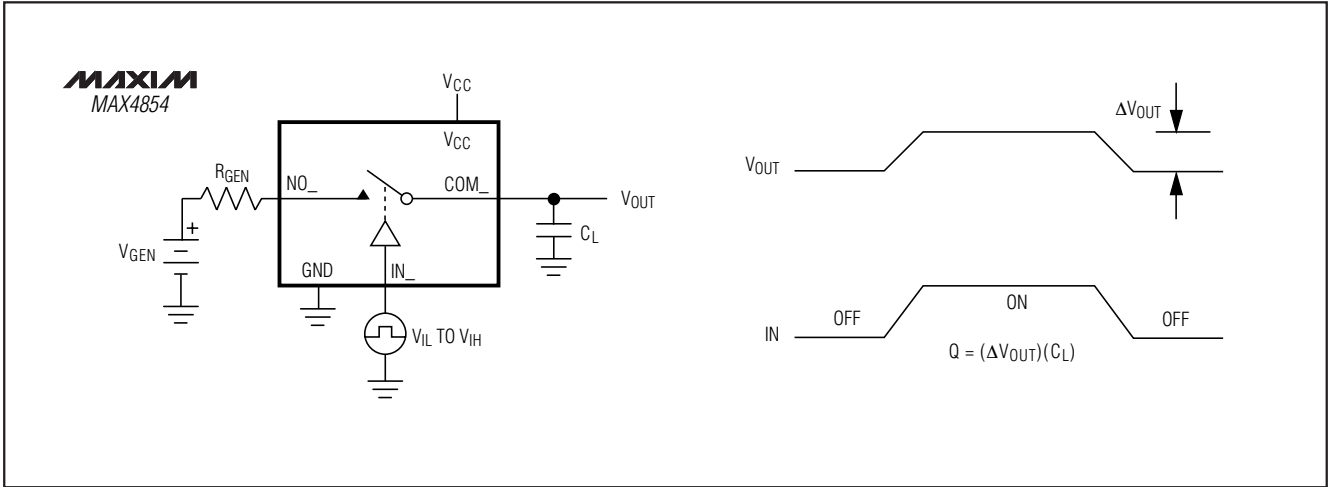


图 3. 电荷注入

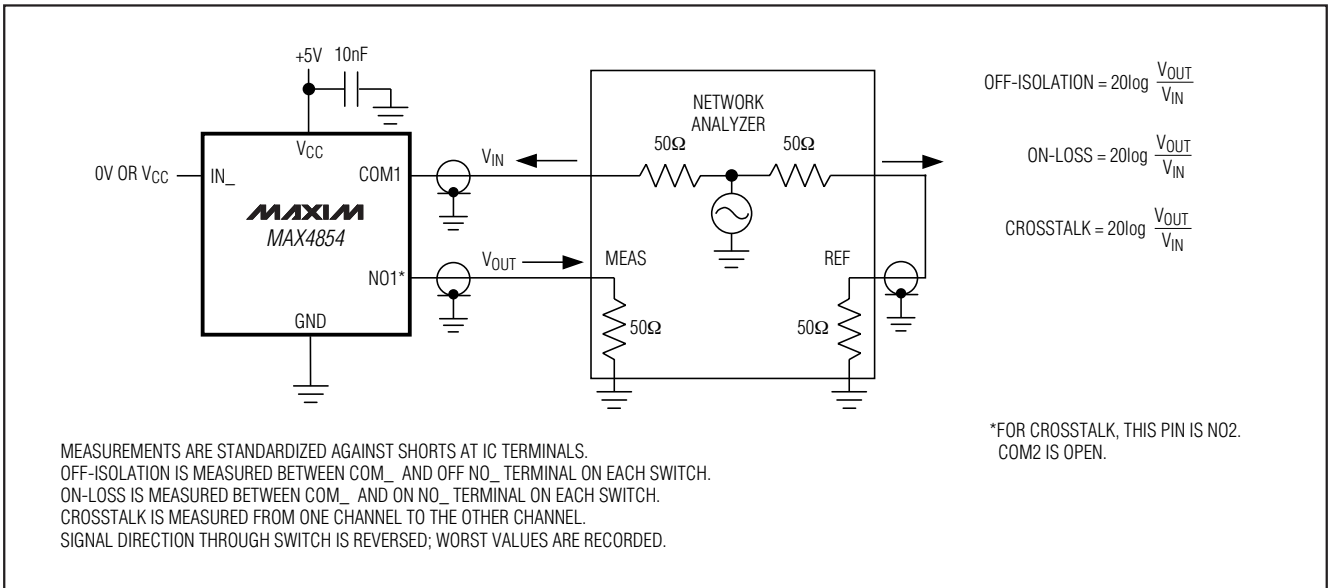


图 4. 导通损耗、关断隔离和串扰



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测试电路/时序图 (续)

芯片信息

TRANSISTOR COUNT: 735  
PROCESS: CMOS

MAX4854

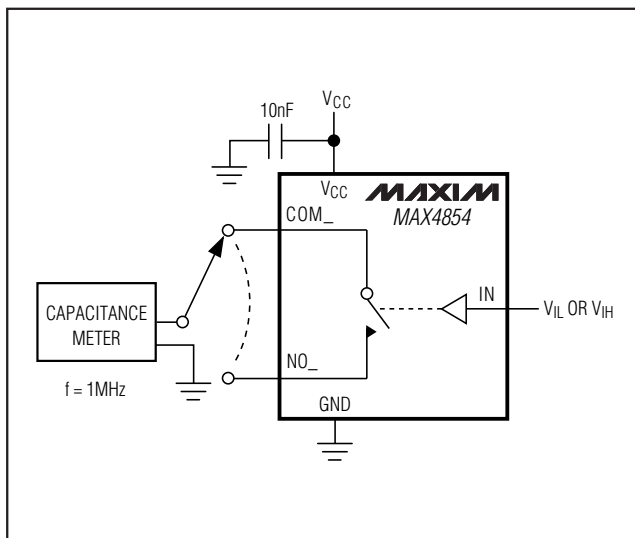
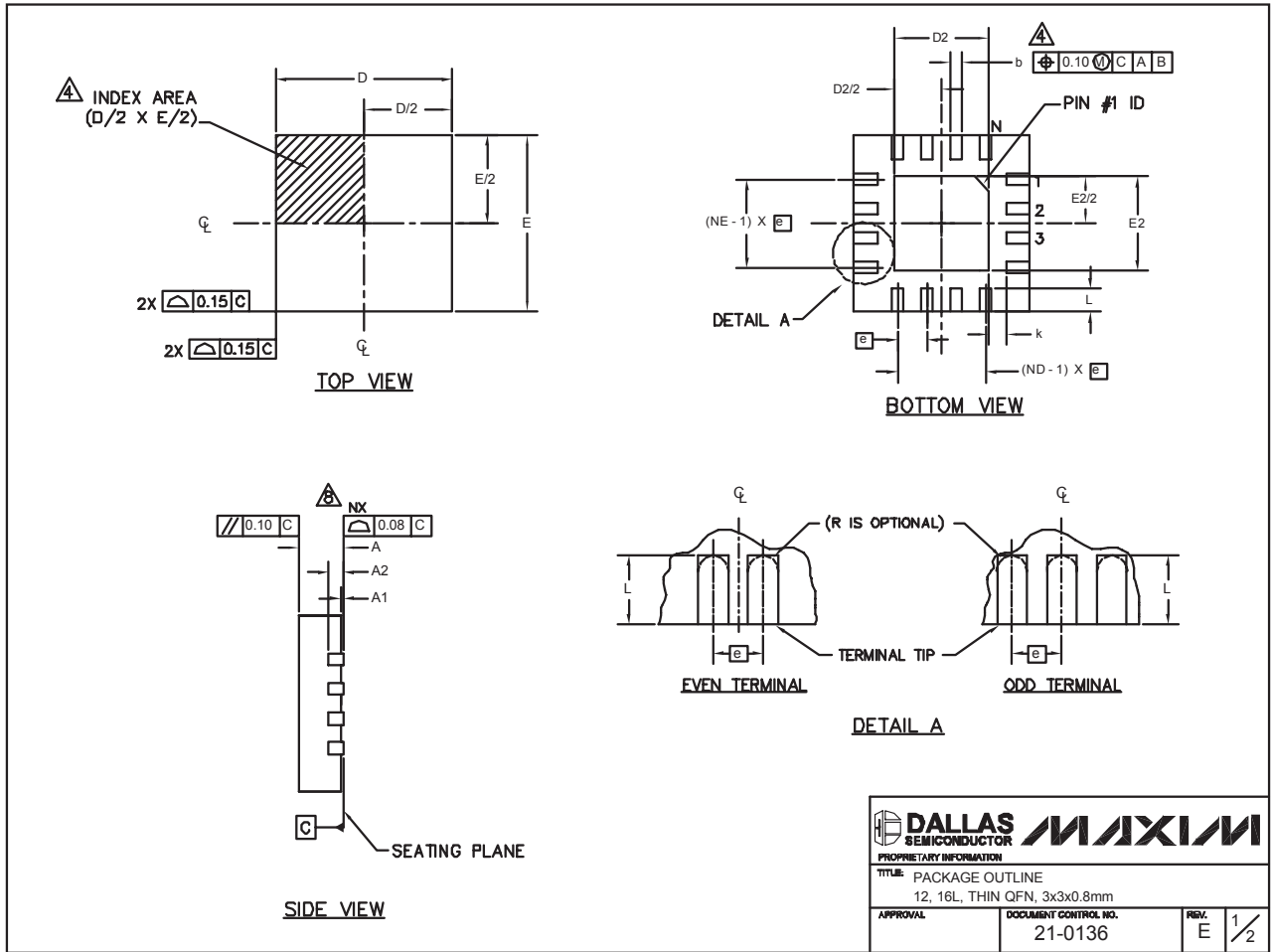


图 5. 通道关/开电容

# 7Ω、四路 SPST 开关， 可处理超摆幅信号

封装信息

(本数据资料提供的封装图可能不是最近的规格，如需最近的封装外型信息，请查询 [www.maxim-ic.com.cn/packages](http://www.maxim-ic.com.cn/packages)。)



12x16L QFN THIN.EPS

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封装信息 (续)

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MAX4854

PKG REF.	12L 3x3			16L 3x3		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.70	0.75	0.80
b	0.20	0.25	0.30	0.20	0.25	0.30
D	2.90	3.00	3.10	2.90	3.00	3.10
E	2.90	3.00	3.10	2.90	3.00	3.10
e	0.50 BSC.			0.50 BSC.		
L	0.45	0.65	0.65	0.30	0.40	0.50
N	12			16		
ND	3			4		
NE	3			4		
A1	0	0.02	0.05	0	0.02	0.05
A2	0.20 REF			0.20 REF		
k	0.25	-	-	0.25	-	-

PKG. CODES	EXPOSED PAD VARIATIONS						PIN ID	JEDEC	DOWN BONDS ALLOWED
	D2			E2					
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.			
T1233-1	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-1	NO
T1233-3	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-1	YES
T1633-1	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-2	NO
T1633-2	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-2	YES
T1633F-3	0.85	0.80	0.95	0.85	0.80	0.95	0.225 x 45°	WEED-2	N/A
T1633-4	0.95	1.10	1.25	0.95	1.10	1.25	0.35 x 45°	WEED-2	NO

NOTES:

- DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M-1994.
- ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- N IS THE TOTAL NUMBER OF TERMINALS.
- △ THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JESD 95-1 SPP-012. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD OR MARKED FEATURE.
- △ DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.20 mm AND 0.25 mm FROM TERMINAL TIP.
- △ ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
- DEPOPULATION IS POSSIBLE IN A SYMMETRICAL FASHION.
- △ COPLANARITY APPLIES TO THE EXPOSED HEAT SINK SLUG AS WELL AS THE TERMINALS.
- DRAWING CONFORMS TO JEDEC MO220 REVISION C.

PROPRIETARY INFORMATION			
TITLE: PACKAGE OUTLINE 12, 16L, THIN QFN, 3x3x0.8mm			
APPROVAL	DOCUMENT CONTROL NO.	REV.	2/2
	21-0136	E	

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