

# 四路 SPST、宽带、信号线保护开关

## 概述

MAX4854H/MAX4854HL 模拟开关采用 +2V 至 +5.5V 单电源供电，能够处理大于电源摆幅的信号。器件有四个低导通电阻 ( $7\Omega$ ) 的单刀/单掷 (SPST) 开关，导通电容为  $27.5\text{pF}$ ，十分适合数据信号切换。如果输入信号超过电源摆幅，开关将变为高阻，以防止信号通过开关到达输出端。

MAX4854H/MAX4854HL 采用节省空间的 ( $3\text{mm} \times 3\text{mm}$ ) 16 引脚薄型 QFN 封装，工作在  $-40^\circ\text{C}$  至  $+85^\circ\text{C}$  的扩展级温度范围。

## 应用

USB 开关  
宽带数据切换  
蜂窝电话  
笔记本电脑  
PDA 及其它手持设备

## 特性

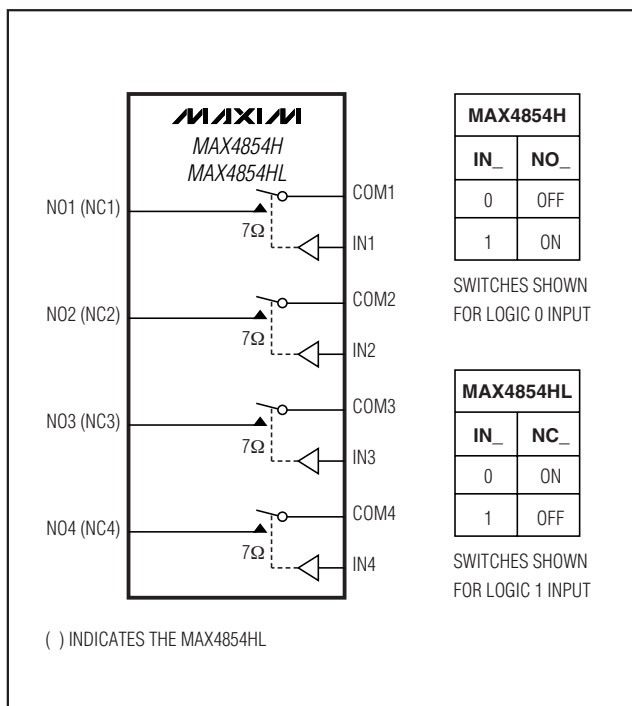
- ◆ 符合 USB 2.0 全速 (12MB) 和 USB 1.1 信号开关要求
- ◆ 如果信号超过  $V_{CC}$ ，则进行过压保护
- ◆ 150MHz 的 -3dB 带宽
- ◆  $27.5\text{pF}$  导通电容
- ◆ +2V 至 +5.5V 电源范围
- ◆  $7\Omega$  导通电阻
- ◆  $10\mu\text{A}$  的低电源电流
- ◆ 兼容 1.8V 逻辑电平
- ◆ 采用节省空间的 ( $3\text{mm} \times 3\text{mm}$ ) 16 引脚 TQFN 封装

## 订购信息

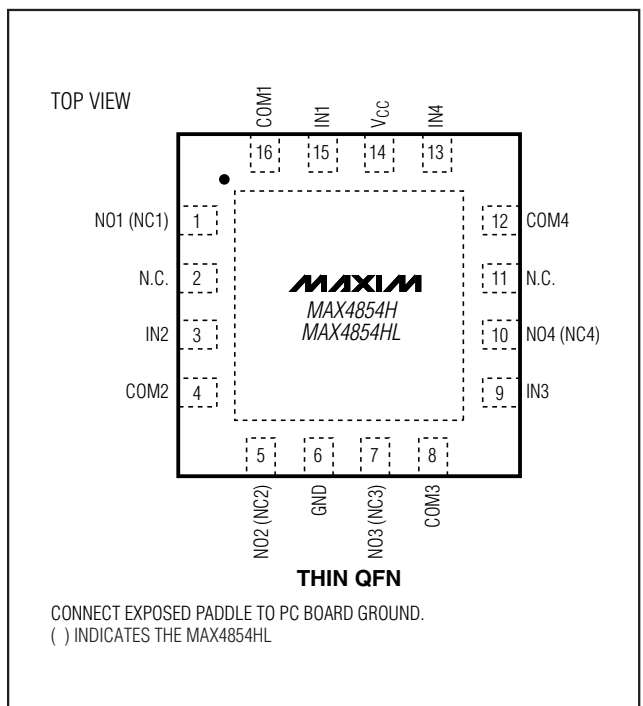
PART	TEMP RANGE	PIN-PACKAGE	TOP MARK
MAX4854HETE	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	16 TQFN-EP*	ACD
MAX4854HLETE	$-40^\circ\text{C}$ to $+85^\circ\text{C}$	16 TQFN-EP*	ACX

\*EP = 裸露焊盘。

## 框图/真值表



## 引脚配置



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## ABSOLUTE MAXIMUM RATINGS

$V_{CC}$ ,  $IN_{-}$ ,  $COM_{-}$ ,  $NO_{-}$ ,  $NC_{-}$  to GND (Note 1) ..... -0.3V to +6.0V  
 Closed Switch Continuous Current  $COM_{-}$ ,  $NO_{-}$ ,  $NC_{-}$  .....  $\pm 50$ mA  
 Peak Current  $COM_{-}$ ,  $NO_{-}$ ,  $NC_{-}$   
 (pulsed at 1ms, 50% duty cycle) .....  $\pm 100$ mA  
 Peak Current  $COM_{-}$ ,  $NO_{-}$ ,  $NC_{-}$   
 (pulsed at 1ms, 10% duty cycle) .....  $\pm 120$ mA

Continuous Power Dissipation ( $T_A = +70^{\circ}\text{C}$ )  
 16-Pin Thin QFN (derate 20.8mW/ $^{\circ}\text{C}$  above  $+70^{\circ}\text{C}$ ) ..... 1667mW  
 Operating Temperature Range .....  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$   
 Junction Temperature .....  $+150^{\circ}\text{C}$   
 Storage Temperature Range .....  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
 Lead Temperature (soldering, 10s) .....  $+300^{\circ}\text{C}$

**Note 1:** Signals on  $NO_{-}/NC_{-}$  or  $COM_{-}$  exceeding GND are clamped by internal diodes. Signals on  $IN$  exceeding GND are clamped by an internal diode. Limit the forward-diode current to the 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

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

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	$V_{CC}$		2.0		5.5	V
Supply Current	$I_{CC}$	$V_{CC} = 5.5\text{V}$ , $V_{IN_{-}} = 0\text{V}$ or $V_{CC}$		10	20	$\mu\text{A}$
<b>ANALOG SWITCH</b>						
Analog Signal Range	$V_{NO_{-}}$ , $V_{COM_{-}}$		0		$V_{CC}$	V
On-Resistance	$R_{ON}$	$V_{CC} = 3\text{V}$ , $I_{COM_{-}} = 10\text{mA}$ , $V_{NO_{-}}$ or $V_{NC_{-}} = 0$ to $V_{CC}$	$T_A = +25^{\circ}\text{C}$	7	9	$\Omega$
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		10	
On-Resistance Match Between Channels (Notes 3, 4)	$\Delta R_{ON}$	$V_{CC} = 3\text{V}$ , $I_{COM_{-}} = 10\text{mA}$ , or $V_{NO_{-}}$ or $V_{NC_{-}} = 1.5\text{V}$	$T_A = +25^{\circ}\text{C}$	0.2	0.4	$\Omega$
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		0.5	
On-Resistance Flatness (Note 5)	$R_{FLAT}$	$V_{CC} = 3\text{V}$ , $I_{COM_{-}} = 10\text{mA}$ , $V_{NO_{-}}$ or $V_{NC_{-}} = 1\text{V}$ , $2\text{V}$ , $3\text{V}$	$T_A = +25^{\circ}\text{C}$	2.5	3.75	$\Omega$
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		4	
$NO_{-}$ or $NC_{-}$ Off-Leakage Current	$I_{OFF}$	$V_{CC} = 5.5\text{V}$ , $V_{NO_{-}}$ or $V_{NC_{-}} = 1\text{V}$ or $4.5\text{V}$ , $V_{COM_{-}} = 4.5\text{V}$ or $1\text{V}$	$T_A = +25^{\circ}\text{C}$	-2	+2	nA
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	-10	+10	
$COM_{-}$ On-Leakage Current	$I_{ON}$	$V_{CC} = 5.5\text{V}$ ; $V_{NO_{-}}$ or $V_{NC_{-}} = 1\text{V}$ , $4.5\text{V}$ , or floating; $V_{COM_{-}} = 1\text{V}$ , $4.5\text{V}$ , or floating	$T_A = +25^{\circ}\text{C}$	-2	+2	nA
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	-12.5	+12.5	
<b>DYNAMIC CHARACTERISTICS</b>						
Signal Over Rail to High-Z Switching Time		$V_{NO_{-}}$ or $V_{NC_{-}} = V_{CC}$ to $(V_{CC} + 0.5\text{V})$ , $V_{CC} < 5\text{V}$ (Figure 1)		0.5	1	$\mu\text{s}$
High-Z to Low-Z Switching Time		$V_{NO_{-}}$ or $V_{NC_{-}} = (V_{CC} + 0.5\text{V})$ to $V_{CC}$ , $V_{CC} < 5\text{V}$ (Figure 1)		0.5	1	$\mu\text{s}$
Skew (Note 3)	$t_{SKEW}$	$R_S = 39\Omega$ , $C_L = 50\text{pF}$ (Figure 2)		0.15	1	ns
Propagation Delay (Note 3)	$t_{PD}$	$R_S = 39\Omega$ , $C_L = 50\text{pF}$ (Figure 2)		0.9	2	ns
Turn-On Time	$t_{ON}$	$V_{CC} = 3\text{V}$ , $V_{NO_{-}}$ or $V_{NC_{-}} = 1.5\text{V}$ , $R_L = 300\Omega$ , $C_L = 50\text{pF}$ (Figure 1)	$T_A = +25^{\circ}\text{C}$	40	60	ns
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		100	
Turn-Off Time	$t_{OFF}$	$V_{CC} = 3\text{V}$ , $V_{NO_{-}}$ or $V_{NC_{-}} = 1.5\text{V}$ , $R_L = 300\Omega$ , $C_L = 50\text{pF}$ (Figure 1)	$T_A = +25^{\circ}\text{C}$	30	40	ns
			$T_A = -40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$		60	

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MAX4854H/MAX4854HL

## 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
Charge Injection	Q	$V_{COM\_} = 1.5V$ , $R_S = 0\Omega$ , $C_L = 1nF$ (Figure 3)		8		pC
Off-Isolation (Note 6)	$V_{ISO}$	$f = 100kHz$ , $V_{COM\_} = 1V_{RMS}$ , $R_L = 50\Omega$ , $C_L = 5pF$ (Figure 4)		-80		dB
Crosstalk	$V_{CT}$	$f = 1MHz$ , $V_{COM\_} = 1V_{RMS}$ , $R_L = 50\Omega$ , $C_L = 5pF$ (Figure 4)		-95		dB
-3dB Bandwidth	BW	Signal = 0dBm, $R_L = 50\Omega$ , $C_L = 5pF$ (Figure 4)		150		MHz
Total Harmonic Distortion	THD	$f = 20Hz$ to $20kHz$ , $V_{COM\_} = 1V + 2V_{P-P}$ , $R_L = 600\Omega$		0.04		%
NO_ Off-Capacitance	$C_{OFF}$	$f = 1MHz$ (Figure 5)		12		pF
COM On-Capacitance	$C_{ON}$	$f = 1MHz$ (Figure 5)		27.5		pF
<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 Current	$I_{IN}$	$V_{IN\_} = 0$ 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.

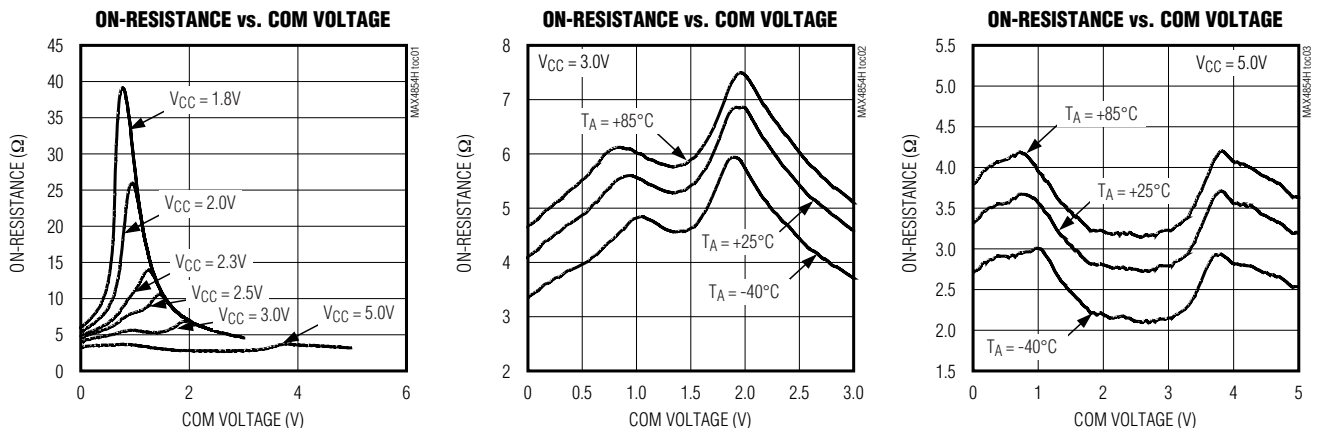
**Note 4:**  $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ .

**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.)

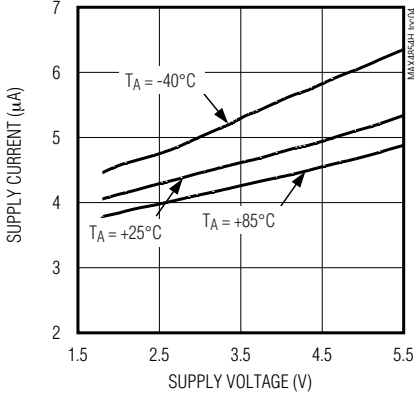


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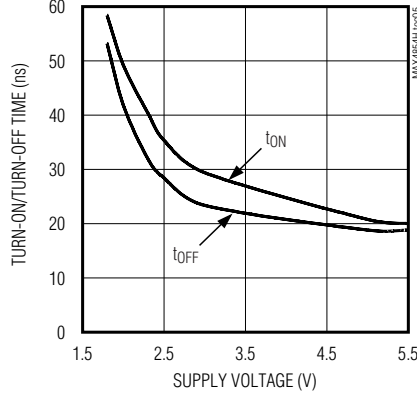
典型工作特性 (续)

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

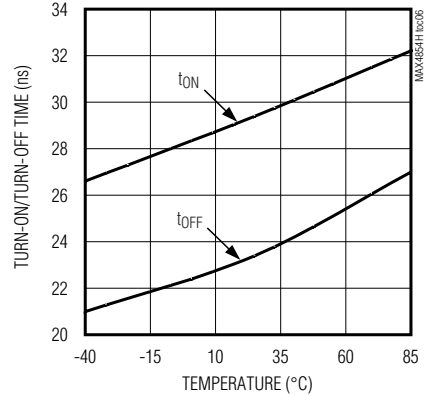
**SUPPLY CURRENT vs. SUPPLY VOLTAGE**



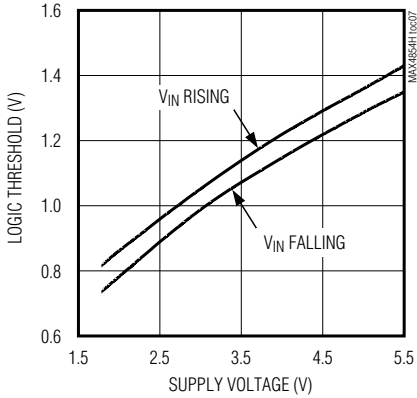
**TURN-ON/TURN-OFF TIME vs. SUPPLY VOLTAGE**



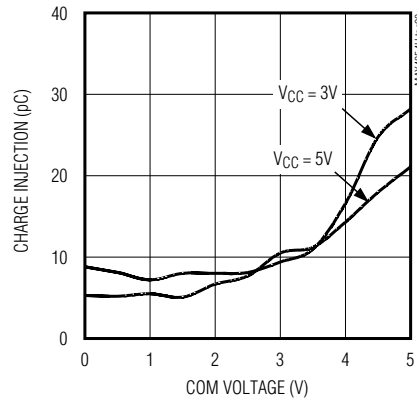
**TURN-ON/TURN-OFF TIME vs. TEMPERATURE**



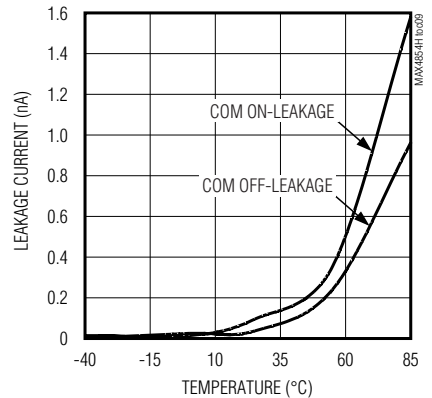
**LOGIC THRESHOLD vs. SUPPLY VOLTAGE**



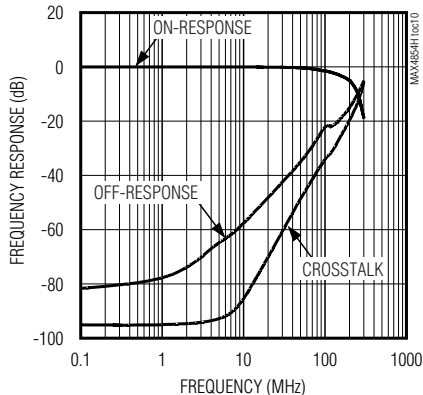
**CHARGE INJECTION vs. COM VOLTAGE**



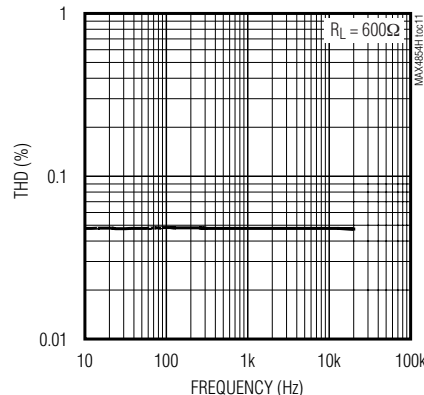
**LEAKAGE CURRENT vs. TEMPERATURE**



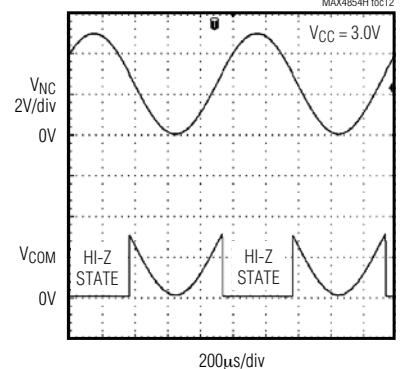
**FREQUENCY RESPONSE**



**TOTAL HARMONIC DISTORTION vs. FREQUENCY**



**SWITCH ENTERING HIGH-IMPEDANCE STATE**



# 四路 SPST、宽带、信号线保护开关

引脚说明

MAX4854H/MAX4854HL

引脚	名称	功能
1, 5, 7, 10	NO1, NO2, NO3, NO4	模拟开关的常开端 (MAX4854H)
1, 5, 7, 10	NC1, NC2, NC3, NC4	模拟开关的常闭端 (MAX4854HL)
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 (MAX4854H) 或逻辑高 (MAX4854HL) 时开关 2 关断。IN2 为逻辑高 (MAX4854H) 或逻辑低 (MAX4854HL) 时 COM2 与 NO2 (MAX4854H)/NC2 (MAX4854HL) 导通。
4	COM2	模拟开关 2 的公共端
6	GND	地
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 (MAX4854H) 或逻辑高 (MAX4854HL) 时开关 3 关断。IN3 为逻辑高 (MAX4854H) 或逻辑低 (MAX4854HL) 时 COM3 与 NO3 (MAX4854H)/NC3 (MAX4854HL) 导通。
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 (MAX4854H) 或逻辑高 (MAX4854HL) 时开关 4 关断。IN4 为逻辑高 (MAX4854H) 或逻辑低 (MAX4854HL) 时 COM4 与 NO4 (MAX4854H)/NC4 (MAX4854HL) 导通。
14	V <sub>CC</sub>	电源电压，用一个尽可能靠近引脚的 0.01μF 电容将 V <sub>CC</sub> 旁路至 GND。
15	IN1	模拟开关 1 的数字控制输入。IN1 为逻辑低 (MAX4854H) 或逻辑高 (MAX4854HL) 时开关 1 关断。IN1 为逻辑高 (MAX4854H) 或逻辑低 (MAX4854HL) 时 COM1 与 NO1 (MAX4854H)/NC4 (MAX4854HL) 导通。
16	COM1	模拟开关 1 的公共端
—	EP	裸露焊盘。接至 PCB 板地层。

## 详细说明

MAX4854H/MAX4854HL 四路 SPST 开关具有低导通电阻，可工作在 +2V 到 +5.5V 电源下，并且完全规范于电源标称值为 3.0V 的应用。器件具有过压保护功能，当开关输入超过 V<sub>CC</sub> 时，开关进入高阻模式。

开关具有 27.5pF 的低导通电容，可用作 USB 2.0 全速/1.1 应用中 12Mbps 数据信号的开关。MAX4854H/MAX4854HL 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% 处所测量的偏差小于 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，也可以高至 +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> 引脚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，因为超过该值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。

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测试电路/时序图

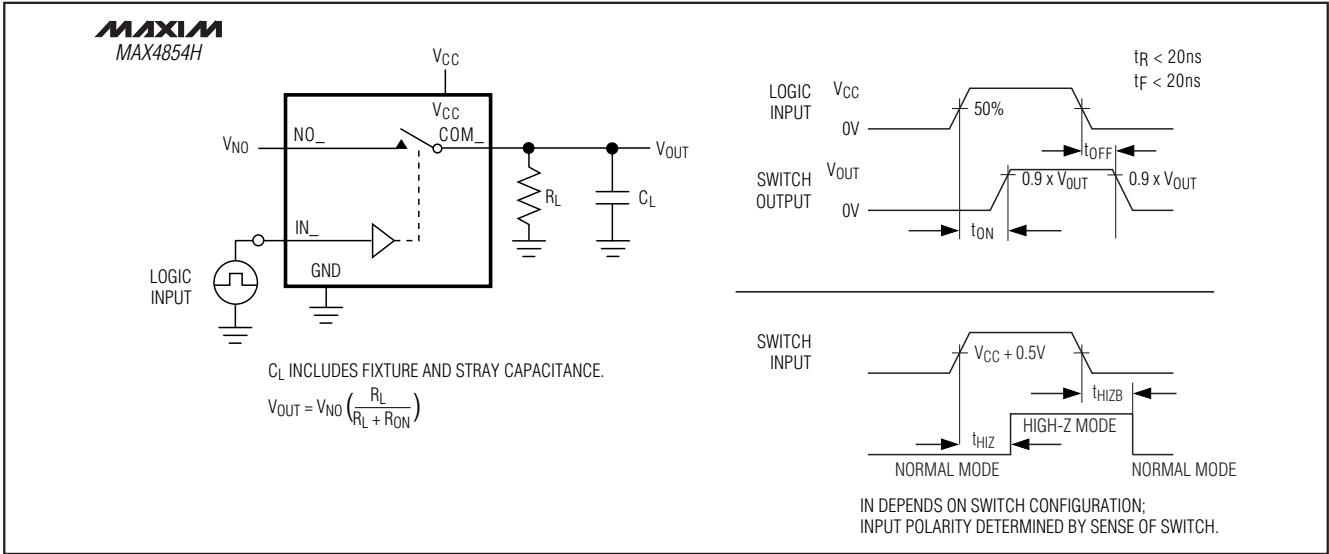


图 1. 开关时间

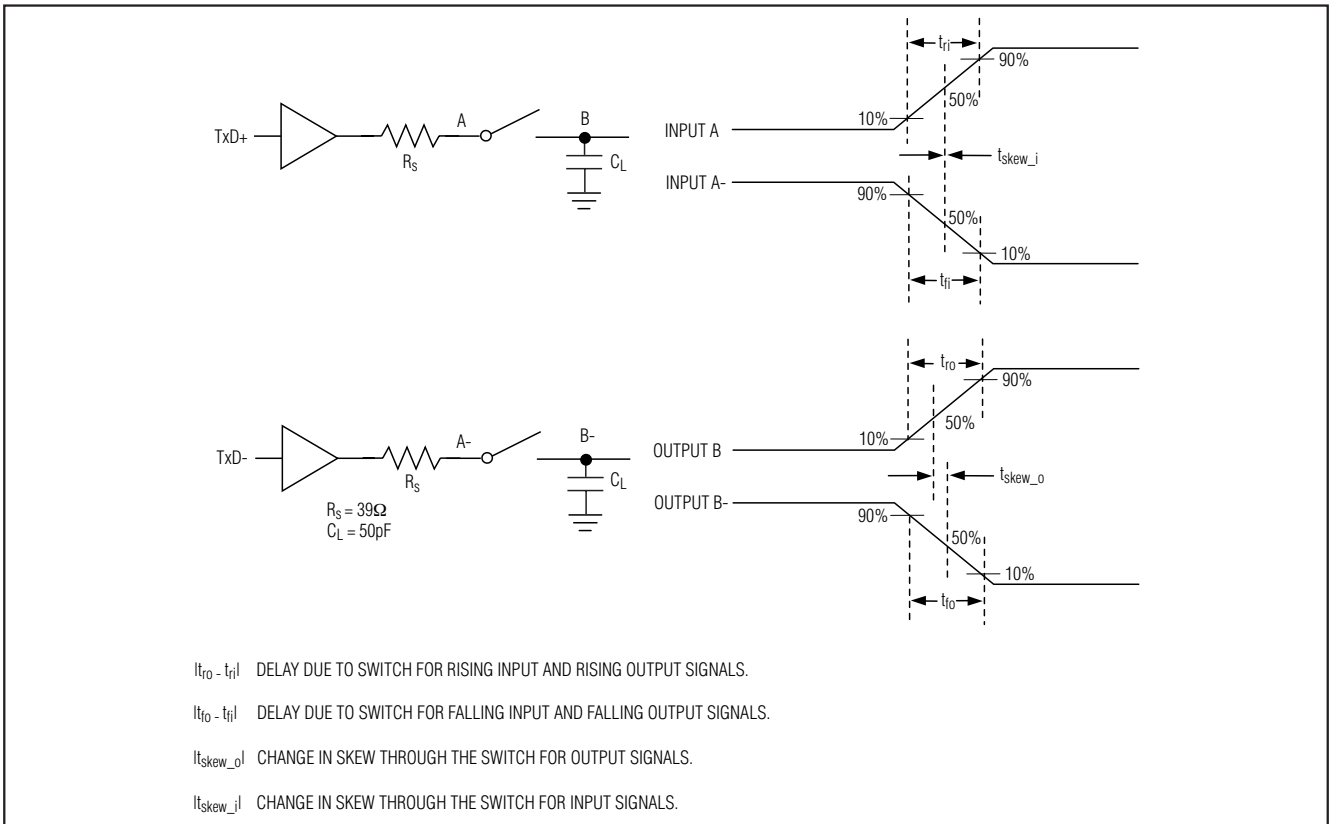


图 2. 输出信号偏差

# 四路 SPST、宽带、信号线保护开关

MAX4854H/MAX4854HL

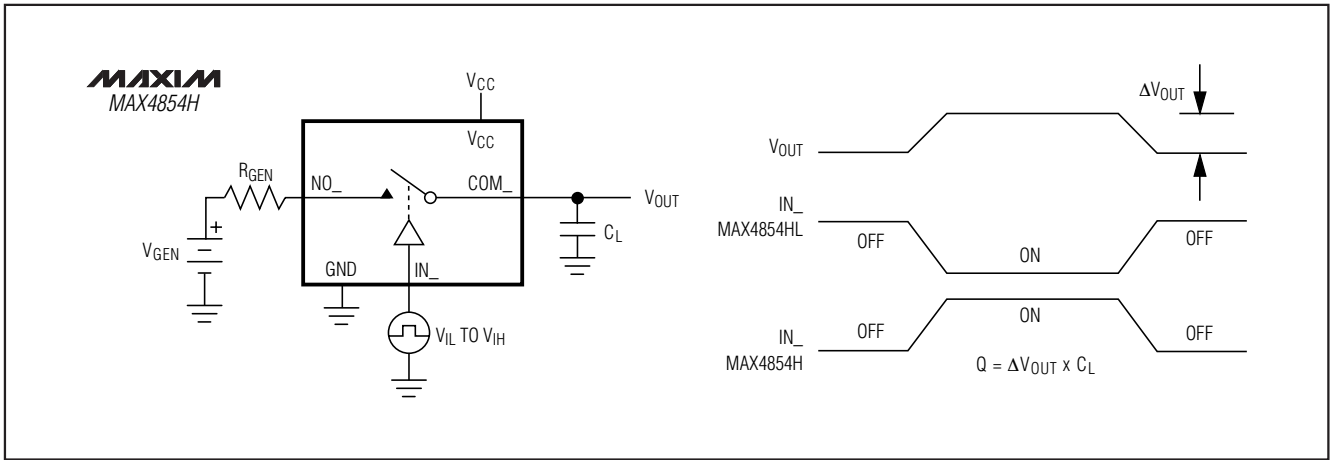


图 3. 电荷注入

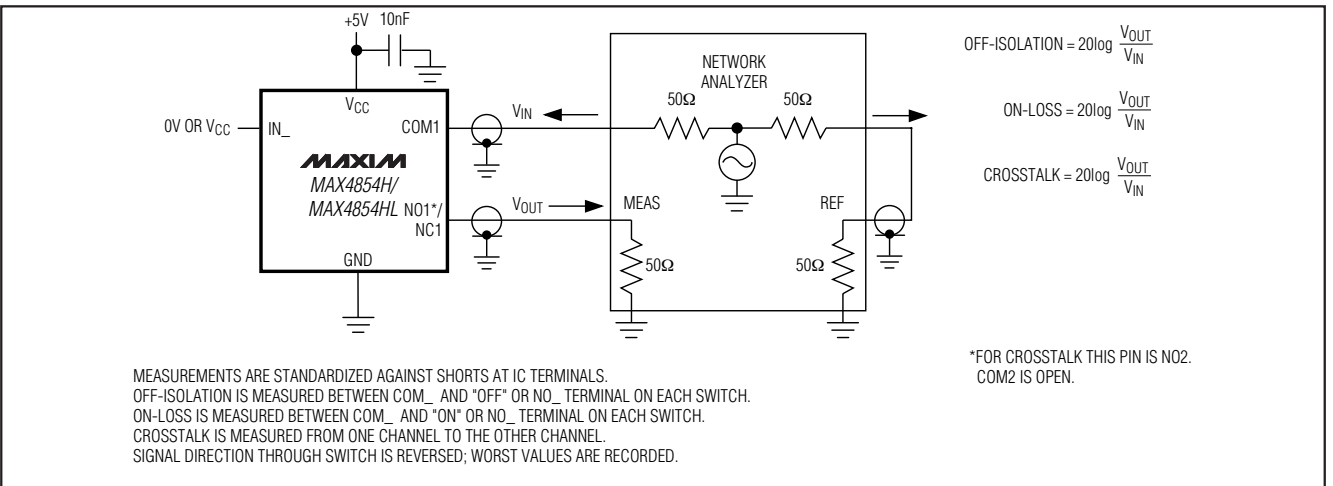


图 4. 导通损耗、关断隔离和串扰

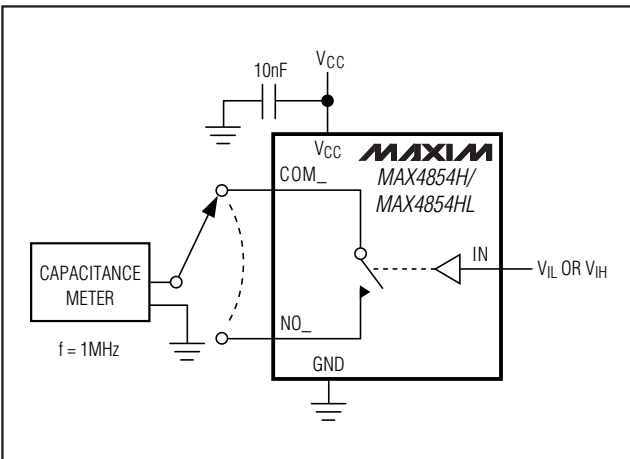


图 5. 通道关/开电容

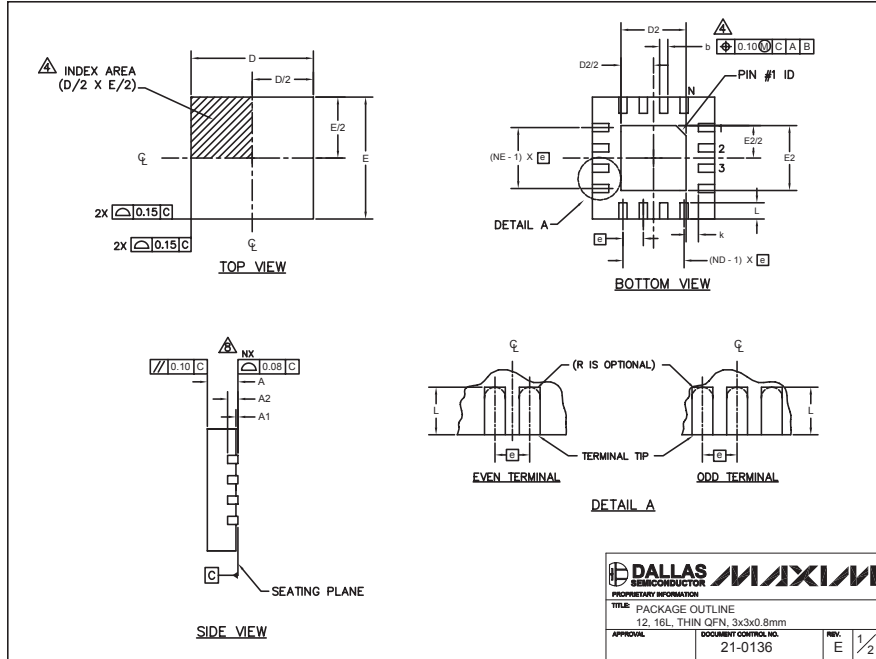
## 芯片信息

TRANSISTOR COUNT: 735  
 PROCESS: CMOS

# 四路 SPST、宽带、信号线保护开关

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)。)



PKG	12L 3x3			16L 3x3		
REF.	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	0.55	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	D2			E2			PIN ID	JEDEC	DOWN BONDS ALLOWED
	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	0.65	0.80	0.95	0.65	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 JEDEC 96-1 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.

**DALLAS SEMICONDUCTOR MAXIM**

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE  
12, 16L, THIN QFN, 3x3x0.8mm

APPROVAL: \_\_\_\_\_ DOCUMENT CONTROL NO. 21-0136 REV. E 2/2

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