19-3037; Rev 5; 4/09

宽带、四路DPDT开关

概述

MAX4760/MAX4760A/MAX4761/MAX4761A (DPDT)模拟开关采用+1.8V至+5.5V单电源供电。这些开关具有54pF (典型值)的低电容特性，适合高速数据切换的应用。

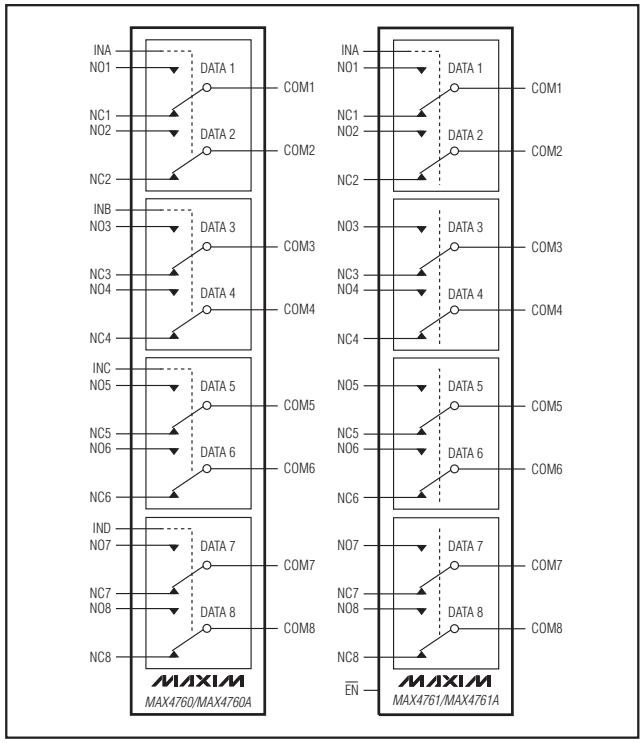
MAX4760/MAX4760A为4路双刀双掷(DPDT)开关，MAX4761/MAX4761A为8路单刀双掷开关(SPDT)，它们均有8个导通电阻为2.0Ω (典型值)的低电容开关，可用于切换音频和数据信号。MAX4760/MAX4760A有4个逻辑输入端，分别控制成对的开关。MAX4761/MAX4761A有1个逻辑控制输入端和1个可用来禁止开关的使能输入端($\overline{EN}$)。

MAX4760/MAX4760A/MAX4761/MAX4761A提供小型36引脚(6mm x 6mm) TQFN封装和36焊球(3mm x 3mm)晶片级封装(UCSP™)。

应用

USB信号切换
音频信号切换
蜂窝电话
PDA/手持式设备
笔记本电脑

功能框图



UCSP是 Maxim Integrated Products, Inc.的商标。

特性

- ♦ 符合USB 1.1和USB 2.0 (全速12Mbps)信号开关规范
- ♦ 用于数据和音频信号切换
- ♦ 低电容数据开关
- ♦ 偏差小于0.2ns
- ♦ -3dB带宽：150MHz (典型值)
- ♦ 0.2Ω (典型值)通道间匹配度
- ♦ 0.8Ω (典型值)导通电阻平坦度
- ♦ 满摆幅信号处理
- ♦ 0.03% (典型值) THD
- ♦ +1.8V至+5.5V电源供电范围
- ♦ 低电源电流，具有1.8V逻辑门限 (MAX4760A/MAX4761A)
- ♦ 微型36焊球UCSP (3mm x 3mm)封装
- ♦ 36引脚TQFN (6mm x 6mm)封装
- ♦ -40°C至+85°C工作温度范围

定购信息

PART	TEMP RANGE	PIN-PACKAGE
MAX4760EBX+T	-40°C to +85°C	36 UCSP
MAX4760ETX+T	-40°C to +85°C	36 TQFN-EP**
MAX4760AEWX+T	-40°C to +85°C	36 UCSP
MAX4760AETX+T*	-40°C to +85°C	36 TQFN-EP**
MAX4761EBX+T	-40°C to +85°C	36 UCSP
MAX4761ETX+T	-40°C to +85°C	36 TQFN-EP**
MAX4761AEBX+T*	-40°C to +85°C	36 UCSP
MAX4761AETX+T*	-40°C to +85°C	36 TQFN-EP**

**未来产品—供货状况请联系工厂。*
***EP = 裸焊盘。*
+表示无铅(Pb)/符合RoHS标准的封装。
T = 卷带包装。

引脚配置/真值表和典型工作电路在数据资料的最后给出。

ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to GND.)
V+ .....-0.3V to +6V
IN_, $\overline{EN}$ (MAX4761) .....-0.3V to +6V
IN_, $\overline{EN}$ (MAX4761A) .....-0.3V to (V+ + 0.3V)
COM_, NO_, NC_ (Note 1) .....-0.3V to (V+ + 0.3V)
Continuous Current
NO_, NC_, COM_ .....±100mA
Peak Current
(pulsed at 1ms, 10% duty cycle).....±200mA
(pulsed at 1ms, 50% duty cycle)..... ±300mA

Continuous Power Dissipation (T_A = +70°C)
36-Bump UCSP (derate 15.3mW/°C above +70°C).... 1221mW
36-Pin TQFN (derate 26.3mW/°C above +70°C) 2105mW
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
Bump Temperature (soldering)
Infrared (15s) .....+220°C
Vapor Phase (60s) .....+215°C

Note 1: Signals on NO_, NC_, COM_ exceeding V+ or 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+ = +2.7V to +5.25V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V+ = 3V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		T_A	MIN	TYP	MAX	UNITS
ANALOG SWITCH								
Analog Signal Range	$V_{COM\_}$, $V_{NO\_}$, $V_{NC\_}$			T_{MIN} to T_{MAX}	0		V+	V
On-Resistance	R_{ON}	V+ = 2.7V, $I_{COM\_}$ = 10mA, $V_{NC\_}$ or $V_{NO\_}$ = 0V or V+ (Note 4)		+25°C		2.0	3.5	Ω
				T_{MIN} to T_{MAX}			4	
On-Resistance Match Between Channels	ΔR_{ON}	V+ = 2.7V, $I_{COM\_}$ = 10mA, $V_{NO\_}$ or $V_{NC\_}$ = 1.5V (Notes 4, 5)		+25°C		0.2	0.4	Ω
				T_{MIN} to T_{MAX}			0.55	
On-Resistance Flatness	$R_{FLAT(ON)}$	V+ = 2.7V, $I_{COM\_}$ = 10mA, $V_{NC\_}$ or $V_{NO\_}$ = 0V or V+ (Note 6)		+25°C		0.8	1.5	Ω
				T_{MIN} to T_{MAX}			1.8	
NO_, NC_ Off-Leakage Current	$I_{NO\_(OFF)}$, $I_{NC\_(OFF)}$	V+ = 3.6V; $V_{COM\_}$ = 3.3V, 0.3V; $V_{NO\_}$ or $V_{NC\_}$ = 0.3V, 3.3V		+25°C	-5		+5	nA
				T_{MIN} to T_{MAX}	-25		+25	
COM_ Off-Leakage Current		V+ = 3.6V (MAX4761/MAX4761A); $V_{COM\_}$ = 3.3V, 0.3V; $V_{NO\_}$ or $V_{NC\_}$ = 0.3V, 3.3V		+25°C	-5	0.1	+5	nA
				T_{MIN} to T_{MAX}	-25		+25	
COM_ On-Leakage Current	$I_{COM\_(ON)}$	V+ = 3.6V; $V_{COM\_}$ = 3.3V, 0.3V; $V_{NO\_}$ or $V_{NC\_}$ = 3.3V, 0.3V or unconnected		+25°C	-5		+5	nA
				T_{MIN} to T_{MAX}	-25		+25	
DYNAMIC								
Turn-On Time	t_{ON}	$V_{NO\_}$ or $V_{NC\_}$ = 1.5V; R_L = 50Ω; C_L = 35pF, Figure 2	MAX4760/ MAX4761	+25°C		45	140	ns
				T_{MIN} to T_{MAX}			150	
			MAX4760A/ MAX4761A	+25°C		400	800	ns
				T_{MIN} to T_{MAX}			800	

ELECTRICAL CHARACTERISTICS (continued)

(V+ = +2.7V to +5.25V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V+ = 3V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS		T_A	MIN	TYP	MAX	UNITS
Turn-Off Time	t_{OFF}	V+ = 2.7V, $V_{NO\_}$ or $V_{NC\_}$ = 1.5V; R_L = 50Ω; C_L = 35pF, Figure 2	MAX4760/ MAX4761	+25°C		25	50	ns
				T_{MIN} to T_{MAX}			60	
			MAX4760A/ MAX4761A	+25°C		300	800	ns
				T_{MIN} to T_{MAX}			800	
Break-Before-Make	t_{BBM}	V+ = 2.7V, $V_{NO\_}$ or $V_{NC\_}$ = 1.5V; R_L = 50Ω, C_L = 35pF, Figure 3 (Note 7)		+25°C		100		ns
				T_{MIN} to T_{MAX}	2			
Skew	t_{SKEW}	R_S = 39Ω, C_L = 50pF, Figure 4 (Note 7)		+25°C		0.2		ns
Charge Injection	Q	V_{GEN} = 0V, R_{GEN} = 0V, C_L = 1.0nF, Figure 5		+25°C		15		pC
On-Channel -3dB Bandwidth	BW	Signal = 0dBm, C_L = 5pF, R_L = 50Ω		+25°C		150		MHz
Off-Isolation	V_{ISO}	C_L = 5pF, R_L = 50Ω, $V_{COM\_}$ = $1V_{P-P}$, f = 100kHz, Figure 6 (Note 8)		+25°C		80		dB
Crosstalk	V_{CT}	C_L = 5pF, R_L = 50Ω, $V_{COM\_}$ = $1V_{P-P}$, f = 100kHz, Figure 6 (Note 9)		+25°C		95		dB
Total Harmonic Distortion	THD	f = 20Hz to 20kHz , $V_{COM\_}$ = $1V_{P-P}$, DC bias = V+/2, R_L = R_S = 600Ω		+25°C		0.03		%
NO_, NC_ Off-Capacitance	$C_{NO\_(OFF)}$, $C_{NC\_(OFF)}$	$V_{NO\_}$, $V_{NC\_}$ = GND, f = 1MHz, Figure 7		+25°C		25		pF
COM_ On-Capacitance	$C_{COM(ON)}$	$V_{NO\_}$, $V_{NC\_}$ = GND, f = 1MHz, Figure 7		+25°C		54		pF
COM_ Off-Capacitance	$C_{COM(OFF)}$	$V_{COM\_}$ = GND, f = 1MHz (MAX4761/ MAX4761A), Figure 7		+25°C		25		pF
DIGITAL I/O (IN_, $\overline{EN}$)								
Input-Logic High	V_{IH}	V+ = 2.7V to 3.6V		T_{MIN} to T_{MAX}	1.4			V
		V+ = 3.6V to 5.5V (MAX4760A/MAX4761A)		T_{MIN} to T_{MAX}	1.6			
		V+ = 3.6V to 5.25V (MAX4760/MAX4761)		T_{MIN} to T_{MAX}	2.0			
Input-Logic Low	V_{IL}	V+ = 2.7V to 3.6V		T_{MIN} to T_{MAX}			0.5	V
		V+ = 3.6V to 5.5V (MAX4760A/MAX4761A)		T_{MIN} to T_{MAX}			0.5	
		V+ = 3.6V to 5.25V (MAX4760/MAX4761)		T_{MIN} to T_{MAX}			0.6	
Input Leakage Current	I_{IN}, I_{EN}	V_{IN} = 0V or V+		T_{MIN} to T_{MAX}			1	µA

ELECTRICAL CHARACTERISTICS (continued)

(V+ = +2.7V to +5.25V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V+ = 3V, T_A = +25°C.) (Notes 2, 3)

PARAMETER	SYMBOL	CONDITIONS	T_A	MIN	TYP	MAX	UNITS
POWER SUPPLY							
Power-Supply Range	V+		T_{MIN} to T_{MAX}	1.8		5.5	V
Power Supply Current	I+	V+ = 4.3V, $V_{IN\_}$ = 0V or V+ (MAX4760/MAX4761)	+25°C		0.01		µA
			T_{MIN} to T_{MAX}			1.0	
		V+ = 5.5V, $V_{IN\_}$ = 0V or V+ (MAX4760A/MAX4761A)	+25°C		0.01		
			T_{MIN} to T_{MAX}			1.0	
		V+ = 5.5V, $V_{IN\_}$ = 1.8V (MAX4760A/MAX4761A)	+25°C		5.5		
			T_{MIN} to T_{MAX}			12	

Note 2: The algebraic convention is used in this data sheet; the most negative value is shown in the minimum column.

Note 3: UCSP packages are 100% tested at +25°C and limits across the full temperature range are guaranteed by correlation and design. TQFN packages are 100% tested at +85°C and limits across the full temperature range are guaranteed by correlation and design.

Note 4: R_{ON} and ΔR_{ON} matching specifications are guaranteed by design.

Note 5: $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.

Note 6: Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

Note 7: Guaranteed by design, not production tested.

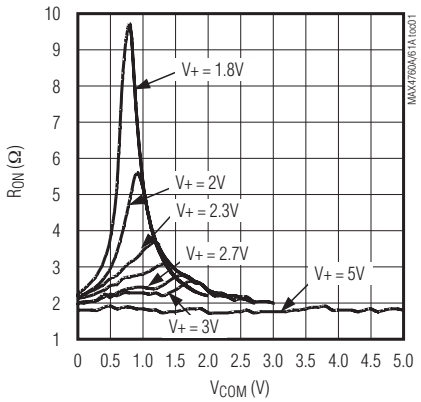
Note 8: Off-isolation = $20\log_{10}$ [$V_{COM\_}$/($V_{NO\_}$ or $V_{NC\_}$)], $V_{COM\_}$ = output, $V_{NO\_}$ or $V_{NC\_}$ = input to off switch.

Note 9: Between any two switches.

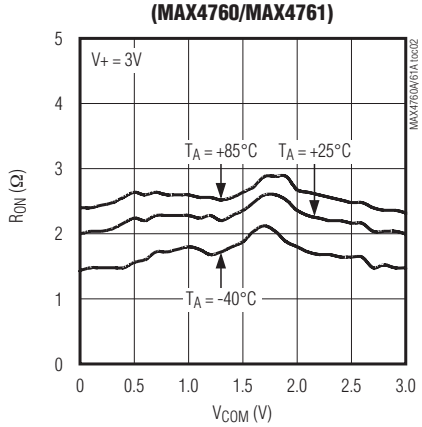
典型工作特性

(V+ = 3V, T_A = +25°C, unless otherwise noted.)

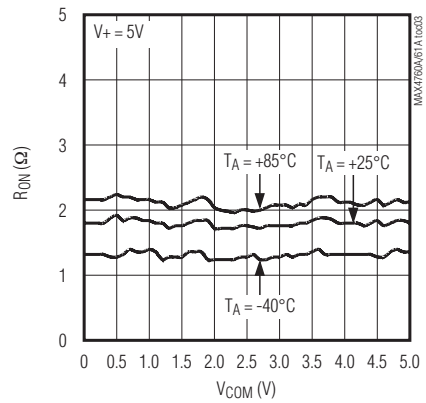
ON-RESISTANCE vs. V_{COM} (MAX4760/MAX4761)



ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (MAX4760/MAX4761)



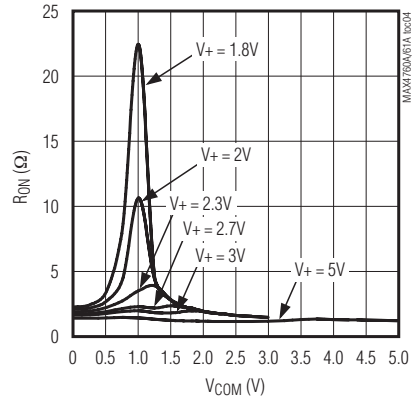
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (MAX4760/MAX4761)



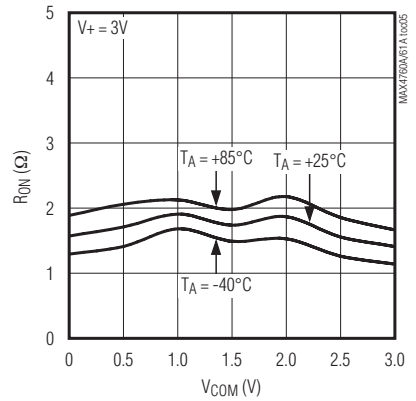
典型工作特性(续)

(V+ = 3V, T_A = +25°C, unless otherwise noted.)

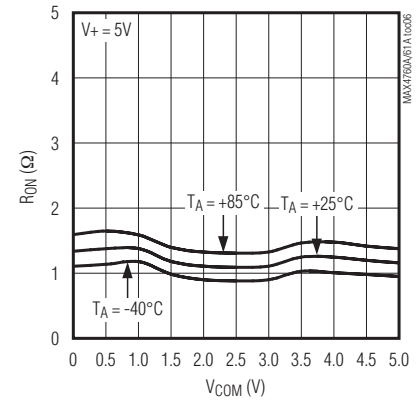
ON-RESISTANCE vs. V_{COM} (MAX4760A/MAX4761A)



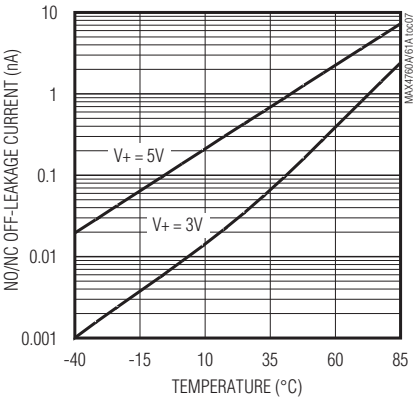
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (MAX4760A/MAX4761A)



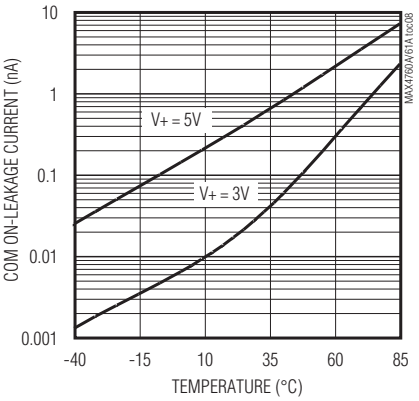
ON-RESISTANCE vs. V_{COM} AND TEMPERATURE (MAX4760A/MAX4761A)



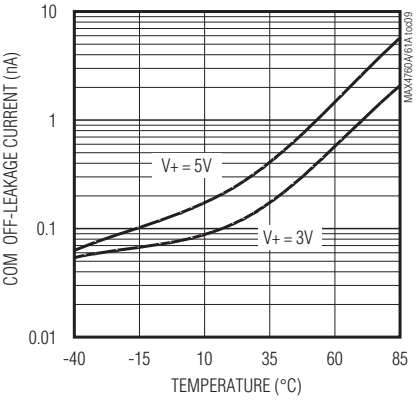
NO/NC OFF-LEAKAGE CURRENT vs. TEMPERATURE



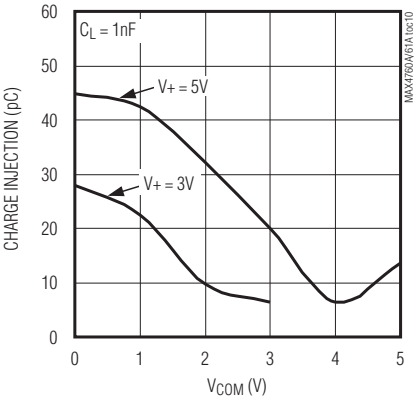
COM ON-LEAKAGE CURRENT vs. TEMPERATURE



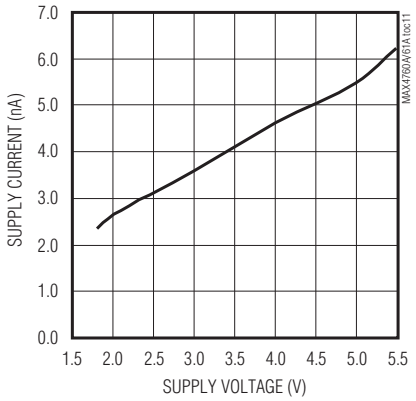
COM OFF-LEAKAGE CURRENT vs. TEMPERATURE



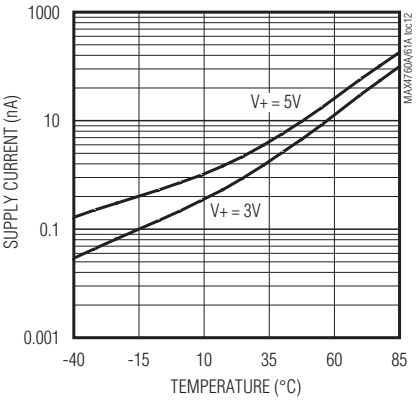
CHARGE INJECTION vs. V_{COM}



SUPPLY CURRENT vs. SUPPLY VOLTAGE



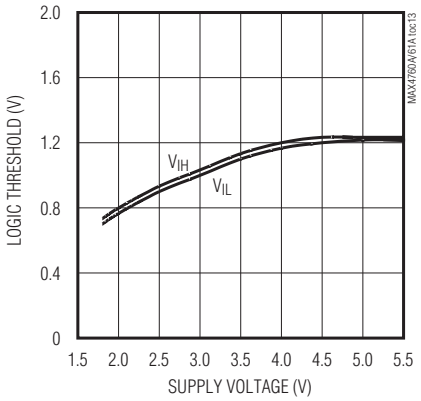
SUPPLY CURRENT vs. TEMPERATURE



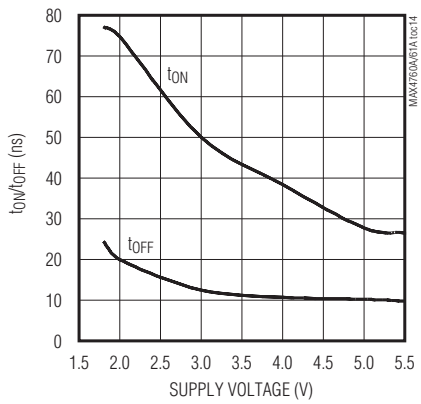
典型工作特性(续)

(V+ = 3V, T_A = +25°C, unless otherwise noted.)

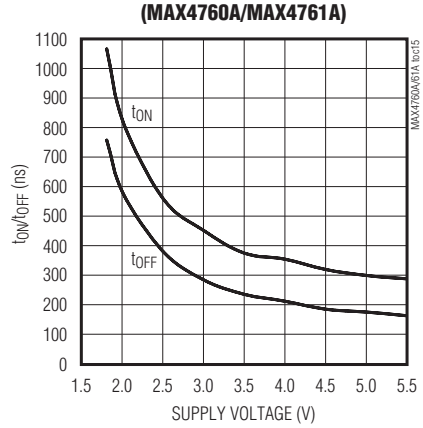
LOGIC THRESHOLD vs. SUPPLY VOLTAGE



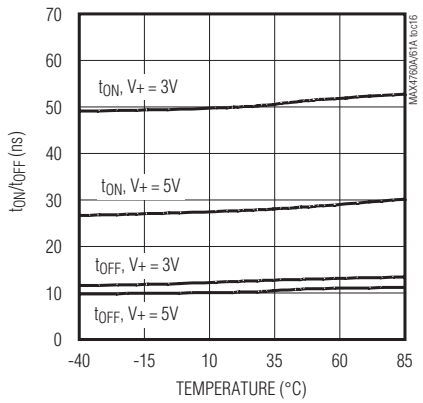
TURN-ON/OFF TIME vs. SUPPLY VOLTAGE (MAX4760/MAX4761)



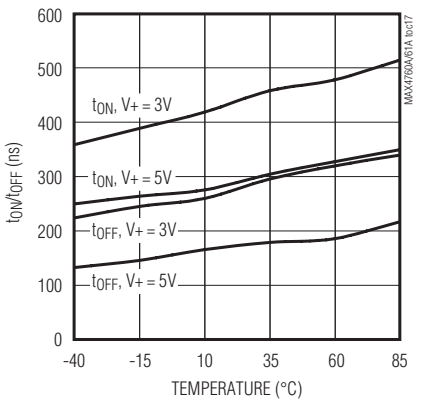
TURN-ON/OFF TIME vs. SUPPLY VOLTAGE (MAX4760A/MAX4761A)



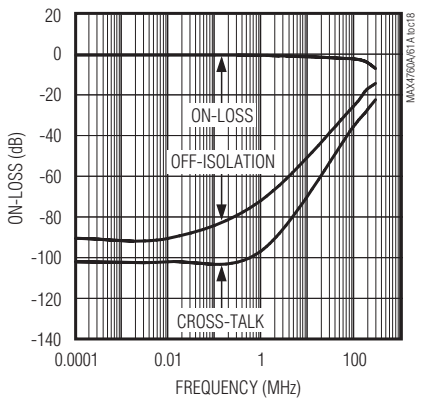
TURN-ON/OFF TIMES vs. TEMPERATURE (MAX4760/MAX4761)



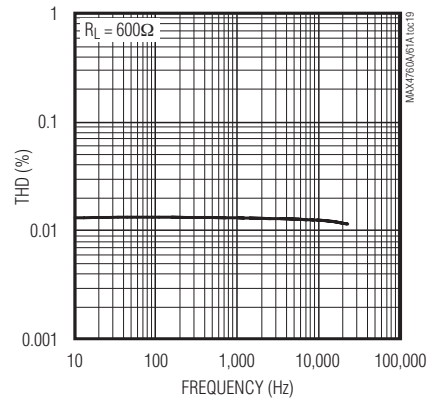
TURN-ON/OFF TIMES vs. TEMPERATURE (MAX4760A/MAX4761A)



FREQUENCY RESPONSE



TOTAL HARMONIC DISTORTION vs. FREQUENCY



引脚说明

引脚				名称	功能
MAX4760/MAX4760A		MAX4761/MAX4761A			
TQFN-EP	UCSP	TQFN-EP	UCSP		
1	A1	1	A1	NC1	模拟开关1，常闭端1。
2	B2	2	B2	COM2	模拟开关2，公共端2。
3	A2	3	A2	NC2	模拟开关2，常闭端2。
4	A3	4	A3	INA	MAX4760/MAX4760A开关1和开关2的逻辑数控输入端。 MAX4761/MAX4761A所有开关的数控输入端。
5	C3, D4	5	C3, D4	V+	正电源输入。
6	A4	—	—	INB	开关3和开关4的逻辑数控输入端。
7	A5	7	A5	NC3	模拟开关3，常闭端3。
8	B5	8	B5	COM3	模拟开关3，公共端3。
9	A6	9	A6	NC4	模拟开关4，常闭端4。
10	B6	10	B6	COM4	模拟开关4，公共端4。
11, 14, 17, 29, 32, 35	—	6, 11, 14, 17, 24, 29, 32, 35	A4, F3	N.C.	未接，N.C.无连接。
12	C5	12	C5	NO3	模拟开关3，常开端3。
13	C6	13	C6	NO4	模拟开关4，常开端4。
15	D6	15	D6	NO8	模拟开关8，常开端8。
16	D5	16	D5	NO7	模拟开关7，常开端7。
18	E6	18	E6	COM8	模拟开关8，公共端8。
19	F6	19	F6	NC8	模拟开关8，常闭端8。
20	E5	20	E5	COM7	模拟开关7，公共端7。
21	F5	21	F5	NC7	模拟开关7，常闭端7。
22	F4	—	—	IND	开关7和开关8的逻辑数控输入端。
23	C4, D3	23	C4, D3	GND	地。
24	F3	—	—	INC	开关5和开关6的逻辑数控输入端。
25	F2	25	F2	NC6	模拟开关6，常闭端6。
26	E2	26	E2	COM6	模拟开关6，公共端6。
27	F1	27	F1	NC5	模拟开关5，常闭端5。
28	E1	28	E1	COM5	模拟开关5，公共端5。
30	D2	30	D2	NO6	模拟开关6，常开端6。
31	D1	31	D1	NO5	模拟开关5，常开端5。
33	C1	33	C1	NO1	模拟开关1，常开端1。
34	C2	34	C2	NO2	模拟开关2，常开端2。
36	B1	36	B1	COM1	模拟开关1，公共端1。
—	—	22	F4	$\overline{EN}$	输出使能端，低电平有效。
—	—	—	—	EP	裸焊盘(TQFN封装)，EP接GND。

宽带、四路DPDT开关

详细说明

四路双刀双掷(DPDT)模拟开关MAX4760/MAX4760A和八路单刀双掷(SPDT)模拟开关MAX4761/MAX4761A采用+1.8V至+5.5V单电源供电，这些开关完全规范于+3V电源供电的应用。

MAX4760/MAX4760A/MAX4761/MAX4761A导通电阻可保证为2.0Ω (典型值)，可用于切换数据和音频信号。低至54pF (典型值)的电容和0.2ns的偏差变化非常适合数据切换应用。MAX4760/MAX4760A有4个逻辑输入端，分别控制两个成对的开关。MAX4761/MAX4761A有1个逻辑输入端和1个可用来禁止开关的使能输入端($\overline{EN}$)。

应用信息

数控输入

无论采用何种电源电压，MAX4760/MAX4760A/MAX4761/MAX4761A可接受高达+5.5V的逻辑输入，例如在+3.3V供电时，IN_可以低至GND，也可以高至+5.5V，保证了系统混合逻辑电平的兼容性。满摆幅驱动控制逻辑输入可将功耗降至最低。

MAX4761/MAX4761A使能端($\overline{EN}$)低电平有效，$\overline{EN}$端为高电平时，COM_为高阻状态。

模拟信号电平

处于供电电压范围(0V至V+)内的模拟输入信号都可通过开关，且导通电阻变化极小(见*典型工作特性*)，由于开关是双向的，所以NO_、NC_、COM_可作为输入，也可作为输出。

电源旁路

电源旁路设计能够改善噪声容限，并防止开关噪声通过V+电源传播到其他器件，对于多数应用来说，在V+和GND之间并联一个0.1µF的电容即可满足要求。

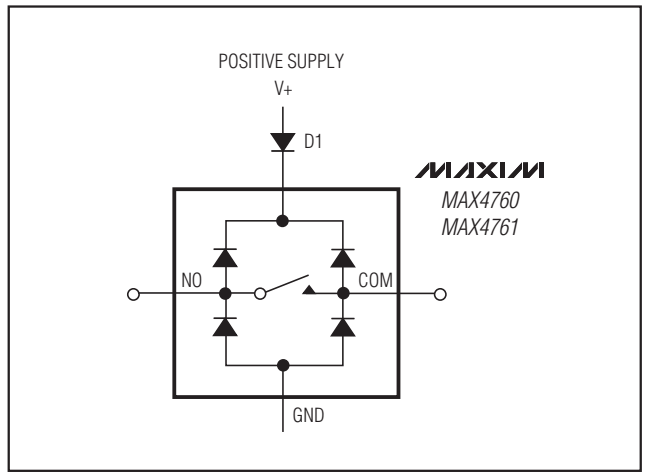


图1. 外接隔离二级管实现过压保护

供电顺序

CMOS器件需要正确的供电顺序，总是在加载模拟信号前先加V+，特别是在输入信号没有限流的情况下。如果供电顺序不能保证，而且输入信号电流无法限制在20mA以内，则需要加一个小信号二极管(见图1)。增加了这个二极管，模拟信号范围要比V+降低一个二极管压降(0.7V)，并略微增大导通电阻。无论何时，最大供电电压都不能超过+6V。

UCSP应用信息

关于UCSP结构、尺寸、载带信息、印刷电路板技术、焊盘布局、推荐的回流焊温度特性，以及可靠性测试结果的最新应用数据，请参考Maxim网站www.maxim-ic.com.cn/ucsp上的应用笔记1891：*晶片级封装(WLP)及其应用*。

测试电路/时序图

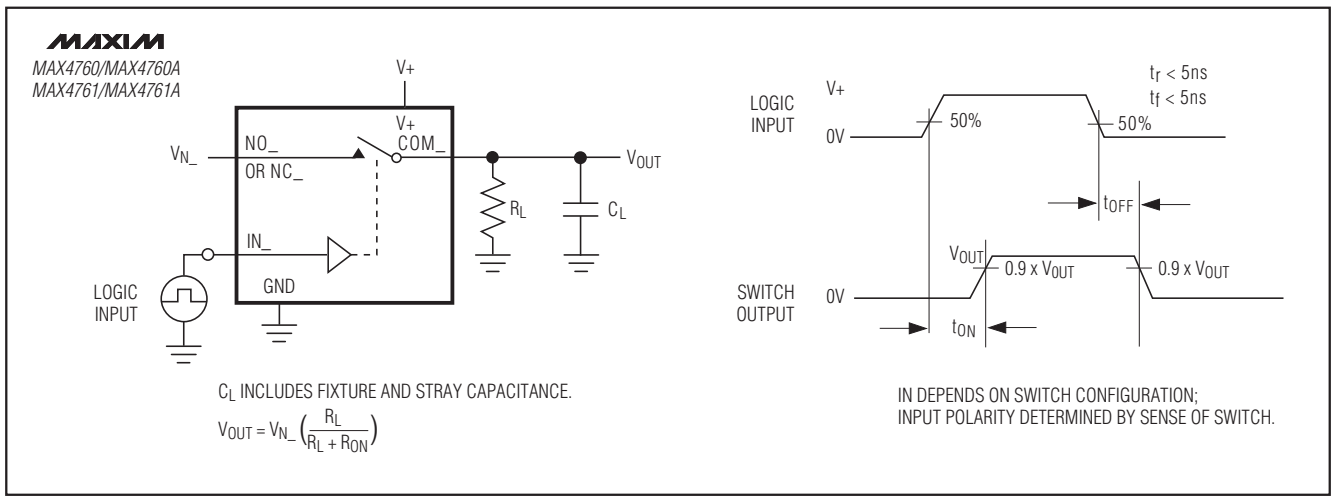


图2. 开关时间

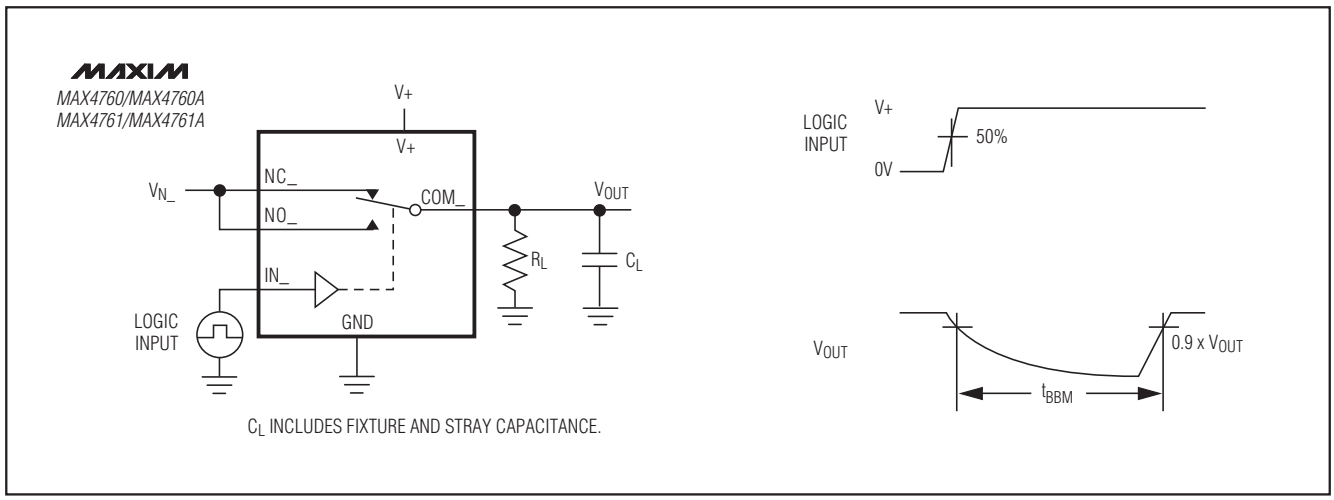
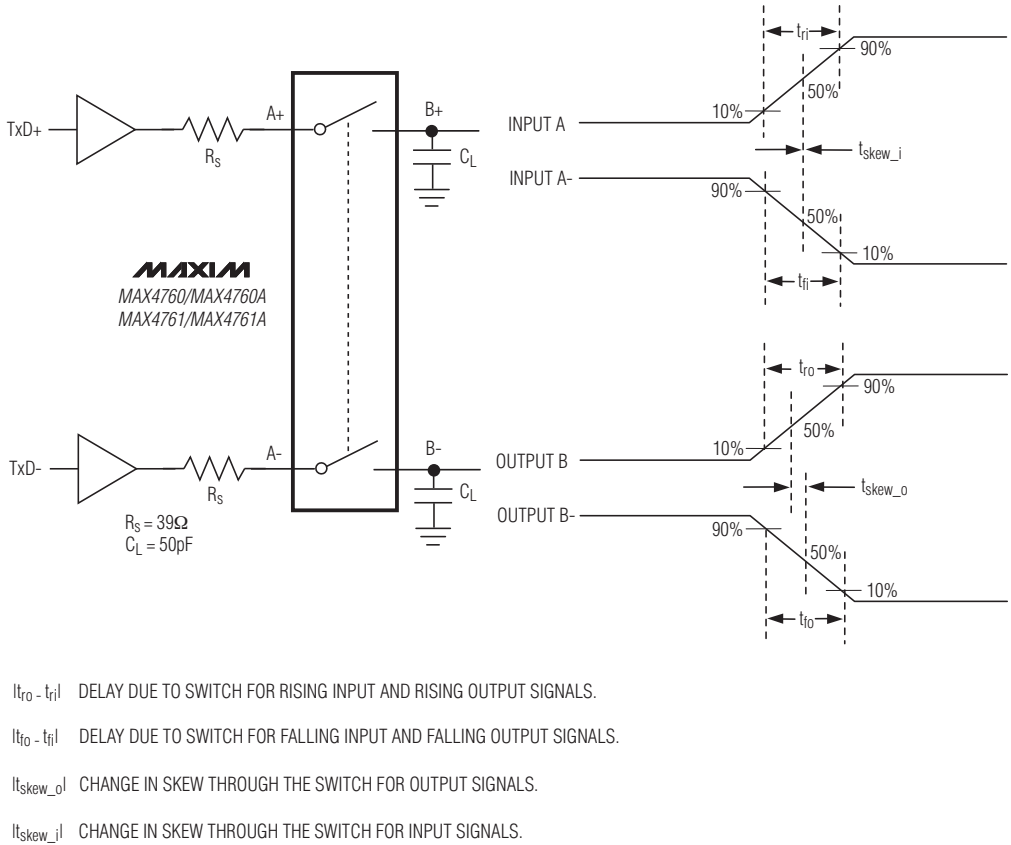


图3. 先断后合的间隔

测试电路/时序图(续)



$|t_{ro} - t_{ri}|$ DELAY DUE TO SWITCH FOR RISING INPUT AND RISING OUTPUT SIGNALS.

$|t_{fo} - t_{fi}|$ DELAY DUE TO SWITCH FOR FALLING INPUT AND FALLING OUTPUT SIGNALS.

$|t_{skew\_o}|$ CHANGE IN SKEW THROUGH THE SWITCH FOR OUTPUT SIGNALS.

$|t_{skew\_i}|$ CHANGE IN SKEW THROUGH THE SWITCH FOR INPUT SIGNALS.

图4. 输入/输出偏差时序图

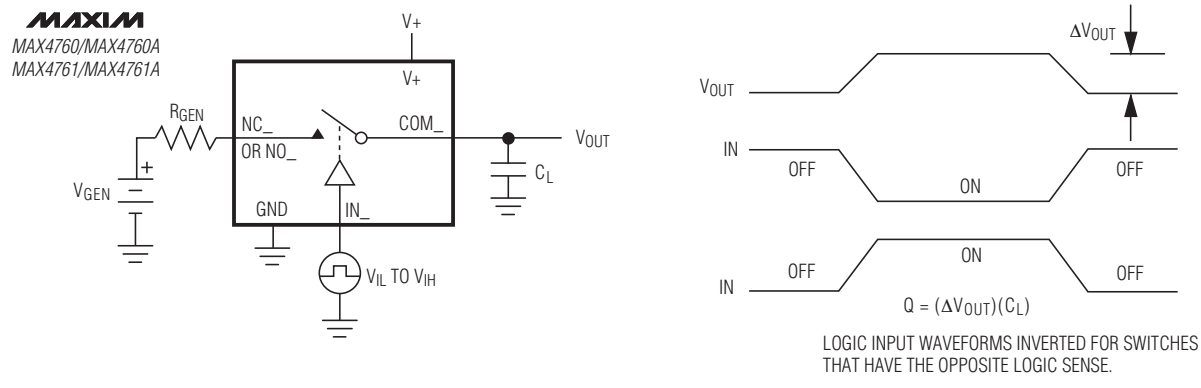


图5. 电荷注入

测试电路/时序图(续)

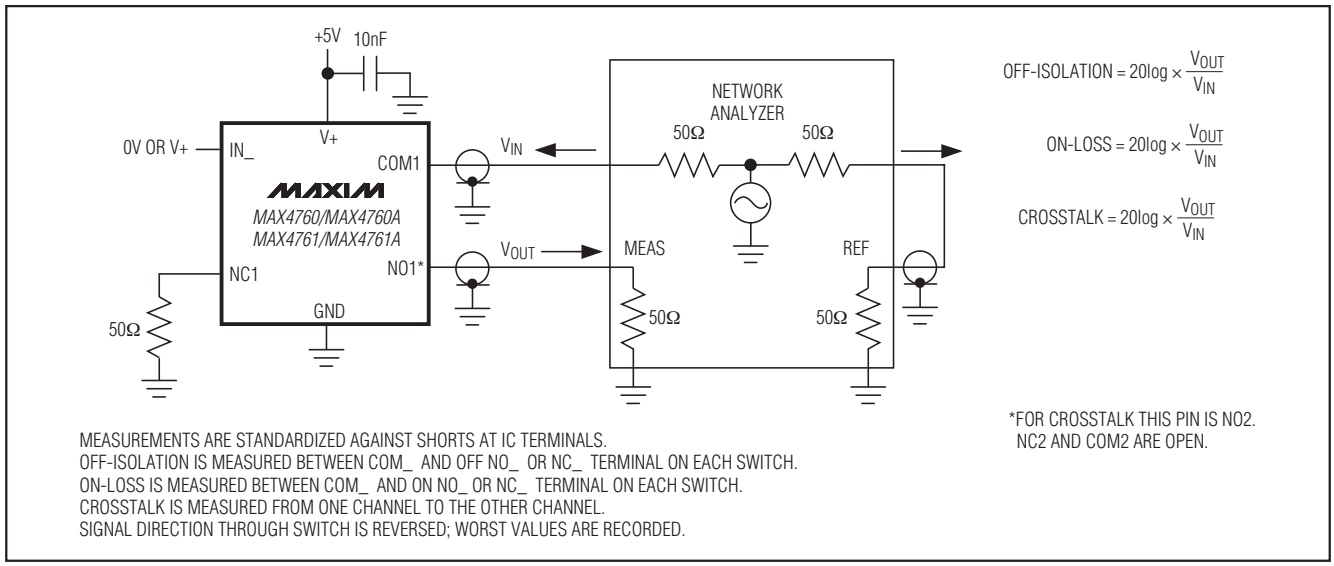


图6. 导通损耗，关断隔离和串扰

典型工作电路

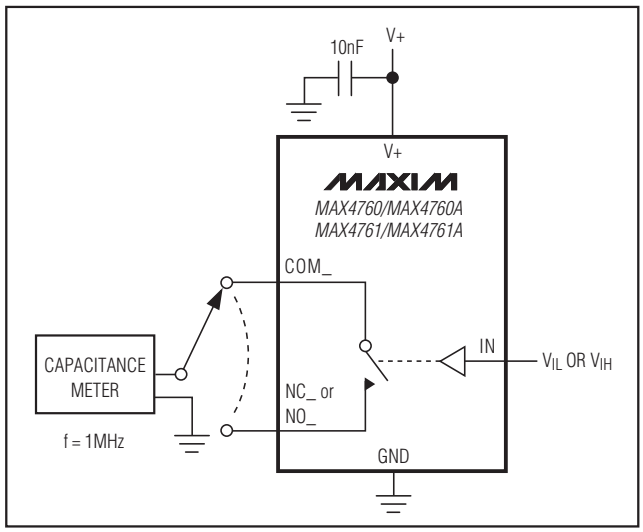
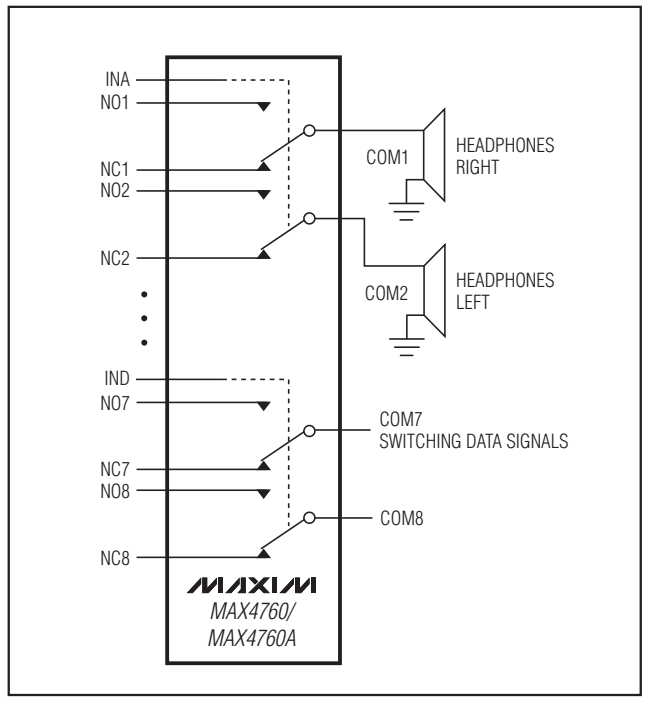


图7. 通道开/关电容



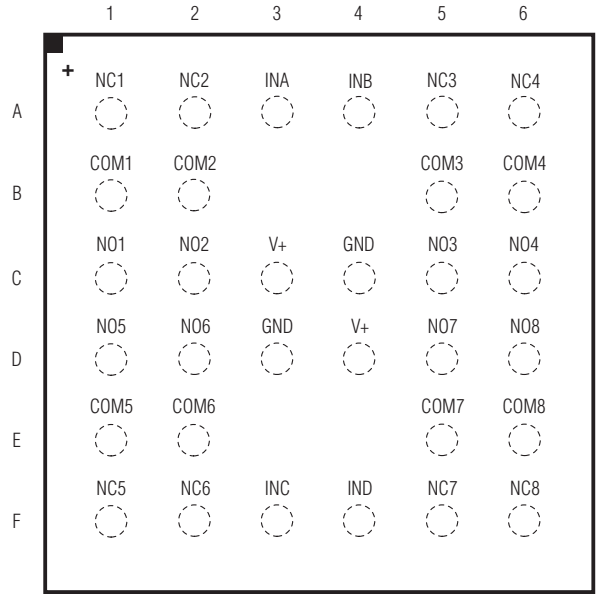
引脚配置/真值表

TOP VIEW

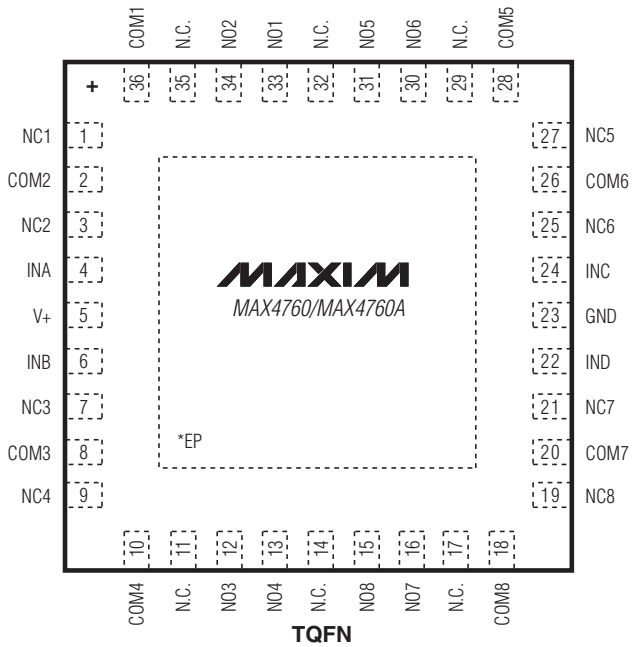
MAXIM

MAX4760/MAX4760A

(BUMP SIDE DOWN)



UCSP



TQFN

*EXPOSED PADDLE CONNECTED TO GND.

MAX4760/MAX4760A

INA	NO1/NO2	NC1/NC2
LOW	OFF	ON
HIGH	ON	OFF
INB	**NO3/NO4**	**NC3/NC4**
LOW	OFF	ON
HIGH	ON	OFF
INC	**NO5/NO6**	**NC5/NC6**
LOW	OFF	ON
HIGH	ON	OFF
IND	**NO7/NO8**	**NC7/NC8**
LOW	OFF	ON
HIGH	ON	OFF

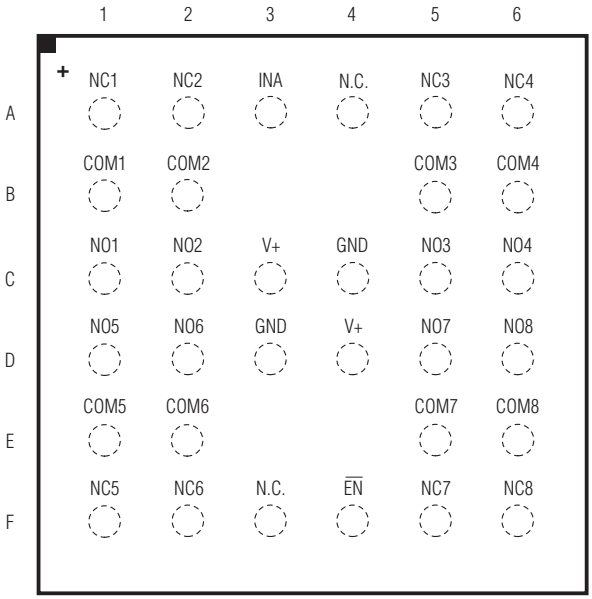
引脚配置/真值表(续)

TOP VIEW

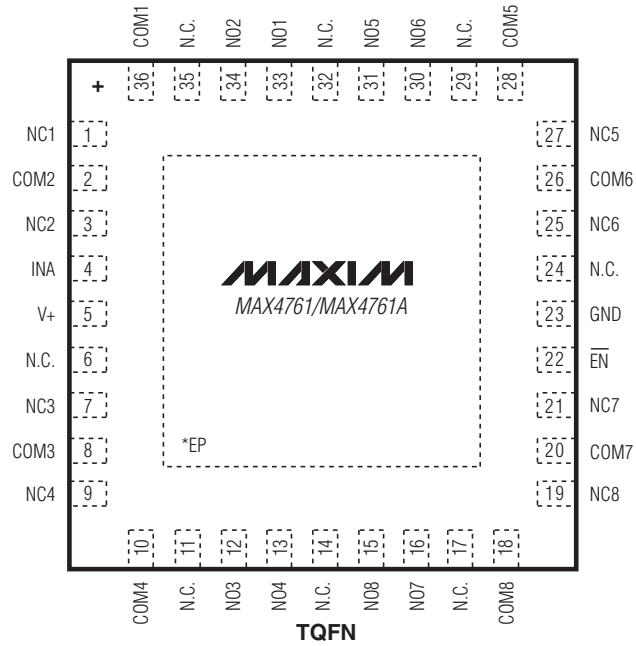
MAXIM

MAX4761/MAX4761A

(BUMP SIDE DOWN)



UCSP



TQFN

*EXPOSED PADDLE CONNECTED TO GND.

MAX4761/MAX4761A

$\overline{EN}$	INA	NO_	NC_
LOW	LOW	OFF	ON
LOW	HIGH	ON	OFF
HIGH	X	OFF	OFF
HIGH	X	OFF	OFF

芯片信息

PROCESS: CMOS

封装信息

如需最近的封装外形信息和焊盘布局，请查询 **www.maxim-ic.com.cn/packages**。

封装类型	封装编码	文档编号
36 UCSP	B36-2	**21-0082**
36 TQFN-EP	T3666-3	**21-0141**

修订历史

修订次数	修订日期	说明	修改页
4	4/07	增加了MAX4760A/MAX4761A。	1–14
5	4/09	对*定购信息*、*Electrical Characteristics*表以及*引脚说明*进行了修订。	1, 3, 7

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