19-0558; Rev 1; 11/07

MAXIM

四路SPDT音频开关

概述

MAX4740/MAX4740H是具有较低导通电阻(典型值0.61Ω)的模拟开关，采用1.6V至5.5V单电源供电。MAX4740/MAX4740H为四路单刀/双掷(SPDT)开关，专为音频信号切换应用设计。MAX4740/MAX4740H和ST Microelectronics的四路SPDT模拟开关STG3699引脚兼容。

MAX4740是四路SPDT开关，MAX4740H则是四路SPDT开关，可置为高阻模式。开关逻辑由两个控制端(CB1和CB2)控制。MAX4740/MAX4740H还具有较高的导通电阻匹配度(0.06Ω)，以及低电源电流(0.3µA)，可增加电池寿命。

MAX4740/MAX4740H采用微型3mm x 3mm、16引脚TQFN-EP封装以及2.5mm x 2.5mm、16引脚超薄QFN封装。

应用

音频信号切换

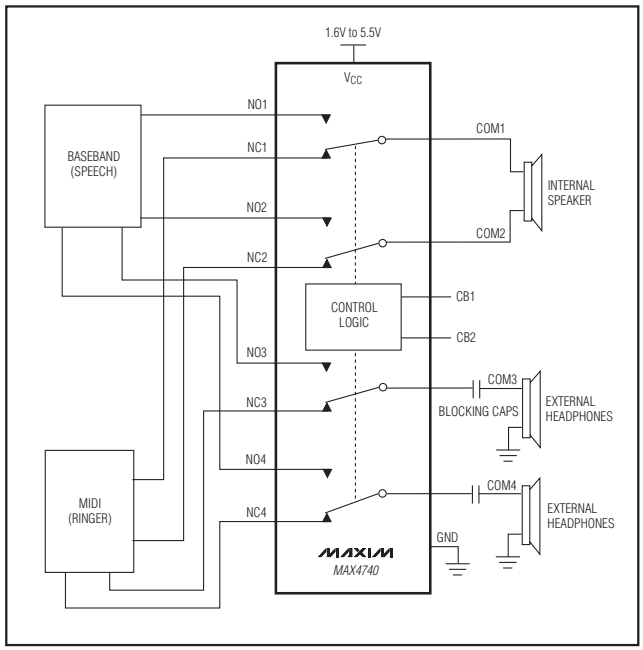
蜂窝电话

PDA及其它手持式设备

MP3播放器

笔记本电脑

典型工作电路



特性

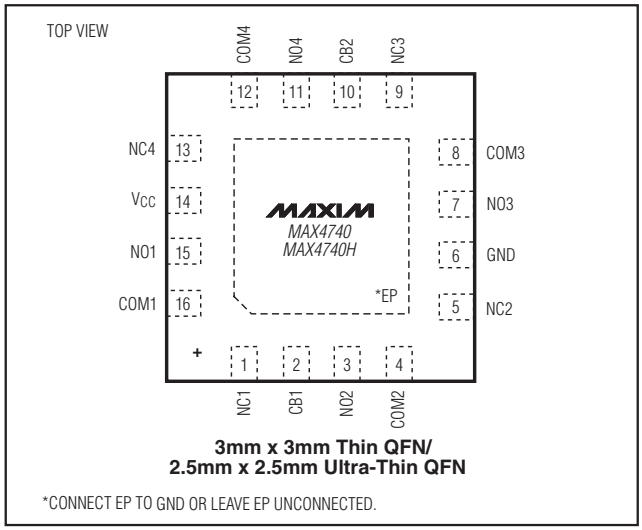
- ♦ 低导通电阻(典型值0.61Ω)
- ♦ 0.06Ω (典型值)的通道间匹配度
- ♦ 0.32Ω (典型值)导通电阻平坦度
- ♦ 1.6V至5.5V单电源电压
- ♦ 高PSRR降低了电源噪声(典型值-60dB)
- ♦ 0.08%总谐波失真
- ♦ -68dB典型串扰(100kHz)
- ♦ -64dB典型关断隔离(100kHz)
- ♦ 低电源电流(典型值0.3µA)
- ♦ 低泄漏电流(典型值0.1µA)
- ♦ 与ST Micro STG3699引脚兼容
- ♦ (3mm x 3mm) 16引脚TQFN和(2.5mm x 2.5mm) 16引脚超薄QFN封装

定购信息

PART	PIN-PACKAGE	TOP MARK	PKG CODE
MAX4740ETE+	16 TQFN-EP (3mm x 3mm)	AEV	T1633-4
MAX4740EVE+	16 Ultra-Thin QFN (2.5mm x 2.5mm)	+AAA	V162A2-1
MAX4740HETE+	16 TQFN-EP (3mm x 3mm)	AEW	T1633-4
MAX4740HEVE+	16 Ultra-Thin QFN (2.5mm x 2.5mm)	+AAB	V162A2-1

注：所有器件工作在-40°C至+85°C温度范围内。
EP = 裸焊盘。

引脚配置



3mm x 3mm Thin QFN/
2.5mm x 2.5mm Ultra-Thin QFN

*CONNECT EP TO GND OR LEAVE EP UNCONNECTED.

四路SPDT音频开关

ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to GND.)
V_{CC}, CB_ .....-0.3V to +6.0V
COM_, NC_, NO_ .....-0.3V to (V_{CC} + 0.3V)
Continuous Current NO_, NC_, COM_ .....±300mA
Peak Current NO_, NC_, COM_
(pulsed at 1ms, 50% duty cycle).....±400mA
Peak Current NO_, NC_, COM_
(pulsed at 1ms, 10% duty cycle).....±500mA

Continuous Power Dissipation (T_A = +70°C)
16-Pin TQFN (3mm x 3mm), Single-Layer Board
(derate 15.6mW/°C above +70°C).....1250mW
16-Pin TQFN (3mm x 3mm), Multilayer Board (derate
20.8mW/°C above +70°C) 1667mW
16-Pin Ultra-Thin QFN (2.5mm x 2.5mm), MultiLayer
Board (derate 11.5mW/°C above +70°C) 923.8mW
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

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} = +2.7V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C, V_{CC} = +3.3V.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
POWER SUPPLY							
Supply Voltage Range	V_{CC}			1.6		5.5	V
Supply Current	I_{CC}	V_{CC} = +5.5V, $V_{CB\_}$ = 0V or V_{CC}			0.3	1	µA
		V_{CC} = +5.5V, $V_{CB\_}$ = 0.5V or +1.6V			0.3	5	
		V_{CC} = +2.5V, $V_{CB\_}$ = 0.5V or +1.4V			0.1		
ANALOG SWITCH							
Analog Signal Range	$V_{NC\_}$, $V_{NO\_}$, $V_{COM\_}$,	(Note 2)		0		V_{CC}	V
On-Resistance	R_{ON}	V_{CC} = 3.3V, $I_{COM\_}$ = 100mA; CB_ = low or high	T_A = +25°C		0.61	0.90	Ω
			T_A = T_{MIN} to T_{MAX}			1	
On-Resistance Match Between Channels	ΔR_{ON}	V_{CC} = 3.3V, $V_{NC\_}$ or $V_{NO\_}$ = 0.875V; $I_{COM\_}$ = 100mA (Note 3)	T_A = +25°C		0.06		Ω
			T_A = T_{MIN} to T_{MAX}			0.1	
On-Resistance Flatness	$R_{FLAT(NO)}$	V_{CC} = 3.3V, $V_{COM\_}$ = 0 to V_{CC}; $I_{COM\_}$ = 100mA (Note 4)	T_A = +25°C		0.32	0.72	Ω
			T_A = T_{MIN} to T_{MAX}			0.87	
NO_, NC_ Off-Leakage Current	$I_{NO\_(OFF)}$, $I_{NC\_(OFF)}$	V_{CC} = 5.5V; $V_{NC\_}$ or $V_{NO\_}$ = 0.3V, 5.5V; $V_{COM\_}$ = 5.5V or 0.3V		-1	0.1	+1	µA
COM_ On-Leakage Current	$I_{COM\_(ON)}$	V_{CC} = 5.5V, $V_{NC\_}$ or $V_{NO\_}$ = 0.3V, 5.5V, or unconnected; $V_{COM\_}$ = 0.3V, 5.5V, or unconnected		-1	0.1	+1	µA

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +2.7V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C, V_{CC} = 3.3V.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
DYNAMIC CHARACTERISTICS							
Turn-On Time	t_{ON}	R_L = 32Ω, C_L = 35pF, Figure 2	For NO_, $V_{NO\_}$ = 1V		70		ns
			For NC_, $V_{NC\_}$ = 1V		210		
Turn-Off Time	t_{OFF}	R_L = 32Ω, C_L = 35pF, Figure 2	For NO_, $V_{NO\_}$ = 1V		210		ns
			For NC_, $V_{NC\_}$ = 1V		55		
Charge Injection	Q	$V_{GEN\_}$ = 0V; R_{GEN} = 0Ω; C_L = 1nF; Figure 3			200		pC
Off-Isolation	V_{ISO}	C_L = 5pF; R_L = 32Ω; f = 100kHz; $V_{COM\_}$ = $1V_{RMS}$; Figure 4 (Note 5)			-64		dB
Crosstalk	V_{CT}	C_L = 5pF; R_L = 32Ω; f = 100kHz; $V_{COM\_}$ = $1V_{RMS}$; Figure 4			-68		dB
Power-Supply Rejection Ratio	PSRR	f = 20kHz, $V_{COM\_}$ = $1V_{RMS}$, R_L = 50Ω, C_L = 5pF			-60		dB
Total Harmonic Distortion	THD	f = 20Hz to 20kHz, V_{P-P} = 0.5V, R_L = 32Ω			0.08		%
NO_, NC_ Off-Capacitance	$C_{NC\_(OFF)}$, $C_{NO\_(OFF)}$	f = 1MHz, Figure 5			40		pF
COM_ On-Capacitance	$C_{COM\_(ON)}$	f = 1MHz, Figure 5			150		pF
DIGITAL INPUTS (CB_)							
Input Logic-High	V_{IH}	V_{CC} = 1.6V to 2.7V		1.4			V
		V_{CC} = 2.7V to 5.5V		1.6			
Input Logic-Low	V_{IL}					0.5	V
Input Leakage Current	I_{IN}			-1	0.1	+1	µA

Note 1: For TQFN (3mm x 3mm) electrical specifications are production tested at T_A = +85°C and guaranteed by design at T_A = +25°C and -40°C. For Ultra-Thin QFN (2.5mm x 2.5mm) electrical specifications are production tested at T_A = +25°C and guaranteed by design at T_A = +85°C and -40°C.

Note 2: Signals on COM_, NO_, or NC_ exceeding V_{CC} are clamped by internal diodes. Limit forward-diode current to maximum current rating.

Note 3: $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$.

Note 4: Flatness is defined as the difference between the maximum and minimum value of on-resistance as measured over the specified analog signal ranges.

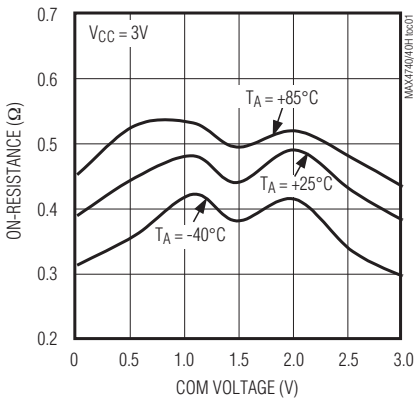
Note 5: Off-isolation = 20log10 [$V_{COM\_}$/ $V_{NO\_}$], $V_{COM\_}$ = output, $V_{NO\_}$ = input to off switch.

四路SPDT音频开关

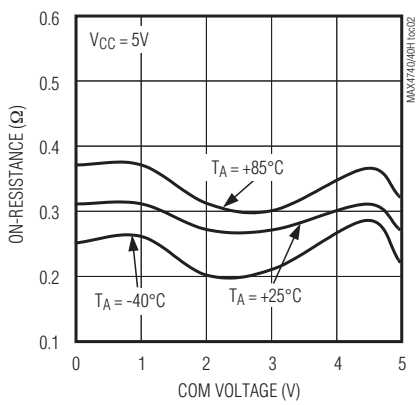
典型工作特性

(V_{CC} = 3.3V, T_A = +25°C, unless otherwise noted)

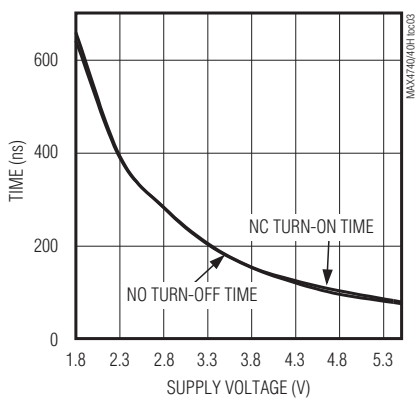
ON-RESISTANCE vs. COM VOLTAGE



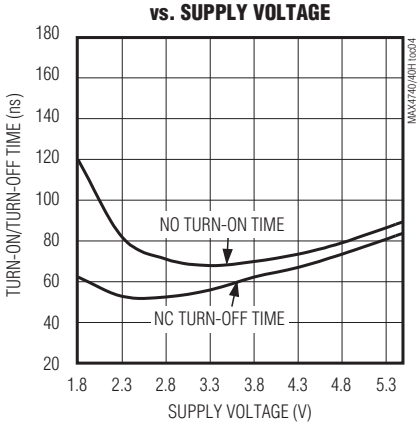
ON-RESISTANCE vs. COM VOLTAGE



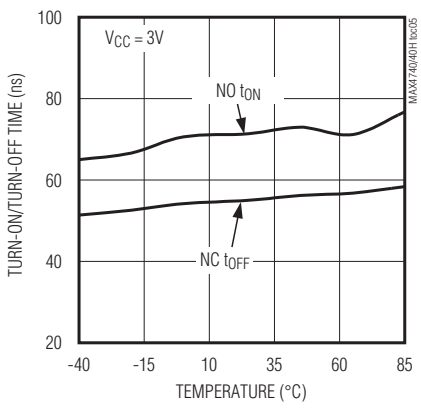
NC TURN-ON/NO TURN-OFF TIME vs. SUPPLY VOLTAGE



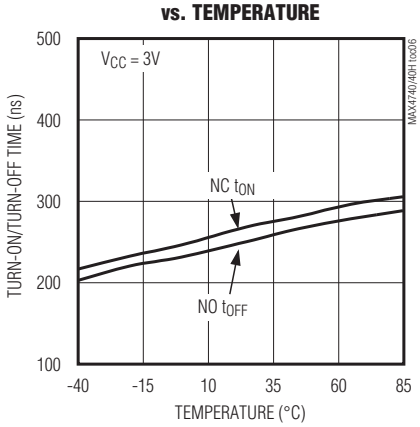
NO TURN-ON/NC TURN-OFF TIME vs. SUPPLY VOLTAGE



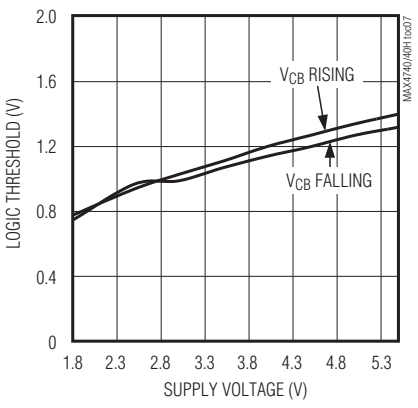
NO TURN-ON/NC TURN-OFF TIME vs. TEMPERATURE



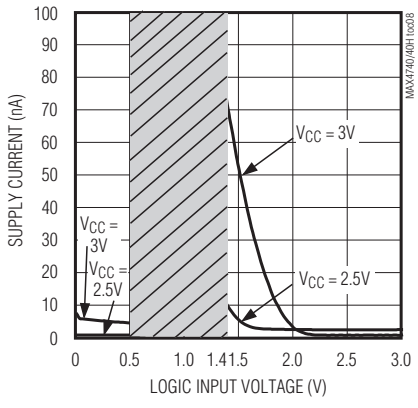
NC TURN-ON/NO TURN-OFF TIME vs. TEMPERATURE



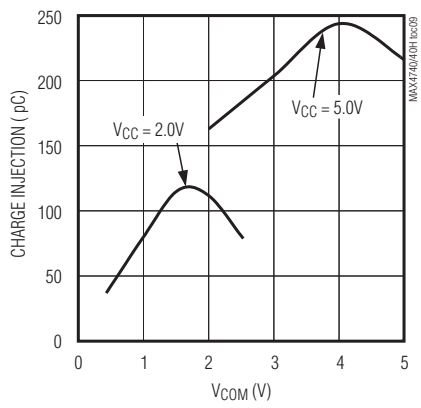
LOGIC THRESHOLD vs. SUPPLY VOLTAGE



SUPPLY CURRENT vs. LOGIC INPUT VOLTAGE



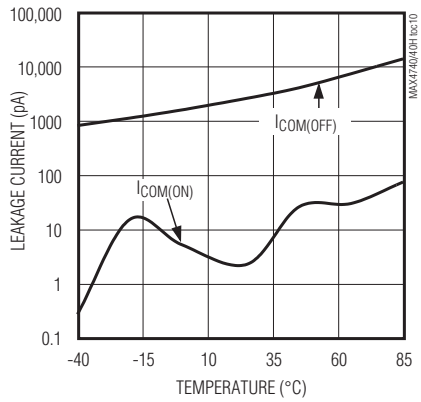
CHARGE INJECTION vs. COM VOLTAGE



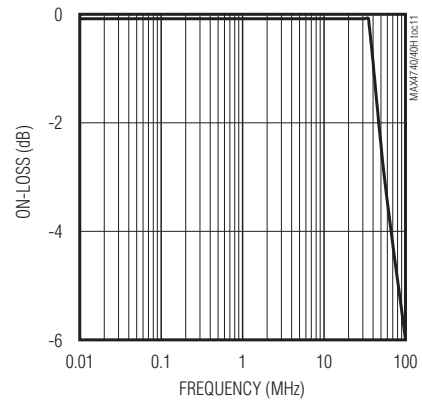
典型工作特性(续)

(V_{CC} = 3.3V, T_A = +25°C, unless otherwise noted)

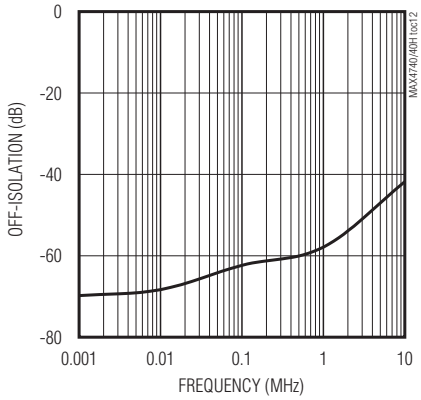
LEAKAGE CURRENT vs. TEMPERATURE



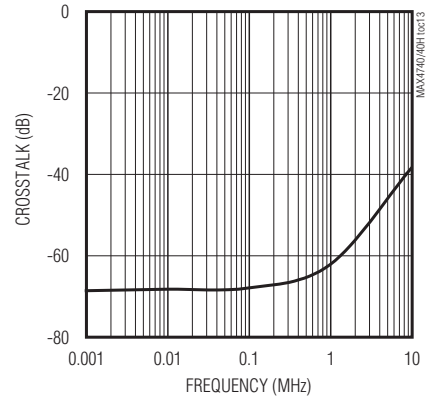
FREQUENCY RESPONSE



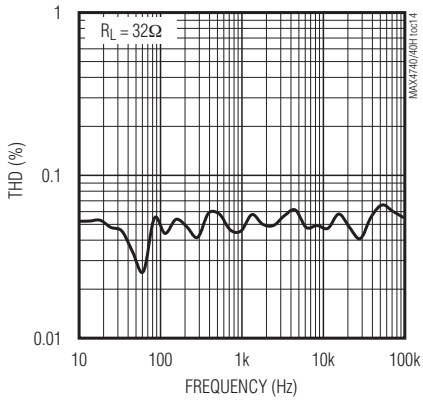
OFF-ISOLATION vs. FREQUENCY



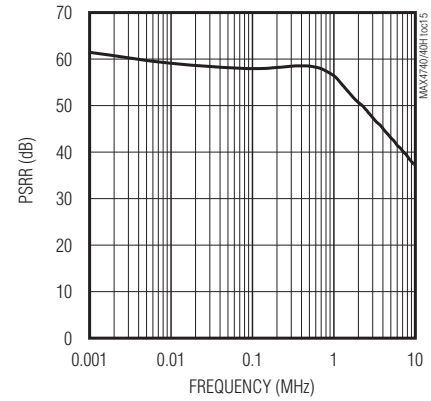
CROSSTALK vs. FREQUENCY



TOTAL HARMONIC DISTORTION vs. FREQUENCY



POWER-SUPPLY REJECTION RATIO vs. FREQUENCY



四路SPDT音频开关

引脚说明

引脚	名称	功能
1	NC1	模拟开关1—常闭端。
2	CB1	模拟开关1和模拟开关2的数字控制输入。
3	NO2	模拟开关2—常开端。
4	COM2	模拟开关2—公共端。
5	NC2	模拟开关2—常闭端。
6	GND	地。
7	NO3	模拟开关3—常开端。
8	COM3	模拟开关3—公共端。
9	NC3	模拟开关3—常闭端。
10	CB2	模拟开关3和模拟开关4的数字控制输入。
11	NO4	模拟开关4—常开端。
12	COM4	模拟开关4—公共端。
13	NC4	模拟开关4—常闭端。
14	V_{CC}	正电源电压。
15	NO1	模拟开关1—常开端。
16	COM1	模拟开关1—公共端。
EP	EP	裸焊盘，正常工作时，连接至GND或悬空。

详细说明

MAX4740/MAX4740H四路SPDT音频开关是具有低导通电阻、低电源电流、高电源电压抑制比(PSRR)的器件，工作在+1.6V至+5.5V单电源。MAX4740/MAX4740H具有两路数字控制输入CB1和CB2，每一路控制一对开关(见表1和表2)。

应用信息

MAX4740/MAX4740H逻辑输入接受高达+5.5V的电压，与电源电压无关。例如， +3.3V供电时，CB1和CB2可低至GND，或高达+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CB1和CB2可使功耗降至最低。对于3.3V电源电压，逻辑门限值为+0.5V (低)和+1.6V (高)。

模拟信号电平

当模拟输入信号在整个电源电压范围内(V_{CC}至GND)变化时，开关的导通电阻变化极小(见*典型工作特性*)。这些开关是双向的，因此NO_、NC_和COM_既可作为输入也可作为输出。

表1. MAX4740真值表

CONTROL		SWITCH STATE	
CB2	CB1	Switch 3/4	Switch 1/2
0	0	COM = NC	COM = NC
0	1	COM = NC	COM = NO
1	0	COM = NO	COM = NC
1	1	COM = NO	COM = NO

表2. MAX4740H真值表

CONTROL		SWITCH STATE	
CB2	CB1	Switch 3/4	Switch 1/2
0	0	COM = NC	COM = NC
0	1	High-Z	High-Z
1	0	COM = NO	COM = NC
1	1	COM = NO	COM = NO

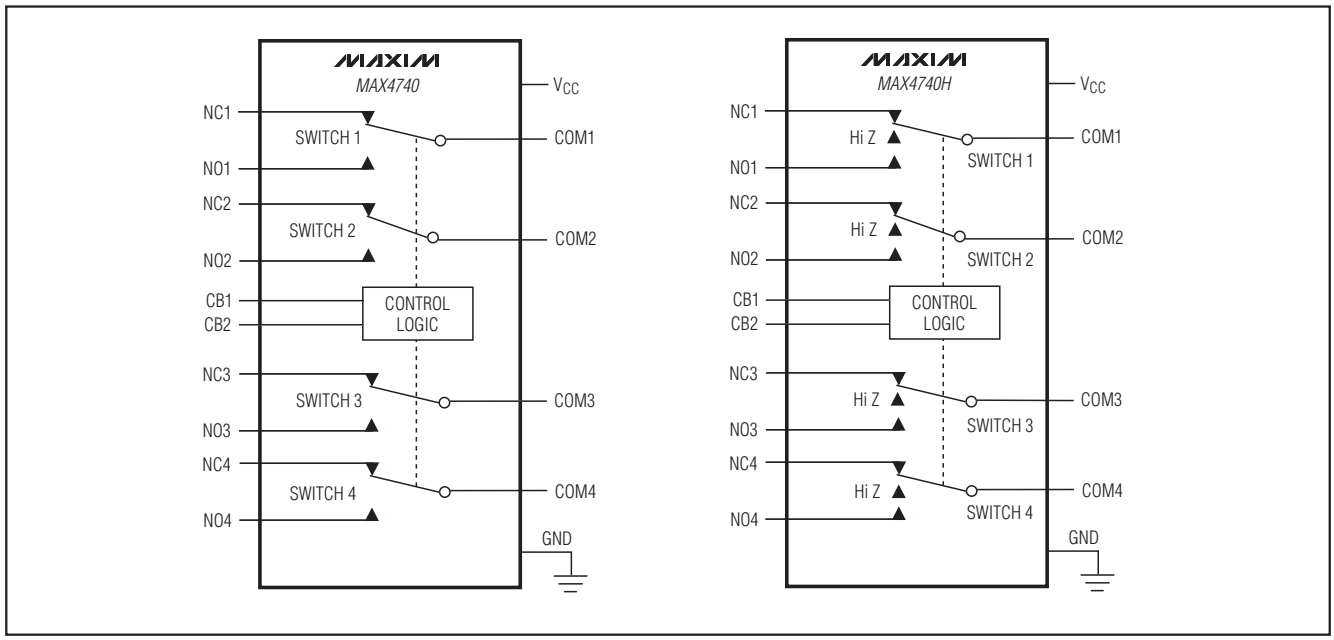


图1. 功能框图

测试电路/时序图

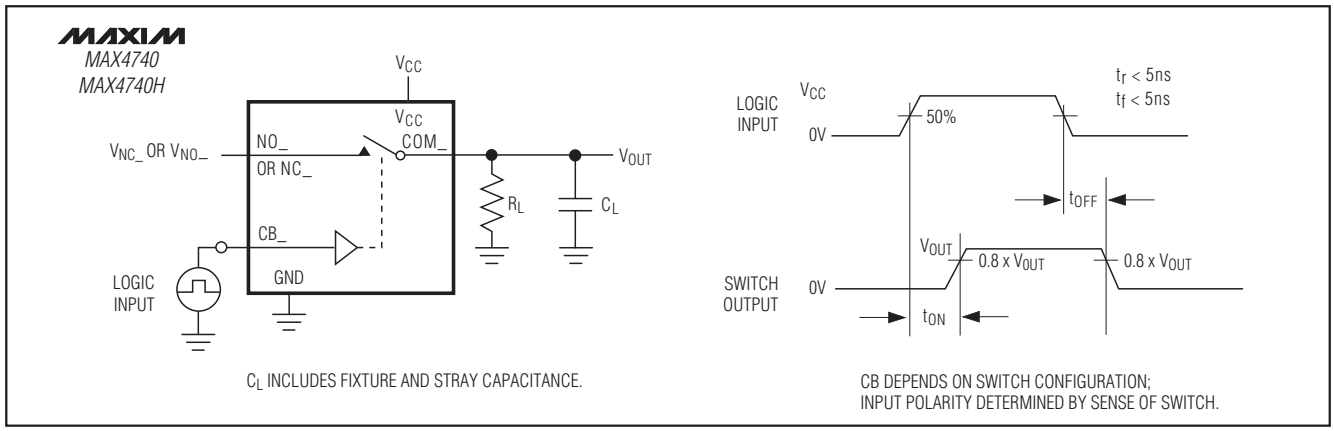


图2. 开关时间

供电顺序和过压保护

警告：不要超过Absolute Maximum Ratings中的额定值，因为超过规定的额定值可能造成器件永久损坏。

所有CMOS器件都推荐使用正确的供电顺序。不恰当的上电顺序会使开关进入闭锁状态，导致芯片吸取过大的电源电流。跳出闭锁的唯一办法就是重新上电并以正确的顺序加载信号。首先连接所有接地引脚，然后加载电源V_{CC}，最后加载信号至NO_、NC_和COM_。断电时采用相反的顺序。

芯片信息

PROCESS: BICMOS

四路SPDT音频开关

测试电路/时序图(续)

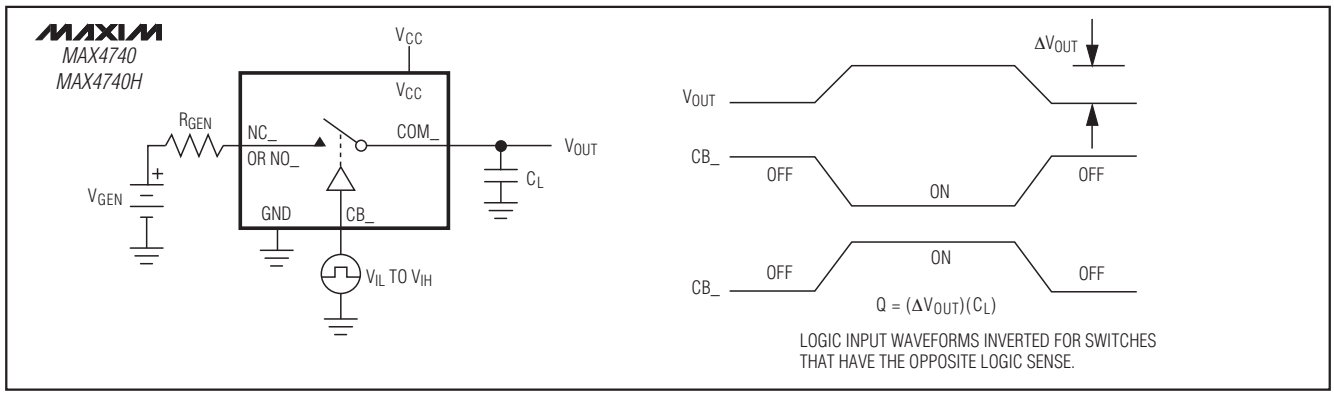


图3. 电荷注入

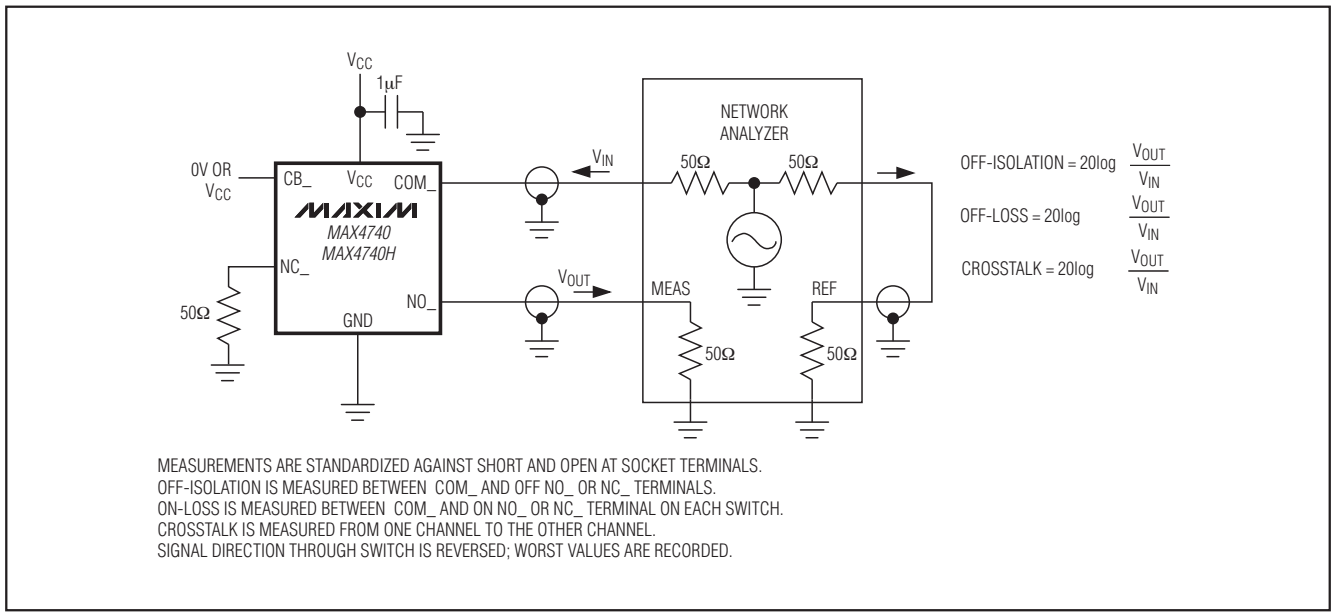


图4. 关断隔离、导通损耗和串扰

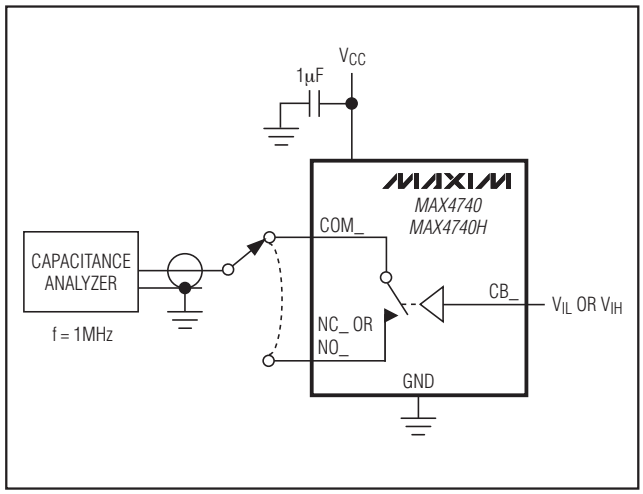


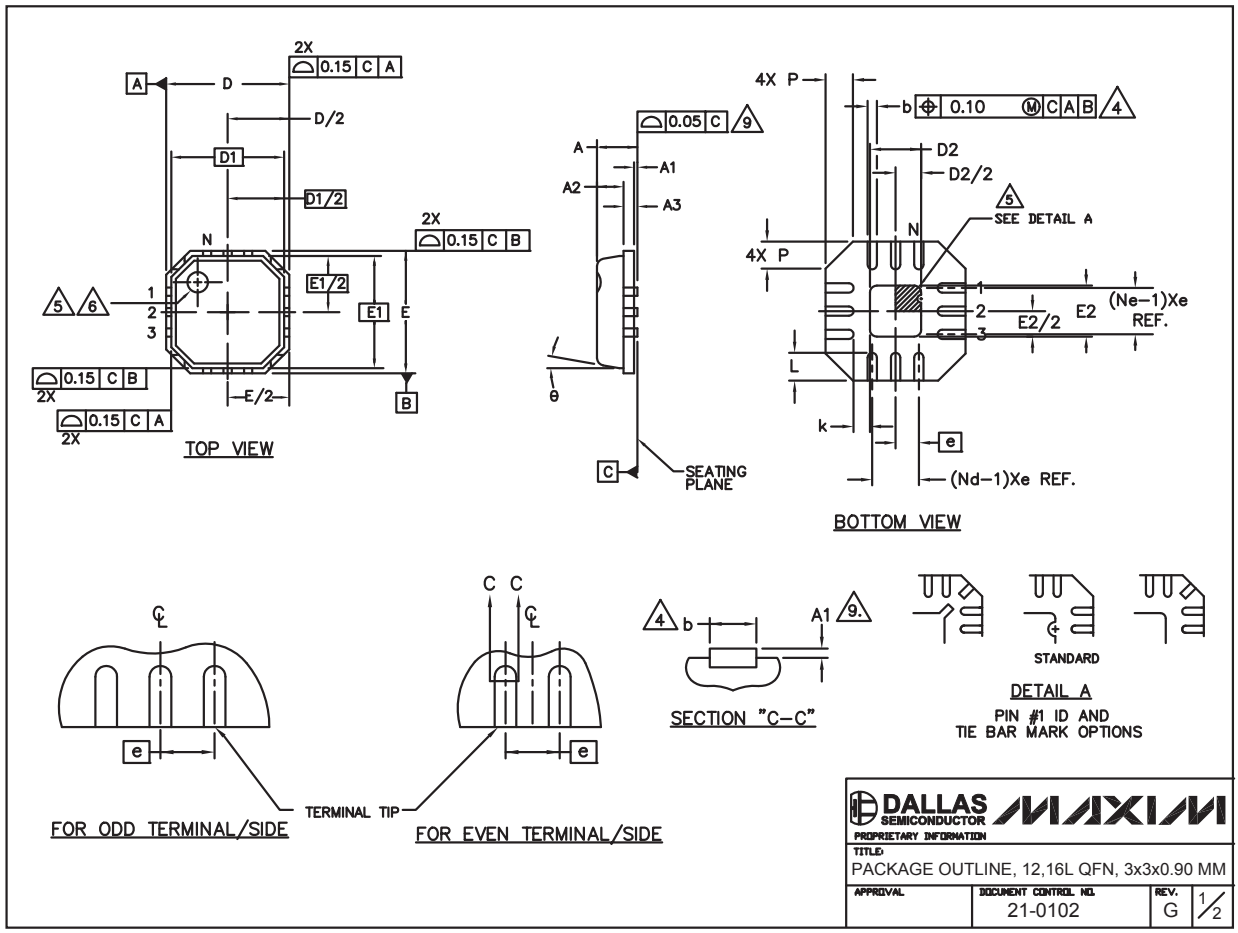
图5. 通道通/断状态下的电容

四路SPDT音频开关

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**。)

12, 16L QFN.EPS



封装信息(续)

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

COMMON DIMENSIONS						
PKG	12L 3x3			16L 3x3		
SYMBOL	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.80	0.90	1.00	0.80	0.90	1.00
A1	0.00	0.01	0.05	0.00	0.01	0.05
A2	0.00	0.65	1.00	0.00	0.65	1.00
A3	0.20 REF			0.20 REF		
b	0.18	0.23	0.30	0.18	0.23	0.30
D	2.90	3.00	3.10	2.90	3.00	3.10
D1	2.75 BSC			2.75 BSC		
E	2.90	3.00	3.10	2.90	3.00	3.10
E1	2.75 BSC			2.75 BSC		
e	0.50 BSC			0.50 BSC		
k	0.25	–	–	0.25	–	–
L	0.35	0.55	0.75	0.30	0.40	0.50
N	12			16		
ND	3			4		
NE	3			4		
P	0.00	0.42	0.60	0.00	0.42	0.60
θ	0°		12°	0°		12°

EXPOSED PAD VARIATIONS						
PKG. CODES	D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
G1233-1	0.95	1.10	1.25	0.95	1.10	1.25
G1633-2	0.95	1.10	1.25	0.95	1.10	1.25

NOTES:

1. DIE THICKNESS ALLOWABLE IS 0.305mm MAXIMUM (.012 INCHES MAXIMUM).
2. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. – 1994.
3. N IS THE NUMBER OF TERMINALS.
   Nd IS THE NUMBER OF TERMINALS IN X–DIRECTION &
   Ne IS THE NUMBER OF TERMINALS IN Y–DIRECTION.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
5. THE PIN #1 IDENTIFIER MUST EXIST ON THE TOP SURFACE OF THE PACKAGE BY USING INDENTATION MARK OR INK/LASER MARKED. DETAILS OF PIN #1 IDENTIFIER IS OPTIONAL, BUT MUST BE LOCATED WITHIN ZONE INDICATED.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. PACKAGE WARPAGE MAX 0.05mm.
9. APPLIED FOR EXPOSED PAD AND TERMINALS. EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
10. MEETS JEDEC MO220.
11. THIS PACKAGE OUTLINE APPLIES TO ANVIL SINGULATION (STEPPED SIDES).

DALLAS SEMICONDUCTOR MAXIM

PROPRIETARY INFORMATION

TITLE: PACKAGE OUTLINE, 12,16L QFN, 3x3x0.90 MM

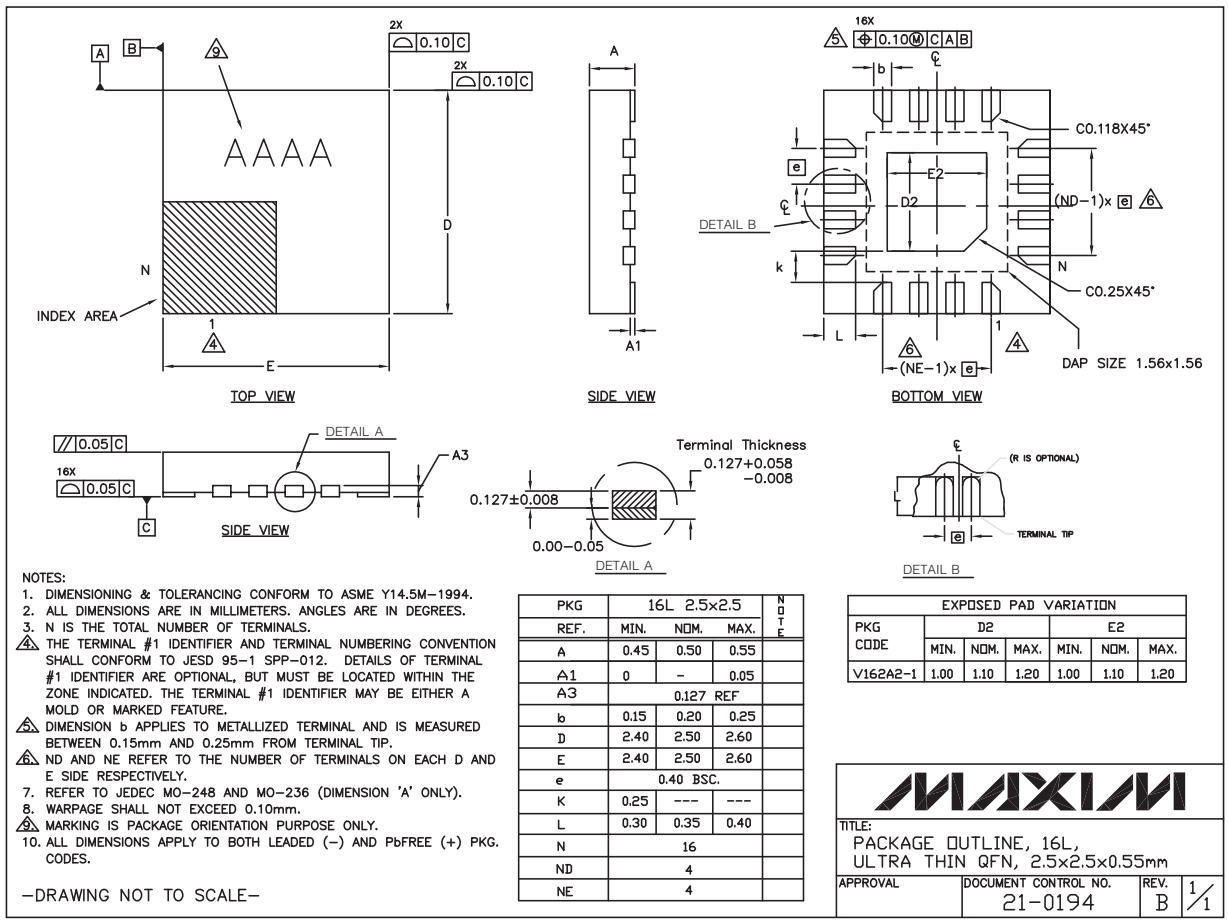
APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0102	G	1/2

四路SPDT音频开关

封装信息(续)

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

ULTRA THIN QFN.EPS



NOTES:
1. DIMENSIONING & TOLERANCING CONFORM TO ASME Y14.5M−1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3. N IS THE TOTAL NUMBER OF TERMINALS.
4. 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.
5. DIMENSION b APPLIES TO METALLIZED TERMINAL AND IS MEASURED BETWEEN 0.15mm AND 0.25mm FROM TERMINAL TIP.
6. ND AND NE REFER TO THE NUMBER OF TERMINALS ON EACH D AND E SIDE RESPECTIVELY.
7. REFER TO JEDEC MO−248 AND MO−236 (DIMENSION 'A' ONLY).
8. WARPAGE SHALL NOT EXCEED 0.10mm.
9. MARKING IS PACKAGE ORIENTATION PURPOSE ONLY.
10. ALL DIMENSIONS APPLY TO BOTH LEADED (−) AND PbFREE (+) PKG. CODES.

−DRAWING NOT TO SCALE−

PKG	16L 2.5x2.5			NOTE
REF.	MIN.	NOM.	MAX.	
A	0.45	0.50	0.55	
A1	0	−	0.05	
A3	0.127 REF			
b	0.15	0.20	0.25	
D	2.40	2.50	2.60	
E	2.40	2.50	2.60	
e	0.40 BSC.			
K	0.25	---	---	
L	0.30	0.35	0.40	
N	16			
ND	4			
NE	4			

EXPOSED PAD VARIATION						
PKG CODE	D2			E2		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
V162A2-1	1.00	1.10	1.20	1.00	1.10	1.20

MAXIM

TITLE: PACKAGE OUTLINE, 16L, ULTRA THIN QFN, 2.5x2.5x0.55mm

APPROVAL	DOCUMENT CONTROL NO.	REV.	
	21-0194	B	1/1

修订历史

修订次数	修订日期	说明	修改页
0	5/06	最初版本。	—
1	11/07	增加了超薄QFN封装。	1, 2, 3, 10–13

Maxim北京办事处

北京 8328信箱 邮政编码 100083

免费电话：800 810 0310

电话：010-6211 5199

传真：010-6211 5299