19-4206; Rev 0; 8/08

可提供评估板

USB 2.0高速4选2交叉点开关

MAX4989

概述

MAX4989为双向、4选2、USB 2.0交叉点开关。MAX4989具有低导通电容和低导通电阻，可支持USB 2.0低速/全速/高速信号，支持高达480Mbps的数据速率。该器件允许4个USB对中的任何2个接在一起，并可通过简单的3路输入控制逻辑接口进行配置。

MAX4989工作于+2.7V至+5.5V单电源，并具有内部电荷泵，提供满摆幅信号。该器件还具有高阻关断模式，使电源电流降低至100nA (典型值)。

MAX4989采用14引脚、3mm x 3mm、TDFN封装，工作于-40°C至+85°C扩展级温度范围。

特性

- ♦ +2.7V至+5.5V单电源供电
- ♦ 1µA (典型值)低电源电流
- ♦ -3dB带宽：1GHz (典型值)
- ♦ 5Ω (典型值)低R_{ON}
- ♦ 高阻关断模式
- ♦ 逻辑输入控制信号切换
- ♦ +1.8V CMOS逻辑兼容
- ♦ 超小型14引脚、3mm x 3mm、TDFN封装

应用

笔记本电脑

蜂窝电话

定购信息

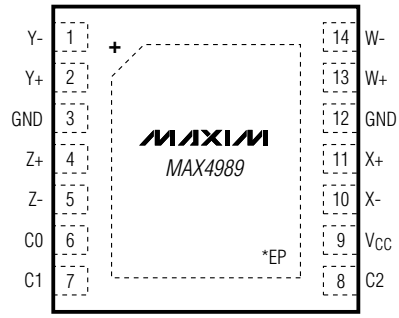
PART	TEMP RANGE	PIN-PACKAGE	PKG CODE
MAX4989ETD+	-40°C to +85°C	14 TDFN-EP* (3mm x 3mm)	T1433-2

+表示无铅/符合RoHS标准的封装。

**EP = 裸焊盘。*

引脚配置

TOP VIEW



3mm x 3mm TDFN

*EP = EXPOSED PAD. CONNECT EP TO GROUND.

ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to GND.)
V_{CC} ..... -0.3V to +6.0V
C_ ..... -0.3V to +6.0V
W_, X_, Y_, Z_ ..... -0.3V to (V_{CC} + 0.3V)
Continuous Current C_ ..... ±30mA
Continuous Current W_, X_, Y_, Z_..... ±120mA
Peak Current W_, X_, Y_, Z_
(pulsed at 1ms, 10% duty cycle) ..... ±240mA
Continuous Power Dissipation (T_A = +70°C)
14-Pin TDFN (derate 24.4mW/°C above +70°C) 1951mW
Junction-to-Case Thermal Resistance (Θ_{JC}) (Note 1)
14-Pin TDFN ..... 8°C/W
Junction-to-Ambient Thermal Resistance (Θ_{JA}) (Note 1)
14-Pin TDFN ..... 41°C/W
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: Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a 4-layer board. For detailed information on package thermal considerations, refer to **www.maxim-ic.com.cn/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

(V_{CC} = +2.7V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V, T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Power-Supply Range	V_{CC}			2.7		5.5	V
Supply Current	I_{CC}	Switch enabled	V_{CC} = +3.3V		1	3.5	µA
			V_{CC} = +5.5V		3	6.5	
Shutdown Supply Current	I_{SHDN}	C1 = C2 = C3 = GND or V_{CC}			0.1	0.5	µA
Analog Signal Range	$V_{W\_}$, $V_{X\_}$, $V_{Y\_}$,$V_{Z\_}$			0		V_{CC}	V
On-Resistance	R_{ON}	V_{IN} = +3.0V, I_{OUT} = 10mA (Note 3)			5	9	Ω
On-Resistance Match Between Channels	ΔR_{ON}	V_{CC} = +3.3V, V_{IN} = +1.5V, I_{OUT} = 10mA (Note 3)			0.5		Ω
On-Resistance Flatness	R_{FLAT}	V_{CC} = +3.3V, V_{IN} = 0V to V_{CC}, I_{OUT} = 10mA (Notes 3, 4, 5)			0.4		Ω
Off-Leakage Current	$I_{IN(OFF)}$	V_{CC} = +5.5V, V_{IN} = 0V or V_{CC}, V_{OUT} = V_{CC} or 0V or unconnected (Note 3)		-1		+1	µA
On-Leakage Current	$I_{IN(ON)}$	V_{CC} = +5.5V, V_{IN} = 0V or V_{CC}, V_{OUT} = unconnected (Note 3)		-1		+1	µA
AC PERFORMANCE (Note 4)							
On-Channel -3dB Bandwidth	BW	R_L = R_S = 50Ω, V_{IN} = 0dBm, Figure 1			1		GHz
Insertion Loss	S_{12}	R_L = R_S = 50Ω, f = 10MHz			0.5		dB
Off-Isolation (Note 3) Figure 1	V_{ISO}	f = 10MHz, V_{IN} = 0dBm, R_L = R_S = 50Ω			-43		dB
		f = 250MHz, V_{IN} = 0dBm, R_L = R_S = 50Ω			-15		
Crosstalk	V_{CT}	f = 50MHz, V_{IN} = 0dBm, R_L = R_S = 50Ω, between adjacent pairs (Note 3), Figure 1			-50		dB

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = +2.7V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at V_{CC} = +3.3V, T_A = +25°C.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
DYNAMIC (Note 4)						
Turn-On Time	t_{ON}	V_{IN} = +1.5V, R_L = 300Ω, C_L = 35pF, $V_{C\_}$ = 0V to V_{CC}, Figure 2		15	100	µs
Turn-Off Time	t_{OFF}	V_{IN} = +1.5V, R_L = 300Ω, C_L = 35pF, $V_{C\_}$ = 0V to V_{CC}, Figure 2		2	6	µs
Propagation Delay	t_{PLH}, t_{PHL}	R_L = R_S = 50Ω, Figure 3		120		ps
Output Skew Between Switches	$t_{SK(O)}$	R_L = R_S = 50Ω, Figure 3		50		ps
Output Skew Same Switch	$t_{SK(P)}$	R_L = R_S = 50Ω, Figure 3		50		ps
Off-Capacitance	C_{OFF}	f = 1MHz, V_{BIAS} = 0V, V_{IN} = 0.5V_{P-P}		13.5		pF
		f at -3dB = 240MHz, V_{BIAS} = 0V, V_{IN} = 0.5V_{P-P}		4		
On-Capacitance	C_{ON}	f = 1MHz, V_{BIAS} = 0V, V_{IN} = 0.5V_{P-P}		6		pF
		f at -3dB = 240MHz, V_{BIAS} = 0V, V_{IN} = 0.5V_{P-P}				
LOGIC INPUTS						
Input Logic High	V_{IH}		1.7			V
Input Logic Low	V_{IL}				0.5	V
Input Logic Hysteresis	V_{HYST}			75		mV
Input Leakage Current	I_{IN}	V_{CC} = +5.5V, $V_{C\_}$= GND or V_{CC}	-1		+1	µA

Note 2: All devices are 100% production tested at T_A = +25°C. All temperature limits are guaranteed by design.
Note 3: IN and OUT refer to input and output terminals (W_, X_, Y_, Z_) of any switch configuration.
Note 4: Not production tested. Guaranteed by design.
Note 5: Flatness is defined as the difference between the maximum and minimum value of on-resistance, as measured over specified analog signal ranges.

USB 2.0高速4选2交叉点开关

测试电路/时序图

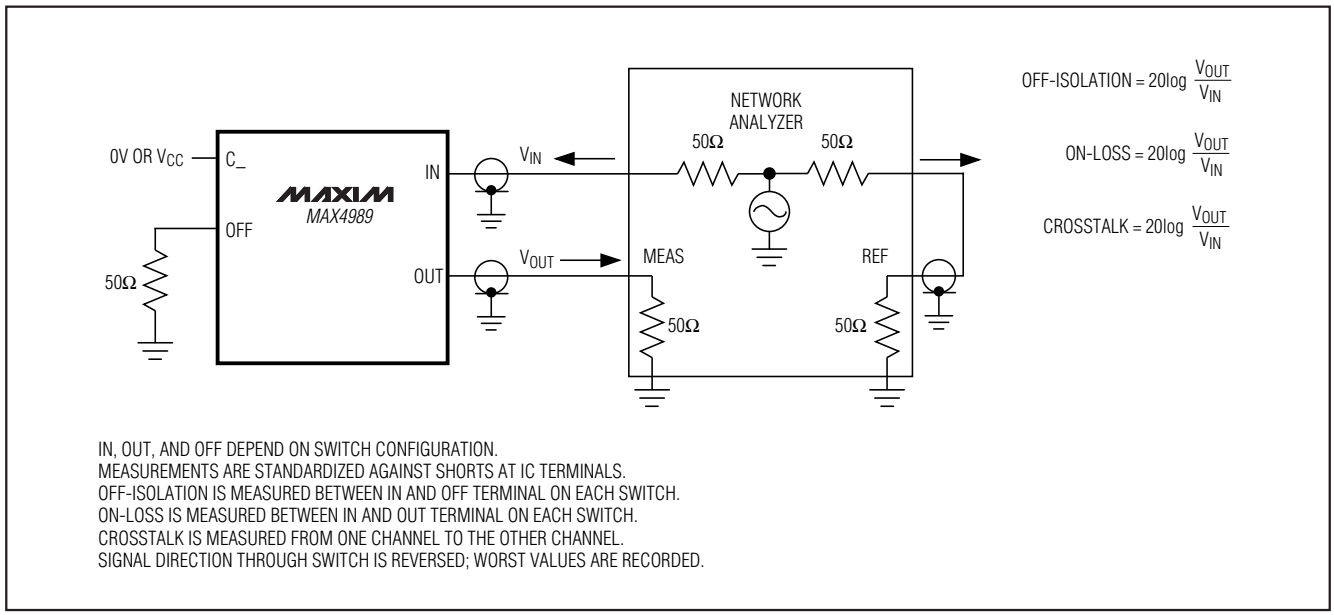


图1. 导通损耗、关断隔离和串扰

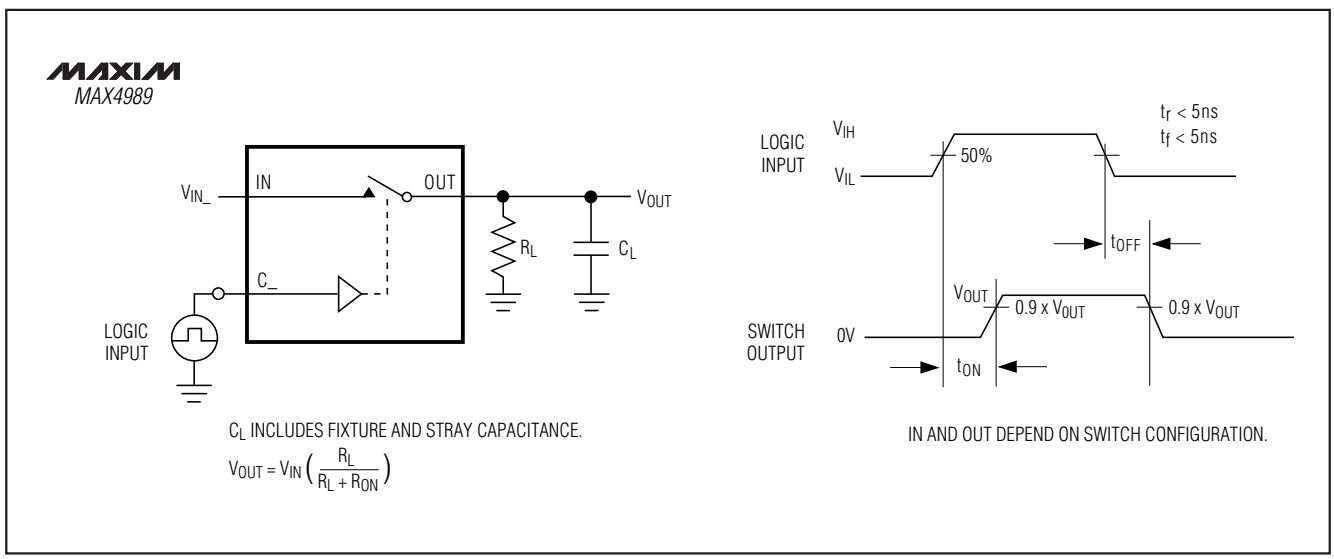


图2. 开关时间

测试电路/时序图(续)

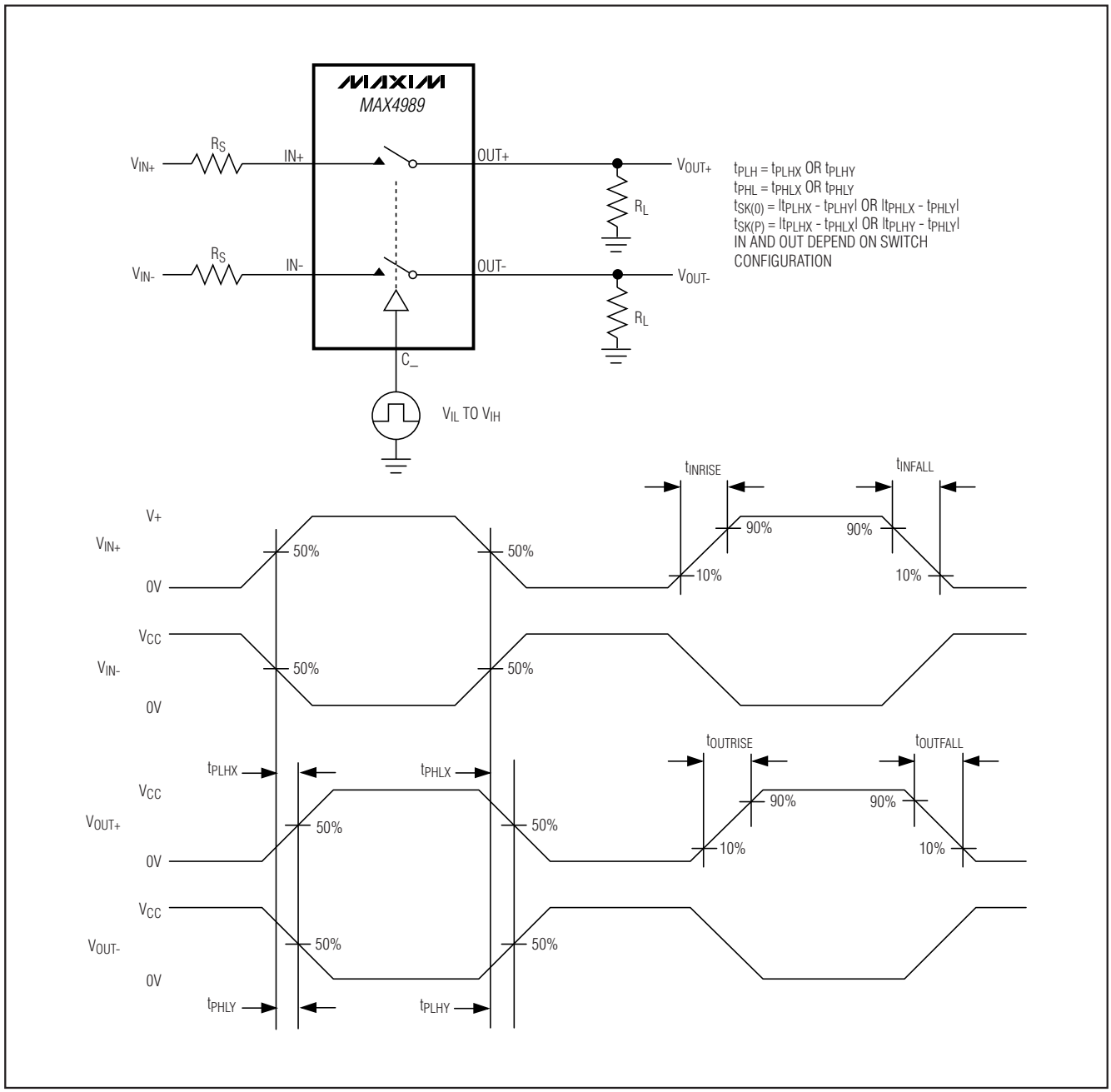


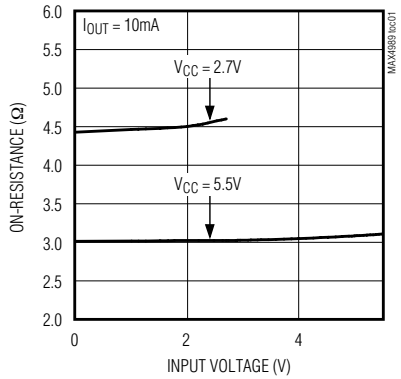
图3. 输出信号偏差、上升/下降时间、传输延迟

USB 2.0高速4选2交叉点开关

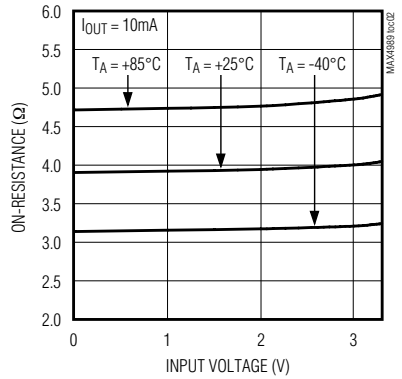
典型工作特性

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

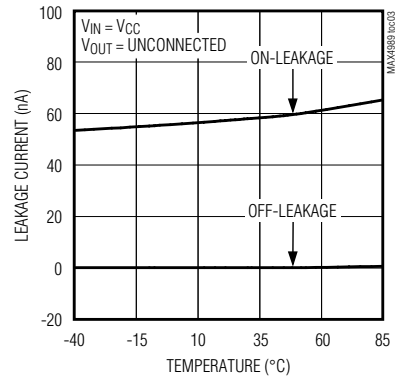
ON-RESISTANCE vs. INPUT VOLTAGE



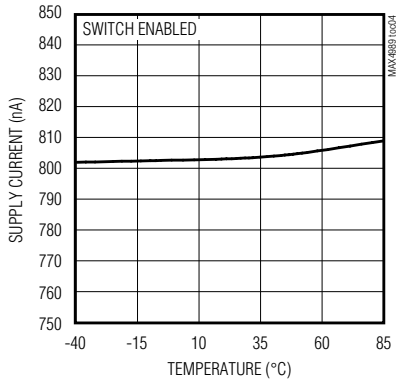
ON-RESISTANCE vs. INPUT VOLTAGE



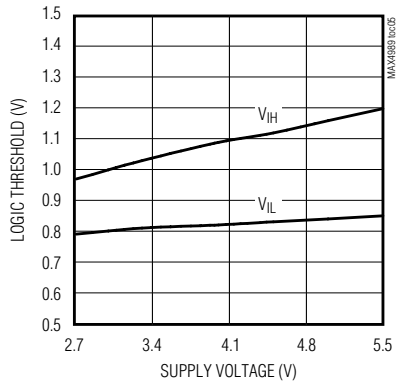
LEAKAGE CURRENT vs. TEMPERATURE



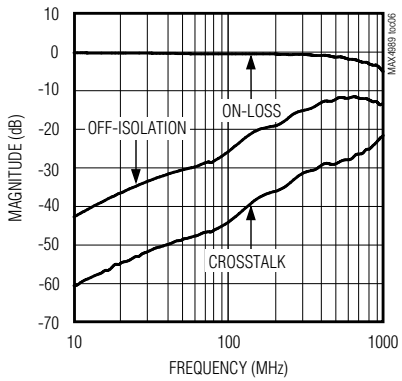
SUPPLY CURRENT vs. TEMPERATURE



INPUT LOGIC THRESHOLD vs. SUPPLY VOLTAGE



FREQUENCY RESPONSE



引脚说明

引脚	名称	功能
1	Y-	Y端反相输入/输出。
2	Y+	Y端同相输入/输出。
3	GND	地。
4	Z+	Z端同相输入/输出。
5	Z-	Z端反相输入/输出。
6	C0	控制输入0。
7	C1	控制输入1。
8	C2	控制输入2。
9	V_{CC}	正电源电压输入，采用一只0.1µF的陶瓷电容将V_{CC}旁路至GND，并尽可能靠近器件放置。
10	X-	X端反相输入/输出。
11	X+	X端同相输入/输出。
12	GND	地。
13	W+	W端同相输入/输出。
14	W-	W端反相输入/输出。
—	EP	裸焊盘，EP可连接至GND或悬空。EP不作为电气连接点。

详细说明

MAX4989为USB 2.0双向交叉点开关，允许用户连接4个USB差分对的任意两个。该器件工作于+2.7V至+5.5V单电源，并具有内部电荷泵，提供满摆幅信号。支持USB低速/全速/高速应用，数据速率高达480Mbps。

逻辑控制输入

MAX4989提供3路控制逻辑输入：C0、C1和C2，用于控制开关连接，如*功能框图/真值表*所示。满摆幅驱动逻辑控制输入能够使功耗最小。

关断模式

MAX4989具有关断模式，可将电源电流降至0.5µA以下，并将所有开关端置于高阻态。将所有控制输入驱动到高电平或将所有控制输入驱动到低电平时，器件置于关断模式(参见*功能框图/真值表*。)

USB开关

MAX4989的低导通电容和低导通电阻使其非常适合高性能高速USB 2.0开关应用。MAX4989可理想用于切换USB数据线以及需要在多个USB主机或USB设备之间进行切换的应用(图4)。

布局

高速USB需要仔细的PCB布局，阻抗受控的高速信号线应该具有相同长度。确保旁路电容尽可能靠近器件安装，尽量采用大面积的接地层。

上电顺序

警告：不要超出绝对最大额定参数，超出规定的额定值会对器件造成永久性损害。

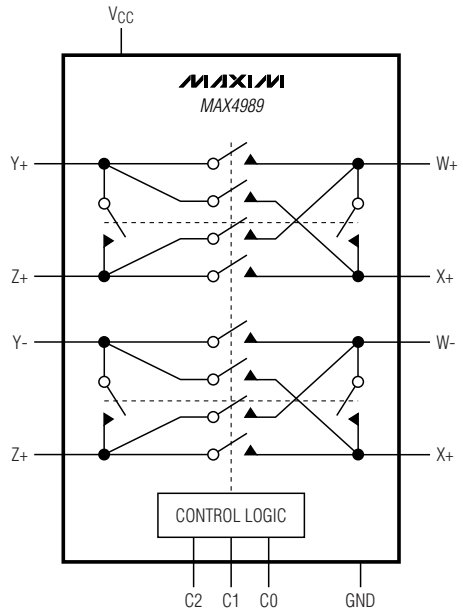
推荐所有器件采用正确的上电顺序。加载信号之前一定要先加载V_{CC}电源，特别是对于没有限流保护的信号。

芯片信息

PROCESS: BiCMOS

USB 2.0高速4选2交叉点开关

功能框图/真值表



MAX4989			
C2	C1	C0	SWITCH
0	0	0	SHUTDOWN
0	0	1	W AND X CONNECTED
0	1	0	W AND Y CONNECTED
0	1	1	W AND Z CONNECTED
1	0	0	X AND Z CONNECTED
1	0	1	X AND Y CONNECTED
1	1	0	Y AND Z CONNECTED
1	1	1	SHUTDOWN

应用信息

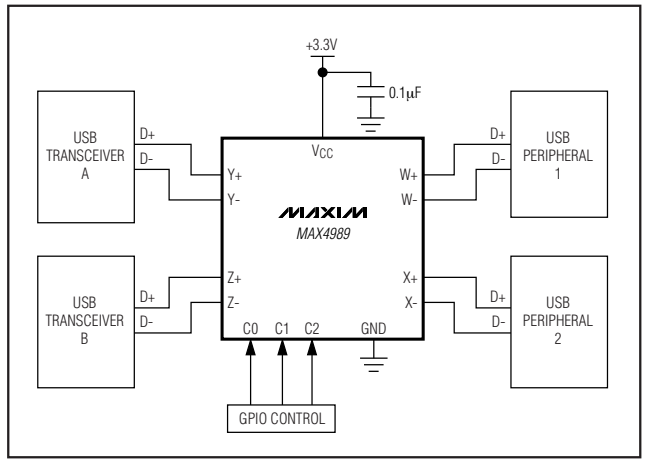


图4. 典型应用电路

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
14 TDFN	T1433-2	**21-0137**

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