具有逻辑电平转换功能的 CD405xB-Q1 CMOS 单路 8 通道模拟多路复用器/多路解复用器

1 特性

- 符合面向汽车应用的 AEC-Q100 标准
  - 温度等级 1：–45°C 至 +125°C，T_A
- 宽数字和模拟信号电平范围
  - 数字：3V 至 20V
  - 模拟：≤ 20V_{P-P}
- 在 $V_{DD} – V_{EE}$ = 18V 时的 15 V_{P-P}信号输入范围内，具有 125Ω（典型值）的低导通电阻
- 高关断电阻，$V_{DD} – V_{EE}$ = 18V 时，信道泄漏为 ±100pA（典型值）
- 适用于 3V 至 20V 数字寻址信号（$V_{DD} – V_{SS}$ = 3V 至 20V）的逻辑电平转换功能，可将模拟信号切换至与 20 V_{P-P} ($V_{DD} – V_{EE}$ = 20V) 相匹配的开关特性，$V_{DD} – V_{EE}$ = 15V 时，r_{ON} = 5Ω（典型值），在所有数字控制输入和电源条件下，具有极低的静态功率损耗，在 $V_{DD} – V_{SS} = V_{DD} – V_{EE}$ = 10V 时，功率损耗为 0.2μW（典型值）
- 二进制地址片上解码
- 5V、10V 和 15V 参数额定值
- 在 20V 静态电流下经过 100% 测试
- 在全封装温度范围内，18V 时的最大输入电流为 1μA，18V 和 25°C 时为 100nA
- 先断后合开关消除了通道重叠

2 应用

- 模拟和数字多路复用和多路解复用
- A/D 和 D/A 转换
- 信号门控
- 工厂自动化
- 电视
- 电器
- 消费类音频
- 可编程逻辑电路
- 传感器

3 说明

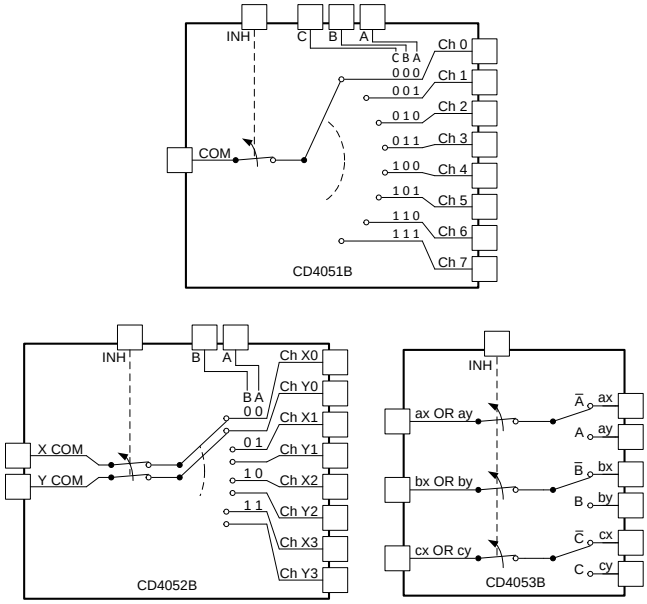
CD405xB-Q1 模拟多路复用器和多路解复用器是数字控制的模拟开关，具有低接通阻抗和极低的关断泄漏电流。这些多路复用器电路在整个 $V_{DD} – V_{SS}$ 和 $V_{DD} – V_{EE}$ 电源电压范围内，消耗的静态功率极低，而不受控制信号的逻辑状态影响。

器件信息(1)

器件型号	封装	封装尺寸（标称值）
CD405xB	SOIC (D) (16)	9.90mm x 3.91mm
	TSSOP (PW) (16)	5.00mm × 4.40mm

(1) 如需了解所有可用封装，请参阅产品说明书末尾的可订购产品附录。

CD405xB-Q1 的功能图



目录

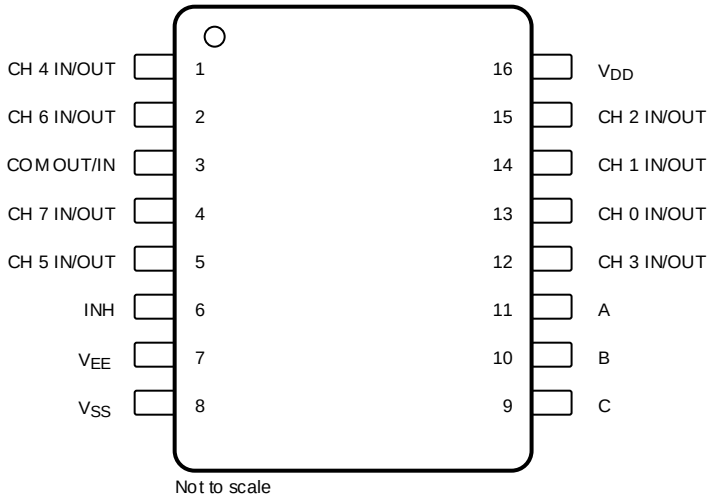
4 修订历史记录

Changes from Revision A (January 2008) to Revision B **Page**

- 已添加 添加了*引脚配置和功能* 部分、*ESD 额定值* 表、*特性* *说明* 部分、*器件功能模式*、*应用和实施*部分、*电源相关建议*部分、*布局*部分、*器件和文档支持*部分以及*机械、封装和可订购信息*部分 ... 1
- 已删除数据表中的部件编号 CD4052B-Q1 ... 1

5 Pin Configuration and Functions

CD4051B-Q1
D or PW Package
(Top View)



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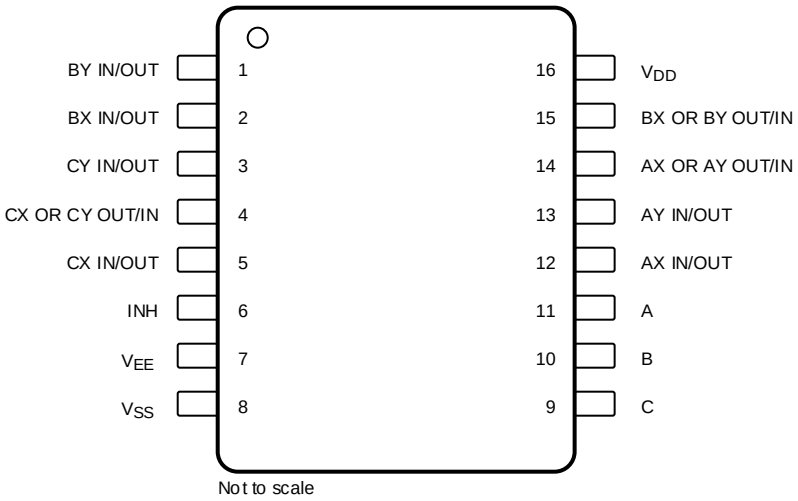
Pin Functions CD4051B-Q1

PIN		I/O	DESCRIPTION
NO.	NAME		
1	CH 4 IN/OUT	I/O	Channel 4 in/out
2	CH 6 IN/OUT	I/O	Channel 6 in/out
3	COM OUT/IN	I/O	Common out/in
4	CH 7 IN/OUT	I/O	Channel 7 in/out
5	CH 5 IN/OUT	I/O	Channel 5 in/out
6	INH	I	Disables all channels. See Table 1.
7	V_{EE}	—	Negative power input
8	V_{SS}	—	Ground
9	C	I	Channel select C. See Table 1.
10	B	I	Channel select B. See .
11	A	I	Channel select A. See Table 1.
12	CH 3 IN/OUT	I/O	Channel 3 in/out
13	CH 0 IN/OUT	I/O	Channel 0 in/out
14	CH 1 IN/OUT	I/O	Channel 1 in/out
15	CH 2 IN/OUT	I/O	Channel 2 in/out
16	V_{DD}	—	Positive power input

CD4053B-Q1
D or PW Package
(Top View)



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Pin Functions CD4053B-Q1

PIN		I/O	DESCRIPTION
NO.	NAME		
1	BY IN/OUT	I/O	B channel Y in/out
2	BX IN/OUT	I/O	B channel X in/out
3	CY IN/OUT	I/O	C channel Y in/out
4	CX OR CY OUT/IN	I/O	C common out/in
5	CX IN/OUT	I/O	C channel X in/out
6	INH	I	Disables all channels. See Table 1.
7	V_{EE}	—	Negative power input
8	V_{SS}	—	Ground
9	C	I	Channel select C. See Table 1.
10	B	I	Channel select B. See Table 1.
11	A	I	Channel select A. See Table 1.
12	AX IN/OUT	I/O	A channel X in/out
13	AY IN/OUT	I/O	A channel Y in/out
14	AX OR AY OUT/IN	I/O	A common out/in
15	BX OR BY OUT/IN	I/O	B common out/in
16	V_{DD}	—	Positive power input

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)(1)

			MIN	MAX	UNIT
	Supply Voltage	V+ to V-, Voltages Referenced to V_{SS} Terminal	–0.5	20	V
	DC Input Voltage		–0.5	V_{DD} + 0.5	V
	DC Input Current	Any One Input	–10	10	mA
T_{JMAX1}	Maximum junction temperature, ceramic package			175	°C
T_{JMAX2}	Maximum junction temperature, plastic package			150	°C
T_{stg}	Storage temperature		–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

			VALUE	UNIT
CD4051B-Q1 in PDIP, CDIP, SOIC, SOP, TSSOP Packages				
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per AEC Q100-002(1) HBM ESD Classification Level 2	±3000	V
		Charged-device model (CDM), per AEC Q100-011 CDM ESD Classification Level C6	±2000	
CD4053B-Q1 in PDIP, CDIP, SOP and TSSOP Packages				
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per AEC Q100-002(1) HBM ESD Classification Level 2	±2500	V
		Charged-device model (CDM), per AEC Q100-011 CDM ESD Classification Level C6	±1500	

(1) AEC Q100-002 indicates that HBM stressing shall be in accordance with the ANSI/ESDA/JEDEC JS-001 specification.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Temperature Range	–55	125	°C

6.4 Thermal Information

THERMAL METRIC(1)		CD405xB-Q1		UNIT
		D	PW	
		16 Pins	16 Pins	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	86.7	108	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	47.3		°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	45.3		°C/W
ψ_{JT}	Junction-to-top characterization parameter	12.1		°C/W
ψ_{JB}	Junction-to-board characterization parameter	44.9		°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A		°C/W

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

6.5 Electrical Characteristics

over operating free-air temperature range, V_{SUPPLY} = ±5 V, and R_L = 100 Ω, (unless otherwise noted)(1)

PARAMETER			TEST CONDITIONS					MIN	TYP	MAX	UNIT
			V_{IS} (V)	V_{EE} (V)	V_{SS} (V)	V_{DD} (V)	TEMP				
SIGNAL INPUTS (V_{IS}) AND OUTPUTS (V_{OS})											
Quiescent Device Current, I_{DD} Max						5	–55°C			5	µA
							–40°C			5	
							25°C		0.04	5	
							85°C			150	
							125°C			150	
						10	–55°C			10	
							–40°C			10	
							25°C		0.04	10	
							85°C			300	
							125°C			300	
						15	–55°C			20	
							–40°C			20	
							25°C		0.04	20	
							85°C			600	
							125°C			600	
						20	–55°C			100	
							–40°C			100	
							25°C		0.08	100	
							85°C			3000	
							125°C			3000	
Drain to Source ON Resistance r_{ON} Max $0 \le V_{IS} \le V_{DD}$				0	0	5	–55°C			800	Ω
							–40°C			850	
							25°C		470	1050	
							85°C			1200	
							125°C			1300	
				0	0	10	–55°C			310	
							–40°C			300	
							25°C		180	400	
							85°C			520	
							125°C			550	
				0	0	15	–55°C			200	
							–40°C			210	
							25°C		125	240	
							85°C			300	
							125°C			300	
Change in ON Resistance (Between Any Two Channels), Δr_{ON}				0	0	5	25°C		15		Ω
				0	0	10			10		
				0	0	15			5		
OFF Channel Leakage Current: Any Channel OFF (Max) or ALL Channels OFF (Common OUT/IN) (Max)				0	0	18	–55°C			± 100	nA
							–40°C				
							25°C		± 0.01	± 100(2)	
							85°C			± 1000(2)	
							125°C				
ON Channel Leakage Current: Any Channel ON (Max) or ALL Channels ON (Common OUT/IN) (Max)			5 or 0	-5	0	10.5	85°C			± 300(3)	nA
			5	0	0	18	85°C			± 300(3)	
Capacitance	Input, C_{IS}			–5	–5	–5	25°C		5		pF
	Output, C_{OS}	CD4051B-Q1					25°C		30		
		CD4053B-Q1							9		
	Feed through, C_{IOS}								0.2		

(1) Peak-to-Peak voltage symmetrical about (V_{DD} – V_{EE}) / 2.
(2) Determined by minimum feasible leakage measurement for automatic testing.
(3) Does not apply to Hi-Rel CD4051BF and CD4051BFA3 devices.

Electrical Characteristics (continued)

over operating free-air temperature range, V_{SUPPLY} = ±5 V, and R_L = 100 Ω, (unless otherwise noted)(1)

PARAMETER		TEST CONDITIONS					MIN	TYP	MAX	UNIT
		V_{IS} (V)	V_{EE} (V)	V_{SS} (V)	V_{DD} (V)	TEMP				
Propagation Delay Time (Signal Input to Output)		V_{DD} 	R_L = 200 kΩ , C_L = 50 pF, t_r , t_f = 20 ns		5	25°C		30	60	ns
					10			15	30	
					15			10	20	
CONTROL (ADDRESS OR INHIBIT), V_C										
Input Low Voltage, V_{IL} , Max		V_{IL} = V_{DD} through 1 kΩ ; V_{IH} = V_{DD} through 1 kΩ	V_{EE} = V_{SS}, R_L = 1 kΩ to V_{SS}, I_{IS} < 2 µA on All OFF Channels		5	–55°C		1.5		V
						–40°C		1.5		
						25°C			1.5	
						85°C		1.5		
						125°C		1.5		
					10	–55°C		3		
						–40°C		3		
						25°C			3	
						85°C		3		
						125°C		3		
					15	–55°C		4		
						–40°C		4		
						25°C			4	
						85°C		4		
						125°C		4		
Input High Voltage, V_{IH} , Min					5	–55°C		3.5		V
						–40°C		3.5		
						25°C	3.5			
						85°C		3.5		
						125°C		3.5		
					10	–55°C		7		
						–40°C		7		
						25°C	7			
						85°C		7		
						125°C		7		
					15	–55°C		11		
						–40°C		11		
						25°C	11			
						85°C		11		
						125°C		11		
Input Current, I_{IN} (Max)		V_{IN} = 0, 18			18	–55°C		± 0.1		µA
						–40°C		± 0.1		
						25°C		± 10^{-5}	± 0.1	
						85°C		± 1		
						125°C		± 1		
Propagation Delay Time	Address-to-Signal OUT (Channels ON or OFF) (See Figure 9, Figure 10, and Figure 14)	t_r , t_f = 20 ns, C_L = 50 pF, R_L = 10 kΩ	0	0	5			450	720	ns
			0	0	10			160	320	
			0	0	15			120	240	
			–5	0	5			225	450	
Propagation Delay Time	Inhibit-to-Signal OUT (Channel Turning ON) (See Figure 10)	t_r , t_f = 20 ns, C_L = 50 pF, R_L = 1 kΩ	0	0	5			400	720	ns
			0	0	10			160	320	
			0	0	15			120	240	
			–10	0	5			200	400	
Propagation Delay Time	Inhibit-to-Signal OUT (Channel Turning OFF) (See Figure 16)	t_r , t_f = 20 ns, C_L = 50 pF, R_L = 10 kΩ	0	0	5			200	450	ns
			0	0	10			90	210	
			0	0	15			70	160	
			–10	0	5			130	300	
Input Capacitance, C_{IN} (Any Address or Inhibit Input)								5	7.5	pF

6.6 AC Performance Characteristics

PARAMETER	TEST CONDITIONS					TYP	UNIT
	V_{IS} (V)	V_{DD} (V)	R_L (kΩ)				
Cutoff (–3dB) Frequency Channel ON (Sine Wave Input)	5(1)	10	1	V_{OS} at Common OUT/IN	CD4053B-Q1	30	MHz
					CD4051B-Q1	20	
	$V_{EE} = V_{SS}$, $20Log\frac{V_{OS}}{V_{IS}} = -3\,dB$			V_{OS} at Any Channel		60	
Total Harmonic Distortion, THD	2(1)	5	10			0.3%	
	3(1)	10				0.2%	
	5(1)	15				0.12%	
	$V_{EE} = V_{SS}$, f_{IS} = 1 kHz Sine Wave						
–40dB Feedthrough Frequency (All Channels OFF)	5(1)	10	1	V_{OS} at Common OUT/IN	CD4053B-Q1	8	MHz
					CD4051B-Q1	12	
	$V_{EE} = V_{SS}$, $20Log\frac{V_{OS}}{V_{IS}} = -40dB$			V_{OS} at Any Channel		8	
–40dB Signal Crosstalk Frequency	5(1)	10	1	Between Any two Channels		3	MHz
	$V_{EE} = V_{SS}$, $20Log\frac{V_{OS}}{V_{IS}} = -40dB$			Between Sections, CD4052 Only	Measured on Common	6	
					Measured on Any Channel	10	
				Between Any Two Sections, CD4053 Only	In Pin 2, Out Pin 14	2.5	
					In Pin 15, Out Pin 14	6	
Address-or-Inhibit-to-Signal Crosstalk		10	10(2)			65	mV_{PEAK}
	$V_{EE} = 0$, $V_{SS} = 0$, t_r, t_f = 20 ns, $V_{CC} = V_{DD} – V_{SS}$ (Square Wave)					65	

(1) Peak-to-Peak voltage symmetrical about (V_{DD} - V_{EE}) / 2.
(2) Both ends of channel.

6.7 Typical Characteristics

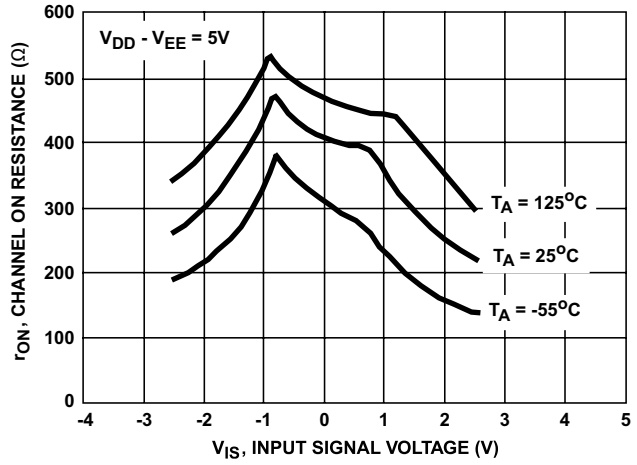


Figure 1. Channel ON Resistance vs Input Signal Voltage (All Types)

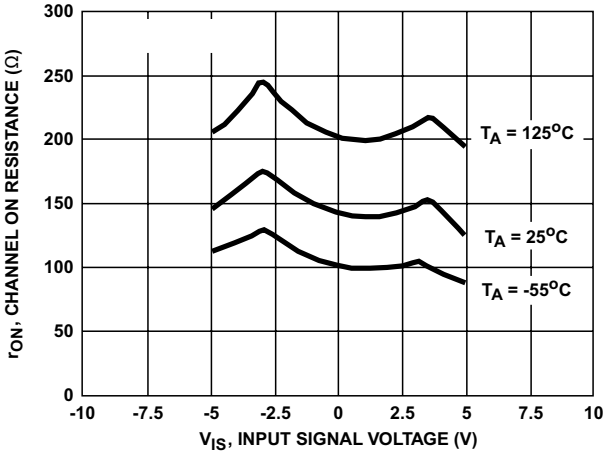


Figure 2. Channel ON Resistance vs Input Signal Voltage (All Types)

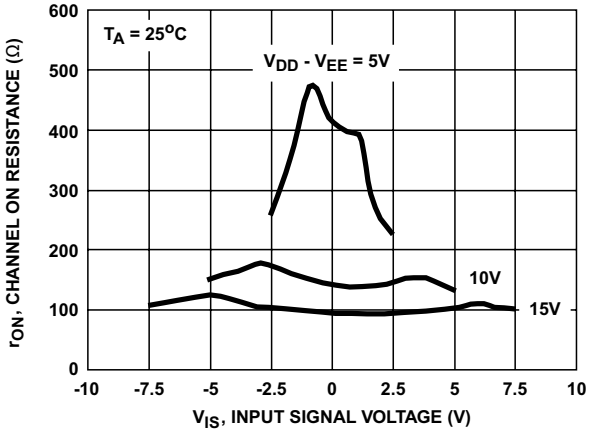


Figure 3. Channel ON Resistance vs Input Signal Voltage (All Types)

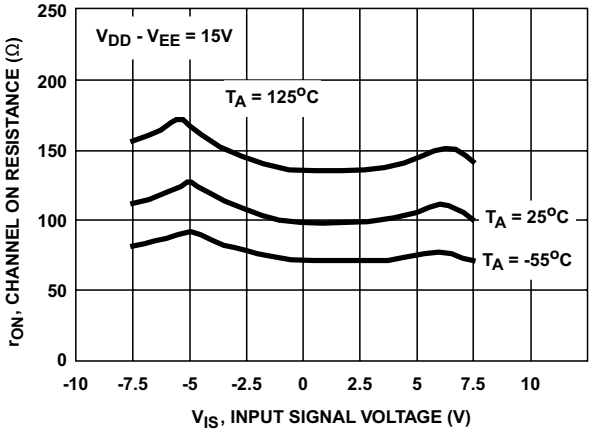


Figure 4. Channel ON Resistance vs Input Signal Voltage (All Types)

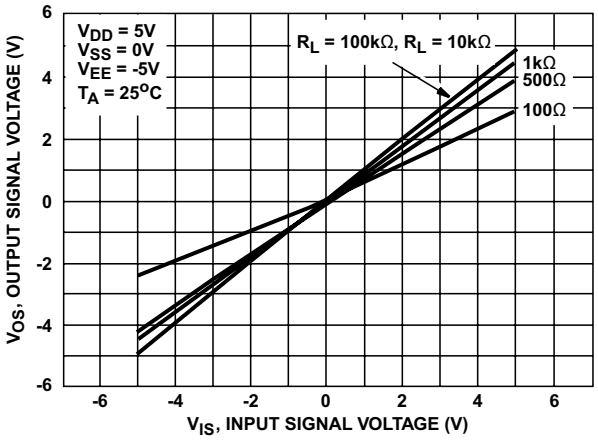


Figure 5. ON Characteristics for 1 of 8 Channels (CD4051B-Q1)

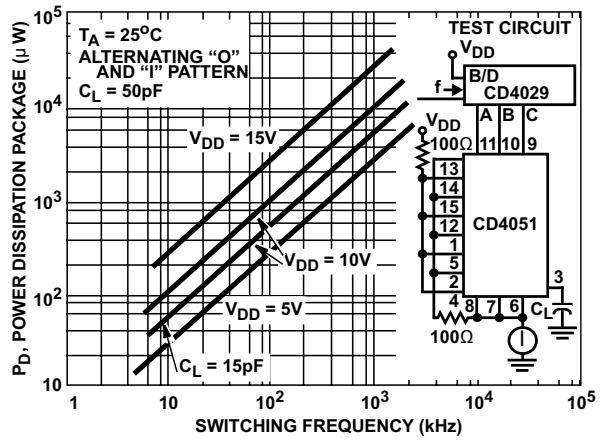


Figure 6. Dynamic Power Dissipation vs Switching Frequency (CD4051B-Q1)

Typical Characteristics (continued)

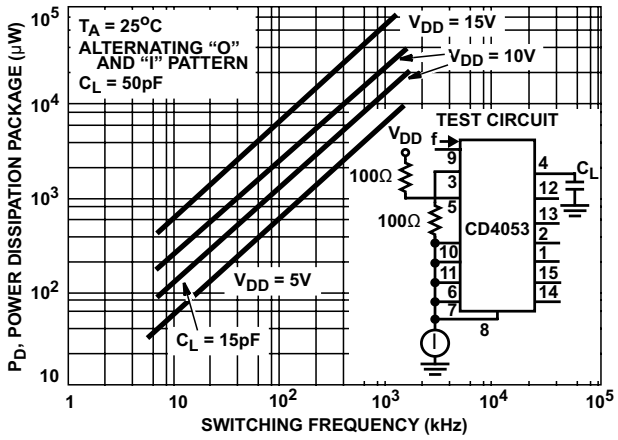


Figure 7. Dynamic Power Dissipation vs Switching Frequency (CD4053B-Q1)

7 Parameter Measurement Information

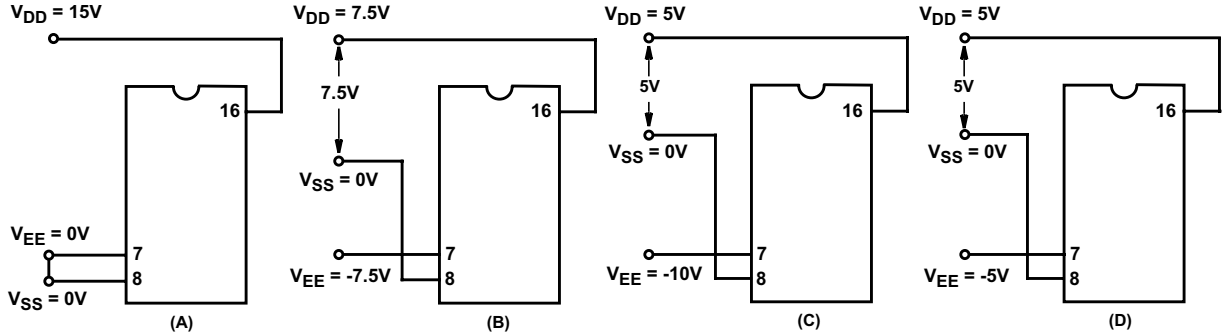


Figure 8. Typical Bias Voltages

NOTE

The ADDRESS (digital-control inputs) and INHIBIT logic levels are: 0 = V_{SS} and 1 = V_{DD}. The analog signal (through the TG) may swing from V_{EE} to V_{DD}.

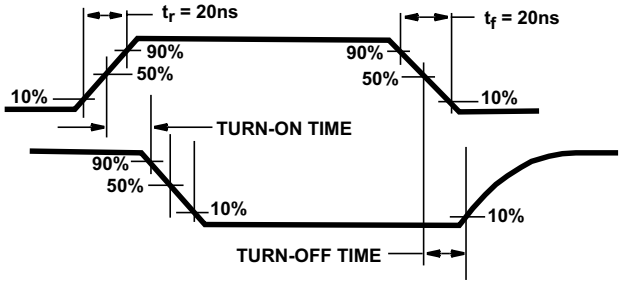


Figure 9. Waveforms, Channel Being Turned ON (R_L = 1 kΩ)

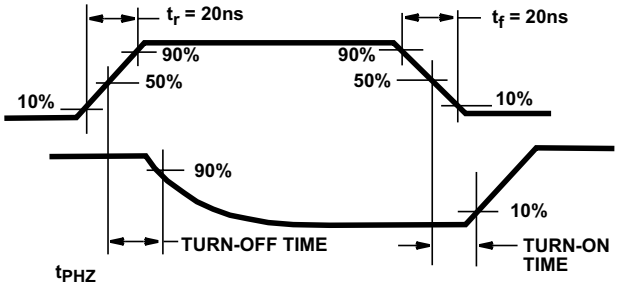


Figure 10. Waveforms, Channel Being Turned OFF (R_L = 1 kΩ)

Parameter Measurement Information (continued)

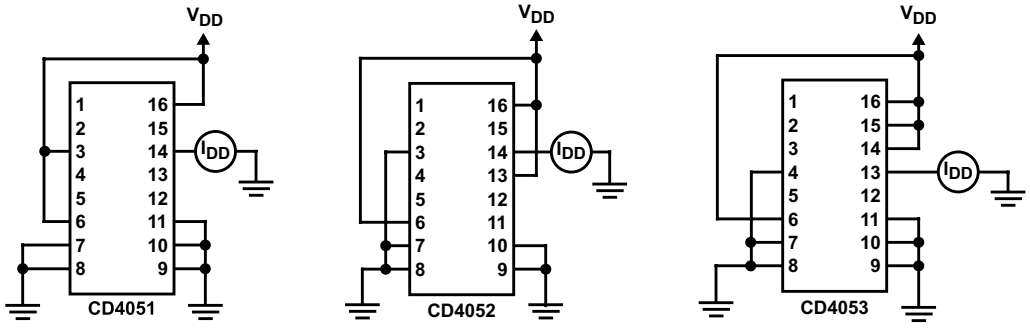


Figure 11. OFF Channel Leakage Current - Any Channel OFF

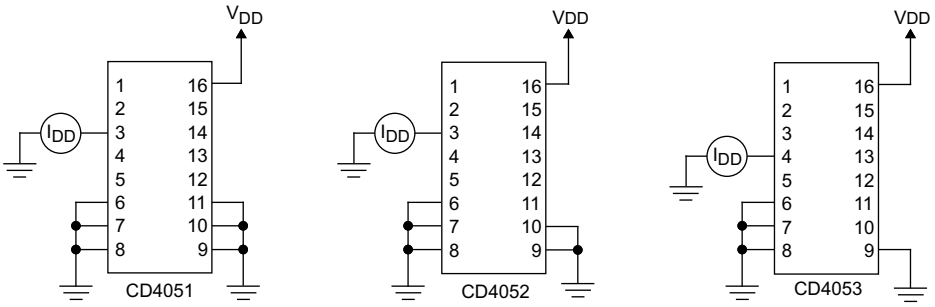


Figure 12. On Channel Leakage Current - Any Channel On

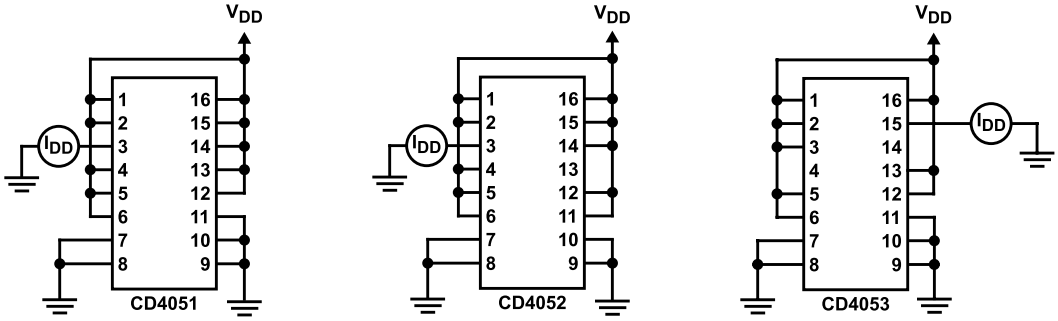


Figure 13. OFF Channel Leakage Current - All Channels OFF

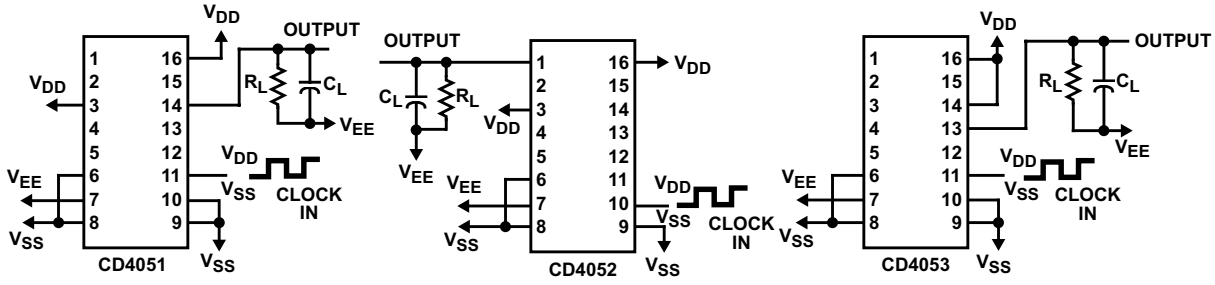


Figure 14. Propagation Delay - Address Input to Signal Output

Parameter Measurement Information (continued)

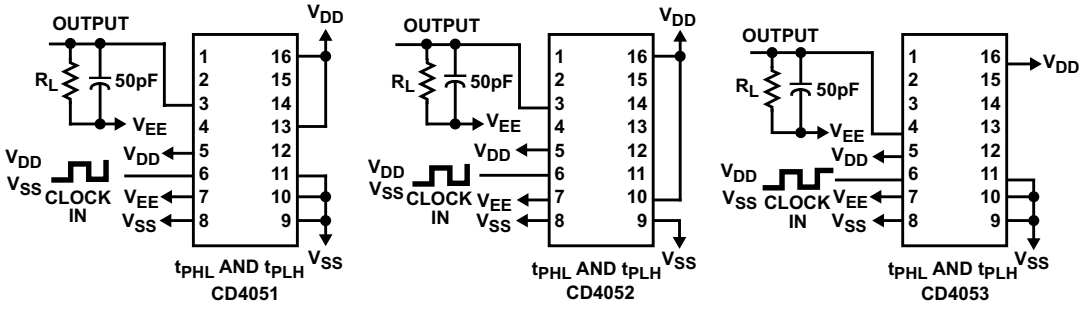


Figure 15. Propagation Delay - Inhibit Input to Signal Output

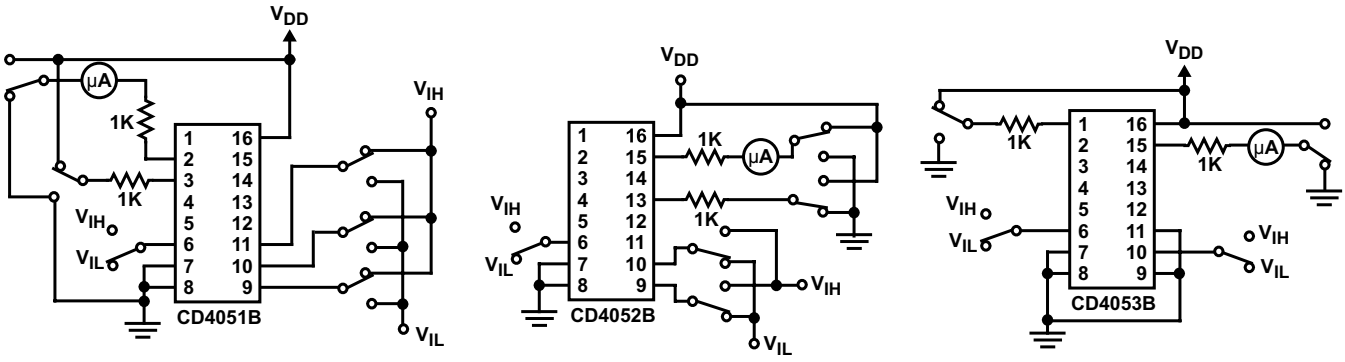


Figure 16. Input Voltage Test Circuits (Noise Immunity)

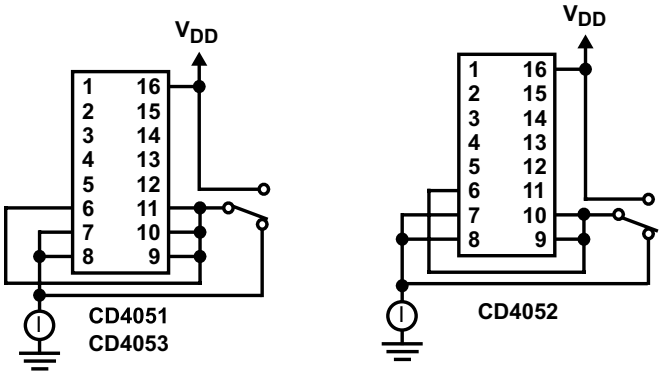


Figure 17. Quiescent Device Current

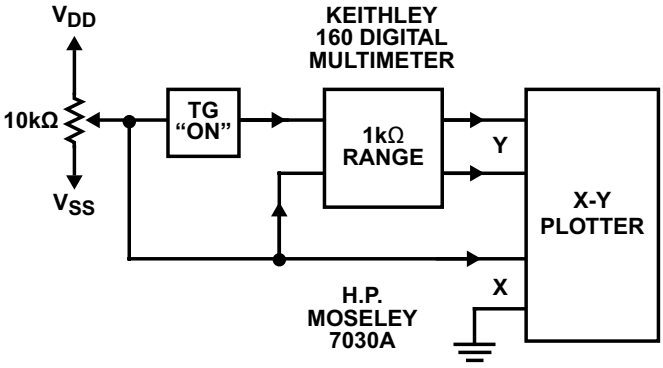


Figure 18. Channel ON Resistance Measurement Circuit

Parameter Measurement Information (continued)

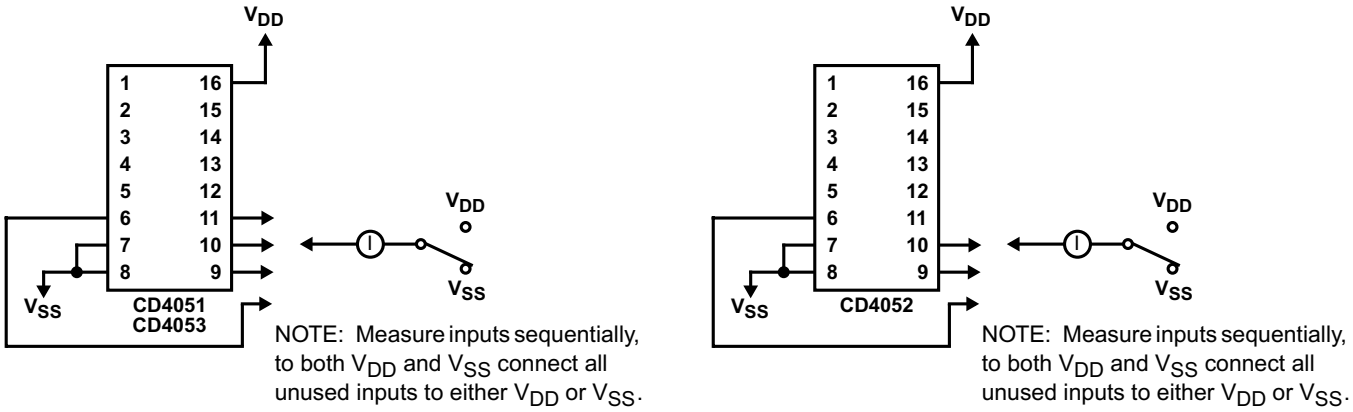


Figure 19. Input Current

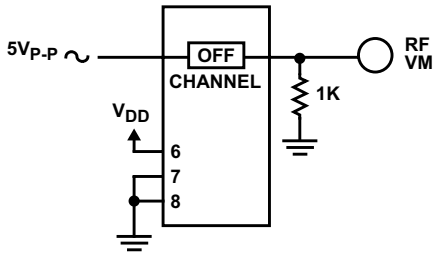


Figure 20. Feedthrough (All Types)

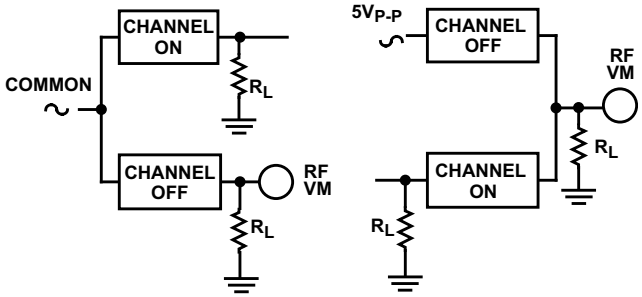


Figure 21. Crosstalk Between Any Two Channels (All Types)

Figure 22. Crosstalk Between Duals or Triplets (CD4053B-Q1)

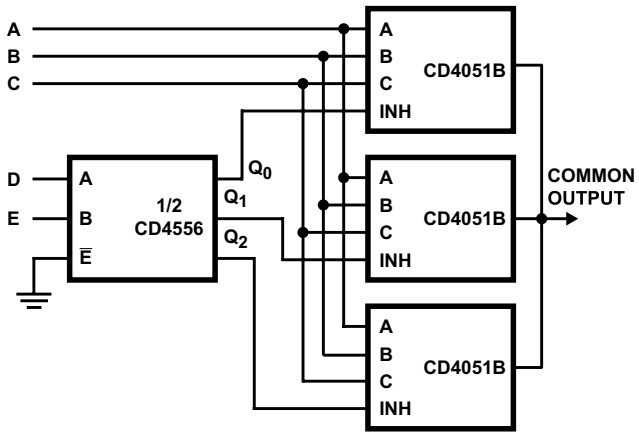


Figure 23. 24-to-1 MUX Addressing

8 Detailed Description

8.1 Overview

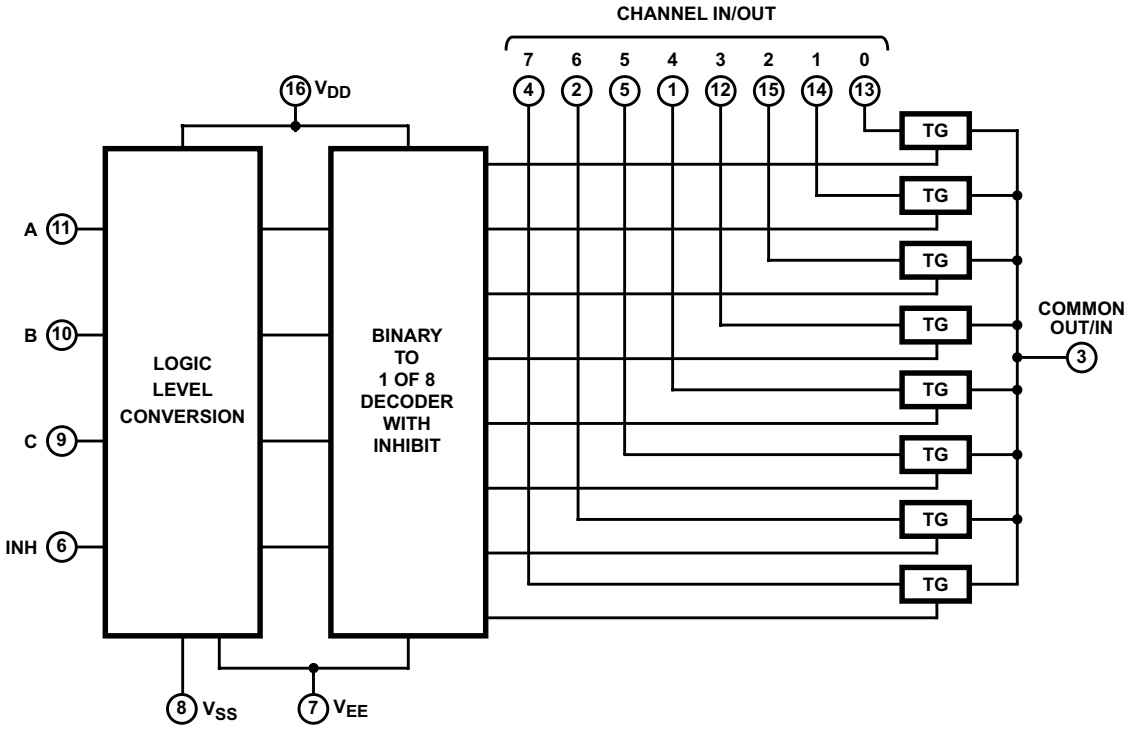
The CD4051B-Q1and CD4053B-Q1analog multiplexers are digitally-controlled analog switches having low ON impedance and very low OFF leakage current. Control of analog signals up to 20 V_{P-P} can be achieved by digital signal amplitudes of 4.5 V to 20 V (if $V_{DD} – V_{SS}$ = 3 V, a $V_{DD} – V_{EE}$ of up to 13 V can be controlled; for $V_{DD} – V_{EE}$ level differences above 13 V, a $V_{DD} – V_{SS}$ of at least 4.5 V is required). For example, if V_{DD} = +4.5 V, V_{SS} = 0 V, and V_{EE} = –13.5 V, analog signals from –13.5 V to +4.5 V can be controlled by digital inputs of 0 V to 5 V. These multiplexer circuits dissipate extremely low quiescent power over the full $V_{DD} – V_{SS}$ and $V_{DD} – V_{EE}$ supply-voltage ranges, independent of the logic state of the control signals. When a logic 1 is present at the inhibit input terminal, all channels are off.

The CD4051B-Q1 device is a single 8-channel multiplexer having three binary control inputs, A, B, and C, and an inhibit input. The three binary signals select 1 of 8 channels to be turned on, and connect one of the 8 inputs to the output.

The CD4053B-Q1 device is a triple 2-channel multiplexer having three separate digital control inputs, A, B, and C, and an inhibit input. Each control input selects one of a pair of channels which are connected in a single-pole, double-throw configuration.

When these devices are used as demultiplexers, the CHANNEL IN/OUT terminals are the outputs and the COMMON OUT/IN terminals are the inputs.

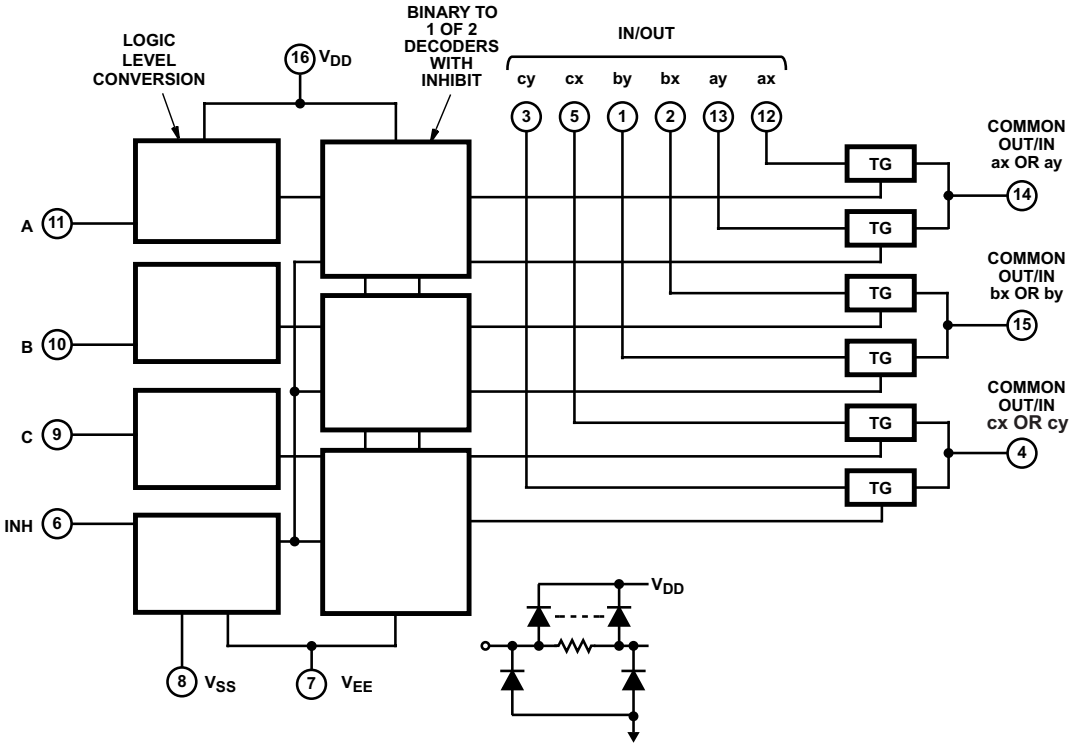
8.2 Functional Block Diagrams



All inputs are protected by standard CMOS protection network.

Figure 24. Functional Block Diagram, CD4051B-Q1

Functional Block Diagrams (continued)



All inputs are protected by standard CMOS protection network.

Figure 25. Functional Block Diagram, CD4053B-Q1

8.3 Feature Description

The CD405xB-Q1 line of multiplexers and demultiplexers can accept a wide range of digital and analog signal levels. Digital signals range from 3 V to 20 V, and analog signals are accepted at levels ≤ 20 V. They have low ON resistance, typically 125 Ω over 15 V_{P-P} signal input range for $V_{DD} – V_{EE}$ = 18 V. This allows for very little signal loss through the switch. Matched switch characteristics are typically r_{ON} = 5 Ω for $V_{DD} – V_{EE}$ = 15 V.

The CD405xB-Q1 devices also have high OFF resistance, which keeps from wasting power when the switch is in the OFF position, with typical channel leakage of ±100 pA at $V_{DD} – V_{EE}$ = 18 V. Very low quiescent power dissipation under all digital-control input and supply conditions, typically 0.2 µW at $V_{DD} – V_{SS} = V_{DD} – V_{EE}$ = 10 V keeps power consumption total very low. All devices have been 100% tested for quiescent current at 20 V with maximum input current of 1 µA at 18 V over the full package temperature range, and only 100 nA at 18 V and 25°C.

Logic-level conversion for digital addressing signals of 3 V to 20 V ($V_{DD} – V_{SS}$ = 3 V to 20 V) to switch analog signals to 20 V_{P-P} ($V_{DD} – V_{EE}$ = 20 V). Binary address decoding on chip makes channel selection easy. When channels are changed, a break-before-make system eliminates channel overlap.

8.4 Device Functional Modes

Table 1. Truth Table(1)

INPUT STATES				ON CHANNEL(S)
INHIBIT	C	B	A	
CD4051B-Q1				
L	L	L	L	0
L	L	L	H	1
L	L	H	L	2
L	L	H	H	3
L	H	L	L	4
L	H	L	H	5
L	H	H	L	6
L	H	H	H	7
H	X	X	X	None
CD4053B				
L	L	L	L	ay or by or cy
L	H	H	H	ay or by or cy
H	X	X	X	None

(1) X = Don't Care

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

The CD405xB-Q1 multiplexers and demuliplexers can be used for a wide variety of applications.

9.2 Typical Application

One application of the CD4051B-Q1 is to use it in conjunction with a microcontroller to poll a keypad. Figure 26 shows the basic schematic for such a polling system. The microcontroller uses the channel select pins to cycle through the different channels while reading the input to see if a user is pressing any of the keys. This is a very robust setup, allowing for multiple simultaneous key-presses with very little power consumption. It also uses very few pins on the microcontroller. The down side of polling is that the microcontroller must continually scan the keys for a press and can do little else during this process.

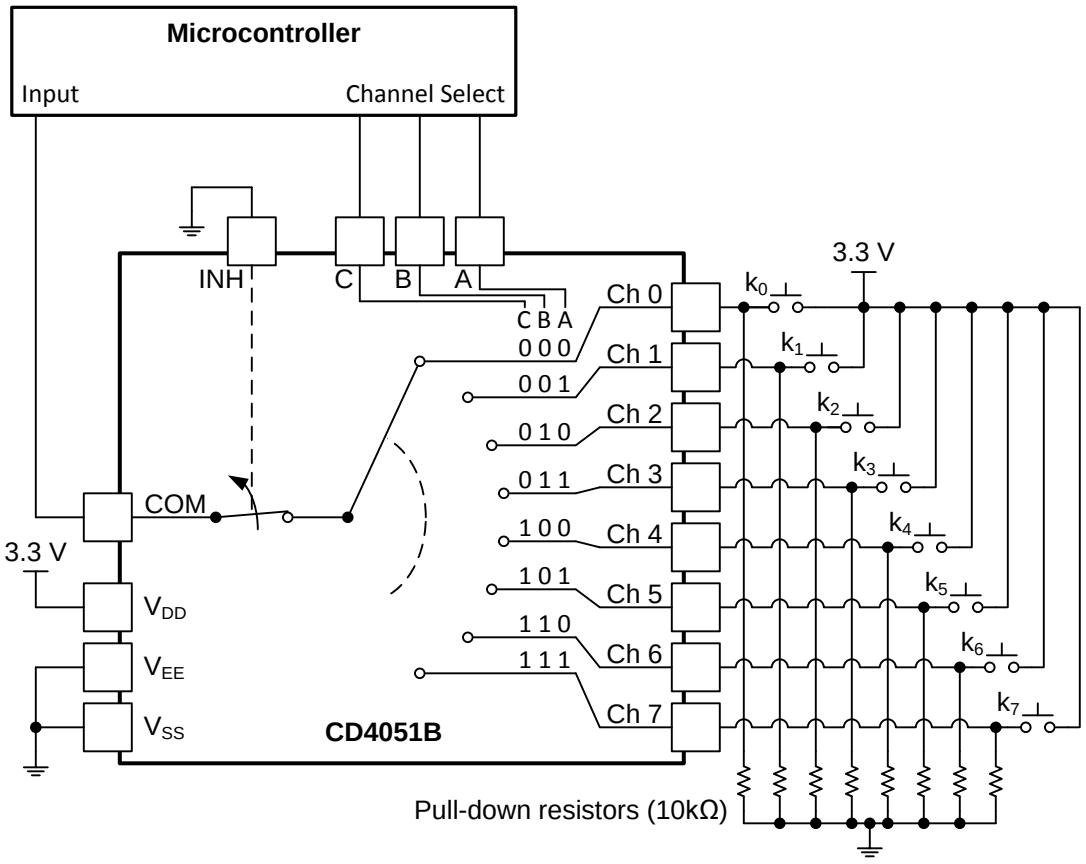


Figure 26. The CD4051B-Q1 Being Used to Help Read Button Presses on a Keypad.

9.2.1 Design Requirements

These devices use CMOS technology and have balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads, so routing and load conditions should be considered to prevent ringing.

Typical Application (continued)

9.2.2 Detailed Design Procedure

1. Recommended Input Conditions
   - For switch time specifications, see propagation delay times in *Electrical Characteristics*.
   - Inputs should not be pushed more than 0.5 V above V_{DD} or below V_{EE}.
   - For input voltage level specifications for control inputs, see V_{IH} and V_{IL} in *Electrical Characteristics*.
2. Recommended Output Conditions
   - Outputs should not be pulled above V_{DD} or below V_{EE}.
3. Input/output current consideration: The CD405xB-Q1 series of parts do not have internal current drive circuitry and thus cannot sink or source current. Any current will be passed through the device.

9.2.3 Application Curve

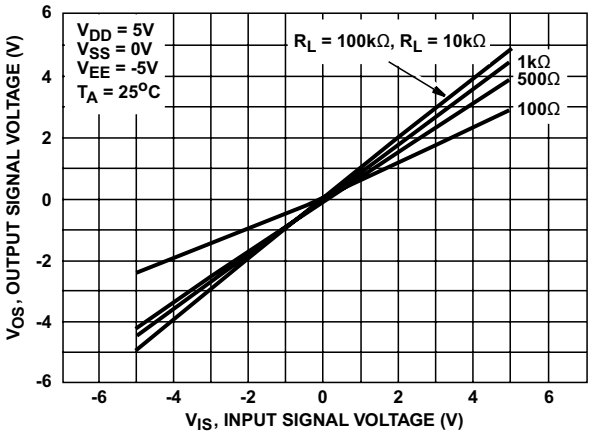


Figure 27. ON Characteristics for 1 of 8 Channels (CD4051B-Q1)

10 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Electrical Characteristics*.

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, a 0.1-µF bypass capacitor is recommended. If there are multiple pins labeled V_{CC}, then a 0.01-µF or 0.022-µF capacitor is recommended for each V_{CC} because the V_{CC} pins will be tied together internally. For devices with dual supply pins operating at different voltages, for example V_{CC} and V_{DD}, a 0.1-µF bypass capacitor is recommended for each supply pin. It is acceptable to parallel multiple bypass capacitors to reject different frequencies of noise. 0.1-µF and 1-µF capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

11 Layout

11.1 Layout Guidelines

Reflections and matching are closely related to loop antenna theory, but different enough to warrant their own discussion. When a PCB trace turns a corner at a 90° angle, a reflection can occur. This is primarily due to the change of width of the trace. At the apex of the turn, the trace width is increased to 1.414 times its width. This upsets the transmission line characteristics, especially the distributed capacitance and self–inductance of the trace — resulting in the reflection. It is a given that not all PCB traces can be straight, and so they will have to turn corners. Figure 28 shows progressively better techniques of rounding corners. Only the last example maintains constant trace width and minimizes reflections.

11.2 Layout Example

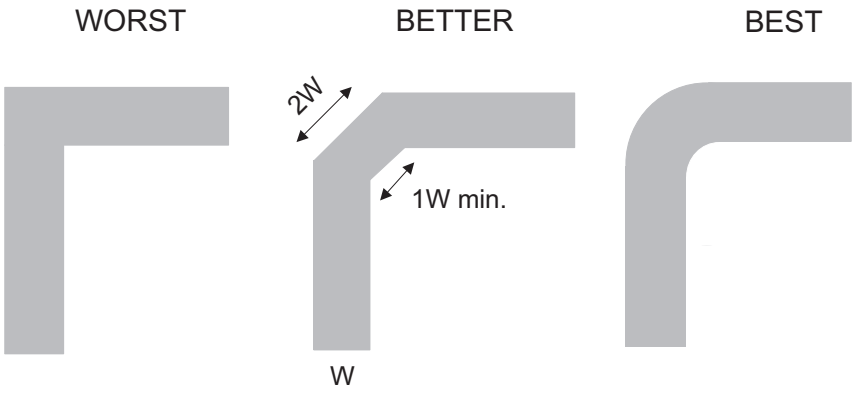


Figure 28. Trace Example

12 器件和文档支持

12.1 文档支持

12.1.1 相关文档

- *《CMOS 输入缓慢变化或悬空的影响》*，SCBA004

12.2 相关链接

下表列出了快速访问链接。类别包括技术文档、支持和社区资源、工具和软件，以及立即订购快速访问。

表 2. 相关链接

器件	产品文件夹	立即订购	技术文档	工具与软件	支持和社区
CD4051B-Q1	请单击此处	请单击此处	请单击此处	请单击此处	请单击此处
CD4053B-Q1	请单击此处	请单击此处	请单击此处	请单击此处	请单击此处

12.3 接收文档更新通知

要接收文档更新通知，请导航至 TI.com.cn 上的器件产品文件夹。单击右上角的*通知我* 进行注册，即可每周接收产品信息更改摘要。有关更改的详细信息，请查看任何已修订文档中包含的修订历史记录。

12.4 社区资源

下列链接提供到 TI 社区资源的连接。链接的内容由各个分销商“按照原样”提供。这些内容并不构成 TI 技术规范，并且不一定反映 TI 的观点；请参阅 TI 的 《使用条款》。

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.5 商标

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

12.6 静电放电警告

这些装置包含有限的内置 ESD 保护。 存储或装卸时，应将导线一起截短或将装置放置于导电泡棉中，以防止 MOS 门极遭受静电损伤。

12.7 术语表

SLYZ022 — *TI 术语表*。

这份术语表列出并解释术语、缩写和定义。

13 机械、封装和可订购信息

以下页面包含机械、封装和可订购信息。这些信息是指定器件的最新可用数据。数据如有变更，恕不另行通知，且不会对此文档进行修订。如需获取此数据表的浏览器版本，请查阅左侧的导航栏。

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CD4051BQPWRG4Q1	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CM051BQ	Samples
CD4051BQPWRQ1	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CM051BQ	Samples
CD4053BQM96G4Q1	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CD4053Q	Samples
CD4053BQM96Q1	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CD4053Q	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

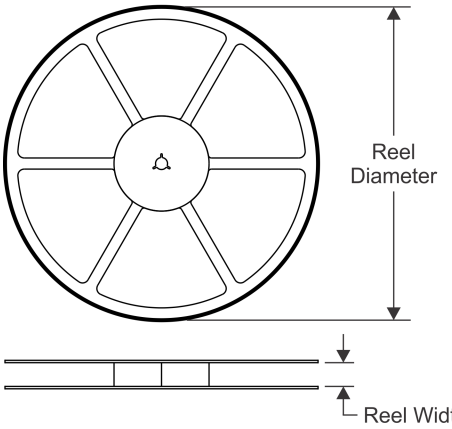
(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals.
TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

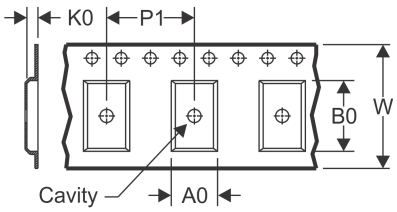
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

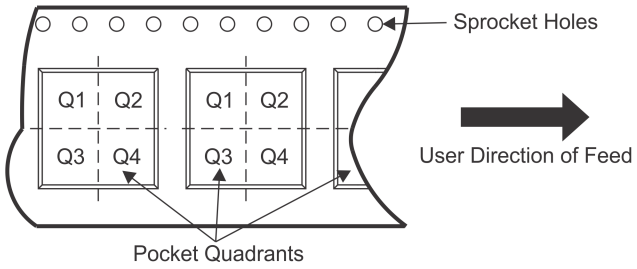


TAPE DIMENSIONS



A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

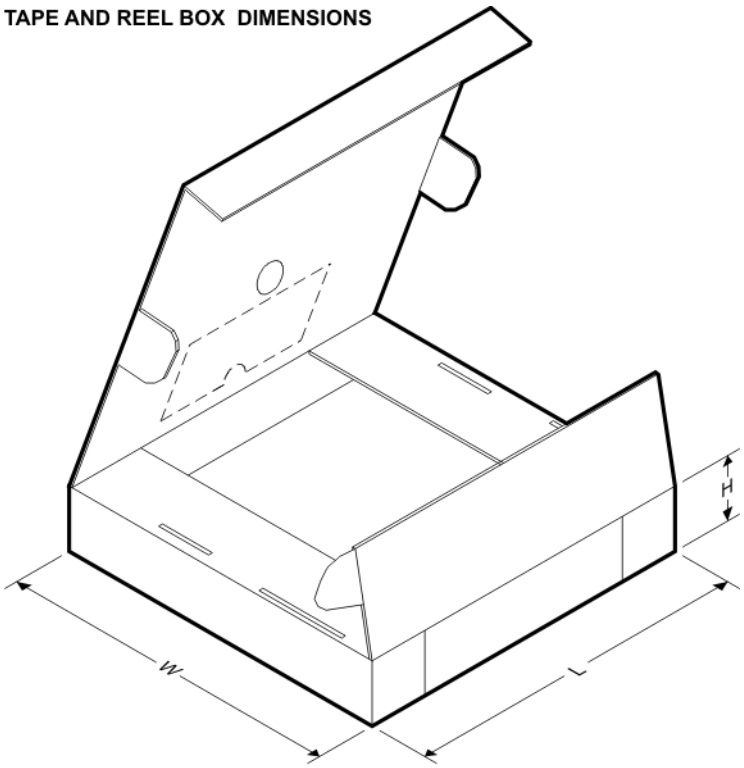
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD4051BQPWRG4Q1	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD4051BQPWRQ1	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

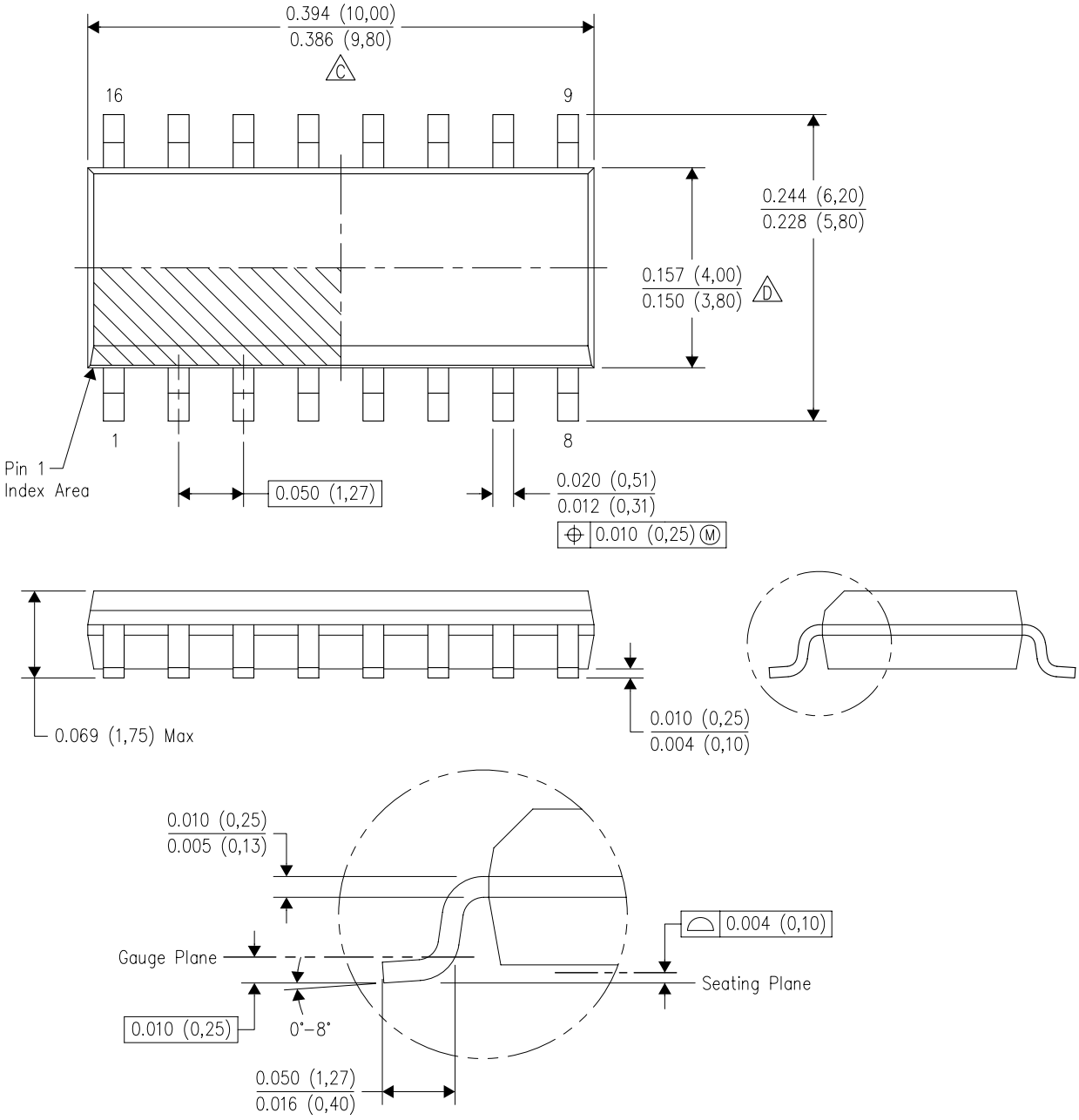
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4051BQPWRG4Q1	TSSOP	PW	16	2000	367.0	367.0	35.0
CD4051BQPWRQ1	TSSOP	PW	16	2000	367.0	367.0	35.0

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



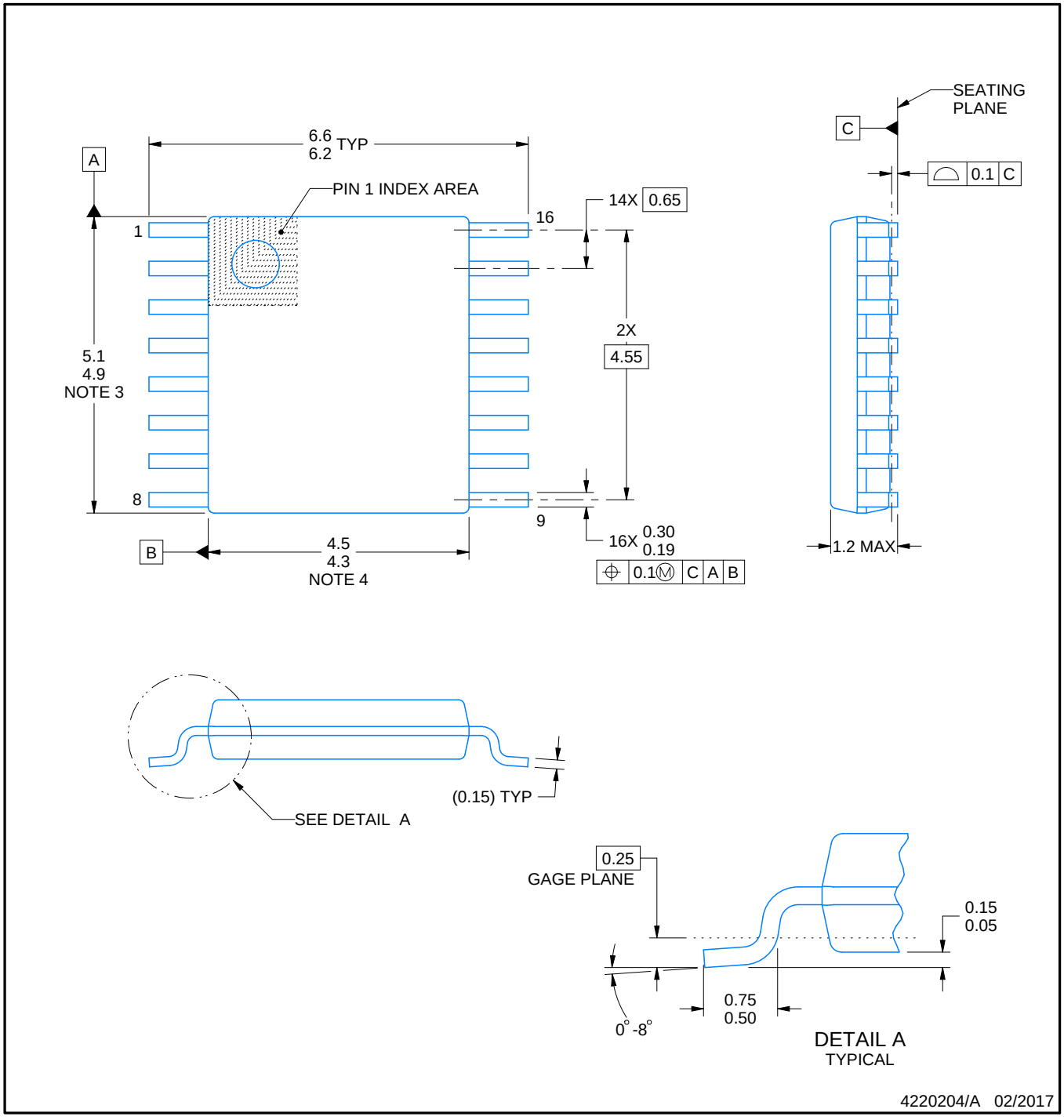
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
E. Reference JEDEC MS–012 variation AC.

PACKAGE OUTLINE

PW0016A

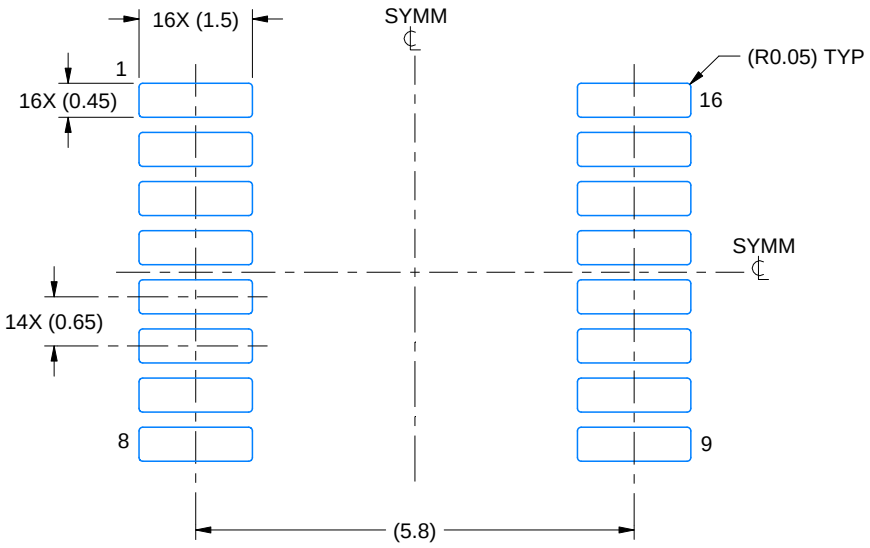
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

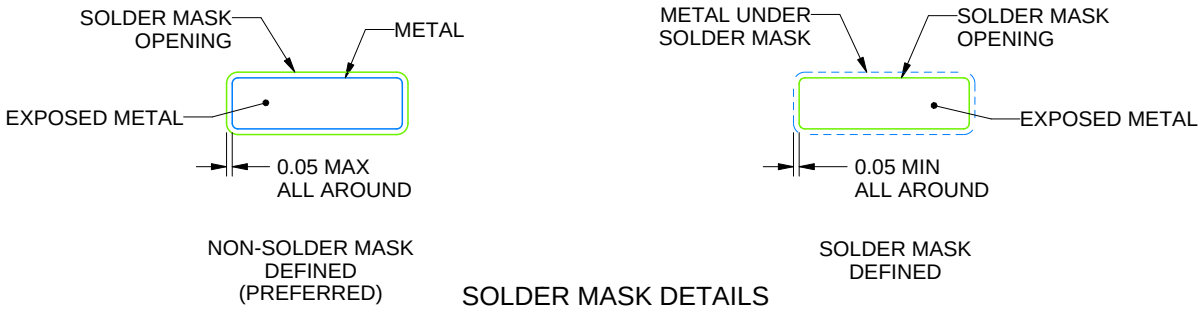


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

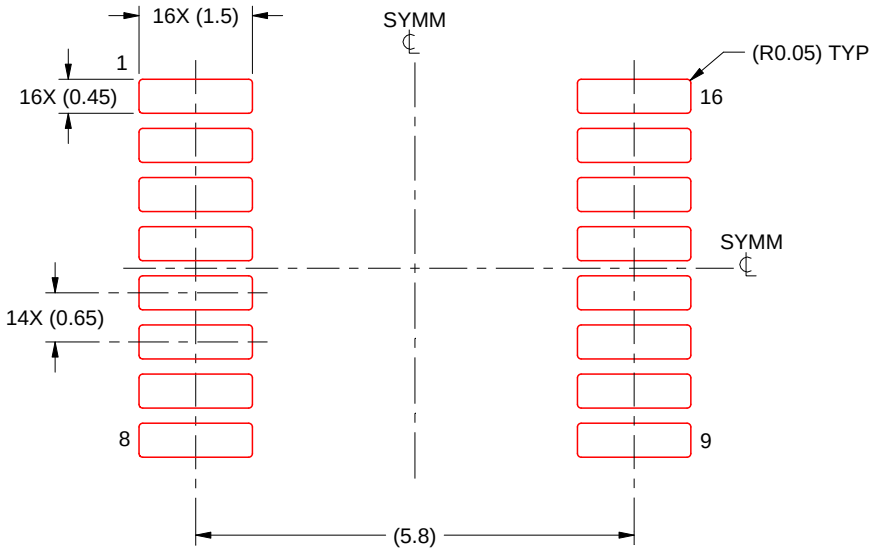


SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4220204/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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