TEXAS INSTRUMENTS

CD4051B-Q1 Automotive CMOS Single 8-Channel Analog Multiplexer or Demultiplexer with Logic-Level Conversion

1 Features

- AEC-Q100 qualified for automotive applications:
  - Temperature grade 1: –45°C to +125°C, T_A
- Wide range of digital and analog signal levels:
  - Digital: 3V to 20V
  - Analog: ≤ $20V_{P-P}$
- Single supply range : 3V to 20V (performance degrades for VDD < 3V)
- Dual Supply range: ± 3V to ± 10V
- Low ON resistance, 125Ω (typical) over input range for VDD = 15V
- Low channel leakage of ±10pA (typical) at VDD = 15V
- Low quiescent power dissipation : 0.2µW (typical)
- Bidirectional signal path
- ESD protection HBM: 3000V, CDM: 2000V
- Pin compatible with industry standard 4051

2 Applications

- Analog and digital multiplexing and demultiplexing
- Analog to digital and digital to analog conversion
- Signal gating
- Factory automation
- Televisions
- Appliances
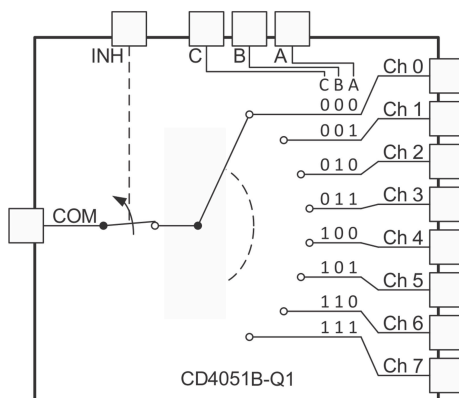- Consumer audio
- Programmable logic circuits
- Sensors

3 Description

The CD4051B-Q1 analog multiplexers and demultiplexers are digitally-controlled analog switches having low ON impedance and very low OFF leakage current. 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.

Package Information

PART NUMBER	PACKAGE [1]	PACKAGE SIZE[2]
CD4051B-Q1	D (SOIC, 16)	9.9mm × 6mm
	PW (TSSOP, 16)	5mm × 6.4mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.

Functional Diagram of CD4051B-Q1

Table of Contents

4 Pin Configuration and Functions

Figure 4-1. CD4051B-Q1 D or PW Package, (Top View)

Table 4-1. Pin Functions CD4051B-Q1

PIN		TYPE[1]	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 7-1.
7	V$_{EE}$	—	Negative power input
8	V$_{SS}$	—	Ground
9	C	I	Channel select C. See Table 7-1.
10	B	I	Channel select B. See Table 7-1.
11	A	I	Channel select A. See Table 7-1.
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

(1)   I = input, O = output

5 Specifications

5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)[1] [2]

			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 Rating* 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 Condition*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

(2) All voltages are with respect to ground, unless otherwise specified.

5.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins[1]	±3000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins[2]	±2000	

(1) JEDEC document JEP155 states that 500V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

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

	MIN	NOM	MAX	UNIT
Temperature Range	−55		125	°C

Product Folder Links: *CD4051B-Q1*

5.4 Thermal Information

THERMAL METRIC[1]		CD4051B-Q1		UNIT
		D (SOIC)	PW (TSSOP)	
		16 PINS	16 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	86.7	116.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	47.3	47.2	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	45.3	63.0	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	12.1	6.4	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	44.9	62.1	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	N/A	N/A	°C/W

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

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Product Folder Links: *CD4051B-Q1*

5.5 Electrical Characteristics - CD4051B-Q1

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
SIGNAL INPUTS (V_{IS}) AND OUTPUTS (V_{OS}) - CD4051B-Q1									
	V_{IS} (V)	V_{EE} (V)	V_{SS} (V)	V_{DD} (V)	TEMP				
Quiescent Device Current, I_{DD} (Max)		0 V	0 V	5 V	−55°C			60	μA
					−40°C			60	
					25°C		17	60	
					85°C			150	
					125°C			150	
		0 V	0 V	10 V	−55°C			60	
					−40°C			60	
					25°C		18	60	
					85°C			300	
					125°C			300	
		0 V	0 V	15 V	−55°C			60	
					−40°C			60	
					25°C		18	60	
					85°C			600	
					125°C			600	
		0 V	0 V	20 V	−55°C			100	
					−40°C			100	
					25°C		18	100	
					85°C			3000	
					125°C			3000	
Drain to Source ON Resistance r_{ON} (Max) $0 \leq V_{IS} \leq V_{DD}$		0 V	0 V	5 V	−55°C			800	Ω
					−40°C			850	
					25°C		470	1050	
					85°C			1200	
					125°C			1300	
		0 V	0 V	10 V	−55°C			310	
					−40°C			300	
					25°C		180	400	
					85°C			520	
					125°C			550	
		0 V	0	15 V	−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 V	0 V	5 V	25°C		15		Ω
		0 V	0 V	10 V			10		
		0 V	0 V	15 V			5		

Product Folder Links: *CD4051B-Q1*

5.5 Electrical Characteristics - CD4051B-Q1 (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
OFF Channel Leakage Current: Any Channel OFF (Max) or ALL Channels OFF (COMMON OUT/IN) (Max)			0 V	0 V	18 V	−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 V	0 V	10.5 V	85°C			± 300	nA
		5	0 V	0 V	18 V	85°C			± 300	
Capacitance	Input, C_{IS}		0 V	0 V	10 V	25°C			5	pF
	Output, C_{OS}	CD4051-Q1							30	
	Feed through, C_{IOS}								0.2	
Prop Delay			V_{DD}	R_L = 200 kΩ	5 V	25°C		30	60	ns
				C_L = 50 pF	10 V			15	30	
				t_r, t_f = 20 ns	15 V			10	20	

Product Folder Links: CD4051B-Q1

5.5 Electrical Characteristics - CD4051B-Q1 (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
CONTROL (ADDRESS OR INHIBIT), V_C - CD4051B-Q1									
Input Low Voltage, V_{IL}, (Max)				5 V	–55°C			0.8	V
					–40°C			0.8	
					25°C			0.8	
					85°C			0.8	
					125°C			0.8	
				10 V	–55°C			0.8	
					–40°C			0.8	
					25°C			0.8	
					85°C			0.8	
					125°C			0.8	
				15 V	–55°C			0.8	
					–40°C			0.8	
					25°C			0.8	
					85°C			0.8	
					125°C			0.8	
Input High Voltage, V_{IH}, (Min)				5 V	–55°C		3.5		V
					–40°C		3.5		
					25°C	3.5			
					85°C		3.5		
					125°C		3.5		
				10 V	–55°C		7		
					–40°C		7		
					25°C	7			
					85°C		7		
					125°C		7		
				15 V	–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 V	–55°C			±1	µA
					–40°C			±1	
					25°C		±0.6	±1	
					85°C			±1	
					125°C			±1	
Propagation Delay Time	Address-to-Signal OUT (Channels ON or OFF) (See Figure 10, Figure 11, and Figure 15)	t_r , t_f = 20ns, C_L = 50 pF, R_L = 10 kΩ	0 V	0 V	5 V			450	720	ns
			0 V	0 V	10 V			160	320	
			0 V	0 V	15 V			120	240	
			–5 V	0 V	5 V			225	450	

Product Folder Links: *CD4051B-Q1*

5.5 Electrical Characteristics - CD4051B-Q1 (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
Propagation Delay Time	Inhibit-to-Signal OUT (Channel Turning ON) (See Figure 11)	t_r, t_f = 20 ns, C_L = 50 pF, R_L = 1 kΩ	0 V	0 V	5 V			400	720	ns
			0 V	0 V	10 V			160	320	
			0 V	0 V	15 V			120	240	
			−10 V	0 V	5 V			200	400	
Propagation Delay Time	Inhibit-to-Signal OUT (Channel Turning OFF) (See Figure 17)	t_r, t_f = 20 ns, C_L = 50 pF, R_L = 10 kΩ	0 V	0 V	5 V			200	450	ns
			0 V	0 V	10 V			90	210	
			0 V	0 V	15 V			70	160	
			−10 V	0 V	5 V			130	300	
Input Capacitance, C_{IN} (Any Address or Inhibit Input)		−5 V	0 V	5 V	25°C			5	7.5	pF

(1) Peak-to-Peak voltage symmetrical about ($V_{DD} - V_{EE}$) / 2.
(2) Determined by minimum feasible leakage measurement for automatic testing.

5.6 AC Performance Characteristics - CD4051B-Q1

V_{DD} = +15 V, V_{SS} = V_{EE} = 0 V,
T_A = 25℃ (unless otherwise noted)

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	CD4051-Q1	20	MHz
	V_{EE} = V_{SS} , 20Log(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	10			0.2%	
	5[1]	15	10			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	CD4051-Q1	12	MHz
	V_{EE} = V_{SS} , 20Log(V_{OS}/V_{IS}) = –40 dB			V_{OS} at Any Channel		8	MHz
–40dB Signal Crosstalk Frequency	5[1]	10	1			3	MHz
Address-or-Inhibit-to-Signal Crosstalk		10	10[2]			65	mV$_{PEAK}$
	V_{EE} = 0, V_{SS} = 0, t_r , t_f = 20 ns, mVPEAK V_{CC} = V_{DD} – V_{SS} (Square Wave)					65	mV$_{PEAK}$

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

Product Folder Links: *CD4051B-Q1*

5.7 Typical Characteristics
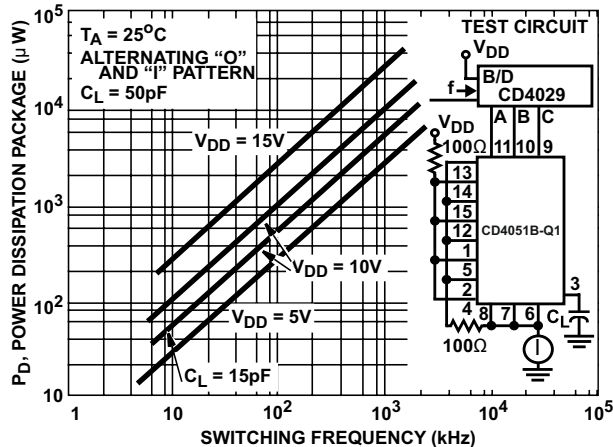
Figure 5-1. Dynamic Power Dissipation vs Switching Frequency (CD4051B-Q1)

Product Folder Links: *CD4051B-Q1*

6 Parameter Measurement Information
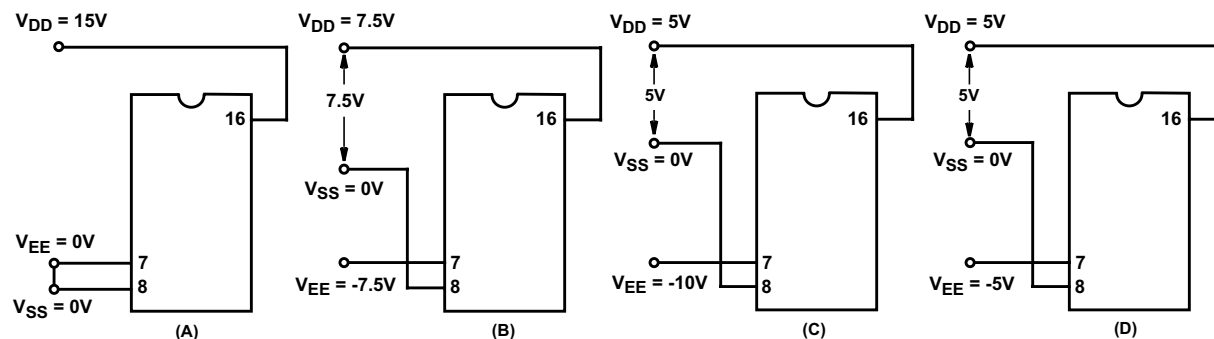
Figure 6-1. Typical Bias Voltages

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}.
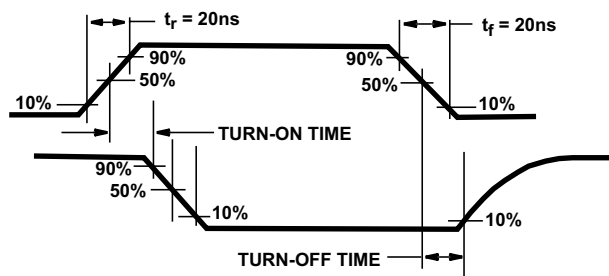
Figure 6-2. Waveforms, Channel Being Turned ON (R_L = 1 kΩ)
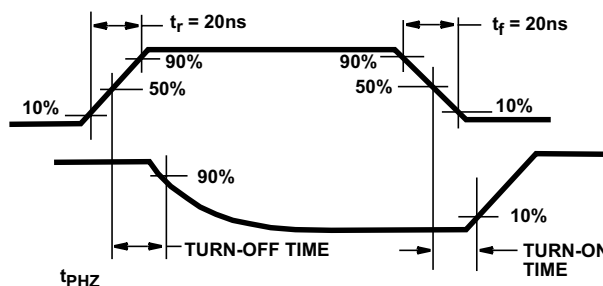
Figure 6-3. Waveforms, Channel Being Turned OFF (R_L = 1 kΩ)
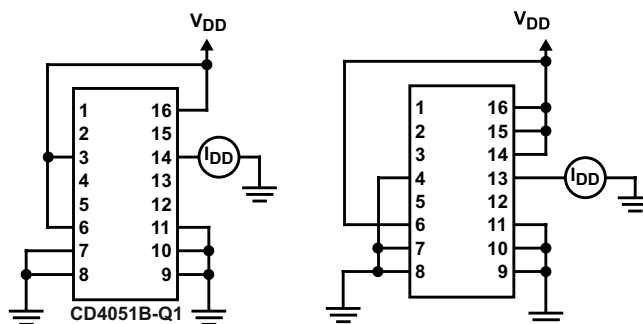
Figure 6-4. OFF Channel Leakage Current – Any Channel OFF
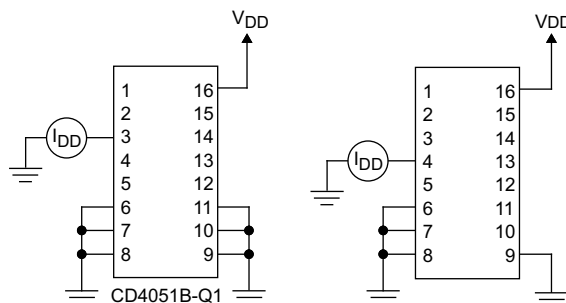
Figure 6-5. On Channel Leakage Current – Any Channel On
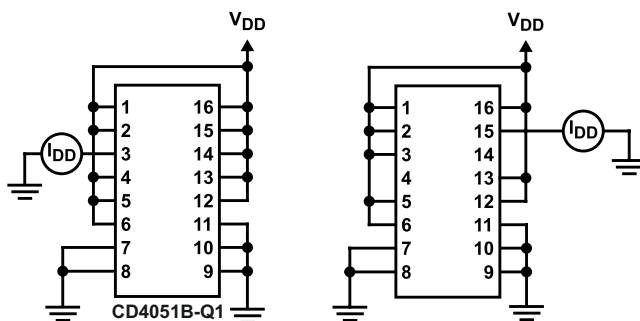
Figure 6-6. OFF Channel Leakage Current – All Channels OFF
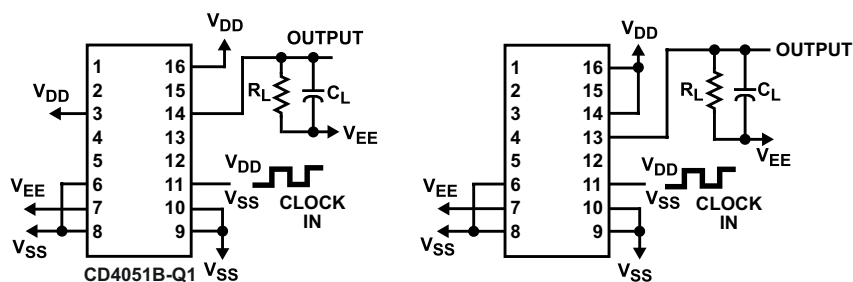
Figure 6-7. Propagation Delay – Address Input to Signal Output
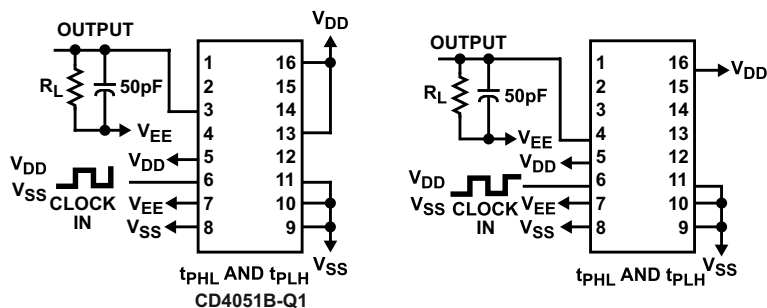
Figure 6-8. Propagation Delay – Inhibit Input to Signal Output
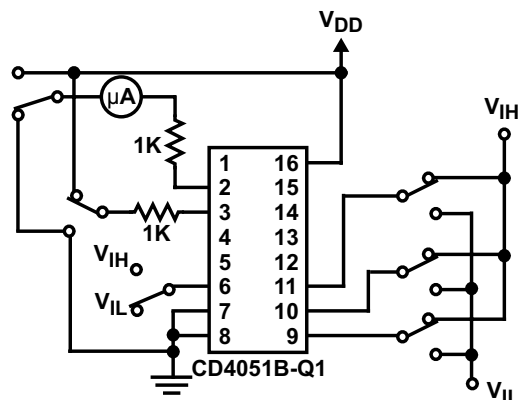
MEASURE < 2μA ON ALL
"OFF" CHANNELS (e.g., CHANNEL 6)
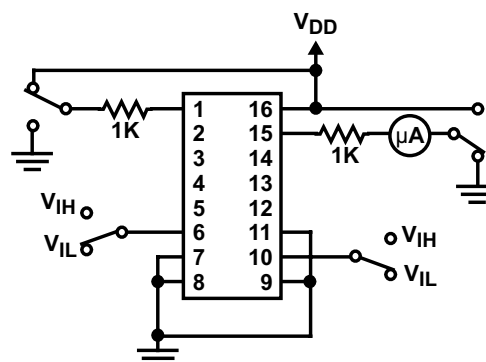
MEASURE < 2μA ON ALL
"OFF" CHANNELS (e.g., CHANNEL by)
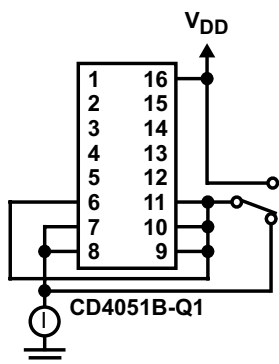
Figure 6-9. Input Voltage Test Circuits (Noise Immunity)
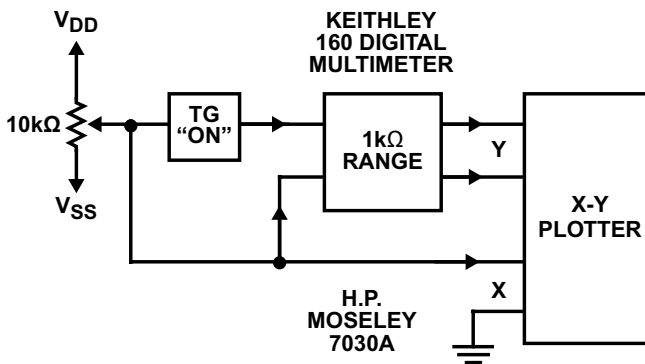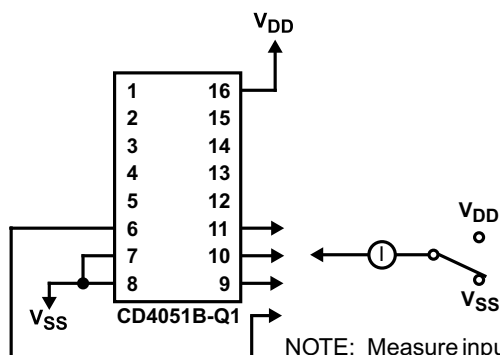

Figure 6-10. Quiescent Device Current

Figure 6-11. Channel ON Resistance Measurement Circuit

NOTE: Measure inputs sequentially, to both V_{DD} and V_{SS} connect all unused inputs to either V_{DD} or V_{SS}.
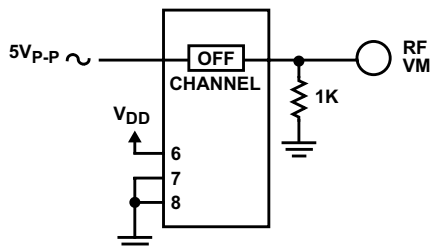
Figure 6-12. Input Current

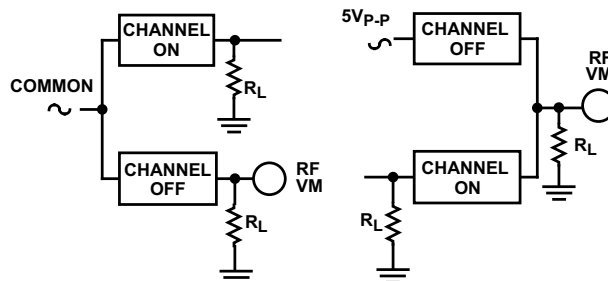**Figure 6-13. Feed-Through (All Types)**

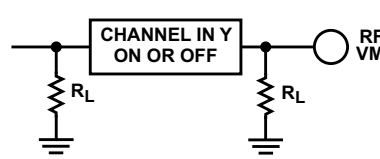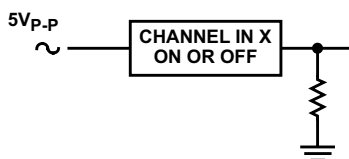**Figure 6-14. Crosstalk Between Any Two Channels (All Types)**
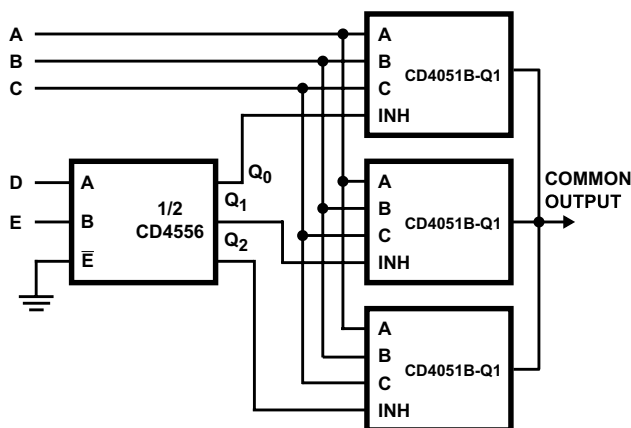
Figure 6-15. Crosstalk Between Duals or Triplets ()

**Figure 6-16. 24-to-1 MUX Addressing**

7 Detailed Description

7.1 Overview

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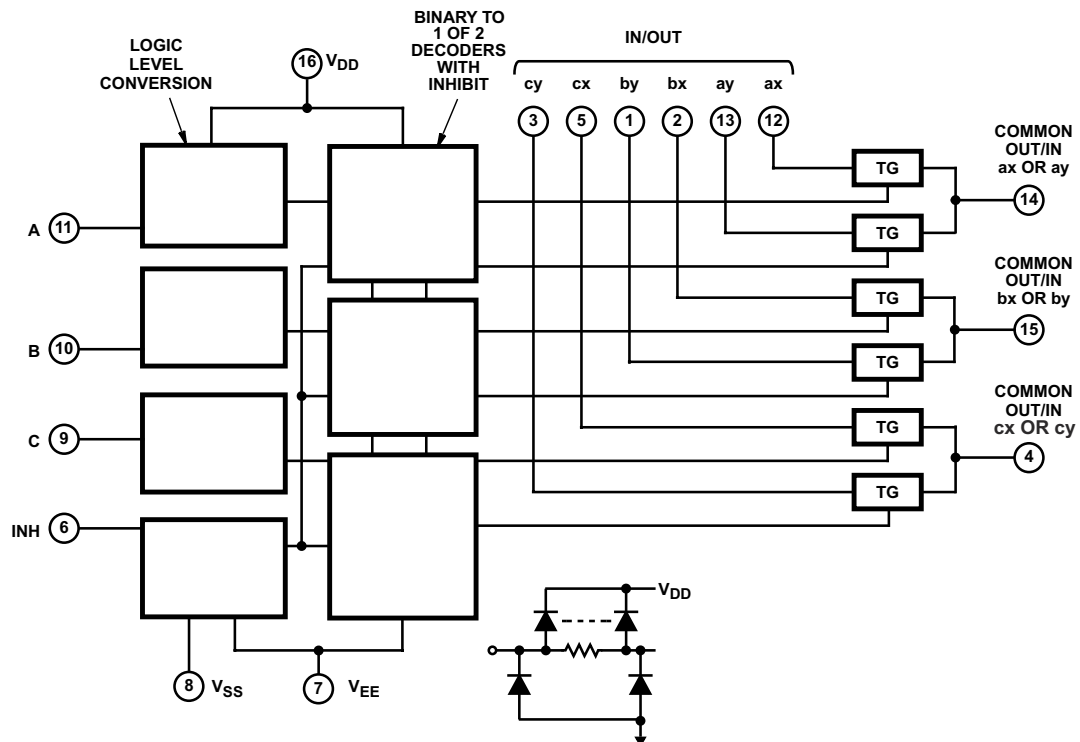
When these devices are used as demultiplexers, the CHANNEL IN/OUT terminals are the outputs and the COMMON OUT/IN terminals are the inputs.

7.2 Functional Block Diagrams
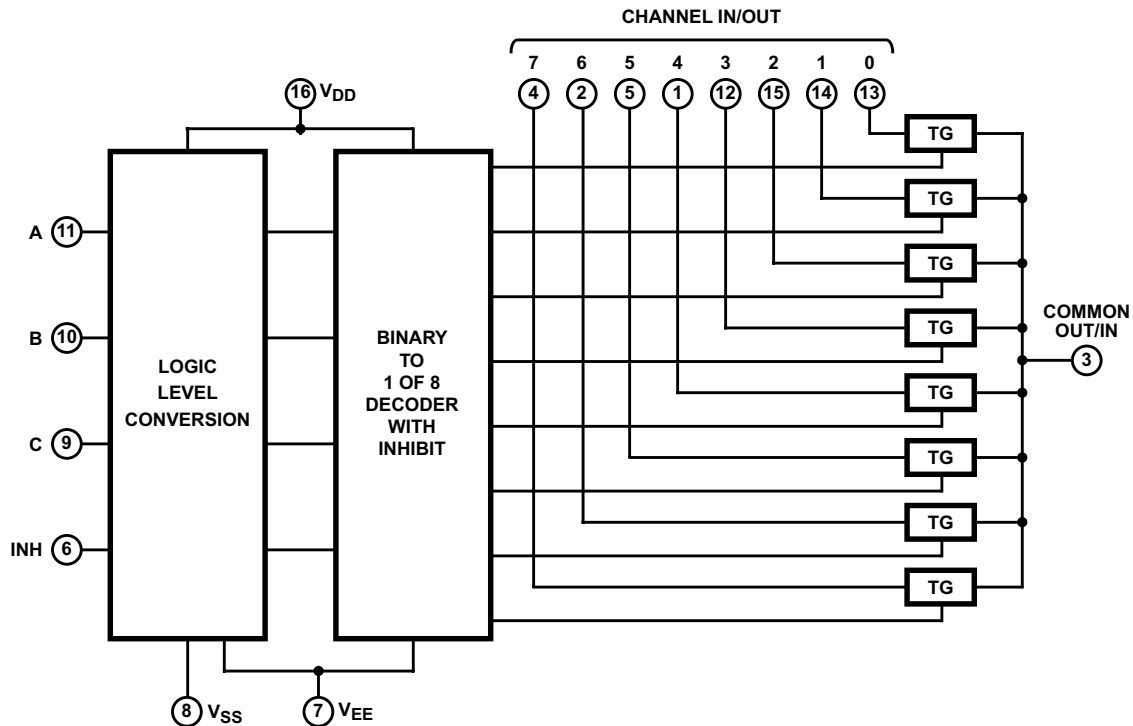
All inputs are protected by standard CMOS protection network.

Figure 7-1. Functional Block Diagram, CD4051B-Q1

All inputs are protected by standard CMOS protection network.

Figure 7-2. Functional Block Diagram,

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7.3 Feature Description

The CD4051B-Q1 line of multiplexers and demultiplexers can accept a wide range of digital and analog signal levels. Digital signals range from 3V to 20V, and analog signals are accepted at levels ≤ 20V. The devices have low ON resistance, typically 125Ω over 15$V_{P\text{-}P}$ signal input range for $V_{DD} - V_{EE}$ = 18V. This feature allows for very little signal loss through the switch.

The CD4051B-Q1 devices also have high OFF resistance, which keeps from the devices from wasting power when the switch is in the OFF position, with typical channel leakage of ±100pA at $V_{DD} - V_{EE}$ = 18V.

Binary address decoding on the chip makes channel selection simple. When channels are changed, a break-before-make system eliminates channel overlap.

7.4 Device Functional Modes

Table 7-1. Truth Table

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

Product Folder Links: *CD4051B-Q1*

8 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, as well as validating and testing their design implementation to confirm system functionality.

8.1 Application Information

The CD4051B-Q1 multiplexers and demultiplexers can be used for a wide variety of applications.

8.2 Typical Application

One application of the CD4051B-Q1 is to use it in conjunction with a microcontroller to poll a keypad. Figure 8-1 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 application is a very robust setup, allowing for multiple simultaneous key-presses with very little power consumption. This setup 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.
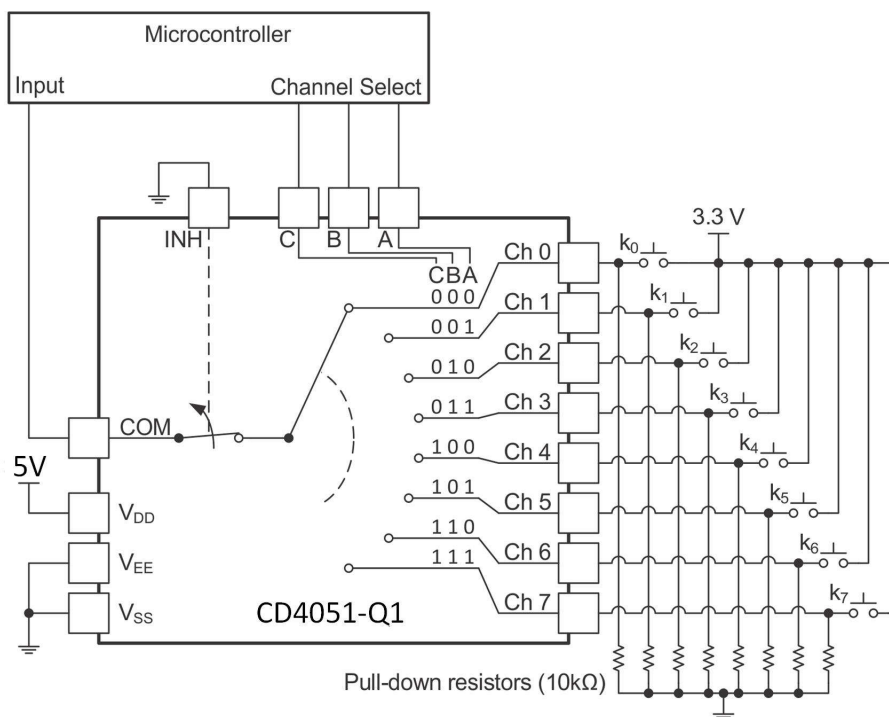

Figure 8-1. The CD4051B-Q1 Being Used to Help Read Button Presses on a Keypad

8.2.1 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.

8.2.2 Detailed Design Procedure

1. Recommended Input Conditions:
   - For switch time specifications, see propagation delay times in Section 5.5.
   - Inputs should not be pushed more than 0.5V above V_{DD} or below V_{EE}.

- For input voltage level specifications for control inputs, see V_{IH} and V_{IL} in Section 5.5.
2. Recommended Output Conditions:
   - Outputs should not be pulled above V_{DD} or below V_{EE}.
3. Input or output current consideration:
   - The CD4051B-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.
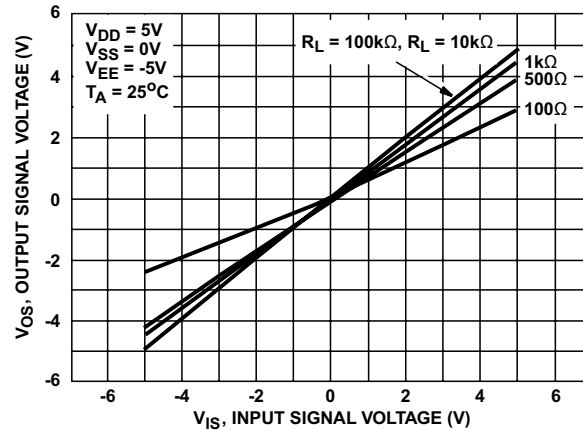
8.2.3 Application Curve

Figure 8-2. ON Characteristics for 1 of 8 Channels (CD4051B-Q1)

8.3 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the Section 5.5.

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

8.4 Layout

8.4.1 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 reflection 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 8-3 shows progressively better techniques of rounding corners. Only the last example maintains constant trace width and minimizes reflections.
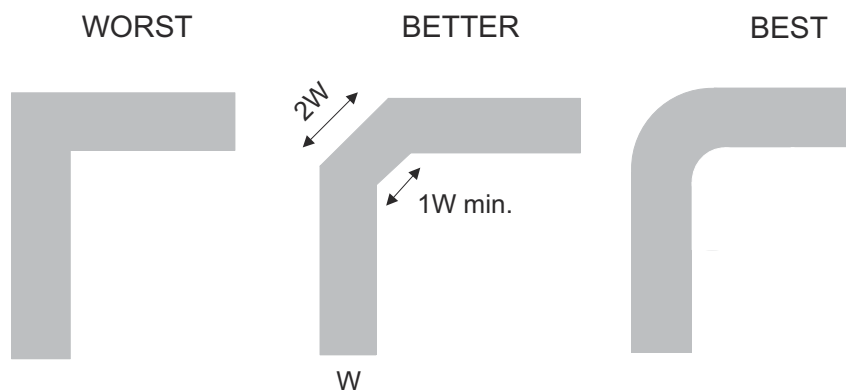
8.4.2 Layout Example

WORST   BETTER   BEST

2W

1W min.

W

Figure 8-3. Trace Example

9 Device and Documentation Support

9.1 Documentation Support

9.1.1 Related Documentation

For related documentation, see the following:

•   Texas Instruments, *Implications of Slow or Floating CMOS Inputs*

9.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

9.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

9.4 Trademarks

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

9.5 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

9.6 Glossary

TI Glossary   This glossary lists and explains terms, acronyms, and definitions.

10 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision C (March 2023) to Revision D (March 2025)	Page
• Updated Section 1	1
• Moved CD4053B-Q1 to SCHS469	1
• Updated HBM & CDM ESD values	4
• Updated Figure 8-1 to 5V VDD	18

Changes from Revision B (April 2019) to Revision C (March 2023)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document	1
• Updated CD4051-Q1 specifications throughout the data sheet	1

Changes from Revision A (January 2008) to Revision B (April 2019)	Page
• Added *Pin Configuration and Functions* section, *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section	1
• Deleted part number CD4052B-Q1 from the data sheets	1

11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CD4051BQPWRG4Q1	Obsolete	Production	TSSOP (PW) | 16	-	-	Call TI	Call TI	-40 to 125	CM051BQ
CD4051BQPWRQ1	Active	Production	TSSOP (PW) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CM051BQ
CD4051BQPWRQ1.A	Active	Production	TSSOP (PW) | 16	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	CM051BQ

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts 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.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and 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.

OTHER QUALIFIED VERSIONS OF CD4051B-Q1 :

● Catalog : CD4051B

● Military : CD4051B-MIL

NOTE: Qualified Version Definitions:

     ● Catalog - TI's standard catalog product

     ● Military - QML certified for Military and Defense Applications

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
CD4051BQPWRQ1	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)
CD4051BQPWRQ1	TSSOP	PW	16	2000	367.0	367.0	35.0
CD4051BQPWRQ1	TSSOP	PW	16	2000	367.0	367.0	35.0

PIN 1 INDEX AREA

6.6
6.2 TYP

A

14X 0.65

16

2X

4.55

5.1
4.9
NOTE 3

1

8

9

4.5
4.3
NOTE 4

B

16X 0.30
0.19

⊕ 0.1 Ⓜ C A B

SEATING PLANE

C

⌒ 0.1 C

1.2 MAX

SEE DETAIL A

(0.15) TYP

0.25
GAGE PLANE

0° -8°

0.75
0.50

0.15
0.05

DETAIL A
TYPICAL

4220204/A   02/2017

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.

16X (1.5)

SYMM

1

16X (0.45)

(R0.05) TYP

16

SYMM

14X (0.65)

8

9

(5.8)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK
OPENING

METAL

EXPOSED METAL

0.05 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.05 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS
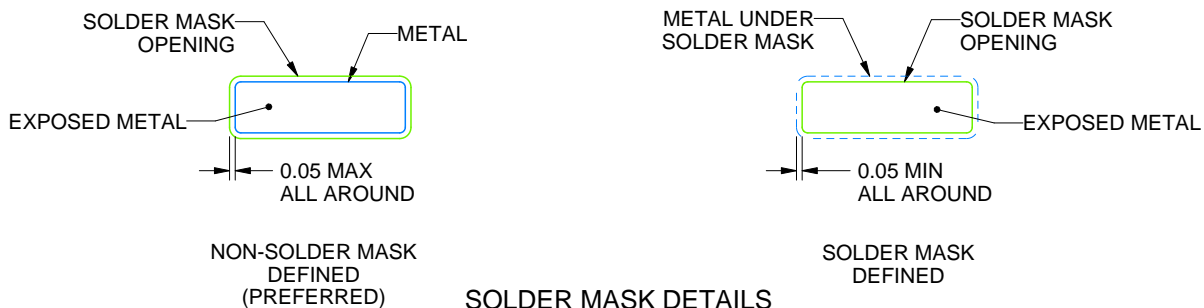
4220204/A   02/2017

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

16X (1.5)

16X (0.45)

14X (0.65)

(5.8)

SYMM

SYMM

(R0.05) TYP

1

16

8

9

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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