

CD405xB 8 チャンネルを 1 セット備えた、CMOS アナログ・マルチプレクサ/デマルチプレクサ、ロジック・レベル変換付き

1 特長

- 幅広いデジタルおよびアナログ信号レベル:
 - デジタル: 3V ~ 20V
 - アナログ: 20V_{P-P} 以下
- 単電源電圧範囲: 3V ~ 20V (V_{DD} が 3V 未満の場合は性能が低下)
- 両電源電圧範囲: ±3V ~ ±10V
- 低いオン抵抗、V_{DD} = 15V の信号入力範囲で、125Ω (代表値)
- V_{DD} = 15V で ±10pA (代表値) という低いチャネルリーク
- 低静止電力消費量: 0.2μW (標準値)
- Break-Before-Make スイッチングにより、チャネルのオーバーラップを排除
- 双方向の信号パス
- ESD 保護 (HBM): 3000V、CDM: 2000V
- 業界標準の 4051 マルチプレクサとピン互換

2 アプリケーション

- アナログおよびデジタルの多重化 / 多重分離
- アナログ・デジタルおよびデジタル・アナログ変換
- 信号ゲーティング
- ファクトリ・オートメーション
- テレビ
- 電化製品
- 民生用オーディオ
- プログラム可能な論理回路
- センサ

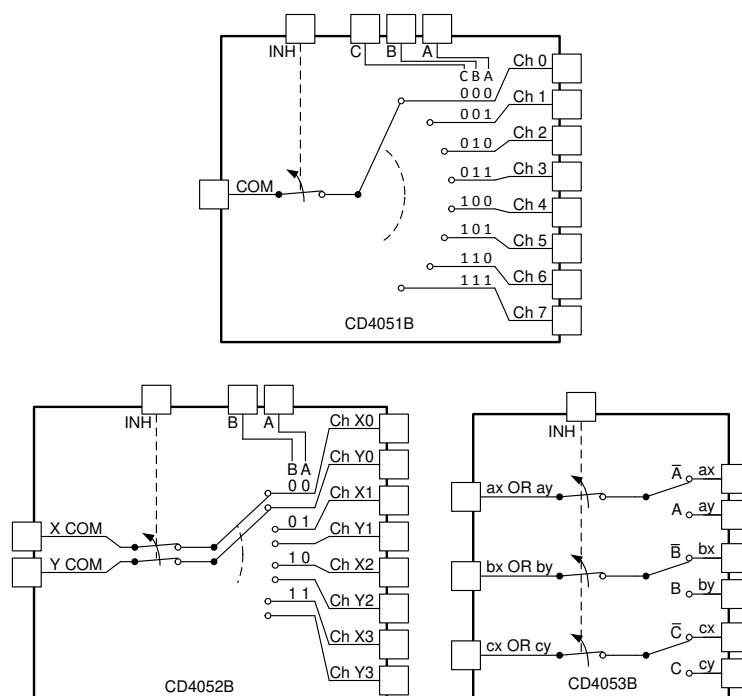
3 概要

CD405xB アナログ マルチプレクサ / デマルチプレクサは、オン状態のインピーダンスが低くオフ状態のリーク電流が非常に小さいデジタル制御のアナログ スイッチです。これらのマルチプレクサ回路は、制御信号の論理状態にかかわらず、V_{DD} - V_{SS} および V_{DD} - V_{EE} の電源電圧範囲全体にわたって非常に小さな静止電力しか消費しません。

パッケージ情報

部品番号	パッケージ (1)	パッケージ サイズ (2)
CD405xB	J (CDIP, 16)	19.50mm × 6.92mm
	N (PDIP, 16)	19.3mm × 9.4mm
	D (SOIC, 16)	9.9mm × mm
	NS (SOP, 16)	10.2mm × 7.8mm
	PW (TSSOP, 16)	5mm × 6.4mm

- 利用可能なすべてのパッケージについては、データシートの末尾にある注文情報を参照してください。
- パッケージ サイズ (長さ × 幅) は公称値であり、該当する場合はピンも含まれます。



CD4051B の機能図



Table of Contents

1 特長	1	7.4 Device Functional Modes.....	18
2 アプリケーション	1	8 Application and Implementation	19
3 概要	1	8.1 Application Information.....	19
4 Pin Configuration and Functions	3	8.2 Typical Application.....	19
5 Specifications	5	8.3 Power Supply Recommendations.....	20
5.1 Absolute Maximum Ratings.....	5	8.4 Layout.....	21
5.2 ESD Ratings.....	5	9 Device and Documentation Support	22
5.3 Recommended Operating Conditions.....	5	9.1 Documentation Support.....	22
5.4 Thermal Information.....	5	9.2 ドキュメントの更新通知を受け取る方法.....	22
5.5 Electrical Characteristics.....	6	9.3 サポート・リソース.....	22
5.6 AC Performance Characteristics.....	10	9.4 Trademarks.....	22
5.7 Typical Characteristics.....	11	9.5 静電気放電に関する注意事項.....	22
6 Parameter Measurement Information	11	9.6 用語集.....	22
7 Detailed Description	15	10 Revision History	23
7.1 Overview.....	15	11 Mechanical, Packaging, and Orderable Information	23
7.2 Functional Block Diagrams.....	16		
7.3 Feature Description.....	17		

4 Pin Configuration and Functions

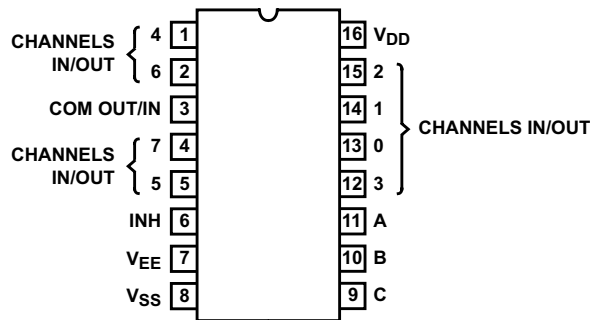


図 4-1. CD4051B E, M, NS, and PW Package, 16-Pin PDIP, CDIP, SOIC, SOP, and TSSOP (Top View)

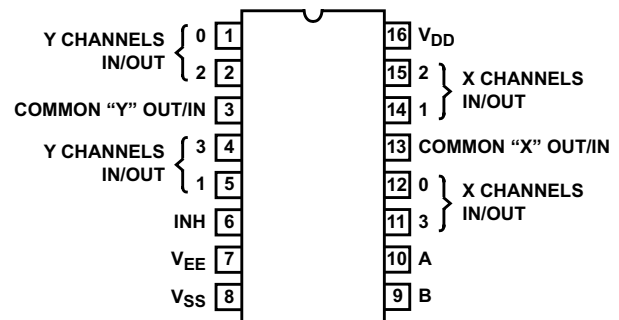


図 4-2. CD4052B E, M, NS, and PW Package, 16-Pin PDIP, CDIP, SOP, and TSSOP (Top View)

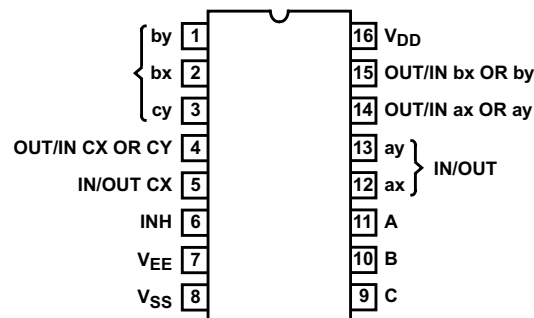


図 4-3. CD4053B E, M, NS, and PW Package, 16-Pin PDIP, CDIP, SOP, and TSSOP (Top View)

表 4-1. Pin Functions CD4051B

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 表 7-1.
7	V _{EE}	—	Negative power input
8	V _{SS}	—	Ground
9	C	I	Channel select C. See 表 7-1.
10	B	I	Channel select B. See 表 7-1.
11	A	I	Channel select A. See 表 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

表 4-2. Pin Functions CD4052B

PIN		TYPE ⁽¹⁾	DESCRIPTION
NO.	NAME		
1	Y CH 0 IN/OUT	I/O	Channel Y0 in/out
2	Y CH 2 IN/OUT	I/O	Channel Y2 in/out
3	Y COM OUT/IN	I/O	Y common out/in
4	Y CH 3 IN/OUT	I/O	Channel Y3 in/out
5	Y CH 1 IN/OUT	I/O	Channel Y1 in/out
6	INH	I	Disables all channels. See 表 7-1.
7	V _{EE}	—	Negative power input
8	V _{SS}	—	Ground
9	B	I	Channel select B. See 表 7-1.
10	A	I	Channel select A. See 表 7-1.
11	X CH 3 IN/OUT	I/O	Channel X3 in/out
12	X CH 0 IN/OUT	I/O	Channel X0 in/out
13	X COM IN/OUT	I/O	X common out/in
14	X CH 1 IN/OUT	I/O	Channel in/out
15	X CH 2 IN/OUT	I/O	Channel in/out
16	V _{DD}	—	Positive power input

(1) I = input, O = output

表 4-3. Pin Functions CD4053B

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

(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

5.4 Thermal Information

THERMAL METRIC ⁽¹⁾		CD405x				UNIT
		E (PDIP)	M (SOIC)	NS (SOP)	PW (TSSOP)	
		16 PINS	16 PINS	16 PINS	16 PINS	
R _{θJA}	Junction-to-ambient thermal resistance	67	73	64	116.5	°C/W

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

5.5 Electrical Characteristics

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5\text{V}$, and $R_L = 100\Omega$, (unless otherwise noted)⁽¹⁾

PARAMETER	TEST CONDITIONS					MIN	TYP	MAX	UNIT
SIGNAL INPUTS (V _{IS}) AND OUTPUTS (V _{OS})									
	V _{IS} (V)	V _{EE} (V)	V _{SS} (V)	V _{DD} (V)	TEMP				
Quiescent Device Current, I _{DD} Max		0V	0V	5V	–55°C	60		μA	
					–40°C	60			
					25°C	17 60			
					85°C	150			
					125°C	150			
		0V	0V	10V	–55°C	60			
					–40°C	60			
					25°C	18 60			
					85°C	300			
					125°C	300			
	0V	0V	15V	–55°C	60				
				–40°C	60				
				25°C	18 60				
				85°C	600				
				125°C	600				
	0V	0V	20V	–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 ≤ V _{IS} ≤ V _{DD}		0V	0V	5V	–55°C	800		Ω	
					–40°C	850			
					25°C	470 1050			
					85°C	1200			
					125°C	1300			
	0V	0V	10V	–55°C	310				
				–40°C	300				
				25°C	180 400				
				85°C	520				
				125°C	550				
	0V	0	15V	–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}		0V	0V	5V	25°C	15		Ω	
		0V	0V	10V		10			
		0V	0V	15V		5			

5.5 Electrical Characteristics (続き)

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5\text{V}$, and $R_L = 100\Omega$, (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)			0V	0V	18V	–55°C			± 100	nA
						–40°C			± 100	
						25°C		± 0.3	± 100 (2)	
						85°C			± 1000 (2)	
						125°C			± 1000 (2)	
ON Channel Leakage Current: Any Channel ON (Max) or ALL Channels ON (COMMON OUT/IN) (Max)			5 or 0	–5V	0V	10.5V	85°C		± 300	nA
			5	0V	0V	18V	85°C		± 300	
Capacitance	Input, C_{IS}		0V	0V	10V	25°C			5	pF
	Output, C_{OS}	CD4051							30	
	Output, C_{OS}	CD4052							18	
	Output, C_{OS}	CD4053							9	
	Feed through, C_{IOS}								0.2	
Prop Delay			V_{DD}	$R_L = 200\text{k}\Omega$	5V	25°C			30	ns
				$C_L = 50\text{pF}$	10V				15	
				$t_r, t_f = 20\text{ns}$	15V				10	

5.5 Electrical Characteristics (続き)

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5\text{V}$, and $R_L = 100\Omega$, (unless otherwise noted)⁽¹⁾

PARAMETER				TEST CONDITIONS				MIN	TYP	MAX	UNIT
CONTROL (ADDRESS OR INHIBIT), V _C											
Input Low Voltage, V _{IL} , Max						5V	−55°C	0.8		V	
							−40°C	0.8			
							25°C	0.8			
							85°C	0.8			
							125°C	0.8			
						10V	−55°C	0.8			
							−40°C	0.8			
							25°C	0.8			
							85°C	0.8			
							125°C	0.8			
						15V	−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						5V	−55°C	3.5		V	
							−40°C	3.5			
							25°C	3.5			
							85°C	3.5			
							125°C	3.5			
						10V	−55°C	7			
							−40°C	7			
							25°C	7			
							85°C	7			
							125°C	7			
						15V	−55°C	11			
							−40°C	11			
							25°C	11			
							85°C	11			
							125°C	11			
Input current, I _{IN} (Max)				V _{IN} = 0, 18		18V	−55°C	±1		μA	
							−40°C	±1			
							25°C	±0.6			
							85°C	±1			
							125°C	±1			
Propa- gation 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 = 50pF, R _L = 10kΩ	0V	0V	5V		450	720	ns
					0V	0V	10V		160	320	
					0V	0V	15V		120	240	
					−5V	0V	5V		225	450	

5.5 Electrical Characteristics (続き)

Over operating free-air temperature range, $V_{\text{SUPPLY}} = \pm 5\text{V}$, and $R_L = 100\Omega$, (unless otherwise noted)⁽¹⁾

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

(1) Peak-to-Peak voltage symmetrical about $(V_{\text{DD}} - V_{\text{EE}}) / 2$.

(2) Determined by minimum feasible leakage measurement for automatic testing.

5.6 AC Performance Characteristics

$V_{DD} = +15V$, $V_{SS} = V_{EE} = 0V$, $T_A = 25^\circ C$ (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	CD4053	30	MHz
		10	1		CD4052	25	
		10	1		CD4051	20	
	V _{EE} = V _{SS} , 20Log(V _{OS} /V _{IS}) = –3dB			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} = 1kHz Sine Wave						
–40dB Feedthrough Frequency (All Channels OFF)	5 ⁽¹⁾	10	1	V _{OS} at Common OUT/IN	CD4053	8	MHz
					CD4052	10	
					CD4051	12	
	V _{EE} = V _{SS} , 20Log(V _{OS} /V _{IS}) = –40dB			V _{OS} at Any Channel		8	
–40dB Signal Crosstalk Frequency	5 ⁽¹⁾	10	1			3	MHz
	V _{EE} = V _{SS} , 20Log(V _{OS} /V _{IS}) = –3dB			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 = 20ns, mV _{PEAK} 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.

5.7 Typical Characteristics

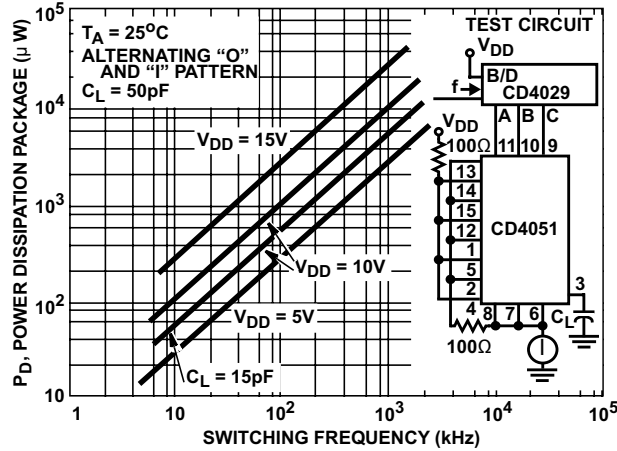


図 5-1. Dynamic Power Dissipation vs Switching Frequency (CD4051B)

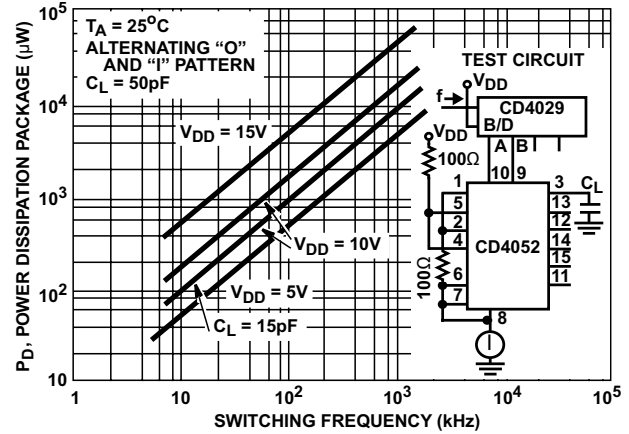


図 5-2. Dynamic Power Dissipation vs Switching Frequency (CD4052B)

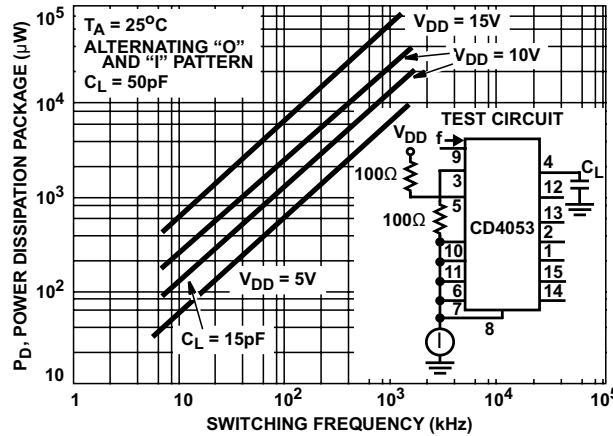


図 5-3. Dynamic Power Dissipation vs Switching Frequency (CD4053B)

6 Parameter Measurement Information

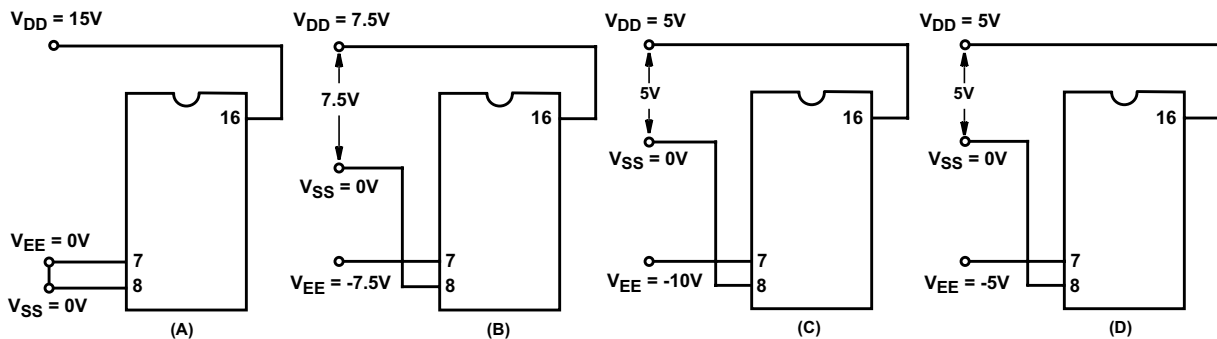


図 6-1. Typical Bias Voltages

注

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} .

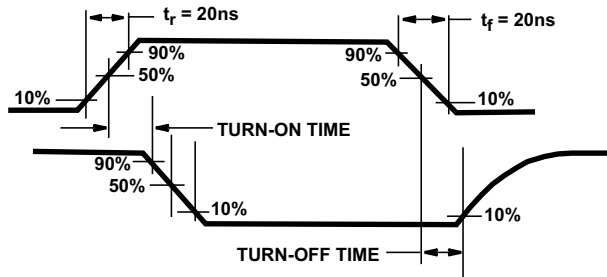


図 6-2. Waveforms, Channel Being Turned ON ($R_L = 1k\Omega$)

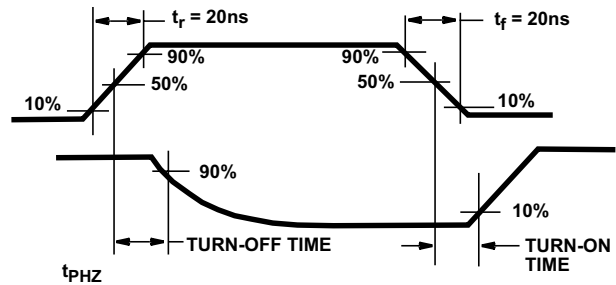


図 6-3. Waveforms, Channel Being Turned OFF ($R_L = 1k\Omega$)

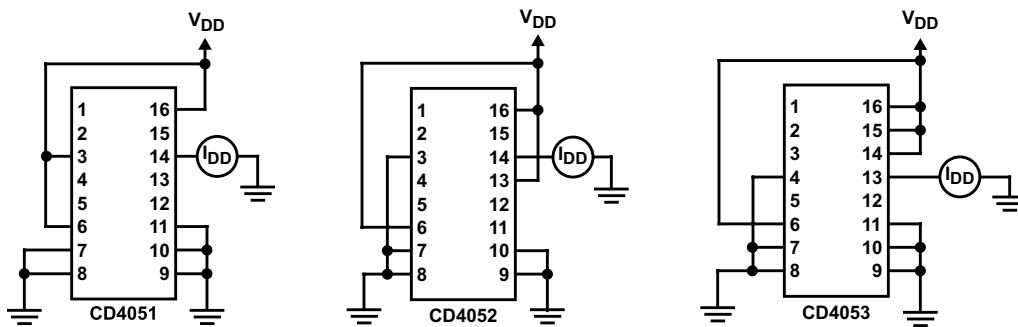
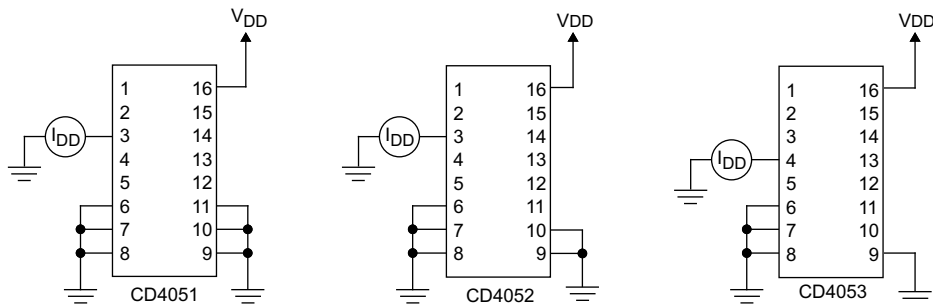


図 6-4. OFF Channel Leakage Current – Any Channel OFF



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図 6-5. On Channel Leakage Current – Any Channel On

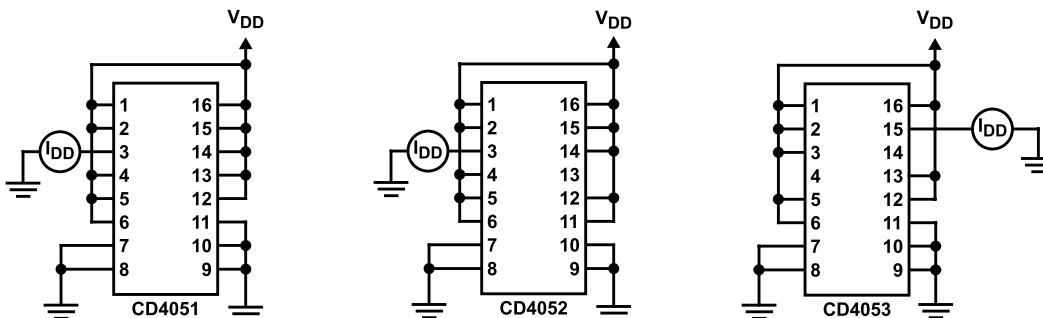


図 6-6. OFF Channel Leakage Current – All Channels OFF

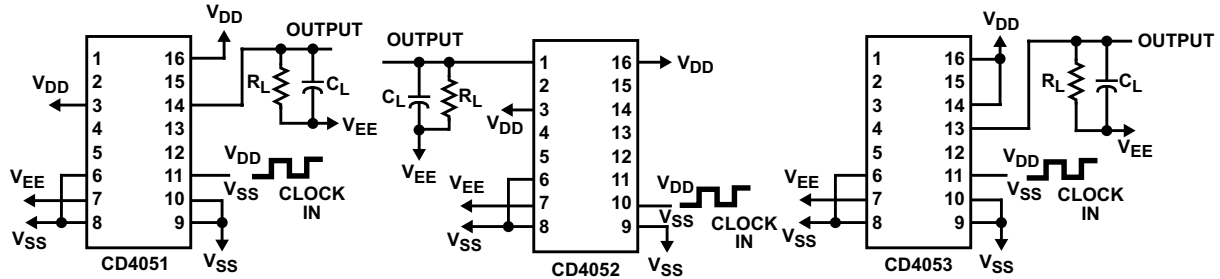


図 6-7. Propagation Delay – Address Input to Signal Output

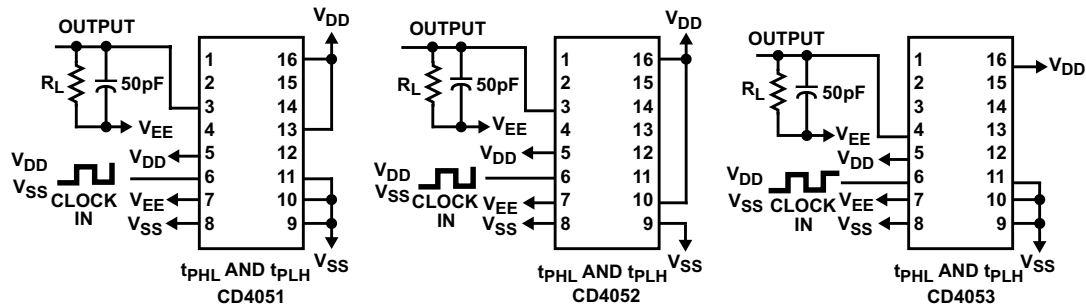


図 6-8. Propagation Delay – Inhibit Input to Signal Output

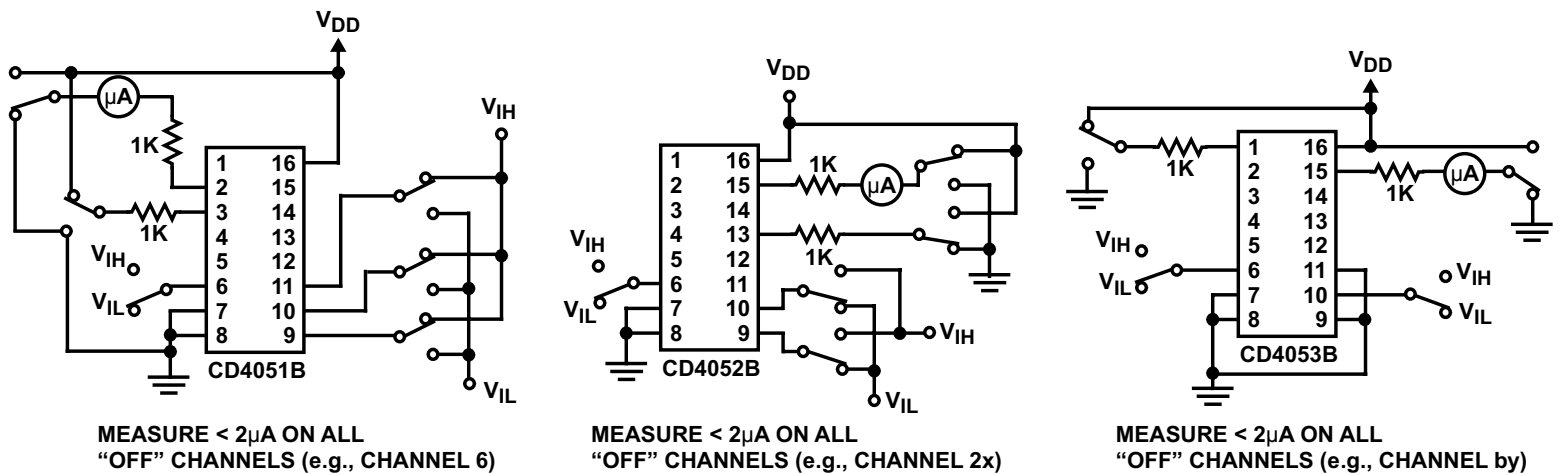


図 6-9. Input Voltage Test Circuits (Noise Immunity)

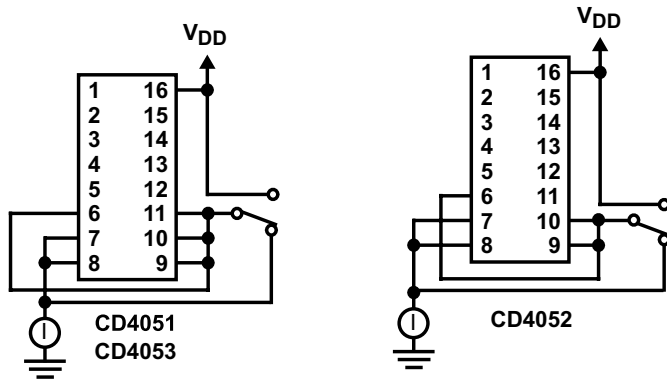


図 6-10. Quiescent Device Current

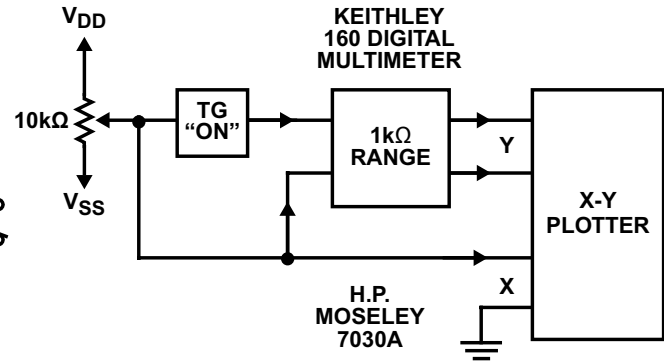


図 6-11. Channel ON Resistance Measurement Circuit

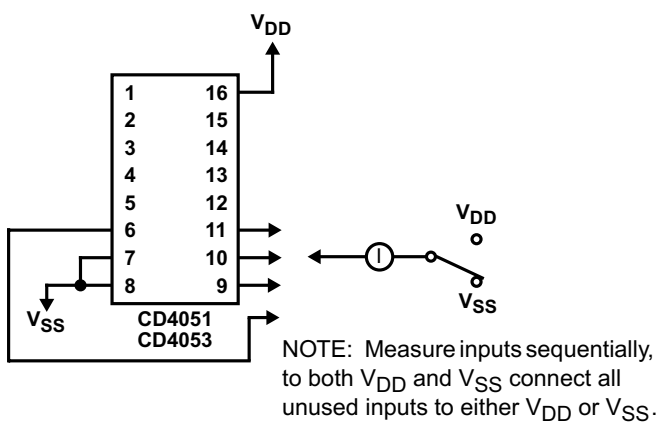


図 6-12. Input Current

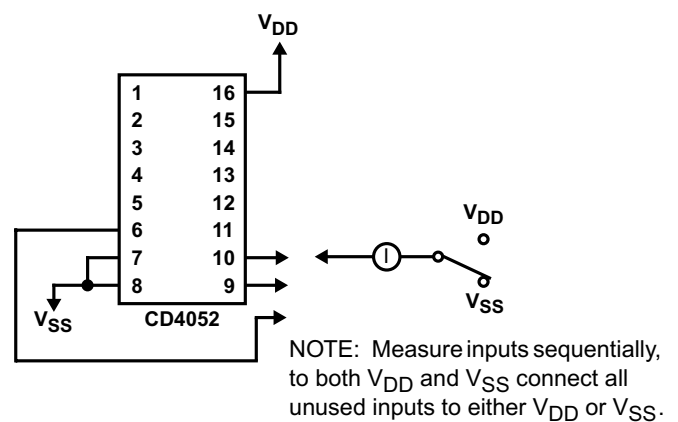


図 6-13. Feed-Through (All Types)

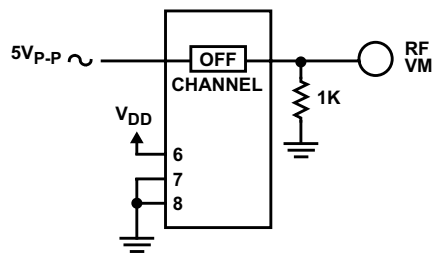


図 6-14. Crosstalk Between Any Two Channels (All Types)

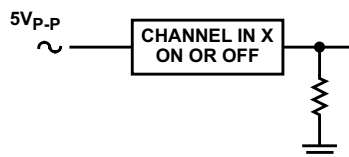
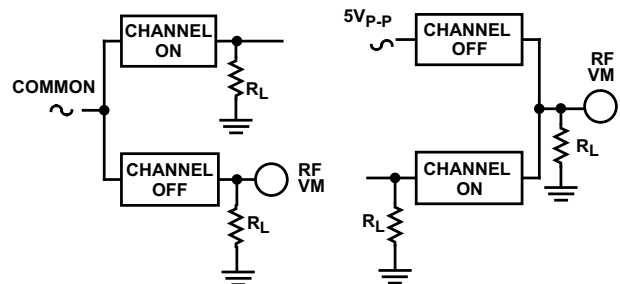
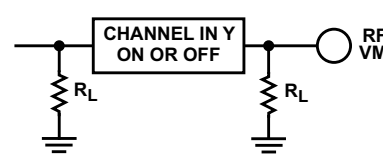
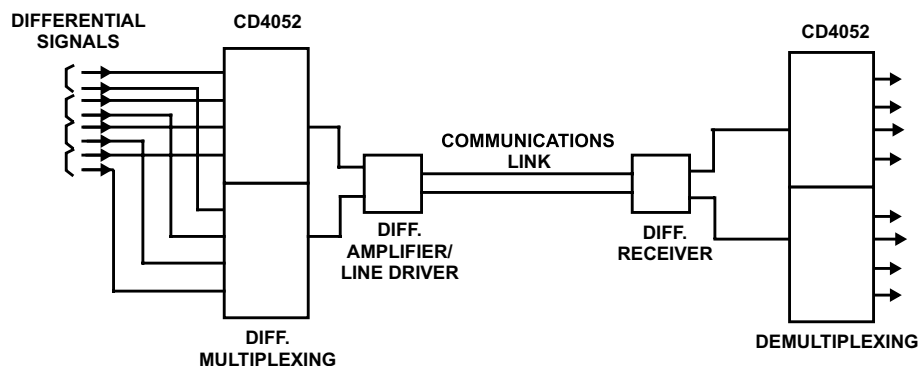


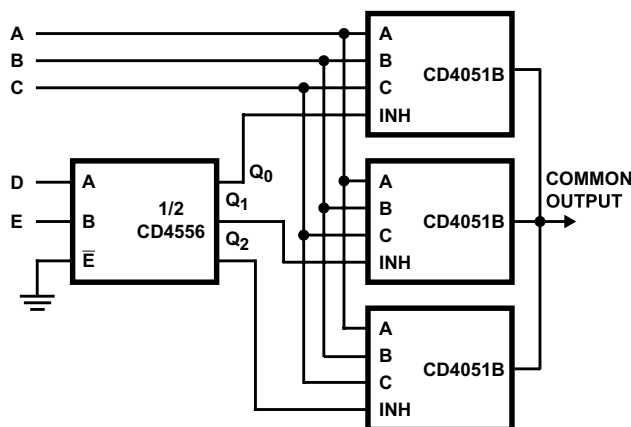
図 6-15. Crosstalk Between Duals or Triplets (CD4052B, CD4053B)





Special Considerations: In applications where separate power sources are used to drive V_{DD} and the signal inputs, the V_{DD} current capability should exceed V_{DD}/R_L (R_L = effective external load). This provision avoids permanent current flow or clamp action on the V_{DD} supply when power is applied or removed from the CD4051B, CD4052B or CD4053B.

❏ 6-16. Typical Time-Division Application of the CD4052B



❏ 6-17. 24-to-1MUX Addressing

7 Detailed Description

7.1 Overview

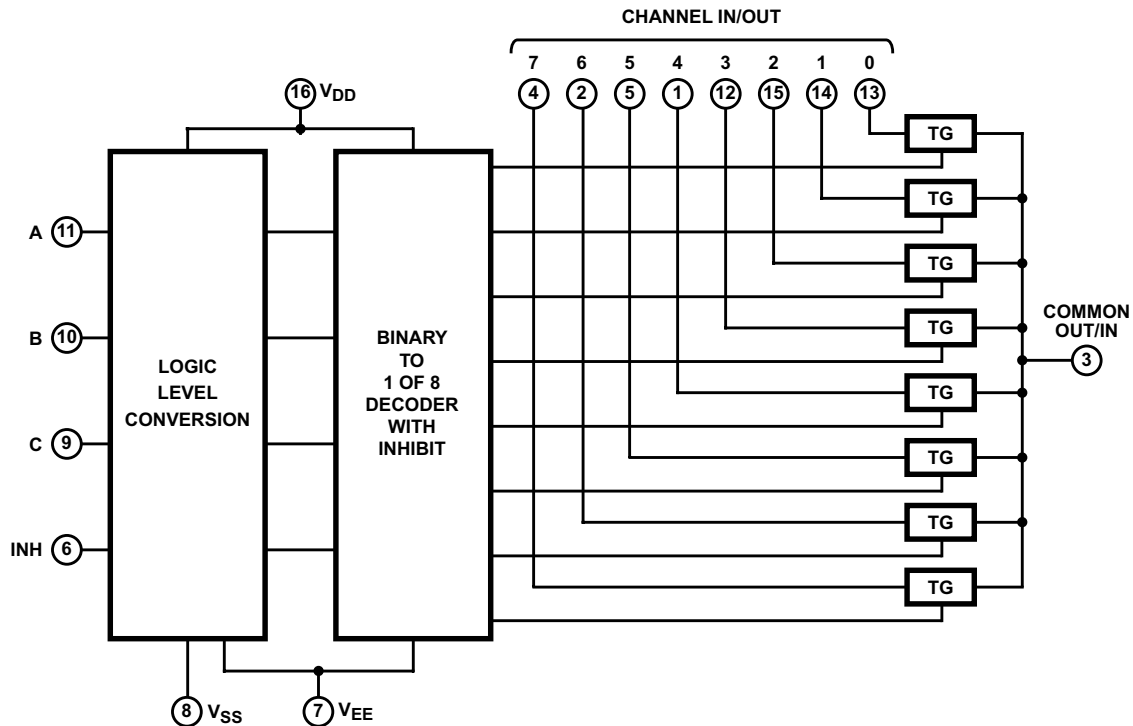
The CD4051B device is a single 8-channel multiplexer having three binary control inputs, A, B, and C, and an inhibit input. The three binary signals select 1 of 8 channels to be turned on, and connect one of the 8 inputs to the output.

The CD4052B device is a differential 4-channel multiplexer having two binary control inputs, A and B, and an inhibit input. The two binary input signals select 1 of 4 pairs of channels to be turned on and connect the analog inputs to the outputs.

The 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.

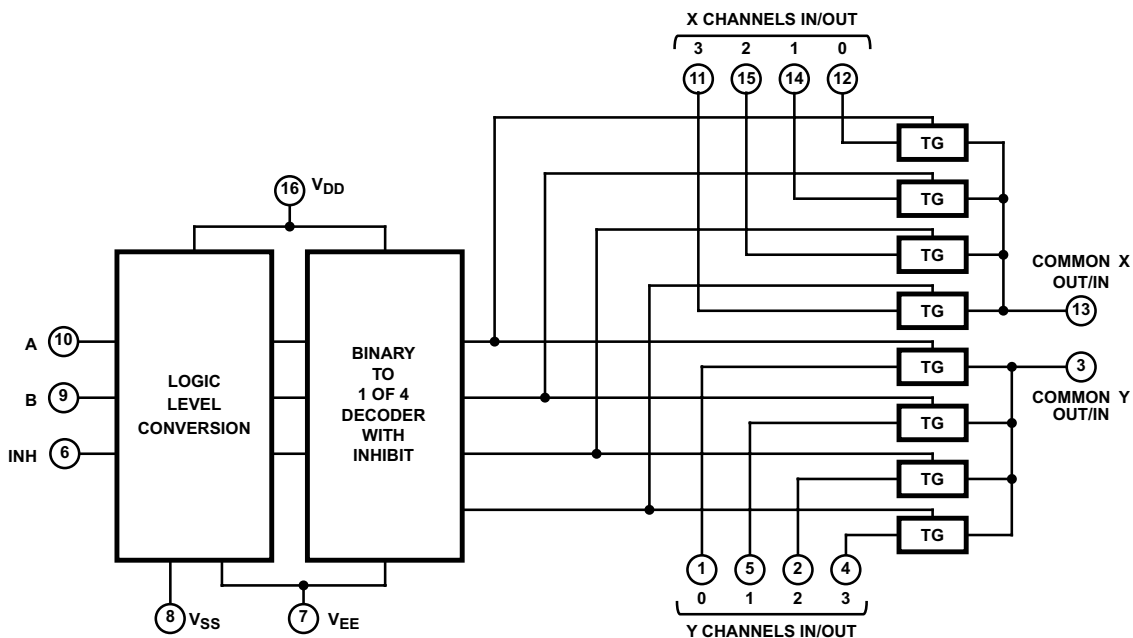
When these devices are used as demultiplexers, the CHANNEL IN/OUT terminals are the outputs and the COMMON OUT/IN terminals are the inputs.

7.2 Functional Block Diagrams



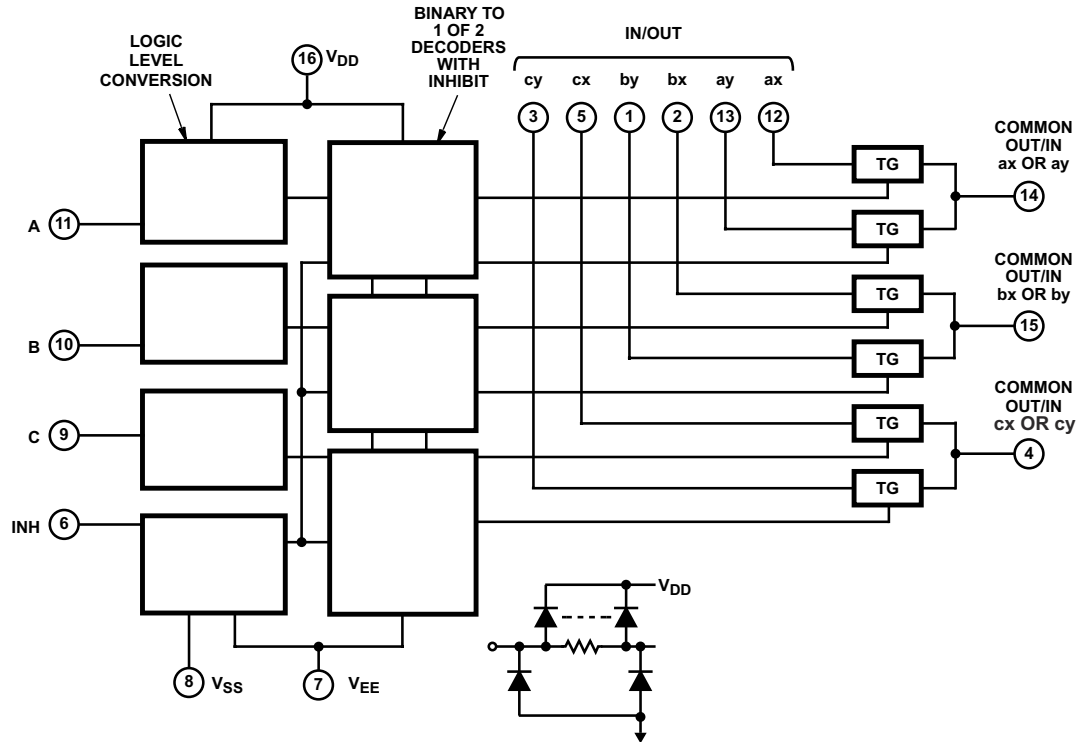
All inputs are protected by standard CMOS protection network.

図 7-1. Functional Block Diagram, CD4051B



All inputs are protected by standard CMOS protection network.

図 7-2. Functional Block Diagram, CD4052B



All inputs are protected by standard CMOS protection network.

図 7-3. Functional Block Diagram, CD4053B

7.3 Feature Description

The CD405xB 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 $\leq 20V$. The devices have low ON resistance, typically 125Ω over $15V_{P-P}$ signal input range for $V_{DD} - V_{EE} = 18V$. This feature allows for very little signal loss through the switch.

The CD405xB 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 $\pm 100pA$ 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

表 7-1. Truth Table ⁽¹⁾

INPUT STATES				ON CHANNEL(S)
INHIBIT	C	B	A	
CD4051B				
0	0	0	0	0
0	0	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	X	X	X	None
CD4052B				
0		0	0	0x, 0y
0		0	1	1x, 1y
0		1	0	2x, 2y
0		1	1	3x, 3y
1		X	X	None
CD4053B				
0	X	X	0	ax
0	X	X	1	ay
0	X	0	X	bx
0	X	1	X	by
0	0	X	X	cx
0	1	X	X	cy
1	X	X	X	None

(1) X = Do not care

8 Application and Implementation

注

以下のアプリケーション情報は、TI の製品仕様に含まれるものではなく、TI ではその正確性または完全性を保証いたしません。個々の目的に対する製品の適合性については、お客様の責任で判断していただくことになります。お客様は自身の設計実装を検証しテストすることで、システムの機能を確認する必要があります。

8.1 Application Information

The CD405xB multiplexers and demultiplexers can be used for a wide variety of applications.

8.2 Typical Application

One application of the CD4051B is to use it in conjunction with a microcontroller to poll a keypad. 図 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.

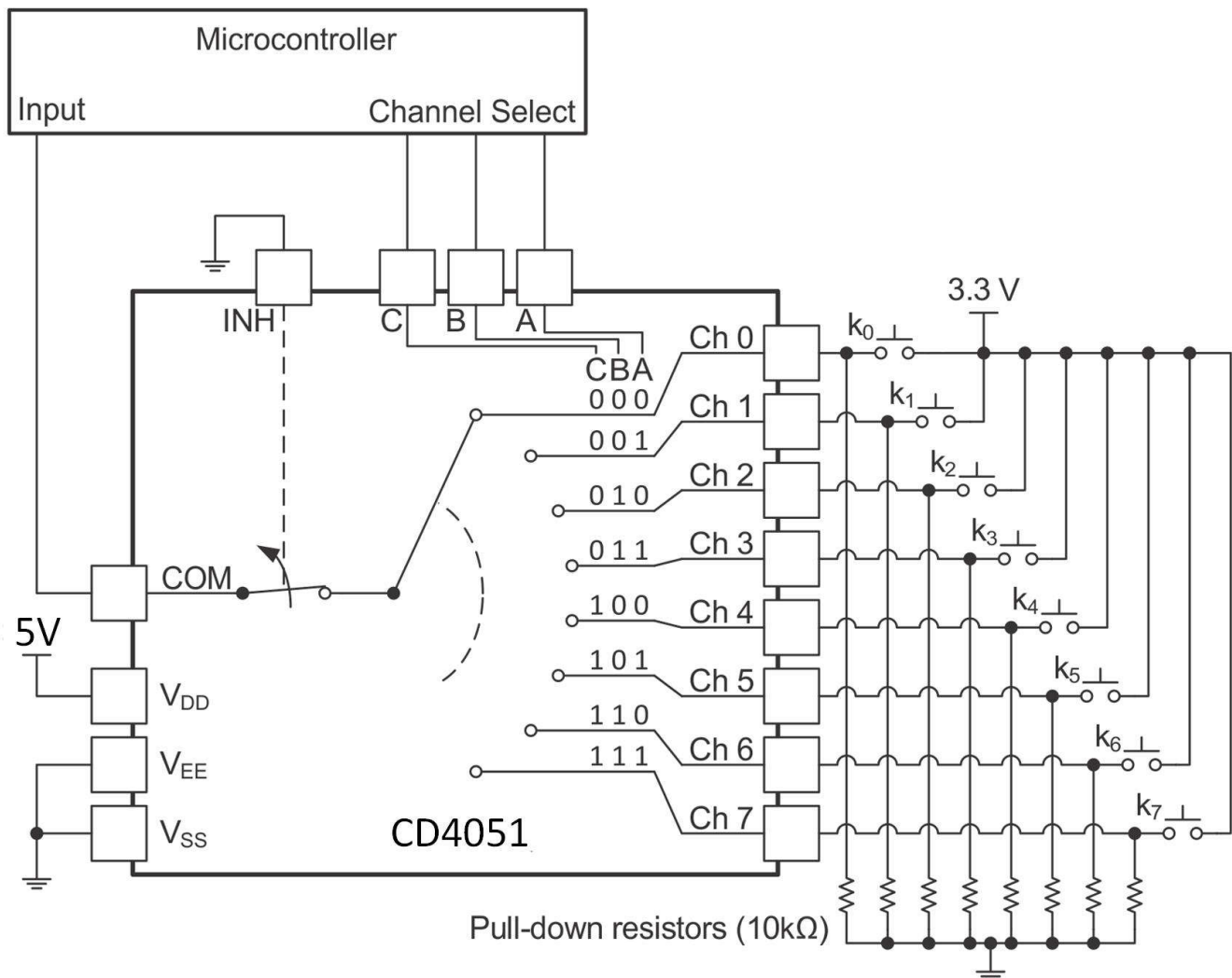


図 8-1. The CD4051B Being Used to Help Read Button Presses on a Keypad

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

- Recommended Input Conditions:
 - For switch time specifications, see propagation delay times in [Electrical Characteristics](#).
 - 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 [Electrical Characteristics](#).
- Recommended Output Conditions:
 - Outputs should not be pulled above V_{DD} or below V_{EE} .
- Input or output current consideration:
 - The CD405xB 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

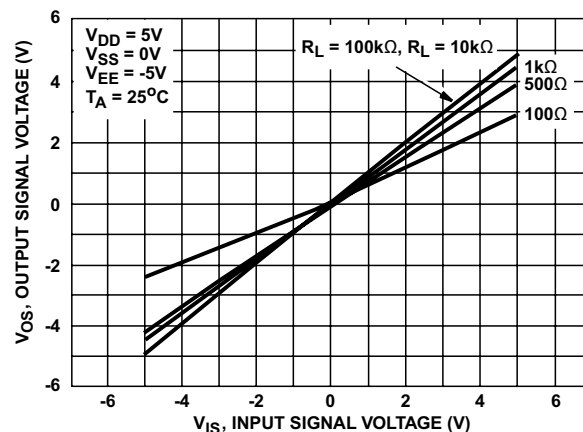


図 8-2. ON Characteristics for 1 of 8 Channels (CD4051B)

8.3 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 0.1μF 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

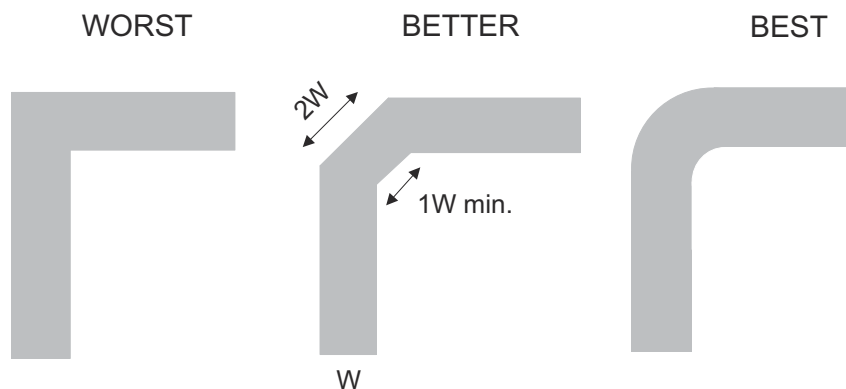


Figure 8-3. Trace Example

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 ドキュメントの更新通知を受け取る方法

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9.6 用語集

テキサス・インスツルメンツ用語集

この用語集には、用語や略語の一覧および定義が記載されています。

10 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

Changes from Revision M (November 2024) to Revision N (February 2025)	Page
• セクション 1 を更新.....	1
• Removed Figure 5-4 and Figure 5-5.....	11
• Updated セクション 7.1	15
• Updated セクション 7.3	17
• Updated Figure 8-1 to 5V VDD.....	19

Changes from Revision L (September 2023) to Revision M (November 2024)	Page
• Updated the <i>Typical Characteristics</i> section.....	11
• Added Figure 5-4 and Figure 5-5.....	11

Changes from Revision K (March 2023) to Revision L (September 2023)	Page
• 「パッケージ情報」表のフォーマットを更新し、パッケージリード サイズを追加.....	1
• Changed the format of the <i>ESD Ratings</i> , <i>Electrical Characteristics</i> , and <i>AC Performance</i> to consolidate package specifications.....	5

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.

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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)
7901502EA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7901502EA CD4052BF3A
8101801EA	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8101801EA CD4053BF3A
CD4051BE	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU NIPDAU	N/A for Pkg Type	-55 to 125	CD4051BE
CD4051BE.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4051BE
CD4051BEE4	Obsolete	Production	PDIP (N) 16	-	-	Call TI	Call TI	-55 to 125	CD4051BE
CD4051BF	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4051BF
CD4051BF.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4051BF
CD4051BF3A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4051BF3A
CD4051BF3A.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4051BF3A
CD4051BM96	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4051BM
CD4051BM96.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4051BM
CD4051BM96G3	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4051BM
CD4051BM96G4	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4051BM
CD4051BMT	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4051BM
CD4051BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4051B
CD4051BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4051B
CD4051BPW	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM051B
CD4051BPWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM051B
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CD4052BF	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4052BF
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CD4052BF3A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7901502EA CD4052BF3A

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)
CD4052BF3A.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	7901502EA CD4052BF3A
CD4052BM	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4052BM
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CD4052BM96.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4052BM
CD4052BM961G4	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4052BM
CD4052BM961G4.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4052BM
CD4052BM96G3	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4052BM
CD4052BM96G4	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4052BM
CD4052BMT	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4052BM
CD4052BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4052B
CD4052BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4052B
CD4052BPW	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM052B
CD4052BPWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM052B
CD4052BPWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM052B
CD4052BPWRG3	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM052B
CD4052BPWRG4	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM052B
CD4053BE	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4053BE
CD4053BE.A	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4053BE
CD4053BEE4	Active	Production	PDIP (N) 16	25 TUBE	Yes	NIPDAU	N/A for Pkg Type	-55 to 125	CD4053BE
CD4053BF	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4053BF
CD4053BF.A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	CD4053BF
CD4053BF3A	Active	Production	CDIP (J) 16	25 TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	8101801EA CD4053BF3A
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CD4053BM	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4053M
CD4053BM96	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4053M
CD4053BM96.A	Active	Production	SOIC (D) 16	2500 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4053M
CD4053BM96G3	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4053M
CD4053BM96G4	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4053M

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)
CD4053BMT	Obsolete	Production	SOIC (D) 16	-	-	Call TI	Call TI	-55 to 125	CD4053M
CD4053BNSR	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4053B
CD4053BNSR.A	Active	Production	SOP (NS) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4053B
CD4053BPW	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM053B
CD4053BPWR	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM053B
CD4053BPWR.A	Active	Production	TSSOP (PW) 16	2000 LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM053B
CD4053BPWRG3	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM053B
CD4053BPWRG4	Obsolete	Production	TSSOP (PW) 16	-	-	Call TI	Call TI	-55 to 125	CM053B

⁽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.

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OTHER QUALIFIED VERSIONS OF CD4051B, CD4051B-MIL, CD4052B, CD4052B-MIL, CD4053B, CD4053B-MIL :

- Catalog : [CD4051B](#), [CD4052B](#), [CD4053B](#)
- Automotive : [CD4051B-Q1](#), [CD4051B-Q1](#), [CD4053B-Q1](#), [CD4053B-Q1](#)
- Military : [CD4051B-MIL](#), [CD4052B-MIL](#), [CD4053B-MIL](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Military - QML certified for Military and Defense Applications

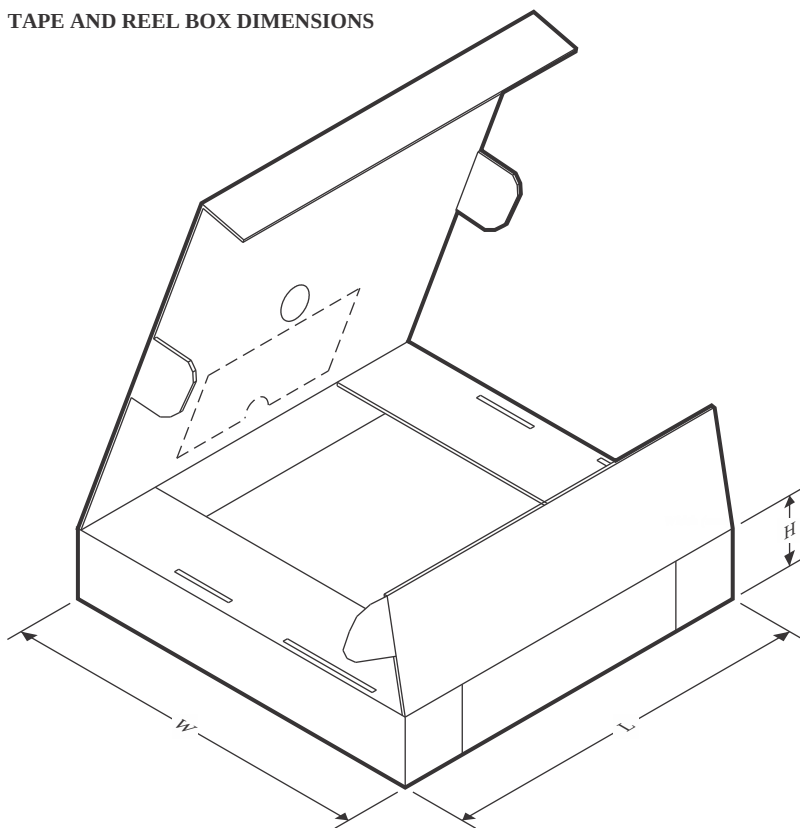
TAPE AND REEL INFORMATION



*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
CD4051BM96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4051BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD4051BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD4051BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD4052BM96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4052BM961G4	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4052BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD4052BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD4052BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD4053BM96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4053BNSR	SOP	NS	16	2000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
CD4053BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD4053BPWR	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)
CD4051BM96	SOIC	D	16	2500	353.0	353.0	32.0
CD4051BNSR	SOP	NS	16	2000	353.0	353.0	32.0
CD4051BPWR	TSSOP	PW	16	2000	367.0	367.0	35.0
CD4051BPWR	TSSOP	PW	16	2000	353.0	353.0	32.0
CD4052BM96	SOIC	D	16	2500	353.0	353.0	32.0
CD4052BM961G4	SOIC	D	16	2500	353.0	353.0	32.0
CD4052BNSR	SOP	NS	16	2000	353.0	353.0	32.0
CD4052BPWR	TSSOP	PW	16	2000	367.0	367.0	35.0
CD4052BPWR	TSSOP	PW	16	2000	353.0	353.0	32.0
CD4053BM96	SOIC	D	16	2500	353.0	353.0	32.0
CD4053BNSR	SOP	NS	16	2000	353.0	353.0	32.0
CD4053BPWR	TSSOP	PW	16	2000	353.0	353.0	32.0
CD4053BPWR	TSSOP	PW	16	2000	367.0	367.0	35.0

TUBE



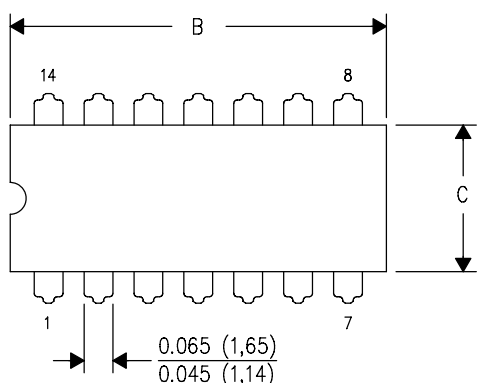
*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
CD4051BE	N	PDIP	16	25	506	13.97	11230	4.32
CD4051BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD4052BE	N	PDIP	16	25	506	13.97	11230	4.32
CD4052BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD4052BEE4	N	PDIP	16	25	506	13.97	11230	4.32
CD4053BE	N	PDIP	16	25	506	13.97	11230	4.32
CD4053BE.A	N	PDIP	16	25	506	13.97	11230	4.32
CD4053BEE4	N	PDIP	16	25	506	13.97	11230	4.32

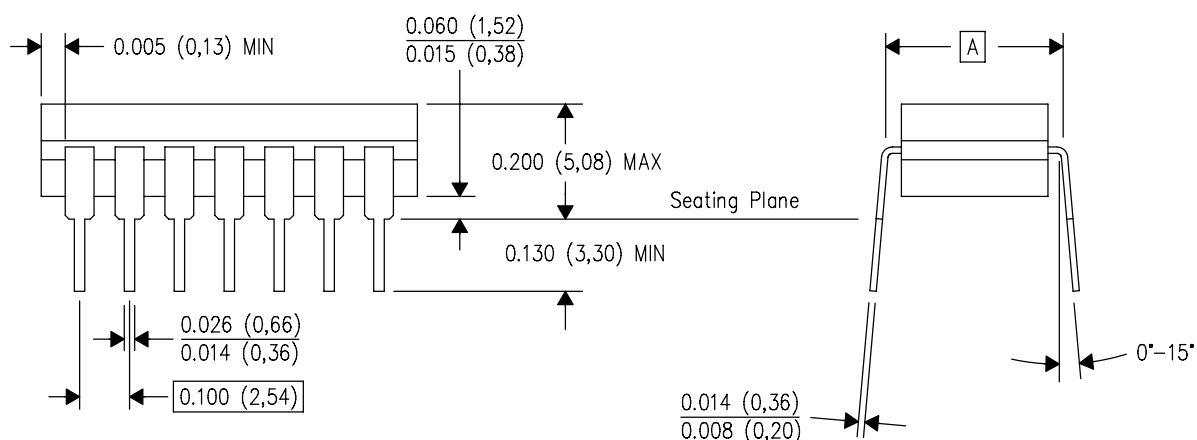
J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE

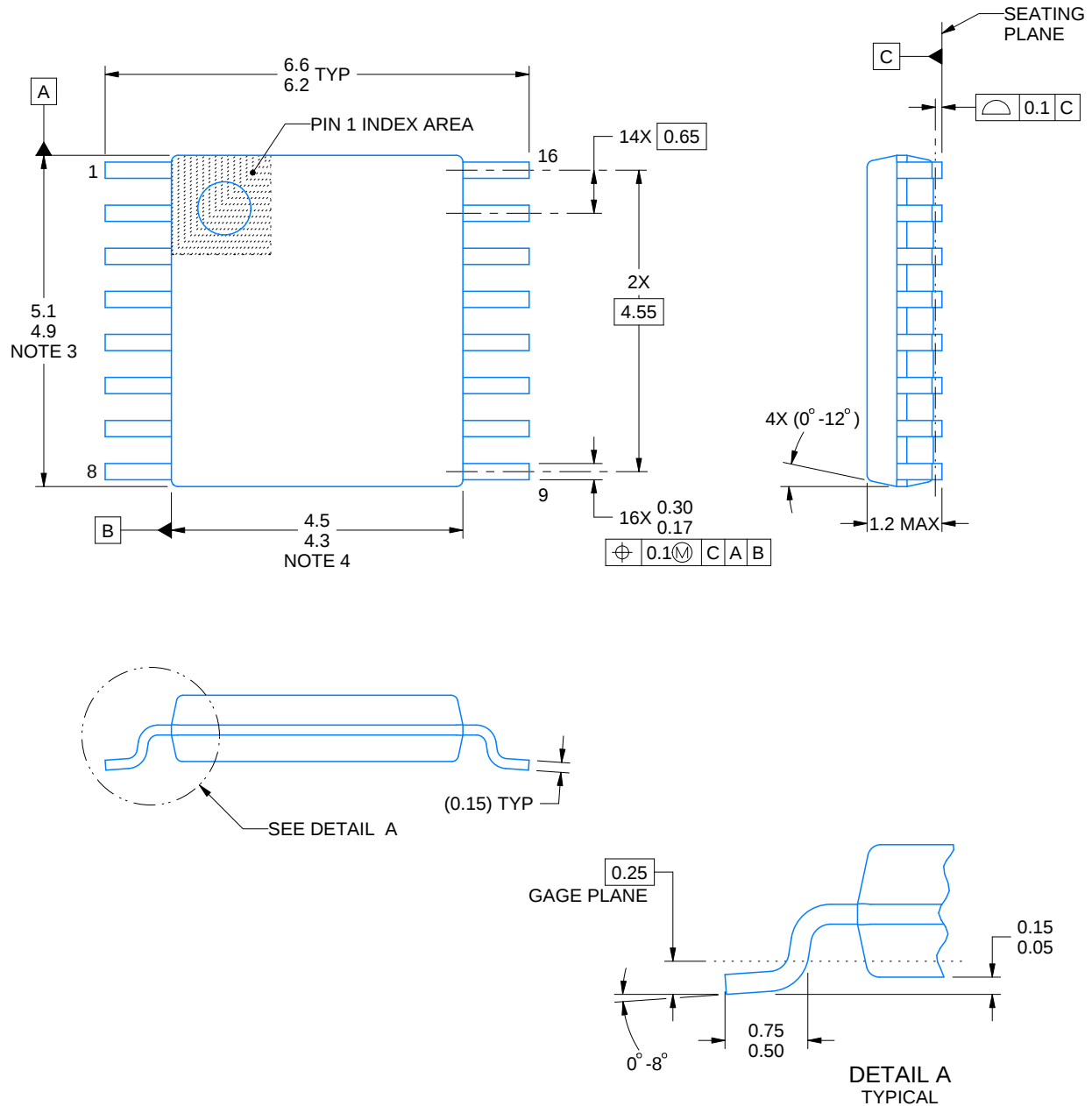


PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.



4220204/B 12/2023

NOTES:

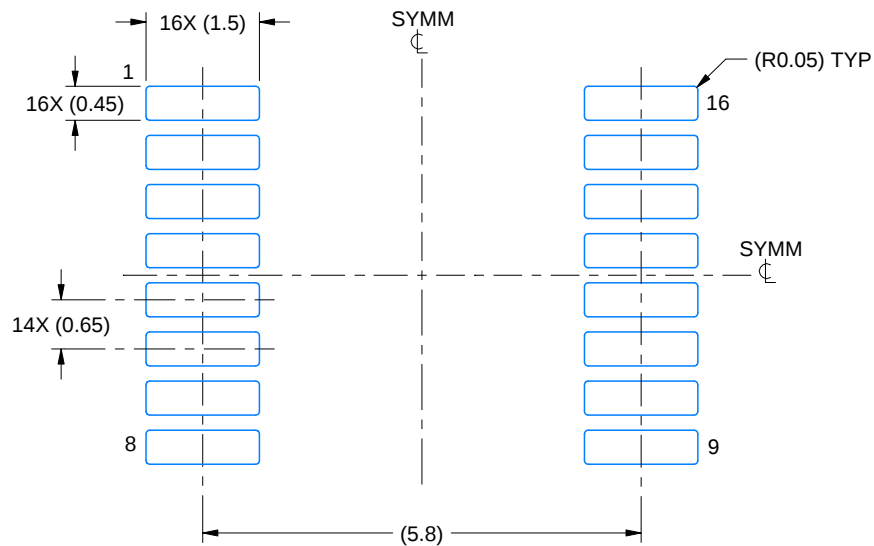
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

EXAMPLE BOARD LAYOUT

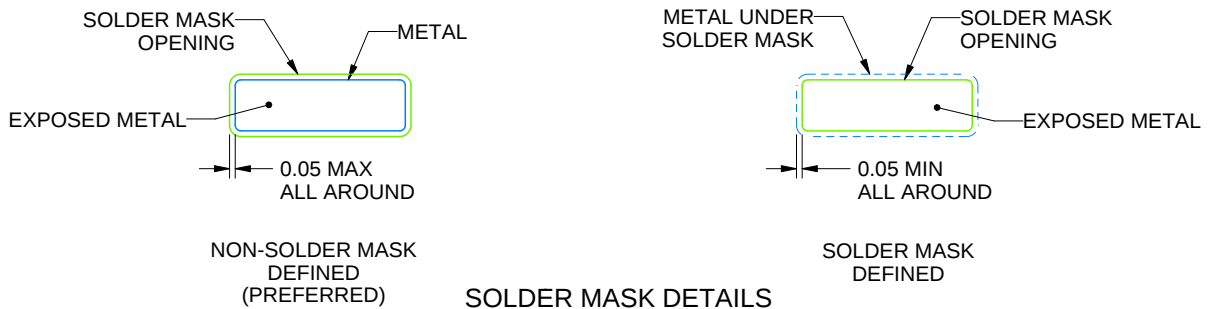
PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X



4220204/B 12/2023

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.

EXAMPLE STENCIL DESIGN

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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

4220204/B 12/2023

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.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



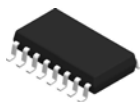
PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



4040049/E 12/2002

NOTES:

- A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
-  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 The 20 pin end lead shoulder width is a vendor option, either half or full width.

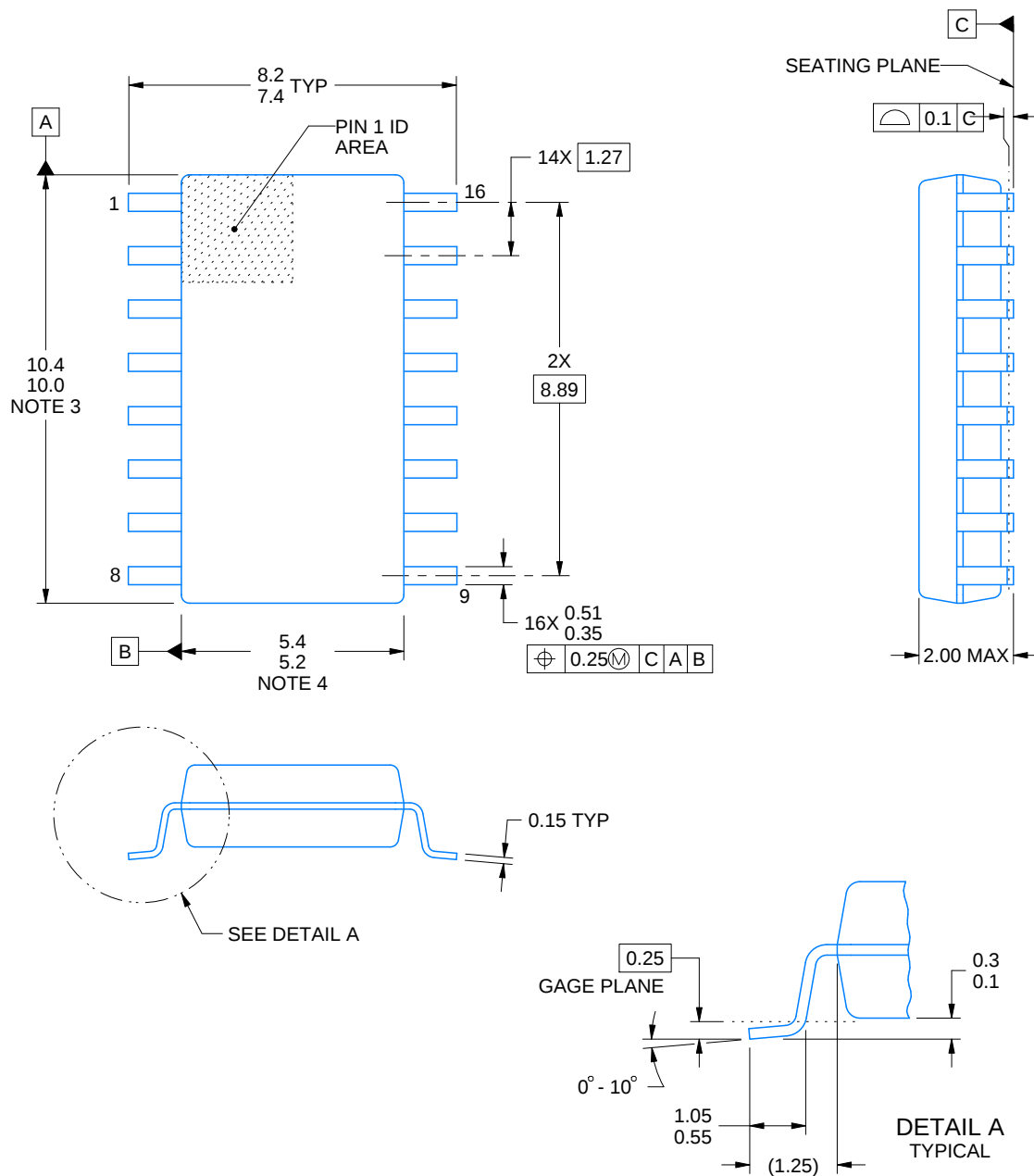


PACKAGE OUTLINE

NS0016A

SOP - 2.00 mm max height

SOP



4220735/A 12/2021

NOTES:

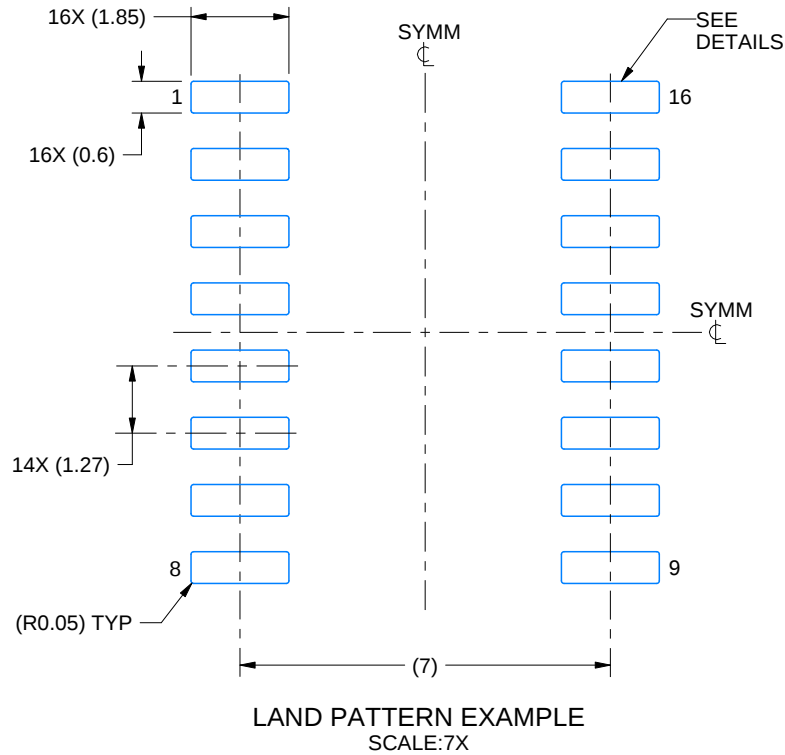
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate 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.

EXAMPLE BOARD LAYOUT

NS0016A

SOP - 2.00 mm max height

SOP

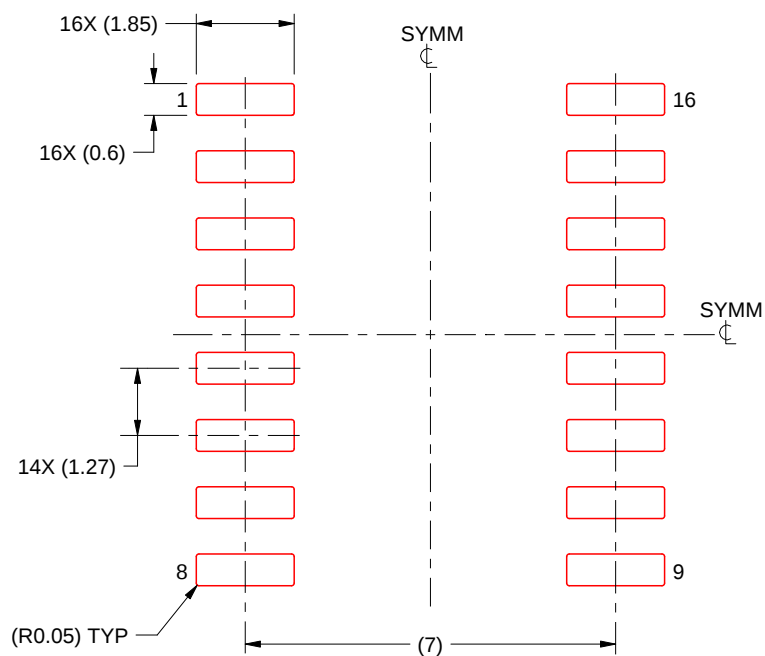


4220735/A 12/2021

NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

6. 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:7X

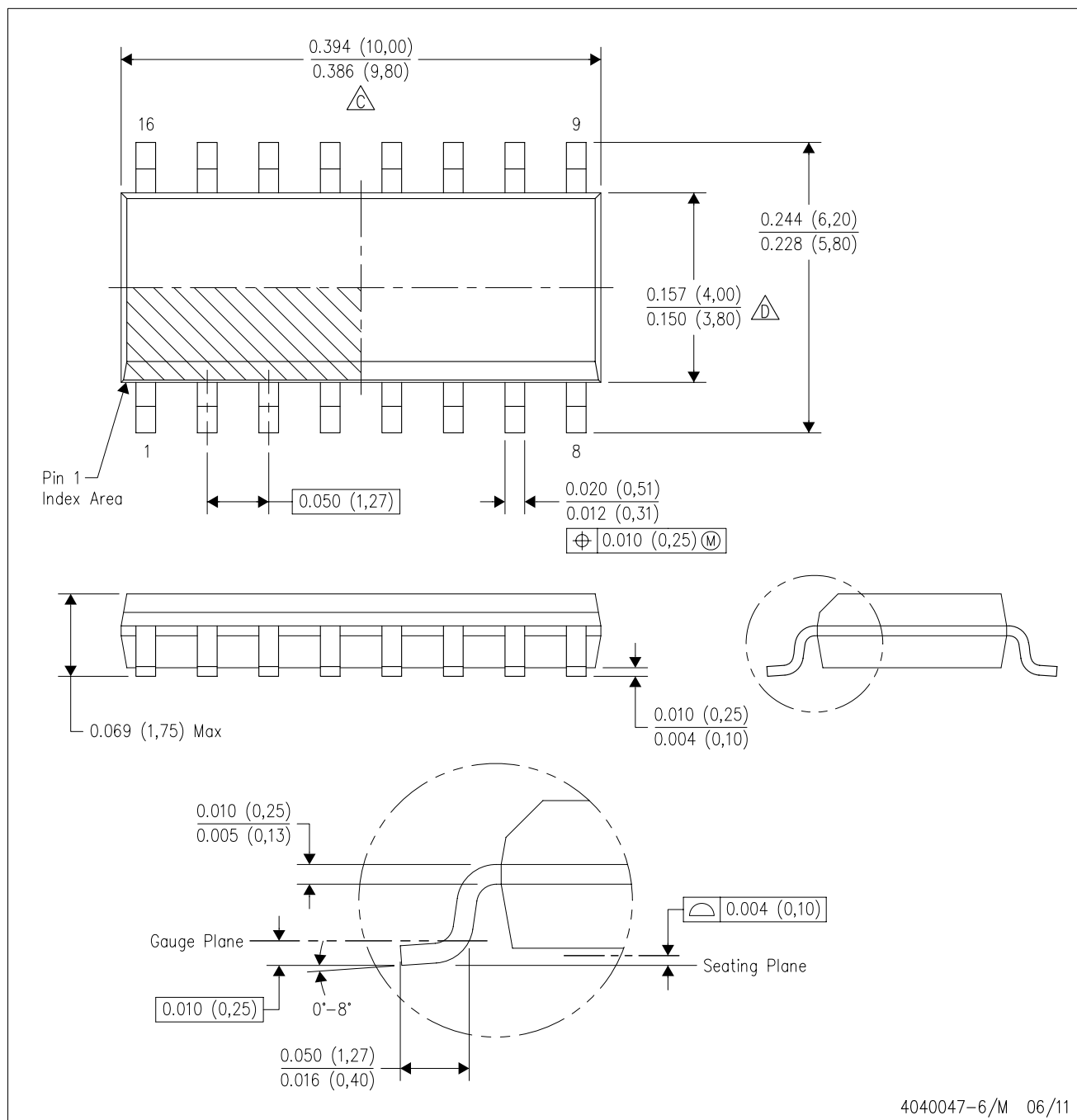
4220735/A 12/2021

NOTES: (continued)

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

D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



4040047-6/M 06/11

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.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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