CD4016B Types CMOS Quad Bilateral Switch

1 Features

- 20V digital or ± 10V peak-to-peak switching
- 280Ω typical on-state resistance for 15V operation
- Switch on-state resistance matched to within 10Ω typ over 15V signal-input range
- High on/off output-voltage ratio: 65dB typ at f_{is} = 10kHz, R_L= 10kΩ
- High degree of linearity: <0.5% distortion typ at f_{is}= 1kHz, V_{is}= $5V_{p-p}$, V_{DD} −V_{SS} 10V, R_L = 10kΩ
- Extremely low off-state switch leakage resulting in very low offset current and high effective off-state resistance: 100pA typ. at V_{DD} −V_{SS} =18V, T_A=25°C
- Extremely high control input impedance (control circuit isolated from signal circuit: 10^{12} Ω typ.
- Low crosstalk between switches: −50dB typ at f_{is} = 0.9MHz, R_L = 1kΩ
- Matched control-input to signal-output capacitance: Reduces output signal transients
- Frequency response, switch on = 40MHz (typical)
- 100% tested for quiescent current at 20V
- Maximum control input current of 1µA at 18V over full package temperature range; 100nA at 18V at 25°C
- 5V, 10V, and 15V parametric ratings

2 Applications

- Analog signal switching/multiplexing signal gating
- Modulator squelch control
- Demodulator chopper
- Commutating switch
- Digital signal switching/multiplexing
- CMOS logic implementation
- Analog-to-digital and digital-to-analog conversion
- Digital control of frequency, impedance, phase, and analog-signal gain

3 Description

For transmission or multiplexing of analog or digital signals high-voltage types (20V rating).

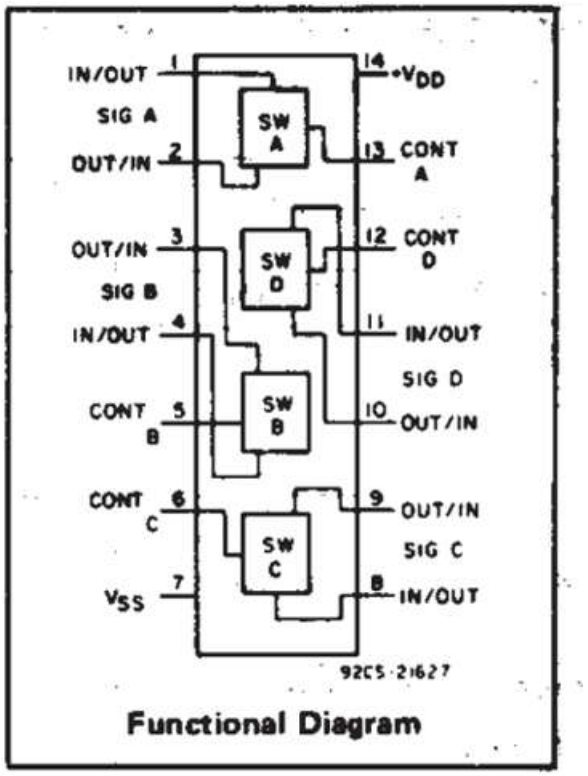
CD4016B *B* Series types are quad bilateral switches intended for the transmission or multiplexing of analog or digital signals. Each of the four independent bilateral switches has a single control signal input which simultaneously biases both the p and n device in a given switch on or off.

The CD4016B *B* Series types are supplied in 14-lead hermetic dual-in-line ceramic packages (F3A suffix), 14-lead dual-in-line plastic packages (E suffix), 14-lead small-outline packages (M, MT, M96, and NSR suffixes), and 14-lead thin shrink small-outline packages (PW and PWR suffixes).

Package Information

PART NUMBER	PACKAGE(1)	PACKAGE SIZE(2)
CD4016B	N (PDIP, 14)	19.3mm × 9.4mm
	D (SOIC, 14)	8.65mm × 6mm

(1) For more information, see Section 8.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.



Schematic Diagram - 1 of 4 Identical Sections

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4 Specifications

4.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
$V_{DD} - V_{SS}$	Supply voltage		20	V
V_{DD}		–0.5	20	V
V_{SS}		–20	0.5	V
I_{SEL} or I_{EN}	Logic control input pin current ($\overline{EN}$, Ax, SELx)	–30	30	mA
V_S or V_D	Source or drain voltage (Sx, D)	V_{SS}–0.5	V_{DD}+0.5	V
I_S or $I_{D\ (CONT)}$	Source or drain continuous current (Sx, D)	–20	20	mA
T_J	Junction temperature		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.

4.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	±500	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	±1500	

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

4.3 Recommended Operating Conditions

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

		MIN	NOM	MAX	UNIT
$V_{DD} - V_{SS}$ (1)	Power supply voltage differential	3		18	V
V_{DD}	Positive power supply voltage	3		18	V
V_S or V_D	Signal path input/output voltage (source or drain pin) (Sx, D)	V_{SS}		V_{DD}	V
V_{SEL} or V_{EN}	Address or enable pin voltage	0		V_{DD}	V
I_S or $I_{D\ (CONT)}$	Source or drain continuous current (Sx, D)	–10		10	mA
T_A	Ambient temperature	–55		125	°C

(1) V_{DD} and V_{SS} can be any value as long as $3V \le (V_{DD} - V_{SS}) \le 24V$, and the minimum V_{DD} is met.

4.4 Thermal Information

THERMAL METRIC[1]		CD4016		UNIT
		N (PDIP)	D (SOIC)	
		14 PINS	14 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	93.7	109.7	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	72.5	69.4	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	68.0	67.9	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	50.3	25.8	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	67.3	67.1	°C/W

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

4.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
SIGNAL INPUTS (V_{IS}) AND OUTPUTS (V_{OS})									
I_{DD}	Quiescent Device Current	V_{is} = 0 to 5V V_{DD} = 5V	T_A = –55°C					5	µA
			T_A = –40°C					5	
			T_A = 25°C				4.5	6	
			T_A = 85°C					7.5	
			T_A = 125°C					7.5	
		V_{is} = 0 to 10V V_{DD} = 10V	T_A = –55°C					6	
			T_A = –40°C					6	
			T_A = 25°C				5	7	
			T_A = 85°C					15	
			T_A = 125°C					15	
		V_{is} = 0 to 15V V_{DD} = 15V	T_A = –55°C					7	
			T_A = –40°C					7.2	
			T_A = 25°C				6	8	
			T_A = 85°C					30	
			T_A = 125°C					30	
		V_{is} = 0 to 20V V_{DD} = 20V	T_A = –55°C					8.5	
			T_A = –40°C					8.5	
			T_A = 25°C				6.5	9	
			T_A = 85°C					150	
			T_A = 125°C					150	

4.5 Electrical Characteristics (continued)

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

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
r_{ON}	ON Resistance r_{ON} Max	to $(V_{DD}+V_{SS})/2$, $V_C = V_{DD}$, RL = 10kΩ	V_{DD} = 10V $V_{is} = V_{SS}$ or V_{DD}	T_A = –55°C				600	Ω
				T_A = –40°C				610	
				T_A = 25°C			250	660	
				T_A = 85°C				840	
				T_A = 125°C				960	
			V_{DD} = 10V V_{is} = 4.75 to 5.75V	T_A = –55°C				1870	
				T_A = –40°C				1900	
				T_A = 25°C				2000	
				T_A = 85°C				2380	
				T_A = 125°C				2600	
			V_{DD} = 15V $V_{is} = V_{SS}$ or V_{DD}	T_A = –55°C				360	
				T_A = –40°C				370	
				T_A = 25°C			200	400	
				T_A = 85°C				520	
				T_A = 125°C				600	
			V_{DD} = 15V V_{is} = 7.25 to 7.75V	T_A = –55°C				775	
				T_A = –40°C				790	
				T_A = 25°C				850	
				T_A = 85°C				1080	
				T_A = 125°C				1230	
r_{ON}	ON Resistance r_{ON} Max	to $(V_{DD}+V_{SS})/2$, $V_C = V_{DD}$, RL = 10kΩ	V_{DD} = 5V V_{SS} = 0V	T_A = 25°C			580	7000	Ω
			V_{DD} = 7.5V V_{SS} = -7.5V	T_A = 25°C			200	280	
			V_{DD} = 5V V_{SS} = -5V	T_A = 25°C			250	580	
			V_{DD} = 2.5V V_{SS} = -2.5V	T_A = 25°C			520	30000	
ΔR_{ON}	On-state resistance difference between any two switches	R_L = 10kΩ, $V_C = V_{DD}$	V_{DD} = 5V				15		Ω
			V_{DD} = 10V				10		
			V_{DD} = 15V				5		
THD	Total Harmonic Distortion	$V_C = V_{DD}$ = 5V, V_{SS} = –5V, $V_{is(p-p)}$ = 5V (sine wave centered on 0V), R_L = 10kΩ, f_{is} = 1kHz sine wave					0.4		%
BW	–3-dB cutoff frequency (switch on)	$V_C = V_{DD}$ = 5V, V_{SS} = –5V, $V_{is(p-p)}$ = 5V (sine wave centered on 0V), R_L = 1kΩ					40		MHz
OISO	–50-dB feedthrough frequency (switch off)	$V_C = V_{DD}$ = 5V, V_{SS} = –5V, $V_{is(p-p)}$ = 5V (sine wave centered on 0V), R_L = 1kΩ					1.25		MHz
I_{is}	Input/Output Leakage Current (switch off)	V_{DD} = 18V V_C = 0V V_{is} = 18V, V_{os} = 0V V_{is} = 0V, V_{os} = 18V		T_A = –55°C		-0.1		0.1	µA
				T_A = –40°C		-0.1		0.1	
				T_A = 25°C			0.0001	0.1	
				T_A = 85°C		-1		1	
				T_A = 125°C		-1		1	
XTALK	–50-dB crosstalk frequency	$V_C = V_{DD}$ = 5V, V_{SS} = –5V, $V_{is(p-p)}$ = 5V (sine wave centered on 0V), R_L = 1kΩ					0.9		MHz

4.5 Electrical Characteristics (continued)

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

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{pd}	Propagation delay	V_C = V_{DD}, V_{SS} = GND V_{IS} = Square Wave 0 to V_{DD}, C_L = 50pF, R_L = 200kΩ	V_{DD} = 5V			40	100	ns
			V_{DD} = 10V			20	40	
			V_{DD} = 15V			15	30	
C_{IS}	Input capacitance	V_{DD} = 5V, VC = V_{SS} = –5V				4		pF
C_{OS}	Output capacitance	V_{DD} = 5V, VC = V_{SS} = –5V				4		pF
C_{IOS}	Feed through	V_{DD} = 5V, VC = V_{SS} = –5V				0.2		pF
V_{ILC}	Control input, low voltage (max)	$\|I_{is}\|$ < 10µA, V_{is} = V_{SS}, V_{OS} = V_{DD}, and V_{is} = V_{DD}, V_{OS} = V_{SS}	V_{DD} = 5V V_{DD} = 10V V_{DD} = 15V	T_A = –55°C			0.9	V
				T_A = –40°C			0.9	
				T_A = 25°C			0.7	
				T_A = 85°C			0.4	
				T_A = 125°C			0.4	
V_{IHC}	Control input, high voltage	See Figure 10	V_{DD} = 5V		3.5			V
			V_{DD} = 10V		7			V
			V_{DD} = 15V		11			V
I_{IH}	Input High Lekaage		V_{DD} = 18V			0.5	1	µA
I_{IL}	Input Low Leakage		V_{DD} = 18V		-1	-0.1		µA
	Crosstalk (control input to signal output)	V_C = 10V (square wave), t_r , t_f = 20ns, R_L = 10kΩ V_{DD} = 10V	V_{DD} = 10V			50		mV
	Turn-on propagation delay	t_r , t_f = 20ns C_L = 50pF, R_L = 1kΩ	V_{DD} = 5V			35	70	ns
			V_{DD} = 10V			20	40	ns
			V_{DD} = 15V			15	30	ns
	Maximum control input repetition rate	V_{IN} = V_{DD}, C_L = 50pF, R_L = 1kΩ V_C = 10V (square wave centered on 5V), t_r , t_f = 20ns, V_{os} = 1/2V_{os} at 1kHz	V_{DD} = 10V			10		MHz
C_{IN}	Input Capacitance					5	7.5	pF

4.5 Electrical Characteristics (continued)

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

PARAMETER		TEST CONDITIONS				MIN	TYP	MAX	UNIT
I_{IS}	Switch input current	V_{DD} = 5V V_{is} = 0V	T_A = –55°C					0.25	mA
			T_A = –40°C					0.2	
			T_A = 25°C					0.2	
			T_A = 85°C					0.12	
			T_A = 125°C					0.14	
		V_{DD} = 5V V_{is} = 5V	T_A = –55°C					-0.25	mA
			T_A = –40°C					-0.2	
			T_A = 25°C					-0.2	
			T_A = 85°C					-0.12	
			T_A = 125°C					-0.14	
		V_{DD} = 10V V_{is} = 0V	T_A = –55°C					0.62	mA
			T_A = –40°C					0.5	
			T_A = 25°C					0.5	
			T_A = 85°C					0.3	
			T_A = 125°C					0.35	
		V_{DD} = 10V V_{is} = 10V	T_A = –55°C					-0.62	mA
			T_A = –40°C					-0.5	
			T_A = 25°C					-0.5	
			T_A = 85°C					-0.3	
			T_A = 125°C					-0.35	
		V_{DD} = 15V V_{is} = 0V	T_A = –55°C					1.8	mA
			T_A = –40°C					1.4	
			T_A = 25°C					1.5	
			T_A = 85°C					1	
			T_A = 125°C					1.1	
		V_{DD} = 15V V_{is} = 15V	T_A = –55°C					-1.8	mA
			T_A = –40°C					-1.4	
			T_A = 25°C					-1.5	
			T_A = 85°C					-1	
			T_A = 125°C					-1.1	
V_{OS}	Switch output voltage	V_{DD} = 5V V_{is} = 0V						0.4	V
		V_{DD} = 5V V_{is} = 5V				4.6			V
		V_{DD} = 10V V_{is} = 0V						0.5	V
		V_{DD} = 10V V_{is} = 10V				9.5			V
		V_{DD} = 15V V_{is} = 0V						1.5	V
		V_{DD} = 15V V_{is} = 15V				13.5			V

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

4.6 Electrical Characteristics

CHARACTERISTIC	TEST CONDITIONS		V_{IN} (V)	V_{DD} (V)	LIMITS AT INDICATED TEMPERATURES (°C)						UNITS
									+25		
					−55	−40	+85	+125	TYP	MAX	
Quiescent Device Current, I_{DD}			0,5	5	025	0.25	7.5	7.5	0.01	0.25	μA
			0,10	10	0.5	0.5	15	15	0.01	0.5	
			0,15	15	1	1	30	30	0.01	1	
			0,20	20	5	5	150	150	0.02	5	
Signal Inputs (V_{is}) and Output (V_{os})											
On-State Resistance, r_{on} MAX	V_C=V_{DD} R_L=10kΩ Returned to $\frac{V_{DD}-V_{SS}}{2}$	V_{is}=V_{DD} or V_{SS}		10	600	610	840	960	–	660	Ω
		V_{is}=4.75 to 5.75V		10	1870	1900	2380	2600	–	2000	
		V_{is}=V_{DD} or V_{SS}		15	360	370	520	600	–	400	
		V_{is}=7.25 to 7.75V		15	775	790	1080	1230	–	850	
ΔOn-State Resistance Between Any 2 Switches, Δr_{on}	R_L=10kΩ, V_C = V_{DD}			5	–	–	–	–	15	–	Ω
				10	–	–	–	–	10	–	
				15	–	–	–	–	5	–	
Total Harmonic Distortion, THD	V_C=V_{DD} =5V, V_{SS} = −5V,$V_{is(p-p)}$ = 5V (Sine wave centered on 0V) R_L = 10kΩ, f_{is} = 1kHz sine wave				–	–	–	–	0.4	–	%
−3dB Cutoff Frequency (Switch on)	V_C=V_{DD}=5V, V_{SS}=−5V, $V_{is(p-p)}$ (Sine wave centered on 0V) R_L=1kΩ,				–	–	–	–	40	–	MHz
−50dB Feed-through Frequency (Switch off)	V_C=V_{SS}= −5V, $V_{is(p-p)}$=5V (Sine wave centered on 0V) R_L = 1 lkΩ				–	–	–	–	1.25	–	MHz
Input/Output Leakage Current (Switch off) I_{is} MAX	V_C = 0V V_{is} = 18V, V_{OS} = 0V; V_{is} = 0V, V_{OS} = 18V			18	±0.1	±0.1	±1	±1	10^{-4}	±0.1	μA
−50dB Crosstalk Frequency	V_C(A) = V_{DD}= +5V, V_C(B) = V_{SS}=−5V, V_{is}(A)= $5V_{p-p}$, 50Ω source R_L= 1kΩ				–	–	–	–	0.9	–	MHz
Propagation Delay (Signal Input to Signal Output) t_{pd}	R_L = 200kΩ V_C = V_{DD}, V_{SS} = GND, C_L = 50pF V_{is} = Square Wave 0 to V_{DD} t_r, t_f = 20ns			5	–	–	–	–	40	100	ns
				10	–	–	–	–	20	40	
				15	–	–	–	–	15	30	
Capacitance: Input, C_{is} Output, C_{OS} Feed-through, C_{ios}	V_{DD} = +5V V_C=V_{SS}=−5V				–	–	–	–	4	–	pF
					–	–	–	–	4	–	
					–	–	–	–	0.2	–	
Control (V_C)											
Control Input Low Voltage, V_{ILC}(MAX)	$\|I_{is}\|$< 10 μA V_{is} = V_{SS}, V_{OS} = V_{DD} and V_{is} = V_{DD}, V_{OS} = V_{SS}			5,10, 15	0.9	0.9	0.4	0.4	–	0.7	V
Control Input High Voltage, V_{IHC}	See Figure 4-8			5	3.5 (Min.)						V
				10	7 (Min.)						
				15	11 (Min.)						
Input Current, I_{IN} (MAX)	Input Current, I_{IN} (MAX)V_{is}□ V_{DD}			18	±0.1	±0.1	±1	±1	$±10^{-5}$	±0.1	μA
	V_{DD} − V_{SS} = 18V										
	V_{CC} □ V_{DD} − V_{SS}										
Crosstalk (Control Input to Signal Output)	V_C= 10V (Sq. Wave)			10	–	–	–	–	50	–	mV
	t_r, t_f = 20ns										
	R_L = 10kΩ										
Turn-On Propagation Delay	Turn-On Propagation Delay t_r, t_f = 20ns			5	–	–	–	–	35	70	ns
	C_L = 50pF			10	–	–	–	–	20	40	
	R_L= 1kΩ			15	–	–	–	–	15	30	

4.6 Electrical Characteristics (continued)

CHARACTERISTIC	TEST CONDITIONS	V_{IN} (V)	V_{DD} (V)	LIMITS AT INDICATED TEMPERATURES (°C)						UNITS
								+25		
				−55	−40	+85	+125	TYP	MAX	
Maximum Control Input Repetition Rate	Maximum Control Input Repetition Rate V_{is} = V_{DD}< V_{SS} = GND, R_L = 1kΩ to GND, C_L = 50pF, V_C = 10V(Square wave centered on 5V) t_r, t_f = 20ns, V_{OS} = ½ V_{OS} at 1kHz		10	–	–	–	–	10	–	MHz
Input Capacitance, C_{IN}				–	–	–	–	5	7.5	µF

4.7 Typical Characteristics

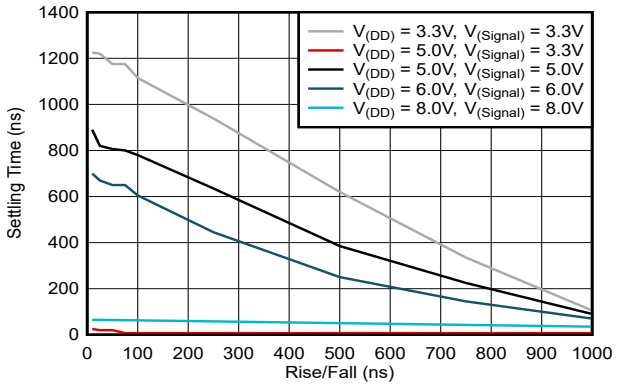


Figure 4-1. System Settling Time vs Signal Rise/Fall Time

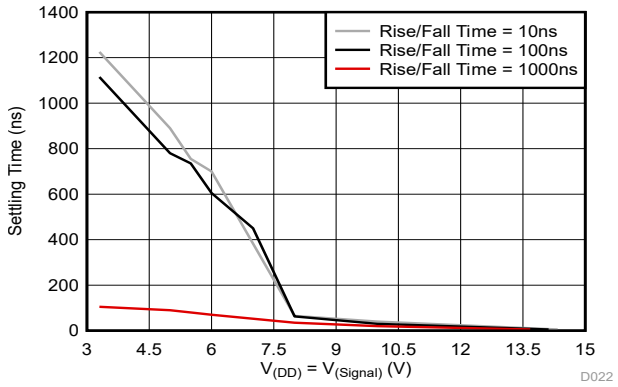


Figure 4-2. System Settling Time vs Signal Voltage

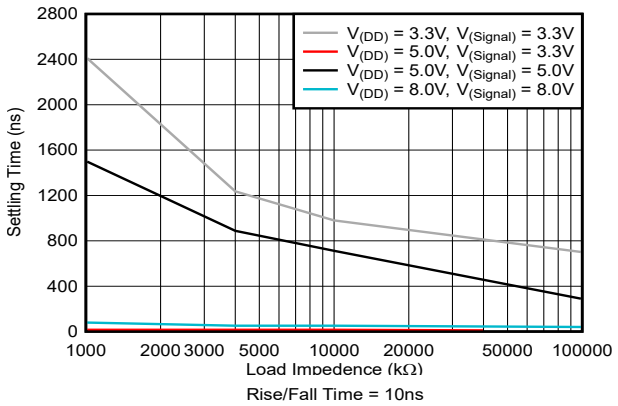


Figure 4-3. System Settling Time vs Signal Voltage

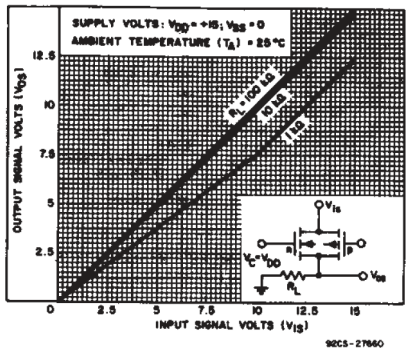


Figure 4-4. On-state Characteristics for 1 of 4 Switches with v_{DD} = +15V, v_{SS} = 0V.

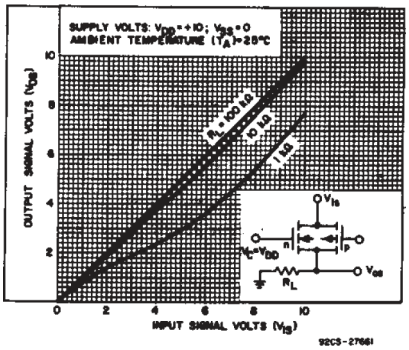


Figure 4-5. On-state Characteristics for 1 of 4 Switches with v_{DD} =+10V, v_{SS} = 0V.

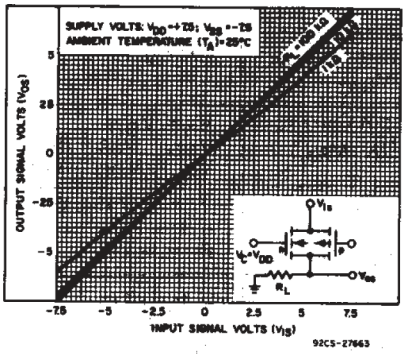


Figure 4-6. On-state Characteristics for 1 of 4 Switches with v_{DD} = +7.5V, v_{SS}= − 7.5V.

4.7 Typical Characteristics (continued)

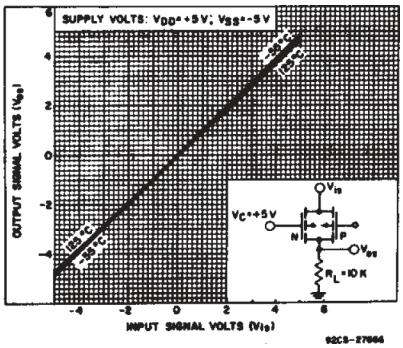


Figure 4-7. On-state Characteristics as a Function of Temp. for 1 of 4 Switches with v_{DD} = +5V, v_{SS} = − 5V.

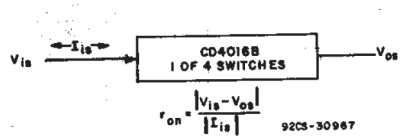


Figure 4-8. Determination of R_{on} As a Test Condition for Control Input High Voltage Specification.

5 Parameter Measurement Information

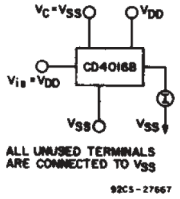


Figure 5-1. Off-state Switch Input or Output Leakage Current Test Circuit.

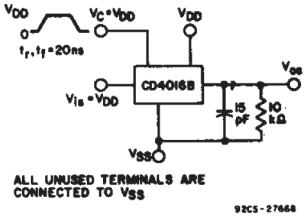


Figure 5-2. Test Circuit for Square-wave Response.

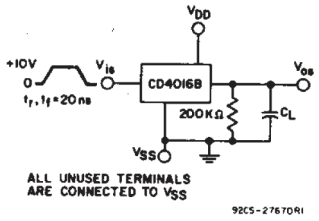


Figure 5-3. Propagation Delay Time Signal Input (v_{IS}) To Signal Output (v_{OS})

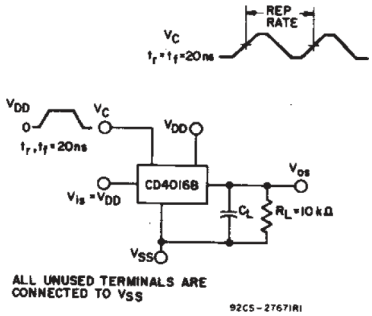


Figure 5-4. MAX Control-input Repetition Rate.

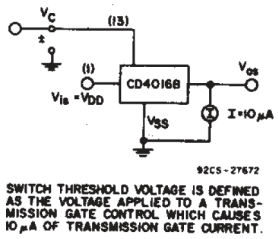


Figure 5-5. Switch Threshold Voltage.

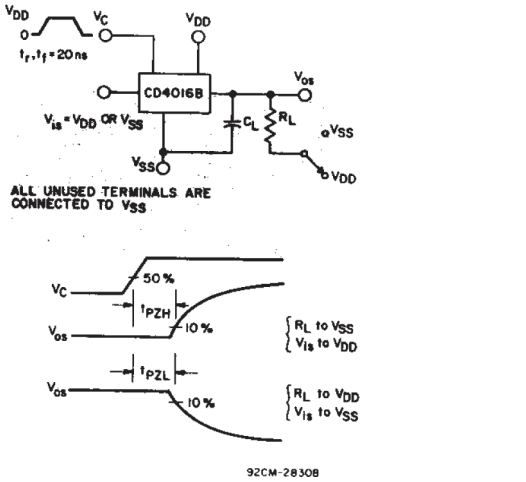


Figure 5-6. Turn-On Propagation Delay-control Input.

6 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

6.1 Documentation Support

6.1.1 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.

6.1.2 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.

6.1.3 Trademarks

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

6.1.4 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.

6.1.5 Glossary

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

7 Revision History

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

Changes from Revision D (May 2024) to Revision E (August 2024)	Page
• Added Settling Time plots	10

Changes from Revision C (September 2003) to Revision D (May 2024)	Page
• Increased IDD max/typ for the lower Temperature cases	5
• Changed typical IIH to 0.5µA	5
• Changed typical IIL to -0.1µA	5

8 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 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
5962-9064001CA	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9064001CA CD4016BF3A	Samples
CD4016BE	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD4016BE	Samples
CD4016BEE4	ACTIVE	PDIP	N	14	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD4016BE	Samples
CD4016BF	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	CD4016BF	Samples
CD4016BF3A	ACTIVE	CDIP	J	14	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9064001CA CD4016BF3A	Samples
CD4016BM	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-55 to 125	CD4016BM	
CD4016BM96	ACTIVE	SOIC	D	14	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4016BM	Samples
CD4016BMT	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-55 to 125	CD4016BM	
CD4016BNSR	NRND	SOP	NS	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CD4016B	
CD4016BPW	NRND	TSSOP	PW	14	90	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM016B	
CD4016BPWR	NRND	TSSOP	PW	14	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	CM016B	

(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.

OTHER QUALIFIED VERSIONS OF CD4016B, CD4016B-MIL :

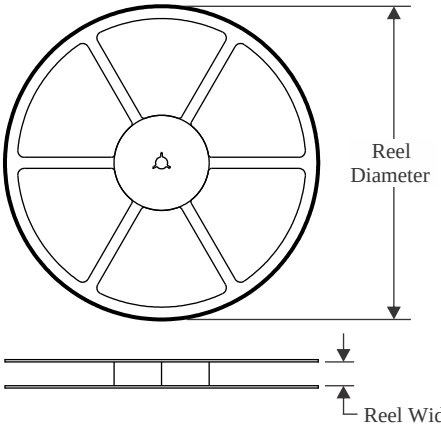
- Catalog : CD4016B
- Military : CD4016B-MIL

NOTE: Qualified Version Definitions:

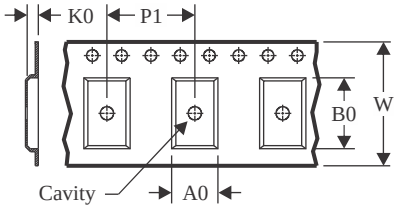
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

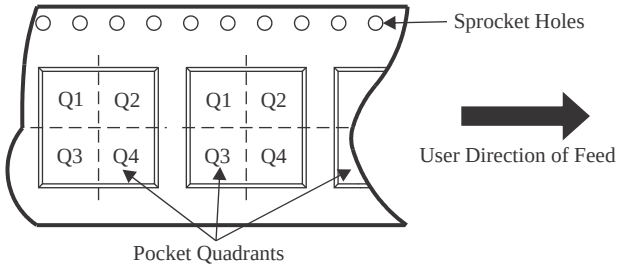


TAPE DIMENSIONS



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

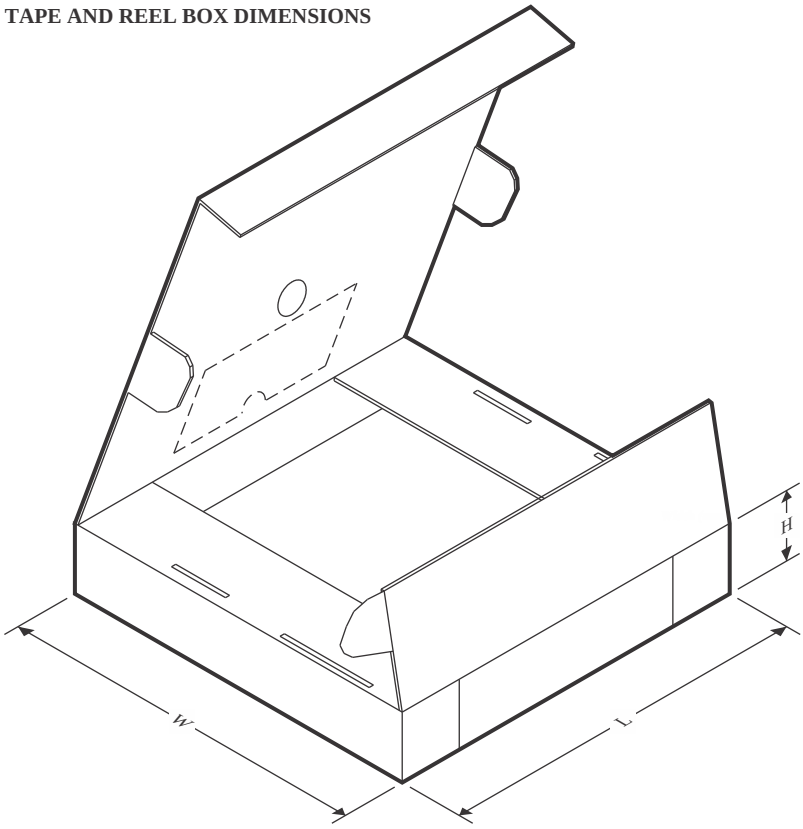
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CD4016BM96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD4016BM96	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CD4016BNSR	SOP	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD4016BPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

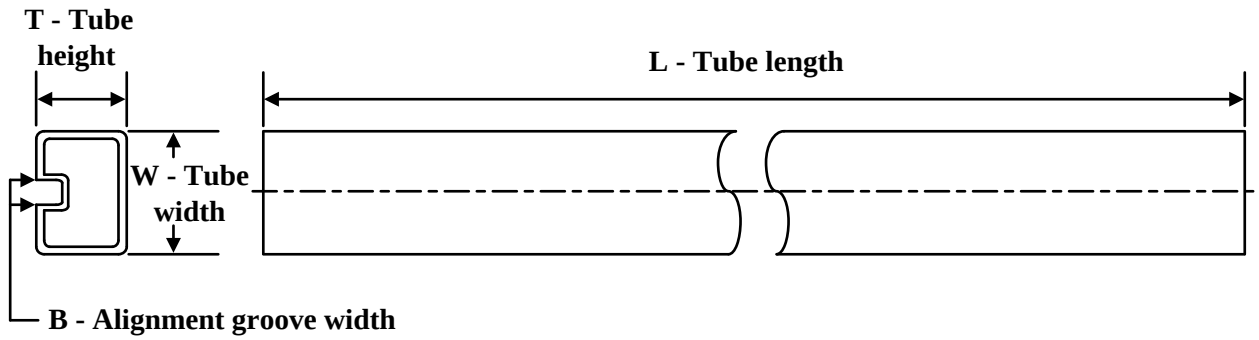
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

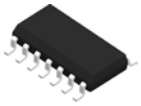
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4016BM96	SOIC	D	14	2500	356.0	356.0	35.0
CD4016BM96	SOIC	D	14	2500	353.0	353.0	32.0
CD4016BNSR	SOP	NS	14	2000	356.0	356.0	35.0
CD4016BPWR	TSSOP	PW	14	2000	367.0	367.0	35.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
CD4016BE	N	PDIP	14	25	506	13.97	11230	4.32
CD4016BEE4	N	PDIP	14	25	506	13.97	11230	4.32
CD4016BPW	PW	TSSOP	14	90	530	10.2	3600	3.5

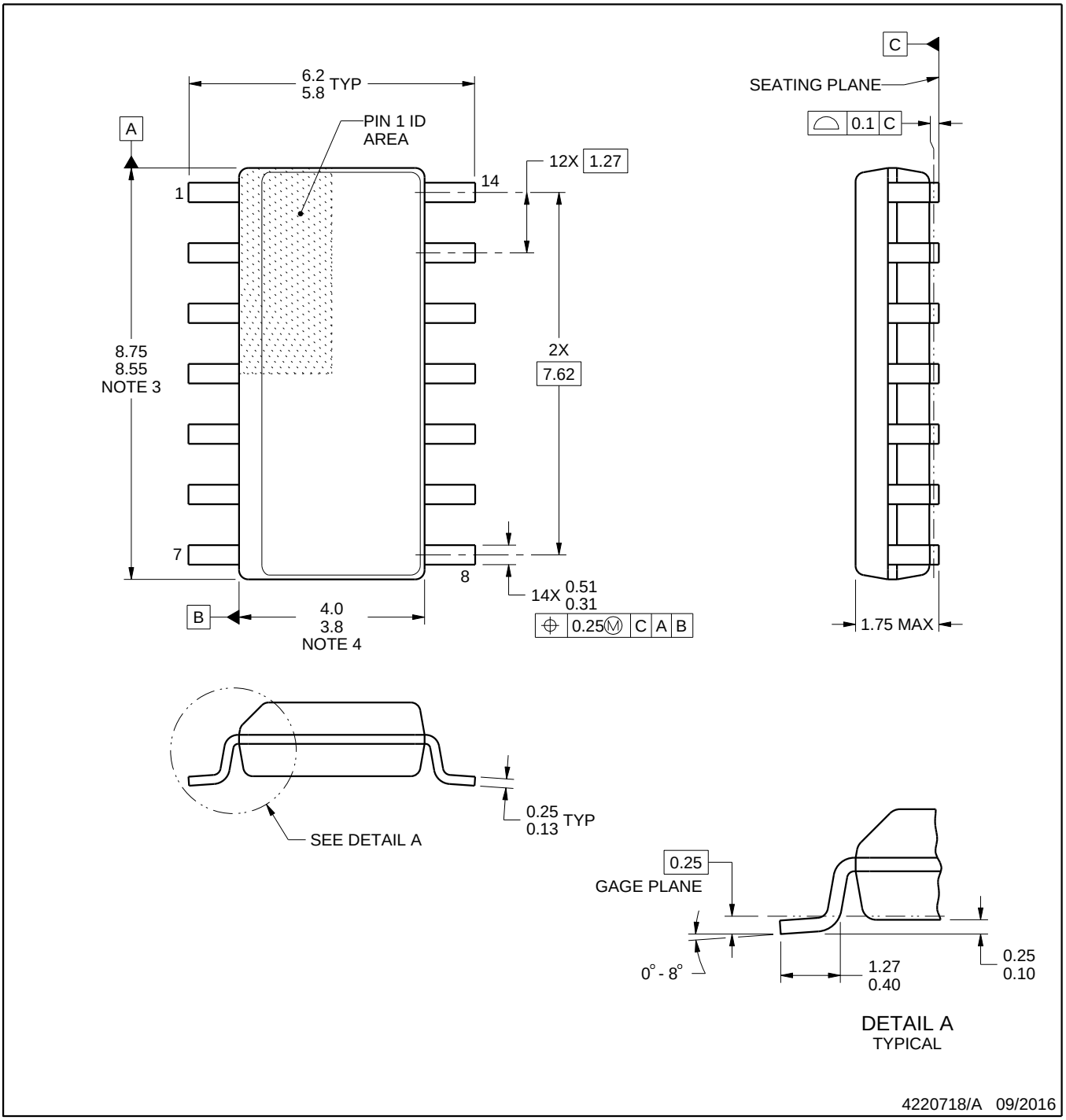


PACKAGE OUTLINE

D0014A

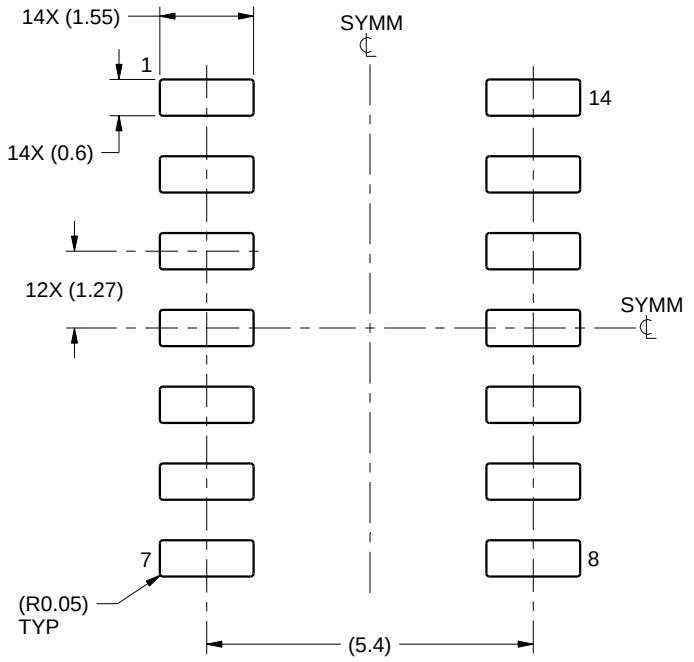
SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT

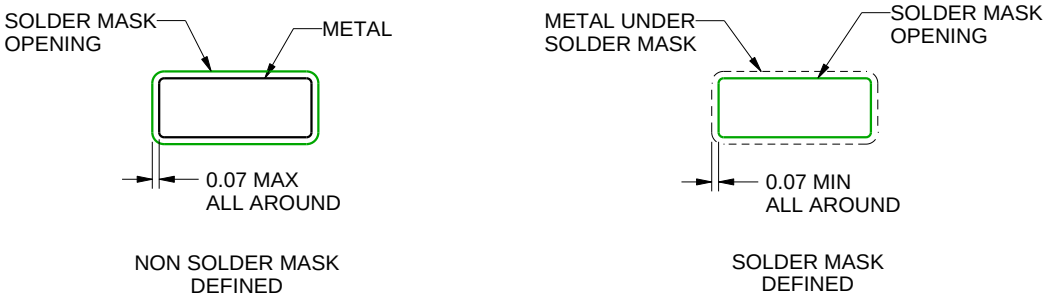


NOTES:

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 0.43 mm, per side.
5. Reference JEDEC registration MS-012, variation AB.



LAND PATTERN EXAMPLE
SCALE:8X



SOLDER MASK DETAILS

4220718/A 09/2016

NOTES: (continued)

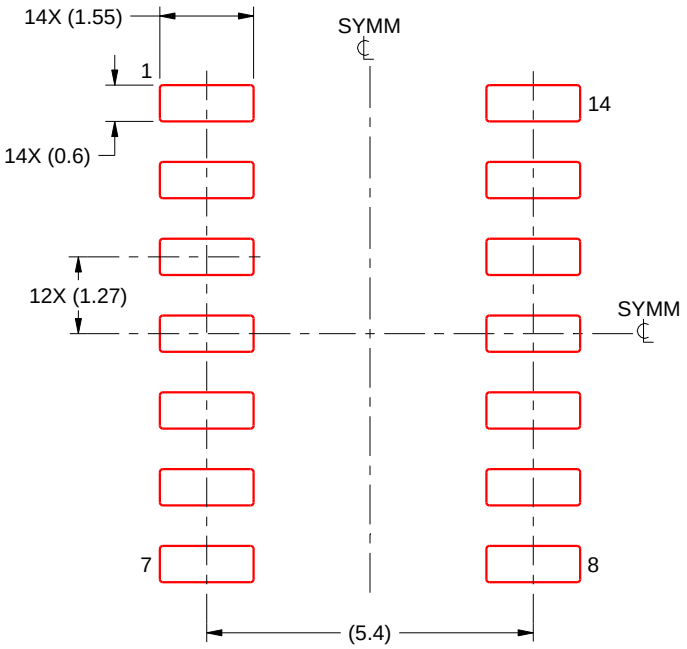
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

D0014A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:8X

4220718/A 09/2016

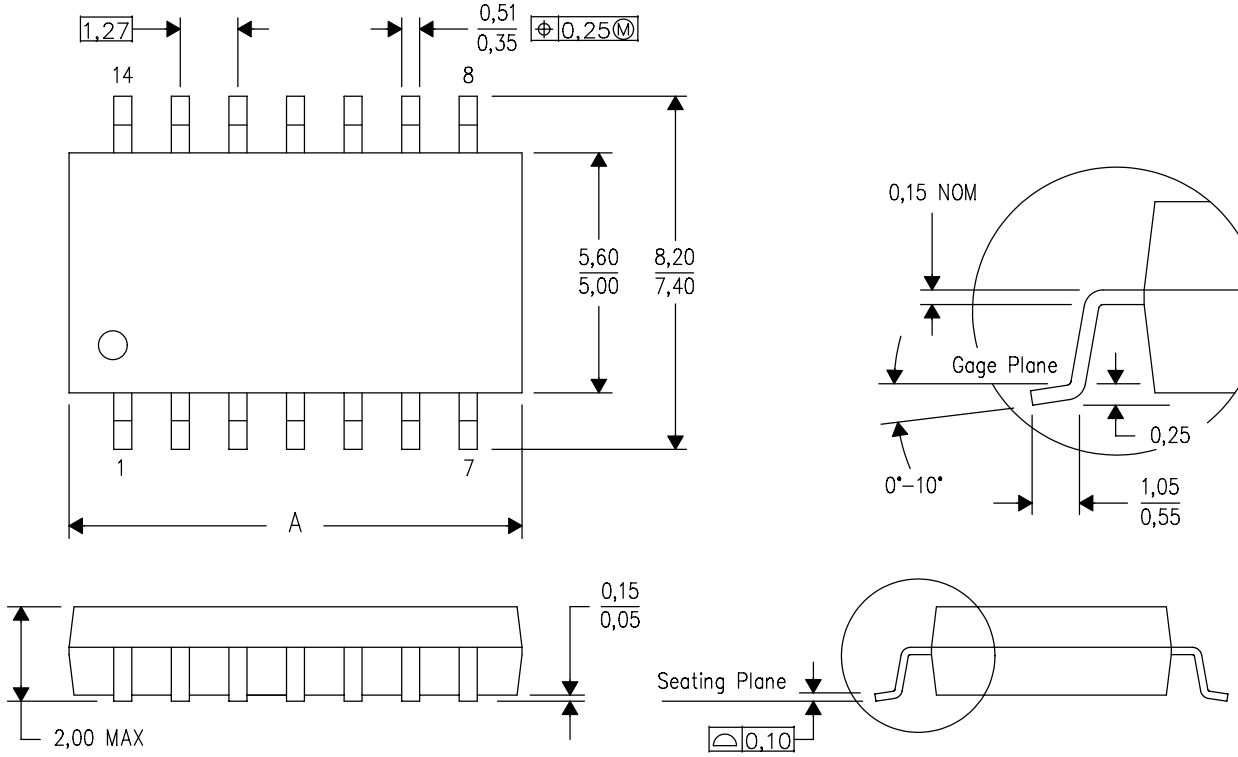
NOTES: (continued)

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.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

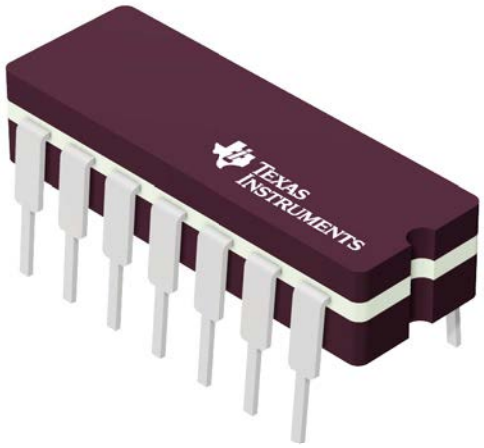
4040062/C 03/03

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

GENERIC PACKAGE VIEW

J 14 CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

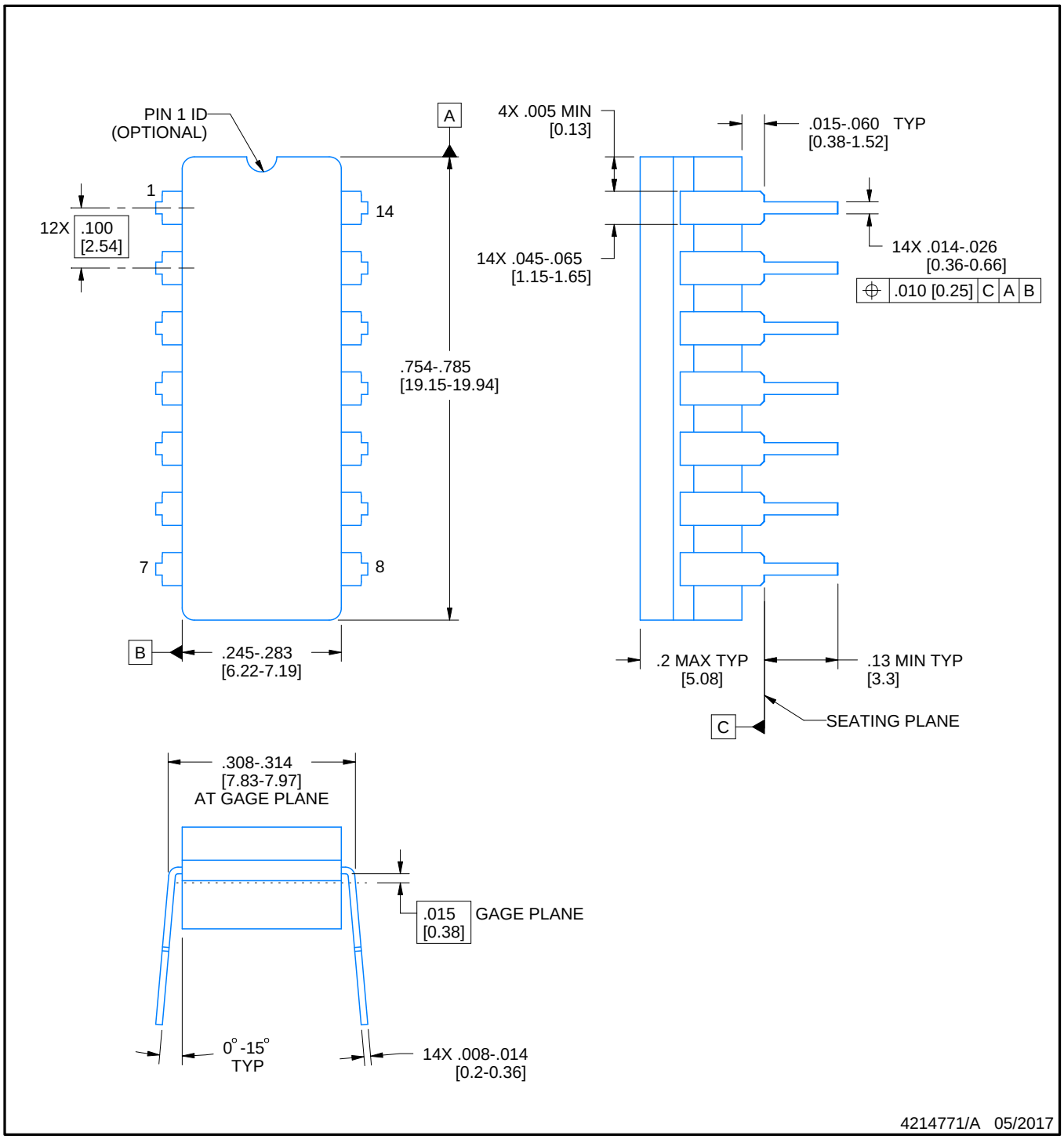
4040083-5/G

PACKAGE OUTLINE

J0014A

CDIP - 5.08 mm max height

CERAMIC DUAL IN LINE PACKAGE



NOTES:

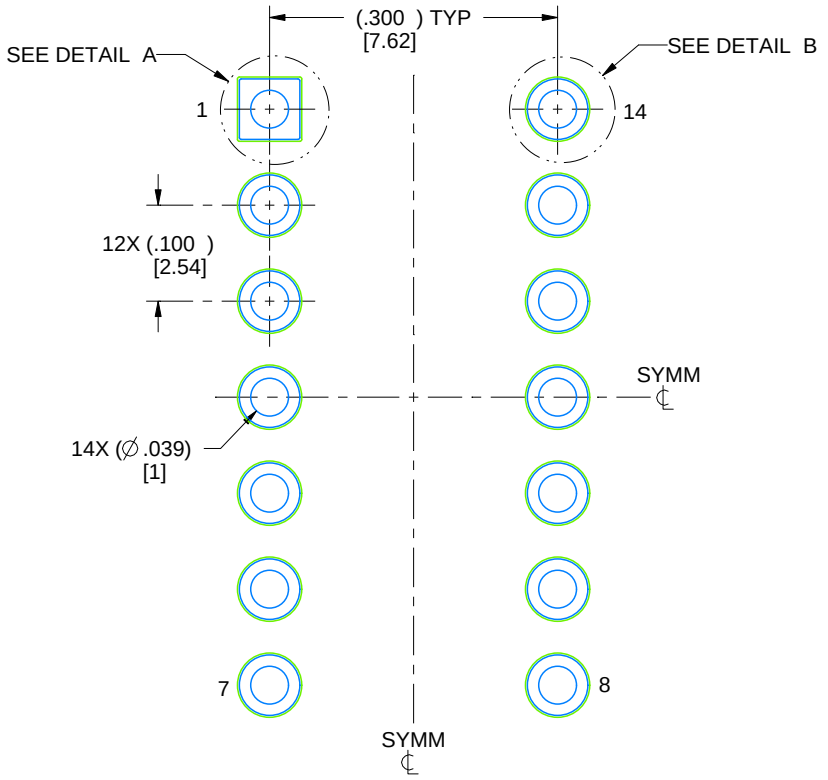
1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This package is hermitically sealed with a ceramic lid using glass frit.
4. Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
5. Falls within MIL-STD-1835 and GDIP1-T14.

EXAMPLE BOARD LAYOUT

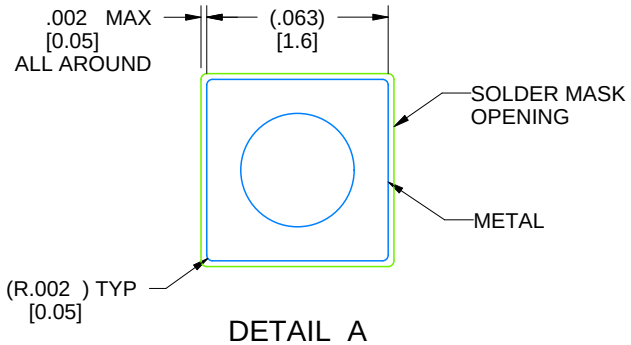
J0014A

CDIP - 5.08 mm max height

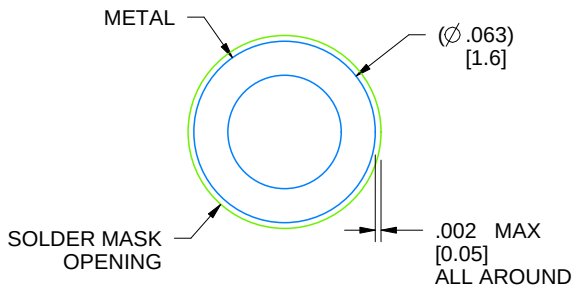
CERAMIC DUAL IN LINE PACKAGE



LAND PATTERN EXAMPLE
NON-SOLDER MASK DEFINED
SCALE: 5X



DETAIL A
SCALE: 15X



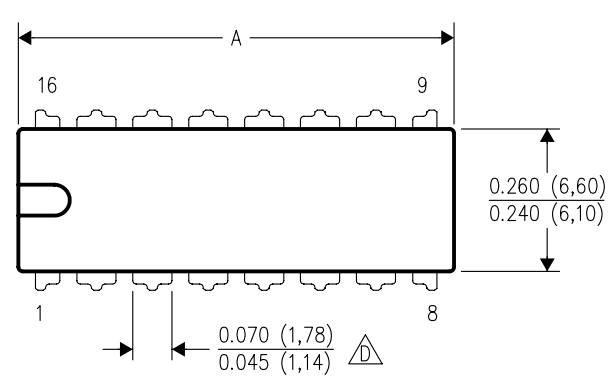
DETAIL B
13X, SCALE: 15X

4214771/A 05/2017

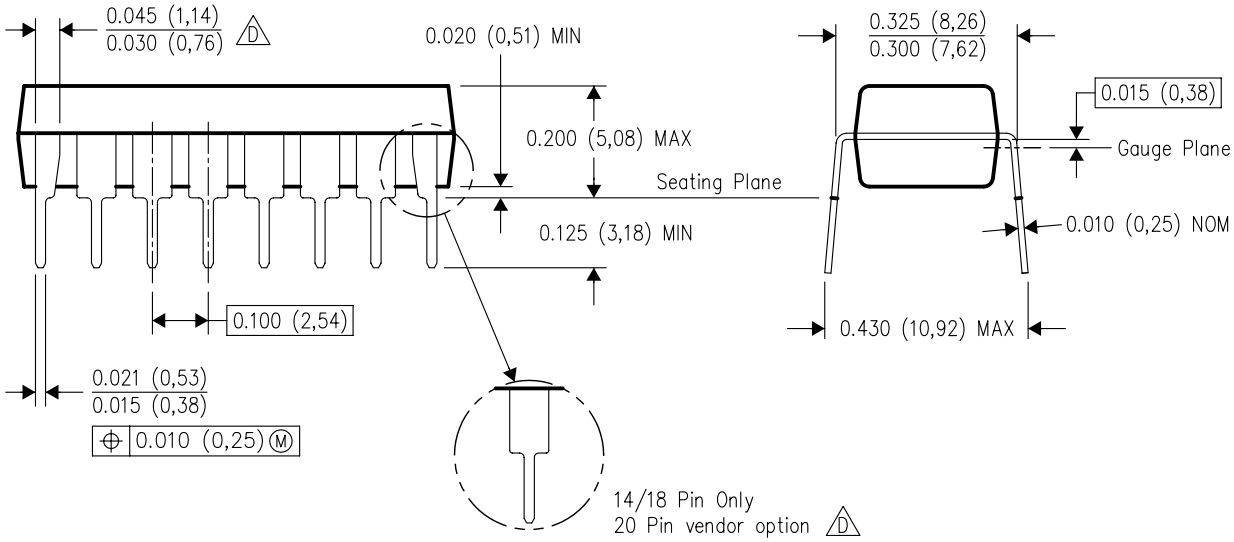
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN



DIM \ PINS **	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 (C)	AA	BB	AC	AD



4040049/E 12/2002

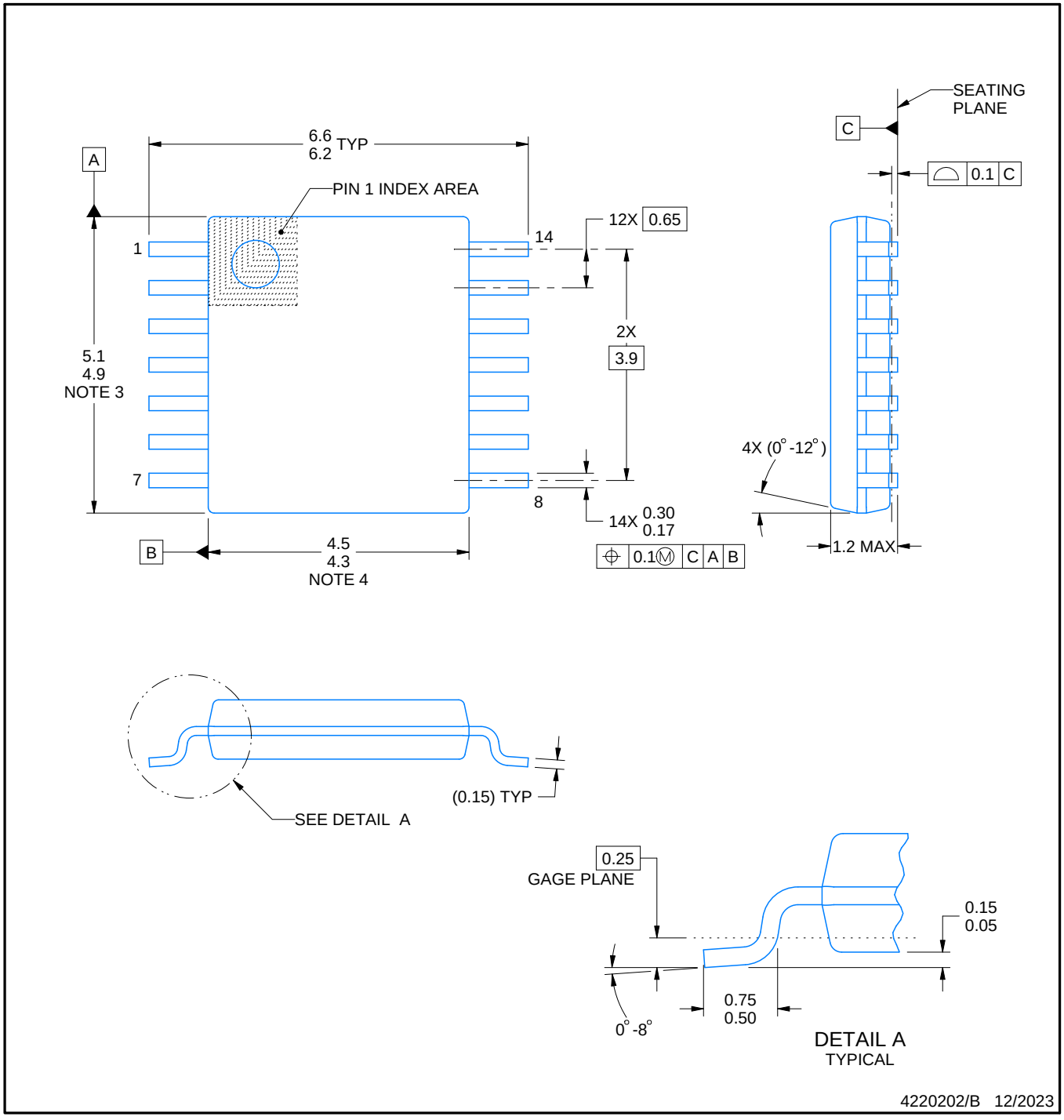
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

PACKAGE OUTLINE

PW0014A

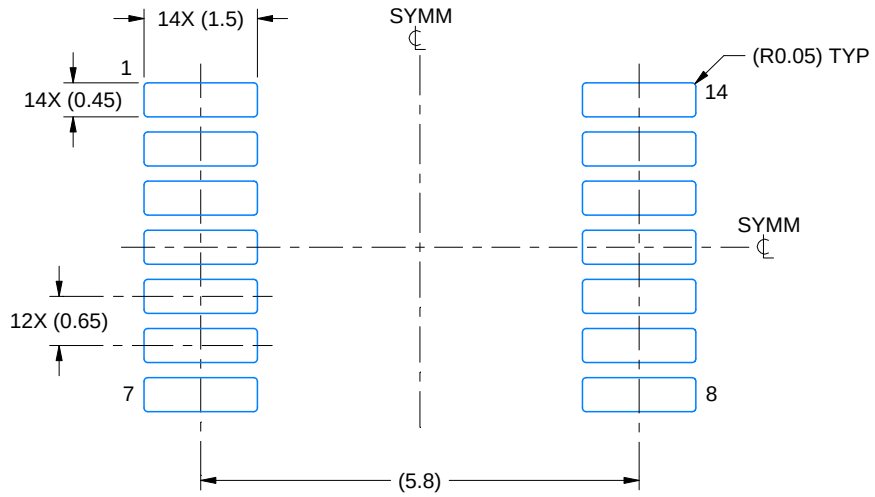
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

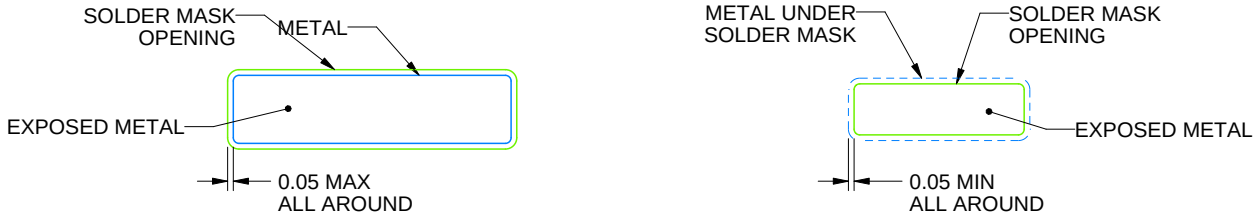


NOTES:

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

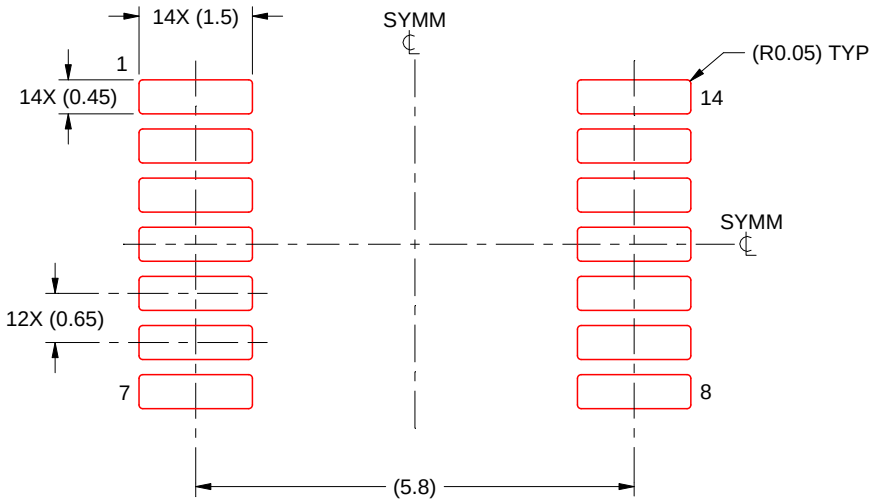


SOLDER MASK DETAILS

4220202/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.



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

4220202/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.

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