CDx4HCx4316 High-Speed CMOS Logic Quad Analog Switch with Level Translation

1 Features

- Wide analog-input-voltage range:

  V_{CC} - V_{EE}: 0V to 10V
- Low ON resistance:
  - 45Ω (typical): V_{CC} = 4.5V
  - 35Ω (typical): V_{CC} = 6V
  - 30Ω (typical): V_{CC} – V_{EE} = 9V
- Fast switching and propagation delay times
- Low OFF leakage current
- Built-in break-before-make switching
- Logic-level translation to enable 5V logic to accommodate ±5 V analog signals
- Wide operating temperature range: -55°C to 125°C
- HC types:
  - 2V to 10V operation
  - High noise immunity: N_{IL} = 30%, N_{IH} = 30% of V_{CC} at V_{CC} = 5V
- HCT types:
  - Direct LSTTL input logic compatibility, V_{IL}= 0.8V (maximum), V_{IH} = 2V (minimum)
  - CMOS input compatibility, $I_I \leq 1$ µA at V_{OL}, V_{OH}

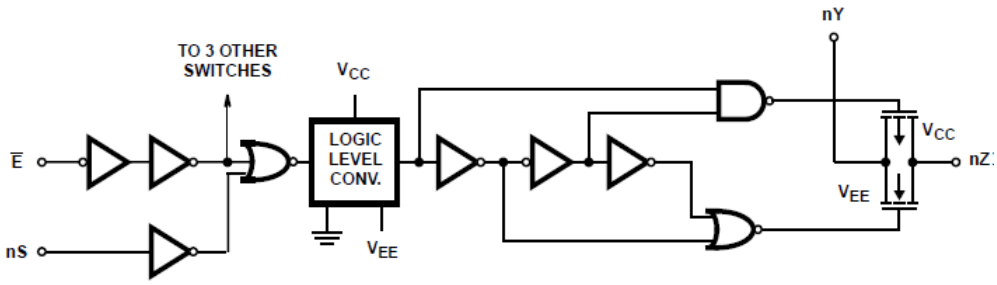
2 Description

The ’HC4316 and CD74HCT4316 contain four independent digitally controlled analog switches that use silicon-gate CMOS technology to achieve operating speeds similar to LSTTL with the low power consumption of standard CMOS integrated circuits.

In addition these devices contain logic-level translation circuits that provide for analog signal switching of voltages between ±5V via 5V logic. Each switch is turned on by a high-level voltage on its select input (S) when the common Enable (E) is Low. A High E disables all switches. The digital inputs can swing between V_{CC} and GND; the analog inputs/outputs can swing between V_{CC} as a positive limit and V_{EE} as a negative limit. Voltage ranges are shown in Figure 13-1 and Figure 13-2.

Device Information

Inputs		Switch
$\overline{E}$	S	ON/OFF
L	L	OFF
L	H	ON
H	H	OFF



One Switch

Table of Contents

3 Pin Configurations and Functions

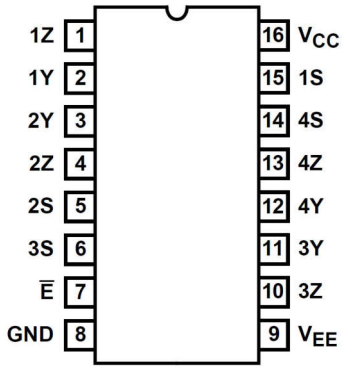


Figure 3-1. CD74HC4316 (TSSOP)

Table 3-1. Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
1Z	1	I/O	Input/Output for Switch 1
1Y	2	I/O	Input/Output for Switch 1
2Y	3	I/O	Input/Output for Switch 2
2Z	4	I/O	Input/Output for Switch 2
2S	5	I	Control pin for Switch 2
3S	6	I	Control pin for Switch 3
E	7	I	Enable Pin
GND	8	-	Ground Pin
V_{EE}	9	-	Power Pin
3Z	10	I/O	Input/Output for Switch 3
3Y	11	I/O	Input/Output for Switch 3
4Y	12	I/O	Input/Output for Switch 4
4Z	13	I/O	Input/Output for Switch 4
4S	14	I	Control pin for Switch 4
1S	15	I	Control pin for Switch 1
V_{CC}	16	-	Power Pin

4 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
$V_{CC} – V_{EE}$	DC Supply voltage		-0.5	10.5	V
V_{CC}			–0.5	7	V
V_{EE}			0.5	-7	V
I_{IK}	DC input diode current	$V_I < – 0.5$ V or $V_I > V_{CC} + 0.5$ V	–20	20	mA
I_{OK}	DC switch diode current	$V_I < V_{EE} – 0.5$ V or $V_I < V_{CC} + 0.5$ V	–25	25	mA
I_{OK}	DC Output Diode Current	For $V_O < -0.5$V or $V_O > V_{CC} + 0.5$V	–20	20	mA
I_O	DC Output Source or Sink Current per Output Pin	For $V_O > -0.5$V or $V_O < V_{CC} + 0.5$V	–25	25	mA
I_{CC}	DC V_{CC} or ground current		–50	50	mA
T_{JMAX}	Maximum junction temperature			150	°C
T_{LMAX}	Maximum lead temperature	Soldering 10 s		300	°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.

5 Thermal Information

THERMAL METRIC (1)		PW (TSSOP) 16 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	127.9	°C/W

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

6 Recommended Operating Conditions

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

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage range (T_A = full package temperature range)(2)	CD54 and 74HC types	2		6	V
		CD54 and 74HCT types	4.5		5.5	
$V_{CC} – V_{EE}$ (1)	Supply voltage range (T_A = full package temperature range)(2)	CD54 and 74HC types, CD54 and 74HCT types	2		10	V
V_{EE}	Supply voltage range (T_A = full package temperature range)(3)	CD54 and 74HC types, CD54 and 74HCT types	0		–6	V
V_I	DC input control voltage		GND		V_{CC}	V
V_{IS}	Analog switch I/O voltage		V_{EE}		V_{CC}	V
T_A	Ambient temperature		–55		125	°C
t_r , t_f	Input rise and fall times	2 V	0		1000	ns
		4.5 V	0		500	
		6 V	0		400	

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

7 Electrical Characteristics: HC Devices

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})									
	V_{IS} (V)	**V_I (V)**	**V_{EE} (V)**	**V_{CC} (V)**	**T_A**				
Input High Voltage, V_{IH}, Min				2	25°C			1.5	V
					–40°C to +85°C			1.5	
					–55°C to +125°C			1.5	
				4.5	25°C			3.15	
					–40°C to +85°C			3.15	
					–55°C to +125°C			3.15	
				6	25°C			4.2	
					–40°C to +85°C			4.2	
					–55°C to +125°C			4.2	
Input Low Voltage, V_{IL}, Max				2	25°C		0.5		V
					–40°C to +85°C		0.5		
					–55°C to +125°C		0.5		
				4.5	25°C		1.35		
					–40°C to +85°C		1.35		
					–55°C to +125°C		1.35		
				6	25°C		1.8		
					–40°C to +85°C		1.8		
					–55°C to +125°C		1.8		

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
r_{ON} ON resistance I_O = 1mA	V_{CC} or V_{EE}	V_{IH} or V_{IL}	0	4.5	25°C		30	180	Ω
					–40°C to +85°C			225	
					–55°C to +125°C			270	
			0	6	25°C		35	160	
					–40°C to +85°C			200	
					–55°C to +125°C			240	
			-4.5	4.5	25°C		30	135	
					–40°C to +85°C			170	
					–55°C to +125°C			205	
	V_{CC} to V_{EE}		0	4.5	25°C		40	320	Ω
					–40°C to +85°C			400	
					–55°C to +125°C			480	
			0	6	25°C		30	240	
					–40°C to +85°C			300	
					–55°C to +125°C			360	
			-4.5	4.5	25°C		35	170	
					–40°C to +85°C			215	
					–55°C to +125°C			255	
Δr_{ON} Maximum ON resistance between any two channels			0	4.5	25°C		10		Ω
			0	6	25°C		8.5		
			-4.5	4.5	25°C		5		
I_{IZ} Switch OFF leakage current	V_{CC} - V_{EE}	V_{IH} or V_{IL} $\overline{E}$ = V_{CC}	0	6	25°C			±0.1	µA
			0	6	–55°C to 85°C			±1	
			0	6	–55°C to 125°C			±1	
			-5	5	25°C			±0.1	
			-5	5	–55°C to 85°C			±1	
			-5	5	–55°C to 125°C			±1	
I_{IL} Control input leakage current		V_{CC} or GND	0	6	25°C			±0.1	µA
					–55°C to 85°C			±1	
					–55°C to 125°C			±1	

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
Quiescent Device Current, I_{DD} Max I_O = 1mA	When V_{IS} = V_{EE}, V_{OS} = V_{CC}	V_{CC} or GND	0	6	25°C			14	µA
					–55°C to 85°C			80	
					–55°C to 125°C			160	
	When V_{IS} = V_{CC}, V_{OS} = V_{EE}		-5	5	25°C			30	
					–55°C to 85°C			160	
					–55°C to 125°C			320	
CONTROL (ADDRESS OR INHIBIT), V_C									

(1) For dual-supply systems theoretical worst case (VI = 2.4V, VCC = 5.5V) specification is 1.8mA

8 Electrical Characteristics: HCT Devices

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})										
		V_{IS} (V)	**V_I (V)**	**V_{CC} (V)**	**V_{EE} (V)**	**T_A**				
High Level Input Voltage	V_{IH}			4.5 to 5.5		25°C	2			V
						–40°C to +85°C	2			
						–55°C to +125°C	2			
Low Level Input Voltage	V_{IL}					25°C			0.8	V
						–40°C to +85°C			0.8	
						–55°C to +125°C			0.8	
"ON" Resistance IO = 1mA	R_{ON}	V_{CC} or V_{EE}	V_{IH} or V_{IL}	4.5	0	25°C		30	180	Ω
						–40°C to +85°C		45	225	
						–55°C to +125°C			270	
		V_{CC} to V_{EE}		4.5	-4.5	25°C			135	
						–40°C to +85°C		30	170	
						–55°C to +125°C			205	
		V_{CC} or V_{EE}		4.5	0	25°C			320	
						–40°C to +85°C		85	400	
						–55°C to +125°C			480	
		V_{CC} to V_{EE}		4.5	-4.5	25°C		35	170	
						–40°C to +85°C			215	
						–55°C to +125°C			255	
"ON" Resistance Between Any Two Switches	$\blacktriangle R_{ON}$		VCC	4.5	0	25°C		10		Ω
				4.5	-4.5	25°C		5		Ω
Off-Switch Leakage Current	I_{IZ}	V_{CC} - V_{EE}	V_{IH} or V_{IL}	6	0	25°C			±0.1	µA
						–55°C to 85°C			±1	µA
						–55°C to 125°C			±1	µA
				5	-5	25°C			±0.1	µA
						–55°C to 85°C			±1	
						–55°C to 125°C			±1	
Input Leakage Current (Any Control)	I_{IL}		V_{CC} or GND	5.5	0	25°C			±0.1	µA
						–55°C to 85°C			±1	
						–55°C to 125°C			±1	

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
Quiescent Device Current	I_{CC}	When V_{IS} = V_{EE}, V_{OS} = V_{CC}, When V_{IS} = V_{CC}, V_{OS} = V_{EE}	Any voltage between V_{CC} and GND	5.5	0	25°C			8	µA
						–55°C to 85°C			80	
						–55°C to 125°C			160	
				5.5	-4.5	25°C			16	
						–55°C to 85°C			160	
						–55°C to 125°C			320	
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	▲I_{CC} (1)	V_{CC} - 2.1		4.5 to 5.5		25°C		100	360	µA
						–55°C to 85°C			450	
						–55°C to 125°C			490	
CONTROL (ADDRESS OR INHIBIT), V_C										

(1) For dual-supply systems theoretical worst case (VI = 2.4V, VCC = 5.5V) specification is 1.8mA

9 Switching Characteristics HC

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Propagation Delay, Switch In to Out	t_{PLH}, t_{PHL}	0	2	50pF	25°C			60	ns
		0	2		–40°C to +85°C			75	
		0	2		–55°C to +125°C			90	
		0	4.5		25°C			12	
		0	4.5		–40°C to +85°C			15	
		0	4.5		–55°C to +125°C			18	
		0	6		25°C			10	
		0	6		–40°C to +85°C			13	
		0	6		–55°C to +125°C			15	
		-4.5	4.5		25°C			8	
		-4.5	4.5		–40°C to +85°C			10	
		-4.5	4.5		–55°C to +125°C			12	

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Turn "ON" Time !E to Out	tPZH, tPZL	0	2	50pF	25°C			205	ns
		0	2		–40°C to +85°C			255	
		0	2		–55°C to +125°C			310	
		0	4.5		25°C			41	
		0	4.5		–40°C to +85°C			51	
		0	4.5		–55°C to +125°C			62	
		0	6		25°C			35	
		0	6		–40°C to +85°C			43	
		0	6		–55°C to +125°C			53	
		-4.5	4.5		25°C			37	
		-4.5	4.5		–40°C to +85°C			47	
		-4.5	4.5		–55°C to +125°C			56	
		-	5	15pF	25°C		8		
Turn "ON" Time nS to Out	t_{PZH}, t_{PZL}	0	2	50pF	25°C			175	ns
		0	2		–40°C to +85°C			220	
		0	2		–55°C to +125°C			265	
		0	4.5		25°C			35	
		0	4.5		–40°C to +85°C			44	
		0	4.5		–55°C to +125°C			53	
		0	6		25°C			30	
		0	6		–40°C to +85°C			37	
		0	6		–55°C to +125°C			45	
		-4.5	4.5		25°C			34	
		-4.5	4.5		–40°C to +85°C			43	
		-4.5	4.5		–55°C to +125°C			51	
		-	5	15pF	25°C		14		

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Turn "OFF" Time !E to Out	t_{PLZ}, t_{PHZ}	0	2	50pF	25°C			205	ns
		0	2		–40°C to +85°C			255	ns
		0	2		–55°C to +125°C			310	ns
		0	4.5		25°C			41	ns
		0	4.5		–40°C to +85°C			51	ns
		0	4.5		–55°C to +125°C			62	ns
		0	6		25°C			35	ns
		0	6		–40°C to +85°C			43	ns
		0	6		–55°C to +125°C			53	ns
		-4.5	4.5		25°C			37	ns
		-4.5	4.5		–40°C to +85°C			47	ns
		-4.5	4.5		–55°C to +125°C			56	ns
		-	5	15pF	25°C		8		ns
Turn "OFF" Time nS to Out	t_{PLZ}, t_{PHZ}	0	2	50pF	25°C			175	ns
		0	2		–40°C to +85°C			220	
		0	2		–55°C to +125°C			265	
		0	4.5		25°C			35	
		0	4.5		–40°C to +85°C			44	
		0	4.5		–55°C to +125°C			53	
		0	6		25°C			30	
		0	6		–40°C to +85°C			37	
		0	6		–55°C to +125°C			45	
		-4.5	4.5		25°C			34	
		-4.5	4.5		–40°C to +85°C			43	
		-4.5	4.5		–55°C to +125°C			51	
		-	5	15pF	25°C		14		

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Input (Control) Capacitance	C_I	-	-	-	25°C			10	pF
Input (Control) Capacitance		-	-		–40°C to +85°C			10	
Input (Control) Capacitance		-	-		–55°C to +125°C			10	
Power dissipation capacitance(1)	C_{PD}	-	5		25°C		42		

10 Switching Characteristics HCT

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Propagation Delay, Switch In to Out	t_{PLH}, t_{PHL}	0	4.5	50pF	25°C			12	ns
					–40°C to +85°C			15	
					–55°C to +125°C			18	
		-4.5	4.5		25°C			8	
					–40°C to +85°C			10	
					–55°C to +125°C			12	
Turn "ON" Time !E to Out	tPZH, tPZL	0	4.5	50pF	25°C			44	ns
					–40°C to +85°C			55	
					–55°C to +125°C			66	
		-4.5	4.5		25°C			42	
					–40°C to +85°C			53	
					–55°C to +125°C			63	
		-	5	15pF	25°C		18		
		0	4.5	50pF	25°C			56	
					–40°C to +85°C			70	
					–55°C to +125°C			85	
		-4.5	4.5		25°C			42	
					–40°C to +85°C			53	
					–55°C to +125°C			63	
		-	5	15pF	25°C		24		

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Turn "ON" Time nS to Out	t_{PZH}, t_{PZL}	0	4.5	50pF	25°C			40	ns
					–40°C to +85°C			53	
					–55°C to +125°C			60	
		-4.5	4.5		25°C			34	
					–40°C to +85°C			43	
					–55°C to +125°C			51	
		0	5	15pF	25°C		17		
		0	4.5	50pF	25°C			50	
					–40°C to +85°C			63	
					–55°C to +125°C			75	
		-4.5	4.5		25°C			34	
					–40°C to +85°C			43	
					–55°C to +125°C			51	
		-	5	15pF	25°C		18		
Turn "OFF" Time !E to Out	t_{PLZ}, t_{PHZ}	0	4.5	50pF	25°C			50	ns
					–40°C to +85°C			63	
					–55°C to +125°C			75	
		-4.5	4.5		25°C			46	
					–40°C to +85°C			58	
					–55°C to +125°C			69	
		-	5	15pF	25°C		21		
Turn "OFF" Time nS to Out	t_{PLZ}, t_{PHZ}	0	4.5	50pF	25°C			44	ns
					–40°C to +85°C			55	
					–55°C to +125°C			66	
		-4.5	4.5		25°C			40	
					–40°C to +85°C			50	
					–55°C to +125°C			60	
		-	5	15pF	25°C		18		

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

Parameter		VEE (V)	VCC (V)	Test Conditions		MIN	NOM	MAX	UNIT
Input (Control) Capacitance	C_I	-	-	-	25°C			10	pF
		-	-	-	–40°C to +85°C			10	
		-	-	-	–55°C to +125°C			10	
Power dissipation capacitance(1)	C_{PD}	-	5	-	25°C		47		

11 Analog Channel Specifications

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

Parameter	Test Conditions		HC, HCT TYPES	V_{CC} (V)	MIN	NOM	MAX	UNIT
f_{MAX} Minimum switch frequency response at –3 dB			HC	4.5		200		MHz
			HCT	4.5		200		
THD Sine-wave distortion	1kHz, V_{IS} = $4V_{P-P}$		HC	4.5		0.078		%
	1kHz, V_{IS} = $8V_{P-P}$			9		0.018		
	1kHz, V_{IS} = $4V_{P-P}$		HCT	4.5		0.078		
	1kHz, V_{IS} = $8V_{P-P}$			9		0.018		
Switch "OFF" Signal Feedthrough			HC	4.5		-62		dB
			HCT	4.5		-62		
Switch Input Capacitance, C_S			HC	-		5		pF
			HCT	-		5		

12 HCT Input Loading Table

INPUT	UNIT LOADS(1)
All	0.5

(1) Unit Load is ΔI_{CC} limit specified in DC Electrical Table, e.g., 360µA max at 25°C

13 Recommended Operating Area as a Function of Supply Voltage

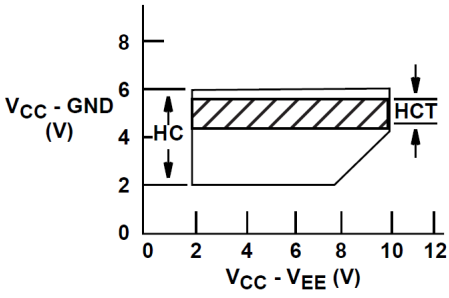


Figure 13-1.

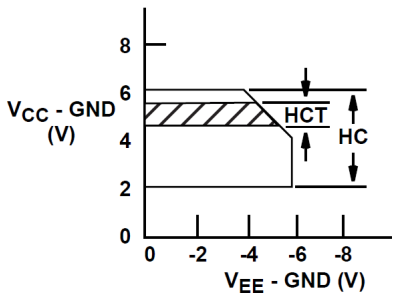


Figure 13-2.

14 Typical Performance Curves

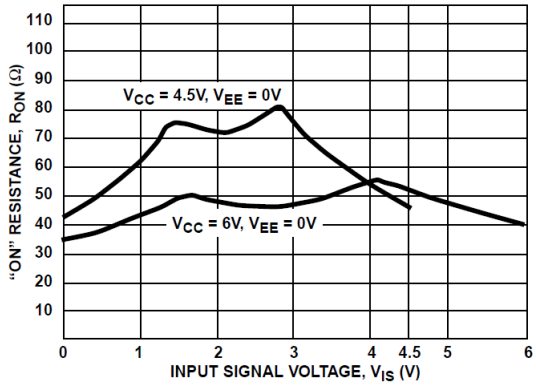


Figure 14-1. Typical On Resistance vs Input Signal Voltage

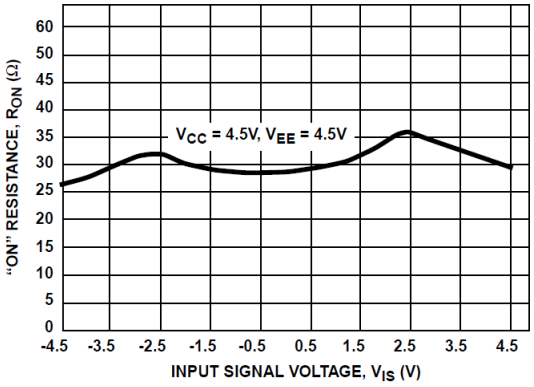


Figure 14-2. Typical On Resistance vs Input Signal Voltage

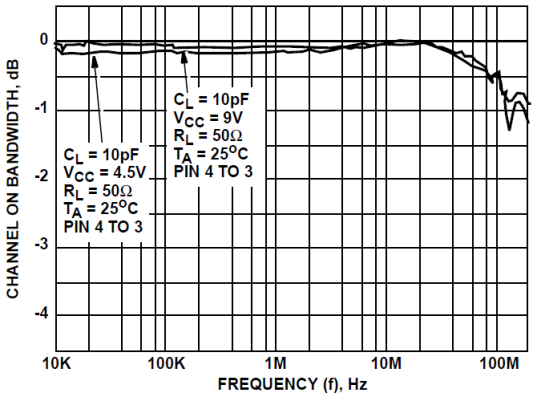


Figure 14-3. Switch Frequency Response

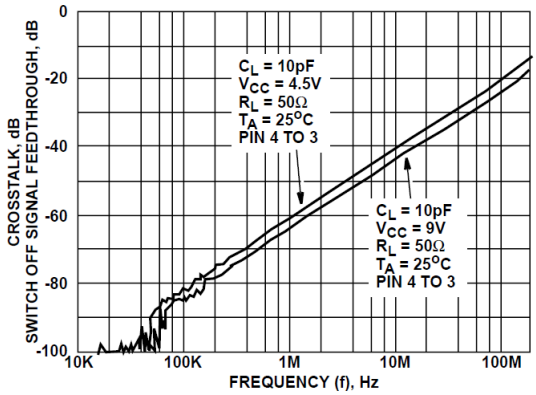


Figure 14-4. Switch-Off Signal Feedthrough and Crosstalk vs Frequency

15 Parameter Measurement Information

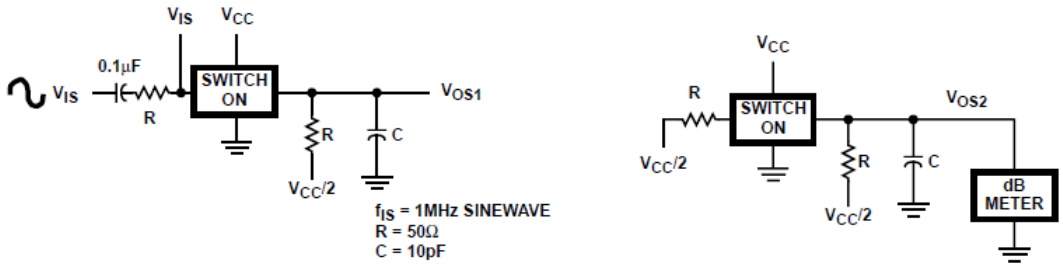


Figure 15-1. Crosstalk Between Two Switches Test Circuit

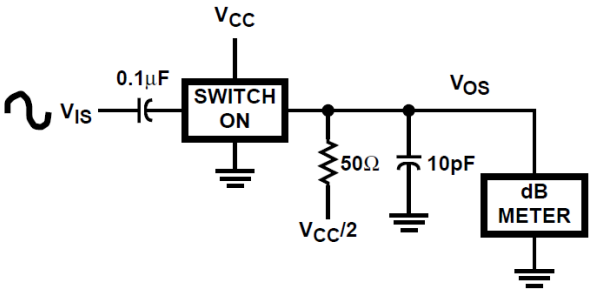


Figure 15-2. Frequency Response Test Circuit

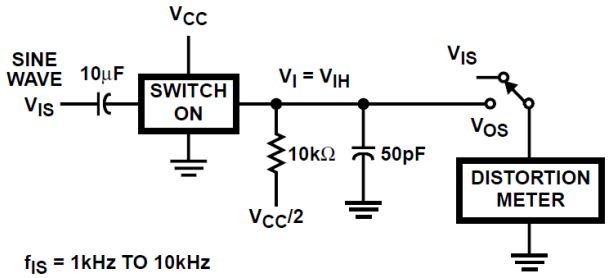


Figure 15-3. Total Harmonic Distortion Test Circuit

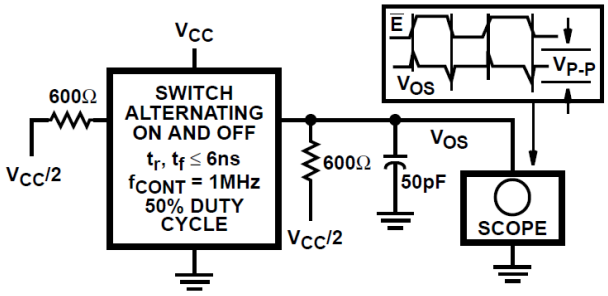


Figure 15-4. Control-To-Switch Feedthrough Noise Test Circuit

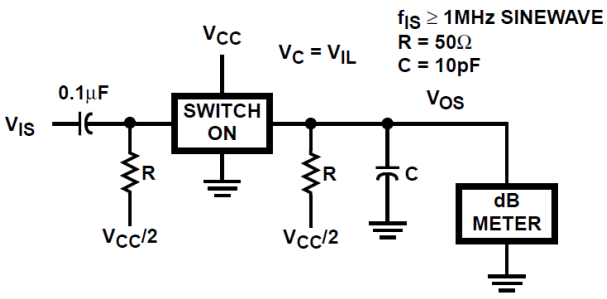


Figure 15-5. Switch Off Signal Feedthrough

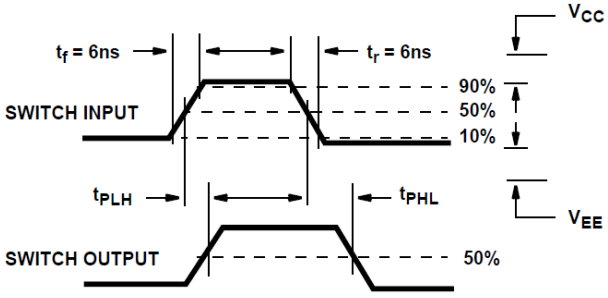


Figure 15-6. Switch Propagation Delay Times

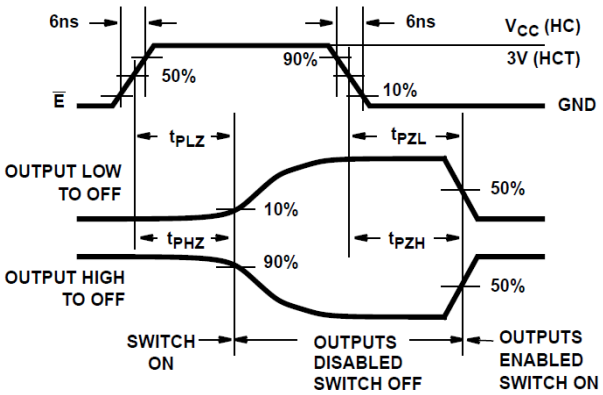
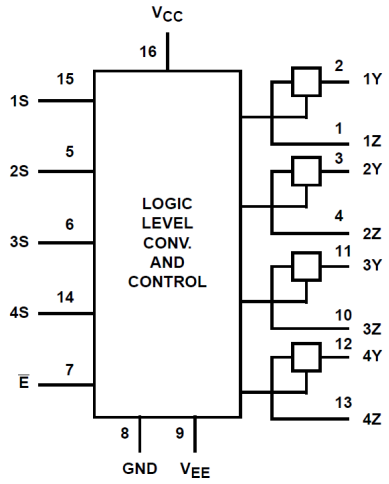


Figure 15-7. Switch Turn-On and Turn-Off Propagation Delay Times Waveforms

16 Detailed Description

16.1 Functional Block Diagram



16.2 Device Functional Modes

Table 16-1. Truth Table(1)

INPUTS		SWITCH
E	S	
L	L	OFF
L	H	ON
H	X	OFF

(1) H = High Level Voltage, L = Low Level Voltage, X = Do not Care

17 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.

17.1 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.

17.2 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.

17.3 Trademarks

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

17.4 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.

17.5 Glossary

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

18 Revision History

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

Changes from Revision D (October 2003) to Revision E (July 2024)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document	1
• Updated thermal information	5
• Updated electrical specifications	6
• Updated switching specifications	10
• Updated analog channel specifications	15
• Updated orderable information	19

19 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
CD54HC4316F3A	ACTIVE	CDIP	J	16	25	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	CD54HC4316F3A	Samples
CD74HC4316E	NRND	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD74HC4316E	
CD74HC4316M	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI	-55 to 125	HC4316M	
CD74HC4316M96	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC4316M	Samples
CD74HC4316NSR	NRND	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HC4316M	
CD74HC4316PW	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-55 to 125	HJ4316	
CD74HC4316PWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HJ4316	Samples
CD74HCT4316E	NRND	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-55 to 125	CD74HCT4316E	
CD74HCT4316M	NRND	SOIC	D	16	40	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT4316M	
CD74HCT4316M96	NRND	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-55 to 125	HCT4316M	

(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 CD54HC4316, CD74HC4316 :

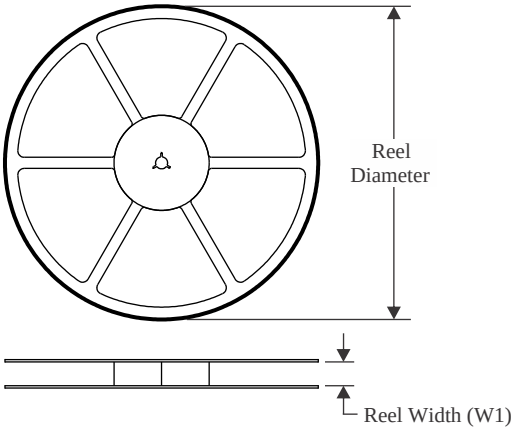
- Catalog : CD74HC4316
- Military : CD54HC4316

NOTE: Qualified Version Definitions:

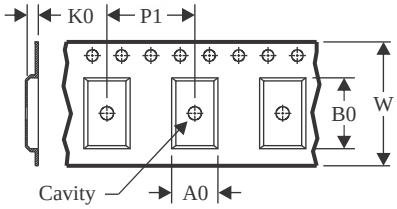
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS

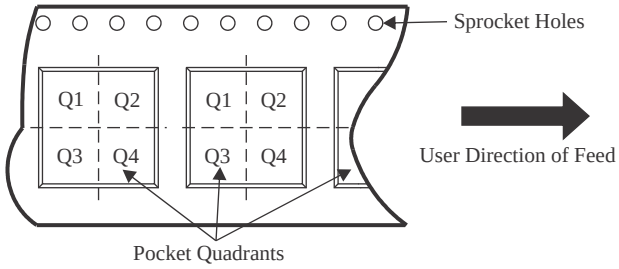


TAPE DIMENSIONS



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

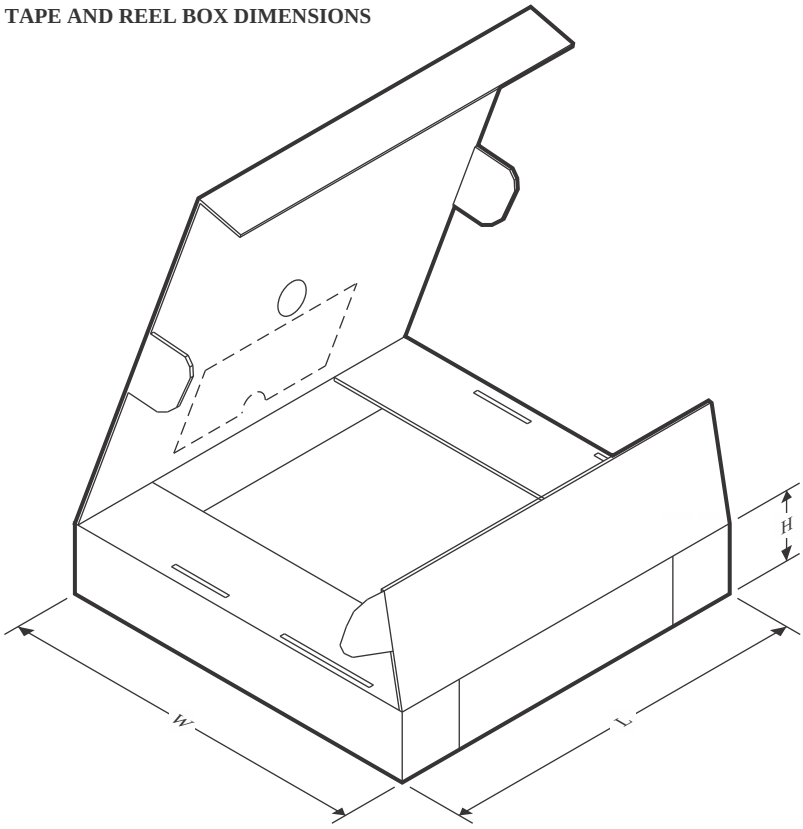
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CD74HC4316M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD74HC4316NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD74HC4316PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
CD74HCT4316M96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1

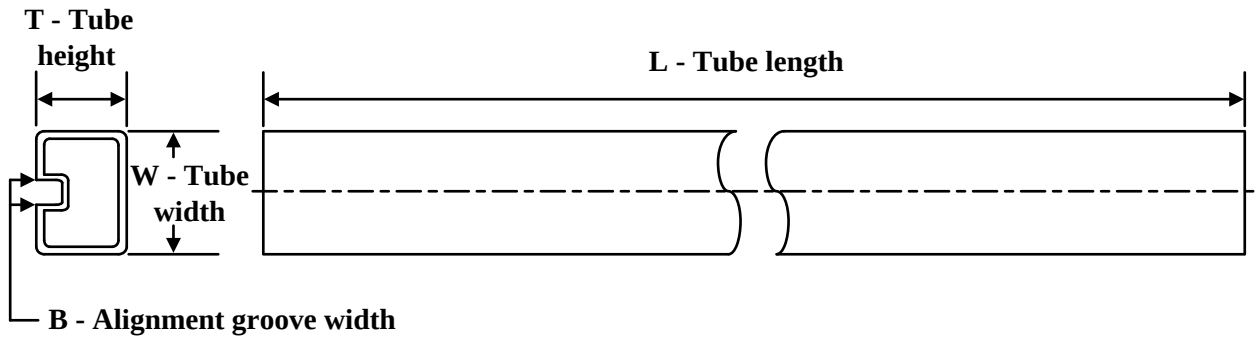
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

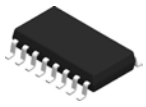
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD74HC4316M96	SOIC	D	16	2500	353.0	353.0	32.0
CD74HC4316NSR	SO	NS	16	2000	356.0	356.0	35.0
CD74HC4316PWR	TSSOP	PW	16	2000	356.0	356.0	35.0
CD74HCT4316M96	SOIC	D	16	2500	340.5	336.1	32.0

TUBE



*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
CD74HC4316E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HC4316E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT4316E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT4316E	N	PDIP	16	25	506	13.97	11230	4.32
CD74HCT4316M	D	SOIC	16	40	507	8	3940	4.32

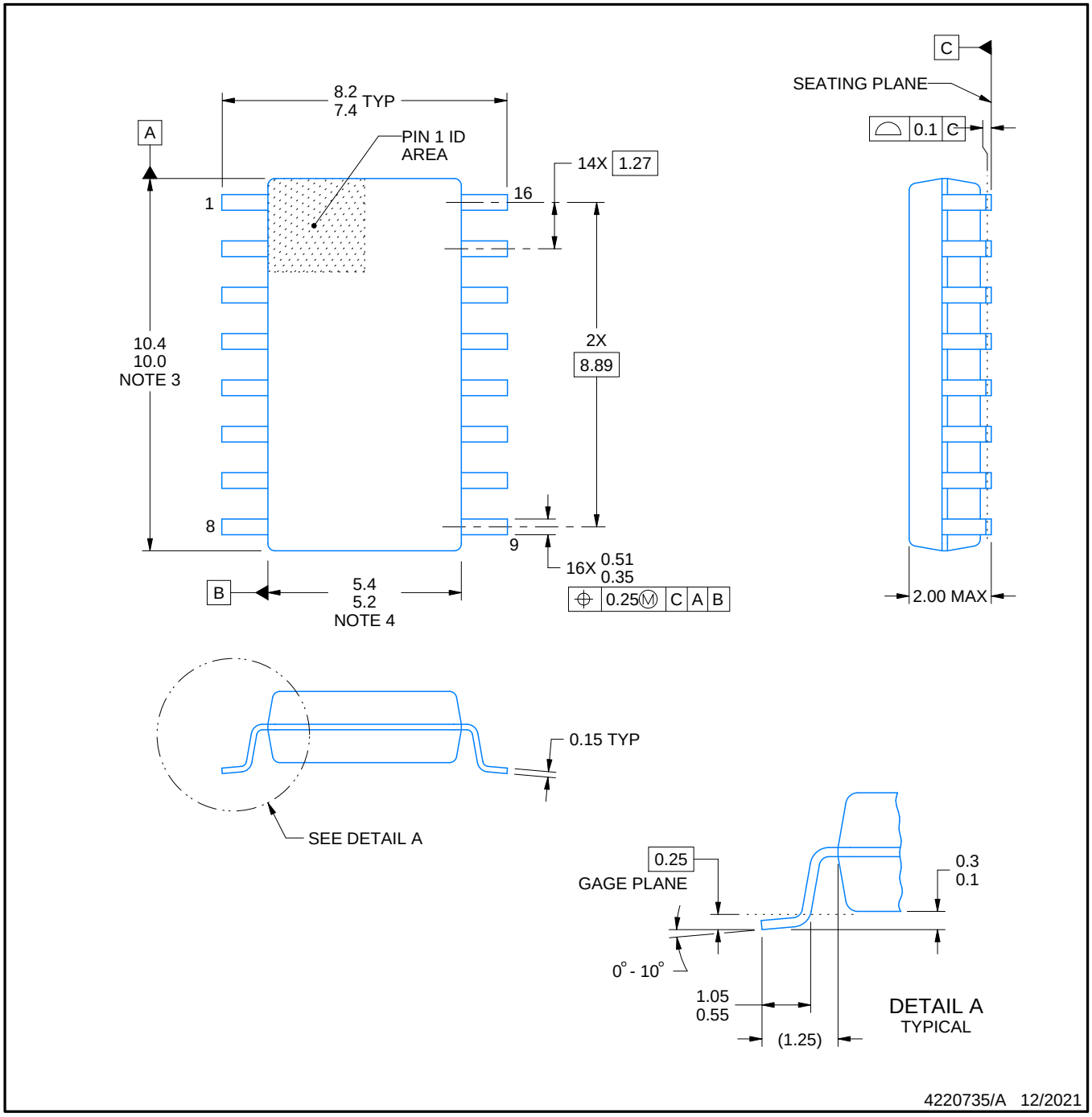


PACKAGE OUTLINE

NS0016A

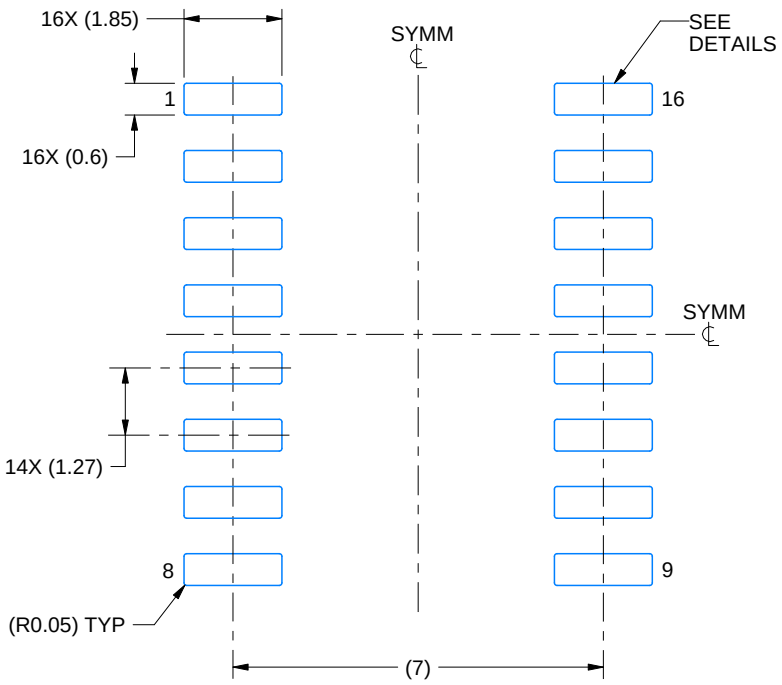
SOP - 2.00 mm max height

SOP

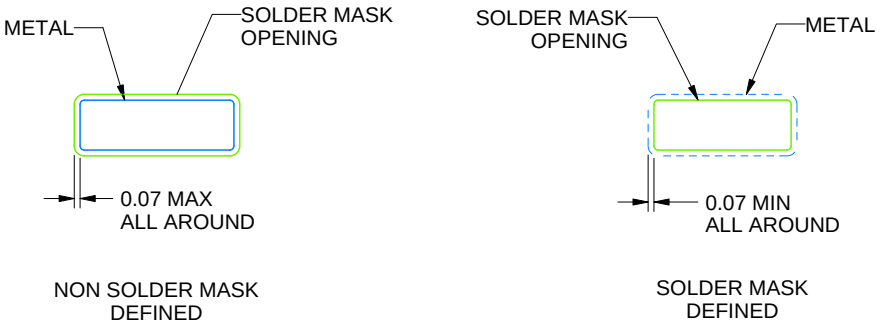


NOTES:

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.



LAND PATTERN EXAMPLE
SCALE:7X



NON SOLDER MASK
DEFINED

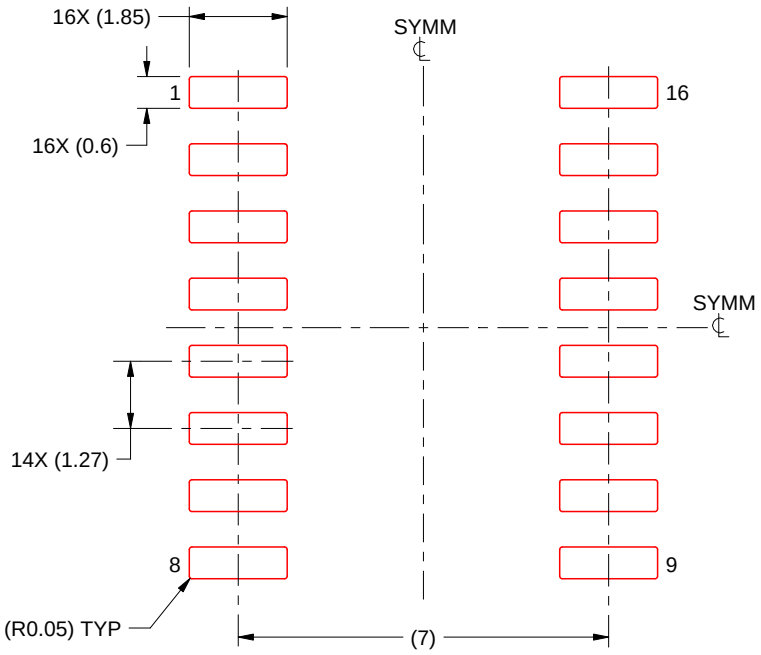
SOLDER MASK
DEFINED

SOLDER MASK DETAILS

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.



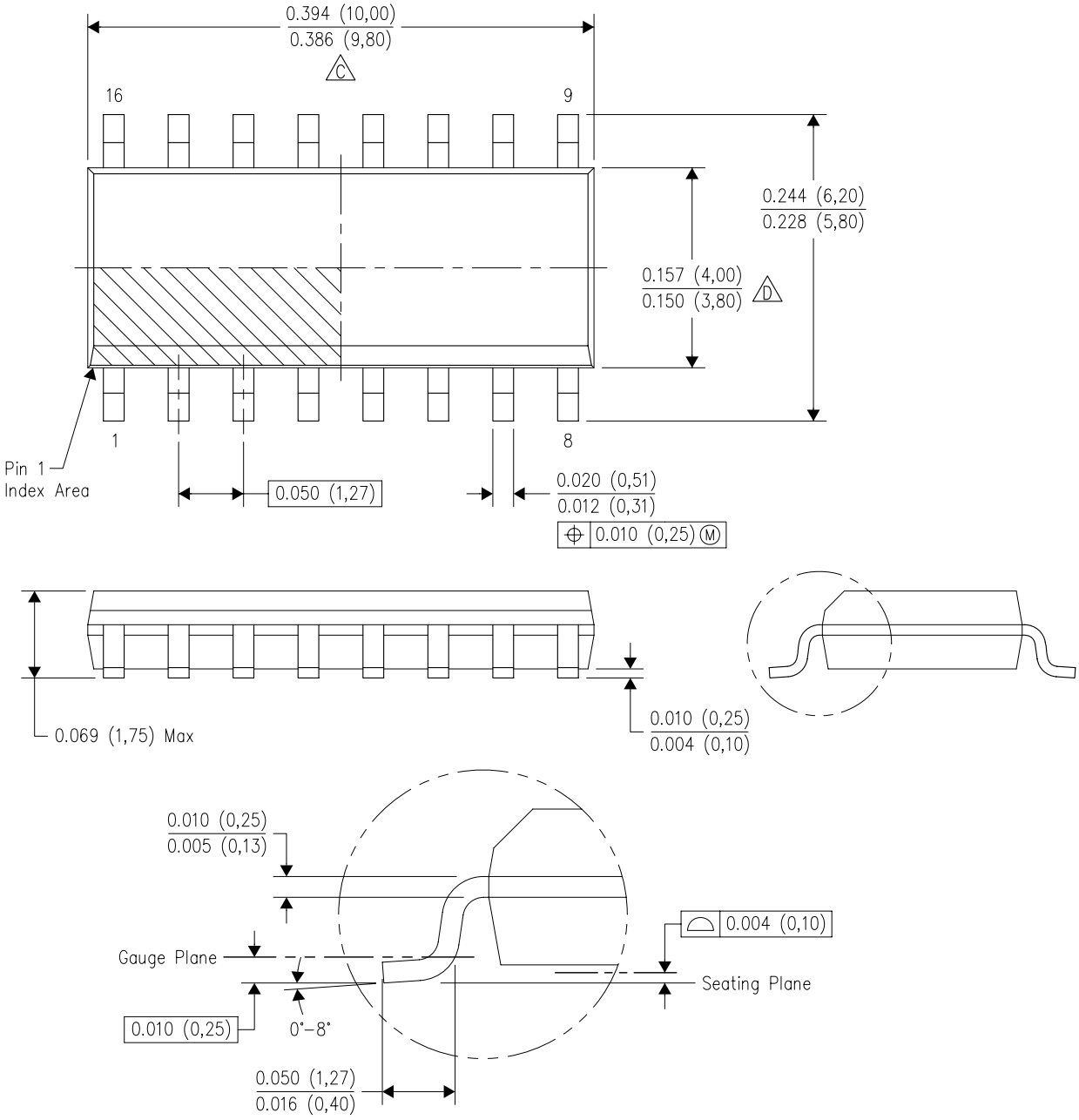
SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:7X

4220735/A 12/2021

NOTES: (continued)

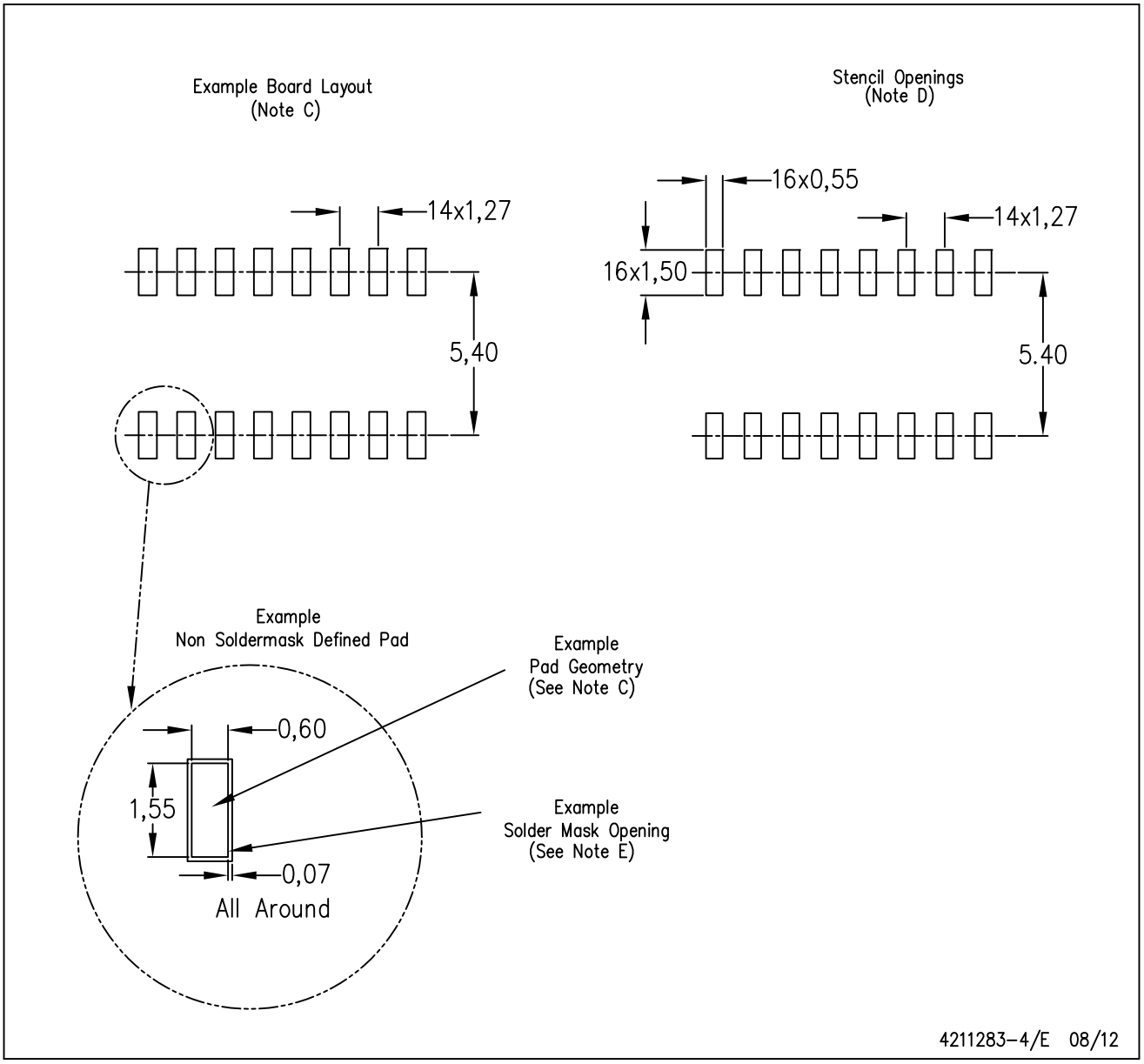
7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



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.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



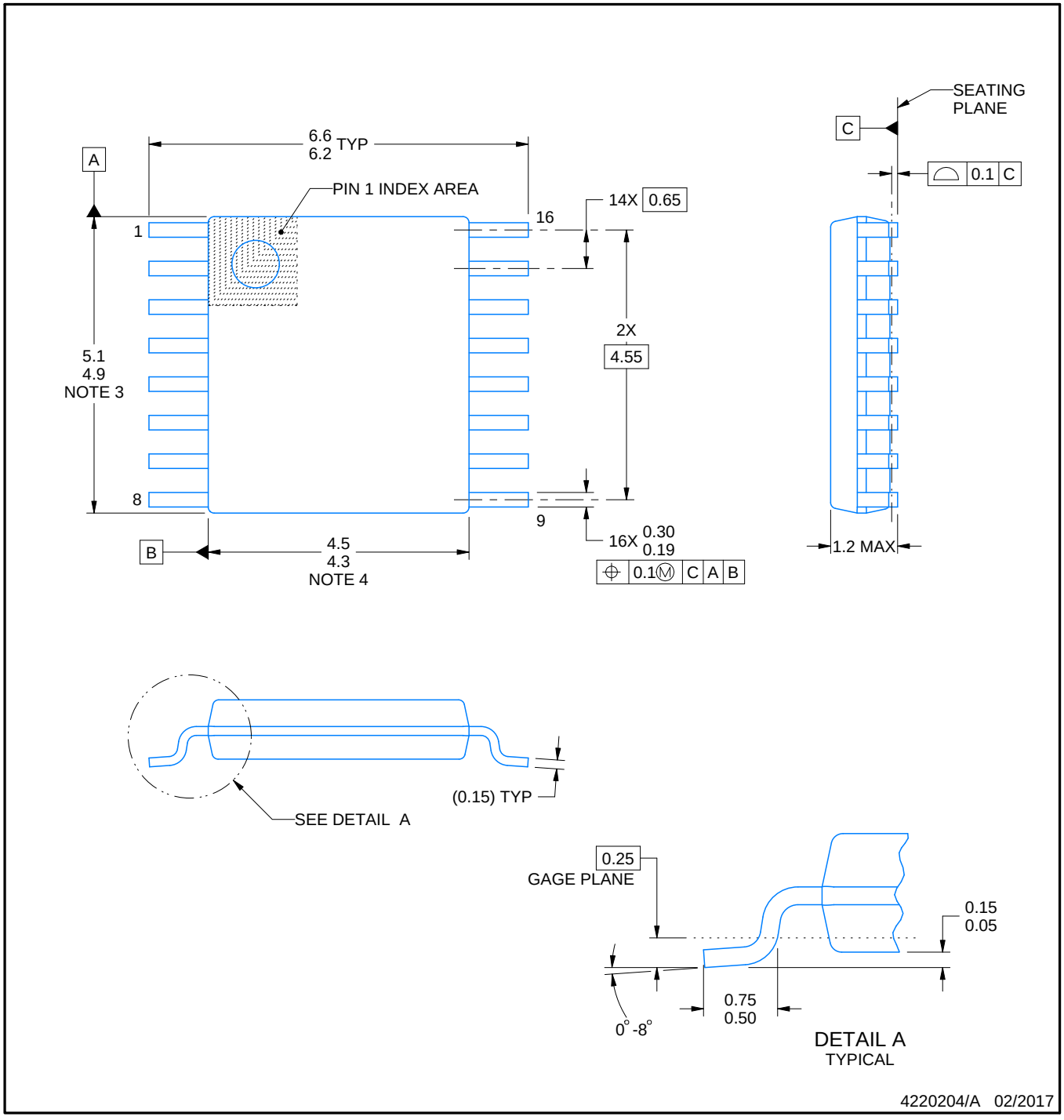
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PACKAGE OUTLINE

PW0016A

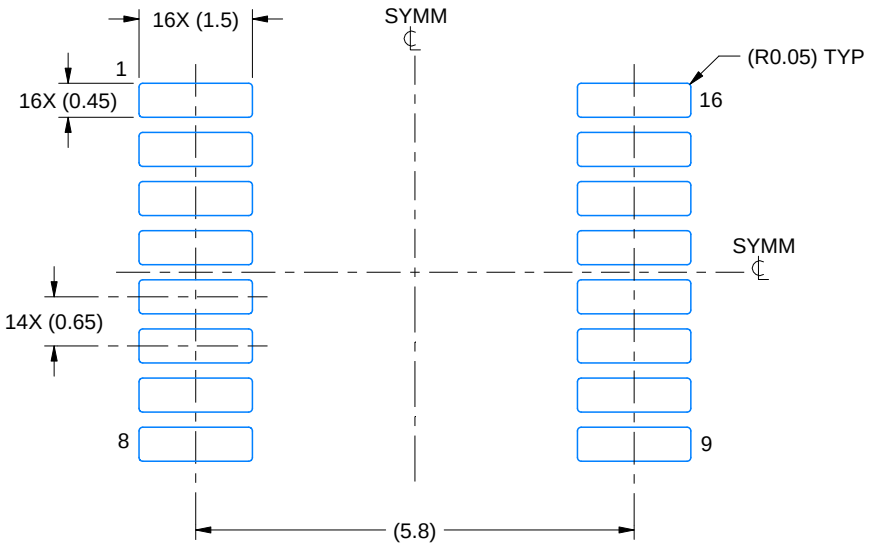
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

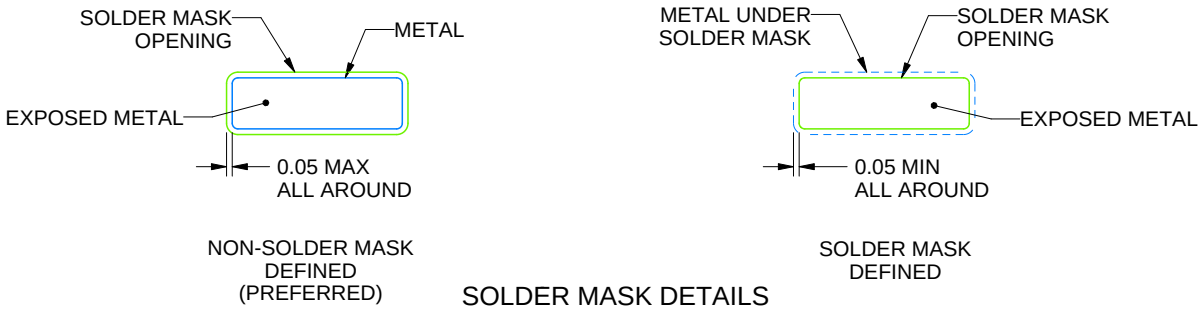


NOTES:

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



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

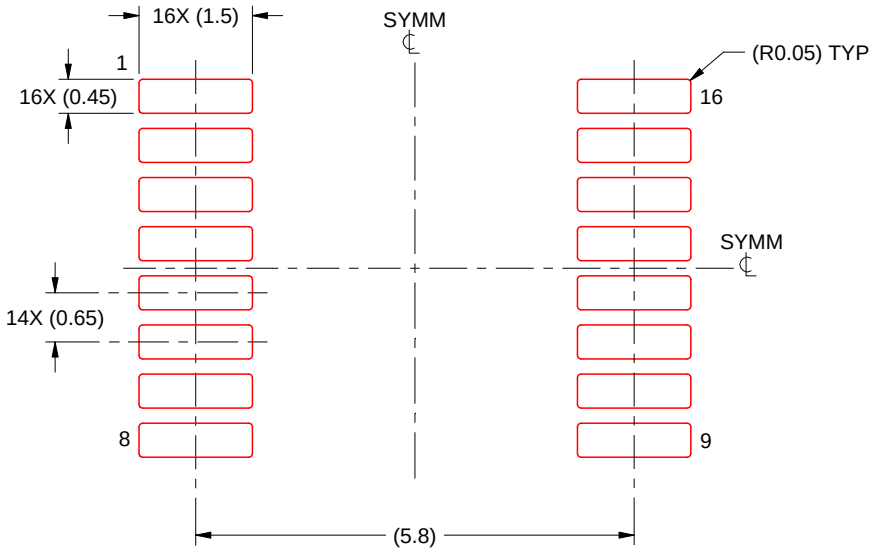


SOLDER MASK DETAILS

4220204/A 02/2017

NOTES: (continued)

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



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

4220204/A 02/2017

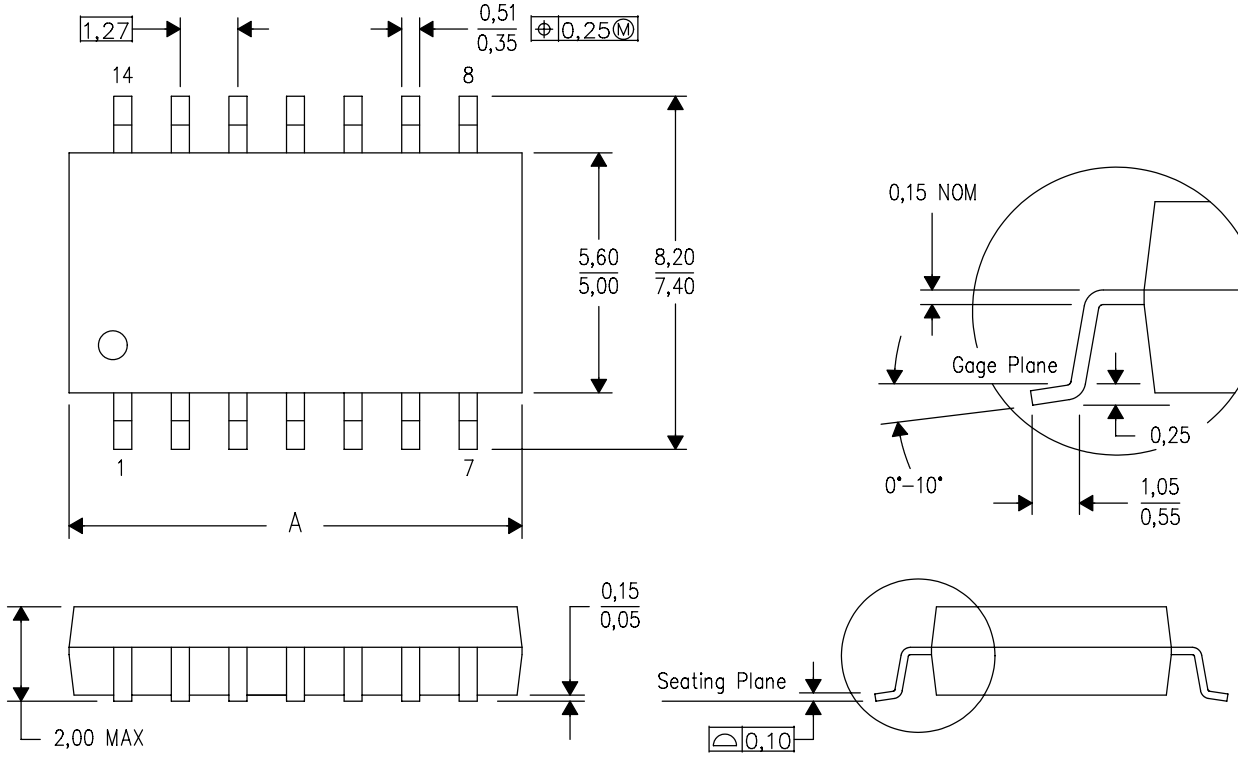
NOTES: (continued)

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

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

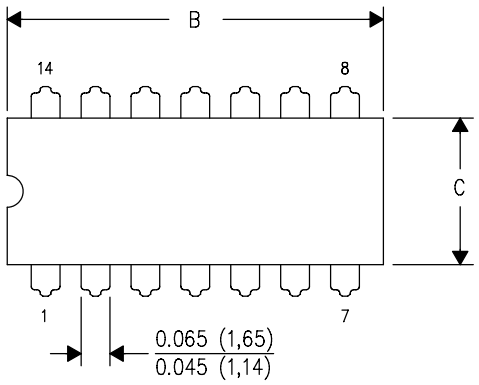
4040062/C 03/03

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.

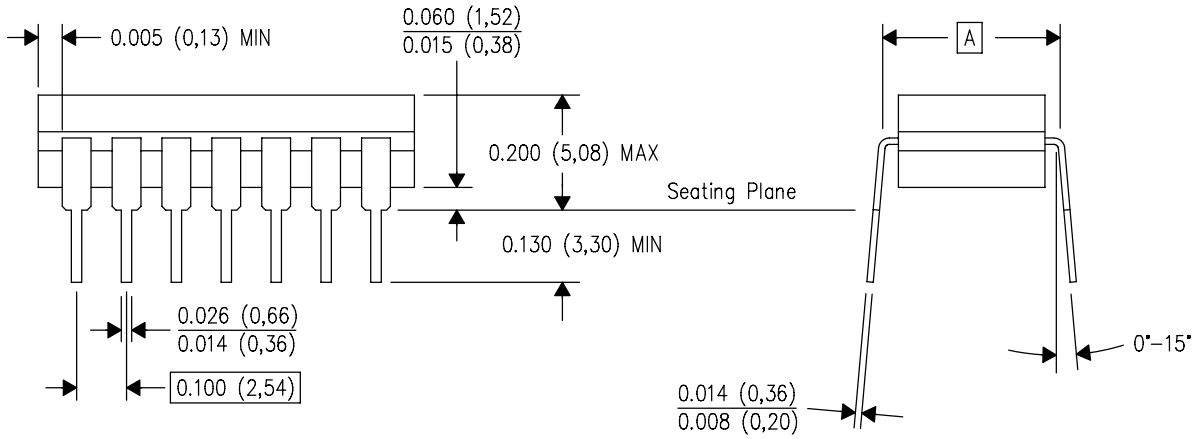
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



DIM \ PINS **	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)



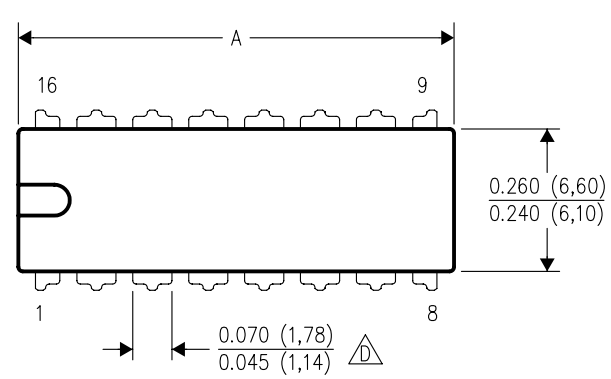
4040083/F 03/03

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.

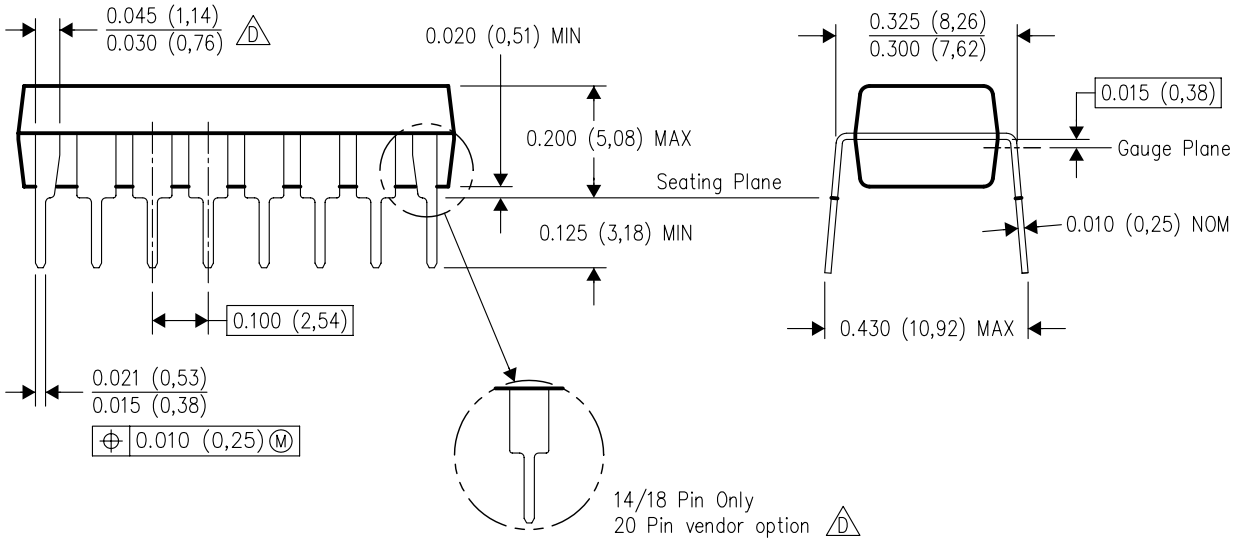
N (R–PDIP–T**)

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.

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