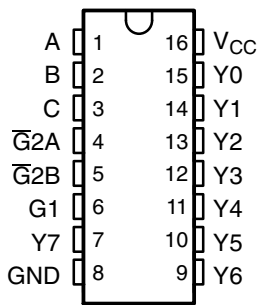


# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

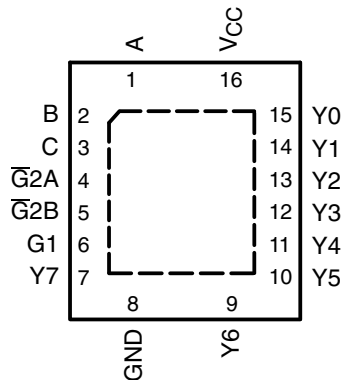
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- Operating Range 2-V to 5.5-V  $V_{CC}$
- Designed Specifically for High-Speed Memory Decoders and Data-Transmission Systems
- Incorporate Three Enable Inputs to Simplify Cascading and/or Data Reception
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

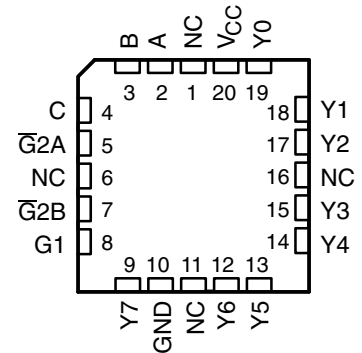
SN54AHC138 . . . J OR W PACKAGE  
SN74AHC138 . . . D, DB, DGV, N, NS,  
OR PW PACKAGE  
(TOP VIEW)



SN74AHC138 . . . RGY PACKAGE  
(TOP VIEW)



SN54AHC138 . . . FK PACKAGE  
(TOP VIEW)



NC – No internal connection

## description/ordering information

The 'AHC138 decoders/demultiplexers are designed for high-performance memory-decoding and data-routing applications that require very short propagation-delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When employed with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory usually are less than the typical access time of the memory. This means that the effective system delay introduced by the decoders is negligible.

## ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Tape and reel	SN74AHC138RGYR	HA138
	PDIP – N	Tube	SN74AHC138N	SN74AHC138N
	SOIC – D	Tube	SN74AHC138D	AHC138
		Tape and reel	SN74AHC138DR	
	SOP – NS	Tape and reel	SN74AHC138NSR	AHC138
	SSOP – DB	Tape and reel	SN74AHC138DBR	HA138
	TSSOP – PW	Tube	SN74AHC138PW	HA138
Tape and reel		SN74AHC138PWR		
–55°C to 125°C	TVSOP – DGV	Tape and reel	SN74AHC138DGVR	HA138
	CDIP – J	Tube	SNJ54AHC138J	SNJ54AHC138J
	CFP – W	Tube	SNJ54AHC138W	SNJ54AHC138W
	LCCC – FK	Tube	SNJ54AHC138FK	SNJ54AHC138FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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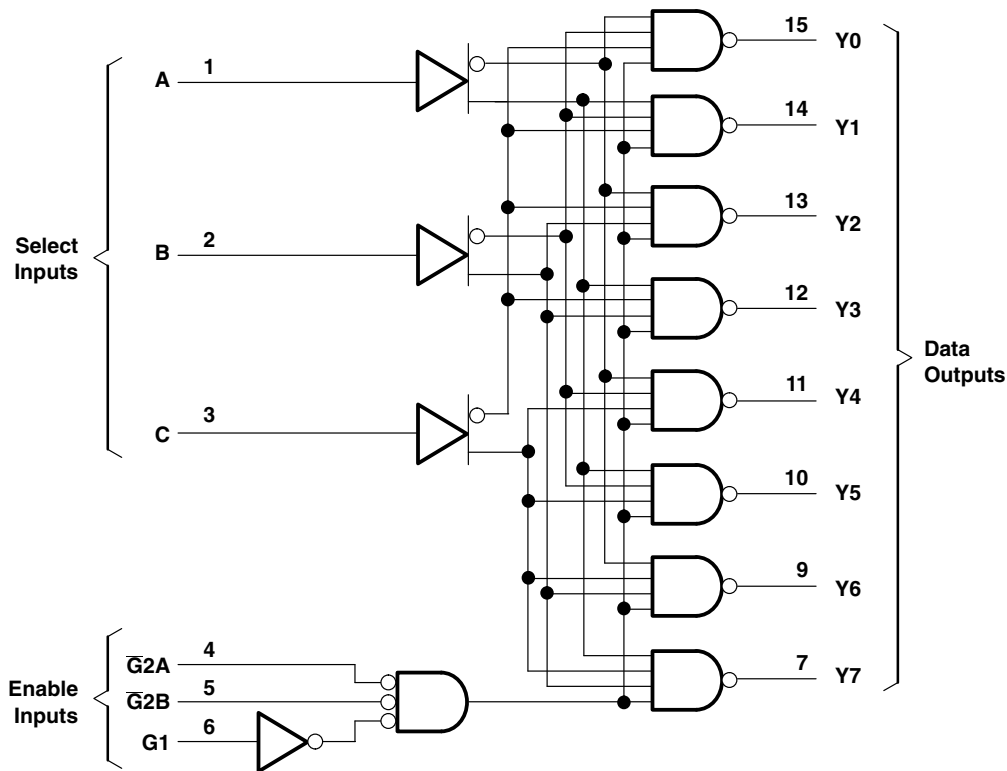
## description/ordering information (continued)

The conditions at the binary-select inputs and the three enable inputs select one of eight output lines. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters, and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

FUNCTION TABLE

ENABLE INPUTS			SELECT INPUTS			OUTPUTS							
G1	G2A	G2B	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	L	H	H	H	H	H
H	L	L	H	L	L	H	H	H	H	L	H	H	H
H	L	L	H	L	H	H	H	H	H	H	L	H	H
H	L	L	H	H	L	H	H	H	H	H	L	H	H
H	L	L	H	H	H	H	H	H	H	H	H	L	L

## logic diagram (positive logic)



Pin numbers shown are for the D, DB, DGV, J, N, NS, PW, RGY, and W packages.



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# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Supply voltage range, $V_{CC}$	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1)	–0.5 V to 7 V
Output voltage range, $V_O$ (see Note 1)	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	–20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±25 mA
Continuous current through $V_{CC}$ or GND	±75 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): D package	73°C/W
(see Note 2): DB package	82°C/W
(see Note 2): DGV package	120°C/W
(see Note 2): N package	67°C/W
(see Note 2): NS package	64°C/W
(see Note 2): PW package	108°C/W
(see Note 3): RGY package	39°C/W
Storage temperature range, $T_{stg}$	–65°C to 150°C

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 2. The package thermal impedance is calculated in accordance with JESD 51-7.  
 3. The package thermal impedance is calculated in accordance with JESD 51-5.

## recommended operating conditions (see Note 4)

		SN54AHC138		SN74AHC138		UNIT
		MIN	MAX	MIN	MAX	
$V_{CC}$	Supply voltage	2	5.5	2	5.5	V
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V		1.5	1.5	V
		$V_{CC} = 3$ V		2.1	2.1	
		$V_{CC} = 5.5$ V		3.85	3.85	
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V		0.5	0.5	V
		$V_{CC} = 3$ V		0.9	0.9	
		$V_{CC} = 5.5$ V		1.65	1.65	
$V_I$	Input voltage	0	5.5	0	5.5	V
$V_O$	Output voltage	0	$V_{CC}$	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2$ V		–50	–50	µA
		$V_{CC} = 3.3$ V ± 0.3 V		–4	–4	mA
		$V_{CC} = 5$ V ± 0.5 V		–8	–8	
$I_{OL}$	Low-level output current	$V_{CC} = 2$ V		50	50	µA
		$V_{CC} = 3.3$ V ± 0.3 V		4	4	mA
		$V_{CC} = 5$ V ± 0.5 V		8	8	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3$ V ± 0.3 V		100	100	ns/V
		$V_{CC} = 5$ V ± 0.5 V		20	20	
$T_A$	Operating free-air temperature	–55	125	–40	85	°C

NOTE 4: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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

PARAMETER	TEST CONDITIONS	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54AHC138		SN74AHC138		UNIT
			MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	2 V	1.9	2		1.9		1.9	V	
		3 V	2.9	3		2.9		2.9		
		4.5 V	4.4	4.5		4.4		4.4		
	I <sub>OH</sub> = -4 mA	3 V	2.58			2.48		2.48		
	I <sub>OH</sub> = -8 mA	4.5 V	3.94			3.8		3.8		
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	2 V			0.1		0.1	0.1	V	
		3 V			0.1		0.1	0.1		
		4.5 V			0.1		0.1	0.1		
	I <sub>OL</sub> = 4 mA	3 V		0.36		0.5		0.44		
	I <sub>OL</sub> = 8 mA	4.5 V		0.36		0.5		0.44		
I <sub>I</sub>	V <sub>I</sub> = 5.5 V or GND	0 V to 5.5 V			±0.1		±1*		μA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			4		40		μA	
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		2	10				pF	

\* On products compliant to MIL-PRF-38535, this parameter is not production tested at V<sub>CC</sub> = 0 V.

switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			SN54AHC138		SN74AHC138		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A, B, C	Any Y	C <sub>L</sub> = 15 pF	8.2**	11.4**		1**	13**	1	13	ns
t <sub>PHL</sub>				8.2**	11.4**		1**	13**	1	13	
t <sub>PLH</sub>	G1	Any Y	C <sub>L</sub> = 15 pF	8.1**	12.8**		1**	15**	1	15	ns
t <sub>PHL</sub>				8.1**	12.8**		1**	15**	1	15	
t <sub>PLH</sub>	G̅2A, G̅2B	Any Y	C <sub>L</sub> = 15 pF	8.2**	11.4**		1**	13.5**	1	13.5	ns
t <sub>PHL</sub>				8.2**	11.4**		1**	13.5**	1	13.5	
t <sub>PLH</sub>	A, B, C	Any Y	C <sub>L</sub> = 50 pF	10	15.8		1	18	1	18	ns
t <sub>PHL</sub>				10	15.8		1	18	1	18	
t <sub>PLH</sub>	G1	Any Y	C <sub>L</sub> = 50 pF	10.6	16.3		1	18.5	1	18.5	ns
t <sub>PHL</sub>				10.6	16.3		1	18.5	1	18.5	
t <sub>PLH</sub>	G̅2A, G̅2B	Any Y	C <sub>L</sub> = 50 pF	10.7	14.9		1	17	1	17	ns
t <sub>PHL</sub>				10.7	14.9		1	17	1	17	

\*\* On products compliant to MIL-PRF-38535, this parameter is not production tested.



# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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switching characteristics over recommended operating free-air temperature range,  
 $V_{CC} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54AHC138		SN74AHC138		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
$t_{PLH}$	A, B, C	Any Y	$C_L = 15\text{ pF}$	5.7*	8.1*	1*	9.5*	1	9.5	ns	
$t_{PHL}$				5.7*	8.1*	1*	9.5*	1	9.5		
$t_{PLH}$	G1	Any Y	$C_L = 15\text{ pF}$	5.6*	8.1*	1*	9.5*	1	9.5	ns	
$t_{PHL}$				5.6*	8.1*	1*	9.5*	1	9.5		
$t_{PLH}$	$\overline{G}2A, \overline{G}2B$	Any Y	$C_L = 15\text{ pF}$	5.8*	8.1*	1*	9.5*	1	9.5	ns	
$t_{PHL}$				5.8*	8.1*	1*	9.5*	1	9.5		
$t_{PLH}$	A, B, C	Any Y	$C_L = 50\text{ pF}$	7.2	10.1	1	11.5	1	11.5	ns	
$t_{PHL}$				7.2	10.1	1	11.5	1	11.5		
$t_{PLH}$	G1	Any Y	$C_L = 50\text{ pF}$	7.1	10.1	1	11.5	1	11.5	ns	
$t_{PHL}$				7.1	10.1	1	11.5	1	11.5		
$t_{PLH}$	$\overline{G}2A, \overline{G}2B$	Any Y	$C_L = 50\text{ pF}$	7.3	10.1	1	11.5	1	11.5	ns	
$t_{PHL}$				7.3	10.1	1	11.5	1	11.5		

\* On products compliant to MIL-PRF-38535, this parameter is not production tested.

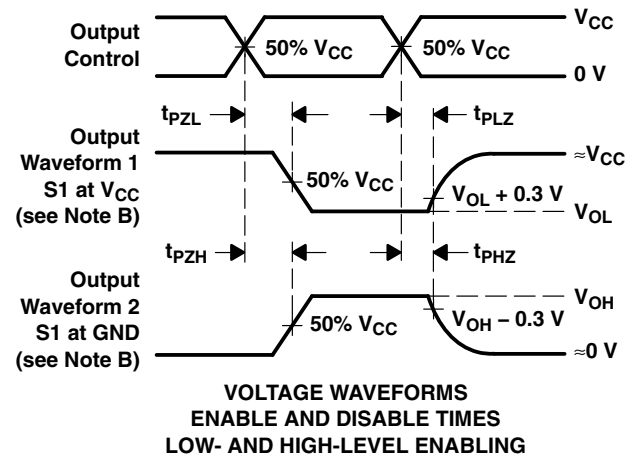
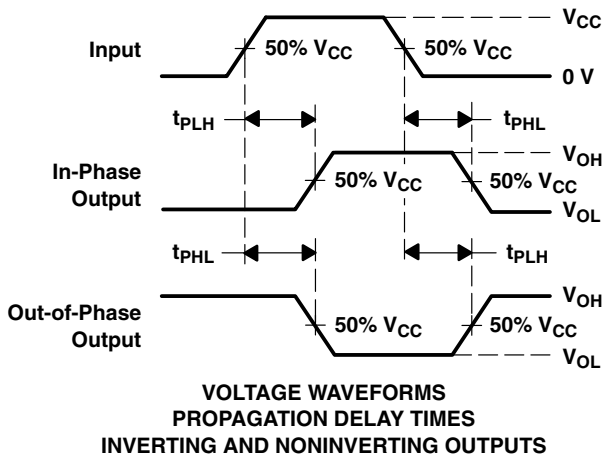
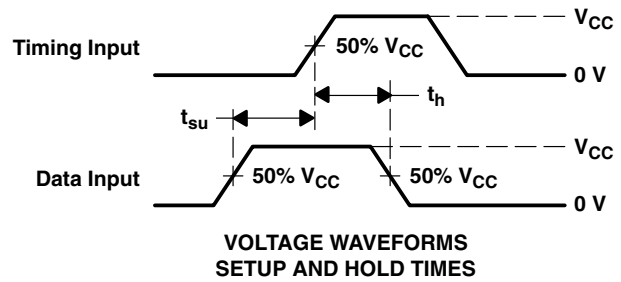
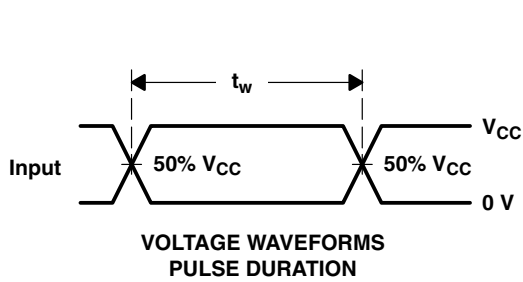
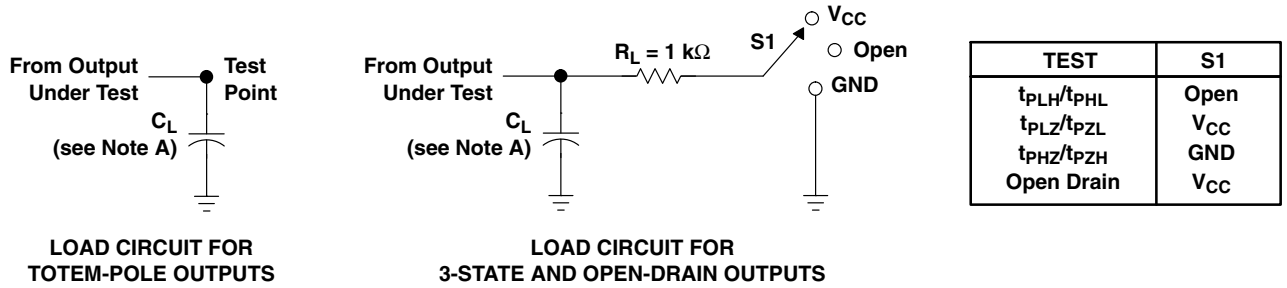
operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance	No load, $f = 1\text{ MHz}$	13	pF

# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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## PARAMETER MEASUREMENT INFORMATION



- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
  - D. The outputs are measured one at a time with one input transition per measurement.
  - E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

# SN54AHC138, SN74AHC138 3-LINE TO 8-LINE DECODERS/DEMULTIPLEXERS

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## APPLICATION INFORMATION

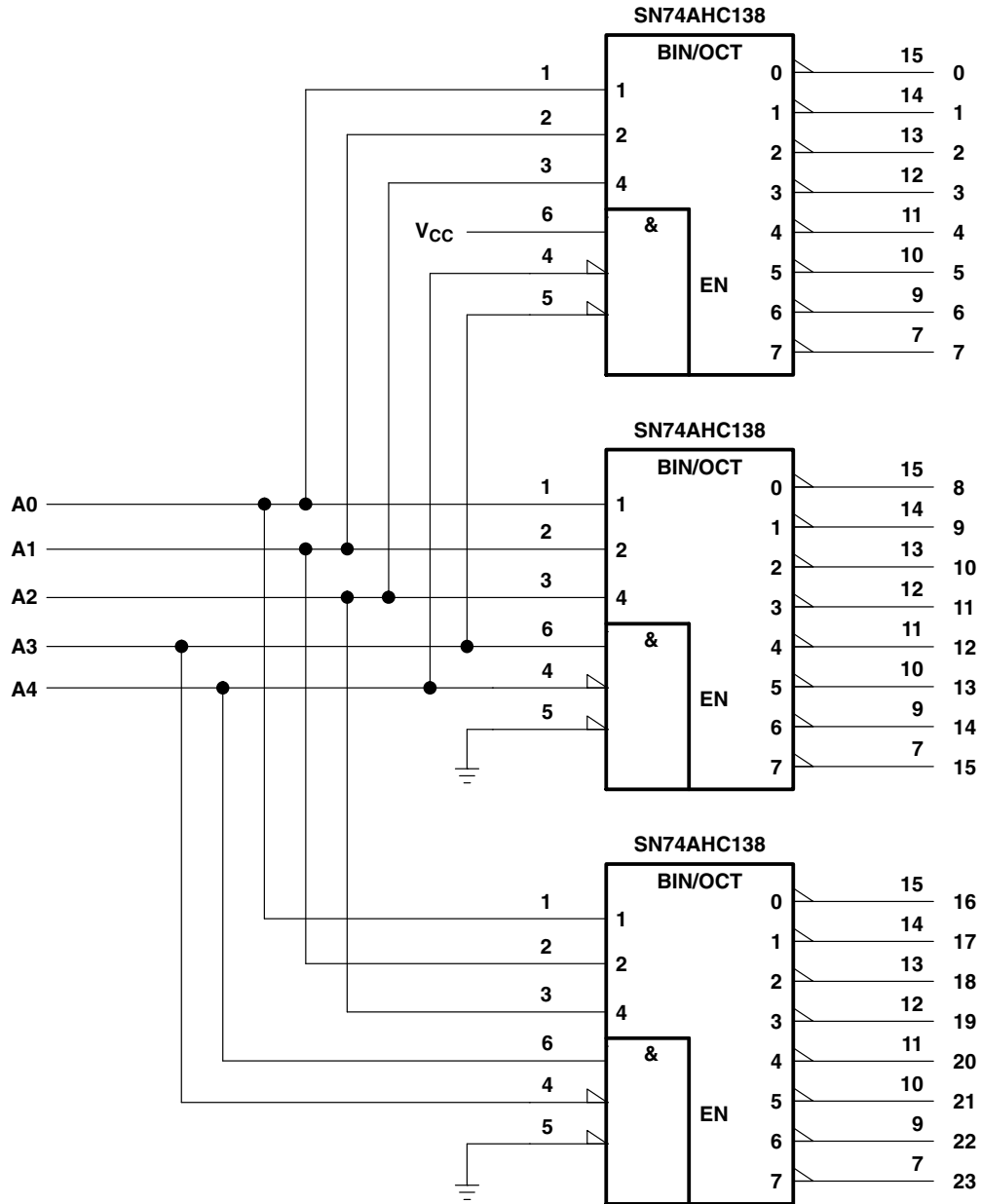


Figure 2. 24-Bit Decoding Scheme

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## APPLICATION INFORMATION

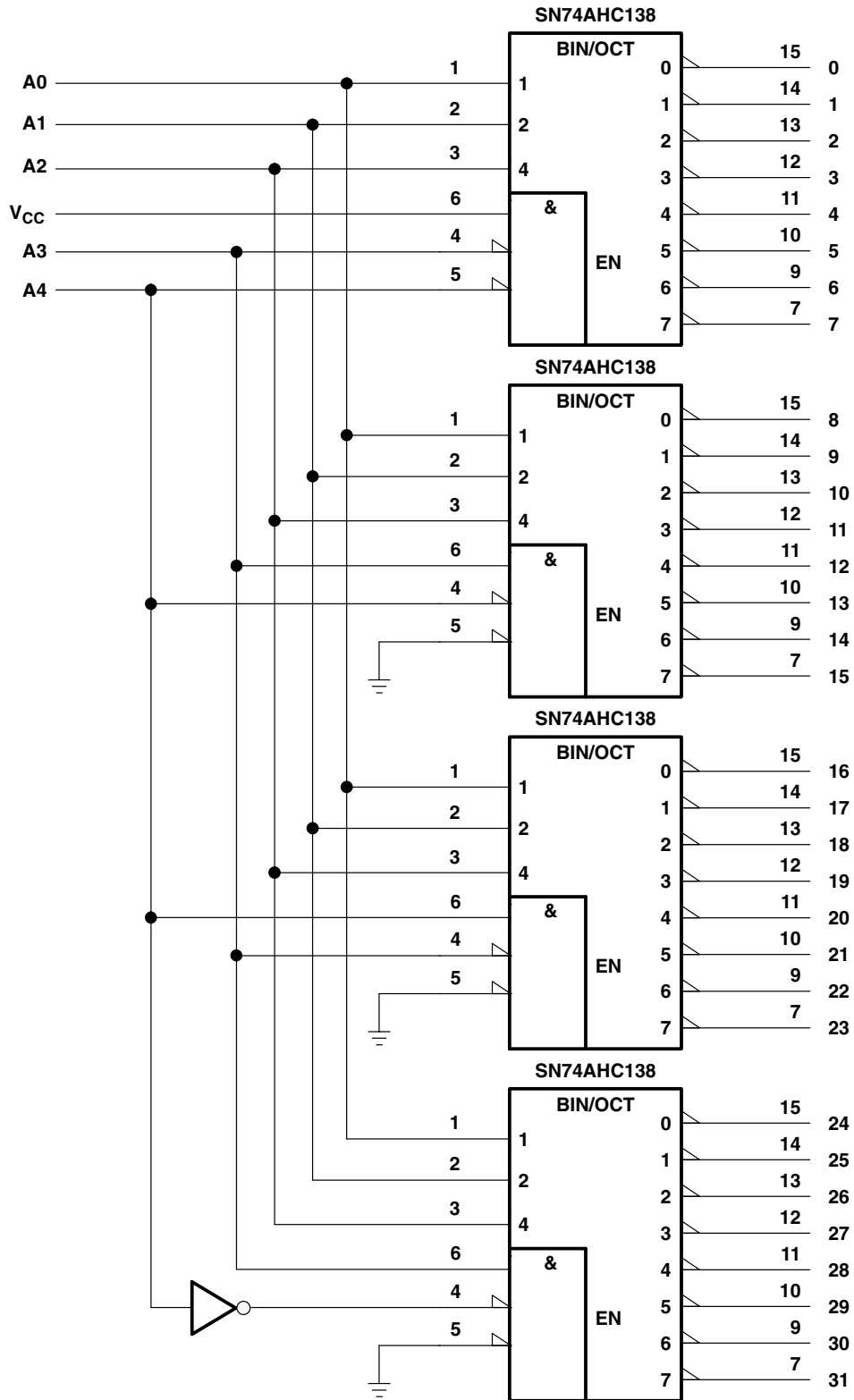


Figure 3. 32-Bit Decoding Scheme



**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
5962-9851601Q2A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9851601Q2A SNJ54AHC 138FK	<a href="#">Samples</a>
5962-9851601QEA	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9851601QE A SNJ54AHC138J	<a href="#">Samples</a>
5962-9851601QFA	ACTIVE	CFP	W	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9851601QF A SNJ54AHC138W	<a href="#">Samples</a>
SN74AHC138DBR	ACTIVE	SSOP	DB	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HA138	<a href="#">Samples</a>
SN74AHC138DGVR	ACTIVE	TVSOP	DGV	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HA138	<a href="#">Samples</a>
SN74AHC138DR	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHC138	<a href="#">Samples</a>
SN74AHC138DRE4	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHC138	<a href="#">Samples</a>
SN74AHC138DRG4	ACTIVE	SOIC	D	16	2500	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHC138	<a href="#">Samples</a>
SN74AHC138N	ACTIVE	PDIP	N	16	25	RoHS & Green	NIPDAU	N / A for Pkg Type	-40 to 85	SN74AHC138N	<a href="#">Samples</a>
SN74AHC138NSR	ACTIVE	SO	NS	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	AHC138	<a href="#">Samples</a>
SN74AHC138PWR	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HA138	<a href="#">Samples</a>
SN74AHC138PWRE4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HA138	<a href="#">Samples</a>
SN74AHC138PWRG4	ACTIVE	TSSOP	PW	16	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HA138	<a href="#">Samples</a>
SN74AHC138RGYR	ACTIVE	VQFN	RGY	16	3000	RoHS & Green	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	HA138	<a href="#">Samples</a>
SNJ54AHC138FK	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9851601Q2A SNJ54AHC 138FK	<a href="#">Samples</a>
SNJ54AHC138J	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-9851601QE A	<a href="#">Samples</a>

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
SNJ54AHC138W	ACTIVE	CFP	W	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	SNJ54AHC138J 5962-9851601QF A SNJ54AHC138W	<a href="#">Samples</a>

(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.

**OBSELETE:** 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.

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**OTHER QUALIFIED VERSIONS OF SN54AHC138, SN74AHC138 :**

- Catalog : [SN74AHC138](#)
- Military : [SN54AHC138](#)

NOTE: Qualified Version Definitions:

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

**TAPE AND REEL INFORMATION**

**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
SN74AHC138DBR	SSOP	DB	16	2000	330.0	16.4	8.35	6.6	2.4	12.0	16.0	Q1
SN74AHC138DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74AHC138DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74AHC138NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74AHC138PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHC138RGYR	VQFN	RGY	16	3000	330.0	12.4	3.8	4.3	1.5	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)
SN74AHC138DBR	SSOP	DB	16	2000	356.0	356.0	35.0
SN74AHC138DGVR	TVSOP	DGV	16	2000	356.0	356.0	35.0
SN74AHC138DR	SOIC	D	16	2500	340.5	336.1	32.0
SN74AHC138NSR	SO	NS	16	2000	356.0	356.0	35.0
SN74AHC138PWR	TSSOP	PW	16	2000	356.0	356.0	35.0
SN74AHC138RGYR	VQFN	RGY	16	3000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-9851601Q2A	FK	LCCC	20	1	506.98	12.06	2030	NA
5962-9851601QFA	W	CFP	16	1	506.98	26.16	6220	NA
SN74AHC138N	N	PDIP	16	25	506	13.97	11230	4.32
SN74AHC138N	N	PDIP	16	25	506	13.97	11230	4.32
SNJ54AHC138FK	FK	LCCC	20	1	506.98	12.06	2030	NA
SNJ54AHC138W	W	CFP	16	1	506.98	26.16	6220	NA

DGV (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

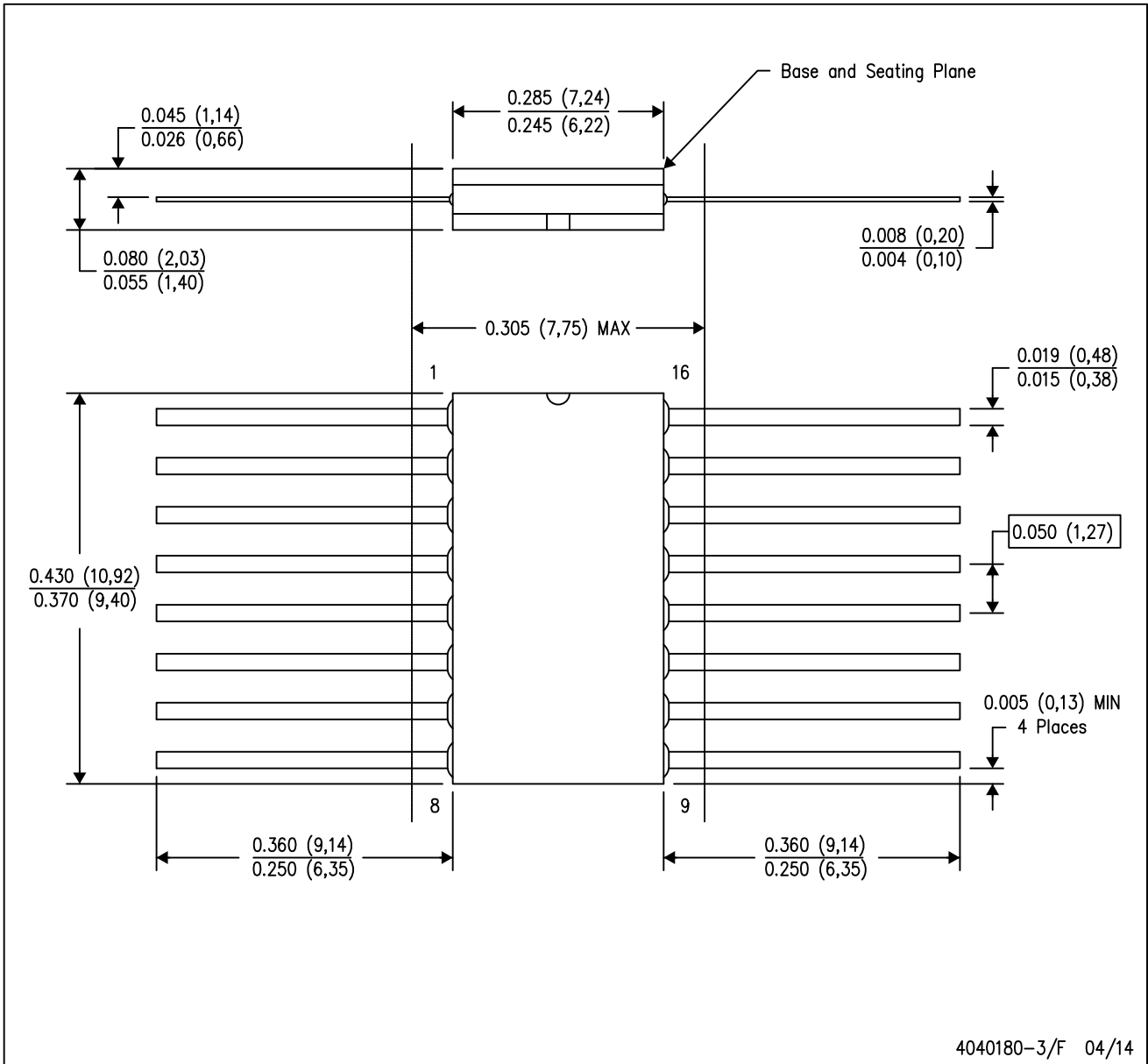


4073251/E 08/00

- 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 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

W (R-GDFP-F16)

CERAMIC DUAL FLATPACK



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package can be hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only.
  - E. Falls within MIL STD 1835 GDFP2-F16



## GENERIC PACKAGE VIEW

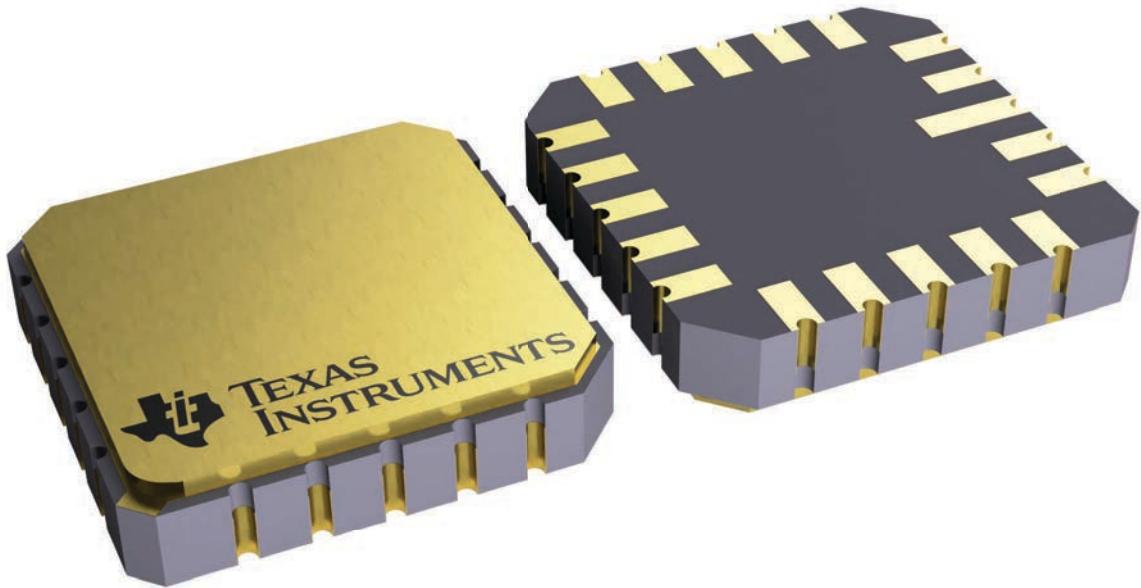
**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4229370VA\

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:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package is hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - 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

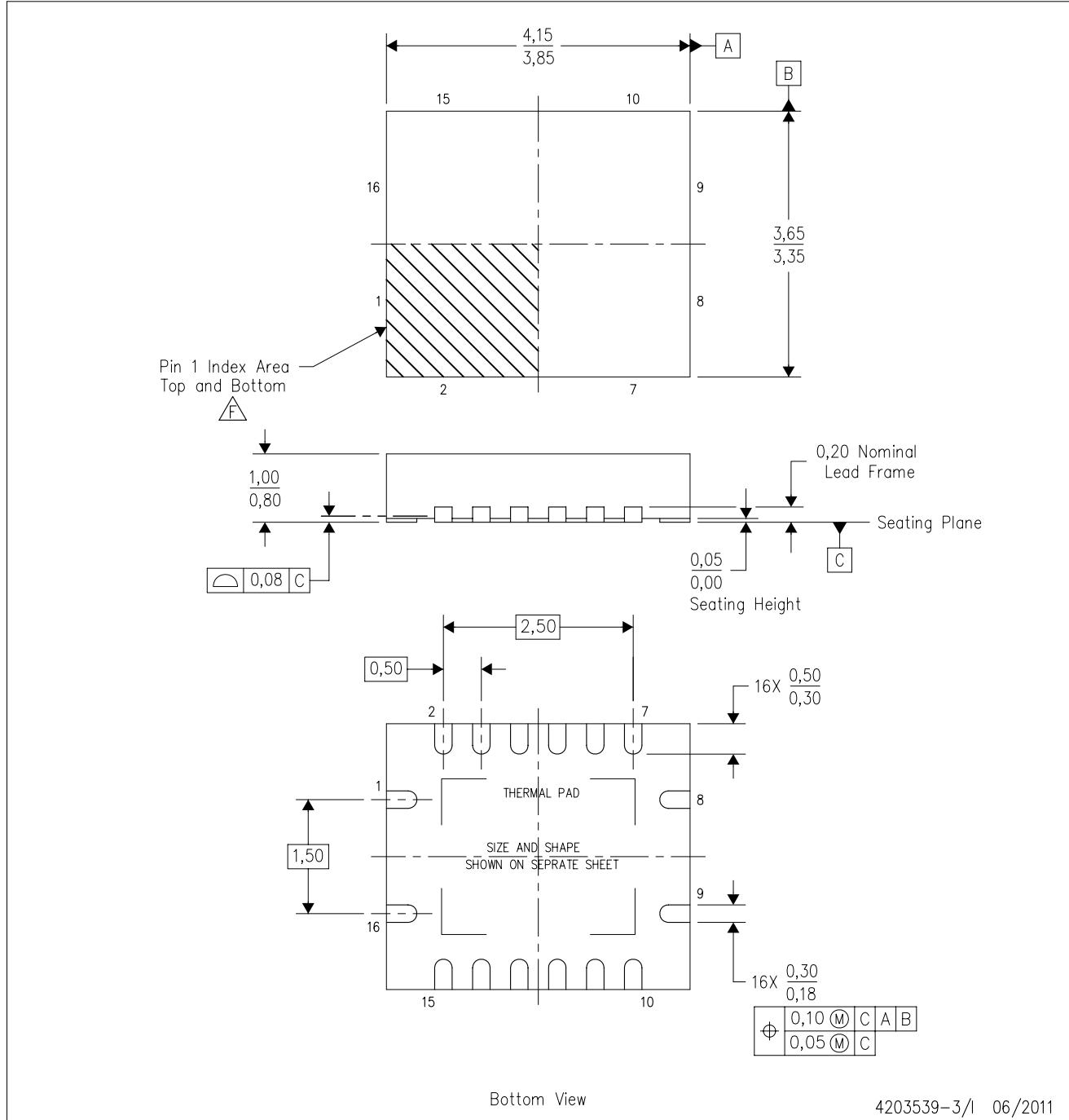


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

RGY (R-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. QFN (Quad Flatpack No-Lead) package configuration.
  - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
  - E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
  - F. Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
  - G. Package complies to JEDEC MO-241 variation BA.

RGY (R-PVQFN-N16)

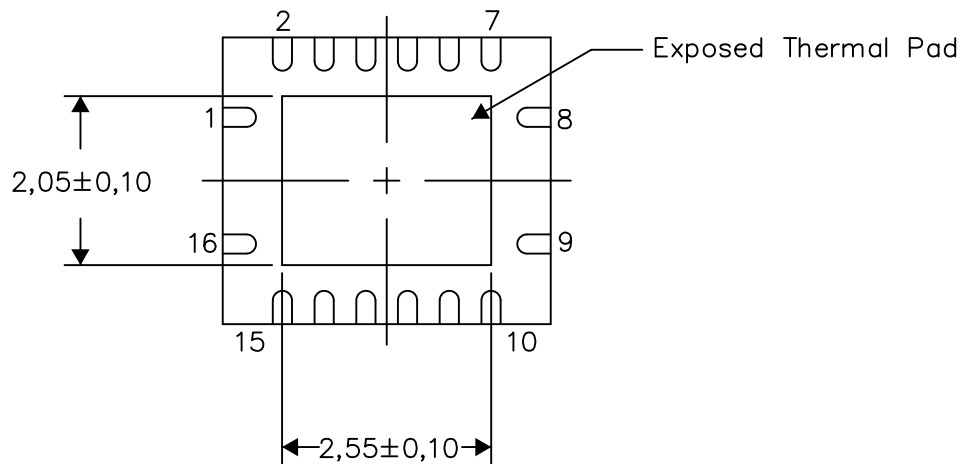
PLASTIC QUAD FLATPACK NO-LEAD

**THERMAL INFORMATION**

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at [www.ti.com](http://www.ti.com).

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

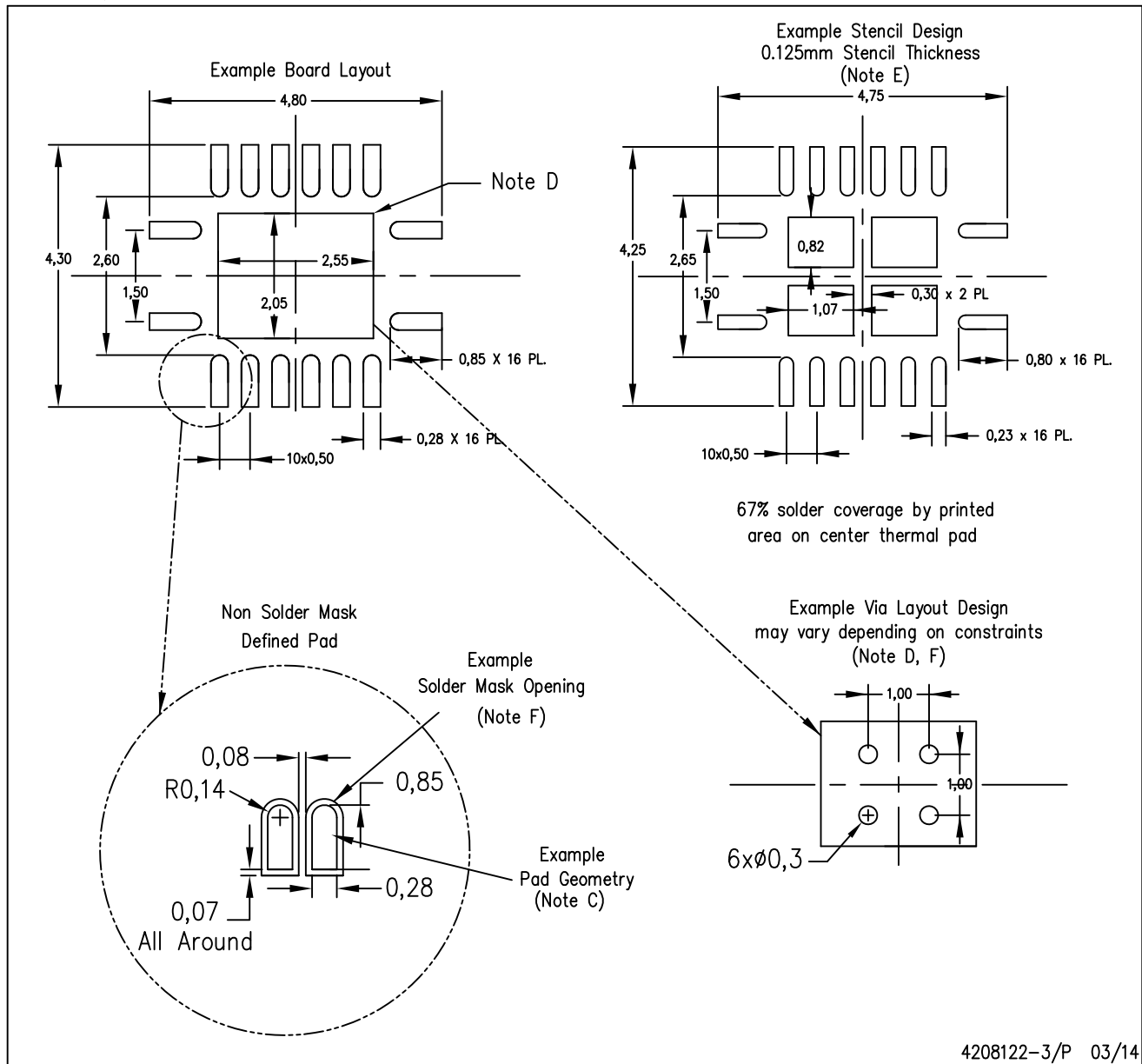
Exposed Thermal Pad Dimensions

4206353-3/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (R-PVQFN-N16)

PLASTIC QUAD FLATPACK NO-LEAD



- 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. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at [www.ti.com](http://www.ti.com) <<http://www.ti.com>>.
  - E. 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 stencil design considerations.
  - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

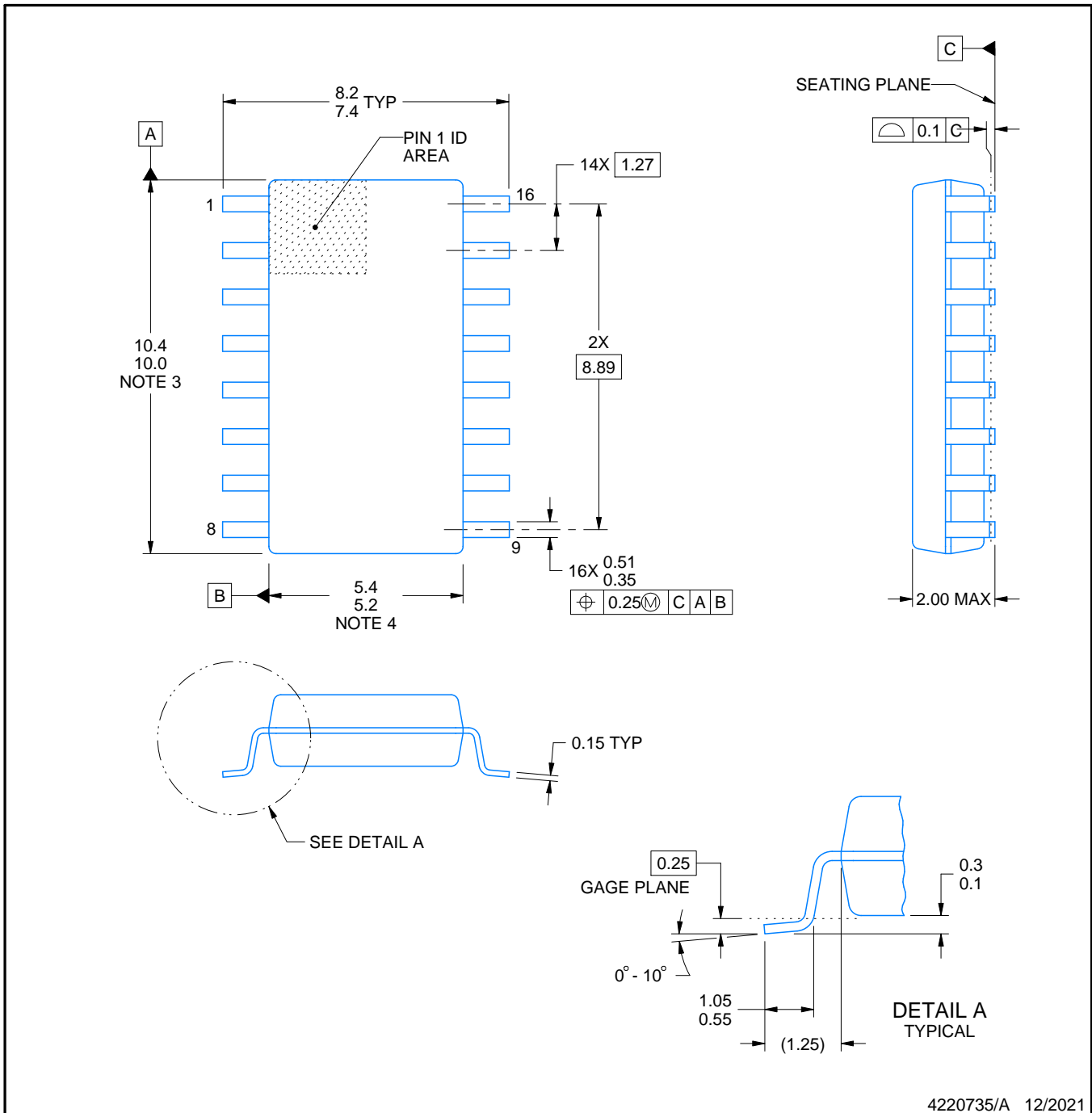


# PACKAGE OUTLINE

## NS0016A

### SOP - 2.00 mm max height

SOP



4220735/A 12/2021

#### NOTES:

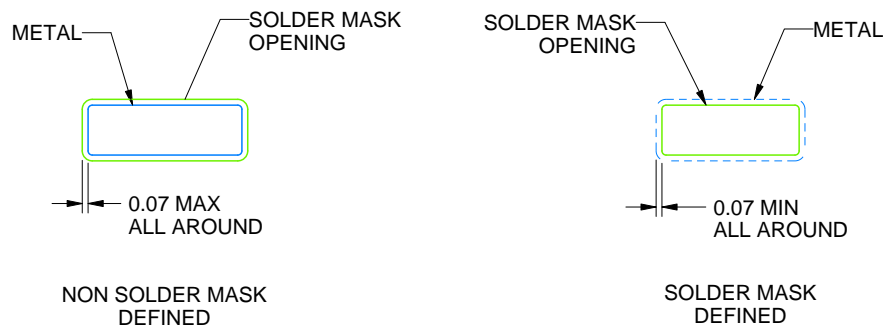
1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate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



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.

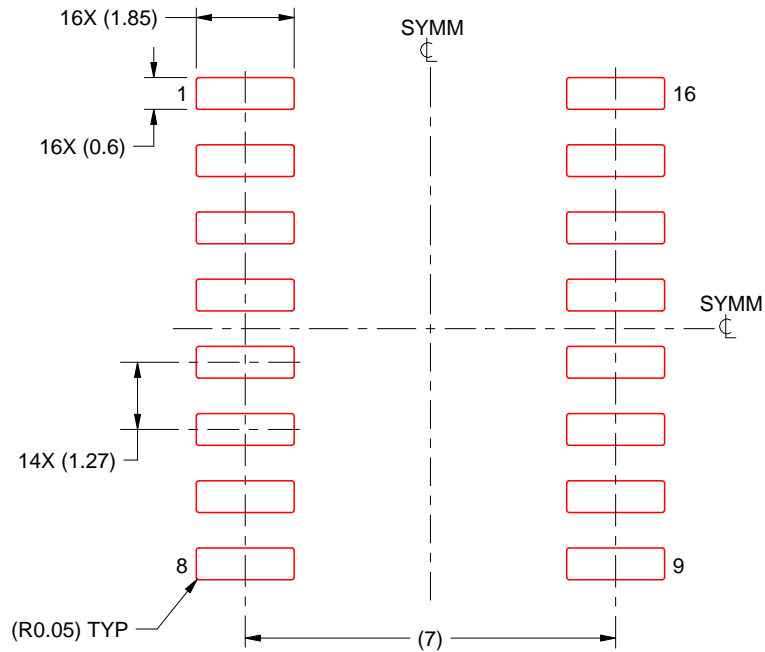


# EXAMPLE STENCIL DESIGN

NS0016A

SOP - 2.00 mm max height

SOP



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

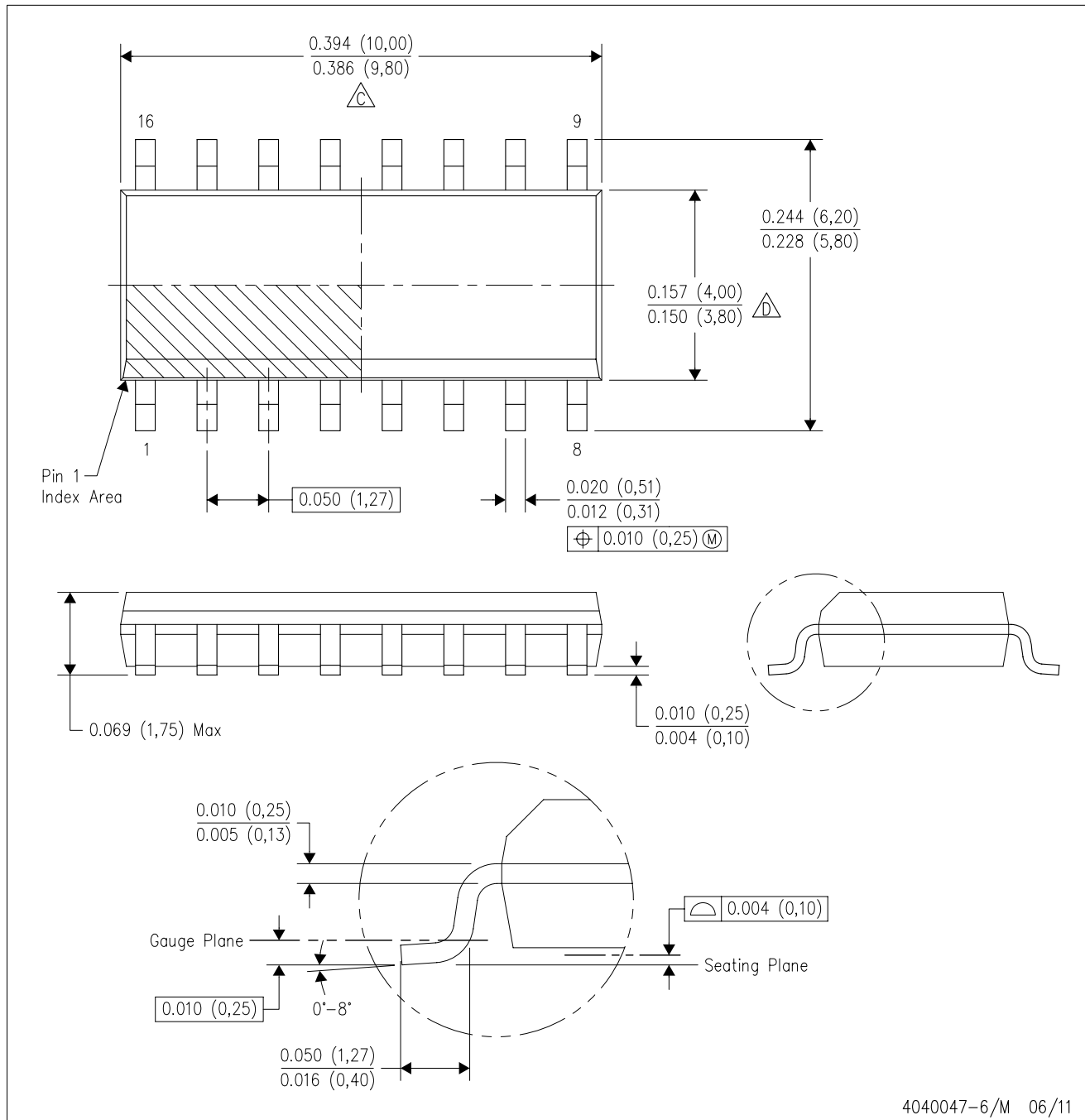
4220735/A 12/2021

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:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



4220204/A 02/2017

NOTES:

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

# EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



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.

# 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/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.

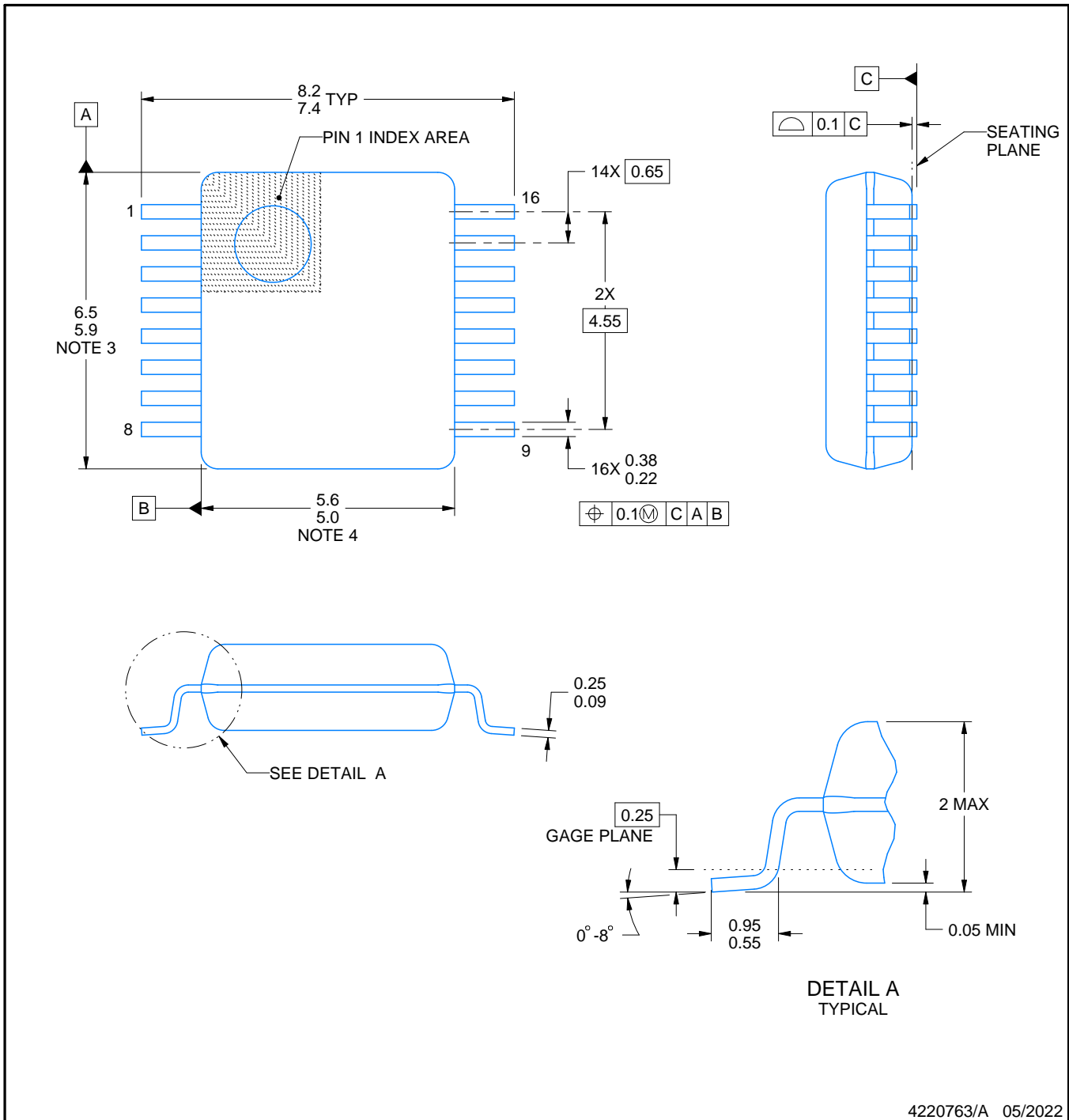
# DB0016A



# PACKAGE OUTLINE

## SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



4220763/A 05/2022

### NOTES:

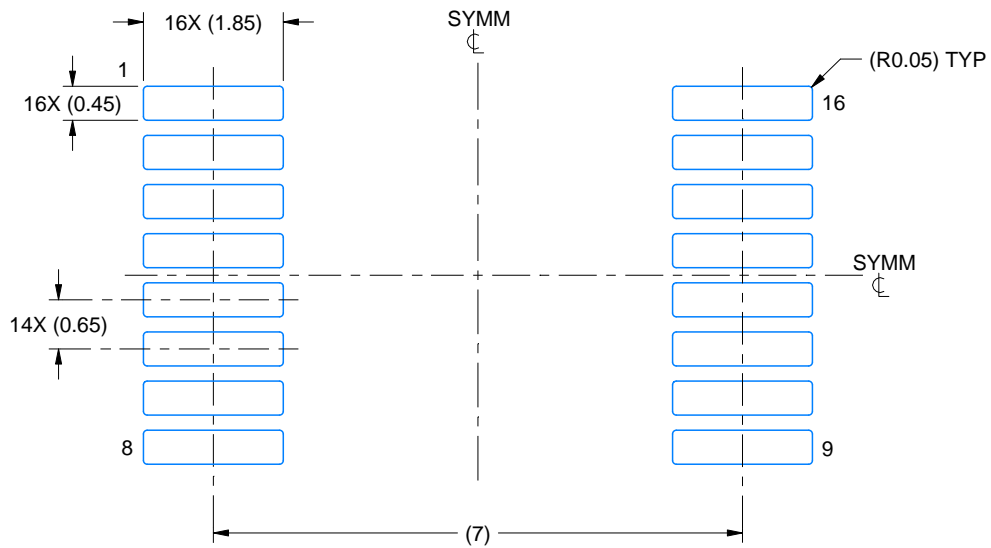
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-150.

# EXAMPLE BOARD LAYOUT

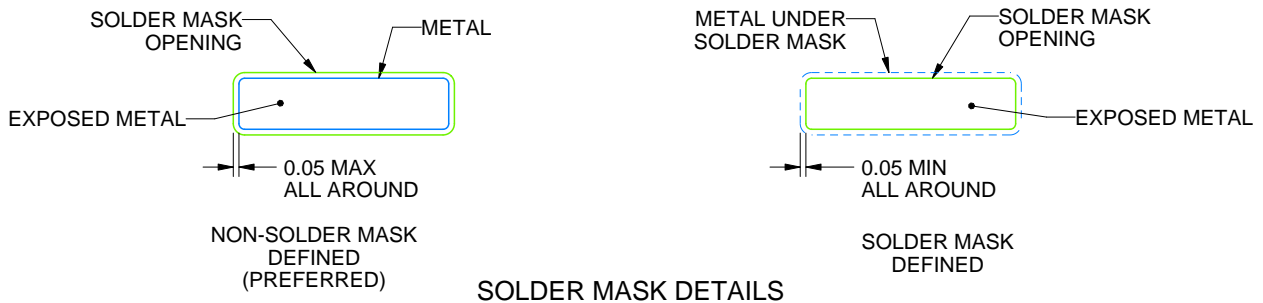
DB0016A

SSOP - 2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220763/A 05/2022

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.





## MECHANICAL DATA

**NS (R-PDSO-G\*\*)**

**PLASTIC SMALL-OUTLINE PACKAGE**

**14-PINS SHOWN**



- 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.

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