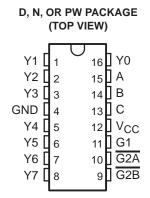
- Designed Specifically for High-Speed Memory Decoders and Data Transmission Systems
- Incorporates Three Enable Inputs to Simplify Cascading and/or Data Reception
- Center-Pin V<sub>CC</sub> and GND Configurations Minimize High-Speed Switching Noise
- EPIC<sup>™</sup> (Enhanced-Performance Implanted CMOS) 1-µm Process
- 500-mA Typical Latch-Up Immunity at 125°C
- Package Options Include Plastic Small-Outline (D) and Thin Shrink Small-Outline (PW) Packages, and Standard Plastic 300-mil DIPs (N)



#### description

The 74AC11138 circuit is designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, this decoder 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 this decoder and the enable time of the memory are usually less than the typical access time of the memory. This means that the effective system delay introduced by the decoder is negligible.

The conditions at the binary-select (A, B, C) inputs and the three enable (G1,  $\overline{G2A}$ ,  $\overline{G2B}$ ) 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.

The 74AC11138 is characterized for operation from –40°C to 85°C.

#### **FUNCTION TABLE**

ENA	BLE INF	UTS	SEL	ECT INP	UTS				OUTI	PUTS			
G1	G2A	G2B	С	В	Α	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Х	Н	Х	Χ	Χ	Χ	Н	Н	Н	Н	Н	Н	Н	Н
Х	X	Н	Χ	X	X	Н	Н	Н	Н	Н	Н	Н	Н
L	X	X	Χ	Χ	Χ	Н	Н	Н	Н	Н	Н	Н	Н
Н	L	L	L	L	L	L	Н	Н	Н	Н	Н	Н	Н
Н	L	L	L	L	Н	Н	L	Н	Н	Н	Н	Н	Н
Н	L	L	L	Н	L	Н	Н	L	Н	Н	Н	Н	Н
Н	L	L	L	Н	Н	Н	Н	Н	L	Н	Н	Н	Н
Н	L	L	Н	L	L	Н	Н	Н	Н	L	Н	Н	Н
Н	L	L	Н	L	Н	Н	Н	Н	Н	Н	L	Н	Н
Н	L	L	Н	Н	L	Н	Н	Н	Н	Н	Н	L	Н
Н	L	L	Н	Н	Н	Н	Н	Н	Н	Н	Н	Н	L

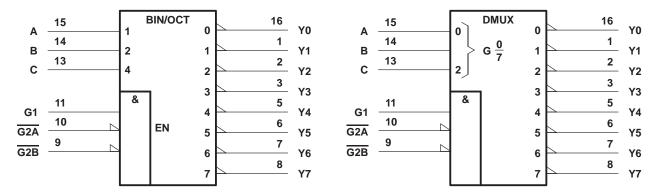


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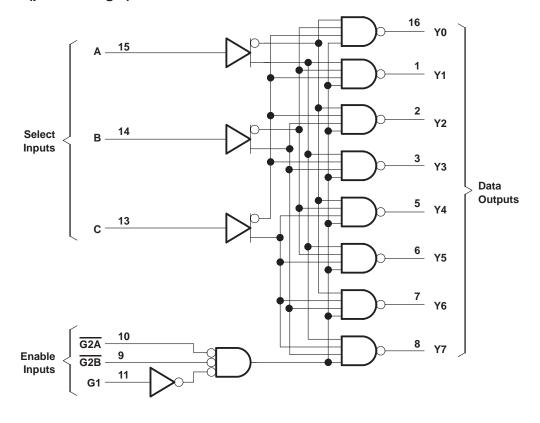


### logic symbols (alternatives)†



<sup>&</sup>lt;sup>†</sup>These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

# logic diagram (positive logic)



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

Supply voltage range, V <sub>CC</sub>	0.5 V to 7 V
Input voltage range, V <sub>I</sub> (see Note 1)	0.5 V to V <sub>CC</sub> + 0.5 V
Output voltage range, VO (see Note 1)	0.5 V to V <sub>CC</sub> + 0.5 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	±20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ )	±50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±50 mA
Continuous current through V <sub>CC</sub> or GND	±200 mA
Maximum power dissipation at $T_A = 55^{\circ}C$ (in still air) (see Note	e 2): D package1.3 W
	N package1.1 W
	PW package 0.5 W
Storage temperature range, T <sub>stg</sub>	–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.

# recommended operating conditions

			MIN	NOM	MAX	UNIT
Vcc	Supply voltage		3	5	5.5	V
		V <sub>CC</sub> = 3 V	2.1			
ViH	High-level input voltage	V <sub>CC</sub> = 4.5 V	3.15			V
		V <sub>CC</sub> = 5.5 V	3.85			
		V <sub>CC</sub> = 3 V			0.9	
VIL	Low-level input voltage	V <sub>CC</sub> = 4.5 V			1.35	V
		V <sub>CC</sub> = 5.5 V			1.65	
٧ı	Input voltage		0		VCC	V
٧o	Output voltage		0		VCC	V
		V <sub>CC</sub> = 3 V			-4	
lOH	High-level output current	$V_{CC} = 4.5 \text{ V}$			-24	mA
		V <sub>CC</sub> = 5.5 V			-24	
		V <sub>CC</sub> = 3 V			12	
lOL	Low-level output current	V <sub>CC</sub> = 4.5 V			24	mA
		V <sub>CC</sub> = 5.5 V			24	
Δt/Δν	Input transition rise or fall rate		0		10	ns/V
TA	Operating free-air temperature		-40		85	°C

<sup>2.</sup> The maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the N package, which has a trace length of zero.

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

DADAMETED	TEGT COMPLETIONS		T,	<sub>Δ</sub> = 25°C		MAIN	MAY	
PARAMETER	TEST CONDITIONS	VCC	MIN	TYP	MAX	MIN	MAX	UNIT
		3 V	2.9			2.9		
	I <sub>OH</sub> = -50 μA	4.5 V	4.4			4.4		
		5.5 V	5.4			5.4		
VOH	I <sub>OH</sub> = -4 mA	3 V	2.58			2.48		V
		4.5 V	3.94			3.8		
	I <sub>OH</sub> = -24 mA	5.5 V	4.94			4.8		
	I <sub>OH</sub> = -75 mA <sup>†</sup>	5.5 V				3.85		
		3 V			0.1		0.1	
	I <sub>OL</sub> = 50 μA	4.5 V			0.1		0.1	
		5.5 V			0.1		0.1	
VOL	I <sub>OL</sub> = 12 mA	3 V			0.36		0.44	V
		4.5 V			0.36		0.44	
	I <sub>OL</sub> = 24 mA	5.5 V			0.36		0.44	
	$I_{OL} = 75 \text{ mA}^{\dagger}$	5.5 V					1.65	
lį	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			±0.1		±1	μΑ
lcc	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			4		40	μΑ
Ci	$V_I = V_{CC}$ or GND	5 V		3.5				pF

<sup>†</sup> Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.

# switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 3.3 V $\pm$ 0.3 V (unless otherwise noted) (see Figure 1)

DADAMETED	FROM	то	T,	4 = 25°C	;	MAINI	MAV	UNIT
PARAMETER	(INPUT)	(OUTPUT)	MIN	TYP	MAX	MIN	MAX	UNII
tPLH	A D C	Amy V	1.5	8.3	10.2	1.5	11.4	20
<sup>t</sup> PHL	A, B, C	Any Y	1.5	8.9	10.9	1.5	12.2	ns
<sup>t</sup> PLH	04	A.m. V	1.5	7.2	9.2	1.5	10.2	
<sup>t</sup> PHL	G1	Any Y	1.5	7.3	9.4	1.5	10.5	ns
<sup>t</sup> PLH	<u> </u>	A V	1.5	8.2	10.4	1.5	11.5	
t <sub>PHL</sub>	G2A, G2B	Any Y	1.5	8.3	10.4	1.5	11.6	ns

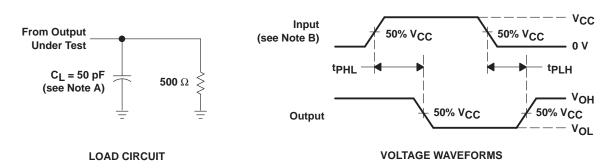
# switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V $\pm$ 0.5 V (unless otherwise noted) (see Figure 1)

DADAMETED	FROM	то	T,	4 = 25°C	;	BAINI	MAY	LINUT
PARAMETER	(INPUT)	(OUTPUT)	MIN	TYP	MAX	MIN	MAX	UNIT
t <sub>PLH</sub>	A D O	Anna	1.5	5.7	7.3	1.5	8.1	
t <sub>PHL</sub>	A, B, C	Any Y	1.5	6.2	7.9	1.5	8.8	ns
<sup>t</sup> PLH	0.4	Anna	1.5	5.1	6.9	1.5	7.5	
t <sub>PHL</sub>	G1	Any Y	1.5	5.2	6.9	1.5	7.7	ns
<sup>t</sup> PLH		A V	1.5	5.8	7.6	1.5	8.3	
t <sub>PHL</sub>	G2A, G2B	Any Y	1.5	5.6	7.5	1.5	8.3	ns

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

	PARAMETER	TEST CO	TYP	UNIT	
C <sub>pd</sub>	Power dissipation capacitance per gate	$C_L = 50 \text{ pF},$	f = 1 MHz	51	pF

### PARAMETER MEASUREMENT INFORMATION



NOTES: A.  $C_L$  includes probe and jig capacitance.

- B. Input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz, Z<sub>O</sub> = 50  $\Omega$ , t<sub>f</sub> = 3 ns, t<sub>f</sub> = 3 ns.
- C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

### **APPLICATION INFORMATION**

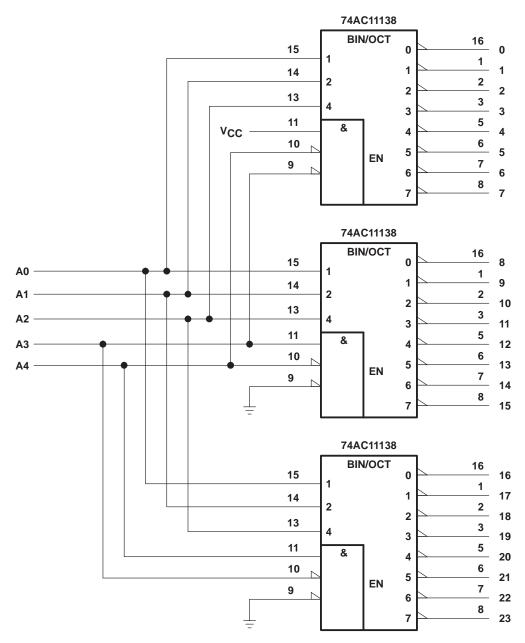


Figure 2. 24-Bit Decoding Scheme

### **APPLICATION INFORMATION**

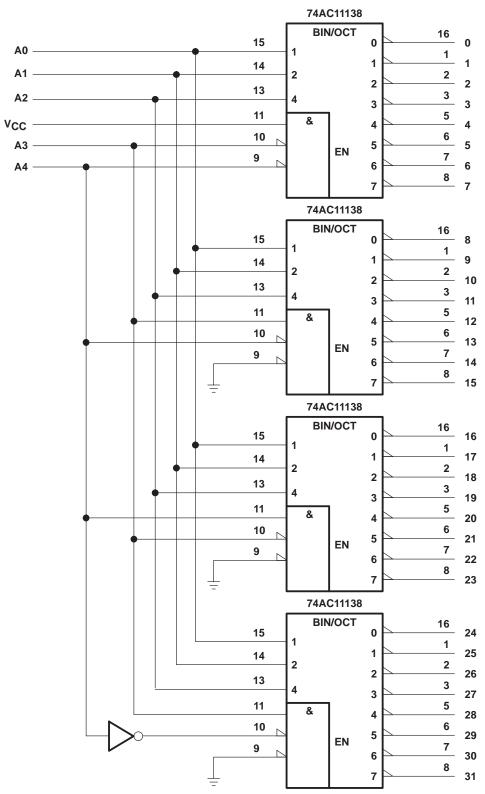


Figure 3. 32-Bit Decoding Scheme







24-Jan-2013

### **PACKAGING INFORMATION**

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
74AC11138D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	74AC11138N	Samples
74AC11138NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	74AC11138N	Samples
74AC11138NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138NSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC11138	Samples
74AC11138PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AE138	Samples
74AC11138PWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AE138	Samples
74AC11138PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AE138	Samples
74AC11138PWLE	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI	-40 to 85		
74AC11138PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AE138	Sample
74AC11138PWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AE138	Samples



## PACKAGE OPTION ADDENDUM

24-Jan-2013

Orderable Device	Status	Package Type	_	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
	(1)		Drawing			(2)		(3)		(4)	
74AC11138PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AE138	Samples

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Only one of markings shown within the brackets will appear on the physical device.

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# PACKAGE MATERIALS INFORMATION

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## TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
	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

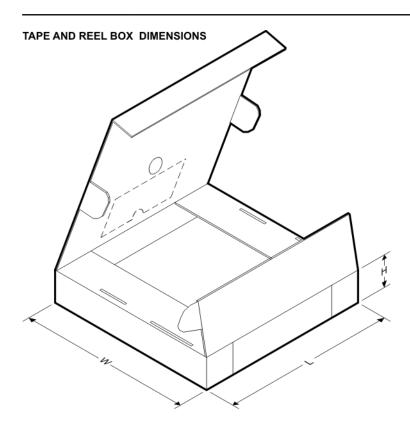
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

All difficulties are florifical	1				I							
Device	Package Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
74AC11138DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
74AC11138NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
74AC11138PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

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\*All dimensions are nominal

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
74AC11138DR	SOIC	D	16	2500	333.2	345.9	28.6
74AC11138NSR	SO	NS	16	2000	367.0	367.0	38.0
74AC11138PWR	TSSOP	PW	16	2000	367.0	367.0	35.0

# N (R-PDIP-T\*\*)

# PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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



# D (R-PDS0-G16)

### PLASTIC SMALL OUTLINE



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- 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.
- 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



- 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.



PW (R-PDSO-G16)

# PLASTIC SMALL OUTLINE

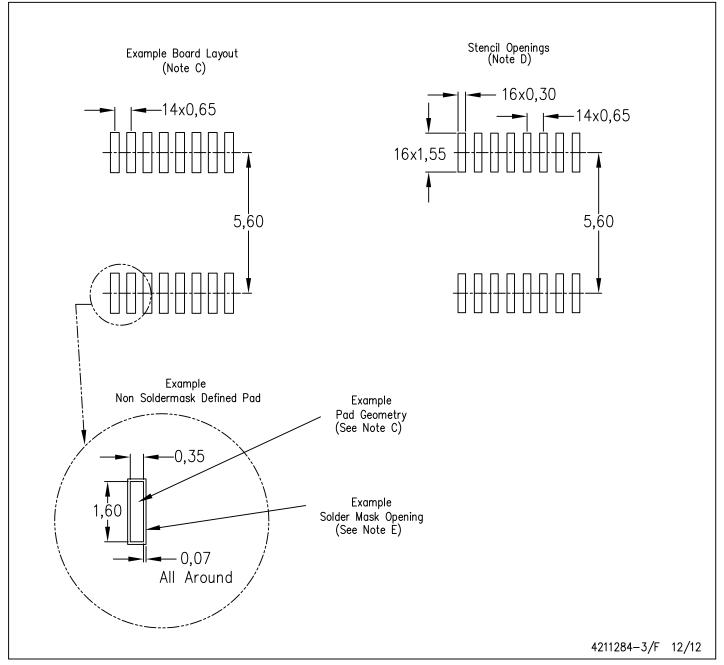


- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



# PW (R-PDSO-G16)

# PLASTIC SMALL OUTLINE



- 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.



### **MECHANICAL DATA**

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

# 14-PINS SHOWN

### PLASTIC SMALL-OUTLINE PACKAGE



- 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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