



THE DATASHEET OF SN74AHC139D



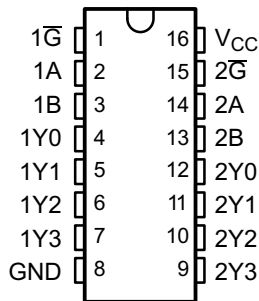
DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

Check for Samples: [SN74AHC139](#), [SN54AHC139](#)

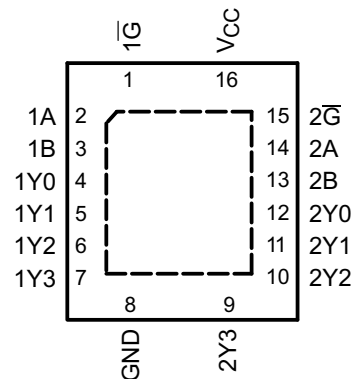
FEATURES

- Operating Range 2-V to 5.5-V
- Designed Specifically for High-Speed Memory Decoders and Data-Transmission Systems
- Incorporate Two 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)

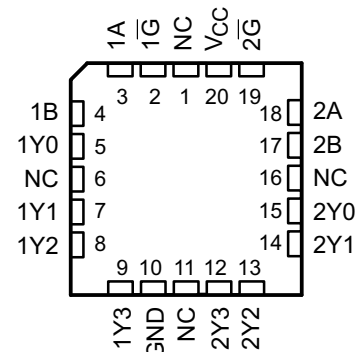
SN54AHC139 . . . J or W PACKAGE
SN74AHC139 . . . D,DB,DGV,N,NS
OR PW PACKAGE
(TOP VIEW)



SN74AHC139 . . . RGY PACKAGE
(TOP VIEW)



SN54AHC139 . . . FKP PACKAGE
(TOP VIEW)



NC – No internal connection

DESCRIPTION

The 'AHC139 devices are dual 2-line to 4-line decoders/demultiplexers designed for 2-V to 5.5-V V_{CC} operation. These devices are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When used 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.

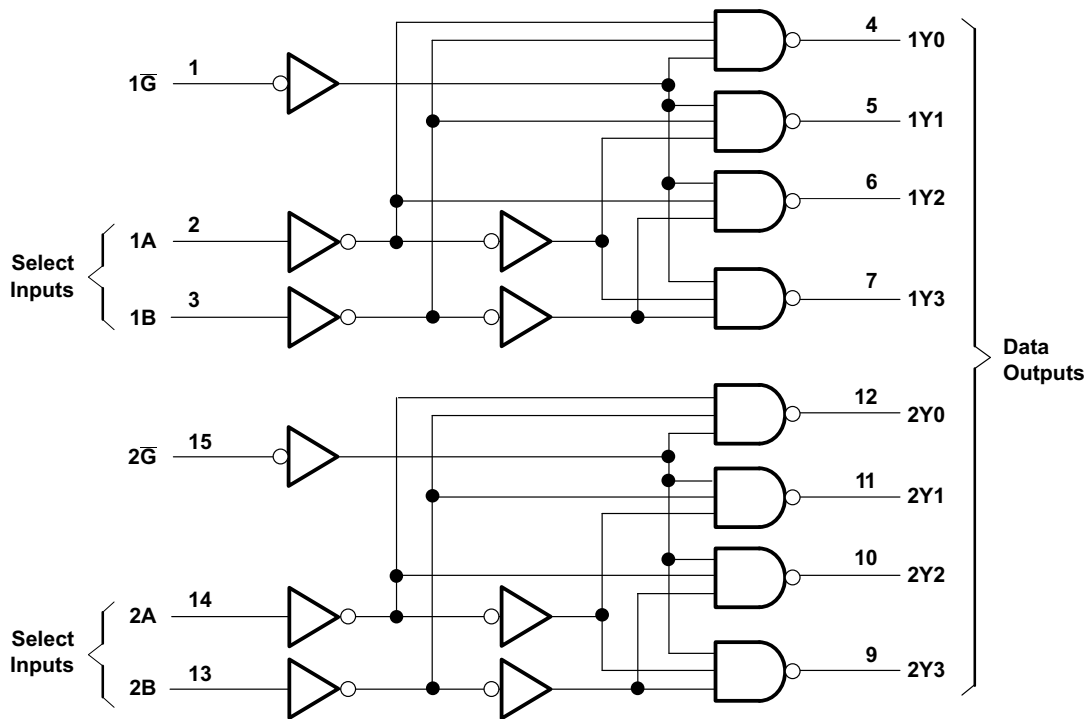
FUNCTION TABLE
(EACH GATE)

INPUTS			OUTPUT			
\overline{G}	SELECT		Y0	Y1	Y2	Y3
	B	A				
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L



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.

LOGIC DIAGRAM, EACH GATE (POSITIVE LOGIC)



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

ABSOLUTE MAXIMUM RATINGS

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

	VALUE	UNIT
Supply voltage range, V_{CC}	-0.5 to 7	V
Input voltage range, V_I ⁽²⁾	-0.5 to 7	V
Output voltage range, V_O ⁽²⁾	-0.5 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, θ_{JA}	D package ⁽³⁾	73
	DB package ⁽³⁾	82
	DGV package ⁽³⁾	120
	N package ⁽³⁾	67
	NS package ⁽³⁾	64
	PW package ⁽³⁾	108
	RGY package ⁽⁴⁾	39
Storage temperature range, T_{stg}	-65 to 150	°C

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

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

		SN54AHC139		SN74AHC139		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	mA
		V _{CC} = 3.3 V ± 0.3 V		-4	-4	
		V _{CC} = 5 V ± 0.5 V		-8	-8	
I _{OL}	Low-level output current	V _{CC} = 2 V		50	50	mA
		V _{CC} = 3.3 V ± 0.3 V		4	4	
		V _{CC} = 5 V ± 0.5 V		8	8	
Δt/Δv	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	125	°C

(1) 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](#).

ELECTRICAL CHARACTERISTICS

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = -55°C TO 125°C		T _A = -40°C TO 85°C		T _A = -40°C TO 125°C		UNIT
			MIN	TYP	MAX	SN54AHC139		SN74AHC139		Recommended SN74AHC139		
						MIN	MAX	MIN	MAX	MIN	MAX	
V _{OH}	I _{OH} = -50 μA	2 V	1.9	2		1.9		1.9		1.9		V
		3 V	2.9	3		2.9		2.9		2.9		
		4.5 V	4.4	4.5		4.4		4.4		4.4		
	I _{OH} = -4 mA	3 V	2.58			2.48		2.48		2.48		
	I _{OH} = -8 mA	4.5 V	3.94			3.8		3.8		3.8		
V _{OL}	I _{OL} = 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 _{OH} = 4 mA	3 V			0.36			0.5		0.44	0.5	
	I _{OH} = 8 mA	4.5 V			0.36			0.5		0.44	0.5	
I _I	V _I = 5.5 V or GND	0 V to 5.5 V			±0.1			±1 ⁽¹⁾		±1		μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V			4			40		40		μA
C _i	V _I = V _{CC} or GND	5 V		2	10					10		pF

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

SWITCHING CHARACTERISTICS

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$		$T_A = -55^\circ\text{C TO } 125^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 85^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
						Recommended		SN74AHC139		SN74AHC139		
				TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	$C_L = 15\text{ pF}$	7.2 ⁽¹⁾	11 ⁽¹⁾	1 ⁽¹⁾	13 ⁽¹⁾	1	13	1	13	ns
t_{PHL}				7.2 ⁽¹⁾	11 ⁽¹⁾	1 ⁽¹⁾	13 ⁽¹⁾	1	13	1	13	
t_{PLH}	\bar{G}	Y	$C_L = 15\text{ pF}$	6.4 ⁽¹⁾	9.2 ⁽¹⁾	1 ⁽¹⁾	11 ⁽¹⁾	1	11	1	11	ns
t_{PHL}				6.4 ⁽¹⁾	9.2 ⁽¹⁾	1 ⁽¹⁾	11 ⁽¹⁾	1	11	1	11	
t_{PLH}	A or B	Y	$C_L = 50\text{ pF}$	9.7	14.5	1	16.5	1	16.5	1	16.5	ns
t_{PHL}				9.7	14.5	1	16.5	1	16.5	1	16.5	
t_{PLH}	\bar{G}	Y	$C_L = 50\text{ pF}$	8.9	12.7	1	14.5	1	14.5	1	14.5	ns
t_{PHL}				8.9	12.7	1	14.5	1	14.5	1	14.5	

(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.

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	$T_A = 25^\circ\text{C}$		$T_A = -55^\circ\text{C TO } 125^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 85^\circ\text{C}$		$T_A = -40^\circ\text{C TO } 125^\circ\text{C}$		UNIT
						Recommended		SN74AHC139		SN74AHC139		
				TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	$C_L = 15\text{ pF}$	5 ⁽¹⁾	7.2 ⁽¹⁾	1 ⁽¹⁾	8.5 ⁽¹⁾	1	8.5	1	8.5	ns
t_{PHL}				5 ⁽¹⁾	7.2 ⁽¹⁾	1 ⁽¹⁾	8.5 ⁽¹⁾	1	8.5	1	8.5	
t_{PLH}	\bar{G}	Y	$C_L = 15\text{ pF}$	4.4 ⁽¹⁾	6.3 ⁽¹⁾	1 ⁽¹⁾	7.5 ⁽¹⁾	1	7.5	1	7.5	ns
t_{PHL}				4.4 ⁽¹⁾	6.3 ⁽¹⁾	1 ⁽¹⁾	7.5 ⁽¹⁾	1	7.5	1	7.5	
t_{PLH}	A or B	Y	$C_L = 50\text{ pF}$	6.5	9.5	1	10.5	1	10.5	1	10.5	ns
t_{PHL}				6.5	9.5	1	10.5	1	10.5	1	10.5	
t_{PLH}	\bar{G}	Y	$C_L = 50\text{ pF}$	5.9	8.3	1	9.5	1	9.5	1	9.5	ns
t_{PHL}				5.9	8.3	1	9.5	1	9.5	1	9.5	

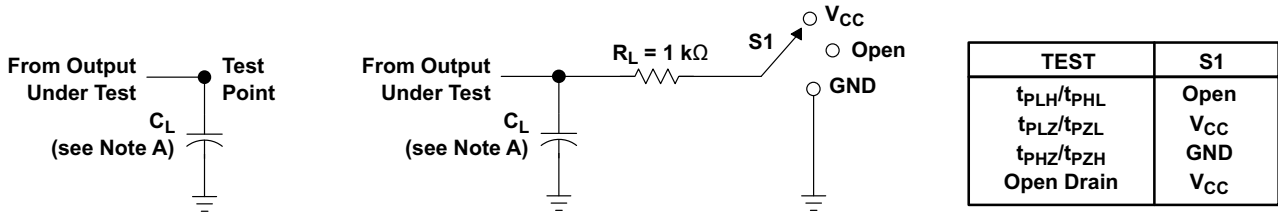
(1) On products compliant to MIL-PRF-38535, this parameter is not production tested.

OPERATING CHARACTERISTICS

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

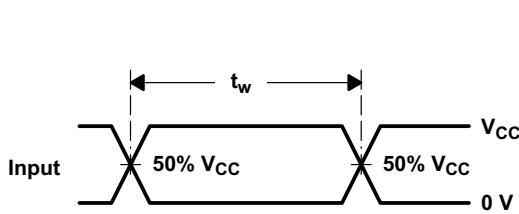
PARAMETER	TEST CONDITIONS	TYP	UNIT
C_{pd} Power dissipation capacitance	No load, $f = 1\text{ MHz}$	13	pF

PARAMETER MEASUREMENT INFORMATION

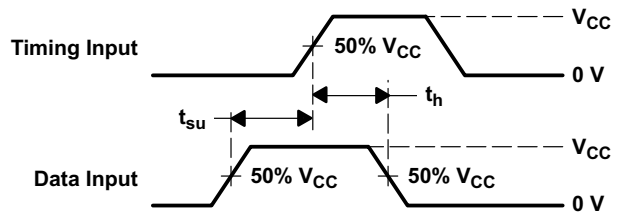


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

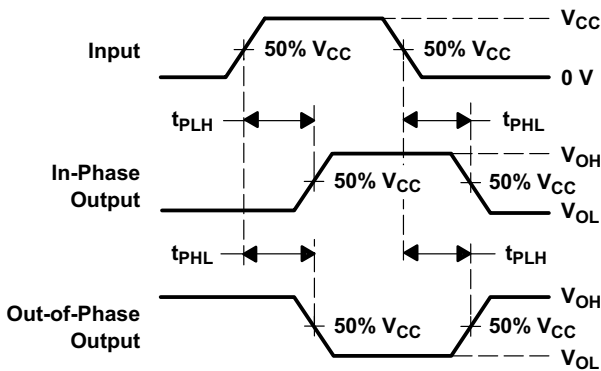
LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS



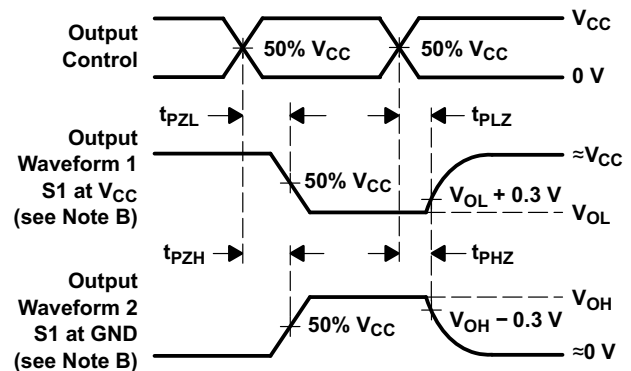
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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: $PRR \leq 1$ MHz, $Z_O = 50 \Omega$, $t_r \leq 3$ ns, $t_f \leq 3$ 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

REVISION HISTORY

Changes from Revision K (December 1995) to Revision L	Page
• Changed document format from Quicksilver to DocZone.	1
• Extended operating temperature range to 125°C	3

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AHC139D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC139	Samples
SN74AHC139DBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA139	Samples
SN74AHC139DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC139	Samples
SN74AHC139DGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA139	Samples
SN74AHC139DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC139	Samples
SN74AHC139N	ACTIVE	PDIP	N	16	25	Green (RoHS & no Sb/Br)	CU NIPDAU	N / A for Pkg Type	-40 to 125	SN74AHC139N	Samples
SN74AHC139NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	AHC139	Samples
SN74AHC139PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA139	Samples
SN74AHC139PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA139	Samples
SN74AHC139RGYR	ACTIVE	VQFN	RGY	16	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	HA139	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) **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/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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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
SN74AHC139DGVR	TVSOP	DGV	16	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
SN74AHC139DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
SN74AHC139NSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74AHC139PWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74AHC139RGYR	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)
SN74AHC139DGVR	TVSOP	DGV	16	2000	367.0	367.0	35.0
SN74AHC139DR	SOIC	D	16	2500	333.2	345.9	28.6
SN74AHC139NSR	SO	NS	16	2000	367.0	367.0	38.0
SN74AHC139PWR	TSSOP	PW	16	2000	367.0	367.0	35.0
SN74AHC139RGYR	VQFN	RGY	16	3000	367.0	367.0	35.0

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.

EXAMPLE BOARD LAYOUT

PW0016A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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.

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.

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.

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.

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



4208122-3/P 03/14

- 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>>.
 - 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.

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

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

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