

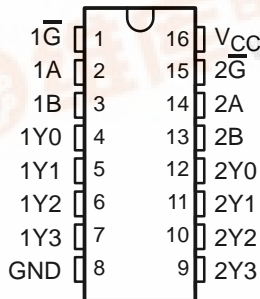
# SN54AHC139, SN74AHC139

## DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

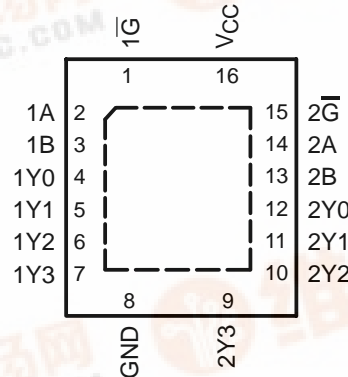
SCLS259K – DECEMBER 1995 – REVISED MARCH 2003

- Operating Range 2-V to 5.5-V  $V_{CC}$
- 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)

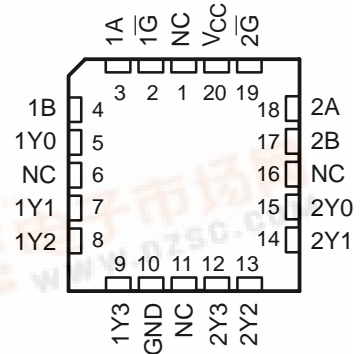
SN54AHC139 ... J OR W PACKAGE  
SN74AHC139 ... D, DB, DGV, N, NS  
OR PW PACKAGE  
(TOP VIEW)



SN74AHC139 ... RGY PACKAGE  
(TOP VIEW)



SN54AHC139 ... FK PACKAGE  
(TOP VIEW)



NC – No internal connection

### description/ordering information

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.

### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Tape and reel	SN74AHC139RGYR	HA139
	PDIP – N	Tube	SN74AHC139N	SN74AHC139N
	SOIC – D	Tube	SN74AHC139D	AHC139
		Tape and reel	SN74AHC139DR	
	SOP – NS	Tape and reel	SN74AHC139NSR	AHC139
	SSOP – DB	Tape and reel	SN74AHC139DBR	HA139
	TSSOP – PW	Tube	SN74AHC139PW	HA139
		Tape and reel	SN74AHC139PWR	
–55°C to 125°C	TVSOP – DGV	Tape and reel	SN74AHC139DGV	HA139
	CDIP – J	Tube	SNJ54AHC139J	SNJ54AHC139J
	CFP – W	Tube	SNJ54AHC139W	SNJ54AHC139W
	LCCC – FK	Tube	SNJ54AHC139FK	SNJ54AHC139FK

† 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.

# SN54AHC139, SN74AHC139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

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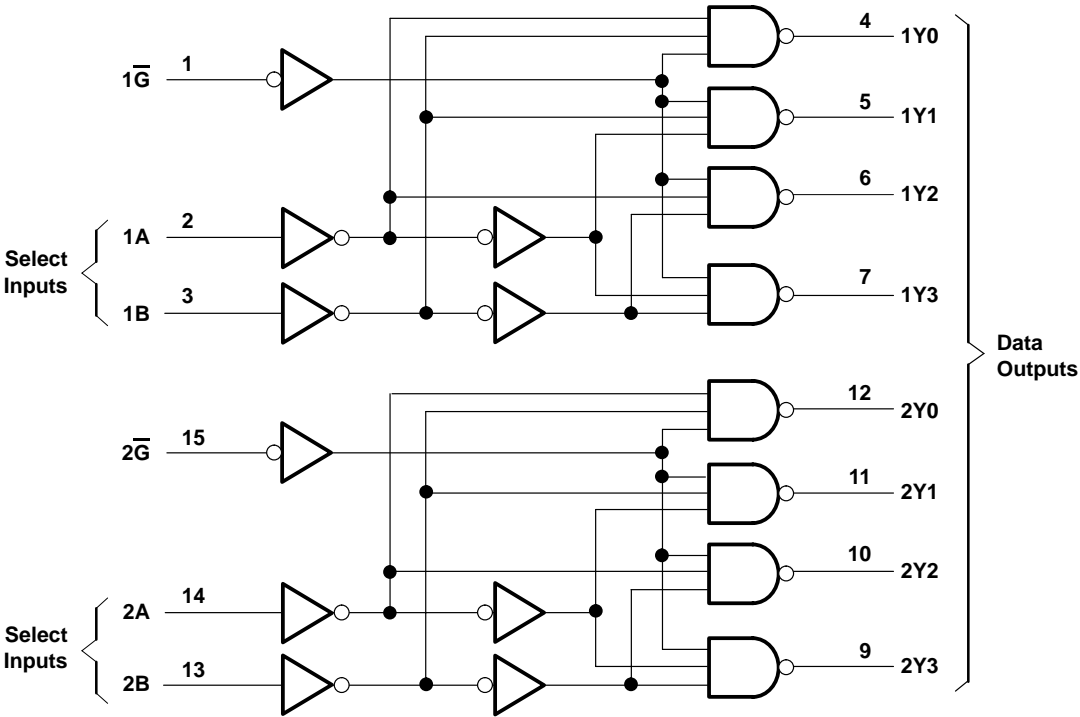
## description/ordering information (continued)

The active-low enable ( $\overline{G}$ ) input can be used as a data line in demultiplexing applications. These decoders/demultiplexers feature fully buffered inputs, each of which represents only one normalized load to its driving circuit.

FUNCTION TABLE  
(each decoder/demultiplexer)

INPUTS			OUTPUTS			
$\overline{G}$	SELECT					
	B	A	Y0	Y1	Y2	Y3
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

## logic diagram (positive logic)



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

# SN54AHC139, SN74AHC139

## DUAL 2-LINE TO 4-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)

			SN54AHC139		SN74AHC139		UNIT
			MIN	MAX	MIN	MAX	
V <sub>CC</sub>	Supply voltage		2	5.5	2	5.5	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5		1.5		V
		V <sub>CC</sub> = 3 V	2.1		2.1		
		V <sub>CC</sub> = 5.5 V	3.85		3.85		
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V	0.5		0.5		V
		V <sub>CC</sub> = 3 V	0.9		0.9		
		V <sub>CC</sub> = 5.5 V	1.65		1.65		
V <sub>I</sub>	Input voltage		0	5.5	0	5.5	V
V <sub>O</sub>	Output voltage		0	V <sub>CC</sub>	0	V <sub>CC</sub>	V
I <sub>OH</sub>	High-level output current	V <sub>CC</sub> = 2 V	−50		−50		μA
		V <sub>CC</sub> = 3.3 V ± 0.3 V	−4		−4		mA
		V <sub>CC</sub> = 5 V ± 0.5 V	−8		−8		
I <sub>OL</sub>	Low-level output current	V <sub>CC</sub> = 2 V	50		50		μA
		V <sub>CC</sub> = 3.3 V ± 0.3 V	4		4		mA
		V <sub>CC</sub> = 5 V ± 0.5 V	8		8		
Δt/Δv	Input transition rise or fall rate	V <sub>CC</sub> = 3.3 V ± 0.3 V	100		100		ns/V
		V <sub>CC</sub> = 5 V ± 0.5 V	20		20		
T <sub>A</sub>	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.

# SN54AHC139, SN74AHC139

## DUAL 2-LINE TO 4-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			SN54AHC139		SN74AHC139		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*		±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		40	µA
C <sub>i</sub>	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V		2	10				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			SN54AHC139		SN74AHC139		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 15 pF		7.2**	11**	1**	13**	1	13	ns
t <sub>PHL</sub>					7.2**	11**	1**	13**	1	13	
t <sub>PLH</sub>	$\overline{G}$	Y	C <sub>L</sub> = 15 pF		6.4**	9.2**	1**	11**	1	11	ns
t <sub>PHL</sub>					6.4**	9.2**	1**	11**	1	11	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		9.7	14.5	1	16.5	1	16.5	ns
t <sub>PHL</sub>					9.7	14.5	1	16.5	1	16.5	
t <sub>PLH</sub>	$\overline{G}$	Y	C <sub>L</sub> = 50 pF		8.9	12.7	1	14.5	1	14.5	ns
t <sub>PHL</sub>					8.9	12.7	1	14.5	1	14.5	

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

**switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			SN54AHC139		SN74AHC139		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 15 pF		5**	7.2**	1**	8.5**	1	8.5	ns
t <sub>PHL</sub>					5**	7.2**	1**	8.5**	1	8.5	
t <sub>PLH</sub>	$\overline{G}$	Y	C <sub>L</sub> = 15 pF		4.4**	6.3**	1**	7.5**	1	7.5	ns
t <sub>PHL</sub>					4.4**	6.3**	1**	7.5**	1	7.5	
t <sub>PLH</sub>	A or B	Y	C <sub>L</sub> = 50 pF		6.5	9.2	1	10.5	1	10.5	ns
t <sub>PHL</sub>					6.5	9.2	1	10.5	1	10.5	
t <sub>PLH</sub>	$\overline{G}$	Y	C <sub>L</sub> = 50 pF		5.9	8.3	1	9.5	1	9.5	ns
t <sub>PHL</sub>					5.9	8.3	1	9.5	1	9.5	

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

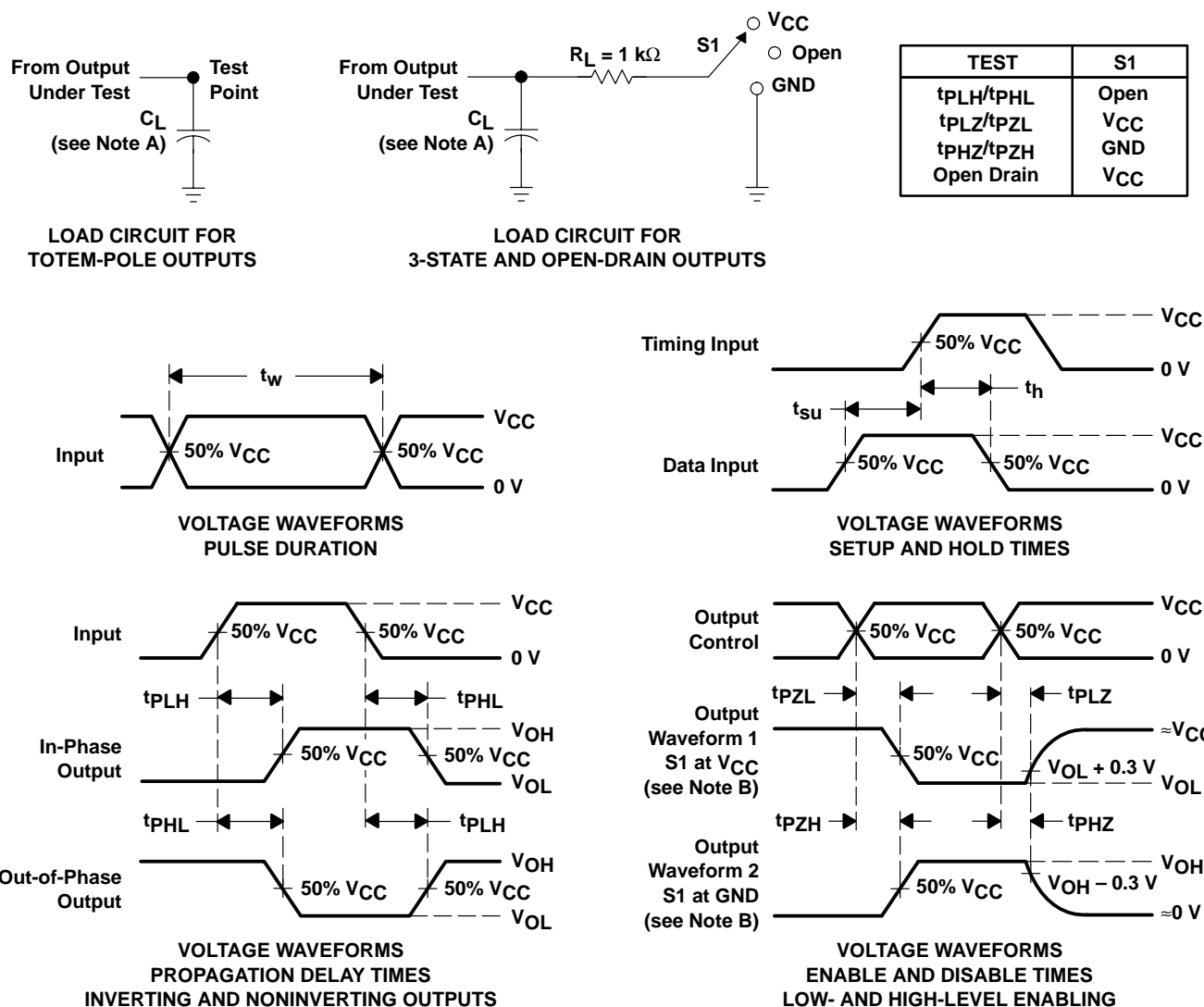
# SN54AHC139, SN74AHC139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS259K – DECEMBER 1995 – REVISED MARCH 2003

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



- 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

## PACKAGING INFORMATION

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
SN74AHC139D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DBLE	OBSOLETE	SSOP	DB	16		TBD	Call TI	Call TI
SN74AHC139DBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DGVR	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DGVRE4	ACTIVE	TVSOP	DGV	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74AHC139NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
SN74AHC139NSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139NSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139PW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139PWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139PWLE	OBSOLETE	TSSOP	PW	16		TBD	Call TI	Call TI
SN74AHC139PWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139PWRG4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AHC139RGYR	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74AHC139RGYRG4	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

**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)

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

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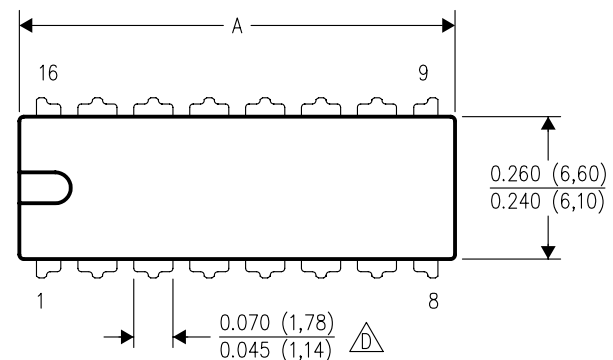
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# MECHANICAL DATA

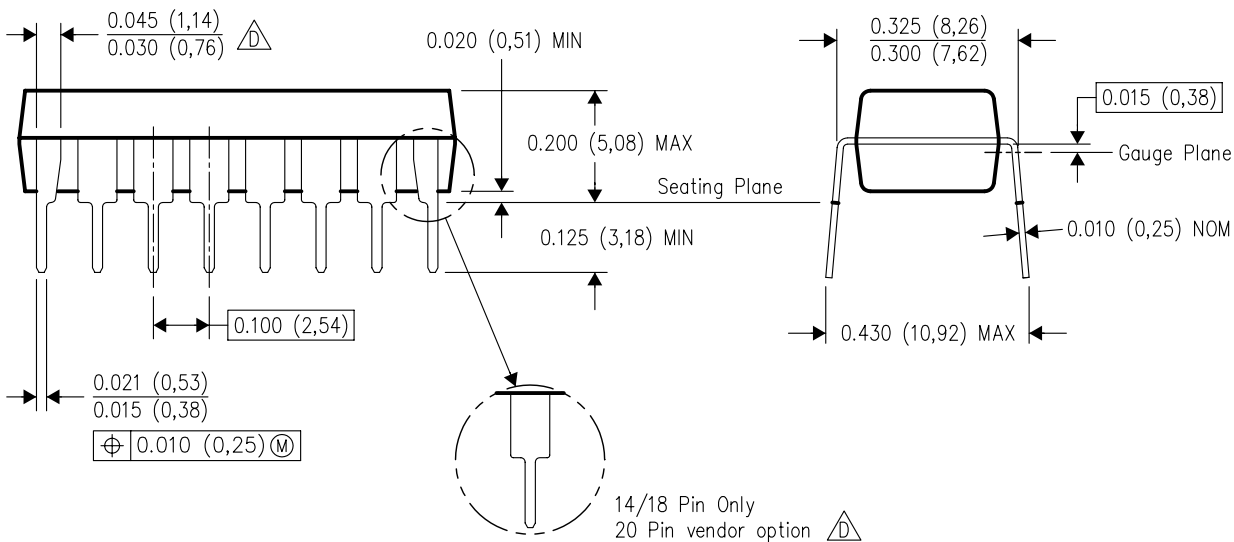
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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	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.
  - $\triangle C$  Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - $\triangle D$  The 20 pin end lead shoulder width is a vendor option, either half or full width.



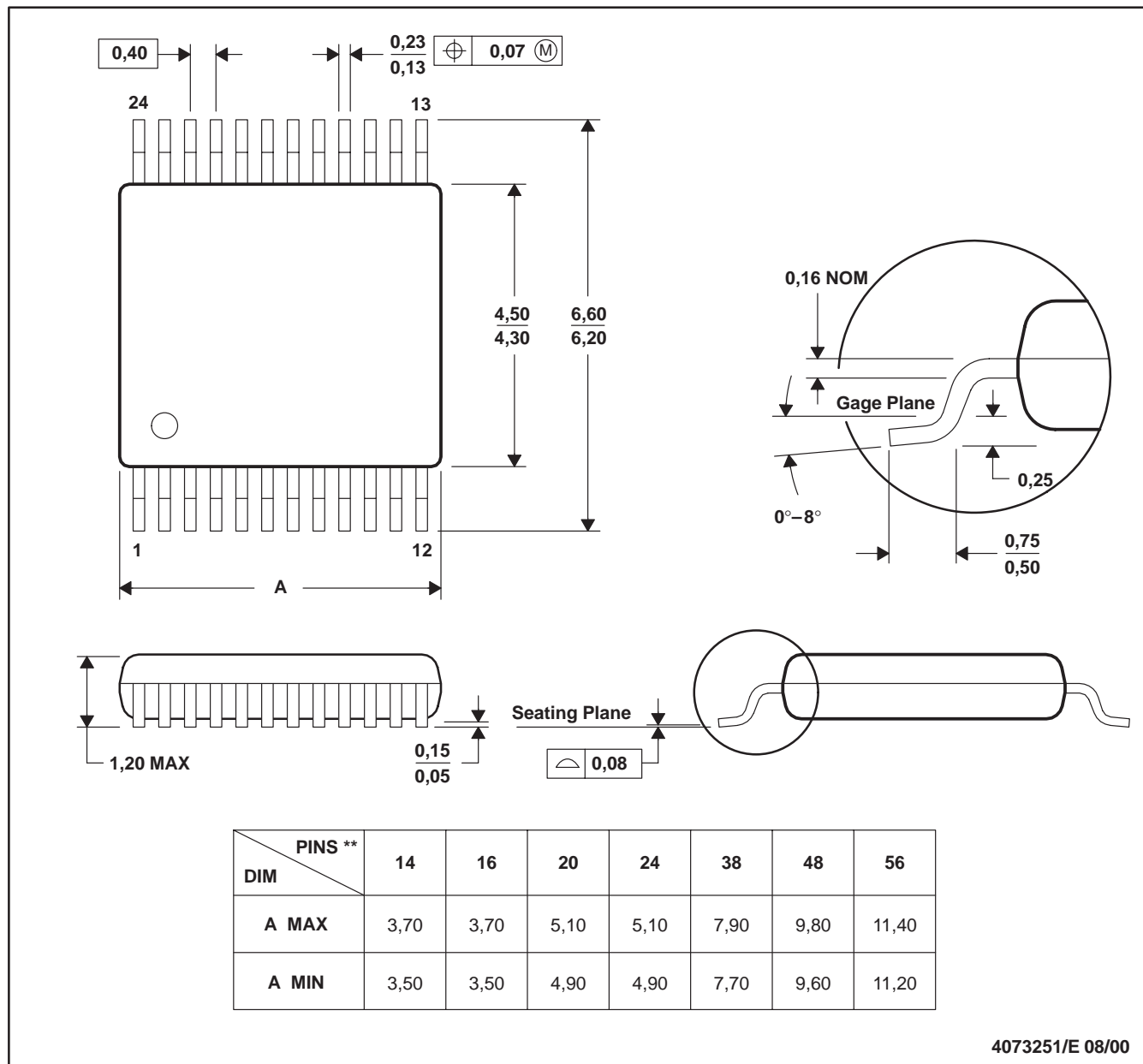
# MECHANICAL DATA

MPDS006C – FEBRUARY 1996 – REVISED AUGUST 2000

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

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

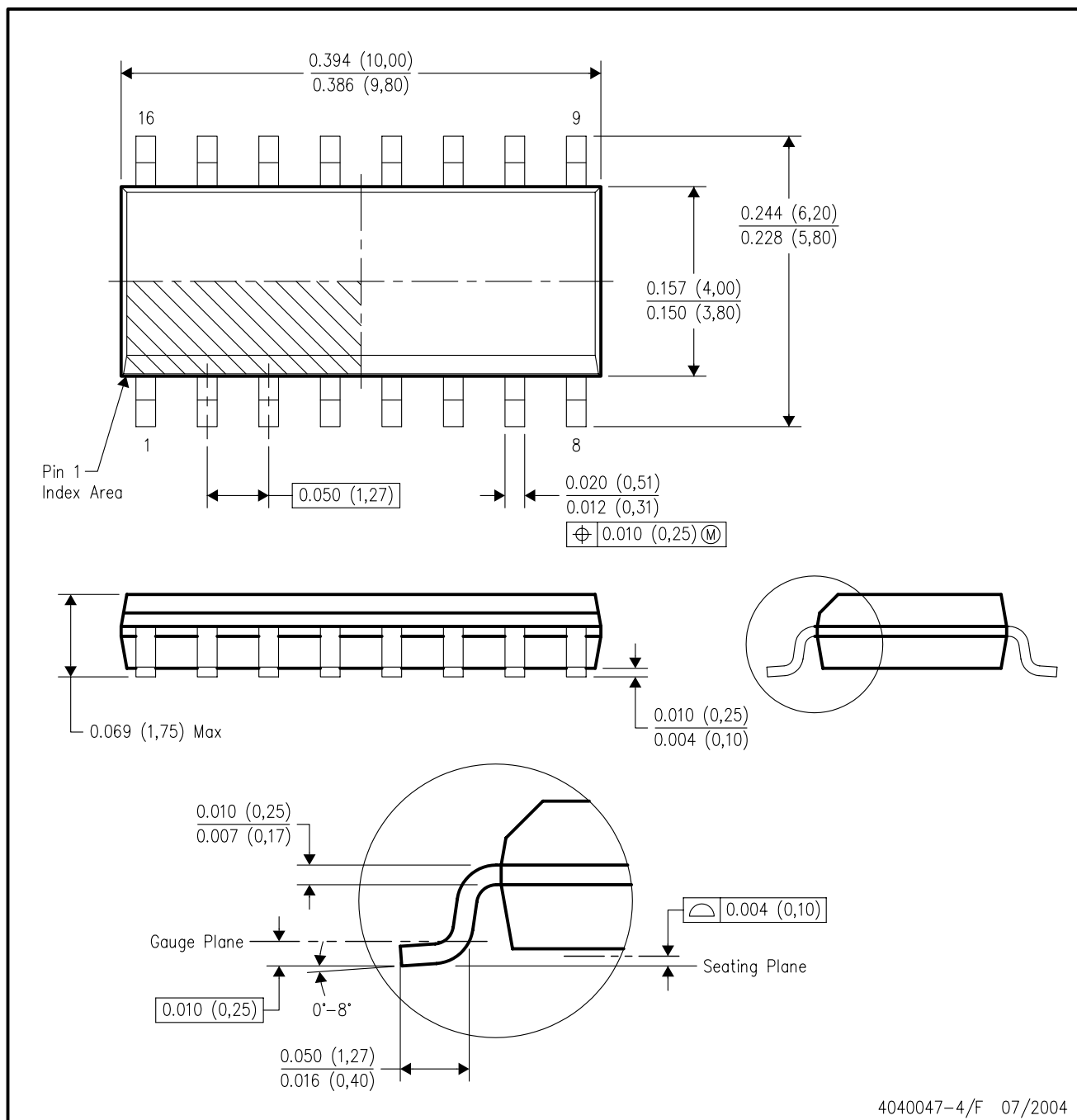


- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

# MECHANICAL DATA

## D (R-PDSO-G16)

## PLASTIC SMALL-OUTLINE PACKAGE

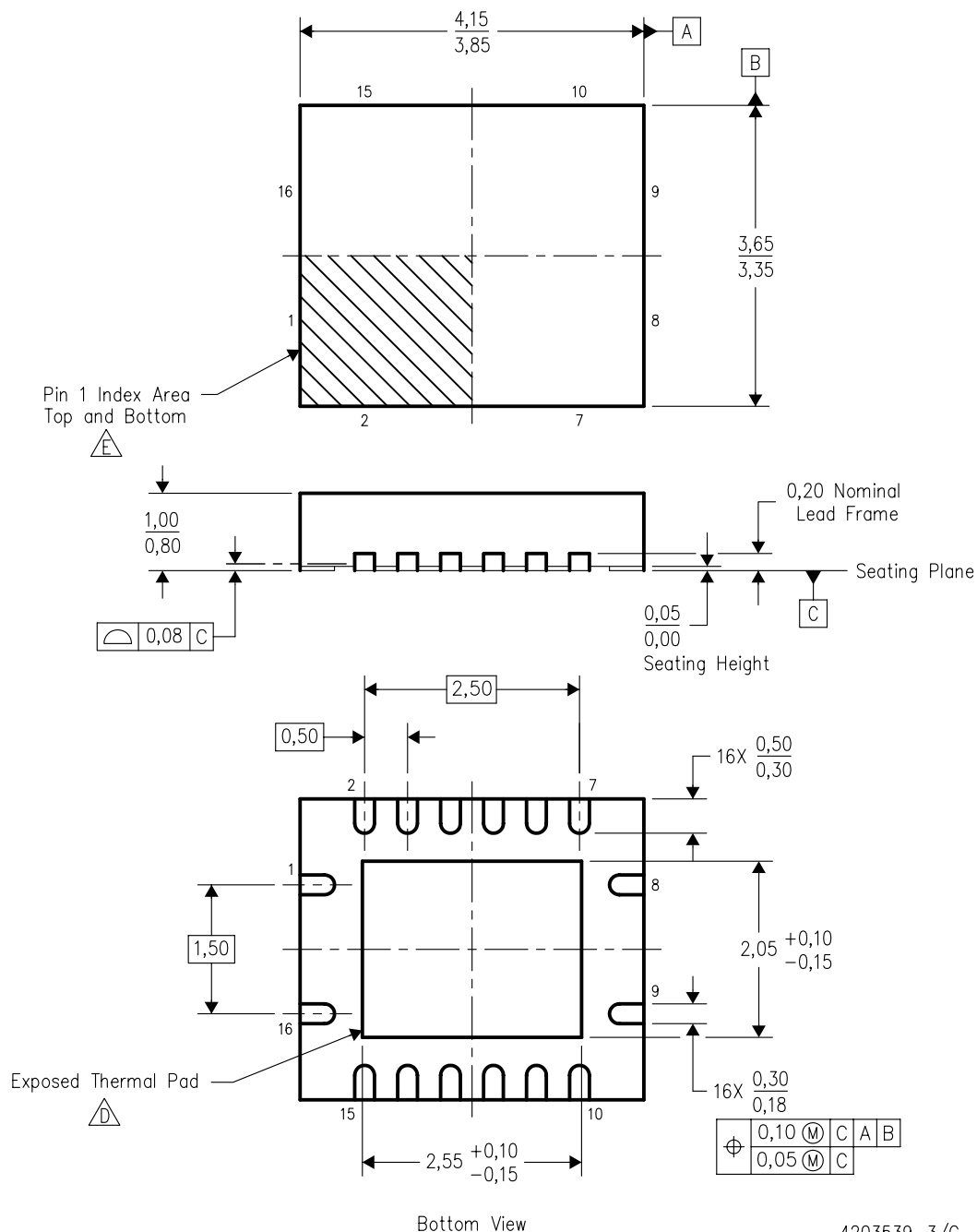


4040047-4/F 07/2004

## MECHANICAL DATA

## RGY (R-PQFP-N16)

## PLASTIC QUAD FLATPACK



NOTES:

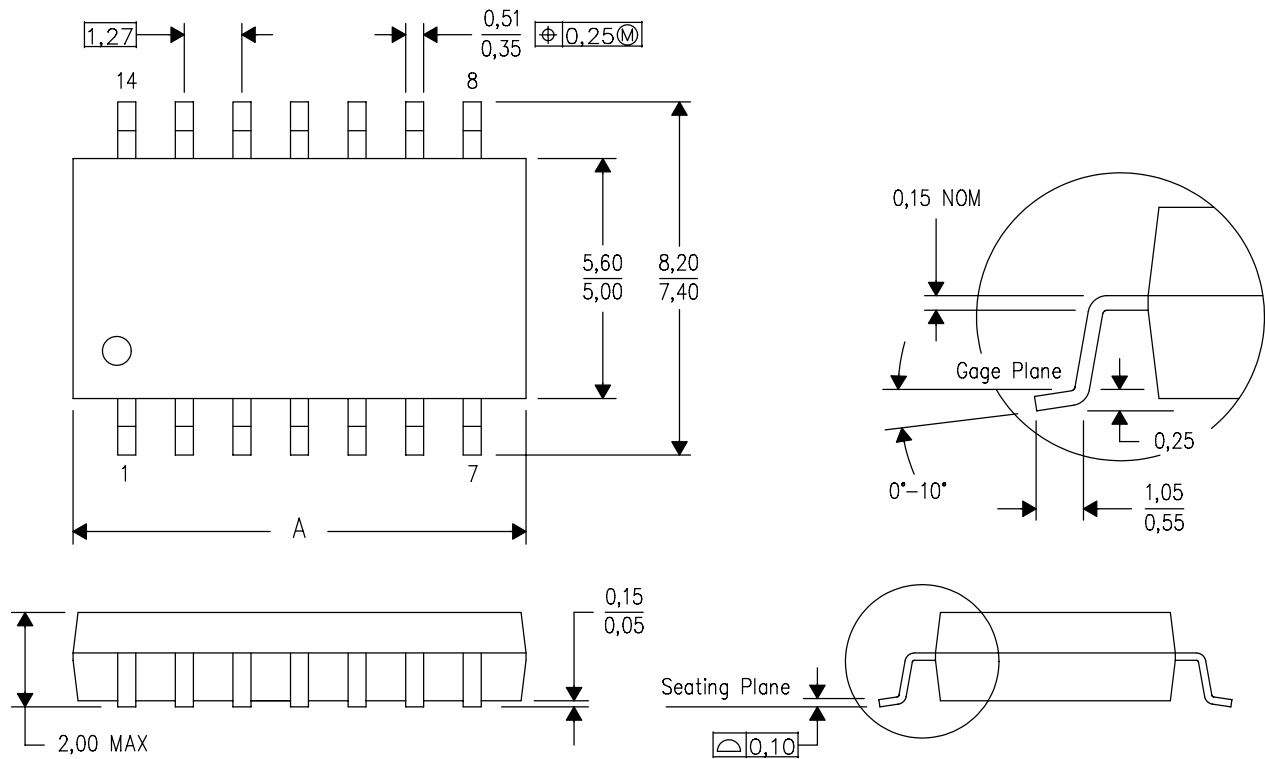
A.	All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
B.	This drawing is subject to change without notice.
C.	QFN (Quad Flatpack No-Lead) package configuration.
<u>D.</u>	The package thermal pad must be soldered to the board for thermal and mechanical performance.
<u>E.</u>	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.
F.	Package complies to JEDEC MO-241 variation BB.

## 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.

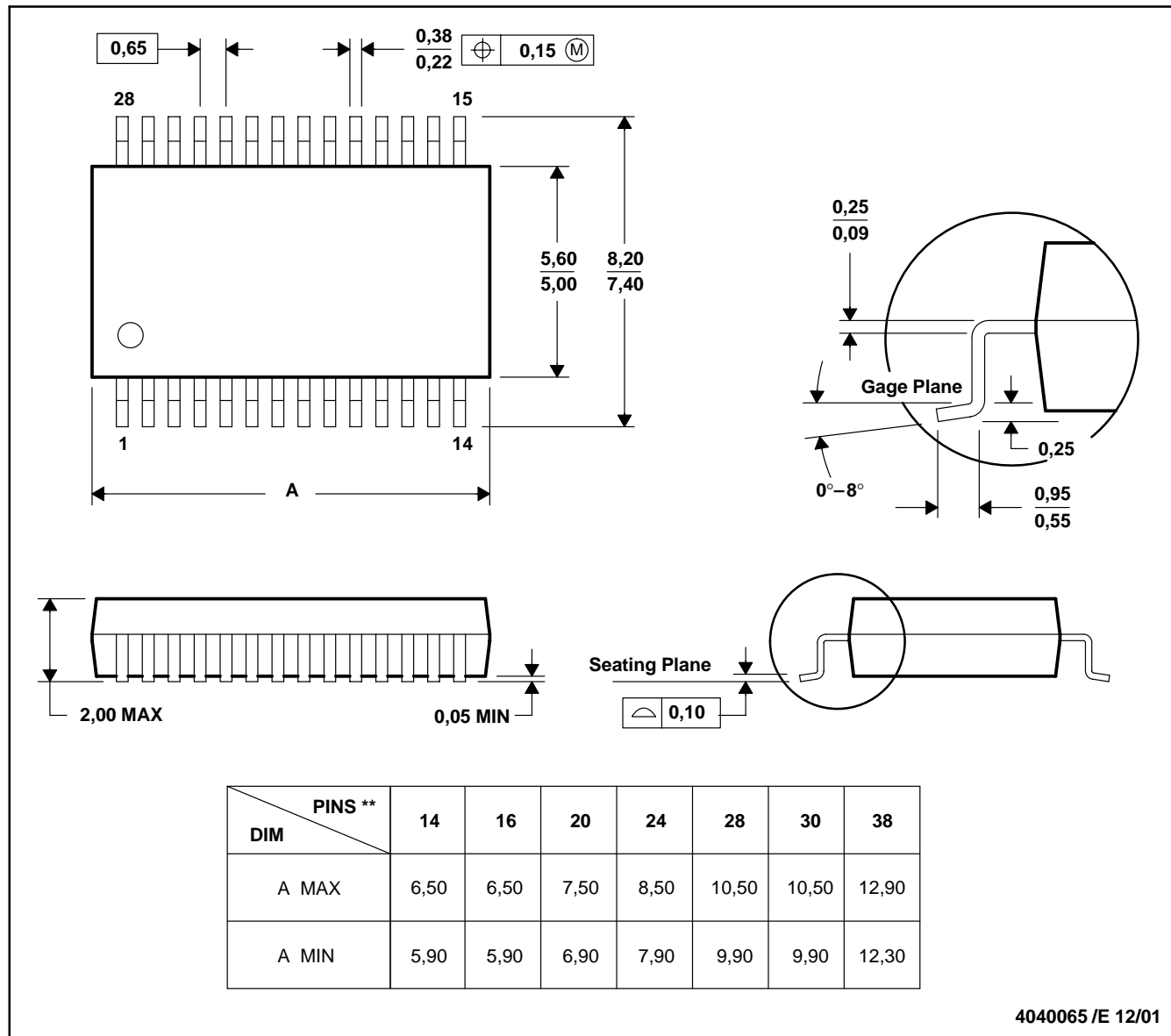
# MECHANICAL DATA

MSS0002E – JANUARY 1995 – REVISED DECEMBER 2001

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

PLASTIC SMALL-OUTLINE

28 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.  
 D. Falls within JEDEC MO-150

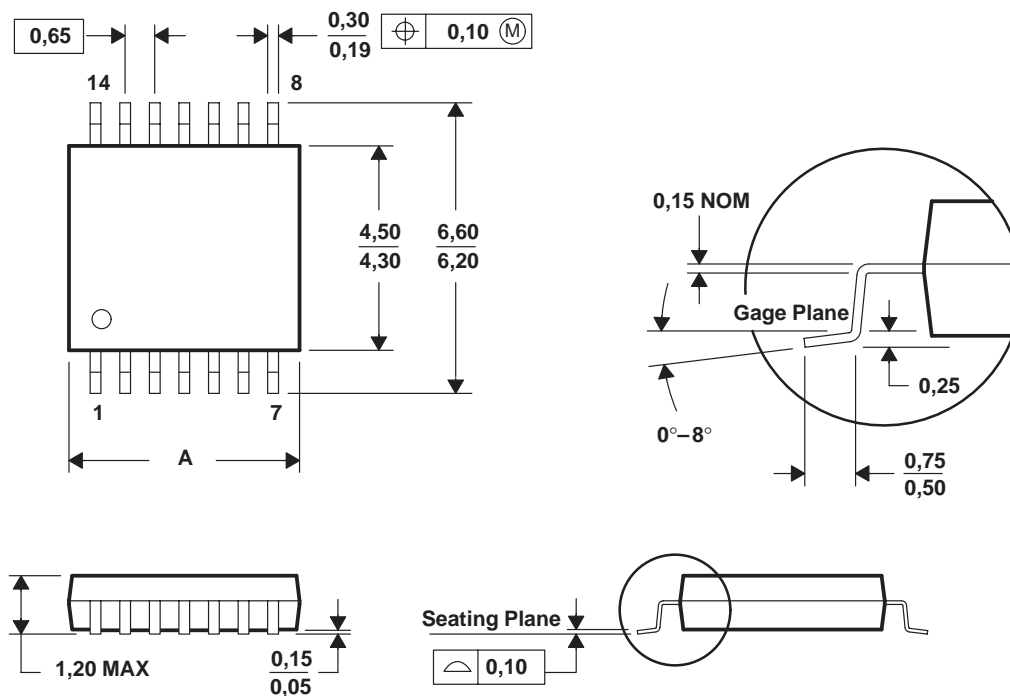
# MECHANICAL DATA

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

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

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



PINS **	8	14	16	20	24	28
DIM						
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/F 01/97

- 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.
  - D. Falls within JEDEC MO-153

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