

CD54/74HC240, CD54/74HCT240, CD74HC241, CD54/74HCT241, CD54/74HC244, CD54/74HCT244

High-Speed CMOS Logic Octal Buffer/Line Drivers, Three-State

Features

- HC/HCT240 Inverting
- HC/HCT241 Non-Inverting
- HC/HCT244 Non-Inverting
- Typical Propagation Delay = 8ns at $V_{CC} = 5V$, $C_L = 15pF$, $T_A = 25^\circ C$ for HC240
- Three-State Outputs
- Buffered Inputs
- High-Current Bus Driver Outputs
- Fanout (Over Temperature Range)
 - Standard Outputs 10 LSTTL Loads
 - Bus Driver Outputs 15 LSTTL Loads
- Wide Operating Temperature Range . . . $-55^\circ C$ to $125^\circ C$
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- HC Types
 - 2V to 6V Operation
 - High Noise Immunity: $N_{IL} = 30\%$, $N_{IH} = 30\%$ of V_{CC} at $V_{CC} = 5V$
- HCT Types
 - 4.5V to 5.5V Operation
 - Direct LSTTL Input Logic Compatibility, $V_{IL} = 0.8V$ (Max), $V_{IH} = 2V$ (Min)
 - CMOS Input Compatibility, $I_I \leq 1\mu A$ at V_{OL} , V_{OH}

Description

The 'HC240 and 'HCT240 are inverting three-state buffers having two active-low output enables. The CD74HC241, 'HCT241, 'HC244 and 'HCT244 are non-inverting three-state buffers that differ only in that the 241 has one active-high and one active-low output enable, and the 244 has two active-low output enables. All three types have identical pinouts.

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE
CD54HC240F3A	-55 to 125	20 Ld CERDIP
CD54HC244F3A	-55 to 125	20 Ld CERDIP
CD54HCT240F3A	-55 to 125	20 Ld CERDIP
CD54HCT241F3A	-55 to 125	20 Ld CERDIP
CD54HCT244F3A	-55 to 125	20 Ld CERDIP
CD74HC240E	-55 to 125	20 Ld PDIP
CD74HC240M	-55 to 125	20 Ld SOIC
CD74HC240M96	-55 to 125	20 Ld SOIC
CD74HC241E	-55 to 125	20 Ld PDIP
CD74HC241M	-55 to 125	20 Ld SOIC
CD74HC241M96	-55 to 125	20 Ld SOIC
CD74HC244E	-55 to 125	20 Ld PDIP
CD74HC244M	-55 to 125	20 Ld SOIC
CD74HC244M96	-55 to 125	20 Ld SOIC
CD74HCT240E	-55 to 125	20 Ld PDIP
CD74HCT240M	-55 to 125	20 Ld SOIC
CD74HCT240M96	-55 to 125	20 Ld SOIC
CD74HCT240PW	-55 to 125	20 Ld TSSOP
CD74HCT240PWR	-55 to 125	20 Ld TSSOP
CD74HCT240PWT	-55 to 125	20 Ld TSSOP
CD74HCT241E	-55 to 125	20 Ld PDIP
CD74HCT241M	-55 to 125	20 Ld SOIC
CD74HCT241M96	-55 to 125	20 Ld SOIC
CD74HCT244E	-55 to 125	20 Ld PDIP
CD74HCT244M	-55 to 125	20 Ld SOIC
CD74HCT244M96	-55 to 125	20 Ld SOIC

NOTE: When ordering, use the entire part number. The suffixes 96 and R denote tape and reel. The suffix T denotes a small-quantity reel of 250.

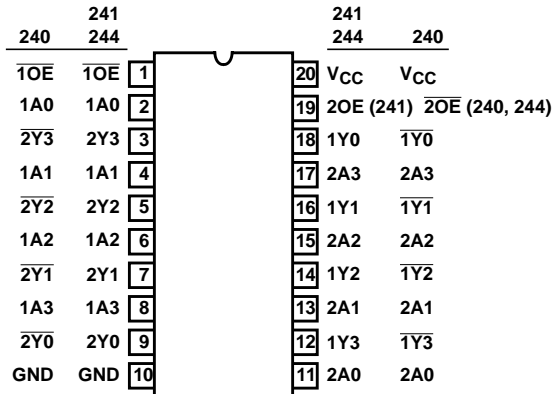
Pinout

CD54HC240, CD54HCT240, CD54HCT241,
CD54HC244, CD54HCT244
(CERDIP)

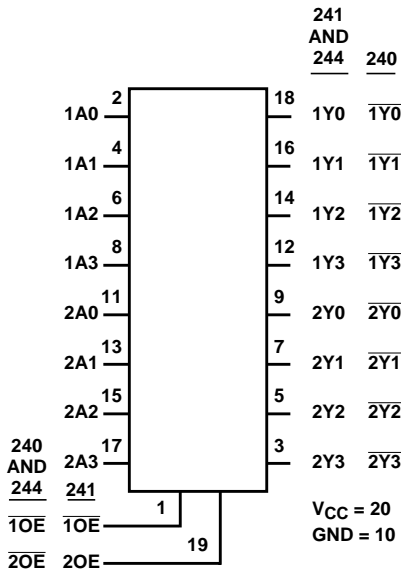
CD74HC240, CD74HC241, CD74HCT241,
CD74HC244, CD74HCT244
(PDIP, SOIC)

CD74HCT240,
(PDIP, SOIC, TSSOP)

TOP VIEW



Functional Diagram



Absolute Maximum Ratings

DC Supply Voltage, V_{CC} -0.5V to 7V
 DC Input Diode Current, I_{IK}
 For $V_I < -0.5V$ or $V_I > V_{CC} + 0.5V$ $\pm 20mA$
 DC Output Diode Current, I_{OK}
 For $V_O < -0.5V$ or $V_O > V_{CC} + 0.5V$ $\pm 20mA$
 DC Drain Current, per Output, I_O
 For $-0.5V < V_O < V_{CC} + 0.5V$ $\pm 35mA$
 DC Output Source or Sink Current per Output Pin, I_O
 For $V_O > -0.5V$ or $V_O < V_{CC} + 0.5V$ $\pm 25mA$
 DC V_{CC} or Ground Current, I_{CC} $\pm 70mA$

Thermal Information

Thermal Resistance (Typical, Note 1) θ_{JA}
 E (PDIP) Package 69°C/W
 M (SOIC) Package 58°C/W
 PW (TSSOP) Package 83°C/W
 Maximum Junction Temperature 150°C
 Maximum Storage Temperature Range -65°C to 150°C
 Maximum Lead Temperature (Soldering 10s) 300°C
 (SOIC - Lead Tips Only)

Operating Conditions

Temperature Range (T_A) -55°C to 125°C
 Supply Voltage Range, V_{CC}
 HC Types 2V to 6V
 HCT Types 4.5V to 5.5V
 DC Input or Output Voltage, V_I, V_O 0V to V_{CC}
 Input Rise and Fall Time
 2V 1000ns (Max)
 4.5V 500ns (Max)
 6V 400ns (Max)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

1. The package thermal impedance is calculated in accordance with JESD 51-7.

DC Electrical Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		V_{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V_I (V)	I_O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
HC TYPES												
High Level Input Voltage	V_{IH}	-	-	2	1.5	-	-	1.5	-	1.5	-	V
				4.5	3.15	-	-	3.15	-	3.15	-	V
				6	4.2	-	-	4.2	-	4.2	-	V
Low Level Input Voltage	V_{IL}	-	-	2	-	-	0.5	-	0.5	-	0.5	V
				4.5	-	-	1.35	-	1.35	-	1.35	V
				6	-	-	1.8	-	1.8	-	1.8	V
High Level Output Voltage CMOS Loads	V_{OH}	V_{IH} or V_{IL}	-0.02	2	1.9	-	-	1.9	-	1.9	-	V
			-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
			-0.02	6	5.9	-	-	5.9	-	5.9	-	V
High Level Output Voltage TTL Loads	V_{OH}	V_{IH} or V_{IL}	-6	4.5	3.98	-	-	3.84	-	3.7	-	V
			-7.8	6	5.48	-	-	5.34	-	5.2	-	V
Low Level Output Voltage CMOS Loads	V_{OL}	V_{IH} or V_{IL}	0.02	2	-	-	0.1	-	0.1	-	0.1	V
			0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
			0.02	6	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads	V_{OL}	V_{IH} or V_{IL}	6	4.5	-	-	0.26	-	0.33	-	0.4	V
			7.8	6	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I_I	V_{CC} or GND	-	6	-	-	± 0.1	-	± 1	-	± 1	μA
Quiescent Device Current	I_{CC}	V_{CC} or GND	0	6	-	-	8	-	80	-	160	μA

DC Electrical Specifications (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS		V _{CC} (V)	25°C			-40°C TO 85°C		-55°C TO 125°C		UNITS
		V _I (V)	I _O (mA)		MIN	TYP	MAX	MIN	MAX	MIN	MAX	
Three-State Leakage Current	I _{OZ}	V _{IL} or V _{IH}	-	6	-	-	±0.5	-	±0.5	-	±10	µA
HCT TYPES												
High Level Input Voltage	V _{IH}	-	-	4.5 to 5.5	2	-	-	2	-	2	-	V
Low Level Input Voltage	V _{IL}	-	-	4.5 to 5.5	-	-	0.8	-	0.8	-	0.8	V
High Level Output Voltage CMOS Loads	V _{OH}	V _{IH} or V _{IL}	-0.02	4.5	4.4	-	-	4.4	-	4.4	-	V
High Level Output Voltage TTL Loads			-6	4.5	3.98	-	-	3.84	-	3.7	-	V
Low Level Output Voltage CMOS Loads	V _{OL}	V _{IH} or V _{IL}	0.02	4.5	-	-	0.1	-	0.1	-	0.1	V
Low Level Output Voltage TTL Loads			6	4.5	-	-	0.26	-	0.33	-	0.4	V
Input Leakage Current	I _I	V _{CC} to GND	0	5.5	-	-	±0.1	-	±1	-	±1	µA
Quiescent Device Current	I _{CC}	V _{CC} or GND	0	5.5	-	-	8	-	80	-	160	µA
Additional Quiescent Device Current Per Input Pin: 1 Unit Load	ΔI _{CC} (Note 2)	V _{CC} -2.1	-	4.5 to 5.5	-	100	360	-	450	-	490	µA
Three-State Leakage Current	I _{OZ}	V _{IL} or V _{IH}	-	5.5	-	-	±0.5	-	±5	-	±10	µA

NOTE:

2. For dual-supply systems theoretical worst case (V_I = 2.4V, V_{CC} = 5.5V) specification is 1.8mA.

HCT Input Loading Table

INPUT	UNIT LOADS
HCT240	
nA0-A3	1.5
$\overline{1}OE$	0.7
$\overline{2}OE$	0.7
HCT241	
nA0-A3	0.7
$\overline{1}OE$	0.7
$\overline{2}OE$	1.5
HCT244	
nA0-A3	0.7
$\overline{1}OE$	0.7
$\overline{2}OE$	0.7

NOTE: Unit Load is ΔI_{CC} limit specified in DC Electrical Specifications table, e.g., 360µA max at 25°C.

CD54/74HC240, CD54/74HCT240, CD74HC241, CD54/74HCT241, CD54/74HC244, CD54/74HCT244

Switching Specifications $C_L = 50\text{pF}$, Input $t_r, t_f = 6\text{ns}$

PARAMETER	SYMBOL	TEST CONDITIONS	V _{CC} (V)	25°C			-40°C TO 85°C			-55°C TO 125°C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
HC TYPES													
Propagation Delay Data to Outputs HC240	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	2	-	-	100	-	-	125	-	-	150	ns
			4.5	-	-	20	-	-	25	-	-	30	ns
		$C_L = 15\text{pF}$	5	-	8	-	-	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	17	-	-	21	-	-	26	ns
Data to Outputs HC241	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	2	-	-	110	-	-	140	-	-	165	ns
			4.5	-	-	22	-	-	28	-	-	33	ns
		$C_L = 15\text{pF}$	5	-	9	-	-	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	19	-	-	24	-	-	28	ns
Data to Outputs HC244	t_{PLH}, t_{PHL}	$C_L = 50\text{pF}$	2	-	-	110	-	-	140	-	-	165	ns
			4.5	-	-	22	-	-	28	-	-	33	ns
		$C_L = 15\text{pF}$	5	-	9	-	-	-	-	-	-	-	ns
		$C_L = 50\text{pF}$	6	-	-	19	-	-	24	-	-	28	ns
Output Enable and Disable Time	t_{THL}, t_{TLH}	$C_L = 50\text{pF}$	2	-	-	150	-	-	190	-	-	225	ns
			4.5	-	-	30	-	-	38	-	-	45	ns
		5	-	12	-	-	-	-	-	-	-	-	ns
		6	-	-	26	-	-	33	-	-	38	ns	
Output Transition Time	t_{TLH}, t_{THL}	$C_L = 50\text{pF}$	2	-	-	60	-	-	75	-	-	90	ns
			4.5	-	-	12	-	-	15	-	-	18	ns
			6	-	-	10	-	-	13	-	-	15	ns
Input Capacitance	C_I	$C_L = 50\text{pF}$	-	10	-	10	-	-	10	-	-	10	pF
Three-State Output Capacitance	C_O	$C_L = 50\text{pF}$	-	-	-	20	-	-	20	-	-	20	pF
Power Dissipation Capacitance (Notes 3, 4)	C_{PD}	$C_L = 15\text{pF}$	5	-	38	-	-	-	-	-	-	-	pF
			5	-	34	-	-	-	-	-	-	-	pF
			5	-	46	-	-	-	-	-	-	-	pF
HCT TYPES													
Propagation Delay Data to Outputs HCT240	t_{PHL}, t_{PLH}	$C_L = 50\text{pF}$	4.5	-	-	22	-	-	28	-	-	33	ns
		$C_L = 15\text{pF}$	5	-	9	-	-	-	-	-	-	-	ns
Data to Outputs HCT241	t_{PHL}, t_{PLH}	$C_L = 50\text{pF}$	4.5	-	-	25	-	-	31	-	-	38	ns
		$C_L = 15\text{pF}$	5	-	10	-	-	-	-	-	-	-	ns
Data to Outputs HCT244	t_{PHL}, t_{PLH}	$C_L = 50\text{pF}$	4.5	-	-	25	-	-	31	-	-	38	ns
		$C_L = 15\text{pF}$	5	-	10	-	-	-	-	-	-	-	ns

Switching Specifications $C_L = 50\text{pF}$, Input $t_r, t_f = 6\text{ns}$ (Continued)

PARAMETER	SYMBOL	TEST CONDITIONS	V_{CC} (V)	25°C			-40°C TO 85°C			-55°C TO 125°C			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
Output Enable and Disable Times	t_{TLH}, t_{TLH}	$C_L = 50\text{pF}$	4.5	-	-	30	-	-	38	-	-	45	ns
Output Transition Time	t_{THL}, t_{TLH}	$C_L = 50\text{pF}$	4.5	-	-	12	-	-	15	-	-	18	ns
Input Capacitance	C_I	$C_L = 50\text{pF}$	-	10	-	10	-	-	10	-	-	10	pF
Power Dissipation Capacitance (Notes 3, 4)	C_{PD}												
HCT240		-	5	-	40	-	-	-	-	-	-	-	pF
HCT241		-	5	-	38	-	-	-	-	-	-	-	pF
HCT244		-	5	-	40	-	-	-	-	-	-	-	pF

NOTES:

- C_{PD} is used to determine the dynamic power consumption, per channel.
- $P_D = V_{CC}^2 f_i (C_{PD} + C_L)$ where f_i = Input Frequency, f_o = Output Frequency, C_L = Output Load Capacitance, V_{CC} = Supply Voltage.

Test Circuits and Waveforms



FIGURE 1. HC TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC



FIGURE 2. HCT TRANSITION TIMES AND PROPAGATION DELAY TIMES, COMBINATION LOGIC

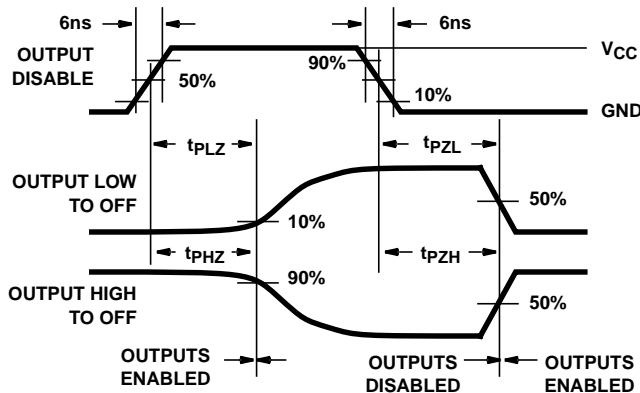
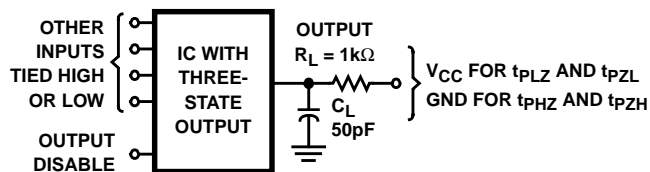


FIGURE 3. HC THREE-STATE PROPAGATION DELAY WAVEFORM



FIGURE 4. HCT THREE-STATE PROPAGATION DELAY WAVEFORM

Test Circuits and Waveforms (Continued)



NOTE: Open drain waveforms t_{PLZ} and t_{PZL} are the same as those for three-state shown on the left. The test circuit is Output $R_L = 1k\Omega$ to V_{CC} , $C_L = 50pF$.

FIGURE 5. HC AND HCT THREE-STATE PROPAGATION DELAY TEST CIRCUIT

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

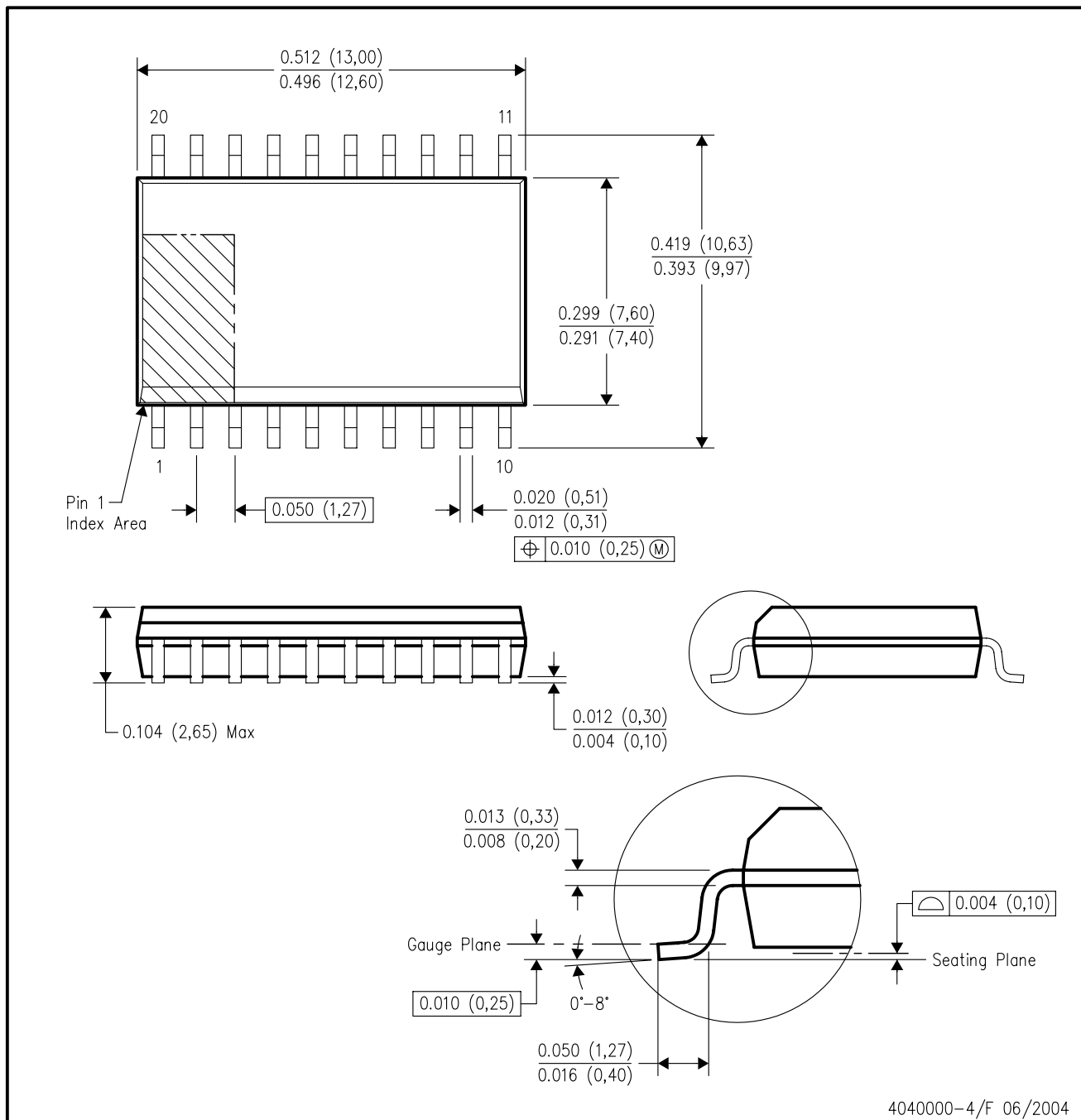


- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - $\triangle D$ The 20 pin end lead shoulder width is a vendor option, either half or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

4040049/E 12/2002

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-013 variation AC.

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



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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Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265