SN54HCT374, SN74HCT374
OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS
WITH 3-STATE OUTPUTS

SCLS005D – MARCH 1984 – REVISED AUGUST 2003

- **Operating Voltage Range of 4.5 V to 5.5 V**
- **High-Current 3-State True Outputs Can Drive Up To 15 LSTTL Loads**
- **Low Power Consumption, 80-μA Max I_{CC}**
- **Typical t_{pd} = 22 ns**
- **$\pm$6-mA Output Drive at 5 V**
- **Low Input Current of 1 μA Max**
- **Inputs Are TTL-Voltage Compatible**
- **Eight D-Type Flip-Flops in a Single Package**
- **Full Parallel Access for Loading**

description/ordering information

These 8-bit flip-flops feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

The eight flip-flops of the 'HCT374 devices are edge-triggered D-type flip-flops. On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels that were set up at the data (D) inputs.

An output-enable ($\overline{OE}$) input places the eight outputs in either a normal logic state (high or low logic levels) or the high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and increased drive provide the capability to drive bus lines without interface or pullup components.

SN54HCT374 . . . J OR W PACKAGE
SN74HCT374 . . . DB, DW, N, NS, OR PW PACKAGE
(TOP VIEW)

```
        _____
 OE  [ 1      20 ] V_CC
 1Q  [ 2      19 ] 8Q
 1D  [ 3      18 ] 8D
 2D  [ 4      17 ] 7D
 2Q  [ 5      16 ] 7Q
 3Q  [ 6      15 ] 6Q
 3D  [ 7      14 ] 6D
 4D  [ 8      13 ] 5D
 4Q  [ 9      12 ] 5Q
 GND [ 10     11 ] CLK
```

SN54HCT374 . . . FK PACKAGE
(TOP VIEW)

```
        1D  1Q  OE  V_CC  8Q
         3   2   1   20   19
  2D [ 4                  18 ] 8D
  2Q [ 5                  17 ] 7D
  3Q [ 6                  16 ] 7Q
  3D [ 7                  15 ] 6Q
  4D [ 8                  14 ] 6D
         9  10  11  12  13
        4Q  GND  CLK  5Q  5D
```

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube of 20	SN74HCT374N	SN74HCT374N
	SOIC – DW	Tube of 25	SN74HCT374DW	HCT374
		Reel of 2000	SN74HCT374DWR	
	SOP – NS	Reel of 2000	SN74HCT374NSR	HCT374
	SSOP – DB	Reel of 2000	SN74HCT374DBR	HT374
	TSSOP – PW	Tube of 70	SN74HCT374PW	HT374
		Reel of 2000	SN74HCT374PWR	
		Reel of 250	SN74HCT374PWT	
–55°C to 125°C	CDIP – J	Tube of 20	SNJ54HCT374J	SNJ54HCT374J
	CFP – W	Tube of 85	SNJ54HCT374W	SNJ54HCT374W
	LCCC – FK	Tube of 55	SNJ54HCT374FK	SNJ54HCT374FK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at 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.

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description/ordering information (continued)

$\overline{OE}$ does not affect the internal operations of the flip-flops. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT
$\overline{OE}$	CLK	D	Q
L	↑	H	H
L	↑	L	L
L	H or L	X	Q_0
H	X	X	Z

logic diagram (positive logic)

To Seven Other Channels

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

Supply voltage range, V_{CC} .... −0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1) .... ±20 mA
Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1) .... ±20 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC}) .... ±35 mA
Continuous current through V_{CC} or GND .... ±70 mA
Package thermal impedance, θ_{JA} (see Note 2): DB package .... 70°C/W
    DW package .... 58°C/W
    N package .... 69°C/W
    NS package .... 60°C/W
    PW package .... 83°C/W
Storage temperature range, T_{stg} .... −65°C to 150°C

† 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.

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recommended operating conditions (see Note 3)

			SN54HCT374			SN74HCT374			UNIT
			MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage		4.5	5	5.5	4.5	5	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 4.5 V to 5.5 V	2			2			V
V_{IL}	Low-level input voltage	V_{CC} = 4.5 V to 5.5 V			0.8			0.8	V
V_I	Input voltage		0		V_{CC}	0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	0		V_{CC}	V
$\Delta t/\Delta v$	Input transition rise/fall time				500			500	ns
T_A	Operating free-air temperature		−55		125	−40		85	°C

NOTE 3: 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 recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS		V_{CC}	T_A = 25°C			SN54HCT374		SN74HCT374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}	V_I = V_{IH} or V_{IL}	I_{OH} = −20 µA	4.5 V	4.4	4.499		4.4		4.4		V
		I_{OH} = −6 mA		3.98	4.3		3.7		3.84		
V_{OL}	V_I = V_{IH} or V_{IL}	I_{OL} = 20 µA	4.5 V		0.001	0.1		0.1		0.1	V
		I_{OL} = 6 mA			0.17	0.26		0.4		0.33	
I_I	V_I = V_{CC} or 0		5.5 V		±0.1	±100		±1000		±1000	nA
I_{OZ}	V_O = V_{CC} or 0		5.5 V		±0.01	±0.5		±10		±5	µA
I_{CC}	V_I = V_{CC} or 0, I_O = 0		5.5 V			8		160		80	µA
ΔI_{CC}†	One input at 0.5 V or 2.4 V, Other inputs at 0 or V_{CC}		5.5 V		1.4	2.4		3		2.9	mA
C_i			4.5 V to 5.5 V		3	10		10		10	pF

† This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or V_{CC}.

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

		V_{CC}	T_A = 25°C		SN54HCT374		SN74HCT374		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
f_{clock}	Clock frequency	4.5 V		31		21		25	MHz
		5.5 V		36		23		28	
t_w	Pulse duration, CLK high or low	4.5 V	16		24		20		ns
		5.5 V	14		22		18		
t_{su}	Setup time, data before CLK↑	4.5 V	20		30		25		ns
		5.5 V	17		27		23		
t_h	Hold time, data after CLK↑	4.5 V	10		10		10		ns
		5.5 V	10		10		10		

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	T_A = 25°C			SN54HCT374		SN74HCT374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			4.5 V	31	36		21		25		MHz
			5.5 V	36	40		23		28		
t_{pd}	CLK	Any Q	4.5 V		30	36		54		45	ns
			5.5 V		25	32		49		41	
t_{en}	$\overline{OE}$	Any Q	4.5 V		26	30		45		38	ns
			5.5 V		23	27		41		34	
t_{dis}	$\overline{OE}$	Any Q	4.5 V		23	30		45		38	ns
			5.5 V		22	27		41		34	
t_t		Any Q	4.5 V		10	12		18		15	ns
			5.5 V		9	11		16		14	

switching characteristics over recommended operating free-air temperature range, C_L = 150 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	T_A = 25°C			SN54HCT374		SN74HCT374		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{pd}	CLK	Any Q	4.5 V		40	46		69		58	ns
			5.5 V		35	41		62		52	
t_{en}	$\overline{OE}$	Any Q	4.5 V		34	40		60		50	ns
			5.5 V		29	36		54		45	
t_t		Any Q	4.5 V		18	42		63		53	ns
			5.5 V		16	38		57		48	

operating characteristics, T_A = 25°C

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per flip-flop	No load	85	pF

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PARAMETER MEASUREMENT INFORMATION

LOAD CIRCUIT
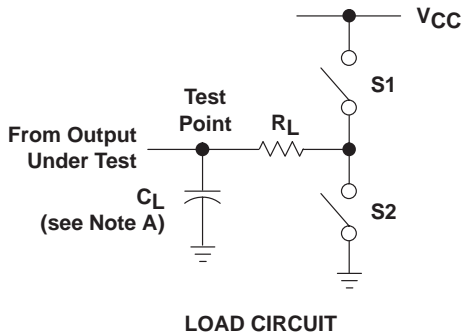
PARAMETER		R_L	C_L	S1	S2
t_{en}	t_{PZH}	1 kΩ	50 pF or 150 pF	Open	Closed
	t_{PZL}			Closed	Open
t_{dis}	t_{PHZ}	1 kΩ	50 pF	Open	Closed
	t_{PLZ}			Closed	Open
t_{pd} or t_t		––	50 pF or 150 pF	Open	Open

VOLTAGE WAVEFORMS
PULSE DURATIONS

VOLTAGE WAVEFORMS
SETUP AND HOLD AND INPUT RISE AND FALL TIMES

VOLTAGE WAVEFORMS
PROPAGATION DELAY AND OUTPUT RISE AND FALL TIMES

VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES FOR 3-STATE OUTPUTS
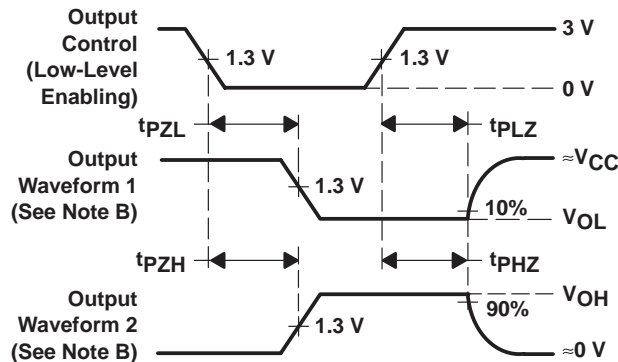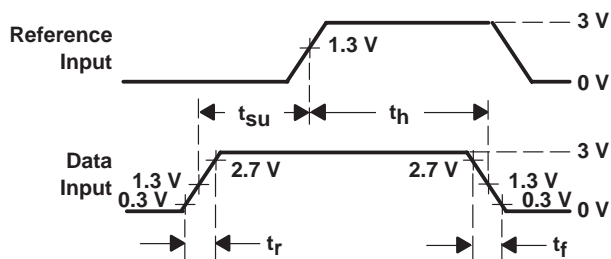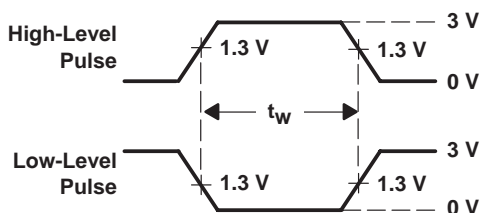
NOTES: A. C_L includes probe and test-fixture capacitance.
      B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
         Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
      C. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following
         characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 ns.
      D. For clock inputs, f_{max} is measured when the input duty cycle is 50%.
      E. The outputs are measured one at a time with one input transition per measurement.
      F. t_{PLZ} and t_{PHZ} are the same as t_{dis}.
      G. t_{PZL} and t_{PZH} are the same as t_{en}.
      H. t_{PLH} and t_{PHL} are the same as t_{pd}.

Figure 1. Load Circuit and Voltage Waveforms

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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
85507012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	85507012A SNJ54HCT 374FK	Samples
8550701RA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	8550701RA SNJ54HCT374J	Samples
JM38510/65652BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 65652BRA	Samples
M38510/65652BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 65652BRA	Samples
SN54HCT374J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54HCT374J	Samples
SN74HCT374DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT374	Samples
SN74HCT374DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT374	Samples
SN74HCT374DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT374	Samples
SN74HCT374DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT374	Samples
SN74HCT374DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT374	Samples
SN74HCT374N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	SN74HCT374N	Samples
SN74HCT374NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HCT374	Samples
SN74HCT374PW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT374	Samples
SN74HCT374PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT374	Samples
SN74HCT374PWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HT374	Samples
SNJ54HCT374FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	85507012A SNJ54HCT 374FK	Samples

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
SNJ54HCT374J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	8550701RA SNJ54HCT374J	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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OTHER QUALIFIED VERSIONS OF SN54HCT374, SN74HCT374 :

● Catalog: SN74HCT374

● Military: SN54HCT374

NOTE: Qualified Version Definitions:

　　　● Catalog - TI's standard catalog product

　　　● Military - QML certified for Military and Defense Applications

PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	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

| 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
SN74HCT374DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74HCT374DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HCT374NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HCT374DBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74HCT374DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HCT374NSR	SO	NS	20	2000	367.0	367.0	45.0

J (R−GDIP−T**)   CERAMIC DUAL IN−LINE PACKAGE
14 LEADS SHOWN
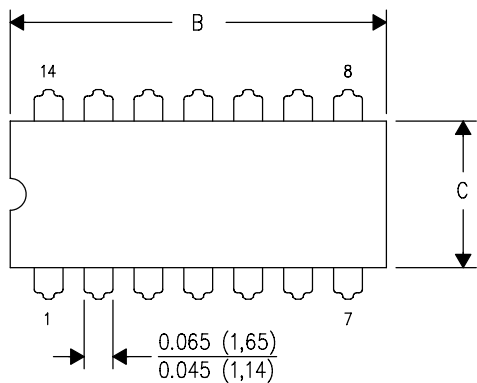
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	——	——	——	——
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

B

14   8

1   7

0.065 (1,65)
0.045 (1,14)

0.005 (0,13) MIN

0.060 (1,52)
0.015 (0,38)

0.200 (5,08) MAX

Seating Plane

0.130 (3,30) MIN

0.026 (0,66)
0.014 (0,36)

0.100 (2,54)

A

0°−15°

0.014 (0,36)
0.008 (0,20)
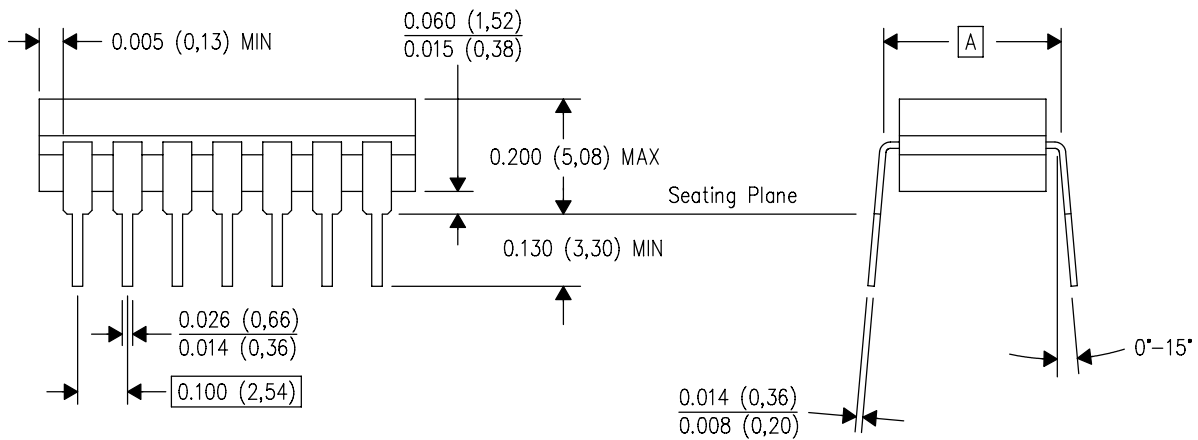
4040083/F 03/03

NOTES: A. All linear dimensions are in inches (millimeters).
          B. This drawing is subject to change without notice.
          C. This package is hermetically sealed with a ceramic lid using glass frit.
          D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
          E. Falls within MIL STD 1835 GDIP1−T14, GDIP1−T16, GDIP1−T18 and GDIP1−T20.

PW (R−PDSO−G20)   PLASTIC SMALL OUTLINE

0,65

0,30
0,19

⊕ 0,10 Ⓜ

20   11

⚠D   4,50   6,60
     4,30   6,20

1   10

6,60
6,40

△C

0,15 NOM

Gage Plane

0°−8°

0,25

0,75
0,50

1,20 MAX

0,15
0,05

Seating Plane

⬜ 0,10
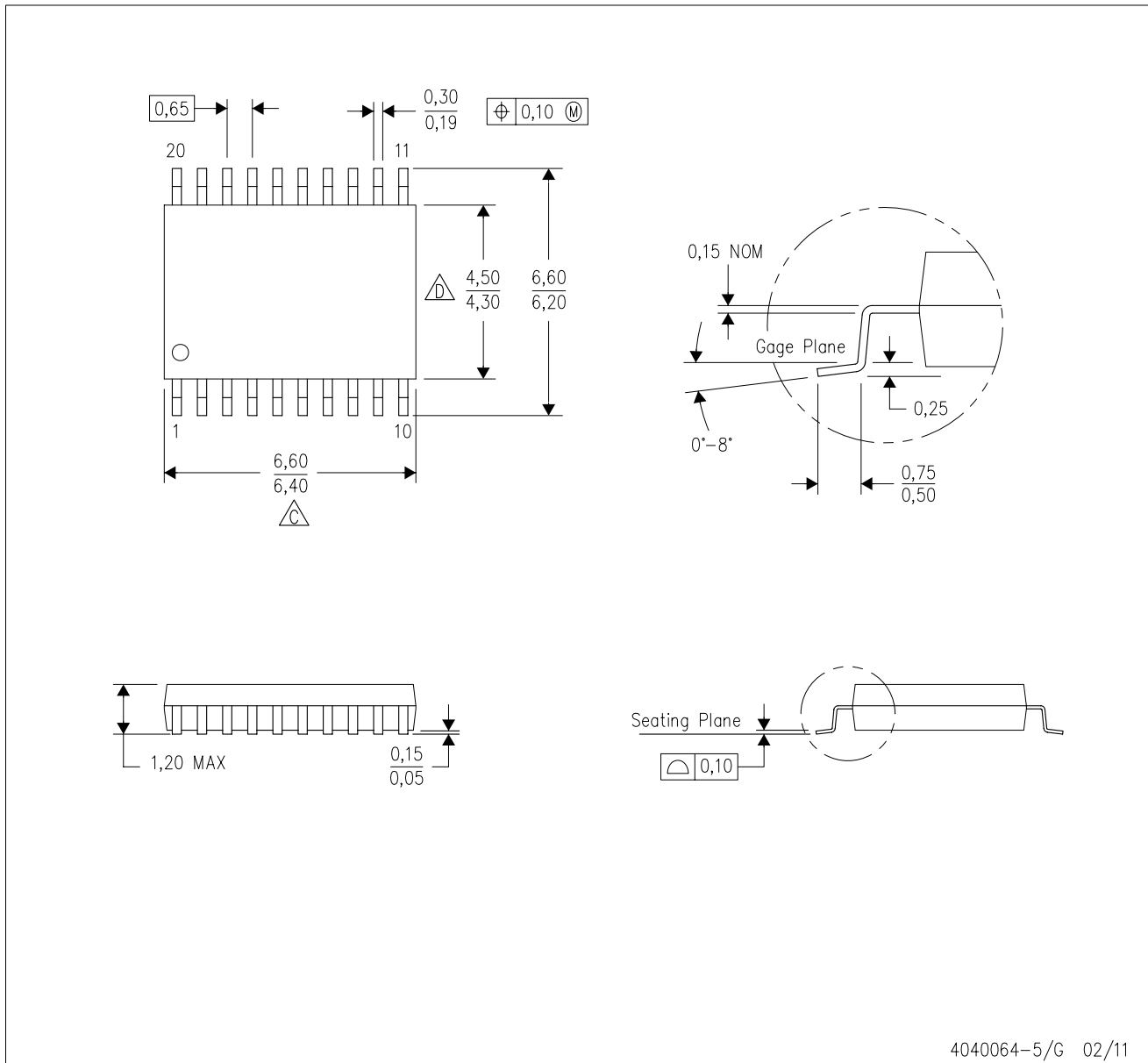
4040064−5/G 02/11

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.   Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall
              not exceed 0,15 each side.
       △D.   Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
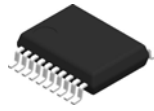   E.   Falls within JEDEC MO−153

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PW (R-PDSO-G20)   PLASTIC SMALL OUTLINE

Example Board Layout

Based on a stencil thickness
of .127mm (.005inch).

18x0,65

20x0,25

1,55

5,6

5,6

18x0,65

Example
Non Soldermask Defined Pad

Example
Solder Mask Opening
(See Note E)

0,3

1,6

Pad Geometry

0,07
All Around

4211284-5/G   08/15

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 design.
         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.
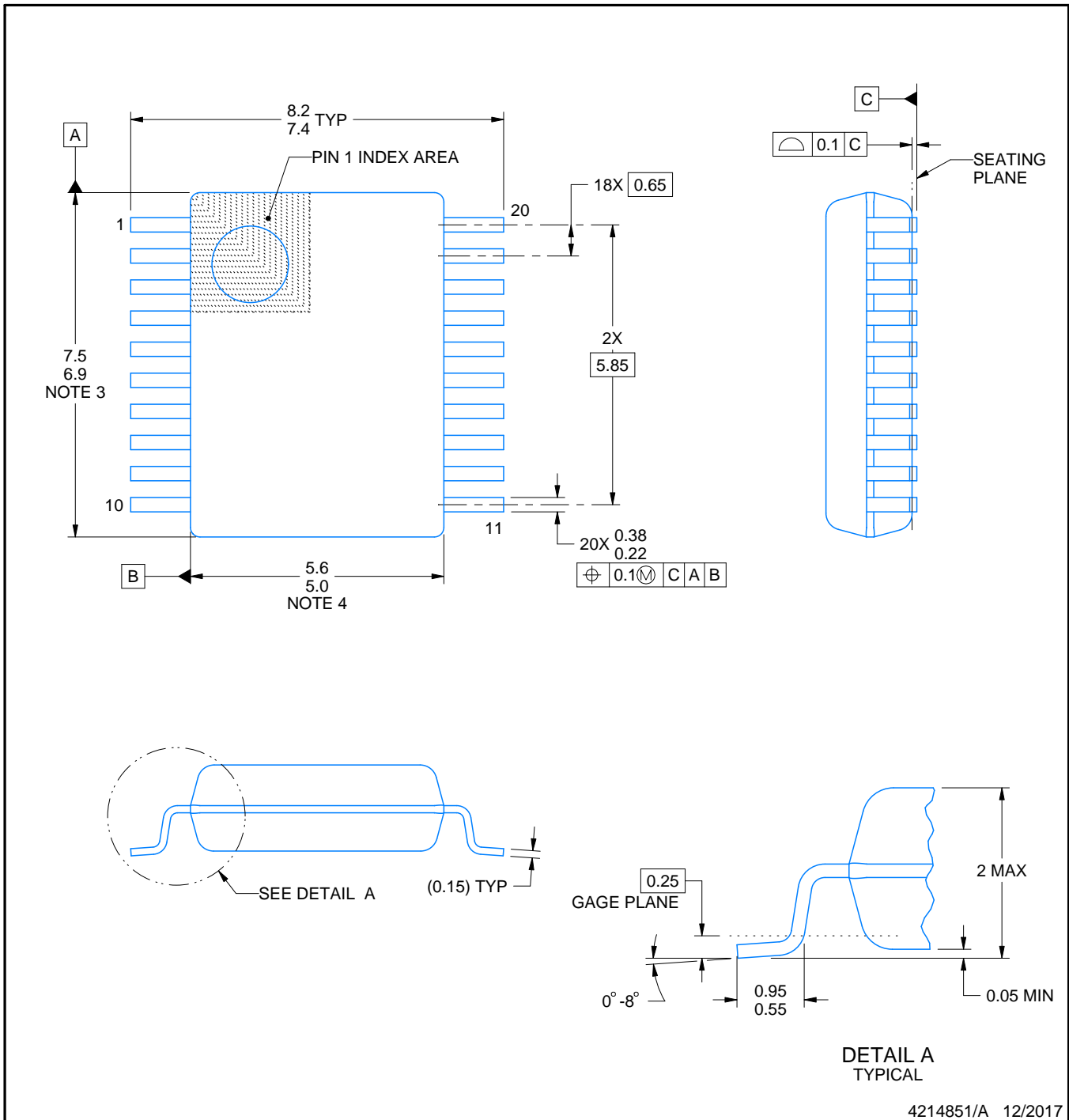
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8.2 / 7.4 TYP

A

PIN 1 INDEX AREA

18X [0.65]

1

20

7.5 / 6.9 NOTE 3

2X [5.85]

10

11

20X 0.38 / 0.22

[⊕ | 0.1 Ⓜ | C | A | B]

B

5.6 / 5.0 NOTE 4

C

[⌒ | 0.1 | C]

SEATING PLANE

SEE DETAIL A

(0.15) TYP

GAGE PLANE

[0.25]

0°-8°

0.95 / 0.55

2 MAX

0.05 MIN

DETAIL A
TYPICAL

4214851/A 12/2017

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-150.

20X (1.85)

SYMM

(R0.05) TYP

1

20

20X (0.45)

18X (0.65)

SYMM

10

11

(7)

LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

SOLDER MASK OPENING

METAL

EXPOSED METAL

0.07 MAX
ALL AROUND

NON-SOLDER MASK
DEFINED
(PREFERRED)

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

EXPOSED METAL

0.07 MIN
ALL AROUND

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4214851/A   12/2017

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.

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214851/A   12/2017

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.

N (R−PDIP−T**) PLASTIC DUAL−IN−LINE PACKAGE

16 PINS SHOWN

PINS ** DIM	14	16	18	20
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

0.260 (6,60) / 0.240 (6,10)

0.070 (1,78) / 0.045 (1,14) D

0.045 (1,14) / 0.030 (0,76) D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53) / 0.015 (0,38)

⊕ 0.010 (0,25) M

0.325 (8,26) / 0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

14/18 Pin Only
20 Pin vendor option D

4040049/E 12/2002

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.

TEXAS INSTRUMENTS
www.ti.com

10.63 / 9.97 TYP

A

PIN 1 ID
AREA

1

18X 1.27

20

13.0
12.6
NOTE 3

2X
11.43

10

11

B

7.6
7.4

NOTE 4

20X 0.51 / 0.31

⊕ 0.25 Ⓜ C A B

C

SEATING PLANE

⌒ 0.1 C

2.65 MAX

SEE DETAIL A

0.33 / 0.10 TYP

0.25

GAGE PLANE

0° - 8°

1.27 / 0.40

0.3 / 0.1

DETAIL A
TYPICAL

4220724/A   05/2016

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 0.43 mm per side.
5. Reference JEDEC registration MS-013.

20X (2)

SYMM

1

20

20X (0.6)

18X (1.27)

SYMM

(R0.05)
TYP

10

11

(9.3)

LAND PATTERN EXAMPLE
SCALE:6X

SOLDER MASK
OPENING

METAL

METAL UNDER
SOLDER MASK

SOLDER MASK
OPENING

0.07 MAX
ALL AROUND

0.07 MIN
ALL AROUND

NON SOLDER MASK
DEFINED

SOLDER MASK
DEFINED

SOLDER MASK DETAILS

4220724/A   05/2016

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.

20X (2)

1

20X (0.6)

18X (1.27)

SYMM

20

SYMM

11

10

(9.3)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:6X

4220724/A   05/2016

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.

FK (S−CQCC−N**)
28 TERMINAL SHOWN

LEADLESS CERAMIC CHIP CARRIER

NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

B SQ
A SQ

0.020 (0,51) / 0.010 (0,25)

0.020 (0,51) / 0.010 (0,25)

0.080 (2,03) / 0.064 (1,63)

0.055 (1,40) / 0.045 (1,14)

0.045 (1,14) / 0.035 (0,89)

0.028 (0,71) / 0.022 (0,54)

0.050 (1,27)

0.045 (1,14) / 0.035 (0,89)

4040140/D 01/11

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 metal lid.
        D. Falls within JEDEC MS−004

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.