SCCS074 - OCTOBER 2001

- Function and Pinout Compatible With FCT and F Logic
- 25-Ω Output Series Resistors Reduce Transmission-Line Reflection Noise
- TTL-Output-Level Version of Equivalent FCT Functions
- Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics
- I<sub>off</sub> Supports Partial-Power-Down Mode Operation
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)
- Fully Compatible With TTL Input and Output Logic Levels
- 12-mA Output Sink Current
   15-mA Output Source Current
- 3-State Outputs

#### **Q OR SO PACKAGE** (TOP VIEW) OE<sub>Δ</sub> [ $V_{CC}$ DA<sub>0</sub> **∏**2 19 OE<sub>B</sub> OB<sub>0</sub> [] 3 18 OA<sub>0</sub> $DA_1 \prod 4$ 17 DB<sub>0</sub> OB₁ **1**5 16 ¶ OA₁ $DA_2 \begin{bmatrix} 6 \end{bmatrix}$ 15 DB₁ OB<sub>2</sub> | 7 14 OA<sub>2</sub> $DA_3 \Pi 8$ 13 DB<sub>2</sub> OB<sub>3</sub> [] 9 12 OA<sub>3</sub> GND ∏10 11 **□** DB<sub>3</sub>

#### description

The CY74FCT2244T is an octal buffer and line driver that includes on-chip  $25-\Omega$  terminating resistors at each of the outputs to minimize noise resulting from reflections or standing waves in high-performance applications. The on-chip resistors reduce overall board space and component count. Designed to be employed as a memory address driver, clock driver, and bus-oriented transmitter/receiver, this device provides speed and drive capabilities commensurate with its fastest bipolar logic counterparts, while reducing power dissipation. The input and output voltage levels allow direct interface with TTL, NMOS, and CMOS devices, without the need for external components.

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

#### ORDERING INFORMATION

TA	PACI	KAGE†	SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
	QSOP - Q	Tape and reel	4.3	CY74FCT2244CTQCT	FCT2244C
	SOIC - SO	Tube	4.3	CY74FCT2244CTSOC	FCT2244C
	3010 - 30	Tape and reel	4.3	CY74FCT2244CTSOCT	FC12244C
	QSOP - Q	Tape and reel	4.6	CY74FCT2244ATQCT	FCT2244A
–40°C to 85°C	SOIC - SO Tube		4.6	CY74FCT2244ATSOC	FCT2244A
	3010 - 30	Tape and reel	4.6	CY74FCT2244ATSOCT	FC12244A
	QSOP - Q	Tape and reel	6.5	CY74FCT2244TQCT	FCT2244
	SOIC - SO	Tube		CY74FCT2244TSOC	FCT2244
	3010 - 30	Tape and reel	6.5	CY74FCT2244TSOCT	FC12244

<sup>†</sup> 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.

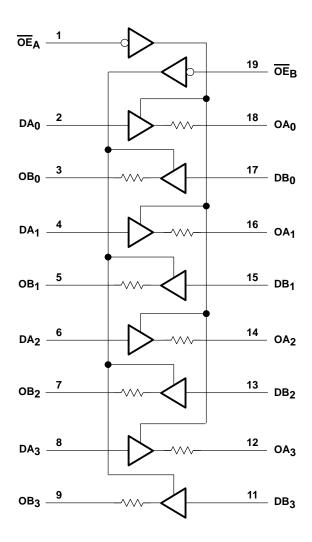


#### **FUNCTION TABLE**

	INPUTS	OUTPUT	
OEA	OE <sub>B</sub>	D	0
L	L	L	L
L	L	Н	Н
Н	Н	Χ	Z

H = High logic level, L = Low logic level, X = Don't care, Z = High-impedance (off)

## logic diagram





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

Supply voltage range to ground potential	–0.5 V to 7 V
DC input voltage range	–0.5 V to 7 V
DC output voltage range	–0.5 V to 7 V
DC output current (maximum sink current/pin)	120 mA
Package thermal impedance, θ <sub>JA</sub> (see Note 1): Q package	68°C/W
SO package	58°C/W
Ambient temperature range with power applied, T <sub>A</sub>	–65°C to +135°C
Storage temperature range, T <sub>stq</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.

#### recommended operating conditions (see Note 2)

		MIN	NOM	MAX	UNIT
Vcc	Supply voltage	4.75	5	5.25	V
VIH	High-level input voltage	2			V
VIL	Low-level input voltage			0.8	V
ІОН	High-level output current			-15	mA
loL	Low-level output current			12	mA
TA	Operating free-air temperature	-40		85	°C

NOTE 2: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.



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

### CY74FCT2244T 8-BIT BUFFER/LINE DRIVER WITH 3-STATE OUTPUTS

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

PARAMETER		TEST CONDITIONS	3	MIN	TYP†	MAX	UNIT
VIK	$V_{CC} = 4.75 \text{ V},$	$I_{IN} = -18 \text{ mA}$			-0.7	-1.2	V
Voн	$V_{CC} = 4.75 \text{ V},$	$I_{OH} = -15 \text{ mA}$		2.4	3.3		V
V <sub>OL</sub>	$V_{CC} = 4.75 \text{ V},$	$I_{OL} = 12 \text{ mA}$			0.3	0.55	V
ROUT	$V_{CC} = 4.75 \text{ V},$	$I_{OL} = 12 \text{ mA}$		20	25	40	Ω
$V_{hys}$	All inputs				0.2		V
lį	$V_{CC} = 5.25 \text{ V},$	VIN = VCC				5	μΑ
lН	V <sub>CC</sub> = 5.25 V,	$V_{IN} = 2.7 \text{ V}$				±1	μΑ
Ι <sub>Ι</sub> L	V <sub>CC</sub> = 5.25 V,	$V_{IN} = 0.5 V$				±1	μΑ
<sup>I</sup> OZH	$V_{CC} = 5.25 \text{ V},$	V <sub>OUT</sub> = 2.7 V				10	μΑ
lozL	V <sub>CC</sub> = 5.25 V,	V <sub>OUT</sub> = 0.5 V				-10	μΑ
los <sup>‡</sup>	V <sub>CC</sub> = 5.25 V,	V <sub>OUT</sub> = 0 V		-60	-120	-225	mA
l <sub>off</sub>	V <sub>CC</sub> = 0 V,	V <sub>OUT</sub> = 4.5 V				±1	μΑ
lcc	$V_{CC} = 5.25 \text{ V},$	$V_{IN} \le 0.2 V$ ,	$V_{IN} \ge V_{CC} - 0.2 V$		0.1	0.2	mA
ΔlCC	$V_{CC} = 5.25 \text{ V}, V_{IN} = 3$	$6.4 \text{ V}$ , $f_1 = 0$ , Outputs op	en		0.5	2	mA
<sup>I</sup> CCD <sup>¶</sup>	$\frac{V_{CC}}{OE_{A}} = \frac{5.25}{OE_{B}} = GND, V$	out switching at 50% duty $I_{IN} \le 0.2 \text{ V or } V_{IN} \ge V_{CC}$	cycle, Outputs open, - 0.2 V		0.06	0.12	mA/ MHz
		One bit switching at f <sub>1</sub> = 10 MHz	$V_{IN} \le 0.2 \text{ V or}$ $V_{IN} \ge V_{CC} - 0.2 \text{ V}$		0.7	1.4	
1-#	V <sub>CC</sub> = 5.25 V,	at 50% duty cycle	V <sub>IN</sub> = 3.4 V or GND		10 -10 0 -120 -225 ±1 0.1 0.2 0.5 2 0.06 0.12 0.7 1.4 1 2.4 1.3 2.6   3.3 10.6	mA	
IC#	$\frac{\text{Outputs open,}}{\text{OE}_{A} = \text{OE}_{B} = \text{GND}}$	Eight bits switching at f <sub>1</sub> = 2.5 MHz	$V_{IN} \le 0.2 \text{ V or}$ $V_{IN} \ge V_{CC} - 0.2 \text{ V}$		1.3	2.6	mA
		at 50% duty cycle	V <sub>IN</sub> = 3.4 V or GND		3.3	10.6	
C <sub>i</sub>					5	10	pF
Co					9	12	pF

<sup>†</sup> Typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^{\circ}\text{C}$ .

Where:

I<sub>C</sub> = Total supply current

I<sub>CC</sub> = Power-supply current with CMOS input levels

ΔICC = Power-supply current for a TTL high input (VIN = 3.4 V)

D<sub>H</sub> = Duty cycle for TTL inputs high N<sub>T</sub> = Number of TTL inputs at D<sub>H</sub>

I<sub>CCD</sub> = Dynamic current caused by an input transition pair (HLH or LHL)

f<sub>0</sub> = Clock frequency for registered devices, otherwise zero

f<sub>1</sub> = Input signal frequency

N<sub>1</sub> = Number of inputs changing at f<sub>1</sub>

All currents are in milliamperes and all frequencies are in megahertz.

Values for these conditions are examples of the I<sub>CC</sub> formula.



Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample-and-hold techniques are preferable to minimize internal chip heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output can raise the chip temperature well above normal and cause invalid readings in other parametric tests. In any sequence of parameter tests, I<sub>OS</sub> tests should be performed last.

<sup>§</sup> Per TTL-driven input (VIN = 3.4 V); all other inputs at VCC or GND

This parameter is derived for use in total power-supply calculations.

 $<sup>^{\#}</sup>$ IC = ICC +  $\Delta$ ICC  $\times$  D<sub>H</sub>  $\times$  N<sub>T</sub> + ICCD (f<sub>0</sub>/2 + f<sub>1</sub>  $\times$  N<sub>1</sub>)

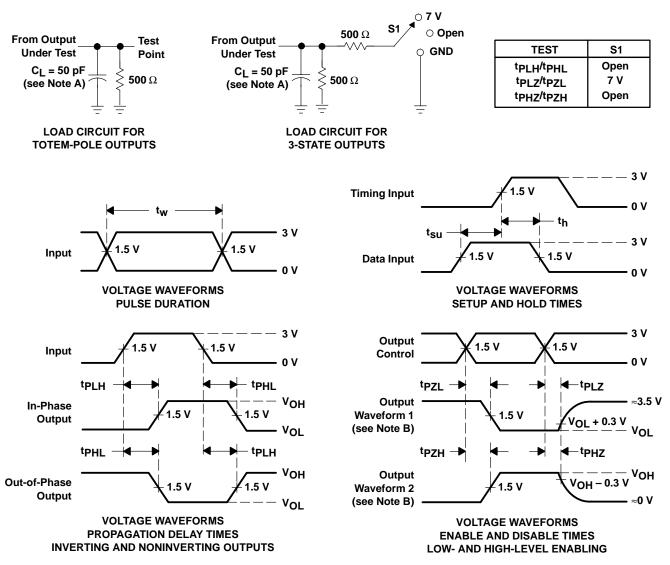
## CY74FCT2244T **8-BIT BUFFER/LINE DRIVER** WITH 3-STATE OUTPUTS SCCS074 - OCTOBER 2001

## switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM TO		TO CY74FCT2244T		CY74FCT	2244AT	CY74FCT	UNIT	
PARAMETER	(INPUT)	(OUTPUT)	MIN	MAX	MIN	MAX	MIN	MAX	UNII
t <sub>PLH</sub>	D	0	1.5	6.5	1.5	4.6	1.5	4.1	ns
t <sub>PHL</sub>	D	O	1.5	6.5	1.5	4.6	1.5	4.1	115
<sup>t</sup> PZH	ŌĒ	0	1.5	8	1.5	6.2	1.5	5.8	no
t <sub>PZL</sub>	OE	O	1.5	8	1.5	6.2	1.5	5.8	ns
<sup>t</sup> PHZ	ŌĒ	0	1.5	7	1.5	5.6	1.5	5.2	no
tPLZ	UE UE	U	1.5	7	1.5	5.6	1.5	5.2	ns



#### PARAMETER MEASUREMENT INFORMATION



NOTES: A. C<sub>L</sub> 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. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms







10-Jun-2014

#### PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
74FCT2244CTSOCTE4	ACTIVE	SOIC	DW	20		TBD	Call TI	Call TI	-40 to 85		Samples
74FCT2244CTSOCTG4	ACTIVE	SOIC	DW	20		TBD	Call TI	Call TI	-40 to 85		Samples
CY74FCT2244ATQCT	ACTIVE	SSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2244A	Samples
CY74FCT2244ATQCTE4	ACTIVE	SSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2244A	Samples
CY74FCT2244ATSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT2244A	Samples
CY74FCT2244CTQCT	ACTIVE	SSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2244C	Samples
CY74FCT2244CTSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT2244C	Samples
CY74FCT2244CTSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT2244C	Samples
CY74FCT2244CTSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT2244C	Samples
CY74FCT2244TQCT	ACTIVE	SSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FCT2244	Samples
CY74FCT2244TSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	FCT2244	Samples

<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.

**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.

<sup>(2)</sup> 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.



### **PACKAGE OPTION ADDENDUM**

10-Jun-2014

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) 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.

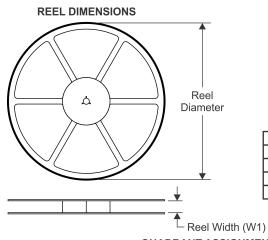
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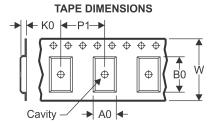
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## PACKAGE MATERIALS INFORMATION

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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

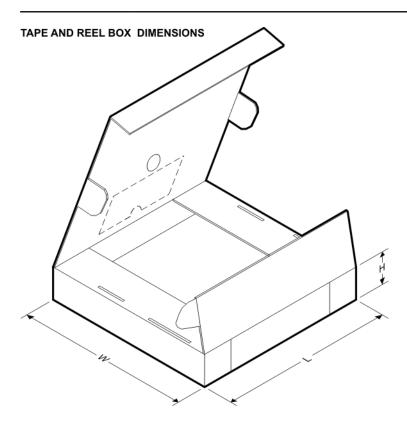
#### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

All differisions are norminal												
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
CY74FCT2244ATQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT2244CTQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT2244CTSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
CY74FCT2244TQCT	SSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

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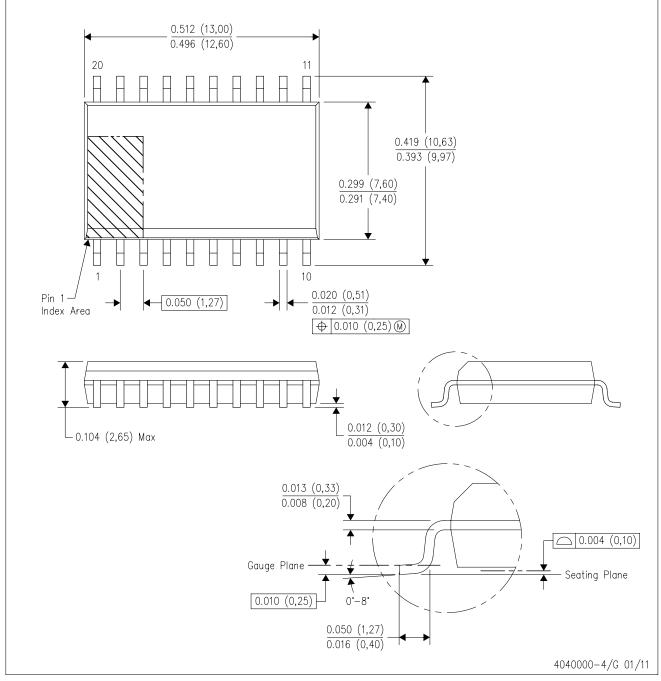


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY74FCT2244ATQCT	SSOP	DBQ	20	2500	367.0	367.0	38.0
CY74FCT2244CTQCT	SSOP	DBQ	20	2500	367.0	367.0	38.0
CY74FCT2244CTSOCT	SOIC	DW	20	2000	367.0	367.0	45.0
CY74FCT2244TQCT	SSOP	DBQ	20	2500	367.0	367.0	38.0

DW (R-PDSO-G20)

#### PLASTIC SMALL OUTLINE



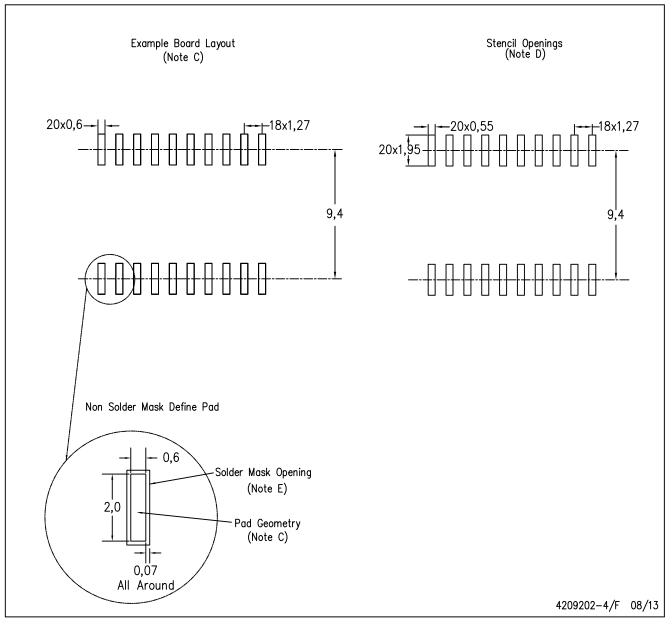
NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.

- 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.



## DW (R-PDSO-G20)

## PLASTIC SMALL OUTLINE



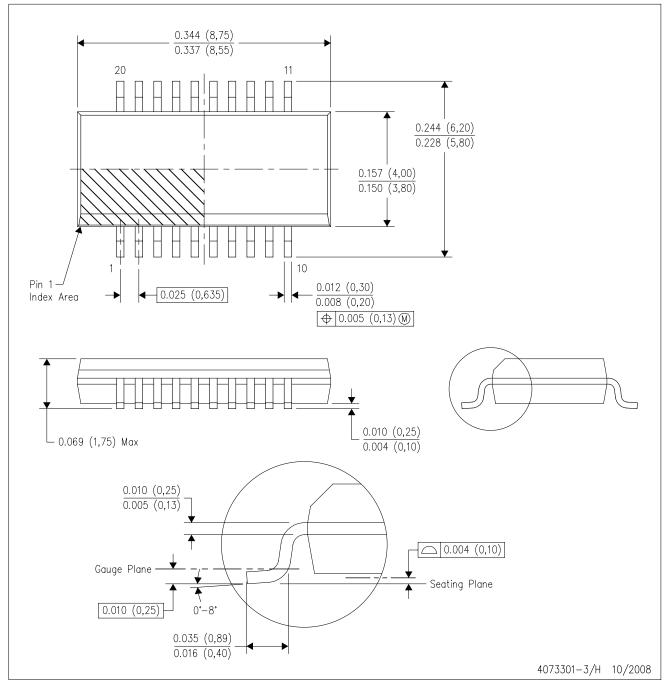
NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Refer to IPC7351 for alternate board 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
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



DBQ (R-PDSO-G20)

## PLASTIC SMALL-OUTLINE PACKAGE



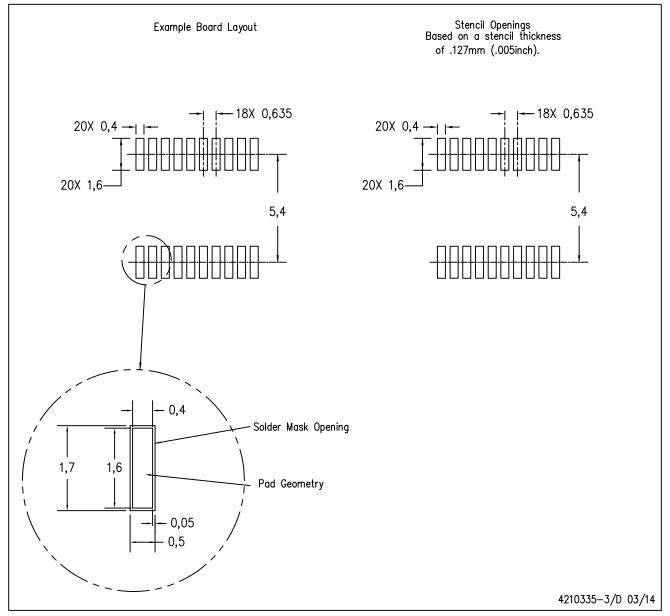
NOTES:

- 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) per side.
- D. Falls within JEDEC MO-137 variation AD.



DBQ (R-PDSO-G20)

## PLASTIC SMALL OUTLINE PACKAGE



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. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.



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RFID <u>www.ti-rfid.com</u>

OMAP Applications Processors <a href="https://www.ti.com/omap">www.ti.com/omap</a> TI E2E Community <a href="https://example.com/omap">e2e.ti.com/omap</a>

Wireless Connectivity <u>www.ti.com/wirelessconnectivity</u>