

CY74FCT2245T

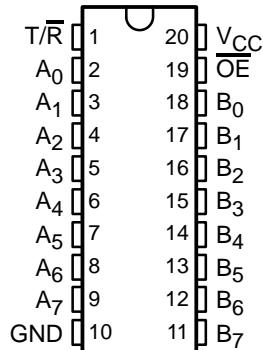
8-BIT TRANSCEIVER

WITH 3-STATE OUTPUTS

SCCS037B – JULY 1994 – REVISED NOVEMBER 2001

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

P, Q, OR SO PACKAGE
(TOP VIEW)



description

The CY74FCT2245T contains eight noninverting, bidirectional buffers with 3-state outputs intended for bus-oriented applications. On-chip termination resistors at the outputs reduce system noise caused by reflections. For this reason, the CY74FCT2245T can replace the CY74FCT245T in an existing design. The CY74FCT2245T current-sinking capability is 12 mA at the A and B ports.

The transmit/receive (T/R) input determines the direction of data flow through the bidirectional transceiver. Transmit (active high) enables data from A ports to B ports; receive (active low) enables data from B ports to A ports. The output-enable (\overline{OE}) input, when high, disables both the A and B ports by putting them in the high-impedance state.

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

T_A	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – Q	Tape and reel	4.1	CY74FCT2245CTQCT	FCT2245
	SOIC – SO	Tube	4.1	CY74FCT2245CTSOC	FCT2245
		Tape and reel	4.1	CY74FCT2245CTSOCT	
	DIP – P	Tube	4.6	CY74FCT2245ATPC	74FCT2245ATPC
	QSOP – Q	Tape and reel	4.6	CY74FCT2245ATQCT	FCT2245A
	SOIC – SO	Tube	4.6	CY74FCT2245ATSOC	FCT2245A
		Tape and reel	4.6	CY74FCT2245ATSOCT	
	QSOP – Q	Tape and reel	7.0	CY74FCT2245TQCT	FCT2245
	SOIC – SO	Tube	7.0	CY74FCT2245TSOC	FCT2245
		Tape and reel	7.0	CY74FCT2245TSOCT	

† 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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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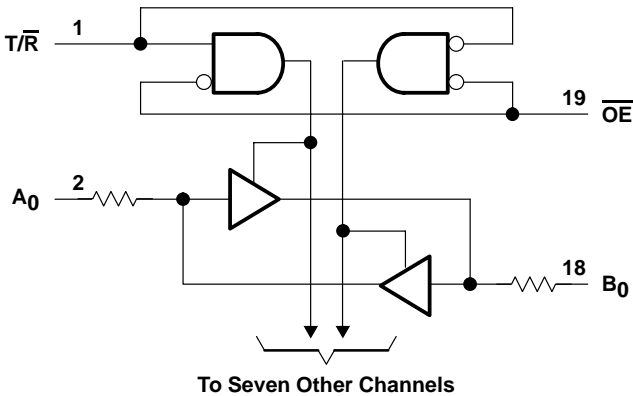
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FUNCTION TABLE

INPUTS		OUTPUT
OE	T/R	
L	L	Bus B data to bus A
L	H	Bus A data to bus B
H	X	Z

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

logic diagram (positive logic)



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_{JA} (see Note 1): P package	69°C/W
Q package	68°C/W
SO package	58°C/W
Ambient temperature range with power applied, T_A	−65°C to 135°C
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.

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

recommended operating conditions (see Note 2)

	MIN	NOM	MAX	UNIT
VCC Supply voltage	4.75	5	5.25	V
V _{IH} High-level input voltage	2			V
V _{IL} Low-level input voltage			0.8	V
I _{OH} High-level output current			−15	mA
I _{OL} Low-level output current			12	mA
T _A Operating free-air temperature	−40		85	°C

NOTE 2: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

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

PARAMETER	TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}	$V_{CC} = 4.75$,	$I_{IN} = -18$ mA		-0.7	-1.2	V
V_{OH}	$V_{CC} = 4.75$,	$I_{OH} = -15$ mA	2.4	3.3		V
V_{OL}	$V_{CC} = 4.75$,	$I_{OL} = 12$ mA		0.3	0.55	V
R_{out}	$V_{CC} = 4.75$,	$I_{OL} = 12$ mA	20	25	40	Ω
V_{hys}	All inputs			0.2		V
I_I	$V_{CC} = 5.25$ V,	$V_{IN} = V_{CC}$			5	μ A
I_{IH}	$V_{CC} = 5.25$ V,	$V_{IN} = 2.7$ V			± 1	μ A
I_{IL}	$V_{CC} = 5.25$ V,	$V_{IN} = 0.5$ V			± 1	μ A
I_{OZH}	$V_{CC} = 5.25$ V,	$V_{OUT} = 2.7$ V			10	μ A
I_{OZL}	$V_{CC} = 5.25$ V,	$V_{OUT} = 0.5$ V			-10	μ A
I_{OS}^\ddagger	$V_{CC} = 5.25$ V,	$V_{OUT} = 0$ V	-60	-120	-225	mA
I_{off}	$V_{CC} = 0$ V,	$V_{OUT} = 4.5$ V			± 1	μ A
I_{CC}	$V_{CC} = 5.25$ V,	$V_{IN} \leq 0.2$ V, $V_{IN} \geq V_{CC} - 0.2$ V		0.1	0.2	mA
ΔI_{CC}	$V_{CC} = 5.25$ V, $V_{IN} = 3.4$ V § , $f_1 = 0$, Outputs open			0.5	2	mA
I_{CCD}^\P	$V_{CC} = 5.25$ V, One input switching at 50% duty cycle, Outputs open, $T/R = \overline{OE} = GND$, $V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V			0.06	0.12	mA/MHz
$I_C^\#$	$V_{CC} = 5.25$ V, Outputs open, $T/R = \overline{OE} = GND$	One input switching at $f_1 = 10$ MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V	0.7	1.4	mA
			$V_{IN} = 3.4$ V or GND	1	2.4	
		Eight bits switching at $f_1 = 2.5$ MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V	1.3	2.6 $^{ }$	
			$V_{IN} = 3.4$ V or GND	3.3	10.6 $^{ }$	
C_i				5	10	pF
C_o				9	12	pF

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

‡ 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_{OS} tests should be performed last.

§ Per TTL-driven input ($V_{IN} = 3.4$ V); all other inputs at V_{CC} or GND

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

$I_C = I_{CC} + \Delta I_{CC} \times D_H \times N_T + I_{CCD} (f_0/2 + f_1 \times N_1)$

Where:

I_C = Total supply current

I_{CC} = Power-supply current with CMOS input levels

ΔI_{CC} = Power-supply current for a TTL high input ($V_{IN} = 3.4$ V)

D_H = Duty cycle for TTL inputs high

N_T = Number of TTL inputs at D_H

I_{CCD} = Dynamic current caused by an input transition pair (HLH or LHL)

f_0 = Clock frequency for registered devices, otherwise zero

f_1 = Input signal frequency

N_1 = Number of inputs changing at f_1

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

$^{||}$ Values for these conditions are examples of the I_{CC} formula.

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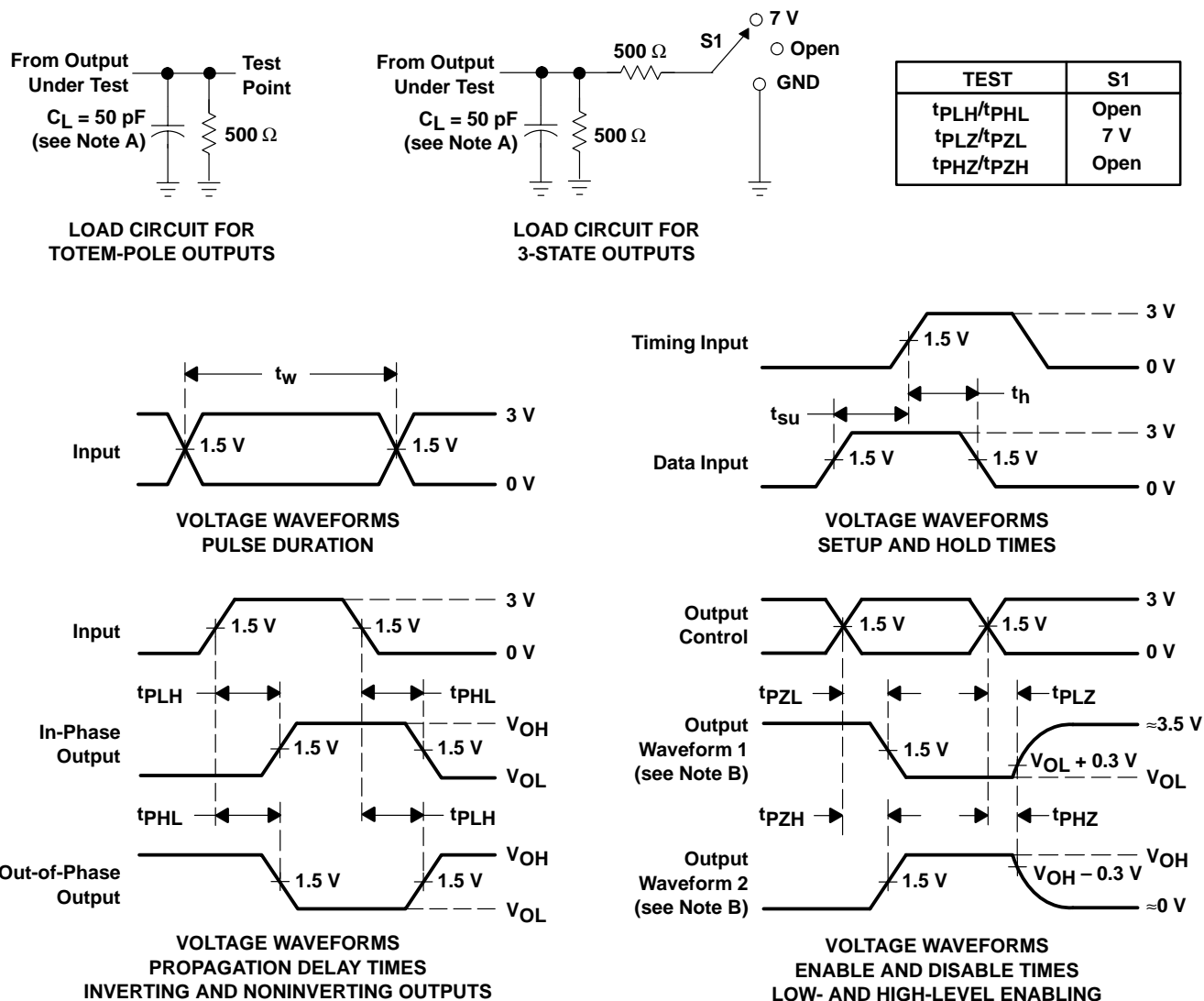
switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT2245T		CY74FCT2245AT		CY74FCT2245CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _{PLH}	A _n or B _n	B _n or A _n	1.5	7	1.5	4.6	1.5	4.1	ns
t _{PHL}			1.5	7	1.5	4.6	1.5	4.1	
t _{PZH}	$\overline{\text{OE}}$	A or B	1.5	9.5	1.5	6.2	1.5	5.8	ns
t _{PZL}			1.5	9.5	1.5	6.2	1.5	5.8	
t _{PHZ}	$\overline{\text{OE}}$	A or B	1.5	7.5	1.5	5	1.5	4.5	ns
t _{PLZ}			1.5	7.5	1.5	5	1.5	4.5	



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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. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
74FCT2245ATSOCTE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74FCT2245ATSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74FCT2245CTSOCTE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
74FCT2245CTSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATPC	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CY74FCT2245ATPCE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CY74FCT2245ATPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATPWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATPWG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATQCT	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245ATQCTE4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245ATQCTG4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245ATSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATSOCE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245ATSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245CTQCT	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245CTQCTE4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245CTQCTG4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245CTSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245TQCT	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245TQCTG4	ACTIVE	SSOP/QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT2245TSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245TSOCE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245TSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CY74FCT2245TSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245TSOCTE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT2245TSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

⁽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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ 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.

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.

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.

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TAPE AND REEL INFORMATION



*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
CY74FCT2245ATPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
CY74FCT2245ATQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT2245ATSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
CY74FCT2245CTQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT2245CTSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
CY74FCT2245TQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT2245TSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	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)
CY74FCT2245ATPWR	TSSOP	PW	20	2000	346.0	346.0	33.0
CY74FCT2245ATQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT2245ATSOCT	SOIC	DW	20	2000	346.0	346.0	41.0
CY74FCT2245CTQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT2245CTSOCT	SOIC	DW	20	2000	346.0	346.0	41.0
CY74FCT2245TQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT2245TSOCT	SOIC	DW	20	2000	346.0	346.0	41.0

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

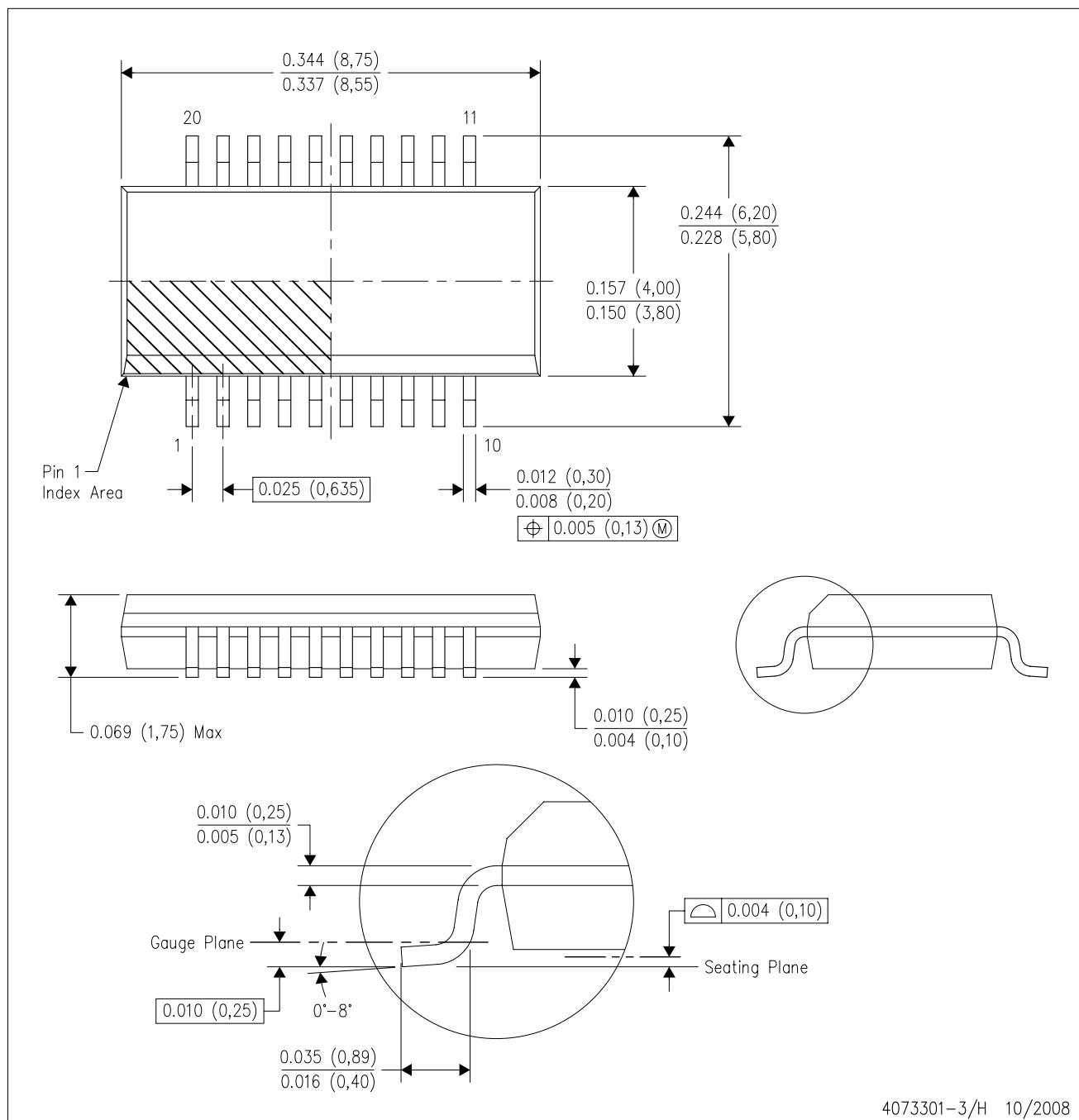
14 PINS SHOWN



- 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.
 D. Falls within JEDEC MO-153

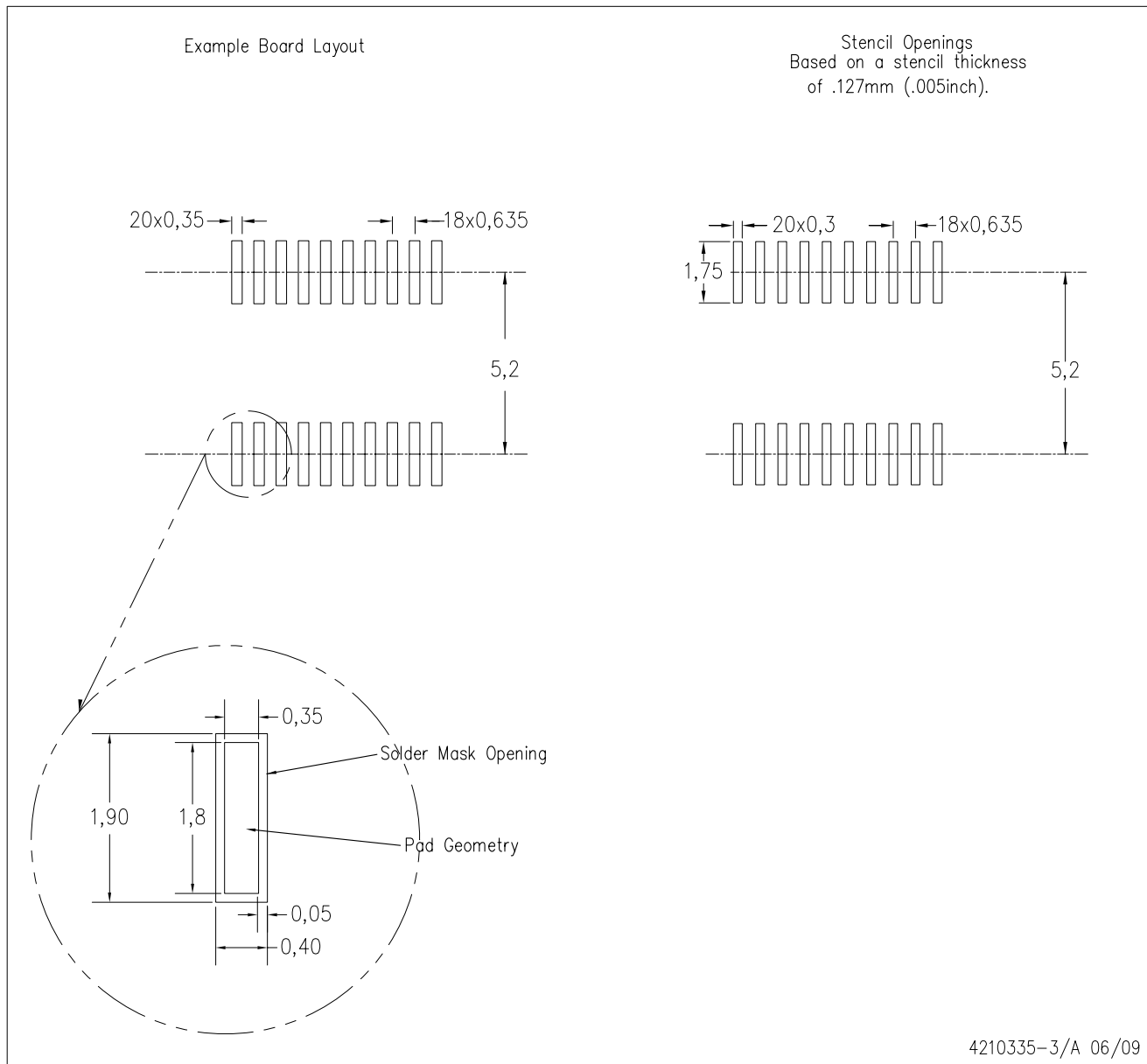
DBQ (R-PDSO-G20)

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)



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- 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.

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



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



4040049/E 12/2002

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

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