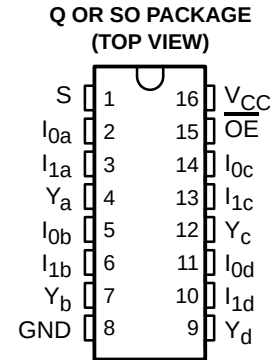


CY74FCT2257T QUAD 2-INPUT MULTIPLEXER WITH 3-STATE OUTPUTS

SCCS038B – SEPTEMBER 1994 – REVISED OCTOBER 2001

- Function and Pinout Compatible With FCT and F Logic
- 25- Ω Output Series Resistors to Reduce Transmission-Line Reflection Noise
- TTL Output Level Versions of Equivalent FCT Functions
- 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



description

The CY74FCT2257T has four identical two-input multiplexers that select four bits of data from two sources under the control of a common data-select (S) input. The I_0 inputs are selected when S is low, and the I_1 inputs are selected when S is high. Data appears at the output in noninverted form for the CY74FCT2257T. On-chip termination resistors at the outputs reduce system noise caused by reflections. The CY74FCT2257T can replace the FCT257T to reduce noise in an existing design.

The CY74FCT2257T is a logic implementation of a four-pole, two-position switch, in which the position of the switch is determined by the logic levels supplied to S. Outputs are forced to the high-impedance off state when the output-enable ($\overline{OE}$) input is high.

All but one device must be in the high-impedance state to prevent currents from exceeding the maximum ratings if outputs are tied together. Design of the $\overline{OE}$ signals must ensure that there is no overlap when outputs of 3-state devices are tied together.

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.

PIN DESCRIPTION

NAME	DESCRIPTION
I	Data inputs
S	Common data-select input
$\overline{OE}$	Output-enable input (active low)
Y	Data outputs



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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CY74FCT2257T
QUAD 2-INPUT MULTIPLEXER
WITH 3-STATE OUTPUTS

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ORDERING INFORMATION

T _A	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – Q	Tape and reel	4.3	CY74FCT2257CTQCT	FR257-3
	SOIC – SO	Tube	4.3	CY74FCT2257CTSOC	FCT2257C
		Tape and reel	4.3	CY74FCT2257CTSOCT	
	QSOP – Q	Tape and reel	5	CY74FCT2257ATQCT	FR257-1

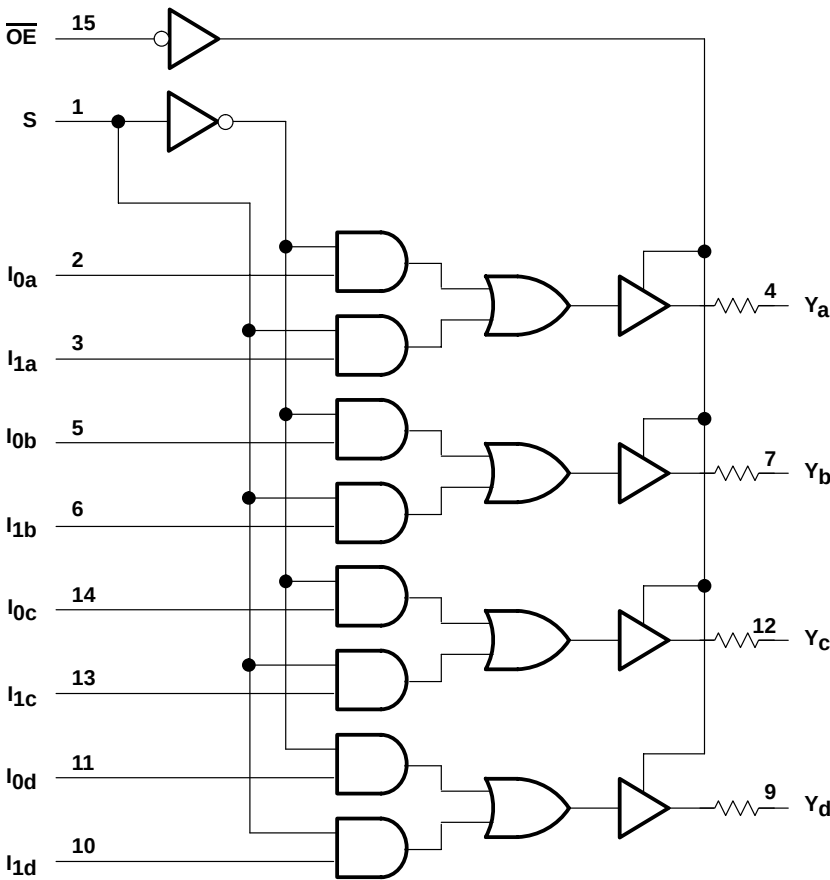
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE

INPUTS				OUTPUT Y
OE	S	I ₀	I ₁	
H	X	X	X	Z
L	H	X	L	L
L	H	X	H	H
L	L	L	X	L
L	L	H	X	H

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

logic diagram (positive logic)



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absolute maximum rating 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): Q package	90°C/W
SO package	57°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.

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

recommended operating conditions (see Note 2)

	MIN	NOM	MAX	UNIT
V_{CC} 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.



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QUAD 2-INPUT MULTIPLEXER

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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 V,	I _{IN} = −18 mA		−0.7	−1.2	V
V _{OH}	V _{CC} = 4.75 V,	I _{OH} = −15 mA	2.4	3.3		V
V _{OL}	V _{CC} = 4.75 V,	I _{OL} = 12 mA		0.3	0.55	V
R _{out}	V _{CC} = 4.75 V,	I _{OL} = 12 mA	20	25	40	Ω
V _{hys}	All inputs			0.2		V
I _{IH}	V _{CC} = 5.25 V,	V _{IN} = 2.7 V			±1	μA
I _{IL}	V _{CC} = 5.25 V,	V _{IN} = 0.5 V			±1	μA
I _{OZH}	V _{CC} = 5.25 V,	V _{OUT} = 2.7 V			10	μA
I _{OZL}	V _{CC} = 5.25 V,	V _{OUT} = 0.5 V			−10	μA
I _{OS} [‡]	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	μA
I _{CC}	V _{CC} = 5.25 V,	V _{IN} ≤ 0.2 V, V _{IN} ≥ 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} [¶]	V _{CC} = 5.25 V, One input switching at 50% duty cycle, Outputs open, OE = GND, V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} − 0.2 V			0.06	0.12	mA/MHz
I _C [#]	V _{CC} = 5.25 V, Outputs open, OE = GND	One bit switching at f ₁ = 10 MHz at 50% duty cycle	V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} − 0.2 V	0.7	1.4	mA
			V _{IN} = 3.4 V or GND	1	2.4	
		Four bits switching at f ₁ = 2.5 MHz at 50% duty cycle	V _{IN} ≤ 0.2 V or V _{IN} ≥ V _{CC} − 0.2 V	0.7	1.4	
			V _{IN} = 3.4 V or GND	1.7	5.4	
C _i				5	10	pF
C _o				9	12	pF

[†] Typical values are at V_{CC} = 5 V, T_A = 25°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} + ΔI_{CC} × D_H × N_T + I_{CCD} (f₀/2 + f₁ × N₁)

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)

f₀ = Clock frequency for registered devices, otherwise zero

f₁ = Input signal frequency

N₁ = Number of inputs changing at f₁

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)	CY74FCT2257AT		CY74FCT2257CT		UNIT
			MIN	MAX	MIN	MAX	
t _{PLH}	I _a or I _b	Y	1.5	5	1.5	4.7	ns
t _{PHL}			1.5	5	1.5	4.7	
t _{PLH}	S	Y	1.5	7	1.5	5.2	ns
t _{PHL}			1.5	7	1.5	5.2	
t _{PZH}	$\overline{OE}$	Y	1.5	7	1.5	6	ns
t _{PZL}			1.5	7	1.5	6	
t _{PHZ}	$\overline{OE}$	Y	1.5	5.5	1.5	5	ns
t _{PLZ}			1.5	5.5	1.5	5	



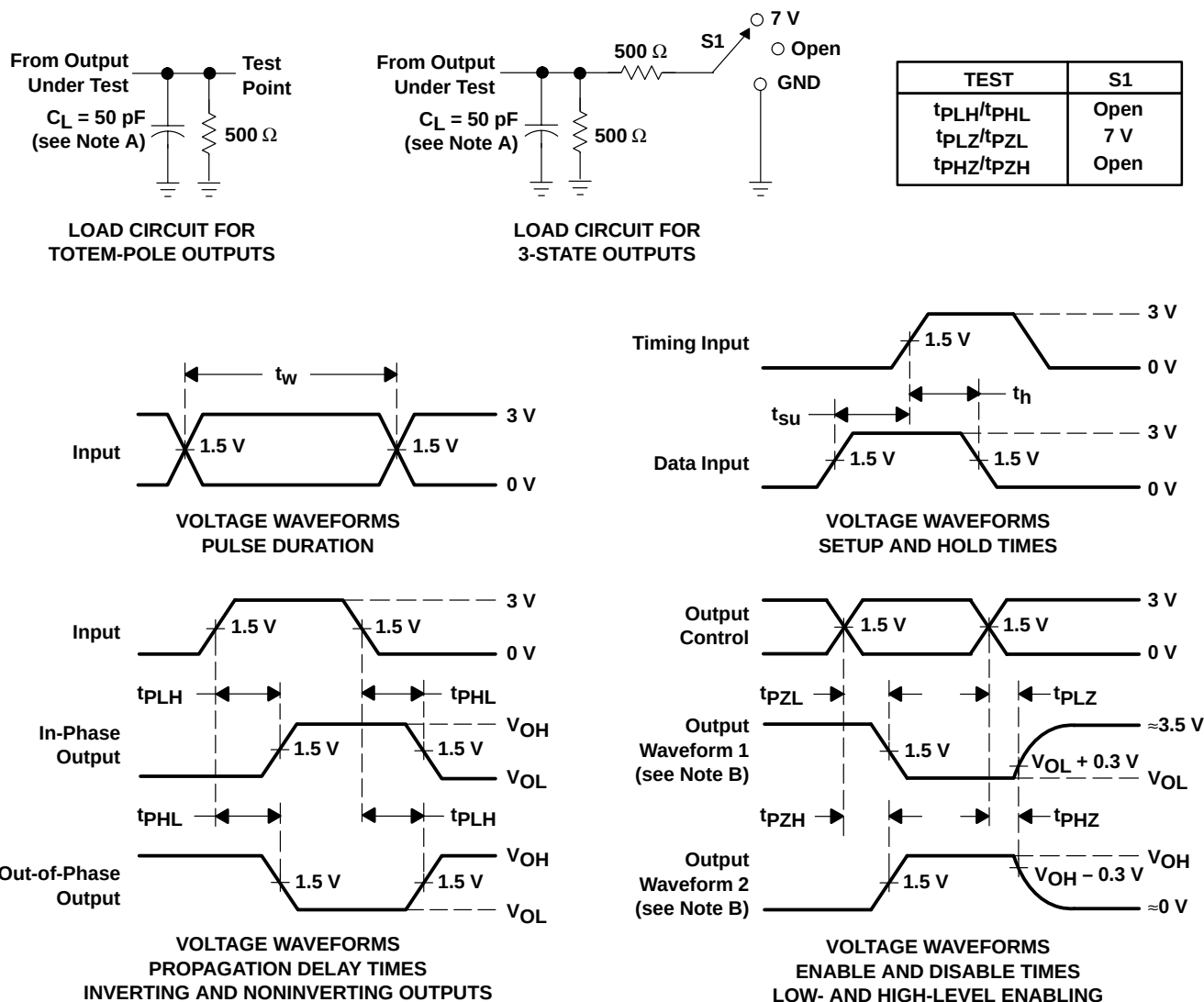
CY74FCT2257T

QUAD 2-INPUT MULTIPLEXER

WITH 3-STATE OUTPUTS

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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 (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
CY74FCT2257ATQCT	ACTIVE	SSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	FR257-1	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.

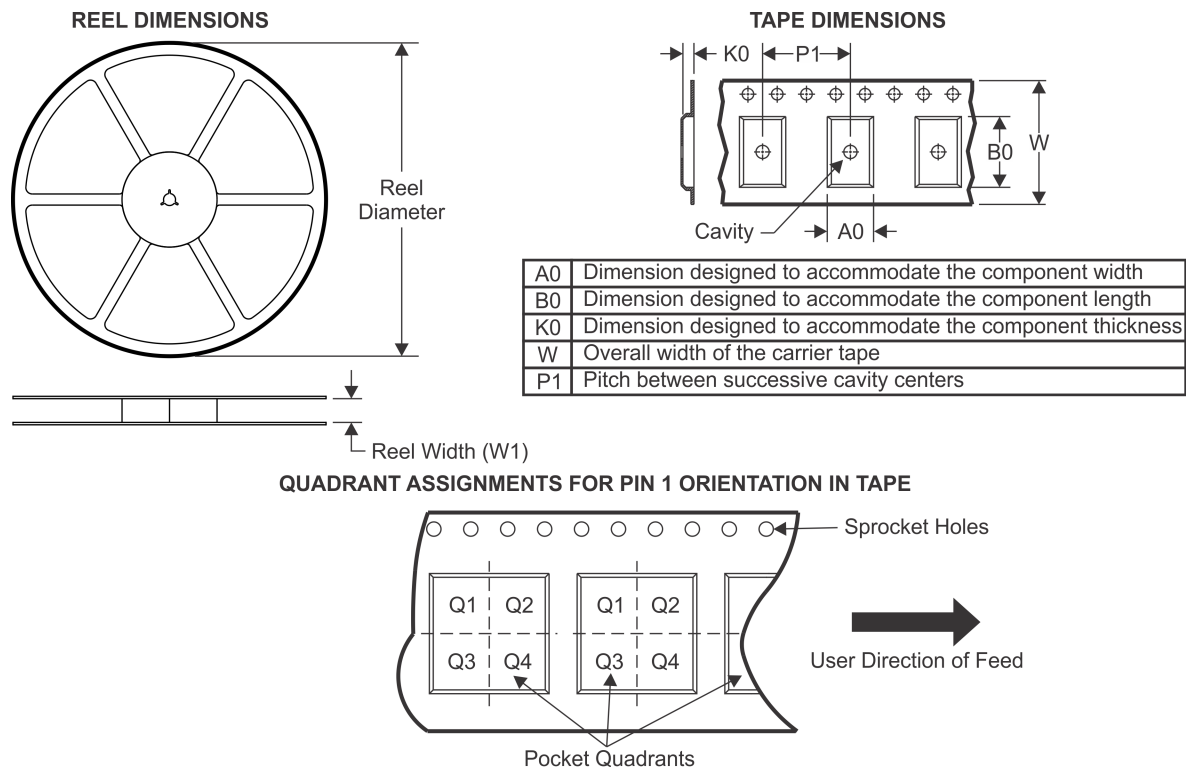
⁽⁴⁾ There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

⁽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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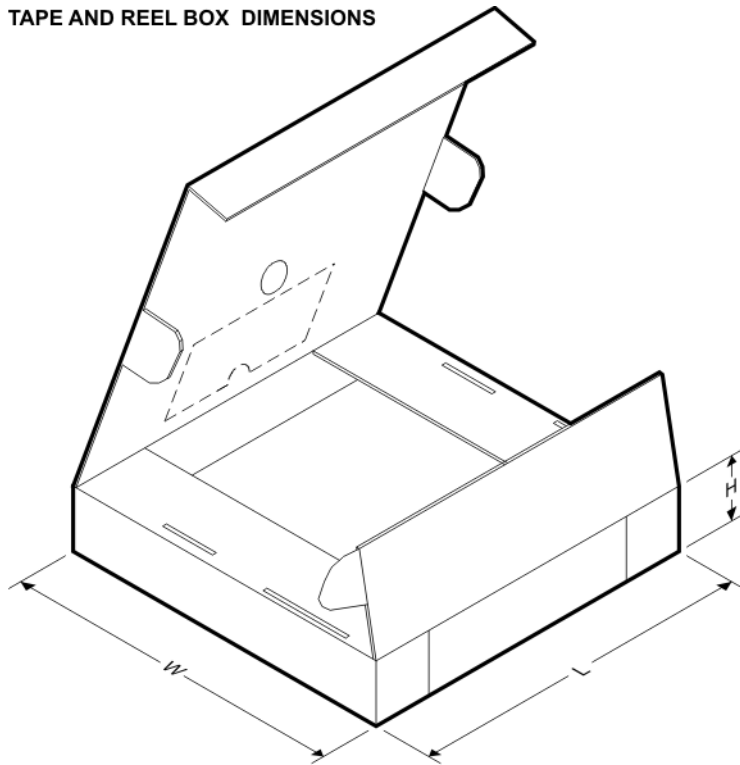
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TAPE AND REEL INFORMATION


*All dimensions are nominal

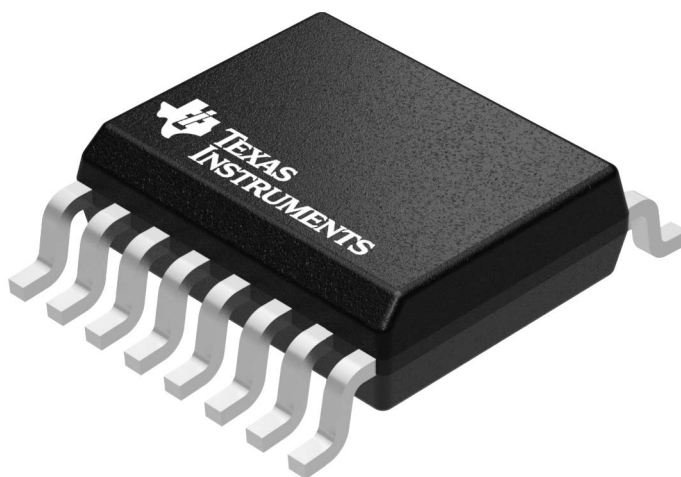
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CY74FCT2257ATQCT	SSOP	DBQ	16	2500	330.0	12.5	6.4	5.2	2.1	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS

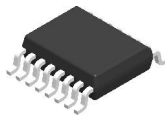


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY74FCT2257ATQCT	SSOP	DBQ	16	2500	340.5	338.1	20.6



Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

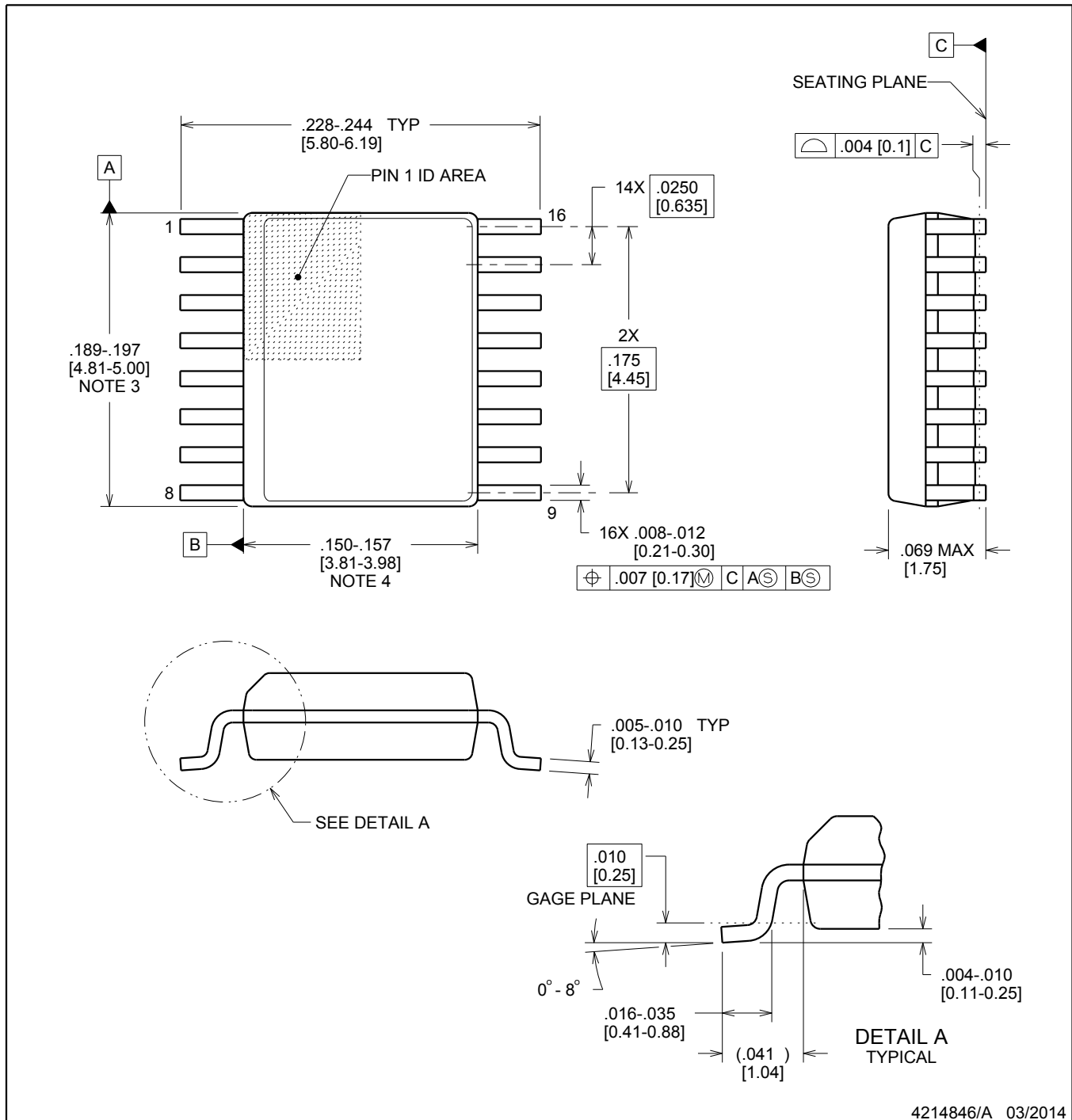


DBQ0016A

PACKAGE OUTLINE

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



4214846/A 03/2014

NOTES:

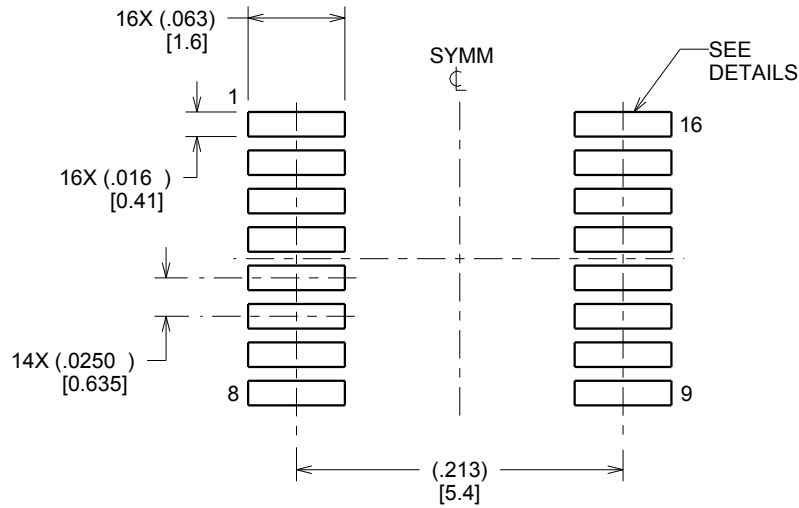
- Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 inch, per side.
- This dimension does not include interlead flash.
- Reference JEDEC registration MO-137, variation AB.

EXAMPLE BOARD LAYOUT

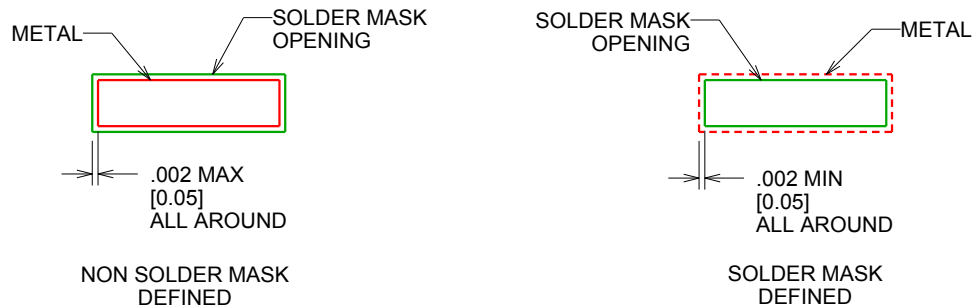
DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



LAND PATTERN EXAMPLE
SCALE:8X



SOLDER MASK DETAILS

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NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

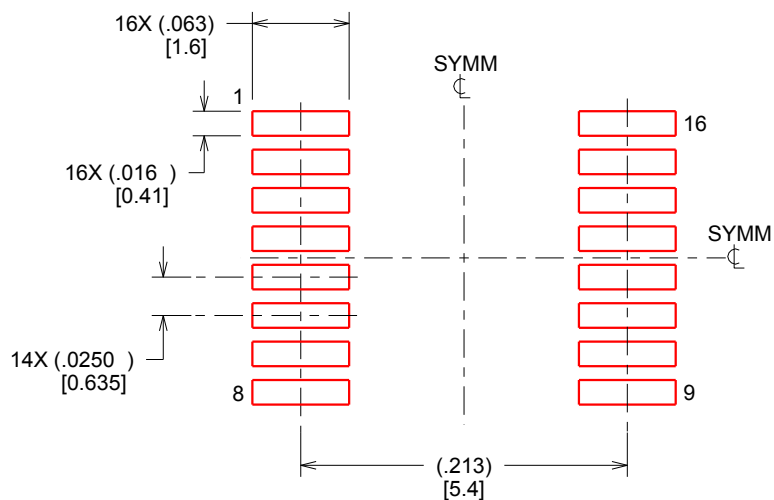
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

EXAMPLE STENCIL DESIGN

DBQ0016A

SSOP - 1.75 mm max height

SHRINK SMALL-OUTLINE PACKAGE



SOLDER PASTE EXAMPLE
BASED ON .005 INCH [0.127 MM] THICK STENCIL
SCALE:8X

4214846/A 03/2014

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.

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