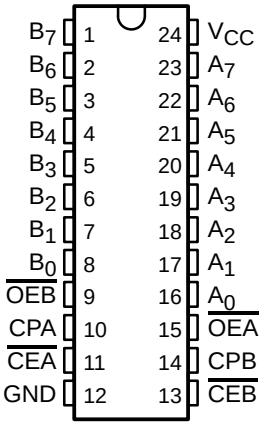
- **Function, Pinout, and Drive Compatible With FCT, F Logic, and AM2952**
- **Reduced V_{OH} (Typically = 3.3 V) Versions of Equivalent FCT Functions**
- **Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics**
- **ESD Protection Exceeds JESD 22**
  - **2000-V Human-Body Model (A114-A)**
  - **200-V Machine Model (A115-A)**
  - **1000-V Charged-Device Model (C101)**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **Matched Rise and Fall Times**
- **Fully Compatible With TTL Input and Output Logic Levels**
- **64-mA Output Sink Current 32-mA Output Source Current**

Q OR SO PACKAGE
(TOP VIEW)



description

The CY29FCT52T has two 8-bit back-to-back registers that store data flowing in both directions between two bidirectional buses. Separate clock, clock enable, and 3-state output-enable signals are provided for each register. Both A outputs and B outputs are specified to sink 64 mA.

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
A	A register inputs or B register outputs
B	B register inputs or A register outputs
CPA	Clock for the A register. When $\overline{CEA}$ is low, data enters the A register on the low-to-high transition of the CPA signal.
$\overline{CEA}$	Clock enable for the A register. When $\overline{CEA}$ is low, data enters the A register on the low-to-high transition of the CPA signal. When $\overline{CEA}$ is high, the A register holds its contents, regardless of CPA signal transitions.
$\overline{OEA}$	Output enable for the A register. When $\overline{OEA}$ is low, the A register outputs are enabled onto the B lines. When $\overline{OEA}$ is high, the A outputs are in the high-impedance state.
CPB	Clock for the B register. When $\overline{CEB}$ is low, data enters the B register on the low-to-high transition of the CPB signal.
$\overline{CEB}$	Clock enable for the B register. When $\overline{CEB}$ is low, data enters the B register on the low-to-high transition of the CPB signal. When $\overline{CEB}$ is high, the B register holds its contents, regardless of CPA signal transitions.
$\overline{OEB}$	Output enable for the B register. When $\overline{OEB}$ is low, the B register outputs are enabled onto the A lines. When $\overline{OEB}$ is high, the B outputs are in the high-impedance state.

ORDERING INFORMATION

T_A	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QSOP – Q	Tape and reel	6.3	CY29FCT52CTQCT	29FCT52C
	SOIC – SO	Tube	6.3	CY29FCT52CTSOC	29FCT52C
		Tape and reel	6.3	CY29FCT52CTSOCT	

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

Function Tables

FUNCTION TABLE

INPUTS			INTERNAL Q	FUNCTION
D	CP	CE		
X	X	H	NC	Hold data
L	↑	L	L	Load data
H	↑	L	H	

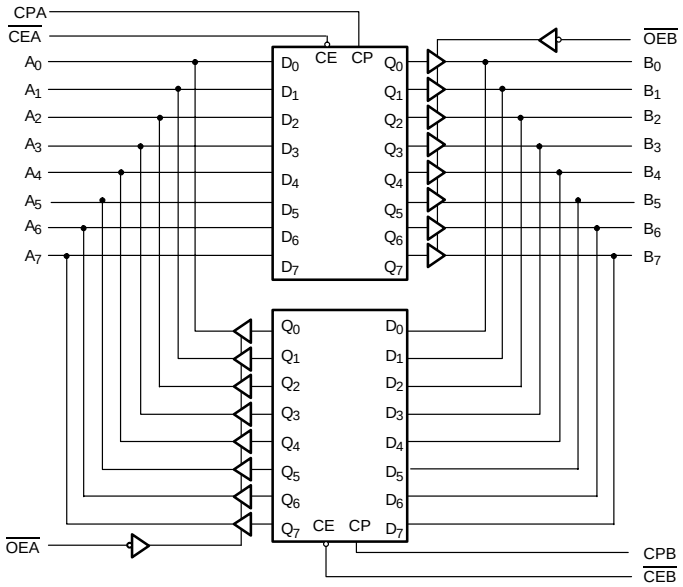
H = High logic level, L = Low logic level, X = Don't care, NC = No change

OUTPUT CONTROL

$\overline{OE}$	INTERNAL Q	Y OUTPUTS	FUNCTION
H	X	Z	Disable outputs
L	L	L	Enable outputs
L	H	H	

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

logic diagram



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 . . . . . 61°C/W
SO package . . . . . 46°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
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			–32	mA
I_{OL}	Low-level output current			64	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 V,	I_{IN} = –18 mA			–0.7	–1.2	V
V_{OH}	V_{CC} = 4.75 V	I_{OH} = –32 mA		2			V
		I_{OH} = –15 mA		2.4	3.3		
V_{OL}	V_{CC} = 4.75 V,	I_{OL} = 64 mA			0.3	0.55	V
V_H	All inputs				0.2		V
I_I	V_{CC} = 5.25 V,	V_{IN} = V_{CC}				5	µA
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_{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, $V_{IN} \le$ 0.2 V, $V_{IN} \ge V_{CC}$ – 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, $\overline{OEA}$ or $\overline{OEB}$ = GND, $V_{IN} \le$ 0.2 V or $V_{IN} \ge V_{CC}$ – 0.2 V				0.06	0.12	mA/ MHz
I_C#	V_{CC} = 5.25 V, f_0 = 10 MHz, Outputs open, $\overline{OEA}$ or $\overline{OEB}$ = GND	One bit switching at f_1 = 5 MHz at 50% duty cycle	$V_{IN} \le$ 0.2 V or $V_{IN} \ge V_{CC}$ – 0.2 V		0.7	1.4	mA
			V_{IN} = 3.4 V or GND		1.2	3.4	
		Eight bits switching at f_1 = 2.5 MHz at 50% duty cycle	$V_{IN} \le$ 0.2 V or $V_{IN} \ge V_{CC}$ – 0.2 V		1.6	3.2‖	
			V_{IN} = 3.4 V or GND		3.9	12.2‖	
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.

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

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.

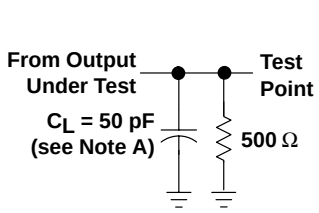
timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER			MIN	MAX	UNIT
t_w	Pulse duration, clock		3		ns
t_{su}	Setup time, before CPA↑ or CPB↑	Data	2.5		ns
		$\overline{CEA}$ or $\overline{CEB}$	3		
t_h	Hold time, after CPA↑ or CPB↑	Data	1.5		ns
		$\overline{CEA}$ or $\overline{CEB}$	2		

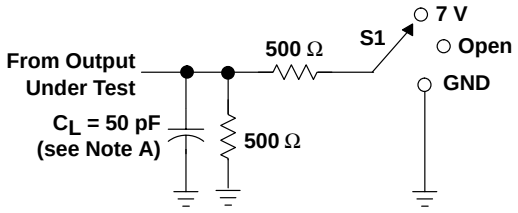
switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	MIN	MAX	UNIT
t_{PLH}	CPA, CPB	A, B	2	6.3	ns
t_{PHL}			2	6.3	
t_{PZH}	$\overline{OEA}$ or $\overline{OEB}$	A or B	1.5	7	ns
t_{PZL}			1.5	7	
t_{PHZ}	$\overline{OEA}$ or $\overline{OEB}$	A or B	1.5	6.5	ns
t_{PLZ}			1.5	6.5	

PARAMETER MEASUREMENT INFORMATION

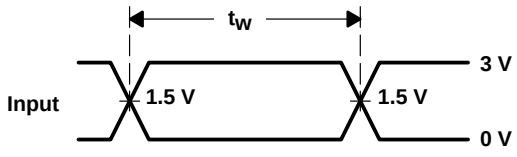


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

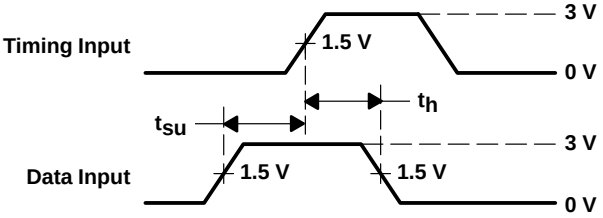


LOAD CIRCUIT FOR
3-STATE OUTPUTS

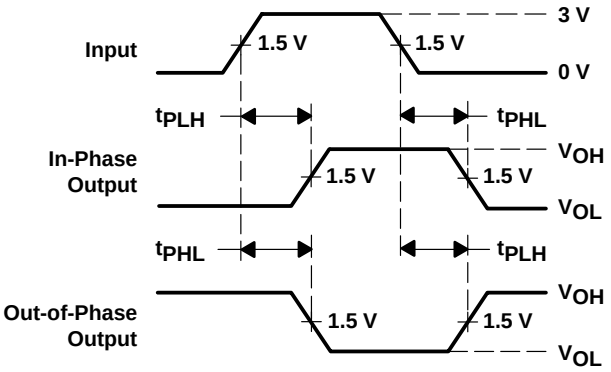
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



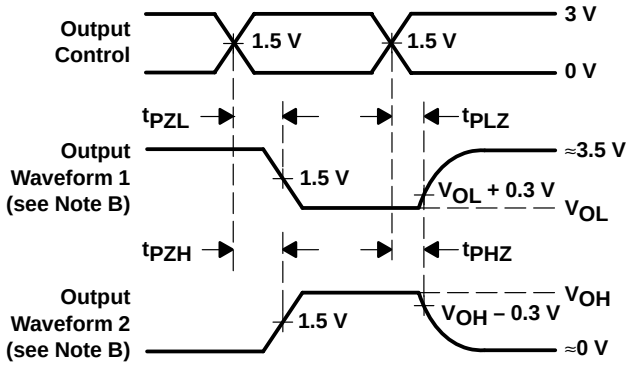
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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 part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CY29FCT52CTQCT	Active	Production	SSOP (DBQ) | 24	2500 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	29FCT52C
CY29FCT52CTQCT.B	Active	Production	SSOP (DBQ) | 24	2500 | LARGE T&R	Yes	NIPDAU	Level-2-260C-1 YEAR	-40 to 85	29FCT52C
CY29FCT52CTSOC	Active	Production	SOIC (DW) | 24	25 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	29FCT52C
CY29FCT52CTSOC.B	Active	Production	SOIC (DW) | 24	25 | TUBE	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	29FCT52C

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

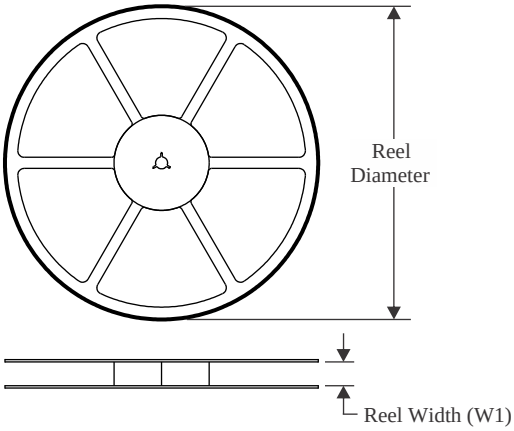
(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

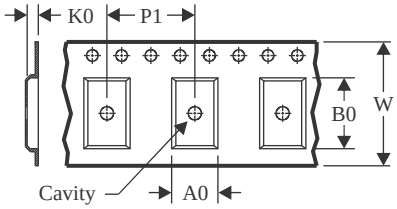
Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

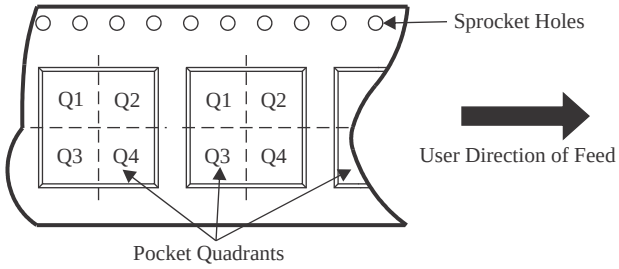


TAPE DIMENSIONS



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

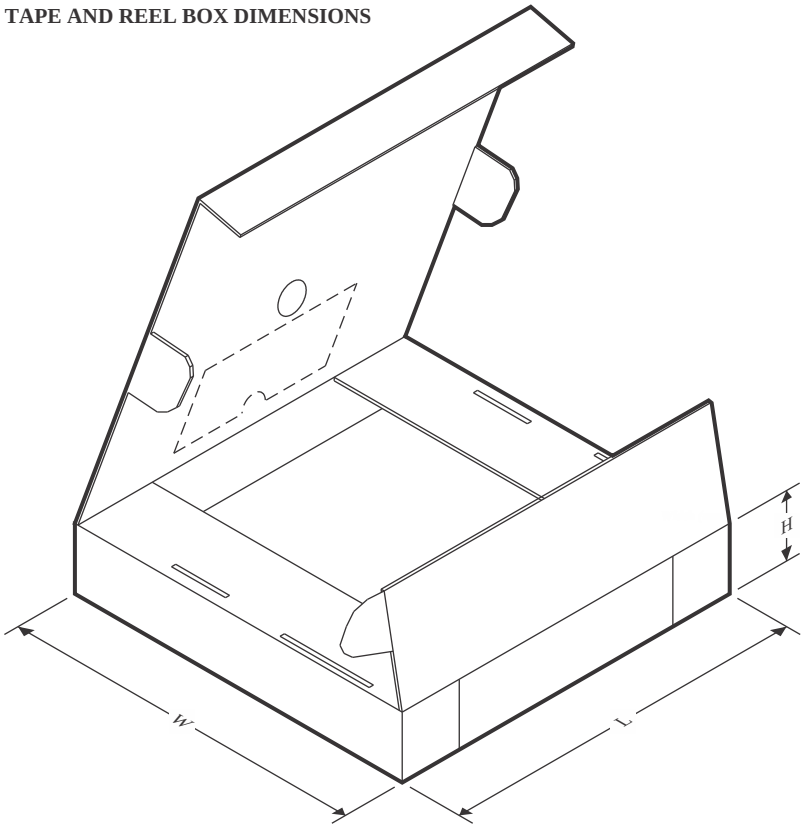
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CY29FCT52CTQCT	SSOP	DBQ	24	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

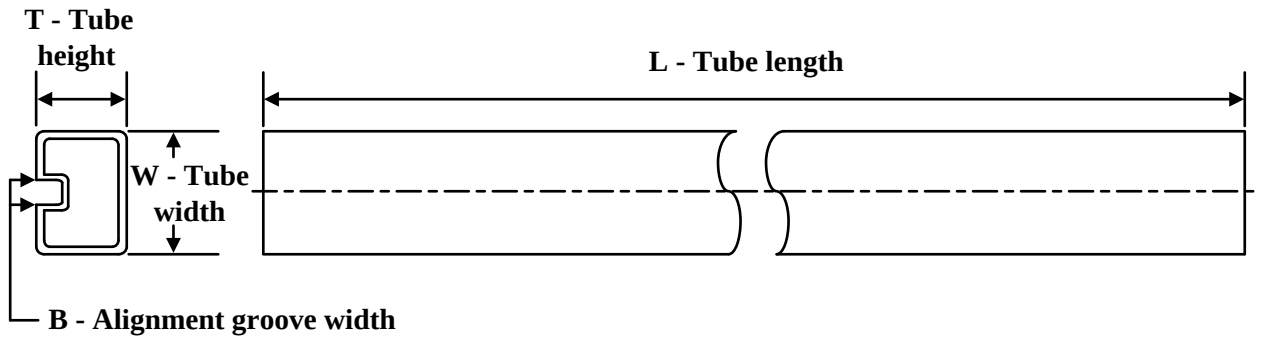
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY29FCT52CTQCT	SSOP	DBQ	24	2500	353.0	353.0	32.0

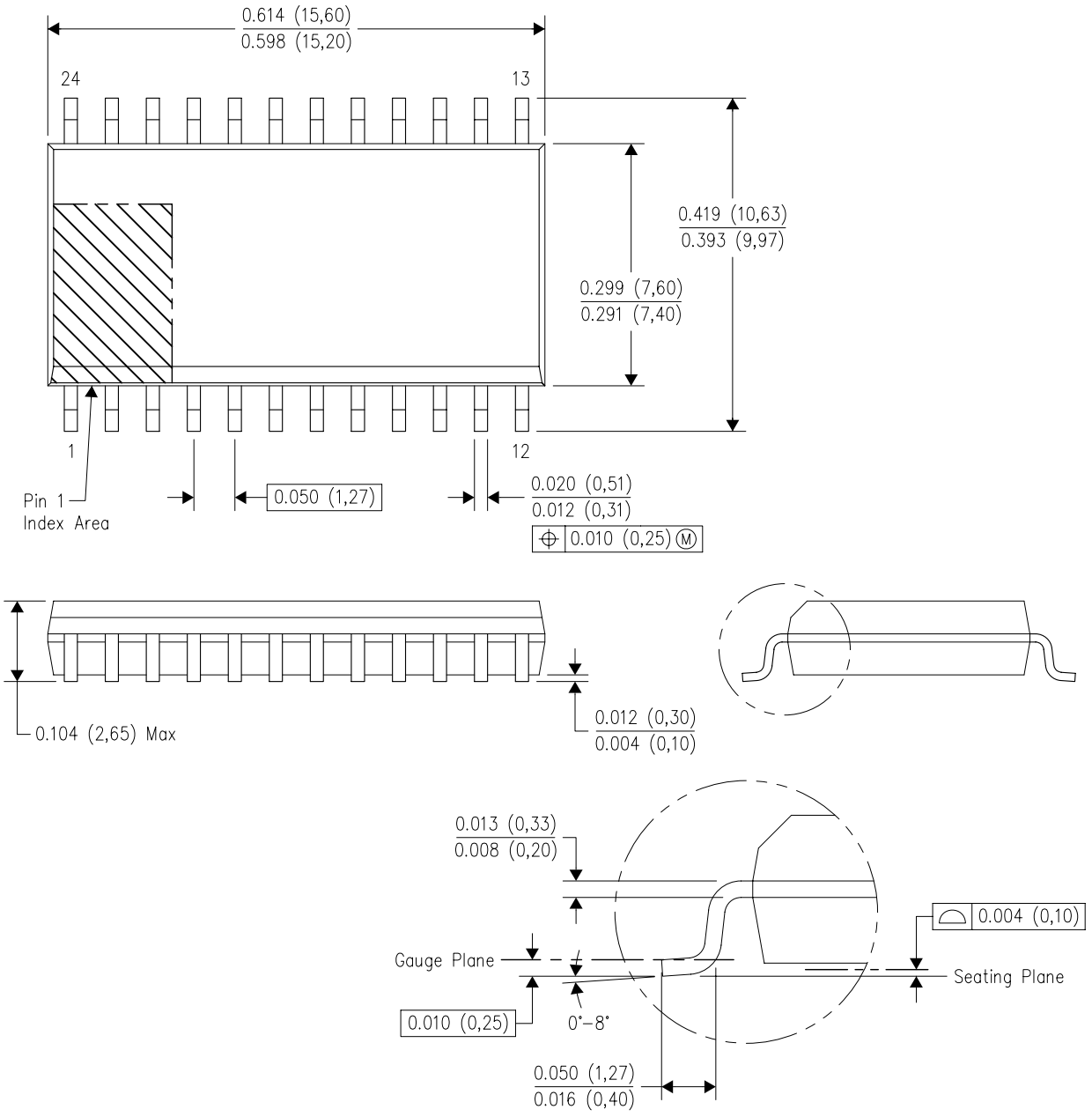
TUBE



*All dimensions are nominal

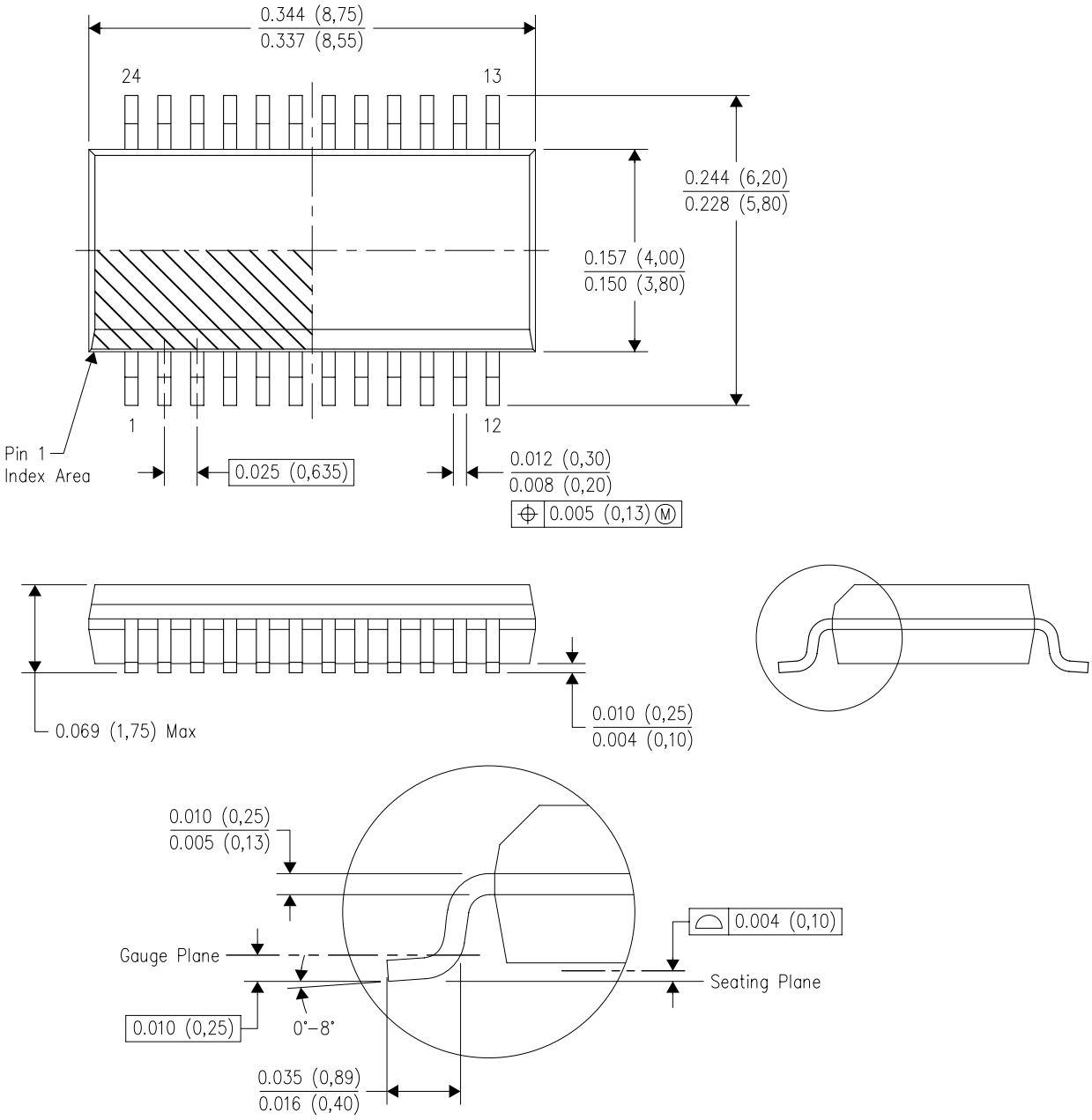
Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (µm)	B (mm)
CY29FCT52CTSOC	DW	SOIC	24	25	506.98	12.7	4826	6.6
CY29FCT52CTSOC.B	DW	SOIC	24	25	506.98	12.7	4826	6.6

DW (R–PDSO–G24) 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 AD.

DBQ (R–PDSO–G24) 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 AE.

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