

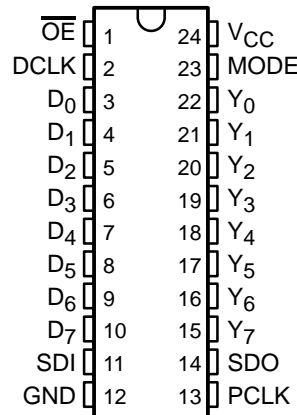
# CY29FCT818T

## DIAGNOSTIC SCAN REGISTER WITH 3-STATE OUTPUTS

SCCS012B – MAY 1994 – REVISED NOVEMBER 2001

- **Function, Pinout, and Drive Compatible With FCT, F Logic, and AM29818**
- **Reduced  $V_{OH}$  (Typically = 3.3 V) Version of Equivalent FCT Functions**
- **Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics**
- **$I_{off}$  Supports Partial-Power-Down Mode Operation**
- **Matched Rise and Fall Times**
- **Fully Compatible With TTL Input and Output Logic Levels**
- **8-Bit Pipeline and Shadow Register**
- **ESD Protection Exceeds JESD 22**
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)
- **CY29FCT818CT**
  - 64-mA Output Sink Current
  - 32-mA Output Source Current
- **CY29FCT818ATDMB**
  - 20-mA Output Sink Current
  - 3-mA Output Source Current
- **3-State Outputs**

**D, P, Q, OR SO PACKAGE  
(TOP VIEW)**



### description

The CY29FCT818T contains a high-speed 8-bit general-purpose data pipeline register and a high-speed 8-bit shadow register. The general-purpose register can be used in an 8-bit-wide data path for a normal system application. The shadow register is designed for applications such as diagnostics in sequential circuits, where it is desirable to load known data at a specific location in the circuit and to read the data at that location.

The shadow register can load data from the output of the device, and can be used as a right-shift register with bit-serial input (SDI) and output (SDO), using DCLK. The data register input is multiplexed to enable loading from the shadow register or from the data input pins, using PCLK. Data can be loaded simultaneously from the shadow register to the pipeline register, and from the pipeline register to the shadow register, provided setup-time and hold-time requirements are satisfied, with respect to the two independent clock inputs.

In a typical application, the general-purpose register in this device replaces an 8-bit data register in the normal data path of a system. The shadow register is placed in an auxiliary bit-serial loop that is used for diagnostics. During diagnostic operation, data is shifted serially into the shadow register, then transferred to the general-purpose register to load a known value into the data path. To read the contents at that point in the data path, the data is transferred from the data register into the shadow register, then shifted serially in the auxiliary diagnostic loop to make it accessible to the diagnostics controller. This data then is compared with the expected value to diagnose faulty operation of the sequential circuit.

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.



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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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# CY29FCT818T

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### WITH 3-STATE OUTPUTS

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#### ORDERING INFORMATION

T <sub>A</sub>	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	DIP – P	Tube	6	CY29FCT818CTPC	CY29FCT818CTPC
	QSOP – Q	Tape and reel	6	CY29FCT818CTQCT	29FCT818C
	SOIC – SO	Tube	6	CY29FCT818CTSOC	29FCT818C
		Tape and reel	6	CY29FCT818CTSOCT	
–55°C to 125°C	CDIP – D	Tube	12	CY29FCT818ATDMB	

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

#### FUNCTION TABLE

INPUTS				OUTPUT SDO	SHADOW REGISTER	PIPELINE REGISTER	OPERATION
MODE	SDI	DCLK	PCLK				
L	X	↑	X	S <sub>7</sub>	S <sub>0</sub> ←SDI S <sub>i</sub> ←S <sub>i-1</sub>	NA	Serial shift; D <sub>7</sub> –D <sub>0</sub> output disabled
L	X	X	↑	S <sub>7</sub>	NA	P <sub>i</sub> ←D <sub>i</sub>	Load pipeline register from data input
H	L	↑	X	L	S <sub>i</sub> ←Y <sub>i</sub>	NA	Load shadow register from Y output
H	H	↑	X	H	Hold	NA	Hold shadow register; D <sub>7</sub> –D <sub>0</sub> output enabled
H	X	X	↑	SDI	NA	P <sub>i</sub> ←S <sub>i</sub>	Load pipeline register from shadow register

H = High logic level, L = Low logic level, X = Don't care, ↑ Low-to-high transition, ← = Transfer direction, NA = Not applicable



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## DIAGNOSTIC SCAN REGISTER

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#### recommended operating conditions (see Note 3)

	CY29FCT818ATDMB			CY29FCT818T			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub> Supply voltage	4.5	5	5.5	4.75	5	5.25	V
V <sub>IH</sub> High-level input voltage	2			2			V
V <sub>IL</sub> Low-level input voltage			0.8			0.8	V
I <sub>OH</sub> High-level output current			–3			–32	mA
I <sub>OL</sub> Low-level output current			20			64	mA
T <sub>A</sub> Operating free-air temperature	–55		125	–40		85	°C

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation.

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

PARAMETER	TEST CONDITIONS		CY29FCT818ATDMB			CY29FCT818T			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V <sub>IK</sub>	V <sub>CC</sub> = 4.5 V, I <sub>IN</sub> = –18 mA		–0.7	–1.2					V
	V <sub>CC</sub> = 4.75 V, I <sub>IN</sub> = –18 mA					–0.7	–1.2		
V <sub>OH</sub>	V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –3 mA		2.4	3.3					V
	V <sub>CC</sub> = 4.75 V	I <sub>OH</sub> = –32 mA				2			
		I <sub>OH</sub> = –15 mA				2.4	3.3		
V <sub>OL</sub>	V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 20 mA		0.3	0.55					V
	V <sub>CC</sub> = 4.75 V, I <sub>OL</sub> = 64 mA					0.3	0.55		
V <sub>hys</sub>	All inputs		0.2			0.2			V
I <sub>I</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = V <sub>CC</sub>				5				μA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = V <sub>CC</sub>							5	
I <sub>IH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 2.7 V				±1				μA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 2.7 V							±1	
I <sub>IL</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 0.5 V				±1				μA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 0.5 V							±1	
I <sub>OZH</sub>	V <sub>CC</sub> = 5.5 V, V <sub>OUT</sub> = 2.7 V				10				μA
	V <sub>CC</sub> = 5.25 V, V <sub>OUT</sub> = 2.7 V							10	
I <sub>OZL</sub>	V <sub>CC</sub> = 5.5 V, V <sub>OUT</sub> = 0.5 V				–10				μA
	V <sub>CC</sub> = 5.25 V, V <sub>OUT</sub> = 0.5 V							–10	
I <sub>OS</sub> ‡	V <sub>CC</sub> = 5.5 V, V <sub>OUT</sub> = 0 V		–60	–120	–225				mA
	V <sub>CC</sub> = 5.25 V, V <sub>OUT</sub> = 0 V					–60	–120	–225	
I <sub>off</sub>	V <sub>CC</sub> = 0 V, V <sub>OUT</sub> = 4.5 V				±1			±1	μA
I <sub>CC</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> ≤ 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> – 0.2 V		0.2		1.5				mA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> ≤ 0.2 V, V <sub>IN</sub> ≥ V <sub>CC</sub> – 0.2 V					0.2		1.5	
ΔI <sub>CC</sub>	V <sub>CC</sub> = 5.5 V, V <sub>IN</sub> = 3.4 V <sup>§</sup> , f <sub>1</sub> = 0, Outputs open		0.5		2				mA
	V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 3.4 V <sup>§</sup> , f <sub>1</sub> = 0, Outputs open					0.5		2	

† Typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 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<sub>OS</sub> tests should be performed last.

§ Per TTL-driven input (V<sub>IN</sub> = 3.4 V); all other inputs at V<sub>CC</sub> or GND



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

PARAMETER	TEST CONDITIONS			CY29FCT818ATDMB			CY29FCT818T			UNIT
				MIN	TYP†	MAX	MIN	TYP†	MAX	
$I_{CCD}^{\dagger\dagger}$	$V_{CC} = 5.5\text{ V}$ , Outputs open, One input switching at 50% duty cycle, $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$					0.25				mA/ MHz
	$V_{CC} = 5.25\text{ V}$ , Outputs open, One input switching at 50% duty cycle, $\overline{OE} = \text{GND}$ , $V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$							0.25		
$I_C^{\#}$	$V_{CC} = 5.5\text{ V}$ , Outputs open, $f_0 = 10\text{ MHz}$ , $\overline{OE} = \text{GND}$	One bit switching at $f_1 = 5\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$			5.3				mA
			$V_{IN} = 3.4\text{ V}$ or GND			7.3				
		Eight bits and four controls switching at $f_1 = 5\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$			17.8				
			$V_{IN} = 3.4\text{ V}$ or GND			30.8				
	$V_{CC} = 5.25\text{ V}$ , Outputs open, $f_0 = 10\text{ MHz}$ , $\overline{OE} = \text{GND}$	One bit switching at $f_1 = 5\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$						5.3	
			$V_{IN} = 3.4\text{ V}$ or GND						7.3	
		Eight bits and four controls switching at $f_1 = 5\text{ MHz}$ at 50% duty cycle	$V_{IN} \leq 0.2\text{ V}$ or $V_{IN} \geq V_{CC} - 0.2\text{ V}$						17.8	
			$V_{IN} = 3.4\text{ V}$ or GND						30.8	
$C_i$					5	10		5	10	pF
$C_o$					9	12		9	12	pF

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

†† 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

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

$D_H$  = 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.

# CY29FCT818T

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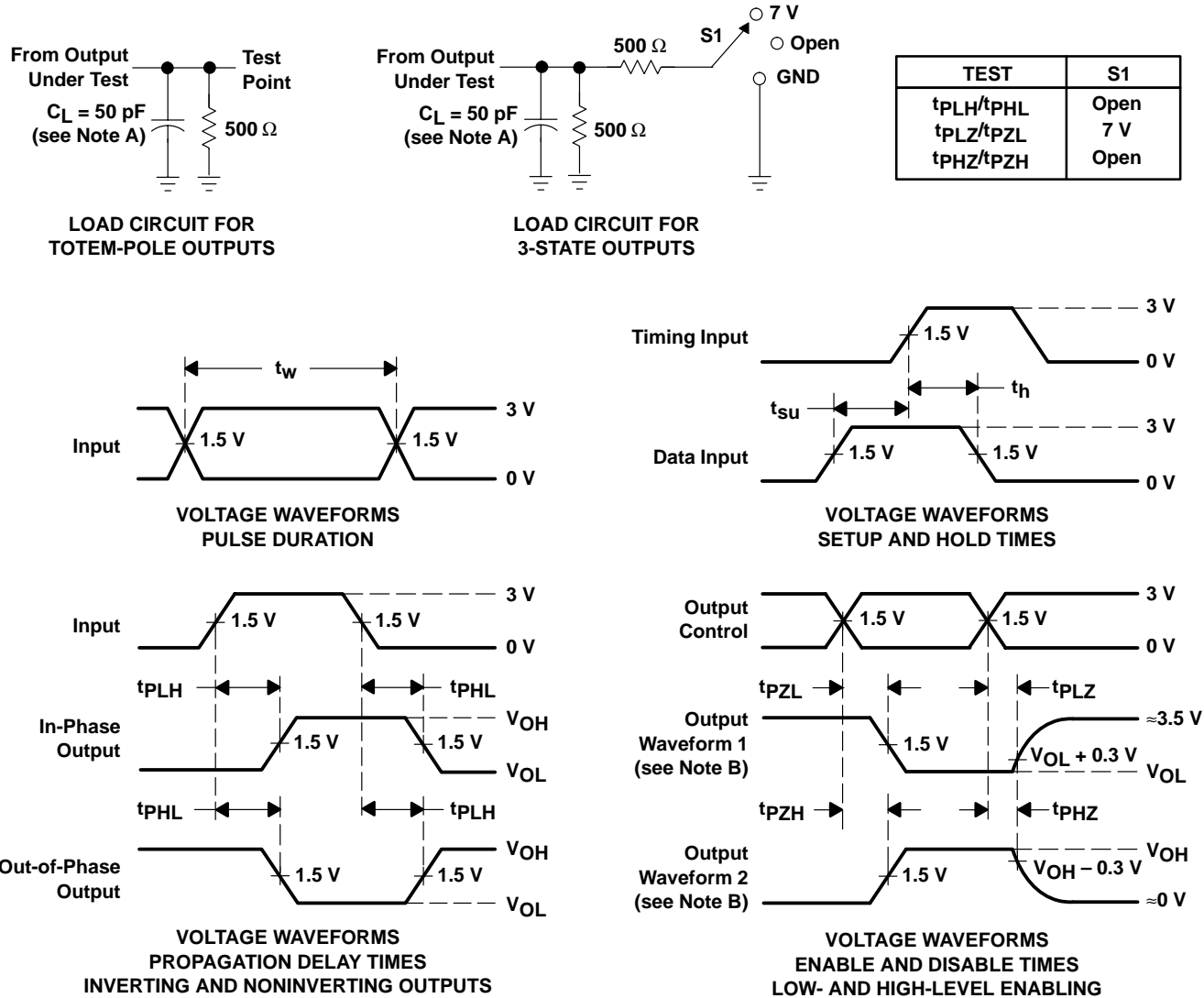
timing requirements over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

PARAMETER		CY29FCT818AT		CY29FCT818CT		UNIT
		MIN	MAX	MIN	MAX	
$t_w$ Pulse width	PCLK high and low	15		5		ns
	DCLK high and low	25		5		
$t_{su}$ Setup time	D before PCLK↑	6		2		ns
	MODE before PCLK↑	15		3.5		
	Y before DCLK↑	5		2		
	MODE before DCLK↑	12		3.5		
	SDI before DCLK↑	10		3.5		
	DCLK before PCLK↑	15		3.5		
	PCLK before DCLK↑	45		8.5		
$t_h$ Hold time	D after PCLK↑	2		1.5		ns
	MODE after PCLK↑	0		0		
	Y after DCLK↑	5		1.5		
	MODE after DCLK↑	5		1.5		
	SDI after DCLK↑	0		0		

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY29FCT818AT		CY29FCT818CT		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}$	PCLK	Y		12		6	ns
	MODE	SDO		18		7.2	
	SDI	SDO		18		7.1	
	DCLK	SDO		30		7.2	
$t_{pZL}$	$\overline{OE}$	Y		20		8	ns
	DCLK	D		35		9	
$t_{pZH}$	$\overline{OE}$	Y		20		8.5	ns
	DCLK	D		30		9	
$t_{PLZ}$	$\overline{OE}$	Y		20		5.5	ns
	DCLK	D		45		5.5	
$t_{PHZ}$	$\overline{OE}$	Y		30		8	ns
	DCLK	D		90		8	

### 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 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)
<a href="#">5962-9682701QLA</a>	Active	Production	CDIP (JT)   24	15   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9682701QL A CY29FCT818ATDM B
<a href="#">CY29FCT818ATDMB</a>	Active	Production	CDIP (JT)   24	15   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-9682701QL A CY29FCT818ATDM B
<a href="#">CY29FCT818CTSOCT</a>	Active	Production	SOIC (DW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	29FCT818C
CY29FCT818CTSOCT.B	Active	Production	SOIC (DW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	29FCT818C
CY29FCT818CTSOCTG4.B	Active	Production	SOIC (DW)   24	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	29FCT818C

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **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.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

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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
CY29FCT818CTSOCT	SOIC	DW	24	2000	330.0	24.4	10.75	15.7	2.7	12.0	24.0	Q1

## TAPE AND REEL BOX DIMENSIONS



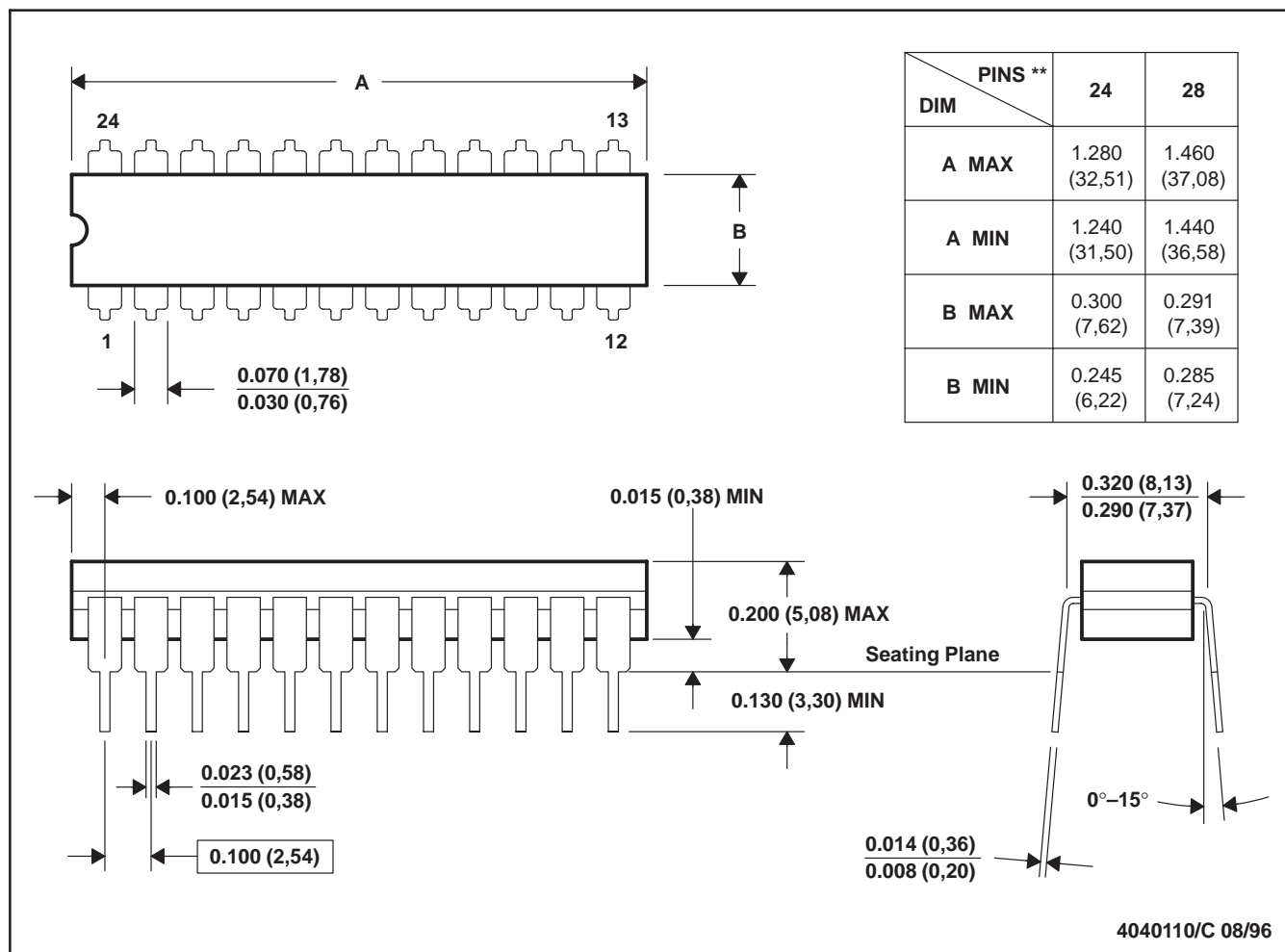
\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY29FCT818CTSOCT	SOIC	DW	24	2000	350.0	350.0	43.0

## JT (R-GDIP-T\*\*)

24 LEADS SHOWN

## CERAMIC DUAL-IN-LINE



- 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 ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification.  
 E. Falls within MIL STD 1835 GDIP3-T24, GDIP4-T28, and JEDEC MO-058 AA, MO-058 AB

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.

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