Data sheet acquired from Harris Semiconductor SCHS034C – Revised October 2003

CMOS Presettable Up/Down Counter

Binary or BCD-Decade

High-Voltage Types (20-Volt Rating)

■ CD4029B consists of a four-stage binary or BCD-decade up/down counter with provisions for look-ahead carry in both counting modes. The inputs consist of a single CLOCK, CARRY-IN (CLOCK EN-ABLE), BINARY/DECADE, UP/DOWN, PRE-SET ENABLE, and four individual JAM signals. Q1, Q2, Q3, Q4 and a CARRY OUT signal are provided as outputs.

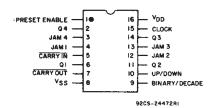
A high PRESET ENABLE signal allows information on the JAM INPUTS to preset the counter to any state asynchronously with the clock. A low on each JAM line, when the PRESET-ENABLE signal is high, resets the counter to its zero count. The counter is advanced one count at the positive transition of the clock when the CARRY-IN and PRE-SET ENABLE signals are low. Advancement is inhibited when the CARRY-IN or PRESET ENABLE signals are high. The CARRY-OUT signal is normally high and goes low when the counter reaches its maximum count in the UP mode or the minimum count in the DOWN mode provided the CARRY-IN signal is low. The CARRY-IN signal in the low state can thus be considered a CLOCK ENABLE. The CARRY-IN terminal must be connected to V_{SS} when not in use.

Binary counting is accomplished when the BINARY/DECADE input is high; the counter counts in the decade mode when the BI-NARY/DECADE input is low. The counter counts up when the UP/DOWN input is high, and down when the UP/DOWN input is low. Multiple packages can be connected in either a parallel-clocking or a rippleclocking arrangement as shown in Fig. 17.

Parallel clocking provides synchronous control and hence faster response from all counting outputs. Ripple-clocking allows for longer clock input rise and fall times.

The CD4029B-series types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

CD4029B Terminal Diagram

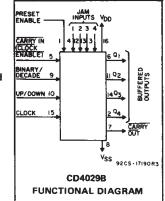


Features:

- Medium-speed operation . . . 8 MHz (typ.)
- $@ C_L = 50 \text{ pF} \text{ and } V_{DD} V_{SS} = 10 \text{ V}$
- Multi-package parallel clocking for synchronous high speed output response or ripple clocking for slow clock input rise and fall times
- "Preset Enable" and individual "Jam" inputs provided
- Binary or decade up/down counting
- BCD outputs in decade mode
- 100% tested for quiescent current at 20 V
- 5-V, 10-V, and 15-V parametric ratings
- Standardized, symmetrical output characteristics
- Maximum input current of 1 μA at 18 V over full package-temperature range; 100 nA at 18 V and 25^oC
- Noise margin (over full package-temperature range)
 - 1 V at V_{DD} = 5 V
 - 2 V at V_{DD} = 10 V
 - 2.5 V at VDD = 15 V
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications:

- Programmable binary and decade
- counting/frequency synthesizers-BCD output Analog to digital and digital to
- analog conversion
- Up/Down binary counting
- Magnitude and sign generation
- Up/Down decade counting
- Difference counting

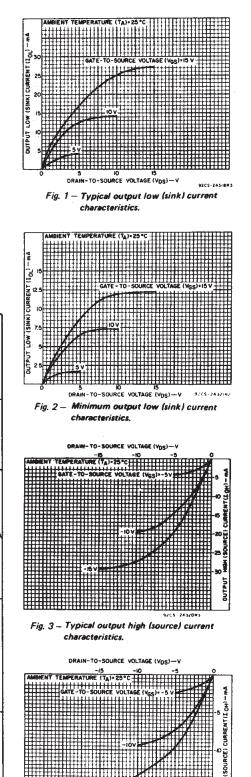


CD4029B Types

CHARACTERISTIC		V _{DD}	LIN	AITS	UNITS
		(v)	Min.	Max.	
Supply-Voltage Ran Temperature Rang	ge (For Ť _A ≓ Full Package- e)	-	3	18	v
Setup Time t _{SU} :		5	200	_	
Carry-In		10	70	-	
Garry-III		15	60		
· · · · · · · · · · · · · · · · · · ·		5	340	_	
U/D or B/D		10	140	_	
		15	100	-	ns
·		5	180	-	
Clock Pulse Width, 1	W .	10	90	-	
		15	60	-	
		5	130	-	
Preset Enable Pulse	Width, t _W	10	70	-	
		15	50	-	
		5	_	2	
Clock Input Freque	ncy, fcL	10	-	4	MHz
		15	-	5.5	
		5	-		
Clock Rise and Fall	Time, t _r CL, t _f CL	10	-	15	μs
	· ·	15	-		

RECOMMENDED OPERATING CONDITIONS at $T_A = 25^{\circ}$ C, Except as Noted. For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

MAXIMUM RATINGS, Absolute-Maximum Values:
DC SUPPLY-VOLTAGE RANGE, (V _{DD})
Voltages referenced to V _{SS} Terminal)
INPUT VOLTAGE RANGE, ALL INPUTS
DC INPUT CURRENT, ANY ONE INPUT
POWER DISSIPATION PER PACKAGE (PD):
For T _A = -55°C to +100°C
For T _A = +100°C to +125°C Derate Linearity at 12mW/°C to 200mW
For T _A = +100°C to +125°C Derate Linearity at 12mW/°C to 200mW
For T _A = +100°C to +125°C Derate Linearity at 12mW/°C to 200mW DEVICE DISSIPATION PER OUTPUT TRANSISTOR FOR T _A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)
For T _A = +100°C to +125°C Derate Linearity at 12mW/°C to 200mW DEVICE DISSIPATION PER OUTPUT TRANSISTOR FOR T _A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)
For T _A = +100°C to +125°C Derate Linearity at 12mW/°C to 200mW DEVICE DISSIPATION PER OUTPUT TRANSISTOR FOR T _A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)



characteristics.

....Minimum output high (source) current

Fig. 4

HOH OUTPUT

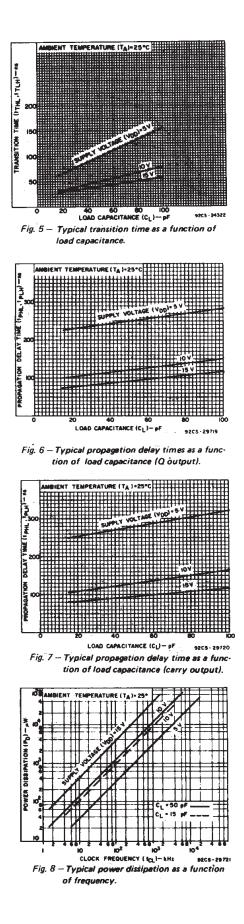
9255-2452192

3

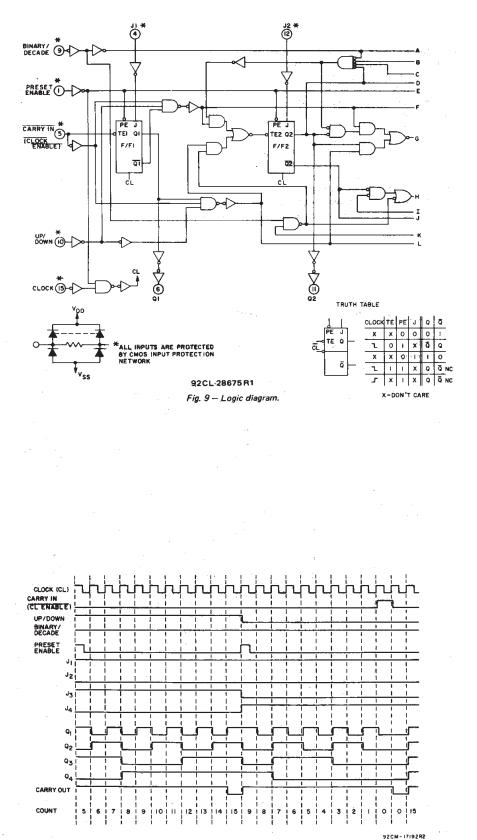
COMMERCIAL CMOS HIGH VOLTAGE ICs

STATIC	ELECTRICAL	CHARACTERISTICS
017110		OTHANAOTETHOUTOU

CHARAC- TERISTIC	CON	DITIO	NS	LIMITS AT INDICATED TEMPERATURES (°C)								
	V ₀ (V)		V _{DD}	-55	-40	+85	+125	Min.	+25 Typ.	Max.	s	
	_	0,5	5	5	5	150	150		0.04	5	<u> </u>	
Quiescent Device	_	0,10	10	10	10	300	300	_	0.04	10		
Current,		0,15	15	20	20	600	600	_	0.04	20	μA	
IDD Max.		0,20	20	100	100	3000	3000	_	0.08	100		
	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1			
Output Low (Sink) Current		0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	_		
IOL Min.	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8			
Output High	4.6	0,5	5	-0.64	-0.61	-0.42	-0.36	-0.51	-1	· -	mA	
Current, IOH Min.	2.5	0,5	5	-2	-1.8	-1.3	1.15	-1.6	-3.2	-	-	
	9.5	0,10	10	-1.6	-1.5	-1.1	-0.9	-1.3	-2.6	-		
ЮНИШ	13.5	0,15	15	-4.2	-4	-2.8	- 2.4	-3.4	-6.8	-		
Output Voltage:	_	0,5	5		0.	_	0	0.05				
Low-Level,	-	0,10	10		0	05	_	0	0.05	- 1		
VOL Max.		0,15	15		0.	05	-	0	0.05			
Output		0,5	5		4.	4.95	5					
Voltage: High-Level,		0,10	10		9	95		9.95	10	-		
V _{OH} Min.	-	0,15	15		14.	95		14.95	15	-		
Input Low	0.5,4.5	-	5			1.5		-		1.5		
Voltage	1,9	_	10			3		-		3		
V _{IL} Max.	1.5,13.5		15			4		-	_	4	lv	
Input High	0.5,4.5	_	5	0.0					-	_		
Voltage,	1,9	-	10						_	-		
V _{IH} Min.	1.5,13.5		15			11		11	-			
Input Current I _{IN} Max.	-	0,18	18	±0.1	±0.1	±1	±1	_	±10-5	±0.1	μΑ	



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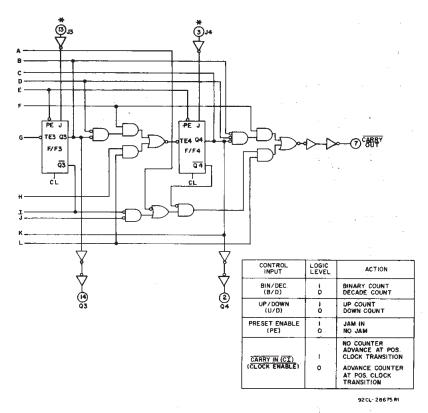


Fig. 9 — Logic diagram (cont'd).

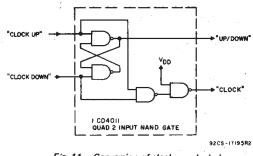


Fig. 11 – Conversion of clock up, clock down input signals to clock and up/down input signals.

The CD4029B CLOCK and UP/DOWN inputs are used directly in most applications. In applications where CLOCK UP and CLOCK DOWN inputs are provided, conversion to the CD4029B CLOCK and UP/DOWN inputs can easily be realized by use of the circuit in Fig. 11.

CD4029B changes count on positive transitions of CLOCK UP or CLOCK DOWN inputs. For the gate configuration shown below, when counting up the CLOCK DOWN input must be maintained high and conversely when counting down the CLOCK UP input must be maintained high.

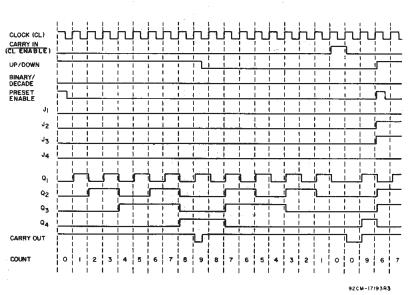


Fig. 12 - Timing diagram-decade mode.

DYNAMIC ELECTRICAL CHARACTERISTICS at T_A = 25°C, input t_r, t_f = 20 ns, C_L = 50 pF, R_L = 200 k\Omega

CHARACTERISTIC	TEST CO	NDITIONS		UNITS		
		V _{DD} (V)	Min.	Тур.	Max.	
Clocked Operation			•	•		
Propagation Delay Time: tPHL, tPLH		5	-	250	500	
Q Output		10	-	120	240	
		15		90	180	
		5	-	280	560	
Carry Output		10	-	130	260	
		15	-	95	190	ns
		5	-	100	200	
Transition Time: tTHL, tTLH		10	-	50	100	
Q Outputs, Carry Output		15	-	40	80	
		5	-	90	180	
Minimum Clock Pulse Width, tw		10	-	45	90	
		15	-	30	60	
		5	_	_	15	
Clock Rise & Fall Time, trCL, trCL **		10	-	-	15	μs
		15			15	
Minimum Cont		5	_	170	340	
Minimum Setup Times, tS [*] B/D or U/D		10	-	70	140	ns
B/D of 0/D		15	-	50	100	
		5	2	4		
Maximum Clock Input Frequency, fCL		10	4	8	-	MHz
		15	5.5	11	-	
Input Capacitance, C _{IN}	Any Input	t	-	5	7.5	pF
Preset Enable	. <u></u>					
	Ī	5	· _	235	470	
Propagation Delay Time: tpHL, tpLH		10	-	100	200	
Q Outputs		15	-	80	160	
		5		320	640	
Carry Output		10		145	290	
	ľ	15		105	210	ns
	ŀ	5		65	130	115
Minimum Preset Enable Pulse Width, tw	ŀ	10		35	70	
	ŀ	15	-	25	50	
Minimum Prove Crackly D		5	_	100	200	
Minimum Preset Enable Removal	ŀ	10	-	55	110	
Time, ^t rem [*]	1	15	-	40	80	
Carry Input						
Propagation Delay Time: tpHL, tpLH		5	-	170	340	
Carry Output	ľ	10	-	70	140	ns
		15	-	50	100	
Min. HOLD Time	ľ	5	-	25	50	ns
tu*** Carry In	ľ	10	-	15	30	ł
	ľ	15	-	12	25	•
Min Set-Up Time	ľ	5	_	100	200	ns
te*** Carry in	ł	10	_	35	70	
· · · · · · · · · · · · · · · · · · ·	ł	15	_	30	60	1

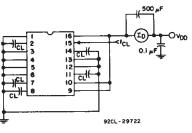


Fig. 13 - Power dissipation test circuit.

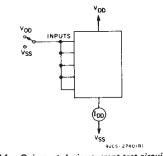


Fig. 14 - Quiescent-device current test circuit.

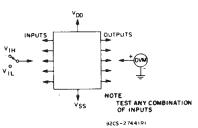


Fig. 15 - Input voltage test circuit.

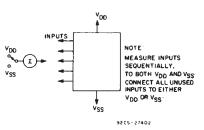
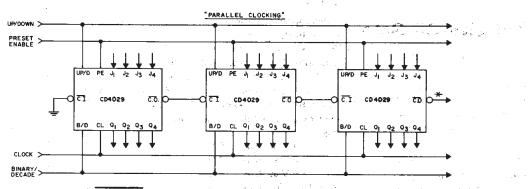


Fig. 16 - Input current test circuit.

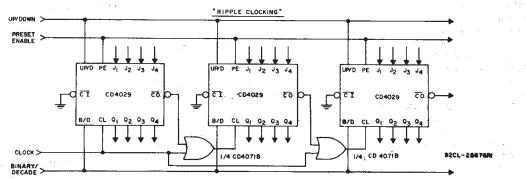
* From Up/Down, Binary/Decode, Carry In, or Preset Enable Control Inputs to Clock Edge.

*** From Up/Down, Binary/Decode, Carry In, or Freet Ensure Control inputs to Clock Edge.
** If more than one unit is cascaded in the parallel clocked application, t_yCL should be made less than or equal to the sum of the fixed propagation delay at 15 pF and the transition time of the carry output driving stage for the estimated capacitive load. This measurement wat made with a decoupling capacitor (>1 µF) between V_{DD} and V_{SS}.





* CARRY OUT lines at the 2nd, 3rd, etc., stages may have a negative-going glitch pulse resulting from differential delays of different CD4029B tC's. These negativegoing glitches do not affect proper CD4029B operation. However, if the CARRY OUT signals are used to trigger other edge-sensitive logic devices, such as FF's or counters, the CARRY OUT signals should be gated with the clock signal using a 2-input OR gate such as CD4071B.



Ripple Clocking Mode:

The Up/Down control can be changed at any count. The only restriction on changing the Up/Down control is that the clock input to the first counting stage must be high. For cascading counters operating in a fixed up-count or down-count mode, the OR gates are not required between stages, and \overline{CO} is connected directly to the CL input of the next stage with \overline{CI} grounded.

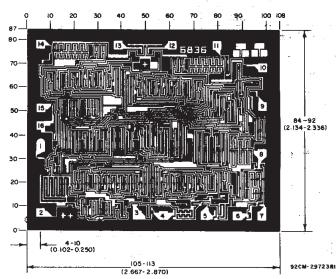


Fig. 17 - Cascading counter packages.

Chip dimensions and pad layout for CD4029B

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch) .



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5-Sep-2011

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
8101602EA	ACTIVE	CDIP	J	16	1	TBD	Call TI	Call TI	
CD4029BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
CD4029BEE4	ACTIVE	PDIP	Ν	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
CD4029BF	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
CD4029BF3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
CD4029BM	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BM96	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BM96E4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BM96G4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BMG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BMT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BMTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BMTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BNSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BNSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4029BPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	



5-Sep-2011

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
CD4029BPWRG4	ACTIVE	TSSOP	PW	16	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.

OBSOLETE: 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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OTHER QUALIFIED VERSIONS OF CD4029B, CD4029B-MIL :

• Catalog: CD4029B

Military: CD4029B-MIL

NOTE: Qualified Version Definitions:

• Catalog - TI's standard catalog product

PACKAGE OPTION ADDENDUM



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5-Sep-2011

• Military - QML certified for Military and Defense Applications

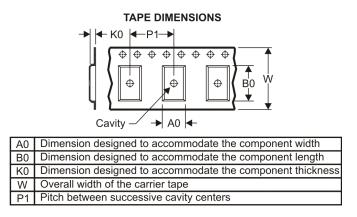
PACKAGE MATERIALS INFORMATION

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Texas Instruments

TAPE AND REEL INFORMATION





QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal												
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
CD4029BM96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4029BNSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
CD4029BPWR	TSSOP	PW	16	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

TEXAS INSTRUMENTS

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PACKAGE MATERIALS INFORMATION

30-Jul-2010



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4029BM96	SOIC	D	16	2500	333.2	345.9	28.6
CD4029BNSR	SO	NS	16	2000	346.0	346.0	33.0
CD4029BPWR	TSSOP	PW	16	2000	346.0	346.0	29.0

J (R-GDIP-T**) 14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



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).
- \triangle The 20 pin end lead shoulder width is a vendor option, either half or full width.



D (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES: A. All linear dimensions are in inches (millimeters).

- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AC.



4211283-4/D 06/11

D (R-PDSO-G16) PLASTIC SMALL OUTLINE Stencil Openings (Note D) Example Board Layout (Note C) -16x0,55 - 14x1,27 -14x1,27 16x1,95 4,80 4,80 Example Non Soldermask Defined Pad Example Pad Geometry (See Note C) 0,60 Example 2,00 Solder Mask Opening

(See Note E)

NOTES: A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

← 0,07 All Around

- 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. Refer to IPC-7525 for other stencil recommendations.
 E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



PW (R-PDSO-G16)

PLASTIC SMALL OUTLINE



NOTES:

A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994. β . This drawing is subject to change without notice.

Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.

Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.

E. Falls within JEDEC MO-153



LAND PATTERN DATA



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. Refer to IPC-7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.



MECHANICAL DATA

PLASTIC SMALL-OUTLINE PACKAGE

0,51 0,35 ⊕0,25⊛ 1,27 8 14 0,15 NOM 5,60 8,20 5,00 7,40 \bigcirc Gage Plane ₽ 0,25 7 1 1,05 0,55 0°-10° Δ 0,15 0,05 Seating Plane — 2,00 MAX 0,10PINS ** 14 16 20 24 DIM 10,50 10,50 12,90 15,30 A MAX A MIN 9,90 9,90 12,30 14,70 4040062/C 03/03

NOTES: A. All linear dimensions are in millimeters.

NS (R-PDSO-G**)

14-PINS SHOWN

- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.



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