

Data sheet acquired from Harris Semiconductor SCHS042C – Revised July 2003

CD4045B Types

CMOS 21-Stage Counter

High-Voltage Types (20-Volt Rating)

■ CD4045B is a timing circuit consisting of 21 counter stages, two output-shaping flip-flops, two inverter output drivers, and input inverters for use in a crystal oscillator. The CD4045B configuration provides 21 flip-flop counting stages, and two flip-flops for shaping the output waveform for a 3.125% duty cycle. Push-pull operation is provided by the inverter output drivers.

The first inverter is intended for use as a crystal oscillator/amplifier. However, it may be used as a normal logic inverter if desired. A crystal oscillator circuit can be made less sensitive to voltage-supply variations by the use of source resistors. In this device, the sources of the p and n transistors have been brought out to package terminals. If external resistors are not required, the sources must be shorted to their respective substrates (Sp to VDD, Sn to VSS). See Fig. 1. The first inverter in conjunction with an outboard inverter, such as 1/6 CD4069, and R_X, C_X, and RS can also be used to construct an RC oscillator. The following data is supplied as a guide in the selection of values for RX, R_S, and C_X used in Fig. 11:

- 1. R_X max = 10 $M\Omega$ with R_S = 10 $M\Omega$ and C_X = 50 pF
- 2. C_X max = 25 μ F with R_S = 560 $k\Omega$ and R_X = 50 $k\Omega$

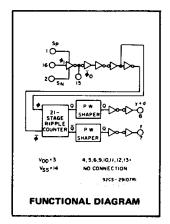
The CD4045B types are supplied in 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline package (NSR suffix), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

Applications:

- Digital equipment in which ultra-low dissipation and/or operation using a battery source is required.
- Accurate timing from a crystal oscillator for timing applications such as wall clocks, table clocks, automobile clocks, and digital timing references in any circuit requiring accurately timed outputs at various intervals in the counting sequence.
- Driving miniature synchronous motors, stepping motors, or external bipolar transistors in push-pull fashion.

Features:

- Very low operating dissipation
 <1 mW (typ.) @ VDD = 5 V, fø = 1 MHz</p>
- Medium speed (typ.) . . . $f\phi$ = 25 MHz @ V_{DD} = 10 V
- 100% tested for quiescent current at 20 V
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, Standard Specifications for Descripiton of 'B' Series CMOS Devices"



MAXIMUM RATINGS, Absolute-Maximum Values:

LEAD TEMPERATURE (DURING SOLDERING):

DC SUPPLY-VOLTAGE RANGE, (V_{DD})

Voltages referenced to V_{SS} Terminal)

INPUT VOLTAGE RANGE, ALL INPUTS

CINPUT CURRENT, ANY ONE INPUT

E10mA

POWER DISSIPATION PER PACKAGE (P_{D}):

For T_{A} = -55°C to +100°C

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)

100mW

OPERATING-TEMPERATURE RANGE (T_{A})

-55°C to +125°C

STORAGE TEMPERATURE RANGE (T_{SIQ})

-65°C to +150°C

At distance 1/16 \pm 1/32 inch (1.59 \pm 0.79mm) from case for 10s max+265°C

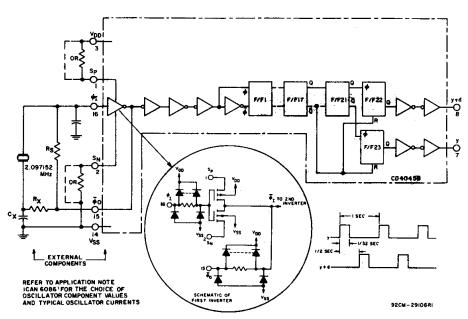


Fig. 1 - CD4045B and outboard components in a typical 21-stage counter application.

CD4045B Types

STATIC ELECTRICAL CHARACTERISTICS

	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							ZZ
CHARACTERISTIC				LIN	IIISAI	INDICA				ı	
	Vo		VDD			1		<u> </u>	+25		T
	(V)	(V)	(V)	-55	-40	+85	+125	Min.	Тур.	Max.	S
Quiescent Device		0,5	5	5	5	150	150		0.04	5	
Current, IDD Max.	<u>- i</u>	0,10	.10	. 10	10.	300	300	_	0.04	10	μА
* .		0,15	•	20	20	600	600		0.04	20	" .
		0,20	20	100	100.	3000	3000		0.08	100	
Output Low (Sink)	0.4	0,5	5	4.5	4.3	2.9	2.5	3.6	7	_	
Current IOL Min.	0.5	0,10	_	11.2	10.5	7.7	6.3	9.1	18	_	1
	1.5	0,15	15	29.4	28	19.6	16.8	23.8	47	_	mA
Output High (Source)		0,5	5	-4.5	-4.3	-2.9	-2.5	-3.6	-7		
Current, IOH Min.	9.5	0,10	10	-11.2	-10.5	-7.7	-6.3	-9.1	-18		
	13.5	0,15	15	-29.4	-28	-19.6	-16.8	-23.8	-47	_	
Pin 15 Output	0.4,4.6	0,5	5				±0.1	±0.18			
Low and High	0.5,9.5						±0.2	±0.3		mΑ	
Current, IOL, IOH	1.5,13.5		15		<u>-</u>		±0.5	±1		نـــــا	
Output Voltage:		0,5	5			0.05	-	-	0.05		
Low-Level,		0,10	10	0.05				_		0.05	
VOL Max.		0,15	15		0.05 – 4.95 4.9					0.05	v
Output Voltage:		0,5	5						- 5	-	
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	1	5			1.5	-		1.5		
Voltage	1,9	1	10	,		3	_	_	3		
V∣∟ Max.	1.5,13.5	1	15	4						4	v
Input High	0.5,4.5	_	5	1.		3.5	3.5	_	+		
Voltage,	1,9	1	10			7	7	-	_		
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

RECOMMENDED OPERATING CONDITIONS

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges

CHARACTERISTIC	V _{DD}	LIN	·	
CHARACTERISTIC	(v)	Min.	Max.	UNITS
Supply-Voltage Range (For T _A = Full Package- Temperature Range)	_	3	18	v
Minimum Input-Pulse Width, tw	5 10 15	- - -	100 50 40	ns
Maximum Input-Pulse Frequency, fφ (External Pulse Source)	5 10 15	5 12 15	- - -	MHz

CD4045B Types

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

	TEST			LIMITS		
CHARACTERISTIC	CONDITIONS	V _{DD}	Min.	Тур.	Max.	UNITS
Propagation Delay Time:		5	_	2.2	5.5	
ϕ_{\parallel} to y or y+d out		10	l _	0.9	2.7	μs
tphl, tplh		15	-	0.65	2	"
Transition Time:		5	<u> </u>	25	50	
	.	10	_	13	25	
^t thl ^{, t} tlh	1	15	-	10	20	
Minimum Input-Pulse Width		5	-	50	100	ns
		10	-	25	50	
^t w		15	_	20	40	
Input-Pulse Rise or Fall Time:		5			500	
		10		l –	500	μs
$t_r \phi$, $t_f \phi$		15		_	500	·
Maximum Input-Pulse		5	5	10	_	
Frequency:		10	12	25	_	MHz
(External Pulse Source) f _φ		15	15	30	-	
Input Capacitance, C _{IN}	Any Input	-		5	7.5	pF
Variation of Output Frequency		5	-	0.05	_	
(Unit-to-Unit)	f = 5 MHz	10	l –	0.03	_	%
		15	_	0.1	<u> </u>	
RC Oscillator Operation	-					
Maximum Oscillator Frequency	$R_X = 50 k\Omega$,	5	45	60	75	
(See Fig. 11)	$R_S = 560 \mathrm{k}\Omega$,	10	45	60	75	kHz
fosc	$C_X = 50 pF$	15	45	60	75	

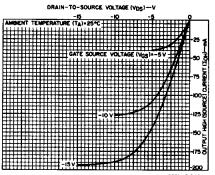


Fig. 4 — Typical output high (source) current characteristics.

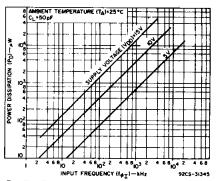


Fig. 7 — Typical power dissipation as a function of input frequency (21 counting stages).

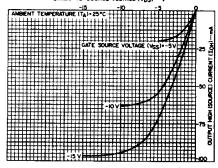


Fig. 5 – Minimum output high (source) characteristics.

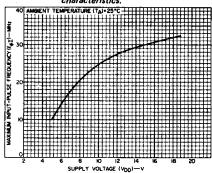


Fig. 8 — Typical maximum input-pulse frequency as a function of supply voltage.

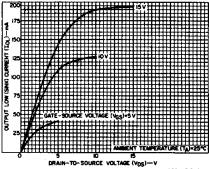


Fig. 2 — Typical output low (sink) current characteristics.

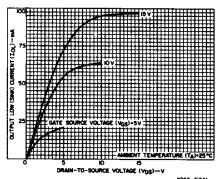


Fig. 3 – Minimum output low (sink) current cheracteristics.

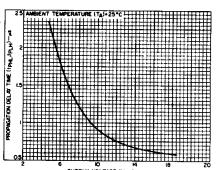


Fig. 6 — Typical propagation delay time as a function of supply voltage (\$\phi_p\$). Voltage (\$\phi_i\$) for \$y + d\$ out \$vs. \$V_{DD}\$.

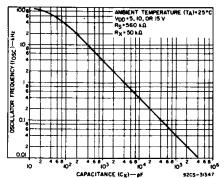


Fig. 9 — Typical RC oscillator frequency as a function of capacitance (C_X), See Fig. 11.

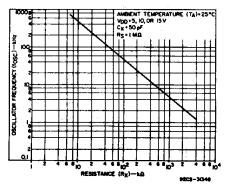


Fig. 10 — Typical RC oscillator frequency as a function of resistance (R_X),
See Fig. 11.

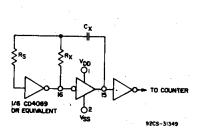


Fig. 11 - Typical RC circuit.

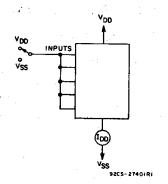


Fig. 12 - Quiescent-device-current test circuit.

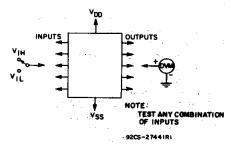


Fig. 13 - Noise-immunity test circuit.

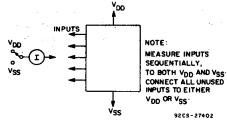


Fig. 14 - Input-leakage-current test circuit.

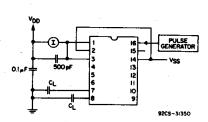
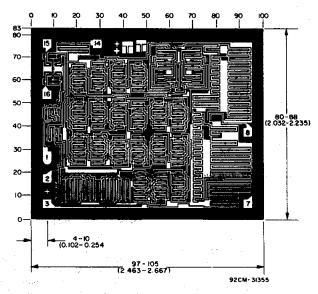


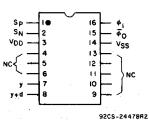
Fig. 15 - Dynamic power dissipation test circuit.



Chip dimensions and pad layout for CD4045B

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

TERMINAL DIAGRAM Top View



NC - NO CONNECTION

NOTE Observe power-supply terminal connections, V_{DD} is terminal No. 3 and V_{SS} is terminal No. 14 (not 16 and 8 respectively, as in other CD40008 Series 16-lead devices).





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PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
CD4045BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4045BEE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
CD4045BNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4045BNSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4045BPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4045BPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4045BPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CD4045BPWRE4	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) 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.

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.

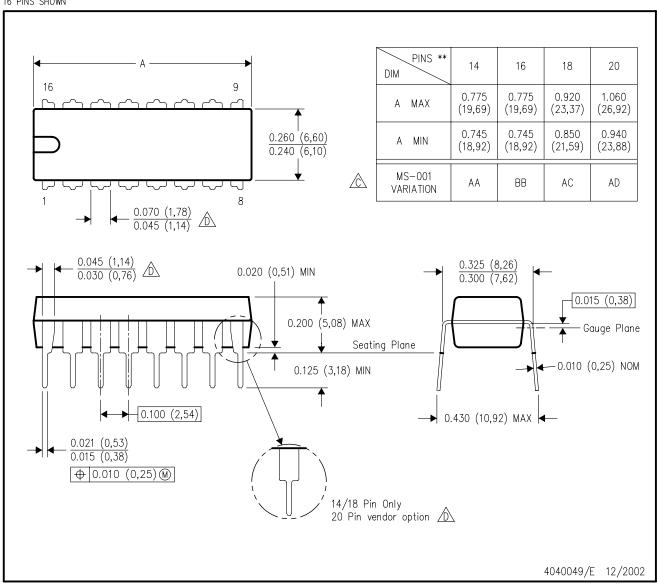
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N (R-PDIP-T**)

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



MECHANICAL DATA

NS (R-PDSO-G**)

14-PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



NOTES:

- . 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.



PW (R-PDSO-G**)

14 PINS SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



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

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