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CD4018B Types

CMOS Presettable Divide-By-'N' Counter

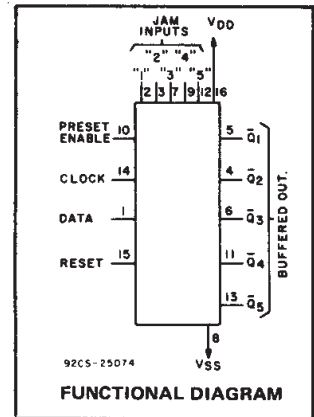
High-Voltage Types (20-Volt Rating)

■ CD4018B types consist of 5 Johnson-Counter stages, buffered Q outputs from each stage, and counter preset control gating. CLOCK, RESET, DATA, PRESET ENABLE, and 5 individual JAM inputs are provided. Divide by 10, 8, 6, 4, or 2 counter configurations can be implemented by feeding the $\bar{Q}5$, $\bar{Q}4$, $\bar{Q}3$, $\bar{Q}2$, $\bar{Q}1$ signals, respectively, back to the DATA input. Divide-by-9, 7, 5; or 3 counter configurations can be implemented by the use of a CD4011B to gate the feedback connection to the DATA input. Divide-by functions greater than 10 can be achieved by use of multiple CD4018B units. The counter is advanced one count at the positive clock-signal transition. Schmitt Trigger action on the clock line permits unlimited clock rise and fall times. A high RESET signal clears the counter to an all-zero condition. A high PRESET-ENABLE signal allows information on the JAM inputs to preset the counter. Anti-lock gating is provided to assure the proper counting sequence.

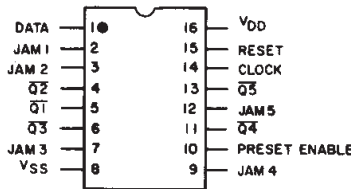
The CD4018B types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

Features:

- Medium speed operation 10 MHz (typ.) at $V_{DD} - V_{SS} = 10\text{ V}$
- Fully static operation
- 100% tested for quiescent current at 20 V
- Standardized, symmetrical output characteristics
- 5-V, 10-V, and 15-V parametric ratings
- Maximum input current of 1 μA at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (full package-temperature range) =
 - 1 V at $V_{DD} = 5\text{ V}$
 - 2 V at $V_{DD} = 10\text{ V}$
 - 2.5 V at $V_{DD} = 15\text{ V}$
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"



TERMINAL DIAGRAM
Top View



92CS-24460

Applications:

- Fixed and programmable divide-by-10, 9, 8, 7, 6, 5, 4, 3, 2 counters
- Fixed and programmable counters greater than 10
- Programmable decade counters
- Divide-by-"N" counters/frequency synthesizers
- Frequency division
- Counter control/timers

MAXIMUM RATINGS, Absolute-Maximum Values:

DC SUPPLY-VOLTAGE RANGE, (V_{DD})	
Voltages referenced to V_{SS} Terminal)	-0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS	-0.5V to $V_{DD} + 0.5\text{V}$
DC INPUT CURRENT, ANY ONE INPUT	$\pm 10\text{ mA}$
POWER DISSIPATION PER PACKAGE (P_D):	
For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$	500mW
For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$	Derate Linearly at 12mW/ $^\circ\text{C}$ to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR	
FOR $T_A = \text{FULL PACKAGE-TEMPERATURE RANGE (All Package Types)}$	100mW
OPERATING-TEMPERATURE RANGE (T_A)	-55°C to $+125^\circ\text{C}$
STORAGE TEMPERATURE RANGE (T_{stg})	-65°C to $+150^\circ\text{C}$
LEAD TEMPERATURE (DURING SOLDERING):	
At distance $1/16 \pm 1/32$ inch ($1.59 \pm 0.79\text{mm}$) from case for 10s max	$+265^\circ\text{C}$

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

CHARACTERISTIC	V_{DD}	Min.	Max.	UNITS
Supply Voltage Range (at $T_A = \text{Full Package-Temperature Range}$)		3	18	V
Clock Input Frequency, f_{CL}	5	—	3	MHz
	10	—	7	
	15	—	8.5	
Clock Pulse Width, t_W	5	160	—	ns
	10	70	—	
	15	50	—	
Clock Rise & Fall Time, t_{rCL}, t_{fCL}	5	Unlimited		μs
	10			
	15			
Data Input Set-Up Time, t_S	5	40	—	ns
	10	12	—	
	15	16	—	
Data Input Hold Time, t_H	5	140	—	ns
	10	80	—	
	15	60	—	
Preset or Reset Pulse Width, t_W	5	160	—	ns
	10	70	—	
	15	50	—	
Preset or Reset Removal Time	5	160	—	ns
	10	60	—	
	15	40	—	

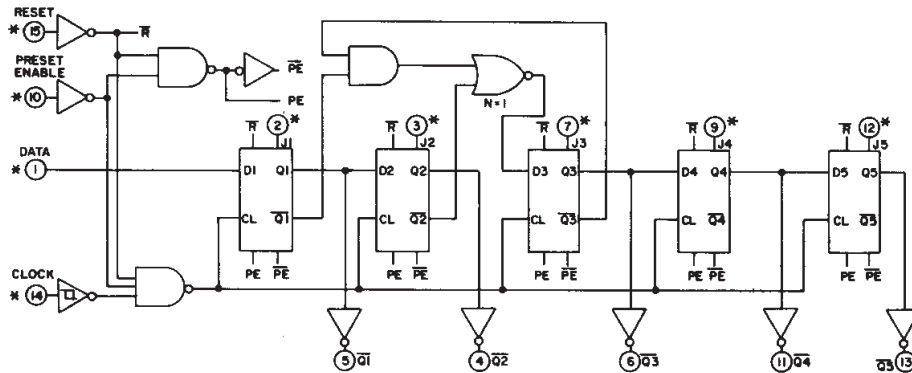
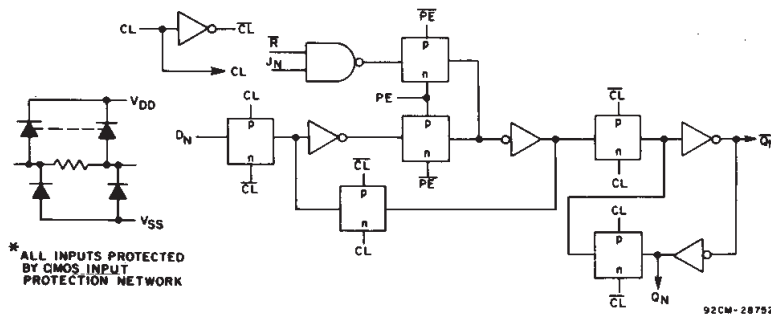


Fig. 1 - Logic diagram.



* ALL INPUTS PROTECTED BY CMOS INPUT PROTECTION NETWORK

92CM-28752

Fig. 2 - Detail of a typical stage.

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STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V _O (V)	V _{IN} (V)	V _{DD} (V)	-55	-40	+85	+125	+25			
								Min.	Typ.	Max.	
Quiescent Device Current, I _{DD} Max.	-	0,5	5	5	5	150	150	-	0,04	5	μA
	-	0,10	10	10	10	300	300	-	0,04	10	
	-	0,15	15	20	20	600	600	-	0,04	20	
	-	0,20	20	100	100	3000	3000	-	0,08	100	
Output Low (Sink) Current, I _{OL} Min.	0,4	0,5	5	0,64	0,61	0,42	0,36	0,51	1	-	mA
	0,5	0,10	10	1,6	1,5	1,1	0,9	1,3	2,6	-	
	1,5	0,15	15	4,2	4	2,8	2,4	3,4	6,8	-	
Output High (Source) Current, I _{OH} Min.	4,6	0,5	5	-0,64	-0,61	-0,42	-0,36	-0,51	-1	-	mA
	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	-	
	13,5	0,15	15	-4,2	-4	-2,8	-2,4	-3,4	-6,8	-	
Output Voltage: Low-Level, V _{OL} Max.	-	0,5	5	0,05				-	0	0,05	V
	-	0,10	10	0,05				-	0	0,05	
	-	0,15	15	0,05				-	0	0,05	
Output Voltage: High-Level, V _{OH} Min.	-	0,5	5	4,95				4,95	5	-	V
	-	0,10	10	9,95				9,95	10	-	
	-	0,15	15	14,95				14,95	15	-	
Input Low Voltage, V _{IL} Max.	0,5,4,5	-	5	1,5				-	-	1,5	V
	1,9	-	10	3				-	-	3	
	1,5,13,5	-	15	4				-	-	4	
Input High Voltage, V _{IH} Min.	0,5,4,5	-	5	3,5				3,5	-	-	V
	1,9	-	10	7				7	-	-	
	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	μA

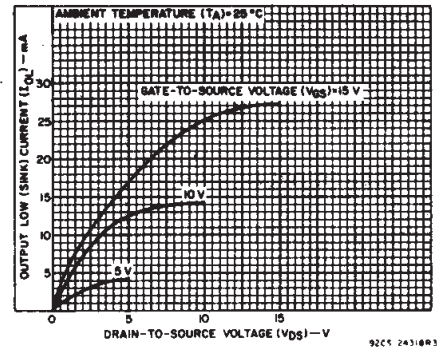


Fig. 3 - Typical output low (sink) current characteristics.

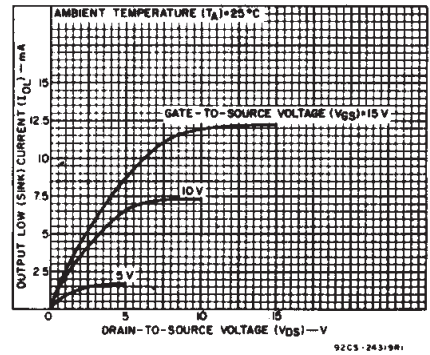


Fig. 4 - Minimum output low (sink) current characteristics.

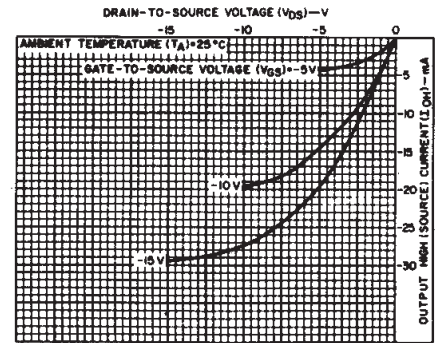


Fig. 5 - Typical output high (source) current characteristics.

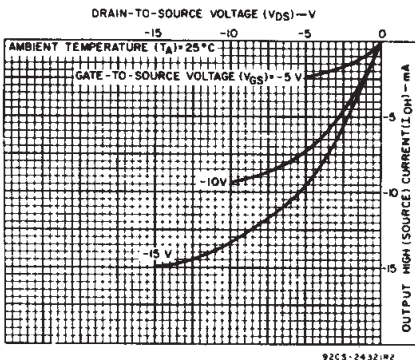


Fig. 6 - Minimum output high (source) current characteristics.

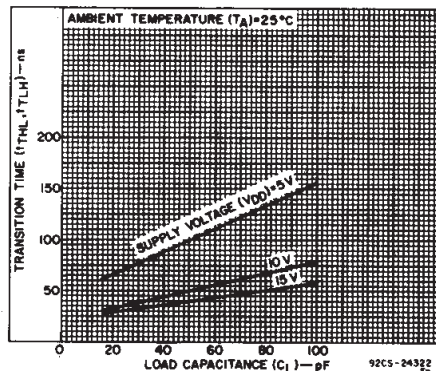


Fig. 7 - Typical transition time as a function of load capacitance.

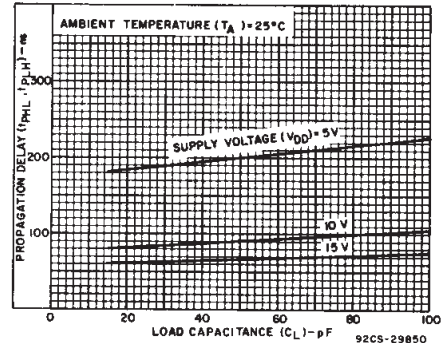


Fig. 8 - Typical propagation delay time as a function of load capacitance (CLOCK to Q).

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DYNAMIC ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$, Input $t_r, t_f = 20\text{ ns}$, $C_L = 50\text{ pF}$, $R_L = 200\text{ k}\Omega$

CHARACTERISTIC	TEST CONDITIONS	LIMITS			UNITS	
		V_{DD} (V)	Min.	Typ.		Max.
CLOCKED OPERATION						
Propagation Delay Time; t_{PLH}, t_{PHL}		5	—	200	400	ns
		10	—	90	180	
		15	—	65	130	
Transition Time; t_{THL}, t_{TLH}		5	—	100	200	ns
		10	—	50	100	
		15	—	40	80	
Maximum Clock Input Frequency, f_{CL}		5	3	6	—	MHz
		10	7	14	—	
		15	8.5	17	—	
Minimum Clock Pulse Width, t_W		5	—	80	160	ns
		10	—	35	70	
		15	—	25	50	
Clock Rise & Fall Time; t_{rCL}, t_{fCL}		5	Unlimited			μs
		10	Unlimited			
		15	Unlimited			
Minimum Data Input Set-Up Time, t_S		5	—	20	40	ns
		10	—	6	12	
		15	—	3	6	
Minimum Data Input Hold Time, t_H		5	—	70	140	ns
		10	—	40	80	
		15	—	30	60	
Average Input Capacitance, C_I	Any Input	—	5	7.5	pF	
PRESET* OR RESET OPERATION						
Propagation Delay Time; Preset or Reset to \bar{Q} t_{PLH}, t_{PHL}		5	—	275	550	ns
		10	—	125	250	
		15	—	90	180	
Minimum Preset or Reset Pulse Width, t_W		5	—	80	160	ns
		10	—	35	70	
		15	—	25	50	
Minimum Preset or Reset Removal Time		5	—	80	160	ns
		10	—	30	60	
		15	—	20	40	

* At PRESET ENABLE or JAM Inputs.

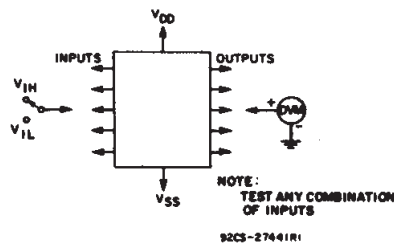


Fig. 12 - Input voltage test circuit.

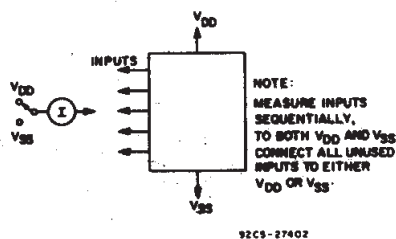


Fig. 13 - Input current test circuit.

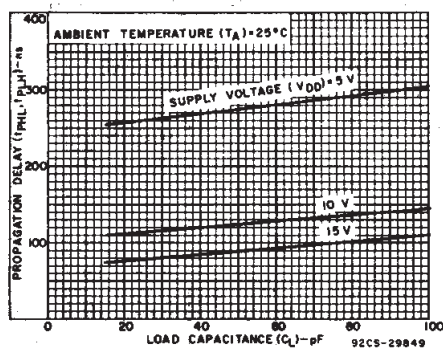


Fig. 9 - Typical propagation delay time as a function of load capacitance (RESET to Q).

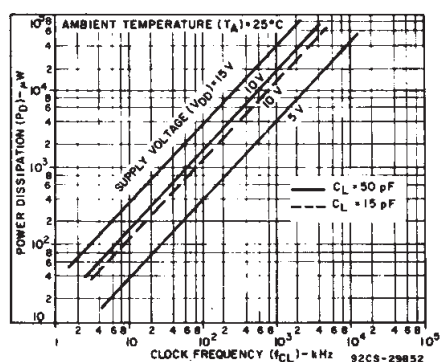


Fig. 10 - Typical dynamic power dissipation as a function of clock input frequency.

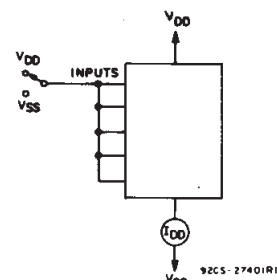


Fig. 11 - Quiescent device current test circuit.

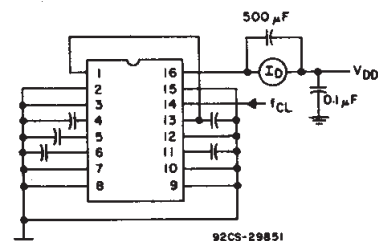


Fig. 14 - Dynamic power dissipation test circuit.

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("DATA" INPUT TIED TO \bar{Q}_5 FOR DECADE COUNTER CONFIGURATION)

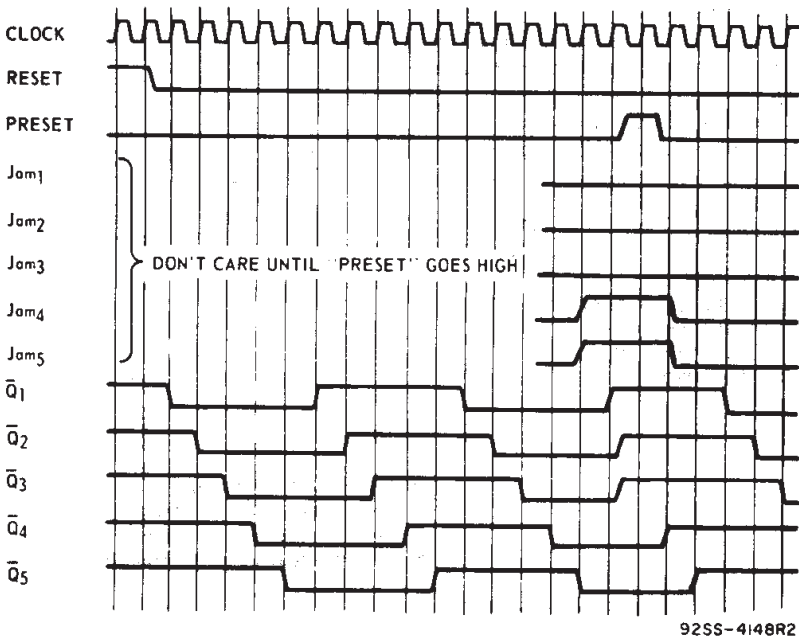


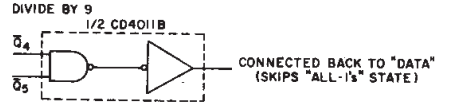
Fig. 15 — Timing diagram.

92SS-4148R2

EXTERNAL CONNECTIONS FOR DIVIDE BY 10, 9, 8, 7, 6, 5, 4, 3 OPERATION

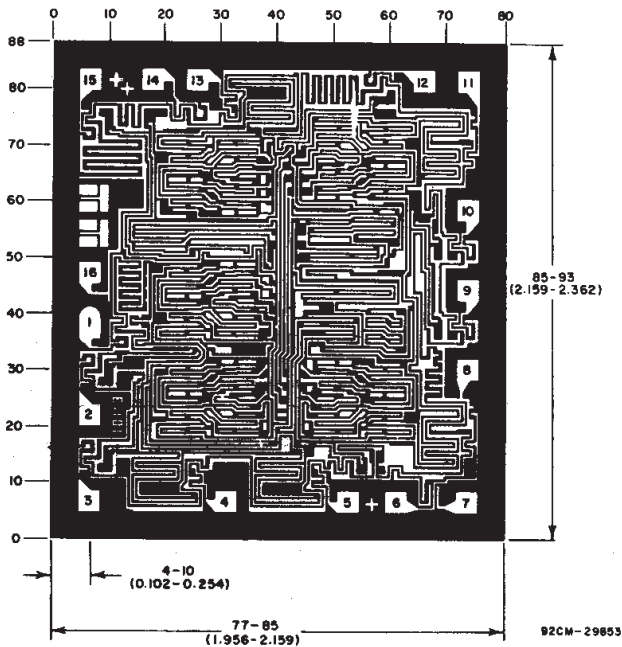
DIVIDE BY 10 \bar{Q}_5
 DIVIDE BY 8 \bar{Q}_4
 DIVIDE BY 6 \bar{Q}_3
 DIVIDE BY 4 \bar{Q}_2
 DIVIDE BY 2 \bar{Q}_1

CONNECTED BACK TO "DATA" } NO EXTERNAL COMPONENTS REQUIRED



92CS-17071R3

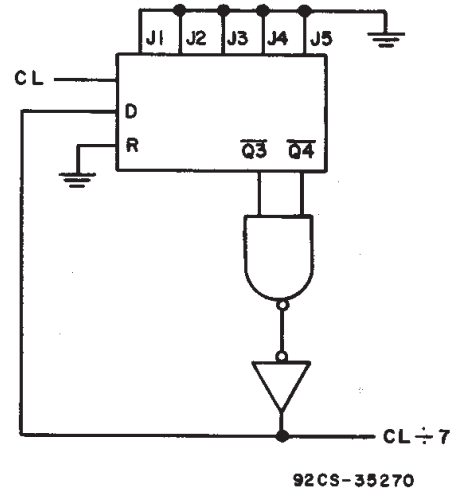
Fig. 16 — External connections for divide by 10, 9, 8, 7, 5, 4, 3, 2 operation.



Chip dimensions and pad layout for CD4018B

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

92CM-29853



92CS-35270

Fig. 17 — Example of divide by 7.

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