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CD4018B Types

CMOS Presettable Divide-By-'N' Counter

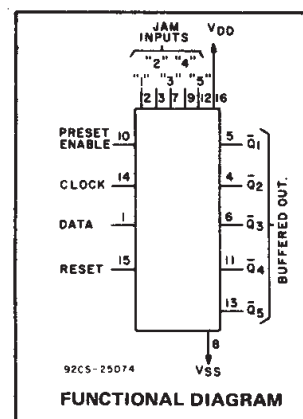
High-Voltage Types (20-Volt Rating)

■ 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.

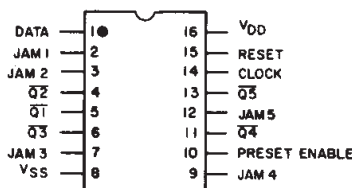
The CD4018B types are supplied in 16-lead hermetic dual-in-line ceramic packages (D and F suffixes), 16-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

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 $\pm$ 0.79mm) from case for 10s max $+265^\circ\text{C}$

Activity	Sedentary (n=10)	Low active (n=10)	High active (n=10)
Sleeping	~35%	~25%	~20%
Eating	~15%	~10%	~10%
Drinking	~5%	~5%	~5%
Working	~10%	~25%	~20%
Studying	~5%	~15%	~15%
Leisure	~35%	~35%	~50%
Total	~100%	~100%	~100%

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 = Full Package-Temperature Range)		3	18	V
Clock Input Frequency, f _{CL}	5 10 15	— — —	3 7 8.5	MHz
Clock Pulse Width, t _W	5 10 15	160 70 50	— — —	ns
Clock Rise & Fall Time, t _{rCL} , t _{fCL}	5 10 15	Unlimited		μs
Data Input Set-Up Time, t _S	5 10 15	40 12 16	— — —	ns
Data Input Hold Time, t _H	5 10 15	140 80 60	— — —	ns
Preset or Reset Pulse Width, t _W	5 10 15	160 70 50	— — —	ns
Preset or Reset Removal Time	5 10 15	160 60 40	— — —	ns

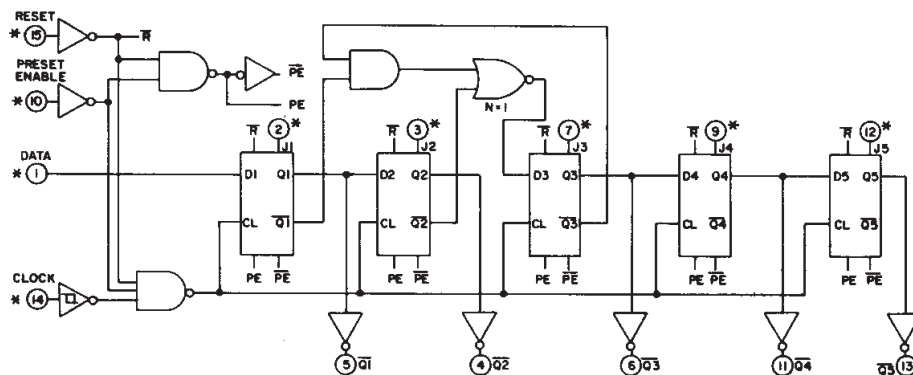


Fig. 1 — Logic diagram.

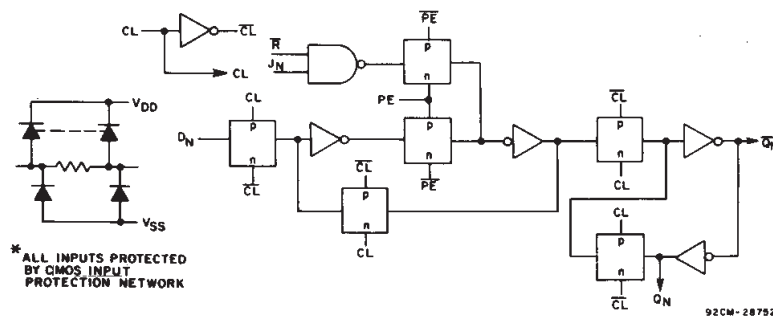


Fig. 2 — Detail of a typical stage.

CD4018B Types

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

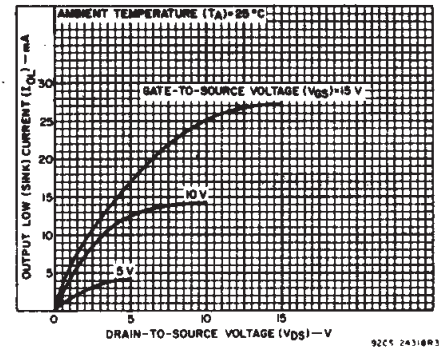


Fig. 3 - Typical output low (sink) current characteristics.

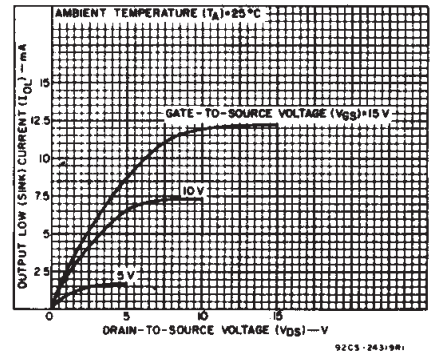


Fig. 4 - Minimum output low (sink) current characteristics.

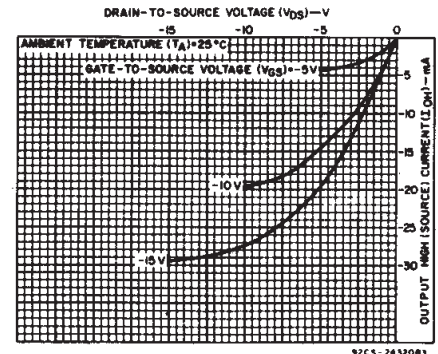


Fig. 5 - Typical output high (source) current characteristics.

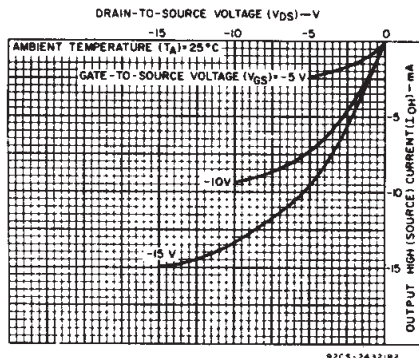


Fig. 6 - Minimum output high (source) current characteristics.

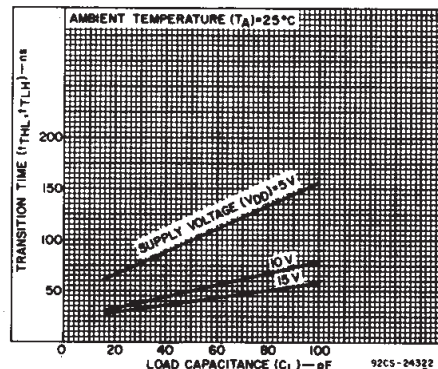


Fig. 7 - Typical transition time as a function of load capacitance.

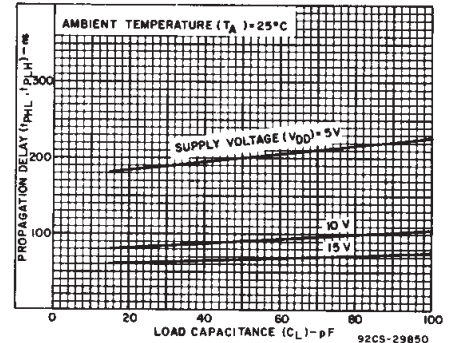


Fig. 8 - Typical propagation delay time as a function of load capacitance (CLOCK to Q).

CD4018B Types

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				
		15				
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 Q̄ 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.

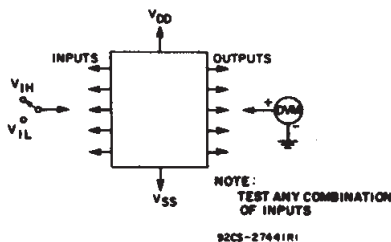


Fig. 12 - Input voltage test circuit.

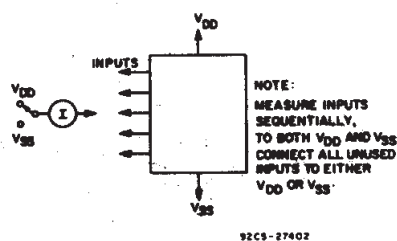


Fig. 13 - Input current test circuit.

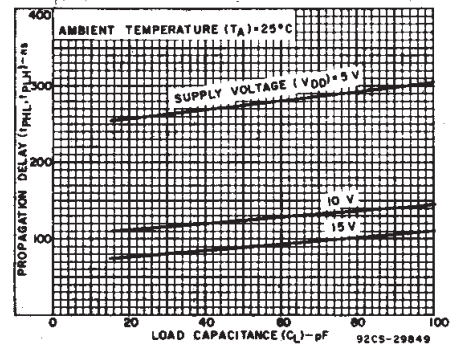


Fig. 9 - Typical propagation delay time as a function of load capacitance (RESET to Q).

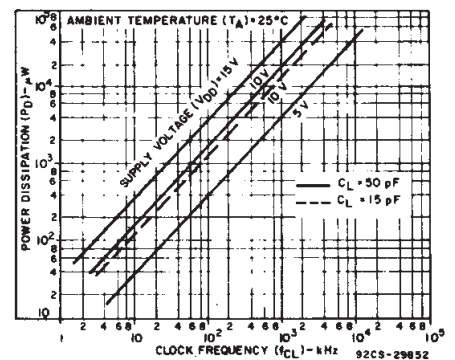


Fig. 10 - Typical dynamic power dissipation as a function of clock input frequency.

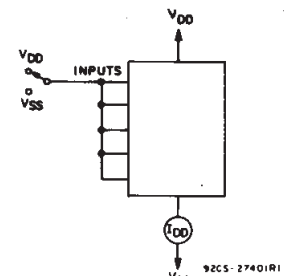


Fig. 11 - Quiescent device current test circuit.

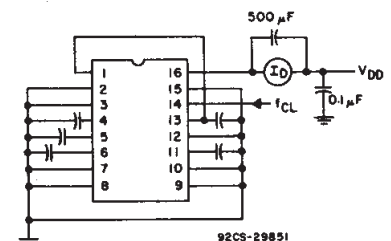


Fig. 14 - Dynamic power dissipation test circuit.

CD4018B Types

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

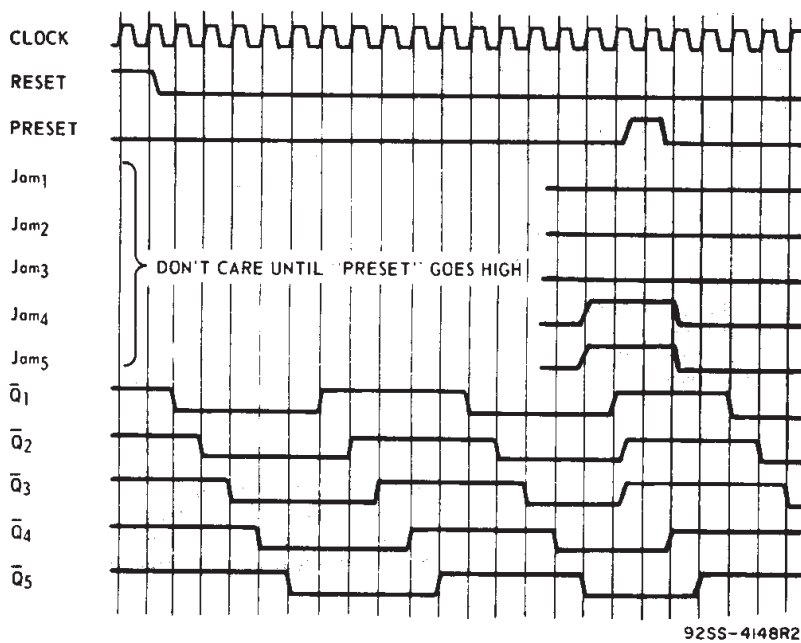
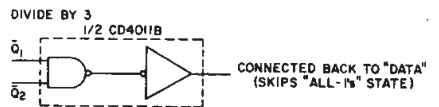
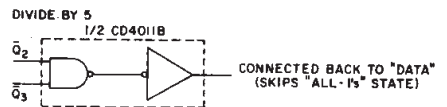
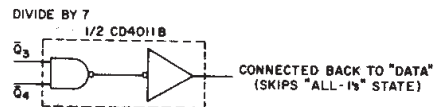
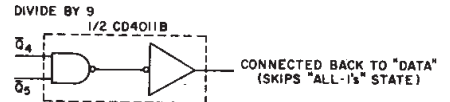


Fig. 15 — Timing diagram.

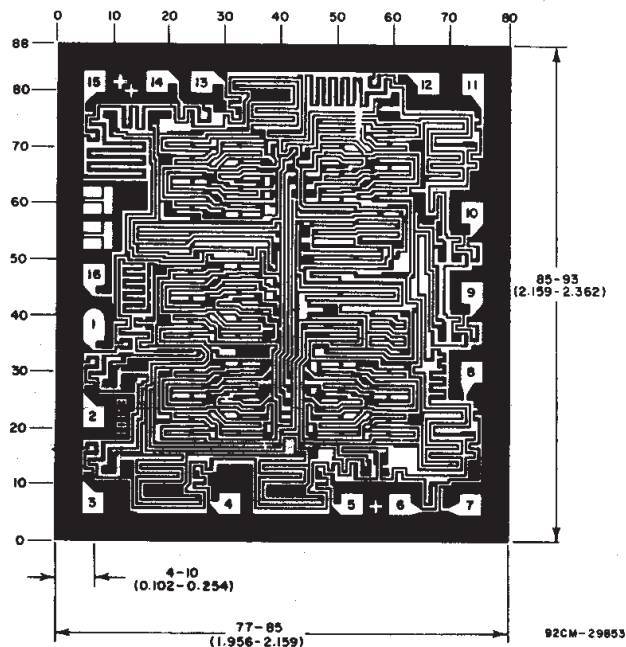
EXTERNAL CONNECTIONS FOR DIVIDE BY 10, 9, 8, 7, 6, 5, 4, 3 OPERATION

DIVIDE BY 10	$\bar{Q}_5$	CONNECTED BACK TO "DATA" NO EXTERNAL COMPONENTS REQUIRED
DIVIDE BY 8	$\bar{Q}_4$	
DIVIDE BY 6	$\bar{Q}_3$	
DIVIDE BY 4	$\bar{Q}_2$	
DIVIDE BY 2	$\bar{Q}_1$	



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).

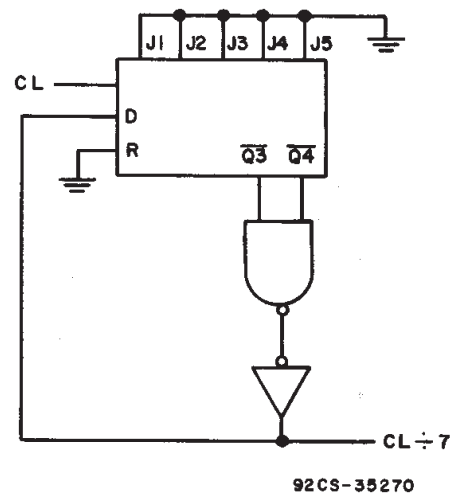


Fig. 17 — Example of divide by 7.

3

COMMERCIAL CMOS
HIGH VOLTAGE ICs

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