

Presetable Divide-By-N Counter

The MC14018B contains five Johnson counter stages which are asynchronously presetable and resettable. The counters are synchronous, and increment on the positive going edge of the clock.

Presetting is accomplished by a logic 1 on the preset enable input. Data on the Jam inputs will then be transferred to their respective $\bar{Q}$ outputs (inverted). A logic 1 on the reset input will cause all $\bar{Q}$ outputs to go to a logic 1 state.

Division by any number from 2 to 10 can be accomplished by connecting appropriate $\bar{Q}$ outputs to the data input, as shown in the Function Selection table. Anti-lock gating is included in the MC14018B to assure proper counting sequence.

- Fully Static Operation
- Schmitt Trigger on Clock Input
- Capable of Driving Two Low-power TTL Loads or One Low-power Schottky TTL Load Over the Rated Temperature Range
- Pin-for-Pin Replacement for CD4018B

MAXIMUM RATINGS* (Voltages Referenced to V_{SS})

Symbol	Parameter	Value	Unit
V_{DD}	DC Supply Voltage	- 0.5 to + 18.0	V
V_{in}, V_{out}	Input or Output Voltage (DC or Transient)	- 0.5 to $V_{DD} + 0.5$	V
I_{in}, I_{out}	Input or Output Current (DC or Transient), per Pin	± 10	mA
P_D	Power Dissipation, per Package†	500	mW
T_{stg}	Storage Temperature	- 65 to + 150	°C
T_L	Lead Temperature (8-Second Soldering)	260	°C

* Maximum Ratings are those values beyond which damage to the device may occur.

† Temperature Derating:

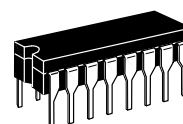
Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

Ceramic "L" Packages: - 12 mW/°C From 100°C To 125°C

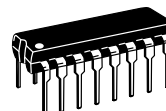
This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.

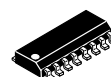
MC14018B



L SUFFIX
CERAMIC
CASE 620



P SUFFIX
PLASTIC
CASE 648



D SUFFIX
SOIC
CASE 751B

ORDERING INFORMATION

MC14XXXBCP Plastic
MC14XXXBCL Ceramic
MC14XXXBD SOIC

$T_A = -55^\circ$ to 125°C for all packages.

FUNCTIONAL TRUTH TABLE

Clock	Reset	Preset Enable	Jam Input	$\bar{Q}_n$
	0	0	X	$\bar{Q}_n$
	0	0	X	$\bar{D}_n^*$
X	0	1	0	1
X	0	1	1	0
X	1	X	X	1

* $\bar{D}_n$ is the Data input for that stage. Stage 1 has Data brought out to Pin 1.

PIN ASSIGNMENT

D_{in}	1	16	V_{DD}
JAM 1	2	15	R
JAM 2	3	14	C
$\bar{Q}_2$	4	13	$\bar{Q}_5$
$\bar{Q}_1$	5	12	JAM 5
$\bar{Q}_3$	6	11	$\bar{Q}_4$
JAM 3	7	10	PE
V_{SS}	8	9	JAM 4

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	V _{DD} Vdc	– 55°C		25°C			125°C		Unit
			Min	Max	Min	Typ #	Max	Min	Max	
Output Voltage V _{in} = V _{DD} or 0 V _{in} = 0 or V _{DD}	V _{OL}	5.0	—	0.05	—	0	0.05	—	0.05	Vdc
		10	—	0.05	—	0	0.05	—	0.05	
		15	—	0.05	—	0	0.05	—	0.05	
	V _{OH}	5.0	4.95	—	4.95	5.0	—	4.95	—	Vdc
		10	9.95	—	9.95	10	—	9.95	—	
		15	14.95	—	14.95	15	—	14.95	—	
Input Voltage V _O = 4.5 or 0.5 Vdc V _O = 9.0 or 1.0 Vdc V _O = 13.5 or 1.5 Vdc V _O = 0.5 or 4.5 Vdc V _O = 1.0 or 9.0 Vdc V _O = 1.5 or 13.5 Vdc	V _{IL}	5.0	—	1.5	—	2.25	1.5	—	1.5	Vdc
		10	—	3.0	—	4.50	3.0	—	3.0	
		15	—	4.0	—	6.75	4.0	—	4.0	
	V _{IH}	5.0	3.5	—	3.5	2.75	—	3.5	—	Vdc
		10	7.0	—	7.0	5.50	—	7.0	—	
		15	11	—	11	8.25	—	11	—	
Output Drive Current V _{OH} = 2.5 Vdc V _{OH} = 4.6 Vdc V _{OH} = 9.5 Vdc V _{OH} = 13.5 Vdc V _{OL} = 0.4 Vdc V _{OL} = 0.5 Vdc V _{OL} = 1.5 Vdc	Source I _{OH}	5.0	– 3.0	—	– 2.4	– 4.2	—	– 1.7	—	mAdc
		5.0	– 0.64	—	– 0.51	– 0.88	—	– 0.36	—	
		10	– 1.6	—	– 1.3	– 2.25	—	– 0.9	—	
		15	– 4.2	—	– 3.4	– 8.8	—	– 2.4	—	
	Sink I _{OL}	5.0	0.64	—	0.51	0.88	—	0.36	—	mAdc
		10	1.6	—	1.3	2.25	—	0.9	—	
		15	4.2	—	3.4	8.8	—	2.4	—	
Input Current	I _{in}	15	—	± 0.1	—	± 0.00001	± 0.1	—	± 1.0	μAdc
Input Capacitance (V _{in} = 0)	C _{in}	—	—	—	—	5.0	7.5	—	—	pF
Quiescent Current (Per Package)	I _{DD}	5.0	—	5.0	—	0.005	5.0	—	150	μAdc
		10	—	10	—	0.010	10	—	300	
		15	—	20	—	0.015	20	—	600	
Total Supply Current**† (Dynamic plus Quiescent, Per Package) (C _L = 50 pF on all outputs, all buffers switching)	I _T	5.0 10 15	I _T = (0.3 μA/kHz) f + I _{DD} I _T = (0.7 μA/kHz) f + I _{DD} I _T = (1.0 μA/kHz) f + I _{DD}							μAdc

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

**The formulas given are for the typical characteristics only at 25°C.

†To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) V f k$$

where: I_T is in μA (per package), C_L in pF, V = (V_{DD} – V_{SS}) in volts, f in kHz is input frequency, and k = 0.001.

SWITCHING CHARACTERISTICS* ($C_L = 50 \text{ pF}$, $T_A = 25^\circ\text{C}$)

Characteristic	Symbol	V_{DD} Vdc	All Types			Unit
			Min	Typ #	Max	
Output Rise and Fall Time $t_{TLH}, t_{THL} = (1.35 \text{ ns/pF}) C_L + 32 \text{ ns}$ $t_{TLH}, t_{THL} = (0.6 \text{ ns/pF}) C_L + 20 \text{ ns}$ $t_{TLH}, t_{THL} = (0.4 \text{ ns/pF}) C_L + 20 \text{ ns}$	t_{TLH}, t_{THL}	5.0 10 15	— — —	100 50 40	200 100 80	ns
Propagation Delay Time Clock to $\bar{Q}$ $t_{PLH}, t_{PHL} = (0.90 \text{ ns/pF}) C_L + 265 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.36 \text{ ns/pF}) C_L + 102 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.26 \text{ ns/pF}) C_L + 72 \text{ ns}$	t_{PLH}, t_{PHL}	5.0 10 15	— — —	310 120 85	620 240 170	ns
Reset to $\bar{Q}$ $t_{PLH} = (0.90 \text{ ns/pF}) C_L + 325 \text{ ns}$ $t_{PLH} = (0.36 \text{ ns/pF}) C_L + 132 \text{ ns}$ $t_{PLH} = (0.26 \text{ ns/pF}) C_L + 81 \text{ ns}$		5.0 10 15	— — —	370 150 100	740 300 200	ns
Preset Enable to $\bar{Q}$ $t_{PLH}, t_{PHL} = (0.90 \text{ ns/pF}) C_L + 325 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.36 \text{ ns/pF}) C_L + 132 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.26 \text{ ns/pF}) C_L + 81 \text{ ns}$		5.0 10 15	— — —	370 150 100	740 300 200	ns
Setup Time Data (Pin 1) to Clock	t_{su}	5.0 10 15	200 100 80	0 0 0	— — —	ns
Jam Inputs to Preset Enable		5.0 10 15	200 100 80	0 0 0	— — —	ns
Data (Jam Inputs)–to–Preset Enable Hold Time		5.0 10 15	540 500 480	270 250 240	— — —	ns
Clock Pulse Width	t_{WH}	5.0 10 15	400 200 160	200 100 80	— — —	ns
Reset or Preset Enable Pulse Width	t_{WH}	5.0 10 15	290 130 110	145 65 55	— — —	ns
Clock Rise and Fall Time	t_{TLH}, t_{THL}	5.0 10 15	No Limit			ns
Clock Pulse Frequency	f_{cl}	5.0 10 15	— — —	2.5 6.5 8.0	1.25 3.25 4.0	MHz

* The formulas given are for the typical characteristics only at 25°C .

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

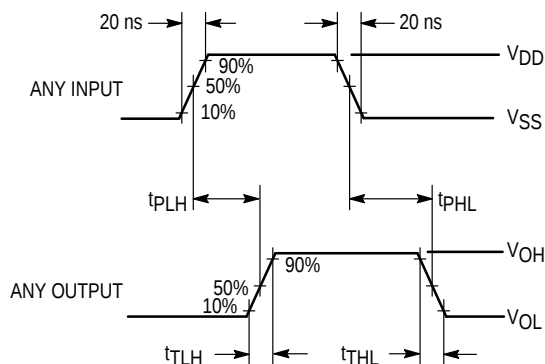
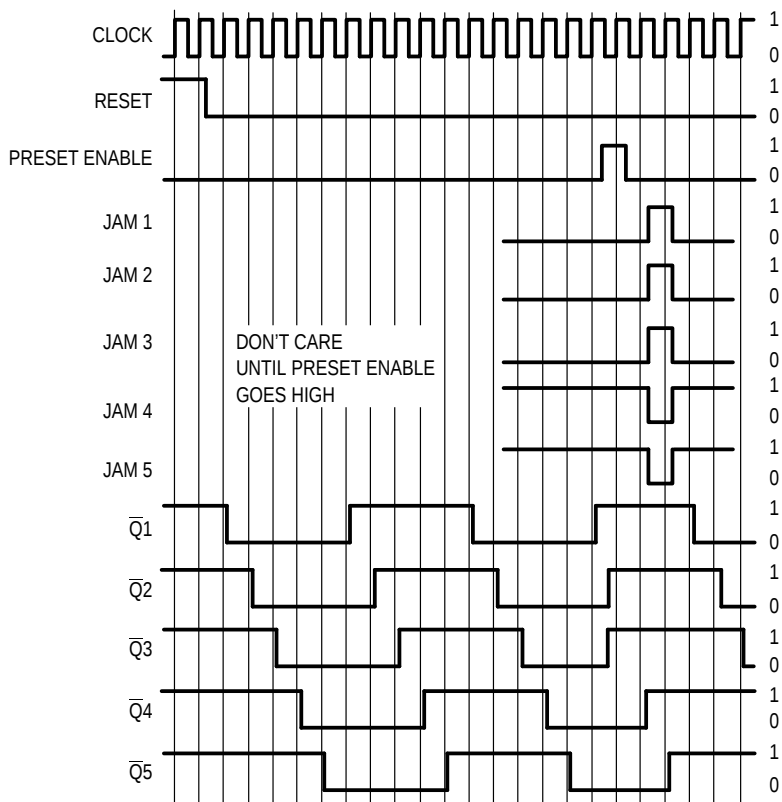


Figure 1. Switching Time Waveforms

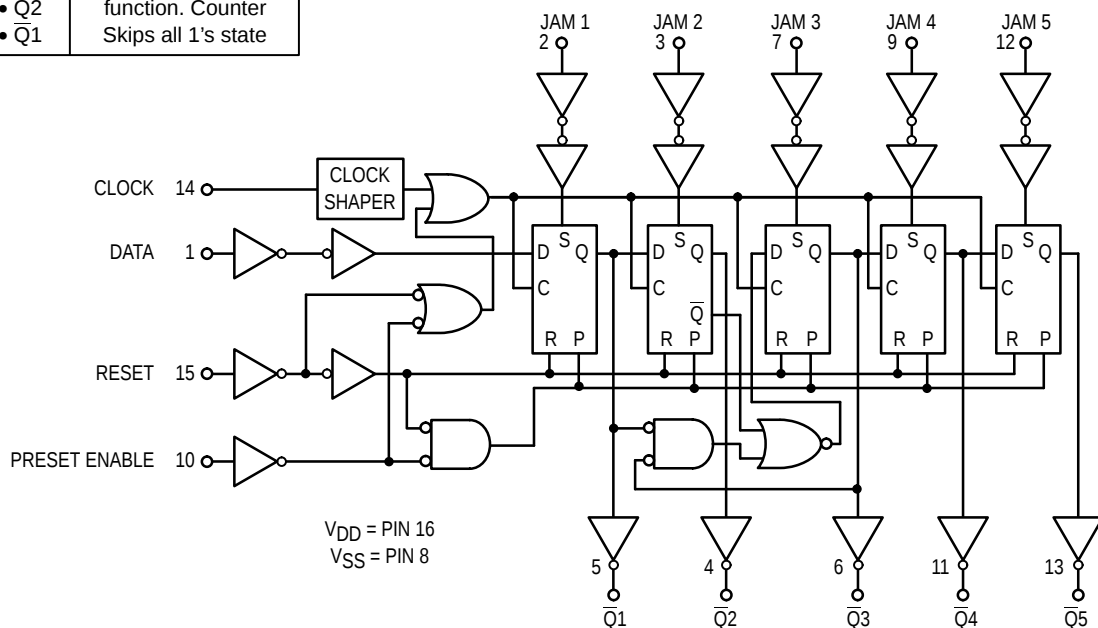
TIMING DIAGRAM
($\overline{Q}5$ Connected to Data Input)



FUNCTION SELECTION

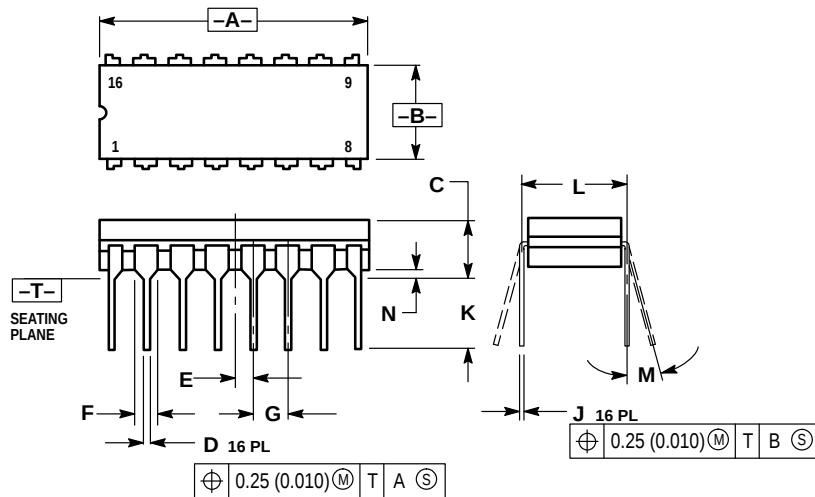
Counter Mode	Connect Data Input (Pin 1) to:	Comments
Divide by 10 Divide by 8 Divide by 6 Divide by 4 Divide by 2	$\overline{Q}5$ $\overline{Q}4$ $\overline{Q}3$ $\overline{Q}2$ $\overline{Q}1$	No external components needed.
Divide by 9 Divide by 7 Divide by 5 Divide by 3	$\overline{Q}5 \cdot \overline{Q}4$ $\overline{Q}4 \cdot \overline{Q}3$ $\overline{Q}3 \cdot \overline{Q}2$ $\overline{Q}2 \cdot \overline{Q}1$	Gate package needed to provide AND function. Counter Skips all 1's state

LOGIC DIAGRAM



OUTLINE DIMENSIONS

L SUFFIX CERAMIC DIP PACKAGE CASE 620-10 ISSUE V

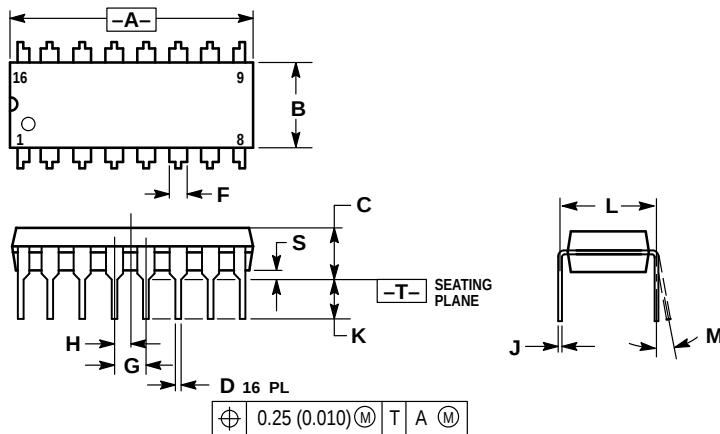


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.750	0.785	19.05	19.93
B	0.240	0.295	6.10	7.49
C	—	0.200	—	5.08
D	0.015	0.020	0.39	0.50
E	0.050	BSC	1.27	BSC
F	0.055	0.065	1.40	1.65
G	0.100	BSC	2.54	BSC
H	0.008	0.015	0.21	0.38
K	0.125	0.170	3.18	4.31
L	0.300	BSC	7.62	BSC
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

P SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R



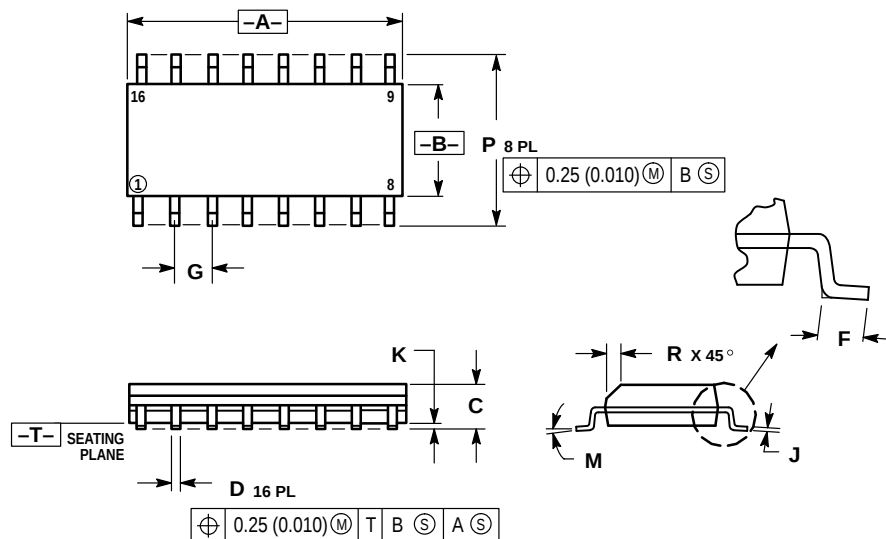
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100	BSC	2.54	BSC
H	0.050	BSC	1.27	BSC
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

OUTLINE DIMENSIONS

D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27	BSC	0.050	BSC
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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MOTOROLA



MC14018B/D

