

# CD54/74HC4538

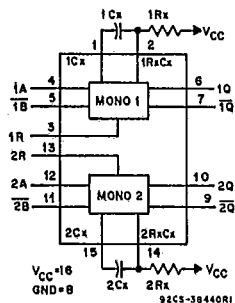
## CD54/74HCT4538

File Number 1671

HARRIS SEMICONDUCTOR

27E D 4302271 0017993 5 HAS

### High-Speed CMOS Logic



FUNCTIONAL DIAGRAM

### Dual Retriggerable Precision Monostable Multivibrator

#### Type Features:

- Retriggerable/resettable capability
- Trigger and Reset propagation delays independent of  $R_x$ ,  $C_x$
- Triggering from the leading or trailing edge
- $Q$  and  $\bar{Q}$  Buffered Outputs available
- Separate Resets
- Wide Range of Output-Pulse Widths
- Schmitt Trigger input on  $A$  and  $\bar{B}$  inputs
- Retrigger Time is independent of  $C_x$

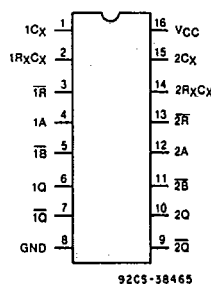
The RCA-CD54/74HC4538 and CD54/74HCT4538 are dual retriggerable/resettable monostable precision multivibrators for fixed voltage timing applications. An external resistor ( $R_x$ ) and an external capacitor ( $C_x$ ) control the timing and the accuracy for the circuit. Adjustment of  $R_x$  and  $C_x$  provides a wide range of output pulse widths from the  $Q$  and  $\bar{Q}$  terminals. The propagation delay from trigger input-to-output transition and the propagation delay from reset input-to-output transition are independent of  $R_x$  and  $C_x$ .

Leading-edge triggering ( $A$ ) and trailing edge triggering ( $\bar{B}$ ) inputs are provided for triggering from either edge of the input pulse. An unused "A" input should be tied to Gnd and an unused  $\bar{B}$  should be tied to  $V_{CC}$ . On power up the IC is reset. Unused resets and sections must be terminated. In normal operation the circuit retriggeres on the application of each new trigger pulse. To operate in the non-retriggerable mode  $\bar{Q}$  is connected to  $\bar{B}$  when leading edge triggering ( $A$ ) is used or  $Q$  is connected to  $A$  when trailing edge triggering ( $\bar{B}$ ) is used. The period ( $\tau$ ) can be calculated from  $\tau = (0.7) R_x C_x$ ;  $R_{min}$  is 5k ohms.  $C_{min}$  is 0 pF.

The CD54HC/HCT4538 are supplied in 16-lead ceramic dual-in-line packages (F suffix). The CD74HC/HCT4538 are supplied in 16-lead dual-in-line plastic packages (E suffix), also in 16-lead dual-in-line surface mount plastic packages (M suffix). The CD54/74HC/HCT4538 are also available in chip form (H suffix).

#### Family Features:

- Fanout (Over Temperature Range):
  - Standard Outputs - 10 LSTTL Loads
  - Bus Driver Outputs - 15 LSTTL Loads
- Wide Operating Temperature Range:
  - CD74HC/HCT: -40 to +85°C
- Balanced Propagation Delay and Transition Times
- Significant Power Reduction Compared to LSTTL Logic ICs
- Alternate Source is Philips/Sigmetics
- CD54HC/CD74HC Types:
  - 2 to 6 V Operation
  - High Noise Immunity:
    - $N_{IL} = 30\%$ ,  $N_{IH} = 30\%$  of  $V_{CC}$ ; @  $V_{CC} = 5 V$
- CD54HCT/CD74HCT Types:
  - 4.5 to 5.5 V Operation
  - Direct LSTTL Input Logic Compatibility
    - $V_{IL} = 0.8 V$  Max.,  $V_{IH} = 2 V$  Min.
  - CMOS Input Compatibility
    - $I_L \leq 1 \mu A$  @  $V_{OL}$ ,  $V_{OH}$



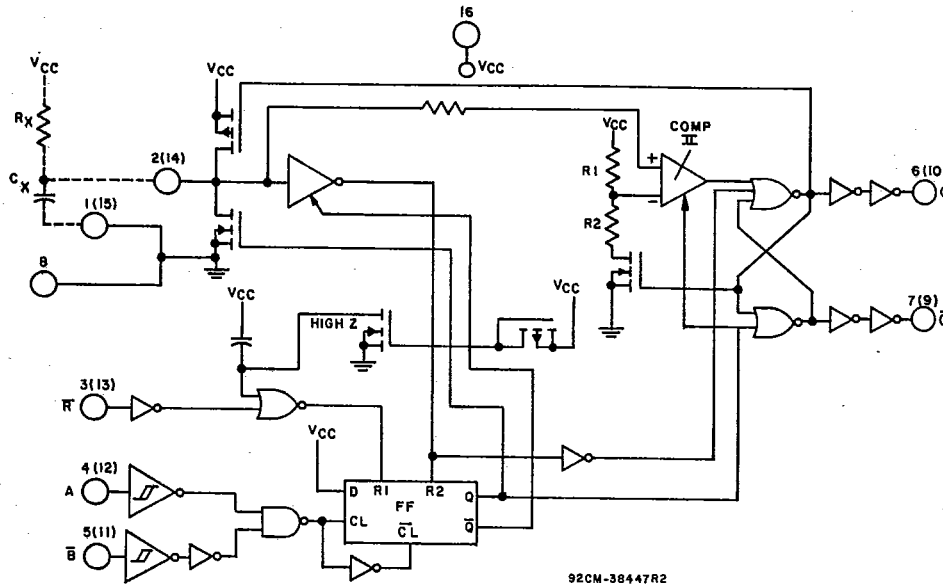
TERMINAL ASSIGNMENT

# CD54/74HC4538

## CD54/74HCT4538

HARRIS SEMICONDUCTOR

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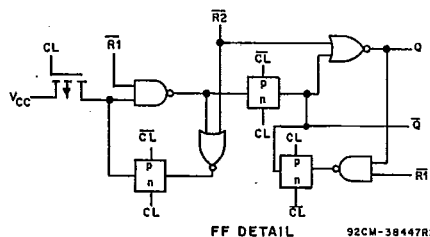
92CM-38447R2

Fig. 1 - Logic diagram (1 mono).

## TRUTH TABLE

| INPUTS |   |   | OUTPUTS |    |
|--------|---|---|---------|----|
| R      | A | B | Q       | Q̄ |
| L      | X | X | L       | H  |
| X      | H | X | L       | H  |
| X      | X | L | L       | H  |
| H      | L | L | L       | H  |
| H      | L | H | L       | H  |

H = High Level  
 L = Low Level  
 ↗ = Transition from Low to High  
 ↘ = Transition from High to Low  
 — = One High Level Pulse  
 — = One Low Level Pulse  
 X = Irrelevant



FF DETAIL

92CM-38447R2

## HC/HCT4538 FUNCTIONAL TERMINAL CONNECTIONS

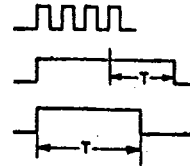
| FUNCTION                                    | Vcc TO TERM. NO.  |                   | Gnd TO TERM. NO.  |                   | INPUT PULSE TO TERM. NO. |                   | OTHER CONNECTIONS |                   |
|---------------------------------------------|-------------------|-------------------|-------------------|-------------------|--------------------------|-------------------|-------------------|-------------------|
|                                             | MONO <sub>1</sub> | MONO <sub>2</sub> | MONO <sub>1</sub> | MONO <sub>2</sub> | MONO <sub>1</sub>        | MONO <sub>2</sub> | MONO <sub>1</sub> | MONO <sub>2</sub> |
| Leading-Edge Trigger/<br>Retriggerable      | 3, 5              | 11, 13            |                   |                   | 4                        | 12                |                   |                   |
| Leading-Edge Trigger/<br>Non-Retriggerable  | 3                 | 13                |                   |                   | 4                        | 12                | 5-7               | 11-9              |
| Trailing-Edge Trigger/<br>Retriggerable     | 3                 | 13                | 4                 | 12                | 5                        | 11                |                   |                   |
| Trailing-Edge Trigger/<br>Non-Retriggerable | 3                 | 13                |                   |                   | 5                        | 11                | 4-6               | 12-10             |

## NOTES:

1. A RETRIGGERABLE ONE-SHOT MULTIVIBRATOR HAS AN OUTPUT PULSE WIDTH WHICH IS EXTENDED ONE FULL TIME PERIOD (T) AFTER APPLICATION OF THE LAST TRIGGER PULSE.
2. A NON-RETRIGGERABLE ONE-SHOT MULTIVIBRATOR HAS A TIME PERIOD (T) REFERENCED FROM THE APPLICATION OF THE FIRST TRIGGER PULSE.

## INPUT PULSE TRAIN

RETRIGGERABLE MODE PULSE WIDTH (A MODE)  
 NON-RETRIGGERABLE MODE PULSE WIDTH (A MODE)



# CD54/74HC4538 CD54/74HCT4538

## MAXIMUM RATINGS, Absolute-Maximum Values:

|                                                                                                             |                                               |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| DC SUPPLY-VOLTAGE, ( $V_{CC}$ ):<br>(Voltages referenced to ground)                                         | -0.5 to +7 V                                  |
| *DC INPUT DIODE CURRENT, $I_{IK}$ (FOR $V_I < -0.5$ V OR $V_I > V_{CC} + 0.5$ V)                            | $\pm 20$ mA                                   |
| DC OUTPUT DIODE CURRENT, $I_{OK}$ (FOR $V_O < -0.5$ V OR $V_O > V_{CC} + 0.5$ V)                            | $\pm 20$ mA                                   |
| DC DRAIN CURRENT, PER OUTPUT ( $I_O$ ) (FOR $-0.5$ V $< V_O < V_{CC} + 0.5$ V)                              | $\pm 25$ mA                                   |
| DC $V_{CC}$ OR GROUND CURRENT ( $I_{CC}$ )                                                                  | $\pm 50$ mA                                   |
| POWER DISSIPATION PER PACKAGE ( $P_D$ ):                                                                    |                                               |
| For $T_A = -40$ to $+60^\circ$ C (PACKAGE TYPE E)                                                           | 500 mW                                        |
| For $T_A = +60$ to $+85^\circ$ C (PACKAGE TYPE E)                                                           | Derate Linearly at 8 mW/ $^\circ$ C to 300 mW |
| For $T_A = -55$ to $+100^\circ$ C (PACKAGE TYPE F, H)                                                       | 500 mW                                        |
| For $T_A = +100$ to $+125^\circ$ C (PACKAGE TYPE F, H)                                                      | Derate Linearly at 8 mW/ $^\circ$ C to 300 mW |
| For $T_A = -40$ to $+70^\circ$ C (PACKAGE TYPE M)                                                           | 400 mW                                        |
| For $T_A = +70$ to $+125^\circ$ C (PACKAGE TYPE M)                                                          | Derate Linearly at 6 mW/ $^\circ$ C to 70 mW  |
| OPERATING-TEMPERATURE RANGE ( $T_A$ ):                                                                      |                                               |
| PACKAGE TYPE F, H                                                                                           | -55 to $+125^\circ$ C                         |
| PACKAGE TYPE E, M                                                                                           | -40 to $+85^\circ$ C                          |
| STORAGE TEMPERATURE ( $T_{stg}$ )                                                                           | -65 to $+150^\circ$ C                         |
| LEAD TEMPERATURE (DURING SOLDERING):                                                                        |                                               |
| At distance $1/16 \pm 1/32$ in. ( $1.59 \pm 0.79$ mm) from case for 10 s max.                               | $+265^\circ$ C                                |
| Unit inserted into a PC Board (min. thickness $1/16$ in., 1.59 mm)<br>with solder contacting lead tips only | $+300^\circ$ C                                |
| *DC INPUT CURRENT FOR $C_X$ $R_X$ PIN = 30 mA                                                               |                                               |

## RECOMMENDED OPERATING CONDITIONS:

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

| CHARACTERISTIC                                                                | LIMITS      |           | UNITS      |
|-------------------------------------------------------------------------------|-------------|-----------|------------|
|                                                                               | MIN.        | MAX.      |            |
| Supply-Voltage Range (For $T_A$ = Full Package-Temperature Range) $V_{CC}$ .* |             |           |            |
| CD54/74HC Types                                                               | 2           | 6         | V          |
| CD54/74HCT Types                                                              | 4.5         | 5.5       | V          |
| DC Input or Output Voltage $V_I$ , $V_O$                                      | 0           | $V_{CC}$  | V          |
| Operating Temperature $T_A$ :                                                 |             |           |            |
| CD74 Types                                                                    | -40         | +85       | $^\circ$ C |
| CD54 Types                                                                    | -55         | +125      | $^\circ$ C |
| Input Rise and Fall Times $t_r$ , $t_f$                                       |             |           |            |
| Reset Input                                                                   |             |           |            |
| at 2 V                                                                        | 0           | 1000      | ns         |
| at 4.5 V                                                                      | 0           | 500       | ns         |
| at 6 V                                                                        | 0           | 400       | ns         |
| Trigger Inputs<br>A or $\bar{B}$                                              |             |           |            |
| at 2 V                                                                        | 0           | Unlimited | ns         |
| at 4.5 V                                                                      | 0           | Unlimited | ns         |
| at 6 V                                                                        | 0           | Unlimited | ns         |
| External Timing Resistor, $R_X$                                               | 5k $\Omega$ | #         |            |
| External Timing Capacitor, $C_X$                                              | 0           | #         |            |

\*Unless otherwise specified, all voltages are referenced to Ground.

#The maximum allowable values of  $R_X$  and  $C_X$  are a function of leakage of capacitor  $C_X$ , the leakage of the HC4538, and leakage due to board layout and surface resistance. Values of  $R_X$  and  $C_X$  should be chosen so that the maximum current into pin 2 or pin 14 is 30 mA. Susceptibility to externally induced noise signals may occur for  $R_X > 1$  M $\Omega$ .

# CD54/74HC4538

## CD54/74HCT4538

### STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                                                                        | CD74HC4538/CD54HC4538 |                      |                      |                |     |       |               |      |                |      | CD74HCT4538/CD54HCT4538                               |                      |                  |     |       |               |      |                |      |    | UNITS |
|-------------------------------------------------------------------------------------------------------|-----------------------|----------------------|----------------------|----------------|-----|-------|---------------|------|----------------|------|-------------------------------------------------------|----------------------|------------------|-----|-------|---------------|------|----------------|------|----|-------|
|                                                                                                       | TEST CONDITIONS       |                      |                      | 74HC/54HC TYPE |     |       | 74HC TYPE     |      | 54HC TYPE      |      | TEST CONDITIONS                                       |                      | 74HCT/54HCT TYPE |     |       | 74HCT TYPE    |      | 54HCT TYPE     |      |    |       |
|                                                                                                       | V <sub>i</sub><br>V   | I <sub>o</sub><br>mA | V <sub>cc</sub><br>V | +25°C          |     |       | -40/<br>+85°C |      | -55/<br>+125°C |      | V <sub>i</sub><br>V                                   | V <sub>cc</sub><br>V | +25°C            |     |       | -40/<br>+85°C |      | -55/<br>+125°C |      |    |       |
|                                                                                                       |                       |                      |                      | Min            | Typ | Max   | Min           | Max  | Min            | Max  |                                                       |                      | Min              | Typ | Max   | Min           | Max  | Min            | Max  |    |       |
| High-Level<br>Input Voltage    V <sub>IH</sub>                                                        |                       |                      | 2                    | 1.5            | —   | —     | 1.5           | —    | 1.5            | —    | —                                                     | 4.5                  | 2                | —   | —     | 2             | —    | 2              | —    | V  |       |
|                                                                                                       |                       |                      | 4.5                  | 3.15           | —   | —     | 3.15          | —    | 3.15           | —    |                                                       | to                   | —                | —   | 0.8   | —             | 0.8  | —              | 0.8  | V  |       |
|                                                                                                       |                       |                      | 6                    | 4.2            | —   | —     | 4.2           | —    | 4.2            | —    |                                                       | 5.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
| Low-Level<br>Input Voltage    V <sub>IL</sub>                                                         |                       |                      | 2                    | —              | —   | 0.5   | —             | 0.5  | —              | 0.5  | —                                                     | 4.5                  | —                | —   | 0.8   | —             | 0.8  | —              | 0.8  | V  |       |
|                                                                                                       |                       |                      | 4.5                  | —              | —   | 1.35  | —             | 1.35 | —              | 1.35 | —                                                     | to                   | —                | —   | —     | —             | —    | —              | —    |    |       |
|                                                                                                       |                       |                      | 6                    | —              | —   | 1.8   | —             | 1.8  | —              | 1.8  | —                                                     | 5.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
| High-Level<br>Output Voltage    V <sub>OH</sub>                                                       | V <sub>IL</sub>       | -0.02                | 2                    | 1.9            | —   | —     | 1.9           | —    | 1.9            | —    | V <sub>IL</sub>                                       | 4.5                  | 4.4              | —   | —     | 4.4           | —    | 4.4            | —    | V  |       |
| CMOS Loads                                                                                            | V <sub>IH</sub>       |                      | 4.5                  | 4.4            | —   | —     | 4.4           | —    | 4.4            | —    | or                                                    | 4.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
|                                                                                                       | V <sub>OH</sub>       |                      | 6                    | 5.9            | —   | —     | 5.9           | —    | 5.9            | —    | V <sub>IH</sub>                                       | 5.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
| TTL Loads                                                                                             | V <sub>IL</sub>       |                      |                      |                |     |       |               |      |                |      | V <sub>IL</sub>                                       | 4.5                  | 3.98             | —   | —     | 3.84          | —    | 3.7            | —    | V  |       |
|                                                                                                       | or                    | -4                   | 4.5                  | 3.98           | —   | —     | 3.84          | —    | 3.7            | —    | or                                                    | 4.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
|                                                                                                       | V <sub>OH</sub>       | -5.2                 | 6                    | 5.48           | —   | —     | 5.34          | —    | 5.2            | —    | V <sub>IH</sub>                                       | 5.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
| Low-Level<br>Output Voltage    V <sub>OL</sub>                                                        | V <sub>IL</sub>       | 0.02                 | 2                    | —              | —   | 0.1   | —             | 0.1  | —              | 0.1  | V <sub>IL</sub>                                       | 4.5                  | —                | —   | 0.1   | —             | 0.1  | —              | 0.1  | V  |       |
| CMOS Loads                                                                                            | V <sub>IH</sub>       |                      | 4.5                  | —              | —   | 0.1   | —             | 0.1  | —              | 0.1  | —                                                     | or                   | 4.5              | —   | —     | —             | —    | —              | —    |    |       |
|                                                                                                       | V <sub>OH</sub>       |                      | 6                    | —              | —   | 0.1   | —             | 0.1  | —              | 0.1  | —                                                     | V <sub>IH</sub>      | 5.5              | —   | —     | —             | —    | —              | —    |    |       |
| TTL Loads                                                                                             | V <sub>IL</sub>       |                      |                      |                |     |       |               |      |                |      | V <sub>IL</sub>                                       | 4.5                  | —                | —   | 0.26  | —             | 0.33 | —              | 0.4  | V  |       |
| Standard Output                                                                                       | V <sub>IH</sub>       | 5.2                  | 6                    | —              | —   | 0.26  | —             | 0.33 | —              | 0.4  | V <sub>IH</sub>                                       | 5.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |
| Input Leakage<br>Current A, B, R    I <sub>L</sub>                                                    | V <sub>cc</sub>       |                      | 6                    | —              | —   | ±0.1  | —             | ±1   | —              | ±1   | Any<br>Voltage<br>Between<br>V <sub>cc</sub><br>& Gnd | 5.5                  | —                | —   | ±0.1  | —             | ±1   | —              | ±1   | μA |       |
| • Input Leakage<br>Current<br>R <sub>X</sub> C <sub>X</sub> I <sub>L</sub>                            | or                    |                      | 6                    | —              | —   | ±0.05 | —             | ±0.5 | —              | ±0.5 |                                                       | 5.5                  | —                | —   | ±0.05 | —             | ±0.5 | —              | ±0.5 | μA |       |
|                                                                                                       | Gnd                   |                      |                      |                |     |       |               |      |                |      |                                                       |                      |                  |     |       |               |      |                |      |    |       |
| Quiescent<br>Device<br>Current            I <sub>cc</sub>                                             | V <sub>cc</sub>       | 0                    | 6                    | —              | —   | 8     | —             | 80   | —              | 160  | V <sub>cc</sub>                                       | 5.5                  | —                | —   | 8     | —             | 80   | —              | 160  | μA |       |
|                                                                                                       | or                    |                      |                      |                |     |       |               |      |                |      |                                                       | or                   | 5.5              | —   | —     | —             | —    | —              | —    |    |       |
| Current            I <sub>cc</sub>                                                                    | Gnd                   |                      |                      |                |     |       |               |      |                |      |                                                       | Gnd                  | 5.5              | —   | —     | —             | —    | —              | —    |    |       |
| Active Device<br>Current<br>Q = High & Pins 2 & 14<br>@ V <sub>cc</sub> /4            I <sub>CC</sub> | V <sub>cc</sub>       | 0                    | 6                    | —              | —   | 0.6   | —             | 0.8  | —              | 1    | V <sub>cc</sub>                                       | 5.5                  | —                | —   | 0.6   | —             | 0.8  | —              | 1    | mA |       |
|                                                                                                       | or                    |                      |                      |                |     |       |               |      |                |      |                                                       | or                   | 5.5              | —   | —     | —             | —    | —              | —    |    |       |
|                                                                                                       | Gnd                   |                      |                      |                |     |       |               |      |                |      |                                                       | Gnd                  | 5.5              | —   | —     | —             | —    | —              | —    |    |       |
| Additional<br>Quiescent<br>Device Current<br>per input pin:<br>1 unit load        ΔI <sub>cc</sub> *  |                       |                      |                      |                |     |       |               |      |                |      | V <sub>cc</sub> -2.1                                  | 4.5                  | —                | 100 | 360   | —             | 450  | —              | 490  | μA |       |
|                                                                                                       |                       |                      |                      |                |     |       |               |      |                |      |                                                       | 5.5                  | —                | —   | —     | —             | —    | —              | —    |    |       |

\* For dual-supply systems theoretical worst case ( $V_i = 2.4$  V,  $V_{cc} = 5.5$  V) specification is 1.8 mA.

• When testing  $I_L$  the Q output must be high. If Q is low (device not triggered) the pull-up P device will be ON and the low resistance path from  $V_{cc}$  to the test pin will cause a current far exceeding the specification.

HCT Input Loading Table

| Input | Unit Loads* |
|-------|-------------|
| All   | 0.5         |

\*Unit Load is  $\Delta I_{cc}$  limit specified in Static Characteristic Chart, e.g., 360 μA max. @ 25°C.

HAS 2 430227J 0017997 27E D HARRIS SEMICONDUCTOR

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CD54/74HCT4538

SWITCHING CHARACTERISTICS ( $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , Input  $t_i = 6\text{ ns}$ )

| CHARACTERISTIC                | $C_L$<br>(pF) | TYPICAL |          | UNITS |
|-------------------------------|---------------|---------|----------|-------|
|                               |               | 54/74HC | 54/74HCT |       |
| Propagation Delay             |               |         |          |       |
| A, $\bar{B}$ to Q             | $t_{PLH}$     | 21      | 23       | ns    |
| A, $\bar{B}$ to $\bar{Q}$     | $t_{PHL}$     | 21      | 23       | ns    |
| $\bar{R}$ to Q                | $t_{PHL}$     | 21      | 17       | ns    |
| $\bar{R}$ to $\bar{Q}$        | $t_{PLH}$     | 21      | 21       | ns    |
| Power Dissipation Capacitance | $C_{PD}^*$    | 136     | 134      | pF    |

\* $C_{PD}$  is used to determine the dynamic power consumption, per one shot.

$P_D = (C_{PD} + O_d) V_{CC}^2 f_i + \Sigma (C_L V_{CC}^2 f_o)$  where:

$f_i$  = input frequency.

$f_o$  = output frequency.

$C_L$  = output load capacitance.

$V_{CC}$  = supply voltage.

assuming  $f_i \ll \frac{1}{T}$

PREREQUISITE FOR SWITCHING FUNCTION

| CHARACTERISTIC                     | SYMBOL                             | V <sub>CC</sub> | LIMITS  |      |      |      |                  |      |       |      |                   |      |       |      | UNITS |
|------------------------------------|------------------------------------|-----------------|---------|------|------|------|------------------|------|-------|------|-------------------|------|-------|------|-------|
|                                    |                                    |                 | 25° C   |      |      |      | -40° C to +85° C |      |       |      | -55° C to +125° C |      |       |      |       |
|                                    |                                    |                 | HC      |      | HCT  |      | 74HC             |      | 74HCT |      | 54HC              |      | 54HCT |      |       |
|                                    |                                    |                 | Min.    | Max. | Min. | Max. | Min.             | Max. | Min.  | Max. | Min.              | Max. | Min.  | Max. |       |
| Input Pulse Widths<br>A, $\bar{B}$ | t <sub>WH</sub><br>t <sub>WL</sub> | 2               | 80      | —    | —    | —    | 100              | —    | —     | —    | 120               | —    | —     | —    | ns    |
|                                    |                                    | 4.5             | 16      | —    | 16   | —    | 20               | —    | 20    | —    | 24                | —    | 24    | —    |       |
|                                    |                                    | 6               | 14      | —    | —    | —    | 17               | —    | —     | —    | 20                | —    | —     | —    |       |
| $\bar{R}$                          | t <sub>WL</sub>                    | 2               | 80      | —    | —    | —    | 100              | —    | —     | —    | 120               | —    | —     | —    | ns    |
|                                    |                                    | 4.5             | 16      | —    | 20   | —    | 20               | —    | 25    | —    | 24                | —    | 30    | —    |       |
|                                    |                                    | 6               | 14      | —    | —    | —    | 17               | —    | —     | —    | 20                | —    | —     | —    |       |
| Reset Recovery<br>Time             | t <sub>REC</sub>                   | 2               | 5       | —    | —    | —    | 5                | —    | —     | —    | 5                 | —    | —     | —    | ns    |
|                                    |                                    | 4.5             | 5       | —    | 5    | —    | 5                | —    | 5     | —    | 5                 | —    | 5     | —    |       |
|                                    |                                    | 6               | 5       | —    | —    | —    | 5                | —    | —     | —    | 5                 | —    | —     | —    |       |
| Retrigger Time<br>(See Fig. 5)     | t <sub>rr</sub>                    | 5               | Typical |      |      |      |                  |      |       |      |                   |      |       | ns   |       |
|                                    |                                    |                 | 175     |      |      |      |                  |      |       |      |                   |      |       |      |       |

# CD54/74HC4538 CD54/74HCT4538

SWITCHING CHARACTERISTICS ( $C_L = 50$  pF, Input  $t_r, t_f = 6$  ns)

| CHARACTERISTIC                                                       | SYMBOL                               | V <sub>CC</sub> | 25°C     |      |      |      | -40°C to +85°C |       |       |       | -55°C to +125°C |       |       |       | UNITS |
|----------------------------------------------------------------------|--------------------------------------|-----------------|----------|------|------|------|----------------|-------|-------|-------|-----------------|-------|-------|-------|-------|
|                                                                      |                                      |                 | HC       |      | HCT  |      | 74HC           |       | 74HCT |       | 54HC            |       | 54HCT |       |       |
|                                                                      |                                      |                 | Min.     | Max. | Min. | Max. | Min.           | Max.  | Min.  | Max.  | Min.            | Max.  | Min.  | Max.  |       |
| Propagation Delay,<br>A, B̄ to Q                                     | t <sub>PLH</sub>                     | 2               | —        | 250  | —    | —    | —              | 315   | —     | —     | —               | 375   | —     | —     | ns    |
|                                                                      |                                      | 4.5             | —        | 50   | —    | 55   | —              | 63    | —     | 69    | —               | 75    | —     | 83    |       |
|                                                                      |                                      | 6               | —        | 43   | —    | —    | —              | 54    | —     | —     | —               | 64    | —     | —     |       |
| A, B̄ to Q̄                                                          | t <sub>PHL</sub>                     | 2               | —        | 250  | —    | —    | —              | 315   | —     | —     | —               | 375   | —     | —     | ns    |
|                                                                      |                                      | 4.5             | —        | 50   | —    | 55   | —              | 63    | —     | 69    | —               | 75    | —     | 83    |       |
|                                                                      |                                      | 6               | —        | 43   | —    | —    | —              | 54    | —     | —     | —               | 64    | —     | —     |       |
| R̄ to Q                                                              | t <sub>PHL</sub>                     | 2               | —        | 250  | —    | —    | —              | 315   | —     | —     | —               | 375   | —     | —     | ns    |
|                                                                      |                                      | 4.5             | —        | 50   | —    | 40   | —              | 63    | —     | 50    | —               | 75    | —     | 60    |       |
|                                                                      |                                      | 6               | —        | 43   | —    | —    | —              | 54    | —     | —     | —               | 64    | —     | —     |       |
| R̄ to Q̄                                                             | t <sub>PLH</sub>                     | 2               | —        | 250  | —    | —    | —              | 315   | —     | —     | —               | 375   | —     | —     | ns    |
|                                                                      |                                      | 4.5             | —        | 50   | —    | 50   | —              | 63    | —     | 63    | —               | 75    | —     | 75    |       |
|                                                                      |                                      | 6               | —        | 43   | —    | —    | —              | 54    | —     | —     | —               | 64    | —     | —     |       |
| Output<br>Transition Time                                            | t <sub>TLH</sub><br>t <sub>THL</sub> | 2               | —        | 75   | —    | —    | —              | 95    | —     | —     | —               | 110   | —     | —     | ns    |
|                                                                      |                                      | 4.5             | —        | 15   | —    | 15   | —              | 19    | —     | 19    | —               | 22    | —     | 22    |       |
|                                                                      |                                      | 6               | —        | 13   | —    | —    | —              | 16    | —     | —     | —               | 19    | —     | —     |       |
| Output Pulse<br>Width<br>R <sub>X</sub> =10Ω, C <sub>X</sub> =0.1 μF | τ                                    | 3               | 0.64     | 0.78 | —    | —    | 0.612          | 0.812 | —     | —     | 0.605           | 0.819 | —     | —     | ms    |
|                                                                      |                                      | 5               | 0.63     | 0.77 | 0.63 | 0.77 | 0.602          | 0.798 | 0.602 | 0.798 | 0.595           | 0.805 | 0.595 | 0.805 |       |
| Output Pulse Width<br>Match, Same Pkg.                               |                                      |                 | Typ ± 1% |      |      |      |                |       |       |       |                 |       |       |       |       |
| Input Capacitance                                                    | C <sub>i</sub>                       |                 | —        | 10   | —    | 10   | —              | 10    | —     | 10    | —               | 10    | —     | 10    | pF    |

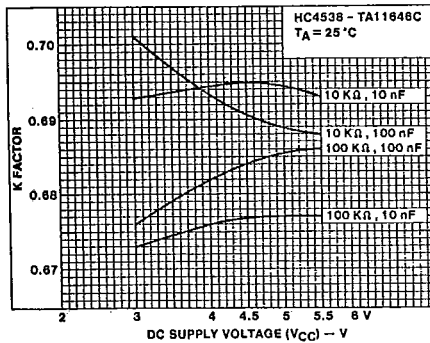


Fig. 2 - K Factor Vs DC Supply Voltage ( $V_{CC}$ )-V.

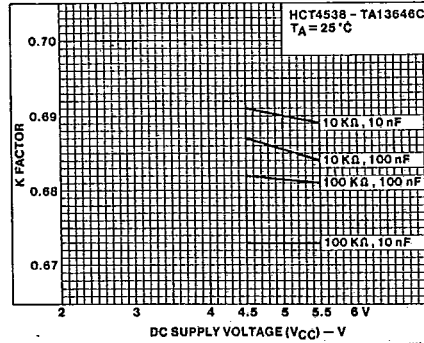


Fig. 3 - K Factor Vs DC Supply Voltage ( $V_{CC}$ )-V.

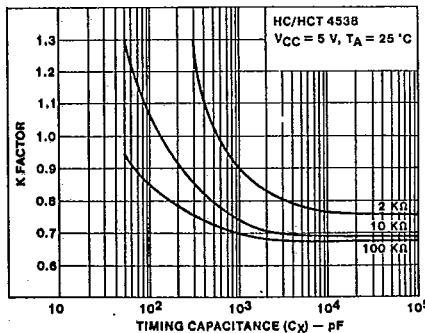


Fig. 4 - K Factor Vs  $C_x$ .

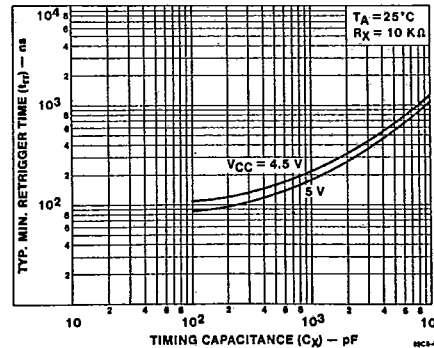
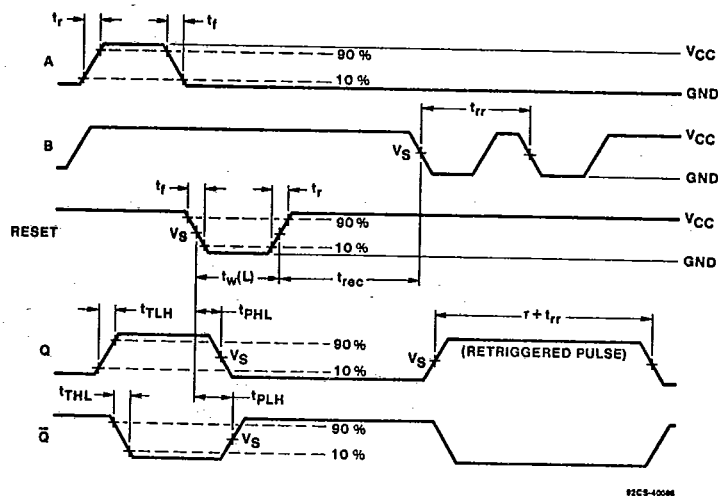
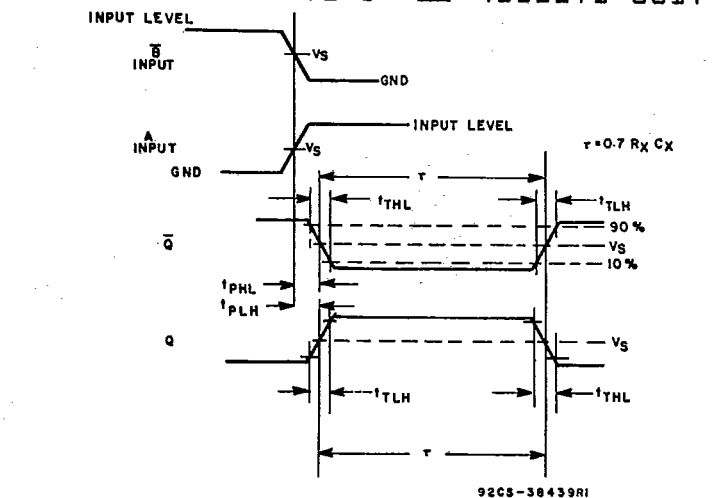


Fig. 5 - Minimum Retrigger Time Vs Timing Capacitance.

**CD54/74HC4538**  
**CD54/74HCT4538**

HARRIS SEMICONDUCTOR

27E D 4302271 0017999 6 HAS



|                          | 54/74HC      | 54/74HCT     |
|--------------------------|--------------|--------------|
| Input Level              | $V_{CC}$     | $\approx 3V$ |
| Switching Voltage, $V_S$ | 50% $V_{CC}$ | 1.3 V        |

Fig. 6 — Switching Waveforms

# CD54/74HC4538

## CD54/74HCT4538

HARRIS SEMICONDUCTOR

27E D ■ 4302271 0018000 7 ■ HAS

### Power-Down Mode

During a rapid power-down condition, as would occur with a power-supply short circuit or with a poorly filtered power supply, the energy stored in  $C_X$  could discharge into Pin 2 or 14. To avoid possible device damage in this mode, when  $C_X$  is  $\geq 0.5$  microfarad, a protection diode with a 1-ampere or higher rating (1N5395 or equivalent) and a separate ground return for  $C_X$  should be provided as shown in Fig. 7.

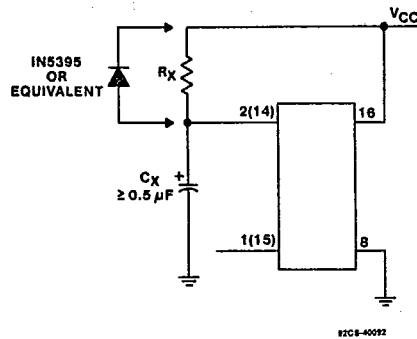


Fig. 7 — Rapid power-down protection circuit.

An alternate protection method is shown in Fig. 8, where a 51-ohm current-limiting resistor is inserted in series with  $C_X$ . Note that a small pulse width decrease will occur however, and  $R_X$  must be appropriately increased to obtain the originally desired pulse width.

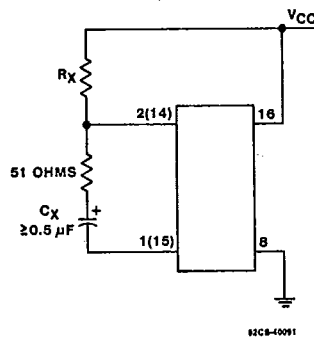


Fig. 8 — Alternate rapid power-down protection circuit.