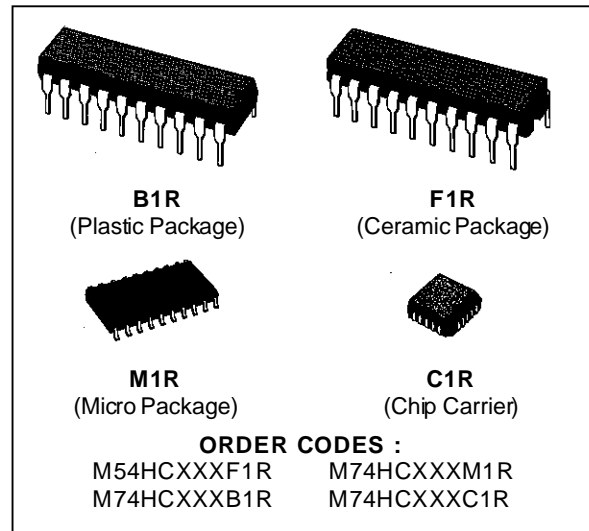


HC690/692 DECADE COUNTER/REGISTER (3-STATE) HC691/693 4 BIT BINARY COUNTER/REGISTER (3-STATE)

- HIGH SPEED
 $f_{MAX} = 50 \text{ MHz (TYP.) at } V_{CC} = 5 \text{ V}$
- LOW POWER DISSIPATION
 $I_{CC} = 4 \mu\text{A (MAX.) at } T_A = 25 \text{ }^\circ\text{C}$
- HIGH NOISE IMMUNITY
 $V_{NIH} = V_{NIL} = 28 \% V_{CC} \text{ (MIN.)}$
- OUTPUT DRIVE CAPABILITY
 15 LSTTL LOADS (for Q_A to Q_D)
 10 LSTTL LOADS (for RCO)
- SYMMETRICAL OUTPUT IMPEDANCE
 $|I_{OH}| = I_{OL} = 6 \text{ mA (MIN.) (for } Q_A \text{ to } Q_D)$
 $|I_{OH}| = I_{OL} = 4 \text{ mA (MIN.) (for RCO)}$
- BALANCED PROPAGATION DELAYS
 $t_{PLH} = t_{PHL}$
- WIDE OPERATING VOLTAGE RANGE
 $V_{CC} \text{ (OPR)} = 2 \text{ V to } 6 \text{ V}$
- PIN AND FUNCTION COMPATIBLE
 WITH LSTTL 54/74LS690/691



DESCRIPTION

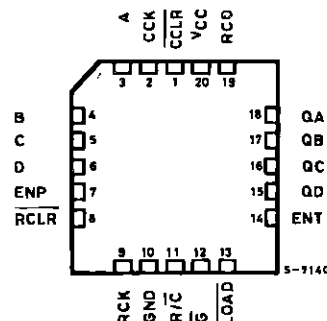
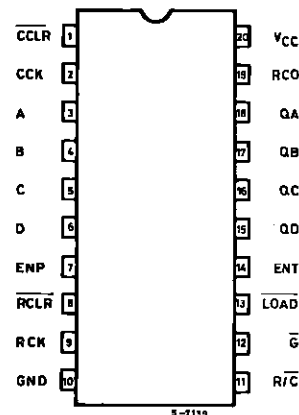
The HC690/691/692/693 are high speed CMOS COUNTER/REGISTER fabricated in silicon gate C²MOS technology.

They have the same high speed performance of LSTTL combined with true CMOS low power consumption.

The internal circuit is composed of 3 stages including buffer output, which offers high noise immunity and stable output. These devices incorporate a synchronous counter, four-bit D-type register, and quadruple two-line to one-line multiplexers with three-state outputs in a single 20-pin package. The counter can be programmed from the data inputs and have enable P and enable T inputs and a ripple-carry output for easy expansion. The register/counter select input, R/\bar{C} , selects the counter when low or the register when high for the three-state outputs, Q_A , Q_B , Q_C , and Q_D .

If the LOAD input ($\overline{\text{LOAD}}$) is held "L" DATA input (A-D) are loaded in to the internal counter at positive edge of counter clock input ($\overline{\text{CCK}}$). In the counter mode, internal counter counts up at the positive of the counter clock. If the counter clear input ($\overline{\text{CCLR}}$) is held "L", the internal counter is cleared (synchronously to the counter clock for HC692/HC693, and asynchronously for HC690/HC691). The internal

PIN CONNECTIONS (top view)

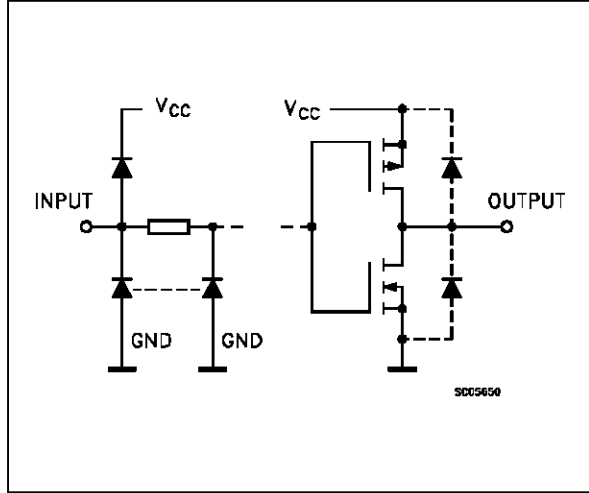


M54/M74HC690/691/692/693

counter's outputs are stored in the output register at the positive edge of the register clock (RCK). If the register clear input (RCLR) is held "L" the register is cleared (synchronously to register clock for

HC692/HC693 and asynchronously for HC690/HC691). All inputs are equipped with protection circuits against static discharge and transient excess voltage.

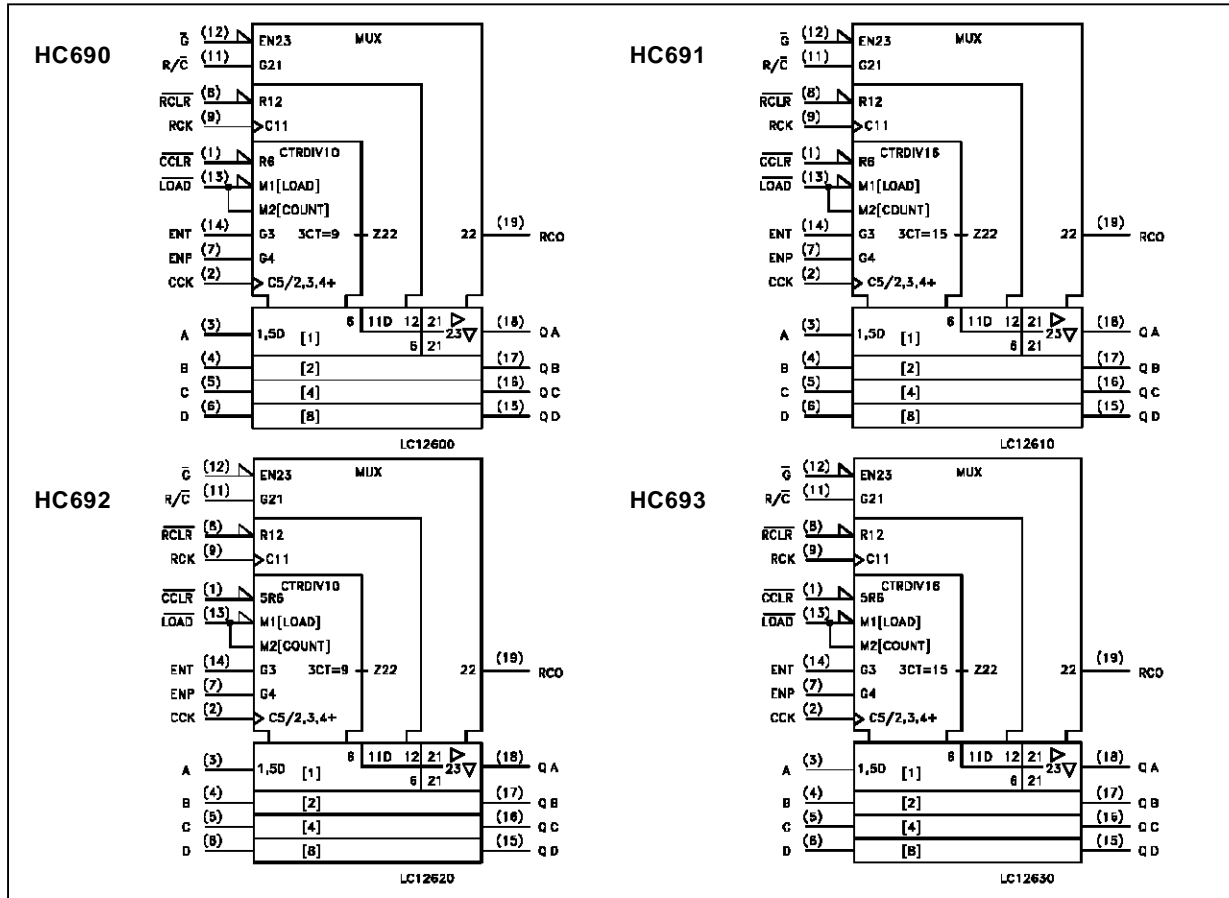
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

| PIN No | SYMBOL | NAME AND FUNCTION |
|----------|--------------------------|-----------------------------|
| 3 to 6 | A to D | Data Inputs |
| 7, 14 | ENT, ENP | Enable Inputs |
| 15 to 18 | QA to QD | Data Outputs |
| 1 | $\overline{\text{CCLR}}$ | Counter Clear (Active LOW) |
| 2 | CCK | Counter Clock |
| 11 | R/C | Counter/ Register Select |
| 8 | $\overline{\text{RCLR}}$ | Register Clear (Active LOW) |
| 9 | RCK | Register Clock |
| 19 | RCO | Ripple Counter Output |
| 10 | GND | Ground (0V) |
| 20 | V _{CC} | Positive Supply Voltage |

IEC LOGIC SYMBOLS



TRUTH TABLE

| INPUTS | | | | | | | | | OUTPUTS | | | | FUNCTION |
|--------|------|-----|-----|-----|------|-----|-----|---|-----------|----|----|----|----------------|
| CCLR | LOAD | ENP | ENT | CCK | RCLR | RCK | R/C | G | QA | QB | QC | QD | |
| X | X | X | X | X | X | X | X | X | Z | Z | Z | Z | HIGH IMPEDANCE |
| L | X | X | X | (*) | X | X | L | L | L | L | L | L | CLEAR COUNTER |
| H | L | X | X | ┐ | X | X | L | L | a | b | c | d | LOAD COUNTER |
| H | H | L | X | ┐ | X | X | L | L | NO CHANGE | | | | NO COUNT |
| H | H | X | L | ┐ | X | X | L | L | NO CHANGE | | | | NO COUNT |
| H | H | H | H | ┐ | X | X | L | L | COUNT UP | | | | COUNT UP |
| H | X | X | X | └ | X | X | L | L | NO CHANGE | | | | NO COUNT |
| X | X | X | X | X | L | (*) | H | L | L | L | L | L | CLEAR REGISTER |
| X | X | X | X | X | H | ┐ | H | L | a' | b' | c' | d' | LOAD REGISTER |
| X | X | X | X | X | H | └ | H | L | NO CHANGE | | | | NO LOAD |

(*): X for HC690/691 ┐ for HC692/693

X: DON'T CARE

Z: HIGH IMPEDANCE

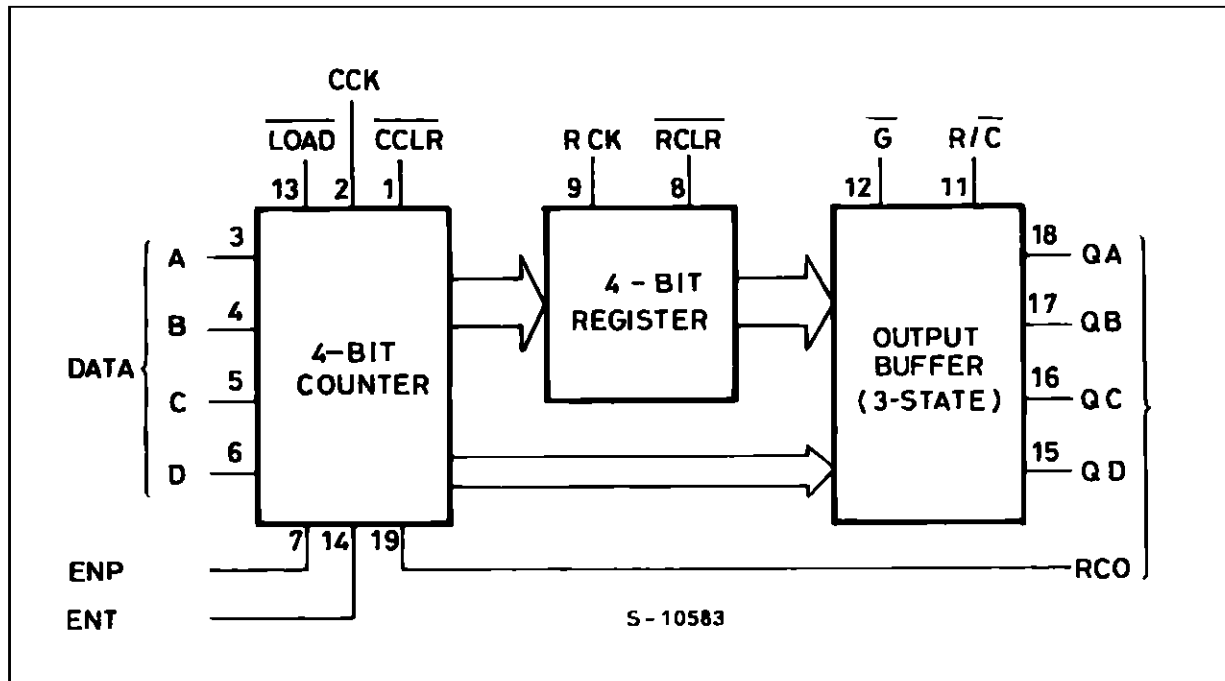
a-d: THE LEVEL OF STEADY STATE INPUTS AT INPUTS A THROUGH D RESPECTIVELY.

a'-d': THE LEVEL OF STEADY STATE OUTPUTS AT INTERNAL COUNTER OUTPUTS a' through qd' respectively

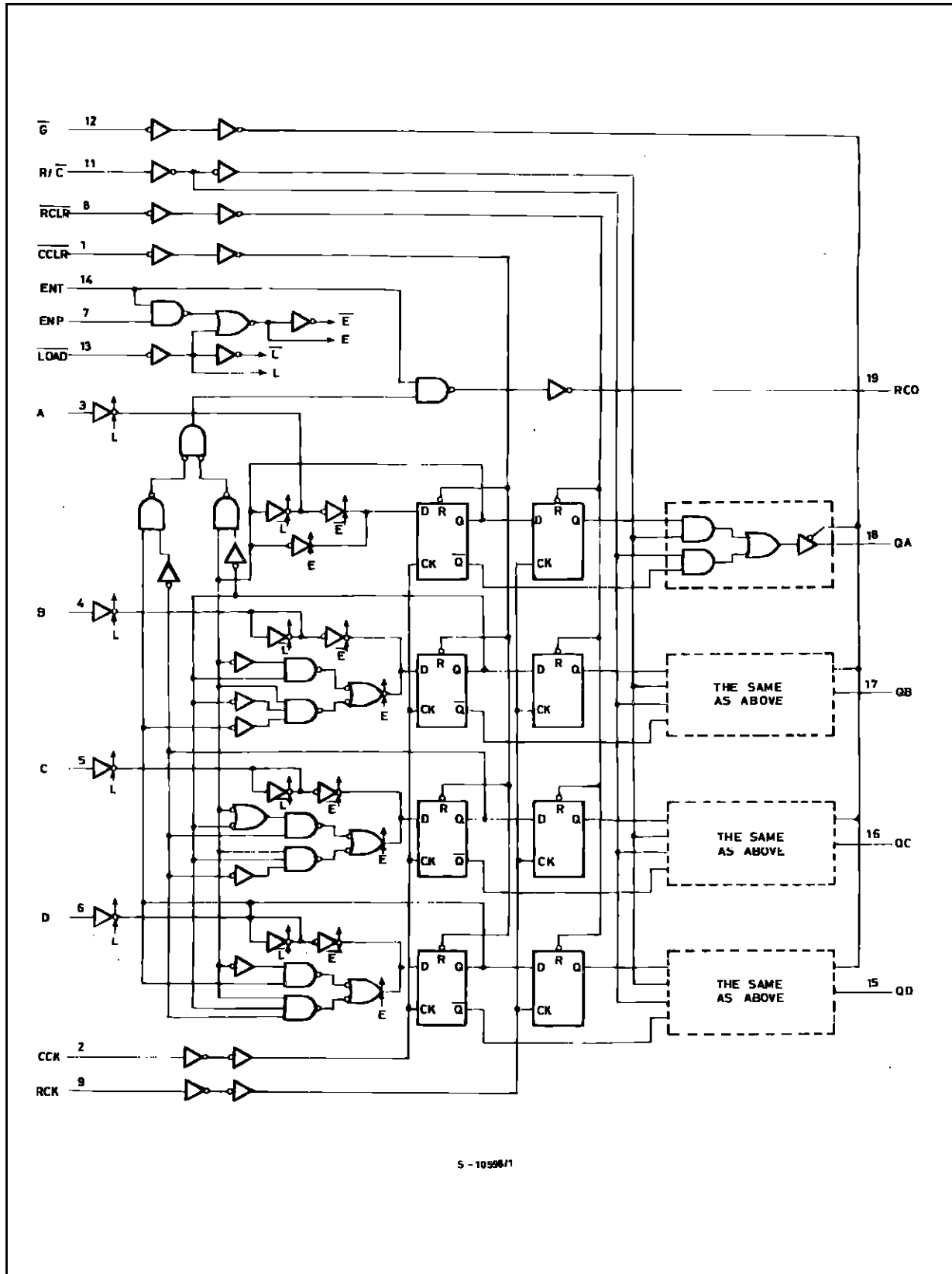
HC690/692 $RCO = QA \cdot QD \cdot ENT$

HC691/693 $RCO = QA \cdot QB \cdot QC \cdot QD \cdot ENT$

BLOCK DIAGRAM

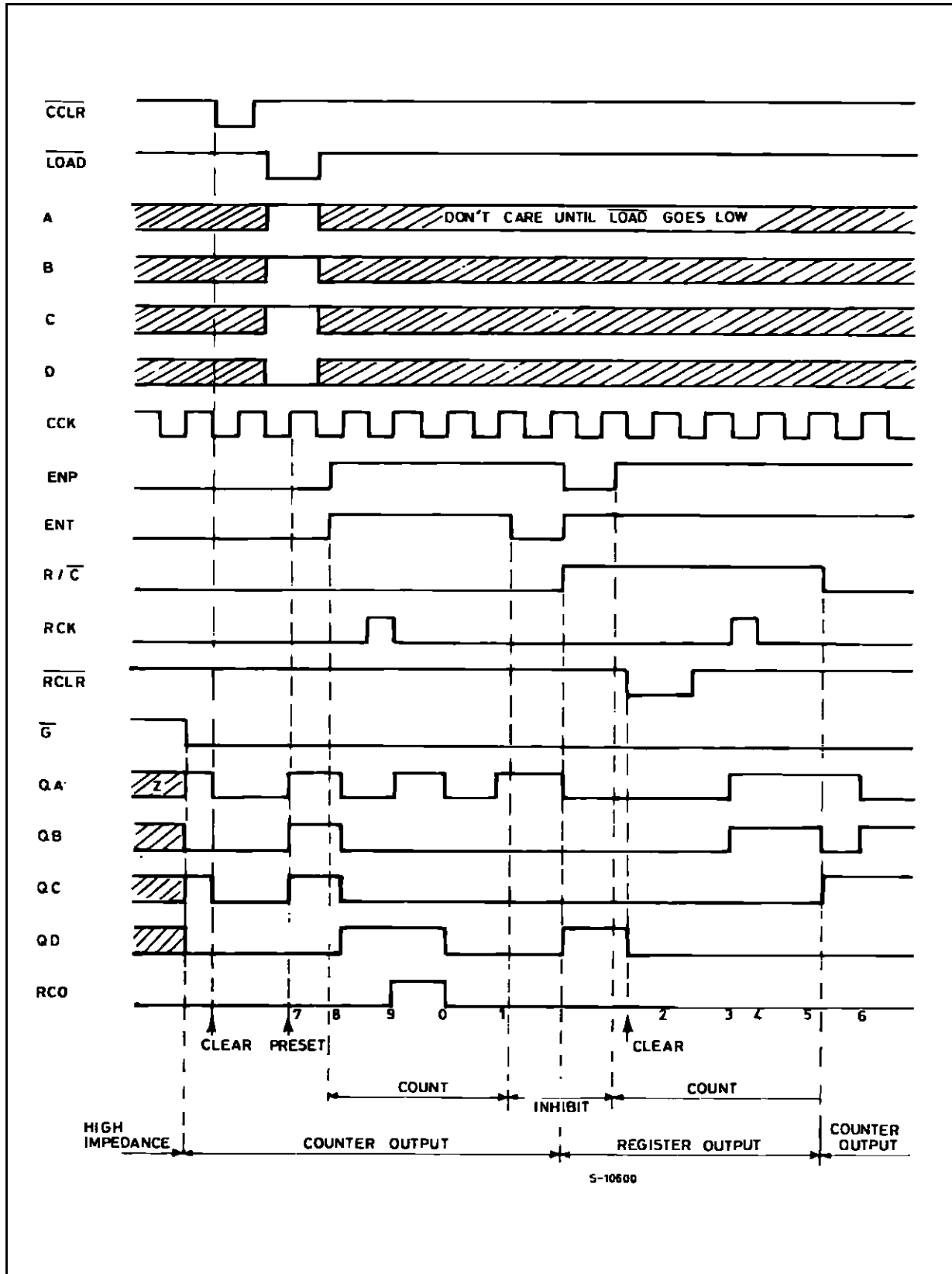


LOGIC DIAGRAM (HC690)

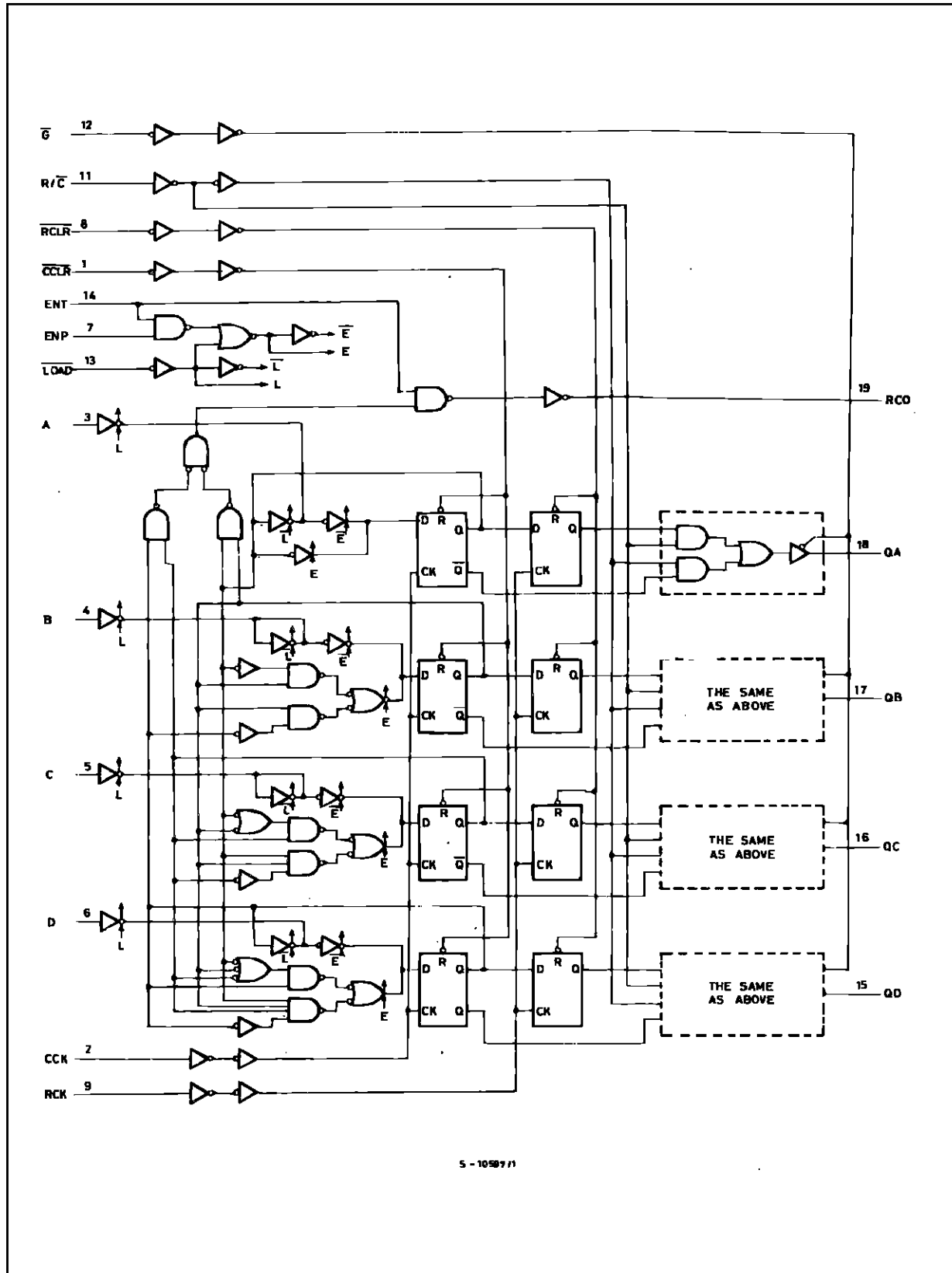


S-10596/1

TIMING CHART (HC690)

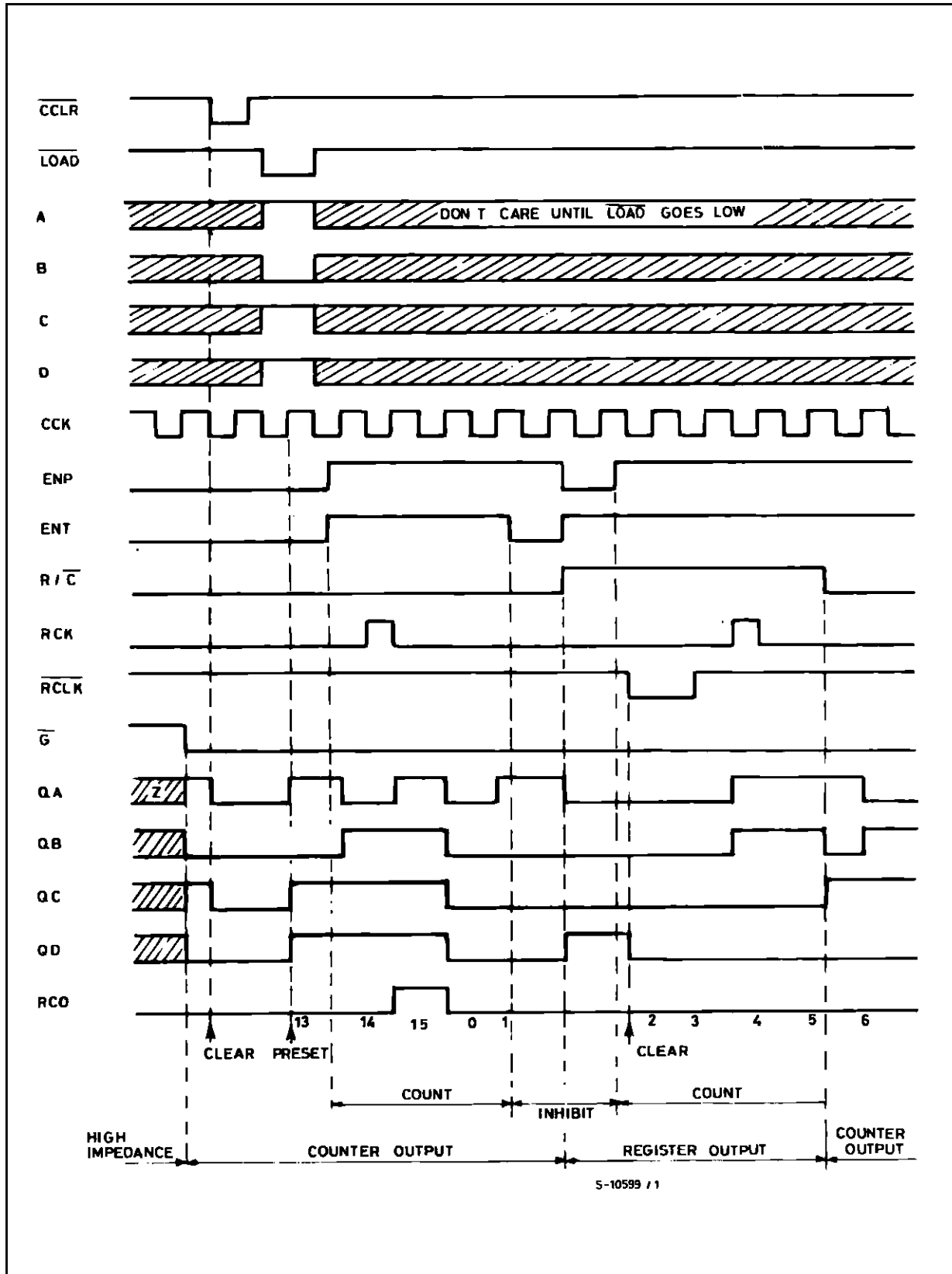


LOGIC DIAGRAM (HC691)

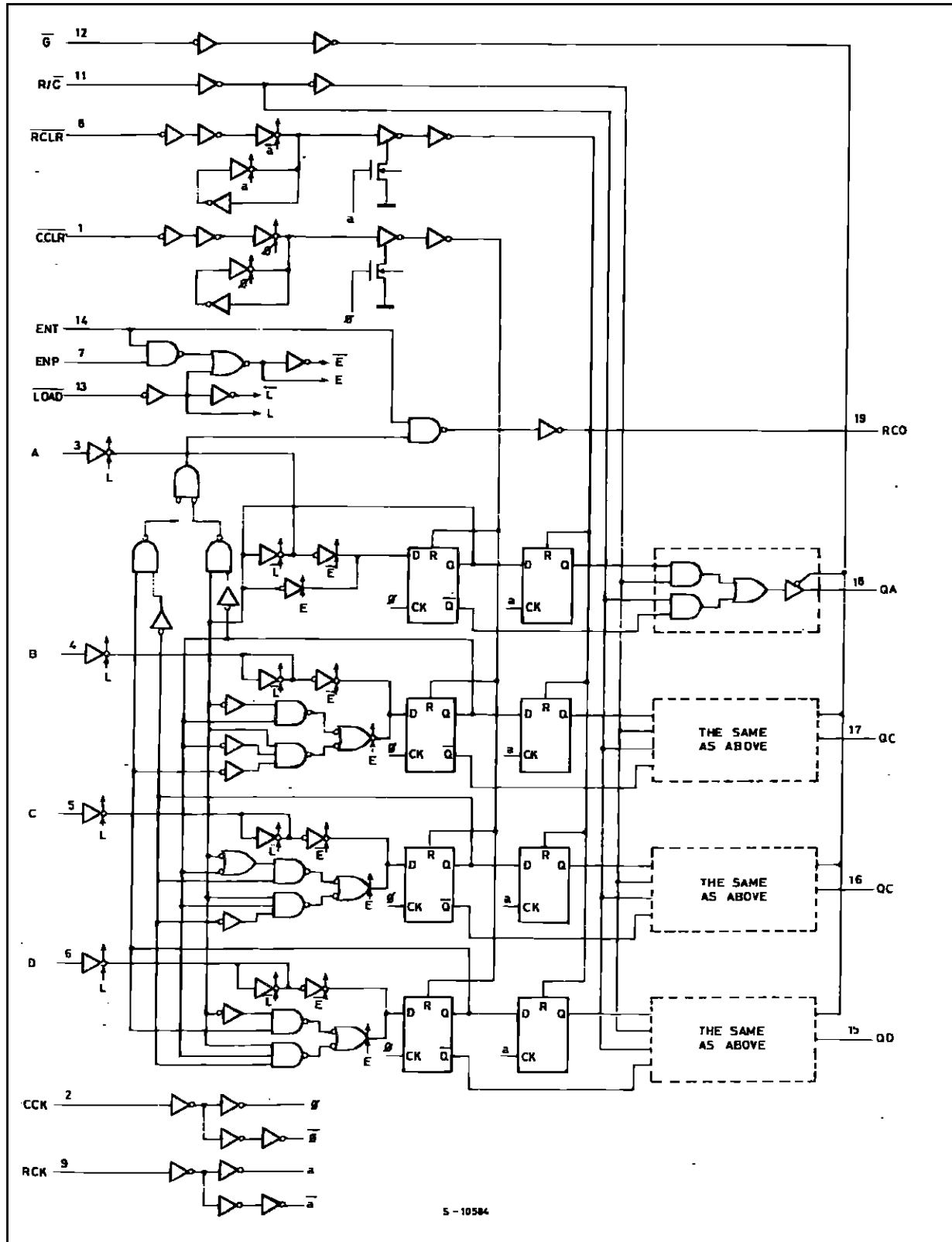


S-10587/1

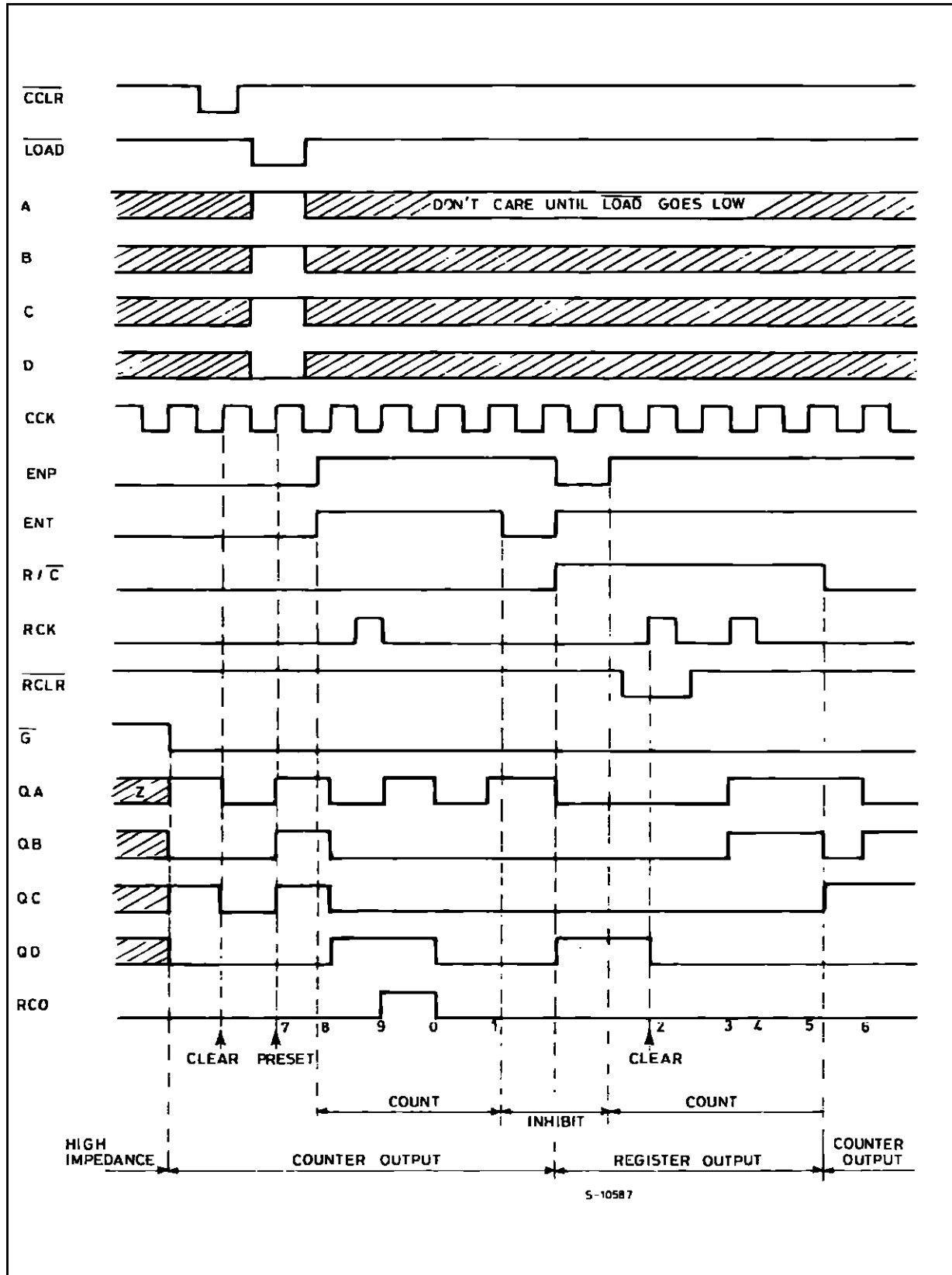
TIMING CHART (HC691)



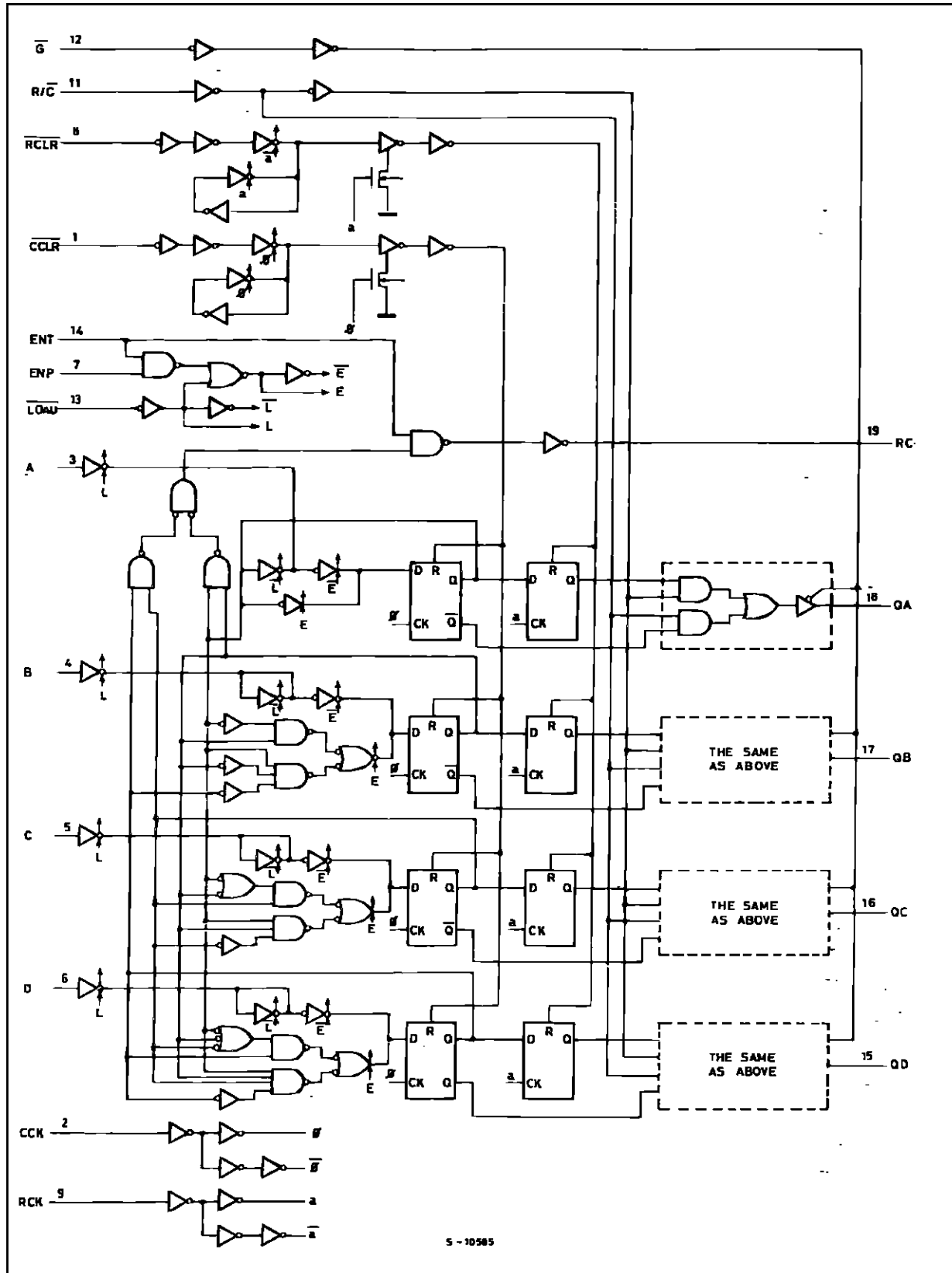
LOGIC DIAGRAM (HC692)



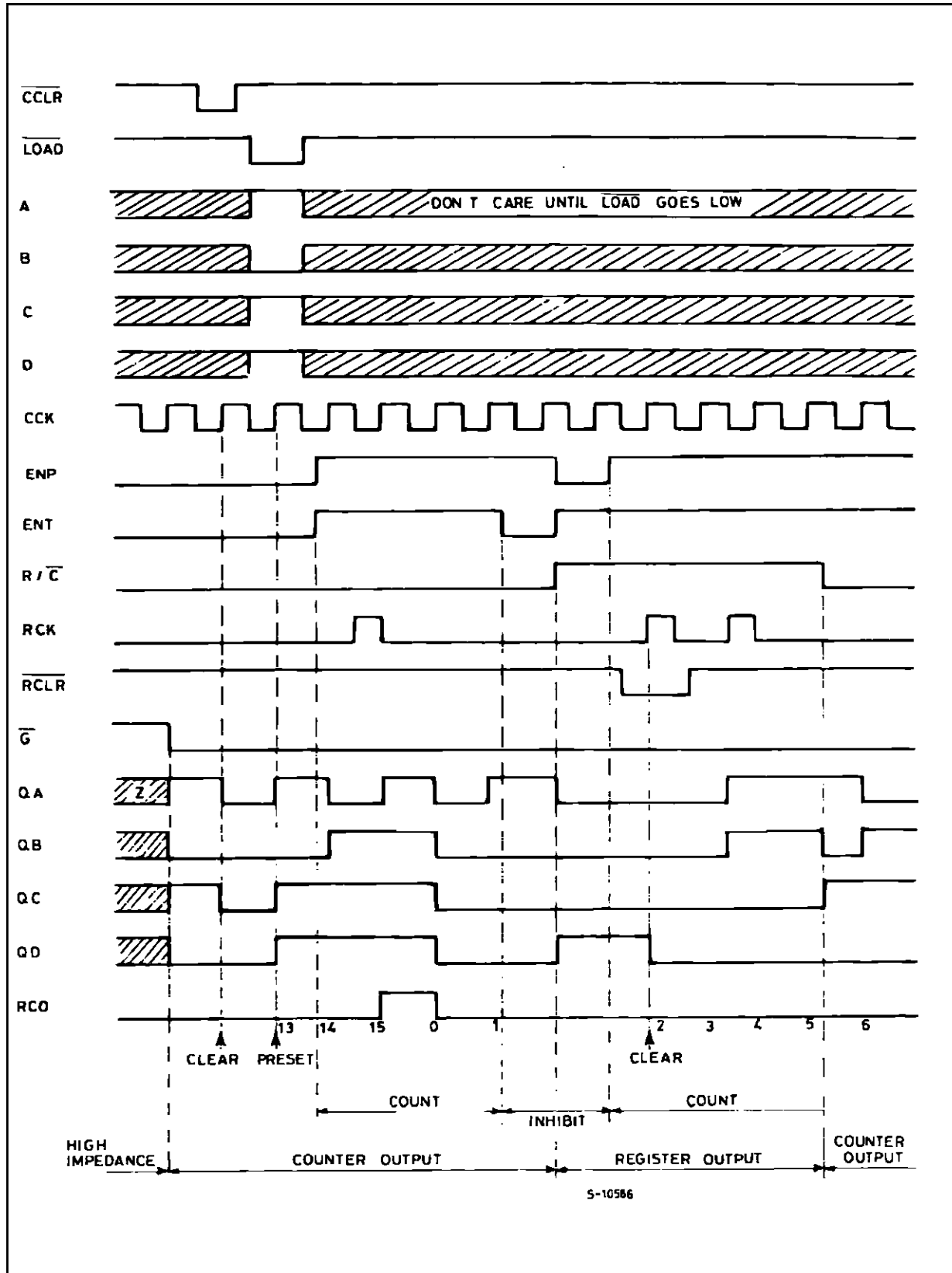
TIMING CHART (HC692)



LOGIC DIAGRAM (HC693)



TIMING CHART (HC693)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-------------------------------------|--|-------------------------------|------|
| V _{CC} | Supply Voltage | -0.5 to +7 | V |
| V _I | DC Input Voltage | -0.5 to V _{CC} + 0.5 | V |
| V _O | DC Output Voltage | -0.5 to V _{CC} + 0.5 | V |
| I _{IK} | DC Input Diode Current | ± 20 | mA |
| I _{OK} | DC Output Diode Current | ± 20 | mA |
| I _O | DC Output Source Sink Current Per Output Pin | RCO | ± 25 |
| | | QA to QD | ± 35 |
| I _{CC} or I _{GND} | DC V _{CC} or Ground Current | ± 70 | mA |
| P _D | Power Dissipation | 500 (*) | mW |
| T _{stg} | Storage Temperature | -65 to +150 | °C |
| T _L | Lead Temperature (10 sec) | 300 | °C |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

(*) 500 mW: ≡ 65 °C derate to 300 mW by 10mW/°C: 65 °C to 85 °C

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|---------------------------------|---|-------------------------|-----------|
| V _{CC} | Supply Voltage | 2 to 6 | V |
| V _I | Input Voltage | 0 to V _{CC} | V |
| V _O | Output Voltage | 0 to V _{CC} | V |
| T _{op} | Operating Temperature: M54HC Series M74HC Series | -55 to +125 | °C |
| | | -40 to +85 | °C |
| t _r , t _f | Input Rise and Fall Time | V _{CC} = 2 V | 0 to 1000 |
| | | V _{CC} = 4.5 V | 0 to 500 |
| | | V _{CC} = 6 V | 0 to 400 |

DC SPECIFICATIONS

| Symbol | Parameter | Test Conditions | | Value | | | | | | Unit | | |
|-----------------|-------------------------------------|------------------------|--|---|------|------|----------------------|------|-----------------------|------|------|---|
| | | V _{CC} (V) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | | |
| | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. | |
| V _{IH} | High Level Input Voltage | 2.0 | | 1.5 | | | 1.5 | | 1.5 | | V | |
| | | 4.5 | | 3.15 | | | 3.15 | | 3.15 | | | |
| | | 6.0 | | 4.2 | | | 4.2 | | 4.2 | | | |
| V _{IL} | Low Level Input Voltage | 2.0 | | | | 0.5 | | 0.5 | | 0.5 | V | |
| | | 4.5 | | | | 1.35 | | 1.35 | | 1.35 | | |
| | | 6.0 | | | | 1.8 | | 1.8 | | 1.8 | | |
| V _{OH} | High Level Output Voltage (QA - QD) | 2.0 | V _I = V _{IH} or V _{IL} | I _O = -20 μA | 1.9 | 2.0 | | 1.9 | | 1.9 | V | |
| | | 4.5 | | | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | | | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | | I _O = -6.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | | I _O = -7.8 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| V _{OH} | High Level Output Voltage (RCO) | 2.0 | V _I = V _{IH} or V _{IL} | I _O = -20 μA | 1.9 | 2.0 | | 1.9 | | 1.9 | V | |
| | | 4.5 | | | 4.4 | 4.5 | | 4.4 | | 4.4 | | |
| | | 6.0 | | | 5.9 | 6.0 | | 5.9 | | 5.9 | | |
| | | 4.5 | | I _O = -4.0 mA | 4.18 | 4.31 | | 4.13 | | 4.10 | | |
| | | 6.0 | | I _O = -5.2 mA | 5.68 | 5.8 | | 5.63 | | 5.60 | | |
| V _{OL} | Low Level Output Voltage (QA - QD) | 2.0 | V _I = V _{IH} or V _{IL} | I _O = 20 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | | I _O = 6.0 mA | | 0.17 | 0.26 | | 0.37 | | 0.40 | |
| | | 6.0 | | I _O = 7.8 mA | | 0.18 | 0.26 | | 0.37 | | 0.40 | |
| V _{OL} | Low Level Output Voltage (RCO) | 2.0 | V _I = V _{IH} or V _{IL} | I _O = 20 μA | | 0.0 | 0.1 | | 0.1 | | 0.1 | V |
| | | 4.5 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 6.0 | | | | 0.0 | 0.1 | | 0.1 | | 0.1 | |
| | | 4.5 | | I _O = 4.0 mA | | 0.17 | 0.26 | | 0.37 | | 0.40 | |
| | | 6.0 | | I _O = 5.2 mA | | 0.18 | 0.26 | | 0.37 | | 0.40 | |
| I _I | Input Leakage Current | 6.0 | V _I = V _{CC} or GND | | | ±0.1 | | ±1 | | ±1 | μA | |
| I _{OZ} | 3 State Output Off State Current | 6.0 | V _I = V _{IH} or V _{IL} V _O = V _{CC} or GND | | | ±0.5 | | ±5.0 | | ±10 | μA | |
| I _{CC} | Quiescent Supply Current | 6.0 | V _I = V _{CC} or GND | | | 4 | | 40 | | 80 | μA | |

M54/M74HC690/691/692/693

AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, Input t_r = t_f = 6 ns)

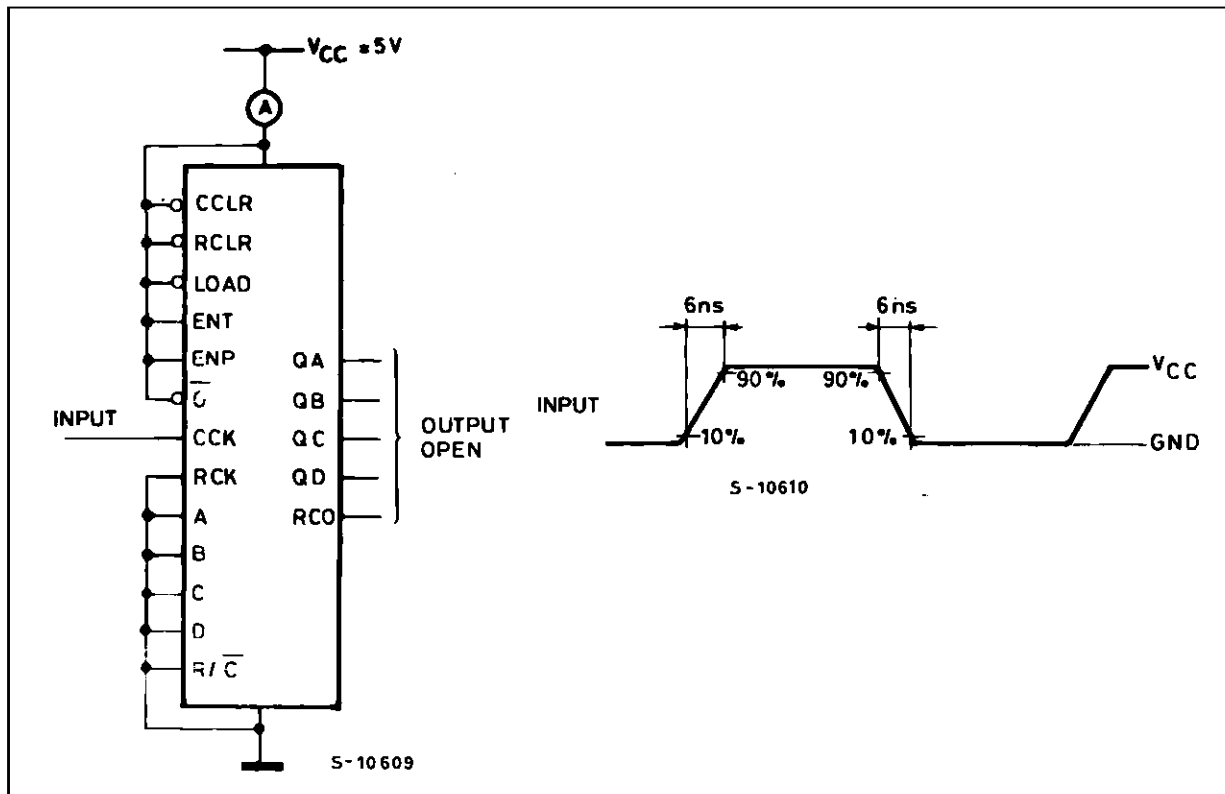
| Symbol | Parameter | Test Conditions | | | Value | | | | | | Unit | |
|--------------------------------------|---|------------------------|------------------------|----|---|------|------|----------------------|------|-----------------------|------|------|
| | | V _{CC} (V) | C _L (pF) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| t _{TLH} t _{THL} | Output Transition Time (Q) | 2.0 | 50 | | 25 | 60 | | 75 | | 90 | ns | |
| | | 4.5 | | 7 | 12 | | 15 | | 19 | | | |
| | | 6.0 | | 6 | 10 | | 13 | | 15 | | | |
| t _{TLH} t _{THL} | Output Transition Time (RCO) | 2.0 | 50 | | 30 | 75 | | 95 | | 115 | ns | |
| | | 4.5 | | 8 | 15 | | 19 | | 23 | | | |
| | | 6.0 | | 7 | 13 | | 16 | | 20 | | | |
| t _{PLH} t _{PHL} | Propagation Delay Time (CCK - Q) | 2.0 | 50 | | 82 | 205 | | 255 | | 310 | ns | |
| | | 4.5 | | 26 | 41 | | 51 | | 62 | | | |
| | | 6.0 | | 22 | 35 | | 43 | | 53 | | | |
| | | 2.0 | 150 | | 95 | 235 | | 295 | | 255 | ns | |
| | | 4.5 | | 30 | 47 | | 59 | | 71 | | | |
| | | 6.0 | | 26 | 40 | | 50 | | 60 | | | |
| t _{PLH} t _{PHL} | Propagation Delay Time (RCK - Q) | 2.0 | 50 | | 86 | 210 | | 265 | | 315 | ns | |
| | | 4.5 | | 27 | 42 | | 53 | | 63 | | | |
| | | 6.0 | | 23 | 36 | | 45 | | 54 | | | |
| | | 2.0 | 150 | | 99 | 240 | | 300 | | 360 | ns | |
| | | 4.5 | | 31 | 48 | | 60 | | 72 | | | |
| | | 6.0 | | 26 | 41 | | 51 | | 61 | | | |
| t _{PLH} t _{PHL} | Propagation Delay Time (CCK - RCO) | 2.0 | 50 | | 65 | 165 | | 205 | | 250 | ns | |
| | | 4.5 | | 21 | 33 | | 41 | | 50 | | | |
| | | 6.0 | | 18 | 28 | | 35 | | 43 | | | |
| t _{PLH} t _{PHL} | Propagation Delay Time (R/C - Q) | 2.0 | 50 | | 59 | 145 | | 180 | | 220 | ns | |
| | | 4.5 | | 18 | 29 | | 36 | | 44 | | | |
| | | 6.0 | | 15 | 25 | | 31 | | 37 | | | |
| | | 2.0 | 150 | | 72 | 175 | | 220 | | 265 | ns | |
| | | 4.5 | | 22 | 35 | | 44 | | 53 | | | |
| | | 6.0 | | 19 | 30 | | 37 | | 45 | | | |
| t _{PLH} t _{PHL} | Propagation Delay Time (ENT - RCO) | 2.0 | 50 | | 36 | 100 | | 125 | | 150 | ns | |
| | | 4.5 | | 12 | 20 | | 25 | | 30 | | | |
| | | 6.0 | | 10 | 17 | | 21 | | 26 | | | |
| t _{PHL} | Propagation Delay Time (CCLR - Q) (for HC690/691) | 2.0 | 50 | | 91 | 225 | | 280 | | 340 | ns | |
| | | 4.5 | | 29 | 45 | | 56 | | 68 | | | |
| | | 6.0 | | 25 | 38 | | 48 | | 58 | | | |
| | | 2.0 | 150 | | 104 | 255 | | 320 | | 385 | ns | |
| | | 4.5 | | 33 | 51 | | 64 | | 77 | | | |
| | | 6.0 | | 28 | 43 | | 54 | | 65 | | | |
| t _{PHL} | Propagation Delay Time (RCLR - Q) (for HC690/691) | 2.0 | 50 | | 86 | 210 | | 265 | | 315 | ns | |
| | | 4.5 | | 27 | 42 | | 53 | | 63 | | | |
| | | 6.0 | | 23 | 36 | | 45 | | 54 | | | |
| | | 2.0 | 150 | | 100 | 240 | | 300 | | 360 | ns | |
| | | 4.5 | | 31 | 48 | | 60 | | 72 | | | |
| | | 6.0 | | 26 | 41 | | 51 | | 61 | | | |
| t _{PHL} | Propagation Delay Time (CCLR - RCO) (for HC690/691) | 2.0 | 50 | | 70 | 175 | | 220 | | 265 | ns | |
| | | 4.5 | | 22 | 35 | | 44 | | 53 | | | |
| | | 6.0 | | 19 | 30 | | 37 | | 45 | | | |

AC ELECTRICAL CHARACTERISTICS (Continued)

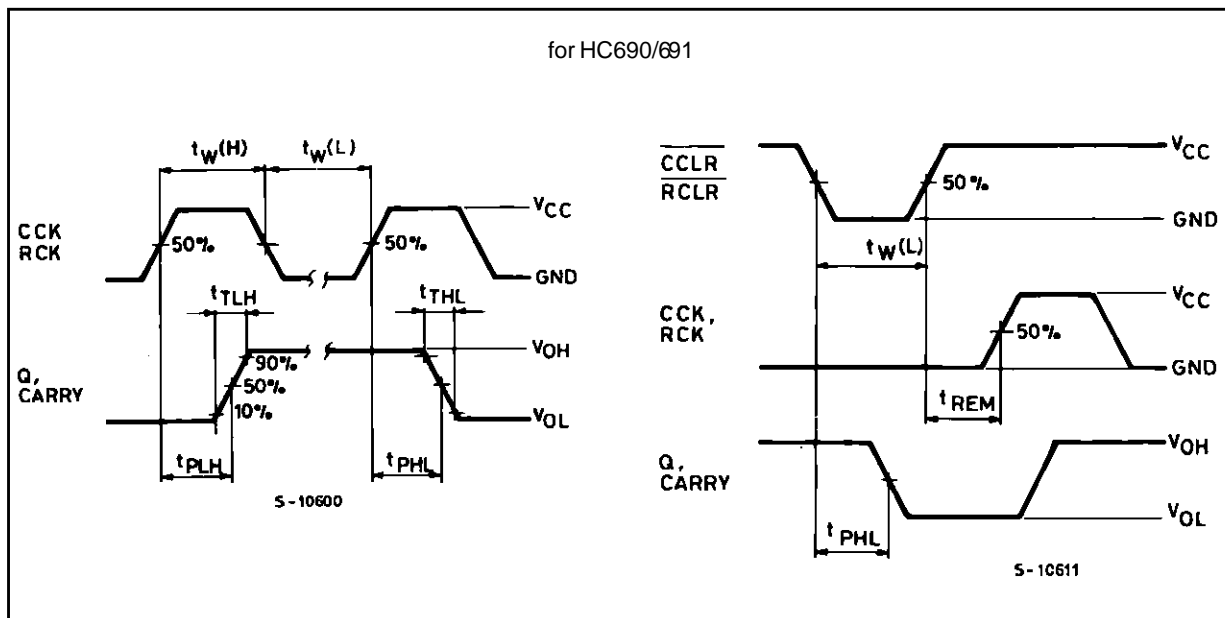
| Symbol | Parameter | Test Conditions | | | Value | | | | | | Unit | |
|--|---|------------------------|------------------------|--------------------------------|---|----------|------|----------------------|------|-----------------------|------|------|
| | | V _{CC} (V) | C _L (pF) | | T _A = 25 °C 54HC and 74HC | | | -40 to 85 °C 74HC | | -55 to 125 °C 54HC | | |
| | | | | | Min. | Typ. | Max. | Min. | Max. | Min. | | Max. |
| f _{MAX} | Maximum Clock Frequency | 2.0 | 50 | | 4.4 | 12 | | 3.6 | | 3 | | MHz |
| | | 4.5 | | | 22 | 45 | | 18 | | 15 | | |
| | | 6.0 | | | 26 | 53 | | 21 | | 18 | | |
| t _{PZL} t _{PZH} | Output Enable Time | 2.0 | 50 | R _L = 1 KΩ | | 48 | 120 | | 150 | | 180 | ns |
| | | 4.5 | | | 15 | 24 | | 30 | | 36 | | |
| | | 6.0 | | | 13 | 20 | | 26 | | 31 | | |
| | | 2.0 | 150 | R _L = 1 KΩ | | 61 | 150 | | 190 | | 225 | ns |
| | | 4.5 | | | 19 | 30 | | 38 | | 45 | | |
| | | 6.0 | | | 17 | 26 | | 32 | | 38 | | |
| t _{PLH} t _{PHL} | Output Disable Time | 2.0 | 50 | R _L = 1 KΩ | | 32 | 145 | | 180 | | 220 | ns |
| | | 4.5 | | | 15 | 29 | | 36 | | 44 | | |
| | | 6.0 | | | 13 | 25 | | 31 | | 37 | | |
| t _{W(H)} t _{W(L)} | Minimum Pulse Width (CCK - RCK) | 2.0 | 50 | | | 28 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 7 | 15 | | 19 | | 22 | | |
| | | 6.0 | | | 6 | 13 | | 16 | | 19 | | |
| t _{W(L)} | Minimum Pulse Width (CCLR - RCLR) (for HC690/691) | 2.0 | 50 | | | 40 | 75 | | 95 | | 110 | ns |
| | | 4.5 | | | 8 | 15 | | 19 | | 22 | | |
| | | 6.0 | | | 7 | 13 | | 16 | | 19 | | |
| t _s | Minimum Set-up Time (LOAD, ENT, ENP) | 2.0 | 50 | | | 68 | 150 | | 190 | | 220 | ns |
| | | 4.5 | | | 17 | 30 | | 38 | | 44 | | |
| | | 6.0 | | | 14 | 26 | | 32 | | 37 | | |
| t _s | Minimum Set-up Time (A, B, C, D) | 2.0 | 50 | | | 44 | 100 | | 125 | | 145 | ns |
| | | 4.5 | | | 11 | 20 | | 25 | | 29 | | |
| | | 6.0 | | | 9 | 17 | | 21 | | 25 | | |
| t _s | Minimum Set-up Time (CCLR, RCLR) (for HC692/693) | 2.0 | 50 | | | 44 | 100 | | 125 | | 145 | ns |
| | | 4.5 | | | 11 | 20 | | 25 | | 29 | | |
| | | 6.0 | | | 9 | 17 | | 21 | | 25 | | |
| t _s | Minimum Set-up Time (CCK, RCK) | 2.0 | 50 | | | 48 | 125 | | 155 | | 180 | ns |
| | | 4.5 | | | 12 | 25 | | 31 | | 36 | | |
| | | 6.0 | | | 10 | 21 | | 26 | | 31 | | |
| t _h | Minimum Hold Time | 2.0 | 50 | | | | 0 | | 0 | | 0 | ns |
| | | 4.5 | | | | | | 0 | | 0 | | |
| | | 6.0 | | | | | | 0 | | 0 | | |
| t _{REM} | Minimum Removal Time (for HC690/691) | 2.0 | 50 | | | | 25 | | 30 | | 40 | ns |
| | | 4.5 | | | | | | 5 | | 6 | 8 | |
| | | 6.0 | | | | | | 5 | | 5 | 7 | |
| C _{IN} | Input Capacitance | | | | | 5 | 10 | | 10 | | 10 | pF |
| C _{PD} (*) | Power Dissipation Capacitance | | | for HC690/691 for HC692/693 | | 70 80 | | | | | | pF |

(*) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

TEST CIRCUIT I_{CC} (Opr.)

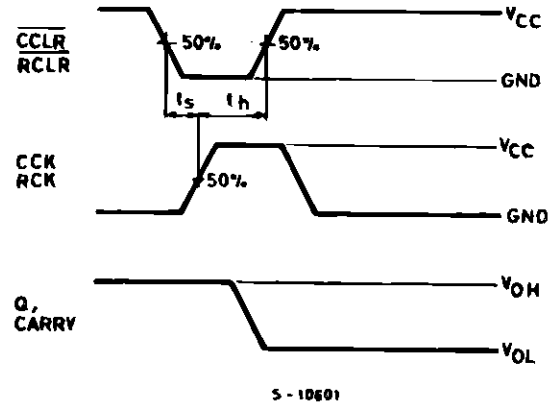
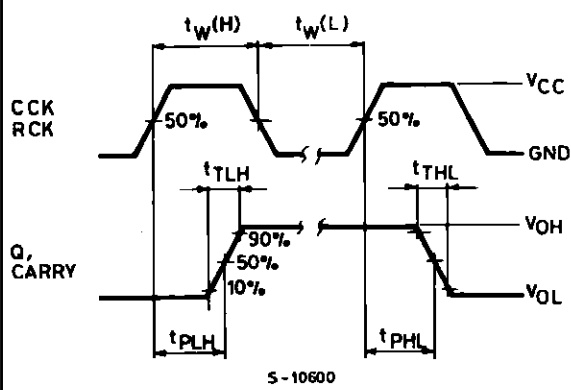


SWITCHING CHARACTERISTICS TEST WAVEFORM

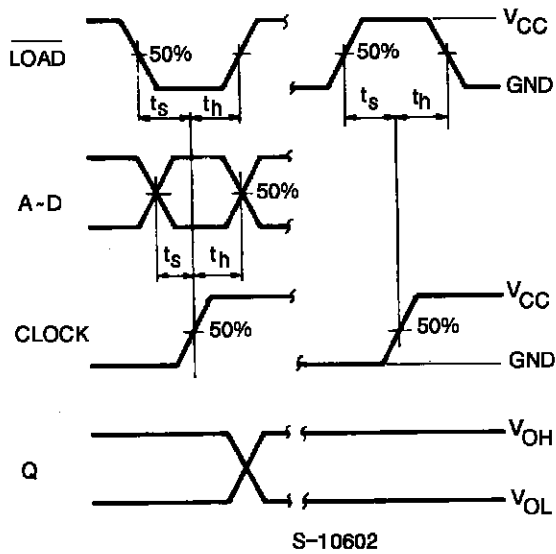


SWITCHING CHARACTERISTICS TEST WAVEFORM (Continued)

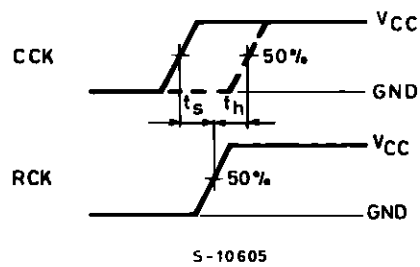
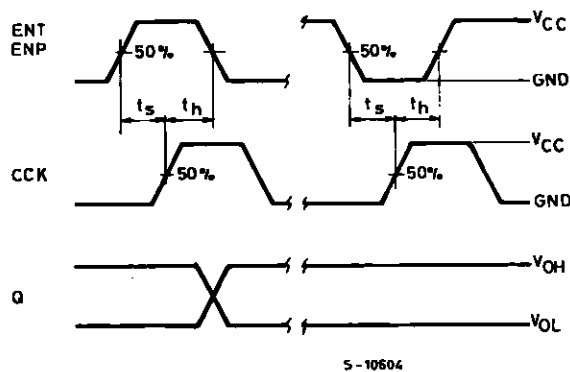
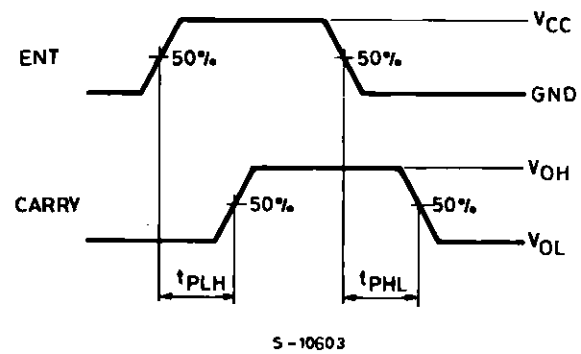
for HC692/693



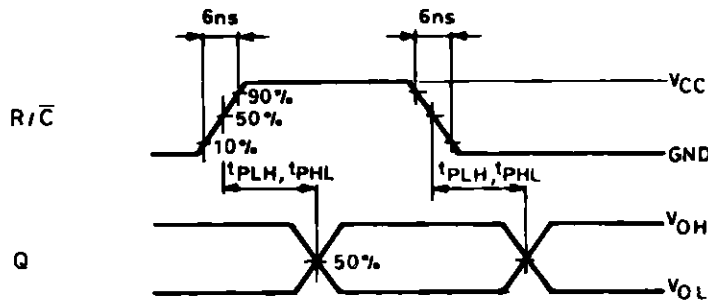
for ALL TYPES



(Fix Maximum Count)



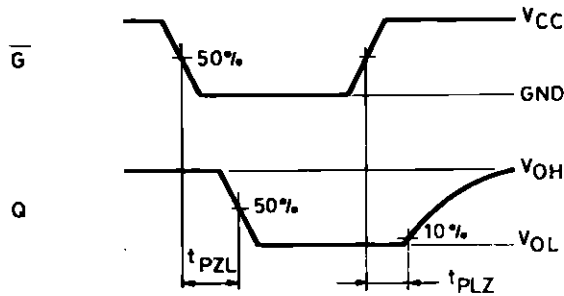
SWITCHING CHARACTERISTICS (continued)



S-10606

t_{PLZ} , t_{PZL}

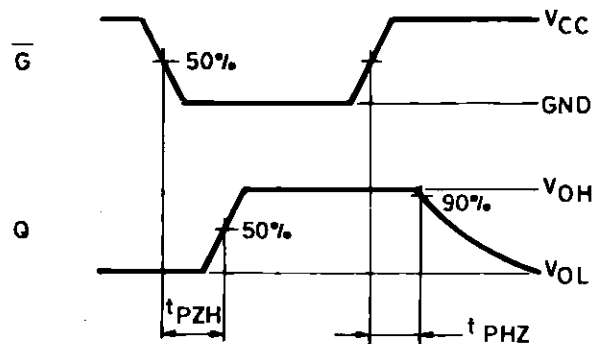
The 1 k Ω load resistors should be connected between outputs and V_{CC} line and the 50 pF load capacitors should be connected between outputs and GND line. All inputs except \bar{G} input should be connected to V_{CC} line or GND line such that outputs will be in low logic level while \bar{G} input is held low.



S-10607

t_{PHZ} , t_{PZH}

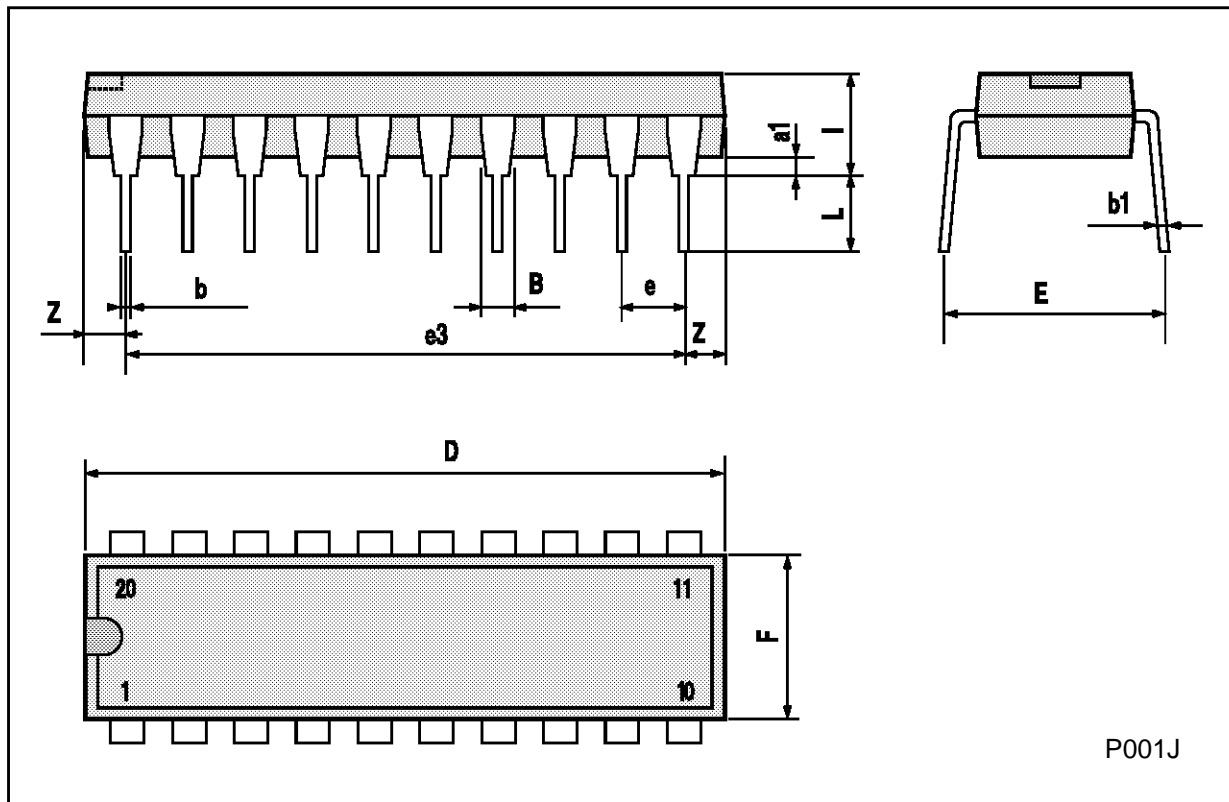
The 1 k Ω load resistors and the 50 pF load capacitors should be connected between each output and GND line. All inputs except \bar{G} input should be connected to V_{CC} or GND line such that output will be in high logic level while \bar{G} input is held low.



S-10608

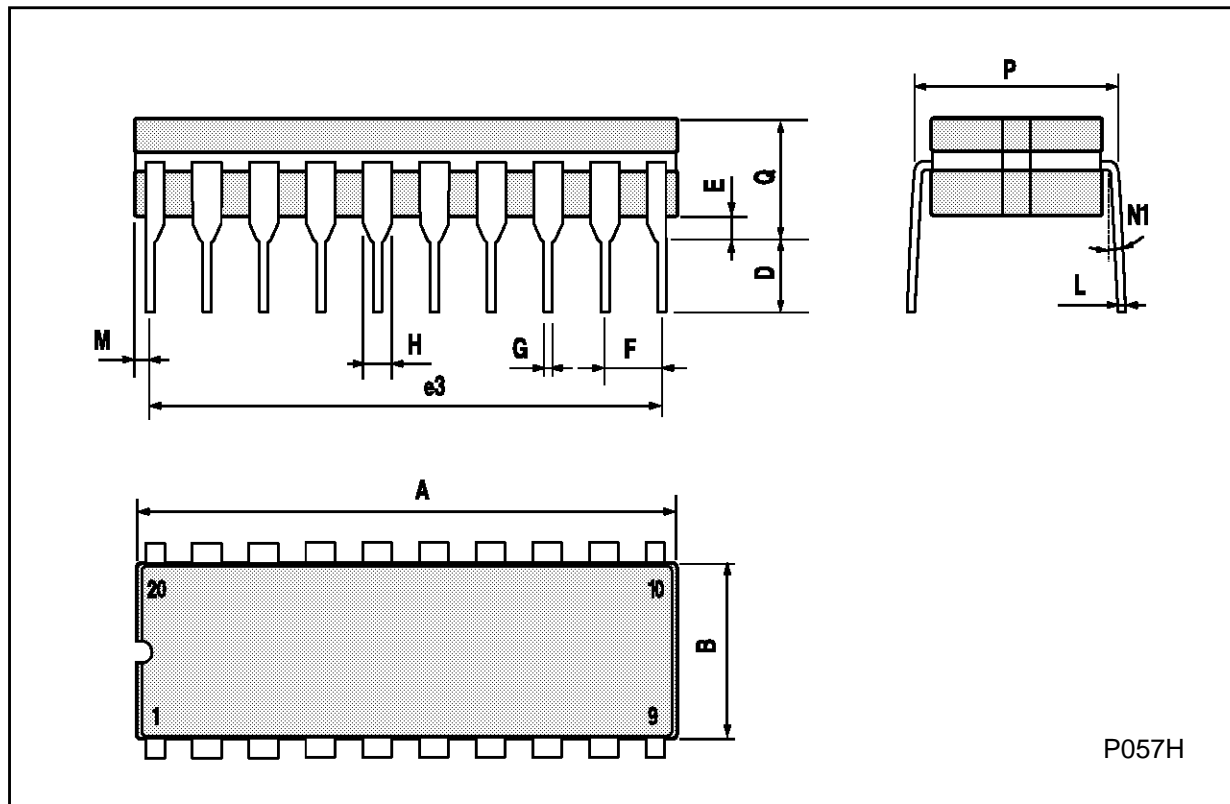
Plastic DIP20 (0.25) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.254 | | | 0.010 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.45 | | | 0.018 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 25.4 | | | 1.000 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 22.86 | | | 0.900 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 3.93 | | | 0.155 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.34 | | | 0.053 |



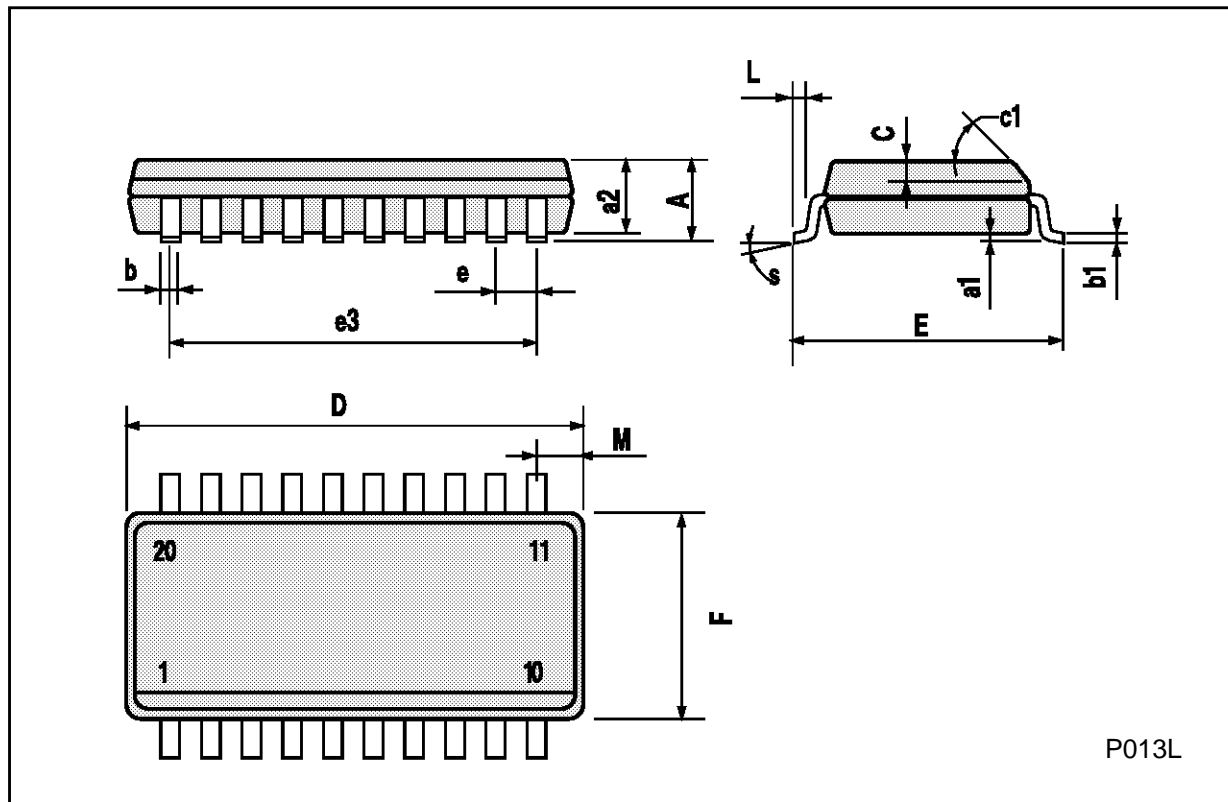
Ceramic DIP20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-----------------------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 25 | | | 0.984 |
| B | | | 7.8 | | | 0.307 |
| D | | 3.3 | | | 0.130 | |
| E | 0.5 | | 1.78 | 0.020 | | 0.070 |
| e3 | | 22.86 | | | 0.900 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 0.016 | | 0.022 |
| I | 1.27 | | 1.52 | 0.050 | | 0.060 |
| L | 0.22 | | 0.31 | 0.009 | | 0.012 |
| M | 0.51 | | 1.27 | 0.020 | | 0.050 |
| N1 | 4° (min.), 15° (max.) | | | | | |
| P | 7.9 | | 8.13 | 0.311 | | 0.320 |
| Q | | | 5.71 | | | 0.225 |



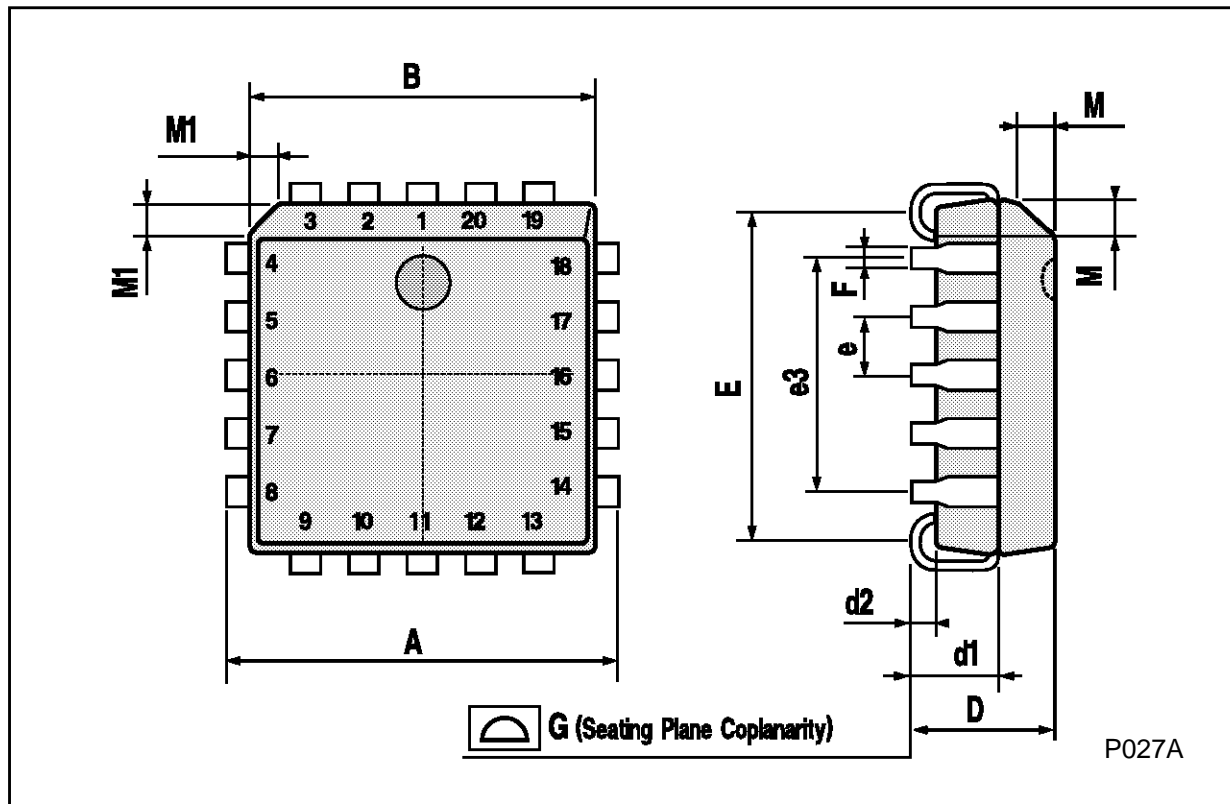
SO20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 2.65 | | | 0.104 |
| a1 | 0.10 | | 0.20 | 0.004 | | 0.007 |
| a2 | | | 2.45 | | | 0.096 |
| b | 0.35 | | 0.49 | 0.013 | | 0.019 |
| b1 | 0.23 | | 0.32 | 0.009 | | 0.012 |
| C | | 0.50 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 12.60 | | 13.00 | 0.496 | | 0.512 |
| E | 10.00 | | 10.65 | 0.393 | | 0.419 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 11.43 | | | 0.450 | |
| F | 7.40 | | 7.60 | 0.291 | | 0.299 |
| L | 0.50 | | 1.27 | 0.19 | | 0.050 |
| M | | | 0.75 | | | 0.029 |
| S | 8° (max.) | | | | | |



PLCC20 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 9.78 | | 10.03 | 0.385 | | 0.395 |
| B | 8.89 | | 9.04 | 0.350 | | 0.356 |
| D | 4.2 | | 4.57 | 0.165 | | 0.180 |
| d1 | | 2.54 | | | 0.100 | |
| d2 | | 0.56 | | | 0.022 | |
| E | 7.37 | | 8.38 | 0.290 | | 0.330 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 5.08 | | | 0.200 | |
| F | | 0.38 | | | 0.015 | |
| G | | | 0.101 | | | 0.004 |
| M | | 1.27 | | | 0.050 | |
| M1 | | 1.14 | | | 0.045 | |



Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1994 SGS-THOMSON Microelectronics - All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES

Australia - Brazil - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco - The Netherlands -
Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A