

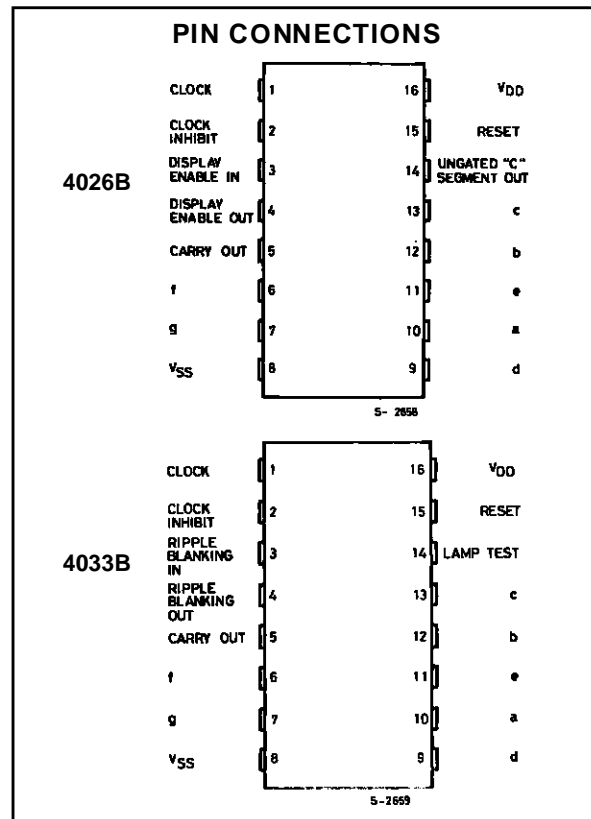
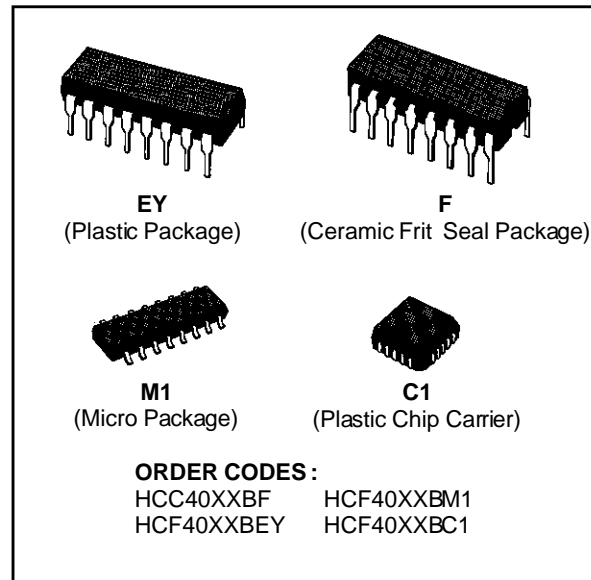
DECADE COUNTERS/DIVIDERS WITH DECODED 7-SEGMENT DISPLAY OUTPUTS

WITH; DISPLAY ENABLE 4026B RIPPLE BLANKING 4033B

- COUNTER AND 7-SEGMENT DECODING IN ONE PACKAGE
- EASILY INTERFACED WITH 7-SEGMENT DISPLAY TYPES
- FULLY STATIC COUNTER OPERATION : DC TO 6MHz (typ.) AT $V_{DD} = 10V$
- IDEAL FOR LOW-POWER DISPLAYS
- DISPLAY ENABLE OUTPUT - 4026B
- "RIPPLE BLANKING" AND LAMP TEST - 4033B
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATING
- INPUT CURRENT OF 100nA AT 18V AND 25°C FOR HCC DEVICE
- 100% TESTED FOR QUIESCENT CURRENT
- MEETS ALL REQUIREMENTS OF JEDEC TENTATIVE STANDARD N° 13A, "STANDARD SPECIFICATIONS FOR DESCRIPTION OF "B" SERIES CMOS DEVICES"

DESCRIPTION

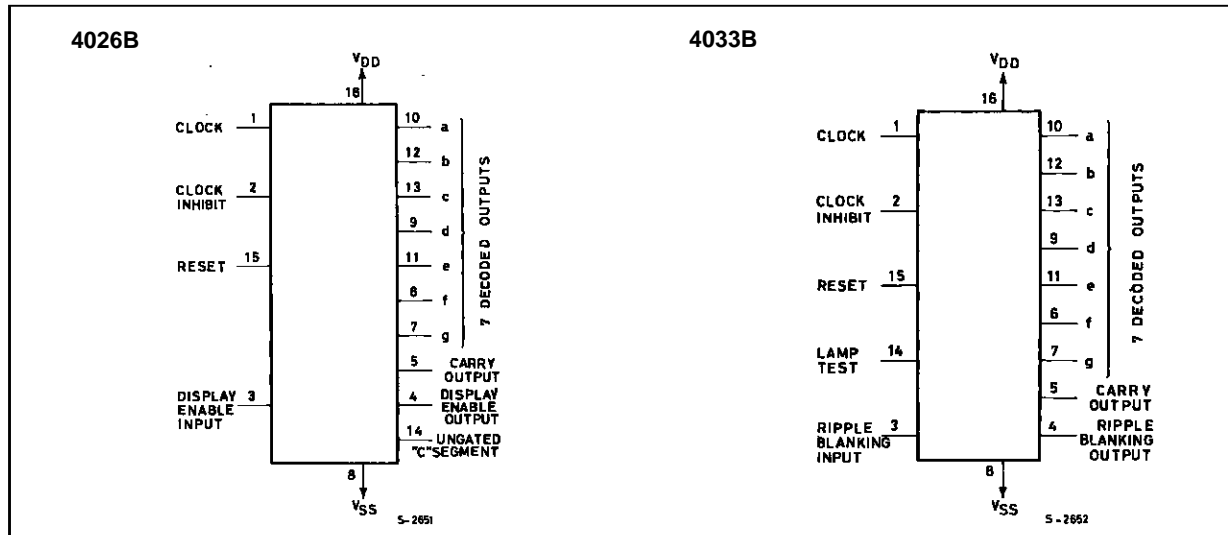
The **HCC4026B/4033B** (extended temperature range) and **HCF4026B/4033B** (intermediate temperature range) are monolithic integrated circuits, available in 16-lead dual in-line plastic or ceramic package and plastic micro package. The **HCC/HCF4026B** and **HCC/HCF4033B** each consist of a 5-stage Johnson decade counter and an output decoder which converts the Johnson code to a 7-segment decoded output for driving one stage in a numerical display. These devices are particularly advantageous in display applications where low power dissipation and/or low package count are important. Inputs common to both types are CLOCK, RESET, & CLOCK INHIBIT ; common outputs are CARRY OUT and the seven decoded outputs (a, b, c, d, e, f, g). Additional inputs and outputs for the **HCC/HCF4026B** include DISPLAY ENABLE input and DISPLAY ENABLE and UNGATED "C-SEGMENT" outputs. Signals peculiar to the **HCC/HCF4033B** are RIPPLE-BLANKING INPUT AND LAMP TEST INPUT and a RIPPLE-BLANKING OUTPUT. A high RESET signal clears the de-



cade counter to its zero count. The counter is advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. Counter advancement via the clock line is inhibited when the CLOCK INHIBIT signal is high. Antilock gating is provided on the OHNSON counter, thus ensuring proper counting sequence. The CARRY-OUT (C

Numbers 0 to 9. The 7-segment output.66(go)-292(hig)73(h)-272(o)0(n)JTJ

FUNCTIONAL DIAGRAMS



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|---|--------------------------------|----------------------------|
| V_{DD}^* | Supply Voltage : HCC Types HCF Types | - 0.5 to + 20 - 0.5 to + 18 | V V |
| V_i | Input Voltage | - 0.5 to $V_{DD} + 0.5$ | V |
| I_i | DC Input Current (any one input) | ± 10 | mA |
| P_{tot} | Total Power Dissipation (per package) Dissipation per Output Transistor for T_{op} = Full Package-temperature Range | 200 100 | mW mW |
| T_{op} | Operating Temperature : HCC Types HCF Types | - 55 to + 125 - 40 to + 85 | $^{\circ}C$ $^{\circ}C$ |
| T_{stg} | Storage Temperature | - 65 to + 150 | $^{\circ}C$ |

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for external periods may affect device reliability.

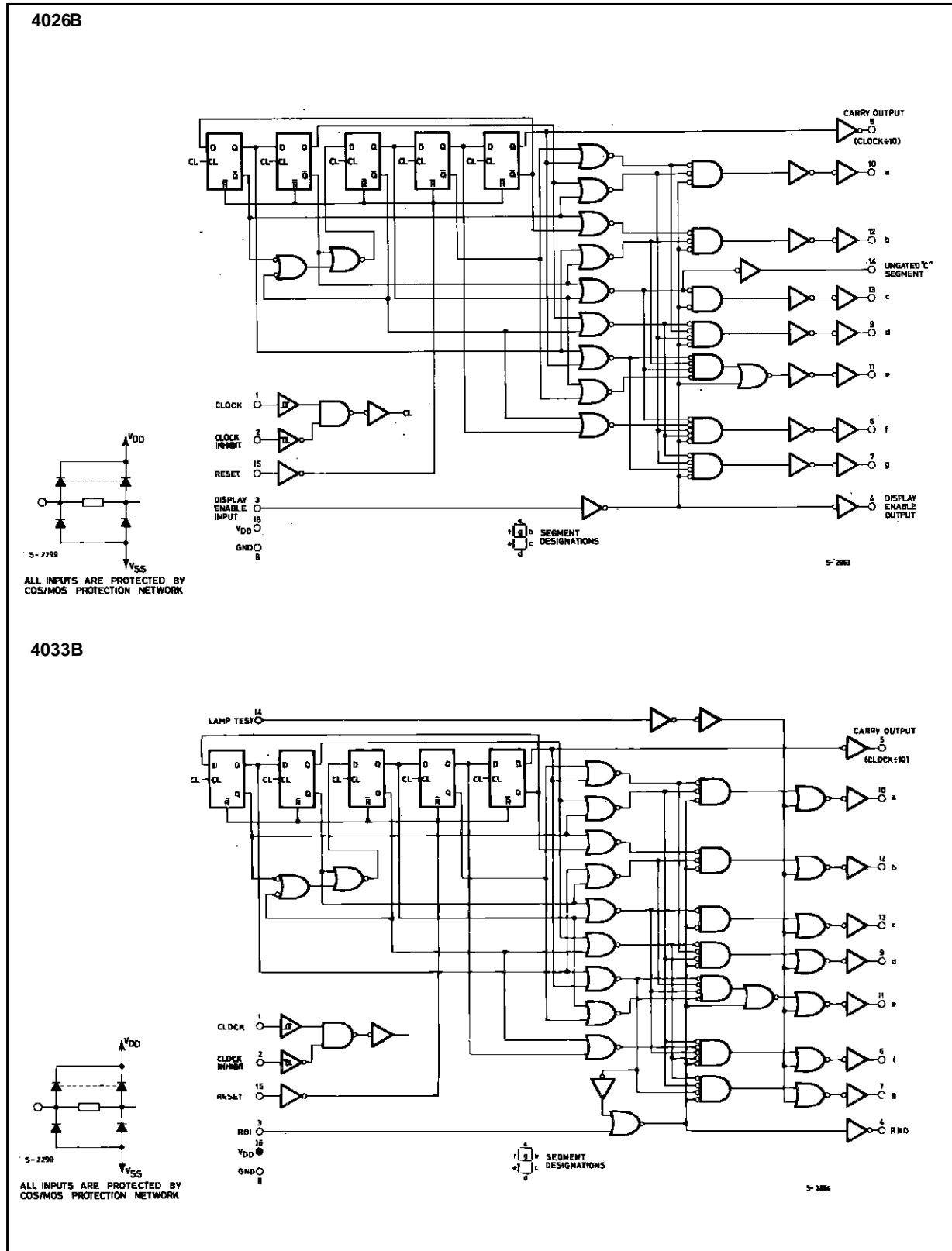
* All voltages values are referred to V_{SS} pin voltage.

RECOMMENDED OPERATING CONDITIONS

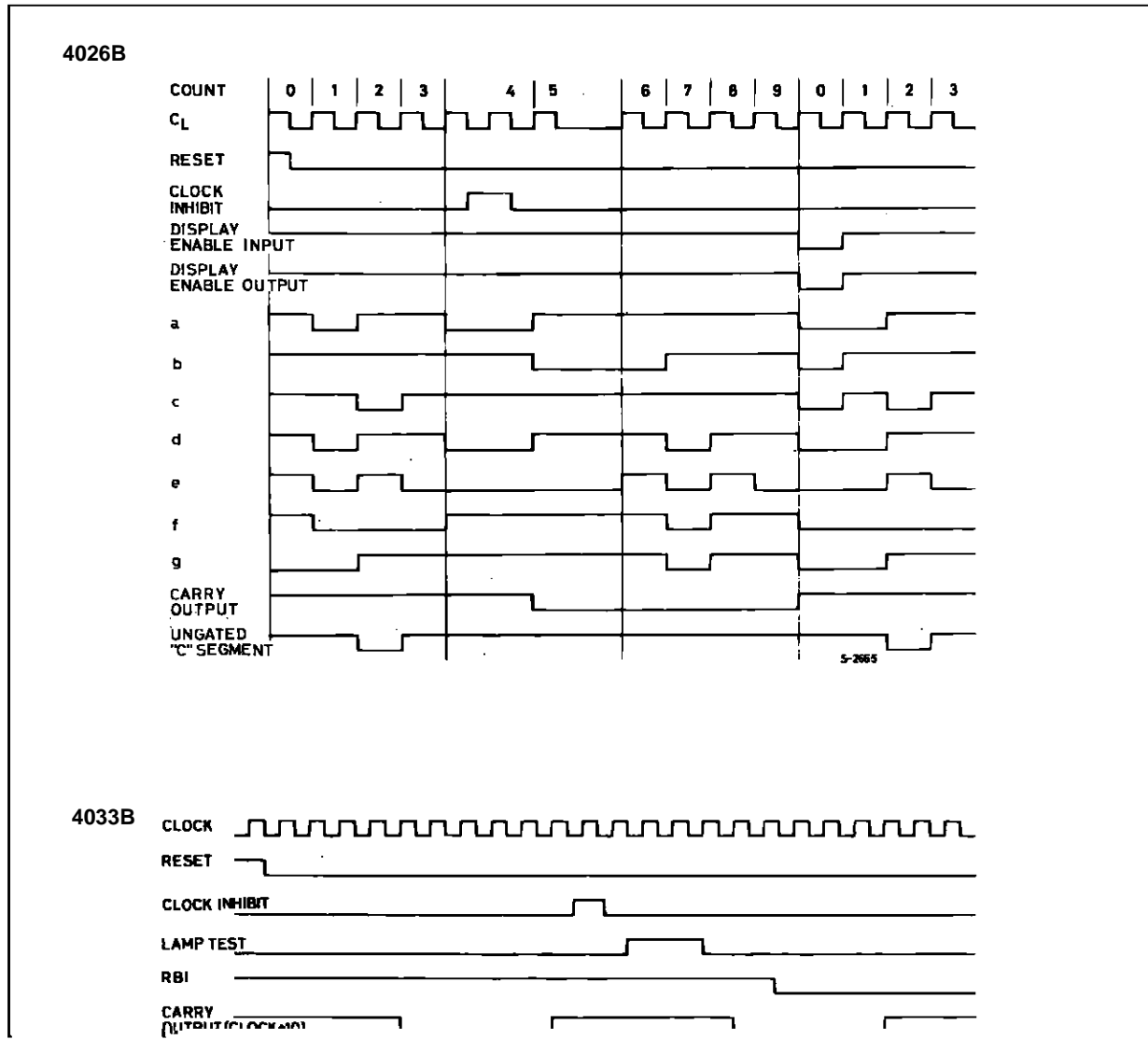
| Symbol | Parameter | Value | Unit |
|----------|--|-------------------------------|----------------------------|
| V_{DD} | Supply Voltage : HCC Types HCF Types | 3 to 18 3 to 15 | V V |
| V_i | Input Voltage | 0 to V_{DD} | V |
| T_{op} | Operating Temperature : HCC Types HCF Types | - 55 to + 125 - 40 to + 85 | $^{\circ}C$ $^{\circ}C$ |

HCC/HCF4026B/4033B

LOGIC DIAGRAMS



TIMING DIAGRAMS



HCC/HCF4026B/4033B

STATIC ELECTRICAL CHARACTERISTICS (over recommended operating conditions)

| Symbol | Parameter | | Test Conditions | | | | Value | | | | | | Unit | |
|-----------------------------------|-----------------------|-----------|-----------------------|-----------------------|--------------------------------|------------------------|--------------------|-----------|--------|------------------------|-----------|---------------------|---------|---------|
| | | | V _I (V) | V _O (V) | I _O (μ A) | V _{DD} (V) | T _{Low} * | | 25°C | | | T _{High} * | | |
| | | | | | | | Min. | Max. | Min. | Typ. | Max. | Min. | | Max. |
| I _L | Quiescent Current | HCC Types | 0/ 5 | | | 5 | | 5 | | 0.04 | 5 | | 150 | μ A |
| | | | 0/10 | | | 10 | | 10 | | 0.04 | 10 | | 300 | |
| | | | 0/15 | | | 15 | | 20 | | 0.04 | 20 | | 600 | |
| | | | 0/20 | | | 20 | | 100 | | 0.08 | 100 | | 3000 | |
| | | HCF Types | 0/ 5 | | | 5 | | 20 | | 0.04 | 20 | | 150 | |
| | | | 0/10 | | | 10 | | 40 | | 0.04 | 40 | | 300 | |
| V _{OH} | Output High Voltage | | 0/ 5 | | < 1 | 5 | 4.95 | | 4.95 | | | 4.95 | V | |
| | | | 0/10 | | < 1 | 10 | 9.95 | | 9.95 | | | 9.95 | | |
| | | | 0/15 | | < 1 | 15 | 14.95 | | 14.95 | | | 14.95 | | |
| V _{OL} | Output Low Voltage | | 5/0 | | < 1 | 5 | | 0.05 | | | 0.05 | | V | |
| | | | 10/0 | | < 1 | 10 | | 0.05 | | | 0.05 | | | |
| | | | 15/0 | | < 1 | 15 | | 0.05 | | | 0.05 | | | |
| V _{IH} | Input High Voltage | | | 0.5/4.5 | < 1 | 5 | 3.5 | | 3.5 | | | 3.5 | V | |
| | | | | 1/9 | < 1 | 10 | 7 | | 7 | | | 7 | | |
| | | | | 1.5/13.5 | < 1 | 15 | 11 | | 11 | | | 11 | | |
| V _{IL} | Input Low Voltage | | | 4.5/0.5 | < 1 | 5 | | 1.5 | | | 1.5 | | V | |
| | | | | 9/1 | < 1 | 10 | | 3 | | | 3 | | | |
| | | | | 13.5/1.5 | < 1 | 15 | | 4 | | | 4 | | | |
| I _{OH} | Output Drive Current | HCC Types | 0/ 5 | 2.5 | | 5 | - 2 | | - 1.6 | - 3.2 | | - 1.15 | mA | |
| | | | 0/ 5 | 4.6 | | 5 | - 0.64 | | - 0.51 | - 1 | | - 0.36 | | |
| | | | 0/10 | 9.5 | | 10 | - 1.6 | | - 1.3 | - 2.6 | | - 0.9 | | |
| | | | 0/15 | 13.5 | | 15 | - 4.2 | | - 3.4 | - 6.8 | | - 2.4 | | |
| | | HCF Types | 0/ 5 | 2.5 | | 5 | - 1.53 | | - 1.36 | - 3.2 | | - 1.1 | | |
| | | | 0/ 5 | 4.6 | | 5 | - 0.52 | | - 0.44 | - 1 | | - 0.36 | | |
| | | | 0/10 | 9.5 | | 10 | - 1.3 | | - 1.1 | - 2.6 | | - 0.9 | | |
| | | | 0/15 | 13.5 | | 15 | - 3.6 | | - 3.0 | - 6.8 | | - 2.4 | | |
| I _{OL} | Output Sink Current | HCC Types | 0/ 5 | 0.4 | | 5 | 0.64 | | 0.51 | 1 | | 0.36 | mA | |
| | | | 0/10 | 0.5 | | 10 | 1.6 | | 1.3 | 2.6 | | 0.9 | | |
| | | | 0/15 | 1.5 | | 15 | 4.2 | | 3.4 | 6.8 | | 2.4 | | |
| | | HCF Types | 0/ 5 | 0.4 | | 5 | 0.52 | | 0.44 | 1 | | 0.36 | | |
| | | | 0/10 | 0.5 | | 10 | 1.3 | | 1.1 | 2.6 | | 0.9 | | |
| | | | 0/15 | 1.5 | | 15 | 3.6 | | 3.0 | 6.8 | | 2.4 | | |
| I _{IH} , I _{IL} | Input Leakage Current | HCC Types | 0/18 | Any Input | | 18 | | \pm 0.1 | | \pm 10 ⁻⁵ | \pm 0.1 | | \pm 1 | μ A |
| | | HCF Types | 0/15 | Any Input | | 15 | | \pm 0.3 | | \pm 10 ⁻⁵ | \pm 0.3 | | \pm 1 | |
| C _I | Input Capacitance | | Any Input | | | | | | 5 | 7.5 | | | pF | |

(*) T_{Low}= - 55°C for HCC device : - 40°C for HCF device.

T_{High}= + 125°C for HCC device : + 85°C for HCF device.

The Noise Margin for both "1" and "0" level is : 1V min. with V_{DD} = 5V, 2V min. with V_{DD} = 10V, 2.5V min. with V_{DD} = 15V.

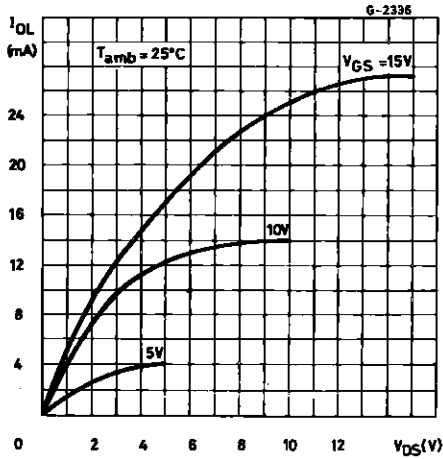
DYNAMIC ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}\text{C}$, $C_L = 50\text{pF}$, $R_L = 200\text{k}\Omega$, typical temperature coefficient for all V_{DD} values is $0.3\%/^{\circ}\text{C}$, all input rise and fall times = 20ns)

| Symbol | Parameter | Test Conditions | | Value | | | Unit |
|--------------------------|--|-----------------|--------------|-----------|------|------|---------------|
| | | | V_{DD} (V) | Min. | Typ. | Max. | |
| CLOCKED OPERATION | | | | | | | |
| t_{PLH}, t_{PHL} | Propagation Delay Time Carry Out Line | | 5 | | 250 | 500 | ns |
| | | | 10 | | 100 | 200 | |
| | | | 15 | | 75 | 150 | |
| t_{PLH}, t_{PHL} | Propagation Delay Time Decode Out Lines | | 5 | | 350 | 700 | ns |
| | | | 10 | | 125 | 250 | |
| | | | 15 | | 90 | 180 | |
| t_{THL}, t_{TLH} | Transition Time Carry Out Line | | 5 | | 100 | 200 | ns |
| | | | 10 | | 50 | 100 | |
| | | | 15 | | 25 | 50 | |
| f_{CL}^* | Maximum Clock Input Frequency | | 5 | 2.5 | 5 | | MHz |
| | | | 10 | 5.5 | 11 | | |
| | | | 15 | 8 | 16 | | |
| t_{WC} | Clock Pulse Width | | 5 | | 110 | 270 | ns |
| | | | 10 | | 50 | 100 | |
| | | | 15 | | 40 | 80 | |
| t_r, t_f | Clock Input Rise or Fall Time | | 5 | Unlimited | | | μs |
| | | | 10 | | | | |
| | | | 15 | | | | |
| RESET OPERATION | | | | | | | |
| t_{PLH}, t_{PHL} | Propagation Delay Time Carry Out Line | | 5 | | 275 | 550 | ns |
| | | | 10 | | 120 | 240 | |
| | | | 15 | | 80 | 160 | |
| t_{PLH}, t_{PHL} | Propagation Delay Time Decode Out Lines | | 5 | | 300 | 600 | ns |
| | | | 10 | | 125 | 250 | |
| | | | 15 | | 90 | 180 | |
| t_{WR} | Reset Pulse Width | | 5 | | 100 | 120 | ns |
| | | | 10 | | 50 | 100 | |
| | | | 15 | | 25 | 50 | |
| t_{rem} | Reset Removal Time | | 5 | | 0 | 30 | ns |
| | | | 10 | | 0 | 15 | |
| | | | 15 | | 0 | 10 | |

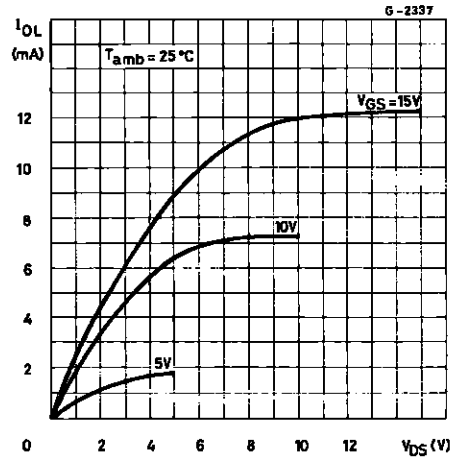
* Measured with respect to carry output line.

HCC/HCF4026B/4033B

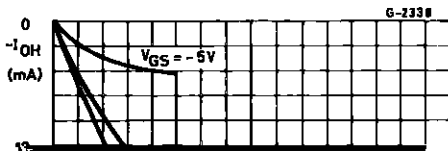
Typical Output Low (sink) Current



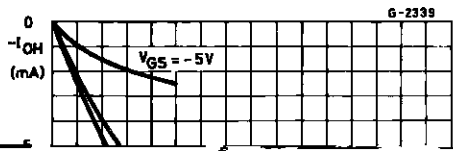
Minimum Output Low (sink) Current Characteristics.



Typical Output High (source) Current Characteristics.



Minimum Output High (source) Current Characteristics.



TYPICAL APPLICATIONS

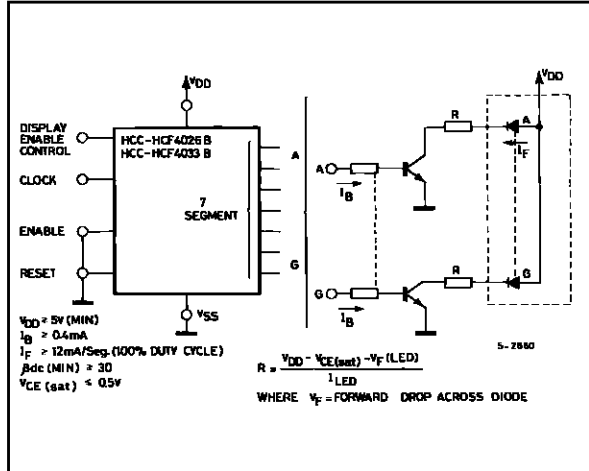
Interfacing with Filament Fluorescent Display.

Detail of Typical Flip-flop Stage for Both Types.

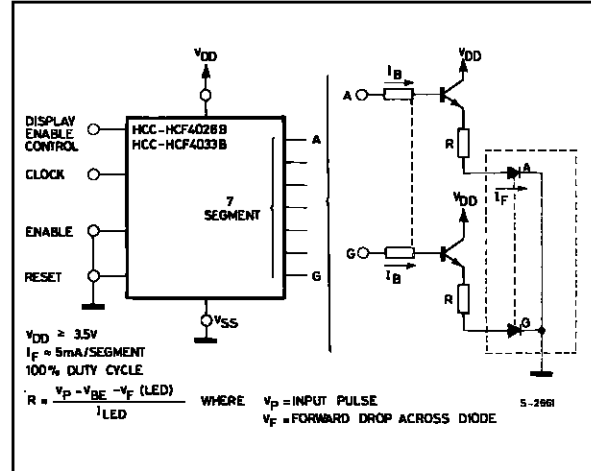


TYPICAL APPLICATIONS (continued)

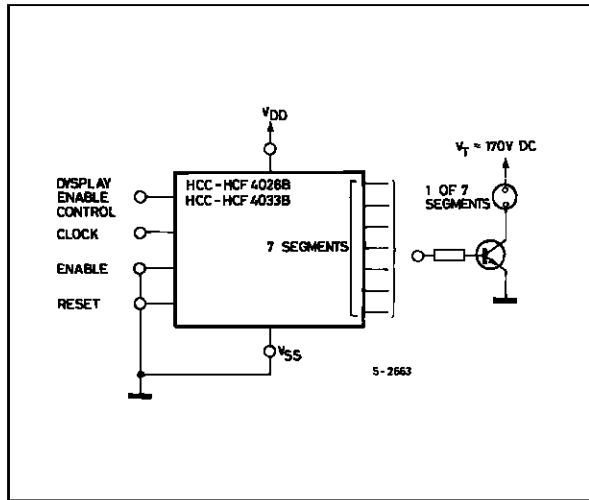
Interfacing with LED Displays (display common anode).



(Display Common Cathode).

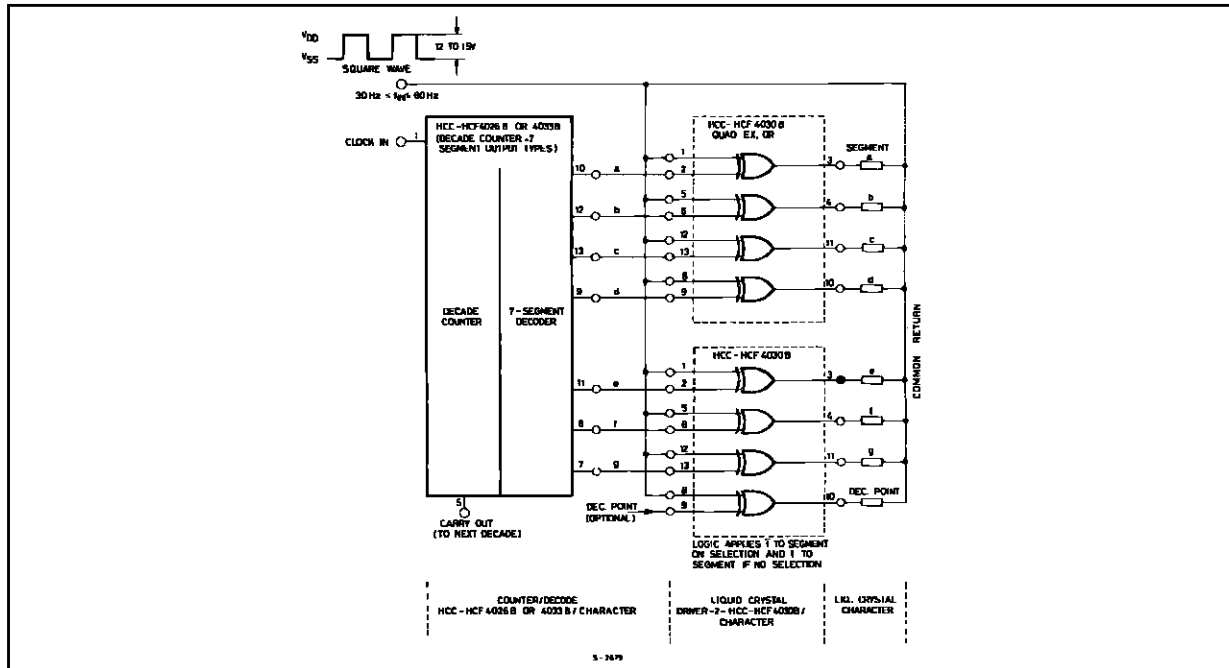


Interfacing with NIXIE Tube.



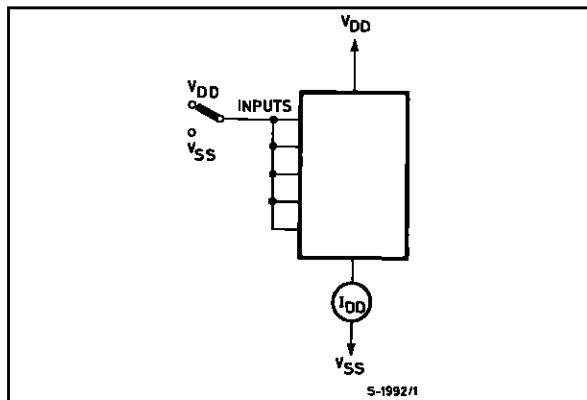
HCC/HCF4026B/4033B

Interfacing with Liquid Cristal Displays.

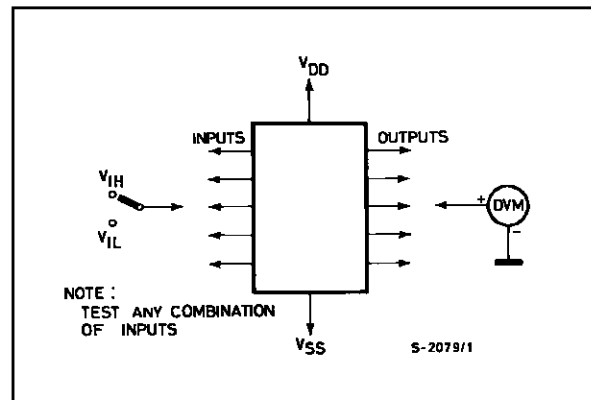


TEST CIRCUITS

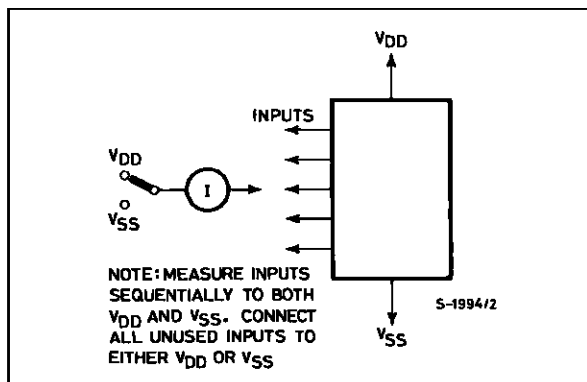
Quiescent Device Current



Input Voltage

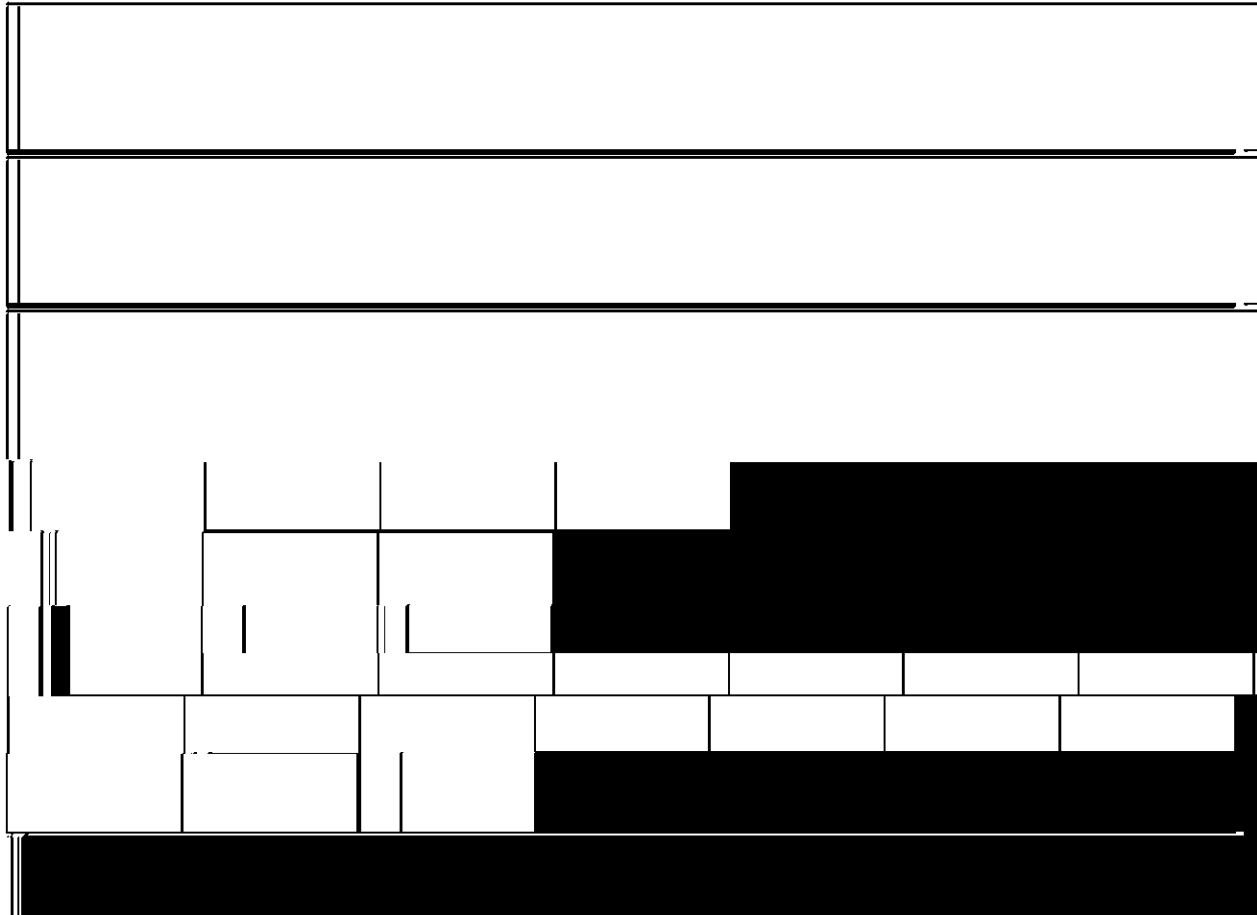


Input Current



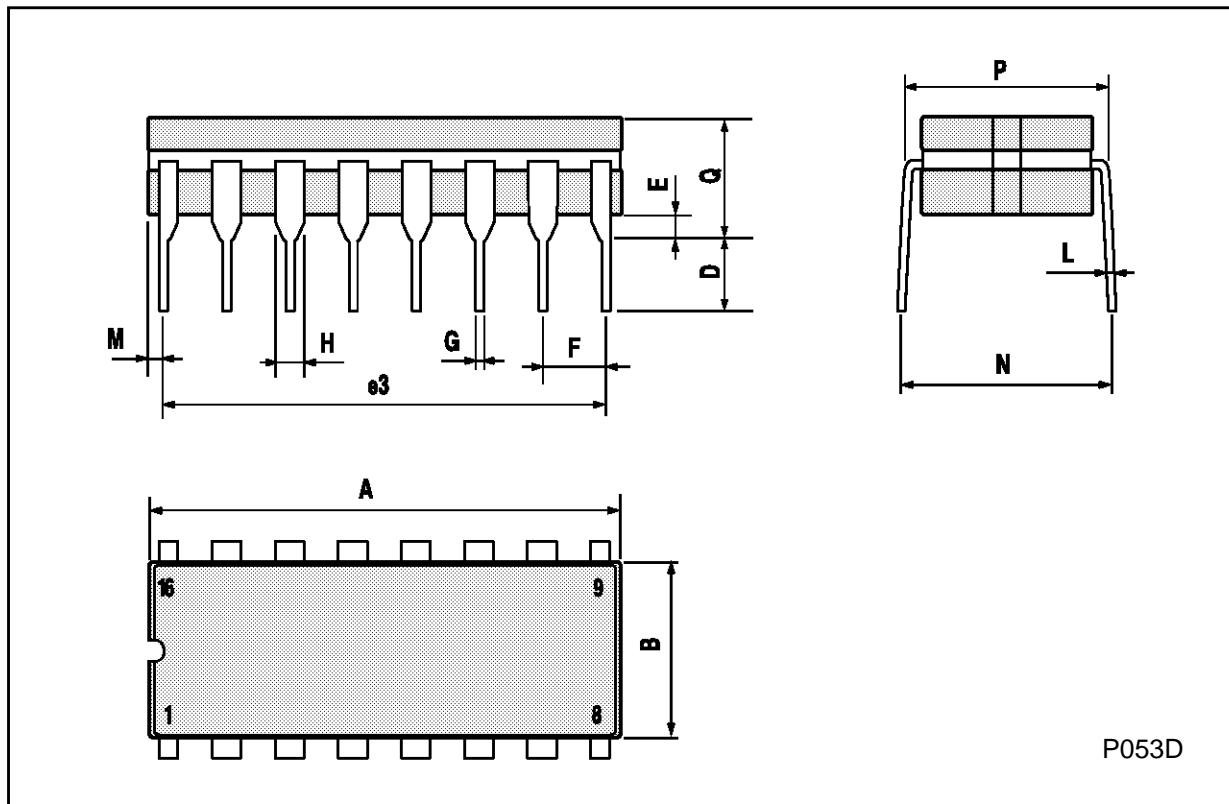
Plastic DIP16 (0.25) MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |



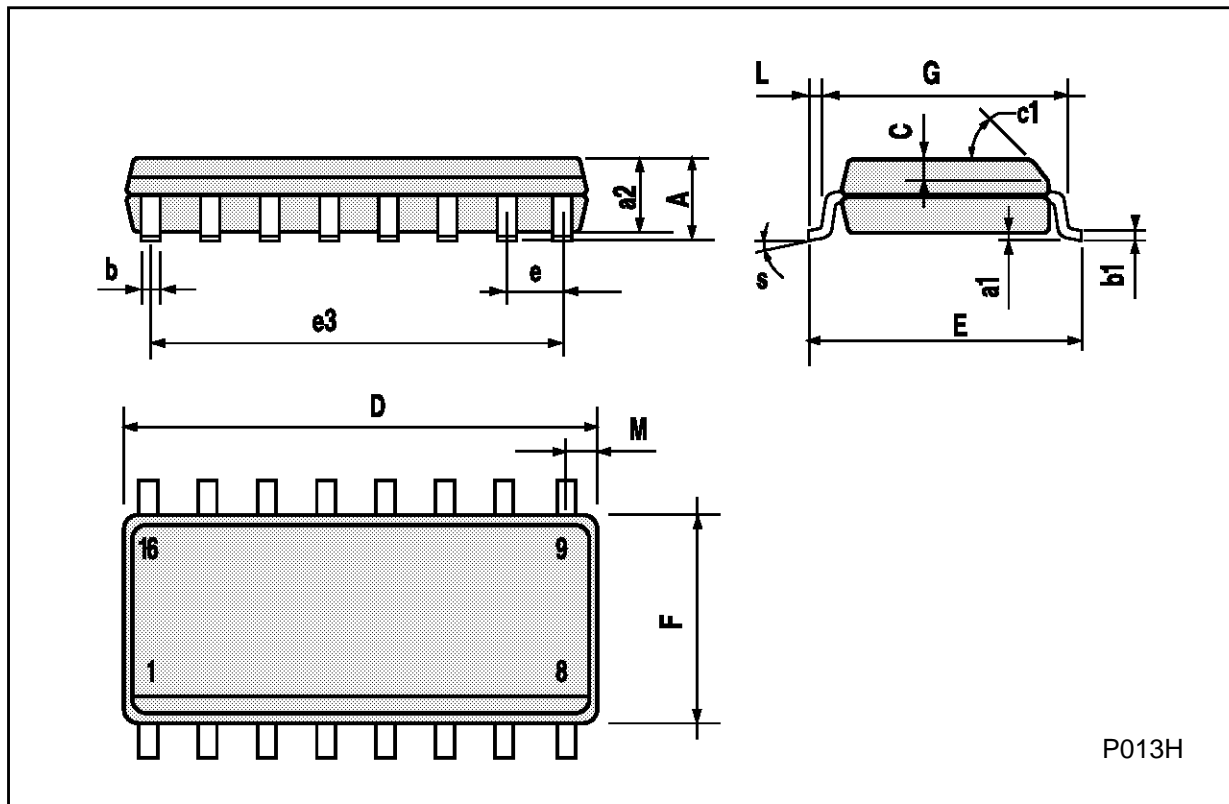
Ceramic DIP16/1 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 20 | | | 0.787 |
| B | | | 7 | | | 0.276 |
| D | | 3.3 | | | 0.130 | |
| E | 0.38 | | | 0.015 | | |
| e3 | | 17.78 | | | 0.700 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 0.016 | | 0.022 |
| H | 1.17 | | 1.52 | 0.046 | | 0.060 |
| L | 0.22 | | 0.31 | 0.009 | | 0.012 |
| M | 0.51 | | 1.27 | 0.020 | | 0.050 |
| N | | | 10.3 | | | 0.406 |
| P | 7.8 | | 8.05 | 0.307 | | 0.317 |
| Q | | | 5.08 | | | 0.200 |



SO16 (Narrow) MECHANICAL DATA

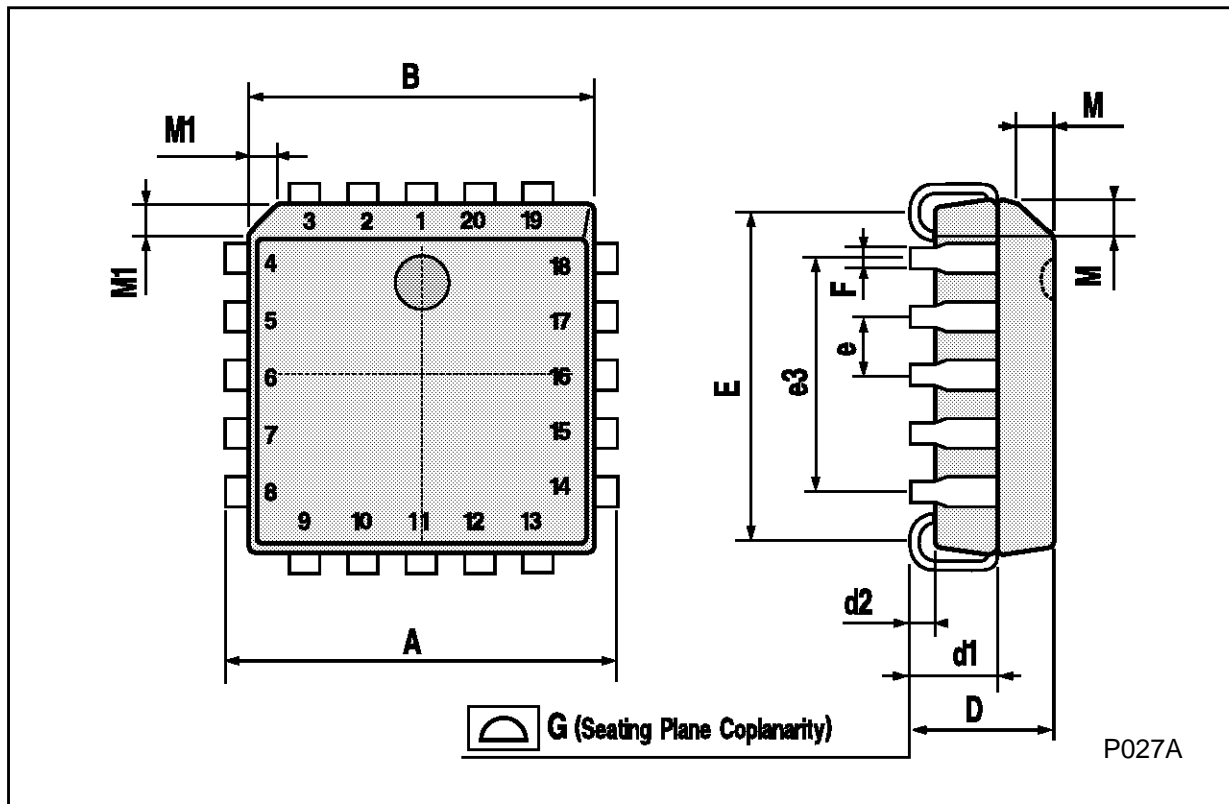
| DIM. | mm | | | inch | | |
|------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.019 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.385 | | 0.393 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.149 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.208 |
| L | 0.5 | | 1.27 | 0.019 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8° (max.) | | | | | |



P013H

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 | |



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