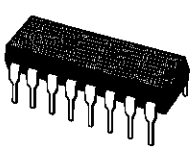
SGS-THOMSON MICROELECTRONICS

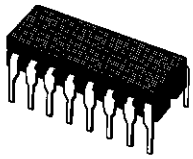
# HCC/HCF4532B

## 8–BIT PRIORITY ENCODER

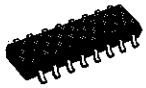
- CONVERTS FROM 1 OF 8 TO BINARY
- PROVIDES CASCADING FEATURE TO HANDLE ANY NUMBER OF INPUTS
- GROUP SELECT INDICATES ONE OR MORE PRIORITY INPUTS
- QUIESCENT CURRENT SPECIFIED TO 20V FOR HCC DEVICE
- STANDARDIZED SYMMETRICAL OUTPUT CHARACTERISTICS
- 5V, 10V, AND 15V PARAMETRIC RATINGS
- INPUT CURRENT OF 100 nA 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"



**EY**
(Plastic Package)



**F**
(Ceramic Frit Seal Package)



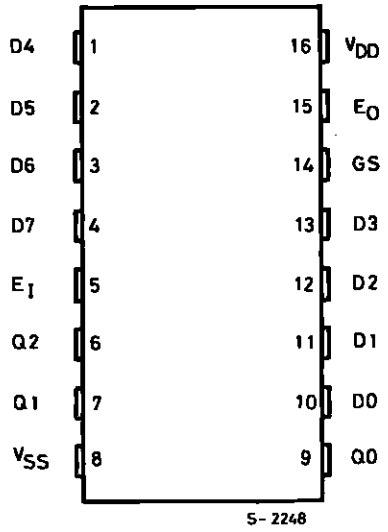
**M1**
(Micro Package)

**C1**
(Plastic Chip Carrier)

**ORDER CODES :**

HCC4532BF HCF4532BM1
HCF4532BEY HCF4532BC1

**PIN CONNECTIONS**

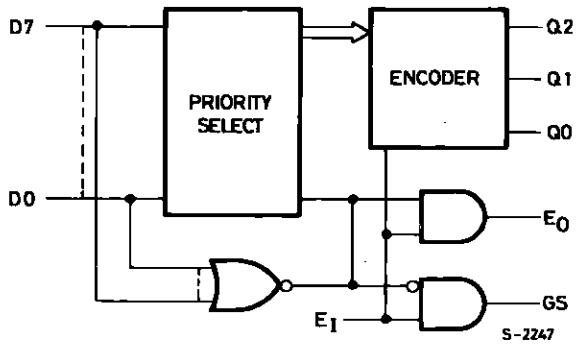



### DESCRIPTION

The **HCC4532B** (extended temperature range) and **HCF4532B** (intermediate temperature range) are monolithic integrated circuit, available in 16-lead dual in-line plastic or ceramic package and plastic micro package.

The **HCC/HCF4532** consists of combinational logic that encodes the highest priority input (D7-D0) to a 3-bit binary code. The eight inputs, D7 through D0, each have an assigned priority. D7 is the highest priority and D0 is the lowest. The priority encoder is inhibited when the chip-enable input $E_I$ is low. When $E_I$ is high, the binary representation of the highest-priority input appears on output lines Q2-Q0, and the group select line GS is high to indicate that priority inputs are present. The enable-out ($E_O$) is high when no priority inputs are present. If any one input is high, $E_O$ is low and all cascaded lower-order stages are disabled.

## FUNCTIONAL DIAGRAM




## ABSOLUTE MAXIMUM RATINGS

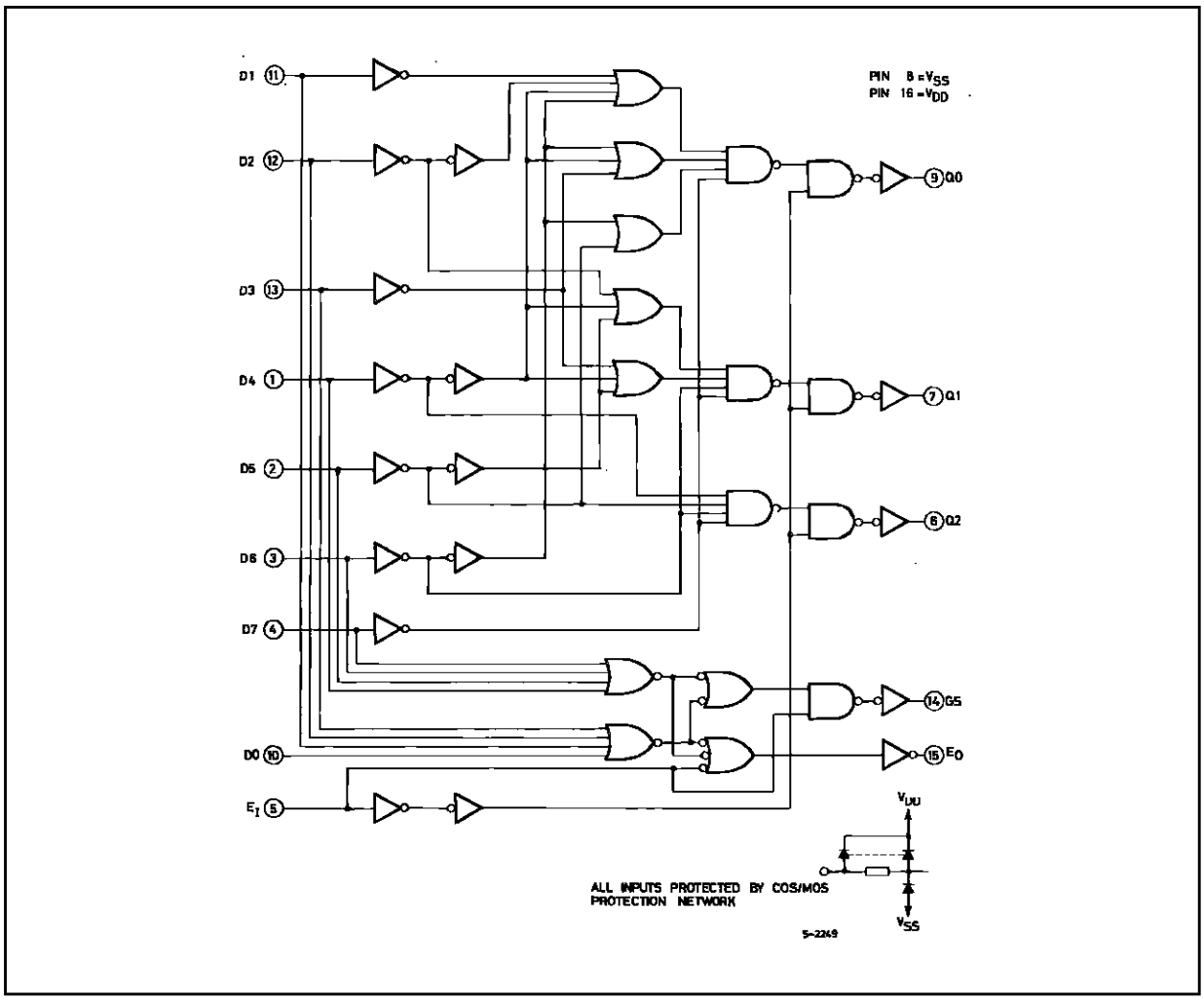
| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DD}$* | Supply Voltage : **HCC** Types<br>**HCF** Types | – 0.5 to + 20<br>– 0.5 to + 18 | V<br>V |
| $V_i$ | Input Voltage | – 0.5 to $V_{DD}$ + 0.5 | V |
| $I_I$ | DC Input Current (any one input) | ± 10 | mA |
| $P_{tot}$ | Total Power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

## RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DD}$ | Supply Voltage : **HCC** Types<br>**HCF** Types | 3 to 18<br>3 to 15 | V<br>V |
| $V_I$ | Input Voltage | 0 to $V_{DD}$ | V |
| $T_{op}$ | Operating Temperature : **HCC** Types<br>**HCF** Types | – 55 to + 125<br>– 40 to + 85 | °C<br>°C |

## LOGIC DIAGRAM




## TRUTH TABLE

| Input | | | | | | | | | Output | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $E_I$ | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | GS | Q2 | Q1 | Q0 | $E_O$ |
| 0 | X | X | X | X | X | X | X | X | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | X | X | X | X | X | X | X | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | X | X | X | X | X | X | 1 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 1 | X | X | X | X | X | 1 | 1 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | X | X | X | X | 1 | 1 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 | X | X | X | 1 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 1 | X | X | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

X ≡ Don't Care  Logic 1 ≡ High  Logic 0 ≡ Low

**STATIC ELECTRICAL CHARACTERISTICS** (over recommended operating conditions)

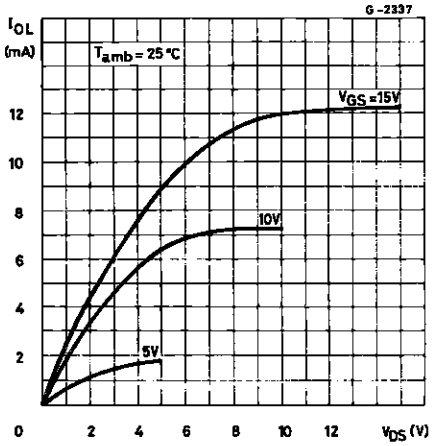
| Symbol | Parameter | | Test Conditions | | | | Value | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $V_I$ (V) | $V_O$ (V) | $\|I_O\|$ (μA) | $V_{DD}$ (V) | $T_{Low}$* | | 25°C | | | $T_{High}$* | | |
| | | | | | | | Min. | Max. | Min. | Typ. | Max. | Min. | Max. | |
| $I_L$ | Quiescent Current | HCC Types | 0/ 5 | | | 5 | | 5 | | 0.04 | 5 | | 150 | μA |
| | | | 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 | |
| | | | 0/15 | | | 15 | | 80 | | 0.04 | 80 | | 600 | |
| $V_{OH}$ | 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 | | 0.05 | V |
| | | | 10/0 | | < 1 | 10 | | 0.05 | | | 0.05 | | 0.05 | |
| | | | 15/0 | | < 1 | 15 | | 0.05 | | | 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 | | 1.5 | V |
| | | | | 9/1 | < 1 | 10 | | 3 | | | 3 | | 3 | |
| | | | | 13.5/1.5 | < 1 | 15 | | 4 | | | 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 | | ± 0.1 | | $\pm 10^{-5}$ | ± 0.1 | | ± 1 | μA |
| | | HCF Types | 0/15 | | | 15 | | ± 0.3 | | $\pm 10^{-5}$ | ± 0.3 | | ± 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, 2.5 V min. with $V_{DD}$ = 15V.

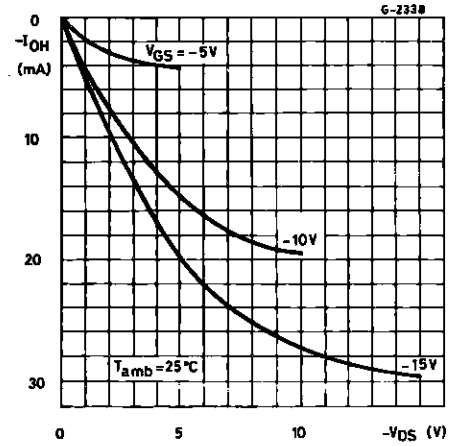
**DYNAMIC ELECTRICAL CHARACTERISTICS** ($T_{amb}$ = 25°C, $C_L$ = 50pF, $R_L$ = 200kΩ, typical temperature coefficient for all $V_{DD}$ values is 0.3%/°C, all input rise and fall times = 20ns)

| Symbol | Parameter | Test Conditions | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | $V_{DD}$ (V) | Min. | Typ. | Max. | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Time ($E_I$ to $E_O$, $E_I$ to GS) | | 5 | | 110 | 220 | ns |
| | | | 10 | | 55 | 110 | |
| | | | 15 | | 45 | 85 | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Time ($E_I$ to Qm, Dn to GS) | | 5 | | 170 | 340 | ns |
| | | | 10 | | 85 | 170 | |
| | | | 15 | | 65 | 125 | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay Time (Dn to $Q_M$) | | 5 | | 220 | 440 | ns |
| | | | 10 | | 110 | 220 | |
| | | | 15 | | 85 | 160 | |
| $t_{TLH}$, $t_{THL}$ | Transition Time | | 5 | | 100 | 200 | ns |
| | | | 10 | | 50 | 100 | |
| | | | 15 | | 40 | 80 | |

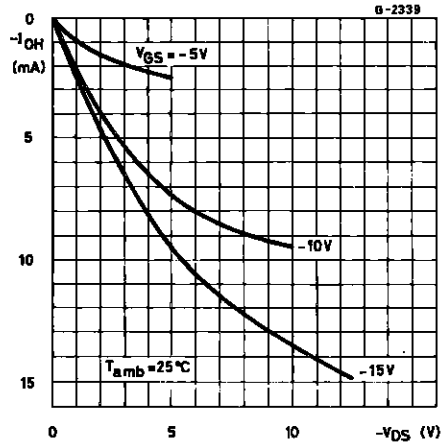
Minimum Output Low (sink) Current Characteristics.



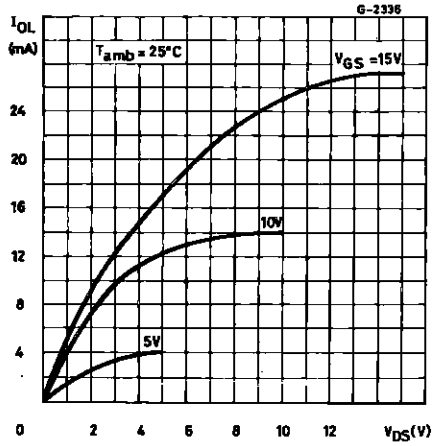

Typical Output High (source) Current Characteristics.



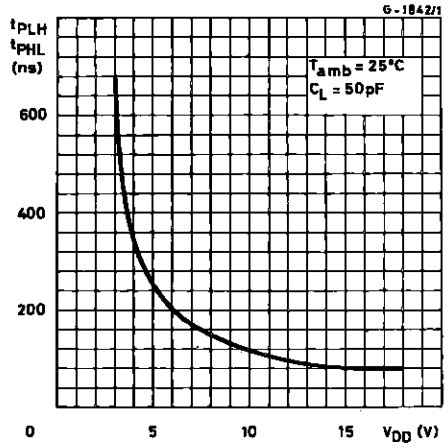
Minimum Output High (source) Current Characteristics.



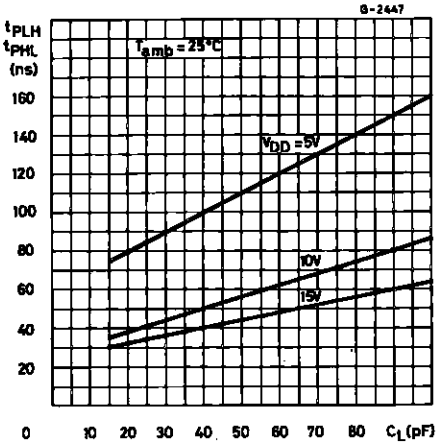

Typical Output Low (sink) Current Characteristics.



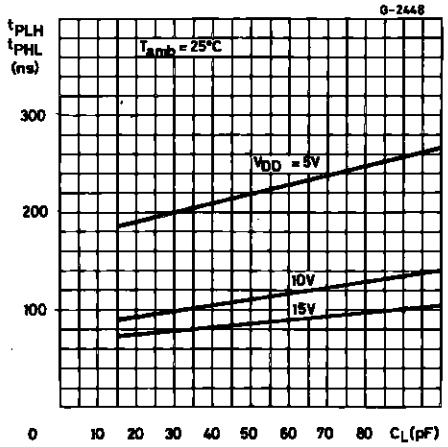

Typical Propagation Delay (Dn to Qm) vs. Supply Voltage.



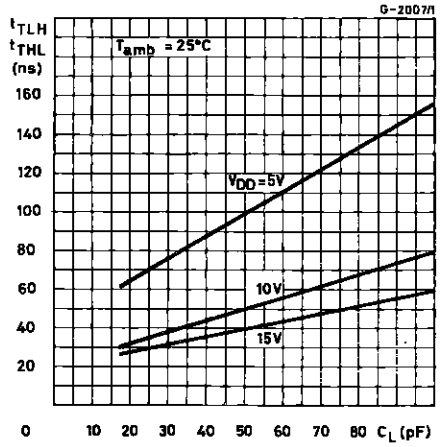

Typical Propagation Delay ($E_I$ to GS, $E_I$ to $E_O$) vs. Load Capacitance.



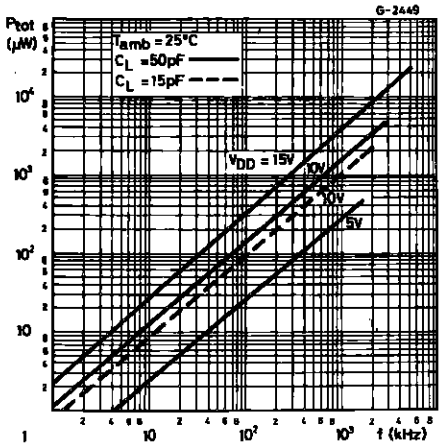

Typical Propagation Delay (Dn to Qm) vs. Load Capacitance.




Typical Transition Time vs. Load Capacitance.

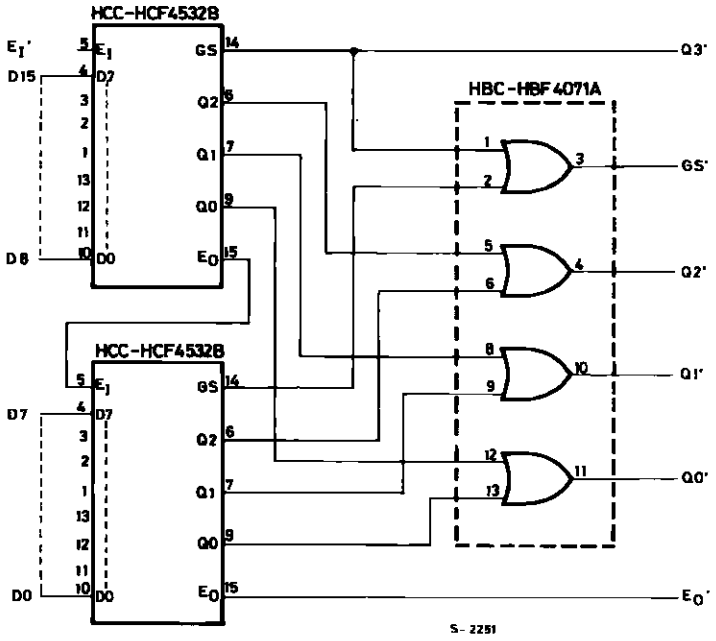


Typical Dynamic Power Dissipation vs. Frequency.



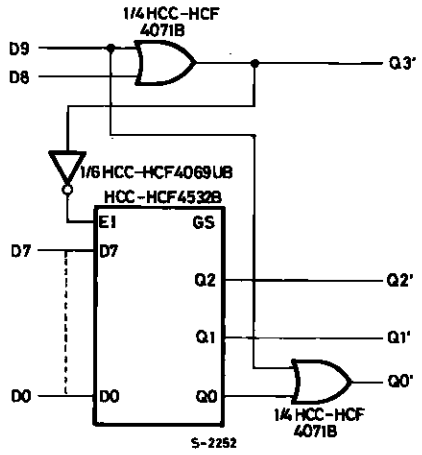

## APPLICATIONS

16-LEVEL PRIORITY ENCODER



**APPLICATIONS** (continued)

0-TO-9 KEYBOARD ENCODER



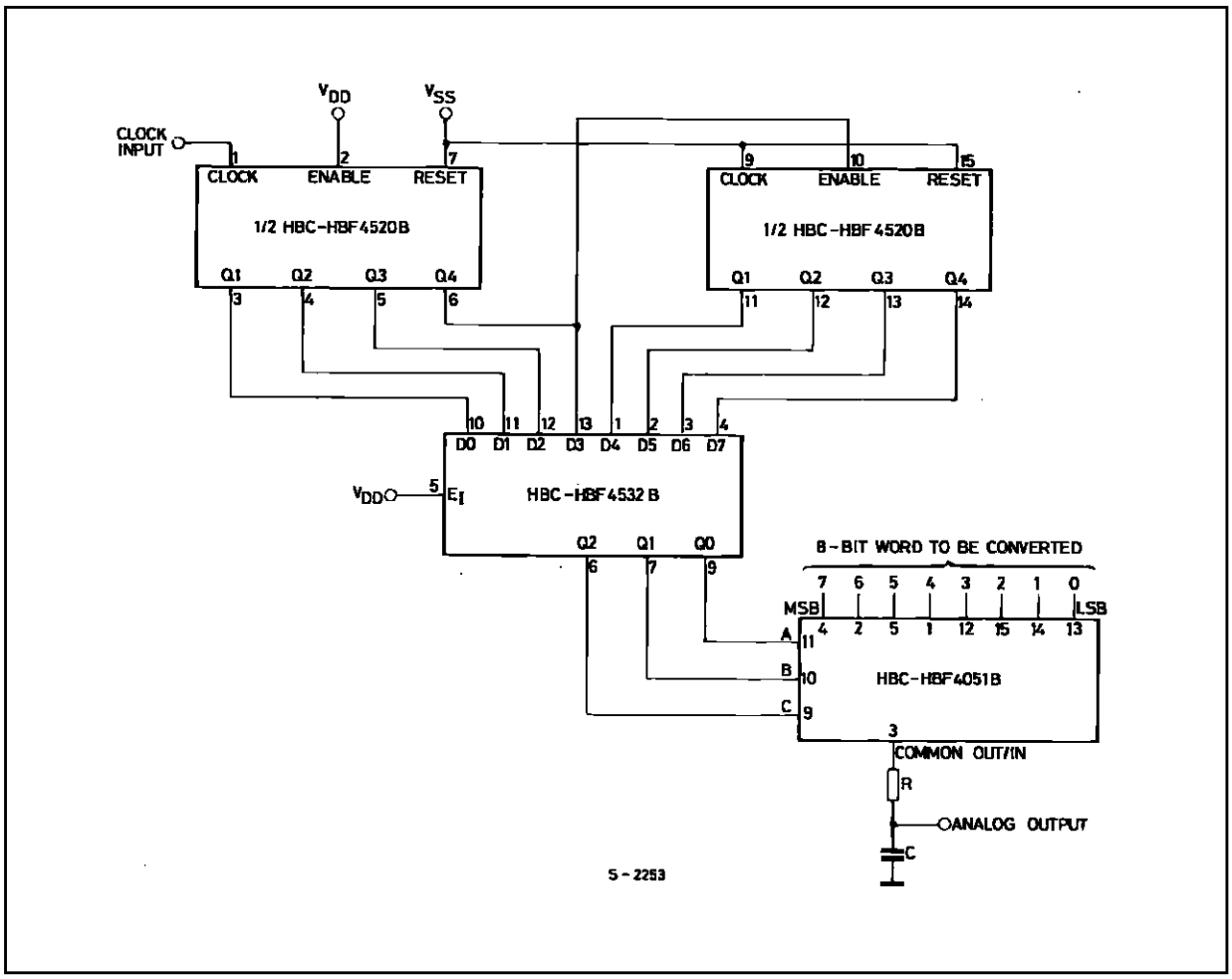

**TRUTH TABLE**

| Input | | | | | | | | | | Output | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | GS | Q3' | Q2' | Q1' | Q0 |
| 1 | X | X | X | X | X | X | X | X | X | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | X | X | X | X | X | X | X | X | 0 | 1 | 0 | 0 | 0 |
| 0 | 0 | 1 | X | X | X | X | X | X | X | 1 | 0 | 1 | 1 | 1 |
| 0 | 0 | 0 | 1 | X | X | X | X | X | X | 1 | 0 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 1 | X | X | X | X | X | 1 | 0 | 1 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 1 | X | X | X | X | 1 | 0 | 1 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | X | X | 1 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | X | 1 | 0 | 0 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |

X = Don't Care  Logic 1 ≡ High  Logic 0 ≡ Low

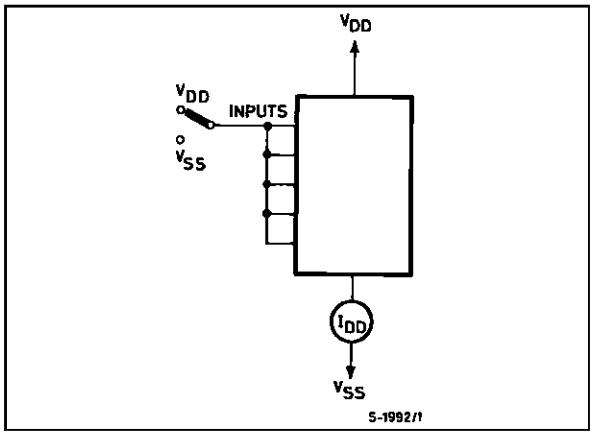
**APPLICATIONS** (continued)

DIGITAL TO ANALOG CONVERSION

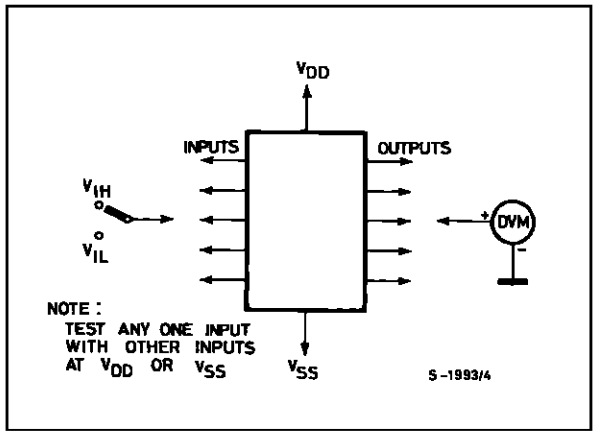



**TEST CIRCUITS**

Input Leakage Current.

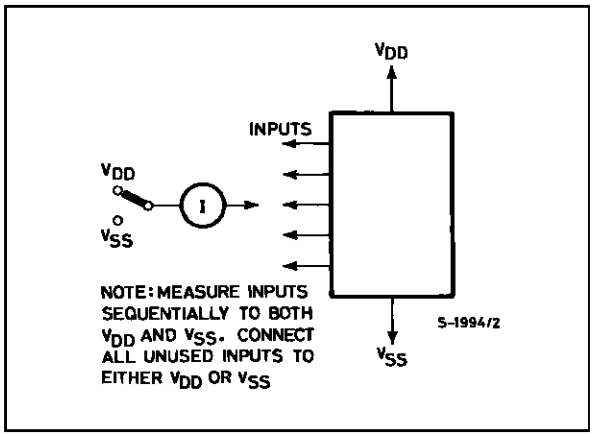



Noise Immunity.

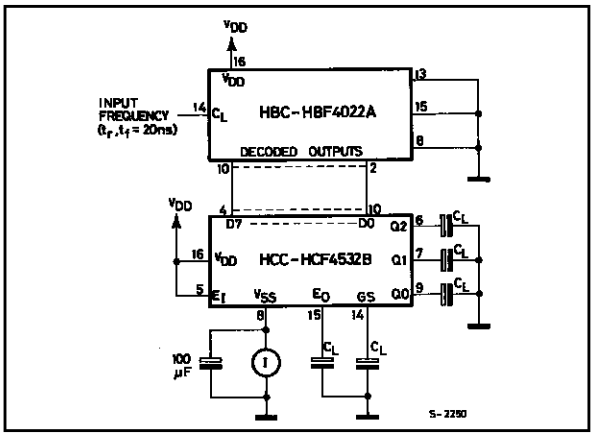


**TEST CIRCUITS** (continued)

Quiescent Device Current.

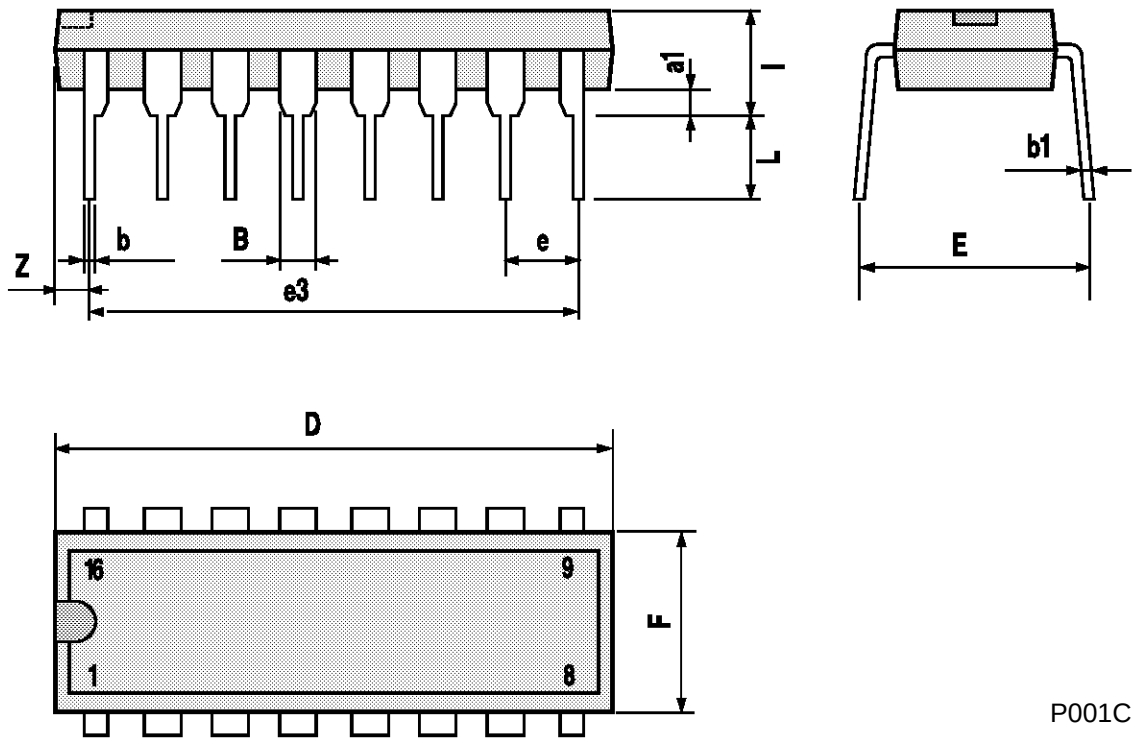



Dynamic Power Dissipation.



## Plastic DIP16 (0.25) MECHANICAL DATA

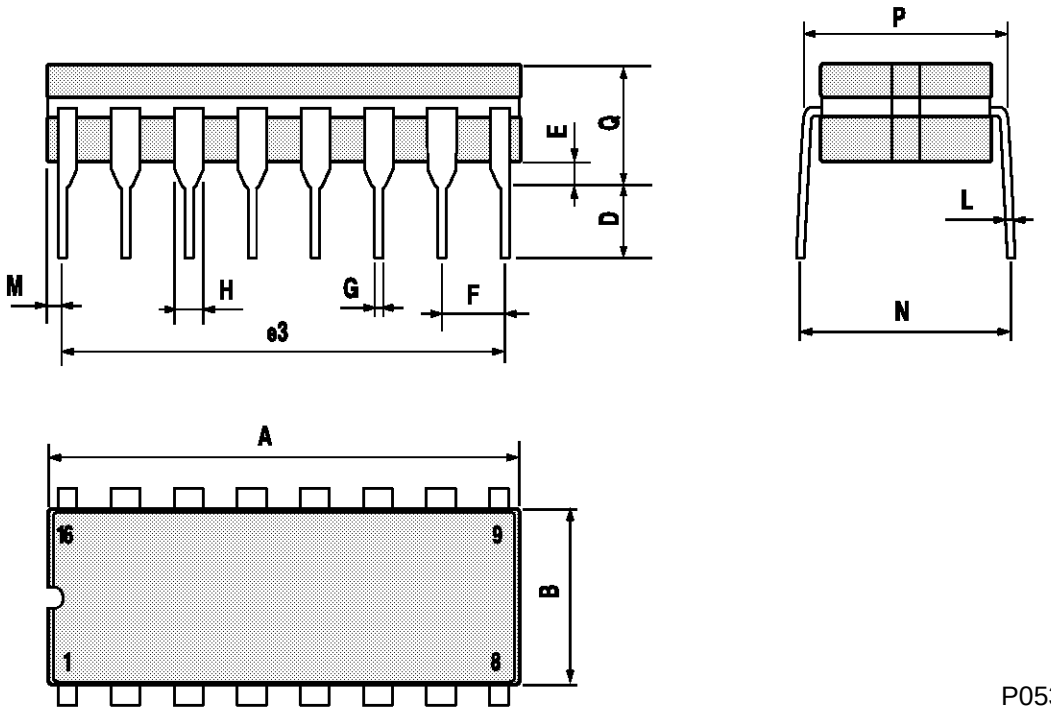
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 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 |




P001C

## Ceramic DIP16/1 MECHANICAL DATA

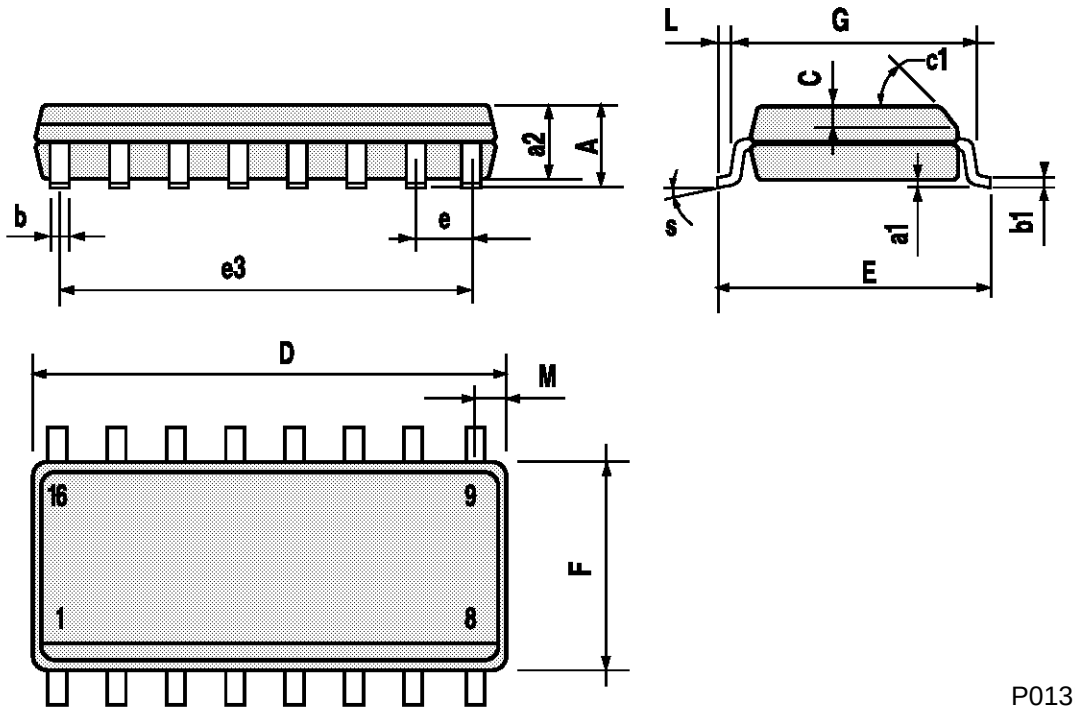
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 20 | | | 0.787 |
| B | | | 7 | | | 0.276 |
| D | | 3.3 | | | 0.130 | |
| E | 0.38 | | | 0.015 | | |
| e3 | | 17.78 | | | 0.700 | |
| F | 2.29 | | 2.79 | 0.090 | | 0.110 |
| G | 0.4 | | 0.55 | 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 |




P053D

## SO16 (Narrow) MECHANICAL DATA

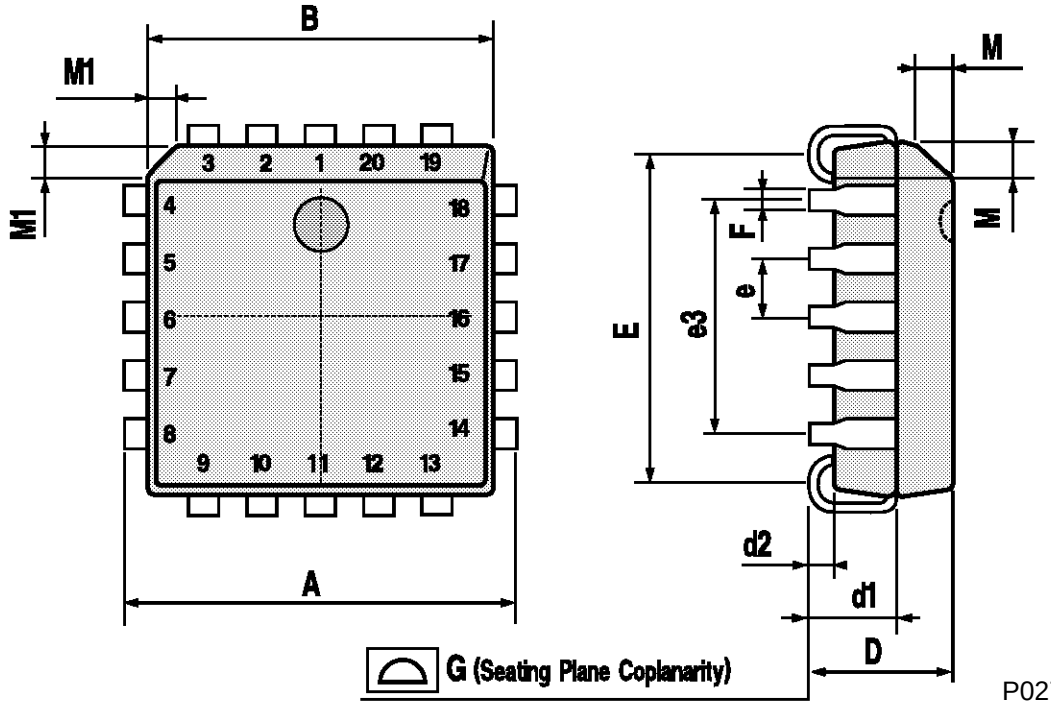
| DIM. | mm | | | inch | | |
|---|---|---|---|---|---|---|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.068 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.007 |
| a2 | | | 1.65 | | | 0.064 |
| b | 0.35 | | 0.46 | 0.013 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 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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