



## M74HCT125

### QUAD BUS BUFFER (3-STATE)

- HIGH SPEED:  
 $t_{PD} = 13\text{ns}$  (TYP.) at  $V_{CC} = 4.5\text{V}$
- LOW POWER DISSIPATION:  
 $I_{CC} = 4\mu\text{A}$  (MAX.) at  $T_A = 25^\circ\text{C}$
- COMPATIBLE WITH TTL OUTPUTS :  
 $V_{IH} = 2\text{V}$  (MIN.)  $V_{IL} = 0.8\text{V}$  (MAX)
- BALANCED PROPAGATION DELAYS:  
 $t_{PLH} \cong t_{PHL}$
- SYMMETRICAL OUTPUT IMPEDANCE:  
 $|I_{OH}| = I_{OL} = 6\text{mA}$  (MIN)
- PIN AND FUNCTION COMPATIBLE WITH  
74 SERIES 125

#### DESCRIPTION

The M74HCT125 is an high speed CMOS QUAD BUFFER (3-STATE) fabricated with silicon gate C<sup>2</sup>MOS technology.

The device requires the 3-STATE control input  $\overline{G}$  to be set high to place the output in to the high impedance state.



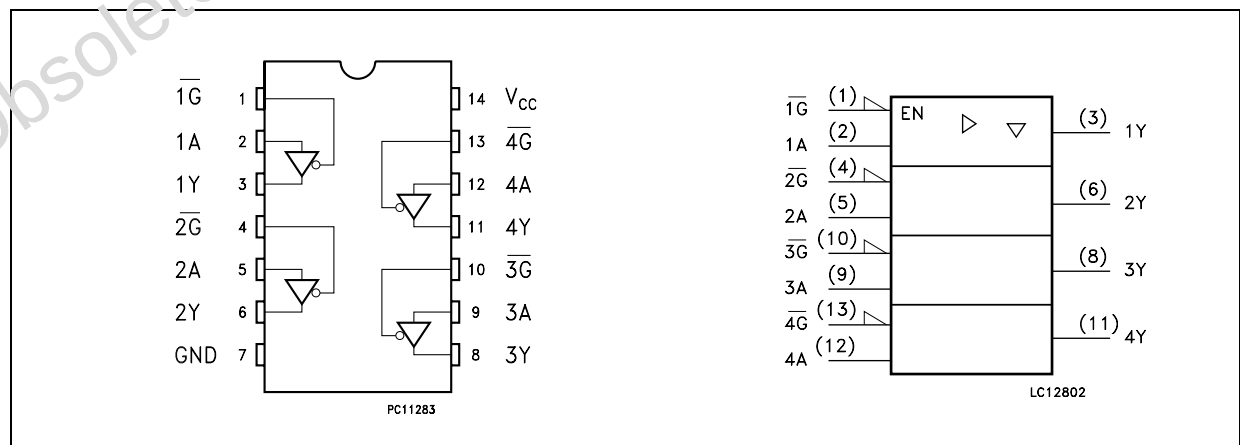
#### ORDER CODES

| PACKAGE | TUBE         | T & R           |
|---------|--------------|-----------------|
| DIP     | M74HCT125B1R |                 |
| SOP     | M74HCT125M1R | M74HCT125RM13TR |
| TSSOP   |              | M74HCT125TTR    |

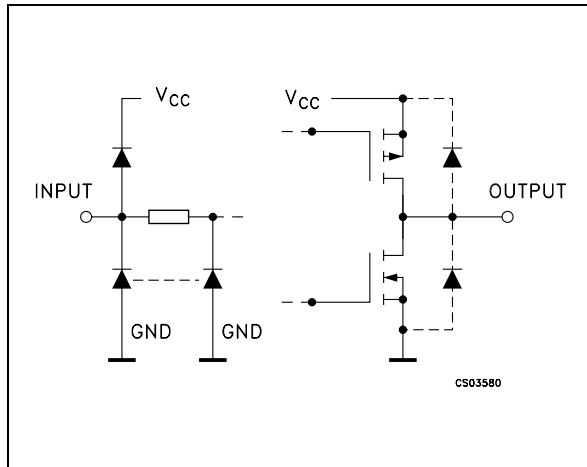
The M74HCT125 is designed to directly interface HSC<sup>2</sup>MOS systems with TTL and NMOS components.

All inputs are equipped with protection circuits against static discharge and transient excess voltage.

#### PIN CONNECTION AND IEC LOGIC SYMBOLS



## INPUT AND OUTPUT EQUIVALENT CIRCUIT



## PIN DESCRIPTION

| PIN No       | SYMBOL                             | NAME AND FUNCTION       |
|--------------|------------------------------------|-------------------------|
| 1, 4, 10, 13 | $\overline{1G}$ TO $\overline{4G}$ | Output Enable Input     |
| 2, 5, 9, 12  | 1A TO 4A                           | Data Inputs             |
| 3, 6, 8, 11  | 1Y TO 4Y                           | Data Outputs            |
| 7            | GND                                | Ground (0V)             |
| 14           | $V_{CC}$                           | Positive Supply Voltage |

## TRUTH TABLE

| A | $\overline{G}$ | Y |
|---|----------------|---|
| X | H              | Z |
| L | L              | L |
| H | L              | H |

## 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        | $\pm 20$               | mA   |
| $I_{OK}$              | DC Output Diode Current       | $\pm 20$               | mA   |
| $I_O$                 | DC Output Current             | $\pm 35$               | mA   |
| $I_{CC}$ or $I_{GND}$ | DC $V_{CC}$ or Ground Current | $\pm 70$               | 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 conditions is not implied.

(\*) 500mW at 65 °C; derate to 300mW by 10mW/°C from 65°C to 85°C

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter                                             | Value         | Unit |
|------------|-------------------------------------------------------|---------------|------|
| $V_{CC}$   | Supply Voltage                                        | 4.5 to 5.5    | V    |
| $V_I$      | Input Voltage                                         | 0 to $V_{CC}$ | V    |
| $V_O$      | Output Voltage                                        | 0 to $V_{CC}$ | V    |
| $T_{op}$   | Operating Temperature                                 | -55 to 125    | °C   |
| $t_r, t_f$ | Input Rise and Fall Time ( $V_{CC} = 4.5$ to $5.5V$ ) | 0 to 500      | ns   |

## DC SPECIFICATIONS

| Symbol            | Parameter                             | Test Condition         |                                                                                                                                       | Value                 |      |       |             |      |              | Unit |      |
|-------------------|---------------------------------------|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------|-------------|------|--------------|------|------|
|                   |                                       | V <sub>CC</sub><br>(V) |                                                                                                                                       | T <sub>A</sub> = 25°C |      |       | -40 to 85°C |      | -55 to 125°C |      |      |
|                   |                                       |                        |                                                                                                                                       | Min.                  | Typ. | Max.  | Min.        | Max. | Min.         |      | Max. |
| V <sub>IH</sub>   | High Level Input Voltage              | 4.5 to 5.5             |                                                                                                                                       | 2.0                   |      |       | 2.0         |      | 2.0          |      | V    |
| V <sub>IL</sub>   | Low Level Input Voltage               | 4.5 to 5.5             |                                                                                                                                       |                       |      | 0.8   |             | 0.8  |              | 0.8  | V    |
| V <sub>OH</sub>   | High Level Output Voltage             | 4.5                    | I <sub>O</sub> =-20 μA                                                                                                                | 4.4                   | 4.5  |       | 4.4         |      | 4.4          |      | V    |
|                   |                                       |                        | I <sub>O</sub> =-6.0 mA                                                                                                               | 4.18                  | 4.31 |       | 4.13        |      | 4.10         |      |      |
| V <sub>OL</sub>   | Low Level Output Voltage              | 4.5                    | I <sub>O</sub> =20 μA                                                                                                                 |                       | 0.0  | 0.1   |             | 0.1  |              | 0.1  | V    |
|                   |                                       |                        | I <sub>O</sub> =6.0 mA                                                                                                                |                       | 0.17 | 0.26  |             | 0.33 |              | 0.40 |      |
| I <sub>I</sub>    | Input Leakage Current                 | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                               |                       |      | ± 0.1 |             | ± 1  |              | ± 1  | μA   |
| I <sub>OZ</sub>   | High Impedance Output Leakage Current | 5.5                    | V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>V <sub>O</sub> = V <sub>CC</sub> or GND                                        |                       |      | ± 0.5 |             | ± 5  |              | ± 10 | μA   |
| I <sub>CC</sub>   | Quiescent Supply Current              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                               |                       |      | 4     |             | 40   |              | 80   | μA   |
| Δ I <sub>CC</sub> | Additional Worst Case Supply Current  | 5.5                    | Per Input pin<br>V <sub>I</sub> = 0.5V or<br>V <sub>I</sub> = 2.4V<br>Other Inputs at<br>V <sub>CC</sub> or GND<br>I <sub>O</sub> = 0 |                       |      | 2.0   |             | 2.9  |              | 3.0  | mA   |

AC ELECTRICAL CHARACTERISTICS (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6ns)

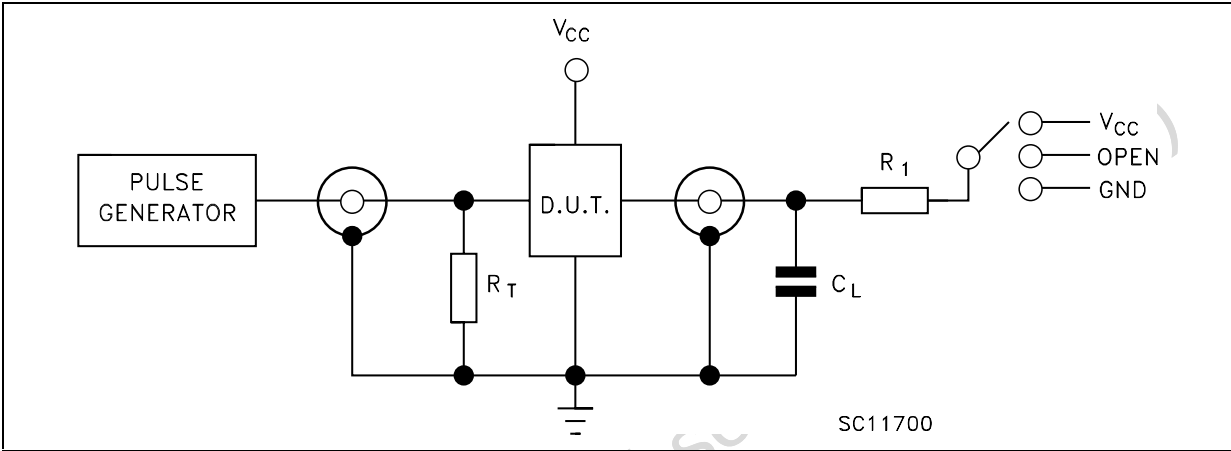
| Symbol                            | Parameter              | Test Condition         |                        |                       | Value                 |      |      |             |      |              | Unit |      |
|-----------------------------------|------------------------|------------------------|------------------------|-----------------------|-----------------------|------|------|-------------|------|--------------|------|------|
|                                   |                        | V <sub>CC</sub><br>(V) | C <sub>L</sub><br>(pF) |                       | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                                   |                        |                        |                        |                       | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| t <sub>TLH</sub> t <sub>THL</sub> | Output Transition Time | 4.5                    | 50                     |                       |                       | 7    | 12   |             | 15   |              | 18   | ns   |
| t <sub>PLH</sub> t <sub>PHL</sub> | Propagation Delay Time | 4.5                    | 50                     |                       |                       | 13   | 21   |             | 26   |              | 32   | ns   |
|                                   |                        | 4.5                    | 150                    |                       |                       | 17   | 27   |             | 34   |              | 41   |      |
| t <sub>PZL</sub> t <sub>PZH</sub> | Output Enable Time     | 4.5                    | 50                     | R <sub>L</sub> = 1 KΩ |                       | 15   | 24   |             | 30   |              | 36   | ns   |
|                                   |                        | 4.5                    | 150                    |                       |                       | 19   | 30   |             | 38   |              | 45   |      |
| t <sub>PLZ</sub> t <sub>PHZ</sub> | Output Disable Time    | 4.5                    | 50                     | R <sub>L</sub> = 1 KΩ |                       | 17   | 24   |             | 30   |              | 36   | ns   |

CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                              | Test Condition         |  | Value                 |      |      |             |      |              | Unit |      |
|-----------------|----------------------------------------|------------------------|--|-----------------------|------|------|-------------|------|--------------|------|------|
|                 |                                        | V <sub>CC</sub><br>(V) |  | T <sub>A</sub> = 25°C |      |      | -40 to 85°C |      | -55 to 125°C |      |      |
|                 |                                        |                        |  | Min.                  | Typ. | Max. | Min.        | Max. | Min.         |      | Max. |
| C <sub>IN</sub> | Input Capacitance                      |                        |  |                       | 5    | 10   |             | 10   |              | 10   | pF   |
| C <sub>PD</sub> | Power Dissipation Capacitance (note 1) |                        |  |                       | 56   |      |             |      |              |      | pF   |

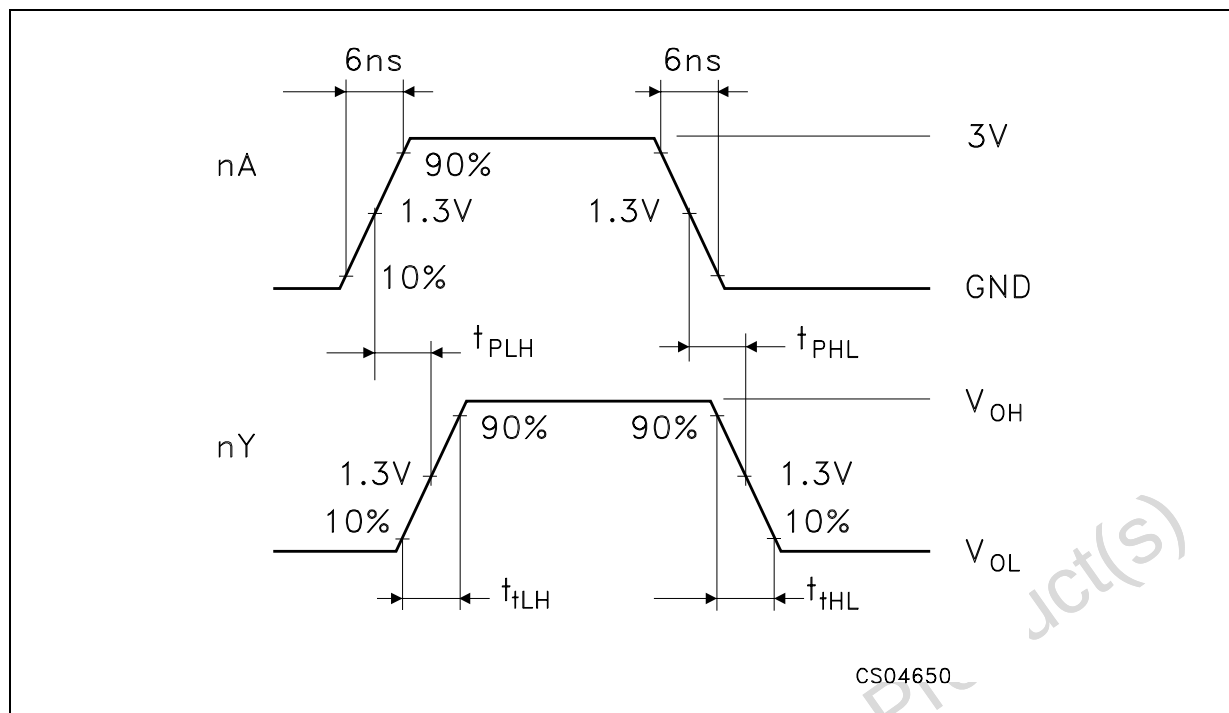
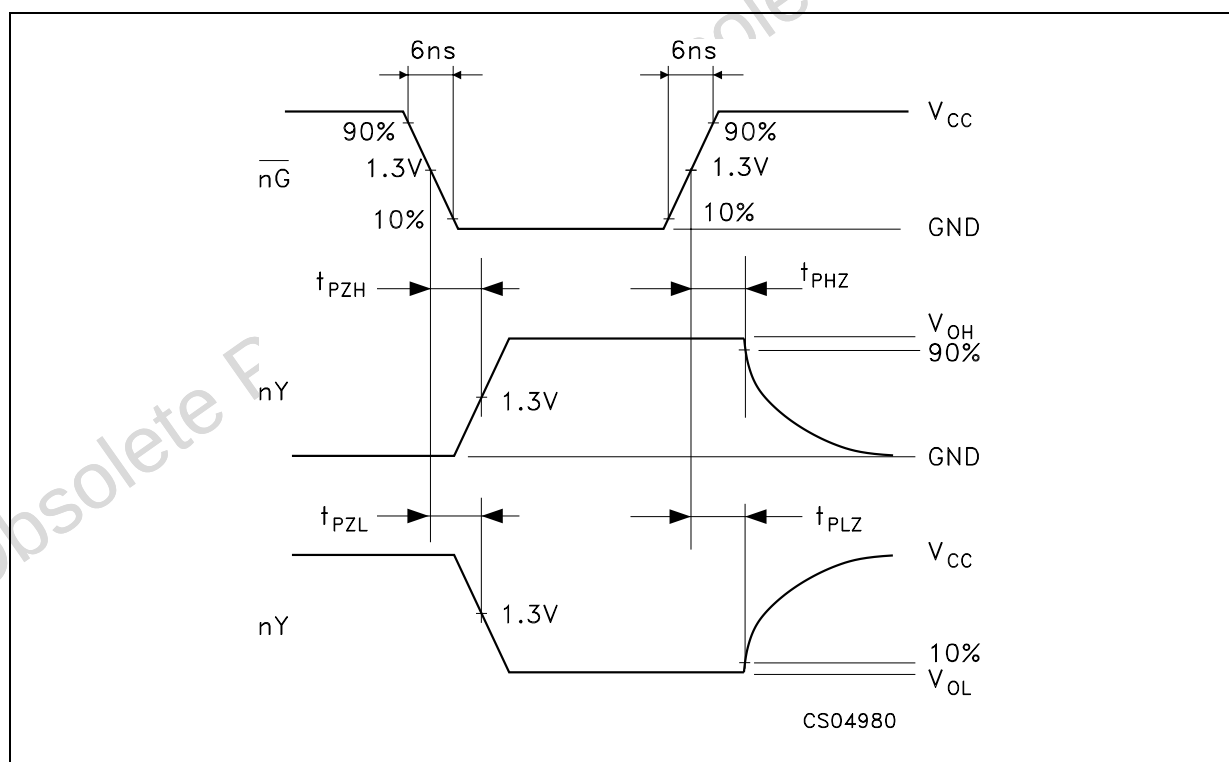
1) C<sub>PD</sub> is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN}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

TEST CIRCUIT



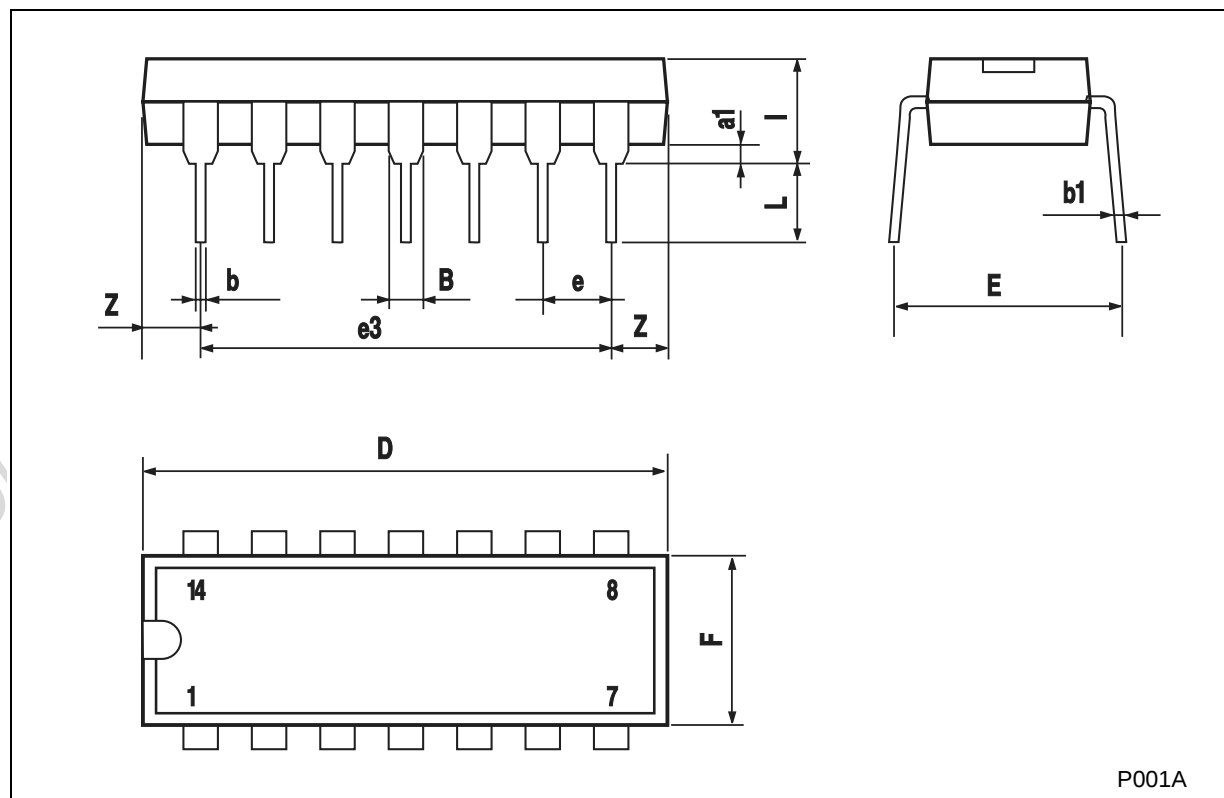
| TEST                                | SWITCH          |
|-------------------------------------|-----------------|
| t <sub>PLH</sub> , t <sub>PHL</sub> | Open            |
| t <sub>PZL</sub> , t <sub>PLZ</sub> | V <sub>CC</sub> |
| t <sub>PZH</sub> , t <sub>PHZ</sub> | GND             |

C<sub>L</sub> = 50pF/150pF or equivalent (includes jig and probe capacitance)  
R<sub>1</sub> = 1KΩ or equivalent  
R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50Ω))

**WAVEFORM 1 : PROPAGATION DELAY TIMES** ( $f=1\text{MHz}$ ; 50% duty cycle)**WAVEFORM 2 : OUTPUT ENABLE AND DISABLE TIMES** ( $f=1\text{MHz}$ ; 50% duty cycle)

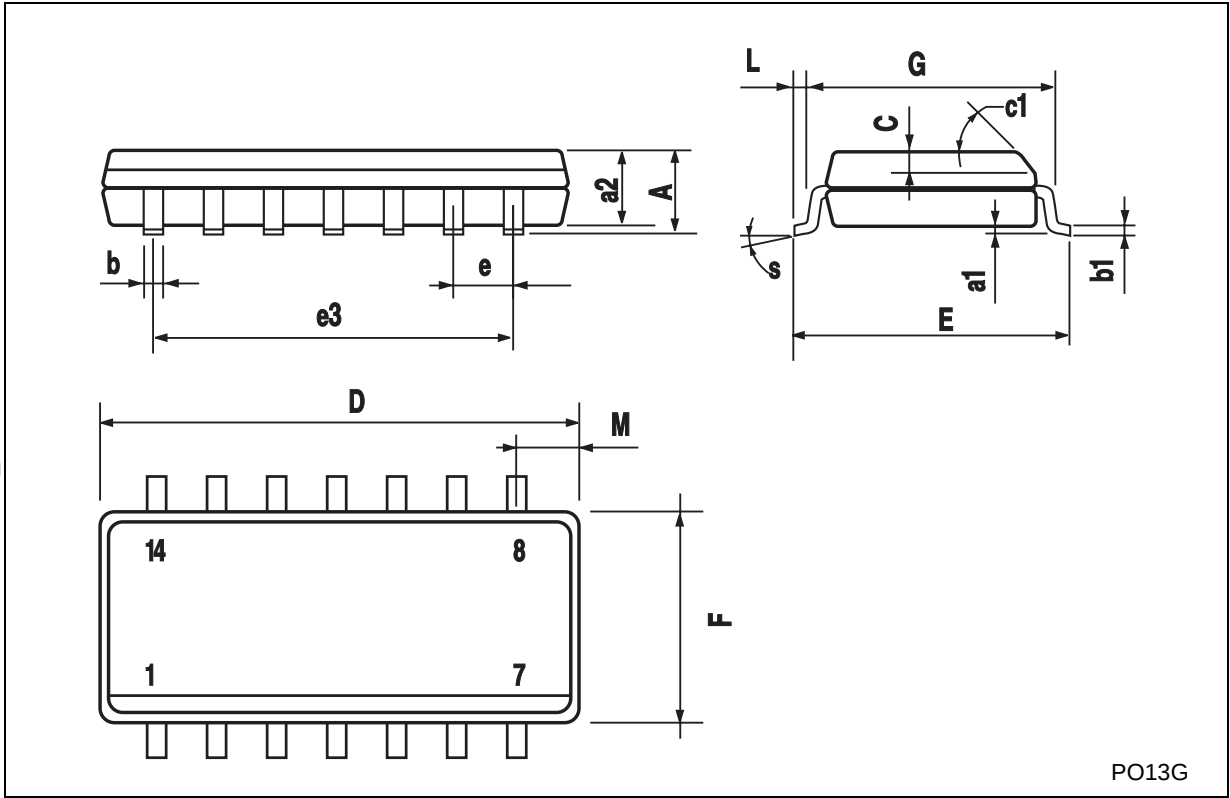
## Plastic DIP-14 MECHANICAL DATA

| DIM. | mm.  |       |      | inch  |       |       |
|------|------|-------|------|-------|-------|-------|
|      | MIN. | TYP   | MAX. | MIN.  | TYP.  | MAX.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 1.39 |       | 1.65 | 0.055 |       | 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   |      | 15.24 |      |       | 0.600 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| I    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    | 1.27 |       | 2.54 | 0.050 |       | 0.100 |



SO-14 MECHANICAL DATA

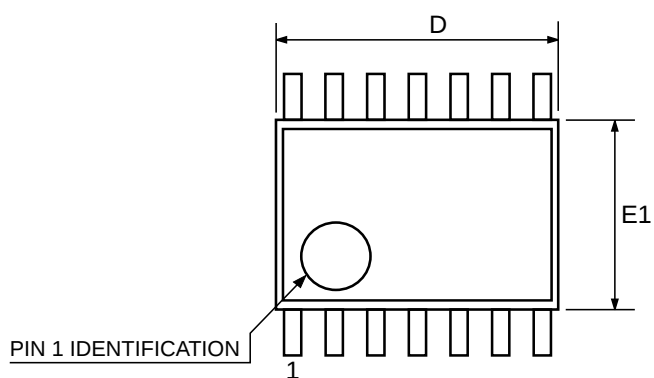
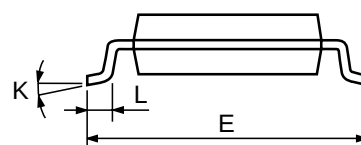
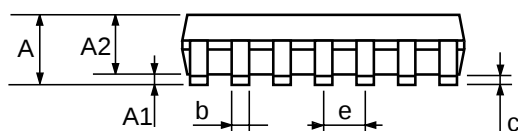
| DIM. | mm.        |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.2  | 0.003 |       | 0.007 |
| 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    | 8.55       |      | 8.75 | 0.336 |       | 0.344 |
| E    | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e    |            | 1.27 |      |       | 0.050 |       |
| e3   |            | 7.62 |      |       | 0.300 |       |
| 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    |            |      | 0.68 |       |       | 0.026 |
| S    | 8° (max.)  |      |      |       |       |       |



PO13G

## TSSOP14 MECHANICAL DATA

| DIM. | mm.  |          |      | inch  |            |        |
|------|------|----------|------|-------|------------|--------|
|      | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0089 |
| D    | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |



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