



## ST3232

### 3 TO 5.5V, LOW POWER, UP TO 400KBPS, RS-232 DRIVERS AND RECEIVERS

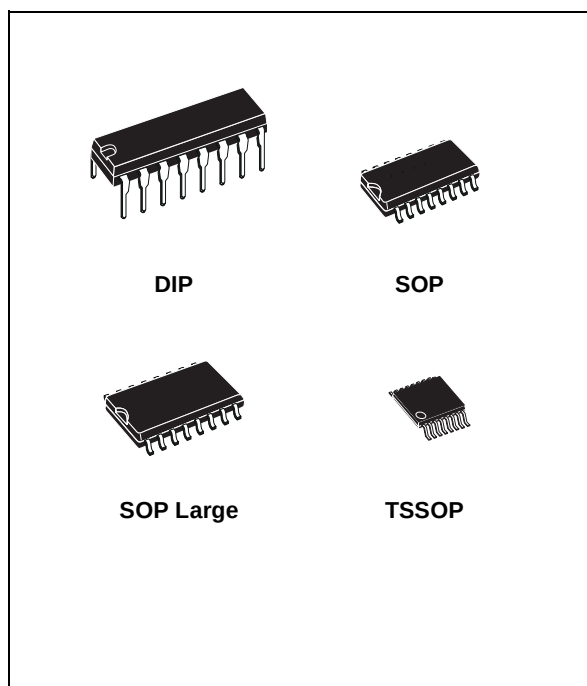
- 300 $\mu$ A SUPPLY CURRENT
- 300Kbps MINIMUM GUARENTEED DATA RATE
- 6V/ $\mu$ s MINIMUM GUARANTEED SLEW RATE
- MEET EIA/TIA-232 SPECIFICATIONS DOWN TO 3V
- AVAILABLE IN DIP-16, SO-16, SO-16 LARGE AND TSSOP16

#### DESCRIPTION

The ST3232 is a 3V powered EIA/TIA-232 and V.28/V.24 communication interface with low power requirements, high data-rate capabilities. ST3232 has a proprietary low dropout transmitter output stage providing true RS-232 performance from 3 to 5.5V supplies. The device requires only four small 0.1 $\mu$ F standard external capacitors for operations from 3V supply.

The ST3232 has two receivers and two drivers.

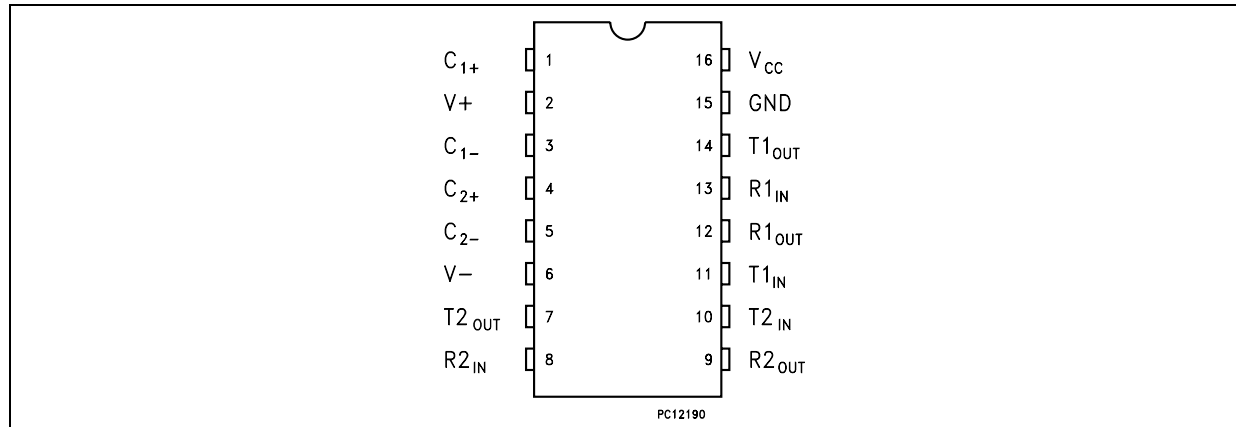
The device is guaranteed to run at data rates of 250Kbps while maintaining RS-232 output levels. Typical applications are Notebook, Subnotebook and Palmtop Computers, Battery Powered Equipment, Hand-Held Equipment, Peripherals and Printers.



#### ORDERING CODES

| Type      | Temperature Range | Package                   | Comments                          |
|-----------|-------------------|---------------------------|-----------------------------------|
| ST3232CN  | 0 to 70 °C        | DIP-16                    | 25parts per tube / 40tube per box |
| ST3232BN  | -40 to 85 °C      | DIP-16                    | 25parts per tube / 40tube per box |
| ST3232CD  | 0 to 70 °C        | SO-16 (Tube)              | 50parts per tube / 20tube per box |
| ST3232BD  | -40 to 85 °C      | SO-16 (Tube)              | 50parts per tube / 20tube per box |
| ST3232CDR | 0 to 70 °C        | SO-16 (Tape & Reel)       | 2500 parts per reel               |
| ST3232BDR | -40 to 85 °C      | SO-16 (Tape & Reel)       | 2500 parts per reel               |
| ST3232CW  | 0 to 70 °C        | SO-16 Large (Tube)        | 49parts per tube / 25tube per box |
| ST3232BW  | -40 to 85 °C      | SO-16 Large (Tube)        | 49parts per tube / 25tube per box |
| ST3232CWR | 0 to 70 °C        | SO-16 Large (Tape & Reel) | 1000 parts per reel               |
| ST3232BWR | -40 to 85 °C      | SO-16 Large (Tape & Reel) | 1000 parts per reel               |
| ST3232CTR | 0 to 70 °C        | TSSOP16 (Tape & Reel)     | 2500 parts per reel               |
| ST3232BTR | -40 to 85 °C      | TSSOP16 (Tape & Reel)     | 2500 parts per reel               |

## PIN CONFIGURATION



## PIN DESCRIPTION

| PIN N° | SYMBOL                        | NAME AND FUNCTION                                      |
|--------|-------------------------------|--------------------------------------------------------|
| 1      | C <sub>1</sub> <sup>+</sup>   | Positive Terminal for the first Charge Pump Capacitor  |
| 2      | V <sup>+</sup>                | Doubled Voltage Terminal                               |
| 3      | C <sub>1</sub> <sup>-</sup>   | Negative Terminal for the first Charge Pump Capacitor  |
| 4      | C <sub>2</sub> <sup>+</sup>   | Positive Terminal for the second Charge Pump Capacitor |
| 5      | C <sub>2</sub> <sup>-</sup>   | Negative Terminal for the second Charge Pump Capacitor |
| 6      | V <sup>-</sup>                | Inverted Voltage Terminal                              |
| 7      | T <sub>2</sub> <sup>OUT</sup> | Second Transmitter Output Voltage                      |
| 8      | R <sub>2</sub> <sup>IN</sup>  | Second Receiver Input Voltage                          |
| 9      | R <sub>2</sub> <sup>OUT</sup> | Second Receiver Output Voltage                         |
| 10     | T <sub>2</sub> <sup>IN</sup>  | Second Transmitter Input Voltage                       |
| 11     | T <sub>1</sub> <sup>IN</sup>  | First Transmitter Input Voltage                        |
| 12     | R <sub>1</sub> <sup>OUT</sup> | First Receiver Output Voltage                          |
| 13     | R <sub>1</sub> <sup>IN</sup>  | First Receiver Input Voltage                           |
| 14     | T <sub>1</sub> <sup>OUT</sup> | First Transmitter Output Voltage                       |
| 15     | GND                           | Ground                                                 |
| 16     | V <sub>CC</sub>               | Supply Voltage                                         |

## ABSOLUTE MAXIMUM RATINGS

| Symbol                           | Parameter                            | Value                           | Unit |
|----------------------------------|--------------------------------------|---------------------------------|------|
| V <sub>CC</sub>                  | Supply Voltage                       | -0.3 to 6                       | V    |
| V <sup>+</sup>                   | Doubled Voltage Terminal             | (V <sub>CC</sub> - 0.3) to 7    | V    |
| V <sup>-</sup>                   | Inverted Voltage Terminal            | 0.3 to -7                       | V    |
| V <sup>+</sup> +  V <sup>-</sup> |                                      | 13                              | V    |
| T <sub>IN</sub>                  | Transmitter Input Voltage Range      | -0.3 to 6                       | V    |
| R <sub>IN</sub>                  | Receiver Input Voltage Range         | ± 25                            | V    |
| T <sub>OUT</sub>                 | Transmitter Output Voltage Range     | ± 13.2                          | V    |
| R <sub>OUT</sub>                 | Receiver Output Voltage Range        | -0.3 to (V <sub>CC</sub> + 0.3) | V    |
| t <sub>SHORT</sub>               | Transmitter Output Short to GND Time | Continuous                      |      |

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied. V<sup>+</sup> and V<sup>-</sup> can have a maximum magnitude of +7V, but their absolute addition can not exceed 13 V.

**ELECTRICAL CHARACTERISTICS**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF, V<sub>CC</sub> = 3V to 5.5V, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

| Symbol              | Parameter                            | Test Conditions                                         | Min. | Typ. | Max. | Unit |
|---------------------|--------------------------------------|---------------------------------------------------------|------|------|------|------|
| I <sub>SUPPLY</sub> | V <sub>CC</sub> Power Supply Current | No Load V <sub>CC</sub> = 3V ±10% T <sub>A</sub> = 25°C |      | 0.3  | 1    | mA   |
|                     |                                      | No Load V <sub>CC</sub> = 5V ±10% T <sub>A</sub> = 25°C |      | 1    | 2    | mA   |

**LOGIC INPUT ELECTRICAL CHARACTERISTICS**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF, V<sub>CC</sub> = 3V to 5.5V, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

| Symbol           | Parameter                  | Test Conditions                                | Min.     | Typ.   | Max. | Unit   |
|------------------|----------------------------|------------------------------------------------|----------|--------|------|--------|
| V <sub>TIL</sub> | Input Logic Threshold Low  | T-IN (Note 1)                                  |          |        | 0.8  | V      |
| V <sub>TIH</sub> | Input Logic Threshold High | V <sub>CC</sub> = 3.3V<br>V <sub>CC</sub> = 5V | 2<br>2.4 |        |      | V<br>V |
| I <sub>IL</sub>  | Input Leakage Current      | T-IN                                           |          | ± 0.01 | ± 1  | μA     |

Note 1: Transmitter input hysteresis is typically 250mV

**TRANSMITTER ELECTRICAL CHARACTERISTICS**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF tested at V<sub>CC</sub> = 3V to 5.5V, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

| Symbol            | Parameter                     | Test Conditions                                                                | Min. | Typ.  | Max. | Unit |
|-------------------|-------------------------------|--------------------------------------------------------------------------------|------|-------|------|------|
| V <sub>TOUT</sub> | Output Voltage Swing          | All Transmitter outputs are loaded with 3KΩ to GND                             | ± 5  | ± 5.4 |      | V    |
| R <sub>TOUT</sub> | Transmitter Output Resistance | V <sub>CC</sub> = V <sub>+</sub> = V <sub>-</sub> = 0V V <sub>OUT</sub> = ± 2V | 300  | 10M   |      | Ω    |
| I <sub>TSC</sub>  | Output Short Circuit Current  | V <sub>CC</sub> = 3V to 5V V <sub>OUT</sub> = ± 12V                            |      |       | ± 60 | mA   |

**RECEIVER ELECTRICAL CHARACTERISTICS**(C<sub>1</sub> - C<sub>4</sub> = 0.1μF tested at V<sub>CC</sub> = 3V to 5.5V, T<sub>A</sub> = -40 to 85°C, unless otherwise specified.Typical values are referred to T<sub>A</sub> = 25°C)

| Symbol             | Parameter                              | Test Conditions                              | Min.                 | Typ.                 | Max. | Unit |
|--------------------|----------------------------------------|----------------------------------------------|----------------------|----------------------|------|------|
| V <sub>RIN</sub>   | Receiver Input Voltage Operating Range |                                              | -25                  |                      | 25   | V    |
| V <sub>RIL</sub>   | RS-232 Input Threshold Low             | T <sub>A</sub> = 25°C V <sub>CC</sub> = 3.3V | 0.6                  | 1.2                  |      | V    |
|                    |                                        | T <sub>A</sub> = 25°C V <sub>CC</sub> = 5V   | 0.8                  | 1.5                  |      | V    |
| V <sub>RIH</sub>   | RS-232 Input Threshold High            | T <sub>A</sub> = 25°C V <sub>CC</sub> = 3.3V |                      | 1.5                  | 2.4  | V    |
|                    |                                        | T <sub>A</sub> = 25°C V <sub>CC</sub> = 5V   |                      | 1.8                  | 2.4  | V    |
| V <sub>RIHYS</sub> | Input Hysteresis                       |                                              |                      | 0.3                  |      | V    |
| R <sub>RIN</sub>   | Input Resistance                       | T <sub>A</sub> = 25°C                        | 3                    | 5                    | 7    | KΩ   |
| V <sub>ROL</sub>   | TTL/CMOS Output Voltage Low            | I <sub>OUT</sub> = 1.6mA                     |                      |                      | 0.4  | V    |
| V <sub>ROH</sub>   | TTL/CMOS Output Voltage High           | I <sub>OUT</sub> = -1mA                      | V <sub>CC</sub> -0.6 | V <sub>CC</sub> -0.1 |      | V    |

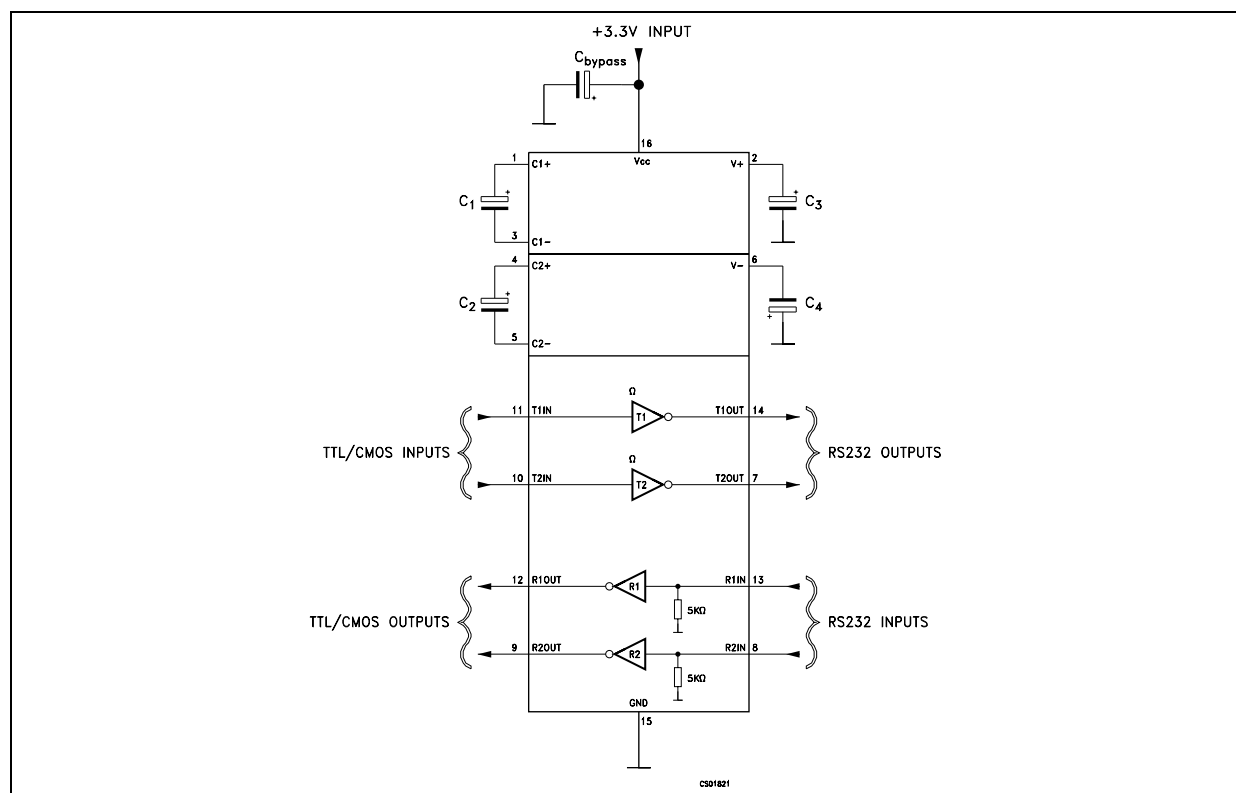
**TIMING CHARACTERISTICS**

( $C_1 - C_4 = 0.1\mu\text{F}$ ,  $V_{CC} = 3\text{V to } 5.5\text{V}$ ,  $T_A = -40 \text{ to } 85^\circ\text{C}$ , unless otherwise specified.)

Typical values are referred to  $T_A = 25^\circ\text{C}$ )

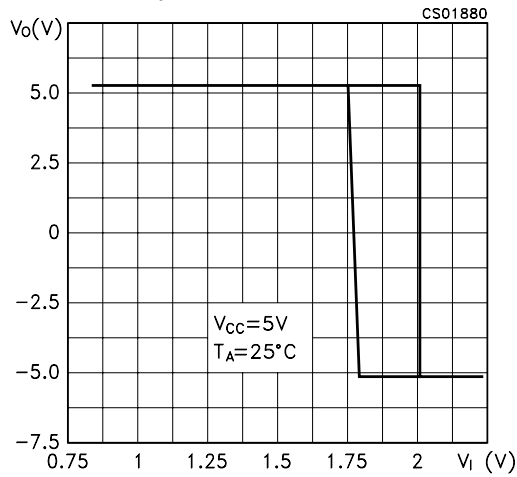
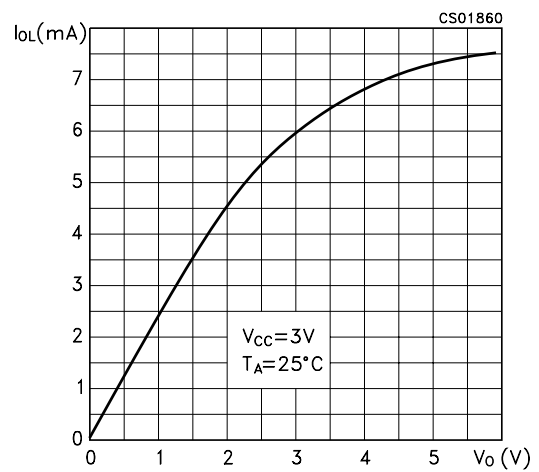
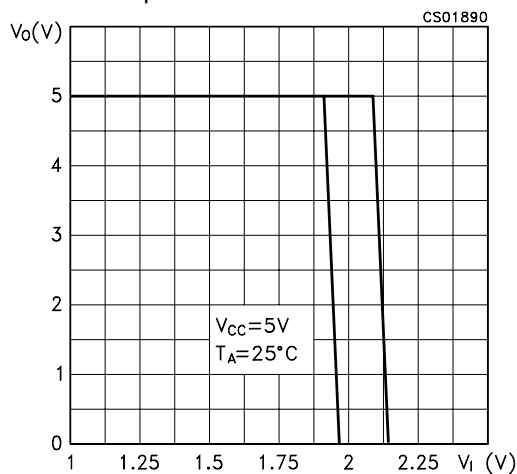
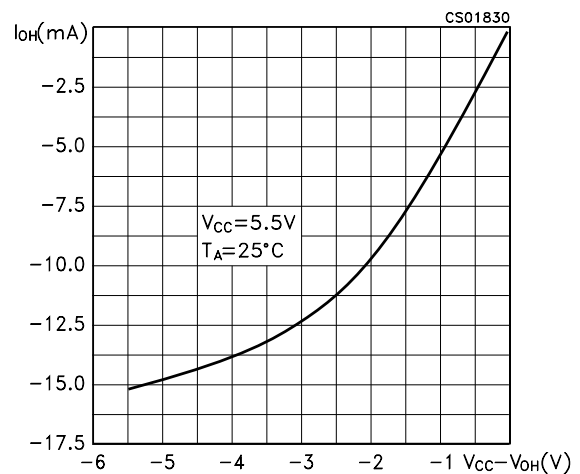
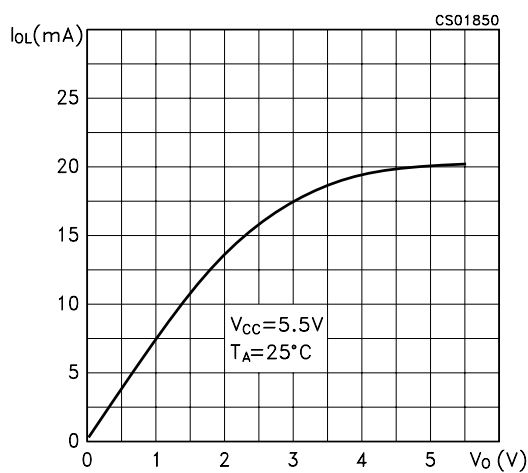
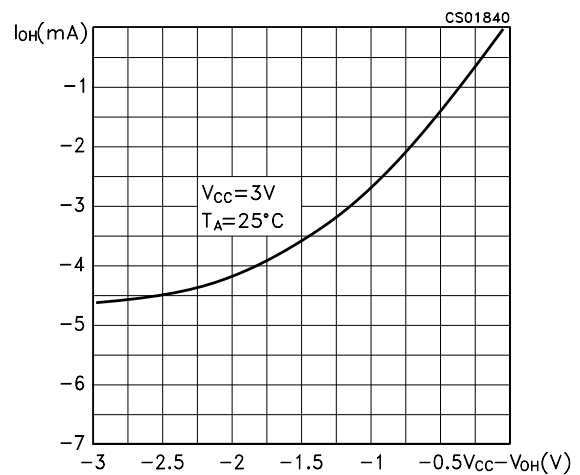
| Symbol                   | Parameter                                | Test Conditions                                                                                                                                                                                                                                                         | Min.   | Typ. | Max.     | Unit                                             |
|--------------------------|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|----------|--------------------------------------------------|
| $D_R$                    | Data Transfer Rate                       | $R_L = 3\text{K}\Omega$ $C_{L2} = 1000\text{pF}$<br>one trasmitter switching                                                                                                                                                                                            | 300    | 400  |          | Kbps                                             |
| $t_{PHLR}$<br>$t_{PLHR}$ | Propagation Delay Input to Output        | $R_{XIN} = R_{XOUT}$ $C_L = 150\text{pF}$                                                                                                                                                                                                                               |        | 0.2  |          | $\mu\text{s}$                                    |
| $ t_{PHLT} - t_{THL} $   | Transmitter Propagation Delay Difference | (Note 1)                                                                                                                                                                                                                                                                |        | 100  |          | ns                                               |
| $ t_{PHLR} - t_{THR} $   | Receiver Propagation Delay Difference    |                                                                                                                                                                                                                                                                         |        | 50   |          | ns                                               |
| $S_{RT}$                 | Trnasition Slew Rate                     | $T_A = 25^\circ\text{C}$ $R_L = 3\text{K}\Omega \text{ to } 7\text{K}\Omega$ $V_{CC} = 3.3\text{V}$<br>measured from $+3\text{V}$ to $-3\text{V}$ or $-3\text{V}$ to $+3\text{V}$<br>$C_L = 150\text{pF}$ to $1000\text{pF}$<br>$C_L = 150\text{pF}$ to $2500\text{pF}$ | 6<br>4 |      | 30<br>30 | $\text{V}/\mu\text{s}$<br>$\text{V}/\mu\text{s}$ |

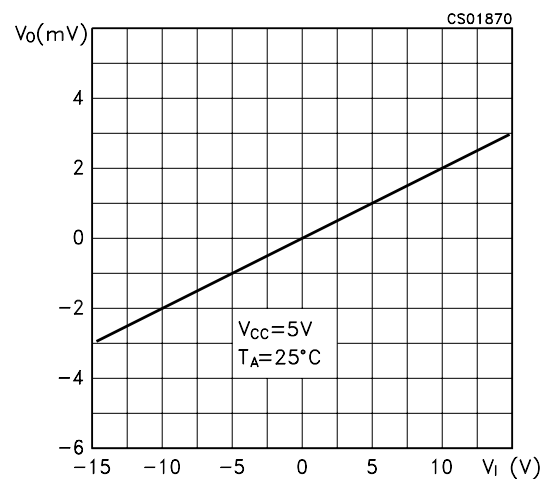
Transmitter Skew is measured at the transmitter zero cross points

**APPLICATION CIRCUITS****CAPACITANCE VALUE ( $\mu\text{F}$ )**

| $V_{CC}$   | C1    | C2   | C3   | C4   | $C_{bypass}$ |
|------------|-------|------|------|------|--------------|
| 3.0 to 3.6 | 0.1   | 0.1  | 0.1  | 0.1  | 0.1          |
| 4.5 to 5.5 | 0.047 | 0.33 | 0.33 | 0.33 | 0.33         |

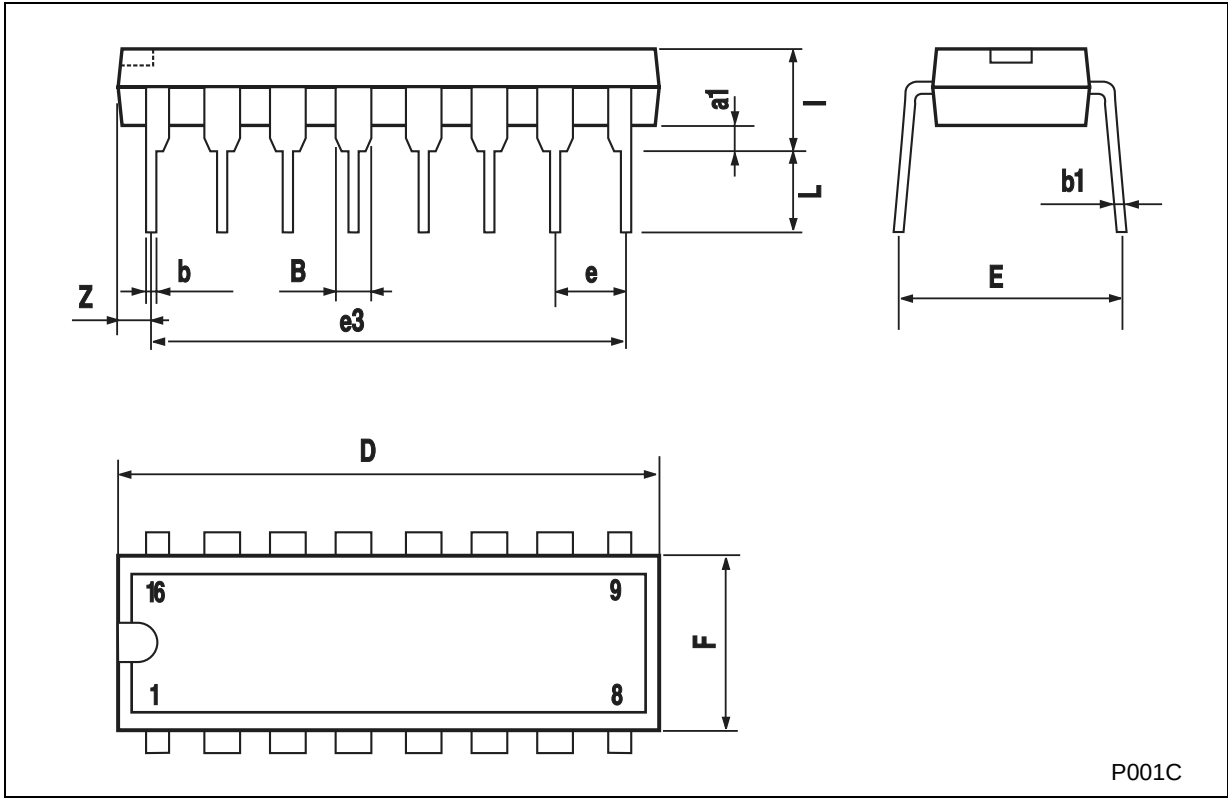
**TYPICAL PERFORMANCE CHARACTERISTICS** (unless otherwise specified  $T_j = 25^\circ\text{C}$ )

**Figure 1 : Driver Voltage Transfer Characteristics for Transmitter Inputs**

**Figure 4 : Output Current vs Output Low Voltage**

**Figure 2 : Driver Voltage Transfer Characteristics for Receiver Inputs**

**Figure 5 : Output Current vs Output High Voltage**

**Figure 3 : Output Current vs Output Low Voltage**

**Figure 6 : Output Current vs Output High Voltage**


**Figure 7 : Receiver Input Resistance**

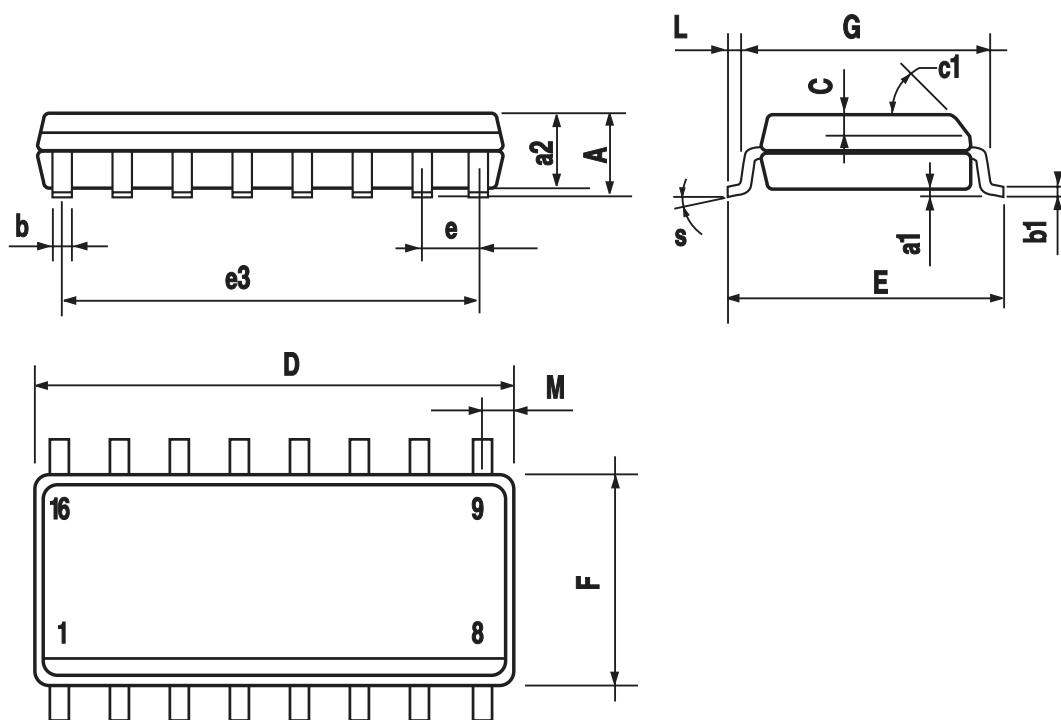
Plastic DIP-16 (0.25) MECHANICAL DATA

| 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 |



## SO-16 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    | 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.)  |      |      |       |       |       |



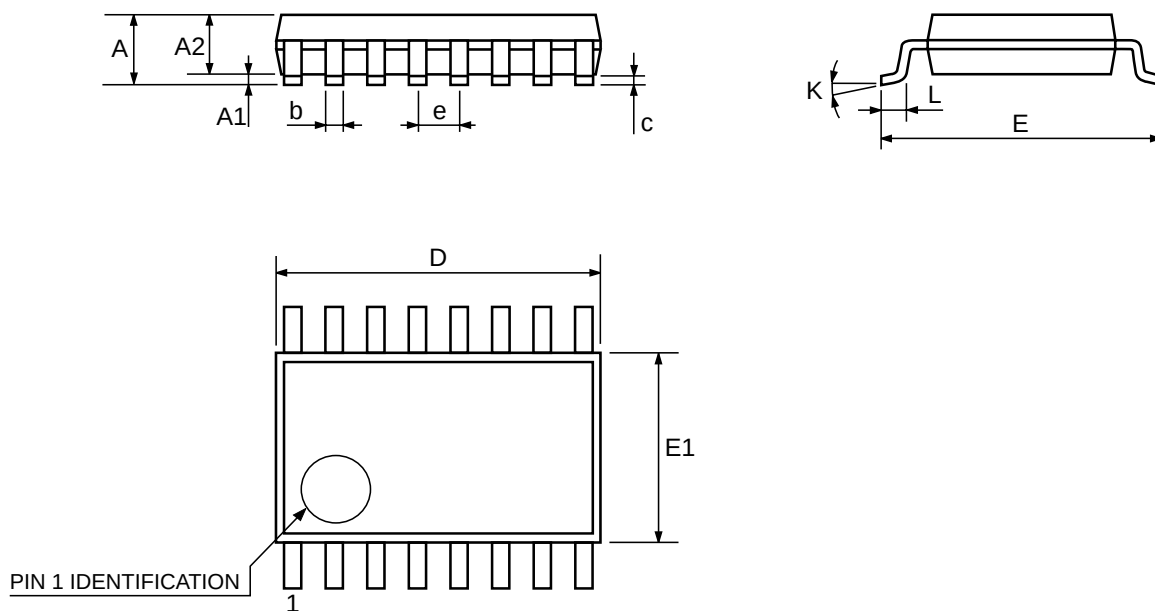
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## TSSOP16 MECHANICAL DATA

| 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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