

## QUAD BILATERAL SWITCH

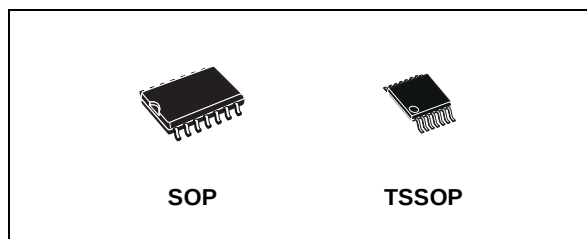
- **HIGH SPEED:**  
 $t_{PD} = 0.4 \text{ ns (TYP.) at } V_{CC} = 3.3 \text{ V}$   
 $t_{PD} = 0.1 \text{ ns (TYP.) at } V_{CC} = 5 \text{ V}$
- **LOW POWER DISSIPATION:**  
 $I_{CC} = 2\mu\text{A (MAX.) at } T_A = 25^\circ\text{C}$
- **LOW "ON " LOW RESISTANCE**  
 $R_{ON} = 14\Omega \text{ at } V_{CC} = 3.3\text{V}, I_{I/O} \leq 1 \text{ mA}$   
 $R_{ON} = 12\Omega \text{ at } V_{CC} = 5.0\text{V}, I_{I/O} \leq 1 \text{ mA}$
- **SINE WAVE DISTORTION :**  
 $0.04\% \text{ at } V_{CC} = 3.3\text{V}, f = 1\text{KHz}$
- **OPERATING VOLTAGE RANGE:**  
 $V_{CC(OPR)} = 2\text{V to } 5.5\text{V}$
- **PIN AND FUNCTION COMPATIBLE WITH**  
**74 SERIES 4066**
- **IMPROVED LATCH-UP IMMUNITY**

### DESCRIPTION

The 74LVQ4066 is a low voltage CMOS QUAD BILATERAL SWITCH fabricated with sub-micron silicon gate and double-layer metal wiring C<sup>2</sup>MOS technology.

It is ideal for low power and low noise 3.3V applications and each switch is designed to handle both analog and digital signals.

The switches permit signals with amplitudes up to V<sub>cc</sub> (peak) to be transmitted in either direction



### ORDER CODES

| PACKAGE | TUBE       | T & R        |
|---------|------------|--------------|
| SOP     | 74LVQ4066M | 74LVQ4066MTR |
| TSSOP   |            | 74LVQ4066TTR |

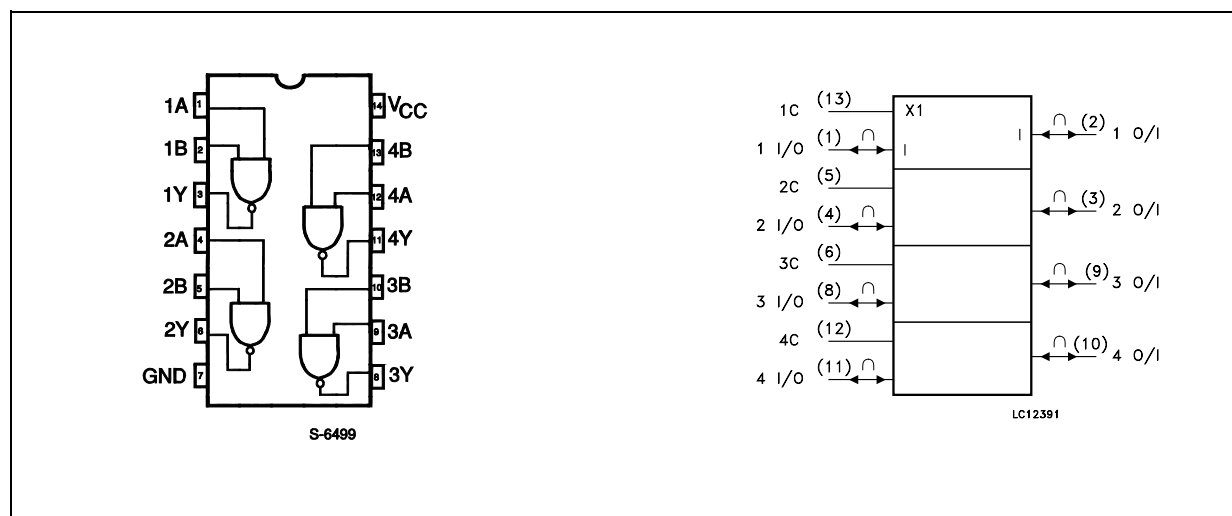
without relevant propagation delay and without generating additional ground bounce noise.

It has an ON-Resistance which is greatly reduced in comparison with 74HC4066.

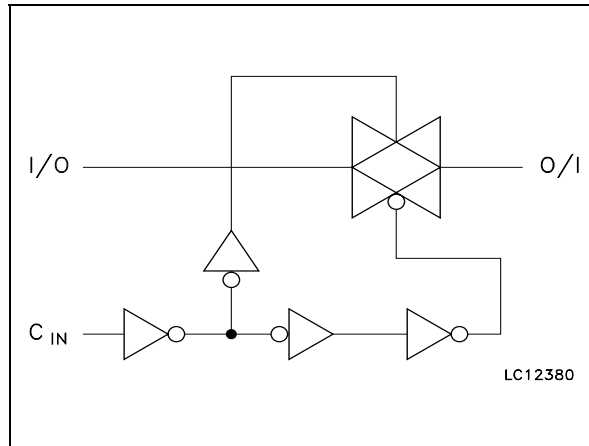
It is provided of four individual enable inputs to control the switches; the switch is ON when the C input is held high and OFF (High Impedance) when C is held low.

All inputs and outputs are equipped with protection circuits against static discharge, giving them ESD immunity and transient excess voltage.

### PIN CONNECTION AND IEC LOGIC SYMBOLS



## LOGIC DIAGRAM



## PIN DESCRIPTION

| PIN No       | SYMBOL          | NAME AND FUNCTION          |
|--------------|-----------------|----------------------------|
| 1, 4, 8, 11  | 1 to 4 I/O      | Independent Input/Output   |
| 2, 3, 9, 10  | 1 to 4 O/I      | Independent Output/Input   |
| 13, 5, 6, 12 | 1C to 4C        | Enable Input (Active HIGH) |
| 7            | GND             | Ground (0V)                |
| 14           | V <sub>CC</sub> | Positive Supply Voltage    |

## TRUTH TABLE

| A | B    |
|---|------|
| H | ON   |
| L | OFF* |

(\*) High Impedance

## ABSOLUTE MAXIMUM RATINGS

| Symbol                              | Parameter                            | Value                         | Unit |
|-------------------------------------|--------------------------------------|-------------------------------|------|
| V <sub>CC</sub>                     | Supply Voltage                       | -0.5 to +7                    | V    |
| V <sub>I</sub>                      | DC Input Voltage                     | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| V <sub>O</sub>                      | DC Output Voltage                    | -0.5 to V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>                     | DC Input Diode Current               | ± 20                          | mA   |
| I <sub>OK</sub>                     | DC Output Diode Current              | ± 20                          | mA   |
| I <sub>O</sub>                      | DC Output Current                    | ± 50                          | mA   |
| I <sub>CC</sub> or I <sub>GND</sub> | DC V <sub>CC</sub> or Ground Current | ± 200                         | mA   |
| T <sub>stg</sub>                    | Storage Temperature                  | -65 to +150                   | °C   |
| T <sub>L</sub>                      | 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.

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter                                                               | Value                | Unit |
|-----------------|-------------------------------------------------------------------------|----------------------|------|
| V <sub>CC</sub> | Supply Voltage (note 1)                                                 | 2 to 5.5             | V    |
| V <sub>I</sub>  | Input Voltage                                                           | 0 to V <sub>CC</sub> | V    |
| V <sub>O</sub>  | Output Voltage                                                          | 0 to V <sub>CC</sub> | V    |
| T <sub>op</sub> | Operating Temperature                                                   | -55 to 125           | °C   |
| dt/dv           | Input Rise and Fall Time on control pin V <sub>CC</sub> = 3.0V (note 2) | 0 to 10              | ns/V |

1) Truth Table guaranteed: 1.2V to 5.5V

2) V<sub>IN</sub> from 30% to 70%V<sub>CC</sub>

## 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                              | 2.7 to 5.5             |                                                                                                                          | 0.7 V <sub>CC</sub>   |      |                     | 0.7 V <sub>CC</sub> |                     | 0.7 V <sub>CC</sub> |                     | V    |
| V <sub>IL</sub>  | Low Level Input Voltage                               |                        |                                                                                                                          |                       |      | 0.3 V <sub>CC</sub> |                     | 0.3 V <sub>CC</sub> |                     | 0.3 V <sub>CC</sub> | V    |
| R <sub>ON</sub>  | ON Resistance                                         | 3.3 (**)               | V <sub>I</sub> =V <sub>IH</sub><br>V <sub>I/O</sub> =V <sub>CC</sub> to GND                                              |                       | 16.5 | 23                  |                     | 32                  |                     | 40                  | Ω    |
|                  |                                                       | 5.0(*)                 | I <sub>I/O</sub> ≤ 1mA                                                                                                   |                       | 12   | 17                  |                     | 22                  |                     | 26                  |      |
|                  |                                                       | 3.3 (**)               | V <sub>I</sub> =V <sub>IH</sub><br>V <sub>I/O</sub> =V <sub>CC</sub> or GND                                              |                       | 12   | 17                  |                     | 24                  |                     | 30                  |      |
|                  |                                                       | 5.0(*)                 | I <sub>I/O</sub> ≤ 1mA                                                                                                   |                       | 9.5  | 13                  |                     | 17                  |                     | 20                  |      |
| R <sub>ON</sub>  | Difference of ON Resistance Between Switches          | 3.0 to 5.5             | V <sub>I</sub> =V <sub>IH</sub><br>V <sub>I/O</sub> =V <sub>CC</sub> to GND<br>I <sub>I/O</sub> ≤ 1mA                    |                       | 2    |                     |                     |                     |                     |                     | Ω    |
| I <sub>OFF</sub> | Input/Output Leakage Current (SWITCH OFF)             | 5.5                    | V <sub>OS</sub> = V <sub>CC</sub> to GND<br>V <sub>IS</sub> = V <sub>CC</sub> to GND<br>V <sub>I</sub> = V <sub>IL</sub> |                       |      | ± 0.1               |                     | ± 1.0               |                     | ± 1.0               | μA   |
| I <sub>Iz</sub>  | Switch Input Leakage Current (SWITCH ON , OUTPUT OFF) | 5.5                    | V <sub>OS</sub> = V <sub>CC</sub> to GND<br>V <sub>I</sub> = V <sub>IH</sub>                                             |                       |      | ± 0.1               |                     | ± 1.0               |                     | ± 1.0               | μA   |
| I <sub>IN</sub>  | Control Input Leakage Current                         | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                  |                       |      | ± 0.1               |                     | ± 1.0               |                     | ± 1.0               | μA   |
| I <sub>CC</sub>  | Quiescent Supply Current                              | 5.5                    | V <sub>I</sub> = V <sub>CC</sub> or GND                                                                                  |                       |      | 2                   |                     | 20                  |                     | 20                  | μA   |

(\*)Voltage range is 5V ±0.5V

(\*\*)Voltage range is 3.3V ±0.3V

**AC ELECTRICAL CHARACTERISTICS** ( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 3 \text{ ns}$ )

| 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. |
| t <sub>PD</sub>                      | Delay Time                             | 3.3(*)                 |                       |                       | 0.4  | 0.8  |             | 1.2  |              | 2.0  | ns   |
|                                      |                                        | 5.0<br>(**)            |                       |                       | 0.1  | 0.2  |             | 1.0  |              | 1.8  |      |
| t <sub>PZL</sub><br>t <sub>PZH</sub> | Output Enable Time                     | 3.3(*)                 | R <sub>L</sub> = 1 kΩ |                       | 2.5  | 4.0  |             | 5.0  |              | 7.0  | ns   |
|                                      |                                        | 5.0<br>(**)            |                       |                       | 2.0  | 4.0  |             | 5.0  |              | 7.0  |      |
| t <sub>PLZ</sub><br>t <sub>PHZ</sub> | Output Disable Time                    | 3.3(*)                 | R <sub>L</sub> = 1 kΩ |                       | 5.0  | 7.5  |             | 9.0  |              | 11.0 | ns   |
|                                      |                                        | 5.0<br>(**)            |                       |                       | 5.0  | 7.5  |             | 9.0  |              | 11.0 |      |
| C <sub>IN</sub>                      | Input Capacitance                      |                        |                       |                       | 5    |      |             |      |              |      | pF   |
| C <sub>I/O</sub>                     | Switch Terminal Capacitance            |                        |                       |                       | 10   |      |             |      |              |      | pF   |
| C <sub>PD</sub>                      | Power Dissipation Capacitance (note 1) | 3.3                    |                       |                       | 2.5  |      |             |      |              |      | pF   |
|                                      |                                        | 5.0                    |                       |                       | 3    |      |             |      |              |      |      |

1)  $C_{PD}$  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.  $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4$  (Switch).

(\*) Voltage range is  $3.3 \text{ V} \pm 0.3 \text{ V}$

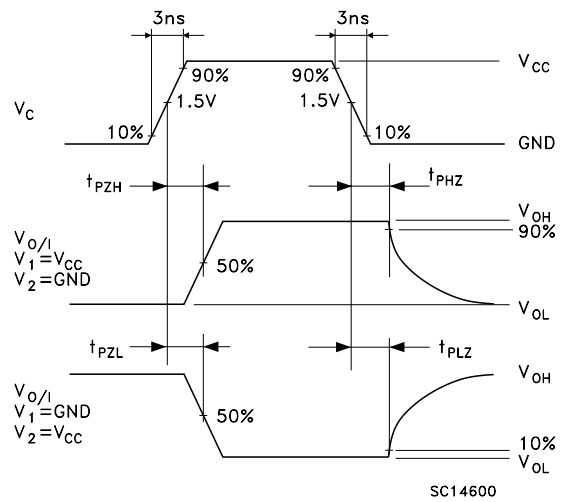
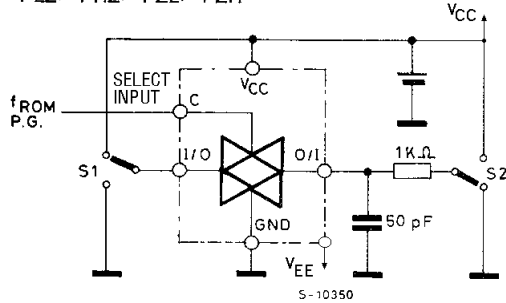
(\*) Voltage range is  $5 \text{ V} \pm 0.5 \text{ V}$

**ANALOG SWITCH CHARACTERISTICS** ( $\text{GND} = 0 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ )

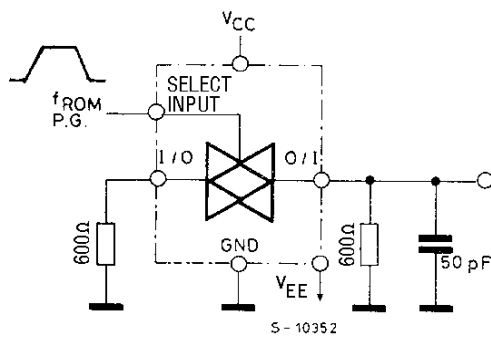
| Symbol           | Parameter                                  | Test Condition         |                                                                                                                                                                        |                                                                                | Value | Unit |     |
|------------------|--------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------|------|-----|
|                  |                                            | V <sub>CC</sub><br>(V) | V <sub>IN</sub><br>(V <sub>p-p</sub> )                                                                                                                                 |                                                                                |       |      |     |
|                  | Sine Wave Distortion (THD)                 | 3.3                    | 2.75                                                                                                                                                                   | f <sub>IN</sub> = 1 KHz      R <sub>L</sub> = 10KΩ      C <sub>L</sub> = 50 pF | 0.04  | %    |     |
|                  |                                            | 5.0(*)                 | 4                                                                                                                                                                      |                                                                                | 0.04  |      |     |
| f <sub>MAX</sub> | Frequency Response (Switch ON)             | 3.3                    | Adjust f <sub>IN</sub> voltage to Obtain 0dBm at V <sub>OS</sub> .<br>Increase f <sub>IN</sub> Frequency until dB Meter reads -3dB<br>RL = 50Ω , C <sub>L</sub> = 10pF |                                                                                |       | 150  | MHz |
|                  |                                            | 5.0(*)                 |                                                                                                                                                                        |                                                                                |       | 180  |     |
|                  | Feed through Attenuation (Switch OFF)      | 3.3                    | V <sub>IN</sub> is centered at V <sub>CC</sub> /2. Adjust input for 0dBm<br>R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF, F <sub>IN</sub> = 1 MHz sine wave            |                                                                                |       | -60  | dB  |
|                  |                                            | 5.0(*)                 |                                                                                                                                                                        |                                                                                |       | -60  |     |
|                  | Crosstalk (Control Input to Signal Output) | 3.3                    | R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF, f <sub>IN</sub> = 1MHz square wave                                                                                       |                                                                                |       | 60   | mV  |
|                  |                                            | 5.0(*)                 |                                                                                                                                                                        |                                                                                |       | 60   |     |
|                  | Crosstalk (Between Any Switches)           | 3.3                    | R <sub>L</sub> = 600Ω, C <sub>L</sub> = 50pF, f <sub>IN</sub> = 1MHz sine wave                                                                                         |                                                                                |       | -60  | dB  |
|                  |                                            | 5.0(*)                 |                                                                                                                                                                        |                                                                                |       | -60  |     |

(\*) Voltage range is  $5 \text{ V} \pm 0.5 \text{ V}$

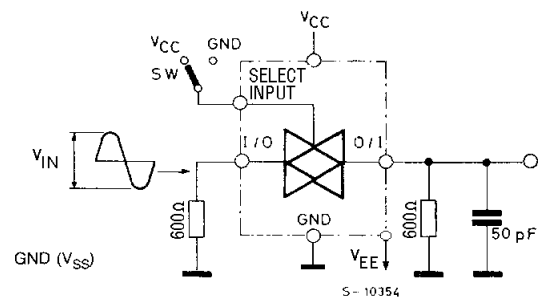
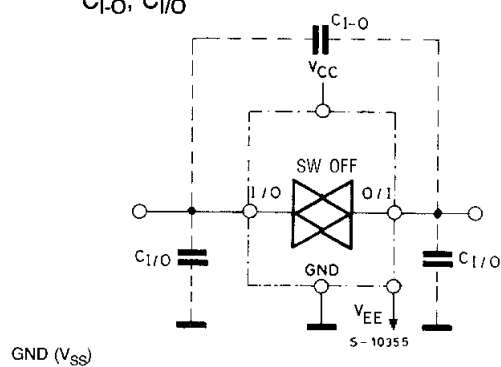
## SWITCHING CHARACTERISTICS TEST CIRCUIT

 $t_{PLZ}$ ,  $t_{PHZ}$ ,  $t_{PZL}$ ,  $t_{PZH}$ 

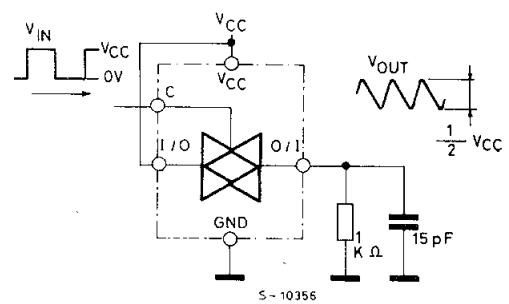
## CROSSTALK (control to output)

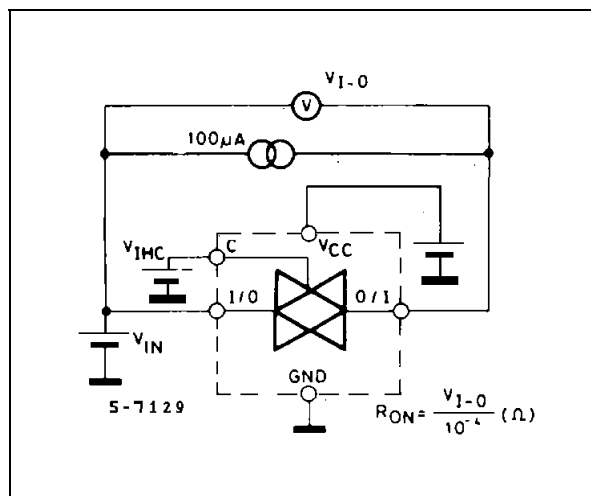
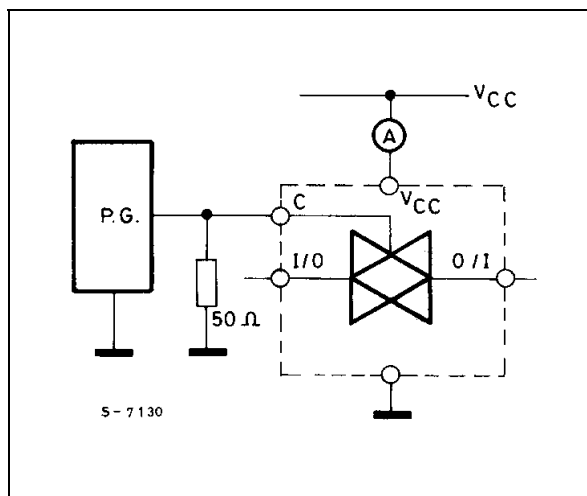


## BANDWIDTH AND FEEDTHROUGH ATTENUATION

 $C_{I/O}$ ,  $C_{I/O}$ 

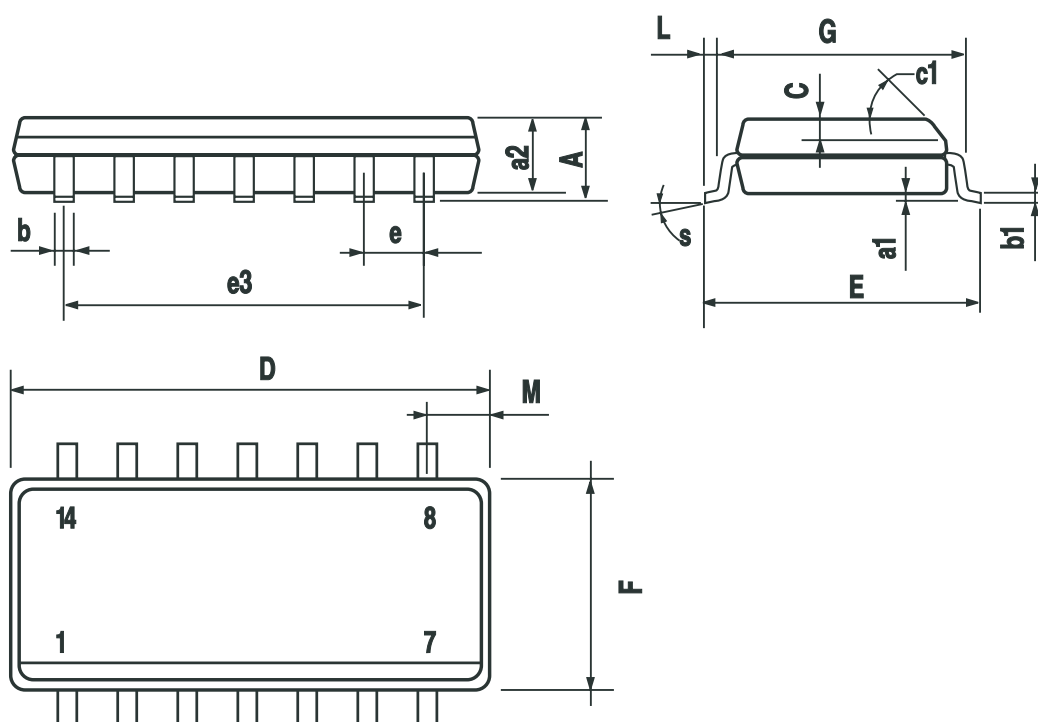
## MAXIMUM CONTROL FREQUENCY



CHANNEL RESISTANCE ( $R_{ON}$ ) $I_{CC}$  (Opr.)

## SO-14 MECHANICAL DATA

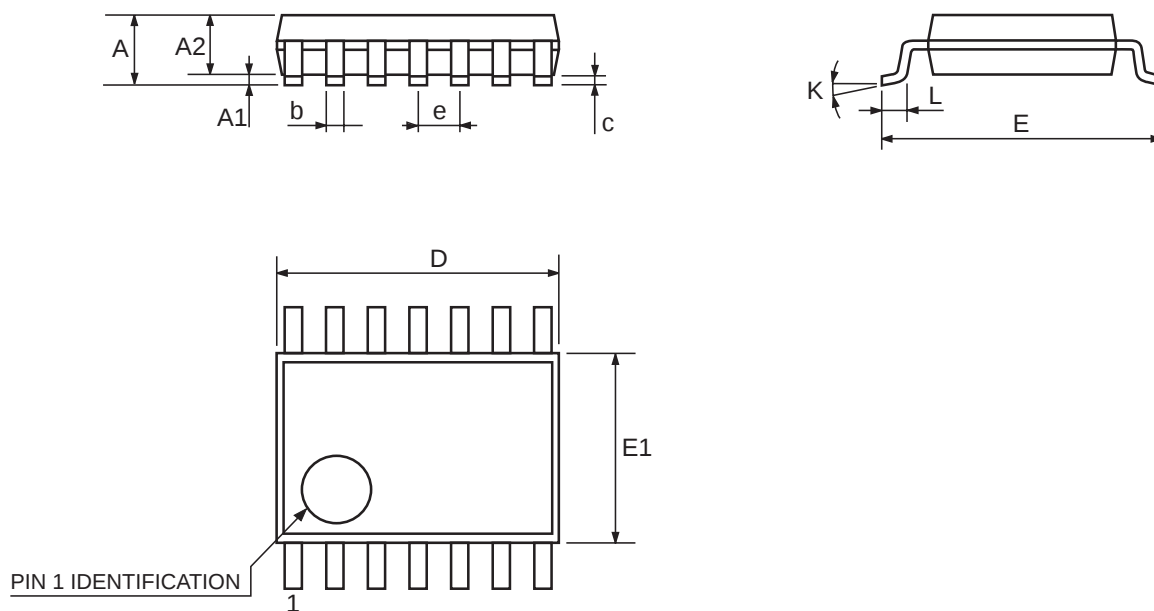
| DIM. | mm.        |      |      | inch  |       |       |
|------|------------|------|------|-------|-------|-------|
|      | MIN.       | TYP  | MAX. | MIN.  | TYP.  | MAX.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.2  | 0.003 |       | 0.007 |
| 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

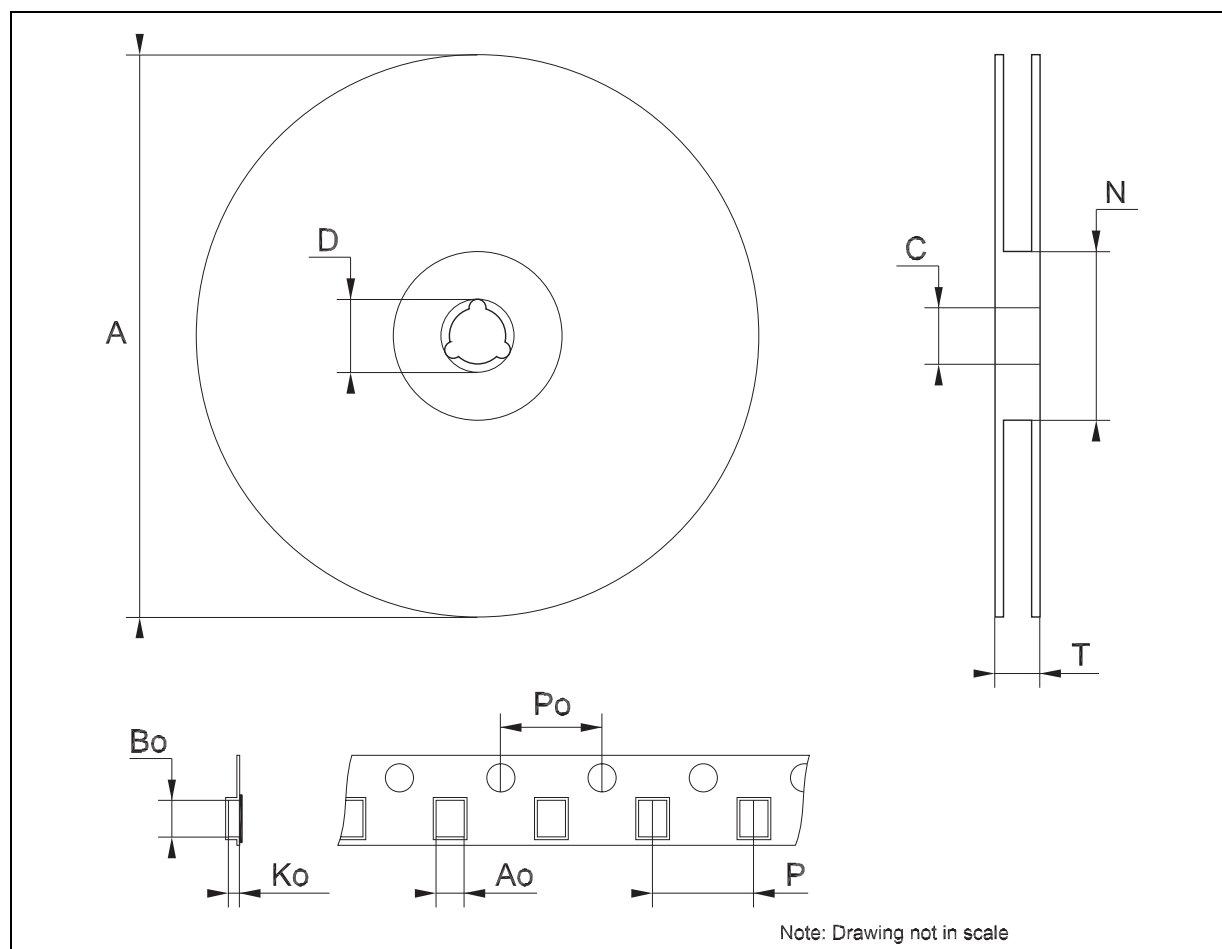
| DIM. | mm.  |          |      | inch  |            |        |
|------|------|----------|------|-------|------------|--------|
|      | MIN. | TYP      | MAX. | MIN.  | TYP.       | MAX.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 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  |



0080337D

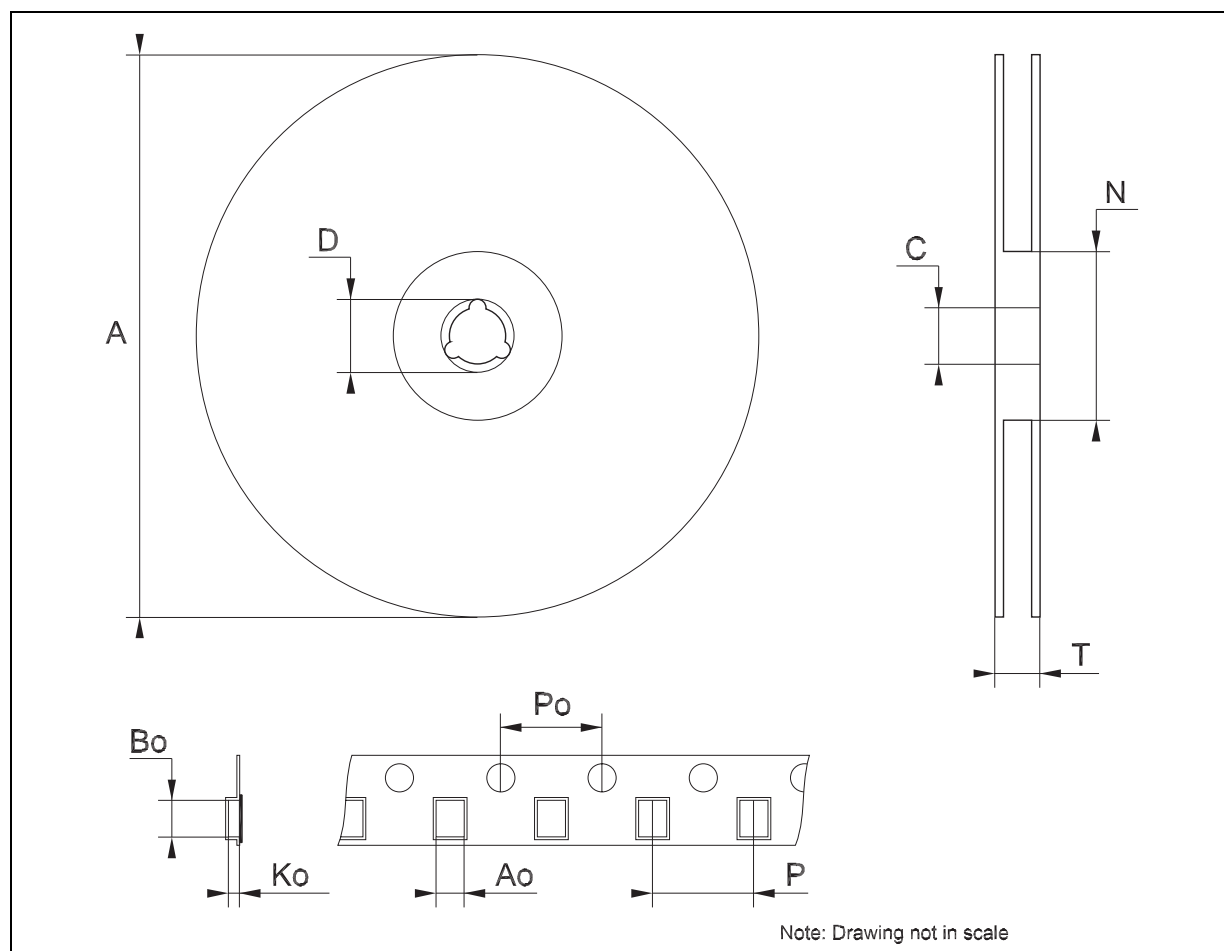
### Tape & Reel SO-14 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 22.4 |       |      | 0.882  |
| Ao   | 6.4  |     | 6.6  | 0.252 |      | 0.260  |
| Bo   | 9    |     | 9.2  | 0.354 |      | 0.362  |
| Ko   | 2.1  |     | 2.3  | 0.082 |      | 0.090  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |     | 8.1  | 0.311 |      | 0.319  |



## Tape &amp; Reel TSSOP14 MECHANICAL DATA

| DIM. | mm.  |     |      | inch  |      |        |
|------|------|-----|------|-------|------|--------|
|      | MIN. | TYP | MAX. | MIN.  | TYP. | MAX.   |
| A    |      |     | 330  |       |      | 12.992 |
| C    | 12.8 |     | 13.2 | 0.504 |      | 0.519  |
| D    | 20.2 |     |      | 0.795 |      |        |
| N    | 60   |     |      | 2.362 |      |        |
| T    |      |     | 22.4 |       |      | 0.882  |
| Ao   | 6.7  |     | 6.9  | 0.264 |      | 0.272  |
| Bo   | 5.3  |     | 5.5  | 0.209 |      | 0.217  |
| Ko   | 1.6  |     | 1.8  | 0.063 |      | 0.071  |
| Po   | 3.9  |     | 4.1  | 0.153 |      | 0.161  |
| P    | 7.9  |     | 8.1  | 0.311 |      | 0.319  |



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