



# Product Specification

XBLW ULN2004

Seven Darlington Arrays

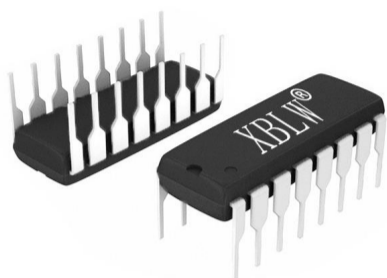
WEB | [www.xinboleic.com](http://www.xinboleic.com)



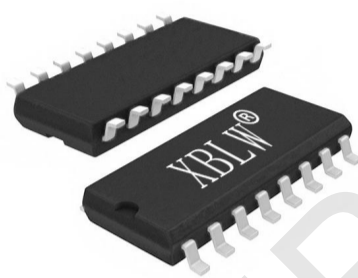
## Descriptions

ULN2004 is seven Darlington array structure. Each channel is rated at 500 mA and can withstand peak currents of 600 mA. Its output voltage is 50V and Suppression diodes are included for inductive load driving. It is useful for driving a wide range of loads including relay DC motors, LED display filament lamps, high-power buffers, 5V TTL, CMOS and other industry-standard logical circuit.

This chip is available in DIP16 or SOP 16 package form.



DIP-16



SOP-16

## Feature

- Output current 500 mA per driver
- Withstand High Voltage
- Input Pins Compatible to TTL/CMOS Logic Signal
- a Wide Application in Relay Driver

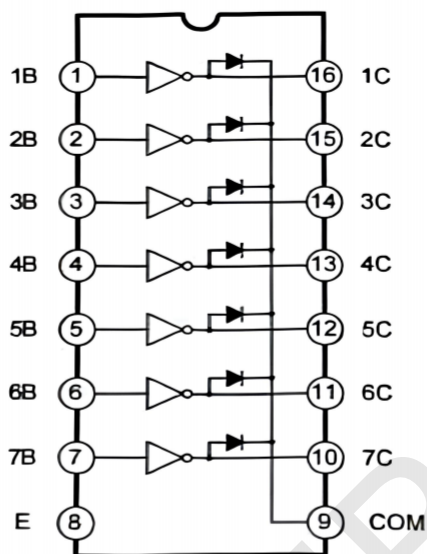
## Applications

- Relay Driver
- Lamps Driver
- Display Driver

## Ordering Information

| Product Model    | Package Type | Marking   | Packing | Packing Qty  |
|------------------|--------------|-----------|---------|--------------|
| XBLW ULN2004AN   | DIP-16       | ULN2004AN | Tube    | 1000pcs/Box  |
| XBLW ULN2004ADTR | SOP-16       | ULN2004A  | Tape    | 2500pcs/Reel |

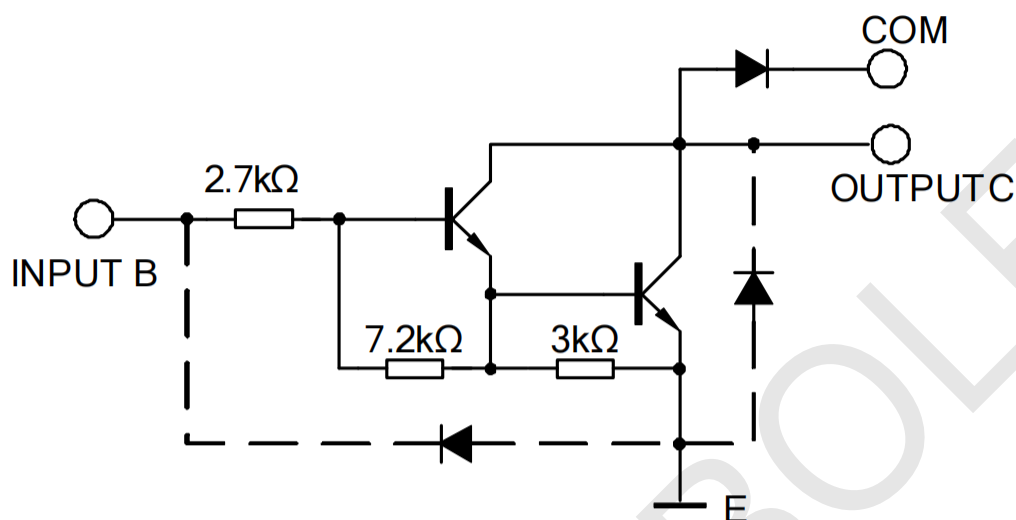
## Pins Configuration



## Pins Description

| No. | Name | Type | Description                 |
|-----|------|------|-----------------------------|
| 1   | 1B   | I    | Input 1                     |
| 2   | 2B   | I    | Input 2                     |
| 3   | 3B   | I    | Input 3                     |
| 4   | 4B   | I    | Input 4                     |
| 5   | 5B   | I    | Input 5                     |
| 6   | 6B   | I    | Input 6                     |
| 7   | 7B   | I    | Input 7                     |
| 8   | E    | -    | Ground                      |
| 9   | COM  | -    | Common Free Wheeling Diodes |
| 10  | 7C   | O    | Output 7                    |
| 11  | 6C   | O    | Output 6                    |
| 12  | 5C   | O    | Output 5                    |
| 13  | 4C   | O    | Output 4                    |
| 14  | 3C   | O    | Output 3                    |
| 15  | 2C   | O    | Output 2                    |
| 16  | 1C   | O    | Output 1                    |

## Circuit Diagram



## Maximum Ratings

| Symbol    | Parameter                    | Max. Ratings | Unit |
|-----------|------------------------------|--------------|------|
| $V_o$     | Output voltage               | 50           | V    |
| $V_{in}$  | Input voltage                | 30           | V    |
| $I_c$     | Continuous collector current | 500          | mA   |
| $I_b$     | Continuous base current      | 25           | mA   |
| $T_{amb}$ | Operating Temperature Range  | -40~85       | °C   |

## Recommended Operating Conditions

( $T_A=25^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                    | Symbol        | Conditions                         | Min. | Max.  | Unit |
|------------------------------|---------------|------------------------------------|------|-------|------|
| Collector-Emitter Voltage    | $V_{CE}$      |                                    | 0    | 50    | V    |
| Maximum Junction Temperature | $T_J$         |                                    |      | 125   | °C   |
| Input Voltage                | $V_{IN}$      |                                    | 0    | 24    | V    |
| Input Voltage (Output On)    | $V_{IN(ON)}$  | $I_{OUT}=400\text{mA}, h_{FE}=800$ | 2.5  | 24    | V    |
| Input Voltage (Output Off)   | $V_{IN(OFF)}$ |                                    | 0    | 0.7   | V    |
| Clamp Forward Current        | $I_F$         |                                    |      | 350   | mA   |
| Power Dissipation            | $P_D$         | $T_A=-85^{\circ}\text{C}$          |      | 0.325 | V    |

## Electrical Characteristics

( $T_A=25^{\circ}\text{C}$ , unless otherwise noted)

| Parameter                            | Test Conditions                             | Symbol        | Value |      |      | Unit           |
|--------------------------------------|---------------------------------------------|---------------|-------|------|------|----------------|
|                                      |                                             |               | Min.  | Typ. | Max. |                |
| Output leakage current               | $V_{CE}=50\text{ V}$                        | $I_{CEX}$     | -     | -    | 50   | $\mu\text{ A}$ |
| Collector-emitter saturation voltage | $I_C=100\text{ mA}$ , $I_B=250\mu\text{ A}$ | $V_{CE(sat)}$ | -     | 0.9  | 1.1  | V              |
|                                      | $I_C=200\text{ mA}$ , $I_B=350\mu\text{ A}$ |               | -     | 1.1  | 1.3  |                |
|                                      | $I_C=350\text{ mA}$ , $I_B=500\mu\text{ A}$ |               | -     | 1.3  | 1.6  |                |
| Input current                        | $V_i=3.85\text{ V}$                         | $I_{i(on)}$   | -     | 0.93 | 1.35 | mA             |
| Input voltage                        | $V_{CE}=2.0\text{ V}$ , $I_C=200\text{ mA}$ | $V_{i(on)}$   | -     | -    | 2.4  | V              |
|                                      | $V_{CE}=2.0\text{ V}$ , $I_C=250\text{ mA}$ |               | -     | -    | 2.7  |                |
|                                      | $V_{CE}=2.0\text{ V}$ , $I_C=300\text{ mA}$ |               | -     | -    | 3.0  |                |
| Clamp diode leakage current          | $V_R=50\text{ V}$                           | $I_R$         | -4.0  | -    | 50   | $\mu\text{ A}$ |
| Clamp diode forward voltage          | $I_F=350\text{ mA}$                         | $V_F$         | -     | 1.7  | 2    | V              |
| Output leakage current               | $V_{CE}=50\text{ V}$ , $V_i=1\text{ V}$     | $I_{CEX-1V}$  | -5    | -    | 80   | $\mu\text{ A}$ |

## Test Parameter Diagram

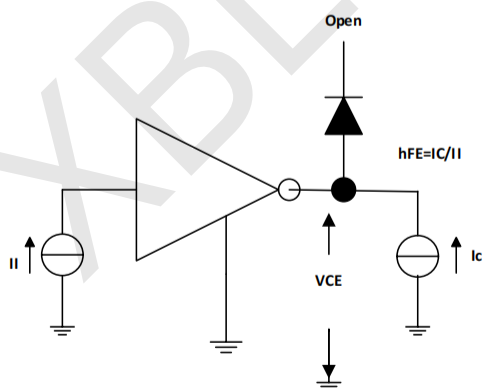


Figure 1.  $h_{FE}$ ,  $V_{CE(sat)}$  Test Circuit

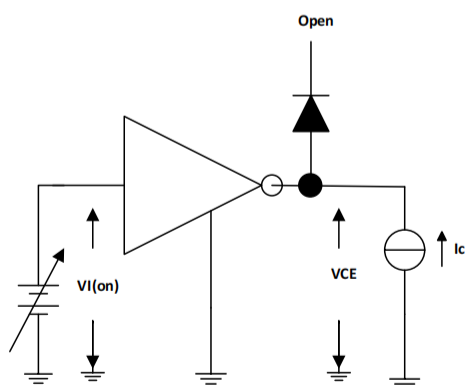


Figure 2.  $V_{i(on)}$  Test Circuit

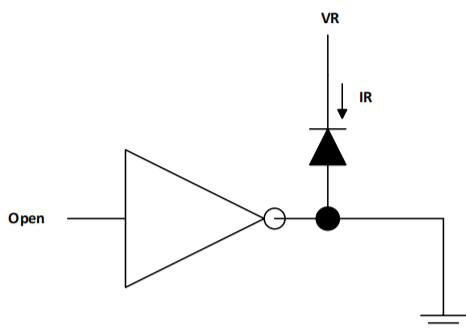


Figure 3. IR Test Circuit

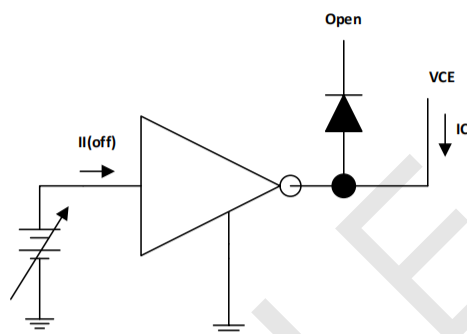


Figure 4. I(off) Test Circuit

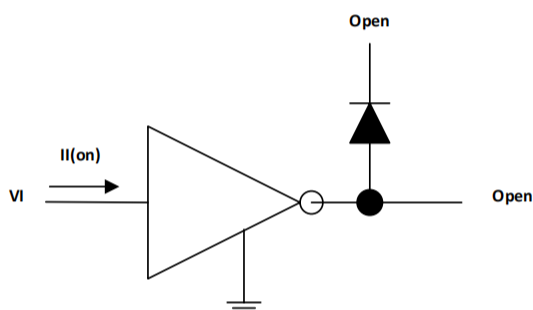


Figure 5. I(on) Test Circuit

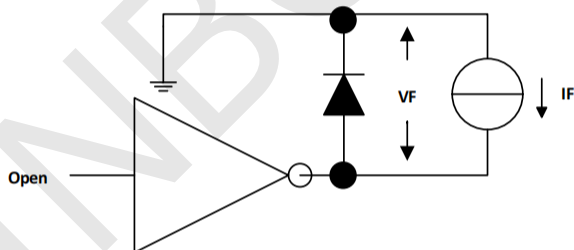


Figure 6. VF Test Circuit

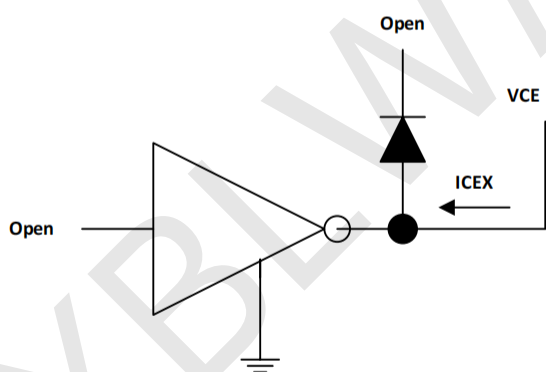


Figure 7. IC(ON) Test Circuit

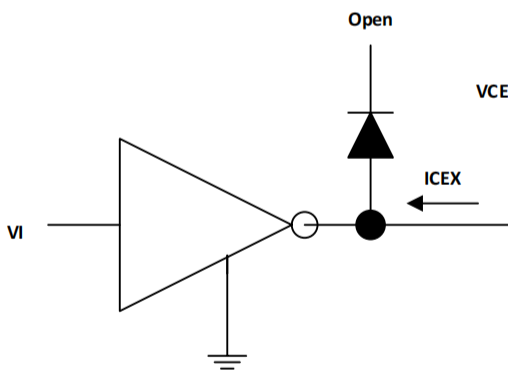


Figure 8. IC(ON) Test Circuit

## Characteristic Curves

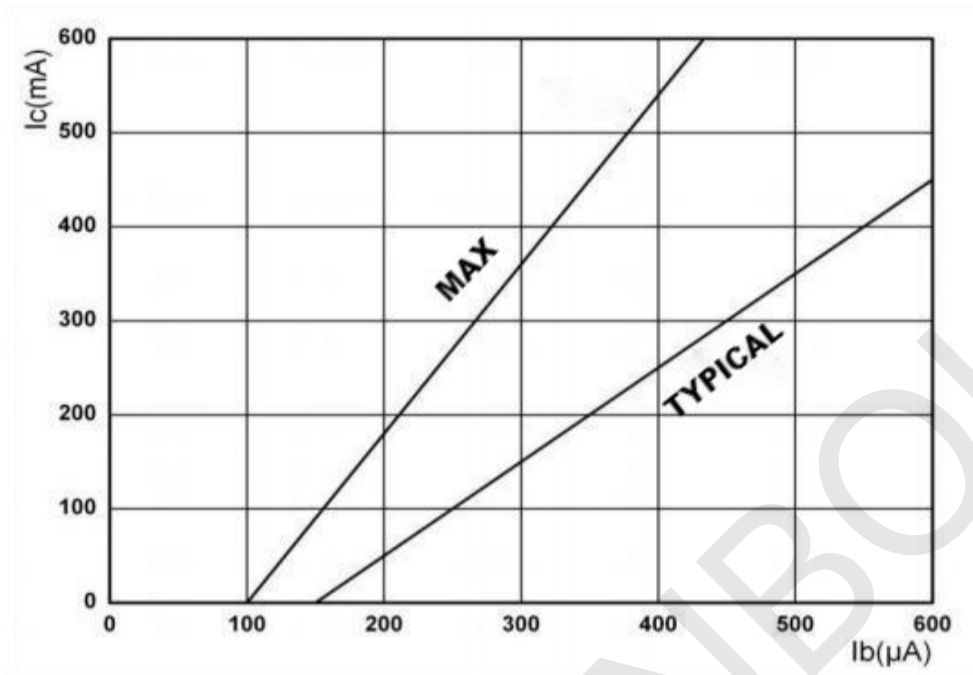


Figure 9. Input current vs. input voltage

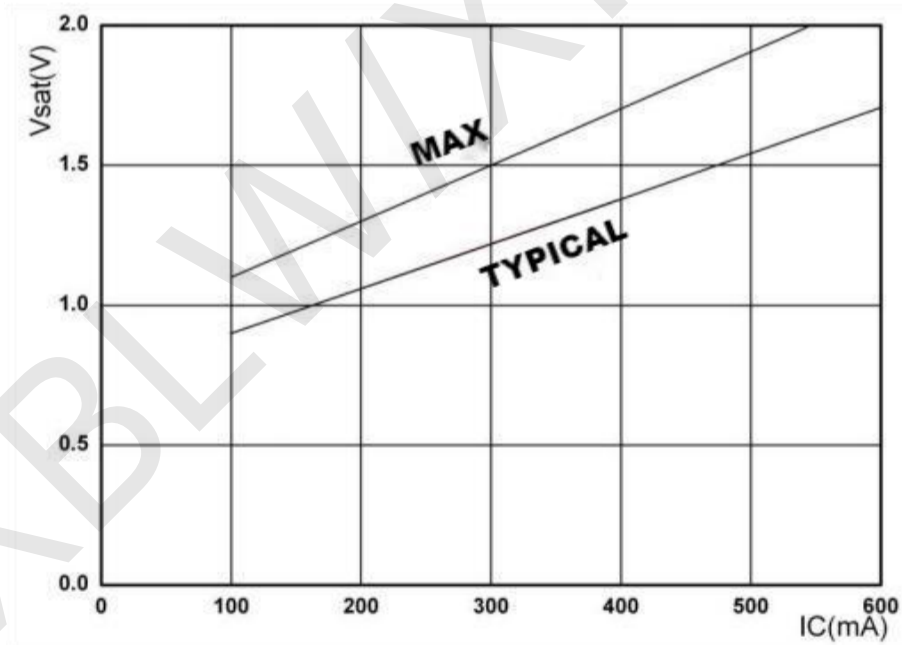
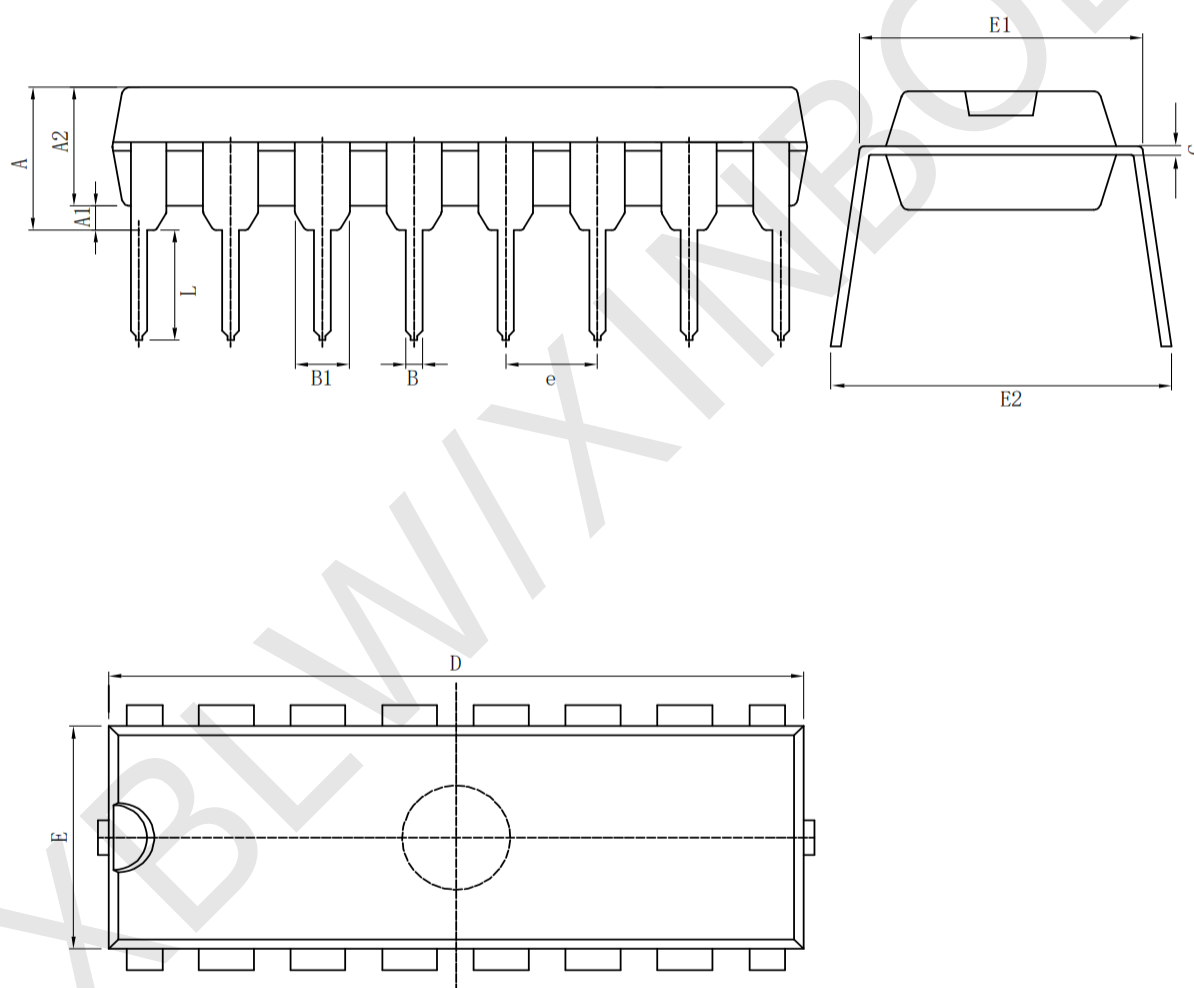


Figure 10. Collector current vs. saturation voltage

## Package Information

### · DIP-16

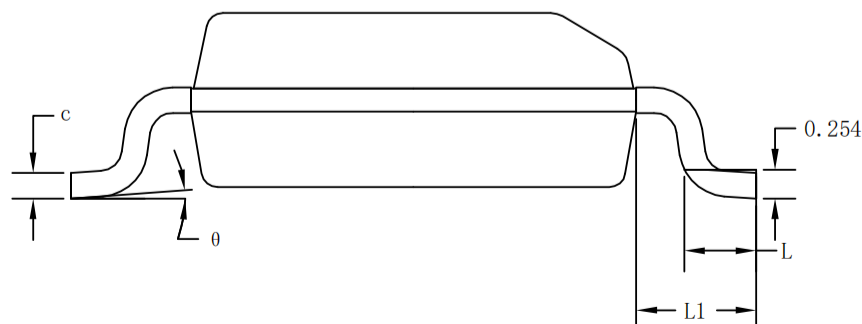
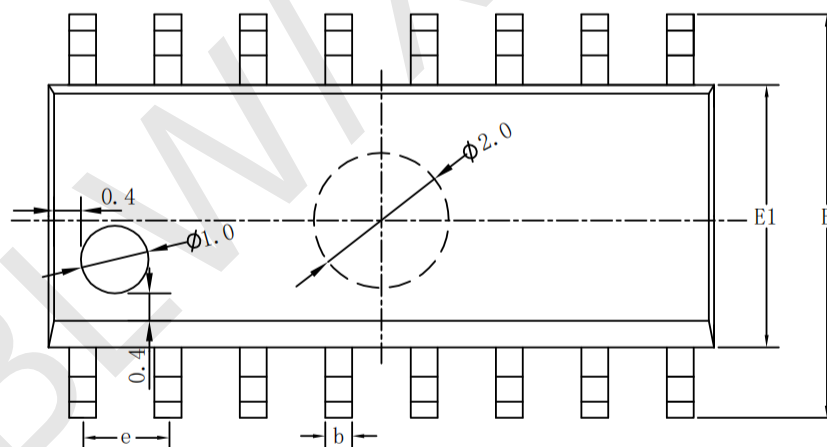
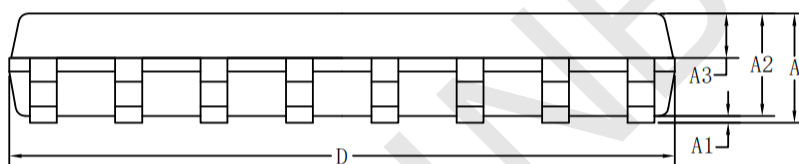
| Symbol | Size | Dimensions In Millimeters |          | Symbol | Size | Dimensions In Inches |          |
|--------|------|---------------------------|----------|--------|------|----------------------|----------|
|        |      | Min( mm)                  | Max( mm) |        |      | Min( in)             | Max( in) |
| A      |      | 3.710                     | 4.310    | A      |      | 0.146                | 0.170    |
| A1     |      | 0.510                     |          | A1     |      | 0.020                |          |
| A2     |      | 3.200                     | 3.600    | A2     |      | 0.126                | 0.142    |
| B      |      | 0.380                     | 0.570    | B      |      | 0.015                | 0.022    |
| B1     |      | 1.524 (BSC)               |          | B1     |      | 0.060 (BSC)          |          |
| C      |      | 0.204                     | 0.360    | C      |      | 0.008                | 0.014    |
| D      |      | 18.80                     | 19.20    | D      |      | 0.740                | 0.756    |
| E      |      | 6.200                     | 6.600    | E      |      | 0.244                | 0.260    |
| E1     |      | 7.320                     | 7.920    | E1     |      | 0.288                | 0.312    |
| e      |      | 2.540 (BSC)               |          | e      |      | 0.100 (BSC)          |          |
| L      |      | 3.000                     | 3.600    | L      |      | 0.118                | 0.142    |
| E2     |      | 8.400                     | 9.000    | E2     |      | 0.331                | 0.354    |





· SOP-16

| Symbol | Size | Dimensions In Millimeters |          |          | Symbol | Size | Dimensions In Inches |          |          |
|--------|------|---------------------------|----------|----------|--------|------|----------------------|----------|----------|
|        |      | Min (mm)                  | Nom (mm) | Max (mm) |        |      | Min (in)             | Nom (in) | Max (in) |
| A      |      | 1.500                     | 1.600    | 1.700    | A      |      | 0.059                | 0.063    | 0.067    |
| A1     |      | 0.100                     | 0.150    | 0.250    | A1     |      | 0.004                | 0.006    | 0.010    |
| A2     |      | 1.400                     | 1.450    | 1.500    | A2     |      | 0.055                | 0.057    | 0.059    |
| A3     |      | 0.600                     | 0.650    | 0.700    | A3     |      | 0.024                | 0.026    | 0.028    |
| b      |      | 0.300                     | 0.400    | 0.500    | b      |      | 0.012                | 0.016    | 0.020    |
| c      |      | 0.150                     | 0.200    | 0.250    | c      |      | 0.006                | 0.008    | 0.010    |
| D      |      | 9.800                     | 9.900    | 10.00    | D      |      | 0.386                | 0.390    | 0.394    |
| E      |      | 5.800                     | 6.000    | 6.200    | E      |      | 0.228                | 0.236    | 0.244    |
| E1     |      | 3.850                     | 3.900    | 3.950    | E1     |      | 0.152                | 0.154    | 0.156    |
| e      |      | 1.27 (BSC)                |          |          | e      |      | 0.050 (BSC)          |          |          |
| L      |      | 0.500                     | 0.600    | 0.700    | L      |      | 0.020                | 0.024    | 0.028    |
| L1     |      | 1.05 (BSC)                |          |          | L1     |      | 0.041 (BSC)          |          |          |
| θ      |      | 0°                        | 4°       | 8°       | θ      |      | 0°                   | 4°       | 8°       |



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