

## Low- Power Single 2-Input Positive Exclusive-OR Gate

### Description

This single 2-input exclusive-OR gate is designed for 0.8-V to 3.6-V VCC operation.

The FLG74AUP1G86 performs the Boolean function  $Y = \overline{A}B + A\overline{B}$  in positive logic.

The CMOS device has high output drive while maintaining low static power dissipation over a broad VCC operating range.

The FLG74AUP1G86 device is available in a variety of packages, including SOT23-5, SC70.

### Features

- Inputs Accept Voltages 0.8V to 3.6 V
- Max Tpd of 5.4 ns at 3.3 V
- Low Static-Consumption, 0.5-  $\mu$  A Max  $I_{CC}$
- Low Noise Overshoot and Undershoot < 10% of  $V_{CC}$
- Ioff Supports Live Insertion, Partial-Power-Down Mode, and Back-Drive Protection
- Input Hysteresis Allows Slow Input Transition and Better Switching Noise Immunity at Input ( $V_{hys} = 250\text{mV}$  Typical 3.3V)

- 3.6V I/O Tolerant to Support Mixed-Mode Signal Operation
- Suitable for Point-to-Point Applications
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 1000-V Charged-Device Model (C101)

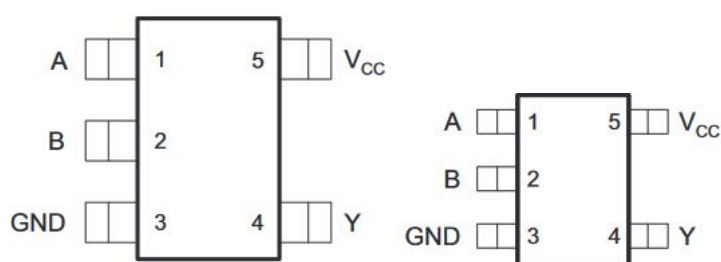
### Applications

- ATCA Solutions
- Active Noise Cancellation (ANC)
- Barcode Scanner
- Blood Pressure Monitor
- CPAP Machine
- Cable Solutions
- DLP 3DMachine Vision, Hyperspectral Imaging, Optical Networking, and Spectroscopy
- E-Book
- Embedded PC
- Field Transmitter : Temperature or Pressure Sensor
- Fingerprint Biometrics
- HVAC: Heating, Ventilating, and Air Conditioning

## Order information

| Mode         | Package | Ordering Number         | Packing Option     |
|--------------|---------|-------------------------|--------------------|
| FLG74AUP1G86 | SOT23-5 | FLG74AUP1G86YSOT235G/TR | Tape and Reel,3000 |
|              | SC70    | FLG74AUP1G86YSC70G/TR   | Tape and Reel,3000 |

## Pin Configuration



## Simplified Schematic



## Pin Assignment

| Pin Name | Pin No. | Pin Function |
|----------|---------|--------------|
| A        | 1       | Input        |
| B        | 2       | Input        |
| GND      | 3       | Ground       |
| Y        | 4       | Output       |
| VCC      | 5       | Power Pin    |

## Absolute Maximum Ratings (Note1)

- $V_{CC}$  ----- -0.5V to +4.6V
- $V_I$  ----- -0.5V to +4.6V
- $V_O$  (Voltage range applied to any output in the high-impedance or power-off state) ----- -0.3V to +4.6V
- $V_O$  (Voltage range applied to any output in the high or low state) ----- -0.3V to  $V_{CC}+0.3V$
- Input clamp current ----- -50mA
- Output clamp current ----- -50mA
- Continuous output current -----  $\pm 20mA$
- Storage Temperature -----  $-65^{\circ}C$  to  $150^{\circ}C$

## Recommended Operating Conditions

| Parameter                          | Symbol              | Test Conditions            | Min                  | Typ | Max                  | Units       |
|------------------------------------|---------------------|----------------------------|----------------------|-----|----------------------|-------------|
| Supply voltage                     | $V_{CC}$            | Operating                  | 0.8                  |     | 3.6                  | V           |
| Input voltage                      | $V_I$               |                            | 0                    |     | 3.6                  | V           |
| Output voltage                     | $V_O$               |                            | 0                    |     | $V_{CC}$             | V           |
| High- level input voltage          | $V_{IH}$            | $V_{CC} = 0.8V$            | $V_{CC}$             |     |                      | V           |
|                                    |                     | $V_{CC} = 1.1V$ to $1.95V$ | $0.65 \times V_{CC}$ |     |                      |             |
|                                    |                     | $V_{CC} = 2.3V$ to $2.7V$  | 1.6                  |     |                      |             |
|                                    |                     | $V_{CC} = 3V$ to $3.6V$    | 2                    |     |                      |             |
| Low- level input voltage           | $V_{IL}$            | $V_{CC} = 0.8V$            |                      |     | 0                    | V           |
|                                    |                     | $V_{CC} = 1.1V$ to $1.95V$ |                      |     | $0.35 \times V_{CC}$ |             |
|                                    |                     | $V_{CC} = 2.3V$ to $2.7V$  |                      |     | 0.7                  |             |
|                                    |                     | $V_{CC} = 3V$ to $3.6V$    |                      |     | 0.9                  |             |
| High- level output current         | $I_{OH}$            | $V_{CC} = 0.8V$            |                      |     | -20                  | uA          |
|                                    |                     | $V_{CC} = 1.1V$            |                      |     | -1.1                 | mA          |
|                                    |                     | $V_{CC} = 1.4V$            |                      |     | -1.7                 |             |
|                                    |                     | $V_{CC} = 1.65V$           |                      |     | -1.9                 |             |
|                                    |                     | $V_{CC} = 2.3V$            |                      |     | -3.1                 |             |
|                                    |                     | $V_{CC} = 3V$              |                      |     | -4                   |             |
| Low- level output current          | $I_{OL}$            | $V_{CC} = 0.8V$            |                      |     | 20                   | uA          |
|                                    |                     | $V_{CC} = 1.1V$            |                      |     | 1.1                  | mA          |
|                                    |                     | $V_{CC} = 1.4V$            |                      |     | 1.7                  |             |
|                                    |                     | $V_{CC} = 1.65V$           |                      |     | 1.9                  |             |
|                                    |                     | $V_{CC} = 2.3V$            |                      |     | 3.1                  |             |
|                                    |                     | $V_{CC} = 3V$              |                      |     | 4                    |             |
| Input transition rise or fall rate | $\Delta T/\Delta V$ | $V_{CC} = 0.8V$ to $3.6V$  |                      |     | 200                  | ns/V        |
| Operating temperature              | $T_A$               |                            | -40                  |     | 85                   | $^{\circ}C$ |

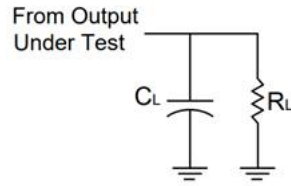
## Electrical Characteristics

| Parameter                               | Symbol           | Test Conditions  | Min.                 | Typ. | Max.                | Unit |
|---|------------------|--|----------------------|------|---------------------|------|
| High- level output voltage              | V <sub>OH</sub>  | V <sub>CC</sub> = 0.8~3.6V, I <sub>OH</sub> = -20uA  | V <sub>CC</sub> -0.1 |      |                     | V    |
|   |                  | V <sub>CC</sub> = 1.1V, I <sub>OH</sub> = -1.1mA   | 0.75×V <sub>CC</sub> |      |                     |      |
|   |                  | V <sub>CC</sub> = 1.4V, I <sub>OH</sub> = -1.7mA   | 1.11                 |      |                     |      |
|   |                  | V <sub>CC</sub> = 1.65V, I <sub>OH</sub> = -1.9mA  | 1.32                 |      |                     |      |
|   |                  | V <sub>CC</sub> = 2.3V, I <sub>OH</sub> = -2.3mA   | 2.05                 |      |                     |      |
|   |                  | V <sub>CC</sub> = 2.3V, I <sub>OH</sub> = -3.1mA   | 1.9                  |      |                     |      |
|   |                  | V <sub>CC</sub> = 3V, I <sub>OH</sub> = -2.7mA   | 2.72                 |      |                     |      |
|   |                  | V <sub>CC</sub> = 3V, I <sub>OH</sub> = -4mA   | 2.6                  |      |                     |      |
| Low- level output voltage               | V <sub>OL</sub>  | V <sub>CC</sub> = 0.8~3.6V, I <sub>OL</sub> = 20uA   |                      |      | 0.1                 | V    |
|   |                  | V <sub>CC</sub> = 1.1V, I <sub>OL</sub> = 1.1mA  |                      |      | 0.3×V <sub>CC</sub> |      |
|   |                  | V <sub>CC</sub> = 1.4V, I <sub>OL</sub> = 1.7mA  |                      |      | 0.31                |      |
|   |                  | V <sub>CC</sub> = 1.65V, I <sub>OL</sub> = 1.9mA   |                      |      | 0.31                |      |
|   |                  | V <sub>CC</sub> = 2.3V, I <sub>OL</sub> = 2.3mA  |                      |      | 0.31                |      |
|   |                  | V <sub>CC</sub> = 2.3V, I <sub>OL</sub> = 3.1mA  |                      |      | 0.44                |      |
|   |                  | V <sub>CC</sub> = 3V, I <sub>OL</sub> = 2.7mA  |                      |      | 0.31                |      |
|   |                  | V <sub>CC</sub> = 3V, I <sub>OL</sub> = 4mA  |                      |      | 0.44                |      |
| Input leakage current                   | I <sub>I</sub>   | V <sub>IN</sub> = 3.6V or GND, V <sub>CC</sub> = 0~3.6V  |                      |      | 0.1                 | uA   |
| Power off leakage current               | I <sub>OFF</sub> | V <sub>I</sub> or V <sub>O</sub> =0V to 3.6V, V <sub>CC</sub> =0V                                    |                      |      | 0.2                 | uA   |
| Supply current                          | I <sub>CC</sub>  | V <sub>I</sub> = GND or (V <sub>CC</sub> to 3.6V),<br>I <sub>OUT</sub> =0, V <sub>CC</sub> =0.8~3.6V |                      |      | 0.5                 | uA   |
| Additional supply current per input pin | ΔI <sub>CC</sub> | V <sub>I</sub> = V <sub>CC</sub> -0.6V, I <sub>OUT</sub> =0  |                      |      | 40                  | uA   |

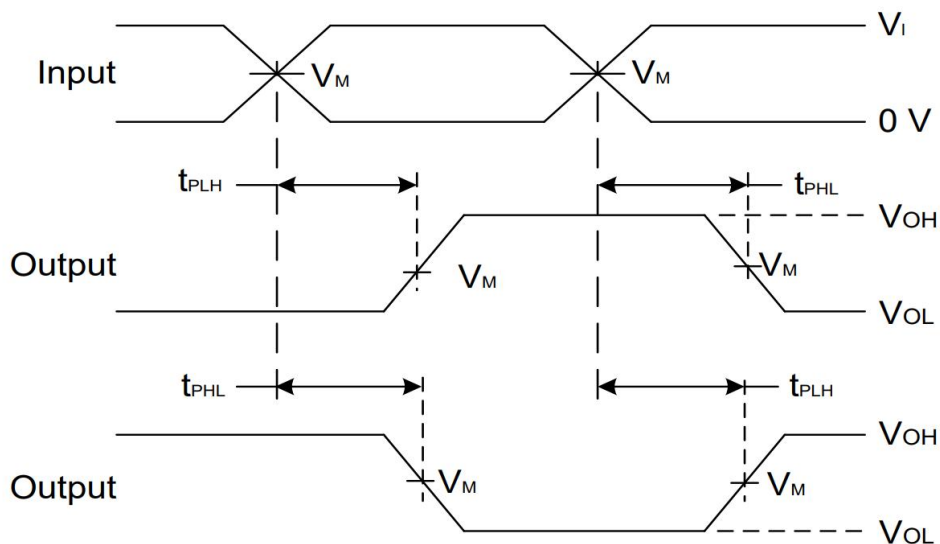
## Switching Characteristics

| Parameter   | Symbol          | Test Conditions              | Min.  | Typ. | Max. | Unit |      |
|---|-----------------|------------------------------|---|------|------|------|------|
| Propagation delay from input(A or B) to output(Y) | T <sub>PD</sub> | V <sub>CC</sub> = 0.8V       |   | 28.2 |      | ns   |      |
|   |                 | V <sub>CC</sub> = 1.2V±0.1V  |   | 3.0  | 7.6  |      | 16.5 |
|   |                 | V <sub>CC</sub> = 1.5V±0.1V  | C <sub>L</sub> =15pF<br>R <sub>L</sub> =1MΩ | 2.4  | 5.3  |      | 9.6  |
|   |                 | V <sub>CC</sub> = 1.8V±0.15V |   | 2.1  | 4.4  |      | 7.5  |
|   |                 | V <sub>CC</sub> = 2.5V±0.2V  |   | 1.8  | 3.6  |      | 5.9  |
|   |                 | V <sub>CC</sub> = 3.3V±0.3V  |   | 1.6  | 3.3  |      | 5.4  |

## Parameter Measurement Information



| V <sub>CC</sub> | INPUTS          |                                | V <sub>M</sub>     | C <sub>L</sub> | R <sub>L</sub> |
|-----------------|-----------------|--------------------------------|--------------------|----------------|----------------|
|                 | V <sub>I</sub>  | t <sub>r</sub> /t <sub>f</sub> |                    |                |                |
| 0.8V            | V <sub>CC</sub> | ≅ 2ns                          | V <sub>CC</sub> /2 | 15pF           | 1MΩ            |
| 1.2V ± 0.1V     | V <sub>CC</sub> | ≅ 2ns                          | V <sub>CC</sub> /2 | 15pF           | 1MΩ            |
| 1.5V ± 0.1V     | V <sub>CC</sub> | ≅ 2ns                          | V <sub>CC</sub> /2 | 15pF           | 1MΩ            |
| 1.8V ± 0.15V    | V <sub>CC</sub> | ≅ 2ns                          | V <sub>CC</sub> /2 | 15pF           | 1MΩ            |
| 2.5V ± 0.2V     | 3V              | ≅ 2.5ns                        | 1.5V               | 15pF           | 1MΩ            |
| 3.3V ± 0.3V     | V <sub>CC</sub> | ≅ 2.5ns                        | V <sub>CC</sub> /2 | 15pF           | 1MΩ            |



Voltage Waveform Propagation Delay Times  
Inverting and Non Inverting Outputs

- Notes:
- A. C<sub>L</sub> includes probe and jig capacitance
  - B. All pulses and supplied at pulse repetition rate ≅ 10MHz
  - C. The Inputs are measured separately one transition per measurement
  - D. t<sub>PLH</sub> and t<sub>PHL</sub> are the same as t<sub>PD</sub>

## IC Operation Information

### Basic Operation

The FLG74AUP1G86 device performs the Boolean function  $Y = \overline{A}B + A\overline{B}$ .

The AUP family of devices has quiescent power consumption less than 1  $\mu$ A.

This device is fully specified for partial-power-down applications using Ioff. The Ioff circuitry disables the outputs, preventing damaging current backflow through the device when it is powered. The Ioff feature also allows for live insertion.

### Function Block Diagram



### Feature Description

- Wide operating  $V_{CC}$  range of 0.8V to 3.6V.
- 3.6-V I/O tolerant to support down translation.
- Input hysteresis allows slow input transition and better switching noise immunity at the input.
- Ioff feature allows voltages on the inputs and outputs when  $V_{CC}$  is 0 V.
- Low noise due to slower edge rates.

### Device Functional Table

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | X | H      |
| X      | H | H      |
| L      | L | L      |

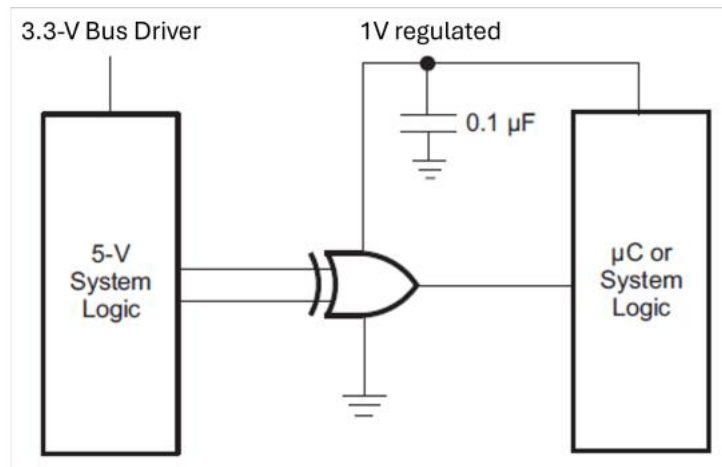
### IC Application Information

The AUP family is the solution to the industry's low-power needs in battery-powered portable applications. This family ensures a very low static and dynamic power consumption across the entire  $V_{CC}$  range of 0.8 V to 3.6 V, resulting in an increased battery life. This product also maintains excellent signal integrity. It has a small amount of hysteresis built in allowing for slower or noisy input signals. The lowered drive produces slower edges and prevents overshoot and undershoot on the outputs.

The AUP family of single gate logic makes excellent translators for the new lower voltage Microprocessors that typically

are powered from 0.8 V to 1.2 V. They can drop the voltage of peripheral drivers and accessories that are still powered by 3.3 V to the new uC power levels.

## Typical Application



## Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits

## Detailed Design Procedure

### 1. Recommended Input conditions:

- Rise time and fall time specs. See ( $\Delta t/\Delta V$ )
- Specified high and low levels. See ( $V_{IH}$  and  $V_{IL}$ )
- Inputs are overvoltage tolerant allowing them to go as high as 3.6 V at any valid VCC

### 2. Recommended output conditions:

- Load currents should not exceed 20 mA on the output and 50 mA total for the part
- Outputs should not be pulled above VCC

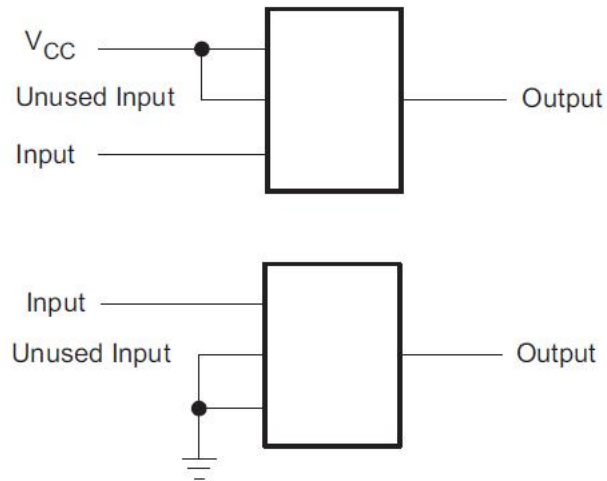
## Power Supply Recommendations

The power supply can be any voltage between the Min and Max supply voltage rating located in the Recommended Operating Conditions table. Each VCC pin should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 µF is recommended; if there are multiple VCC pins, then 0.01 µF or 0.022 µF is recommended for each power pin. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 µF and a 1 µF are commonly used in parallel. The bypass capacitor should be installed as close to the power pin as possible for best results.

## Layout Considerations

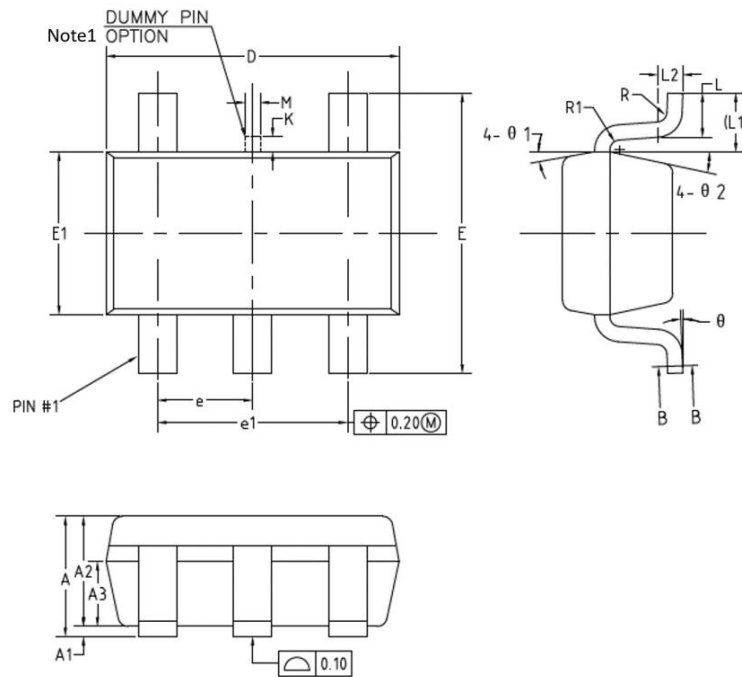
When using multiple-bit logic devices, inputs should never float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Below figure specifies the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or VCC, whichever makes more sense or is more convenient. It is generally acceptable to float outputs, unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the output section of the part when asserted. This will not disable the input section of the I/Os, so they cannot float when disabled.



## Package Information

(1) Package Type: SOT23-5

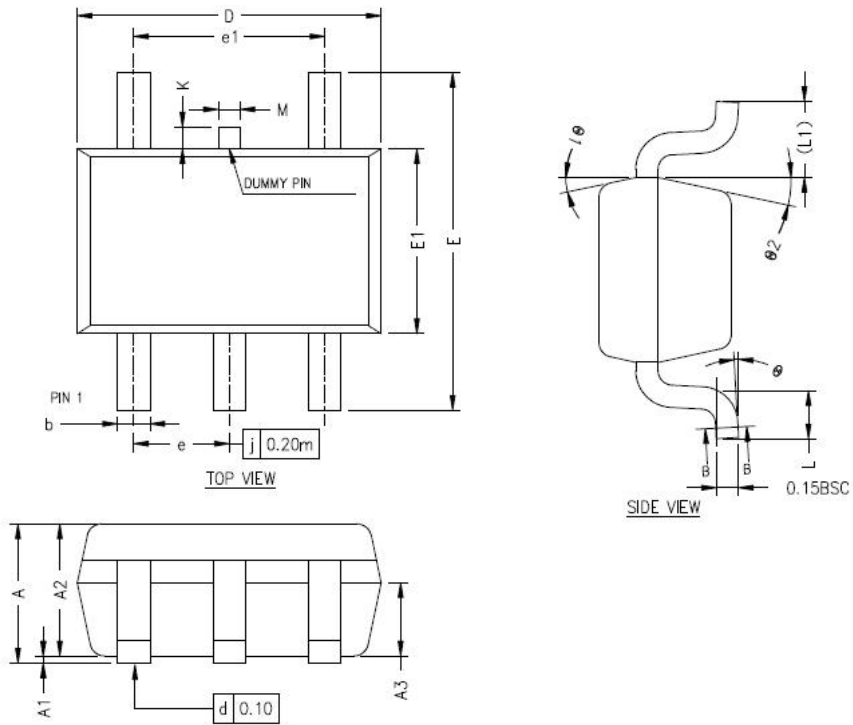


COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN     | NOM   | MAX   |
|--------|---------|-------|-------|
| A      | —       | —     | 1.25  |
| A1     | 0       | —     | 0.15  |
| A2     | 1.00    | 1.10  | 1.20  |
| A3     | 0.60    | 0.65  | 0.70  |
| ⚠ b    | 0.34    | —     | 0.45  |
| ⚠ b1   | 0.34    | 0.38  | 0.41  |
| ⚠ c    | 0.12    | —     | 0.20  |
| ⚠ c1   | 0.12    | 0.15  | 0.16  |
| D      | 2.826   | 2.926 | 3.026 |
| E      | 2.60    | 2.80  | 3.00  |
| ⚠ E1   | 1.526   | 1.626 | 1.700 |
| e      | 0.90    | 0.95  | 1.00  |
| e1     | 1.80    | 1.90  | 2.00  |
| ⚠ K    | 0       | —     | 0.20  |
| L      | 0.30    | 0.40  | 0.60  |
| L1     | 0.59REF |       |       |
| L2     | 0.25BSC |       |       |
| ⚠ M    | 0.10    | 0.15  | 0.20  |
| R      | 0.05    | —     | 0.20  |
| R1     | 0.05    | —     | 0.20  |
| θ      | 0°      | —     | 8°    |
| θ 1    | 8°      | 10°   | 12°   |
| θ 2    | 10°     | 12°   | 14°   |

Notes: 1. Dummy pin may differ or may not be present.

(2) Package Type: SC70



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL           | MIN     | NOM  | MAX  |
|------------------|---------|------|------|
| A                | 0.80    | —    | 1.10 |
| A1               | 0       | —    | 0.10 |
| A2               | 0.80    | 0.90 | 1.00 |
| A3               | 0.40    | 0.50 | 0.60 |
| b                | 0.17    | —    | 0.30 |
| b1               | 0.17    | 0.22 | 0.25 |
| $\triangle 3$ c  | 0.12    | —    | 0.20 |
| $\triangle 3$ c1 | 0.12    | 0.15 | 0.16 |
| D                | 2.02    | 2.07 | 2.12 |
| E                | 2.20    | 2.30 | 2.40 |
| E1               | 1.21    | 1.26 | 1.31 |
| e                | 0.60    | 0.65 | 0.70 |
| e1               | 1.20    | 1.30 | 1.40 |
| L                | 0.26    | 0.33 | 0.46 |
| L1               | 0.52REF |      |      |
| $\triangle 2$ M  | 0.10    | 0.15 | 0.20 |
| $\triangle 2$ K  | 0       | —    | 0.20 |
| $\theta$         | 0°      | —    | 8°   |
| $\theta 1$       | 10°     | 12°  | 14°  |
| $\theta 2$       | 10°     | 12°  | 14°  |

## Important Notice And Disclaimer

- We reserves the right to change the instruction manual without prior notice.
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