# MC7101

EARTH LEAKAGE CURRENT DETECTOR

## Features

- Low Power consumption (PD = 5mW) 100V/ 200V
- 100V/200V Common Built-in Voltage Regulator
- High Gain Differential Amplifier
- High Input Sensitivity (VT = 13.5mV Typ.)
- Minimum External Parts
- Large Surge Margin
- Wide Operating Temperature Range ($T_A$ = -30 to 85℃)
- High Noise Immunity
- GL7101,M54122 pin compatible

## Ordering Information

| Device name | Package | Wafer / Chip size |
|---|---|---|
| MC7101C(F) | wafer ring based<br>UV tape carrier | - Wafer : 6inch<br>- Chip : 810um x 840um<br>(without S/L 100um) |
| MC7101D | 8_SOP | - |
| MC7101B | 8_PDIP | - |

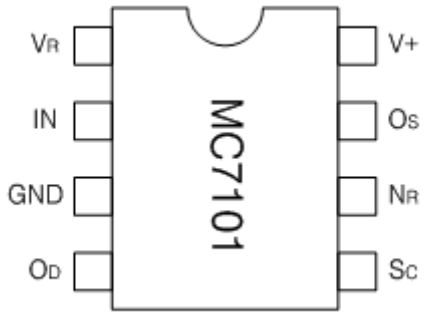
## CONTENTS

# MC7101

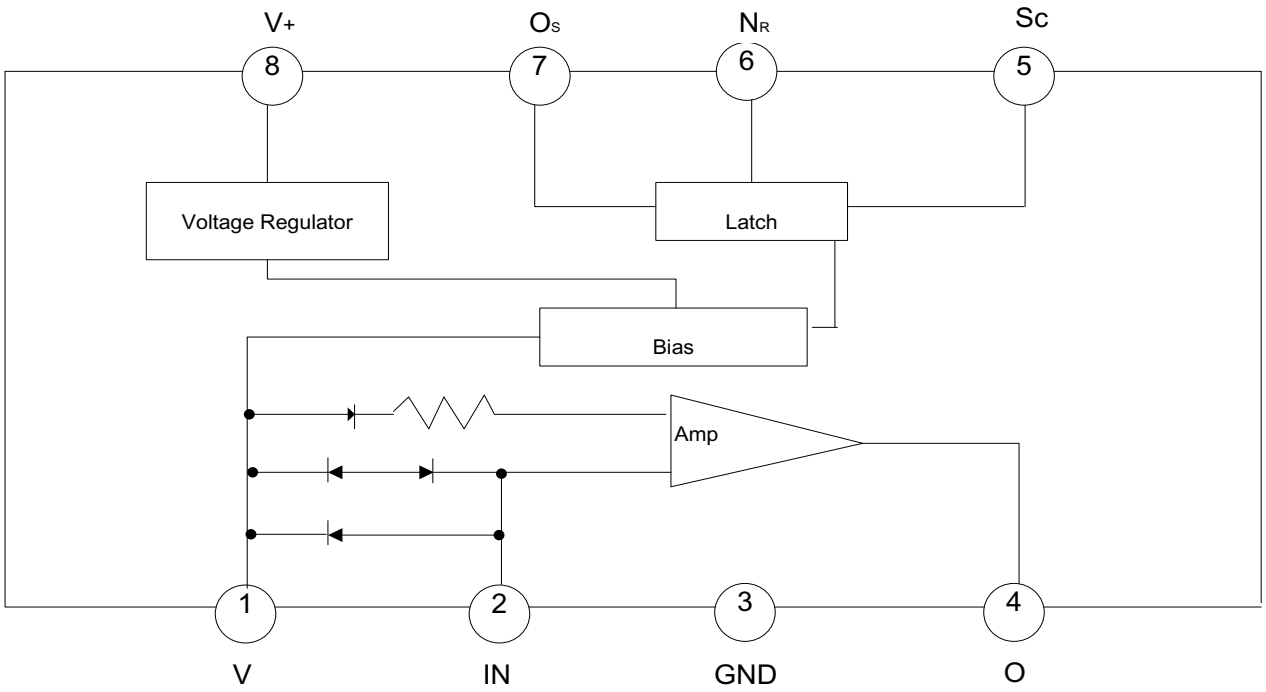
## 1. General Description

The MC7101 is designed for use in earth leakage circuit interrupters for operation directly off the AC Line in breakers. It contains pre-regulator, main-regulator, after-regulator, differential amplifier, level comparator, latch circuit. The input in the differential amplifier is connected to the secondary node of zero current transformer. The level comparator generates high level when earth leakage current is greater than some level.

## 2. Pin Assignment




## 3. Block Diagram



## 4. Absolute Maximum Rating (TA = 25℃)

| | | |
|---|---|---|
| Supply voltage | 20 | V |
| Supply Current | 8 | mA |
| Power Dissipation | 200 | mW |
| Operating Temperature | -30 to 85 | ℃ |
| Storage Temperature | -55 to 125 | ℃ |

## 5. Recommended Operating Condition : Ta = -30°C to 85°C

| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|
| Supply Voltage | V+ | 12 | | | V |
| Vs-GND Capacitor | Cvs | 1 | | | uF |
| Os-GND Capacitor | Cos | | | 1 | uF |

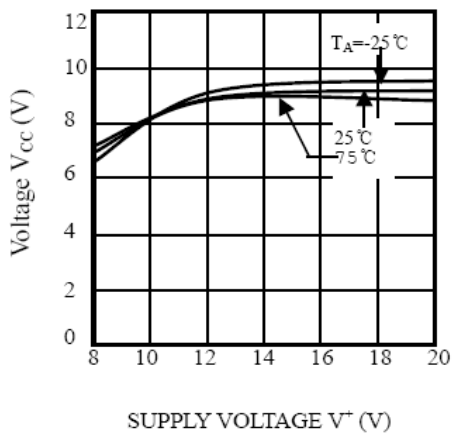
## 6. Electrical Characteristics

| PARAMETER | SYMBOL | CONDTIONS | | TEMP (°C) | MIN. | TYP. | MAX. | UNIT | TEST CIRCUT |
|---|---|---|---|---|---|---|---|---|---|
| SupplyCurrent1 | $I_{S1}$ | V+=12V, $V_R$-$V_I$=30mV | | -30 | - | - | 580 | uA | 1 |
| | | | | 25 | - | 400 | 530 | | |
| | | | | 85 | - | - | 480 | | |
| *Trip Voltage | $V_T$ | V+=16V. $V_R$-$V_I$=X | | -30~85 | 9 | 13.5 | 18 | mV(rms) | 2 |
| Differential Amplifier Output Current1 | $I_{TD1}$ | V+=16V, $V_R$-$V_I$=30mV $V_{OD}$=1.2V | | 25 | -12 | - | -30 | uA | 3 |
| Differential Amplifier Output Current2 | $I_{TD2}$ | V+=16V, $V_R$-$V_I$=short $V_{OD}$=0.8V | | 25 | 17 | - | 37 | uA | 4 |
| Output Current | $I_O$ | $V_{SC}$=1.4V $V_{OS}$=0.8V | $I_{S1}$=580 uA | -30 | -200 | - | | uA | 5 |
| | | | $I_{S1}$=530 uA | 25 | -100 | - | | | |
| | | | $I_{S1}$=480 uA | 85 | -75 | - | | | |
| Sc On Voltage | $V_{SC}$ ON | V+=16V | | 25 | 0.7 | - | 1.4 | V | 6 |
| Sc Input Current | $I_{SC}$ ON | V+=12V | | 25 | - | - | 5 | uA | 7 |
| Output “L” Current | $I_{OSL}$ | V+12V, $V_{OSL}$ =0.2V | | -30~85 | 200 | - | - | uA | 8 |
| Input Clamp Voltage | $V_{IC}$ | V+=12V, $V_{IC}$=20mA | | -30~85 | 4.3 | - | 6.7 | V | 9 |
| Differential Input Clamp Voltage | $V_{IDC}$ | $I_{IDC}$ = 100mV | | -30~85 | 0.4 | - | 2 | V | 10 |
| Max Current voltage | $V_{SM}$ | $I_{SM}$=7mA | | 25 | 20 | - | 28 | V | 11 |
| Supply Current 2 | $I_{S2}$ | $V_{OS}$=0.5V, $V_R$-$V_I$=X | | -30~85 | - | - | 900 | uA | 12 |
| Latch Circuit Off Supply Voltage | V+OFF | | | 25 | 0.5 | - | | V | 13 |
| Response Time | $T_{ON}$ | V+=16V, $V_R$-$V_I$=0.3V | | 25 | 1 | - | 4 | ms | 14 |

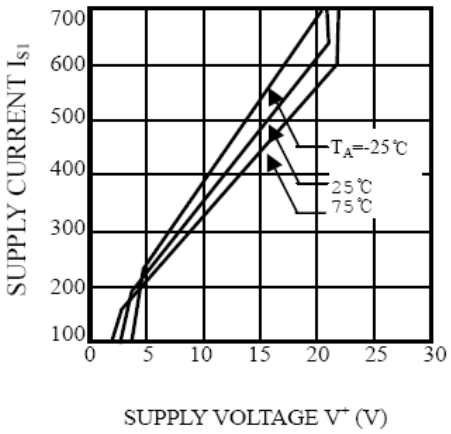
* A :9~12.55 ,B :11.5~15.5 ,C :14.5 ~ 18

## 7. Typical Performance Curves

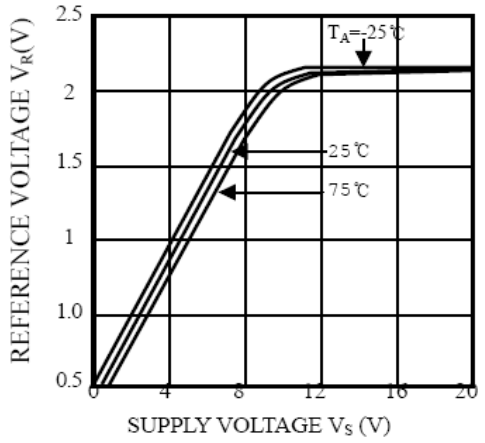
VOLTAE-SUPPLY VOLTAGE



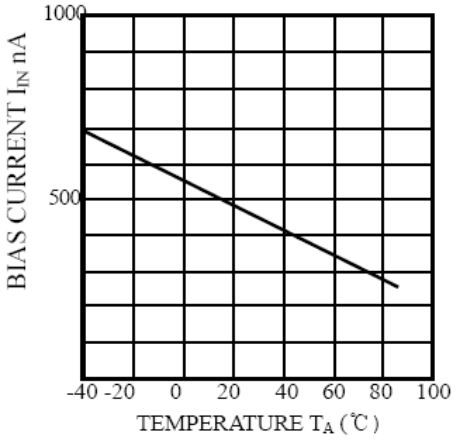

SUPPLY CURRENT-SUPPLY VOLTAGE



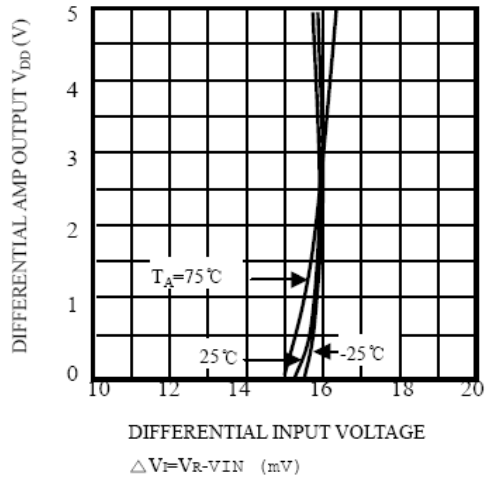

REFERENCE VOLTAGE-SUPPLY VOLTAGE



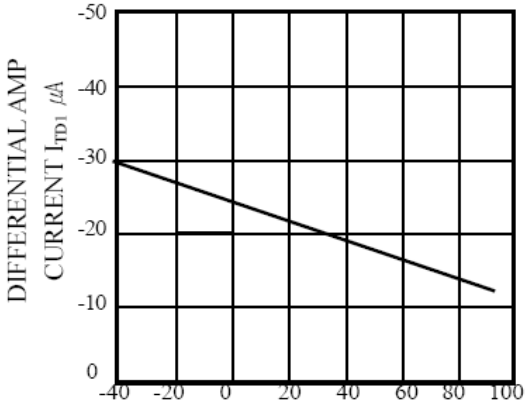

BIAS CURRENT-TEMPERATURE




DIFFERENTIAL AMPLIFIER OUTPUT VOLTAGE - DIFFERENTIAL INPUT VOLTAGE




DIFFERENTIAL AMPLIFIER OUTPUT CURRENT-TEMP



## 8. Test Circuit

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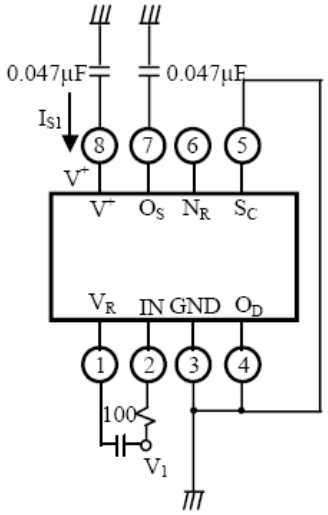


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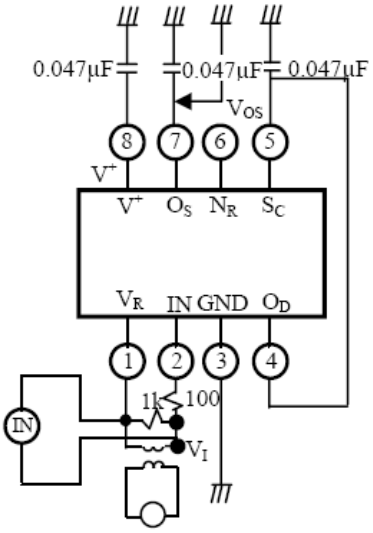


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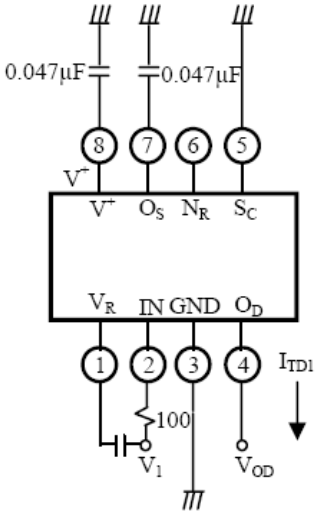


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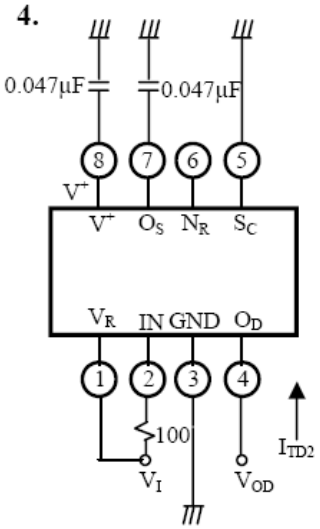


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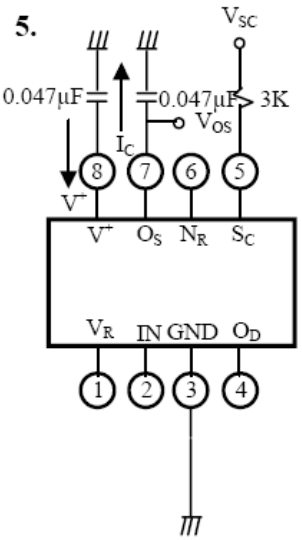


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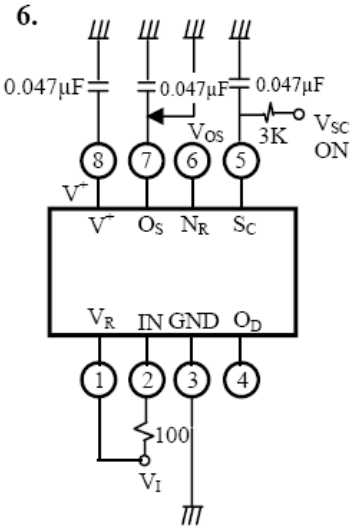


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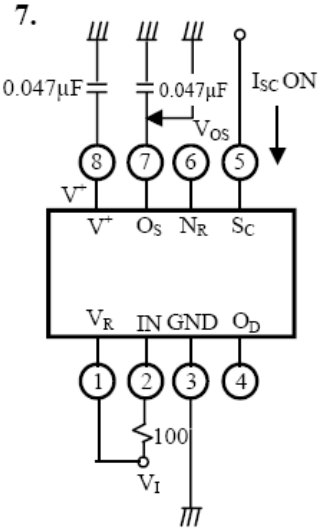


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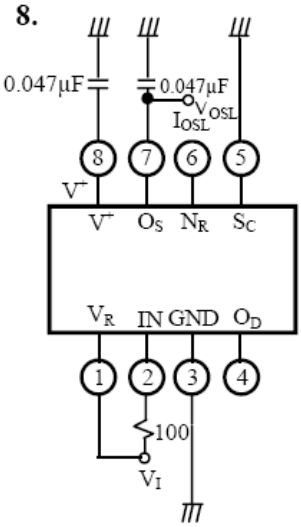


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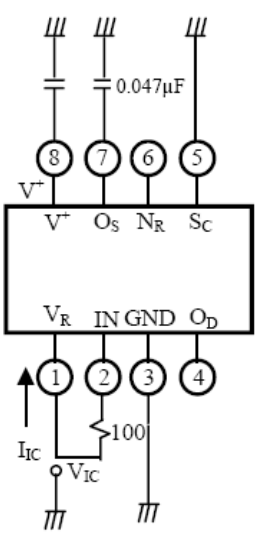

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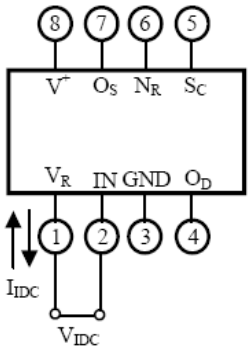
8
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VR
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GND
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2
3
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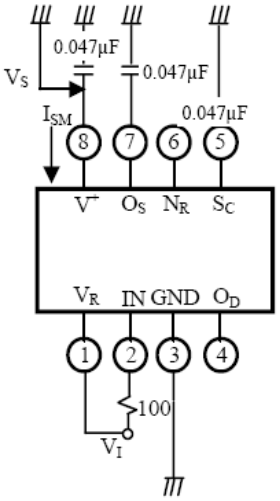
IIDC
VIDC

**11.**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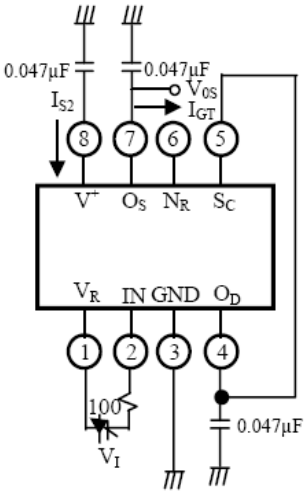
**12.**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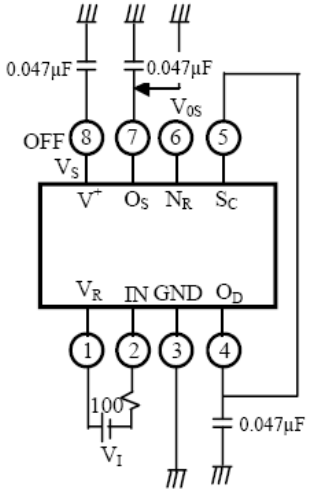
**13.**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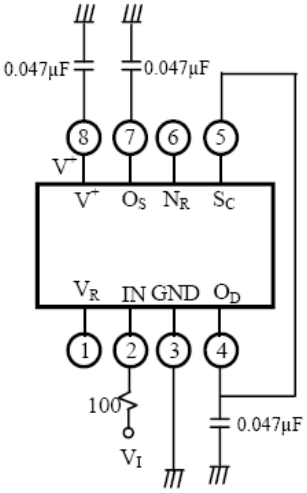
**14.**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V+
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SC
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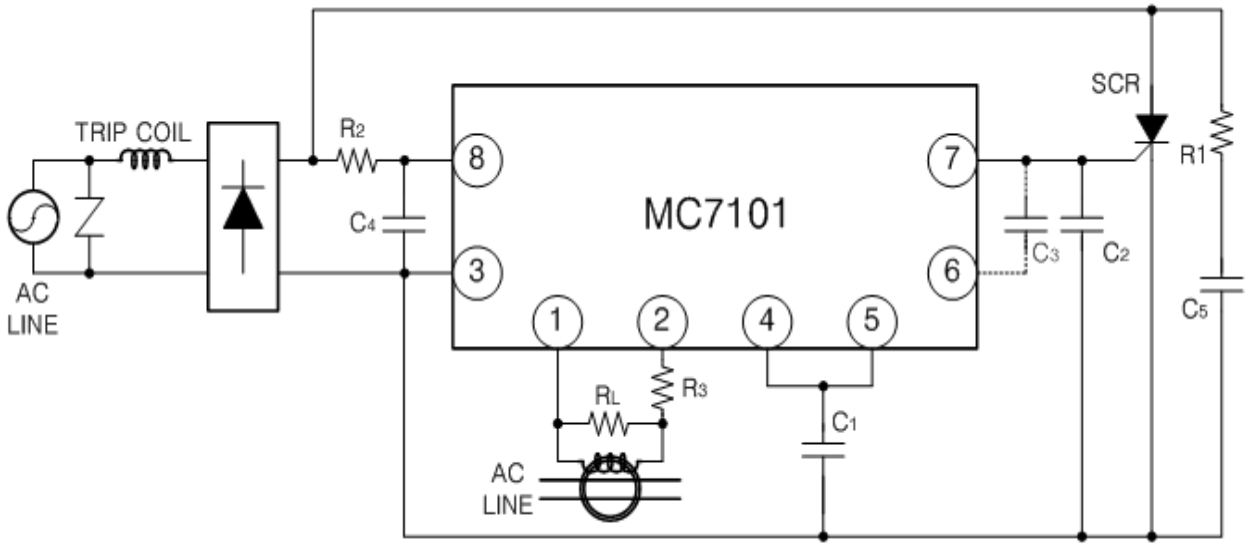
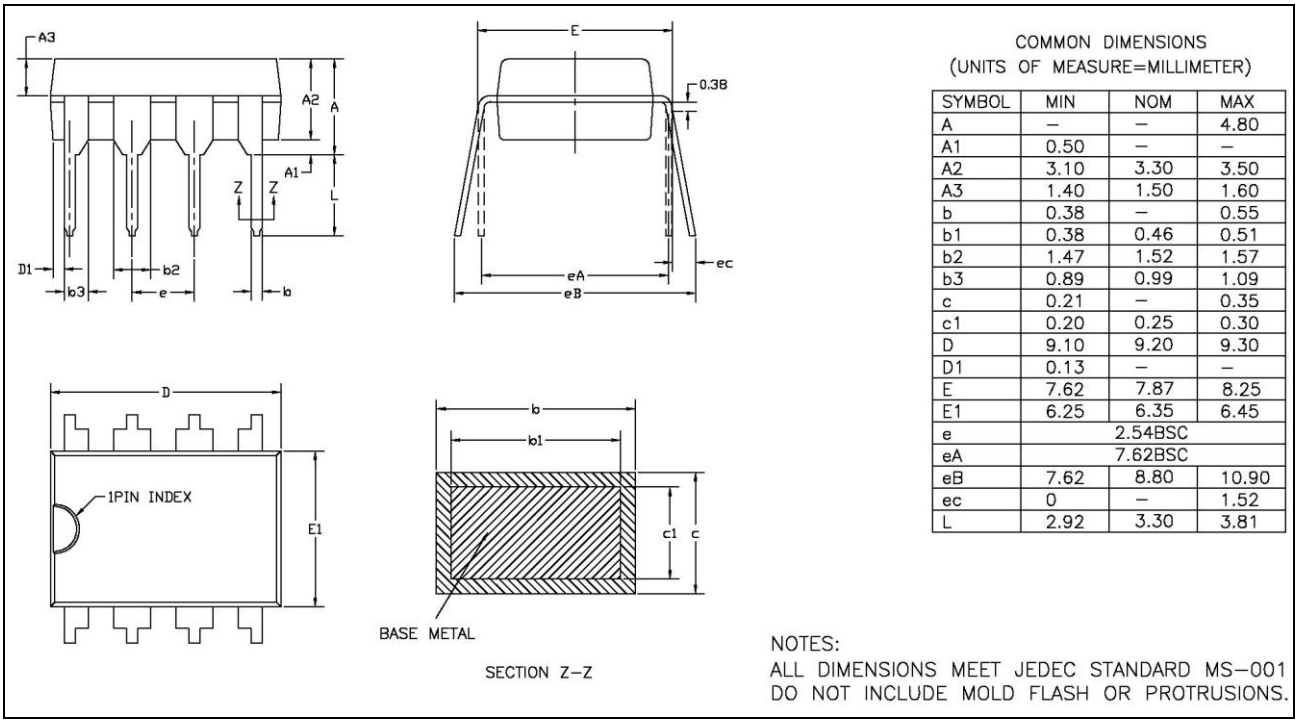
## 9. Typical Application



## 10. Package Dimension

### 8DIP

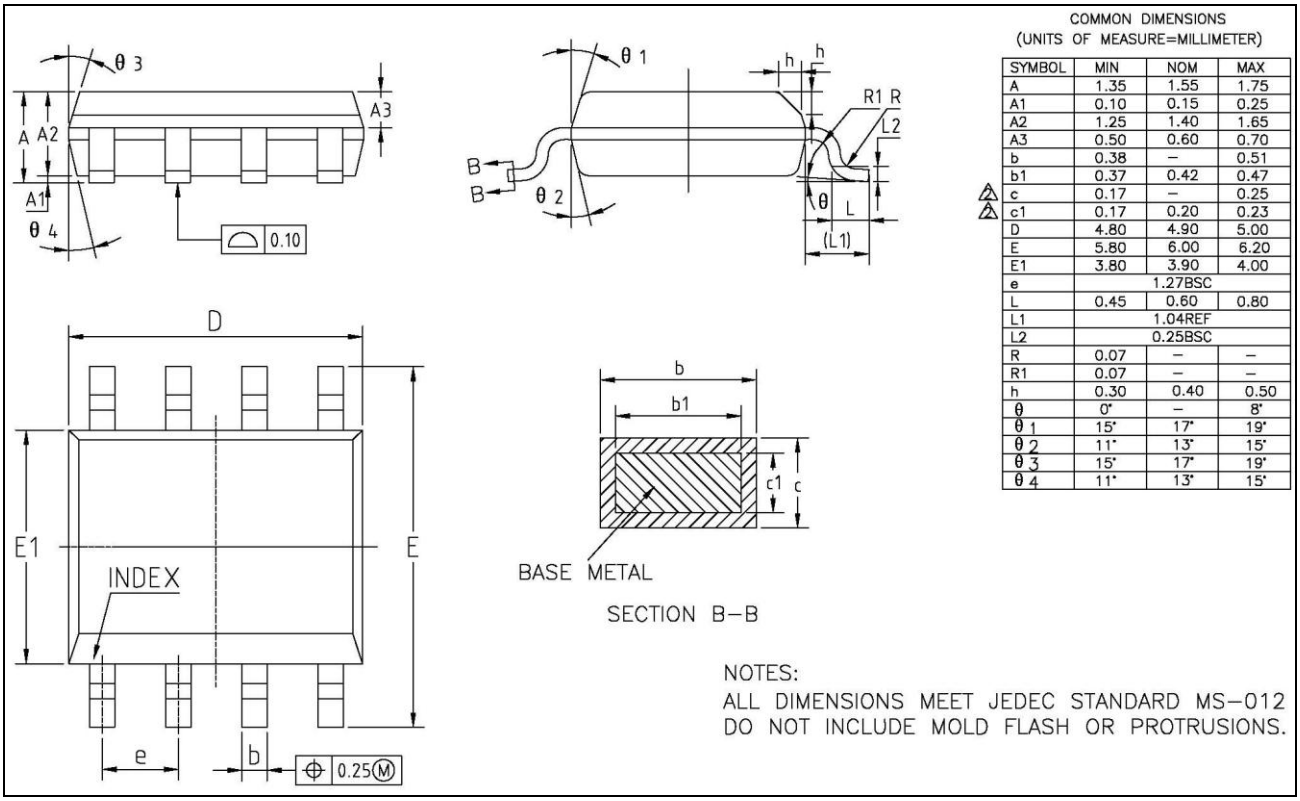



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | – | – | 4.80 |
| A1 | 0.50 | – | – |
| A2 | 3.10 | 3.30 | 3.50 |
| A3 | 1.40 | 1.50 | 1.60 |
| b | 0.38 | – | 0.55 |
| b1 | 0.38 | 0.46 | 0.51 |
| b2 | 1.47 | 1.52 | 1.57 |
| b3 | 0.89 | 0.99 | 1.09 |
| c | 0.21 | – | 0.35 |
| c1 | 0.20 | 0.25 | 0.30 |
| D | 9.10 | 9.20 | 9.30 |
| D1 | 0.13 | – | – |
| E | 7.62 | 7.87 | 8.25 |
| E1 | 6.25 | 6.35 | 6.45 |
| e | 2.54BSC | | |
| eA | 7.62BSC | | |
| eB | 7.62 | 8.80 | 10.90 |
| ec | 0 | – | 1.52 |
| L | 2.92 | 3.30 | 3.81 |

NOTES:
ALL DIMENSIONS MEET JEDEC STANDARD MS-001
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

### 8SOP




COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 1.35 | 1.55 | 1.75 |
| A1 | 0.10 | 0.15 | 0.25 |
| A2 | 1.25 | 1.40 | 1.65 |
| A3 | 0.50 | 0.60 | 0.70 |
| b | 0.38 | – | 0.51 |
| b1 | 0.37 | 0.42 | 0.47 |
| c | 0.17 | – | 0.25 |
| c1 | 0.17 | 0.20 | 0.23 |
| D | 4.80 | 4.90 | 5.00 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.80 | 3.90 | 4.00 |
| e | 1.27BSC | | |
| L | 0.45 | 0.60 | 0.80 |
| L1 | 1.04REF | | |
| L2 | 0.25BSC | | |
| R | 0.07 | – | – |
| R1 | 0.07 | – | – |
| h | 0.30 | 0.40 | 0.50 |
| θ | 0° | – | 8° |
| θ 1 | 15° | 17° | 19° |
| θ 2 | 11° | 13° | 15° |
| θ 3 | 15° | 17° | 19° |
| θ 4 | 11° | 13° | 15° |

NOTES:
ALL DIMENSIONS MEET JEDEC STANDARD MS-012
DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

## 11. Revision History

| Rev. No. | Description | Paragraph and chapter modified |
|---|---|---|
| 0.0 | The First Edition. | - |
| 0.1 | Addition of 8_SOP, 8_DIP | 1page, 10page |