# 40V Low Power Dual and Quad Operational Amplifier

## ISL28325, ISL28345

The ISL28325 and ISL28345 are dual and quad general purpose amplifiers featuring low noise vs power consumption. The combination of low noise and small footprint provides the user with outstanding value and flexibility relative to similar competitive parts.

Applications for this amplifier include active filters, medical and analytical instrumentation, power supply controls, and industrial controls.

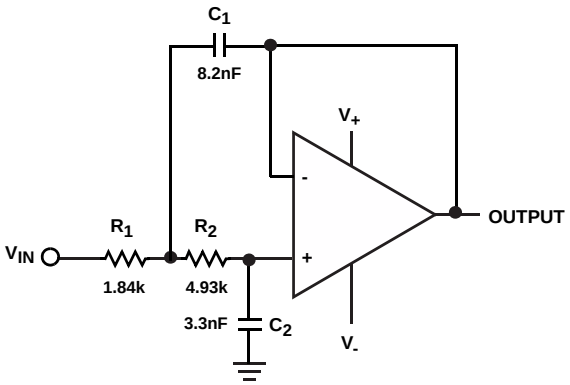
The ISL28325 is offered in 8 Ld SOIC and MSOP packages and the ISL28345 is offered in the 14 Ld SOIC package and operates over the -40°C to +125°C temperature range.

## Features

- Input Offset Voltage . . . . . 1mV, Max.
- Input Bias Current . . . . . ±5nA, Max.
- Low Current Consumption. . . . . 500µA
- Voltage Noise . . . . . 9nV/Hz
- Wide Supply Range . . . . . 4.5V to 40V
- Operating Temperature Range. . . . . -40°C to +125°C
- Pb-Free (RoHS Compliant)

## Applications

- Analytical Instrumentation
- Medical Instrumentation
- Spectral Analysis Equipment
- Active Filter Blocks
- Thermocouples and RTD Reference Buffers
- Data Acquisition
- Power Supply Control




SALLEN-KEY LOW PASS FILTER (10kHz)

**FIGURE 1. TYPICAL APPLICATION**



CAUTION: These devices are sensitive to electrostatic discharge; follow proper IC Handling Procedures.
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# Ordering Information

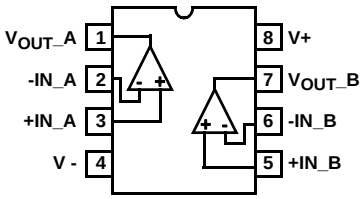
| PART NUMBER (Notes 1, 2, 3) | PART MARKING | TEMP RANGE (°C) | PACKAGE (Pb-Free) | PKG. DWG. # |
|---|---|---|---|---|
| ISL28325FBZ | 28325 FBZ | -40 to +125 | 8 Ld SOIC | M8.15E |
| ISL28325FUZ | 8325Z | -40 to +125 | 8 Ld MSOP | M8.118B |
| ISL28345FBZ | 28345 FBZ | -40 to +125 | 14 Ld SOIC | MDP0027 |

NOTES:

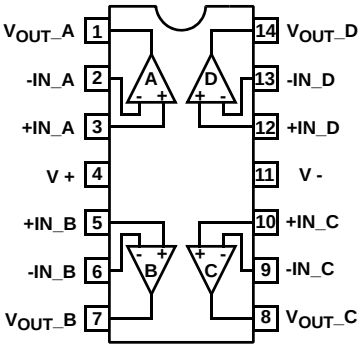
1. Add "-T*" suffix for tape and reel. Please refer to TB347 for details on reel specifications.
2. These Intersil Pb-free plastic packaged products employ special Pb-free material sets, molding compounds/die attach materials, and 100% matte tin plate plus anneal (e3 termination finish, which is RoHS compliant and compatible with both SnPb and Pb-free soldering operations). Intersil Pb-free products are MSL classified at Pb-free peak reflow temperatures that meet or exceed the Pb-free requirements of IPC/JEDEC J STD-020.
3. For Moisture Sensitivity Level (MSL), please see device information page for ISL28325, ISL28345. For more information on MSL please see techbrief TB363.

# Pin Configurations

ISL28325
(8 LD SOIC, MSOP)
TOP VIEW

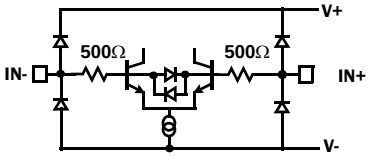



ISL28345
(14 LD SOIC)
TOP VIEW

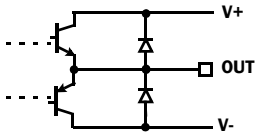


# Pin Descriptions

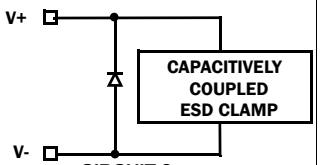
| ISL28325 (8 LD SOIC, MSOP) | ISL28345 (14 LD SOIC) | PIN NAME | EQUIVALENT CIRCUIT | DESCRIPTION |
|---|---|---|---|---|
| 3 | 3 | +IN_A | Circuit 1 | Amplifier non-inverting input |
| 5 | 5 | +IN_B | | |
| - | 10 | +IN_C | | |
| - | 12 | +IN_D | | |
| 4 | 11 | V- | Circuit 3 | Negative power supply |
| 2 | 2 | -IN_A | Circuit 1 | Amplifier inverting input |
| 6 | 6 | -IN_B | | |
| - | 9 | -IN_C | | |
| - | 13 | -IN_D | | |
| 8 | 4 | V+ | Circuit 3 | Positive power supply |
| 1 | 1 | $V_{OUT}$_A | Circuit 2 | Amplifier output |
| 7 | 7 | $V_{OUT}$_B | | |
| - | 8 | $V_{OUT}$_C | | |
| - | 14 | $V_{OUT}$_D | | |



CIRCUIT 1



CIRCUIT 2



CIRCUIT 3

## Absolute Maximum Ratings

Maximum Supply Voltage ..... ...42V
Maximum Differential Input Current ..... 20mA
Maximum Differential Input Voltage ..... 42V
Min/Max Input Voltage ..... V- - 0.5V to V+ + 0.5V
Max/Min Input current for Input Voltage >V+ or <V- ..... ±20mA
Output Short-Circuit Duration (1 output at a time). ..... Indefinite
ESD Rating
Human Body Model ..... 5kV
Machine Model ..... 300V
Charged Device Model ..... 2kV

## Thermal Information

| Thermal Resistance (Typical Notes 4, 5) | $\theta_{JA}$ (°C/W) | $\theta_{JC}$ (°C/W) |
|---|---|---|
| 8 Ld SOIC | 125 | 65 |
| 8 Ld MSOP | 160 | 55 |
| 14 Ld SOIC | 73 | 45 |

Maximum Storage Temperature Range ..... -65°C to +150°C
Maximum Junction Temperature ($T_{JMAX}$) ..... +150°C
Pb-Free Reflow Profile ..... see link below
http://www.intersil.com/pbfree/Pb-FreeReflow.asp

## Recommended Operating Conditions

Ambient Temperature Range ($T_A$) ..... -40°C to +125°C

*CAUTION: Do not operate at or near the maximum ratings listed for extended periods of time. Exposure to such conditions may adversely impact product reliability and result in failures not covered by warranty.*

NOTES:

4. $\theta_{JA}$ is measured with the component mounted on a high effective thermal conductivity test board in free air. See Tech Brief TB379 for details.
5. For $\theta_{JC}$, the "case temp" location is taken at the package top center.

## Electrical Specifications

$V_S$ ± 5V and $V_S$ ± 15V, $V_{CM}$ = 0, $V_O$ = 0V, $T_A$ = +25°C, unless otherwise noted. **Boldface limits apply over the operating temperature range, -40°C to +125°C.**

| PARAMETER | DESCRIPTION | CONDITIONS | MIN (Note 6) | TYP | MAX (Note 6) | UNIT |
|---|---|---|---|---|---|---|
| $V_{OS}$ | Input Offset Voltage | | -1 | 0.1 | 1 | mV |
| $TCV_{OS}$ | Input $V_{OS}$ Temperature Coefficient | | | 4 | **15** | µV/C |
| $I_B$ | Input Bias Current | | -5 | 0.2 | 5 | nA |
| $I_{OS}$ | Input Offset Current | | -5 | 0.2 | 5 | nA |
| $V_{CM}$ | Input Voltage Range | | -13 | | 13 | V |
| CMRR | Common-Mode Rejection Ratio | $V_{CM}$ = -13V to +13V | 80 | 100 | | dB |
| PSRR | Power Supply Rejection Ratio | $V_S$ = ±2.25V to ±20V | 80 | 100 | | dB |
| $A_{VOL}$ | Open-Loop Gain | $V_O$ = -13V to +13V, $R_L$ = 10kΩ to ground | 100 | 110 | | dB |
| $V_{OH}$ | Output Voltage High | $R_L$ = 10kΩ to ground | 13.0 | 13.5 | | V |
| $V_{OL}$ | Output Voltage Low | $R_L$ = 10kΩ to ground | | -13.7 | -13.5 | V |
| $I_S$ | Supply Current/Amplifier | | | 0.5 | 0.7 | mA |
| | | | | | **0.9** | mA |
| $I_{SC}$ | Short-Circuit | | | 40 | | mA |
| $V_{SUPPLY}$ | Supply Voltage Range | | **± 2.25** | | **± 20** | V |
| **AC SPECIFICATIONS** | | | | | | |
| GBWP | Gain Bandwidth Product | $A_V$ = 1k, $R_L$ = 2kΩ | | 1.2 | | MHz |
| SR | Slew Rate, $V_{OUT}$ 20% to 80% | $A_V$ = 11, $R_L$ = 2kΩ, $V_O$ = $4V_{P-P}$ | | 0.4 | | V/µs |
| $e_{nVp-p}$ | Voltage Noise $V_{P-P}$ | 0.1Hz to 10Hz | | 0.4 | | $µV_{P-P}$ |
| $e_n$ | Voltage Noise Density | f = 1kHz | | 9 | | nV/√Hz |
| in | Current Noise Density | f = 1kHz | | 0.1 | | pA/√Hz |

NOTE:

6. Compliance to datasheet limits is assured by one or more methods: production test, characterization and/or design.

## Typical Performance Curves

$V_S$ = ±15V, $V_{CM}$ = 0V, $R_L$ = Open, unless otherwise specified.

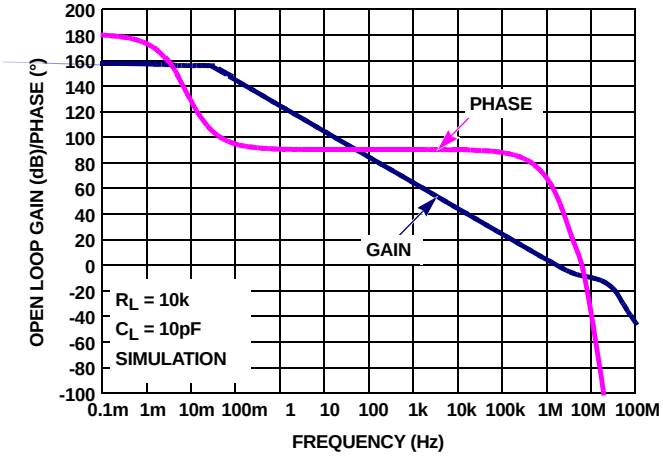



FIGURE 2. OPEN-LOOP GAIN, PHASE vs FREQUENCY, $R_L$ = 10kΩ, $C_L$ = 10pF

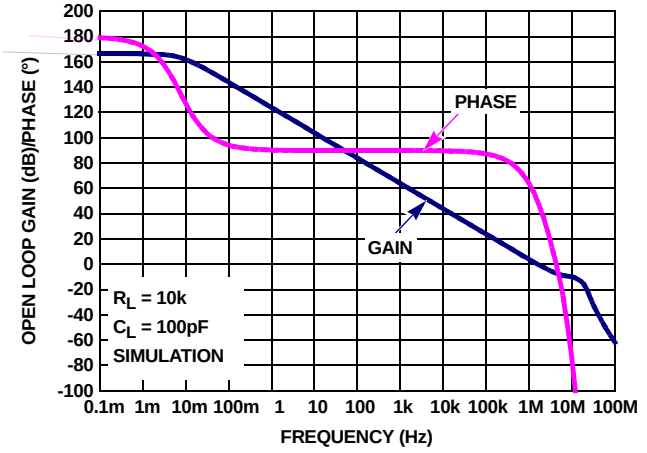



FIGURE 3. OPEN-LOOP GAIN, PHASE vs FREQUENCY, $R_L$ = 10kΩ, $C_L$ = 100pF

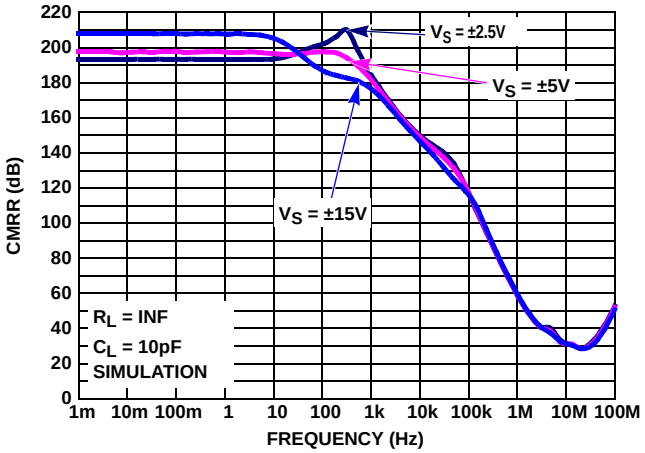



FIGURE 4. CMRR vs FREQUENCY, $V_S$ = ±2.25, ±5V, ±15V

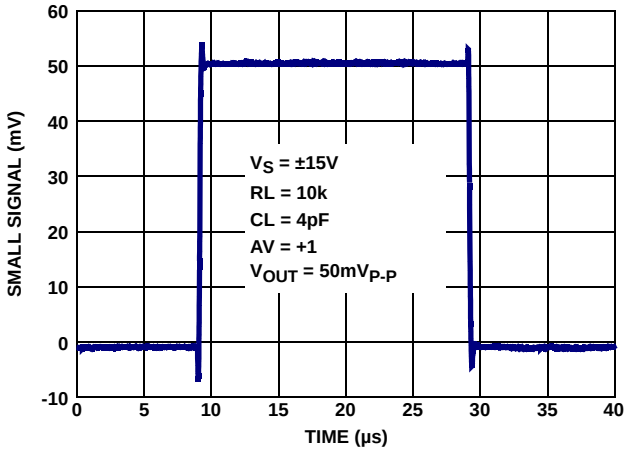



FIGURE 5. SMALL SIGNAL TRANSIENT RESPONSE, $V_S$ = ±5V, ±15V

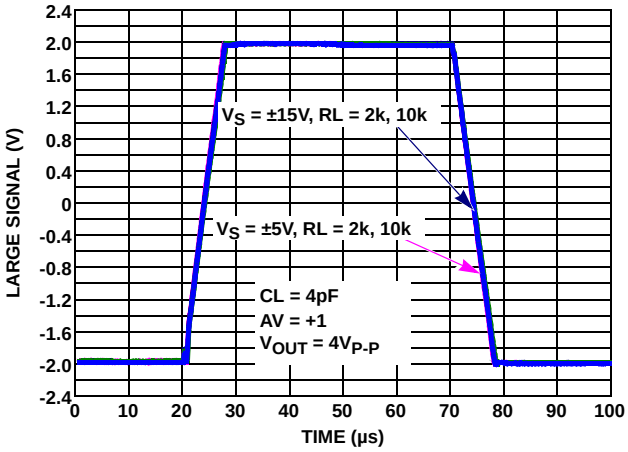



FIGURE 6. LARGE SIGNAL TRANSIENT RESPONSE vs $R_L$ $V_S$ = ±5V, ±15V

# Applications Information

## Functional Description

The ISL28325 and ISL28345 are dual and quad general purpose amplifiers featuring low noise vs power consumption. They are offered in industry standard pinouts in 8 Ld SOIC, 8 Ld MSOP and 14 Ld SOIC packages. Applications for this amplifier include active filters, medical and analytical instrumentation, power supply controls, and industrial controls..

## Operating Voltage Range

The devices are designed to operate over the 4.5V (±2.25V) to 40V (±20V) range over the -40°C to +125°C temperature range. For best amplifier performance, decouple the power supply with a 0.01µF or larger capacitors by placing them close to the supply pins of the amplifier.

## Input ESD Diode Protection

The input terminals (IN+ and IN-) have internal ESD protection diodes to the positive and negative supply rails, series connected 500Ω current limiting resistors and an anti-parallel diode pair across the inputs.

The series resistors limit the high feed-through currents that can occur in pulse applications when the input dV/dT exceeds the 0.4V/µs slew rate of the amplifier. Without the series resistors, the input can forward-bias the anti-parallel diodes causing current to flow to the output resulting in severe distortion and possible diode failure.

In applications where one or both amplifier input terminals are at risk of exposure to high voltages beyond the power supply rails, current limiting resistors may be needed at the input terminal to limit the current through the power supply ESD diodes to 20mA max.

# Revision History

The revision history provided is for informational purposes only and is believed to be accurate, but not warranted. Please go to web to make sure you have the latest revision.

| DATE | REVISION | CHANGE |
|---|---|---|
| 09/27/2011 | FN7854.0 | Initial Release |

# Products

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For a complete listing of Applications, Related Documentation and Related Parts, please see the respective device information page on intersil.com: ISL28325, ISL28345

To report errors or suggestions for this datasheet, please go to: www.intersil.com/askourstaff

FITs are available from our website at: http://rel.intersil.com/reports/search.php

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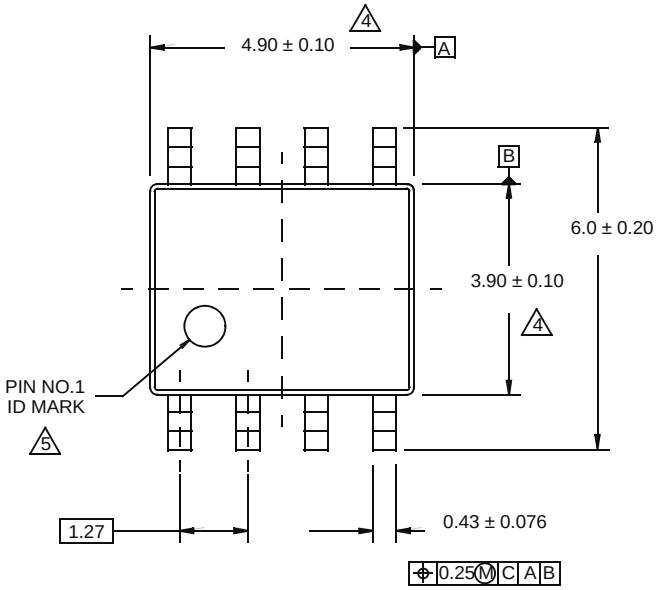
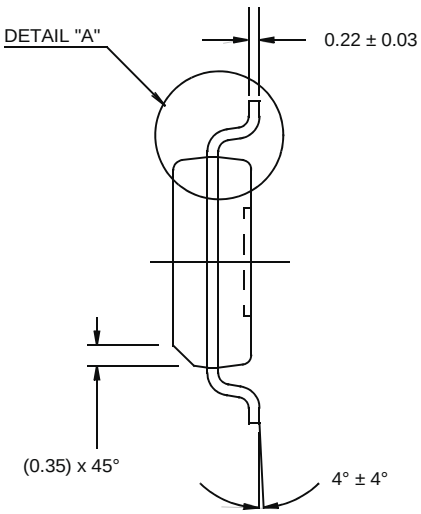
# Package Outline Drawing

## M8.15E

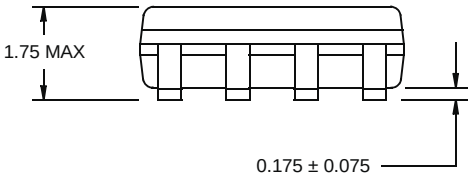
**8 LEAD NARROW BODY SMALL OUTLINE PLASTIC PACKAGE**
**Rev 0, 08/09**



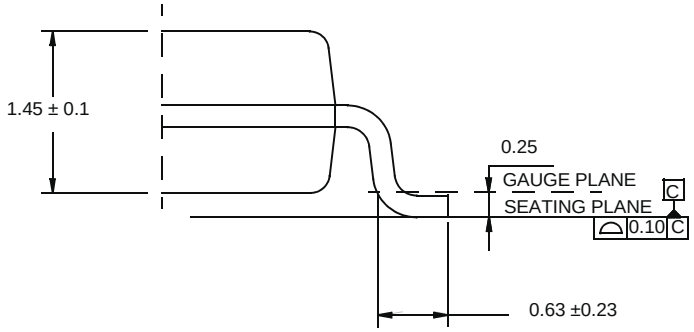

TOP VIEW



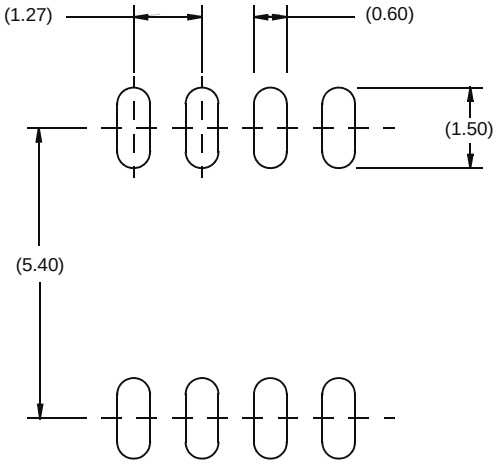

SIDE VIEW “B”




SIDE VIEW “A”




DETAIL "A"




TYPICAL RECOMMENDED LAND PATTERN

NOTES:

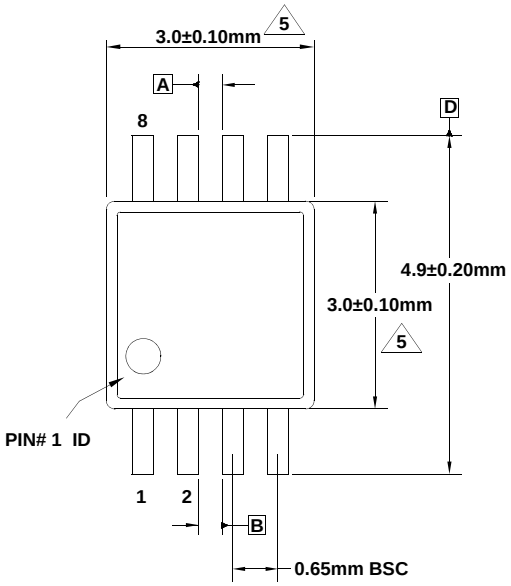
1. Dimensions are in millimeters.
   Dimensions in ( ) for Reference Only.
2. Dimensioning and tolerancing conform to AMSE Y14.5m-1994.
3. Unless otherwise specified, tolerance : Decimal ± 0.05
4. Dimension does not include interlead flash or protrusions.
   Interlead flash or protrusions shall not exceed 0.25mm per side.
5. The pin #1 identifier may be either a mold or mark feature.
6. Reference to JEDEC MS-012.

# Package Outline Drawing

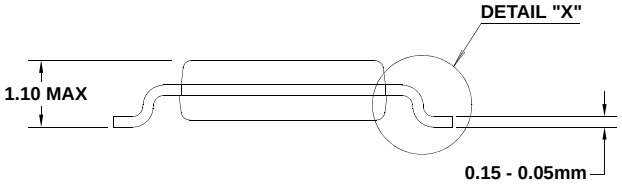
## M8.118B

**8 LEAD MINI SMALL OUTLINE PLASTIC PACKAGE**

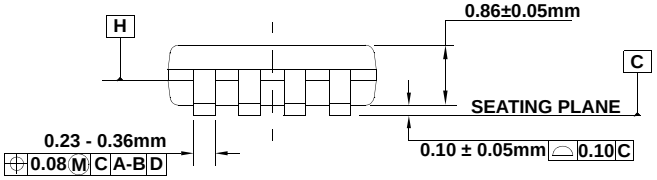
**Rev 0, 7/11**



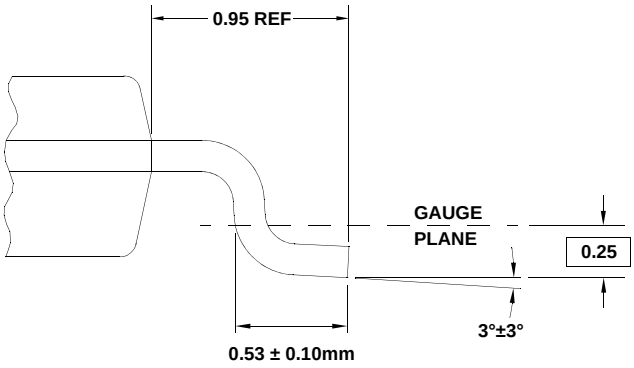

TOP VIEW



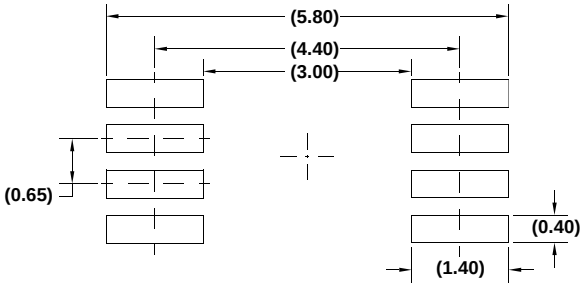

SIDE VIEW 2




SIDE VIEW 1




DETAIL "X"

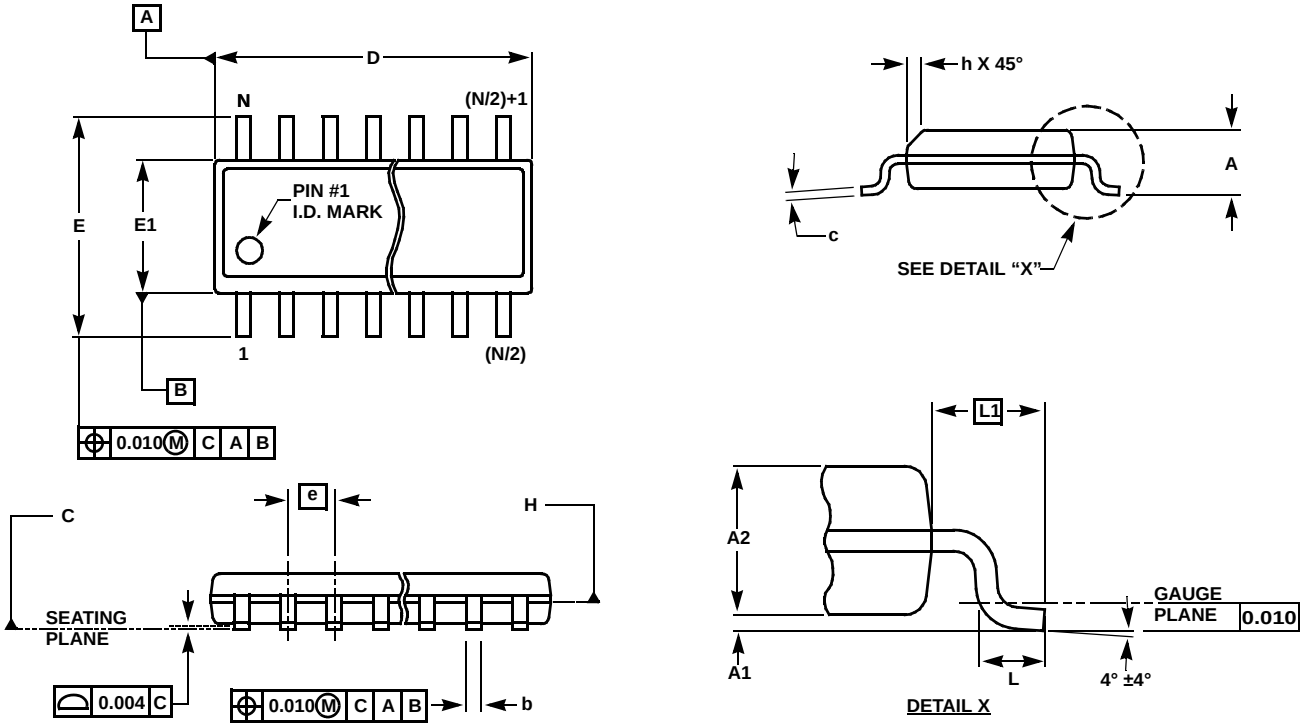



TYPICAL RECOMMENDED LAND PATTERN

**NOTES:**

1. Dimensions are in millimeters.
2. Dimensioning and tolerancing conform to JEDEC MO-187-AA and AMSEY14.5m-1994.
3. Plastic or metal protrusions of 0.15mm max per side are not included.
4. Plastic interlead protrusions of 0.15mm max per side are not included.
5. Dimensions are measured at Datum Plane "H".
6. Dimensions in ( ) are for reference only.

## *Small Outline Package Family (SO)*




## MDP0027

**SMALL OUTLINE PACKAGE FAMILY (SO)**

| SYMBOL | INCHES | | | | | | | TOLERANCE | NOTES |
|---|---|---|---|---|---|---|---|---|---|
| | SO-8 | SO-14 | SO16 (0.150") | SO16 (0.300") (SOL-16) | SO20 (SOL-20) | SO24 (SOL-24) | SO28 (SOL-28) | | |
| A | 0.068 | 0.068 | 0.068 | 0.104 | 0.104 | 0.104 | 0.104 | MAX | - |
| A1 | 0.006 | 0.006 | 0.006 | 0.007 | 0.007 | 0.007 | 0.007 | ±0.003 | - |
| A2 | 0.057 | 0.057 | 0.057 | 0.092 | 0.092 | 0.092 | 0.092 | ±0.002 | - |
| b | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | 0.017 | ±0.003 | - |
| c | 0.009 | 0.009 | 0.009 | 0.011 | 0.011 | 0.011 | 0.011 | ±0.001 | - |
| D | 0.193 | 0.341 | 0.390 | 0.406 | 0.504 | 0.606 | 0.704 | ±0.004 | 1, 3 |
| E | 0.236 | 0.236 | 0.236 | 0.406 | 0.406 | 0.406 | 0.406 | ±0.008 | - |
| E1 | 0.154 | 0.154 | 0.154 | 0.295 | 0.295 | 0.295 | 0.295 | ±0.004 | 2, 3 |
| e | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | Basic | - |
| L | 0.025 | 0.025 | 0.025 | 0.030 | 0.030 | 0.030 | 0.030 | ±0.009 | - |
| L1 | 0.041 | 0.041 | 0.041 | 0.056 | 0.056 | 0.056 | 0.056 | Basic | - |
| h | 0.013 | 0.013 | 0.013 | 0.020 | 0.020 | 0.020 | 0.020 | Reference | - |
| N | 8 | 14 | 16 | 16 | 20 | 24 | 28 | Reference | - |

Rev. M 2/07

NOTES:

1. Plastic or metal protrusions of 0.006" maximum per side are not included.
2. Plastic interlead protrusions of 0.010" maximum per side are not included.
3. Dimensions "D" and "E1" are measured at Datum Plane "H".
4. Dimensioning and tolerancing per ASME Y14.5M-1994