

MC14557B

1-to-64 Bit Variable Length Shift Register

The MC14557B is a static clocked serial shift register whose length may be programmed to be any number of bits between 1 and 64. The number of bits selected is equal to the sum of the subscripts of the enabled Length Control inputs (L1, L2, L4, L8, L16, and L32) plus one. Serial data may be selected from the A or B data inputs with the A/B select input. This feature is useful for recirculation purposes. A Clock Enable (CE) input is provided to allow gating of the clock or negative edge clocking capability.

The device can be effectively used for variable digital delay lines or simply to implement odd length shift registers.

- 1–64 Bit Programmable Length
- Q and \bar{Q} Serial Buffered Outputs
- Asynchronous Master Reset
- All Inputs Buffered
- No Limit On Clock Rise and Fall Times
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving Two Low–power TTL Loads or one Low–power Schottky TTL Load Over the Rated Temperature Range
- These Devices are Pb–Free and are RoHS Compliant

MAXIMUM RATINGS (Voltages Referenced to V_{SS})

| Symbol | Parameter | Value | Unit |
|-------------------|---|------------------------|--------------------|
| V_{DD} | DC Supply Voltage Range | -0.5 to +18.0 | V |
| V_{in}, V_{out} | Input or Output Voltage Range (DC or Transient) | -0.5 to $V_{DD} + 0.5$ | V |
| I_{in}, I_{out} | Input or Output Current (DC or Transient) per Pin | ± 10 | mA |
| P_D | Power Dissipation, per Package (Note 2) | 500 | mW |
| T_A | Ambient Temperature Range | -55 to +125 | $^{\circ}\text{C}$ |
| T_{stg} | Storage Temperature Range | -65 to +150 | $^{\circ}\text{C}$ |
| T_L | Lead Temperature (8–Second Soldering) | 260 | $^{\circ}\text{C}$ |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

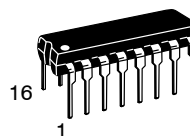
1. V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.
2. Temperature Derating:
Plastic "P and D/DW" Packages: - 7.0 mW/ $^{\circ}\text{C}$ From 65 $^{\circ}\text{C}$ To 125 $^{\circ}\text{C}$



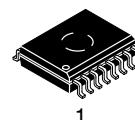
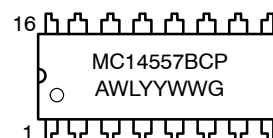
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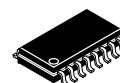
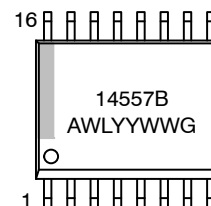
MARKING DIAGRAMS



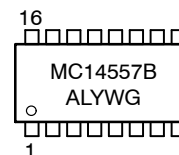
PDIP-16
P SUFFIX
CASE 648



SO-16 WB
DW SUFFIX
CASE 751G



SOEIAJ-16
F SUFFIX
CASE 966



- A = Assembly Location
- WL, L = Wafer Lot
- YY, Y = Year
- WW, W = Work Week
- G = Pb–Free Package

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

MC14557B

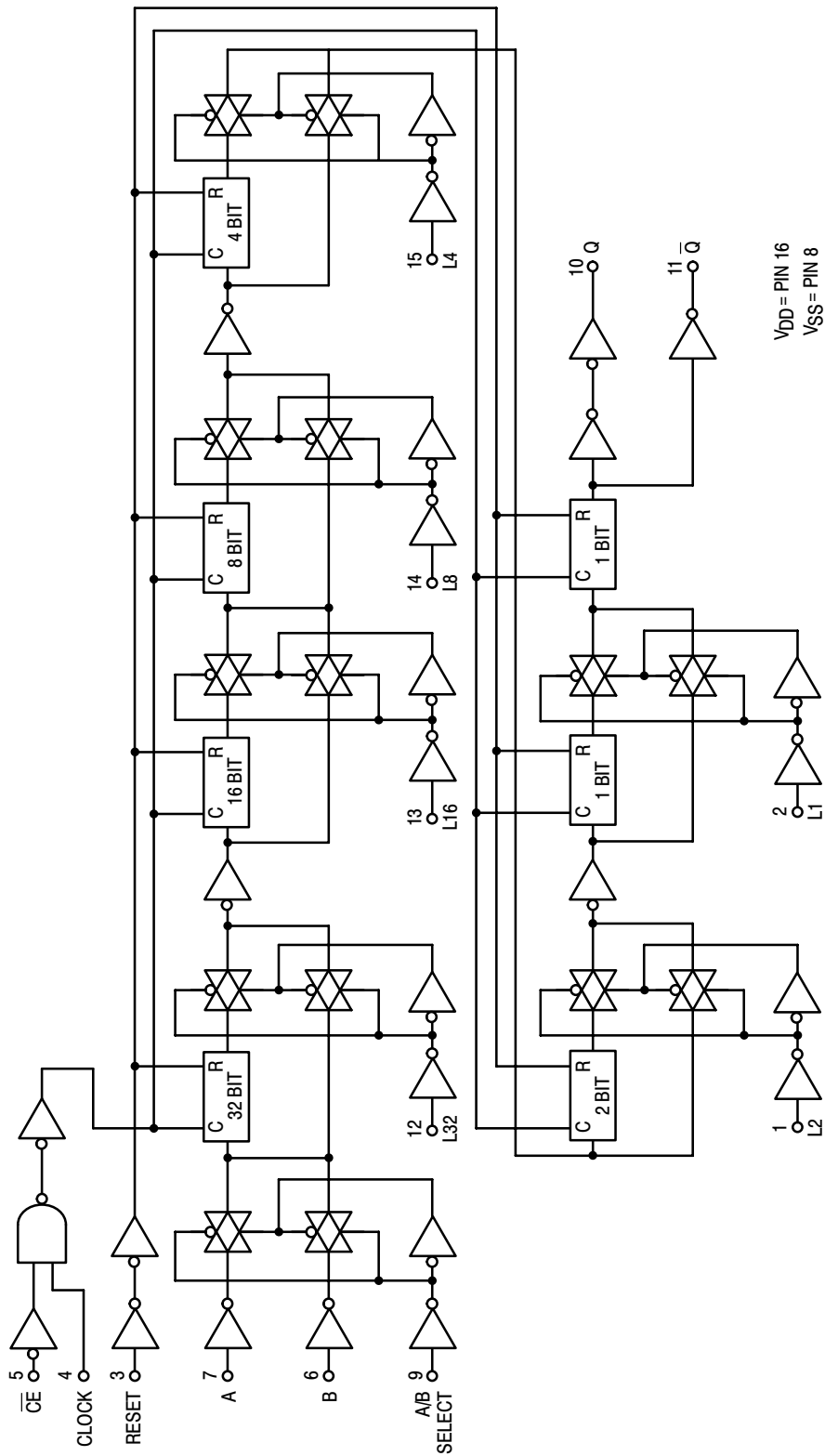


Figure 1. Logic Diagram

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ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

| Symbol | Characteristic | V _{DD} Vdc | - 55°C | | 25°C | | | 125°C | | Unit | |
|-----------------|---|------------------------|--|-------|------|-----------------|-------|-------|-------|------|------|
| | | | Min | Max | Min | Typ (Note 3) | Max | Min | Max | | |
| V _{OL} | Output Voltage V _{in} = V _{DD} or 0 | "0" Level | 5.0 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | Vdc |
| | | | 10 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| | | | 15 | - | 0.05 | - | 0 | 0.05 | - | 0.05 | |
| V _{OH} | V _{in} = 0 or V _{DD} | "1" Level | 5.0 | 4.95 | - | 4.95 | 5.0 | - | 4.95 | - | Vdc |
| | | | 10 | 9.95 | - | 9.95 | 10 | - | 9.95 | - | |
| | | | 15 | 14.95 | - | 14.95 | 15 | - | 14.95 | - | |
| V _{IL} | Input Voltage (V _O = 4.5 or 0.5 Vdc) (V _O = 9.0 or 1.0 Vdc) (V _O = 13.5 or 1.5 Vdc) | "0" Level | 5.0 | - | 1.5 | - | 2.25 | 1.5 | - | 1.5 | Vdc |
| | | | 10 | - | 3.0 | - | 4.50 | 3.0 | - | 3.0 | |
| | | | 15 | - | 4.0 | - | 6.75 | 4.0 | - | 4.0 | |
| V _{IH} | (V _O = 0.5 or 4.5 Vdc) (V _O = 1.0 or 9.0 Vdc) (V _O = 1.5 or 13.5 Vdc) | "1" Level | 5.0 | 3.5 | - | 3.5 | 2.75 | - | 3.5 | - | Vdc |
| | | | 10 | 7.0 | - | 7.0 | 5.50 | - | 7.0 | - | |
| | | | 15 | 11 | - | 11 | 8.25 | - | 11 | - | |
| I _{OH} | Output Drive Current (V _{OH} = 2.5 Vdc) (V _{OH} = 4.6 Vdc) (V _{OH} = 9.5 Vdc) (V _{OH} = 13.5 Vdc) | Source | 5.0 | -3.0 | - | -2.4 | -4.2 | - | -1.7 | - | mAdc |
| | | | 5.0 | -0.64 | - | -0.51 | -0.88 | - | -0.36 | - | |
| | | | 10 | -1.6 | - | -1.3 | -2.25 | - | -0.9 | - | |
| | | | 15 | -4.2 | - | -3.4 | -8.8 | - | -2.4 | - | |
| I _{OL} | (V _{OL} = 0.4 Vdc) (V _{OL} = 0.5 Vdc) (V _{OL} = 1.5 Vdc) | Sink | 5.0 | 0.64 | - | 0.51 | 0.88 | - | 0.36 | - | mAdc |
| | | | 10 | 1.6 | - | 1.3 | 2.25 | - | 0.9 | - | |
| | | | 15 | 4.2 | - | 3.4 | 8.8 | - | 2.4 | - | |
| I _{in} | Input Current | 15 | - | ±0.1 | - | ±0.00001 | ±0.1 | - | ±1.0 | μAdc | |
| C _{in} | Input Capacitance (V _{in} = 0) | - | - | - | - | 5.0 | 7.5 | - | - | pF | |
| I _{DD} | Quiescent Current (Per Package) | 5.0 | - | 5.0 | - | 0.010 | 5.0 | - | 150 | μAdc | |
| | | 10 | - | 10 | - | 0.020 | 10 | - | 300 | | |
| | | 15 | - | 20 | - | 0.030 | 20 | - | 600 | | |
| I _T | Total Supply Current (Notes 4, 5) (Dynamic plus Quiescent, Per Package) (C _L = 50 pF on all outputs, all buffers switching) | 5.0 | I _T = (1.75 μA/kHz) f + I _{DD} | | | | | | | μAdc | |
| 10 | I _T = (3.50 μA/kHz) f + I _{DD} | | | | | | | | | | |
| 15 | I _T = (5.25 μA/kHz) f + I _{DD} | | | | | | | | | | |

3. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

4. The formulas given are for the typical characteristics only at 25°C.

5. To calculate total supply current at loads other than 50 pF: I_T(C_L) = I_T(50 pF) + (C_L - 50) Vfk where: I_T is in μA (per package), C_L in pF, V = (V_{DD} - V_{SS}) in volts, f in kHz is input frequency, and k = 0.001.

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SWITCHING CHARACTERISTICS (Note 6) ($C_L = 50$ pF, $T_A = 25^\circ\text{C}$)

| Symbol | Characteristic | V_{DD} | Min | Typ (Note 7) | Max | Unit |
|--------------------------|--|------------------------------------|---|--|--------------------------------|---------------|
| t_{TLH} , t_{THL} | Rise and Fall Time, Q or \bar{Q} Output $t_{TLH}, t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$ $t_{TLH}, t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$ $t_{TLH}, t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$ | 5 10 15 | – – – | 100 50 40 | 200 100 80 | ns |
| t_{PLH} , t_{PHL} | Propagation Delay, Clock or \bar{CE} to Q or \bar{Q} $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 215 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 97 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 65 \text{ ns}$ | 5 10 15 | – – – | 300 130 90 | 600 260 180 | ns |
| t_{PLH} , t_{PHL} | Propagation Delay, Reset to Q or \bar{Q} $t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 215 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 97 \text{ ns}$ $t_{PLH}, t_{PHL} = (0.5 \text{ ns/pF}) C_L + 70 \text{ ns}$ | 5 10 15 | – – – | 300 130 95 | 600 260 190 | ns |
| $t_{WH(cl)}$ | Pulse Width, Clock | 5 10 15 | 200 100 75 | 95 45 35 | – – – | ns |
| $t_{WH(rst)}$ | Pulse Width, Reset | 5 10 15 | 300 140 100 | 150 70 50 | – – – | ns |
| f_{cl} | Clock Frequency (50% Duty Cycle) | 5 10 15 | – – – | 3.0 7.5 13.0 | 1.7 5.0 6.7 | MHz |
| t_{su} | Setup Time, A or B to Clock or \bar{CE} Worst case condition: $L1 = L2 = L4 = L8 = L16 = L32 = V_{SS}$ (Register Length = 1) Best case condition: $L32 = V_{DD}$, L1 through L16 = Don't Care (Any register length from 33 to 64) | 5 10 15 5 10 15 | 700 290 145 400 165 60 | 350 130 85 45 5 0 | – – – – – – | ns |
| t_h | Hold Time, Clock or \bar{CE} to A or B Best case condition: $L1 = L2 = L4 = L8 = L16 = L32 = V_{SS}$ (Register Length = 1) Worst case condition: $L32 = V_{DD}$, L1 through L16 = Don't Care (Any register length from 33 to 64) | 5 10 15 5 10 15 | 200 100 10 400 185 85 | –150 –60 –50 50 25 22 | – – – – – – | ns |
| t_r , t_f | Rise and Fall Time, Clock | 5 10 15 | No Limit | | | – |
| t_r , t_f | Rise and Fall Time, Reset or \bar{CE} | 5 10 15 | – – – | – – – | 15 5 4 | μs |
| t_{rem} | Removal Time, Reset to Clock or \bar{CE} | 5 10 15 | 160 80 70 | 80 40 35 | – – – | ns |

6. The formulas given are for the typical characteristics only at 25°C .

7. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

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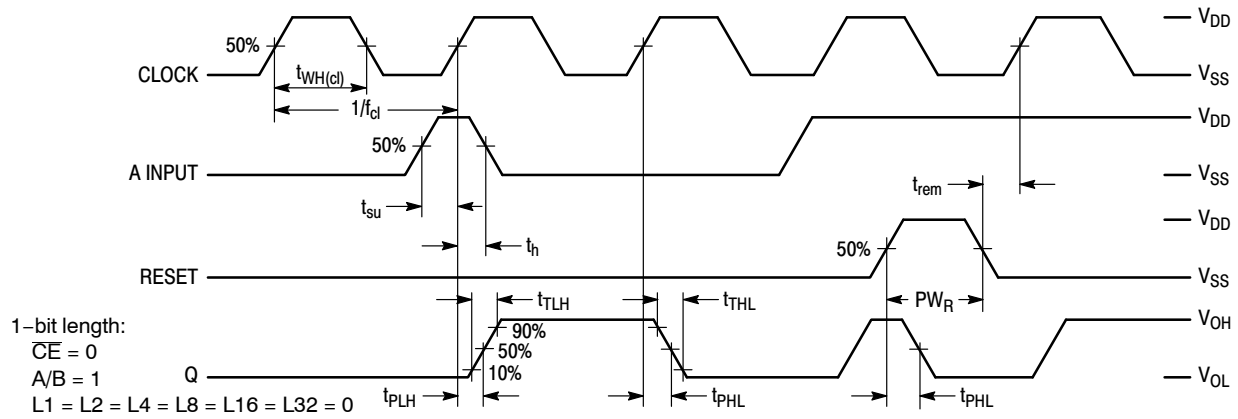


Figure 4. Timing Diagram

ORDERING INFORMATION

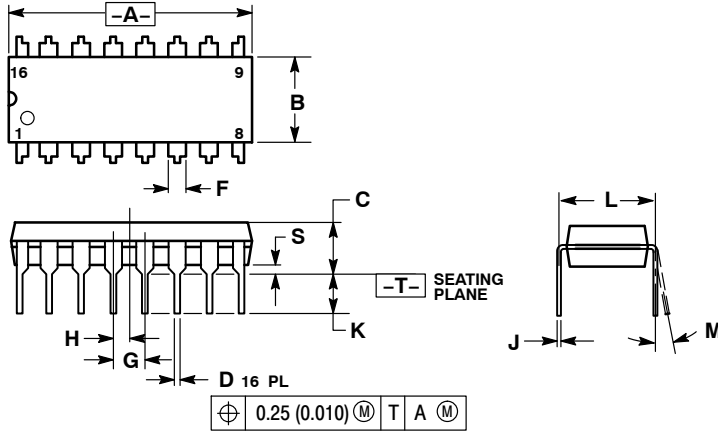
| Device | Package | Shipping† |
|---------------|------------------------|--------------------|
| MC14557BFELG | SOEIAJ-16 (Pb-Free) | 2000 / Tape & Reel |
| MC14557BDWR2G | SO-16 (WB) | 1000 / Tape & Reel |
| MC14557BCPG | PDIP-16 (Pb-Free) | 500 Units / Rail |
| MC14557BDWG | SO-16 (WB) | 47 Units / Rail |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MC14557B

PACKAGE DIMENSIONS

PDIP-16
P SUFFIX
CASE 648-08
ISSUE T

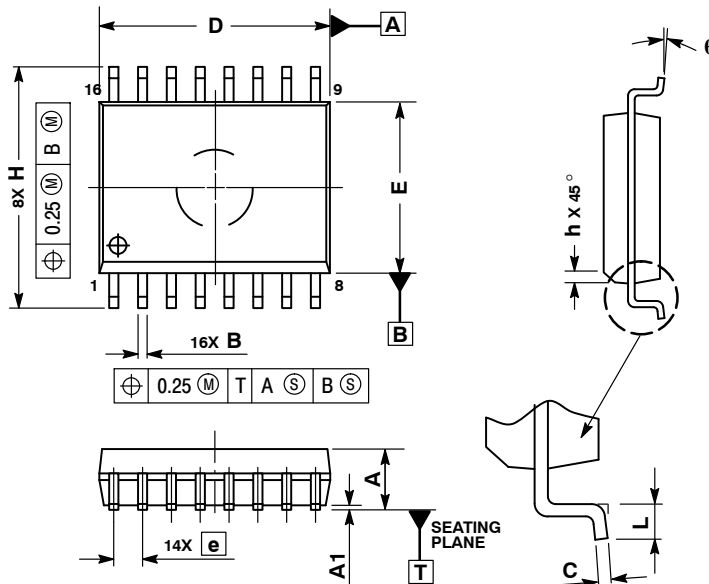


NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.740 | 0.770 | 18.80 | 19.55 |
| B | 0.250 | 0.270 | 6.35 | 6.85 |
| C | 0.145 | 0.175 | 3.69 | 4.44 |
| D | 0.015 | 0.021 | 0.39 | 0.53 |
| F | 0.040 | 0.70 | 1.02 | 1.77 |
| G | 0.100 BSC | | 2.54 BSC | |
| H | 0.050 BSC | | 1.27 BSC | |
| J | 0.008 | 0.015 | 0.21 | 0.38 |
| K | 0.110 | 0.130 | 2.80 | 3.30 |
| L | 0.295 | 0.305 | 7.50 | 7.74 |
| M | 0° | | 10° | |
| S | 0.020 | 0.040 | 0.51 | 1.01 |

SO-16 WB
DW SUFFIX
CASE 751G-03
ISSUE C



NOTES:

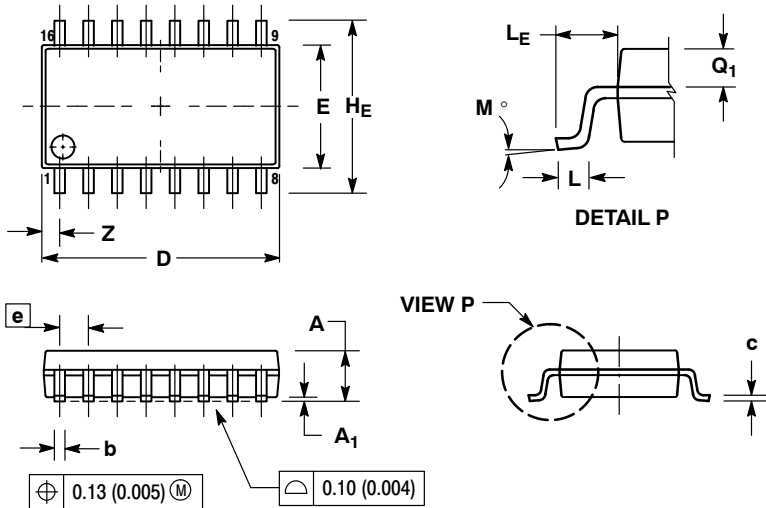
1. DIMENSIONS ARE IN MILLIMETERS.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS | |
|-----|-------------|-------|
| | MIN | MAX |
| A | 2.35 | 2.65 |
| A1 | 0.10 | 0.25 |
| B | 0.35 | 0.49 |
| C | 0.23 | 0.32 |
| D | 10.15 | 10.45 |
| E | 7.40 | 7.60 |
| e | 1.27 BSC | |
| H | 10.05 | 10.55 |
| h | 0.25 | 0.75 |
| L | 0.50 | 0.90 |
| q | 0° | |
| | 7° | |

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PACKAGE DIMENSIONS

SOEIAJ-16
CASE 966-01
ISSUE A



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM | MILLIMETERS | | INCHES | |
|----------------|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | --- | 2.05 | --- | 0.081 |
| A ₁ | 0.05 | 0.20 | 0.002 | 0.008 |
| b | 0.35 | 0.50 | 0.014 | 0.020 |
| c | 0.10 | 0.20 | 0.007 | 0.011 |
| D | 9.90 | 10.50 | 0.390 | 0.413 |
| E | 5.10 | 5.45 | 0.201 | 0.215 |
| e | 1.27 BSC | | 0.050 BSC | |
| HE | 7.40 | 8.20 | 0.291 | 0.323 |
| L | 0.50 | 0.85 | 0.020 | 0.033 |
| LE | 1.10 | 1.50 | 0.043 | 0.059 |
| M | 0° | 10° | 0° | 10° |
| Q ₁ | 0.70 | 0.90 | 0.028 | 0.035 |
| Z | --- | 0.78 | --- | 0.031 |

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