MOTOROLA

# SN75175

# Quad EIA-485 Line Receiver

The Motorola SN75175 is a monolithic quad differential line receiver with three–state outputs. It is designed specifically to meet the requirements of EIA–485, EIA–422A/23A Standards and CCITT recommendations.

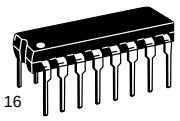
The device is optimized for balanced multipoint bus transmission at rates up to 10 megabits per second. It also features high input impedance, input hysteresis for increased noise immunity, and input sensitivity of ±200 mV over a common mode input voltage range of –12 V to 12 V. The SN75175 is designed for optimum performance when used with the SN75172 or SN75174 quad differential line drivers.

- Meets EIA Standards EIA–422A and EIA–423A, EIA–485
- Meets CCITT Recommendations V.10, V.11, X.26, and X.27
- Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments
- 3–State Outputs
- Common–Mode Input Voltage Range . . . –12 V to 12 V
- Input Sensitivity . . . ±200 mV
- Input Hysteresis . . . 50 mV Typ
- High Input Impedance . . . 1 EIA–485 Unit Load
- Operates from Single 5.0 V Supply
- Lower Power Requirements
- Plug–In Replacement for MC3486

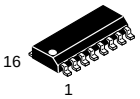
This device contains 174 active transistors.

**QUAD EIA–485 LINE RECEIVER WITH THREE–STATE OUTPUTS**

**SEMICONDUCTOR TECHNICAL DATA**

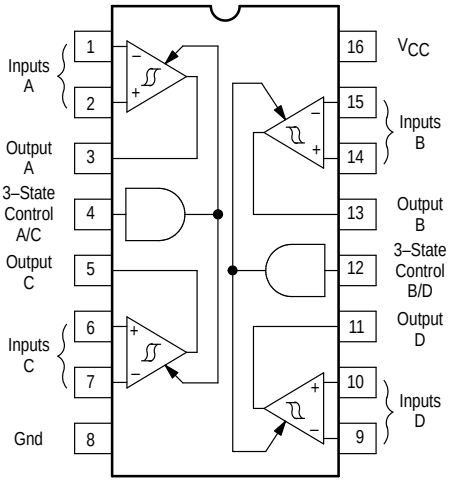



**N SUFFIX**
PLASTIC PACKAGE
CASE 648




**D SUFFIX**
PLASTIC PACKAGE
CASE 751B
(SO–16)

**PIN CONNECTIONS**




(Top View)

**MAXIMUM RATINGS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 7.0 | Vdc |
| Input Common Mode Voltage | $V_{ICM}$ | ±25 | Vdc |
| Input Differential Voltage | $V_{ID}$ | ±25 | Vdc |
| Three–State Control Input Voltage | $V_I$ | 7.0 | Vdc |
| Output Sink Current | $I_O$ | 50 | mA |
| Storage Temperature | $T_{stg}$ | –65 to +150 | °C |
| Operating Junction Temperature | $T_J$ | +150 | °C |

**NOTE:** ESD data available upon request.

**RECOMMENDED OPERATING CONDITIONS**

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Power Supply Voltage | $V_{CC}$ | 4.75 to 5.25 | Vdc |
| Operating Ambient Temperature | $T_A$ | 0 to +70 | °C |
| Input Common Mode Voltage Range | $V_{ICM}$ | –12 to +12 | Vdc |
| Input Differential Voltage Range | $V_{IDR}$ | –12 to +12 | Vdc |

**ORDERING INFORMATION**

| Device | Operating Temperature Range | Package |
|---|---|---|
| SN75175N | $T_A$ = 0 to +70°C | Plastic DIP |
| SN75175D | | SO–16 |

**ELECTRICAL CHARACTERISTICS** (Unless otherwise noted, minimum and maximum limits apply over recommended temperature and power supply voltage ranges. Typical values are for $T_A$ = 25°C, $V_{CC}$ = 5.0 V, and $V_{ICM}$ = 0 V, Note 1.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Differential Input Threshold Voltage (Note 2)<br>(–12 V ≤ $V_{ICM}$ ≤ 12 V, $V_{IH}$ = 2.0 V)<br>($I_O$ = –0.4 mA, $V_{OH}$ ≥ 2.7 V)<br>($I_O$ = 16 mA, $V_{OL}$ ≤ 0.5 V) | $V_{TH(D)}$ | <br><br>–<br>– | <br><br>–<br>– | <br><br>0.2<br>–0.2 | V |
| Input Hysteresis | $V_{T+} - V_{T-}$ | – | 50 | – | mV |
| Input Line Current (Differential Inputs)<br>(Unmeasured Input at 0 V, Note 3)<br>($V_I$ = 12 V)<br>($V_I$ = –7.0 V) | $I_I$ | <br><br>–<br>– | <br><br>–<br>– | <br><br>1.0<br>–0.8 | mA |
| Input Resistance (Note 4) | $r_i$ | 1 Unit Load | – | – | |
| Input Balance and Output Level (Note 3)<br>(–12 V ≤ $V_{ICM}$ ≤ 12 V, $V_{IH}$ = 2.0 V)<br>($I_O$ = –0.4 mA, $V_{ID}$ = 0.2 V)<br>($I_O$ = 8.0 mA, $V_{ID}$ = –0.2 V)<br>($I_O$ = 16 mA, $V_{ID}$ = –0.2 V) | <br><br>$V_{OH}$<br>$V_{OL}$<br>$V_{OL}$ | <br><br>2.7<br>–<br>– | <br><br>–<br>–<br>– | <br><br>–<br>0.45<br>0.5 | V |
| Input Voltage – High Logic State (Three–State Control) | $V_{IH}$ | 2.0 | – | – | V |
| Input Voltage – Low Logic State (Three–State Control) | $V_{IL}$ | – | – | 0.8 | V |
| Input Current – High Logic State (Three–State Control)<br>($V_{IH}$ = 2.7 V)<br>($V_{IH}$ = 5.5 V) | $I_{IH}$ | <br>–<br>– | <br>–<br>– | <br>20<br>100 | µA |
| Input Current – Low Logic State (Three–State Control)<br>($V_{IL}$ = 0.4 V) | $I_{IL}$ | – | – | –100 | µA |
| Input Clamp Diode Voltage (Three–State Control)<br>($I_{IK}$ = –18 mA) | $V_{IK}$ | – | – | –1.5 | V |
| Output Third State Leakage Current<br>($V_{I(D)}$ = 3.0 V, $V_{IL}$ = 0.8 V, $V_O$ = 0.4 V)<br>($V_{I(D)}$ = –3.0 V, $V_{IL}$ = 0.8 V, $V_O$ = 2.4 V) | $I_{OZ}$ | <br>–<br>– | <br>–<br>– | <br>–20<br>20 | µA |
| Output Short–Circuit Current (Note 5)<br>($V_{I(D)}$ = 3.0 V, $V_{IH}$ = 2.0 V, $V_O$ = 0 V) | $I_{OS}$ | –15 | – | –85 | mA |
| Power Supply Current ($V_{IL}$ = 0 V) (All Inputs Grounded) | $I_{CC}$ | – | – | 70 | mA |

**NOTES:** 1. All currents into device pins are shown as positive, out of device pins are negative. All voltages referenced to ground unless otherwise noted.
2. Differential input threshold voltage and guaranteed output levels are done simultaneously for worst case.
3. Refer to EIA–485 for exact conditions. Input balance and guaranteed output levels are done simultaneously for worst case.
4. Input resistance should be derived from input line current specifications and is shown for reference only. See EIA–485 and input line current specifications for more specific input resistance information.
5. Only one output at a time should be shorted.

**SWITCHING CHARACTERISTICS** (Unless otherwise noted, $V_{CC}$ = 5.0 V and $T_A$ = 25°C.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Propagation Delay Time – Differential Inputs to Output<br>Output High to Low<br>Output Low to High | <br>$t_{PHL(D)}$<br>$t_{PLH(D)}$ | <br>–<br>– | <br>25<br>25 | <br>35<br>35 | ns |
| Propagation Delay Time – Three–State Control to Output<br>Output Low to Third State<br>Output High to Third State<br>Output Third State to High<br>Output Third State to Low | <br>$t_{PLZ}$<br>$t_{PHZ}$<br>$t_{PZH}$<br>$t_{PZL}$ | <br>–<br>–<br>–<br>– | <br>16<br>19<br>11<br>11 | <br>35<br>35<br>30<br>30 | ns |

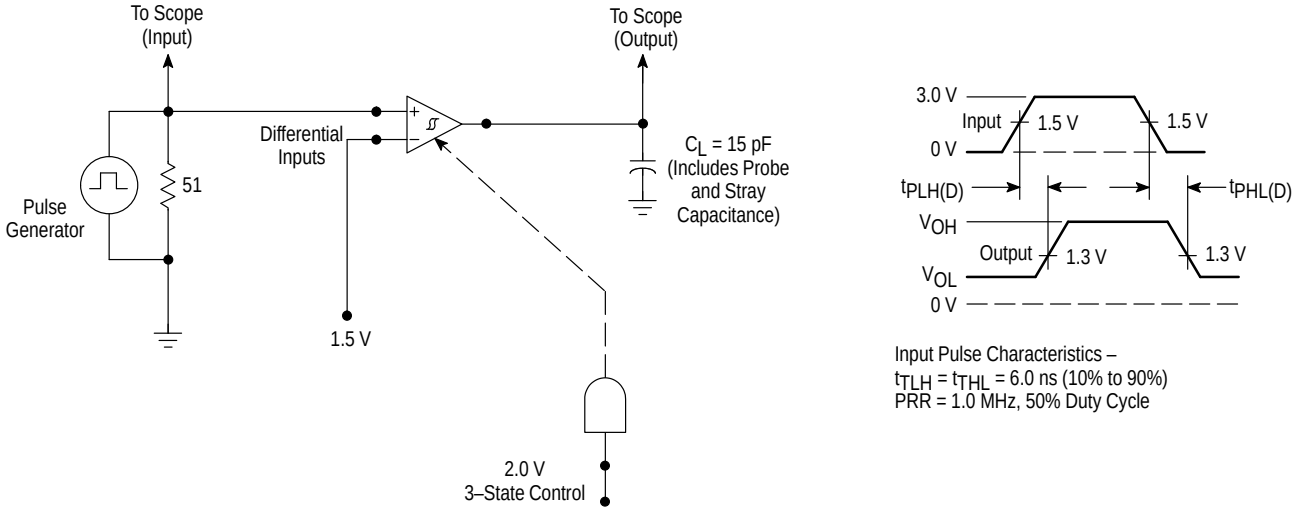
**FUNCTION TABLE (EACH RECEIVER)**

| Differential Inputs | 3–State Control | Output Y |
|---|---|---|
| $V_{ID} \geq 2.0$ V | H | H |
| –0.2 V < $V_{ID}$ < 0.2 V | H | ? |
| $V_{ID} \leq -0.2$ V | H | L |
| X | L | Z |

H = high level
L = low level
X = irrelevant
? = indeterminate
Z = high–impedance (off)

**SWITCHING TEST CIRCUIT AND WAVEFORMS**

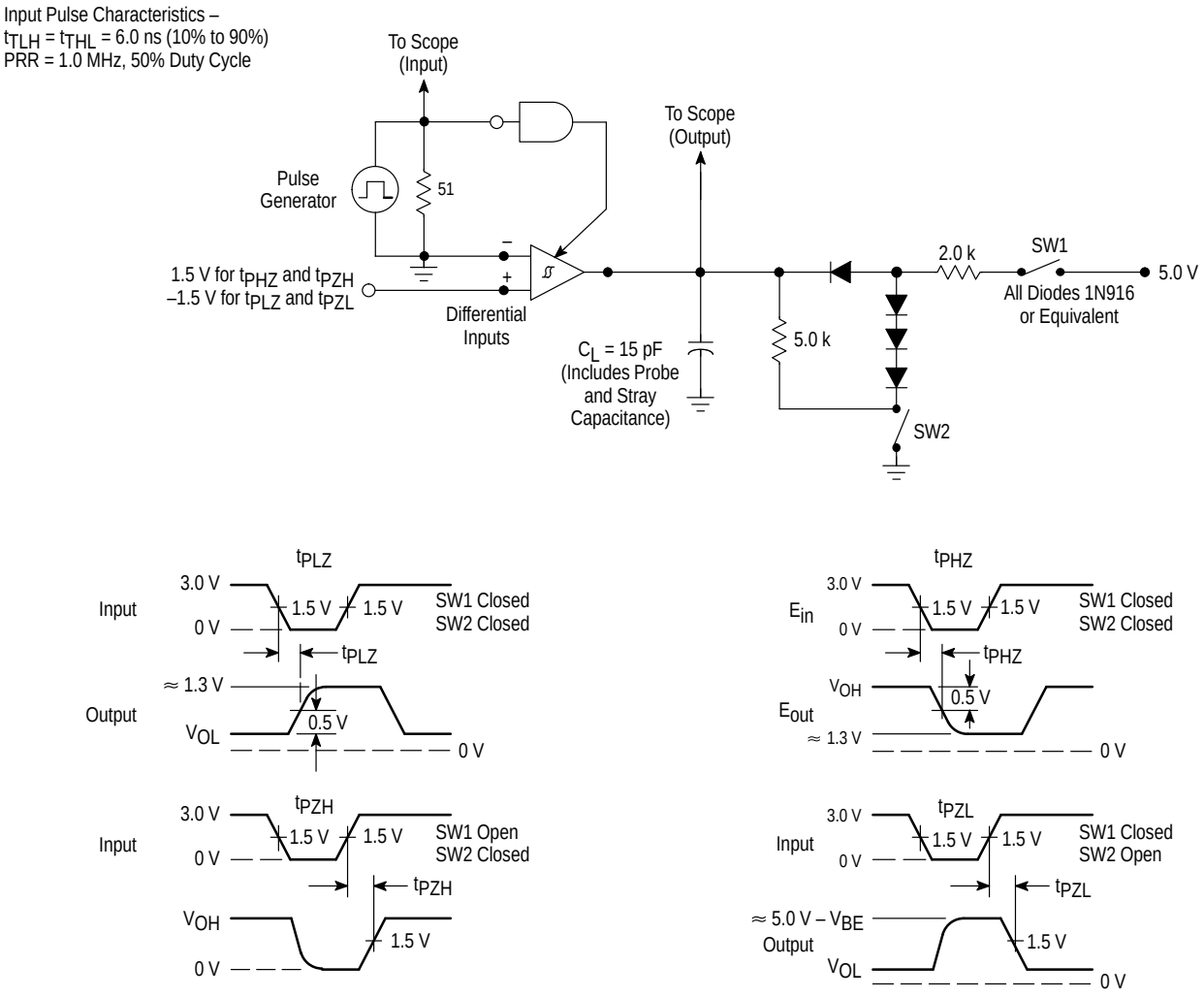
**Figure 1. Propagation Delay, Differential Input to Output**




Input Pulse Characteristics –
$t_{TLH} = t_{THL}$ = 6.0 ns (10% to 90%)
PRR = 1.0 MHz, 50% Duty Cycle

**SWITCHING TEST CIRCUIT AND WAVEFORMS** (continued)

**Figure 2. Propagation Delay, Three–State Control Input to Output**



## TYPICAL CHARACTERISTICS

**Figure 3. Output Voltage versus Differential Input Voltage**

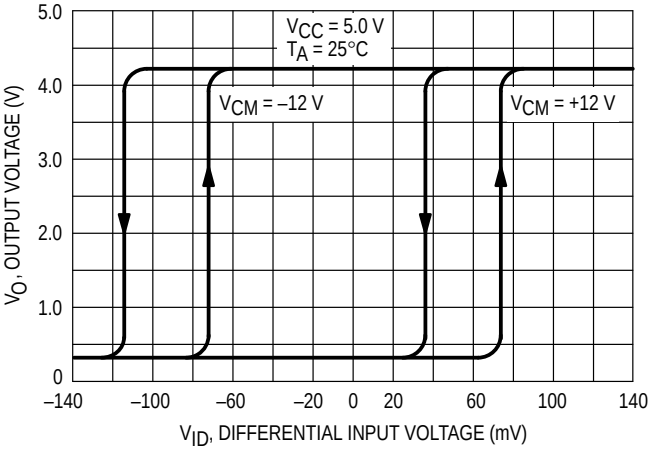



**Figure 4. Output Voltage versus 3–State Control Voltage**

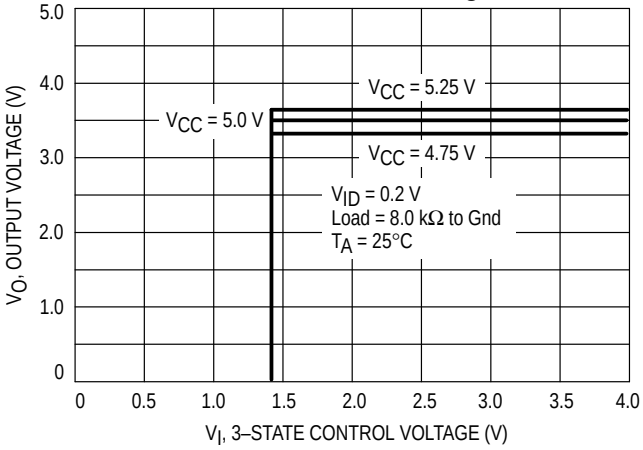



**Figure 5. High Level Output Voltage versus Output Current**

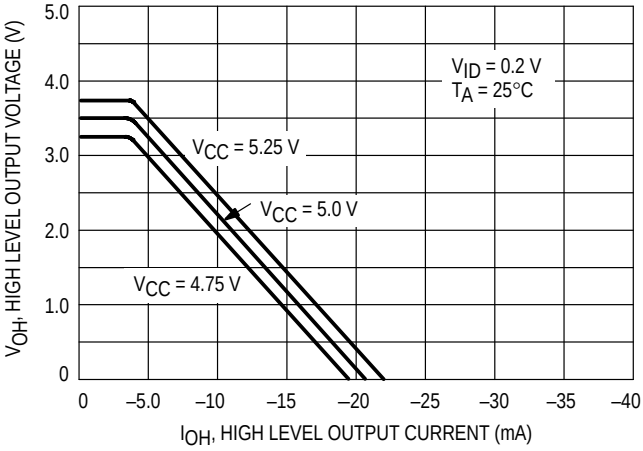



**Figure 6. Low Level Output Voltage versus Output Current**

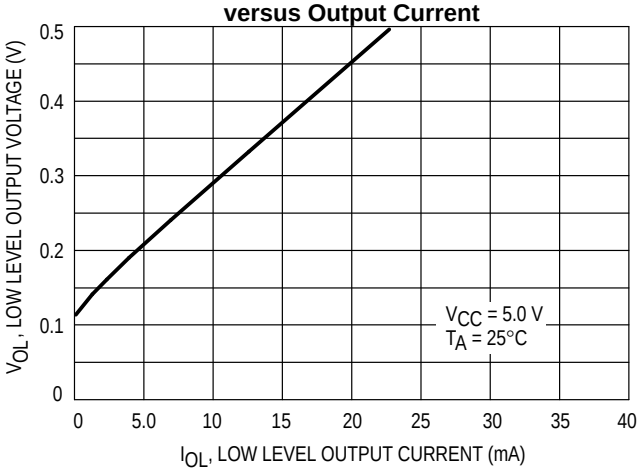



**Figure 7. High Level Output Voltage versus Temperature**

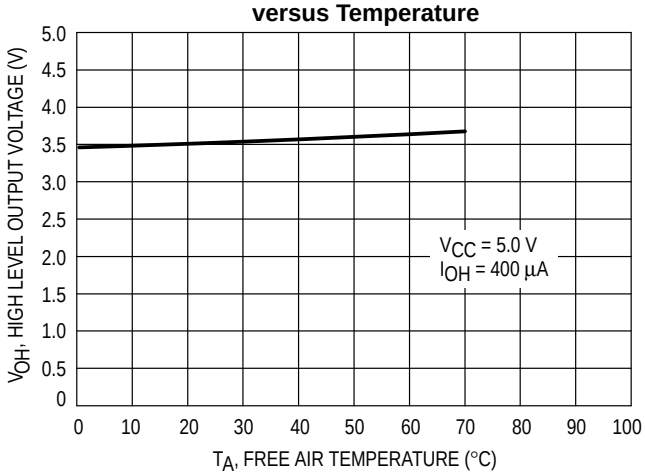
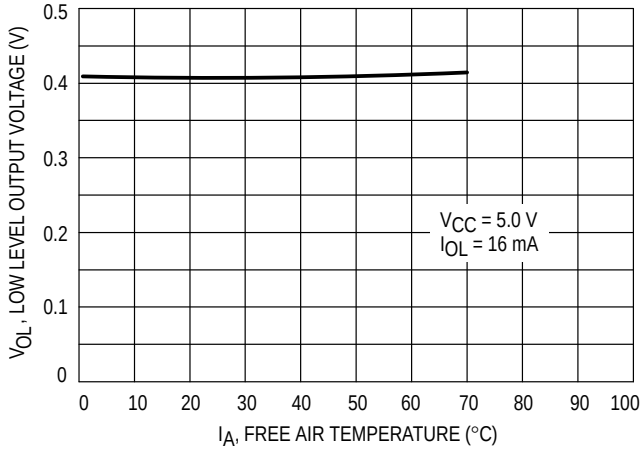
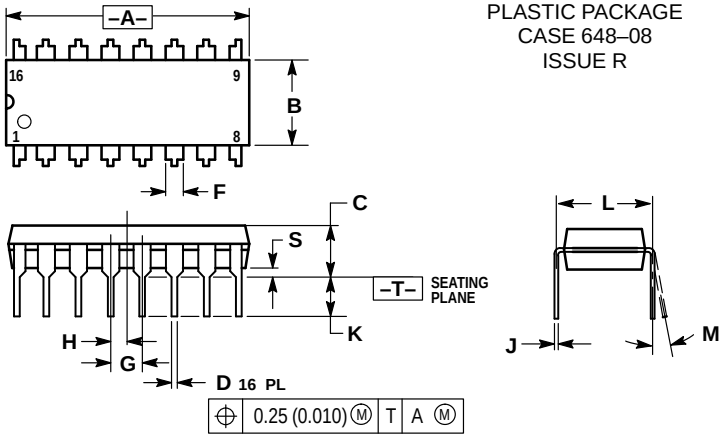



**Figure 8. Low Level Output Voltage versus Temperature**



## OUTLINE DIMENSIONS

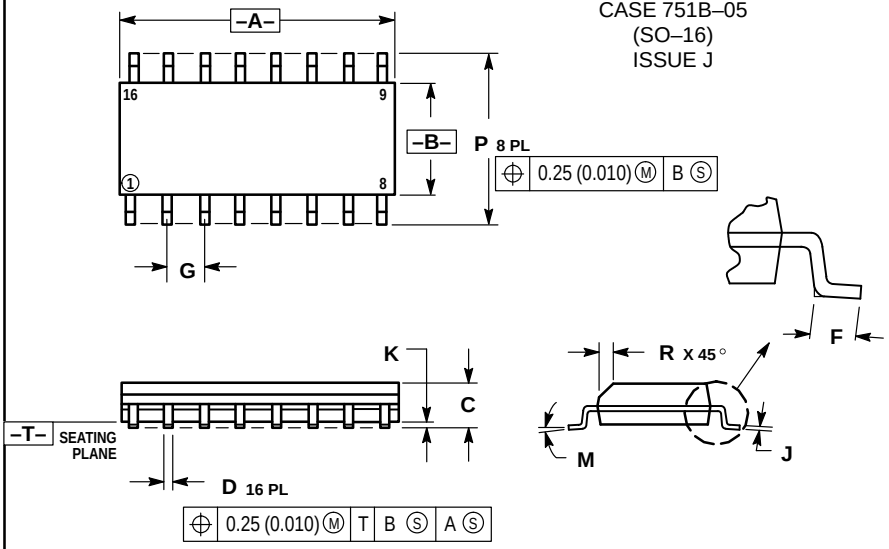
**N SUFFIX**
PLASTIC PACKAGE
CASE 648–08
ISSUE R




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.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | 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 ° | 0 ° | 10 ° |
| S | 0.020 | 0.040 | 0.51 | 1.01 |

**D SUFFIX**
PLASTIC PACKAGE
CASE 751B–05
(SO–16)
ISSUE J




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 9.80 | 10.00 | 0.386 | 0.393 |
| B | 3.80 | 4.00 | 0.150 | 0.157 |
| C | 1.35 | 1.75 | 0.054 | 0.068 |
| D | 0.35 | 0.49 | 0.014 | 0.019 |
| F | 0.40 | 1.25 | 0.016 | 0.049 |
| G | 1.27 BSC | | 0.050 BSC | |
| J | 0.19 | 0.25 | 0.008 | 0.009 |
| K | 0.10 | 0.25 | 0.004 | 0.009 |
| M | 0 ° | 7 ° | 0 ° | 7 ° |
| P | 5.80 | 6.20 | 0.229 | 0.244 |
| R | 0.25 | 0.50 | 0.010 | 0.019 |

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