


**MOTOROLA**

## Quad EIA-485 Line Receivers

The Motorola SN75173/175 are monolithic quad differential line receivers with three-state outputs. They are designed specifically to meet the requirements of EIA-485, EIA-422A/23A Standards and CCITT recommendations.

The devices are optimized for balanced multipoint bus transmission at rates up to 10 megabits per second. They also feature high input impedance, input hysteresis for increased noise immunity, and input sensitivity of  $\pm 200$  mV over a common mode input voltage range of  $-12$  V to  $12$  V. The SN75173/175 are designed for optimum performance when used with the SN75172 or SN75174 quad differential line drivers.

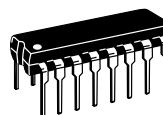
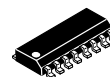
- Meets EIA Standards EIA-422A and EIA-423A, EIA-485
- Meets CCITT Recommendations V.10, V.11, X.26, and X.27
- Designed for Multipoint Transmission on Long Bus Lines in Noisy Environments
- 3-State Outputs
- Common-Mode Input Voltage Range . . .  $-12$  V to  $12$  V
- Input Sensitivity . . .  $\pm 200$  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 (SN75175)  
AM26LS32 (SN75173)

# SN75173 SN75175

### QUAD EIA-485 LINE RECEIVERS WITH THREE-STATE OUTPUTS

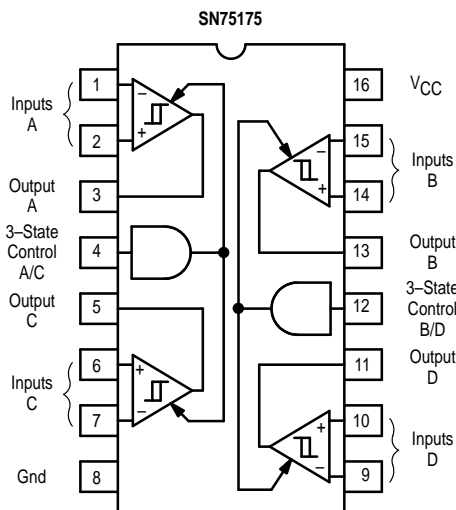
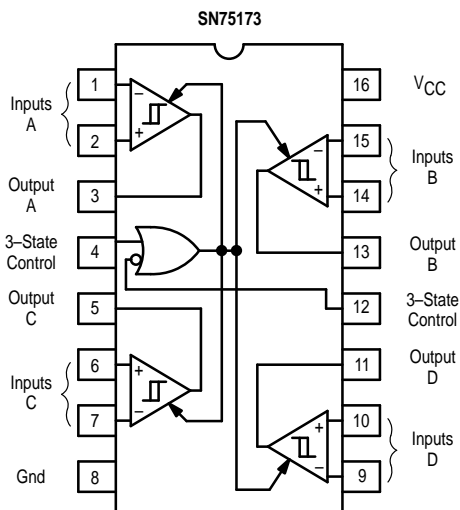
**SEMICONDUCTOR  
TECHNICAL DATA**

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



**N SUFFIX**  
PLASTIC PACKAGE  
CASE 648

### PIN CONNECTIONS



### ORDERING INFORMATION

Device	Operating Temperature Range	Package
SN75173N	$T_A = 0$ to $+70^\circ\text{C}$	Plastic DIP

### ORDERING INFORMATION

Device	Operating Temperature Range	Package
SN75175N	$T_A = 0$ to $+70^\circ\text{C}$	Plastic DIP
SN75175D		SO-16

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Power Supply Voltage	$V_{CC}$	7.0	Vdc
Input Common Mode Voltage	$V_{ICM}$	$\pm 25$	Vdc
Input Differential Voltage	$V_{ID}$	$\pm 25$	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

**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

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

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

# SN75173 SN75175

**SWITCHING CHARACTERISTICS** (Unless otherwise noted,  $V_{CC} = 5.0\text{ V}$  and  $T_A = 25^\circ\text{C}$ )

Characteristic	Symbol	SN75173			SN75175			Unit
		Min	Typ	Max	Min	Typ	Max	
Propagation Delay Time – Differential Inputs to Output								ns
Output High to Low	$t_{PHL(D)}$	–	25	35	–	25	35	
Output Low to High	$t_{PLH(D)}$	–	25	35	–	25	35	
Propagation Delay Time – Three-State Control to Output								ns
Output Low to Third State	$t_{PLZ}$	–	20	40	–	16	35	
Output High to Third State	$t_{PHZ}$	–	20	30	–	19	35	
Output Third State to High	$t_{PZH}$	–	16	22	–	11	30	
Output Third State to Low	$t_{PZL}$	–	16	25	–	11	30	

**SN75173**  
**FUNCTION TABLE (EACH RECEIVER)**

Differential Inputs	3-State Control		Output Y
	4	12	
$V_{ID} \geq 0.2\text{ V}$	H	X	H
	X	L	H
$-0.2 < V_{ID} < 0.2\text{ V}$	H	X	?
	X	L	?
$V_{ID} \leq -0.2\text{ V}$	H	X	L
	X	L	L
X	L	H	Z

**SN75175**  
**FUNCTION TABLE (EACH RECEIVER)**

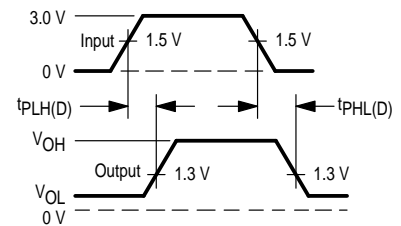
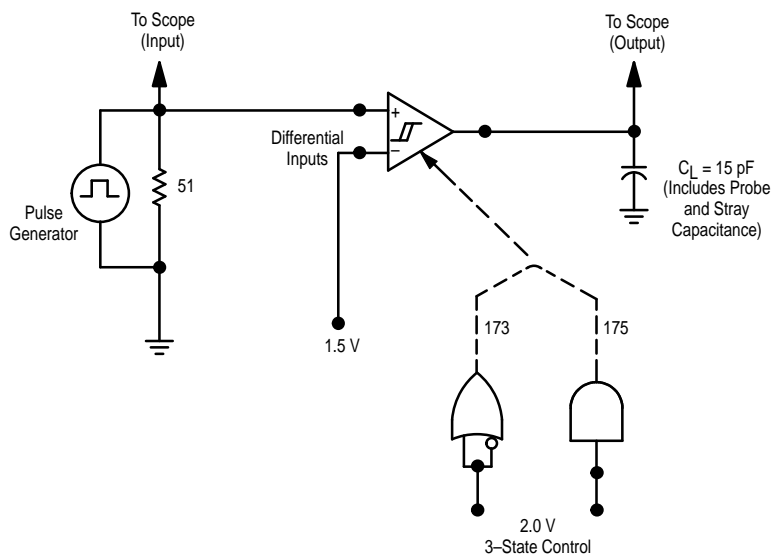
Differential Inputs	3-State Control	Output Y
$V_{ID} \geq 2.0\text{ V}$	H	H
$-0.2\text{ V} < V_{ID} < 0.2\text{ V}$	H	?
$V_{ID} \leq -0.2\text{ V}$	H	L
X	L	Z

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**

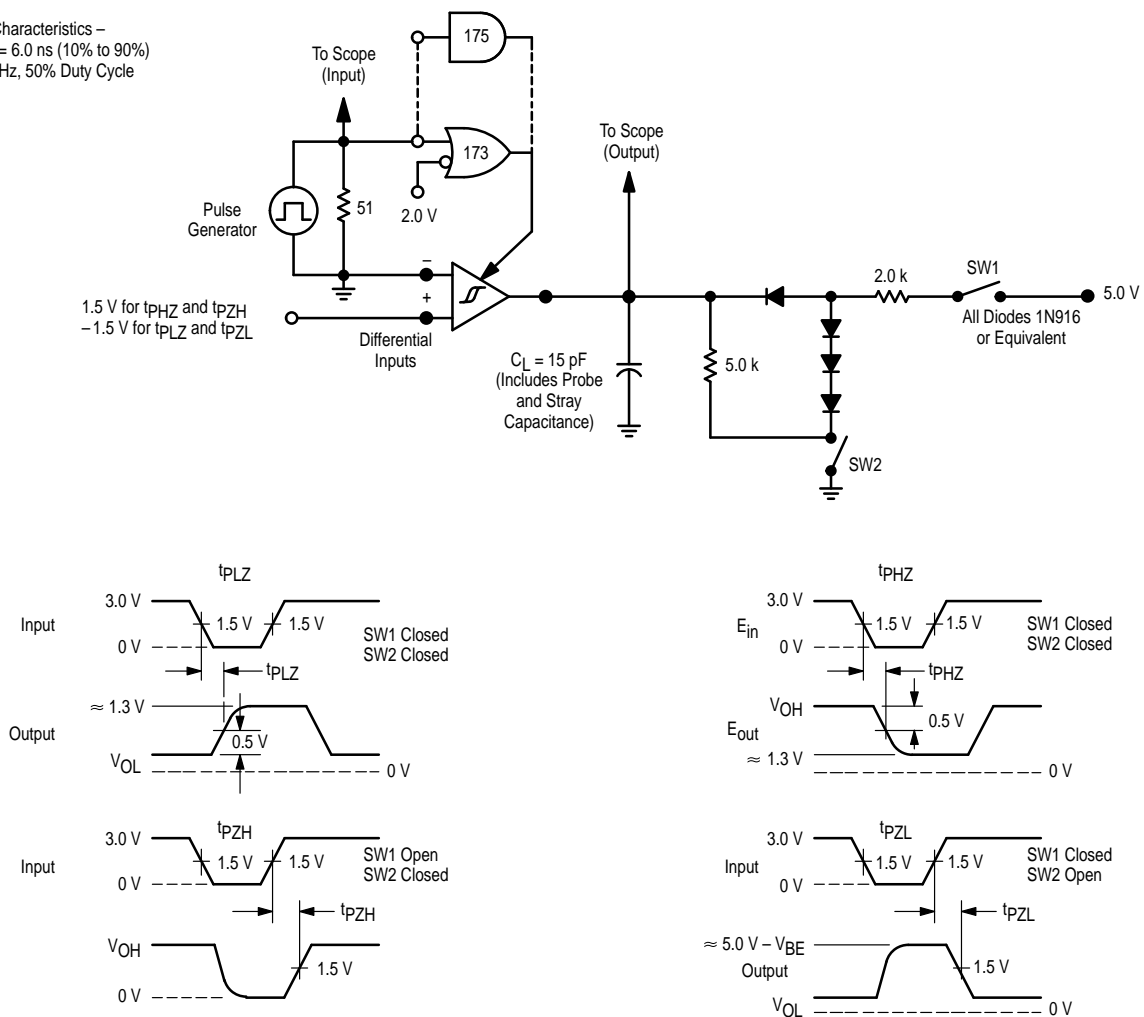


Input Pulse Characteristics –  
 $t_{TLH} = t_{THL} = 6.0\text{ ns}$  (10% to 90%)  
PRR = 1.0 MHz, 50% Duty Cycle

SWITCHING TEST CIRCUIT AND WAVEFORMS (continued)

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

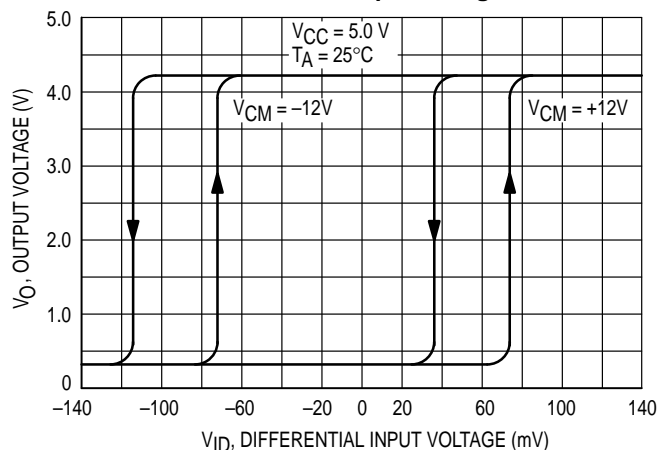
Input Pulse Characteristics –  
 $t_{TLH} = t_{THL} = 6.0$  ns (10% to 90%)  
 PRR = 1.0 MHz, 50% Duty Cycle



TYPICAL CHARACTERISTICS

(Both Device Types, Unless Otherwise Noted)

Figure 3. Output Voltage versus Differential Input Voltage



TYPICAL CHARACTERISTICS (continued)

Figure 4. Output Voltage versus 3-State Control Voltage

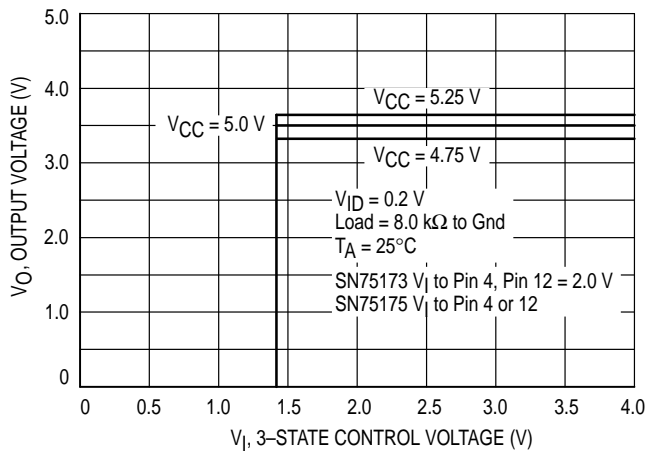


Figure 5. Output Voltage versus (Inverted) 3-State Control Voltage – SN75173

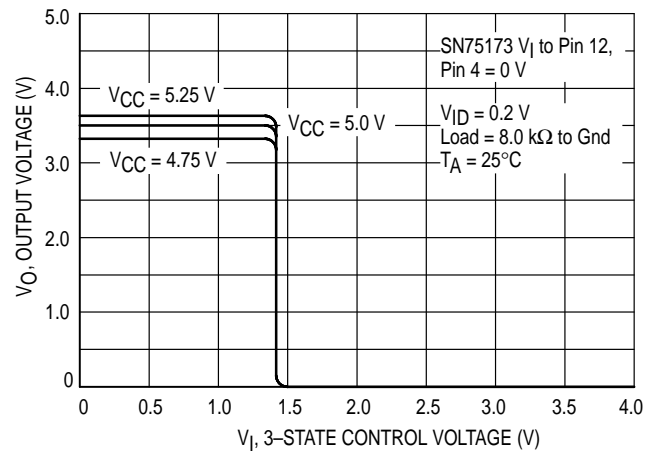


Figure 6. High Level Output Voltage versus Output Current

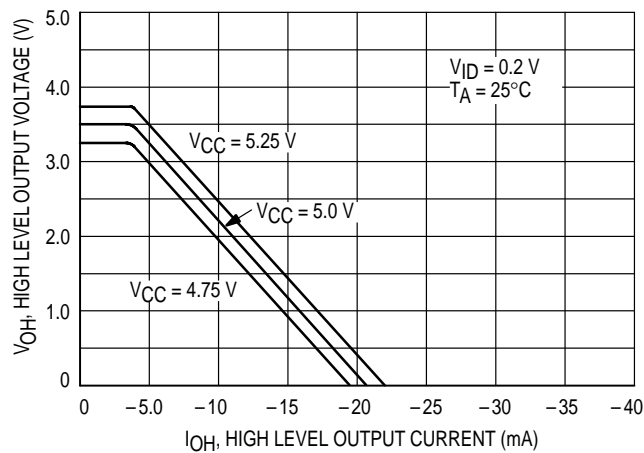


Figure 7. Low Level Output Voltage versus Output Current

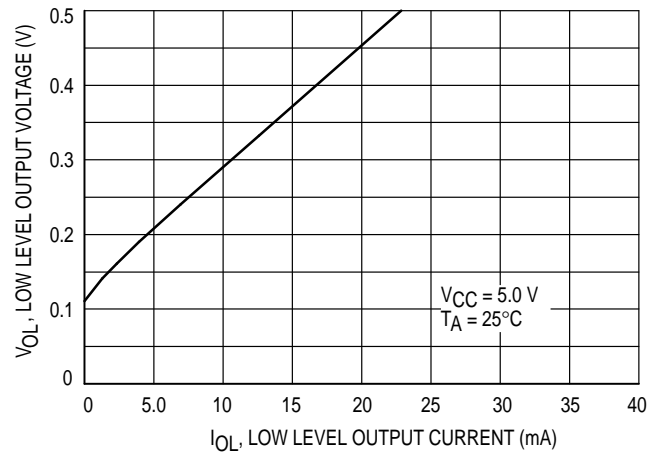


Figure 8. High Level Output Voltage versus Temperature

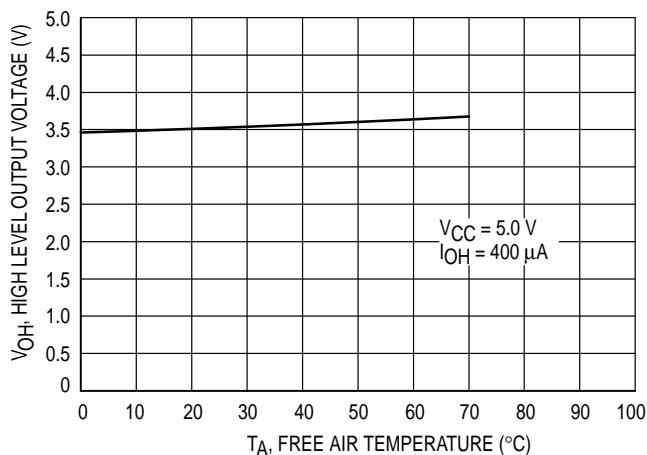
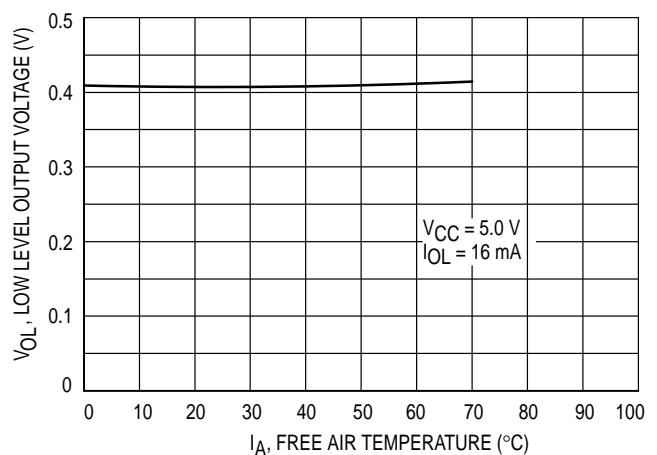
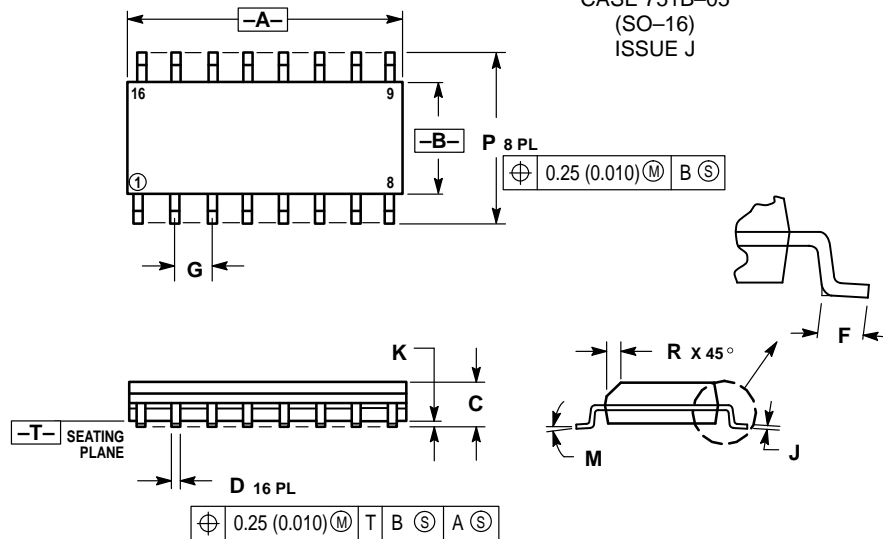


Figure 9. Low Level Output Voltage versus Temperature



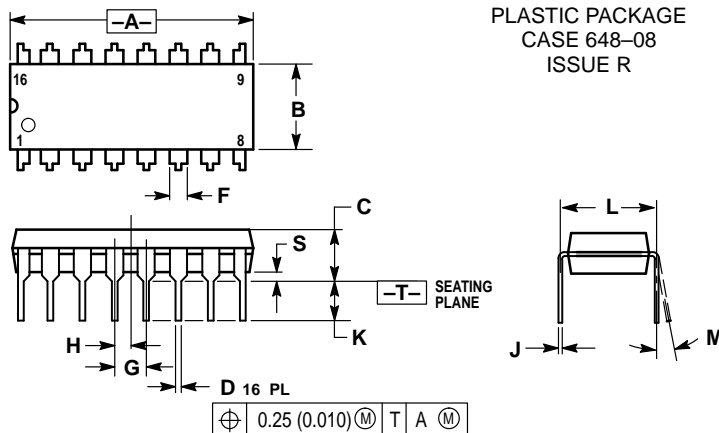
## OUTLINE DIMENSIONS

**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.


DIM	MILLIMETERS		INCHES	
	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

**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.

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°	0°	10°
S	0.020	0.040	0.51	1.01

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