

DS96F173M,DS96F175C,DS96F175M

DS96F173M/DS96F175C/DS96F175M EIA-485/EIA-422 Quad Differential Receivers



Literature Number: SNOSC40E

EIA-485/EIA-422 Quad Differential Receivers

General Description

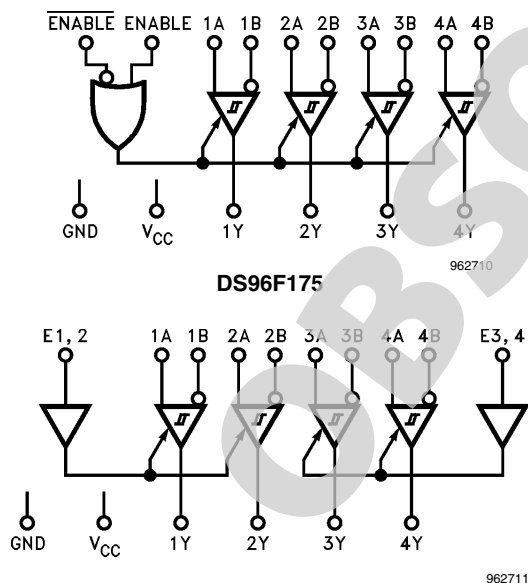
The DS96F173 and the DS96F175 are high speed quad differential line receivers designed to meet the EIA-485 standard. The DS96F173 and the DS96F175 offer improved performance due to the use of L-FAST bipolar technology. The use of LFAST technology allows the DS96F173 and DS96F175 to operate at higher speeds while minimizing power consumption.

The DS96F173 and the DS96F175 have TRI-STATE® outputs and are optimized for balanced multipoint data bus transmission at rates up to 15 Mbps. The receivers feature high input impedance, input hysteresis for increased noise immunity, and input sensitivity of 200 mV over a common mode input voltage range of -7V to +12V. The receivers are therefore suitable for multipoint applications in noisy environments. The DS96F173 features an active high and active low Enable, common to all four receivers. The DS96F175 features separate active high Enables for each receiver pair.

Features

- Meets EIA-485, EIA-422A, EIA-423A standards
- Designed for multipoint bus applications
- TRI-STATE outputs
- Common mode input voltage range: -7V to +12V
- Operates from single +5.0V supply
- Reduced power consumption ($I_{CC} = 50 \text{ mA max}$)
- Input sensitivity of $\pm 200 \text{ mV}$ over common mode range
- Input hysteresis of 50 mV typical
- High input impedance
- Military temperature range available
- Qualified for MIL STD 883C
- Available to standard military drawings (SMD)
- Available in DIP(J), LCC(E), and FlatPak (W) packages
- DS96F173 and DS96F175 are lead and function compatible with SN75173/175 or the AM26LS32/MC3486

Logic Diagrams



Function Tables

(Each Receiver) DS96F173

Differential Inputs A-B	Enable		Output Y
	E	\bar{E}	
$V_{ID} \geq 0.2V$	H	X	H
$V_{ID} \leq -0.2V$	H	X	L
X	L	X	Z
X	X	H	Z

H = High Level
L = Low Level
Z = High Impedance (off)
X = Don't Care

(Each Receiver) DS96F175

Differential Inputs A-B	Enable	Output Y
	E	
$V_{ID} \geq 0.2V$	H	H
$V_{ID} \leq -0.2V$	H	L
X	L	Z

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Absolute Maximum Ratings

COMMERCIAL (Note 2)

Specifications for the 883 version of this product are listed separately.

Storage Temperature Range (T_{STG})	-65°C to +175°C
Lead Temperature (Soldering, 60 sec.)	300°C
Max. Package Power Dissipation (Note 1) at 25°C	
Ceramic DIP (J)	1500 mW
Supply Voltage	7.0V
Input Voltage, A or B Inputs	±25V
Differential Input Voltage	±25V
Enable Input Voltage	7.0V
Low Level Output Current	50 mA

Recommended Operating Conditions

	Min	Typ	Max	Units
Supply Voltage (V_{CC}) DS96F175C	4.75	5.0	5.25	V
Common Mode Input Voltage (V_{CM})	-7		+12	V
Differential Input Voltage (V_{ID})			1121	V
Output Current HIGH (I_{OH})			-400	μA
Output Current LOW (I_{OL})			11	mA
Operating Temperature (T_A) DS96F175C	0	25	70	°C

Note 1: Derate package 10 mW/°C above 25°C.

Electrical Characteristics (Note 3, Note 4)

Over recommended supply voltage and operating temperature ranges, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{TH}	Differential-Input High Threshold Voltage	$V_O = V_{OH}$			0.2	V
V_{TL}	Differential-Input (Note 5) Low Threshold Voltage	$V_O = V_{OL}$	-0.2			V
$V_{TH} - V_{TL}$	Hysteresis (Note 6)	$V_{CM} = 0V$		50		mV
V_{IH}	Enable Input Voltage HIGH		2.0			V
V_{IL}	Enable Input Voltage LOW				0.8	V
V_{IC}	Enable Input Clamp Voltage	$I_I = -18 \text{ mA}$			-1.5	V
V_{OH}	Output Voltage HIGH	$V_{ID} = 200 \text{ mV}$ $I_{OH} = -400 \text{ μA}$	0°C to +70°C	2.8		V
			-55°C to +125°C	2.5		
V_{OL}	Output Voltage LOW	$V_{ID} = -200 \text{ mV}$	$I_{OL} = 8.0 \text{ mA}$		0.45	V
			$I_{OL} = 11 \text{ mA}$		0.50	
I_{OZ}	High-Impedance State Output	$V_O = 0.4V \text{ to } 2.4V$			±20	μA
I_I	Line Input Current (Note 7)	Other Input = 0V	$V_I = 12V$		1.0	mA
			$V_I = -7.0V$		-0.8	
I_{IH}	Enable Input Current HIGH	$V_{IH} = 2.7V$			20	μA
I_{IL}	Enable Input Current LOW	$V_{IL} = 0.4V$			-100	μA
R_I	Input Resistance		14	18	22	kΩ
I_{OS}	Short Circuit Output Current	(Note 8)	-15		-85	mA
I_{CC} I_{CCX}	Supply Current	No Load	Outputs Enabled		50	mA
			Outputs Disabled		50	

COMMERCIAL

Switching Characteristics

 $V_{CC} = 5.0V$, $T_A = 25^\circ C$

Symbol	Parameter	Conditions	Min	Typ	Max	Units
t_{PLH}	Propagation Delay Time, Low to High Level Output	$V_{ID} = -2.5V$ to $+2.5V$, $C_L = 15$ pF, <i>Figure 1</i>	5.0	15	22	ns
t_{PHL}	Propagation Delay Time, High to Low Level Output	$V_{CM} = 0V$	5.0	15	22	ns
t_{ZH}	Output Enable Time to High Level	$C_L = 15$ pF, <i>Figure 2</i>		12	16	ns
t_{ZL}	Output Enable Time to Low Level	$C_L = 15$ pF, <i>Figure 3</i>		13	18	ns
t_{HZ}	Output Disable Time from High Level	$C_L = 5.0$ pF, <i>Figure 2</i>		14	20	ns
t_{LZ}	Output Disable Time from Low Level	$C_L = 5.0$ pF, <i>Figure 3</i>		14	18	ns
$ t_{PLH} - t_{PHL} $	Pulse Width Distortion (SKEW)	<i>Figure 1</i>		1.0	3.0	ns

Note 2: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" provide conditions for actual device operation.

Note 3: Unless otherwise specified min/max limits apply across the $0^\circ C$ to $+70^\circ C$ range for the DS96F175C. All typicals are given for $V_{CC} = 5V$ and $T_A = 25^\circ C$.

Note 4: All currents into the device pins are positive; all currents out of the device pins are negative. All voltages are reference to ground unless otherwise specified.

Note 5: The algebraic convention, when the less positive (more negative) limit is designated minimum, is used in this data sheet for common mode input voltage and threshold voltage levels only.

Note 6: Hysteresis is the difference between the positive-going input threshold voltage, V_{TH} , and the negative going input threshold voltage, V_{TL} .

Note 7: Refer to EIA-485 Standard for exact conditions.

Note 8: Only one output at a time should be shorted.

Order Number: DS96F175CJ

See NS Package Number J16A

Absolute Maximum Ratings

MIL-STD-883C (Note 2)

For complete Military Specifications, refer to the appropriate SMD or MDS.

Storage Temperature Range (T_{STG})	-65°C to +175°C
Lead Temperature (Soldering, 60 sec.)	300°C
Max. Package Power Dissipation (Note 9) at 25°C	
Ceramic DIP (J)	1500 mW
Ceramic Flatpak (W)	1034 mW
Ceramic LCC (E)	1500 mW
Supply Voltage	7.0V
Input Voltage, A or B Inputs	±25V
Differential Input Voltage	±25V
Enable Input Voltage	7.0V
Low Level Output Current	50 mA

Note 9: Above $T_A = 25^\circ\text{C}$ derate J package 10 mW/°C, W package 6.90 mW/°C, E package 11.11 mW/°C.

Recommended Operating Conditions

	Min	Typ	Max	Units
Supply Voltage (V_{CC})				
DS96F173M/DS96F175M	4.50	5.0	5.50	V
Common Mode				
Input Voltage (V_{CM})	-7		+12	V
Differential Input Voltage (V_{ID})			12	V
Output Current HIGH (I_{OH})			-400	μA
Output Current LOW (I_{OL})			11	mA
Operating Temperature (T_A)				
DS96F173M/DS96F175M	-55	25	125	°C

Electrical Characteristics (Note 3, Note 4)

Over recommended supply voltage and operating temperature ranges, unless otherwise specified

Symbol	Parameter	Conditions	Min	Max	Units
V_{TH}	Differential-Input High Threshold Voltage	$V_{CC} = 4.5V, 5.5V$ $V_{CM} = 0V, 12V, -12V$		0.2	V
V_{TL}	Differential-Input (Note 5) Low Threshold Voltage	$V_{CC} = 4.5V, 5.5V$ $V_{CM} = 0V, 12V, -12V$	-0.2		V
V_{IH}	Enable Input Voltage HIGH		2.0		V
V_{IL}	Enable Input Voltage LOW			0.8	V
V_{IC}	Enable Input Clamp Voltage	$I_I = -18\text{ mA}, V_{CC} = 4.5V$		-1.5	V
V_{OH}	Output Voltage HIGH	$V_{ID} = 200\text{ mV}$ $I_{OH} = -400\text{ }\mu\text{A}$ -55°C to +125°C	2.5		V
V_{OL}	Output Voltage LOW	$V_{ID} = -200\text{ mV}$ $I_{OL} = 8.0\text{ mA}$		0.45	V
I_{OZ}	High-Impedance State Output	$V_O = 0.4V, 2.4V, V_{CC} = 5.5V$		±20	μA
I_I	Line Input Current (Note 7)	Other Input = 0V $V_I = 12V$ $V_I = -7.0V$		1.0 -0.8	mA
I_{IH}	Enable Input Current HIGH	$V_{IH} = 2.7V, V_{CC} = 5.5V$		20	μA
I_{IL}	Enable Input Current LOW	$V_{IL} = 0.4V, V_{CC} = 5.5V$		-100	μA
R_I	Input Resistance		10		kΩ
I_{OS}	Short Circuit Output Current	(Note 8)	-15	-85	mA
I_{CC}	Supply Current	No Load		50	mA
I_{CCX}					

MIL-STD-883C

Switching Characteristics

 $V_{CC} = 5.0V$

Symbol	Parameter	Conditions	$T_A = 25^\circ C$		$T_A = -55^\circ C$	$T_A = 125^\circ C$	Units
			Typ	Max	Max	Max	
t_{PLH}	Propagation Delay Time, Low to High Level Output	$V_{ID} = -2.5V$ to $+2.5V$, $C_L = 15$ pF, <i>Figure 1</i>	15	22	30	30	ns
t_{PHL}	Propagation Delay Time, High to Low Level Output	$V_{CM} = 0V$	15	22	30	30	ns
t_{ZH}	Output Enable Time to High Level	$C_L = 15$ pF, <i>Figure 2</i>	12	16	27	27	ns
t_{ZL}	Output Enable Time to Low Level	$C_L = 15$ pF, <i>Figure 3</i>	13	18	27	27	ns
t_{HZ}	Output Disable Time from High Level	$C_L = 5.0$ pF, <i>Figure 2(Notes 15)</i>	14	20	27	27	ns
		$C_L = 20$ pF, <i>Figure 2(Notes 15)</i>	14	30	37	37	ns
t_{LZ}	Output Disable Time from Low Level	$C_L = 5.0$ pF, <i>Figure 3</i>	14	18	30	30	ns
$ t_{PLH} - t_{PHL} $	Pulse Width Distortion (SKEW)	<i>Figure 1</i>	1	3	5.0	5.0	ns

SMD Number:

DS96F173MJ	5962-9076602 MEA
DS96F173MW	5962-9076602 MFA
DS96F173ME	5962-9076602 M2A
DS96F175MJ	5962-9076601 MEA
DS96F175MW	5962-9076601 MFA
DS96F175ME	5962-9076601 M2A

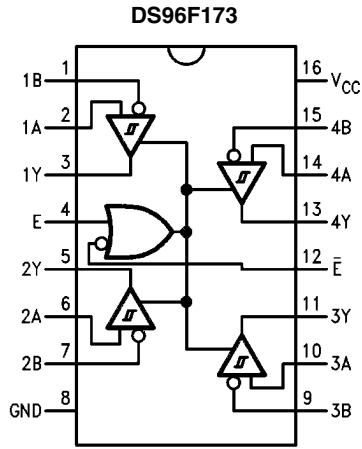
Order Number:

883 Marking	SMD Marking
DS96F173MJ/883	DS96F173MJ-SMD
DS96F175MJ/883	DS96F175MJ-SMD
See NS Package Number J16A	
DS96F173ME/883	DS96F173ME-SMD
DS96F175ME/883	DS96F175ME-SMD
See NS Package Number E20A	
DS96F173MW/883	DS96F173MW-SMD
DS96F175MW/883	DS96F175MW-SMD
See NS Package Number W16A	

For complete Military Product Specifications, refer to the appropriate SMD or MDS.

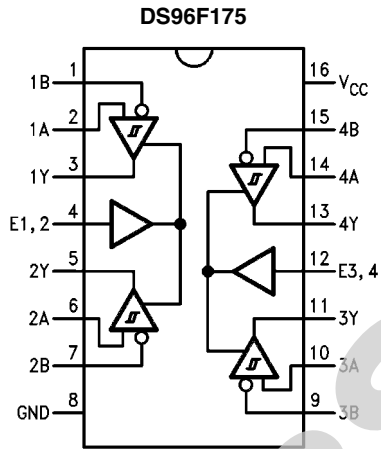
Connection Diagrams

16-Lead Ceramic Dual-In-Line Package
NS Package Number J16A



Top View

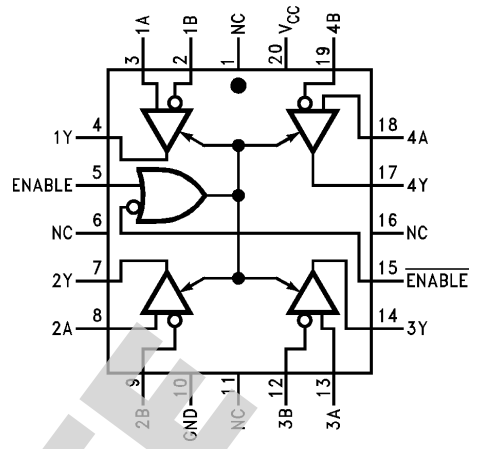
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Top View

962702

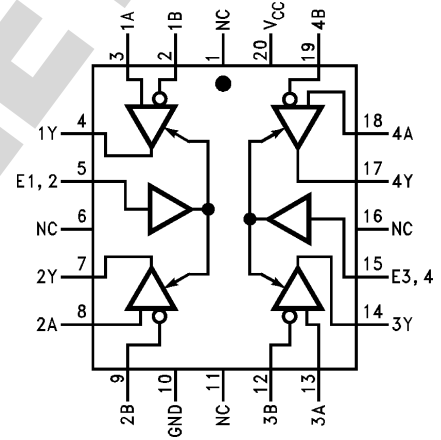
20-Lead Ceramic Leadless Chip Carrier
NS Package Number E20A



Top View

962712

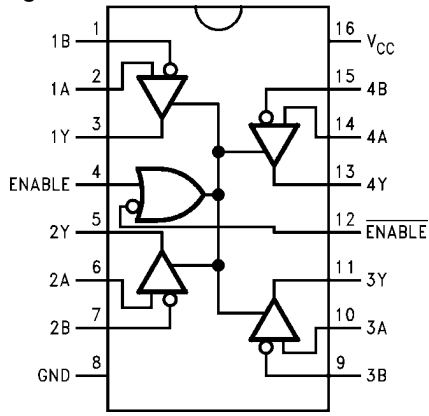
*NC—No Connection



Top View

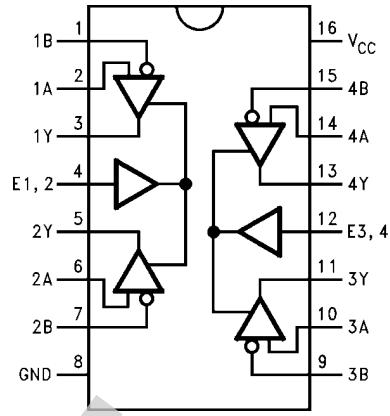
962713

**16-Lead Ceramic Flatpak
NS Package Number W16A**



Top View

962714



Top View

962715

Order Numbers are located at the end of the respective Electrical Tables.

Parameter Measurement Information

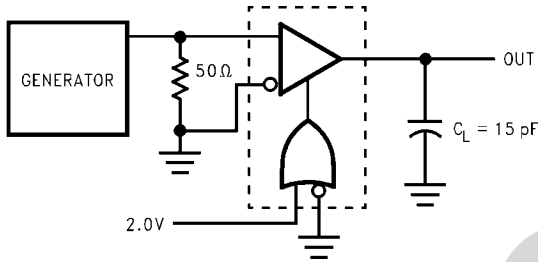
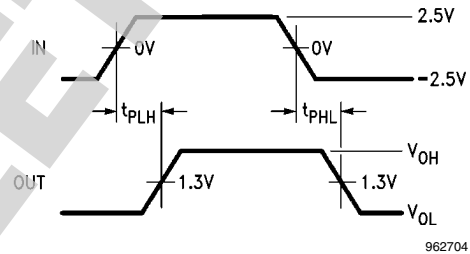


FIGURE 1. t_{PLH} , t_{PHL} (Note 10, Note 11)



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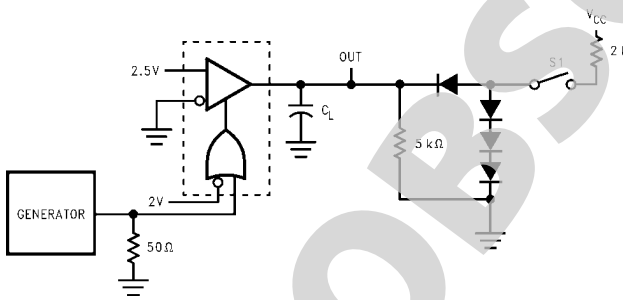
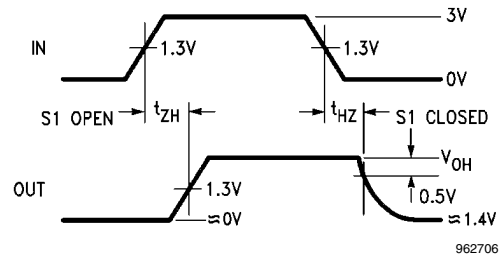


FIGURE 2. t_{HZ} , t_{ZH} (Note 10, Note 11, Note 13, Note 14)



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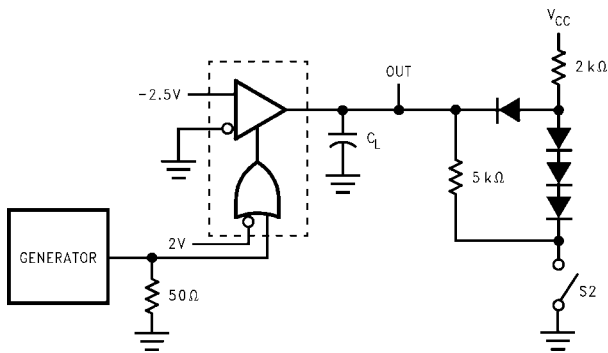
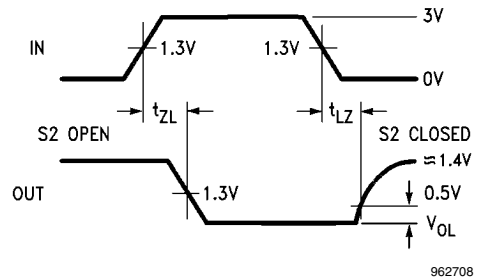


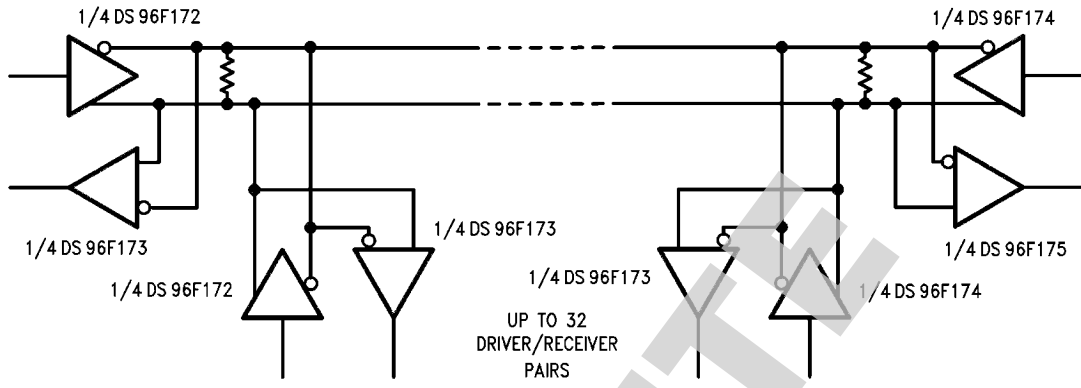
FIGURE 3. t_{ZL} , t_{LZ} (Note 10, Note 11, Note 13, Note 14)



962708

- Note 10:** The input pulse is supplied by a generator having the following characteristics: $f = 1.0 \text{ MHz}$, 50% duty cycle, $t_r \leq 6.0 \text{ ns}$, $t_f \leq 6.0 \text{ ns}$, $Z_0 = 50\Omega$.
- Note 11:** C_L includes probe and stray capacitance.
- Note 12:** DS96F173 with active high and active low Enables are shown. DS96F175 has active high Enable only.
- Note 13:** All diodes are 1N916 or equivalent.
- Note 14:** To test the active low Enable \bar{E} of DS96F173, ground E and apply an inverted input waveform to \bar{E} . DS96F175 has active high enable only.
- Note 15:** Testing at 20 pF assures conformance to 5 pF specification.

Typical Application



962709

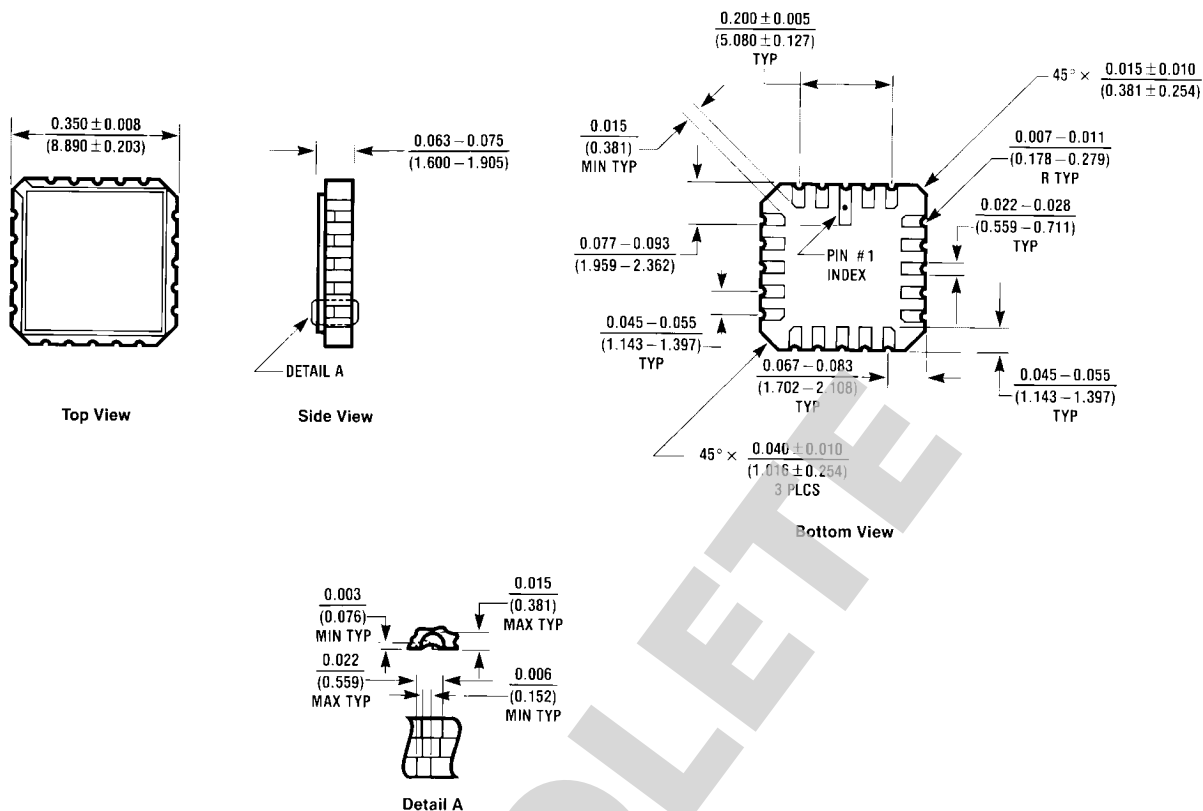
FIGURE 4.

Note: The line length should be terminated at both ends in its characteristic impedance. Stub lengths off the main line should be kept as short as possible.

OBSOLETE

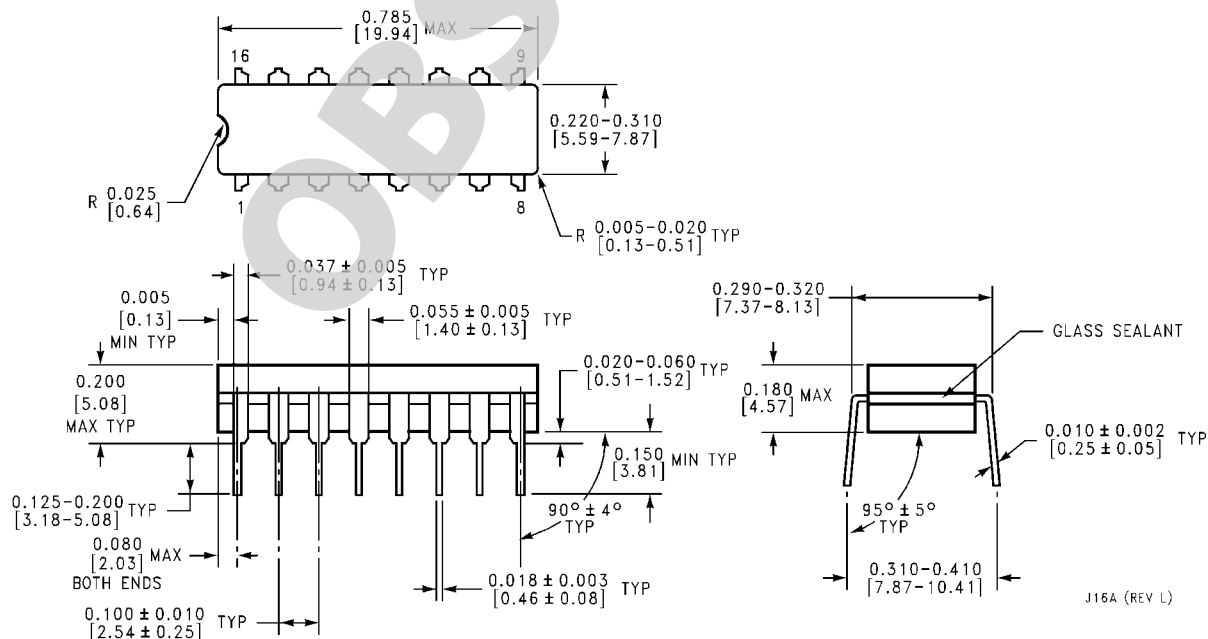
Physical Dimensions inches (millimeters) unless otherwise noted

DS96F173M/DS96F175C/DS96F175M



20-Lead Ceramic Leadless Chip Carrier (E)
 Order Number DS96F173ME/883 or DS96F175ME/883
 NS Package Number E20A

L20A (REV D)



16-Lead Ceramic Dual-In-Line Package (J)
 Order Number DS96F175CJ, DS96F173MJ/883 or DS96F175MJ/883
 NS Package Number J16A

J16A (REV L)

Notes

OBSOLETE

Notes

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