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# HD75153

Quadruple Differential Line Drivers With 3 State Outputs

# HITACHI

ADE-205-588 (Z)  
1st. Edition  
Dec. 2000

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## Description

HD75153 features line drivers which satisfy the requirements of EIA RS 422 A and Federal Standard 1020. This device is designed to provide differential signals with high current capability on bus lines. The circuit provides strobe and enable inputs to control all four drivers. The output circuit has active pull up and pull down and is capable of sinking or sourcing 40 mA.

## Function Table

Input			Output	
Enable CC	Strobe S	Data A	Y	Z
L	X	X	Z	Z
H	L	X	L	H
H	X	L	L	H
H	H	H	H	L

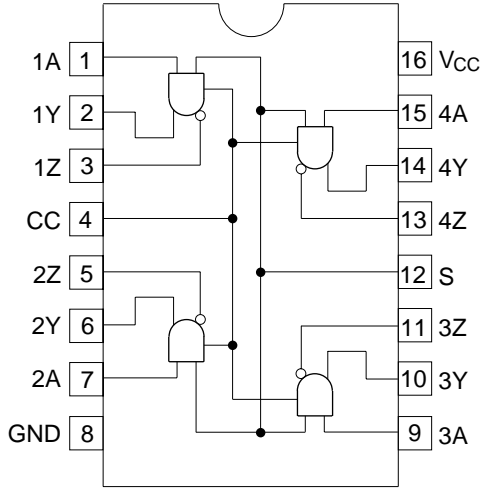
H : High level

L : Low level

X : Irrelevant

Z : High impedance

## Pin Arrangement



(Top view)

## Absolute Maximum Ratings

Item	Symbol	Rating	Unit	
Supply Voltage	$V_{CC}$	7	V	
Input Voltage	$V_{IN}$	5.5	V	
Power Dissipation ( $T_a = 25^\circ\text{C}$ )	$P_T$	DP	1000	mW
		FP	785	
Operating Temperature Range	$T_{opr}$	0 to +70	$^\circ\text{C}$	
Storage Temperature Range	$T_{stg}$	-60 to +150	$^\circ\text{C}$	

Note: 1. The above data were taken by the  $\Delta V_{BE}$  method, mounting on a glass epoxy board ( $40 \times 40 \times 1.6$  mm) of 10 % wiring density.

2. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

**Recommended Operating Conditions**

Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	$V_{CC}$	4.75	500	5.25	V
Common Mode Output Voltage	$V_{out C}$	-0.25		6	V
Output Current	$I_{OH}$	—	—	-40	mA
Output Current	$I_{OL}$	—	—	40	mA
Operating Temperature	$T_{opr}$	0	—	70	°C

**Electrical Characteristics (Ta = 0 to 70°C)**

Item	Symbol	Min	Typ*1	Max	Unit	Conditions
Input Voltage	$V_{IH}$	2	—	—	V	
	$V_{IL}$	—	—	0.8		
Input Clamp Voltage	$V_{IK}$	—	—	-2	V	$V_{CC} = 4.75 V, I_I = -12 mA, CC, S$
		-0.9	-1.5			$V_{CC} = 4.75 V, I_I = -12 mA, All Others$
Output Voltage	$V_{OH}$	2.5	—	—	V	$V_{CC} = 4.75 V, V_{IL} = 0.8 V, V_{IH} = 2 V, I_{OH} = -20 mA$
		2.4	—	—		$V_{CC} = 4.75 V, V_{IL} = 0.8 V, V_{IH} = 2 V, I_{OH} = -40 mA$
	$V_{OL}$	—	—	0.5		$V_{CC} = 4.75 V, V_{IL} = 0.8 V, V_{IH} = 2 V, I_{OL} = 40 mA$
Differential Output Voltage	$V_{OD1}$	—	3.4	$2 V_{OD2}$	V	$V_{CC} = 5.25 V, I_O = 0$
	$V_{OD2}^{*5}$	2	2.8	—		$V_{CC} = 4.75 V, R_L = 100 \Omega$
Change In Magnitude Of Differential Output Voltage	$\Delta  V_{OD} ^{*2}$	—	0.01	0.4	V	$V_{CC} = 4.75 V, R_L = 100 \Omega$
Common Mode Output Voltage	$V_{OC}^{*3}$	—	1.8	3	V	$V_{CC} = 5.25 V, R_L = 100 \Omega$
		—	1.6	3		$V_{CC} = 4.75 V, R_L = 100 \Omega$
Change In MagnitudeOf Common Mode Output Voltage	$\Delta  V_{OC} ^{*2}$	—	0.02	0.4	V	$V_{CC} = 4.75 V \text{ or } 5.25 V, R_L = 100 \Omega$
Off State (High Impedance State) Output Current	$I_{OZ}$	—	—	-20	$\mu A$	$V_{CC} = 5.25 V, Enable = 0.8 V, V_O = 0.5 V$
		—	—	20		$V_{CC} = 5.25 V, Enable = 0.8 V, V_O = 2.5 V$
		—	—	20		$V_{CC} = 5.25 V, Enable = 0.8 V, V_O = V_{CC}$
Output Current With Power Off	$I_O$	—	0.1	100	$\mu A$	$V_{CC} = 0 V, V_O = 6 V$
		—	-0.1	-100		$V_{CC} = 0 V, V_O = -0.25 V$
		—	—	$\pm 100$		$V_{CC} = 0 V, V_O = -0.25 V \text{ to } 6 V$

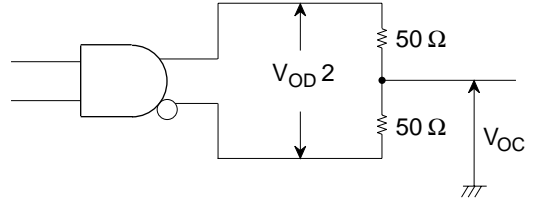
## Electrical Characteristics (Ta = 0 to 70°C) (cont)

Item	Symbol	Min	Typ* <sup>1</sup>	Max	Unit	Conditions
Input Current	$I_I$	—	—	0.1	mA	$V_{CC} = 5.25\text{ V}, V_I = 5.5\text{ V}$
	$I_{IH}$	—	—	20	$\mu\text{A}$	$V_{CC} = 5.25\text{ V}, V_I = 2.4\text{ V}, A$
		—	—	80		$V_{CC} = 5.25\text{ V}, V_I = 2.4\text{ V}, CC, S$
	$I_{IL}$	—	—	-0.36	mA	$V_{CC} = 5.25\text{ V}, V_I = 0.4\text{ V}, A$
—		—	-1.6		$V_{CC} = 5.25\text{ V}, V_I = 0.4\text{ V}, CC, S$	
Short Circuit Output Current	$I_{OS}^{*4}$	-50	-90	-150	mA	$V_{CC} = 5.25\text{ V}$
Supply Current	$I_{CC}$	30	—	60	mA	$V_{CC} = 5.25\text{ V}$ Outputs Disabled
		—	60	84		No Load    Outputs Enabled

Notes: 1. All typical values are at  $V_{CC} = 5\text{ V}, T_a = 25^\circ\text{C}$ .

$\Delta|V_{OD}|$  and  $\Delta|V_{OC}|$  are the changes in magnitudes of  $V_{OD}$  and  $V_{OC}$ , respectively, that occur when the input is changed from a high level to a low level.

- In EIA standard RS-422A,  $V_{OC}$ , which is the average of the two output voltages with respect to ground, is called output offset voltage,  $V_{OS}$ .
- Only one output should be shorted at a time, and duration of the short circuit should not exceed one second.
- Differential and common mode output voltages.



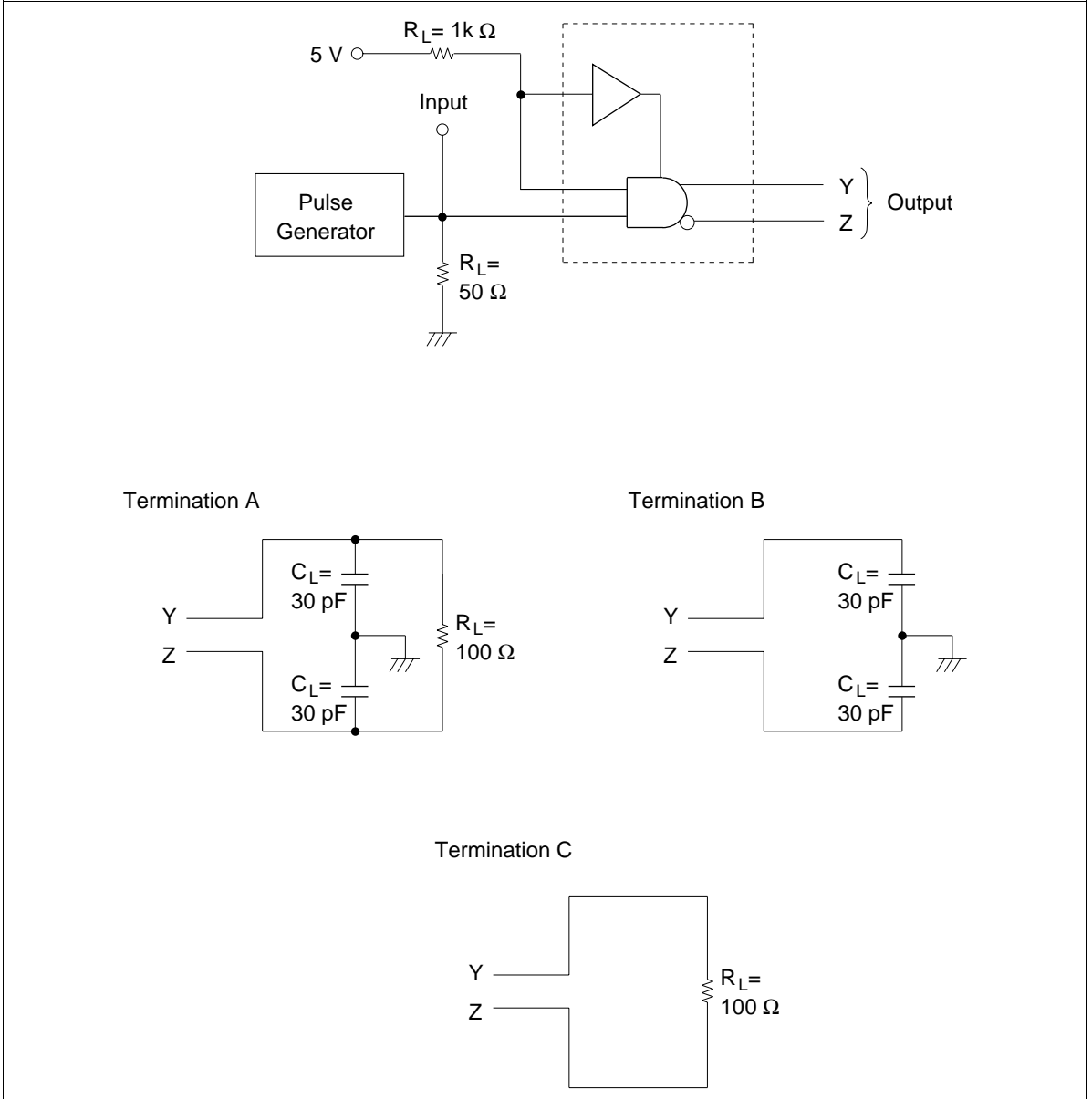
## Switching Characteristics ( $V_{CC} = 5.0\text{ V}, T_a = 25^\circ\text{C}$ )

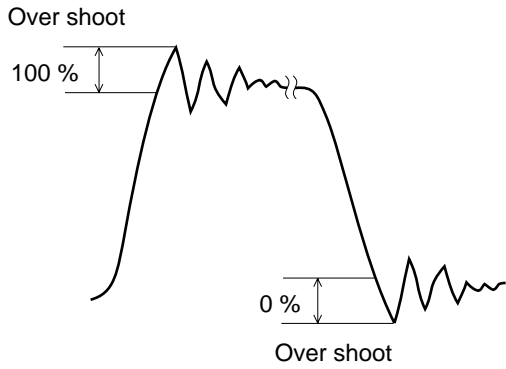
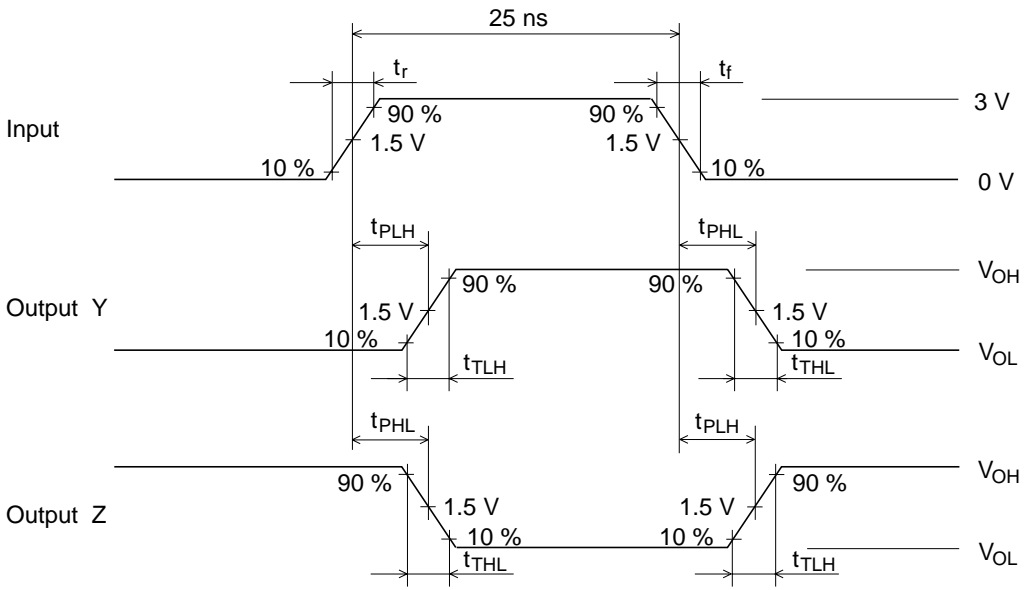
Item	Symbol	Min	Typ	Max	Unit	Conditions
Propagation Delay Time	$t_{PLH}$	—	15	30	ns	$C_L = 30\text{ pF}, R_L = 100\ \Omega$
	$t_{PHL}$	—	15	30		Termination A
	$t_{PLH}$	—	13	25		$C_L = 30\text{ pF}$ Termination B
	$t_{PHL}$	—	13	25		
Transition Time	$t_{TLH}$	—	12	20	ns	$C_L = 30\text{ pF}, R_L = 100\ \Omega$
	$t_{THL}$	—	12	20		Termination A
Output Enable Time	$t_{ZH}$	—	18	35	ns	$C_L = 30\text{ pF}, R_L = 60\ \Omega$
	$t_{ZL}$	—	20	35		$C_L = 30\text{ pF}, R_L = 111\ \Omega$
Output Disable Time	$t_{HZ}$	—	19	30	ns	$C_L = 30\text{ pF}, R_L = 60\ \Omega$
	$t_{LZ}$	—	13	30		$C_L = 30\text{ pF}, R_L = 111\ \Omega$
Overshoot Factor		—	—	10	%	$R_L = 100\ \Omega$ Termination C

# Switching Time Test Method

## Test Circuit

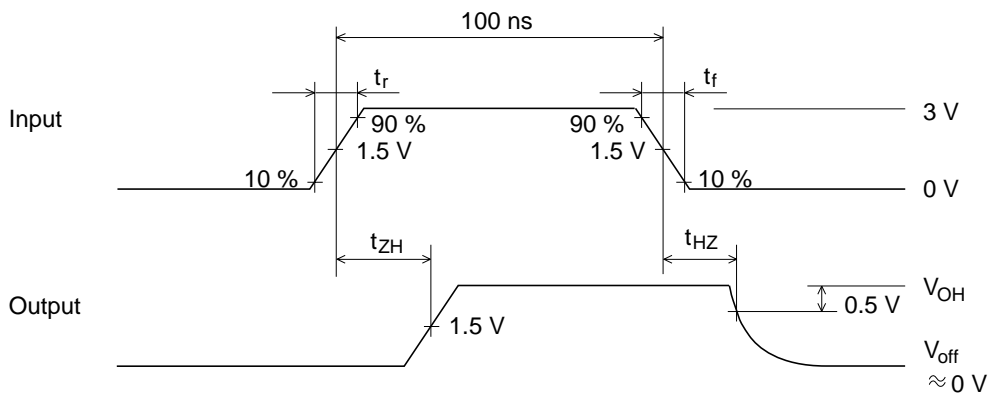
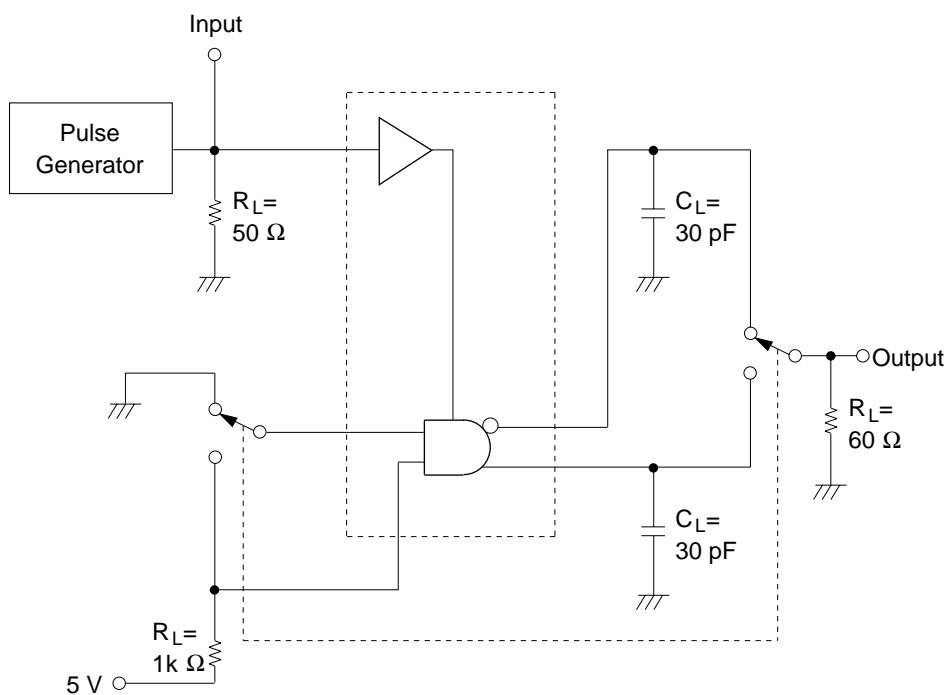
### 1. $t_{PLH}$ , $t_{PHL}$ , $t_{TLB}$ , $t_{THL}$ , and overshoot factor



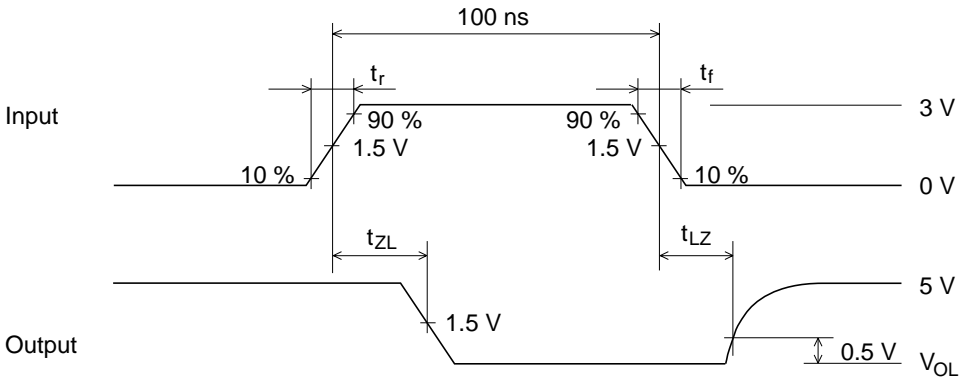
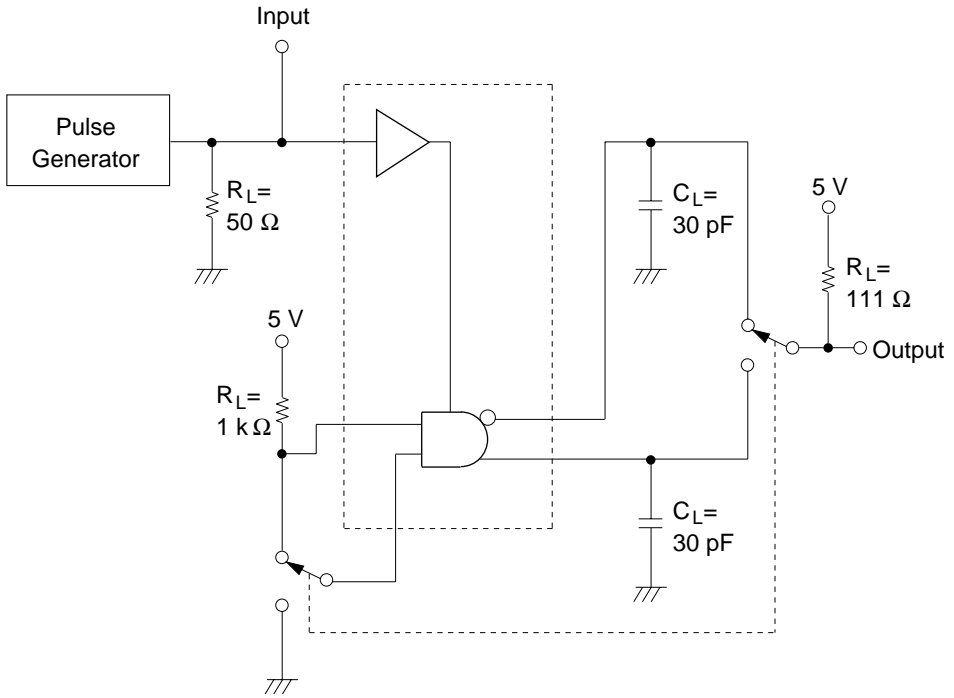


- Notes:
1. The pulse generator has the following characteristics:  
 $Z_{out} = 50 \Omega$ , PRR = 10 MHz
  2.  $C_L$  includes probe and jig capacitance.

2.  $t_{ZH}$ ,  $t_{HZ}$



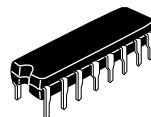
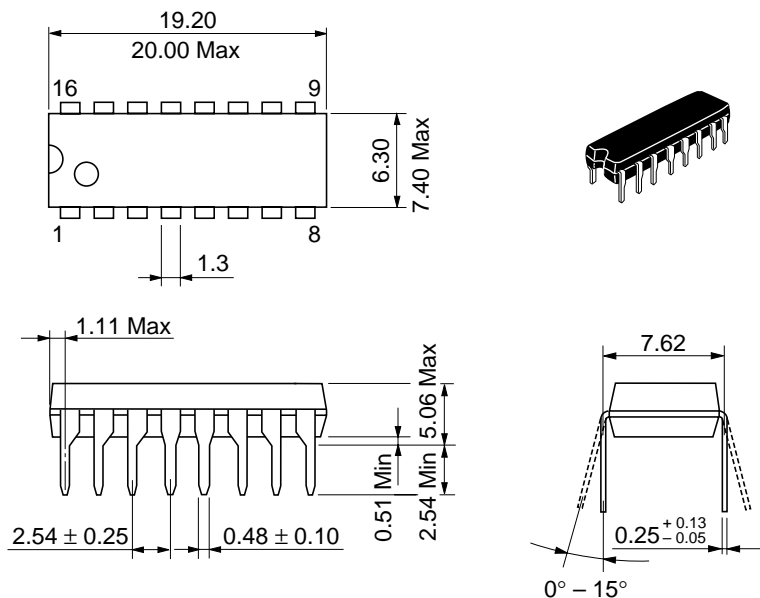
3.  $t_{zL}$ ,  $t_{Lz}$



- Notes:
1. The pulse generator has the following characteristics:  
 $Z_{out} = 50 \Omega$ , PRR = 500 kHz
  2.  $C_L$  includes probe and jig capacitance.

Package Dimensions

Unit: mm



Hitachi Code	DP-16
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	1.07 g

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