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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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HD29050

Dual Differential Line Drivers/Receivers With 3 State Outputs



ADE-205-034A (Z)
2nd. Edition
Mar. 1993

Description

The HD29050 features differential line drivers/receivers with three state output designed to meet the spec of EIA RS-422A and 423A. Each device has two drivers/receivers in a 16 pin package.

The device becomes in enable state when active high for a driver and active low for a receiver.

Features

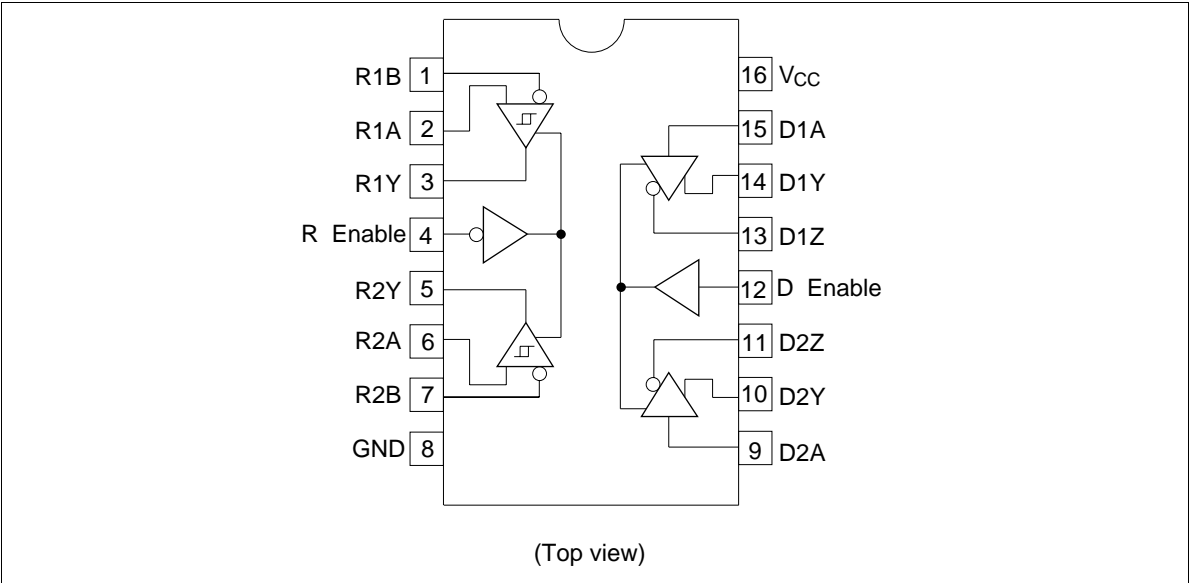
Driver

- Built in current restriction when short circuit
- Power up/down protection.
- High output current $I_{OH} = -40 \text{ mA}$
 $I_{OL} = 40 \text{ mA}$

Receiver

- Input hysteresis (Typ. 50 mV)
- In phase input voltage $\pm 200 \text{ mV}$ of input sensitivity in the range -7 to $+12 \text{ V}$.

Pin Arrangement



Function Table

Drivers				Receivers		
Input A	Enable	Output Y	Output Z	Differential Input A – B	Enable	Output Y
L	H	L	H	$V_{ID} \geq 0.2 \text{ V}$	L	H
H	H	H	L	$-0.2 \text{ V} < V_{ID} < 0.2 \text{ V}$	L	?
X	L	Z	Z	$V_{ID} \leq -0.2 \text{ V}$	H	Z
				X	H	Z

H : High level
L : Low level
Z : High impedance
X : Immaterial
? : Irrelevant

Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply Voltage* ¹	V_{CC}	7	V
Input Voltage A, B* ³	V_{IN}	±25	V
Differential Input Voltage* ^{2*3}	V_{ID}	±25	V
Output Current* ³	I_O	50	mA
Enable Input Voltage	V_{IE}	5.5	V
Input Voltage* ⁴	V_{IN}	5.5	V
Output Applied Voltage* ^{4*5}	V_O	−1.0 to 7.0	V
Operating Temperature Range	Topr	0 to 70	°C
Storage Temperature Range	Tstg	−65 to 150	°C

- Notes: 1. All voltage values except for differential input voltage are with respect to network ground terminal.
2. Differential input voltage is measured at the noninverting input with respect to the corresponding inverting input.
3. Only receiver
4. Only driver
5. Z state
6. 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	5.0	5.25	V
In Phase Input Voltage* ¹	V_{IC}	−7.0	—	12	V
Differential Input Voltage* ¹	V_{ID}	−6.0	—	6.0	V
Enable Input Voltage	V_{IE}	0	—	5.25	V
Input Voltage* ²	V_{IN}	0	—	5.25	V
Operating Temperature	Topr	0	25	70	°C

- Notes: 1. Only receiver
2. Only driver

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

Driver

Item	Symbol	Min	Typ	Max	Unit	Conditions
Input Voltage	V_{IHD}	2.0	—	—	V	
	V_{ILD}	—	—	0.8	V	
Input Clamp Voltage	V_{IKD}	—	—	−1.5	V	$V_{CC} = 4.75\text{ V}$, $I_I = -18\text{ mA}$
Output Voltage	V_{OHD}	2.5	—	—	V	$V_{CC} = 4.75\text{ V}$, $I_{OH} = -20\text{ mA}$
		2.4	—	—	V	$V_{CC} = 4.75\text{ V}$, $I_{OH} = -40\text{ mA}$
	V_{OLD}	—	—	0.45	V	$V_{CC} = 4.75\text{ V}$, $I_{OL} = 20\text{ mA}$
		—	—	0.5	V	$V_{CC} = 4.75\text{ V}$, $I_{OL} = 40\text{ mA}$
	I_{OZD}	−100	—	100	μA	$V_{CC} = 5.25\text{ V}$, $V_O = 0.5\text{ V}$, Enable = 0.8 V
Output Leak Current	$I_{O(Off)}$	−100	—	100	μA	$V_{CC} = 5.25\text{ V}$, $V_O = 2.7\text{ V}$, Enable = 0.8 V
		—	—	−100	μA	$V_{CC} = 0\text{ V}$, $V_O = -0.25\text{ V}$
	$I_{O(Off)}$	—	—	−100	μA	$V_{CC} = 0\text{ V}$, $V_O = 6.0\text{ V}$
		—	—	−100	μA	$V_{CC} = 0\text{ V}$, $V_O = 6.0\text{ V}$
Input Current	I_{ID}	—	—	100	μA	$V_{CC} = 5.25\text{ V}$, $V_I = 5.25\text{ V}$
	I_{IHD}	—	—	20	μA	$V_{CC} = 5.25\text{ V}$, $V_I = 2.7\text{ V}$
	I_{IHD}	—	—	−360	μA	$V_{CC} = 5.25\text{ V}$, $V_I = 0.4\text{ V}$
Differential Output Voltage	$\Delta V_{oc} $	—	—	0.4	V	
	$ V_{od2} $	2.0	—	—	V	
	$\Delta V_{od} $	—	—	0.4	V	
Short Circuit Output Current*1	I_{OSD}	−30	—	−150	mA	$V_{CC} = 5.25\text{ V}$, $V_O = 0\text{ V}$

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

Receiver

Item	Symbol	Min	Typ	Max	Unit	Conditions
Differential Input Threshold Voltage*2	V_{THR}	—	—	0.2	V	$V_O \geq 2.7$ V -7.0 V < V_{IC} < 12 V
		-0.2	—	—	V	$V_O \leq 0.45$ V -7.0 V < V_{IC} < 12 V
Input Current	I_{IBR}	—	—	1.0	mA	$V_{IN} = 12$ V, 0 V $\leq V_{CC} \leq 5.25$ V
		—	—	-0.8	mA	$V_{IN} = -7$ V, 0 V $\leq V_{CC} \leq 5.25$ V
Output Voltage	V_{OHR}	2.7	—	—	V	$V_{CC} = 4.75$ V, $I_O = -400$ mA $V_{ID} = 0.4$ V, -7.0 V < V_{ICM} < 12 V
	V_{OLR}	—	—	0.45	V	$V_{CC} = 4.75$ V, $I_O = 8.0$ mA $V_{ID} = -0.4$ V, -7.0 V < V_{ICM} < 12 V
Output Leak Current	I_{OZR}	-100	—	100	mA	$V_{CC} = 5.25$ V, $V_O = 0.4$ V $V_{ID} = 3.0$ V, Enable = 2.0 V
		-100	—	100	mA	$V_{CC} = 5.25$ V, $V_O = 2.4$ V $V_{ID} = -3.0$ V, Enable = 2.0 V
Short Circuit Output Current*1	I_{OSR}	-15	—	-85	mA	$V_{CC} = 5.25$ V, $V_O = 0$ V $V_{ID} = 3.0$ V
Input Voltage	V_{IHE}	2.0	—	—	V	
	V_{ILE}	—	—	0.8	V	
Input Current	I_{ILE}	—	—	-100	μ A	$V_{CC} = 5.25$ V, $V_{IL} = 0.4$ V
	I_{IHE}	—	—	20	μ A	$V_{CC} = 5.25$ V, $V_{IH} = 2.7$ V
	I_{IE}	—	—	100	μ A	$V_{CC} = 5.25$ V, $V_{IH} = 5.25$ V
Input Clamp Voltage	V_{IKE}	—	—	-1.5	V	$V_{CC} = 4.75$, $I_I = -18$ mA

Supply

Item	Symbol	Min	Typ	Max	Unit	Conditions
Supply Current	I_{CC}	—	55*3	80	mA	$V_{CC} = 5.25$ V

Notes: 1. Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

2. In this table, only the threshold voltage is expressed in algebra.

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

Switching Characteristics (Ta = 25°C, V_{CC} = 5 V)

Driver

Item	Symbol	Min	Typ	Max	Unit	Conditions
Propagation Delay Time	t _{PLHD}	—	—	20	ns	C _L = 30 pF, R _L = 75 Ω to GND R _L = 180 Ω to V _{CC}
	t _{PHLD}	—	—	20	ns	C _L = 30 pF, R _L = 75 Ω to GND R _L = 180 Ω to V _{CC}
Propagation Delay Time Difference	t _{SKD} ^{*1}	—	—	4	ns	C _L = 30 pF, R _L = 75 Ω to GND R _L = 180 Ω to V _{CC}
Output Enable Time	t _{ZHD}	—	—	20	ns	C _L = 30 pF, R _L = 75 Ω to GND
	t _{ZLD}	—	—	35	ns	C _L = 30 pF, R _L = 180 Ω to V _{CC}
Output Disable Time	t _{HZD}	—	—	20	ns	C _L = 10 pF, R _L = 75 Ω to GND
	t _{LZD}	—	—	25	ns	C _L = 10 pF

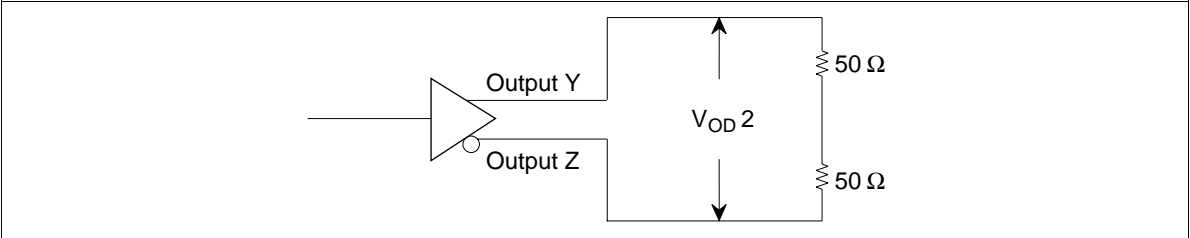
Receiver

Item	Symbol	Min	Typ	Max	Unit	Conditions
Propagation Delay Time	t _{PLHR}	—	—	40	ns	C _L = 15 pF
	t _{PHLR}	—	—	40	ns	C _L = 15 pF
Output Enable Time	t _{ZHR}	—	—	20	ns	C _L = 15 pF, R _L = 5 KΩ to GND
	t _{ZLR}	—	—	25	ns	C _L = 15 pF, R _L = 2 KΩ to V _{CC}
Output Disable Time	t _{HZR}	—	—	30	ns	C _L = 15 pF, R _L = 5 KΩ to GND R _L = 2 KΩ to V _{CC}
	t _{LZR}	—	—	30	ns	

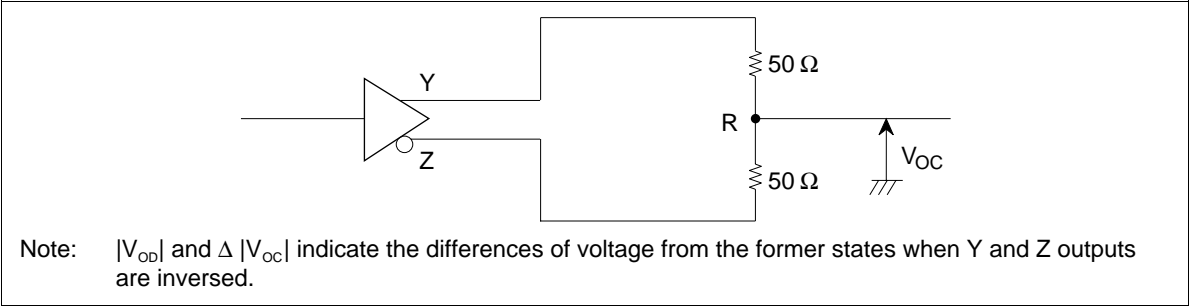
Note: 1. t_{SKD} = |t_{PLHD} - t_{PHLD}|

DC Test ($|V_{OD2}|$, $\Delta |V_{OD}|$, V_{OC} , $\Delta |V_{OC}|$)

$|V_{OD2}|$, $\Delta |V_{OD}|$ Test



V_{OC} , $\Delta |V_{OC}|$ Test

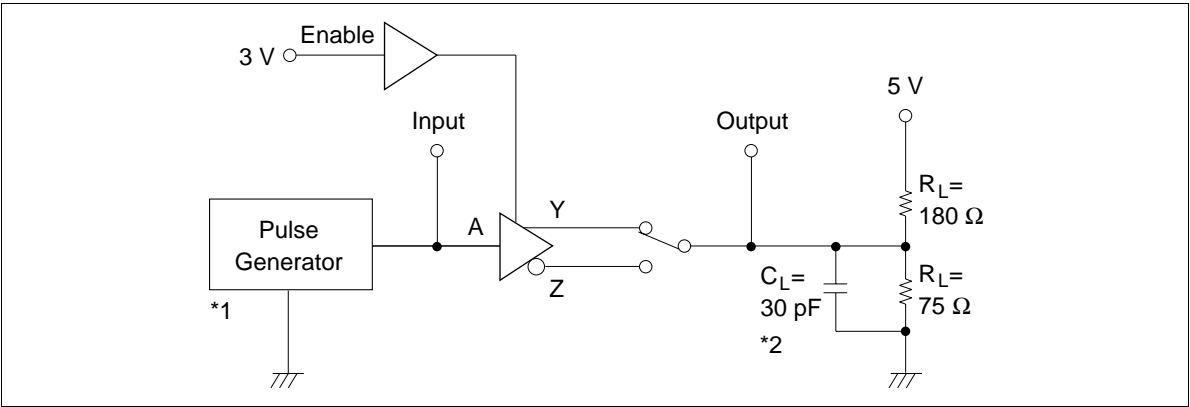


$\Delta |V_{OD}| = ||V_{OD2}| - |V_{OD2}||$

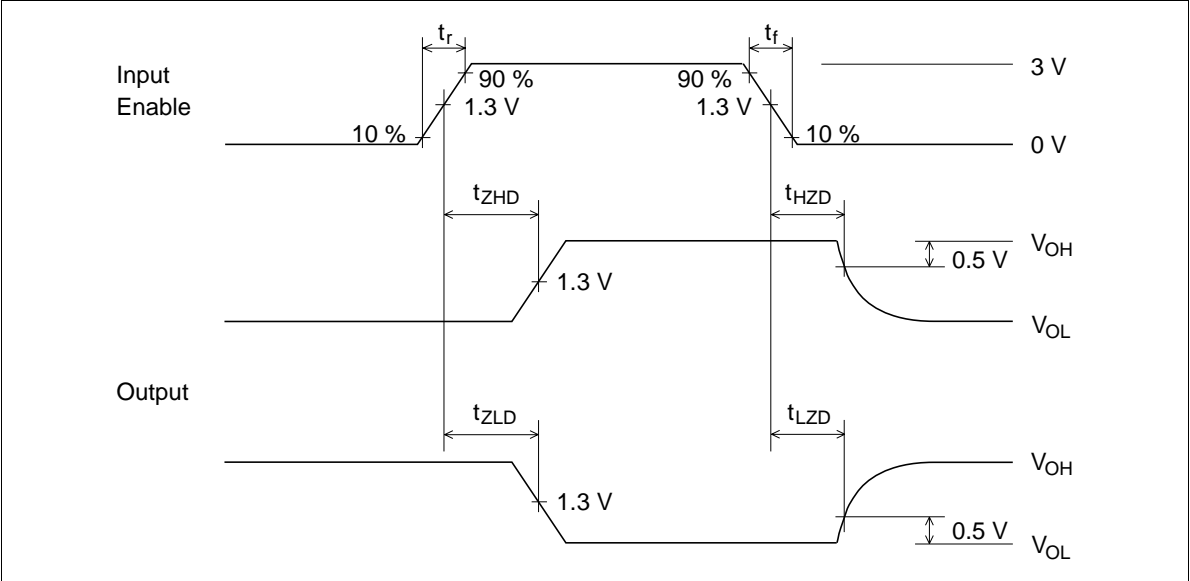
$\Delta |V_{OC}| = |V_{OC} - V_{OC}|$

1. t_{PLHD} , t_{PHLD}

Test circuit

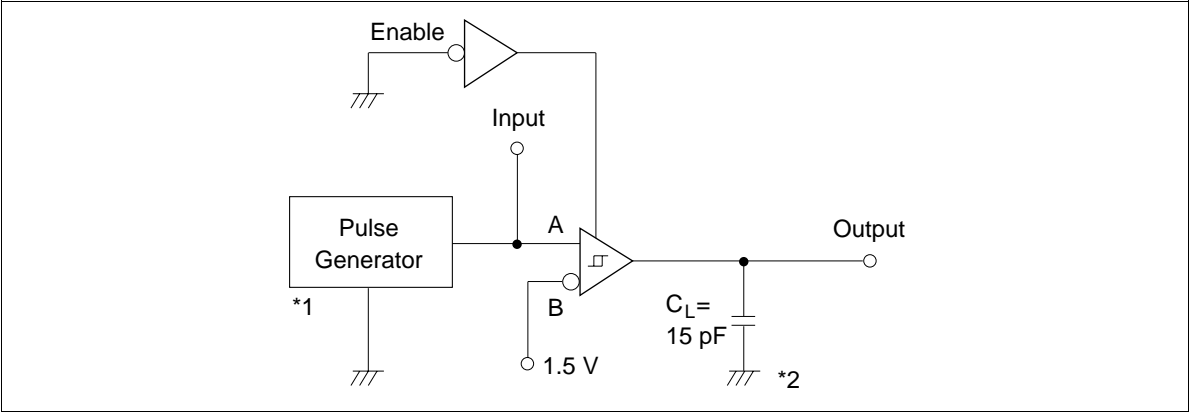


Waveforms

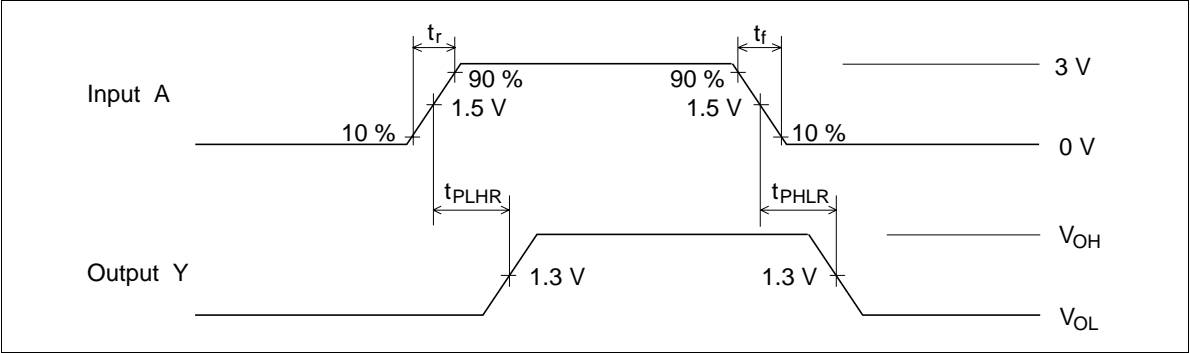


3. t_{PLHR} , t_{PHLR}

Test circuit

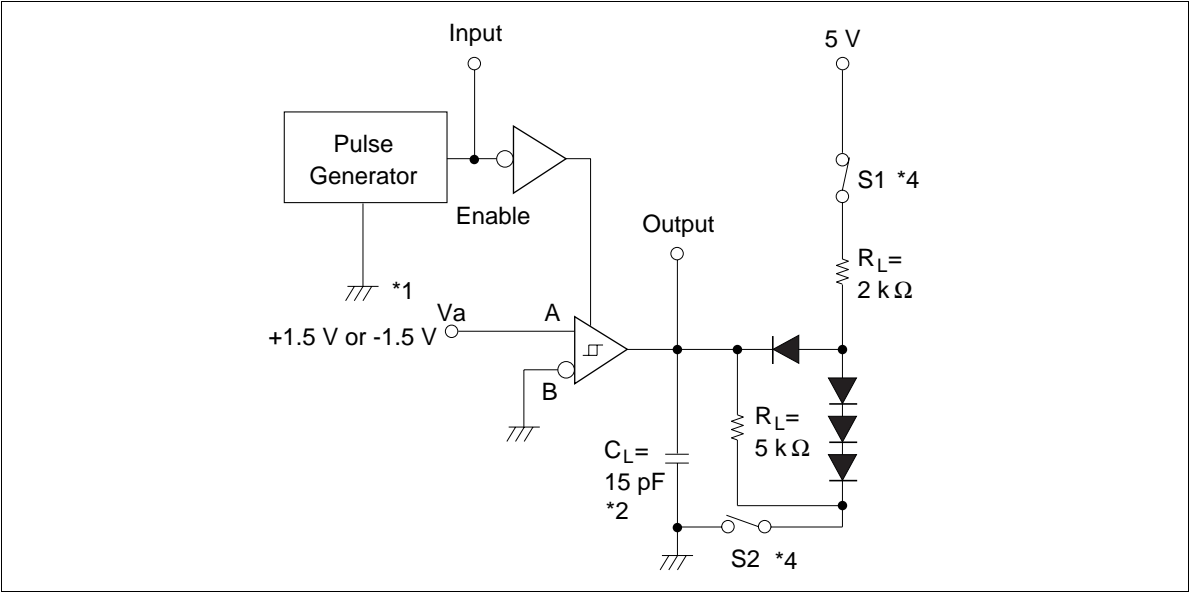


Waveforms

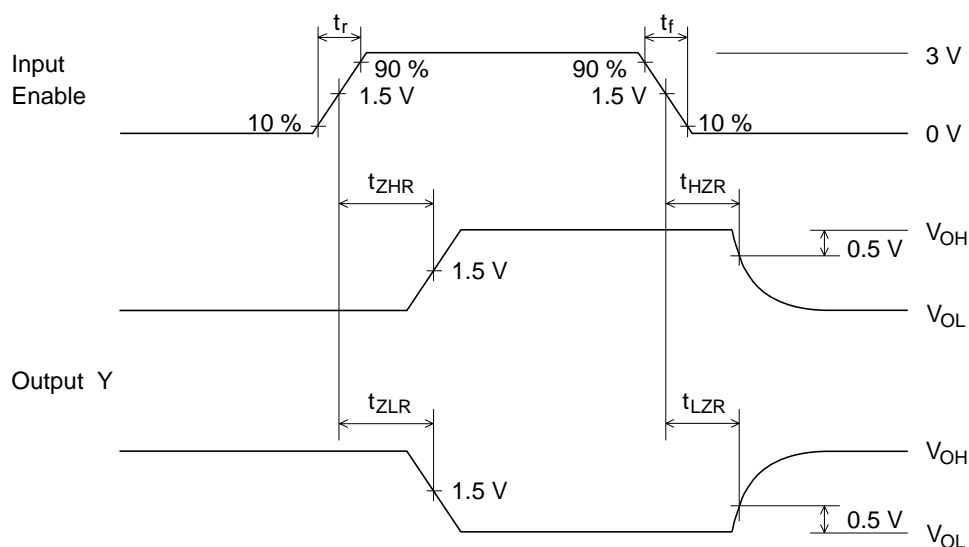


4. t_{ZHR} , t_{ZLR} , t_{HZR} , t_{LZR}

Test circuit



Waveforms

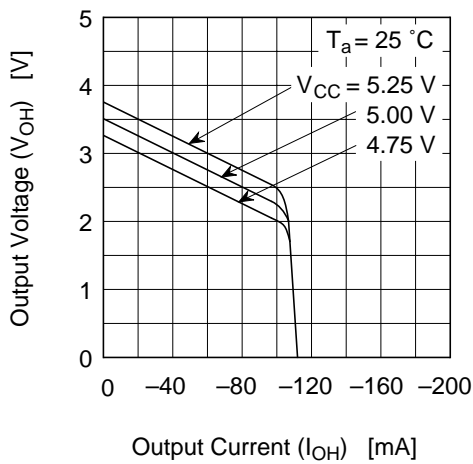


Notes:

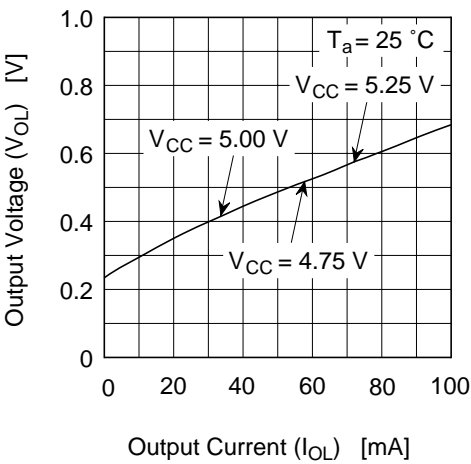
1. The pulse generator has the following characteristics:
 $PRR = 1 \text{ MHz}$, 50% duty cycle, $t_r = t_f = 6.0 \text{ ns}$.
2. C_L includes probe and jig capacitance.
3. 75Ω connected between the pin and GND at t_{ZHD} t_{HZD} test.
 180Ω connected between the pin and GND at t_{ZHD} t_{HZD} test.
4. At t_{HZR} , t_{LZR} test, S_1 and S_2 are closed.
 At t_{ZHR} test, S_1 is open and S_2 is closed.
 At t_{ZLR} test, S_1 is closed and S_2 is open.

Main Characteristics

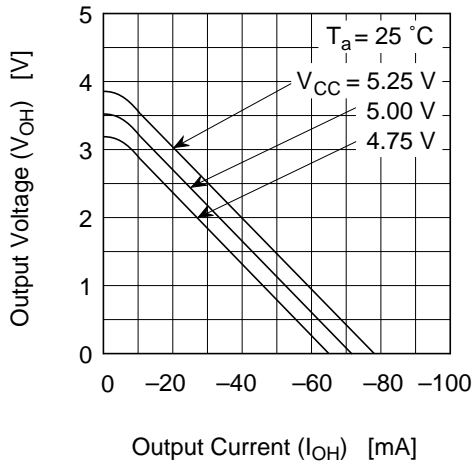
Output Characteristics (High level)
[Driver]



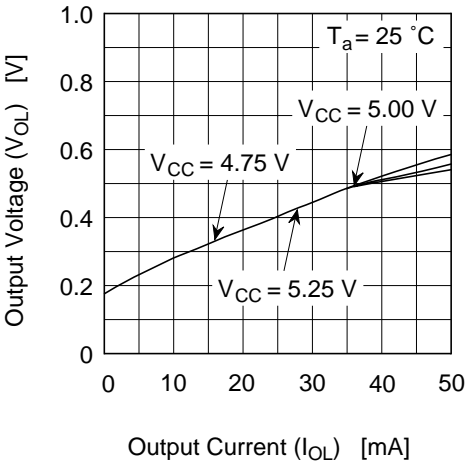
Output Characteristics (Low level)
[Driver]



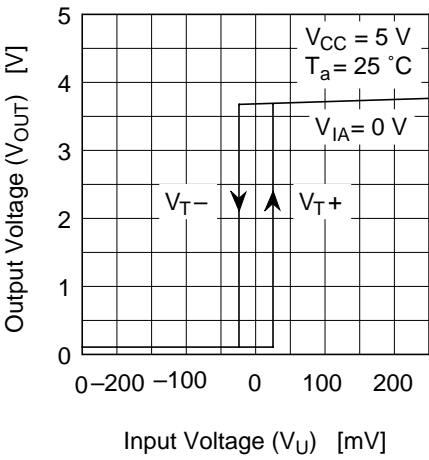
Output Characteristics (High level)
[Receiver]



Output Characteristics (Low level)
[Driver]

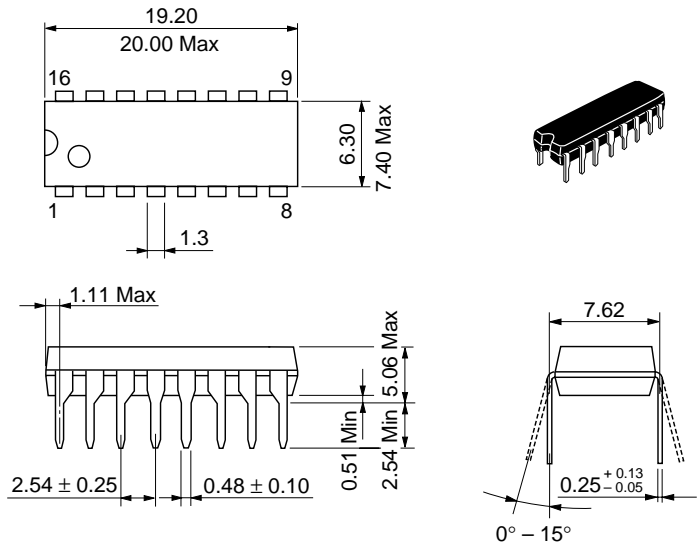


Input / Output Characteristics
[Receiver]



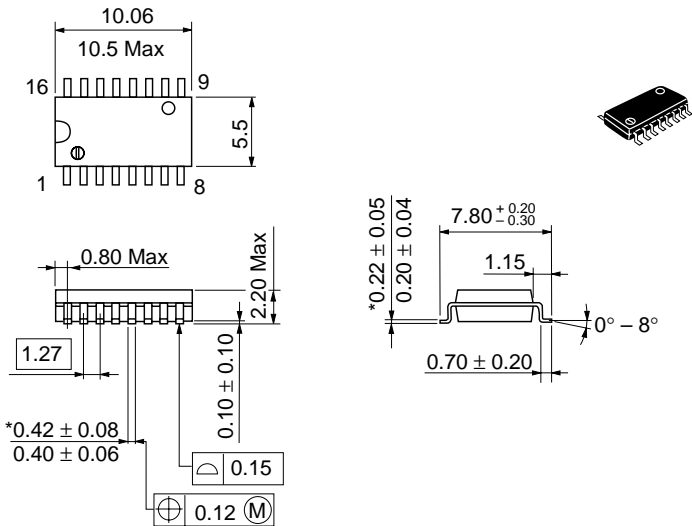
Package Dimensions

Unit: mm



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

Unit: mm



*Dimension including the plating thickness
Base material dimension

Hitachi Code	FP-16DA
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.24 g

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