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

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HD29412

Dual Differential Line Drivers With 3 State Output



ADE-205-581 (Z)
1st. Edition
Dec. 2000

Description

The HD29412 features dual differential line drivers with three state outputs designed to satisfy the requirements of EIA-422. Each driver has an output control is low, the associated outputs are in a high impedance state. This permits many devices to be connected together on the same transmission line for party line applications.

Function Table

Input				Output	
A	B	C	D	Y	Z
H	H	H	H	H	L
H	L	H	H	L	H
L	H	H	H	L	H
L	L	H	H	L	H
X	X	L	X	Z	Z
X	X	X	L	Z	Z

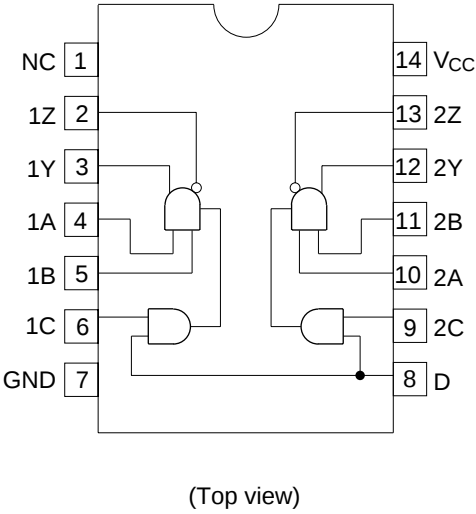
H : High level

L : Low level

X : Irrelevant

Z : High impedance

Pin Arrangement



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply Voltage	V_{CC}^{*1}	7	V
Input Voltage	V_{IN}	5.5	V
Power Dissipation	P_T	1150	mW
Operating Temperature	T_{opr}	0 to + 70	°C
Storage Temperature	T_{stg}	-65 to + 150	°C

Notes: 1. The values is defined as of ground terminal.
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

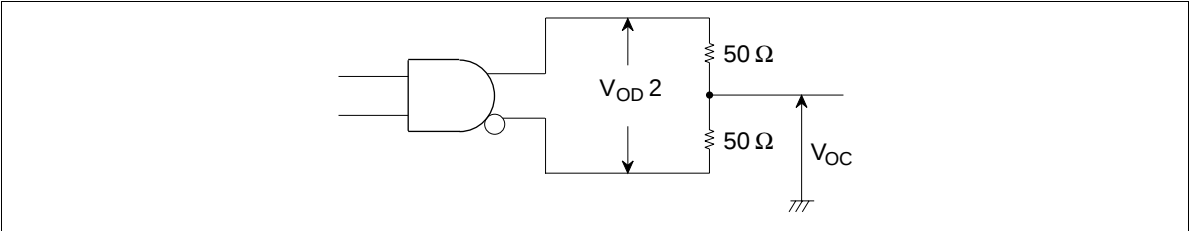
Item	Symbol	Min	Typ	Max	Unit
Supply Voltage	V_{CC}	4.75	5.00	5.25	V
Output Current	I_{OH}	—	—	−40	mA
	I_{OL}	—	—	40	mA
Operating Temperature	T_{opr}	0	—	70	°C

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	V	
Input Clamp Voltage	V_{IK}	—	—	-1.5	V	$V_{CC} = 4.75\text{ V}$, $I_I = -12\text{ mA}$
Output Voltage	V_{OH}	2.5	—	—	V	$V_{CC} = 4.75\text{ V}$, $V_{IL} = 0.8\text{ V}$ $V_{IH} = 2\text{ V}$, $I_{OH} = -40\text{ mA}$
	V_{OL}	—	—	0.5	V	$V_{CC} = 4.75\text{ V}$, $V_{IL} = 0.8\text{ V}$ $V_{IH} = 2\text{ V}$, $I_{OL} = 40\text{ mA}$
Output Clamp Voltage	V_{OK}	—	—	-1.5	V	$V_{CC} = 5.25\text{ V}$, $I_O = -40\text{ mA}$
Differential Output Voltage	V_{OD1}	—	—	2 V_{OD2}	V	$V_{CC} = 5.25\text{ V}$, $I_O = 0\text{ mA}$
	V_{OD2}	2	—	—	V	$V_{CC} = 4.75\text{ V}$ $R_L = 100\ \Omega$
Change In Magunitude of Differential Output Voltage*1	V_{OD}	—	—	0.4	V	$V_{CC} = 4.75\text{ V}$
Common Mode Output Voltage*3	V_{OC}	—	—	3	V	$V_{CC} = 5.25\text{ V}$
		—	3	—	V	$V_{CC} = 4.75\text{ V}$
Magunitude of Common Mode Output Voltage*2	$\Delta V_{OC} $	—	—	0.4	V	$V_{CC} = 4.75\text{ V}$ or 5.25 V
Output Current With Power Off	I_O	—	—	100	μA	$V_{CC} = 0$ $V_O = 6\text{ V}$
		—	—	-100		$V_O = -0.25\text{ V}$
		—	—	± 100		$V_O = -0.25\text{ V}$ to 6 V
Off State (HighImpedance) Output Current	I_{OZ}	—	—	± 10	μA	$V_{CC} = 5.25\text{ V}$ $T_a = 25^\circ\text{C}$, $V_O = 0$ to V_{CC}
		—	—	-20		Output $T_a = 70^\circ\text{C}$ $V_O = 0\text{ V}$
		—	—	± 20		Control $V_O = 0.4\text{ V}$
		—	—	± 20		$= 0.8\text{ V}$ $V_O = 2.4\text{ V}$
		—	—	20		$V_O = V_{CC}$
		—	—			
Input Current (A, B, C Input)	I_I	—	—	1	mA	$V_{CC} = 5.25\text{ V}$, $V_I = 5.5\text{ V}$
	I_{IH}	—	—	40	μA	$V_{CC} = 5.25\text{ V}$, $V_I = 2.4\text{ V}$
	I_{IL}	—	—	-1.6	mA	$V_{CC} = 5.25\text{ V}$, $V_I = 0.4\text{ V}$
Input Current (D Input)	I_I	—	—	2	mA	$V_{CC} = 5.25\text{ V}$, $V_I = 5.5\text{ V}$
	I_{IH}	—	—	80	μA	$V_{CC} = 5.25\text{ V}$, $V_I = 2.4\text{ V}$
	I_{IL}	—	—	-1.8	mA	$V_{CC} = 5.25\text{ V}$, $V_I = 0.4\text{ V}$
Short Circuit Output*4	I_{OS}	-40	—	-150	mA	$V_{CC} = 5.25\text{ V}$
Supply Current (All Input GND)	I_{CC}	—	31	65	mA	$V_{CC} = 5.25\text{ V}$, $T_a = 25^\circ\text{C}$

Notes: 1. All typical values are at $V_{CC} = 5.0\text{ V}$, $T_a = 25^\circ\text{C}$ 2. $\Delta |V_{OD}|$ and $\Delta |V_{OC}|$ denote the change of V_{OD} and V_{OC} in absolute values, respectively. Voltage generated when input level is changed from high to low.

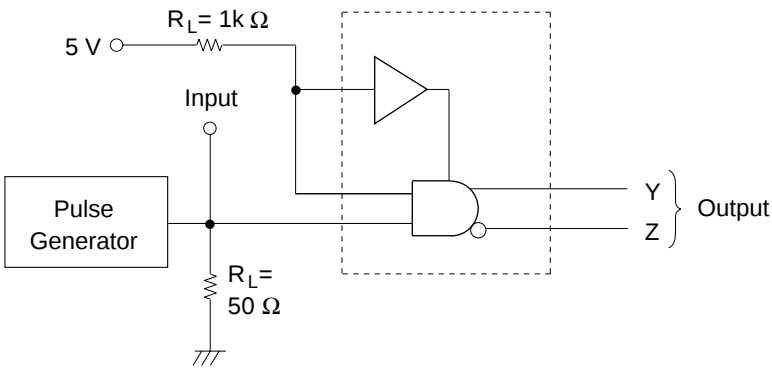
- 3. Voc is the average of two output voltages referenced to GND, and is identical to output offset voltage (V_{OS}) in EIA standard RS-422.
- 4. Not more than one output should be shorted at a time and duration of the short circuit should not exceed one second.



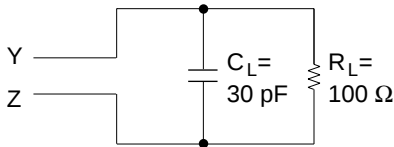
Switching Characteristics ($V_{CC} = 5\text{ V}$, $T_a = 25^\circ\text{C}$)

Item	Symbol	Test Circuit	Min	Typ	Max	Unit	Conditions
Propagation Delay Time	t_{PLH}	1 Connection A	—	16	25	ns	$C_L = 30\text{ pF}$, $R_L = 100\ \Omega$
	t_{PHL}		11	—	20		
	t_{PLH}	1 Connection B	—	13	20		$C_L = 15\text{ pF}$
	t_{PHL}		9	—	15		
Transition Time	t_{TLH}	1 Connection A	—	4	20	ns	$C_L = 30\text{ pF}$, $R_L = 100\ \Omega$
	t_{THL}		4	—	20		
Output Enable Time	t_{ZH}	2	—	7	20	ns	$C_L = 30\text{ pF}$, $R_L = 180\ \Omega$
	t_{ZL}	3	—	14	40		$C_L = 30\text{ pF}$, $R_L = 250\ \Omega$
Output Disable Time	t_{HZ}	2	—	10	30	ns	$C_L = 30\text{ pF}$, $R_L = 180\ \Omega$
	t_{LZ}	3	—	17	35		$C_L = 30\text{ pF}$, $R_L = 250\ \Omega$
Over Shoot Coefficient		2, Connection C	—	—	10	%	$R_L = 100\ \Omega$

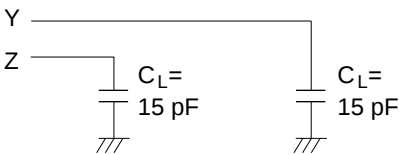
1. Switching Time Test Circuit



Connection A

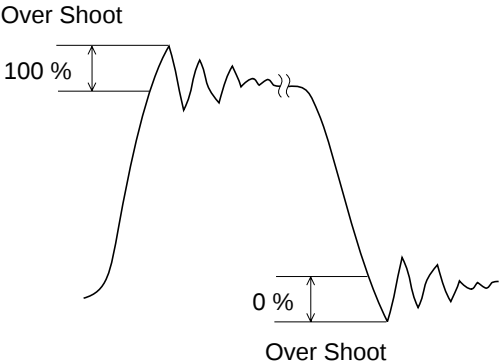
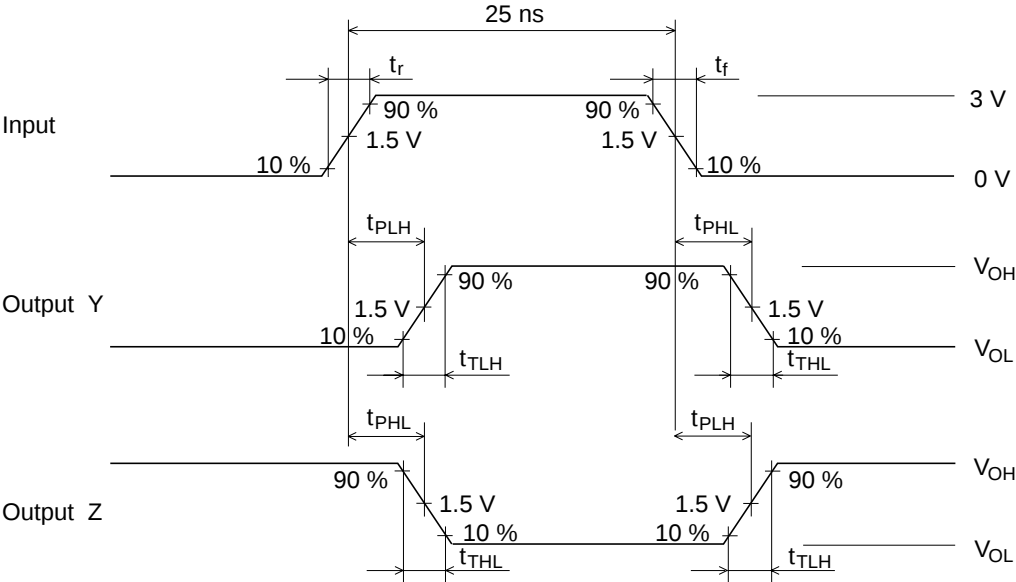


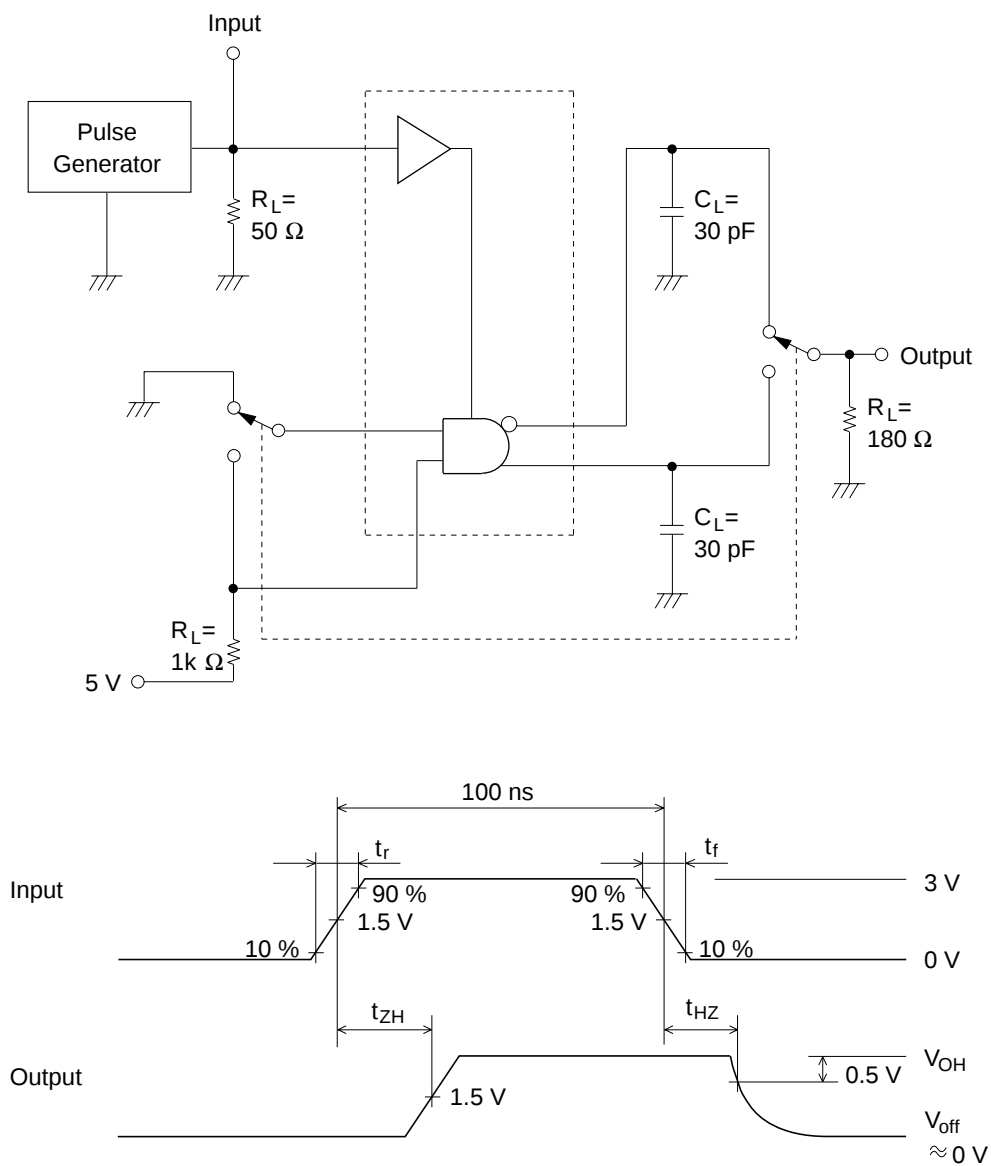
Connection B



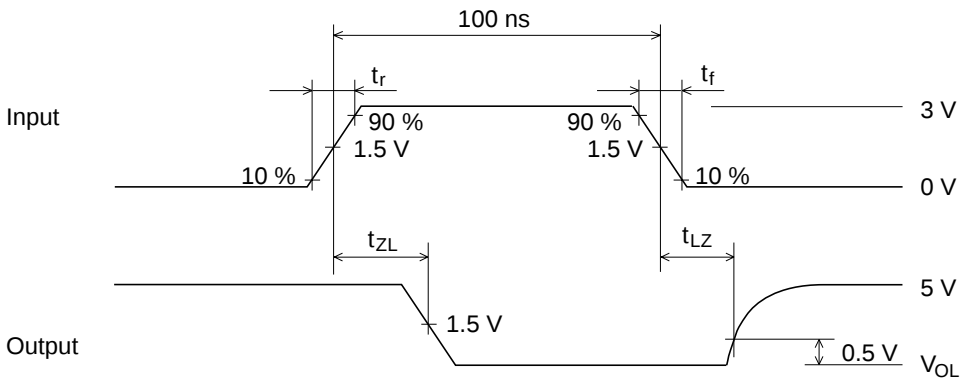
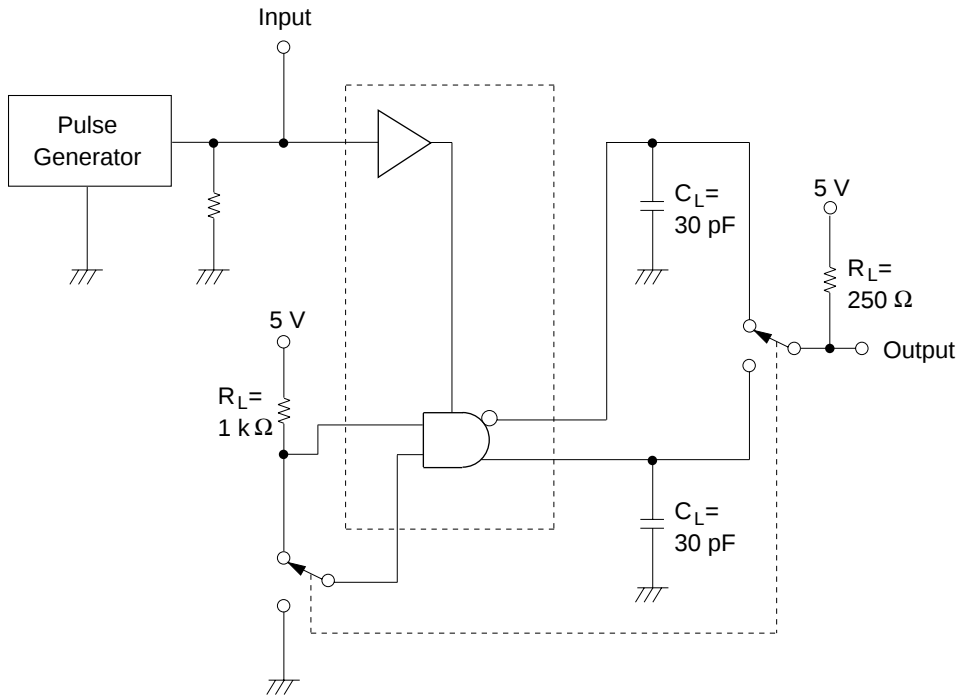
Connection C





2. t_{ZH} , t_{HZ} 

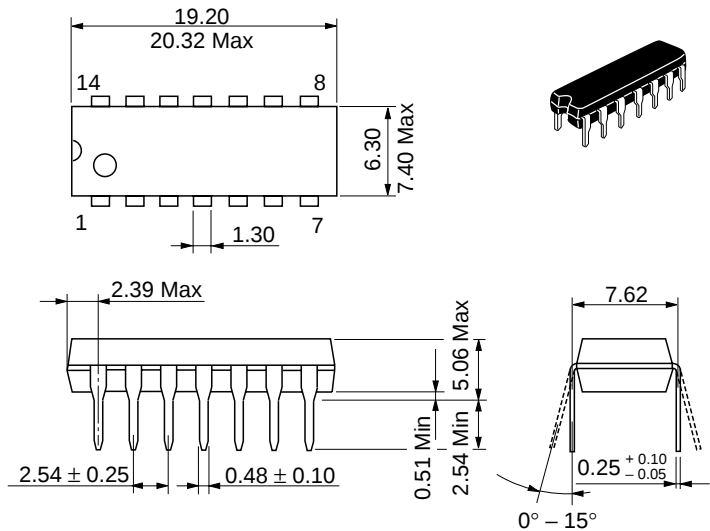
3. t_{ZL} , t_{LZ}



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

Package Dimensions

Unit: mm



Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.97 g

Cautions

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