

HD151015

9 bit Level Shifter/Transceiver With 3 State Outputs

 R04DS0043EJ0600
 (Previous: REJ03D0300-0500)

Rev.6.00

May 30, 2014

Description

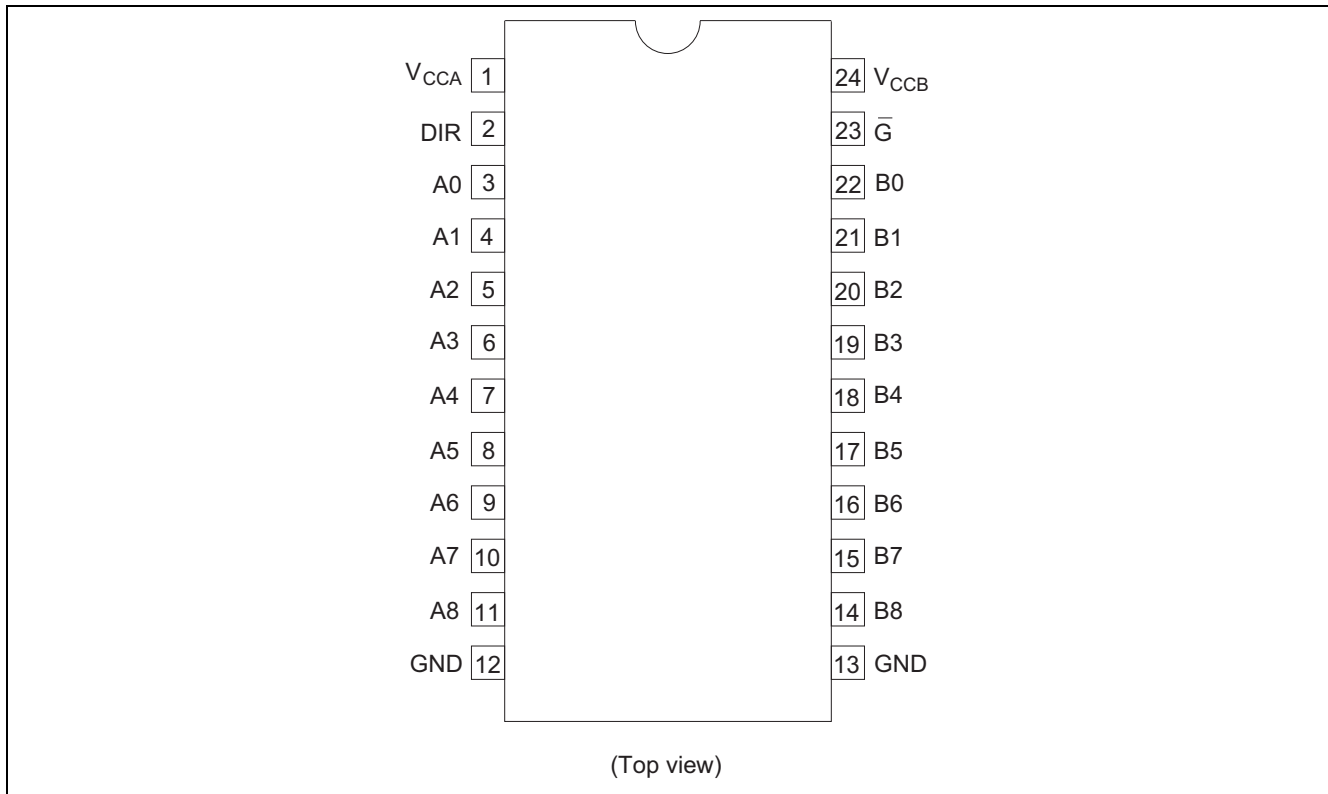
The HD151015 is an IC which consists of 9 bus transceivers (three state output) in a 24 pin package. Signals are transmitter from A to B when the direction control input (DiR) is at a high level, and from B to A when DiR is at a low level. When the enable input (\bar{G}) is high, A and B are isolated. And this product has two terminals (V_{CCA} , V_{CCB}), V_{CCA} is connected with control input and A bus side, V_{CCB} is connected with B bus side. V_{CCA} and V_{CCB} are isolated. Consequently, it is best to change the level in case of two supply voltage coexist on one board and application of power management.

Features

- This product function as level shift transceiver that change V_{CCA} input level to V_{CCB} output level, V_{CCB} input level to V_{CCA} output level by providing different supply voltages to V_{CCA} and V_{CCB} .
- This product is able to the power management : Turn on and off the supply on V_{CCB} side with providing the supply of V_{CCA} .
(Enable input (\bar{G}) : High level)
- Inputs and outputs are CMOS level, and the power dissipation is the same as CMOS standard logic.
- Wide operating supply voltage range:
 $V_{CCA} = V_{CCB} = 2$ to 6 V ($V_{CCB} \geq V_{CCA} - 0.5$ V)
- Wide operating temperature range: $T_a = -40$ to 85°C
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
151015TEL-E	TSSOP-24 pin	PTSP0024JB-A (TTP-24DBV)	T	EL (1,000 pcs/reel)

Pin Arrangement



Function Table

Inputs		Outputs
\bar{G}	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Z

H : High level
 L : Low level
 Z : High Impedance
 X : Immaterial

Absolute Maximum Ratings

Item	Symbol	Rating	Unit	Conditions
Supply Voltage	V_{CCA}, V_{CCB}	-0.5 to +7.0	V	
Input Diode Current	I_{IK}	-20	mA	$V_I = -0.5$
		20	mA	$V_I = V_{CC} + 0.5$
Input Voltage	V_{IN}	-0.5 to $V_{CC} + 0.5$	V	
Output Diode Current	I_{OK}	-50	mA	$V_O = -0.5$
		50	mA	$V_O = V_{CC} + 0.5$
Output Voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V	
Output Current	I_O	±50	mA	
VCC or Ground Current	I_{CC} or I_{GND}	±50	mA	per output pin
Storage Temperature	Tstg	-65 to + 150	°C	

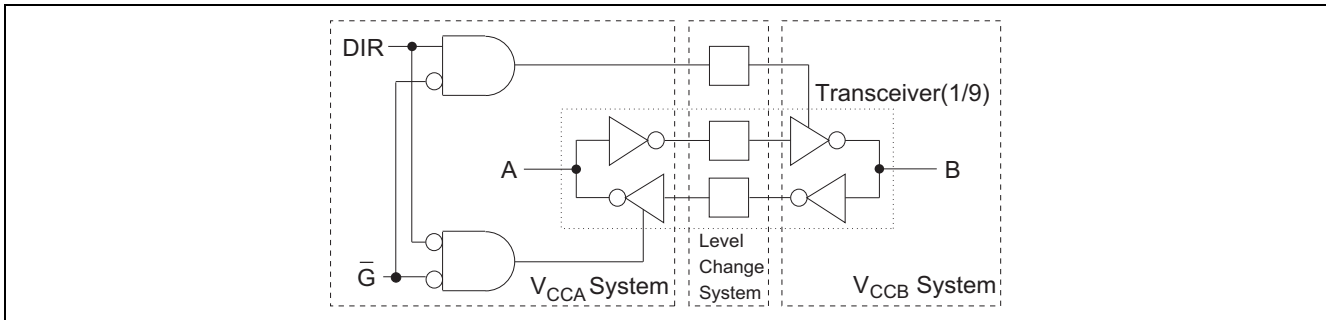
Note: 1. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

Recommended Operating Conditions

Item	Symbol	Rating	Unit	Conditions
Supply voltage	$V_{CCA, B}$	2.0 to 6.0	V	$V_{CCB} \geq V_{CCA} - 0.5 V$
Input voltage	V_{IN}	0 to V_{CC}	V	
Output voltage	V_{OUT}	0 to V_{CC}	V	
Operating Temperature	T_A	-40 to +85	°C	
Input Rise and Fall Time* ¹	t_r, t_f	8	ns/V	$V_{CC}@3.0 V$ (Input DiR, \bar{G} , A)
				$V_{CC}@4.5 V$ (Input B)
				$V_{CC}@5.5 V$ (Input B)

Note: 1. The item guarantees maximum limit when one input switches.
 Waveform: Refer to test circuit of switching characteristics.

Logick Diagram



Electrical Characteristics

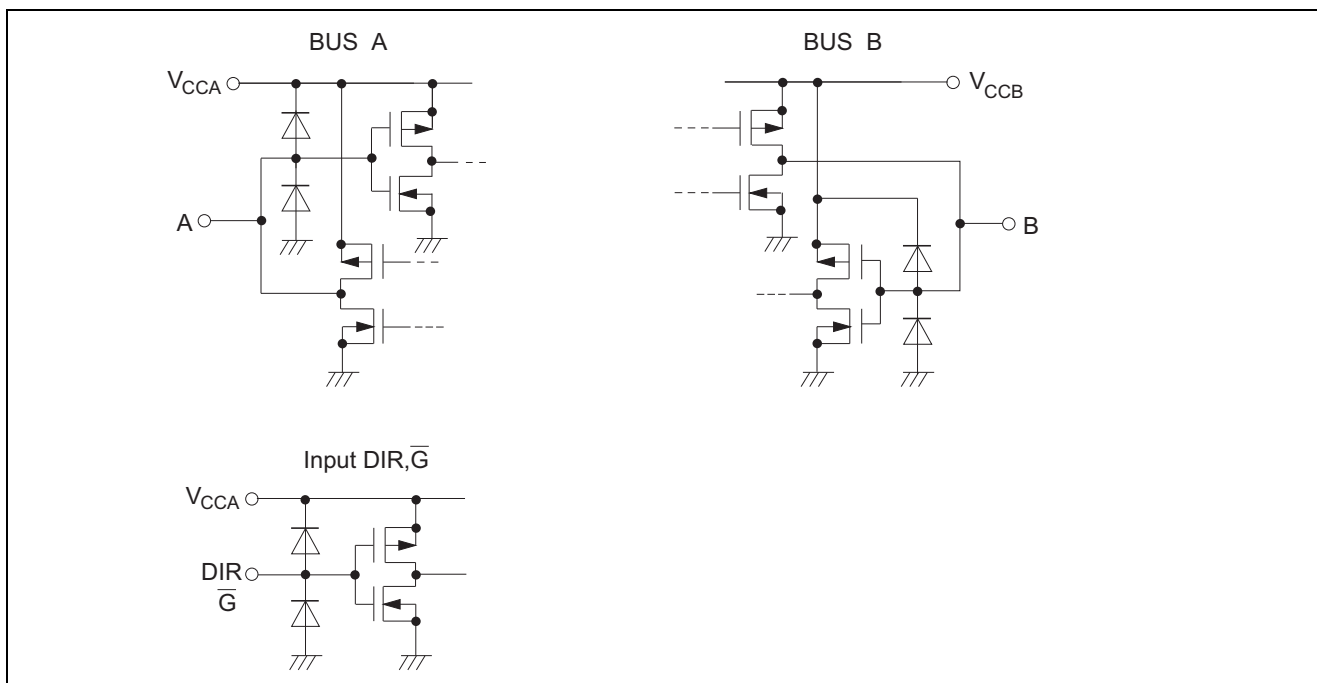
Item	Sym- bol	V_{CCA} (V)	V_{CCB} (V)	$T_a = 25^\circ C$			$T_a = -40 \text{ to } 85^\circ C$		Unit	Conditions		
				Min	Typ	Max	Min	Max				
Input Voltage	V_{IH}	3.0	3.0	2.1	1.5	—	2.1	—	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$		
		4.5	4.5	3.15	2.25	—	3.15	—				
		5.5	5.5	3.85	2.75	—	3.85	—				
	V_{IL}	3.0	3.0	—	1.5	0.9	—	0.9	V	$V_{OUT} = 0.1 V$ or $V_{CC} - 0.1 V$		
		4.5	4.5	—	2.25	1.35	—	1.35				
		5.5	5.5	—	2.75	1.65	—	1.65				
Output Voltage	V_{OH}	2.7	4.5	2.6	2.69	—	2.6	—	V	$V_{IN} = V_{IL}$ or V_{IH} , $I_{OH} = -50 \mu A$	A* ¹	
		2.7	4.5	4.4	4.49	—	4.4	—		$V_{IN} = V_{IL}$ or V_{IH} , $I_{OH} = -50 \mu A$	B	
		2.7	4.5	2.3	—	—	2.2	—	V	$V_{IN} =$	$I_{OH} = -4 mA$	A
		2.7	4.5	3.9	—	—	3.8	—		V_{IL} or V_{IH}	$I_{OH} = -12 mA$	B
	V_{OL}	2.7	4.5	—	0.001	0.1	—	0.1	V	$V_{IN} = V_{IL}$ or V_{IH} , $I_{OL} = 50 \mu A$	A.B	
		2.7	4.5	—	—	0.32	—	0.37		$V_{IN} = V_{IL}$ or V_{IH} , $I_{OL} = 12 mA$	A.B	
Input Current	I_{IN}	3.3	5.5	—	—	± 0.1	—	± 1.0	μA	$V_{IN} = V_{CC}$ or GND		
Off State Output Current	I_{OZ}	3.3	5.5	—	—	± 0.5	—	± 5.0	μA	$V_{IN}(\bar{G}) = V_{IH}$, $V_{IN} = V_{CC}$ or GND, $V_{OUT} = V_{CC}$ or GND		
Supply Current	$I_{CCA, B}$	3.3	5.5	—	—	8.0	—	80	μA	$V_{IN} = V_{CC}$ or GND		
	I_{CCA}	5.5	0	—	—	8.0	—	80	μA	$V_{IN} = V_{CC}$ or GND, B Input OPEN		

Note: 1. A: Output A, B: Output B, A.B: Output A.B

Switching Characteristics

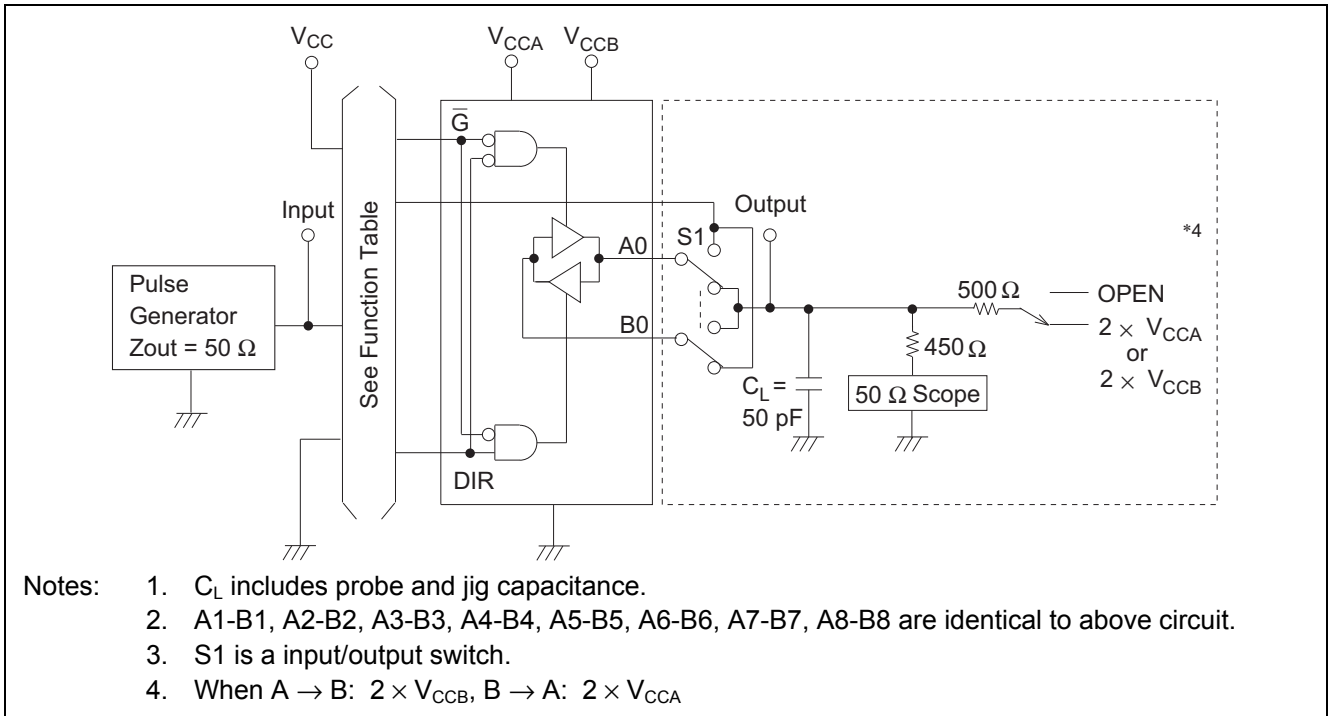
Item	Symbol	Ta = 25°C			Ta = -40 to 85°C		Unit	Conditions
		V _{CCA} = 3.0 V, V _{CCB} = 5.0 V			V _{CC} = 2.7 V, V _{CCB} = 4.5 V			
		Min	Typ	Max	Min	Max		
Propagation Delay Time	t _{PLH}	1.0	5.0	10.0	1.0	12.0	ns	B → A
		1.0	5.0	10.0	1.0	12.0		A → B
	t _{PHL}	1.0	5.0	10.0	1.0	12.0	ns	B → A
		1.0	5.0	10.0	1.0	12.0		A → B
Output Enable Time	t _{ZH}	1.0	8.0	16.0	1.0	20.0	ns	\overline{G} → A
		1.0	8.0	16.0	1.0	20.0		\overline{G} → B
	t _{ZL}	1.0	9.0	16.0	1.0	20.0	ns	\overline{G} → A
		1.0	9.0	16.0	1.0	20.0		\overline{G} → A
Output Disable Time	t _{HZ}	1.0	9.0	16.0	1.0	20.0	ns	\overline{G} → A
		1.0	9.0	16.0	1.0	20.0		\overline{G} → B
	t _{LZ}	1.0	8.0	16.0	1.0	20.0	ns	\overline{G} → A
		1.0	8.0	16.0	1.0	20.0		\overline{G} → B

Input and Output Equivalent Circuit

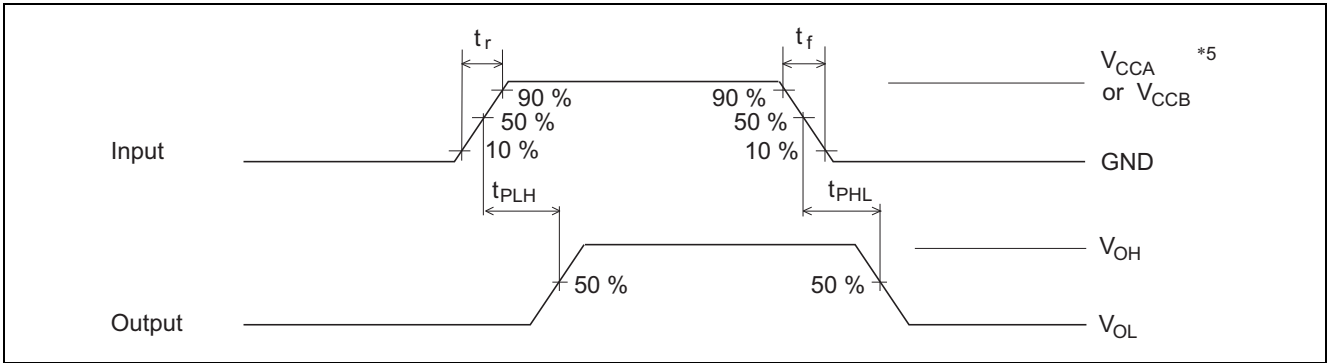


Switching Time Test Method

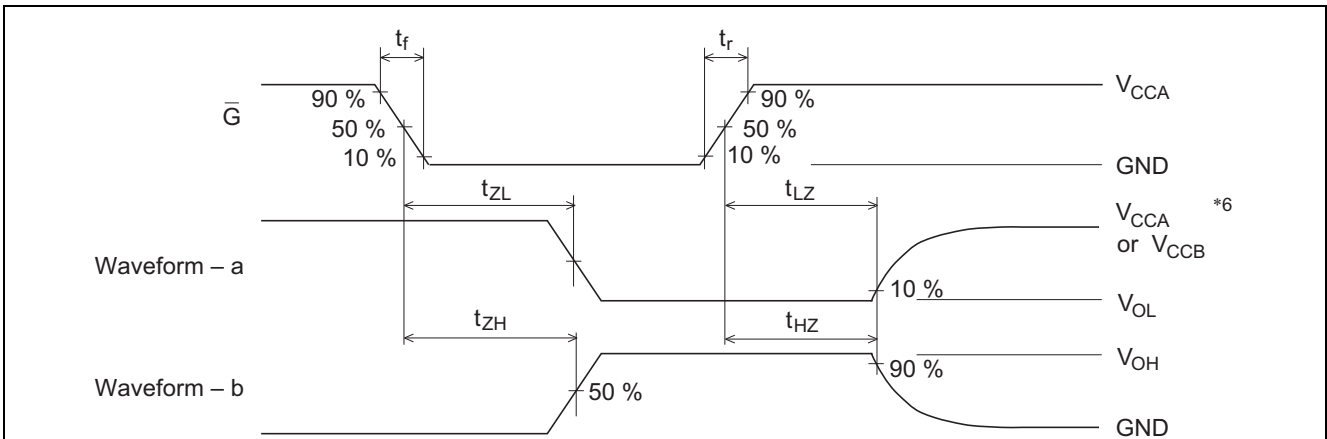
Test Circuit



Waveforms-1



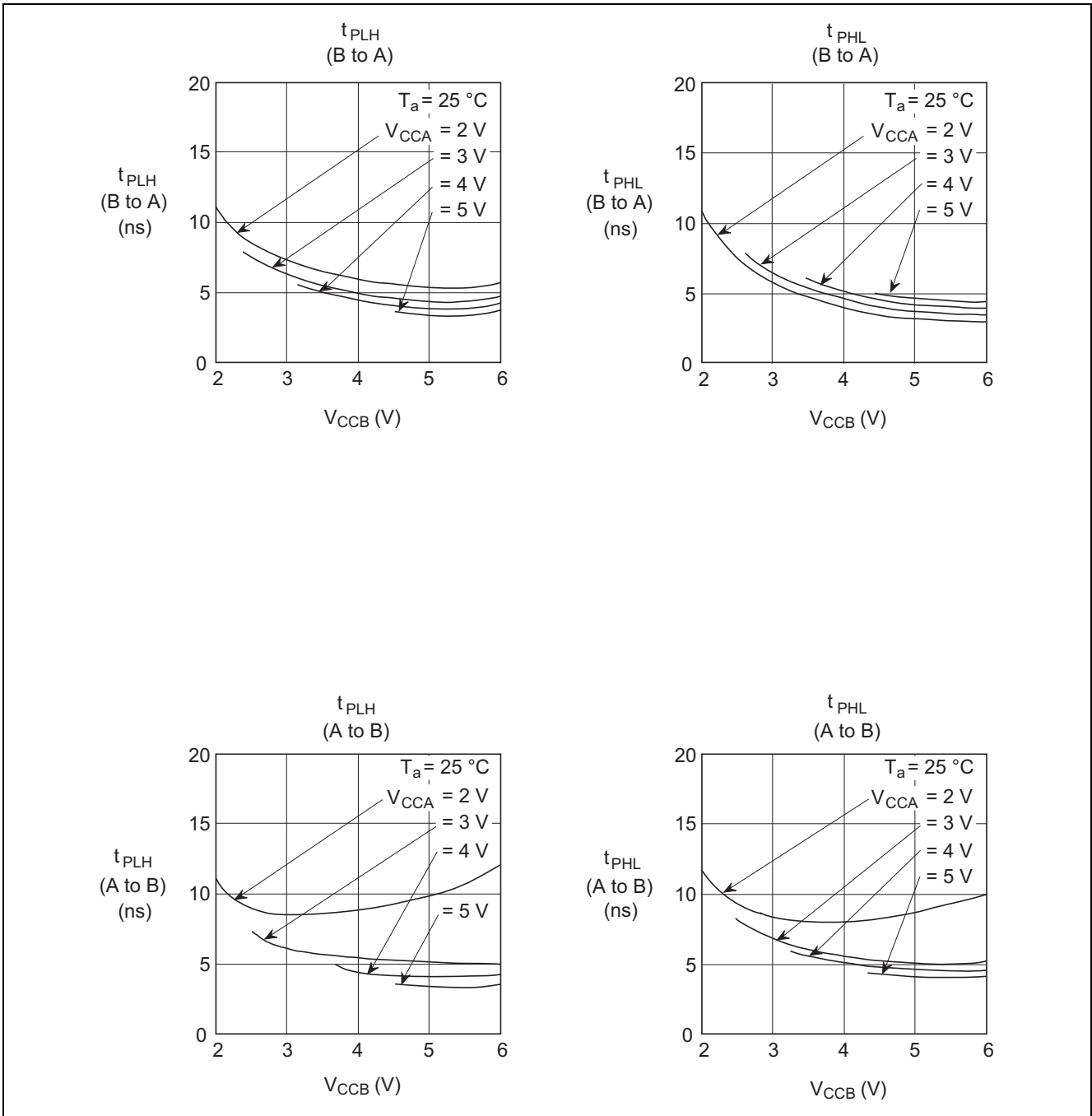
Waveforms-2



- Notes:
1. $t_r = t_f = 2.5$ ns.
 2. Input Waveform: PRR = 1 MHz, duty cycle 50%
 3. Waveform-a is set as outputs are "Low" when enable input is "Low".
 4. Waveform-b is set as outputs are "High" when enable input is "Low".
 5. When A \rightarrow B: V_{CCA} , B \rightarrow A : V_{CCB}
 6. When $\bar{G} \rightarrow$ A: V_{CCA} , $\bar{G} \rightarrow$ B : V_{CCB}

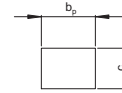
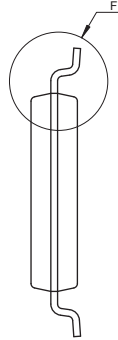
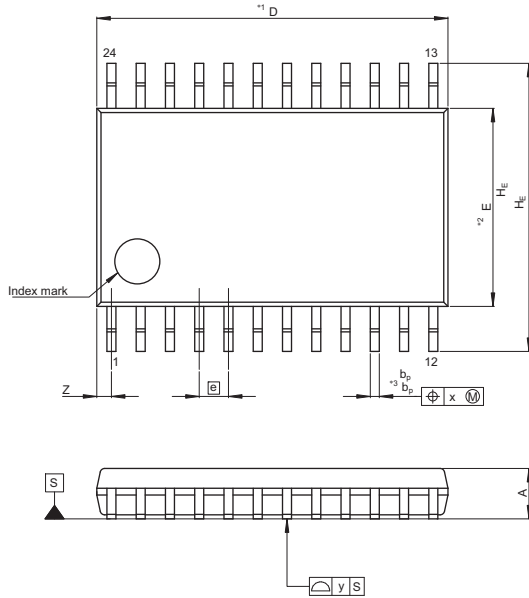
Typical Characteristic Curves

Propagation Delay Times vs Power Supply (V_{CCA} , V_{CCB})

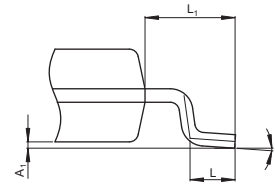


Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-TSSOP24-4.4x7.8-0.65	PTSP0024JB-A	TTP-24DBV	0.08g



Terminal cross section
(Ni/Pd/Au plating)



NOTE)
1. DIMENSIONS**1 (Nom)**AND**2"
DO NOT INCLUDE MOLD FLASH.
2. DIMENSION**3**DOES NOT
INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	7.80	8.10
E	—	4.40	—
A ₂	—	—	—
A ₁	0.03	0.07	0.10
A	—	—	1.10
b _p	0.15	0.20	0.25
b ₁	—	—	—
c	0.10	0.15	0.20
c ₁	—	—	—
θ	0°	—	8°
H _E	6.20	6.40	6.60
e	—	0.65	—
x	—	—	0.13
y	—	—	0.10
Z	—	—	0.65
L	0.4	0.5	0.6
L ₁	—	1.0	—

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