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788-697

HD151015

9bit Level Shifter / Transceiver With 3 State Outputs

HITACHI

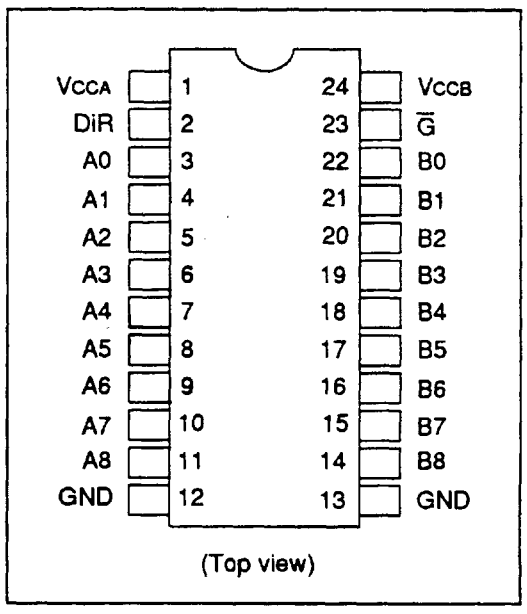
Preliminary
June 1993
Rev.3

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($\overline{G}$) 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($\overline{G}$) : 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 ($V_{CCB} \geqq V_{CCA} - 0.5$ V)
- Wide operating temperature range: Ta = –40 to 85 °C

Pin Arrangement



(Top view)

Function Table

Inputs		Outputs
$\overline{G}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	×	Z

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

Hitachi semiconductor

93.06.18
ADE-205-039C(Z)

Absolute Maximum Ratings

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

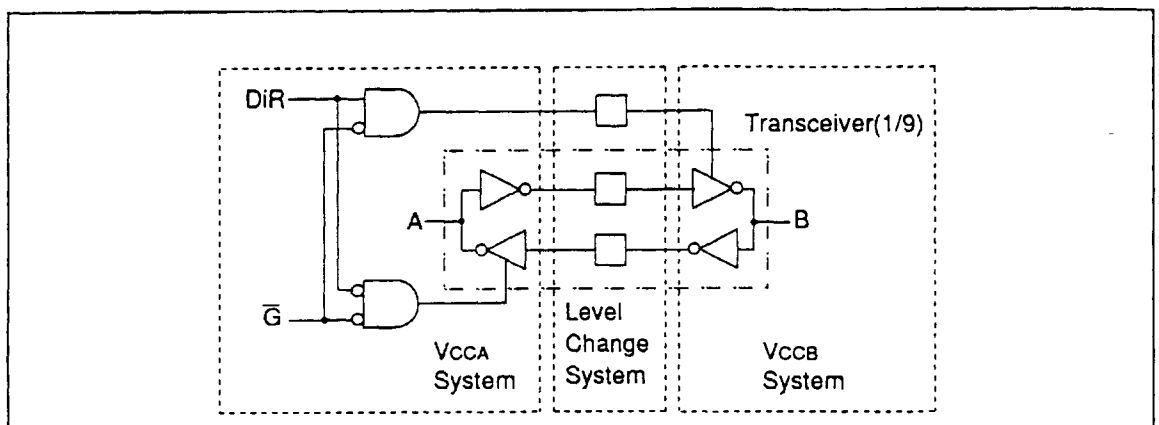
Note: 1. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

Recommended Operating Conditions

Item	Symbol	Conditions	Rating	Unit
Supply voltage	$V_{CCA, B}$	$V_{CCB} \geqq V_{CCA}$ − 0.5 V	2.0 to 6.0	V
Input voltage	V_{IN}		0 to Vcc	V
Output voltage	V_{OUT}		0 to Vcc	V
Operating Temperature	T_A		−40 to +85	°C
Input Rise and Fall Time*1	tr, tf	Vcc@3.0 V (Input DiR,$\overline{G}$,A)	8	ns/V
		Vcc@4.5 V (Input B)		
		Vcc@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	Symbol	Conditions		VCCA (V)	VCCB (V)	Ta = 25 °C Min.	Typ.	Max.	Ta = –40 to 85 °C Min.	Max.	Unit
Input Voltage	V_{IH}	V_{OUT} = 0.1 V or V_{CC} – 0.1 V		3.0	3.0	2.1	1.5	—	2.1	—	V
				4.5	4.5	3.15	2.25	—	3.15	—	
				5.5	5.5	3.85	2.75	—	3.85	—	
	V_{IL}	V_{OUT} = 0.1 V or V_{CC} – 0.1 V		3.0	3.0	—	1.5	0.9	—	0.9	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}	V_{IN} = V_{IL} or V_{IH} I_{OUT} = –50 µA	A*1	2.7	4.5	2.6	2.69	—	2.6	—	V
			B	2.7	4.5	4.4	4.49	—	4.4	—	
		V_{IN} = V_{IL} I_{OH} = –4 mA	A	2.7	4.5	2.3	—	—	2.2	—	V
		or V_{IH} I_{OH} = –12 mA	B	2.7	4.5	3.9	—	—	3.8	—	
	V_{OL}	V_{IN} = V_{IL} or V_{IH} I_{OUT} = 50 µA	A.B	2.7	4.5	—	0.001	0.1	—	0.1	V
		V_{IN} = V_{IL} or V_{IH} I_{OL} = 12 mA	A.B	2.7	4.5	—	—	0.32	—	0.37	V
Input Current	I_{IN}	V_{IN} = Vcc or GND		3.3	5.5	—	—	±0.1	—	±1.0	µA
Off state Output Current	I_{OZ}	$V_{IN}(\overline{G})$ = V_{IH} V_{IN} = Vcc or GND V_{OUT} = Vcc or GND		3.3	5.5	—	—	±0.5	—	±5.0	µA
Supply Current	$I_{CCA.B}$	V_{IN} = Vcc or GND		3.3	5.5	—	—	8.0	—	80	µA
	I_{CCA}	V_{IN} = Vcc or GND B Input OPEN		5.5	0	—	—	8.0	—	80	µA

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

Date

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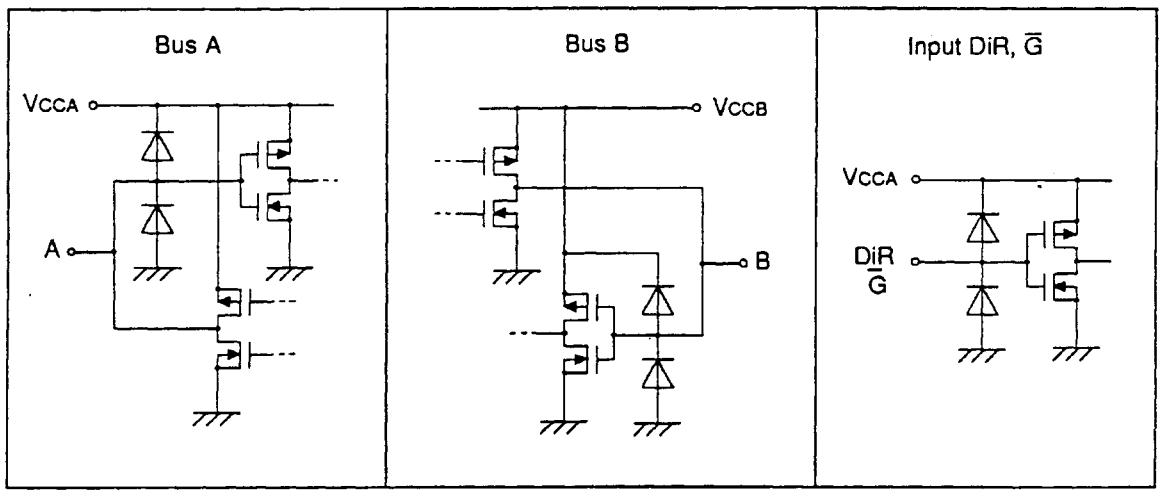
Switching Characteristics

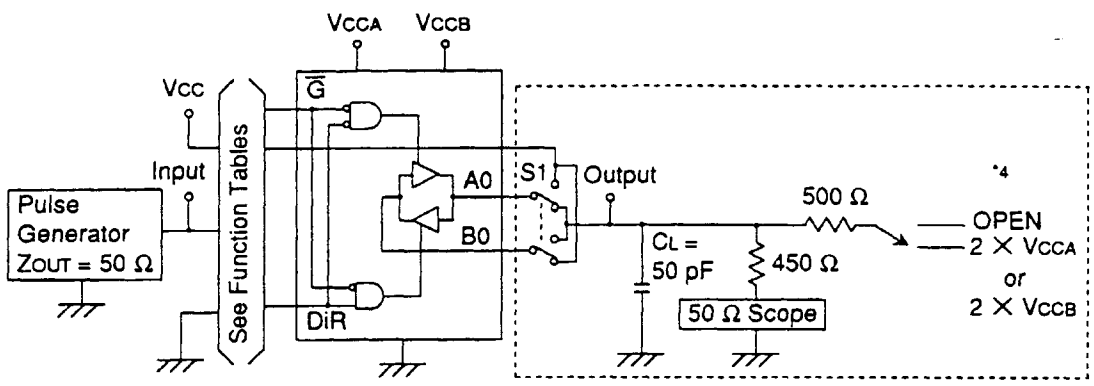
Item	Symbol	Conditions	Ta = 25 °C VCCA = 3.0 V, VCCB = 5.0 V Min.	Typ.	Max.	Ta = –40 to 85 °C Vcc = 2.7 V, VCCB = 4.5 V Min.	Max.	Unit
Propagation Delay Time	tPLH	B→A	1.0	5.0	10.0	1.0	12.0	ns
		A→B	1.0	5.0	10.0	1.0	12.0	
	tPHL	B→A	1.0	5.0	10.0	1.0	12.0	ns
		A→B	1.0	5.0	10.0	1.0	12.0	
Output Enable Time	tZH	$\overline{G}$→A	1.0	8.0	16.0	1.0	20.0	ns
		$\overline{G}$→B	1.0	8.0	16.0	1.0	20.0	
	tZL	$\overline{G}$→A	1.0	9.0	16.0	1.0	20.0	ns
		$\overline{G}$→B	1.0	9.0	16.0	1.0	20.0	
Output Disable Time	tHZ	$\overline{G}$→A	1.0	9.0	16.0	1.0	20.0	ns
		$\overline{G}$→B	1.0	9.0	16.0	1.0	20.0	
	tLZ	$\overline{G}$→A	1.0	8.0	16.0	1.0	20.0	ns
		$\overline{G}$→B	1.0	8.0	16.0	1.0	20.0	

Input and output equivalent circuit



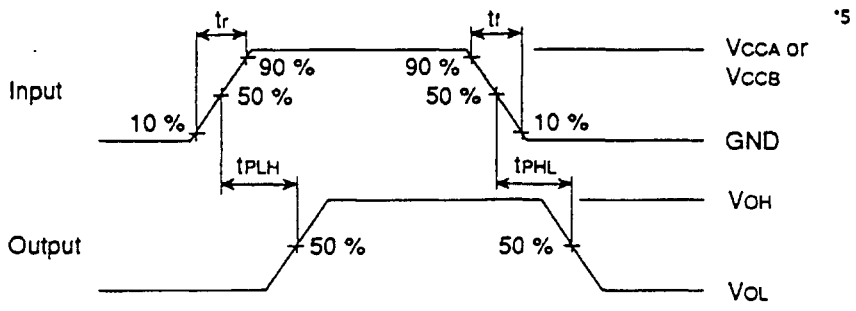
Switching Time Test Method

• Test circuit

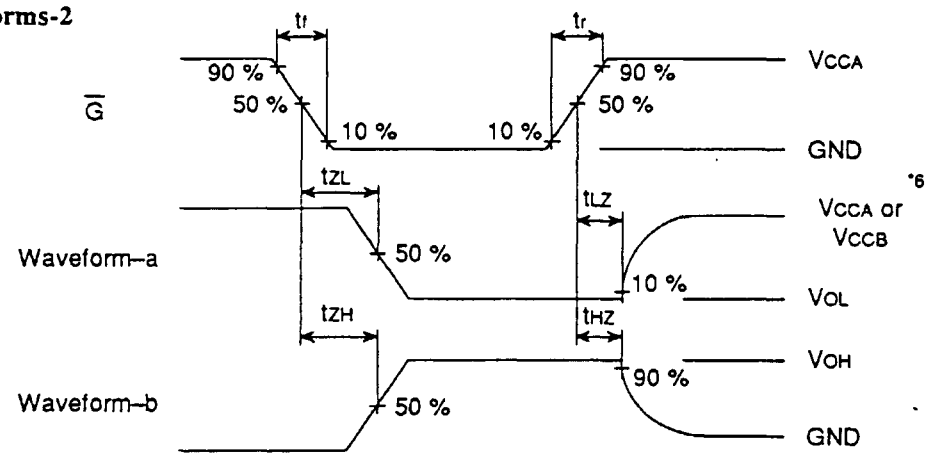


Notes: 1. C_L includes probe and jig capacitance.
2. A1–B1, A2–B2, A3–B3, A4–B4, A5–B5, A6–B6, A7–B7, A8–B8 are identical to above circuit.
3. S1 is a input/output switch.
4. When A→B : 2 × V_{CCB}, B→A : 2 × V_{CCA}

• **Waveforms-1**



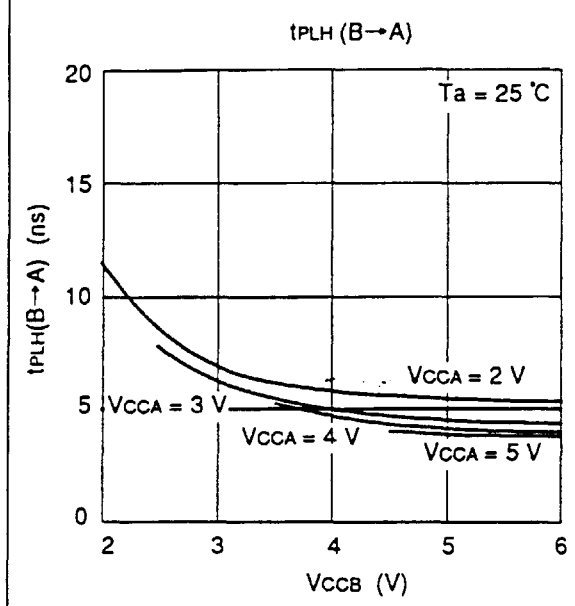
• **Waveforms-2**

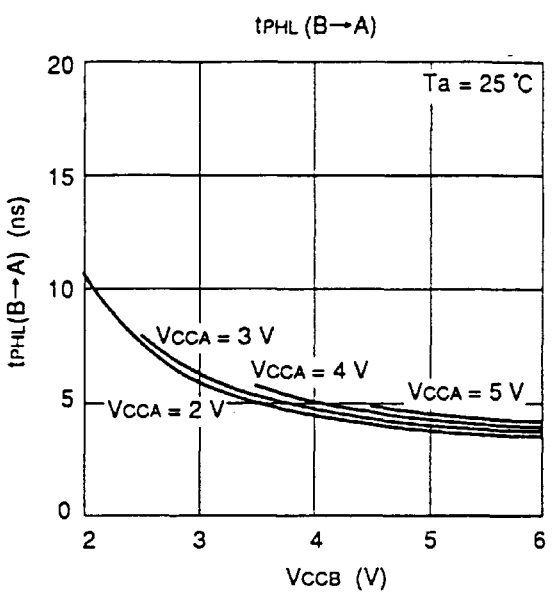


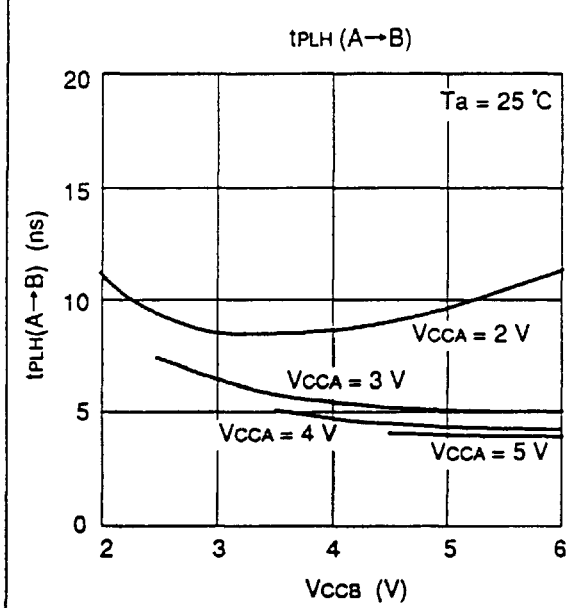
Notes: 1. $t_r = t_f = 2.5$ ns.
2. Input Waveform : PRR = 1MHz, duty cycle 50 %
3. Waveform-a is set as outputs are "Low" when enable input is "Low".
4. Waveform-b is set as outputs are "High" when enable input is "Low".
5. When A→B : V_{CCA}, B→A : V_{CCB}
6. When $\overline{G}$→A : V_{CCA}, $\overline{G}$→B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

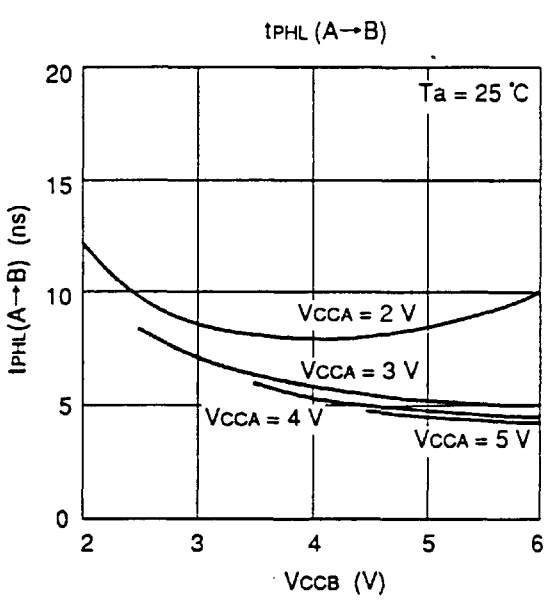
Typical Characteristic Curves

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

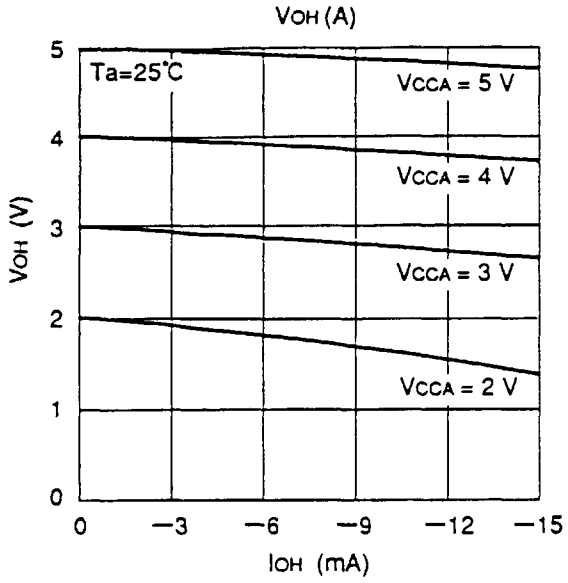


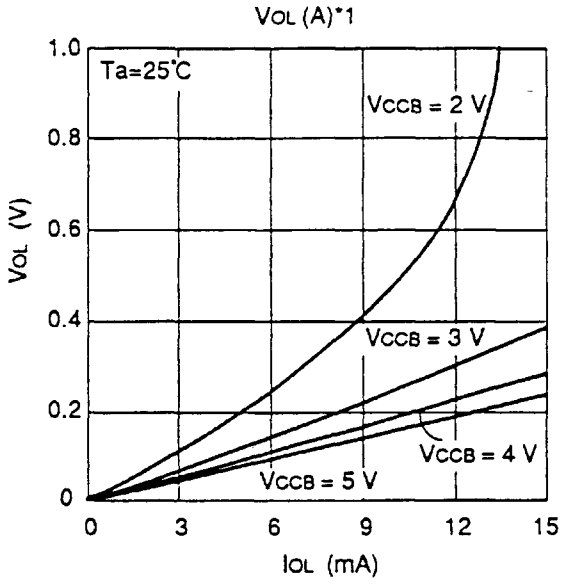




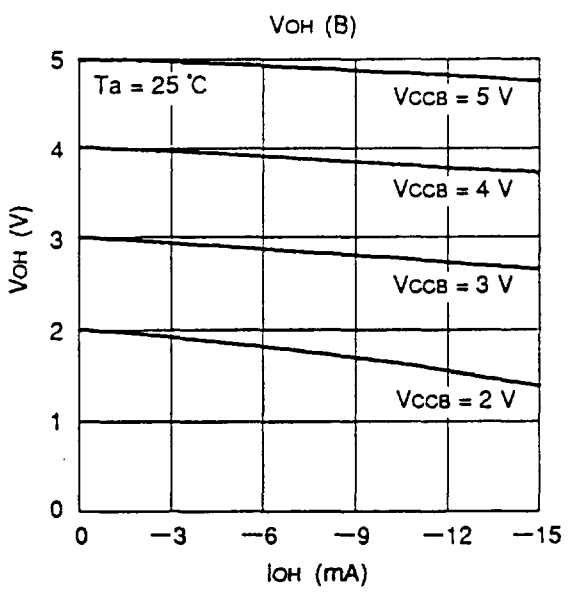


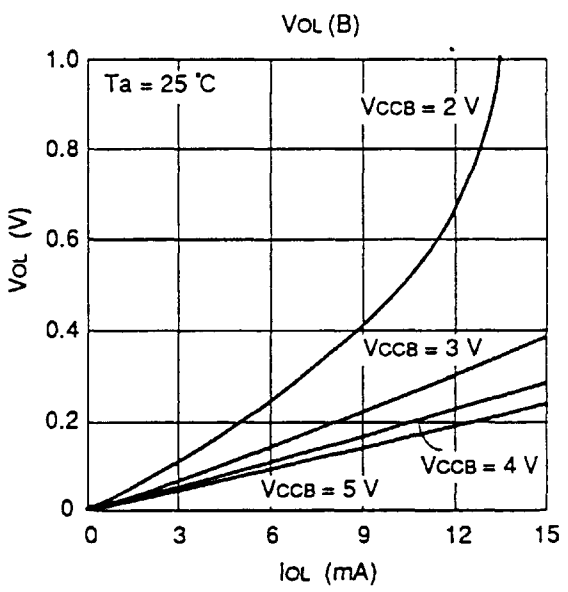
• **Output Voltage vs Output Current**





Note: 1. VOL(A) does not depend on VCCA



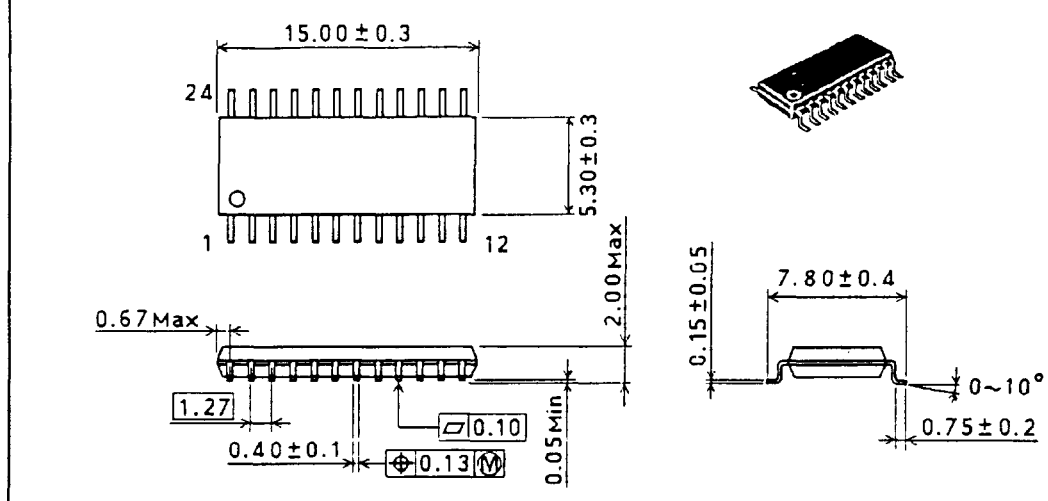


HD151015

Package Dimensions

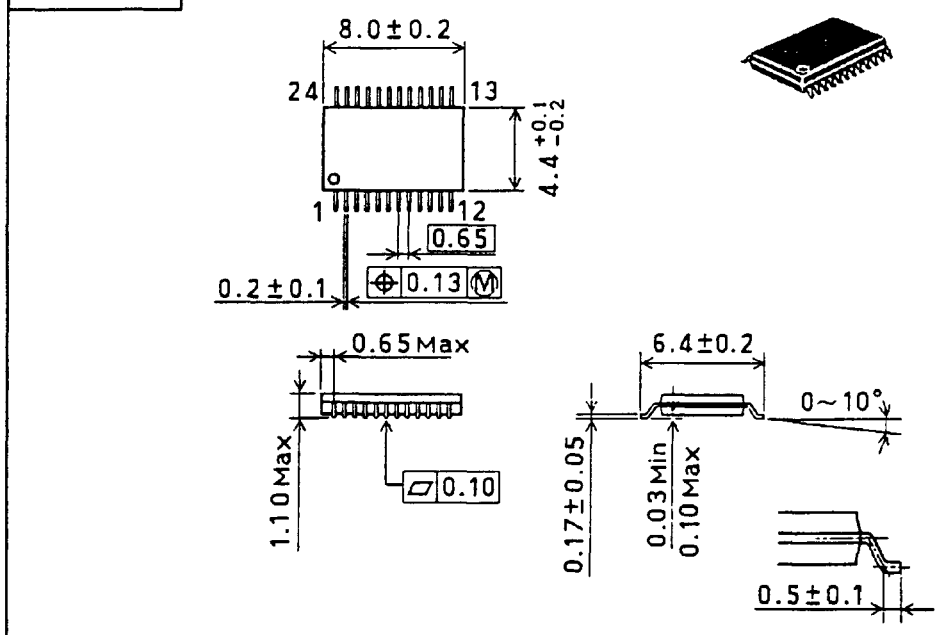
Unit : mm

FP—24DA



HITACHI CODE	FP-24DA
EIAJ	——
JEDEC	——

TTP—24DB



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JEDEC	——

Unit : mm

Under Development