

788-697

HD151015

9bit Level Shifter / Transceiver With 3 State Outputs

HITACHI

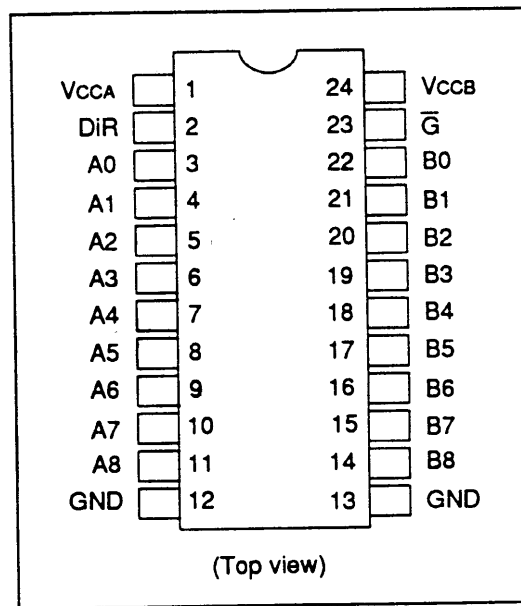
Preliminary
June 1993
Rev.3

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(\bar{G}) is high, A and B are isolated. And this product has two terminals (VCCA, VCCB), VCCA is connected with control input and A bus side, VCCB is connected with B bus side. VCCA and VCCB 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 VCCA input level to VCCB output level, VCCB input level to VCCA output level by providing different supply voltages to VCCA and VCCB.
- This product is able to the power management : Turn on and off the supply on VCCB side with providing the supply of VCCA.
(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:
VCCA = VCCB = 2 to 6 V (VCCB \geq VCCA - 0.5 V)
- Wide operating temperature range:
Ta = -40 to 85 °C

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

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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 = V _{CC} + 0.5 | 20 | mA |
| Input Voltage | V _{IN} | | -0.5 to V _{CC} + 0.5 | V |
| Output Diode Current | I _{OK} | V _O = -0.5 | -50 | mA |
| | | V _O = V _{CC} + 0.5 | 50 | mA |
| Output Voltage | V _{OUT} | | -0.5 to V _{CC} + 0.5 | V |
| Output Current | I _O | | ± 50 | mA |
| V _{CC} or Ground Current | I _{CC} or I _{GND} | per output pin | ± 50 | mA |
| Storage Temperature | T _{stg} | | -65 to + 150 | °C |

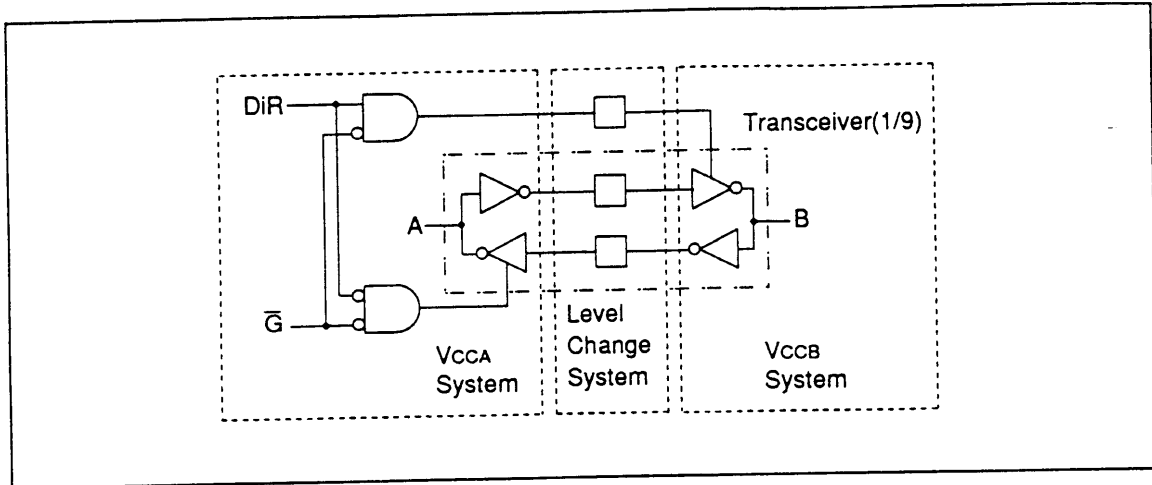
Note: 1. The absolute maximum ratings are values which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

Recommended Operating Conditions

| Item | Symbol | Conditions | Rating | Unit |
|----------------------------|----------------------|---|----------------------|------|
| Supply voltage | V _{CCA} , B | V _{CCB} ≥ V _{CCA} - 0.5 V | 2.0 to 6.0 | 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** | tr, tf | V _{CC} @3.0 V (Input DiR, G, A) | 8 | ns/V |
| | | 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 | Symbol | Conditions | VCCA (V) | | VCCB (V) | | Ta = 25 °C | | | Ta = -40 to 85 °C | | Unit | |
|--------------------------|--------|---------------------------------------|----------------------------------|------|----------|------|------------|-------|------|-------------------|------|------|---|
| | | | Min. | Typ. | Min. | Typ. | Min. | Typ. | Max. | Min. | Max. | | |
| Input Voltage | VIH | VOUT = 0.1 V or VCC - 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 | — | — | — | | |
| | VIL | VOUT = 0.1 V or VCC - 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 | VOH | VIN = VIL or VIH IOUT = -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 | — | — | | |
| | | VIN = VIL or VIH | IOH = -4 mA IOH = -12 mA | A | 2.7 | 4.5 | 2.3 | — | — | 2.2 | — | — | V |
| | | | | B | 2.7 | 4.5 | 3.9 | — | — | 3.8 | — | — | |
| | | VOL | VIN = VIL or VIH IOUT = 50 µA | A,B | 2.7 | 4.5 | — | 0.001 | 0.1 | — | 0.1 | — | V |
| | | | | A,B | 2.7 | 4.5 | — | — | 0.32 | — | 0.37 | — | V |
| Input Current | IIN | VIN = VCC or GND | 3.3 | 5.5 | — | — | ±0.1 | — | ±1.0 | — | µA | | |
| Off state Output Current | IOZ | VIN(G) = VIH | 3.3 | 5.5 | — | — | ±0.5 | — | ±5.0 | — | µA | | |
| | | VIN = VCC or GND VOUT = VCC or GND | 3.3 | 5.5 | — | — | ±0.5 | — | ±5.0 | — | µA | | |
| Supply Current | ICCA,B | VIN = VCC or GND | 3.3 | 5.5 | — | — | 8.0 | — | 80 | — | µA | | |
| | | VIN = VCC or GND B Input OPEN | 5.5 | 0 | — | — | 8.0 | — | 80 | — | µA | | |

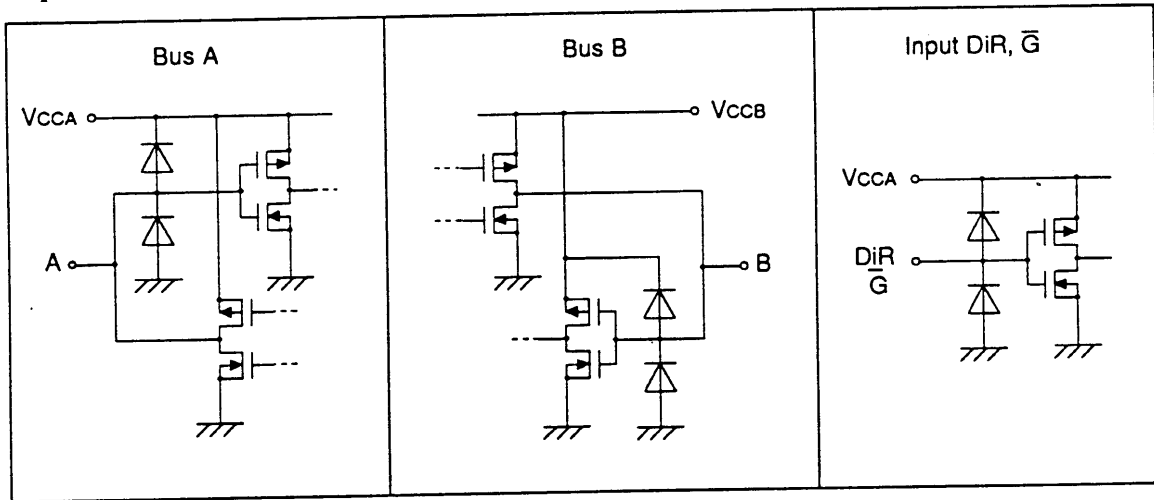
Note: 1. A : Output A, B : Output B, A.B : Output A.B

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Switching Characteristics

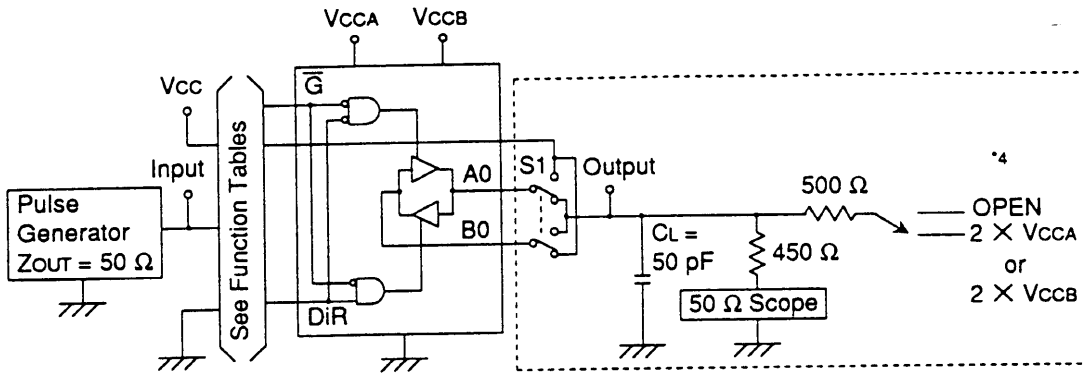
| Item | Symbol | Conditions | Ta = 25 °C | | | Ta = -40 to 85 °C | | Unit |
|------------------------|--------|---------------|------------|------|------|-------------------|------|------|
| | | | Min. | Typ. | Max. | Min. | Max. | |
| Propagation Delay Time | tPLH | B → A | 1.0 | 5.0 | 10.0 | 1.0 | 12.0 | ns |
| | | A → B | 1.0 | 5.0 | 10.0 | 1.0 | 12.0 | ns |
| | 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 | ns |
| Output Enable Time | tZH | \bar{G} → A | 1.0 | 8.0 | 16.0 | 1.0 | 20.0 | ns |
| | | \bar{G} → B | 1.0 | 8.0 | 16.0 | 1.0 | 20.0 | ns |
| | tZL | \bar{G} → A | 1.0 | 9.0 | 16.0 | 1.0 | 20.0 | ns |
| | | \bar{G} → B | 1.0 | 9.0 | 16.0 | 1.0 | 20.0 | ns |
| Output Disable Time | tHZ | \bar{G} → A | 1.0 | 9.0 | 16.0 | 1.0 | 20.0 | ns |
| | | \bar{G} → B | 1.0 | 9.0 | 16.0 | 1.0 | 20.0 | ns |
| | tLZ | \bar{G} → A | 1.0 | 8.0 | 16.0 | 1.0 | 20.0 | ns |
| | | \bar{G} → B | 1.0 | 8.0 | 16.0 | 1.0 | 20.0 | ns |

Input and output equivalent circuit



Switching Time Test Method

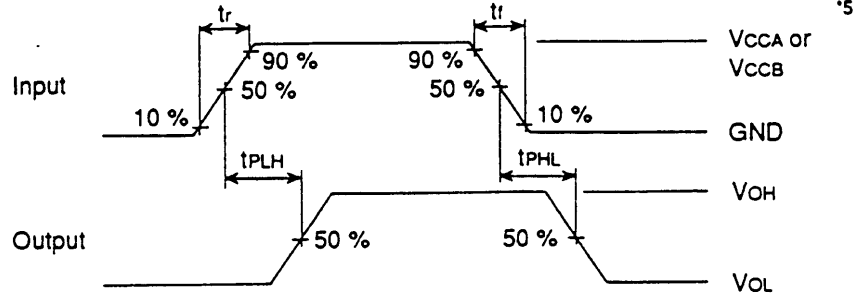
• Test circuit



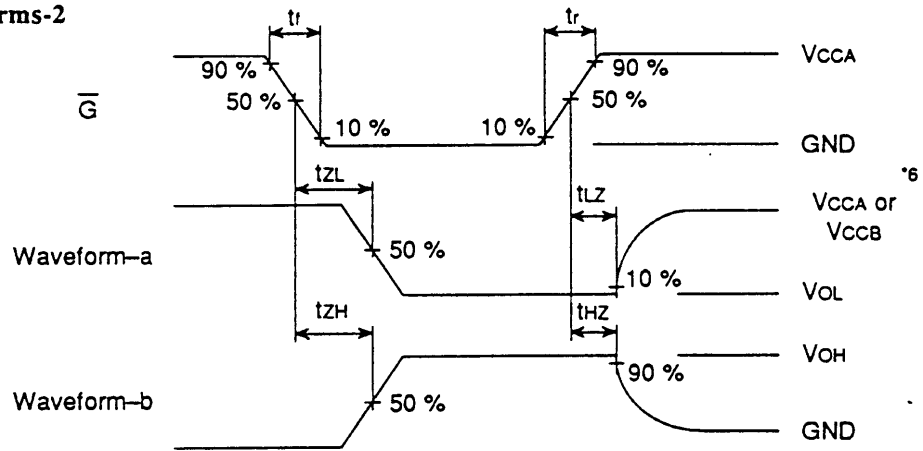
- Notes:
1. CL includes probe and jig capacitance.
 2. A1-B1, A2-B2, A3-B3, A4-B4, A5-B5, A6-B6, A7-B7, A8-B8 are identical to above circuit.
 3. S1 is a input/output switch.
 4. When A → B : 2 × VCCB, B → A : 2 × VCCA

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• Waveforms-1



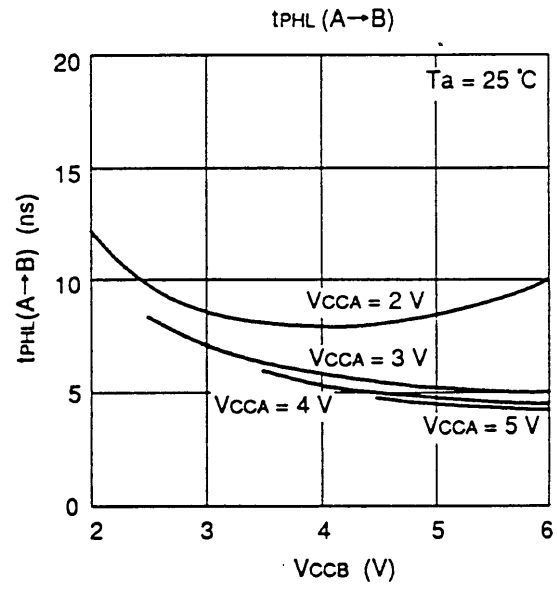
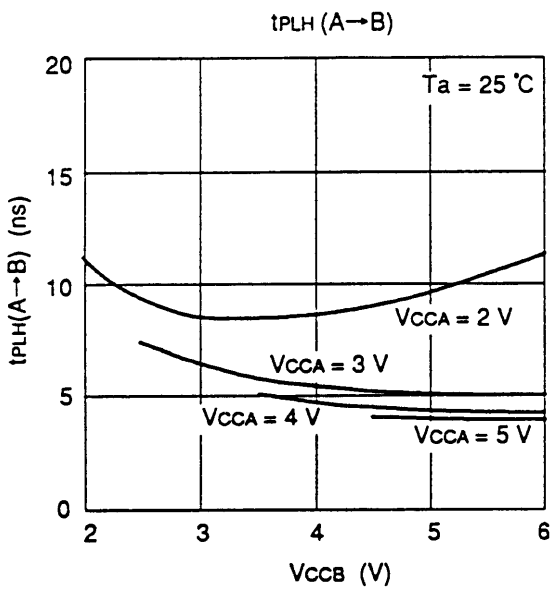
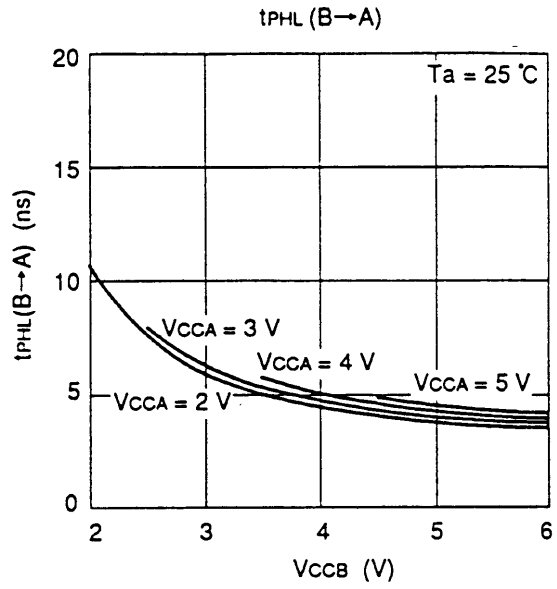
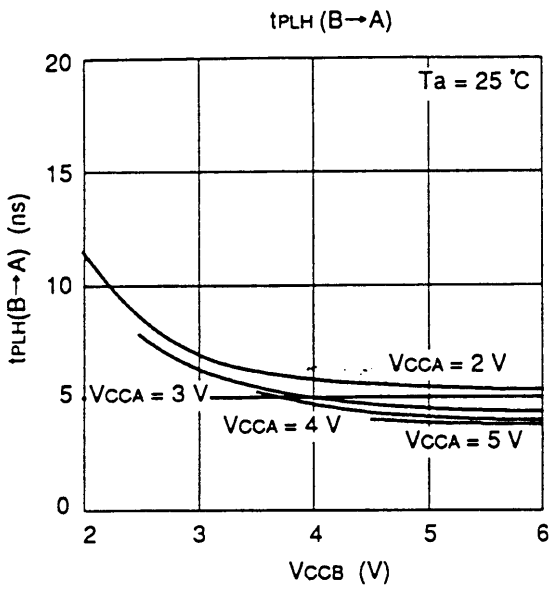
• Waveforms-2



- 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 $A \rightarrow B$: V_{CCA} , $B \rightarrow A$: V_{CCB}
 6. When $\bar{G} \rightarrow A$: V_{CCA} , $\bar{G} \rightarrow B$: V_{CCB}

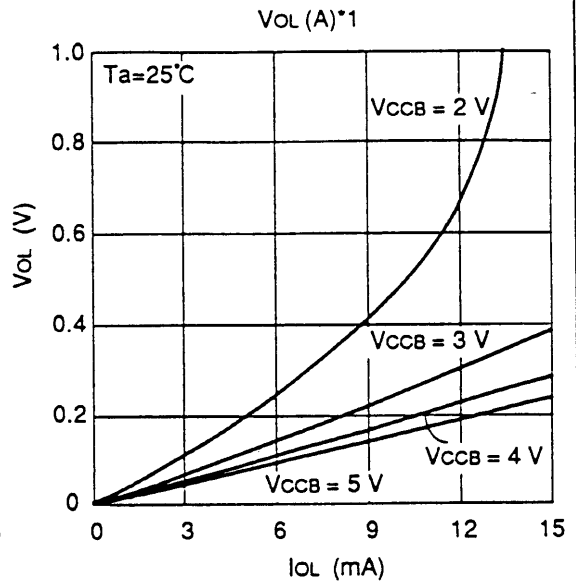
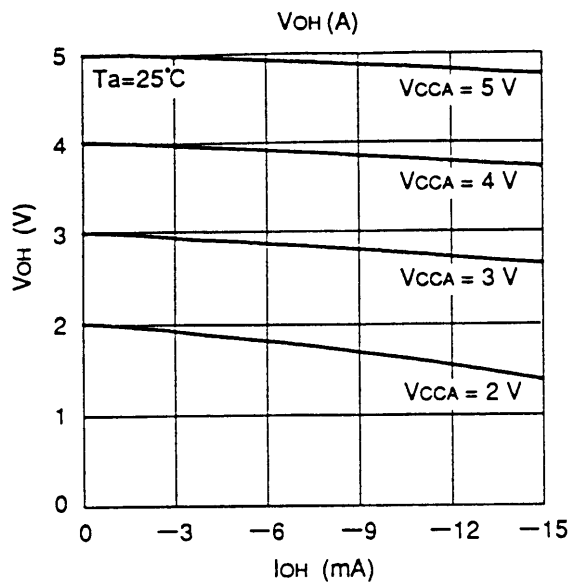
Typical Characteristic Curves

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

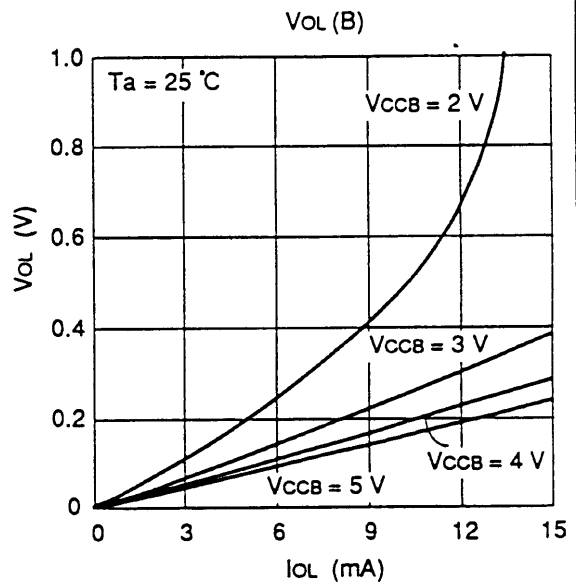
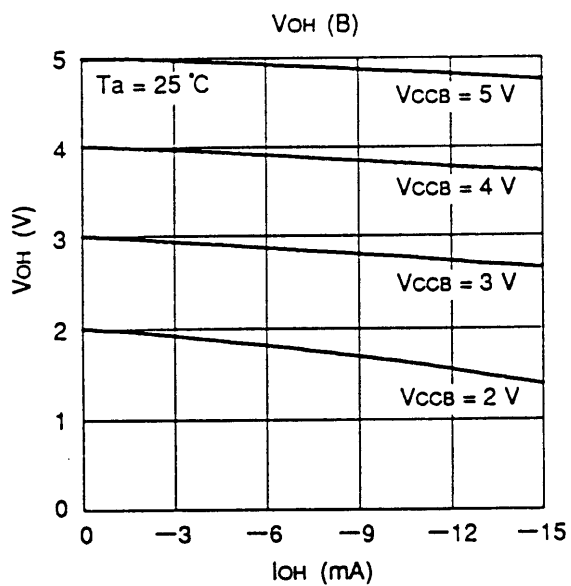


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• Output Voltage vs Output Current



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



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Package Dimensions

Unit : mm

FP-24DA

Technical drawing of the FP-24DA package. The top view shows a rectangular package with 24 pins (12 on each side) and a width of 15.00 ± 0.3 mm. The height is 5.30 ± 0.3 mm. The side view shows a lead height of 0.67 Max and a lead thickness of 0.40 ± 0.1 mm. The lead pitch is 1.27 mm. The lead width is 0.10 mm. The lead diameter is $\phi 0.13$ mm. The lead length is 2.00 Max. The lead angle is $0 \sim 10^\circ$. The lead thickness is 0.15 ± 0.05 mm. The lead width is 7.80 ± 0.4 mm. The lead thickness is 0.75 ± 0.2 mm.

| | |
|--------------|---------|
| HITACHI CODE | FP-24DA |
| EIAJ | — |
| JEDEC | — |

TTP-24DB

Technical drawing of the TTP-24DB package. The top view shows a rectangular package with 24 pins (13 on each side) and a width of 8.0 ± 0.2 mm. The height is $4.4^{+0.1}_{-0.2}$ mm. The side view shows a lead height of 0.65 Max and a lead thickness of 0.2 ± 0.1 mm. The lead pitch is 0.65 mm. The lead width is 0.10 mm. The lead diameter is $\phi 0.13$ mm. The lead length is 1.10 Max. The lead angle is $0 \sim 10^\circ$. The lead thickness is 0.17 ± 0.05 mm. The lead width is 6.4 ± 0.2 mm. The lead thickness is 0.03 Min and 0.10 Max. The lead thickness is 0.5 ± 0.1 mm.

| | |
|--------------|----------|
| HITACHI CODE | TTP-24DB |
| EIAJ | — |
| JEDEC | — |

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Unit : mm

Under Development

