

RD74VT1G08

2–input AND Gate / Dual Supply Voltage Translator

REJ03D0495–0200

Rev.2.00

Apr. 01, 2005

Description

The RD74VT1G08 has two–input AND gate in a 6 pin package. The input is designed to track V_{CCIN} , which accepts voltages from 1.2 V to 3.6 V, and the output is designed to track V_{CCOUT} , which operates at 1.2 V to 3.6 V. Low voltage and high-speed operation is suitable for the battery powered products (e.g., notebook computers), and the low power consumption extends the battery life.

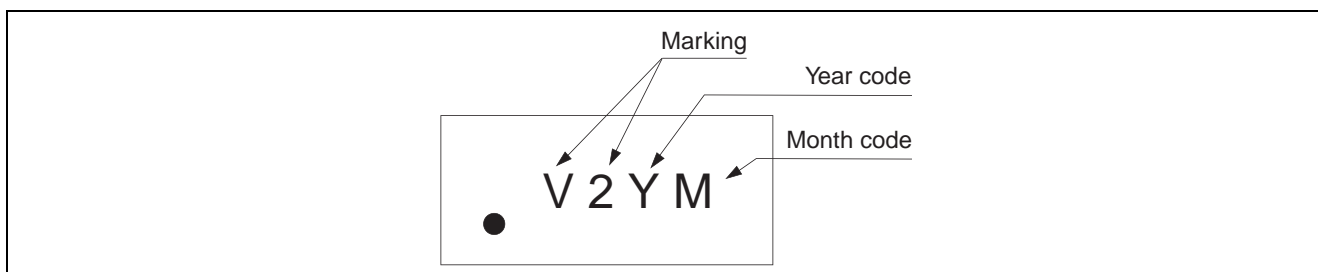
Features

- This product function as level shift that change V_{CCIN} input level to V_{CCOUT} output level by providing different supply voltage to V_{CCIN} and V_{CCOUT} .
- Supplied on emboss taping for high-speed automatic mounting.
- Supply voltage range:
 - $V_{CCIN} = 1.2 \text{ V to } 3.6 \text{ V}$
 - $V_{CCOUT} = 1.2 \text{ V to } 3.6 \text{ V}$
- Operating temperature range: $-40 \text{ to } +85^\circ\text{C}$
- All inputs $V_{IH}(\text{Max.}) = 3.6 \text{ V}$ (@ $V_{CCIN} = 0 \text{ V to } 3.6 \text{ V}$)
- Outputs $V_O(\text{Max.}) = 3.6 \text{ V}$ (@ $V_{CCOUT} = 0 \text{ V}$)
- Output current
 - $\pm 2 \text{ mA}$ (@ $V_{CCOUT} = 1.2 \text{ V}$)
 - $\pm 4 \text{ mA}$ (@ $V_{CCOUT} = 1.4 \text{ V to } 1.6 \text{ V}$)
 - $\pm 6 \text{ mA}$ (@ $V_{CCOUT} = 1.65 \text{ V to } 1.95 \text{ V}$)
 - $\pm 18 \text{ mA}$ (@ $V_{CCOUT} = 2.3 \text{ V to } 2.7 \text{ V}$)
 - $\pm 24 \text{ mA}$ (@ $V_{CCOUT} = 3.0 \text{ V to } 3.6 \text{ V}$)

- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
RD74VT1G08CLE	WCSP–6 pin	SXBG0006KB–A (TBS–6AV)	CL	E (3,000 pcs / reel)

Article Indication



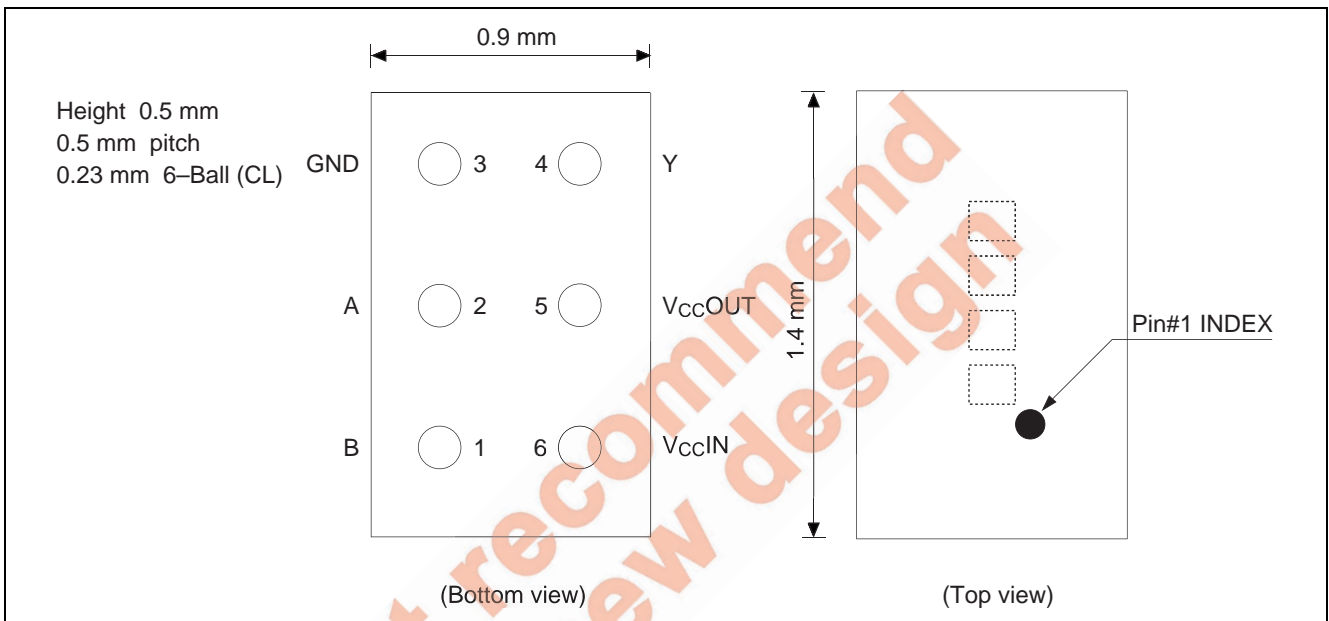
Function Table

Inputs		OUTPUT Y
A	B	
L	L	L
H	L	L
L	H	L
H	H	H

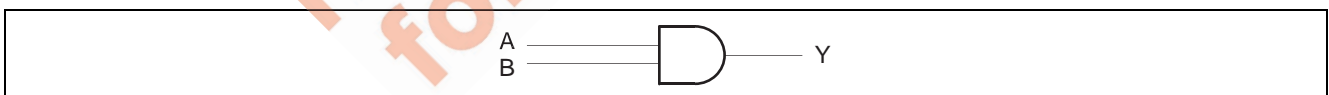
H: High level

L: Low level

Pin Arrangement



Logic Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CCIN}, V_{CCOUT}	-0.5 to 4.6	V	
Input voltage range ^{*1}	V_I	-0.5 to 4.6	V	
Output voltage range ^{*1, 2}	V_O	-0.5 to $V_{CCOUT}+0.5$	V	Output: "H" or "L"
		-0.5 to 4.6		V_{CCOUT} : OFF
Input clamp current	I_{IK}	-50	mA	$V_I < 0$
Output clamp current	I_{OK}	-50	mA	$V_O < 0$
		50		$V_O > V_{CC}+0.5$
Continuous output current	I_O	± 50	mA	
Continuous output current V_{CC} or GND	$I_{CCIN}, I_{CCOUT}, I_{GND}$	± 100	mA	
Package Thermal impedance	θ_{ja}	123	$^{\circ}C/W$	
Storage temperature	Tstg	-65 to 150	$^{\circ}C$	

Notes: 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.

- The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- This value is limited to 4.6 V maximum.

Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Conditions
Supply voltage range	V_{CCIN}	1.2 to 3.6	V	
	V_{CCOUT}	1.2 to 3.6		
Input/Output voltage	V_I	0 to 3.6	V	
	V_O	0 to V_{CCOUT}	V	Output: "H" or "L"
0 to 3.6		V_{CCOUT} : OFF		
Output current	I_{OH}	-2	mA	$V_{CCOUT} = 1.2$ V
		-4		$V_{CCOUT} = 1.5 \pm 0.1$ V
		-6		$V_{CCOUT} = 1.8 \pm 0.15$ V
		-18		$V_{CCOUT} = 2.5 \pm 0.2$ V
		-24		$V_{CCOUT} = 3.3 \pm 0.3$ V
	I_{OL}	2	mA	$V_{CCOUT} = 1.2$ V
		4		$V_{CCOUT} = 1.5 \pm 0.1$ V
		6		$V_{CCOUT} = 1.8 \pm 0.15$ V
		18		$V_{CCOUT} = 2.5 \pm 0.2$ V
		24		$V_{CCOUT} = 3.3 \pm 0.3$ V
Input transition rise or fall time	$\Delta t / \Delta v$	10	ns / V	
Operation free-air temperature	Ta	-40 to 85	$^{\circ}C$	

Electrical Characteristics

(Ta = -40 to 85°C)

Item	Symbol	V _{CCIN} (V)*	V _{CCOUT} (V)*	Min	Typ	Max	Unit	Test conditions
Input voltage	V _{IH}	1.2	1.2 to 3.6	V _{CCIN} ×0.75	—	—	V	
		1.5±0.1		V _{CCIN} ×0.70	—	—		
		1.8±0.15		V _{CCIN} ×0.65	—	—		
		2.5±0.2		1.6	—	—		
		3.3±0.3		2.0	—	—		
	V _{IL}	1.2	1.2 to 3.6	—	—	V _{CCIN} ×0.25	V	
		1.5±0.1		—	—	V _{CCIN} ×0.30		
		1.8±0.15		—	—	V _{CCIN} ×0.35		
		2.5±0.2		—	—	0.7		
		3.3±0.3		—	—	0.8		
Output voltage	V _{OH}	1.2 to 3.6	1.2 to 3.6	V _{CCOUT} -0.2	—	—	V	I _{OH} = -100 μA
			1.2	0.9	—	—		I _{OH} = -2 mA
			1.5±0.1	1.1	—	—		I _{OH} = -4 mA
			1.8±0.15	1.25	—	—		I _{OH} = -6 mA
			2.5±0.2	1.7	—	—		I _{OH} = -18 mA
			3.3±0.3	2.2	—	—		I _{OH} = -24 mA
	V _{OL}	1.2 to 3.6	1.2 to 3.6	—	—	0.2	V	I _{OL} = 100 μA
			1.2	—	—	0.3		I _{OL} = 2 mA
			1.5±0.1	—	—	0.3		I _{OL} = 4 mA
			1.8±0.15	—	—	0.3		I _{OL} = 6 mA
			2.5±0.2	—	—	0.6		I _{OL} = 18 mA
			3.3±0.3	—	—	0.55		I _{OL} = 24 mA
Input current	I _{IN}	3.6	3.6	-1.0	—	1.0	μA	V _{IN} = GND or V _{CCIN}
Output leakage current	I _{OFF}	0	0	—	—	1.5	μA	V _{IN} , V _{OUT} = 0 to 3.6 V
Quiescent supply current	I _{CCIN}	1.2 to 3.6	1.2 to 3.6	-3.0	—	3.0	μA	I _{O(Y port)} = 0 V _{IN} = V _{CCIN} or GND
	I _{CCOUT}	1.2 to 3.6	1.2 to 3.6	-3.0	—	3.0		I _{O(Y port)} = 0 V _{IN} = V _{CCIN} or GND
Increase in I _{CC} per input	ΔI _{CC}	3.6	3.6	—	—	250	μA	A or B port V _{CCIN} -0.6 (1 input)
Input capacitance	C _{IN}	3.3	3.3	—	3.5	—	pF	V _{IN} = V _{CC} or GND

Note: For conditions shown as Min or Max, use the appropriate values under recommended operating conditions.

Switching Characteristics

V_{CCIN} = 3.3±0.3 V

Item	Symbol	From (input)	To (output)	Ta = -40 to 85°C								Unit	Test conditions		
				V _{CCOUT} = 1.2 V		V _{CCOUT} = 1.5±0.1 V		V _{CCOUT} = 1.8±0.15 V		V _{CCOUT} = 2.5±0.2 V				V _{CCOUT} = 3.3±0.3 V	
				Typ	Min	Max	Min	Max	Min	Max	Min			Max	Min
Propagation delay time	t _{PLH}	A or B	Y	8.4	2.0	7.8	1.5	5.2	1.0	4.1	1.0	3.5	ns	C _L = 15pF R _L = 2.0kΩ	
	t _{PHL}			8.4	2.0	7.8	1.5	5.2	1.0	4.1	1.0	3.5			

Switching Characteristics (Cont.)

$V_{CCIN} = 2.5 \pm 0.2 \text{ V}$

Item	Symbol	From (input)	To (output)	Ta = -40 to 85°C										Unit	Test conditions
				V _{CCOUT} = 1.2 V		V _{CCOUT} = 1.5±0.1 V		V _{CCOUT} = 1.8±0.15 V		V _{CCOUT} = 2.5±0.2 V		V _{CCOUT} = 3.3±0.3 V			
				Typ	Min	Max	Min	Max	Min	Max	Min	Max	Min		
Propagation delay time	t _{PLH}	A or B	Y	8.5	2.0	8.2	1.5	5.5	1.0	4.3	1.0	3.9	ns	C _L = 15pF R _L = 2.0kΩ	
	t _{PHL}			8.5	2.0	8.2	1.5	5.5	1.0	4.3	1.0	3.9			

$V_{CCIN} = 1.8 \pm 0.15 \text{ V}$

Item	Symbol	From (input)	To (output)	Ta = -40 to 85°C										Unit	Test conditions
				V _{CCOUT} = 1.2 V		V _{CCOUT} = 1.5±0.1 V		V _{CCOUT} = 1.8±0.15 V		V _{CCOUT} = 2.5±0.2 V		V _{CCOUT} = 3.3±0.3 V			
				Typ	Min	Max	Min	Max	Min	Max	Min	Max	Min		
Propagation delay time	t _{PLH}	A or B	Y	8.7	2.0	8.6	1.5	6.6	1.0	5.9	1.0	5.5	ns	C _L = 15pF R _L = 2.0kΩ	
	t _{PHL}			8.7	2.0	8.6	1.5	6.6	1.0	5.9	1.0	5.5			

$V_{CCIN} = 1.5 \pm 0.1 \text{ V}$

Item	Symbol	From (input)	To (output)	Ta = -40 to 85°C										Unit	Test conditions
				V _{CCOUT} = 1.2 V		V _{CCOUT} = 1.5±0.1 V		V _{CCOUT} = 1.8±0.15 V		V _{CCOUT} = 2.5±0.2 V		V _{CCOUT} = 3.3±0.3 V			
				Typ	Min	Max	Min	Max	Min	Max	Min	Max	Min		
Propagation delay time	t _{PLH}	A or B	Y	8.9	2.0	10.0	1.5	8.4	1.0	7.4	1.0	7.2	ns	C _L = 15pF R _L = 2.0kΩ	
	t _{PHL}			8.9	2.0	10.0	1.5	8.4	1.0	7.4	1.0	7.2			

$V_{CCIN} = 1.2 \text{ V}$

Item	Symbol	From (input)	To (output)	Ta = -40 to 85°C										Unit	Test conditions
				V _{CCOUT} = 1.2 V		V _{CCOUT} = 1.5±0.1 V		V _{CCOUT} = 1.8±0.15 V		V _{CCOUT} = 2.5±0.2 V		V _{CCOUT} = 3.3±0.3 V			
				Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ	Typ		
Propagation delay time	t _{PLH}	A or B	Y	10.5	9.0	8.2	7.6	7.5	ns	C _L = 15pF R _L = 2.0kΩ					
	t _{PHL}			10.5	9.0	8.2	7.6	7.5							

Operating Characteristics

$T_a = 25^\circ\text{C}$

Item	Symbol	V _{CCIN} (V)	V _{CCOUT} (V)	Min	Typ	Max	Unit	Test conditions
Power dissipation capacitance	C _{PD}	3.3	3.3	—	12	—	pF	f = 10 MHz C _L = 0

Power-up Considerations

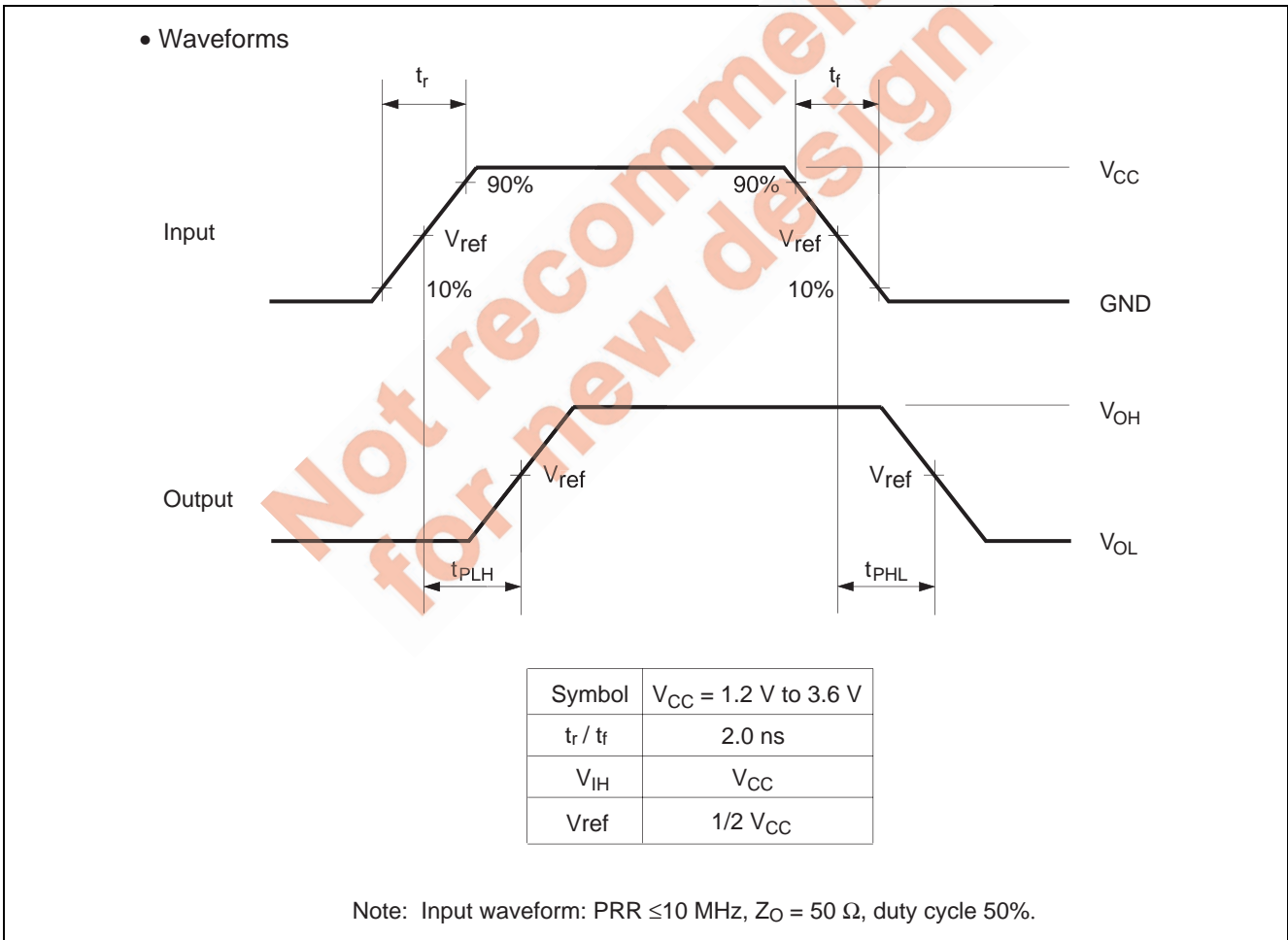
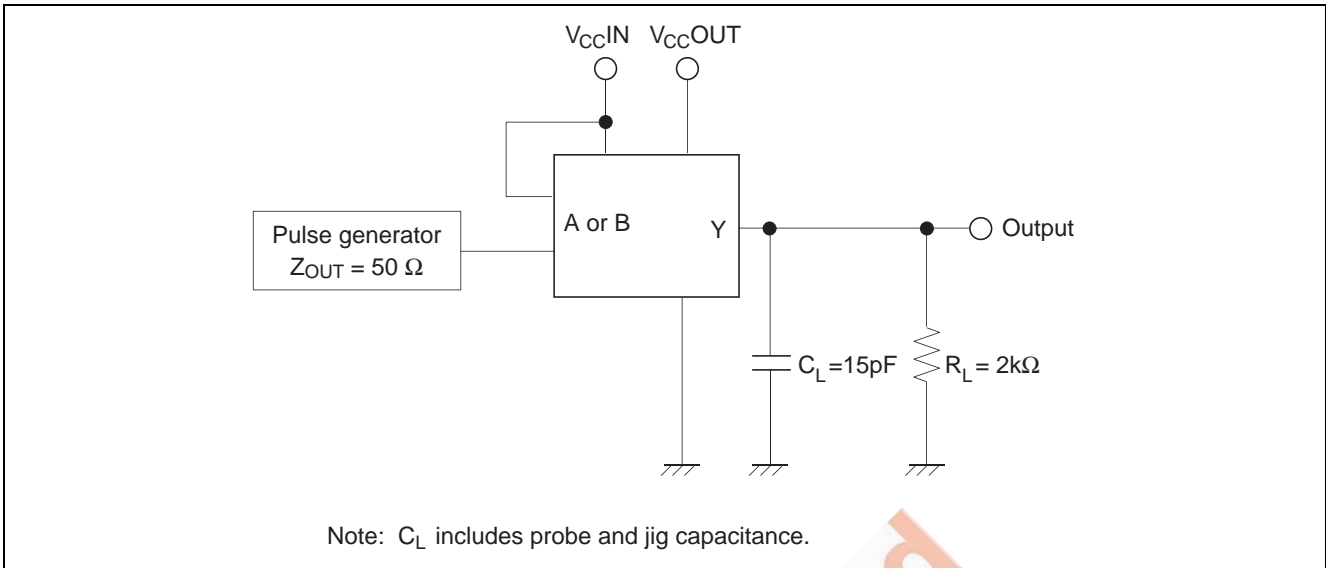
Level-translation devices offer an opportunity for successful mixed-voltage signal design.

A proper power-up sequence always should be followed to avoid excessive supply current, bus contention, oscillations, or other anomalies caused by improperly biased device pins.

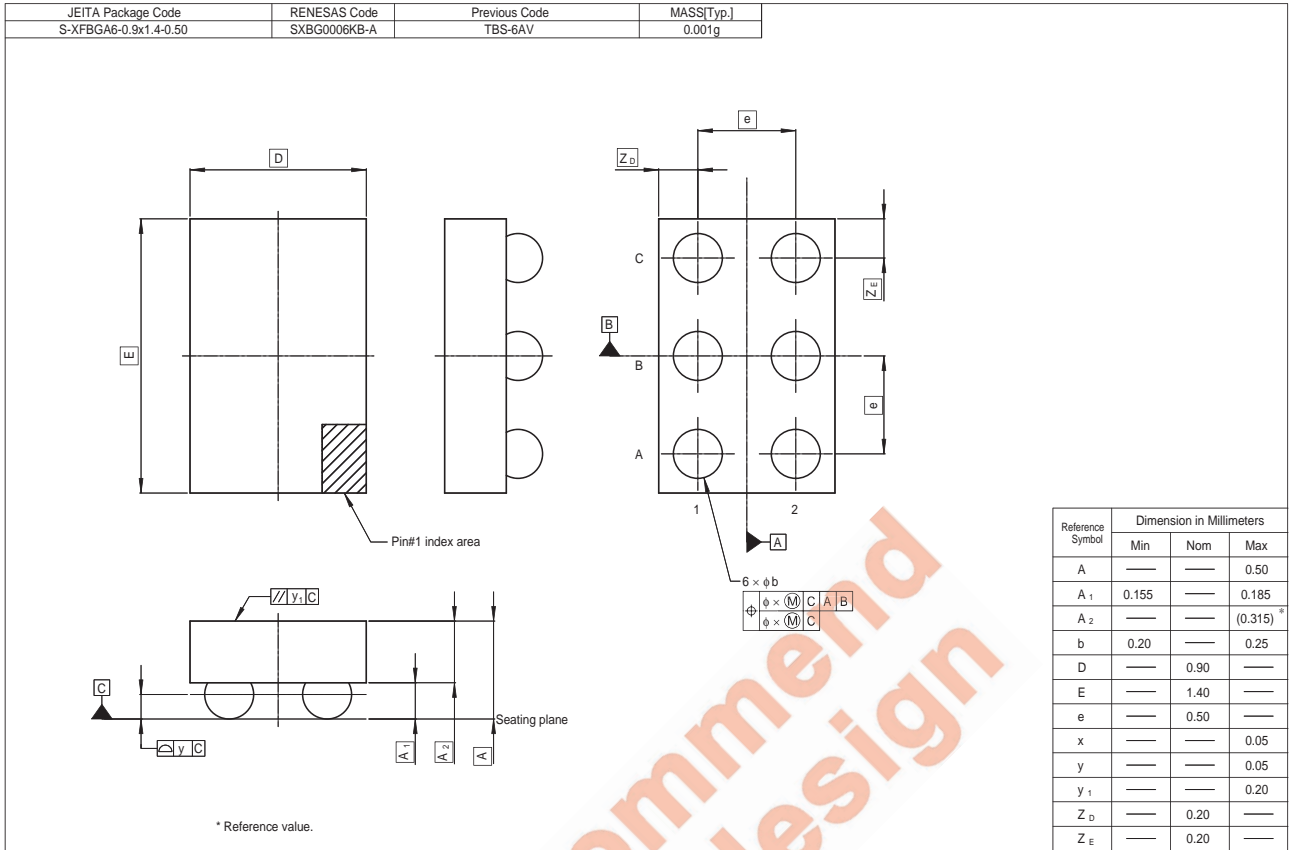
Take these precautions to guard against such power-up problems.

1. Connect ground before any supply voltage is applied.
2. Next, power up the input side of the device.
(Power up of V_{CCIN} is first. Next power up is V_{CCOUT})

Test Circuit



Package Dimensions



Not recommended for new design

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Renesas Technology Europe Limited

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Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

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Tel: <852> 2265-6688, Fax: <852> 2730-6071

Renesas Technology Taiwan Co., Ltd.

10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 2713-2999

Renesas Technology (Shanghai) Co., Ltd.

Unit2607 Ruijing Building, No.205 Maoming Road (S), Shanghai 200020, China
Tel: <86> (21) 6472-1001, Fax: <86> (21) 6415-2952

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