

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# HD74HC83

## 4-bit Binary Full Adder (with Fast Carry)

REJ03D0554-0200  
 (Previous ADE-205-426)  
 Rev.2.00  
 Oct 06, 2005

### Description

This improved full adder performs the addition of two 4-bit binary numbers. The sum ( $\Sigma$ ) output are provided for each bit and the resultant carry ( $C_4$ ) is obtained from the fourth bit.

This adder features full internal look ahead across all four bit generating the carry term in ten nanoseconds typically.

This provides the system designer with partial look-ahead performance at the economy and reduced package count of a ripple-carry implementation.

### Features

- High Speed Operation:  $t_{pd}$  ( $A_i$  or  $B_i$  to  $Z_i$ ) = 16 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  to 6 V
- Low Input Current: 1  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HC83FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)
HD74HC83RPEL	SOP-16 pin (JEDEC)	PRSP0016DG-A (FP-16DNV)	RP	EL (2,500 pcs/reel)

Note: Please consult the sales office for the above package availability.

Function Table

Inputs				Outputs					
				When $C_0 = L$ / When $C_2 = L$			When $C_0 = H$ / When $C_2 = H$		
$A_1 / A_3$	$B_1 / B_3$	$A_1 / A_3$	$A_1 / A_3$	$\Sigma_1 / \Sigma_3$	$\Sigma_2 / \Sigma_4$	$C_2 / C_4$	$\Sigma_1 / \Sigma_3$	$\Sigma_2 / \Sigma_4$	$C_2 / C_4$
L	L	L	L	L	L	L	H	L	L
H	L	L	L	H	L	L	L	H	L
L	H	L	L	H	L	L	L	H	L
H	H	L	L	L	H	L	H	H	L
L	L	H	L	L	H	L	H	H	L
H	L	H	L	H	H	L	L	L	H
L	H	H	L	H	H	L	L	L	H
H	H	H	L	L	L	H	H	L	H
L	L	L	H	L	H	L	H	H	L
H	L	L	H	H	H	L	L	L	H
L	H	L	H	H	H	L	L	L	H
H	H	L	H	L	L	H	H	L	H
L	L	H	H	L	L	H	H	L	H
H	L	H	H	H	L	H	L	H	H
L	H	H	H	H	L	H	L	H	H
H	H	H	H	L	H	H	H	H	H

H : High level

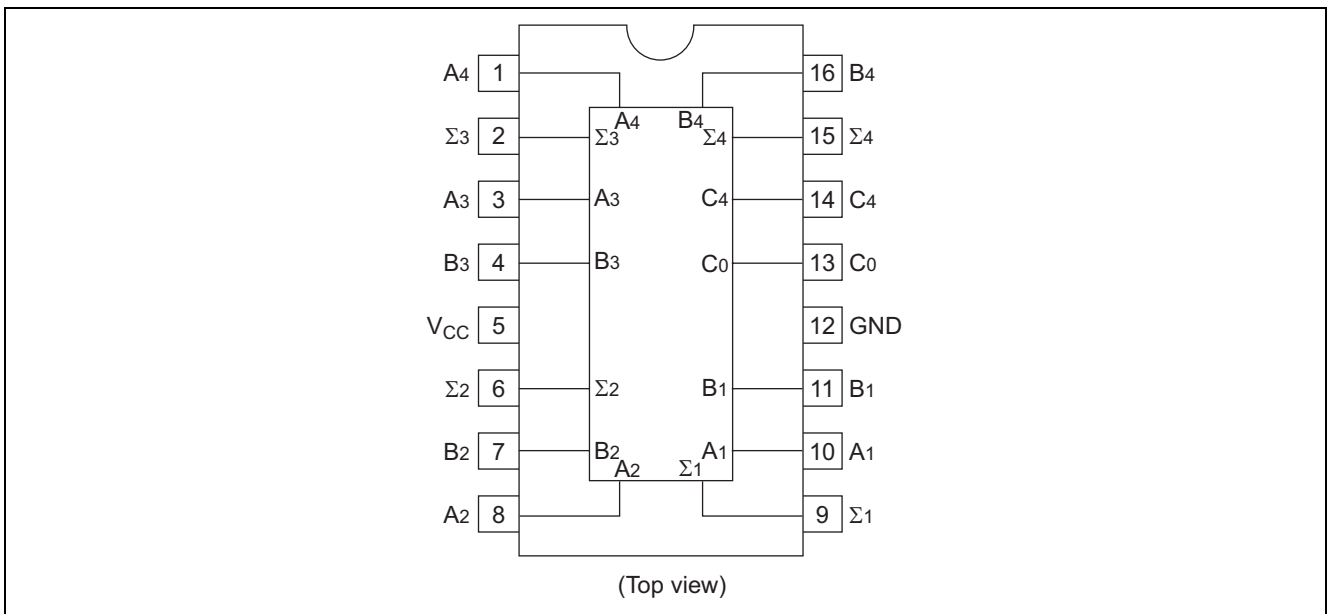
L : Low level

X : Irrelevant

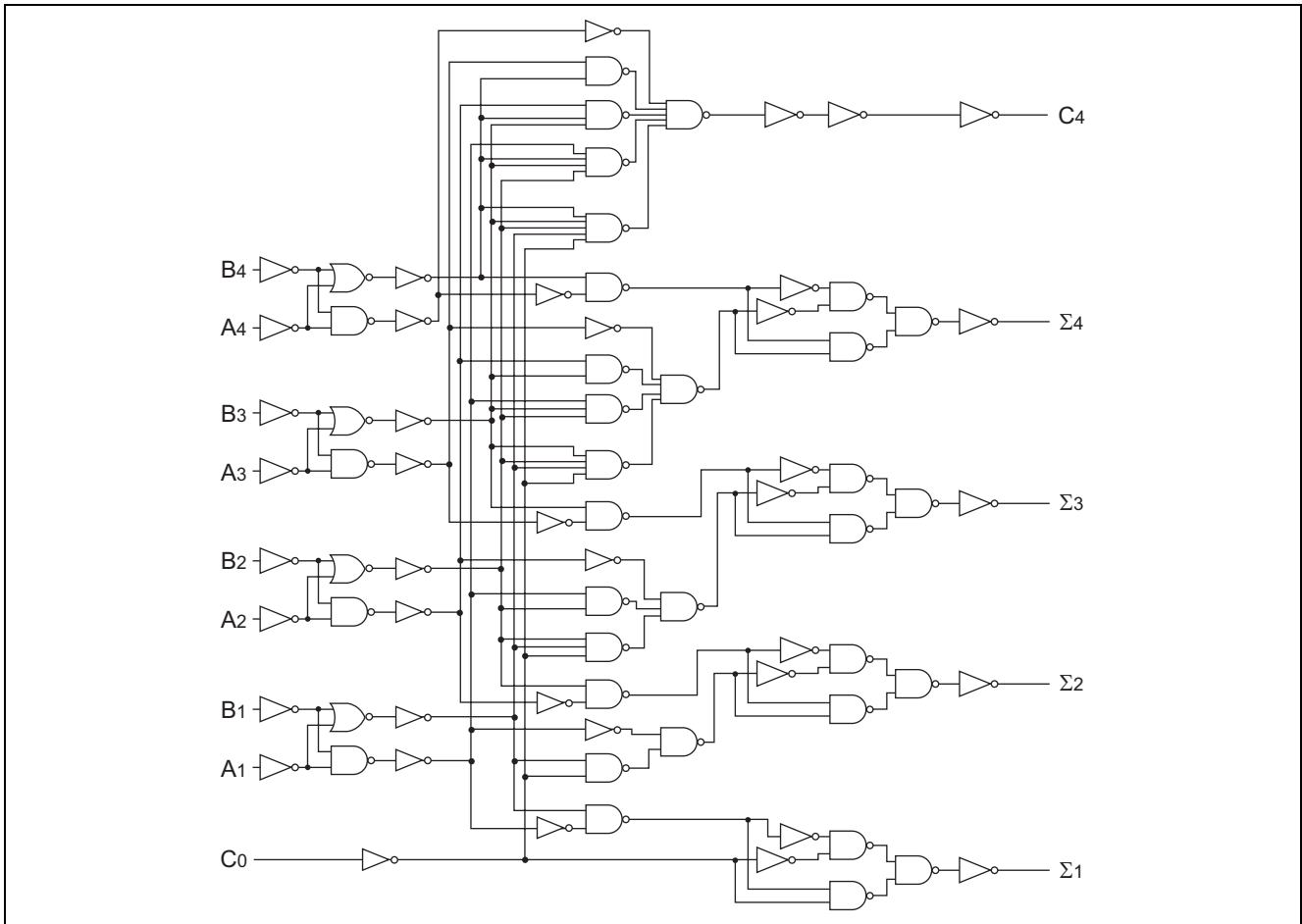
Note : Input conditions at  $A_1, B_1, A_2, B_2$  and  $C_0$  are used to determine outputs  $\Sigma_1$  and  $\Sigma_2$  and the value of the internal carry  $C_2$ .

The value at  $C_2, A_3, B_3, A_4$  and  $B_4$  are then used to determine outputs  $\Sigma_3, \Sigma_4$  and  $C_4$

Pin Arrangement



Logic Diagram



Absolute Maximum Ratings

Item	Symbol	Ratings	Unit
Supply voltage range	$V_{CC}$	-0.5 to 7.0	V
Input / Output voltage	$V_{in}, V_{out}$	-0.5 to $V_{CC} + 0.5$	V
Input / Output diode current	$I_{IK}, I_{OK}$	$\pm 20$	mA
Output current	$I_o$	$\pm 25$	mA
$V_{CC}, GND$ current	$I_{CC}$ or $I_{GND}$	$\pm 50$	mA
Power dissipation	$P_T$	500	mW
Storage temperature	$T_{stg}$	-65 to +150	$^{\circ}C$

Note: 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	Ratings	Unit	Conditions
Supply voltage	$V_{CC}$	2 to 6	V	
Input / Output voltage	$V_{IN}, V_{OUT}$	0 to $V_{CC}$	V	
Operating temperature	$T_a$	-40 to 85	$^{\circ}C$	
Input rise / fall time <sup>*1</sup>	$t_r, t_f$	0 to 1000	ns	$V_{CC} = 2.0 V$
		0 to 500		$V_{CC} = 4.5 V$
		0 to 400		$V_{CC} = 6.0 V$

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

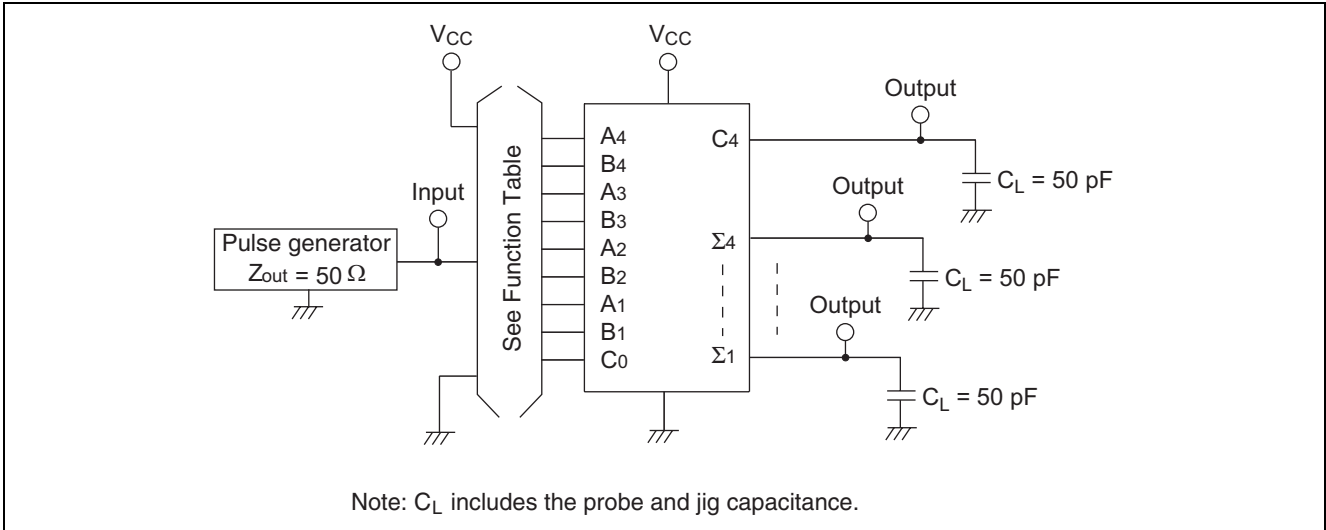
## Electrical Characteristics

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Input voltage	V <sub>IH</sub>	2.0	1.5	—	—	1.5	—	V		
		4.5	3.15	—	—	3.15	—			
		6.0	4.2	—	—	4.2	—			
	V <sub>IL</sub>	2.0	—	—	0.5	—	0.5	V		
		4.5	—	—	1.35	—	1.35			
		6.0	—	—	1.8	—	1.8			
Output voltage	V <sub>OH</sub>	2.0	1.9	2.0	—	1.9	—	V	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA
		4.5	4.4	4.5	—	4.4	—			I <sub>OH</sub> = -4 mA
		6.0	5.9	6.0	—	5.9	—			I <sub>OH</sub> = -5.2 mA
		4.5	4.18	—	—	4.13	—			
		6.0	5.68	—	—	5.63	—			
		6.0	5.68	—	—	5.63	—			
	V <sub>OL</sub>	2.0	—	0.0	0.1	—	0.1	V	V <sub>in</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA
		4.5	—	0.0	0.1	—	0.1			
		6.0	—	0.0	0.1	—	0.1			
		4.5	—	—	0.26	—	0.33			I <sub>OL</sub> = 4 mA
		6.0	—	—	0.26	—	0.33			I <sub>OL</sub> = 5.2 mA
		6.0	—	—	0.26	—	0.33			
Input current	I <sub>in</sub>	6.0	—	—	±0.1	—	±1.0	μA	V <sub>in</sub> = V <sub>CC</sub> or GND	
Quiescent supply current	I <sub>CC</sub>	6.0	—	—	4.0	—	40	μA	V <sub>in</sub> = V <sub>CC</sub> or GND, I <sub>out</sub> = 0 μA	

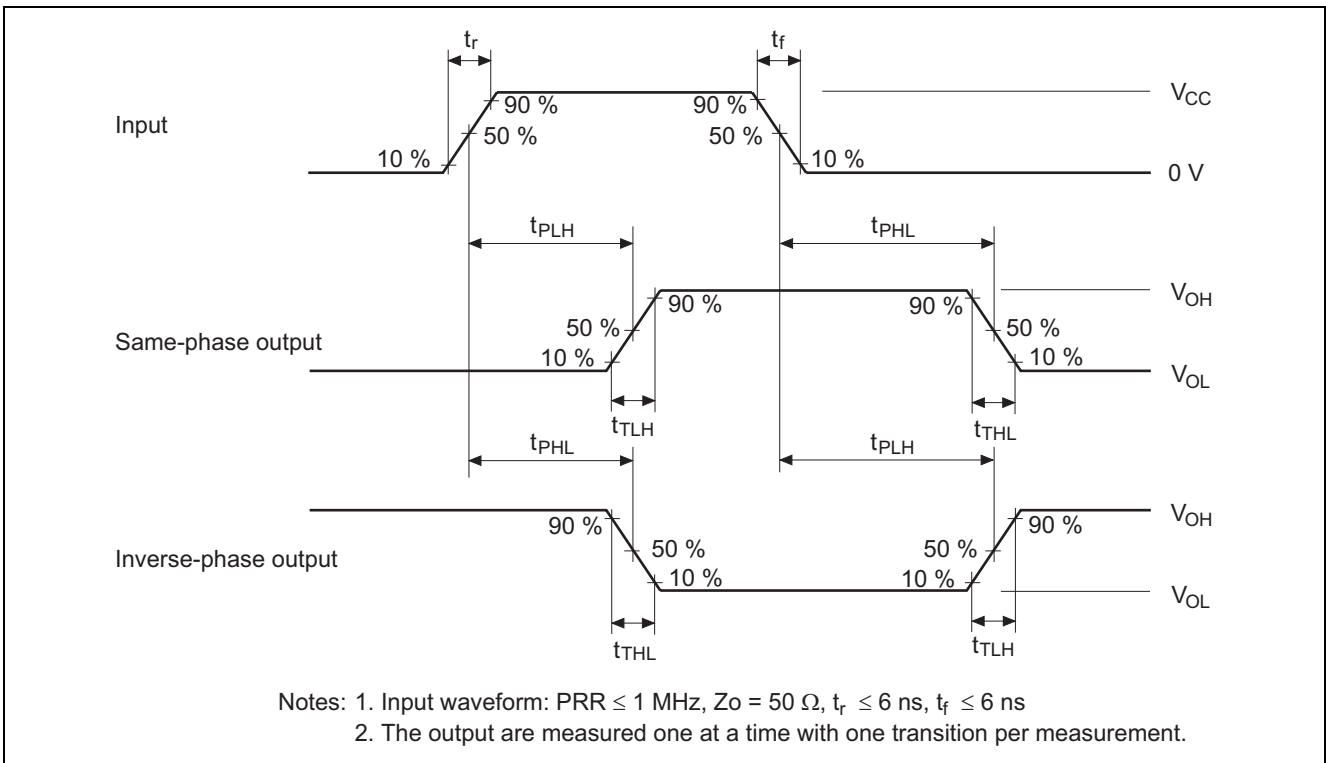
Switching Characteristics (C<sub>L</sub> = 50 pF, Input t<sub>r</sub> = t<sub>f</sub> = 6 ns)

Item	Symbol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Propagation delay time	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0	—	—	150	—	190	ns	C <sub>0</sub> to Σ <sub>1</sub>	
		4.5	—	19	30	—	38			
		6.0	—	—	26	—	33			
	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0	—	—	150	—	190	ns	A <sub>1</sub> or B <sub>1</sub> to Σ <sub>1</sub>	
		4.5	—	16	30	—	38			
		6.0	—	—	26	—	33			
	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0	—	—	150	—	190	ns	C <sub>0</sub> to C <sub>4</sub>	
		4.5	—	17	30	—	38			
		6.0	—	—	26	—	33			
	t <sub>PLH</sub> , t <sub>PHL</sub>	2.0	—	—	150	—	190	ns	A <sub>1</sub> or B <sub>1</sub> to C <sub>4</sub>	
		4.5	—	18	30	—	38			
		6.0	—	—	26	—	33			
Output fall time	t <sub>THL</sub>	2.0	—	—	75	—	95	ns		
		4.5	—	5	15	—	19			
		6.0	—	—	13	—	16			
Input capacitance	C <sub>in</sub>	—	—	5	10	—	10	pF		

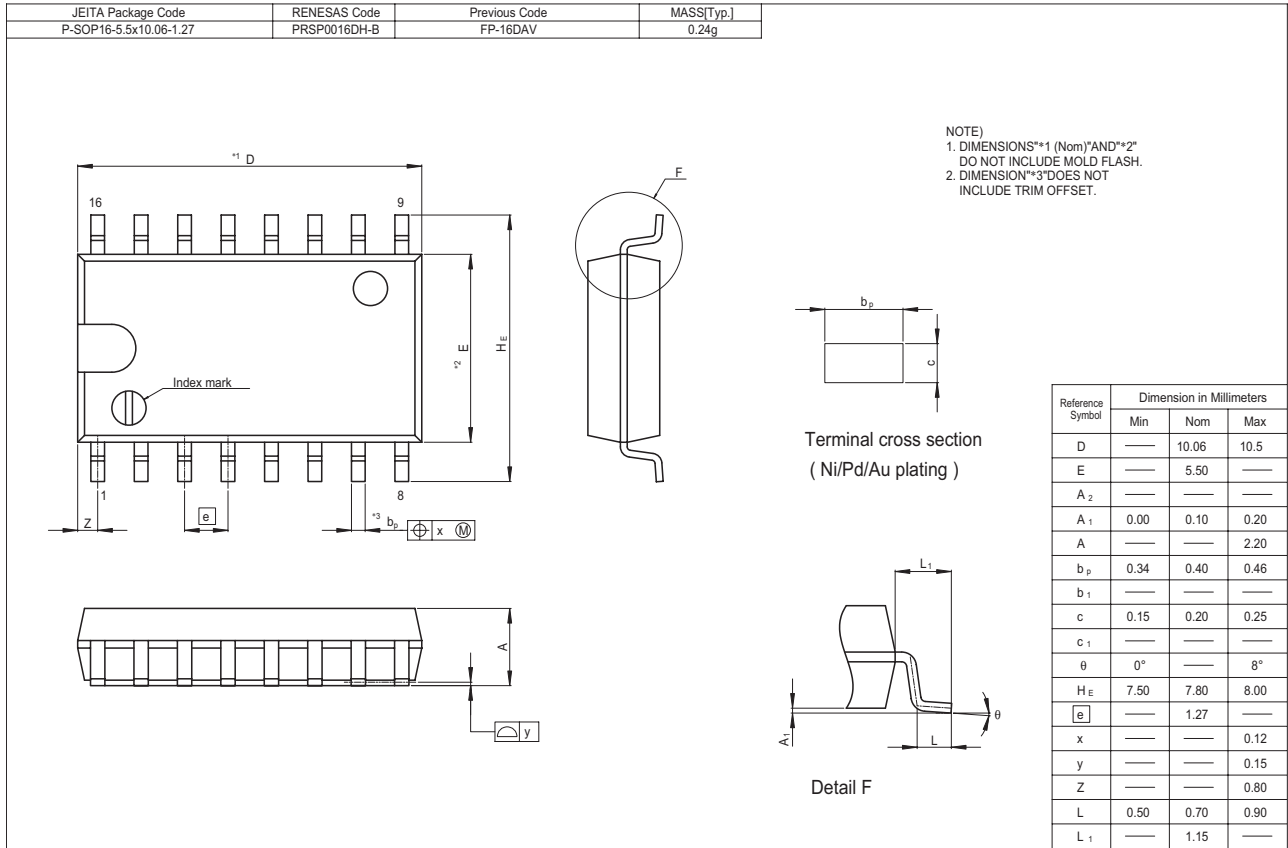
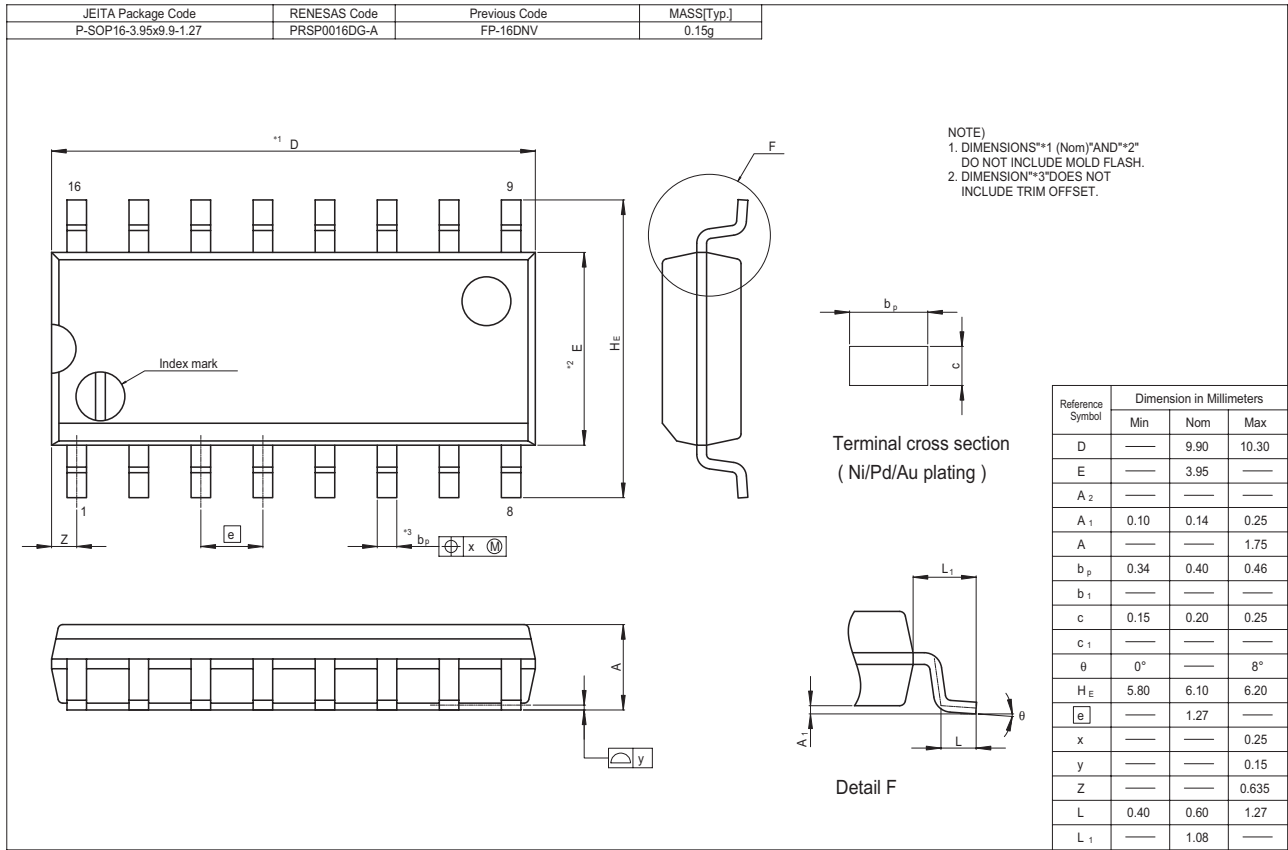
Test Circuit



Waveforms



Package Dimensions





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