

# HD74LS138

## 3-Line-to-8-Line Decoders / Demultiplexers

REJ03D0434-0300

Rev.3.00

Jul.13.2005

The HD74LS138 decodes one-of-eight line dependent on the conditions at the three binary select inputs and the three enable inputs. Two active-low and one active-high enable inputs reduce the need for external gates or inverters when expanding. A 24-line decoder can be implemented without external inverters and a 32-line decoder requires only one inverter. An enable input can be used as a data input for demultiplexing applications.

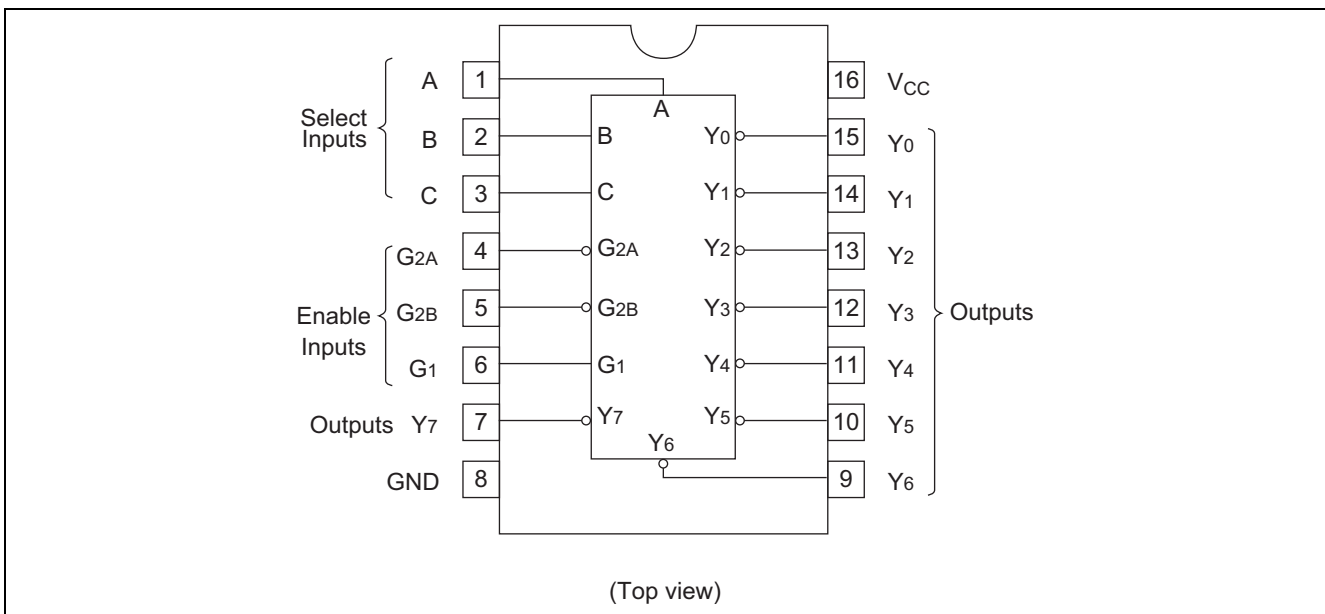
### Features

- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74LS138P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	-
HD74LS138FPEL	SOP-16 pin (JEITA)	PRSP0016DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)
HD74LS138RPEL	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.

### Pin Arrangement



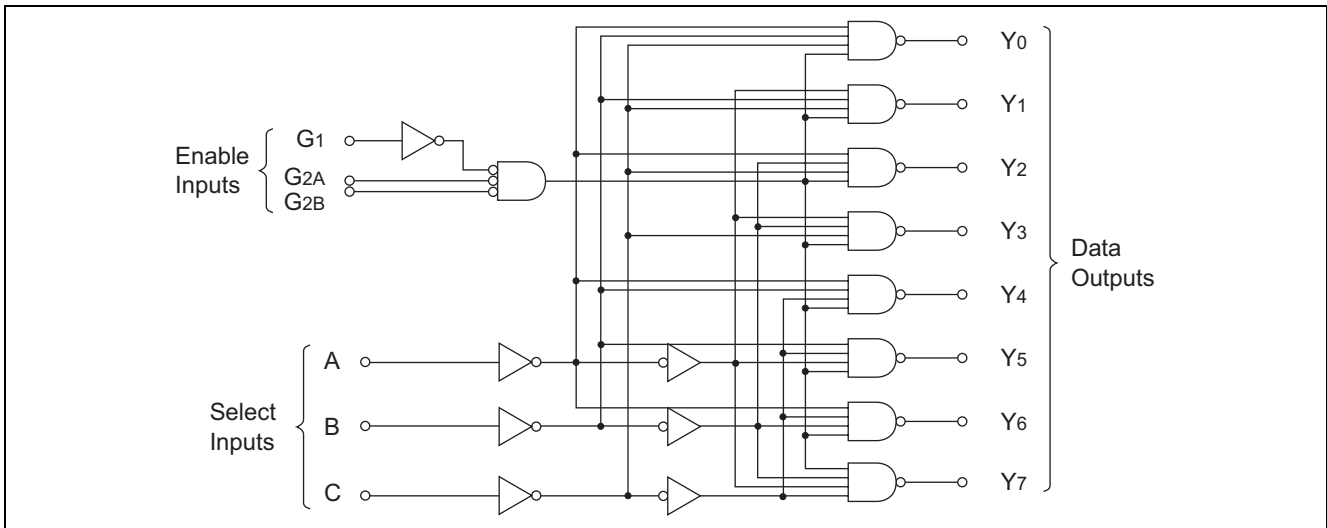
**Function Table**

Inputs					Outputs							
Enable		Select										
G1	G2*	C	B	A	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>	Y <sub>5</sub>	Y <sub>6</sub>	Y <sub>7</sub>
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

H ; high level, L ; low level, X ; irrelevant

\* ; G<sub>2</sub> = G<sub>2A</sub> + G<sub>2B</sub>

**Block Diagram**



**Absolute Maximum Ratings**

Item	Symbol	Ratings	Unit
Supply voltage	V <sub>CC</sub>	7	V
Input voltage	V <sub>IN</sub>	7	V
Power dissipation	P <sub>T</sub>	400	mW
Storage temperature	T <sub>stg</sub>	-65 to +150	°C

Note: Voltage value, unless otherwise noted, are with respect to network ground terminal.

**Recommended Operating Conditions**

Item	Symbol	Min	Typ	Max	Unit
Supply voltage	V <sub>CC</sub>	4.75	5.00	5.25	V
Output current	I <sub>OH</sub>	—	—	-400	μA
	I <sub>OL</sub>	—	—	8	mA
Operating temperature	Topr	-20	25	75	°C

## Electrical Characteristics

(Ta = -20 to +75 °C)

Item	Symbol	min.	typ.*	max.	Unit	Condition
Input voltage	V <sub>IH</sub>	2.0	—	—	V	
	V <sub>IL</sub>	—	—	0.8	V	
Output voltage	V <sub>OH</sub>	2.7	—	—	V	V <sub>CC</sub> = 4.75 V, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OH</sub> = -400 μA
	V <sub>OL</sub>	—	—	0.4	V	V <sub>CC</sub> = 4.75 V, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V
—		—	0.5			
Input current	I <sub>IH</sub>	—	—	20	μA	V <sub>CC</sub> = 5.25 V, V <sub>I</sub> = 2.7 V
	I <sub>IL</sub>	—	—	-0.4	mA	V <sub>CC</sub> = 5.25 V, V <sub>I</sub> = 0.4 V
	I <sub>I</sub>	—	—	0.1	mA	V <sub>CC</sub> = 5.25 V, V <sub>I</sub> = 7 V
Short-circuit output current	I <sub>OS</sub>	-20	—	-100	mA	V <sub>CC</sub> = 5.25 V
Supply current	I <sub>CC</sub>	—	6.3	10	mA	V <sub>CC</sub> = 5.25 V, Outputs enabled and open
Input clamp voltage	V <sub>IK</sub>	—	—	-1.5	V	V <sub>CC</sub> = 4.75 V, I <sub>IN</sub> = -18 mA

Note: \* V<sub>CC</sub> = 5 V, Ta = 25°C

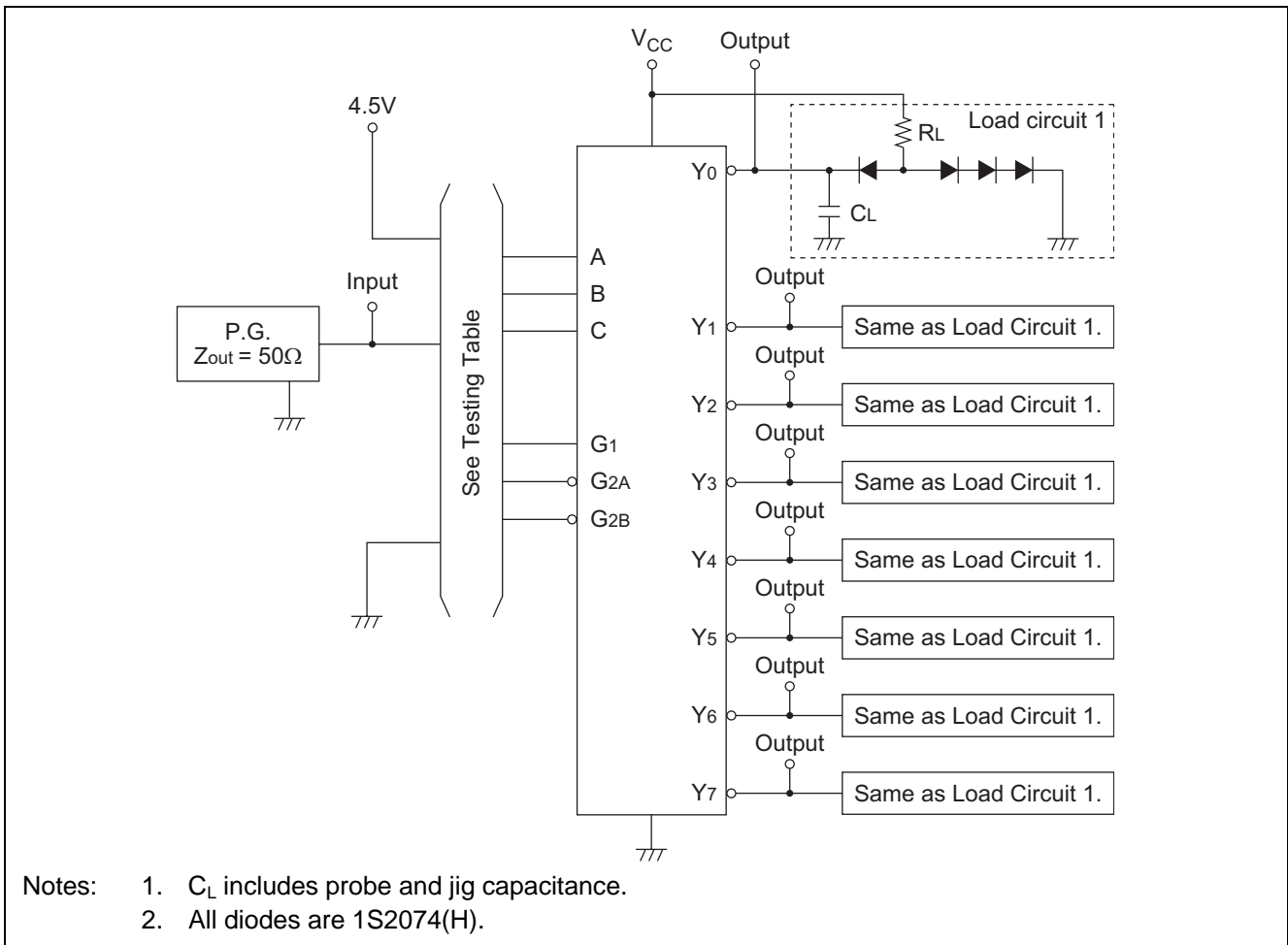
## Switching Characteristics

(V<sub>CC</sub> = 5 V, Ta = 25°C)

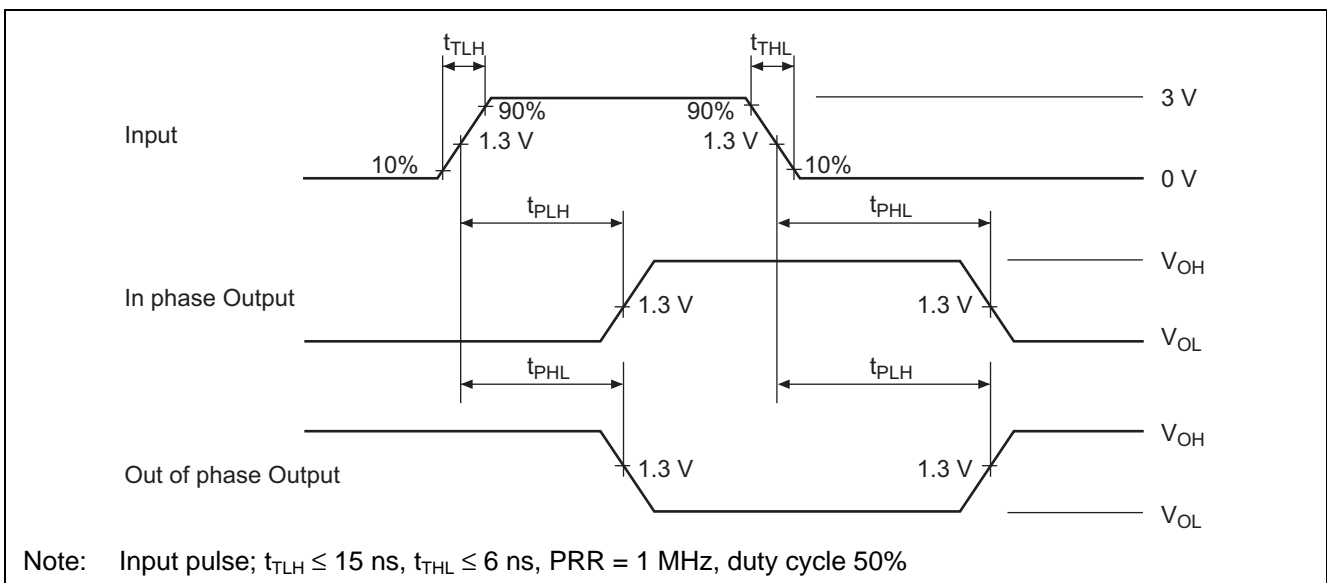
Item	Symbol	Inputs	Output	Levels of delay	min.	typ.	max.	Unit	Condition
Propagation delay time	t <sub>PLH</sub>	Binary select A, B, C	Y	2	—	13	20	ns	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 2 kΩ
	t <sub>PHL</sub>				—	27	41	ns	
	t <sub>PLH</sub>			3	—	18	27	ns	
	t <sub>PLH</sub>				—	26	39	ns	
	t <sub>PLH</sub>	Enable G <sub>2A</sub> , G <sub>2B</sub>	Y	2	—	12	18	ns	
	t <sub>PHL</sub>				—	21	32	ns	
	t <sub>PLH</sub>	Enable G <sub>1</sub>	3	—	17	26	ns		
	t <sub>PLH</sub>			—	25	38	ns		

## Testing Method

### Test Circuit



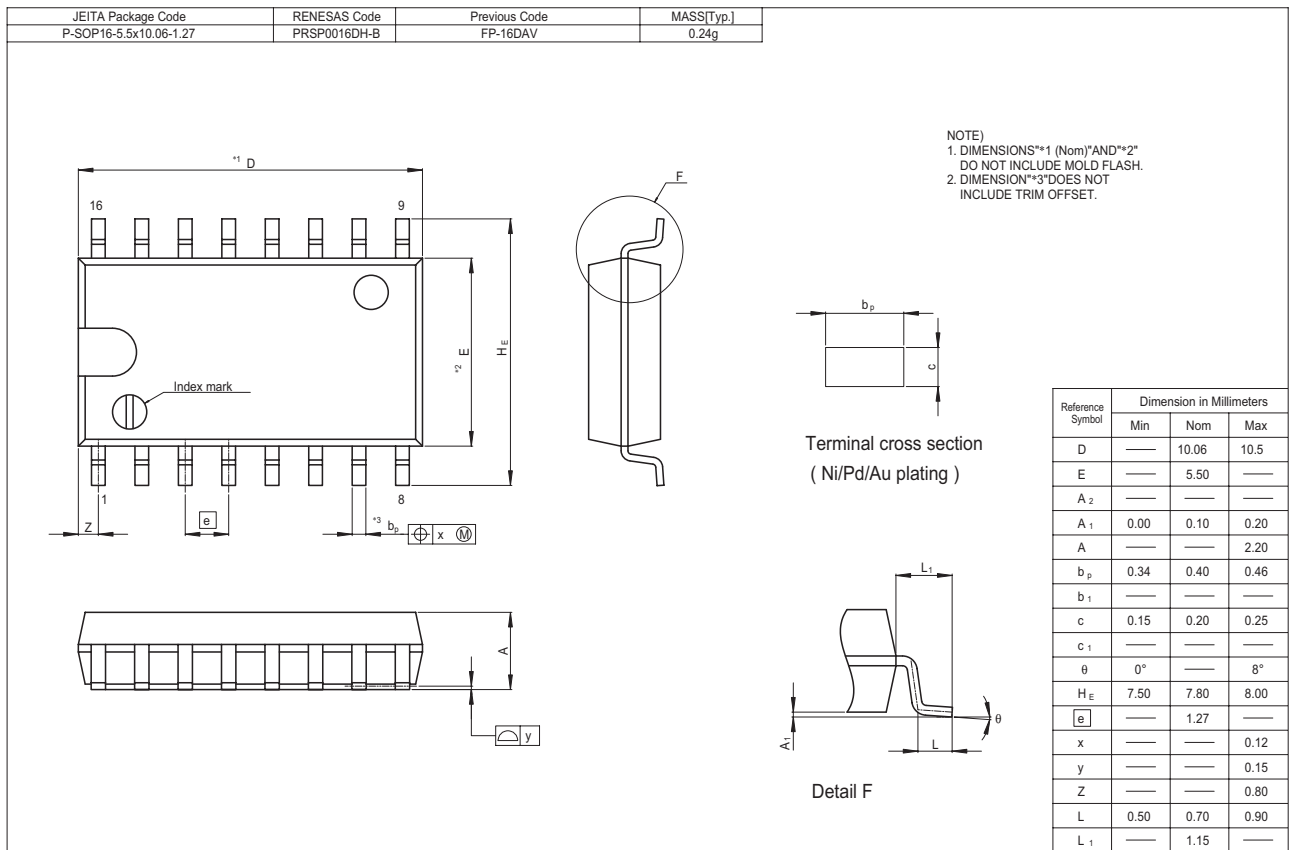
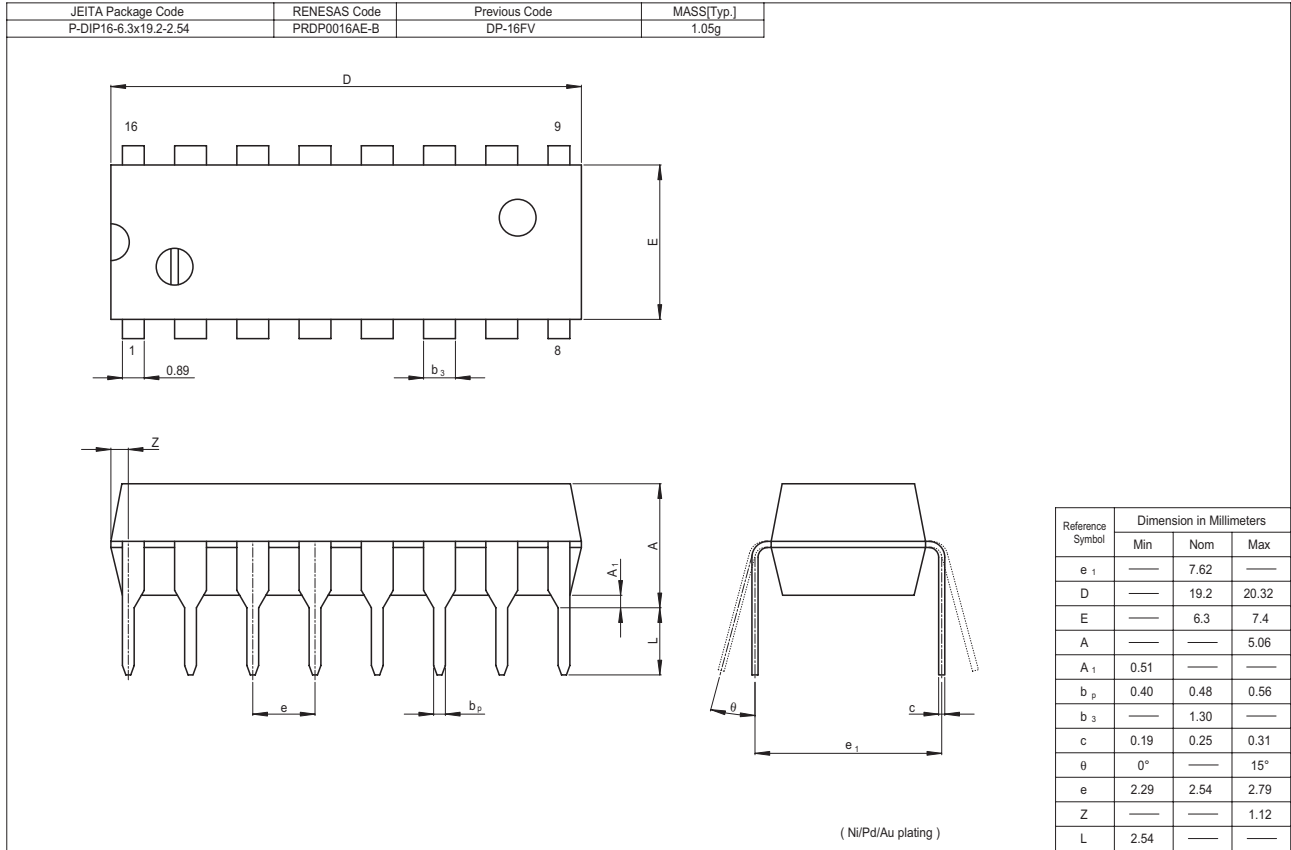
### Waveform



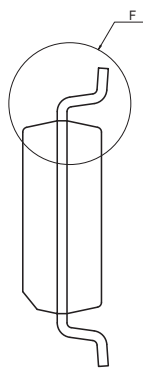
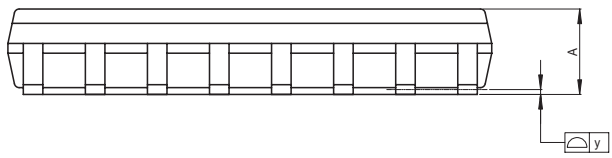
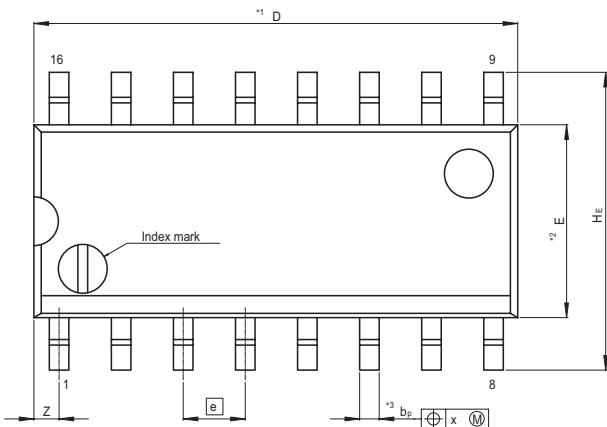
**Relation Between Input and Output to Levels of Delay**

Inputs	Outputs							
	2 levels of delay				3 levels of delay			
A	Y <sub>0</sub>	Y <sub>2</sub>	Y <sub>4</sub>	Y <sub>6</sub>	Y <sub>1</sub>	Y <sub>3</sub>	Y <sub>5</sub>	Y <sub>7</sub>
B	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>4</sub>	Y <sub>5</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>6</sub>	Y <sub>7</sub>
C	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>3</sub>	Y <sub>4</sub>	Y <sub>5</sub>	Y <sub>6</sub>	Y <sub>7</sub>
G <sub>1</sub>					Y <sub>0</sub> to Y <sub>7</sub>			
G <sub>2A</sub> , G <sub>2B</sub>	Y <sub>0</sub> to Y <sub>7</sub>							

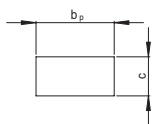
Package Dimensions



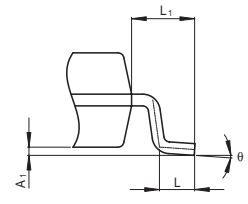
JEITA Package Code P-SOP16-3.95x9.9-1.27	RENESAS Code PRSP0016DG-A	Previous Code FP-16DNV	MASS[Typ.] 0.15g
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NOTE)  
1. DIMENSIONS  $^{*1}$  (Nom)  $^{*2}$  AND  $^{*3}$   
DO NOT INCLUDE MOLD FLASH.  
2. DIMENSION  $^{*3}$  DOES NOT  
INCLUDE TRIM OFFSET.



Terminal cross section  
( Ni/Pd/Au plating )



Detail F

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	9.90	10.30
E	—	3.95	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.10	0.14	0.25
A	—	—	1.75
b <sub>p</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
$\theta$	0°	—	8°
H <sub>E</sub>	5.80	6.10	6.20
e	—	1.27	—
x	—	—	0.25
y	—	—	0.15
Z	—	—	0.635
L	0.40	0.60	1.27
L <sub>1</sub>	—	1.08	—

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