

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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# HD74AC139/HD74ACT139

## Dual 1-of-4 Decoder/Demultiplexer

REJ03D0249-0200Z  
(Previous ADE-205-369 (Z))  
Rev.2.00  
Jul.16.2004

### Description

The HD74AC139/HD74ACT139 is a high-speed, dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each accepting two inputs and providing four mutually-exclusive active-Low outputs. Each decoder has an active-Low Enable input which can be used as a data input for a 4-output demultiplexer. Each half of the HD74AC139/HD74ACT139 can be used as a function generator providing all four minterms of two variables.

### Features

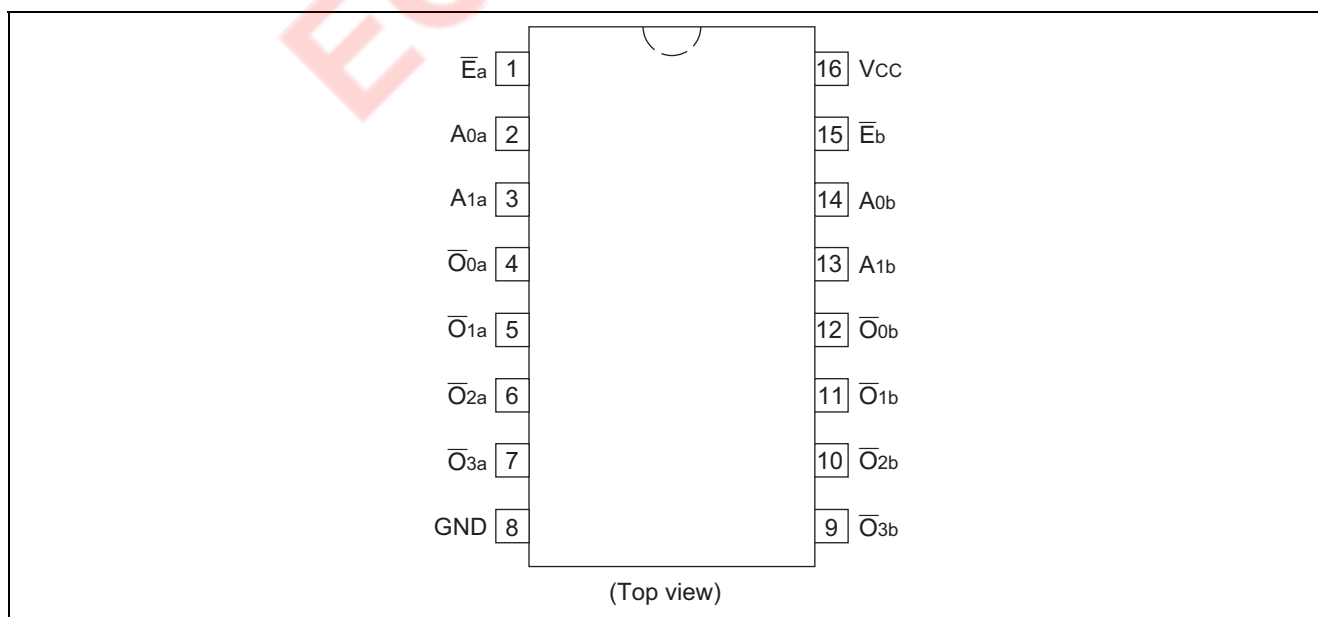
- Multifunction Capability
- Two Completely Independent 1-of-4 Decoders
- Active Low Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- HD74ACT139 has TTL-Compatible Inputs
- Ordering Information: Ex. HD74AC139

Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC139AP	DIP-16 pin	DP-16E, -16FV	P	—
HD74AC139AFPEL	SOP-16 pin (JEITA)	FP-16DAV	FP	EL (2,000 pcs/reel)
HD74AC139ARPEL	SOP-16 pin (JEDEC)	FP-16DNV	RP	EL (2,500 pcs/reel)
HD74AC139TELL	TSSOP-16 pin	TTP-16DAV	T	ELL(2,000 pcs/reel)

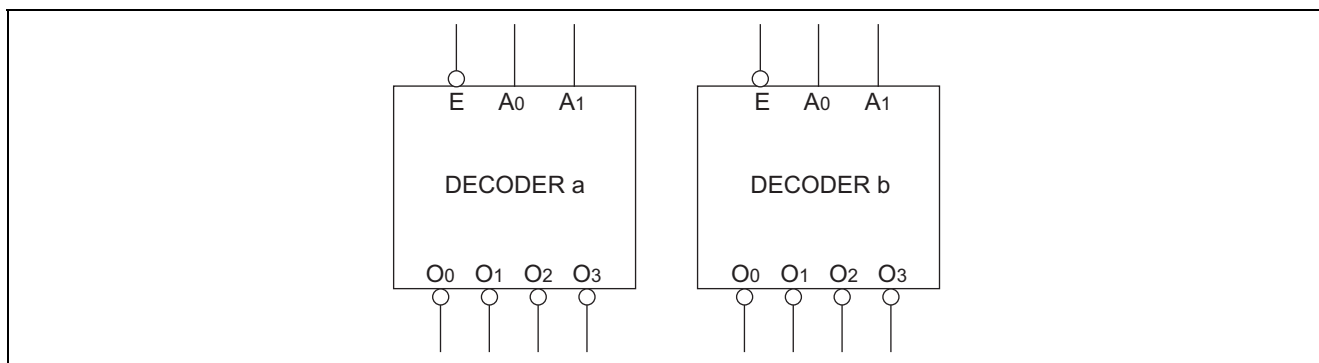
Notes: 1. Please consult the sales office for the above package availability.

2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

### Pin Arrangement



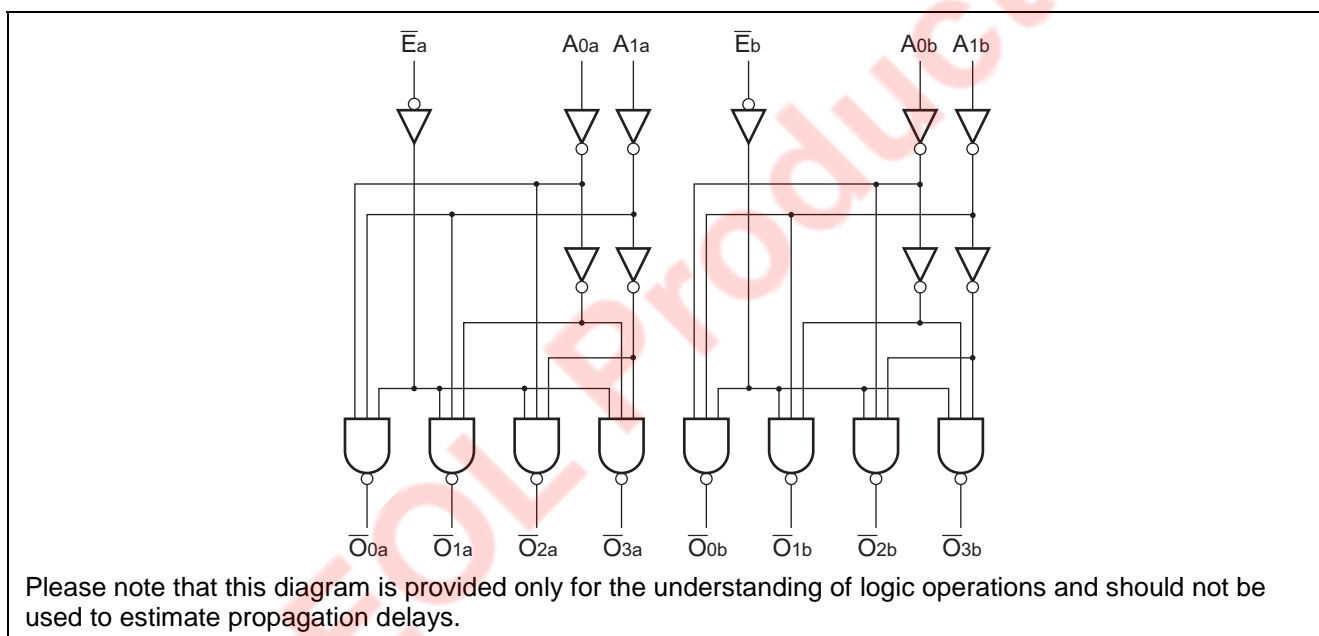
## Logic Symbol



## Pin Names

$A_0, A_1$	Address Inputs
$\overline{E}$	Enable Inputs
$\overline{O}_0$ to $\overline{O}_3$	Outputs

## Logic Diagram



## Functional Description

The HD74AC139/HD74ACT139 is a high-speed dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each of which accepts two binary weighted inputs ( $A_0$  to  $A_1$ ) and provides four mutually exclusive active-Low outputs ( $\overline{O}_0$  to  $\overline{O}_3$ ). Each decoder has an active-Low enable ( $\overline{E}$ ). When  $\overline{E}$  is High all outputs are forced High. The enable can be used as the data input for a 4-output demultiplexer application. Each half of the HD74AC139/HD74ACT139 generates all four minterms of two variables. These four minterms are useful in some applications, replacing multiple gate functions as shown in Figure a, and thereby reducing the number of packages required in a logic network.

## Truth Table

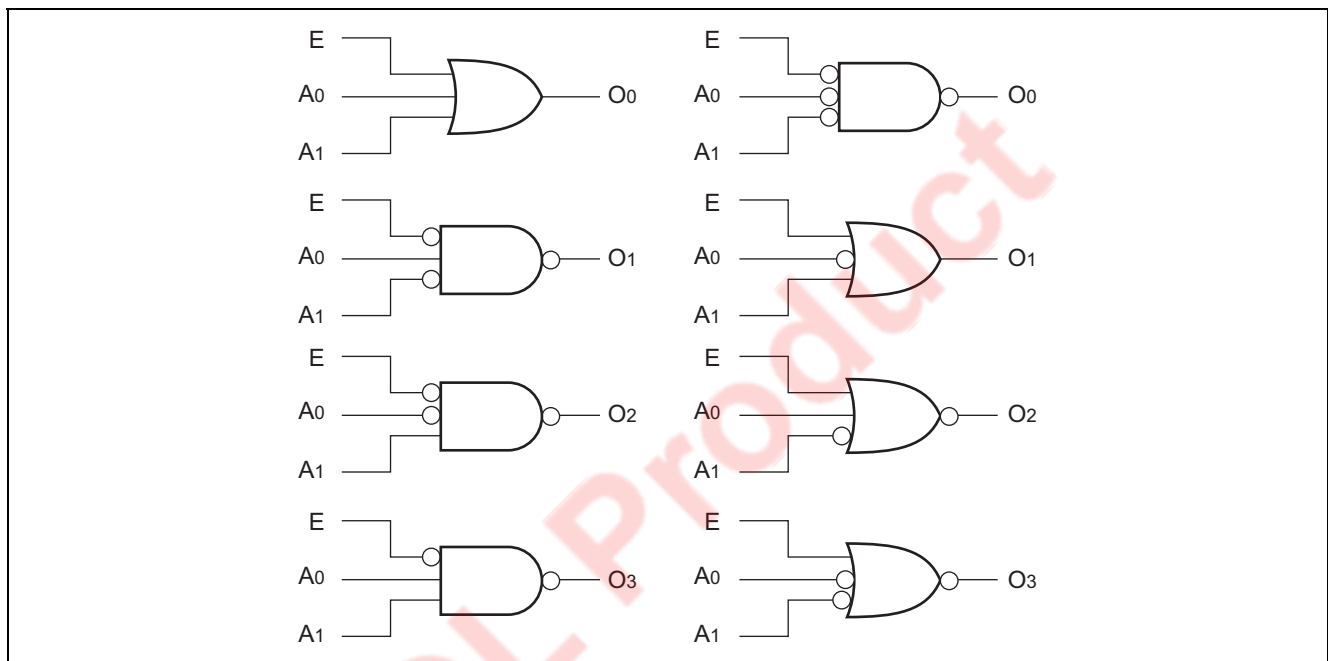
Inputs			Outputs			
$\bar{E}$	$A_0$	$A_1$	$\bar{O}_0$	$\bar{O}_1$	$\bar{O}_2$	$\bar{O}_3$
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	H	L	H	L	H	H
L	L	H	H	H	L	H
L	H	H	H	H	H	L

H : High Voltage Level

L : Low Voltage Level

X : Immaterial

**Figure a: Gate Functions (each half)**



## Absolute Maximum Ratings

Item	Symbol	Ratings	Unit	Condition
Supply voltage	$V_{CC}$	-0.5 to 7	V	
DC input diode current	$I_{IK}$	-20	mA	$V_I = -0.5V$
		20	mA	$V_I = V_{CC}+0.5V$
DC input voltage	$V_I$	-0.5 to $V_{CC}+0.5$	V	
DC output diode current	$I_{OK}$	-50	mA	$V_O = -0.5V$
		50	mA	$V_O = V_{CC}+0.5V$
DC output voltage	$V_O$	-0.5 to $V_{CC}+0.5$	V	
DC output source or sink current	$I_O$	$\pm 50$	mA	
DC $V_{CC}$ or ground current per output pin	$I_{CC}, I_{GND}$	$\pm 50$	mA	
Storage temperature	$T_{stg}$	-65 to +150	$^{\circ}C$	

## Recommended Operating Conditions: HD74AC139

Item	Symbol	Ratings	Unit	Condition
Supply voltage	$V_{CC}$	2 to 6	V	
Input and output voltage	$V_I, V_O$	0 to $V_{CC}$	V	
Operating temperature	$T_a$	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) $V_{IN}$ 30% to 70% $V_{CC}$	$t_r, t_f$	8	ns/V	$V_{CC} = 3.0V$ $V_{CC} = 4.5V$ $V_{CC} = 5.5V$

## DC Characteristics: HD74AC139

Item	Sym- bol	$V_{CC}$ (V)	$T_a = 25^\circ C$			$T_a = -40 \text{ to } +85^\circ C$		Unit	Condition
			min.	typ.	max.	min.	max.		
Input Voltage	$V_{IH}$	3.0	2.1	1.5	—	2.1	—	V	$V_{OUT} = 0.1V \text{ or } V_{CC} - 0.1V$
		4.5	3.15	2.25	—	3.15	—		
		5.5	3.85	2.75	—	3.85	—		
	$V_{IL}$	3.0	—	1.50	0.9	—	0.9		$V_{OUT} = 0.1V \text{ or } V_{CC} - 0.1V$
		4.5	—	2.25	1.35	—	1.35		
		5.5	—	2.75	1.65	—	1.65		
Output voltage	$V_{OH}$	3.0	2.9	2.99	—	2.9	—	V	$V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OUT} = -50 \mu A$
		4.5	4.4	4.49	—	4.4	—		
		5.5	5.4	5.49	—	5.4	—		
		3.0	2.58	—	—	2.48	—		$V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OH} = -12 \text{ mA}$ $I_{OH} = -24 \text{ mA}$ $I_{OH} = -24 \text{ mA}$
		4.5	3.94	—	—	3.80	—		
		5.5	4.94	—	—	4.80	—		
	$V_{OL}$	3.0	—	0.002	0.1	—	0.1		$V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OUT} = 50 \mu A$
		4.5	—	0.001	0.1	—	0.1		
		5.5	—	0.001	0.1	—	0.1		
		3.0	—	—	0.32	—	0.37		$V_{IN} = V_{IL} \text{ or } V_{IH}$ $I_{OL} = 12 \text{ mA}$ $I_{OL} = 24 \text{ mA}$ $I_{OL} = 24 \text{ mA}$
		4.5	—	—	0.32	—	0.37		
		5.5	—	—	0.32	—	0.37		
Input leakage current	$I_{IN}$	5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu A$	$V_{IN} = V_{CC} \text{ or GND}$
Dynamic output current*	$I_{OLD}$	5.5	—	—	—	86	—	mA	$V_{OLD} = 1.1V$
	$I_{OHD}$	5.5	—	—	—	-75	—	mA	$V_{OHD} = 3.85V$
Quiescent supply current	$I_{CC}$	5.5	—	—	8.0	—	80	$\mu A$	$V_{IN} = V_{CC} \text{ or ground}$

\*Maximum test duration 2.0 ms, one output loaded at a time.

## Recommended Operating Conditions: HD74ACT139

Item	Symbol	Ratings	Unit	Condition
Supply voltage	$V_{CC}$	2 to 6	V	
Input and output voltage	$V_I, V_O$	0 to $V_{CC}$	V	
Operating temperature	$T_a$	-40 to +85	°C	
Input rise and fall time (except Schmitt inputs) $V_{IN}$ 0.8 to 2.0 V	$t_r, t_f$	8	ns/V	$V_{CC} = 4.5V$ $V_{CC} = 5.5V$

## DC Characteristics: HD74ACT139

Item	Sym- bol	V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40 to +85°C		Unit	Condition	
			min.	typ.	max.	min.	max.			
Input voltage	V <sub>IH</sub>	4.5	2.0	1.5	—	2.0	—	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> -0.1 V	
		5.5	2.0	1.5	—	2.0	—			
	V <sub>IL</sub>	4.5	—	1.5	0.8	—	0.8		V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> -0.1 V	
		5.5	—	1.5	0.8	—	0.8			
Output voltage	V <sub>OH</sub>	4.5	4.4	4.49	—	4.4	—	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OUT</sub> = -50 μA	
		5.5	5.4	5.49	—	5.4	—			
		4.5	3.94	—	—	3.80	—		V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OH</sub> = -24 mA
		5.5	4.94	—	—	4.80	—		I <sub>OH</sub> = -24 mA	
	V <sub>OL</sub>	4.5	—	0.001	0.1	—	0.1		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> I <sub>OUT</sub> = 50 μA	
		5.5	—	0.001	0.1	—	0.1			
		4.5	—	—	0.32	—	0.37		V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 24 mA
		5.5	—	—	0.32	—	0.37		I <sub>OL</sub> = 24 mA	
Input current	I <sub>IN</sub>	5.5	—	—	±0.1	—	±1.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND	
I <sub>CC</sub> /input current	I <sub>CCT</sub>	5.5	—	0.6	—	—	1.5	mA	V <sub>IN</sub> = V <sub>CC</sub> -2.1 V	
Dynamic output current*	I <sub>OLD</sub>	5.5	—	—	—	86	—	mA	V <sub>OLD</sub> = 1.1 V	
	I <sub>OHD</sub>	5.5	—	—	—	-75	—	mA	V <sub>OHD</sub> = 3.85 V	
Quiescent supply current	I <sub>CC</sub>	5.5	—	—	8.0	—	80	μA	V <sub>IN</sub> = V <sub>CC</sub> or ground	

\*Maximum test duration 2.0 ms, one output loaded at a time.

## AC Characteristics: HD74AC139

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF			Ta = -40°C to +85°C C <sub>L</sub> = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Propagation delay A <sub>n</sub> to $\overline{O}_n$	t <sub>PLH</sub>	3.3	1.0	8.0	11.5	1.0	13.0	ns
		5.0	1.0	6.5	8.5	1.0	9.5	
Propagation delay A <sub>n</sub> to $\overline{O}_n$	t <sub>PHL</sub>	3.3	1.0	7.0	10.0	1.0	11.0	ns
		5.0	1.0	5.5	7.5	1.0	8.5	
Propagation delay $\overline{E}_n$ to $\overline{O}_n$	t <sub>PLH</sub>	3.3	1.0	9.5	12.0	1.0	13.0	ns
		5.0	1.0	7.0	8.5	1.0	10.0	
Propagation delay $\overline{E}_n$ to $\overline{O}_n$	t <sub>PHL</sub>	3.3	1.0	8.0	10.0	1.0	11.0	ns
		5.0	1.0	6.0	7.5	1.0	8.5	

Note: 1. Voltage Range 3.3 is 3.3 V ± 0.3 V

Voltage Range 5.0 is 5.0 V ± 0.5 V

## AC Characteristics: HD74ACT139

Item	Symbol	V <sub>CC</sub> (V)*1	Ta = +25°C C <sub>L</sub> = 50 pF			Ta = -40°C to +85°C C <sub>L</sub> = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Propagation delay A <sub>n</sub> to $\overline{O}_n$	t <sub>PLH</sub>	5.0	1.0	6.0	8.5	1.0	9.5	ns
Propagation delay A <sub>n</sub> to $\overline{O}_n$	t <sub>PHL</sub>	5.0	1.0	6.0	9.5	1.0	10.5	ns
Propagation delay $\overline{E}_n$ to $\overline{O}_n$	t <sub>PLH</sub>	5.0	1.0	7.0	10.0	1.0	11.0	ns
Propagation delay $\overline{E}_n$ to $\overline{O}_n$	t <sub>PHL</sub>	5.0	1.0	7.0	9.5	1.0	10.5	ns

Note: 1. Voltage Range 5.0 is 5.0 V ± 0.5 V

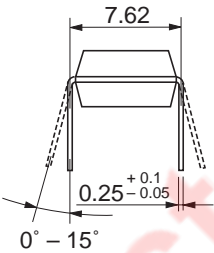
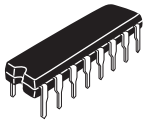
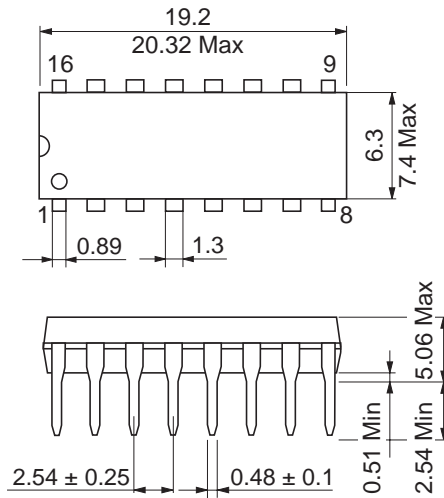
**Capacitance**

Item	Symbol	Typ	Unit	Condition
Input capacitance	$C_{IN}$	4.5	pF	$V_{CC} = 5.5 \text{ V}$
Power dissipation capacitance	$C_{PD}$	40.0	pF	$V_{CC} = 5.0 \text{ V}$

EOL Product

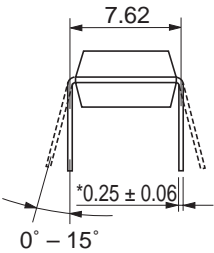
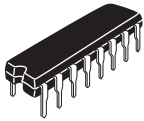
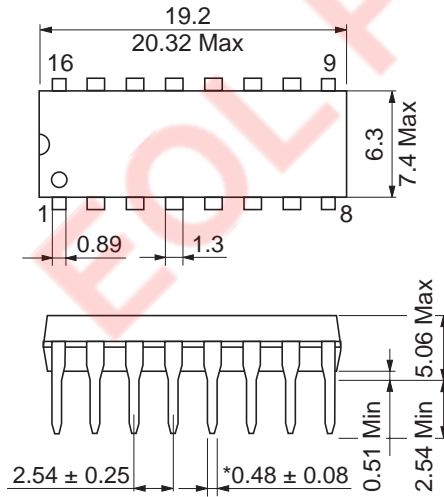
Package Dimensions

As of January, 2003  
Unit: mm



Package Code	DP-16E
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	1.05 g

Unit: mm

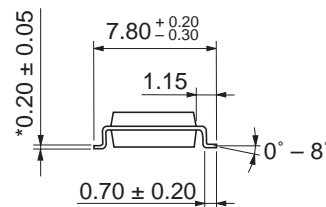
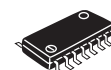
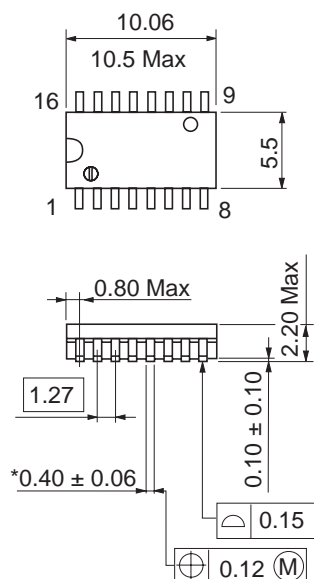


\*Ni/Pd/AU Plating

Package Code	DP-16FV
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JEITA	Conforms
Mass (reference value)	1.05 g

As of January, 2003

Unit: mm

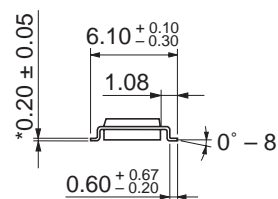
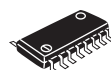
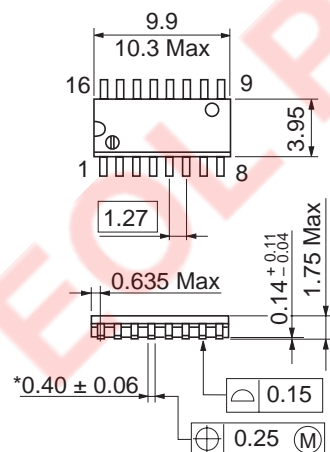


\*Ni/Pd/Au plating

Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

As of January, 2003

Unit: mm

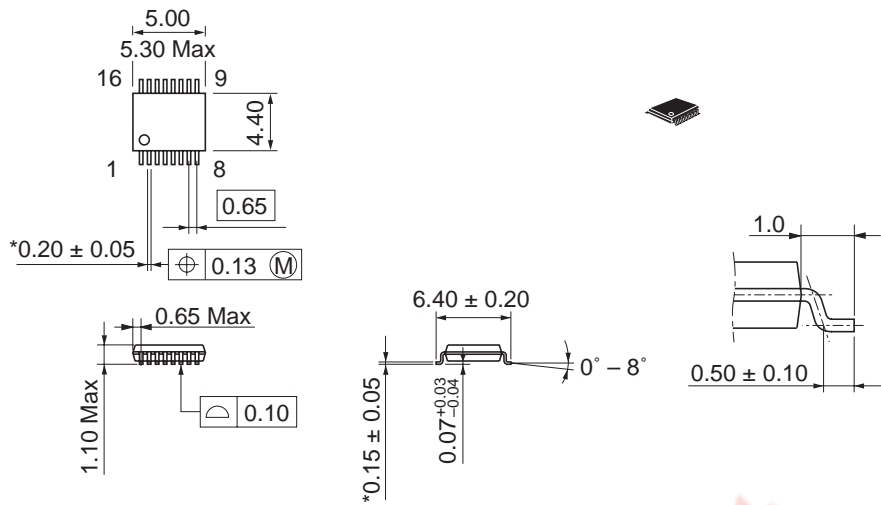


\*Ni/Pd/Au plating

Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

As of January, 2003

Unit: mm



\*Ni/Pd/Au plating

Package Code	TTP-16DAV
JEDEC	—
JEITA	—
Mass (reference value)	0.05 g

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