To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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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

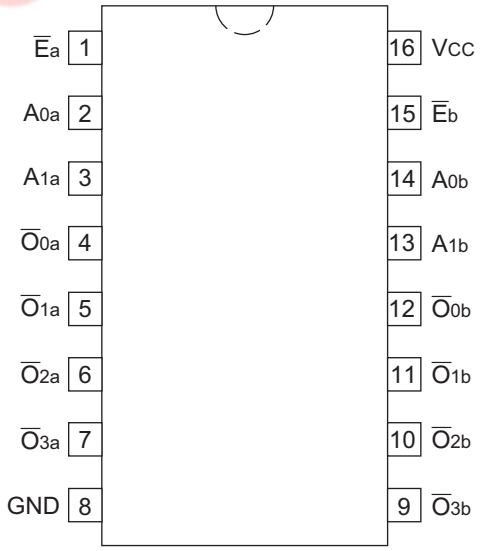
- Multifunction Capability
- Two Completely Independent 1-of-4 Decoders
- Active Low Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- HD74ACT139 has TTL-Compatible Inputs

- 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)

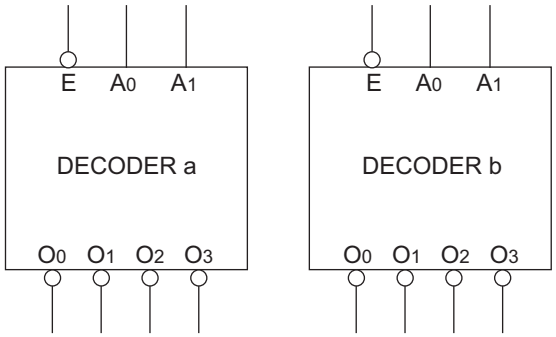
Notes: 1. Please consult the sales office for the above package availability.
2. The packages with lead-free pins are distinguished from the conventional products by adding V at the end of the package code.

Pin Arrangement



(Top view)

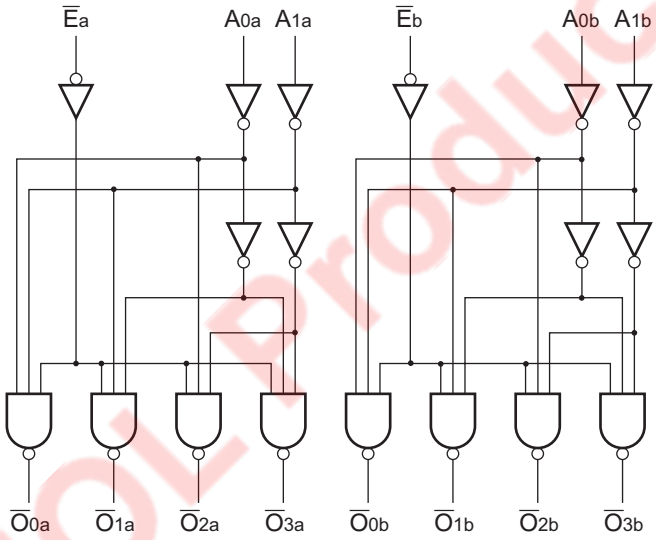
Logic Symbol



Pin Names

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

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Functional Description

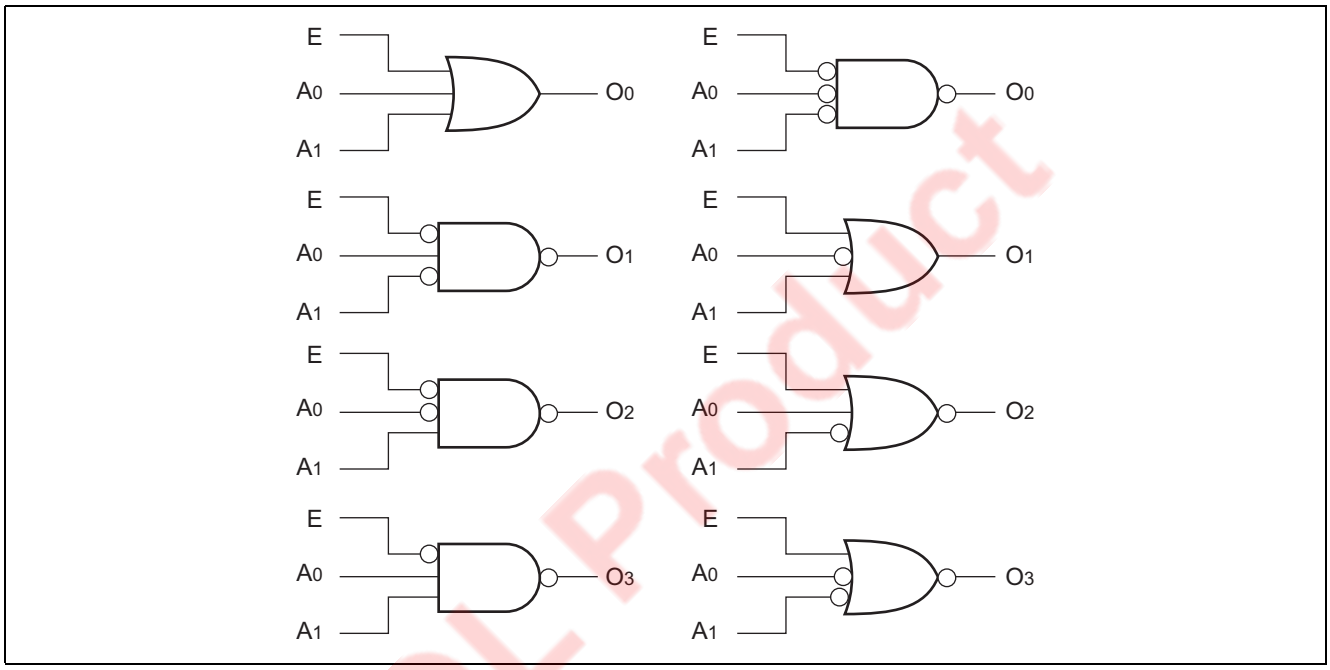
The HD74AC139/HD74ACT139 is a high-speed dual 1-of-4 decoder/demultiplexer. The device has two independent decoders, each of which accepts two binary weighted inputs (A_0 to A_1) and provides four mutually exclusive active-Low outputs ($\overline{O}_0$ to $\overline{O}_3$). Each decoder has an active-Low 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			
$\overline{E}$	A_0	A_1	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$
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 = Vcc+0.5V
DC input voltage	V_I	–0.5 to Vcc+0.5	V	
DC output diode current	I_{OK}	–50	mA	V_O = –0.5V
		50	mA	V_O = Vcc+0.5V
DC output voltage	V_O	–0.5 to Vcc+0.5	V	
DC output source or sink current	I_O	±50	mA	
DC V_{CC} or ground current per output pin	I_{CC}, I_{GND}	±50	mA	
Storage temperature	Tstg	–65 to +150	°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	Ta	–40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V_{IN} 30% to 70% V_{CC}	tr, tf	8	ns/V	V_{CC} = 3.0V
				V_{CC} = 4.5 V
				V_{CC} = 5.5 V

DC Characteristics: HD74AC139

Item	Sym-bol	Vcc (V)	Ta = 25°C			Ta = –40 to +85°C		Unit	Condition	
			min.	typ.	max.	min.	max.			
Input Voltage	V_{IH}	3.0	2.1	1.5	—	2.1	—	V	V_{OUT} = 0.1 V or V_{CC} –0.1 V	
		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} = 0.1 V or V_{CC} –0.1 V	
		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} or V_{IH} I_{OUT} = –50 µA	
		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} or V_{IH}	I_{OH} = –12 mA
		4.5	3.94	—	—	3.80	—			I_{OH} = –24 mA
		5.5	4.94	—	—	4.80	—			I_{OH} = –24 mA
	V_{OL}	3.0	—	0.002	0.1	—	0.1		V_{IN} = V_{IL} or V_{IH} I_{OUT} = 50 µA	
		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} or V_{IH}	I_{OL} = 12 mA
		4.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
		5.5	—	—	0.32	—	0.37			I_{OL} = 24 mA
Input leakage current	I_{IN}	5.5	—	—	±0.1	—	±1.0	µA	V_{IN} = V_{CC} or GND	
Dynamic output current*	I_{OLD}	5.5	—	—	—	86	—	mA	V_{OLD} = 1.1 V	
	I_{OHD}	5.5	—	—	—	–75	—	mA	V_{OHD} = 3.85 V	
Quiescent supply current	I_{CC}	5.5	—	—	8.0	—	80	µA	V_{IN} = V_{CC} 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	Ta	–40 to +85	°C	
Input rise and fall time (except Schmitt inputs) V_{IN} 0.8 to 2.0 V	tr, tf	8	ns/V	V_{CC} = 4.5V V_{CC} = 5.5V

DC Characteristics: HD74ACT139

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

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

AC Characteristics: HD74AC139

Item	Symbol	V_{CC} (V)*[1]	Ta = +25°C C_L = 50 pF			Ta = –40°C to +85°C C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Propagation delay A_n to $\overline{O}_n$	t_{PLH}	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_n to $\overline{O}_n$	t_{PHL}	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_{PLH}	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_{PHL}	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_{CC} (V)*[1]	Ta = +25°C C_L = 50 pF			Ta = –40°C to +85°C C_L = 50 pF		Unit
			Min	Typ	Max	Min	Max	
Propagation delay A_n to $\overline{O}_n$	t_{PLH}	5.0	1.0	6.0	8.5	1.0	9.5	ns
Propagation delay A_n to $\overline{O}_n$	t_{PHL}	5.0	1.0	6.0	9.5	1.0	10.5	ns
Propagation delay $\overline{E}_n$ to $\overline{O}_n$	t_{PLH}	5.0	1.0	7.0	10.0	1.0	11.0	ns
Propagation delay $\overline{E}_n$ to $\overline{O}_n$	t_{PHL}	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

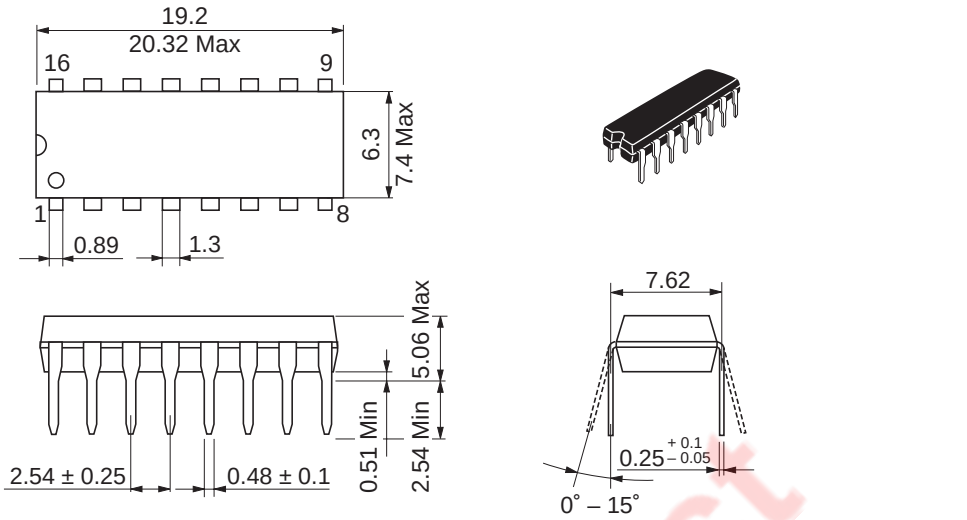
Capacitance

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

Package Dimensions

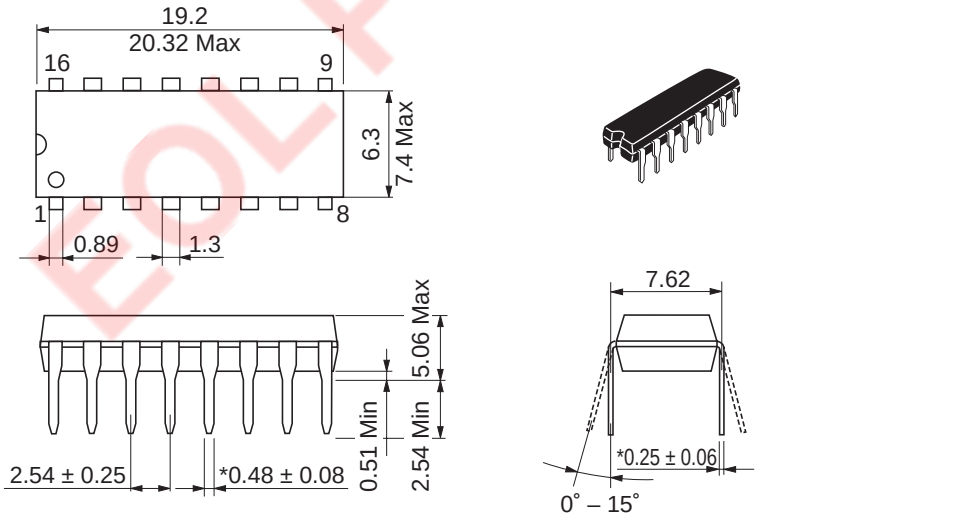
As of January, 2003

Unit: mm



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

Unit: mm

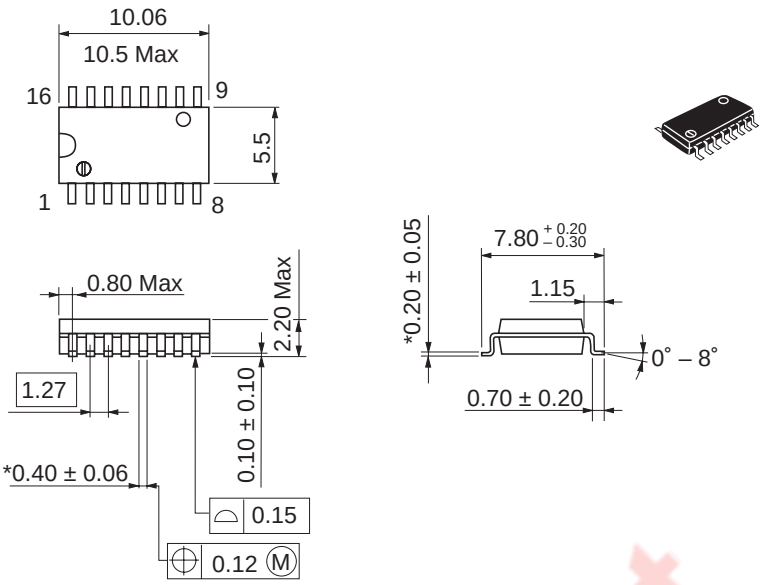


Package Code	DP-16FV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	1.05 g

*NI/Pd/AU Plating

As of January, 2003

Unit: mm

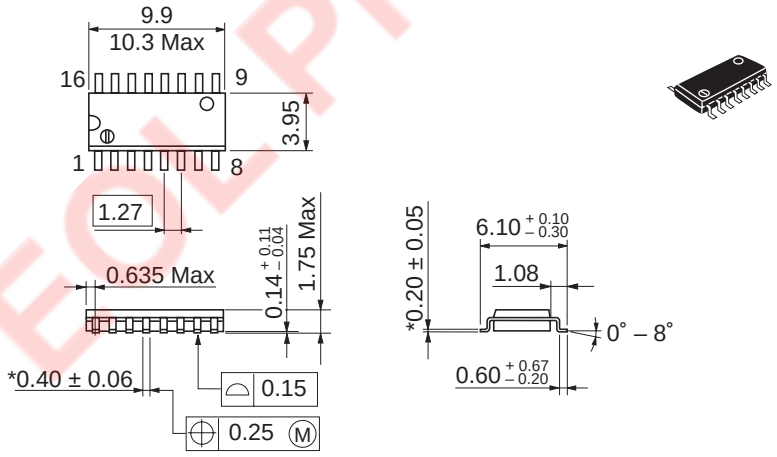


Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm

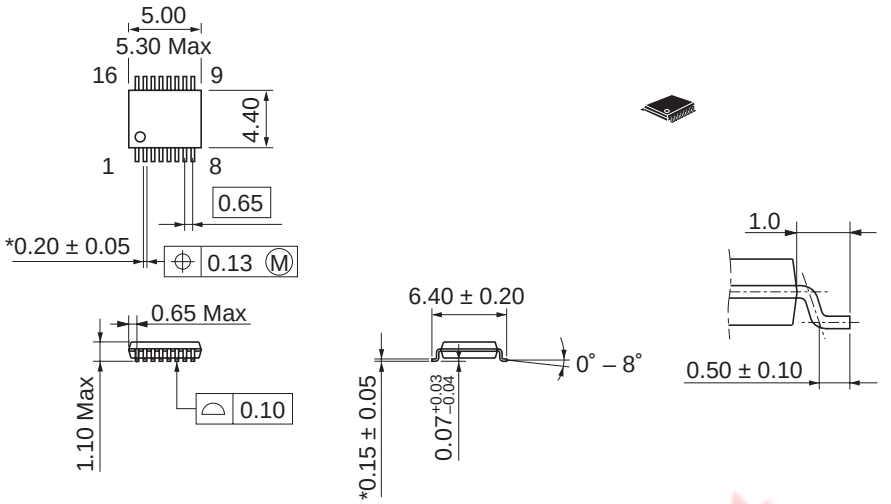


Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm



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

*Ni/Pd/Au plating

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