To our customers,

Old Company Name in Catalogs and Other Documents

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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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HD74AC138/HD74ACT138

1-of-8 Decoder/Demultiplexer

REJ03D0248–0200Z
(Previous ADE-205-368 (Z))
Rev.2.00
Jul.16.2004

Description

The HD74AC138/HD74ACT138 is a high-speed 1-of-8 decoder/demultiplexer. This device is ideally suited for high-speed bipolar memory chip select address decoding. The multiple input enables allow parallel expansion to a 1-of-24 decoder using just three HD74AC138/HD74ACT138 devices or a 1-of-32 decoder using four HD74AC138/HD74ACT138 devices and one inverter.

Features

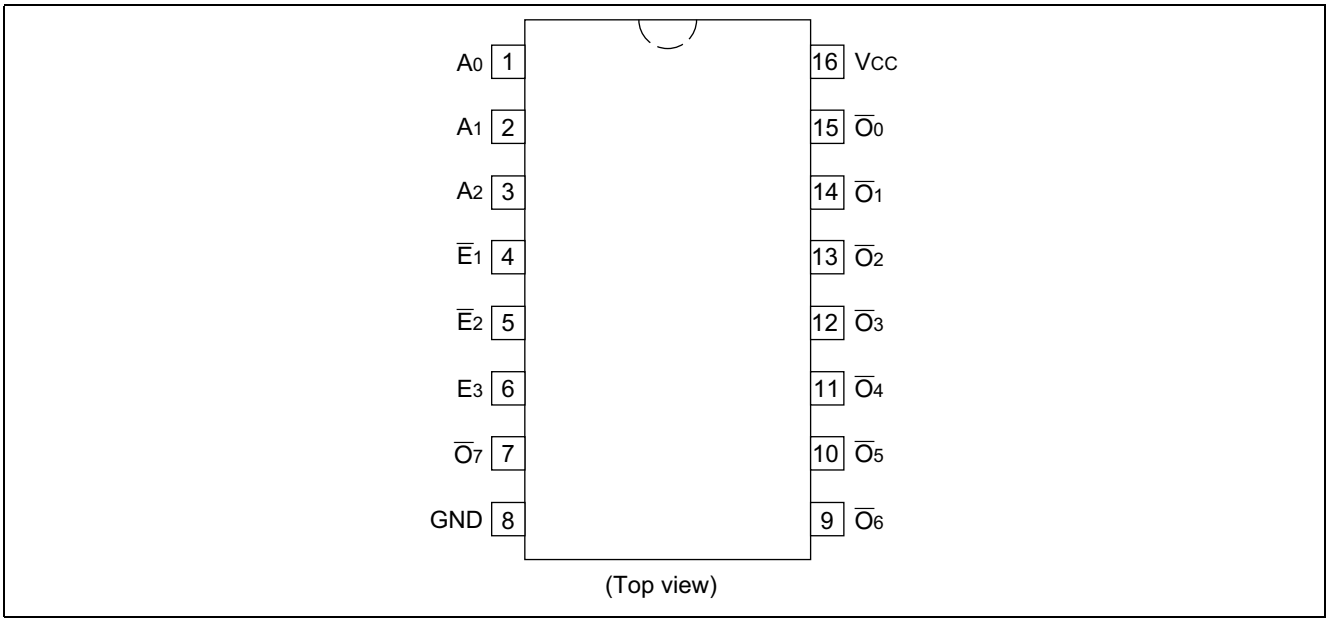
- Demultiplexing Capability
- Multiple Input Enable for Easy Expansion
- Active LOW Mutually Exclusive Outputs
- Outputs Source/Sink 24 mA
- HD74ACT138 has TTL-Compatible Inputs

- Ordering Information: Ex. HD74AC138

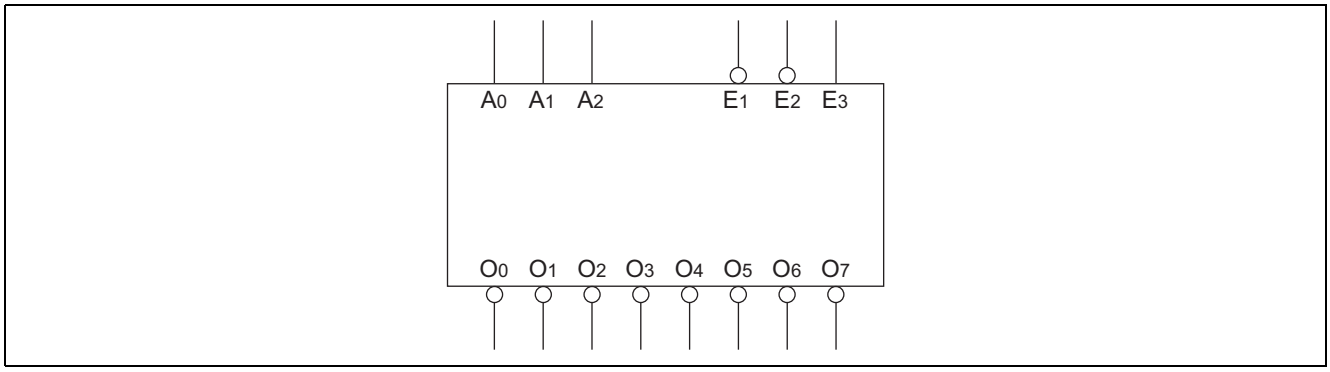
Part Name	Package Type	Package Code	Package Abbreviation	Taping Abbreviation (Quantity)
HD74AC138AP	DIP-16 pin	DP-16E, -16FV	P	—
HD74AC138AFPEL	SOP-16 pin (JEITA)	FP-16DAV	FP	EL (2,000 pcs/reel)
HD74AC138ARPEL	SOP-16 pin (JEDEC)	FP-16DNV	RP	EL (2,500 pcs/reel)
HD74AC138TELL	TSSOP-16 pin	TTP-16DAV	T	ELL(2,000 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 to A_2	Address Inputs
$\overline{E}_1$ to $\overline{E}_2$	Enable Inputs
E_3	Enable Input
$\overline{O}_0$ to $\overline{O}_7$	Outputs

Functional Description

The HD74AC138/HD74ACT138 high-speed 1-of-8 decoder/demultiplexer accepts three binary weighted inputs (A_0, A_1, A_2) and, when enabled, provides eight mutually exclusive active-LOW outputs ($\overline{O}_0$ to $\overline{O}_7$). The HD74AC138/HD74ACT138 features three Enable inputs, two active-Low ($\overline{E}_1$, $\overline{E}_2$) and one active-High (E_3). All outputs will be High unless $\overline{E}_1$ and $\overline{E}_2$ are Low and E_3 is High. This multiple enabled function allows easy parallel expansion of the device to a 1-of-32 (5 lines to 32 lines) decoder with just four HD74AC138/HD74ACT138 devices and one inverter (See Figure a). The HD74AC138/HD74ACT138 can be used as an 8-output demultiplexer by using one of the active Low Enable inputs as the data input and the other Enable inputs as strobes. The Enables inputs which are not used must be permanently tied to their appropriate active-High or active-Low state.

Truth Table

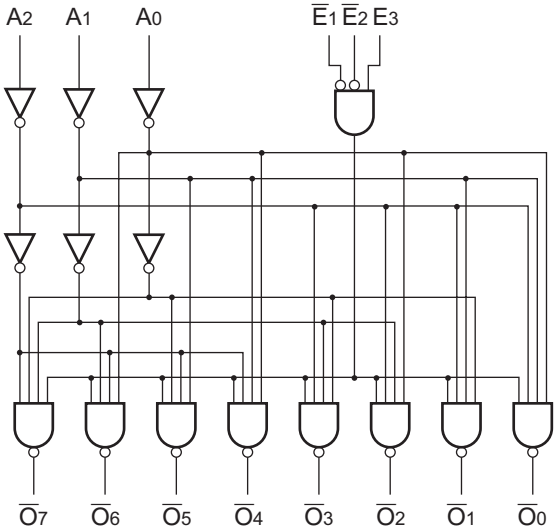
Inputs						Outputs							
$\overline{E}_1$	$\overline{E}_2$	E_3	A_0	A_1	A_2	$\overline{O}_0$	$\overline{O}_1$	$\overline{O}_2$	$\overline{O}_3$	$\overline{O}_4$	$\overline{O}_5$	$\overline{O}_6$	$\overline{O}_7$
H	X	X	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
X	X	L	X	X	X	H	H	H	H	H	H	H	H
L	L	H	L	L	L	L	H	H	H	H	H	H	H
L	L	H	H	L	L	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	L	H	H	H	H	H
L	L	H	H	H	L	H	H	H	L	H	H	H	H
L	L	H	L	L	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	L	H	H
L	L	H	L	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	L

H : High Voltage Level

L : Low Voltage Level

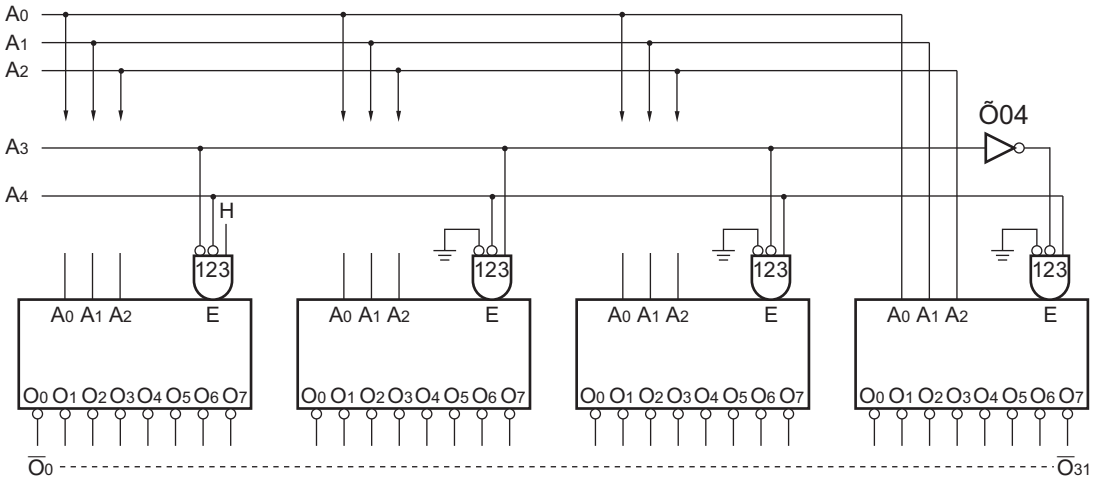
X : Immaterial

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.

Figure a: Expansion of 1-of-32 Decoding



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: HD74AC138

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: HD74AC138

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: HD74ACT138

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: HD74ACT138

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: HD74AC138

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	8.5	13.0	1.0	15.0	ns
		5.0	1.0	6.5	9.5	1.0	10.5	
Propagation delay A_n to $\overline{O}_n$	t_{PHL}	3.3	1.0	8.0	12.5	1.0	14.0	ns
		5.0	1.0	6.0	9.0	1.0	10.5	
Propagation delay $\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$	t_{PLH}	3.3	1.0	11.0	15.0	1.0	16.0	ns
		5.0	1.0	8.0	11.0	1.0	12.0	
Propagation delay $\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$	t_{PHL}	3.3	1.0	9.5	13.5	1.0	15.0	ns
		5.0	1.0	7.0	9.5	1.0	10.5	
Propagation delay E_3 to $\overline{O}_n$	t_{PLH}	3.3	1.0	11.0	15.5	1.0	16.5	ns
		5.0	1.0	8.0	11.0	1.0	12.5	
Propagation delay E_3 to $\overline{O}_n$	t_{PHL}	3.3	1.0	8.5	13.0	1.0	14.0	ns
		5.0	1.0	6.0	8.0	1.0	9.5	

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: HD74ACT138

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 An to $\overline{O}_n$	t_{PLH}	5.0	1.0	7.0	10.5	1.0	11.5	ns
Propagation delay An to $\overline{O}_n$	t_{PHL}	5.0	1.0	6.5	10.5	1.0	11.5	ns
Propagation delay $\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$	t_{PLH}	5.0	1.0	8.0	11.5	1.0	12.5	ns
Propagation delay $\overline{E}_1$ or $\overline{E}_2$ to $\overline{O}_n$	t_{PHL}	5.0	1.0	7.5	11.5	1.0	12.5	ns
Propagation delay E_3 to $\overline{O}_n$	t_{PLH}	5.0	1.0	8.0	12.0	1.0	13.0	ns
Propagation delay E_3 to $\overline{O}_n$	t_{PHL}	5.0	1.0	6.5	10.5	1.0	11.5	ns

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

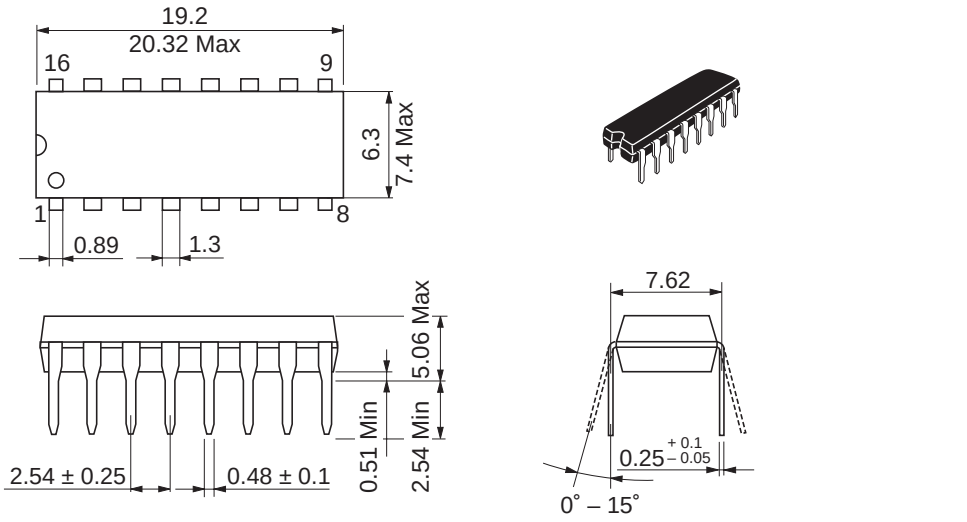
Capacitance

Item	Symbol	Typ	Unit	Condition
Input capacitance	C_{IN}	4.5	pF	V_{CC} = 5.5 V
Power dissipation capacitance	C_{PD}	60.0	pF	V_{CC} = 5.0 V

Package Dimensions

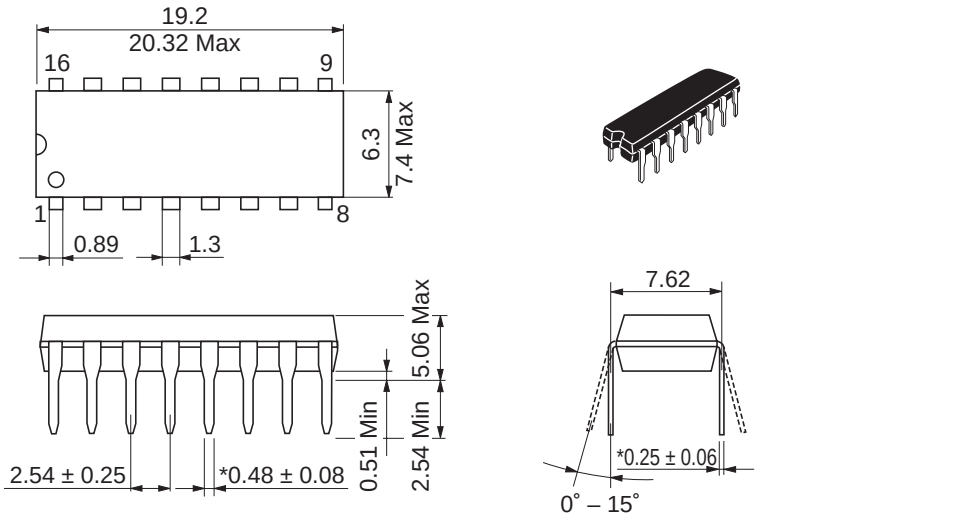
As of January, 2003

Unit: mm



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

Unit: mm

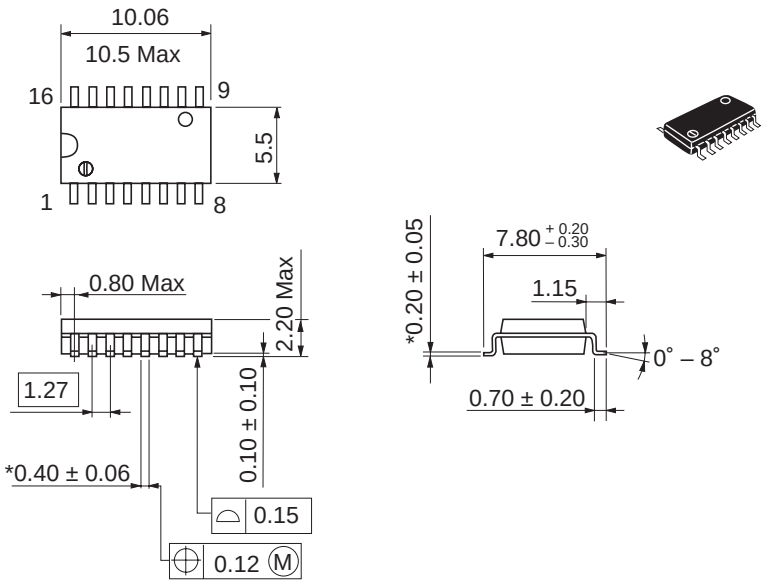


Package Code	DP-16FV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	1.05 g

*NI/Pd/AU Plating

As of January, 2003

Unit: mm

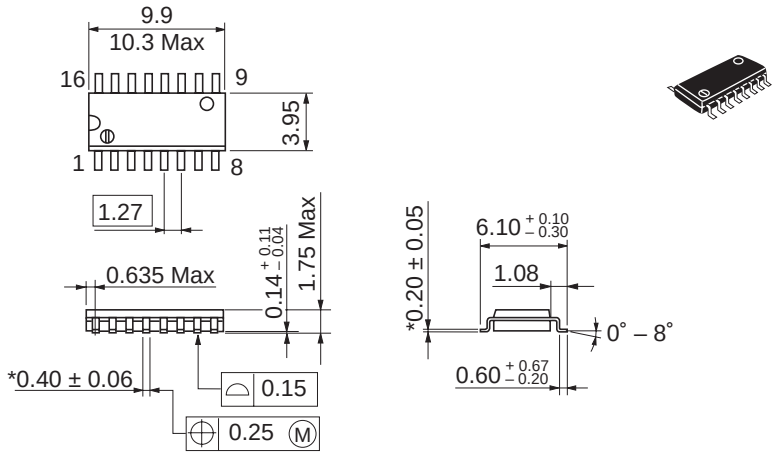


Package Code	FP-16DAV
JEDEC	—
JEITA	Conforms
Mass (reference value)	0.24 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm

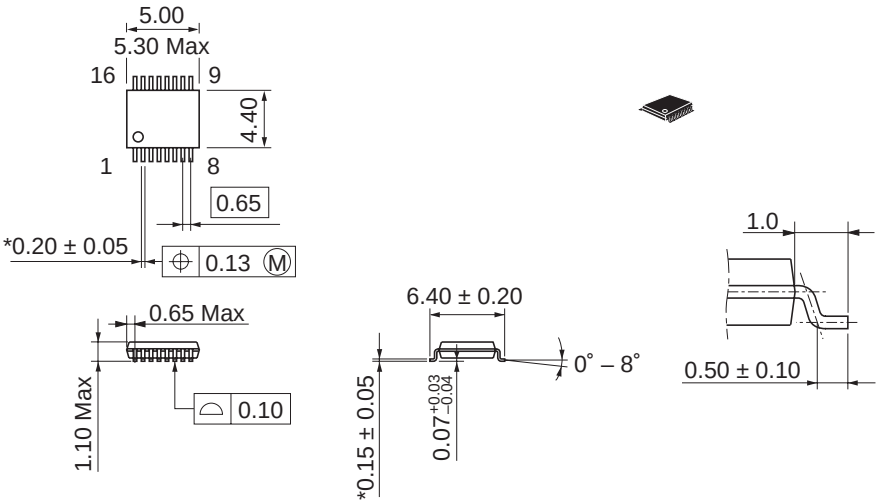


Package Code	FP-16DNV
JEDEC	Conforms
JEITA	Conforms
Mass (reference value)	0.15 g

*Ni/Pd/Au plating

As of January, 2003

Unit: mm



*Ni/Pd/Au plating

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

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