M74HC147P/FP/DP

10-LINE DECIMAL TO 4-LINE BCD PRIORITY ENCODER

DESCRIPTION

The M74HC147 is a semiconductor integrated circuit consisting of a 10-line decimal to 4-line BCD encoder with priority.

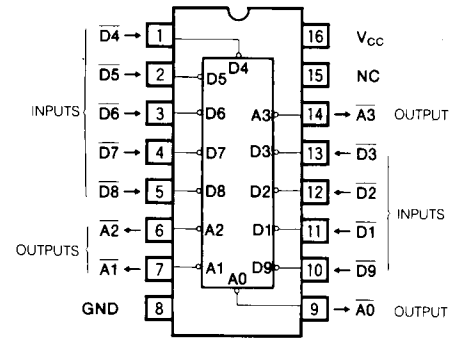
FEATURES

- Priority for data input
- High-speed: 16ns typ. (C_L=15pF, V_{CC}=5V)
- Low power dissipation: 20μW/package, max (V_{CC}=5V, T_a=25℃, quiescent state)
- High noise margin: 30% of V_{CC}, min (V_{CC}=4.5V, 6V)
- Capable of driving 10 74LSTTL loads
- Wide operating voltage range: V_{CC}=2~6V
- Wide operating temperature range: T_a=−40~+85℃

APPLICATION

General purpose, for use in industrial and consumer digital equipment.

PIN CONFIGURATION (TOP VIEW)



Outline 16P4, 16P2N, 16P2P

NC : NO CONNECTION

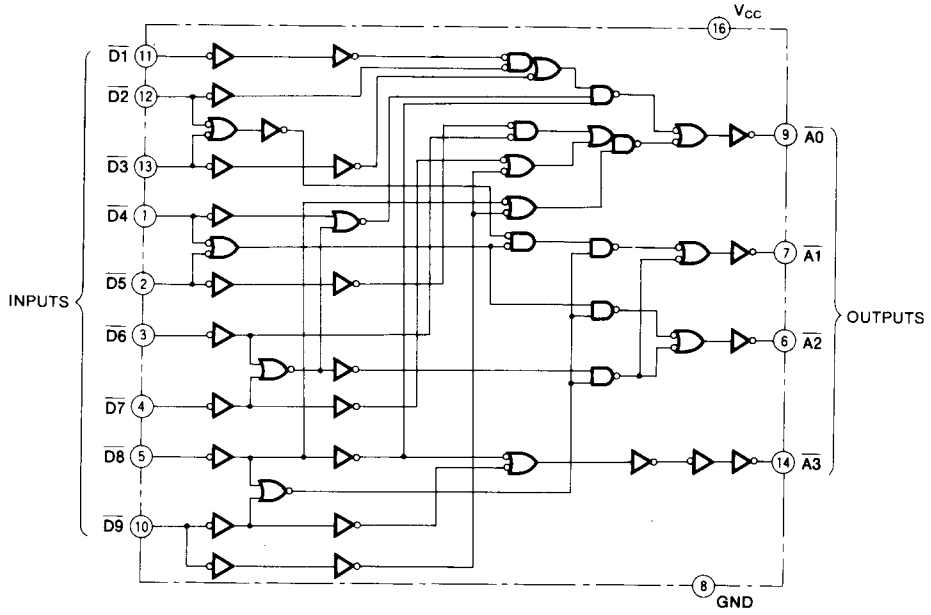
FUNCTIONAL DESCRIPTION

Use of silicon gate technology allows the M74HC147 to maintain the low power dissipation and high noise margin characteristics of the standard CMOS logic 4000B series while giving high-speed performance equivalent to the 74LS147.

When an input is applied to one of the nine input lines $\overline{D1}$ through $\overline{D9}$, the corresponding inverted BCD code is output at $\overline{A0}$ through $\overline{A3}$. When more than one input is applied simultaneously, the signal at the highest order input pin is given priority.

$\overline{D0}$ does not exist as an input, and when all inputs are high, all outputs will become high, allowing zero to be obtained. The device is ideal for Keyboard encoders or range selectors.

LOGIC DIAGRAM



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FUNCTION TABLE (Note 1)

Inputs									Outputs			
$\overline{D1}$	$\overline{D2}$	$\overline{D3}$	$\overline{D4}$	$\overline{D5}$	$\overline{D6}$	$\overline{D7}$	$\overline{D8}$	$\overline{D9}$	$\overline{A3}$	$\overline{A2}$	$\overline{A1}$	$\overline{A0}$
H	H	H	H	H	H	H	H	H	H	H	H	H
X	X	X	X	X	X	X	X	L	L	H	H	L
X	X	X	X	X	X	X	L	H	L	H	H	H
X	X	X	X	X	X	L	H	H	H	L	L	L
X	X	X	X	X	L	H	H	H	H	L	L	H
X	X	X	X	L	H	H	H	H	H	L	H	L
X	X	X	L	H	H	H	H	H	H	L	H	H
X	X	L	H	H	H	H	H	H	H	H	L	L
X	L	H	H	H	H	H	H	H	H	H	L	H
L	H	H	H	H	H	H	H	H	H	H	H	L

Note 1 : X : Irrelevant

ABSOLUTE MAXIMUM RATINGS (T_a = −40~+85℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		−0.5~+7.0	V
V_I	Input voltage		−0.5~V_{CC}+0.5	V
V_O	Output voltage		−0.5~V_{CC}+0.5	V
I_{IK}	Input protection diode current	V_I < 0V	−20	mA
		V_I > V_{CC}	20	
I_{OK}	Output parasitic diode current	V_O < 0V	−20	mA
		V_O > V_{CC}	20	
I_O	Output current per, output pin		±25	mA
I_{CC}	Supply/GND current	V_{CC}, GND	±50	mA
P_d	Power dissipation	(Note 2)	500	mW
Tstg	Storage temperature range		−65~+150	℃

Note 2 : M74HC147FP, T_a = −40~+70℃ and T_a = 70~85℃ are derated at −6mW/℃.
M74HC147DP, T_a = −40~+50℃ and T_a = 50~85℃ are derated at −5mW/℃.

RECOMMENDED OPERATING CONDITIONS (T_a = −40~+85℃)

Symbol	Parameter		Limits			Unit
			Min	Typ	Max	
V_{CC}	Supply voltage		2		6	V
V_I	Input voltage		0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	V
T_{opr}	Operating temperature range		−40		+85	℃
t_r, t_f	Input risetime, falltime	V_{CC} = 2.0V	0		1000	ns
		V_{CC} = 4.5V	0		500	
		V_{CC} = 6.0V	0		400	

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions		Limits					Unit
				25℃			−40～+85℃		
			V_{CC}(V)	Min	Typ	Max	Min	Max	
V_{IH}	High-level input voltage	V_O = 0.1V, V_{CC}−0.1V $\|I_O\|$ = 20μA	2.0	1.5			1.5		V
			4.5	3.15			3.15		
			6.0	4.2			4.2		
V_{IL}	Low-level input voltage	V_O = 0.1V, V_{CC}−0.1V $\|I_O\|$ = 20μA	2.0			0.5		0.5	V
			4.5			1.35		1.35	
			6.0			1.8		1.8	
V_{OH}	High-level output voltage	V_I = V_{IH}, V_{IL}	I_{OH} = −20μA	2.0	1.9			1.9		V
			I_{OH} = −20μA	4.5	4.4			4.4		
			I_{OH} = −20μA	6.0	5.9			5.9		
			I_{OH} = −4.0mA	4.5	4.18			4.13		
			I_{OH} = −5.2mA	6.0	5.68			5.63		
V_{OL}	Low-level output voltage	V_I = V_{IH}, V_{IL}	I_{OL} = 20μA	2.0			0.1		0.1	V
			I_{OL} = 20μA	4.5			0.1		0.1	
			I_{OL} = 20μA	6.0			0.1		0.1	
			I_{OL} = 4.0mA	4.5			0.26		0.33	
			I_{OL} = 5.2mA	6.0			0.26		0.33	
I_{IH}	High-level input current	V_I = 6V		6.0			0.1		1.0	μA
I_{IL}	Low-level input current	V_I = 0V		6.0			−0.1		−1.0	μA
I_{CC}	Quiescent supply current	V_I = V_{CC}, GND, I_O = 0μA		6.0			4.0		40.0	μA

SWITCHING CHARACTERISTICS (V_{CC} = 5V, T_a = 25℃)

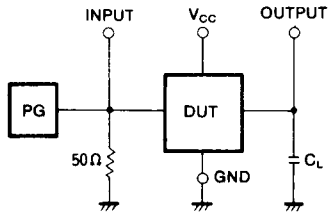
Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t_{TLH}	Low-level to high-level and high-level to low-level	C_L = 15pF (Note 4)			10	ns
t_{THL}	output transition time				10	ns
t_{PLH}	Low-level to high-level and high-level to low-level				26	ns
t_{PHL}	output propagation time ($\overline{D1}$～$\overline{D9}$ − $\overline{A0}$～$\overline{A3}$)				26	ns

SWITCHING CHARACTERISTICS (V_{CC} = 2～6V, T_a = −40～+85℃)

Symbol	Parameter	Test conditions	Limits					Unit
			25℃			−40～+85℃		
		V_{CC}(V)	Min	Typ	Max	Min	Max	
t_{TLH}	Low-level to high-level and high-level to low-level output transition time	C_L = 50pF (Note 4)	2.0		75		95	ns
			4.5		15		19	
			6.0		13		16	
t_{THL}			2.0		75		95	ns
			4.5		15		19	
			6.0		13		16	
t_{PLH}	Low-level to high-level and high-level to low-level output propagation time ($\overline{D}$ − $\overline{A}$)		2.0		150		190	ns
			4.5		30		38	
			6.0		26		33	
t_{PHL}			2.0		150		190	ns
			4.5		30		38	
			6.0		26		33	
C_I	Input capacitance				10		10	pF
C_{PD}	Power dissipation capacitance (Note 3)							pF

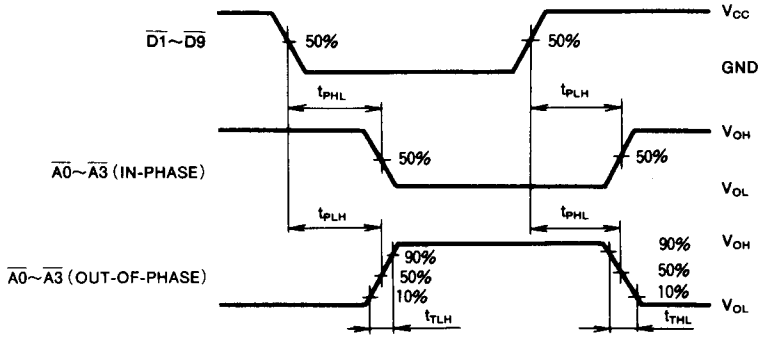
Note 3 : C_{PD} is the internal capacitance of the IC calculated from operation supply current under no-load conditions.
The power dissipated during operation under no-load conditions is calculated using the following formula:
$P_D = C_{PD} \cdot V_{CC}^2 \cdot f_I + I_{CC} \cdot V_{CC}$

Note 4 : Test Circuit



(1) The pulse generator (PG) has the following characteristics (10%~90%): t_r = 6ns, t_f = 6ns
(2) The capacitance C_L includes stray wiring capacitance and the probe input capacitance.

TIMING DIAGRAM

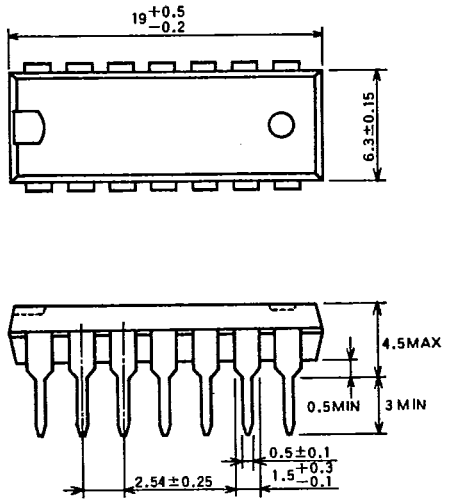


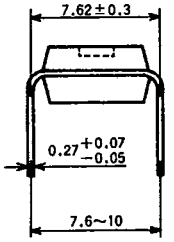
MITSUBISHI HIGH SPEED CMOS

PACKAGE OUTLINES

TYPE 14P4 14-PIN MOLDED PLASTIC DIP

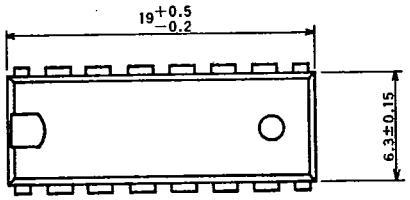
Dimension in mm

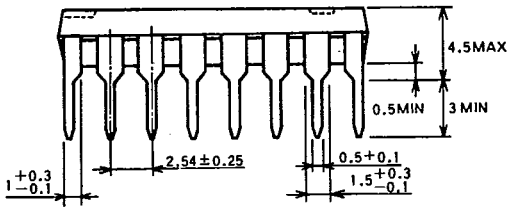


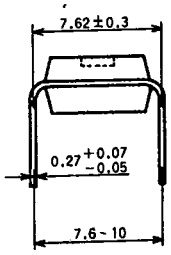


TYPE 16P4 16-PIN MOLDED PLASTIC DIP

Dimension in mm





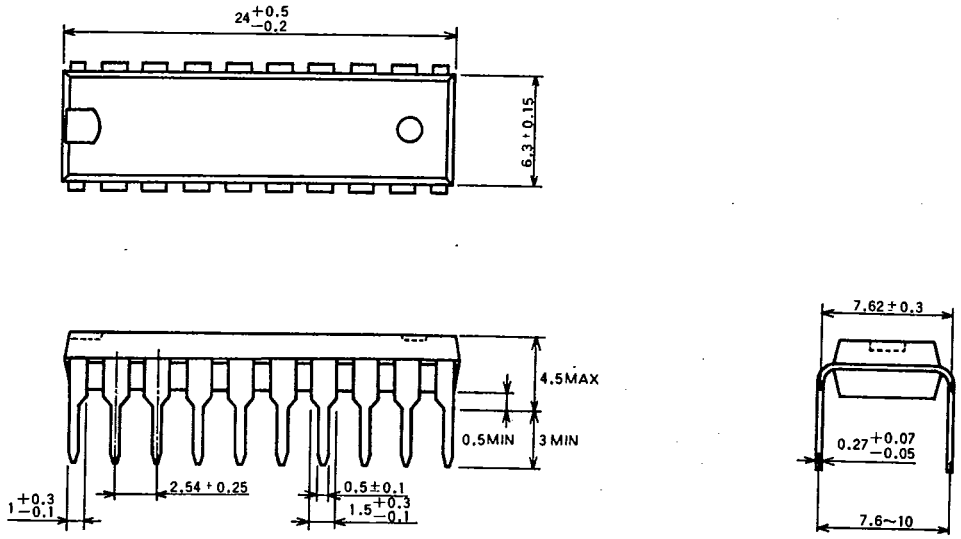


MITSUBISHI HIGH SPEED CMOS

PACKAGE OUTLINES

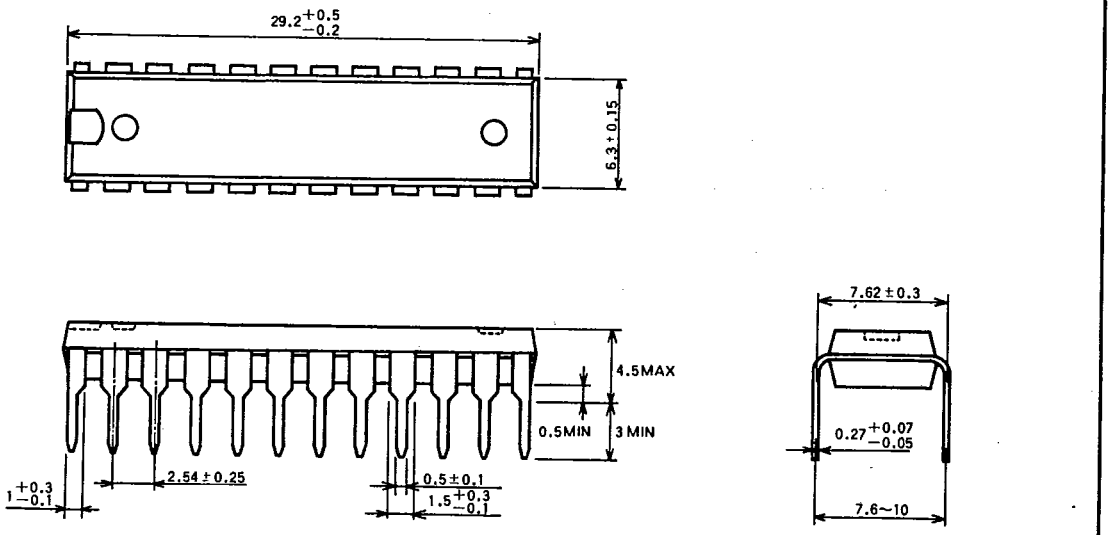
TYPE 20P4 20-PIN MOLDED PLASTIC DIP

Dimension in mm



TYPE 24P4D 24-PIN MOLDED PLASTIC DIP

Dimension in mm



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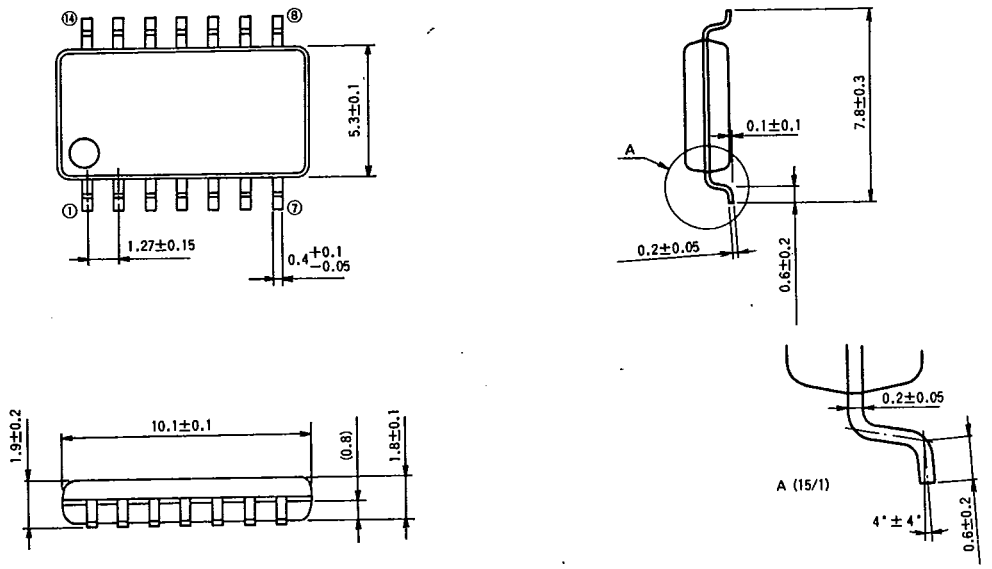
PACKAGE OUTLINES

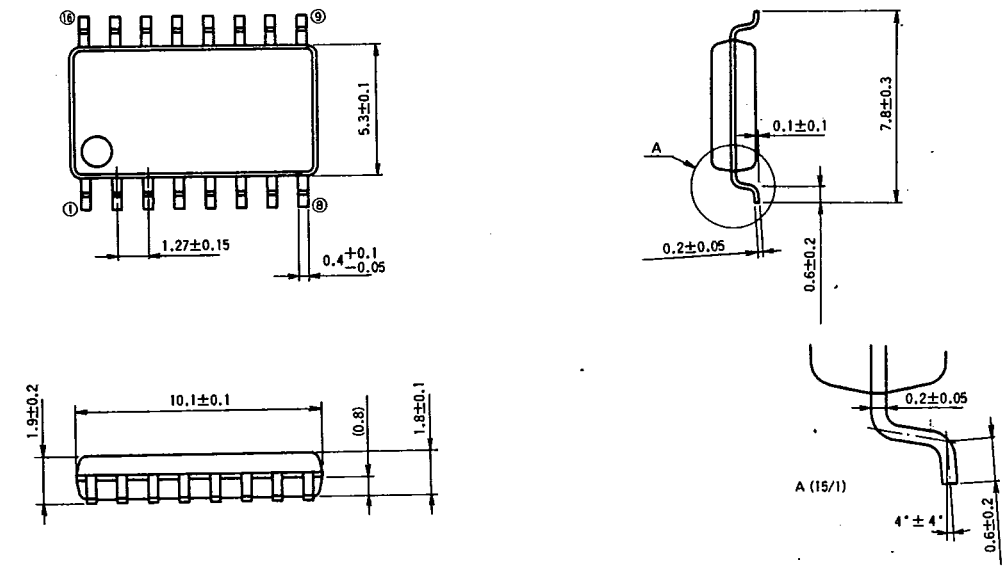
TYPE 14P2N 14PIN MOLDED PLASTIC SOP

Dimension in mm



TYPE 16P2N 16PIN MOLDED PLASTIC SOP

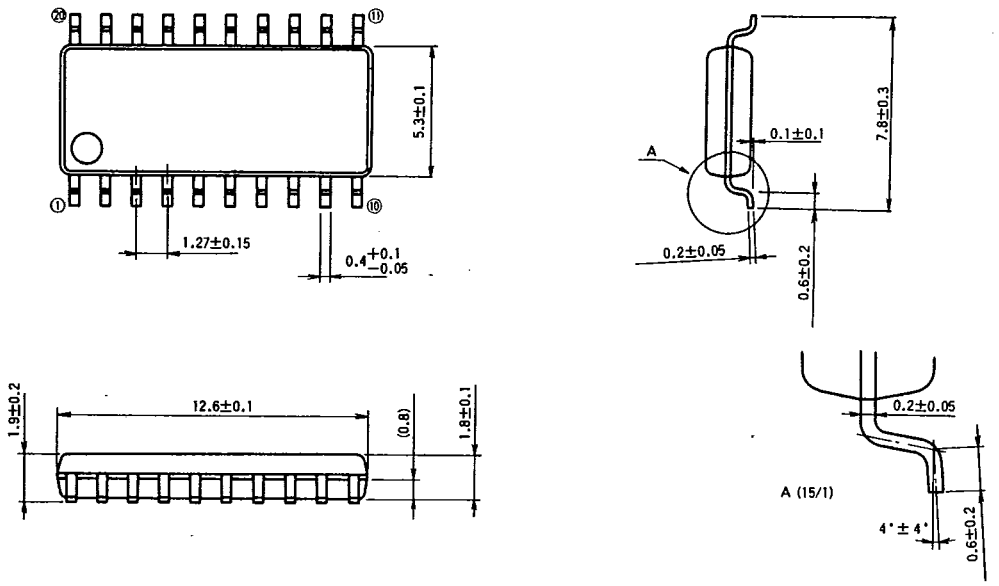
Dimension in mm



PACKAGE OUTLINES

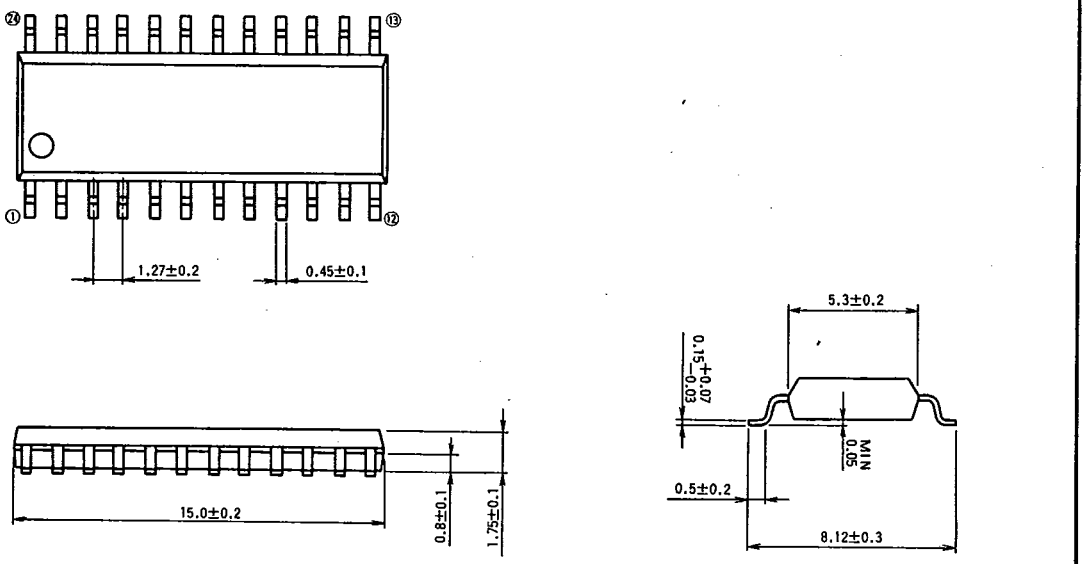
TYPE 20P2N 20PIN MOLDED PLASTIC SOP

Dimension in mm



TYPE 24P2 24PIN MOLDED PLASTIC SOP

Dimension in mm

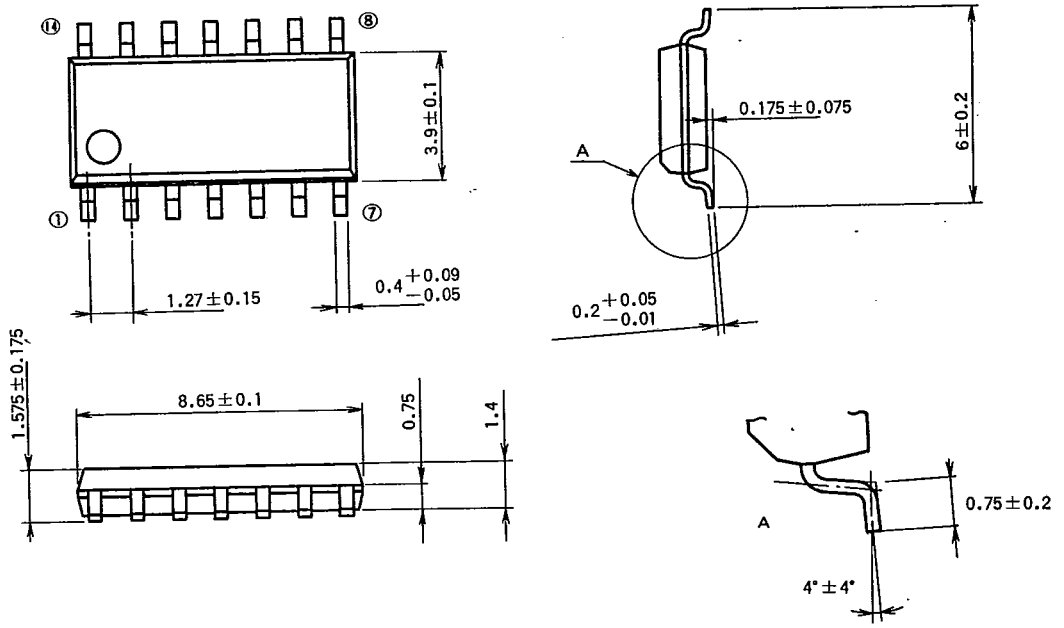


MITSUBISHI ELECTRIC

PACKAGE OUTLINES

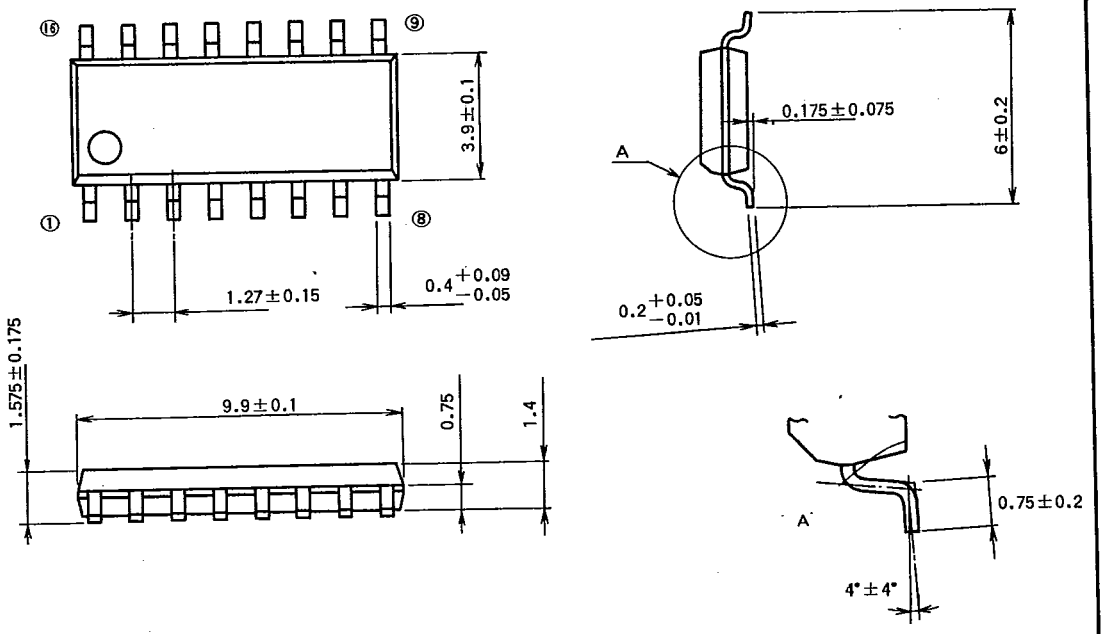
TYPE 14P2P 14-PIN MOLDED PLASTIC SOP(JEDEC 150mil body)

Dimension in mm



TYPE 16P2P 16-PIN MOLDED PLASTIC SOP(JEDEC 150mil body)

Dimension in mm



PACKAGE OUTLINES

TYPE 20P2V 20-PIN MOLDED PLASTIC SOP(JEDEC 300mil body)

Dimension in mm