

MITSUBISHI HIGH SPEED CMOS M74HC153P/FP/DP

DUAL 4-INPUT DATA SELECTOR/MULTIPLEXER

DESCRIPTION

The M74HC153 is a semiconductor integrated circuit consisting of two 4-line to 1-line data selectors/multiplexers.

FEATURES

- High-speed: 13ns typ. ($C_L=15\text{pF}$, $V_{CC}=5\text{V}$)
- Low power dissipation: $20\mu\text{W}/\text{package}$, max ($V_{CC}=5\text{V}$, $T_a=25^\circ\text{C}$, quiescent state)
- High noise margin: 30% of V_{CC} , min ($V_{CC}=4.5, 6\text{V}$)
- Capable of driving 10 74LSTTL loads
- Wide supply voltage range: $V_{CC}=2\sim 6\text{V}$
- Wide operating temperature range: $T_a=-40\sim +85^\circ\text{C}$

APPLICATION

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

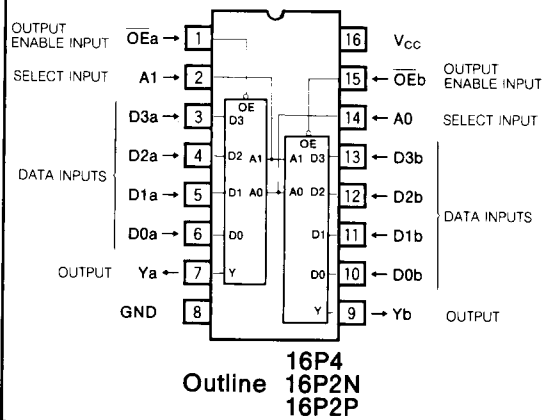
FUNCTIONAL DESCRIPTION

Use of silicon gate technology allows the M74HC153 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 74LS153.

The M74HC153 consists of data selector functions for selecting one of four input line signals and multiplex functions for converting 4-bit parallel data into serial data using time-division.

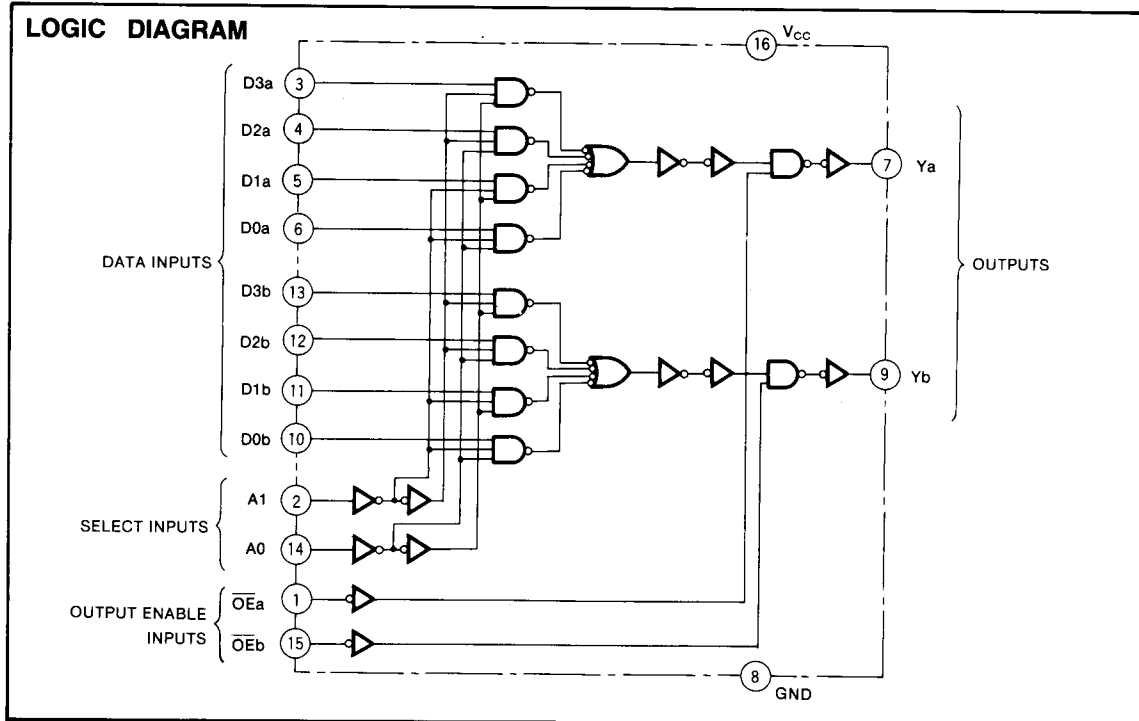
The 4-line signal is applied to data inputs D0 through D3, and after one of the data inputs has been selected by select inputs A0 and A1, that input signal will be output at

PIN CONFIGURATION (TOP VIEW)



Y. By applying 4-bit parallel data to D0 through D3 and connecting the output of a synchronous quadruple counter to A0 and A1, D0 through D3 data will be output at Y synchronous with the clock pulse in the order of D0-D3. Select inputs A are common to the two circuits while the output-enable inputs \overline{OE} are independent. When \overline{OE} is high, Y will become low irrespective of other inputs.

LOGIC DIAGRAM



DUAL 4-INPUT DATA SELECTOR/MULTIPLEXER

FUNCTION TABLE (Note 1)

Inputs							Output
A1	A0	D0	D1	D2	D3	OE	Y
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
L	H	X	L	X	X	L	L
L	H	X	H	X	X	L	H
H	L	X	X	L	X	L	L
H	L	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

Note 1 : X : Irrelevant

ABSOLUTE MAXIMUM RATINGS ($T_a = -40 \sim +85^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		$-0.5 \sim +7.0$	V
V_I	Input voltage		$-0.5 \sim V_{CC} + 0.5$	V
V_O	Output voltage		$-0.5 \sim V_{CC} + 0.5$	V
I_{IK}	Input protection diode current	$V_I < 0\text{V}$	-20	mA
		$V_I > V_{CC}$	20	
I_{OK}	Output parasitic diode current	$V_O < 0\text{V}$	-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
T_{stg}	Storage temperature range		$-65 \sim +150$	$^\circ\text{C}$

Note 2 : M74HC153FP, $T_a = -40 \sim +70^\circ\text{C}$ and $T_a = 70 \sim 85^\circ\text{C}$ are derated at $-6\text{mW}/^\circ\text{C}$.
M74HC153DP, $T_a = -40 \sim +50^\circ\text{C}$ and $T_a = 50 \sim 85^\circ\text{C}$ are derated at $-5\text{mW}/^\circ\text{C}$.

RECOMMENDED OPERATING CONDITIONS ($T_a = -40 \sim +85^\circ\text{C}$)

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	$^\circ\text{C}$
t_r, t_f	Input risetime, falltime	$V_{CC} = 2.0\text{V}$	0	1000	ns
		$V_{CC} = 4.5\text{V}$	0	500	
		$V_{CC} = 6.0\text{V}$	0	400	

DUAL 4-INPUT DATA SELECTOR/MULTIPLEXER

ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test conditions	Limits						Unit	
			V _{CC} (V)	25°C			-40~+85°C			
				Min	Typ	Max	Min	Max		
V _{IH}	High-level input voltage	V _O = 0.1V, V _{CC} = 0.1V I _O = 20μA	2.0 4.5 6.0	1.5 3.15 4.2			1.5 3.15 4.2		V	
V _{IL}	Low-level input voltage	V _O = 0.1V, V _{CC} = 0.1V I _O = 20μA	2.0 4.5 6.0			0.5 1.35 1.8		0.5 1.35 1.8	V	
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°C)

Symbol	Parameter	Test conditions	Limits			Unit
			Min	Typ	Max	
t _{TLH}	Low-level to high-level and high-level to low-level output transition time	C _L = 15pF (Note 4)			10	ns
t _{THL}					10	ns
t _{PLH}	Low-level to high-level and high-level to low-level output propagation time (D - Y)				23	ns
t _{PHL}					23	ns
t _{PLH}	Low-level to high-level and high-level to low-level output propagation time (A - Y)				30	ns
t _{PHL}					30	ns
t _{PLH}	Low-level to high-level and high-level to low-level output propagation time (OE - Y)				15	ns
t _{PHL}					15	ns

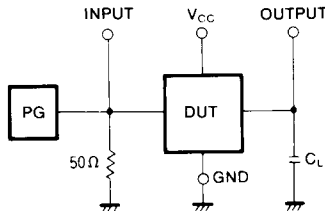
DUAL 4-INPUT DATA SELECTOR/MULTIPLEXER

SWITCHING CHARACTERISTICS ($V_{CC} = 2\sim 6V$, $T_a = -40\sim +85^\circ C$)

Symbol	Parameter	Test conditions	Limits					Unit	
			$V_{CC}(V)$	25°C			-40~+85°C		
				Min	Typ	Max	Min		Max
t_{TLH}	Low-level to high-level and high-level to low-level		2.0			75		95	ns
			4.5			15		19	
			6.0			13		16	
t_{THL}	output transition time		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		2.0			126		158	ns
			4.5			28		35	
			6.0			23		29	
t_{PHL}	output propagation time (D - Y)		2.0			126		158	ns
			4.5			28		35	
			6.0			23		29	
t_{PLH}	Low-level to high-level and high-level to low-level	$C_L = 50pF$ (Note 4)	2.0			158		198	ns
			4.5			35		44	
			6.0			30		38	
t_{PHL}	output propagation time (A - Y)		2.0			158		198	ns
			4.5			35		44	
			6.0			30		38	
t_{PLH}	Low-level to high-level and high-level to low-level		2.0			95		120	ns
			4.5			19		24	
			6.0			16		20	
t_{PHL}	output propagation time ($\overline{OE} - Y$)		2.0			95		120	ns
			4.5			19		24	
			6.0			16		20	
C_I	Input capacitance				10		10	pF	
C_{PD}	Power dissipation capacitance (Note 3)			48				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 :
 $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_I + I_{CC} \cdot V_{CC}$

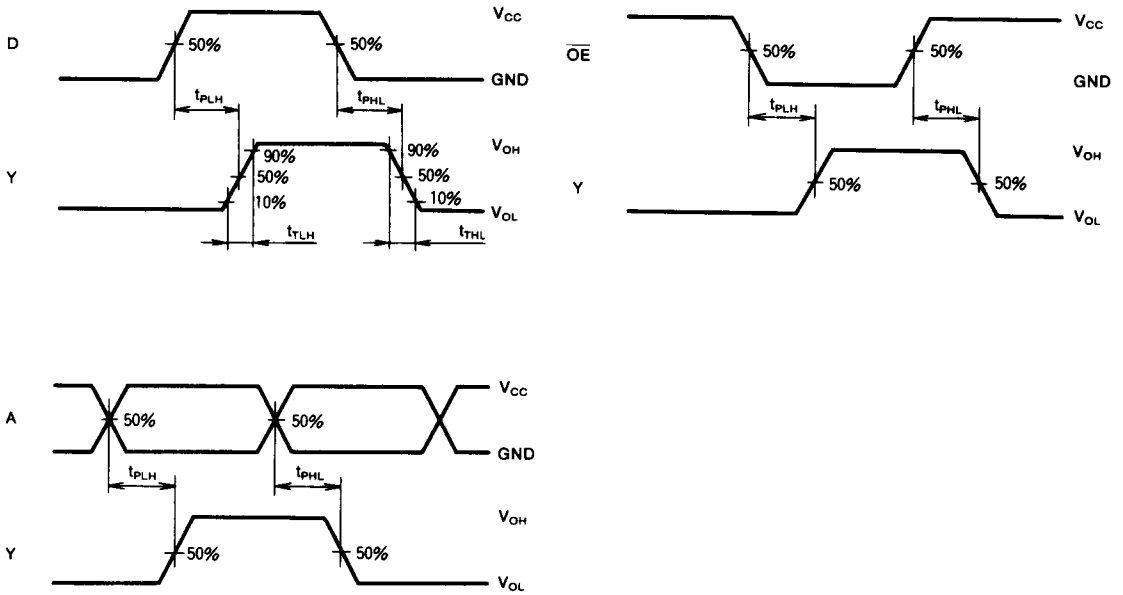
Note 4 : Test Circuit



- (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.

DUAL 4-INPUT DATA SELECTOR/MULTIPLEXER

TIMING DIAGRAM



MITSUBISHI HIGH SPEED CMOS PACKAGE OUTLINES

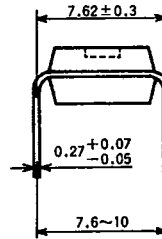
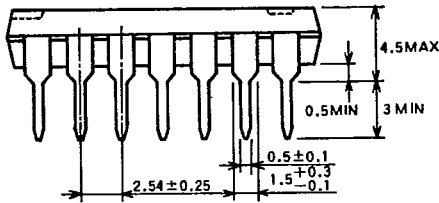
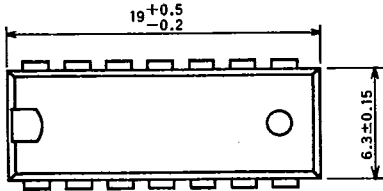
6249827 MITSUBISHI (DGTL LOGIC)

91D 12849

D T-90-20

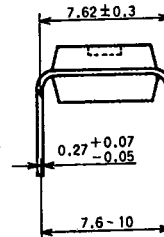
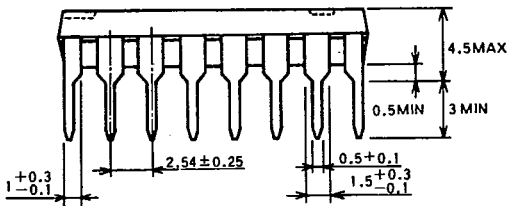
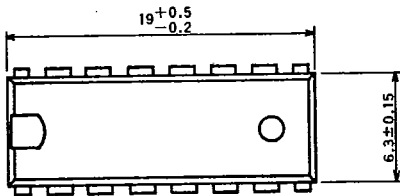
TYPE 14P4 14-PIN MOLDED PLASTIC DIP

Dimension in mm



TYPE 16P4 16-PIN MOLDED PLASTIC DIP

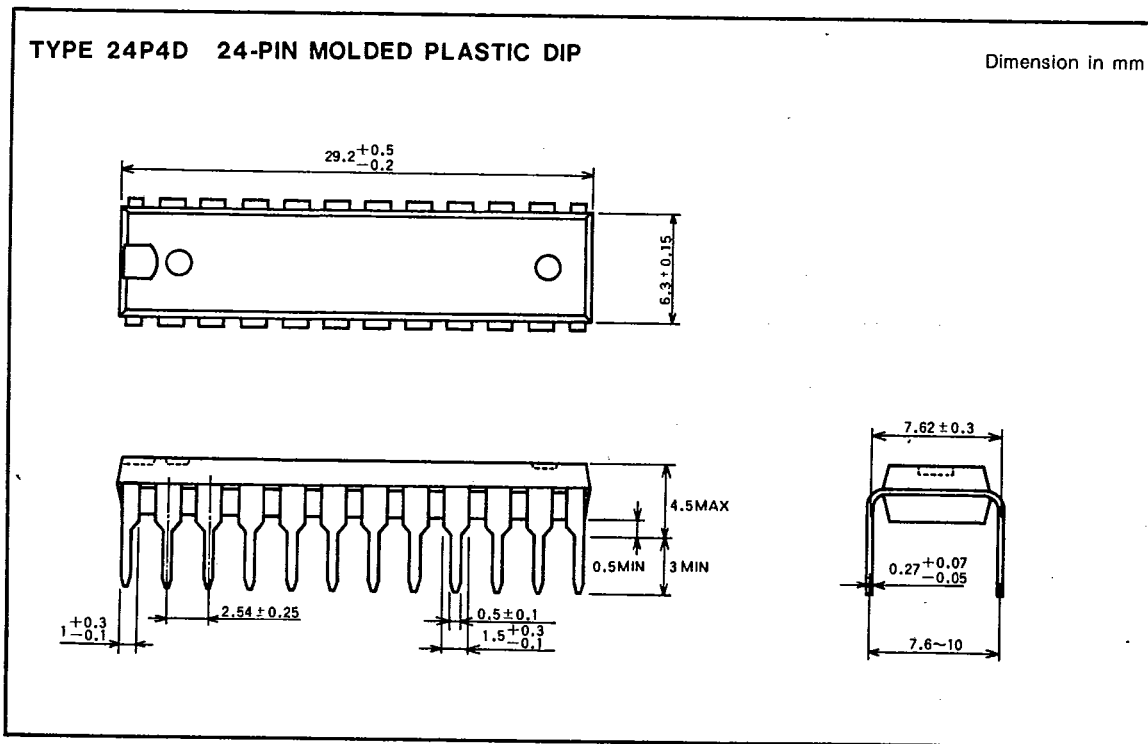
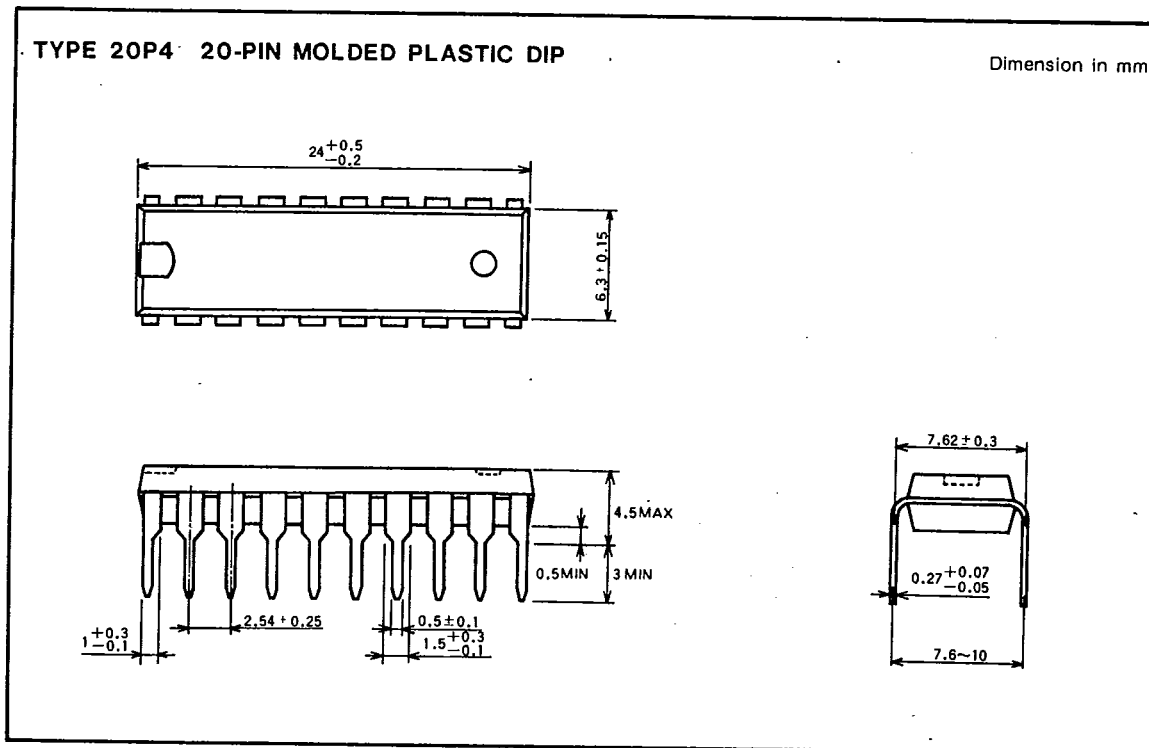
Dimension in mm



MITSUBISHI HIGH SPEED CMOS
PACKAGE OUTLINES

6249827 MITSUBISHI (DGTL LOGIC)

91D 12850 D.T-90-20



2933

G-02

1-52

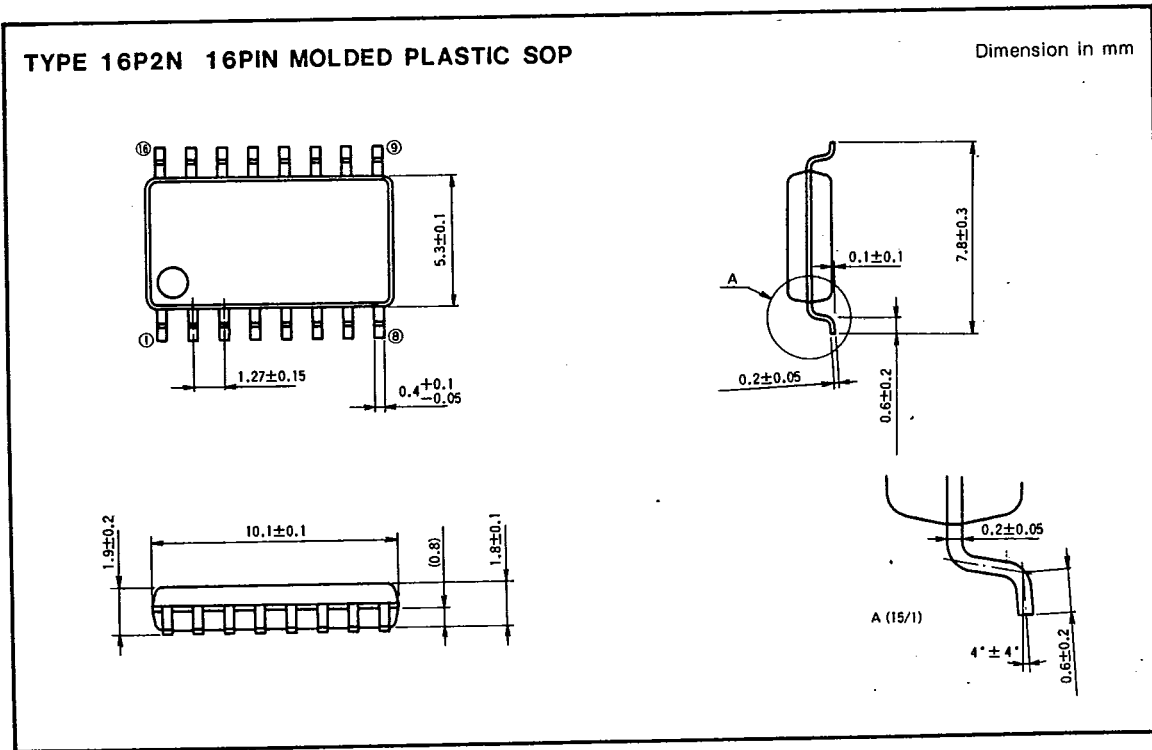
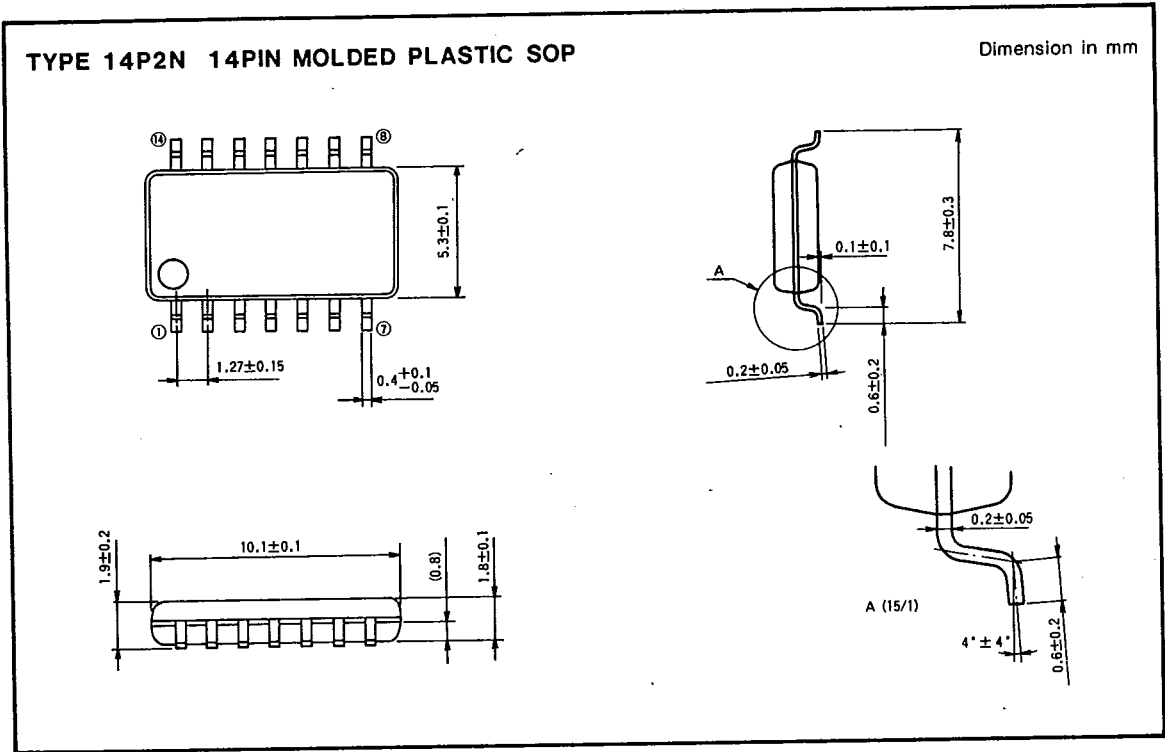


MITSUBISHI ELECTRIC CO. TOKYO, JAPAN

MITSUBISHI HIGH SPEED CMOS
PACKAGE OUTLINES

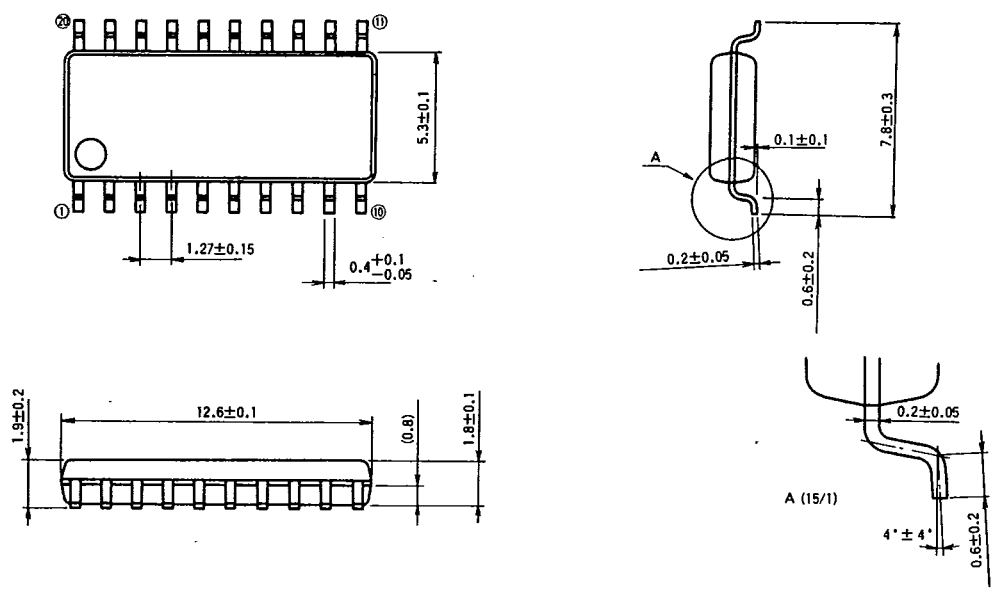
6249827 MITSUBISHI (DGTL LOGIC)

91D 12851 D T-90.20



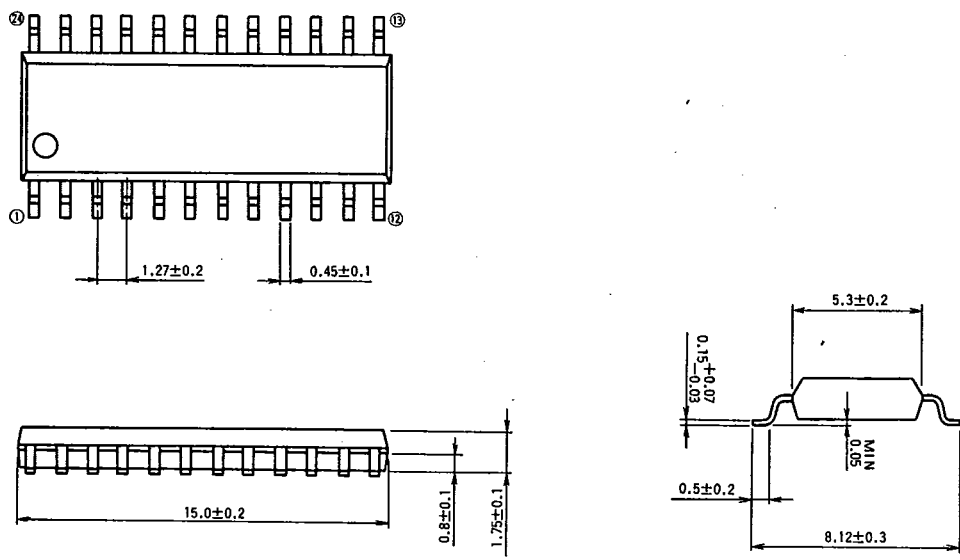
TYPE 20P2N 20PIN MOLDED PLASTIC SOP

Dimension in mm



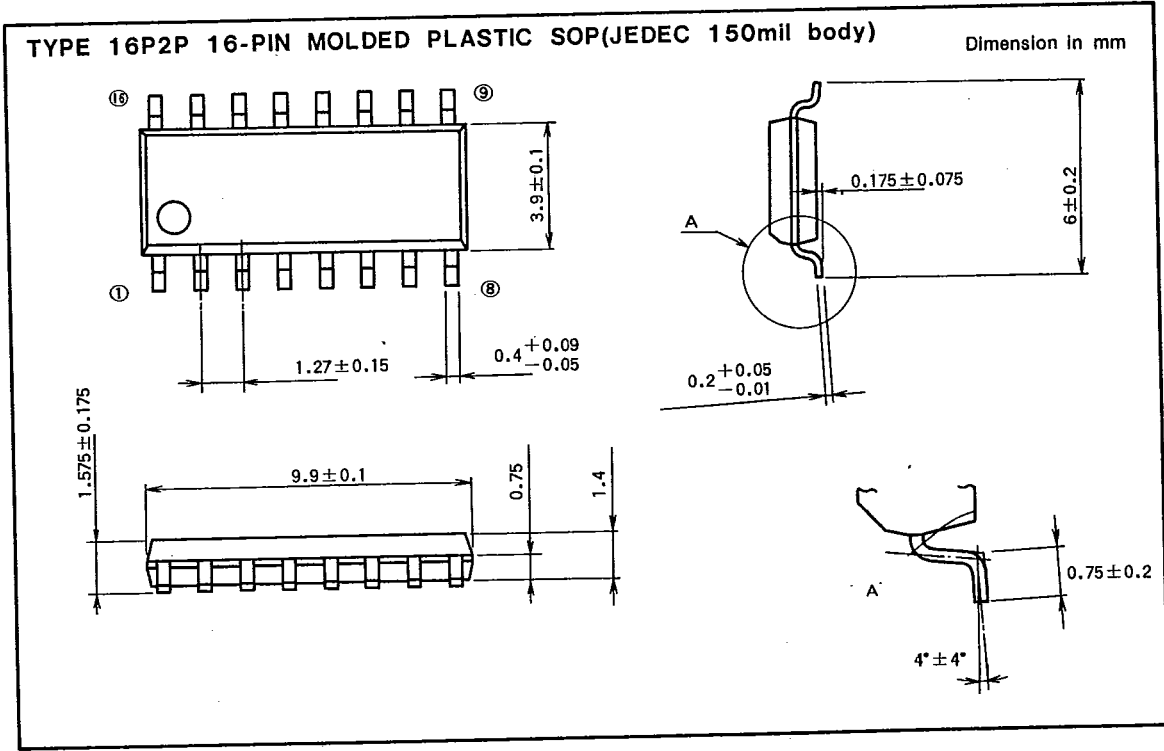
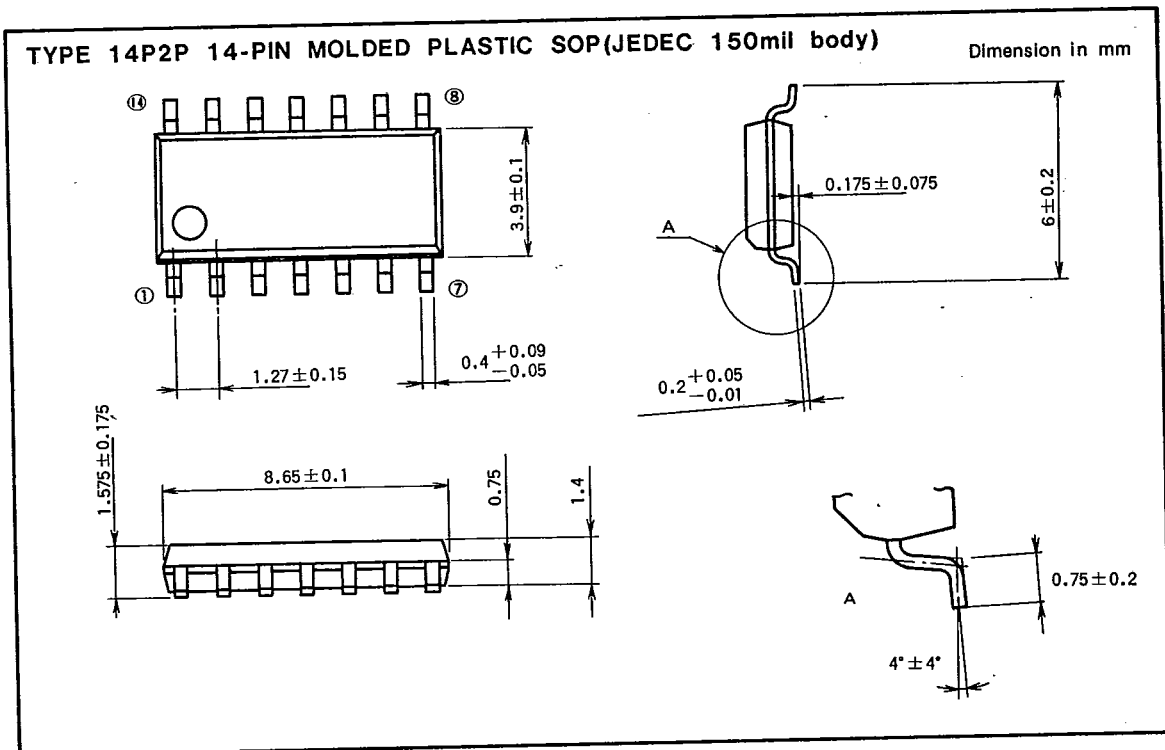
TYPE 24P2 24PIN MOLDED PLASTIC SOP

Dimension in mm



6249827 MITSUBISHI (DGTL LOGIC)

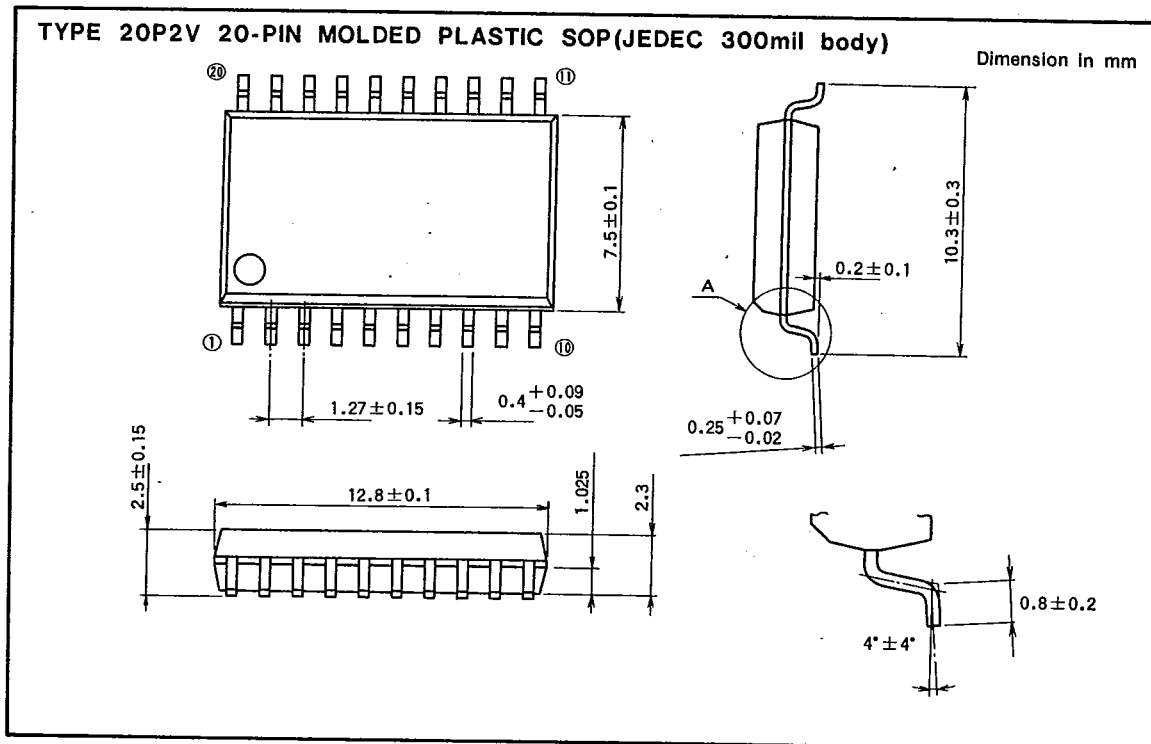
91D 12853 D T90-20



MITSUBISHI HIGH SPEED CMOS
PACKAGE OUTLINES

6249827 MITSUBISHI (DGTL LOGIC)

91D 12854 D T-90-20



Vertical text on the left margin.