

# ASSP 1 CHANNEL 6-BIT VIDEO A/D CONVERTER MB40576

## 1 CHANNEL 6-BIT VIDEO A/D CONVERTER (20MSPS)

The Fujitsu MB40576 is a low power ultra-high speed video A/D converter fabricated with Fujitsu Advanced Bipolar Technology. The MB40576 also adopts the fully-parallel comparison technique (flash method) for high speed conversion and can convert wide band analog signal such as video signal to digital signal at a sampling rate of DC through 20 Mega-samples/sec. Because of such high-speed operation, the MB40576 is suitable for digital video applications such as the digital TV, video processing with computer, or radar signal processing.

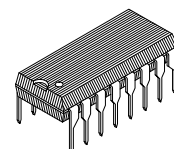
- Resolution: 6 bits
- Linearity Error:  $\pm 0.8\%$  max.
- Maximum Conversion Rate: 20 MSPS min.
- Analog Input Voltage:  $V_{CC}$  to  $V_{CC} - 2(V)$
- Analog Input Dynamic Range: 1V
- Digital I/O level: TTL Compatible
- Single Power Supply: +5V
- Power Dissipation: 270mW typ.
- Package: Standard 16-pin DIP Package (Suffix: -P)  
Standard 16-pin FLAT Package (Suffix: -PF)

### ABSOLUTE MAXIMUM RATINGS (See NOTE)

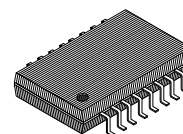
Rating	Symbol	Value	Unit
Power Supply Voltage	$V_{CCA}$ $V_{CCD}$	-0.5 to +7.0	V
Digital Input Voltage	$V_{IND}$	-0.5 to +7.0	V
Analog Input Voltage	$V_{INA}$	-0.5 to $V_{CC} + 0.5$	V
Analog Reference Voltage	$V_{RT}, V_{RB}^*$	-0.5 to $V_{CC} + 0.5$	V
Storage Temperature	$T_{STG}$	-55 to +125	°C

\*:  $|V_{RT} - V_{RB}| < 2V$

**NOTE:** Permanent device damage may occur if the above **Absolute Maximum Ratings** are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

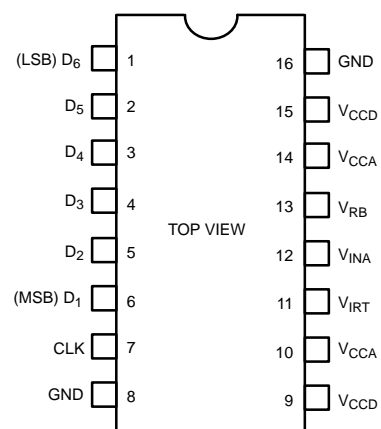


**PLASTIC PACKAGE  
DIP-16P-M04**



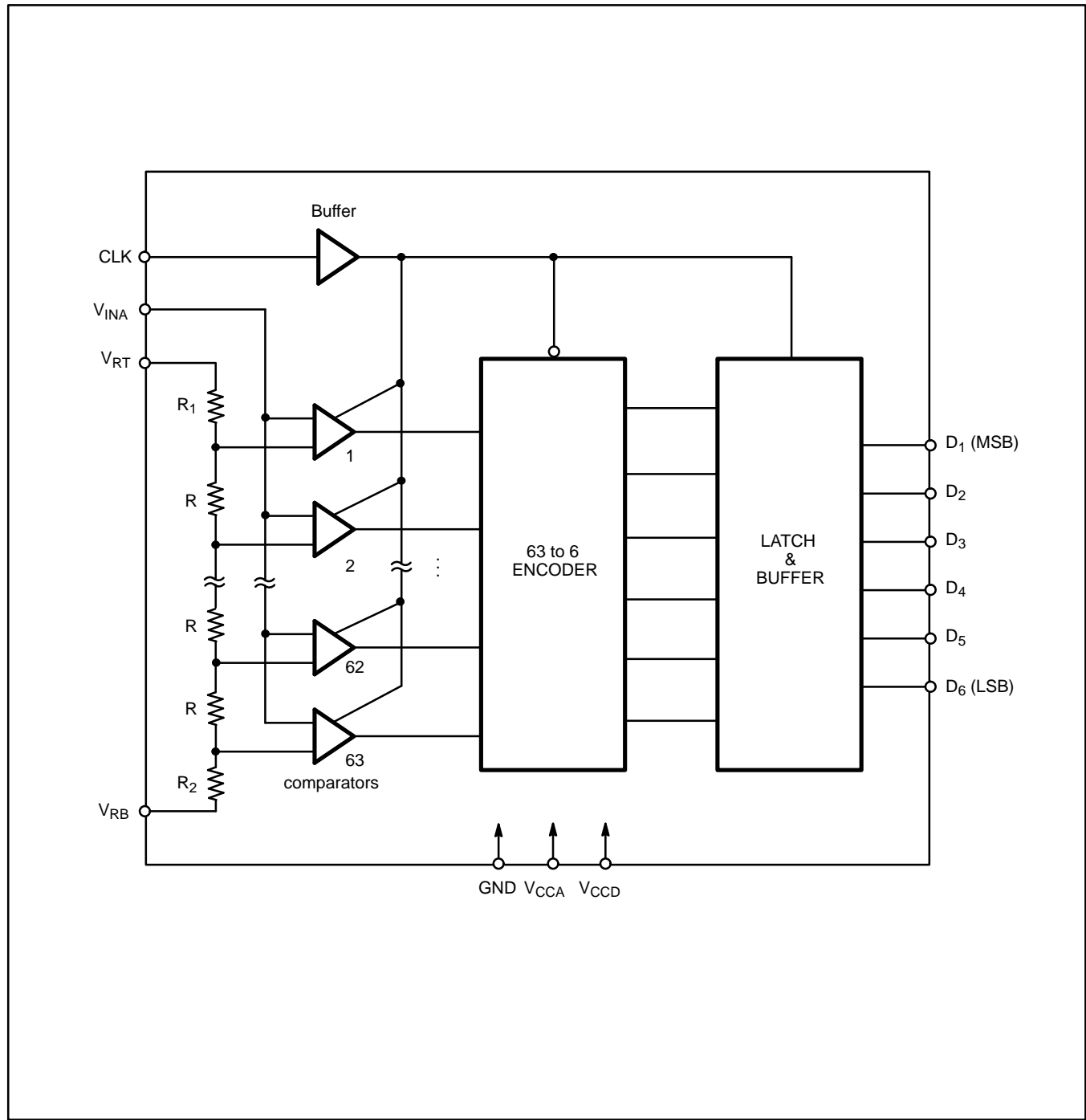
**PLASTIC PACKAGE  
FPT-16P-M03**

### PIN ASSIGNMENT



This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

BLOCK DIAGRAM



## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power Supply Voltage	$V_{CCA}$ $V_{CCD}$	4.75	5.00	5.25	V
Analog Input Voltage *	$V_{INA}$	4	–	5	V
Analog Reference Voltage (Top side) *	$V_{RT}$	4	5	5.1	V
Analog Reference Voltage (Bottom side) *	$V_{RB}$	3	4	4.1	V
Digital High-level Output Current	$I_{OHD}$	–400	–	–	$\mu A$
Digital Low-level Output Current	$I_{OLD}$	–	–	4	mA
Clock Pulse Width at High level	$t_{W+}$	25	–	–	ns
Clock Pulse Width at Low level	$t_{W-}$	25	–	–	ns
Operating Temperature	$T_a$	0	–	70	$^{\circ}C$

\* :  $V_{RB} < V_{INA} < V_{RT}$ ,  $V_{RT} - V_{RB} = 1V \pm 0.1V$   
Please keep  $V_{CCA}$  and  $V_{CCD}$  at the same potential.

# ELECTRICAL CHARACTERISTICS

## ANALOG DC CHARACTERISTICS

( $V_{CC} = 5.00 \pm 5\%V$ ,  $T_a = 0$  to  $70^\circ C$ )

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Resolution			–	–	6	bits
Linearity Error	LE	DC	–	–	$\pm 0.8$	%
Equivalent Resistance for Analog Input	$R_{INA}$		100	–	–	$k\Omega$
Input Capacitance	$C_{INA}$		–	35	65	pF
High-Level Input Current	$I_{IHA}$		–	–	75	$\mu A$
Low-Level Input Current	$I_{ILA}$		–	–	73	$\mu A$
Reference Current	$I_{RB}$	$V_{RT} = 5V$ $V_{RB} = 4V$	–	4	7.2	mA

## DIGITAL DC CHARACTERISTICS

( $V_{CC} = 5.00 \pm 5\%V$ ,  $T_a = 0$  to  $70^\circ C$ )

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
High-Level Output Volotage	$V_{OHD}$	$I_{OHD} = -400\mu A$	2.7	–	–	V
Low-Level Output Volotage	$V_{OLD}$	$I_{OLD} = 1.6mA$	–	–	0.4	V
High-Level Input Volotage	$V_{IHD}$		2	–	–	V
Low-Level Input Volotage	$V_{ILD}$		–	–	0.8	V
Maximum Input Current	$I_{ID}$	$V_{ID} = 7V$	–	–	100	$\mu A$
High-Level Input Current	$I_{IHD}$	$V_{IHD} = 2.7V$	–	0	20	$\mu A$
Low-Level Input Current	$I_{ILD}$	$V_{ILD} = 0.4V$	–400	–40	–	$\mu A$
Power Supply Current	$I_{CC}$		–	54	80	mA

# ELECTRICAL CHARACTERISTICS (continued)

## SWITCHING CHARACTERISTICS

( $V_{CC} = 5V$ ,  $T_a = 25^\circ C$ )

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Maximum Conversion Rate	FS		20	30	–	MSPS
Digital Output Delay Time	$t_{pd}$		–	26	40	ns

Fig. 1 – TIMING DIAGRAM

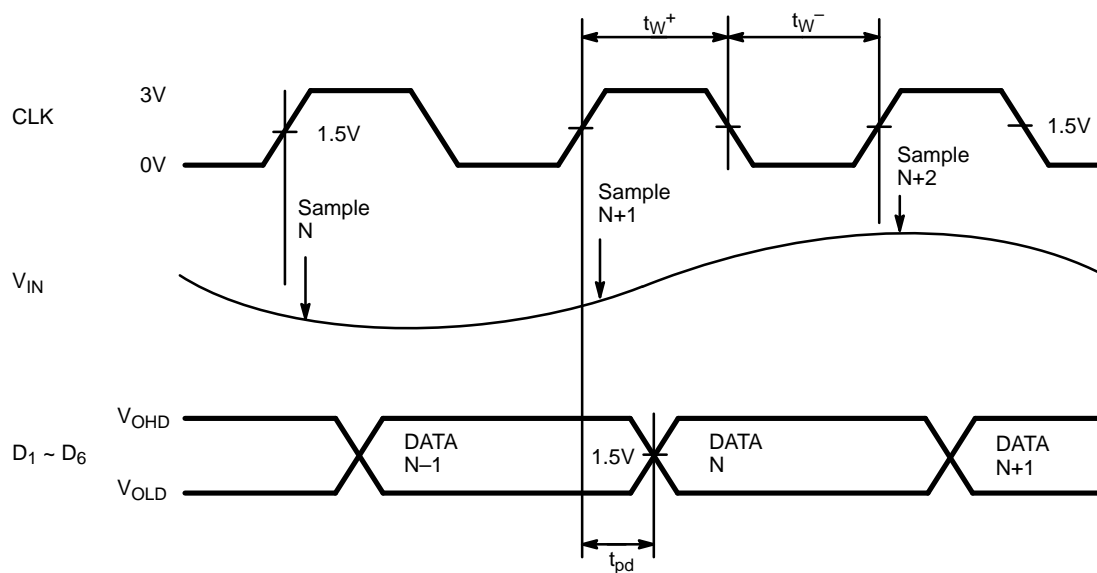
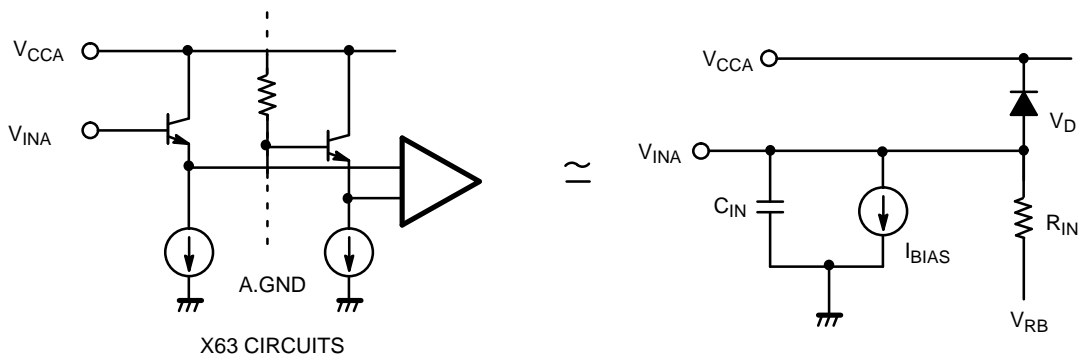


Fig. 2 – ANALOG INPUT EQUIVALENT CIRCUIT



X63 CIRCUITS

- $C_{INA}$ : Non-linear Emitter-follower Junction Capacitance  
 $R_{INA}$ : Linear Resistance Model for Input Current Transition by Comparator Switching:  
Infinite value for  $V_{INA} < V_{RB}$  or when CLK = High  
 $V_{RB}$ : Voltage at  $V_{RB}$  terminal.  
 $I_{BIAS}$ : Constant Input Bias Current  
 $V_D$ : The base-collector junction diode of emitter-follower transistor.

Fig. 3 – DIGITAL INPUT EQUIVALENT

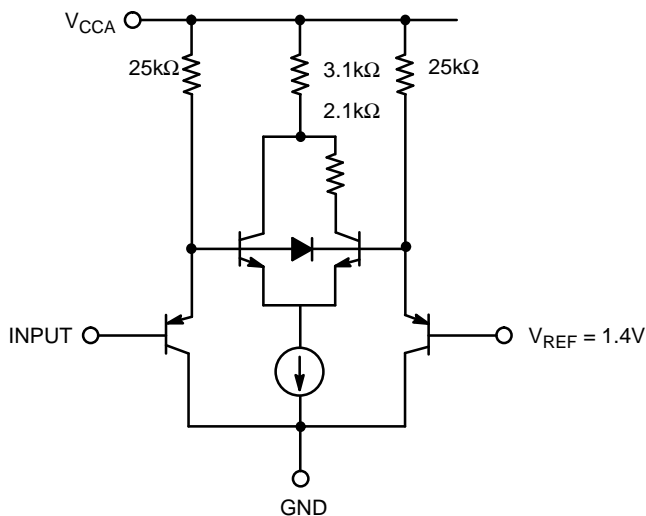
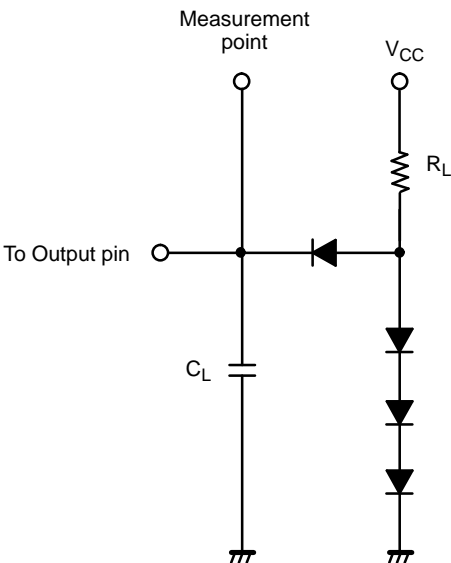


Fig. 4 – LOAD CIRCUIT FOR OUTPUT BUFFER



$R_L = 2k\Omega$   
 $C_L = 15pF$  including scope and jig capacitance  
Diodes: IN 3064 or equivalent.

## OUTPUT CODE

 $(V_{CC} \doteq 5V, V_{RT} \doteq V_{RB} = 4V)$ 

Step	Analog Input Voltage	Digital Output Code
0	3.992 V	000000
1	4.008 V	000001
.	.	.
.	.	.
31	4.488 V	011111
32	4.504 V	100000
33	4.520 V	100001
.	.	.
.	.	.
62	4.984 V	111110
63	5.000 V	111111

**Note:** One step of output voltage ( $I_{LSB}$ ) is 16 mV when  $V_{FT}$  is adjusted at 4.992V, and  $V_{ZT}$  at 4.000 V by  $V_{RT}$  and  $V_{RB}$ . The Analog Input Voltage are the centre value of each step.

Fig. 5 – IDEAL CONVERSION CHARACTERISTICS

STEP OUTPUT CODE

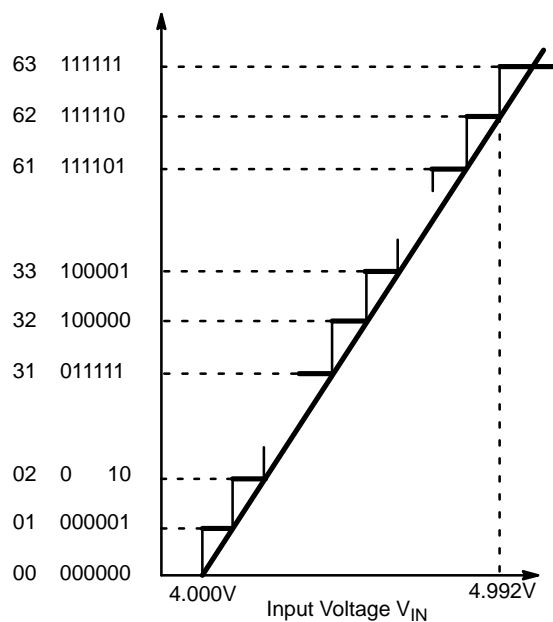
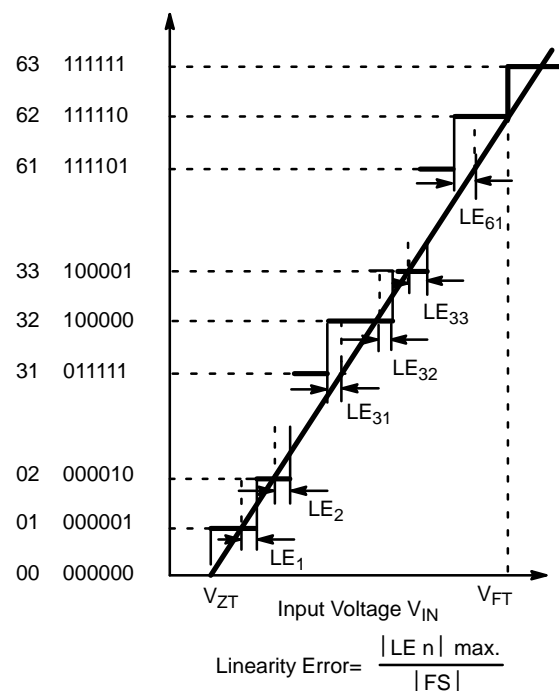


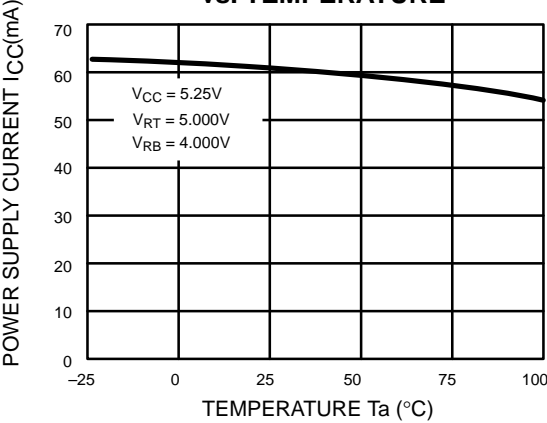
Fig. 6 – ACTUAL CONVERSION CHARACTERISTICS

STEP OUTPUT CODE

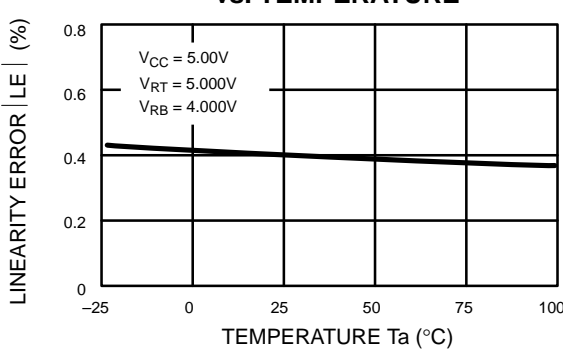


# TYPICAL CHARACTERISTICS CURVES

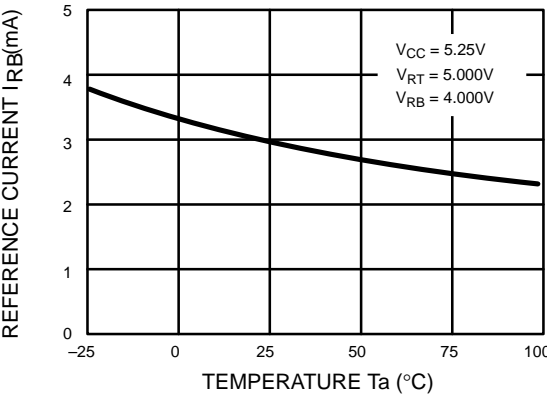
**Fig. 7 – POWER SUPPLY CURRENT vs. TEMPERATURE**



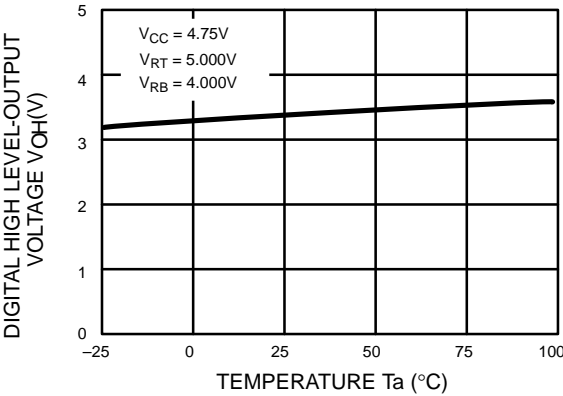
**Fig. 8 – LINEARITY ERROR vs. TEMPERATURE**



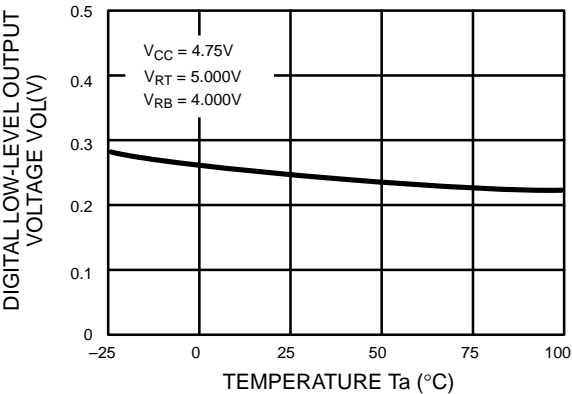
**Fig. 9 – REFERENCE CURRENT vs. TEMPERATURE**



**Fig. 10 – DIGITAL HIGH-LEVEL OUTPUT VOLTAGE vs. TEMPERATURE**



**Fig. 11 – DIGITAL LOW-LEVEL OUTPUT VOLTAGE vs. TEMPERATURE**





## TYPICAL CHARACTERISTICS CURVES (Continued)

Fig. 12 – DELAY TIME vs. TEMPERATURE

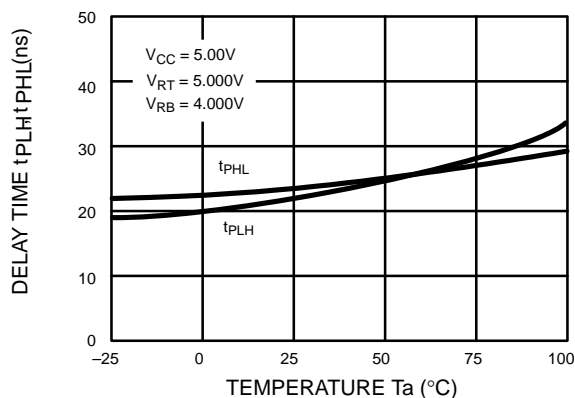


Fig. 13 – DELAY TIME vs. POWER SUPPLY VOLTAGE

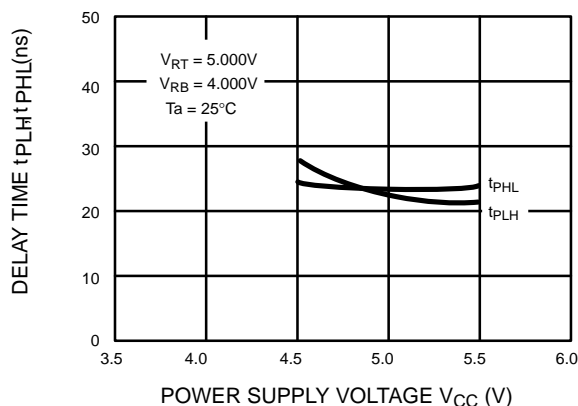


Fig. 14 – CLOCK PULSE WIDTH vs. TEMPERATURE

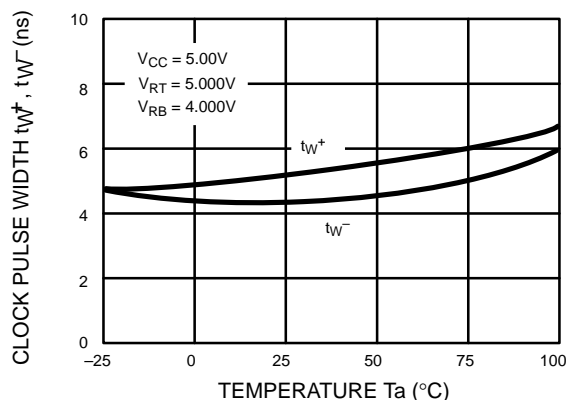


Fig. 15 – CLOCK PULSE WIDTH vs. POWER SUPPLY VOLTAGE

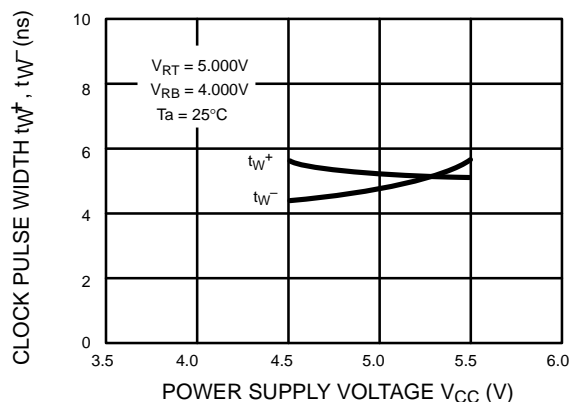
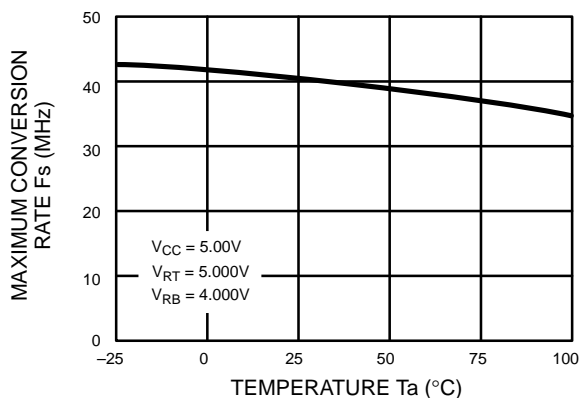
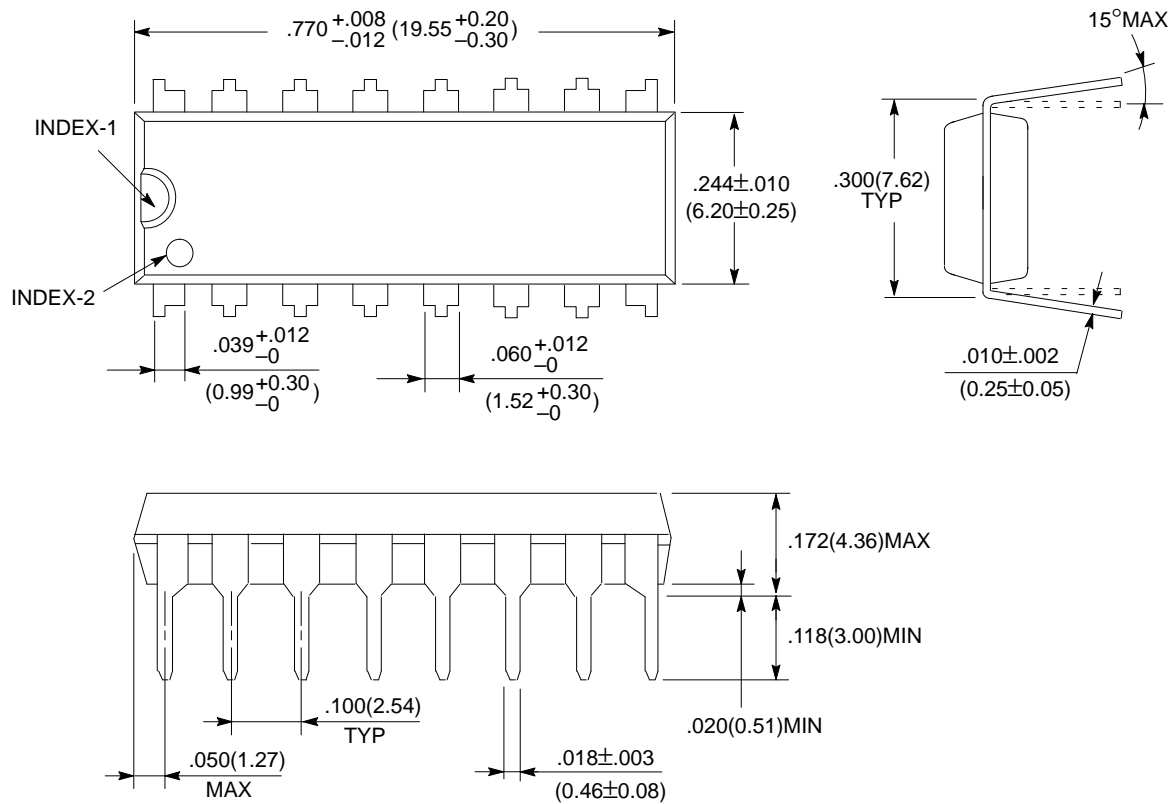


Fig. 16 – MAXIMUM CONVERSION RATE vs. TEMPERATURE



# PACKAGE DIMENSIONS

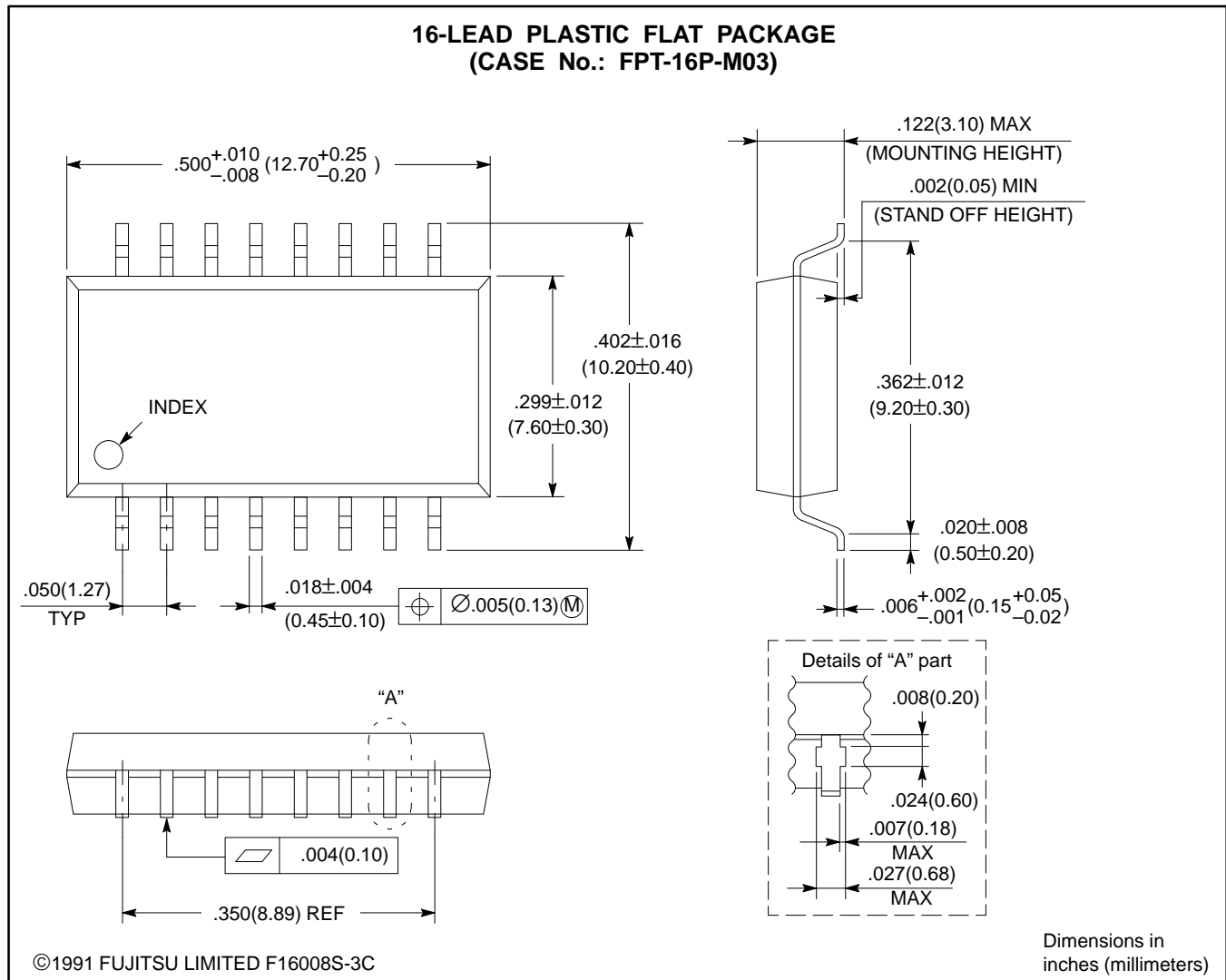
## 16-LEAD PLASTIC DUAL IN-LINE PACKAGE (CASE No.: DIP-16P-M04)



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Dimensions in  
inches (millimeters)

## PACKAGE DIMENSIONS (Continued)



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