DS04-28200-4E

FUJITSU

DATA SHEET

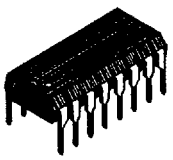
ASSP 1 CHANNEL 6-BIT VIDEO A/D CONVERTER

MB40576

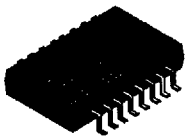
1 CHANNEL 6-BIT VIDEO A/D CONVERTER (20MSPS)

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: ±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: Standerd 16-pin DIP Package (Suffix: -P)
  Standerd 16-pin FLAT Package (Suffix: -PF)

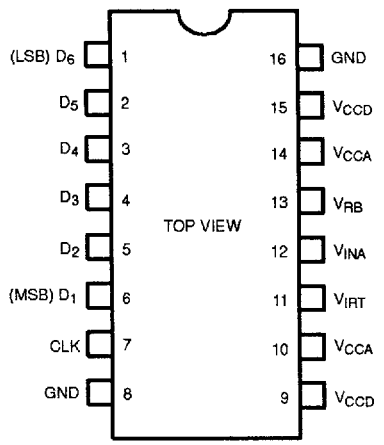


PLASTIC PACKAGE
DIP-16P-M04



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.

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.

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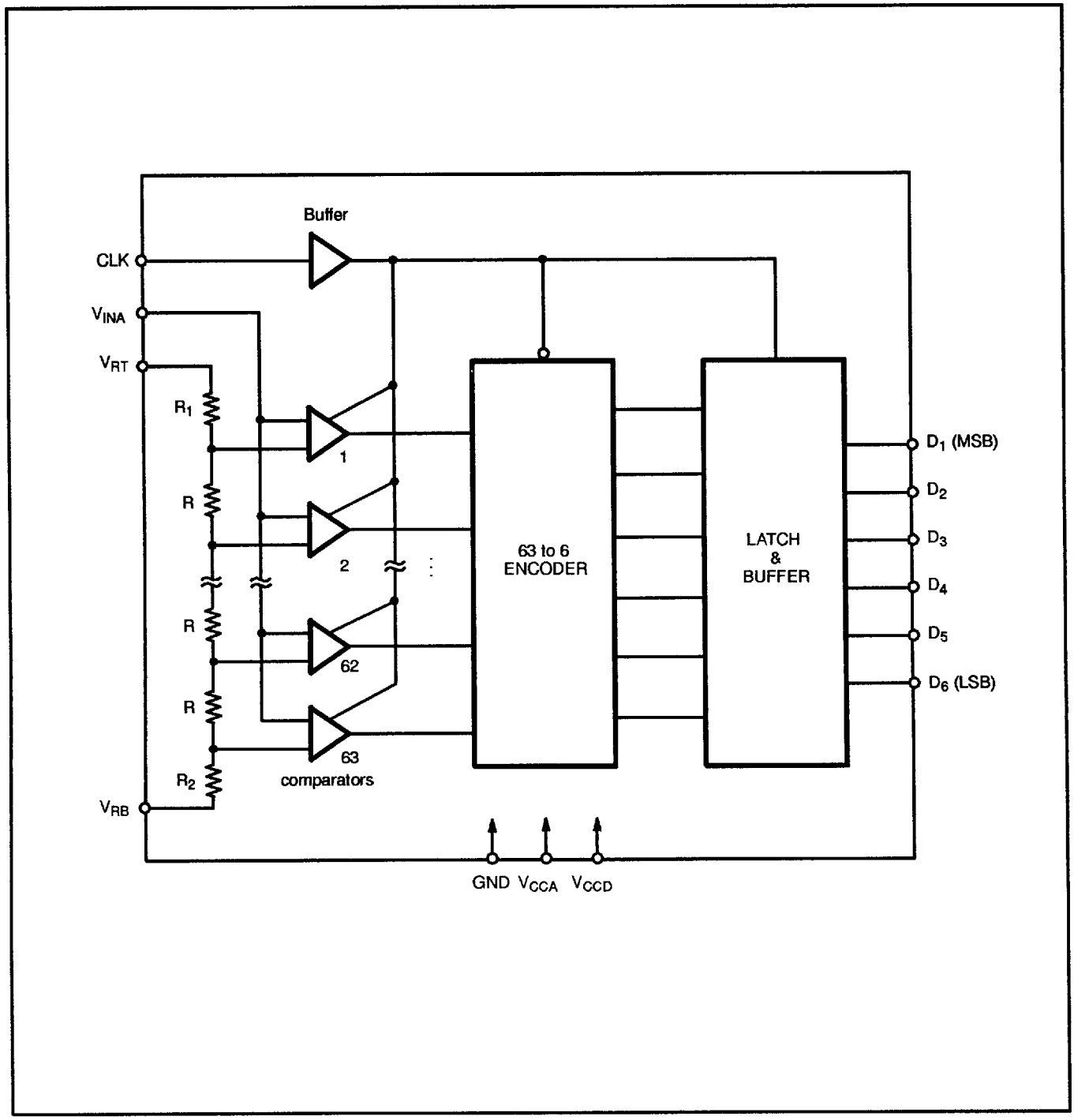
BLOCK DIAGRAM



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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	–	–	µA
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	Ta	0	–	70	°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.

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ELECTRICAL CHARACTERISTICS

ANALOG DC CHARACTERISTICS

(V_{CC} = 5.00±5%V, Ta = 0 to 70°C)

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

DIGITAL DC CHARACTERISTICS

(V_{CC} = 5.00±5%V, Ta = 0 to 70°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
High-Level Output Volotage	V_{OHD}	I_{OHD} = -400µA	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	µA
High-Level Input Current	I_{IHD}	V_{IHD} = 2.7V	-	0	20	µA
Low-Level Input Current	I_{ILD}	V_{ILD} = 0.4V	-400	-40	-	µA
Power Supply Current	I_{CC}		-	54	80	mA

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ELECTRICAL CHARACTERISTICS (continued)

SWITCHING CHARACTERISTICS

(V_{CC} = 5V, Ta = 25°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

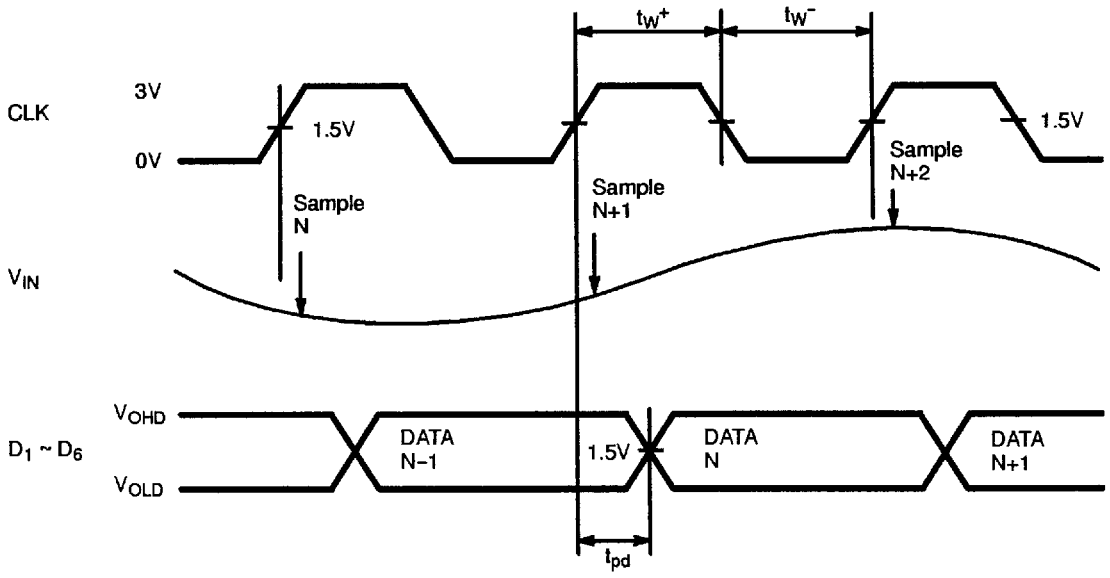

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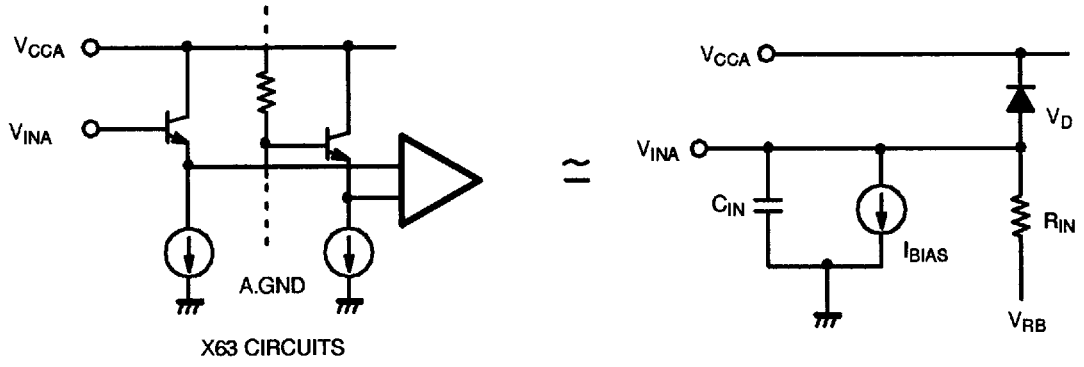
Fig. 2 – ANALOG INPUT EQUIVALENT CIRCUIT



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

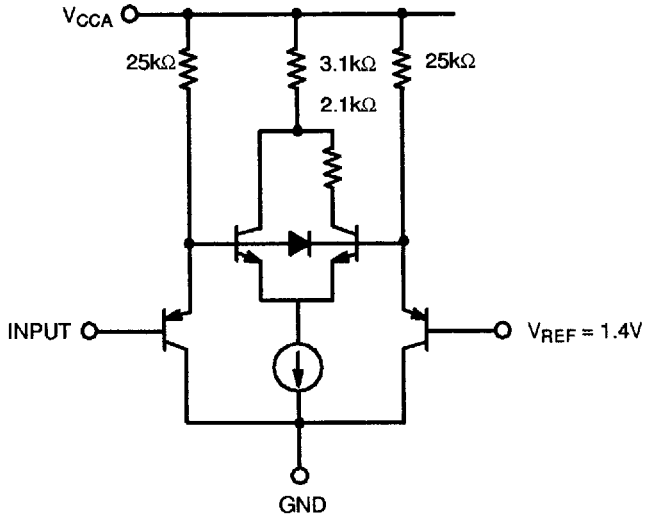
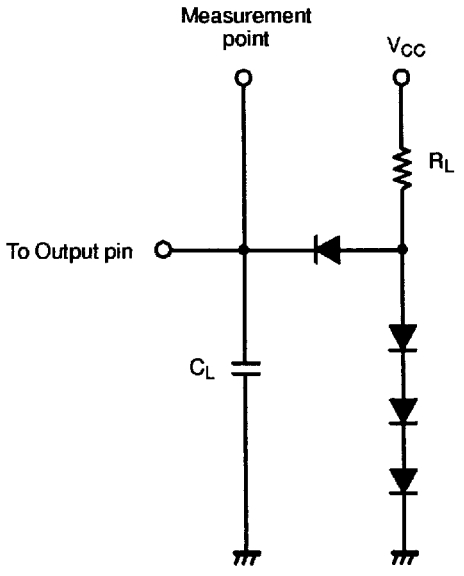


Fig. 4 – LOAD CIRCUIT FOR OUTPUT BUFFER



R_L = 2kΩ
C_L = 15pF including scope and jig capacitance
Diodes: IN 3064 or equivalent.

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OUTPUT CODE

(V_{CC} ≒ 5V, V_{RT} ≒ 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

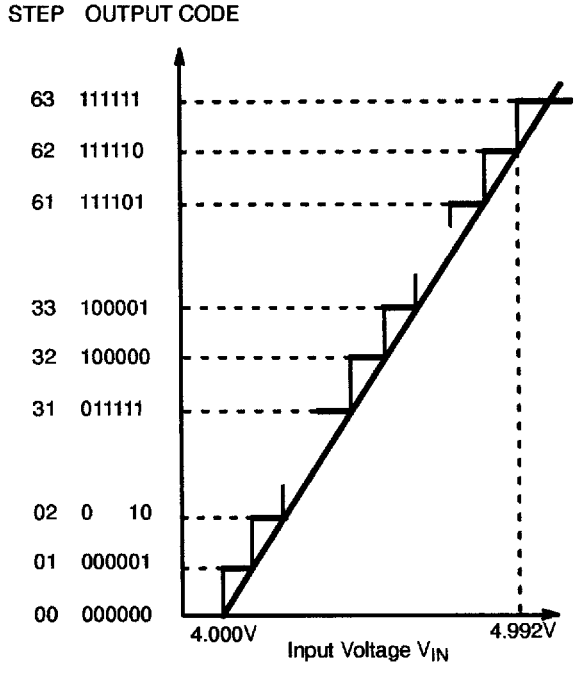
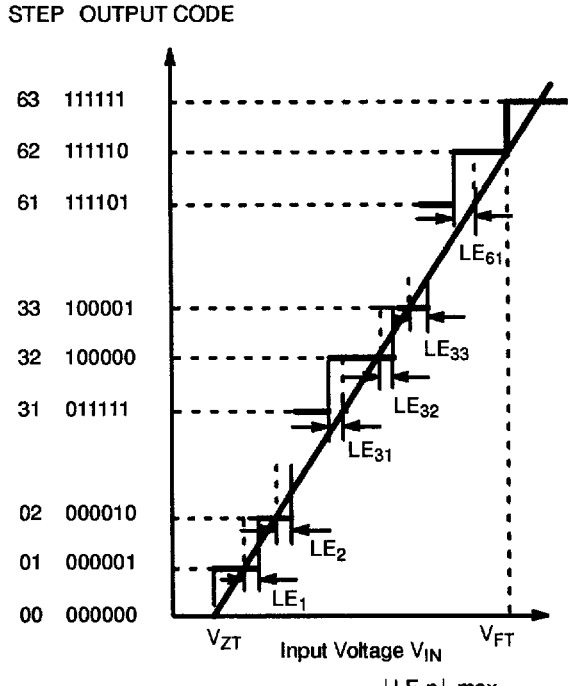


Fig. 6 – ACTUAL CONVERSION CHARACTERISTICS



Linearity Error= $\frac{|LE\ n|\ max.}{|FS|}$

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TYPICAL CHARACTERISTICS CURVES

Fig. 7 – POWER SUPPLY CURRENT vs. TEMPERATURE

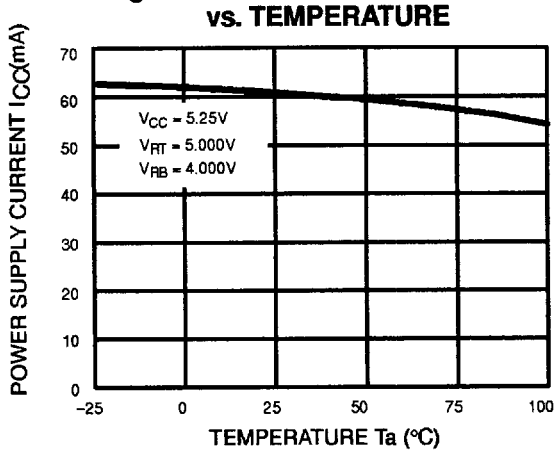


Fig. 8 – LINEARITY ERROR vs. TEMPERATURE

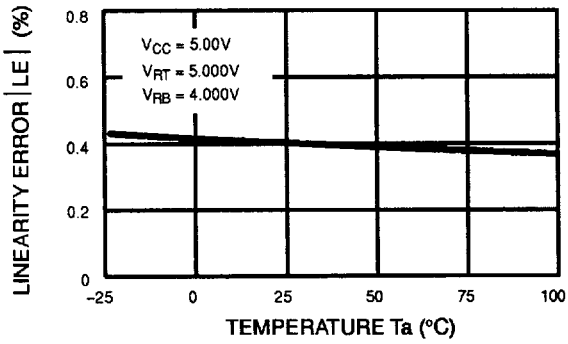


Fig. 9 – REFERENCE CURRENT vs. TEMPERATURE

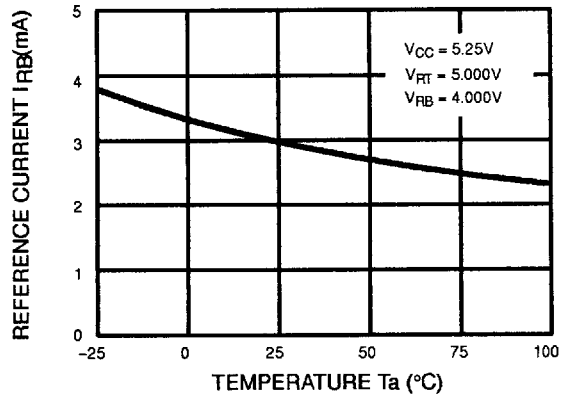


Fig. 10 – DIGITAL HIGH-LEVEL OUTPUT VOLTAGE vs. TEMPERATURE

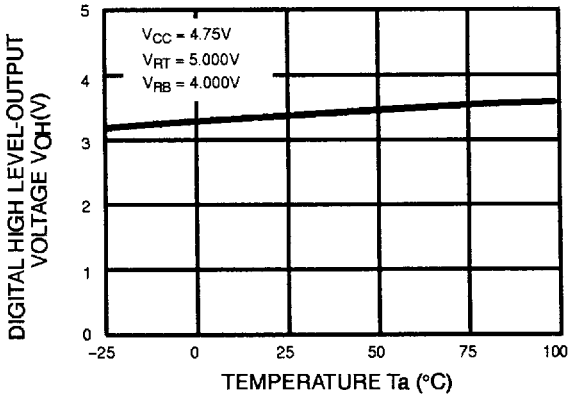
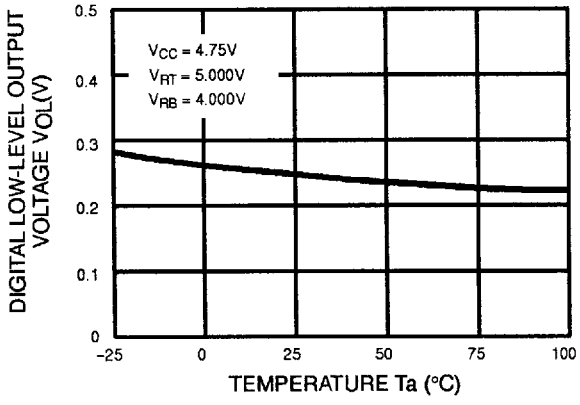


Fig. 11 – DIGITAL LOW-LEVEL OUTPUT VOLTAGE vs. TEMPERATURE



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TYPICAL CHARACTERISTICS CURVES (Continued)

Fig. 12 – DELAY TIME vs. TEMPERATURE

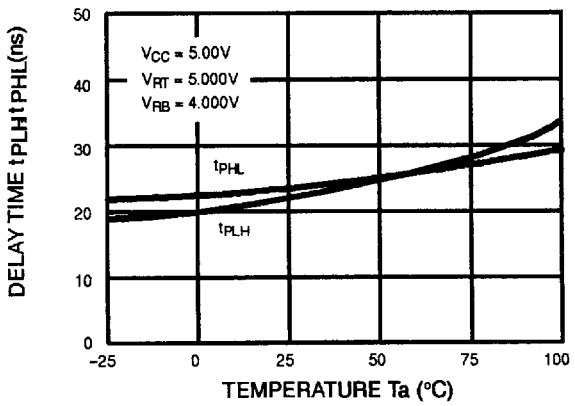


Fig. 13 – DELAY TIME vs. POWER SUPPLY VOLTAGE

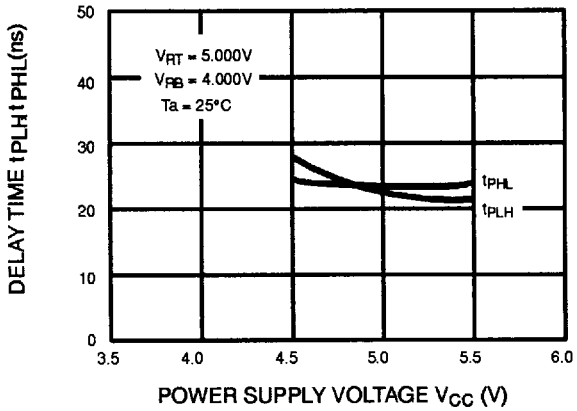


Fig. 14 – CLOCK PULSE WIDTH vs. TEMPERATURE

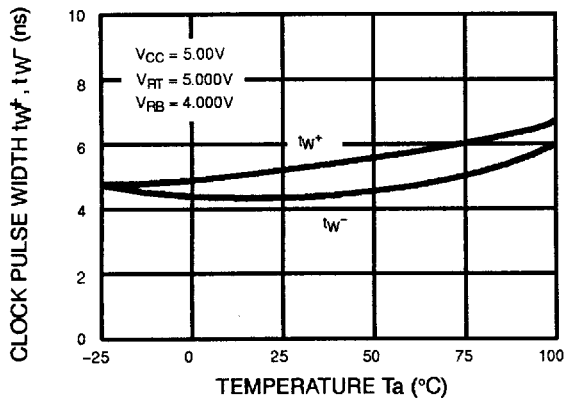


Fig. 15 – CLOCK PULSE WIDTH vs. POWER SUPPLY VOLTAGE

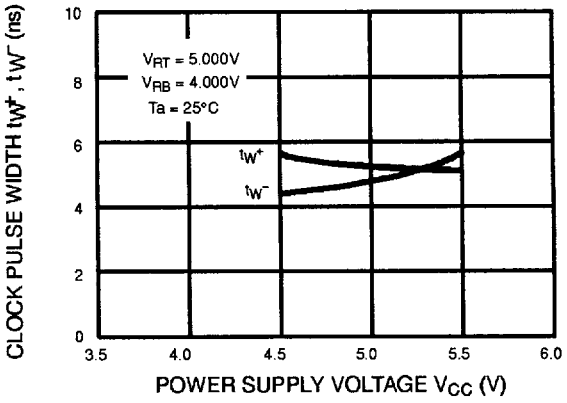
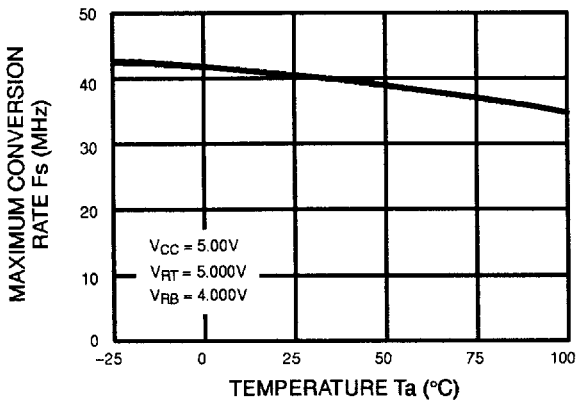


Fig. 16 – MAXIMUM CONVERSION RATE vs. TEMPERATURE



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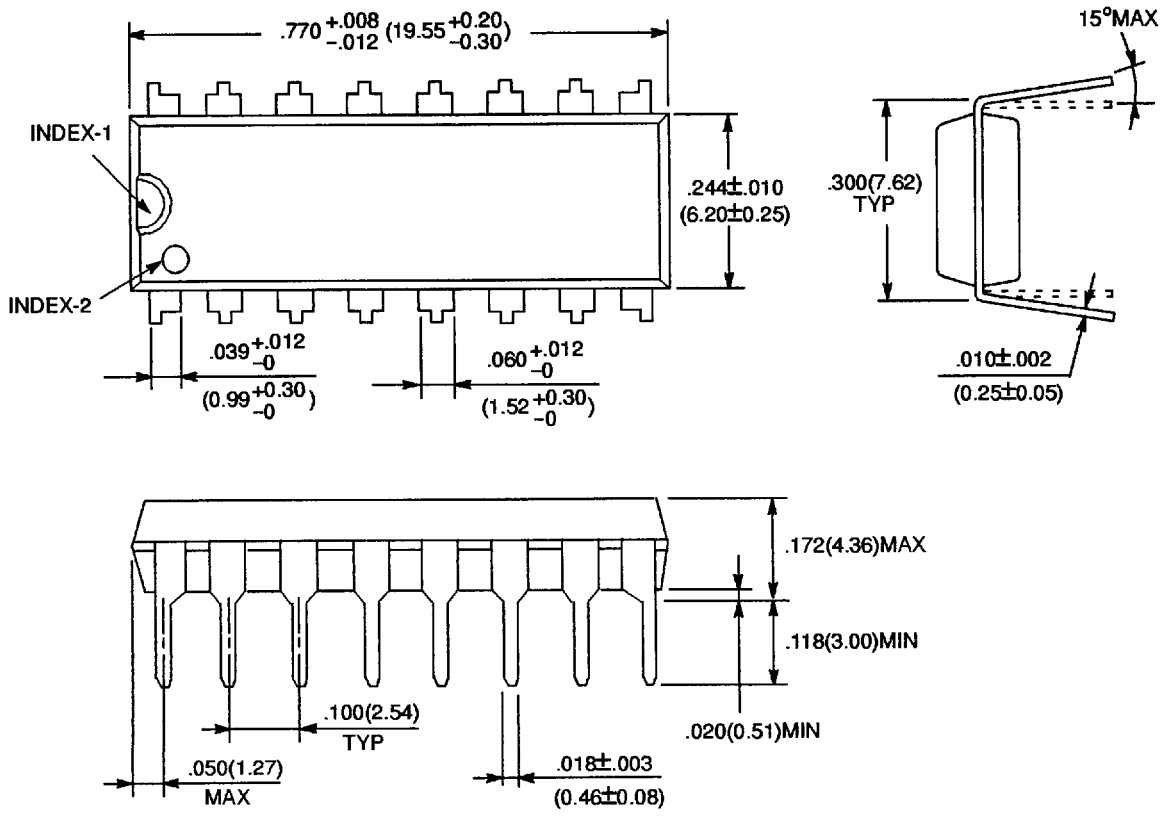
PACKAGE DIMENSIONS

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



Dimensions in
inches (millimeters)

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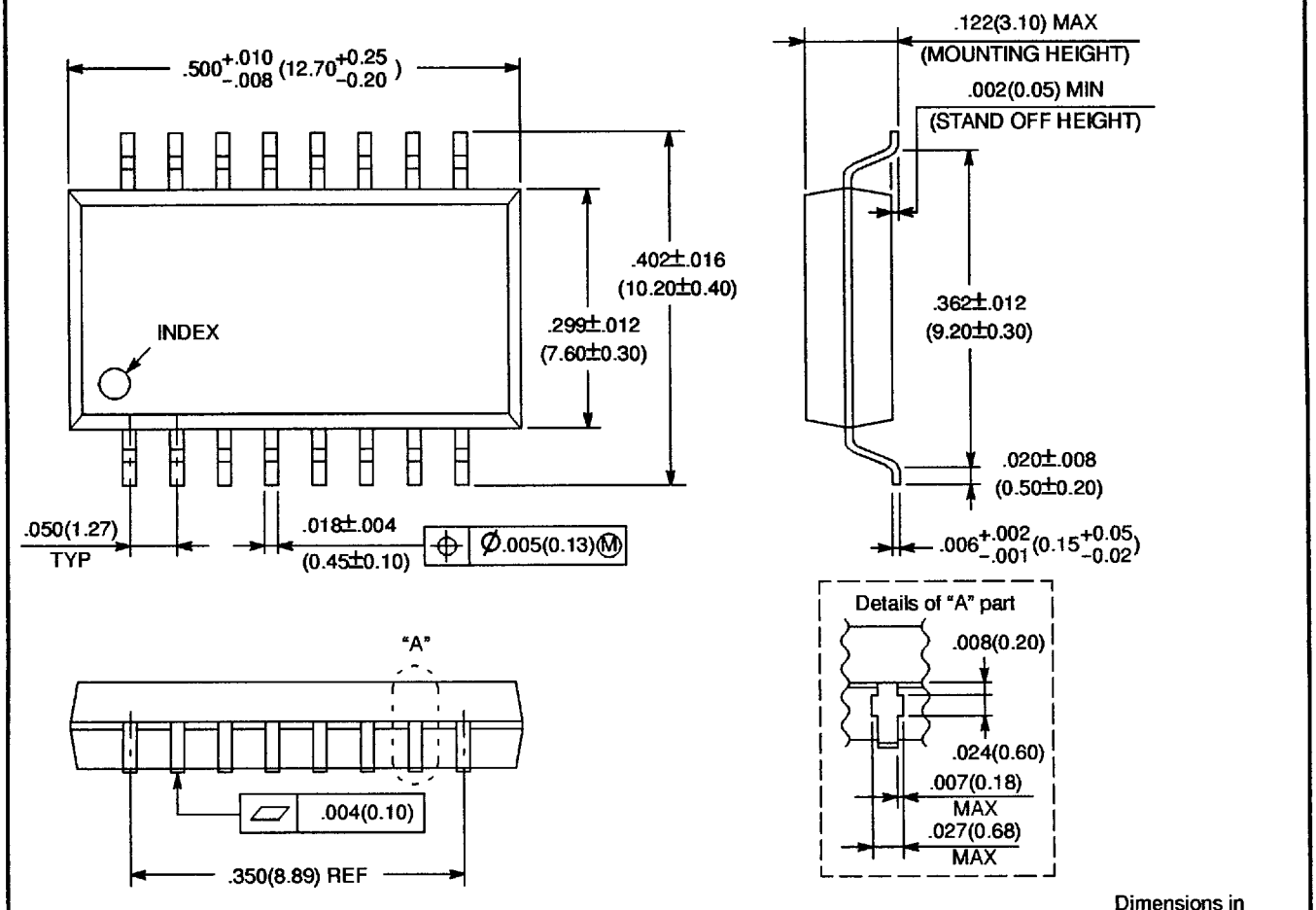
PACKAGE DIMENSIONS (Continued)

16-LEAD PLASTIC FLAT PACKAGE
(CASE No.: FPT-16P-M03)



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Dimensions in
inches (millimeters)

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