

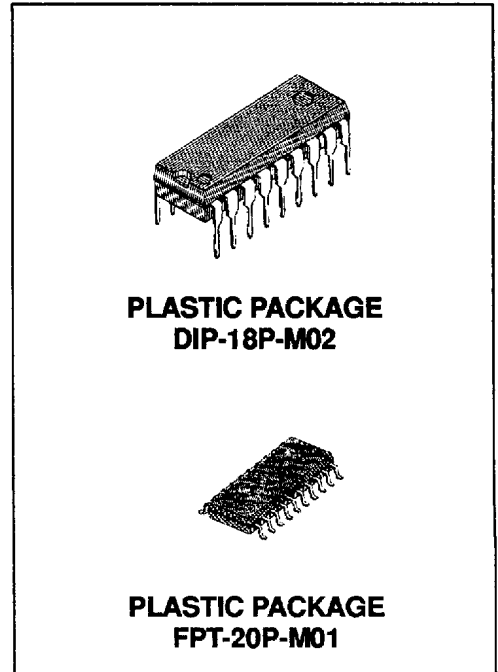
# MB40778

## 1 CHANNEL 8-BIT D/A CONVERTER

### 1 CHANNEL 8-BIT D/A CONVERTER (20MSPS)

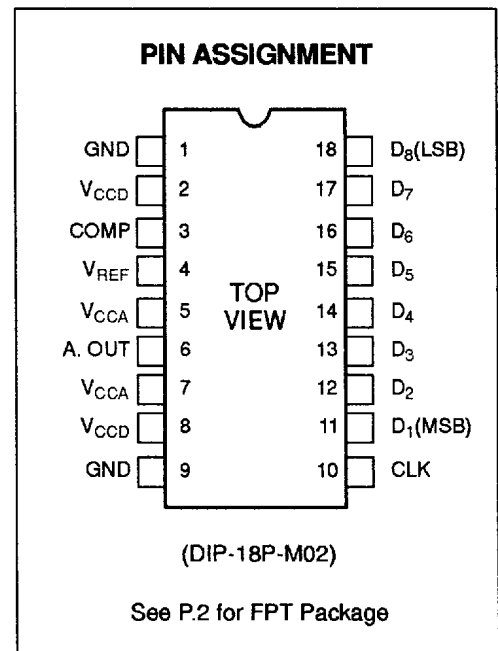
The Fujitsu MB40778 is an 8-bit, low power, ultra-high speed D/A converter fabricated with Fujitsu Advanced Bipolar Technology. The MB40778 can convert 8-bit digital signals into analog signals at a rate of DC to 20 mega-samples/sec (MSPS). Because of such high speed operation, the MB40778 is suitable for applications such as digital color TV, video processing with computer, and radar signal processing.

- Resolution : 8 bits
- Linearity :  $\pm 0.2\%$  max.
- Maximum Conversion Rate : 20MSPS min.
- Analog Output Voltage range :  $V_{CC}$  to  $V_{CC} - 1(V)$
- Digital I/O level : TTL Compatible
- Single Power Supply : +5V
- Power Dissipation : 250mW typ.
- Standard 18-pin DIP Package (Suffix: -P)
- Standard 20-pin FPT 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 Reference Voltage	$V_{REF}$	3.70 to $V_{CC} + 0.5$	V
Storage Temperature	$T_{STG}$	- 55 to +125	$^{\circ}C$



**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.

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.

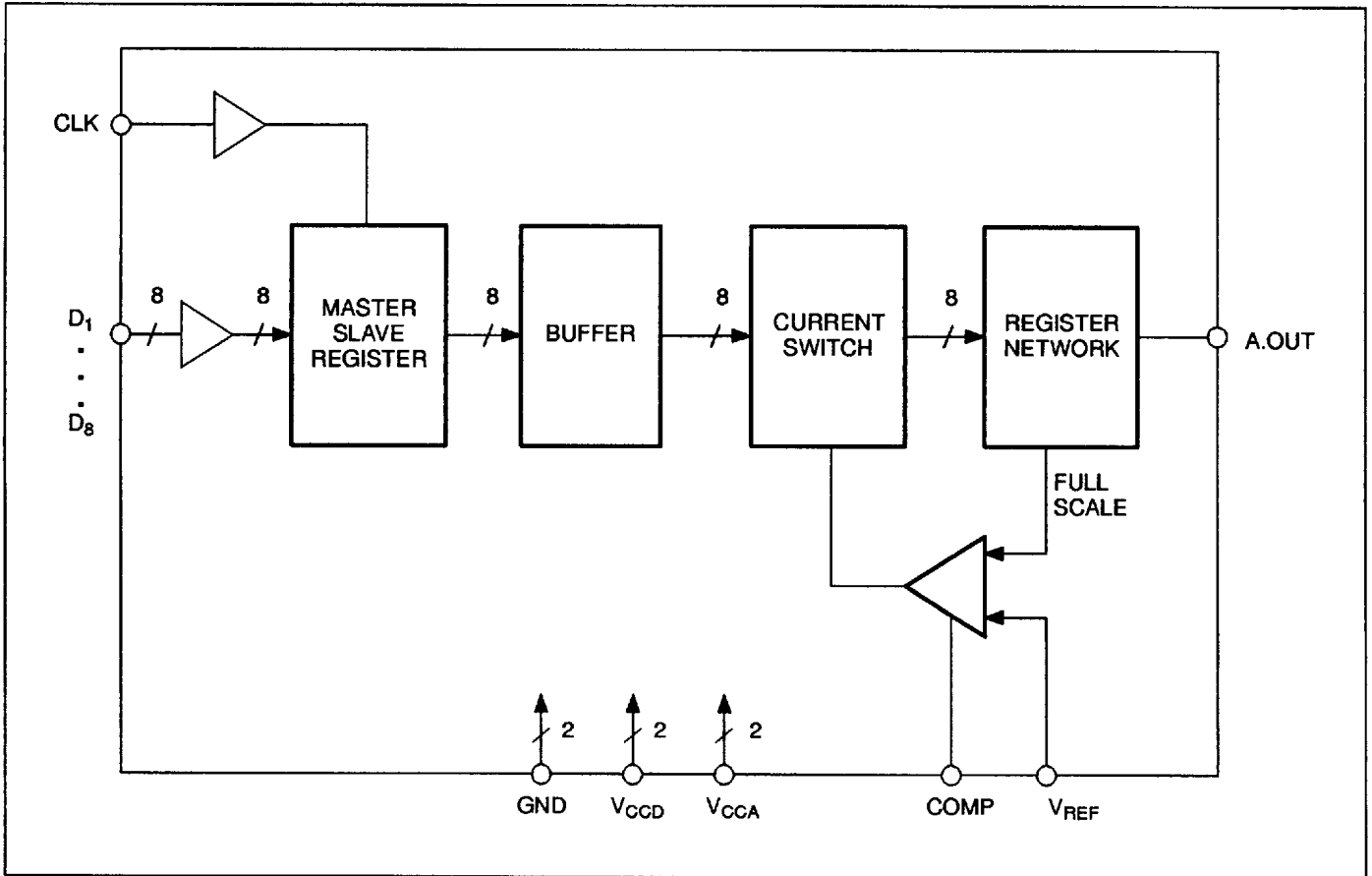


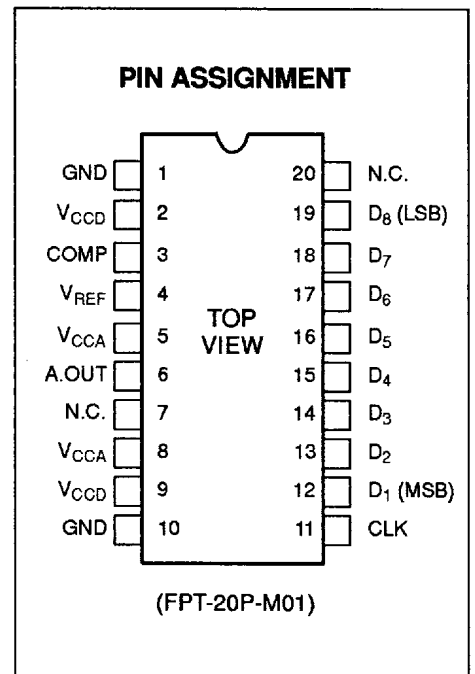
Figure 1. MB40778H Block Diagram

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Power Supply Voltage	V <sub>CCA</sub> V <sub>CCD</sub>	4.75	5.00	5.25	V
Analog Reference Voltage <sup>1</sup>	V <sub>REF</sub>	3.70	4.00	4.30	V
Clock Pulse Width at High level	t <sub>W+</sub>	25			ns
Clock Pulse Width at Low level	t <sub>W-</sub>	25			ns
Data Setup Time	t <sub>S</sub>	12.5			ns
Data Hold Time	t <sub>H</sub>	12.5			ns
Operating Temperature	T <sub>A</sub>	0		70	°C
Phase Compensation Capacitance <sup>2</sup>	C <sub>COMP</sub>	1			μF

**Note:**

1. V<sub>CC</sub> - V<sub>REF</sub> ≤ 1.2V.
2. The capacitor should be connected between COMP and GND.



## ELECTRICAL CHARACTERISTICS

## ANALOG DC CHARACTERISTICS

 $(V_{CC} = 4.75 \text{ to } 5.25\text{V}, T_A = 0 \text{ to } 70^\circ\text{C})$ 

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Resolution					8	bits
Linearity Error	LE	DC			$\pm 0.2$	%
Full-Scale Analog Output Voltage	$V_{OFS}$	$V_{CC} = 5.000\text{V}$ $V_{REF} = 3.976\text{V}$	$V_{CCA}$ -0.015	$V_{CCA}$	$V_{CCA}$ +0.015	V
Zero-Scale Analog Output Voltage	$V_{OZS}$	$V_{CC} = 5.000\text{V}$ $V_{REF} = 3.976\text{V}$	3.919	3.980	4.042	V
Reference Current	$I_{REF}$	$V_{REF} = 4.00\text{V}$			10	$\mu\text{A}$
Output Impedance	$Z_{OUT}$	$T_A = 25^\circ\text{C}$	70	80	90	$\Omega$

## DIGITAL DC CHARACTERISTICS

 $(V_{CC} = 4.75 \text{ to } 5.25\text{V}, T_A = 0 \text{ to } 70^\circ\text{C})$ 

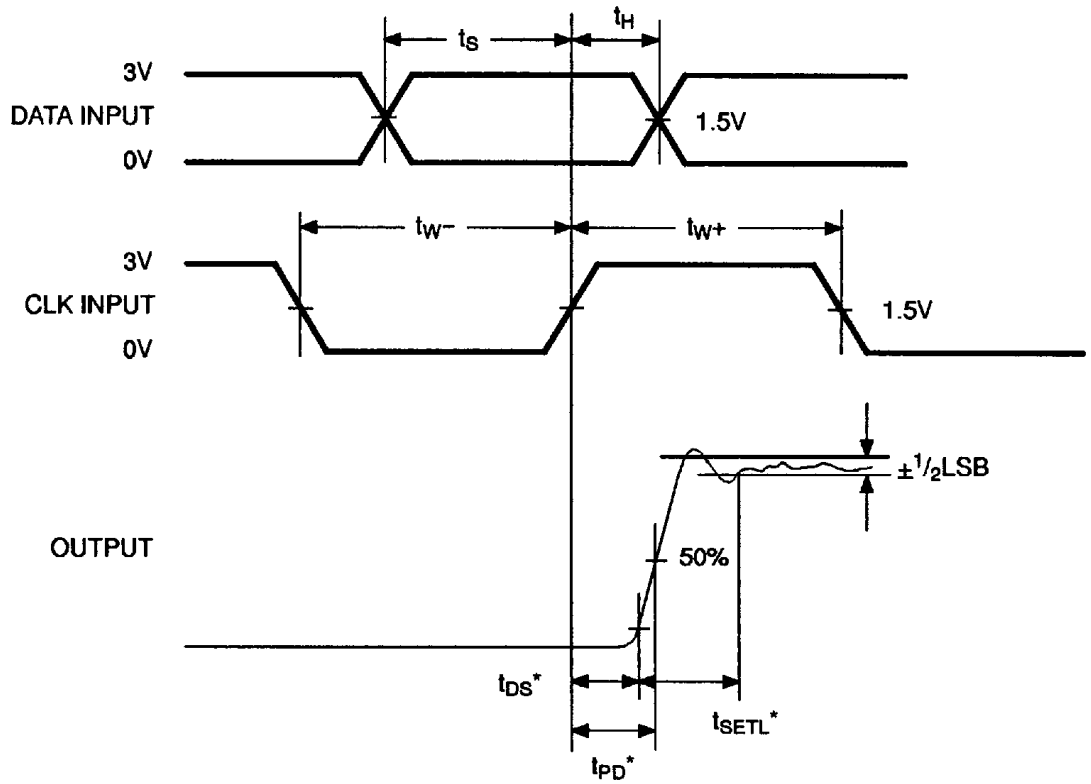
Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
High-level Input Voltage	$V_{IHD}$		2.0			V
Low-level Input Voltage	$V_{ILD}$				0.8	V
Maximum Input Current	$I_{ID}$	$V_{CC} = 5.25\text{V}$ $V_{ID} = 7.00\text{V}$		0	100	$\mu\text{A}$
High-level Input Current	$I_{IHD}$	$V_{CC} = 5.25\text{V}$ $V_{IHD} = 2.70\text{V}$		0	20	$\mu\text{A}$
Low-level Input Current	$I_{ILD}$	$V_{CC} = 5.25\text{V}$ $V_{ILD} = 0.40\text{V}$	-400	-40		$\mu\text{A}$
Power Supply Current	$I_{CC}$	$V_{REF} = 4.05\text{V}$		50°	75	mA

Note: \*  $V_{CC} = 5.00\text{V}$ ,  $V_{REF} = 4.00\text{V}$ .

## SWITCHING CHARACTERISTICS

 $(V_{CC} = 4.75 \text{ to } 5.25\text{V}, T_A = 0 \text{ to } 70^\circ\text{C})$ 

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Maximum Conversion Rate	FS		20	30		MSPS



**Note:** \*These values are not specified because they depend on application circuit.

Figure 2. Timing Diagram

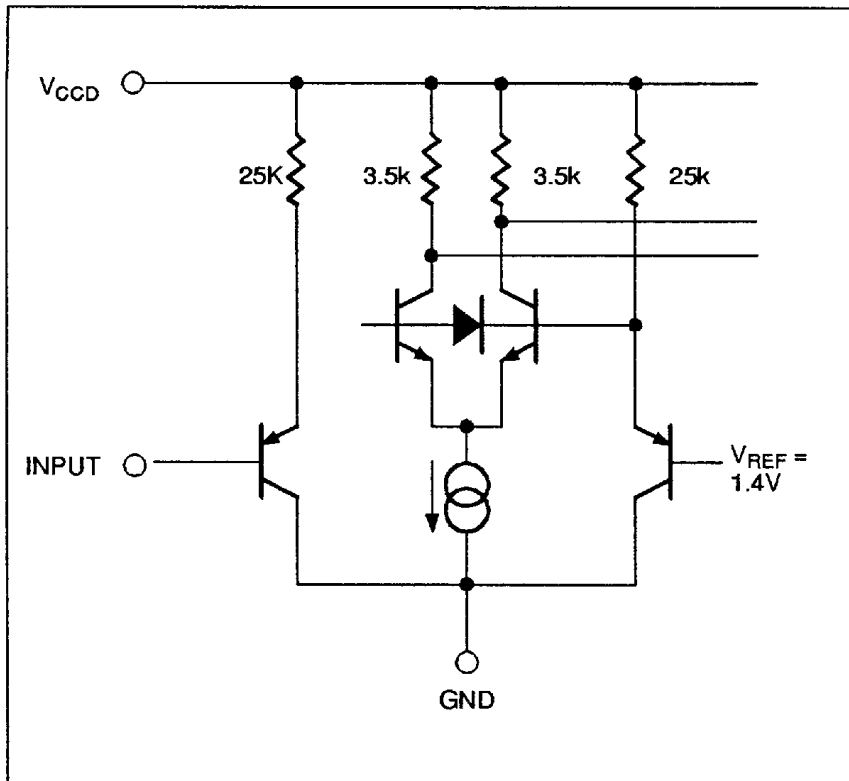


Figure 3. Digital Input Equivalent Circuit

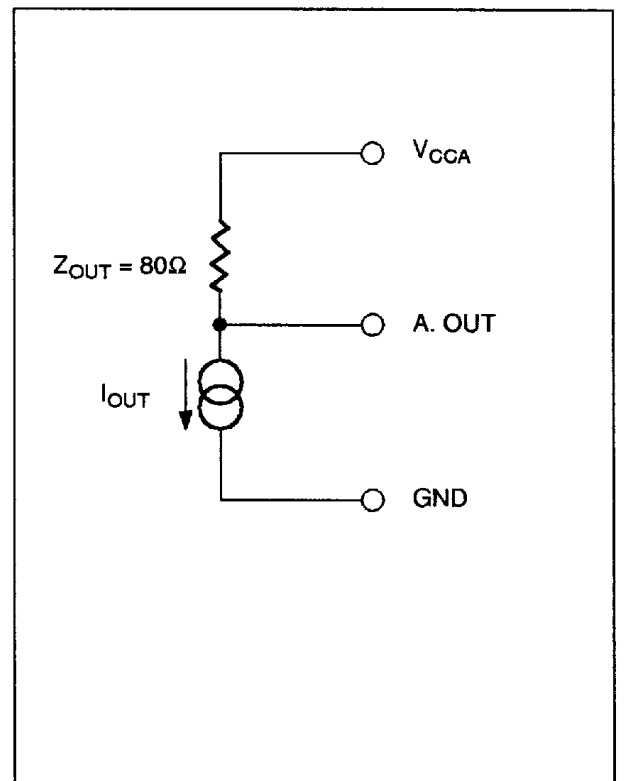
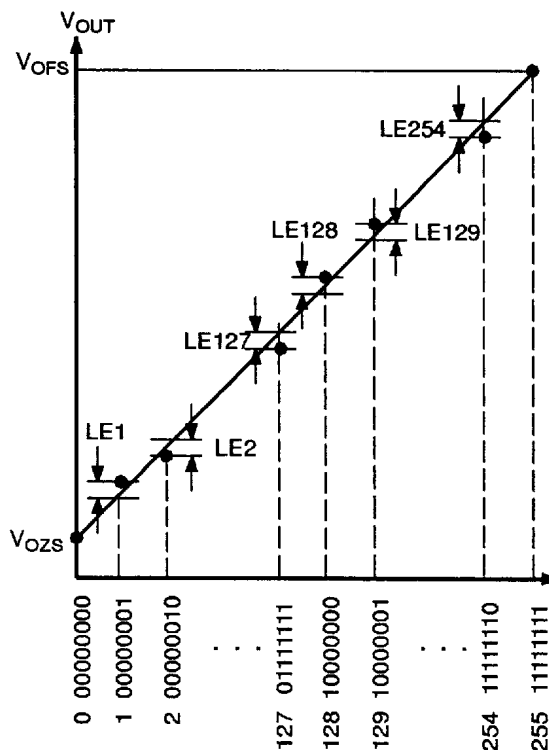
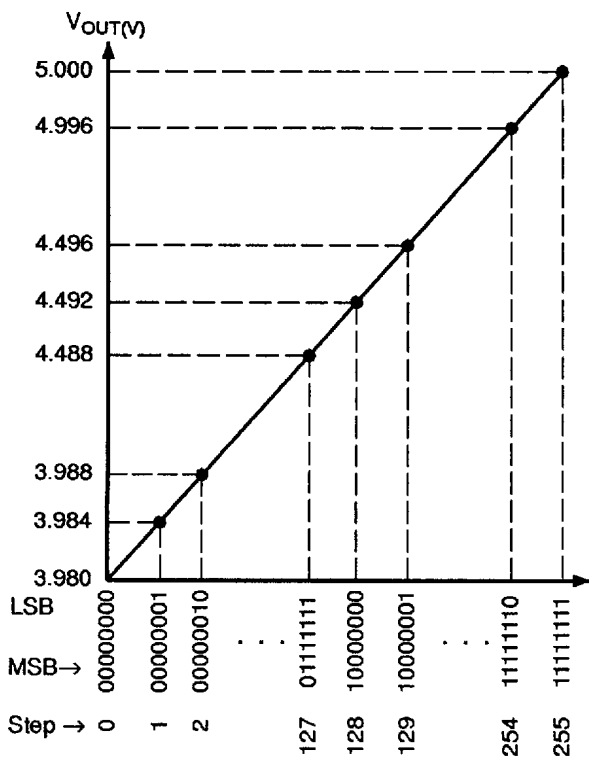


Figure 4. Output Equivalent Circuit

**OUTPUT VOLTAGE**

( $V_{CCA} = 5.000V$ ,  $V_{REF} = 3.976V$ )

Step	Input Code	Output Voltage (V)
0	00000000	3.980
1	00000001	3.984
	•	•
	•	•
	•	•
127	01111111	4.488
128	10000000	4.492
129	10000001	4.496
	•	•
	•	•
	•	•
254	11111110	4.996
255	11111111	5.000

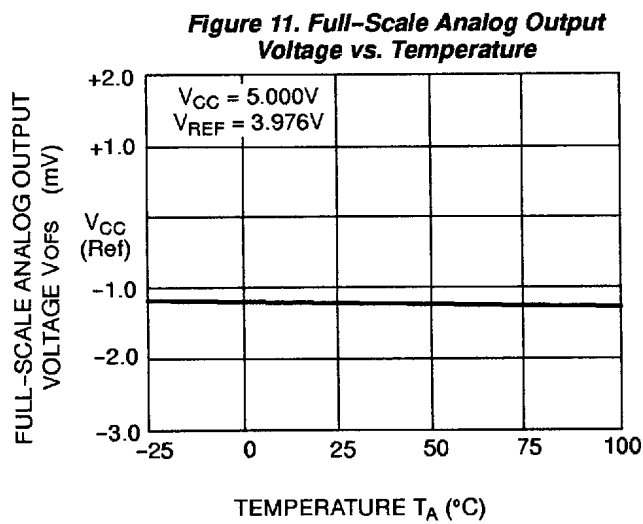
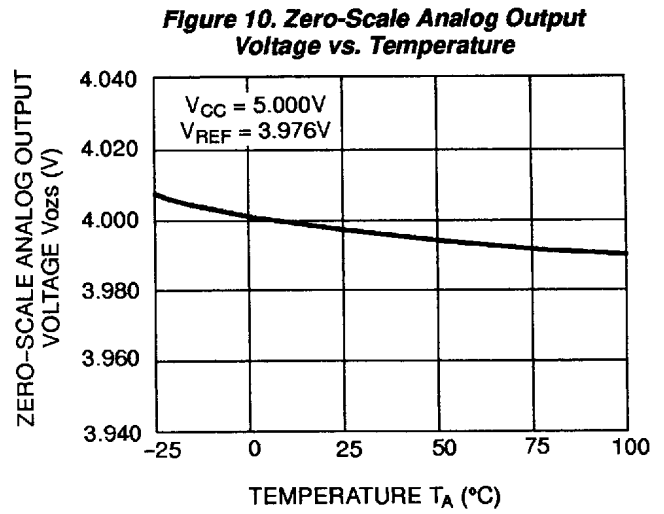
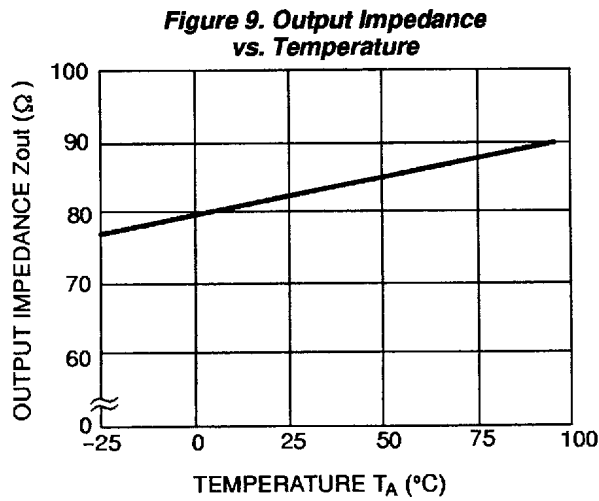
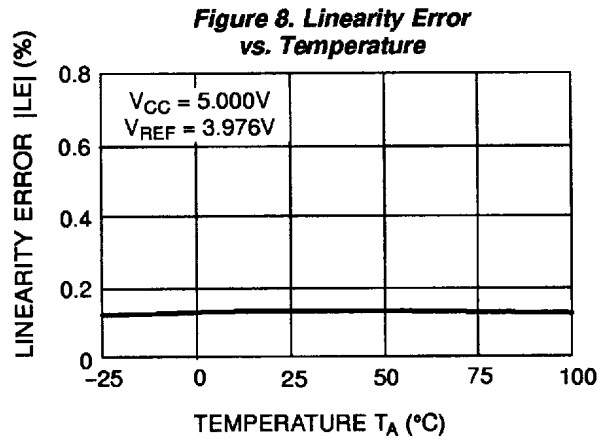
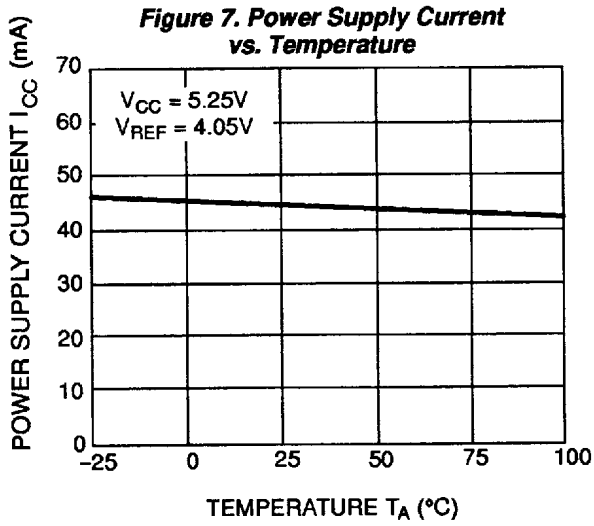


$$\text{Linearity Error} = \frac{|LE_n|_{\max}}{|FS|}$$

Figure 5. Ideal Output Operation

Figure 6. Practical Output Operation

TYPICAL CHARACTERISTIC CURVES



TYPICAL CHARACTERISTIC CURVES (Continued)

Figure 12. Delay Time vs. Temperature

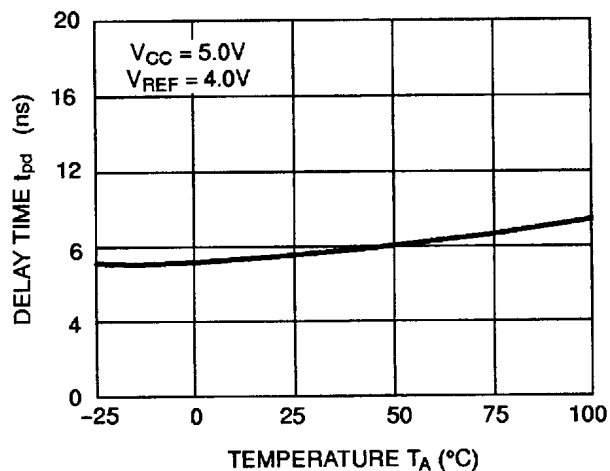


Figure 13. Delay Time vs. Power Supply Voltage

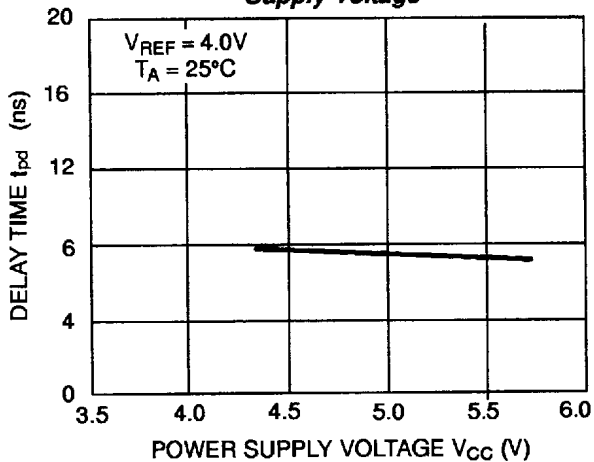


Figure 14. Clock Pulse Width vs. Temperature

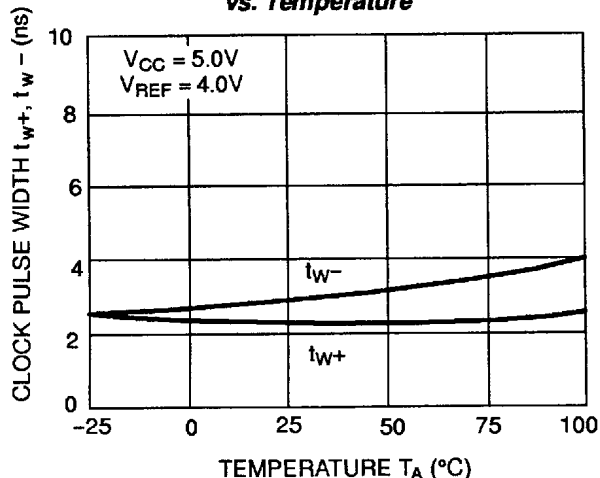


Figure 15. Clock Pulse Width vs. Power Supply Voltage

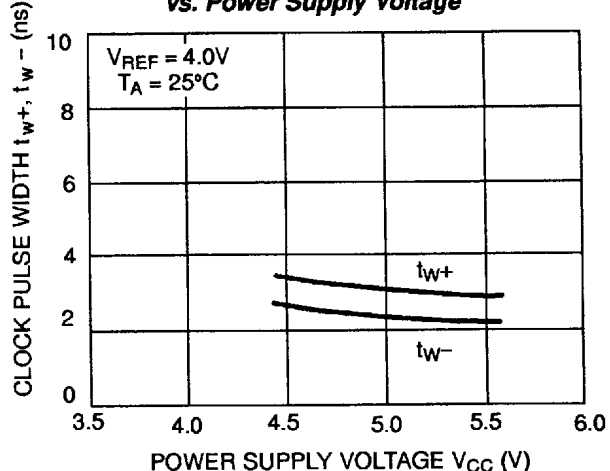
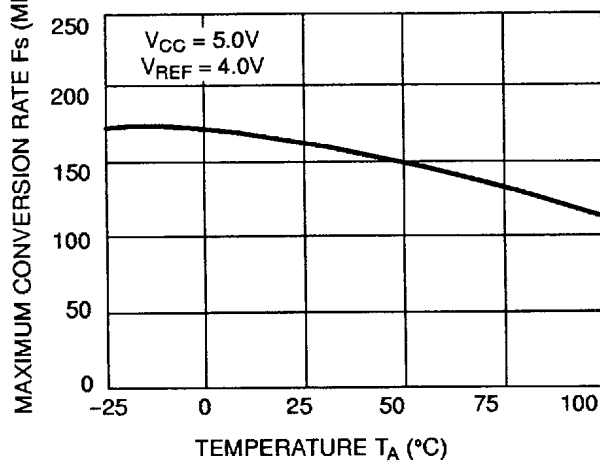
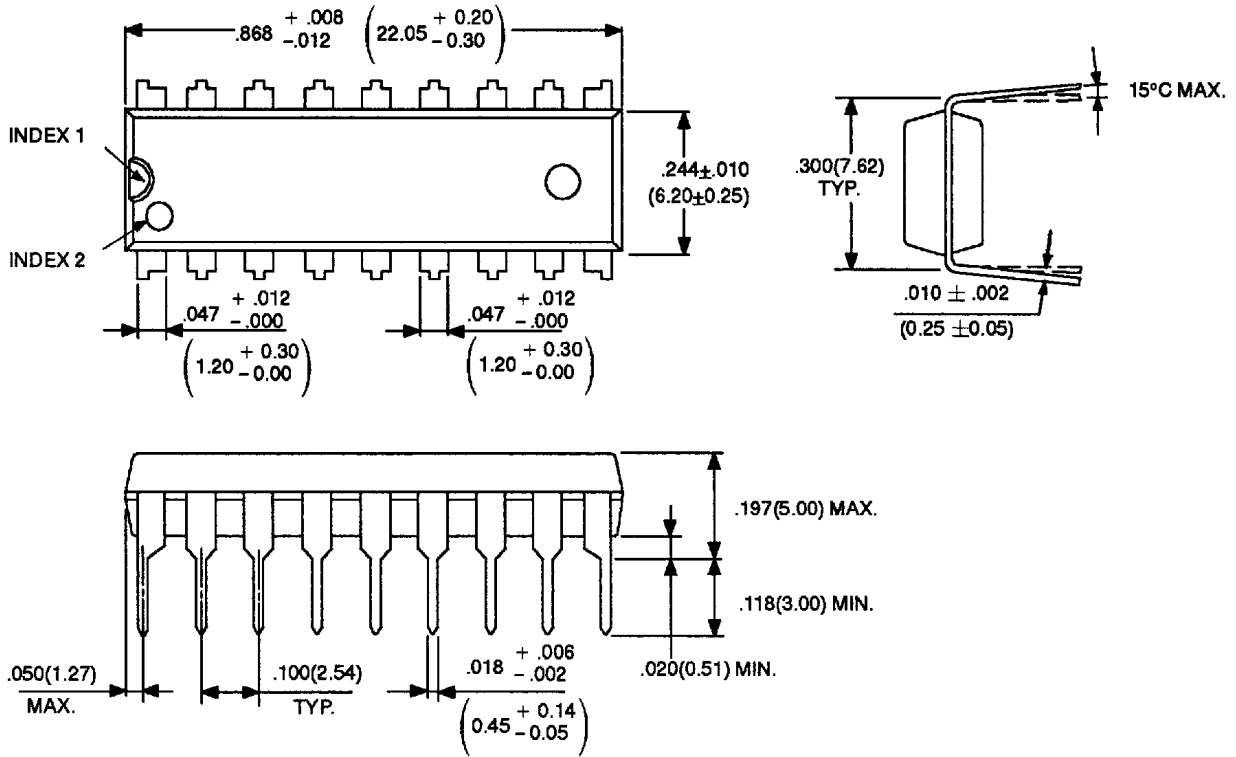


Figure 16. Maximum Conversion Rate vs. Temperature



PACKAGE DIMENSIONS

18-LEAD PLASTIC DUAL IN-LINE PACKAGE  
(CASE No.: DIP-18P-M02)

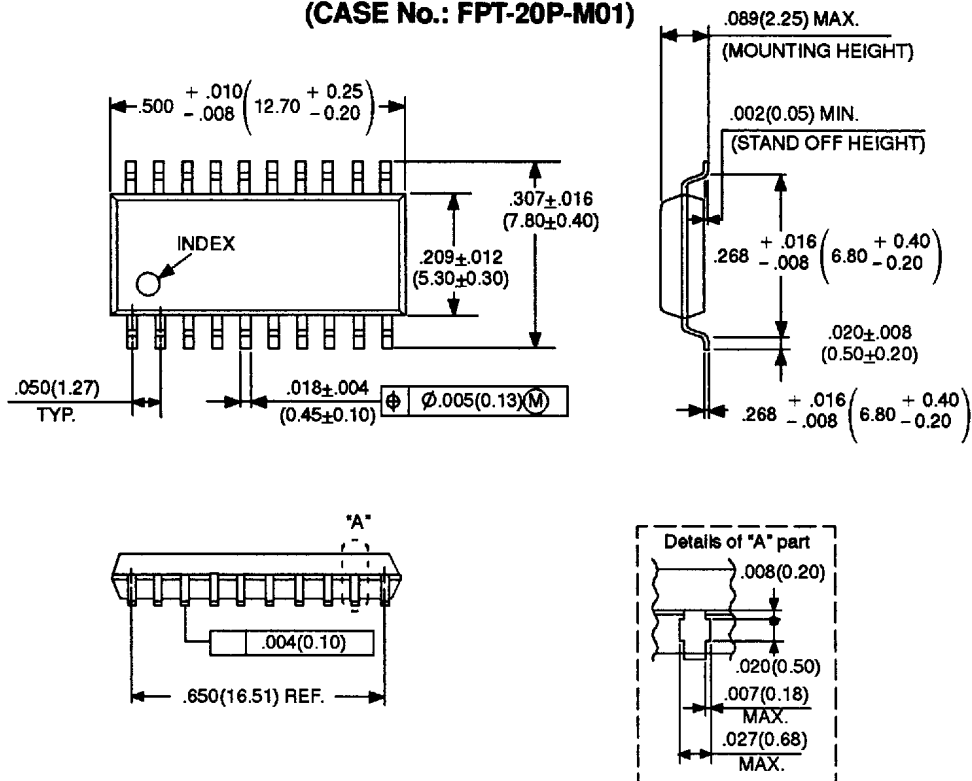


Dimensions in inches (millimeters)



PACKAGE DIMENSIONS (Continued)

20-LEAD PLASTIC FLAT PACKAGE  
(CASE No.: FPT-20P-M01)



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Dimensions in inches (millimeters)