August 1990
Edition 4.0

FUJITSU

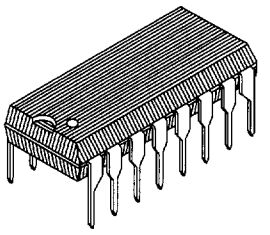
DATA SHEET

MB40576
1 CHANNEL 6-BIT VIDEO A/D CONVERTER

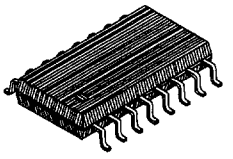
1 CHANNEL 6-BIT VIDEO A/D CONVERTER (20 MSPS)

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 signals (such as video signals) to digital signals, at a sampling rate of DC through 20 mega-samples/sec. Because of this high-speed operation, the MB40576 is suitable for digital video applications such as digital TV, video processing with a computer, and radar signal processing.

- Resolution: 6 bits
- Linearity Error: ±0.8% maximum
- Maximum Conversion Rate: 20 MSPS mininum
- 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: 270 mW typical
- Package: Standard 16-pin DIP package (Suffix: –P)
  Standard 16–pin FLAT package (Suffix: –PF)

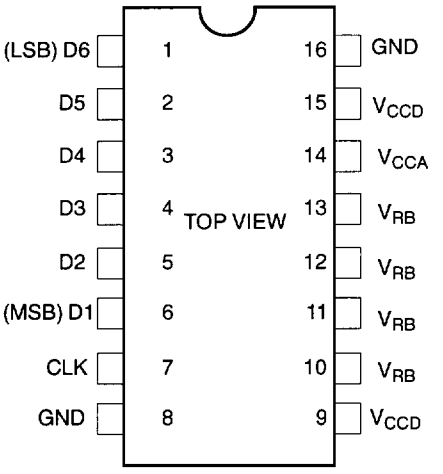


DIP–16P–M04



PLASTIC PACKAGE
(FPT-16P-M03)

PIN ASSIGNMENT



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 : Permanentdevice 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 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.

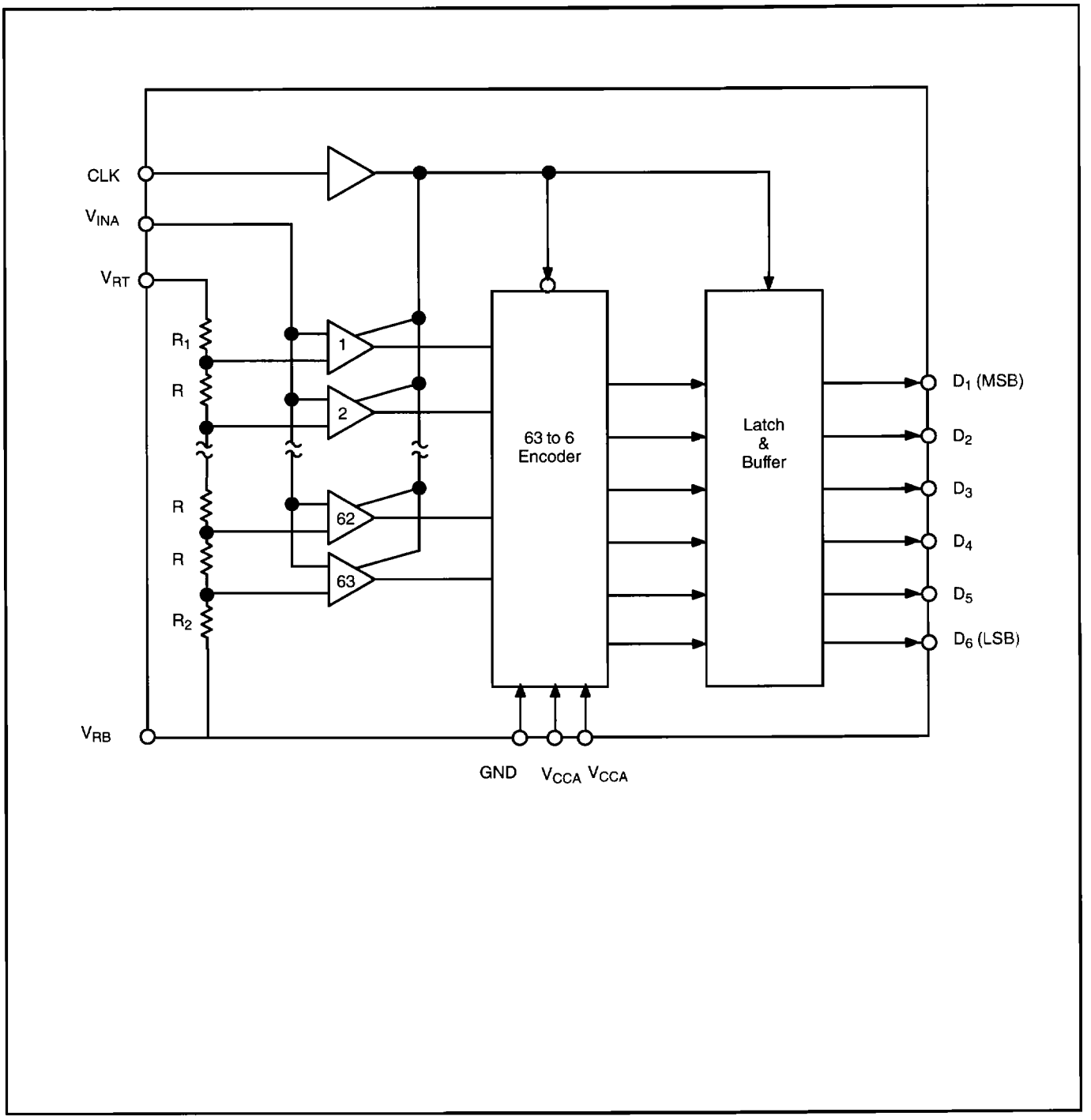


Figure 1. MB40576 Block Diagram

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power supply voltage[1]	V_{CC} V_{CCD}	4.75	5.00	5.25	V
Analog input voltage[2]	V_{INA}	4		5	V
Analog reference voltage (top side)	V_{RT}	4	5	5.1	V
Analog reference voltage (bottom side)[2]	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
Operatingtemperature	T_A	0		70	°C

Notes: [1] Keep V_{CCA} and V_{CCD} at the same potential.
[2] $V_{RB}<V_{INA}<V_{RT}-V_{RB}\approx 1V \pm 0.1V$

ELECTRICAL CHARACTERISTICS

ANALOG DC CHARACTERISTICS

(V_{CC}=4.75 to 5.25V, T_A=0 to 70°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Resolution					6	bits
Linearity error	LE	DC			±0.8	%
Equivalent analog input resistance	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_{CCA}=4.75 to 5.25V, T_A=0 to 70°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
High-level output voltage	V_{OHD}	I_{OHD} = –400 µA	2.7			V
Low-level output voltage	V_{OLD}	I_{OLD} = 1 .6 mA			0.4	V
High-level input voltage	V_{IHD}		2.0			V
Low-level input voltage	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

ELECTRICAL CHARACTERISTICS, continued

SWITCHING CHARACTERISTICS

(V_{CC}=5V, T_A=25°C)

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Maximum conversion rate	FS	20	30		MSPS
Digital output delay time	t_{pd}		26	40	ns

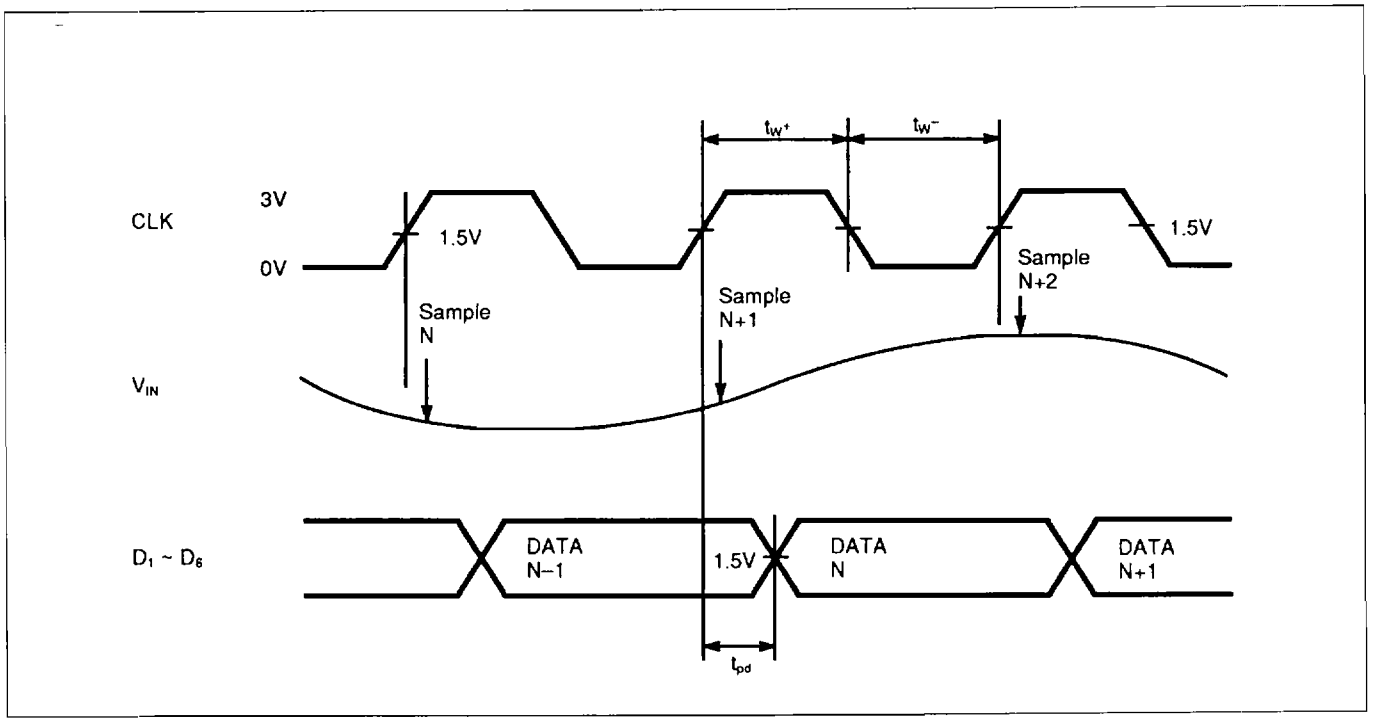


Figure 2. Timing Diagram

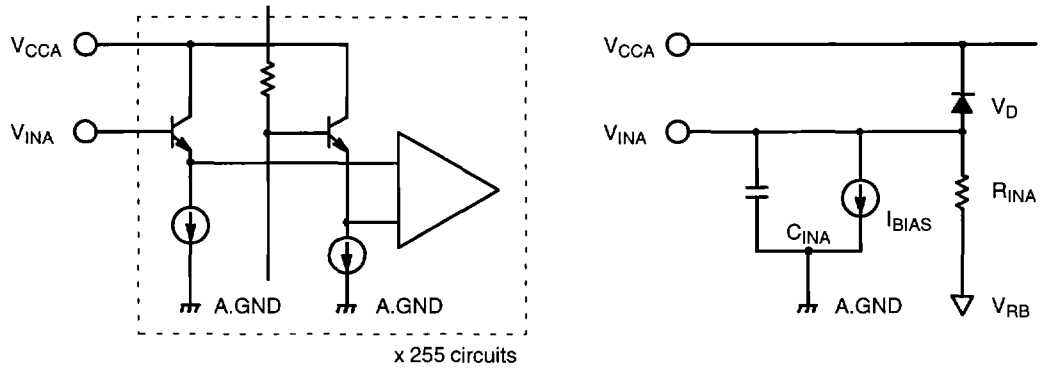


Figure 3. Analog Input Equivalent Circuit

C_{INA}: Nonlinear 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: Base-collector junction diode of emitter-follower transistor

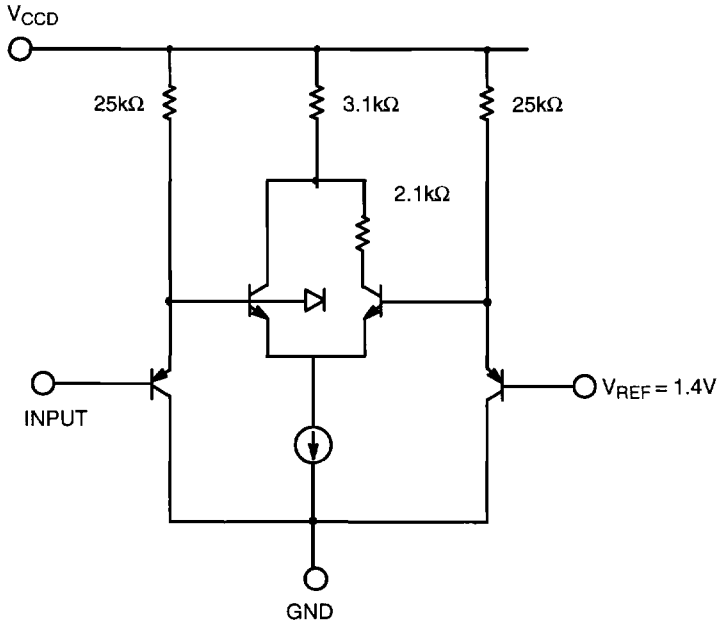
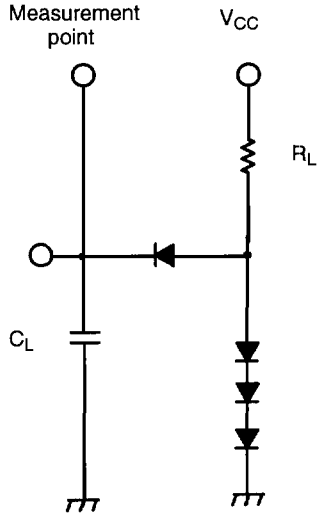


Figure 4. Digital Input Equivalent



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

Figure 5. Load Circuit for Output Buffer

OUTPUT CODE

(V_{CC} ≒ 5V, V_{RT} ≒ V_{RB} = 4V)

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

Note: One step of output voltage (I_{LSB}) is 16 mV when V_{FT} is adjusted at 4.992V, and V_{ZT} at 4.000V by V_{RT} and V_{RB}. The analog input voltages are the center values of each step.

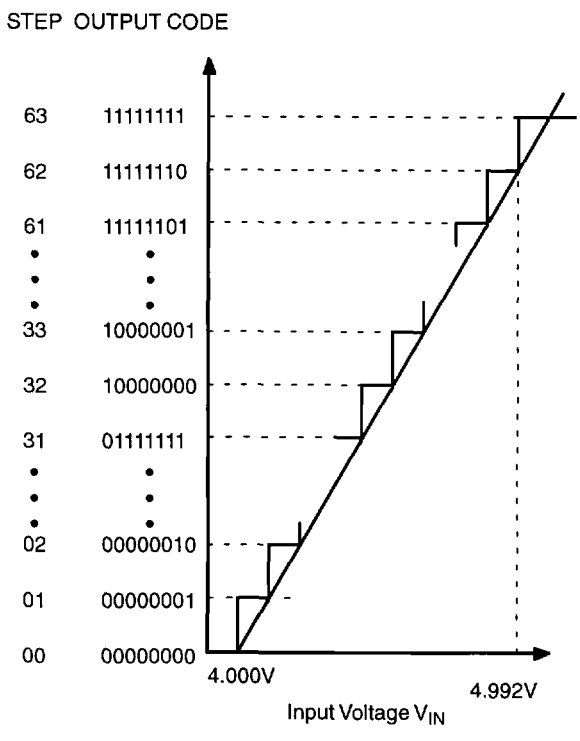


Figure 6. Ideal Conversion Characteristics

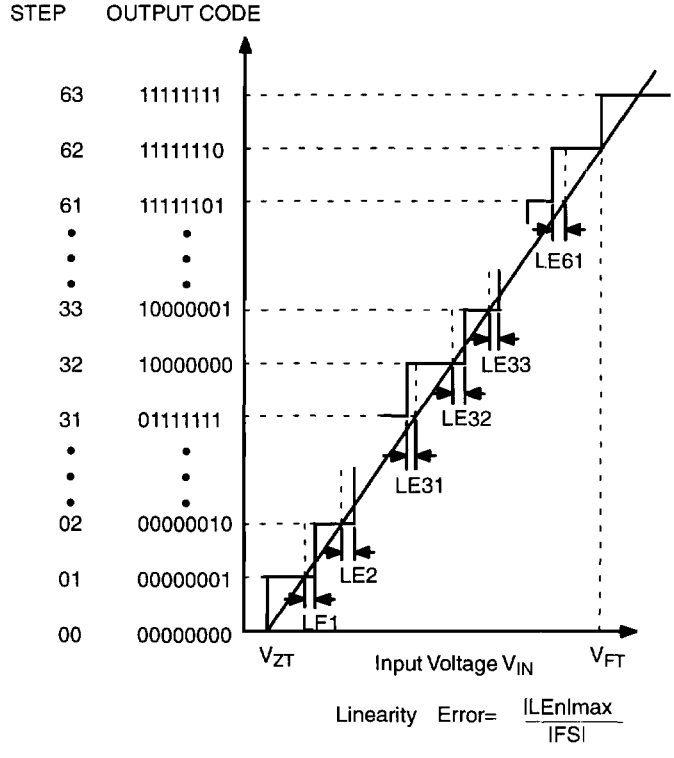


Figure 7. Practical Conversion Characteristics

TYPICAL CHARACTERISTICS CURVES

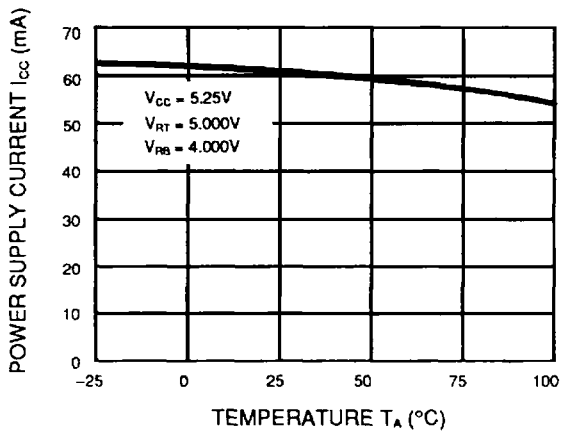


Figure 8. Power Supply Current vs. Temperature

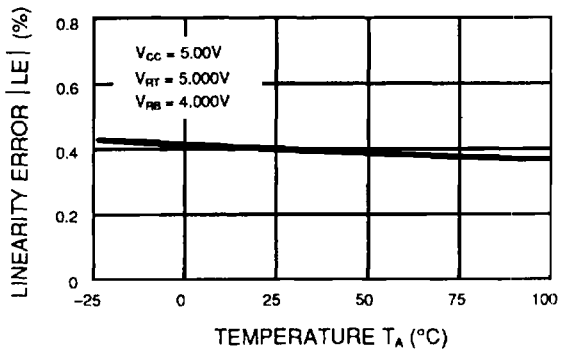


Figure 9. Linearity Error vs. Temperature

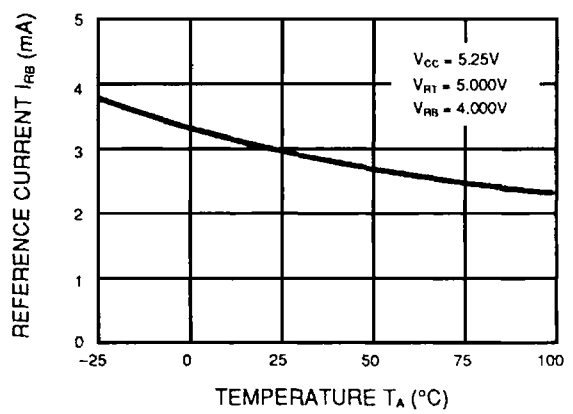


Figure 10. Reference Current vs. Temperature

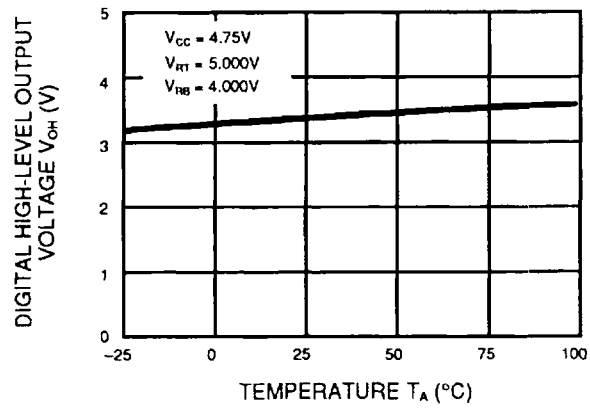


Figure 11. Digital High-level Output Voltage vs. Temperature

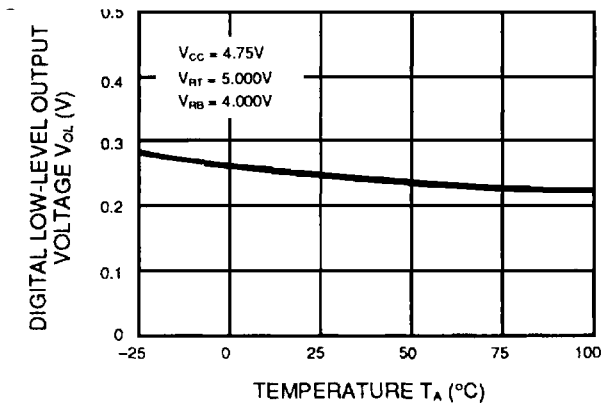


Figure I2. Digital Low-level Output Voltage vs. Temperature

TYPICAL CHARACTERISTICS CURVES, continued

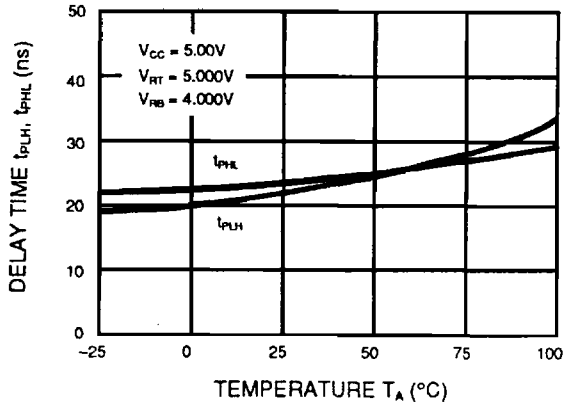


Figure 13. Delay Time vs. Temperature

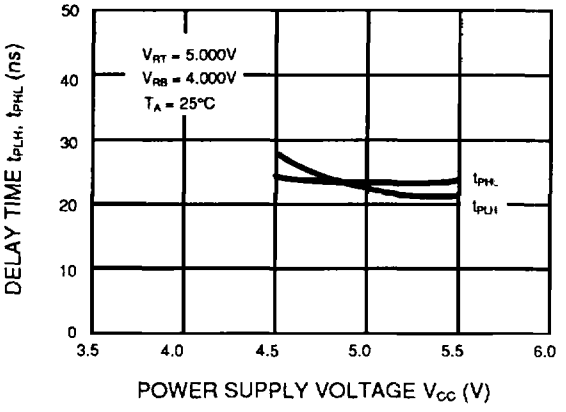


Figure 14. Delay Time vs. Power Supply Voltage

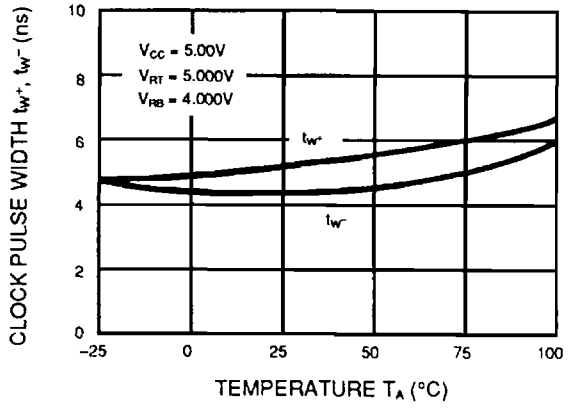


Figure 15. Clock Pulse Width vs. Temperature

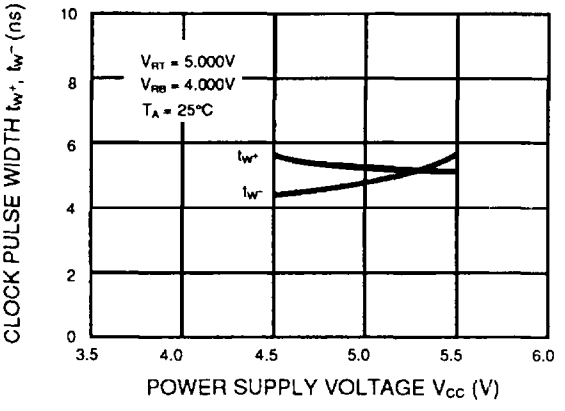


Figure 16. Clock Pulse Width vs. Power Supply Voltage

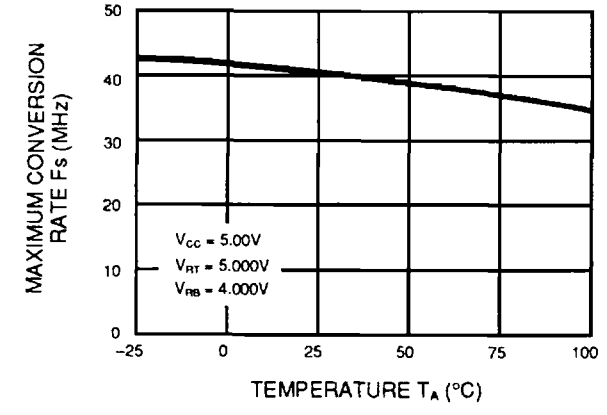
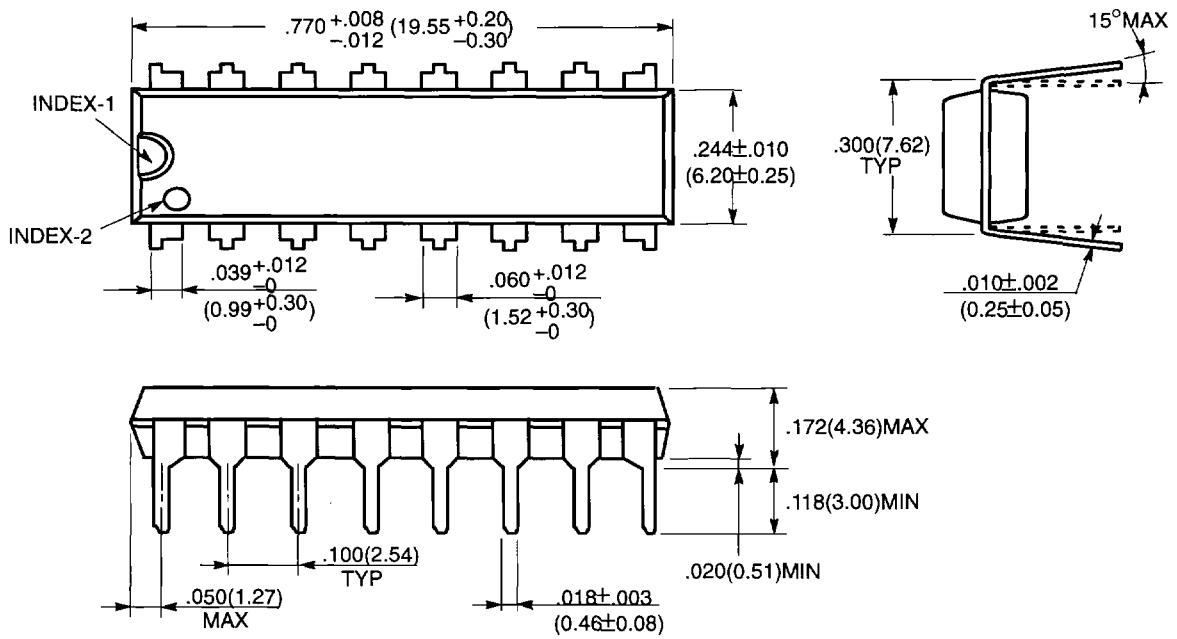


Figure 17. Maximum Conversion Rate vs. Temperature

PACKAGE DIMENSIONS

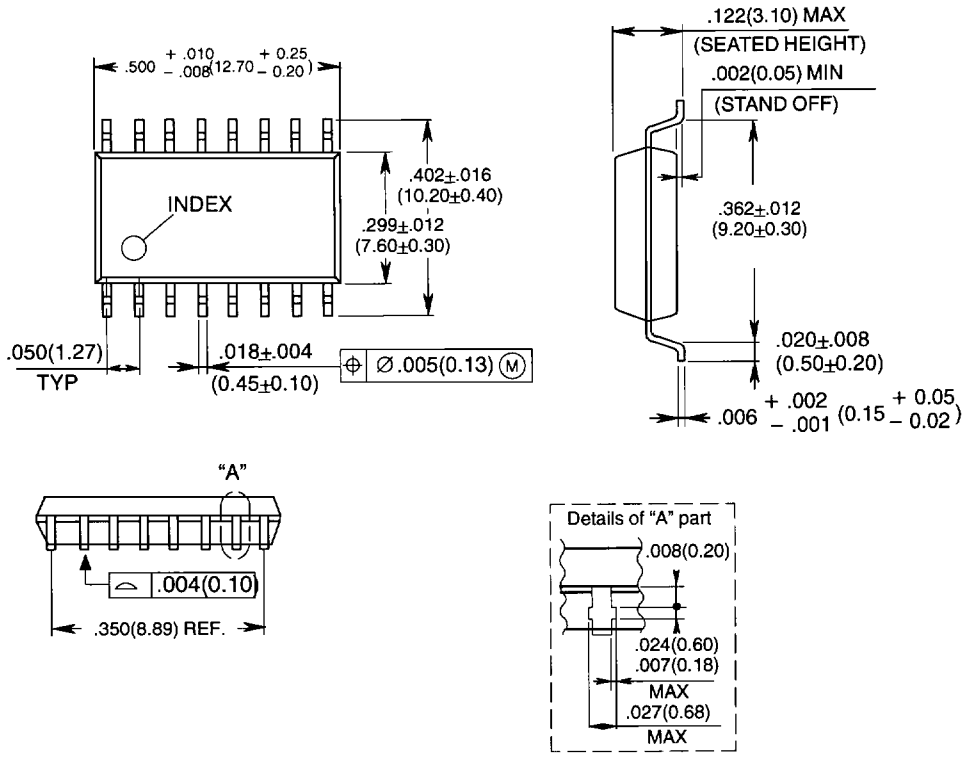
16-LEAD PLASTIC DUAL IN-LINE PACKAGE
(CASE No.: DIP-16P-M04)



Dimensions in
inches (millimeters)

PACKAGE DIMENSIONS,continued

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



Dimensions in inches (millimeters).

Circuit diagrams utilizing Fujitsu products are included as a means of illustrating typical semiconductor applications. Complete information sufficient for construction purposes is not necessarily given.

The information contained in this document has been carefully checked and is believed to be reliable. However, Fujitsu assumes no responsibility for inaccuracies.

The information contained in this document does not convey any license under the copyrights, patent rights or trademarks claimed and owned by Fujitsu.

Fujitsu reserves the right to change products or specifications without notice.

No part of this publication may be copied or reproduced in any form or by any means, or transferred to any third party without prior written consent of Fujitsu.

FUJITSU LIMITED

For further information please contact:

Japan

FUJITSU LIMITED
Integrated Circuits and Semiconductor Marketing
Furukawa Sogo Bldg., 6–1, Marunouchi 2–chome
Chiyoda–ku, Tokyo 100, Japan
Tel: (03) 3216–3211
Telex: 781–2224361
FAX: (03) 3216–9771

North and South America

FUJITSU MICROELECTRONICS, INC.
Integrated Circuits Division
3545 North First Street
San Jose, CA 95134–1804 USA
Tel: 408 –922–9000
Telex: 910–671–4915
FAX: 408–432–9044

Europe

FUJITSU MIKROELEKTRONIK GMBH
Am Siebenstein 6–10,
6072 Dreieich-Buchschlag,
Germany
Tel: (06103) 690–0
Telex: 411963 fmg d
FAX: (06103) 690–122

Asia

FUJITSU MICROELECTRONICS ASIA PTE LIMITED
51 Bras Basah Road,
Plaza By The Park,
#06–04/07,
Singapore 0718
Tel: 336–1600
Telex: 55573
FAX: 336–1609

Printed in Japan PV00794–908A4