August 1990
Edition 3.0

FUJITSU

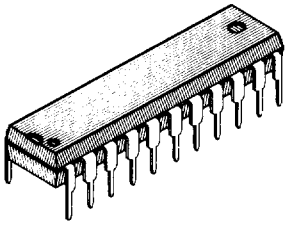
DATA SHEET

MB40578/40578-7
1 CHANNEL 8-BIT VIDEO A/D CONVERTER

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

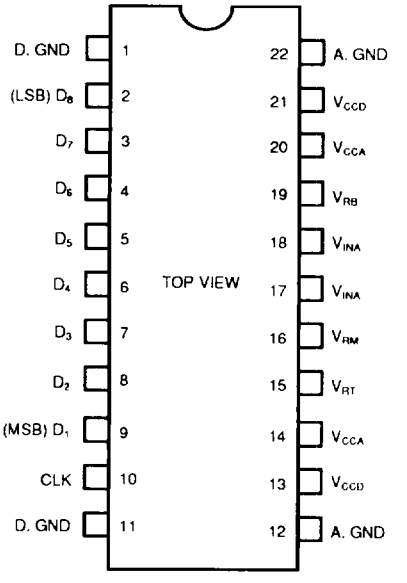
The Fujitsu MB40578 is a low power ultra-high speed video A/D converter fabricated with Fujitsu Advanced Bipolar Technology. The MB40578 also adopts the fully-parallel comparison technique (flash method) for high speed convertion and can convert wide band analog signal such as video signal to digital signal at a sampling rate of DC through 20 Mega-samples/sec. Because of such high-speed poeration, the MB40578 is suitable for digital video applications such as the digital TV, video processing with computer, or radar signal processing.

- Resolution: 8 bits
- Linearity Error: ±0.2% max. (MB40578)
  ±0.4% max. (MB40578-7)
- Maximum conversion Rate: 20 MSPS min.
- Analog Input Voltage: 3.0V to 5.0V
- Digital I/O level: TTL compatible
- Single power supply: +5V
- Power Dissipation: 480mW typ.
- Package: Standard 22-pin DIP Package: Suffix: -P



PLASTIC PACKAGE
DIP-22P-M04

PIN ASSIGNMENT



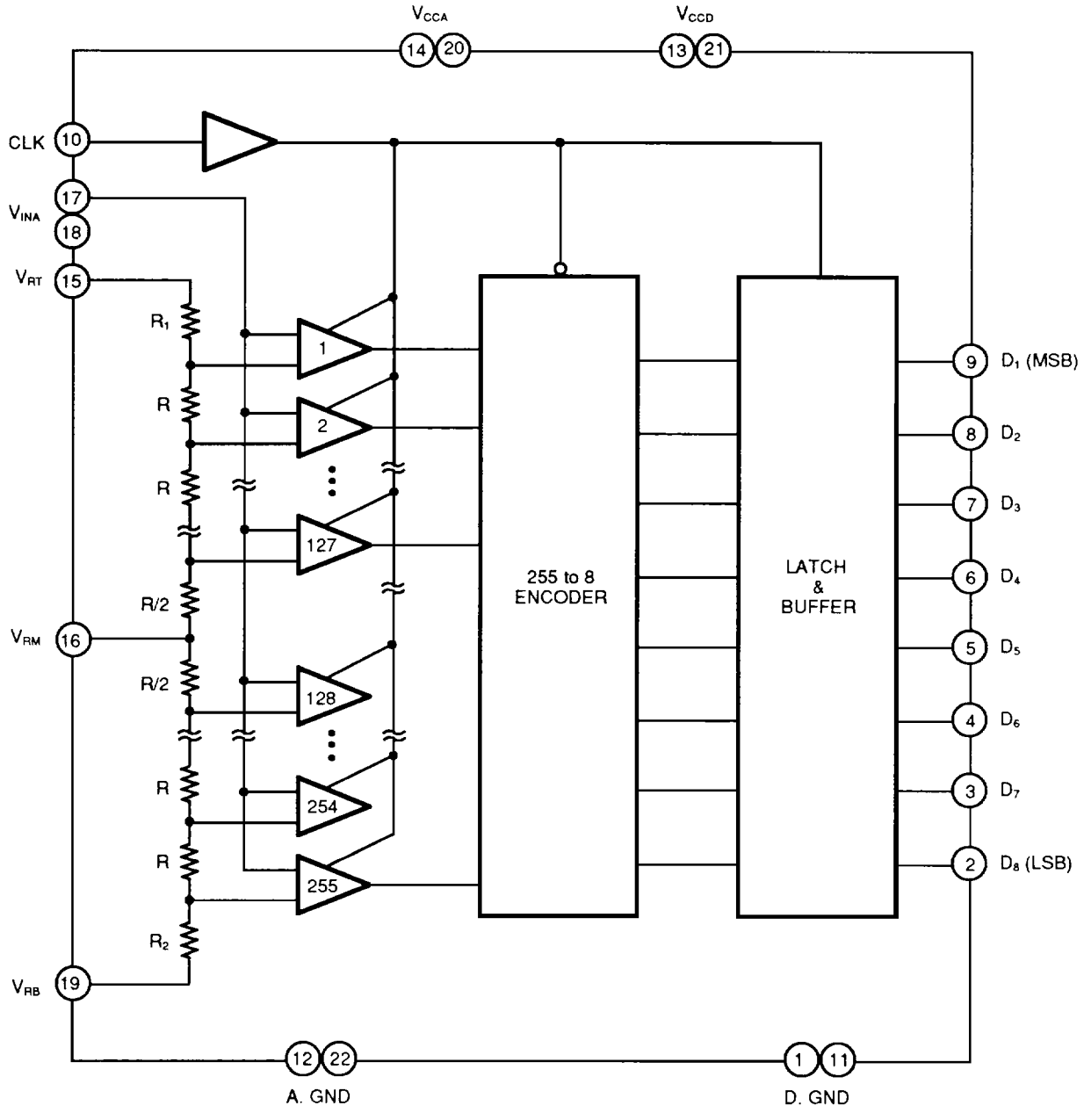
ABSOLUTE MAXIMUM RATINGS (See NOTE)

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

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.

Fig. 1 – MB40578 BLOCK DIAGRAM



RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power Supply Voltage *1	V_{CCA} V_{CCD}	4.75	5.00	5.25	V
Analog Input Voltage *2	V_{INA}	3		5	V
Analog Reference Voltage (Top Side) *2	V_{RT}		5	5.1	V
Analog Reference Voltage (Bottom Side) *2	V_{RB}	2.9	3		V
Digiral 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	T_A	0		70	°C

Note *1: Please keep V_{CCA} and V_{CCD} at the same potential.
*2: $V_{RB} < V_{INA} < V_{RT}$, $V_{RT} - V_{RB} = 2V + 0.1V$.

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						8	bits
Linearity Error	MB40578	LE	DC			±0.2	%
	MB40578-8					±0.4	
Equivalent Analog Input Resistance		R_{INA}		50			kΩ
Analog Input Capacitance		C_{INA}			120	230	pF
Analog High-Level Input Current		I_{IHA}				150	µA
Analog Low-Level Input Current		I_{ILA}				145	µA
Reference Current		I_{RB}	V_{RT} = 5V V_{RB} = 3V	–15	–9		mA

DIGITAL DC CHARACTERISTICS

(V_{CC} = 4.75 to 5.25V, T_A = 0 to 70°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
High-Level Output Volotage	V_{OHD}	I_{OH} = –400µA	2.7			V
Low-Level Output Volotage	V_{OLD}	I_{OL} = 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}			92	160	mA

ELECTRICAL CHARACTERISTICS (Continued)

SWITCHING CHARACTERISTICS (V_{CC} = 5V, T_A = 25°C)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Maximum Conversion Rate	FS		20	30		MSPS
Digital Output Delay Time	tpd		5	15	40	ns

Fig. 2 – TIMING DIAGRAM

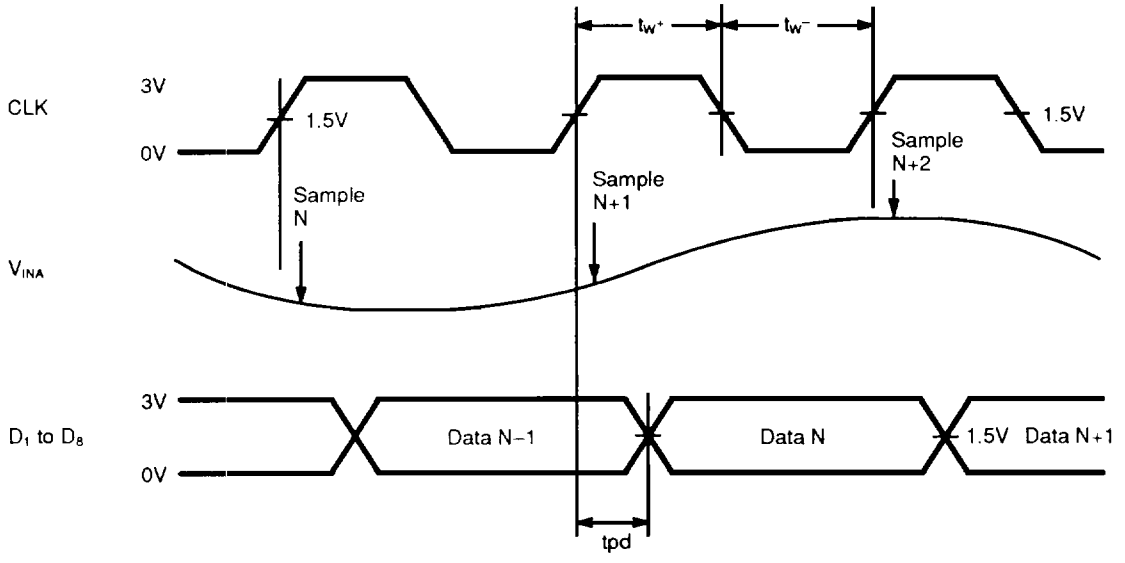
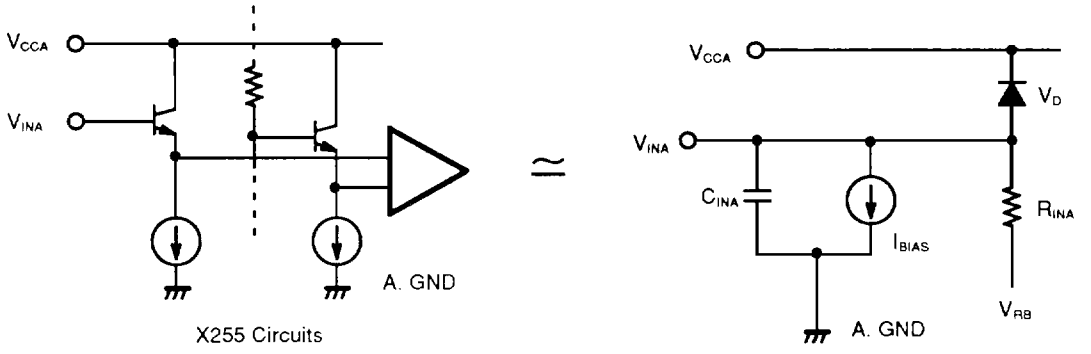


Fig. 3 – ANALOG INPUT EQUIVALENT CIRCUIT



C_{INA}: Non-linear Emitter-follower Junction Capacitance

R_{INA} Linear Resistance Model for Input Current Transition by Comparator Switching:

Infinite value for $V_{IN} < V_{RB}$ 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. 4 – DIGITAL INPUT EQUIVALENT

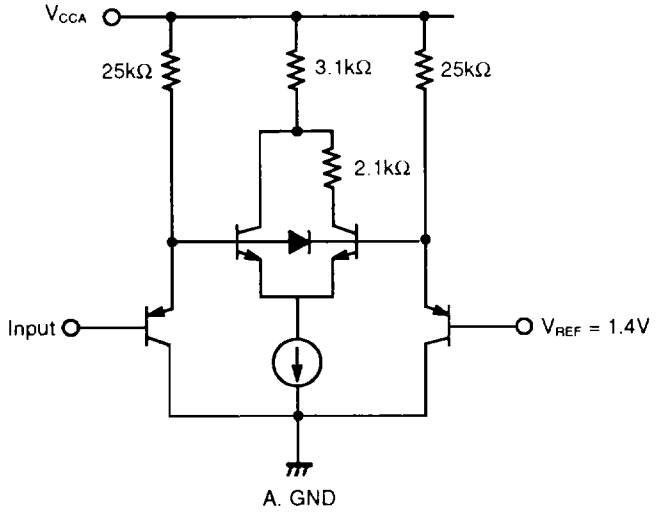
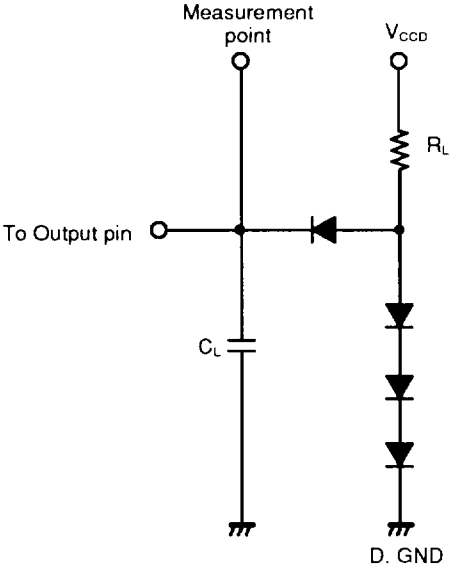


Fig. 5 – LOAD CIRCUIT FOR OUTPUT BUFFER



Note R_L = 2kΩ
C_L = 15pF including scope and jig capacitance
Diodes: IN3064 or equivalent

OUTPUT CODE

(V_{CC} = 5.0V, $V_{RT} \fallingdotseq$ 5.0V, $V_{RB} \fallingdotseq$ 3.0V)

Step	Analog Input Voltage	Digital Output Code
0	2.960V	00000000
1	2.968V	00000001
.	.	.
.	.	.
.	.	.
127	3.976V	01111111
128	3.984V	10000000
129	3.992V	10000001
.	.	.
.	.	.
.	.	.
245	4.992V	11111110
255	5.000V	11111111

Note: Ajust V_{ZT} = 2.964V and V_{FT} = 4.996V with V_{RT} and V_{RB}. The Analog Input Voltage are the center values of each step.

Fig. 6 – IDEAL CONVERSION CHARACTERISTICS

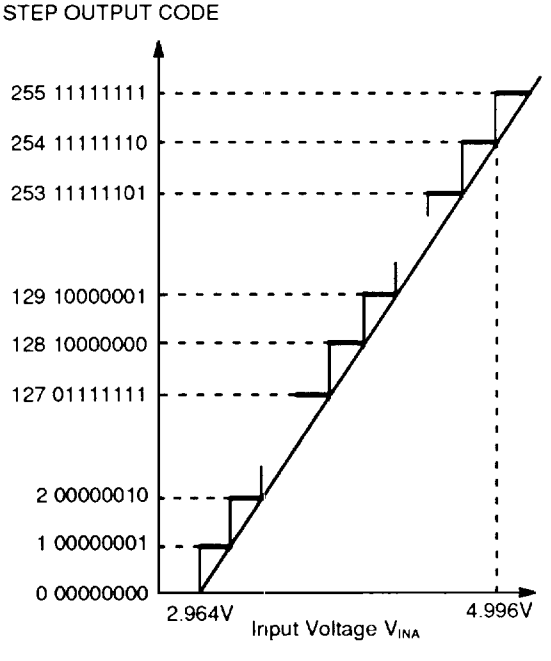
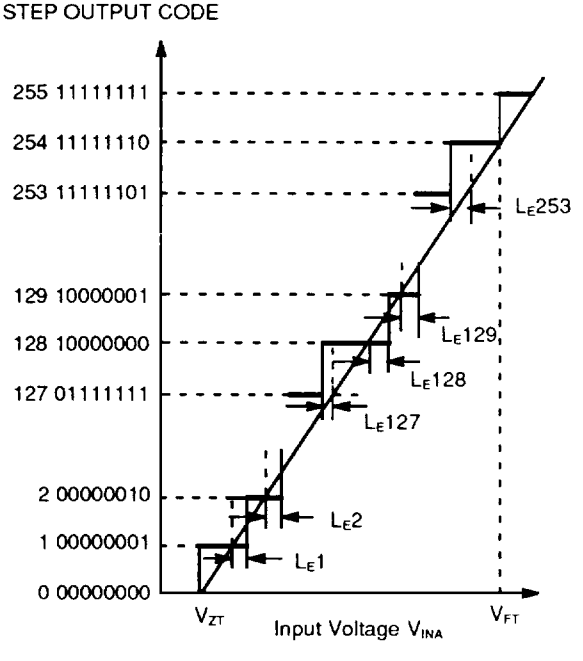


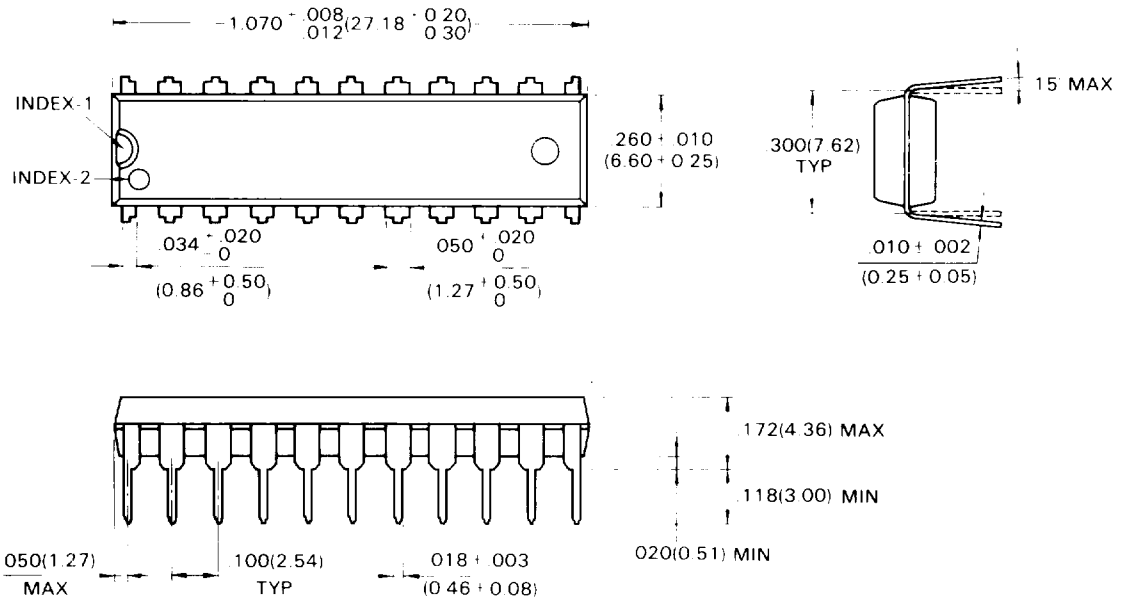
Fig. 7 – PRACTICAL CONVERSION CHARACTERISTICS



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

PACKAGE DIMENSIONS

22-LEAD PLASTIC IN-LINE PACKAGE
(CASE No.: DIP-22P-M04)



Dimensions in inches (millimeters)

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) 216–3211
Telex: 781–2224361
FAX: (03) 216–9771

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
Arabella Centre 9. OG
Lyoner Strasse 44–48
D–6000 Frankfurt 71
F.R. Germany
Tel: (069) 66320
Telex: 411963
FAX: (069) 6632122

Asia
FUJITSU MICROELECTRONICS ASIA PTE LIMITED
#06–04 to #06–07
Plaza By The Park
No. 51 Bras Basah Road
Singapore 0718
Tel: 336–1600
Telex: 55573
FAX: 336–1609