



8-BIT ULTRA-HIGH SPEED VIDEO A/D CONVERTER

MB40578 MB40578-7

March 1988
Edition 2.0

8-BIT ULTRA HIGH SPEED VIDEO A/D CONVERTER

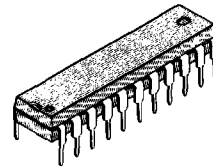
The Fujitsu MB 40578 is a low power ultra-high speed video A/D converter fabricated with Fujitsu Advanced Bipolar Technology. The MB 40578 also adopts the fully-parallel comparison technique (flash method) for high speed conversion and can convert wide band analog signal such as video signal to digital signal at a sampling rate of DC through 20 Mega-samples/sec. Because of such high-speed operation, the MB 40578 is suitable for digital video applications such as the digital TV, video processing with computer, or radar signal processing.

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

ABSOLUTE MAXIMUM RATINGS (See NOTE)

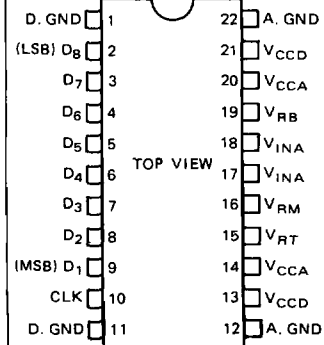
Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CCA} V_{CCD}	-0.5 to +7.0	V
Digital Input Voltage	V_{IND}	-0.5 to +7.0	V
Analog Input Voltage	V_{INA}	-0.5 to $V_{CC} + 0.5$	V
Analog Reference Voltage	V_{RT}, V_{RB}	-0.5 to $V_{CC} + 0.5$	V
Storage Temperature	T_{STG}	-55 to +125	$^{\circ}\text{C}$

NOTE: Permanent device damage may occur if 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-22P-M04

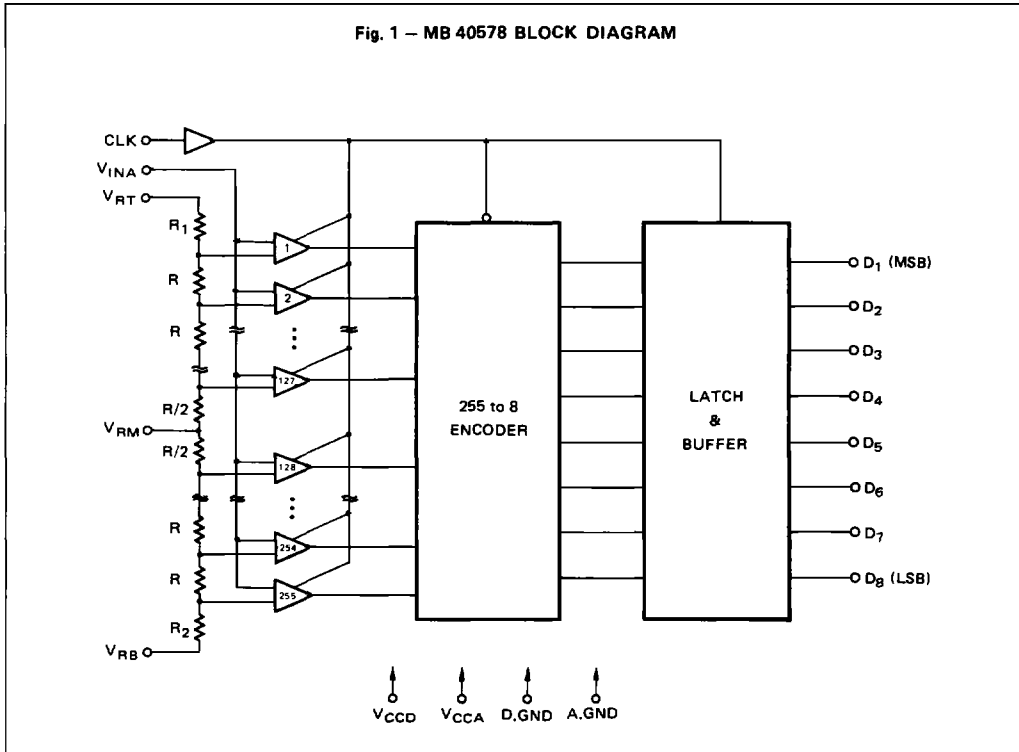
PIN ASSIGNMENT



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.

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Fig. 1 – MB 40578 BLOCK DIAGRAM



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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
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	T_A	0		70	$^{\circ}C$

NOTE: *1 Please keep V_{CCA} and V_{CCD} at the same potential.

*2 $V_{RB} < V_{INA} < V_{RT}$, $V_{RT} - V_{RB} = 2V \pm 0.1V$.



ELECTRICAL CHARACTERISTICS

ANALOG DC CHARACTERISTICS

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

Parameter	Symbol	Condition	Value			Unit	
			Min	Typ	Max		
Resolution	—				8	bits	
Linearity Error	MB40578	LE	DC			± 0.2	%
	MB40578-7					± 0.4	
Equivalent Analog Input Resistance	R_{INA}		50			$\text{K}\Omega$	
Analog Input Capacitance	C_{INA}			120	230	μF	
Analog High-Level Input Current	I_{IHA}				150	μA	
Analog Low-Level Input Current	I_{ILA}				145	μA	
Reference Current	I_{RB}	$V_{RT} = 5$ V $V_{RB} = 3$ V	-15	-9		mA	

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DIGITAL DC CHARACTERISTICS

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

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
High-Level Output Voltage	V_{OHD}	$I_{OH} = -400$ μA	2.7			V
Low-Level Output Voltage	V_{OLD}	$I_{OL} = 1.6$ mA			0.4	V
High-Level Input Voltage	V_{IHD}		2			V
Low-Level Input Voltage	V_{ILD}				0.8	V
Maximum Input Current	I_{ID}	$V_{ID} = 7$ V			100	μA
High-Level Input Current	I_{IHD}	$V_{IHD} = 2.7$ V		0	20	μA
Low-Level Input Current	I_{ILD}	$V_{ILD} = 0.4$ V	-400	-40		μA
Power Supply Current	I_{CC}			92	160	mA

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING CHARACTERISTICS

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

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

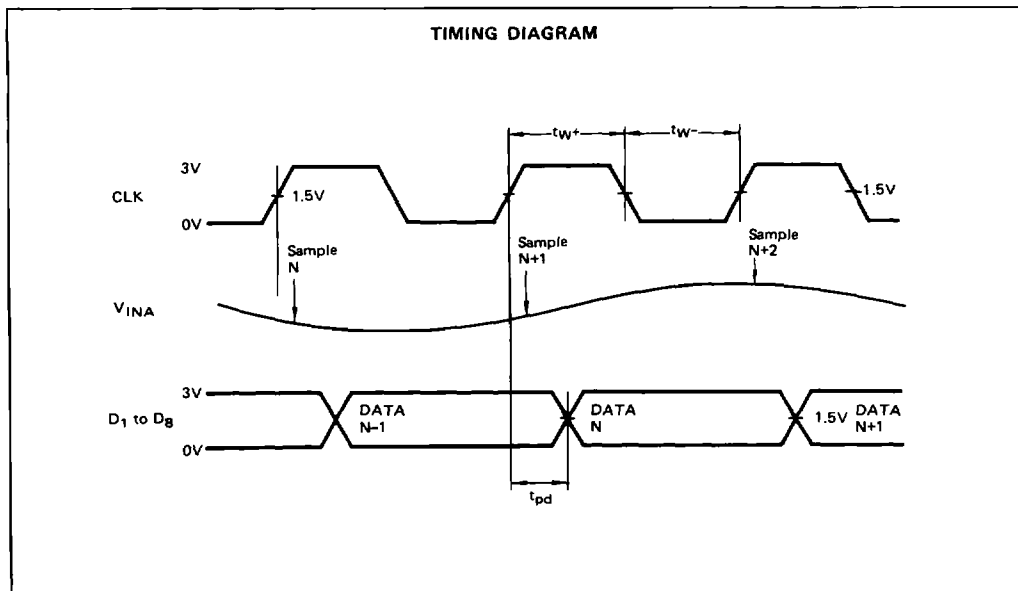
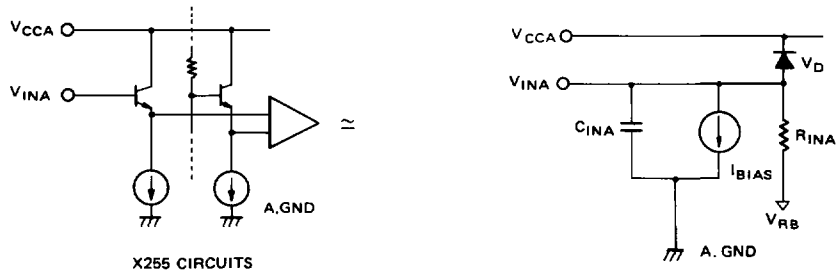


Fig. 2 – ANALOG INPUT EQUIVALENT CIRCUIT



- C_{INA} : Non-linear Emitter-follower Junction Capacitance
- R_{INA} : Linear Resistance Model for Input Current Transition by Comparator Switching:
 Infinite value for $V_{IN} < V_{RB}$ 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. 3 – DIGITAL INPUT EQUIVALENT

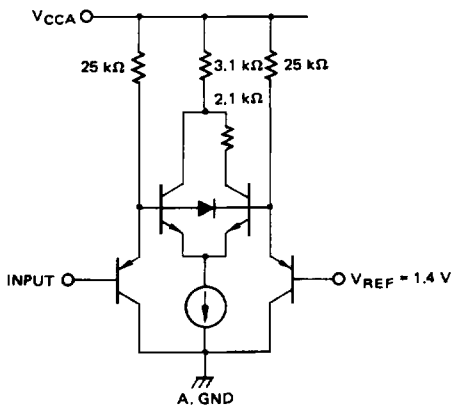
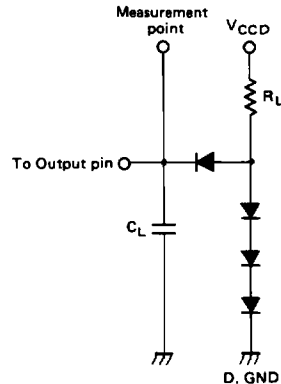


Fig. 4 – LOAD CIRCUIT FOR OUTPUT BUFFER



Note: $R_L = 2k\Omega$
 $C_L = 15pF$ including scope and jig capacitance
 Diodes: IN3064 or equivalent

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OUTPUT CODE

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

Step	Analog Input Voltage	Digital Output Code
0	2.960 V	00000000
1	2.968 V	00000001
⋮	⋮	⋮
127	3.976 V	01111111
128	3.984 V	10000000
129	3.992 V	10000001
⋮	⋮	⋮
254	4.992 V	11111110
255	5.000 V	11111111

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

Fig. 5 — IDEAL CONVERSION CHARACTERISTICS

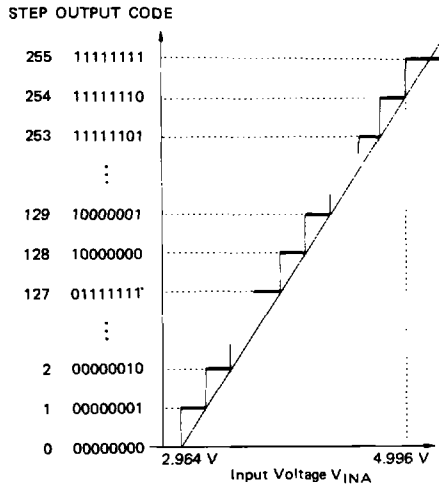
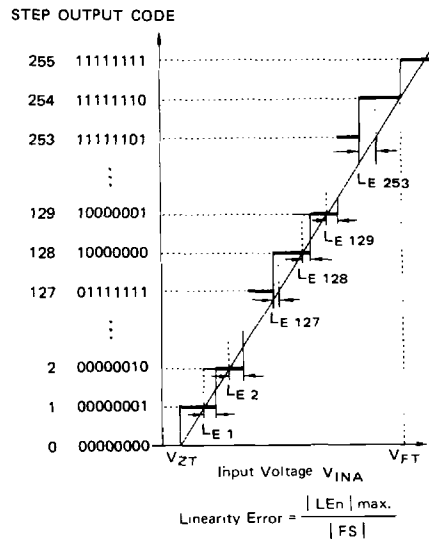


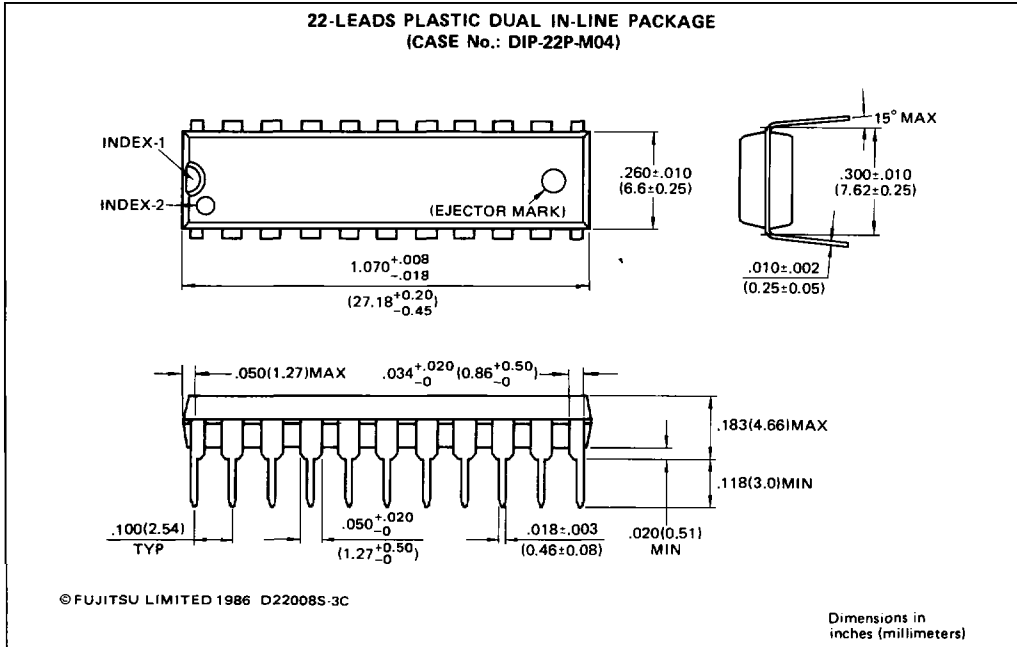
Fig. 6 — PRACTICAL CONVERSION CHARACTERISTICS





FUJITSU MB40578
MB40578-7

PACKAGE DIMENSIONS



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