August 1990
Edition 3.0

FUJITSU

DATA SHEET

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

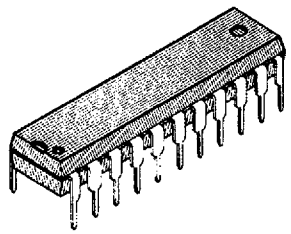
1-CHANNEL 8-BIT VIDEO A/D CONVERTER (20 MSPS)

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 conversion and can convert a wide-band analog signal (such as video signal) to a digital signal at a sampling rate of DC through 20 mega-samples/sec.

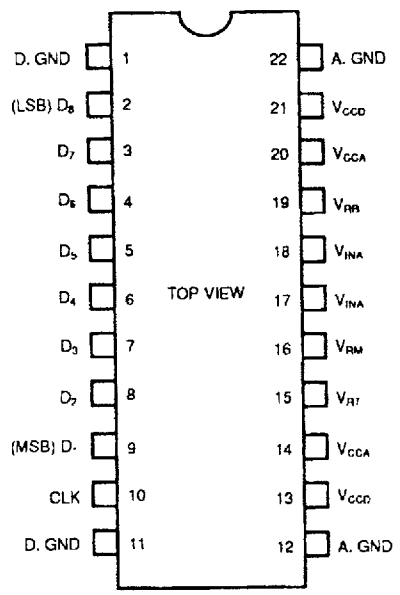
This high-speed operation makes the MB40578 suitable for digital video applications such as digital TV, computer video processing, and radar signal processing.

- Resolution: 8 bits
- Linearity Error: ±0.2% maximum (MB40578)
  ±0.4% maximum (MB40578-7)
- Maximum conversion Rate: 20 MSPS minimum
- Analog input voltage: 3.0V to 5.0V
- Digital I/O level: TTL compatible
- Single power supply: +5V
- Power dissipation: 480 mW 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_{RB}	−0.5 to V_{CC} +0.5	V
Clamp circuit input voltage	V_{INC}	−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 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.

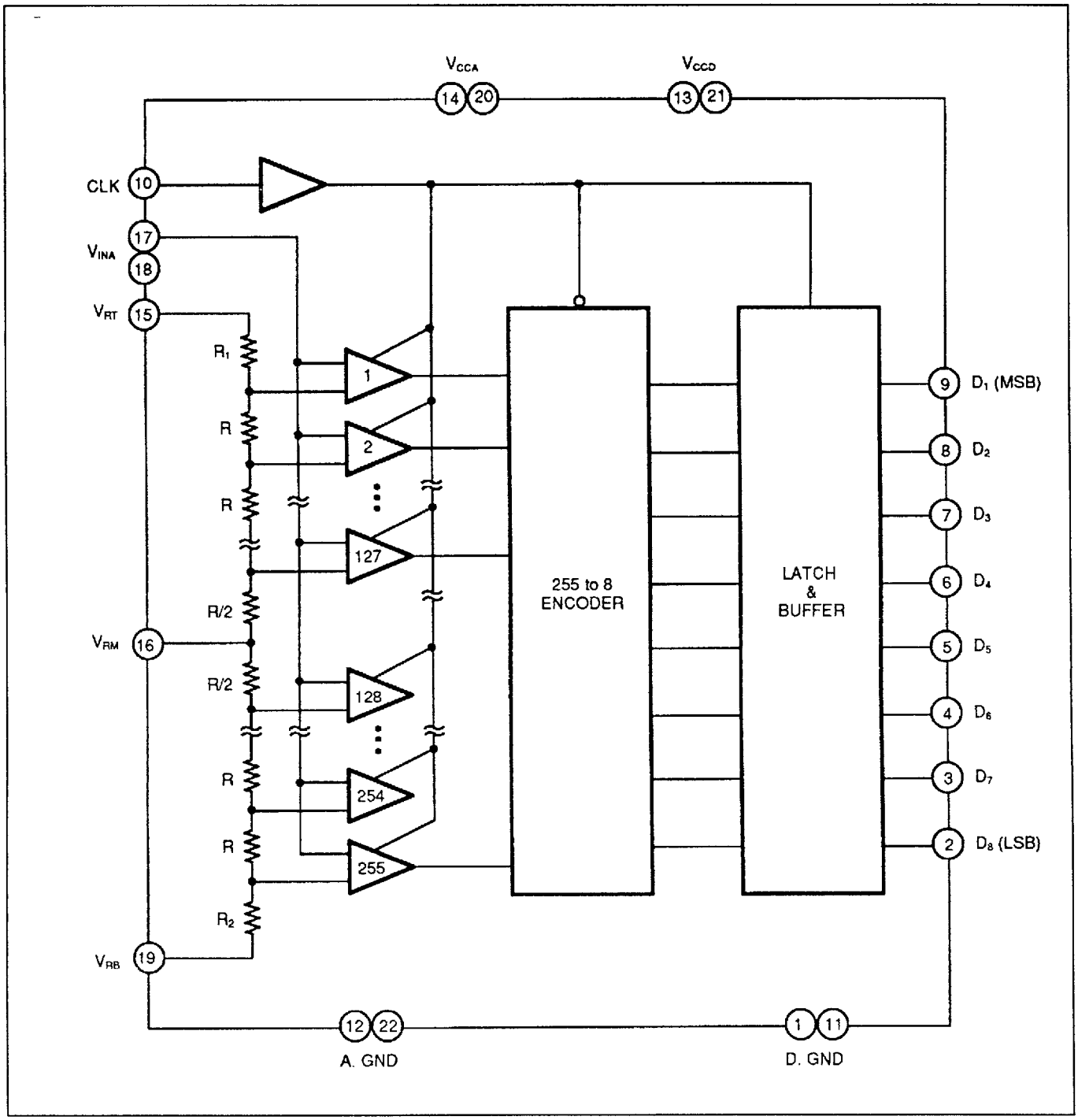


Figure 1. MB40578 Block Diagram

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
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	°C

Notes: [1] 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	%
	MB40578-7					±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 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}		2.0			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}			40*	85	mA

SWITCHING CHARACTERISTICS

(V_{CC}= 5V, T_A=0 to 25°C)

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Maximum conversion rate	FS	20	30		MSPS
Digital output delay time	t_{pd}	5	15	40	ns

ELECTRICAL CHARACTERISTICS, continued

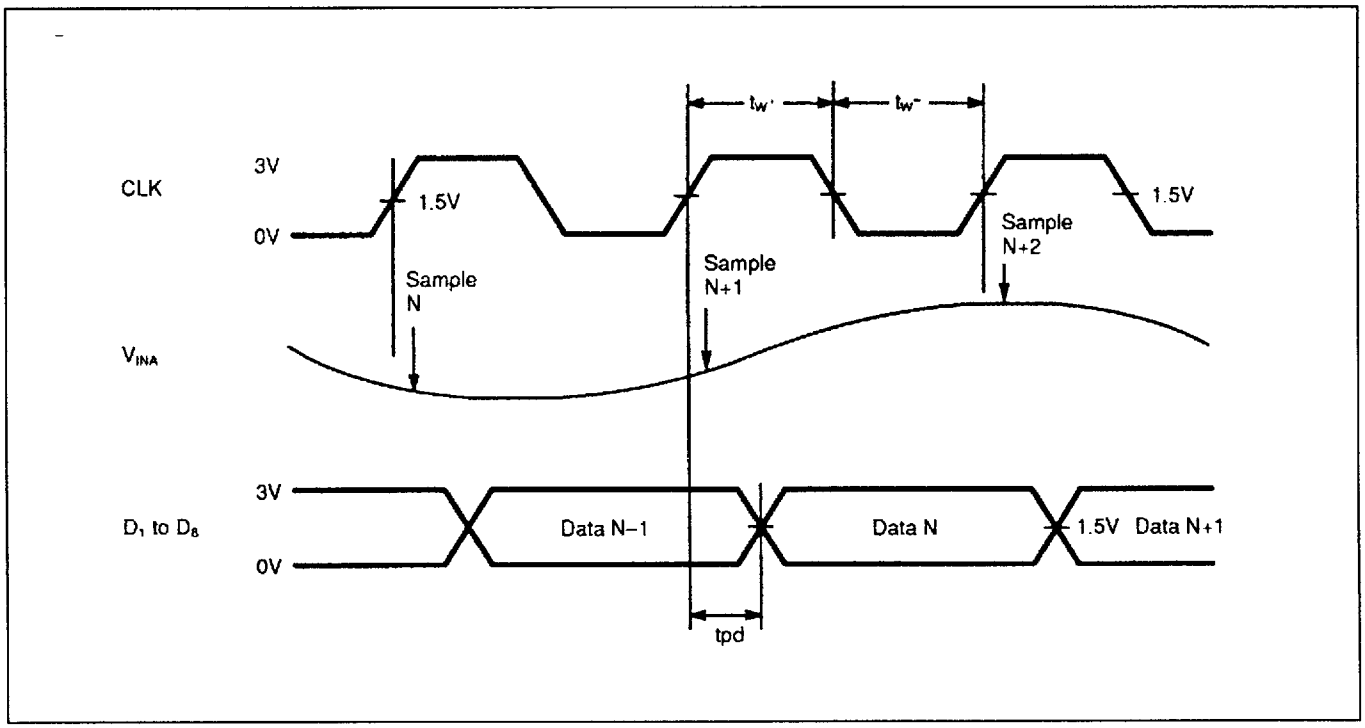


Figure 2. Timing Diagram

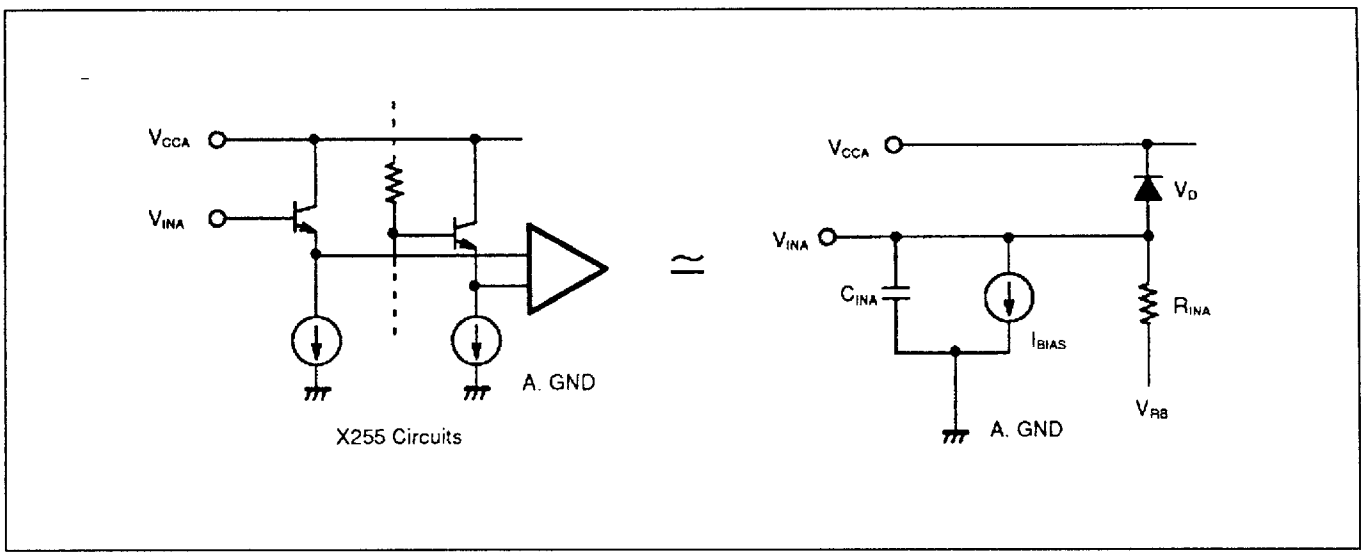


Figure 3. Analog Input Equivalent Circuit

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

ELECTRICAL CHARACTERISTICS, continued

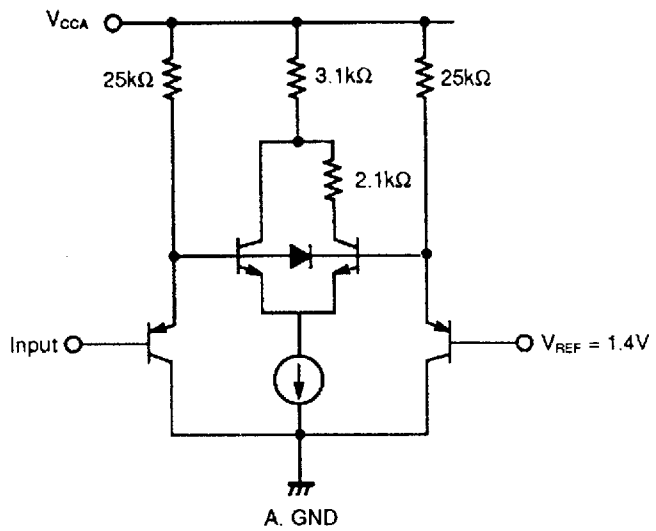
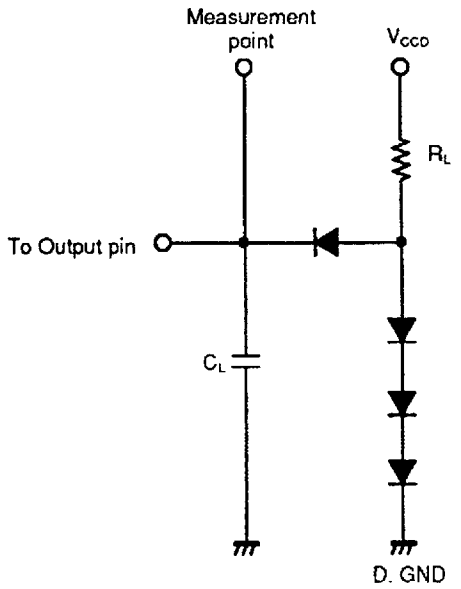


Figure 4. Digital Input Equivalent



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

Figure 5. Load Circuit for Output Buffer

OUTPUT CODE

(V_{CC} = 5V, $V_{RT} \doteqdot$ 5.0V, V_{RB} = 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: 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.

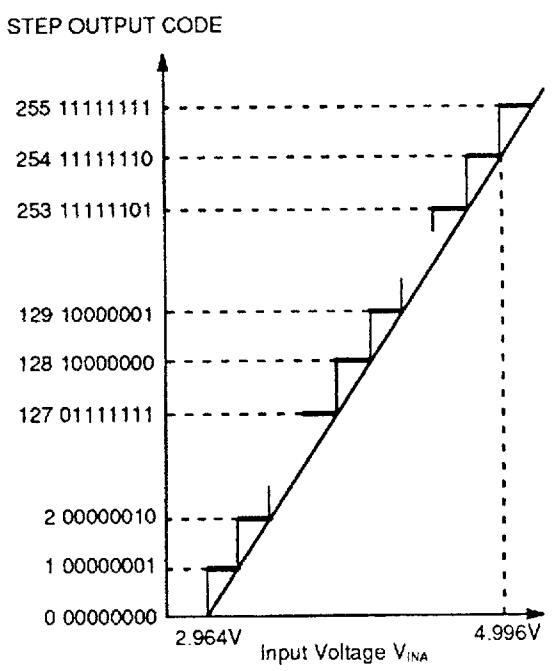


Figure 6. Ideal Conversion Characteristics

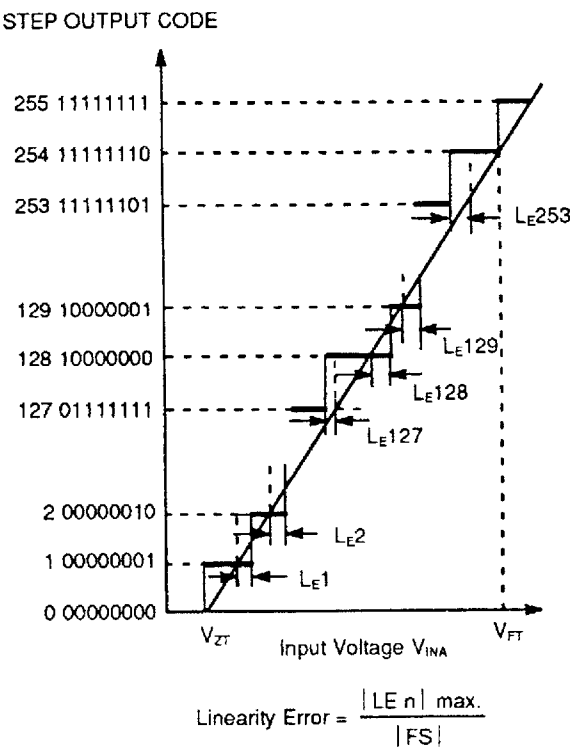
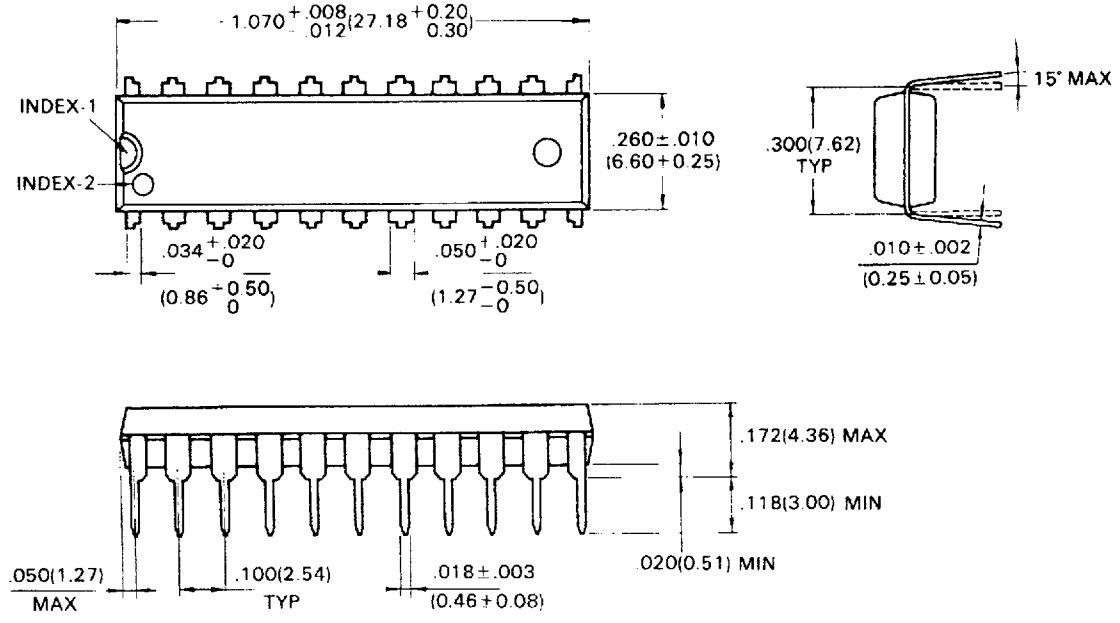


Figure 7. Practical Conversion Characteristics

PACKAGE DIMENSIONS

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



Dimensions in
inches (millimeters)

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Printed in Japan PV0078-908A3