FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-28214-2E

ASSP

CMOS

20 MHz 10-bit A/D Converter

MB40C360

■ DESCRIPTION

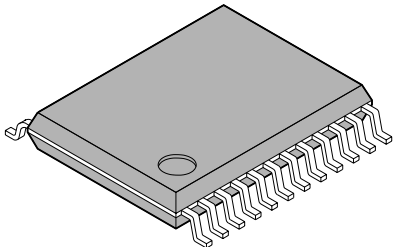
MB40C360 is a high-speed A/D converter using a fast CMOS technology.

■ FEATURES

- Resolution : 10 bits
- Differential linearity error : ±1.0 LSB (max.)
- Maximum conversion rate : 20 MSPS (min.)
- Supply voltage : Single +3.0 V
- Digital in/output voltage : 3 V CMOS level (tristate)
- Analog input voltage range : 0 V to AV_{DD} (1.5 V to 2.1 Vp-p)
- Analog input capacitance : 18 pF (standard)
- Dissipation power : 40 mW
- Additional capabilities : Power saving function
  tristate output
- Package : 24-pin SSOP

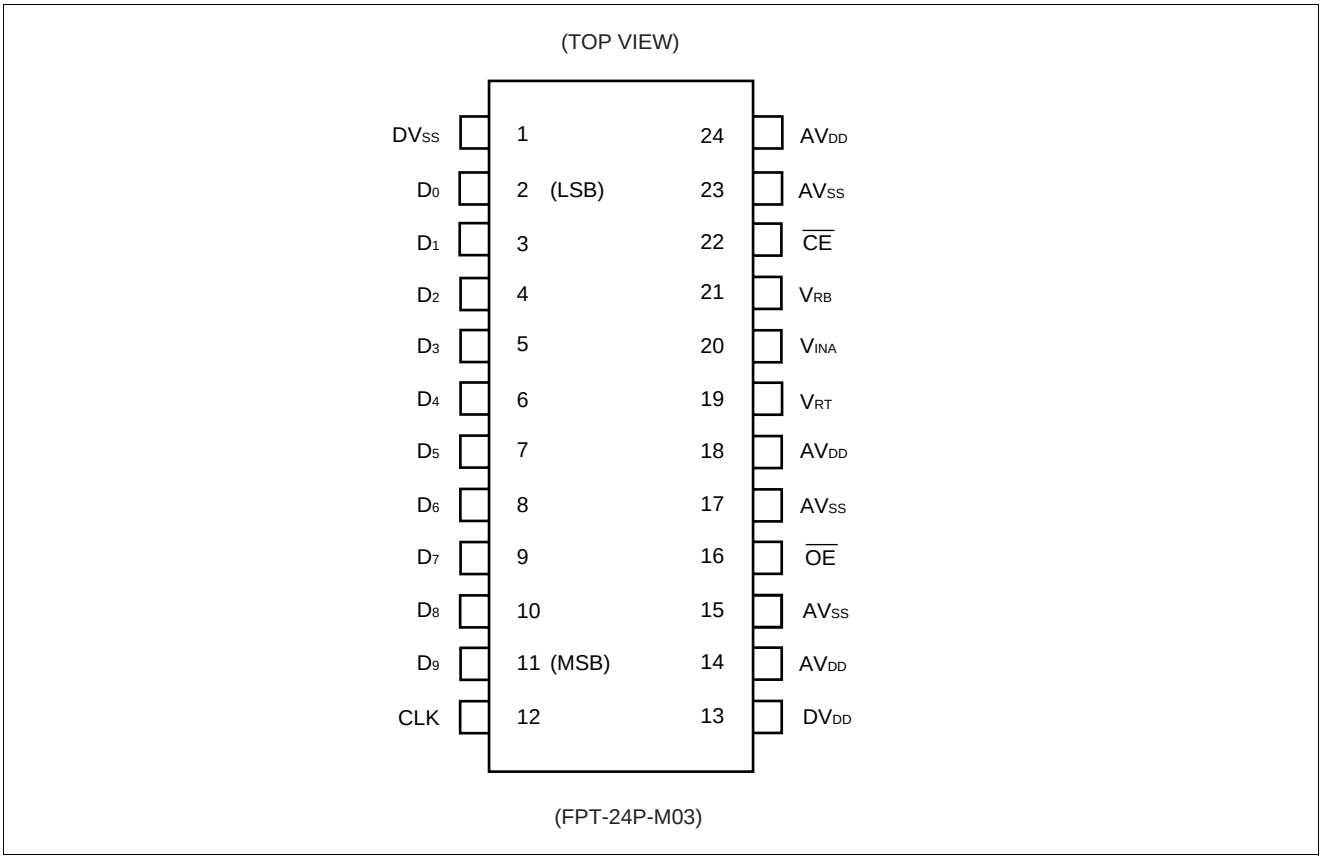
■ PACKAGE

24-pin Plastic SSOP



(FPT-24P-M03)

■ PIN ASSIGNMENT



■ PIN DESCRIPTION

Pin No.	Symbol	Description
14, 18, 24	AV_{DD}	Analog power supply (+3.0 V)
13	DV_{DD}	Digital power supply (+3.0 V)
15, 17, 23	AV_{SS}	Analog power supply ground pin (0 V)
1	DV_{SS}	Digital power supply ground pin (0 V)
2, 3, 4, 5, 6 7, 8, 9, 10, 11	D_0 to D_9	Digital output pin (D_0: LSB, D_9: MSB)
12	CLK	Clock input pin (3 V CMOS input)
20	V_{INA}	A/D converter analog input pin Input range is V_{RB} to V_{RT} (0 V to 2.0 V: standard)
19	V_{RT}	Reference voltage input pin on top side (2.0 V: standard)
21	V_{RB}	Reference voltage input pin on bottom side (0 V: standard)
22	$\overline{CE}$	Chip enable input pin Input high signal brings standby state. Input low signal brings operation state.
16	$\overline{OE}$	Output enable input pin Input high signal readies digital output high-impedance state. Input low signal induces digital output state.

Note: The values in parentheses are standard.

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min.	Max.	
Power supply voltage	AV_{DD}, DV_{DD}	–0.3	+4.0	V
Input voltage (analog/digital)	CLK, V_{INA}, V_{RT}, V_{RB}, $\overline{CE}$, $\overline{OE}$	–0.3	AV_{DD} + 0.3*	V
Output voltage	D_0 to D_9	–0.3	DV_{DD} + 0.3*	V
Storage temperature	Tstg	–55	+125	°C

* : Don't exceed 4.0V

WARNING: Semiconductor devices can be permanently damaged by application of stress (voltage, current, temperature, etc.) in excess of absolute maximum ratings. Do not exceed these ratings.

■ RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Power supply voltage	AV_{DD}	2.70	3.00	3.60	V
	DV_{DD}	2.70	3.00	3.60	V
	$\lvert AV_{DD} - DV_{DD} \rvert$	0.0	—	0.2	V
Analog input voltage	V_{INA}	V_{RB}	—	V_{RT}	V
Analog reference voltage: T	V_{RT}	1.5	2.0	AV_{DD}	V
Analog reference voltage: B	V_{RB}	0.0	—	AV_{DD} – 1.5	V
Analog reference voltage range	$V_{RT} - V_{RB}$	1.5	2.0	2.1	V
Digital "H" level input voltage	V_{IHD}	2.3	—	DV_{DD}	V
Digital "L" level input voltage	V_{ILD}	0	—	0.5	V
Digital input current	I_{ID}	—	—	5	µA
Clock frequency	f_{CLK}	0.5	—	20	MHz
"H" level minimum clock pulse width	t_{W^+}	20.0	—	—	ns
"L" level minimum clock pulse width	t_{W^-}	20.0	—	—	ns
Operating temperature range	Ta	–20	—	+70	°C

WARNING: The recommended operating conditions are required in order to ensure the normal operation of the semiconductor device. All of the device's electrical characteristics are warranted when the device is operated within these ranges.

Always use semiconductor devices within their recommended operating condition ranges. Operation outside these ranges may adversely affect reliability and could result in device failure.

No warranty is made with respect to uses, operating conditions, or combinations not represented on the data sheet. Users considering application outside the listed conditions are advised to contact their FUJITSU representatives beforehand.

■ ELECTRICAL CHARACTERISTICS

• Analog Section

(AV_{DD} = 2.7 V to 3.6 V, DV_{DD} = 2.7 V to 3.6 V, V_{RT} = 2.0 V, V_{RB} = 0 V, Ta = –20°C to +70°C)

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Resolution		RES	—	10	—	bit
Linearity error	DC precision	LE	—	±1.00	±2.00	LSB
Differential linearity error		DLE	—	±0.50	±1.00	LSB
Analog input capacity		C_{INA}	—	18	—	pF
Analog “H” level input current		I_{IHA}*1	—	200	—	µA
Analog “L” level input current		I_{ILA}*2	—	–250	—	µA
Analog input bandwidth (–0.5 dB)		f_{BW}	—	20	—	MHz
Reference current (BOTTOM side)		I_{RB}	3.0	6.0	10.0	mA
Analog supply current		AI_{DD}	—	13.0	40.0	mA
Digital supply current		DI_{DD}	—	1.5	4.0	mA
Standby supply current		I_{STBA}	—	100	—	µA
		I_{STBD}	—	5	—	µA

*1: V_{INA} = 2.0 V

*2: V_{INA} = 0.0 V

• Digital Section

(AV_{DD} = 2.7 V to 3.6 V, DV_{DD} = 2.7 V to 3.6 V, V_{RT} = 2.0 V, V_{RB} = 0 V, Ta = –20°C to +70°C)

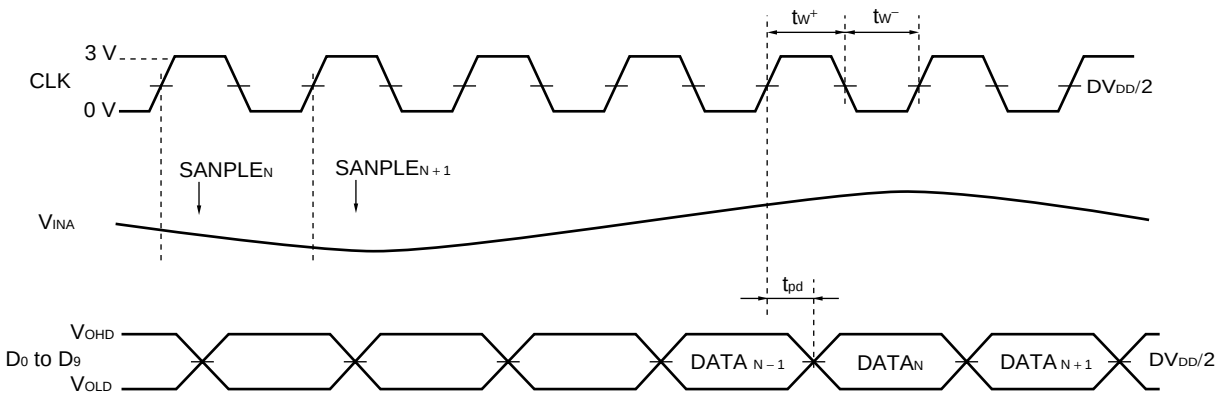
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Digital “H” level output voltage	V_{OHD}	2.5	—	DV_{DD}	V
Digital “L” level output voltage	V_{OLD}	0	—	0.4	V
Digital “H” level output current	I_{OHD}	–400	—	—	µA
Digital “L” level output current	I_{OLD}	—	—	1.6	mA

• Switching Section

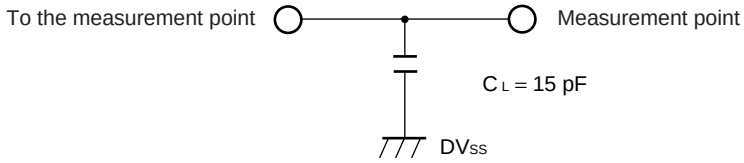
(AV_{DD} = 2.7 V to 3.6 V, DV_{DD} = 2.7 V to 3.6 V, V_{RT} = 2.0 V, V_{RB} = 0 V, Ta = –20°C to +70°C)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Maximum conversion rate	f_S	20	—	—	MSPS
Digital output delay time	t_{pd}	1	6	15	ns

■ DIAGRAM



■ DIGITAL OUTPUT BUFFER LOAD CIRCUIT



(Note) C_L includes a stray capacitance of a probe and a fixture.

■ USAGE PRECAUTIONS

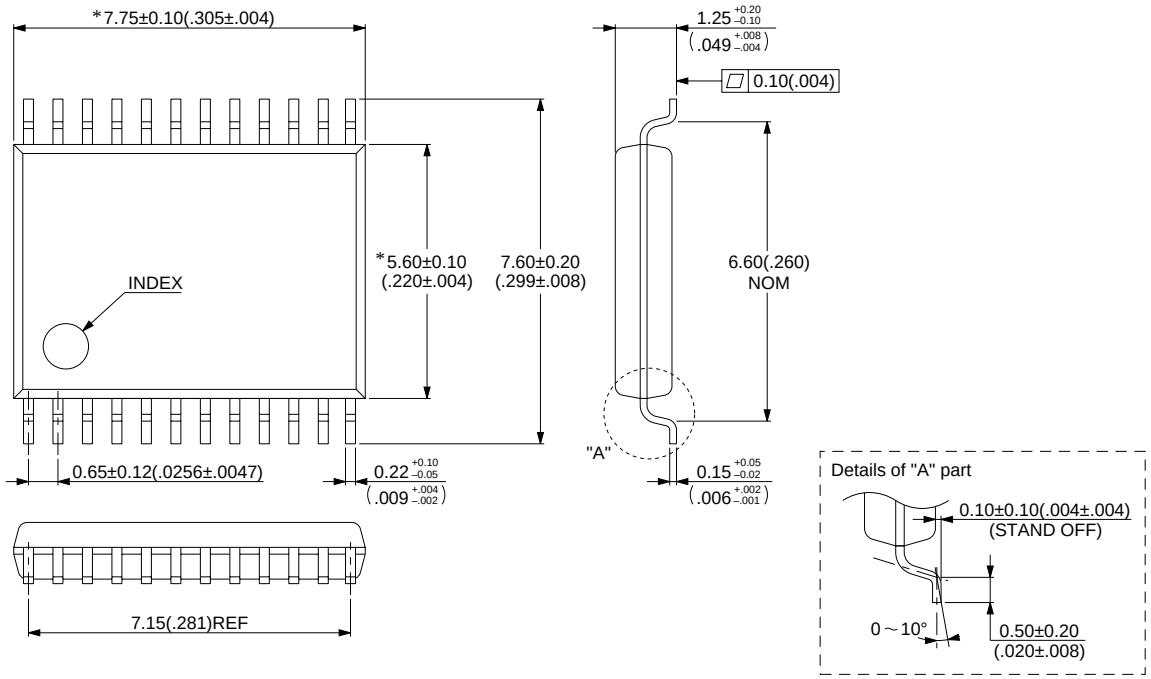
- Be sure to ground the pins of AV_{DD}, DV_{DD}, V_{RT} and V_{RB} via high-frequency capacitor. Place the high-frequency capacitor as close as possible to the pin.
- You can minimize the power supply current dissipation due to the internal logic indetermination by making the clock to 4CLK or higher.

■ ORDERING INFORMATION

Part number	Package	Remark
MB40C360PFV	24-pin Plastic SSOP (FPT-24P-M03)	

■ PACKAGE DIMENSION

24-pin Plastic SSOP
(FPT-24P-M03)



Dimensions in mm (inches).

FUJITSU LIMITED

For further information please contact:

Japan
FUJITSU LIMITED
Corporate Global Business Support Division
Electronic Devices
KAWASAKI PLANT, 4-1-1, Kamikodanaka
Nakahara-ku, Kawasaki-shi
Kanagawa 211-8588, Japan
Tel: 81(44) 754-3763
Fax: 81(44) 754-3329

http://www.fujitsu.co.jp/

North and South America
FUJITSU MICROELECTRONICS, INC.
Semiconductor Division
3545 North First Street
San Jose, CA 95134-1804, USA
Tel: (408) 922-9000
Fax: (408) 922-9179

Customer Response Center
Mon. - Fri.: 7 am - 5 pm (PST)
Tel: (800) 866-8608
Fax: (408) 922-9179

http://www.fujitsumicro.com/

Europe
FUJITSU MIKROELEKTRONIK GmbH
Am Siebenstein 6-10
D-63303 Dreieich-Buchschlag
Germany
Tel: (06103) 690-0
Fax: (06103) 690-122

http://www.fujitsu-ede.com/

Asia Pacific
FUJITSU MICROELECTRONICS ASIA PTE LTD
#05-08, 151 Lorong Chuan
New Tech Park
Singapore 556741
Tel: (65) 281-0770
Fax: (65) 281-0220

http://www.fmap.com.sg/

F9810

The contents of this document are subject to change without notice. Customers are advised to consult with FUJITSU sales representatives before ordering.

The information and circuit diagrams in this document are presented as examples of semiconductor device applications, and are not intended to be incorporated in devices for actual use. Also, FUJITSU is unable to assume responsibility for infringement of any patent rights or other rights of third parties arising from the use of this information or circuit diagrams.

FUJITSU semiconductor devices are intended for use in standard applications (computers, office automation and other office equipment, industrial, communications, and measurement equipment, personal or household devices, etc.).
CAUTION:
Customers considering the use of our products in special applications where failure or abnormal operation may directly affect human lives or cause physical injury or property damage, or where extremely high levels of reliability are demanded (such as aerospace systems, atomic energy controls, sea floor repeaters, vehicle operating controls, medical devices for life support, etc.) are requested to consult with FUJITSU sales representatives before such use. The company will not be responsible for damages arising from such use without prior approval.

Any semiconductor devices have an inherent chance of failure. You must protect against injury, damage or loss from such failures by incorporating safety design measures into your facility and equipment such as redundancy, fire protection, and prevention of over-current levels and other abnormal operating conditions.

If any products described in this document represent goods or technologies subject to certain restrictions on export under the Foreign Exchange and Foreign Trade Law of Japan, the prior authorization by Japanese government will be required for export of those products from Japan.