FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-28213-2E

ASSP

CMOS

30 MHz 8-bit A/D Converter

MB40C238

■ DESCRIPTION

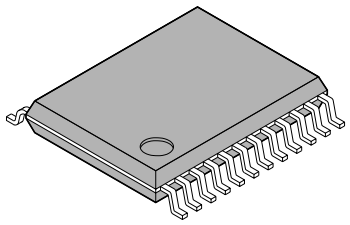
MB40C238 is a high-speed converter using a fast CMOS technology.

■ FEATURES

- Resolution : 8 bit
- Linearity error : ±0.2% (standard)
- Differential linearity error : ±0.12% (standard)
- Maximum conversion rate : 30 MSPS (minimum)
- Power supply voltage : +3.0 V (single)
- Digital input voltage range : 3 V CMOS level
- Digital output voltage range : 3 V CMOS level compatible (tristate output)
- Analog input voltage range : 0 to 2.0 V (1.2 to 1.8 Vp-p)
- Analog input capacitance : 15 pF (standard)
- Power dissipation : 50 mW (standard: including reference current)
- Additional features : VRT voltage adjustment amp (VRT = 1.2 to 2.0 V)
  Power saving capacity (also reference current set to OFF: 0.5 mW or less)
  High impedance output
- Package : 24-pin SSOP

■ PACKAGE

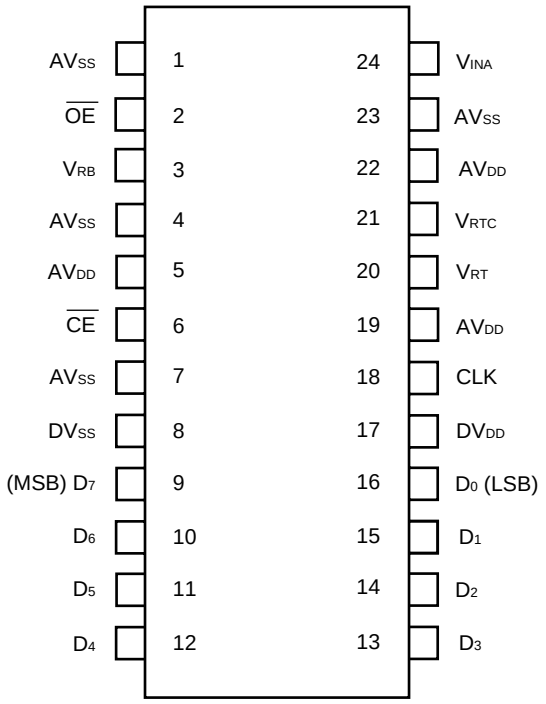
24-pin Plastic SSOP



(FPT-24P-M03)

■ PIN ASSIGNMENT

(TOP VIEW)



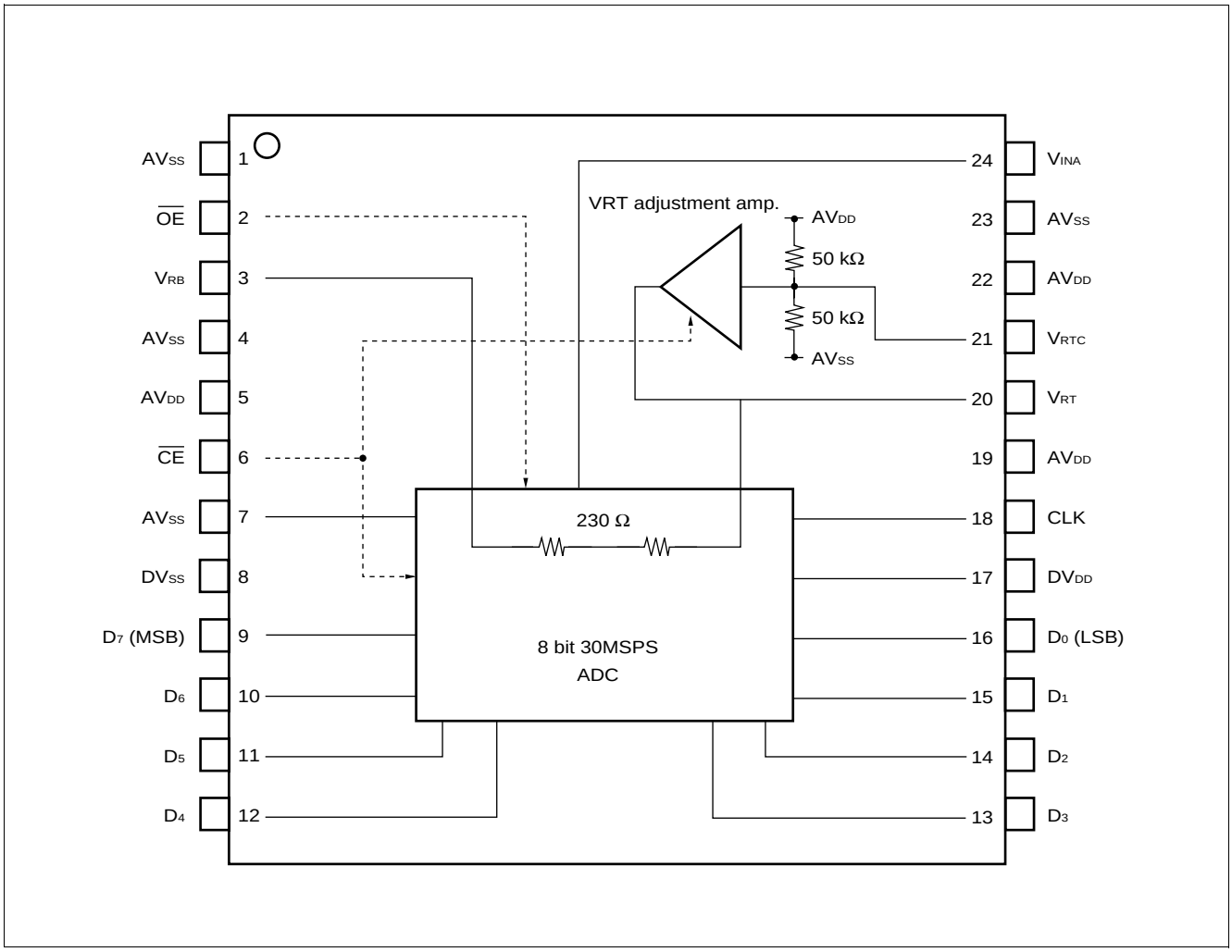
(FPT-24P-M03)

■ PIN DESCRIPTION

Pin No.	Symbol	Description
5, 19, 22	AV_{DD}	Analog power supply (+3.0 V)
17	DV_{DD}	Digital power supply (+3.0 V)
1, 4, 7, 23	AV_{SS}	Analog power supply ground pin (0 V)
8	DV_{SS}	Digital power supply ground pin (0 V)
9, 10, 11, 12, 13, 14, 15, 16	D_7 to D_0	Digital output pin (D_7: MSB, D_0: LSB)
18	CLK	Clock input pin
24	V_{INA}	A/D converter analog input pin Input range is V_{RB} to V_{RT} (0 to 1.5 V: standard)
21	V_{RTC}	V_{RT} voltage adjustment amp input pin (VRTC: 1.5 V is output when opened.)
20	V_{RT}	Reference voltage output pin on top side. The voltage fed to V_{RTC} is output. (1.5 V: standard)
3	V_{RB}	Reference voltage input pin on bottom side (0 V: standard)
6	$\overline{CE}$	Input pin for toggling standby function. Input high signal brings the ADC and reference voltage circuit.
2	$\overline{OE}$	Input pin for toggling output high impedance function. Input high signal brings the ADC output high impedance state.

Note: The values in parentheses are standard.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating		Unit
		Min.	Max.	
Power supply voltage	AV_{DD}, DV_{DD}	–0.3	+7.0	V
Input voltage (analog/digital)	CLK, V_{INA}, V_{RTC}, V_{RB}	–0.3	AV_{DD}+0.3	V
Output voltage	D_0 to D_7	–0.3	DV_{DD}+0.3	V
	V_{RT}	–0.3	AV_{DD}+0.3	V
Storage temperature	Tstg	–55	+125	°C

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_{RTC}	1.2	1.5	2.0	V
Analog reference voltage: B	V_{RB}	0.0	—	0.8	V
Analog reference voltage range	$V_{RT} - V_{RB}$	1.2	1.5	1.8	V
Digital “H” level input voltage	V_{IHD}	2.3	—	—	V
Digital “L” level input voltage	V_{ILD}	—	—	0.5	V
Digital input current	I_{ID}	—	—	5	µA
Clock frequency	f_{CLK}	0.5	—	30	MHz
“H” level minimum clock pulse width	t_{W^+}	16.0	—	—	ns
“L” level minimum clock pulse width	t_{W^-}	16.0	—	—	ns
Operating temperature range	Ta	–20	—	+75	°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

1. DC Characteristics in Analog Section

(AV_{DD} = 2.70 V to 3.60 V, DV_{DD} = 2.70 V to 3.60 V, Ta = –20°C to +75°C)

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
Resolution		—	—	8	—	bit
Linearity error	Conditional DC precision $V_{RT} – V_{RB}$ = 1.5 V	LE	—	±0.20	±0.40	%
Differential linearity error		DLE	—	±0.12	±0.20	%
Analog input capacity		C_{INA}	—	15	—	pF
Reference input voltage (Top side) (V_{RTC} opened)		V_{RTC}	—	0.50 × AV_{DD}	—	V
Reference output voltage (Top side)		V_{RT}	—	V_{RTC}	—	V
Reference current (Bottom side)		I_{RB}	—	6.5	—	mA
Analog supply current		AI_{DD}	—	14.0	34.0	mA
Digital supply current		DI_{DD}	—	3.0	7.0	mA
Standby supply current		I_{STBA}	—	100	—	µA
		I_{STBD}	—	1	—	µA

2. DC Characteristics in Digital Section

(AV_{DD} = 2.70 V to 3.60 V, DV_{DD} = 2.70 V to 3.60 V, Ta = –20°C to +75°C)

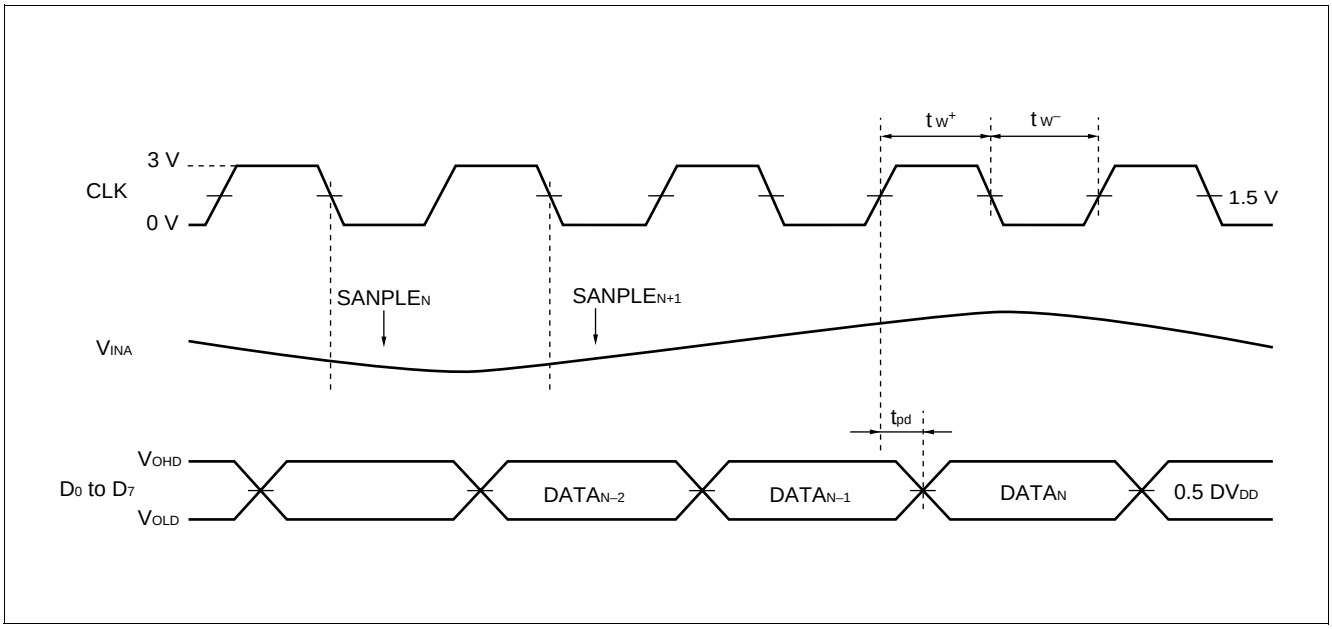
Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Digital “H” level output voltage	V_{OHD}	2.4	—	DV_{DD}	V
Digital “L” level output voltage	V_{OLD}	—	—	0.4	V
Digital “H” level output current	I_{OHD}	–400	—	—	µA
Digital “L” level output current	I_{OLD}	—	—	1.6	mA

3. Switching Characteristics

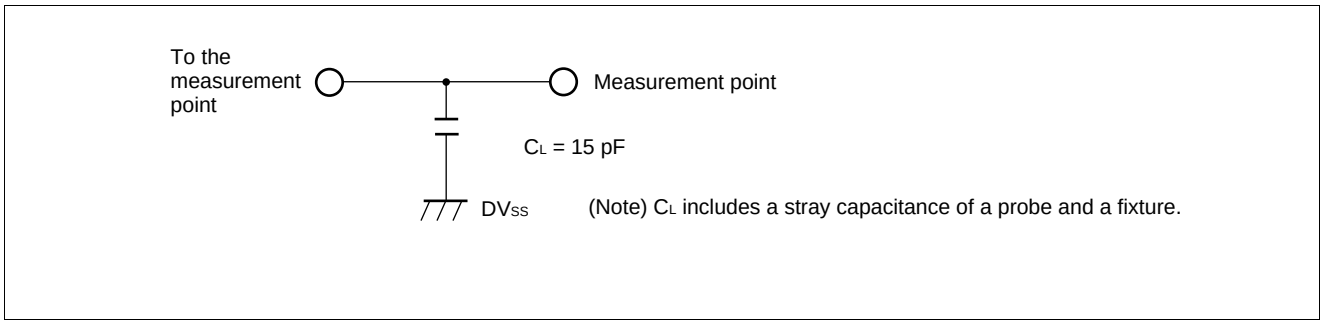
(AV_{DD} = 2.70 V to 3.60 V, DV_{DD} = 2.70 V to 3.60 V, Ta = –20°C to +75°C)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Maximum conversion rate	f_S	30	—	—	MSPS
Digital output delay time	t_{pd}	3	8	20	ns

■ DIAGRAM



■ DIGITAL OUTPUT BUFFER LOAD CIRCUIT



■ USAGE PRECAUTIONS

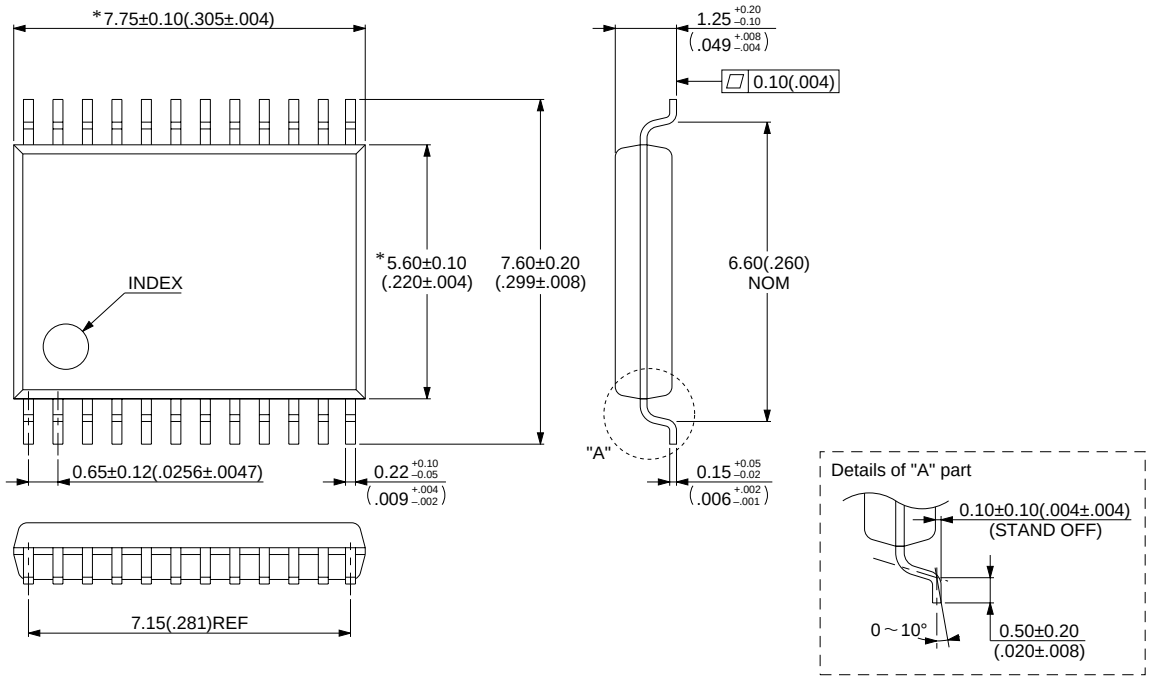
- Be sure to ground the pins of AV_{DD}, DV_{DD}, V_{RT} and V_{RB} via high-frequency capacitor. Place the high-frequency capacitor as close as possible to the pin.
- You can minimize the power supply current dissipation due to the internal logic indetermination by making the clock to 4CLK or higher.

■ ORDERING INFORMATION

Part number	Package	Remark
MB40C238PFV	24-pin Plastic SSOP (FPT-24P-M03)	

■ PACKAGE DIMENSION

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



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Dimensions in mm (inches).

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