

ASSP

CMOS

20 MHz 10-bit A/D Converter

MB40C360

■ DESCRIPTION

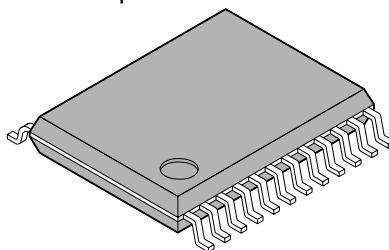
MB40C360 is a high-speed A/D converter using a fast CMOS technology.

■ 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 V_{p-p})
- Analog input capacitance : 18 pF (standard)
- Dissipation power : 40 mW
- Additional capabilities : Power saving function
tristate output
- Package : 24-pin SSOP

■ PACKAGE

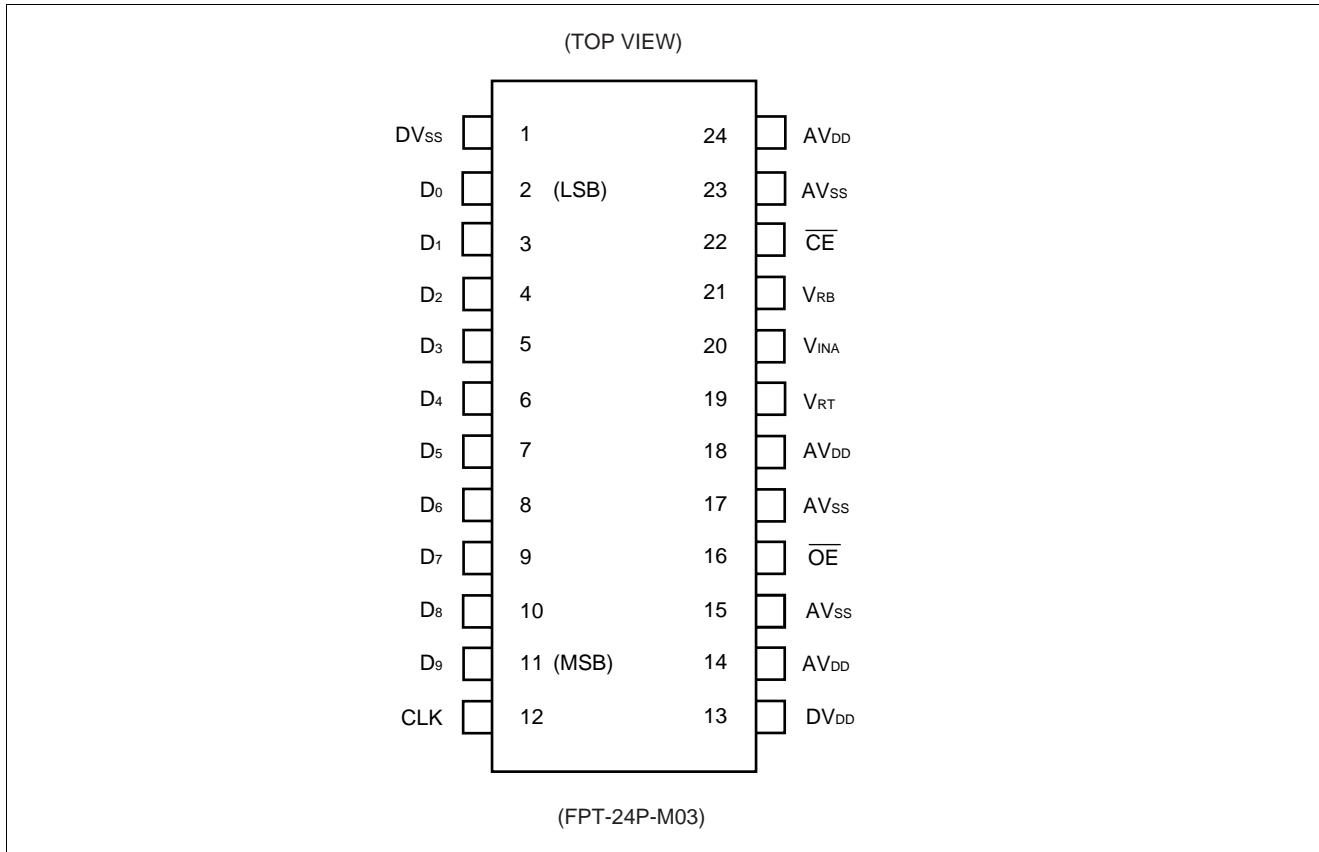
24-pin Plastic SSOP



(FPT-24P-M03)

MB40C360

■ 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, $V_{INA}, V_{RT}, V_{RB},$ CE, OE | -0.3 | $AV_{DD} + 0.3^*$ | V |
| Output voltage | D ₀ to D ₉ | -0.3 | $DV_{DD} + 0.3^*$ | V |
| Storage temperature | T _{stg} | -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 |
| | $ AV_{DD} - DV_{DD} $ | 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 | T _a | -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.

MB40C360

■ ELECTRICAL CHARACTERISTICS

• Analog Section

($V_{DD} = 2.7\text{ V to }3.6\text{ V}$, $DV_{DD} = 2.7\text{ V to }3.6\text{ V}$, $V_{RT} = 2.0\text{ V}$, $V_{RB} = 0\text{ V}$, $T_a = -20^\circ\text{C to }+70^\circ\text{C}$)

| 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 |
| 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 | A_{DD} | — | 13.0 | 40.0 | mA |
| Digital supply current | D_{DD} | — | 1.5 | 4.0 | mA |
| Standby supply current | I_{STBA} | — | 100 | — | μA |
| | I_{STBD} | — | 5 | — | μA |

*1: $V_{INA} = 2.0\text{ V}$

*2: $V_{INA} = 0.0\text{ V}$

• Digital Section

($V_{DD} = 2.7\text{ V to }3.6\text{ V}$, $DV_{DD} = 2.7\text{ V to }3.6\text{ V}$, $V_{RT} = 2.0\text{ V}$, $V_{RB} = 0\text{ V}$, $T_a = -20^\circ\text{C to }+70^\circ\text{C}$)

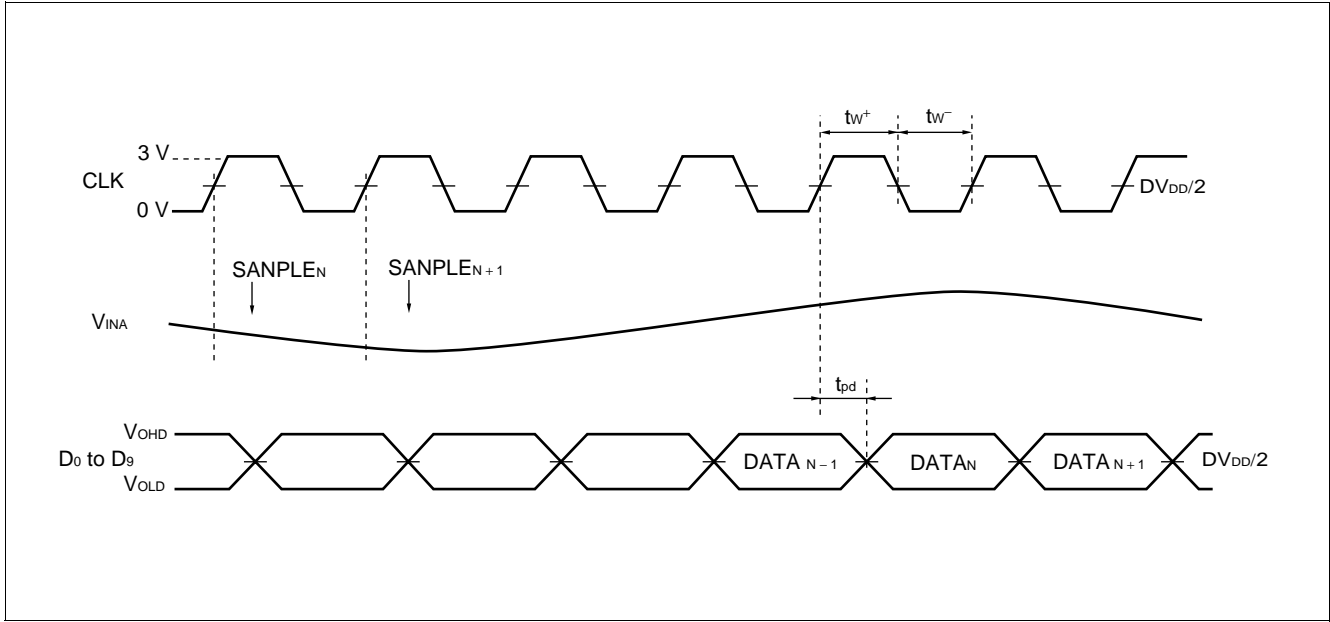
| Parameter | Symbol | Value | | | Unit |
|----------------------------------|-----------|-------|------|-----------|------|
| | | Min. | Typ. | Max. | |
| Digital “H” level output voltage | V_{OHD} | 2.5 | — | DV_{DD} | V |
| Digital “L” level output voltage | V_{OLD} | 0 | — | 0.4 | V |
| Digital “H”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

• Switching Section

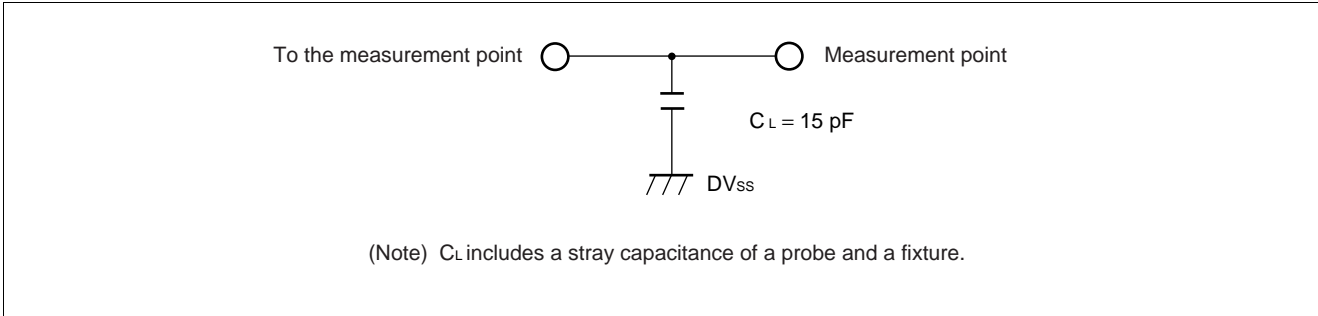
($V_{DD} = 2.7\text{ V to }3.6\text{ V}$, $DV_{DD} = 2.7\text{ V to }3.6\text{ V}$, $V_{RT} = 2.0\text{ V}$, $V_{RB} = 0\text{ V}$, $T_a = -20^\circ\text{C to }+70^\circ\text{C}$)

| 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



MB40C360

■ USAGE PRECAUTIONS

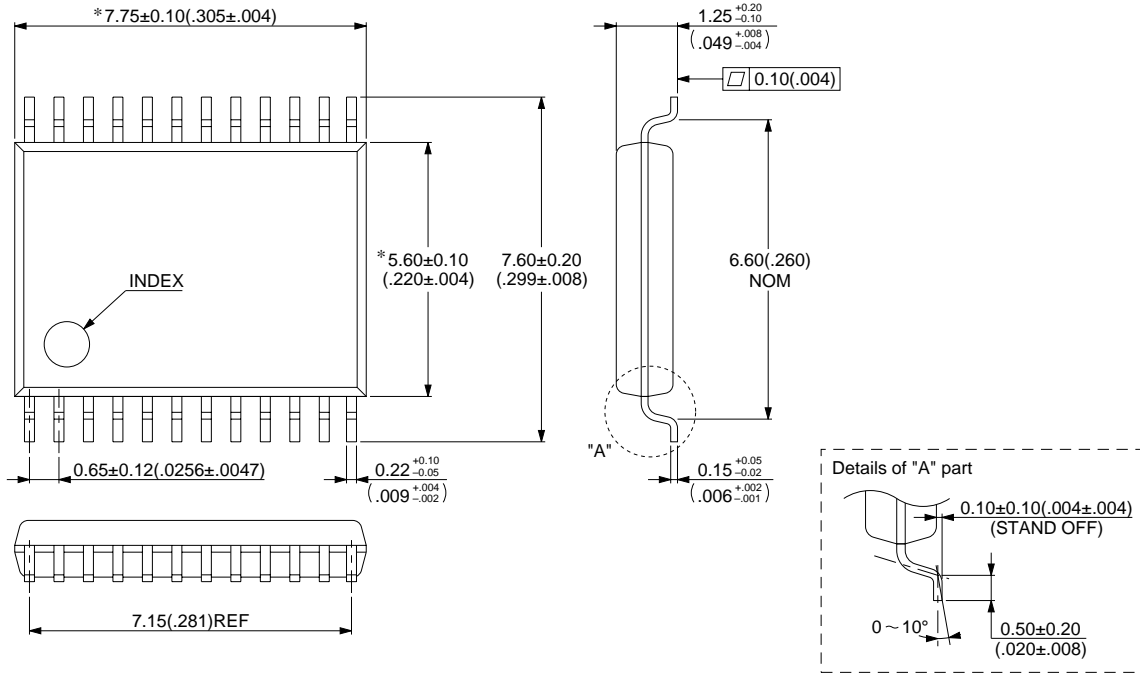
- Be sure to ground the pins of AV_{DD} , DV_{DD} , V_{RT} and V_{RB} via high-frequency capacitor. Place the high-frequency capacitor as close as possible to the pin.
- You can minimize the power supply current dissipation due to the internal logic indetermination by making the clock to 4CLK or higher.

■ ORDERING INFORMATION

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

■ PACKAGE DIMENSION

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



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Dimensions in mm (inches).

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