FUJITSU SEMICONDUCTOR
DATA SHEET

DS04-28206-2E

ASSP

1 Channel 8-bit A/D Converter

MB40528

■ DESCRIPTION

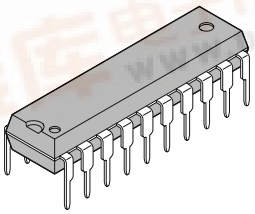
The MB40528 is a full parallel comparison (flash) type 8-bit resolution analog-to-digital converter, designed for various video and image processing applications.
The MB40528 has 8-bit resolution 1 channel A/D converter. Input analog data are converted into digital data by the A/D converter in minimum 60 Mega samples per seconds (MSPS).
The analog data is provided in a range of DC +3V to +5V (2Vp-p level) and the output digital data in TTL level.
The MB40528 is fabricated by the Fujitsu's advanced bipolar process and housed in a 20-pin plastic DIP/SOP.
The MB40528 is suitable for various video and image applications.

■ FEATURES

- Conversion method : Full parallel comparison type
- 8-bit x 1 channel A/D converter
- Max. 60 MHz input clock frequency providing 60 MSPS data conversion rate
- Linearity error : Typical +/-0.15%
- Analog input voltage range : 3V to 5V (2Vp-p level)
- Digital input/output voltage level : TTL level
- On-chip reference voltage generator
- Low power consumption : Typical 400mW
- Single +5V power supply
- Operating temperature range : -20°C to +70°C
- Fujitsu's advanced bipolar process

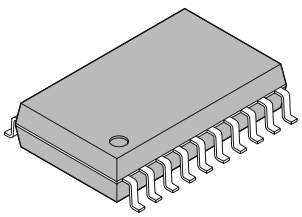
■ PACKAGES

20-pin Plastic DIP



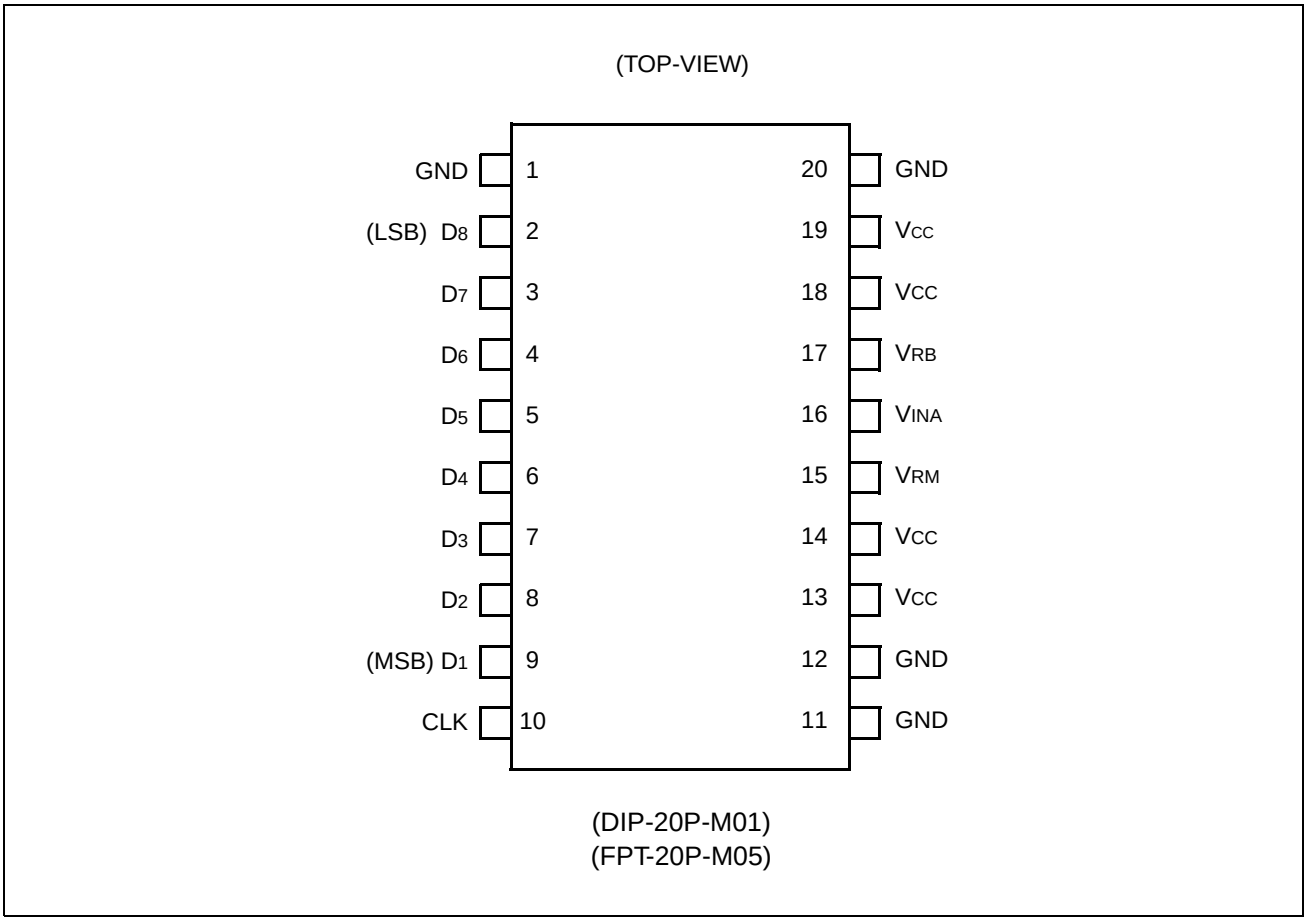
(DIP-20P-M01)

20-pin Plastic SOP



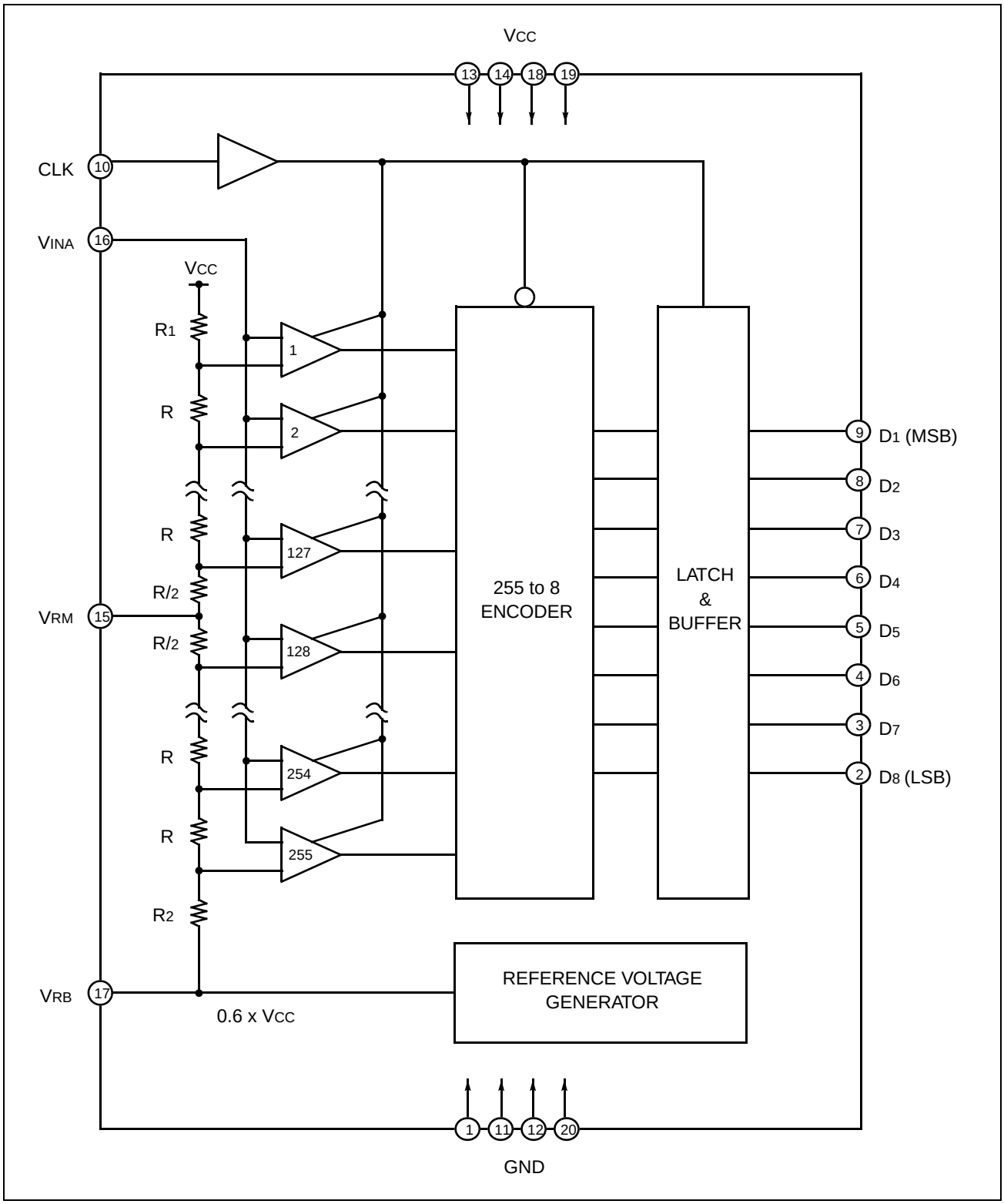
(FPT-20P-M05)

■ PIN ASSIMENT



(DIP-20P-M01)
(FPT-20P-M05)

■ BLOCK DIAGRAM



■ PIN DESCRIPTION

Symbol	Pin No.	Type	Name & Function
Power Supply			
V_{CC}	13, 14, 18, 19	-	+5 V DC power supply pins.
GND	1, 11, 12, 20	-	Ground pins.
Clock			
CLK	10	I	Clock input pin. The input voltage is a TTL level.
Analog Input			
V_{INA}	16	I	Analog signal input pin. The analog data to be converted is input to this pin. The input voltage range is 3V to 5V (V_{RB} to V_{CC}).
Digidal Output			
D_1	9	O	8-bit resolution A/D converter outputs. The output voltage is a TTL level. Also, D_1 pin is an MSB and D_8 pin is a LSB.
D_2	8		
D_3	7		
D_4	6		
D_5	5		
D_6	4		
D_7	3		
D_8	2		
Refernce Voltage Output			
V_{RB}	17	O	Reference voltage output pin. This pin outputs 0.6 x V_{CC} [V] (Typ. 3V). An 1µF or more capacitor having superior frequency characteristic should be connected to this pin. The capacitor must be connected near the device.
Others			
V_{RM}	15	O	An intermediate voltage output pin. An intermediate voltage between V_{CC} and V_{RB} (Typ. 4V) is output from this pin. Normally this pin is left open.

■ ABSOLUTE MAXIMUM RATINGS

(GND = 0 V)

Parameter	Symbol	Condition	Rating		Unit
			Min.	Max.	
Supply Voltage	V_{CC}	–	-0.5	+7.0	V
Analog Input Voltage	V_{INA}	–	-0.5	V_{CC} +0.5	V
Digital Input Voltage	V_{IND}	–	-0.5	+7.0	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

(GND = 0 V)

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Supply Voltage	V_{CC}	–	4.75	5.00	5.25	V
Analog Input Voltage	V_{INA}	–	V_{RB}	–	V_{CC}	V
Digital “H” Level Input Voltage	V_{IHD}	–	2.0	–	–	V
Digital “L” Level Input Voltage	V_{ILD}	–	–	–	0.8	V
Digital “H” Level Output Current	I_{OH}	–	-400	–	–	µA
Digital “L” Level Output Current	I_{OL}	–	–	–	1.6	mA
Clock Frequency	f_{CLK}	–	–	–	60	MHz
Minimum Clock “H” Level Pulse Width	t_{wH}	–	7.0	–	–	ns
Minimum Clock “L” Level Pulse Width	t_{wL}	–	8.0	–	–	ns
Operating Ambient Temperature	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 conditionranges. 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

(1) Analog Block

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Resolution	–	–	–	8	–	bit
Linearity Error	LE	DC Accuracy	–	±0.15	±0.3	%
Differentioal Linearity Error	DLE	DC Accuracy	–	0.12	–	%
Analog Input Equivalent Resister	R_{INA}	–	0.2	1.5	–	MΩ
Analog Input Capacitance	C_{INA}	–	–	40	–	pF
Analog “H” Level Input Current	I_{IHA}	$V_{INA} = V_{CC}$	–	–	210	µA
Analog “L” Level Input Current	I_{ILA}	$V_{INA} = V_{REF}$	–	–	200	µA
Reference Voltage	V_{RB}	–	0.6V_{CC}-0.1	0.6V_{CC}	0.6V_{CC}+0.1	V
Supply Current	I_{CC}	–	–	80*	150	mA

* : V_{CC} = 5.0V, Ta = +25°C

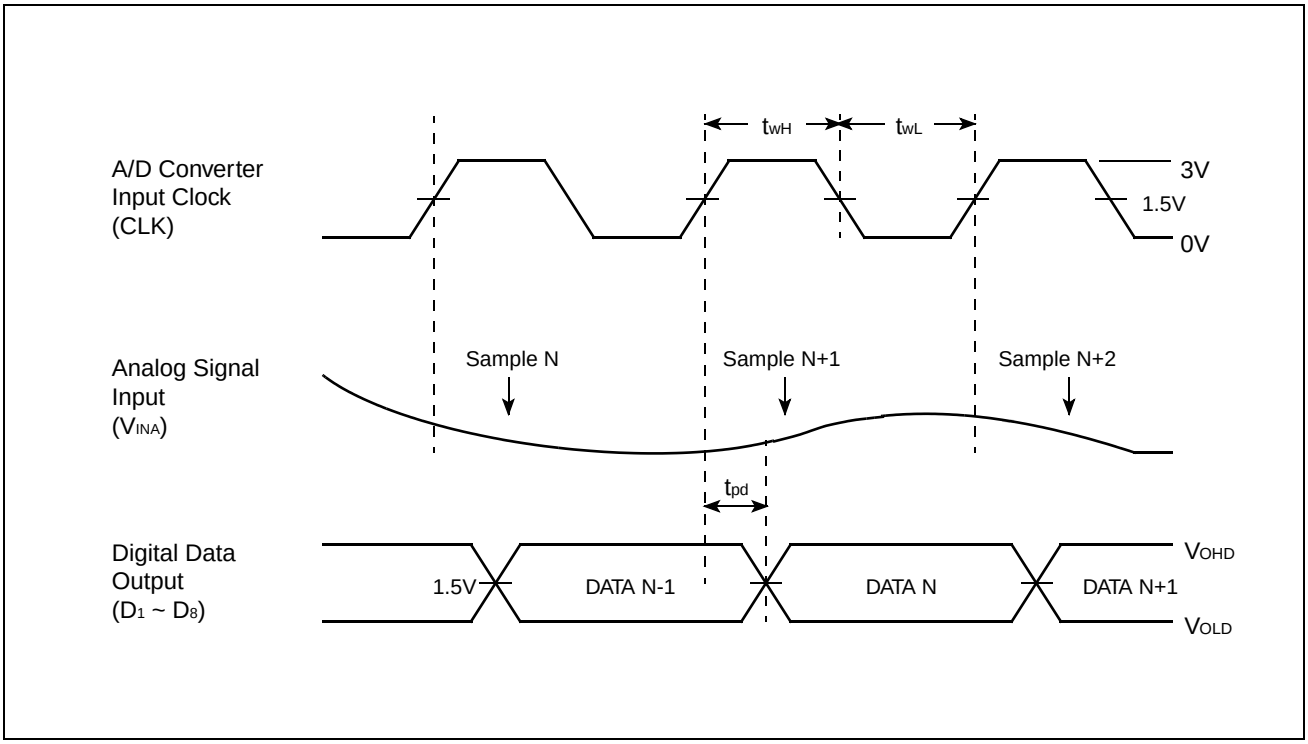
(2) Digital Block

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Digital “H” Level Output Voltage	V_{OHD}	I_{OH} =-400µA	2.7	–	–	V
Digital “L” Level Output Voltage	V_{OLD}	I_{OL} = 1.6mA	–	–	0.4	V
Digital “H” Level Input Voltage	V_{IHD}	–	2.0	–	–	V
Digital “L” Level Input Voltage	V_{ILD}	–	–	–	0.8	V
Digital “H” Level Input Current	I_{IHD}	–	–	–	20	µA
Digital “L” Level Input Current	I_{ILD}	–	-100	–	–	µA

2. AC CHARACTERISTICS

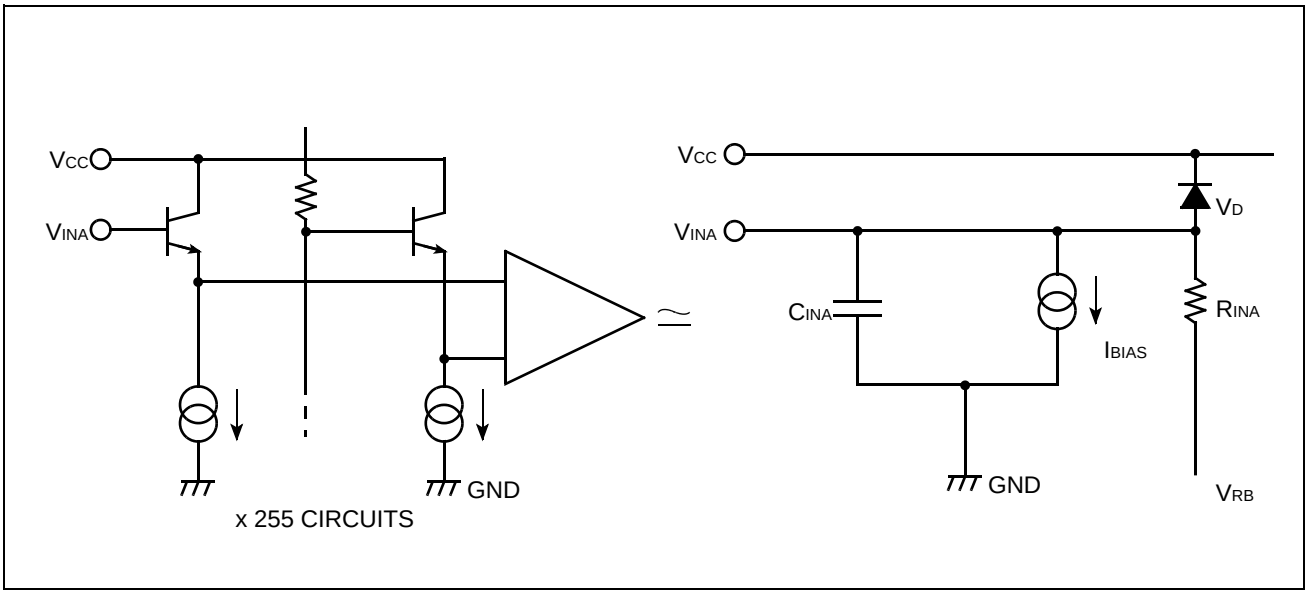
Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Maximum Conversion Rate	f_S	–	60	–	–	MSPS
Digital Output Delay Time	t_{pd}	–	5.0	8.5	15	ns

Figure 1. AC Timing Chart



■ EQUIVALENT CIRCUITS

Figure 2. Analog Input Equivalent Circuit



CINA: Non-linear Emitter-follower Junction Capacitance

RINA: Linear Resistance Model for Input Current Transition by Comparator Switching:
finite value for VINA < VRB or when CLK = “H” level

VRB: Voltage at VRB pin (Not the VRB pin itself)

IBIAS: Constant Input Bias Current

VD: The base-collector junction diode of emitter-follower transistor.

Figure 3. Reference Voltage Circuit

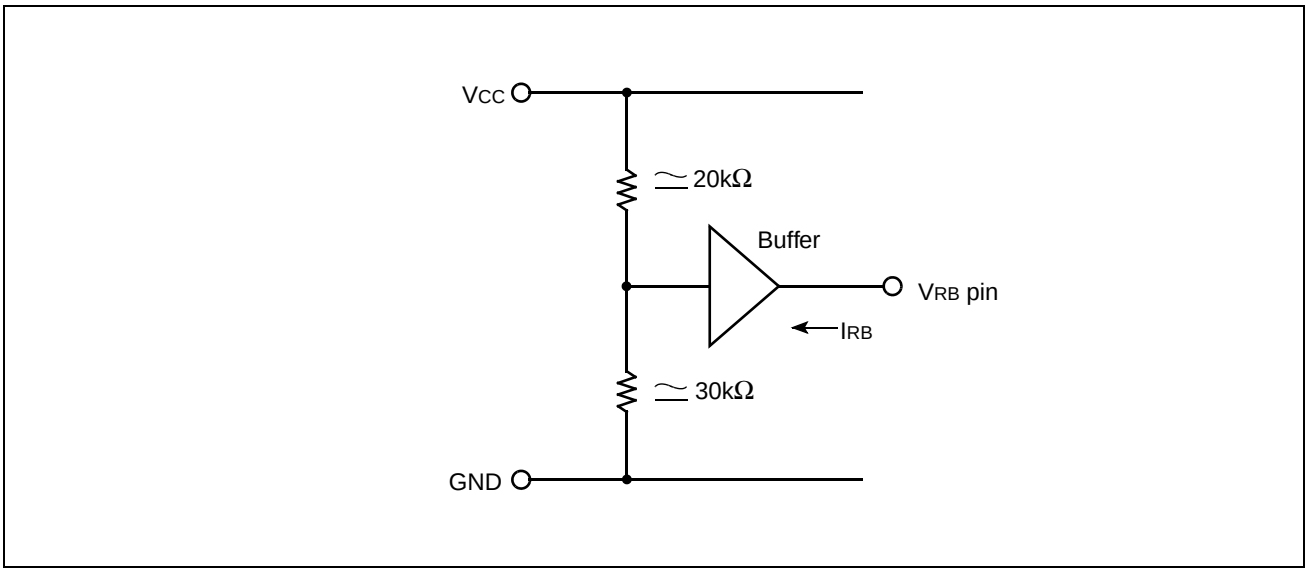


Figure 4. Digital Input Equivalent Circuit

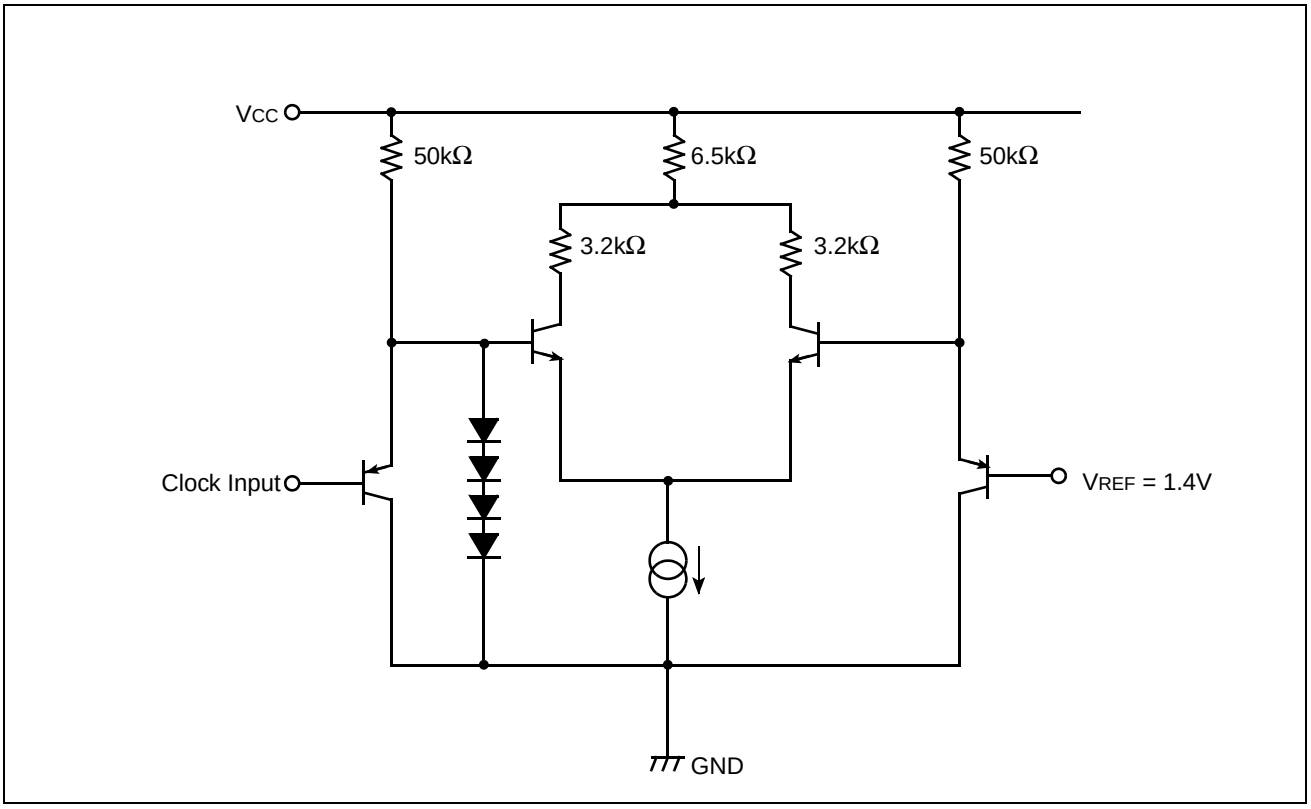
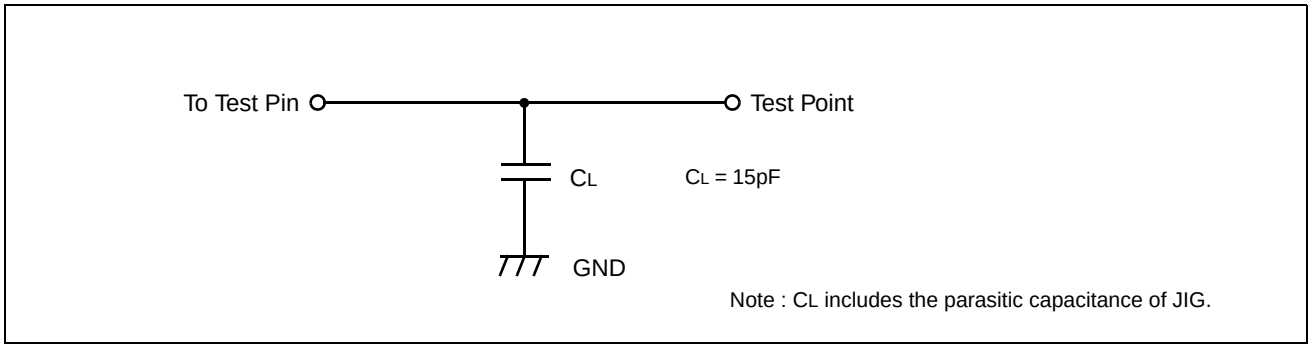
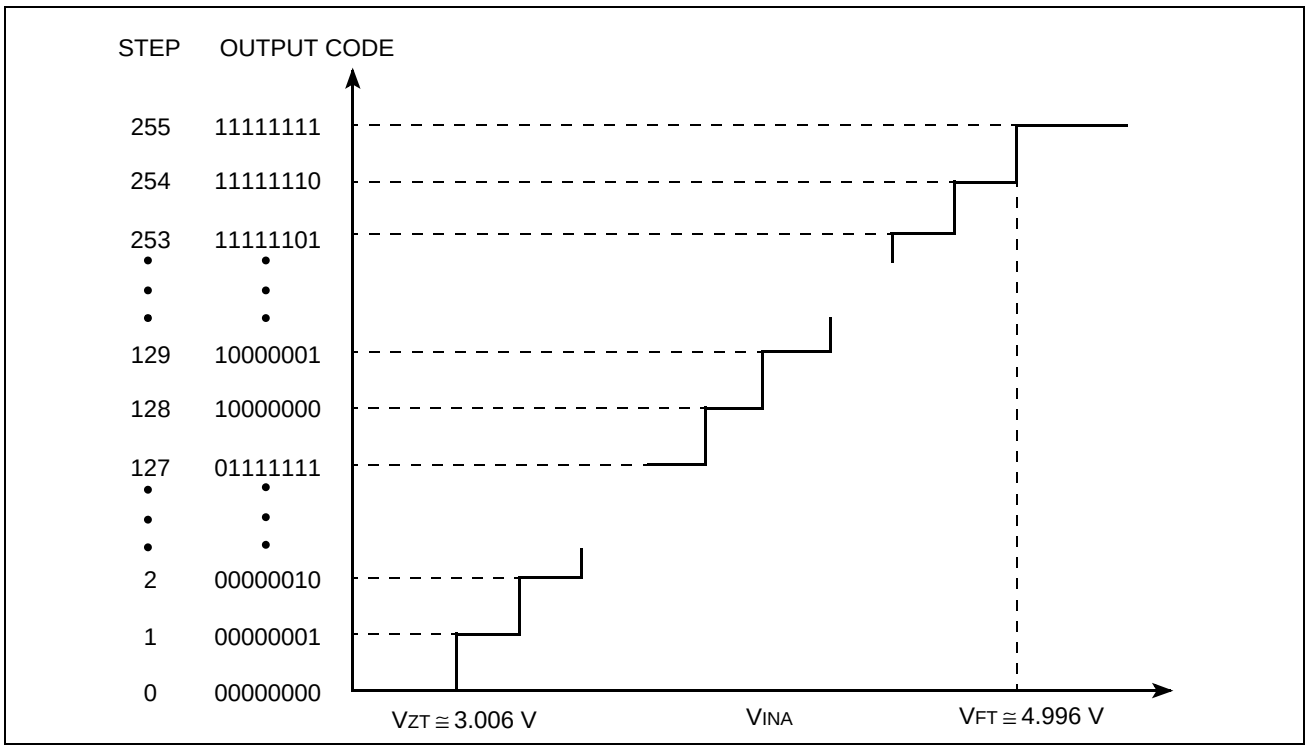


Figure 5. Output Buffer Load Circuit



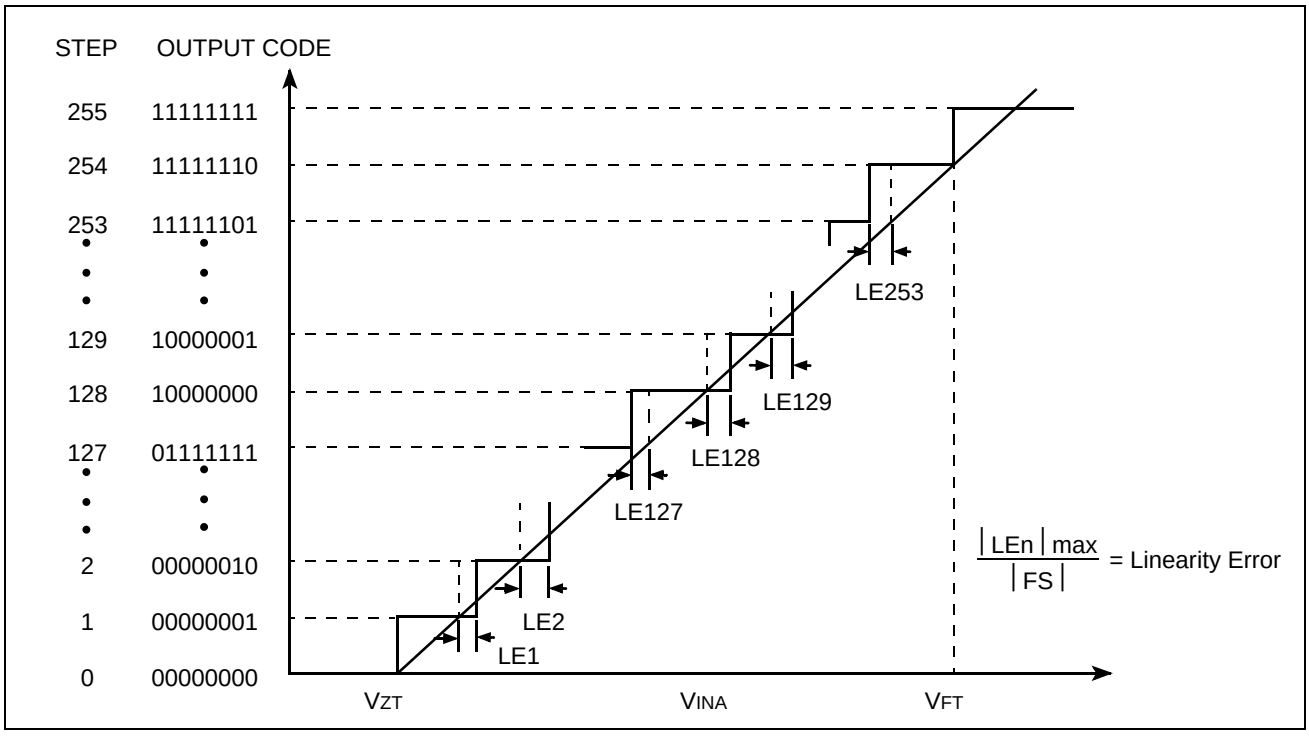
■ LINEARITY ERROR

1. Ideal Conversion Characteristic



V_{ZT} and V_{FT} are the typical values when V_{CC} = 5 V and V_{RB} = 3 V.

2. Actual Conversion Characteristic



NOTE: Refer to "■ELECTRICAL CHARACTERISTICS" for a range of V_{INA} inputs.

■ NOTES ON USE

1. Power Supply Patterns of the PCB

The power supply wire patterns (V_{CC} and GND patterns) of the PCB should be designed as wide as possible in order to reduce parasitic impedance.

Also, the V_{CC} and GND patterns which are connected to the V_{CC} and GND pins of the device must be handled and designed as analog system pattern and so, their circuit patterns must be separate from digital system patterns of other peripheral devices.

2. Switching Noise

In order to reduce switching noise as much as possible, high-frequency bypass capacitor must be connected between V_{CC} and GND pins and V_{RB} and GND pins.

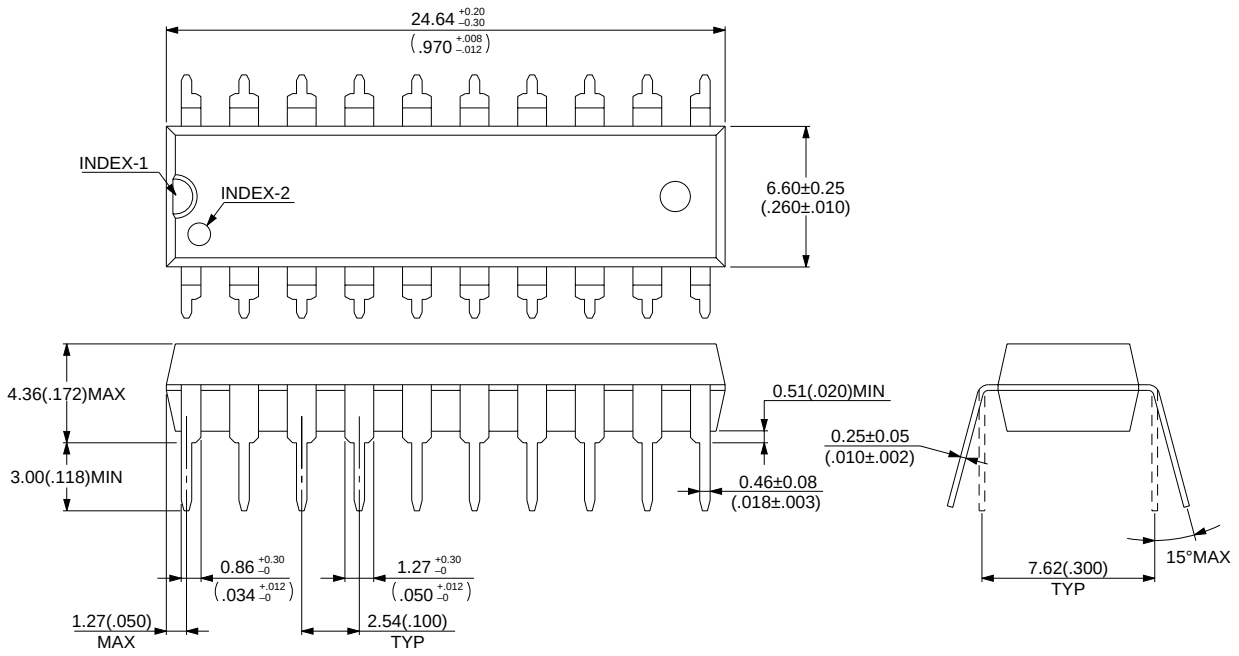
In this case, the capacitor should be connected to the pins as near as possible.

■ ORDERING INFORMATION

Part number	Package	Remarks
MB40528P	20-pin Plastic DIP (DIP-20P-M01)	
MB40528PF	20-pin Plastic SOP (FPT-20P-M05)	

■ PACKAGE DIMENSIONS

20-pin Plastic DIP
(DIP-20P-M01)



Dimensions in mm (inches)

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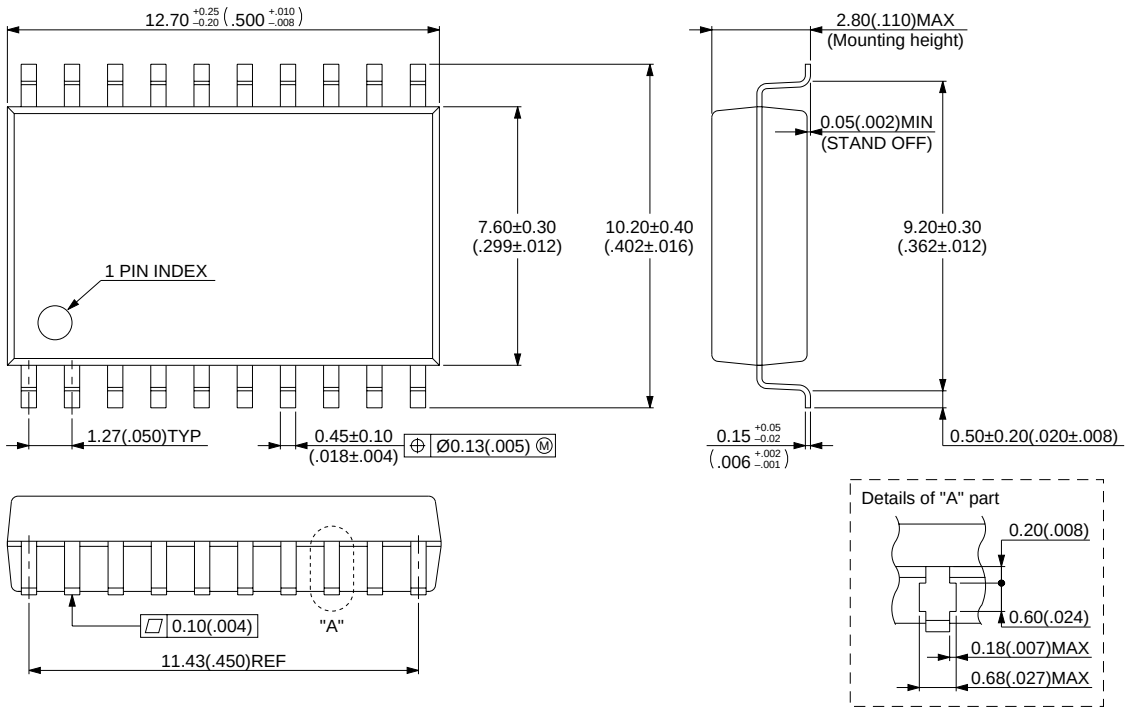
20-pin Plastic SOP
(FPT-20P-M05)



Dimensions in mm (inches)

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