

ASSP

3-Channel 8-Bit D/A Converter

MB40958

■ DESCRIPTION

The MB40958 is an 8-bit resolution high-speed digital-to-analog converter, designed for video processing applications.

The MB40958 has 8-bit resolution 3 channel D/A converters. Digital signals are input to the 8-bit digital input ports, and the input digital data are converted to the analog signals in minimum 60 Mega sample per seconds (MSPS). The analog output voltage is provided in a range of DC +3V to +5V (2Vp-p level) .

The MB40958 is fabricated by the Fujitsu's advanced bipolar process and housed in a 48-pin plastic QFP.

The MB40958 is designed for video signal processing applications, and it is suitable for TVs and VCRs.

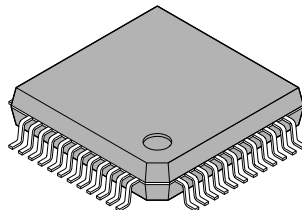
■ FEATURES

- 8-bit x 3 channels D/A converters
- Max. 60 MHz input clock frequency providing 60 MSPS data conversion rate
- Linearity error : Max. +/-0.2%
- Analog input voltage range : 3V to 5V (2Vp-p level)
- Digital input voltage level : TTL level

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■ PACKAGE

48 pin, Plastic QFP



(FPT-48P-M15)

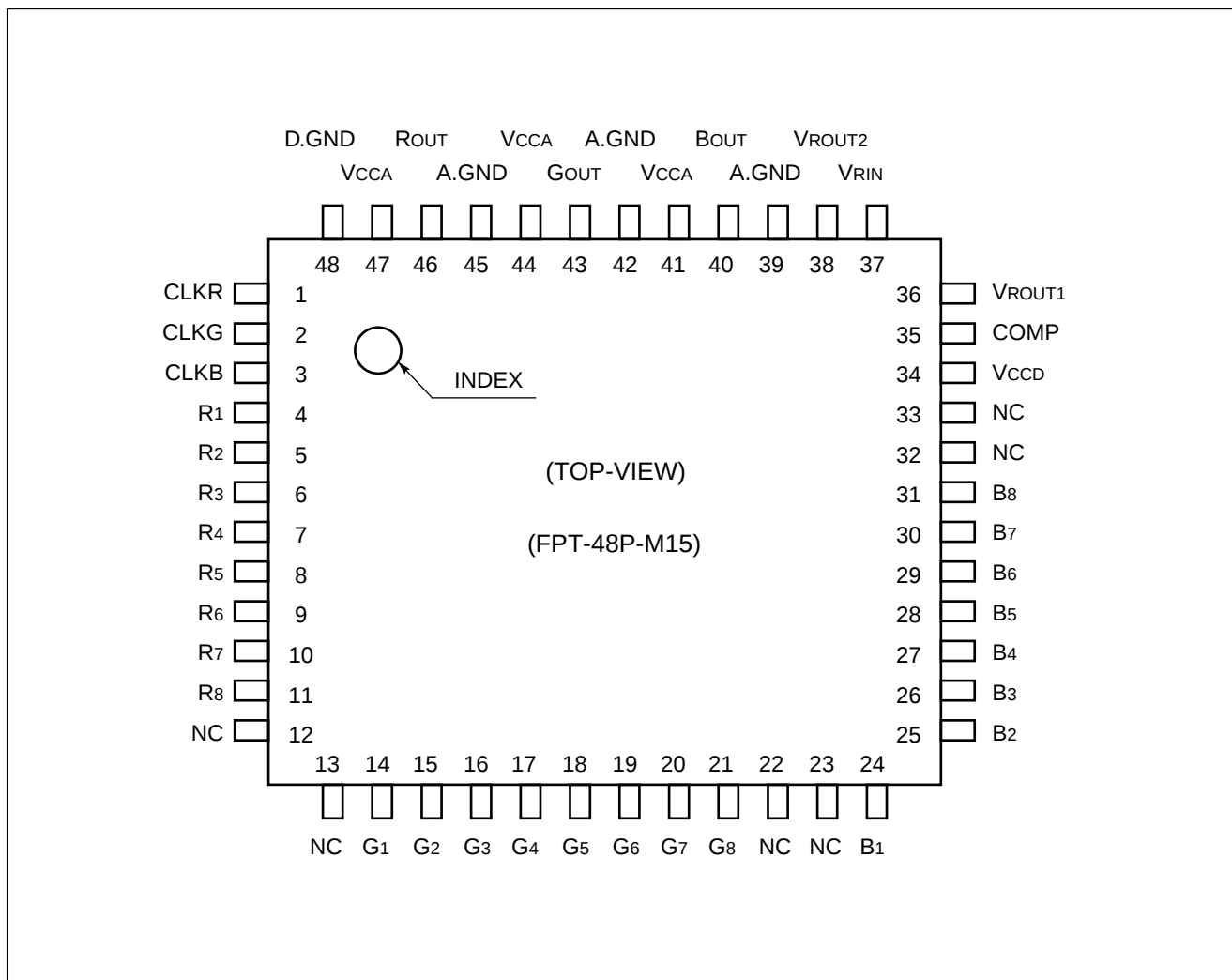
This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

MB40958

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- On-chip reference voltage outputs :
 - Output by resistor divided ($0.6 \times V_{CCA}$)
 - Output by band gap reference ($V_{CCA} - 2[V]$)
- Low power consumption : Typical 400mW at 2Vp-p analog output voltage
Typical 300mW at 1Vp-p analog output voltage
- Single +5V power supply
- Operating temperature range : -20°C to $+70^{\circ}\text{C}$
- Fujitsu's advanced bipolar process
- Package : 48-pin plastic QFP (Suffix : -PF)

PIN ASSIGNMENT



■ PIN DESCRIPTION

Symbol	Pin No.	Type	Name & Function
Power Supply			
VCCD	34	—	+5V DC power supply pins for digital block.
D. GND	48	—	Ground pin for digital block.
VCCA	41, 44, 47	—	DC power supply pins for analog block.
A. GND	39, 42, 45	—	Ground pins for analog block.
Clock			
CLKR	1	I	Clock input pin for R channel.
CLKG	2	I	Clock input pin for G channel.
CLKB	3	I	Clock input pin for B channel.
Digital Input			
R1 R2 R3 R4 R5 R6 R7 R8	4 5 6 7 8 9 10 11	I	Digital data input pins for R channel. 8-bit data is input to the pins. The R ₁ pin is the MSB and the R ₈ pin is the LSB.
G1 G2 G3 G4 G5 G6 G7 G8	14 15 16 17 18 19 20 21	I	Digital data input pins for G channel. 8-bit data is input to the pins. The G ₁ pin is the MSB and the G ₈ pin is the LSB.
B1 B2 B3 B4 B5 B6 B7 B8	24 25 26 27 28 29 30 31	I	Digital data input pins for B channel. 8-bit data is input to the pins. The B ₁ pin is the MSB and the B ₈ pin is the LSB.

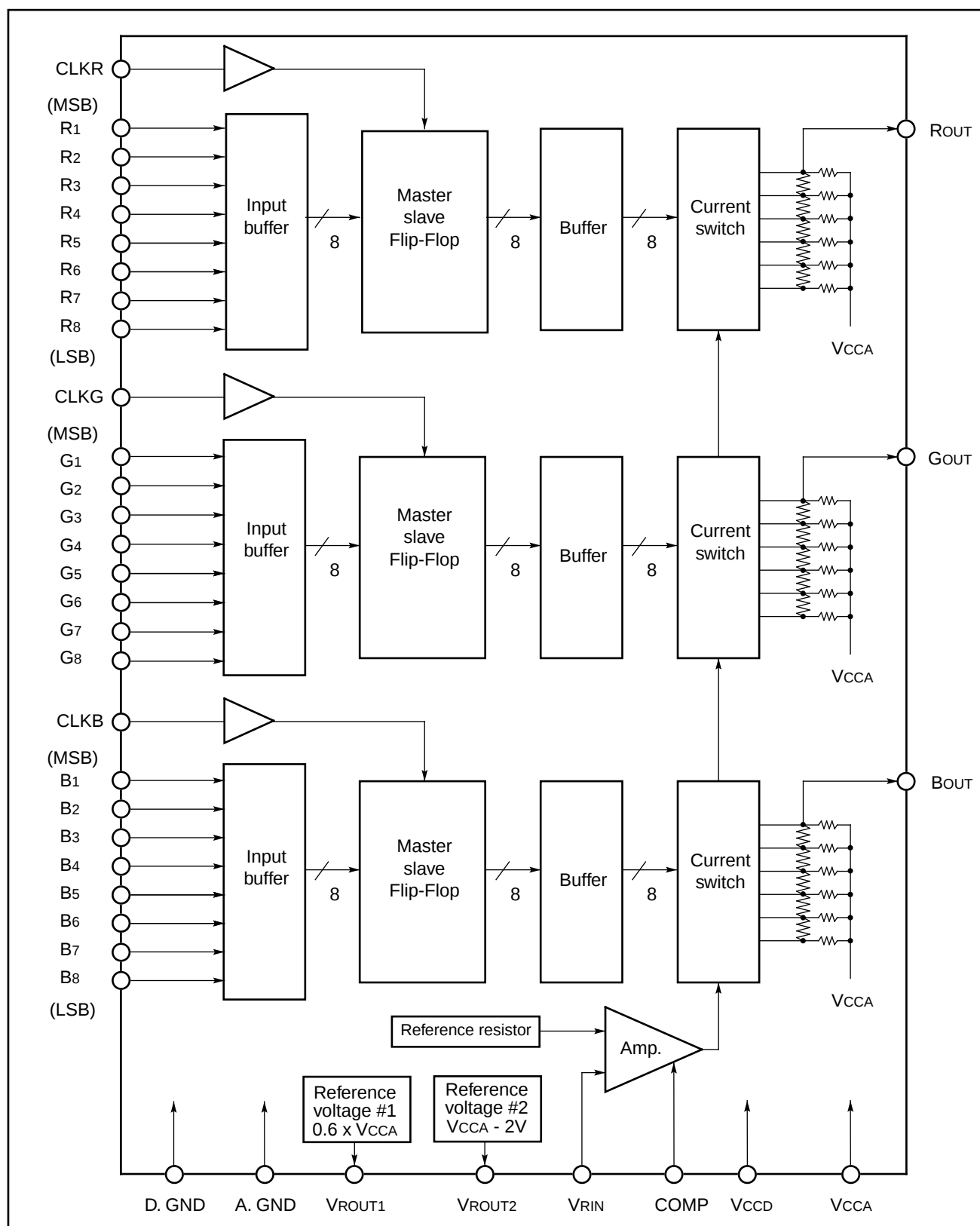
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MB40958

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Symbol	Pin No.	Type	Name & Function
Analog Output			
ROUT	46	O	Analog signal output pin for R channel.
GOUT	43	O	Analog signal output pin for G channel.
BOUT	40	O	Analog signal output pin for B channel.
Reference Voltage			
VRIN	37	I	Reference voltage input pin. This pin is used to set the analog output dynamic range. When the internal reference voltage is used, this pin is connected with VROUT1 pin (36 pin) or VROUT2 pin (38 pin). When the reference voltage is supplied from the external generator, 2.65V to 4.3V or $V_{CCA} - V_{RIN} = 0.7V$ to 2.2V is input to this pin.
VROUT1	36	O	Reference voltage output #1 pin. The output voltage is set to $0.6 \times V_{CCA}$ by the resistor divided method. When this pin is connected with VRIN pin (37 pin), an analog voltage is output from this pin in a range of $0.6 \times V_{CCA}$ to V_{CCA} .
VROUT2	38	O	Reference voltage output #2 pin. The output voltage is set to $V_{CCA} - 2V$ by the band-gap reference method. When this pin is connected with VRIN pin (37 pin), an analog voltage is output from this pin in a range of $V_{CCA} - 2V$ to V_{CCA} .
Compensation Capacitor			
COMP	35	—	Phase compensation capacitor pin. A phase compensation capacitor of $0.1\mu F$ or greater is connected between this pin and A. GND pin.
No Connection			
NC	12, 13, 22, 23, 32, 33	—	No connection, Leave those pins open.

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATINGS

(A. GND = D. GND = 0V)

Parameter	Symbol	Rating	Unit
Power supply voltage	V_{CCA}, V_{CCD}	-0.5 to +7.0	V
Power supply voltage difference	$V_{CCD} - V_{CCA}$	1.5	V
Analog reference voltage	V_{RIN}	-0.5 to $V_{CCA} + 7.0$	V
Digital input Voltage	V_{ID}	-0.5 to +7.0	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 of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

■ RECOMMENDED OPERATING CONDITIONS

(A. GND = D. GND = 0V)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Power supply voltage	V_{CCA}, V_{CCD}	4.75	5.00	5.25	V
Power supply voltage difference	$V_{CCA} - V_{CCD}$	-0.2	—	0.2	V
Analog reference voltage	$V_{CCA} - V_{RIN}$	0.70	2.00	2.20	V
	V_{RIN}	2.65	3.00	4.30	V
Digital "H" level input voltage	V_{IHD}	2.0	—	—	V
Digital "L" level input voltage	V_{ILD}	—	—	0.8	V
Clock frequency	f_{CLK}	—	—	60	MHz
Setup time	t_{SU}	8.0	—	—	ns
Hold time	t_h	2.0	—	—	ns
Minimum clock "H" level pulse width	t_{wH}	6.5	—	—	ns
Minimum clock "L" level pulse width	t_{wL}	6.5	—	—	ns
Phase compesation capacitance	C_{COMP}	0.1	—	—	μF
Operating ambient temperature	T_{OP}	-20	—	70	°C

■ ELECTRICAL CHARACTERISTICS

(Recommended Operating Conditions Otherwise Noted)

1. DC Characteristics

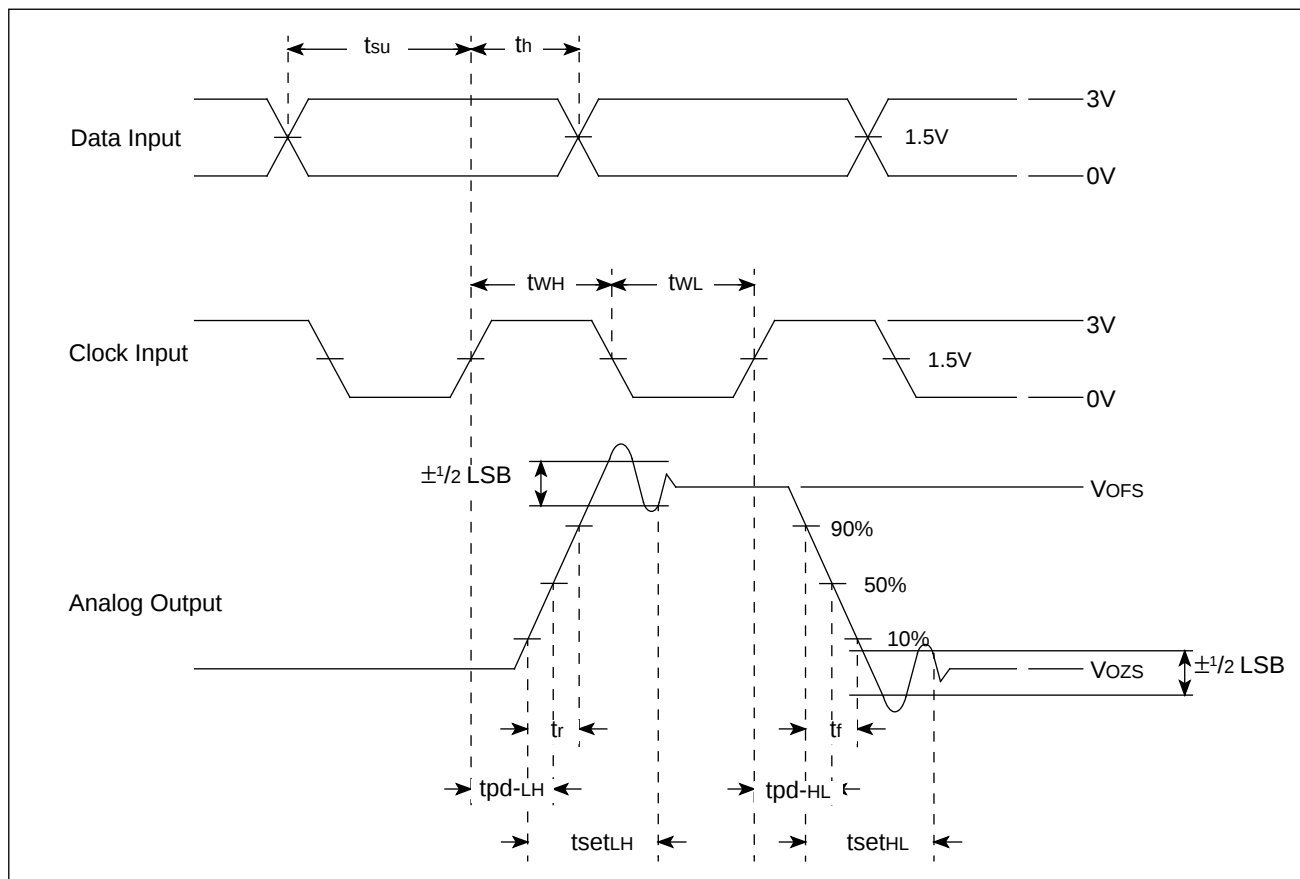
Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Resolution	—	—	—	8	bit	—
Linearity error	LE	—	—	±0.2	%	DC Accuracy
Digital "H" level input current	I _{IHD}	—	—	20	μA	V _{IHD} = 2.7 (V)
Digital "L" level input current	I _{ILD}	−100	—	—	μA	V _{ILD} = 0.4 (V)
Reference input current	I _{RIN}	—	—	10	μA	V _{RIN} = 3.000 (V)
Reference voltage (Resister divided)	V _{ROUT1}	2.900	3.000	3.100	V	V _{CCA} = V _{CCD} = 5.00 (V)
Reference voltage (BGR)	V _{ROUT2}	V _{CCA} −2.100	V _{CCA} −2.000	V _{CCA} −1.900	V	—
Reference voltage (BGR)	—	—	100	—	ppm/°C	—
RGB output voltage ratio	FSR	0	—	6	%	V _{CCA} = V _{CCD} = 5.00 (V)
Full-scale output voltage	V _{OFS}	V _{CCA} −20	V _{CCA}	—	mV	—
Zero-scale output voltage	V _{OZS}	2.938	3.008	3.078	V	V _{CCA} = V _{CCD} = 5.00 (V) V _{RIN} = 3.000 (V)
Output resistance	R _O	192	240	288	Ω	T _a = 25°C
Supply current	I _{CC}	—	80*	133	mA	V _{CCA} = V _{CCD} = 5.25 (V) V _{RIN} = V _{ROUT1}

* : V_{CCA} = V_{CCD} = 5.00V

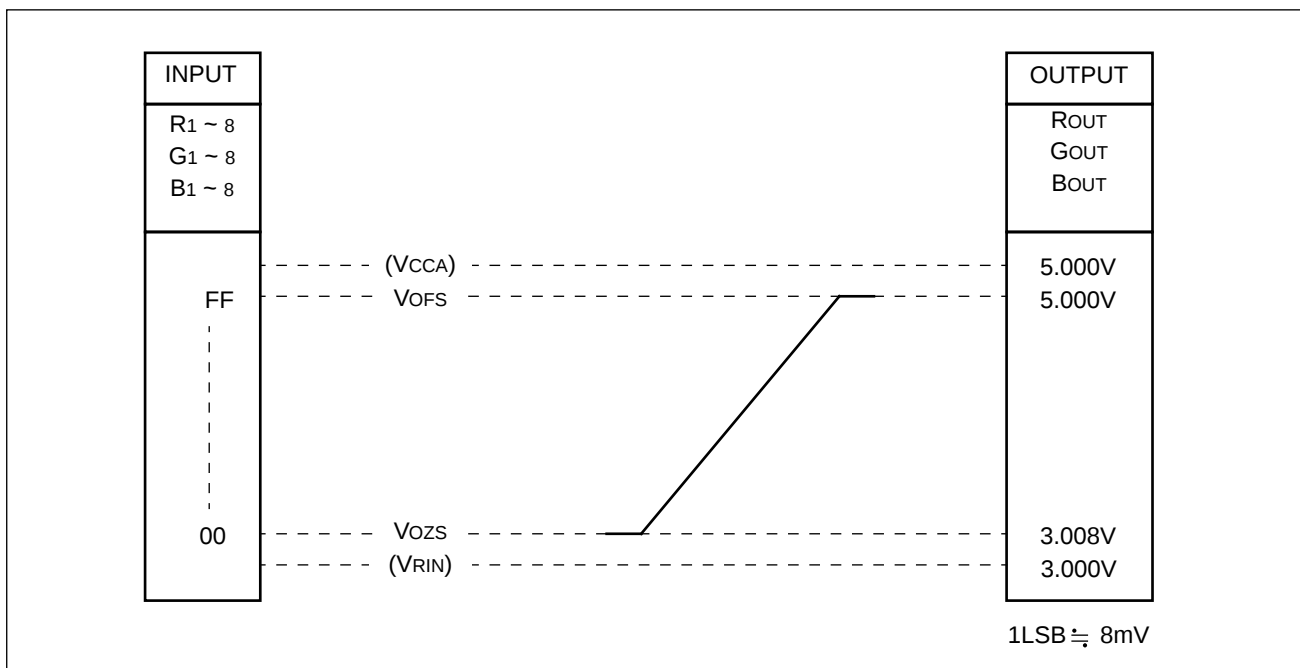
2. AC Characteristics

Parameter	Symbol	Value			Unit	Remark
		Min.	Typ.	Max.		
Maximum conversion rate	F _s	60	—	—	MSPS	Terminated A. OUT pin with 240Ω, C _L = 15pF
Output propagation delay time	t _{pd}	—	7	—	ns	
Output rising time	t _r	—	5	—	ns	
Output falling time	t _f	—	5	—	ns	
Setting time	t _{set}	—	15	—	ns	

■ ACTIMINT CHART



■ DAC OUTPUT VOLTAGE RANGE



■ CALCULATION OF DAC OUTPUT VOLTAGE AT IDEAL CONVERSION

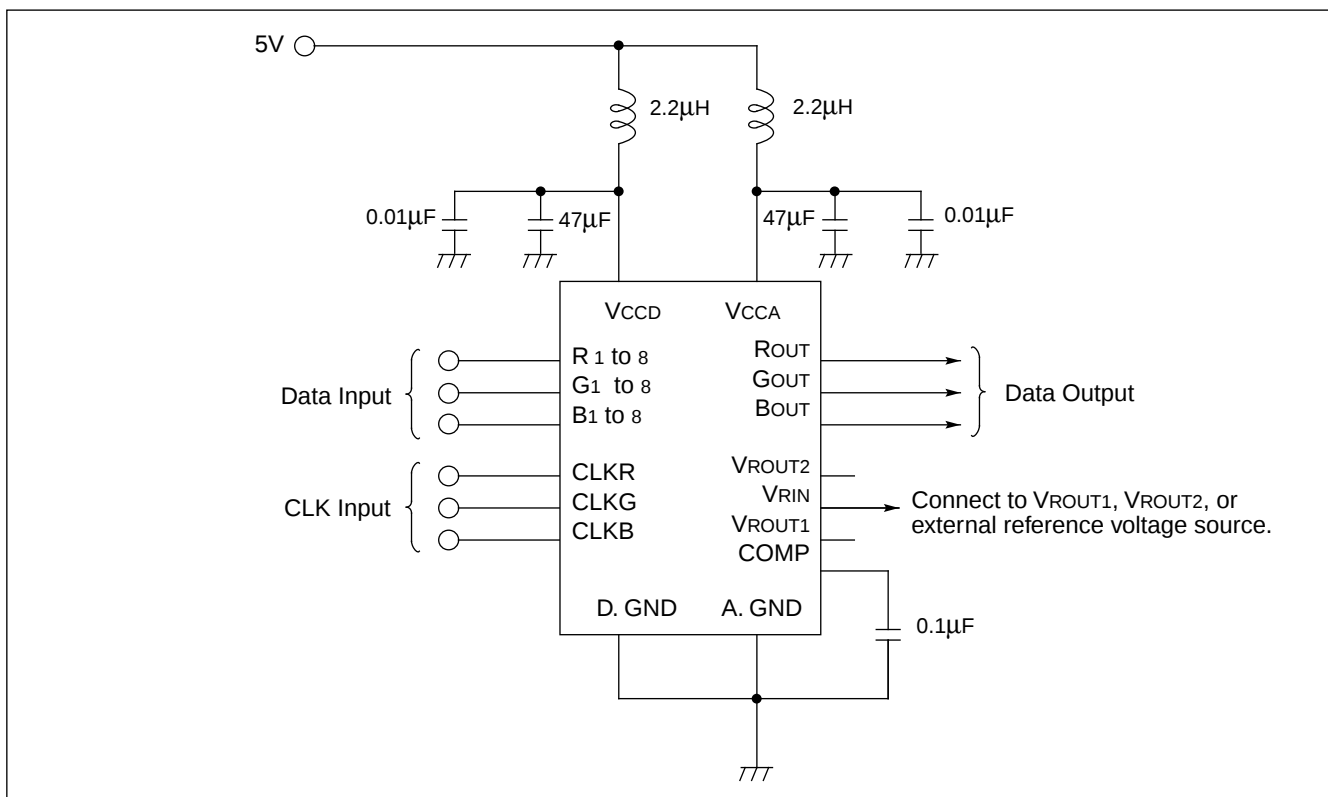
$$R_{OUT} \text{ (GOUT, BOUT) } = V_{CCA} - \frac{255 - N}{256} \times (V_{CCA} - V_{RIN})$$

[N : Digital Input Code (0 to 255)]

$$V_{OFS} = V_{CCA}$$

$$V_{OZS} = V_{CCA} - \frac{255}{256} \times (V_{CCA} - V_{RIN})$$

■ TYPICAL CONNECTION EXAMPLE



■ NOTES ON USE

1. Power Supply Patterns of the PCB

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

2. Switching Noise

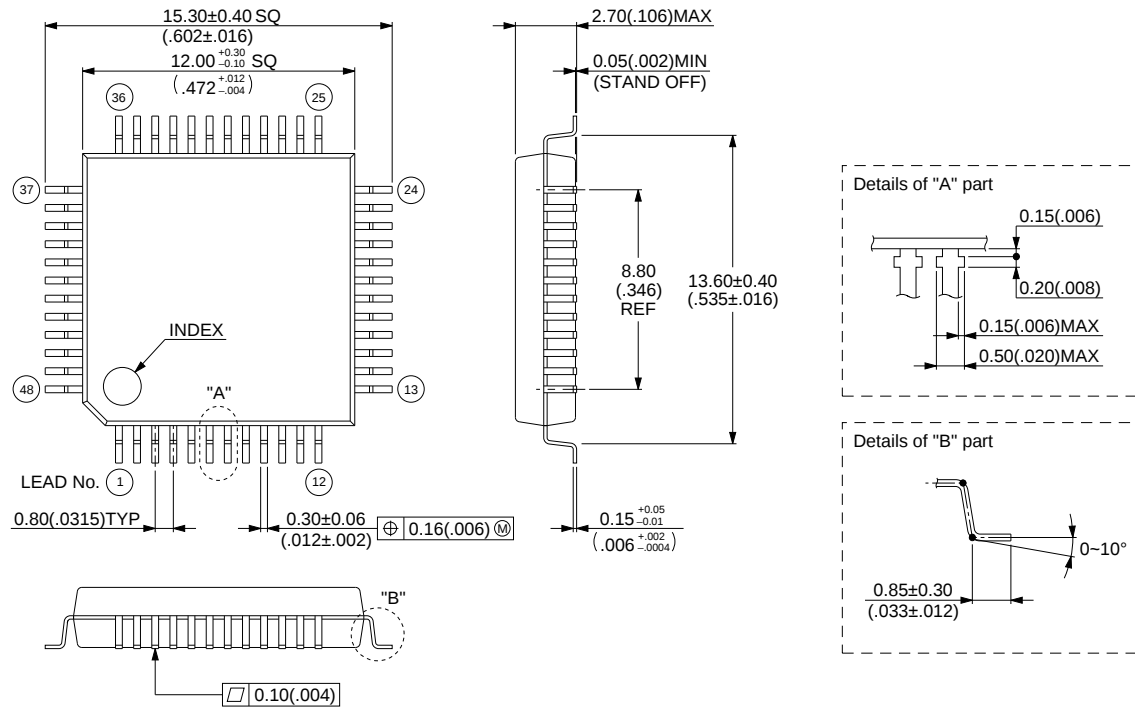
In order to reduce switching noise as much as possible, noise limit capacitor must be connected between V_{CCD} and D. GND pins and V_{CCA} and A. GND pins.

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

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■ PACKAGE DIMENSION

48 pin, Plastic QFP
(FPT-48P-M15)



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Dimensions in mm (inches).

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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 211-88, Japan
Tel: (044) 754-3753
Fax: (044) 754-3329

North and South America

FUJITSU MICROELECTRONICS, INC.
Semiconductor Division
3545 North First Street
San Jose, CA 95134-1804, U.S.A.
Tel: (408) 922-9000
Fax: (408) 432-9044/9045

Europe

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

Asia Pacific

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

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