

ASSP

# 3-Channel 8-Bit RGB D/A Converter

## MB40978

### DESCRIPTION

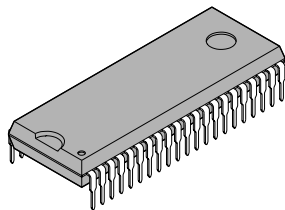
The Fujitsu MB40978 is a 8-bit ultra high speed digital to analog converter for video frequency band fabricated by Fujitsu Advanced Bipolar Technology. Owing to adoption of RGB 3-channel input/output, it is suitable for digital TV, graphic display etc.

### FEATURES

- Resolution : 8bits
- Linearity :  $\pm 0.2\%$  max.
- Maximum Conversion Rate : 60MSPS min.
- Analog Output Voltage Range :  $V_{CC}$  to  $V_{CC} - 1(V)$
- Digital Input Voltage : TTL Compatible
- Single Power Supply Voltage : +5.0V
- Power Dissipation : 350mW typ.
- Package : Plastic DIP Package (Suffix: -P)  
: Plastic Flat Package (Suffix: -PFQ)

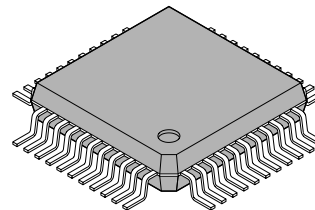
### PACKAGES

42 pin, Plastic SH-DIP



(DIP-42P-M02)

44 pin, Plastic FPT



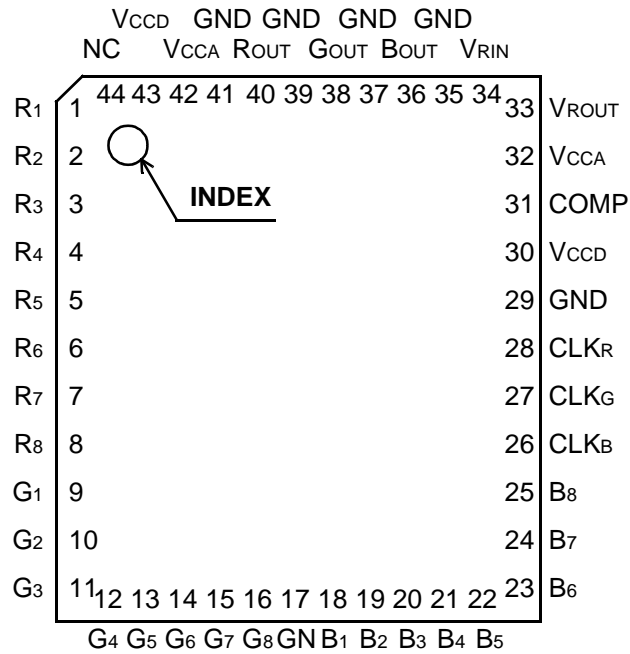
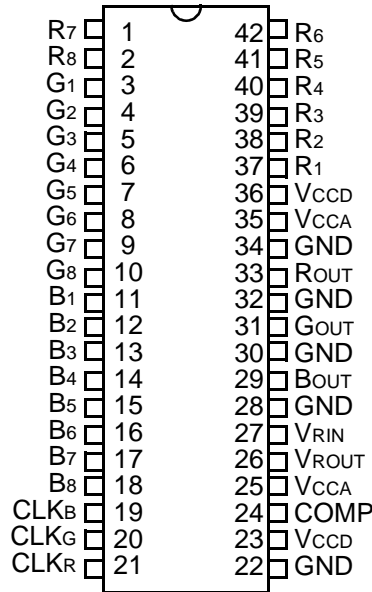
(FPT-44P-M11)

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.

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## ■ PIN ASSIGNMENTS

(TOP VIEW)

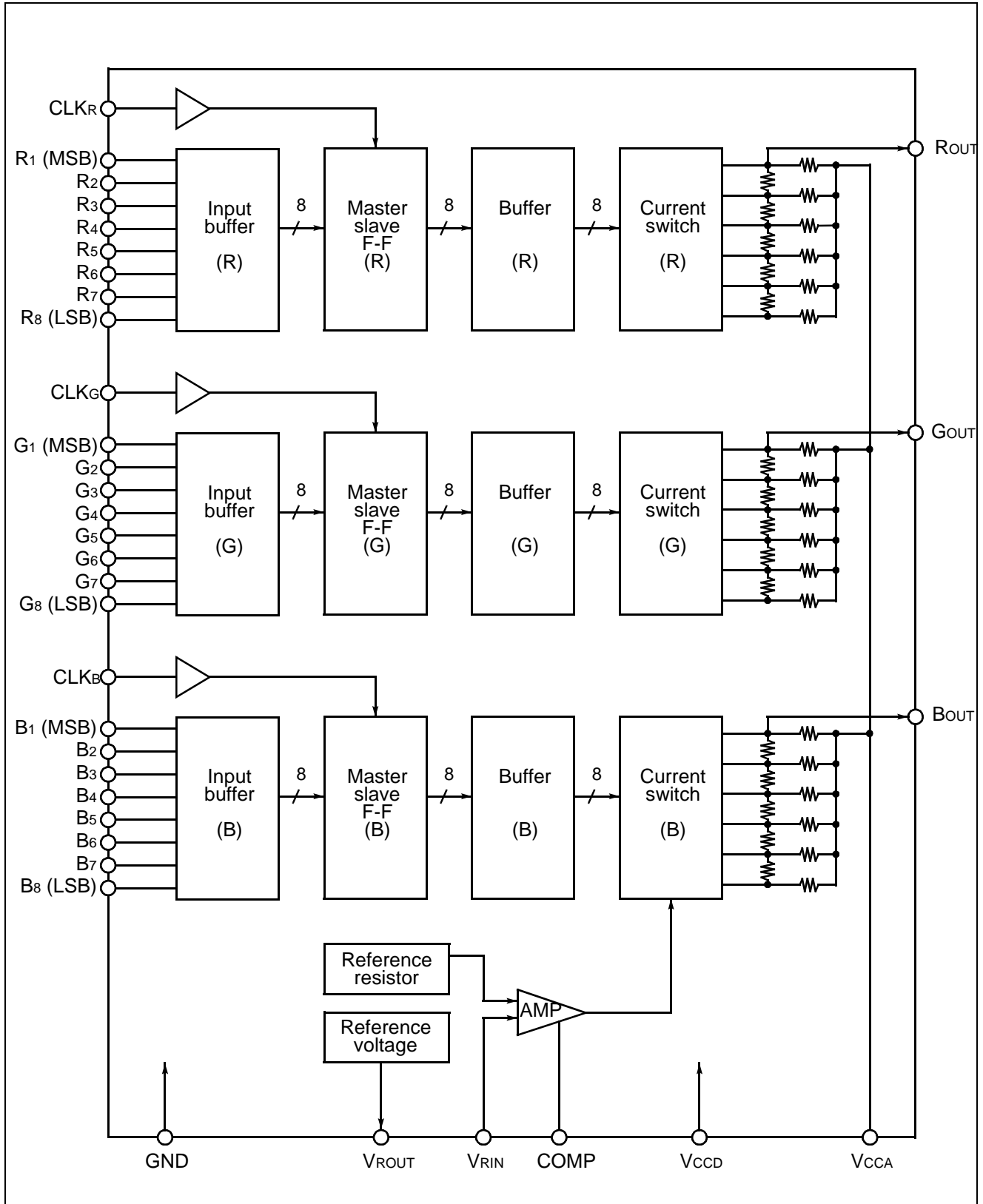


## ■ PIN DESCRIPTION

Pin Number		Symbol	Description
DIP	QFP		
1, 2, 37 to 42	1 to 8	R1 to R8	R-channel Digital Signal Inputs $V_{IH}=2.0V$ min. $V_{IL}=0.8V$ max.
3 to 10	9 to 16	G1 to G8	G-channel Digital Signal Inputs
11 to 18	18 to 25	B1 to B8	B-channel Digital Signal Inputs
33	40	ROUT	R-channel Analog Signal Output
31	38	GOUT	G-channel Analog Signal Output
29	36	BOUT	B-channel Analog Signal Output
21	28	CLKR	R-channel Clock Input $V_{IH}=2.0V$ min. $V_{IL}=0.8V$ max.
20	27	CLKG	G-channel Clock Input
19	26	CLKB	B-channel Clock Input
27	34	VRIN	Reference Voltage Input
26	33	VROUT	Reference Voltage Output
24	31	COMP	This pin is provided to connect a phase compensation capacitance. $1\mu F$ min capacitor is connected between GND.
25, 35	32, 42	VCCA	Power Supply for Analog Circuit $5V \pm 5\%$
23, 36	30, 43	VCCD	Power Supply for Digital Circuit $5V \pm 5\%$
22, 28, 30, 32, 34	17, 29, 35, 37, 39, 41	GND	Ground
—	44	N.C.	No connection

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## ■ BLOCK DIAGRAM



## ■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Unit
Power supply voltage	$V_{CCA}, V_{CCD}$	-0.5 to +7.0	V
Analog reference voltage	$V_{RIN}$	-0.5 to $V_{CCA} + 0.5$	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

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power supply voltage	$V_{CCA}, V_{CCD}$ ( $V_{CCA} - V_{CCD}$ )	4.75 (-0.2)	5.0	5.25 (0.2)	V
Analog reference voltage	$V_{RIN}$	3.70	4.00	4.30	V
Digital high-level input voltage	$V_{IHD}$	2.0	—	—	V
Digital low-level voltage	$V_{ILD}$	—	—	0.8	V
Clock frequency	$f_{CLK}$	—	—	60	MHz
Set-up time	$t_s$	10	—	—	ns
Hold time	$t_H$	4.0	—	—	ns
Minimum high pulse width	$t_{w+}$	7.5	—	—	ns
Minimum low pulse width	$t_{w-}$	7.5	—	—	ns
Phase compensation capacitance	$C_{COPM}$	1.0	—	—	μF
Operating temperature	$T_a$	0	—	70	°C

Note:  $V_{CCA} - V_{REF} \leq 1.2V$

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## ■ ELECTRICAL CHARACTERISTICS

( $V_{CCA} = V_{CCD} = 4.75$  to  $5.25V$ ,  $T_a = 0$  to  $70^{\circ}C$ )

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Resolution	—	—	—	—	8	Bits
Linearity error	LE	—	—	—	$\pm 0.2$	%
Reference input current	$I_{RIN}$	$V_{RIN}, V_{ROUT}$ Short	—	—	10	$\mu A$
Reference output voltage	$V_{ROUT}$	$V_{CC}=5.00V$	3.900	4.000	4.100	V
Digital high-level input current	$I_{IHD}$	$V_{IHD}=2.7V$	—	—	20	$\mu A$
Digital low-level input current	$I_{ILD}$	$V_{ILD}=0.4V$	-100	—	—	$\mu A$
RGB output voltage ratio	FSR	—	0	2	6	%
Full-scale output voltage	$V_{OFS}$	$V_{CCA}=5.000V$ $V_{RIN}, V_{ROUT}$ Short	$V_{CCA} - 15$	$V_{CCA}$	—	mV
Zero-scale output voltage	$V_{OZS}$	$V_{CCA}=V_{CCD}=5.000V$ $V_{RIN}=4.00V$	3.944	4.004	4.064	V
		$V_{CCA}=V_{CCD}=5.000V$ $V_{RIN}, V_{ROUT}$ Short	3.884	4.004	4.124	V
Output resistance	$R_o$	—	—	240	—	$\Omega$
Power supply current	$I_{CC}$	$V_{CC}=5.25V$ $V_{RIN}, V_{ROUT}$ Short	—	*70	102	mA

Note:  $V_{CCA} = V_{CCD} = 5.00V$

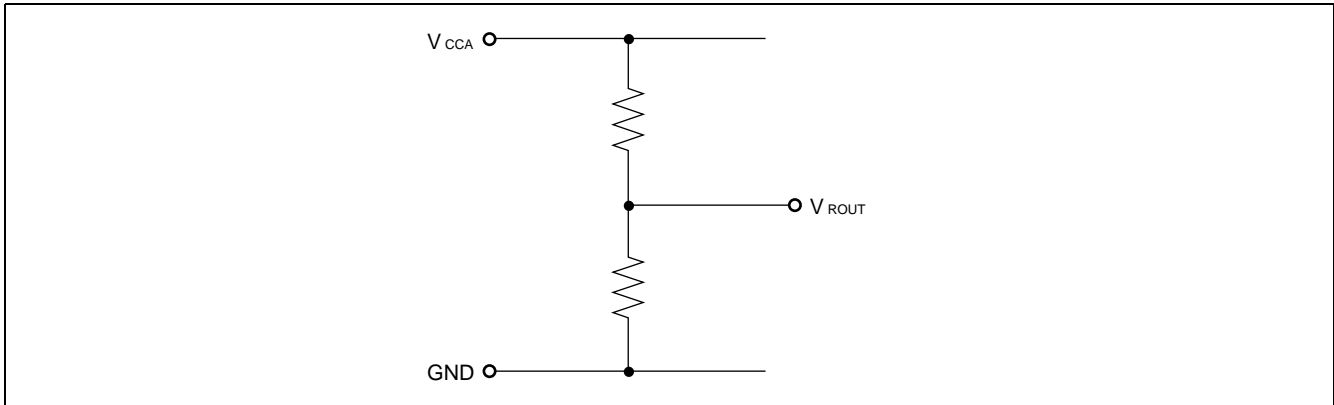
## ■ SWITCHING CHARACTERISTICS

( $V_{CCA} = V_{CCD} = 4.75$  to  $5.25V$ ,  $T_a = 0$  to  $70^{\circ}C$ )

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
Maximum conversion rate	$F_s$	60	—	—	MSPS
Output delay time	$t_{PLH}$ $t_{PHL}$	—	10	—	ns
Output rise time	$t_r$	—	5	—	ns
Output fall time	$t_f$	—	5	—	ns

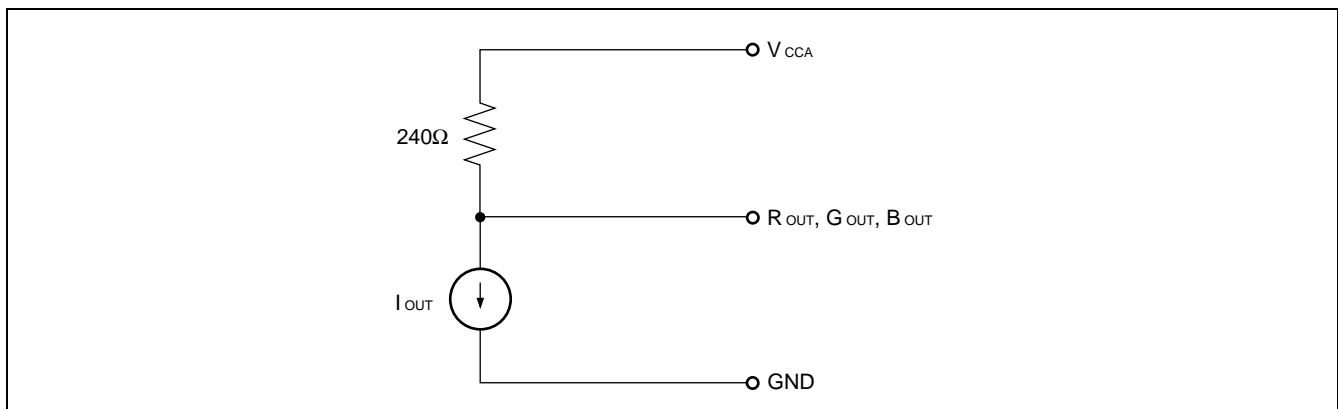
## ■ REFERENCE VOLTAGE OUTPUT EQUIVALENT CIRCUIT

- $V_{ROUT}$

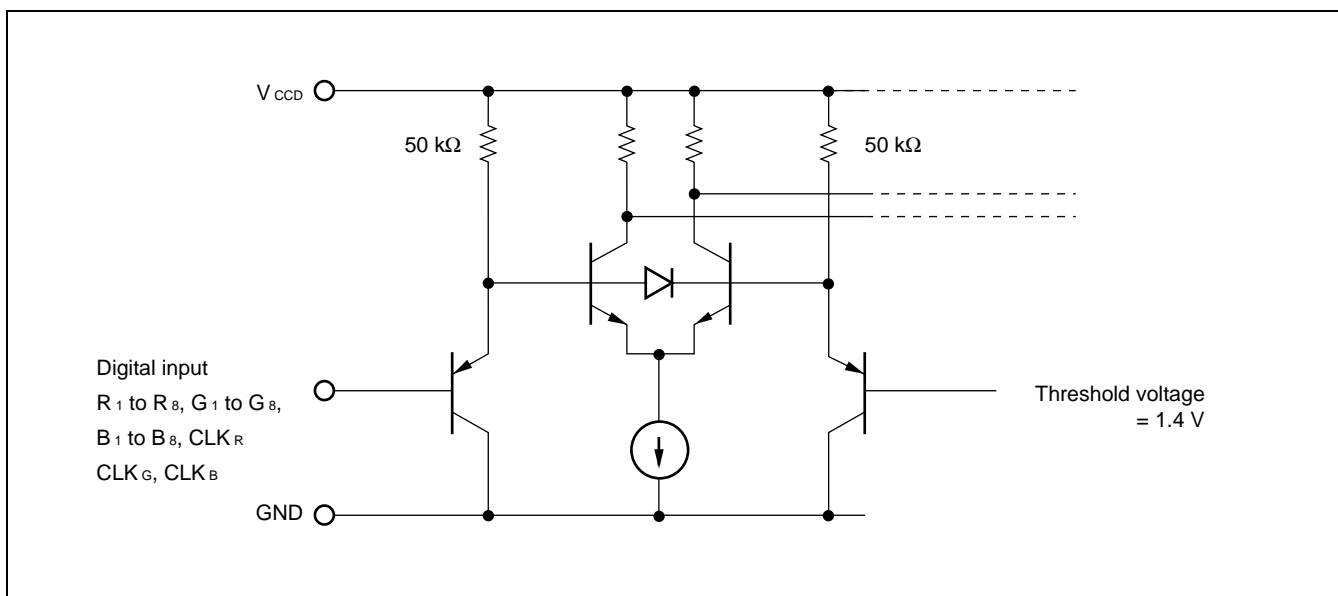


## ■ ANALOG OUTPUT EQUIVALENT CIRCUIT

- $R_{OUT}$ ,  $G_{OUT}$ ,  $B_{OUT}$

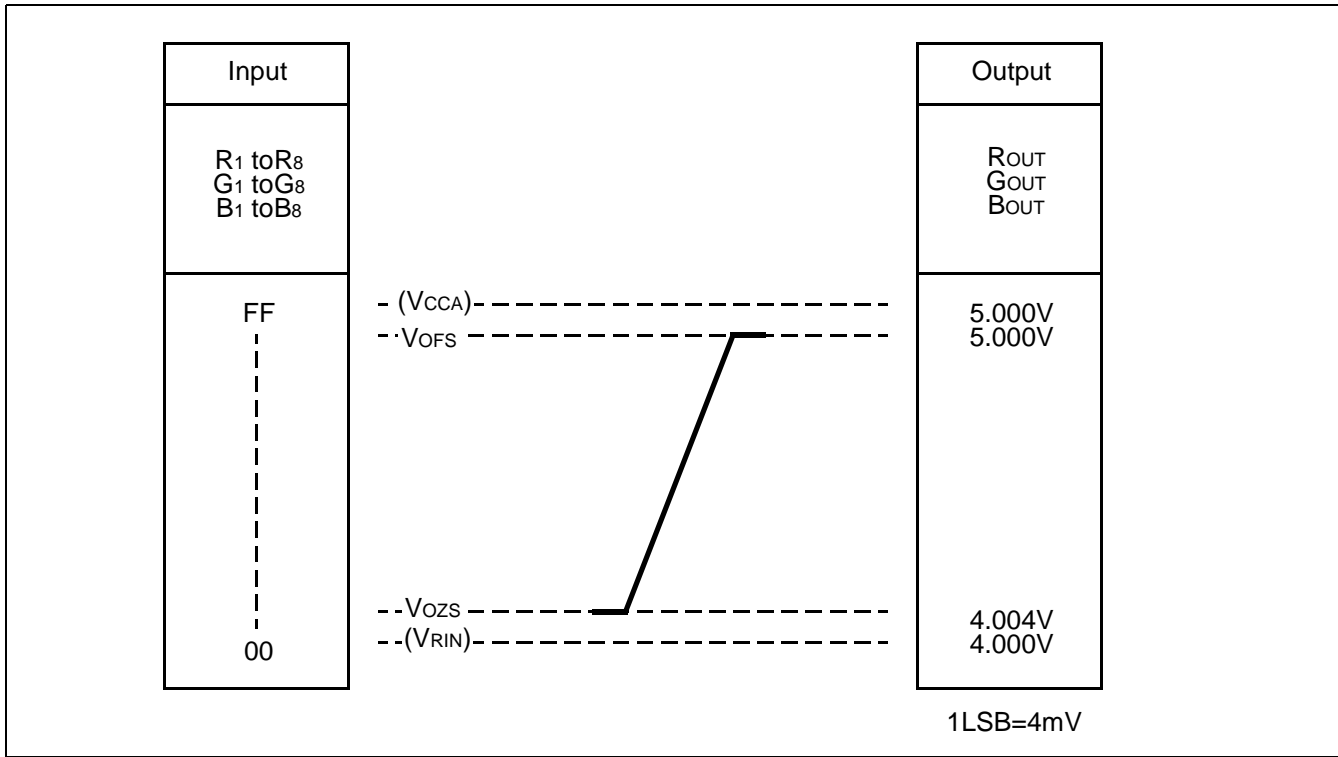


## ■ DIGITAL INPUT EQUIVALENT CIRCUIT

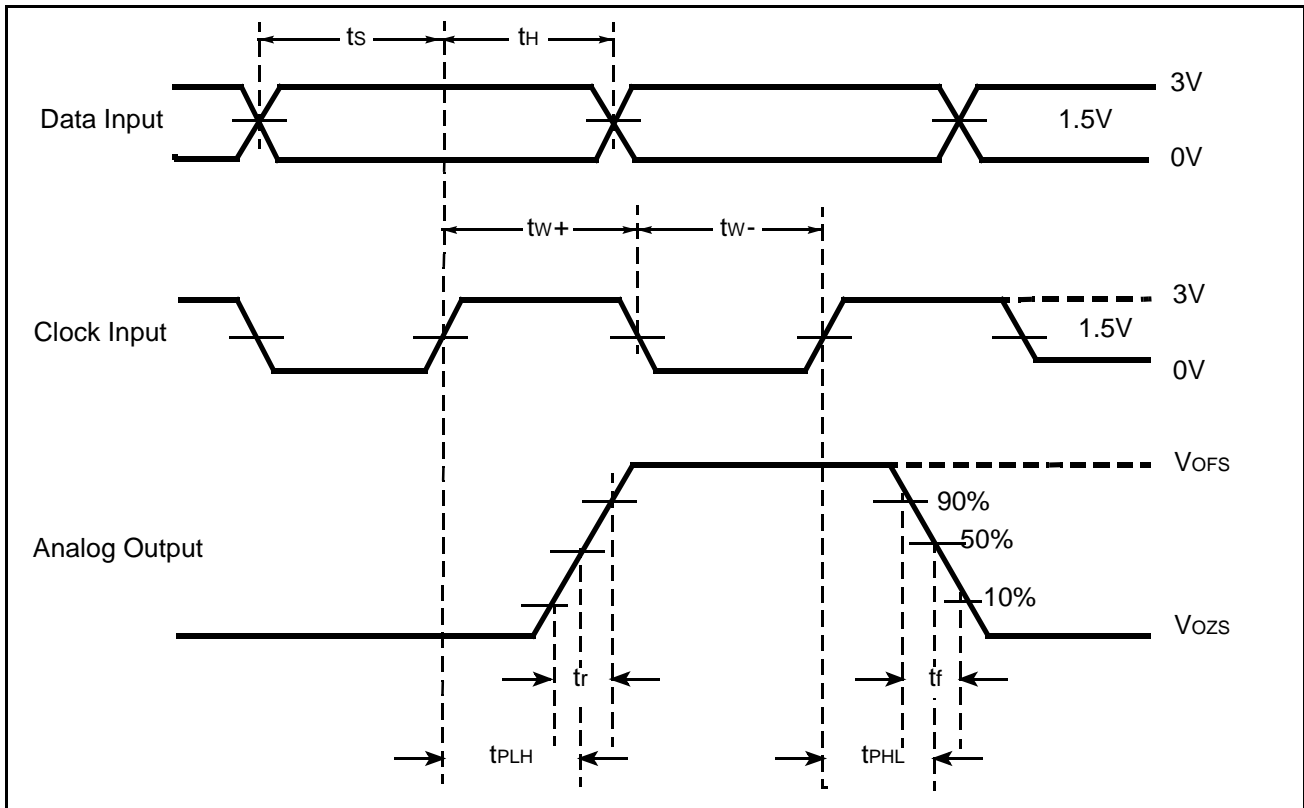


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## ■ DAC OUTPUT VOLTAGE



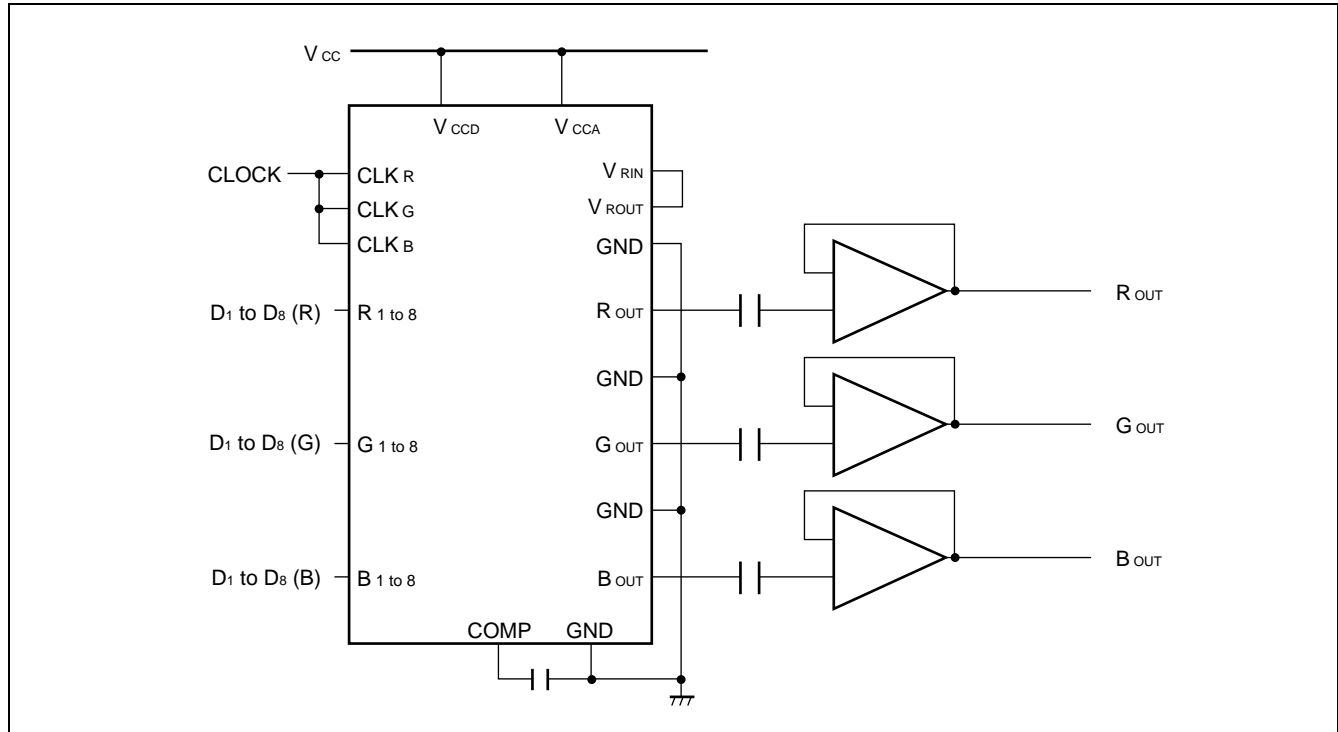
## ■ TIMING DIAGRAM



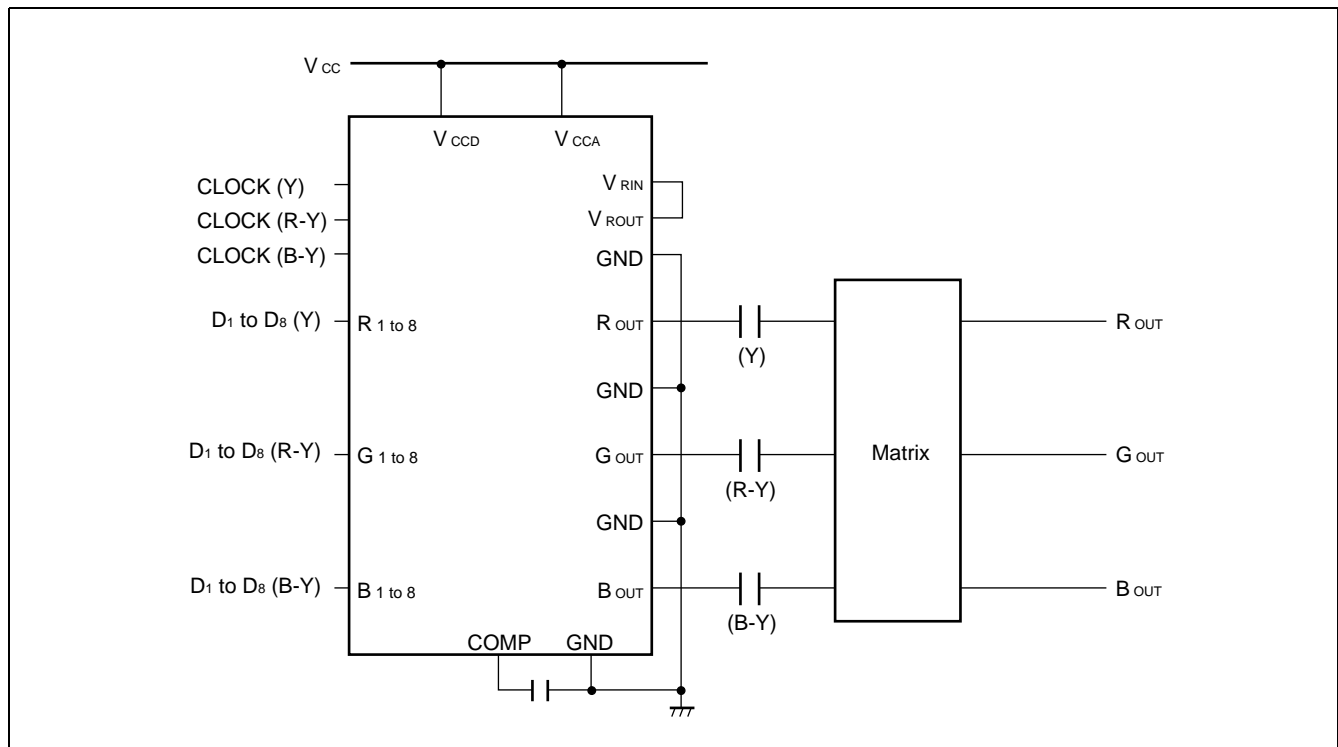


## ■ APPLICATION EXAMPLES

### 1. RGB Signal Process



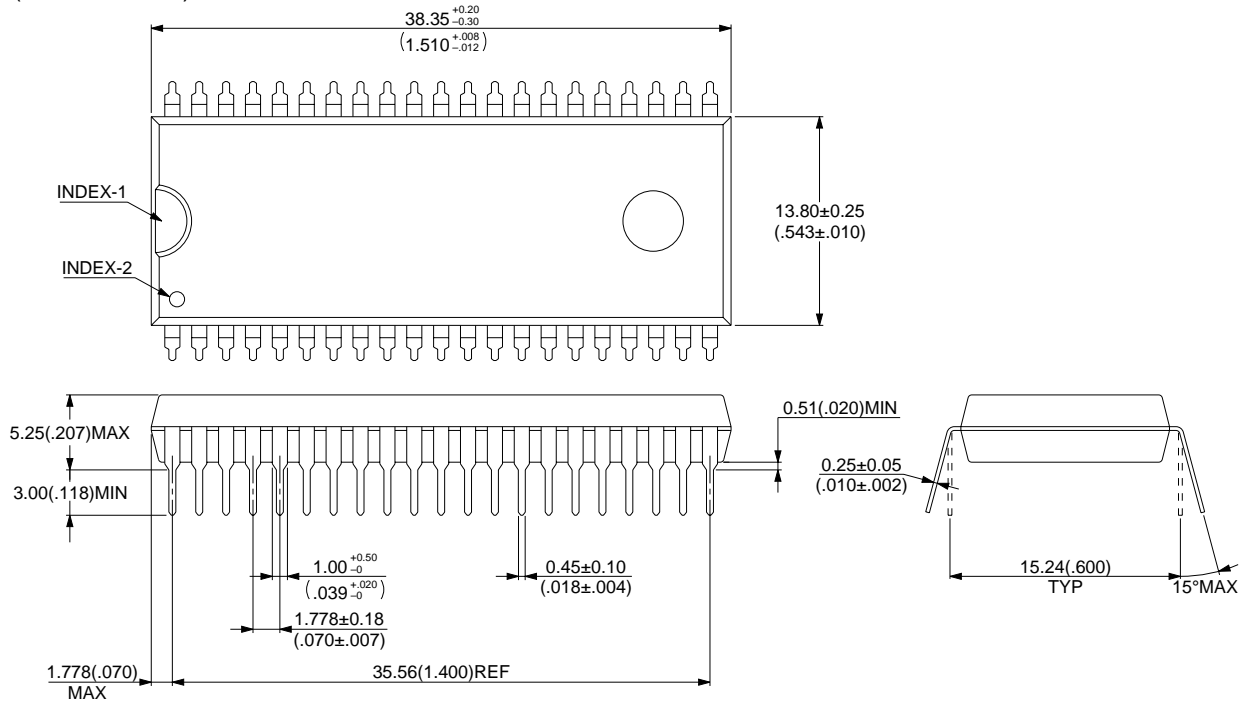
### 2. Component Signal Processing



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## ■ PACKAGE DIMENSIONS

42 pin, Plastic DIP  
(DIP-42P-M02)

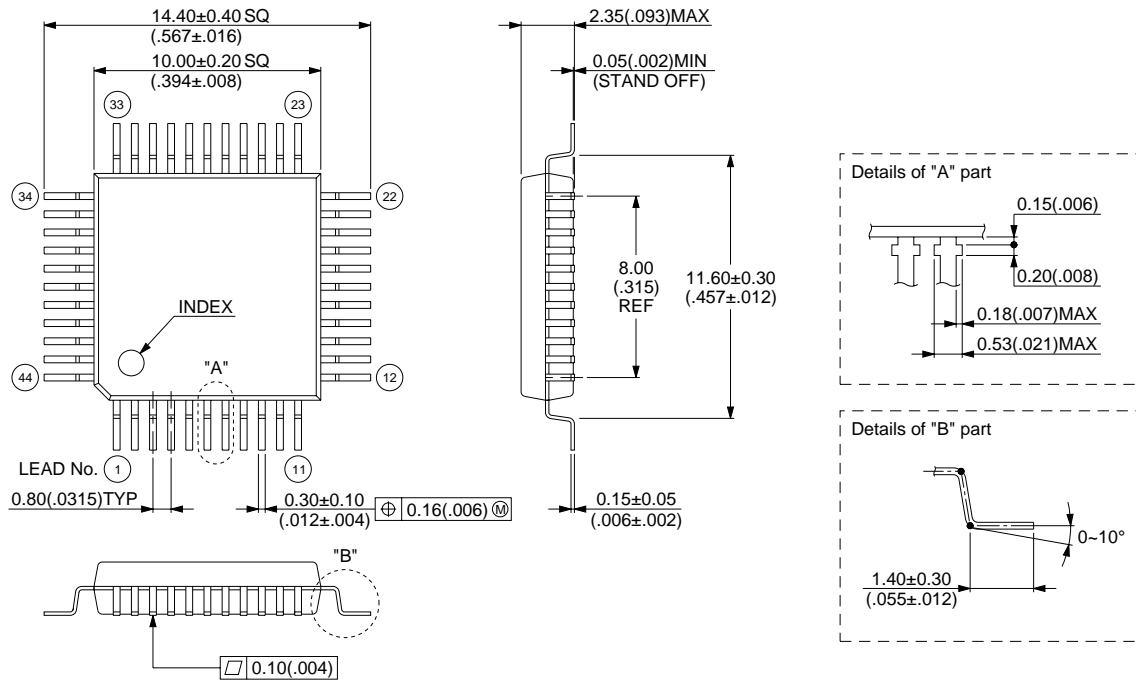


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Dimensions in mm (inches).

(Continued)

44 pin, Plastic FPT  
(FPT-44P-M11)



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Dimensions in mm (inches).

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