

MB86140

Picture-in-Picture Controller

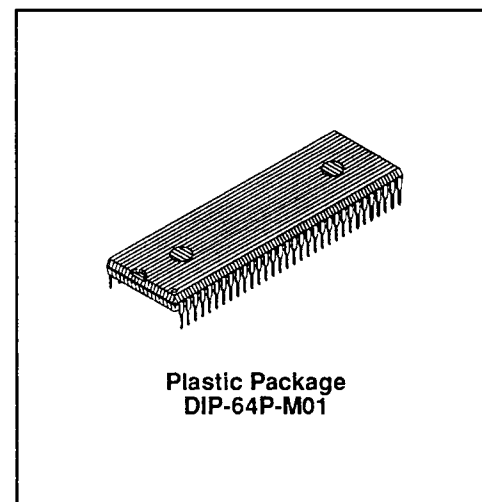
DESCRIPTION

The Fujitsu MB86140, fabricated in CMOS process technology, is a picture-in-picture (PIP) controller for TV/VTR applications conforming to NTSC mode.

The MB86140 is an exclusive controller of the picture-in-picture system composed of a PLL IC (MB3511), dual port RAM (MB81461), and A/D D/A converter (MB40176).

FEATURES

- NTSC mode
- Picture-in-picture function
 - Separate/Compress/Composite function of brightness signal and color signal
 - Memory Control function
 - Selectable motion picture mode (all fields) or still picture mode (single field)
 - Selectable sub-picture position: Upper left, lower left, upper right, or lower right
 - AFC (automatic frequency control) function
- Solarization mode function
- Indication signal output for PIP mode or solarization mode
- Input video signal: NTSC composite video signal (6 Bit/4 fsc)
- Output video signal for sub-picture: NTSC composite video signal (6 Bit/4 fsc)
- Single supply voltage: +5 V
- 64-pin plastic dual in-line package



ABSOLUTE MAXIMUM RATINGS (See Note)

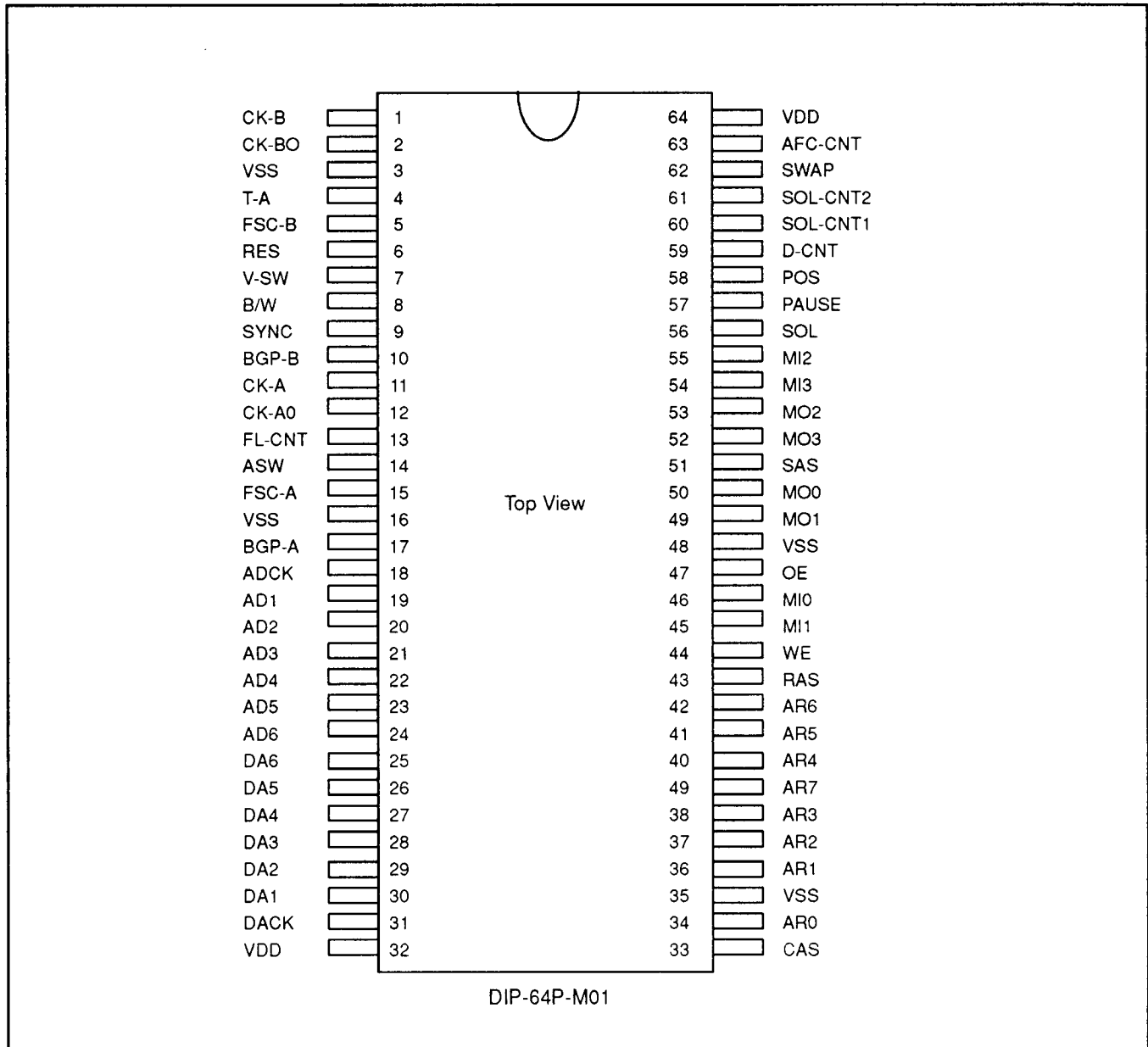
(V_{SS} = 0 V)

Rating	Symbol	Condition	Value	Unit
Supply Voltage	V _{DD}		V _{SS} -0.5 to +6.0	V
Input Voltage	V _I		V _{SS} -0.5 to V _{DD} +0.5	V
Output Voltage	V _O		V _{SS} -0.5 to V _{DD} +0.5	V
Operating Temperature	T _A		-25 to +85	°C
Storage Temperature	T _{STG}		-40 to +125	°C
Output Current	I _O	V _{DD} = Max. V _O = V _{DD} V _O = 0 V	+70	mA
			-40	

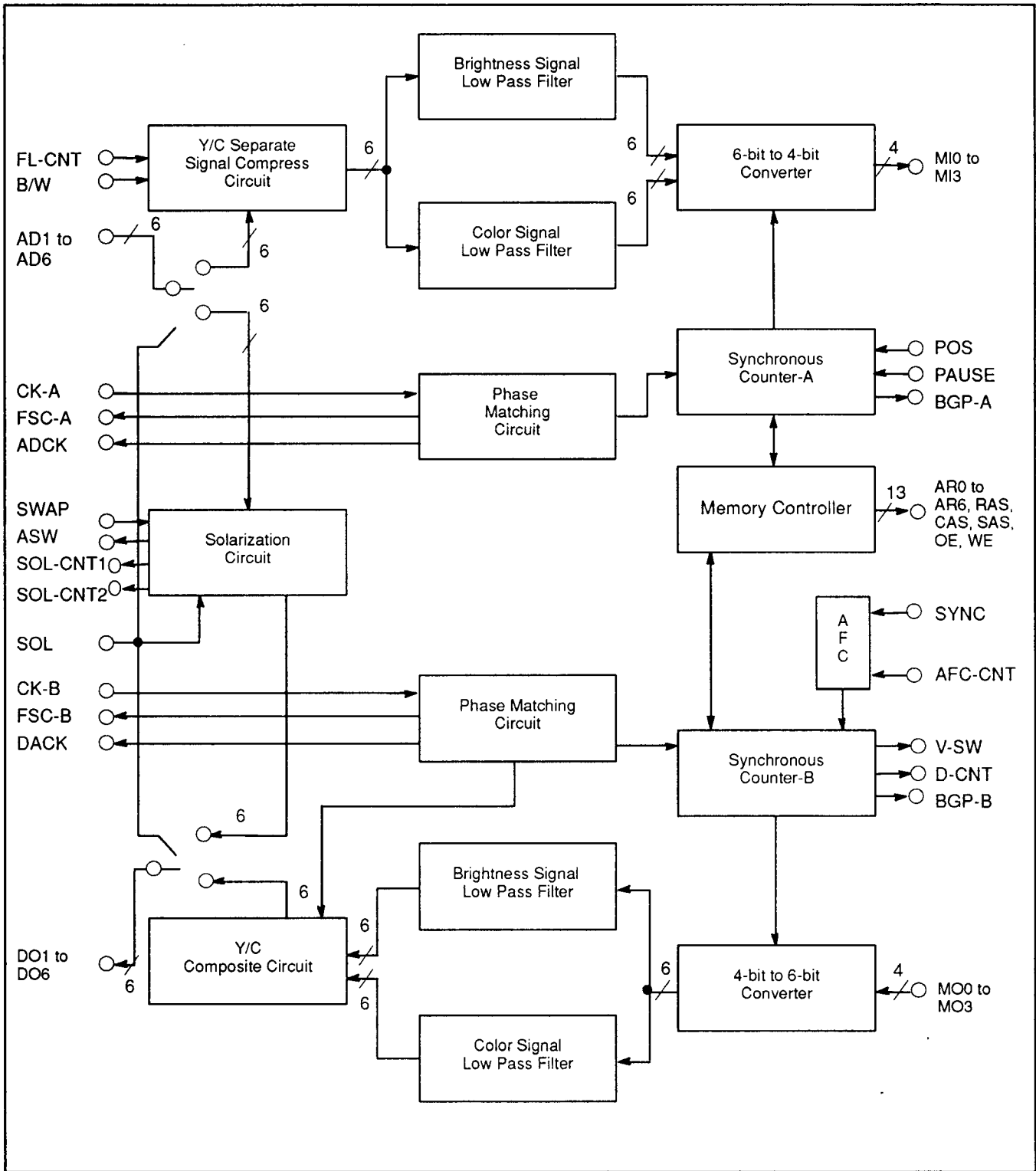
Note: Permanent device damage may occur if absolute maximum ratings are exceeded. Functional operation should be restricted to the conditions as detailed in the operation sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

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.

PIN ASSIGNMENT



BLOCK DIAGRAM



PIN DESCRIPTIONS



Pin No.	Pin Name	I/O	Descriptions	Connection To
1	CK-B	IC	4 fsc input for main picture	MB3511
2	CK-BO	BC	4 fsc AMP output for main picture	MB3511
3	VSS	—	Ground (0V)	GND
4	T-A	IT	Test Pin. This pin is grounded.	GND
5	FSC-B	0	fsc output for main picture (PLL input signal)	MB3511
6	RES	IT	Reset signal input High Level: Reset Mode Low Level: Operating Mode	MB3511
7	V-SW	0	Video switch control signal input for PIP composition	MB3511
8	B/W	IC	Color black and white indication signal output for sub-picture	MB3511
9	SYNC	IT	Composite sync input for main picture	MB3511
10	BGP-B	0	Burst gate pulse output for main picture	MB3511
11	CK-A	IC	4 fsc input for sub-picture	MB3511
12	CK-AO	BC	4 fsc AMP output for sub-picture	MB3511
13	FL-CNT	IC	Sharp mode or smooth mode control input for sub-picture	MB3511
14	ASW	IC	Sub-picture switching control signal output	MB3511
15	FSC-A	0	4 fsc output for sub-picture (PLL input signal)	MB3511
16	VSS	—	Ground (0V)	GND
17	BGP-A	0	Burst gate pulse output for sub-picture	MB3511
18	ADCK	0	Clock output for AD converter	ADC
19 to 24	AD1 to AD6	IT	Video signal input for sub-picture (AD1:MSB, AD6:LSB)	DAC
25 to 30	DA6 to DA1	0	Video signal output for sub-picture (DA6:LSB, DA1:MSB)	DAC
31	DACK	0	Clock output for DA Converter	DAC
32	VDD	—	Supply voltage input (+5 V)	+5V
33	CAS	0	CAS (column address) control output for memory	MB81461
34	ARO	0	Memory address output	MB81461
35	VSS	—	Ground (0 V)	GND
37 to 38	AR1 to AR3	0	Memory address output	MB81461
39	AR7	0	Memory address output	MB81461
40 to 42	AR4 to AR6	0	Memory address output	MB81461
43	RAS	0	RAS (row address) control output for memory	MB81461
44	WE	0	WE (write enable) output for memory	MB81461

Note:

IT: TTL interface input pin

IC: CMOS interface input pin

BC: CMOS interface 3-state pin

Pin No.	Pin Name.	I/O	Descriptions	Connection To
45, 46	MI1, MI0	0	Sub-picture video signal output (memory input)	MB81461
47	OE	0	OE (Out enable) output for memory	MB81461
48	VSS	—	Ground (0 V)	GND
49, 50	MO1, MO0	0	Sub-picture video signal input (memory output)	MB81461
51	SAS	IT	SAS (Serial access) control output for memory	MB81461
52, 53	MO3, MO2	IT	Sub-picture video signal input (memory output)	MB81461
54, 55	MI3, MI2	0	Sub-picture video signal output (memory input)	MB81461
56	SOL	IC	Solarization mode control input  : Solarization mode High Level: Operating mode	MB81461
57	PAUSE	IC	Still picture mode or motion picture mode control input High Level: Motion picture mode Low Level: Still picture mode	
58	POS	ISM	PIP mode selection/sub-picture position control input  : PIP mode/sub-picture position control High Level: Main picture mode	
59	D-CNT	0	PIP mode indication output	
60	SOL-CNT1	0	Solarization mode indication output	
61	SOL-CNT2	0	Solarization mode indication output	
62	SWAP	IC	Main or sub-picture switching control input	MB3511
63	AFC-CNT	IC	AFC (Automatic Frequency Control) proceeding control signal for main picture synchronous signal	
64	VDD	—	Supply voltage input (+5 V)	+5 V

Note:


IT: TTL interface input pin

IC: CMOS interface input pin

ISM: Schmitt trigger input pin

FUNCTIONAL DESCRIPTIONS

Selection of Either Picture-in-Picture Mode or Solarization Mode

POS Pin	SOL Pin	Mode	Note
 5 V	X (Don't Care)	PIP	The sub-picture shifts lower right, upper right, upper left, lower left by instruction of pulse input.
	0 V	Solarization	Main picture with solarization effect is displayed
	5 V	Main picture	Main picture is displayed

Sub-Picture Position Control Function (Picture-in-Picture Mode)

The picture-in-picture mode and sub-picture position are selected by POS pin input level. Input timing is shown in Figure 1 and sub-picture position is shown in Figure 2.

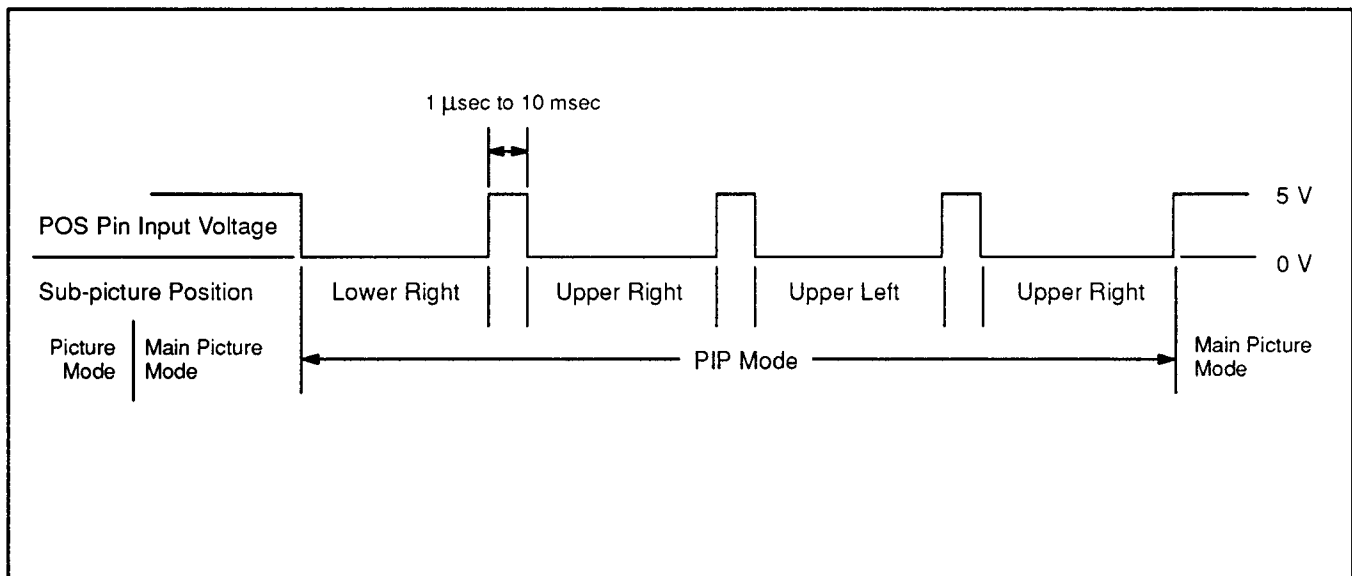


Figure 1. Sub-Picture Position Control Pulse Timing

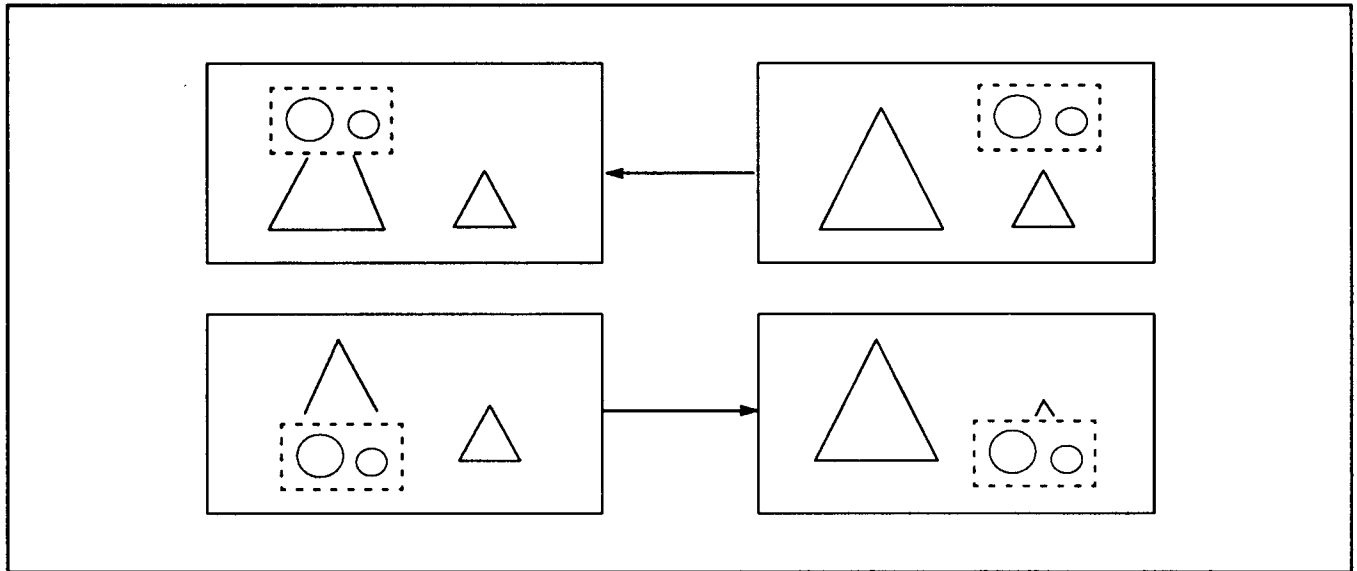


Figure 2. The Order of Sub-Picture Shift in PIP Mode

Selection of Still Picture Mode or Motion Picture Mode of Sub-Picture

The still picture mode or motion picture mode of the sub-picture is selected by PAUSE input voltage level as follows.

PAUSE Pin Level	Sub-Picture Mode	Note
5 V	Motion Picture	All Field
0 V	Still Picture	Single Field

Selection Function of Sub-Picture Quality (Sharp or Smooth)

Sharp mode (clear picture) or smooth mode (soft picture) of sub-picture quality can be selected to control the low pass filter circuit. The mode is selected by FL-CNT input voltage level as follows. Figure 3 shows the low pass filter characteristics.

FL-CNT Pin Level	Sub-Picture Mode	Note
5 V	Sharp	Sub-picture has clear quality
0 V	Smooth	Sub-picture has normal quality

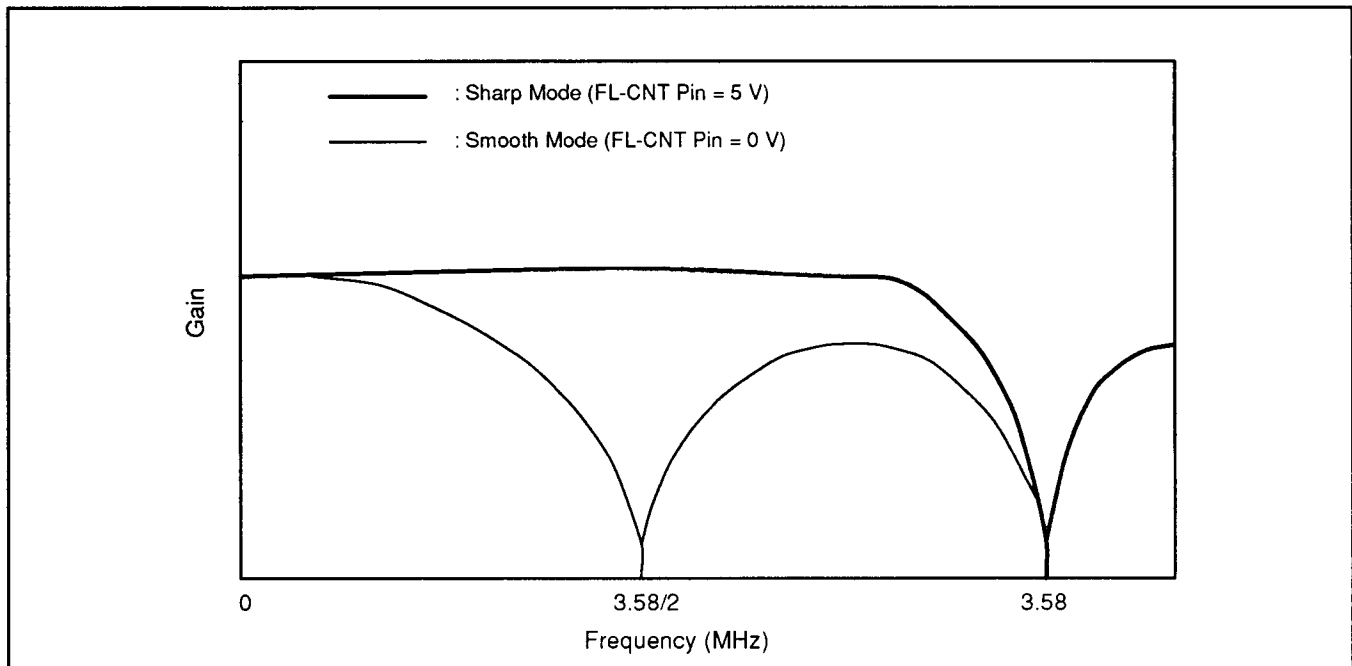


Figure 3. Low Pass Filter Characteristics

AFC Proceeding of Main Picture Synchronous Signal

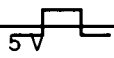
The MB86140 contains the AFC (automatic frequency control) circuit, which compensates the main picture synchronous signal. AFC proceeding is enabled or disabled by the AFC-CNT input level.

AFC-CNT Pin Level	Description
5 V	AFC proceeding is used on the main picture synchronous signal.
0 V	AFC proceeding is not used on main picture synchronous signal.

Solarization Mode

Solarization mode coarsens the brightness of the main picture in three stages. Selection of three levels of solarization, Mode 1, Mode 2, or Mode 3, is done by the SOL pin input level.

When the SOL pin is set to low level, the main picture goes into solarization mode. When a positive pulse between 1 μ s to 10 ms is applied to the SOL pin, the mode shifts to Mode 1, Mode 2, and Mode 3 in that order.

SOL Pin	Mode	Description
	Solarization	The mode shifts to Solarization Mode 1, Mode 2, and Mode 3 in that order.
	Main picture	Normal main picture is displayed.

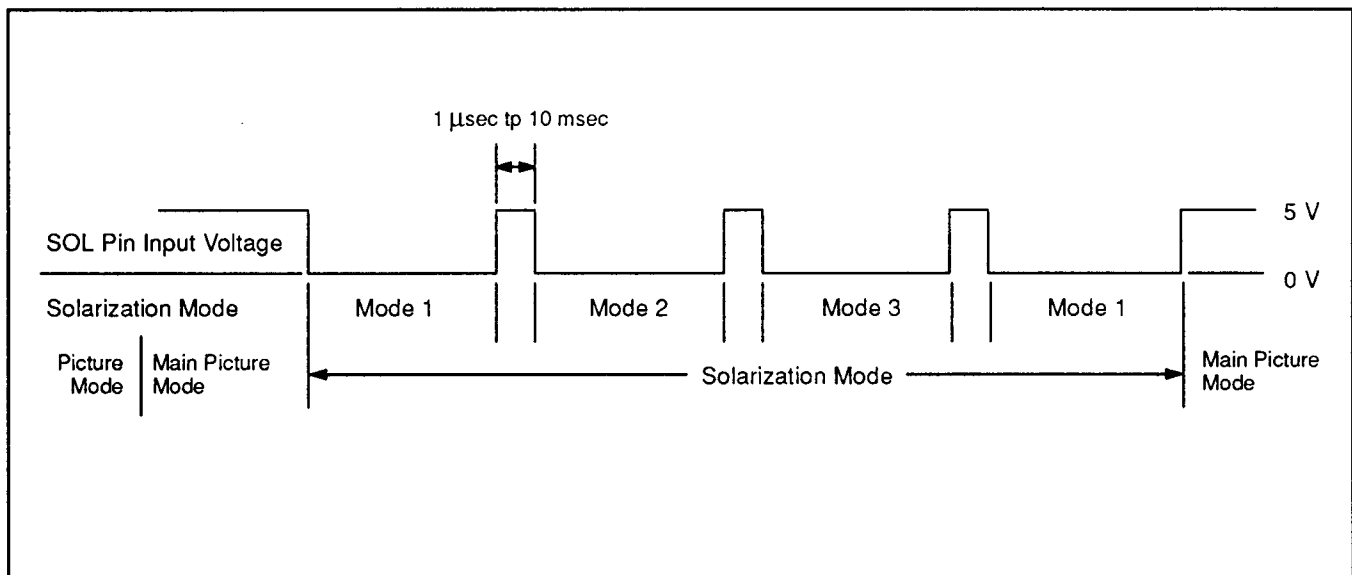


Figure 4. Solarization Mode Control Pulse Timing

Mode Indication Function

Output pins D-CNT, SOL-CNT1, and SOL-CNT2 indicate the condition of PIP mode or solarization mode as follows.

Output Pin Name	Picture-in-Picture Mode	Solarization Mode 1	Solarization Mode 2	Solarization Mode 3
D CNT	High Level	Low Level	Low Level	Low Level
SOL CNT1	Low Level	Low Level	High Level	Low Level
SOL CNT2	Low Level	Low Level	Low Level	High Level

Sub-Picture Position of Picture-in-Picture Mode

The picture area is 216H (vertical) x 682CK (horizontal); it is read by the memory LSI and reduced in sub-picture mode. Sub-picture size in PIP mode is 72H (vertical) x 226CK (horizontal).

The sub-picture positions that can be selected are upper left, upper right, lower right, and lower left. The PIP positions are shown in Figure 5.

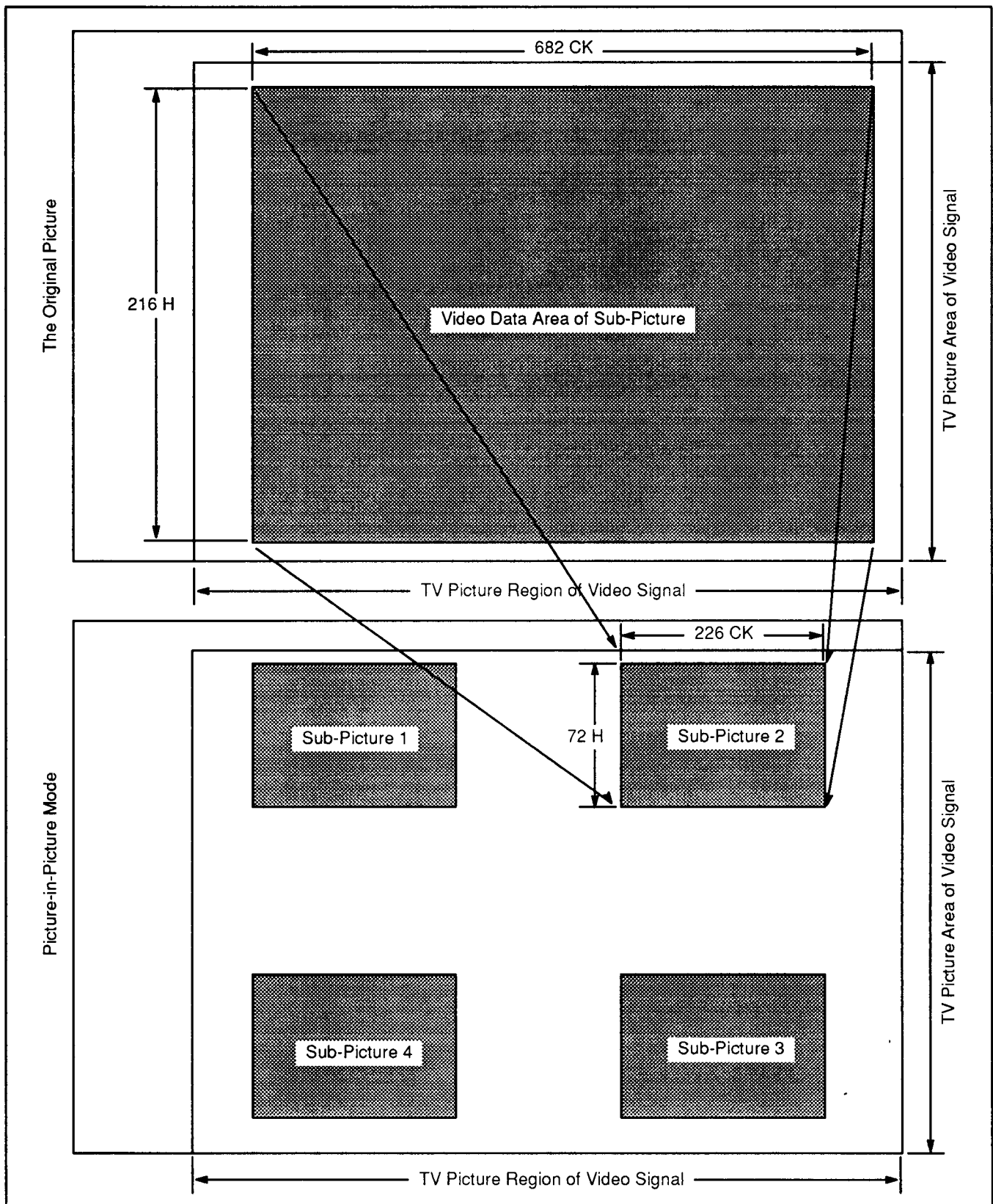


Figure 5. Sub-Picture Position in PIP Mode (CK=4fsc)

RECOMMENDED OPERATING CONDITIONS

 $V_{SS} = 0\text{ V}$

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Supply Voltage	V_{DD}		4.75	5.00	5.25	V
Operating Temperature	T_A		0		70	°C
High-Level Output Current	I_{OH}				-0.4	mA
Low-Level Output Current	I_{OL}				3.2	mA

INPUT/OUTPUT CAPACITANCE

 $T_A = 25\text{ °C}$

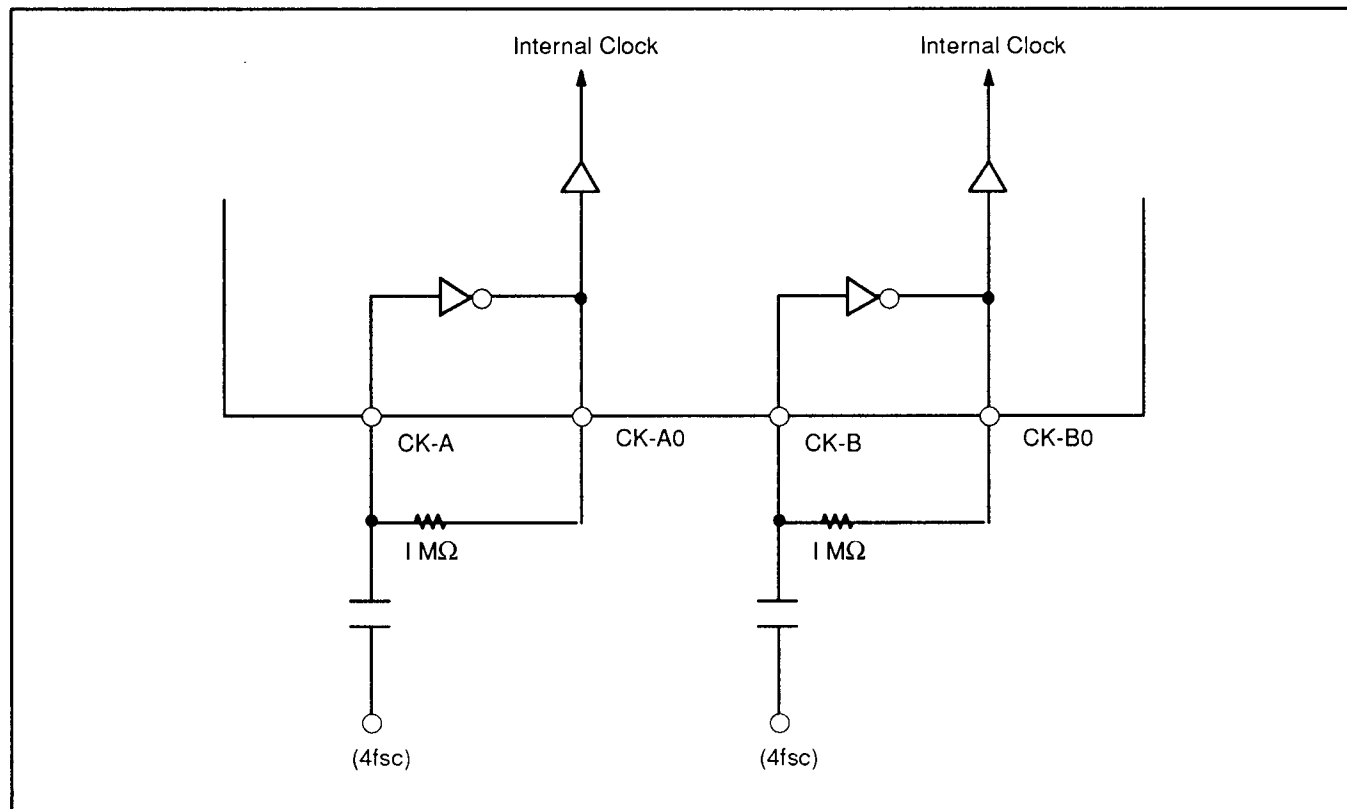
Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Input Pin Capacitance	C_I	$f = 1\text{ MHz}, V_I = V_O = 0\text{ V}$			9	pF
Output Pin Capacitance	C_O	$f = 1\text{ MHz}, V_I = V_O = 0\text{ V}$			9	pF
Input/Output Pin Capacitance	$C_{I/O}$	$f = 1\text{ MHz}, V_I = V_O = 0\text{ V}$			11	pF

DC CHARACTERISTICS

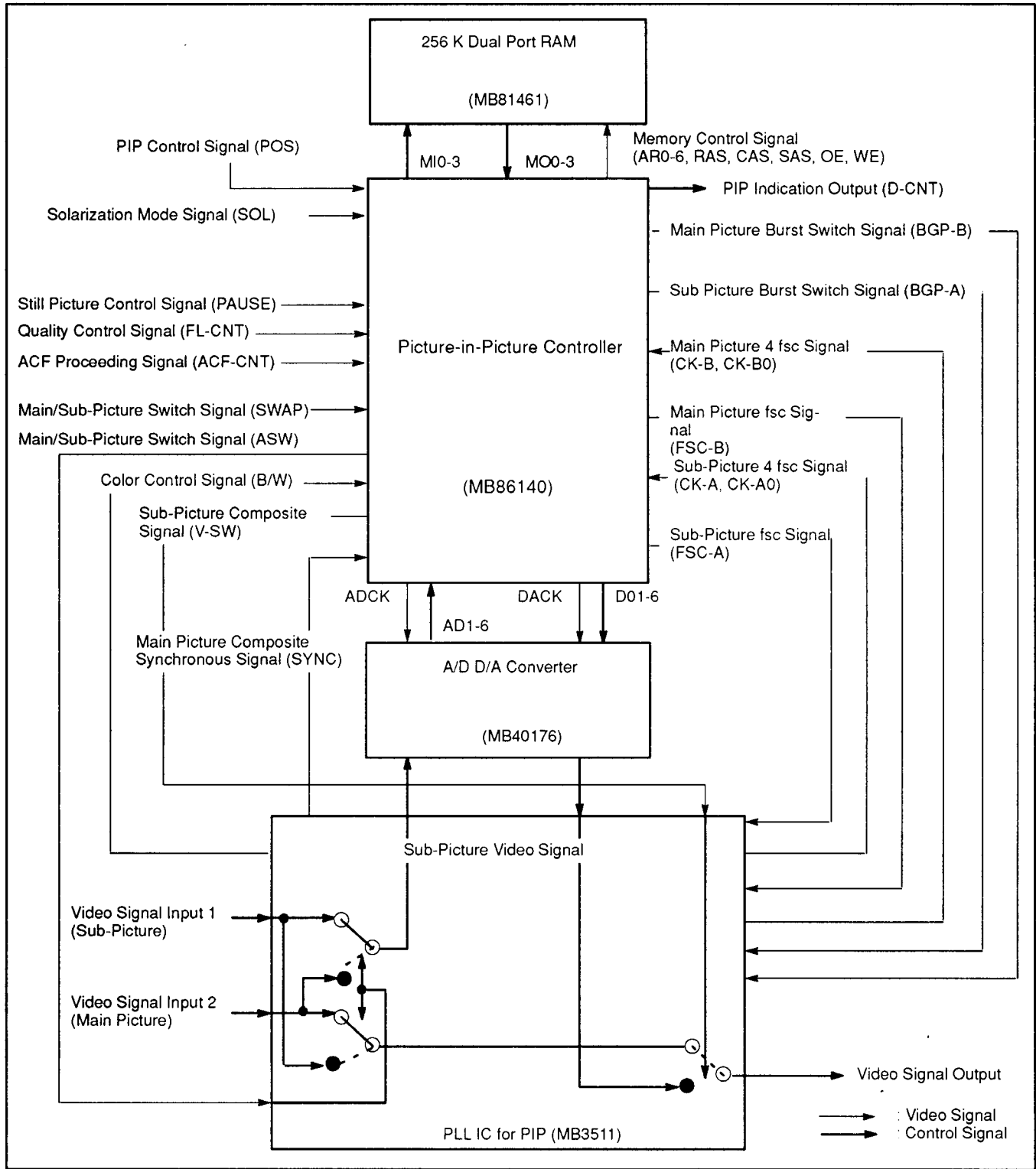
 $V_{DD} = 4.75\text{ to }5.25\text{ V}, V_{SS} = 0\text{ V}, T_A = 0\text{ to }70\text{ °C}$

Parameter	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Supply Current (For Stable State)	I_{DDs}	$V_{IH} = V_{DD}$ or $V_{IL} = V_{SS}$			0.1	mA
High-Level Input Voltage	V_{IH}	TTL Level	2.2			V
		CMOS Level	$V_{DD} \times 0.7$			
		Schmitt Trigger Level	$V_{DD} \times 0.8$			
Low-Level Input Voltage	V_{IL}	TTL Level			0.8	V
		CMOS Level			$V_{DD} \times 0.3$	
		Schmitt Trigger Level			0.6	
High-Level Output Voltage	V_{OH}	$I_{OH} = -0.4\text{ mA}$	4.2		V_{DD}	V
Low-Level Output Voltage	V_{OL}	$I_{OL} = 3.2\text{ mA}$	V_{SS}		0.4	V
Input Leakage Current (For 3-State Pin)	I_{LI}	$V_I = 0\text{ to }V_{DD}$	-10		10	μA
	I_{LZ}		-10		10	

CLOCK INPUT SECTION EQUIVALENT CIRCUIT



APPLICATION CIRCUIT



PACKAGE DIMENSIONS

