M61251AFP

Single-chip NTSC TV signal processor

REJ03F0078-0100Z
Rev.1.0
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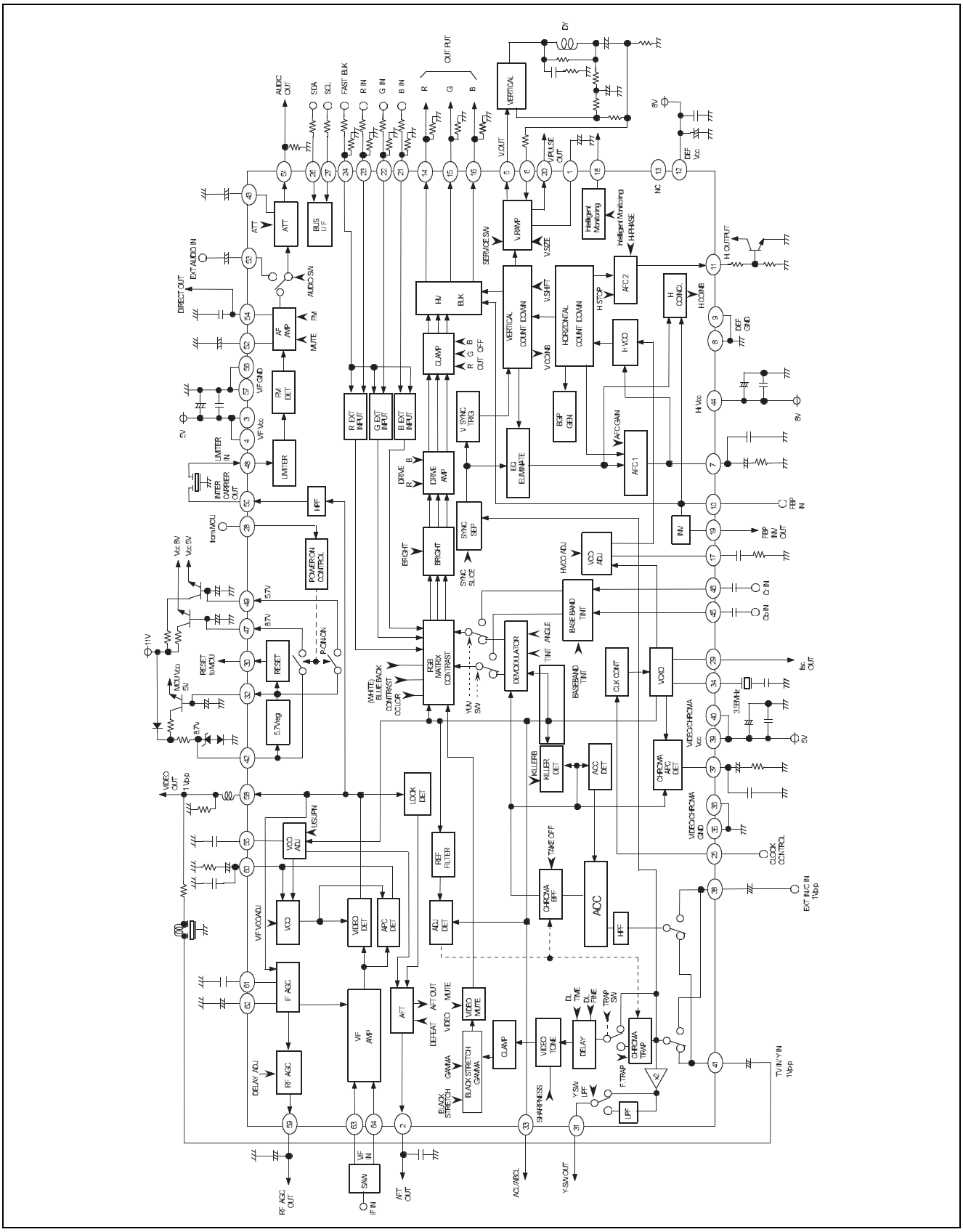
Description

The M61251AFP is a single-chip TV-signal processor IC for the NTSC format and is ideal for use in combination with a microcomputer. Processing circuits for all signals, including intermediate-frequency video and audio, video, color, the on-screen display of characters, and the deflection system are all included, and various functions are controllable via an I^2C bus. Furthermore, a reset circuit, clock circuit, and regulator are included for use with microcomputers.

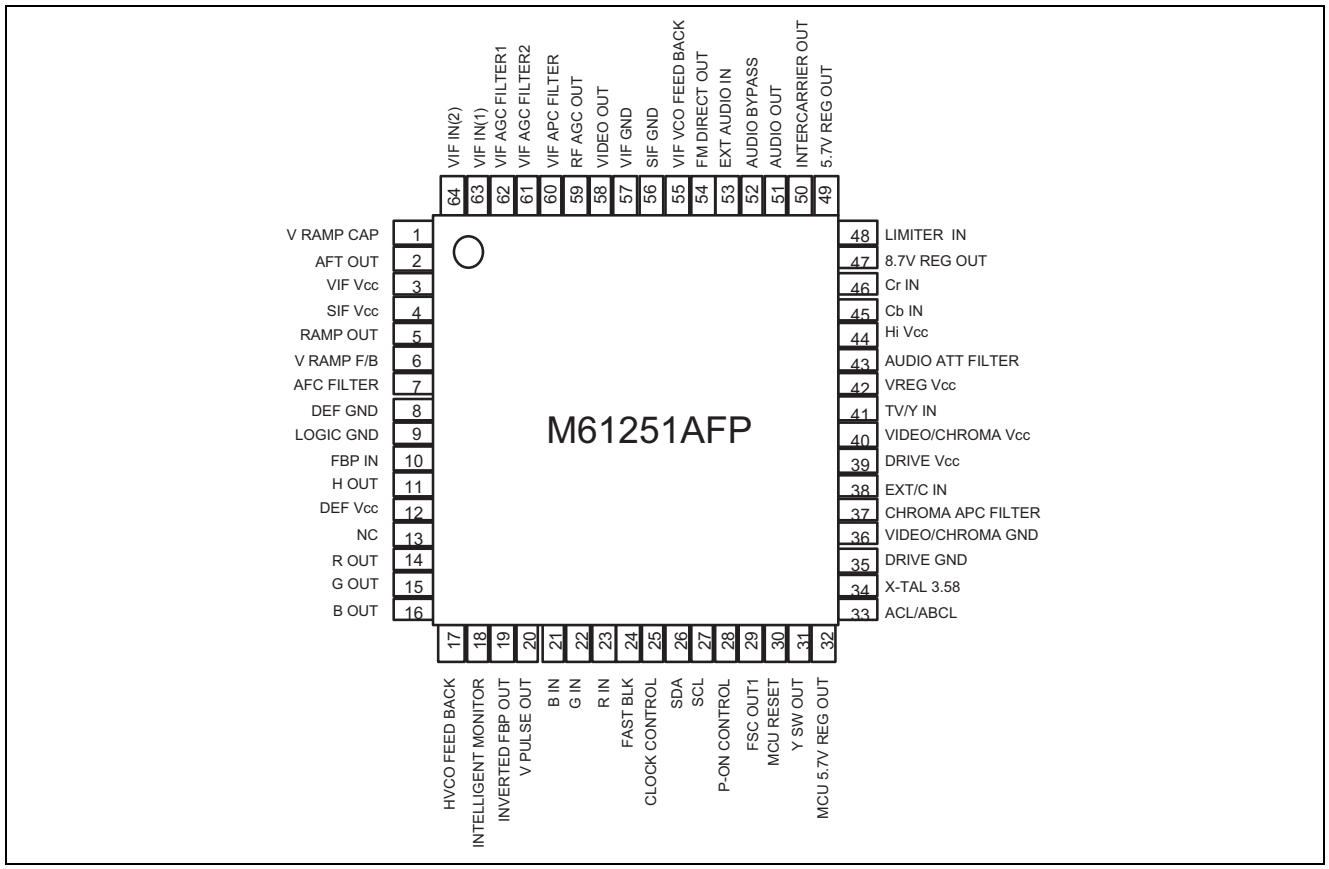
Features

- Handling of VIF does not require a VCO coil
- Adjustment-free audio demodulator
- PLL-SPLIT SIF system with FM radio function
- Supports component video-signal input
- Fsc output available
- ACL or ABCL is selectable
- Built-in horizontal oscillator
- Built-in sawtooth waveform generator for vertical sync
- Self-diagnostic function
- Built-in black-peak hold, AFC2, color killer filter
- Horizontal / vertical pulse output for OSD
- Built-in microcomputer reset circuit
- Built-in microcomputer clock output
- Built-in 5- and 8-V regulators

Block diagram



Pin configuration



Absolute maximum, ratings

Symbol	Parameter	Ratings	Unit
Vcc	Supply voltage	6.0, 10.0	V
Pd	Power dissipation	1325	mW
Kt	Thermal derating	10.6	mW / °C
Topr	Operating temperature	–20 to + 65	°C
Tstg	Storage temperature	–40 to +150	°C

Recommended operating conditions

Supply-voltage terminals	Blocks	Voltage
Pins 3 and 4	VIF / SIF	5.0 V
Pins 39 and 40	Video, chroma	5.0 V
Pin 12	Deflection/CMOS (start - up Vcc)	8.0 V
Pin 44	SIF/ATT, deflection, RGB	8.0 V
Pin 42	Power supply	8.7 V

GND terminals	Blocks
Pins 56 and 57	VIF / SIF
Pins 35 and 36	Video, chroma
Pins 8 and 9	Deflection, CMOS

Electrical characteristics

Function	Block	Parameter	Specification (typ.)	Pin no.	Condition
VIF	IF amplifier	Gain-control range	45 to 108dBμ	63.64	
		Input impedance	2 kΩ, 5pF		
	Video detector	Video output level	1.2 Vpp	58	Negative sync.
		I^2C video-output gain range	+ / – 0.1 Vpp		I^2C: 3 bits
		Video S / N	54 dB		
		Video frequency response	6 MHz		–3dB
		DG / DP	3% / 3deg		
		Intermodulation	50 dB		
	VCO	Frequency	45.75 / 58.75 MHz	–	
		IIC “VIF VCO ADJ” Range	+ / –4 MHz		I^2C: 6bit
	PLL	Capture range	+ / –2 MHz	–	
	IF AGC	IF AGC range	45 to 107 dBμ	–	
	RF AGC	Output range	0.3 to 4.7 V	59	
		I^2C RF delay adj. range	60 to 110 dBμ		I^2C: 7bit
	AFT	Output range	0.3 to 4.7 V	2	
		Sensitivity	10 mV / KHz		
		I^2C output	Below 100 kHz	–	I^2C “AFTO / AFT1”
			Between 100 kHz and f0		
			Between f0 and +100 kHz		
			Over +100 kHz		
SIF	Limiter	Limiting sensitivity	43 dBμ	48	
	FM detector	PLL capture range	4.5 MHz +/ –1.0 MHz	–	
	AF amplifier	FM Direct output level (TV)	500 mVrms	54	Input 4.5 MHz / 25 KHz 100dBμ
		AF S/N	60 dB		
		AMR	55 dB		
		Distortion (T.H.D)	1%		
	Audio ATT	Control range	–70 to 0 dB	51	
		TV / EXT crosstalk	–70 dB		

Electrical characteristics (cont)

Function	Block	Parameter	Specification (typ.)	Pin no.	Condition
Video	Video switch	TV / EXT crosstalk	–55dB	31	at 5 MHz
	Chroma trap	Center frequency	3.58 MHz	–	
		Suppression at subcarrier frequency (fsc)	–30dB		
		Suppression at fsc+/-100 kHz	–25dB		
		Suppression at fsc+/-500 kHz	–10dB		
		Trap fine adjustment			I^2C: 2bits
	Video tone	Delay time	125 ns	–	
		Peak frequency for emphasis	2.5 MHz		
		Control range	–2.5 to +10dB		I^2C: 6 bits
	Delay line	Delay-time adjustment	125 / 250 / 400 / 550nsec	–	I^2C: 2 bits
		Delay fine adjustment	0 / 80nsec		I^2C: 1 bit
	Black stretch	Start Point	60 I RE	–	
		End Stop	8 IRE		
		Max. effect	6dB (25 IRE)		
	Y SW OUT	Gain	6dB	31	
		Y SW LPF cut-off frequency	700 KHz		I^2C “Y SW LPF” : 1
	Video mute	Mute suppression (Y)	–45dB	14. 15. 16	
Chroma	Chroma BPF	Center frequency	3.58 MHz	–	
		2 - MHz suppression	–22 dB		
	ACC	ACC range	+6 to –22 dB	–	
		Overload	chroma 169%		
	VCXO	fo	3.579545 MHz	14, 15, 16	
		fsc out 1 level - 1	1Vpp	29	Pin25 CLK CONT : High
		fsc out 1 level - 2	OFF		Pin25 CLK CONT : Low
	APC	Pull - IN	+ / –600 Hz	14, 15, 16	APC Filter 1µF+4.7K//0.015µF
	Color killer detector	Color killer level	–45dB	–	
		Suppression	–40dB		
	Demodulator	Tint control	+/- 45deg	–	I^2 C 7bit
		Demodulation angle	103deg / 95deg		I^2 C”C Angle 95”
		Carrier leakage	–40dB		
		Demodulation ratio	(B - Y) : (R –Y) = 1:0.55		

Electrical characteristics (cont)

Function	Block	Parameter	Specification (typ.)	Pin no.	Condition
RGB	Matrix	Color control		14, 15, 16	I^2C: 7 bits
		Max. attenuation	–45dB		B / W mode at I^2C data = 0
	External RGB	Input level	Digital: 1 Vp-p Analog: 0.7 Vp-p	21, 22, 23	I^2C Analog OSD”
		OSD speed (rise)	0.02µs		
		OSD speed (fall)	0.02µs		
	Contrast control	Range of control	–40 to 3dB	14, 15, 16	I^2C: 7 bits
			External control	33	Decoupling 0.1 µF
	Brightness control	Range of control	–0.85 to + 0.85 V	14, 15, 16	I^2C: 8 bits
			External control	33	De-coupling 0.1 µF
	Drive control	Range of control	+ / -3dB (R / B)	14, 16	I^2C: 7 bits
	Cut-off	Range of control	+0.9 to –0.9 V	14, 15, 16	
	RGB OUT	Output pedestal voltage	2.4 V	14, 15, 16	Open emitter output
		Distribution of output voltage	Less than 300 mW		
		Clamp ability	100%		
		Output blanking voltage	0.3 V		
MCU reset	Reset	Pin 32 voltage detection	4.2 V	30	
		Reset polarity	Low reset		
		Maximum sink current	4 mA		
Power supply	VREG Vcc	Supply voltage (P-ON)	8.7 V	42	
	MCU 5.7 V REGOUT	Output voltage	5.7 V	32	
		Maximum output current	2.5 mA		
	5.7 V REGOUT	Output voltage	5.7 V	49	Pin 28 (Power on control) = 5 V
		Maximum output current	5 mA		Pin 28 (Power on control) = 5 V
	8.7 REGOUT	Output voltage 1	8.7 V	47	Pin 28 (Power on control) = 0 V
		Output voltage 2	0 V		
		Maximum output current	1 mA		

Electrical characteristics (cont)

Function	Block	Parameter	Specification (typ.)	Pin no.	Condition
Deflection	Sync. separation	Slice level	50% / 25%	–	I^2C "S SiliceDown1"
			50% / 45%		I^2C "S SiliceDown2"
	Horizontal VCO	Horizontal VCO free-running frequency	15.734 KHz	11	
		Horizontal VCO adjustment	fH+ / –500 KHz		I^2C: 3 bits
	AFCI	Horizontal pull-in range	+/–500 Hz (normal)	11	Filter 1uF 6.2 K / 0.01 uF
			+/–800 Hz (fast)		
	Horizontal phase	Range of control	+/–1.6µs	11	I^2C: 5 bits
		Horizontal pulse timing	8.5µs		
		Horizontal pulse width	25µs		
	Inverter FBP OUT	Output range	0.1 to 5.0 V	19	
	Vertical count down	Vertical free-running frequency	60 Hz	5	
		Vertical pull - in range	55 to 67 Hz		
		Vertical position adjustment	8 Positions		I^2C: 3 bits
		Vertical position step	2Horizontal Line / Step		
		V-ramp variable range	2 Vpp +/- 0.8Vpp		I^2C: 7 bits
		V-pulse width (pulse mode)	0.5ms		
		V-BLK width (pulse mode)	1.5ms		
I^2C bus	I^2C bus	Acknowledge current	5 mA	26, 27	
		SCL/SDA Vth (high)	0.75 V		
		SCL/SDA Vth (low)	4.25 V		
		Clock frequency	100 KHz		

Bus table

Slave address = BAH (write), BBH (read)

A6	A5	A4	A3	A2	A1	A0	R / W
1	0	1	1	1	1	1	1 / 0

Write table (input bytes)

SUB ADDRESS		DATA								
HEX	BIN	D7	D6	D5	D4	D3	D2	D1	D0	INITIAL
		(inhibited)	RF Felay Adj							
00H	00000000	0	1	0	0	0	0	0	0	40H
		(inhibited)	VIFFreq5875	VIF VCD ADJ						
01H	00000001	0	0	1	0	0	0	0	0	20H
		Video Mute	Audio EXT	C. Clip level	TRAP Off	Video T Sharp	ABCL	Black Stre. Off	Take Off	
02H	00000010	0	0	0	0	0	0	0	0	00H
		Audio Mute	Audio ATT							
03H	00000011	0	0	0	0	0	0	0	0	00H
		ABCL Gain	AFT Defeat	Video Tone						
04H	00000100	0	0	V1	V0	V0	V0	V0	V0	20H
		EXTRGB C. Clip	Contrast Control							
05H	00000101	V0	V1	V0	V0	V0	V0	V0	V0	40H
		VIF Video Out Gain			Y/C	EXT	Y DL Fine Adj	Y DL Time Adj		
06H	00000110	1	0	0	V0	V0	0	0	0	80H
		VIF Defeat	Tint Control							
07H	00000111	0	V1	V0	V0	V0	V0	V0	V0	40H
		Blue Back	Color Control							
08H	00001000	V0	V1	V0	V0	V0	V0	V0	V0	40H
		HV BLK OFF	VOUT STOP	FSC FREE	HTONE SW	(inhibited)				
09H	00001001	0	0	0	0	0	1	0	0	04H
		Brightness Control								
0AH	00001010	V1	V0	V0	V0	V0	V0	V0	V0	80H
		(inhibited)	DRIVE (R)							
0BH	00001011	0	1	0	0	0	0	0	0	40H
		(inhibited)	DRIVE (B)							
0CH	00001100	0	1	0	0	0	0	0	0	40H
		Cut Off (R)								
0DH	00001101	1	0	0	0	0	0	0	0	80H
		Cut Off (G)								
0EH	00001110	1	0	0	0	0	0	0	0	80H
		Cut Off (B)								
0FH	00001111	1	0	0	0	0	0	0	0	80H
		White Back	V-free	(inhibited)			H VCO Adj			
10H	00010000	0	0	1	0	0	1	0	0	24H
		(inhibited)		V-Size						
11H	00010001	0	0	1	0	0	0	0	0	20H
		Monitoring				Gamma Control		TRAP Fine Adj		
12H	00010010	0	0	0	0	0	0	0	0	00H
		H-free	V. 1Windows	YSW LPF	H Start	Service SW	V Shift			
13H	00010011	0	0	0	0	0	0	0	0	00H
		Black Strech Discharge		Black Strech Charge		S.Slice Down2	S.Slice Down1	(inhibited)		
14H	00010100	0	0	0	0	0	0	1	1	03H
		AFC1 Gain	AFC2 Gain	OSD level	Analog OSD	US/JPN SW			Killer level	
15H	00010101	0	0	0	0	0	0	0	0	00H
		VSYNCDET	Auto Slice down	FBP Vth L	AFC2 H Phase					
16H	00010110	1	0	0	1	0	0	0	0	90H
		YUV SW	Baseband Tint Control							
17H	00010111	0	V1	V0	V0	V0	V0	V0	V0	40H
		Test1		(inhibited)						
18H	00011000	0	0	0	0	0	0	0	0	00H
		BGPFBP OFF	Test2	(inhibited)						
19H	00011001	0	0	0	0	0	0	0	0	00H
		Test3		(inhibited)						
1AH	00011010	0	0	0	0	0	0	0	0	00H
		(inhibited)								
1BH	00011011	0	0	0	0	0	0	0	0	00H
		(inhibited)								
1CH	00011100	0	0	0	0	0	0	0	0	00H

NOTE: V0/V1 ==> V–LATCH BIT

Read table (output bytes)

SUB ADDRESS		D7	D6	D5	D4	D3	D2	D1	D0
00H	00000000	KILLERB	(not assigned)	STPETB	VCOINB	AFT 0	AFT 1	HCOINB	(not assigned)

Bus table

Write

	Function	Bit	Sub-address	Data	Description	Initial value	Note
VIF	RF delay adjustment	7	00H	D0 to D6	RF AGC delay point adjustment	40H	
	VIF VCO adjustment	6	10H	D0 to D5	VIF VCO free-run frequency adjustment (VIF defeat = 1, AFT output: center)	20H	
	VIF frequency 58, 75	1	01H	D6	IF output at 45.75 / 58.75 MHz. 0: 45.75 MHz, 1: 58.75 MHz	0	
	VIF video out gain	3	06H	D5 – D7	Adjustment of output level for VIF-demodulated video waveform on pin 58	80H	
	AFT defeat	1	04H	D6	AFT output on / off (defeat). 0: AFT on (non defeat), 1: defeat	0	
	VIF defeat	1	07H	D7	VIF gain normal/minimum. 0: AGC function, 1: defeat (minimum gain)	0	
SIF	Audio attenuation	7	03H	D0 to D6	Pin 51 audio-output level adjustment	00H	
	Audio EXT	1	02H	D6	Switches between the internal and external-input audio signals. 0: internal, 1: external	0	
	Audio mute	1	03H	D7	Pin 54 audio direct output on / off (mute). 0: audio on (no mute), 1: mute	0	

Write (Cont)

	Function	Bit	Sub-address	Data	Description	Initial value	Note
VIDEO	Video tone	6	04H	D0 to D5	Sharpness level control	20H	V Latch
	Contrast control	7	05H	D0 to D6	Contrast level control	40H	V Latch
	EXTRGB contrast clip	1	05H	D7	EXT RGB contrast lower limit clipping on/off. 0: clipping on, 1: clipping off	0	V Latch
	C. clip level	1	02H	D5	EXT RGB contrast lower-limit clipping level. 0: low (20H), 1: high (40H)	0	
	Y delay time adjustment	2	06H	D0 to D1	Y signal delay adjustment	X0H	
	Y delay fine adjustment	1	06H	D2	Y signal delay fine adjustment	0	
	EXT	1	06H	D3	Selects video input on pin 41 or 38. 0: pin 41, 1: pin 38	0	V Latch
	Y / C	1	06H	D4	Selects composite input or YC on pin 38 or 41. 0: composite, 1: Y / C mode	0	V Latch
	Y SW LPF	1	13H	D5	Pin 31 (Y SW OUT) output frequency characteristic. 0: flat, 1: LPF (fc = 700 kHz)	0	
	Video tone sharpness	1	02H	D3	Selects one of two video-tone levels (sharp or soft). 0: standard, 1: sharp	0	
	Video mute	1	02H	D7	Y-signal output on / off (video mute). 0: mute off, 1: mute	0	
	TRAP off	1	02H	D4	Y-signal chroma trapping on / off. 0: trapping on, 1: trapping off	0	
	TRAP fine adjustment	2	12H	D0 – D1	Chroma-trapping frequency fine adjustment	X0H	
	Black stretch off	1	02H	D1	Black - stretch circuit on / off. 1: on, 1: off	0	
	Black stretch charge	2	14H	D4 – D5	Adjustment of charge - time - constant for black stretch	0XH	
	Discharge	2	14H	D6 to D7	Adjustment of discharge – time - constant for black stretch	0XH	
	Gamma control	2	12H	D2 to D3	Gamma-level adjustment	X0H	
CHROMA	Tint control	7	07H	D0 to D6	Hue control	40H	V Latch
	Baseband tint control	7	17H	D0 to D6	YUV input hue control	40H	V Latch
	YUV SW	1	17H	D7	Switches between YUV and other input mode	0	
	Color control	7	08H	D0 to D6	Color level control	40H	V Latch
	Take off	1	02H	D0	Chroma BPF take-off on / off, 0: BPF, 1: take-off	0	
	JS / JPN / SW	1	15H	D1 to D3	US / JPN modes, 100: US mode, 011: JPN mode	0	
	Killer level	1	15H	D0	Color killer sensitivity, 0: 43 dB, 1: 45 dB	0	
	Fsc free	1	09H	D5	Crystal oscillator circuit forced free-running mode. 0: off, 1: free-running	0	

Write (Cont)

	Function	Bit	Sub-address	Data	Description	Initial value	Note
R G B	Brightness control	8	0AH	D0 to D7	Brightness level control	80H	V Latch
	Drive (red)	7	0BH	D0 to D6	Red-output level control	40H	
	Drive (blue)	7	0CH	D0 to D6	Blue-output level control	40H	
	Cut-off (red)	8	0CH	D0 to D7	Red-output DC-level control	80H	
	Cut-off (green)	8	0EH	D0 to D7	Green-output DC-level control	80H	
	Cut-off (blue)	8	0FH	D0 to D7	Blue-output DC-level control	80H	
	Blue background	1	08H	D7	Blue-background screen on / off. 1: off, 1: blue background	0	
	White background	1	10H	D7	White background on / off, 1: off, 1: white background	0	
	ABCL	1	02H	D2	ABCL on/off. 0: off, 1: ABCL on	0	
	ABCL gain	1	04H	D7	ABCL sensitivity low / high. 0: low, 1: high	0	
	On-screen display level	1	15H	D5	On-screen display level (70 / 90%). 0: 70%, 1: 90%	0	
	Halftone SW	1	09H	D4	Halftone on / off. 0: off, 1: on	0	
	Analog on-screen display	1	15H	D4	On-screen display digital / analog input. 0: digital, 1: analog	0	

Write (Cont)

	Function	Bit	Sub-address	Data	Description	Initial value	Note
DEF	AFC2 horizontal phase	5	16H	D0 to D4	Adjustment of horizontal phase of display	90H	
	Ramp stop	1	09H	D6	Pin 5 VOUT (ramp / pulse) forcible stop mode (when stopped, pin 5 is at ground level). 0: VOUT, 1: stopped	0	
	Service switch	1	13H	D3	Vertical output on / off, 0: vertical output on, 1: vertical output off	0	
	Horizontal start	1	13H	D4	Horizontal output out / stopped. 0: stopped, 1: H OUT	0	
	AFC1 gain	1	15H	D7	Horizontal AFC gain high / low. 0: low, 1: high	0	
	AFC2 gain	1	15H	D6	Horizontal AFC2 gain high/low. 0: high, 1: low	0	
	Horizontal VCO adjustment	3	10H	D0 to D2	Adjustment of horizontal VCO free-running frequency	24H	
	Vertical shift	3	13H	D0 to D2	Adjustment of vertical ramp start timing	X0H	
	Vertical size	6	11H	D0 to D5	Adjustment of vertical ramp amplitude	20H	
	Horizontal free	1	13H	D7	Horizontal output forced free-run mode on/off. 0: off, 1: horizontal free-run	0	
	Vertical free	1	10H	D6	Vertical output forced free-run mode on/off. 0: off, 1: vertical free-run	0	
	S slice down 1	1	14H	D2	Sync detection slice level (50 / 30%). 0: 50%, 1: 30%	0	
	S slice down 2	1	14H	D3	Sync detection slice level (50 / 40%), 0: 50%, 1: 40%	0	
	Auto slice down	1	16H	D6	Synchronous detection slice level during video period, 0: Slice level remains constant, 1: slice level decreased during video period	0	
	FBP Vth L	1	16H	D5	Pin 10 (FBP in) FBP slice level. 0: Vth = 2 V (HBLK width: narrow), 1: Vth = 1 V (HBLK width: wide)	0	
	HV BLK OFF	1	09H	D7	Horizontal / vertical blanking. 0: blanking ON, 1: blanking OFF	0	
	Vertical sync. detection	1	16H	D7	Minimum width for vertical sync detection. 0: synchronous detection width = 18 us, 1: synchronous detection width = 14 us	90H	
	One window	1	13H	D6	Minimum width for vertical sync detection (1 / 2 windows). 0: 2 windows, 1: 1 window	0	
	BGPFBP off	1	19H	D7	Internal BGP on / off when there is no FBP input. 0: BGP on, 1: BGP off	0	

Write (Cont)

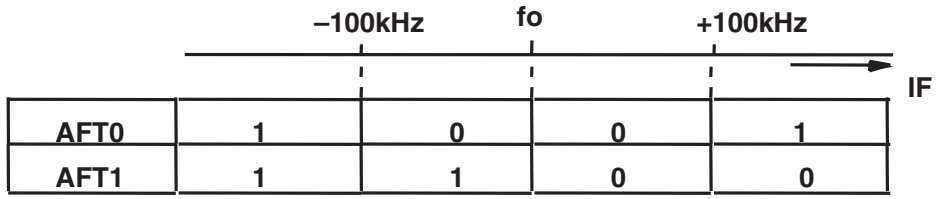
Function	Bit	Sub-address	Data	Description	Initial value	Note
Monitoring	4	12H	D4 to D7	Pin 18 intelligent monitoring mode switch	0XH	
Test 1	1	18H	D6 to D7	Reserved (test bit)	0	
Test 2	2	19H	D6	Reserved (test bit)	0	
Test 3	2	1AH	D6 to D7	Reserved (test bit)	0	

Read:

KILLERB	1	00H	D7	Color killer information output; 1 when killer is off.
AFTO	1	00H	D3	AFT information output (note 1)
AFT1	1	00H	D2	AFT information output (note 1)
HCOINB	1	00H	D1	Horizontal sync detection, not synchronized = 1
VCOINB	1	00H	D5	Vertical sync detection, not detected = 1
STDETB	1	00H	D4	Station detection in TV mode, not detected = 1

Note 1: AFT0 / AFT1, read byte: AFT OUTPUT

AFT0/AFT1 <READ BYTE: AFT OUTPUT>



Intelligent monitor

(1) Sub-address: 12H D4 to D7 (4 bits)
(2) Output pin: pin 18
(3) Specifications

Decimal	Hexadecimal	Binary				Output signal	Vcc voltage	Specifications		AC / DC
		D7	D6	D5	D4					
0	0X	0	0	0	0	Composite sync	8V	0 / 5 V	Positive sync.	AC
1	1X	0	0	0	1	AFT OUT (pin2)	5V			DC
2	2X	0	0	1	0	RF AGC OUT (pin59)	5V	95 / 100		DC
5	5X	0	1	0	1	TV / Y IN (pin41)	5V		1 Vp-p (typ.)	AC
6	6X	0	1	1	0	G OUT (pin15)	8V	1 / 2		AC
7	7X	0	1	1	1	R OUT (pin14)	8V	1 / 2		AC
8	8X	1	0	0	0	B OUT (pin16)	8V	1 / 2		AC
9	9X	1	0	0	1	ACL (pin33)	5V	0 dB		DC
10	AX	1	0	1	0	HOUT	5V	0 / 4 V	Positive sync.	AC
11	BX	1	0	1	1	VIF VCC (pin10)	8V	0 / 4.75 V		AC
12	CX	1	1	0	0	VIF VCC (pin 3,4)	5V			AC
13	DX	1	1	0	1	START UP VCC (pin 12)	8V	1 / 3		DC
14	EX	1	1	1	0	VIDEO / CROMA VCC (pin 39 40)	5V			DC
15	FX	1	1	1	1	HI VCC (pin44)	8V	1 / 3		DC

Package Dimensions

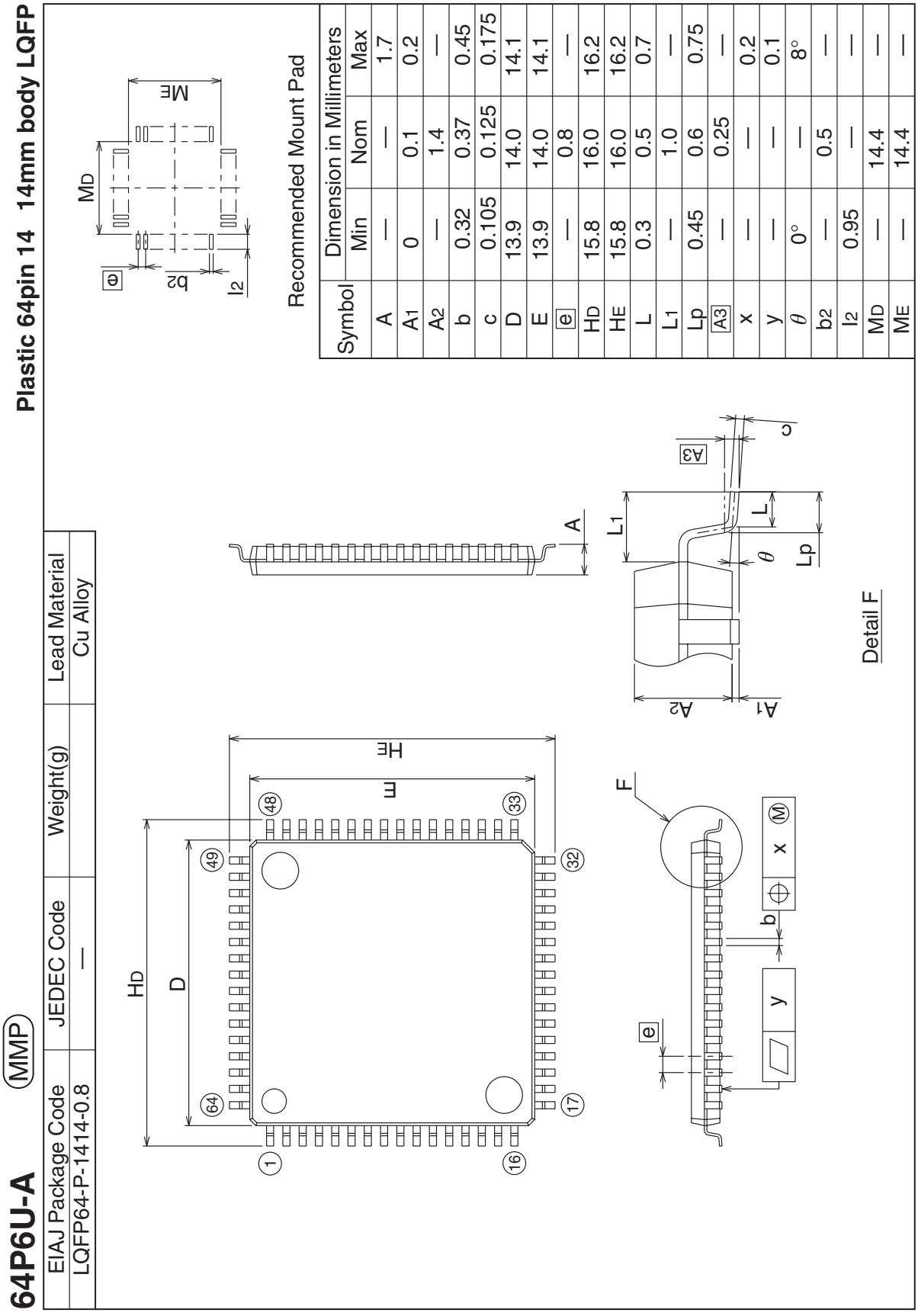
Plastic 64pin 14 14mm body LQFP

64P6U-A (MMP)

EIAJ Package Code	JEDEC Code	Weight(g)	Lead Material
LQFP64-P-1414-0.8	—		Cu Alloy

Recommended Mount Pad

Symbol	Dimension in Millimeters		
	Min	Nom	Max
A	—	—	1.7
A_1	0	0.1	0.2
A_2	—	1.4	—
b	0.32	0.37	0.45
c	0.105	0.125	0.175
D	13.9	14.0	14.1
E	13.9	14.0	14.1
e	—	0.8	—
H_D	15.8	16.0	16.2
H_E	15.8	16.0	16.2
L	0.3	0.5	0.7
L_1	—	1.0	—
Lp	0.45	0.6	0.75
A3	—	0.25	—
x	—	—	0.2
y	—	—	0.1
θ	0°	—	8°
b_2	—	0.5	—
l_2	0.95	—	—
M_D	—	14.4	—
M_E	—	14.4	—



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