

MITSUBISHI ICs (TV)
M52015FP

NTSC VIDEO CHROMA SIGNAL PROCESSOR

DESCRIPTION

The M52015FP is a semiconductor integrated circuit for processing video signals in an NTSC system color LCD TV. It contains ACC, color signal demodulator, picture quality control, APC, VCXO, RGB matrix amplifier, tint and killer circuits.

FEATURES

- Low supply voltage, low power dissipation IC
- Picture soft/sharp-adjustable via picture quality control circuit
- Primary color contrast control
- 24-pin flat package

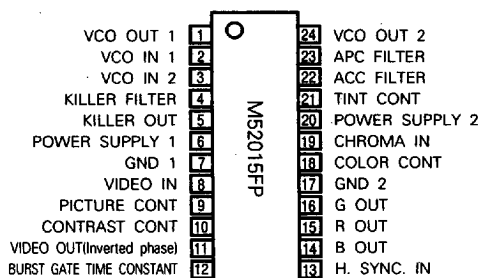
APPLICATION

LCD TV

RECOMMENDED OPERATING CONDITION

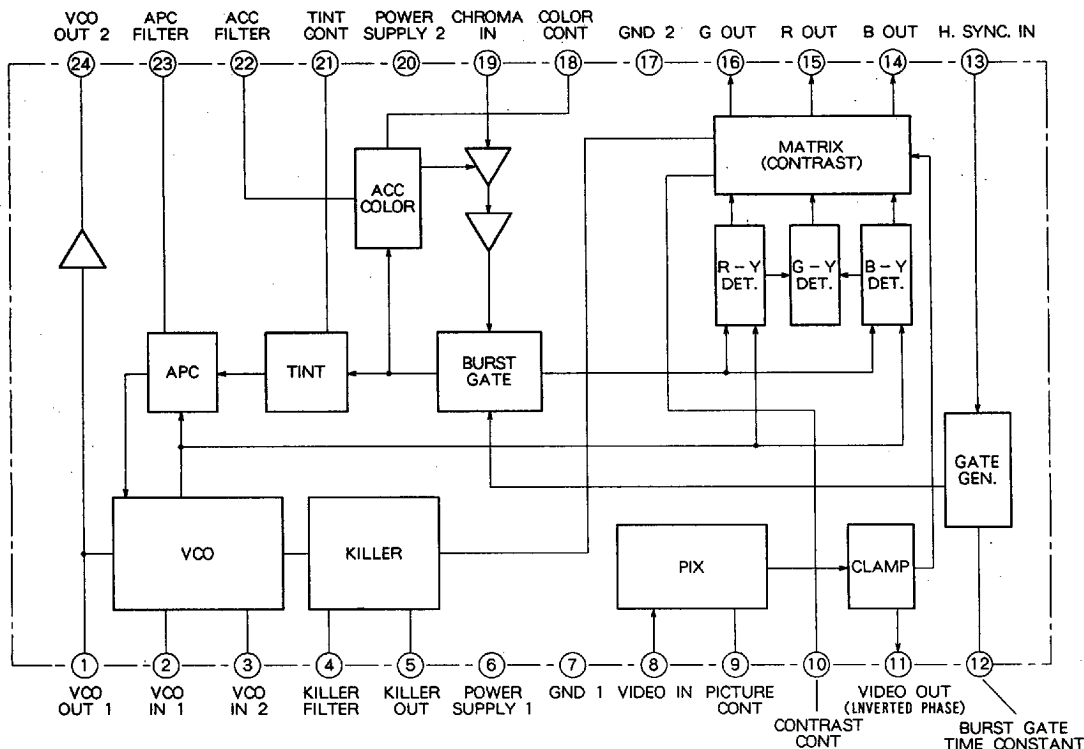
Supply voltage range.....3.5~4.5V
 Rated supply voltage4.0V

PIN CONFIGURATION (TOP VIEW)



Outline 24P2W-D

BLOCK DIAGRAM



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2-617

NTSC VIDEO CHROMA SIGNAL PROCESSOR

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
V _{CC}	Supply voltage	4.8	V
V _{IN2}	Input amplitude at pin ②	500	mV _{P-P}
I _{OUT5}	Output current at pin ⑤	800	mA
I _{OUT11}	Output current at pin ⑪	900	mA
V _{IN13}	Input voltage at pin ⑬	V _{CC} + 0.3	V
I _{OUT} ¹⁴ 15 16	Output current at pins ⑭, ⑮ and ⑯	900	mA
I _{OUT24}	Output current at pin ⑳	450	mA
P _d	Power dissipation	500	mW
T _{opr}	Operating temperature	-20~75	°C
T _{stg}	Storage temperature	-40~125	°C

ELECTRICAL CHARACTERISTICS (T_a = 25°C, V_{CC} = 4.0V, unless otherwise noted)

Symbol	Parameter	Test conditions/Method	Limits			Unit
		Circled numerals indicate pin numbers	Min.	Typ.	Max.	
I _{CC}	Circuit current	Measure input current with 4V _{CC} applied to pins ⑥ and ⑫.	8.0	13.0	19.0	mA
VIDEO SECTION *						
Y _{max}	Maximum output	Input 100kHz sine wave of 0.3V _{P-P} to pin ③, and measure output amplitude at pin ④ with 4V _{CC} at pin ⑤.	1.8	2.2		V _{P-P}
GY	Video amplifier gain	Input 100kHz sine wave of 0.3V _{P-P} to pin ③, measure output amplitude at pin ④ when voltage at pin ⑤ is 2V _{CC} , and calculate output/input amplitude ratio.	10.5	13.0	15.0	dB
Y _{CTRST} (2)	Contrast control characteristics	Input 100kHz sine wave of 0.3V _{P-P} to pin ③, measure output amplitude at pin ④ when voltage at pin ⑤ is changed to 2, 0.5 and 0V _{CC} , and calculate ratio of measured amplitude to that in 6Y.	1.0	3.4	5.8	dB
Y _{CTRST} (0.5)			-12.0	-5.5	0	dB
Y _{CTRST} (0)				-23	-20	dB
Y _{tone} (4)	Picture quality control characteristics	Input 1.5MHz sine wave of 0.3V _{P-P} to pin ③, measure output amplitude at pin ④ when voltage at pin ⑤ is changed to 2, 4 and 0V _{CC} with voltage at pin ⑥ set at 1V _{CC} , and calculate ratio of measured amplitude to that obtained with pin ⑤ voltage at 2V _{CC} .	-4.0	-2.7	-1.5	dB
Y _{tone} (0)			3.0	6.3	10.0	dB
Y _{FREQ}	Frequency characteristics	Input 100kHz and 2MHz sine waves of 0.3V _{P-P} in sequence to pin ③, and measure output amplitude at pin ④ for each input with voltages at pins ⑤ and ⑥ set at 2V _{CC} and 1V _{CC} , respectively. Then calculate output amplitude ratio for 2MHz/100kHz input.	-9.5	-6.5	-4.5	dB
CHROMA SECTION *						
C _{max}	Maximum output	Input sine wave of 0dB to pin ③, and measure output amplitude at pin ④ when voltage at pins ⑤ and ⑥ is 4V _{CC} . (See Note 2.)	2.0	2.4	3.0	V _{P-P}
G _C	Chroma maximum gain	Input sine wave of -26dB to pin ③, and measure output amplitude at pin ④ when voltage at pins ⑤ and ⑥ is 4V _{CC} . (See Note 2.)	45	51	57	dB
C _{ACC} (+6)	ACC control characteristics	Input sine waves of 0, +6 and -20dB in sequence to pin ③, and measure output amplitude at pin ④ for each input with voltages at pins ⑤ and ⑥ set at 1V _{CC} and 1.5V _{CC} , respectively. Then calculate ratio of measured amplitude to that for 0dB input. (See Note 2.)	0	0.1	1.0	dB
C _{ACC} (-20)			-5.0	-2.0	0	dB
C _{IKLR}	Killer operating input	Input sine wave of 0dB to pin ③, decrease input amplitude until voltage at pin ⑤ becomes 2.9V _{CC} or more, and measure input amplitude. Then calculate ratio of measured amplitude to that for 0dB input. (See Note 1.)	-55	-45	-35	dB
D _{KLR}	Killer color residual	Input sine wave of 0dB to pin ③, and measure output amplitude at pin ④ when voltages at pins ⑤ and ⑥ are 1V _{CC} and 1.5V _{CC} , respectively. (See Note 4.)	0	10	25	mV _{P-P}
C _{SAT} (4)	Color saturation control characteristics	Input sine wave of 0dB to pin ③, and measure output amplitude at pin ④ when voltage at pin ⑤ is changed to 1.5, 4, 2, 1 and 0.5V _{CC} with voltage at pin ⑥ set at 1V _{CC} . Then calculate ratio of measured amplitude to that obtained when voltage at pin ⑤ is 1.5V _{CC} . (See Note 2.)	1.2	2.8	4.8	dB
C _{SAT} (2)			0.5	2.3	4.8	dB
C _{SAT} (1)			-6.5	-4.0	-0.5	dB
C _{SAT} (0.5)			-17.5	-12.0	-8.0	dB
Δf _{vc0}	VCO free run frequency	Input synchronization signal only, measure oscillation frequency at pin ③, and calculate difference from 3.579545MHz. (Pin ③-No input)	-950	0	+950	Hz
Δf _{vcopull}	APC pull-in range	Input sine wave of 0dB to pin ③, and change frequency. Measure frequency at which DC voltage ⑤ changes from H to L. (See Note 5.)	+300 -700	+550 -300	+900 -100	Hz
D _B	B demodulator sensitivity	Input sine wave of 0dB to pin ③, and measure output amplitude at pin ④ when voltages at pins ⑤ and ⑥ are 1V _{CC} and 1.5V _{CC} , respectively. (See Note 2.)	1.0	1.4	1.8	V _{P-P}

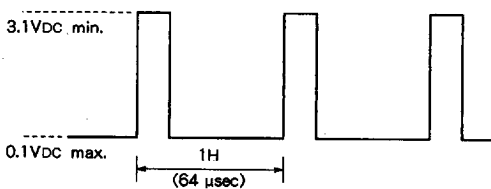
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ELECTRICAL CHARACTERISTICS (cont.)

Symbol	Parameter	Test conditions/Method	Limits			Unit
		Circled numerals indicate pin numbers	Min.	Typ.	Max.	
R (R/B)	Demodulated output voltage ratio	Input sine wave of 0dB to pin ④, measure output amplitude at pin ④ when voltages at pins ⑤ and ⑥ are 1Vcc and 1.5 Vcc, respectively, and calculate ratio of measured amplitude to that obtained in test 15. (See Note 2.)	0.5	0.6	0.7	—
R (G/B)				0.28	0.35	0.42
DleakB	Demodulated output carrier leak	Input sine wave of 0dB to pin ④, and measure output amplitude at pins ④, ⑤ and ⑥ for 7.1MHz component when voltages at pins ⑤ and ⑥ are 1Vcc and 1.5Vcc, respectively. (See Note 3.)	0	8	20	mVP-P
DleakR			0	8	25	mVP-P
DleakG			0	8	20	mVP-P
VSKLR-H	H voltage at KILLER OUT pin	Input synchronization signal alone, and measure DC voltage at pin ⑤ when pin ④ is connected via 10kΩ to GND(L) and when pin ④ is connected via 10kΩ to Vcc(H). (Pin ⑥=No input)	3.0	3.3	4.0	Vdc
VSKLR-L	L voltage at KILLER OUT pin		0	0.1	0.3	Vdc
T	Tint control variation	Input sine wave of 0dB to pin ④, and measure phase variation at pin ④ when voltage at pin ⑤ is changed from 0 to 4Vcc, with voltages at pins ⑥ and ⑦ set at 1Vcc and 1.5Vcc, respectively.	80	125		deg
Tmin	Tine control characteristics	Input sine wave of 0dB to pin ④, and measure phase variation at pin ④ when voltage at pin ⑤ is changed from 2 to 0.5Vcc and from 2 to 3.5Vcc with the voltages at pins ⑥ and ⑦ set at 1Vcc and 1.5Vcc, respectively.	-83	-57	-31	deg
Tmax				44	66	90
Y OUTPUT SECTION						
Vcont	Voltage for no signal input	Measure output DC voltage at pin ⑪ when no signal is input	2.50	2.75	3.00	Vdc
Gco	Luminance amplifier gain	Input 100kHz sine wave of 0.1VP-P to pin ⑥, measure output amplitude at pin ⑪, and calculate measured/input amplitude ratio.	11.5	14.0	16.5	dB
Gmax	Maximum output	Input 100kHz sine wave of 0.5VP-P to pin ⑥, and measure output amplitude at pin ⑪.	1.7	2.5		VP-P

ELECTRICAL CHARACTERISTIC TEST METHOD

- * Video section..... Unless otherwise specified, measure with 2Vcc at pin ⑤, 0Vcc at pin ⑥ and 2Vcc at pin ⑦.
- Chroma section.. Unless otherwise specified, measure with 2Vcc at pin ⑤, 2Vcc at pin ⑦ and 2.85Vcc at pin ⑥, and with following synch signal input to pin ⑩.



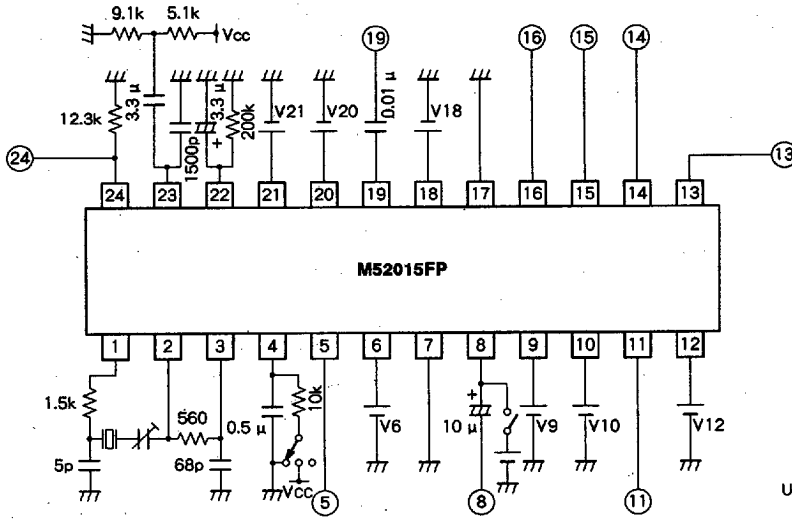
- Notes:1 Input sine wave signal with frequency of 3.579545MHz to pin ⑩. Input level of 100mVp-P is set at 0dB.
- Notes:2 Same as Note 1. Beat output (input frequency: 3.580545MHz) by VCO is measured for each output. Pin ④ is connected via 10kΩ to GND.
- Notes:3. Same as Note 1. Pin ④ is connected via 10kΩ to GND.
- Notes:4. Same as Note 1. Pin ④ is connected via 10kΩ to Vcc.
- Notes:5. Same as Note 1. Increase input frequency, and measure frequency at which Pin ⑤ DC voltage changes from H (3.2Vcc) to L (locked state). Take same measurement after decreasing input frequency. Calculate difference between each measured input frequency and free run frequency. When adjusting free run frequency, connect CHROMA INPUT pin ⑩ with POWER SUPPLY 2 pin ② via 0.1μF, and input signal with no chroma component. Measure oscillation frequency at pin ②. Adjust typical trimmer capacitor of X'tal circuit to set free run frequency at 3.579545MHz; and maintain this frequency during test.



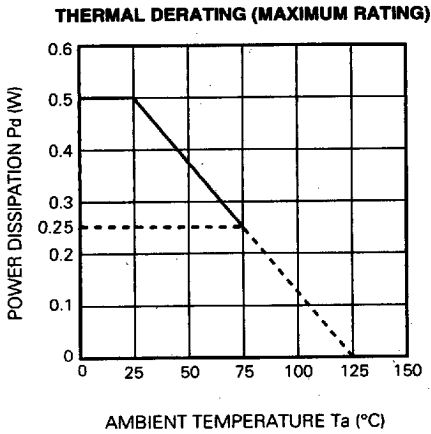
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TEST CIRCUIT



TYPICAL CHARACTERISTICS



The schematic diagram illustrates the internal circuitry of a 12-pin integrated circuit (IC) used for chroma processing in a color TV receiver. The IC pins are numbered 1 through 12 along the bottom edge. The circuit includes several functional blocks: APC (Automatic Phase Control), TINT (Tint control), Burst Gate, VCO (Voltage-Controlled Oscillator), KILLER, PIX (Picture control), CLAMP, GATE GEN. (Gate Generator), MATRIX (CONTRAST), R-Y DET. (Red-Yellow Detector), G-Y DET. (Green-Yellow Detector), and B-Y DET. (Blue-Yellow Detector). The input section at the top shows a 4VDC chroma input connected to pins 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, and 13. The output section at the bottom shows a VIDEO IN signal connected to pin 12. Various external components, including resistors (e.g., 5.1k, 9.1k, 200k, 10k, 1k, 20k), capacitors (e.g., 3.3μ, 1500p, 0.01μ, 0.1μ, 0.001μ, 0.5μ, 68p, 10μ, 22μ, 150p), and a 3.579545 MHz crystal are connected to the IC pins. The diagram also shows the internal connections between the various functional blocks and the IC pins.

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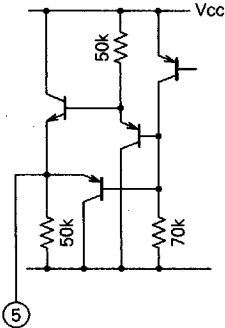
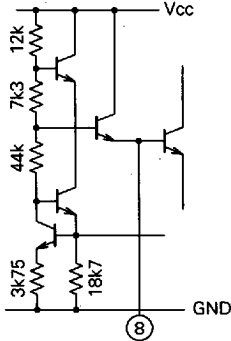
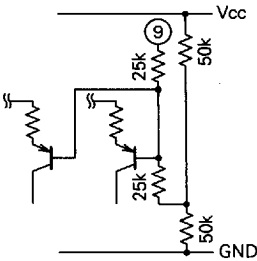
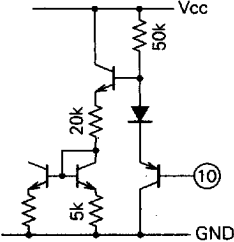
DESCRIPTION OF PIN

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
①	VCXO OUT 1	2.3V Emitter follower output $Z_0=10\Omega$	
②	VCXO IN 1	3.3V $Z_i=17K\Omega$	
③	VCXO IN 2	Open base input $Z_i>100K\Omega$	
④	KILLER FILTER	3.0V $Z_i>100K\Omega$ 42K5 with B.G.P. ON	

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DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
⑤	KILLER OUT	H: 3.3V L: 0.1V Emitter follower output $Z_o = 300\Omega$	
⑥	POWER SUPPLY 1	4.0V	—
⑦	GND 1	0V	—
⑧	VIDEO IN	Sync tip 2.5V Sync tip clamping input Low $Z_i < 100\Omega$ at clamping	
⑨	PICTURE CONT	2.5V $Z_i = 75K$	
⑩	CONTRAST CONT	Open base input $Z_i > 100K\Omega$	

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DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
⑪	VIDEO OUT	2.5~0V Emitter follower output Approx. $Z_o = 60\Omega$	
⑫	BURST GATE TIME CONSTANT	$Z_i > 100k\Omega$	
⑬	H. SYNC IN	Same as above	
⑭	B OUT	2.2~0V $Z_o \approx 100\Omega$	
⑮	R OUT		
⑯	G OUT		
⑰	GND 2	0V	—
㉑	POWER SUPPLY 2	4.0V	—

DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
⑮	COLOR CONT	$Z_i > 100k\Omega$	
⑲	CHROMA IN	3.3V $Z_i = 12k\Omega$	
⑳	TINT CONT	1.6V $Z_i = 87K5$	
㉒	ACC FILTER	0.9V Hi Z_i	

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DESCRIPTION OF PIN (cont.)

Pin No.	Name	Voltage and wave information	Peripheral circuit of pins
23	APC FILTER	2.6V *Zi=12K5 with B. G. P. "ON" *Zi>100kΩ with B. G. P. "OFF"	
24	VCXO OUT 2	3.2V Zo=26Ω when R=3K2	

PRECAUTIONS FOR APPLICATION

- 1) Adjust trimmer capacitor to set VCO free run frequency at 3.579545MHz.
- 2) Pin 24 outputs VCO signal through open emitter. Use this pin to measure VCO oscillation frequency.
- 3) Burst gate width varies with time constant at pin 12. Set resistance at 20kΩ or higher.
- 4) Sync tip-clamped luminance signal is output at pin 11 in inverted phase through emitter follower. With standard input, output amplitude is about 1.5V_{P-P}.
- 5) R, G and B output clamping voltages vary with contrast voltage. Signals other than color burst component of chroma signal are not blanked.

