

AN5307K

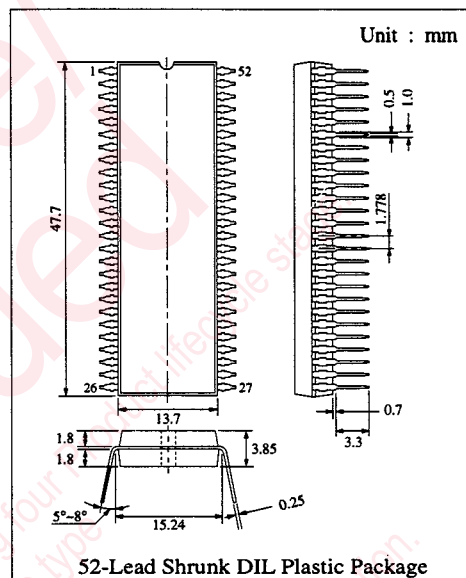
NTSC Video • Chroma • RGB • Synchronous • Deflection Signal Processing Circuit

■ Description

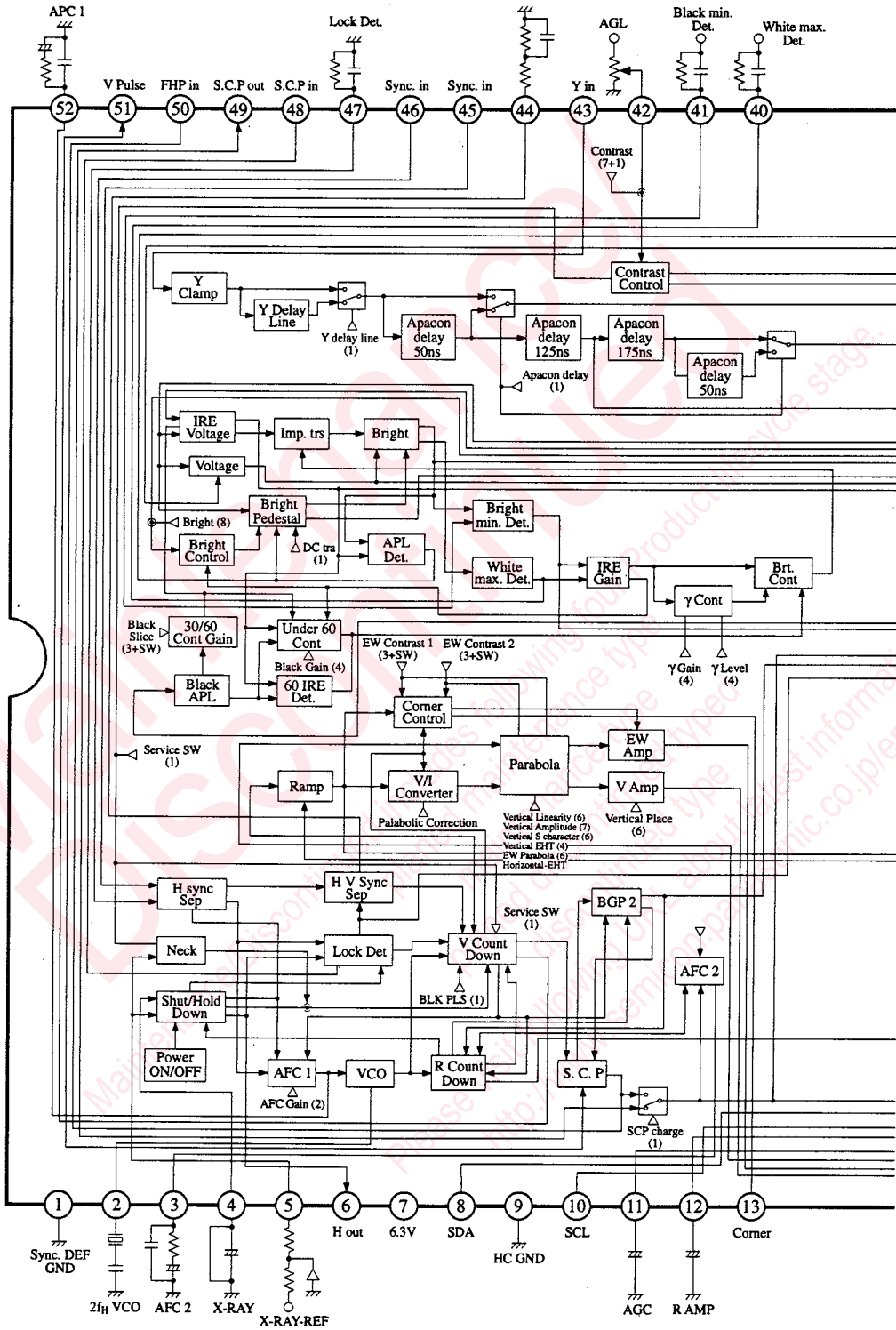
The AN5307K is an integrated circuit consisting of video signal processing, colour signal processing, RGB processing, synchronizing signal processing circuits (with I²C Bus) for use in NTSC Colour TV.

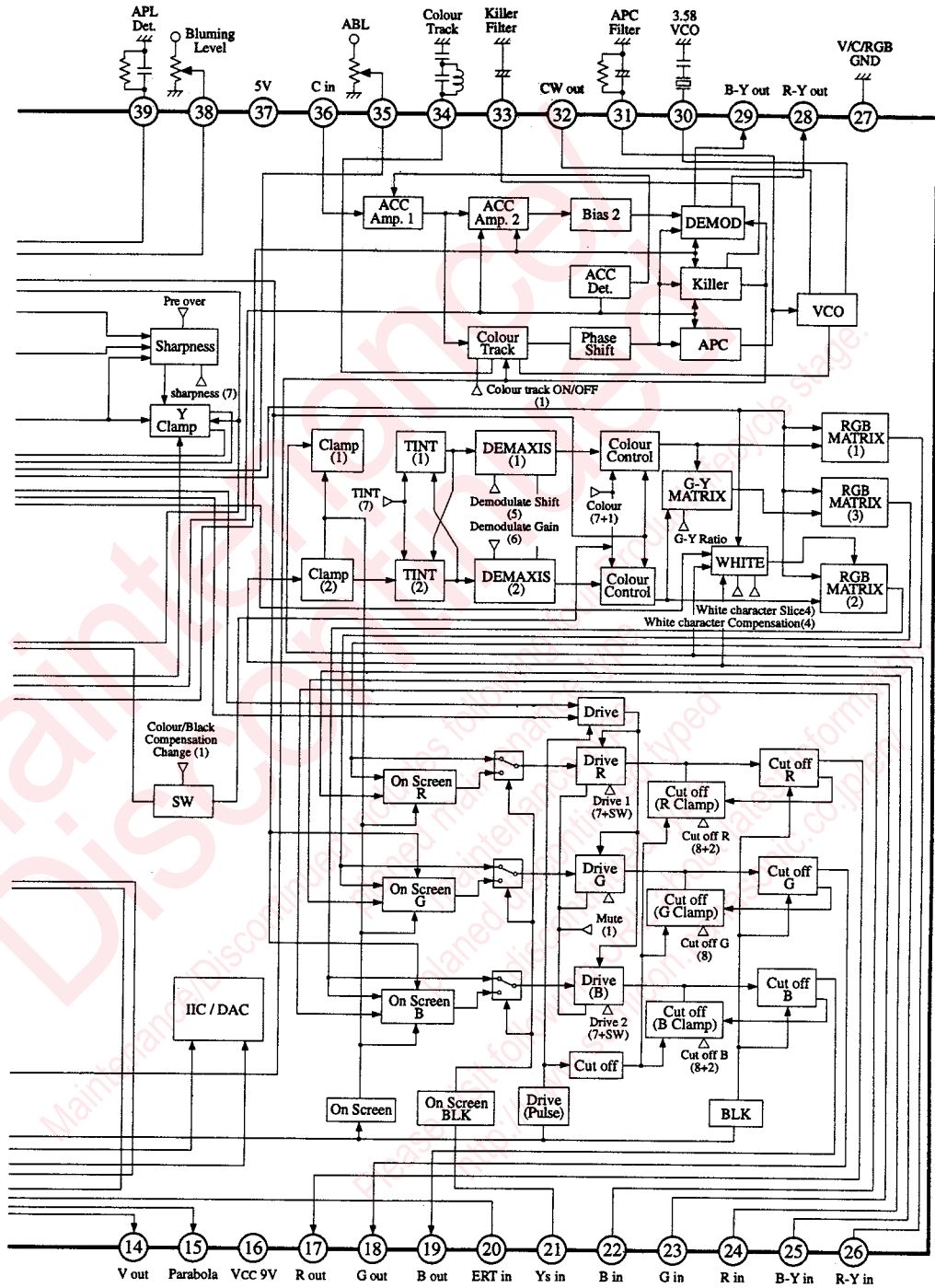
■ Features

- Video portion : Built-in high pass filter, pre-shoot / overshoot adjustment, switchable outline emphasis, ABL pin.
- Chroma portion : Built-in ACC filter, with colour difference output pin.
- RGB portion : With colour difference signal input pin, RGB output.
- Sync. portion : With sync BLK input / output pin, switchable AFC1 time constant, H center adjustable.
- Deflection portion : Parabola waveform, sawtooth oscillation and distortion correction.



■ Block Diagram





■ Pin Descriptions

Pin No.	Pin Name	Pin No.	Pin Name
1	Sync. Def GND	27	V/C/RGB GND
2	503kHz VCO	28	R-Y Output
3	AFC2 Filter	29	B-Y Output
4	High Tension Detection Input (X-ray)	30	3.58MHz VCO
5	High Tension Detection Reference voltage	31	Chroma APC Filter
6	Horizontal Drive Pulse Output	32	VCO Output
7	Horizontal Power supply (HVCC)	33	Killer Filter
8	IIC SDA Input	34	Colour Track Filter
9	IIC GND	35	ABL Input
10	IIC SCL Input	36	Chroma Input
11	Reference Ramp Waveform AGC	37	5V Power Supply (VCC2)
12	Reference Ramp Waveform Generation	38	Blooming Level Input
13	Corner Slicing Level	39	APL Detection Filter
14	Vertical Deflection Sawtooth Waveform Output	40	White Detection Filter
15	EW Output	41	Black Detection Filter / Colour Control
16	9V Power Supply (VCC1)	42	ACL Input
17	R Output	43	Y Signal Input
18	G Output	44	V Sync Sep Filter
19	B Output	45	H Sync Input
20	EHT Voltage Detection	46	V Sync Input
21	Ys Input	47	Lock Det Filter
22	On-screen B Input	48	Sand-castle Pulse Input / FBP Input for BLK
23	On-screen G Input	49	Sand-castle Pulse Output
24	On-screen R Input	50	Flyback Pulse (FBP) Input for BLK
25	B-Y Input	51	V Pulse Output
26	R-Y Input	52	AFC1 Filter

■ Absolute Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Supply Voltage	V _{CC1}	9.6	V
	V _{CC2}	5.6	V
Supply Current	I _{CC1} (I ₁₆)	87	mA
	I _{CC2} (I ₃₇)	89	mA
	I ₇	26	mA
Power Dissipation (Ta=70°C)	P _D	1481	mW
Temperature	Operating Ambient Temperature	T _{opr}	-20 ~ +70 °C
	Storage Temperature	T _{stg}	-55 ~ +150 °C

■ Recommended Operating Range (Ta=25°C)

Item	Symbol	Range
Operating Supply Voltage Range	V _{CC1} V _{16-1,9,27}	8.5V ~ 9.5V
Operating Supply Voltage Range	V _{CC2} V _{37-1,9,27}	4.5V ~ 5.5V
Operating Supply Current Range	I ₇	15 ~ 20 ~ 25 mA

■ Electrical Characteristics (Ta=25°C)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
(1) DC Characteristics							
Circuit Current	I ₁₆	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	61	71	81	mA
Circuit Current	I ₃₇	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	59	71	83	mA
Synchronous Input Pin Voltage	V ₄₅₋₁	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	0.8	1.3	1.8	V
Synchronous Input Pin Voltage	V ₄₆₋₁	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	0.8	1.3	1.8	V
Video Input Pin Voltage	V ₆₋₂₇	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	2.7	3.2	3.7	V
ABL Input Pin Voltage	V ₃₅₋₂₇	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	2.5	3.0	3.5	V
ACL Input Pin Voltage	V ₄₂₋₂₇	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	2.5	3.0	3.5	V
Blooming Level Pin Voltage	V ₃₈₋₂₇	-	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	2.2	2.7	3.2	V
Chroma Input Pin Voltage	V ₃₆₋₂₇	1	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	1.5	2.0	2.5	V
B-Y Output Pin Voltage	V ₂₅₋₂₇	-	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	2.3	2.8	3.3	V
R-Y Output Pin Voltage	V ₂₆₋₂₇	-	V _{CC1} = 9V, V _{CC2} = 5V, Pin 7 380Ω : 12V	2.3	2.8	3.3	V

■ Electrical Characteristics (Ta=25°C) (Continue)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Horizontal Signal Processing							
Horizontal Stabilized Supply Voltage	HV _{CC}	2	V _{CC1} =9V, V _{CC2} =5V, Pin 7 380Ω =12V	5.9	6.3	6.7	V
Constant Voltage Operating Resistance	RHV _{CC}	2	I ₇ = 15 ~ 25mA	-	-	30	Ω
Horizontal Natural Oscillation Frequency (1)	f _{HO-1}	2		15.45	15.75	16.05	kHz
f _{HO} Variation at the Rise of Power Supply	$\frac{\Delta f_{HO}}{V_{CC}}$	2	f _{HO} freq. difference when other power supply is turned from OFF to ON.	0	100	200	Hz
Horizontal Output Pulse Duty	τ _{HO}	2		34.4	37.5	40.6	%
Horizontal Output Start Voltage	V _{FH(S)}	2	f=10k ~ 20kHz when the horizontal oscillation output is 1Vp-p or more.	-	-	5.2	V
Horizontal Output Level	V _{FH}	2		2.4	2.9	3.4	V
Horizontal Pull-in Range	f _{PH}	2	f _{HO} =15.75kHz	±400	-	-	Hz
H Center Variable Range (1)	T _{DH}	2	Phase advance from 1A[10] → [00]	1.8	2.5	3.2	μs
H Center Variable Range (1)	T _{DH}	2	Phase advance from 1A[10] → [1F]	-3.0	-2.3	-1.6	μs
Lock Detector Output Voltage (1)	V _{47-M}	2	Synchronous	5.1	5.8	6.5	V
Lock Detector Output Voltage (2)	V _{47-L}	2	Asynchronous	-0.1	0	0.5	V
Lock Detector Output Voltage (3)	V _{47-T}	2	Hold-down	7.6	8.3	9.0	V
Hold-down Operating Voltage	V _{Hth}	2		2.5	2.8	3.1	V
Bust Gate Pulse Width	T _{BGP}	2	Sand castle pulse output	1.8	2.5	3.2	μs
Sand Castle Pulse Output Level (BGP)	V _{BGP}	2	V _{CC} =typ.	4.0	4.3	4.6	V
Sand Castle Pulse Output Level (HBLK)	V _{HBLK}	2	V _{CC} =typ.	2.7	3	3.3	V
Sand Castle Pulse Output Level (VBLK)	V _{VBLK}	2	V _{CC} =typ.	1.2	1.5	1.8	V
Vertical Signal Processing							
Vertical Output Pulse Width	τ _{YO}	2		360	380	400	μs
Vertical Output Level	V ₁₄	2		1.3	1.8	2.3	V
Vertical Output Free-running Frequency	f _{VO}	2		58.8	60	61.2	Hz
Vertical Blanking Pulse Width	τ _{VBLK}	2		1.37	1.4	1.43	ms
Y Signal Processing							
Video Voltage Gain	AY _G	2	Cont=Max. Sharp=Min.	17	20	23	dB
Video Voltage Gain Relative Ratio	AY	2	Ratio between channels Drive =Typ.	-2.5	0	2.5	dB

■ Electrical Characteristics (Ta=25°C) (Continue)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Video Voltage Gain Relative Ratio DL	AY _{GD1}	2	Y delay line ON/OFF	-1.5	0	1.5	dB
Sharpness 1	AG _(SH1)	2	f=4MHz Aperture Control SW : 250n	11.5	14.5	17.5	dB
Sharpness 2	AG _(SH2)	2	f=3MHz Aperture Control SW : 300n	11.5	14.5	17.5	dB
Contrast Control Range Max	AG _(CON)	2	Cont : Typ Sharp : Min	3.5	6	8.5	dB
Contrast Control Range Min	yG _(CON) _{min}	2	Contrast : Min	-	30	100	mV
Brightness Variable Range	V _{BR}	2	No input, Bright : Min → Max	3.0	3.7	4.4	V
DC Regeneration Rate 1	TDC1	2	APL 10 → 90%, DC transmission rate changeover : - direction	90	96	102	%
DC Regeneration Rate 2	TDC2	2	APL 10 → 90%, DC transmission rate changeover : + direction	96	103	110	%
Y Signal Delay Time 1	τ _{DL1}	2	Y delay line : ON	260	325	390	ns
Y Signal Delay Time 2	τ _{DL2}	2	Y delay line : OFF	160	205	250	ns
Y Frequency Characteristics 1	Δy _{1(Y)}	2	Attenuation rate of 10MHz for f=3MHz, DL : ON	-6	-3	+1	dB
Y Frequency Characteristics 2	Δy _{2(Y)}	2	Attenuation rate of 10MHz for f=3MHz, DL : OFF	-5	-2	+2	dB
ACL Characteristics	Δy _{ACL}	2	Pin 42 3V → 3.5V	8	11	14	dB/V
ABL Characteristics	ΔY _{ACL}	2	Pin 35 2.7V → 3.5V	2.7	3.4	4.1	V/V
Black Extension	ΔY _{B1}	2	Input : all black, Pin 41 : 5V → CR filter	-0.1	0	0.1	V
Black Extension Gain	ΔY _{B2}	2	Input : all black, Pin 41 : 3V, Black gain : Min → Max	1.1	1.45	1.8	V
Black Extension Start Point 1	ΔY _{B3}	2	Pin 41 : 5V, 2.7Vpp by contrast, then Pin 41 CR filter	-0.12	0	0.12	V
Black Extension	ΔY _{B4}	2	Black level : Min, 0.8Vpp by contrast, then black level : Max	0.08	0.18	0.28	V
γ Correction Min ~ Max	Y _γ	2	White γ gain : Max, White γ level : Min ~ Max	0.5	0.85	1.2	V
Blooming Level Variation	ΔY _{BLM}	2	Blooming, Pin 38 DC : 0.5V → 4.5V	3.2	3.9	4.6	V
Pedestal Level (Standard)	Y _G	2	Cut off : 80	2.0	2.4	2.8	V

Chroma Signal Processing

ACC Characteristics 1	ACC1	2	Colour bar signal (Burst 300mVpp)	-1	0	+1	dB
ACC Characteristics 2	ACC2	2	Colour bar signal (Burst 15mVpp)	-3	0	+3	dB
Killer Tolerance	eK	2	Colour bar burst, 0dB=150mVpp	-48	-43	-38	dB
Killer Tolerance Hysteresis	eK	2	Colour bar burst, 0dB=150mVpp	-	+2	+4	dB
Demodulation Output Amplitude B-Y	e _{OB}	2	Colour bar signal (Burst 150mVpp)	1.04	1.34	1.64	Vpp

■ Electrical Characteristics (Ta=25°C) (Continue)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Demodulation Output Amplitude R-Y	e_{OR}	2	Colour bar signal (Burst 150mVpp)	0.82	1.07	1.32	Vpp
Demodulation Output Ratio	R/B	2	Rainbow signal R-Y/B-Y output ratio	0.48	0.56	0.64	Times
Demodulation Angle B-Y	$\angle B$	2		-5	0	5	Degree
Demodulation Angle R-Y	$\angle R$	2		83	88	93	Degree
Colour Residue	e_{killer}	2	Killer filter pin : to be grounded at 20k Ω	-	-	50	mVpp
Demodulation Output Residual Carrier	e_{car}	2	No signal input	-	-	50	mVpp
APC Pull-in Range Low	f_{pull}	2	Burst frequency change	500	600	-	Hz
APC Pull-in Range High	f_{pull}	2	Burst frequency change	-500	-600	-	Hz
CW Output Amplitude	e_{cw}	2		600	800	1100	mVpp
Free-running Frequency	f_{CO}	2	Deviation from 3.579545MHz	-200	0	200	Hz

RGB Signal Processing

Tint Center	θ_t	2	Pin 26 : 356mVpp, Pin 25 : 200mVpp, DAC value at which R output coincides with B output	[2F]	[3A]	[4A]	-
Tint Variable Range MAX	$\Delta\theta_1$	2	Tint : Typ \rightarrow max	40	65	-	Degree
Tint Variable Range Min	$\Delta\theta_2$	2	Tint : Typ \rightarrow max	-37	-50	-	Degree
R-Y Demodulation Variable Range	$\Delta\theta_{Dem}$	2	Demodulation axis : Min \rightarrow Max	16	28	39	Degree
B-Y Ratio Variable Range (1)	AB-Ymin	2	Demodulation axis : Typ \rightarrow Min	-	0	0.25	Times
B-Y Ratio Variable Range (2)	AB-Ymin	2	Demodulation axis : Typ \rightarrow Min	1.25	1.5	1.75	Times
G-Y/R-Y Ratio (1)	eG/eR_2	2	G-Y ratio changeover : 01	0.47	0.57	0.67	Times
G-Y/R-Y Ratio (2)	eG/eR_3	2	G-Y ratio changeover : 03	0.27	0.35	0.44	Times
G-Y/B-Y Ratio (1)	eG/eB_2	2	G-Y ratio changeover : 01	0.18	0.27	0.36	Times
G-Y/B-Y Ratio (2)	eG/eB_3	2	G-Y ratio changeover : 03	0.3	0.36	0.42	Times
RGB Output Blanking Voltage	E_{BLK}	2	Brightness : Typ, Cut off	0.7	1.1	1.5	V
Colour Control Range Max	$A_{B-Yclmax}$	2	Cont: Typ, Colour : Typ \rightarrow Max	3.4	5.0	6.6	dB
Colour Control Min Value	$A_{B-Yclmin}$	2	Cont: Typ, Colour : Typ \rightarrow Min	-	25	50	mV
Colour Difference Contrast Variable Range	$A_{B(CON)}$	2	Colour : Typ, Cont : Typ \rightarrow Max	3.5	6	8.5	dB
Drive Control Range	$A_{R(DR)}$	2	Drive SW : 00 \rightarrow 04, Drive : Min \rightarrow Max	4	6	8	dB
Cut off R/B Control Range	$V_{(CO)}$	2	Cut off SW : Cut off : Min \rightarrow Max	1.6	2.1	2.6	V

■ Electrical Characteristics (Ta=25°C) (Continue)

Item	Symbol	Test Circuit	Condition	min.	typ.	max.	Unit
Cutoff G Control Range	$V_{(CO)G}$	2	Cutoff Min ~ Max	0.6	1.1	1.6	V
On-screen Voltage Gain	A_{yG}	2	$Y_S=1V$, Contrast : Max	8	10	12	dB
On-screen Contrast Range	$A_{yG(ON)}$	2	$Y_S=1V$, Typ → Max	0	1.5	3.5	dB
On-screen Contrast Min Value	$A_{yG(ON)min}$	2	0.5V input	0.1	0.3	0.5	Vpp
On-screen Frequency Characteristics	Δe	2	Attenuation of $f=3MHz$ for $f=10MHz$	-6	-3	+1	dB

Deflection Signal Processing

Standard Vertical Output Amplitude	V_{out}	2		2.2	2.6	3.0	Vpp
Standard EW Output Amplitude	V_{EW}	2		1.8	2.2	2.6	Vpp

Colour Track

Colour Track OFF/ON Variation (1) Blue	Δe_{BB}	2	B-Y : 1.39V, R-Y : 1.1V after tint and colour adjustment	-160	0	160	mV
Colour Track OFF/ON Variation (2) Red	Δe_{BR}		Colour track ON, Variation when 0E is change from 03 to 04	-240	-40	160	mV
Colour Track OFF/ON Variation (3) Yellow	Δe_{BY}	2	Colour track ON, Variation when 0E is change from 03 to 04	-350	-200	-16	mV

● I²C Bus Protocol

(1) Slave address :

1 0 0 0 1 0 1 0

(2) Slave address format :

S SLAVE ADDR 0 A SUB ADDR A DATA BYTE A P

↑ Start condition

↑ Write

↑ Acknowledge bit

↑ Stop condition

AN5307K DAC CONTROL

No.	DAC Name	Number of bits	Sub Address	Data Address	Remarks	Standard Measurement Conditions
1	Colour control	7+offSW	00(00000000)	00-40-7F	Data:[00], Colour: OFF	40
2	Tint control	7	01(00000001)	00-40-7F		40
3	Brightness control	8	02(00000010)	00-80-FF		80
4	Contrast control	7	03(00000011)	00-40-7F		7F
5	Sharpness control	7	04(00000100)	00-40-7F		00
6	Cut-off R	8(+2SW)	05(00000101)	00-80-FF	4-stage selection with SW	FF
7	Cut-off G	8	06(00000110)	00-80-FF		FF
8	Cut-off B	8(+2SW)	07(00000111)	00-80-FF	4-stage selection with SW	FF
9	Drive R	7(+2SW)	08(00001000)	00-40-7F	2-stage selection with SW	7F
10	Drive B	7(+2SW)	09(00001001)	00-40-7F	2-stage selection with SW	7F
11	Vertical amplitude	7	0A(00001010)	00-40-7F		40
12	EW parabola	6	0B(00001101)	00-20-3F		20
13	Horizontal amplitude	6	0C(00001100)	00-20-3F		20
14	Y delay line selection	1	0D(00001101)	01(00000001)	[00]→ON [01]→OFF	
15	Aperture control delay rate selection	1	0D(00001101)	02(00000010)	[00]→50ns, 250ns [02]→0ns,300ns	
16	DC transmission rate selection	1	0D(00001101)	04(00000100)	[00]→- [04]→+	
17	Output blanking ON/OFF	1	0D(00001101)	08(00001000)	[00]→Output BLK pulse [08]→No pulse	08
18	AFCI gain selection	2	0D(00001101)	10, 20	"μ" of AFC1 increase when changed from [30] to [00]	
19	BLK pulse width selection	1	0D(00001101)	40(01000000)	[00]→Normal screen [40]→wide screen	
20	Service switch ON/OFF	1	0D(00001101)	80(10000000)	[00]→Normal [80]→def V output DC	
21	Sand castle pulse selection	1	0E(00001110)	01(00000001)	[00]→Internal SCP [01]→external SCP	
22	Vertical amp. polarity selection	1	0E(00001110)	02(00000010)	Def V. amp. FB pin polarity [00]→- [02]→+	
23	Colour track ON/OFF	1	0E(00001110)	04(00000100)	[00]→Colour track OFF [04]→Colour track ON	00
24	Mute ON/OFF	1	0E(00001110)	10(00010000)	[00]→Normal [01]→RGB output OFF	
25	Sharpness ON/OFF	1	0E(00001110)	20(00100000)	[00]→Sharpness ON [02]→Sharpness OFF	
26	Black detection / Colour selection	1	0F(00001111)	40(01000000)	Black det. pin [00]→Black det. [40]→Colour Pin	
27	Cut-off R switch-1	1	0F(00001111)	01(00000001)	[00]→[01]→[02]→[03]: Cut-off R level	
28	Cut-off R switch-2	1	0F(00001111)	02(00000010)	increase	
29	Drive R switch	1	0F(00001111)	04(00000100)	[00]→[04]: Drive R gain increase	
30	Drive B switch	1	0F(00001111)	08(00001000)	[00]→[08]: Drive B gain increase	11
31	Cut-off B switch-1	1	0F(00001111)	10(00010000)	[00]→[10]→[20]→[30]: Cut-off R level	
32	Cut-off B switch-2	1	0F(00001111)	20(00100000)	increase	
33	H Blanking Selection	1	0F(00001111)	40(01000000)	Chroma BGP [00]→H.BLK [40]→BBP1	
34	Pre-shooting / Over-shooting amount	3	10(00010000)	00-04-07		04

Note: DAC default value : Center (eg.: [80] for 8 bits)

SW default value : [00]

G-Y ratio TYPE 1 : $G-Y = -0.57(R-Y) - 0.27(B-Y)$

TYPE 2 : $G-Y = -0.35(R-Y) - 0.36(B-Y)$

● I²C Bus protocol (Continue)

AN5307K DAC CONTROL

No.	DAC Name	Number of bits	Sub Address	Data Address	Remarks	Standard Measurement Conditions
35	Black Extension Gain	4	11(00010001)	00~08~0F		00
36	White γ level	4	12(00010010)	00~08~0F		08
37	White γ gain	4	13(00010011)	00~08~0F	[00]→[07]: Contrast interlocked [08]Æ[0F]: Independent	08
38	Black extension slicing position	8+offSW	14(00010100)	00~04~07		04
39	Demodulation axis R-Y	5	15(00010101)	00~10~1F		00
40	Demodulation axis B-Y	6	16(00010110)	00~20~3F	[00], [01]: TYPE1 [02]: TYPE2 [03]:TYPE1	20
41	G-Y ratio selection	2	17(00010111)	00~02~03		00
42	White character correction	4	18(00011000)	00~08~0F		00
43	White character slicing voltage	4	19(00011001)	00~08~0F		00
44	H center position	5	1A(00011010)	00~10~1F		10
45	Vertical S-shape	6	1B(00011011)	00~20~3F		20
46	Vertical linearity	6	1C(00011100)	00~20~3F		20
47	Vertical position	6	1D(00011101)	00~20~3F		20
48	Trapezoidal correction	6	1E(00011110)	00~20~3F		20
49	EW corner 1	3	1F(00011111)	00~04~07		04
50	EW corner 2	3	20(00100000)	00~04~07		04
51	Vertical EHT	4	21(00100001)	00~08~0F		08
52	Horizontal EHT	4	22(00100010)	00~08~0F		08

Note: DAC default value : Center (eg.: [80] for 8 bits)
 SW default value : [00]
 G-Y ratio TYPE 1 : $G-Y = -0.57(R-Y) - 0.27(B-Y)$
 TYPE 2 : $G-Y = -0.35(R-Y) - 0.36(B-Y)$

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