AN5304NK

NTSC Video Signal Processor IC

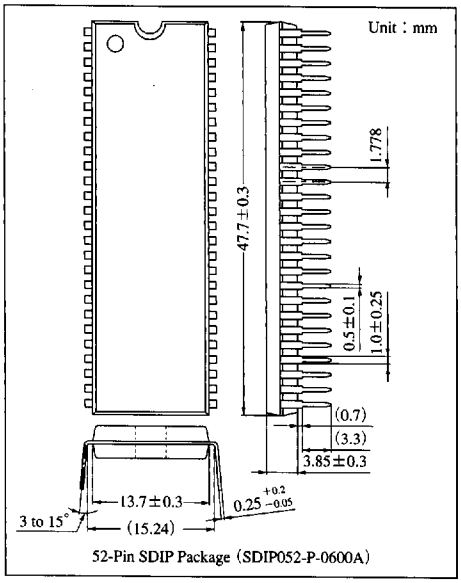
■ Overview

The AN5304NK is used to process video, chroma, and synchronization signals for NTSC TV.

It includes mono-color luminance correction, dynamic gamma correction, and white-character correction for better video quality and reliability.

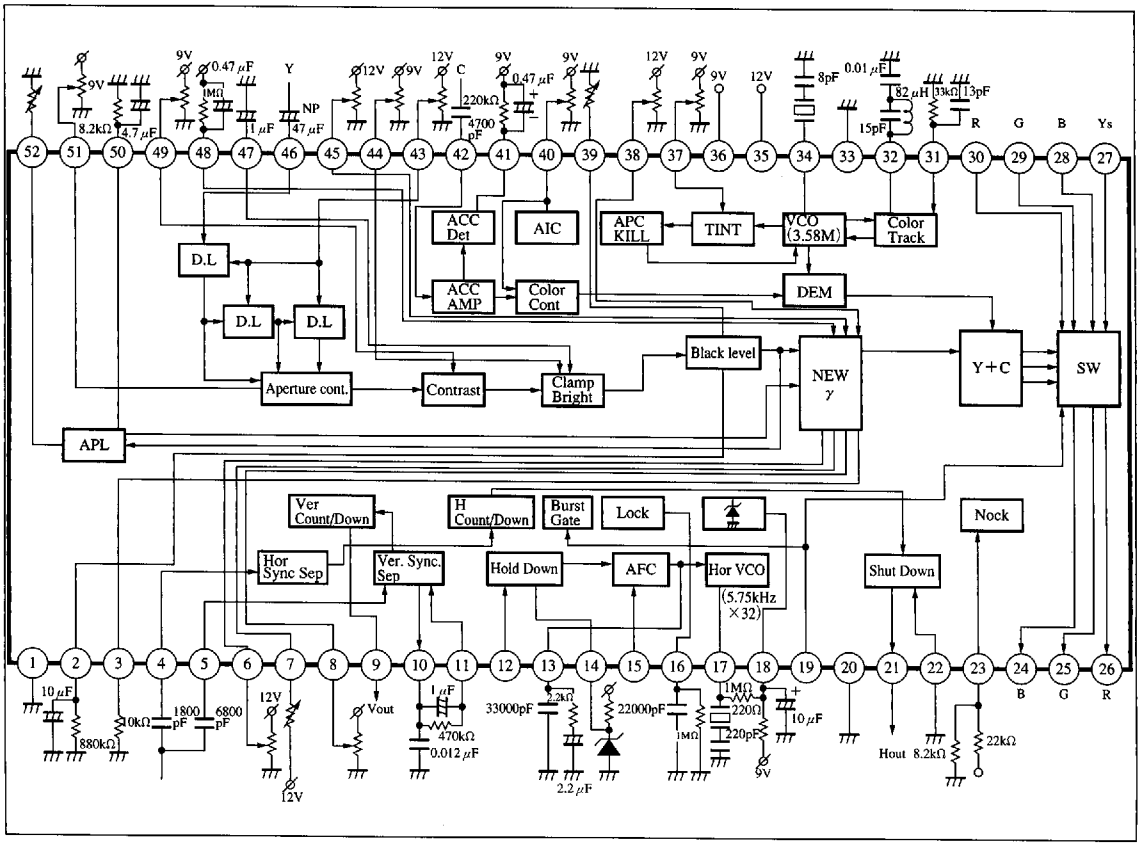
■ Features

- A aperture correction function using delay lines
- A dynamic gamma correction circuit to reduce blooming
- A white-character correction circuit for good white character.
- An APL detection circuit



52-Pin SDIP Package (SDIP052-P-0600A)

■ Block Diagram



■ Pin Descriptions

Pin No.	Pin name	Pin No.	Pin name
1	Vertical system GND	27	Y_S input
2	Black level detection filter	28	B input
3	White char. slice level	29	G input
4	Horizontal sync. separation input	30	R input
5	Vertical sync. separation input	31	AIC filter, flesh-tone correction ON/OFF
6	White char. correction control	32	Flesh-tone phase adj.
7	Single color slice level correction	33	Video/chroma system GND
8	Single color correction control	34	3.58MHz oscillation
9	Vertical pulse output	35	Supply voltage 1 (V_{CC1})
10	Vertical integral filter	36	Supply voltage 2 (V_{CC2})
11	Vertical sync. separation input	37	Tint control
12	High voltage det. input (hold-down input)	38	Blooming level adj.
13	Horizontal AFC filter	39	Black level correction start point Adj.
14	Hold down reference voltage	40	Color control
15	FBP input for phase comparison	41	ACC detection filter
16	Lock detection filter	42	Chroma signal input
17	504kHz ($32f_H$) oscillation	43	Delay time adj.
18	Supply voltage 3 (hor. system supply voltage)	44	Brightness control
19	Hor. blanking pulse input	45	Gamma control
20	Hor. system GND	46	Y signal input
21	Hor. drive pulse output	47	Capacitor for Y clamp
22	High voltage det. input (shut down input)	48	White peak det. filter
23	Neck break detection	49	Contrast control
24	B output	50	APL detection filter
25	G output	51	Image quality control
26	R output	52	DC regeneration amount adj.

■ Absolute Maximum Ratings

Parameter	Symbol	Rating		Unit
Supply voltage	V_{CC}	$V_{35-1,20,33}$	13.8	V
		$V_{36-1,20,33}$	10.35	
Supply current	I_{CC}	I_{35}	42	mA
		I_{36}	59	
Power dissipation Note 2)	P_D	1300		mW
Operating ambient temperature Note 1)	T_{opr}	−20 to +70		℃
Storage temperature Note 1)	T_{stg}	−55 to +150		℃

Note 1) Ta=25℃ except operating ambient temperature and storage temperature.
Note 2) Allowable power dissipation of the package at Ta=70℃.

■ Recommended Operating Range (Ta=25℃)

Parameter	Symbol	Range
Operating supply voltage range Note 1), Note 2)	V_{CC1} $V_{35-1,20,33}$	9.6V to 13.2V
	V_{CC2} $V_{36-1,20,33}$	7.6V to 9.9V
Operating supply current range	I_{18}	8.0mA to 25.0mA

Note 1) $V_{CC1} \geqq V_{CC2}$
Note 2) Within the limits of P_D, $V_{CC1} \leqq 13.8V$, $V_{CC2} \leqq 10.35V$

■ Electrical Characteristics (Ta=25±2℃)

Parameter	Symbol	Condition	min	typ	max	Unit
DC Characteristics						
Circuit current 1	I_{36}	V_{CC1}=12V, V_{CC2}=9V I_{18}=13.5mA	33	43	54	mA
Circuit current 2	I_{35}	V_{CC1}=12V, V_{CC2}=9V I_{18}=13.5mA	22	30	38	mA
Circuit voltage	V_{18}	V_{CC1}=12V, V_{CC2}=9V I_{18}=13.5mA	5.8	6.3	6.9	V
Constant voltage operation resistor	γ_{18}	V_{CC1}=12V, V_{CC2}=9V I_{18}=9 to 25mA	—	—	30	Ω
New Signal Processing						
APL detection voltage	V_{APL}	V_{CC1}=12V, V_{CC2}=9V Cont ; max., Bright ; min. Vin=0.3V_{P-P}	0.85	1.3	1.7	V
APL detection voltage ratio	ΔV_{APL}	V_{CC1}=12V, V_{CC2}=9V Cont ; max., Bright ; min. Vin=0.15V_{P-P}	0.44	0.5	0.56	times
White character correction	ΔV_{WI}	V_{38}=3.4V, V_6=0 to 5V	0.78	1.1	1.42	V_{P-P}
Color dullness correction quantity	ΔCY	Color=max., Cont=typ. V_8=0 to 5V	0.25	0.5	0.75	V
Blooming level (1)	B(1)	Cont ; max., Bright ; max. V_{38}=0V	7.5	8.2	9.0	V
Blooming level (2)	B(2)	Cont ; max., Bright ; max. V_{38}=6V	3.5	4.3	5.1	V
Static γ characteristics (1)	γ(1)	Cont ; typ., Bright ; typ. V_{45}=open to 0V	0.3	0.7	0.95	V
Static γ characteristics (2)	γ(2)	Cont ; typ., Bright ; typ. V_{45}=open to 6V	−1.3	−0.9	−0.4	V
Neck break (1)		Bright ; max., Cont ; max. V_{23}=0V pedestal voltage	0.5	1.6	2.2	V
Neck break (2)		Bright ; max., Cont ; max. V_{23}=0V pedestal voltage signal amplitude $v$in=0.2V_{P-P}, f=2MHz	—	—	100	mV_{P-P}
Y Signal Processing						
Terminal voltage (2)	V_{46-33}	V_{CC1}=12V, V_{CC2}=9V I_{18}=13.5mA	1.6	2.1	2.6	V
Video voltage gain	A_V	Input ; sine wave 0.2V_{P-P}2MHz Cont ; max. Aperture ; min. Bright ; 3V	13.0	15.5	18.0	times
Video frequency characteristics	f_{YC}	Attenuation quantity in f=7MHz for output level in f=2MHz V_{43}=6.4V	−5	−3	—	dB
Sharpness variable range (1)	$\frac{A_{S\,typ.}}{A_{S\,min.}}$	f=4.0MHz	6.0	9	11.5	dB
Contrast variable range	$\frac{e_{max.}}{e_{min.}}$	Input ; sine wave 0.2V_{P-P}2MHz Cont ; max. to min. Aperture ; min., Bright ; 3V	11.0	14.0	17.0	dB
Brightness control sensitivity	BR	Bright ; 3.5V, 2.0V Δ($BR_{3.5V}$−$BR_{2.0V}$) /1.5V	1.2	1.5	1.8	V/V
DC restoration rate	T_{DC}	Cont ; max., Aperture ; min. Video input 0.4V_{P-P} APL 10% to 90%	94	97	105	%
Y output BLK level	Y_{BL}	At V_{CC1}=12V and HBLK Level of V_{CC2}=9V, Bright ; typ.	0.6	1.2	1.8	V
Y output pedestal level	Y_{PL}	Bright=2V	2.1	2.7	3.3	V
Black level correction (amplitude variable) (1)	V_{BL} (a)−(b)	Input signal ; full black (a) Pin② RC externally mounted (b) Pin② 9V	−100	0	+100	mV

■ Electrical Characteristics (cont.) (Ta=25±2℃)

Parameter	Symbol	Condition	min	typ	max	Unit
Black level correction (amplitude variable) (2)	V_{BL} (c)−(a)	Input signal ; full black Pin② 3V	0.4	0.7	1.0	V
Black level correction (amplitude variable) (3)	V_{BL} (a)−(b)	Adjust output amplitude at $0.8V_{P-P}$	100	250	400	mV
Black level correction (amplitude variable) (4)	V_{BL} (a)−(b)	Adjust output amplitude at $1.8V_{P-P}$	−120	0	120	mV
Delay time (1)	τ_{D1}	V_{43}=4.0V	365	460	540	ns
Delay time (2)	$\Delta\tau_{D2}$	V_{43}=12V	240	300	355	ns
On-screen Circuit						
Y_S threshold	e_{STH}	Switch level of Pin㉗	0.35	0.7	1.1	V
RGB frequency characteristics	e_{fRGB}	Amplitude at f=7MHz to the one at f=2MHz	−3.0	−1.0	1.0	dB
External input gain	G_{EXT}	f=2MHz $1V_{P-P}$ Y_S=1V	1.6	2.0	2.4	times
Internal·external pedestal difference voltage	ΔY_{PL}	$V_{YS=0V}-V_{YS=1V}$	280	570	720	mV
Color Signal Processing Circuit						
Color difference output (B−Y) (1)	e_{O1}	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; typ.	1.1	1.4	1.7	V_{P-P}
Color difference output (B−Y) (2)	e_{O2}	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; max.	3.5	4.4	5.4	V_{P-P}
Color difference signal (minimum) (3)	e_{O3}	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; mix.	—	35	60	mV_{P-P}
ACC characteristics (1)	A_{CC1}	Color bar signal (burst $400mV_{P-P}$)	0.9	1.0	1.1	times
ACC characteristics (2)	A_{CC2}	Color bar signal (burst $20mV_{P-P}$)	0.7	0.9	1.5	times
Demodulation output ratio (1)	R/B	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; typ.	1.15	1.30	1.45	times
Demodulation output ratio (2)	G/B	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; typ.	0.37	0.50	0.63	times
Demodulation angle R	∠R	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; typ.	94	101	108	deg
Demodulation angle G	∠G	Color bar signal (burst $200mV_{P-P}$) Cont ; typ., Color ; typ.	225	235	245	deg
Demodulation output residual carrier	e_{car}	No signal input 3.58MHz at each output terminal	—	—	25	mV_{P-P}
Color difference contrast variable range	Δe_{OC}	Color bar signal (burst $200mV_{P-P}$) Cont ; min.→ max. Color ; typ.	12.5	14.5	16.5	dB
Tint center voltage	T_C	Color bar signal (burst $200mV_{P-P}$) Color ; typ., Cont ; typ.	2.8	3.2	3.6	V
Tint variable range	$\Delta\theta_t$	Color bar signal (burst $200mV_{P-P}$) Color ; typ., Cont ; typ.	±25	±45	—	deg
APC pull-in range	f_{PC}	f_O adjustment of burst frequency with variable standard sample	±500	±600	—	Hz
VCO free-run frequency	f_{CO}	No signal, ACC : OFF f_O adjustment with standard sample	−150	0	150	Hz
f_{CO} supply voltage dependency	Δf_{CO-V}	V_{CC2}=9V+10%, −15% variation, variation quantity to V_{CC2}=9V	−120	0	120	Hz

■ Electrical Characteristics (cont.) (Ta=25±2℃)

Parameter	Symbol	Condition	min	typ	max	Unit
Color killer tolerance	e_K	Color bar signal (burst 200mV$_{P-P}$) Color ; typ., Cont ; typ.	−55	−48	−30	dB
Color Track						
AIC operation time color control terminal voltage	V_{40}	Color, Cont ; max. DC voltage at Pin㊵	2.45	3.0	3.55	V
Color track OFF/ON variation (1) Blue	Δe_{BB}	Color ; 2.4V Cont ; 3.0V Measure variation quantity of each color output amplitude when color track turned OFF ON Blue, Red : Bout Yellow : Rout	−40	0	40	mV
Color track OFF/ON variation (2) Red	Δe_{BR}		−60	−10	40	mV
Color track OFF/ON variation (3) Yellow	Δe_{RY}		−90	−50	−4	mV
Killer output voltage	V_{37-33}	Chroma no input I_{37}=1mA	0	0.2	0.5	V
Horizontal Signal Processing						
Horizontal free-run frequency (1)	f_{HO-1}	Output frequency at Pin㉑	15.45	15.75	16.05	kHz
Horizontal free-run frequency (2)	f_{HO-2}	At hold-down in operation	16.3	16.4	16.8	kHz
f_{HO} supply voltage variation	$\frac{\Delta f_{HO}}{V_{CC3}}$	f_{HO} (I_{18}=25mA) − f_{HO} (I_{18}=7mA)	0	100	200	Hz
Horizontal output pulse duty	τ_{HO}	Hold−Down OFF	34.4	37.5	40.6	%
HOSC start voltage	$V_{fH\,(S)}$	f=10k to 20kHz when horizontal oscillation output is above 1V$_{P-P}$	—	—	5.2	V
High voltage detection circuit start voltage (shut-down)	V_{sth}	I_{22}=50μA	0.65	0.75	0.85	V
Terminal voltage (4)	V_{4-22}	V_{CC} ; typ.	1.8	2.3	2.8	V
Horizontal pull-in range	f_{PH}	f_{HO}=15.75kHz	±400	—	—	Hz
Vertical Signal Processing						
Terminal voltage (5)	V_{5-22}	V_{CC} ; typ.	1.8	2.3	2.8	V
Vertical free-run oscillation frequency	f_{VO}	$\left(\frac{2}{525} f_H\right)$	58.8	60	61.2	Hz
Vertical free-run oscillation pulse width	τ_{VO}	$(10/f_H)$	610	640	670	μs
Vertical oscillation frequency supply voltage variation	Δf_{VO}	V_{CC1}=12V, I_{18}=13.5mA V_{CC2}=9.9V to 7.6V	−0.8	0	0.8	Hz
Service Switch Circuit						
Service switch threshold	e_{sth}		0.35	0.65	1.10	V
Outflow current	I_S	Inflow current when Pin㊾ grounded	−10	—	—	μA
Y Signal Processing Circuit						
Y input signal	e_Y	Input ; Pin㊻ positive polarity	(0.4V$_{P-P}$ ±3dB)			
Sharpness variable range (2)	$\frac{A_{S\,max.}}{A_{S\,min.}}$	f=4MHz Aper.con. : min. to max.	—	(15)	—	dB
Minimum video output	E_{OD}	Video ; no signal, Bright ; pedestal level of video output at 0.8V	—	(1.4)	—	V
Video output (E_O) DC supply voltage variation	$\frac{\Delta E_O}{\Delta V}$	Variation ration of video output pedestal level at V_{CC}=+10%, −15% variation	—	(0.10)	—	V/V
Contrast fluctuation due to variable sharpness	ΔV_{CA}	Video input ; steps wave 0.4V$_{P-P}$ Cont ; typ. Aper.con. ; min. to max.	—	(−170)	—	mV
Brightness fluctuation due to the variable contrast		Aper.con. ; max. Cont ; min. to max.	—	—	(+150)	mV
Blanking stop voltage		V_{CC} ; typ. Pin㊳ voltage where BLK not applied to output	—	(12.1)	—	V

Note) The characteristics value in parentheses is not a guaranteed value, but reference one on design.

■ Electrical Characteristics (cont.) (Ta=25±2℃)

Parameter	Symbol	Condition	min	typ	max	Unit
Color Signal Processing Circuit						
f_O temperature variation	Δf_{CO-T}	Ta=−20℃ to +70℃ Color signal no input	—	(−1.5)	—	Hz/℃
V_{CO} control sensitivity	β	Burst Gate ; OFF (IC built in)	—	(2.7)	—	Hz/mV
APC phase detection sensitivity	μ	Killer ; OFF	—	(200)	—	$\frac{mV}{deg}$
Phase hold characteristics	$\Delta\phi$	$\frac{1}{\mu \cdot \beta} \times 100$	—	(0.19)	—	$\frac{100deg}{Hz}$
Maximum color difference output	e_{OM}	Color bar signal (burst 200mV_{P-P}) Cont, Color ; max.	(5.7)	(6.2)	(6.7)	V_{P-P}
Color output temperature variation	Δe_{O-T}	Ta=−20℃ to +70℃ Ta=25℃ to be as center	—	—	(±350)	mV_{P-P}
Color output supply voltage variation	Δe_{O-VCC}	Fluctuation range at V_{CC}=+10%, −15% variation for V_{CC}=typ.	—	—	(±350)	mV
Career filter frequency characteristics	e_{cf}	Frequency to be −3dB at color output terminal (IC built-in)	(1.0)	—	—	MHz
DC dispersion of each E_C output	ΔE_{R-G} ΔE_{G-B} ΔE_{B-R}		—	(±100)	—	mV
E_C temperature variation	$\frac{\Delta E_C}{\Delta T}$	Ta=−20℃ to +70℃ Variation quantity of each output level	—	(2.7)	—	mV/℃
Variation quantity for each $\Delta E_{C(T)}$ output	$\Delta E_{R-G(T)}$ $\Delta E_{G-B(T)}$ $\Delta E_{B-R(T)}$	ΔE_C relative variation quantity for each output	—	—	(±60)	mV
E_C supply voltage variation	$\Delta E_{C(V)}$	Variation quantity at V_{CC1}=+10%, −15% variation and V_{CC2}=9V, for V_{CC1}=12V	—	(0.06)	—	V/V
Variation quantity for each $\Delta E_{C(V)}$ output	$\Delta E_{R-G(V)}$ $\Delta E_{G-B(V)}$ $\Delta E_{B-R(V)}$	V_{CC1}=+10%, −15% V_{CC2}=9V, V_{CC1}=12V ΔE_C (V) relative variation for each output	—	—	(±50)	mV
E_C to color fluctuation	$\Delta E_{R-G(C)}$ $\Delta E_{G-B(C)}$ $\Delta E_{B-R(C)}$	Color terminal max.→min. $\Delta E_C A_{CC}$=9V, Cont ; max.	—	—	(100)	mV
E_C to A_{CC} fluctuation	$\Delta E_{R-G(A)}$ $\Delta E_{G-B(A)}$ $\Delta E_{B-R(A)}$	Variation quantity of E_C for A_{CC} voltage variation Color, Cont ; max.	—	—	(60)	mV
Color Track						
Phase correction center	θ_0	Burst · chroma 200mV_{P-P} Adjust to tint center	(113)	(123)	(133)	deg
Phase correction range (1)	θ_{CR1}		(103)	(115)	(127)	deg
Phase correction range (2)	θ_{CR2}		(103)	(115)	(127)	deg
Phase correction quantity (1)	θ_{C1}		(18)	(23)	(28)	deg
Phase correction quantity (2)	θ_{C2}		(13)	(18)	(23)	deg
Maximum phase correction range (1)	θ_{MCR1}		(55)	(63)	(71)	deg
Maximum phase correction range (2)	θ_{MCR2}		(55)	(63)	(71)	deg
Demodulation angle R (2)	∠R2	Demodulation angle at color track ON	—	(90)	—	deg
Demodulation angle G (2)	∠G2		—	(235)	—	deg
Deflection Processing Circuit						
Synchronous separable input	V_{IN}	V_{CC1} to V_{CC3} ; typ. APL50%	(1.0)	(2.0)	(2.8)	V_{P-P}
f_{HO} temperature variation	$\frac{\Delta f_{HO}}{Ta}$	Ta=−20℃ to +70℃	—	(5.5)	—	Hz/℃
Phase detection sensitivity	μ	V_{CC1}=12V, V_{CC2}=9V	—	(31)	—	μA/μs
Horizontal oscillation frequency control sensitivity	β		—	(1.2)	—	Hz/mV
Vertical pull-in possible input frequency	f_{PV}	f_H=15.75kHz	(57)	(60)	(63)	Hz

Note) The characteristics value in parentheses is not a guaranteed value, but reference one on design.

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