

AN5304NK

NTSC Video Signal Processor IC

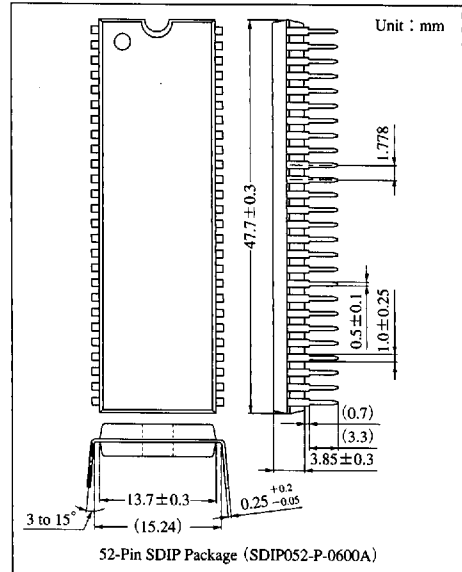
Overview

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.

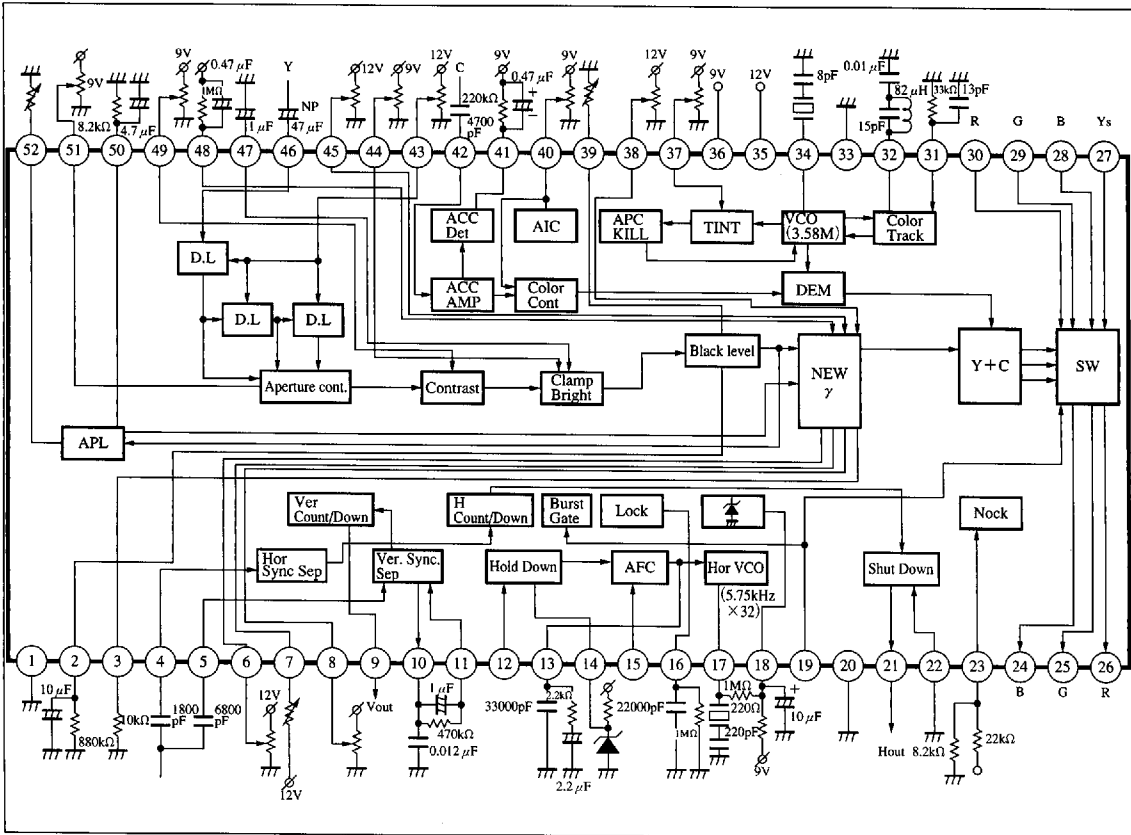
Features

- 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



ICs for TV

Block Diagram



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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 _{36-1, 20, 33}	10.35
Supply current	I _{CC}	I ₃₅	42
		I ₃₆	59
Power dissipation ^{Note 2)}	P _D	1300	mW
Operating ambient temperature ^{Note 1)}	T _{opr}	-20 to +70	°C
Storage temperature ^{Note 1)}	T _{stg}	-55 to +150	°C

Note 1) T_a = 25°C except operating ambient temperature and storage temperature.

Note 2) Allowable power dissipation of the package at T_a = 70°C.

Recommended Operating Range (T_a = 25°C)

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} ≥ V_{CC2}

Note 2) Within the limits of P_D, V_{CC1} ≤ 13.8V, V_{CC2} ≤ 10.35V

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Electrical Characteristics ($T_a = 25 \pm 2^\circ\text{C}$)

Parameter	Symbol	Condition	min	typ	max	Unit
DC Characteristics						
Circuit current 1	I_{36}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ $I_{18} = 13.5\text{mA}$	33	43	54	mA
Circuit current 2	I_{35}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ $I_{18} = 13.5\text{mA}$	22	30	38	mA
Circuit voltage	V_{18}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ $I_{18} = 13.5\text{mA}$	5.8	6.3	6.9	V
Constant voltage operation resistor	r_{18}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ $I_{18} = 9$ to 25mA	—	—	30	Ω
New Signal Processing						
APL detection voltage	V_{APL}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ Cont ; max., Bright ; min. $V_{in} = 0.3V_{P-P}$	0.85	1.3	1.7	V
APL detection voltage ratio	ΔV_{APL}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ Cont ; max., Bright ; min. $V_{in} = 0.15V_{P-P}$	0.44	0.5	0.56	times
White character correction	ΔV_{WI}	$V_{38} = 3.4\text{V}$, $V_6 = 0$ 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. $V_{38} = 0\text{V}$	7.5	8.2	9.0	V
Blooming level (2)	B(2)	Cont ; max., Bright ; max. $V_{38} = 6\text{V}$	3.5	4.3	5.1	V
Static γ characteristics (1)	$\gamma(1)$	Cont ; typ., Bright ; typ. $V_{45} = \text{open to } 0\text{V}$	0.3	0.7	0.95	V
Static γ characteristics (2)	$\gamma(2)$	Cont ; typ., Bright ; typ. $V_{45} = \text{open to } 6\text{V}$	-1.3	-0.9	-0.4	V
Neck break (1)		Bright ; max., Cont ; max. $V_{23} = 0\text{V}$ pedestal voltage	0.5	1.6	2.2	V
Neck break (2)		Bright ; max., Cont ; max. $V_{23} = 0\text{V}$ pedestal voltage signal amplitude $v_{in} = 0.2V_{P-P}$, $f = 2\text{MHz}$	—	—	100	mV_{P-P}
Y Signal Processing						
Terminal voltage (2)	V_{46-33}	$V_{CC1} = 12\text{V}$, $V_{CC2} = 9\text{V}$ $I_{18} = 13.5\text{mA}$	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 $f = 7\text{MHz}$ for output level in $f = 2\text{MHz}$ $V_{43} = 6.4\text{V}$	-5	-3	—	dB
Sharpness variable range (1)	$\frac{A_{S \text{ typ.}}}{A_{S \text{ min.}}}$	$f = 4.0\text{MHz}$	6.0	9	11.5	dB
Contrast variable range	$\frac{e_{\text{max.}}}{e_{\text{min.}}}$	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 $\Delta(BR_{3.5V} - BR_{2.0V}) / 1.5\text{V}$	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 $V_{CC1} = 12\text{V}$ and HBLK Level of $V_{CC2} = 9\text{V}$, 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


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Electrical Characteristics (cont.) (Ta = 25 ± 2°C)

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 Pin⑦	0.35	0.7	1.1	V
RGB frequency characteristics	e _{RGB}	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 ₀ adjustment of burst frequency with variable standard sample	±500	±600	—	Hz
VCO free-run frequency	f _{CO}	No signal, ACC : OFF f ₀ 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

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■ Electrical Characteristics (cont.) ($T_a = 25 \pm 2^\circ\text{C}$)

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 Pin⑩	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 $I_{37} = 1\text{mA}$	0	0.2	0.5	V
Horizontal Signal Processing						
Horizontal free-run frequency (1)	f_{HO-1}	Output frequency at Pin⑫	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	$\frac{\Delta f_{HO}}{V_{CC3}}$	$f_{HO} (I_{18} = 25\text{mA})$ - $f_{HO} (I_{18} = 7\text{mA})$	0	100	200	Hz
Horizontal output pulse duty	τ_{HO}	Hold - Down OFF	34.4	37.5	40.6	%
HOSC start voltage	$V_{fH(S)}$	$f = 10\text{kHz}$ to 20kHz when horizontal oscillation output is above $1V_{P-P}$	—	—	5.2	V
High voltage detection circuit start voltage (shut-down)	V_{sh}	$I_{22} = 50\mu\text{A}$	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}	$f_{HO} = 15.75\text{kHz}$	± 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}	$V_{CC1} = 12\text{V}$, $I_{18} = 13.5\text{mA}$ $V_{CC2} = 9.9\text{V}$ to 7.6V	-0.8	0	0.8	Hz
Service Switch Circuit						
Service switch threshold	e_{sh}		0.35	0.65	1.10	V
Outflow current	I_S	Inflow current when Pin⑭ grounded	-10	—	—	μA
Y Signal Processing Circuit						
Y input signal	e_Y	Input ; Pin⑮ positive polarity	$(0.4V_{P-P} \pm 3\text{dB})$			
Sharpness variable range (2)	$\frac{\Delta S_{max.}}{\Delta S_{min.}}$	$f = 4\text{MHz}$ 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. Pin⑯ 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.

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

Parameter	Symbol	Condition	min	typ	max	Unit
Color Signal Processing Circuit						
f ₀ temperature variation	Δf_{CO-T}	Ta = -20°C to +70°C Color signal no input	—	(-1.5)	—	Hz/°C
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°C to +70°C Ta = 25°C to be as center	—	—	(±350)	mV _{P-P}
Color output supply voltage variation	Δe_{O-VCC}	Fluctuation range at V _{CC1} = +10%, -15% variation for V _{CC2} = 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°C to +70°C Variation quantity of each output level	—	(2.7)	—	mV/°C
Variation quantity for each ΔE_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 ΔE_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. $\Delta E_{CAcc} = 9V$, 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)	$\angle R2$	Demodulation angle at color track ON	—	(90)	—	deg
Demodulation angle G (2)	$\angle G2$		—	(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	$\frac{\Delta f_{HO}}{\Delta Ta}$	Ta = -20°C to +70°C	—	(5.5)	—	Hz/°C
Phase detection sensitivity	μ	V _{CC1} = 12V, V _{CC2} = 9V	—	(31)	—	$\mu A/\mu s$
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.