



# LA7685J

## PAL/NTSC Single-chip Color Television Signal Processing Circuit

### Overview

The LA7685J is a single-chip IC (with VIF, SIF, video, chroma, and deflection circuits built in) for use in PAL or NTSC television sets.

Because the PLL+ splitting method is used in the VIF circuit, the LA7685J is suited for use in top-of-the-line small and mid-size television sets. In addition, when used in combination with the LA7640N SECAM chroma IC, the LA7685J can be used in a PAL/NTSC/SECAM multisystem set.

### Features

#### [VIF Block]

- PLL+ splitting (for excellent image and sound quality)
- High-gain VIF amplifier
- High-speed AGC
- APC time constant switch built in

#### [SIF Block]

- Simultaneous audio IN/OUT
- Video/audio simultaneous muting, or audio only muting also possible
- 1st amplifier with AGC function

#### [AV Switching Block]

- INT/EXT AV switch

Delay line	Video EXT, audio EXT	Switch conditions
OFF	IN	D
OFF	EXT	C
ON	EXT	B
ON	IN	A

#### [OSD Block]

- Three RGB inputs
- RGB linear amplifier (−6 dB input: 2 V to 5 V)
- First blanking (also used for B input)

#### [Chroma Block]

- ACC filter, carrier filter built in
- Ident detection output
- Killer detection output

#### [Video Block]

- Black extension
- DC restoration
- Delay line built in
- Wide band: 9 MHz (with delay line shorted)
- Built-in double differential circuits that also enable soft tone
- Supports S input (for VCRs)
- DC transmission amount can be varied (externally adjustable)

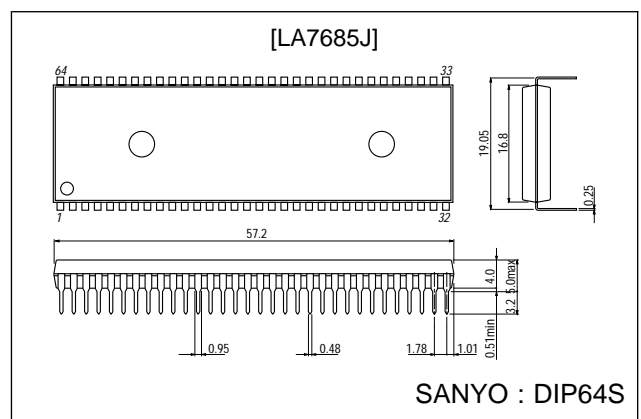
#### [Deflection Block]

- Adjustment-free horizontal and vertical sync
- Excellent anti-noise characteristics due to adoption of duplex AFC
- Vertical sync sensitivity can be adjusted externally
- Constant vertical size with no signal (constant for 60/50 Hz)
- Highly stable image during copy guard tape playback (macrovision tapes, etc.)
- Excellent stability against VCR skew distortion

### Package Dimensions

unit : mm

#### 3071-DIP64S



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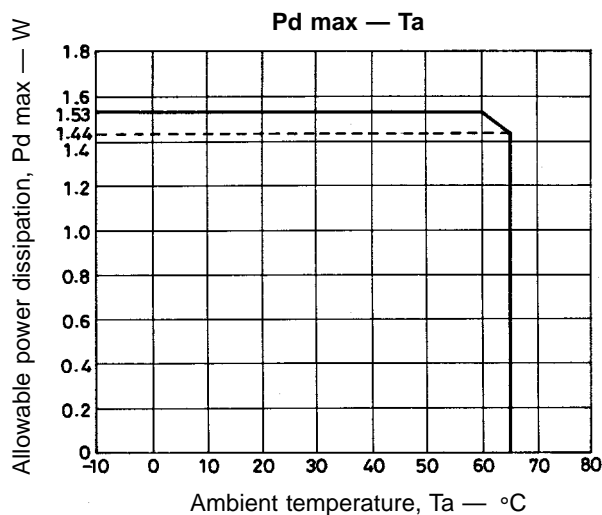
## Specifications

### Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V <sub>2</sub> max		11	V
	V <sub>12</sub> max		11	V
Maximum supply current	I <sub>32</sub> max		16	mA
Allowable power dissipation	Pd max	Ta ≤ 60 °C	1.53	W
Operating temperature	T <sub>opr</sub>		-10 to +65	°C
Storage temperature	T <sub>stg</sub>		-55 to +150	°C
Circuit current	I <sub>56</sub>		-6	mA
	I <sub>6</sub>		-3	mA
FBP input current	I <sub>33</sub> max	Peak current	5	mA
	I <sub>27</sub> max	Peak current	10	mA

### Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V <sub>2</sub>		9	V
	V <sub>12</sub>		9	V
Recommended supply current	I <sub>32</sub>		13	mA
Operating supply voltage range	V <sub>20p</sub>		8 to 9.5	V
	V <sub>120p</sub>		8 to 9.5	V
Operating supply current range	I <sub>320p</sub>		10 to 16	mA



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### Electrical Characteristics at $T_a = 25\text{ }^\circ\text{C}$ , $V_{CC} = V_2 = V_{12} = 9\text{ V}$ , $I_{CC} = I_{32} = 13\text{ mA}$

Parameter	Symbol	Conditions	min	typ	max	Unit
[Circuit Voltage, Current]						
Horizontal supply voltage	$V_{32}$	$V_{CC} = 9\text{ V}$ , $I_{CC} = 13\text{ mA}$	7.1	7.6	8.1	V
Supply current	$I_2 + I_{12}$	$V_{CC} = 9\text{ V}$ , $I_{CC} = 13\text{ mA}$ , $I_{FAGC} = 4\text{ V}$	102	120	138	mA
[VIF Block] $f_p = 38.9\text{ MHz}$						
Video output voltage with no signal	$V_{56}$	No signal	4.3	4.7	5.1	V
AFT output voltage with no signal	$V_{60}$	No signal	3.0	4.5	6.0	V
Maximum RF AGC voltage	$V_{5H}$	CW = 85 dB $\mu$ , RF AGC VR = min	7.6	8.0	8.3	V
Minimum RF AGC voltage	$V_{5L}$	CW = 85 dB $\mu$ , RF AGC VR = max	0	0.01	0.3	V
Input sensitivity	$V_i$	Video output is 0.8 Vp-p (40 % MOD), VIF input level	33	39	45	dB $\mu$
AGC range	GR	Maximum input ( $V_0 = 0.8\text{ Vp-p}$ ) – Input sensitivity	54	62		dB
Maximum allowable input	$V_i\text{ max}$	Video output is +1 dB. VIF input level	97	104		dB $\mu$
Video output amplitude	$V_{O56}$	$V_i = 80\text{ dB}\mu$ , AM = 78 % MOD	1.7	2.0	2.3	Vp-p
Differential gain	DG	$V_i = 80\text{ dB}\mu$ , 87.5 %, VIDEO MOD		3.0	10	%
Differential phase	DP	$V_i = 80\text{ dB}\mu$ , 87.5 %, VIDEO MOD		1.0	10	deg
Video S/N	S/N	$V_i = 80\text{ dB}\mu$ , $20 \log \frac{1.46 (Vp-p)}{\text{Noise (Vrms)}}$	47	54		dB
Sync signal tip level	$V_{56\text{ TIP}}$	CW = 80 dB $\mu$	2.1	2.4	2.7	V
Frequency characteristics	$f_C$	Frequency when video output is –3 dB	6.5	8.0		MHz
1.07 kHz beat level	$I_{1.07}$	V4.43 MHz/V1.07 MHz, $V_i = 80\text{ dB}\mu$	35	50		dB
Maximum AFT output voltage	$V_{60H}$	CW = 80 dB $\mu$ , frequency change	7.6	8.0	8.4	V
Minimum AFT output voltage	$V_{60L}$	CW = 80 dB $\mu$ , frequency change	0.6	1.0	1.4	V
AFT detection sensitivity	Sf	CW = 80 dB $\mu$ , frequency change	50	80	110	mV/kHz
AFT defeat start voltage	$V_{AFT\ SW}$	Measure with sweep signal	0.5	1.0		V
Black noise threshold level	$V_{BTH}$	Measure with sweep signal	1.1	1.4	1.7	V
APC pull-in range (U)	$f_{PU}$	CW = 80 dB $\mu$ , $f_p = 34\text{ MHz}$ to 44 MHz	0.8	1.7		MHz
APC pull-in range (L)	$f_{PL}$	CW = 80 dB $\mu$ , $f_p = 53\text{ MHz}$ to 64 MHz		–2	–1	MHz
VCO maximum variable range	$\Delta f_U$	No signal	0.9	1.7		MHz
	$\Delta f_L$	No signal		–2	–1	MHz
VCO control sensitivity	$\beta$	No signal	1.3	2.5	5.3	kHz/mV
[AVSW Block]						
Image output DC voltage	$V_{50}$	No signal	3.0	3.4	3.8	V
Internal image input voltage	$V_{54}$	No signal	4.4	4.8	5.2	V
External image input voltage	$V_{52}$	No signal	4.4	4.8	5.2	V
External audio input voltage	$V_4$	No signal	5.2	5.6	6.0	V
[1st SIF Block]						
5.5 MHz conversion gain	VG	$V_i = 70\text{ dB}\mu$ , 33.4 MHz	21	26	31	dB
Output level	$V_{59}$	$V_i = 10\text{ mV}$ , 33.4 MHz	210	320	480	mVp-p
Maximum input level	$V_{11\text{ max}}$	$f_S = 33.4\text{ MHz}$	96	101		dB $\mu$
[SIF ATT Block] $f_S = 5.5\text{ MHz}$						
SIF limiting voltage	$V_i\text{ lim}$	SIF input when detection output is –3 dB.		40	47	dB $\mu$
FM detection output voltage	$V_{O1}$	$V_i = 100\text{ dB}\mu$ , $\Delta f = \pm 30\text{ kHz}$	390	500	630	mVrms
FM detection output distortion	THD	$V_i = 100\text{ dB}\mu$ , $\Delta f = \pm 30\text{ kHz}$		0.4	1.0	%
AM rejection ratio	AMR	$V_i = 100\text{ dB}\mu$ , $\frac{FM : \Delta f = \pm 30\text{ kHz}}{AM : 30\%}$	40	60		dB
ATT voltage gain	$G_{AF}$	$V_i = 1\text{ Vrms}$ , $f = 400\text{ Hz}$	–1	0	1	dB
Maximum attenuation of electronic volume control	ATT	$V_i = 2\text{ Vrms}$ , $f = 400\text{ Hz}$	70	80		dB
[Video Block]						
Black extension threshold	$BS_{TH}$	APL variable, input 0.5 Vp-p	40	50	60	IRE
Maximum black extension gain	$BS_{max}$	APL variable, input 0.5 Vp-p	–30	–22	–13	IRE
Soft video tone variable range	$\Delta\text{Soft}$	$f = 2\text{ MHz}$ , 100 mVp-p Video tone $V_R : 4\text{ V} \rightarrow 0\text{ V}$	–6	–4	–2	dB

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Parameter	Symbol	Conditions	min	typ	max	Unit
Sharp video tone variable range	$\Delta$ Sharp	f = 2 MHz, 100 mVp-p, video tone $V_R$ : 4 V $\rightarrow$ 9 V, contrast $V_R$ : 6 V	7	10	13	dB
Video voltage gain AC switch 9 V	$GV_{9V}$	f = 100 kHz, 100 mVp-p, contrast $V_R$ : 9 V, video tone $V_R$ : 4 V	15	18	21	dB
Video voltage gain AV switch 0 V	$GV_{0V}$	f = 100 kHz, 100 mVp-p, contrast $V_R$ : 0 V, video tone $V_R$ : 4 V	15	18	21	dB
Contrast control center	$C_{CEN}$	f = 100 kHz, 100 mVp-p, contrast $V_R$ : 6 V	0.35	0.44	0.53	Vp-p
Contrast control variable range	$\Delta C_V$	Contrast $V_R$ : 3 V $\rightarrow$ 9 V	22	24	26	dB
Bright control	$BR_H$	Bright $V_R$ : 2.0 V	5.5	6.5	7.5	V
	$BR_{CEN}$	Bright $V_R$ : 5.25 V	2.3	2.8	3.3	V
	$BR_L$	Bright $V_R$ : 7.5 V		0.5	1.5	V
Frequency characteristics D.L.ON	$f_{V0V}$	Contrast $V_R$ : 6 V, video tone $V_R$ : 4 V, 3 dB down	4.5	6		MHz
DC transmission amount	$R_{DC}$	Input : STAIR STEP signal, 200 mVp-p	88	93		%
Delay line delay amount (one level)	$T_{DL1}$	Input : WHITE 100 %	300	350	400	ns
Delay line delay amount (two levels)	$T_{DL2}$	Input : WHITE 100 %	370	420	470	ns
[Chroma Block PAL/NTSC Common]						
Color control color residue	$E_{Cmin}$	Color $V_R$ : 0 V, contrast $V_R$ : 9 V			30	mVp-p
Color contrast variable range	$\Delta C_C$	Color $V_R$ : B-Y = 2.5 Vp-p, contrast $V_R$ : 3 V $\rightarrow$ 9 V	18.5	20	21.5	dB
Demodulation output DC voltage	$V_{C-Y}$	Burst signal only, color $V_R$ : 0 V	4.8	5.3	5.8	V
Demodulation output DC difference voltage	$\Delta V_{C-Y}$	Burst signal only, color $V_R$ : 0 V	-300	0	+300	mV
Demodulation output carrier leakage	$E_{car}$	No signal, killer off, color $V_R$ : 0 V			0.03	Vp-p
APC pull-in range	$\Delta F_{APC}$		$\pm 500$			Hz
Kill output	$V_{KiOUT}$				0.35	V
[Chroma Block PAL]						
Color control center	$E_{CCEN}$	Color $V_R$ : 4.5 V, contrast $V_R$ : 6 V	1.5	2.0	2.5	Vp-p
ACC amplitude characteristics	$ACC_{M1P}$	+6 dB	-3	0	+3	dB
	$ACC_{M2P}$	-20 dB	-5	-1	+1	dB
Demodulation output ratio	$B/Rp$		1.10	1.35	1.60	
	$G/Rp$	B-Y no signal	-0.56	-0.51	-0.46	
	$G/Bp$	R-Y no signal	-0.21	-0.19	-0.17	
Demodulation angle	$RBp$		85	90	95	deg
Maximum chroma output	$E_{ch}$	Color $V_R$ : 9 V, contrast $V_R$ : 9 V	1.5	2.0	2.5	Vp-p
Maximum demodulation output	$E_{Cmax}$	Color $V_R$ : 9 V, contrast $V_R$ : 9 V	3.6	4.2		Vp-p
Killer operating point	$E_{KONP}$		-37	-33	-29	dB
PAL output					0.3	V
[Chroma Block NTSC]						
Color control center	$E_{CEN}$	Color $V_R$ : 4.5 V, contrast $V_R$ : 6 V	1.4	1.9	2.4	Vp-p
ACC amplitude characteristics	$ACC_{M1N}$	+6 dB	-3	0	+3	dB
	$ACC_{M2N}$	-20 dB	-3	0	+3	dB
ACC phase characteristics	$ACC_{P1N}$	+6 dB	-3	0	+3	deg
	$ACC_{P2N}$	-20 dB	-7	0	+7	deg
Tint center	$T_{CEN}$	Tint $V_R$ = 4.5 V, color $V_R$ : 4.5 V, contrast $V_R$ : 6 V	-12	0	+12	deg
Tint variable range	$\Delta T$	Tint $V_R$ : 0 V $\leftarrow$ 4.5 V $\rightarrow$ 9 V, color $V_R$ : 4.5 V, contrast $V_R$ : 6 V	$\pm 35$			deg
Demodulation output ratio	$R/B_N$		0.82	0.91	0.99	
	$G/B_N$		0.18	0.25	0.32	
Demodulation angle	$RB_N$		99	105	111	deg
	$GB_N$		-130	-120	-110	deg
Maximum demodulation output	$E_{CmaxN}$	Color $V_R$ : 9 V, contrast $V_R$ : 9 V	3.5	4.1		Vp-p
Kill operation point	$E_{KONN}$		-39	-35	-31	dB
NTSC/SECAM output	$E_{KONN}$		1.4	1.9	2.4	V

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Parameter	Symbol	Conditions	min	typ	max	Unit
[Deflection Block]						
Sync separation input voltage	$V_{S\ DC}$		6.0	6.3	6.6	V
Vertical free-running frequency	$T_{V\ free50}$		312.0	312.5	313.0	H
	$T_{V\ free60}$		262.0	262.5	263.0	H
Vertical sync maximum period	$T_{V\ max50}$	Horizontal sync signal only	356.5	357	357.5	H
	$T_{V\ max60}$	Horizontal sync signal only	296.5	297	297.5	H
Vertical sync minimum period	$T_{V\ min50}$		268.5	269	269.5	H
	$T_{V\ min60}$		224.5	225	225.5	H
Vertical blanking pulse peak value	$V_{H\ VBL}$		7.0	7.5		V
Vertical blanking pulse width	$P_{W\ BLK50}$		21.0	21.5	22.0	H
	$P_{W\ BLK60}$		17.0	17.5	18.0	H
Vertical output pulse width	$P_{W\ VOUT}$		8.0	8.5	9.0	H
Vertical output voltage	$V_{OUT\ H}$		5.7	6	6.3	V
	$V_{OUT\ M}$		4.3	4.6	4.9	V
	$V_{OUT\ L}$				0.3	V
Vertical external trigger load resistance	$R_{TR}$		2.5	3.6		k $\Omega$
Vertical automatic sync stop voltage	$V_{SAS}$		1.2	1.4	1.6	V
Vertical output pulse start $V_{CC}$ voltage	$S_{VV}$				4	V
Horizontal free-running frequency deviation	$\Delta f_H$	Deviation from 15.680 kHz	-100	0	+100	Hz
Dependence of horizontal free-running frequency on $V_{CC}$	$\Delta f_{HVCC}$	$V_{25} = 6.5\ V$ , reference value		2		Hz
Horizontal pull-in range	$f_{HPULL}$	Deviation from 15.680 kHz	$\pm 450$			Hz
Horizontal output pulse start $V_{CC}$ voltage	$S_{HV}$			4.8	5.5	V
AFC II FBP peak value	$FBP_H$		4.1	4.6	5.1	V
VCR switch input voltage	$V_{CR}$			0.7	0.9	V
Horizontal output pulse width	$P_{W\ HOUT}$		21.8	23.8	25.8	$\mu s$
Horizontal output pulse phase	$H_{PF}$		12			$\mu s$
	$H_{PCEN}$		3.4	4.4	5.4	$\mu s$
	$H_{PR}$				0	$\mu s$
Burst gate pulse width	$P_{W\ BGP}$		2.7	3.7	4.7	$\mu s$
Burst gate pulse phase	$T_{d\ BGP}$		0.2	0.6	1.2	$\mu s$
Horizontal sync detection threshold level	$H_{coin}$		4.2	4.5	4.8	V
50/60 output voltage	$V_{50}$			0.5	0.7	V
	$V_{60}$		4.0	4.7		V
50/60 input voltage	$V_{in50}$				0.5	V
	$V_{in60}$		7.2			V
X ray protection circuit operation input voltage	$V_{HD}$		0.64	0.74	0.84	V
Sandcastle H.BLK peak value	$V_H\ SHBL$		3.7	4.0	4.3	V
Sandcastle BGP peak value	$V_H\ SBGP$		7.7	8.0	8.3	V
Sandcastle BP peak value	$V_H\ SBP$		5.7	6.0	6.3	V
Sandcastle BGP width	$P_W\ SBGP$		1.4	1.9	2.4	$\mu s$
Sandcastle BGP phase	$T_{d\ SBGP}$		1.7	2.2	2.7	$\mu s$
Sandcastle field ID width	$P_W\ SFID$		11.5	12	12.5	H
Sandcastle H.BLK width 50	$P_W\ SHBL50$		11.0	12.0	13.0	$\mu s$
Sandcastle H.BLK width 60	$P_W\ SHBL60$		10.0	11.0	12.0	$\mu s$

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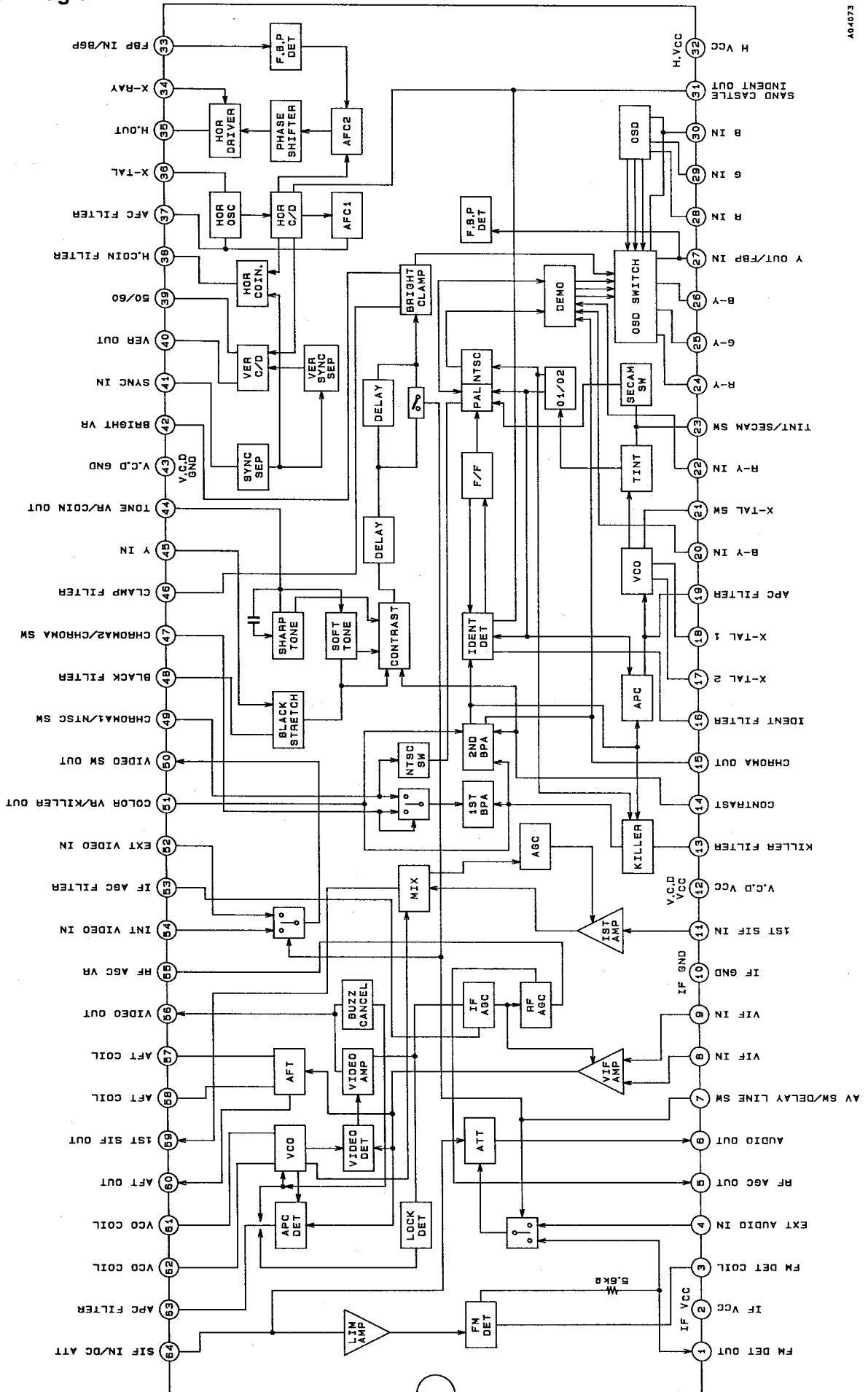
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Parameter	Symbol	Conditions	min	typ	max	Unit
[OSD Block]						
Blanking pulse threshold level	TH <sub>BL</sub>	C-IN : color bar, B-IN : variable	0.6	0.9	1.2	V
-Y OUT DC voltage (OSD mode)	V <sub>Y</sub>	B-IN : 1.5 V	2.4	2.7	3.0	V
R.G.B. -IN threshold level	TH <sub>R</sub>	R-IN : variable, B-IN : 1.5 V	1.4	1.7	2.0	V
	TH <sub>G</sub>	G-IN : variable, B-IN : 1.5 V				
	TH <sub>B</sub>	B-IN : variable				
R.G.B. -Y OUT DC voltage (3 V)	V <sub>R3V</sub>	R, G, B-IN : 3 V	5.2	5.5	5.8	V
	V <sub>G3V</sub>					
	V <sub>B3V</sub>					
R.G.B. -Y OUT DC voltage (4 V)	V <sub>R4V</sub>	R, G, B-IN : 4 V	5.8	6.1	6.4	V
	V <sub>G4V</sub>					
	V <sub>B4V</sub>					
R.G.B. -Y OUT DC voltage (5 V)	V <sub>R5V</sub>	R, G, B-IN : 5 V	6.3	6.6	6.9	V
	V <sub>G5V</sub>					
	V <sub>B5V</sub>					

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## Block Diagram



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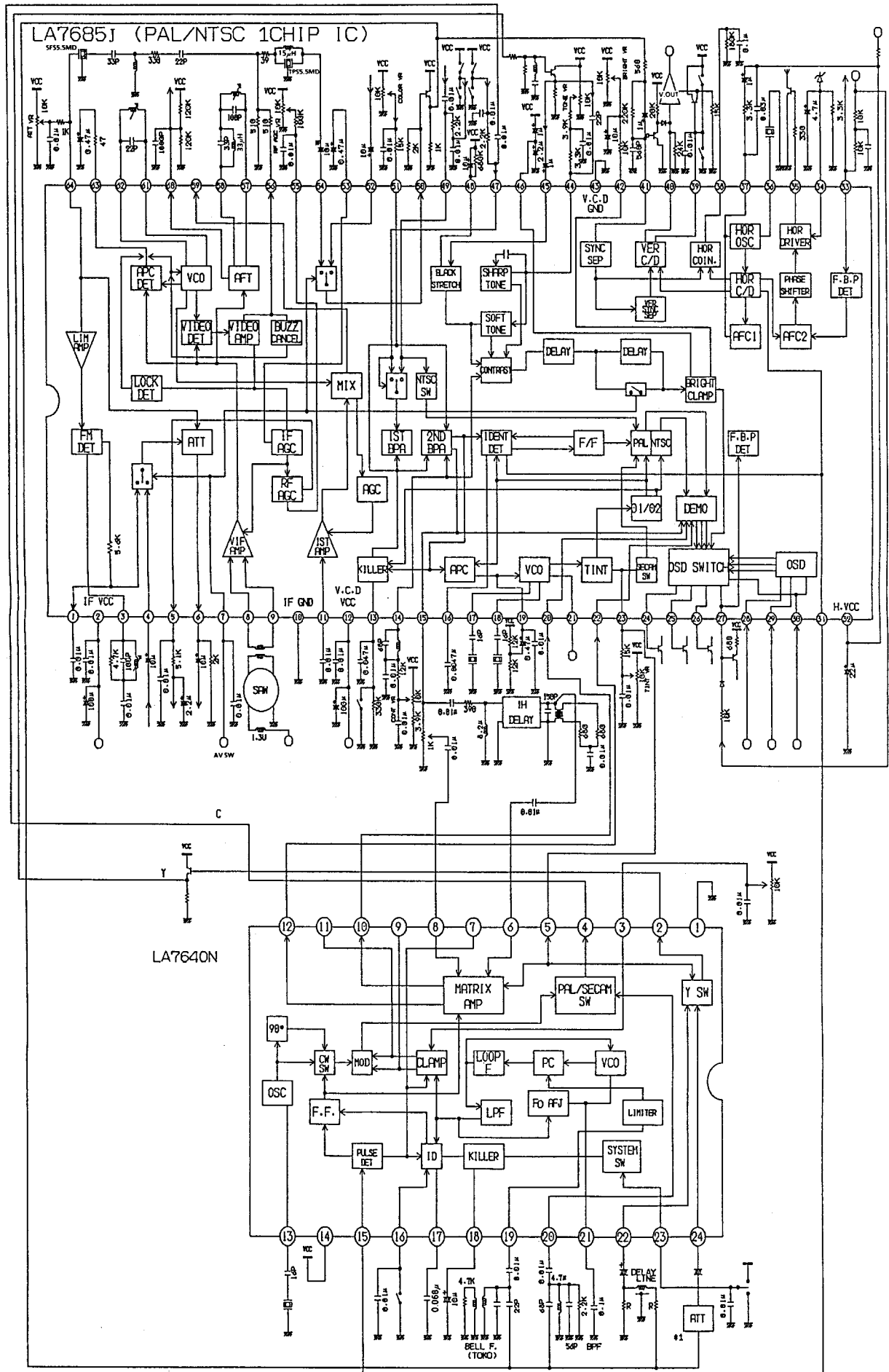




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## LA7685J and LA7640N Connection Diagram (Reference)

Unit (resistance: Ω, capacitance: F)



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