



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)

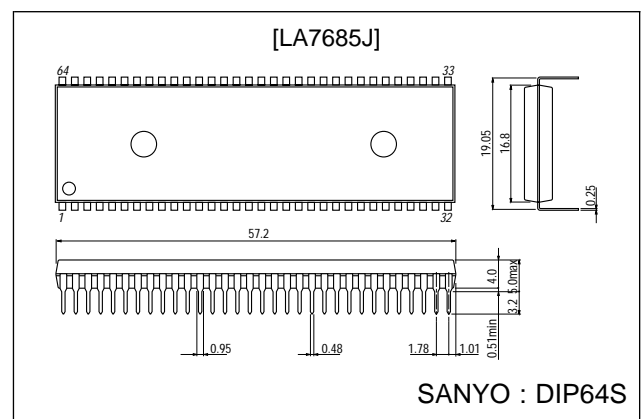
[Deflection Block]

- 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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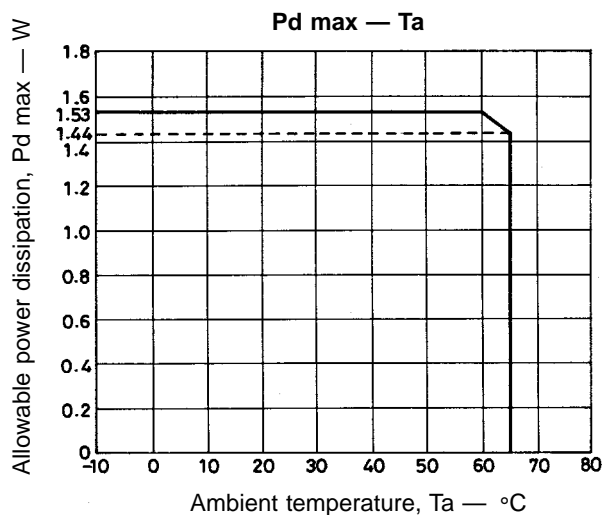
Specifications

Maximum Ratings at Ta = 25 °C

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

Operating Conditions at Ta = 25 °C

| Parameter | Symbol | Conditions | Ratings | Unit |
|--------------------------------|-------------------|------------|----------|------|
| Recommended supply voltage | V ₂ | | 9 | V |
| | V ₁₂ | | 9 | V |
| Recommended supply current | I ₃₂ | | 13 | mA |
| Operating supply voltage range | V _{20p} | | 8 to 9.5 | V |
| | V _{120p} | | 8 to 9.5 | V |
| Operating supply current range | I _{320p} | | 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 μ , RF AGC VR = min | 7.6 | 8.0 | 8.3 | V |
| Minimum RF AGC voltage | V_{5L} | CW = 85 dB μ , 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 μ |
| 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 μ |
| 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 μ | 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 μ , frequency change | 7.6 | 8.0 | 8.4 | V |
| Minimum AFT output voltage | V_{60L} | CW = 80 dB μ , frequency change | 0.6 | 1.0 | 1.4 | V |
| AFT detection sensitivity | Sf | CW = 80 dB μ , 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 μ , $f_p = 34\text{ MHz}$ to 44 MHz | 0.8 | 1.7 | | MHz |
| APC pull-in range (L) | f_{PL} | CW = 80 dB μ , $f_p = 53\text{ MHz}$ to 64 MHz | | –2 | –1 | MHz |
| VCO maximum variable range | Δf_U | No signal | 0.9 | 1.7 | | MHz |
| | Δf_L | No signal | | –2 | –1 | MHz |
| VCO control sensitivity | β | 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 μ |
| [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 μ |
| 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 | ΔSoft | $f = 2\text{ MHz}$, 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 | Δ 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 | ΔC_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 | ΔC_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 | ΔV_{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 | ΔF_{APC} | | ± 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 | ΔT | Tint V_R : 0 V \leftarrow 4.5 V \rightarrow 9 V, color V_R : 4.5 V, contrast V_R : 6 V | ± 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 Ω |
| 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 | Δf_H | Deviation from 15.680 kHz | -100 | 0 | +100 | Hz |
| Dependence of horizontal free-running frequency on V_{CC} | Δf_{HVCC} | $V_{25} = 6.5\ V$, reference value | | 2 | | Hz |
| Horizontal pull-in range | f_{HPULL} | Deviation from 15.680 kHz | ± 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 | μs |
| Horizontal output pulse phase | H_{PF} | | 12 | | | μs |
| | H_{PCEN} | | 3.4 | 4.4 | 5.4 | μs |
| | H_{PR} | | | | 0 | μs |
| Burst gate pulse width | $P_{W\ BGP}$ | | 2.7 | 3.7 | 4.7 | μs |
| Burst gate pulse phase | $T_{d\ BGP}$ | | 0.2 | 0.6 | 1.2 | μs |
| 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 | μs |
| Sandcastle BGP phase | $T_{d\ SBGP}$ | | 1.7 | 2.2 | 2.7 | μs |
| 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 | μs |
| Sandcastle H.BLK width 60 | $P_W\ SHBL60$ | | 10.0 | 11.0 | 12.0 | μs |

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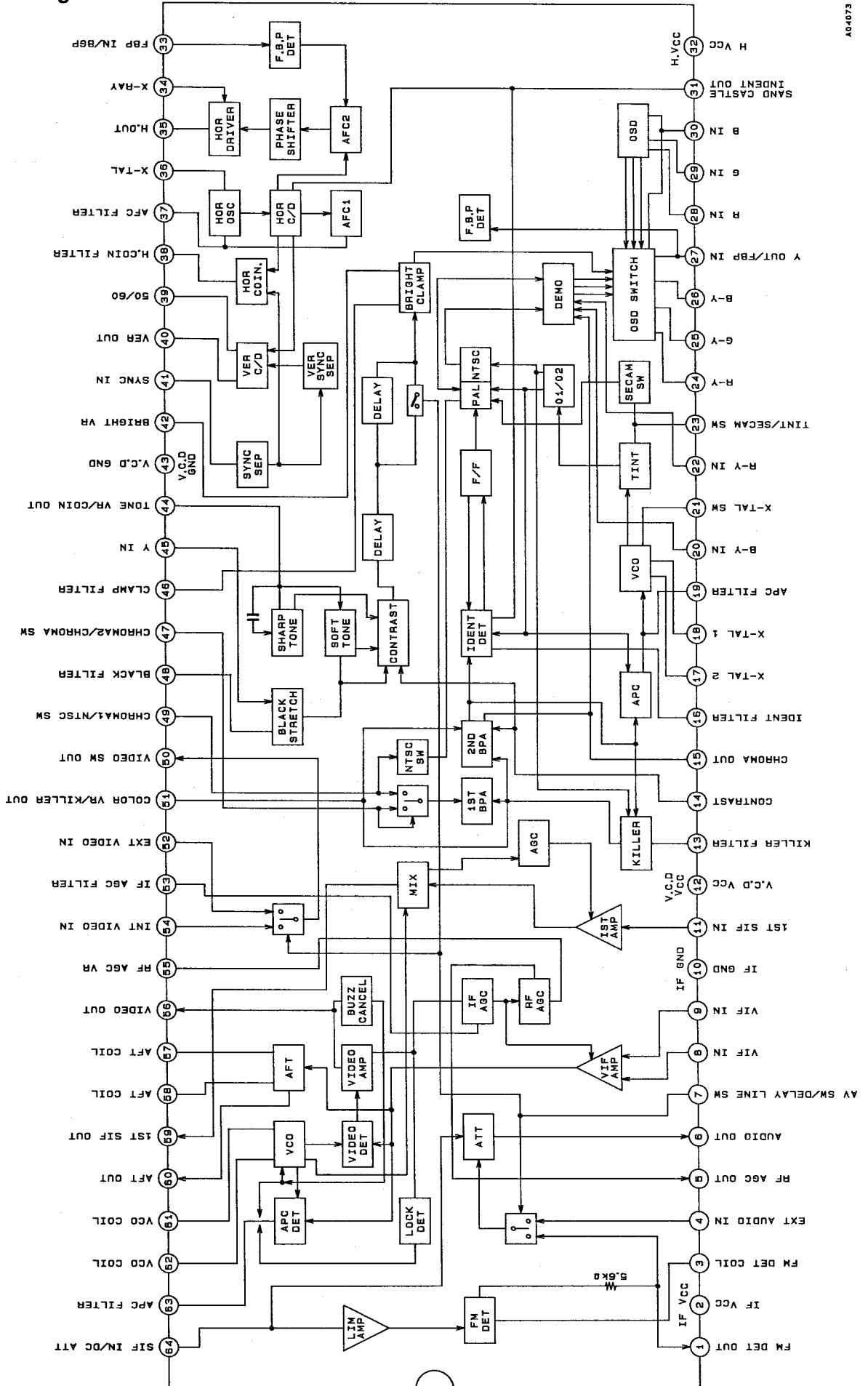
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| Parameter | Symbol | Conditions | min | typ | max | Unit |
|--------------------------------|------------------|-----------------------------------|-----|-----|-----|------|
| [OSD Block] | | | | | | |
| Blanking pulse threshold level | TH _{BL}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

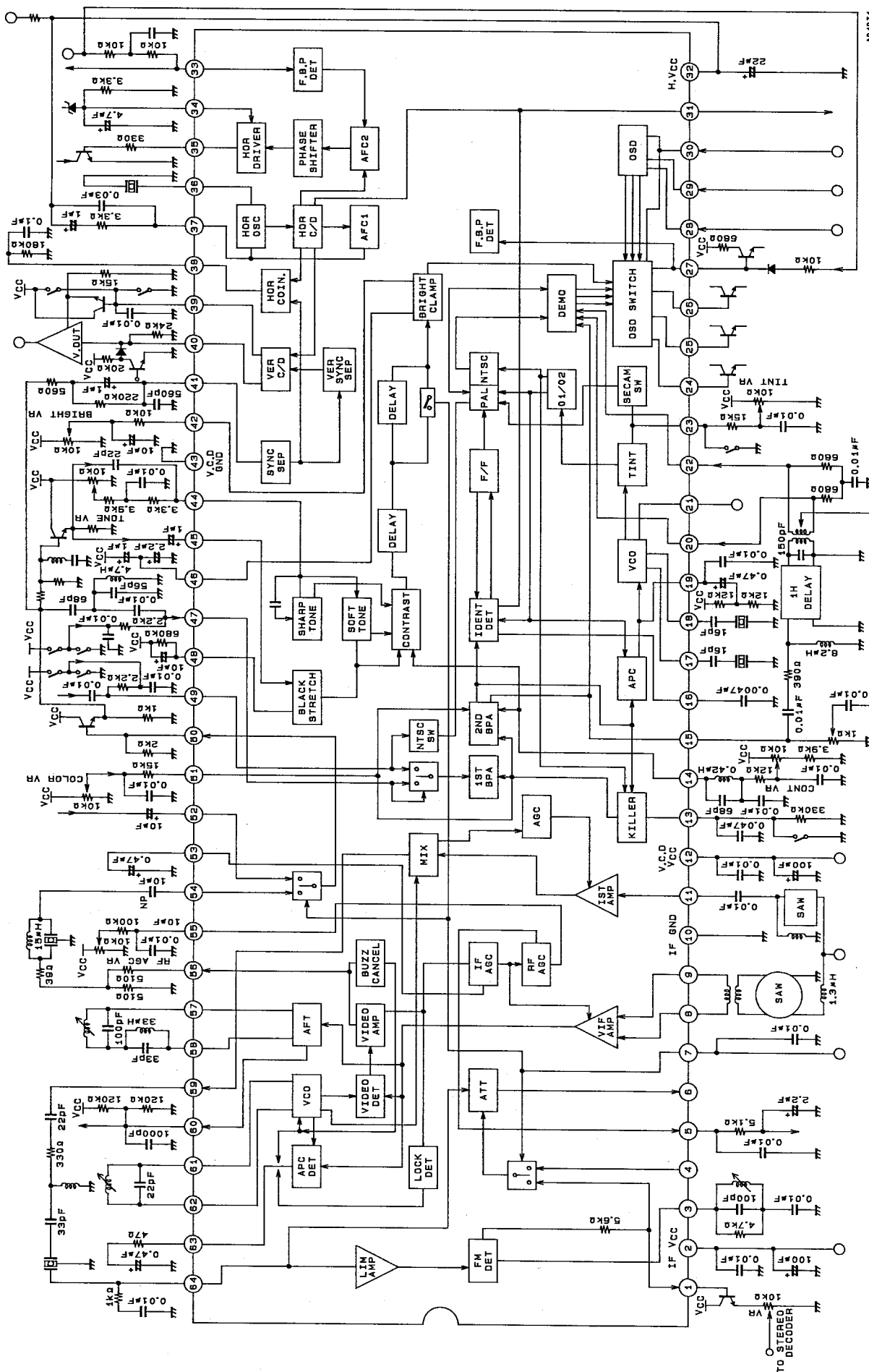
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Block Diagram



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Sample Application Circuit

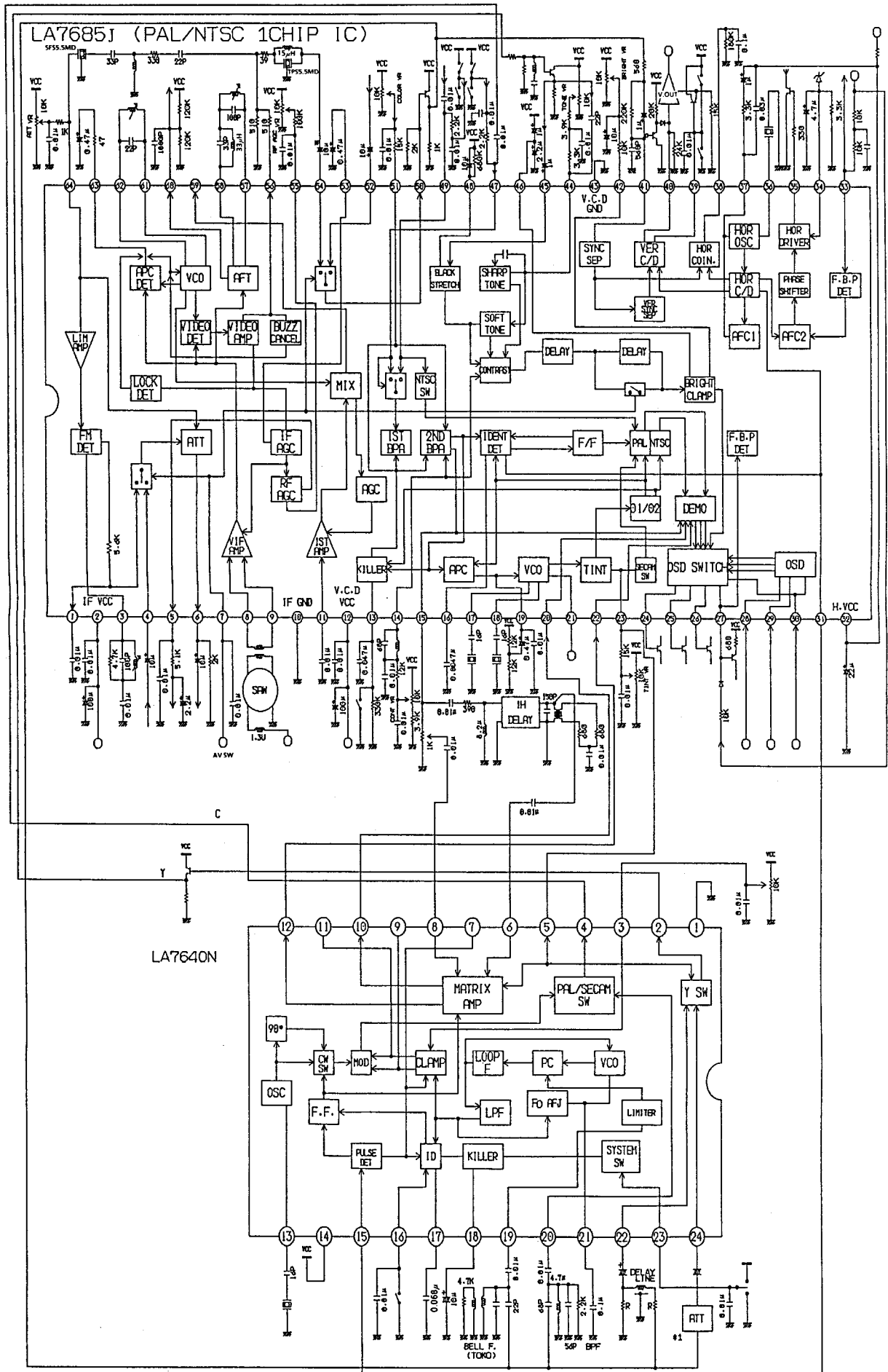


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LA7685J and LA7640N Connection Diagram (Reference)

Unit (resistance: Ω , capacitance: F)



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