

SANYO

No. 5118A

LA7440, 7440M**Video Signal Processing IC
for VHS VCR Systems****Overview**

The LA7440, 7440M is a video signal processing single-chip IC that, except for the VHS format VCR SECAM chrominance signal, handles the PAL-G, B, I M and N, NTSC-M, 4.43 NTSC, MESECAM and NAP-G, B, I, M and N formats. IC internal trimming is used to make the LA7440, 7440M is completely adjustment free, and in combination with a special-purpose CCD (the LC89971, 89971M) it provides a significant reduction in external components, including the glass delay line. Thus the LA7440, 7440M can significantly reduce the signal processing board manufacturing costs. Furthermore, the LA7440, 7440M supports the NAP format (NTSC to PAL conversion) that is poised to become widespread in Europe, China and other markets.

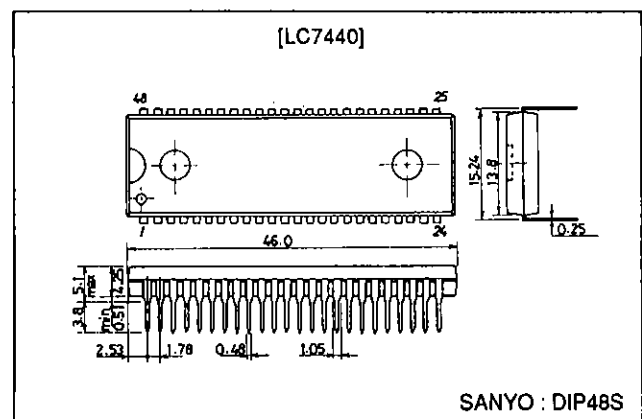
Features

- Completely adjustment free
The AGC, carrier, deviation, and PB-Y level are adjustment free.
The YC record current can also be made adjustment free by using the LA7411, 7416 as the head amplifier.
- Support for NAP and PAL color array correction
Full modulation using a balanced modulator allows playback and conversion to PAL format of NTSC signals recorded on tape.
- Crosstalk exclusion in combination with a special-purpose CCD
Crosstalk can be excluded without using a glass delay line by combining the LA7440, 7440M with a special-purpose CCD (the LC89971, 89971M).
- Minimal number of external components
New built-in components:
 - Detail enhancer CR
 - C-trap in the Y low-pass filter
 - Crystal selector switch
 - Playback C low-pass filter

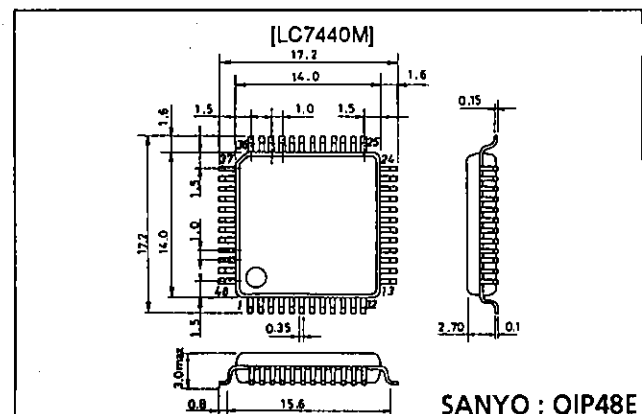
- High performance and multiple functions
Linear phase picture controller
Double high-pass noise canceller, high-speed AFC, DCC
- New built-in functions
 - NAP circuit
 - AVNS (advanced vertical noise suppressor)
 - Automatic QH insertion
 - FM AGC
- Miniature package (48-pin QIP or DIP)

Package Dimensions

unit: mm

3149-DIP48S

unit: mm

3156-QIP48E**SANYO Electric Co., Ltd. Semiconductor Business Headquarters**

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Functions

All VHS format VCR signal processing functions

| | Luminance | | Chrominance | |
|-----|--|---|--|--|
| R/P | Video amp. Feedback clamp Main LPF YNR (AVNS) VCA Sync separator 4.2 V regulator | | 3.58 BPF/4.43 BPF ACC amp. ACC det. Main converter 1.3 M LPF VXO/XO Side lock det. 3rd lock protector | Half H killer BGP generator Killer det. VCO Phase shifter Sub converter 4.21/5.06BPF |
| REC | Video AGC amp. Video AGC det. Pre LPF Detail enhancer 1/2 f _H carrier shift | NL emphasis Main emphasis White/dark clip FM modulator | Pre amp. Burst emphasis (NTSC) Killer APC det. AFC det. | Burst gate amp. |
| PB | FM AGC amp. FM AGC det. Double limiter FM demodulator Sub LPF Double high pass noise canceller QV/QH/character insert Main de-emphasis DOC | Drop out det. NL de-emphasis Picture control Y/C mix | Pre amp. Burst de-emphasis (NTSC) PB amp. Killer NAP PAL burst sequence - Compensator Carrier balancer Burst gate amp. | APC det. ID det. DCC Trick det. DPLL |

Specifications

Pin numbers are for the LA7440M

Maximum Ratings at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|-----------------------------|---------------------|---------------------|-------------|------|
| Maximum supply voltage | V _{CC} max | | 7.0 | V |
| Allowable power dissipation | Pd max | LA7440 | 1150 | mW |
| | | LA7440M: Ta ≤ 65°C* | 1350 | |
| Operating temperature | Topr | | -10 to +65 | °C |
| Storage temperature | Tstg | | -40 to +150 | °C |

Note: * When mounted on a 70 mm by 65 mm, 1.5 mm thickness Bakelite board. The value for the DIP package is 1150 mW.

Operating Conditions at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|----------------------------|--------------------|------------|------------|------|
| Recommended supply voltage | V _{CC} | | 5.0 | V |
| Operating supply voltage | V _{CC} op | | 4.8 to 5.2 | V |

Operating Characteristics at Ta = 25°C, V_{CC} = 5.0 V

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|-------------------|---|------|------|------|-------|
| [Record Mode Y System] | | | | | | |
| Record mode current drain | I _{CCR} | Input: 1.0 Vp-p video signal | 100 | 130 | 160 | mA |
| EE output level 1 | V _{EE1} | Input: 50 Hz system 1.0 Vp-p video signal | 1.95 | 2.05 | 2.15 | Vp-p |
| EE output level 2 | V _{EE2} | Input: 60 Hz system 1.0 Vp-p video signal | 1.95 | 2.05 | 2.15 | Vp-p |
| AGC characteristics 1 | AGC1 | Input: 50 Hz system 2.0 Vp-p video signal | 2.05 | 2.15 | 2.25 | Vp-p |
| AGC characteristics 2 | AGC2 | Input: 50 Hz system 0.5 Vp-p video signal | 1.90 | 2.00 | 2.10 | Vp-p |
| AGC characteristics 3 | AGC3 | Input: 50 Hz system with only SYNC increased 6 dB | 555 | 615 | 695 | mVp-p |
| AGC characteristics 4 | AGC4 | Input: 50 Hz system with only SYNC decreased 6 dB | 370 | 410 | 450 | mVp-p |
| Sync separator output level | V _{SYR} | The SYNC-OUT output pulse wave height | 3.9 | 4.1 | 4.3 | V |
| Sync separator output pulse width | PW _{SYR} | The SYNC-OUT output pulse width | 4.0 | 4.3 | 4.6 | μs |
| Sync separator output pre-record delay time | ΔT _{SYR} | The SYNC-OUT delay time | 0.9 | 1.1 | 1.3 | μs |
| Sync separator threshold level | TH _{SYR} | | | -20 | -15 | dB |

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| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---------------|--|-------|------|------|-------|
| [Record Mode Y System] | | | | | | |
| Pseudo-H insertion level | ΔHD_R | With 2.7 V applied to T14A | -400 | -300 | -200 | mV |
| White insertion level | ΔWH_R | With 1.3 V applied to T14A | 100 | 250 | 400 | mV |
| VCA detection voltage | V_{VCA} | | 3.00 | 3.20 | 3.40 | V |
| Record YNR operation EP/LP | V_{R-YNR1} | Input: 50 Hz system standard color bar signal | 10 | 12 | 14 | mVp-p |
| Y-LPF frequency characteristics 1 | YLPF1 | The 1 MHz attenuation with respect to 500 kHz; 3.58 system | -0.5 | 0.0 | +0.5 | dB |
| Y-LPF frequency characteristics 2 | YLPF2 | The 2 MHz attenuation with respect to 500 kHz; 3.58 system | -1.0 | 0.0 | +1.0 | dB |
| Y-LPF frequency characteristics 3 | YLPF3 | The 3 MHz attenuation with respect to 500 kHz; 3.58 system | -9 | -7 | -5 | dB |
| Y-LPF frequency characteristics 4 | YLPF4 | The 3.58 MHz attenuation with respect to 500 kHz; 3.58 system | | | -25 | dB |
| Y-LPF frequency characteristics 5 | YLPF5 | The 4.2 MHz attenuation with respect to 500 kHz; 3.58 system | | | -15 | dB |
| Y-LPF frequency characteristics 6 | YLPF6 | The 4.43 MHz attenuation with respect to 500 kHz; 4.43 system | | | -25 | dB |
| FM modulator output level | V_{FM} | No input | 1.0 | 1.2 | 1.4 | Vp-p |
| Carrier frequency 1 | F_{FM1} | 50 Hz system | 3.7 | 3.8 | 3.9 | MHz |
| Carrier frequency 2 | F_{FM2} | 60 Hz system | 3.3 | 3.4 | 3.5 | MHz |
| FM modulator output 2nd harmonic distortion | H_{MOD} | | | -40 | -35 | dB |
| Deviation 1 | DEV1 | 50 Hz system | 0.95 | 1.00 | 1.05 | MHz |
| Deviation 2 | DEV2 | 60 Hz system | 0.95 | 1.00 | 1.05 | MHz |
| FM modulator linearity | L_{MOD} | | -2 | 0 | +2 | % |
| 1/2 f_H carrier shift | CS | | 6.5 | 7.8 | 9.1 | kHz |
| Emphasis gain | G_{EMP} | Input: 0.5 Vp-p, 10 kHz sine wave | -0.5 | 0.0 | +0.5 | dB |
| Detail enhancer characteristics 1 | G_{DET1} | Input: 158 mVp-p, 2 MHz sine wave | 1.6 | 1.9 | 2.6 | dB |
| Detail enhancer characteristics 2 | G_{DET2} | Input: 50 mVp-p, 2 MHz sine wave | 3.1 | 4.1 | 5.1 | dB |
| Detail enhancer characteristics 3 | G_{DET3} | Input: 15.8 mVp-p, 2 MHz sine wave | 5.3 | 6.3 | 7.3 | dB |
| NL emphasis characteristics 1 | G_{NLEMP1} | Input: 500 mVp-p, 2 MHz sine wave | 0.5 | 1.4 | 2.3 | dB |
| NL emphasis characteristics 2 | G_{NLEMP2} | Input: 158 mVp-p, 2 MHz sine wave | 2.6 | 3.8 | 5.2 | dB |
| NL emphasis characteristics 3 | G_{NLEMP3} | Input: 50 mVp-p, 2 MHz sine wave | 4.9 | 6.4 | 7.9 | dB |
| Main emphases characteristics 1 | G_{ME1} | Input: 100 mVp-p, 500 kHz sine wave | 4.9 | 5.2 | 5.5 | dB |
| Main emphases characteristics 2 | G_{ME2} | Input: 100 mVp-p, 2 MHz sine wave | 13.1 | 13.6 | 14.1 | dB |
| White clipping level | L_{WC} | Input: 1.0 Vp-p, white 100% video signal | 186 | 195 | 204 | % |
| Dark clipping level | L_{DC} | Input: 1.0 Vp-p, white 100% video signal | -55 | -50 | -45 | % |
| [Playback Mode Y System] | | | | | | |
| Playback mode current drain | I_{CCP} | | 135 | 160 | 185 | mA |
| Dropout compensation time | T_{DOC} | | 0.72 | 0.85 | 0.98 | ms |
| DOC loop gain | G_{DOC} | 5H later | -1.0 | 0.0 | +1.0 | dB |
| Playback Y level | V_{VOUT} | For playback of an FM signal with a 1.0 MHz deviation | 1.95 | 2.05 | 2.15 | Vp-p |
| FM demodulator linearity | L_{DEM} | 2, 4, 6 MHz | -3.5 | 0.0 | +3.5 | % |
| Demodulation sensitivity | S_{DEM} | | 0.47 | 0.52 | 0.57 | V/MHz |
| Carrier leakage | CL | Input: 4 MHz, 600 mVp-p | | -40 | -35 | dB |
| Playback YNR characteristics LP/EP | G_{P-YNR1} | Input: 50% white + CW | -2.5 | | | dB |
| NL de-emphasis characteristics 1 | G_{NLDE1} | Input: 158 mVp-p, 2 MHz sine wave | -6.0 | -5.0 | -4.0 | dB |
| NL de-emphasis characteristics 2 | G_{NLDE2} | Input: 50 mVp-p, 2 MHz sine wave | -10.5 | -9.0 | -7.5 | dB |
| Double noise canceller characteristics 1 | G_{WN1} | Input: 158 mVp-p, 2 MHz sine wave | -2.3 | -1.8 | -1.3 | dB |
| Double noise canceller characteristics 2 | G_{WN2} | Input: 50 mVp-p, 2 MHz sine wave | -6.0 | -5.0 | -4.0 | dB |
| Double noise canceller characteristics 3 | G_{WN3} | Input: 15.8 mVp-p, 2 MHz sine wave | -10.5 | -9.0 | -7.5 | dB |
| PIC-CTL hard response characteristics 1 | G_{PH1} | Input: 50% video + sine wave $f = 1$ MHz, 158 mVp-p | 4.5 | 5.5 | 6.5 | dB |

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| Parameter | Symbol | Conditions | min | typ | max | Unit |
|--|-----------------------|---|-------|------|-------|-------|
| [Record Mode Y System] | | | | | | |
| PIC-CTL hard response characteristics 2 | G _{PH2} | Input: 50% video + sine wave f = 2 MHz, 158 mVp-p | 8.0 | 9.0 | 10.0 | dB |
| PIC-CTL soft response characteristics 1 | G _{PS1} | Input: 50% video + sine wave f = 1 MHz, 158 mVp-p | -4.5 | -3.5 | -2.5 | dB |
| PIC-CTL soft response characteristics 2 | G _{PS2} | Input: 50% video + sine wave f = 2 MHz, 158 mVp-p | -9.0 | -7.0 | -5.0 | dB |
| Pseudo-V insertion level (playback) | ΔV _{Dp} | With 5 V applied to T14A | -150 | -50 | +50 | mV |
| Pseudo-H insertion level (playback) | ΔH _{Dp} | With 2.7 V applied to T14A | -400 | -300 | -200 | mV |
| White insertion level (playback) | ΔW _{Hp} | With 1.3 V applied to T14A | 100 | 250 | 400 | mV |
| Sync separator output level | V _{SYP} | The SYNC-OUT output pulse wave height | 3.9 | 4.1 | 4.3 | V |
| Sync separator output pulse width | PW _{SYP} | The SYNC-OUT output pulse width | 4.2 | 4.5 | 4.8 | μs |
| Sync separator output prerecord delay time | ΔT _{SYP} | | 1.4 | 1.6 | 1.8 | μs |
| 4.2 V regulator voltage | V _{REG} | | 4.0 | 4.2 | 4.4 | V |
| [Record Mode Chrominance System] | | | | | | |
| Chrominance low band conversion output burst level | V _{OR-38} | Input: PAL/GBI standard color bar signal, 1 Vp-p | 150 | 190 | 230 | mVp-p |
| Burst enhancement level | G _{BE} | Input: NTSC standard color bar signal, 1 Vp-p, SP/EP | 5.5 | 6.0 | 6.5 | dB |
| VXO oscillator level 1 | V _{VXO-R1} | Input: NTSC standard color bar signal, 1 Vp-p | 300 | 500 | 700 | mVp-p |
| VXO oscillator level 2 | V _{VXO-R2} | Input: PAL/GBI standard color bar signal, 1 Vp-p | 300 | 500 | 700 | mVp-p |
| Record ACC characteristics 1 | ACC _{-R1} | With only the chrominance signal level increased 6 dB | | +0.2 | +0.6 | dB |
| Record ACC characteristics 2 | ACC _{-R2} | With only the chrominance signal level decreased 6 dB | -0.5 | -0.1 | | dB |
| ACC killer on input level | V _{ACCK-ON} | | | -26 | | dB |
| ACC killer on output level | V _{O-ACCK} | | | -60 | -50 | dB |
| ACC killer recovery input level | V _{ACCK-OFF} | | | -20 | | dB |
| VXO control sensitivity | S _{VXO} | | 1.3 | 3.2 | 5.1 | Hz/mV |
| APC pull-in range 1 | Δf _{APC1} | | 350 | | | Hz |
| APC pull-in range 2 | Δf _{APC2} | | | | -350 | Hz |
| BGP delay time | t _D | Input: PAL/GBI standard color bar signal, 1 Vp-p | 3.1 | 3.4 | 3.7 | μs |
| BGP pulse width | t _W | | 4.7 | 4.9 | 5.1 | μs |
| AFC pull-in range 1 | Δf _{AFC1} | | +1.0 | +7.0 | | kHz |
| AFC pull-in range 2 | Δf _{AFC2} | | | -3.7 | -1.0 | kHz |
| YC separation capability (NTSC) | V _{OR25} | Input: 50% white + 3.571678 MHz | | | -20 | dB |
| [Playback Mode Chrominance System] | | | | | | |
| Video output burst level | V _{OP-11} | SP mode, input: burst 30 mVp-p | 255 | 300 | 345 | mVp-p |
| Pin 25 output burst level | V _{OP-25} | SP mode, input: burst 30 mVp-p | 195 | 230 | 265 | mVp-p |
| Playback ACC characteristics 1 | ACC _{-P1} | With the chrominance level increased 6 dB | | +0.5 | +0.8 | dB |
| Playback ACC characteristics 2 | ACC _{-P2} | With the chrominance level decreased 6 dB | -0.8 | -0.5 | | dB |
| Playback killer on input level | V _{ACK-P} | | -40 | -32 | -25 | dB |
| Playback killer on chrominance output level | V _{OACK-P} | | | -44 | -40 | dB |
| Main converter carrier leakage | C _{LP} | The 5.06 MHz carrier leakage component | | -40 | -33 | dB |
| Burst deemphasis level NT | G _{BD} | NTSC mode | -5.25 | -5.0 | -4.75 | dB |
| Playback XO output level 1 | V _{XO-P1} | | 300 | 450 | 600 | mVp-p |
| Playback XO output level 2 | V _{XO-P2} | | 300 | 450 | 600 | mVp-p |
| Playback XO oscillator frequency deviation | Δf _{XO} | Δf _{XO} = f - 4.433619 (MHz) | -9 | 0 | +9 | Hz |
| SLD detector current 1 | I _{SLD1} | | | 170 | | μA |
| SLD detector current 2 | I _{SLD2} | | | 170 | | μA |
| NTSC playback burst output level | V _{BNT} | NTSC mode | 255 | 300 | 345 | mVp-p |
| NTSC to PAL conversion - V axis burst level | VB-NAP | | -1.0 | 0.0 | +1.0 | dB |
| NTSC to PAL conversion burst level ratio | ΔB-NAP | | -2.0 | 0.0 | +2.0 | dB |

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L7440M Control Pin Table

| Pin No. | Control function | | L | | M | | H | | |
|---------|------------------|-----------------------|------------------------------|--|---------------------------------------|-----------------------------|-----------------------------------|--|--|
| 3 | R/P | Edit | | | | | 3.8 VDC or more | | |
| 5 | R/P | YNR (AVNS)-CTL | 1.0 VDC or less YNR-off | | 1.5 to 2.5 VDC YNR-CTL | | 3.5 VDC or more YNR (strong) | | |
| 6 | R | ***** | | | | | 3.9 VDC or more | | |
| | P | N. C. CTL | 1.5 VDC or less N. C-off | | 2.0 to 3.0 VDC N. C-CTL | | | | |
| 12 | R/P | C-rotary | 0 to 1.9 VDC Low CH | | | 2.3 VDC or more High CH | | | |
| 14 | P | QV/QH CHARA. INS | 0.8 VDC or less Through | | 1.2 to 2.2 VDC CHARA insert | | 2.6 to 3.3 VDC Pedestal insert | | |
| 15 | P | Auto QH INS on | Pull down by 3.9 kΩ | | | | | | |
| 18 | R/P | E-MM | 1.6 V or less E-M (50 Hz) | | | 2.0 V or more M (60 MHz) | | | |
| | | N. L.-on (weak) | 0.6 VDC or less N. L.-off | | 1.0 to 3.0 VDC N. L.-on | | 3.9 VDC or more N. L.-off | | |
| | R | Detail-ENHA | Normal | | Weak and f_C down | | Normal | | |
| 22 | R/P | EP/LP/SP | 1.2 VDC or less SP | | 2.0 to 2.7 VDC LP | | 3.9 VDC or more EP | | |
| 23 | R | SP carrier shift stop | | | | | | | 3.0 VDC or more SP carrier shift stop |
| 24 | P | NAP | 1.2 VDC or less Through | | 2.0 to 2.7 VDC Balanced-mod output | | 3.3 VDC or more NAP-on | | |
| 26 | R/P | NT/MESEC/PAL | 1.2 VDC or less PAL | | 2.0 to 2.7 VDC MESEC | | 3.9 VDC or more NTSC | | |
| 29 | P | Trick | | | | | | | 3.9 VDC or more |
| 35 | R/P | Filter-change | 2.0 VDC or less | | | 3.0 VDC or more | | | |
| 44 | P | DOC-off | | | | | | | 4.1 VDC or more |
| 48 | R/P | PB-H | | | | | | | 4.0 VDC or more |

Note: Do not allow pin 3 to fall under 1.5 V. (The chip will enter test mode.)

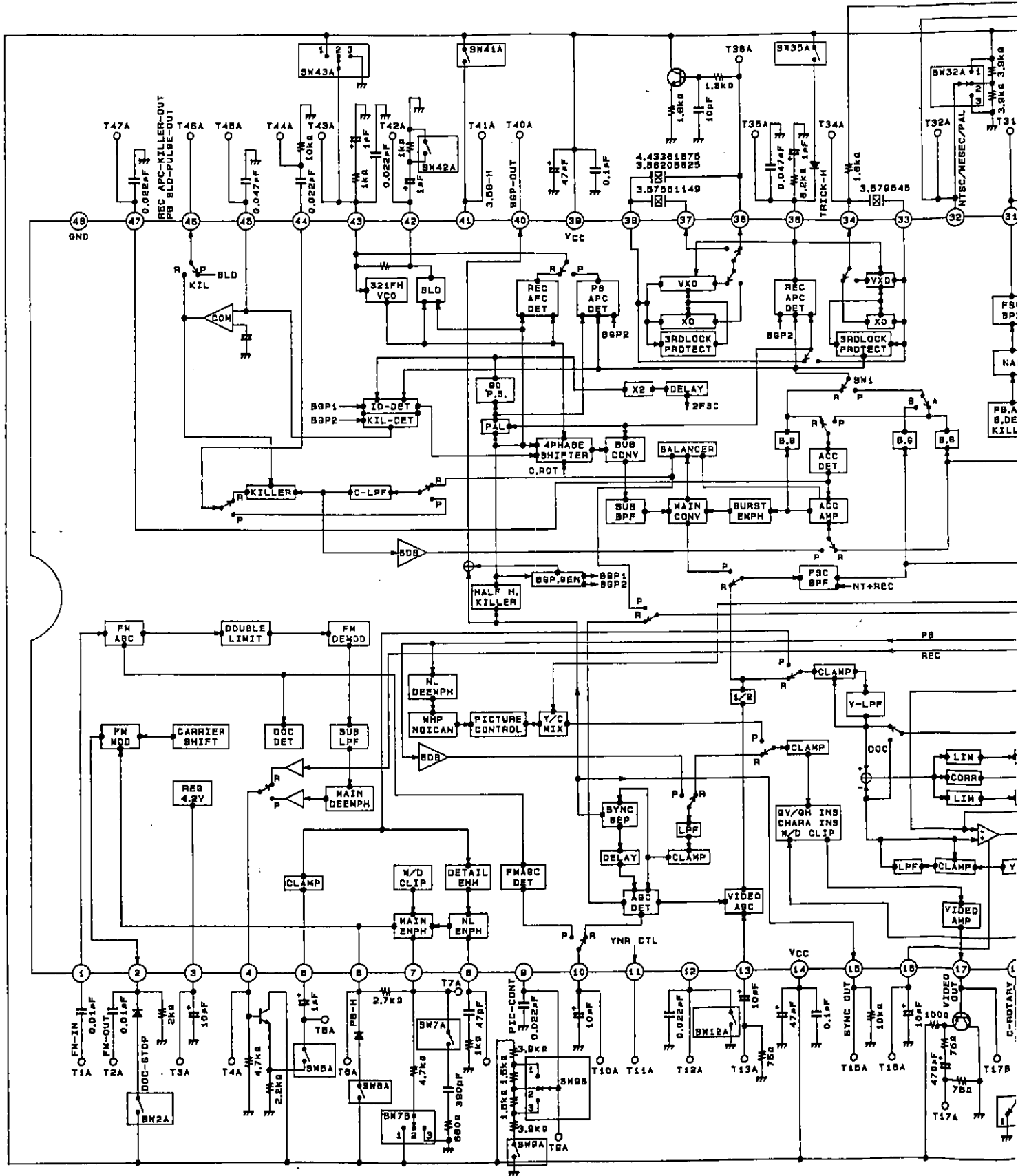
Function Control in each of the LA7440M Operating Modes

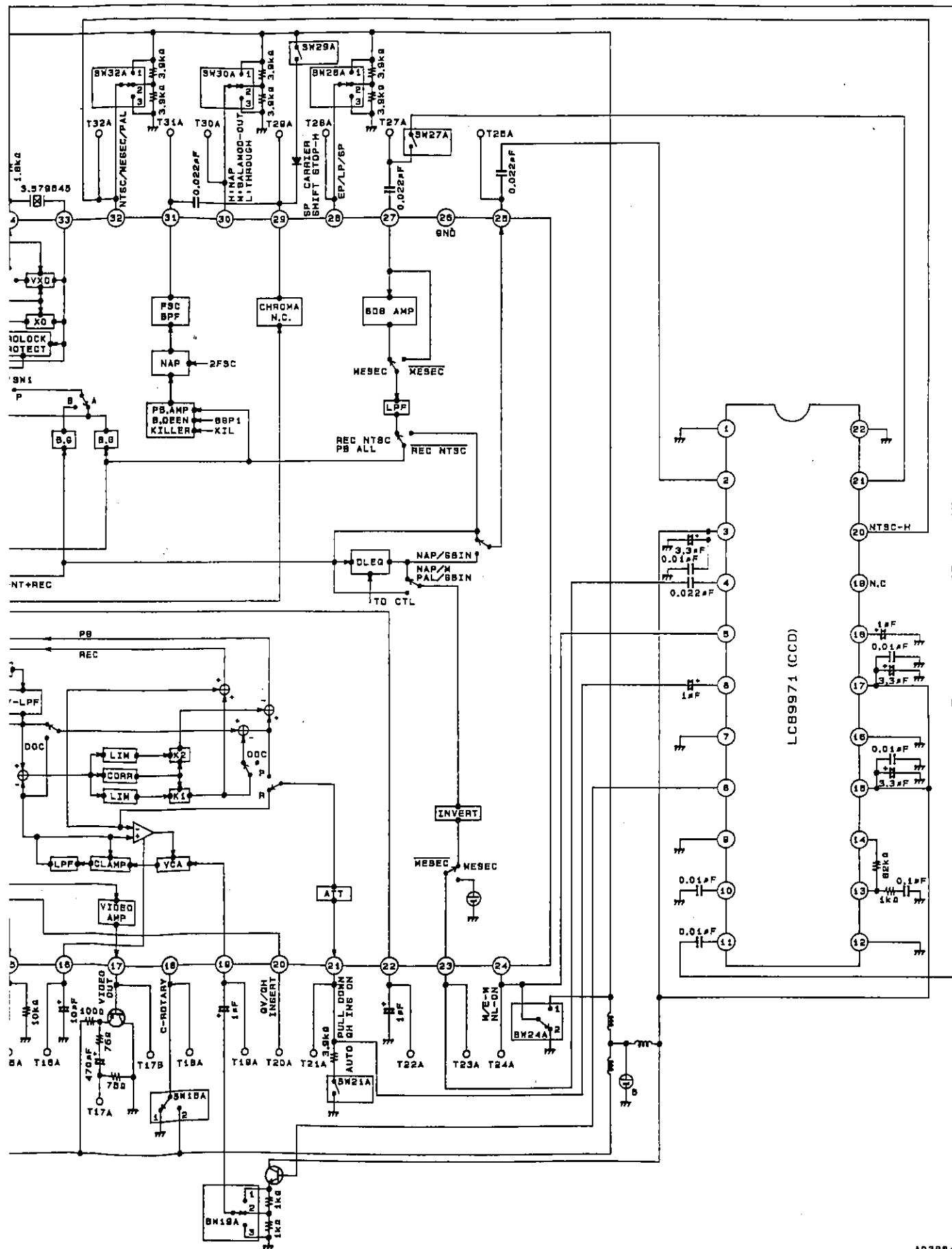
| | Edit | YNR | | | NL | | Detail enhancer | | | NC | | | PIC-CTL | 1/2 f_H carrier shift | |
|-----|----------|---------------|----------------------|----------------------|----------------------|-----|--|-----|----------|---------------|-----|----------|---------|-------------------------------|----------|
| | | Pin 5 control | | | Pin 18 control | | Pin 6 control (with pin 18 control L/H) | | | Pin 6 control | | | | | |
| | | L | M | H | L/H | M | L | M | H | L | M | H | | | |
| REC | SP | On | Off | Off | Off | Off | On | Off | Variable | Center | — | — | — | — | ○ (X) |
| | | Off | Off | Off | Off | Off | On | Off | Variable | Center | — | — | — | — | ○ (X) |
| | LP EP | On | Off | K1 = 0.2 K2 = 0.0 | K1 = 0.2 K2 = 0.0 | On | On | Off | Variable | Center | — | — | — | — | ○ |
| | | Off | Off | K1 = 0.5 K2 = 0.0 | K1 = 0.5 K2 = 0.0 | On | On | Off | Variable | Center | — | — | — | — | ○ |
| PB | SP | On | K1 = 0.0 K2 = 0.0 | K1 = 0.0 K2 = 0.0 | K1 = 0.5 K2 = 0.0 | Off | On | — | — | — | Off | Variable | Center | Center | — |
| | | Off | K1 = 0.0 K2 = 0.0 | K1 = 0.2 K2 = 0.0 | K1 = 0.5 K2 = 0.0 | Off | On | — | — | — | Off | Variable | Center | ○ | — |
| | LP EP | On | K1 = 0.0 K2 = 0.5 | K1 = 0.2 K2 = 0.5 | K1 = 0.5 K2 = 0.5 | On | On | — | — | — | Off | Variable | Center | Center | — |
| | | Off | K1 = 0.0 K2 = 0.5 | K1 = 0.2 K2 = 0.5 | K1 = 0.5 K2 = 0.5 | On | On | — | — | — | Off | Variable | Center | ○ | — |

- Note: 1. K1 is the YNR coefficient, K2 is the LNC coefficient
 2. Use the 1/2 f_H carrier shift entries in parentheses when pin 23 is high.
 3. The detail enhancer is off when pin 18 is at the middle level.

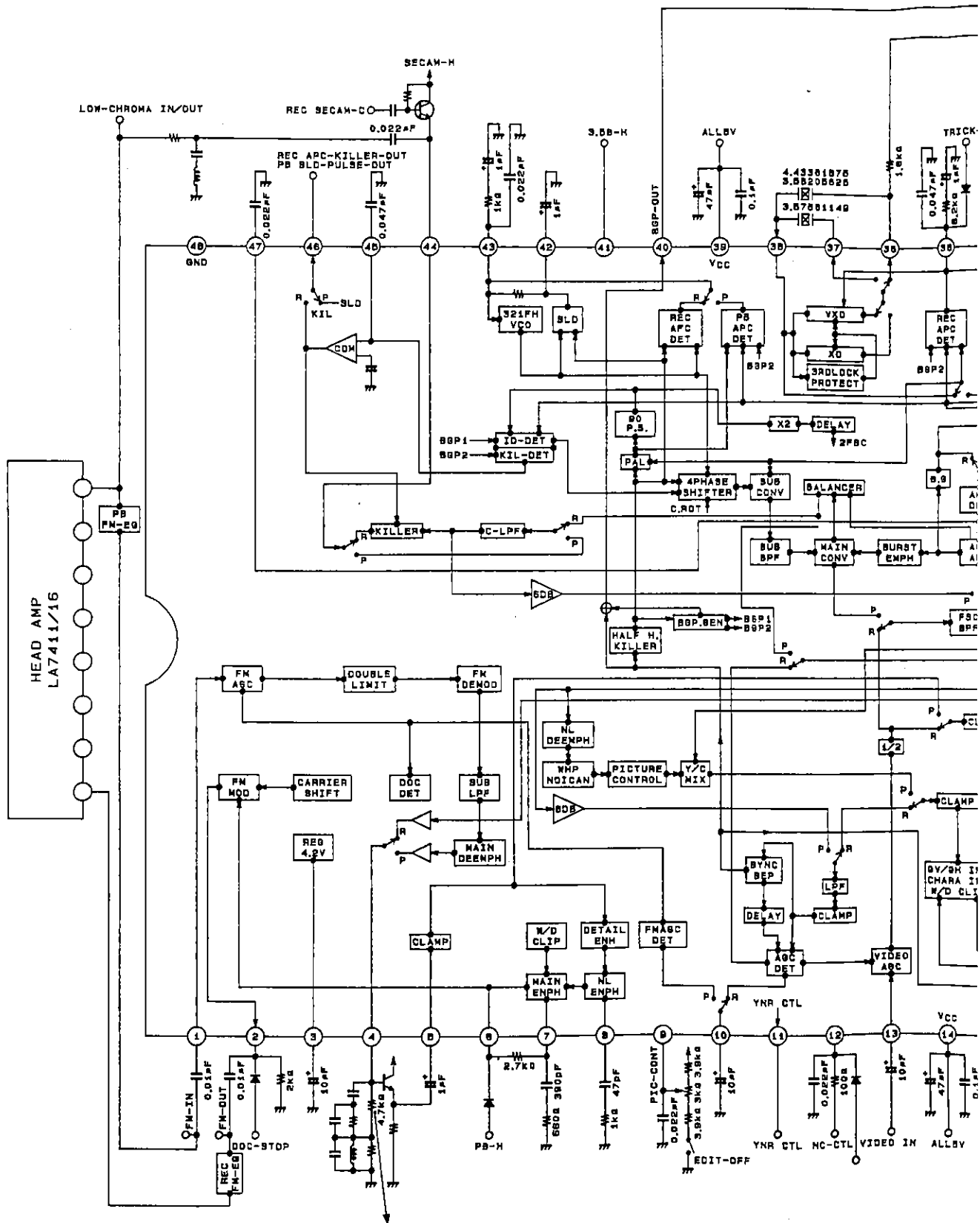
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LA7440 Test Circuit

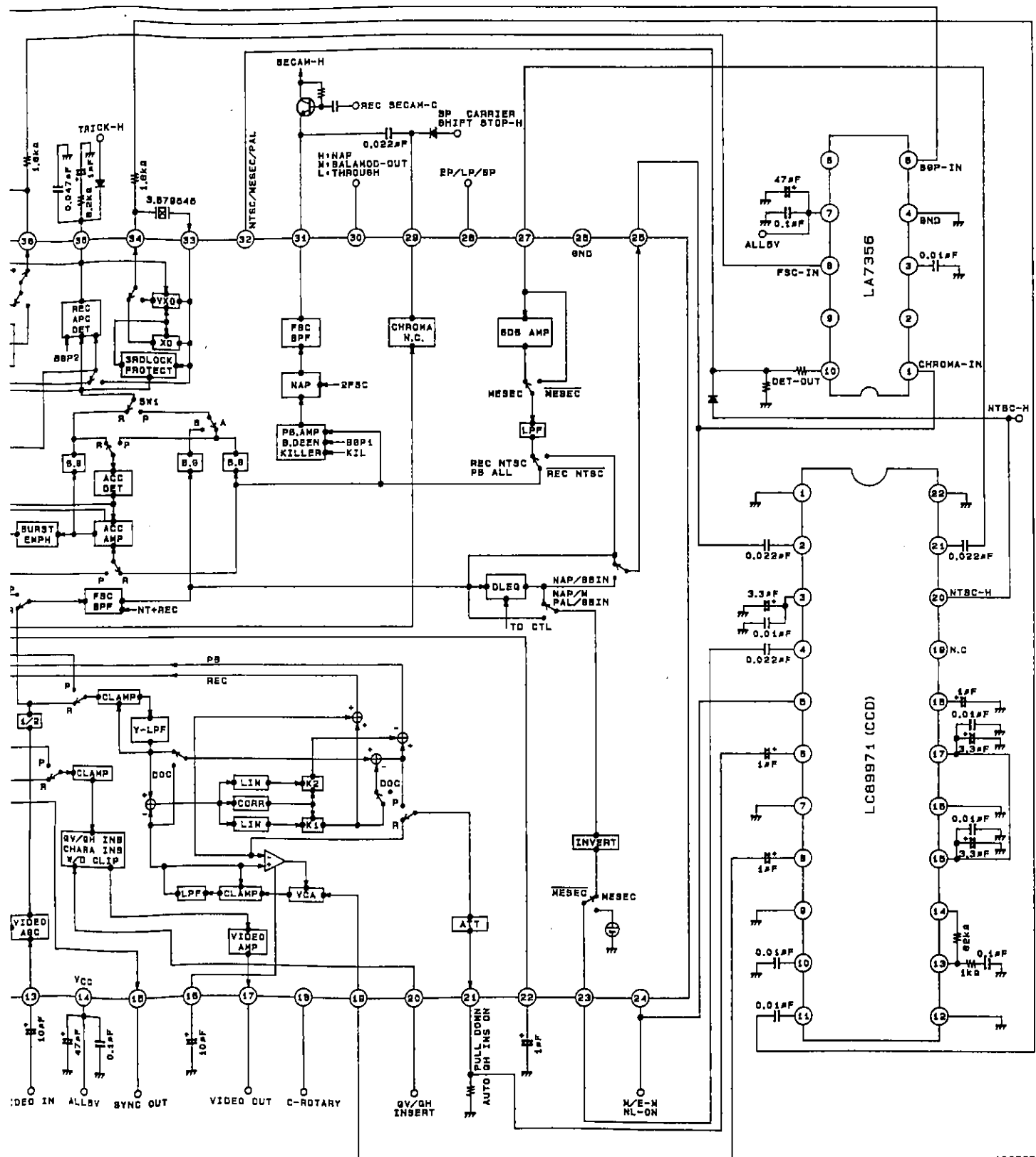




LA7440 Block Diagram

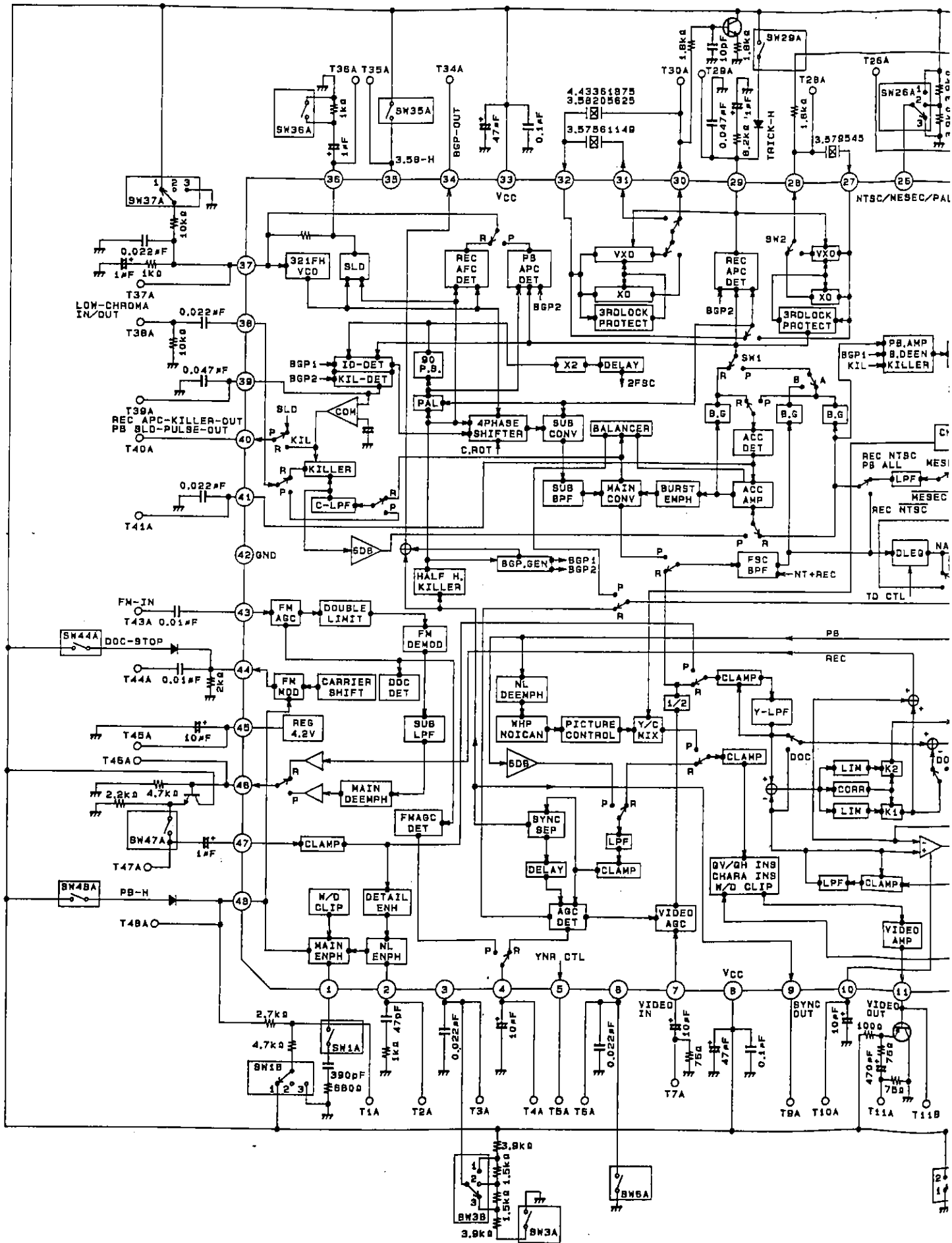


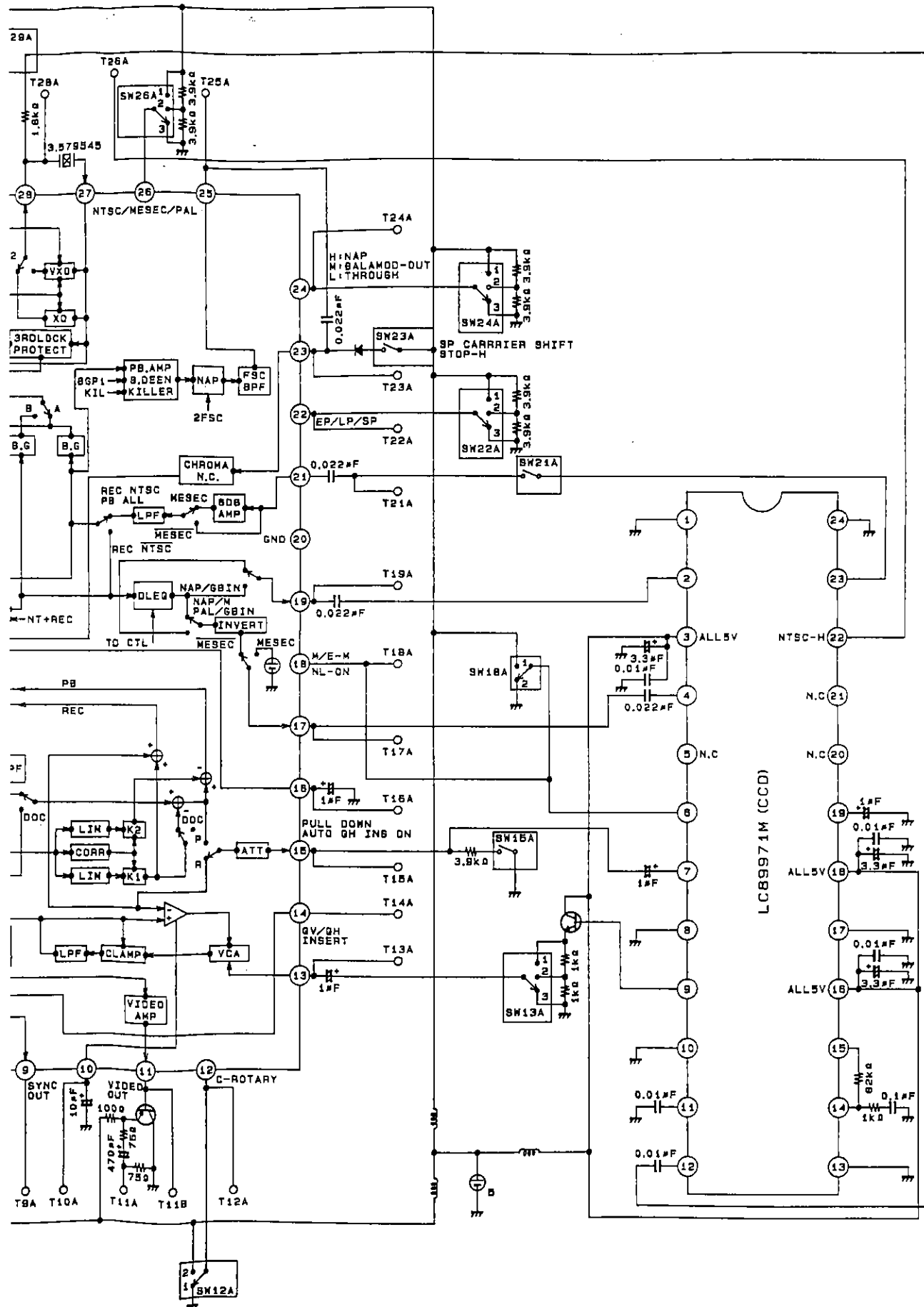
We recommend using a $\pm 1\%$ tolerance resistor here since this resistor determines the PBY level.



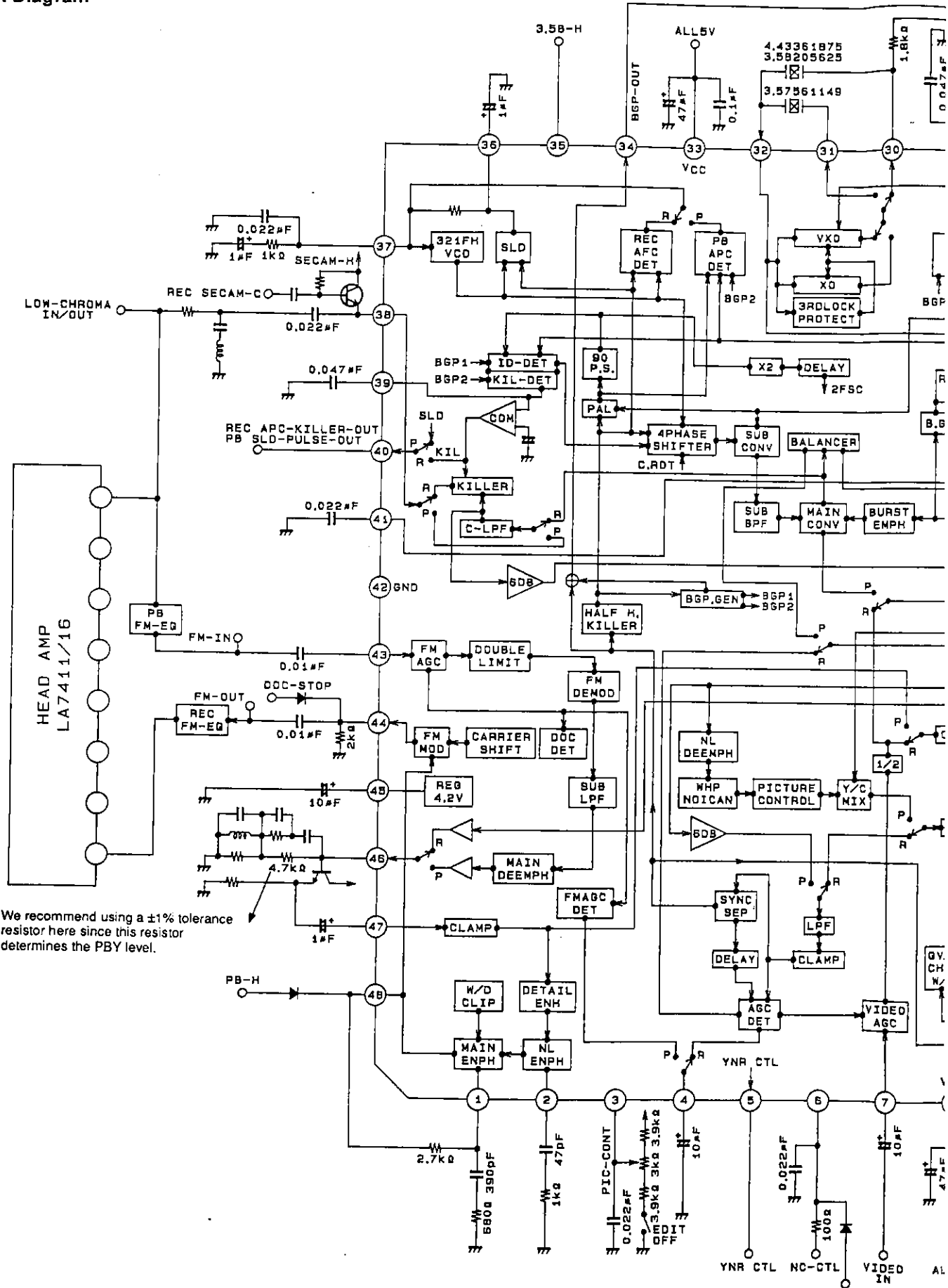
LA7440, 7440M

LA7440M Test Circuit

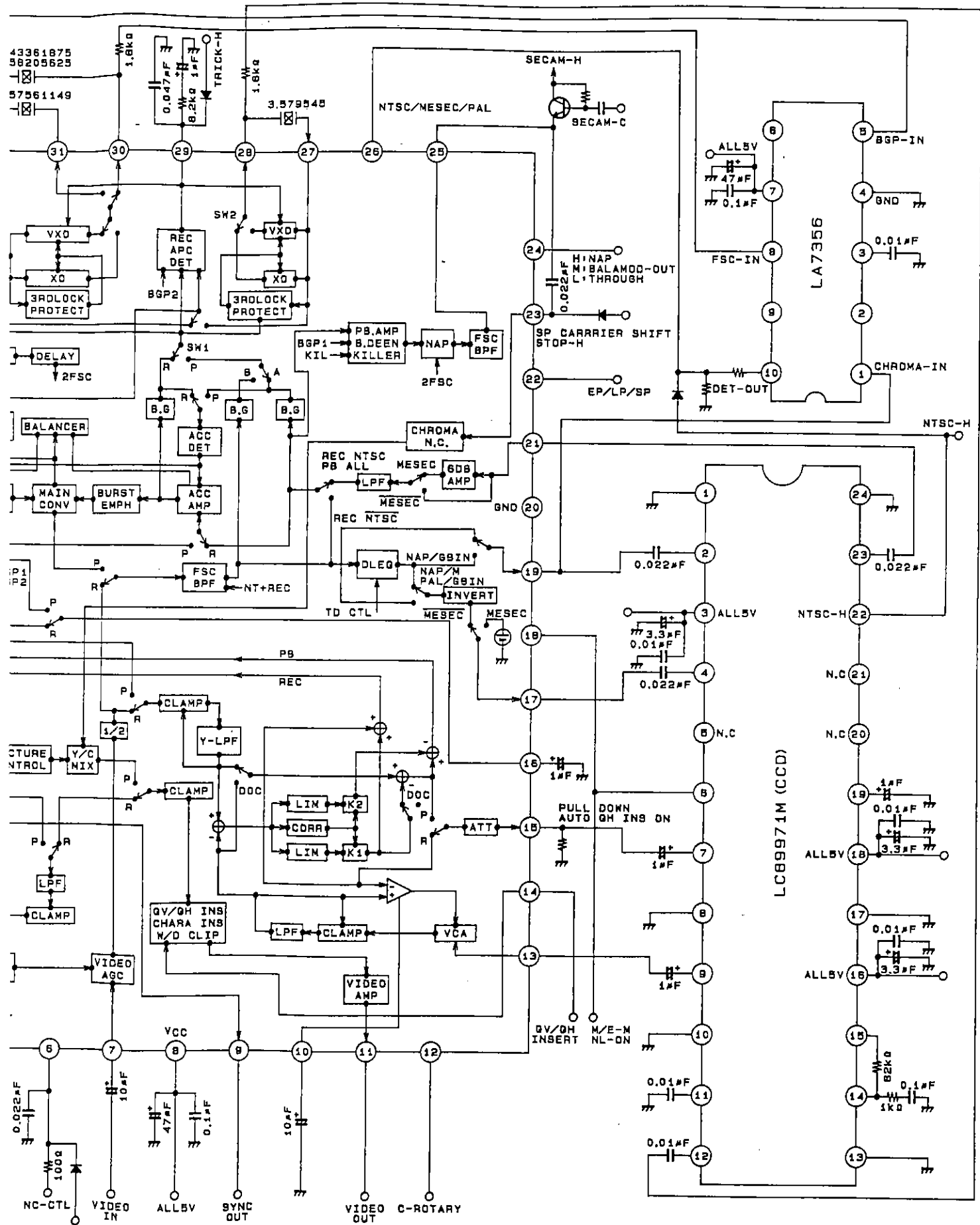




LA7440M Block Diagram



We recommend using a $\pm 1\%$ tolerance resistor here since this resistor determines the PBY level.



LC89971M (CCD)

LA7356

- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
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