Ordering number: EN 3797A

Monolithic linear IC

# LA7698

## Color-Difference Signal Correction IC for Color TVs

## Overview

The LA7698 performs flesh-tone correction and green enhancement for color TV color-difference signals, and includes a color limiter function that prevents color saturation on the screen and color noise reduction (CNR) circuitry that eliminates color- difference output noise.

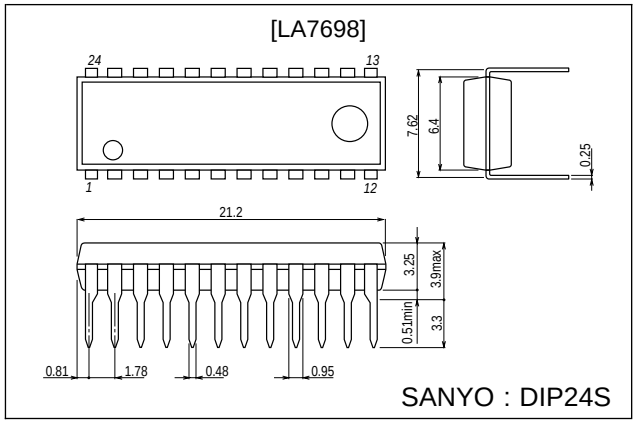
## Functions and Features

- Flesh-tone correction, green enhancement, color limiter and CNR.
- The center axis of flesh-tone correction can be adjusted.
- Because green detection is performed through R-Y and B-Y detection, OSD green is not enhanced.
- The demo mode switch makes it possible to turn flesh-tone correction and green enhancement on and off for the left and right sides of the screen independently.
- The effectiveness of CNR can be adjusted through an external capacitor.

## Package Dimensions

unit: mm

**3067-DIP24S**




## Specifications

### Maximum Ratings at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum supply voltage | $V_{CC}$max | | 13 | V |
| Allowable power dissipation | Pd max | Ta ≦ 65°C | 700 | mW |
| Operating temperature | Topr | | –15 to +65 | °C |
| Storage temperature | Tstg | | –55 to +150 | °C |

### Operating Conditions at Ta = 25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Recommended supply voltage | $V_{CC}$ | | 9 | V |
| Operating supply voltage range | $V_{CC}$op | | 8 to 10 | V |

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## Operating Characteristics at Ta = 25°C, $V_{CC}$ = 9 V

| Parameter | Symbol | Conditions | min | typ | max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Current consumption | $I_{CC}$ | | 19 | 27 | 41 | mA | *1,2 |
| Output voltage | $V_O$ | Pin 9 ( H-BLK IN ) = 2 V | 5 | 5.25 | 5.5 | V | *1,2 |
| Output voltage difference | $\Delta V_O$ | Pin 9 ( H-BLK IN ) = 2 V | | 0 | 50 | mV | *1,2 |
| Output voltage variation | $\Delta V_{O-H}$ | INPUT C = 1 µF | –1 | –0.1 | 0 | mV | *1,2 |
| Input/output gain | $G_O$ | INPUT = Sin : 100 kHz | –0.70 | –0.35 | –0.05 | dB | *1,2 |
| Input/output gain difference | $\Delta G_O$ | INPUT = Sin : 100 kHz | | 0 | 0.15 | dB | *1,2 |
| Frequency characteristics | $F_O$ | Assuming 100 kHz as 0 dB, the frequency where a 3 dB decrease results | 5 | | | MHz | *1,2 |
| Maximum output amplitude | Emax | | 4.1 | 4.7 | | Vp-p | *1,2 |
| BLK threshold voltage | $TH_{BLK}$ | | 1.0 | 1.4 | 1.8 | V | *1,2 |
| BLK minus allowable voltage | $-V_{BL}$ | | –0.7 | | | V | *1,2 |
| DEMO threshold voltage | $TH_{DEMO}$ | | 3.5 | 3.7 | 3.9 | V | *1,2 |
| Color difference input voltage | $V_{IN,\ C-Y}$ | Pin 9 ( H-BLK IN ) = 2 V | 6.15 | 6.40 | 6.65 | V | *1,2 |
| Output voltage temperature characteristic | $\alpha V_O / \alpha T$ | Pin 9 ( H-BLK IN ) = 2 V | | 0 | | mV/°C | *1,2 |
| Variation for no green enhancement input | $\Delta V_{C-YG}$ | No input pin 11 0 V/9 V | –10 | 0 | +10 | mV | *1 |
| Maximum green enhancement level | $\Delta V_{G-YGM}$ | $P_{IN}$ = 227°, $E_{B-Y}$ = 2 Vp-p, pin 11 = 9 V | 200 | 225 | 245 | mV | *1 |
| | $\Delta V_{R-YGM}$ | $P_{IN}$ = 227°, $E_{B-Y}$ = 2 Vp-p, pin 11 = 9 V | –245 | –225 | –200 | mV | *1 |
| Green enhancement range + 1 | $\Delta V_{G-YG+}$ | $P_{IN}$ = 180°, $E_{B-Y}$ = 2 Vp-p, pin 11 = 9 V | 9 | 16 | 26 | mV | *1 |
| Green enhancement range + 2 | $\Delta V_{R-YG+}$ | $P_{IN}$ = 180°, $E_{B-Y}$ = 2 Vp-p, pin 11 = 9 V | –26 | –16 | –9 | mV | *1 |
| Green enhancement range – 1 | $\Delta V_{C-YG-}$ | $P_{IN}$ = 270°, $E_{B-Y}$ = 2 Vp-p, pin 11 = 9 V | 5 | 10 | 18 | mV | *1 |
| Green enhancement range – 2 | $\Delta V_{R-YG-}$ | $P_{IN}$ = 270°, $E_{B-Y}$ = 2 Vp-p, pin 11 = 9 V | –18 | –10 | –5 | mV | *1 |
| Green enhancement starting amplitude | $E_{B-YGS}$ | $P_{IN}$ = 227°, pin 11 = 9 V<br>$\Delta V_{G-Y}$, G = 5 mV | 0.36 | 0.45 | 0.75 | Vp-p | *1 |
| G OSD variation during green enhancement | $\Delta VG_{OSD}$ | Only G-Y ± 2 V, pin 7 = 9 V | | 0 | 50 | mV | *1 |
| Flesh-tone correction voltage variation | $\Delta V_{C-YF}$ | No input pin 12 0 V/9 V | –10 | 0 | +10 | mV | *1 |
| Flesh-tone correction phase | $P_{AF-1}$ | $P_{IN}$ = 120°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | 117 | 120 | 123 | deg | *1 |
| | $P_{AF-2}$ | $P_{IN}$ = 105°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = 1 V, pin 12 = 9 V | 102 | 105 | 108 | deg | *1 |
| | $P_{AF-3}$ | $P_{IN}$ = 138°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = 6 V, pin 12 = 9 V | 135 | 138 | 141 | deg | *1 |
| Maximum correction level + 1 | $\Delta V_{B-Y\ FM+}$ | $P_{IN}$ = 135°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | 68 | 85 | 103 | mV | *1 |
| Maximum correction level + 2 | $\Delta V_{R-Y\ FM+}$ | $P_{IN}$ = 135°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | 21 | 26 | 31 | mV | *1 |
| Maximum correction level – 1 | $\Delta V_{B-Y\ FM-}$ | $P_{IN}$ = 105°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | –120 | –100 | –80 | mV | *1 |
| Maximum correction level – 2 | $\Delta V_{R-Y\ FM-}$ | $P_{IN}$ = 105°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | –10 | 0 | +10 | mV | *1 |
| Flesh-tone correction range + 1 | $\Delta V_{B-Y\ F+}$ | $P_{IN}$ = 50°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | –10 | 0 | +10 | mV | *1 |
| Flesh-tone correction range – 1 | $\Delta V_{B-Y\ F-}$ | $P_{IN}$ = 200°, $E_{B-Y}$ = 1 Vp-p,<br>pin 14 = open, pin 12 = 9 V | –10 | 0 | +10 | mV | *1 |
| Flesh-tone correction range – 2 | $\Delta V_{R-Y\ F-}$ | $P_{IN}$ = 200°, $E_{B-Y}$ = 1 Vp-p,<br>pin14 = open, pin 12 = 9 V | –10 | 0 | +10 | mV | *1 |
| Flesh-tone correction starting amplitude | $E_{B-Y\ FS}$ | $P_{IN}$ = 105°, pin14 = open<br>$\Delta V_{B-Y}$, F = 5 mV | 0.1 | 0.2 | 0.35 | Vp-p | *1 |
| Limiter red detection level | $E_{B-Y\ RD}$ | $P_{IN}$ = 104°, pin 13 = 9 V, pin 15 = open | 2.6 | 3.0 | 3.4 | Vp-p | *1 |
| Limiter magenta detection level | $E_{B-Y\ MD}$ | $P_{IN}$ = 61°, pin 13 = 9 V, pin 15 = open | 1.7 | 2.0 | 2.3 | Vp-p | *1 |

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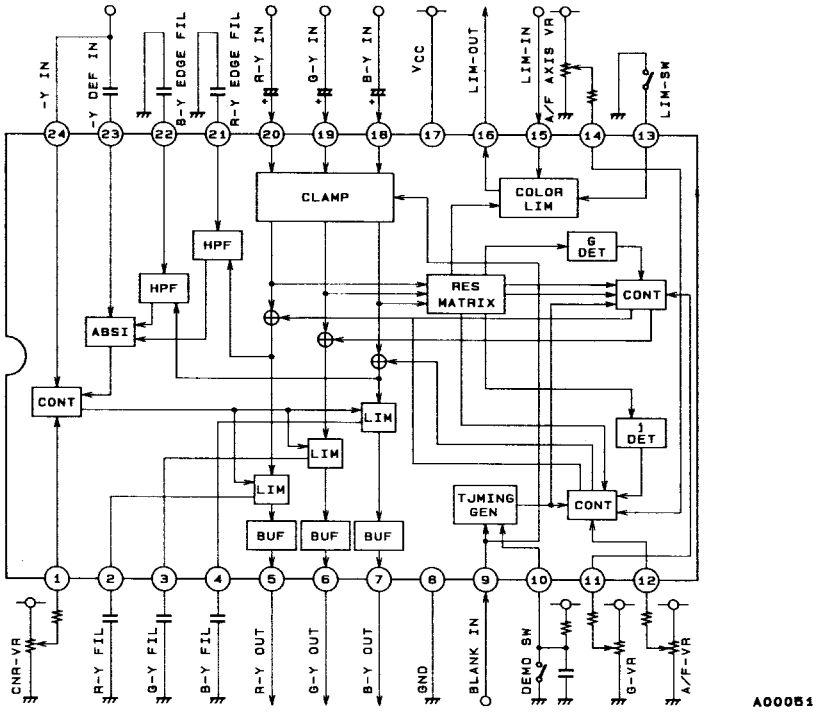
| Parameter | Symbol | Conditions | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Tracking magenta detection | $E_{B\text{-}Y\ MDT}$ | $P_{IN}$ = 61°, pin 13 = 9 V, pin 15 = 3.4 V | 2.9 | 3.3 | 3.7 | Vp-p | *1 |
| Limiter switch off voltage | $V_{CL\ OFF}$ | $P_{IN}$ = 61°, $E_{B\text{-}Y}$ = 3 Vp-p, pin 15 = open | 0.4 | 0.6 | 0.8 | V | *1 |
| Green enhancement release voltage | $V_{GL\ OPEN}$ | pin 11 open level | 6.8 | 7.0 | 7.2 | V | *1 |
| Flesh-tone correction release voltage | $V_{FL\ OPEN}$ | pin 12 open level | 6.8 | 7.0 | 7.2 | V | *1 |
| Flesh-tone phase release voltage | $V_{FP\ OPEN}$ | pin 14 open level | 3.3 | 3.5 | 3.7 | V | *1 |
| CNR-ON voltage variation | $\Delta V_{C\text{-}Y\ CNR}$ | No input pin 1 0 V/9 V | –10 | 0 | +10 | mV | |
| Maximum limiter amount | R-Y | $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V V2 (+100 µA) – V2 (–100 µA) | 600 | 715 | 785 | mV | |
| | G-Y | $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V V3 (+100 µA) – V3 (–100 µA) | 285 | 340 | 370 | mV | |
| | B-Y | $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V V4 (+100 µA) – V4 (–100 µA) | 600 | 715 | 785 | mV | |
| Minimum limiter amount | R-Y | $V_{CNR}$ = 0 V, pin 23 = GND, pin 24 = 7 V V2 (+100 µA) – V2 (–100 µA) | | 0 | | mV | |
| | G-Y | $V_{CNR}$ = 0 V, pin 23 = GND, pin 24 = 7 V V3 (+100 µA) – V3 (–100 µA) | | 0 | | mV | |
| | B-Y | $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V V4 (+100 µA) – V4 (–100 µA) | | 0 | | mV | |
| Maximum limiter level | $G_{R\text{-}Y}$max | INPUT = 500 kHz, 2 Vp-p, $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –4.2 | | dB | |
| | $G_{G\text{-}Y}$max | INPUT = 500 kHz, 1 Vp-p, $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –3.5 | | dB | |
| | $G_{B\text{-}Y}$max | INPUT = 500 kHz, 2 Vp-p, $V_{CNR}$ = 9 V, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –4.2 | | dB | |
| Minimum limiter level | $G_{R\text{-}Y}$min | INPUT = 500 kHz, 0.2 Vp-p, $V_{CNR}$ = 0 V, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –0.5 | | dB | |
| | $G_{G\text{-}Y}$min | INPUT = 500 kHz, 0.1 Vp-p, $V_{CNR}$ = 0 V, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –0.5 | | dB | |
| | $G_{B\text{-}Y}$min | INPUT = 500 kHz, 0.2 Vp-p, $V_{CNR}$ = 0 V, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –0.5 | | dB | |
| Normal limiter level | $G_{R\text{-}Y}$typ | INPUT = 50 kHz, 2 Vp-p, $V_{CNR}$ = open, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –1.2 | | dB | |
| | $G_{G\text{-}Y}$typ | INPUT = 50 kHz, 1 Vp-p, $V_{CNR}$ = open, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –0.6 | | dB | |
| | $G_{B\text{-}Y}$typ | INPUT = 50 kHz, 2 Vp-p,$V_{CNR}$ = open, pin 23 = GND, pin 24 = 7 V, pin 1 = 9 V | | –1.2 | | dB | |
| Color edge detection sensitivity | $\Delta V_{SCE}$ | Voltage difference between open voltage of pins 21 and 22 and edge detection | ±60 | ±85 | ±110 | mV | |
| Y edge detection sensitivity | $\Delta V_{SYE}$ | Voltage difference between open voltage of pin 23 and edge detection | ±130 | ±160 | ±190 | mV | |
| Y level detection voltage | $V_{\text{-}Y}$min | No edge detection $V_{CNT}$ = 9 V | 0.9 | 1.2 | 1.5 | V | |
| Y level detection voltage | $V_{\text{-}Y}$max | No edge detection $V_{CNT}$ = 9 V | 3.6 | 3.9 | 4.2 | V | |
| Limiter level control | $V_{LCNT1}$ | Control voltage at which limiter amount is 50 mV | 4.5 | 4.75 | 5.0 | V | |
| Limiter level control | $V_{LCNT2}$ | Control voltage which is –50 mV from maximum limiter amount | 7.0 | 7.25 | 7.5 | V | |
| Color edge filter voltage | $V_{EF\ OPEN}$ | Open DC voltage of pins 21 and 22 | 4.65 | 4.9 | 5.15 | V | |
| –Y differential input voltage | $V_{dY\ OPEN}$ | Open DC voltage of pin 23 | 3.7 | 3.9 | 4.1 | V | |
| Limiter control voltage | $V_{CNT\ OPEN}$ | Open DC voltage of pin 1 | 5.8 | 6.0 | 6.2 | V | |
| Limiter filter voltage | $V_{LF\ OPEN}$ | Open DC voltage of pins 2, 3 and 4 | 3.95 | 4.2 | 4.45 | V | |

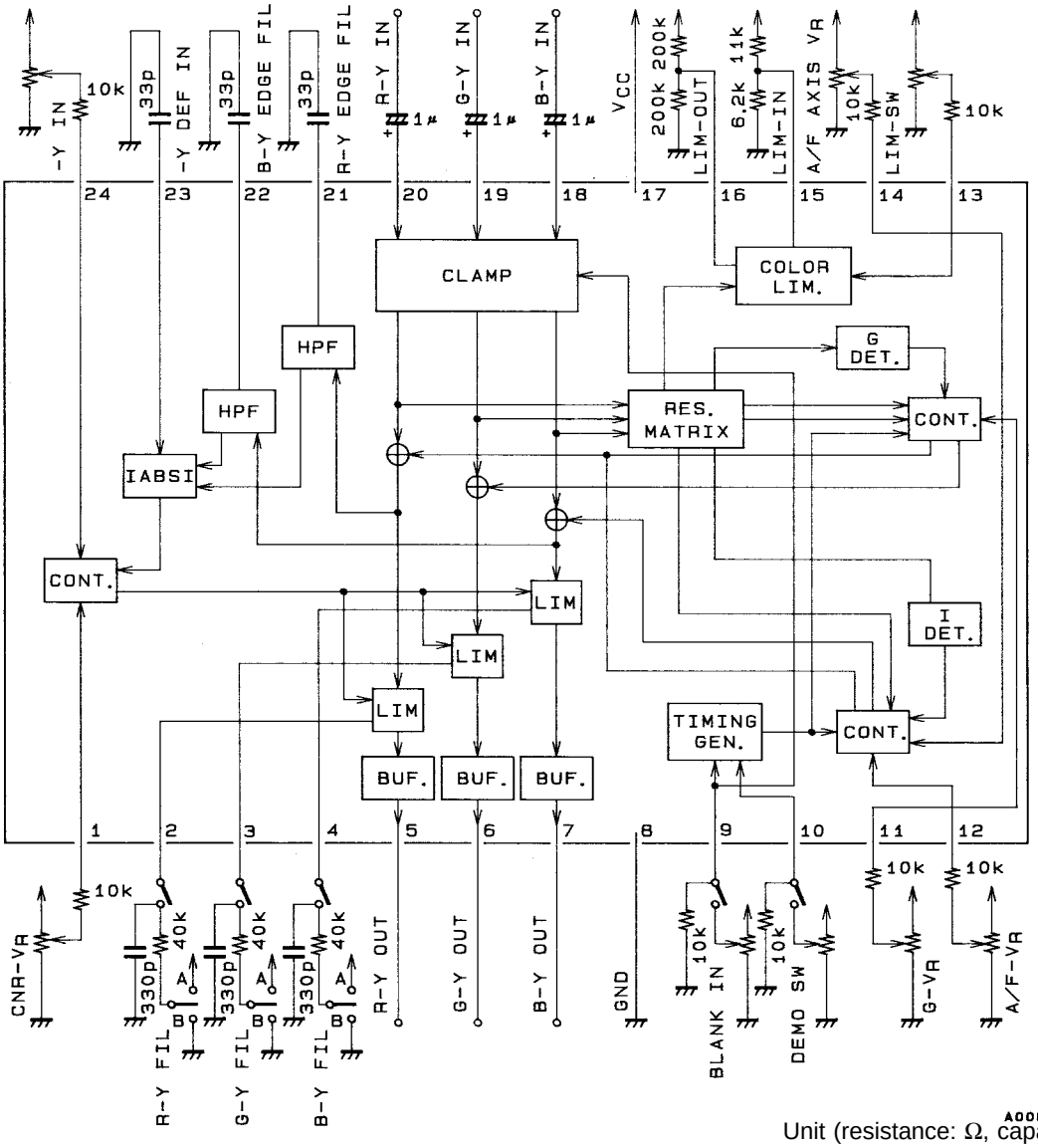
Notes: *1) When the CNR limiter level is at a minimum (pin 1 = 0 V)

*2) When both the green enhancement level and flesh-tone correction level are both at a minimum (pin 11 = 0 V; pin 12 = 0 V)

## Block Diagram



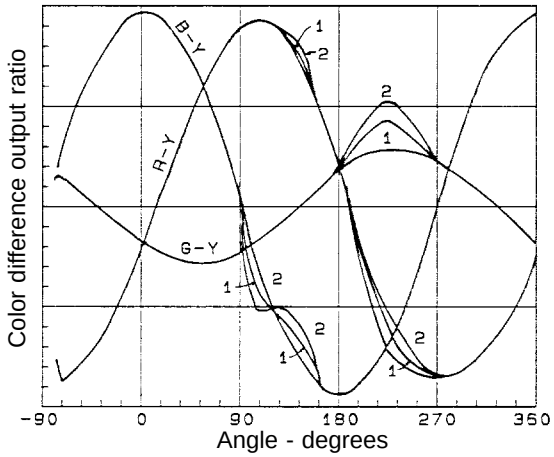

## Test Circuit




Unit (resistance: Ω, capacitance: F)

Note: All $V_R$s are 10 kΩ variable resistors

**Flesh-tone correction and green enhancement characteristics**




**Flesh-tone center adjustment**