



**LA5613**

## VCR Regulator and Control Amplifier

## Overview

The LA5613 is an IC that includes an independently on/off switchable 5-V/0.7-A low-saturation regulator, an 11.3-V/0.3-A ripple filter, and a control amplifier on chip. It is optimal for use in VCR and similar products.

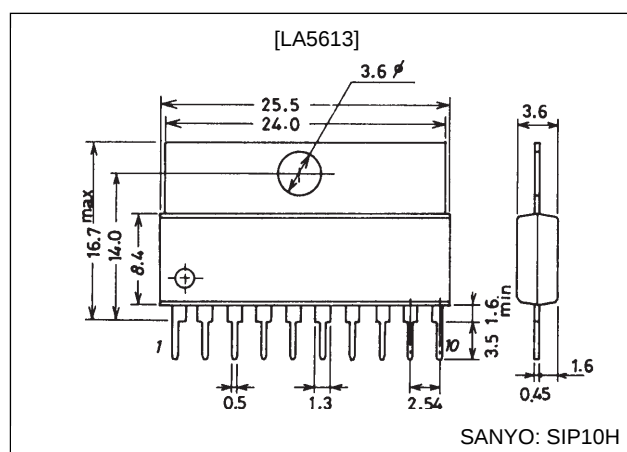
## Functions and Features

- 5-V/0.7-A low-saturation regulator  
(Includes an on/off function.)
- 11.3-V/0.3-A ripple filter (Includes an on/off function.)
- Switching regulator control amplifier
- Includes input overvoltage and thermal protection circuits on chip.

## Package Dimensions

unit: mm

**3046B-SIP10F**



## Specifications

### Maximum Ratings at Ta = 25°C

| Parameter                   | Symbol               | Conditions                          | Ratings          | Unit |
|-----------------------------|----------------------|-------------------------------------|------------------|------|
| Maximum supply voltage      | V <sub>CC1</sub> max |                                     | 14               | V    |
|                             | V <sub>CC2</sub> max | V <sub>CC1</sub> ≥ V <sub>CC2</sub> | V <sub>CC1</sub> |      |
| Allowable power dissipation | P <sub>d</sub> max   | No heat sink                        | 1.7              | W    |
| Operating temperature       | T <sub>opr</sub>     |                                     | −20 to +80       | °C   |
| Storage temperature         | T <sub>stg</sub>     |                                     | −40 to +150      | °C   |

### Operating Conditions at $T_a = 25^\circ\text{C}$

| Parameter        | Symbol    | Conditions | Ratings        | Unit |
|------------------|-----------|------------|----------------|------|
| Input voltage    | $V_{CC1}$ |            | $12.3 \pm 0.4$ | V    |
|                  | $V_{CC2}$ |            | $6 \pm 0.5$    | V    |
| Output current 1 | $I_{O1}$  |            | 0 to 0.3       | A    |
| Output current 2 | $I_{O2}$  |            | 0 to 0.7       | A    |

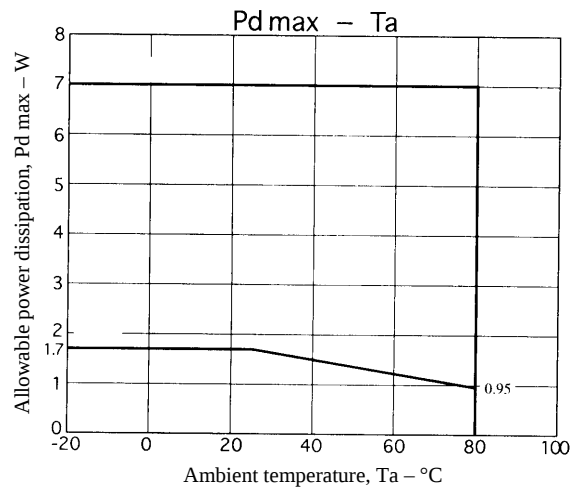
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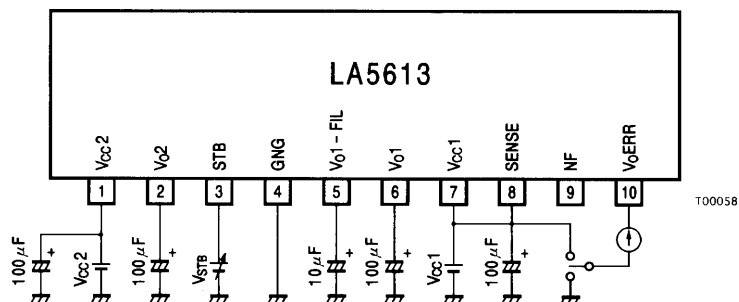
## LA5613

### Electrical Characteristics at Ta = 25°C in the specified Test Circuit

| Parameter                                                                                                                       | Symbol                 | Conditions                                                                      | Ratings |      |                  | Unit |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------------------------------------|---------|------|------------------|------|
|                                                                                                                                 |                        |                                                                                 | min     | typ  | max              |      |
| [No Load] V <sub>STB</sub> = high, V <sub>CC1</sub> = 12.3 V, V <sub>CC2</sub> = 6 V, I <sub>O1</sub> and I <sub>O2</sub> = 0 A |                        |                                                                                 |         |      |                  |      |
| Quiescent current                                                                                                               | I <sub>IN1</sub>       |                                                                                 | –       | 20   | 30               | mA   |
|                                                                                                                                 | I <sub>IN2</sub>       |                                                                                 | –       | 0.2  | 0.3              | mA   |
| [Output 1] V <sub>STB</sub> = high, V <sub>CC1</sub> = 12.3 V, V <sub>CC2</sub> = 6 V, I <sub>O1</sub> = 0.3 A                  |                        |                                                                                 |         |      |                  |      |
| Output voltage 1                                                                                                                | V <sub>O1</sub>        |                                                                                 | 10.9    | 11.3 | –                | V    |
| Dropout voltage                                                                                                                 | V <sub>DROP1</sub>     |                                                                                 | –       | 1.0  | 1.4              | V    |
| Peak output current                                                                                                             | I <sub>OP1</sub>       |                                                                                 | 0.3     | –    | –                | A    |
| Output low-level voltage                                                                                                        | V <sub>O1 OFF</sub>    |                                                                                 | –       | –    | 0.2              | V    |
| [Output 2] V <sub>STB</sub> = high, V <sub>CC1</sub> = 12.3 V, V <sub>CC2</sub> = 6 V, I <sub>O2</sub> = 0.7 A                  |                        |                                                                                 |         |      |                  |      |
| Output voltage 2                                                                                                                | V <sub>O2</sub>        |                                                                                 | 4.9     | 5.1  | 5.3              | V    |
| Dropout voltage                                                                                                                 | V <sub>DROP2</sub>     |                                                                                 | –       | 0.3  | 0.5              | V    |
| Line regulation                                                                                                                 | ΔV <sub>OLN2</sub>     | 6 V ≤ V <sub>CC2</sub> ≤ 7 V                                                    | –       | –    | 20               | mV   |
| Load regulation                                                                                                                 | ΔV <sub>OLD2</sub>     | 0.1 A ≤ I <sub>O2</sub> ≤ 0.7 A                                                 | –       | –    | 300              | mV   |
| Peak output current                                                                                                             | I <sub>OP2</sub>       |                                                                                 | 0.7     | –    | –                | A    |
| Output short-circuit current                                                                                                    | I <sub>OSC2</sub>      |                                                                                 | –       | –    | 0.75             | A    |
| Ripple rejection                                                                                                                | R <sub>rej2</sub>      | f = 120 Hz, 6 V ≤ V <sub>CC2</sub> ≤ 7 V                                        | –       | 50   | –                | dB   |
| Output low-level voltage                                                                                                        | V <sub>O2 OFF</sub>    |                                                                                 | –       | –    | 0.2              | V    |
| [Input Overvoltage Protection]                                                                                                  |                        |                                                                                 |         |      |                  |      |
| Detection voltage                                                                                                               | V <sub>HVTH</sub>      |                                                                                 | 7.6     | 8.0  | 8.4              | V    |
| [Output 1 and Output 2 On/Off Control] V <sub>CC1</sub> = 12.3 V, V <sub>CC2</sub> = 6 V                                        |                        |                                                                                 |         |      |                  |      |
| Output off control voltage                                                                                                      | V <sub>STBL</sub>      | V <sub>O1</sub> and V <sub>O2</sub> : off                                       | –       | –    | 1.0              | V    |
| Output on control voltage                                                                                                       | V <sub>STBH</sub>      | V <sub>O1</sub> and V <sub>O2</sub> : on                                        | 3.0     | –    | V <sub>CC1</sub> |      |
| [Control Amplifier] V <sub>CC1</sub> = 12.3 V, V <sub>CC2</sub> = 6 V                                                           |                        |                                                                                 |         |      |                  |      |
| Control output current (sink)                                                                                                   | I <sub>CONT</sub>      | V <sub>CC1</sub> = 12.8 V                                                       | 10      | –    | –                | mA   |
| Resistance ratio                                                                                                                | K <sub>R</sub>         | K <sub>R</sub> = R <sub>1</sub> /R <sub>2</sub> , V <sub>REF</sub> = 1.28 V typ | –       | 8.61 | –                |      |
| Output inverted input voltage                                                                                                   | V <sub>CC1</sub> - ERR | I <sub>O1</sub> = 0.3 A, I <sub>O2</sub> = 0.7 A                                | 11.9    | 12.3 | 12.7             | V    |



### Test Circuit



## Pin Functions

| Pin No. | Symbol               | Function                                                                                                    |
|---------|----------------------|-------------------------------------------------------------------------------------------------------------|
| 1       | V <sub>CC2</sub>     | Low-voltage input                                                                                           |
| 2       | V <sub>O2</sub>      | 5.1-V/0.7-A regulator output, with on/off, current limiter thermal shutdown.                                |
| 3       | STB                  | V <sub>O1</sub> and V <sub>O2</sub> on/off control. Active high.                                            |
| 4       | GND                  | Substrate of the LA5613 (minimum potential)                                                                 |
| 5       | V <sub>O1</sub> -FIL | V <sub>O1</sub> ripple filter capacitor connection                                                          |
| 6       | V <sub>O1</sub>      | Ripple filter 0.3-A output, with on/off, current limiter thermal shutdown.                                  |
| 7       | V <sub>CC1</sub>     | High-voltage input                                                                                          |
| 8       | SENSE                | V <sub>CC1</sub> voltage detection                                                                          |
| 9       | NF                   | Phase compensation and V <sub>CC1</sub> adjustment. Connect resistors between this pin and SENSE or ground. |
| 10      | V <sub>OERR</sub>    | Switching register control amplifier drive output                                                           |

Notes: 1. CL: Current limiter  
2. TSD: Thermal shutdown

## Function Table (○: built-in, ×: not built-in)

| Circuit block<br>Function   | V <sub>O1</sub>  | V <sub>O2</sub>  | Control amplifier |
|-----------------------------|------------------|------------------|-------------------|
| Input line                  | V <sub>CC1</sub> | V <sub>CC2</sub> | V <sub>CC1</sub>  |
| Output current protection   | ○                | ○                | ×                 |
| Thermal shutdown protection | ○                | ○                | ×                 |
| On/off control              | ○                | ○                | ×                 |
| Overvoltage protection      | ○                | ○                | ○                 |

## Usage Notes

- The relationship  $V_{CC1} \geq V_{CC2}$  must hold at all times when power is applied.
- Power should be applied to V<sub>CC1</sub> and V<sub>CC2</sub> simultaneously. Do not use this IC with only one or the other voltage applied.
- This IC will be destroyed if the V<sub>O1</sub> output load is shorted. Do not short the outputs of this IC.

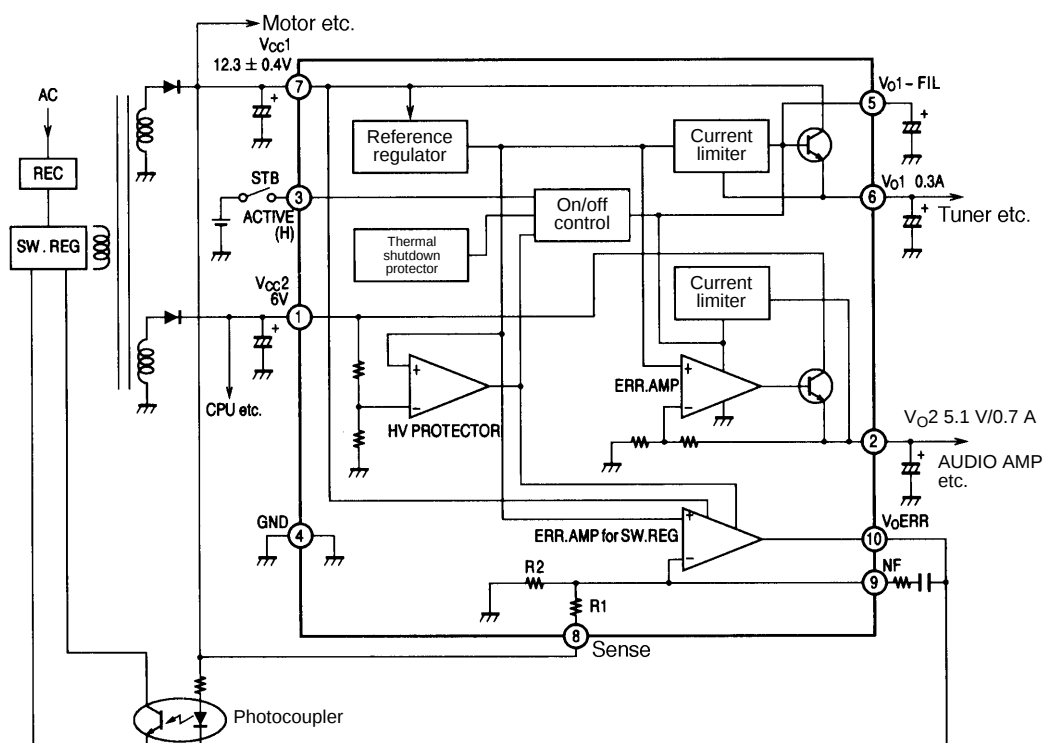
## Logic Table

Conditions: When  $V_{CC1} \geq V_{CC2}$   
(However, the conditions  $11.9\text{ V} \leq V_{CC1} \leq 12.7\text{ V}$  and  $5.5\text{ V} \leq V_{CC2} \leq 6.5\text{ V}$  must also apply.)

|           |                                   |
|-----------|-----------------------------------|
| STB       | V <sub>O1</sub> , V <sub>O2</sub> |
| L or open | L                                 |
| H         | H                                 |

Notes: 1. "H" for STB denotes high level; "L" denotes low level.  
2. "H" for V<sub>O</sub> denotes output ON voltage; "L" denotes output OFF voltage.

## Equivalent Circuit Block Diagram and Sample Application Circuit



T00057

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