



LA5611

Multifunctional Voltage Regulator for TVs and VCRs

Applications

- Audiovisual equipment, VCRs and TVs

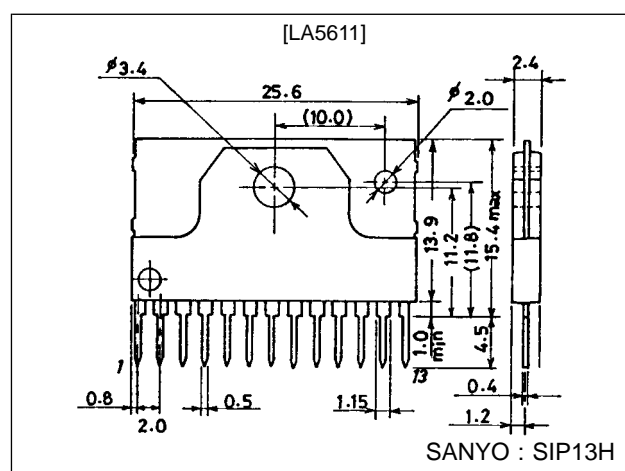
Features

- Low saturation type of regulator (ON/OFF function built in)
- Control amplifier built in.
- Current limit and thermal limit circuits built in
- Reverse current prevention provided (V_{O4})

Package Dimensions

unit : mm

3107-SIP13H



Specifications

Maximum Ratings at $T_a = 25\text{ }^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|--|----------------|-------------------------|-------------|--------------------|
| Maximum input voltage | V_{IN1} max | | 22 | V |
| | V_{IN2} max | $V_{IN1} \cong V_{IN2}$ | V_{IN1} | |
| Allowable power dissipation | P_d max | No heat sink | 2 | W |
| Thermal resistance between junction and case | θ_{j-c} | | 4.7 | $^\circ\text{C/W}$ |
| Operating temperature | T_{opr} | | -20 to +80 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -40 to +150 | $^\circ\text{C}$ |

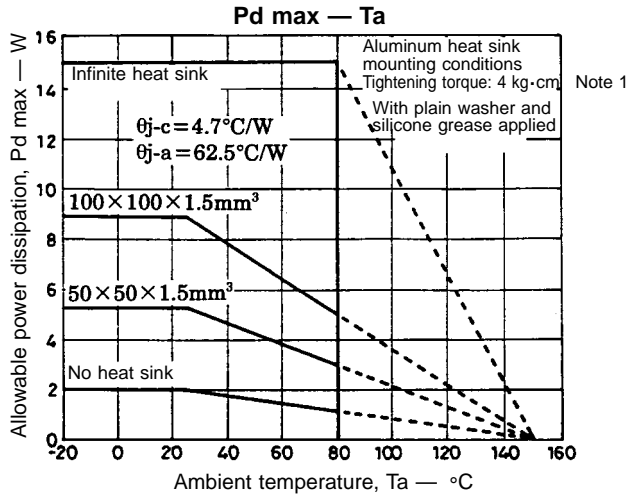
Operating Conditions at $T_a = 25\text{ }^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|------------------|-----------|------------------------------|------------|------|
| Input voltage | V_{IN1} | | 11.5 to 20 | V |
| | V_{IN2} | | 6.2 to 20 | V |
| Output current 1 | I_{O1} | Within ASO of external T_r | | mA |
| Output current 2 | I_{O2} | | 10 to 480 | mA |
| Output current 3 | I_{O3} | | 10 to 240 | mA |
| Output current 4 | I_{O4} | | 5 to 48 | mA |

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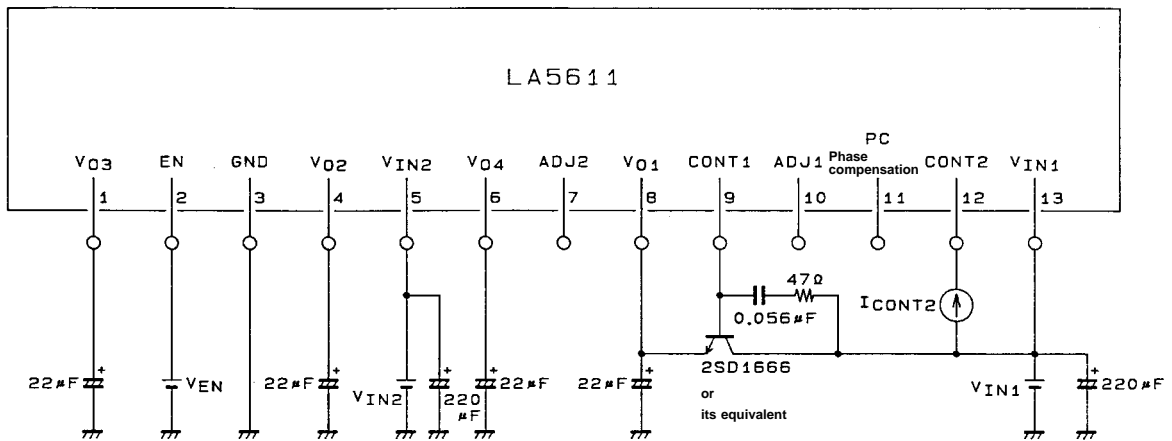
Operating Characteristics at Ta = 25 °C, See specified Test Circuit.

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|--|-----------------------|---|------|------|------------------|--------|
| [No-load mode] V _{EN} = low, V _{IN1} = 14 V, V _{IN2} = 6.6 V, I _{O1} to I _{O4} = 0 mA | | | | | | |
| Quiescent current | I _{IN1} | | | 8 | 16 | mA |
| | I _{IN2} | | | 2 | 4 | mA |
| [Regulator 1] V _{EN} = low, V _{IN1} = 14 V, V _{IN2} = 6.6 V, I _{O1} = 500 mA, with specified external transistor | | | | | | |
| Output voltage 1 | V _{O1} | | 8.5 | 9.0 | 9.5 | V |
| Dropout voltage | V _{DROP1} | | | 0.8 | 1.6 | V |
| Line regulation | ΔV _{OLN1} | 12 V ≤ V _{IN1} ≤ 16 V | | | 140 | mV |
| Load regulation | ΔV _{OLD1} | 0.1 A ≤ I _{O1} ≤ 1 A | | | 150 | mV |
| Ripple rejection | Rrej1 | | | 50 | | dB |
| Output low-level voltage | V _{O1} OFF | | | | 0.2 | V |
| Control output current | I _{CONT1} | | 10 | | | mA |
| Output voltage/temperature coefficient | ΔV _{O1} /ΔTa | | | ±1 | | mV/ °C |
| [Regulator 2] V _{EN} = low, V _{IN1} = 14 V, V _{IN2} = 6.6 V, I _{O2} = 400 mA | | | | | | |
| Output voltage 2 | V _{O2} | | 4.80 | 5.05 | 5.30 | V |
| Dropout voltage | V _{DROP2} | | | 0.5 | 1.0 | V |
| Line regulation | ΔV _{OLN2} | 6 V ≤ V _{IN2} ≤ 7.2 V | | | 20 | mV |
| Load regulation | ΔV _{OLD2} | 0.1 A ≤ I _{O2} ≤ 0.4 A | | | 100 | mV |
| Peak output current | I _{OP2} | | 480 | | | mA |
| Output short-circuit current | I _{OSC2} | | | 90 | 240 | mA |
| Ripple rejection | Rrej2 | | | 50 | | dB |
| Output low-level voltage | V _{O2} OFF | | | | 0.2 | V |
| Output voltage/temperature coefficient | ΔV _{O2} /ΔTa | | | ±0.5 | | mV/ °C |
| [Regulator 3] V _{EN} = high, V _{IN1} = 14 V, V _{IN2} = 6.6 V, I _{O3} = 200 mA | | | | | | |
| Output voltage 3 | V _{O3} | | 4.80 | 5.05 | 5.30 | V |
| Dropout voltage | V _{DROP3} | | | 0.5 | 1.0 | V |
| Line regulation | ΔV _{OLN3} | 6 V ≤ V _{IN2} ≤ 7.2 V | | | 20 | mV |
| Load regulation | ΔV _{OLD3} | 10 mA ≤ I _{O3} ≤ 200 mA | | | 100 | mV |
| Peak output current | I _{OP3} | | 240 | | | mA |
| Output short-circuit current | I _{OSC3} | | | 40 | 120 | mA |
| Ripple rejection | Rrej3 | | | 50 | | dB |
| Output voltage/temperature coefficient | ΔV _{O3} /ΔTa | | | ±0.5 | | mV/ °C |
| [Regulator 4] V _{EN} = high, V _{IN1} = 14 V, V _{IN2} = 6.6 V, I _{O4} = 40 mA | | | | | | |
| Output voltage 4 | V _{O4} | | 5.4 | 5.7 | 6.0 | V |
| Dropout voltage | V _{DROP4} | | | 3.8 | 5.0 | V |
| Line regulation | ΔV _{OLN4} | 12 V ≤ V _{IN1} ≤ 16 V | | | 40 | mV |
| Load regulation | ΔV _{OLD4} | 10 mA ≤ I _{O4} ≤ 40 mA | | | 65 | mV |
| Peak output current | I _{OP4} | | 40 | | | mA |
| Output short-circuit current | I _{OSC4} | | | 70 | | mA |
| Ripple rejection | Rrej4 | | | 50 | | dB |
| Output voltage/temperature coefficient | ΔV _{O4} /ΔTa | | | ±1 | | mV/ °C |
| [Output on/off control] V _{IN1} = 14 V, V _{IN2} = 6.6 V | | | | | | |
| Output on control voltage | V _{ENL} | V _{O1} , V _{O2} : on | | | 1.0 | V |
| Output off control voltage | V _{ENH} | V _{O1} , V _{O2} : off | 3.0 | | V _{IN1} | V |
| [Control Amplifier] V _{IN1} = 14 V, V _{IN2} = 6.6 V | | | | | | |
| Control output current | I _{CONT2} | | 10 | | | mA |
| Resistance ratio | K _R | K _R = R4/R3, V _{ref} = 1.28 V typ | | 9.94 | | |



Note 1: The tightening torque referred to in the above figure is a condition specified for the heat dissipation characteristics and not a working condition to be met when mounting the heat sink.

Test Circuit



A04329

Pin Functions

| No. | Symbol | Function |
|-----|--------|--|
| 1 | VO3 | 5.05 V/240 mA regulator, with current limit, thermal shutdown. |
| 2 | EN | Regulator 1 and regulator 2 on/off control. Low active. |
| 3 | GND | Substrate of the LA5611 (minimum potential). |
| 4 | VO2 | 5.05 V/480 mA regulator, with on/off, current limit, thermal shutdown. |
| 5 | VIN2 | Low voltage input. |
| 6 | VO4 | 5.7 V/40 mA regulator with reverse current prevention. |
| 7 | ADJ2 | VO1 adjustment pin. Resistance between pin 7 and ground → VO1 up. Resistance between pin 7 and pin 8 → VO1 down |
| 8 | VO1 | Output voltage sensor of 9.0 V regulator |
| 9 | CONT1 | Base control of external NPN transistor. ICONT1 = 10 mA, with on/off, thermal shutdown coupled with the internal thermal shutdown of this regulator. |
| 10 | ADJ1 | VIN1 adjustment pin. Resistance between pin 10 and ground → VIN1 up. Resistance between pin 13 and pin 10 → VIN1 down |
| 11 | PC | Phase correction pin of switching regulator control amplifier. |
| 12 | CONT2 | Drive output of switching regulator control amplifier. |
| 13 | VIN1 | High voltage input. |

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

| Function | Circuit block | V _{O1} | V _{O2} | V _{O3} | V _{O4} | Control amplifier |
|----------------|---------------|------------------|------------------|------------------|------------------|-------------------|
| Input line | | V _{IN1} | V _{IN2} | V _{IN2} | V _{IN1} | V _{IN1} |
| Current limit | | × | ○ | ○ | ○ | × |
| Thermal limit | | ○ | ○ | ○ | × | × |
| On/off control | | ○ | ○ | × | × | × |

Usage Notes

- Apply voltages to the voltage input pins on condition that $V_{IN1} \cong V_{IN2}$.
- Supply the voltages simultaneously to V_{IN1} and V_{IN2} . Do not use the LA5611 with voltage applied to only one of these pins.
- Since the control circuit of regulator 1 does not have current limit protection of such as an external NPN transistor, provide this protection in each application.

Logic Table

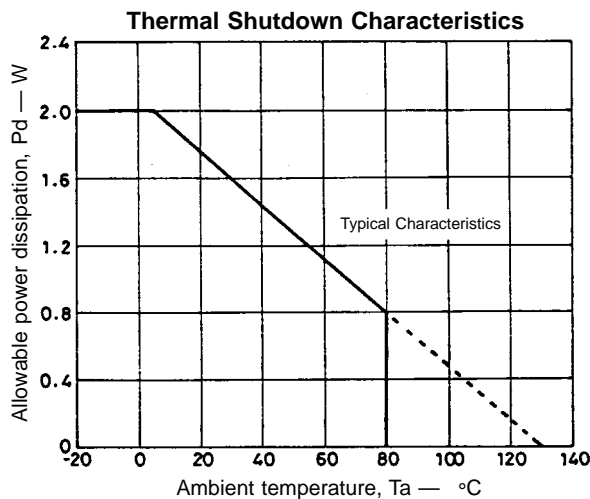
Conditions : when $V_{IN1} \cong V_{IN2}$ (at $V_{IN1} \cong 11.5$ V, $V_{IN2} \cong 6.2$ V)

| EN | V _{O1} , V _{O2} |
|-----------|-----------------------------------|
| L or open | H |
| H | L |

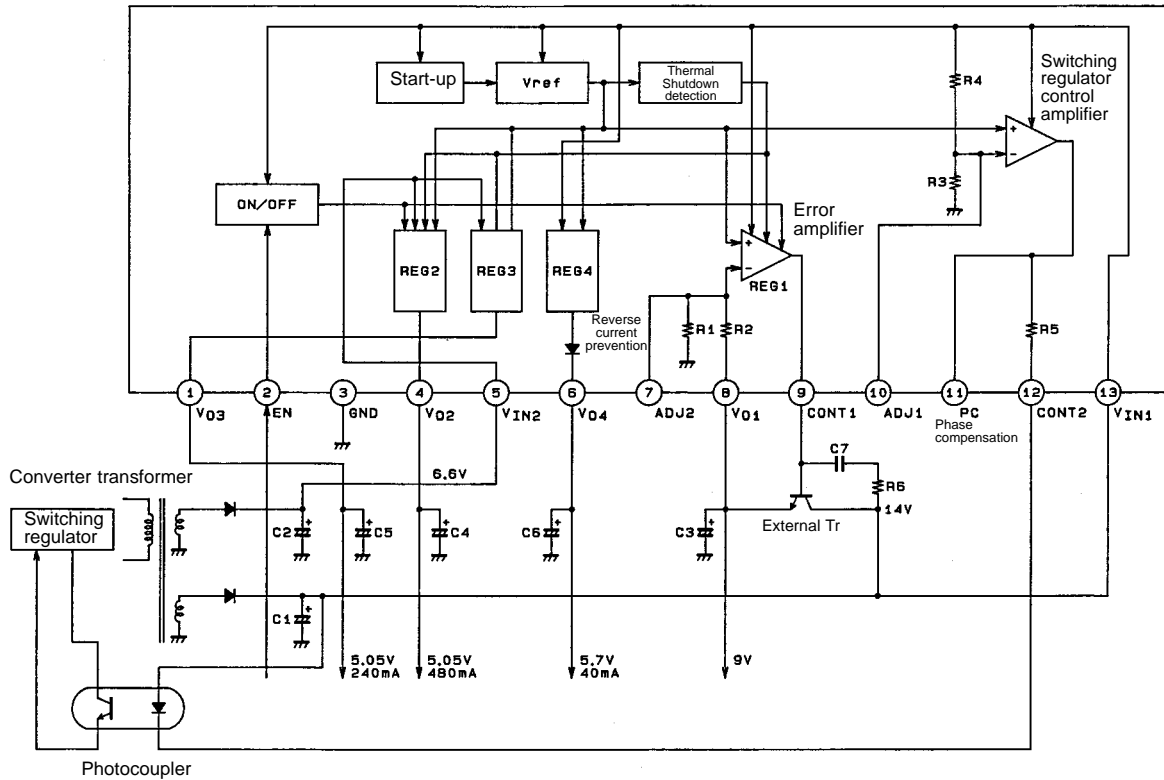
- “H” for EN denotes high level; “L” denotes low level.
- “H” for V_O denotes output ON voltage; “L” denotes output OFF voltage.

Thermal Design Notes

- In the LA5611, the junction temperature (T_j) at which thermal shutdown is activated is approximately equal to 130°C.
- Consequently, the operating temperature range of REG1, REG2 and REG3 with the thermal shutdown function is restricted by the thermal shutdown characteristics (typical value) shown in the figure below.
- The thermal shutdown characteristics vary $\pm 20^\circ\text{C}$ or so. Since thermal shutdown is liable to occur with inadequate heat dissipation, sufficient consideration must be given to the heat dissipation design.



Equivalent Circuit Block Diagram and Sample Application Circuit



A04328

Application Notes

- (1) Depending on the type, load current and connection position (distance from the LA5611) of the external NPN transistor, the capacitor C7 and resistance R6 is necessary for preventing oscillation.
- (2) C1 to C6 are bypass capacitors for preventing oscillation: as such, they must be positioned as close to the LA5611 as possible in order to stabilize operation.

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