



LA5611

Multifunctional Voltage Regulator for TVs and VCRs

Applications

- Audiovisual equipment, VCRs and TVs

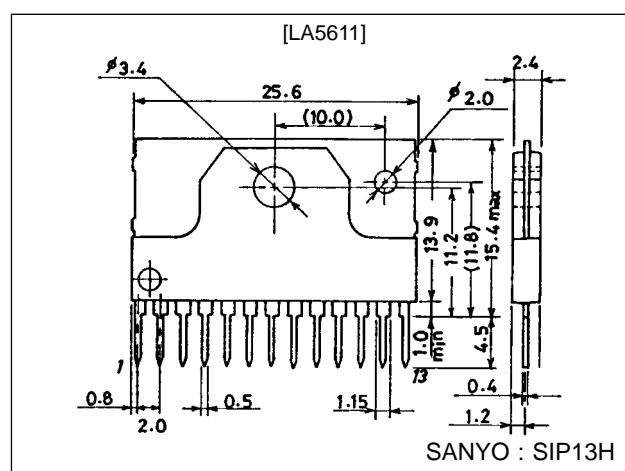
Features

- 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	$^\circ\text{C}$

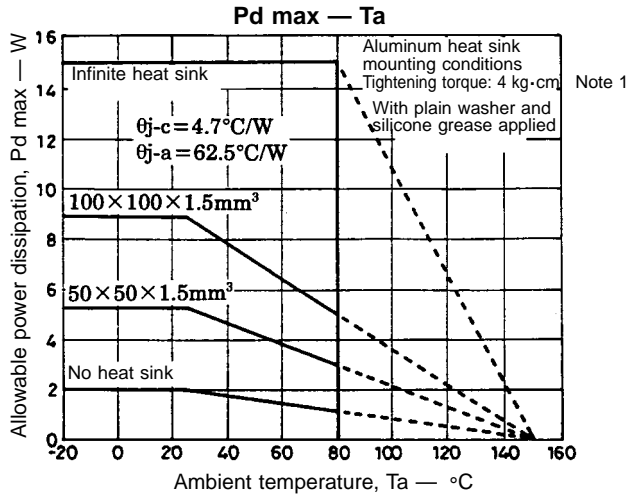
Operating Conditions at $T_a = 25\text{ }^\circ\text{C}$

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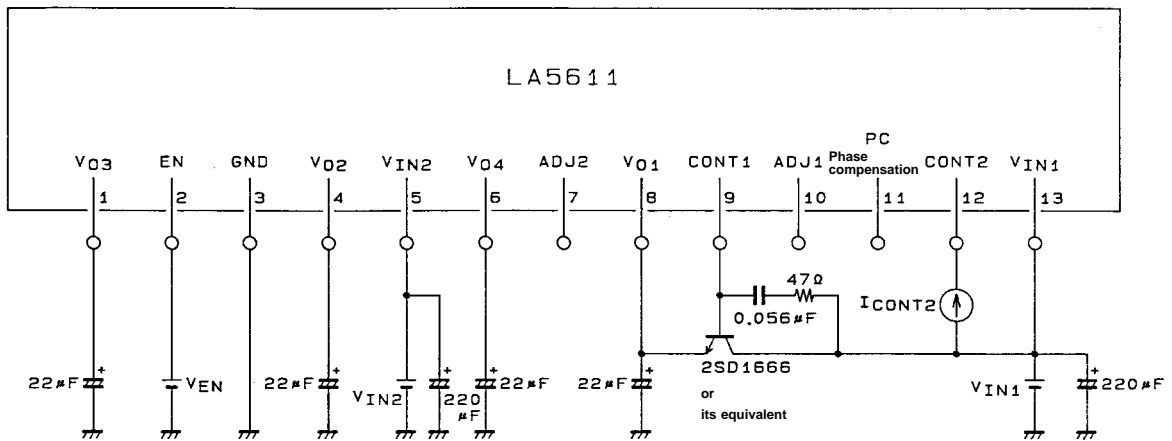
Operating Characteristics at Ta = 25 °C, See specified Test Circuit.

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



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Pin Functions

No.	Symbol	Function
1	V _{O3}	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	V _{O2}	5.05 V/480 mA regulator, with on/off, current limit, thermal shutdown.
5	V _{IN2}	Low voltage input.
6	V _{O4}	5.7 V/40 mA regulator with reverse current prevention.
7	ADJ2	V _{O1} adjustment pin. Resistance between pin 7 and ground → V _{O1} up. Resistance between pin 7 and pin 8 → V _{O1} down
8	V _{O1}	Output voltage sensor of 9.0 V regulator
9	CONT1	Base control of external NPN transistor. I _{CONT1} = 10 mA, with on/off, thermal shutdown coupled with the internal thermal shutdown of this regulator.
10	ADJ1	V _{IN1} adjustment pin. Resistance between pin 10 and ground → V _{IN1} up. Resistance between pin 13 and pin 10 → V _{IN1} down
11	PC	Phase correction pin of switching regulator control amplifier.
12	CONT2	Drive output of switching regulator control amplifier.
13	V _{IN1}	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 $V_{IN1} \geq V_{IN2}$.
- 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

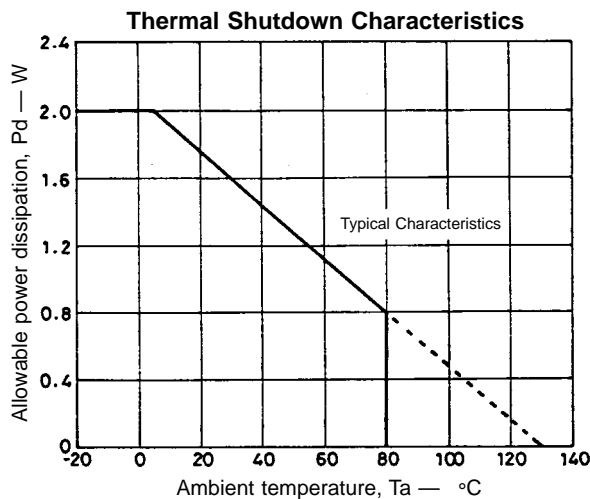
Conditions : when $V_{IN1} \geq V_{IN2}$ (at $V_{IN1} \geq 11.5$ V, $V_{IN2} \geq 6.2$ V)

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

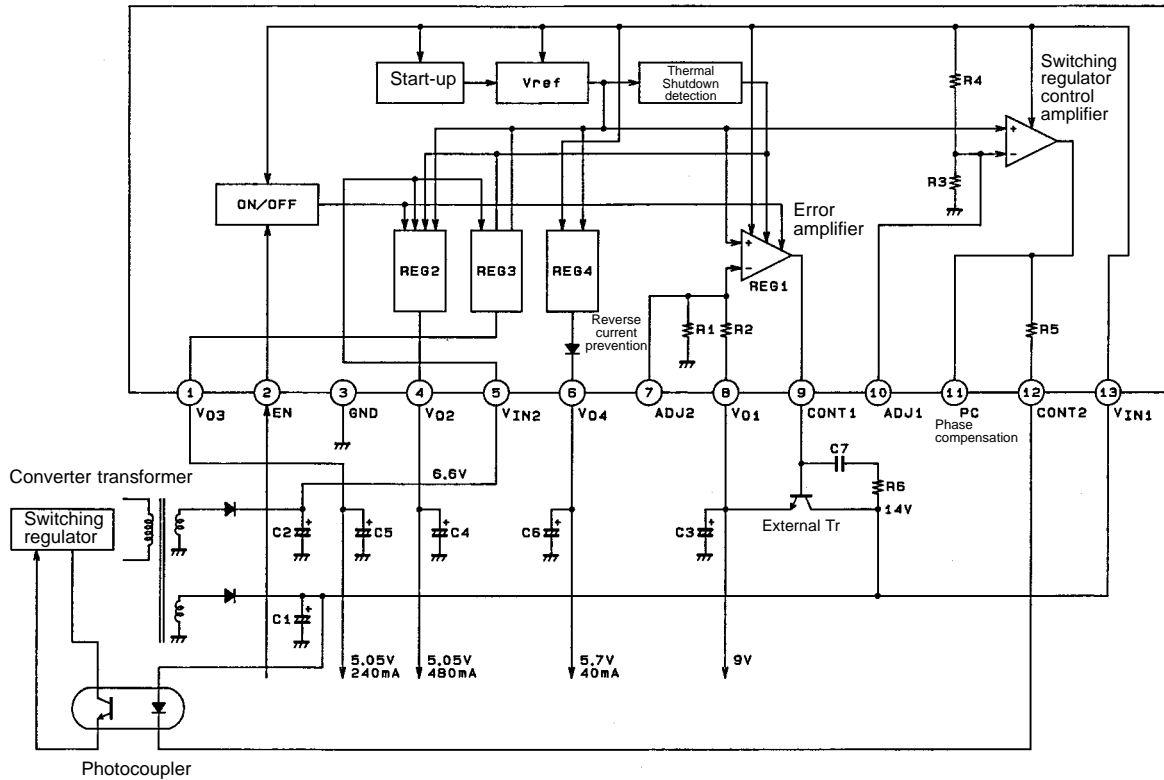
- “H” for EN denotes high level; “L” denotes low level.
- “H” for V_O denotes output ON voltage; “L” denotes output OFF voltage.

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



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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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