

Monolithic Linear IC



LA5611

**Multifunctional Voltage Regulator
for TVs and VCRs**

Applications

- Audiovisual equipment, VCRs and TVs

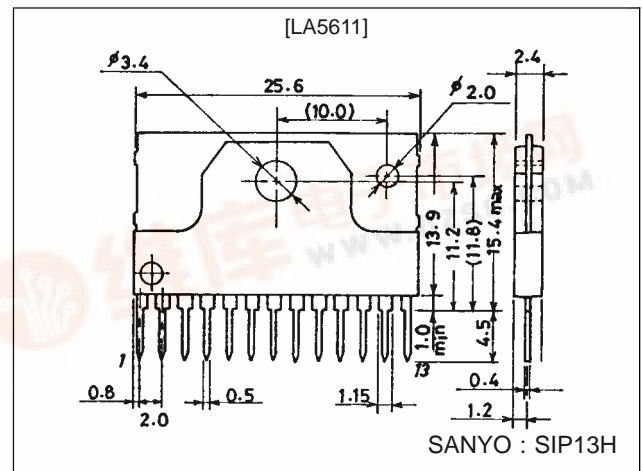
Features

- 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 $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum input voltage	V_{IN1} max		22	V
	V_{IN2} max	$V_{IN1} \geq V_{IN2}$	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 $T_a = 25^\circ\text{C}$

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

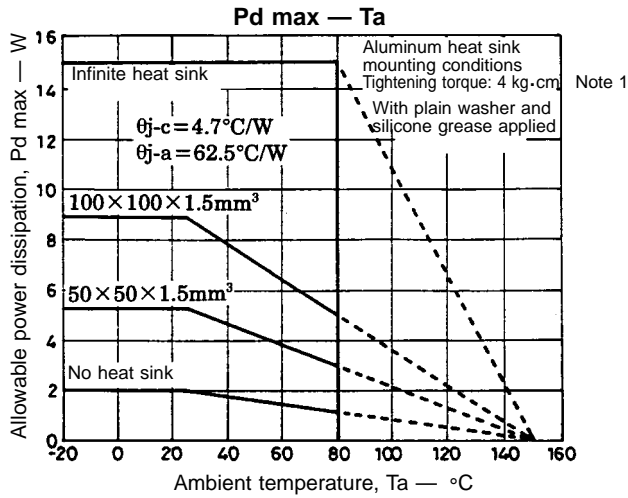


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Operating Characteristics at $T_a = 25\text{ }^\circ\text{C}$, See specified Test Circuit.

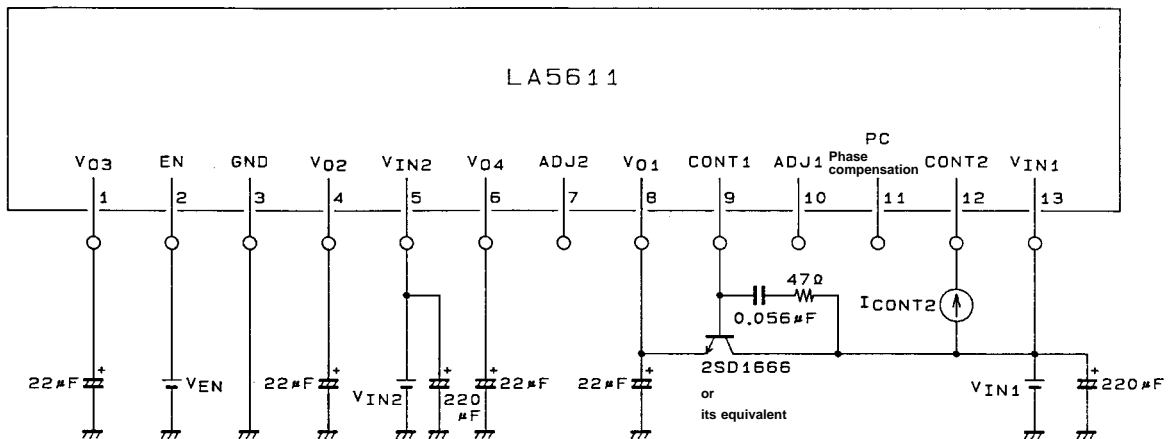
Parameter	Symbol	Conditions	min	typ	max	Unit
[No-load mode] $V_{EN} = \text{low}$, $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$, I_{O1} to $I_{O4} = 0\text{ mA}$						
Quiescent current	I_{IN1}			8	16	mA
	I_{IN2}			2	4	mA
[Regulator 1] $V_{EN} = \text{low}$, $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$, $I_{O1} = 500\text{ mA}$, 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}	$12\text{ V} \leq V_{IN1} \leq 16\text{ V}$			140	mV
Load regulation	ΔV_{OLD1}	$0.1\text{ A} \leq I_{O1} \leq 1\text{ A}$			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	$\Delta V_{O1}/\Delta T_a$			± 1		mV/ $^\circ\text{C}$
[Regulator 2] $V_{EN} = \text{low}$, $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$, $I_{O2} = 400\text{ mA}$						
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}	$6\text{ V} \leq V_{IN2} \leq 7.2\text{ V}$			20	mV
Load regulation	ΔV_{OLD2}	$0.1\text{ A} \leq I_{O2} \leq 0.4\text{ A}$			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	$\Delta V_{O2}/\Delta T_a$			± 0.5		mV/ $^\circ\text{C}$
[Regulator 3] $V_{EN} = \text{high}$, $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$, $I_{O3} = 200\text{ mA}$						
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}	$6\text{ V} \leq V_{IN2} \leq 7.2\text{ V}$			20	mV
Load regulation	ΔV_{OLD3}	$10\text{ mA} \leq I_{O3} \leq 200\text{ mA}$			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	$\Delta V_{O3}/\Delta T_a$			± 0.5		mV/ $^\circ\text{C}$
[Regulator 4] $V_{EN} = \text{high}$, $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$, $I_{O4} = 40\text{ mA}$						
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}	$12\text{ V} \leq V_{IN1} \leq 16\text{ V}$			40	mV
Load regulation	ΔV_{OLD4}	$10\text{ mA} \leq I_{O4} \leq 40\text{ mA}$			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	$\Delta V_{O4}/\Delta T_a$			± 1		mV/ $^\circ\text{C}$
[Output on/off control] $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$						
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] $V_{IN1} = 14\text{ V}$, $V_{IN2} = 6.6\text{ V}$						
Control output current	I_{CONT2}		10			mA
Resistance ratio	K_R	$K_R = R_4/R_3$, $V_{ref} = 1.28\text{ V typ}$		9.94		

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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 $V_{IN1} \geq V_{IN2}$.
- 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

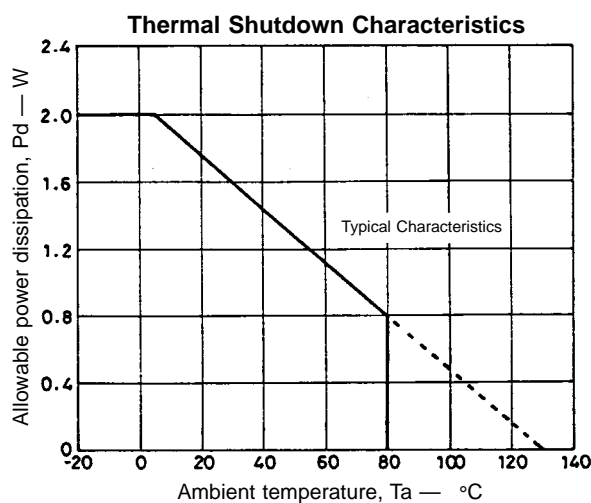
Conditions : when $V_{IN1} \geq V_{IN2}$ (at $V_{IN1} \geq 11.5$ V, $V_{IN2} \geq 6.2$ V)

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.

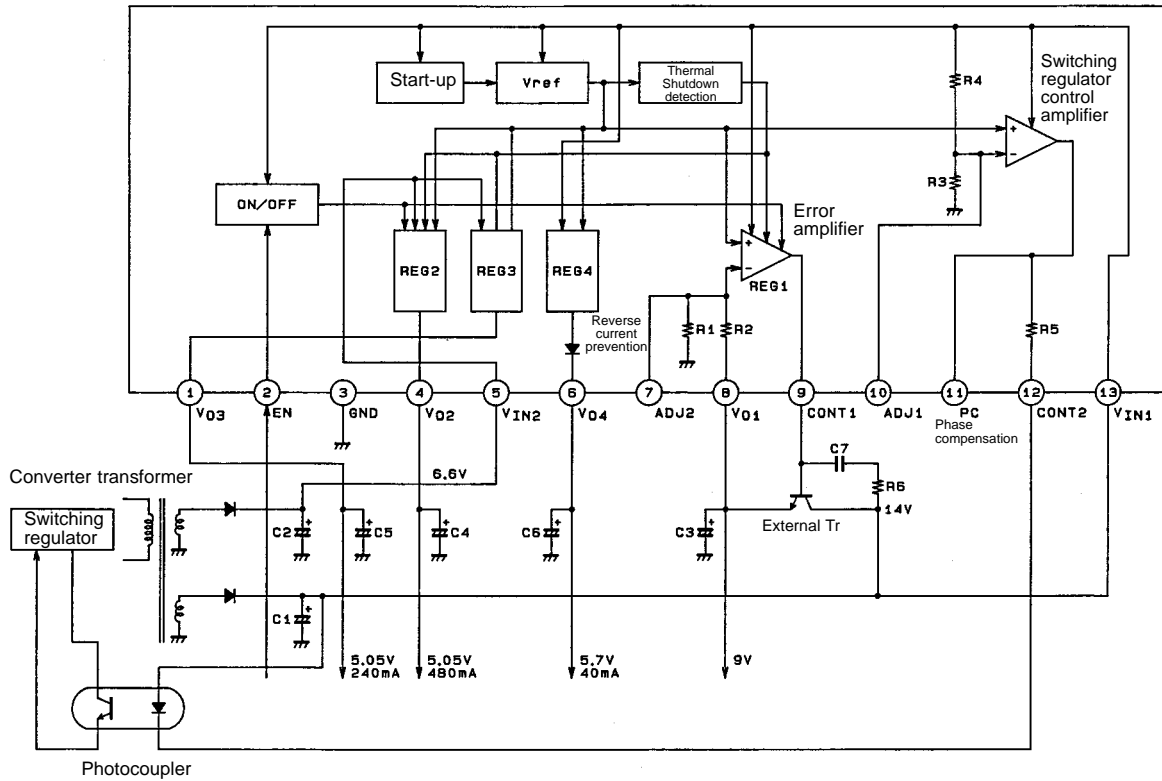
Thermal Design Notes

- 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.



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Equivalent Circuit Block Diagram and Sample Application Circuit



A0432B

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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