Ordering number: EN 5196

Monolithic Linear IC

LA5611

Multifunctional Voltage Regulator for TVs and VCRs

Applications

- Audiovisual equipment, VCRs and TVs

Features

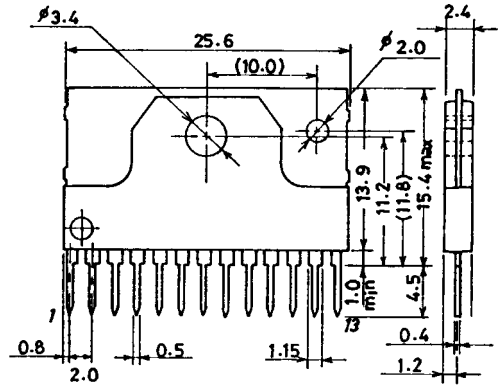
- Low saturation type of regulator (ON/OFF function built in)
- Control amplifier built in.
- Current limit and thermal limit circuits built in
- Reverse current prevention provided (V_O4)

Package Dimensions

unit : mm

3107-SIP13H

[LA5611]



SANYO : SIP13H

Specfications

Maximum Ratings at Ta = 25 °C

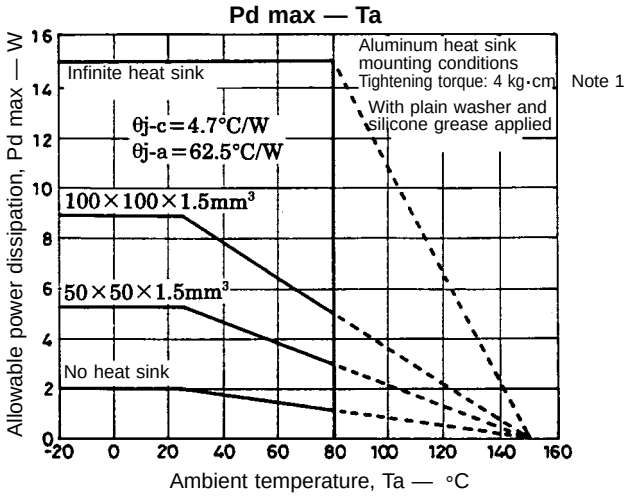
Parameter	Symbol	Conditions	Ratings	Unit
Maximum input voltage	$V_{IN}1$ max		22	V
	$V_{IN}2$ max	$V_{IN}1 \geqq V_{IN}2$	$V_{IN}1$	
Allowable power dissipation	Pd max	No heat sink	2	W
Thermal resistance between junction and case	θj-c		4.7	°C/W
Operating temperature	Topr		–20 to +80	°C
Storage temperature	Tstg		–40 to +150	°C

Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}1$		11.5 to 20	V
	V_{IN} 2		6.2 to 20	V
Output current 1	I_O1	Within ASO of external Tr		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

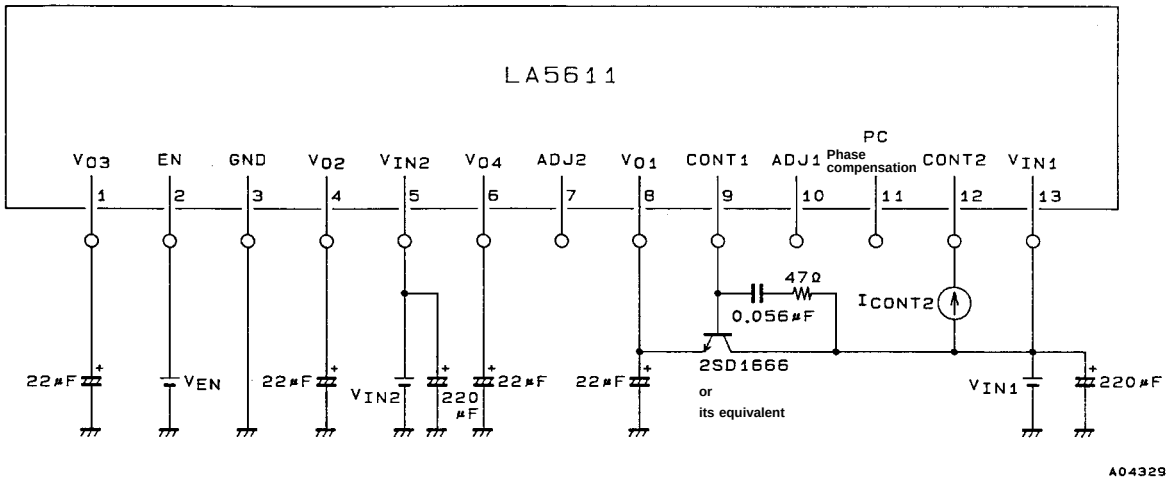
Operating Characteristics at Ta = 25 °C, See specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	Unit
[No-load mode] V_{EN} = low, $V_{IN}1$ = 14 V, $V_{IN}2$ = 6.6 V, I_O1 to I_O4 = 0 mA						
Quiescent current	$I_{IN}1$			8	16	mA
	$I_{IN}2$			2	4	mA
[Regulator 1] V_{EN} = low, $V_{IN}1$ = 14 V, $V_{IN}2$ = 6.6 V, I_O1 = 500 mA, with specified extenal transistor						
Output voltage 1	V_O1		8.5	9.0	9.5	V
Dropout voltage	$V_{DROP}1$			0.8	1.6	V
Line regulation	$\triangle V_{OLN}1$	12 V ≦ $V_{IN}1$ ≦ 16 V			140	mV
Load regulation	$\triangle V_{OLD}1$	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	$I_{CONT}1$		10			mA
Output voltage/temperature coefficient	$\triangle V_O1/\triangle Ta$			±1		mV/ °C
[Regulator 2] V_{EN} = low, $V_{IN}1$ = 14 V, $V_{IN}2$ = 6.6 V, I_O2 = 400 mA						
Output voltage 2	V_O2		4.80	5.05	5.30	V
Dropout voltage	$V_{DROP}2$			0.5	1.0	V
Line regulation	$\triangle V_{OLN}2$	6 V ≦ $V_{IN}2$ ≦ 7.2 V			20	mV
Load regulation	$\triangle V_{OLD}2$	0.1 A ≦ I_O2 ≦ 0.4 A			100	mV
Peak output current	$I_{OP}2$		480			mA
Output short-circuit current	$I_{OSC}2$			90	240	mA
Ripple rejection	Rrej2			50		dB
Output low-level voltage	V_O2 OFF				0.2	V
Output voltage/temperature coefficient	$\triangle V_O2/\triangle Ta$			±0.5		mV/ °C
[Regulator 3] V_{EN} = high, $V_{IN}1$ = 14 V, $V_{IN}2$ = 6.6 V, I_O3 = 200 mA						
Output voltage 3	V_O3		4.80	5.05	5.30	V
Dropout voltage	$V_{DROP}3$			0.5	1.0	V
Line regulation	$\triangle V_{OLN}3$	6 V ≦ $V_{IN}2$ ≦ 7.2 V			20	mV
Load regulation	$\triangle V_{OLD}3$	10 mA ≦ I_O3 ≦ 200 mA			100	mV
Peak output current	$I_{OP}3$		240			mA
Output short-circuit current	$I_{OSC}3$			40	120	mA
Ripple rejection	Rrej3			50		dB
Output voltage/temperature coefficient	$\triangle V_O3/\triangle Ta$			±0.5		mV/ °C
[Regulator 4] V_{EN} = high, $V_{IN}1$ = 14 V, $V_{IN}2$ = 6.6 V, I_O4 = 40 mA						
Output voltage 4	V_O4		5.4	5.7	6.0	V
Dropout voltage	$V_{DROP}4$			3.8	5.0	V
Line regulation	$\triangle V_{OLN}4$	12 V ≦ $V_{IN}1$ ≦ 16 V			40	mV
Load regulation	$\triangle V_{OLD}4$	10 mA ≦ I_O4 ≦ 40 mA			65	mV
Peak output current	$I_{OP}4$		40			mA
Output short-circuit current	$I_{OSC}4$			70		mA
Ripple rejection	Rrej4			50		dB
Output voltage/temperature coefficient	$\triangle V_O4/\triangle Ta$			±1		mV/ °C
[Output on/off control] $V_{IN}1$ = 14 V, $V_{IN}2$ = 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		$V_{IN}1$	V
[Control Amplifier] $V_{IN}1$ = 14 V, $V_{IN}2$ = 6.6 V						
Control output current	$I_{CONT}2$		10			mA
Resistance ratio	K_R	K_R = R4/R3, Vref = 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



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	$V_{IN}2$	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. $I_{CONT}1$ = 10 mA, with on/off, thermal shutdown coupled with the internal thermal shutdown of this regulator.
10	ADJ1	$V_{IN}1$ adjustment pin. Resistance between pin 10 and ground → $V_{IN}1$ up. Resistance between pin 13 and pin 10 → $V_{IN}1$ down
11	PC	Phase correction pin of switching regulator control amplifier.
12	CONT2	Drive output of switching regulator control amplifier.
13	$V_{IN}1$	High voltage input.

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

Circuit block / Function	V_O1	V_O2	V_O3	V_O4	Control amplifier
Input line	$V_{IN}1$	$V_{IN}2$	$V_{IN}2$	$V_{IN}1$	$V_{IN}1$
Current limit	×	○	○	○	×
Thermal limit	○	○	○	×	×
On/off control	○	○	×	×	×

Usage Notes

(1) Apply voltages to the voltage input pins on condition that $V_{IN}1 \geqq V_{IN}2$.
(2) Supply the voltages simultaneously to $V_{IN}1$ and $V_{IN}2$. Do not use the LA5611 with voltage applied to only one of these pins.
(3) 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 $V_{IN}1 \geqq V_{IN}2$ (at $V_{IN}1 \geqq 11.5$ V, $V_{IN}2 \geqq 6.2$ V)

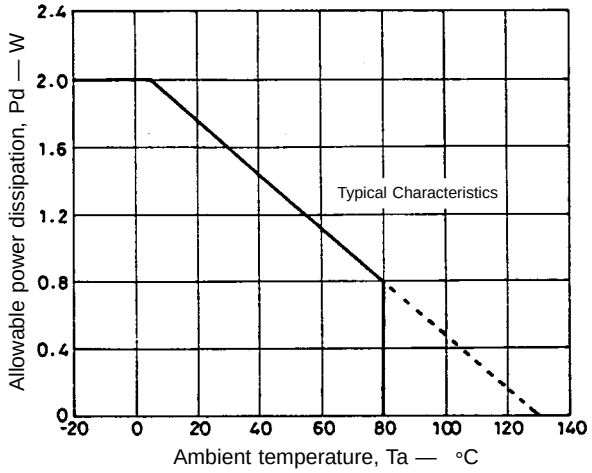
EN	V_O1, V_O2
L or open	H
H	L

(1) "H" for EN denotes high level; "L" denotes low level.
(2) "H" for V_O denotes output ON voltage; "L" denotes output OFF voltage.

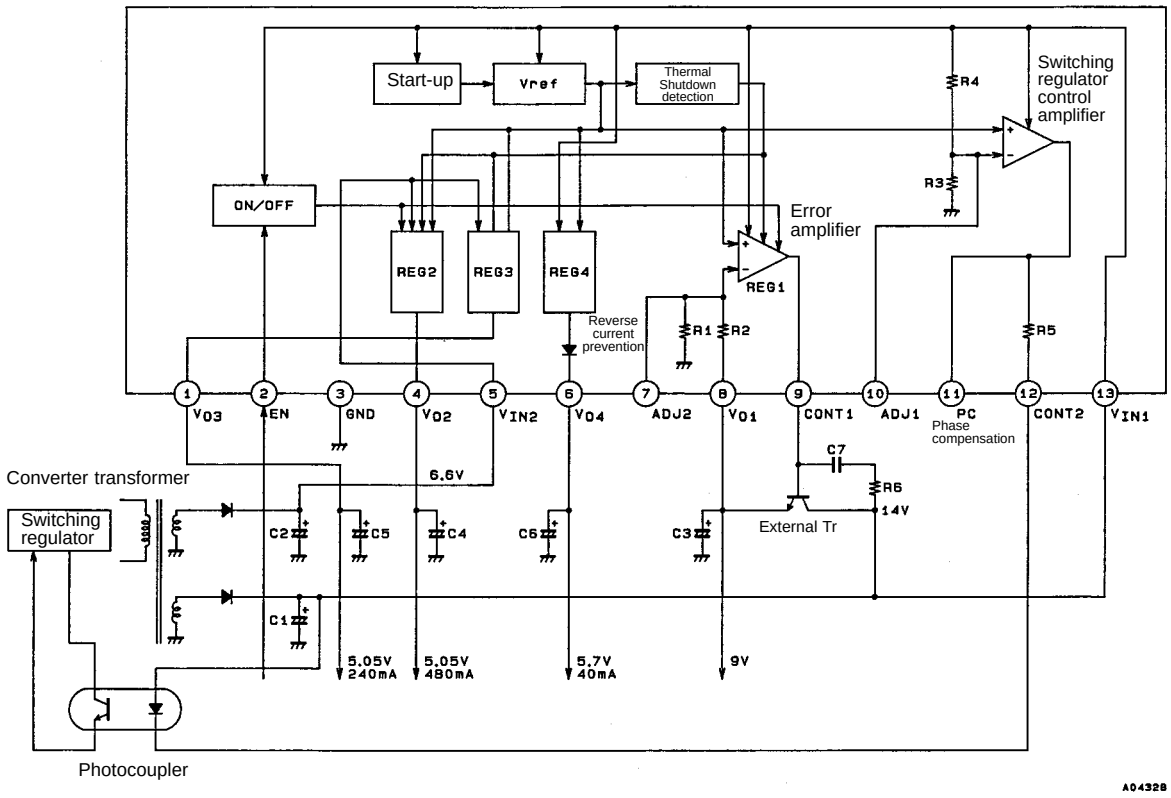
Thermal Design Notes

(1) In the LA5611, the junction temperature (Tj) at which thermal shutdown is activated is approximately equal to 130°C.
(2) 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.
(3) The thermal shutdown characteristics vary ±20°C or so. Since thermal shutdown is liable to occur with inadequate heat dissipation, sufficient consideration must be given to the heat dissipation design.

Thermal Shutdown Characteristics



Equivalent Circuit Block Diagram and Sample Application Circuit



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.