



# LA5612

## Multifunctional Voltage Regulator for TVs and VCRs with BS Tuner

### Applications

- Audiovisual equipment, VCRs and TVs with BS tuner

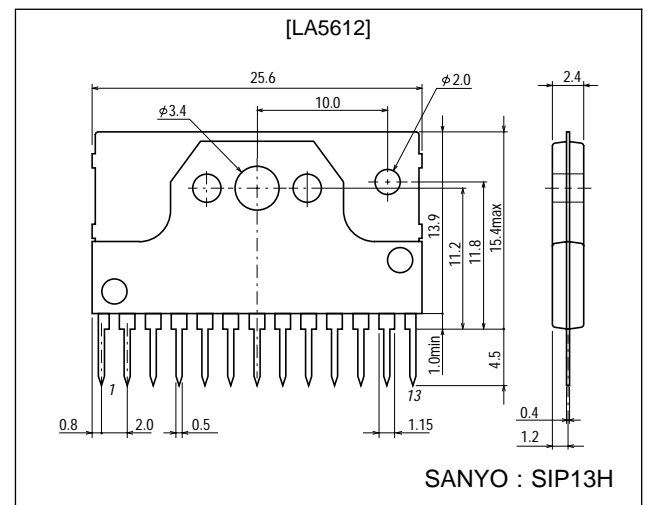
### Features

- Low-saturation regulator (ON/OFF function built in)
- Control amplifier built in.
- Current limit and thermal limit circuits built in
- Reverse current prevention provided ( $V_{O1}$ )

### 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	$V_{IN1\text{ max}}$		22	V
	$V_{IN2\text{ max}}$	$V_{IN\ 1} \geq V_{IN\ 2}$	$V_{IN1}$	
Allowable power dissipation	$P_d\text{ max}$	No heat sink	2	W
Thermal resistance between junction and case	$\theta_{j-c}$		4.7	$^\circ\text{C/W}$
Operating temperature	$T_{opr}$		-20 to +80	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +150	$^\circ\text{C}$

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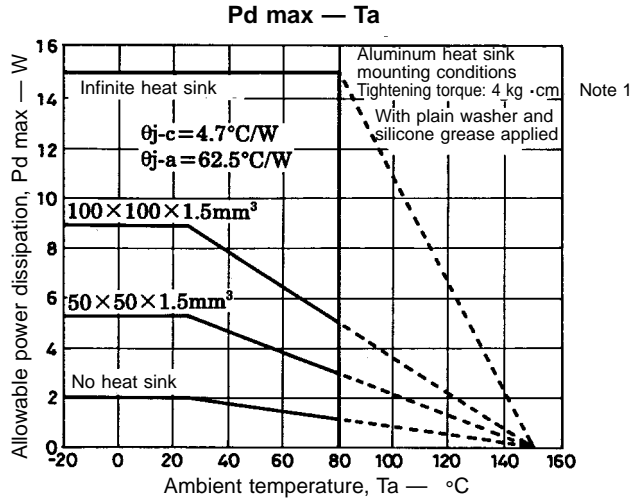
## LA5612

### Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	V <sub>IN1</sub>		11.5 to 20	V
	V <sub>IN2</sub>		6.2 to 20	V
Output current 1	I <sub>O1</sub>		10 to 360	mA
Output current 2	I <sub>O2</sub>		10 to 420	mA
Output current 3	I <sub>O3</sub>		10 to 420	mA

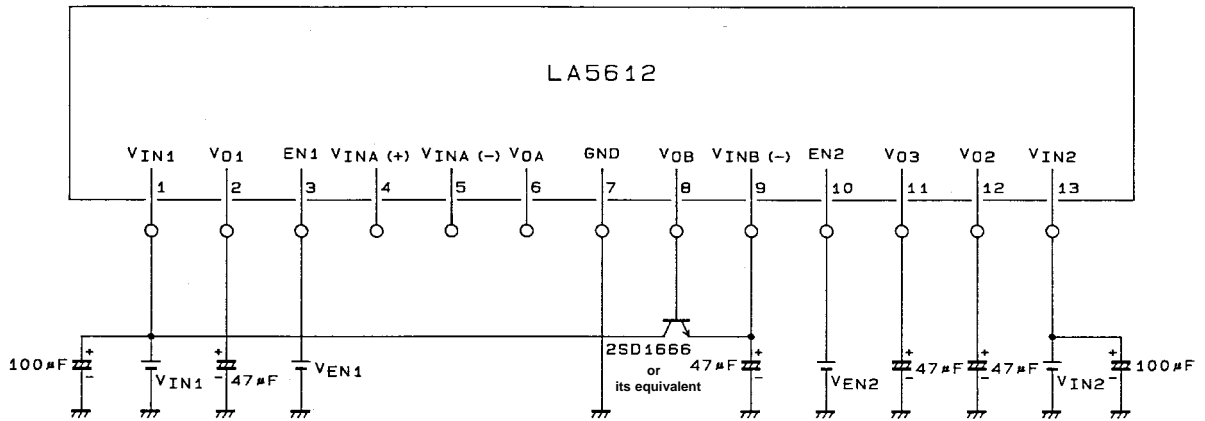
### Operating Characteristics at Ta = 25 °C, See specified Test Circuit.

Parameter	Symbol	Conditions	min	typ	max	Unit
[No-load mode] When V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub> is on : V <sub>EN1</sub> = 3 V, V <sub>EN2</sub> = 3 V, V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V, I <sub>O1</sub> to I <sub>O3</sub> = 0 mA						
Quiescent current	I <sub>IN1</sub>			7	14	mA
	I <sub>IN2</sub>			8	16	mA
[Regulator 1] When V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub> is on : V <sub>EN1</sub> = 3 V, V <sub>EN2</sub> = 3 V, V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V, I <sub>O1</sub> = 300 mA						
Output voltage 1	V <sub>O1</sub>		13.7	14.5	15.2	V
Dropout voltage	V <sub>DROP1</sub>			0.5	1.0	V
Line regulation	ΔV <sub>OLN1</sub>	16.5 V ≤ V <sub>IN1</sub> ≤ 20.5 V			140	mV
Load regulation	ΔV <sub>OLD1</sub>	10mA ≤ I <sub>O1</sub> ≤ 300 mA			150	mV
Output inflow current	I <sub>O1 IN</sub>	22 V applied to pin V <sub>O1</sub> , no-load mode			500	μA
Peak output current	I <sub>OP1</sub>		360			mA
Output short-circuit current	I <sub>OSC1</sub>			45	180	mA
Ripple rejection	Rrej1			50		dB
Output low-level voltage	V <sub>O1 OFF</sub>	V <sub>EN1</sub> = 1 V, when V <sub>O1</sub> is off			0.2	V
Output voltage/temperature coefficient	ΔV <sub>O1</sub> /ΔTa			±0.5		mV/ °C
[Regulator 2] When V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub> is on : V <sub>EN1</sub> = 3 V, V <sub>EN2</sub> = 3 V, V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V, I <sub>O2</sub> = 350 mA						
Output voltage 2	V <sub>O2</sub>		4.80	5.05	5.30	V
Dropout voltage	V <sub>DROP2</sub>			0.5	1.0	V
Line regulation	ΔV <sub>OLN2</sub>	6 V ≤ V <sub>IN2</sub> ≤ 7.2 V			20	mV
Load regulation	ΔV <sub>OLD2</sub>	100 mA ≤ I <sub>O2</sub> ≤ 350 mA			100	mV
Peak output current	I <sub>OP2</sub>		420			mA
Output short-circuit current	I <sub>OSC2</sub>			65	210	mA
Ripple rejection	Rrej2			50		dB
Output low-level voltage	V <sub>O2 OFF</sub>	V <sub>EN2</sub> = 1 V, when V <sub>O2</sub> is off			0.2	V
Output voltage/temperature coefficient	ΔV <sub>O2</sub> /ΔTa			±0.5		mV/ °C
[Regulator 3] When V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub> is on : V <sub>EN1</sub> = 3 V, V <sub>EN2</sub> = 3 V, V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V, I <sub>O3</sub> = 350 mA						
Output voltage 3	V <sub>O3</sub>		4.80	5.05	5.30	V
Dropout voltage	V <sub>DROP3</sub>			0.5	1.0	V
Line regulation	ΔV <sub>OLN3</sub>	6 V ≤ V <sub>IN2</sub> ≤ 7.2 V			20	mV
Load regulation	ΔV <sub>OLD3</sub>	100 mA ≤ I <sub>O3</sub> ≤ 350 mA			100	mV
Peak output current	I <sub>OP3</sub>		420			mA
Output short-circuit current	I <sub>OSC3</sub>			65	210	mA
Ripple rejection	Rrej3			50		dB
Output low-level voltage	V <sub>O3 OFF</sub>	V <sub>EN2</sub> = 1 V, when V <sub>O3</sub> is off			0.2	V
Output voltage/temperature coefficient	ΔV <sub>O3</sub> /ΔTa			±0.5		mV/ °C
[Output on/off control] V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V						
Output on control voltage	V <sub>EN1 H</sub>	V <sub>O1</sub> : on, V <sub>EN1</sub> < 22 V	3.0		V <sub>IN1</sub>	V
	V <sub>EN2 H</sub>	V <sub>O2</sub> , V <sub>O3</sub> : on, V <sub>EN2</sub> < 22 V				
Output off control voltage	V <sub>EN1 L</sub>	V <sub>O1</sub> : off			1.0	V
	V <sub>EN2 L</sub>	V <sub>O2</sub> , V <sub>O3</sub> : off				
[Amplifier A] When V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub> is on : V <sub>EN1</sub> = 3 V, V <sub>EN2</sub> = 3 V, V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V						
Input offset voltage	V <sub>IOA</sub>				±7	mV
Input bias current	I <sub>BA</sub>				250	nA
Output current (source)	I <sub>OA SOURCE</sub>	V <sub>INA</sub> <sup>+</sup> = 1 V, V <sub>INA</sub> <sup>-</sup> = 0 V	10			mA
Output current (sink)	I <sub>OA SINK</sub>	V <sub>INA</sub> <sup>+</sup> = 0 V, V <sub>INA</sub> <sup>-</sup> = 1 V	10			mA
[Amplifier B] When V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub> is on : V <sub>EN1</sub> = 3 V, V <sub>EN2</sub> = 3 V, V <sub>IN1</sub> = 16.5 V, V <sub>IN2</sub> = 6.6 V						
Output current (source)	I <sub>OB SOURCE</sub>		10			mA



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 <sub>IN1</sub>	High voltage input.
2	V <sub>O1</sub>	14.5 V/300 mA regulator, with reverse current prevention.
3	EN1	Regulator 1 on/off control. High active.
4	V <sub>INA(+)</sub>	Amplifier A noninverting input.
5	V <sub>INA(-)</sub>	Amplifier A inverting input.
6	V <sub>OA</sub>	Amplifier A output.
7	GND	Substrate of the LA5612 (minimum potential).
8	V <sub>OB</sub>	Amplifier B output (5 V regulator supported by external NPN transistor).
9	V <sub>INB(-)</sub>	Amplifier B inverting input (5 V regulator supported by external NPN transistor).
10	EN2	Regulator 2 and regulator 3 on/off control. High active.
11	V <sub>O3</sub>	5.05 V/350 mA regulator.
12	V <sub>O2</sub>	5.05 V/350 mA regulator.
13	V <sub>IN2</sub>	Low-voltage input.

## LA5612

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

Function	Circuit block	V <sub>O1</sub>	V <sub>O2</sub>	V <sub>O3</sub>	AMP A	AMP B
Input line		V <sub>IN1</sub>	V <sub>IN2</sub>	V <sub>IN2</sub>	V <sub>IN1</sub>	V <sub>IN1</sub>
Current limit		○	○	○	×	×
Thermal limit		○	○	○	×	×
On/off control		EN1	EN2	EN2	×	×

### Usage Notes

- Apply voltage to the voltage input pins on condition that  $V_{IN1} \geq V_{IN2}$ .
- Apply voltage simultaneously to  $V_{IN1}$  and  $V_{IN2}$ . Do not use the LA5612 with voltage applied to only one of these pins.
- Since the amplifiers do not have current limit protection such as an external NPN transistor, provide this protection in each application.

### Logic Table

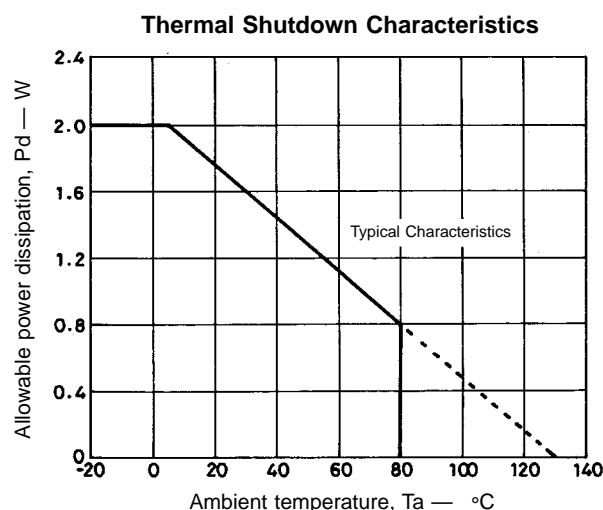
Conditions : when  $V_{IN1} \geq V_{IN2}$  (at  $V_{IN1} \geq 4\text{ V}$ ,  $V_{IN2} \geq 4\text{ V}$ )

EN1,EN2	V <sub>O1</sub> , V <sub>O2</sub> , V <sub>O3</sub>
L or open	L
H	H

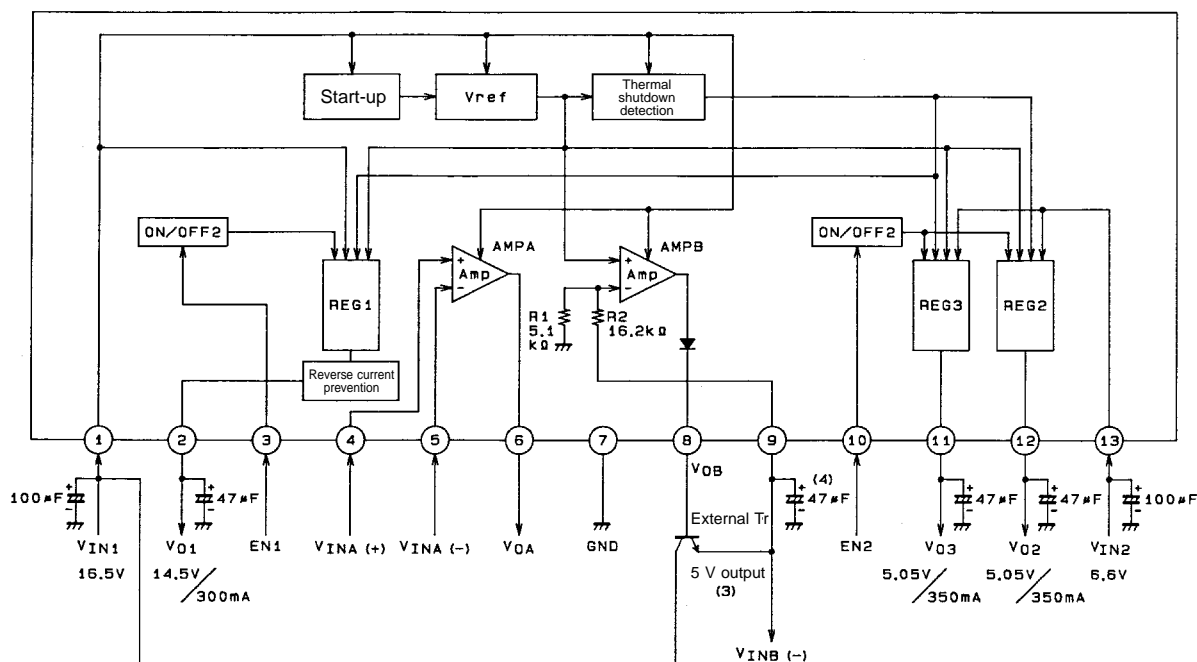
- “H” for EN denotes high level; “L” denotes low level or open.
- “H” for V<sub>O</sub> denotes output ON voltage; “L” denotes output OFF voltage.
- Each output voltage corresponds to each EN and is controlled independently.  
(EN1 is coupled with V<sub>O1</sub>, and EN2 with V<sub>O2</sub> and V<sub>O3</sub>.)

### Thermal Design Notes

- In the LA5612, the junction temperature (T<sub>j</sub>) at which thermal shutdown is activated is approximately equal to 130°C.
- Consequently, the operating 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



## Application Notes

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- (1) The input line for AMP A and AMP B is shared with  $V_{IN1}$ .
- (2) AMP A and AMP B are on in normal use.
- (3) The output voltage is 5 V when an external NPN transistor has been added.
- (4) Depending on the type, load current and connection position (distance from the LA5612) of the external NPN transistor, the value of a capacitor connected between emitter and ground must be changed for stable operation.
- (5) The capacitors connected between each pin and GND are bypass capacitors for preventing oscillation: as such, they must be positioned as close to the LA5612 as possible in order to stabilize operation.

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