

**LA5612**

Multifunctional Voltage Regulator for TVs and VCRs with BS Tuner

Applications

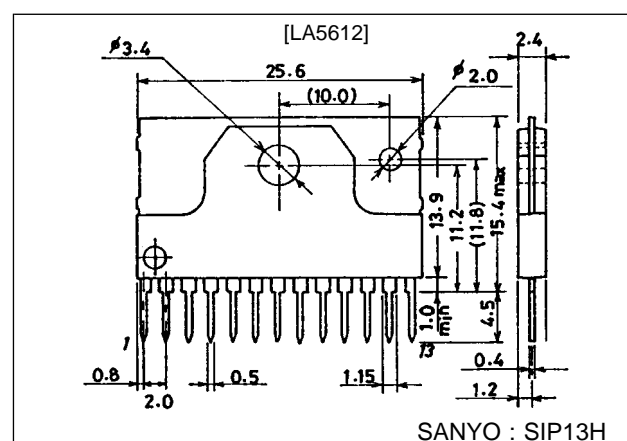
- Audiovisual equipment, VCRs and TVs with BS tuner

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} 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	$^\circ\text{C}$

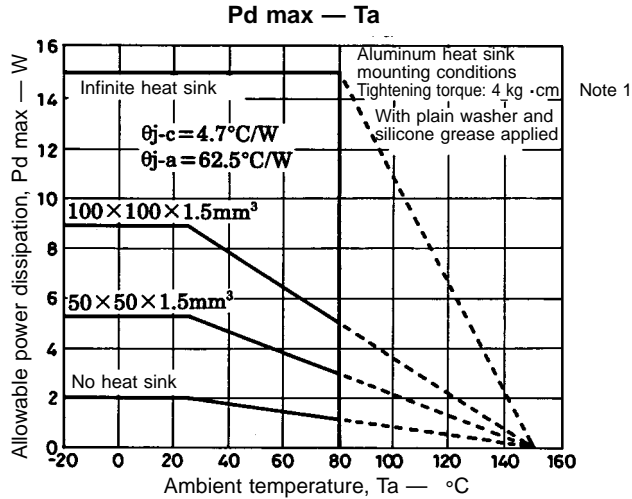
Operating Conditions at $T_a = 25\text{ }^\circ\text{C}$

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}		10 to 360	mA
Output current 2	I_{O2}		10 to 420	mA
Output current 3	I_{O3}		10 to 420	mA

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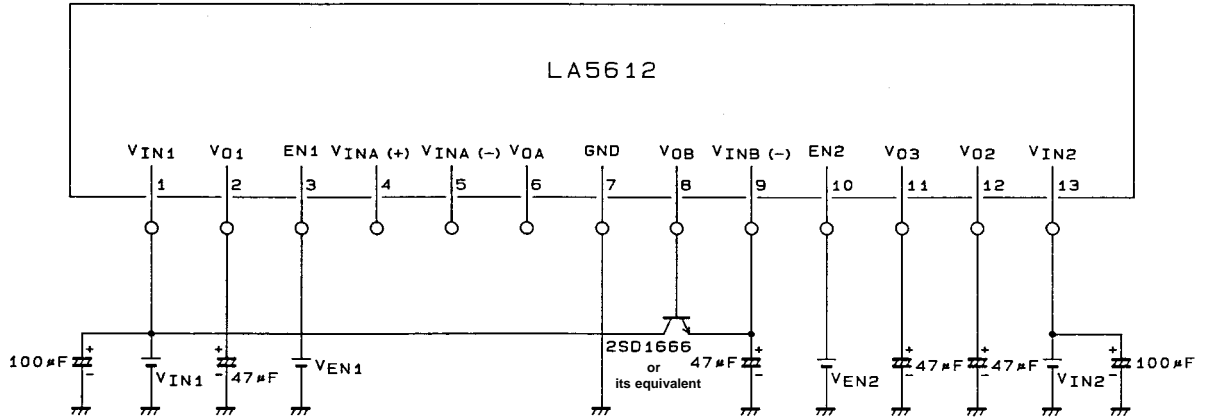
Operating Characteristics at Ta = 25 °C, See specified Test Circuit.

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



A04331

Pin Functions

No.	Symbol	Function
1	V _{IN1}	High voltage input.
2	V _{O1}	14.5 V/300 mA regulator, with reverse current prevention.
3	EN1	Regulator 1 on/off control. High active.
4	V _{INA} (+)	Amplifier A noninverting input.
5	V _{INA} (-)	Amplifier A inverting input.
6	V _{OA}	Amplifier A output.
7	GND	Substrate of the LA5612 (minimum potential).
8	V _{OB}	Amplifier B output (5 V regulator supported by external NPN transistor).
9	V _{INB} (-)	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 _{O3}	5.05 V/350 mA regulator.
12	V _{O2}	5.05 V/350 mA regulator.
13	V _{IN2}	Low-voltage input.

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

Function	Circuit block	V _{O1}	V _{O2}	V _{O3}	AMP A	AMP B
Input line		V _{IN1}	V _{IN2}	V _{IN2}	V _{IN1}	V _{IN1}
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

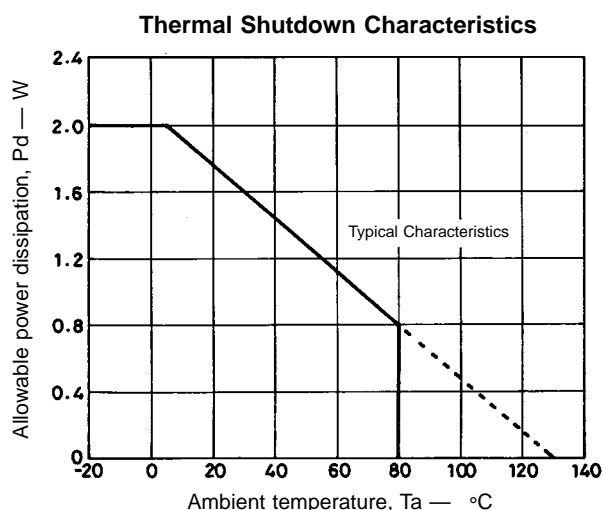
Conditions : when $V_{IN1} \geq V_{IN2}$ (at $V_{IN1} \geq 4\text{ V}$, $V_{IN2} \geq 4\text{ V}$)

EN1, EN2	V _{O1} , V _{O2} , V _{O3}
L or open	L
H	H

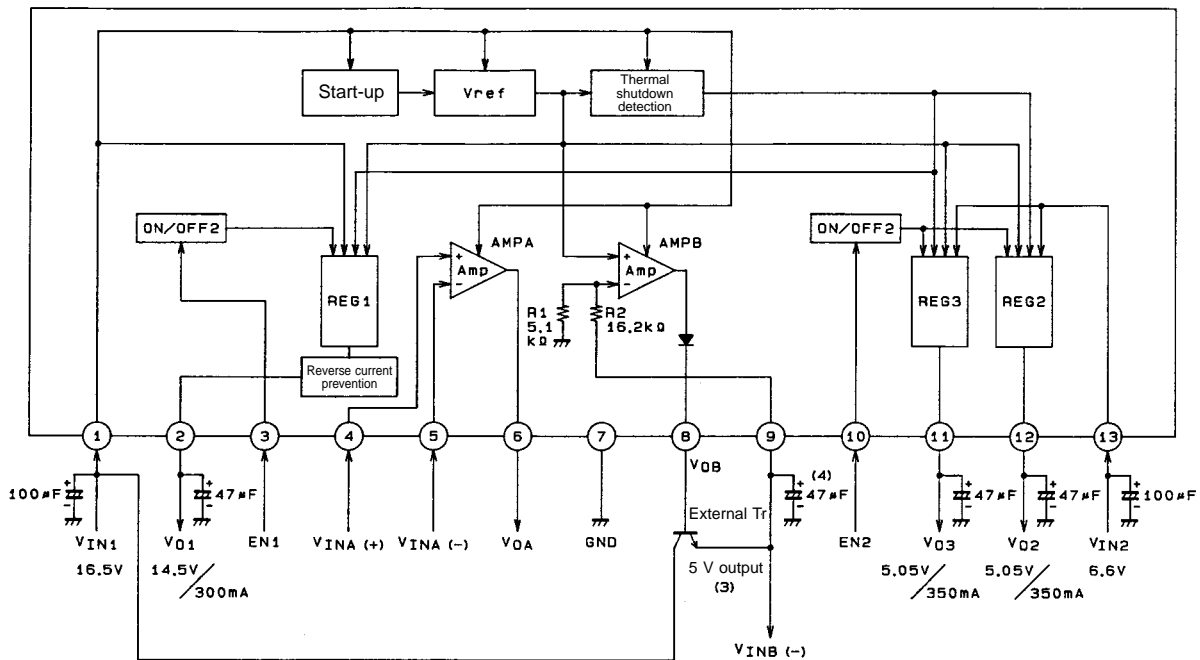
- “H” for EN denotes high level; “L” denotes low level or open.
- “H” for V_O denotes output ON voltage; “L” denotes output OFF voltage.
- Each output voltage corresponds to each EN and is controlled independently.
(EN1 is coupled with V_{O1}, and EN2 with V_{O2} and V_{O3}.)

Thermal Design Notes

- In the LA5612, the junction temperature (T_j) 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



A04330

Application Notes

- (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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