

LA5612

Multifunctional Voltage Regulator for TVs and VCRs with BS Tuner

Applications

· Audiovisual equipment, VCRs and TVs with BS tuner

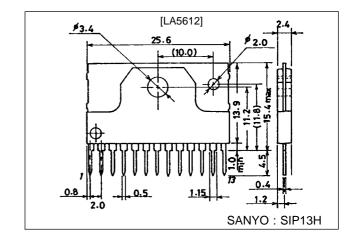
Features

- 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



Specfications

Maximum Ratings at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum input valtage	V _{IN} 1 max		22	V
Maximum input voltage	V _{IN} 2 max	V _{IN} 1≧V _{IN} 2	V _{IN} 1	
Allowable power dissipation	Pd max	No heat sink	2	W
Thermal resistance between junction and case	θј-с		4.7	°C/W
Operating temperature	Topr		-20 to +80	∘C
Storage temperature	Tstg		-40 to +150	∘C

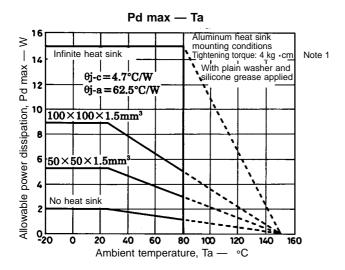
Operating Conditions at Ta = 25 °C

Parameter	Symbol	Conditions	Ratings	Unit
longit voltage	V _{IN} 1		11.5 to 20	V
Input voltage	V _{IN} 2		6.2 to 20	V
Output current 1	I _O 1		10 to 360	mA
Output current 2	I _O 2		10 to 420	mA
Output current 3	I _O 3		10 to 420	mA

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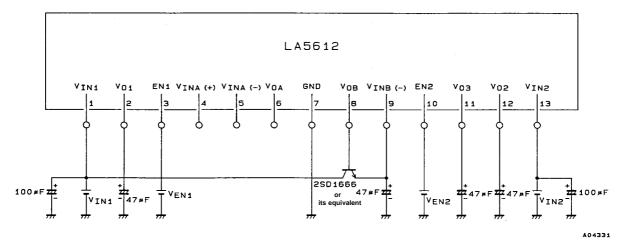
Operating Characteristics at Ta = 25 $^{\circ}$ C, See specified Test Circuit.

Quiescent current	I _{IN} 1	$_{\text{EN}1} = 3 \text{ V}, \text{ V}_{\text{EN}2} = 3 \text{ V}, \text{ V}_{\text{IN}1} = 16.5 \text{ V}, \text{ V}_{\text{IN}2} = 6.6 \text{ V},$ $_{\text{IN}2} = 6.6 \text{ V}, \text{ V}_{\text{IN}2} = 6.6 \text{ V}, \text{ V}_{IN$		3 = 0 m/ 7	14	mA		
Quiescent current [Regulator 1] When V _O 1, V _O 2, V Output voltage 1	$\begin{array}{c c} I_{IN}1 \\ I_{IN}2 \\ V_O3 \text{ is on : } V_{EN} \\ \hline V_O1 \end{array}$			7	14	mA		
[Regulator 1] When V _O 1, V _O 2, V	I_{IN}^2 V_O^3 is on : V_{EN}	1 = 3 V, V _{EN} 2 = 3 V, V _{IN} 1 = 16.5 V, V _{IN} 2 = 6.6 V, I _C		0				
Output voltage 1	V _O 3 is on : V _{EN}	$1 = 3 \text{ V}, \text{ V}_{EN}2 = 3 \text{ V}, \text{ V}_{IN}1 = 16.5 \text{ V}, \text{ V}_{IN}2 = 6.6 \text{ V}, \text{ I}_{C}$			16	mA		
Output voltage 1	V _O 1	[Regulator 1] When $V_{O}1$, $V_{O}2$, $V_{O}3$ is on : $V_{EN}1 = 3$ V, $V_{EN}2 = 3$ V, $V_{IN}1 = 16.5$ V, $V_{IN}2 = 6.6$ V, $I_{O}1 = 300$ mA						
Dropout voltage	V _{DROP} 1		13.7	14.5	15.2	V		
				0.5	1.0	V		
Line regulation	△V _{OLN} 1	16.5 V ≦ V _{IN} 1 ≦ 20.5 V			140	mV		
Load regulation	△V _{OLD} 1	$10\text{mA} \le I_{\text{O}}1 \le 300 \text{ mA}$			150	mV		
Output inflow current	I _O 1 IN	22 V applied to pin V _O 1, no-load mode			500	μA		
Peak output current	I _{OP} 1		360			mA		
Output short-circuit current	I _{OSC} 1			45	180	mA		
Ripple rejection	Rrej1			50		dB		
Output low-level voltage	V _O 1 OFF	V _{EN} 1 = 1 V, when V _O 1 is off			0.2	V		
Output voltage/temperature coefficient	∆V _O 1/∆Ta			±0.5		mV/ °C		
[Regulator 2] When V _O 1, V _O 2, V	√ _O 3 is on : V _{EN}	$1 = 3 \text{ V}, \text{ V}_{EN}2 = 3 \text{ V}, \text{ V}_{IN}1 = 16.5 \text{ V}, \text{ V}_{IN}2 = 6.6 \text{ V}, \text{ I}_{C}$	$_{0}^{2} = 350 \text{ r}$	nΑ				
Output voltage 2	V _O 2		4.80	5.05	5.30	V		
Dropout voltage	V _{DROP} 2			0.5	1.0	V		
Line regulation	△V _{OLN} 2	6 V ≦ V _{IN} 2 ≦ 7.2 V			20	mV		
Load regulation	△V _{OLD} 2	$100 \text{ mA} \le I_{O}2 \le 350 \text{ mA}$			100	mV		
Peak output current	I _{OP} 2		420			mA		
Output short-circuit current	I _{OSC} 2			65	210	mA		
Ripple rejection	Rrej2			50		dB		
Output low-level voltage	V _O 2 OFF	$V_{EN}2 = 1 \text{ V, when } V_O2 \text{ is off}$			0.2	V		
Output voltage/temperature coefficient	∆V _O 2/∆Ta			±0.5		mV/ °C		
[Regulator 3] When V _O 1, V _O 2, V	√ _O 3 is on : V _{EN}	$1 = 3 \text{ V}, \text{ V}_{EN}2 = 3 \text{ V}, \text{ V}_{IN}1 = 16.5 \text{ V}, \text{ V}_{IN}2 = 6.6 \text{ V}, \text{ I}_{C}$	3 = 350 r	nΑ				
Output voltage 3	V _O 3		4.80	5.05	5.30	V		
Dropout voltage	V _{DROP} 3			0.5	1.0	V		
Line regulation	∆V _{OLN} 3	6 V ≦ V _{IN} 2 ≦ 7.2 V			20	mV		
Load regulation	∆V _{OLD} 3	$100 \text{ mA} \le I_{O}3 \le 350 \text{ mA}$			100	mV		
Peak output current	I _{OP} 3		420			mA		
Output short-circuit current	I _{OSC} 3			65	210	mA		
Ripple rejection	Rrej3			50		dB		
Output low-level voltage	V _O 3 OFF	$V_{EN}2 = 1 \text{ V, when } V_O3 \text{ is off}$			0.2	V		
Output voltage/temperature coefficient	∆V _O 3/∆Ta			±0.5		mV/ °C		
[Output on/off control] $V_{IN}1 = 16$	$6.5 \text{ V}, \text{ V}_{\text{IN}}2 = 6.6$	S V	'		•			
Output on control voltage		V _O 1: on, V _{EN} 1 < 22 V	2.0		\/ 4	V		
		V _O 2, V _O 3: on, V _{EN} 2 < 22 V	3.0	3.0	V _{IN} 1	v		
Output off control voltage	V _{EN} 1 L	V _O 1: off			4.0	.,		
Output on control voltage	V _{EN} 2 L	V _O 2, V _O 3: off			1.0	V		
[Amplifier A] When V _O 1, V _O 2, V		= 3 V, V _{EN} 2 = 3 V, V _{IN} 1 = 16.5 V, V _{IN} 2 = 6.6 V				-		
Input offset voltage	V _{IOA}				±7	mV		
Input bias current	I _{BA}				250	nA		
Output current (source)		$V_{INA}^{+} = 1 \text{ V}, V_{INA}^{-} = 0 \text{ V}$	10			mA		
Output current (sink)	I _{OA} SINK	$V_{INA}^{+} = 0 \text{ V, } V_{INA}^{-} = 1 \text{ V}$	10			mA		
[Amplifier B] When V_{O1} , V_{O2} , V_{O3} is on : $V_{EN1} = 3 \text{ V}$, $V_{EN2} = 3 \text{ V}$, $V_{IN1} = 16.5 \text{ V}$, $V_{IN2} = 6.6 \text{ V}$								
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



Pin Functions

No.	Symbol	Function		
1	V _{IN} 1	High voltage input.		
2	V _O 1	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 _O 3	5.05 V/350 mA regulator.		
12	V _O 2	5.05 V/350 mA regulator.		
13	V _{IN} 2	Low-voltage input.		

Function Table (O: built in, x: not built in)

Circuit block Function	V _O 1	V _O 2	V _O 3	AMP A	AMP B
Input line	V _{IN} 1	V _{IN} 2	V _{IN} 2	V _{IN} 1	V _{IN} 1
Current limit	0	0	0	×	×
Thermal limit	0	0	0	×	×
On/off control	EN1	EN2	EN2	×	×

Usage Notes

- (1) Apply voltage to the voltage input pins on condition that $V_{IN}1 \ge V_{IN}2$.
- (2) Apply voltage simultaneously to $V_{IN}1$ and $V_{IN}2$. Do not use the LA5612 with voltage applied to only one of these pins.
- (3) Since the amplifiers do not have current limit protection such as an external NPN transistor, provide this protection in each application.

Logic Table

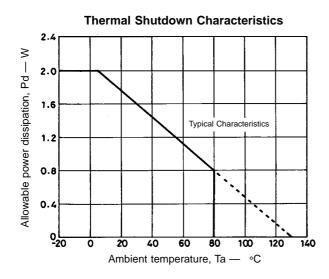
Conditions : when $V_{IN}1 \ge V_{IN}2$ (at $V_{IN}1 \ge 4$ V, $V_{IN}2 \ge 4$ V)

EN1,EN2	V _O 1, V _O 2, V _O 3
L or open	L
Н	Н

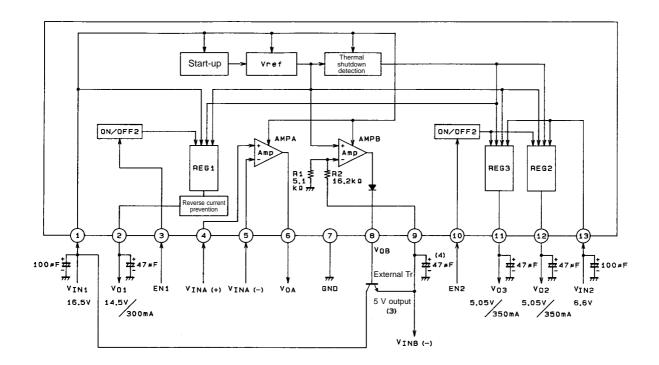
- (1) "H" for EN denotes high level; "L" denotes low level or open.
- (2) "H" for V_O denotes output ON voltage; "L" denotes output OFF voltage.
- (3) Each output voltage corresponds to each EN and is controlled independently. (EN1 is coupled with V_O1 , and EN2 with V_O2 and V_O3 .)

Thermal Design Notes

- (1) In the LA5612, the junction temperature (Tj) at which thermal shutdown is activated is approximately equal to 130°C.
- (2) 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.
- (3) The thermal shutdown characteristics vary $\pm 20^{\circ}$ 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 $V_{IN}1$.
- (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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