



SANYO Semiconductors

## DATA SHEET

# LA5601

## Monolithic Linear IC Low Saturation Regulator with Reset

### Overview

The LA5601 is a voltage regulator with a low-voltage detector and reset controller for use in microprocessor-based systems. It generates a reset signal for low power supply voltage. It also features a low 0.25V (typ.) saturation voltage for reduced power dissipation and power supply size. Applications include microprocessor-controlled consumer electronic equipment such as CD players, tuners and receivers, and preamplifiers.

### Features

- Low minimum input-output voltage difference (0.3V typ).
- Supports setting of reset output delay time using external capacitor.
- Built-in fold-back current limiting circuit and excessive heat protection circuit.
- Reset output using active pull-up for simpler noise reduction and use with internal pull-down logic circuits.
- Error amplifier noise filter pin.
- Auxiliary regulator with reverse current protection.

### Functions

- Low saturation regulator with 250mA and 5.2V output.
- Power supply reset generator function.
- Supports on-off control of 5.2V using equipped enable pin (high active).
- Built-in Darlington driver (120mA).
- Built-in auxiliary regulator (5.2V, 250mA).

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# LA5601

## Specifications

### Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$ max		15	V
Enable pin voltage	$V_{EN}$ max		$V_{IN}$ max	V
Reset output pin voltage	$V_{RES}$ max		15	V
Driver output voltage	$V_{OD}$ max		15	V
Driver input voltage	$V_{ID}$ max		15	V
Allowable power dissipation	$P_d$ max		1	W
Operating temperature	$T_{opr}$		-30 to +80	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-55 to +150	$^\circ\text{C}$

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

Parameter	Symbol	Conditions	Ratings	Unit
Input voltage	$V_{IN}$		5.9 to 14	V
Output current	$I_{OUT}$		0 to 250	mA
H-level reset output current	$\overline{I_{ORH}}$		0 to 200	$\mu\text{A}$
L-level reset output current	$\overline{I_{ORL}}$		0 to 2	mA
Auxiliary regulator output current	$I_{OA}$		0 to 10	mA
Driver output voltage	$V_{OD}$ max		14	V
L-level driver output current	$I_{ODL}$ max		120	mA
H-level driver input voltage	$V_{IDH}$	$I_{ODL} = 120\text{mA}$	3 to 14	V
L-level driver input voltage	$V_{IDL}$	$I_{ODL} \leq 100\mu\text{A}$	-0.3 to +0.3	V

### Electrical Characteristics at $T_j = 25^\circ\text{C}$ , $V_{IN} = 6\text{V}$ , $I_{OUT} = 200\text{mA}$ . See specified Test Circuit.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b>Main regulator</b> : Output ON-state, $V_{EN} = \text{'H'}$ or open						
Output voltage	$V_O$		5.0	5.2	5.4	V
Dropout voltage	$V_{DROP}$	$I_{OUT} = 250\text{mA}$		0.25	0.5	V
Line regulation	$\Delta V_{OLN1}$	$5.5\text{V} \leq V_{IN} \leq 14\text{V}$		30	80	mV
	$\Delta V_{OLN2}$	$6\text{V} \leq V_{IN} \leq 14\text{V}$		20	40	mV
Load regulation	$\Delta V_{OLD1}$	$5\text{mA} \leq I_{OUT} \leq 250\text{mA}$		40	100	mV
	$\Delta V_{OLD2}$	$5\text{mA} \leq I_{OUT} \leq 100\text{mA}$		14	50	mV
Peak output current	$I_{OP}$		250	500		mA
Output short current	$I_{OSC}$			80	300	mA
Current drain	$I_{Q1}$	$I_{OUT} = 0$		2.2	6	mA
	$I_{Q2}$			10	30	mA
Output noise voltage	$V_{NO}$	$10\text{Hz} \leq f \leq 100\text{kHz}$		70		$\mu\text{Vrms}$
Temperature coefficient of output voltage	$\Delta V_O / \Delta T_j$	$T_j = 25$ to $80^\circ\text{C}$		-70		$\text{mV}/^\circ\text{C}$
Ripple rejection	$R_{rej}$	$f = 120\text{Hz}$ , $7\text{V} \leq V_{IN} \leq 13\text{V}$		74		dB
Output ON-state control voltage	$V_{ENH}$	Main regulator, driver ON	2.6		$V_{IN}$	V
<b>Main regulator</b> : Output OFF-state, $V_{EN} = \text{'L'}$						
L-level output voltage	$V_{O\ OFF}$	$V_{EN} = 0$		50	200	mV
Quiescent current	$I_{Q\ OFF}$	$V_{EN} = 0$		1.5	4	mA
Output OFF-state control voltage	$V_{ENL}$	Main regulator, driver OFF			1.0	V
<b>Reset circuit</b>						
H-level reset output voltage	$\overline{V_{ORH}}$	$\overline{I_{ORH}} = 200\mu\text{A}$	4.97	5.17	5.37	V
L-level reset output voltage	$\overline{V_{ORL}}$	$\overline{I_{ORL}} = 2\text{mA}$ , $V_{IN} = 3.7\text{V}$		90	200	mV
Reset threshold voltage	$V_{RT}$	$I_{OUT} = 5\text{mA}$	3.7	3.9	4.1	V
Reset hysteresis voltage	$V_{hys}$	$I_{OUT} = 5\text{mA}$	50	150	300	mV
Reset output delay time	$t_d$	$C_d = 0.1\mu\text{F}$	7.5	10	12.5	ms

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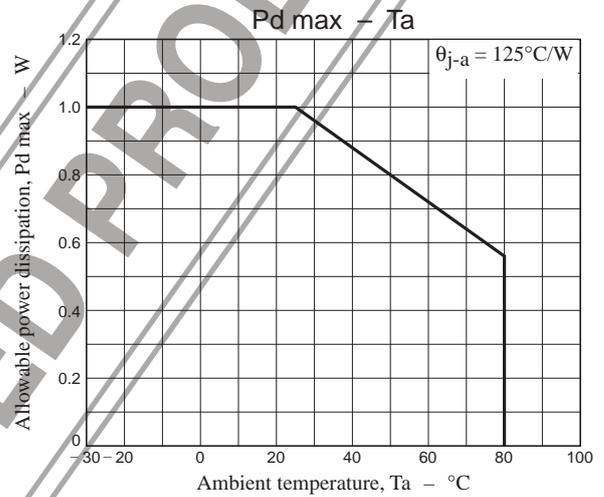
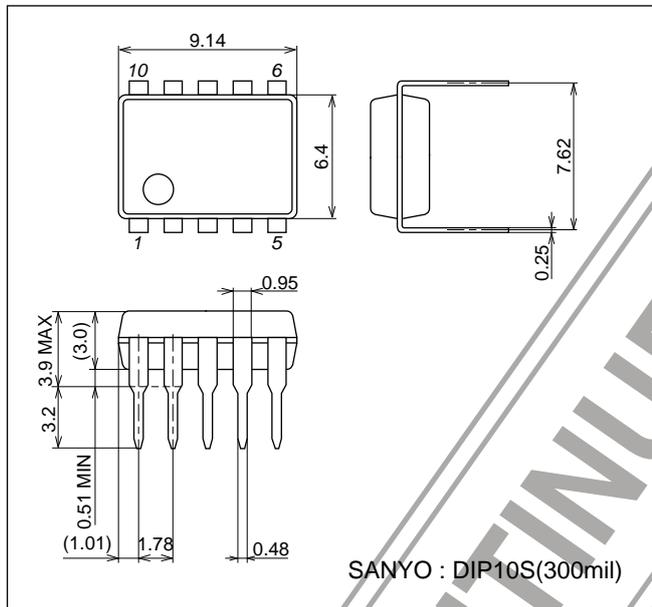
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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
<b>Auxiliary regulator</b>						
Output voltage	$V_{OA}$	$I_{OA} = 5\text{mA}$	3.2	3.4	3.6	V
Line regulation	$\Delta V_{OA LN}$	$6\text{V} \leq V_{IN} \leq 14\text{V}, I_{OA} = 5\text{mA}$		15	40	mV
Load regulation	$\Delta V_{OA LD}$	$2\text{mA} \leq I_{OA} \leq 10\text{mA}$		130	200	mV
Output short current	$I_{OASC}$		10	30		mA
Output pin leakage current	$I_{OA LEAK}$	$V_{IN} = 0, V_{OA} = 6\text{V}$			2	$\mu\text{A}$
<b>Darlington driver</b>						
L-level driver output voltage	$V_{ODL1}$	$I_{ODL} = 80\text{mA}, V_{ID} = 3\text{V}$		1.1	1.6	V
	$V_{ODL2}$	$I_{ODL} = 120\text{mA}, V_{ID} = 3\text{V}$		1.2	1.8	V
H-level driver input current	$I_{IDH}$	$I_{ODL} = 120\text{mA}, V_{ID} = 3\text{V}$		0.4	1	mA
Output pin leakage current	$I_{ODH}$	$V_{IH} = 14\text{V}, V_{OD} = 14\text{V}, V_{ID} = 0.3\text{V}$			50	$\mu\text{A}$

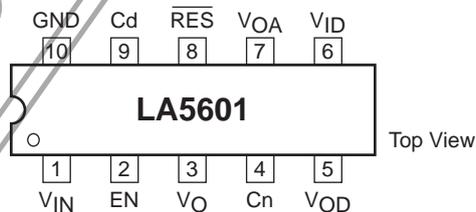
## Package Dimensions

unit : mm (typ)

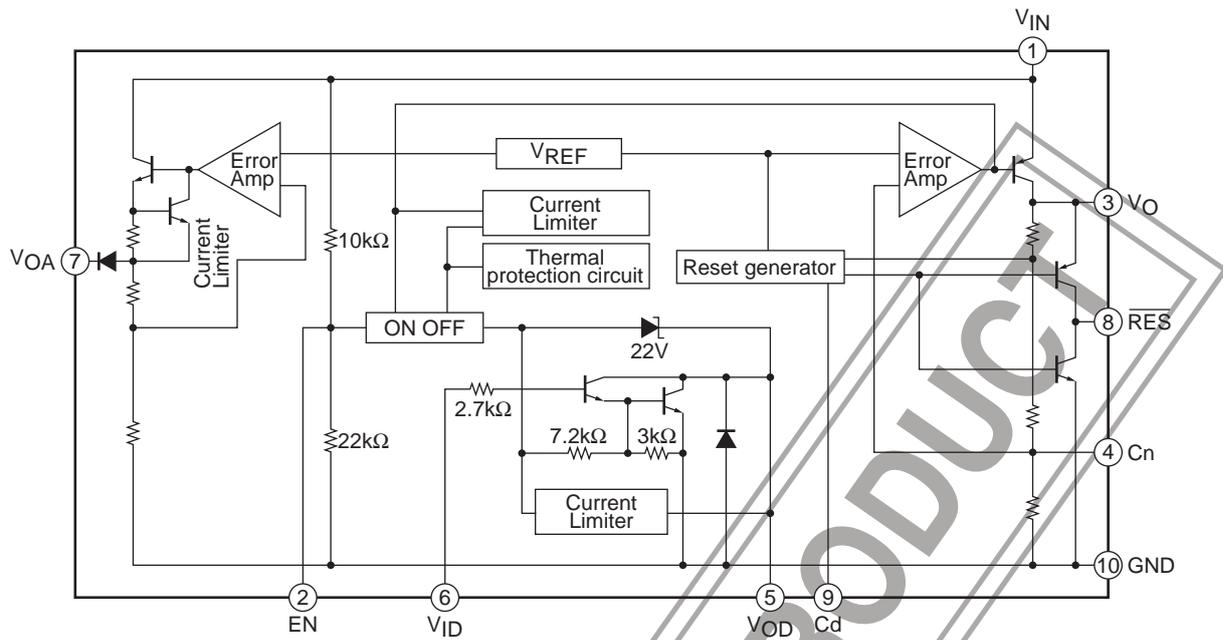
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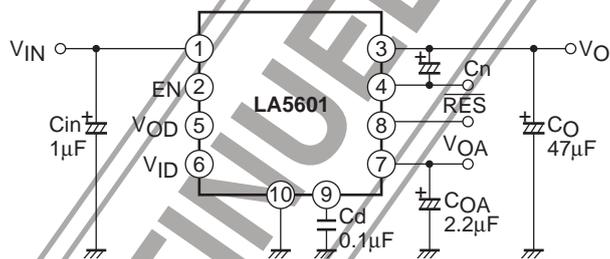
## Pin Assignment



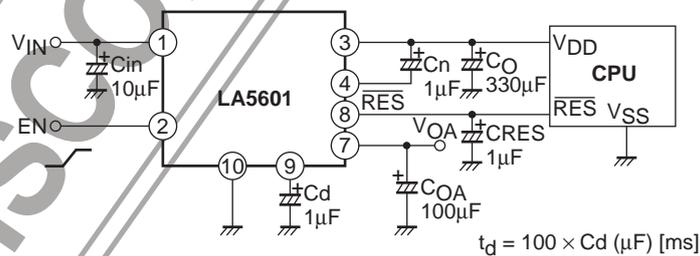
Block Diagram



Specified Test Circuit



Sample Application Circuit 1



- Note)
1. Capacitors  $C_n$  and  $C_{RES}$  are only required if problems are experienced with noise from external sources.
  2. If capacitor  $C_n$  is present, ensure that  $C_o$  is at least more than one-third of the value of  $C_{in}$  in order to prevent output noise at power-down due to capacitor discharge timing.
  3. Use low temperature coefficient capacitor for the delay time capacitor  $C_d$ .
  4. The minimum recommended value of output capacitor  $C_o$  is  $47\mu F$ .