



SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

LV5692P — Monolithic Linear IC For Car Audio Systems Multi-Power Supply System IC

Overview

LV5692P is a multiple voltage regulator for car audio system, which allows reduction of quiescent current. This IC has 5 systems of voltage regulator pre-driver for P-FET which generates USB power and a high side switch for external devices. The following protection circuits are integrated: over current protector, overvoltage protector and Thermal Shut Down. This IC is suitable for use in car audio with USB port.

Features

- Five channel regulator and one channel P-FET pre-driver (for USB-power)
 - For VDD: V_{OUT} is 3.3V, I_{Omax} is 300mA
 - For DSP: V_{OUT} is 3.3V, I_{Omax} is 300mA
 - For CD: V_{OUT} is 8.0V, I_{Omax} is 1300mA
 - For illumination: V_{OUT} is 8.4V, I_{Omax} is 500mA
 - For audio systems: V_{OUT} is 8.4V, I_{Omax} is 500mA
 - For USB (controller), V_{OUT} is flexible (configurable with external resistor), I_{Omax} is 1000mA
- High side switch: Voltage difference between input and output is 0.5V, I_{Omax} is 500mA
- Over current protector
- Overvoltage protector (Without VDD-OUT) Clamp voltage is 21V (typical)
- Thermal Shut down 175°C (typical)
- Quiescent current 50 μ A (Typ. when only VDD is in operation)

(Warning) The protector functions only improve the IC's tolerance and they do not guarantee the safety of the IC if used under the conditions out of safety range or ratings. Use of the IC such as use under over current protection range or thermal shutdown state may degrade the IC's reliability and eventually damage the IC.

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment. The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for new introduction or other application different from current conditions on the usage of automotive device, communication device, office equipment, industrial equipment etc. , please consult with us about usage condition (temperature, operation time etc.) prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

SANYO Semiconductor Co., Ltd.

<http://semicon.sanyo.com/en/network>

LV5692P

Specifications

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

Parameter	Conditions	Conditions	Ratings	Unit	
Power supply voltage	V_{CC} max		36	V	
Power dissipation	P_d max	IC unit	$T_a \leq 25^\circ\text{C}$	1.5	W
		At using Al heat sink		5.6	W
		At infinity heat sink		32.5	W
Peak voltage	V_{CC} peak	Regarding Bias wave, refer to below the pulse.	50	V	
Junction temperature	T_j max		150	$^\circ\text{C}$	
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$	
Storage temperature	T_{stg}		-55 to +150	$^\circ\text{C}$	

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

Parameter	Conditions	Ratings	Unit
Power supply voltage rating 1	V_{DD} output ON, DSP output ON	7 to 16	V
Power supply voltage rating 2	ILM output ON	10.8 to 16	V
Power supply voltage rating 3	Audio output ON, CD output ON	10 to 16	V

* V_{CC1} should be as follows: $V_{CC1} > V_{CC} - 0.7\text{V}$

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = V_{CC1} = 14.4\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I_{CC}	V_{DD} no load, CTRL1/2/3 = [L/L/L]		50	100	μA
CTRL1 Input						
Low input voltage	V_{IL1}		0		0.3	V
Middle input voltage	V_{IM1}		1.1	1.65	2.1	V
High input voltage	V_{IH1}		2.5		5.5	V
Input impedance	R_{IH1}		280	400	520	$\text{k}\Omega$
CTRL2 Input						
Low input voltage	V_{IL2}		0		0.3	V
Middle1 input voltage	V_{IM2}		0.8	1.06	1.4	V
Middle2 input voltage	V_{IM2}		1.9	2.13	2.4	V
High input voltage	V_{IH2}		2.9	3.2	5.5	V
Input impedance	R_{IH2}		280	400	520	$\text{k}\Omega$
CTRL3 input.						
Low input voltage	V_{IL3}		0		0.3	V
High input voltage	V_{IH3}		2.5		5.5	V
Input impedance	R_{IH3}		280	400	520	$\text{k}\Omega$
$V_{DD}3.3\text{V}$ output						
Output voltage	V_{O1}	$I_{O1} = 200\text{mA}$	3.16	3.3	3.45	V
Output current	I_{O1}	$V_{O1} \geq 3.1\text{V}$	300			mA
Line regulation	ΔV_{OLN1}	$7.5\text{V} < V_{CC1} < 16\text{V}$, $I_{O1} = 200\text{mA}$		30	100	mV
Load regulation	ΔV_{OLD1}	$1\text{mA} < I_{O1} < 200\text{mA}$		70	150	mV
Ripple rejection	R_{REJ1}	$f = 120\text{Hz}$, $I_{O1} = 200\text{mA}$	30	40		dB
USB output: CTRL3 = [H] (When external power FET SANYO 2SJ650, it external resists 27kΩ, and 9.1kΩ is set)						
USB output voltage	V_{O2}	$I_{O2} = 1000\text{mA}$	4.75	5	5.25	V
USB output current	I_{O2}	$V_{O2} \geq 4.75\text{V}$	1000			mA
Line regulation	ΔV_{OLN2}	$10\text{V} < V_{CC} < 16\text{V}$, $I_{O2} = 1000\text{mA}$		50	90	mV
Load regulation	ΔV_{OLD2}	$10\text{mA} < I_{O2} < 1000\text{mA}$		100	150	mV
Dropout voltage	V_{DROP2}	$I_{O2} = 1000\text{mA}$		1.0	1.5	V
Ripple rejection	R_{REJ1}	$f = 120\text{Hz}$, $I_{O2} = 1000\text{mA}$	40	50		dB

Continued on next page.

LV5692P

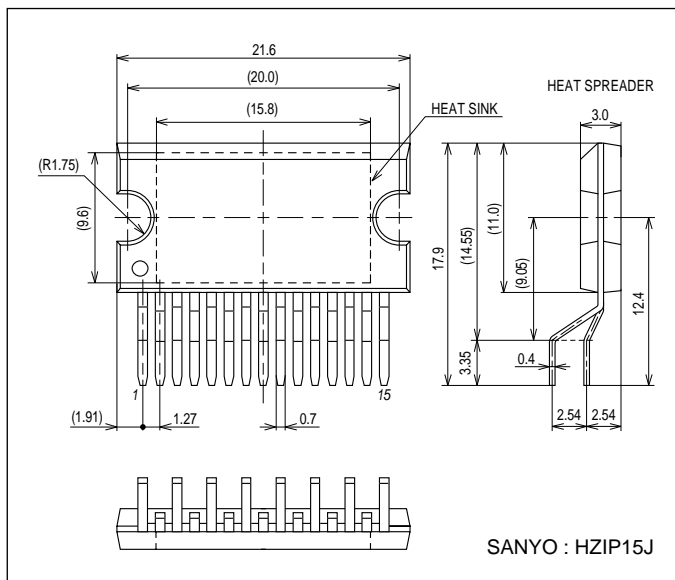
Continued from preceding page.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
AUDIO (8.4V) Output ; CTRL1 = [M or H]						
AUDIO output voltage 1	V_{O3}	$I_{O3} = 400\text{mA}$	8.0	8.4	8.8	V
AUDIO output current	I_{O3}	$V_{O3} \geq 8.0\text{V}$	500			mA
Line regulation	ΔV_{OLN3}	$10\text{V} < V_{CC} < 16\text{V}$, $I_{O3} = 400\text{mA}$		30	90	mV
Load regulation	ΔV_{OLD3}	$1\text{mA} < I_{O3} < 400\text{mA}$		70	150	mV
Dropout voltage 1	V_{DROP3}	$I_{O3} = 400\text{mA}$		0.4	0.8	V
Dropout voltage 2	V_{DROP3}'	$I_{O3} = 200\text{mA}$		0.2	0.4	V
Ripple rejection	R_{REJ3}	$f = 120\text{Hz}$, $I_{O3} = 400\text{mA}$	40	50		dB
ILM (8.4V) Output ; CTRL2 = [M1 or H]						
ILM output voltage	V_{O4}	$I_{O4} = 400\text{mA}$	8.0	8.4	8.8	V
ILM output current	I_{O4}		500			mA
Line regulation	ΔV_{OLN4}	$10.8\text{V} < V_{CC} < 16\text{V}$, $I_{O4} = 400\text{mA}$		30	90	mV
Load regulation	ΔV_{OLD4}	$1\text{mA} < I_{O4} < 400\text{mA}$		70	150	mV
Dropout voltage 1	V_{DROP4}	$I_{O4} = 400\text{mA}$		1.0	1.5	V
Dropout voltage 2	V_{DROP4}'	$I_{O4} = 200\text{mA}$		0.7	1.05	V
Ripple rejection	R_{REJ4}	$f = 120\text{Hz}$, $I_{O4} = 400\text{mA}$	40	50		dB
AMP_HS-SW; CTRL2 = [M2 or H]						
Output voltage	V_{O5}	$I_{O5} = 500\text{mA}$	$V_{CC}-1.0$	$V_{CC}-0.5$		V
Output current	I_{O5}	$V_{O5} \leq V_{CC}-1.0$	350			mA
DSP(3.3V output); CTRL1 = [M or H]						
DSP output voltage	V_{O7}	$I_{O7} = 200\text{mA}$	3.1	3.3	3.5	V
DSP output current	I_{O7}		300			mA
Line regulation	ΔV_{OLN7}	$10\text{V} < V_{CC} < 16\text{V}$, $I_{O7} = 200\text{mA}$		30	90	mV
Load regulation	ΔV_{OLD7}	$1\text{mA} < I_{O7} < 200\text{mA}$		70	150	mV
Ripple rejection	R_{REJ7}	$f = 120\text{Hz}$, $I_{O7} = 200\text{mA}$	40	50		dB
CD(8.0V output); CTRL1 = [H]						
CD output voltage	V_{O8}	$I_{O8} = 1000\text{mA}$	7.6	8.0	8.4	V
CD output current	I_{O8}		1300			mA
Line regulation	ΔV_{OLN8}	$10.5\text{V} < V_{CC} < 16\text{V}$, $I_{O8} = 1000\text{mA}$		50	100	mV
Load regulation	ΔV_{OLD8}	$10\text{mA} < I_{O8} < 1000\text{mA}$		100	200	mV
Dropout voltage	V_{DROP8}	$I_{O8} = 1000\text{mA}$		1.0	1.5	V
Ripple rejection	R_{REJ8}	$f = 120\text{Hz}$, $I_{O8} = 1000\text{mA}$	40	50		dB

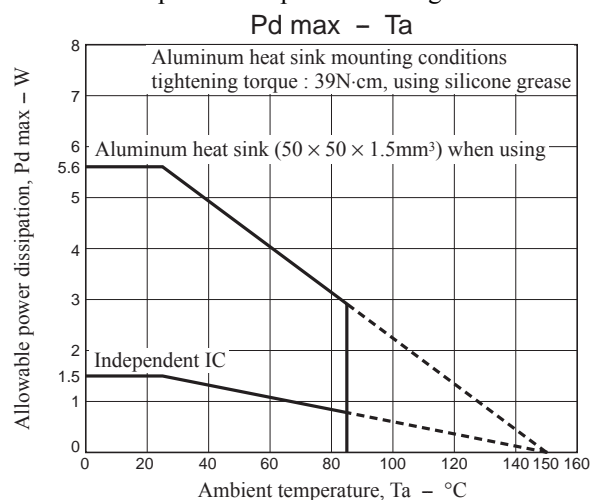
Package Dimensions

unit : mm (typ)

3395

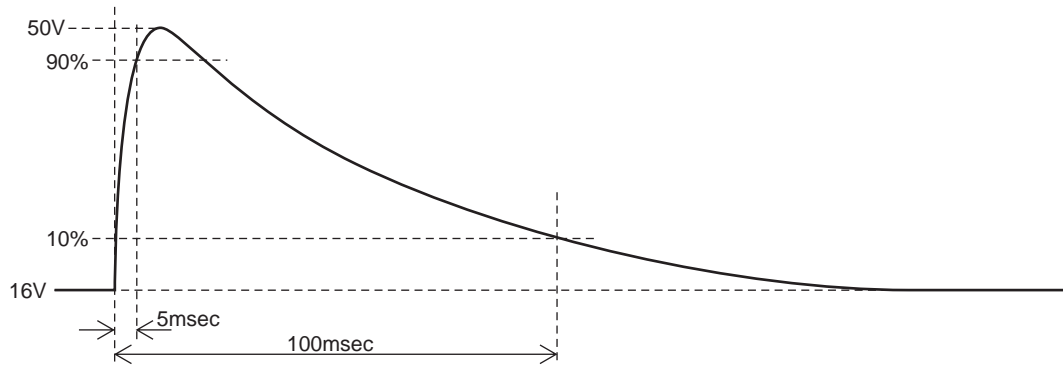


• Allowable power dissipation derating curve



LV5692P

- Waveform applied during surge test



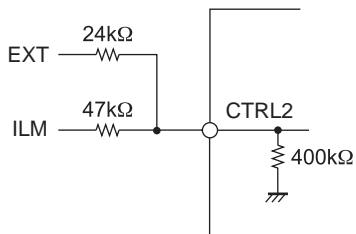
CTRL Pin Output Truth Table

CTRL1	CD	DSP	AUDIO
L	OFF	OFF	OFF
M	OFF	ON	ON
H	ON	ON	ON

CTRL3	USB
L	OFF
H	ON

CTRL2	EXT	ILM
L	OFF	OFF
M1	OFF	ON
M2	ON	OFF
H	ON	ON

Example of CTRL2 application circuit

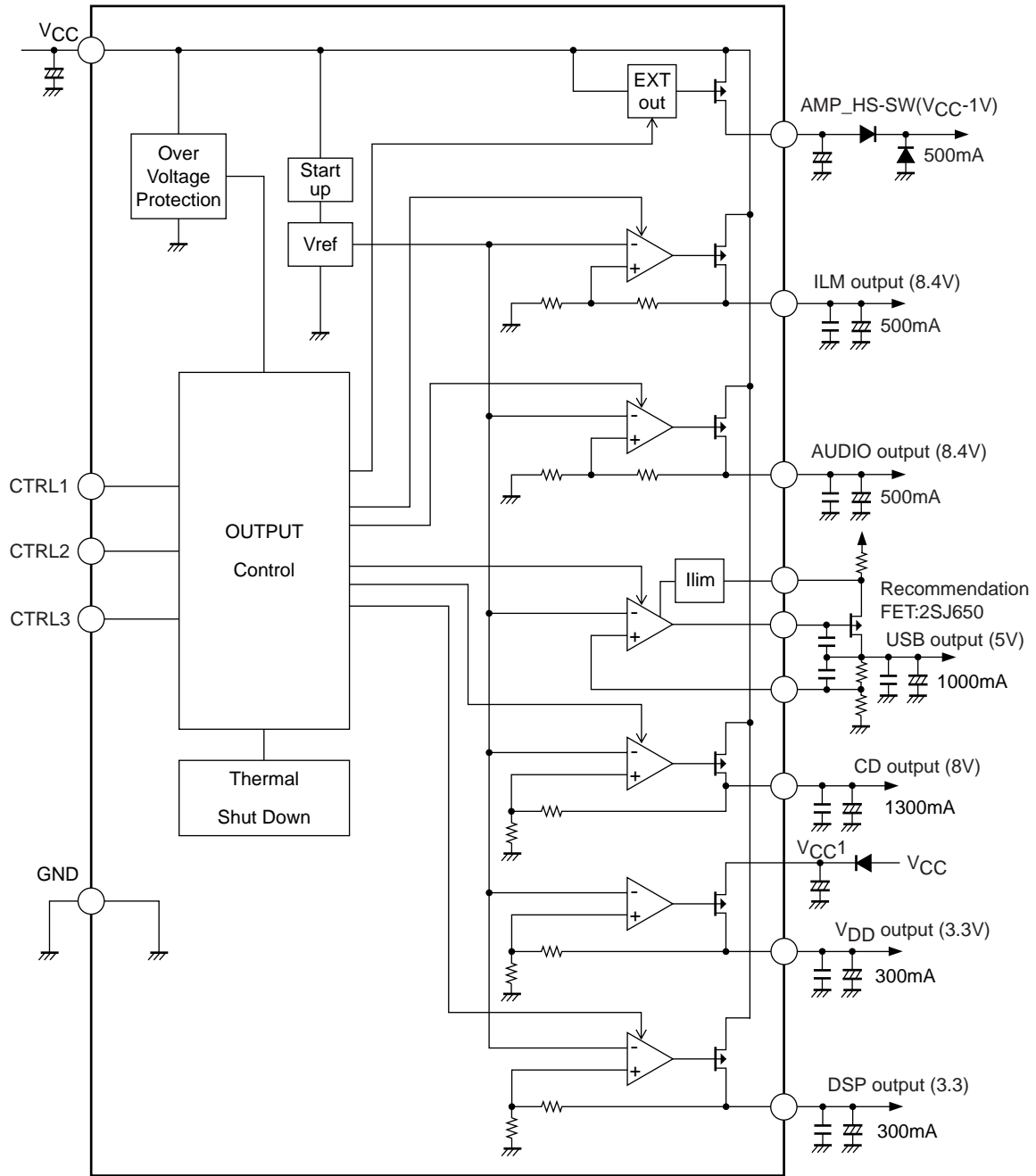


EXT	ILM	CTRL2
0V	0V	0V
0V	3.3V	1.06V
3.3V	0V	2.13V
3.3V	3.3V	3.20V

note) The control terminal is input 3.3V correspondence. Please set it by the input resistance at 5V input.

LV5692P

Block Diagram



LV5692P

Pin Function

Pin No.	Pin name	Description	Equivalent Circuit
1	ILM	ILM output pin ON when CTRL2 = M1, H 8.4V/0.5A	
2	GND	GND pin	
3	CD	CD output pin ON when CTRL1 = H 8.0V/1.3A	
4	CTRL1	CTRL1 input pin Three value input	
5	AUDIO	AUDIO output pin ON when CTRL1 = M, H 8.4V/0.5A	

Continued on next page.

LV5692P

Continued from preceding page.

Pin No.	Pin name	Description	Equivalent Circuit
6	CTRL2	CTRL2 input pin Four-value input	
7	DSP	DSP output pin ON when CTRL1 = M, H 3.3V/0.3A	
8	CTRL3	CTRL3 input pin Two-value input	
9	FB	USB-FB pin 1.26V	

Continued on next page.

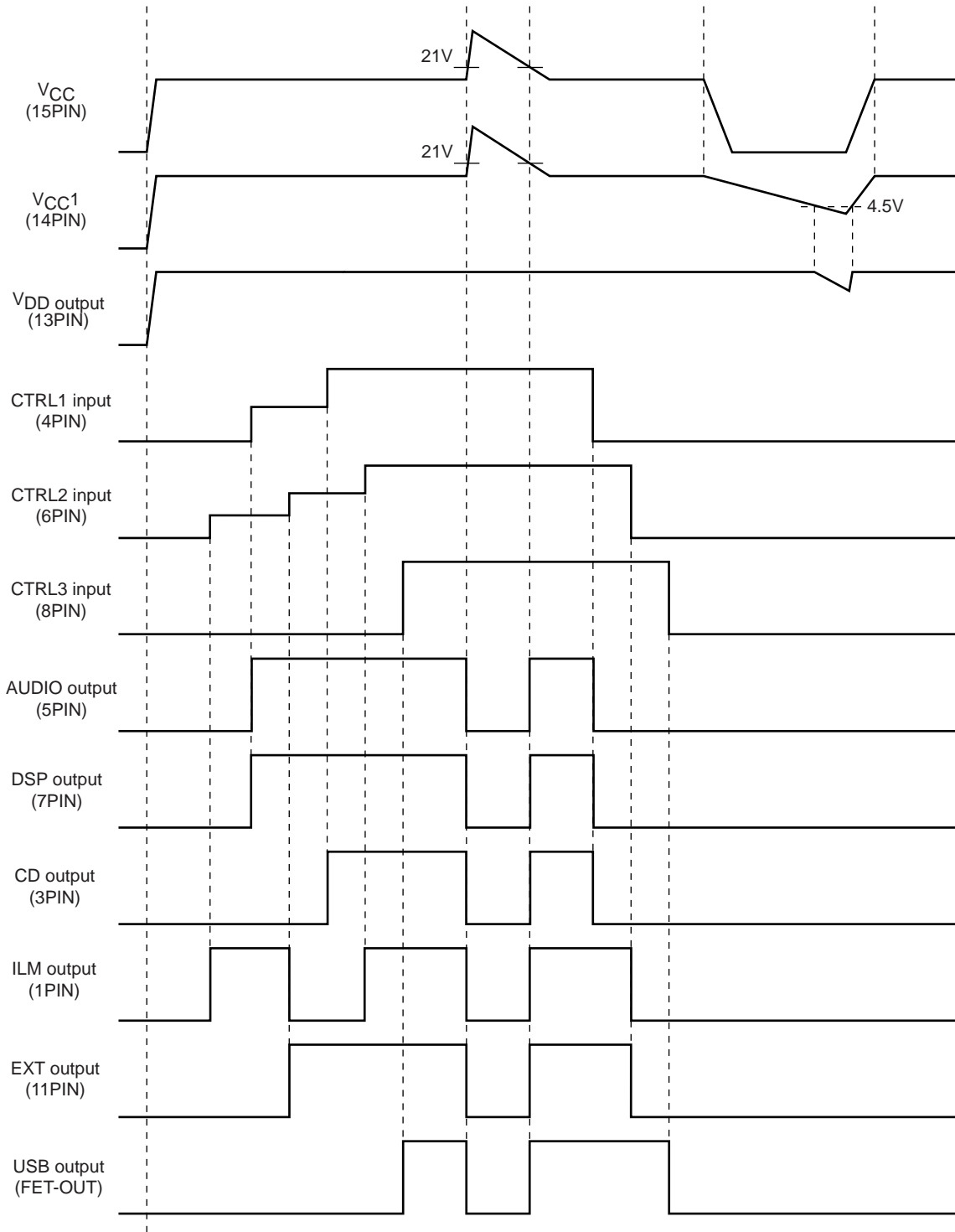
LV5692P

Continued from preceding page.

Pin No.	Pin name	Description	Equivalent Circuit
10	USBGT	Pch-FET gate connect pin 12.0V	
11	EXT	EXT output pin ON when CTRL2 = M2, H V _{CC} -0.5V/500mA	
12	RSNS	USB current detection resistance connection pin 14.3V	
13	V _{DD}	V _{DD} output pin 3.3V/0.3A	
14	V _{CC1}	V _{DD} power supply pin	
15	V _{CC}	Power supply pin	

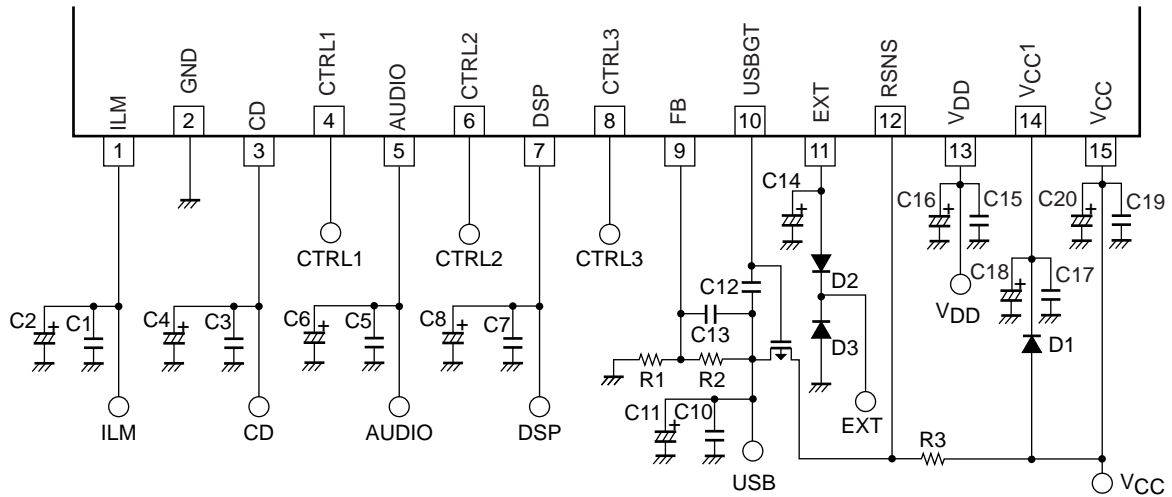
LV5692P

Timing Chart



LV5692P

Recommended Operation Circuit



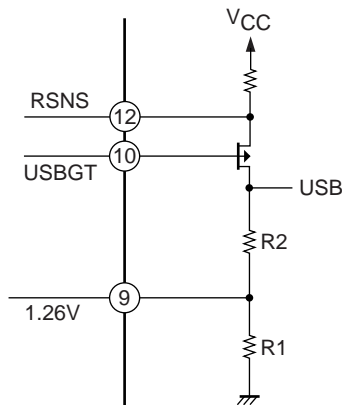
Peripheral parts list

Name of part	Description	Recommended value	Remarks
C2, C4, C6, C8, C11, C16	Output stabilization capacitor	10 μ F or more*	Electrolytic capacitor
C1, C3, C5, C7, C10, C15	Output stabilization capacitor	0.22 μ F or more*	Ceramic capacitor
C12, C13	Capacity for phase amends	C12=1000pF (C13=0pF: TBD)	Ceramic capacitor
C18, C20	Power supply bypass capacitor	100 μ F or more	These capacitors must be placed near the V _{CC} and GND pins.
C17, C19	Oscillation prevention capacitor	0.22 μ F or more	
C14	EXT output stabilization capacitor	2.2 μ F or more	
R1, R2	Resistor for ILM voltage adjustment	R1/R2=9.1k Ω /27k Ω for 5.0V	A resistor with resistance accuracy as low as less than $\pm 1\%$ must be used.
R3	Resistor for AUDIO voltage setting	0.1 Ω for I _{peak} =3A	Panasonic ERJB1CFR10U(Reference)
M1	USB output Pch-FET	SANYO 2SJ650	
D1	Diode for prevention of backflow		
D2, D3	Diode for internal element protection	SANYO SB1003M3	

note)The circuit diagram and the values are only tentative which are subject to change.

* : Make sure that the capacitors of the output pins are 10 μ F or higher and ESR is 10 Ω or lower in total and temperature characteristics and accuracy are taken into consideration. Also the E-cap should have good high frequency characteristics.

• USB output voltage setting method



Formula for USB voltage calculation

$$USB = \frac{1.26[V]}{R_1} \times R_2 + 1.26[V]$$

$$\frac{R_2}{R_1} = \frac{(USB-1.26)}{1.26}$$

Please design so that the ratio of R1 and R2 may fill the above-mentioned expression for the set USB voltage.

$$\frac{R_2}{R_1} = \frac{(5.0-1.26)}{1.26} \cong 2.968$$

$$\frac{R_2}{R_1} = \frac{27k\Omega}{9.1k\Omega} \cong 2.967$$

The FB voltage is determined by the internal band gap voltage of the IC (typ = 1.26V)

$$USB = 1.26V \times 2.967 + 1.26V \cong 4.998V$$

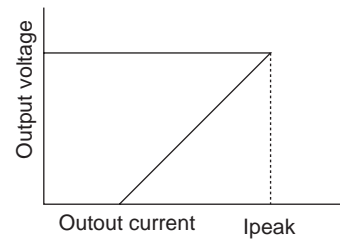
LV5692P

- How to set USB overcurrent limit value (OCP)

OCP of the USB works when the voltage of RSNS is under $V_{CC}-0.3V$. The peak current value of OCP is calculated as follows: $I_{peak}(A) = 0.3/R3$. (ex.) $R3=0.1\Omega \rightarrow I_{peak}=3A$

- Since this IC does not detect the heat generation of the external FET, keep the temperature of the FET as low as possible so as not to exceed the ratings.
- Recommended FET: SANYO 2SJ650.

(note)The above values were obtained under typical conditions. The values may fluctuate in manufacturing processes due to external resistor and IC variation.



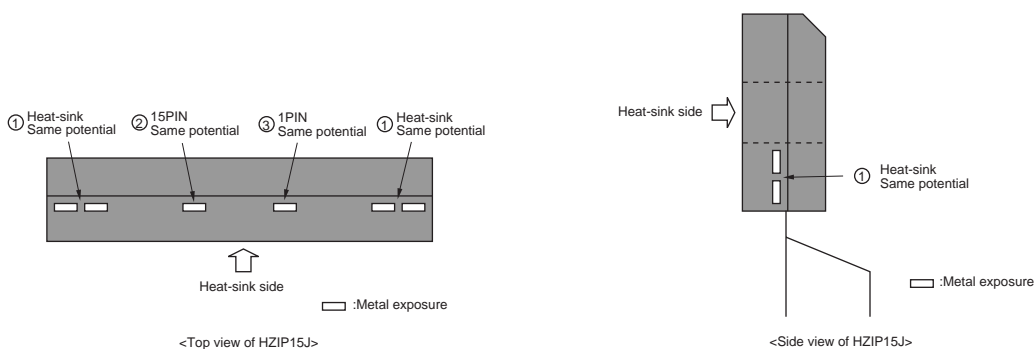
- Warning

The internal circuit of USBGT and RSNS consist of components that support 5V. Do not bias 7V or above between V_{CC} and these pins to prevent the IC from destruction.

Caution for implementing LV5692P to a system board

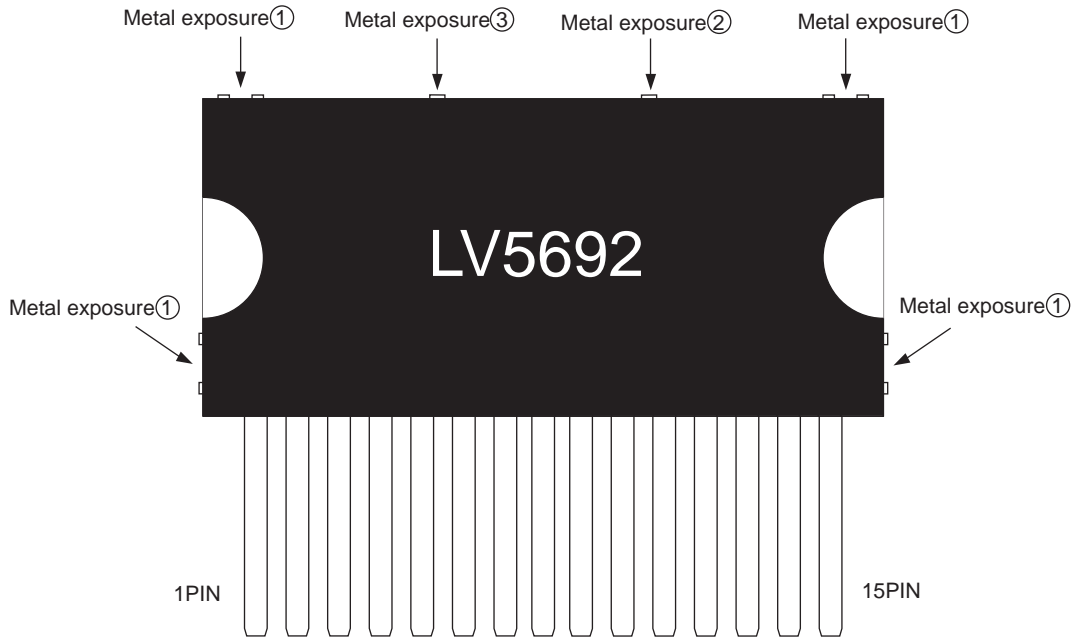
The package of LV5692P is HZIP15J which has some metal exposures other than connection pins and heatsink as shown in the diagram below. The electrical potentials of (2) and (3) are the same as those of pin 15 and pin 1, respectively. (2) (=pin 15) is the V_{CC} pin and (3) (=pin 1) is the ILM (regulator) output pin. When you implement the IC to the set board, make sure that the bolts and the heatsink are out of touch from (2) and (3). If the metal exposures touch the bolts which has the same electrical potential with GND, GND short occurs in ILM output and V_{CC} . The exposures of (1) are connected to heatsink which has the same electrical potential with substrate of the IC chip (GND). Therefore, (1) and GND electrical potential of the set board can connect each other.

- HZIP15J outline



LV5692P

- Frame diagram (LV5692P) *In the system power supply other than LV5692P, pin assignment may differ.



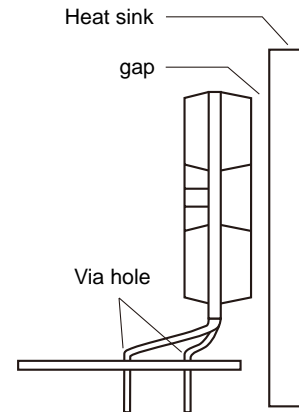
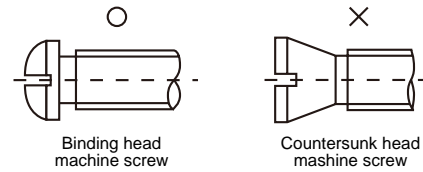
HZIP15J Heat sink attachment

Heat sinks are used to lower the semiconductor device junction temperature by leading the heat generated by the device to the outer environment and dissipating that heat.

- a. Unless otherwise specified, for power ICs with tabs and power ICs with attached heat sinks, solder must not be applied to the heat sink or tabs.

b. Heat sink attachment

- Use flat-head screws to attach heat sinks.
- Use also washer to protect the package.
- Use tightening torques in the ranges 39-59Ncm(4-6kgcm) .
- If tapping screws are used, do not use screws with a diameter larger than the holes in the semiconductor device itself.
- Do not make gap, dust, or other contaminants to get between the semiconductor device and the tab or heat sink.
- Take care a position of via hole .
- Do not allow dirt, dust, or other contaminants to get between the semiconductor device and the tab or heat sink.
- Verify that there are no press burrs or screw-hole burrs on the heat sink.
- Warping in heat sinks and printed circuit boards must be no more than 0.05 mm between screw holes, for either concave or convex warping.
- Twisting must be limited to under 0.05 mm.
- Heat sink and semiconductor device are mounted in parallel.
Take care of electric or compressed air drivers
- The speed of these torque wrenches should never exceed 700 rpm, and should typically be about 400 rpm.



c. Silicone grease

- Spread the silicone grease evenly when mounting heat sinks.
- Sanyo recommends YG-6260 (Momentive Performance Materials Japan LLC)

d. Mount

- First mount the heat sink on the semiconductor device, and then mount that assembly on the printed circuit board.
- When attaching a heat sink after mounting a semiconductor device into the printed circuit board, when tightening up a heat sink with the screw, the mechanical stress which is impossible to the semiconductor device and the pin doesn't hang.

e. When mounting the semiconductor device to the heat sink using jigs, etc.,

- Take care not to allow the device to ride onto the jig or positioning dowel.
- Design the jig so that no unreasonable mechanical stress is not applied to the semiconductor device.

f. Heat sink screw holes

- Be sure that chamfering and shear drop of heat sinks must not be larger than the diameter of screw head used.
- When using nuts, do not make the heat sink hole diameters larger than the diameter of the head of the screws used. A hole diameter about 15% larger than the diameter of the screw is desirable.
- When tap screws are used, be sure that the diameter of the holes in the heat sink are not too small. A diameter about 15% smaller than the diameter of the screw is desirable.

- g. There is a method to mount the semiconductor device to the heat sink by using a spring band. But this method is not recommended because of possible displacement due to fluctuation of the spring force with time or vibration.

- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of October, 2011. Specifications and information herein are subject to change without notice.