SANYO Semiconductors
DATA SHEET

An ON Semiconductor Company

LV5683P — Monolithic Linear IC For Car Audio Systems Multi Voltage Regulator IC

Overview

The LV5683P is a multi voltage regulator suitable for USB silicon tuner car-audio systems. This IC has 4 outputs, V_{DD} 5V(3.3V), AUDIO(8.5V), SWU(3.3V) and USB5V(CD 8V: available). About protection circuits, it has Over-current-protection, Over-voltage-protection and Thermal-shut-down. V_{CC}1(SWU and USB supply) is independent terminal from V_{CC}, and accepts lower voltage(ex. From DC/DC converter) which enables to reduce power dissipation.

Features

- 4 system regulator
  - V_{DD}(LCD micon) : V_{OUT} 5.0V(3.3V), I_O max 300mA, reverse current prevention.
  - Audio : V_{OUT} 8.5V, I_O max 300mA
  - SWU(systems) : V_{OUT} 3.3V, I_O max 500mA
  - USB : V_{OUT} 5.0V(8.0V available for CD), I_O max 1100mA
- Over-current-protection
- Over-voltage-protection: Typ 21V(except V_{DD})
- Thermal-shut-down Typ 175ºC
- Applied Pch-LDMOS for output stages.

(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 overcurrent protection range or thermal shut down state may degrade the IC's reliability and eventually damage the IC.

Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Conditions	Conditions	Ratings	Unit
Supply voltage	V_{CC} max		36	V
Allowable Power dissipation	Pd max (*Ta ≤ 25°C)	IC unit	1.3	W
		With Al heatsink(50×50×1.5mm^3)	5.3	W
		Infinite heat rediation	26	W
Peak supply voltage	V_{CC} peak	See below pulse wave.	50	V
Operating ambient temperature	Topr		-40 to +85	°C
Storage temperature	Tstg		-55 to +150	°C
Junction temperature	Tj max		150	°C

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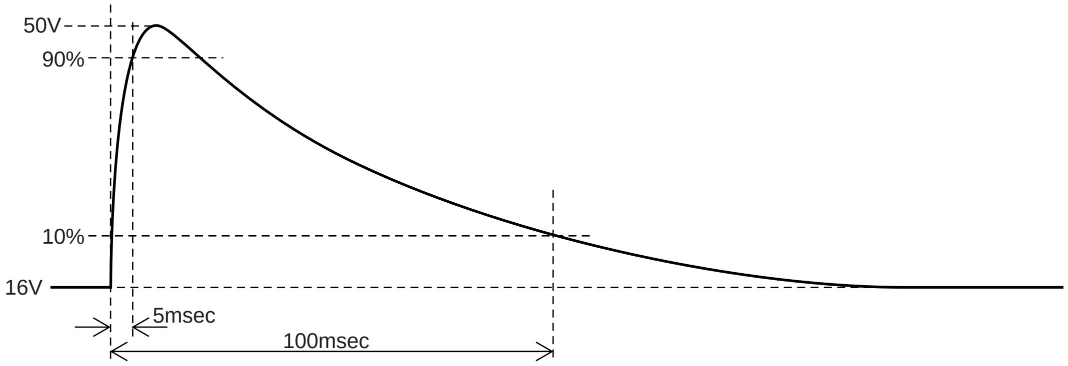
Peak voltage testing pulse wave



Recommended Operating condition at Ta = 25°C

Parameter	Conditions	Ratings	Unit
Power supply voltage rating 1	V_{DD} output(5V/3.3V)	7 to 16	V
Power supply voltage rating 2	USB(5V) output, SWU output: V_{CC}=V_{CC}1	7.5 to 16	V
Power supply voltage rating 3	AUDIO output	10 to 16	V
Power supply voltage rating 4	USB(8V) output: V_{CC}=V_{CC}1	10.5 to 16	V

Electrical Characteristics at Ta = 25°C, V_{CC} = V_{CC}1 =14.4V (*1)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CC}	V_{DD} no load, ALL EN terminal =「L」		50	100	μA
AUDIO_EN Input						
Low input voltage	$V_{IL}1$		0		0.5	V
High input voltage	$V_{IH}1$		2.8		5.5	V
Input impedance	$R_{IH}1$		280	400	520	kΩ
SWU_EN Input						
Low input voltage	$V_{IL}2$		0		0.5	V
High input voltage	$V_{IH}2$		2.8		5.5	V
Input impedance	$R_{IH}2$		280	400	520	kΩ
USB_EN input						
Low input voltage	$V_{IL}3$		0		0.5	V
High input voltage	$V_{IH}3$		2.8		5.5	V
Input impedance	$R_{IH}3$		280	400	520	kΩ
V_{DD} (5V/3.3V)output(reverse current prevention diode implemented)						
V_{DD} output voltage 1	V_O11	I_O11 = 200mA, IKV_{DD}=OPEN, or V_{DD}out	4.75	5.0	5.25	V
V_{DD} output current 1	I_O11	$V_O11 \geq 4.7V$	300			mA
V_{DD} output voltage 2	V_O12	I_O12 = 200mA, IKV_{DD}=GND	3.13	3.3	3.47	V
V_{DD} output current 2	I_O12	$V_O12 \geq 3.1V$	300			mA
Line regulation	$\Delta V_{OLN}1$	7V < V_{CC} < 16V, I_O1 = 200mA		50	100	mV
Load regulation	$\Delta V_{OLD}1$	1mA < I_O11, I_O12 < 200mA		80	150	mV
Dropout voltage 1	$V_{DROP}1$	I_O1 = 200mA (implemented diode)		1.5	2.5	V
V_{CC} ripple rejection	$R_{REJ}1$	f=120Hz, V_{CC}=1V_{PP}, I_O1=200mA	40(*2)	50(*2)		dB
V_{DD} reverse current	I_{REV}	V_O11=5.0V, V_{CC}=0V		10	100	μA
USB/CD output ; USB_EN = High						
USB output voltage 1	V_O21	I_O21 = 200mA, IKUSB=OPEN, or USBout	7.6	8.0	8.4	V
USB output current 1	I_O21	$V_O21 \geq 7.45V$	1100			mA
USB output voltage 2	V_O22	I_O22 = 1000mA, IKUSB=GND	4.75	5.0	5.25	V
USB output current 2	I_O22	$V_O22 \geq 4.6V$	1100			mA
Line regulation	$\Delta V_{OLN}2$	10.5V < $V_{CC}1$ < 16V, I_O2 = 1000mA		50	100	mV
Load regulation	$\Delta V_{OLD}2$	10mA < I_O21, I_O22 < 1000mA		100	200	mV
Dropout voltage 1	$V_{DROP}2$	I_O21, I_O22 = 1000mA		1.0	2.0	V
V_{CC}1 ripple rejection	$R_{REJ}2$	f=120Hz, V_{CC}1=1V_{PP}, I_O2=1000mA	40(*2)	50(*2)		dB

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
AUDIO output ; AUDIO_EN = High						
AUDIO output voltage	V_O3	I_O3 = 200mA	8.1	8.5	8.9	V
AUDIO output current	I_O3	$V_O3 \geq 8V$	300			μA
Line regulation	$\Delta V_{OLN}3$	10V < V_{CC} < 16V, I_O3 = 200mA		30	100	mV
Load regulation	$\Delta V_{OLD}3$	1mA < I_O3 < 200mA		70	140	mV
Dropout voltage	$V_{DROP}3$	I_O3 = 200mA		0.4	0.7	V
V_{CC} ripple rejection	$R_{REJ}3$	f = 120Hz, V_{CC}=1V_{PP}, I_O3=200mA	40(*2)	50(*2)		dB
SWU (3.3V) Output ; SEU_EN = High						
ILM output voltage	V_O4	I_O4 = 400mA	3.13	3.3	3.47	V
ILM output current	I_O4	$V_O4 \geq 3.1V$	500			mA
Line regulation	$\Delta V_{OLN}4$	7.5V < $V_{CC}1$ < 16V, I_O4 = 400mA		30	100	mV
Load regulation	$\Delta V_{OLD}4$	1mA < I_O4 < 400mA		80	150	mV
$V_{CC}1$ ripple rejection	$R_{REJ}4$	f = 120Hz, $V_{CC}1$=1V_{PP}, I_O4=400mA	40(*2)	50(*2)		dB

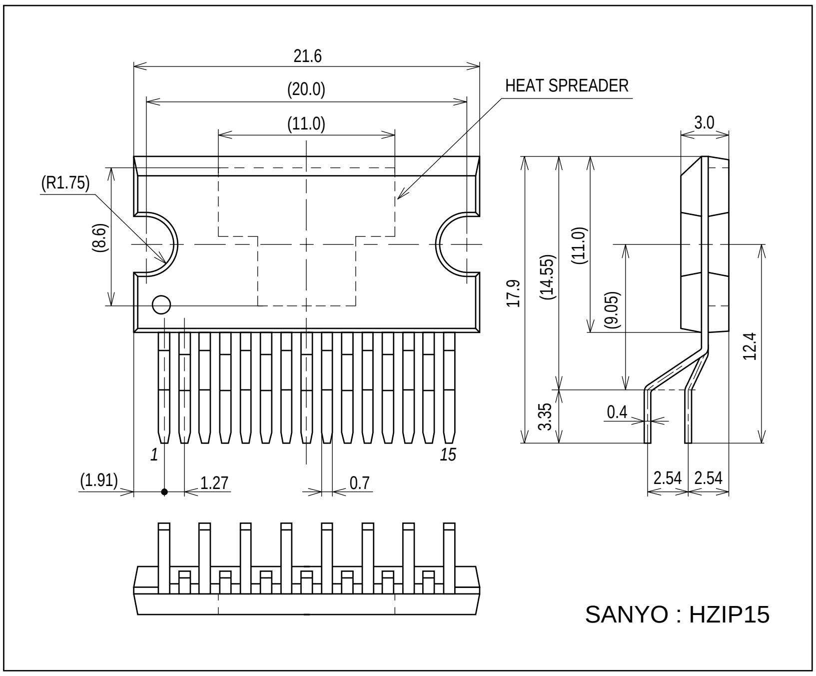
*1: The entire specification has been defined based on the tests performed under the conditions where Tj and Ta(=25°C) are almost equal. There tests were performed with pulse load to minimize the increase of junction temperature(Tj).

*2 : design certification

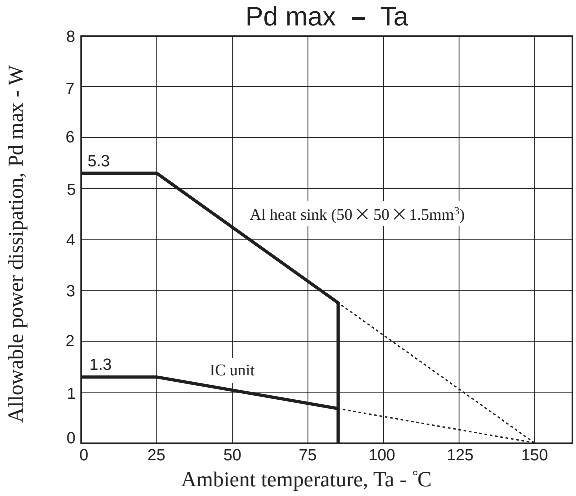
Package Dimensions

unit : mm (typ)

3336

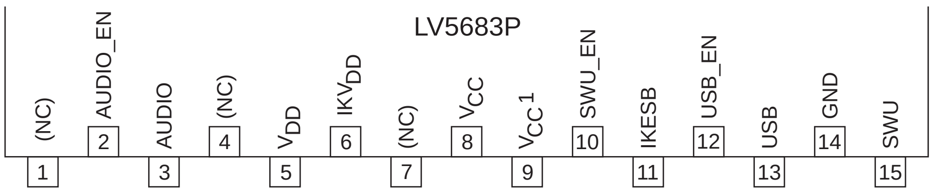


Allowable power dissipation derating curve

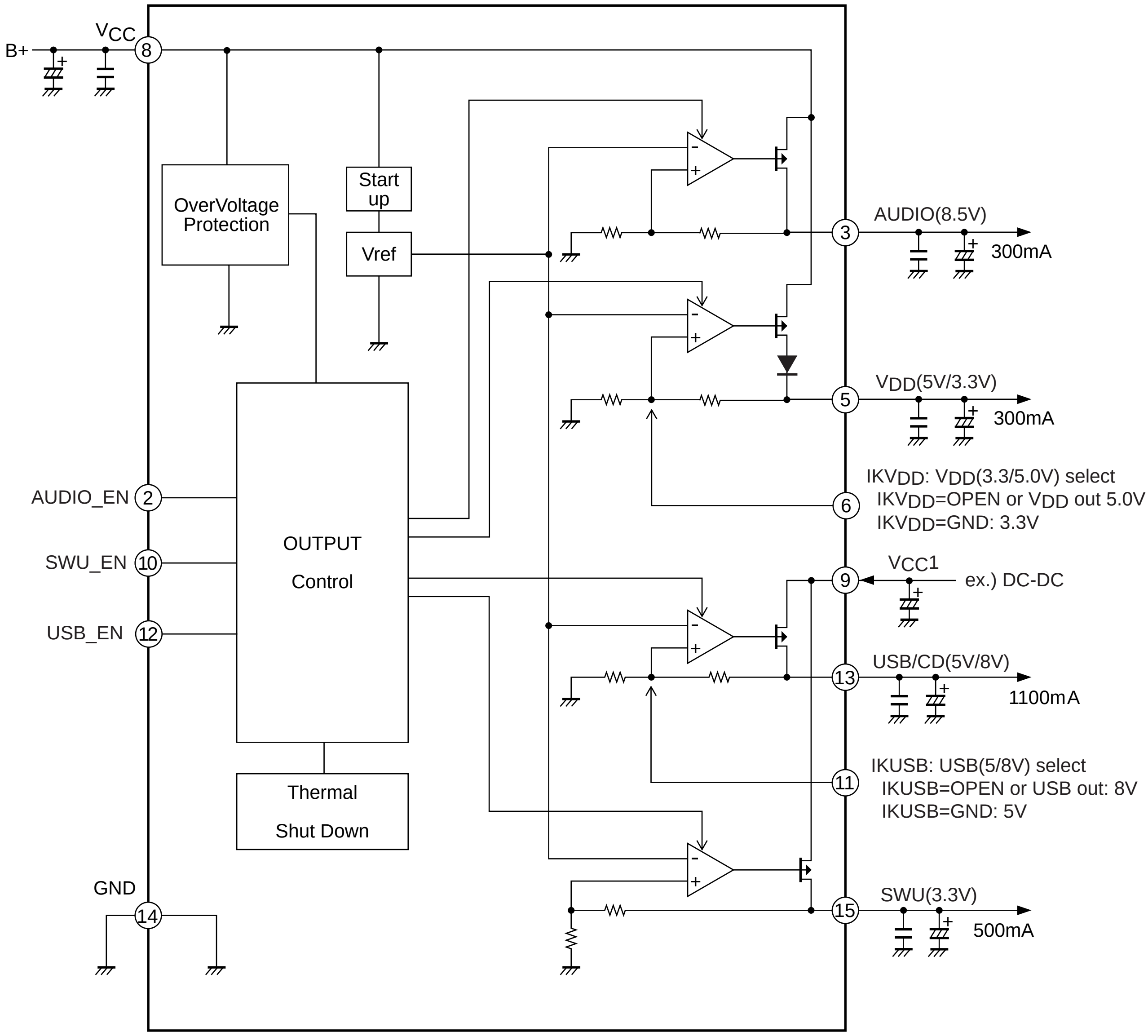


(a) IC unit(HZIP15)
(b) With Al heatsink($50 \times 50 \times 1.5mm^3$)
Al heatsink mounting conditions
Tightening torque: 39N·cm, using silicone grease

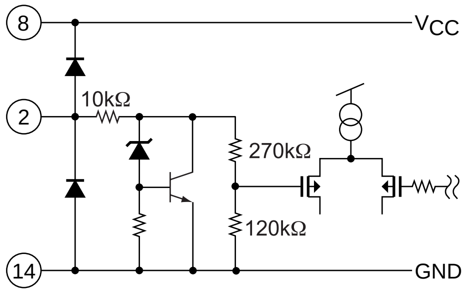
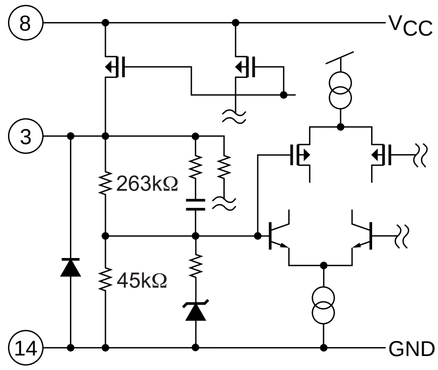
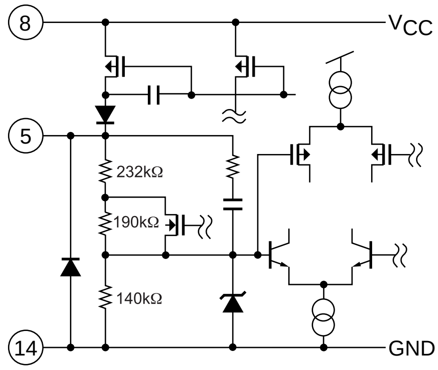
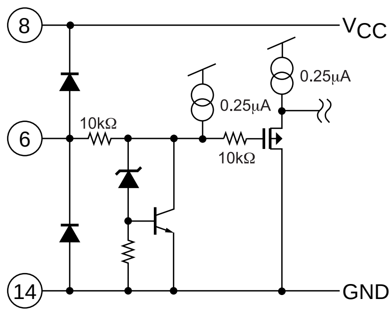
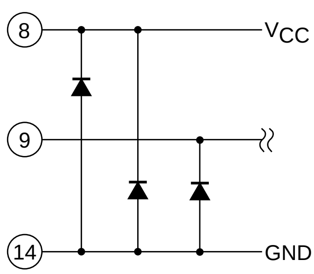
Pin assignment



Block Diagram



Pin Function

Pin No.	Pin name	Description	Equivalent Circuit
1	N.C.	-	-
2	AUDIO_EN	AUDIO output CTRL	
3	AUDIO	AUDIO output when AUDIO_EN = High, ON 8.5V/0.3A	
4	N.C.	-	-
5	V_{DD}	V_{DD} output 5.0V, 3.3V/0.3A	
6	IKV_{DD}	V_{DD} output voltage select OPEN : V_{DD} = 5.0V GND : V_{DD} = 3.3V	
7	N.C.	-	-
8	V_{CC}	V_{CC}	
9	$V_{CC}1$	$V_{CC}1$	

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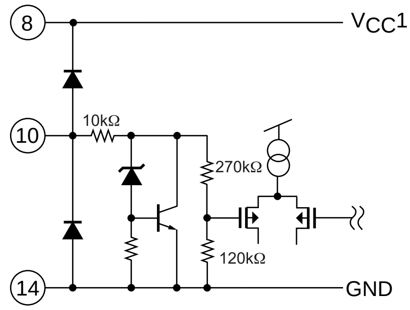
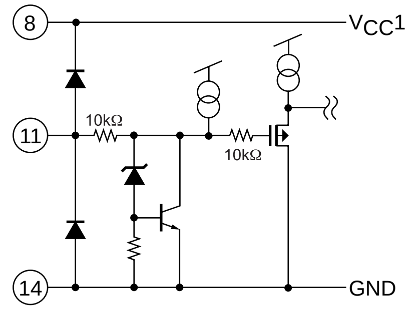
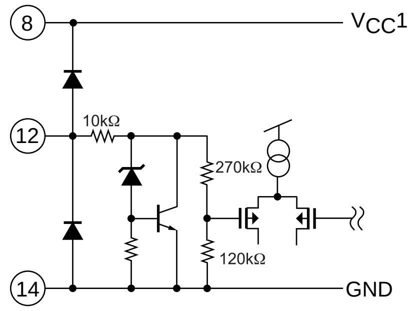
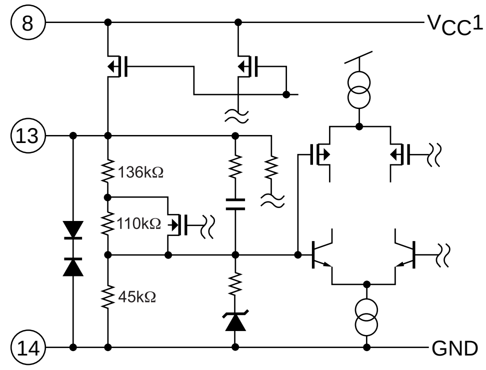
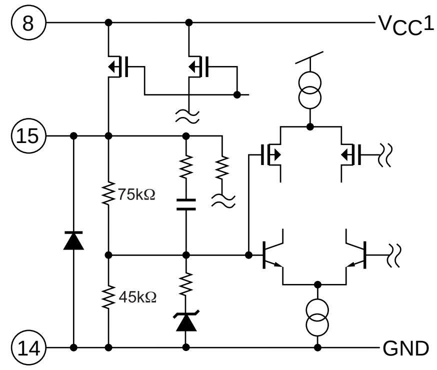
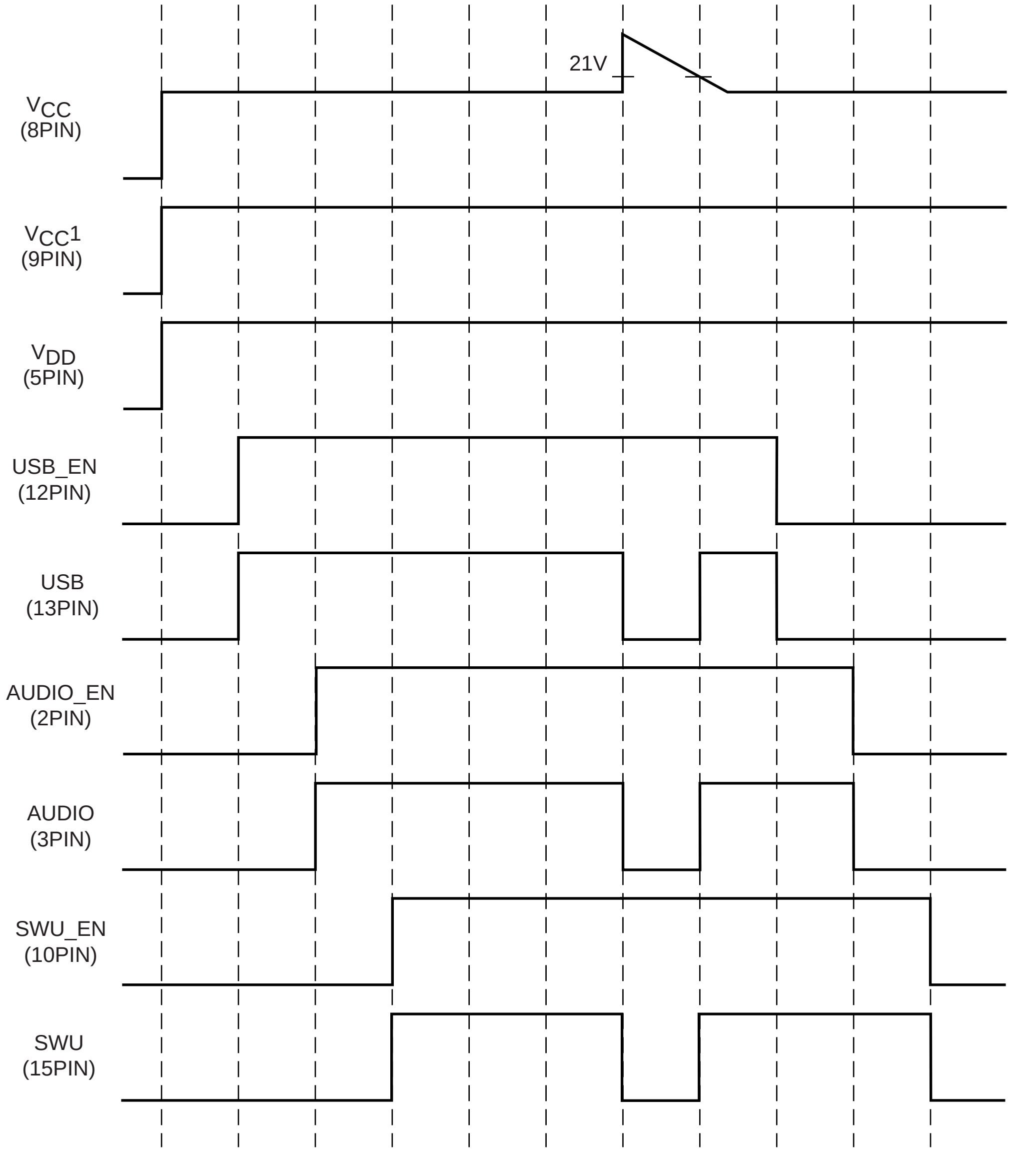
Pin No.	Pin name	Description	Equivalent Circuit
10	SWU_EN	SWU output CTRL	
11	IKUSB	USB output voltage select OPEN : V_{DD} = 8.0V GND : V_{DD} = 5.0V	
12	USB_EN	USB output CTRL	
13	USB	USB output when USB_EN = High, ON 5.0V, 8.0V/1.1A	
14	GND	GND	
15	SWU	SWU output when SWU_EN = High, ON 3.3V/0.5A	

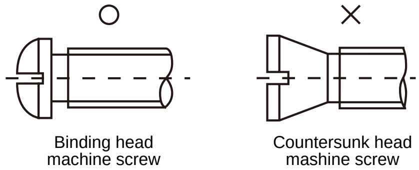
Timing Chart



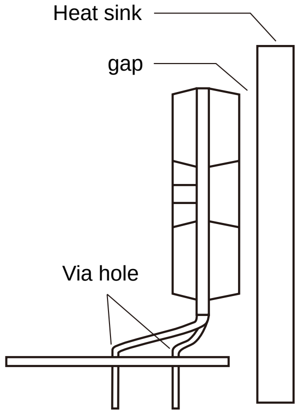
HZIP15 Heat sink attachment

Heat sinks are used to lower the semiconductor device junction temperature by leading the head 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.

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

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Телефон: 8 (812) 309-75-97 (многоканальный)
Факс: 8 (812) 320-03-32
Электронная почта: ocean@oceanchips.ru
Web: http://oceanchips.ru/
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А