



SANYO Semiconductors

DATA SHEET

An ON Semiconductor Company

LV5682P — Monolithic Linear IC

For Car Audio Systems

Multi-Power Supply System IC

Overview

The LV5682P is a multi-power supply system IC that provides four regulator outputs and two high side switches as well as a number of protection functions including overcurrent protection and overheat protection. It is an optimal power supply IC for car audio and car entertainment systems and similar products. It is possible to use it like the bus track etc. in the vehicle whose voltage of the battery is 24V because there is a range of the power-supply voltage up to 32V.

Features

- Four regulator output systems
 - For microcontroller: 5.0V output voltage, 200mA maximum output current
 - For CD drive: 8.0V output voltage, 1300mA maximum output current
 - For illumination: 8 to 12V output voltage (output can be set with external resistors), 300mA maximum output current
 - For audio systems: 8 to 9V output voltage (output voltage can be set with external resistors), 300mA maximum output current
- Two V_{CC} -linked high side switch systems
 - EXT: 350mA maximum output current, 0.5V voltage difference between input and output.
 - ANT: 300mA maximum output current, 0.5V voltage difference between input and output.
- Two V_{DD} 5V-linked high side switch systems
 - SW5V: 200mA maximum output current, 0.2V voltage difference between input and output.
 - ACC (accessory voltage detection output): 100mA maximum output current, 0.2V voltage difference between input and output.
- Overcurrent protection function
- Overheat protection function, typ 175°C
- On-chip accessory voltage detection circuit
- P-channel LDMOS used for power output block

(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 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>

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	Independent IC	2.7	W
		With an infinity heat sink	65	W
Peak supply voltage	V _{CC} peak	Each output is a no load. See below for the waveform applied.	50	V
Junction temperature	Tj max		150	°C
Operating ambient temperature	Topr		-40 to +85	°C
Storage temperature	Tstg		-55 to +150	°C

Allowable Operating range at Ta = 25°C

Parameter	Conditions	Ratings	Unit
Operating supply voltage 1	V _{DD} output, SW output and ACC output total current ≤ 0.5A	7.5 to 30	V
	V _{DD} output, SW output and ACC output total current ≤ 0.4A	7.5 to 32	V
Operating supply voltage 2	ILM output at 10V	12 to 32	V
	ILM output at 8V	10 to 32	V
Operating supply voltage 3	Audio output at 9V	10 to 32	V
Operating supply voltage 4	CD output (CD output current ≤ 1.3A)	10.5 to 24	V
	CD output (CD output current ≤ 0.7A)	10 to 32	V

* The area of safe operation of each output is shown in P13-15. Please perform a set design based on an area of safe operation.

Electrical Characteristics at V_{CC} = 24V, Ta = 25°C (*1)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	I _{CC}	V _{DD} no load, CTRL1/2 = $\lceil L/L \rceil$, ACC = 0V		400	800	μA
CTRL1 Input						
Low input voltage	V _{IL1}		0		0.5	V
M1 input voltage	V _{IM1}		0.8	1.1	1.4	V
M2 input voltage	V _{IM2}		1.9	2.2	2.5	V
High input voltage	V _{IH1}		2.9	3.3	5.5	V
Input impedance	R _{IH1}		350	500	650	kΩ
CTRL2 Input						
Low input voltage	V _{IL2}		0		0.5	V
M input voltage	V _{IM2}		1.1	1.65	2.1	V
High input voltage	V _{IH2}		2.5	3.3	5.5	V
Input impedance	R _{IH2}		350	500	650	kΩ
V_{DD} 5V Output *2 The V_{DD} 5V output supplies the output currents of SW 5V and ACC 5V.						
Output voltage 1	V _{O1}	I _{O1} = 200mA, I _{O7} , I _{O8} = 0A	4.75	5.0	5.25	V
Output voltage 2	V _{O1'}	I _{O1} = 200mA, I _{O7} = 200mA, I _{O8} = 100mA	4.75	5.0	5.25	V
Output total current	I _{to1}	V _{O1} ≥ 4.75V, I _{to1} = I _{O1} + I _{O7} + I _{O8}	500			mA
Line regulation	ΔV _{OLN1}	22V < V _{CC} < 32V, I _{O1} = 200mA *3		30	90	mV
Load regulation	ΔV _{OLD1}	1mA < I _{O1} < 200mA *3		70	150	mV
Dropout voltage 1	V _{DROP1}	I _{O1} = 200mA *3		1.0	1.5	V
Dropout voltage 2	V _{DROP1'}	I _{O1} = 100mA *3		0.7	1.05	V
Dropout voltage 3	V _{DROP1''}	I _{O1} + I _{O7} + I _{O8} = 500mA		2.5	3.75	V
Ripple rejection	R _{REJ1}	f = 120Hz, I _{O1} = 200mA *3	40	50		dB

*1: All the specifications are provided for by the test by the fact that Tj(=25°C) is almost equal. To suppress the rise of Tj in the joint part temperature as much as possible, it tests by the pulse loading.

*2 : The V_{DD} 5V output also supplies the output currents of SW 5V and ACC 5V. Therefore, the current supply capability of the V_{DD} 5V output and its other electrical characteristics are affected by the output statuses of SW 5V and ACC 5V.

*3 : SW 5V and ACC 5V are not subject to a load.

Continued on next page.

LV5682P

Continued from preceding page.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
CD Output ; CTRL2 =「H」						
Output voltage	V _{O2}	I _{O2} = 1000mA	7.6	8.0	8.4	V
Output current	I _{O2}	V _{O2} ≥ 7.6V	1300			mA
Line regulation	ΔV _{OLN2}	22V < V _{CC} < 32V, I _{O2} = 1000mA		50	100	mV
Load regulation	ΔV _{OLD2}	10mA < I _{O2} < 1000mA		100	200	mV
Dropout voltage 1	V _{DROP2}	I _{O2} = 1000mA		1.0	1.5	V
Dropout voltage 2	V _{DROP2} '	I _{O2} = 500mA		0.5	0.75	V
Ripple rejection	R _{REJ2}	f = 120Hz, I _{O2} = 1000mA	40	50		dB
AUDIO (8-9V) Output ; CTRL2 =「M」						
AUDIO_F pin voltage	V _{I3}		1.222	1.260	1.298	V
AUDIO_F pin inflow current	I _{IN3}		-1		1	μA
AUDIO output voltage 1	V _{O3}	I _{O3} = 200mA, R2 = 30kΩ, R3 = 5.6kΩ *4	7.65	8.0	8.35	V
AUDIO output voltage 2	V _{O3} '	I _{O3} = 200mA, R2 = 27kΩ, R3 = 4.7kΩ *4	8.13	8.5	8.87	V
AUDIO output voltage 3	V _{O3} ''	I _{O3} = 200mA, R2 = 24kΩ, R3 = 3.9kΩ *4	8.6	9.0	9.4	V
AUDIO output current	I _{O3}		300			mA
Line regulation	ΔV _{OLN3}	22V < V _{CC} < 32V, I _{O3} = 200mA		30	90	mV
Load regulation	ΔV _{OLD3}	1mA < I _{O3} < 200mA		70	150	mV
Dropout voltage 1	V _{DROP3}	I _{O3} = 200mA		0.3	0.45	V
Dropout voltage 2	V _{DROP3} '	I _{O3} = 100mA		0.15	0.23	V
Ripple rejection	R _{REJ3}	f = 120Hz, I _{O3} = 200mA	40	50		dB
ILM (8-12V) Output ; CTRL1 =「M1」						
ILM_F pin voltage	V _{I4}		1.222	1.260	1.298	V
ILM output voltage 1	V _{O4}	I _{O4} = 200mA	11.4	12.0	12.6	V
ILM output voltage 2	V _{O4} '	I _{O4} = 200mA, R1 = 270kΩ *5	8.5	10.0	11.5	V
ILM output voltage 3	V _{O4} ''	I _{O4} = 200mA, R1 = 100kΩ *5	6.8	8.0	9.2	V
ILM output current	I _{O4}	R1 = 270kΩ	300			mA
Line regulation	ΔV _{OLN4}	22V < V _{CC} < 32V, I _{O4} = 200mA		30	90	mV
Load regulation	ΔV _{OLD4}	1mA < I _{O4} < 200mA		70	150	mV
Dropout voltage 1	V _{DROP4}	I _{O4} = 200mA		0.7	1.05	V
Dropout voltage 2	V _{DROP4} '	I _{O4} = 100mA		0.35	0.53	V
Ripple rejection	R _{REJ4}	f = 120Hz, I _{O4} = 200mA	40	50		dB
Remoto (EXT) ; CTRL1 =「M2」						
Output voltage	V _{O5}	I _{O5} = 350mA	V _{CC} -1.0	V _{CC} -0.5		V
Output current	I _{O5}	V _{O5} ≥ V _{CC} -1.0	350			mA
ANT remoto ; CTRL1 =「H」						
Output voltage	V _{O6}	I _{O6} = 300mA	V _{CC} -1.0	V _{CC} -0.5		V
Output current	I _{O6}	V _{O6} ≥ V _{CC} -1.0	300			mA
SW 5V Output ; CTRL2 =「M」						
Output voltage 1	V _{O7}	I _{O7} = 1mA, I _{O1} , I _{O8} = 0A *6	V _{O1} -0.25	V _{O1}		V
Output voltage 2	V _{O7} '	I _{O7} = 200mA, I _{O1} , I _{O8} = 0A *6	V _{O1} -0.45	V _{O1} -0.2		V
Output current	I _{O7}	V _{O7} ≥ 4.55	200			mA
ACC Detection ; ACC Integration 5V output						
ACC detection voltage	V _{TH8}		2.8	3.0	3.2	V
Hysteresis width	V _{HIS8}		0.2	0.3	0.4	V
Input impedance	Z _{I8}	(Pull-down resistance internal)	42	60	78	kΩ
ACC output voltage 1	V _{O8}	I _{O8} = 0.5mA, I _{O1} , I _{O7} = 0A *6	V _{O1} -0.25	V _{O1}		V
ACC output voltage 2	V _{O8} '	I _{O8} = 100mA, I _{O1} , I _{O7} = 0A *6	V _{O1} -0.45	V _{O1} -0.2		V
ACC output voltage	I _{O8}	V _{O8} ≥ 4.55	100			mA

*4 : When a component with a resistance accuracy of ±1% is used

<Reference> When a component with a resistance accuracy of ±0.5% is used, V_{O3''} is 8.67V ≤ 9.0V ≤ 9.33V.

*5 : When a component with a resistance accuracy of ±1% is used

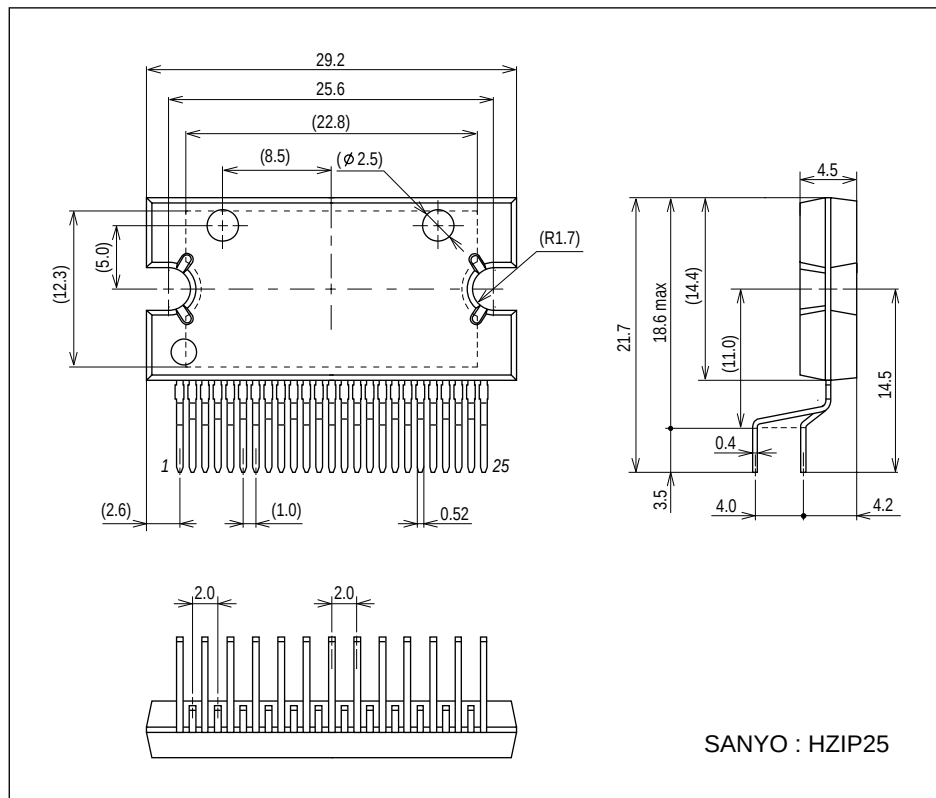
The absolute accuracy of the internal resistance is ±15%.

*6 : Since the SW 5V and ACC 5V are output from V_{DD} 5V through the SW, the voltage drops by an amount equivalent to the ON resistance of the SW.

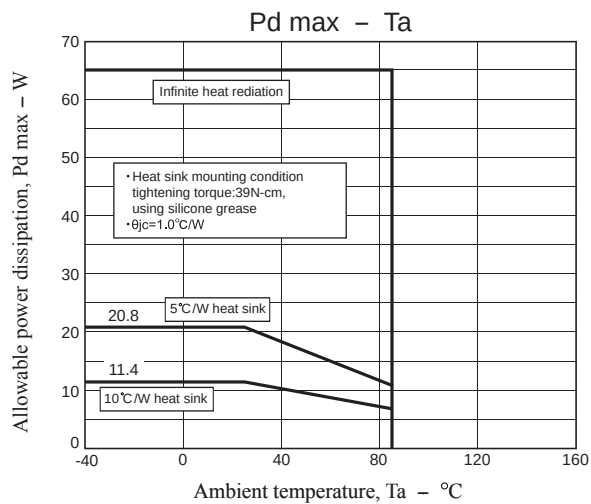
Package Dimensions

unit : mm (typ)

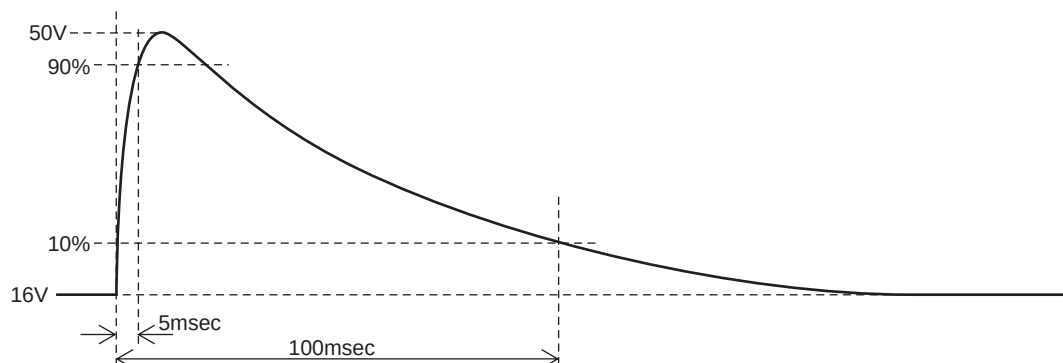
3236A



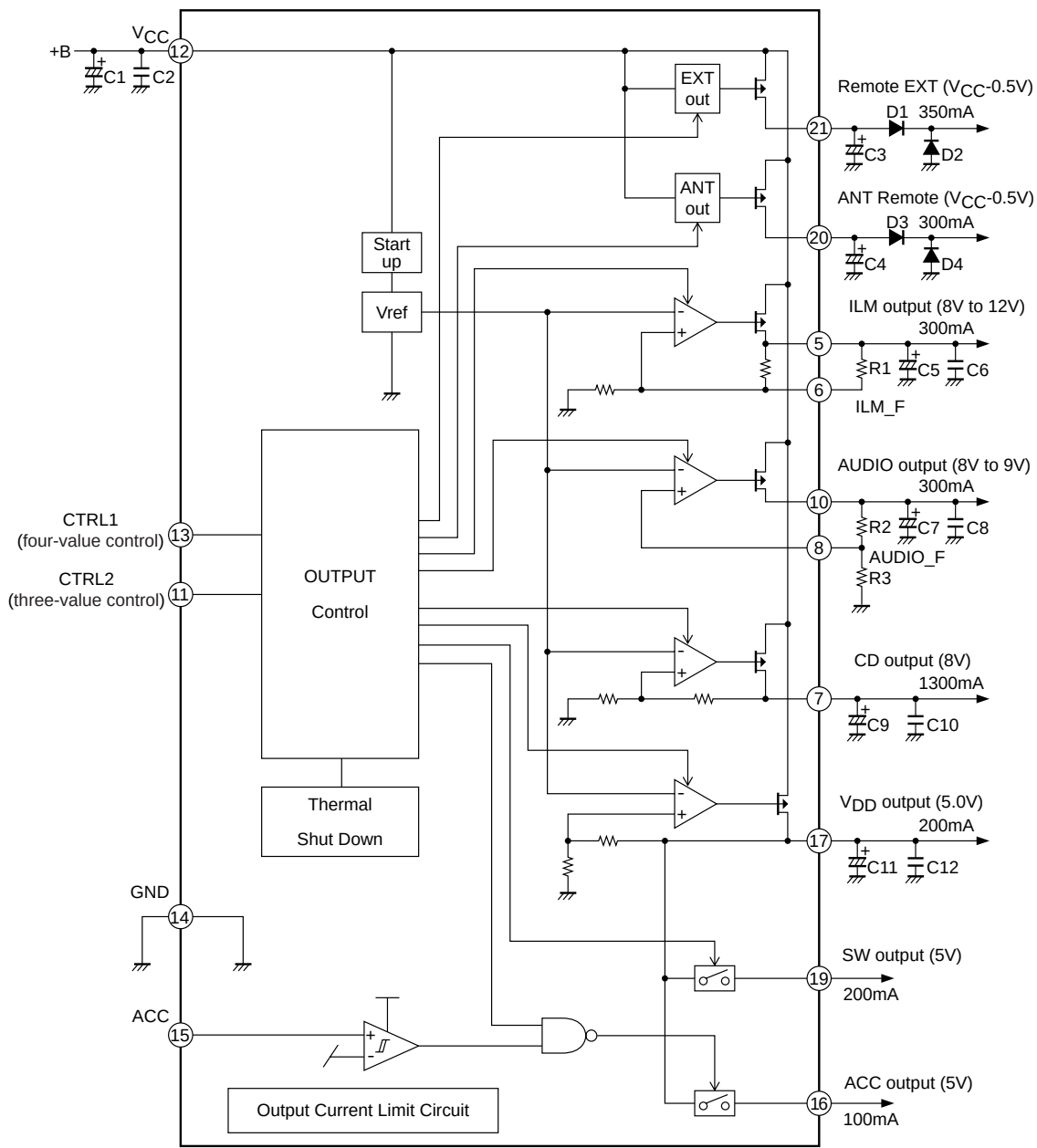
- Allowable power dissipation derating curve



- Waveform applied during surge test



Block Diagram



Pin Function

Pin No.	Pin name	Description	Equivalent Circuit
1 to 4	N.C.	-	-
5	ILM	ILM output pin ON when CTRL1 = M1, M2, H 12.0V/300mA	The equivalent circuit diagram shows the internal structure for pins 5, 6, and 14. It includes a V_{CC} supply, a GND connection, and a network of resistors (59.67kΩ, 7kΩ) and capacitors. The circuit is designed to provide a regulated 12.0V output at 300mA from pin 5, with pin 6 serving as the feedback point (ILM_F) and pin 14 as the ground reference.
6	ILM_F	ILM output voltage adjustment pin	

Continued on next page.

LV5682P

Continued from preceding page.

Pin No.	Pin name	Description	Equivalent Circuit
7	CD	CD output pin ON when CTRL2 = M, H 8.0V/1.3A	
8	AUDIO_F	AUIDO output voltage adjustment pin	
9	N.C.	-	
10	AUDIO	AUDIO output pin ON when CTRL2 = M, H	
11	CTRL2	CTRL2 input pin three-value input	
12	VCC	Supply terminal	
13	CTRL1	CTRL1 input pin four-value input	
14	GND	GND pin	

Continued on next page.

LV5682P

Continued from preceding page.

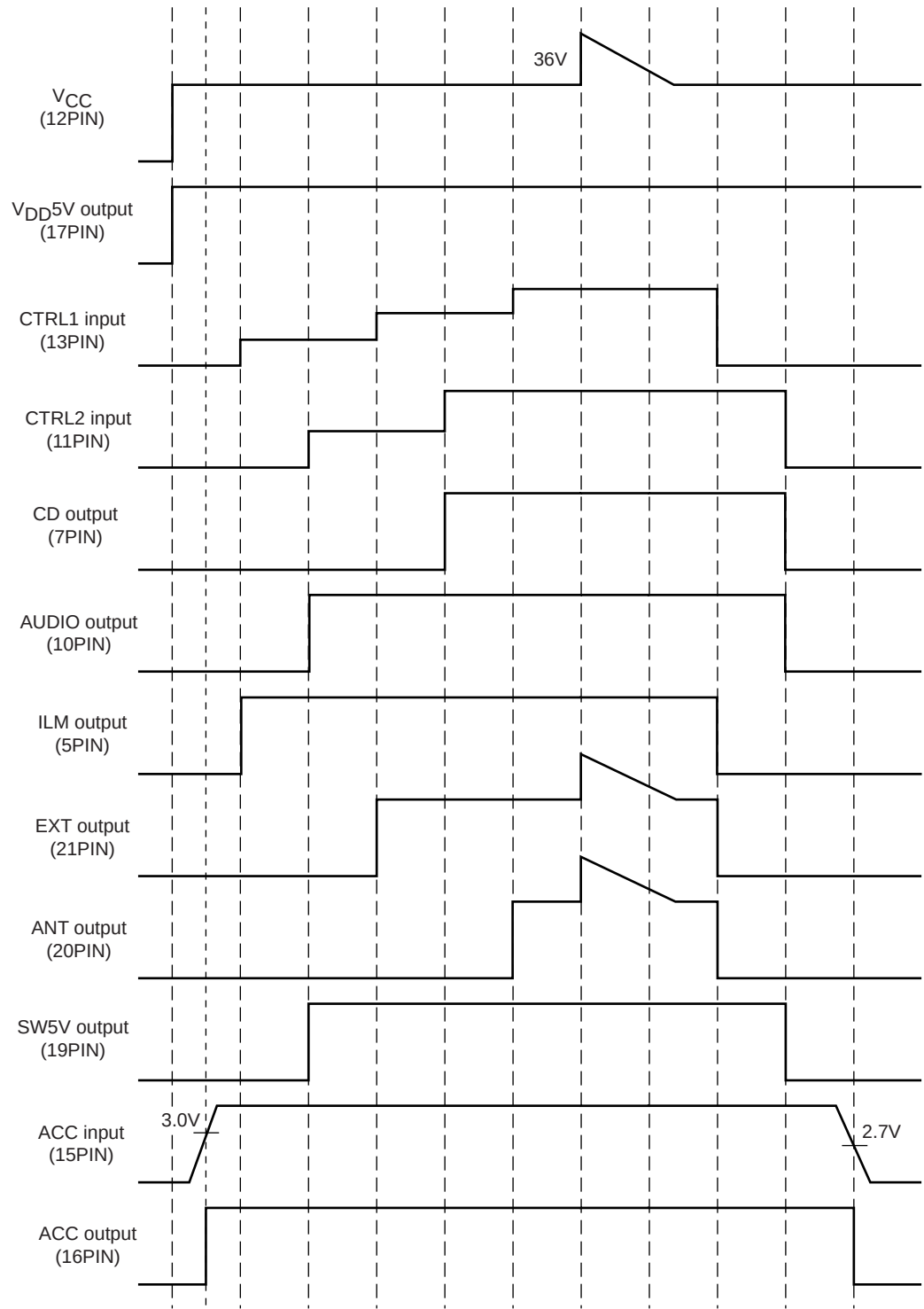
Pin No.	Pin name	Description	Equivalent Circuit
15	ACC	Accessory input	
16	ACC5V	Accessory detection output ON when ACC > 3V	
17	V _{DD} 5V	V _{DD} 5V output pin 5.0V/200mA	
18	N.C.	-	
19	SW5V	SW5V output pin ON when CTRL2 = M, H	
20	ANT	ANT output pin ON when CTRL1 = H V _{CC} -0.5V/300mA	
21	EXT	EXT output pin ON when CTRL1 = M2, H V _{CC} -0.5V/350mA	
22 to 25	N.C.	-	-

CTRL Pin Output Truth Table

CTRL1	ANT	EXT	ILM
L	OFF	OFF	OFF
M1	OFF	OFF	ON
M2	OFF	ON	ON
H	ON	ON	ON

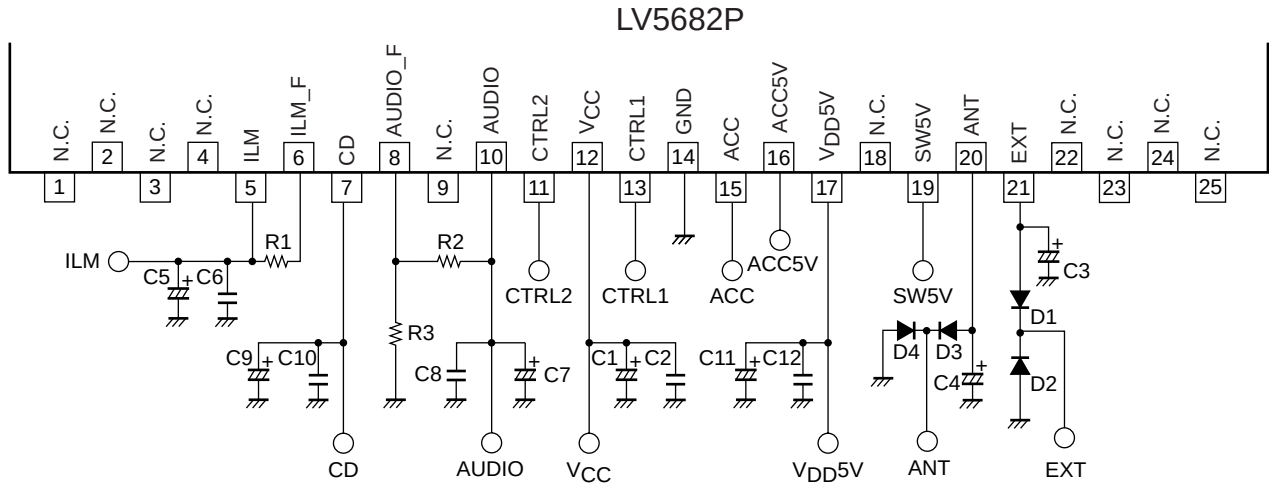
CTRL2	CD	AUDIO	SW5
L	OFF	OFF	OFF
M	OFF	ON	ON
H	ON	ON	ON

Timing Chart



LV5682P

Recommended Operation Circuit



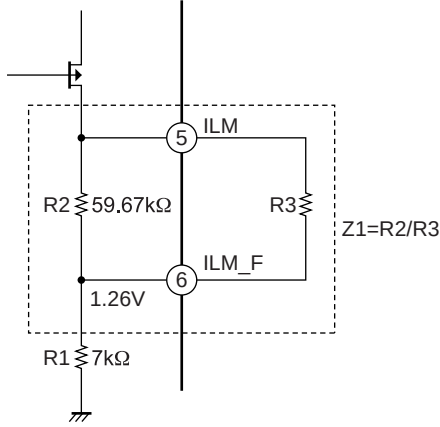
Peripheral parts list

Name of part	Description	Recommended value	Remarks
C1	Power supply bypass capacitor	100 μ F or more	These capacitors must be placed near the V _{CC} and GND pins.
C2	Oscillation prevention capacitor	0.22 μ F or more	
C3	EXT output stabilization capacitor	2.2 μ F or more	
C4	ANT output stabilization capacitor	2.2 μ F or more	
C6, C9, C11, C13	Output stabilization capacitor	4.7 μ F or more	Electrolytic capacitor *
C7, C10, C12, C14	Output stabilization capacitor	0.22 μ F or more	Ceramic capacitor *
R1	Resistor for ILM voltage adjustment	ILM output voltage R1:without = 12.0V :270k Ω = 10.0V	A resistor with resistance accuracy as low as less than $\pm 1\%$ must be used.
R2, R3	Resistor for AUDIO voltage setting	R2/R3:30k Ω /5.6k Ω = 8.0V :27k Ω /4.7k Ω = 8.5V :24k Ω /3.9k Ω = 9.0V	A resistor with resistance accuracy as low as less than $\pm 1\%$ must be used.
D1, D2, D3, D4	Diode for internal device breakdown protection		Recommendation: SBD1003M3(30V/1.0A)

* : In order to stabilize the regulator outputs, it is recommended that the electrolytic capacitor and ceramic capacitor be connected in parallel.

Moreover, the above-mentioned value doesn't guarantee the operation stability in use and the overcurrent protection operation by I_{Omax} or more of the regulator. Therefore, there is a possibility of oscillating by use conditions.

• ILM output voltage setting method



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

Formula for ILM voltage calculation

$$Z_1 = R_2 // R_3 = \frac{R_2 \cdot R_3}{R_2 + R_3}$$

$$ILM = \frac{1.26[V]}{R_1} \times Z_1 + 1.26[V]$$

$$Z_1 = \frac{(ILM - 1.26) \cdot R_1}{1.26} \quad R_3 = \frac{R_2 \cdot Z_1}{R_2 - Z_1}$$

Example : ILM = 9V setting method

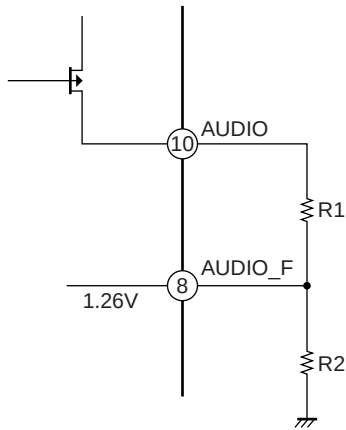
$$Z_1 = \frac{(9V - 1.26V) \cdot 7k\Omega}{1.26V} \cong 43k\Omega$$

When R3 = 150k, the ILM output voltage will be as follows:

$$Z_1' = \frac{59.67k\Omega \cdot 150k\Omega}{59.67k\Omega + 150k\Omega} \cong 42.69k\Omega$$

$$ILM = \frac{1.26V}{7k\Omega} \times 42.69k\Omega + 1.26V \cong 8.94V$$

• AUDIO output voltage setting method



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

Formula for AUDIO voltage calculation

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

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

The circuit must be designed in such a way that the R1:R2 ratio satisfies the formula given above for the AUDIO voltage that has been set.

Example : AUDIO = 8.5V setting method

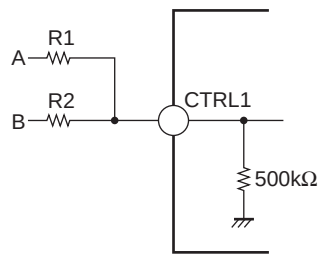
$$\frac{R_1}{R_2} = \frac{(8.5 - 1.26)}{1.26} \cong 5.75$$

$$\frac{R_1}{R_2} = \frac{27k\Omega}{4.7k\Omega} \cong 5.74$$

$$AUDIO = 1.26V \times 5.74 + 1.26V \cong 8.49V$$

Note : In the above, the typical values are given in all instances for the values used and, as such, they will vary due to the effects of production-related variations of the IC and external resistors.

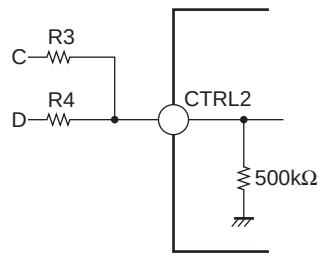
• CTRL1 Application Circuit Example



(1) 3.3V input: R1 = 4.7kΩ, R2 = 10kΩ

A	B	CTRL1
0V	0V	0V
0V	3.3V	1.05V
3.3V	0V	2.23V
3.3V	3.3V	3.20V

• CTRL2 Application Circuit Example



(1) 3.3V input: R3 = R4 = 4.7kΩ

A	B	CTRL2
0V	0V	0V
0V	3.3V	1.61V
3.3V	0V	1.61V
3.3V	3.3V	3.29V

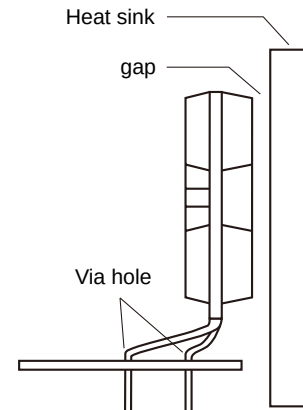
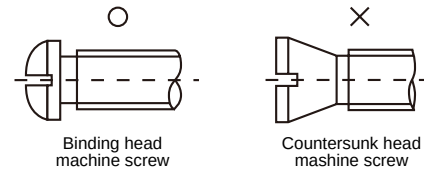
HZIP25 Heat sink attachment

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

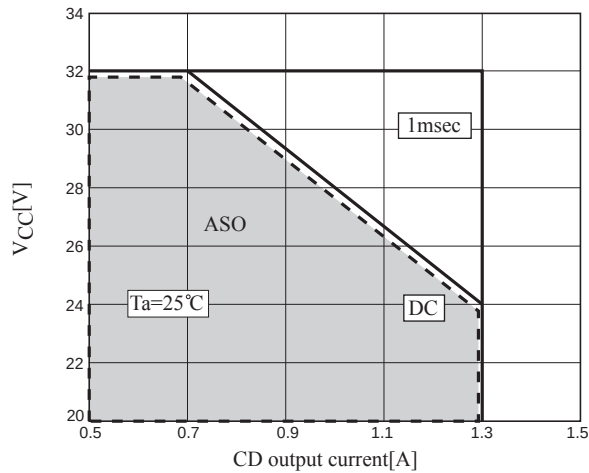
- Be sure that chamfering and shear drop of heat sinks must not be larger than the diameter of screw head used.
- When using nuts, do not make the heat sink hole diameters larger than the diameter of the head of the screws used. A hole diameter about 15% larger than the diameter of the screw is desirable.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

Caution for usage

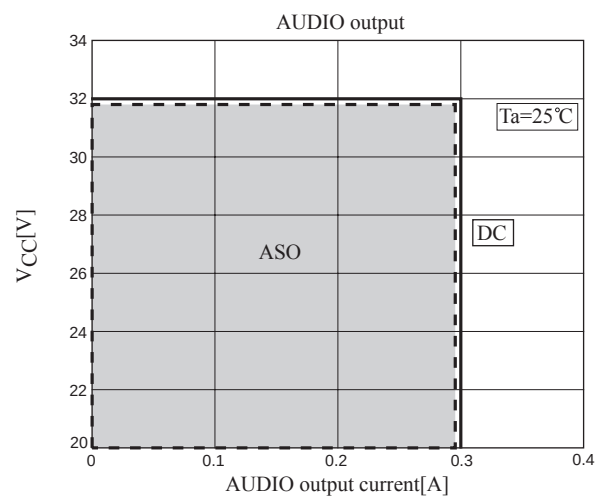
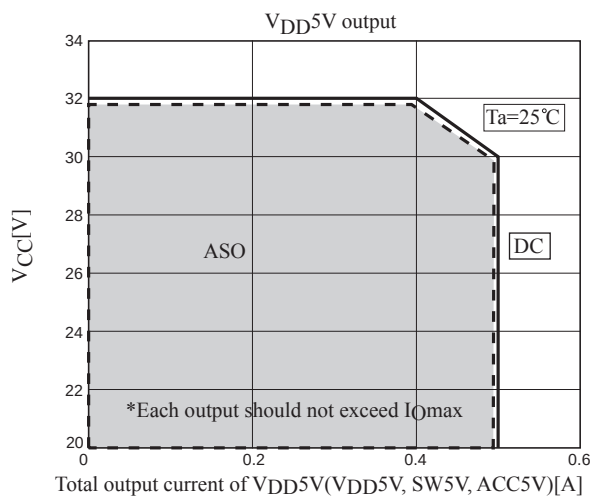
When allowable power dissipation and power supply voltage exceed absolute maximum ratings or depends on usage conditions, LV5682P may be destroyed before Thermal Shut Down circuit operates.

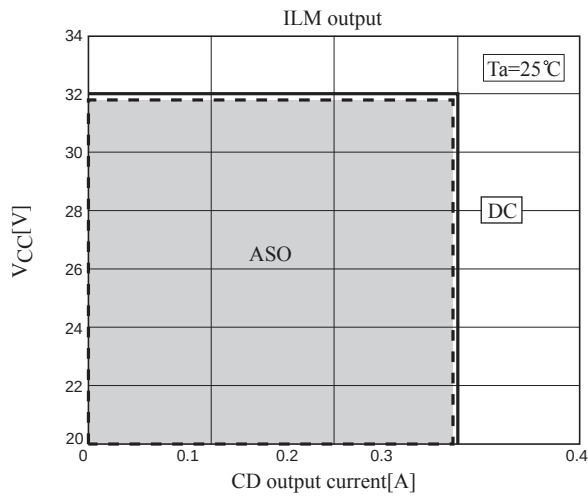
Particularly caution is required for CD output. CD output can output high current and power dissipation is high. Therefore, when electric potential of VCC is high, a risk for IC destruction increases. The following diagram shows Area of Safety Operation (ASO) CD output under the TYP conditions. However, it only shows the case where CD output is used independently. IC destruction may occur due to usage conditions in your system or manufacturing process of the IC. Therefore, your system should be designed with margin for a practical usage.



*CD output is used independently with board and without heatsink

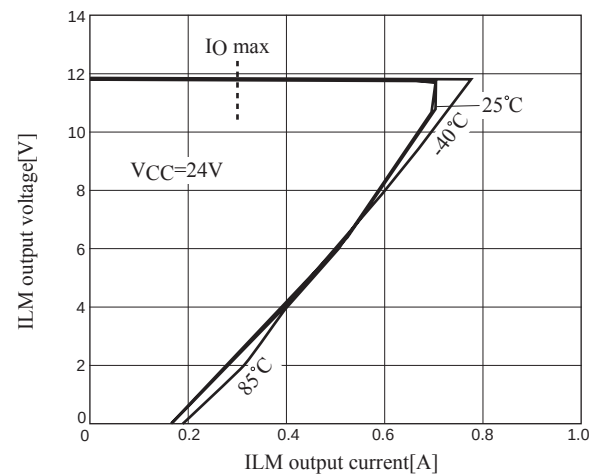
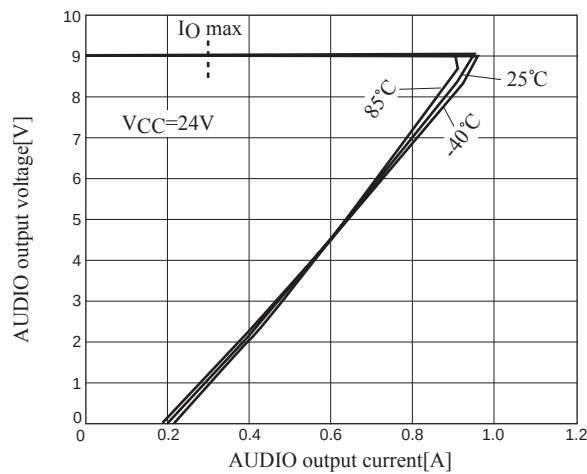
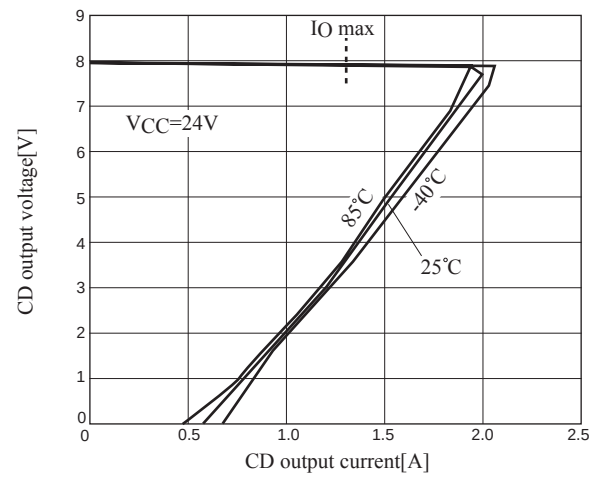
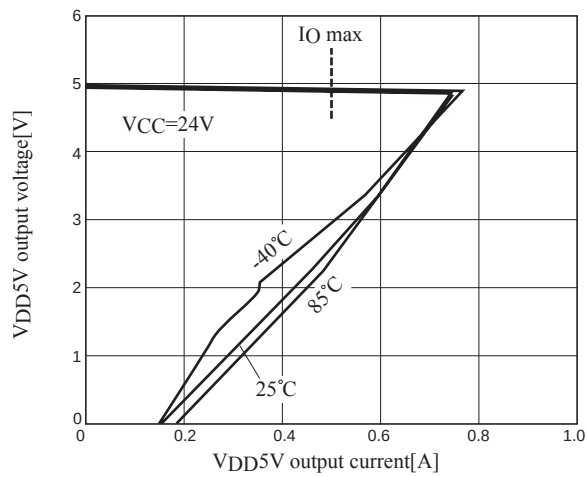
Other channel of Area of Safety Operation (ASO)

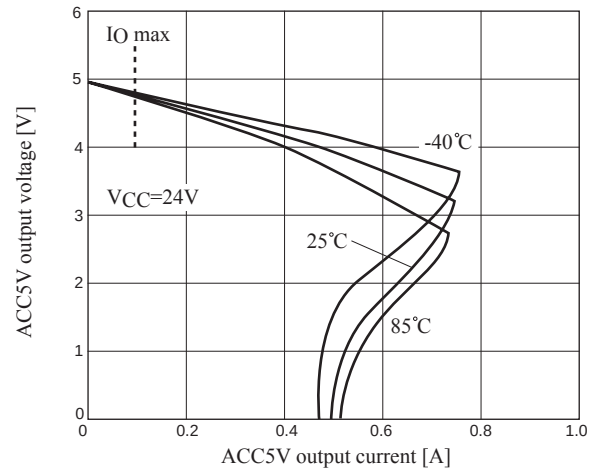
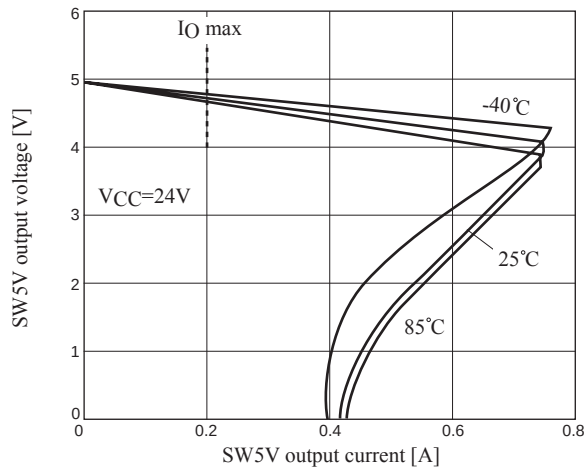
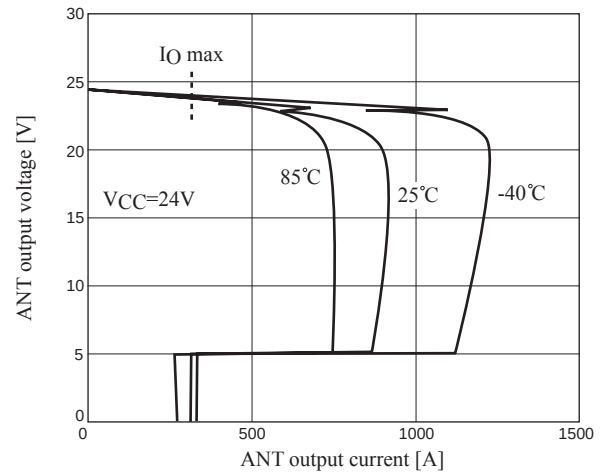
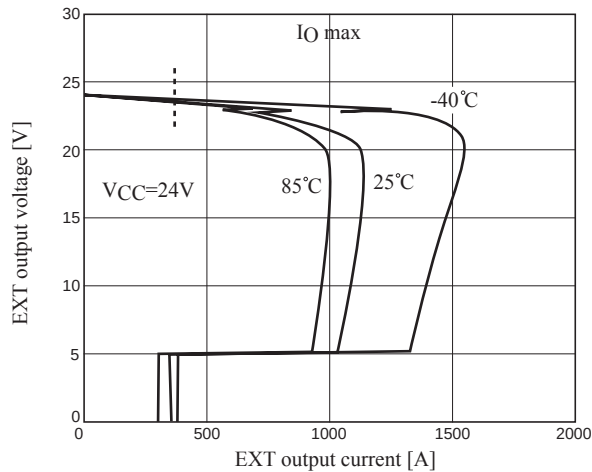




*Characteristics of output current vs. output voltage (output pin).

Evaluation is performed with pulse load so that T_j and T_a become almost equal. Also, the following shows typical characteristics with a standard sample. Characteristics may fluctuate depends on IC manufacturing process.





- 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 November, 2011. Specifications and information herein are subject to change without notice.