

General Description

- Two Pch MOSFETs for high side power switches, two Nch for low side and one control IC are integrated into one package.
- Enables to drive a motor by DC drive at up to 5ADC or by pulse drive at up to 16A.
- PWM input signal is 20 kHz max, and phase changeover frequency is 500Hz max.
- Input signals for IN1 and IN2 control the output of each phase with normal, reverse, brake, and free-run mode.
- In order to prevent shoot through current during phase changeover, the control IC set the dead time. Dead time: 20μS (typ).
- Versatile protection functions:
 - Over current protection for each power switch (Latch mode)
 - Thermal shutdown (TSD)
 - DIAG output function: Outputs the diagnosis during abnormal operation.

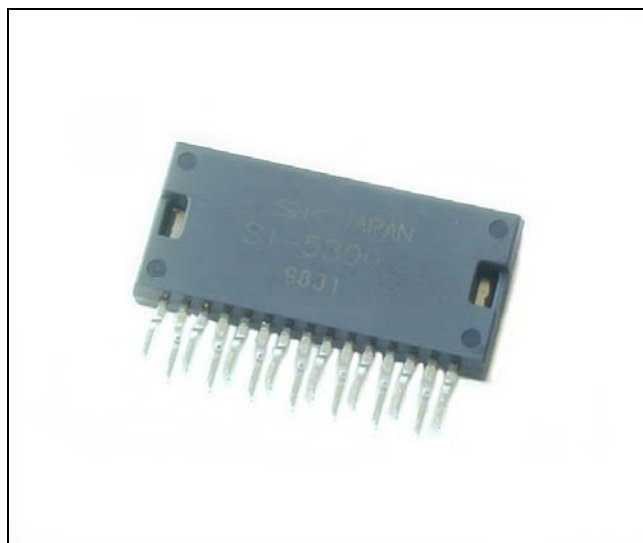
Applications

- Driving various DC motors (PWM control)
- Throttle valve for automotive application

Features

SI-5300 incorporates two high side Pch MOSFETs, two low side Nch MOSFETs, and a control IC in one package. Overcurrent protection function for each power switch, and thermal shutdown function for control IC. Also, the dead time (20μS) is set in the control IC to prevent turning on the high side MOSFETs at the same timing.

Package---SPM

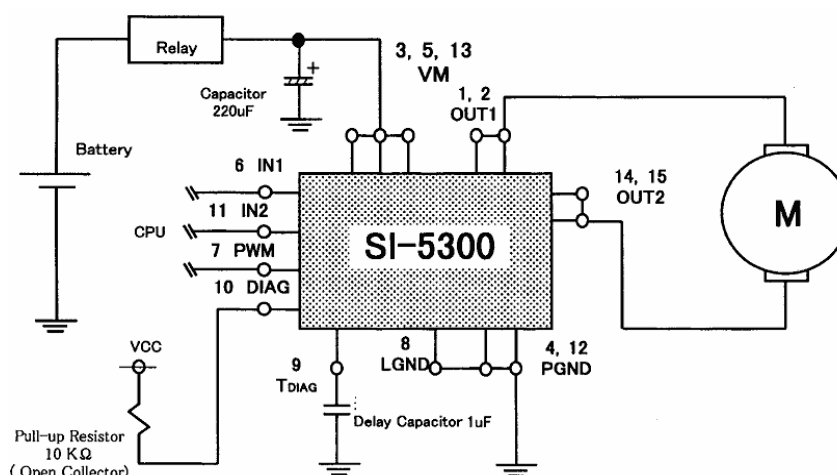


Key Specifications

•Absolute maximum rating *1 with infinite heatsink

Parameter	Signal	Ratings	Remarks
Motor supply voltage	VM	40V(max)	
Input voltage	VINx,PWM	-0.3~7.0V	
Output current	Io	±5A	
	Iop-p	±16A	
PWM control frequency	f PWM	20KHz(max)	
Phase transition frequency	f CW	500Hz(max)	
Junction temperature	Tj	-40~150°C	
Power dissipation	PD1	3.6W	
	PD2	33.7W	*1

Typical Connection



1. Absolute maximum ratings (Ta=25°C)

Characteristics	Symbol	Rating	Unit	Remarks
Motor Supply Voltage	VM	40	V	
Output Current	IOUT1	±5	A	
	IOUT2	±16	A	*1
Logic Input Voltage	IN1	-0.3 to 7	V	
	IN2	-0.3 to 7	V	
	PWM	-0.3 to 7	V	
PWM Control Frequency	fPWM	20	KHz	Duty=20~80%
Forward and Reverse Change Frequency	fCW	500	Hz	*2
Total Device Power Dissipation	Pd1	3.6	W	No heatsink
	Pd2	33.7	W	Infinite heatsink
Thermal Resistance	Θj-a	35	°C/W	
	Θj-c	3.7	°C/W	
Junction Temperature	Tj	-40 to 150	°C	
Operation Temperature	Top	-40 to 85	°C	
Storage Temperature	Tstg	-40 to 150	°C	

*1 $PW \leq 1mS, Duty \leq 50\%$

*2 The dead time for the length current prevention in positive and the reversing switch is set by internal control IC. The set point in internal control IC at the dead time is 20 μS (TYP).

Please confirm, and use the load condition.

2. Recommended operating conditions

Characteristics	Symbol	Rating	Unit	Remarks
Motor Supply Voltage	VM	6 to 18	V	
Logic Input Voltage	VIN1, VIN2, PWM	-0.3 to 5	V	
PWM Control Frequency	fPWM	10	KHz	
Output Current	Io	±3	A	
DIAG Terminal Output Voltage	VDIAG	-0.3 to 6	V	
DIAG Terminal Sink Current	IDIAG	1	mA	
Operation Temperature	Top	-40 to 85	°C	

3. Electrical characteristics (Tj=25°C, VM=14V, Io=3A unless otherwise specified)

Characteristics	Symbol	Rating			Unit	Remarks
		min	typ	max		
Motor Supply Voltage	VM	6		18	V	VM=24V(2min)
Output saturation voltage	V, VM-Vo			0.8	V	Io=3A
	V, Vo-PG			0.3		Io=3A
Output leak current	IL,L			100	μA	VM=40V
	IL,H			100		VM=40V
Output transmission time	tpLH			10 *5	μS	VPWM : L⇒H(Vth=2.5typ)
	tpHL			15 *6		VPWM : H⇒L(Vth=2.5typ)
	tpHL-tpLH			10		
Forward voltage characteristic of diode between drain and source	VF·L		0.8		V	Io=3A
			1.0			Io=10A
	VF·H		0.8			Io=3A
			1.0			Io=10A
Quiescent current	IM1		22		mA	Stop mode
	IM2		22			Forward and reverse mode
	IM3		16			Brake mode
Voltage of input terminal	VIN,H	3.0			V	VIN1=VIN2=VPWM
	VIN,L			2.0		VIN1=VIN2=VPWM
Current of input terminal	IIN,L	-100			μA	VIN1=VIN2=VPWM=0V
	IIN,H			200	μA	VIN1=VIN2=VPWM=5V
Over current protection starting current	Iocp	16			A	*3
DIAG terminal output Voltage of pulse width	tDIAG	20			mS	CDIAG=1μF(typ)
DIAG terminal output Voltage of satisfaction	VD·L			0.3	V	ID·SINK=1mA *4

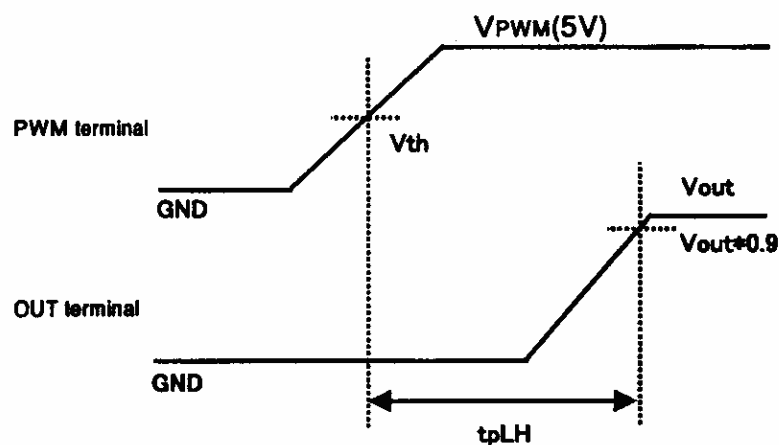
【Note】

- *3 The standard value of Iocp is assumed to be a value by which the output of each power MOSFET cuts off. When the protection circuit of OCP and TSD operates, power MOSFET's keeps cutoff. When a signal(5V:H⇒0V:L) is input to the terminal PWM, the cutoff operation will be released. Moreover, Three minutes (Ta=25°C, fPWM=10Khz, VM=14V) are assumed to be max at the over current state continuance Time in the VM operation and ground of output terminal (OUT1,OUT2). It is not the one to assure the operation including reliability in the state that the sort-circuit continues for along time.

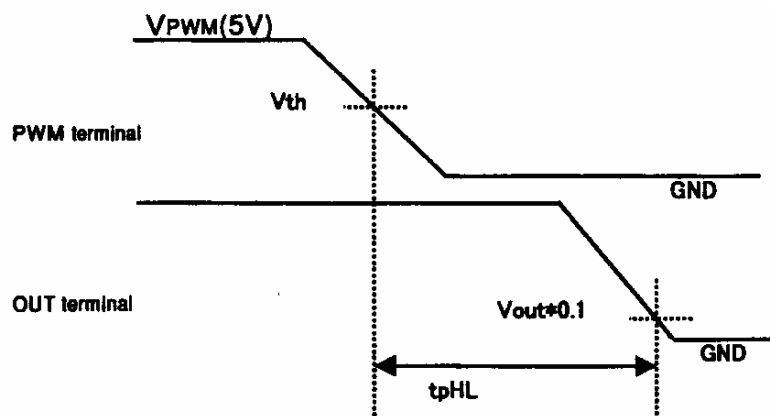
- *4 DIAG signal output terminal is an collector output. Use apull-up resistor when connecting it to a logic circuit.

SI-5300

September 2005

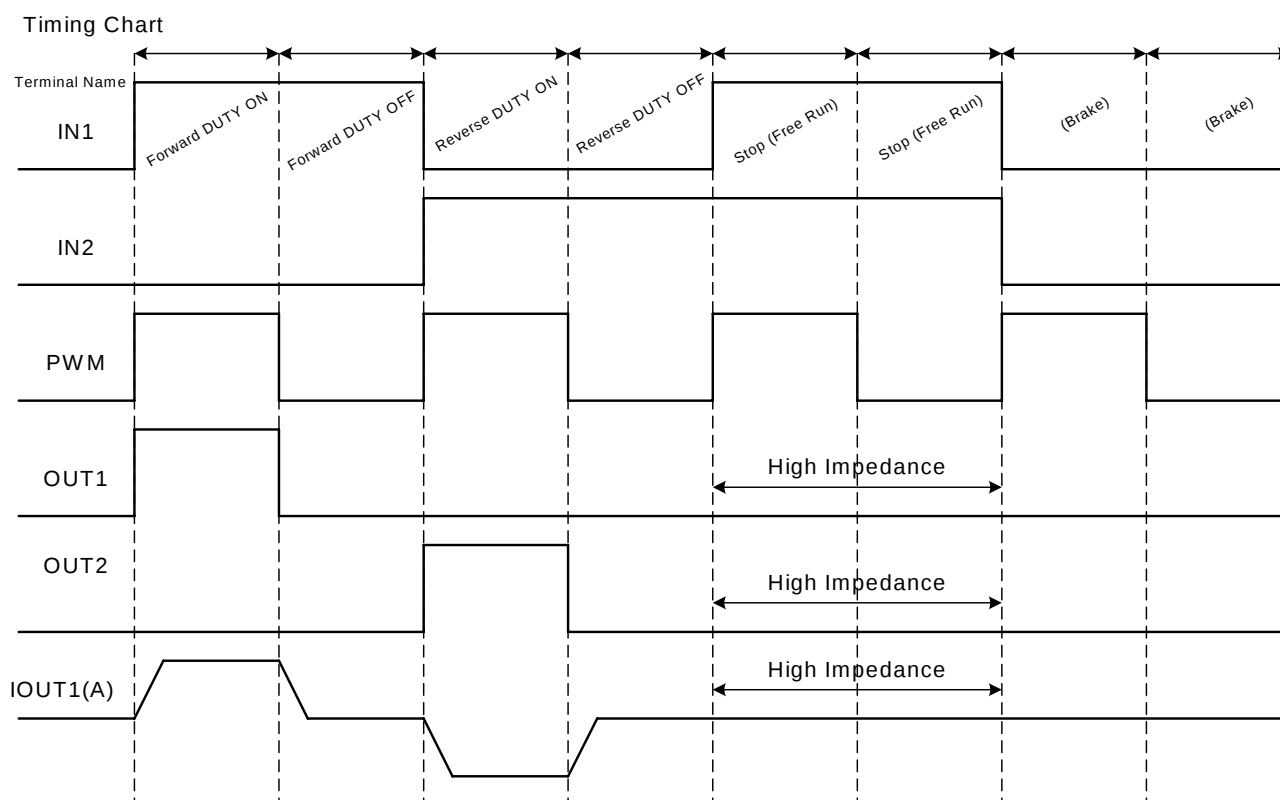
*5 Output transmission time(t_{pLH})

Output transmission time t_{pLH} is time from $V_{th}(2.5V_{typ})$ of the terminal of PWM to output ($V_{out} * 0.9$) of the output terminal.

*6 Output transmission time(t_{pHL})

Output transmission time t_{pHL} is time from $V_{th}(2.5V_{typ})$ of the terminal of PWM to output ($V_{out} * 0.9$) of the output terminal.

4. Timing chart of input and output

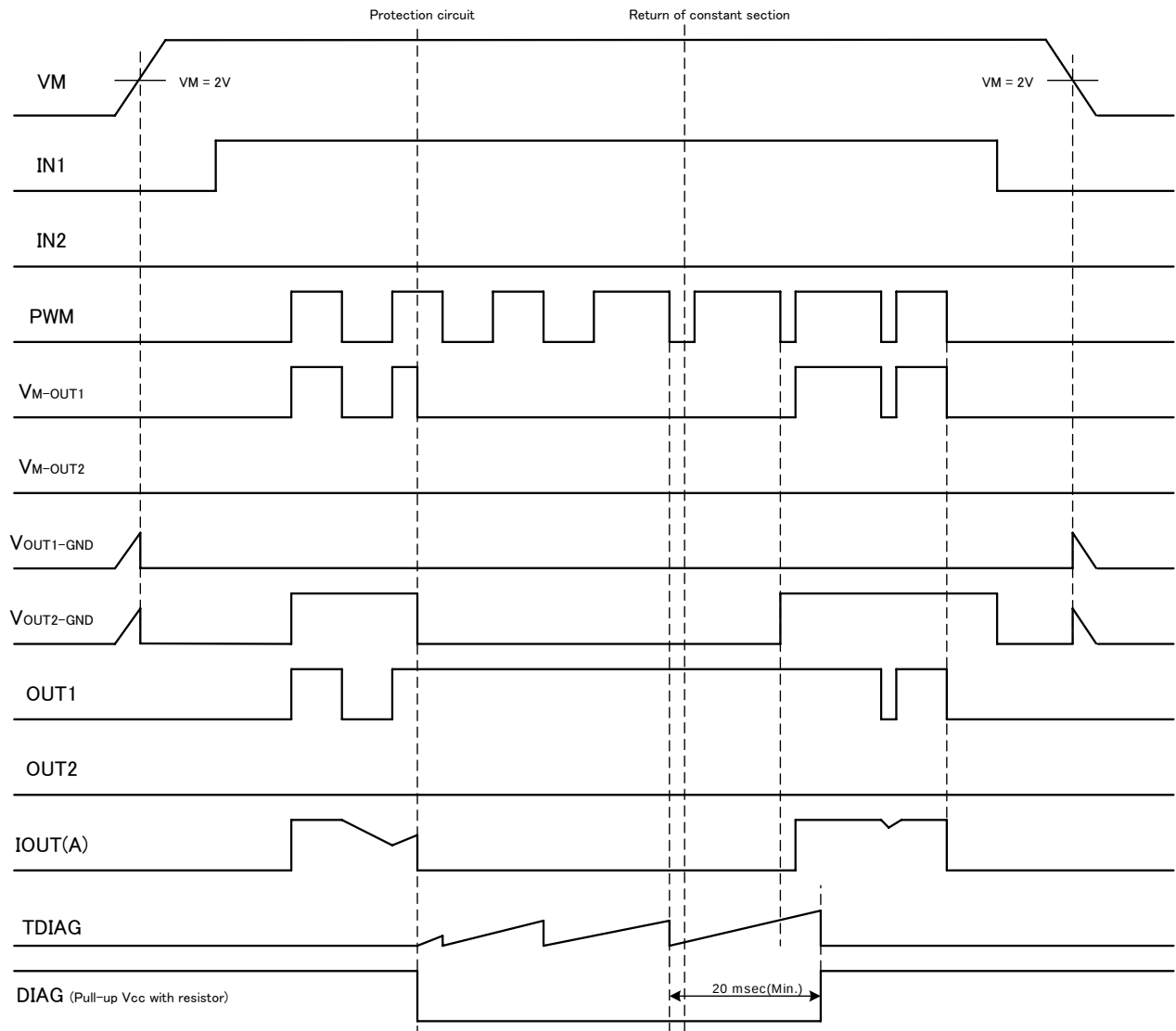


Input signal			Output Signal		Power MOS operation				Function
IN1	IN2	PWM	OUT1	OUT2	Tr1(P1)	Tr2(P2)	Tr3(N1)	Tr4(N2)	
H	H	H	Z	Z	OFF	OFF	OFF	OFF	Stop mode
H	H	L	Z	Z	OFF	OFF	OFF	OFF	Stop mode
L	L	H	GND	GND	OFF	OFF	ON	ON	Break mode
L	L	L	GND	GND	OFF	OFF	ON	ON	Break mode
H	L	H	VM	GND	ON	OFF	OFF	ON	Normal mode(Duty ON)
H	L	L	Z	GND	OFF	OFF	OFF	ON	Normal mode(Duty OFF)
L	H	H	GND	VM	OFF	ON	ON	OFF	Reverse mode(Duty ON)
L	H	L	GND	Z	OFF	OFF	ON	OFF	Reverse mode(Duty OFF)

H: High level L: Low level Z: High impedance

GND: GND level ON: Power MOSFET ON OFF: Power MOSFET OFF

5. Timing chart

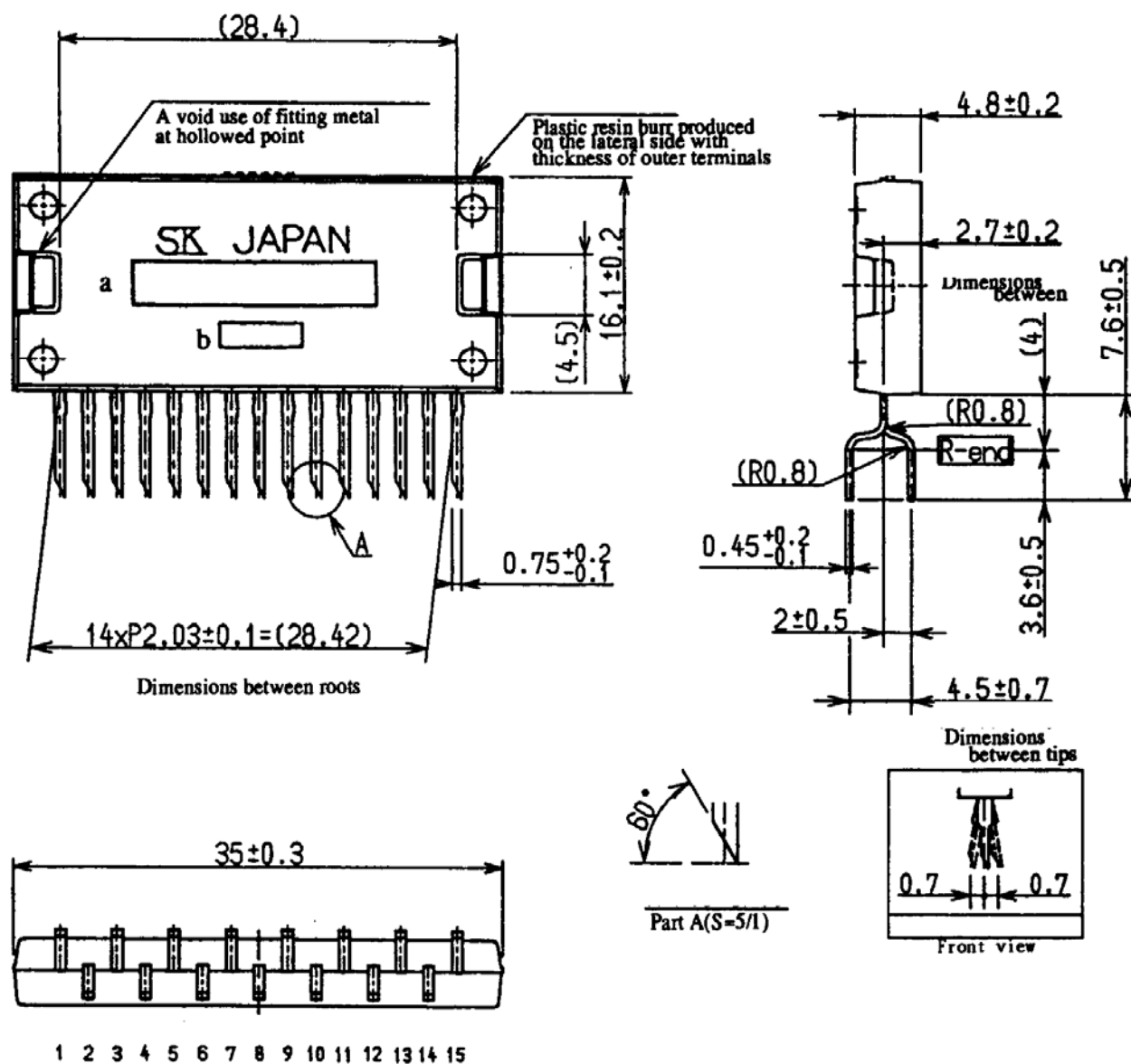


SI-5300

September 2005

7. Package information(Lead forming No.1505)

Package type , physical dimensions and material



☆ Appearance

The body shall be clean and shall not bear any stain , rust or flaw.

☆ Marking

The type number and lot number shall be marked on the body by Laser which shall not be unreadable easily.

a: Type number

SI-5300

b: lot number

1st letter

The last digit of year

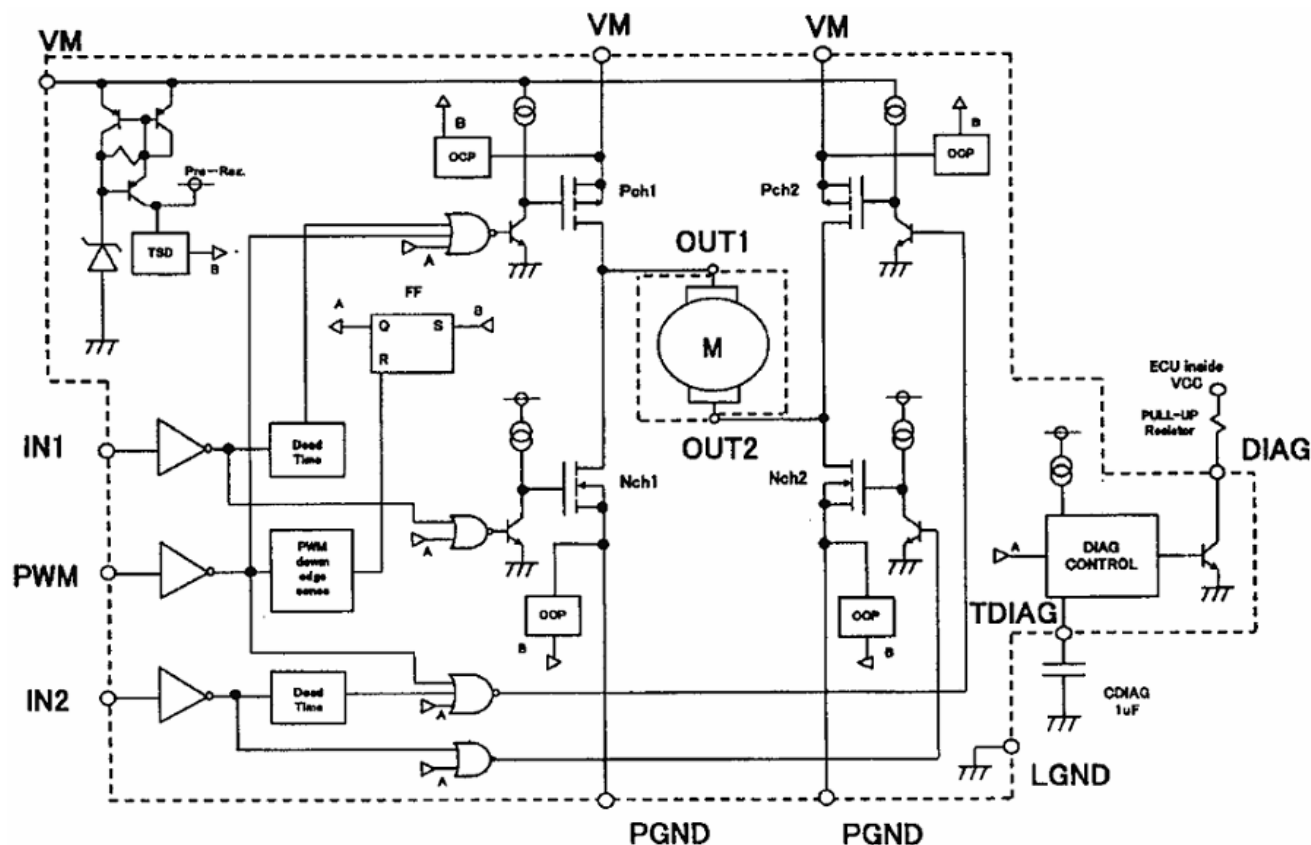
2nd letter

Month

3rd & 4th

day Arabic numerals

8-1. Equivalent Circuit



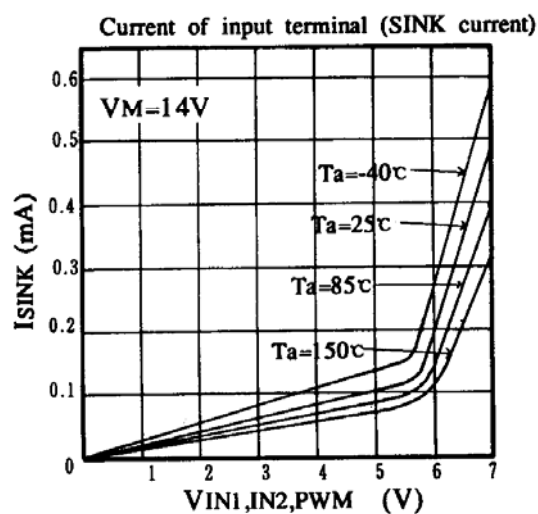
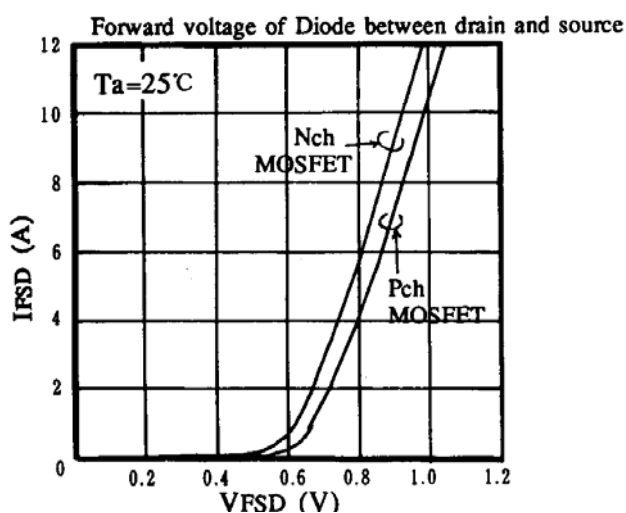
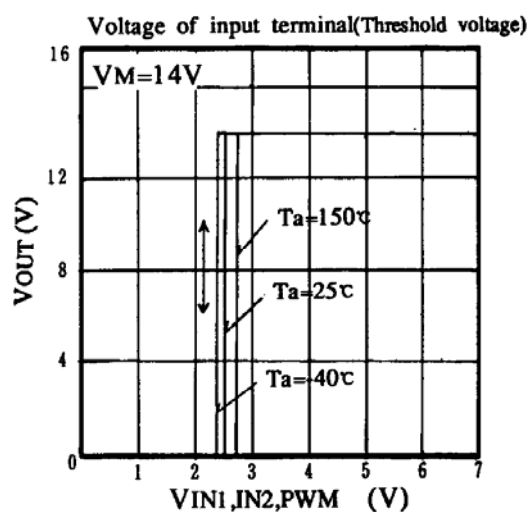
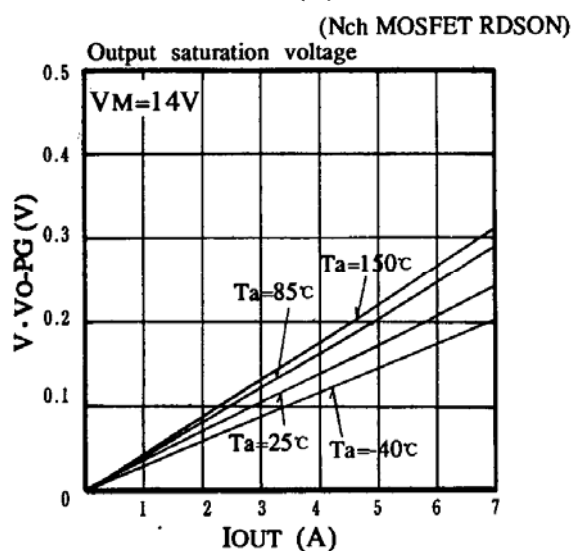
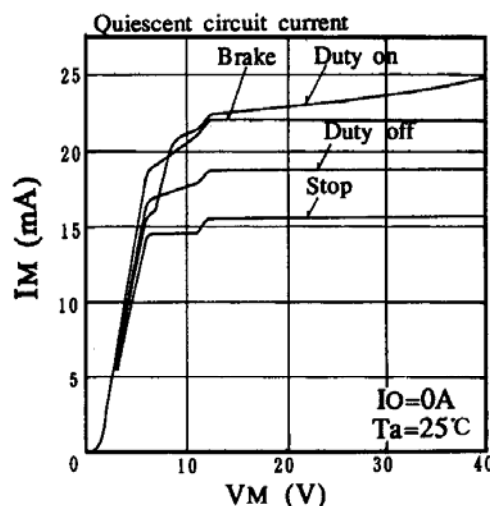
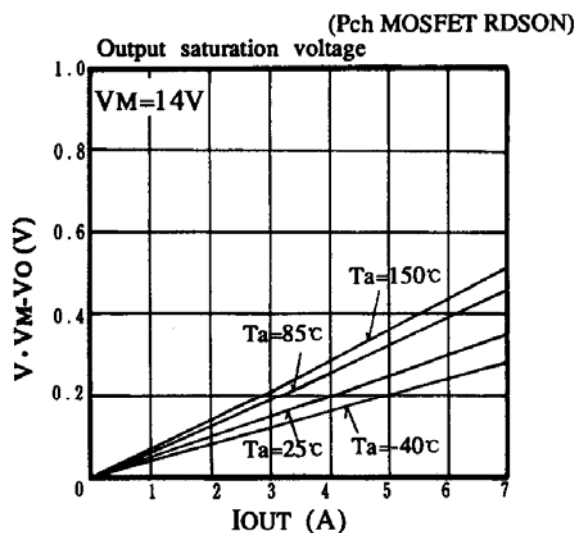
Pre-Reg : Battery inside circuit Dead Time : Protection circuit of length current
 PWM down edge sense : Detection circuit of PWM signal
 OCP : Over Current protection circuit TSD : Over temperature protection circuit
 DIAG CONTROL : DIAG control circuit

8-2. Terminal

Pin	Symbol	Function	Pin	Symbol	Function
1	OUT1	OUTPUT terminal 1	9	TDIAG	DIAG Delay time
2	OUT1	OUTPUT terminal 1	10	DIAG	Output terminal DIAG
3	VM	Motor Supply Voltage terminal	11	IN2	Input terminal IN2
4	PGND	PGND	12	PGND	PGND
5	VM	Motor Supply Voltage terminal	13	VM	Motor Supply Voltage terminal
6	IN1	Input terminal IN1	14	OUT2	OUTPUT terminal 2
7	PWM	Input terminal PWM	15	OUT2	OUTPUT terminal 2
8	LGND	LGND			

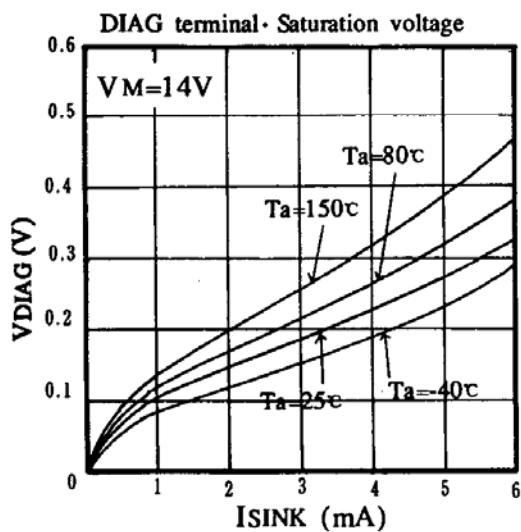
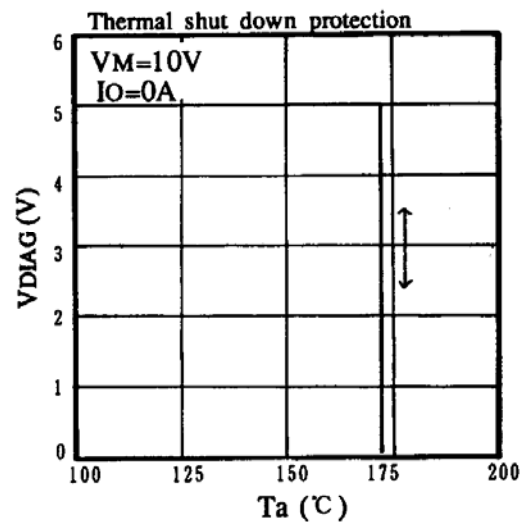
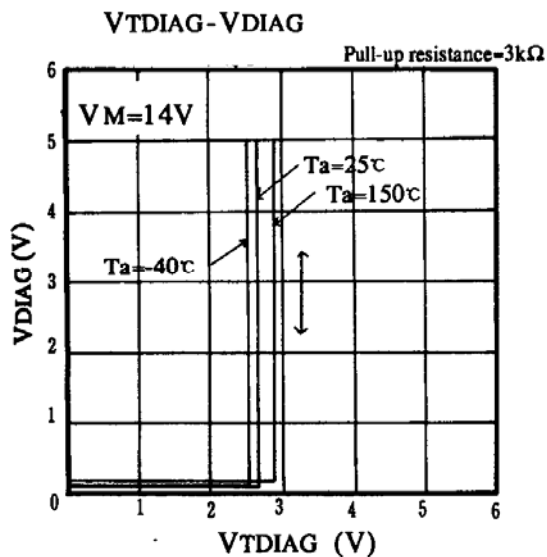
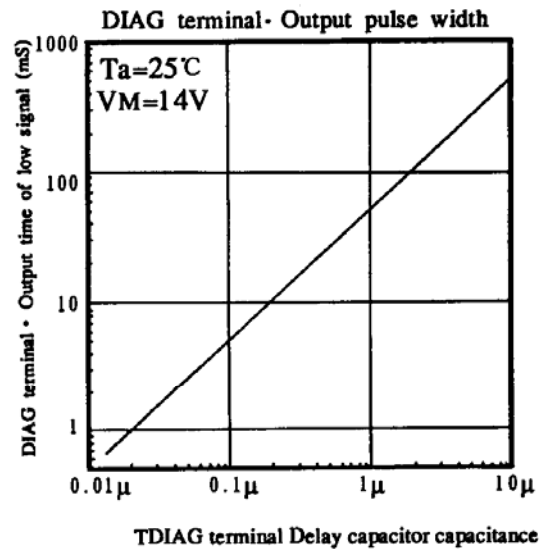
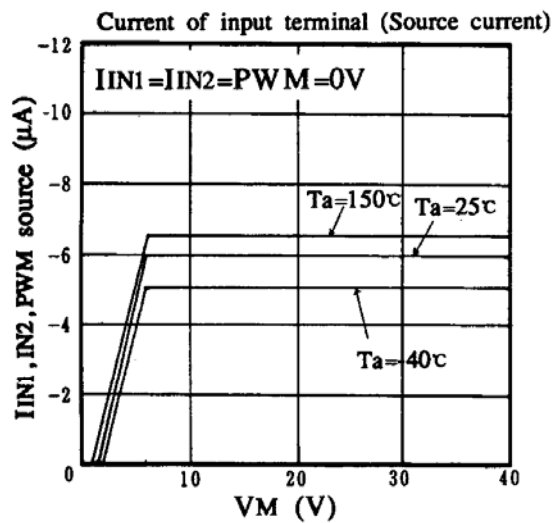
SI-5300

September 2005

9. Electrical characteristics $T_a=25^\circ\text{C}$ 

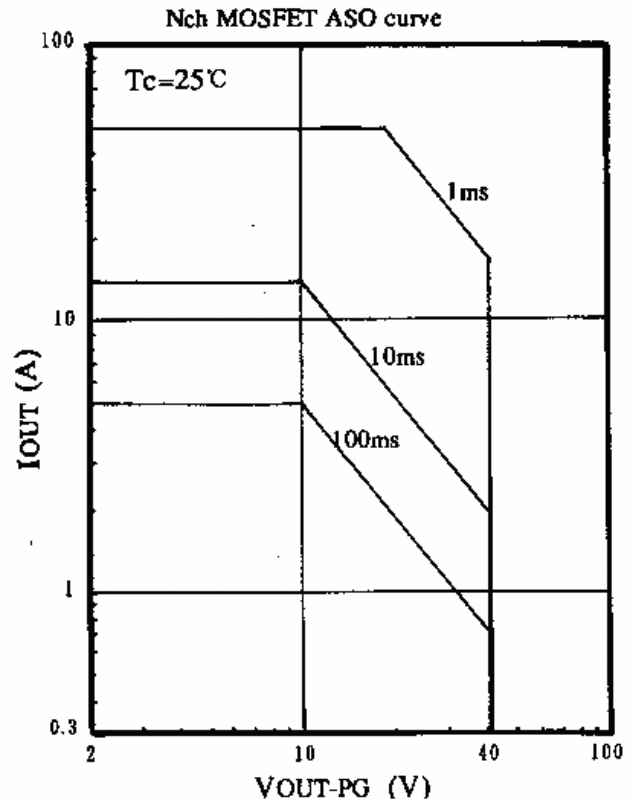
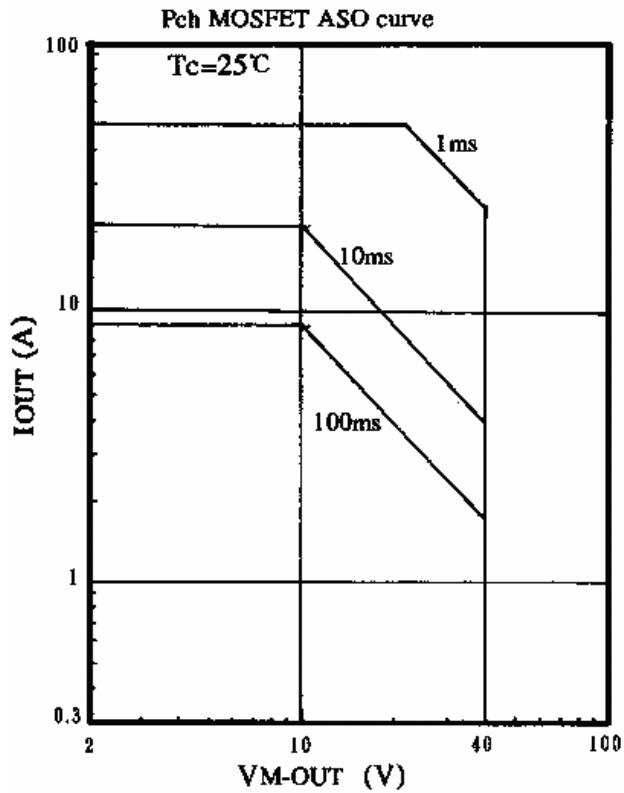
SI-5300

September 2005



SI-5300

September 2005



CAUTION / WARNING

- The information in this publication has been carefully checked and is believed to be accurate; however, no responsibility is assumed for inaccuracies.
 - Sanken reserves the right to make changes without further notice to any products herein in the interest of improvements in the performance, reliability, or manufacturability of its products.
Before placing an order, Sanken advises its customers to obtain the latest version of the relevant information to verify that the information being relied upon is current.
 - Application and operation examples described in this catalog are quoted for the sole purpose of reference for the use of the products herein and Sanken can assume no responsibility for any infringement of industrial property rights, intellectual property rights or any other rights of Sanken or any third party which may result from its use.
 - When using the products herein, the applicability and suitability of such products for the intended purpose or object shall be reviewed at the users' responsibility.
 - Although Sanken undertakes to enhance the quality and reliability of its products, the occurrence of failure and defect of semiconductor products at a certain rate is inevitable. Users of Sanken products are requested to take, at their own risk, preventative measures including safety design of the equipment or systems against any possible injury, death, fires or damages to the society due to device failure or malfunction.
 - Sanken products listed in this catalog are designed and intended for the use as components in general purpose electronic equipment or apparatus (home appliances, office equipment, telecommunication equipment, measuring equipment, etc.). Before placing an order, the user's written consent to the specifications is requested.
When considering the use of Sanken products in the applications where higher reliability is required (transportation equipment and its control systems, traffic signal control systems or equipment, fire/crime alarm systems, various safety devices, etc.), please contact your nearest Sanken sales representative to discuss and obtain written confirmation of your specifications. The use of Sanken products without the written consent of Sanken in the applications where extremely high reliability is required (aerospace equipment, nuclear power control systems, life support systems, etc.) is strictly prohibited.
 - Anti radioactive ray design is not considered for the products listed herein.
 - This publication shall not be reproduced in whole or in part without prior written approval from Sanken.
-
- This is notification that you, as purchaser of the products/technology, are not allowed to perform any of the following:
 1. Resell or retransfer these products/technology to any party intending to disturb international peace and security.
 2. Use these products/technology yourself for activities disturbing international peace and security.
 3. Allow any other party to use these products/technology for activities disturbing international peace and security.Also, as purchaser of these products/technology, you agree to follow the procedures for the export or transfer of these products/technology, under the Foreign Exchange and Foreign Trade Law, when you export or transfer the products/technology abroad.