Single-phase Full-wave Fan Motor Pre-driver

Chip description

The GC1267F is a single-phase bipolar driving motor pre-driver with the variable speed function compatible with external PWM signal. With a few external parts, a highly-efficient and highly-silent variable drive fan motor with low power consumption can be achieved. This product is best suited for driving of the server requiring large air flow and large current and the fan motor of consumer appliances.

Chip features

- Single-phase full-wave driving pre-driver
- Variable speed control possible with external PWM input
- Current limiting circuit incorporated
- Reactive current cut circuit incorporated
- Minimum speed setting pin
- Soft start setting pin
- Lock protection and automatic reset circuits incorporated
- FG (rotation speed detection) output
- Thermal shutdown circuit incorporated

Chip application

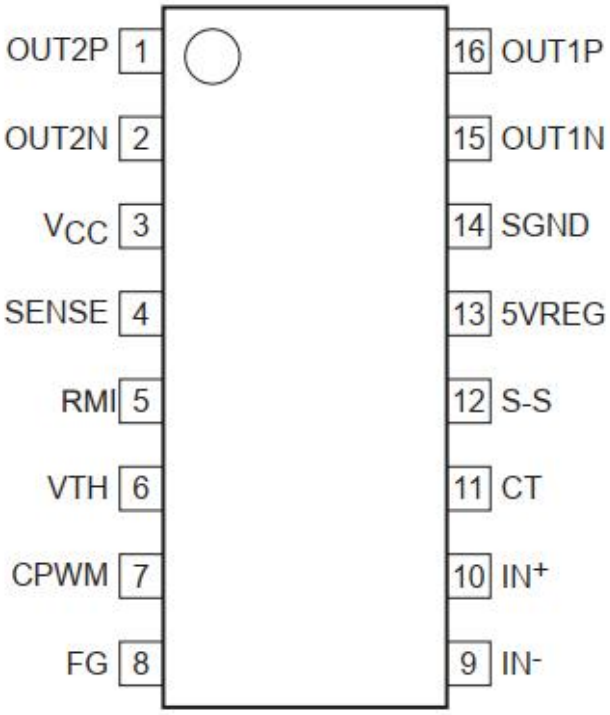
- CPU Cooler/VGA Fan
- Computing & Peripherals
- Industrial
- Server
- Vending Machine

Product name	Package Type	Detail description
GC1267F	SSOP16	4.0*5.0,e=0.635

Packaging Introduction

Per Tray	Per Box	Per Case
4K	8K	64K

Pin Map

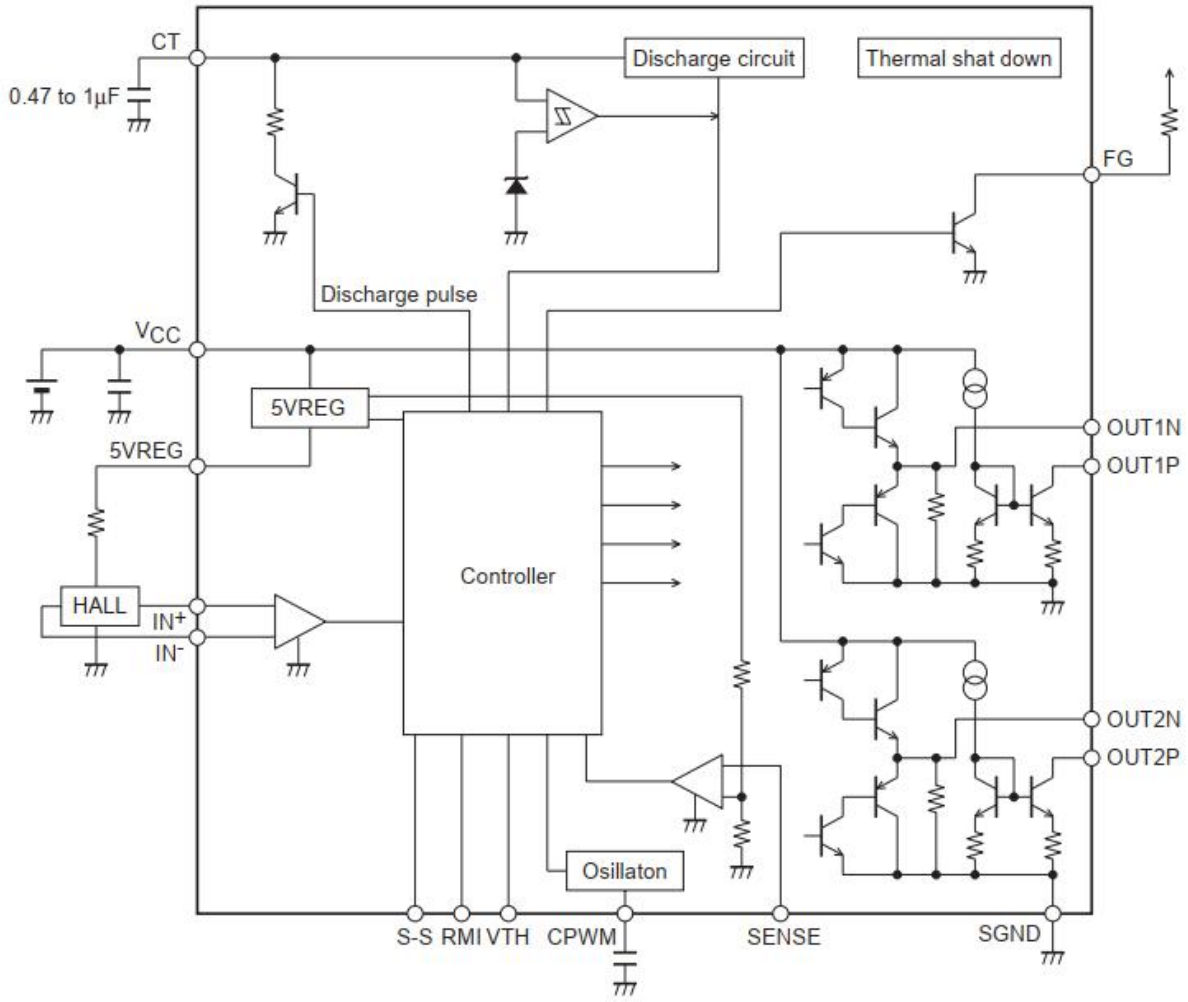


Pin Description

Pin No.	Pin Name	I/O	Pin Function
1	OUT2P	O	High side output 2
2	OUT2N	O	Low side output 2
3	Vcc	power	Power PIN, For the power stabilization capacitor on the signal side, use the capacitance of 1μF or more. Connect VCC and GND with a thick and shortest pattern.
4	SENSE	I/O	Current limiting detection pin. When the pin voltage exceeds 0.2V, the current is limited and the operation enters the lower regeneration mode. Connect this pin to GND when it is not to be used.

5	RMI	I	Minimum speed setting pin. Perform pull-up with 5VREG when this pin is not to be used. If the IC power supply is likely to be turned OFF first when the pin is used with external power supply, be sure to insert the current limiting resistor to prevent inflow of large current. (The same applies to the VTH pin.)
6	VTH	I	Speed control pin. Connect this pin to GND when it is not used (at full speed). For the control method, refer to the timing chart. For control with pulse input, insert the current limiting resistor and use the pin with the frequency of 20k to 100kHz (20kHz to 50kHz recommended).
7	CPWM	I/O	Pin to connect the capacitor for generation of the PWM basic frequency The use of CP = 220pF causes oscillation at f = 30kHz, which is the basic frequency of PWM. As this is used also for the current limiting canceling signal, be sure to connect the capacitor even when the speed control is not made.
8	FG	O	Rotation speed detection pin. This is an open collector output, which can detect the rotation speed from the FG output according to the phase changeover. Keep this pin open when it is not to be used.
9	IN-	I	Hall signal input -
10	IN+	I	Hall signal input +
11	CT	I/O	Pin to connect the lock detection capacitor. The constant-current charge and discharge circuits incorporated cause locking when the pin voltage becomes 3.0V and unlocking when it is 1.1V. Connect the pin to GND when it is not to be used (locking not necessary).
12	S-S	I/O	Pin to connect the soft-start setting capacitor. Connect the capacitor between 5VREG and S-S pin. This pin enables setting of the soft start time according to the capacity of the capacitor. See the timing char. Connect the pin to GND when it is not to be used.
13	5VREG	I/O	Internal 5V VREF output PIN.
14	SGND	ground	Ground PIN, SGND is connected to the control circuit power supply system.
15	OUT1N	O	Low side output 1
16	OUT1P	O	High side output 1

Block Diagram



Truth table

(1) Drive lock CPWM=H VTH, RMI, S-S=L

IN-	IN+	CT	OUT1P	OUT1N	OUT2P	OUT2N	FG	Mode
H	L	L	L	L	OFF	H	L	OUT1 → 2 drive
L	H		OFF	H	L	L	OFF	OUT2 → 1 drive
H	L	H	OFF	L	OFF	H	L	Lock protection
L	H		OFF	H	OFF	L	OFF	

(2) Speed control CT, S-S=L

VTH, RMI	CPWM	IN-	IN+	OUT1P	OUT1N	OUT2P	OUT2N	Mode
L	H	H	L	L	L	OFF	H	OUT1 → 2 drive
		L	H	OFF	H	L	L	OUT2 → 1 drive
H	L	H	L	OFF	L	OFF	H	Regeneration mode
		L	H	OFF	H	OFF	L	

Absolute Maximum Ratings

(over operating free-air temperature range (unless otherwise noted)

Parameter	Symbol	Conditions	Ratings	Unit
VCC pin maximum supply voltage	VCC max		18	V
OUTN pin maximum output current	IOUTN max		20	mA
OUTP pin maximum Sink current	IOUTP max		20	mA
OUT pin output withstand voltage	VOUT max		18	V
VTH, RMI pins withstand voltage	VVTH, VRMI max		7	V
S-S pin withstand voltage	VS-S max		7	V
FG output pin withstand voltage	VFG max		19	V
FG pin maximum output current	IFG max		10	mA
5VREG pin maximum output current	I5VREG max		20	mA
Allowable power dissipation	Pd max		800	mW
Operating temperature	Topr		-40 to 100	°C
Storage temperature	Tstg		-55 to 150	°C

Recommended Operating Conditions

Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
VCC Supply voltage	VCC		5.5 to 16	V
VTH, RMI input voltage range	VTH, RMI		0 to 5	V
Hall input common-phase input voltage range	VICM		0.2 to 3	V

Electrical Characteristics

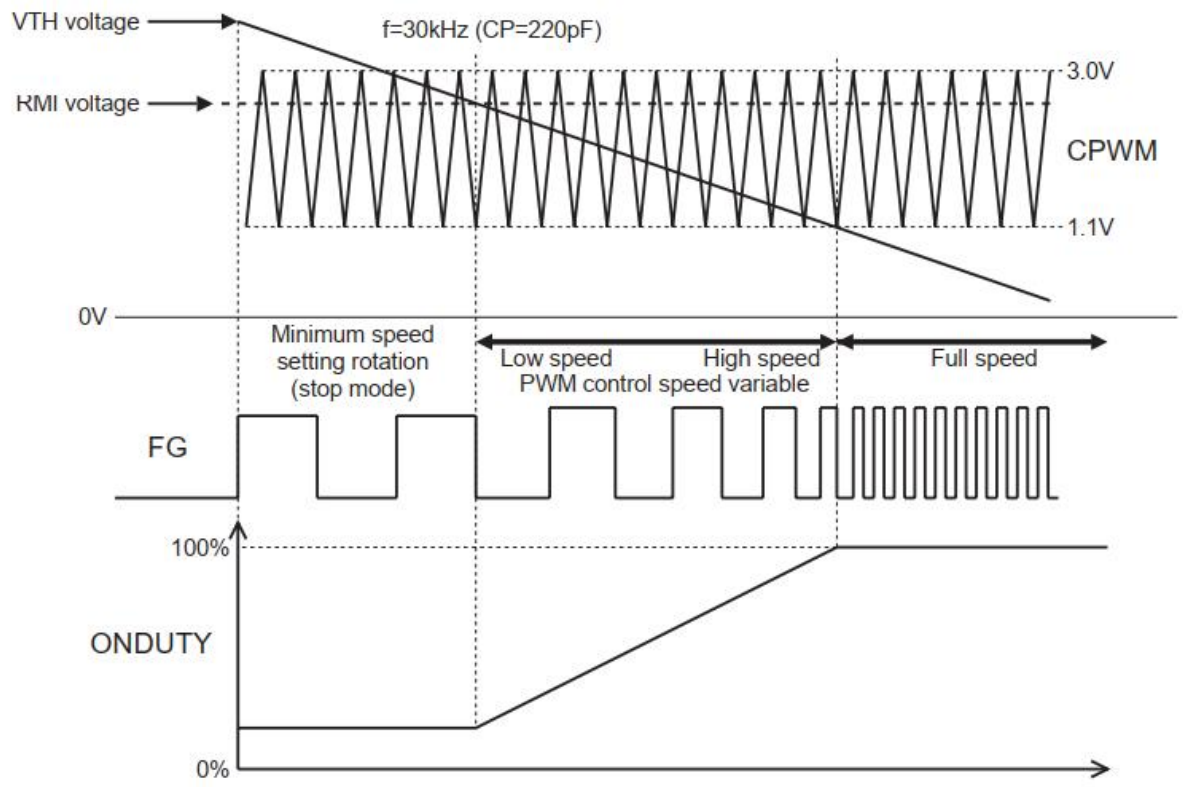
Ta = 25°C, VCC = 12V

Parameter	Symbol	Conditions	min	typ	max	Unit
current	ICC1	During drive	5.5	7.5	9.5	mA
	ICC2	During lock protection	5.5	7.5	9.5	mA
5VREG voltage	5VREG	I5VREG = 5mA	4.80	4.95	5.10	V
Current limiting voltage	VLIM		185	200	220	mV
CPWM pin “H” level voltage	VCPWMH		2.8	3.0	3.2	V
CPWM pin “L” level voltage	VCPWML		0.9	1.1	1.3	V
CPWM pin charge current	ICPWM1	VCPWM = 0.5V	22	30	38	μA
CPWM pin discharge current	ICPWM2	VCPWM = 3.5V	21	25	33	μA

CPWM Oscillation frequency	FPWM	C = 220PF		30		kHz
CT pin “H” level voltage	VCTH		2.8	3.0	3.2	V
CT pin “L” level voltage	VCTL		0.9	1.1	1.3	V
CT pin charge current	ICT1	VCT = 0.5V	1.6	2.0	2.5	μA
CT pin discharge current	ICT2	VCT = 3.5V	0.16	0.20	0.25	μA
CT pin charge/discharge ratio	RCT	ICT1/ICT2	8	10	12	times
S-S pin discharge current	IS-S	VS-S = 1V	0.4	0.5	0.6	μA
OUTN output H-level voltage	VONH	IO = 10mA		VCC-0.85	VCC-1.00	V
OUTN output L-level voltage	VONL	IO = 10mA		0.9	1.00	V
OUTP output L-level voltage	VOPL	IO = 10mA		0.5	0.65	V
Hall input sensitivity	VHN	IN+, IN- differential voltage (including offset and hysteresis)		±10	±20	mV
FG output L-level voltage	VFGL	IFG = 5mA		0.15	0.30	V
FG pin leakage current	IFGL	VFG = 19V			20	μA
VTH/RMI pin bias current	IVTH/IRMI	CPWM = VTH/RMI = 2V			0.1	μA

Function Description

1. Control timing chart (Speed control)



(1) Minimum speed setting (stop) mode

The low-speed fan rotation occurs at the minimum speed set with the RMI pin. When the minimum speed is not set (RMI pin pulled up to 5VREG), the motor stops.

(2) Low speed⇔high speed

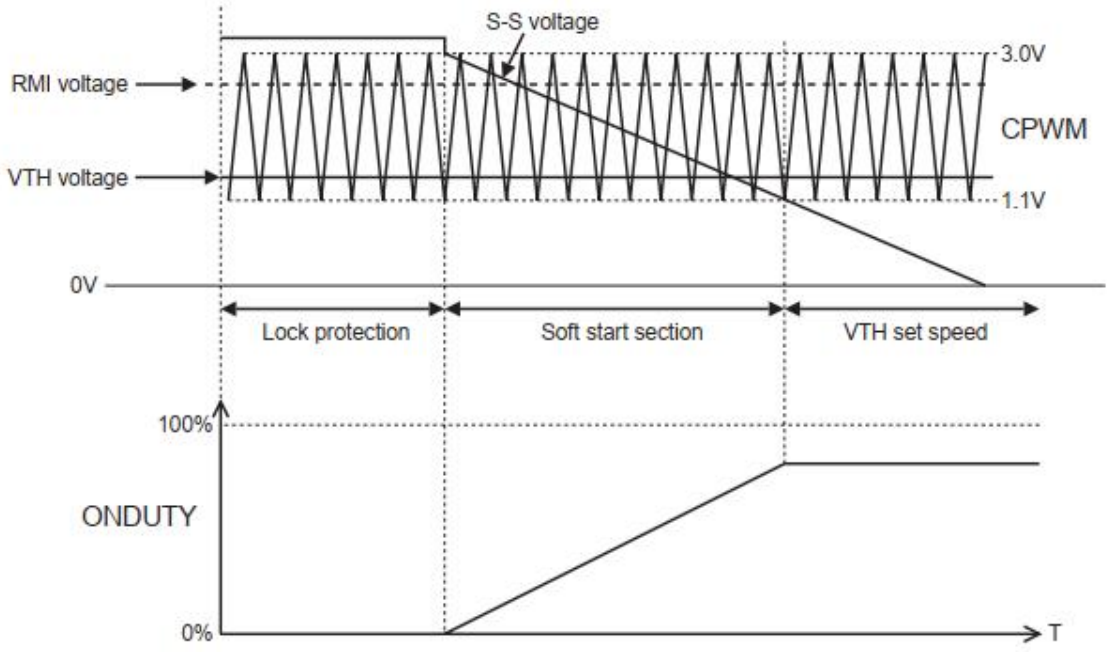
PMW control is made by comparing the CPWM oscillation voltage (1.1V⇔3.0V) and VTH voltage. Both upper and lower output TRs are turned ON when the VTH voltage is low. The upper output TR is turned OFF when the VTH voltage is high, regenerating the coil current in the lower TR. Therefore, as the VTH voltage decreases, the output ON-DUTY increases, causing increase in the coil current, raising the motor rotation speed. The rotation speed can be monitored with the FG output.

(3) Full speed mode

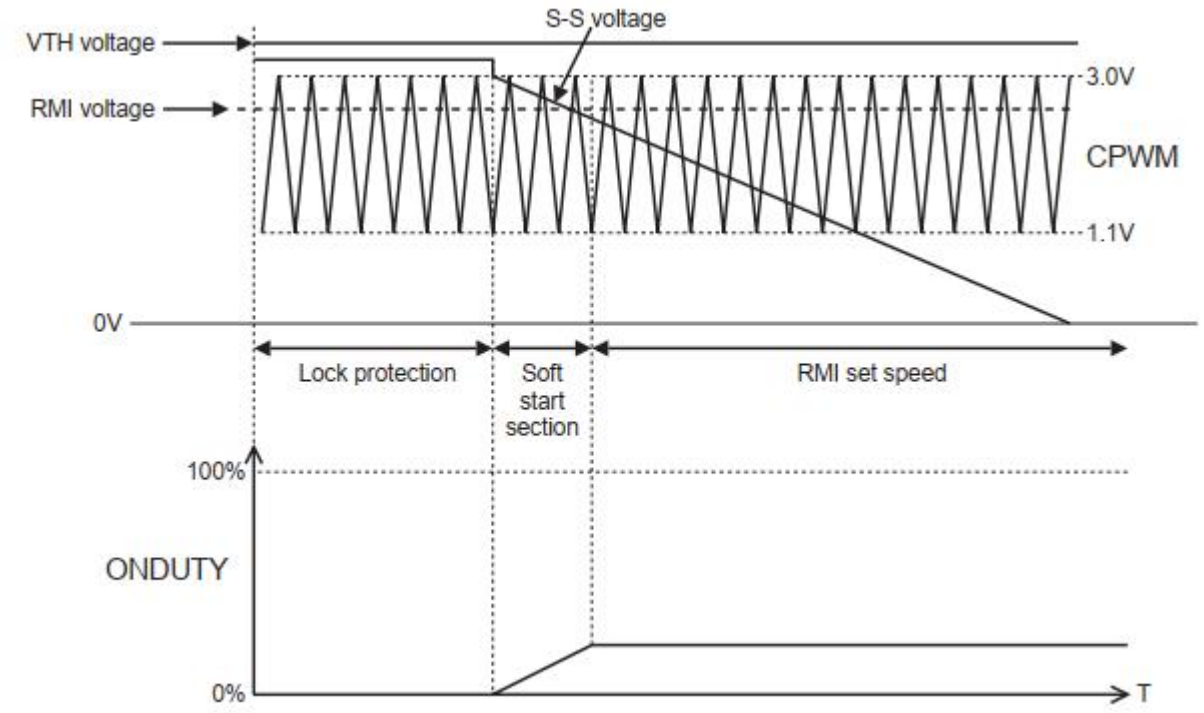
The full speed mode becomes effective when the VTH voltage is 1.1V or less. (Set VTH = GND when the speed control is not to be made.)

2. Control timing chart (Soft start)

(1)At VTH < RMI voltage



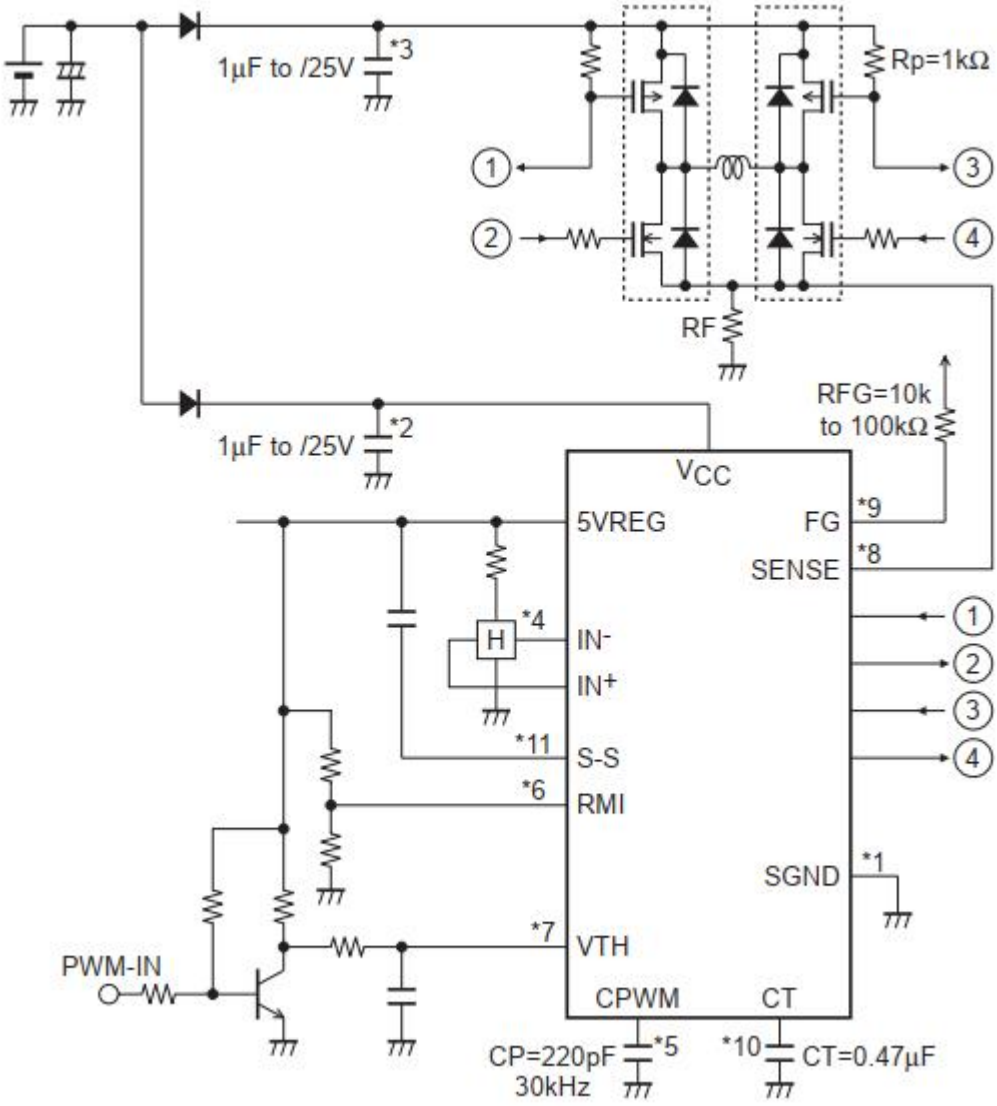
(2) At VTH > RMI voltage



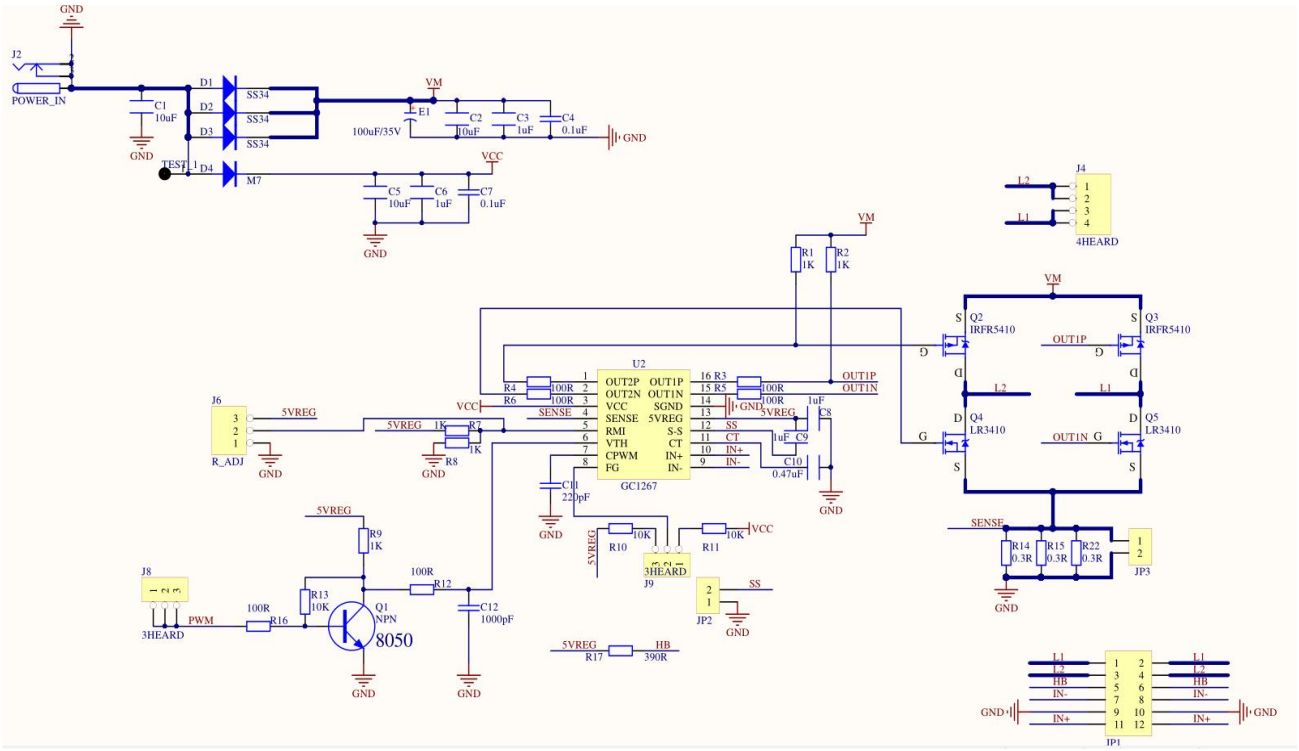
Adjust the S-S pin voltage gradient by means of the capacitance of the capacitor between the S-S pin and 5VREG..

Recommended capacitor: 0.1μ to 1μF

Typical Application

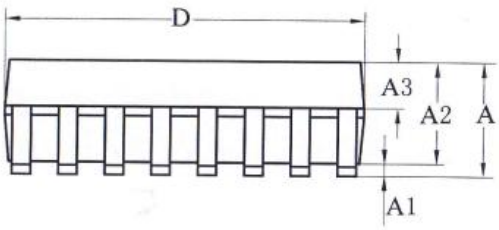


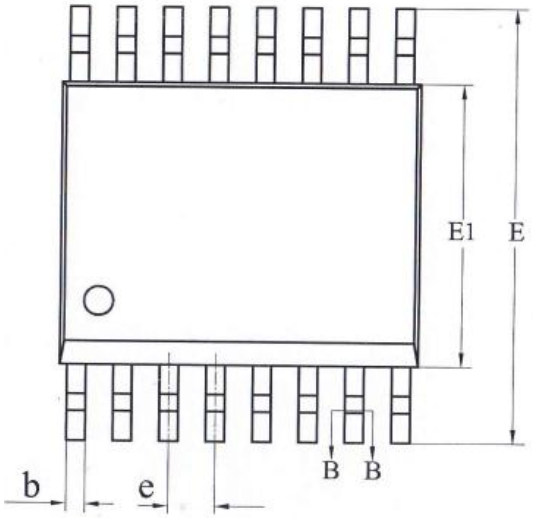
Typical applications 1



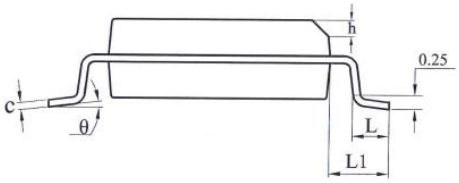
Typical applications 2

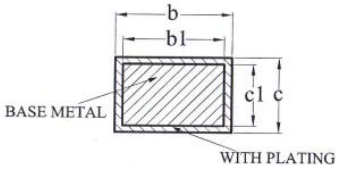
Package Information





SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.75
A1	0.10	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.23	—	0.31
b1	0.22	0.25	0.28
c	0.20	—	0.24
c1	0.19	0.20	0.21
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	0.635BSC		
h	0.25	—	0.50
L	0.50	0.65	0.80
L1	1.05REF		
θ	0	—	8°





SECTION B-B