

**GENERAL DESCRIPTION**

The N3867 is a low cost, high efficiency, synchronous rectification controller that specifically designed for the synchronous rectification applications of the Fly-back AC/DC PWM mode switching power supply.

The N3867 is included a totem pole output ideally suited for driving a synchronous rectification power MOSFET. In the QR mode or discontinuous mode operating, the current detector properly turns off the synchronous rectification power MOSFET by detecting the dropout voltage between source and drain pin. In continuous mode operating, it provides the Aout pin for turning off the GATE output while receive a turn-off signal from the primary side. The operation of N3867 prevents secondary side shoot-through condition by a cycle by cycle control method.

**FEATURES**

- ▲ High efficiency operating.
- ▲ Decrease areas of heatsink or PCB.
- ▲ Solved heat dissipation.
- ▲ Sensitive current detector(about 20mV)
- ▲ Suited for discontinuous,QR or continuous mode operation.
- ▲ Auto frequency tracking with PWM frequency.
- ▲ Suited for fixed or variable frequency
- ▲ SOIC-8 and DIP-8 package.

**APPLICATION**

- Fly-back AC/DC power supply
- Pin to pin compatible with N3856

**DEVICE SELECTION GUIDE**

DIP-8		SOP-8	
SnPb	Pb Free	SnPb	Pb Free
N3867P	N3867PG	N3867V	N3867VG

**THERMAL DATA**

PARAMETER	SYMBOL	DIP-8	UNIT
Thermal Resistance Junction to Ambient	$\theta_{ja}$	53	/W
Thermal Resistance Junction to Case	$\theta_{jc}$	23	/W

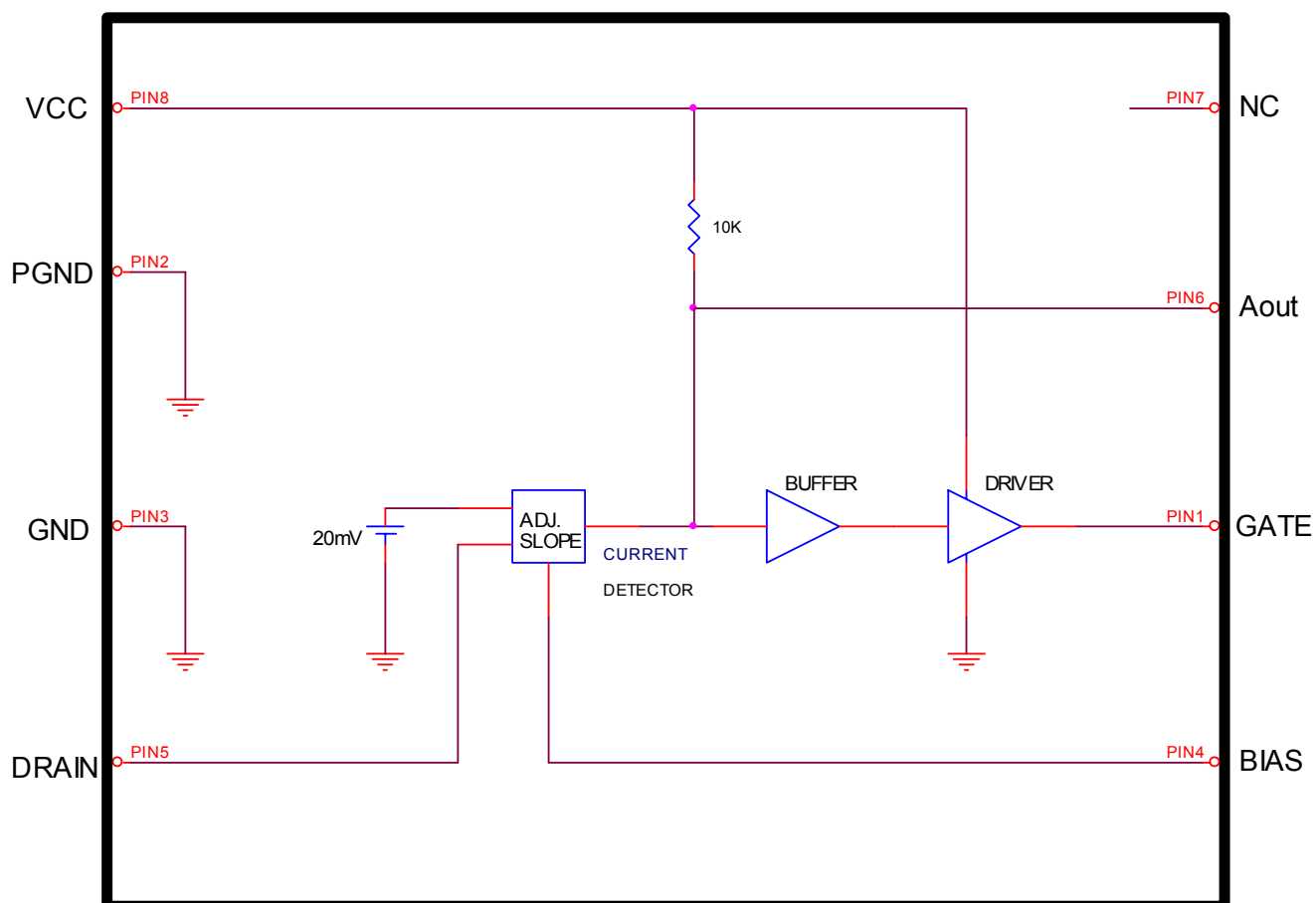
**ABSOLUTE MAXIMUM RATING**

PARAMETERS	SYMBOL	LIMITS	UNITS
Vcc to GND	Vcc	-0.3 to 30	V
Drain to Other Pin		180	V
Power Dissipation at Ta = 25 ,Derate 8mW/ for Ta 25	Pd	725	mW
Operating Junction Temperature Range	Tj	-40 to +150	
Storage Temperature Range	TSTG	-65 to +150	
Lead Temperture(Soldering) 10 sec	TLEAD	300	

**ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25 °C)**

PARAMETER	TEST CONDITIONS	LIMITS			UNIT
		MIN	TYP	MAX	
Supply Voltage	V <sub>CC</sub>	7	12	30	V
Supply Current		-	4.5	-	mA
GATE Sink Current			1		A
GATE Source Current			1		A
Rise Time	C <sub>L</sub> = 1.0nF		40		nS
Fall Time	C <sub>L</sub> = 1.0nF		40		nS
Delay Time			200	300	nS
Max Duty Cycle		90	95		%

**BLOCK DIAGRAM**



## OPERATION DESCRIPTION

### •Discontinuous

In discontinuous or QR mode applications, the N3867 is detecting the MOSFET current to control the MOSFET be ON or OFF by a internal current detector , the current of the secondary winding flows through the Source and Drain of the MOSFET is changing from maximum level to zero , It cause a voltage drop of the MOSFET from the maximum level down to zero , the voltage drop is compared with internal reference voltage 20mV, if voltage dropout is over 20mV ,will make the MOSFET turn-on, if the voltage drop is under 20mV, will make the MOSFET become turn-off.

For the various MOSFET applications , different  $R_{DS(ON)}$  will cause a different voltage drop between the MOSFET,s Source and Drain , the BIAS pin provided the “adjustable slope” function delaying turn-off the MOSFET for better efficiency , the BIAS pin is connected a resistor with VCC used to adjust the gate output slope , change the resistance will get the different slope ,a higher resistance will get the smoother slope, and MOSFET turn-off become slower , a smaller resistance will get the sharper slope , and MOSFET turn-off become quicker .

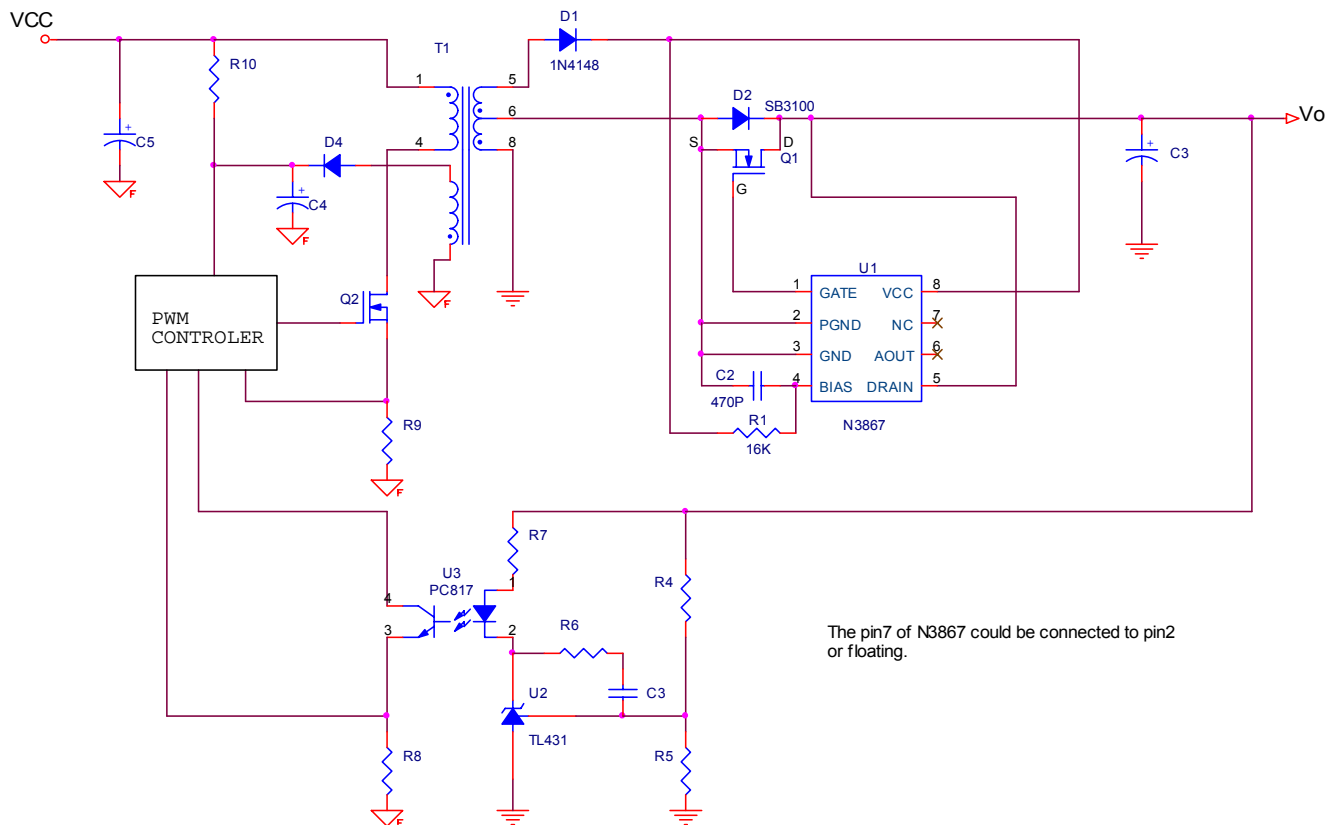
Considering of Bias setting, first, adjust output to heavy load but still in discontinuous mode , changing the Bias resistor make the Gate waveform of MOSFET is sloping to connect the resonant waveform of LC tank of the output circuit, second,adjust output to the minimum load and check the Gate waveform is OK or not , to decrease the resistance until waveform is normal .

### •Continuous mode

In continuous mode application , the current detector can not turn-off the MOSFET directly, the N3867 is using a synchronous signal from the primary side to control the Aout pin , pull the Aout pin to low will turn off the output of Gate driver . Aout pin also can be used to increase Gate drive capability when two parallel MOSFET application , connected a resistor to VCC if need .

**TYPICAL APPLICATION CIRCUIT**

**QR mode or Discontinuous mode application circuit**



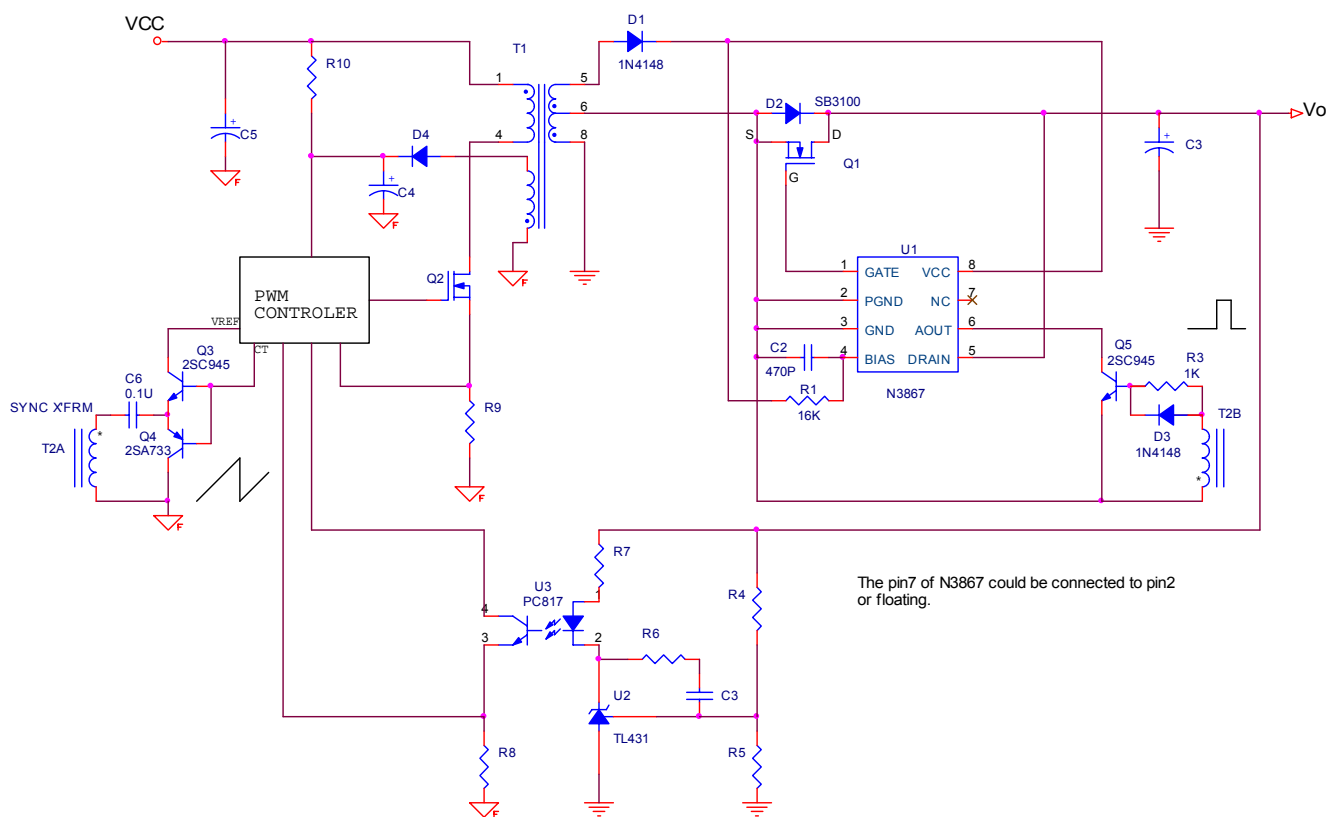
The pin7 of N3867 could be connected to pin2 or floating.

**Schematic 1 QR mode or Discontinuous mode application circuit**

The schematic 1 is shown QR mode or Discontinuous mode application circuit , the AUX winding of secondary is designed to provide the supply voltage about 10V ~15V , the supply voltage via the diode D1 to VCC of the U1 without any capacitor . In the QR or discontinuous mode application, the current detect pin 5 is sensing the voltage drop of the MOSFET , if it is under 20mV ,this IC will turn off the MOSFET by a slope .

**Continuous mode application circuit**

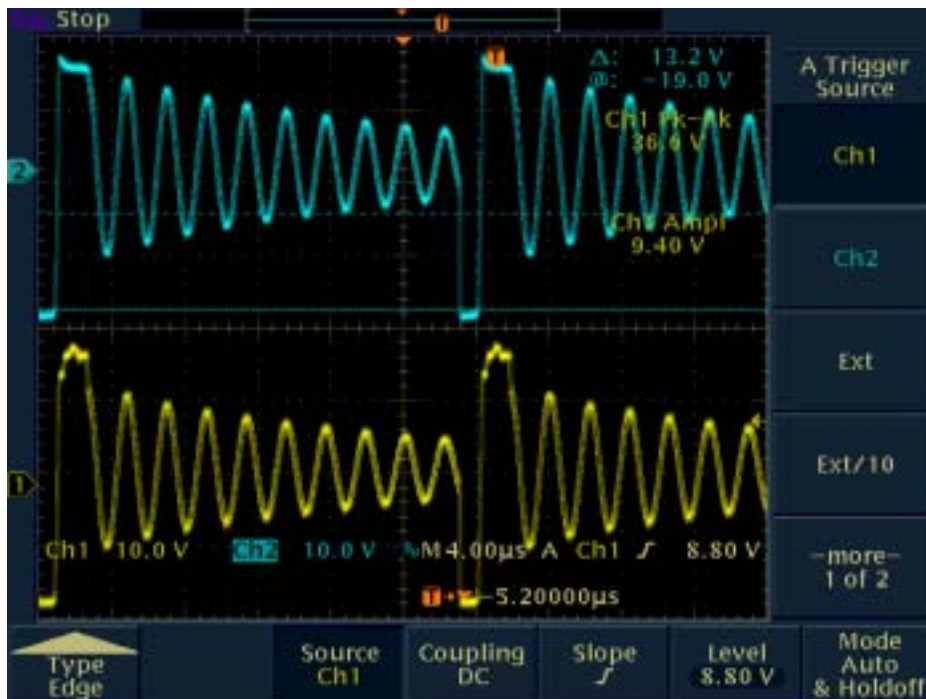
The structure is designed for a high current output , continuous mode flyback power supply , the synchronous signal is provided before the MOSFET Q2 turn on from the triangle wave of the PWM controller , it need to use a isolation transformer between the primary and the secondary for safety request .when the circuit is designed in continuous mode , the MOSFET of the secondary side to be turned off by a synchronous signal from the primary side , if works in discontinuous mode that turned off by the current detect pin 5 to sense the voltage drop between the source and drain of the MOSFET .



**Schematic 2 Continuous mode application circuit**

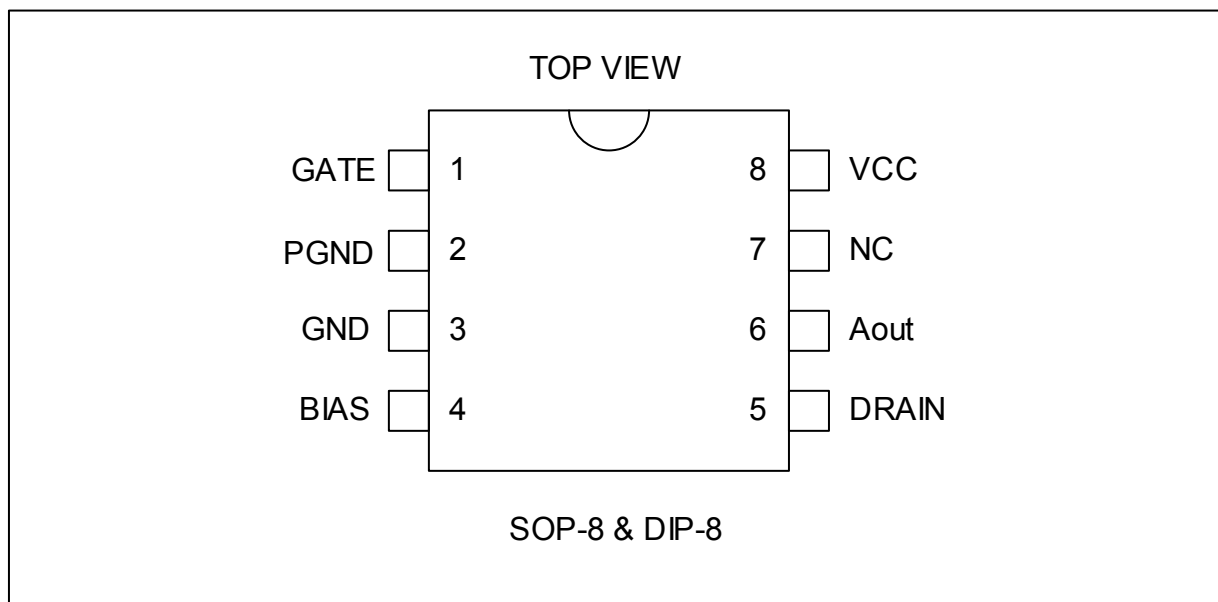
The schematic 2 is shown Continuous mode application circuit , receiving a turn-off signal from the primary side ,the transistor Q5 will be turning on ,then the GATE output is pulled to low voltage and the synchronous rectification MOSFET Q1will be turned off.





pic.3 secondary winding output and gate voltage of MOSFET waveform at no load condition .

**PIN CONFIGURATIONS**



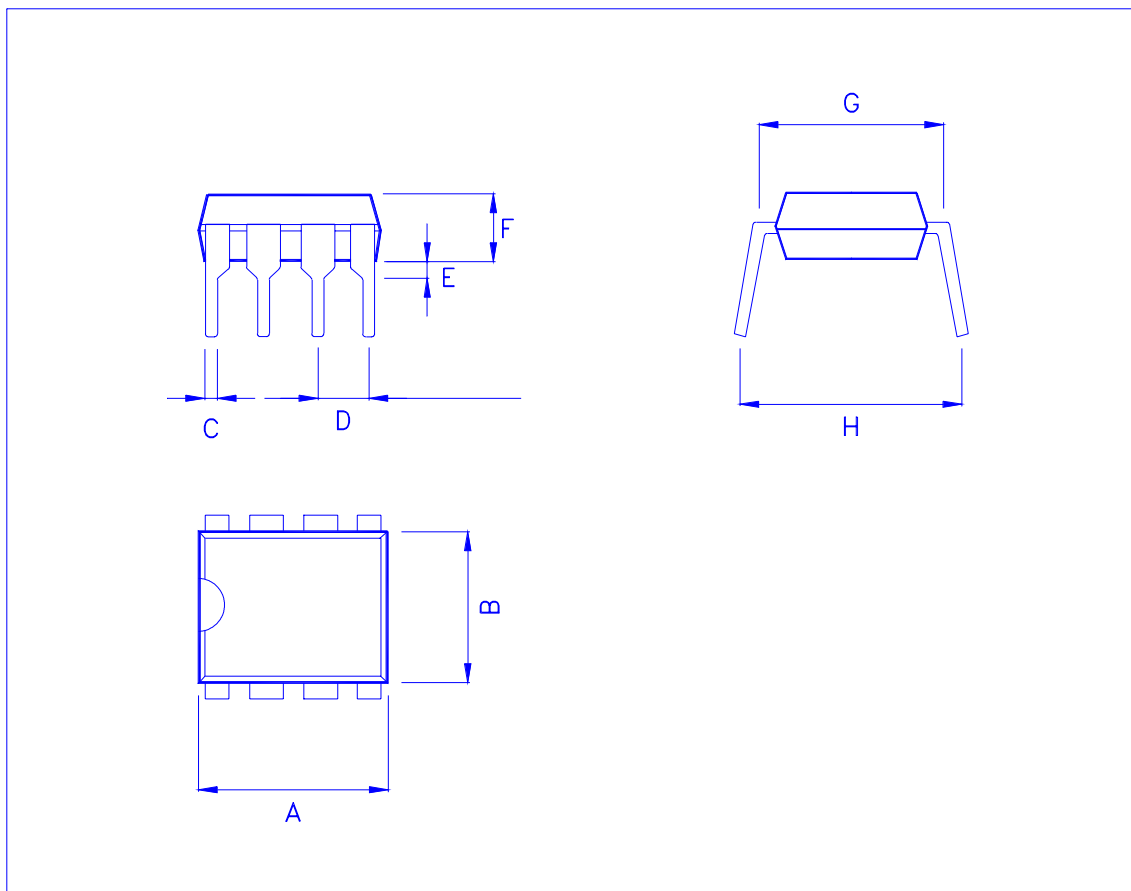
**PIN FUNCTIONS**

NO.	FUNCTION	DESCRIPTION
1	GATE	This pin is the output pin to drive the gate of the power MOSFET.
2	PGND	This pin is to POWER GND for output drive circuit.
3	GND	This is signal GND pin for the control logic signals.
4	BIAS	This pin is bias voltage supply for the internal current detector.
5	DRAIN	Input pin of the internal current detector, connect to drain of MOSFET .
6	Aout	This pin is internal comparator output to control “pin1” output duty.
7	NC	Not use
8	VCC	This pin is for supply voltage.



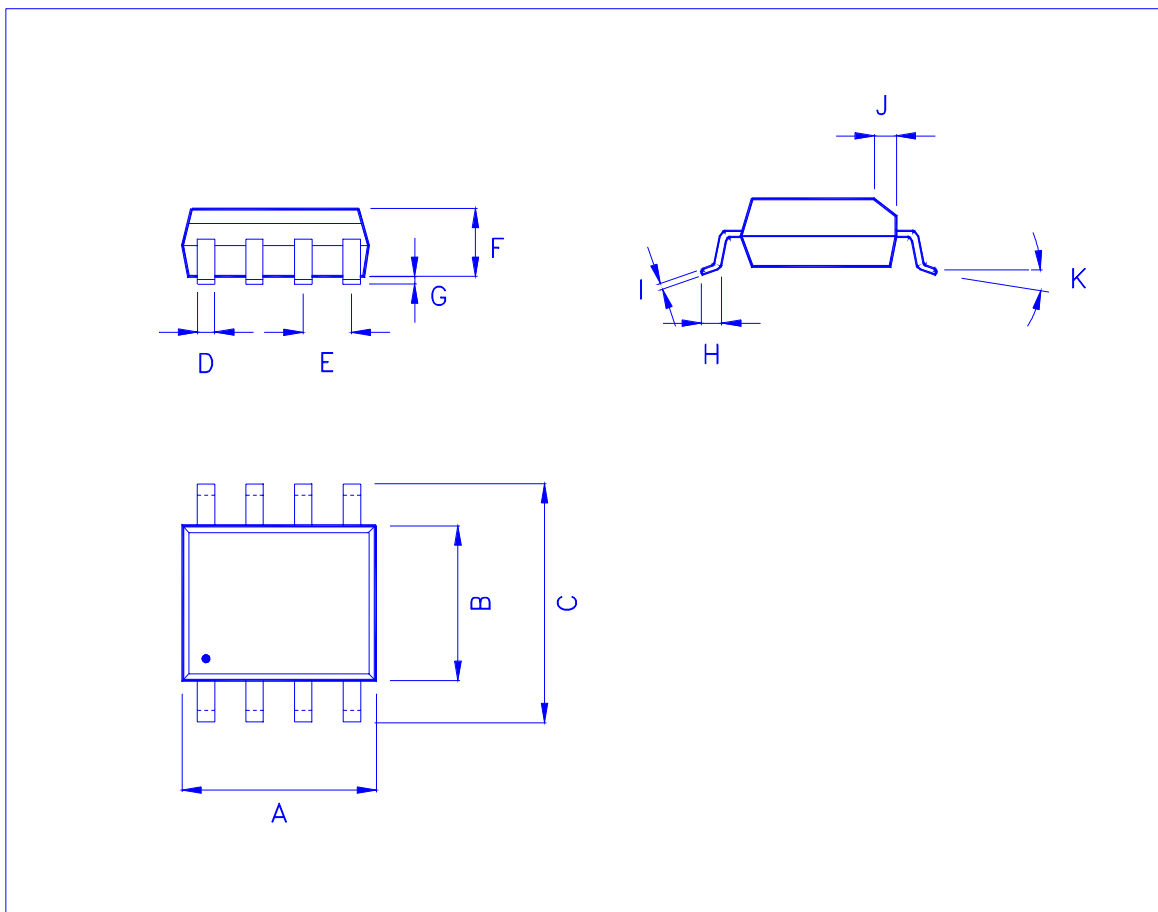
**DIP-8 MECHANICAL DATA**

Dimension	mm			Dimension	mm		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	8.8		9.6	H	7.95		9.75
B	6.2		7.0	I			
C	0.35	0.45	0.55	J			
D		2.54		K			
E	0.5		0.8	L			
F	3.05	3.28	3.56	M			
G	7.48	7.62	8.13	N			



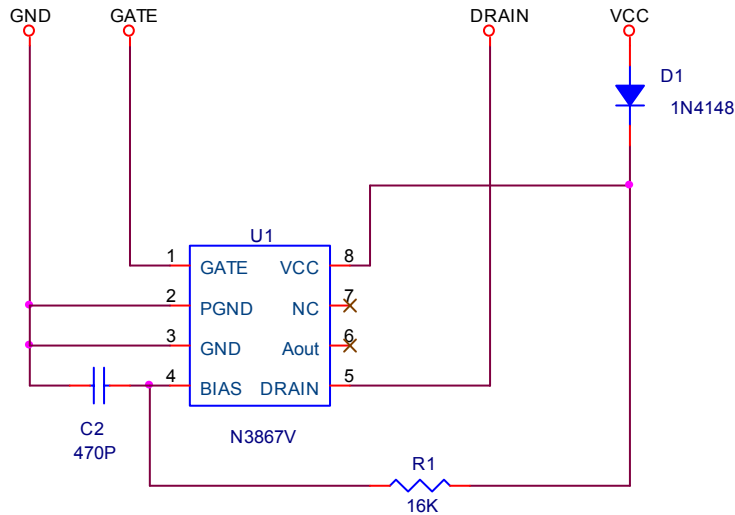
**SOIC-8 (D) MECHANICAL DATA**

Dimension	mm			Dimension	mm		
	Min.	Typ.	Max.		Min.	Typ.	Max.
A	4.8	4.9	5.0	H	0.5	0.715	0.83
B	3.8	3.9	4.0	I	0.18	0.254	0.25
C	5.8	6.0	6.2	J		0.22	
D	0.38	0.445	0.51	K	0°	4°	8°
E		1.27		L			
F	1.35	1.55	1.75	M			
G	0.1	0.175	0.25	N			

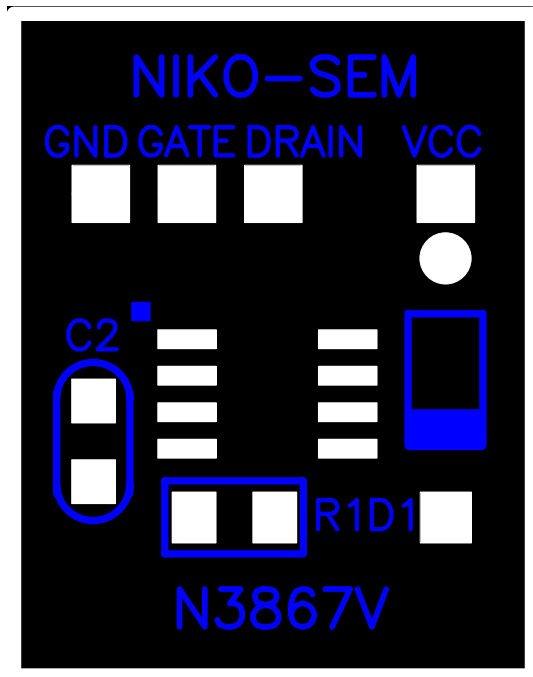


**DEMO BOARD DESCRIPTION**

The Schematic 3 presents a demo board for the N3867V , This board replaces the output rectifier diode with synchronous rectification MOSFET in flyback power supply and includes all the components needs by the N3867V to operate, R1 can be adjusted for different MOSFET application .



**Schematic. 3 demo board**



**pic. 4 componet**



**pic.5 trace**