PWM Controller of Current Mode and Constant power- ME8165

General Description

The current mode PWM controller with high and low voltage constant power compensation uses secondary feedback to provide a continuous output power of 15W and a peak output power of 18W in the full voltage range. The power controller can work in a typical anti-excitation circuit topology. The chip adopts a bipolar circuit design, which increases the reliability of the full temperature range, reduces noise, and improves the switching speed. The IC internal high voltage start circuit is designed as a current inhalation mode in the emitter drive mode. Using the emitter drive isolation effect, the collector's amplification of the base at the start of the power switch tube is started for VCC charging. Reduced the power consumption of the starting resistor during the operation, and the output power is smaller, the IC will automatically reduce the operating frequency, thus achieving low standby power consumption. When the VCC reaches 21V, the internal chip will start overpressure protection, limiting the output voltage rise. IC also provides anti-output short-circuit, anti-overload, anti-saturation, anti-overtemperature and other functions, can effectively protect the output overload, Transformer saturation, output short-circuit, overheating, etc., and improve the reliability of the power supply. Current limits can be set by external resistors according to different output power requirements. The built-in unique active current mirror circuit compensates for the same output power in the full voltage range.

Features

- Built-in 700V high voltage power transistor
- Internal high voltage start current source, quick start, current limit compensation
- Built-in energy efficiency treatment control, standby less than 0.1 W
- Internal Overpressure Overload Overheat and Short Circuit Protection
- Low start-up current and low operating current
- Adaptive frequency rotation design, EMI interference is small
- High conversion efficiency
- There are few peripheral components and the cost of the whole machine is low.
- Internal circuit compensation, accurate LPS control.
- Ejector drive improves start-up time
- The unique start circuit ensures that the low temperature operating point can reach -20°C
- 8165G internal 700V / 4M high-voltage startup resistor

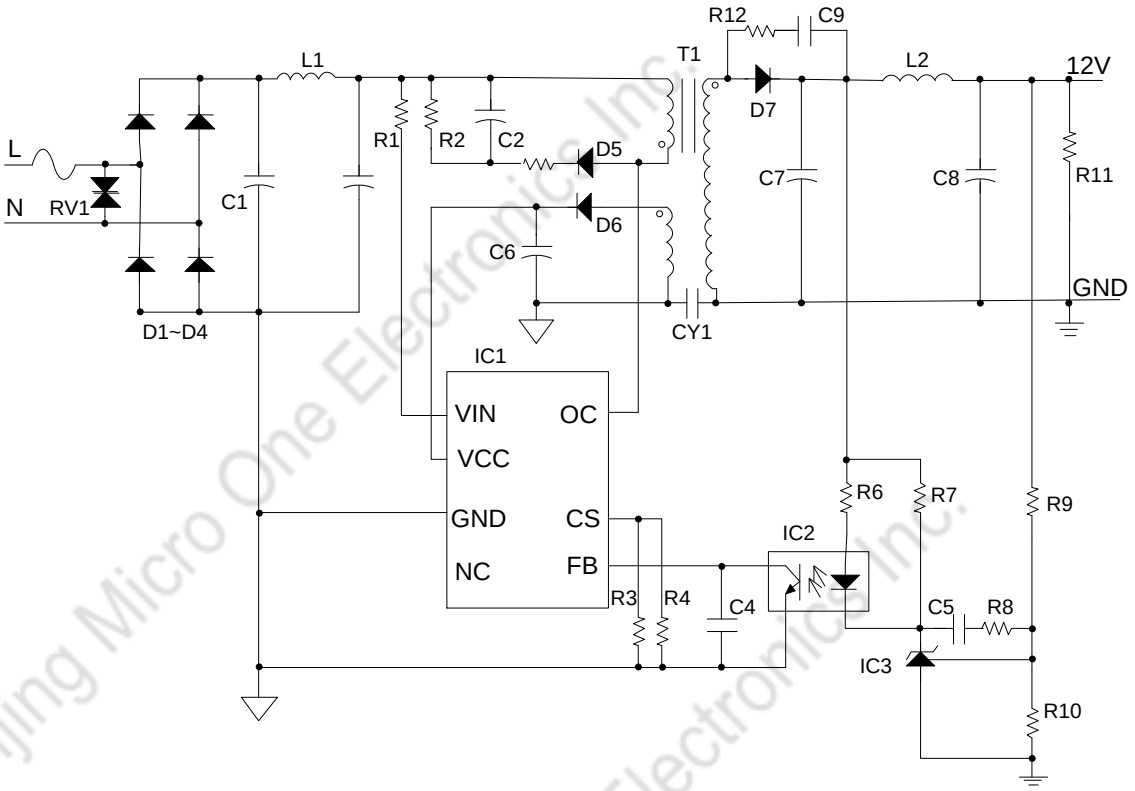
Typical Application

- Power adapter
- Portable equipment charging power
- LED power supply
- Battery charger
- DVD and other small home appliances

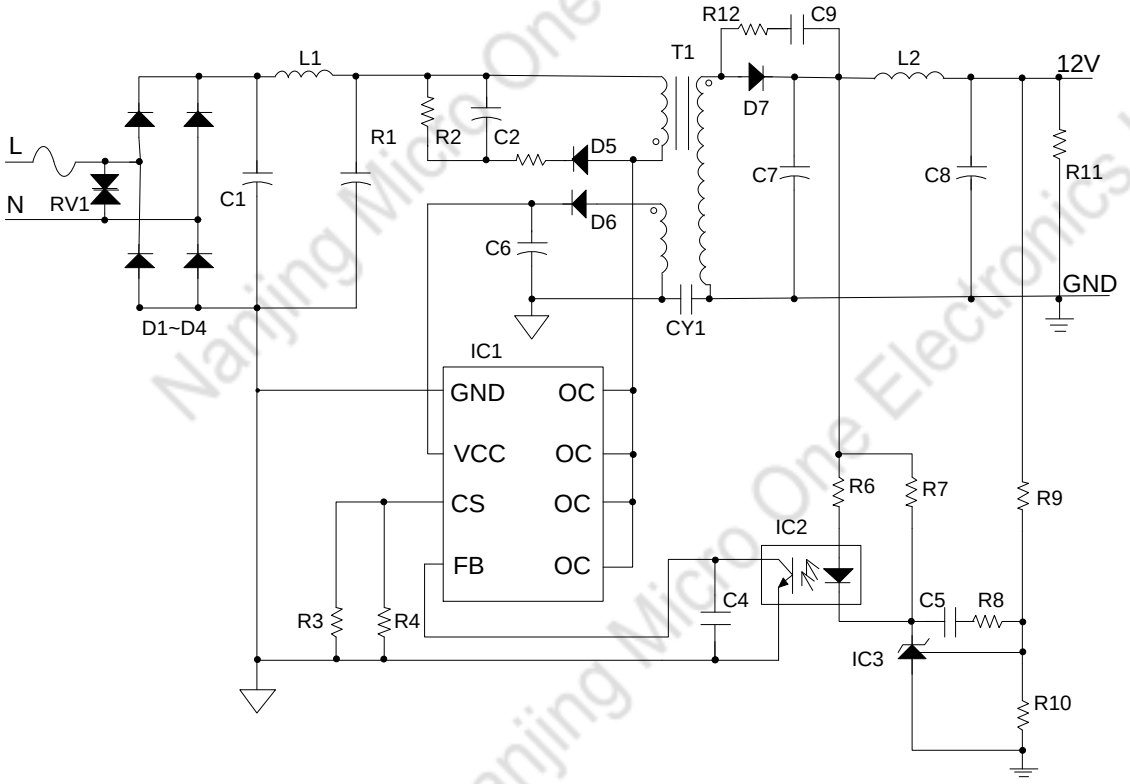
Package

- 7-pin DIP7、DIP7(6)
- 8-pin DIP8、SOP8

Typical Application Circuit



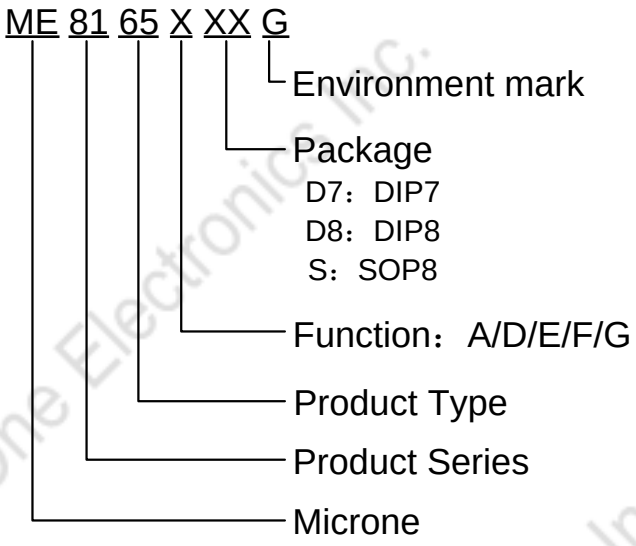
ME8165A/D/E/F Typical Application Circuit



ME8165G Typical Application Circuit

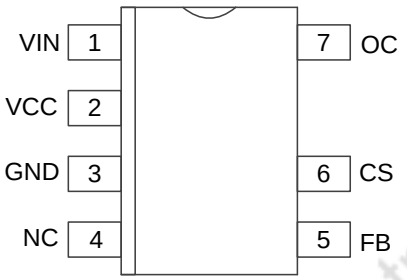
(No high-low voltage current-limit compensation pin, eliminating high-voltage startup resistance, four OC pins help PCB layout heat dissipation)

Selection Guide

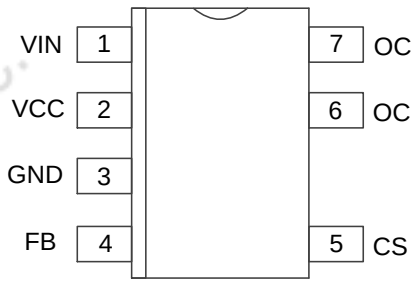


Product series	product description
ME8165AD7G	18W；Package：DIP7(6)
ME8165DD7G	20W；Package：DIP7(6)
ME8165ED7G	12W；Package：DIP7
ME8165FD7G	18W；Package：DIP7
ME8165GD8G	18W；Package：DIP8
ME8165GSG	18W；Package：SOP8

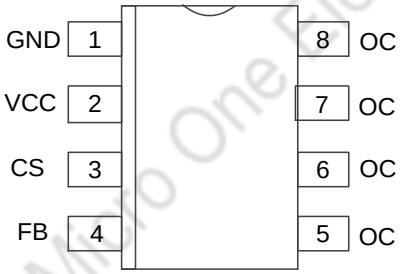
Pin Configuration



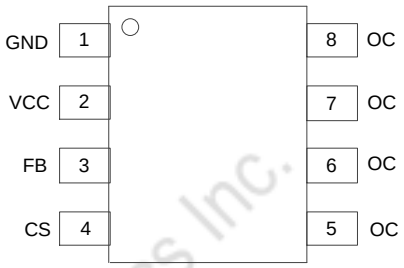
DIP7



DIP7(6)



DIP8

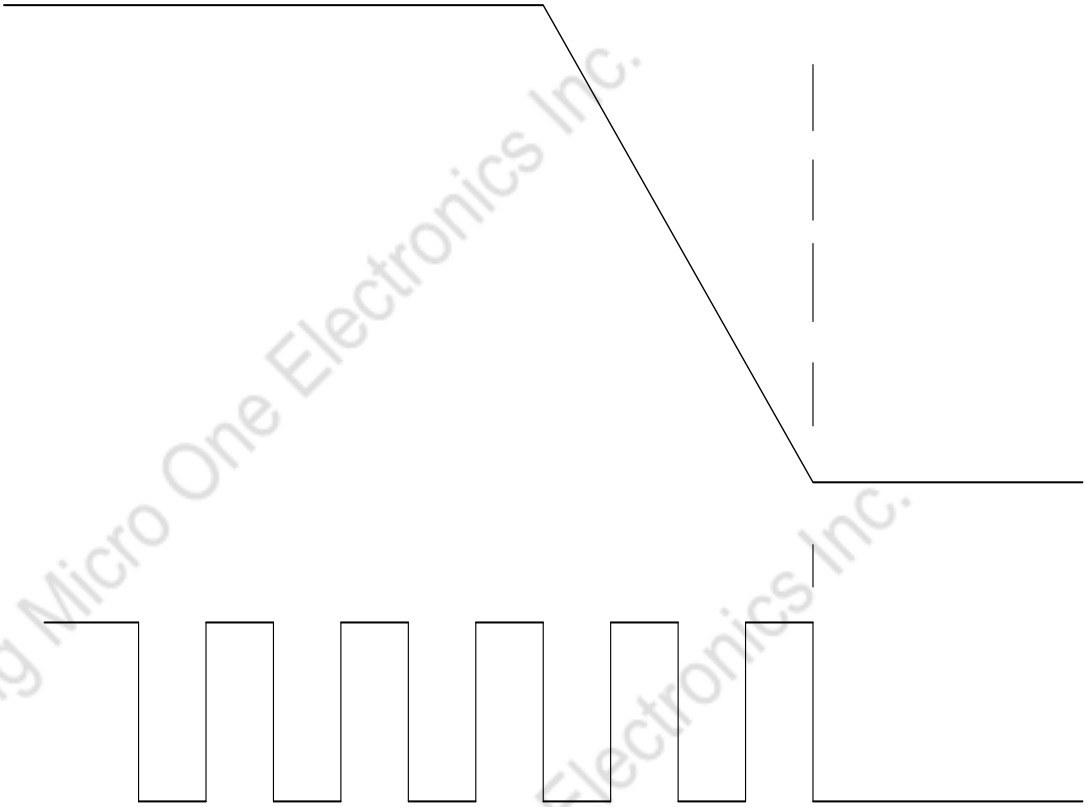


SOP8

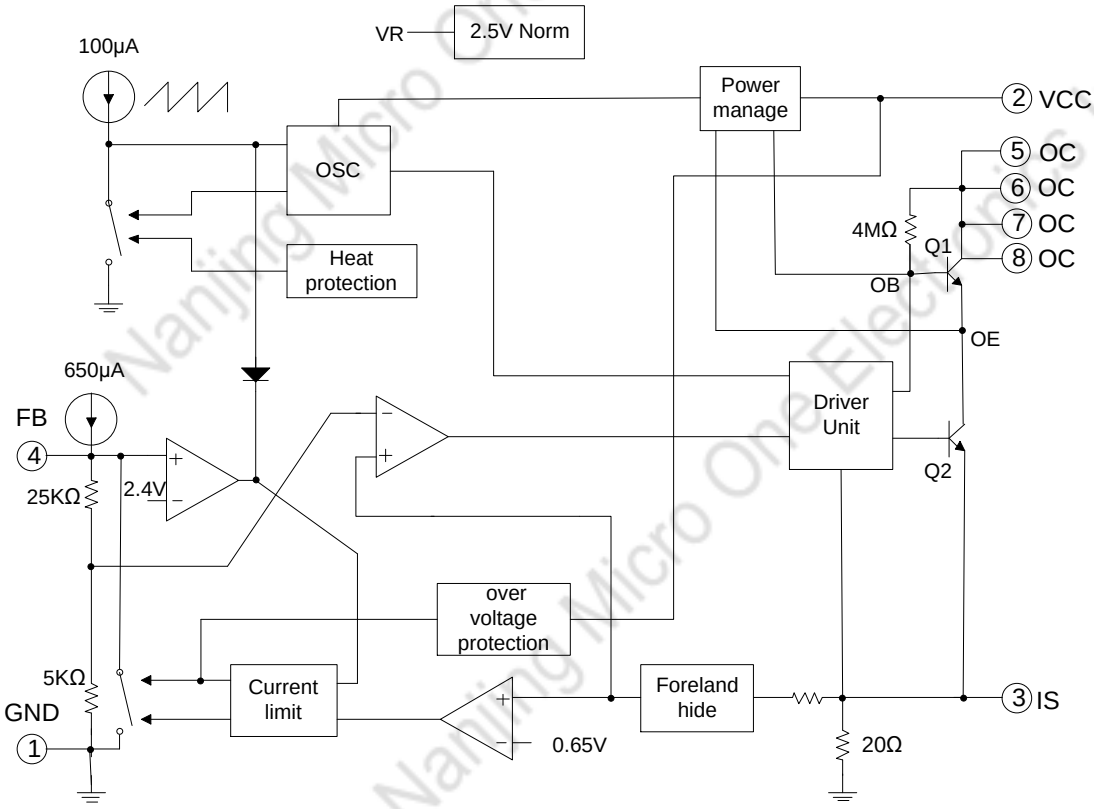
Pin Assignment

DIP7	DIP7(6)	DIP8	SOP8	Symbol	Function
1	1		-	VIN	High voltage line compensation current source input, external resistance to high voltage input terminal
2	2	2	2	VCC	Power Supply Pin.
3	3	1	1	GND	Ground.
4			-	NC	No connect
5	4	4	3	FB	Feedback Pin
6	5	3	4	CS	Switching current sampling and limit enactment, sampling resistance of external current.
7	6、7	5、6、7、8	5、6、7、8	OC	Output pin, meet switching transformer.

Block Diagram



ME8165A/D/E/F（With high and low voltage current limit compensation）



ME8165G（Internally integrated 700V / 4M high-voltage start-up resistor without high-low voltage current-limit compensation）

Absolute Maximum Ratings

Parameter		Ratings	Unit
Power supply voltage, V_{CC}		21	V
Pins input voltage		VCC+0.3	V
Endurance voltage of OC collector		-0.3~700	V
Switching current of peak value(ME8165B)[1]		850	mA
Thermal resistance (Junction to air) θ_{JA}	DIP7	74	℃/W
	DIP8	90	
	SOP8	136	
Continuous Total Power Dissipation P_D	DIP7	1.69	W
	DIP8	1.4	
	SOP8	0.92	
Operating Ambient Temperature		-20 ~ +125	℃
Storage Temperature		-55 ~ +150	℃
Maximum junction temperature		-40 ~ +150	℃
Soldering temperature and time		+260（Recommended 10S）	℃

1. The peak current varies according to the IS pin external resistor and output power.

Recommended working condition

Parameter	Min	Typ.	Max	Unit
Power supply voltage, VCC	4.5	10	18	V
Pins input voltage	-0.3	-	VCC	V
Reverse voltage of peak value	-	-	550	V
Switching current of peak value	-	-	850	mA
Oscillating frequency	52	60	66	KHz
Operating Ambient temperature	0	-	100	℃

Electrical Characteristics（Ta=25℃，V_{CC}=6-15V，Rs=0.75Ω）

Item		Testing condition		Min	Typ.	Max	Unit
Maximum pressure resistance of switching tube		VCC=0V,Ioc=1mA		700	-	-	V
on-saturation pressure drop		Ioc=600mA		-	-	1	V
Output rise-time		CL=1nF		-	-	75	ns
Output fall-time		CL=1nF		-	-	75	ns
Output limit current		Tj=0~100℃		-	-	850	mA
Oscillating frequency				-	60	-	KHz
Frequency change ratio with voltage		VCC=5.5~9V		-	-	3	%
Frequency change rate with temperature		Ta=0~85℃		-	-	1	%
Input impedance	Pull-up current			-	0.5	-	mA
	pull-down resistance			-	18	-	KΩ
Power supply rejection ratio		VCC=5.5V~9V		-	60	70	dB
Current sampling limit				0.6	0.65	0.7	V
upper limit current prevention		R_S=0.75Ω		-	-	0.85	A
Power supply rejection ratio				-	60	70	dB
Maximum duty cycle				-	58	-	%
Minimum duty cycle				-	-	3.5	%
Startup acceptance current		I_{Vin}=0.5mA	ME8165A/D/E/F	1.6	2	2.4	mA
		Iob=30uA	ME8165G	-	0.5	-	
Startup static current				-	55	80	μA
Static current		VCC=8V		-	2.8	-	mA
Startup voltage				8.6	9.0	9.3	V
Close voltage of oscillator				3.5	3.8	4.1	V
Restart voltage				-	2.15	-	V
Over-voltage limit margin				21	22	-	V

Description of the Principle

At the start, the high-pressure power supply provides the power triode with a current current through the high voltage Resistor. After being amplified to charge the VCC external capacitor, when the VCC charging voltage reaches 9V, the chip begins to work, and the auxiliary winding supplies the VCC. VCC voltage should be maintained at 4.5 ~ 18V, VREF output 2.5 V benchmark; FB pull current turned on; The oscillator output triangle wave and 1.6 V voltage benchmark determine the maximum occupancy ratio, the output OSC tries to trigger the power supply into the open mode, and the shield power tube turns on the current peak; If the FB is less than 1.9 V oscillator charging current is diverted, the cycle will increase, the smaller the FB is, the larger the shunt, the wider the oscillator cycle will be until the oscillator stops(this feature reduces the standby power consumption of the switch power supply), if the peripheral feedback tries to make VCC greater than 21V, The internal circuit is fed back to the FB to stabilize the VCC at 21V; In the open mode, the OB provides the base current for the power tube, and the emitter of the OE pull-down power tube is CS. If CS detects the FB specified current, it enters the closing mode; In the open or off mode, if the current of the power tube is detected to be greater than 0.65 V, the FB is forced to fall and the duty ratio becomes smaller, thus protecting the power tube and the Transformer. The next closing mode starts along or FB is less than 1.9 V, and the upper current comparator is reset. In addition, this circuit has a built-in thermal protection. After the internal temperature is higher than 140 °C, the period of the oscillator is widened so that the temperature does not exceed 150 °C. If the VCC drops to about 3.8 V, the oscillator is turned off, the OSC is low, and the power supply remains closed; VCC continued to drop to around 2.15 V, and ME8165 re-entered the startup.

Application Information

High voltage line compensation current source input, external resistance to high voltage input terminal

Start current input, external start resistance, select 1206 resistance with 6M resistance, the drive current is 2mA maximum. At this time, the high and low voltage compensation effect is the best, the specific start time is subject to the standard. The smaller the resistance, the faster the start. When the external starting resistor is selected as 4M, the high-voltage constant power point will be about 10% smaller than the low voltage. It is not recommended that the high voltage starting resistance be less than 4M.

FB feedback and control

In normal operation, the voltage of the FB will determine the value of the occupancy ratio and the maximum switching current. The higher the voltage, the larger the occupancy ratio and the larger the switching current. The inside of the FB pin pulls the 650uA current source, and the pull resistance is about 18KΩ (approximate equivalent). In addition, when the FB voltage is lower than 1.9 V, the oscillation period will increase and the switch frequency will

decrease. The more below 1.9 V, the lower the switch frequency will be. The external FB capacitance will affect the feedback bandwidth, which in turn affects certain external parameters, such as transient output stability. For the CFB capacitor value, a typical application can be between 10-100nF, selected according to the frequency characteristics of the feedback loop, and a general application can use 100nF.(Refer to Infographic 1)

Over temperature protection

The interior of IC integrates the function of over temperature protection. When the internal temperature of the chip reaches 150℃, the over-heat protection circuit will work, it will pull down the clock signal, the switching frequency will fall until the oscillator is turned off. (As shown Fig.2)

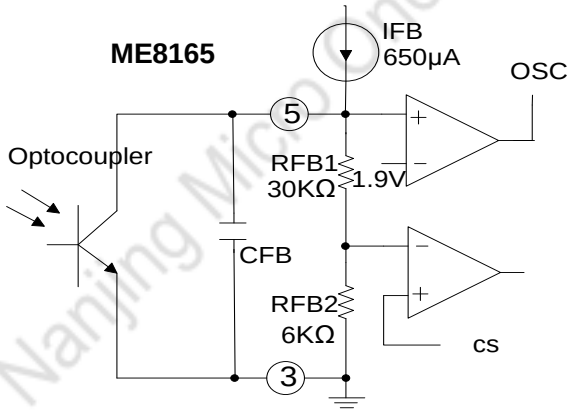


Fig.1

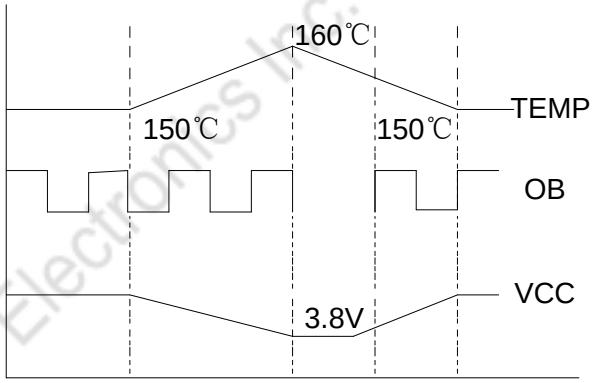


Fig.2

Over-voltage and under-voltage protection

IC has the function of slow-moving under-voltage protection, when the voltage of VCC reaches 9.0V, IC will set out to start, the initial start-up voltage is provided by the driving resistance, the high voltage of input will be injected into the base of the switching tube through Ic current, consequently, the driving voltage is formed. When IC works normally, the voltage of VCC should be keep between 4.5V and 18V (including the situation of full load output), when it decreases to 3.8V further, the oscillator turn off,VCC continued to drop to around 2.15 V, IC will begin to reset. As shown in Fig.3:

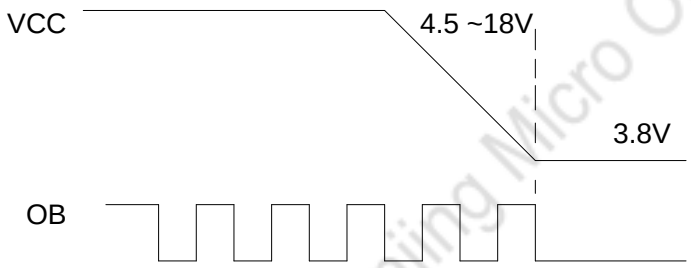


Fig.3

VCC in side IC is provided with a comparator controller of the upper limit voltage, if VCC tries to be more than 21V, the comparator will work, FB will be pulled down, and it will lock VCC to 21V, and reach the limit function of over

voltage, by which the voltage feedback function of the front terminal can be accomplished conveniently, the rising phenomenon of the output voltage in large extent can be avoided when the open-loop is output, so as to guarantee the security of the load. Because of the existence of this characteristic, the design of VCC shall be kept at the proper range, so as to avoid VCC rising excessively high when the output is high, and make the output voltage escape from decreasing when IC over-voltage limit works.

Maximum switching current limit

IC has the function of current limit cycle by cycle. It will test every switching current in every switching cycle, if the current fixed by FB or upper limit current prevention is reached, it will come into the close cycle, and the detection of the current has the function of real-time foreland hide, it can shield the switching peak, and avoid the wrong detection of the switching current. Then the reasonable temperature compensation eliminates the influence of temperature, comparing with normal MOSFET (the alteration of Ron will be large when the temperature changes) switching chip, the switching current can always be very accurate in a larger range, thus not too much allowance is needed to match a larger working temperature range for the designer when he designs the scenario, and the security of the circuit for use can be improved.

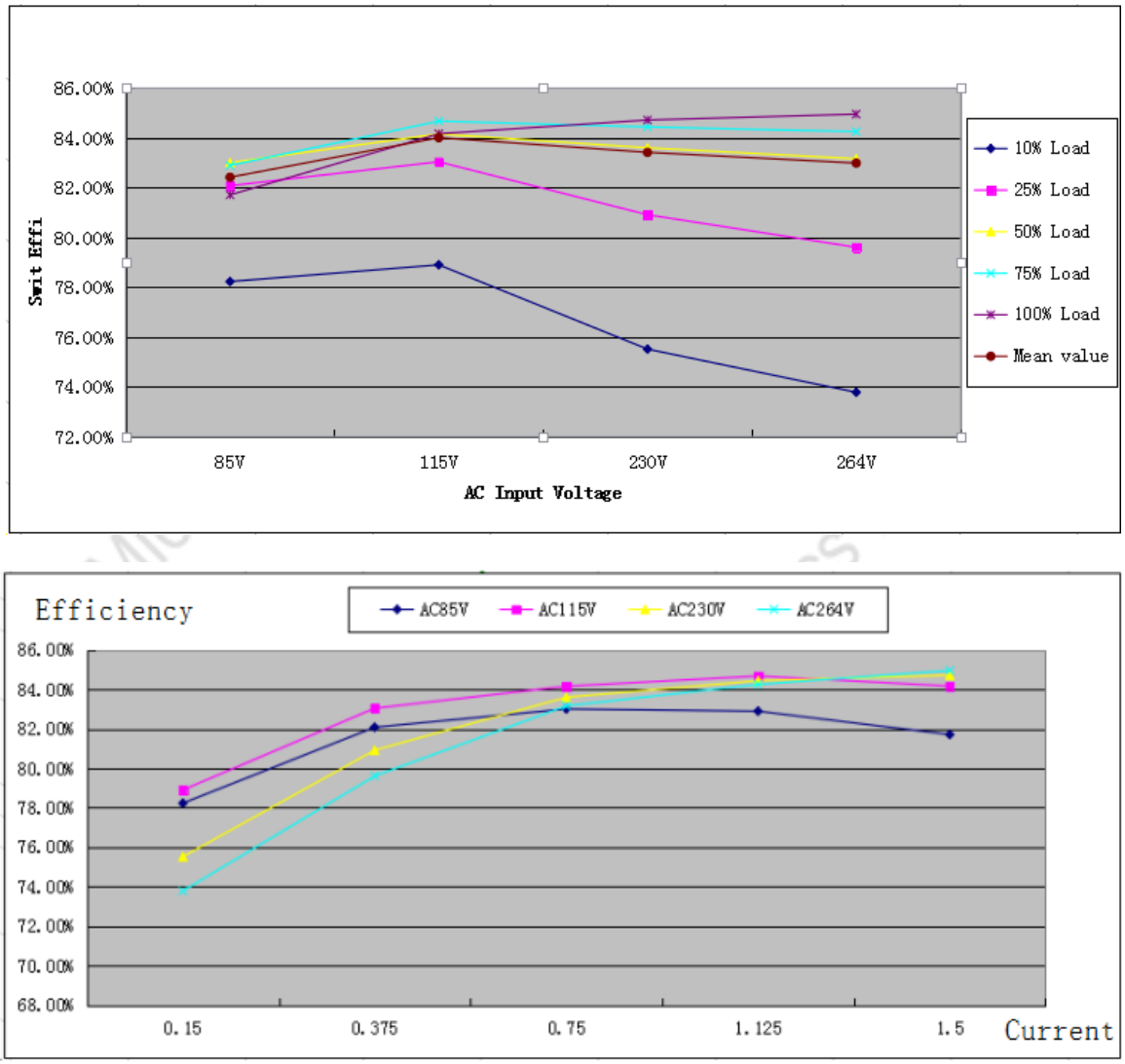
The maximum limit value of switching current for ME8165 is 0.85A. When designing a flyback power with 65V of emitter voltage and 0.85A of switching current, it can accomplish the output power of more than 15W easily, and meet the broad temperature range.

Requirement of heat elimination

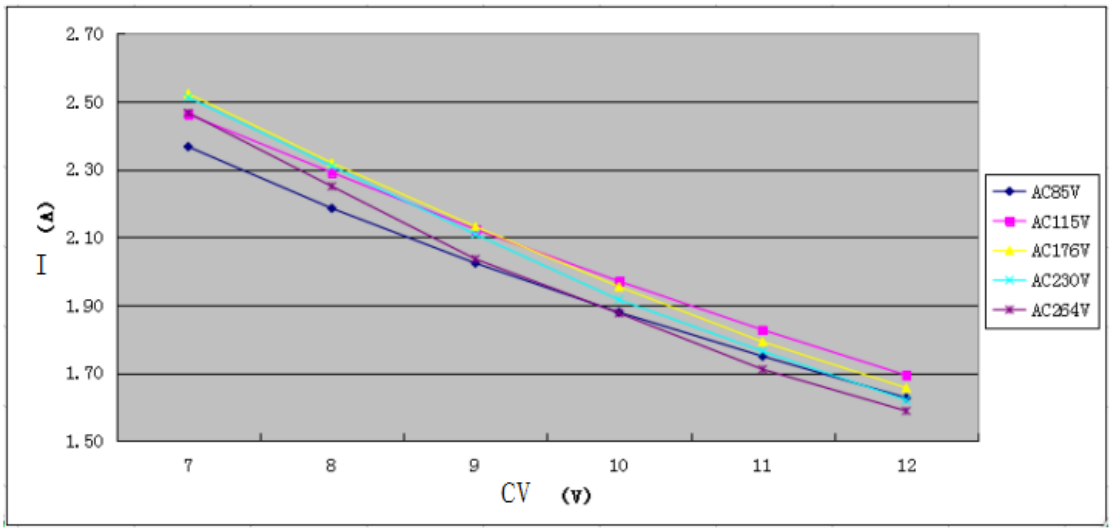
As for a typical power switch, it must have necessary heat elimination measures, so as to avoid that the excessive heat leads to heat protection. The primary heat inside IC is produced by the on-off wasting of the switching tube, so appropriate heat elimination position is Pin6-7 pin of IC, one wieldy way is to pave PCB copper foil of a certain area on Pin6-7 pin, what's more, plating tin on the copper foil will improve the heat elimination ability greatly. For an input of 85~265V, the typical application of 18W output and 300mm^2 copper foil are necessary.

In order to avoid the discharge phenomenon when PCB layout, it is necessary to keep a safe distance of 1mm or more between PIN-6 and PIN-7.

Efficiency curve of different loads in full voltage range, Output full load 12V/1.5A

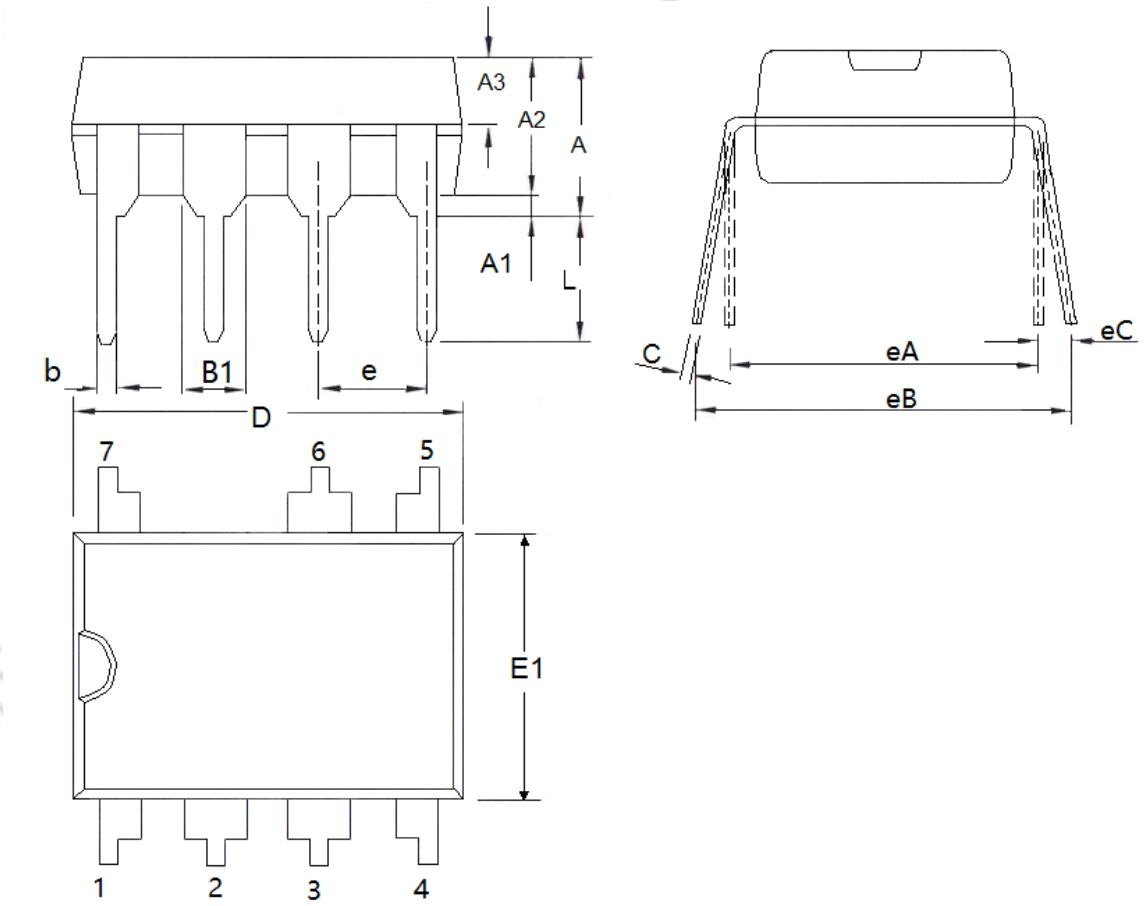


Output Voltage-Current Relation Curve (Constant Power) in Full Voltage Range, Output full load 12V/1.5A



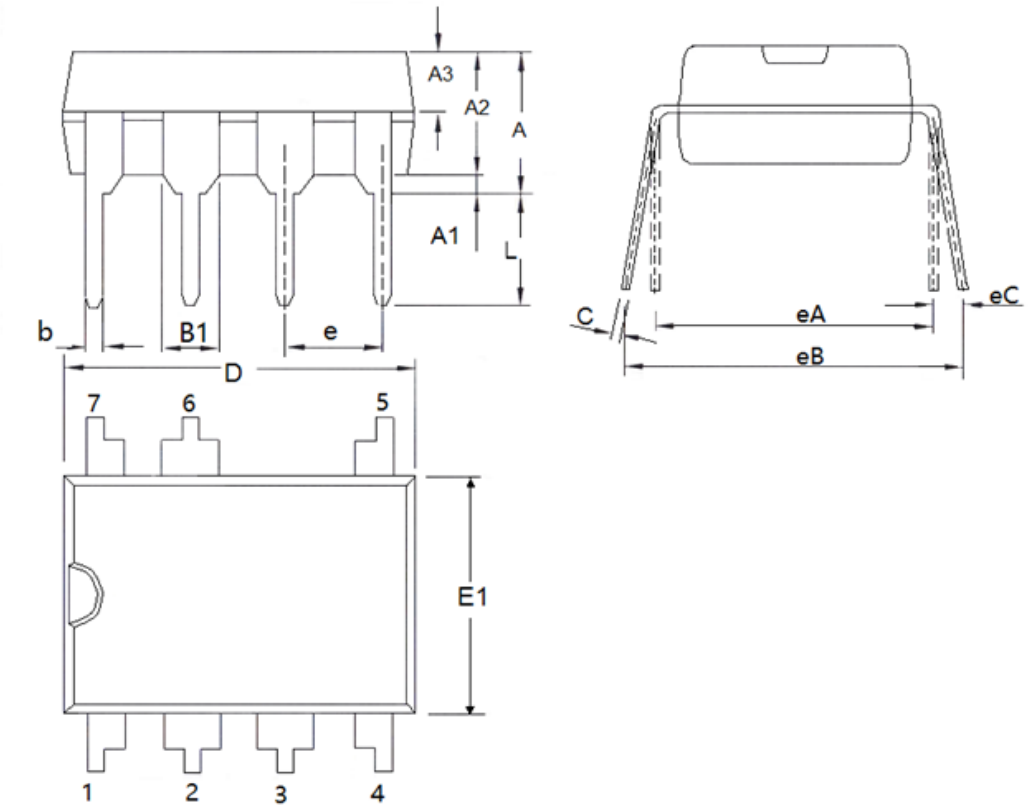
Packaging Information

- **Package: DIP7**



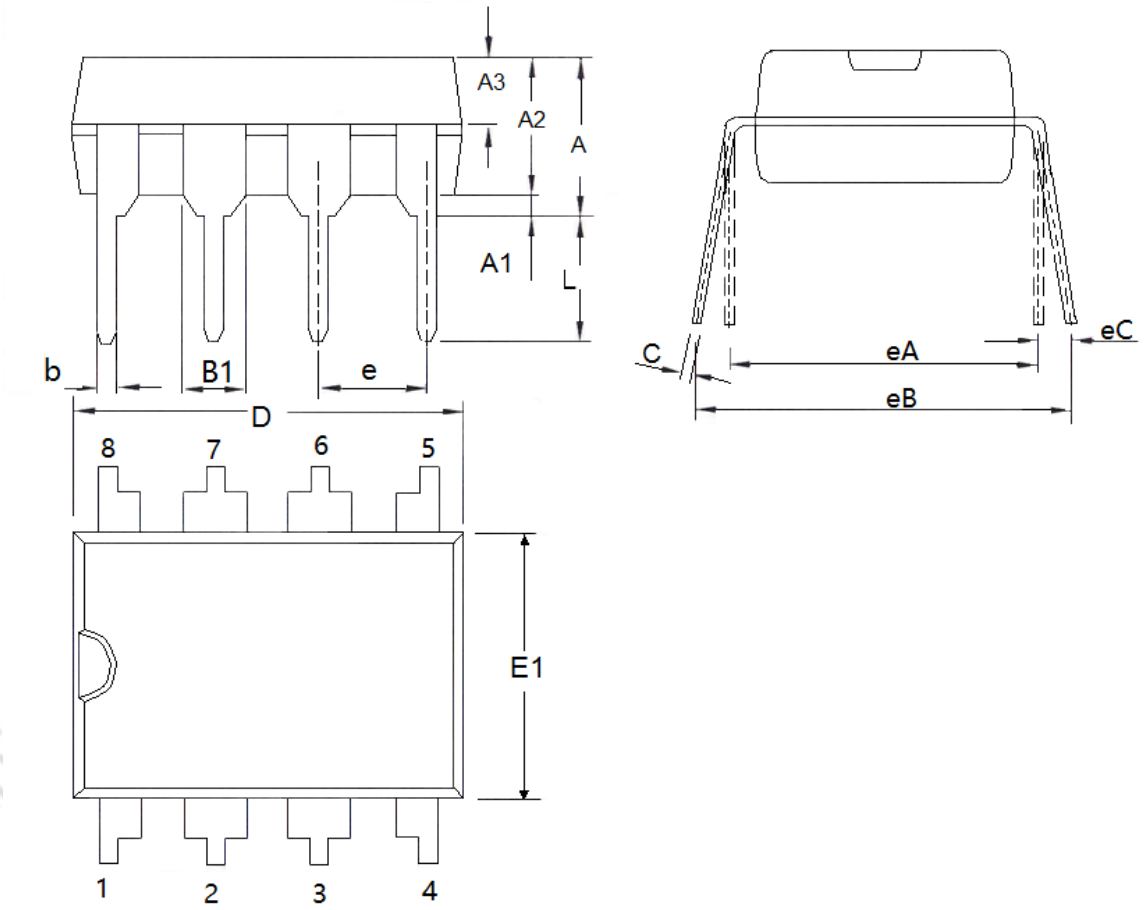
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.6	5.33	0.1417	0.2098
A1	0.5(TYP)		0.0197(TYP)	
A2	3.1	3.6	0.1220	0.1417
A3	1.4	1.65	0.0551	0.0650
b	0.38	0.57	0.0150	0.0224
B1	1.52(TYP)		0.0598(TYP)	
C	0.2	0.36	0.0079	0.0142
D	9	9.4	0.3543	0.3700
E1	6.1	6.6	0.2402	0.2598
e A	7.62(TYP)		0.3(TYP)	
e B	7.62	10.9	0.3000	0.4291
e	2.54(TYP)		0.1(TYP)	
e C	0	1.52	0.0000	0.0598
L	2.93	3.81	0.1154	0.1500

- **Package: DIP7(6)**



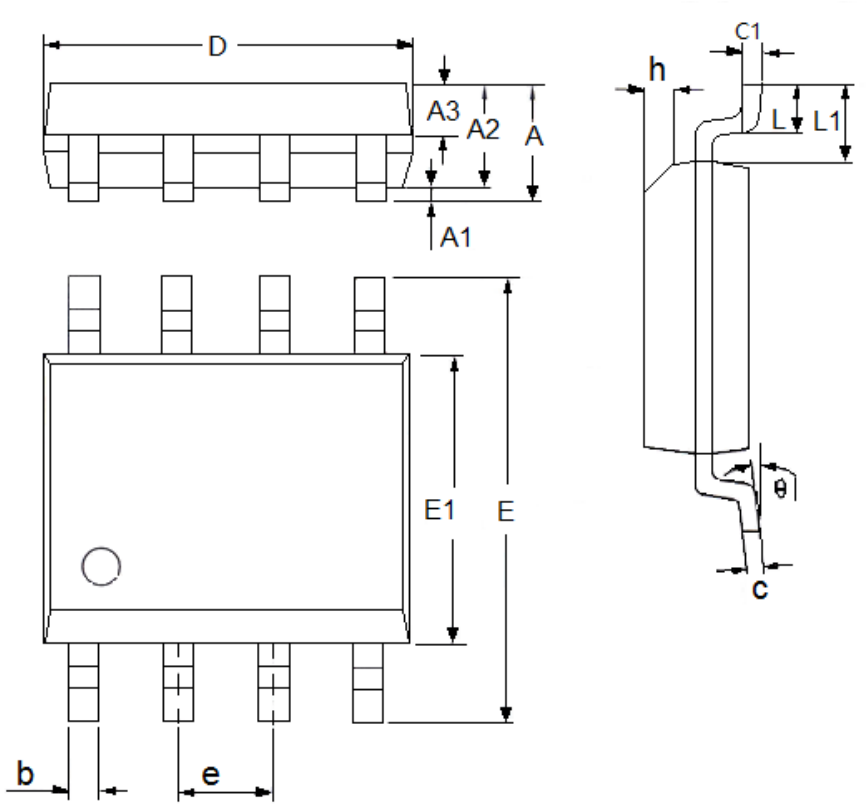
DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.6	4	0.1417	0.1575
A1	0.51		0.0201	
A2	3.2	3.4	0.1260	0.1339
A3	1.55	1.65	0.0610	0.0650
b	0.44	0.52	0.0173	0.0205
B1	1.52(TYP)		0.0598(TYP)	
C	0.25	0.29	0.0098	0.0114
D	9.15	9.35	0.3602	0.3681
E1	6.25	6.45	0.2461	0.2539
e A	7.62(TYP)		0.3(TYP)	
e B	7.62	9.3	0.3000	0.3661
e	2.54(TYP)		0.1(TYP)	
e C	0	0.84	0.0000	0.0331
L	3		0.1181	

- **Package: DIP8**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	3.6	4.31	0.1417	0.1697
A1	0.5(TYP)		0.0197(TYP)	
A2	3.2	3.6	0.1260	0.1417
A3	1.47	1.65	0.0579	0.0650
b	0.38	0.57	0.0150	0.0224
B1	1.52(TYP)		0.0598(TYP)	
C	0.2	0.36	0.0079	0.0142
D	9	9.4	0.3543	0.3700
E1	6.1	6.6	0.2402	0.2598
eA	7.62(TYP)		0.3(TYP)	
eB	7.62	9.3	0.3000	0.3661
e	2.54(TYP)		0.1(TYP)	
eC	0	0.84	0.0000	0.0331
L	3	3.6	0.1181	0.1417

- **Package: SOP8**



DIM	Millimeters		Inches	
	Min	Max	Min	Max
A	1.3	1.8	0.0512	0.0709
A1	0.05	0.25	0.002	0.0098
A2	1.25	1.65	0.0492	0.065
A3	0.5	0.7	0.0197	0.0276
b	0.3	0.51	0.0118	0.0201
c	0.17	0.25	0.0067	0.0098
D	4.7	5.1	0.185	0.2008
E	5.8	6.2	0.2283	0.2441
E1	3.8	4	0.1496	0.1575
e	1.27(TYP)		0.05(TYP)	
h	0.25	0.5	0.0098	0.0197
L	0.4	1.27	0.0157	0.05
L1	1.04(TYP)		0.0409(TYP)	
θ	0	8°	0	8°
c1	0.25(TYP)		0.0098(TYP)	

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