DESCRIPTION

The BM2490 is a monolithic step-down switch mode converter with a programmable output current limit. It achieves 2.5A continuous output current over a wide input supply range with excellent load and line regulation.

The maximum output current can be programmed by sensing current through an accurate sense resistor.

It can output constant current and voltage. Internal thermal shutdown, cycle-by-cycle current limit protection.

The BM2490 requires a minimum number of readily available standard external components. The BM2490 is available in 8-pin SOIC8-EP packages.

MP2490普通的SOP8封装只有1.5A

BM2490，ESOP8封装，能做到2.5A,3A-max, pin-pin MP2490

可以广泛的用于车充，USB电源，LED驱动。

在设定的电流下，恒压输出设定的电压；在达到或超过设定的电流的时候，恒流输出设定的电流。带精准的后端限流.

BM2490能降压恒压输出带精准限流

BM2490能升压-降压恒流输出带限压

FEATURES

- Wide 4.3V to 37V Operating Input Range
- 2.5A continusly, up to 3A-max output Current
- Output Adjustable from 0.8V to 15V
- Programmable Output Current Limit without power loss
- 0.25Ω Internal Power MOSFET Switch
- Stable with Low ESR Output Ceramic Capacitors
- 94% Efficiency @ 500mA (Vo=5V)
- Fixed 900KHz Frequency
- Thermal Shutdown
- Cycle-by-Cycle Over Current Protection
- Available in 8-Pin SOIC8-EP Packages

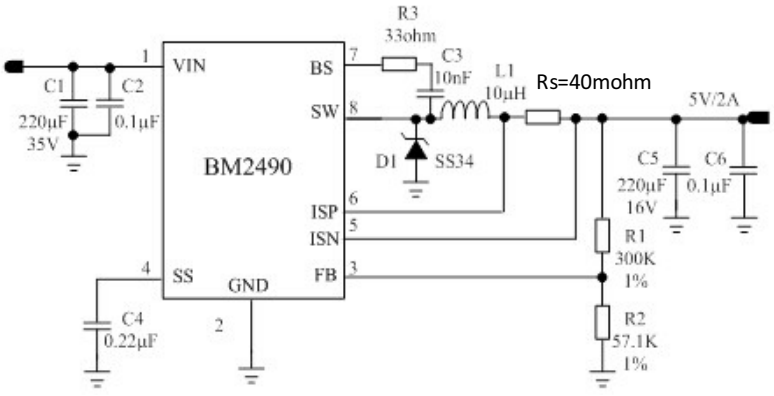
APPLICATIONS

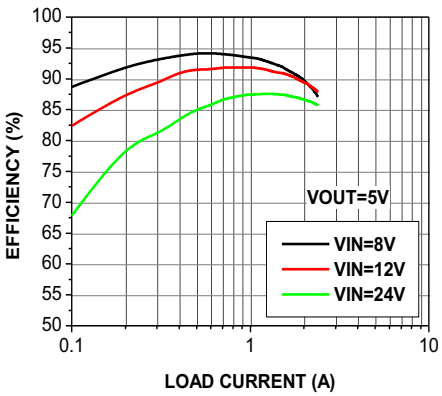
- USB Power Supplies
- Automotive Cigarette Lighter Adapters
- Power Supply for Linear Chargers

带软启动功能,低静态电流 Iq=380uA, 输入输出压差 1V@5V-0.5A

TYPICAL APPLICATION

如果空负载输出电压不稳,在输出端对地加个1-3K电阻负载即可. R1 两端并个 10nF 电容有助于把纹波做得小.





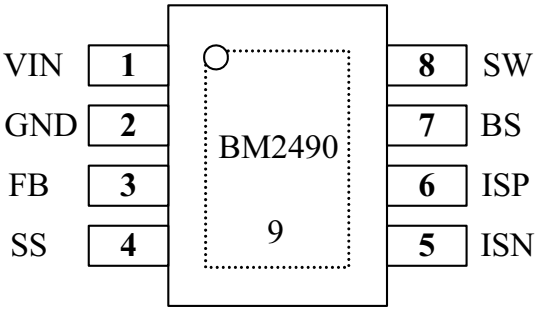
IC 内部已经有限流,如果应用输出电流大到 3A 或不需要精准限流,输出限流电阻(如 Rs=40mohm)短路掉,或用更小的限流电阻.

R3 是为了减小 PWM 波形上的过冲,更好过 EMC,也可以短路掉.

ORDERING INFORMATION

PART NUMBER	BM2490
TEMPERATURE RANGE	-40°C to 85°C
PACKAGE	SOIC8-EP

PIN CONFIGURATION



ABSOLUTE MAXIMUM RATINGS (1)

Supply Voltage V_{IN} 40V
V_{SW} ..... -0.3V to V_{IN} + 0.3V
V_{BST} ..... VSW + 6.0V
V_{ISN}, V_{ISP} 0V to15V
All Other Pins ..... -0.3V to +6.5V
Junction Temperature ..... 150°C
Lead Temperature ..... 260°C
Storage Temperature ..... -65°C to +150°C

Recommended Operating Conditions (2)

Supply Voltage V_{IN} ..... 4.5V to 36V
Output Voltage V_{OUT} (V_{IN}>16.5V) 0.8V to 15V
Output Voltage V_{OUT} (V_{IN}<=16.5V)....0.8V to (V_{IN}-1.5)V
Operating Temperature ..... -40°C to +85°C

Thermal Resistance (3) θ_{JA} θ_{JC}
SOIC8-EP(EXPOSED PAD) ..... 50 ..... 10 ... °C/W

Notes:
1) Exceeding these ratings may damage the device.
2) The device is not guaranteed to function outside of its operating conditions.
3) Measured on approximately 1" square of 1 oz copper.

PIN No.	PIN NAME	PIN DESCRIPTION
1	VIN	Supply Voltage. The BM2490 operates from a +4.5V to +36V unregulated input. C_{IN} is needed to prevent large voltage spikes from appearing at the input. Put C_{IN} as close to the IC as possible. It is the drain of the internal power device and power supply for the whole chip.
2	Gnd	Ground. This pin is the voltage reference for the regulated output voltage. For this reason care must be taken in its layout. This node should be placed outside of the D1 to C_{IN} ground path to prevent switching current spikes from inducing voltage noise into the part.
3	FB	Feedback. An external resistor divider from the output to GND, tapped to the FB pin sets the output voltage. To prevent current limit run away during a short circuit fault condition the frequency-fold-back comparator lowers the oscillator frequency when the FB voltage is below 250mV.
4	SS	Connect to an external capacitor used for Soft-Start and compensation for current limiting loop.
5	ISN	Negative Current Sense Input for load current limiting.
6	ISP	Positive Current Sense Input for load current limiting.
7	BS	Bootstrap. This pin acts as the positive rail for the high-side switch's gate driver. Connect a 10nF between this pin and SW.
8	SW	Switch Output. Connect this pin to the switching end of the inductor.
9		Exposed pad. Connected it to Gnd

ELECTRICAL CHARACTERISTICS

V_{IN} = 12V, T_A = +25°C, unless otherwise noted.

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Feedback Voltage	V_{FB}	4.5V ≤ V_{IN} ≤ 36V	0.785	0.805	0.825	V
Feedback Bias Current	$I_{BIAS(FB)}$	V_{FB} = 0.8V		10		nA
Switch On Resistance	$R_{DS(ON)}$			0.25		Ω
Switch Leakage		V_{EN} = 0V, V_{SW} = 0V		0.1	10	μA
Current Limit (4)			2.5	2.8	3.1	A
Oscillator Frequency	f_{SW}	V_{FB} = 0.6V	700	900	1000	KHz
Fold-Back Frequency		V_{FB} = 0V		200		KHz
Boot-Strap Voltage	V_{BST} - V_{SW}			6		V
Minimum On Time (4)	t_{ON}	V_{FB} = 1V		100		ns
Under Voltage Lockout Threshold Rising			3.0	3.3	3.6	V
Under Voltage Lockout Threshold Hysteresis			200			mV
Supply Current (Quiescent)		V_{EN} = 2V, V_{FB} = 1V		400	700	μA
Thermal Shutdown(4)				160		°C
Current Sense Voltage	V_{ISP} - V_{ISN}	V_{ISP}, V_{ISN} 0.4-15V	85	95	105	mV
Input Bias Current (ISN, ISP)	$I_{BIAS\ (ISN,ISP)}$	V_{ISP}, V_{ISN} 0.4-15V	-1	0.1	+1	uA

Note:

4) Guaranteed by design

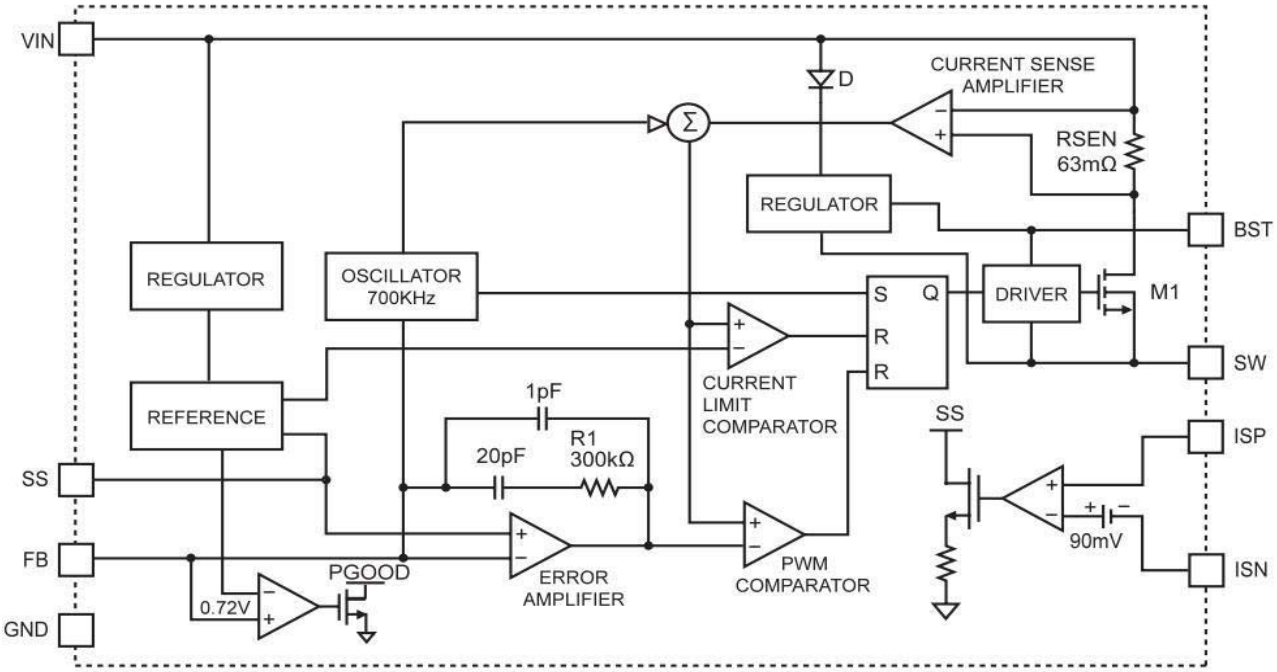
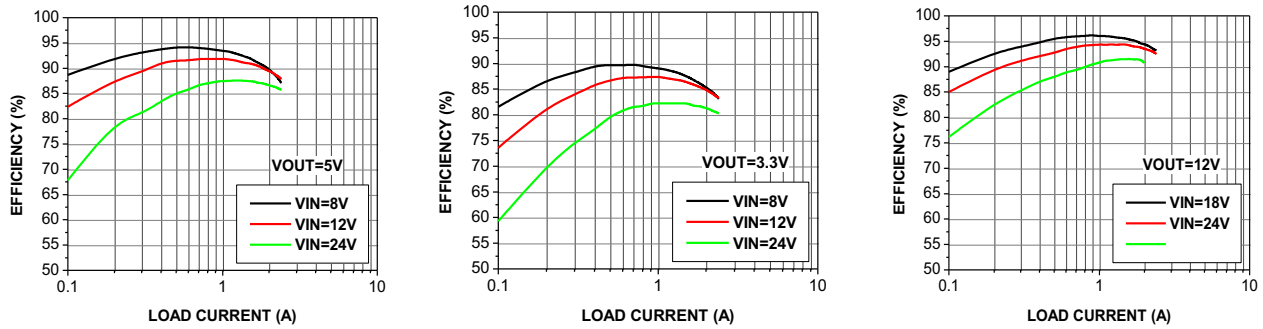


Figure 2 . Functional Block Diagram

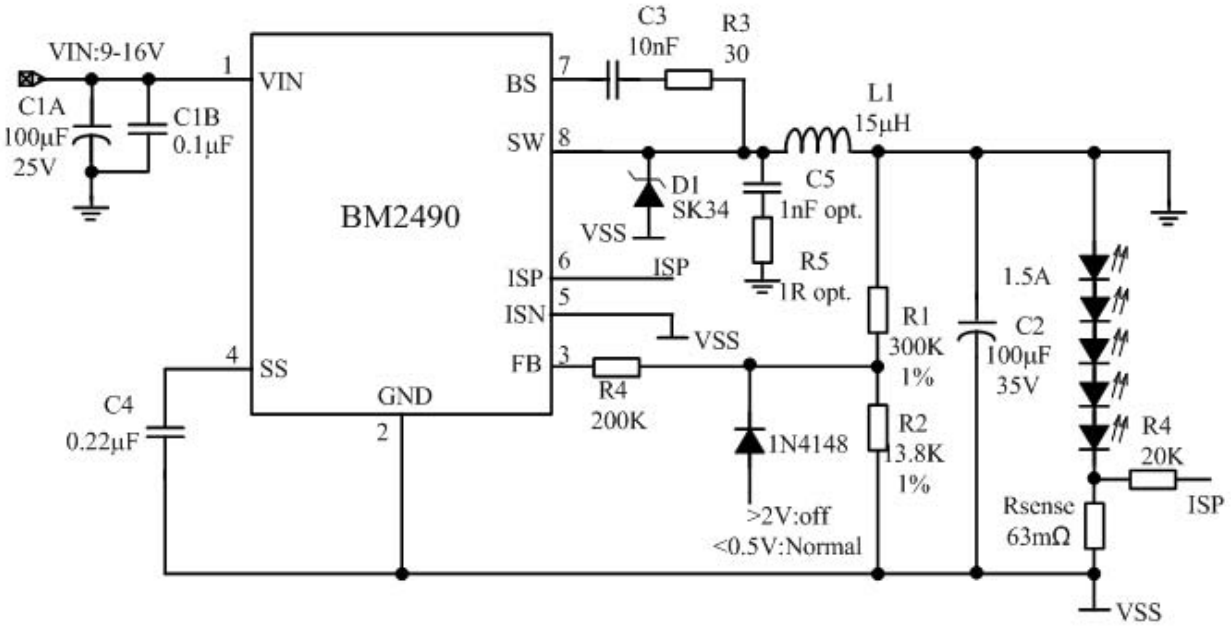
TYPICAL PERFORMANCE CHARACTERISTICS

C1=C2=4.7μF, C4=0.22μF, C5=C6=10μF, L=10μH, T_A=25ºC, unless otherwise noted



升降压或升压应用：LED驱动 （输出电压比输入电压高或低都可以）

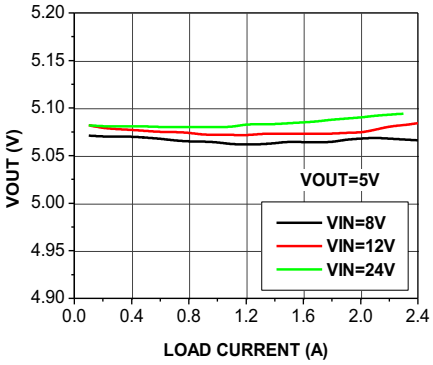
1. OVP设定：（1+R1/R2）×0.8=18.2V
2. 恒流设定：95mv/63mΩ=1.508A
3. 可串接3只LED（10V）或5只（16V），1.5A恒定



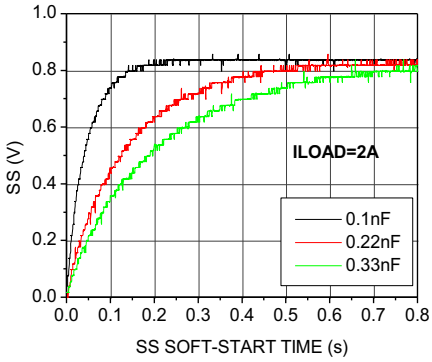
TYPICAL PERFORMANCE CHARACTERISTICS *(continued)*

C1=C2=4.7μF, C4=0.22μF, C5=C6=10μF, L=10μH, T_A=25ºC, unless otherwise noted

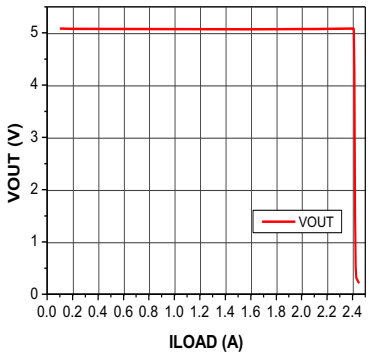
Load Regulator



SS Volt. – Soft start Cap.



CV-CC curve



OPERATION

Main Control Loop

The BM2490 is a current mode buck regulator. That is, the error amplifier (EA) output voltage is proportional to the peak inductor current. At the beginning of a cycle, the integrated high side power switch M1 is off; the EA output voltage is higher than the current sense amplifier output; and the current comparator's output is low. The rising edge of the 900KHz clock signal sets the RS Flip-Flop. Its output turns on M1 thus connecting the SW pin and inductor to the input supply.

The increasing inductor current is sensed and amplified by the Current Sense Amplifier. Ramp compensation is added to Current Sense Amplifier output and compared to the Error Amplifier output by the PWM Comparator. When the Current Sense Amplifier plus Slope Compensation signal exceeds the EA output voltage, the RS Flip-Flop is reset and the BM2490 reverts to its initial M1 off state. If the Current Sense Amplifier plus Slope Compensation signal does not exceed the COMP voltage, then the falling edge of the CLK resets the Flip-Flop. The output of the Error Amplifier integrates the voltage difference between the feedback and the 0.8V bandgap reference. The polarity is such that a FB pin voltage lower than 0.8V increases the EA output voltage. Since the EA output voltage is proportional to the peak inductor current, an increase in its voltage increases current delivered to the output. An external Schottky Diode (D1) carries the inductor current when M1 is off.

Load Current Limiting Loop

The output current information is sensed via the ISP and ISN pins. The regulation threshold is set at 95mV. If VSENSE, the difference of VISP and VISN, is less than 95mV, the output voltage of the power supply will be set by the FB pin. If VSENSE reaches 95mV, the current limit loop will pull down SS and regulate the output at a constant current determined by the external sense resistor. The external capacitor on SS pin is the dominant compensation capacitor for load current regulation loop. The capacitor has normal value of 220nF, which will put the bandwidth of load current regulation loop to be less than 1 kHz. When VSENSE is higher than 95mV, SS will not drop down to the final regulation level immediately. It will cause the load current to be higher than the programmed level for a short period. A fast comparator is added to shut down power switch when the average load current is higher than 120% of the programmed current limit level. An accurate sense resistor can be used for load current sensing.

APPLICATION INFORMATION

Setting the Output Voltage

The external resistor divider is used to set the output voltage (see the schematic on front page). The feedback resistor R1 also sets the feedback loop bandwidth with the internal compensation capacitor (see Figure 1). Choose R1 to be around 300kΩ for optimal transient response. R2 is then given by:

$$R2 = \frac{R1}{V_{OUT} / 0.8 - 1}$$

Table 1 –Resistor Selection for Common

Vout(V)	R1(K Ω)	R2(KΩ)
1.8	300(1%)	240(1%)
2.5	300(1%)	141.1(1%)
3.3	300(1%)	96(1%)
5	300(1%)	57.1(1%)
12	300(1%)	21.4(1%)
15	300(1%)	16.9(1%)

Selecting the Inductor

A 1μH to 15μH inductor with a DC current rating of at least 25% percent higher than the maximum load current is recommended for most applications. For highest efficiency, the inductor DC resistance should be less than 200mΩ. For most designs, the inductance value can be derived from the following equation.

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f\text{sw}}$$

Where ΔIL is the inductor ripple current. Choose inductor current ripple to be approximately 30% of the maximum load current,. The maximum inductor peak current is:

$$I_{L(MAX)} = I_{L(MAX)} - \frac{\Delta I_L}{2}$$

Under light load conditions below 100mA, larger inductance is recommended for improved efficiency.

Output Current Sensing

The output current can be sensed through the accurate sense resistor, as in Figure 3, where the output current limit is set as:

$$I_{L(MAX)} = \frac{95\text{mV}}{\text{Rs}}$$

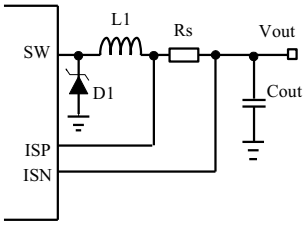


Figure 3: Current Sensing Methods

Selecting the Input Capacitor

The input capacitor reduces the surge current drawn from the input and also the switching noise from the device. The input capacitor impedance at the switching frequency should be less than the input source impedance to prevent high frequency switching current from pass to the input. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. For most applications, a 4.7μF capacitor is sufficient.

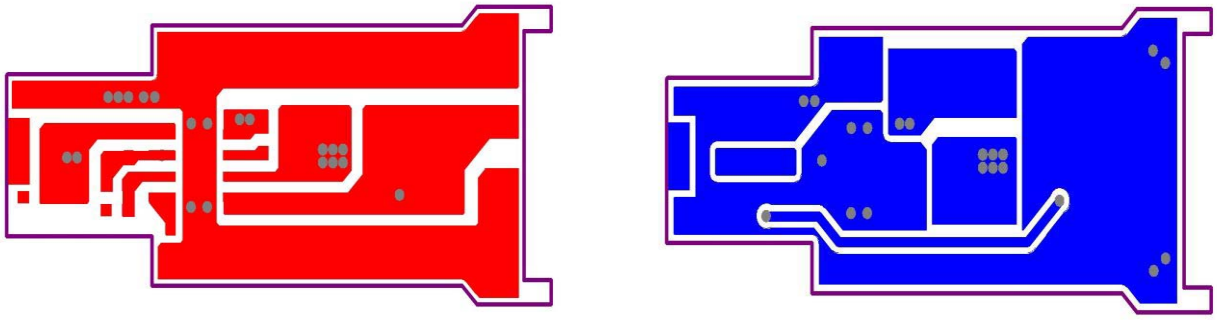
Selecting the Output Capacitor

The output capacitor keeps output voltage small and ensures regulation loop stability. The output capacitor impedance should be low at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended.

PC Board Layout

1) The high current paths (GND, VIN and SW) should be placed very close to the device with short, direct and wide traces.
2) The input capacitor needs to be as close as possible to the VIN and GND pins.
3) The external feedback resistors should be placed next to the FB pin. Keep the switching node SW short and away from the feedback network.
4) ISN, ISP are sensitive nodes. Put the sensing components as close to the device as possible and keep them away from the high current and noisy paths such as GND, VIN, SW). Match the trace and components on ISN, ISP paths as good as possible.

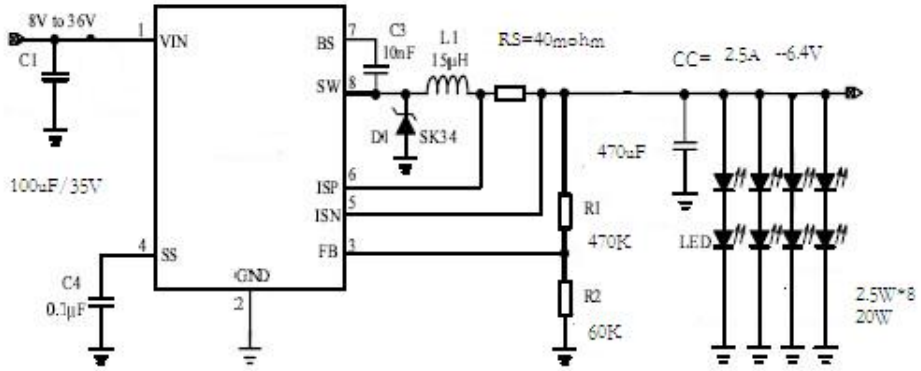
PCB reference:



BOM LIST FOR 5V/2.2A Car Charger:

Ref	Value	Description	Package	Manufacturer	Qty	Manufacturer P/N
C1, C2	4.7uF	Ceramic Cap., 50V, X7R	1210	muRata	2	GRM32ER71H475K
C3	10nF	Ceramic Cap., 50V, X7R	0603	muRata	1	GRM188R71H103K
C4	0.22uF	Ceramic Cap., 16V, X7R	0603	muRata	1	GRM188R71C224K
C5, C6	10uF	Ceramic Cap., 25V, X7R	1210	muRata	2	GRM32DR71E106K
D1	3A	Schottky Diode, SMD, 40V, 3A	SMA	ON Semiconductor	1	MBRA340T3GOSCT
L1	10uH	DS85LC Inductor, 2.3A/51mΩ	SMD	TOKO	1	B1000AS-100M
R1	300KΩ	Film Res., 1%, 300KΩ	0603	Panasonic	1	ERJ-3EKF3003V
R2	57.1KΩ	Film Res., 1%, 57.1KΩ	0603	Panasonic	1	ERJ-3EKF5712V
RS	40mΩ	Film Res., 1%, 40mΩ	2010	Vishay	1	WSLF040TR-ND
U1		DC-DC Converter	SOP8-EP	BM2490	1	

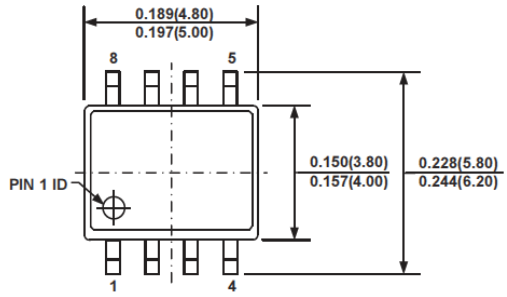
LED 恒流应用电路—2.5A(6.5V 左右)



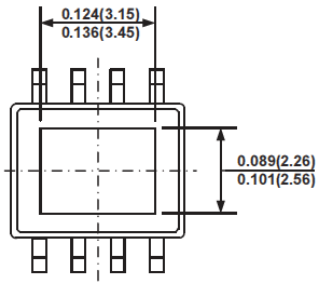
90%的高效率，独特的 LED 负端接地输出,外部小电感 6.8-22UH

PACKAGE OUTLINE

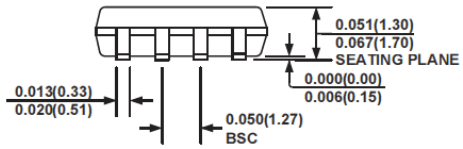
SOIC8-EP PACKAGE OUTLINE AND DIMENSIONS



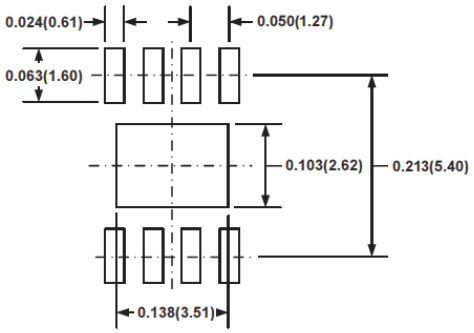
TOP VIEW



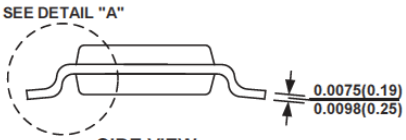
BOTTOM VIEW



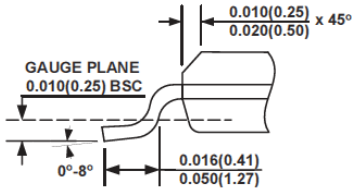
FRONT VIEW



RECOMMENDED LAND PATTERN



SIDE VIEW



DETAIL "A"

NOTE:

1) CONTROL DIMENSION IS IN INCHES. DIMENSION IN BRACKET IS IN MILLIMETERS.
2) PACKAGE LENGTH DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
3) PACKAGE WIDTH DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSIONS.
4) LEAD COPLANARITY (BOTTOM OF LEADS AFTER FORMING) SHALL BE 0.004" INCHES MAX.
5) DRAWING CONFORMS TO JEDEC MS-012, VARIATION BA.
6) DRAWING IS NOT TO SCALE.

比较	输出电容	输出电感
xx2009	大	47uH
BM2490	小	10uH

比较	电流	效率5V@2A	带载开机冲击电流	静态功耗Iq	封装	限流点控制
某家2009	号称3A实际2.5A	89%	大	5mA	普通的SOP8,烫	输入前端限制
BM2490	号称2.5A实际3A	91%	无(软启动)	380uA	ESOP8(SOP8+PAD)	更精准的后端限制