

MSKSEMI 美森科

SEMICONDUCTOR



ESD



TVS



TSS



MOV



GDT



PLED

HX4004-MS

Product specification

概述

MHX4004-MS 是一款低噪声、频率 400KHz 的电荷泵型 DC/DC 转换器,在输入电压 2.7V 到 5V 的情况下,恒定输出 5V 电压,并且有很好的线性调整率 和负载调整率, MHX4004-MS 可以保持稳定的开关频率,输出电流最大达到 300mA。

MHX4004-MS 支持 PFM、PWM 双模式,对芯片的静态功耗做到了有效的优化, 以提升产品的续航时间,所以 在实际应用中, 特别适合锂电池供电设备。

MHX4004-MS 优化后的电荷泵结构, 具有输出纹波小、对 FM 等无线设备干扰极低的优点。

MHX4004-MS 具有过热、过流保护、软启动功能。关断电流小于 1uA。

MHX4004-MS 提供 SOT-23-6 封装形式。

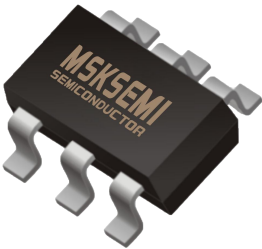
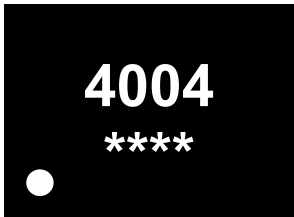
特性

- 固定输出 5V±2%
- 输入电压 2.7V to 5V
- 输出电压 4.9V to 5.1V
- 输出电流高达: 300mA (VIN=3.6V)
- 低 Iq (静态电流) 0.23 mA (VIN=3.6V)
- 低噪声固定频率 400KHz (VIN=3.6V)
- 关断电流小于 1uA
- 具有过热、过流保护
- 软启动功能

应用场合

- 智能蓝牙音响
- 锂电池备用电源
- 智能读卡器
- LED 背光驱动
- 3V to 5V 转换

引脚描述和标记

SOT-23-6	引脚说明	管体标记
	VOUT GND EN 1 2 3 6 5 4 CP VIN CN	

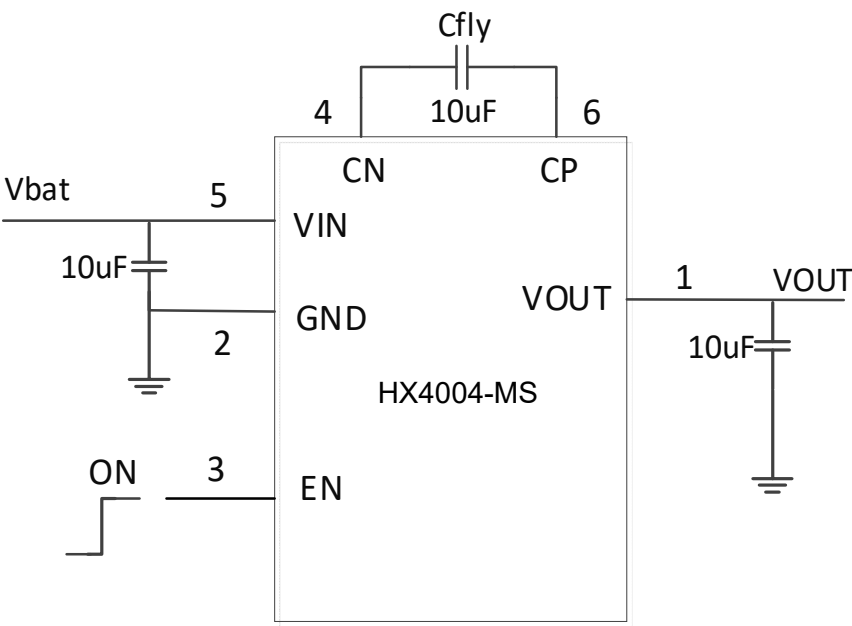
管脚描述

管脚	符号	I/O	描述
1	VOUT	O	电压输出
2	GND	G	地线
3	EN	I	芯片使能脚(高开低关)
4	CN	I/O	电荷泵负端
5	VIN	I	电源输入
6	CP	I/O	电荷泵正端

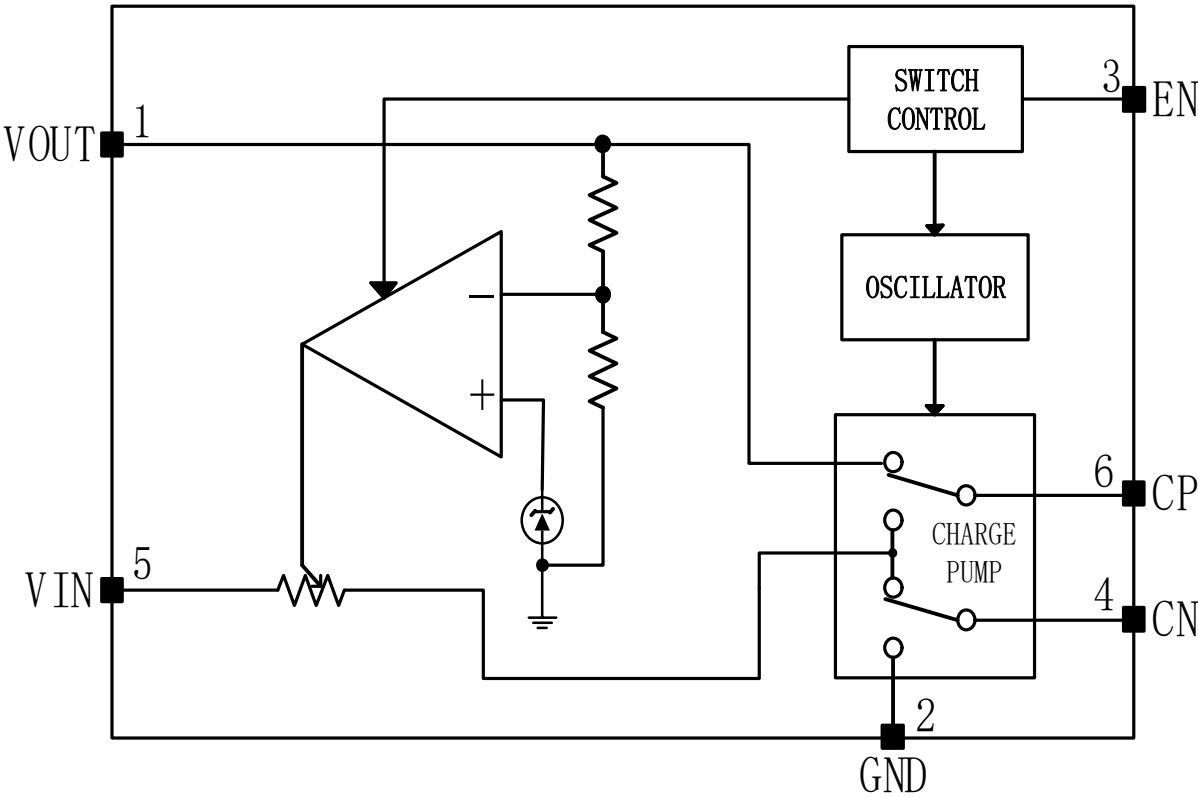
订货信息

料号	封装	包装
HX4004-MS	SOT-23-6	3000PCS

典型应用电路图



内部电路方框图



绝对最大额定值

V_{IN}	供电电压	-0.3V to 6.0V
V_{OUT}	输出电压	-0.3V to 5.5V
T_A	工作温度	-25℃ to 85℃
T_J	结温	-40℃ to 125℃
T_{STG}	存储温度	-65℃ to 150℃
T_{SLD}	焊接温度	260℃, 10sec

注：最大极限值是指超出该工作范围芯片可能会损坏。

推荐额定值

符号	项目	MIN	MAX	UNIT
V_{IN}	输入电压	2.7	5	V
V_{out}	输出电压	4.9	5.1	V
V_{IH}	EN 高电平	2.8V		V
V_{IL}	EN 低电平		0.8	V

热阻参数

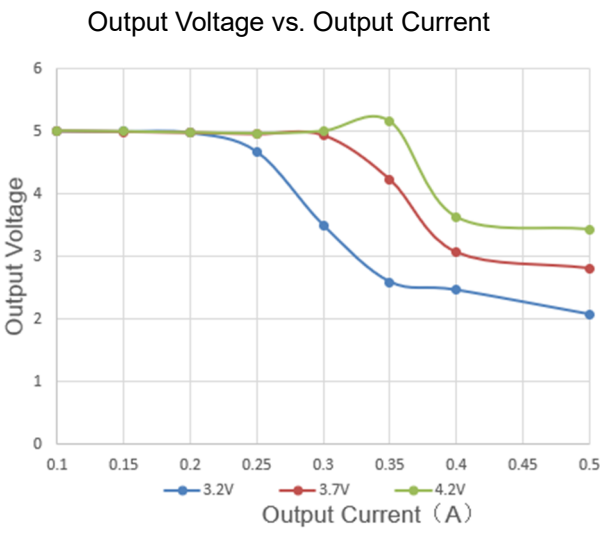
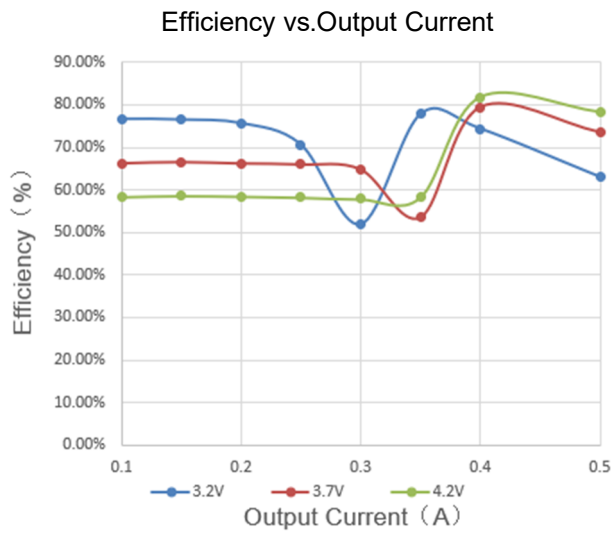
Parameter	Symbol	Package	MAX	UNIT
热阻 (Junction to Ambient)	θ_{JA}	S0T-23-6L	185	℃/W
热阻 (Junction to Case)	θ_{JC}	S0T-23-6L	155	℃/W

电性能参数

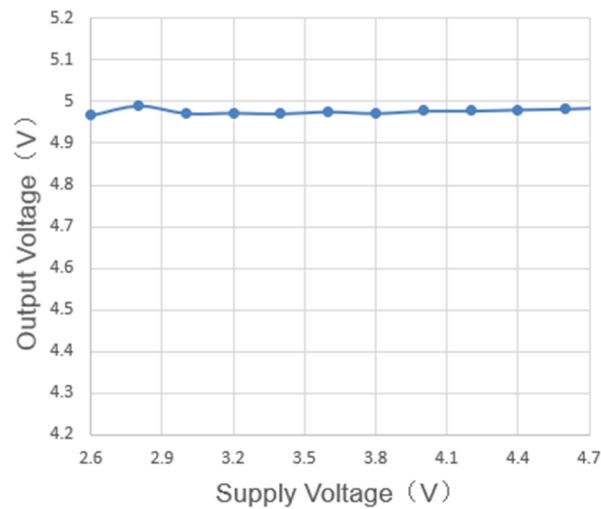
The specifications are at VDD=3.6V, TA = 25℃, unless otherwise noted.

Symbol	Parameter	Test Conditions	MIN	TYP	MAX	UNIT
V _{IN}	输入电源电压		2.7		5	V
V _{OUT}	输出电压	Vbat=3.6V , I _{out} =50mA	4.9	5	5.1	V
I _Q	静态电流	Vbat=3.6V, NO LOAD		0.23		mA
I _{SD}	关断电流	Vbat=3.6V		0.1	1	uA
F _{OSC}	开关频率	Vbat=3.6V, I _{out} =100mA		400		KHz
I _{OUT_MAX}	最大输出电流	Vbat=3.6V		300		mA
V _{RIP}	输出纹波	Vbat=3.6V, I _{out} =100mA		30		mVpp
Efficiency	效率	Vbat=2.8V , I _{OUT} =50mA		85		%
T _{St}	软启动时间	Vbat=3.6V		1.5		mS
V _{ENH}	使能高电平	Vbat=3.6V	2.7		Vbat	V
V _{ENL}	使能低电平	Vbat=3.6V	0		0.8	V
OTP	—	Vbat=3.6V, I _{out} =0A		190		℃
OTH	—			60		℃

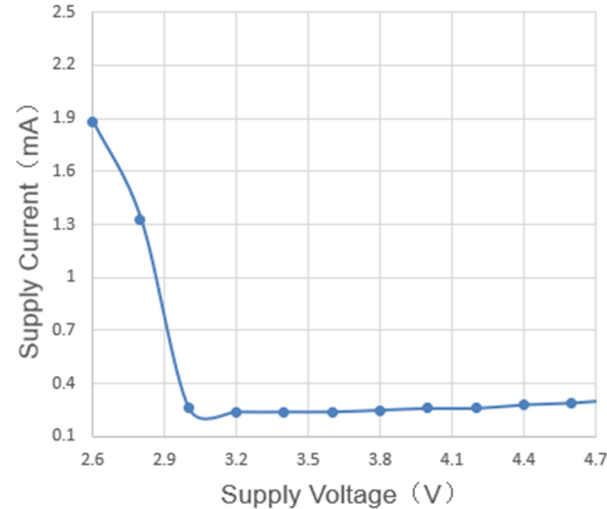
典型特征曲线



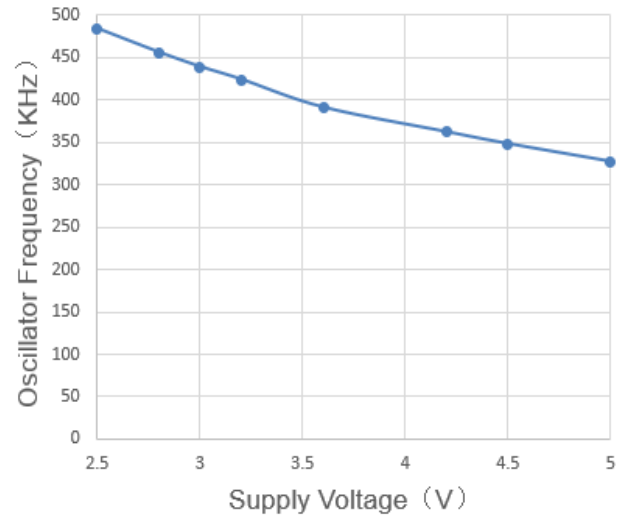
Output Voltage vs. Supply Voltage
(ILOAD=0mA)



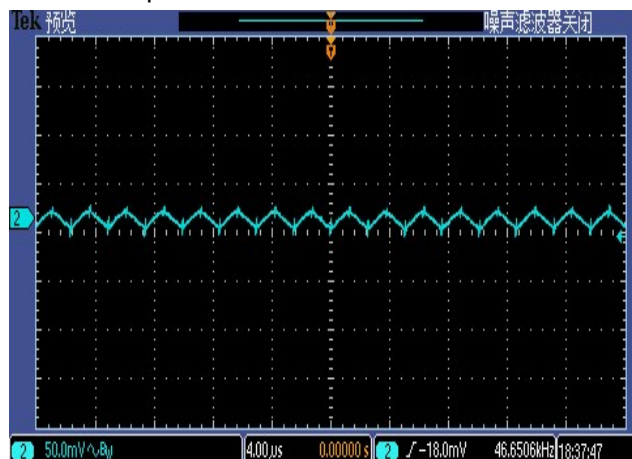
Supply Current vs. Supply Voltage
(ILOAD=0mA)



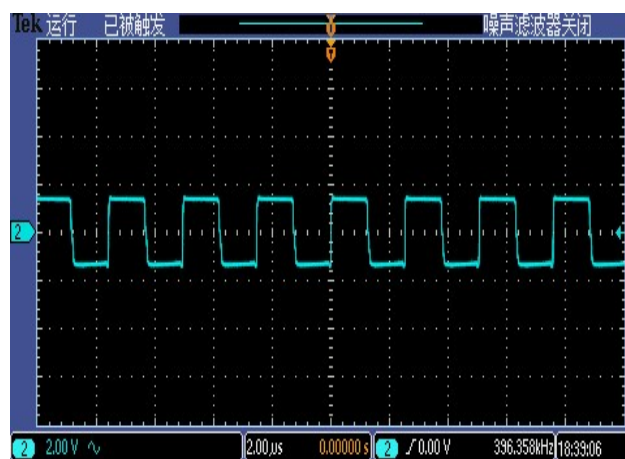
Oscillator Frequency vs. Supply Voltage
(ILOAD=0mA)



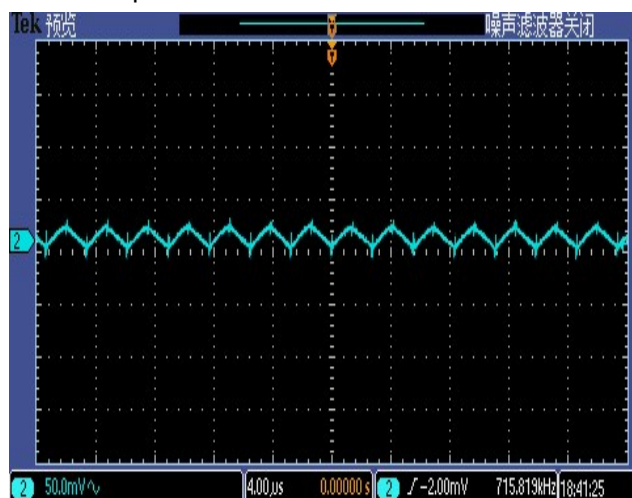
Output Noise ($V_{IN}=3.6V$, $I_{LOAD}=100mA$)



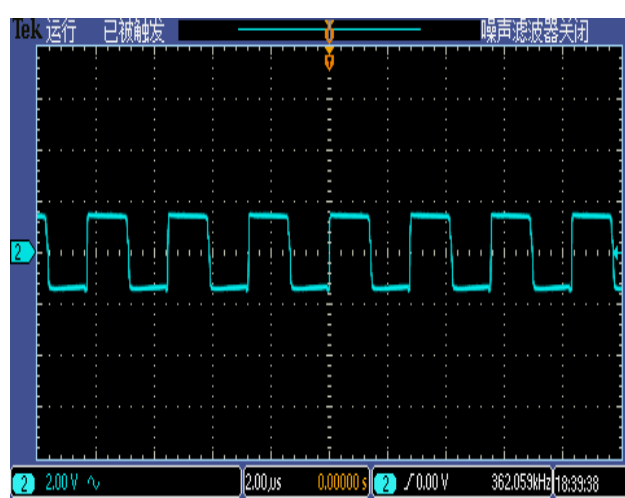
SW Noise ($V_{IN}=3.6V$, $I_{LOAD}=100mA$)



Output Noise ($V_{IN}=4.2V$, $I_{LOAD}=100mA$)



SW Noise ($V_{IN}=4.2V$, $I_{LOAD}=100mA$)



应用信息

HX4004-MS 使用开关电容充电电荷泵将输入 VIN 升压至恒定输出电压，输出恒定电压的产生是根据内部电阻分压器及电荷泵电流调节来获得，2 个非重叠的时钟开关信号去激活电荷泵开关，第 1 个时钟信号控制将电容从 VIN 处充电，第 2 个时钟信号控制电容的放电路径，使电容上的电荷与 VIN 电荷相叠加，通过交替控制实现充放电从而得到所需要的恒定输出电压，控制开关中心频率在 400KHz 运行。

短路保护

HX4004-MS 芯片具有内置过流保护功能，在短路情况下，将输出电压自动关断。

软启动

HX4004-MS 芯片具有软启动功能，在启动瞬间防止大电流的出现，启动时间约为 1.5ms

C_{IN} 及 C_{OUT} 电容选择

V_{OUT} 输出纹波及噪声与 C_{IN} 及 C_{OUT} 电容相关，建议采用低 ESR 的陶瓷电容且不小于 10uF 的容量，输出纹波峰值电压有以下公式表示：

$$V_{\text{RIPPLE}} = \frac{I_{\text{OUT}}}{2F_{\text{OSC}} \times C_{\text{OUT}}}$$

C_{FLY} 电容选择

C_{FLY} 是升压的充放电电容，不可以使用极性电容，建议采用低 ESR 的陶瓷电容且不能低于 10uF 的容量

EN 使能控制

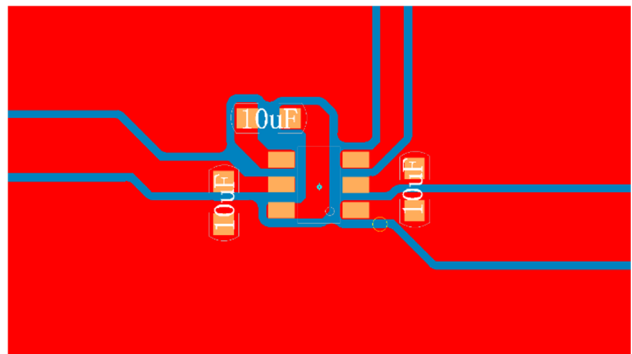
EN 使能引脚为高电平时芯片工作，输出 5V 电压。EN 使能引脚为低电平时芯片关断，此时关断功耗小于 0.1uA。

温度保护

HX4004-MS 带有过温保护电路以防止内部温度超过 190℃时器件损坏。在不同器件之间，这个值有 25℃ 的差异。当内部电路超过设置的保护温度时，器件进入关断状态，输出被截止。当温度下降 60℃后，器件重新正常工作。

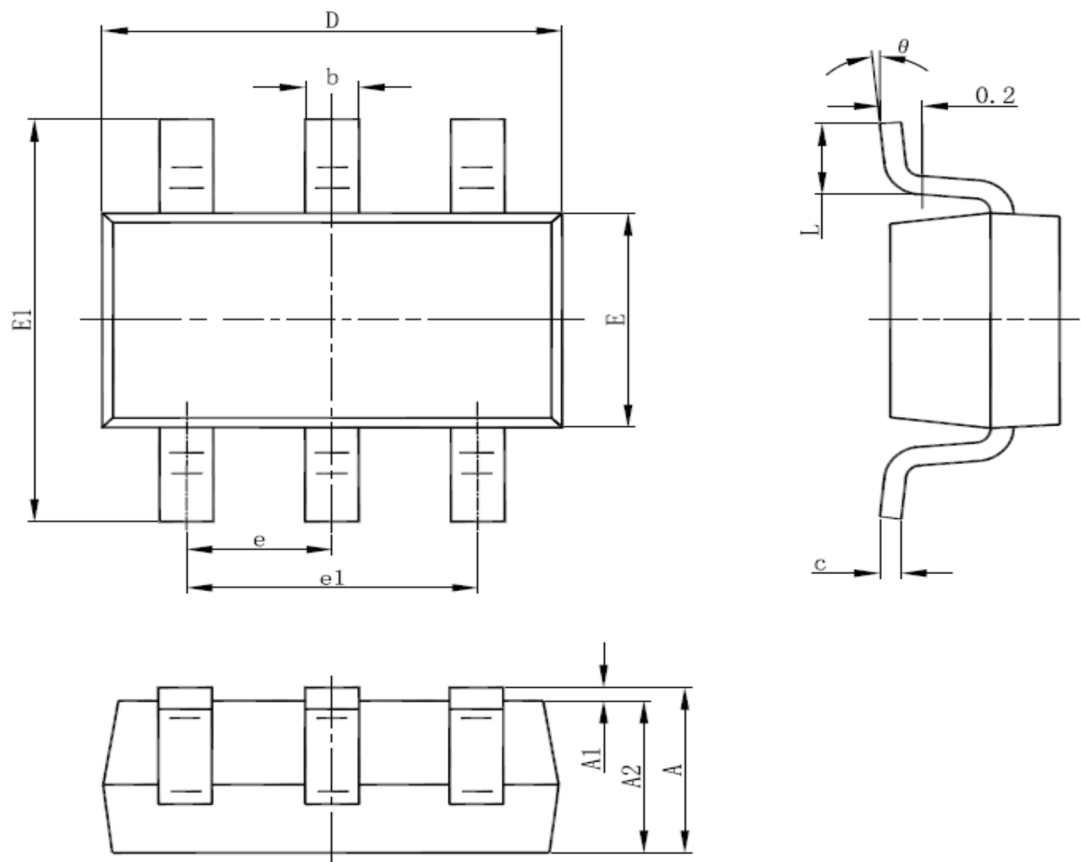
LAYOUT 布局考虑

HX4004-MS 具有高开关频率以及瞬间电流。在布局时，有必要考虑整体的电流路径。良好的接地平面和短连接电容回路的布局能够改善其性能。示例布局如下：



封装信息

SOT-23-6 外形尺寸



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950(BSC)		0.037(BSC)	
e1	1.800	2.000	0.071	0.079
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8

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