BL8080

HIGH INTEGRATED PWM CONTROLLER

GENERAL DISCRIPTION

The BL8080 is a PWM controller designed to drive high voltage NPN transistors. It integrates an oscillator, cycle-by-cycle current limit, thermal protection and over voltage protection, great reducing the number of external components and system level cost.

Compared to conventional controller, BL8080 has a significantly smaller startup current of less than 20uA, which allows large startup resistor that enabes further power saving. The frequency can be adjusted from an external capcitor. At light load condition the frequency of BL8080 can be varied according to the load, which improves the light load efficiency.

FEATURES

◆ Low start up current
◆ Easy programmable frequency
◆ Compact SOT23-6 package
◆ Universal voltage range: 85VAC -264VAC
◆ Thermal shutdown
◆ Cycle by cycle current limit
◆ Slope current drive
◆ Low standby power consumption

APPLICATIONS

◆ Cell phone charger
◆ DVD player power supply
◆ MP3 charger
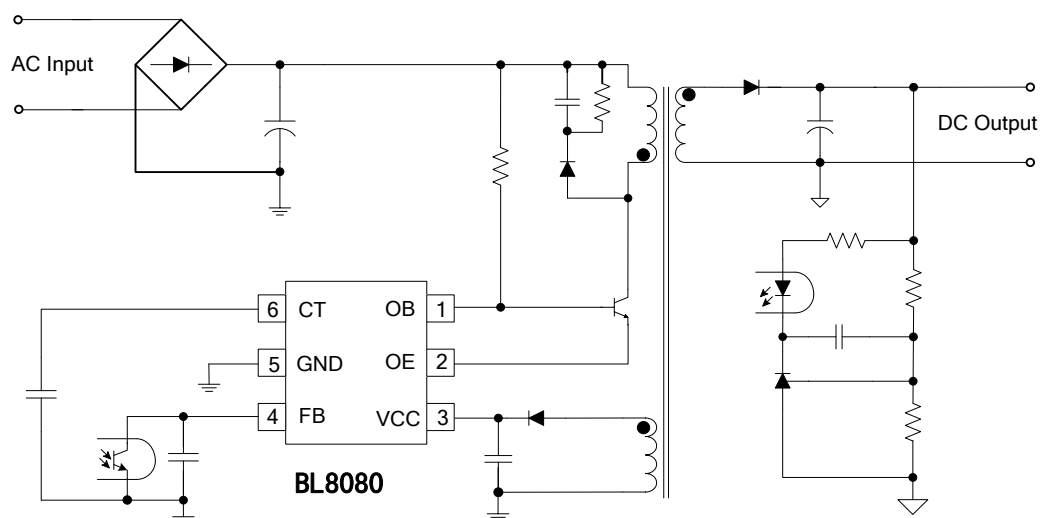◆ LED lighting driver

TYPICAL APPLICATION CIRCUIT
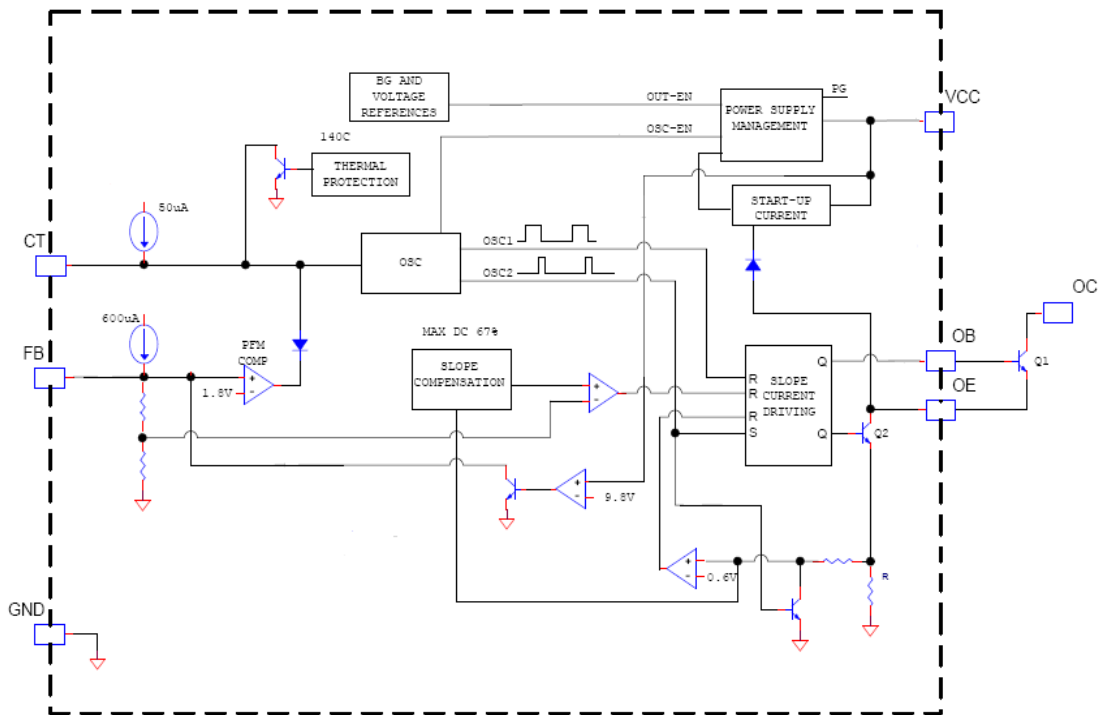

Figure1: BL8080 Typical Application Circuit

BL8080

BLOCK DIAGRAM

Figure2: Block Diagram

PIN CONFIGURATION

SOT23-6

OB	1		6	CT
OE	2		5	GND
VCC	3		4	FB
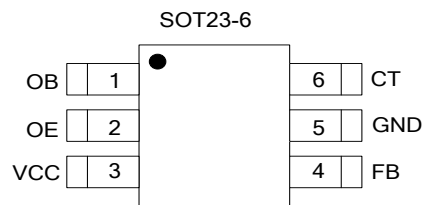
Figure3:BL8080 Top View

PIN DISCRIPTIONS

Pin #	Name	Description
1	OB	Output of the drive, connects this pin to the base of the external power transistor.
2	OE	Connects this pin to the emmiter of the external power transistor.
3	VCC	The power supply. This pin provides power for the internal circuitry and driver.
4	FB	Feedback. Need put a capacitor between this pin and the ground.
5	GND	Ground.
6	CT	Oscillator input pin. Need put a capacitor between this pin and the ground. The oscillator frequency varied with the capacitor value.

BL8080

ORDERING INFORMATION

BL8080 ☐1 ☐2 ☐3

Code	Description
1	Temperature & Rohs: C: -40~85°C, Pb Free Rohs Std.
2	Package Type: B6: SOT-23-6
3	Packing Type: TR: Tape & Reel (Standard)

MARKING INFORMATION

Product Classification	BL8080CB6TR
Marking	
AA	Product code
Y	Year
W	Week

```
  6    5    4
 ┌──────────────┐
 │    AAYW      │
 └──────────────┘
  1    2    3
```

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply Power Voltage	VCC	-0.3	15	V
Voltage at CT, FB, OB, OE		-0.3	12	V
Power Dissipation	P_D		0.25	W
Operating Junction Temperature	T_J	-40	150	℃
Storage Temperature	T_s	-55	150	℃
Electronic static discharg	ESD		2000	V

Notes:

1. Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device.

2. All voltage values are given with respect to GND pin.

RECOMMENDED OPERATING CONDITIONS

The recommended operating conditions table defines the condition for acture device operation. Recommended operating conditions are specified to ensure the optimal performance to the datasheet specifications.

Parameter	Symbol	Min	Max	Unit
Supply Power Voltage	VCC	5.5	9	V
Operating Ambient Temperature	T_A	-25	85	℃

ELECTRICAL CHARACTERISTICS

(All the data tested under the condition: Ta=25℃, unless it is specially noted)

Parameter	Test Condition	Min	Type	Max	Unit
Reference Section					
Reference voltage	Oscillator worked	2.4	2.5	2.6	V
Line regulation	V_{CC} range 4.5V-9V			4	%
Load regulation			2		%
Temperature coefficient	-40℃--120℃		0.2		mV/℃
Feedback Section					
Source current	V_{FB}=1V,Vcc=8V	500	600	700	uA
Pull down resistor			23k		Ω
Sink current	V_{FB} =2V, V_{CC}=11V				mA
PFM threshold VPFM		1.5	1.8	2.0	V
Oscillator stop threshold Vstart		0.8	1	1.2	V
Oscillator Section					
Frequency	C_{CT}=330pF	42	45	48	KHZ
Voltage stability	4.5V≤V_{CC}≤9V				
Amplitude	V_{CT} peak to peak		2.4		V
Temperature stability	-40≤Ta≤125	-10		+10	%
Falling slop time	C_{CT}=330pF	0.8	1	1.3	uS
Source current			37		uA
Sink current			500		uA
PWM Section					
Max duty cycle		60		75	%
Min duty cycle		0			%
Current Sense Section					
Current sense voltage			0.6		V
Peak current limit I_{PK}		450	520	600	mA
I_{PK} temperature coefficient	-40≤Ta≤125	-10		10	%
Propagation delay time				250	nS
Minimum on time		0.5		1.2	uS
Output Section					
OB source current	I_{OC}=0A (V_{CC}=8V) I_{OC}=0.5A		25 35		mA
OB sink current	V_{OB}=1V V_{OB}=2V		50 100		mA
Power Section					
Startup current by OB			30	50	uA
Quiescent current	V_{CC}=8V, V_{FB}=0.6V(note1)			3.5	mA
VCC startup threshold		8.4	8.8	9.2	V

BL8080

ELECTRICAL CHARACTERISTICS (continued)

Parameter	Test Condition	Min	Type	Max	Unit
VCC shut down threshold		4	4.5	5	V
OVP threshold		9.5	10	10.5	V
Others					
Over temperature shut down threshold			135	145	℃

TYPICAL PERFORMANCE INFORMATION
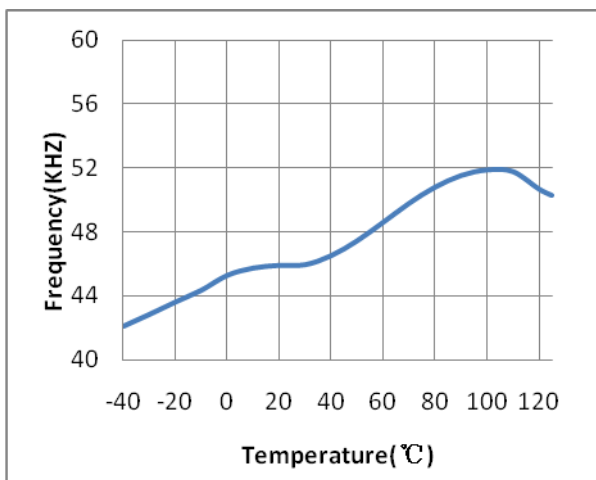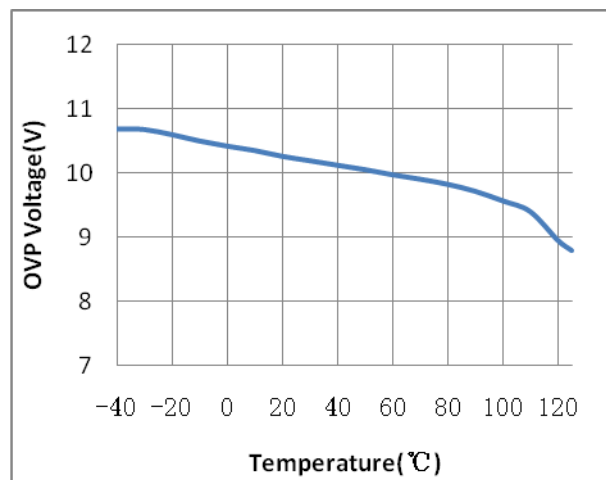

Figure4．Constant operating frequency VS Temperature
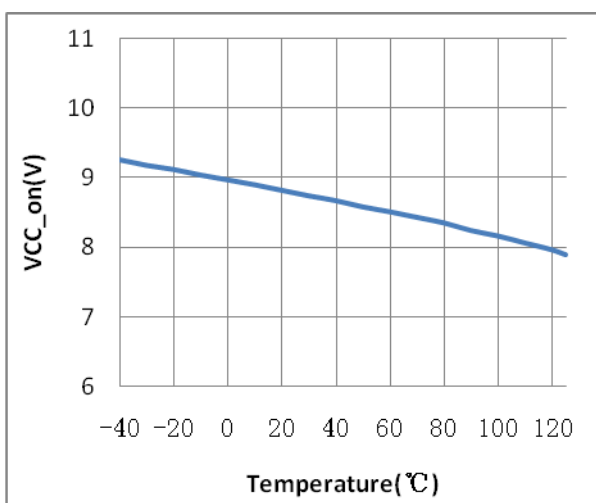

Figure5. VCC Over Voltage Protection Point VS Temperature
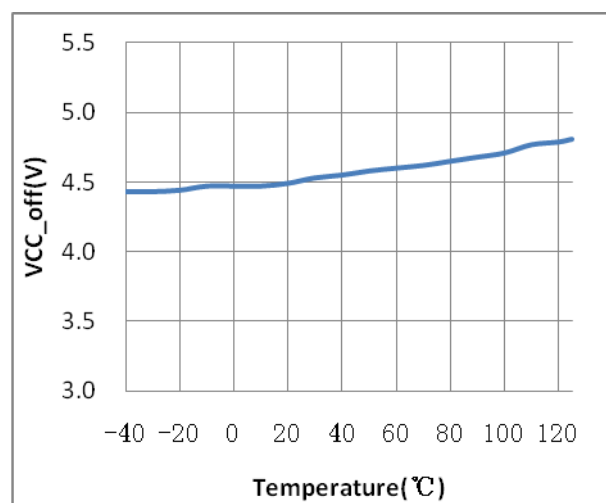

Figure6. VCC Startup Voltage VS Temperature

Figure7. VCC Shutdown Voltage VS Temperature
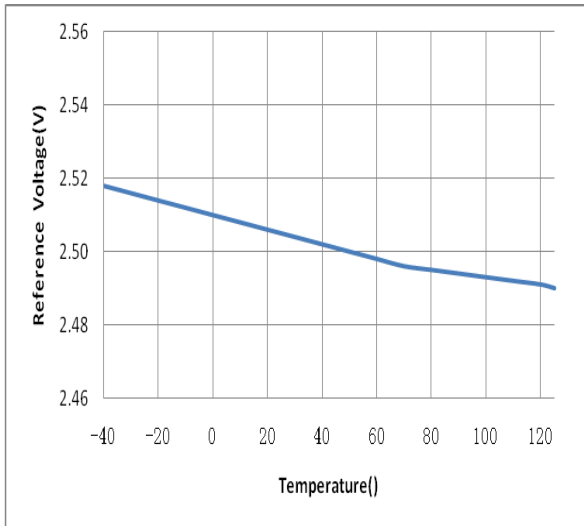
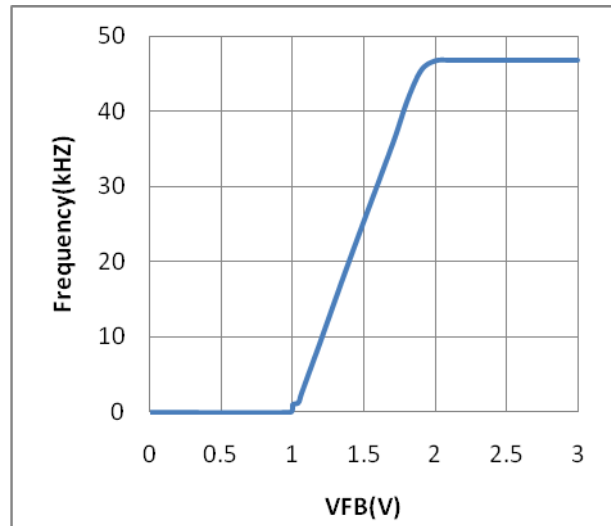## TYPICAL PERFORMANCE INFORMATION

Figure8. Reference Voltage VS Temperature
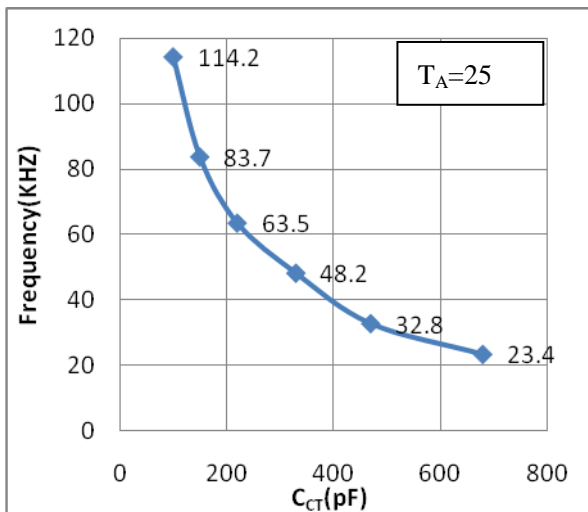

Figure9. Oscillator Frequency VS Feedback Voltage

Figure10. Oscillator Frequency VS CT Cap

BL8080

APPLICATION INFORMATION

Start up

LC 8100 starts to work once VCC reaches the start up threshold voltage (typically 8.8V). The device has a build-in diode of which the anode connects to the OE pin and the cathod to the VCC pin. Through the external power transistor, the VCC storage capacitor can be charged, and the base current of the transistor is supplyed by a resistor connects to the DC bus.because the base current is amplified by transistor, this will greatlly reduce the cosumption. After start up the auxillary power supply take over.

Feedback and control

The FB voltage value controls the peak current of primary side. The oscillator begins to work once V_{FB} exceeds the threshold voltage of 1V. By comparing the voltage across the current sense resistor with a preset value of VFB*k (k is a coefficient less than 1), the internal comparator controls the on/off state of the transistorsin the cycle. BL8080 can automatically adjust the operating mode according to the load condition. If VFB is larger than 1.8V, BL8080 works at constant frequency mode which frequencyset by the CT capacitor, otherwisethe oscillator operates invaried frequency mode.
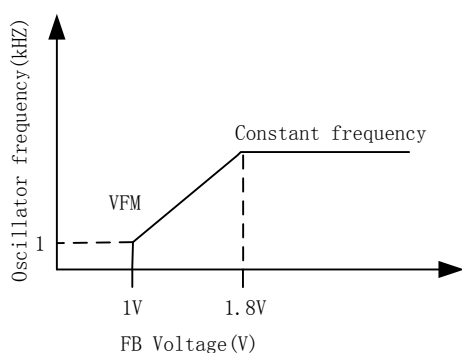

Figure11．Feedback Control of BL8080

Cycle by cycle current limit

Cycle is terminated when the peak current exceeds 0.6A. In normal operation, I_{pk} should be less than 0.6A. When the power supply output is overload or the control loop is open, the internal OCP(over current protection) function circuit istriggered and shuts down the external transistor-pulling down the FB voltage in the rest time of this cycle to decrease the peak current.If FB voltage in one cycle is pulled down to 1.8V, then FB voltage will be clamped to this level till this cycle ended, if the next cycle the fault still exist, FB voltage will continue to be pull down to keep the transistor and transformer work at a save zone.

Leading edge blanking

At the instant the power transistor is turn on, there usually exists a current spike through the transistor caused by primary side capacitor and secondary rectifier reverse recovery which can lead to incorrect OCP action.For this reason, BL8080 employs a leading edge blanking circuit to inhibit the current sense comparator for a short time after the transistor is on.

Over Voltage Protection (OVP)

BL8080 integrates VCC OVP circuit to improve the system stability. When the VCC voltage exceeds 10V due to abnormal condition, the OVP circuit is triggered and shut down the device. When VCC drops bellow UVLO, BL8080 starts again. As the output winding couples with the auxiliary winding, when the output voltage exceeds the set value, the auxiliary voltage rise linearly with the output voltage, if VCC exceeds 10V, PWM pulse is disabled to proventthe system from damage.

BL8080

Over Temperature Protection (OTP)

BL8080 integrates a temperature detection circuit that will shut down PWM output when the junction temperature exceeds 135℃. s When the temperature drops down and the VCC voltage is still over the UVLO voltage, the device resumes operation.

Under Voltage Lockout (UVLO)

The turn-on and turn-off threshold voltage are fixed internally at 8.8V and 4.5V, respectivelly.
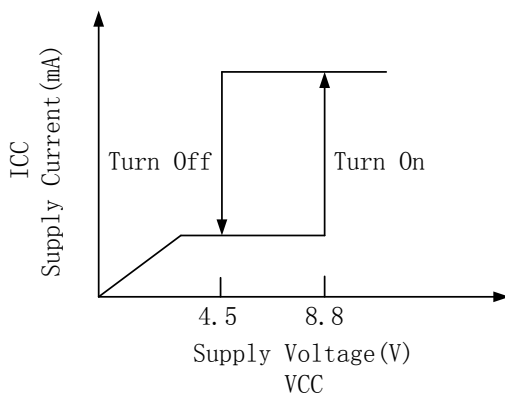

Figure12. UVLO of BL8080

During start up, the hold-up capacitor should be charged up to 8.8V by the start up resistor and external transistor to enable the BL8080. The hold-up capacitor supplies VCC until the auxiliary winding of transformer takes over. When VCC drops below 4.5V, BL8080 stops work. This UVLO hysterisis ensures that the hold-up capacitor is adequate to supply VCC during normal operation.

Built-in Slope Compensation

The voltage across the current sense resistor is collected for current mode control and cycle by cycle current limit. Built-in slope compensation improves the stability and prevents sub-harmonic oscillations when the device works in continue conduction mode -especially when the duty cycle exceeds 50%.
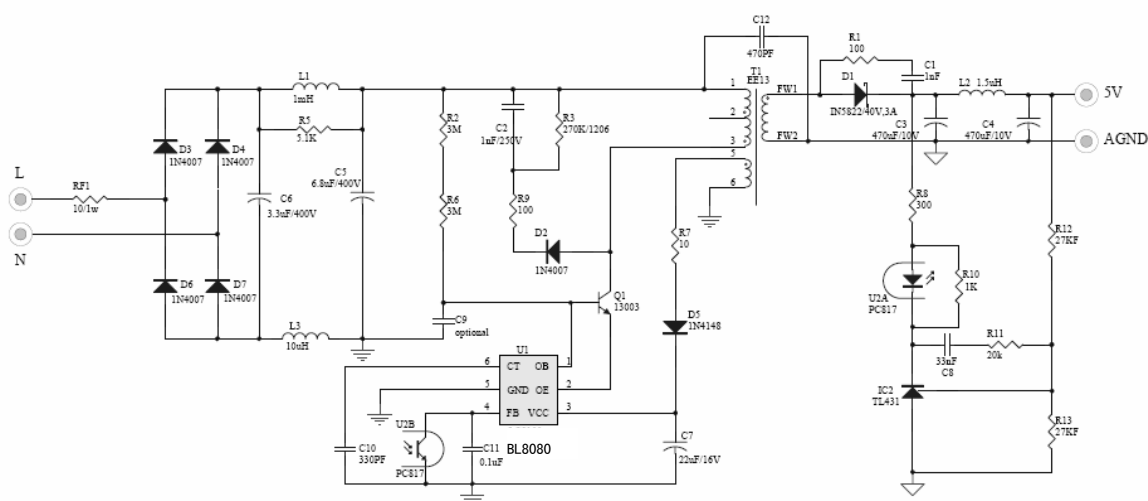
Aplication Design Example

Figure13. 5W (5V/1A) Application Circuit

BOM

Designator	Part Type	Designator	Part Type
D1	IN5822	R1,R9	100
D2,D3,D4,D6,D7	IN4007	R2,R6	3M
D5	IN4148	R3	270K
C1	1nF	R5	5.1K
C2	1nF,250V	R7	10
C3,C4	470uF,10V	R8	300
C5	6.8uF,400V	R10	1K
C6	3.3uF,400V	R11	20K
C7	22uF,16V	R12,R13	27K
C8	33nF	L1c	1mH
C9	10nF(optional)	L2	1.5uH
C10	330pF	L3	10uH
C11	0.1uF	U1	BL8080
Q1	MJE13003	U2	PC817
IC2	TL431	T1	EE16
RF1	10, 2W		

BL8080

PACKAGE INFORMATION

Package Type	SOT23-6	Number of devices per reel	3000
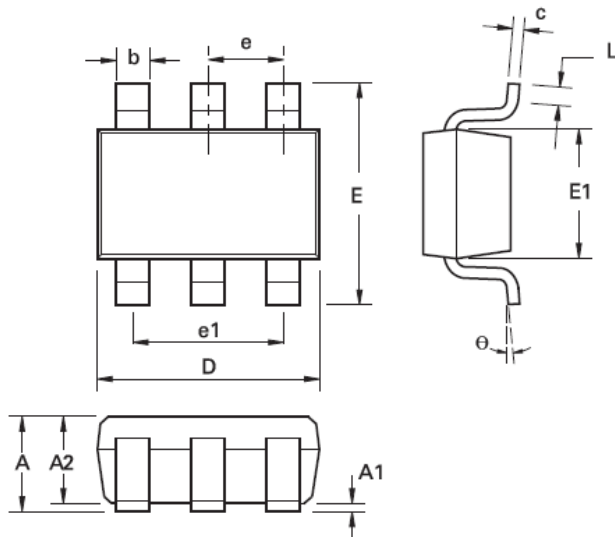
DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.90	1.45	0.0354	0.0570
A1	0.00	0.15	0.00	0.0059
A2	0.90	1.30	0.0354	0.0511
b	0.35	0.50	0.0078	0.0196
C	0.09	0.26	0.0035	0.0102
D	2.70	3.10	0.1062	0.1220
E	2.20	3.20	0.0866	0.1181
E1	1.30	1.80	0.0511	0.0708
L	0.10	0.60	0.0039	0.0236
e	0.95 REF		0.0374 REF	
e1	1.90 REF		0.0748 REF	
L	0°	30°	0°	30°

Note: Controlling dimensions are in millimeters. Approximate dimensions are provided in inches