1.2MHz High Voltage Boost Converter

Features

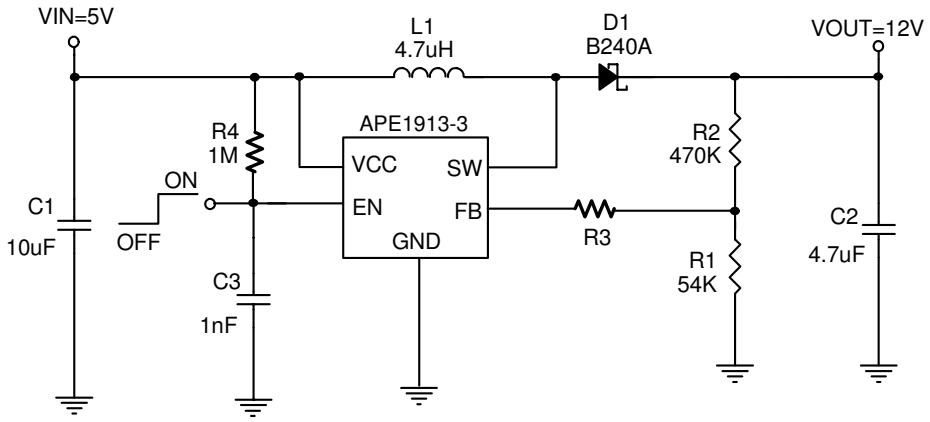
- **Input Voltage from 2.6V to 5.5V**
- **Adjustable Output Voltage Range up to 27V**
- **Fixed Switching Frequency of 1.2MHz**
- **Internal Soft-Start Function**
- **Current Limit and Thermal Shutdown Protection**
- **Under-Voltage Lockout**
- **Shutdown Current < 1μA**
- **Available in a RoHS-compliant, halogen-free TSOT-23-5 Package**

Description

The APE1913-3 is a current mode step up converter intended for small, low power applications. The converter input voltage can range from 2.6V to 5.5V. The output voltage can be set up to 27V. The frequency of 1.2MHz allows the use of small external inductors and capacitors and provides fast transient response. Internal soft start results in small inrush current and extends battery life. An internal power MOSFET with very low Rds(on) provides high efficiency.

The APE1913-3 automatically switches from PWM to PFM during light load conditions further increasing efficiency.The converter also provides protection functions such as under-voltage lockout, current limit and thermal shutdown. The APE1913-3 is available in a RoHS-compliant halogen-free TSOT-23-5 package.

Typical Application



$$VOUT = 1.238V \times (1+ \frac{R2}{R1})$$

Recommended for R2, 390kΩ~820kΩ

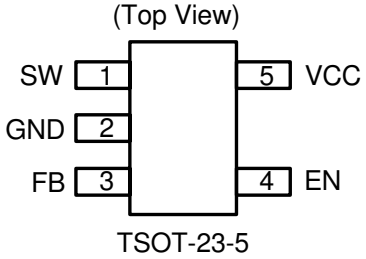
VIN	VOUT	R3
2.6~3.6V	5V	120kΩ
2.6~5.3V	7V	82kΩ
2.6~5.5V	7.5~27V	0Ω

Ordering Information

APE1913TY5-HF-3TR

Package Type:
TY5 : TSOT-23-5

Pin Configuration



TSOT-23-5

Absolute Maximum Ratings (Note 1) at T_A= 25℃

VCC Pin Voltage (V_{CC}) ----------	GND - 0.3V to GND + 6.5V
Feedback Pin Voltage (V_{FB}) ----------	GND - 0.3 to VCC + 0.3
EN Pin Voltage (V_{EN}) ----------	GND - 0.3 to VCC + 0.3
Switch Pin Voltage (V_{SW}) ----------	30V
Power Dissipation (PD) ----------	(T_J-T_A) / R_{thja} W
Storage Temperature Range (T_{ST}) ----------	-40℃ to +150℃
Operating Junction Temperature Range (T_{OP}) -----	-40℃ to +125℃
Thermal Resistance from Junction to Case(Rth_{JC})	110℃/W
Thermal Resistance from Junction to Ambient(Rth_{JA})	250℃/W

Note. R_{thja} is measured with the PCB copper area of approximately 1 in^2 (Multi-layer).

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. Operating Conditions are conditions under which the device functions but the specifications might not be guaranteed. For guaranteed specifications and test conditions see the Electrical Specifications.

Note2: The maximum power dissipation is a function of the maximum junction temperature, T_{Jmax} , total thermal resistance, $R_{th(ja)}$ and ambient temperature T_A . The maximum allowable power dissipation at any ambient temperature is (T_{jmax} -T_A) / $R_{th(ja)}$.

Note3: Low duty pulse techniques are used during test to maintain a junction temperature as close to ambient as possible.

Electrical Specifications (V_{CC}=5V, V_{OUT}=12V, T_A=25°C, unless otherwise specified)

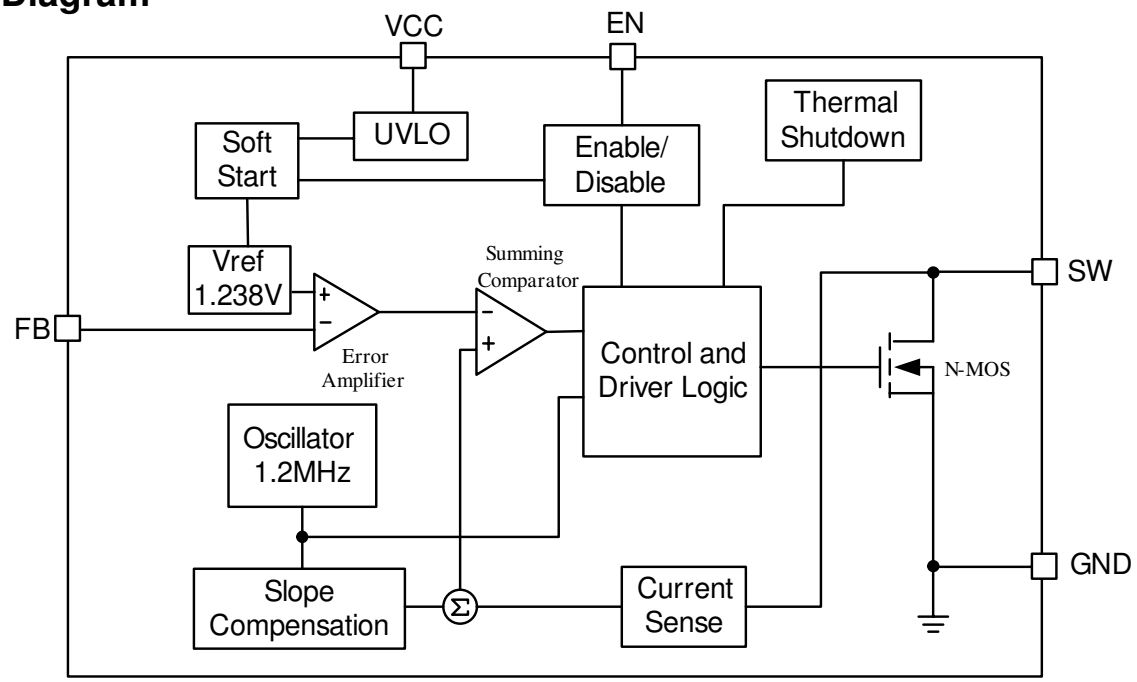
Parameter	SYM	TEST CONDITION	MIN	TYP	MAX	UNITS
Input Voltage Range	V_{CC}		2.6	-	5.5	V
Under Voltage Lockout	UVLO	Rising	-	2.35	2.6	V
UVLO Hysteresis			-	-130	-	mV
Step-Up Voltage Adjust Range	V_{OUT}		3	-	27	V
Operating Quiescent Current	I_{CCQ}	I_{OUT}= 0mA, V_{FB} =1.5V	-	150	250	μA
Shutdown Current	I_{SD}	V_{EN}=0V	-	0.1	1	μA
Feedback Voltage	V_{FB}		1.213	1.238	1.263	V
FB Input Leakage Current	I_{FB-LKG}	V_{FB} = 1.3V	-100	0.01	100	nA
Line Regulation		V_{IN} = 2.5 to 5.5V, I_{OUT} = 20mA	-	0.2	-	%
Load Regulation		V_{IN} = 5V, I_{OUT} = 1mA to 400mA	-	0.2	-	%
Switching Frequency	F_{OSC}		900	1200	1500	kHz
Maximum Duty	D_{MAX}		82	87	-	%
N-channel MOSFET Current Limit	I_{LIM}	Duty cycle = 50%	-	1.9	-	A
MOSFET On-resistance (Note1)	$R_{DS(on)}$	VCC=3V, I_{SW}=1A	-	650	-	mΩ
		VCC=5V, I_{SW}=1A	-	500	-	
SW Leakage Current	I_{SWL}	V_{LX} = 27V, V_{FB} =1.5V	-	-	1	μA
EN High-level Input Voltage	V_{IH}		1	-	-	V
EN Low-level Input Voltage	V_{IL}		-	-	0.4	V
EN Hysteresis	Hys		-	200	-	mV
EN Input Leakage Current	I_{EN-LKG}	V_{EN}=GND or VCC	-	0.01	0.1	μA
Thermal Shutdown	T_{DS}		-	150	-	℃
Thermal Shutdown Hysteresis	T_{SH}		-	35	-	

Note1: Guaranteed by design.

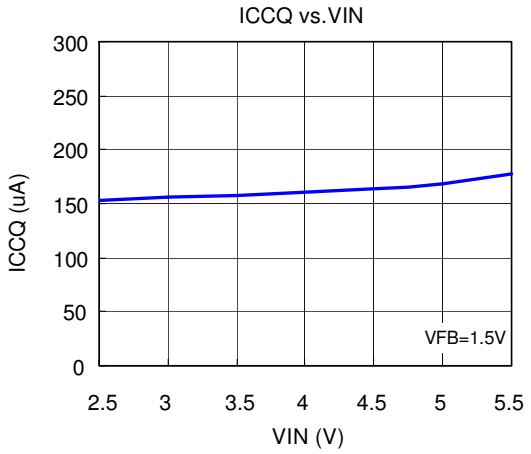
Pin Descriptions

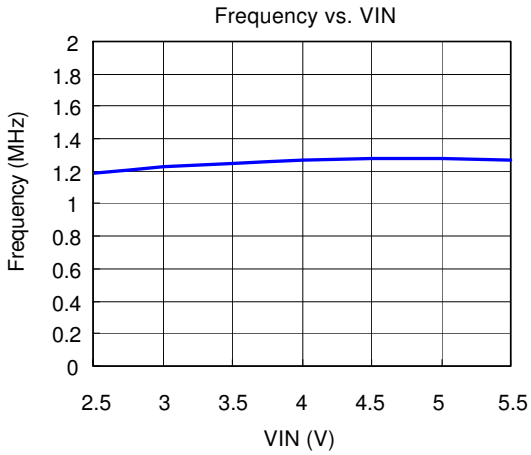
PIN SYMBOL	PIN DESCRIPITON
VCC	Input Supply Pin - must be locally bypassed with an input capacitor.
SW	Power Switch Output. SW is the drain of the internal MOSFET switch. Connect the power inductor and output rectifier to SW. SW can swing between GND and 27V.
FB	Feedback Input. FB voltage is 1.238V. Connect a resistor divider to FB.
EN	Regulator On/Off Control Input. A high input at EN turns on the converter, and a low input turns it off. When not used, connect EN to VCC for automatic startup. The EN pin cannot be left floating.
GND	Ground pin

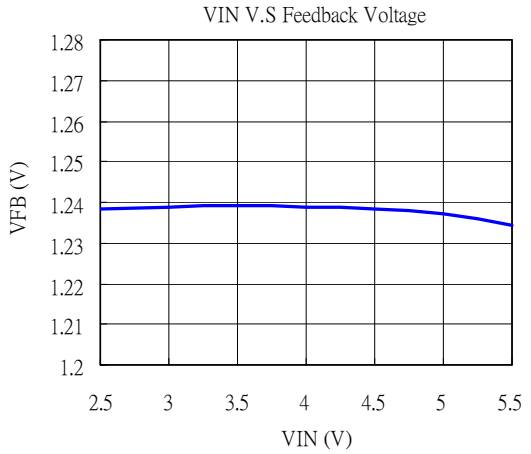
Block Diagram

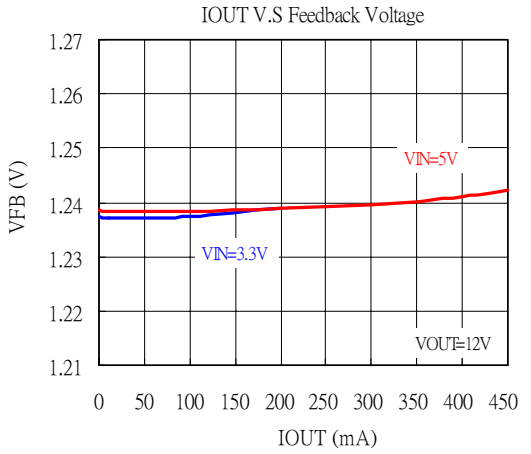


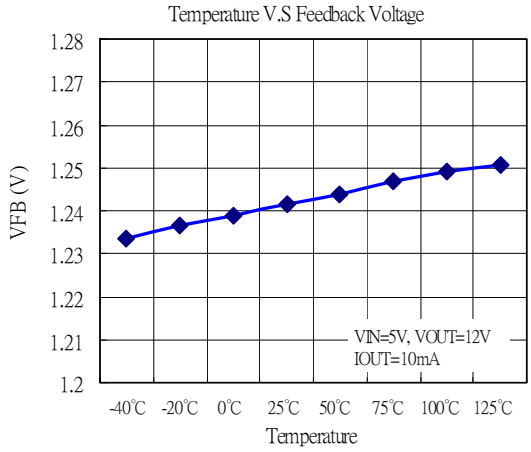
Typical Performance Characteristics

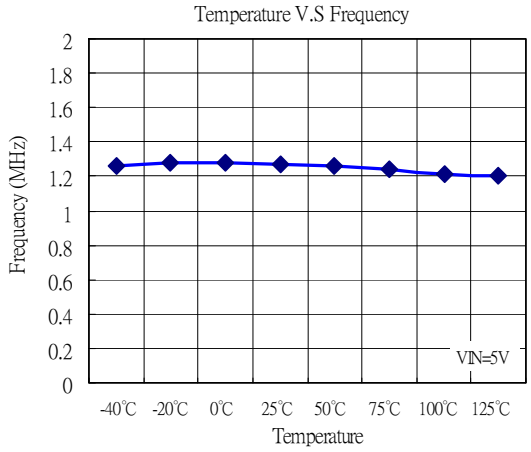




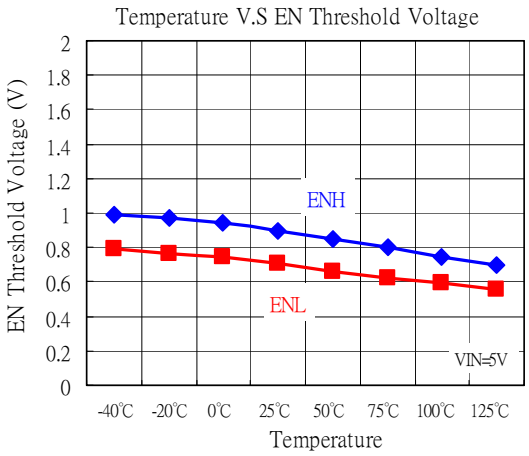


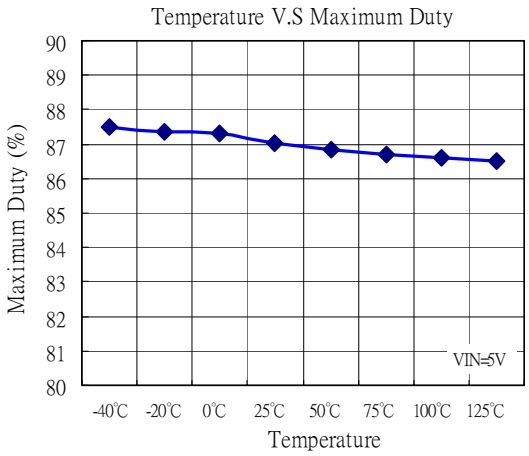


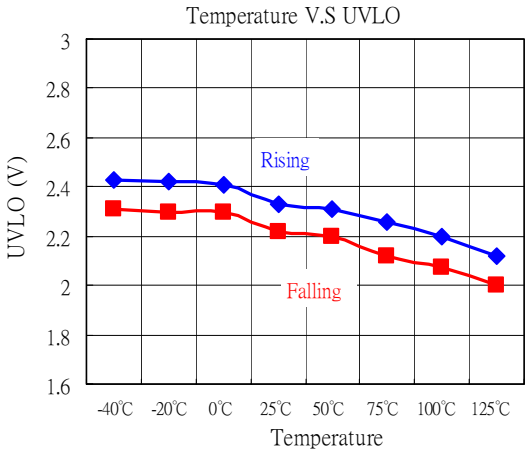


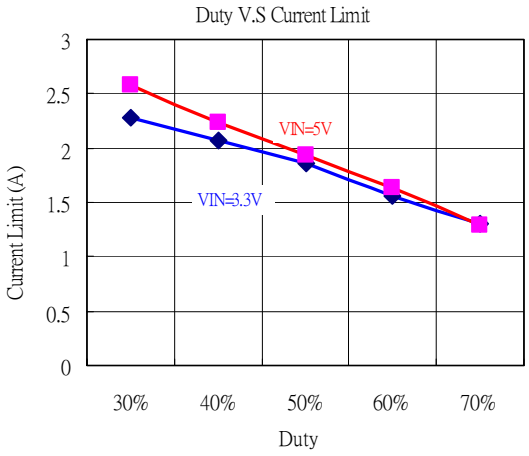


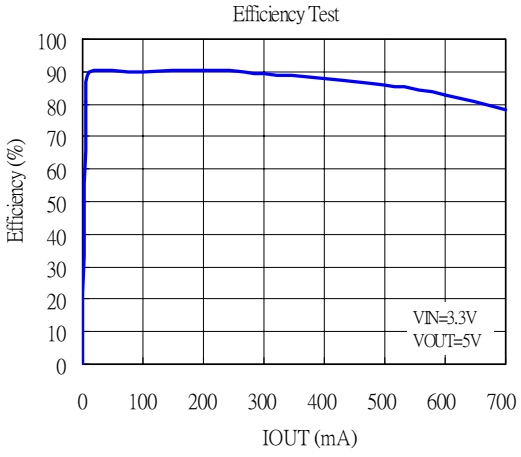
Typical Performance Characteristics (continued)

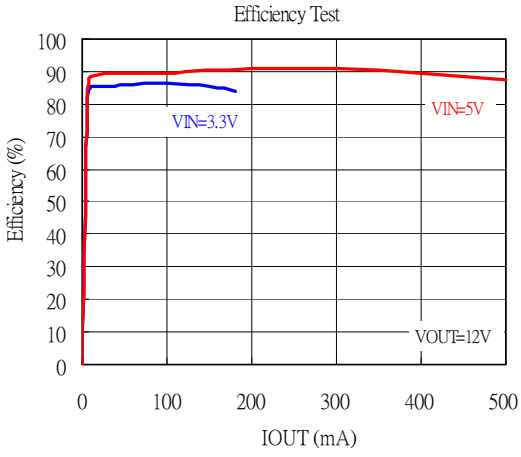










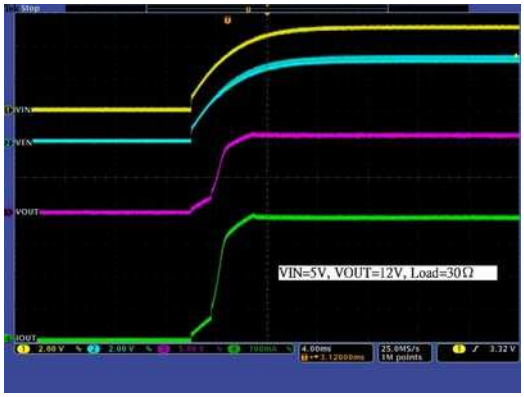


Typical Performance Characteristics (continued)

Load Transient

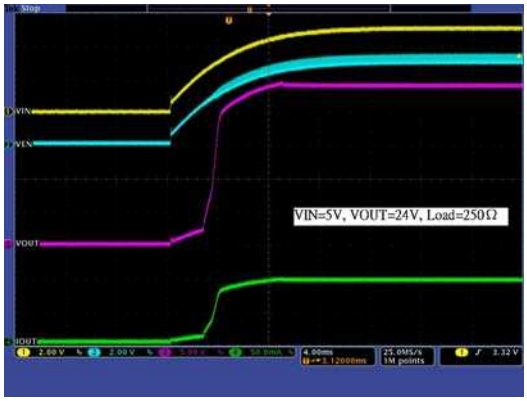
Load Transient

Power ON



Enable ON

Power ON



Enable ON

Application Information

Setting the Output Voltage

The application circuit on page 1 shows the typical basic application circuit for the APE1913-3. The external resistor sets the output voltage according to the following equation:

$$V_{OUT} = 1.238V \times (1 + \frac{R2}{R1})$$

For most applications, we suggest a value of 390k~820kΩ for R2. Place the resistor-divider as close to the IC as possible to reduce the noise sensitivity.

Under Voltage Lockout (UVLO)

To avoid mis-operation of the device at low input voltages, an under voltage lockout is included that disables the device if the input voltage falls below (2.35V-130mV).

Input Capacitor Selection

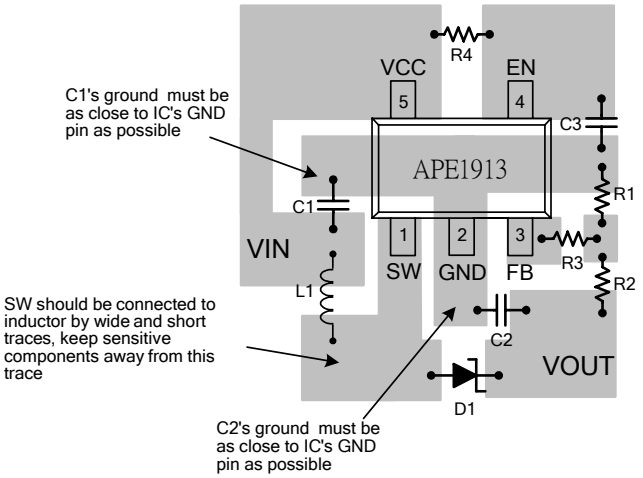
The input capacitor reduces both the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency should be less than the input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used.

Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 10 μ F ceramic capacitor is sufficient for most applications. For a lower output power requirement application, the value can be smaller.

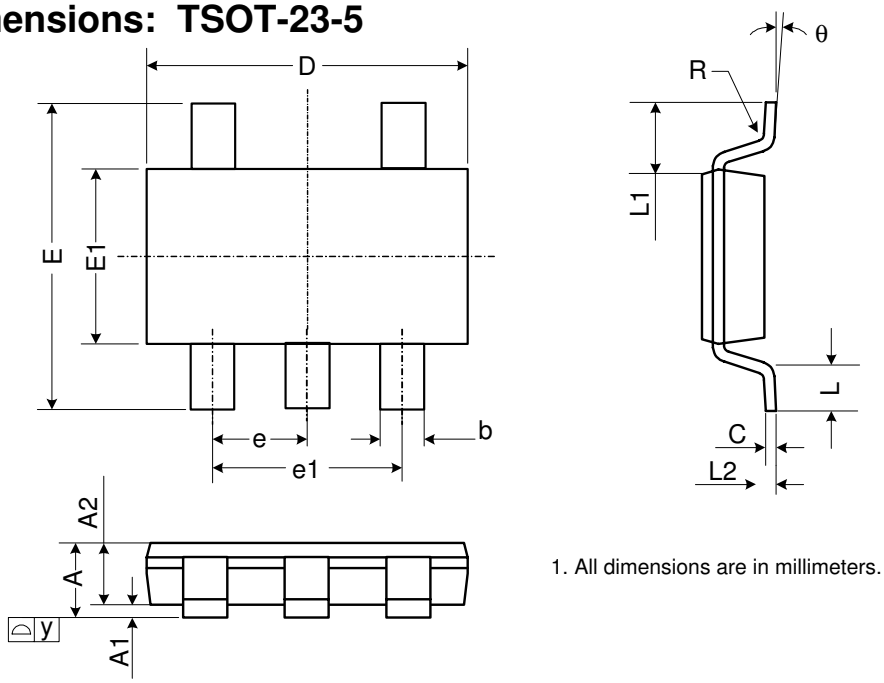
Output Capacitor Selection

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current. A 4.7uF ceramic capacitor works for most applications. Higher capacitor values can be used to improve the load transient response.

Layout Guide



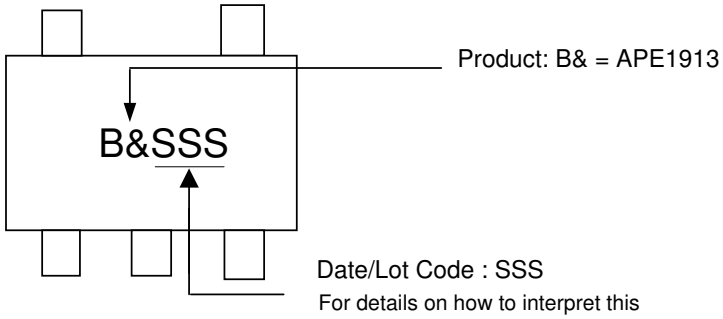
Package Dimensions: TSOT-23-5



1. All dimensions are in millimeters.

Symbol	Min.	Nom.	Max.
A	-	-	1.1
A1	0.00	-	0.10
A2	0.70	0.90	1.00
b	0.30	0.40	0.50
C	0.08	0.14	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC.		
e1	1.90 BSC.		
L	0.30	0.45	0.60
L1	0.60 REF.		
L2	0.25 BSC.		
y	-	-	0.10
R	0.10	-	-
θ	0°	-	8°

Marking Information



For details on how to interpret this date/lot code, please contact APEC