Low Power, Single Inducor, Buck-Boost, 600mA DC-DC Converter

General Description

CS5517T is a miniature Buck-Boost DC-DC converter with ultra-low power consumption and high efficiency. It is applicable to the application scenarios of double/three dry batteries or single lithium battery. It can effectively prolong the service time of the battery. CS5517T consists of current mode PWM control loop, error amplifier, comparator, power switch and other modules. The chip can work efficiently and stably in a wide load range. The input voltage of CS5517T is 1.8V to 5.0V, and the adjustable output voltage is 1.2V to 5V. When the output voltage is 3.3V and the input voltage is from 2.7V to 4.4V, it can provide a maximum current load of 600mA. CS5517T can set the output voltage by adjusting two external resistors. CS5517T provides a slim DFN2x2_8L package is available for customers to choose, and its rated working temperature range is - 40 ℃ to 85 ℃.

Package

- DFN2X2_8L

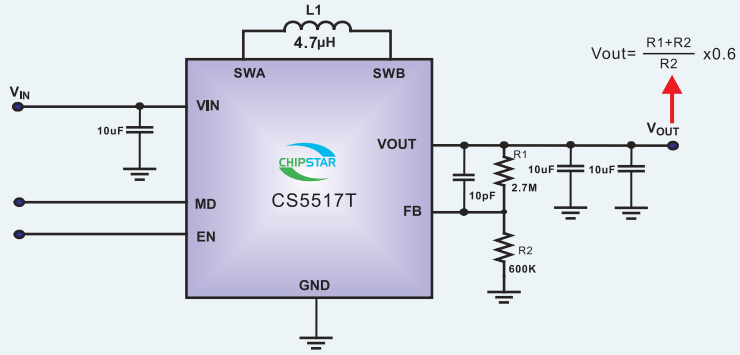
Features

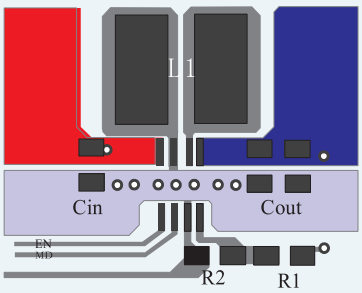
- High Efficiency: Up to 95% Maximum Efficiency
- Maximum Current Output Capacity: 0.6A
- Low Power Consumption: 8uA Quiescent Current
- Input Voltage Range: 1.8V ~ 5V
- Output Voltage Range:1.2V~5V
- Switching Frequency: 1MHz
- Reference Voltage: 0.6V
- Soft Start
- Low Voltage Operation, Up to 100% Duty Cycle
- PWM/PFM Automatic Switching, Duty Cycle is Automatically Adjustable to Maintain High Efficiency and Low Ripple in A Large Load Range

Applications

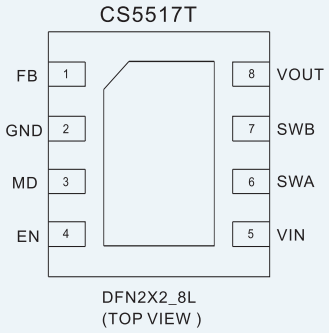
- Portable Equipment
- Security Monitoring Equipment
- Backup Power Supply Equipment

Typical Applications and PCB Example

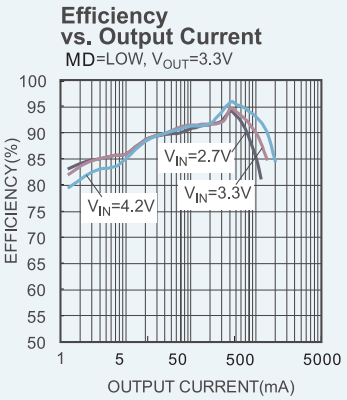




PIN Configuration and Functions



PIN	NAME	I/O	DESCRIPTION
1	FB	I	Output voltage feedback terminal, VFB=0.6V
2	GND	-	Ground
3	MD	I	Mode selection, high-level forced PWM mode, low-level PSM mode
4	EN	I	Enable the control terminal and the high-level chip works
5	VIN	I	Input voltage port
6	SWA	O	Buck inductor port
7	SWB	O	Boost inductor port
8	VOUT	O	Output voltage port



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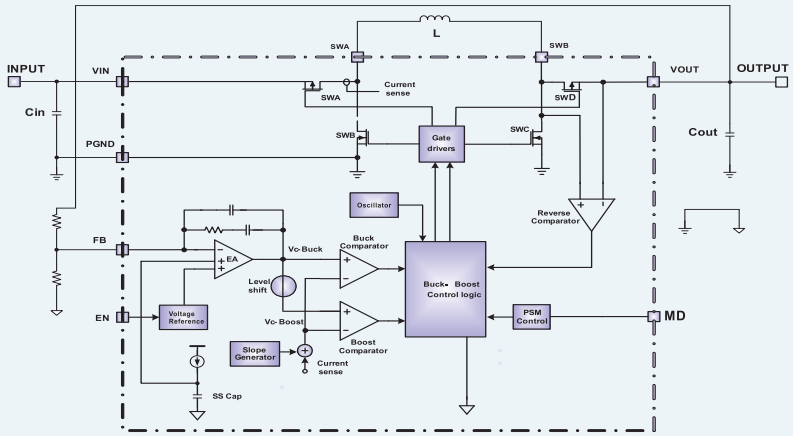
Functional Block Diagram



Absolute Maximum Ratings [1]

SYMBOL	PARAMETER	VALUE	UNIT
V_{DD}	Power supply without signal input	6	V
V_I	Input voltage	-0.3~ V_{DD}+0.3	V
T_J	Junction operating temperature range	-40~150	℃
T_{STG}	Storage temperature range	-60~150	℃
T_{SDR}	Lead temperature (Soldering, 10 sec.)	260	℃

Recommended Operating Conditions

SYMBOL	PARAMETER	VALUE	UNIT
V_{DD}	Input power supply voltage	1.8~5.0	V
T_J	Junction operating temperature range	-40~125	℃
T_A	Ambient temperature range	-40~85	℃

Thermal Information [2]

SYMBOL	PARAMETER	VALUE	UNIT
θ_{JA}(DFN8)	Package thermal resistance - chip to environment thermal resistance	80	℃/W

Ordering Information

Product Name	Package Type	Device Marking	Reel Size (Inch)	Tape width	Quantity
CS5517T	DFN2X2_8L	X FFBH • X	7″	8mm	3000

ESD Range

HBM (Human Body Model) ---------- ±4kV

MM (Machine model) ---------- ±400V

1. The above parameters are only the limit values of device operation. It is not recommended that the working conditions of the device exceed the limit values. Otherwise, the reliability and life of the device will be affected, and even permanent damage will be caused.

2. Where the PCB board is placed in CS5517T, a heat dissipation design is needed. The heat sink at the bottom of CS5517T is connected with the heat sink area of PCB board.

Electrical Characteristics (V_{IN}=4V，C_{IN}=10uF，T_A =25℃ unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
VIN	Input voltage		1.8		5	V
VOUT	Output voltage		1.2		5	V
VFB	FB voltage	MODE="1"	588	600	612	mV
UVLO_R	VIN under voltage lockout threshold			1.6		V
UVLO_HYS	VIN under voltage lockout hysteresis			200		mV
IQ	Input quiescent current	VIN=3.6V		7		μA
IOFF	Input shutdown current	VEN < VENL		0.01	1	μA
FS	Switching frequency			1		MHz
DMAX	Boost maximum duty cycle		85			%
RDSON_H	High-side switch on resistance	VIN=3.6V,IL=0.1A		300		mΩ
RDSON_L	Low-side switch on resistance	VIN=3.6V,IL=0.1A		300		mΩ
IL	Switching current	VIN=4.2V			1.1	A
VLINE	Linear adjustment	ILOAD=0.5A, VIN=2.7 to 5V		0.4		%
VLOAD	Load adjustment	VIN=3.6V,VOUT=3.3V ILOAD=10mA to 0.8A		0.4		%
VENH	EN,MD high level voltage	VIN=3.6V	1.1			V
VENL	EN,MD low level voltage	VIN=3.6V			0.6	V
TSDH	Thermal shutdown temperature	VIN=3.6V, ILOAD=10mA		150		℃
TSDH_HYS	Thermal shutdown temperature hysteresis			20		℃

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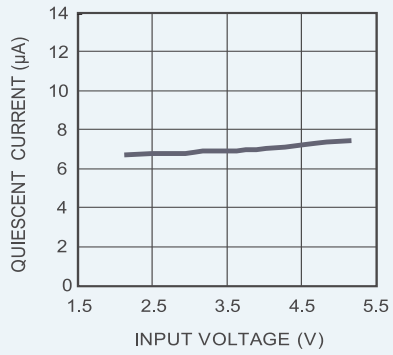
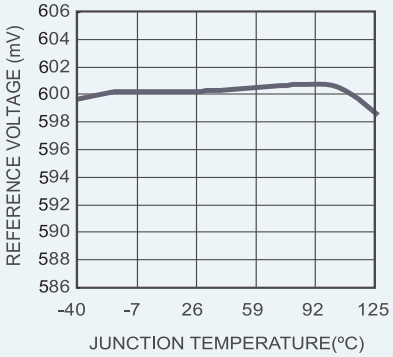
Typical Characteristics (VIN=3.3V, VOUT=3.3V, L=4.7μH, COUT=2x10uF, T_A = 25°C, unless otherwise noted)

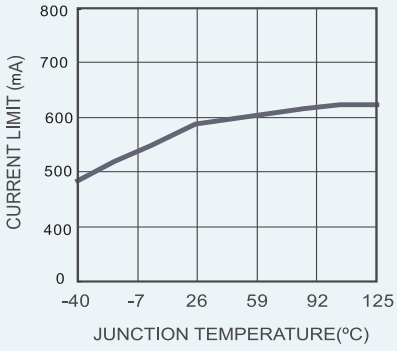
Quiescent Current
V_{FB}=0.6V



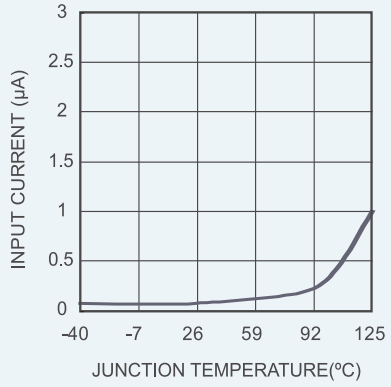
Referenve Voltage vs. Temperature



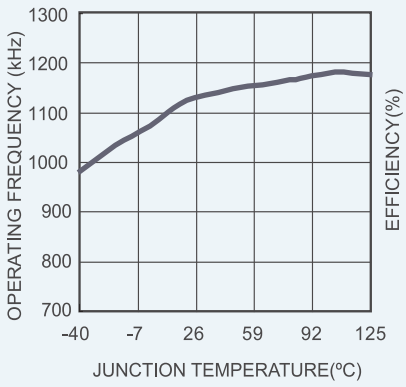
Primary Current Limit vs. Temperature



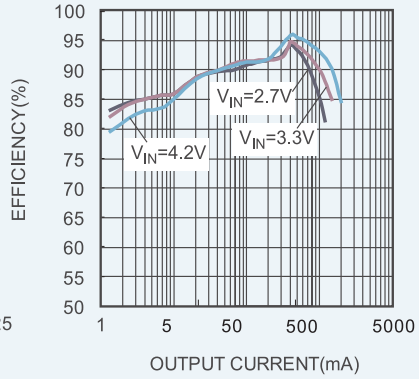
Disabled Supply Current vs. Temperature
V_{EN}=0V



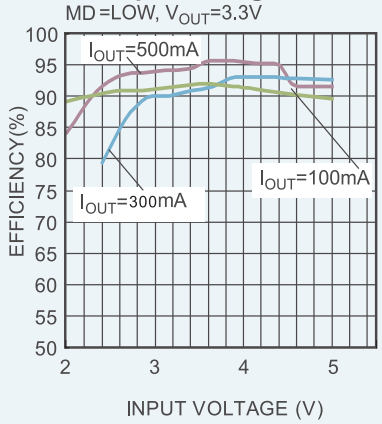
Frequency vs. Temperature
I_{OUT}=0A



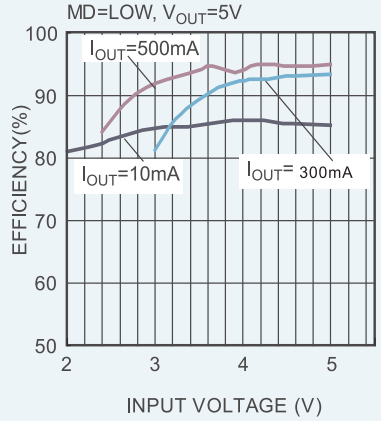
Efficiency vs. Output Current
MD=LOW, V_{OUT}=3.3V



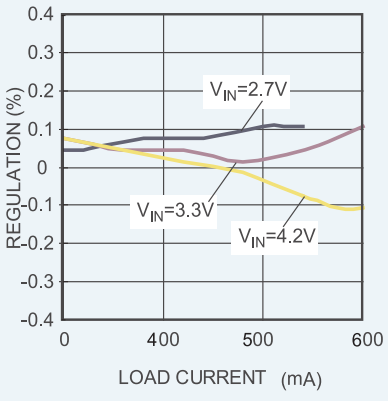
Efficiency vs. Input Voltage
MD =LOW, V_{OUT}=3.3V



Efficiency vs. Input Voltage
MD=LOW, V_{OUT}=5V

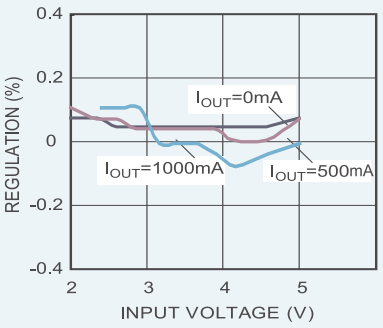


Load Regulation
MODE=HIGH

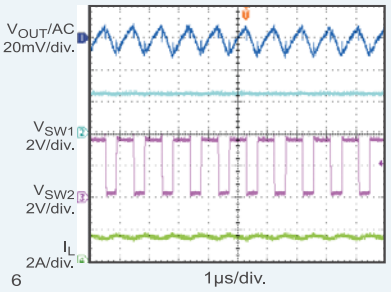


Typical Characteristics (VIN=3.3V, VOUT=3.3V, L=4.7μH, COUT=2x10uF, T_A = 25°C, unless otherwise noted)

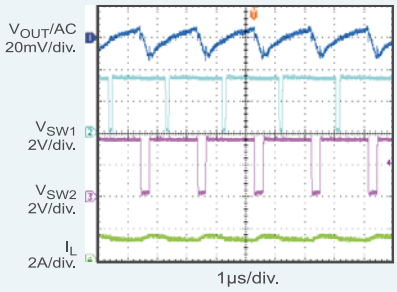
Line Regulation
MODE=HIGH



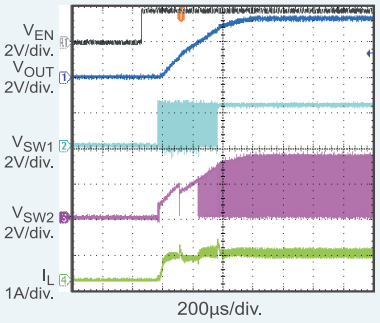
Steady State
V_{IN}=2.4V, I_{OUT}=0.3A, MODE=HIGH



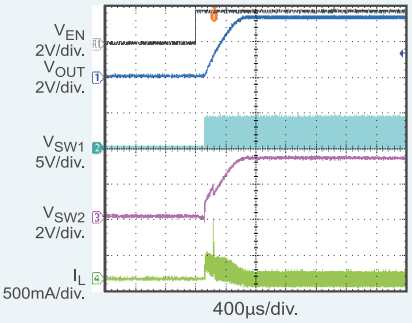
Steady State
V_{IN}=3.3V, I_{OUT}=0.3A , MODE=HIGH



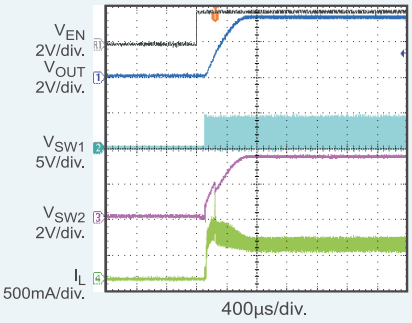
EN Start Up
V_{IN}=2.4V, I_{OUT}=0.5A, MODE=HIGH



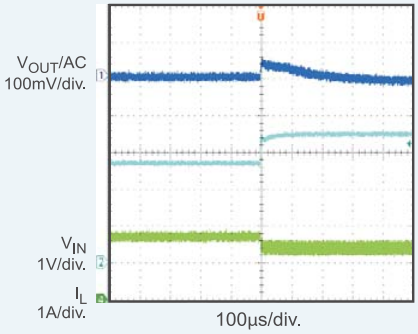
EN Start Up
V_{IN}=4.2V, I_{OUT}=0A, MODE=HIGH



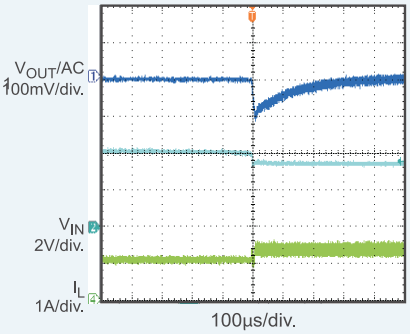
EN Start Up
V_{IN}=4.2V, I_{OUT}=0.5A, MODE=HIGH



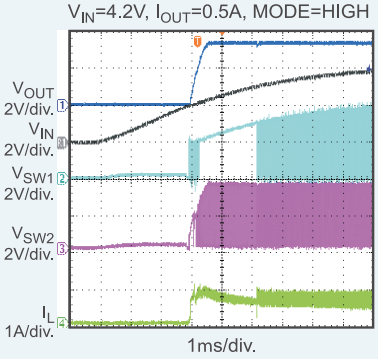
Line Transient Response
V_{IN}=2.4V-->3.3V, I_{OUT}=0.3A



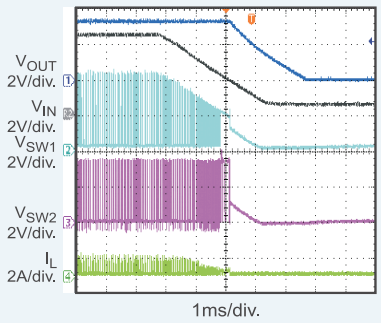
Line Transient Response
V_{IN}=4.2V->3.3V, I_{OUT}= 0.3A



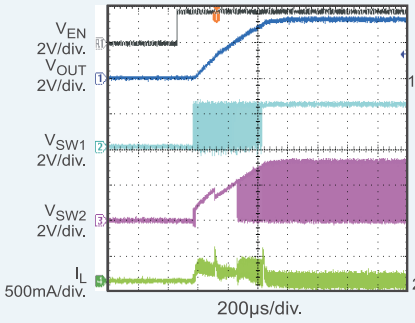
Power Up
V_{IN}=4.2V, I_{OUT}=0.5A, MODE=HIGH



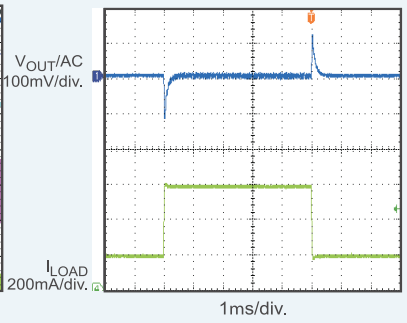
Power Off
V_{IN}=4.2V, I_{OUT}=0.05A, MODE=LOW



EN Start Up
V_{IN}=2.4V, I_{OUT}=0A, MODE=HIGH



Load Transient Response
V_{IN}=2.4V, I_{OUT}=0.2-->0.5A@250mA/μs
MODE=HIGH



CS5517T Application Points

1. Setting of Output Voltage

Through the external resistance voltage division of FB PIN, the output voltage value can be calculated according to the following formula:

$$Vout = \frac{R1+R2}{R2} \times 0.6$$

In order to minimize the leakage of the system, the values of R1 and R2 should be above hundred KΩ level.

2. Inductor Selection

The recommended inductance range is 4.7uH to 10uH. The inductance selection mainly considers the smaller DCR resistance to ensure high efficiency.

3. Input/Output Capacitance Selection

The capacitance of input capacitance and output capacitance is recommended to be more than 10uF. In order to obtain smaller output ripple, it is recommended to use ceramic capacitor.

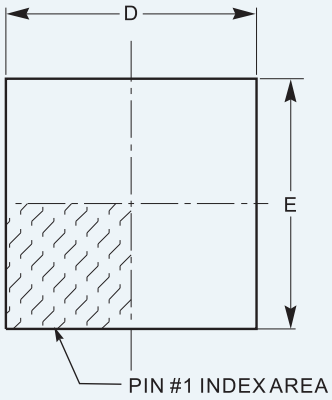
4. PCB Layout

In order to get better performance, the main precautions for PCB layout are as follows:

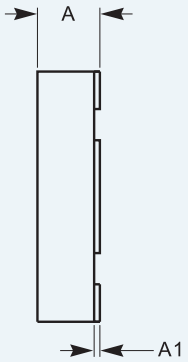
(1) The input capacitance and output capacitance shall be as close to the chip pin as possible.
(2) The power path from VIN to inductor L and then to VOUT shall be as short and thick as possible.
(3) L1 pin has high-frequency switching signal. Pay attention to isolation from other components on the board.

Package Information

CS5517T DFN2X2_8L

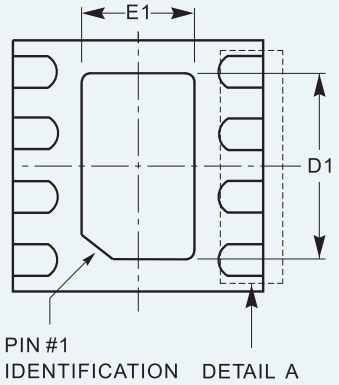


TOP VIEW

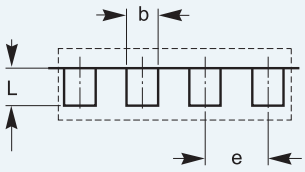


SIDE VIEW

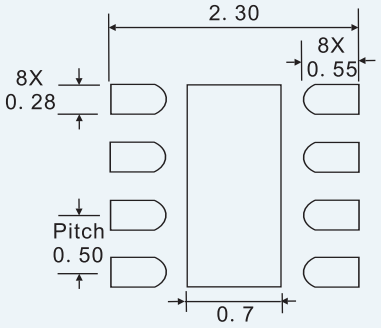
SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
b	0.18	0.25	0.30
D	1.90	2.00	2.10
D1	1.10	1.20	1.30
E	1.90	2.00	2.10
E1	0.50	0.60	0.70
e	0.40	0.50	0.60
L	0.30	0.35	0.40



BOTTOM VIEW



DETAIL A



UNIT:mm

Recommended Land Pattern

Notes:

(1) All dimensions are in millimeters

(2) Reference JEDEC MO-229 standard