

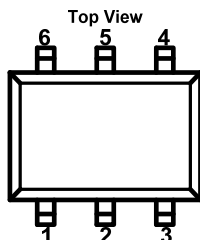


## CJ9113T6

### INTRODUCTION:

The CJ9113T6 is a compact, high-efficiency, fixed frequency, synchronous step-up DC-DC converter. This device provides an easy-to-use power supply solution for applications powered by either one-cell, two-cell or three-cell alkaline, NiCd, NiMH, one-cell Li-Ion or Li-Polymer batteries. A low-voltage technology allows the regulator to start up without high inrush current or output voltage overshoot from a low voltage input. High efficiency is accomplished by integrating the low-resistance N-Channel boost switch and synchronous P-Channel switch. All compensation and protection circuitry are integrated to minimize external components. CJ9113T6 consumes less than 14  $\mu$ A from battery, while operating at no load ( $V_{OUT} = 3.3V$ ,  $V_{IN} = 1.5V$ ). The devices provide a true disconnect from input to output (CJ9113T6A) or an input-to-output bypass (CJ9113T6B), while in shutdown ( $EN = GND$ ) state. Both options consume less than 0.6  $\mu$ A from battery. Output voltage is set by a small external resistor divider.

### PIN CONFIGURATION



### DEVICE INFORMATION:

PART NUMBER	PACKAGE
CJ9113T6	SOT-23-6L

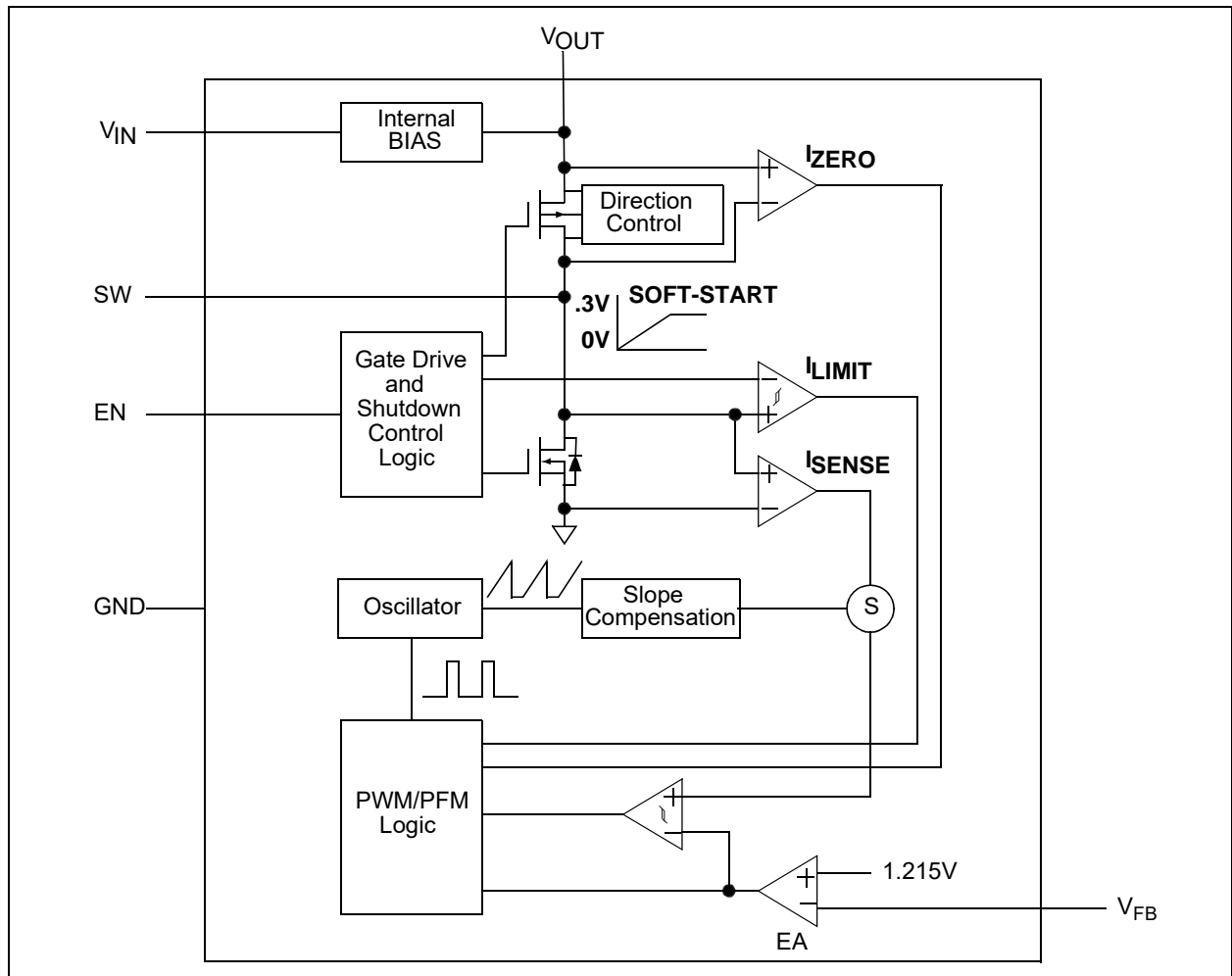
### FEATURES:

- Up to 96% Typical Efficiency
- 1.0A Typical Peak Input Current Limit:  
 $I_{OUT} > 200mA @ V_{OUT}=3.3V, V_{IN}=1.2V$   
 $I_{OUT} > 400mA @ V_{OUT}=3.3V, V_{IN}=2.4V$   
 $I_{OUT} > 400mA @ V_{OUT}=5.0V, V_{IN}=3.3V$
- Low Device Quiescent Current:  
 -Output Quiescent Current:  $< 4 \mu A$  typical, device is not switching ( $V_{OUT} > V_{IN}$ , excluding feedback divider current)  
 -Input Sleep Current: 1  $\mu A$   
 -No Load Input Current: 14  $\mu A$  typical
- Shutdown Current: 0.6  $\mu A$  typical
- Low Start-up Voltage: 0.82V, 1 mA load
- Low Operating Input Voltage: down to 0.65V
- Adjustable Output Voltage Range: 1.8V to 5.5V
- Maximum Input Voltage:  $V_{OUT} < 5.5V$
- Automatic PFM/PWM Operation:  
 -PWM Operation: 500 KHz  
 -PFM Output Ripple: 150 mV typical
- Feedback Voltage: 1.215V
- Inrush Current Limiting and Internal Soft Start (1 ms typical)
- Selectable, Logic Controlled, Shutdown States:  
 -True Load Disconnect Option (CJ9113T6A)  
 -Input to Output Bypass Option (CJ9113T6B)
- Over temperature Protection
- Output Short Protection

### APPLICATIONS:

- One, Two and Three Cell Alkaline and NiMH/NiCd Portable Products
- Solar Cell Applications
- Personal Care and Medical Products
- Bias for Status LEDs
- Smartphones, MP3 Players, Digital Cameras
- Remote controllers, Portable Instruments
- Wireless Sensors
- Bluetooth Headsets
- +3.3V to +5.0V Distributed Power Supply

■ BLOCK DIAGRAM

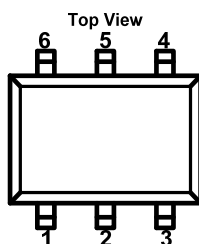


CJ9113T6 Block Diagram

### ■ ORDER INFORMATION

PART NUMBER	SHUTDOWN STATE
CJ9113T6A	True Load Disconnect
CJ9113T6B	Input to Output Bypass

### ■ PIN CONFIGURATION



PIN NO.	PIN NAME	FUNCTION
1	SW	Switch Node, Boost Inductor Input Pin
2	GND	Ground Pin
3	EN	Enable Control Input Pin
4	$V_{FB}$	Feedback Voltage Pin
5	$V_{OUT}$	Output Voltage Pin
6	$V_{IN}$	Input Voltage Pin

### ■ ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

(Unless otherwise specified,  $T_A=25^{\circ}\text{C}$ )

PARAMETER	SYMBOL	RATINGS	UNITS
Input Voltage <sup>(2)</sup>	$V_{IN}$	-0.3~ 6	V
SW Voltage <sup>(2)</sup>		-0.3~ 6	V
CE,FB Voltage <sup>(2)</sup>		-0.3~ 6	V
$V_{OUT}$ Voltage <sup>(2)</sup>		-0.3~6	V
Ourput Current Bypass Mode		1000	mA
Power Dissipation   SOT23-6L	$P_D$	400	mW
Operating Virtual Ambient Temperature Range	$T_A$	-40~+85	$^{\circ}\text{C}$
Storage Temperature Range	$T_{stg}$	-40~+125	$^{\circ}\text{C}$
Lead Temperature (Soldering, 10 sec)	$T_{solder}$	260	$^{\circ}\text{C}$
ESD rating	Human Body Model (HBM)	4000	V
	Machine Model (MM)	400	V

(1) Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods my affect device reliability.

(2) All voltages are with respect to network ground terminal.

### ■ RECOMMENDED OPERATING CONDITIONS

PARAMETER	MIN.	NOM.	MAX.	UNITS
Supply voltage at $V_{IN}$	-0.3	-	6	V
Output voltage at $V_{OUT}$	-0.3	-	6	V
Operating free air temperature range, $T_A$	-40	-	85	$^{\circ}\text{C}$

## Electrical Characteristics

### ■ ELECTRICAL CHARACTERISTICS

$V_{IN}=1.5V$ ,  $C_{OUT}=C_{IN}=10\mu F$ ,  $L=4.7\mu H$ ,  $V_{OUT}=3.3V$ ,  $I_{OUT}=0mA$ , Typical values are at  $T_A=25^\circ C$ , unless otherwise specified.

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP. <sup>(1)</sup>	MAX.	UNITS
Minimum Start-Up Voltage	$V_{IN}$	$I_{LOAD}=1mA$	-	0.82	-	V
Minimum Operating Voltage <sup>(2)</sup>	$V_{IN}$	$I_{LOAD}=1mA$	-	0.65	-	V
Input Voltage Range	$V_{IN}$		0.82		5.5	V
Feedback Voltage	$V_{FB}$		1.179	1.215	1.251	V
Feedback Input Bias Current	$I_{VFB}$		-	10	-	nA
Output Voltage Adjust Range <sup>(3)</sup>	$V_{OUT}$	$V_{OUT}\geq V_{IN}$	1.8		5.5	V
Output Voltage	$V_{OUT}$	EN=0V	CJ9113T6A	0		V
			CJ9113T6B	$V_{IN}-0.6V$		
Maximum Output Current	$I_{OUT}$	$V_{IN}=1.2V, V_{OUT}=2V$		200	-	mA
		$V_{IN}=2.4V, V_{OUT}=3.3V$		400	-	
		$V_{IN}=3.3V, V_{OUT}=5.0V$		400	-	
$V_{OUT}$ Quiescent Current <sup>(4)</sup>	$I_{QOUT}$	$I_{OUT}=0mA$ , device is not switching, EN= $V_{IN}=4V$ , $V_{OUT}=5V$	-	4	8	$\mu A$
$V_{IN}$ Sleep Current <sup>(5)</sup>	$I_{QIN}$	$I_{OUT}=0mA$ , EN= $V_{IN}$	-	1	2.3	$\mu A$
No load Input Current	$I_{INO}$	$I_{OUT}=0mA$ , device is switching	-	14	25	$\mu A$
Quiescent Current Shutdown	$I_{QSHDN}$	$V_{OUT}=3.3V$	-	0.6	-	$\mu A$

(1) Typical numbers are at  $25^\circ C$  and represent the most likely norm.

(2) Minimum  $V_{IN}$  operation after start-up is only limited by the battery's ability to provide the necessary power as it enters a deeply discharged state.

(3) For  $V_{IN} > V_{OUT}$ ,  $V_{OUT}$  will not remain in regulation.

(4)  $I_{QOUT}$  is measured at  $V_{OUT}$ ,  $V_{OUT}$  is external supplied for  $V_{OUT} > V_{IN}$  (device is not switching)

(5)  $I_{QIN}$  is measured at  $V_{IN}$  pin during Sleep period, no load. Determined by characterization, not production tested.

## Electrical Characteristics

### ■ ELECTRICAL CHARACTERISTICS

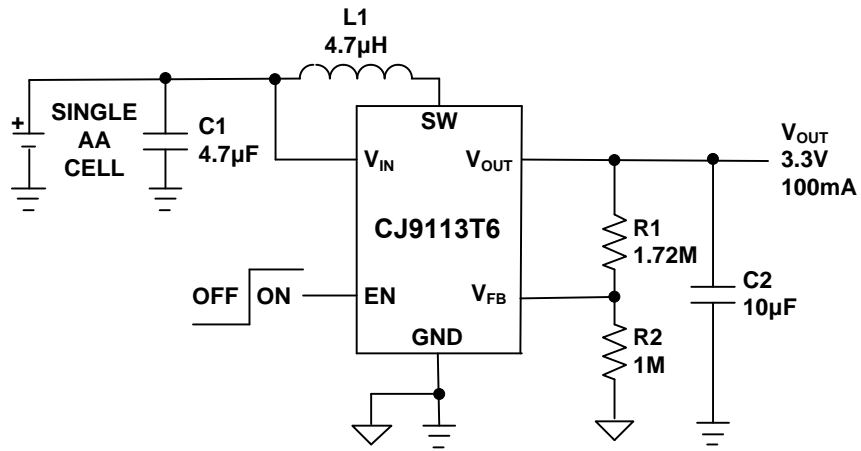
$V_{IN}=1.5V$ ,  $C_{OUT}=C_{IN}=10\mu F$ ,  $L=4.7\mu H$ ,  $V_{OUT}=3.3V$ ,  $I_{OUT}=0mA$ , Typical values are at  $T_A=25^\circ C$ , unless otherwise specified.

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP. <sup>(1)</sup>	MAX.	UNITS
NMOS Switch Leakage	$I_{NLK}$	$V_{IN}=V_{SW}=5V$ , $V_{OUT}=5.5V$ , $EN=V_{FB}=GND$	-	0.15	-	$\mu A$
PMOS Switch Leakage	$I_{PLK}$	$V_{IN}=V_{SW}=GND$ , $V_{OUT}=5.5V$	-	0.15	-	$\mu A$
NMOS Switch On Resistance	$R_{DS(ON)N}$	$V_{OUT} = 3.3V$ , $I_{SW}=100mA$	-	0.25	-	$\Omega$
PMOS Switch On Resistance	$R_{DS(ON)P}$	$V_{OUT} = 3.3V$ , $I_{SW}=100mA$	-	0.5	-	$\Omega$
NMOS Peak Switch Current Limit <sup>(1)</sup>	$I_{N(MAX)}$		-	1	-	A
$V_{OUT}$ Accuracy <sup>(2)</sup>	$V_{OUT}\%$	$V_{IN}=1.5V$	-3	-	+3	%
Switching Frequency	$f_{SW}$			500		KHz
EN Input Logic High	$V_{IH}$	$I_{OUT}=1mA$	70	-	-	% of $V_{IN}$
EN Input Logic Low	$V_{IL}$	$I_{OUT}=1mA$	-	-	20	% of $V_{IN}$
EN Input Leakage Current	$I_{ENLK}$	$V_{EN}=5V$	-	5	-	nA
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta V_{IN}}$	$1.5V \leq V_{IN} \leq 2.8V$ , $I_{OUT}=50mA$	-0.4	0.3	0.4	%/V
Load Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	$25mA \leq I_{OUT} \leq 100mA$ , $V_{IN}=1.5V$	-1.5	0.1	1.5	%
Maximum Duty Cycle <sup>(1)</sup>	$DC_{MAX}$		87	89	91	%
Soft Start Time <sup>(1)</sup>	$t_{SS}$	EN Low to High 90% of $V_{OUT}$	-	1	-	ms
Thermal Shutdown Die Temperature	$T_{SD}$	$I_{OUT}=20mA$ , $V_{IN}=1.4V$	-	160	-	$^\circ C$
Die Temperature Hysteresis	$T_{SDHY}$		-	20	-	$^\circ C$

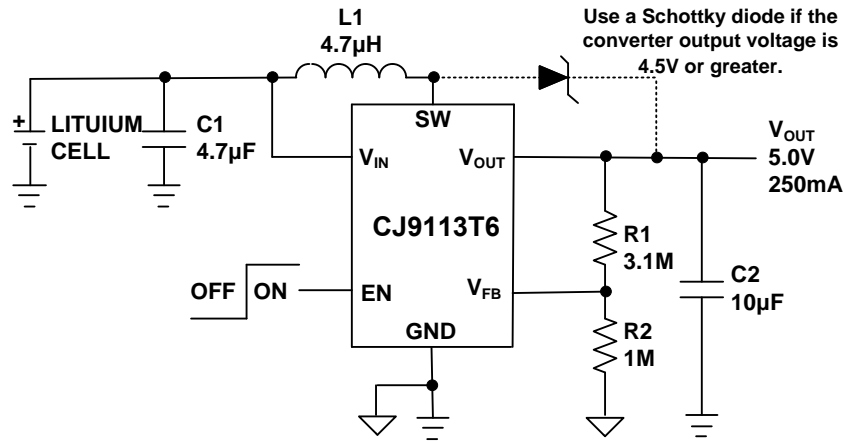
(1) Determined by characterization, not production tested.

(2) Includes Line and Load Regulation

■ TYPICAL APPLICATION CIRCUITS



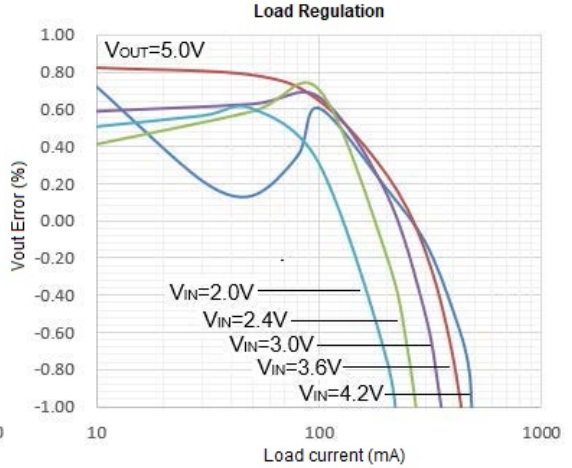
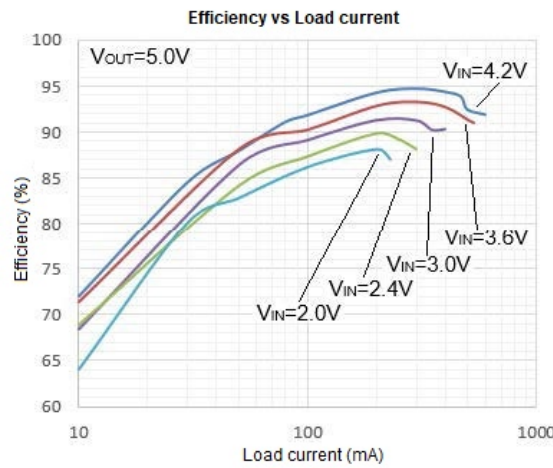
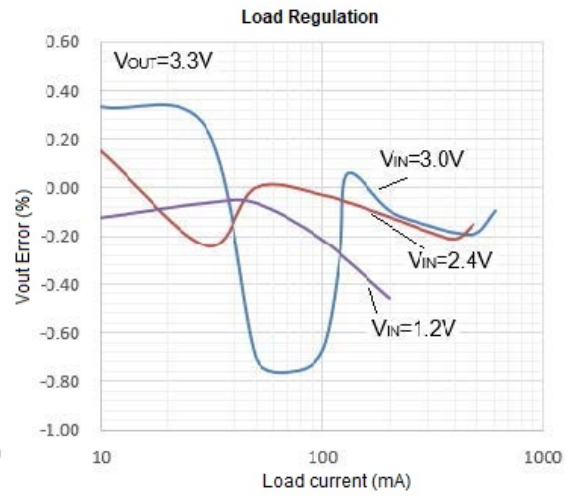
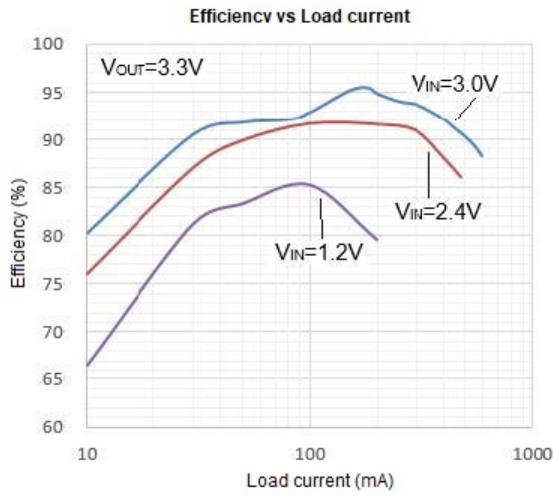
Circuit 1



Circuit 2

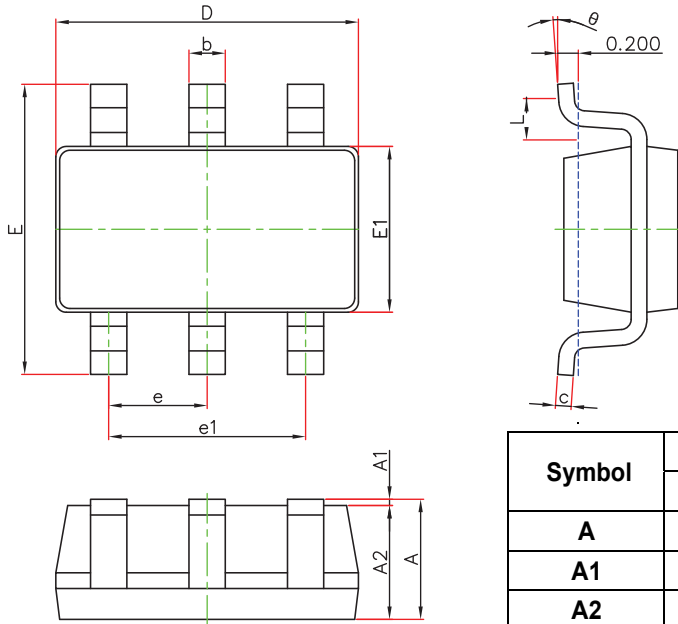
# Typical Characteristics

( $T_A=25^\circ\text{C}$ , unless otherwise specified)



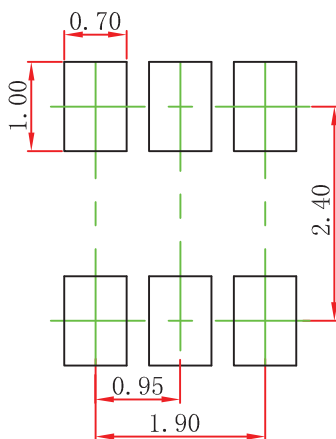


## SOT-23-6L Package Outline Dimensions



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

## SOT-23-6L Suggested Pad Layout



Note:

1. Controlling dimension: in millimeters.
2. General tolerance:  $\pm 0.05$  mm.
3. The pad layout is for reference purposes only.

# DISCLAIMER

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