

1.2A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417B

General Description

The AP3417B is a 1.4MHz fixed frequency, current mode, PWM synchronous buck (step-down) DC-DC converter, capable of driving a 1.2A load with high efficiency, excellent line and load regulation. The device integrates synchronous P-channel and N-channel power MOSFET switches with low on-resistance. It is ideal for powering portable equipment that runs from a single Li-ion battery.

A standard series of inductors are available from several different manufacturers optimized for use with the AP3417B. This feature greatly simplifies the design of switch-mode power supplies.

The AP3417B is available in SOT-23-5 package.

Features

- Input Voltage Range: 2.5V to 5.5V
- Output Voltage: 0.6V to V_{IN}
- ADJ Output
- Fixed 1.4MHz Frequency
- High Efficiency up to 95%
- Output Current: 1.2A
- Current Mode Control
- 100% Duty Cycle in Dropout
- Built-in Over Current Protection
- Built-in Short Circuit Protection
- Built-in Thermal Shutdown Protection
- Built-in UVLO Function
- Built-in Soft-start
- Built-in Input Over Voltage Protection (IOVP)

Applications

- Set-top Box
- Datacom
- Portable Device
- Smart Phone

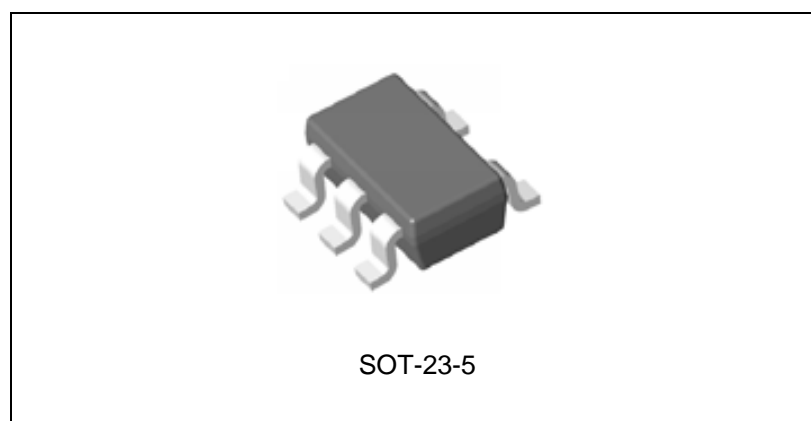


Figure 1. Package Type of AP3417B

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Pin Configuration

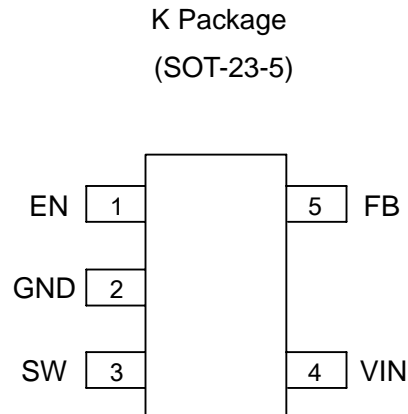


Figure 2. Pin Configuration of AP3417B (Top View)

Pin Description

Pin Number	Pin Name	Function
1	EN	Control input pin. Forcing this pin above 1.5V enables the IC. Forcing this pin below 0.4V shuts down the IC. When the IC is in shutdown mode, all functions are disabled to decrease the supply current below 1μA
2	GND	Ground pin
3	SW	Power switch output pin. Inductor connection to drain of the internal PFET and NFET switches
4	VIN	Supply input pin. Bypass to GND with a 4.7μF or greater ceramic capacitor
5	FB	This is the feedback pin of the device. Connect this pin directly to the output if the fixed output voltage version is used. For the adjustable version, an external resistor divider is connected to this pin

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Functional Block Diagram

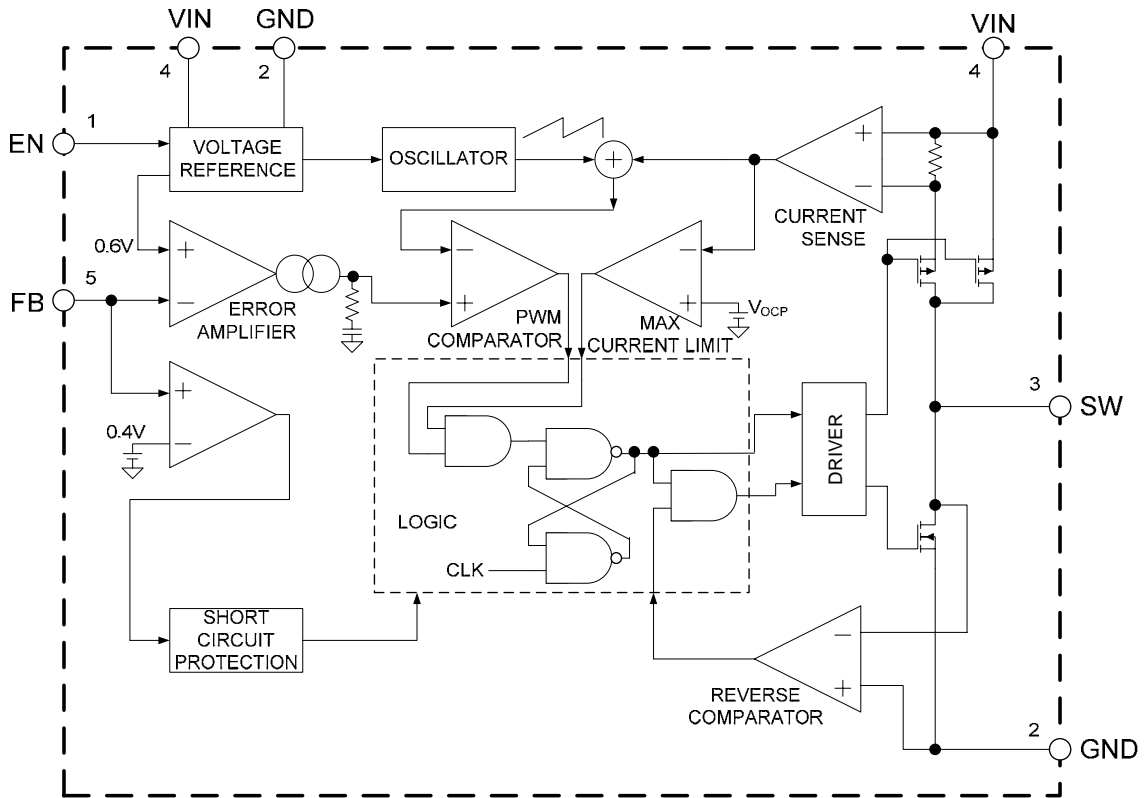
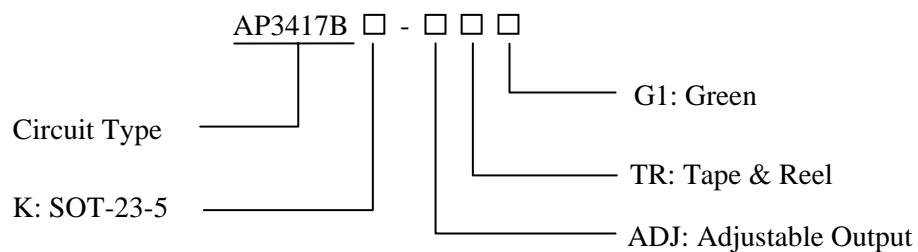


Figure 3. Functional Block Diagram of AP3417B

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOT-23-5	-40 to 85°C	AP3417BK-ADJTRG1	G2J	Tape & Reel

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

**1.2A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417B****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3 to 6.0	V
Feedback Voltage	V_{FB}	-0.3 to $V_{IN} + 0.3$	V
EN Pin Voltage	V_{EN}	-0.3 to $V_{IN} + 0.3$	V
SW Pin Voltage	V_{SW}	-0.3 to $V_{IN} + 0.3$	V
Thermal Resistance	θ_{JA}	265	°C/W
Operating Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260	°C
ESD(Machine Model)		200	V
ESD(Human Body Model)		2000	V

Note 1: Stresses greater than 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 Ratings” for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	2.5	5.5	V
Operating Ambient Temperature	T_A	-40	85	°C



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Electrical Characteristics

$V_{IN}=5V$, $T_A=25^{\circ}C$, unless otherwise specified.

Parameters	Symbol	Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}		2.5		5.5	V
Quiescent Current	I_Q	$V_{FB}=0.65V$		62	100	μA
Shutdown Supply Current	I_{STBY}	$V_{EN}=GND$		0.1	1	μA
Reference Voltage	V_{REF}		0.588	0.6	0.612	V
Feedback Bias Current	I_{FB_H}	$V_{FB}=1V$	-0.1		0.1	μA
	I_{FB_L}	$V_{FB}=0V$	-0.1		0.1	
PMOSFET R_{ON}	$R_{DS(ON)_P}$	$I_{SW}=200mA$		0.25		Ω
NMOSFET R_{ON}	$R_{DS(ON)_N}$	$I_{SW}=-200mA$		0.2		Ω
Switch Current Limit	I_{LIM}	$V_{FB}=0.55V$	1.5	2.0		A
EN Pin Threshold	V_H		1.5			V
	V_L				0.4	
UVLO Threshold	V_{UVLO}	V_{IN} Rising		2.3		V
UVLO Hysteresis	V_{HYS}			0.2		
Oscillator Frequency	f_{OSC}		1.12	1.40	1.68	MHz
Max. Duty Cycle	D_{MAX}		100			%
Min. Duty Cycle	D_{MIN}				0	
SW Leakage Current	I_{SW_H}	$V_{SW}=0V$		0.1		μA
	I_{SW_L}	$V_{SW}=5V$		0.1		
Soft-start Time	t_{SS}			1		ms
Thermal Shutdown	T_{OTSD}			160		$^{\circ}C$
Thermal Shutdown Hysteresis	T_{HYS}			20		$^{\circ}C$
Input OVP Threshold	V_{IOVP}	V_{IN} Rising		6.3		V
Input OVP Hysteresis	V_{IOVP_HYS}			0.5		V

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Typical Performance Characteristics

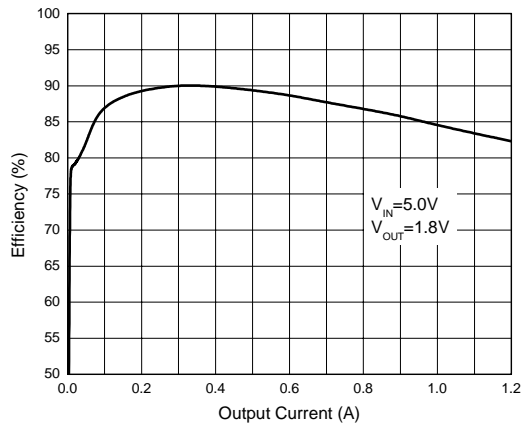


Figure 4. Efficiency vs. Output Current

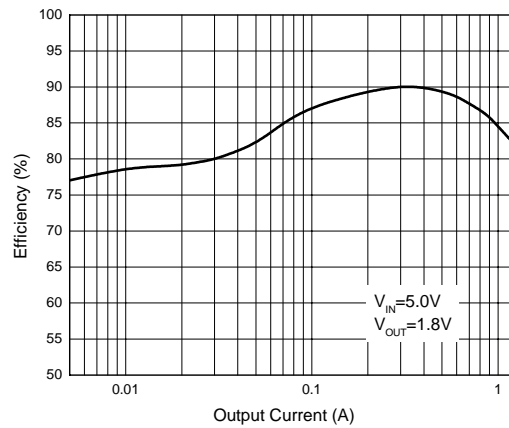


Figure 5. Efficiency vs. Output Current

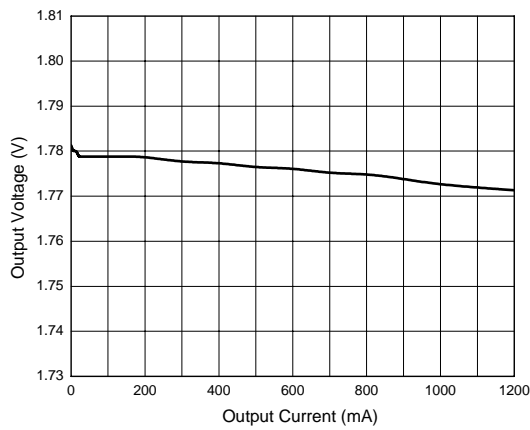


Figure 6. Output Voltage vs. Output Current

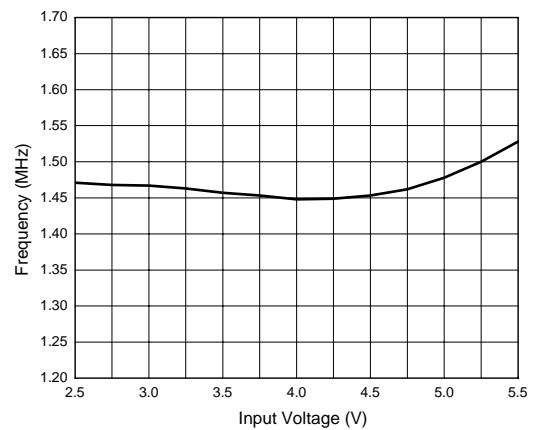


Figure 7. Frequency vs. Input Voltage

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Typical Performance Characteristics (Continued)

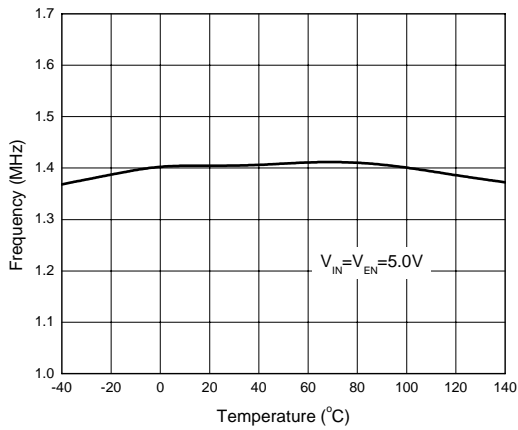


Figure 8. Frequency vs. Temperature

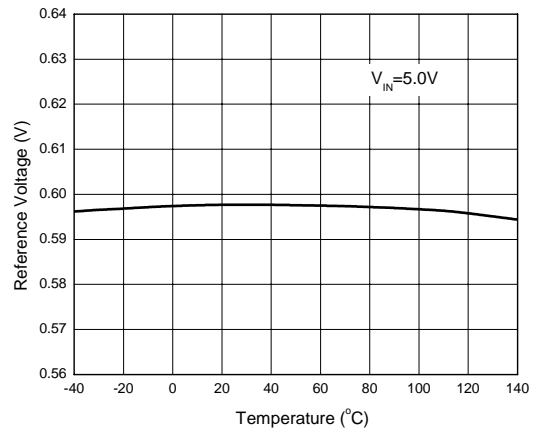


Figure 9. Reference Voltage vs. Temperature

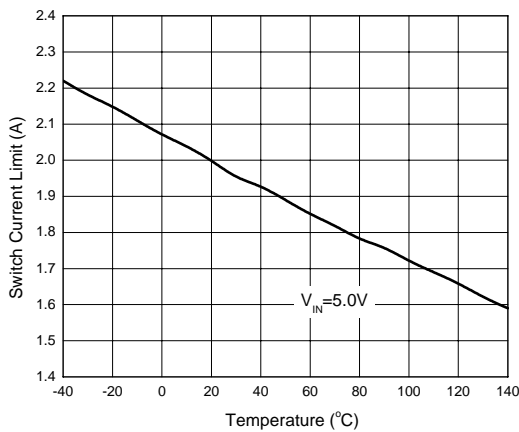


Figure 10. Switch Current Limit vs. Temperature

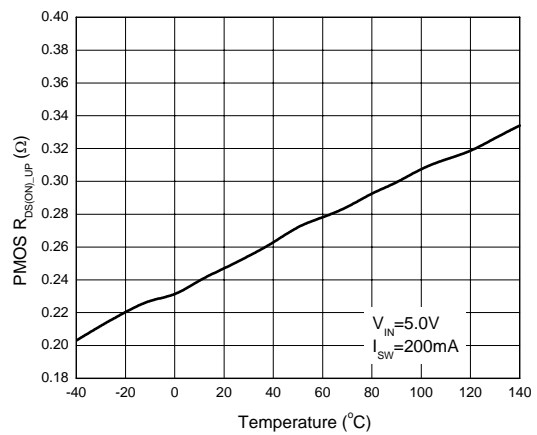


Figure 11. R_DS(ON)_UP vs. Temperature

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Typical Performance Characteristics (Continued)

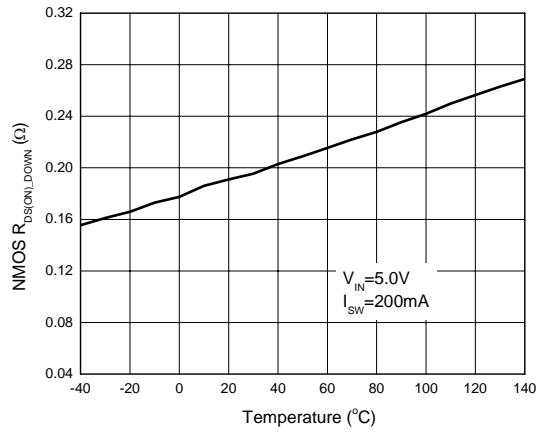


Figure 12. $R_{DS(ON)_DOWN}$ vs. Temperature

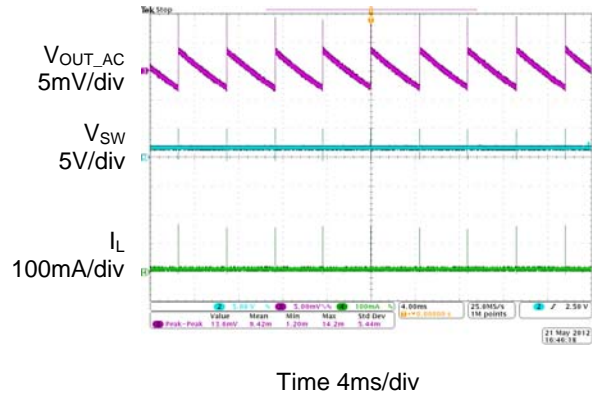


Figure 13. Output Ripple ($I_{OUT}=0A$)

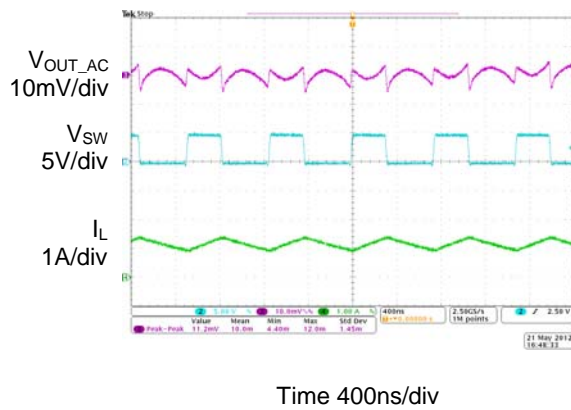


Figure 14. Output Ripple ($I_{OUT}=1.2A$)

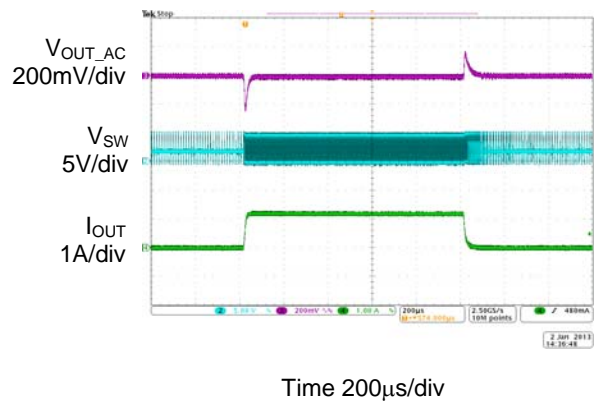
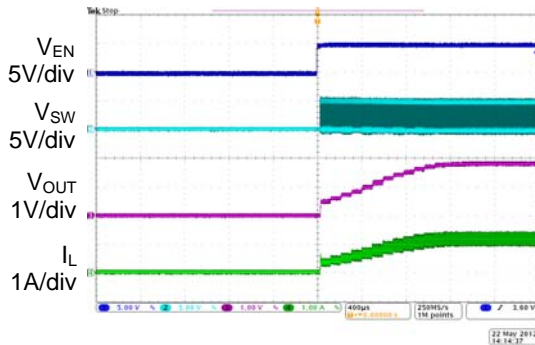


Figure 15. Load Transient ($I_{OUT}=0A$ to $1.2A$)

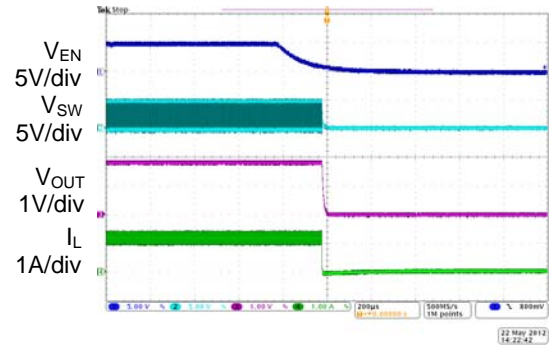
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Typical Performance Characteristics (Continued)



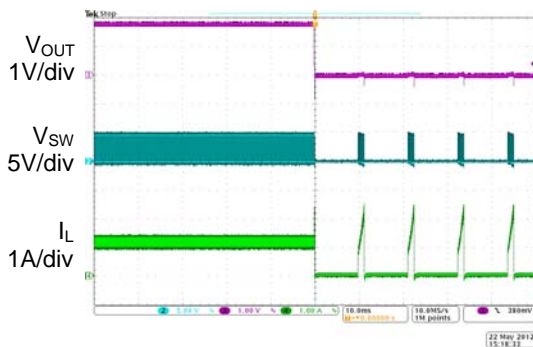
Time 400 μ s/div

Figure 16. Enable Turn On ($I_{OUT}=1.2A$)



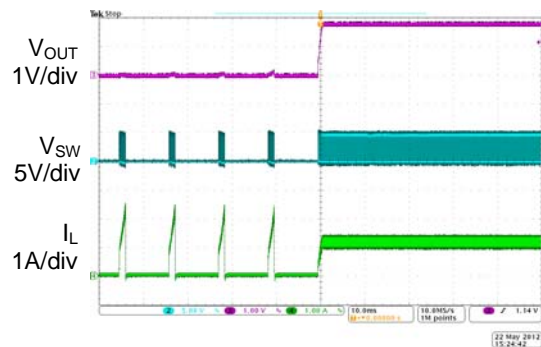
Time 200 μ s/div

Figure 17. Enable Turn Off ($I_{OUT}=1.2A$)



Time 10ms/div

Figure 18. Short Circuit Protection ($I_{OUT}=1.2A$)

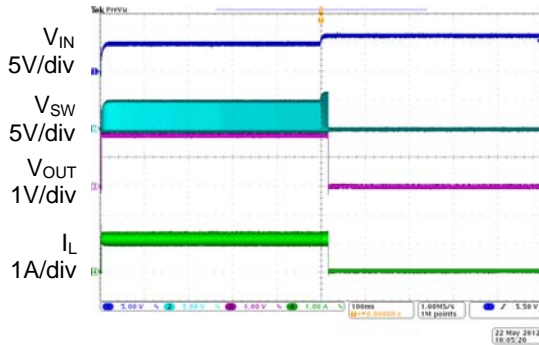


Time 10ms/div

Figure 19. Short Circuit Protection Recovery ($I_{OUT}=1.2A$)

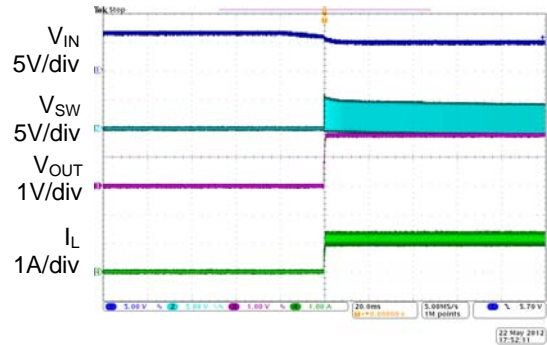
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Typical Performance Characteristics (Continued)



Time 100ms/div

Figure 20. Over Voltage Protection
($I_{OUT}=1.2A$)



Time 20ms/div

Figure 21. Over Voltage Protection Recovery
($I_{OUT}=1.2A$)

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Typical Application

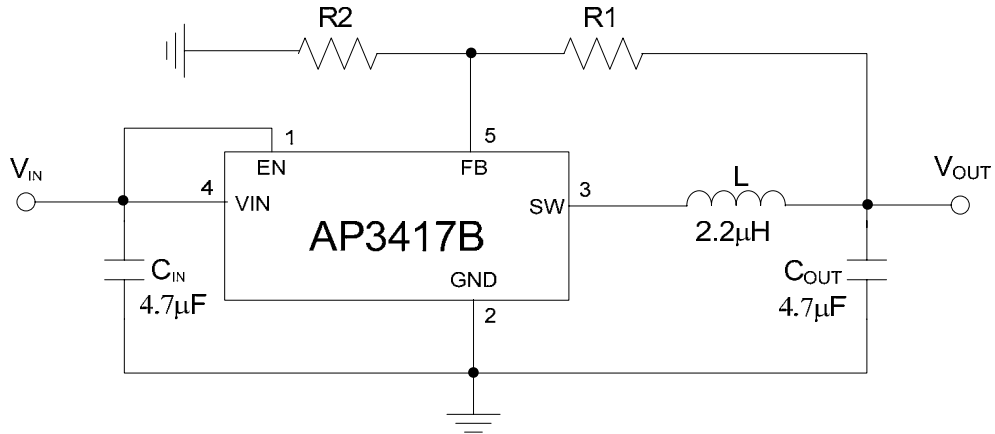


Figure 22. Typical Application of AP3417B



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