

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**

## General Description

The AP3417A is a 1.4MHz fixed frequency, current mode, PWM synchronous buck (step-down) DC-DC converter, capable of driving a 1A 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 AP3417A. This feature greatly simplifies the design of switch-mode power supplies.

The AP3417A 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: 1A
- 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

## Applications

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

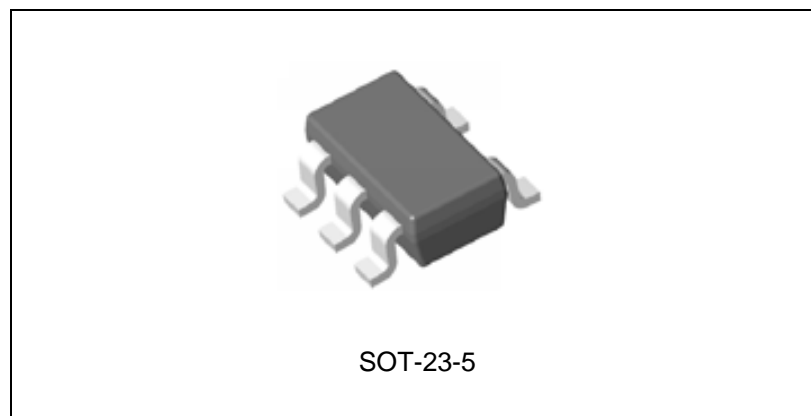


Figure 1. Package Type of AP3417A

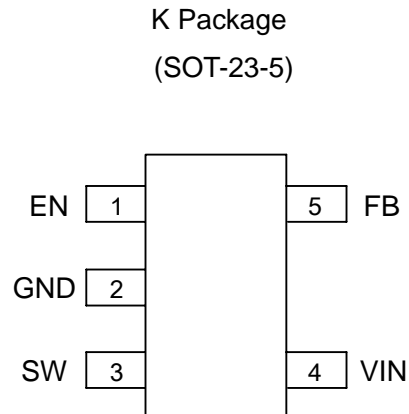
**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**
**Pin Configuration**


Figure 2. Pin Configuration of AP3417A (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 1 $\mu$ A
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 4.7 $\mu$ F 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**

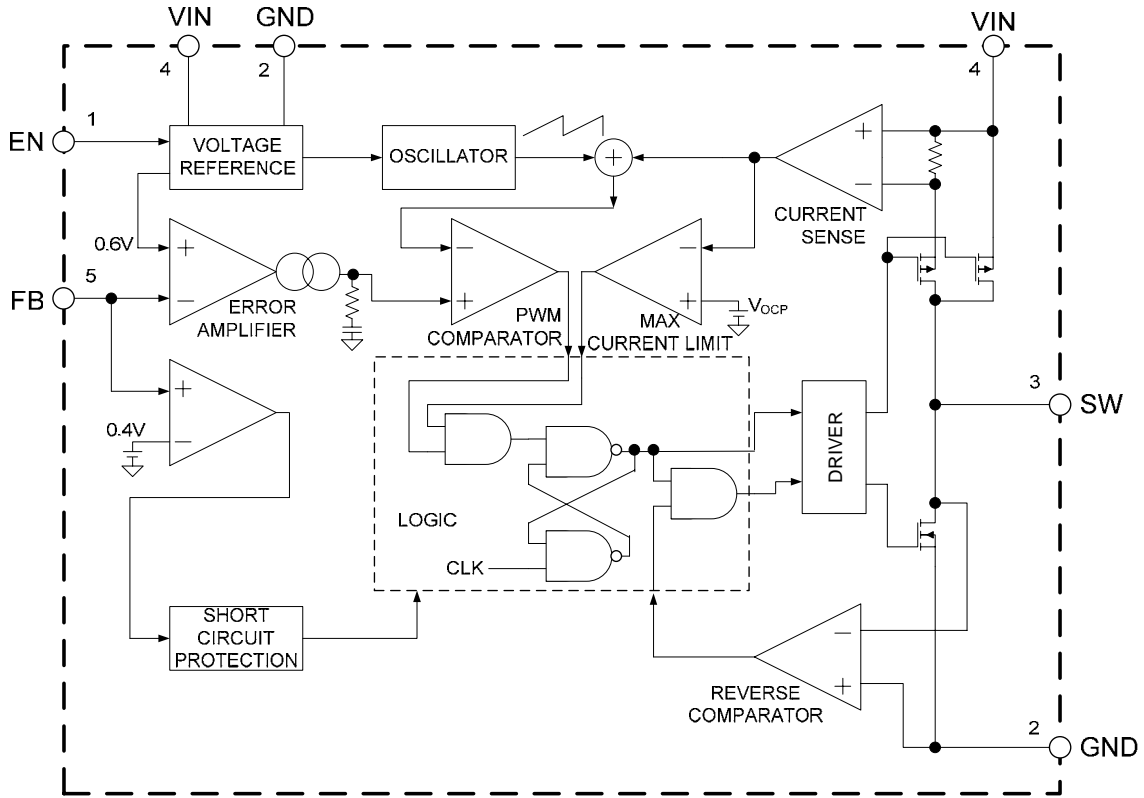
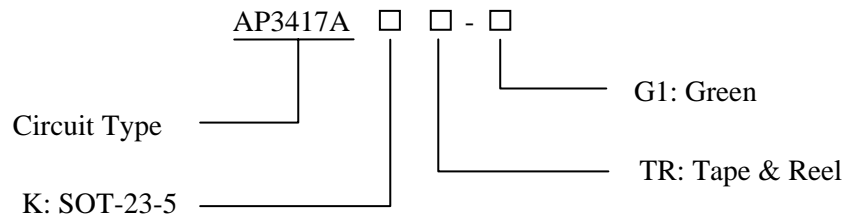


Figure 3. Functional Block Diagram of AP3417A

**Ordering Information**



Package	Temperature Range	Part Number	Marking ID	Packing Type
SOT-23-5	-40 to 85 °C	AP3417AKTR-G1	G4H	Tape & Reel

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

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A****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	$\theta_{JA}$	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

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A****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	$\mu A$
Shutdown Supply Current	$I_{STBY}$	$V_{EN}=GND$		0.1	1	$\mu A$
Reference Voltage	$V_{REF}$	For Adjustable Output Voltage	0.588	0.6	0.612	V
Feedback Bias Current	$I_{FB\_H}$	$V_{FB}=1V$	-0.1		0.1	$\mu A$
	$I_{FB\_L}$	$V_{FB}=0V$	-0.1		0.1	
PMOSFET $R_{ON}$	$R_{DS(ON)\_P}$	$I_{SW} = 200mA$		0.25		$\Omega$
NMOSFET $R_{ON}$	$R_{DS(ON)\_N}$	$I_{SW} = -200mA$		0.2		$\Omega$
Switch Current Limit	$I_{LIM}$	$V_{FB}=0.55V$	1.3	1.8		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		$\mu A$
	$I_{SW\_L}$	$V_{SW} = 5V$		0.1		
Soft-start Time	$t_{SS}$			1		ms
Thermal Shutdown	$T_{OTSD}$			160		$^{\circ}C$
Thermal Shutdown Hysteresis	$T_{HYS}$			20		$^{\circ}C$

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**

**Typical Performance Characteristics**

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

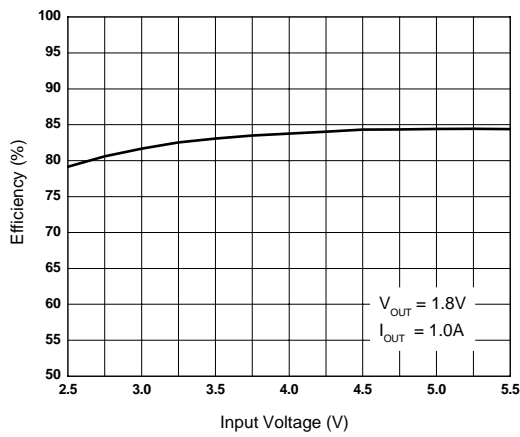


Figure 4. Efficiency vs. Input Voltage

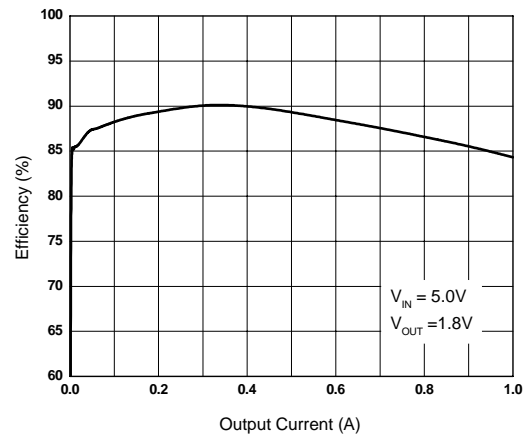


Figure 5. Efficiency vs. Output Current

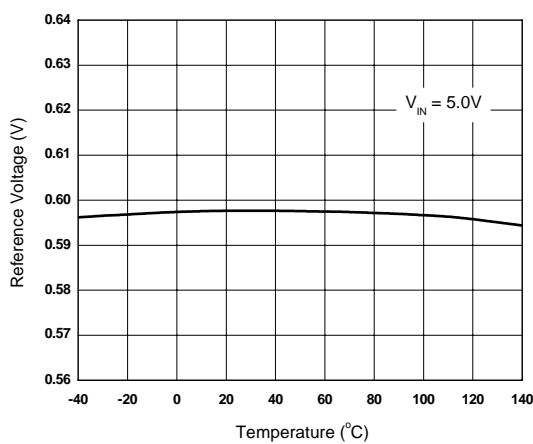


Figure 6. Reference Voltage vs. Temperature

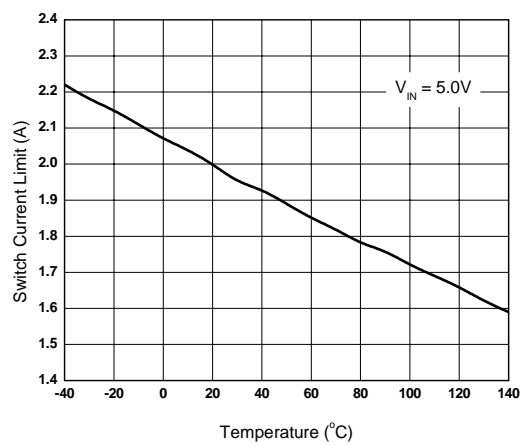


Figure 7. Switch Current Limit vs. Temperature

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**

**Typical Performance Characteristics (Continued)**

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

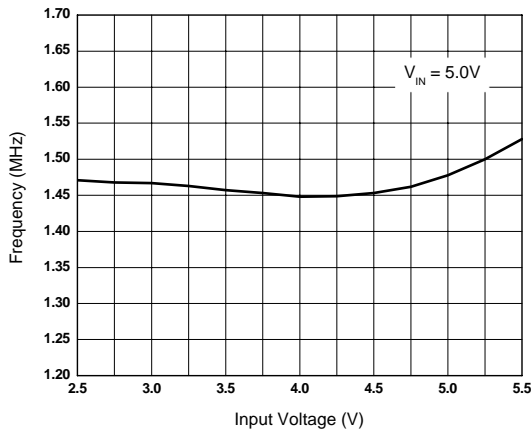


Figure 8. Frequency vs. Input Voltage

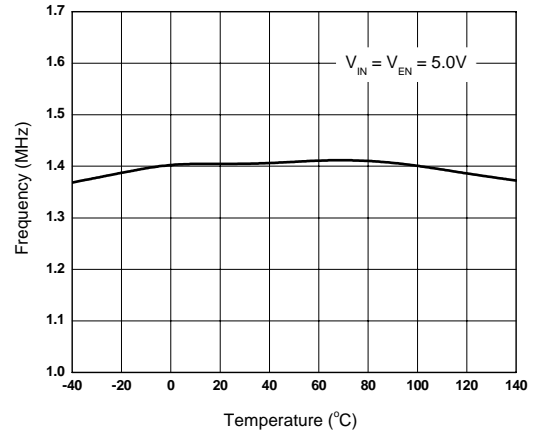


Figure 9. Frequency vs. Temperature

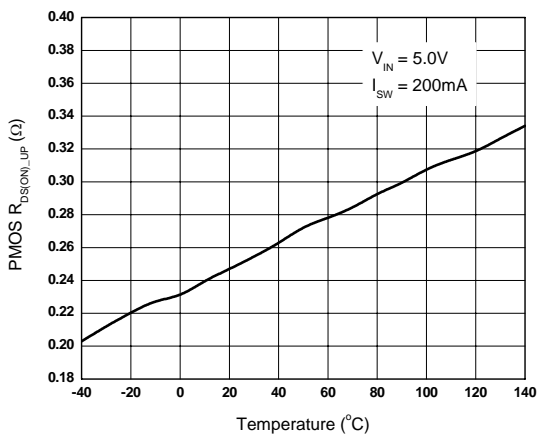


Figure 10.  $R_{DS(ON)_UP}$  vs. Temperature

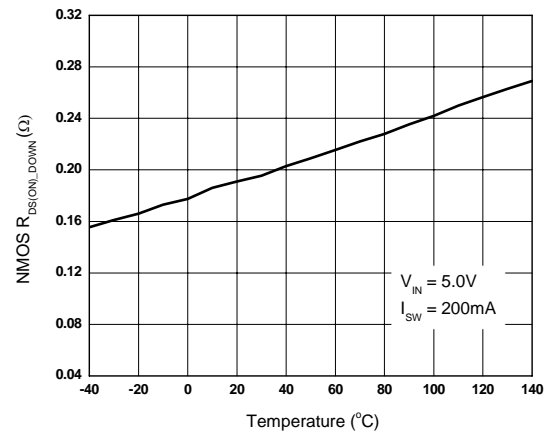
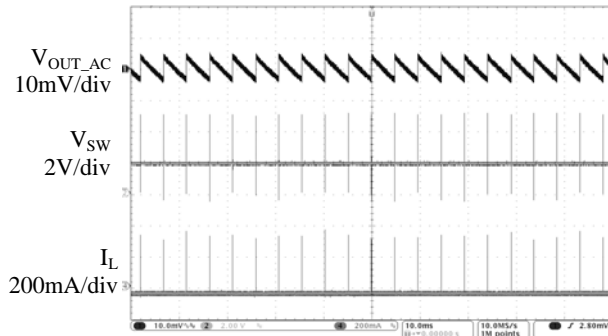


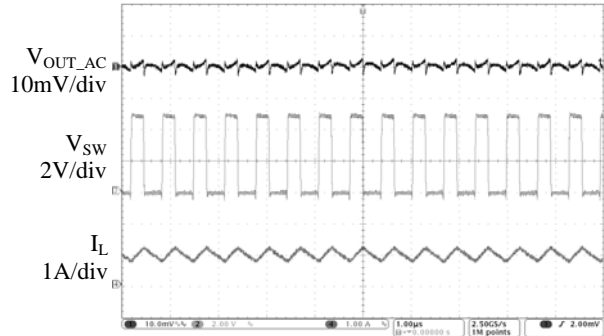
Figure 11.  $R_{DS(ON)_DOWN}$  vs. Temperature

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**
**Typical Performance Characteristics (Continued)**

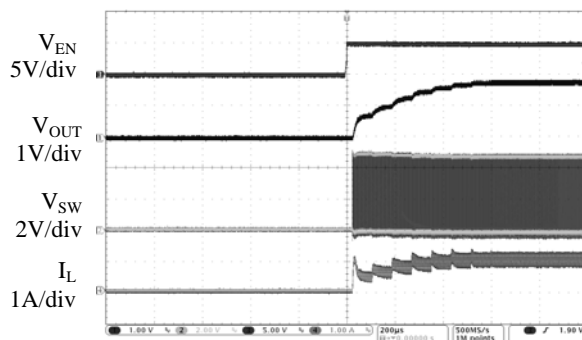
$V_{IN}=5V$ ,  $T_A=25^{\circ}C$ , unless otherwise specified.



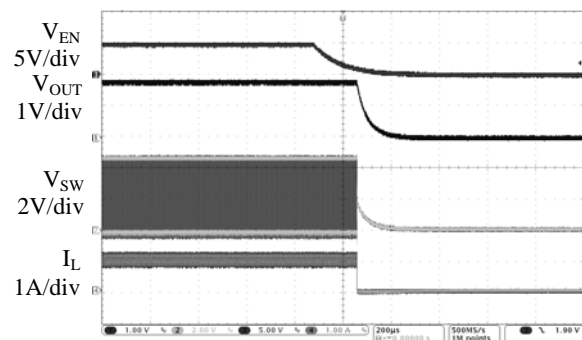
Time 10ms/div

 Figure 12. Output Ripple ( $I_{OUT}=0A$ )


Time 1μs/div

 Figure 13. Output Ripple ( $I_{OUT}=1A$ )


Time 200μs/div

 Figure 14. Enable Turn on ( $I_{OUT}=1A$ )


Time 200μs/div

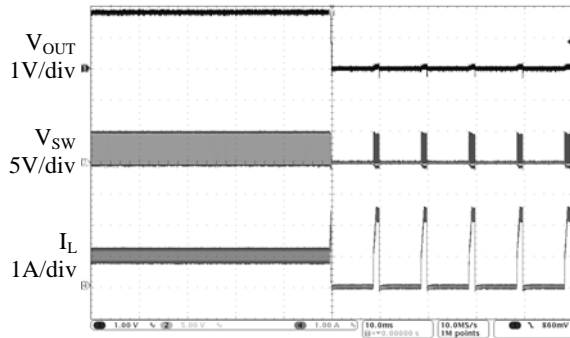
 Figure 15. Enable Turn off ( $I_{OUT}=1A$ )



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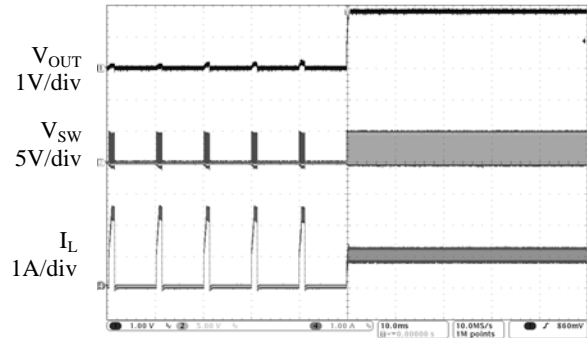
**Typical Performance Characteristics (Continued)**

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



Time 10ms/div

Figure 16. Short Circuit Protection  
( $I_{OUT}=1A$ )



Time 10ms/div

Figure 17. Short Circuit Protection Recovery  
( $I_{OUT}=1A$ )

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**

**Typical Application**

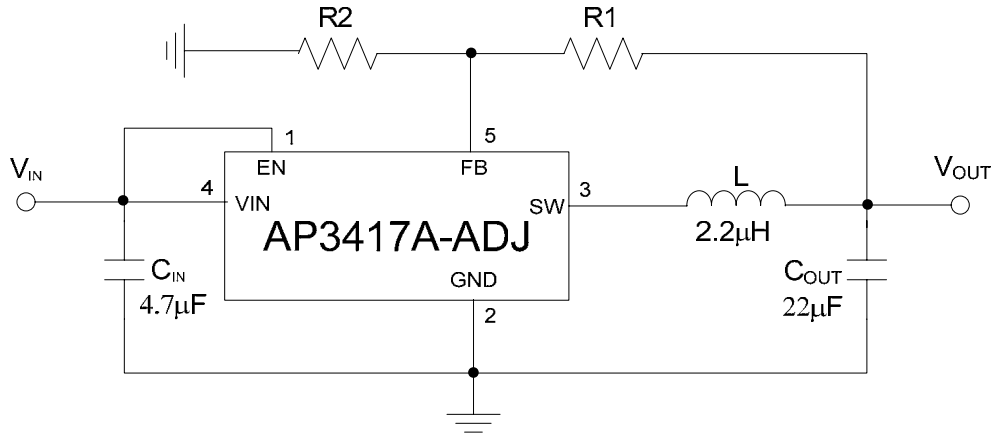


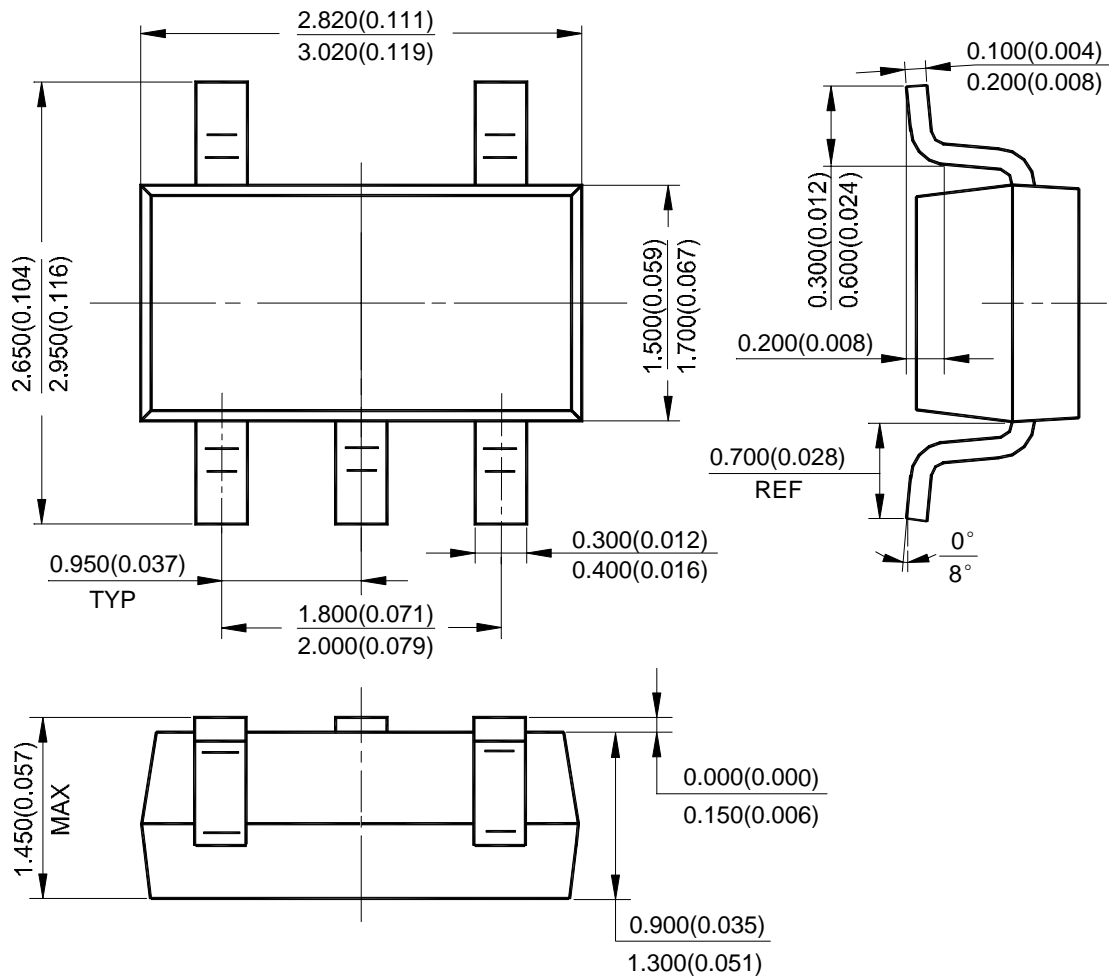
Figure 18. Typical Application of AP3417A

**1A, 1.4MHz High Efficiency Synchronous DC-DC Buck Converter AP3417A**

**Mechanical Dimensions**

**SOT-23-5**

**Unit: mm(inch)**





## BCD Semiconductor Manufacturing Limited

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