

Dual 1A, 1.5MHz Synchronous Step-down DC-DC Converter AP3427M

General Description

The AP3427M is a high efficiency step-down dual channel DC-DC voltage converter. The chip operation is optimized by peak-current mode architecture with built-in synchronous power MOSFET switchers. The oscillator and timing capacitors are all built-in providing an internal switching frequency of 1.5MHz that allows the use of small surface mount inductors and capacitors for portable product implementations.

Integrated Soft Start (SS), Under Voltage Lock Out (UVLO), Thermal Shutdown Detection (TSD) and Short Circuit Protection are designed to provide reliable product applications.

The device is available in adjustable output voltage ranging from 0.6V to $0.9 \times V_{IN}$ when input voltage range is from 2.5V to 5.5V, and is able to deliver up to 1A.

The AP3427M is available in standard DFN-3×3-10 package.

Features

- High Efficiency Buck Power Converter
- Output Current: 1.0A
- Low $R_{DS(ON)}$ Internal Switches: 200m Ω ($V_{IN}=5V$)
- Adjustable Output Voltage from 0.6V to $0.9 \times V_{IN}$
- Wide Operating Voltage Range: 2.5V to 5.5V
- Built-in Power Switches for Synchronous Rectification with High Efficiency
- Feedback Voltage: 600mV
- 1.5MHz Constant Frequency Operation
- Thermal Shutdown Protection
- Low Drop-out Operation at 100% Duty Cycle
- Input Over Voltage Protection
- No Schottky Diode Required

Applications

- Post DC-DC Voltage Regulation
- PDA and Notebook Computer

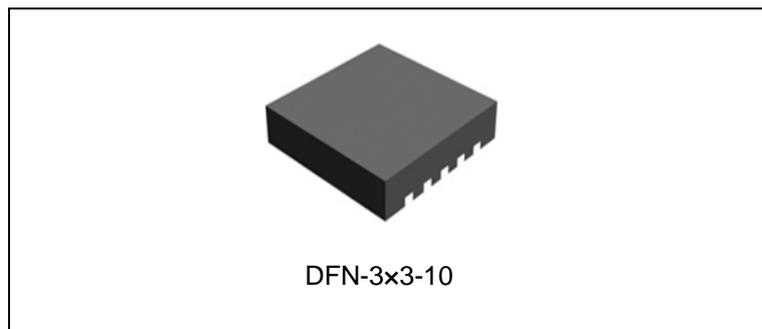


Figure 1. Package Type of AP3427M

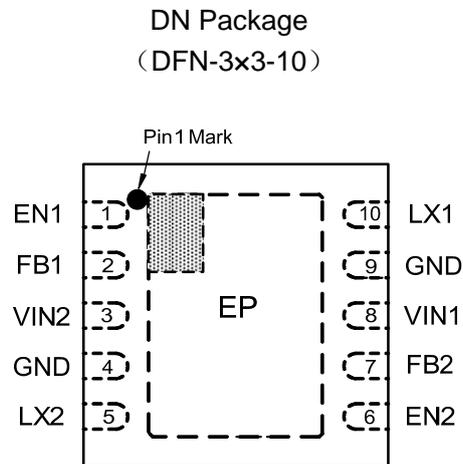
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Pin Configuration


Figure 2. Pin Configuration of AP3427M (Top View)

Pin Description

Pin Number	Pin Name	Function
1	EN1	Enable signal input of channel 1, active high
2	FB1	Feedback voltage of channel 1
3	VIN2	Power supply input of channel 2
4, 9, Exposed Pad	GND	GND. It should be connected to system ground
5	LX2	Connected from channel 2's Power MOSFET to inductor
6	EN2	Enable signal input of channel 2, active high
7	FB2	Feedback voltage of channel 2
8	VIN1	Power supply input of channel 1
10	LX1	Connected from channel 1's Power MOSFET to inductor

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Functional Block Diagram

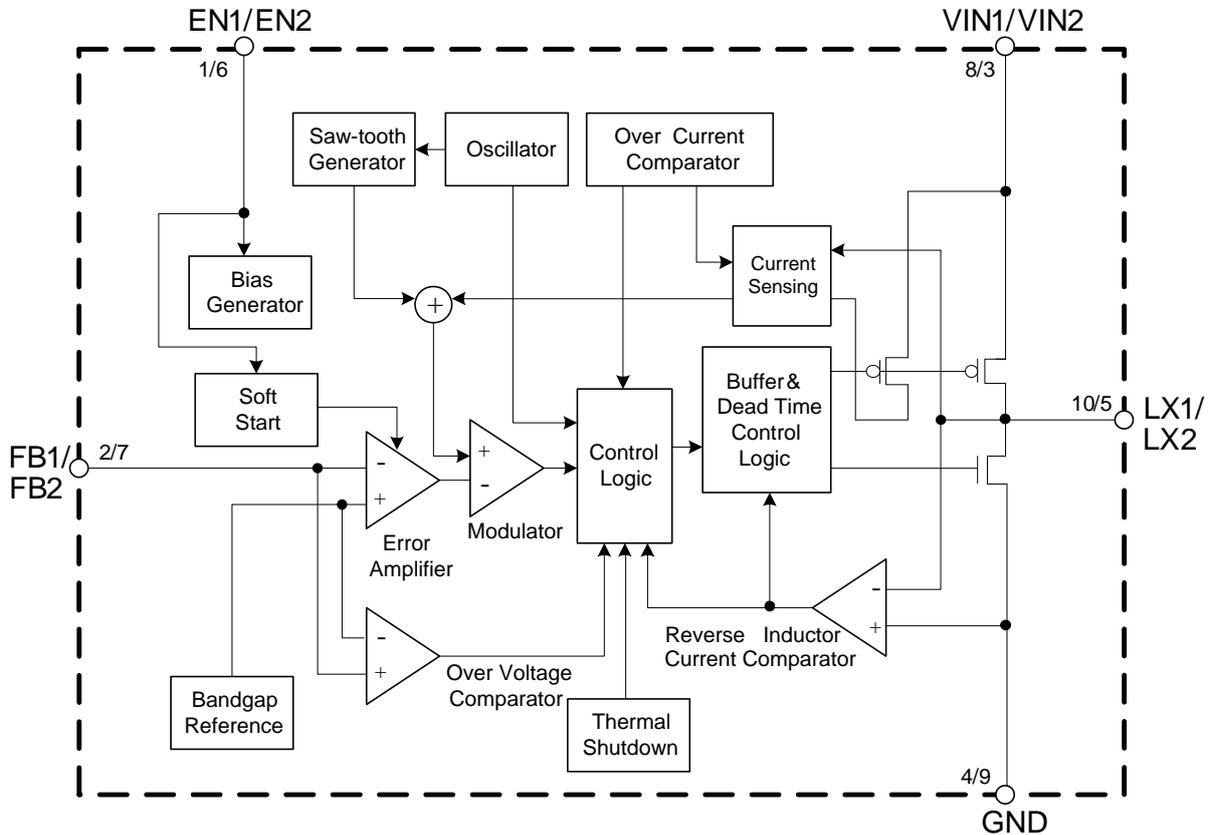
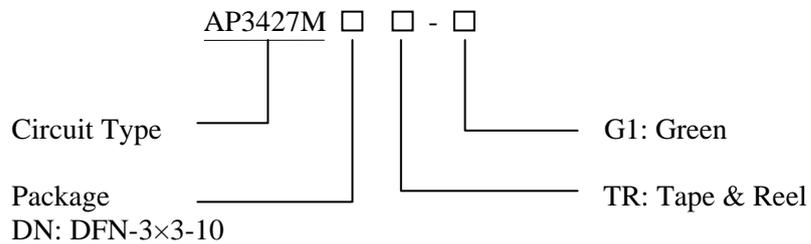


Figure 3. Functional Block Diagram of AP3427M

Ordering Information



Package	Temperature Range	Part Number	Marking ID	Packing Type
DFN-3x3-10	-40 to 80°C	AP3427MDNTR-G1	BFE	Tape & Reel

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

**Dual 1A, 1.5MHz Synchronous Step-down DC-DC Converter AP3427M****Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Value	Unit
Supply Input Voltage for the MOSFET Switch	V_{IN1}, V_{IN2}	0 to 6.5	V
LX Pin Switch Voltage	V_{LX1}, V_{LX2}	-0.3 to $V_{IN}+0.3$	V
Enable Input Voltage	V_{EN1}, V_{EN2}	-0.3 to $V_{IN}+0.3$	V
LX Pin Switch Current	I_{LX1}, I_{LX2}	1.8	A
Power Dissipation (on PCB, $T_A=25^\circ\text{C}$)	P_D	2.44	W
Thermal Resistance (Junction to Ambient, Simulation)	θ_{JA}	41	$^\circ\text{C/W}$
Thermal Resistance (Junction to Case, Simulation)	θ_{JC}	4.2	$^\circ\text{C/W}$
Operating Junction Temperature	T_J	155	$^\circ\text{C}$
Operating Temperature	T_{OP}	-40 to 85	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-55 to 150	$^\circ\text{C}$
ESD (Human Body Model)	V_{HBM}	2000	V
ESD (Machine Model)	V_{MM}	200	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
Supply Input Voltage	V_{IN}	2.5	5.5	V
Operating Junction Temperature	T_J	-40	125	$^\circ\text{C}$
Ambient Temperature	T_A	-40	80	$^\circ\text{C}$



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Electrical Characteristics

$T_A=25^{\circ}\text{C}$, $V_{IN}=V_{IN1}=V_{IN2}=5\text{V}$, $V_{EN1}=V_{EN2}=5\text{V}$, $V_{FB1}=V_{FB2}=0.6\text{V}$, $L1=L2=2.2\mu\text{H}$, $C_{IN1}=C_{IN2}=4.7\mu\text{F}$, $C_{OUT1}=C_{OUT2}=10\mu\text{F}$, $I_{MAX}=1\text{A}$ per Channel, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage Range	V_{IN}	$V_{IN}=V_{IN1}=V_{IN2}$	2.5		5.5	V
Shutdown Current	I_{OFF}	$V_{EN1}=V_{EN2}=0$		0.1	1	μA
Active Current	I_{ON}	$V_{FB1}=V_{FB2}=0.7\text{V}$, $I_{OUT1}=I_{OUT2}=0\text{A}$		220		μA
Regulated Feedback Voltage	V_{FB}	For Adjustable Output Voltage	0.588	0.6	0.612	V
Regulated Output Voltage Accuracy	$\Delta V_{OUT}/V_{OUT}$	$V_{IN}=2.5\text{V}$ to 5.5V , I_{OUT1} or $I_{OUT2}=0$ to 1A	-3		3	%
Peak Inductor Current	I_{PK}		1.5			A
Oscillator Frequency	f_{OSC}	$V_{IN}=2.5\text{V}$ to 5.5V	1.2	1.5	1.8	MHz
PMOSFET $R_{DS(ON)}$	$R_{DS(ON)P}$	$V_{IN}=5\text{V}$		200		$\text{m}\Omega$
NMOSFET $R_{DS(ON)}$	$R_{DS(ON)N}$	$V_{IN}=5\text{V}$		200		$\text{m}\Omega$
EN High-level Input Voltage	V_{EN_H}		1.5			V
EN Low-level Input Voltage	V_{EN_L}				0.4	V
EN Input Current	I_{EN}				0.1	μA
Soft Start Time	t_{SS}			400		μs
Maximum Duty Cycle	D_{MAX}		100			%
Input Over Voltage Protection	V_{IOVP}			6.2		V
Under Voltage Lock Out Threshold	V_{UVLO}	Rising		2.3		V
		Falling		2.1		
		Hysteresis		0.2		
Thermal Shutdown	T_{SD}	Hysteresis= 30°C		155		$^{\circ}\text{C}$



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Typical Performance Characteristics

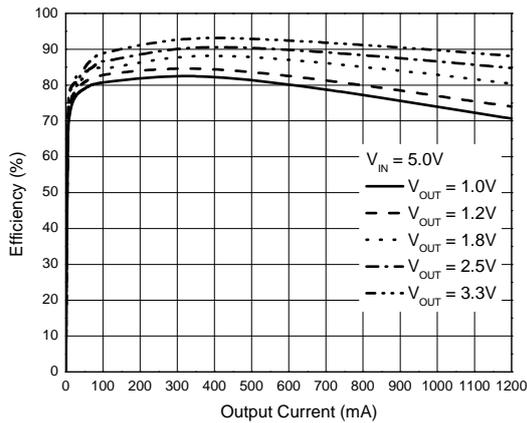


Figure 4. Efficiency vs. Output Current ($V_{IN}=5V$)

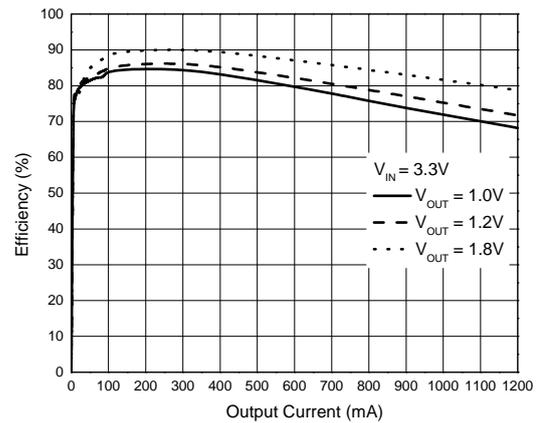


Figure 5. Efficiency vs. Output Current ($V_{IN}=3.3V$)

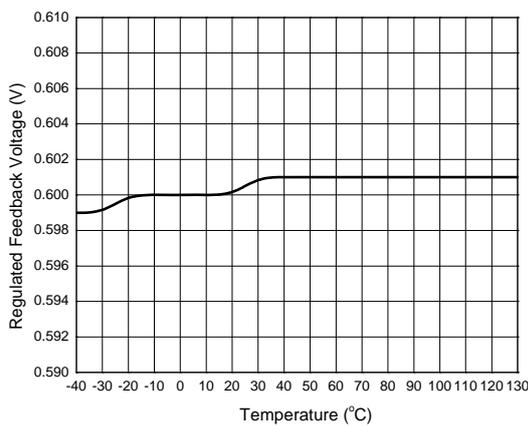


Figure 6. Regulated Feedback Voltage vs. Temperature

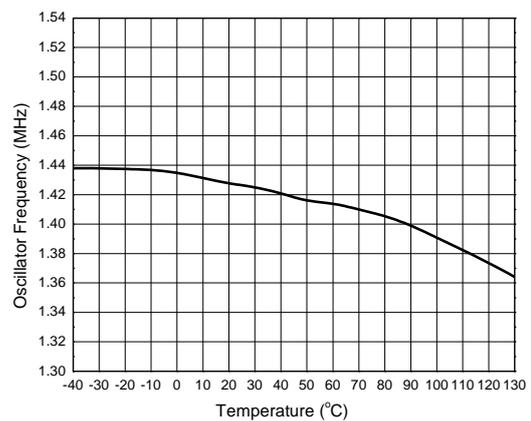


Figure 7. Oscillator Frequency vs. Temperature

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Typical Performance Characteristics (Continued)

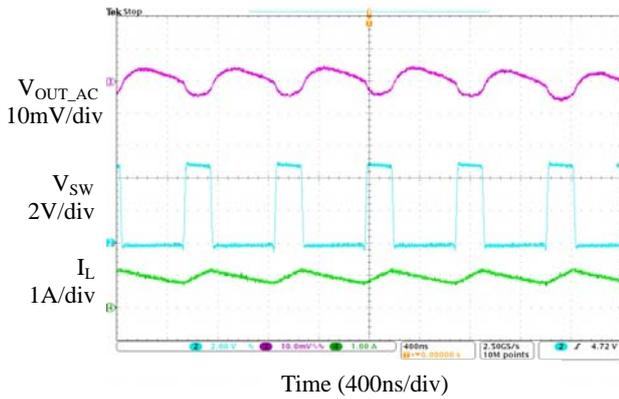


Figure 8. Output Ripple ($V_{OUT}=1.2V$, $I_{OUT}=1A$)

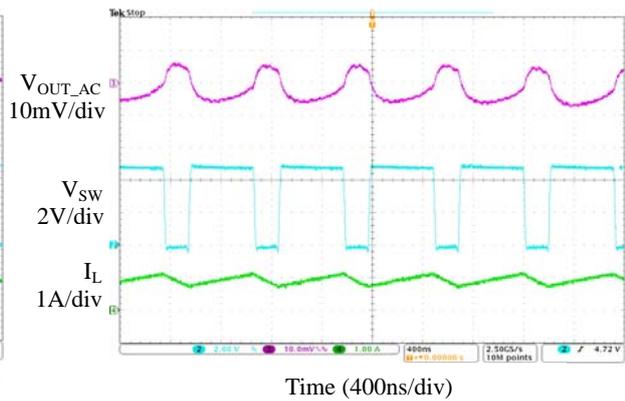


Figure 9. Output Ripple ($V_{OUT}=3.3V$, $I_{OUT}=1A$)

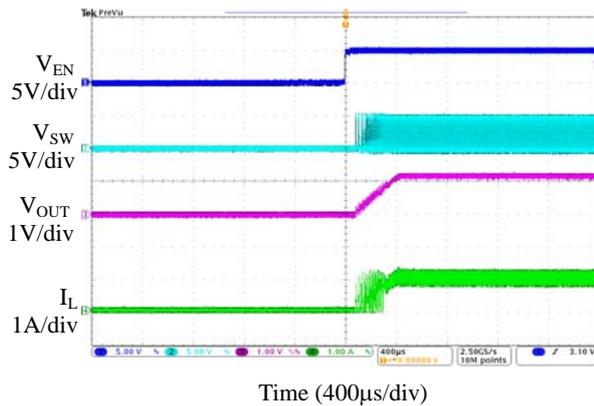


Figure 10. Enable Turn On ($I_{OUT}=1A$)

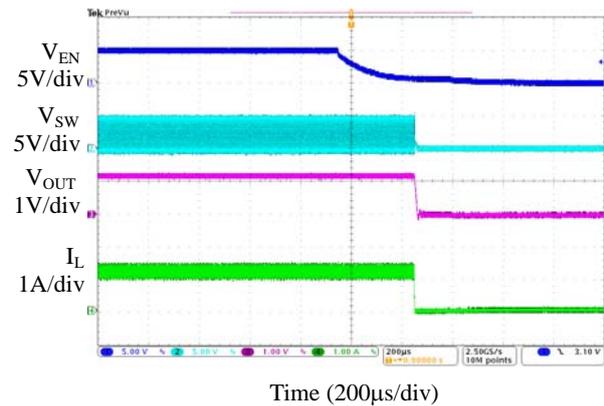


Figure 11. Enable Turn Off ($I_{OUT}=1A$)

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Typical Performance Characteristics (Continued)

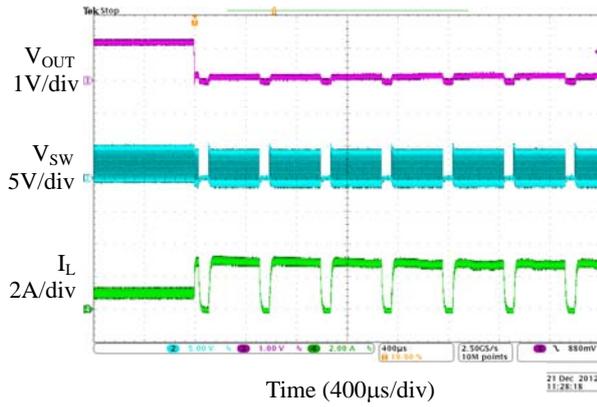


Figure 12. Short Circuit Protection ($I_{OUT}=1A$)

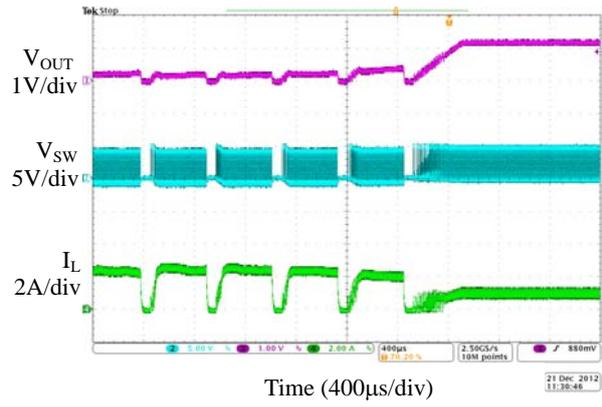
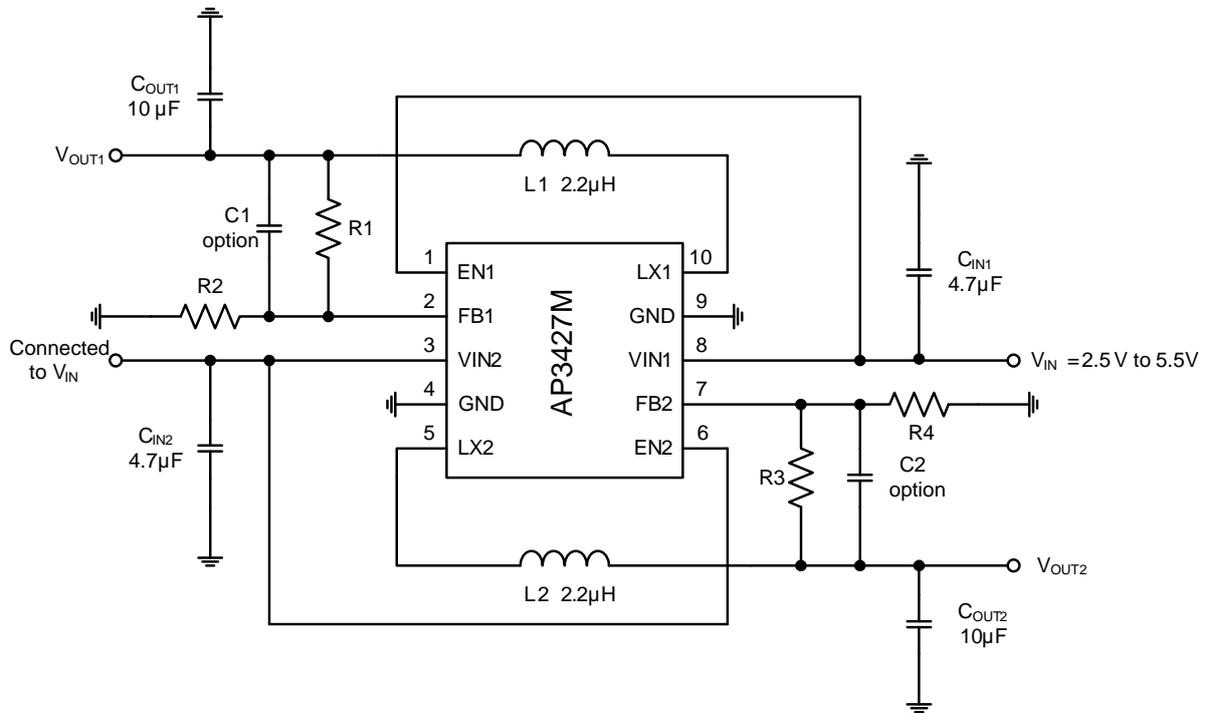


Figure 13. Short Circuit Protection Recovery ($I_{OUT}=1A$)

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Typical Application


Note 2: $V_{OUT1} = V_{FB1} \times (1 + R_1/R_2)$; $V_{OUT2} = V_{FB2} \times (1 + R_3/R_4)$, and $R_2 = R_4 = 10k\Omega$ is recommended.

Figure 14. Typical Application of AP3427M (Note 2)

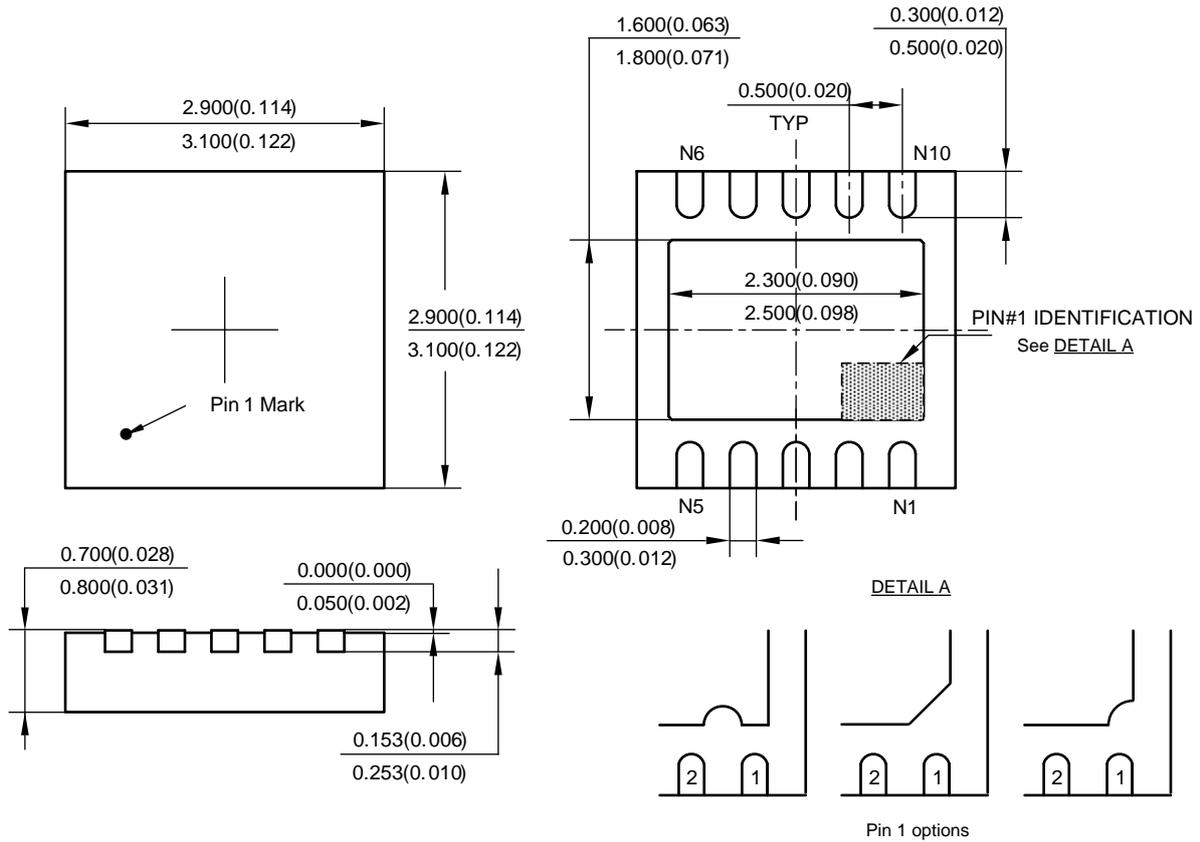


Dual 1A, 1.5MHz Synchronous Step-down DC-DC Converter AP3427M

Mechanical Dimensions

DFN-3x3-10

Unit: mm(inch)





BCD Semiconductor Manufacturing Limited

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MAIN SITE

- Headquarters

BCD (Shanghai) Micro-electronics Limited

No. 1600, Zi Xing Road, Shanghai ZiZhu Science-based Industrial Park, 200241, P. R. C.
Tel: +86-021-2416-2266, Fax: +86-021-2416-2277

- Wafer Fab

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd.

800 Yishan Road, Shanghai 200233, China
Tel: +021-6485-1491, Fax: +86-021-5450-0008

REGIONAL SALES OFFICE

Shenzhen Office

Shanghai SIM-BCD Semiconductor Manufacturing Co., Ltd., Shenzhen Office

Unit A Room 1203, Skyworth Bldg., Gaoxin Ave.1.S., Nanshan District
Shenzhen 518057, China

Tel: +86-0755-8660-4900, Fax: +86-0755-8660-4958

Taiwan Office (Taipei)

BCD Semiconductor (Taiwan) Company Limited

3F, No.17, Lane 171, Sec. 2, Jiu-Zong Rd., Nei-Hu Dist., Taipei(114), Taiwan, R.O.C
Tel: +886-2-2656-2808

Fax: +886-2-2656-2806/26562950

Taiwan Office (Hsinchu)

BCD Semiconductor (Taiwan) Company Limited

8F, No.176, Sec. 2, Gong-Dao 5th Road, East District
HsinChu City 300, Taiwan, R.O.C

Tel: +886-3-5160181, Fax: +886-3-5160181

USA Office

BCD Semiconductor Corp.

48460 Kato Road, Fremont, CA 94538, USA
Tel: +1-510-668-1950

Fax: +1-510-668-1990

Korea Office

BCD Semiconductor Limited Korea office.

Room 101-1112, Digital-Empire II, 486 Sin-dong,
Yeongtong-Gu, Suwon-city, Gyeonggi-do, Korea

Tel: +82-31-695-8430