3A， High Efficiency Buck-Boost Converter

GENERAL DESCRIPTION

The PW2224 is a high efficiency single inductor Buck-Boost converter which can supply the load current up to 4A. It provides auto-transition between Buck and Boost Mode. The PW2224 operates at 2.4MHz and it can also be synchronized with external frequency from 2.2MHz to 2.6MHz. DC/DC converter operates at Pulse-Skipping Mode at light load. The Power Save Mode can be disabled, forcing the PW2224 to operate at FPWM Mode. The load is disconnected from the VIN during shutdown.

The PW2224 is available in TDFN3X4-14 package.

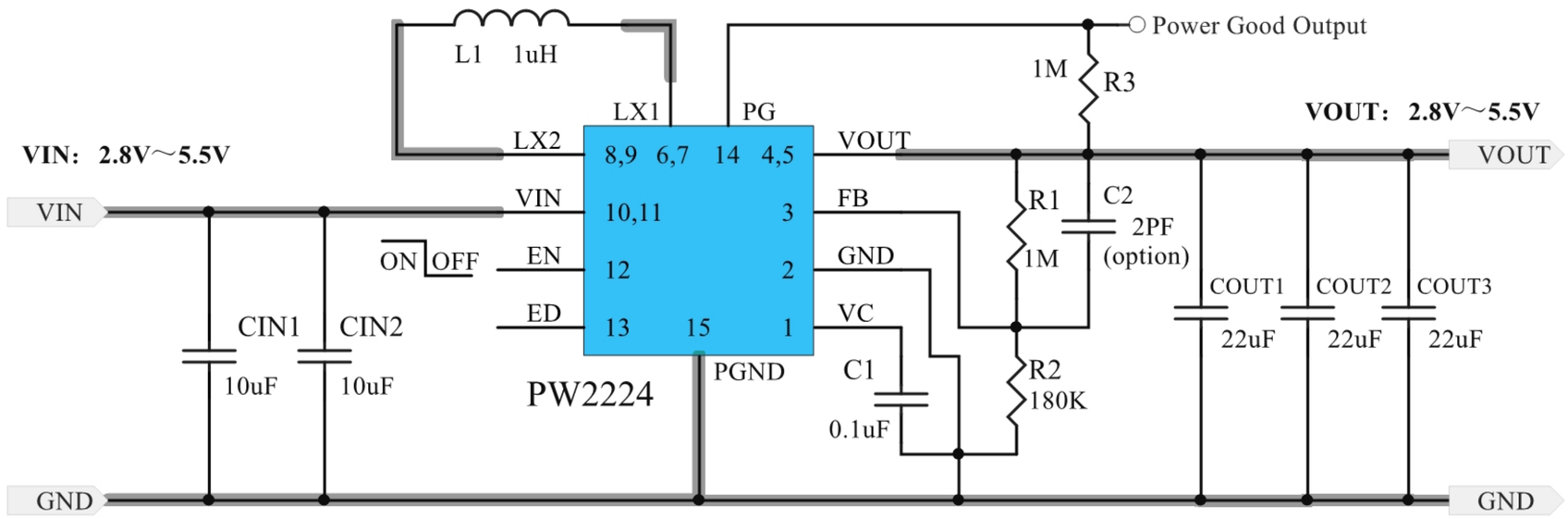
FEATURES

- 2.8V ~ 5.5V Input Voltage Operation
- Adjustable Output Voltage from 2.8V to 5.5V
- 96% Efficiency DC/DC Converter
- 3A Output Current at 3.3V for VIN > 3.6V
- Auto-Transition Between Buck and Boost Mode
- Pulse-Skipping Mode at light load for Efficiency
- Internal Soft-Start
- DC/DC Converter can be set to lower quiescent current at light load
- Fixed 2.4MHz Frequency and Synchronization Possible
- Built-In Cycle-by Cycle Current Limit and Over Voltage Protection
- Built-In Thermal Shutdown Function
- Power Good Function
- TDFN3X4-14 Package (3mmx4mm)

APPLICATIONS

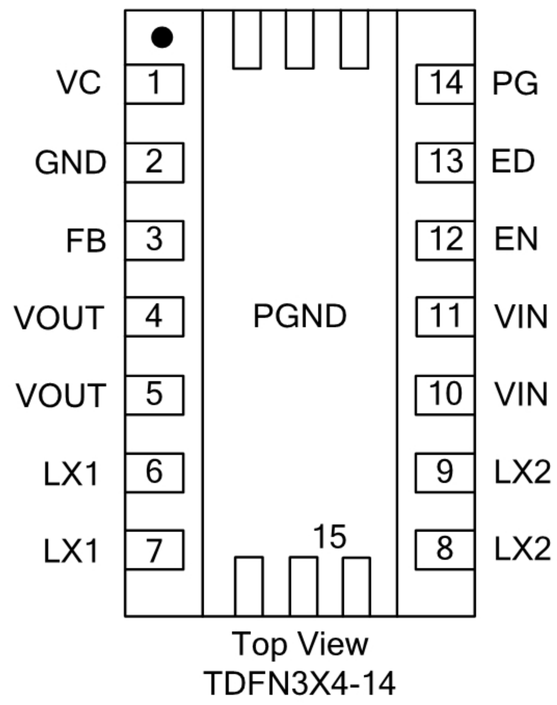
- Mobile Handsets
- Smart Phone

TYPICAL APPLICATION CIRCUIT



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PIN ASSIGNMENT/DESCRIPTION



Pin	Name	Function
1	VC	IC Power Supply Input
2	GND	Chip Analog Ground
3	FB	Output Voltage Feedback Pin. **VOUT=0.5V*(1+R1/R2)**
4	VOUT	Power Output of Buck-Boost Converter
5	VOUT	Power Output of Buck-Boost Converter
6	LX1	Inductor Switch Node
7	LX1	Inductor Switch Node
8	LX2	Inductor Switch Node
9	LX2	Inductor Switch Node
10	VIN	Power Input of Buck-Boost Converter
11	VIN	Power Input of Buck-Boost Converter
12	EN	Enable PIN (1 Enabled, 0 Disabled), must not be left open
13	ED	Enable/Disable Power Save Mode (1 Disabled, 0 Enabled, clock signal for synchronization), must not be left open.
14	PG	Indicator of Power Good with open drain output (1 Good, 0 Failure)
15(EP)	PGND	Power Ground of Buck-Boost Converter. The exposed pad must be soldered to a large PCB and connected to PGND for maximum power dissipation.

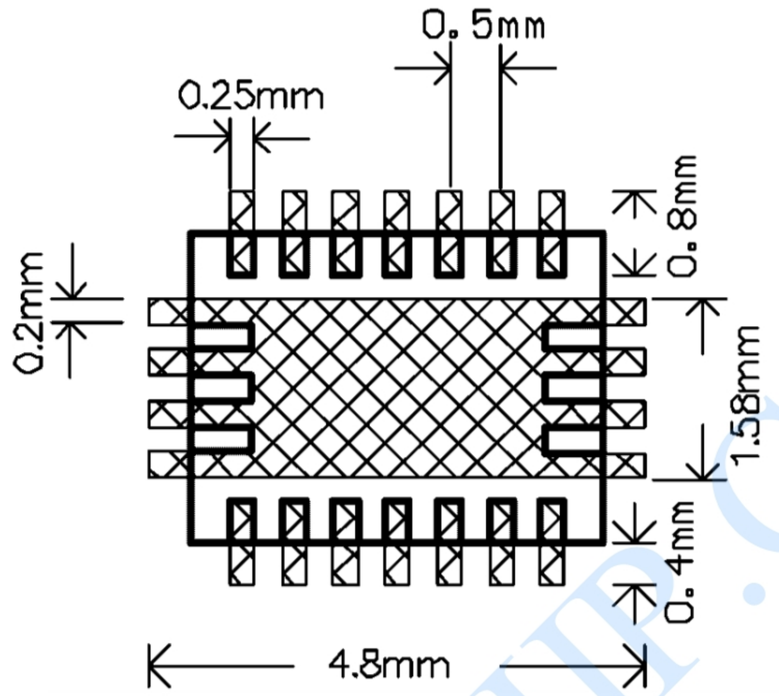
PCB Layout Guide

Careful PCB layout is critical to achieve clean and stable operation. It is highly recommended to duplicate the PW2224 evaluation kit layout for optimum performance. If deviation is necessary, follow these guidelines for good PCB layout:

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1. Place the input and output capacitors as close as possible to the input and output pins.
2. Keep the main power traces as wide and short a possible.
3. Connect the GND and Exposed Pad to a strong ground plane for maximum thermal dissipation and noise protection.
4. Switch node experiences high frequency voltage swings and should be kelp in a small area. Keep analog components away from the switch node to prevent stray capacitive noise pick-up.

TDFN3X4-14



Minimum Footprint PCB Layout Section

Absolute Maximum Ratings (note1/2)

- VIN, VC, VOUT ····· -0.3V to 6.5V
- LX1, LX2 ····· -0.3 to 6.5V
- EN, FB, PG, ED ····· -0.3 to 6.5V
- Continuous Power Dissipation (TA=25°C)* ····· 3.75W
- Operating Ambient Temperature ····· -33°C to +85°C
- Reflow Temperature (soldering, 10 sec)····· 260°C
- ESD (Human Body Made) HMB····· 2KV
- Storage Temperature Range····· -55°C to 150°C
- ESD (Machine Made)MM····· 200V
- Thermal Resistance Junction to Ambient, (θJA)* ····· 33.3 °C/W
- Thermal Resistance Junction to Case, (θJC) ····· 3.6 °C/W

*The package is placed on a 2-layer PCB. Please refer the “Board Layout”

Note:

(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 in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(2) The Device is ESD sensitive. Handling precaution recommended. The Human Body model is a 100Pf capacitor discharged through a 1.5KΩ resistor into each pin.

ELECTRICAL CHARACTERISTICS(note3)

(VIN=VC=3.6V, TA=25°C, unless otherwise specified)

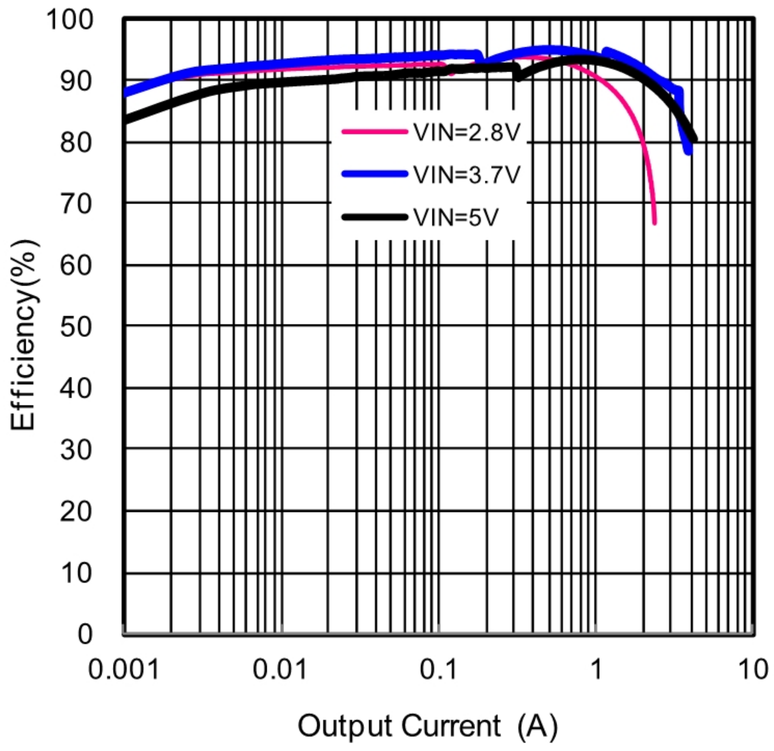
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
VIN minimum Startup Voltage	$V_{IN,ST}$				2.7	V
VIN Operating Voltage	V_{IN}		2.8		5.5	V
Output Voltage Range	V_{OUT}		2.8		5.5	V
Under Voltage Lockout Threshold	$V_{UVLO,R}$	Vc voltage rising		2.5		V
	$V_{UVLO,F}$	Vc voltage falling		2.35		V
Quiescent Current	I_Q	V_{EN}=V_{IN}=Vc=3.6V, I_{OUT}=0A (No Switching)		40	65	μA
Shutdown Current	I_{SD}	V_{EN}=0V, V_{IN}=Vc=3.6V		0.1	1	μA
Oscillator Frequency	F_{OSC}		2.2	2.4	2.6	MHz
Frequency range for Synchronization	F_{SYN}		4.4	4.8	5.2	MHz
Soft-Start Internal	SS	V_{IN}=Vc=3.6V		0.5		ms
Feedback voltage	V_{FB}	Adjustable Output(FPWM)	495	500	505	mV
Line Regulation	$\Delta V_{OUT,LINE}$	FPWM		0.5		%
Load Regulation	$\Delta V_{OUT,LOAD}$	FPWM		0.5		%
Maximum Duty Cycle	$D_{MAX,D}$	LX2		100		%
	$D_{MAX,U}$	LX1	90	93	96	%
FB Leakage Current	$I_{FB,LK}$	Adjustable Mode			1	μA
VOUT Leakage Current	$I_{VO,LK}$	V_{LX1}=0V, V_{OUT}=5V		1	5	μA
LX1, LX2 Leakage Current	$I_{LX2,LK}$, $I_{LX1,LK}$	V_{LX2}=V_{LX1}=5V		1	5	μA
Switch ON Resistance	$R_{ON,P}$	V_{IN}=Vc=3.6V		50		mΩ
	$R_{ON,N}$	V_{IN}=Vc=3.6V		50		mΩ
Peak Current Limit	I_{LIM}	V_{IN}=Vc=3.6V		5		A
Over Voltage Protection Threshold	$\%V_{OVP}$	Ratio=V_{OVP}/V_{OUT}, V_{OUT} voltage rising		120		%
Short Circuit Protection threshold	$\%V_{SCP}$	Ratio=V_{SCP}/V_{OUT}, V_{OUT} voltage falling		20		%
Thermal Shutdown Protection	T_{SD}			150		°C
Thermal Shutdown Hysteresis	ΔT_{SD}			20		°C
EN, ED Input Voltage	V_{TH}	High Threshold	1.2			V
	VTL	Low Threshold			0.4	V
EN, ED Leakage Current	$I_{EN,LK}$	EN=Vc or 0V			1	μA
	$I_{ED,LK}$	ED= Vc or 0V			1	μA
PG Open-Drain Low Voltage	$V_{PG,LOW}$	I_{SINK}=10uA, V_{OUT}=3.3V		40	400	mV
PG Open-Drain Leakage Current	$I_{PG,LK}$	V_{PG}=5V			1	μA
PG Rising Threshold	$V_{OUT,PGH}$	Ratio=V_{OUT}/$V_{OUT,SET}$		95		%

Note3: The device is not guaranteed to function outside its operating conditions. Parameters with MIN and/or MAX limits are 100% tested at +25°C, unless otherwise specified.

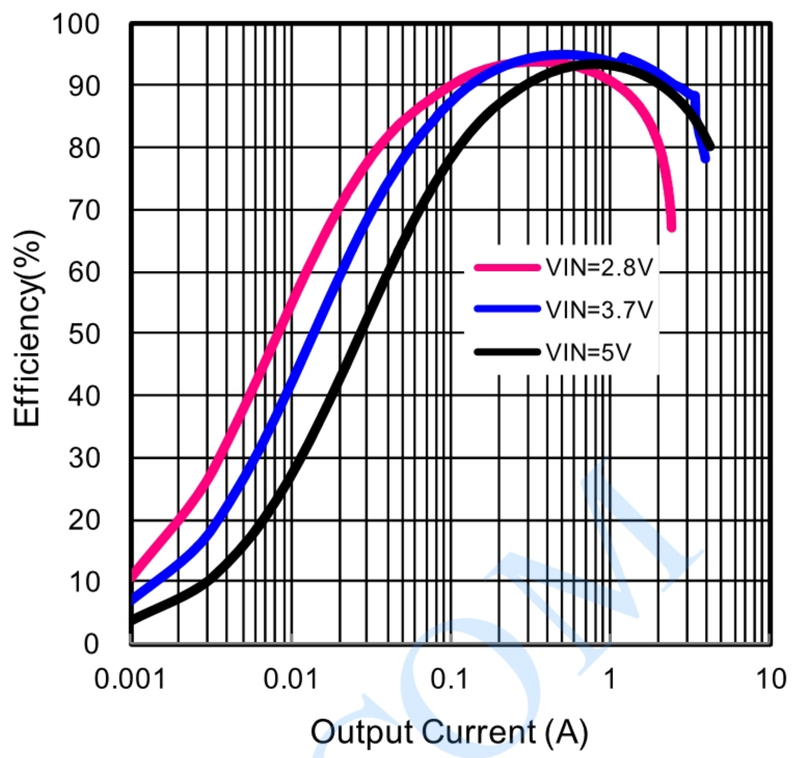
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Typical Performance Characteristics (TA=25°C.)

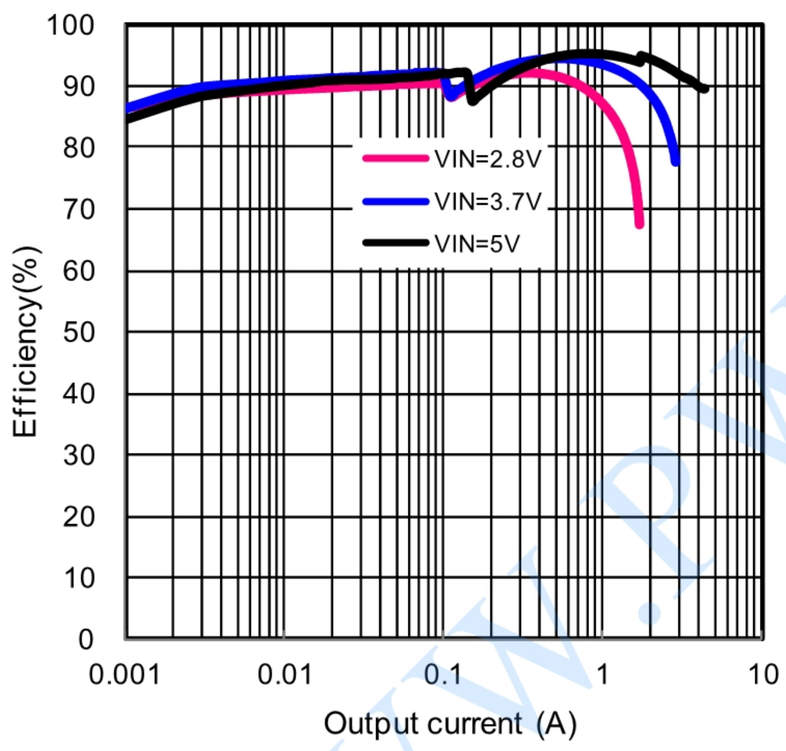
1, Efficiency vs. Output Current



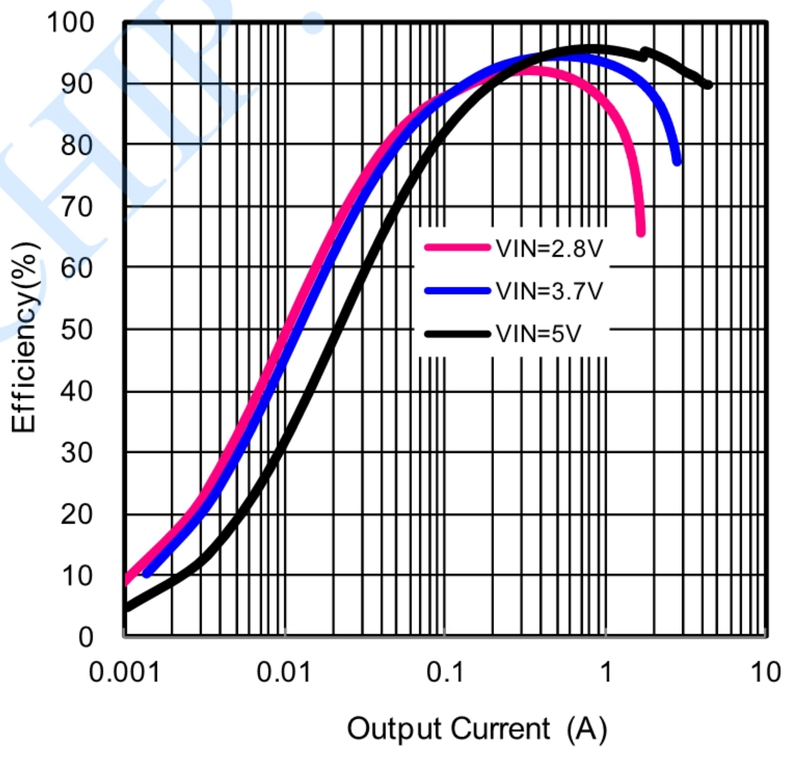
VOUT=3.3V,Power Save Enable



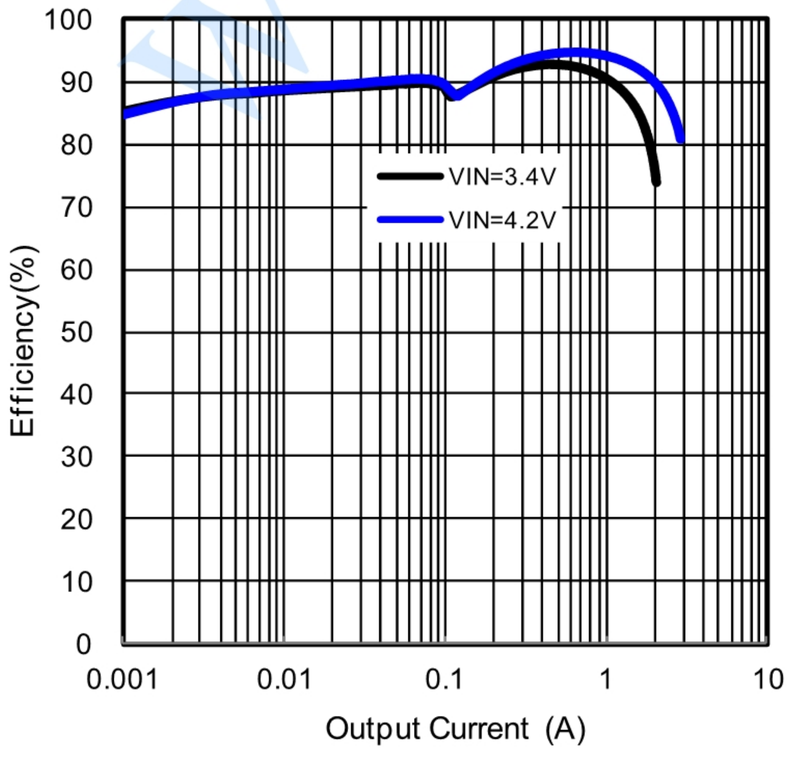
VOUT=3.3V,Power Save Disable



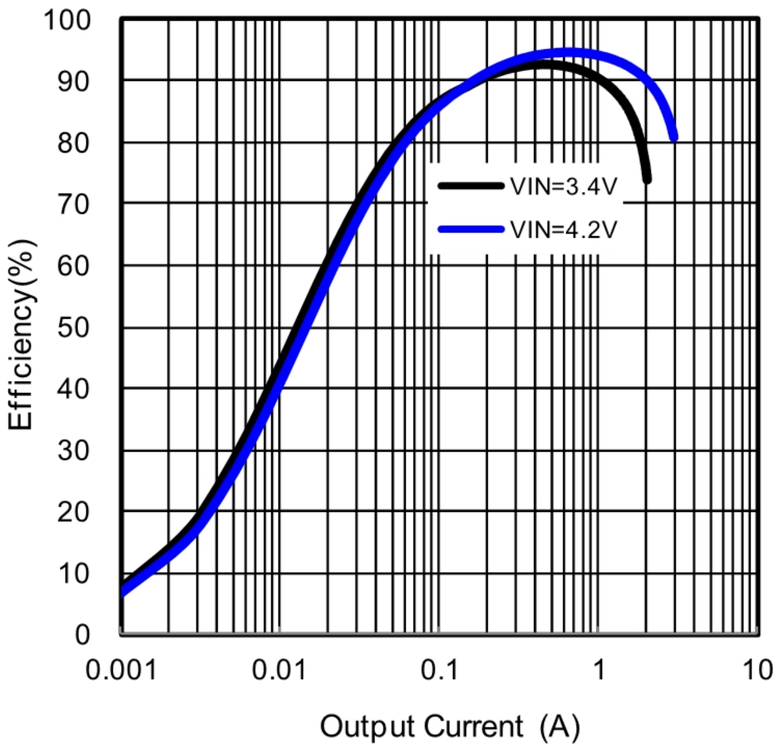
VOUT=4.5V,Power Save Enable



VOUT=4.5V,Power Save Disable



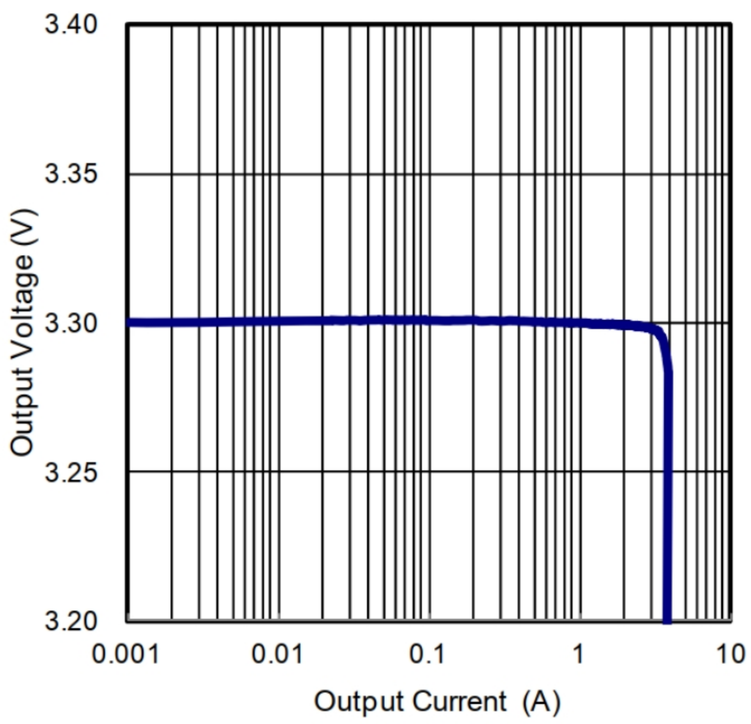
VOUT=5.2V,Power Save Enable



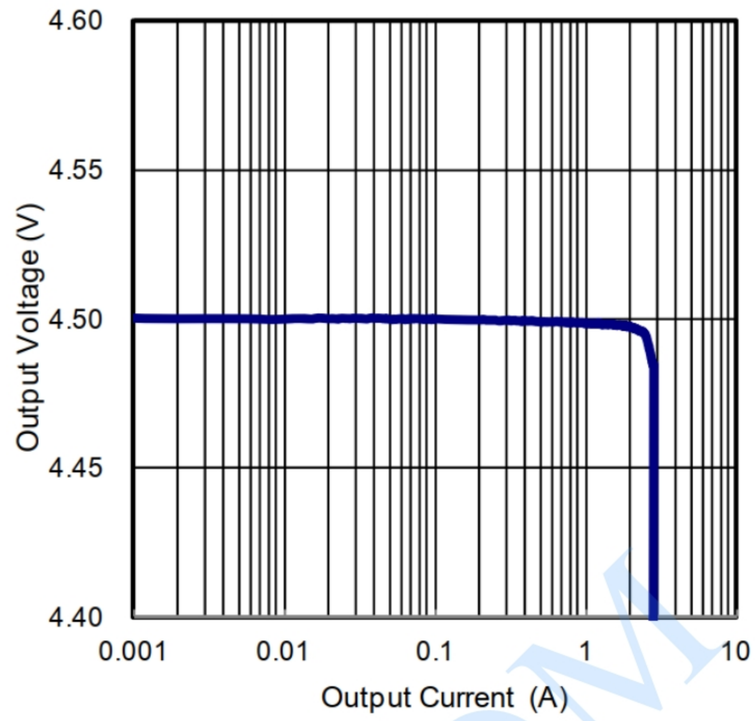
VOUT=5.2V,Power Save Disable

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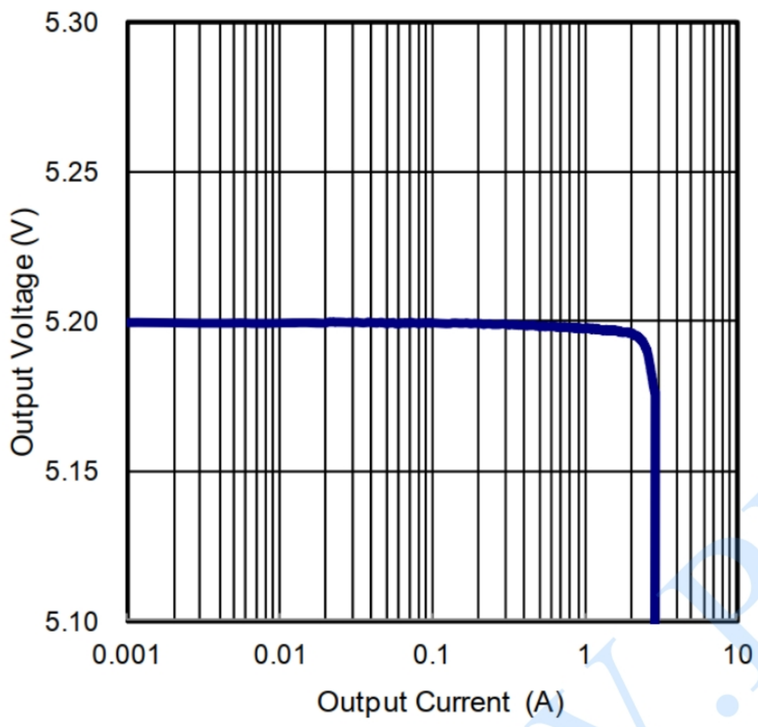
2, Output Voltage vs. Output Current (Power Save Disable)



VIN=3.7V,VOUT=3.3V

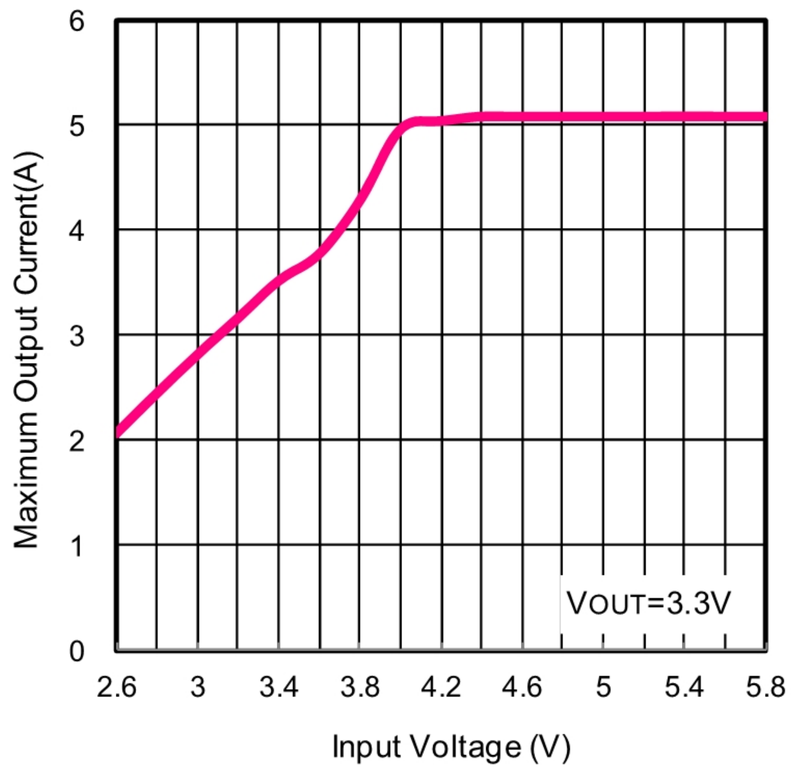


VIN=3.7V,VOUT=4.5V



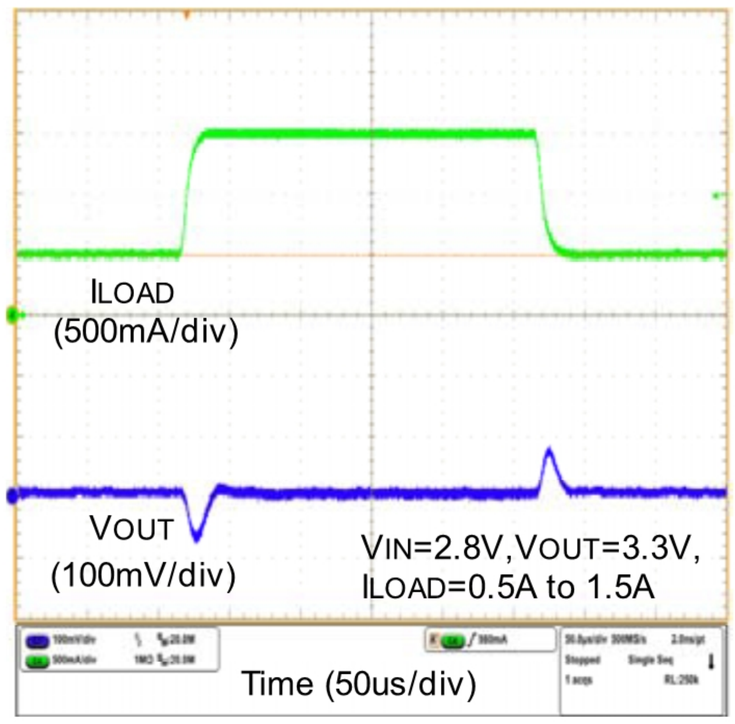
VIN=4.2V,VOUT=5.2V

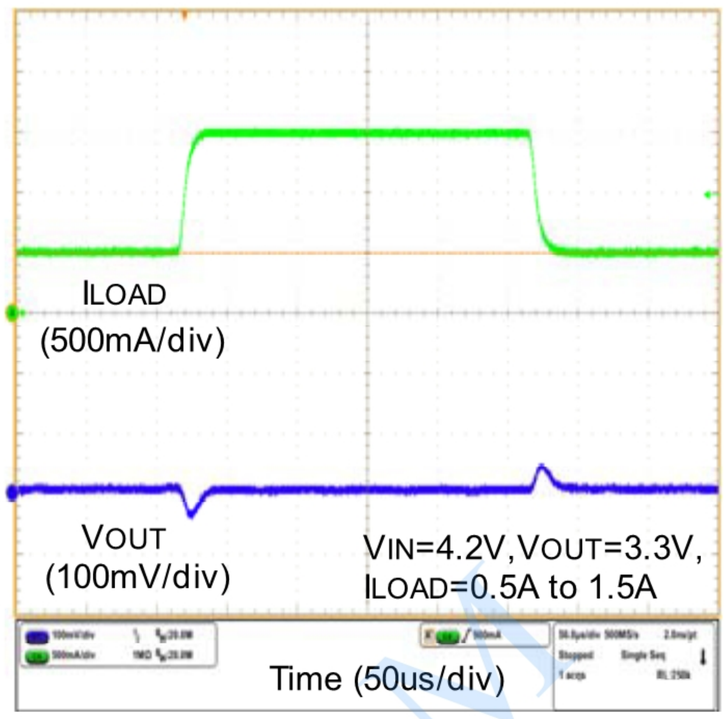
3, Maximum Output Current vs. Input Voltage

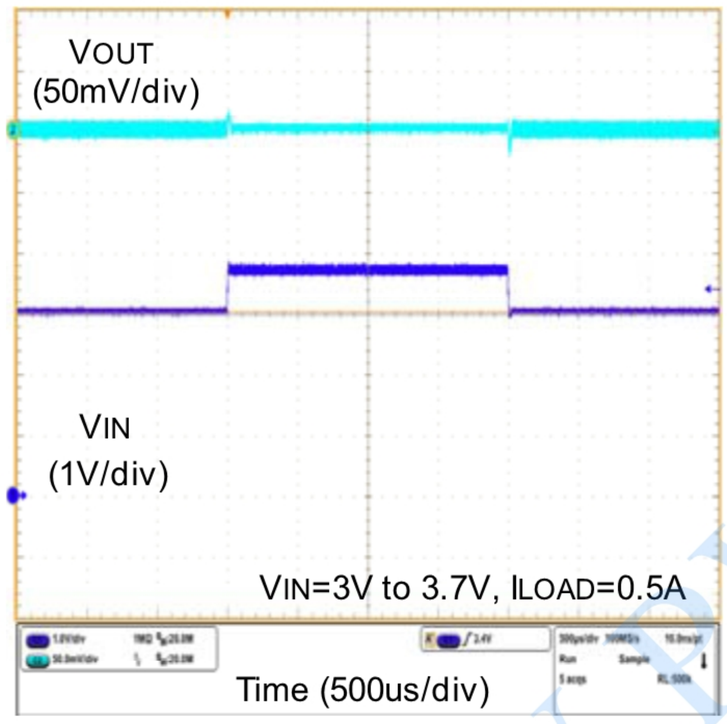


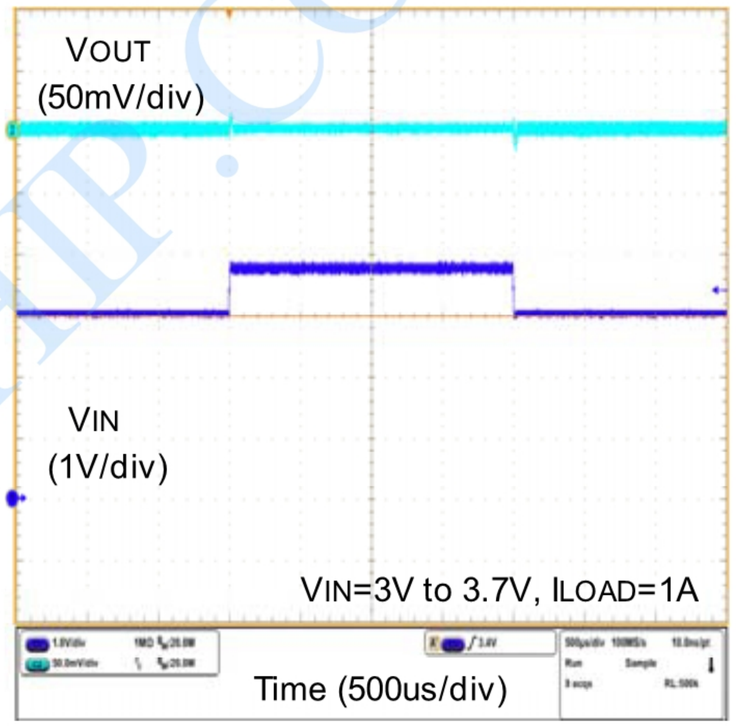
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4, Line Transient Response

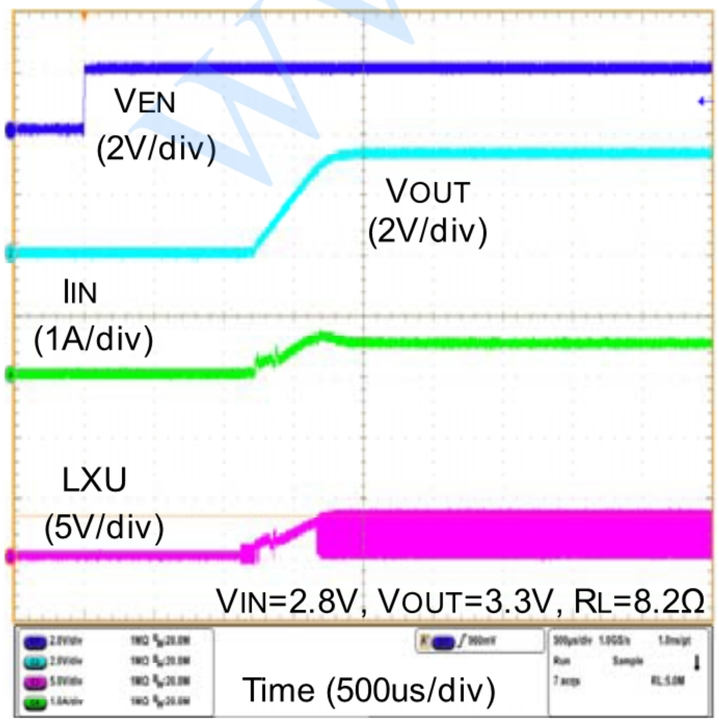


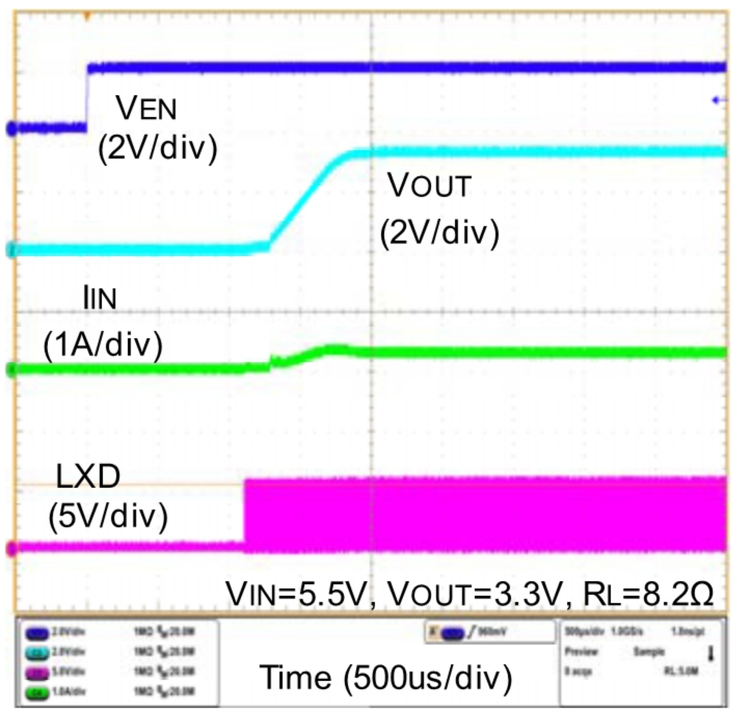






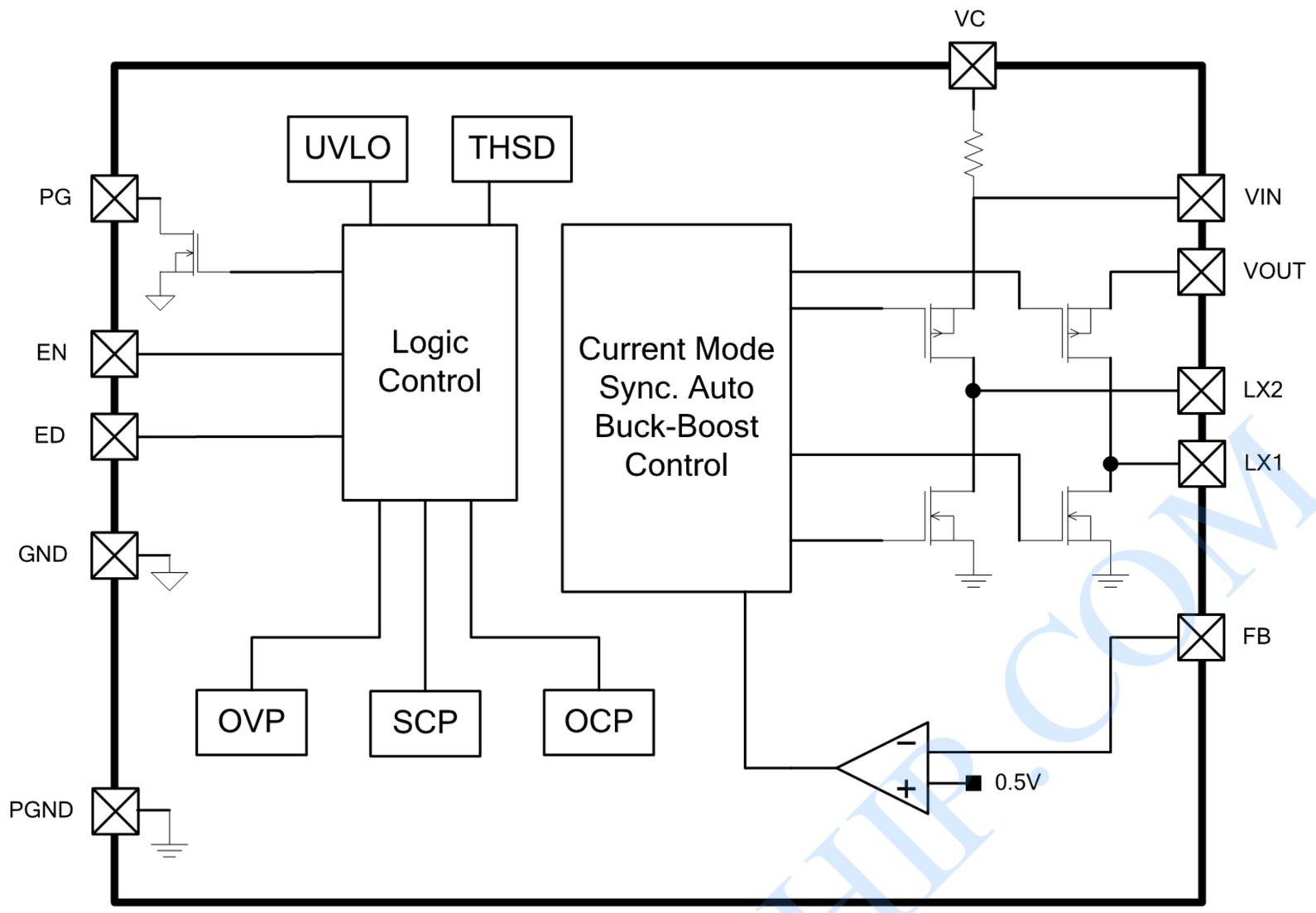
5, Start up After Enable





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Block Diagram



Function Description

Fault Protection

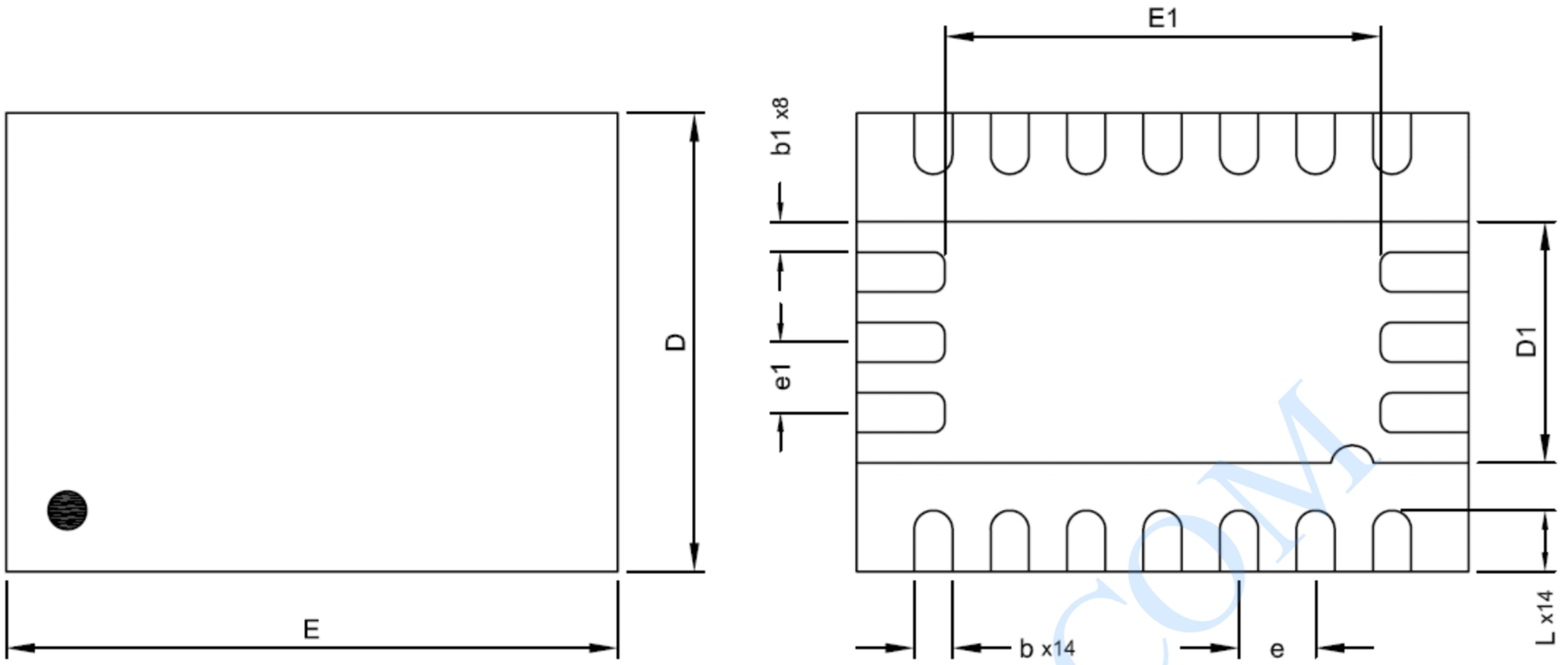
PW2224 provides VIN under-voltage lockout protection, over-current protection, VOUT over-voltage protection, VOUT short-circuit protection, and thermal shutdown protection to achieve complete protection.

	Protection type	Threshold	Protection methods	Reset Method
VIN	UVLO	VIN<2.35V	DCDC shutdown	VIN>2.5V
DCDC Buck-Boost	Current Limit	Peak Inductor current>5A	Buck Mode: PMOS Off, NMOS on Boost Mode: NMOS Off, PMOS on	Automatic Reset at next cycle
	OVP	VOUT>120%*VOUTSET	DCDC stop switching	VOUT1<110%*VOUTSET
	SCP	VOUT<20%*VOUTSET	Current Limit = 2A OSC Frequency=1.2MHz	VOUT>30%*VOUTSET
Thermal	TSD	Junction Temp. >150°C	DCDC shutdown	Junction Temp. <130°C

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PACKAGE DESCRIPTION

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Symbol	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.0276	0.0295	0.0315
A1	0.00	- - -	0.05	0.0000	- - -	0.0020
A2	0.20 REF			0.0079		
D	2.90	3.00	3.10	0.1142	0.1181	0.1220
E	3.90	4.00	4.10	0.1535	0.1575	0.1614
D1	1.53	1.58	1.63	0.0602	0.0622	0.0642
E1	2.80	2.85	2.90	0.1102	01122	0.1142
b	0.20	0.25	0.30	0.0078	0.0098	0.0118
b1	0.20 REF			0.0079 REF		
e	0.50 BSC			0.0197 BSC		
e1	0.46 BSC			0.0181 BSC		
L	0.35	0.40	0.45	0.0138	0.0157	0.0177

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