Is Now Part of

ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

September 2016

FAN48615
Fixed-Output Synchronous TinyBoost® Regulator

Features

- Input Voltage Range: 2.7 V to 4.5 V
- Output Voltage: 5.25 V and 5.4 V
- 1000 mA Max. Load Capability
- PWM Only
- Up to 97% Efficient
- Forced Pass-Through Operation via EN Pin
- Internal Synchronous Rectification
- True Load Disconnect
- Short-Circuit Protection
- Three External Components: 2016 (Metric) 0.47 µH Inductor, 0402 Input and 0603 Output Capacitors

Applications

- Class-D Audio Amplifier
- Boost for Low-Voltage Li-Ion Batteries
- Smart Phones, Tablets, Portable Devices
- RF Applications
- NFC Applications

Description

The FAN48615 is a low-power PWM only boost regulator designed to provide a minimum voltage-regulated rail from a standard single-cell Li-Ion battery and advanced battery chemistries. Even below the minimum system battery voltage, the device maintains the output voltage regulation for an output load current of 1000 mA. The combination of built-in power transistors, synchronous rectification, and low supply current suit the FAN48615 for battery-powered applications.

The FAN48615 is available in a 9-bump, 0.4 mm pitch, (1.215 x 1.215 mm) Wafer-Level Chip-Scale Package (WLCSP).

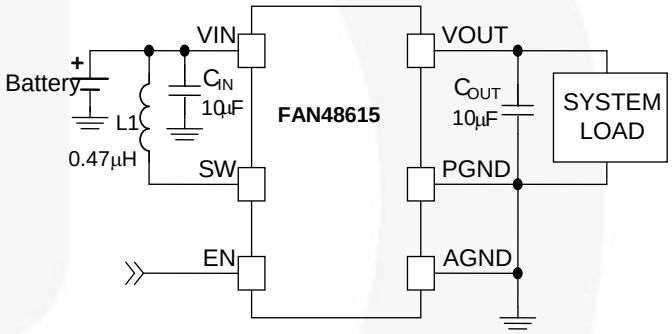


Figure 1. Typical Application

Ordering Information

Part Number	V_{OUT}	Operating Temperature	Package	Packing	Device Marking
FAN48615UC08X	5.25 V	-40°C to 85°C	9-Bump, 0.4 mm Pitch, WLCSP Package	3000 units Tape and Reel	KY
FAN48615UC11X	5.40 V				KZ

© 2016 Fairchild Semiconductor Corporation

Block Diagrams

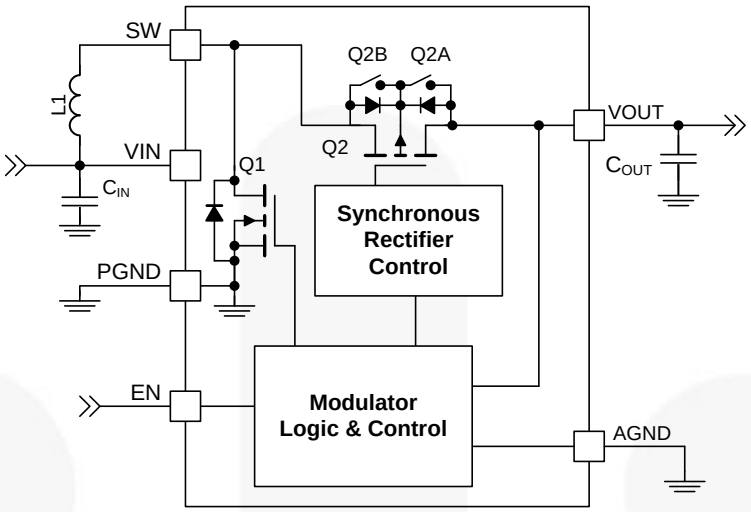


Figure 2. IC Block Diagram

Table 1. Recommended Components

Component	Description	Vendor	Parameter	Typ.	Unit
L1	20%, 5.3 A, 2016, 1.0 mm Height	DFE201610E-R47M TOKO	Inductance	470	nH
			DCR (Series R)	26	mΩ
C_{IN}	20%, 6.3 V, X5R, 0402 (1005)	C1005X5R0J106M050BC TDK	Capacitance	10	µF
C_{OUT}	20%, 10 V, X5R, 0603 (1608)	C1608X5R1A106K080AC TDK	Capacitance	10	

Pin Configuration

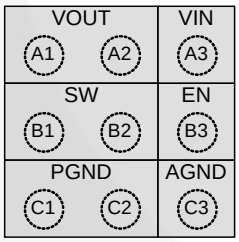


Figure 3. Top View

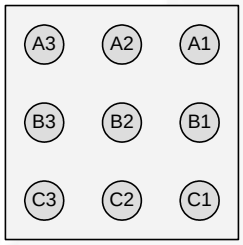


Figure 4. Bottom View

Pin Definitions

Pin #	Name	Description
A1, A2	VOUT	**Output Voltage**. This pin is the output voltage terminal; connect directly to C_{OUT}.
A3	VIN	**Input Voltage**. Connect to Li-Ion battery input power source and C_{IN}.
B1, B2	SW	**Switching Node**. Connect to inductor.
B3	EN	**Enable**. When this pin is HIGH, the circuit is enabled. After part is engaged, pin forces part into Forced-Pass-Through Mode when EN pin is pulled LOW.
C1, C2	PGND	**Power Ground**. This is the power return for the IC. C_{OUT} capacitor should be returned with the shortest path possible to these pins.
C3	AGND	**Analog Ground**. This is the signal ground reference for the IC. All voltage levels are measured with respect to this pin – connect to PGND at a single point.

© 2016 Fairchild Semiconductor Corporation

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter		Min.	Max.	Unit
V_{IN}	Voltage on VIN Pin		-0.3	6.0	V
V_{OUT}	Voltage on VOUT Pin			6.0	V
V_{SW}	SW Node	DC	-0.3	6.0	V
		Transient: 10 ns, 3 MHz	-1.0	8.0	
V_{CC}	Voltage on Other Pins		-0.3	6.0(1)	V
ESD	Electrostatic Discharge Protection Level	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	2.0		kV
		Charged Device Model per JESD22-C101	1.0		
T_J	Junction Temperature		-40	+150	°C
T_{STG}	Storage Temperature		-65	+150	°C
T_L	Lead Soldering Temperature, 10 Seconds			+260	°C

Note:

1. Lesser of 6.0 V or V_{IN} + 0.3 V.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Min.	Max.	Unit
V_{IN}	Supply Voltage	2.7	4.5	V
I_{OUT}	Maximum Output Current	1000		mA
T_A	Ambient Temperature	-40	+85	°C
T_J	Junction Temperature	-40	+125	°C

Thermal Properties

Junction-to-ambient thermal resistance is a function of application and board layout. This data is measured with four-layer 2s2p boards with vias in accordance to JEDEC standard JESD51. Special attention must be paid not to exceed junction temperature, $T_{J(max)}$, at a given ambient temperature, T_A.

Symbol	Parameter	Typical	Unit
Θ_{JA}	Junction-to-Ambient Thermal Resistance	50	°C/W

© 2016 Fairchild Semiconductor Corporation

Electrical Specifications

Recommended operating conditions, unless otherwise noted, circuit per Figure 1, V_{OUT} = 5.40 V. Typical, minimum and maximum values are given at V_{IN} = 3.6 V, T_A = 25°C, -40°C, and +85°C.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Power Supply						
I_Q	V_{IN} Quiescent Current	I_{OUT} = 0 mA, EN = 1.8 V, No Switching		95		µA
		Forced Pass-Through EN=0 V, V_{OUT} = V_{IN}		3.5		
V_{UVLO}	Under-Voltage Lockout	V_{IN} Rising		2.20		V
V_{UVLO_HYS}	Under-Voltage Lockout Hysteresis			150		mV
Inputs						
V_{IH}	Enable HIGH Voltage		1.05			V
V_{IL}	Enable LOW Voltage				0.4	V
Outputs						
V_{REG}	Output Voltage Accuracy DC(2)	2.7 V ≤ V_{IN} ≤ 4.5 V	-2		+2	%
Timing						
f_{SW}	Switching Frequency	I_{OUT} = 300 mA	1.8	2.3	2.8	MHz
t_{SS}(3)	EN HIGH to 95% of Regulation	I_{OUT} = 150 mA		440		µs
t_{RST}(3)	FAULT Restart Timer			20		ms
Power Stage						
$R_{DS(ON)N}$	N-Channel Boost Switch $R_{DS(ON)}$			63		mΩ
$R_{DS(ON)P}$	P-Channel Sync. Rectifier $R_{DS(ON)}$			52		mΩ

Notes:

2. DC I_{LOAD} from 0 to 1 A. V_{OUT} measured from mid-point of output voltage ripple. Effective capacitance of $C_{OUT} \geq 2.2$ µF.
3. Guaranteed by design and characterization; not tested in production.

© 2016 Fairchild Semiconductor Corporation

Typical Performance Characteristics

Unless otherwise specified; V_{IN} = 3.8 V, V_{OUT} = 5.40 V, T_A = 25°C, and circuit according to Figure 1. Components: C_{IN} = 10 µF (0402, X5R, 6.3 V, C1005X5R0J106M050BC), C_{OUT} = 10 µF (0603, X5R, 10 V, C1608X5R1A106K080AC) L1 = 470 nH (2016, 26 mΩ, DFE201610E-R47M).

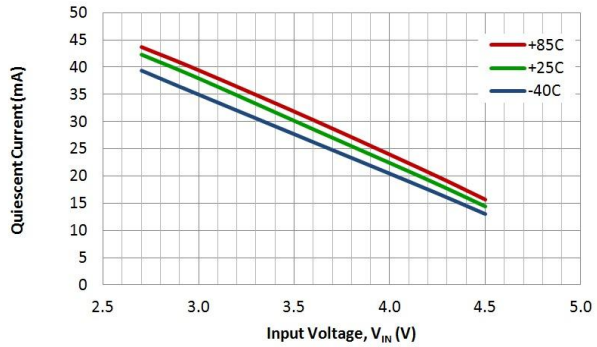


Figure 5. Quiescent Current (Switching) vs. Input Voltage and Temperature

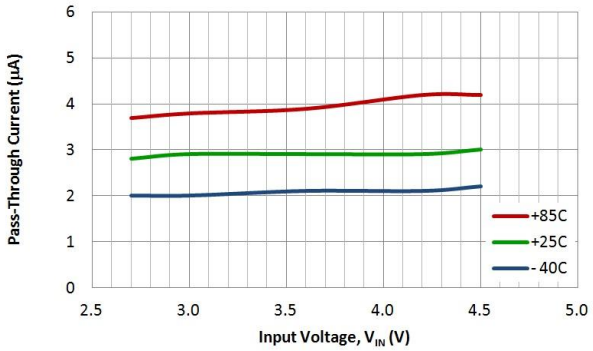


Figure 6. Pass-Through Current vs. Input Voltage and Temperature

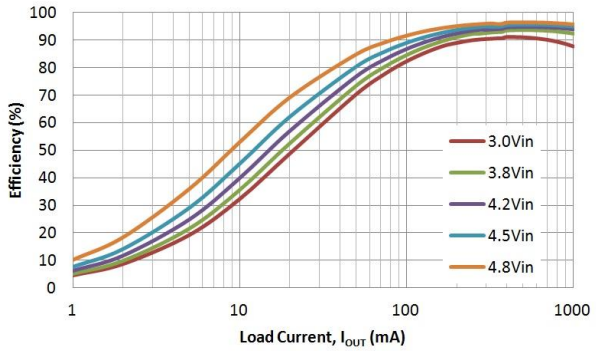


Figure 7. Efficiency vs. Load Current and Input Voltage

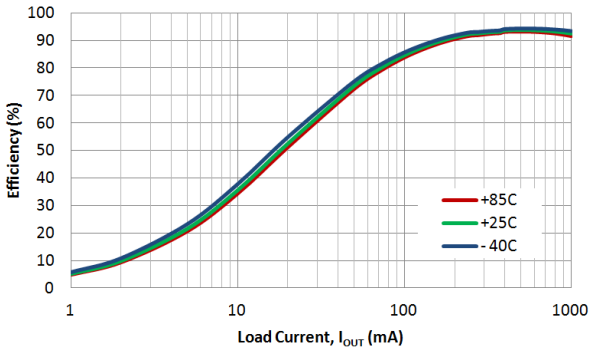


Figure 8. Efficiency vs. Load Current and Temperature

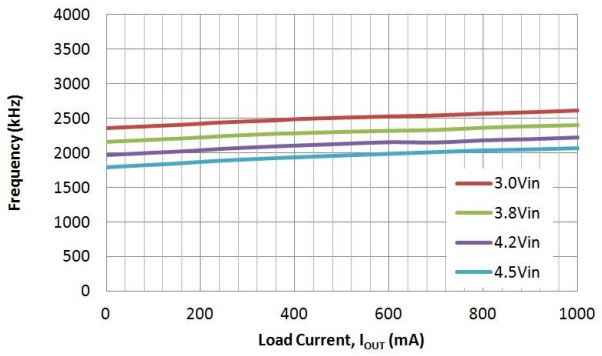


Figure 9. Switching Frequency vs. Load Current and Input Voltage

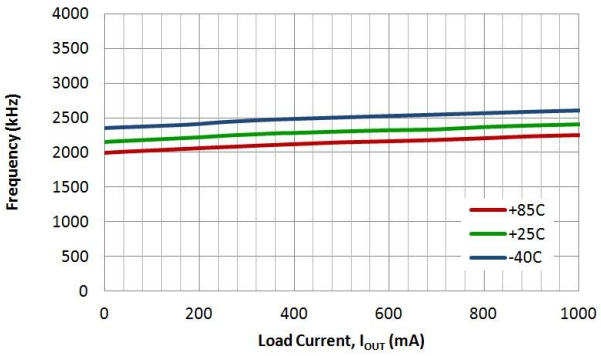


Figure 10. Switching Frequency vs. Load Current and Temperature

Typical Performance Characteristics

Unless otherwise specified; V_{IN} = 3.8 V, V_{OUT} = 5.40 V, T_A = 25°C, and circuit according to Figure 1. Components: C_{IN} = 10 µF (0402, X5R, 6.3 V, C1005X5R0J106M050BC), C_{OUT} = 10 µF (0603, X5R, 10 V, C1608X5R1A106K080AC) L1 = 470 nH (2016, 26 mΩ, DFE201610E-R47M).

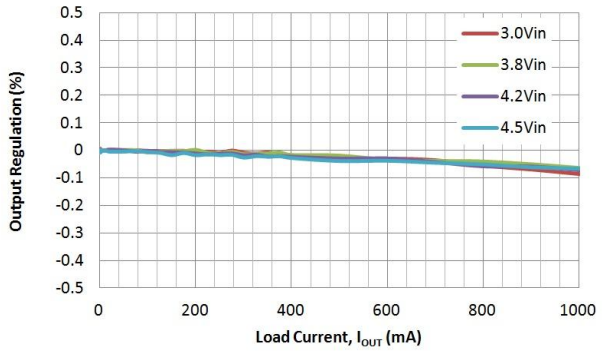


Figure 11. Output Regulation vs. Load Current and Input Voltage

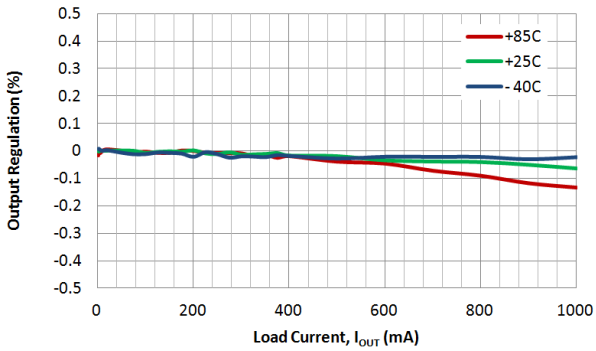


Figure 12. Output Regulation vs. Load Current and Temperature

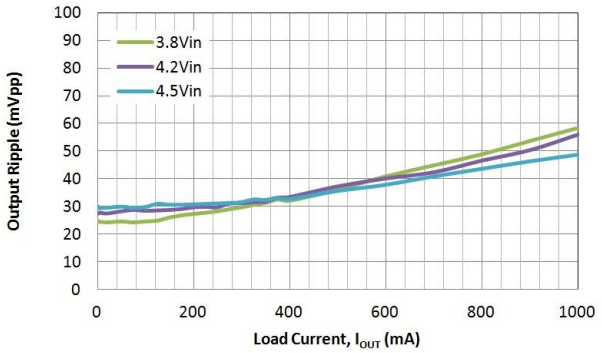


Figure 13. Output Ripple vs. Load Current and Input Voltage

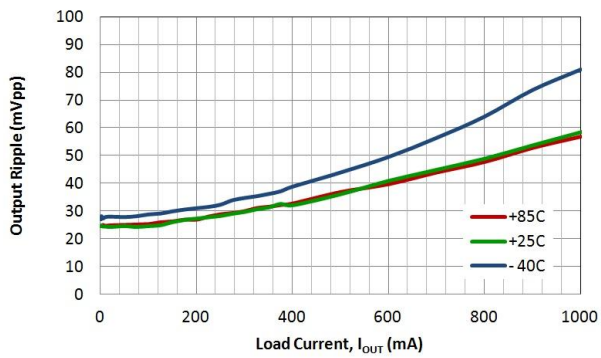


Figure 14. Output Ripple vs. Load Current and Temperature

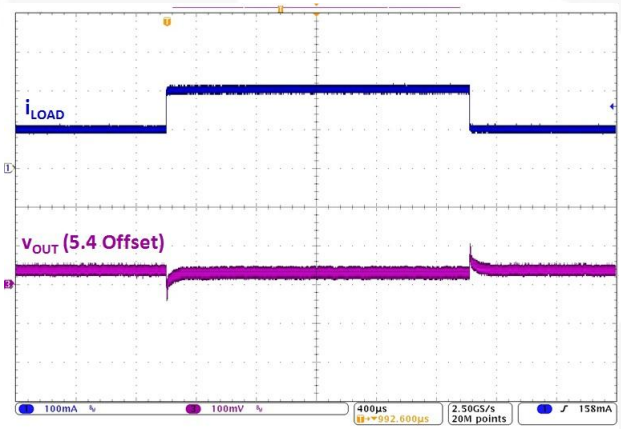


Figure 15. Load Transient, 3.6 V_{IN}, 100↔200 mA, 1 µs Edge

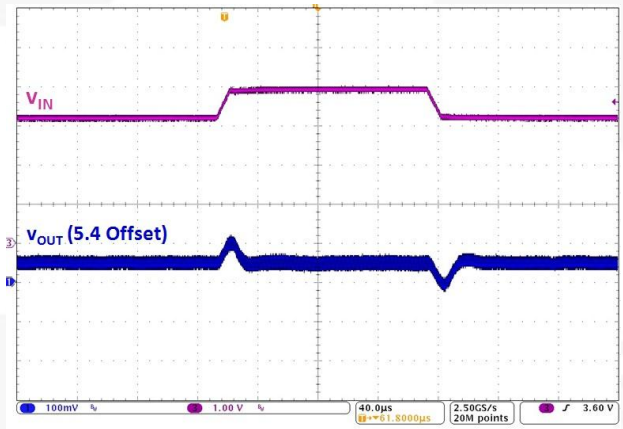


Figure 16. Line Transient, 50 mA, 3.2 V↔3.9 V, 10 µs Edge

Typical Performance Characteristics

Unless otherwise specified; V_{IN} = 3.8 V, V_{OUT} = 5.40 V, T_A = 25°C, and circuit according to Figure 1. Components: C_{IN} = 10 µF (0402, X5R, 6.3 V, C1005X5R0J106M050BC), C_{OUT} = 10 µF (0603, X5R, 10 V, C1608X5R1A106K080AC) L1 = 470 nH (2016, 26 mΩ, DFE201610E-R47M).

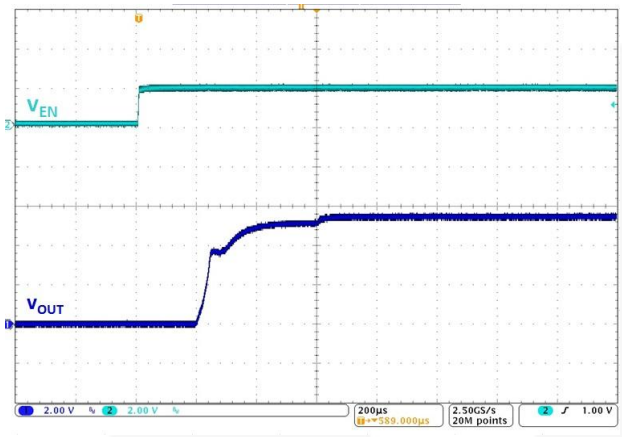


Figure 17. Startup, 150 mA Load

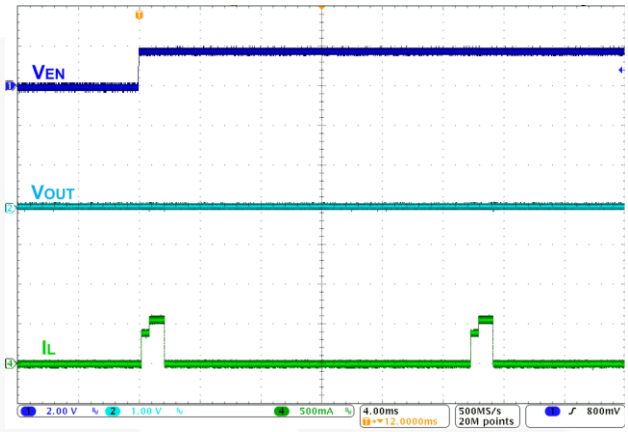


Figure 18. Fault Restart

Circuit Description

FAN48615 is a synchronous PWM Only boost regulator. The regulator's Pass-Through Mode automatically activates when V_{IN} is above the boost regulator's set point.

Table 2. Operating Modes

Mode	Description	Invoked When:
LIN	Linear Startup	$V_{IN} > V_{OUT}$
SS	Boost Soft-Start	$V_{IN} < V_{OUT} < V_{OUT(TARGET)}$
BST	Boost Operating Mode	$V_{OUT} = V_{OUT(TARGET)}$
PT	Pass-Through Mode	$V_{IN} > V_{OUT(TARGET)}$ or when EN is pulled LOW after initial startup

Boost Mode Regulation

The FAN48615 uses a current-mode modulator to achieve excellent transient response.

Table 3. Boost Startup Sequence

Start Mode	Entry	Exit	End Mode	Timeout (µs)
LIN1	$V_{IN} > V_{UVLO}$, EN=1	$V_{OUT} > V_{IN}$-300 mV	SS	
		Timeout	LIN2	512
LIN2	LIN1 Exit	$V_{OUT} > V_{IN}$-300 mV	SS	
		Timeout	FAULT	1024
SS	LIN1 or LIN2 Exit	$V_{OUT}=V_{OUT(TARGET)}$	BST	
		Overload Timeout	FAULT	64

LIN Mode

When EN is HIGH and $V_{IN} > V_{UVLO}$, the regulator first attempts to bring V_{OUT} within 300 mV of V_{IN} by using the internal fixed-current source from VIN (Q2). The current is limited to the LIN1 set point.

If V_{OUT} reaches V_{IN}-300 mV during LIN1 Mode, the SS Mode is initiated. Otherwise, LIN1 times out after 512 µs and LIN2 Mode is entered.

In LIN2 Mode, the current source is incremented. If V_{OUT} fails to reach V_{IN}-300 mV after 1024 µs, a fault condition is declared and the device waits 20 ms to attempt an automatic restart.

Soft-Start (SS) Mode

Upon the successful completion of LIN Mode ($V_{OUT} \geq V_{IN}$-300 mV), the regulator begins switching with boost pulses current limited to 50% of nominal level.

During SS Mode, if V_{OUT} fails to reach regulation during the SS ramp sequence for more than 64 µs, a fault is declared. If large C_{OUT} is used, the reference is automatically stepped slower to avoid excessive input current draw.

Boost (BST) Mode

This is a normal operating mode of the regulator.

Pass-Through (PT) Mode

The device allows the user to force the device in Forced Pass-Through Mode through the EN pin. If the EN pin is pulled HIGH, the device starts operating in Boost Mode. Once the EN pin is pulled LOW, the device is forced into Pass-Through Mode. To disable the device, the input supply voltage must be removed. The device cannot startup in Forced Pass-Through Mode *(see Figure 19)*. During startup, keep the EN pulled HIGH for at least 350 µs before pulling it LOW in order to make sure that the device enters Pass-Through Mode reliably.

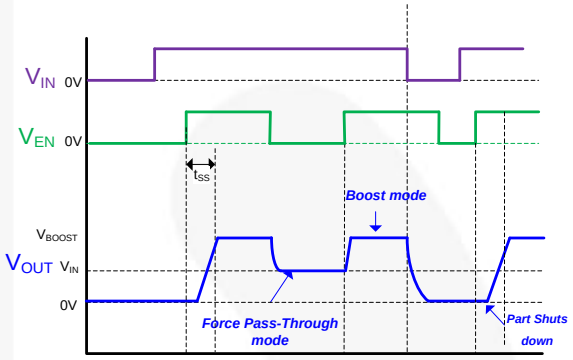


Figure 19. Pass-Through Profile

Current Limit Protection

The FAN48615 has valley current limit protection in case of overload situations. The valley current limit will prevent high current from causing damage to the IC and the inductor. The current limit is halved during soft-start.

When starting into a fault condition, the input current will be limited by LIN1 and LIN2 current threshold.

Fault State

The regulator enters Fault State under any of the following conditions:

- V_{OUT} fails to achieve the voltage required to advance from LIN Mode to SS Mode.
- V_{OUT} fails to achieve the voltage required to advance from SS Mode to BST Mode.
- Boost current limit triggers for 2 ms during BST Mode.
- $V_{IN} - V_{OUT} > 300$ mV; this fault can occur only after successful completion of the soft-start sequence.
- $V_{IN} < V_{UVLO}$.

Once a fault is triggered, the regulator stops switching and presents a high-impedance path between VIN and VOUT. After waiting 20 ms, an automatic restart is attempted.

Over-Temperature

The regulator shuts down if the die temperature exceeds 150°C and restarts when the IC cools by ~20°C.

© 2016 Fairchild Semiconductor Corporation

Layout Recommendations

The layout recommendations below highlight various top-copper pours by using different colors.

To minimize spikes at VOUT, C_{OUT} must be placed as close as possible to PGND and VOUT, as shown in Figure 20.

For best thermal performance, maximize the pour area for all planes other than SW. The ground pour, especially, should fill all available PCB surface area and be tied to internal layers with a cluster of thermal vias.

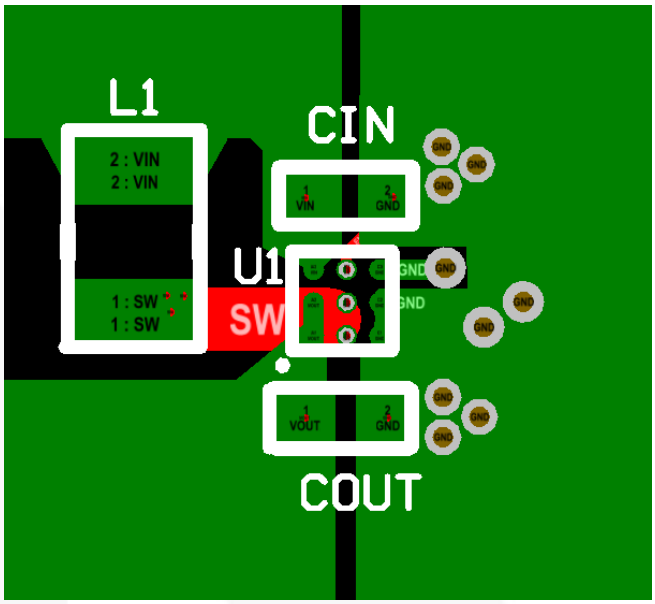


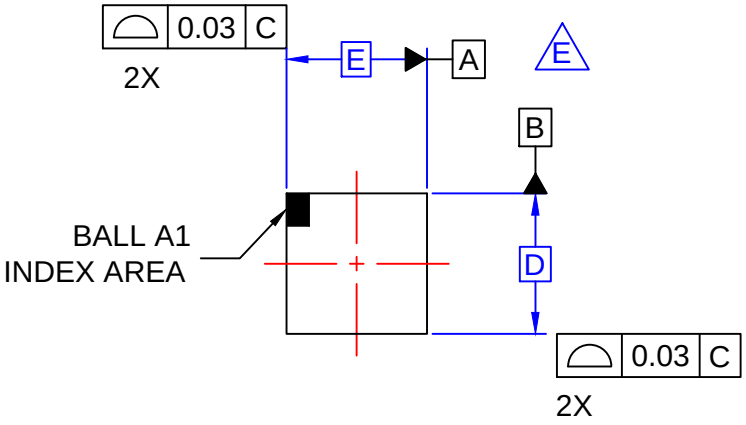
Figure 20. Layout Recommendation

The following information applies to the WLCSP package dimensions on the next page:

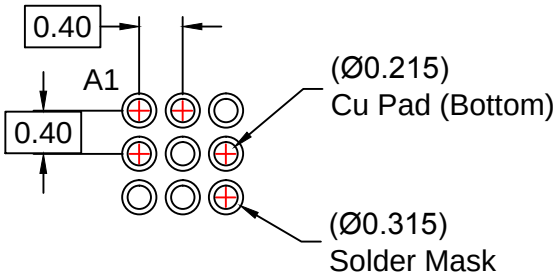
Product-Specific Package Dimensions

D	E	X	Y
1.215 ±0.030 mm	1.215 ±0.030 mm	0.2075 mm	0.2075 mm

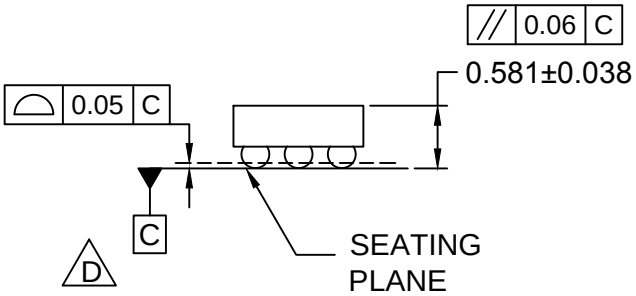
© 2016 Fairchild Semiconductor Corporation

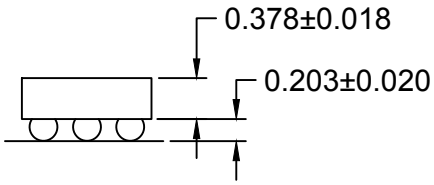


TOP VIEW

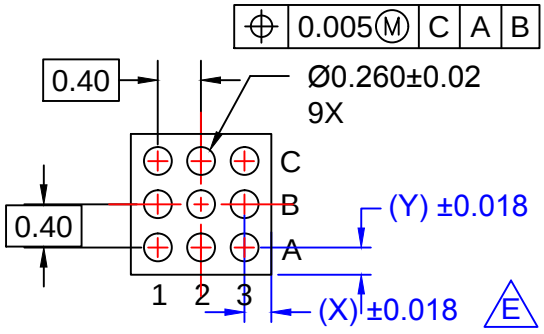


RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)





SIDE VIEWS



BOTTOM VIEW

NOTES

A. NO JEDEC REGISTRATION APPLIES.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCE PER ASME Y14.5M, 2009.
D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
E. FOR DIMENSIONS D,E,X, AND Y SEE PRODUCT DATASHEET.
F. DRAWING FILNAME: MKT-UC009Ak rev3

ON Semiconductor

ON Semiconductor and ON are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent−Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

ON Semiconductor:

FAN48615UC08X FAN48615UC11X

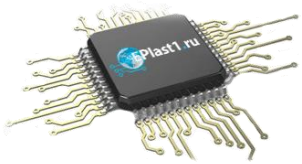
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

Телефон: 8 (812) 309 58 32 (многоканальный)
Факс: 8 (812) 320-02-42
Электронная почта: org@eplast1.ru
Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.