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User Guide for
FEBFDMQ8203_13 W
GreenBridge™ Evaluation Kit
for Power Over Ethernet
13 W Flyback DC-DC

MLP 4.5x5 GreenBridge™
SSOT-6 150 V MOSFET
SSOT-3 30 V MOSFET

Featured Fairchild Products:
FDMQ8203, FDC86244, FDN537N

***Direct questions or comments
about this evaluation board to:
“Worldwide Direct Support”***

Fairchild Semiconductor.com

Table of Contents

1. Introduction.....	3
1.1. Description	3
1.2. Features	3
2. Evaluation Board Specifications.....	3
3. Photographs.....	4
4. Printed Circuit Board	5
5. Schematic	6
6. Bill of Materials	8
7. Electrical Characteristics	10
8. Setup and Test Procedure.....	11
8.1. Hardware Connector Description.....	11
9. Performance of Evaluation Board.....	12
10. Revision History	13

The following user guide supports the evaluation kit for high-efficiency, IEEE802.3af, Class3 Power over Ethernet Power Device (PoE PD) Flyback DCDC with PoE interface controller. It should be used in conjunction with the FDMQ8203 datasheet as well as Fairchild's application notes and technical support team. Please visit Fairchild's website at www.fairchildsemi.com.

1. Introduction

This board is designed to rectify the positive and negative power source from Power Source Equipment (PSE) and regulate 48 V (36 V ~ 57 V) to provide 5 V_{OUT} at maximum 2.6 A with 250 kHz switching frequency and over 90% of the total efficiency in the compact power density. It meets the required specification under IEEE802.3af.

1.1. Description

This kit contains the MLP 4.5x5 GreenBridge™ MOSFET evaluation board.

1.2. Features

- GreenBridge™ FDMQ8203 quad P&N-Channel MOSFET
- Flyback Primary Switch FDC86244 Single N-Channel MOSFET
- Flyback Secondary Switch FDN537N Single N-Channel MOSFET
- Controller IEEE802.3at PD with Flyback Controller
- Output-Voltage Range 5 V, Adjustable by R39 and R37
- Switching Frequency 250 kHz, Adjustable by C55
- Maximum Output Current 2.6 A, Limited by Power Component

2. Evaluation Board Specifications

Table 1. MOSFET Parameters

Part Number	Location	Package	BV _{DSS} (V)	R _{DS(ON)} [mΩ]	Qg [nC]	C _{OSS} [pF]
				at 10 V _{GS}	at 10 V _{GS}	
				Max.	Typ.	Typ.
FDMQ8203	Q1, Q4	MLP4.5x5	100	110	2.9	41.0
	Q2, Q3		-80	190	13	46
FDC86244	Single	SSOT-6	150	144.0	4.2	32.0
FDN537N	Single	SSOT-3	30	28	5.3	135

3. Photographs

Size = 70 X 60 mm.

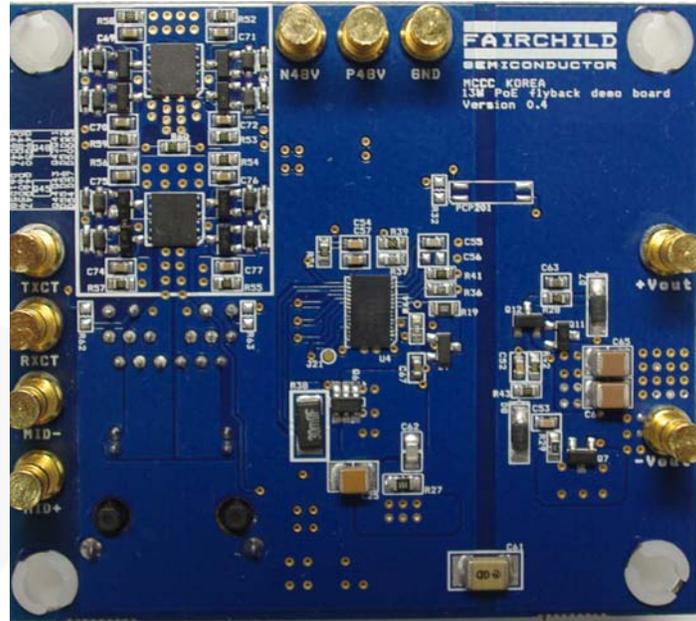


Figure 1. Top Side View of Evaluation Kit

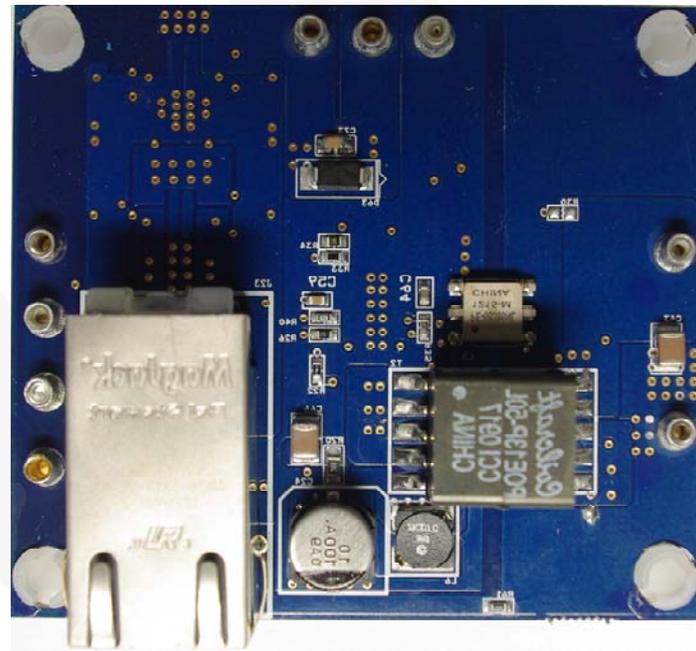


Figure 2. Bottom Side View of Evaluation Kit

4. Printed Circuit Board

PCB Layout (70 mm x 60 mm, 4-Layer).

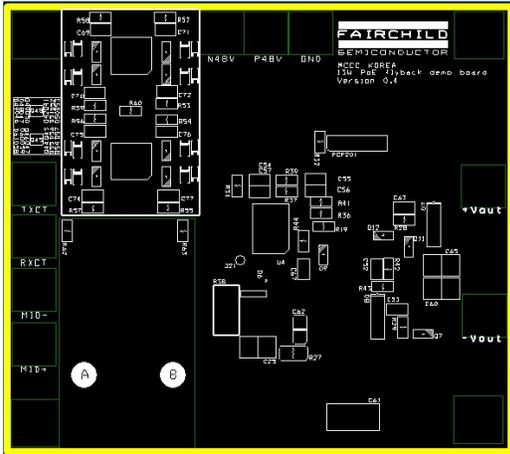


Figure 3. SST (Component Side) Layer

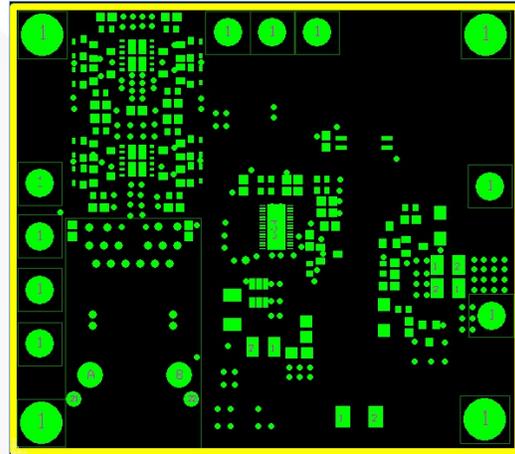


Figure 4. SSB (Component) Layer

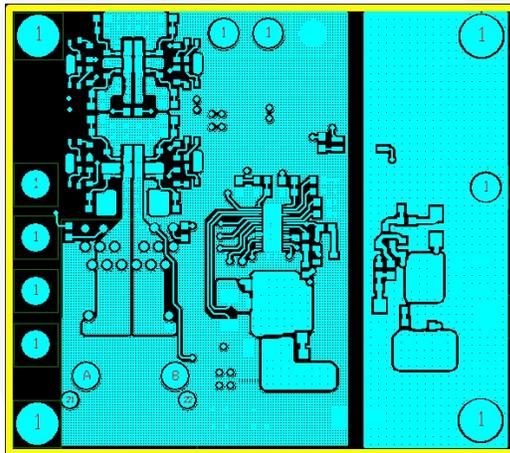


Figure 5. TOP & SMT Layer

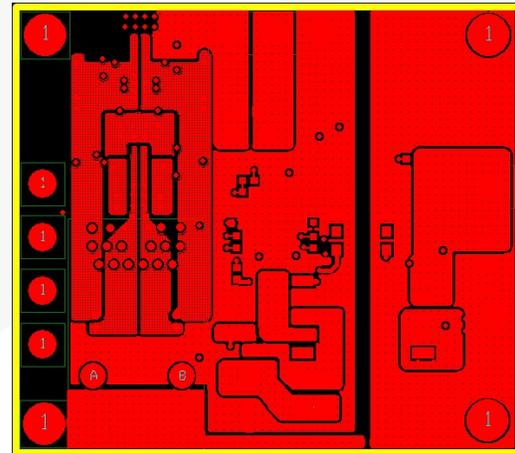


Figure 6. BOT & SMB Layer

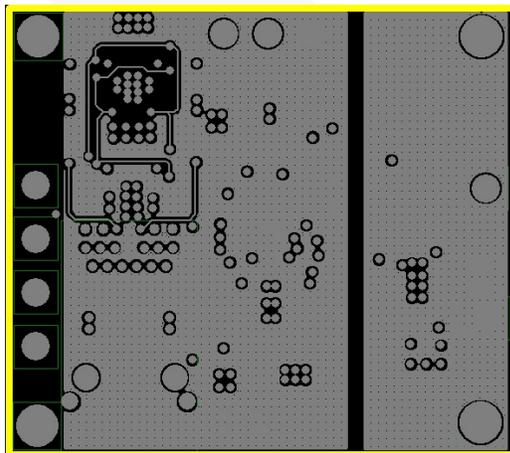


Figure 7. INNER1 (GND) Layer

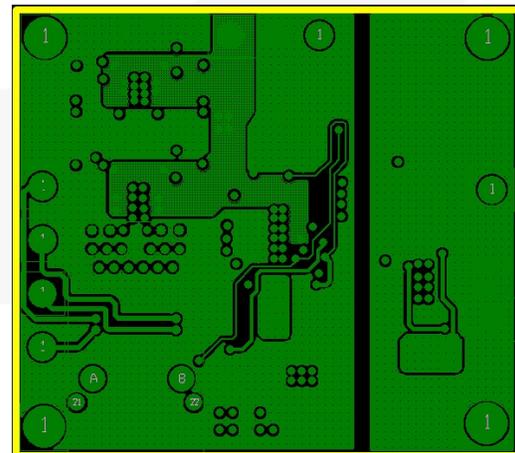


Figure 8. INNER2 (POWER) Layer

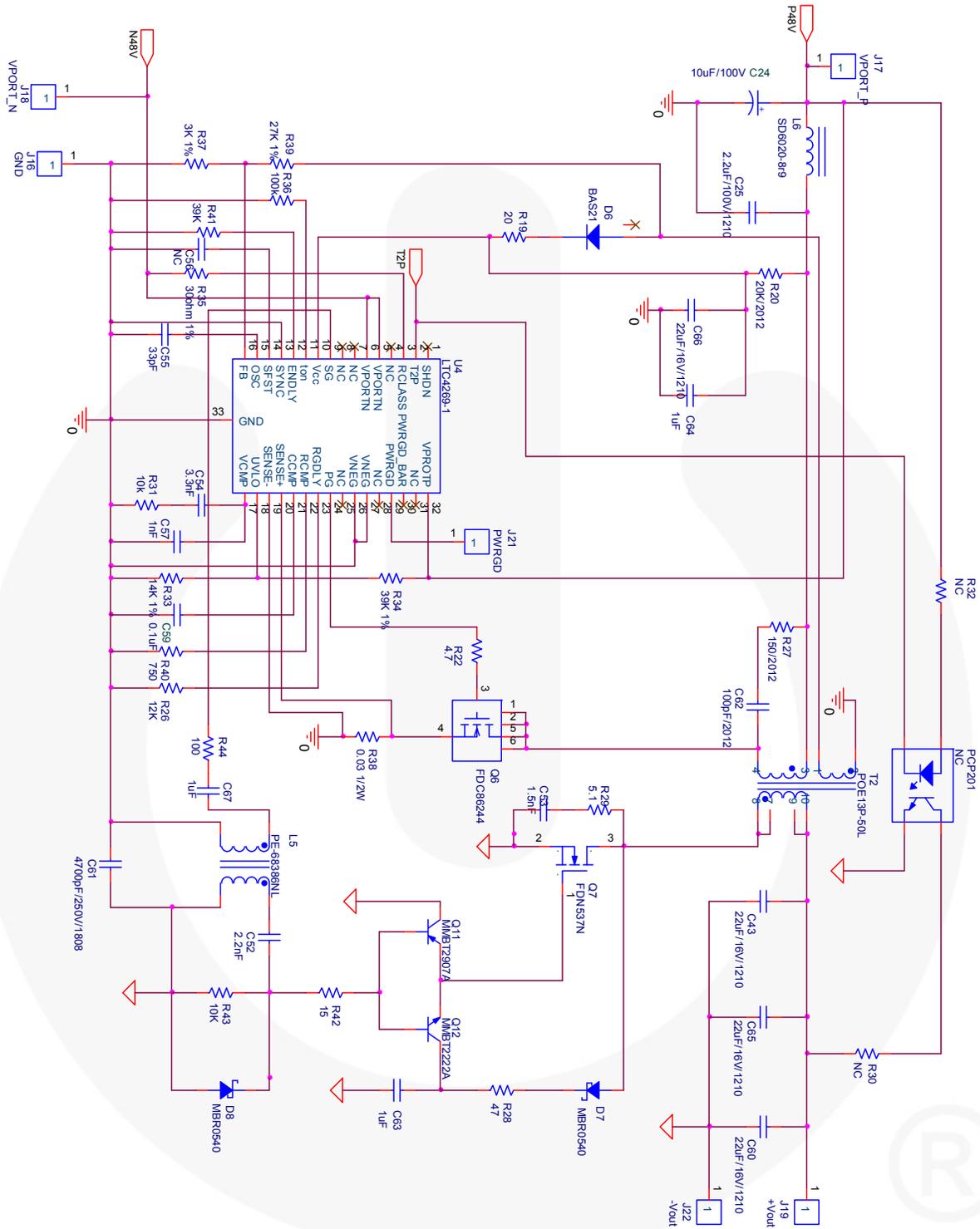


Figure 10. PoE Power Device Controller and Flyback DC-DC Block Schematic

6. Bill of Materials

Table 2. Bill of Materials

Item	Qty.	Reference	Part Name	Vender	Comment
1	1	C24	EEE2AA100UP	Panasonic	10 μ F / 100 V
2	1	C25	GRM32ER72A225KA35	Murata	2.2 μ F / 100 V
3	4	C43, C60, C65, C66	C3225X7RIC226M	TDK	22 μ F / 16 V / 3216
4	1	C52	2.2 nF / 1608	Any	
5	1	C53	1.5 nF / 1608	Any	
6	1	C54	3.3 nF / 1608	Any	
7	1	C55	33 pF / 1608	Any	
8	6	R30, R32, C56, R62, R63, PCP201	NC		
9	9	C57, C69, C70, C71, C72, C74, C75, C76, C77	1 nF / 1608	Any	
10	1	C59	0.1 μ F / 1608	Any	
11	1	C61	GA343D	Murata	4700 pF / 250 V
12	1	C62	100 pF / 2012	Any	
13	3	C63, C64, C67	1 μ F / 1608	Any	
14	1	C73	C0805C823K1RACTU	Kemet	0.082 μ F / 100 V
15	1	D6	BAS21	Fairchild Semiconductor	
16	2	D7, D8	MBR0540	Fairchild Semiconductor	
17	8	D46, D49, D50, D53, D54, D57, D58, D61	MM5Z10V	Fairchild Semiconductor	10 V Zener Diode
19	8	D47, D48, D51, D52, D55, D56, D59, D60	1N4148WS	Fairchild Semiconductor	
20	1	D63	SMAJ58A	Diodes	TVS Diode
21	1	J23	0826-1G1T-GH-F	Belfuse	RJ45 with Transformer
22	1	L5	PE-68386NL	Pulse trans	
23	1	L6	SD6020-8R9	Coiltronics	8.2 μ H
24	1	Q6	FDC86244	Fairchild Semiconductor	150 V 144 m Ω MOSFET
25	1	Q7	FDN537N	Fairchild Semiconductor	30 V 28 m Ω MOSFET
26	5	Q11, Q42, Q44, Q47, Q50	MMBT2907A	Fairchild Semiconductor	
27	5	Q12, Q41, Q43, Q46, Q49	MMBT2222A	Fairchild Semiconductor	
28	2	Q45, Q48	FDMQ8203	Fairchild Semiconductor	GreenBridge™ Quad MOSFET
29	1	R19	20 Ω / 2012	Any	
30	1	R20	20 k Ω / 2012	Any	
31	1	R22	4.7 Ω / 1608	Any	
32	1	R26	12 k Ω / 1608	Any	
33	1	R27	150 Ω / 2012	Any	
34	1	R28	47 Ω / 1608	Any	
35	1	R29	5.1 Ω / 1608	Any	
36	2	R31, R43	10 k Ω / 1608	Any	

Bill of Materials (Continued)

Item	Qty.	Reference	Part Name	Vender	Comment
37	1	R33	14 kΩ 1% / 1608	Any	
38	1	R34	39 kΩ / 1% / 1608	Any	
39	1	R35	45.3 Ω / 1608	Any	
40	1	R36	100 kΩ / 1608	Any	
41	1	R37	3 kΩ / 1% / 1608	Any	
42	1	R38	0.03 mΩ / 0.5 W	HMR	Shunt Resistor
43	1	R39	24 kΩ / 1% / 1608	Any	
44	1	R40	750 Ω / 1608	Any	
45	1	R41	39 kΩ / 1608	Any	
46	1	R42	15 Ω / 1608	Any	
47	1	R44	100 Ω / 1608	Any	
48	9	R52, R53, R54, R55, R56, R57, R58, R59, R60	20 kΩ / 1608	Any	
49	1	R61	0 Ω / 1608	Any	
50	1	T2	POE13P-50L	Coilcraft	13 W PoE Transformer
51	1	U4	LTC4269-1	LTC	PoE Flyback IC

7. Electrical Characteristics

Table 3. Electrical Specification

Parameter	Value	Remark
GreenBridge™	FDMQ8203	Quad P&N-Channel MOSFET, Fairchild Semiconductor
Flyback Primary Switch	FDC86244	Single N-Channel MOSFET, Fairchild Semiconductor
Flyback Secondary Switch	FDN537N	Single N-Channel MOSFET, Fairchild Semiconductor
Controller		IEEE802.3at PD with Flyback Controller
V _{OUT} Range	5 V	Adjustable by R39 and R37
Switching Frequency	250 kHz	Adjustable by C55
Maximum I _{OUT}	2.6 A	Limited by Power Component

8. Setup and Test Procedure

Table 4. Test Point Descriptions

Test Point	Label	Descriptions
J17	P48 V	Measurement test point for rectified positive input voltage
J18	N48 V	Measurement test point for rectified negative input voltage
J16	GND	Measurement test point for input voltage return
J19	+VOUT	Measurement test point for output voltage
J22	-VOUT	Measurement test point for output voltage return

8.1. Hardware Connector Description

The evaluation kit is fully assembled and tested. Follow the steps below to verify board operation.

- Use one of the following methods to power the evaluation kit:
 - If network connectivity is required: Connect a CAT5 Ethernet network cable from the evaluation kit input port RJ45 connector to the corresponding PSE Ethernet LAN connection, which provides power to the evaluation kit. J21 connector provides an interface with the Ethernet data signals only.
 - If network connectivity is not required: Connect a -48 V DC power supply between the TXCT and RXCT. OR connect a -48 V DC power supply between the MID+ and MID-.

Caution: Do not turn on the power supply until all connections are completed.
- Activate the PSE power supply or turn on the external DC power supply.
- Using a voltmeter, verify that the evaluation kit provides +5 V across the +VOUT and -VOUT pins. -VOUT is isolated from the evaluation kit's input N48 V and GND pins.

9. Performance of Evaluation Board

Figure 11 and Figure 12 show measured data.

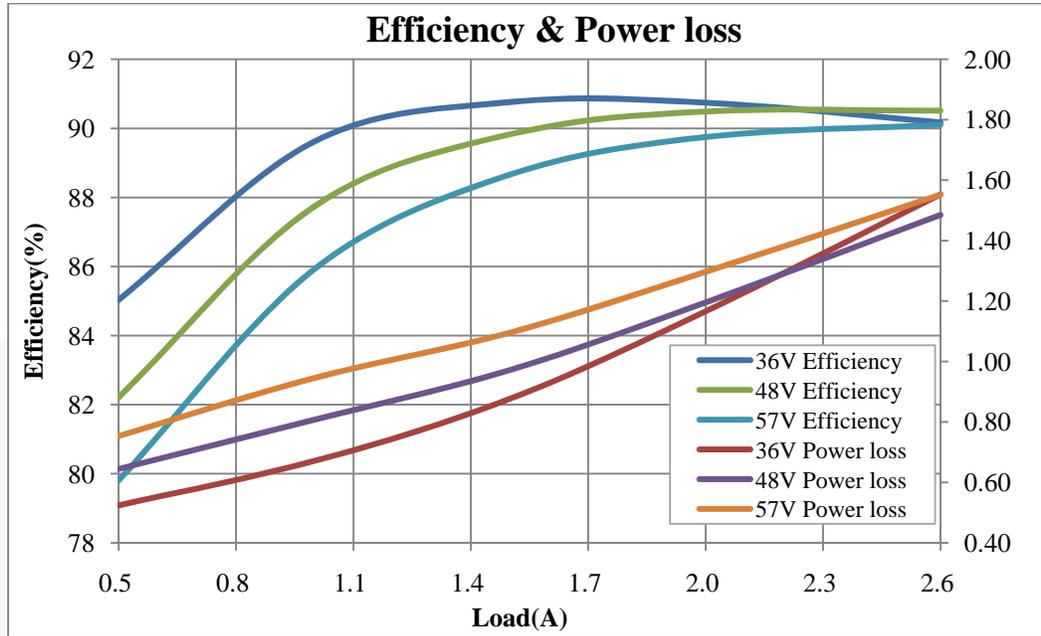


Figure 11. Efficiency & Power Loss at $V_{OUT}=5\text{ V}$, Soaking=5 Minutes, $f_{SW}=250\text{ kHz}$

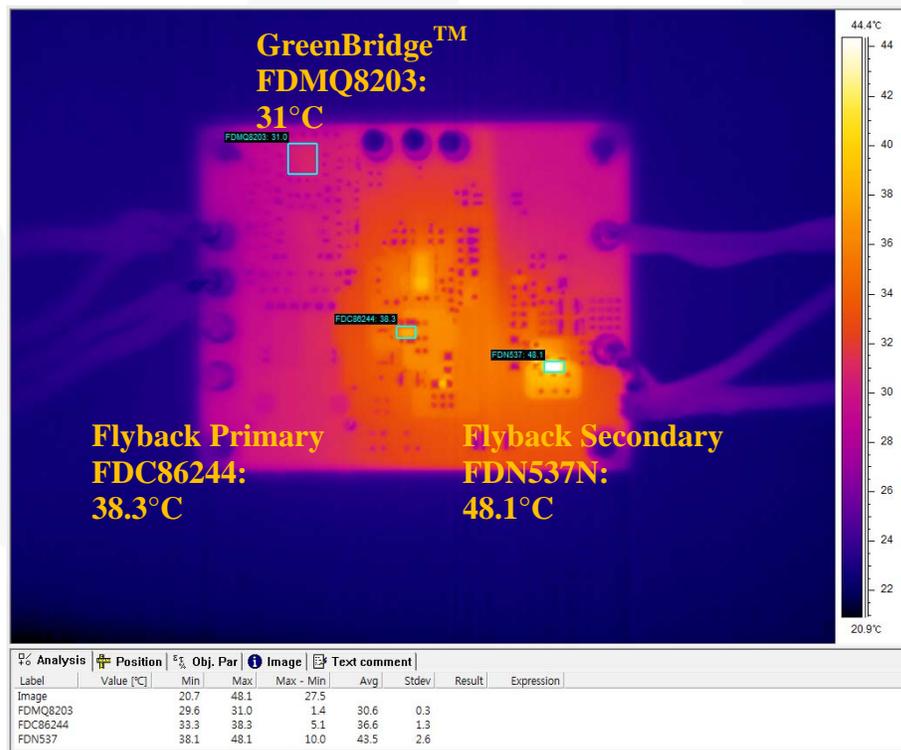


Figure 12. Thermal Performance at $V_{IN}=48\text{ V}$, $V_{OUT}=5\text{ V}$, $I_{OUT}=2.6\text{ A}$, Soaking=5 Minutes, $f_{SW}=250\text{ kHz}$

10. Revision History

Rev.	Date	Description
0.1.0	February 13, 2012	Initial Release
1.0.0	November 28, 2012	Reformat to template Proofread and correct content

WARNING AND DISCLAIMER

Replace components on the Evaluation Board only with those parts shown on the parts list (or Bill of Materials) in the Users' Guide. Contact an authorized Fairchild representative with any questions.

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