



A CREE COMPANY

(CRD15DD17P)

# Wide Input Voltage Range (300VDC-1200VDC) 15W Flyback Auxiliary Power Supply Board



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# OVERVIEW OF CREE'S CRD15DD17P 15 W AUXILIARY POWER SUPPLY BOARD

- CRD15DD17P, 15 W flyback auxiliary power supply board is based on Cree's 1700 V, 1000 m $\Omega$  SiC MOSFET with high blocking voltage capability
- Due to low blocking voltage capability of Si MOSFET, it is very challenging to use them in these kind of applications
- The main target applications of this reference design board are solar power, energy storage and traction industry
- Cree's 1700 V, 1000 m $\Omega$  SiC MOSFET in a TO-263-7 package has been utilized due to the availability of it's high creepage (~ 7 mm) distance



# DESIGN SPECIFICATIONS

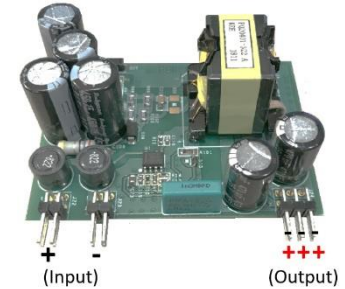
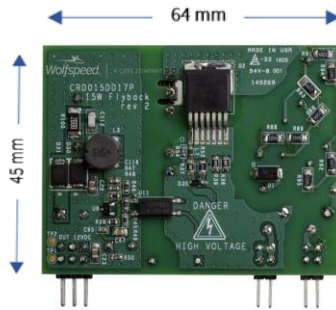
- The design specifications of CRD15DD17P, 15 W flyback auxiliary power supply board are mentioned in the following table:

Parameters	Values
Input voltage range, 50-60Hz	480 VAC - 530 VAC or 300 VDC - 1200 VDC
Output voltage	12 VDC
Output Current	1.3 A
Output Power	15 W
Switching frequency	100 kHz (max)
Efficiency	> 85%
Max ambient operating temperature	50 °C
Topology	Single-end Flyback
Power devices package	TO-263-7

# PHYSICAL DIMENSIONS AND THE PINOUTS OF CREE'S CRD15DD17P 15 W AUXILIARY POWER SUPPLY BOARD

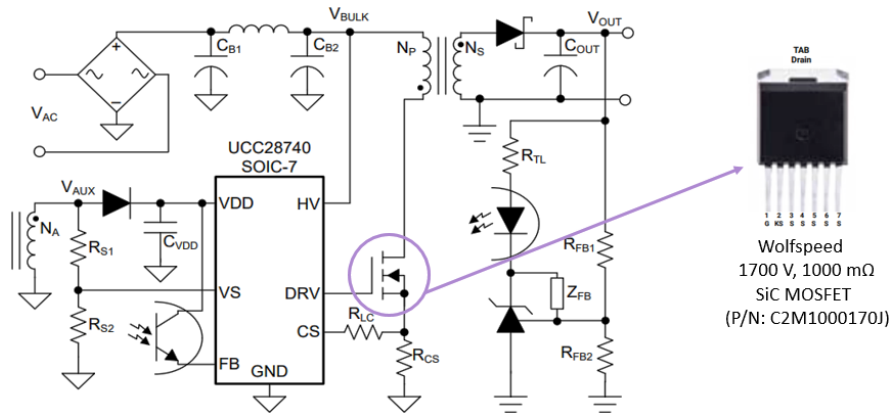
- The physical dimensions and the pinouts of CRD15DD17P, 15 W flyback auxiliary power supply board are:

64 mm (L) X 45 mm (W) X 25 mm (H)



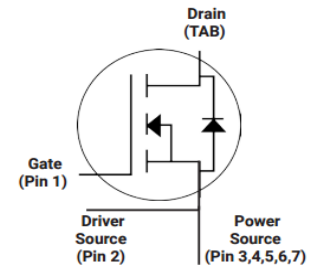
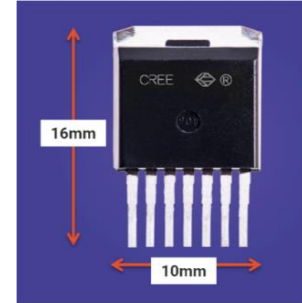
# ELECTRICAL OPERATION

- CRD15DD17P, 15 W auxiliary power supply board consists of a traditional single switch flyback topology.
- Both AC or DC power source with a voltage range of 480 VAC – 530 VAC / 300 VDC – 1200 VDC can be applied directly to the input of CRD15DD17P, 15 W auxiliary power supply board.
- Primary side of the flyback transformer consists of Cree's 1700 V, 1000 mΩ SiC MOSFET, Texas Instruments UCC28740 flyback controller IC and the feedback circuit.
- Secondary side of the flyback transformer uses 150 V/3A Schottky diode with a closed loop voltage feedback.



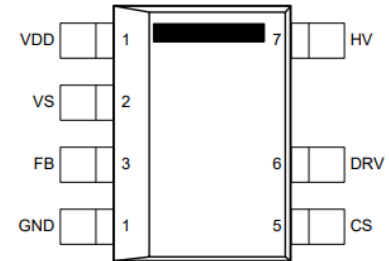
# ELECTRICAL OPERATION (Continued)

- Cree's 1700 V, 1000 mΩ SiC MOSFET has been utilized in CRD15DD17P, 15 W auxiliary power supply board
- Main features are listed below:
  - High Blocking Voltage
  - High Creepage Distance (~ 7 mm)
  - Low Source Inductance due to Kelvin Source availability
  - Low  $R_{DS(on)}$  Change over Temperature
  - High Frequency Operation



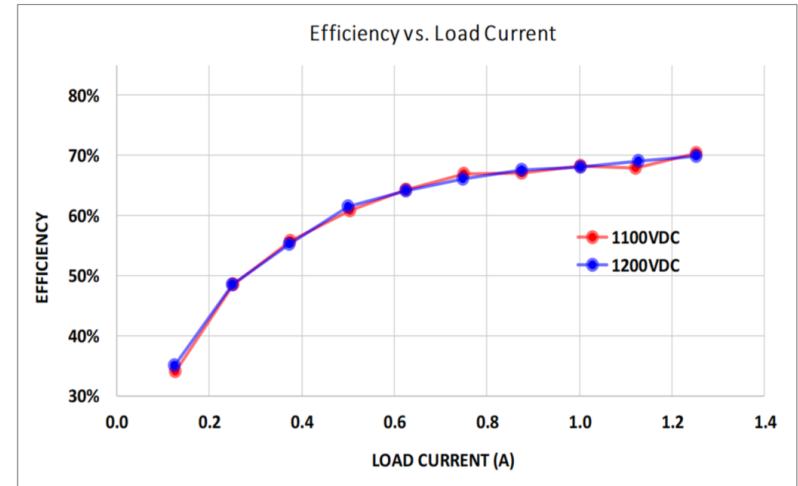
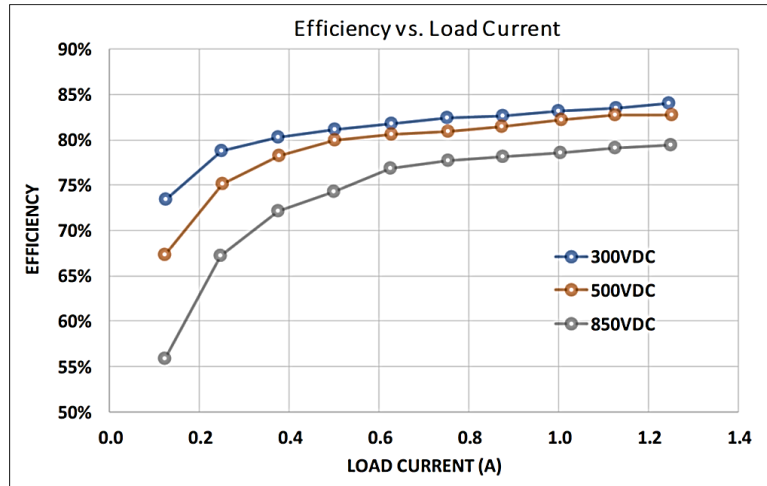
# ELECTRICAL OPERATION (Continued)

- Texas Instruments UCC28740 Flyback controller IC has been utilized in CRD15DD17P, 15 W auxiliary power supply board
- Main features are listed below:
  - No Load Power Consumption < 10 mW
  - Opto-Coupled Feedback
  - $\pm 1\%$  of Voltage Regulation across Line and Load
  - Valley Switching Operation to Reduce Switching Loss
  - Overvoltage and Overcurrent Protection Functions



# PERFORMANCE DATA (EFFICIENCY)

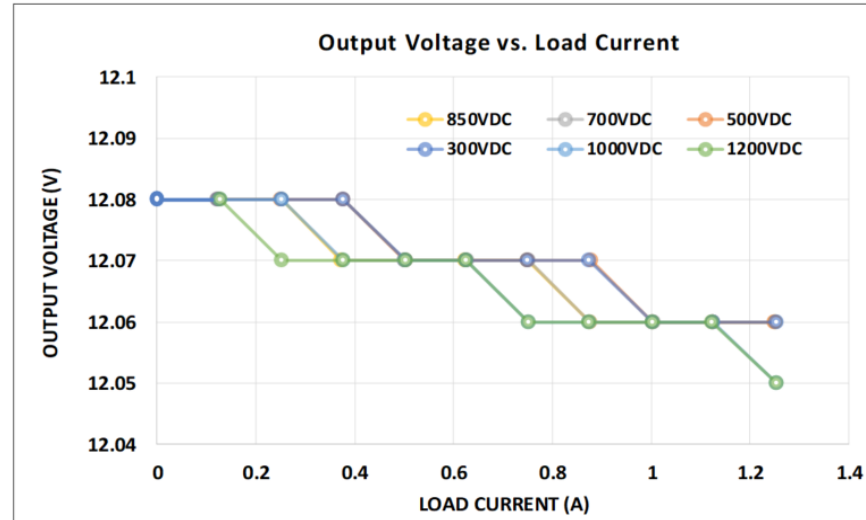
- Cree' CRD15DD17P, 15 W auxiliary power supply board is tested up to full load under the input voltage levels of 300VDC, 500 VDC, 850 VDC, 1100 VDC and 1200 VDC.
- The maximum efficiency achieved by Cree's CRD15DD17P, 15 W auxiliary power supply board is 85 % at 300 VDC.





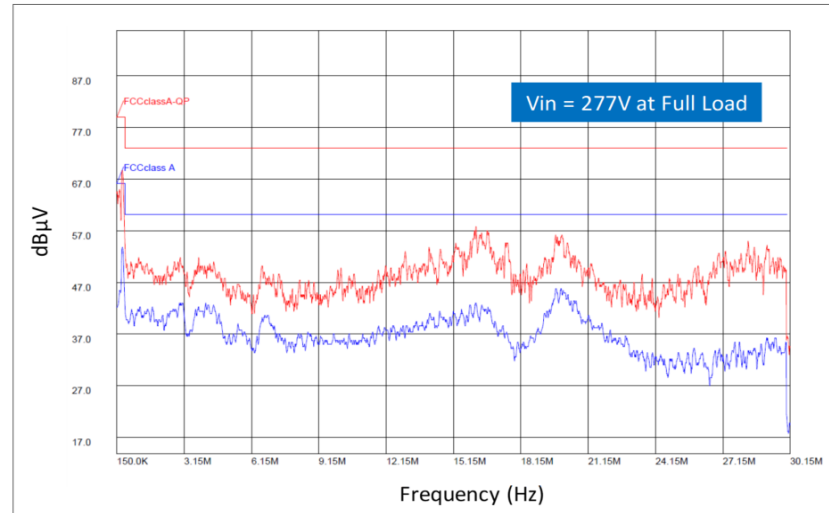
# PERFORMANCE DATA (VOLTAGE REGULATION)

- Cree's CRD15DD17P, 15 W auxiliary power supply board is tested under various load conditions and at various input voltage levels.
- Under all those conditions, the overall voltage regulation of Cree's CRD15DD17P, 15 W auxiliary power supply board is within 0.25 %



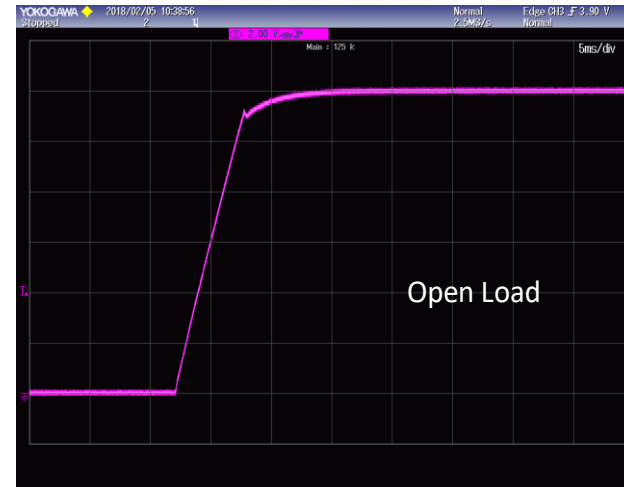
# PERFORMANCE DATA (EMI)

- Conducted EMI of Cree's CRD15DD17P, 15 W auxiliary power supply board has been measured at full load while the input voltage fixed at 277 VAC
- Under these conditions, Cree's CRD15DD17P, 15 W auxiliary power supply board passed FCC Part 15 Class A standard for commercial applications



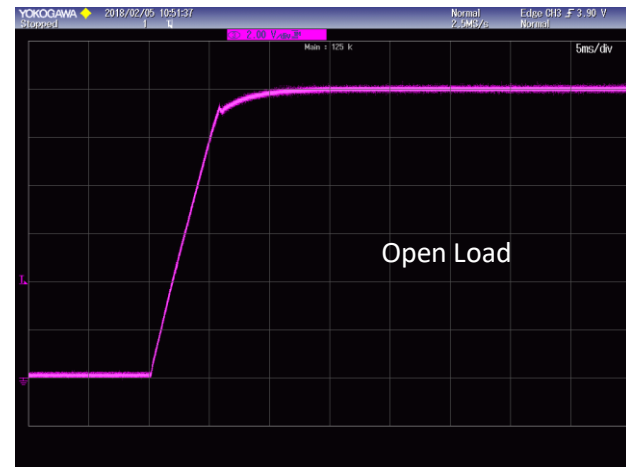
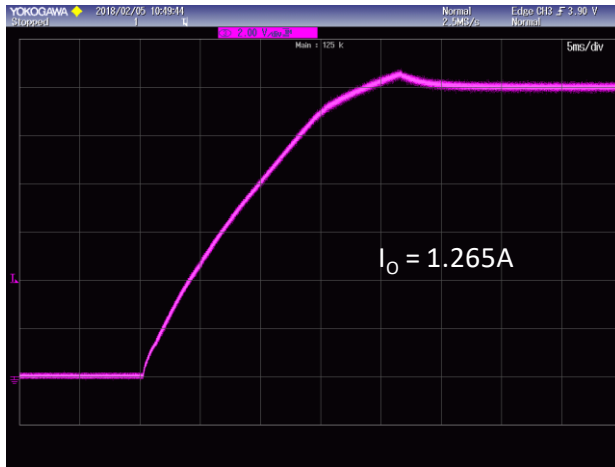
## PERFORMANCE DATA (15 W Load @ 300 VDC Input)

- Performance of Cree's CRD15DD17P, 15 W auxiliary power supply board can be evaluated by the output voltage waveforms both at full load and no load conditions
- Following are the spike-less output voltage waveforms that have been captured at 300 VDC input both under full load and no load conditions.



# PERFORMANCE DATA (15 W Load @ 1200 VDC Input)

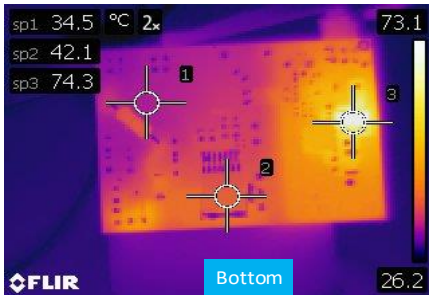
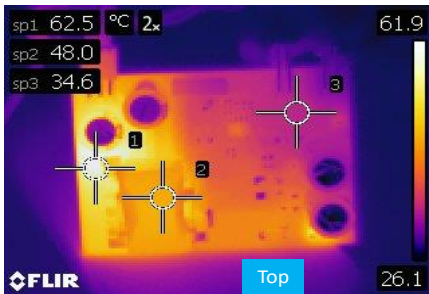
- Performance of Cree's CRD15DD17P, 15 W auxiliary power supply board can be evaluated by the output voltage waveforms both at full load and no load conditions
- Following are the spike-less output voltage waveforms that have been captured at 1200 VDC input both under full load and no load conditions.



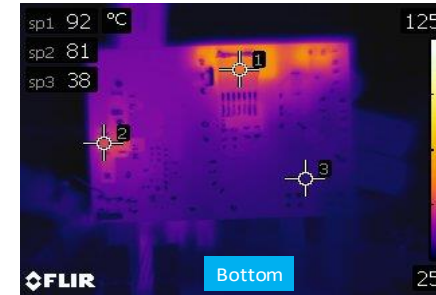
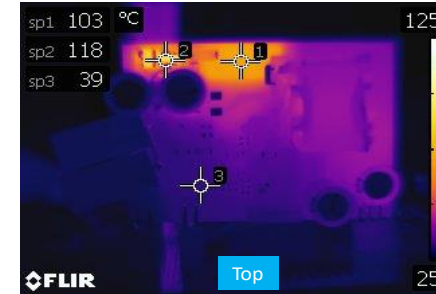
# PERFORMANCE DATA (Thermal Measurements)

- Performance of Cree's CRD15DD17P, 15 W auxiliary power supply board can be evaluated by the thermal measurements as well. Following thermal images show that under each condition, all components on the board operate well below their thermal limits

(Full Load @ 300 VDC Input)



(Full Load @ 1200 VDC Input)



# SUMMARY

- CRD15DD17P, 15 W flyback auxiliary power supply board demonstrates efficient operation of Cree's 1700 V, 1000 mΩ SiC MOSFET that has high blocking voltage and high creepage distance (~ 7mm) availability
- Wolfspeed's 15 W flyback auxiliary power supply board can accept a wide range of AC or DC input voltage (480 VAC – 530 VAC) or (300 VDC – 1200 VDC) and provide 12 VDC at the output with an exceptional efficiency of 85 %
- Simple control approach has been utilized to reduce the overall complexity and cost of the system
- High-frequency operation of Wolfspeed's 1700 V, 1Ω SiC MOSFET has been demonstrated as well that helps in reducing form factor of the board significantly.
- High performance data of CRD15DD17P, 15 W flyback auxiliary power supply board demonstrates the effective utilization of Cree's 1700 V, 1000 mΩ SiC MOSFET for high voltage applications

*(If user require more information about the detailed operation of Cree's CRD15DD17P, 15 W auxiliary power supply board please review Cree's CRD15DD17P, 15 W auxiliary power supply board's Application Note)*

*(If user have questions about Cree's CRD15DD17P, 15 W auxiliary power supply board, please contact Cree at [sic\\_power@cree.com](mailto:sic_power@cree.com))*



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# APPENDIX

- Schematic of Cree's CRD15DD17P, 15 W auxiliary power supply board
- Package Contents of Cree's CRD15DD17P, 15 W auxiliary power supply board

*(If user require more information about the detailed operation of Cree's CRD15DD17P, 15 W auxiliary power supply board please review Cree's CRD15DD17P, 15 W auxiliary power supply board's Application Note)*

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# PACKAGE CONTENTS OF Cree's CRD15DD17P, 15 W AUXILIARY POWER SUPPLY BOARD

Item	Qty	Per	Reference designat	Description	Manufacturer Name	Manufacturer P/N
1	2		C22,C23	CAP CER 1µF 50V X7R 0805	Murata Electronics North America	GRM21BR71H105KA12L
2	1		C67	CAP CER 1000pF 50V 10% 0805 X7R	KEMET	C0805C102K5RACTU
3	1		C73	CAP CER 4.7µF 25V X7R 0805	Taiyo Yuden	TMK212AB7475K-T
4	2		C94,C95	CAP CER 0.033µF 50V X7R 0603	AVX CORP.	06035C333KAT2A
5	1		C96	CAP FILM 1000pF 20% 1.25kVDC RAD	KEMET	PHE850EA4100MA01R17
6	4		C115,C117,C109,C110	CAP ALUM 15µF 20% 450V RADIAL	Rubycon	450BXW15MEFC10X20
7	1		C111	CAP CER 0.033µF 630V X7R 1206	TDK Corporation	C3216X7R2J333K160AA
8	1		C112	CAP CER 100pF 500V X7R 1206	KEMET	C1206C101KCRACTU
9	2		C113,C114	CAP ALUM 470µF 20% 25V RADIAL	Panasonic Electronic Components	EEU-EB1E471
10	1		C118	CAP CER 100PF 16V X7R 0603	AVX Corporation	0603YC101KAT2A
11	2		C116, C119	CAP CER 0.1µF 25V X7R 0603	Murata Electronics North America	GRM188R71E104KA01D
12	1		D10	DIODE GEN PURP 250V 200mA SOD323	ON Semiconductor	BAS21HT1G
13	2		D25,D26	DIODE GEN PURP 1kV 1A DO214AC	MICRO COMMERCIAL COMPONENT	E51M-TP
14	2		D1,D28	DIODE GEN PURP 1KV 1A SMA	Diodes Incorporated	S1M-13-F
15	1		D30,D31	DIODE SCHOTTKY 150V 3A SMBFLAT	STMicroelectronics	STPS3150UF
16	1		D35	DIODE GEN PURP 75V 150mA SOD323	MICRO COMMERCIAL COMPONENT	1N4148WXTPMSTR
17	1		F2	Metal Film Resistor Through Hole 2W 27 ohm 10% FUSIBLE	TT ELECTRONICS	EMC2-27RKI
18	2		J22,J23	4 Positions Header Connector, 0.100" (2.54mm), Through Hole, Right Angle, Tin	SAMTEC INC USA	TSW-102-09-T-D-RA
19	1		J24	6 Positions Header Connector, 0.100" (2.54mm), Through Hole, Right Angle, Tin	SAMTEC INC USA	TSW-103-09-T-D-RA
20	2		L1,L12	FIXED IND 8.2mH 100mA 16Ω TH	Würth Electronics Inc.	744731822
21	1		L3	FIXED IND 3.3µH 4.5A 20 mΩ SMD	Bourns Inc.	SDR0805-3R3MML
22	1		L7	FERRITE BEAD 750Ω 0603 1LN	Laird-Signal Integrity Products	H20603B751R-10
23	1		Q2	MOSFET N-CH 1700V 5.3A Surface Mount D2PAK (7-Lead)	Wolfspeed	C2M1000170J
24	1		R1	RES SMD 10Ω 5% 2/3W 1206	Panasonic Electronic Components	ERJ-P08J100V
25	1		R7	RES SMD 51kΩ 1% 1/10W 0603	Yageo	RC0603FR-0751KL
26	1		R10	RES SMD 14kΩ 1% 1/10W 0603	Panasonic Electronic Components	ERJ-3EKF1402V
27	3		R11,R45,R46	RES SMD 1kΩ 1% 1/4W 0603	Vishay Dale	CRCW06031K00FKEA
28	1		R13	RES SMD 196kΩ 1% 1/10W 0603	Vishay Dale	CRCW0603196KFKEA
29	1		R14	RES SMD 22kΩ 1% 1/10W 0603	Panasonic Electronic Components	ERJ-3EKF2202V
30	1		R37	RES SMD 10Ω 1% 1/8W 0805	Panasonic Electronic Components	ERJ6NF10R0V
31	2		R38,R39	RES SMD 3.9Ω 1% 1/8W 0805	Vishay Dale	CRCW08053R90FKEA
32	1		R47	RES SMD 17.4kΩ 1% 1/10W 0603	Yageo	RC0603FR-0717K4L
33	1		R48	RES SMD 4.53kΩ 1% 1/10W 0603	Panasonic Electronic Components	ERJ-3EKF4531V
34	1		R49	RES SMD 5.1k Ω 1% 1/10W 0603	Panasonic Electronic Components	ERJ-3EKF5101V
35	2		R50,R54	RES SMD 10kΩ 1% 1/10W 0603	Panasonic Electronic Components	ERJ-3EKF1002V
36	1		R56	RES SMD 0Ω JUMPER 1/4W 0603	Vishay Dale	CRCW06030000Z0EA
37	1		R52	RES SMD 5.1Ω 1% 1/8W 0805	Panasonic Electronic Components	ERJ-6RQF5R1V
38	8		R88,R89,R90,R91,R92,R93,R94, R95	RES SMD 2.2MΩ 1% 1/4W 1206	Vishay Dale	CRCW12062M20FKEA
39	6		R96,R97,R98,R99,R102,R103	RES SMD 232kΩ 1% 1/4W 1206	Panasonic Electronic Components	ERJ-8ENF2323V
40	1		R100	RES SMD 200Ω 1% 3/4W 2010	Vishay Dale	CRCW2010200RFKEF
41	1		R101	RES SMD 2.2Ω 5% 1/3W 1206	Stackpole Electronics Inc.	RPC1206JT2R20
42	1		T1	Flyback Transformer 3.2mH	Kunshan Eagerness Electronics Co., Ltd	PQ20401-802 A
43	1		U1	IC REG CTRLR FLYBK ISO 750IC	Texas Instruments	UCC28740D
44	1		U9	IC VREF SHUNT ADJ SOT23-3	Nexperia USA Inc.	TL431AQDBZR,215
45	1		U11	OPTOISOLATR 5KV TRANSISTOR 4-SOP	Vishay Semiconductor Opto Division	TCLT1003



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