



***100-W Universal Line Input PFC
Boost Converter Using the
UCC28051***

User's Guide

DYNAMIC WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 85 V_{AC} to 265 V_{AC}.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 50°C. The EVM is designed to operate properly with certain components above 50°C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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Power Supply Control Products

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1 Introduction

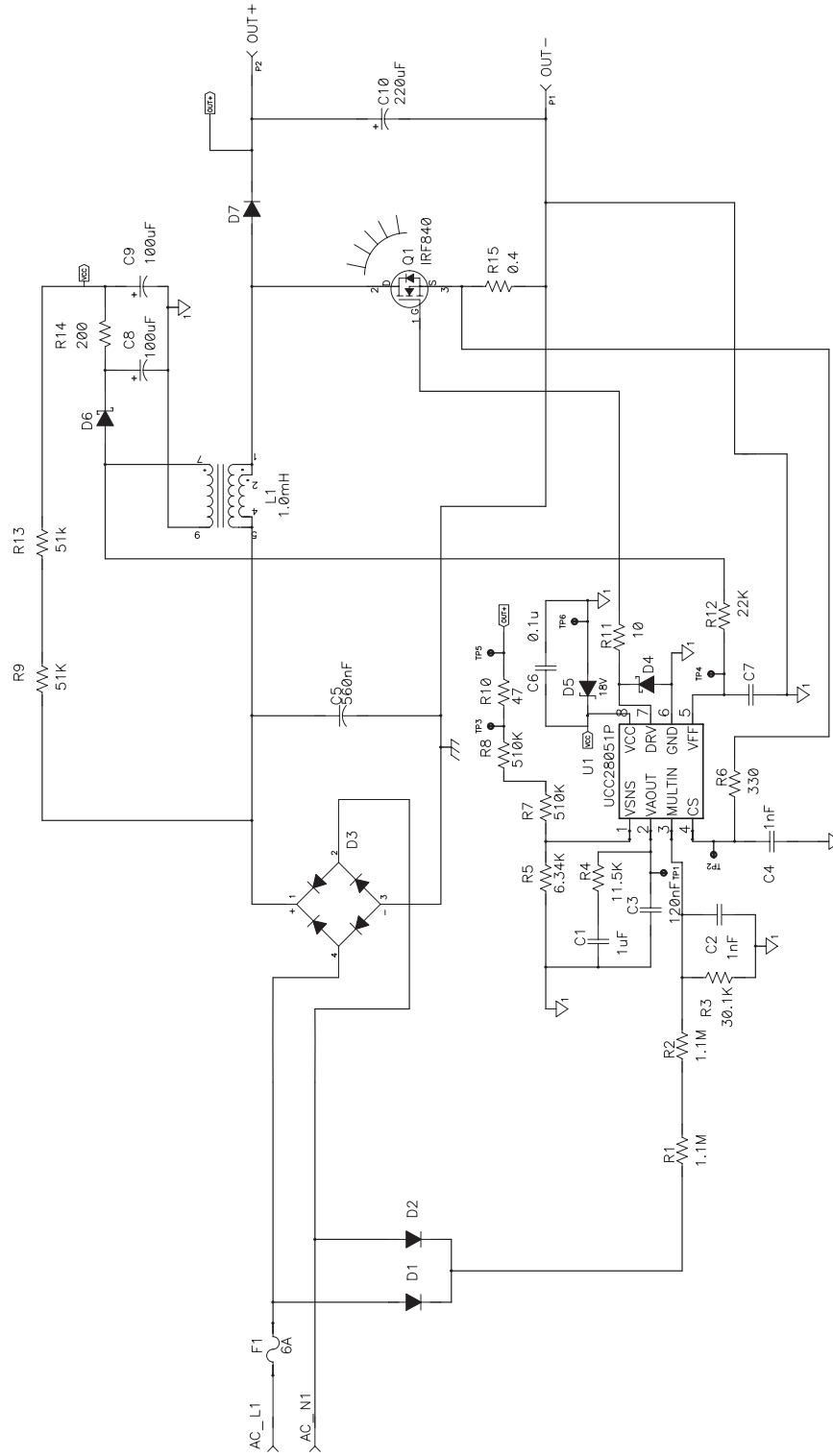
The UCC28051 reference design is a 100-W offline ac-to-dc voltage converter with power factor correction (PFC). The power module was designed to show how the UCC28051 could be configured in an off line power factor corrected preregulator. The module was design to operate over a universal input range of 85 V to 265 V with a 400-V dc regulated output.

For this design to function correctly the output needs a minimum load of 25 W.

2 Caution

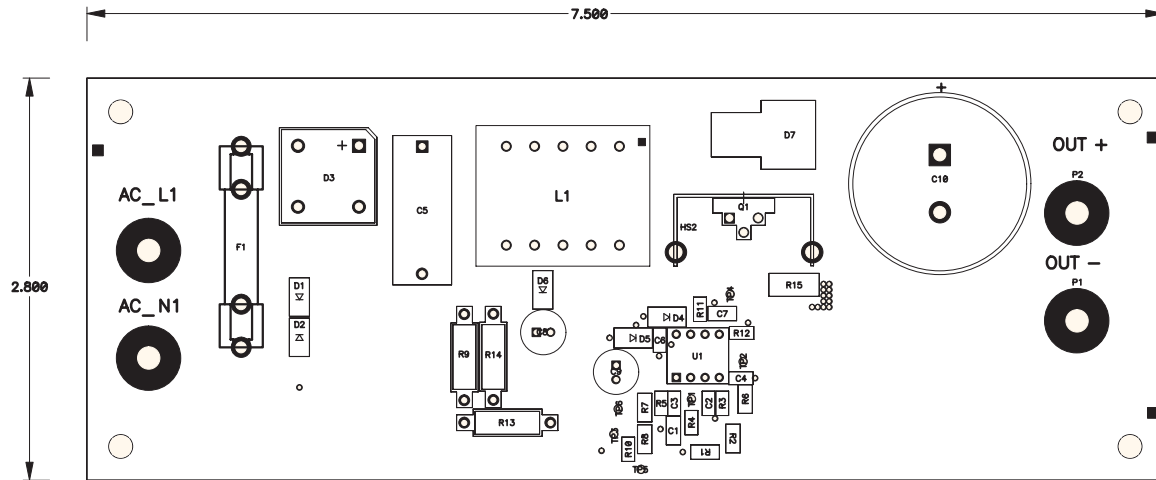
High-voltage levels are present on the evaluation module whenever it is energized. Proper precautions must be taken when working with this power module. The output has a large energy storage capacitor and must be completely discharged before the module can be handled. Serious injury can occur if proper safety precautions are not followed.

3 Schematic



During normal operation, some circuit components may have voltages in excess of 75 V dc and 85 V ac.

4 Reference Design Layout



5 Electrical Characteristics

	MIN	TYP	MAX	UNITS
V _{IN}	85		265	V _{RMS}
Output	375	400	425	V
Output Power	25		100	W
Output Ripple			10	V

6 Reference Design Performance

The following figures show the reference design's performance.

NOTE: To achieve these results requires a 560- μ H differential mode EMI filter. The data was taken with an ac source to achieve reliable results. If a variable transformer, (VARIAC), ac source is used the performance of the converter will look better than these results do to the high inductance of the VARIAC.

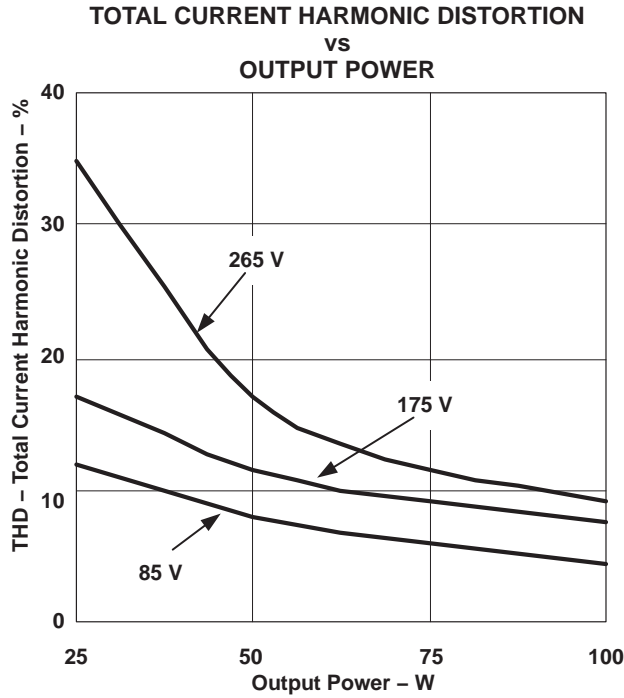


Figure 1

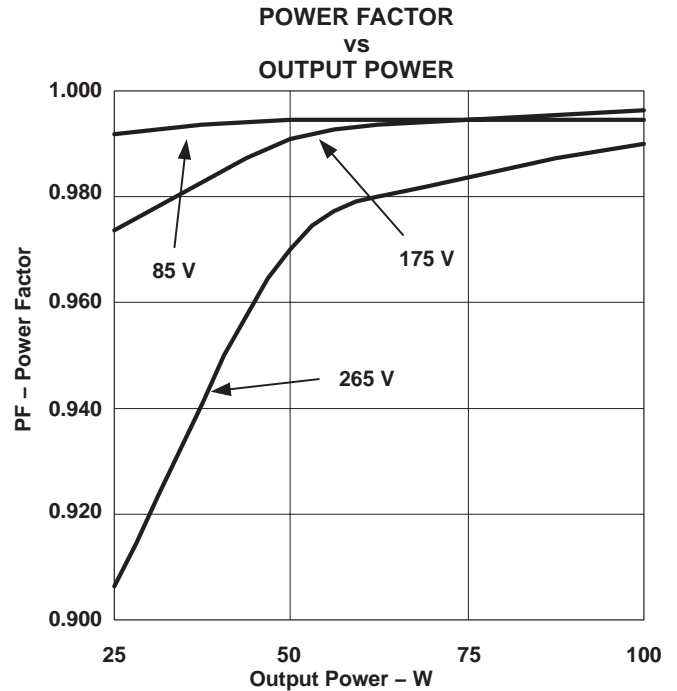


Figure 2

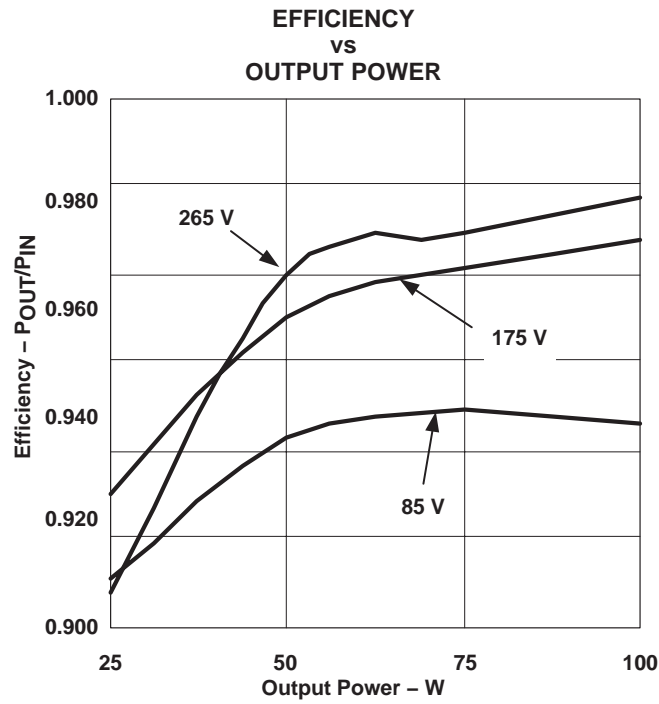


Figure 3

The following graphs show the input current and rectified line for the power module.

- Channel 3 = Rectified Line Voltage
- Channel 4 = Power Module Input Current

$V_{IN} = 85\text{ V}, P_{OUT} = 100\text{ W}$

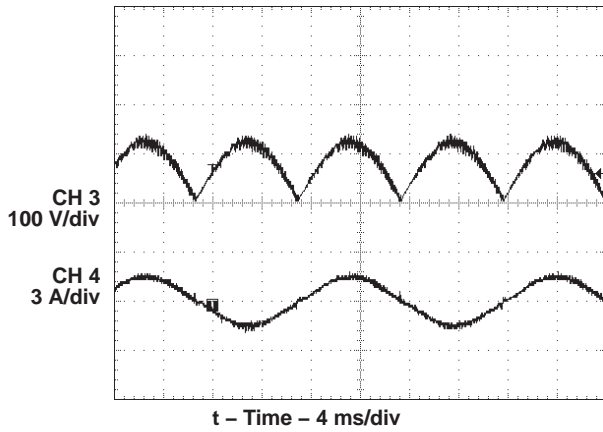


Figure 4

$V_{IN} = 265\text{ V}, P_{OUT} = 100\text{ W}$

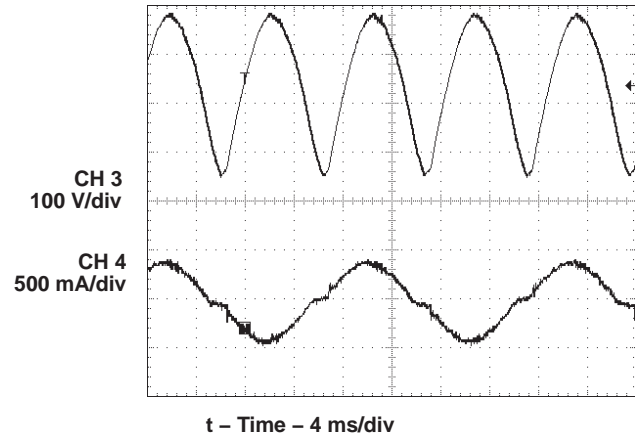


Figure 5

$V_{IN} = 85\text{ V}, P_{OUT} = 25\text{ W}$

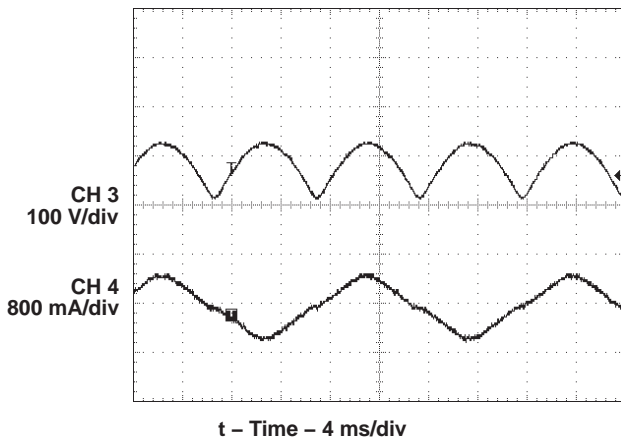


Figure 6

$V_{IN} = 265\text{ V}, P_{OUT} = 25\text{ W}$

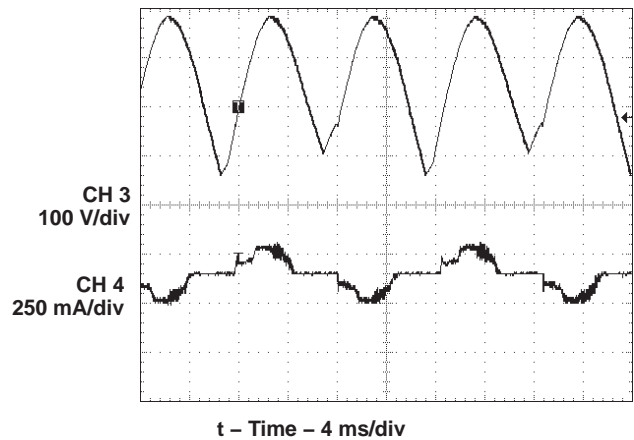


Figure 7

7 List of Materials

	Reference	Qty	Description	Manufacturer	Part Number
Connector	AC_L1, OUT+	0	Binding post, insulated, for standard banana plug, black, 15 A, 0.425 in dia	Johnson	111-0703-001
	AC_N1, OUT-	0	Binding post, insulated, for standard banana plug, red, 15 A, 0.425 in dia	Johnson	111-0703-001
Capacitor	C1	1	1 μ F, 16 V, X7R, 10%, 1206	Yageo America	12062R105K7BB0D
	C10	1	Aluminum electrolytic, 220 μ F, 450 V, 1.18 in dia * 1.575 in	Panasonic	ECO-S2WB221DA
	C2, C4	2	Ceramic, 1 nF, 50 V, X7R, 10%, 805	Panasonic	ECJ-2VB1H102K
	C3	1	Ceramic, 0.12 μ F, 25 V, X7R, 10%, 805	Panasonic	ECJ-2YB1E124K
	C5	1	Polyester, 0.47 μ F, 630 V, 10%, 0.885 in x 0.370 in	Panasonic	ECQ-E6474KF
	C6	1	Ceramic, 0.100 μ F, 50 V, X7R, 10%, 805	Yageo America	08052R104K9BB0D
	C7	1	Ceramic, 18 PF, 50 V, NPO, 5%, 1206	Panasonic	1206CG180J9B200
	C8, C9	2	Aluminum, 100 μ F, 35 V, 20%, 0.2	Panasonic	EEU-FC1V101
Diode	D1, D2	2	Standard rectifier, 1.5 A, 600 V, SMA	Vishay	BYG10J
	D3	1	Bridge rectifier, 6 A, 600 V, GBJ series	General Semiconductor	PB66
	D4	1	Schottky, 1.5 A, 25 V, SMA	Vishay	BYS10-25
	D5	1	Zener, 1 W, 18 V, SMA	Diodes Inc.	SMAZ18-13
	D6	1	Schottky, 1.5 A, 90 V, SMA	Vishay	BYS11-90
	D7	1	Ultra fast, 8 A, 600 V, D2PAK	International Rectifier	HFA08TB60S
Fuseholder	F1	1	1/4 fuses	Littlefuse	FC-250-A-MT
Heatsink	HS1	1	TO-220, Vertical mount, 15°C/W, 0.5x0.95in.	Avvid	593002B33402-ND
PFC inductor	L1	1	2.02x1.90in.	Cooper Electronics Technologies	CTX16-15954
MOSFET	Q1	1	N-channel, 500 V, 8 A, TO-220AB	International Rectifier	IRF840

	Reference	Qty	Description	Manufacturer	Part Number
Resistor	R1, R2	2	Chip, 1.1 M Ω , 1/8 W, 5%, 1206	Panasonic	ERJ-8GEYJ115V
	R10	1	Chip, 47 Ω , 1/10 W, 1%, 805	Panasonic	ERJ-6GEYJ470V
	R11	1	Chip, 10 Ω , 1/10 W, 1%, 805	Susumu Co Ltd	RL1220S-100-F
	R12	1	Chip, 22 k Ω , 1/10 W, 1%, 805	Yageo America	9C08052A2202FKHFT
	R14	1	Wirewound, 200 Ω , 1 W, 1%, 0.130 * 0.600"	Huntington Electric Inc.	ALSR-1-200-1%
	R15	1	Chip, 0.4 Ω , 1 W, 1%, 2512	Vishay	WSL2512 0.4ohm 1% B43
	R3, R4	2	Chip, 30.1 k Ω , 1/8 W, 1%, 805	Yageo America	9C08052A3012FKHFT
	R5	1	Chip, 6.34 k Ω , 1/8 W, 1%, 805	Yageo America	9C08052A6341FKHFT
	R6	1	Chip, 330 Ω , 1/4 W, 1%, 1206	Yageo America	9C12063A3300FKHFT
	R7, R8	2	Chip, 510 k Ω , 1/4 W, 1%, 1206	Yageo America	9C12063A5103FKHFT
	R9, R13	2	Metal Film, 51 k Ω , 1 W, 5%, 0.130 in * 0.600	BC Components	5073NW51K00J12AFX
	SH1	1	This part is designed to be used for keeping gnds sepearate when laying out PCB's.		
Test Point	TP1, TP2, TP3, TP4, TP5, TP6	0	Jack, circle	Farnell	240-3xx
IC	U1	1	Advanced Transistion Mode PFC Controller, DIP8	Texas Instruments	UCC28051P

- NOTES:
1. These assemblies are ESD sensitive, ESD precautions shall be observed.
 2. These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.
 3. These assemblies must comply with workmanship standards IPC-A-610 Class 2.
 4. Ref designators marked with an asterisk (***) cannot be substituted. All other components can be substituted with equivalent MFG's components.

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