EVM3683-20-MN-00B

2.7V to 16V, 15A, Step-Down Power Module Evaluation Board

DESCRIPTION

The EVM3683-20-MN-00B evaluation board is designed to demonstrate the capabilities of the MPM3683-20, a fully integrated, step-down, DC/DC power module with 15A of continuous current.

The MPM3683-20 features a configurable soft-start time (t_{SS}) with one capacitor. An open-drain power good (PG) signal indicates whether the output voltage (V_{OUT}) is within the nominal voltage range. Full protection features include short-circuit protection (SCP), over-current protection (OCP), under-voltage protection (UVP), and over-temperature protection (OTP).

It is recommended to read the MPM3683-20 datasheet prior to making any changes to the EVM3683-20-MN-00B.

PERFORMANCE SUMMARY (1)

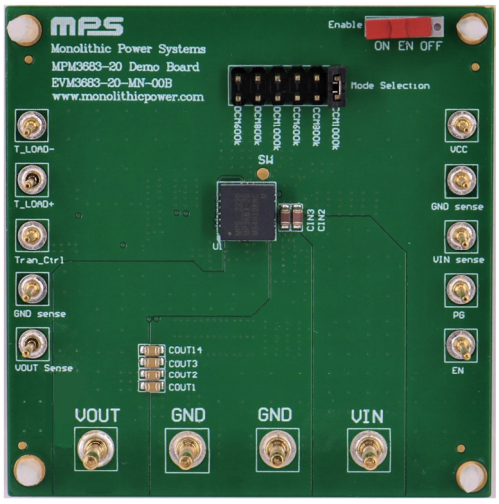
Specifications are at T_A = 25°C, unless otherwise noted.

Parameters	Conditions	Value
Input voltage (V_{IN}) range	2.7V to 16V with external 3.3V V_{CC}, 4V to 16V with internal or external V_{CC}	2.7V to 16V
Output voltage (V_{OUT})	Default configuration	V_{OUT} = 1.2V
Maximum output current (I_{OUT})	V_{IN} = 2.7V to 16V	15A
Typical efficiency	V_{IN} = 5V, V_{OUT} = 1.2V, I_{OUT} = 15A, f_{SW} = 1MHz	85.26%
Peak efficiency	V_{IN} = 5V, V_{OUT} = 1.2V, I_{OUT} = 8A, f_{SW} = 1MHz	88.13%
Switching frequency (f_{SW})	Default configuration	1MHz

Note:

1) For different input/output voltage specifications with different output capacitors, the application circuit parameters may require changes.

EVALUATION BOARD



(LxWxH) 5.1cmx5.1cmx1.6mm

Board Number	MPS IC Number
EVM3683-20-MN-00B	MPM3683GMN-20

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QUICK START GUIDE

The EVM3683-20-MN-00B evaluation board is designed to evaluate the performance of the MPM3683-20. Refer to Figure 1 and follow the steps below to quickly set up the board:

1. Preset the power source (V_{IN}) between 4V and 16V. (2)
2. Turn the power source off.
3. Connect the power source terminals to:
   a. Positive (+): VIN
   b. Negative (-): GND
4. Connect the load terminals to: (3)
   a. Positive (+): VOUT
   b. Negative (-): GND
5. After making the connections, turn on the power supply. The board should automatically start up.
6. Check for the proper output voltage (V_{OUT}) from the VOUT_SENSE and GND_SENSE turrets.
7. Once the proper V_{OUT} is established, adjust the load within the operating range and measure the efficiency, output ripple voltage, and other parameters. When measuring the output voltage ripple and input voltage ripple, do not use the long ground lead on the oscilloscope probe.

Notes:

2) Make sure that the input voltage does not exceed 16V.
3) The initial load should be set to 0A.

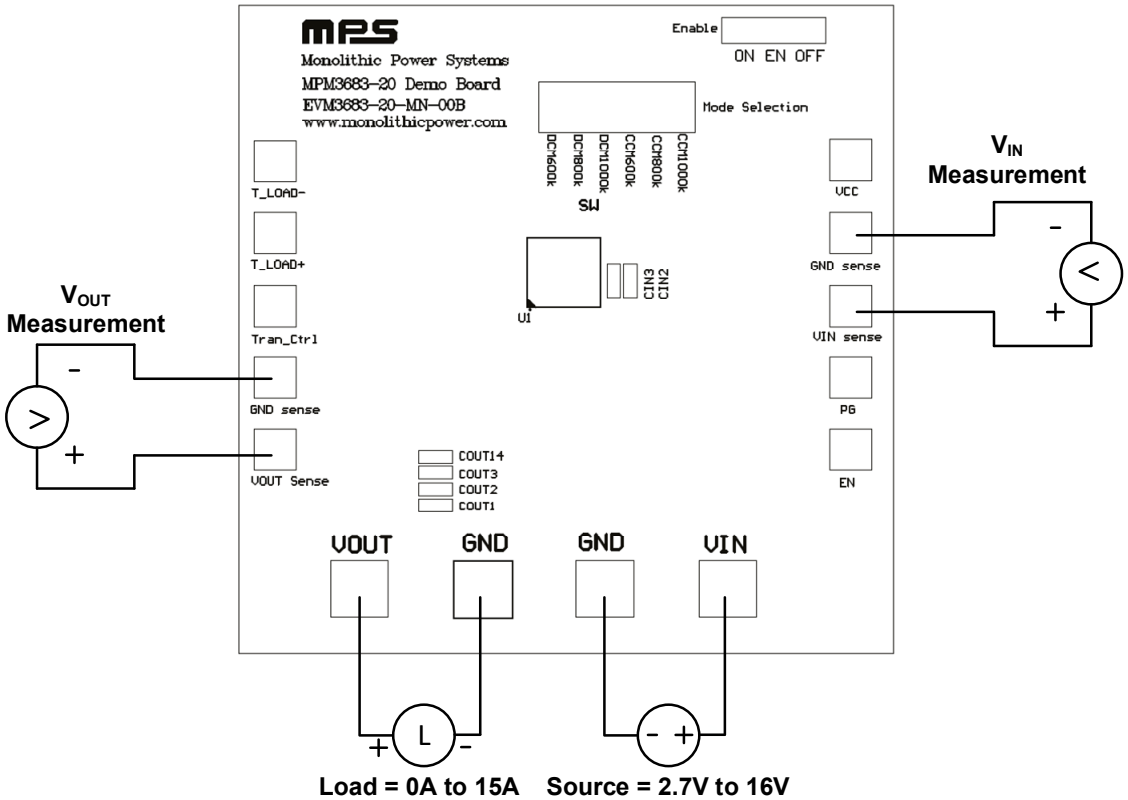

Figure 1: Measurement Equipment Set-Up

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EVALUATION BOARD SCHEMATIC

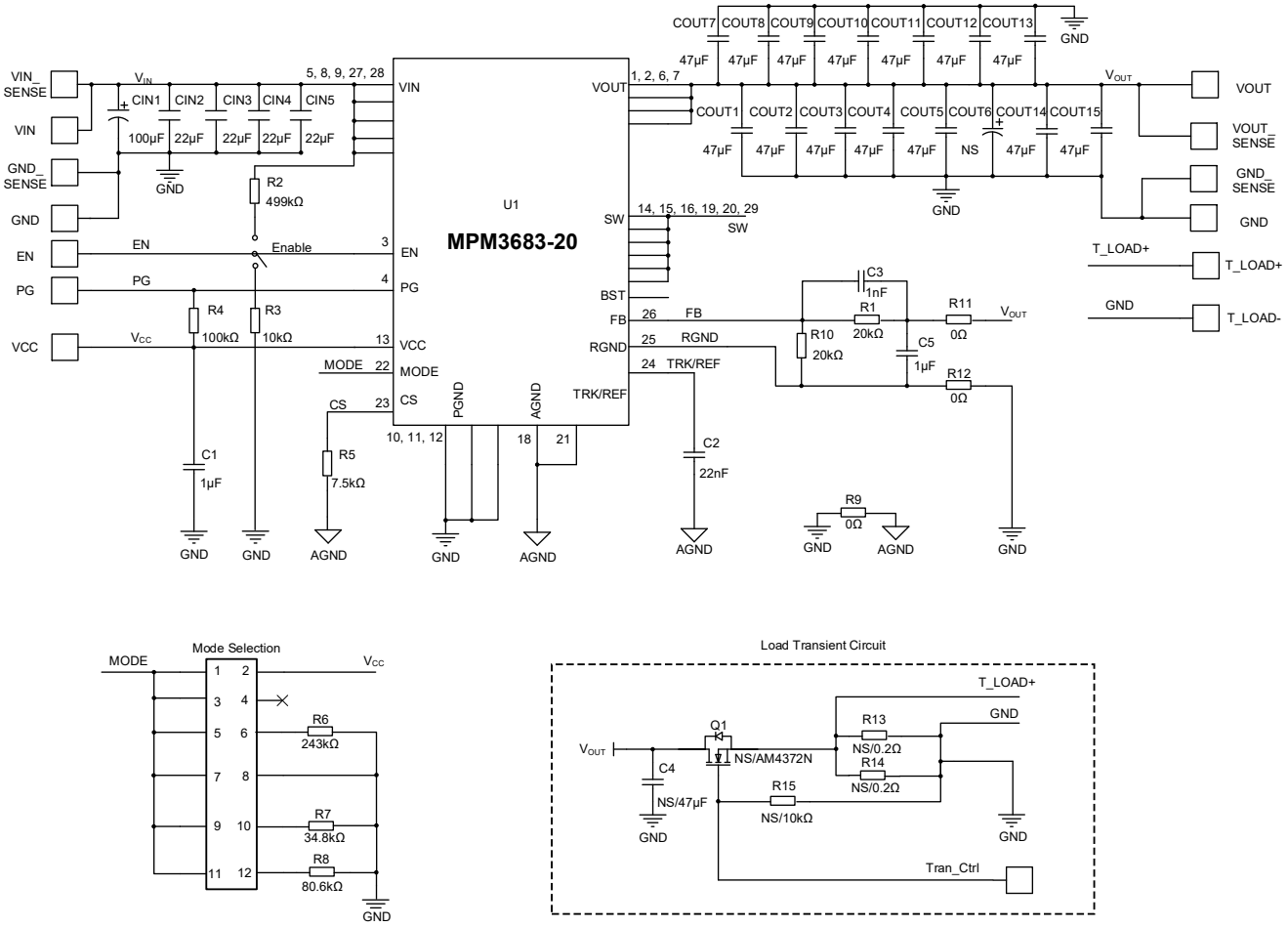

Figure 2: Evaluation Board Schematic

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EVM3683-20-MN-00B BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
1	CIN1,	100µF	Capacitor, 100µF, 35V	SMD	Nippon Chemi-Con	EMZJ350ADA101MF80G
4	CIN2, CIN3, CIN4, CIN5	22µF	Ceramic capacitor, 25V, X5R	0805	Murata	GRM21BR61E226ME44L
14	COUT1, COUT2, COUT3, COUT4, COUT5, COUT7, COUT8, COUT9, COUT10, COUT11, COUT12, COUT13, COUT14, COUT15	47µF	Ceramic capacitor, 10V, X5R	0805	Murata	GRM21BR61A476ME15L
0	C4, COUT6	NS				
2	C1, C5	1µF	Ceramic capacitor, 16V, X5R	0603	Wurth	885012106017
1	C2	22nF	Capacitor, X7R, 16V	0603	Wurth	885012206042
1	C3	1nF	Ceramic capacitor, 50V, X7R	0603	Wurth	885012206083
1	R2	499kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07499KL
1	R3	10kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0710KL
1	R4	100kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07100KL
1	R5	7.5kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-077K5L
1	R6	243kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-07243KL
1	R7	34.8kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0734K8L
1	R8	80.6kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0780K6L
3	R9, R11, R12	0Ω	Film resistor, 1%	0603	Yageo	RC0603FR-070RL
2	R1, R10	20kΩ	Film resistor, 1%	0603	Yageo	RC0603FR-0720KL
0	R13, R14, R15	NS				
0	Q1	NS				
1	Mode Selection	12 pins	12-pin, double-row, straight header	DIP	Wurth	61301221121
1	U1	MPM3683-20	2.7V to 16V, 15A step-down power module	FCM LGA-29 (7mmx 7mmx 4.4mm)	MPS	MPM3683GMN-20
1	Enable	Switch	Slide switch, on-on, vertical type, THT, bulk	DIP	Wurth	450301014042
4	VIN, GND, VOUT	Φ2.0	Φ2.0 copper pin	DIP	Any	Any

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EVM3683-20-MN-00B BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
10	T_LOAD, T_LOAD+, TRAN_CTRL, GND_SENSE, VOUT_SENSE, EN, PG, VIN_SENSE, VCC	φ1.0	φ1.0 copper pin	DIP	Any	Any

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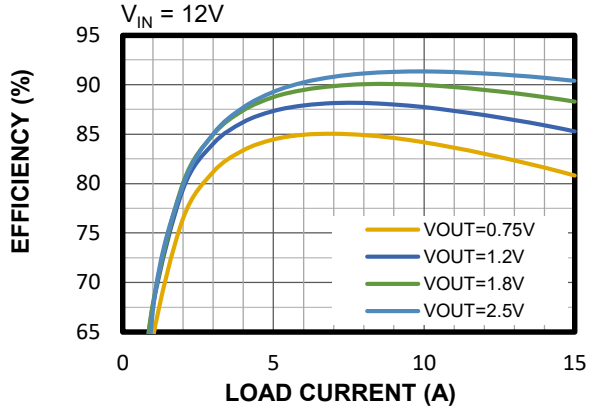
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, V_{OUT} = 1.2V, C_{OUT} = 10 x 47µF ceramic capacitor and 220µF electrolytic capacitor, FCCM, f_{SW} = 1000kHz, T_A = 25°C, unless otherwise noted.

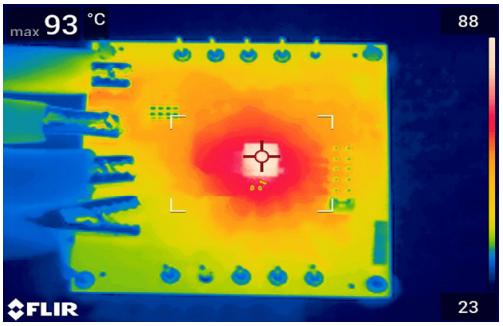
Efficiency vs. Load Current

V_{IN} = 12V



Thermal Rise

I_{OUT} = 15A, TA = 23°C



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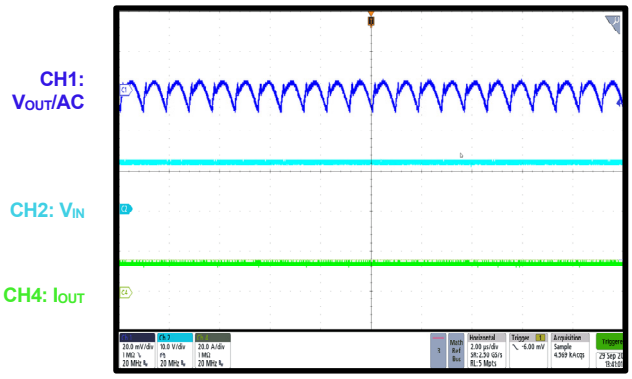
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. V_{IN} = 12V, V_{OUT} = 1.2V, C_{OUT} = 10 x 47µF ceramic capacitor and 220µF electrolytic capacitor, FCCM, f_{SW} = 1000kHz, T_A = 25°C, unless otherwise noted.

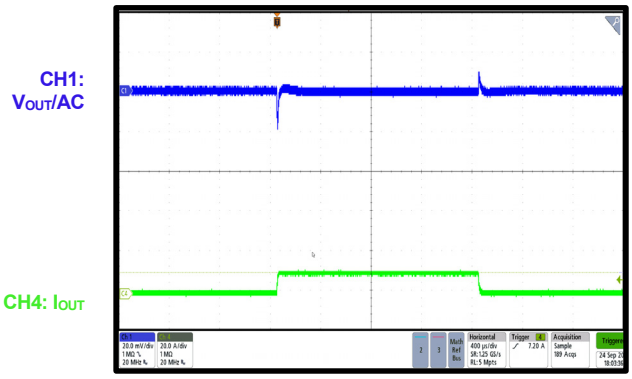
Steady State and Output Ripple

I_{OUT} = 15A



Load Transient Output Ripple

I_{OUT} = 0A to 10A, slow rate = 2.5A/µs e-load,
C_{FF} = 1nF



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PCB LAYOUT

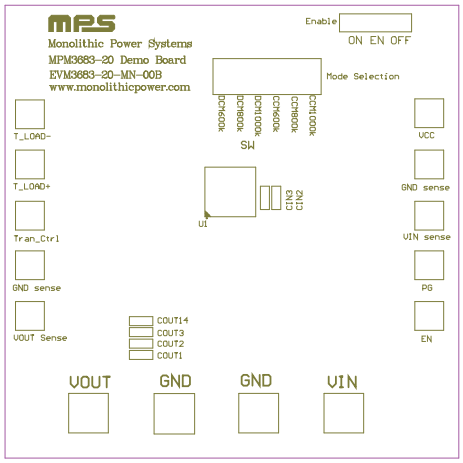

Figure 3: Top Silk

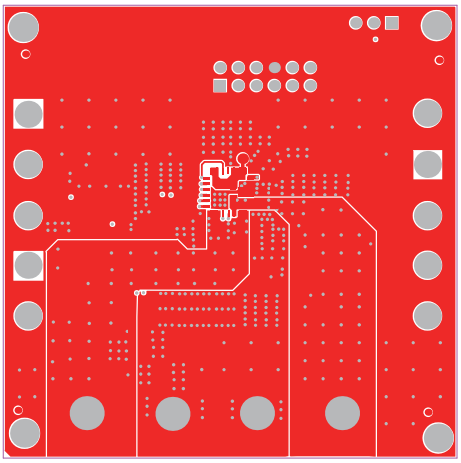

Figure 4: Top Layer

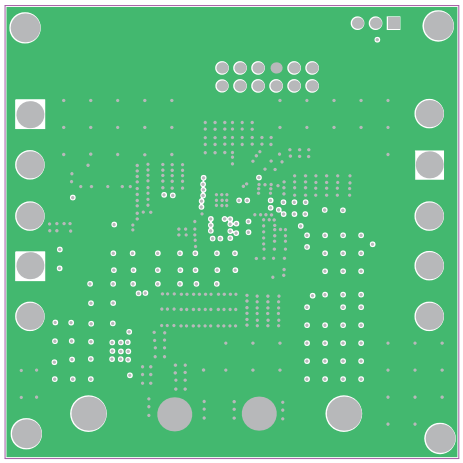

Figure 5: Mid-Layer 1

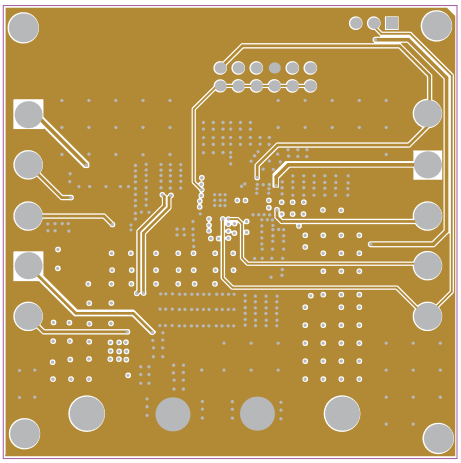

Figure 6: Mid-Layer 2

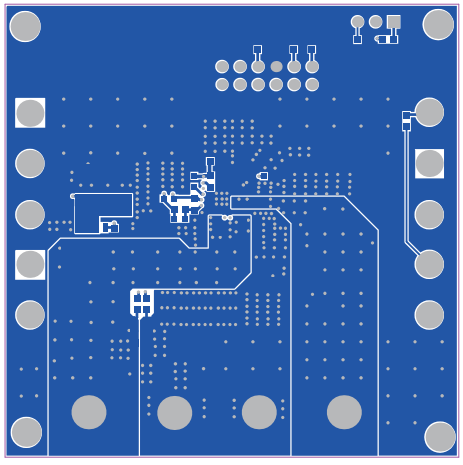

Figure 7: Bottom Layer

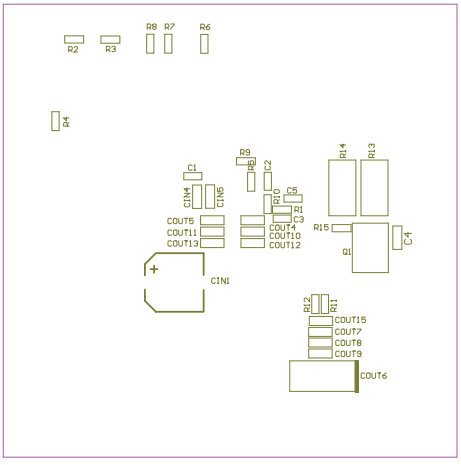

Figure 8: Bottom Silk

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REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	12/8/2022	Initial Release	-

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