

EVM3695-25-RF-03B 16V, 40A, Scalable

DC/DC Power Module Demo

The Future of Analog IC Technology

NOT RECOMMENDED FOR NEW DESIGNS, REFER TO EVM3695-20-PJ-00A

DESCRIPTION

EVM3695-25-RF-03B is a high efficiency, high power density 40A synchronous step-down power converter, featuring MPM3696-25 in parallel. The input range is from 4.5V to 16V. Providing the external 3.3V supply to VCC pin can extend the operation range from 3V to 16V. The output voltage is adjustable from 0.5V to 5.5V, with default at 1.8V. The EVM3695-25-RF-03B can output up to 40A continuously/50A peak load current.

The EVM3695-25-RF-03B has two MPM3695-25 on the board. MPM3695-25 is a scalable, 16V, 20A step-down power modules with PMBus interface. It adopts MPS's proprietary multi-phase constant-on-time (MCOT) control structure which can provide ultra-fast transient responses, and simple loop compensation. The integrated PMBus interface provides flexible power management functions, including setting output voltage, switching frequency, fault management, timing control, and provide telemetry read back. For more details, please check MPM3695-25 datasheet. The EVM3695-25-RF-03B size is 85mm x 90mm. The total solution resides in a 15mm x 21mm area, top and bottom side. The board also provides on-board load transient circuit and SMA connector, to easily measure the voltage ripple and load transient performances.

To fully explore the digital functions of the board, the EVKT-USBI2C-02 and the Virtual Bench Pro 3.0 GUI is needed. Please contact MPS for more information.

Get EVKT-3695-25-RF-03B

| # | Part Number | Item | Qty | Required |
|---|------------------------|--------------------------|-----|--------------|
| 1 | EVM3695-25-RF-03B* | MPM3695-25 Demo board | 1 | \checkmark |
| 2 | EVKT-USBI2C-02* | USB to PMBus Dongle | 1 | √** |
| 3 | MPM3695GRF-25- 2222 | 2pcs Power Module | 2 | \checkmark |

*Datasheet is available. Please contact MPS

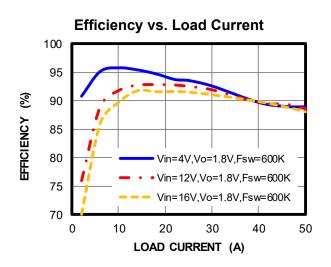
**Only required if the customer does not have these MPS USB Dongle.

EVM3695-25-RF-03B DEMO BOARD



| (L × W) 85mn | א י 90mm |
|--------------|----------|
|--------------|----------|

| Board Number | MPS IC Number | | |
|-------------------|--------------------|--|--|
| EVM3695-25-RF-03B | MPM3695GRF-25-2222 | | |



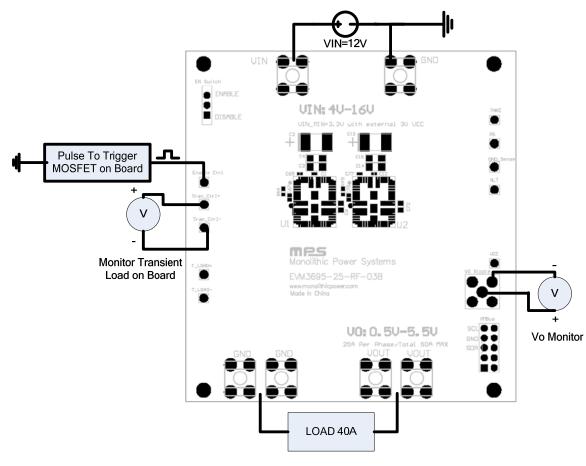


PERFORMANCE SUMMARY

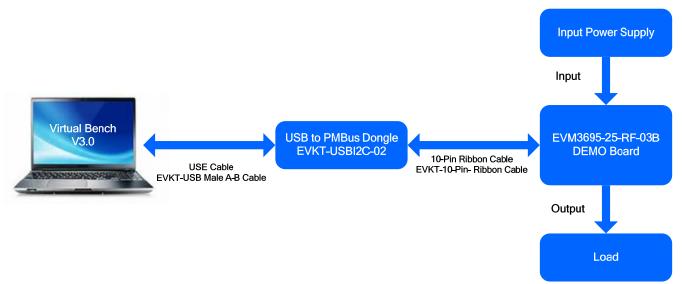
| PARAMETER | CONDITIONS | VALUE |
|------------------------|----------------------------------|---------------|
| Innut Voltago Dongo | No external VCC | 4V to 16V |
| Input Voltage Range | With external 3.3V VCC | 3V to 16V |
| Output Voltage Range | VIN=4V to 16V | Default: 1.8V |
| Maximum Output Current | VIN=4V to 16V, VOUT=0.5V to 3.3V | 50A Peak |
| Typical Efficiency | VIN=12V, VOUT=1.8V, IOUT=40A | 89.70% |
| Peak Efficiency | VIN=12V, VOUT=1.8V, IOUT=20A | 92.50% |
| Default SW Frequency | Pre-Rail | 600kHz |

QUICK START

- 1. Connect the positive and negative terminals of the load to the VOUT and GND pins.
- 2. Preset the power supply output between 4V and 16V, and then turn off the power supply.
- 3. Connect the positive and negative terminals of the power supply to the VIN and GND pins.
- 4. Turn the power supply on. The board will automatically start up.



USE VIRTUAL BENCH PRO 3.0 TO EVALUATE DEMO



- 1. Connect PMBus wires to EVB and click the 'Virtual Bench Pro.exe', GUI will auto scan deceive:
- 2. When the part is found, the PN will be shown. The GUI allow user modify the internal parameters; please refer to the register details in IC datasheet.

On the right side, user can read the VOUT, IOUT, Temperature and other parameters.

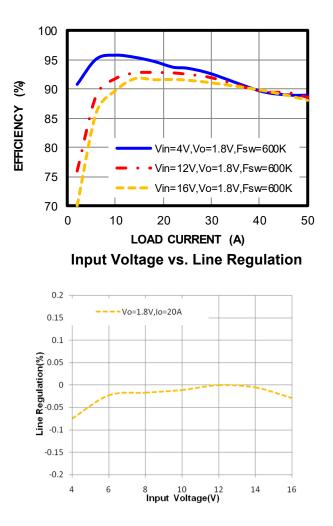
| Virtual Bench Pro | | | | | | | |
|-------------------------|-------------------------------|--------------------------|---------------|-------------------|----------------------|-----------------------|--|
| File View Configuration | Tools Help | | | | | | |
| 🎼 🔒 🕒 📄 I | 🖳 🕑 💽 💽 🕑 🚱 | ≼ 😂 🚦 | | | | | |
| System 💌 🗭 🗙 | Register Map | | | Monitor | | - ↓ × | Fault ▼ ♯ X |
| ▲ System | MPM3695_250x30:CH0 | | • 9 | Input Voltage | 12.3 | V | VIN_OV_FAULT |
| MPM3695_25(3 CH0 | Quick Setting | PWM | Current | Output Voltage | 1.7525 | V | VIN_OV_WARN |
| | Compensation | | liming | Output Current | 10.875 | A | VIN_UV_WARN |
| | Temperature | 7 | Misc | Temperature | 30 | °C | State On |
| | All | Operation | Voltage | 1710.4 | | 2 2 2 22 | VOUT_OV_FAULT |
| | OPEARTION | | * | 1.748 | | * | New yorks in the second s |
| | OPEARTION | ON[0x80] | • | 1.744 | | | VOUT_UV_FAULT |
| | | | E | 24 28 32 36 40 44 | 48 52 56 60 64 68 72 | 76 80 84 88 | IOUT_OC_WARNING |
| | MFR_CTRL_VOUT | | | | | | IOUT_OC 🏾 🐣 |
| | Vo discharge | No active[0b0] | • | | | Iout | OT_FAULT 🐣 |
| | PG delay | 1ms[0b0000] | | 11.2 | | | OT_WARNING 🏾 🌑 |
| | PG delay | Tuestopooool | | 11 | | | Invalid_Command 🌰 |
| | Vout Range | External divier(0.5~0.67 | 2V)[0b00] | | | | Invalid_Data 🛛 🌏 |
| | VOUT MARGIN HIGH | | | 10.8 10.7 | | | |
| | | | | 34.5 | | | |
| | VOUT_MARGIN_HIGH | 112 | %VOUT_COMMAND | 24 28 32 36 40 44 | 48 52 56 60 64 68 72 | 76 80 84 88 | |
| | | | | 24 20 32 30 40 44 | 40 52 50 00 04 00 72 | | |
| | ◇ VOUT_COMMAND | | | 52 | C | | |
| | VOUT_COMMAND | 1.8 | V | | E | Temperature | |
| | | | | 30 | Λ. | | |
| | | | | | | •••• | |
| | VOUT_SCALE | 0.333 | | 28 | | | |
| | | | | | | | |
| | → MFR_CTRL_OPS | | |) > <u>1</u> | 48 52 56 60 64 68 72 | | |
| | SWITCHING_FREQUEN | CY 600KHz[0b01] | • | 24 28 32 36 40 44 | 48 52 56 60 64 68 72 | 76 80 84 88 * Stop | |
| | * | | · · · | | | stop | |
| < <u> </u> | | | | Monitor Register | | | < ► |

EVB TEST RESULTS

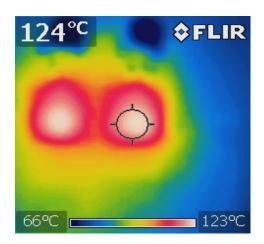
 V_{IN} = 12V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.

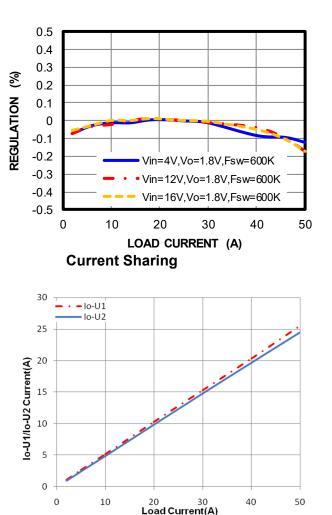
Efficiency vs. Load Current

Regulation vs. Load Current



VIN = 12V, VOUT = 1.8V, IO=40A, TA = 25°C



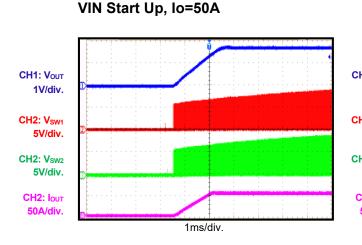


EVM3695-25-RF-03B 16V, 40A, SCALABLE DC/DC POWER MODULE WITH PMBUS

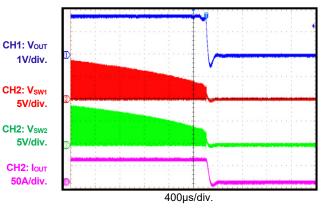
NOT RECOMMENDED FOR NEW DESIGNS, REFER TO EVM3695-20-PJ-00A

EVB TEST RESULTS (Continued)

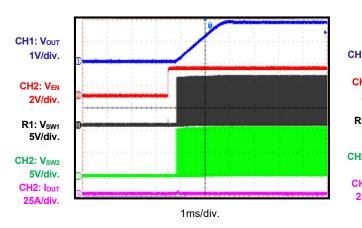
 V_{IN} = 12V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.



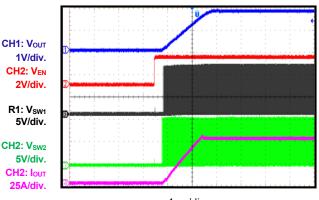
VIN Shutdown, Io=50A





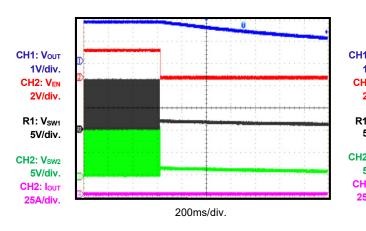


EN Start Up, Io=50A

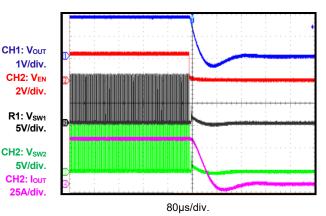


1ms/div.





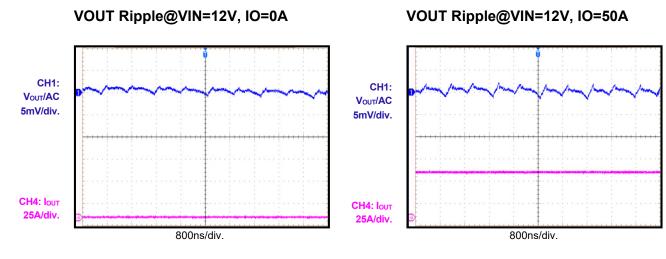
EN Shutdown, Io=50A



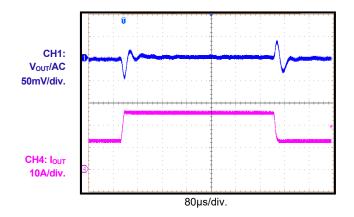


EVB TEST RESULTS (Continued)

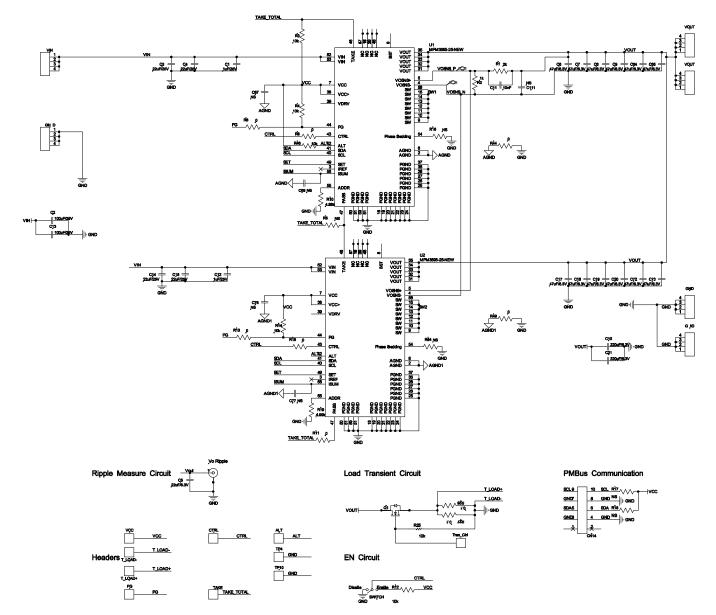
 V_{IN} = 12V, V_{OUT} = 1.8V, T_A = 25°C, unless otherwise noted.



Load Transient @ 25%-50%,2.5A/us



EVM3695-25-RF-03B SCHEMATIC



| Qty | RefDes | Value | Description | Package | Manufacturer | Manufactuer_P/N |
|-----|--|------------|---------------------------|---------|---------------------|--------------------|
| 4 | C3, C4, C14, C15 | 22µF | Ceramic Cap., 25V,X7R | 1206 | Murata | GRM31CR61E226KE15L |
| 2 | C1, C12 | 1µF | Ceramic Cap., 25V,X5R | 0402 | Murata | GRM155R61E105KA12D |
| 1 | C11 | 10nF | Ceramic Cap., 25V,X7R | 0603 | WE | 885012206065 |
| 13 | C5, C6, C7, C8, C9, C17, C18, C19, C20, C64, C65, C72, C73 | 47µF | Ceramic Cap., 10V,X5R | 0805 | Murata | GRM21BR61A476ME15L |
| 2 | C10, C21 | 220µF | Tantalum cap., 6.3V | D2 | Panasonic | EEFCX0J221R |
| 2 | C2, C13 | 100µF | 100µF/35V | SMD | NIPPON CHEMI-CON | EMZJ350ADA101MF80G |
| 6 | R3, R4, R12, R14, R25, R46 | 10K | Film Res, 1%,0603,10K | 0603 | YAGEO | RC0603FR-0710KL |
| 2 | R10, R19 | 4K99 | Film Res, 1%,0603,4K99 | 0603 | YAGEO | RC0603FR-074K99L |
| 7 | R6, R8, R11, R13, R15, R44, R49 | 0R | Film Res, 1%,0603,0R | 0603 | YAGEO | RC0603FR-070RL |
| 1 | R1 | 2k | Film Res, 1%,0603,2K | 0603 | YAGEO | RC0603FR-072KL |
| 1 | R2 | 1k | Film Res, 1%,0603,1K | 0603 | YAGEO | RC0603FR-071KL |
| 2 | U1, U2 | MPM3695-25 | 20A power module | QFN | MPS | MPM3695GRF-25-2222 |

EVM3695-25-RF-03B POWER BOM

mps

EVM3695-25-RF-03B OPTIONAL AND TERMINALS

| Qty | RefDes | Value | Description | Package | Manufacturer | Manufactuer_P/N |
|-----|-----------|--------|--|--------------|--------------|-----------------|
| 9 | ALT | φ1.0 | φ1.0 copper pin | DIP | N/A | φ1.0 copper pin |
| 1 | Vo Ripple | N/A | 4pin | DIP | N/A | SMA connector |
| 2 | R27. R28 | 0R1 | Film Res,1%,2512,OR 1 | 2512 | YAGEO | RC2512FR-070R1L |
| 1 | Q1 | N-MOS | Mosfet,VDS=30V, IDS=24A,Rds=4. 9mOhm | SOIC- 8PP | AnalogPower | AM7432N |
| 1 | PMBus | ١ | 10pin connector | ١ | ١ | ١ |
| 6 | VIN,GND | ١ | ١ | ١ | Keystone | KEYSTONE7697-75 |
| 1 | SWITCH | SWITCH | Tact Switch,push type,white actuator | SMD | WE | 450301014042 |



PRINTED CIRCUIT BOARD LAYOUT

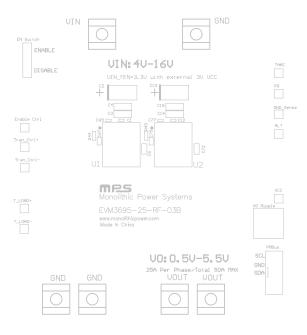


Figure 1: Top Silk Layer

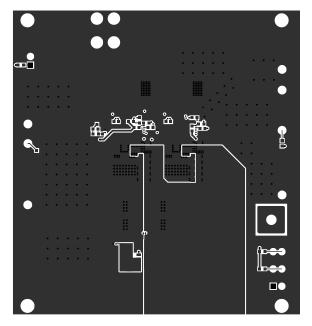


Figure 3: Bottom Layer

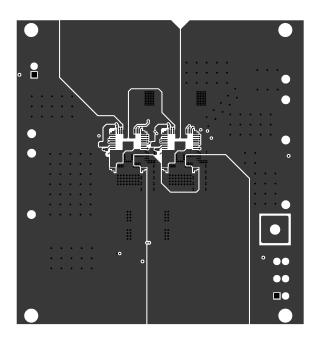


Figure 2: Top Layer

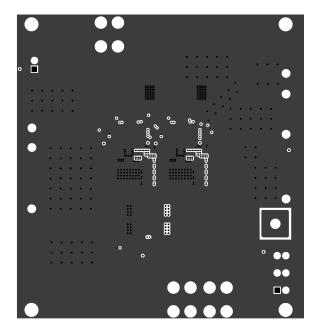


Figure 4: Inner 1 Layer



EVM3695-25-RF-03B 16V, 40A, SCALABLE DC/DC POWER MODULE WITH PMBUS

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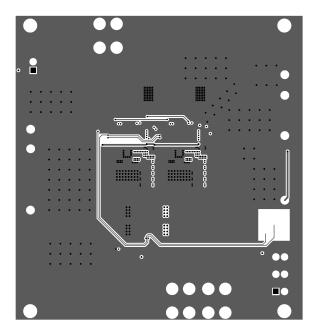


Figure 5: Inner 2 Layer

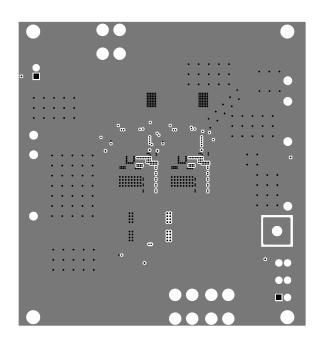


Figure 6: Inner 3 Layer

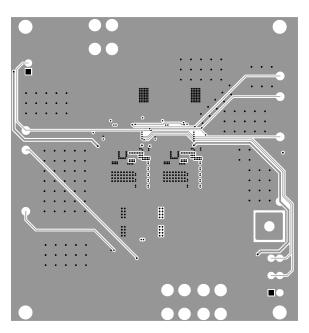


Figure 7: Inner 4 Layer

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