

### DESCRIPTION

MPM3695-25 is a scalable and fully integrated power module with PMBus interface. MPM3695-25 offers a complete power solution that achieves up to 25A peak of output current with excellent load and line regulation over a wide input voltage range. MPM3695-25 operates at a high efficiency over a wide load range and can be paralleled to deliver up to 150A of peak current.

The MPM3695-25 adopts MPS's proprietary, multi-phase constant-on-time (MCOT) control, which provides ultra-fast transient response and simple loop compensation. The PMBus interface provides module configurations and monitoring of key parameters.

MPM3695-25 features full protection functions including over-current protection (OCP), over-voltage protection (OVP), under-voltage protection (UVP), and over-temperature protection (OTP).

MPM3695-25 requires a minimal number of readily available external components and is available in a QFN-59 (10mmx12mmx4mm) package.

### FEATURES

- Wide Input Voltage Range from 3V
  - 3V-16V Input Voltage with External  $V_{CC}$
  - 4V-16V Input Voltage with Internal  $V_{CC}$
- 0.5V to 6V Output Voltage Range
- 20A Continuous Output Current, Peak 25A, Parallel Up to 150A Peak
- Auto-Interleaving for Multi-Phase Operation
- Auto-Compensation with Adaptive MCOT for Ultra-Fast Transient Response
- 0.5% Reference Voltage Over 0°C to +70°C Junction Temperature Range
- True Remote Sense of Output Voltage
- PMBus 1.3 Compliant
- Programmable via PMBus
  - Current Limit
  - Selection of Pulse-Skip Mode or Continuous Conduction Mode (CCM)
  - Soft-Start Time
  - Switching Frequency
  - Fault Limits
- Available in a QFN-59 (10mmx12mmx4mm) Package

### APPLICATIONS

- Telecom and Networking Systems
- Industrial Equipment
- Servers and Computing

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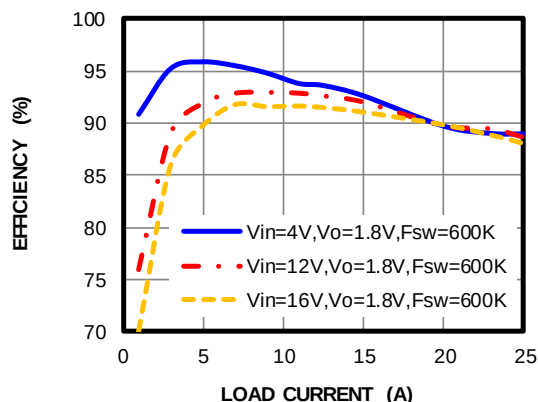
### EVM3695-25-RF-02A DEMO BOARD



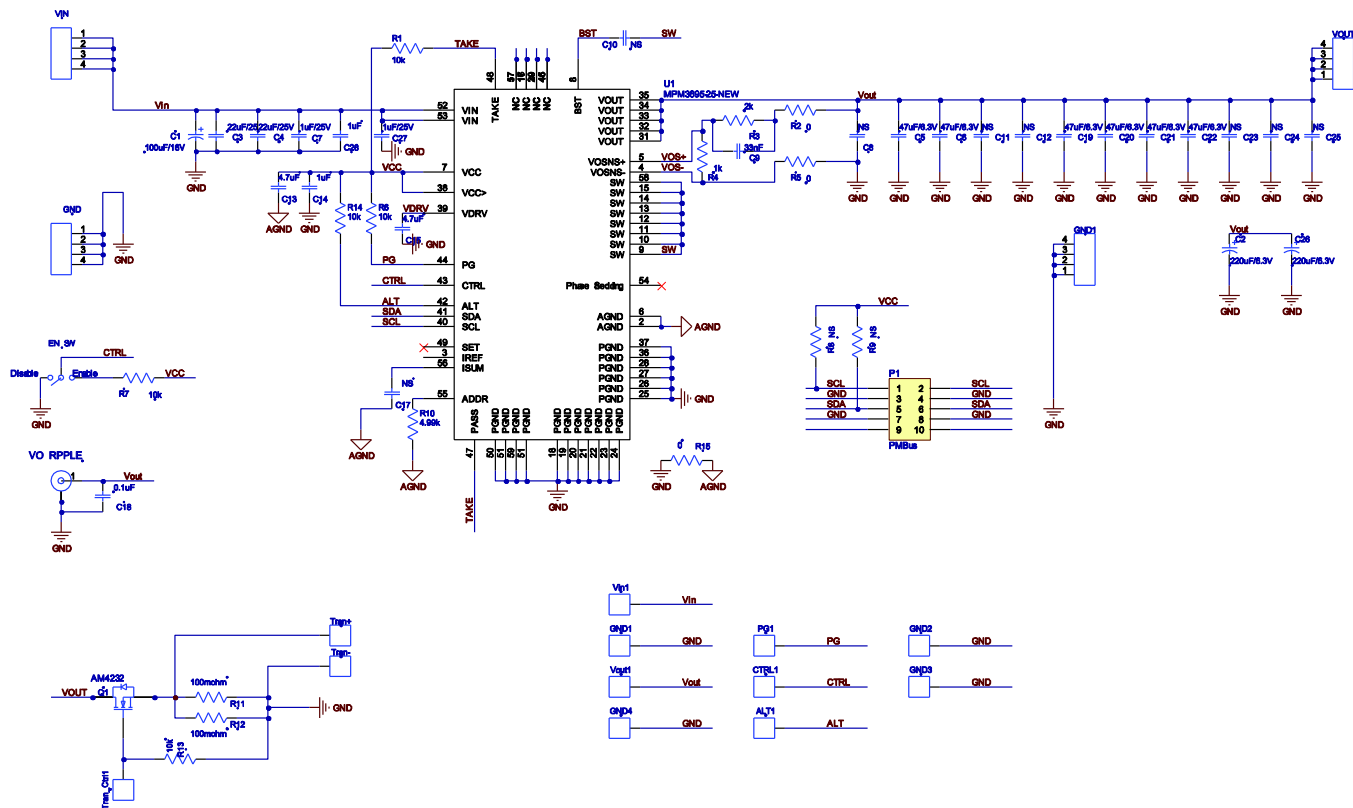
(L × W) 8.9cm × 8.9cm

| Board Number      | MPS IC Number |
|-------------------|---------------|
| EVM3695-25-RF-02A | MPM3695-25    |

Efficiency vs. Load Current



# EVM3695-25-RF-02A SCHEMATIC



**Vin=12V, Vout=1.8V@20A**

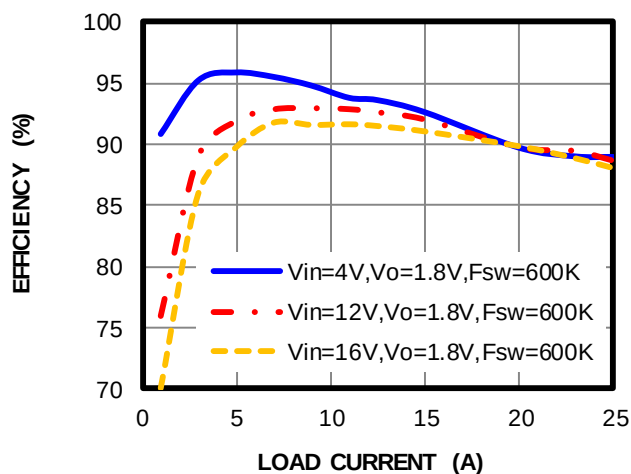
## EVM3695-25-RF-02A BOM

| Qty | RefDes                        | Value      | Description                                 | Package | Manufacturer        | Manufacturer_P/N   |
|-----|-------------------------------|------------|---------------------------------------------|---------|---------------------|--------------------|
| 2   | C3,C4                         | 22μF       | Ceramic Cap.,<br>25V,X7R                    | 1210    | Murata              | GRM32ER71E226KE15L |
| 2   | C7,C27                        | 1μF        | Ceramic Cap.,<br>25V,X5R                    | 0402    | Murata              | GRM155R61E105KA12D |
| 2   | C28,C14                       | 1μF        | Ceramic Cap.,<br>25V,X7R                    | 0603    | Murata              | GRM188R71E105KA12D |
| 2   | C13,C15                       | 4.7μF      | Ceramic Cap.,<br>25V,X5R                    | 0603    | Murata              | GRM188R61E475KE11D |
| 1   | C18                           | 100nF      | Ceramic Cap.,<br>25V,X7R                    | 0603    | Murata              | GRM188R71E104KA01D |
| 1   | C9                            | 33nF       | Ceramic Cap.,<br>25V,X7R                    | 0603    | Murata              | GRM188R71E333KA01D |
| 6   | C5.C6.<br>C19.C20.<br>C21.C22 | 47μF       | Ceramic Cap.,<br>6.3V,X5R                   | 1206    | Murata              | GRM31CR60J476ME19L |
| 2   | C2.C26                        | 220μF      | Tantalum cap.,<br>6.3V                      | D2      | Panasonic           | EEFCX0J221R        |
| 1   | C1                            | 100μF      | 100μF/35V                                   | SMD     | NIPPON<br>CHEMI-CON | EMZJ350ADA101MF80G |
| 5   | R1.R6<br>R14.R7.<br>R13       | 10k        | Film Res,1%,<br>0603,10K                    | 0603    | YAGEO               | RC0603FR-0710KL    |
| 1   | R10                           | 4K99       | Film Res,1%,<br>0603,4K99                   | 0603    | YAGEO               | RC0603FR-074K99L   |
| 3   | R2.R5.<br>R15                 | 0R         | Film Res,1%,<br>0603,0R                     | 0603    | YAGEO               | RC0603FR-070RL     |
| 1   | R3                            | 2k         | Film Res,1%,<br>0603,2K                     | 0603    | YAGEO               | RC0603FR-072KL     |
| 1   | R4                            | 1k         | Film Res,1%,<br>0603,1K                     | 0603    | YAGEO               | RC0603FR-071KL     |
| 4   | VIN,GND                       | N/A        | N/A                                         | N/A     | Keystone            | KEYSTONE7697-75    |
| 6   | ALT                           | φ1.0       | φ1.0 copper pin                             | DIP     | N/A                 | φ1.0 copper pin    |
| 1   | Vo Ripple                     | N/A        | 4pin                                        | DIP     | N/A                 | SMA 射频座            |
| 1   | CN6                           | SWITCH     | Tact Switch,<br>push type,white<br>actuator | SMD     | WE                  | 450301014042       |
| 1   | P1                            |            | 10pin 双排直插<br>针                             |         |                     |                    |
| 1   | U1                            | MPM3695-25 | 20A power<br>module                         | QFN     | MPS                 | MPM3695GRF-25-0022 |
| 2   | R11. R12                      | 0R1        | Film Res,1%,<br>2512,0R1                    | 2512    | YAGEO               | RC2512FR-070R1L    |
| 1   | Q1                            | N-MOS      | 20A MOSFET                                  | D-PARK2 | Analog              | AM4342N            |

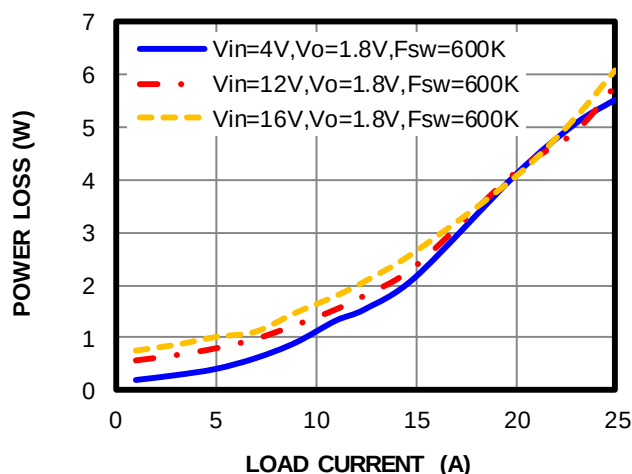
# TYPICAL PERFORMANCE CHARACTERISTICS

$V_{IN} = 12V$ ,  $V_{OUT} = 1.8V$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

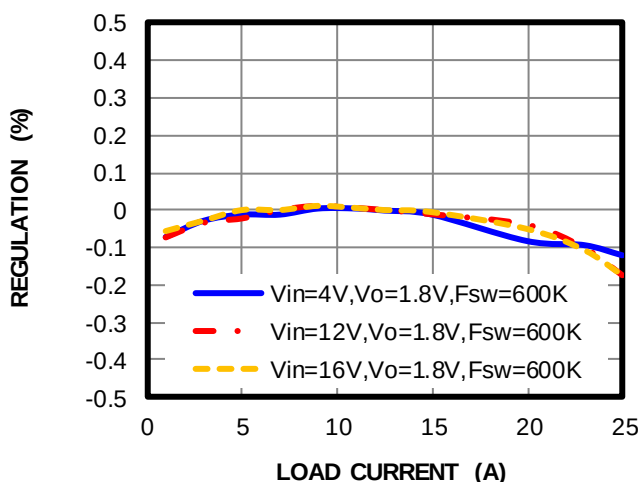
Efficiency vs. Current Load



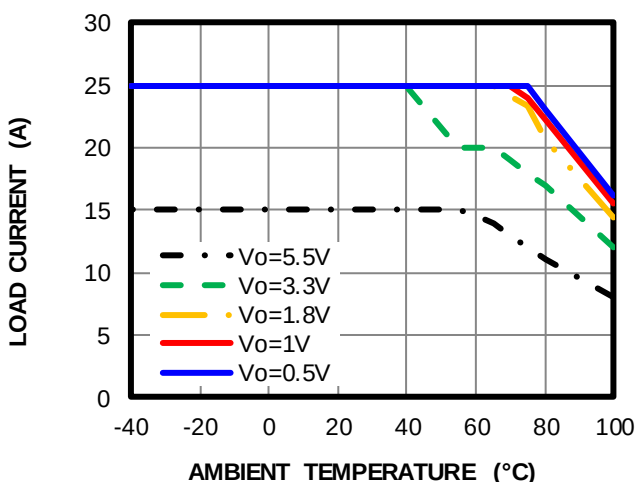
Power Loss vs. Load Current



Regulation vs. Load Current



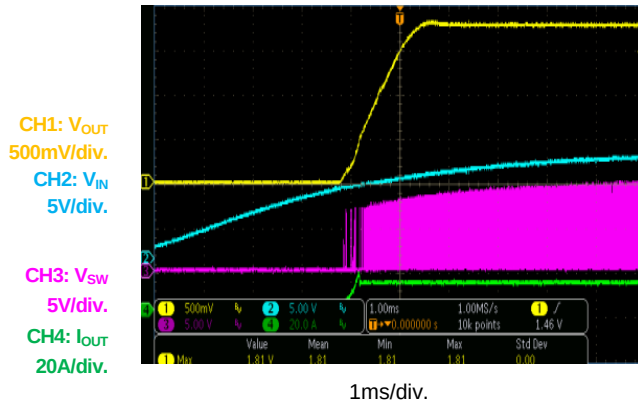
Thermal De-rating vs. Ambient Temp@200LFM Air Flow



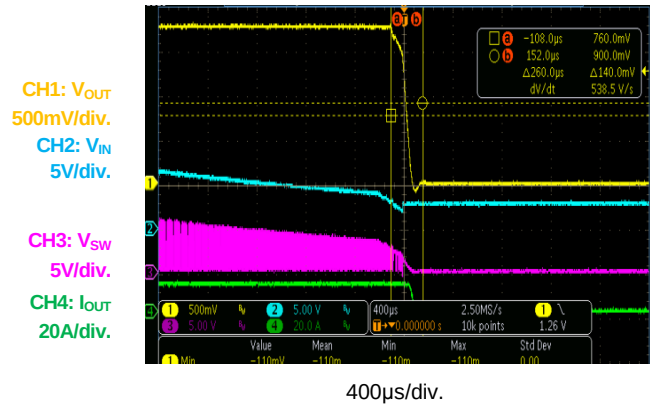
# TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

$V_{IN} = 12V$ ,  $V_{OUT} = 1.8V$ ,  $I_O = 20A$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

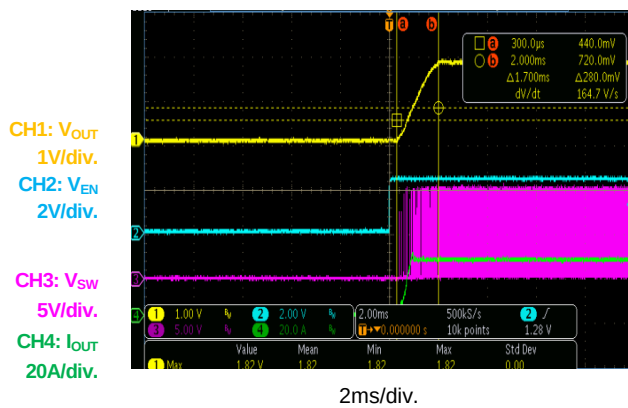
## VIN Start-Up



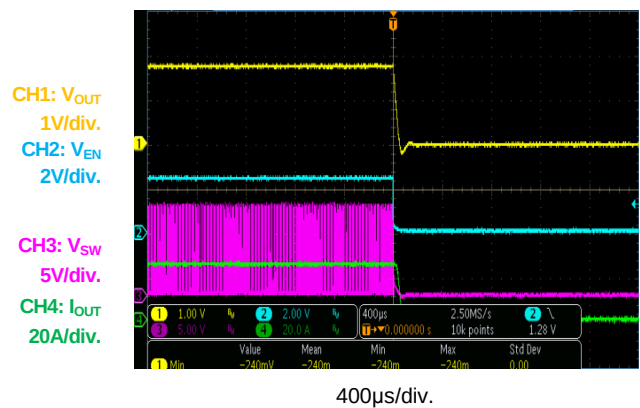
## VIN Shutdown



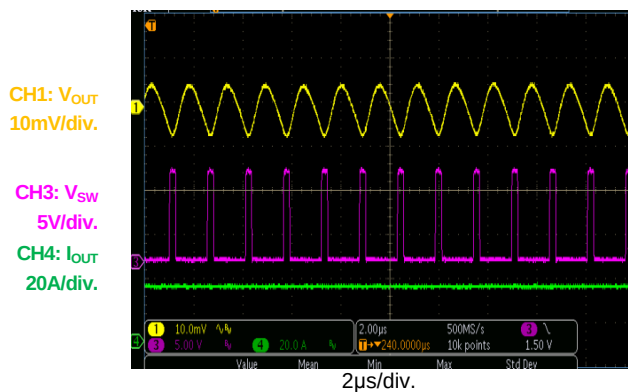
## EN Start-Up



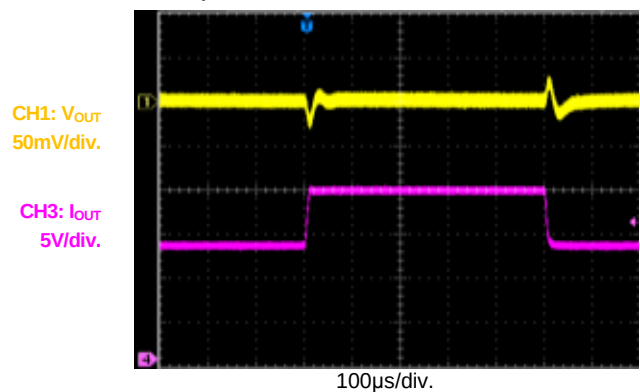
## EN Shutdown



## VOUT Ripple@VIN=12V, IO=20A



## Load Transient@25% to 50% Load, 2.5A/us



## EVM3695-25-RF-02A PCB LAYOUT

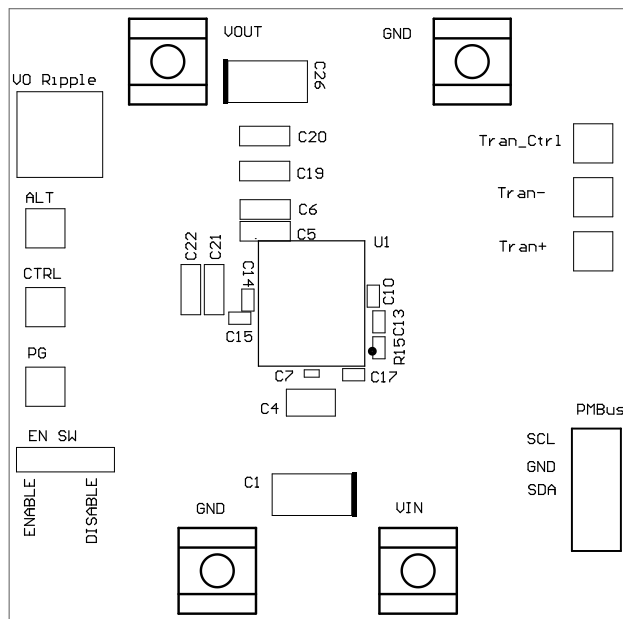


Figure 1-Top Silk Layer

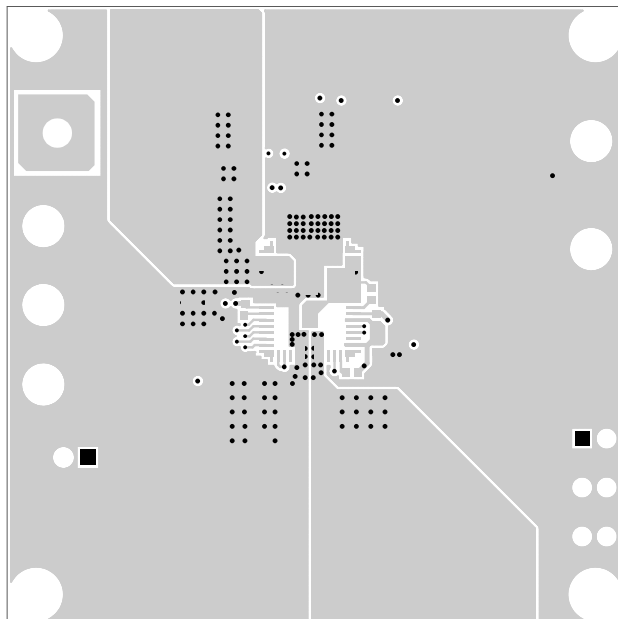


Figure 2-Top Layer

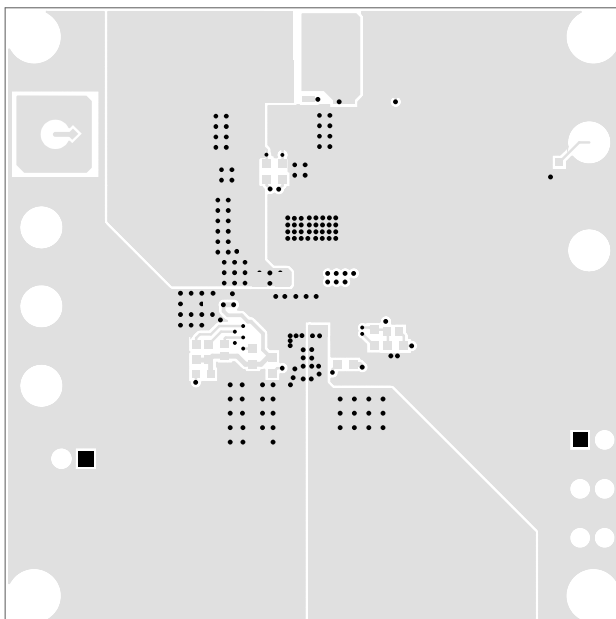


Figure 3-Bottom Layer

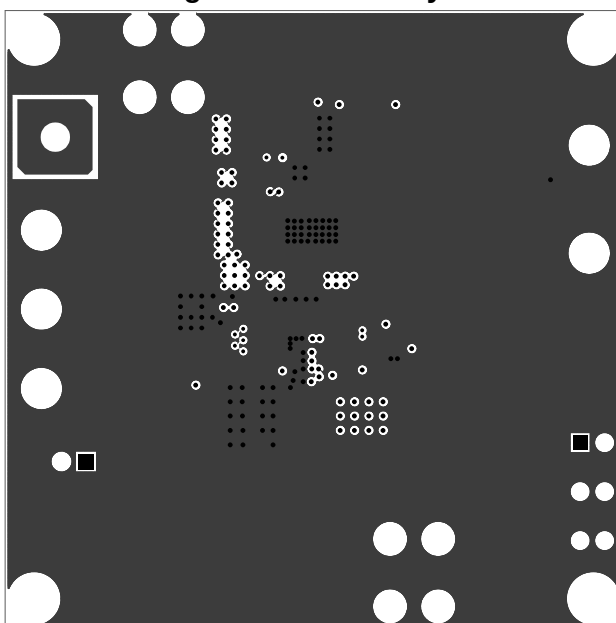


Figure 4-Inner1 Layer

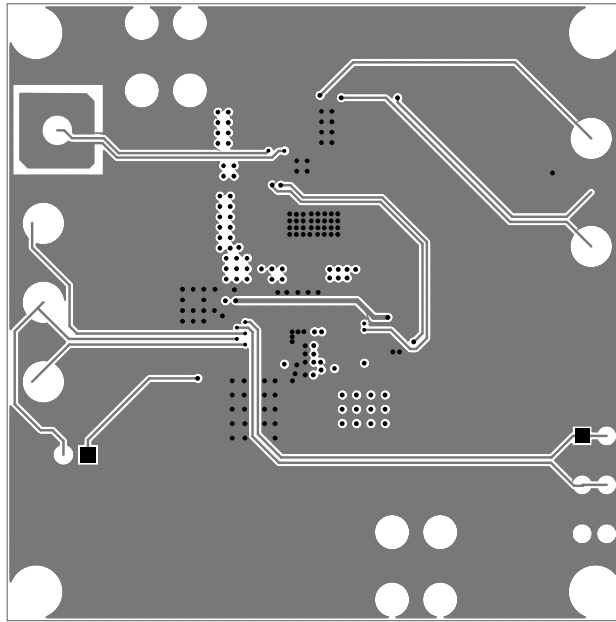


Figure 5-Inner2 Layer

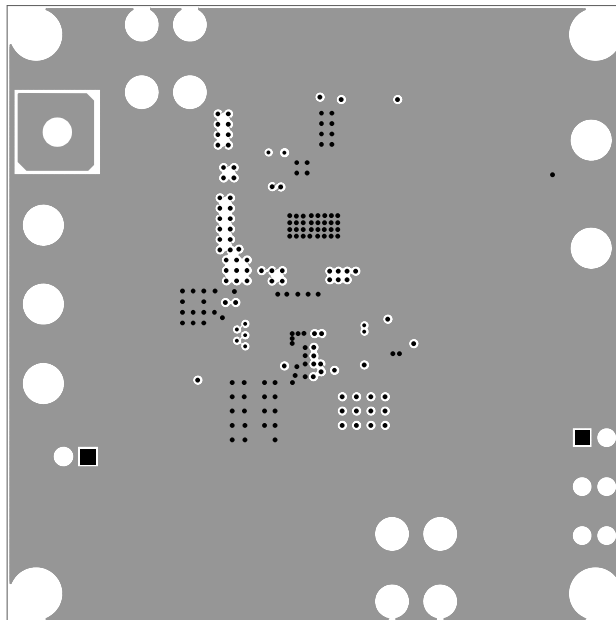


Figure 6-Inner3 Layer



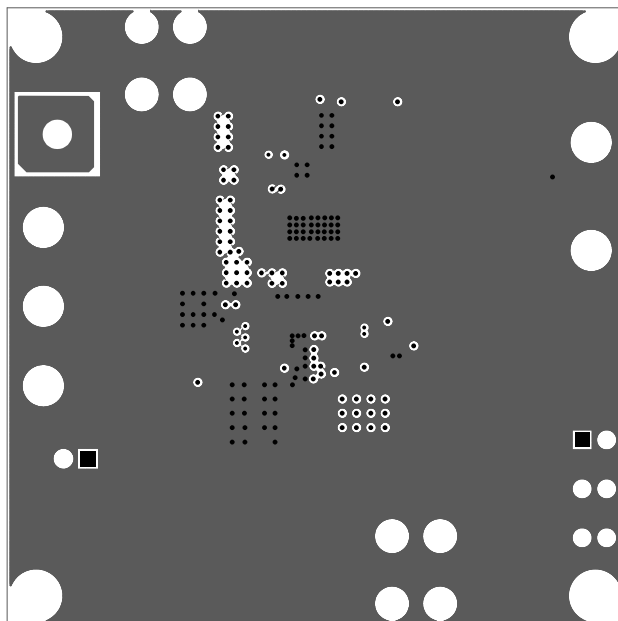


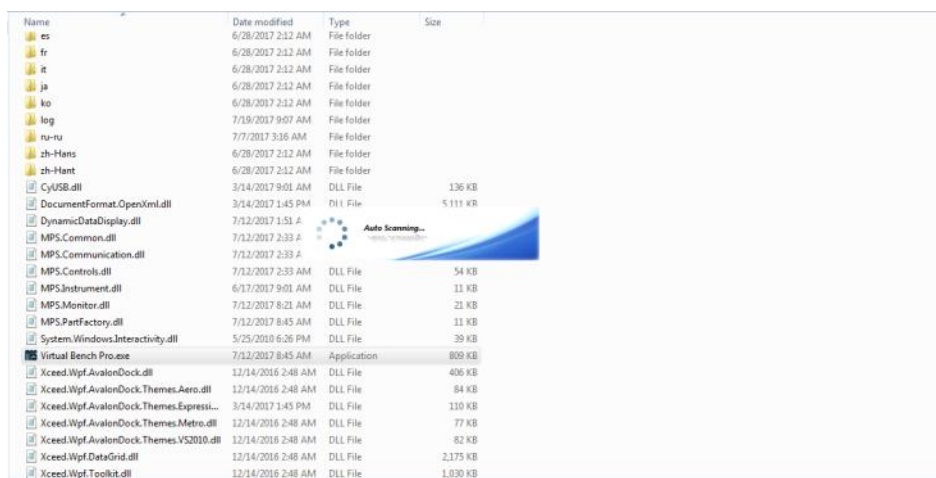
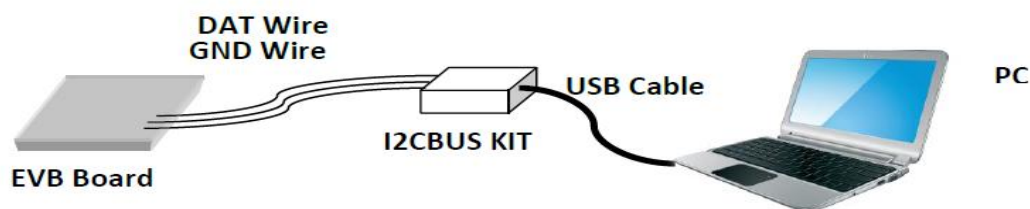
Figure 7-Inner4 Layer

## QUICK START:

1. Connect the positive and negative terminals of the load to the VOUT and GND pins, respectively.
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 output to the VIN and GND pins, respectively.
4. Turn the power supply on. The board will automatically start up. Figure 1-Top Silk Layer
5. MPM3695-25 GUI Simple Guide:
  - a. Check completeness for the PMBus tools:

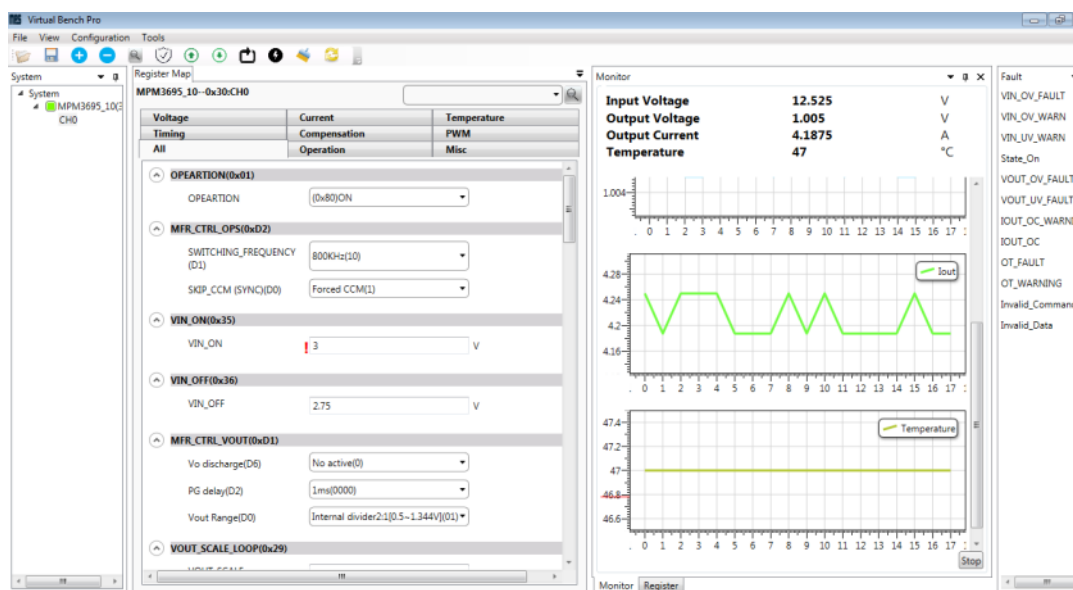
| ITEM       | PN                | QUANTITY |
|------------|-------------------|----------|
| EVB        | EVM3695-25-RF-02A | 1        |
| PMBus Kit  | EVKT-USBI2C-02    | 1        |
| USB Cable  | \                 | 1        |
| PMBUS Wire | \                 | 1        |

- b. Connect PMBus wires to EVB and click the 'Virtual Bench Pro.exe', GUI will auto scan device:



- c. 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.



6. For different Output Voltage, recommended FB divider and PMBus parameters below:

| Recommended Vo Range(V) | R3     | R4     | Vout_scale | Ramp   | Cff  | Fsw  |
|-------------------------|--------|--------|------------|--------|------|------|
| 0.5~1                   | 500ohm | 500ohm | 0.5        | 44.7mV | 33nF | 600k |
| 1~1.8                   | 2k     | 1k     | 0.335      | 44.7mV | 33nF | 600k |
| 1.8~2.4                 | 3k     | 1k     | 0.25       | 44.7mV | 33nF | 600k |
| 2.4~4                   | 6.98k  | 1k     | 0.125      | 44.7mV | 33nF | 600k |
| 4~6                     | 9.09k  | 1k     | 0.1        | 44.7mV | 33nF | 600k |

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