# EVQ77240FS-LT-00A

**16V, 0.8A,180mΩ $R_{DS(ON)}$, Quad-Channel, High-Side Load Switch Evaluation Board, AEC-Q100 Qualified**

## DESCRIPTION

The EVQ77240FS-LT-00A evaluation board is designed to demonstrate the capabilities of the MPQ77240FS, a quad-channel high-side power switch for a nominal 0.8A load per channel. The device covers a 5V to 16V input voltage ($V_{INA/B}$) range.

The MPQ77240FS supports an internal current limit and a configurable, high-accuracy current limit via the I²C. This helps to clamp the inrush current under short-circuit conditions, which improves system reliability. A selectable start-up slew rate also helps to reduce the inrush current during start-up. In addition, a fast-off function can quickly turn off the device if the channel current increases sharply.

The MPQ77240FS communicates to the microcontroller (MCU) via the I²C interface. The device supports up to six addresses, set via an external resistor.

With the help of an internal analog-to-digital converter (ADC), the channel currents, supply voltages, reference voltage ($V_{REF}$), and output voltages can be obtained without additional external circuitry. Full diagnostics and protection are developed for the device, including input over-voltage (OV) and under-voltage (UV) detection, output OV for each channel, open-load and short-to-battery detection, over-current protection (OCP), fast-off short-circuit protection (SCP, fast-off) and over-temperature shutdown. Average and peak current detection improves diagnostic reliability in driver monitoring systems (DMS). Fault statuses can be reported via both the FT pin and I²C interface.

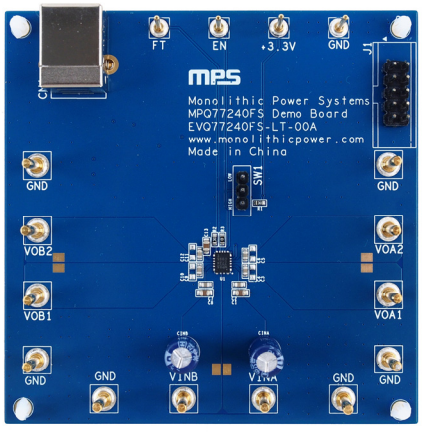
The MPQ77240FS is available in a TQFN-17 (3mmx4mm) package. It is available in AEC-Q100 Grade 1 and compliant with AEC-Q100-012 Test Grade A.

## PERFORMANCE SUMMARY

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

| Parameters | Conditions | Value |
|---|---|---|
| Recommended continuous supply voltage | | 5V to 16V |
| Maximum output current ($I_{OUT}$) per channel | | 0.8A |

## EVQ77240FS-LT-00A EVALUATION BOARD




**LxWxH (8.3cmx8.3cmx1cm)**

| Board Number | MPS IC Number |
|---|---|
| EVQ77240FS-LT-00A | MPQ77240FSGLTE-xxxx-AEC1 |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## QUICK START GUIDE

1. Connect the load terminals to:
   a. Positive (+): OUT_A1, OUT_A2, OUT_B1, OUT_B2
   b. Negative (-): GND
2. Preset the power supply output to the expected value (5V to 16V), and then turn it off.
3. Connect the power supply output terminals to:
   a. Positive (+): VINA/VINB
   b. Negative (-): GND
4. Connect a 3.3V power supply to the +3.3V connector.
5. After making the connections, turn on the VINA (VINB) power supply.
6. Select the correct $I^2C$ address based on R3 (see Table 1). The default $I^2C$ address is 0x70.

**Table 1: $I^2C$ Address Setting**

| Recommended R3 | $I^2C$ R/W |
|---|---|
| Tie to GND | 0x70 |
| 3.65kΩ | 0x73 |
| 5.62kΩ | 0x74 |
| 8.06kΩ | 0x75 |
| 11.0kΩ | 0x76 |
| float | 0x77 |

7. Note that the IC is off by default when it has been connected to the evaluation board, so the user must enable OUT_A1, OUT_A2, OUT_B1, and OUT_B2 via the register.


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# EVALUATION BOARD SCHEMATIC

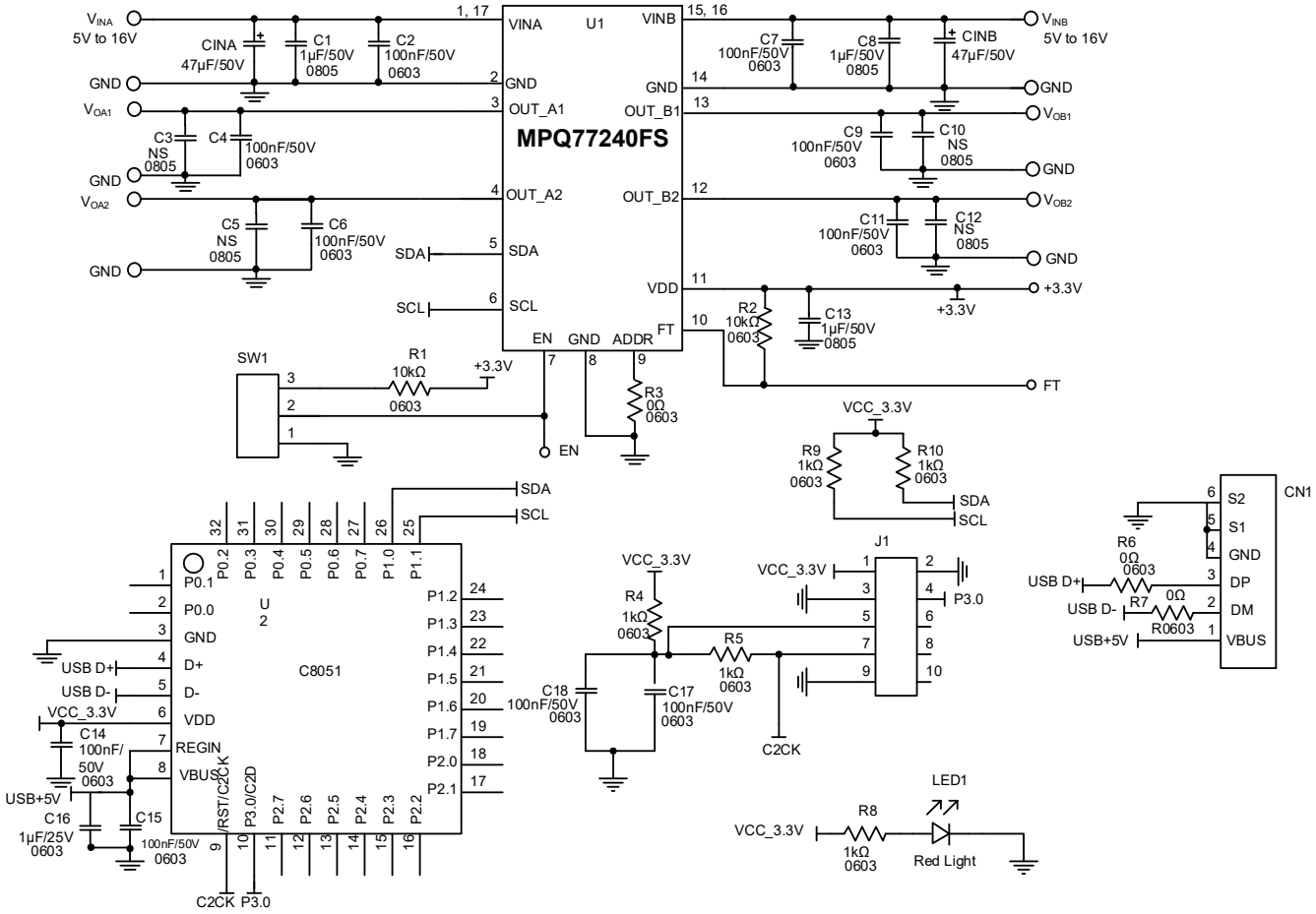


**Figure 1: Evaluation Board Schematic**


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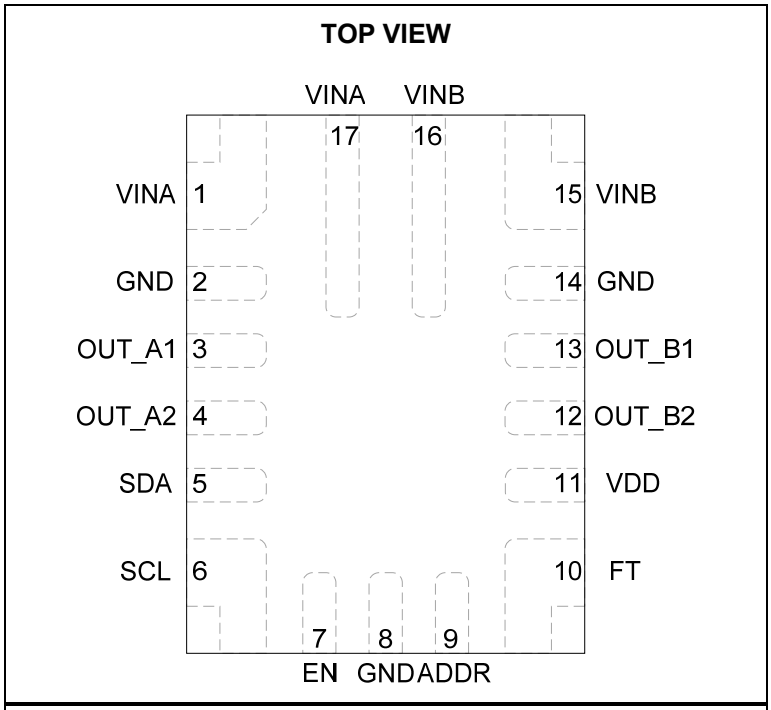
## PACKAGE REFERENCE




TQFN-17 (3mmx4mm)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## EVQ77240FS-LT-00A BILL OF MATERIALS

| Qty | Ref | Value | Description | Package | Manufacturer | Manufacturer PN |
|---|---|---|---|---|---|---|
| 2 | CINA,CINB | 47μF | Electrolytic capacitor, 50V | DIP | Jianghai | CD263-50V47 |
| 3 | C1, C8, C13 | 1μF | Ceramic capacitor, 50V, X7R | 0805 | Wurth | 885012207103 |
| 10 | C2, C4, C6, C7, C9, C11, C14, C15, C17, C18 | 0.1μF | Ceramic capacitor, 50V, X7R | 0603 | Murata | GRM188R71H104KA93D |
| 0 | C3, C5 C10, C12 | NS | | | | |
| 1 | C16 | 1μF | Ceramic capacitor, 25V, X7R | 0603 | Murata | GCM188R71E105KA64D |
| 2 | R1, R2 | 10kΩ | Film resistor, 1% | 0603 | Yageo | RC0603FR-0710KL |
| 3 | R3, R6, R7 | 0Ω | Film resistor, 1% | 0603 | Yageo | RC0603FR-070RL |
| 5 | R4, R5, R8, R9, R10 | 1kΩ | Film resistor, 1% | 0603 | Yageo | RC0603FR-071KL |
| 1 | CN1 | 10mm | USB Type-B connector | DIP | Any | |
| 12 | VOB1, VOA1, GND, VOB2, VOA2, VINB, VINA | 2mm | Golden pin | DIP | Any | |
| 4 | GND, +3.3V, FT, EN | 1mm | Golden pin | DIP | Any | |
| 1 | J1 | 180°, 2x 2.54mm | Connector | DIP | Any | |
| 1 | SW1 | 2.54mm | 3-digit dip switch | DIP | Any | |
| 1 | LED1 | Red | Red LED | 0805 | Baihong | BL-HUE35A-AV-TRB |
| 1 | U2 | 9mmx9mm | Microcontroller unit (MCU) | LQFP-32 | Silicon | C8051F320-GQR |
| 1 | U1 | MPQ77240FS-AEC1 | 16V, 0.8A, quad-channel, high-side switch | TQFN-17 (3mmx4 mm) | MPS | MPQ77240FSGLTE-xxxx-AEC1 |


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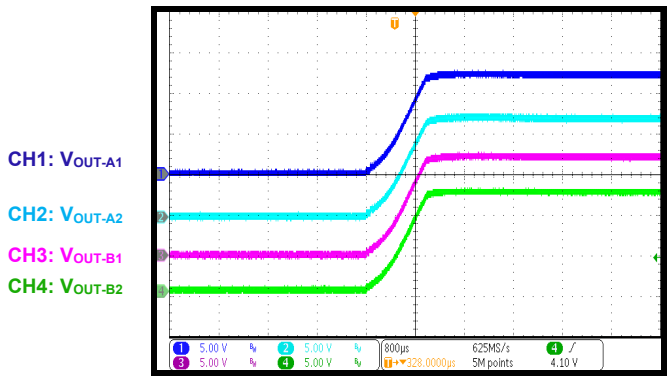
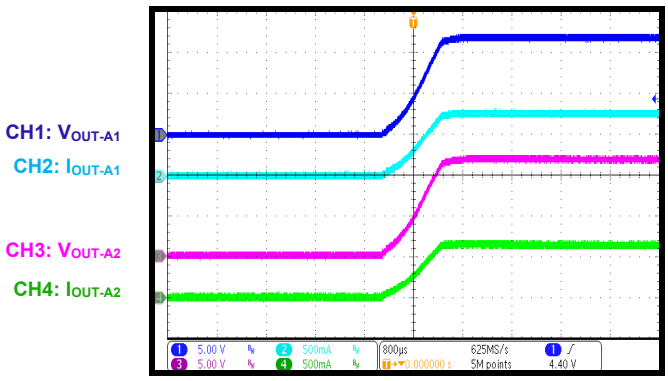
# EVB TEST RESULTS

**$V_{INA}$ = $V_{INB}$ = 12V, $V_{DD}$ = 3.3V, soft-start time = 1ms, $T_A$ = 25°C, unless otherwise noted.**

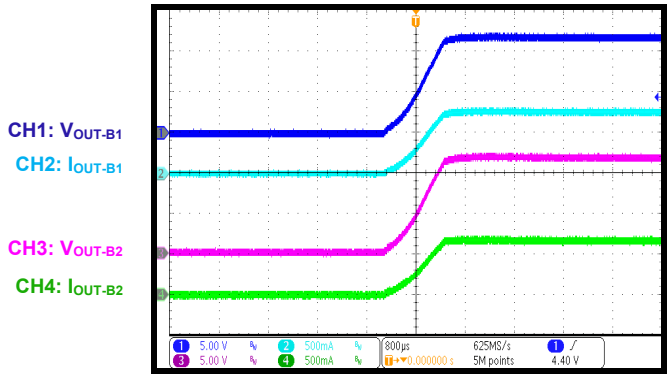
### Start-Up through VIN
All $I_{OUT}$ = 0A



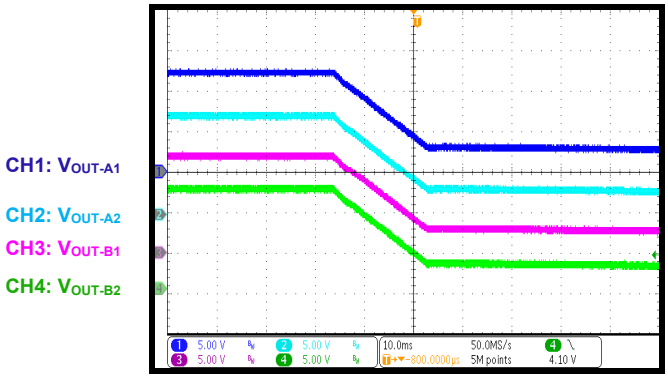

### Start-Up through VIN
All $I_{OUT}$ = 0.8A



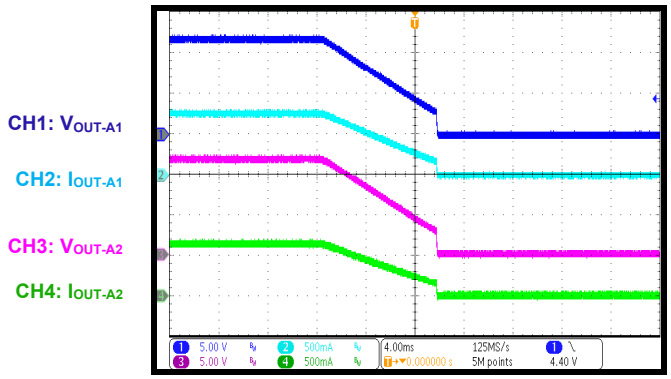

### Start-Up through VIN
All $I_{OUT}$ = 0.8A



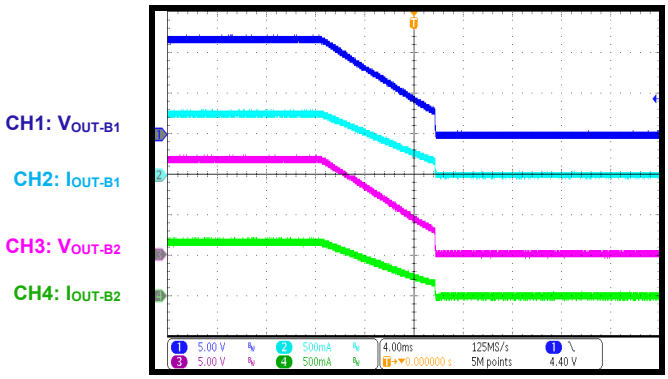

### Shutdown through VIN
All $I_{OUT}$ = 0A




### Shutdown through VIN
All $I_{OUT}$ = 0.8A




### Shutdown through VIN
All $I_{OUT}$ = 0.8A





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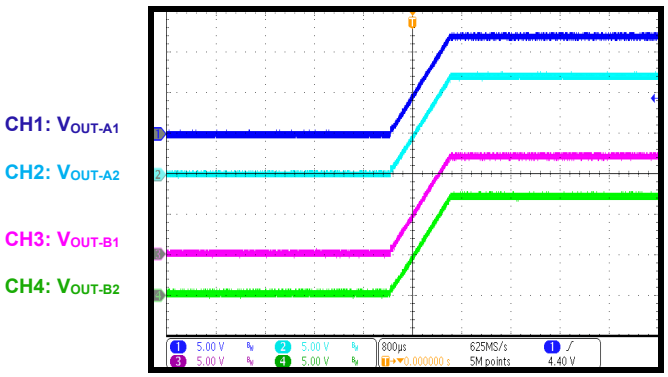
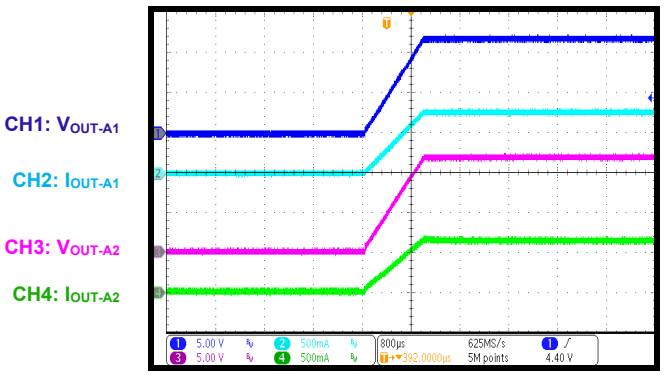
## EVB TEST RESULTS *(continued)*

**$V_{INA}$ = $V_{INB}$ = 12V, $V_{DD}$ = 3.3V, soft-start time = 1ms, $T_A$ = 25°C, unless otherwise noted.**

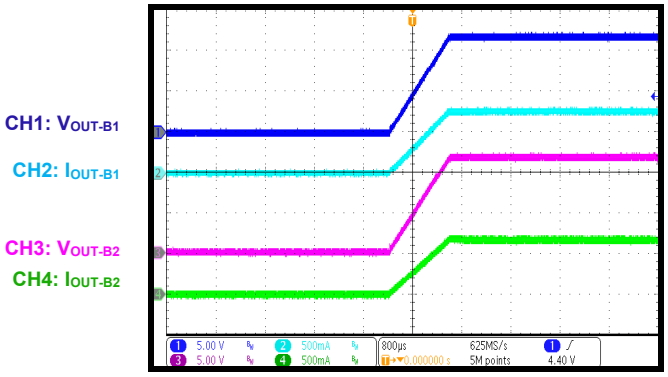
### Start-Up through EN Channel
All $I_{OUT}$ = 0A



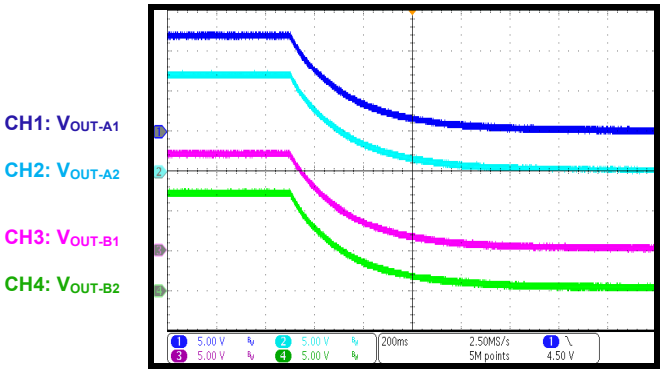

### Start-Up through EN Channel
All $I_{OUT}$ = 0.8A



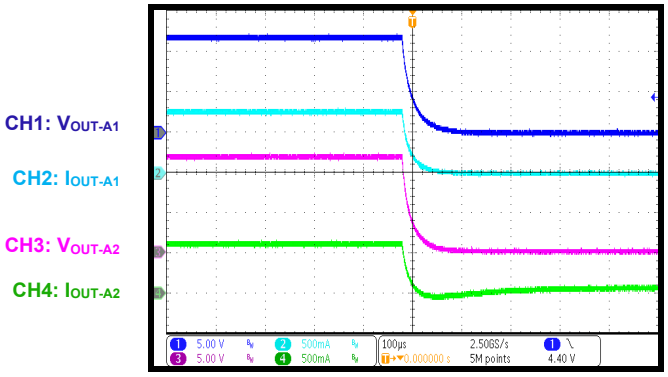

### Start-Up through EN Channel
All $I_{OUT}$ = 0.8A



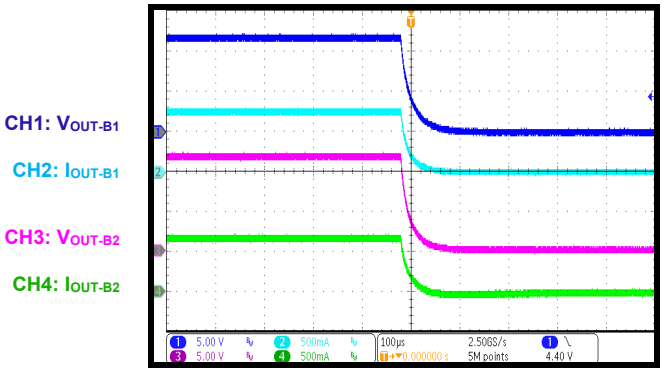

### Shutdown through EN Channel
All $I_{OUT}$ = 0A




### Shutdown through EN Channel
All $I_{OUT}$ = 0.8A




### Shutdown through EN Channel
All $I_{OUT}$ = 0.8A





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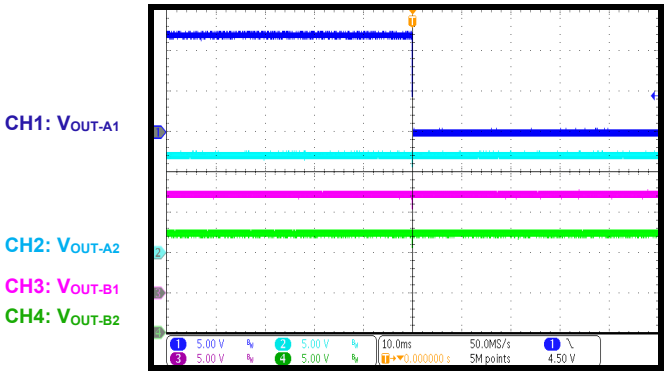
# EVB TEST RESULTS *(continued)*

**$V_{INA}$ = $V_{INB}$ = 12V, $V_{DD}$ = 3.3V, soft-start time = 1ms, $T_A$ = 25°C, unless otherwise noted.**

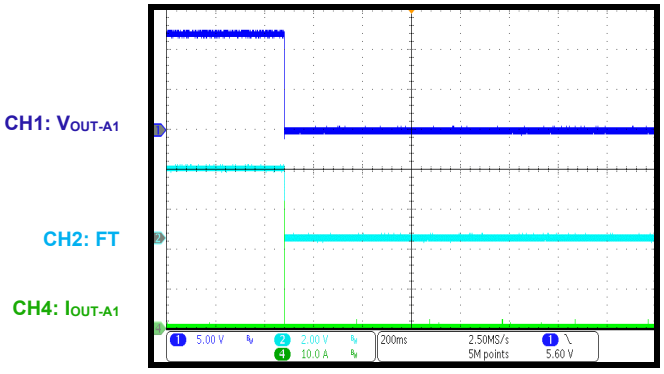
### SCP Entry

All $I_{OUT}$ = 0A, OUT_A1 SCP in auto-recovery mode



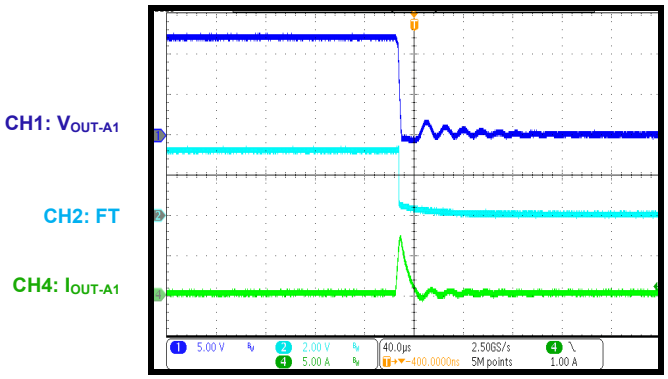

### SCP Entry

All $I_{OUT}$ = 0A, OUT_A1 SCP in auto-recovery mode



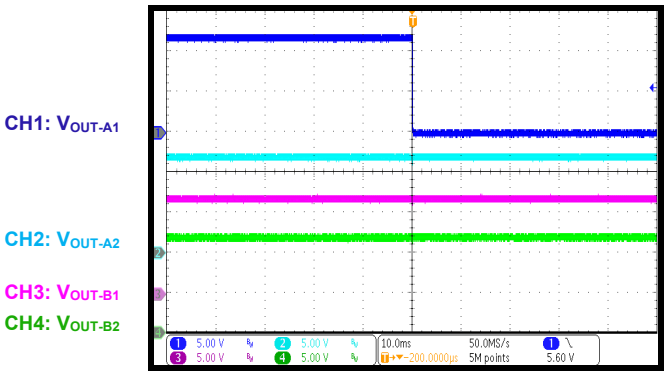

### SCP Entry

All $I_{OUT}$ = 0A, OUT_A1 SCP in auto-recovery mode



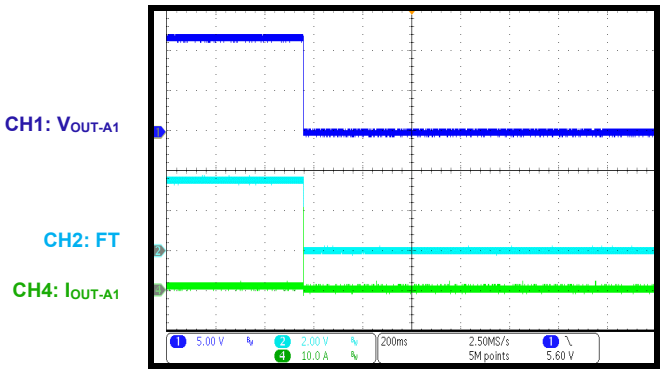

### SCP Entry

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



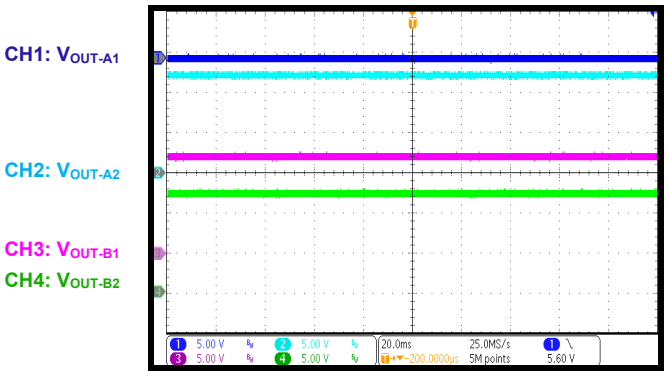

### SCP Entry

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode




### SCP Steady State

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode





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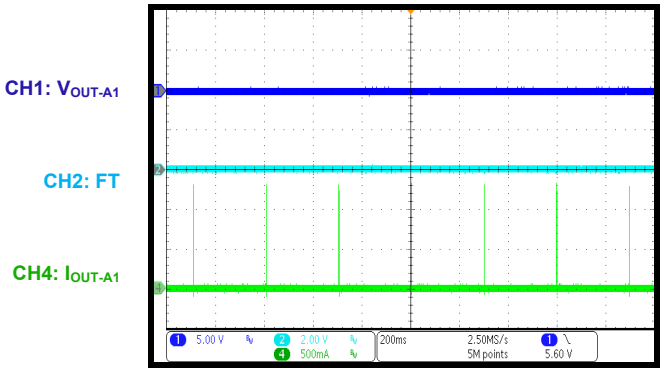
## EVB TEST RESULTS *(continued)*

**$V_{INA}$ = $V_{INB}$ = 12V, $V_{DD}$ = 3.3V, soft-start time = 1ms, $T_A$ = 25°C, unless otherwise noted.**

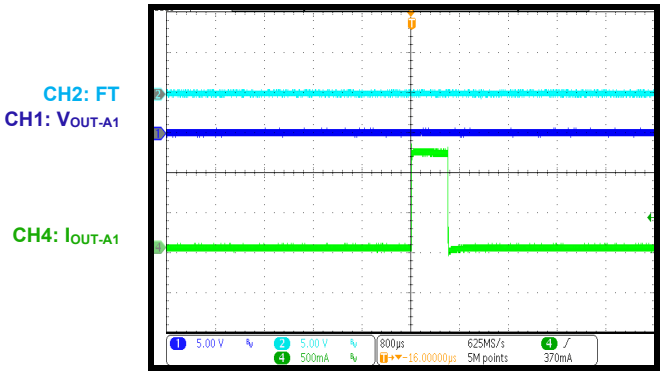
### SCP Steady State

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



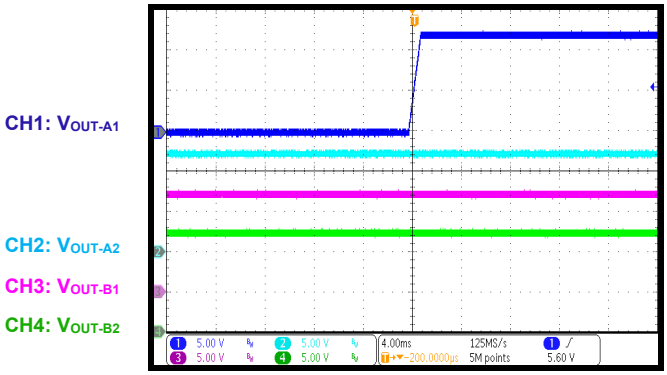

### SCP Steady State

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



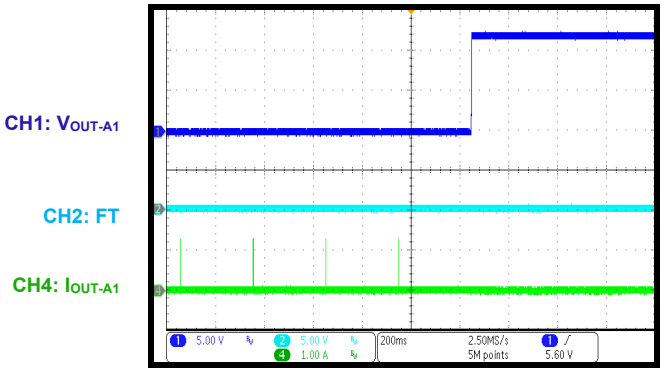

### SCP Recovery

All $I_{OUT}$ = 0A, OUT_A1 SCP in auto-recovery mode



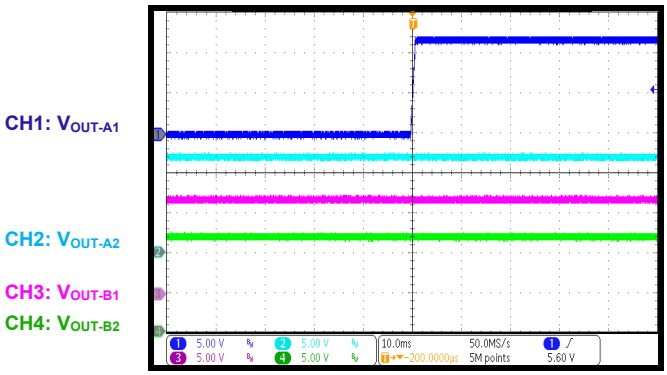

### SCP Recovery

All $I_{OUT}$ = 0A, OUT_A1 SCP in auto-recovery mode



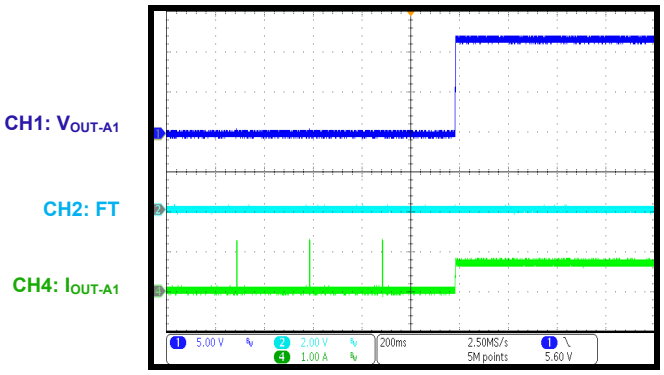

### SCP Recovery

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode




### SCP Recovery

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode





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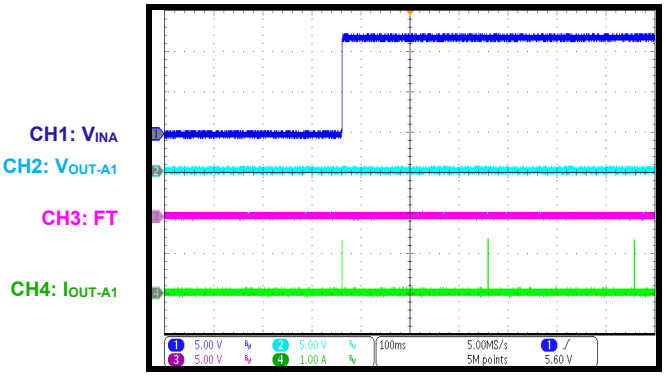
## EVB TEST RESULTS *(continued)*

**$V_{INA}$ = $V_{INB}$ = 12V, $V_{DD}$ = 3.3V, soft-start time = 1ms, $T_A$ = 25°C, unless otherwise noted.**

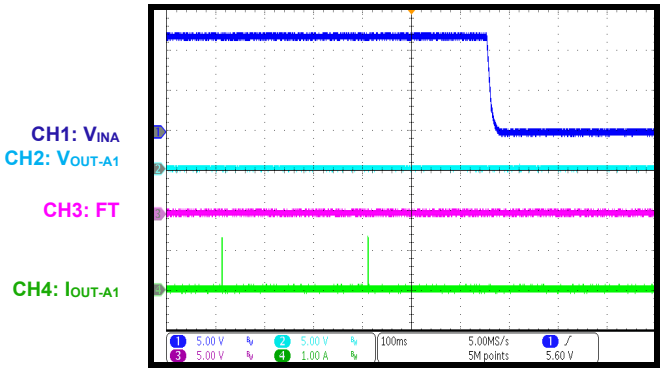
### SCP Start-Up

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



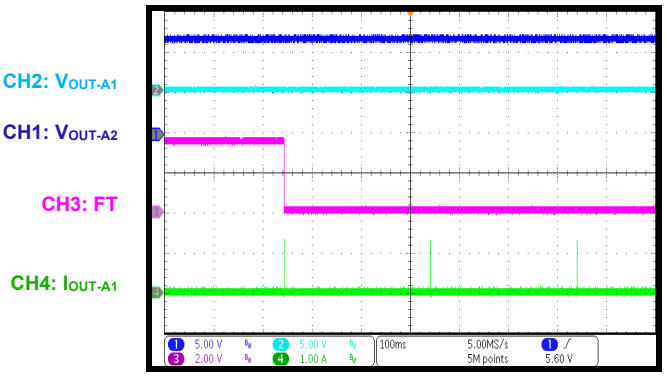

### SCP Shutdown

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



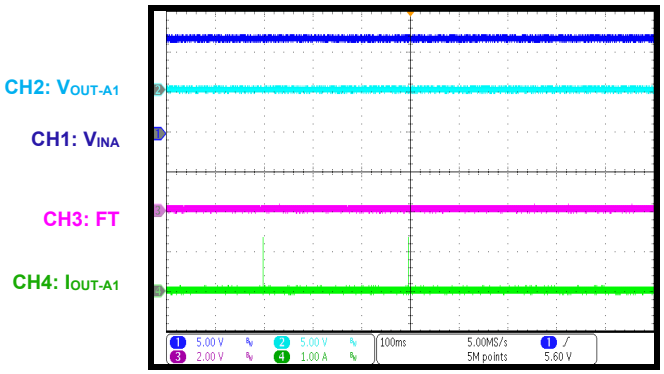

### SCP EN Channel On

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



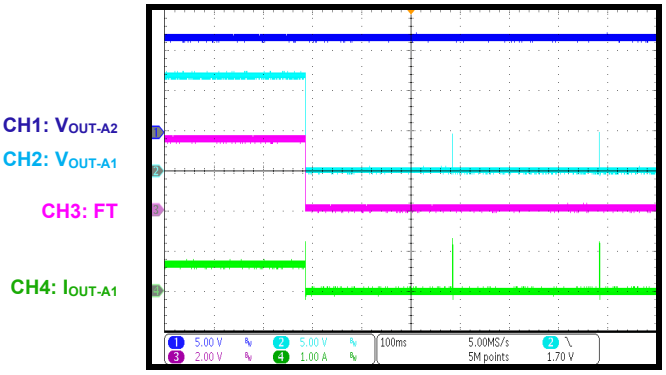

### SCP EN Channel Off

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode



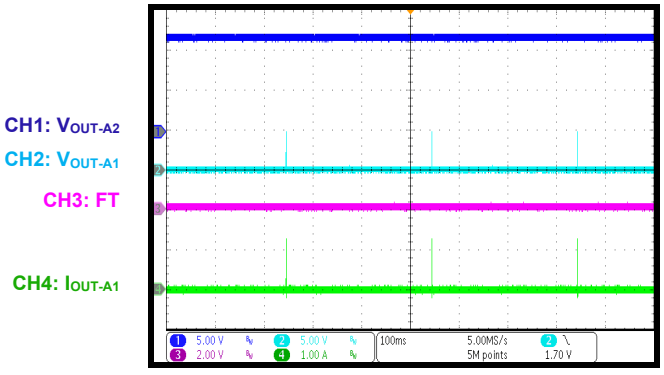

### OCP Entry

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode




### OCP Steady State

All $I_{OUT}$ = 0.8A, OUT_A1 SCP in auto-recovery mode





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## PCB LAYOUT

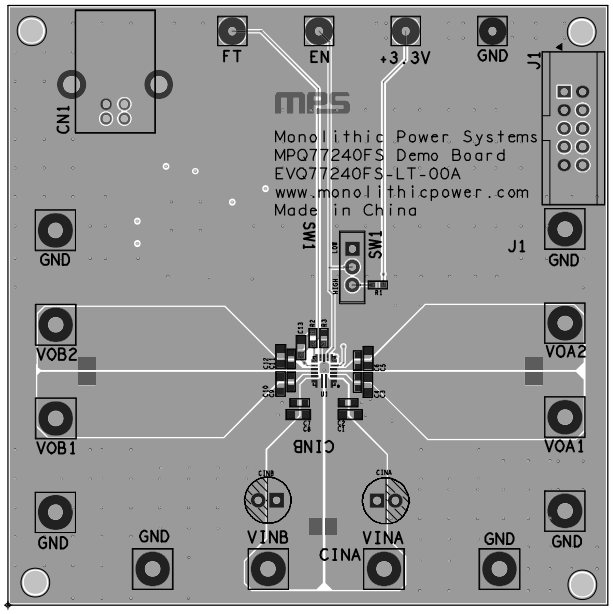


Figure 2: Top Layer

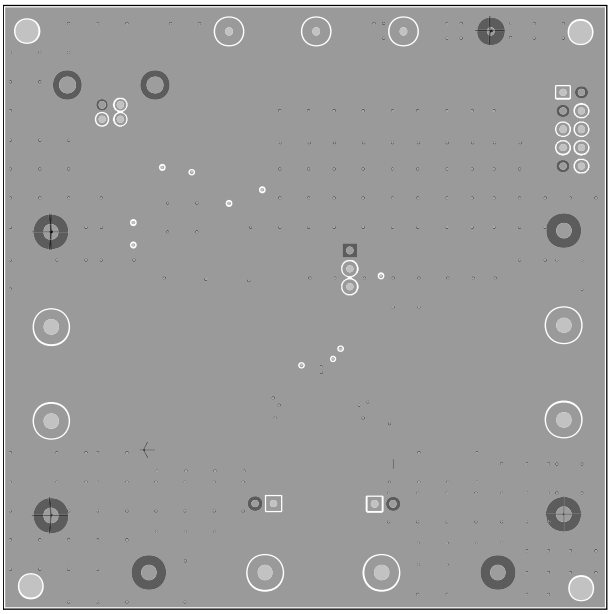

Figure 3: Mid-Layer 1

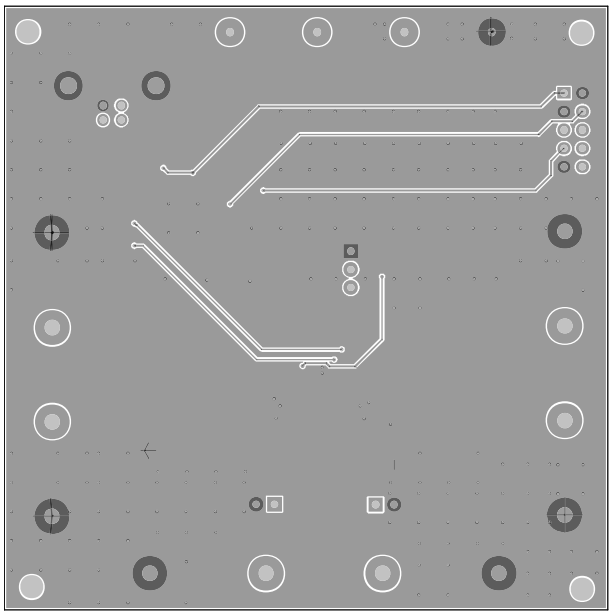

Figure 4: Mid-Layer 2

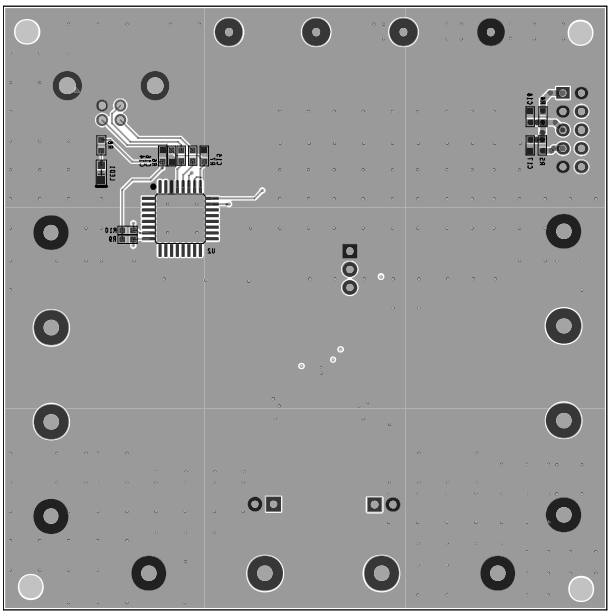

Figure 5: Bottom Layer


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## REVISION HISTORY

| Revision # | Revision Date | Description | Pages Updated |
|---|---|---|---|
| 1.0 | 9/6/2024 | Initial Release | - |

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