EVQ5864-LT-00A

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

DESCRIPTION

The EVQ5864-LT-00A evaluation board is designed to demonstrate the capabilities of the MPQ5864, a quad-channel, high-side power switch that can provide nominal 0.8A load per channel from a 5V to 16V input voltage (V_{IN}) range.

The MPQ5864 supports both an internal current limit and a configurable, high-accuracy current limit via the I^2C interface. This helps clamp the inrush current under short-circuit conditions, which improves system reliability. A selectable start-up slew rate also helps 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 MPQ5864 communicates to the MCU via the I^2C interface. The device supports up to 6 addresses setting by an external resistor.

With the help of an internal analog-to-digital converter (ADC), the channel currents, supply voltages, reference voltage, and output voltages can be obtained without additional external circuitry. Full diagnostic and protection features are integrated, including input over-voltage (OV) and under-voltage (UV), output OV for each channel, open-load and short-to-battery detection, over-current protection (OCP), short-circuit protection (SCP) with fast-off, and over-temperature shutdown. Average/peak current detection improves diagnostic reliability in driver monitoring systems (DMS). The fault status can be reported via both the FT pin and the I^2C.

The MPQ5864 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.

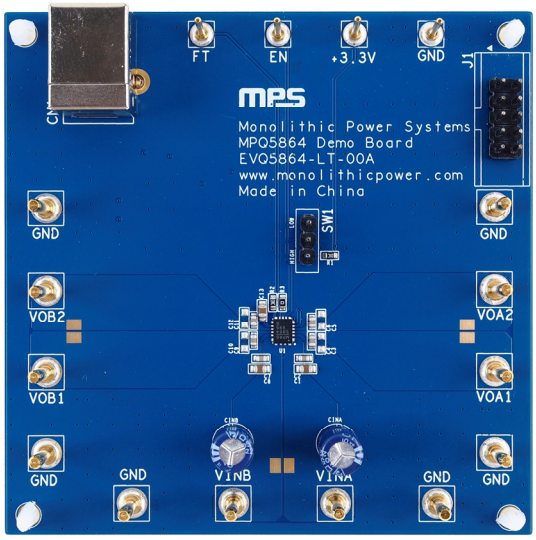
PERFORMANCE SUMMARY

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

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVQ5864-LT-00A EVALUATION BOARD



LxWxH (8.3cmx8.3cmx1cm)

Board Number	MPS IC Number
EVQ5864-LT-00A	MPQ5864GLTE-xxxx-AEC1

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

QUICK START GUIDE

1. Connect the load terminals to:
   a. Positive (+): OUT_A1, OUT_A2, OUT_B1, and OUT_B2
   b. Negative (-): GND
2. Preset the power supply output to be between 5V and 16V, then turn off the power supply.
3. Connect the power supply terminals to:
   a. Positive (+): VINA and 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 I²C address based on R3 (see Table 1). The default I²C address is 0x70.

Table 1: I²C Address Setting

R3 Values	I²C R/W
Tied to GND	0x70
3.65kΩ	0x73
5.62kΩ	0x74
8.06kΩ	0x75
11.0kΩ	0x76
Float	0x77

7. The MPQ5864 is off by default on the evaluation board; enable OUT_A1, OUT_A2, OUT_B1, and OUT_B2 via the registers.

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVALUATION BOARD SCHEMATIC

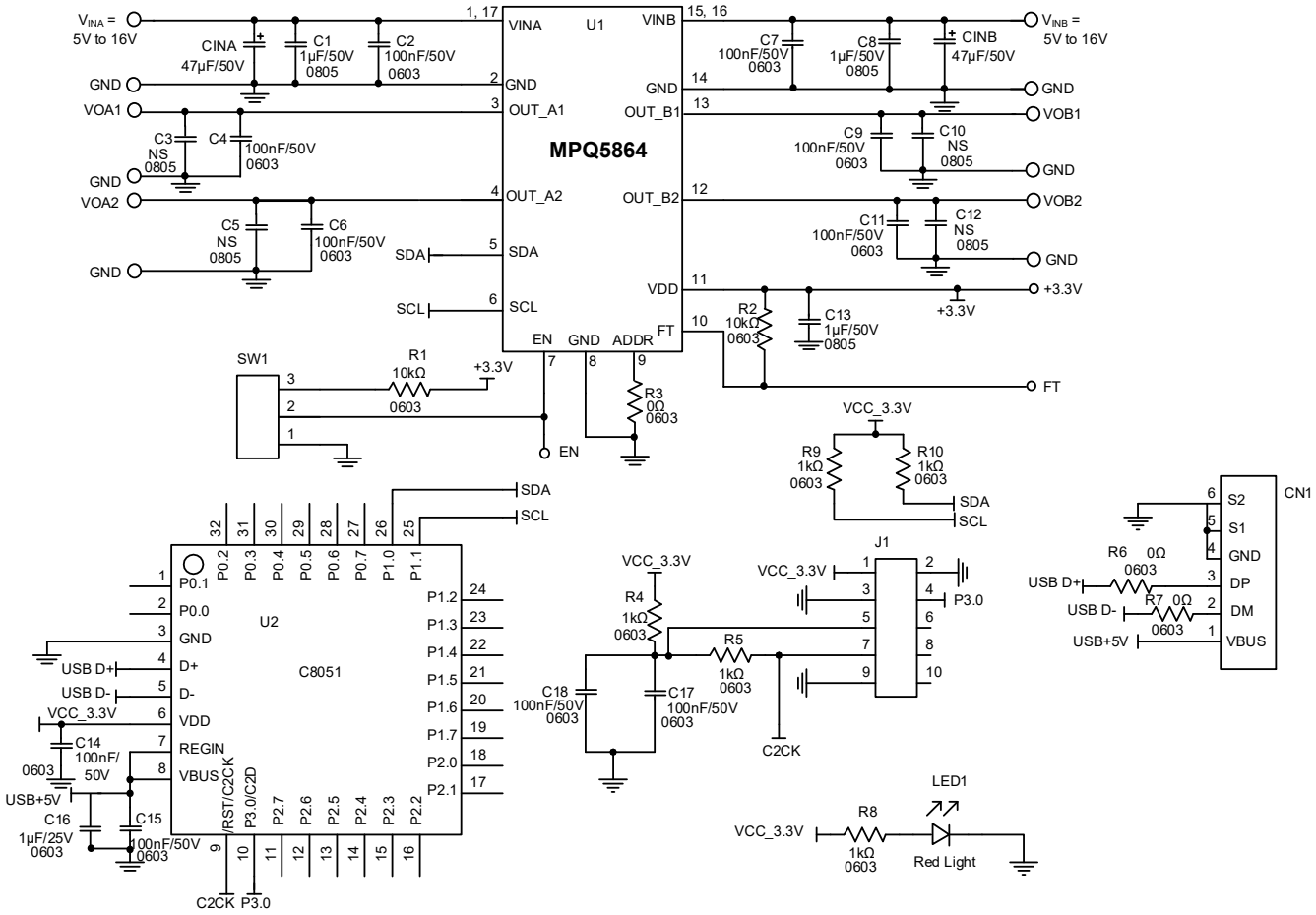
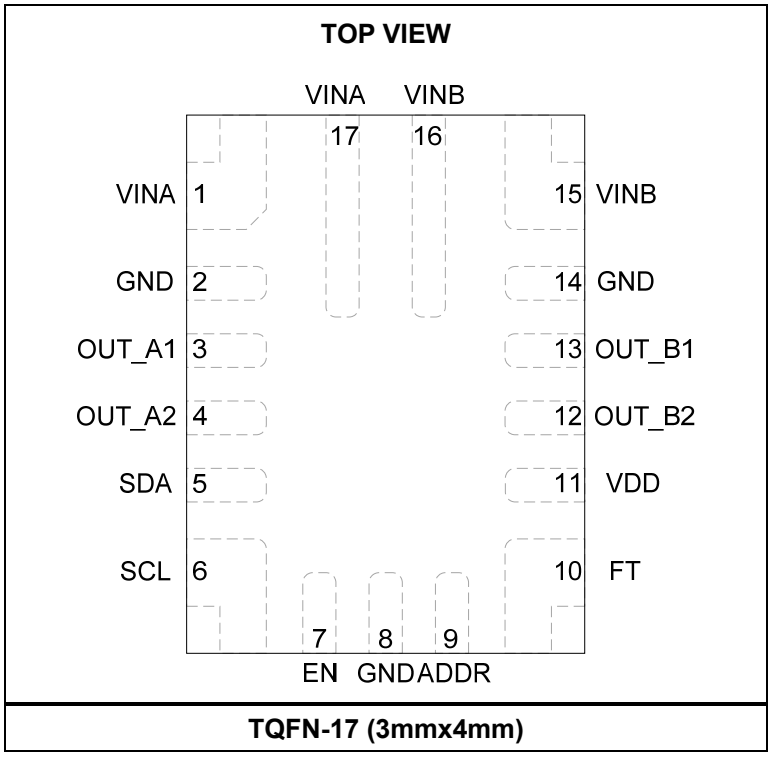


Figure 1: Evaluation Board Schematic

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

PACKAGE REFERENCE



TQFN-17 (3mmx4mm)

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVQ5864-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°	Connector, 2.54mm	DIP	Any	
1	SW1	2.54mm	Three-digit dip switch	DIP	Any	
1	LED1	Red	Red LED	0805	Baihong	BL-HUE35A-AV-TRB
1	U2	9mmx9mm	MCU	LQFP-32	Silicon	C8051F320-GQR
1	U1	MPQ5864-AEC1	16V, 0.8A, quad-channel, high-side switch, AEC-Q100	TQFN-17 (3mmx4 mm)	MPS	MPQ5864GLTE-xxxx-AEC1

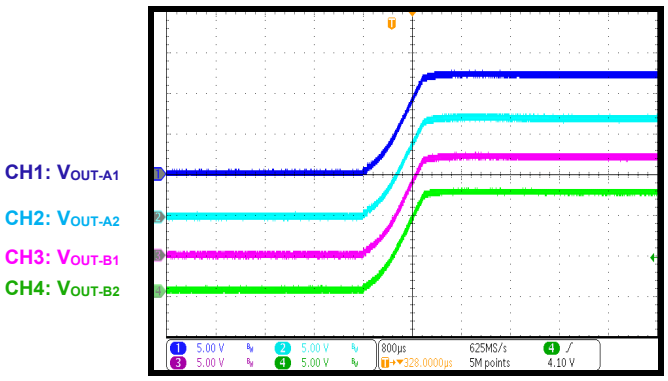
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVB TEST RESULTS

V_{INA} = V_{INB} = 12V, V_{DD} = 3.3V, t_{SS} = 1ms, T_A = 25°C, unless otherwise noted.

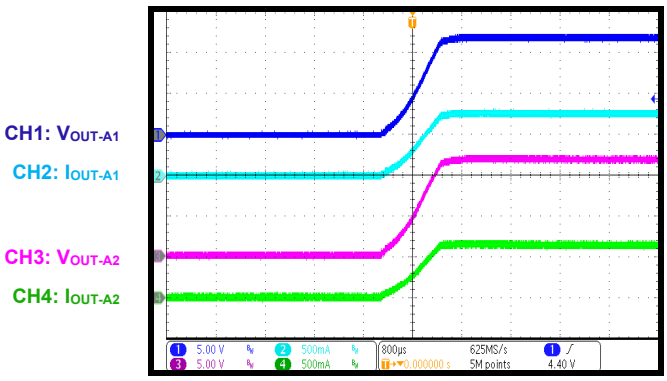
Start-Up through VIN

I_{OUTx} = 0A



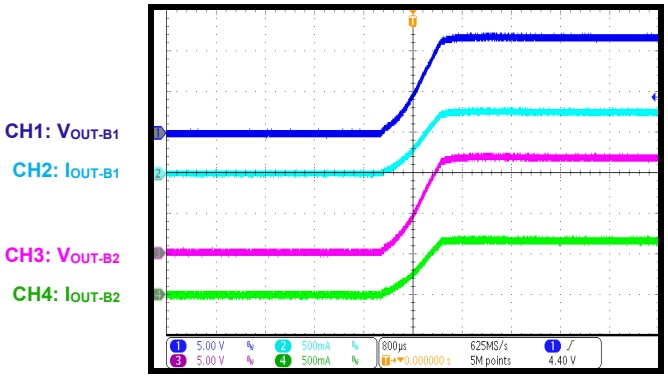
Start-Up through VIN

I_{OUTx} = 0.8A



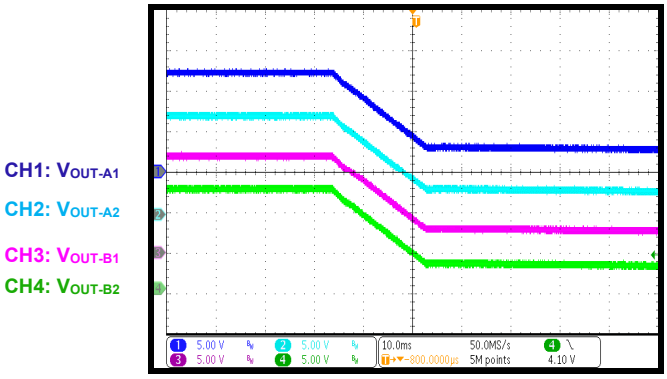
Start-Up through VIN

I_{OUTx} = 0.8A



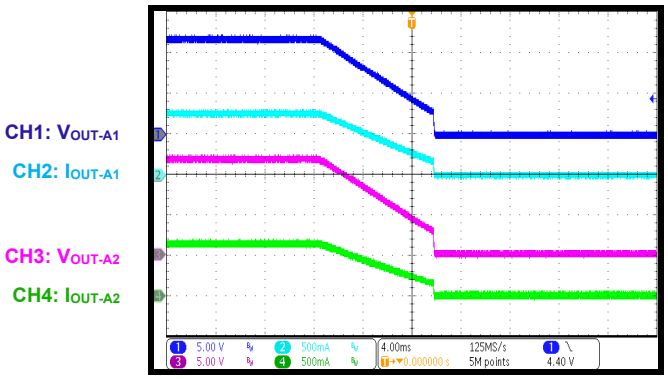
Shutdown through VIN

I_{OUTx} = 0A



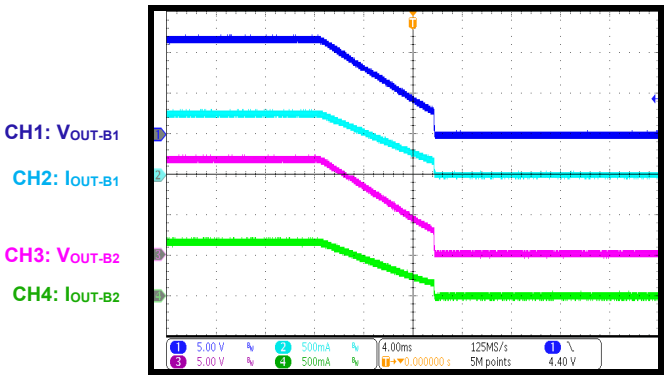
Shutdown through VIN

I_{OUTx} = 0.8A



Shutdown through VIN

I_{OUTx} = 0.8A



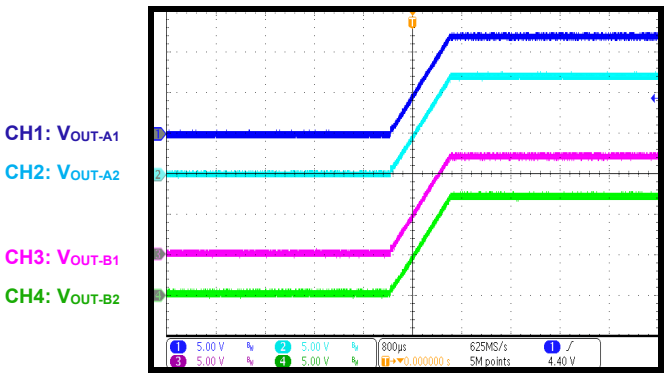
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVB TEST RESULTS *(continued)*

V_{INA} = V_{INB} = 12V, V_{DD} = 3.3V, t_{SS} = 1ms, T_A = 25°C, unless otherwise noted.

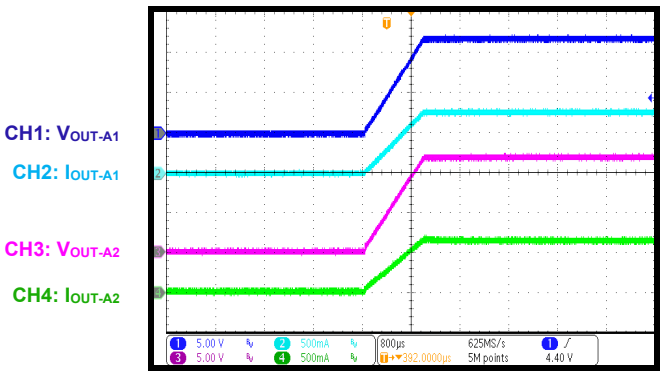
Start-Up through EN Channel

I_{OUTx} = 0A



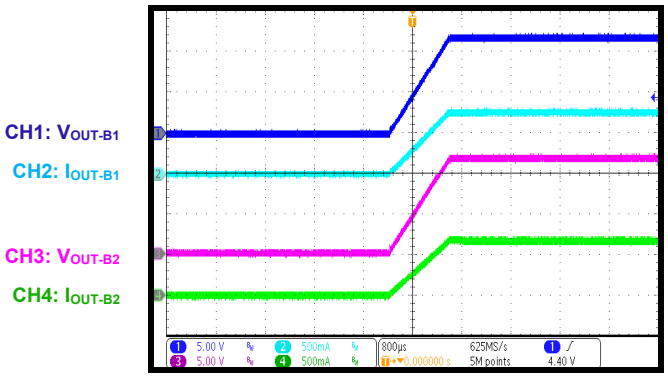
Start-Up through EN Channel

I_{OUTx} = 0.8A



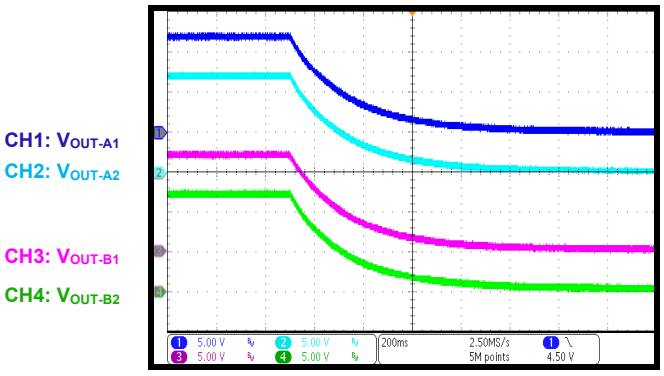
Start-Up through EN Channel

I_{OUTx} = 0.8A



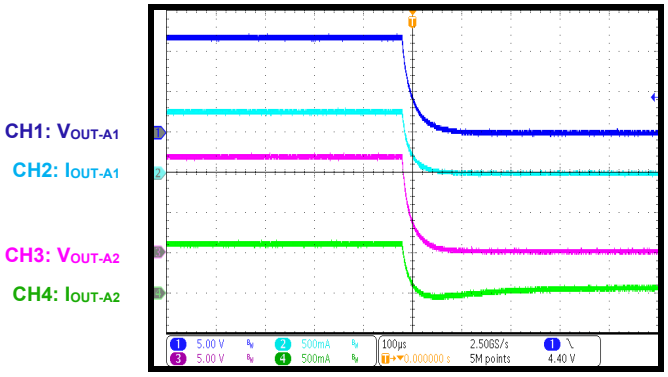
Shutdown through EN Channel

I_{OUTx} = 0A



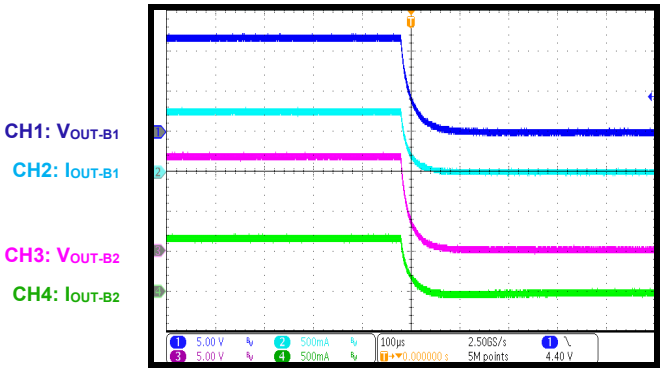
Shutdown through EN Channel

I_{OUTx} = 0.8A



Shutdown through EN Channel

I_{OUTx} = 0.8A



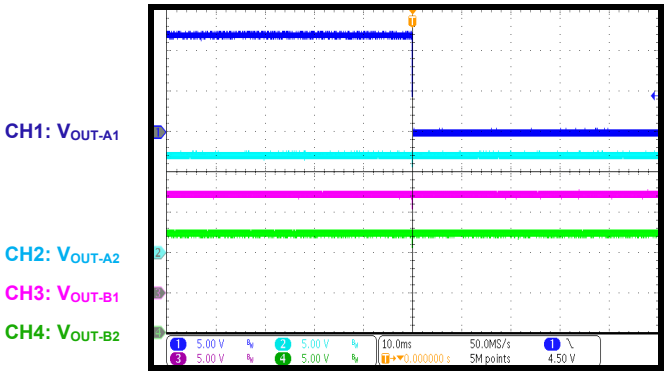
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVB TEST RESULTS *(continued)*

V_{INA} = V_{INB} = 12V, V_{DD} = 3.3V, t_{SS} = 1ms, T_A = 25°C, unless otherwise noted.

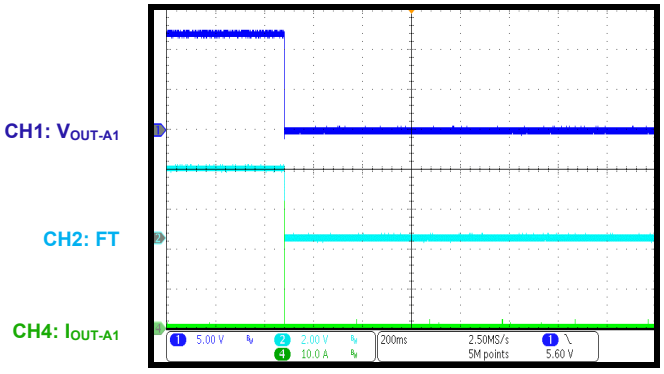
SCP Entry

I_{OUTx} = 0A, OUT_A1 SCP in auto-recovery mode



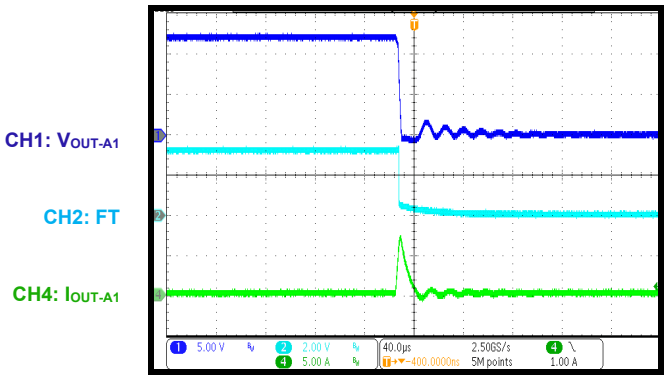
SCP Entry

I_{OUTx} = 0A, OUT_A1 SCP in auto-recovery mode



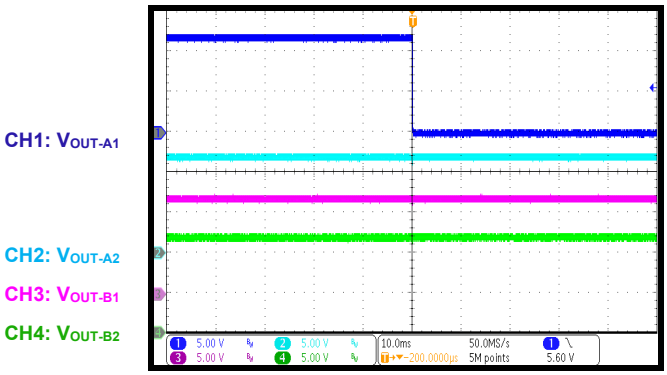
SCP Entry

I_{OUTx} = 0A, OUT_A1 SCP in auto-recovery mode



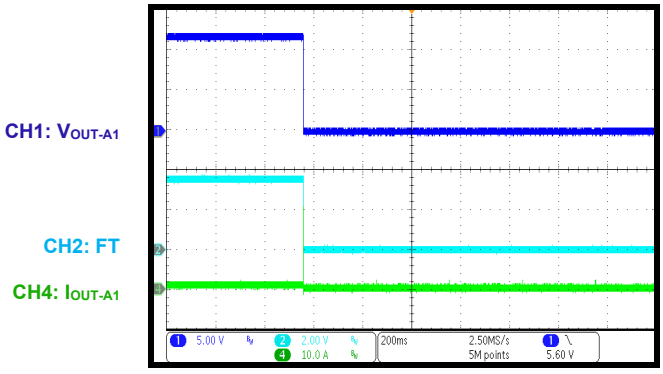
SCP Entry

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



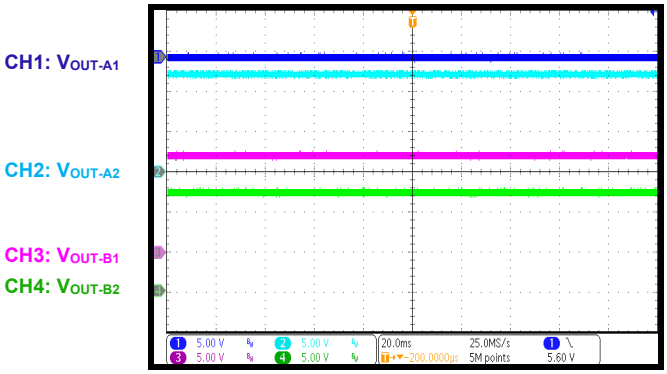
SCP Entry

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



SCP Steady State

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



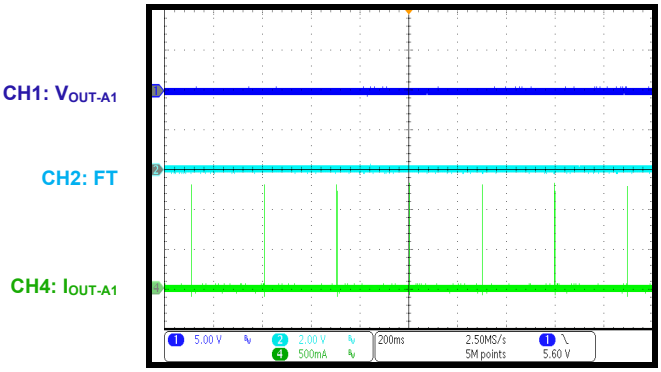
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVB TEST RESULTS *(continued)*

V_{INA} = V_{INB} = 12V, V_{DD} = 3.3V, t_{SS} = 1ms, T_A = 25°C, unless otherwise noted.

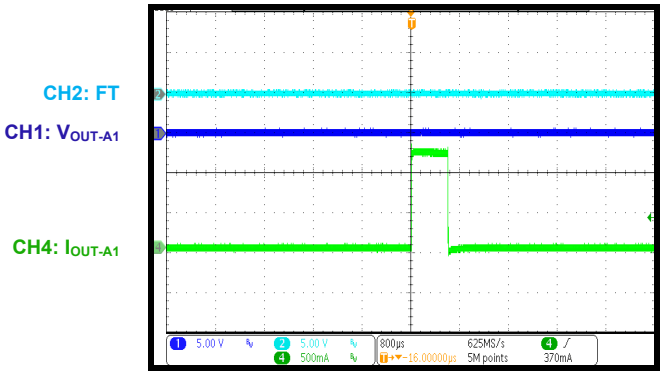
SCP Steady State

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



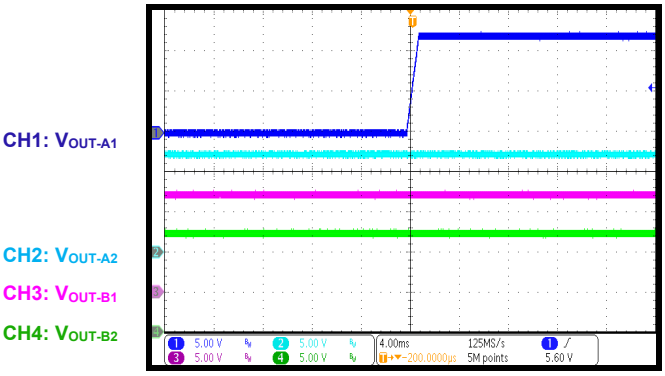
SCP Steady State

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



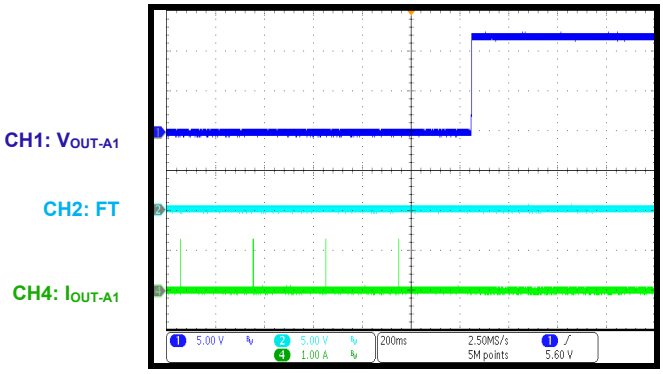
SCP Recovery

I_{OUTx} = 0A, OUT_A1 SCP in auto-recovery mode



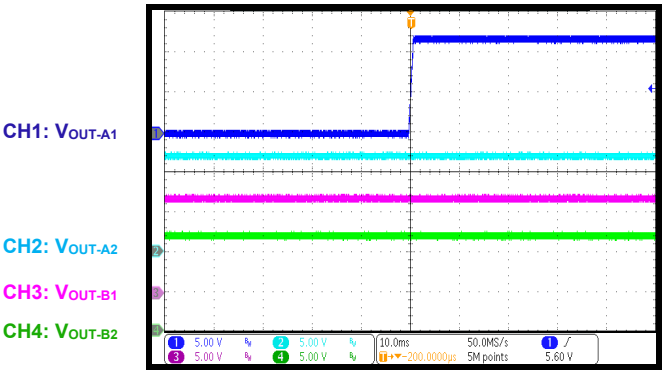
SCP Recovery

I_{OUTx} = 0A, OUT_A1 SCP in auto-recovery mode



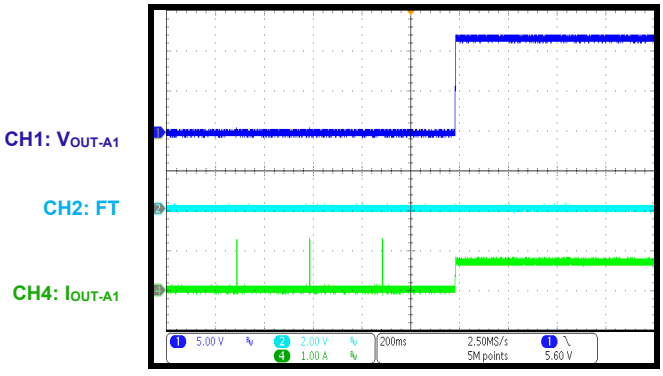
SCP Recovery

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



SCP Recovery

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



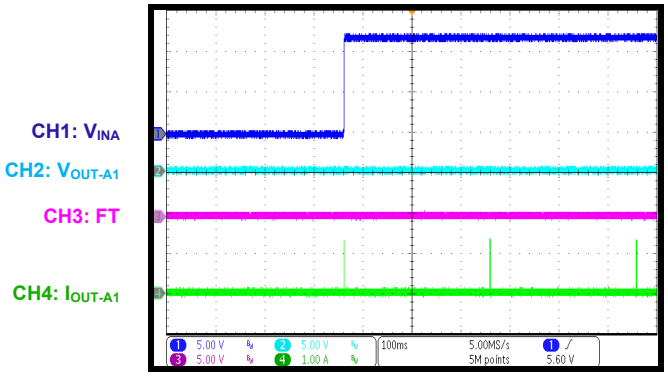
MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

EVB TEST RESULTS *(continued)*

V_{INA} = V_{INB} = 12V, V_{DD} = 3.3V, t_{SS} = 1ms, T_A = 25°C, unless otherwise noted.

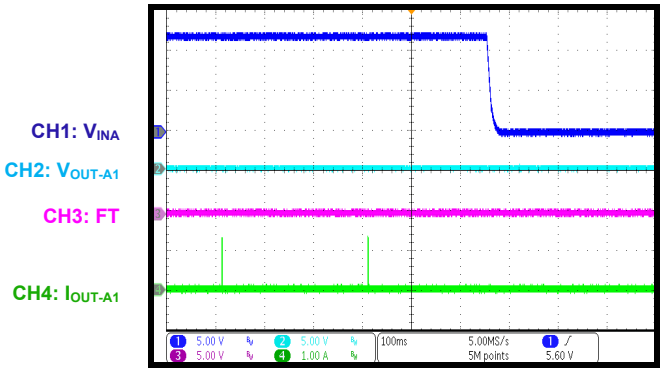
Power On during SCP

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



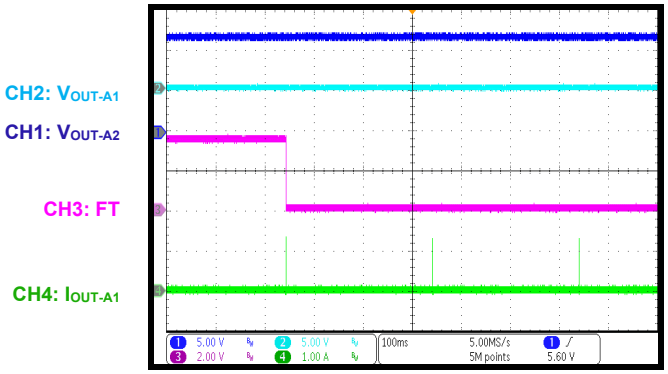
SCP before Shutdown

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



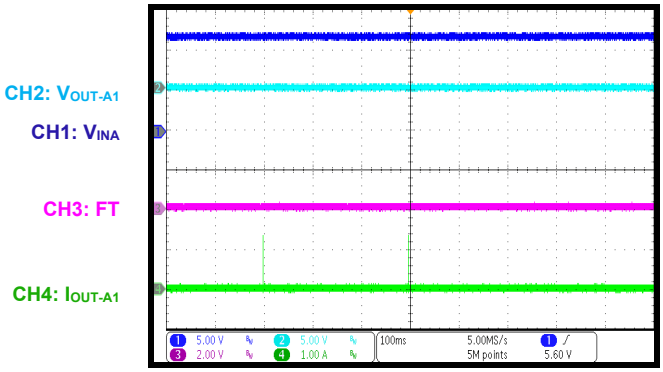
SCP EN Channel On

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



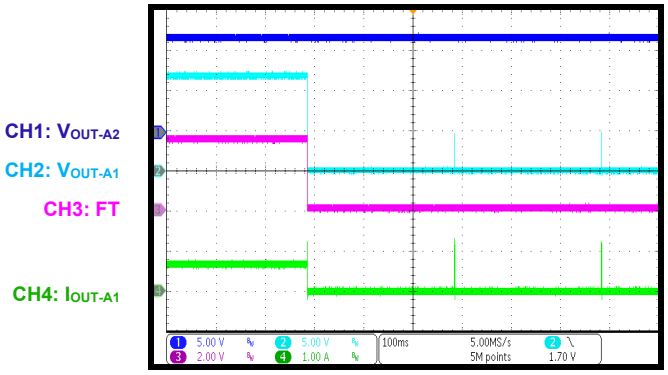
SCP EN Channel Off

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



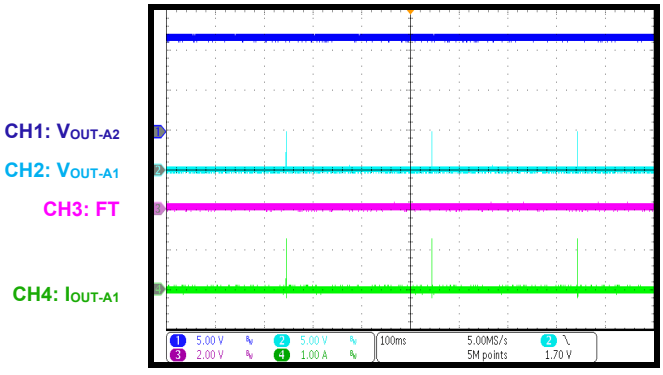
OCP Entry

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



OCP Steady State

I_{OUTx} = 0.8A, OUT_A1 SCP in auto-recovery mode



MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

PCB LAYOUT

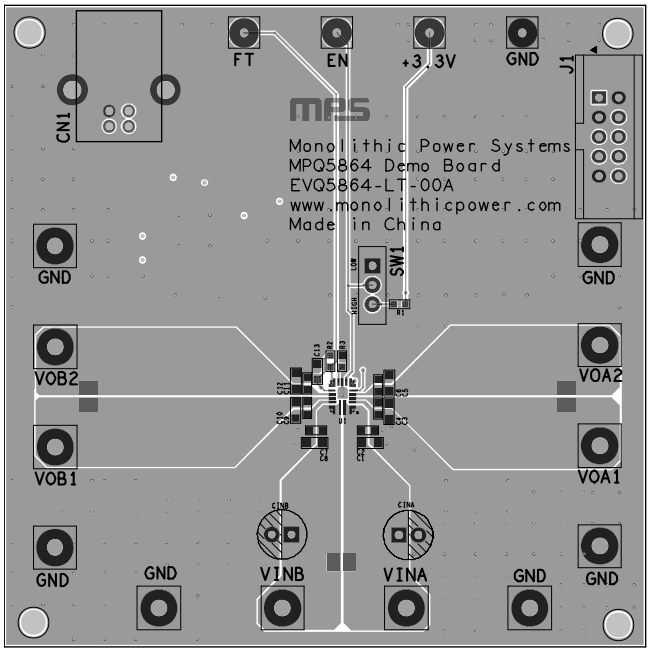


Figure 2: Top Layer

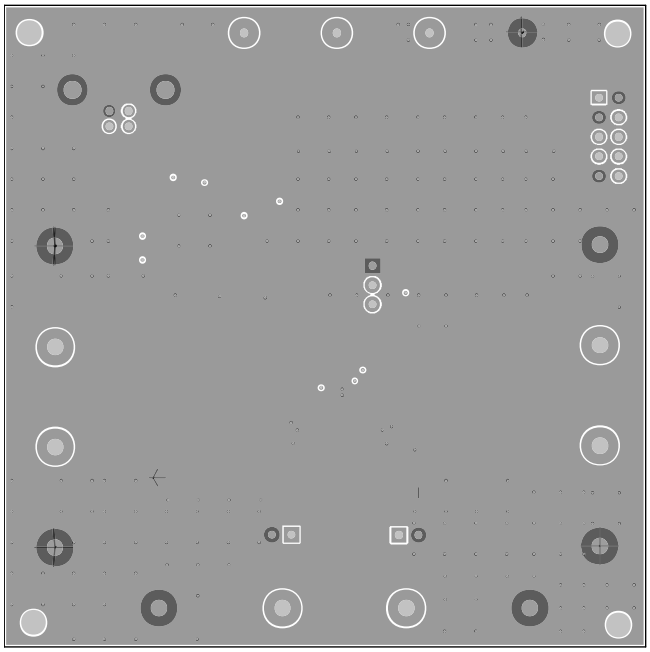


Figure 3: Mid-Layer 1

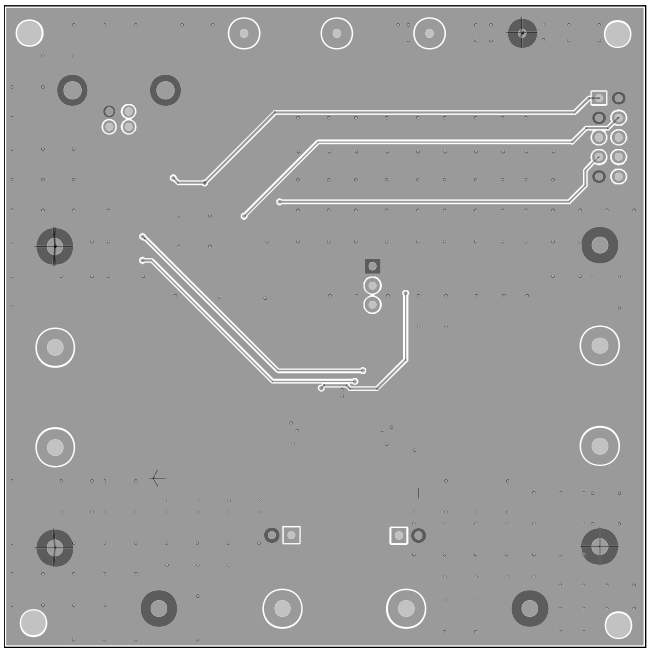


Figure 4: Mid-Layer 2

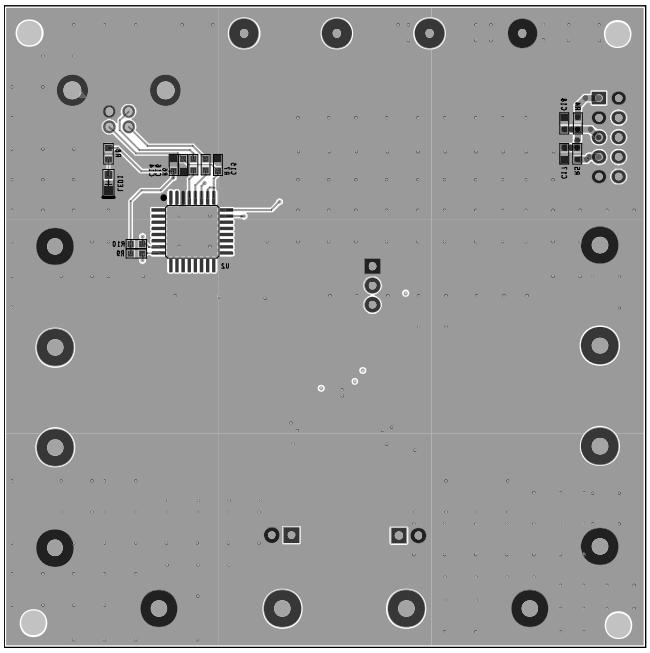


Figure 5: Bottom Layer

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.

REVISION HISTORY

Revision #	Revision Date	Description	Pages Updated
1.0	9/3/2024	Initial Release	-

Notice: The information in this document is subject to change without notice. Please contact MPS for current specifications. Users should warrant and guarantee that third-party Intellectual Property rights are not infringed upon when integrating MPS products into any application. MPS will not assume any legal responsibility for any said applications.

MPS Proprietary Information. Patent Protected. Unauthorized Photocopy and Duplication Prohibited.
© 2024 MPS. All Rights Reserved.