



# EV2760-VT-00A

## I<sup>2</sup>C-Controlled, 1-Cell to 4-Cell, Buck-Boost NVDC Charger with Reverse Source Mode Evaluation Board

### DESCRIPTION

The EV2760-VT-00A evaluation board is designed to demonstrate the capabilities of the MP2760, a buck-boost, narrow voltage DC (NVDC) charger IC designed for applications with 1-cell to 4-cell series battery packs.

The MP2760 can accept a wide 4V to 22V operating input voltage ( $V_{IN}$ ) range to charge the battery and power the load connected on SYS. The device also supplies a wide 3V to 21V voltage at the IN pin in source mode, which

is compliant with USB powered device (PD) specifications.

When input power is present, the EV2760-VT-00A charges the battery with a maximum 6A charge current. It can also supply voltage at the input when source mode is enabled. In source mode, the output current ( $I_{OUT}$ ) is limited to 6A.

The MP2760 is available in a TQFN-30 (4mmx5mm) package.

### PERFORMANCE SUMMARY <sup>(1)</sup>

Specifications are at  $T_A = 25^\circ\text{C}$ , unless otherwise noted.

| Parameters                                            | Conditions                                                                          | Value                                  |
|-------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------|
| Input voltage ( $V_{IN}$ ) range                      |                                                                                     | 4V to 22V                              |
| Battery charge regulation voltage ( $V_{BATT\_REG}$ ) | 2 cells                                                                             | 8.4V (I <sup>2</sup> C-configurable)   |
| Fast charge current ( $I_{CC}$ )                      | $V_{IN} = 9\text{V to } 22\text{V}$                                                 | 2A (I <sup>2</sup> C-configurable)     |
| System voltage ( $V_{SYS\_MIN\_REG}$ )                | 2 cells                                                                             | 6.5V (I <sup>2</sup> C-configurable)   |
| Output voltage in source mode ( $V_{IN\_SRC}$ ) range |                                                                                     | 3V to 21V                              |
| Output voltage in source mode ( $V_{IN\_SRC}$ )       |                                                                                     | 4.98V (I <sup>2</sup> C-configurable)  |
| Output current limit in source mode ( $I_{IN\_SRC}$ ) |                                                                                     | 2A (I <sup>2</sup> C-configurable)     |
| Charge typical efficiency                             | $V_{IN} = 20\text{V}$ , $V_{BATT} = 8\text{V}$ , $I_{CC} = 5\text{A}$               | 93.49%                                 |
| Charge peak efficiency                                | $V_{IN} = 12\text{V}$ , $V_{BATT} = 8\text{V}$ , $I_{CC} = 3\text{A}$               | 96%                                    |
| Source mode typical efficiency                        | $V_{BATT} = 7.4\text{V}$ , $V_{IN\_SRC} = 20\text{V}$ , $I_{IN\_SRC} = 1.5\text{A}$ | 93.5%                                  |
| Source mode peak efficiency                           | $V_{BATT} = 8.4\text{V}$ , $V_{IN\_SRC} = 12\text{V}$ , $I_{IN\_SRC} = 1.5\text{A}$ | 96.37%                                 |
| Switching frequency ( $f_{SW}$ )                      |                                                                                     | 600kHz (I <sup>2</sup> C-configurable) |

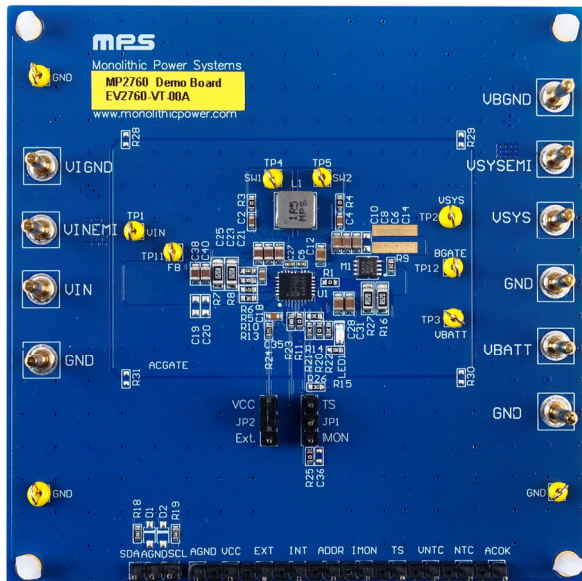
#### Note:

1) Refer to the MP2760 datasheet for details.



Optimized Performance with MPS Inductor MPL-AL5030-1R5

## EVALUATION BOARD



LxWxH (8.9cmx8.9cmx0.8cm)

| Board Number  | MPS IC Number  |
|---------------|----------------|
| EV2760-VT-00A | MP2760GVT-000A |

## QUICK START GUIDE

The EV2760-VT-00A evaluation board is designed for the MP2760, a buck-boost NVDC charger, when the device is used to charge a 2-cell battery. The board layout accommodates most commonly used resistors and capacitors. The board's default function is preset for charger mode, and the full charge voltage is preset to 8.4V. In charge mode, the MP2760 can work automatically in buck or buck-boost mode according to the input and battery voltages.

Follow the steps below to prepare the evaluation board.

1. Ensure that the computer has at least one USB port and a USB cable. The MP2760 evaluation software must be properly installed.
2. Connect the USB-to-I<sup>2</sup>C communication kit (EVKT-USBI2C-02) (see Figure 1).



**Figure 1: USB-to-I<sup>2</sup>C Communication Kit**

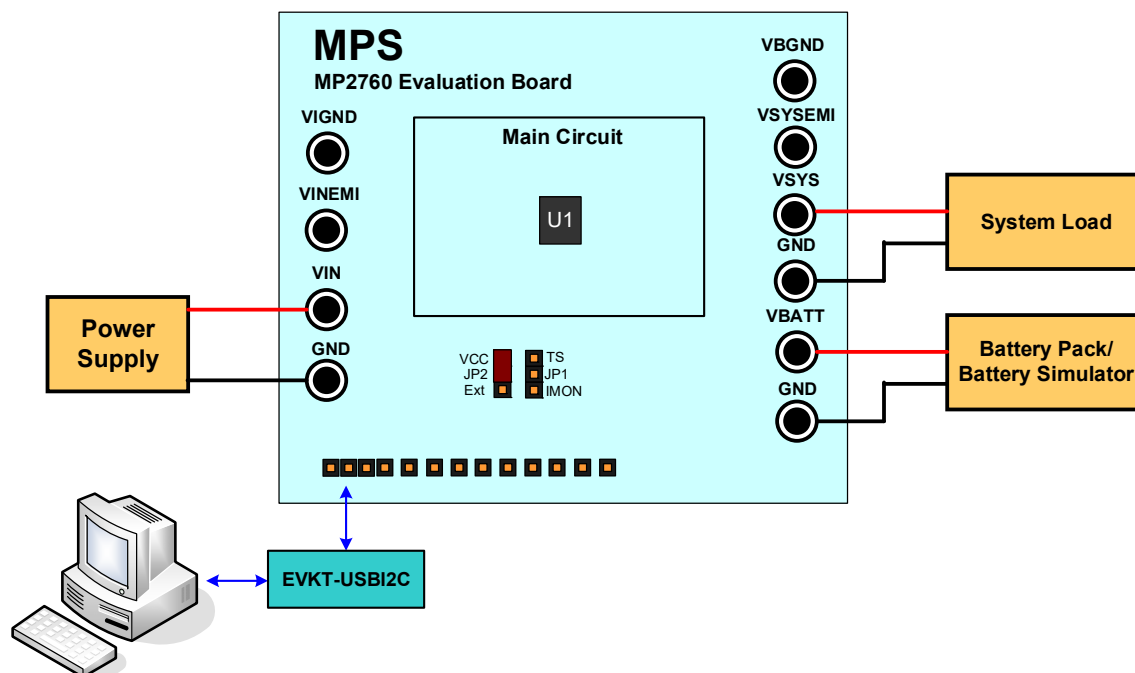
3. To enable the software, double-click on the “MP2760 Evaluation Kit” .exe file to run the MP2760 evaluation software. The software supports Windows 7 and Windows 10 operating systems.

The MP2760 evaluation kit.exe file can be downloaded from the MPS website.

### Original Test Set-Up for the MP2760

1. Connect the battery terminals to:
  - a. Positive (+): VBATT
  - b. Negative (-) GND
2. If using a battery simulator, preset the battery voltage between 0V and 8.4V, then turn off the battery voltage.
3. Connect the battery simulator output to the VBATT and GND pins, respectively.
4. Turn on the battery simulator before starting the test.
5. For charge mode testing, connect the input terminals to:
  - a. Positive (+): VIN
  - b. Negative (-): GND

Figure 2 on page 4 shows the charge mode testing set-up.



**Figure 2: Charge Mode Test Set-Up**

6. Connect the system load terminals to:
  - a. Positive (+): VSYS
  - b. Negative (-): GND
7. For source mode testing, connect the load terminals to:
  - a. Positive (+): VIN
  - b. Negative (-): GND

Table 1 shows the jumper connection settings.

**Table 1: Jumper Connections**

| Jack               | Description                                                                                                           | Default Setting    |
|--------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------|
| JP1 <sup>(2)</sup> | To select the pull-voltage, pull JP1 up to VCC or an external power source.                                           | Pull up JP1 to VCC |
| JP2 <sup>(3)</sup> | For the TS/IMON pin's connection, connect TS/IMON to different external circuitry depending on the TS/IMON selection. | Open               |

**Notes:**

- 2) If EXT is selected, add an external power source (e.g. 3.3V) at EXT to AGND. If VCC is selected, no other action is required.
- 3) TS/IMON has different external circuits. Connect TS/IMON to the corresponding circuit using the I<sup>2</sup>C.

8. Launch the MP2760 evaluation software (see Figure 3).



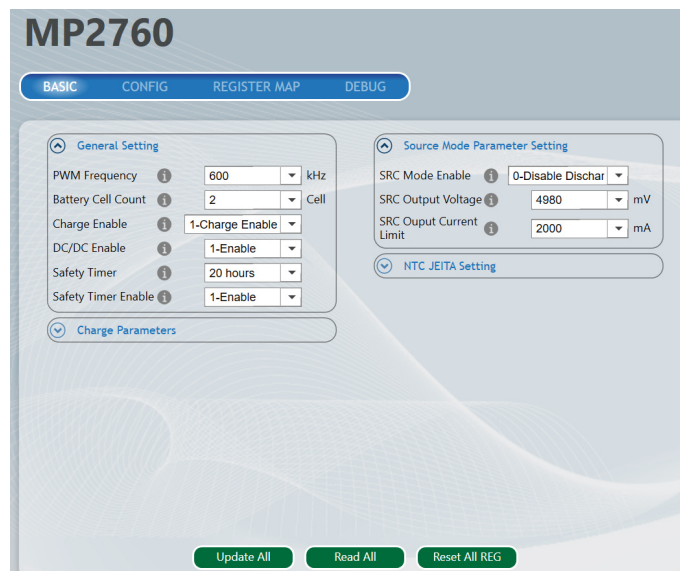
**Figure 3: MP2760 Evaluation Software**

- Turn on the input voltage ( $V_{IN}$ ) to charge the battery and power the system load with the default settings.

## Modifying Parameters via the GUI

To use MPS's GUI, ensure that all connections are successful, such as the connections between the computer, USB-to-I<sup>2</sup>C communication kit, and the evaluation board.

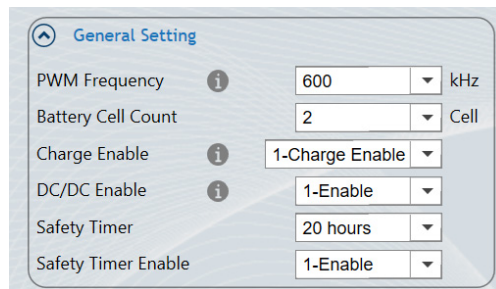
Figure 4 shows the MP2760's basic settings.



**Figure 4: Basic Settings**

Figure 5 on page 6 shows how to configure the general settings. These settings include the pulse-width modulation (PWM) frequency, battery cell count, safety timer, basic controls in charge mode (such as enabling the DC/DC converter), and charge enabling.

Note that the recommended PWM frequency is between 500kHz and 800kHz.



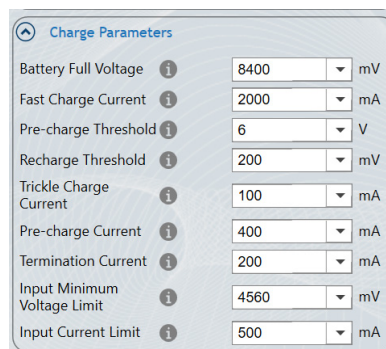
General Setting

|                     |                 |      |
|---------------------|-----------------|------|
| PWM Frequency       | 600             | kHz  |
| Battery Cell Count  | 2               | Cell |
| Charge Enable       | 1-Charge Enable |      |
| DC/DC Enable        | 1-Enable        |      |
| Safety Timer        | 20 hours        |      |
| Safety Timer Enable | 1-Enable        |      |

**Figure 5: General Settings**

Figure 6 shows how to configure the charge parameters, including the battery-full voltage, fast charge current, pre-charge threshold, recharge threshold, trickle charge current, pre-charge current, and termination current.

The charge parameters also provide the parameters for power path management, including the input minimum voltage limit and input current limit. All the parameters can be input directly by keyboard.

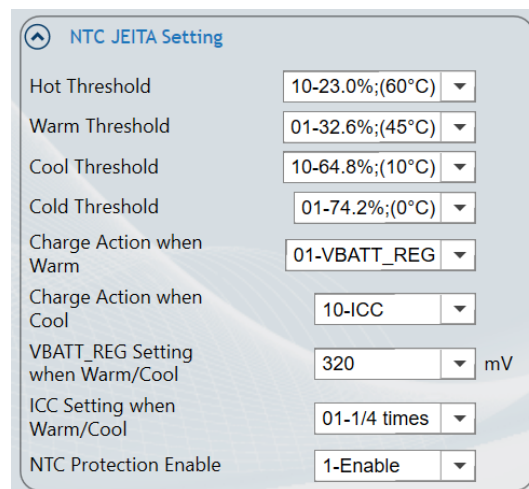


Charge Parameters

|                             |      |    |
|-----------------------------|------|----|
| Battery Full Voltage        | 8400 | mV |
| Fast Charge Current         | 2000 | mA |
| Pre-charge Threshold        | 6    | V  |
| Recharge Threshold          | 200  | mV |
| Trickle Charge Current      | 100  | mA |
| Pre-charge Current          | 400  | mA |
| Termination Current         | 200  | mA |
| Input Minimum Voltage Limit | 4560 | mV |
| Input Current Limit         | 500  | mA |

**Figure 6: Charge Parameters**

Figure 7 shows how to configure the negative temperature coefficient (NTC) JEITA settings for battery thermal protection.

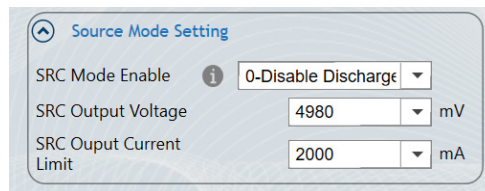


NTC JEITA Setting

|                                  |                 |
|----------------------------------|-----------------|
| Hot Threshold                    | 10-23.0%;(60°C) |
| Warm Threshold                   | 01-32.6%;(45°C) |
| Cool Threshold                   | 10-64.8%;(10°C) |
| Cold Threshold                   | 01-74.2%;(0°C)  |
| Charge Action when Warm          | 01-VBATT_REG    |
| Charge Action when Cool          | 10-ICC          |
| VBATT_REG Setting when Warm/Cool | 320 mV          |
| ICC Setting when Warm/Cool       | 01-1/4 times    |
| NTC Protection Enable            | 1-Enable        |

**Figure 7: NTC JEITA Settings**

Figure 8 on page 7 shows how to configure the source mode settings. In source mode, the battery supplies power to the IN pin. The discharge parameters include the SRC mode (enabled or disabled), SRC output voltage, and SRC output current limit.



**Source Mode Setting**

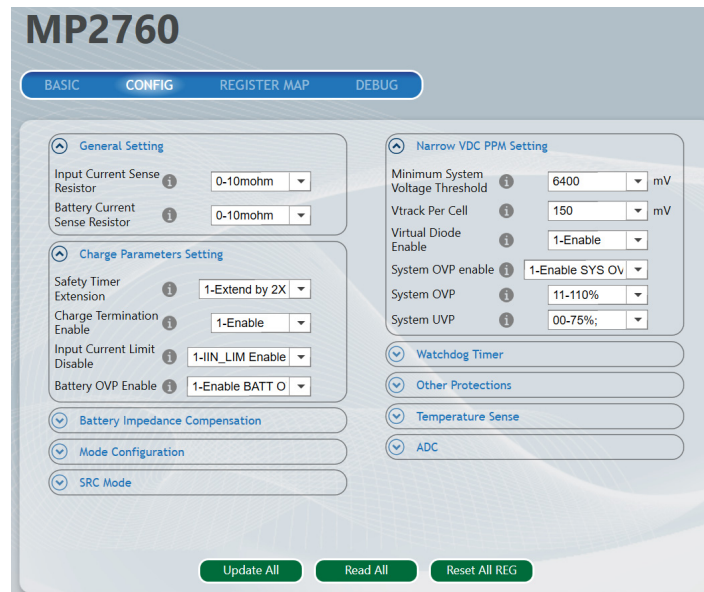
SRC Mode Enable ⓘ 0-Disable Discharge ▼

SRC Output Voltage 4980 ▼ mV

SRC Output Current Limit 2000 ▼ mA

Figure 8: Source Mode Settings

Figure 9 shows the MP2760's configuration settings.



**MP2760**

BASIC CONFIG REGISTER MAP DEBUG

**General Setting**

Input Current Sense Resistor ⓘ 0-10mohm ▼

Battery Current Sense Resistor ⓘ 0-10mohm ▼

**Charge Parameters Setting**

Safety Timer Extension ⓘ 1-Extend by 2X ▼

Charge Termination Enable ⓘ 1-Enable ▼

Input Current Limit Disable ⓘ 1-IIN\_LIM Enable ▼

Battery OVP Enable ⓘ 1-Enable BATT O' ▼

Battery Impedance Compensation

Mode Configuration

SRC Mode

**Narrow VDC PPM Setting**

Minimum System Voltage Threshold ⓘ 6400 ▼ mV

Vtrack Per Cell ⓘ 150 ▼ mV

Virtual Diode Enable ⓘ 1-Enable ▼

System OVP enable ⓘ 1-Enable SYS OV ▼

System OVP ⓘ 11-110% ▼

System LVP ⓘ 00-75% ▼

Watchdog Timer

Other Protections

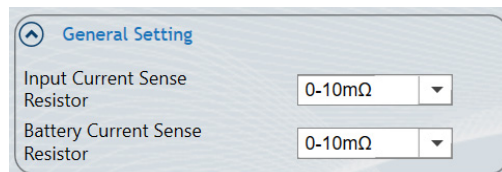
Temperature Sense

ADC

Update All Read All Reset All REG

Figure 9: Configuration Settings

Figure 10 shows how to configure and select the current-sense resistors.



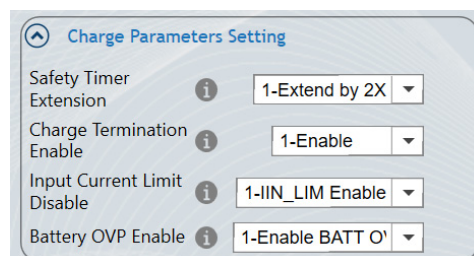
**General Setting**

Input Current Sense Resistor 0-10mΩ ▼

Battery Current Sense Resistor 0-10mΩ ▼

Figure 10: Current-Sense Resistor Settings

Figure 11 shows how to configure the charge protection parameters. These parameters include the safety timer extension, as well as options to enable charge termination, the input current limit, and battery over-voltage protection (OVP).



**Charge Parameters Setting**

Safety Timer Extension ⓘ 1-Extend by 2X ▼

Charge Termination Enable ⓘ 1-Enable ▼

Input Current Limit Disable ⓘ 1-IIN\_LIM Enable ▼

Battery OVP Enable ⓘ 1-Enable BATT O' ▼

Figure 11: Charge Parameters Setting

Figure 12 on page 8 shows how to configure the battery impedance compensation, including the battery impedance and voltage compensation limit.

**Batter Impedance Compensation**

Battery Impedance: 0 mΩ

Voltage Compensation Limit: 0 mV

**Figure 12: Battery Impedance Compensation**

Figure 13 shows how to configure the external MOSFET control. ACGATE can be set to drive the input MOSFET between the ADP pin and the input current-sense resistor. BGATE can be set to control the battery MOSFET between the SYS pin and the battery current-sense resistor.

**Mode Configuration**

BGATE Driver Enable: 1-Enable BGATE

BGATE Force Off: 0-Not force BGAT

ACGATE Force On: 0-Not force ACGA

ACGATE Driver Enable: 1-Enable ACGAE

**Figure 13: External MOSFET Configuration**

Figure 14 shows how to configure the SRC mode control, which includes the SRC output voltage configuration and protections.

**SRC Mode**

SRC Output Voltage Configuration: 0-By register bit

SRC Output Voltage Offset: 0 V

Battery Low Voltage Protection Enable: 1-Enable

Battery Low Voltage Threshold: 6 V

DC/DC Action when Battery Low Voltage: 0-INT

Battery Discharge Current Limit: 6400 mA

Battery Discharge Current Limit Enable: 0-Disable

**Figure 14: SRC Mode Configuration**

Figure 15 shows how to configure the NVDC power path management (PPM).

**Narrow VDC PPM Setting**

Minimum System Voltage Threshold: 6400 mV

Vtrack Per Cell: 100 mV

Virtual Diode Enable: 1-Enable

System OVP enable: 1-Enable SYS OV

System OVP: 11-110%

System UVP: 00-75%;

**Figure 15: NVDC PPM Settings**

Figure 16 on page 9 shows how to configure the watchdog timer.

The screenshot shows the 'Watchdog Timer' configuration panel. It contains three dropdown menus: 'Watchdog Timer' set to '00-Disable Tim', 'Watchdog Feed Bit' set to '0-Normal', and 'Watchdog Timer Setting when Input Absent' set to '1-Enable'.

**Figure 16: Watchdog Timer**

Figure 17 shows how to configure additional protections, including the input under-voltage (UV) threshold, input over-voltage (OV) threshold, and input OV deglitch time.

The screenshot shows the 'Other Protections' configuration panel. It contains three dropdown menus: 'Input Under Voltage Threshold' set to '3.2 V', 'Input Over Voltage Threshold' set to '22.4 V', and 'Input Over Voltage Deglitch Time' set to '0-100ns'.

**Figure 17: Additional Protections**

Figure 18 shows how to configure temperature-sense control. The TS/IMON pin can be set as either the temperature-sense pin (TS) or the battery current monitor pin (IMON).

The screenshot shows the 'Temperature Sense' configuration panel. It contains eight dropdown menus: 'TS/IMON Pin Function' set to '0-TS', 'TS Sense Point' set to '1-Battery FET', 'TS Function Enable' set to '1-Enable', 'TS Function Action Enable when Fault' set to '1-INT and TS a', 'TS Temperature Threshold' set to '100-14.3%;(80°', 'Thermal loop Enable' set to '1-Enable', 'Thermal Loop Temperature Threshold' set to '111-120°C', and 'Thermal Loop Temperature Threshold' set to '111-120°C'.

**Figure 18: Temperature Sense**

Figure 19 shows how to configure the ADC operation mode.

The screenshot shows the 'ADC' configuration panel. It contains two dropdown menus: 'ADC Conversion Behavior' set to '0-One-shot Cor' and 'ADC Conversion One-shot Enable' set to '1-Enable ADC'.

**Figure 19: ADC Operation Mode**

Figure 20 on page 10 shows the register map, which matches all the register results displayed on the BASIC and CONFIG pages.

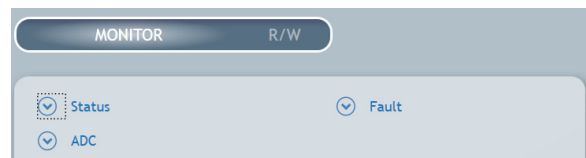
**MP2760**

BASIC CONFIG **REGISTER MAP** DEBUG

| Command code | Command name                                                         | Register |
|--------------|----------------------------------------------------------------------|----------|
| 05H          | Device Address Setting                                               | 0209     |
| 06H          | Input Minimum Voltage Limit Setting                                  | 0039     |
| 07H          | System Minimum Voltage Setting                                       | 002C     |
| 08H          | Input Current Limit Setting                                          | 003C     |
| 09H          | Output Voltage Setting                                               | 00F9     |
| 0AH          | Battery Impedance Compensation and Output Current Limit Setting      | 0028     |
| 0BH          | Battery Low Voltage Setting and Battery Discharge Current Regulation | 308C     |
| 0CH          | JEITA Action Setting                                                 | 341C     |
| 0DH          | Temperature Protection Setting                                       | F399     |
| 0EH          | Configuration Register 0                                             | 001C     |
| 0FH          | Configuration Register 1                                             | F244     |
| 10H          | Configuration Register 2                                             | 0A7E     |
| 11H          | Configuration Register 3                                             | 60EE     |
| 12H          | Configuration Register 4                                             | 3C7E     |
| 14H          | Charge Current Setting                                               | 0A0C     |

**Figure 20: MP2760 Register Map**

Figure 21 shows the monitor view.



**Figure 21: Monitor View**

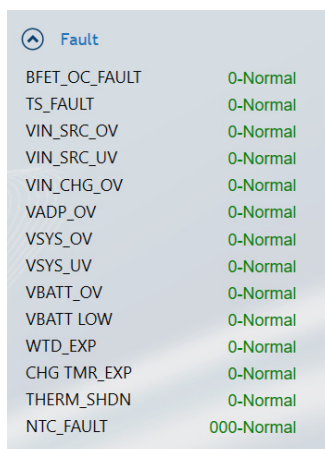
Figure 22 shows how to configure the status.

↑ Status

|                      |                                  |
|----------------------|----------------------------------|
| MD_STAT              | 01-Operation Mode                |
| PG_STAT              | 1-Power Good                     |
| SWITCH_STAT          | 11-BOOST                         |
| BATTMISS_STAT        | 0-Normal                         |
| Address Setting STAT | 0-Single port                    |
| CHG_STAT             | 011-CC charge                    |
| VIN_MIN_STAT         | 0-Not in input voltage limit     |
| IIN_LIM_STAT         | 1-In input current limit         |
| TJREG_STAT           | 0-Not in thermal regulation loop |
| IIN_DPM              | 500 mA                           |

**Figure 22: Status Setting**

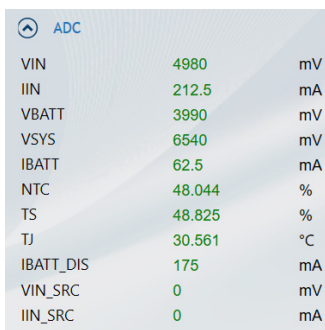
Figure 23 shows how the fault statuses are displayed.



| Fault         |            |
|---------------|------------|
| BFET_OC_FAULT | 0-Normal   |
| TS_FAULT      | 0-Normal   |
| VIN_SRC_OV    | 0-Normal   |
| VIN_SRC_UV    | 0-Normal   |
| VIN_CHG_OV    | 0-Normal   |
| VADP_OV       | 0-Normal   |
| VSYS_OV       | 0-Normal   |
| VSYS_UV       | 0-Normal   |
| VBATT_OV      | 0-Normal   |
| VBATT_LOW     | 0-Normal   |
| WTD_EXP       | 0-Normal   |
| CHG_TMR_EXP   | 0-Normal   |
| THERM_SHDN    | 0-Normal   |
| NTC_FAULT     | 000-Normal |

**Figure 23: Fault Settings**

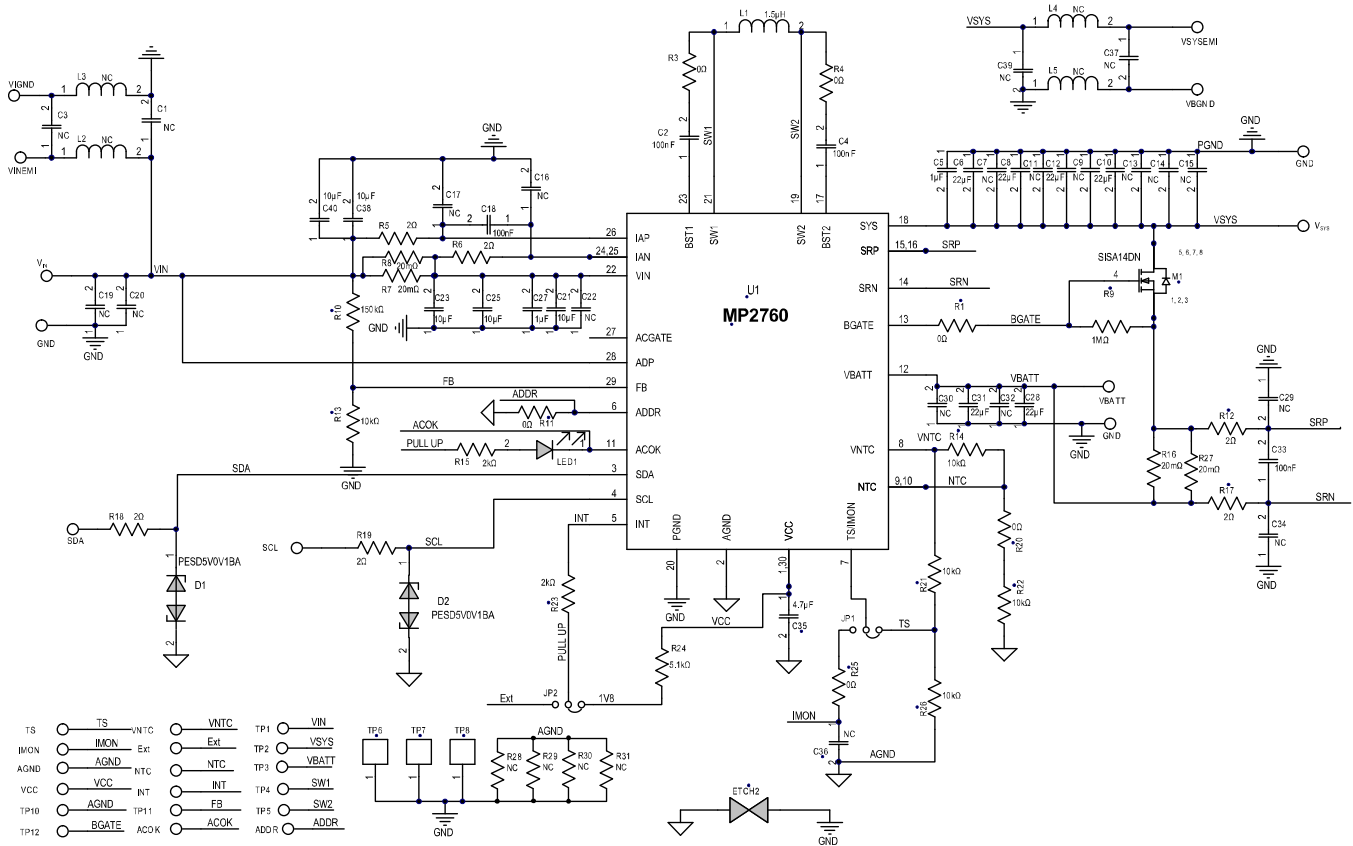
Figure 24 shows how to configure the analog-to-digital converter (ADC).



| ADC       |        |    |
|-----------|--------|----|
| VIN       | 4980   | mV |
| IIN       | 212.5  | mA |
| VBATT     | 3990   | mV |
| VSYS      | 6540   | mV |
| IBATT     | 62.5   | mA |
| NTC       | 48.044 | %  |
| TS        | 48.825 | %  |
| TJ        | 30.561 | °C |
| IBATT_DIS | 175    | mA |
| VIN_SRC   | 0      | mV |
| IIN_SRC   | 0      | mA |

**Figure 24: ADC Settings**

# EVALUATION BOARD SCHEMATIC



**Figure 25: Evaluation Board Schematic**

## EV2760-VT-00A BILL OF MATERIALS

| Qty | Ref                                                                                 | Value  | Description                    | Package            | Manufacturer | Manufacturer PN    |
|-----|-------------------------------------------------------------------------------------|--------|--------------------------------|--------------------|--------------|--------------------|
| 4   | L2, L3, L4, L5                                                                      | NC     |                                |                    |              |                    |
| 6   | R1, R3, R4,<br>R11, R20, R25                                                        | 0      | Film resistor, 5%              | 0603               | Yageo        | RC0603JR-070RL     |
| 6   | R5, R6, R12,<br>R17, R18, R19                                                       | 2Ω     | Film resistor, 5%              | 0603               | Liz          | CR0603JA02R0G      |
| 4   | R7, R8,<br>R16, R27                                                                 | 20mΩ   | Film resistor, 1%,<br>1/4W     | 1206               | Cyntec       | RL1632H-R020-FN    |
| 1   | R9                                                                                  | 1mΩ    | Film resistor, 1%              | 0603               | Yageo        | RC0603FR-071ML     |
| 1   | R10                                                                                 | 150kΩ  | Film resistor, 5%,<br>1/10W    | 0603               | Yageo        | RC0603JR-07150KL   |
| 5   | R13, R14,<br>R21, R22, R26                                                          | 10kΩ   | Film resistor, 1%,<br>1/10W    | 0603               | Yageo        | RC0603FR-0710KL    |
| 2   | R15, R23                                                                            | 2kΩ    | Film resistor, 1%              | 0603               | Yageo        | RC0603FR-072KL     |
| 1   | R24                                                                                 | 5.1kΩ  | Film resistor, 5%              | 0603               | Yageo        | RC0603JR-075K1L    |
| 4   | R28, R29,<br>R30, R31                                                               | NC     |                                |                    |              |                    |
| 11  | C1, C3, C15,<br>C16, C17,<br>C22, C29,<br>C34, C36,<br>C37, C39                     | NC     |                                |                    |              |                    |
| 4   | C2, C4,<br>C18, C33                                                                 | 100nF  | Ceramic capacitor,<br>25V, X7R | 0603               | Würth        | 885012206071       |
| 2   | C5, C27                                                                             | 1μF    | Ceramic capacitor,<br>25V, X5R | 0402               | Murata       | GRM155R61E105KA12  |
| 6   | C6, C8, C10,<br>C12, C28, C31                                                       | 22μF   | Ceramic capacitor,<br>25V, X5R | 0805               | Murata       | GRM21BR61E226ME44L |
| 9   | C7, C9, C11,<br>C13, C14,<br>C19, C20,<br>C30, C32                                  | NC     |                                |                    |              |                    |
| 5   | C21, C23,<br>C25, C38, C40                                                          | 10μF   | Ceramic capacitor,<br>25V, X7S | 0805               | Murata       | GRM21BC7E106KE11L  |
| 1   | C35                                                                                 | 4.7μF  | Ceramic capacitor,<br>25V, X5R | 0603               | Murata       | GRM188R61E475KE11D |
| 1   | LED1                                                                                | Red    | Red LED                        | 0805               | Bright LED   | BL-HUE35A-AV-TRB   |
| 2   | D1, D2                                                                              | NC     |                                |                    |              |                    |
| 1   | M1                                                                                  | 8.5mΩ  | N-channel MOSFET,<br>30V, 20A  | PowerPAK<br>1212-8 | Vishay       | SISA14DN-T1-GE3    |
| 13  | ACOK, ADDR,<br>AGND, AGND,<br>EXT, IMON,<br>INT, NTC, TS,<br>VCC, VNTC,<br>SCL, SDA | 2.54mm | Pin header                     | DIP                | Any          |                    |

**EV2760-VT-00A BILL OF MATERIALS** *(continued)*

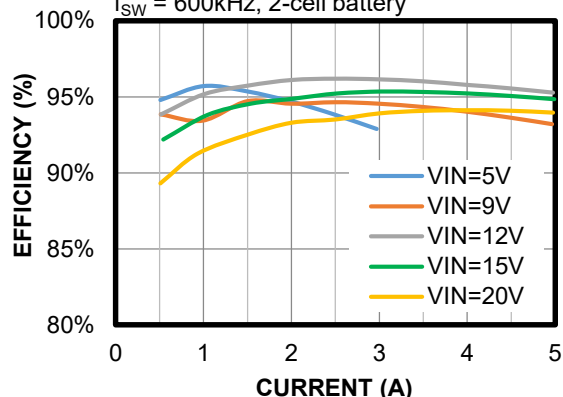
| Qty | Ref                                                                                                 | Value             | Description                             | Package                  | Manufacturer | Manufacturer PN |
|-----|-----------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------|--------------------------|--------------|-----------------|
| 11  | TP1, TP2, TP3,<br>TP4, TP5, TP6<br>(GND), TP7<br>(GND), TP8<br>(GND), TP10<br>(AGND), TP11,<br>TP12 | 1mm               | Test point, $\phi = 1\text{mm}$         | DIP                      | Any          |                 |
| 10  | VIN, VINEMI,<br>VBATT, VSYS,<br>VSYSSEMI, GND,<br>GND, GND,<br>VIGND, VBGND                         | 2mm               | Test point, $\phi = 2\text{mm}$         | DIP                      | Any          |                 |
| 2   | JP1, JP2                                                                                            | 2.54mm            | Pin header                              | DIP                      | Any          |                 |
| 1   | JP1                                                                                                 | 2.54mm            | Jumper                                  | DIP                      | Any          |                 |
| 1   | L1                                                                                                  | 1.5 $\mu\text{H}$ | Inductor, 9.7m $\Omega$ , 9A            | SMD                      | MPS          | MPL-AL5030-1R5  |
| 1   | U1                                                                                                  | MP2760            | 1-cell to 4-cell buck-<br>boost charger | TQFN-30<br>(4mmx<br>5mm) | MPS          | MP2760GVT-000A  |

## EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board. Default setting is for a 2-cell battery,  $C_{IN} = 10\mu F \times 5 + 1\mu F \times 1$ ,  $C_{SYS} = 22\mu F \times 4 + 1\mu F \times 1$ ,  $C_{BATT} = 22\mu F \times 2$ ,  $L = 1.5\mu H$  (10m $\Omega$ ),  $f_{SW} = 600kHz$ , 2-cell battery.  $T_A = 25^\circ C$ , unless otherwise noted.

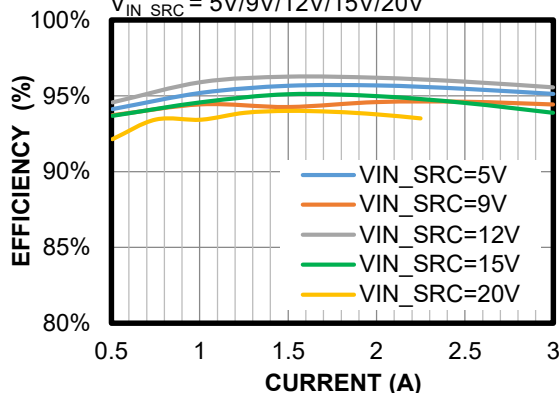
### Efficiency vs. Charge Current in Charge Mode

$V_{BATT} = 8V$ ,  $V_{IN} = 5V/9V/12V/15V/20V$ ,  
 $f_{SW} = 600kHz$ , 2-cell battery



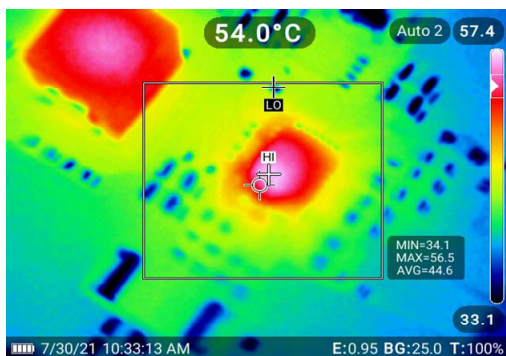
### Efficiency vs. Source Current in Source Mode

$V_{BATT} = 8.4V$ ,  $f_{SW} = 600kHz$ , 2-cell battery,  
 $V_{IN\_SRC} = 5V/9V/12V/15V/20V$



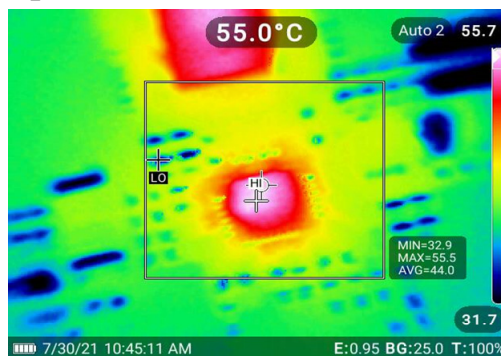
### Thermal Performance

Charge mode,  $V_{IN} = 20V$ ,  $I_{NLIMIT} = 3A$ ,  
 $V_{BATT} = 8.2V$ ,  $I_{CC} = 5A$



### Thermal Performance

Source mode,  $V_{BATT} = 8.4V$ ,  $V_{IN\_SRC} = 20V$ ,  
 $I_{IN\_SRC} = 1.8A$

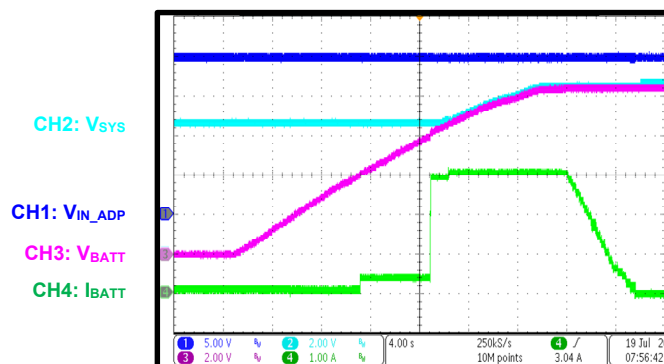


## EVB TEST RESULTS (continued)

Performance curves and waveforms are tested on the evaluation board. Default setting is for a 2-cell battery,  $C_{IN} = 10\mu F \times 5 + 1\mu F \times 1$ ,  $C_{SYS} = 22\mu F \times 4 + 1\mu F \times 1$ ,  $C_{BATT} = 22\mu F \times 2$ ,  $L = 1.5\mu H$  (10m $\Omega$ ),  $f_{SW} = 600kHz$ , 2-cell battery.  $T_A = 25^\circ C$ , unless otherwise noted.

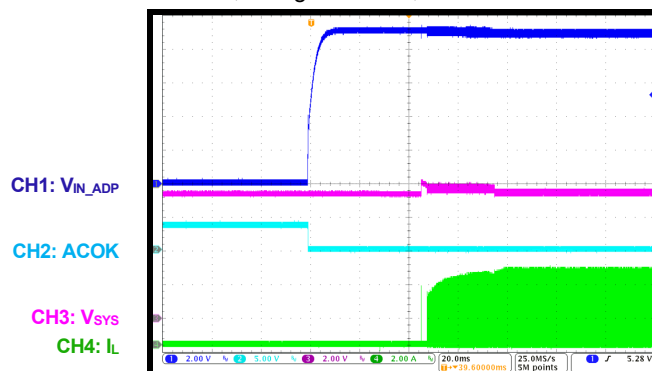
### Charge Profile Curves

$V_{IN\_ADP} = 20V$ ,  $V_{BATT} = 0V$  to  $8.4V$ ,  $I_{IN\_MIN} = 3A$ ,  
 $I_{CC} = 2A$ ,  $V_{SYS\_MIN} = 6.4V$ ,  $V_{TRACK} = 100mV$



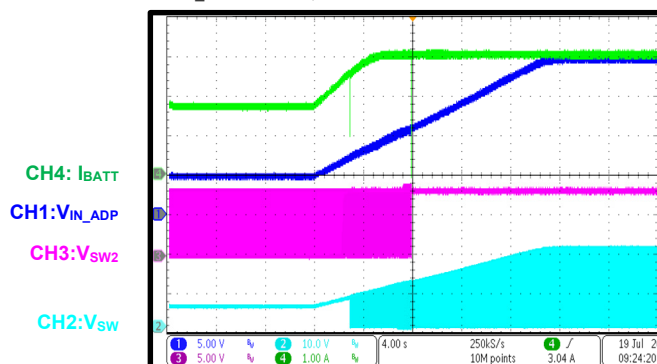
### Start-Up through VIN in Charge Mode

9V input power on,  $V_{BATT} = 7.4V$  (2 cells),  
 $I_{CC} = 2A$ , charge enabled,  $I_{SYS} = 0A$



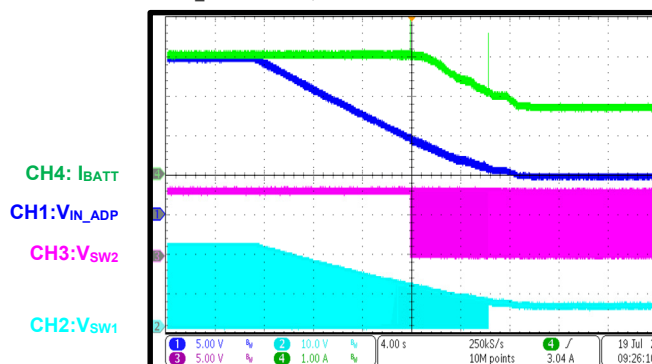
### $V_{IN\_ADP}$ Step from 5V to 20V

$I_{IN\_MIN} = 3A$ ,  $V_{BATT} = 8V$ ,  $I_{CC} = 3A$ ,  
 $V_{SYS\_MIN} = 6.4V$ ,  $V_{TRACK} = 100mV$



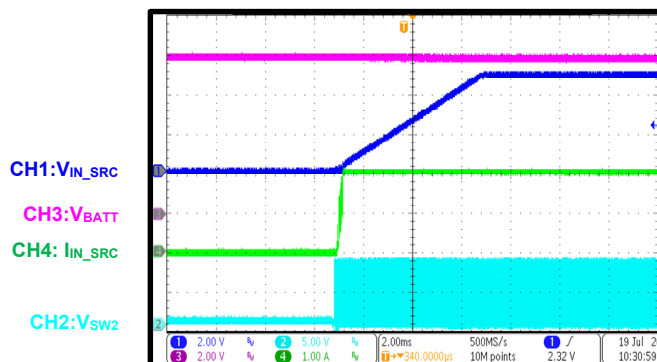
### $V_{IN\_ADP}$ Step from 20V to 5V

$I_{IN\_MIN} = 3A$ ,  $V_{BATT} = 8V$ ,  $I_{CC} = 3A$ ,  
 $V_{SYS\_MIN} = 6.4V$ ,  $V_{TRACK} = 100mV$



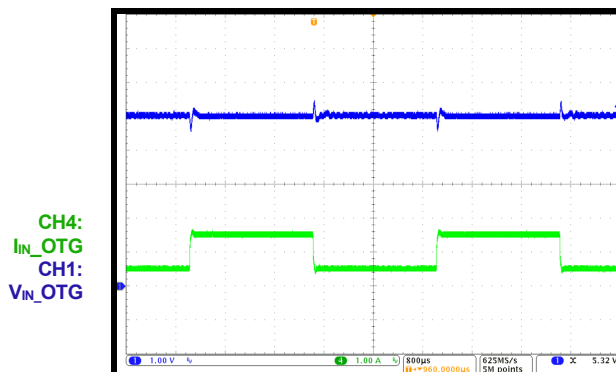
### Start-Up through $V_{IN\_SRC}$ in Source Mode

$V_{BATT} = 8V$ ,  $V_{IN\_SRC} = 5V$ ,  $I_{IN\_SRC} = 2A$



### Load Transient in Source Mode

$V_{BATT} = 7.4V$  (2 cells),  $V_{IN\_SRC} = 5V$ , load current  
 between 0.5A and 1.5A

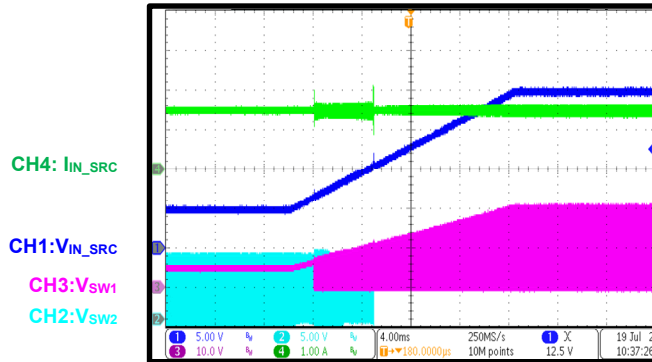


## EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board. Default setting is for a 2-cell battery,  $C_{IN} = 10\mu F \times 5 + 1\mu F \times 1$ ,  $C_{SYS} = 22\mu F \times 4 + 1\mu F \times 1$ ,  $C_{BATT} = 22\mu F \times 2$ ,  $L = 1.5\mu H$  (10m $\Omega$ ),  $f_{SW} = 600kHz$ , 2-cell battery.  $T_A = 25^\circ C$ , unless otherwise noted.

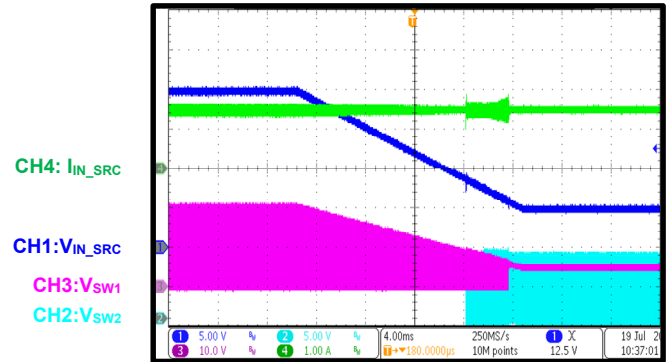
### $V_{IN\_SRC}$ Step from 5V to 20V in Source Mode

$V_{BATT} = 8V$ ,  $V_{IN\_SRC} = 5V$  to  $20V$ ,  $I_{IN\_SRC} = 1.5A$



### $V_{IN\_SRC}$ Step from 20V to 5V in Source Mode

$V_{BATT} = 8V$ ,  $V_{IN\_SRC} = 20V$  to  $5V$ ,  $I_{IN\_SRC} = 1.5A$



## PCB LAYOUT

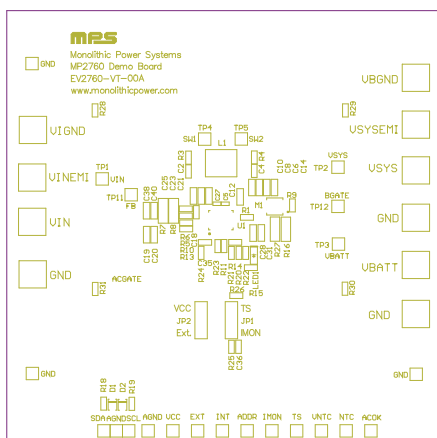


Figure 26: Top Silk

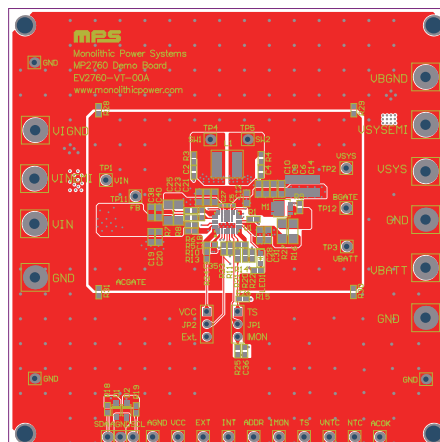


Figure 27: Top Layer

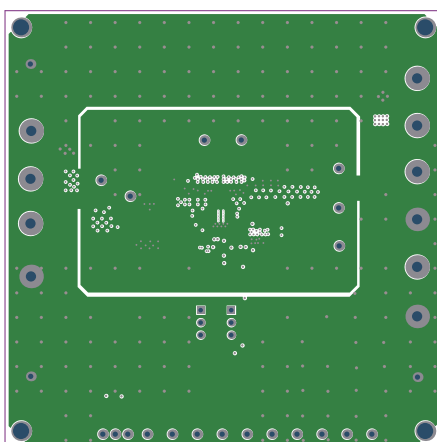


Figure 28: Mid-Layer 1

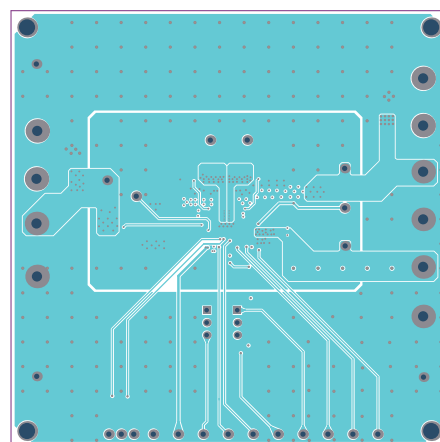


Figure 29: Mid-Layer 2

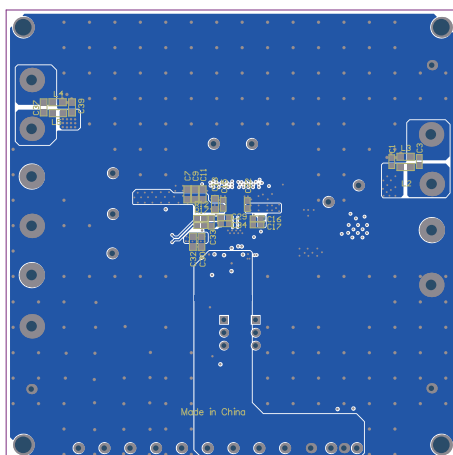


Figure 30: Bottom Layer

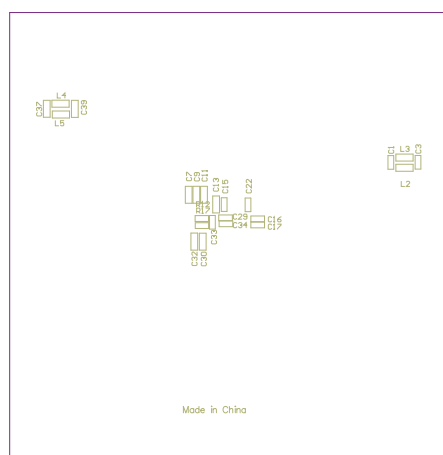


Figure 31: Bottom Silk

## REVISION HISTORY

| Revision # | Revision Date | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Pages Updated |
|------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 1.0        | 3/11/2022     | Initial Release                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | -             |
| 1.1        | 6/30/2023     | Updated Figure 25 to be consistent with the EVB images and BOM: <ul style="list-style-type: none"> <li>• C14 = NC</li> <li>• C19 = NC</li> <li>• C21 = 10<math>\mu</math>F</li> <li>• C25 = 10<math>\mu</math>F</li> <li>• R9 = 1M<math>\Omega</math></li> <li>• R14 = 10k<math>\Omega</math></li> <li>• R20 = 0<math>\Omega</math></li> <li>• Updated the PGND connector to GND</li> <li>• Updated the ACGATE pin to AGND on the TP10 connector</li> <li>• Removed TP9</li> <li>• Added R28 = R29 = R30 = R31 = NC</li> <li>• Removed AGND14</li> </ul> | 12            |
| 1.2        | 2/22/2024     | Updated the MP2760's manufacturer PN in MPS IC Number table to MP2760GVT-000A                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2             |
|            |               | Updated "MP2651" to "MP2760" in step 3 of the Quick Start Guide section                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3             |
|            |               | Updated the Bill of Materials: <ul style="list-style-type: none"> <li>• Updated the MP2760's manufacturer PN to MP2760GVT-000A</li> <li>• Update TP9 (GND) to TP10 (AGND)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                     | 14            |
|            |               | Updated the Rev. 1.1 information in the Revision History table: <ul style="list-style-type: none"> <li>• Updated "Removed T9" to "Removed TP9"</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                | 19            |

**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.