EV2672-D-01A

2-cell Boost Charger EV Board with 2A Charge Current and NVDC

DESCRIPTION

The EV2672 Evaluation Board is designed to demonstrate the capabilities of MPS' MP2672.

The MP2672 is a high-integrated, flexible switch-mode battery charging management device for 2-cell series Li-ion and Li-Polymer battery pack used in a wide range of portable applications.

When 5V adapter or USB input is present, the MP2672 charges 2-cell battery in step-up mode, when 5V input is absent, 2-cell battery discharges and the battery supplies system.

For the charging function in each application, the MP2672 automatically detects the battery voltage and charges the battery in the three phases: pre current, constant current and constant voltage. Other features include charge termination and auto-recharge.

To guaranteed safe operation, the MP2672 limits the die temperature to a preset value 120ºC. Other safety features include input over-voltage protection, battery over-voltage protection, thermal shutdown, battery temperature monitoring, and a programmable timer to prevent prolonged charging of a dead battery.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	4.5 -6.0	V
Pre Charge Threshold	V_{BATT_PRE}	6.4/I²C	V
Battery Charge Voltage Regulation	V_{BATT_REG}	8.4/I²C	V
Fast Charge Current	I_{CC}	2/I²C	A
System Regulation Minimum Voltage	$V_{SYS_REG_MIN}$	6.6	V

FEATURES

- 4.0V-to-5.75V Input Voltage Range
- Compatible with Host and Standalone Mode
- NVDC Power Path Management
- Programmable Input Voltage Limit
- Up to 2A Programmable Charge Current for 2-cell Battery
- Programmable Charge Voltage with 0.5% Accuracy
- No External Sense Resistor Required
- Integrated Cell Balancing Circuit Preconditioning for Fully Depleted Battery
- Flexible New Charging Cycle Initiation
- Charging Operation Indicator
- I²C Port for Flexible System Parameter Setting and Status Reporting
- Negative Temperature Coefficient Pin for Temperature Monitoring
- Built-in Charging Protection and Programmable Safety Timer
- Thermal Regulation and Thermal Shutdown
- 2mmx3mm QFN-18 package

APPLICATIONS

- Portable Hand-held Solutions
- POS Machine
- Blue-tooth Speaker
- E-Cigarette
- General 2-Cell Application

All MPS parts are lead-free, halogen-free, and adhere to the RoHS directive. For MPS green status, please visit the MPS website under Quality Assurance. "MPS" and "The Future of Analog IC Technology" are registered trademarks of Monolithic Power Systems, Inc.

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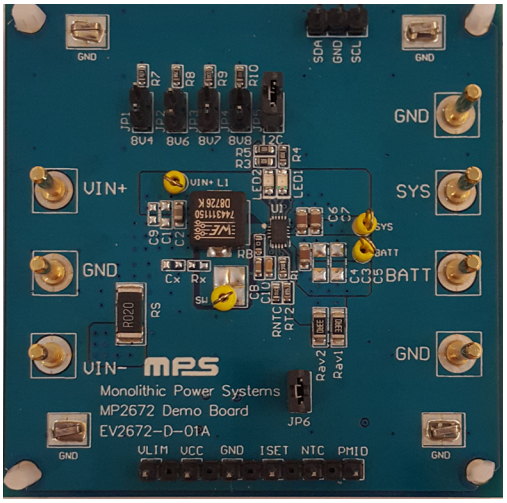
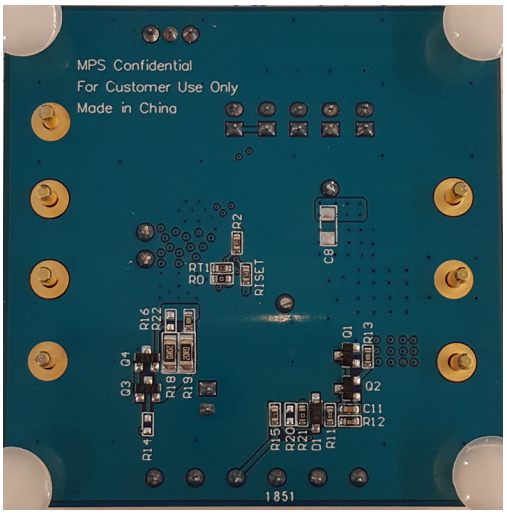
EV2672-D-01A EVALUATION BOARD



Top layer



Bottom layer

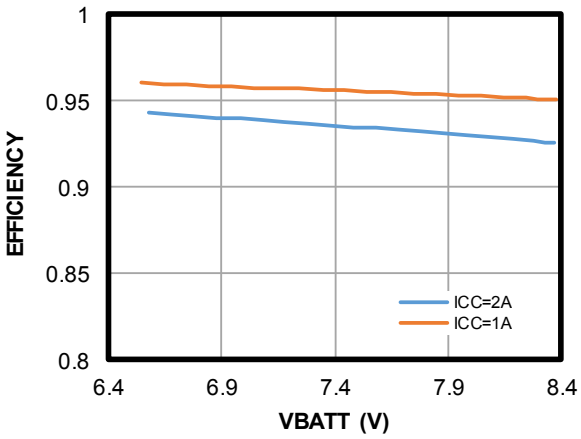
(L × W × H) 6.35cm x 6.35cm x 0.16 cm

Board Number	MPS IC Number
EV2672-D-01A	MP2672GD

Charge Efficiency Test On EVB

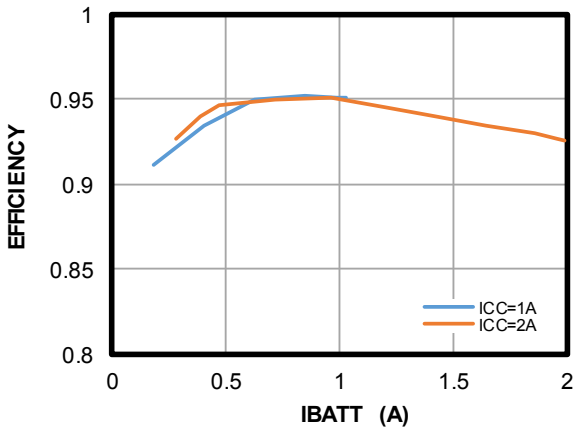
CC Charge Efficiency

Conditions: V_{IN}=5V(5A), I_{SYS}=0A, V_{BATT} ramp from 6.4V to 8.4V in constant current loop.



CV Efficiency

Conditions: V_{IN}=5V(5A), I_{SYS}=0A, V_{BATT}=8.4V, charge current decreases until charge done in CV loop.



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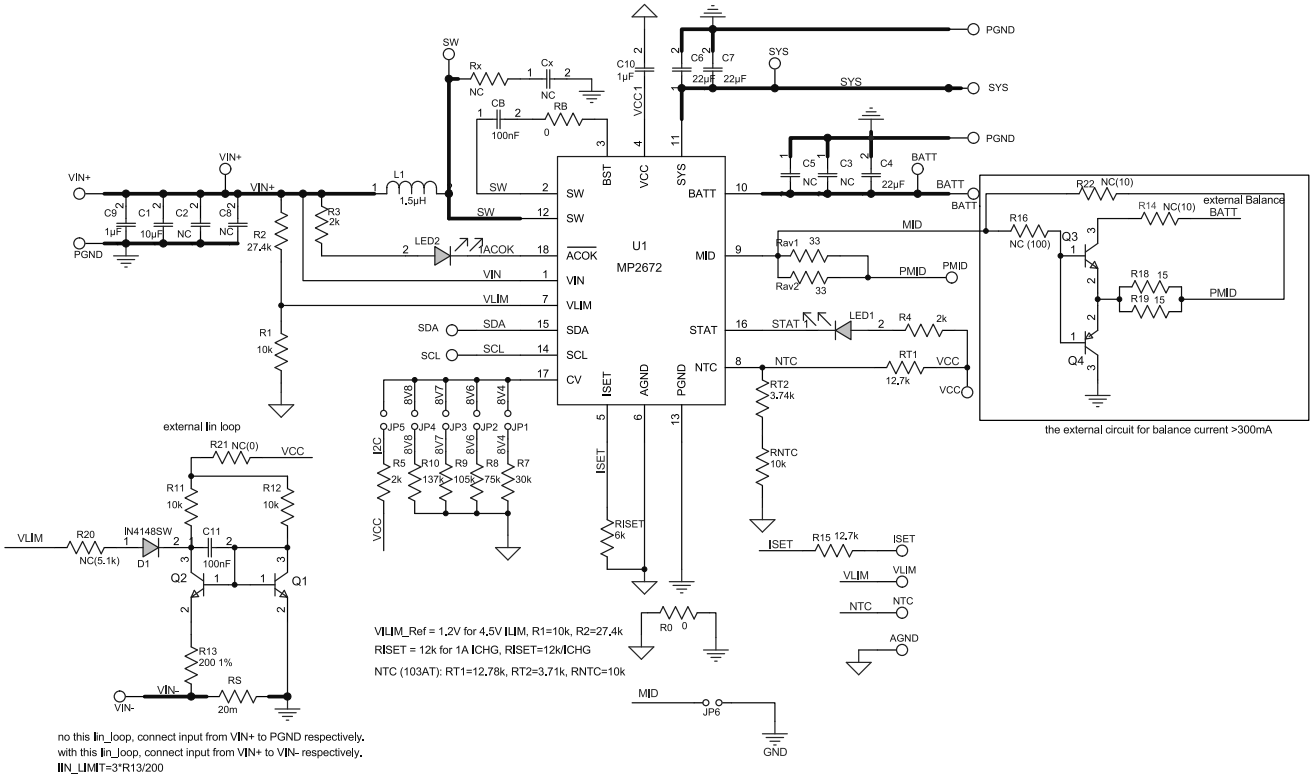
EVALUATION BOARD SCHEMATIC



Notes:

1) Cell Balance Function:
   a. Connect PMID to middle pin of the 2-cell battery pack to enable balance function.
   b. Connect R16=100Ω, R12=R14=0Ω the external cell balance is active.
   c. Connect PMID=GND to disable the balance function.
2) External Input Current Limit Loop:
   Connect R20=5.1kΩ, R21=0Ω and connect the cathnode of input power to VIN- to enable input current limit loop.
3) Jumper connection:

Table 1.

Jumper	Description	Factory Setting
JP1	Standalone Mode BATT_REG 8.4V	Float
JP2	Standalone Mode BATT_REG 8.6V	Float
JP3	Standalone Mode BATT_REG 8.7V	Float
JP4	Standalone Mode BATT_REG 8.8V	Float
JP5	Host Control Mode, BATT_REG=8.4V (default)	Connected

Table 2.

Jumper	Float	Connected	Factory Setting
JP6	Enable Cell Balance	Disable Cell Balance	Connected

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EV2672-D-01A BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer	Manufacturer PN
3	C4,C6,C7	22μF	Capacitor;16V;X5R	0805	Murata	GRM21BR61E226ME44L
1	C2	10μF	Capacitor;16V;X7R	0805	Murata	GRM21BR61C106KE15
6	C1,C3,C5, C8, C9,Cx	NC				
2	C10	1μF	Ceramic Capacitor; 6.3V;X7R;0603;	0603	Murata	GRM188R71C105KA12D
2	C11, CB	100nF	Ceramic Capacitor; 25V;X7R;0603;	0603	Murata	GCJ188R71H104KA12D
1	D1	IN4148W	75V,0.15A	SOD-123	Diodes	IN4148W
1	L1	1.5μH	Inductor;1.5uH; 10m;14A	SMD	Wurth	744311150
1	LED2	BL-HUF35A-TRB	LED; Red light	0805	Hongbai	BL-HUF35A-TRB
1	LED1	BL-HGE35A-AV-TRB	LED; Blue light	0805	Hongbai	BL-HGE35A-AV-TRB
3	Q1, Q2, Q3	S8050	Transistor;25V;0.5A;	SOT-23	Fairchild	S8050
1	Q4		Transistor, PNP, 40V, 200mA	SOT-23	Fairchild	S8550'
3	R0, RB,R21	0Ω	Film Resistor;5%;	0603	Yageo	RTT03000JTP
4	R1, R11, R12, RNTC	10kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0710KL
1	R2	27.4kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-0727K4L
3	R3, R4, R5	2kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-072KL
1	R7	30kΩ	Resistor;1%	0603	Yageo	RC0603FR-0730KL
1	R8	75kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0775KL
1	R9	105kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-07105KL
1	R10	137kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-07137KL
2	R13,R22	200Ω	Film Res., 1%	0603	Yageo	RC0603FR-07200RL
2	R15, RT1	12.7kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0712K7L
2	R18, R19	20Ω	Film Res., 1%	1206	Yageo	RC1206FR-0720RL
2	Rav1, Rav2	20Ω	Resistor;1%	1206	Yageo	RC1206FR-0720RL
1	RISET	6.04kΩ	Film Res., 1%	0603	Yageo	RC0603FR-076K04L
1	RS	20mΩ	Film Resistor;1%;1W;	2512	Yageo	RL2512FK-070R02L
1	RT2	3.74kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-073K74L
4	Rx,R14, R6,R20	NC				

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EV2672-D-01A BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacture	Manufacture PN
1	U1	MP2672GD-0000		QFN18-2x3	MPS	MP2672GD
7	BATT, VIN+ VIN-, SYS, GND	2.0mm	Connector;			
6	PMID, VLIMGND, ISET,NTC,VCC	1.0mm	Connector;			
4	JP1, JP2, JP3, JP4,	2.54mm	short module			
1	EV2672-D-01A		PCB			

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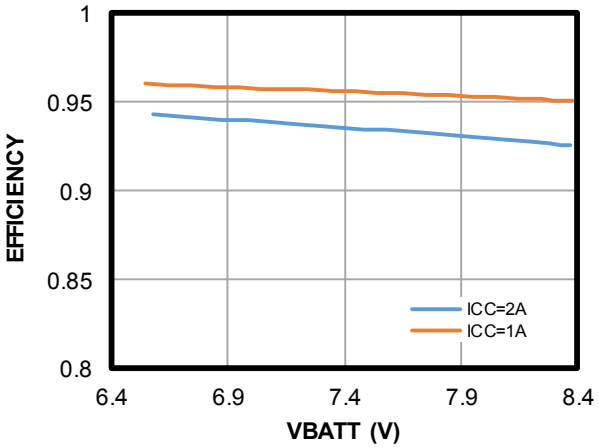
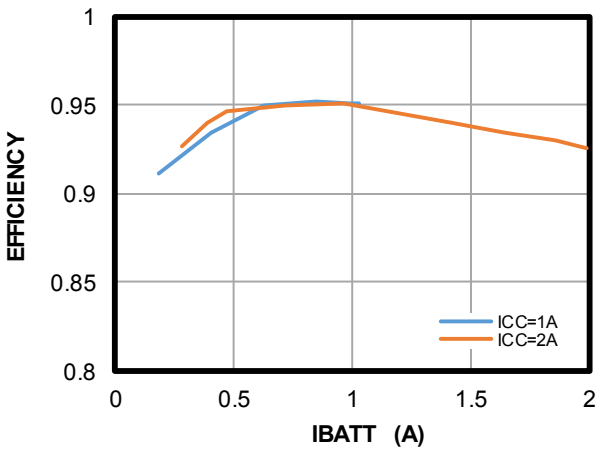
EVB TEST RESULTS

Performance curves and waveforms are tested on the evaluation board.
V_{IN}=5V(5A), $V_{IN\ MIN}$=4.5V, V_{BATT_PRE}=6.5V, I_{CC}=2A, I_{SYS}=0A, V_{BATT}=0V to 8.4V, C_{IN}=10μF, C_{SYS}=44μF, C_{BATT}=22μF, fs=1200kHz, temp=25°C, unless otherwise noted.

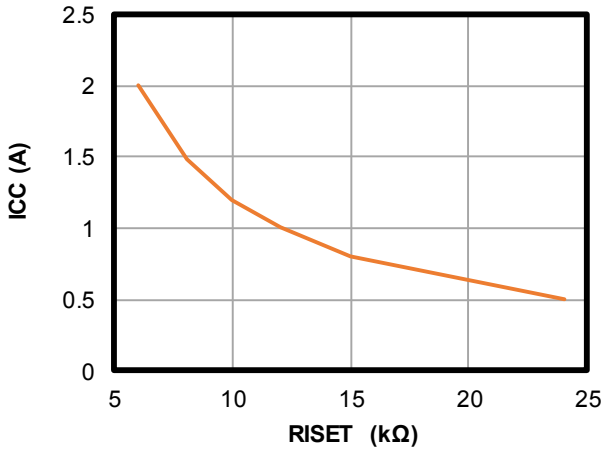
CC Charge Efficiency



CV Efficiency @ BATT = 8.4V



ICC Setting



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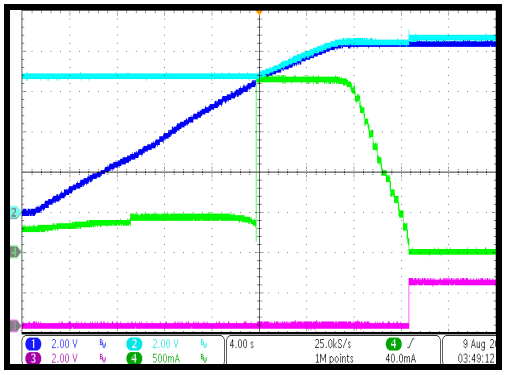
EVB TEST RESULTS *(continued)*

Performance curves and waveforms are tested on the evaluation board.
V_{IN}=5V(5A), $V_{IN\ MIN}$=4.5V, V_{BATT_PRE}=6.5V, I_{CC}=2A, I_{SYS}=0A, V_{BATT}=0V to 8.4V, C_{IN}=10µF, C_{SYS}=44µF, C_{BATT}=22µF, fs=1200kHz, temp=25°C, unless otherwise noted.

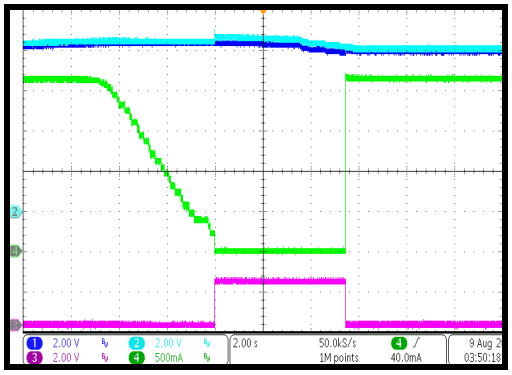
Battery Charge Curve

CH1: V_{BATT}
CH2: V_{SYS}
CH3: V_{STAT}
CH4: I_{BATT}



Auto Recharge

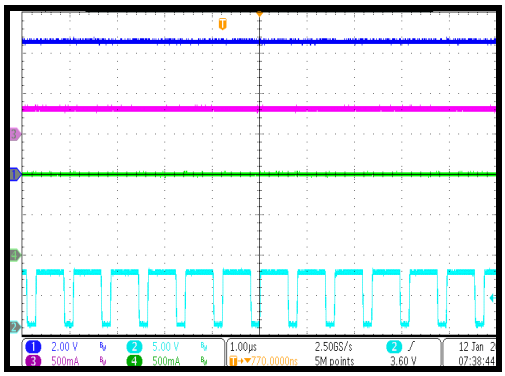
CH1: V_{BATT}
CH2: V_{SYS}
CH3: V_{STAT}
CH4: I_{BATT}



Pre Charge Steady

V_{BATT} = 5V, I_{SYS} = 1A

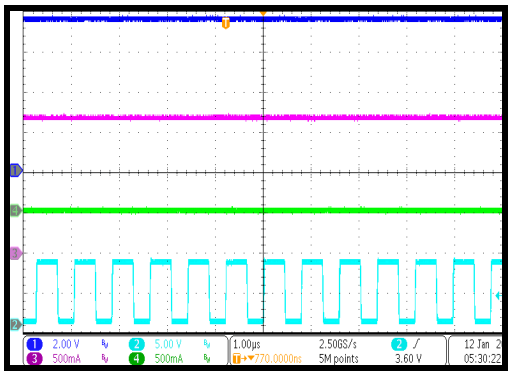
CH1: V_{SYS}
CH2: V_{SW}
CH3: I_{BATT}
CH4: I_{SYS}



CC Charge Steady

V_{BATT} = 7.4V, I_{SYS} = 0A

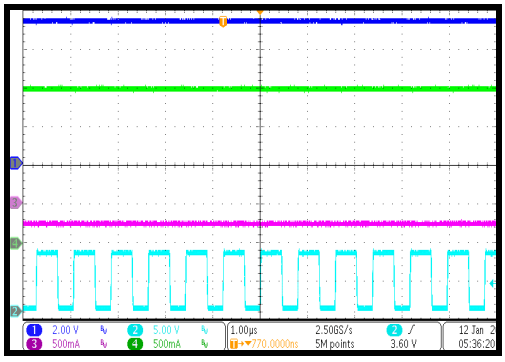
CH1: V_{SYS}
CH2: V_{SW}
CH3: I_{BATT}
CH4: I_{SYS}



CC Charge Steady

V_{BATT} = 7.4V, I_{SYS} = 2A

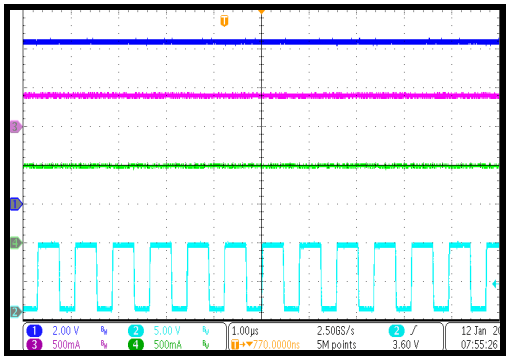
CH1: V_{SYS}
CH2: V_{SW}
CH3: I_{BATT}
CH4: I_{SYS}



CC Charge Steady

V_{BATT} = 8.4V/0.5A, I_{SYS} = 1A

CH1: V_{SYS}
CH2: V_{SW}
CH3: I_{BATT}
CH4: I_{SYS}



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EVB TEST RESULTS *(continued)*

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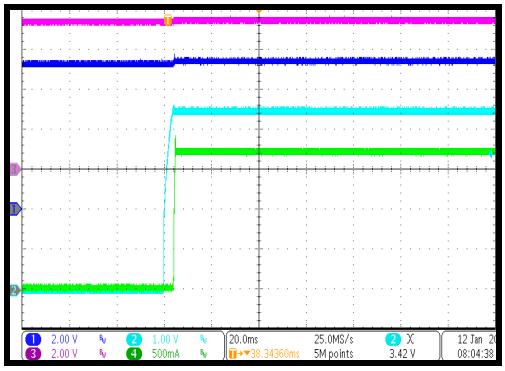
V_{IN}=5V(5A), $V_{IN\ MIN}$=4.5V, V_{BATT_PRE}=6.5V, I_{CC}=2A, I_{SYS}=0A, V_{BATT}=0V to 8.4V, C_{IN}=10µF, C_{SYS}=44µF, C_{BATT}=22µF, fs=1200kHz, temp=25°C, unless otherwise noted.

V_{IN} Power On

V_{BATT} = 7.4V, I_{SYS} = 1.5A

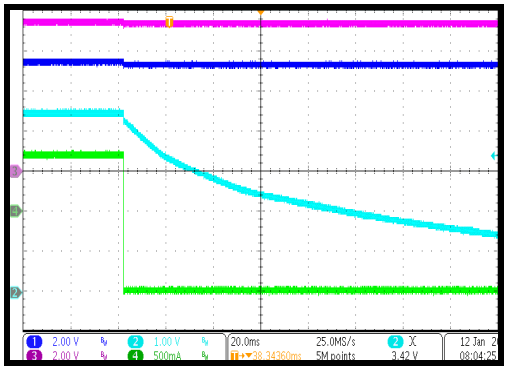
CH1: V_{SYS}
CH2: V_{IN}
CH3: V_{BATT}
CH4: I_{BATT}



V_{IN} Power Off

V_{BATT} = 7.4V, I_{SYS} = 1.5A

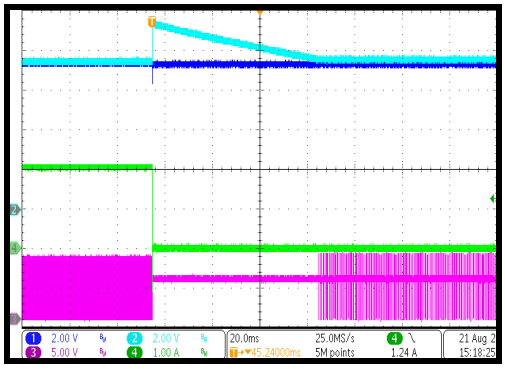
CH1: V_{SYS}
CH2: V_{IN}
CH3: V_{BATT}
CH4: I_{BATT}



CC Charge Disable

V_{BATT} = 7.4V, I_{SYS} = 0A

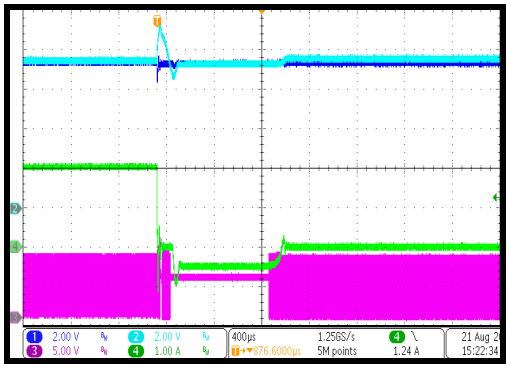
CH1: V_{BATT}
CH2: V_{SYS}
CH3: V_{SW}
CH4: I_{BATT}



CC Charge Disable

V_{BATT} = 7.4V, I_{SYS} = 0.5A

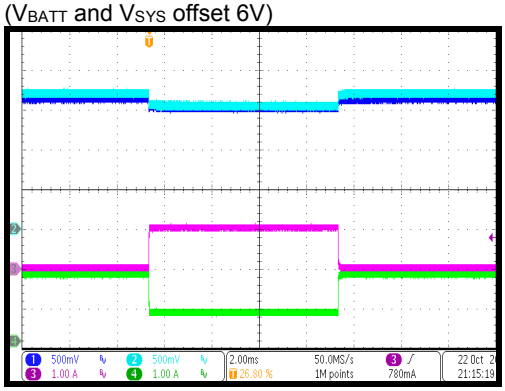
CH1: V_{BATT}
CH2: V_{SYS}
CH3: V_{SW}
CH4: I_{BATT}



Load Transient

V_{BATT} = 7.4V, I_{SYS} = 0A-1A
(V_{BATT} and V_{SYS} offset 6V)

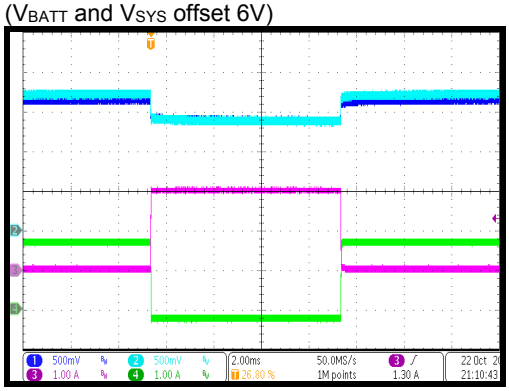
CH1: V_{BATT}
CH2: V_{SYS}
CH3: I_{SYS}
CH4: I_{BATT}



Load Transient

V_{BATT} = 7.4V, I_{SYS} = 0A-2A
(V_{BATT} and V_{SYS} offset 6V)

CH1: V_{BATT}
CH2: V_{SYS}
CH3: I_{SYS}
CH4: I_{BATT}



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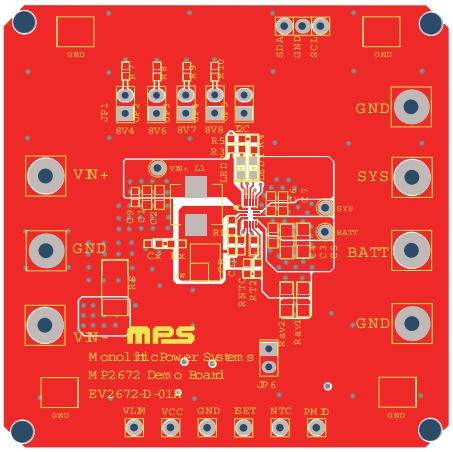
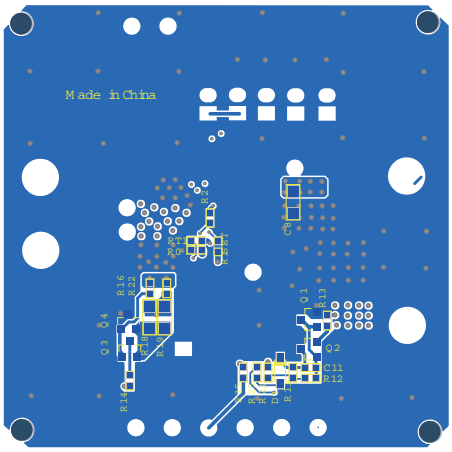
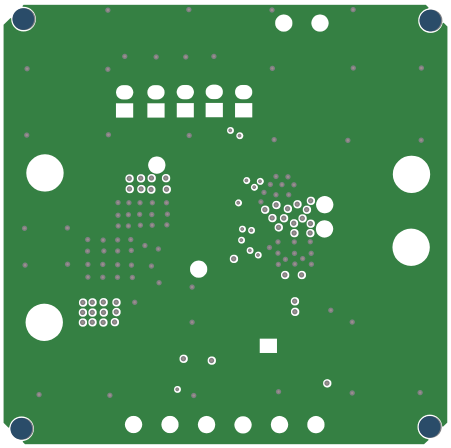
PRINTED CIRCUIT BOARD LAYOUT



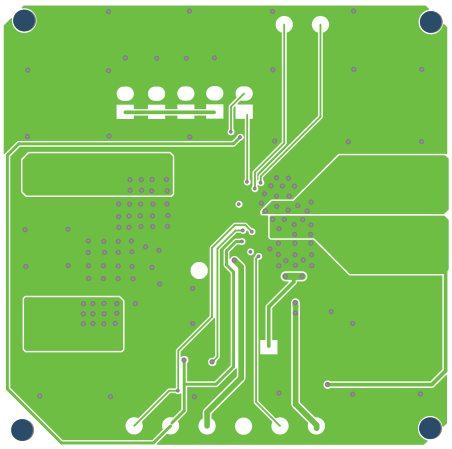
Top Layer



Bottom Layer



Mid Layer 1



Mid Layer 2

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QUICK START GUIDE

This board is designed for MP2672 used as a standalone switching charger with integrated MOSFETs, and layout accommodates most commonly used components. The default function of this board is preset for host control mode and the battery regulation voltage is 8.4V (default) for 2 cell Li-Ion battery.

The evaluation board could work in two control modes: Standalone Mode and Host-control Mode.

Standalone mode.

As figure 1 shows, connect CV pin to AGND via a resistor to set standalone mode. Set the battery regulation voltage.

In standalone mode, charge current is programmed by R_{ISET} - the resistor connected between ISET pin and GND. RISET should be less than 24kΩ.

$$I_{CC}(A) = 1(A) \times \frac{12(k\Omega)}{R_{ISET}(k\Omega)} \quad (1)$$

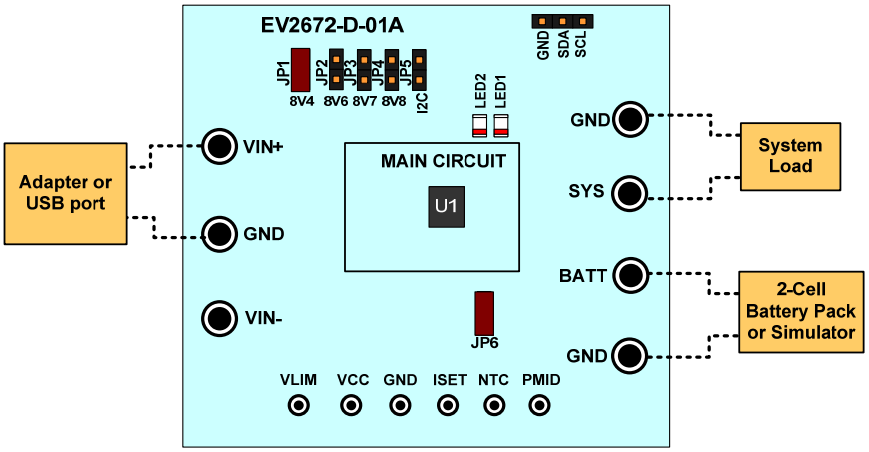

Figure 1: Test Setup for MP2672 Standalone mode

Host-control mode.

As figure 2 shows, connect CV pin to VCC to set Host-control mode. The battery regulation voltage and charge current is according to the register. And evaluation platform need be prepared in advance for Host-control mode.

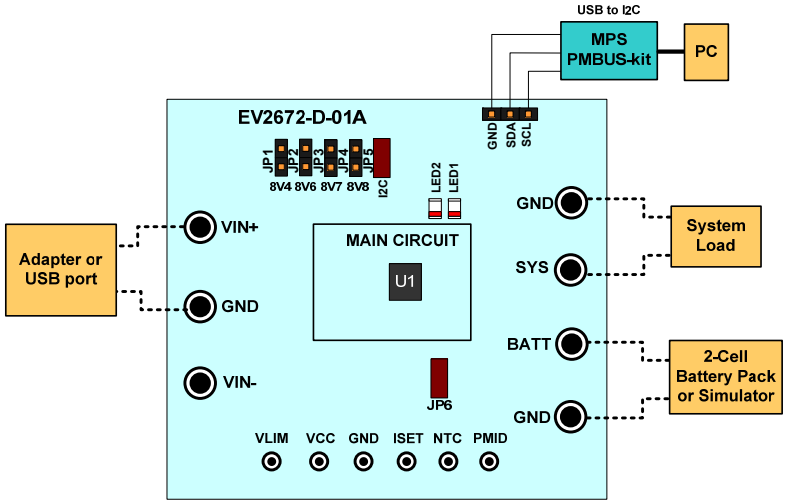

Figure 2: Test Setup for MP2672 Host-control mode

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Evaluation Platform Preparation:

1) A computer with at least one USB port and a USB cable. The MP2672 evaluation software must be properly installed.
2) Figure 3 shows USB-to-I²C Communication Kit (EVKT-USBI2C-02)

Figure 3: USB-to-I²C Communication Kit

3) Software - Double-click on the "MP2672 Evaluation Kit" EXE file to run the MP2672 evaluation software. The software supports the Windows® XP and Windows 7operating systems.

4) Original Test Setup for MP2672 in Figure 2

Attach the input voltage (V_{IN}=5V) and the input ground to the VIN and GND pins, respectively.

Attach the positive and negative ends of the load to the SYS and GND pins, respectively.

Attach the positive and negative ends of the battery (V_{BATT}=6.4V-8.4V) to the BATT and GND pins, respectively.

5) Turn on the computer. Launch the MP2672 evaluation software. The main window of the software is shown in Figure 4.

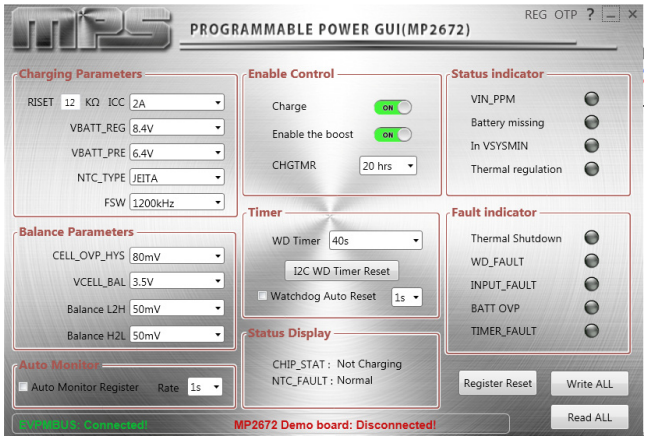

Figure 4: The main window of the software

Procedure:

Make sure all the connections are normal

1) EVPMBUS connected and MP2672 evaluation board connected.
2) Connect power at VIN to GND.
3) Connect system load at VSYS to GND.
4) Connect a battery package or a battery simulator at BATT to GND. Set to 7.4V and 5 A current limit.
5) Power on input DC source. It is ready to run the MP2672.

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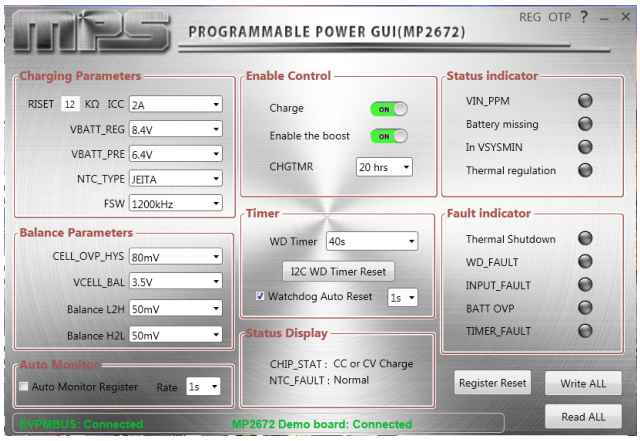
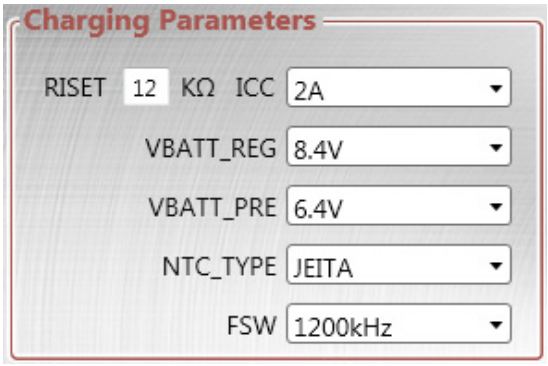
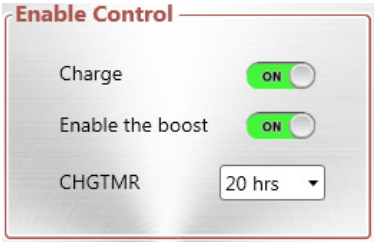


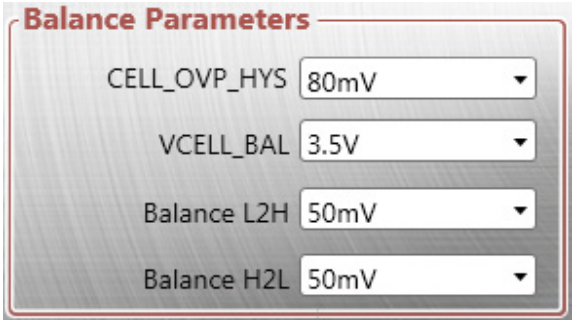
Host-control setup:

1) Boost Charge Control.
   This section is used to configure charge parameters such as charge current, battery regulation voltage , constant charge timer, NTC type and so on.





2) Cell Balance Control.
   Connect PMID to the middle pin of the 2-cell battery pack (or 2 battery simulator in series), set different balance parameters and check the battery cell balance function.



3) Monitor Registers to get MP2672 operation status and fault report.

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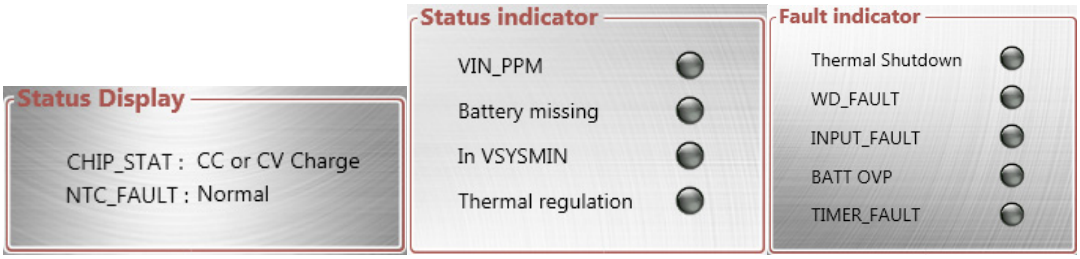
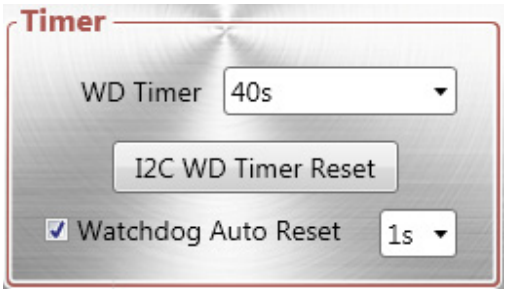
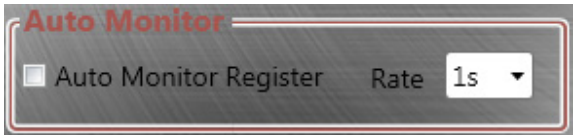


4) Select I2C Watchdog Timer Limit: click “Watchdog AUTO Reset” to run the program automatically.



5) Resister Auto Monitor.



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