

### DESCRIPTION

The EV2690-R-00A is the evaluation board designed to demonstrate the capabilities of MPS' MP2690, a highly-integrated, flexible switch-mode battery charge management for a single-cell Li-ion and Li-Polymer battery used in a wide range of applications.

EV2690 uses two operating modes—charge mode and boost mode—to allow management of system and battery power based on the state of the input.

When input power is present, the board charges a single-cell battery with a programmable charge current of up to 2.5A.

In the absence of an input source, the board switches to boost mode through the PB pin to power the SYS pins from the battery with a current of up to 2.1A.

The evaluation board provides 4-LED to achieve the voltage based fuel gauge indication and distinguish charge mode from boost mode.

To guarantee safe operation, the EV2690 has 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
<b>Charge Mode</b>			
Input Voltage Range	$V_{IN}$	4.55 – 6	V
Charge-Full Voltage	$V_{BATT\_Full}$	4.2 / 4.35 / 4.45	V
Charge Current	$I_{CHG}$	2.5	A
Input Current Limit	$I_{IN\_LIM}$	2.7	A
<b>Boost Mode</b>			
Battery Voltage	$V_{BATT}$	3-4.5	V
SYS Voltage Regulation	$V_{SYS}$	5	V
SYS Output Current Limit	$I_{SYS}$	2.1	A

### FEATURES

- 4.55V-to-6V Operating Input Voltage Range
- Power Management Function Integrated Input-Current-Limit and Input Voltage Regulation
- Up to 2.5A Programmable Charge Current
- Selectable 4.45V / 4.35V / 4.2V Charge Voltage with 0.5% Accuracy
- Battery Temperature Monitoring
- 4-LED for battery fuel gauge indication
- Programmable Timer Back-Up Protection
- Battery-Reverse-Leakage Blocking
- Reverse-Boost-Operation for Powering System
- Up to 94% 5V Boost Mode Efficiency @ 2.1A with BATT=4.5V
- Up to 2.1A Programmable Output Current Limit in Boost Mode

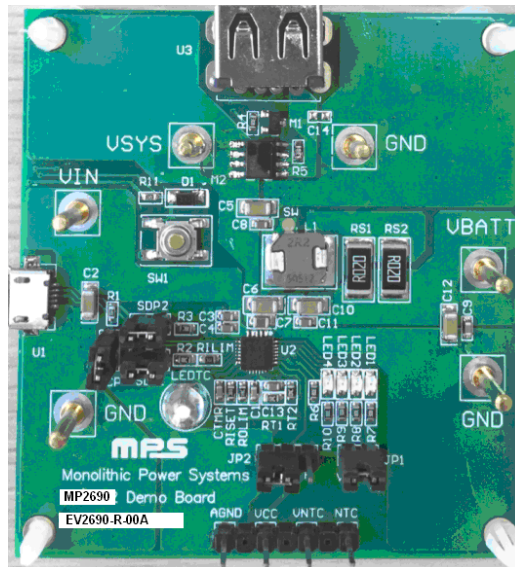
### APPLICATIONS

- Sub-battery Applications
- Power-bank Applications for Smart-Phone, Tablet and Other Portable Devices

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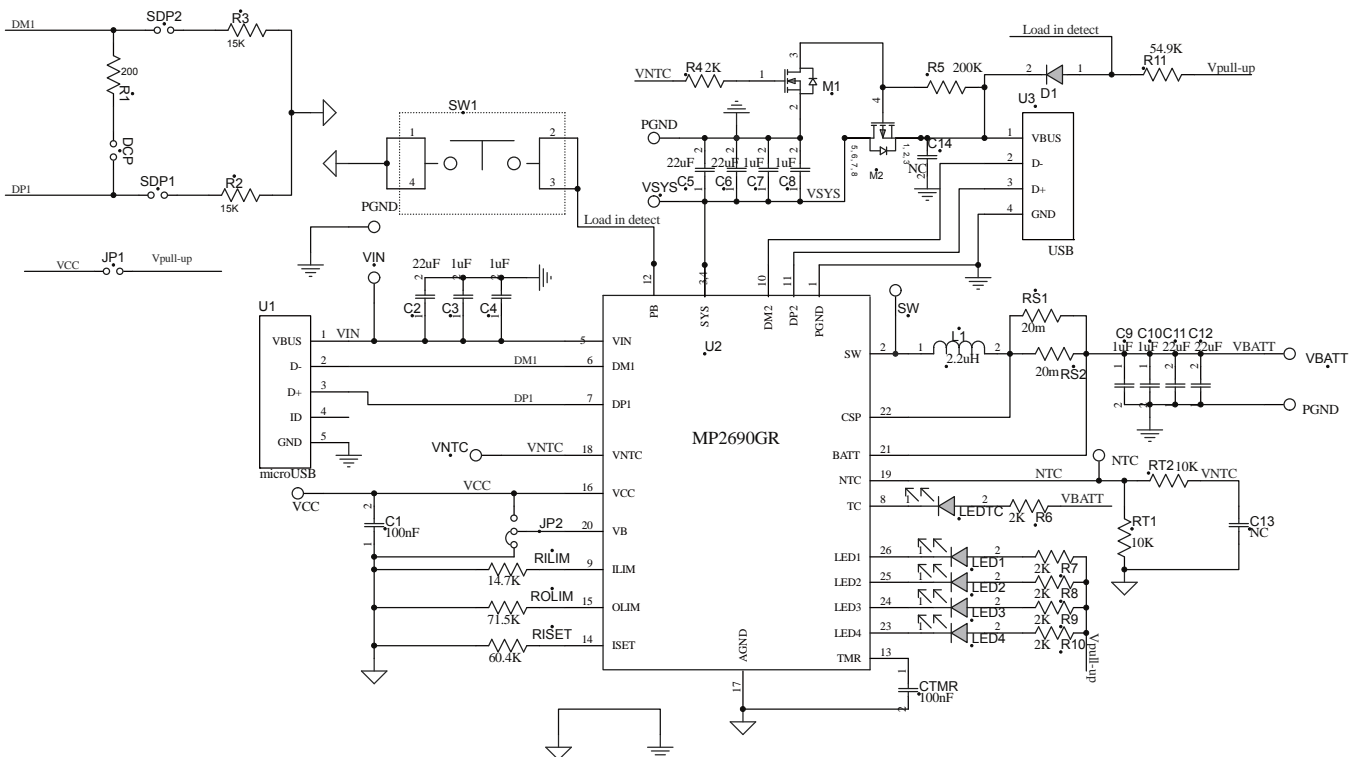
## EV2690-R-00A EVALUATION BOARD



(L x W x H) 2.5" x2.5" x 0.063"  
(6.35cm x 6.35cm x 0.16cm)

Board Number	MPS IC Number
EV2690-R-00A	MP2690GR

## EVALUATION BOARD SCHEMATIC



**EV2690-R-00A BILL OF MATERIALS**

Qty	Ref	Value	Description	Package	Manufacture	Manufacture_PN
1	D1	B130LAW	Schottky;30V;1A	SOD-123		B130LAW-7
2	RS1, RS2	20m	Resistor;1%;	2512	Yageo	RL2512FK-070R02L
1	R1	200	Film Resistor;1%	0603	Yageo	RC0603FR-07200RL
1	R1SET	60.4k	Film Resistor;1%	0603	Yageo	RC0603FR-0760K4L
1	ROLIM	71.5k	Film Resistor;1%	0603	Yageo	RC0603FR-0771K5L
2	R2, R3	15k	Film Resistor;1%;	0603	Yageo	RC0603FR-0715KL
1	RILIM	14.7k	Film Resistor;1%	0603	Yageo	RC0603FR-0714K7L
2	RT1, RT2	10k	Film Resistor;1%;	0603	Yageo	RC0603FR-0710KL
	C13, C14	NC				
5	C2, C5, C6, C10, C12	22µF	Ceramic Capacitor;25V;X5R;	1206	muRata	GRM31CR61E226KE15
1	R5	200k	Film Resistor;1%	0603	Yageo	RC0603FR-07200KL
1	R11	54.9k	Film Resistor;1%	0603	Yageo	RC0603FR-0754K9L
6	R4, R6, R7, R8, R9, R10	2k	Film Resistor;1%	0603	LIZ	CR0603JA0202G
6	C3, C4, C7, C8, C9, C11	1µF	Ceramic Capacitor;25V;X7R	0603	TDK	C1608X7R1E105K
2	C1, CTMR	100nF	Ceramic Capacitor;16V;X7R;0603	0603	TDK	C1608X7R1C104K
1	LEDTC	CB- 482QWC	LED; WLED,20mA,	DIP2		
4	LED1, LED2, LED3, LED4	BL- HGE35A- TRB	LED; Green	0805	BRIGHT LED	BL-HGE35A-TRB
1	M2	AM4825P- T1	P-Channel MOSFET; -30V;	SO-8	Analog Power	AM4825-T1-PF
1	M1	AM2336N	N-Channel MOSFET; 30V;	SOT-23	Analog Power	AM2336N
6	VIN,PGND, VBATT, PGND,VSYS, PGND		2mm terminal			
4	DCP, JP1, SDP1, SDP2		Jumper, 2.54mm			
1	L1	2.2µH	Inductor;2.2uH;0.173m;8.2A	SMD	TDK	SPM6530T-2R2M
1	U1	Micro-USB receptacle				
1	U2	MP2690	IC	QFN26 4*4	MPS	MP2690GR
1	U3	USB A-type receptacle				
1	SW1	Push Switching button	Button; SM 4x10mm;1.5mm Height			

### PRINTED CIRCUIT BOARD LAYOUT

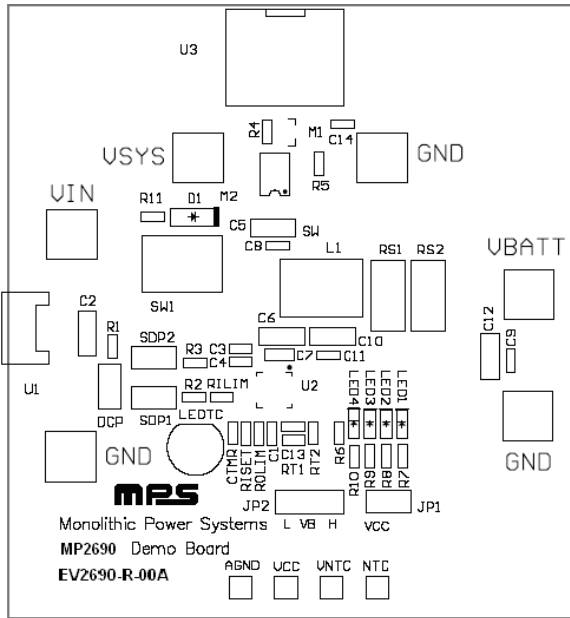


Figure 1: Top Silkscreen Layer

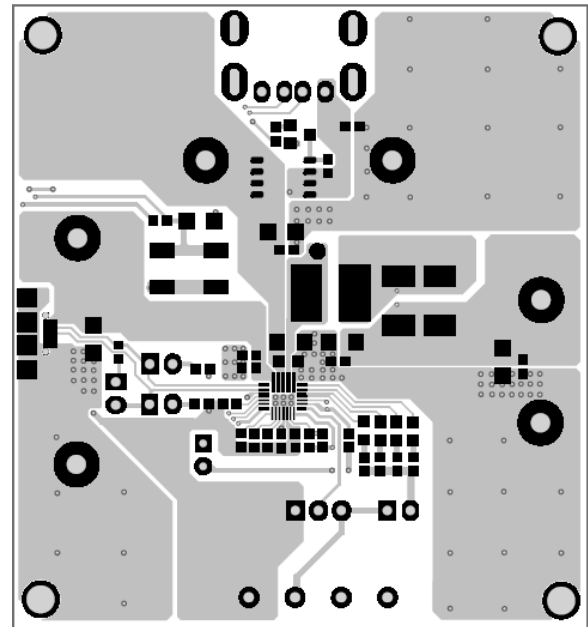


Figure 2: Top Layer

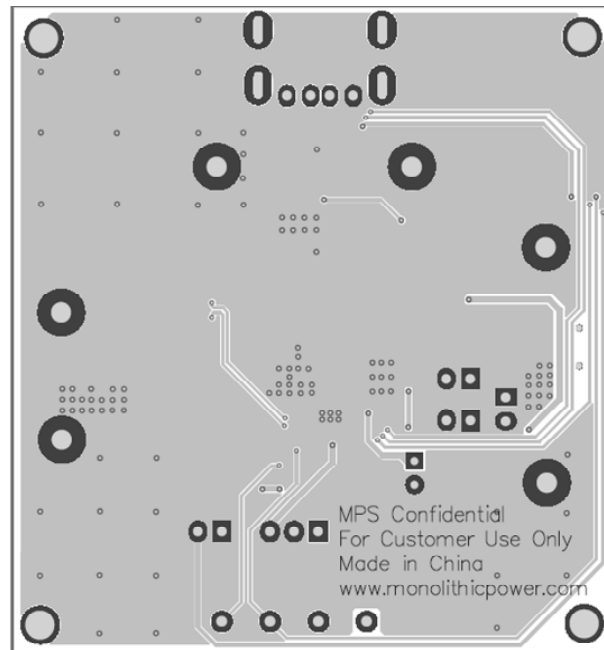


Figure 3: Bottom Layer

## QUICK START GUIDE

This board is designed for the MP2690, a stand-alone switch-mode battery charge management and system power path management device with integrated reverse directional boost from BATT to SYS. The board' layout accommodates most commonly-used capacitors. The default function of this board is preset at charge mode, and the charge full voltage is preset to 4.35V for a 1-cell Li-Ion battery.

### Charge Mode Setting

#### 1. Input Current Limit

An input current limit can be set slightly below the input source's maximum current rating. When the input current hits this limit, the charge current will decrease to keep the input current constant at the limit value to initially power the system.  $R_{ILIM}$ —the resistor connected to the ILIM pin—programs this limit. To set the input current limit at 2.7A, use a  $R_{ILIM}$  of 14.7k $\Omega$ .

$$I_{ILIM}(A) = \frac{40(k\Omega)}{R_{ILIM}(k\Omega)} \quad (1)$$

#### 2. Charge-Full Voltage

To set the charge-full voltage, leave the VB pin floating for 4.2V, connect VB to L for 4.35V and connect VB to H for 4.45V.

#### 3. Charge Current

The charge current can be programmed via both RS1 and  $R_{ISET}$ . With given RS1=10m $\Omega$ , determine the charge current using the following formula:

$$I_{CHG}(A) = \frac{1500}{R_{ISET}(k\Omega) \times RS1(mA)} \quad (2)$$

For example, for a charge current of 2.5A, use a 60k $\Omega$   $R_{ISET}$ .

### Boost Mode

#### 1. System-Output-Current Limit

Set the system-output-current limit in boost mode for the EV2690 to operate like a standard USB charger. Set the output current limit as the following equation:

$$I_{OLIM}(A) = \frac{1500}{R_{OLIM}(k\Omega) \times RS1(m\Omega)} \quad (3)$$

**For the other detailed description on the operation of the MP2690, please refer to the datasheet.**

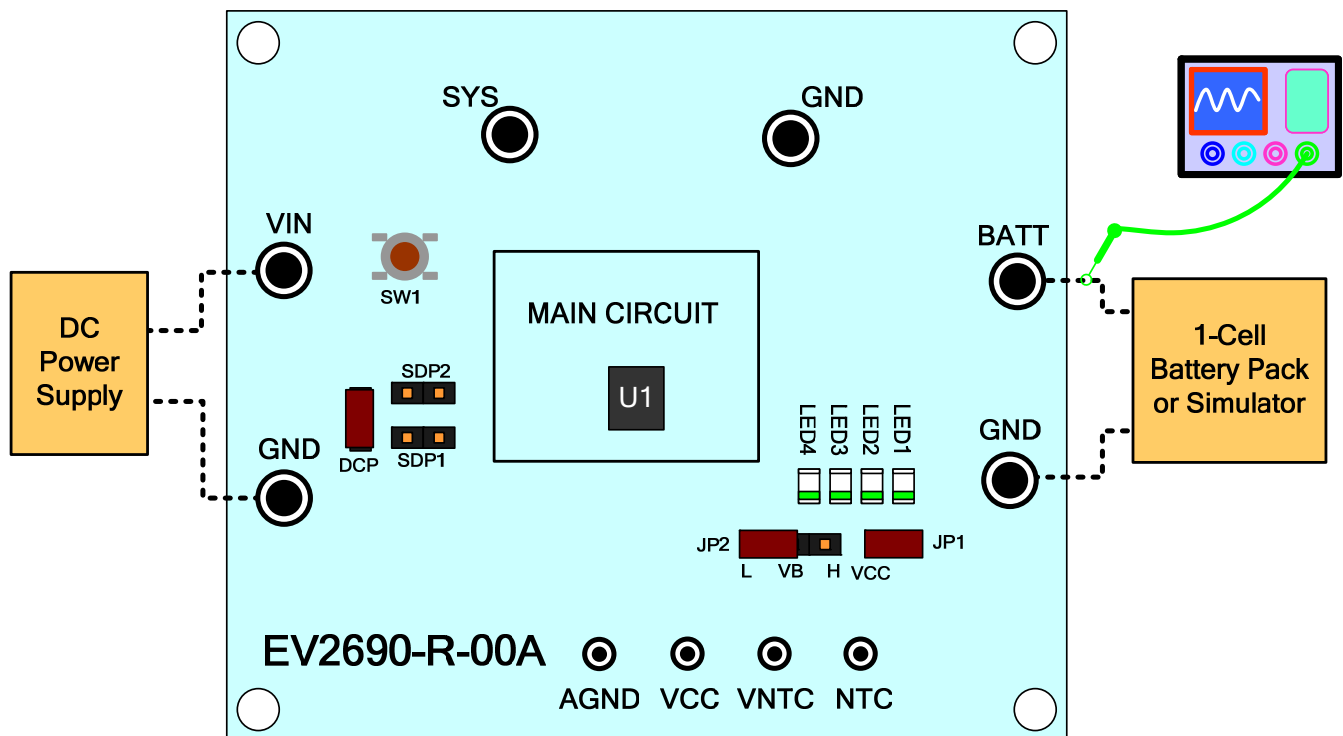
## EQUIPMENT REQUIREMENT

Evaluation requires the following equipments:

1. DC power source. The output voltage should exceed 6.0V, and output current greater than 3A.
2. Battery simulator or a single-cell battery pack. The battery simulator's output rating should exceed 4.5V/7.0A. When using a real battery pack, please observe all precautions on the battery manufacturer's data sheet first and ensure the charger's setting doesn't exceed the battery's absolute maximum specifications.
3. Oscilloscope. A single voltage probe and a single current probe.
4. Multi-meter.

### Charge Function

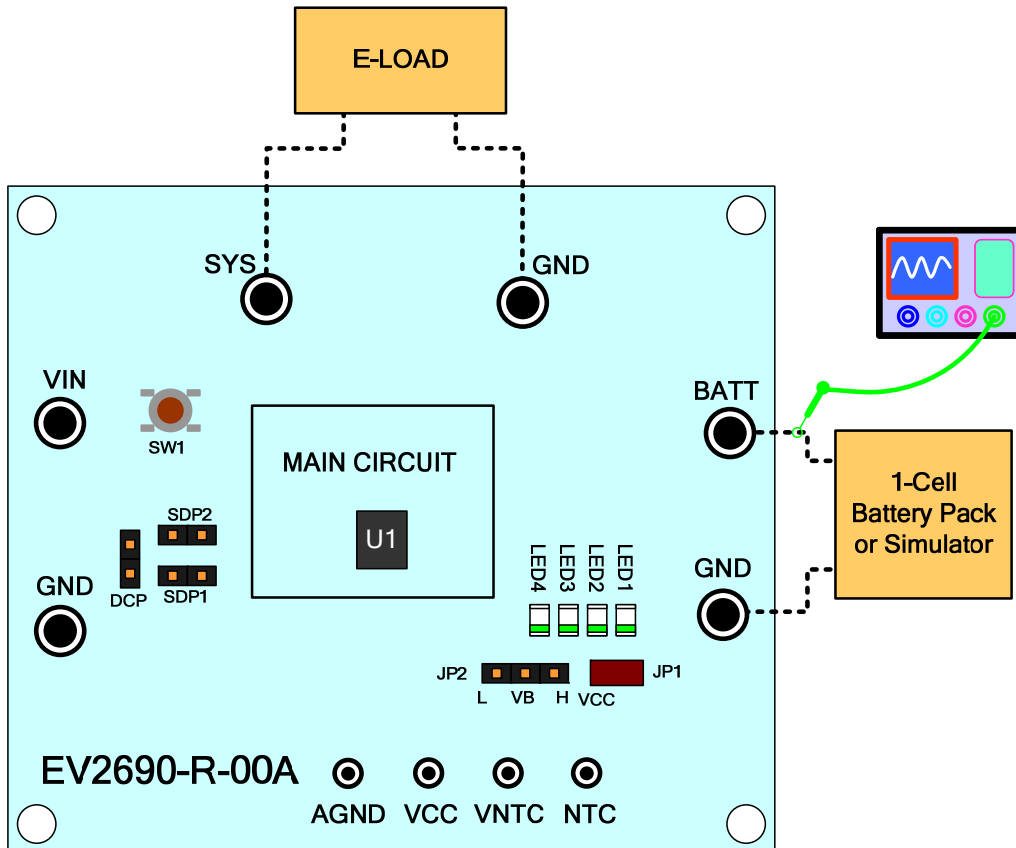
- 1 Connect the jumper "VCC".
- 2 The jumpers "DCP", "SDP1" and "SDP2" are used for the input DP1/DM1 detection setting. Connect "DCP" and leave "SDP1" and "SDP2" float as default, the DP1/DM1 detection will be set as DCP, the  $I_{INLIMIT}$  is set through  $R_{ILIM}$ .  
Otherwise, only connect "SDP1" and "SDP2", or leave the 3 jumpers float will set the  $I_{INLIMIT} = 500mA$ .
- 3 Attach the positive and negative ends of the battery to the "BATT" and "GND" terminals, respectively. If it's a battery simulator, please preset the voltage to 3.8V (typical value) first.
- 4 Preset the DC power source to 5.0V. Then attach the DC output port and ground to the "VIN" and "GND" terminals, respectively.
- 5 Turn on the DC power source. The charger will start. Use the oscilloscope to verify that the 2.5A charge current is being delivered to the battery.



**Figure 4: Setup for Charge Mode**

**Boost Function**

- 1 Attach the load to the “SYS” and “GND” terminals respectively.
- 2 Attach the positive and negative ends of the battery to the “BATT” and “GND” terminals respectively. If it’s a battery simulator, please preset the voltage to 3.8V (typical value) firstly.
- 3 Short push the SW1 button, the boost will start to work. Verify the system output current is limited at 2.1A.


**Figure 5: Setup for Boost Mode**

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