EV2681B-S-00A

CC/CV Controller with Full Protection and Indication

The Future of Analog IC Technology

DESCRIPTION

The MP2681B is a highly integrated Li-ion or Li-polymer switch-mode battery-charge controller with full protection and status indication. This part integrates a precision voltage reference and charge status indications suitable for AC adapter input and cradle charger applications.

The MP2681B detects automatically the battery cell through a battery ID resistor and regulates the battery voltage according to the corresponding cell configurations: 3S, 4S, and 5S. Then, the AC adapter output is regulated automatically according to the chosen battery configuration. Additionally, if the battery pack does not have an ID resistor, the charge termination voltage can be configured by setting a dedicated voltage to the ID pin, according to the pre-set V_{ID} values representing the battery configuration. The MP2681B charges the battery in three phases: pre-charge, constant current and constant voltage. Charge is terminated when the current reaches a minimum set level. An internal charge timer provides safety back-up. The MP2681B provides a fixed pre-charge mode for deeply-discharged batteries and safety features that include battery temperature monitoring, NTC control, charge time-out, and fault control.

ELECTRICAL SPECIFICATION

Parameter	Symbol	Value	Units
Input Voltage	V_{ACIN}	85V-220V	V
Battery Voltage	V_{BATT}	0 to 21	V
VDD Voltage	V_{SYS}	5 to 30	V
Charge Current	I_{CHG}	0-4	A

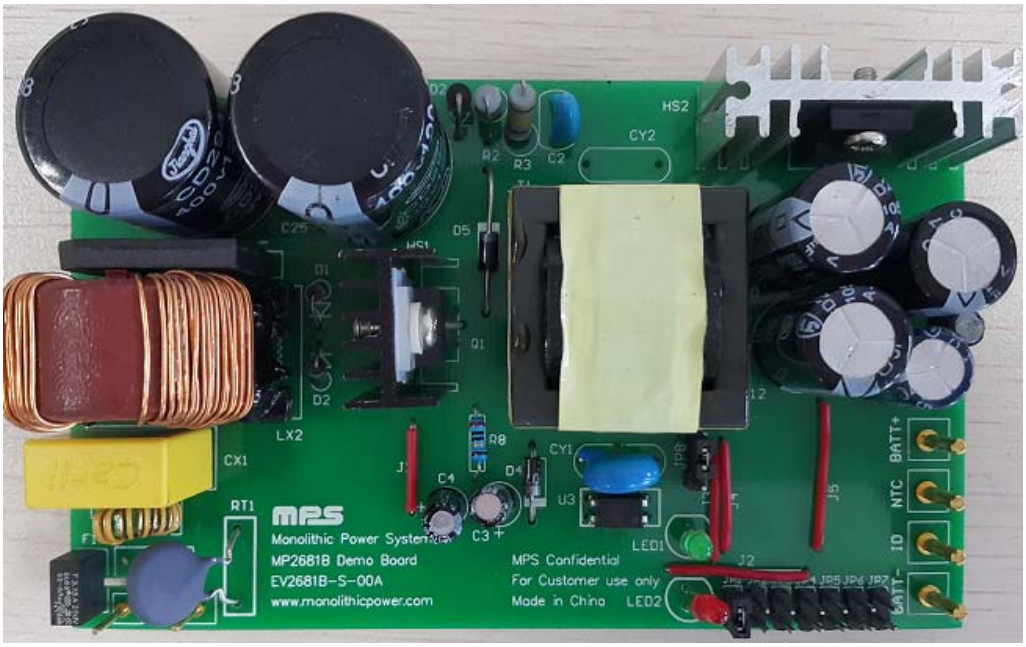
FEATURES

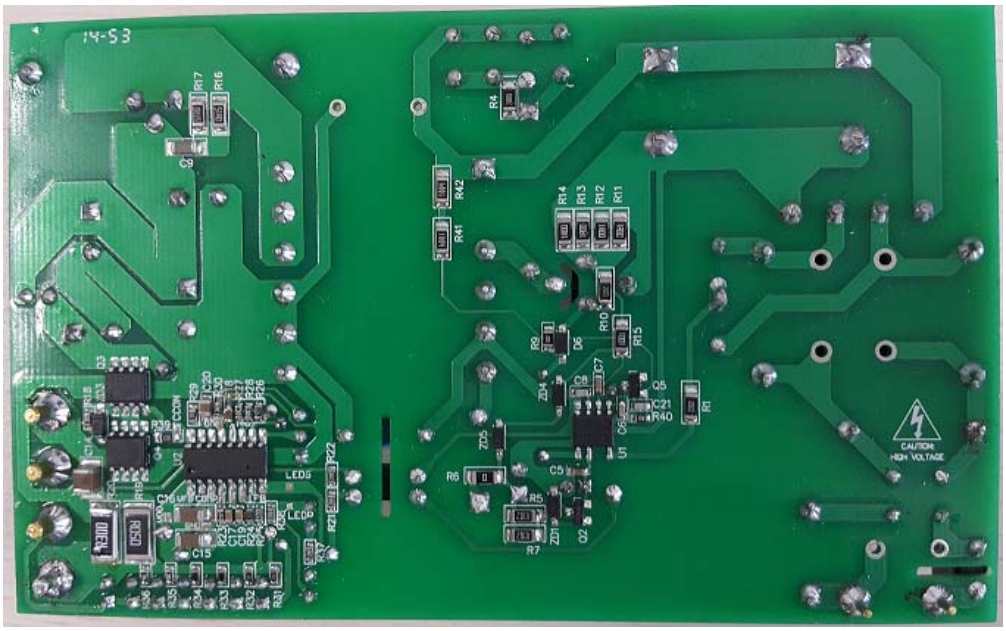
- Constant Voltage and Constant Current Control
- Pre-Charge Mode for Deep-discharged Battery
- Automatic Battery Cell Detection
- Two 1MHz Bandwidth Operational Amplifier Output Connected with OR Logic
- Wide Input Voltage Range: 5V to 30V
- Auto-Recharge
- Charge On/Off Control
- Programmable Internal Timer
- Battery Temperature Monitoring
- Charge Status Indication
- Power Line Fault Detection
- Over Temperature Protection

APPLICATIONS

- Battery Charger for Portable Tools
- Standalone Fast Charger

EV2681B-S-00A EVALUATION BOARD

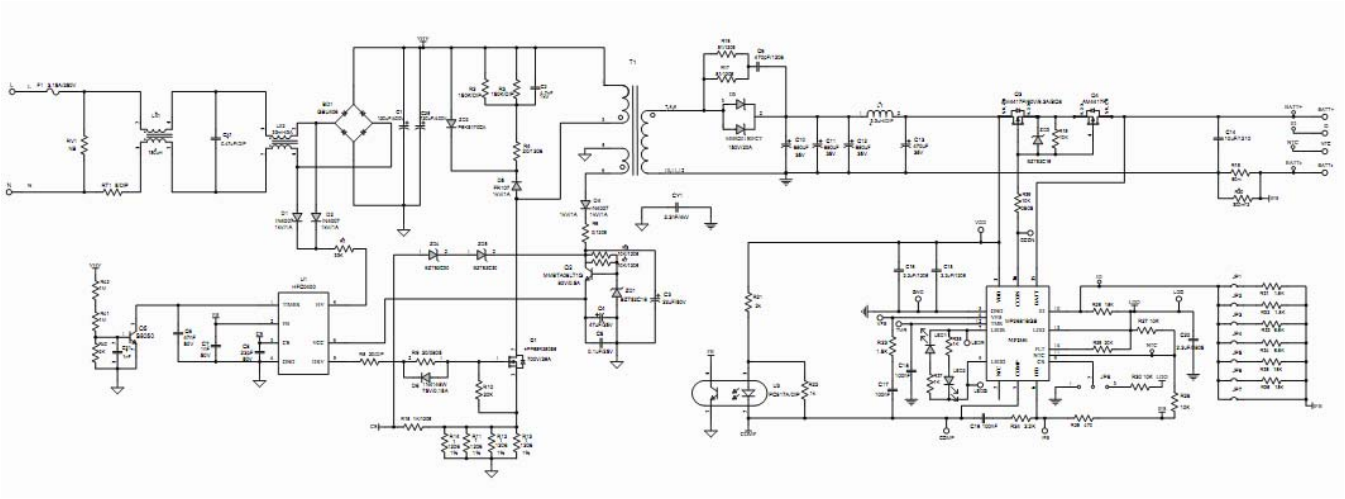




(L x W x H)
(12.2cm x 7.5cm x 0.16cm)

Board Number	MPS IC Number
EV2681B-S-00A	MP2681B

EVALUATION BOARD SCHEMATIC



EV2681B-S-00A BILL OF MATERIALS

Qty	RefDes	Value	Description	Package	Manufacturer	Manufactuer_P/N
1	BD1	GBU406	Diode;600V;4A	DIP	Diodes	GBU406
2	C1,C25	120μF	Electrolytic Capacitor; 400V;Electrolytic;	DIP	Jianghai	
1	C2	4.7nF	High Voltage Capacitor;1000V	DIP	any	any
1	C3	22μF	Capacitor;50V	DIP	Rubycon	50YXM22MEFC5*11
1	C4	47μF	Electrolytic Capacitor; 25V;Electrolytic;	DIP	Jianghai	CD28L-25V47
1	C5	0.1μF	Ceramic Capacitor; 25V;X7R;	0603	Yageo	CC0603KRX7R8BB104
1	C6	47nF	Ceramic Capacitor; 50V;X7R;	0603	muRata	GRM188R71H473KA61D
1	C7	1nF	Ceramic Capacitor; 50V;X7R;	0603	muRata	GRM188R71H102KA01D
1	C8	22pF	Ceramic Capacitor; 50V;C0G;	0603	muRata	GRM1885C1H220JA01D
1	C9	470pF	Ceramic Capacitor; 1000V;U2J;	1206	muRata	GRM31B7U3A471JW31L
3	C10, C11, C12	680μF	Electrolytic Capacitor; 35V;Electrolytic;	DIP	Jianghai	CD287-35V680
1	C13	470μF	Electrolytic Capacitor; 35V;Electrolytic	DIP	Jianghai	CD263-35V470
1	C14	10μF	Ceramic Capacitor; 50V;X7R	1210	Murata	GRM32ER71H106KA12L
2	C15, C16	2.2μF	Ceramic Capacitor; 50V;X7R;	1206	muRata	GRM31CR71H225KA88L
3	C17, C18, C19	100nF	Ceramic Capacitor; 50V;X7R;	0603	muRata	GRM188R71H104KA93D
1	C20	2.2μF	Ceramic Capacitor; 16V;X7R;	0805	TDK	C2012X7R1C225K
1	C21	1nF	Ceramic Capacitor; 50V;C0G;	0603	muRata	GRM1885C1H102JA01D
1	CX1	0.47μF	Film Capacitor; 275V;10%	DIP	Caili	PX474K3ID42L270D9R
1	CY1	2.2nF	Capacitor;4000V;20%	DIP	Hongke	JN12E222MY02N
3	D1, D2, D4	1N4007	Diode;1000V;1A	DO-41	Diodes	1N4007
1	D3	MBR20150FCT	Diode;150V;20A	TO-220AB	Xutong	MBR20150FCT
1	D5	FR107	Diode;1000V;1A	DO-41	Diodes	FR107
1	D6	1N4148W	Diode;75V;0.15A;	SOD-123	Diodes	1N4148W
1	F1	SS-5-3.15A	Fuse;250V;3.15A	DIP	COOPER BUSSMANN	SS-5-3.15A
1	L1	3.3μH	Inductor;3.3μH;25m;4A	DIP	Wurth	7447462033
1	LED1	LED	Green LED;	DIP		F3D02HG-1A
1	LED2	LED	Red LED;	DIP		F3D02R-4A

EV2681B-S-00A BILL OF MATERIALS *(continued)*

Qty	RefDes	Value	Description	Package	Manufacturer	Manufactuer_P/N
1	LX1	150μH	Inductor;150μH; 45m; 3A	DIP	Emei	TP4U150-00
1	LX2	33mH	Inductor;33mH; 210m;3A	DIP	Wurth	744825433
1	Q1	IPP65R280E6	Mosfet;700V; 0.28/10V;45;39	TO220		IPP65R280E6
1	Q2	MMBTA06LT1G	Transistor;80V;0.5A;	SOT-23	Diodes	MMBTA06LT1G
2	Q3, Q4	AM4417P	P-Channel Mosfet;-60V;23;46;9.3	SO-8	Analog Power	AM4417P
1	Q5	S8050	Transistor;25V;0.5A;	SOT-23	Changdian	S8050
1	R1	33kΩ	Resistor;5%;1/4W	1206	Royalohm	1206F3302T5E
2	R2, R3	150kΩ	Resistor;5%;1W	DIP	any	any
1	R4	20Ω	Film Resistor;5%;1/4	1206		1206J0200T5E
2	R5,R7	10kΩ	Film Resistor;1%	1206	Yageo	RC1206FR-0710K
2	R6	0Ω	Resistor;1%; 1/4W;1206	1206	Yageo	RC1206FR-070RL
1	R8	20Ω	Resistor;1%;1/4W	DIP	any	any
1	R9	20Ω	Resistor;5%;1/8W;	0805	Yageo	RC0805JR-0720RL
1	R10	20kΩ	Film Resistor;5%;1/4W	1206	LIZ	CR1206J40203G
4	R11,R12, R13, R14	1Ω	Film Resistor;1%	1206	Yageo	RC1206FR-071RL
1	R15	1kΩ	Resistor;1%	1206	Yageo	RC1206FR-071KL
2	R16, R17	51Ω	Resistor;1%	1206	Yageo	RC1206JR-0751RL
4	R18,R27, R28, R30	10kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0710KL
1	R19	50mΩ	Film Resistor;1%;	2512	Yageo	RL2512FK-070R05L
2	R20	300mΩ*2	Resistor;1%	2512	Yageo	RL2512FK-070R3L
2	R21,R40	2kΩ	Resistor;1%	0603	Yageo	RC0603FR-072KL
1	R22	1kΩ	Film Resistor;1%	0603	Yageo	RC0603FR-071KL
1	R23	1.5kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-071K5L
1	R24	2.2kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-072K2L
1	R25	470	Film Resistor;1%;	0603	Yageo	RC0603FR-07470RL
2	R26	18kΩ	Resistor;1%;1/10W;	0603	Yageo	RC'0603FR-0718KL
1	R29	20kΩ	Resistor;1%;1/10W;	0603	Royalohm	0603F2002T5E
2	R31,R32	1.8kΩ	Film Resistor;5%	0603	LIZ	CR0603JA0182G
2	R33,R34	6.8kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-076K8L
2	R35,R36	15kΩ	Film Resistor;1%;	0603	Yageo	RC0603FR-0715KL
2	R37, R38	1kΩ	Resistor;1%;	0603	Royalohm	0603F1001T5E
1	R39	10kΩ	Film Resistor;5%;	0805	Yageo	RC0805JR-0710KL
2	R41, R42	1M	Film Resistor;1%;	1206	Yageo	RC1206FR-071ML
1	RT1	5Ω	Resistor	DIP	Xinshun	5D2-10LC
1	T1	434μH	EER28,Np:Np_aux:Ns =57:29:12	DIP	Emei	FX0370
1	U1	HFC0400	Offline Regulator	SOIC8-7	MPS	HFC0400HS

EV2681B-S-00A BILL OF MATERIALS *(continued)*

Qty	RefDes	Value	Description	Package	Manufacturer	Manufactuer_P/N
1	U2	MP2681B	CC/CV Controller	SOIC16	MPS	MP2681BGS
1	U3	PC817A	Photocoupler;1-Channel	DIP	Sharp	PC817A
2	ZD1, ZD3	BZT52C16	Zener Diode; 16V;5mA/500mW;	SOD-123	Diodes	BZT52C16
1	ZD2	P6KE170CA	Diode;145V;1mA	DO-15	Brightking	P6KE170CA
2	ZD4, ZD5	BZT52C30	Zener Diode;30V;2mA/500mW;	SOD-123	Diodes	BZT52C30
4	BATT+, BATT-, ID, NTC		2.0 公针	{Package}		
2	L, N		1.0 公针	{Package}		

PRINTED CIRCUIT BOARD LAYOUT

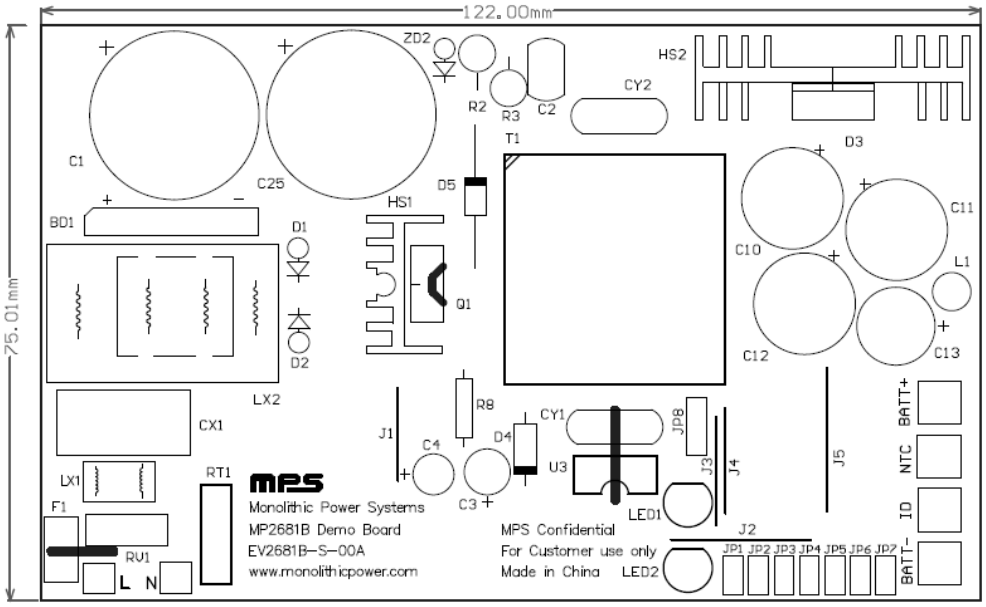


Figure 1—Top Silk Layer

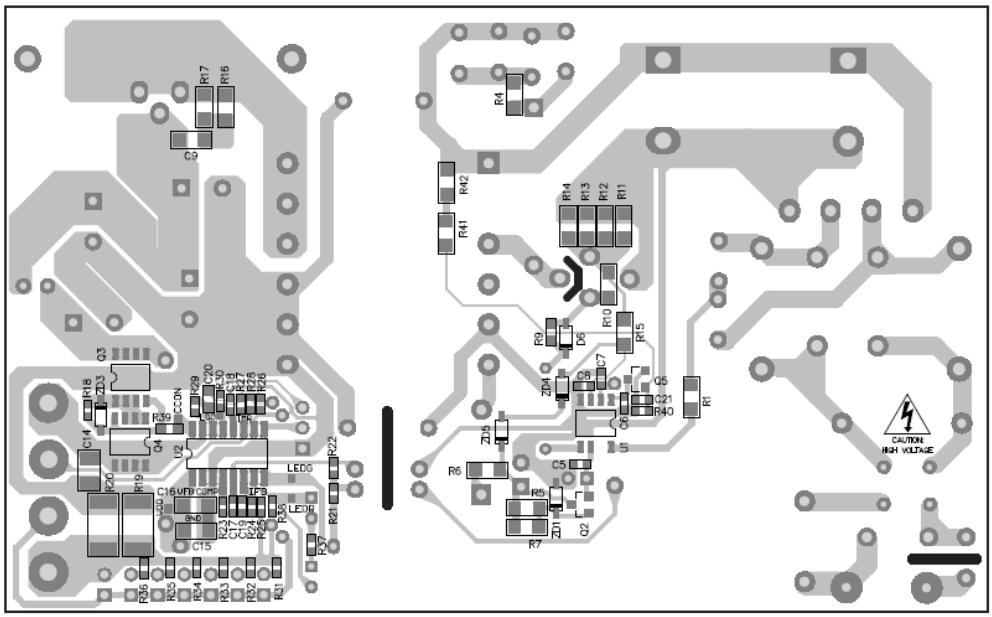


Figure 2—Bottom Layer

QUICK START GUIDE

The MP2681B is a voltage and current control IC integrated a precision voltage reference and charge status indications, which is suitable for AC adapter input in the plug-in, cradle charger applications.

The device automatically detects the battery cell numbers through the battery ID resistor and regulates the battery voltage according to the cell information: 3S, 4S, and 5S.

ID Resistor		Detect Voltage	Operation Mode	Battery Spec	VDD	VBATT
Float	NTC Float	V_{ID} > 2.65V	Sleep Mode	No Battery	10.8V	0
	NTC OK		Default Mode	3S	12.44V	12.44V
1.8k		0.3V < V_{ID} < 0.7V	Automatic Mode	3S	12.44V	12.44V
6.8k		0.95V < V_{ID} < 1.6V		4S	16.59V	16.59V
15k		1.75V < V_{ID} < 2.65V		5S	20.74V	20.74V
Short		V_{ID} < 0.3V	Sleep Mode	Unknown	10.8V	0

1. The charge current is set to 3A as the below formula in this board,

$$I_{CHG} = 0.16/RS = 3A$$

   Note: the reference voltage 0.16V has a +-15% variation.

2. In this board, there are two LEDs controlled by the MP2681B to work as smart charger status indicators.
   a) During the charging, LEDG flashes. At the same time, LEDR keeps off.
   b) When the charging is finished, LEDG keeps on and LEDR is off.
   c) When fault protection happens, LEDR flashes and LEDG keeps off.
3. Attached the AC Line (85~220V) terminals to L and N pins, respectively.
4. Connect the positive terminal of the battery to BATT+ pin, and connect the negative terminal of the battery to BATT- pin, respectively.
5. Turn the power supply on. The board automatically startup.
6. The output voltage on this board is determined by voltage at the ID pin.

For more details, please apply the latest datasheet of the MP2681B for reference.