HM100

QC2.0 Interface Module

General Description

HM100 is designed to support QuickCharge QC 2.0 (QC2.0) specifications. It is a low-cost solution to support QC2.0 functions. HM100 incorporates all necessary functions to add QC2.0 capability to standard Adaptor designs, Portable Battery designs, and Car-charger designs.

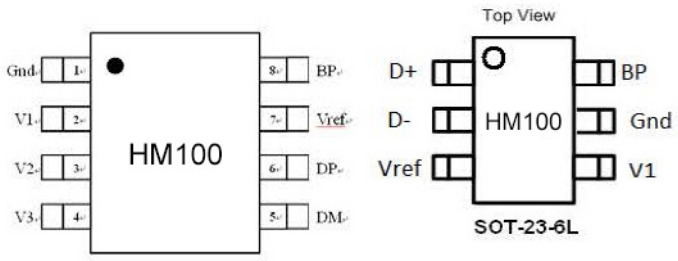
HM100 supports the full output voltage range of either Class A or Class B. Optionally Class B can be inhibited for protecting the battery charger from accidental damage.

HM100 automatically detects whether a co nnected Powered Device (PD) is QC2.0 capable before enabling output voltage adjustment. If a PD that is not compliant to QC2.0 is detected the HM100 disables output voltage adjustment to ensure safe operation with legacy 5 V only USB PDs.

Features

- Fully supports Quick Charge 2.0 specification
- Class A: 5 V, 9 V, and 12 V output voltage
- Class B: 5 V, 9 V, 12 V, and 20 V output voltage
- USB battery charging specification revision 1.2 compatible
- Automatic USB DCP shorting D+ to D- line
- Default 5 V mode operation
- Very low power consumption
- Less than 1 mW at 5 V output
- Fail safe operation
- Adjacent pin-to-pin short-circuit fault
- Open circuit pin fault

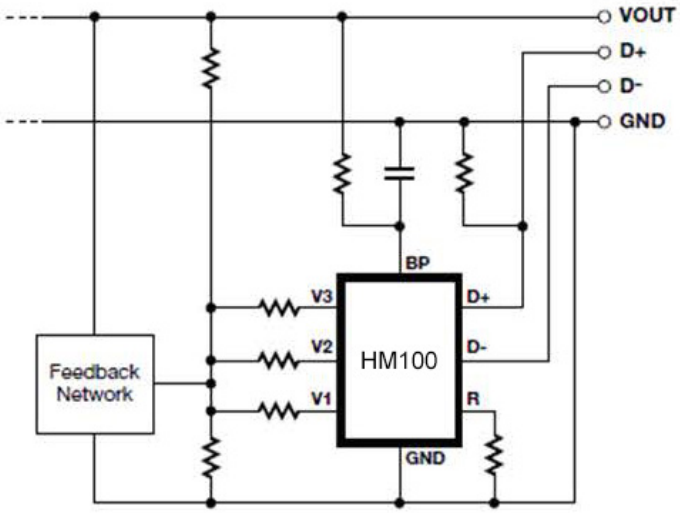
Pin Configuration



Applications

- Adaptors for smart phones, tablets, netbooks, digital cameras, and bluetooth accessories
- Portable Battery Packs supporting QC.20 functions
- Car Cargers supporting QC2.0 functions
- Ogther USB power output ports supporting QC2.0 functions

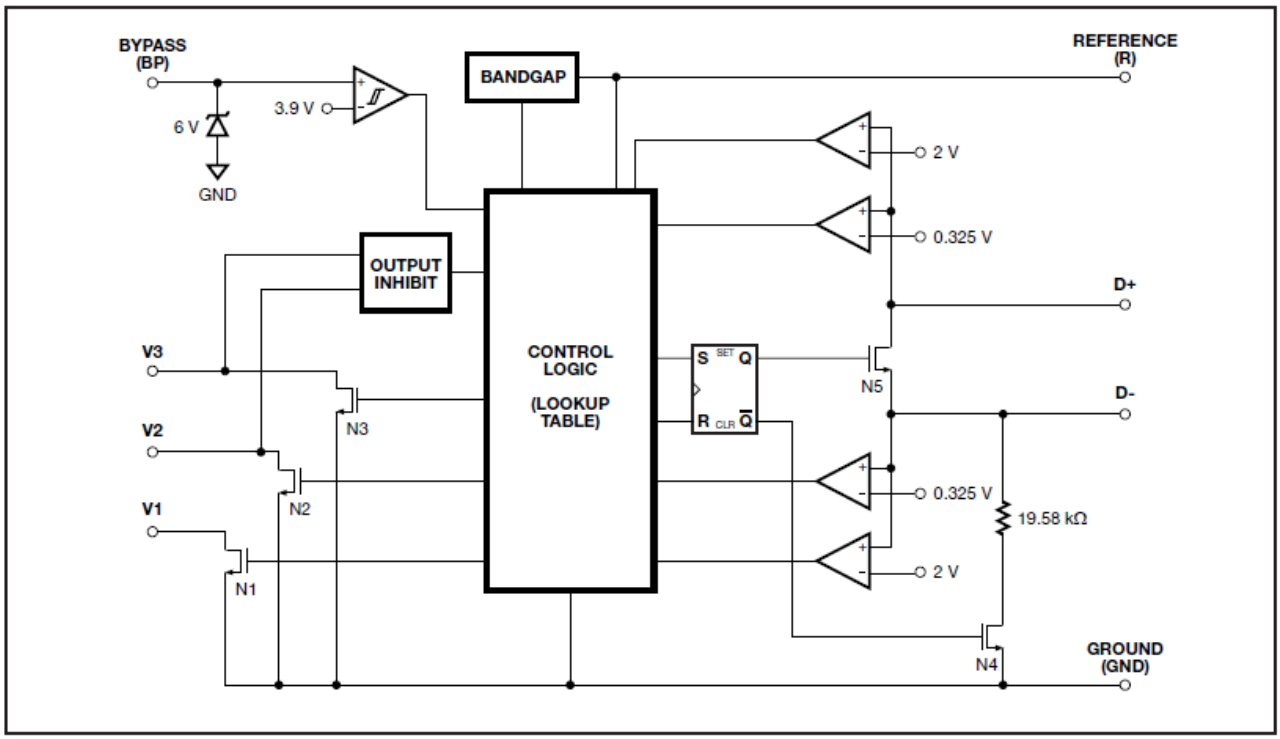
Typical Application



Pin Description

NO.	Pin Name	Pin Function Description
1	GND	Ground
2	V1	Open Drain input of output voltage adjustment switch. Active for 9 V, 12 V, and 20 V output setting.
3	V2	Open Drain input of output voltage adjustment switch. Active for 12 V, and 20 V output setting.
4	V3	Open Drain input of output voltage adjustment switch. Active for 20 V output setting.
5	D-	USB D- data line input.
6	D+	USB D+ data line input.
7	R	Connected to internal band-gap reference. Provides reference current through connected resistor.
8	BP	Connection point for an external bypass capacitor for the internally generated supply voltage.

Functional Block Diagram



Absolute Maximum Ratings

Symbol	Parameter	Maximum	Units
V_{BP}	BYPASS Pin Voltage	5.6	V
V_R	REFERENCE Pin Voltage	5	V
$V_{V1/V2/V3}$	V1/V2/V3 Pin Voltage	V_{BP}	V
$V_{D+/D-}$	D+/D- Pin Voltage	5	V
I_{BP}	BYPASS Pin Current	15	mA
$I_{V1/V2/V3}$	V1/V2/V3 Pin Current	0.5	mA
$I_{D+/D-}$	D+/D- Pin Current	1	mA

Note：$V_{V1/V2/V3}$ 电压不能大于 V_{BP}

Recommended Operating Conditions

Symbol	Parameter	Maximum	Units
T_J	Operating Junction Temperature	-20 to 125	℃
T_A	Operating Ambient Temperature	-20 to 85	℃
T_s	Storage Temperature	-65 to150	℃
	Lead Temperature (less than 15 seconds)	260	℃

Electrical Characteristics（Vcc=5V； Tj=25℃ unless otherwise specified）

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{BP}	BYPASS Pin Voltage		4	5		V
$V_{BP（reset）}$	Power-Up Reset Threshold Voltage		3.8			V
I_{BPSC}	BYPASS Pin Source Current	V_{BP} = 4.3 V, T_J = 25 °CN1 = N2 = N3 = Off		140		μA
$I_{BP(SHUNT)}$	BYPASS Pin Shunt Voltage	I_{BP}=3mA	5.0	5.3	5.6	V
V_R	REFERENCE Pin Voltage		1.22	1.27	1.32	V
$V_{DAT(REF)}$	Data Detect Voltage			0.325		V
$V_{SEL(REF)}$	Output Voltage Selection Reference			2		V
V_{INH}	12 V / 20 V Output Inhibit Threshold		V_{BP}-0.8			V
$I_{DAT(SHORT)}$	Data Lines Short-Circuit Delay	VOUT ⩾ 0.8 V		18		μs
T_{GLITCH}	D+ High Glitch Filter Time			1250		ms
$T_{GLITCH(V)\ CHANGE}$	Output Voltage Glitch Filter Time			32		ms
$R_{DM(DWN)}$	D- Pull-Down Resistance			19.53		Ω
$R_{DS(ON)N1}$	Switch N1 On-Resistance	I_{N1}=200μA			300	Ω
$R_{DS(ON)N2}$	Switch N2 On-Resistance	I_{N2}=200μA			300	Ω
$R_{DS(ON)N3}$	Switch N3 On-Resistance	I_{N3}=200μA			300	Ω
$R_{DS(ON)N4}$	Switch N4 On-Resistance	I_{N4}=200μA			300	Ω
R_{DSN5}	Switch N5 On-Resistance	I_{N1}=200 μA, V_{D+}⩽3.6V			40	Ω

Typical Performance Characteristics

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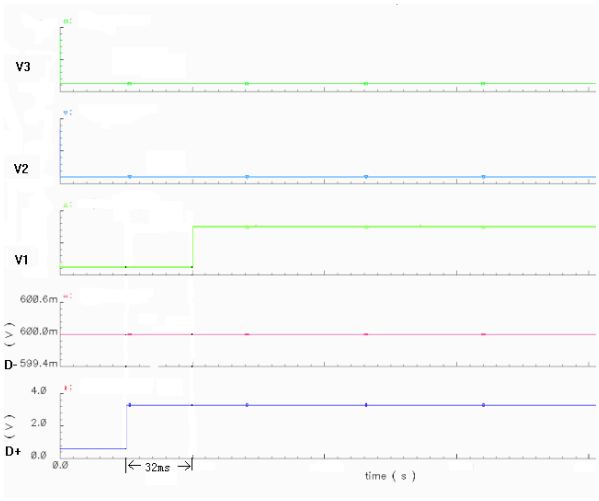
<td> 
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<td>握手完成后，D+,D-输入 0.6V；D+由 0.6V 升到 3.3V，V1 打开</td>
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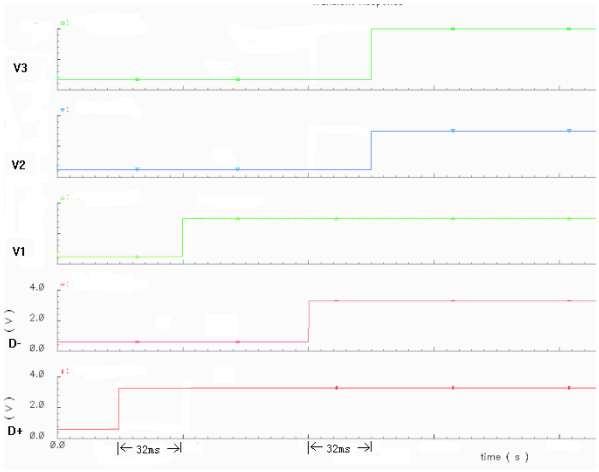
<td> 
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D+	D-	Output	Switch Status
0.6 V	0.6 V	12 V	N1 = N2 = On, N3 = Off
3.3 V	0.6 V	9 V	N1 = On, N2 = N3 = Off
3.3 V	3.3 V	20 V	N1 = N2 = N3 = On
0.6 V	GND	5 V (default)	N1 = N2 = N3 = Off

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<td>握手完成后，D+，D-输入 0.6V;D+由 0.6 升到 3.3V，V1 打开，D-由 0.6 升到 3.3V，V1/V2/V3 打开</td>
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Applications Information

HM100 is a low-cost USB high-voltage dedicated charging port interface IC for the Quick Charge 2.0 specification. It incorporates all necessary functions to add Quick Charge 2.0 capability to standard Adaptors, Car-chargers, and Portable Battery Packs.

HM100 also supports other solutions with traditional feedback schemes like opto-coupler and secondary reference regulator SE431 as depicted in Figure 1.

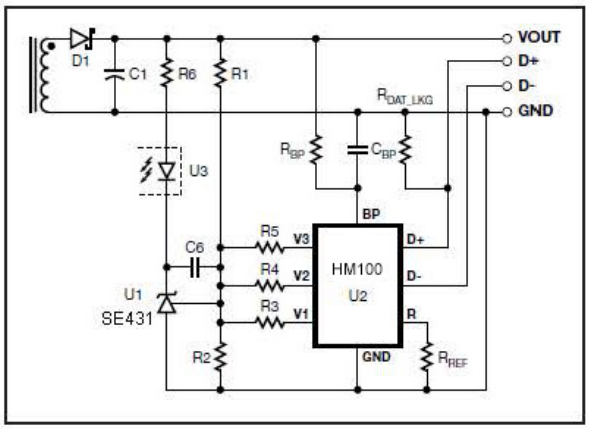


Figure 1. HM100 with Traditional Output Regulation (CV Only).

HM100 supports the full output voltage range of Quick Charge 2.0 Class A (5 V, 9 V, or 12 V) or Class B (5 V, 9 V, 12 V, or 20 V). It automatically detects either Quick Charge 2.0 capable powered devices (PD) or legacy PDs compliant with the USB Battery Charging Specification revision 1.2 and only enables output voltage adjustment accordingly.

Shunt Regulator

The internal shunt regulator clamps the BYPASS pin at 6 V when current is provided through an external resistor (R_{BP} in Figure 1). This facilitates powering of HM100 externally over the wide power supply output voltage range of 5 V to 20 V. Recommended values are R_{BP} = 4.7 kΩ and C_{BP} = 220 nF.

BYPASS Pin Undervoltage

The BYPASS pin undervoltage circuitry resets the HM100 when the BYPASS pin voltage drops below 3.9 V. Once the BYPASS pin voltage drops below 3.9 V it must rise back to 4 V to enable correct operation.

Reference Input

Resister RREF at the REFERENCE pin is connected to an internal band gap reference and provides an accurate reference current for internal timing circuits. The recommended value is RREF = 127 kΩ.

Quick Charge 2.0 Interface

At power-up HM100 turns on switch N5 (see Figure 3) in 20 ms or less after the BYPASS pin voltage has reached 4 V. Switch N4 and output switches N1 to N3 remain off. This sets the default 5 V output voltage level. With D+ and D- short-circuited the normal handshake between the AC-DC adapter (DCP) and powered devices (PD) as described in the USB Battery Charging Specification 1.2 can commence. After switch N5 has been turned on HM100 starts monitoring the voltage level at D+. If it continuously stays

At USB cable disconnect the voltage level at D+

above $V_{DAT(REF)}$ (typ. 0.325 V) and below $V_{SEL(REF)}$ (typ. 2 V) for at least 1.25 seconds HM100 will enter Quick Charge 2.0 op eration mode. If the voltage at D+ drops any time below 0.325 V HM100 resets the 1.25 seconds timer and stays in USB Battery Charging Specification 1.2 compatibility mode with a default output voltage of 5 V.

Once HM100 has entered Quick Charge 2.0 operation mode switch N5 will be turned off. Additionally switch N4 is turned on connecting a 19.53 kΩ pull-down resistor to D-. As soon as the voltage at D- has dropped low (<0.325 V) for at least 1 ms HM100 starts accepting requests for different AC-DC adapter output voltages by means of applied voltage levels at data lines D+ and D- through the powered device. Table 1 summarizes the output voltage lookup table, corresponding AC-DC adapter output voltages and status of switches N1 to N3.

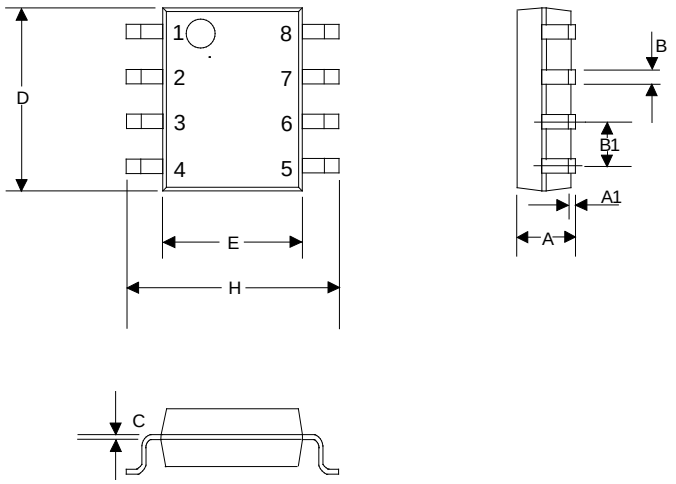
D+	D-	Output	Switch Status
0.6 V	0.6 V	12 V	N1 = N2 = On, N3 = Off
3.3 V	0.6 V	9 V	N1 = On, N2 = N3 = Off
3.3 V	3.3 V	20 V	N1 = N2 = N3 = On
0.6 V	GND	5 V (default)	N1 = N2 = N3 = Off

For Quick Charge 2.0 C lass A support only, the V3 pin has to be connected to the BYPASS pin (directly or through a resistor up to 100 kΩ). This will inhibit any requests for setting a 20 V output.

is pulled down by resistor $R_{DAT(LKG)}$ (see Figure 1). Once it drops below 0.325 V HM100 will turn on switch N5 (thereby short-circuiting D+ and D-) and turns off switches N1 to N4. This sets the default output voltage of 5 V . The recommended value for RDAT(LKG) = 390 kΩ.

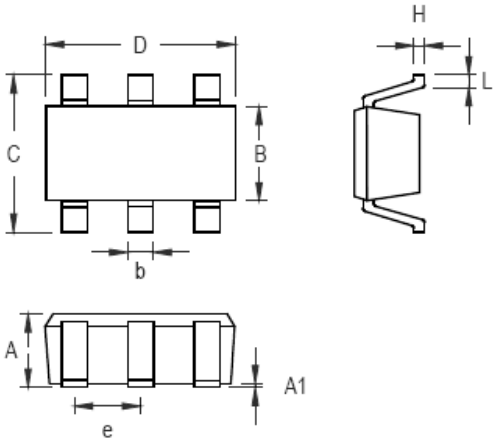
$V_{o1}(5V)=V_{FB}*((R_1/R_2)+1);$
$V_{o2}(9V)= V_{FB}*((R_1/ R_{X1})+1), R_{X1}=R_2//R_3;$
$V_{o3}(12V)= V_{FB}*((R_1/ R_{X2})+1), R_{X2}=R_{X1}//R_4;$
$V_{o4}(20V)= V_{FB}*((R_1/ R_{X3})+1), R_{X3}=R_{X2}//R_5;$

OUTLINE DRAWING SOP-8



DIMENSIONS				
DIM[N]	INCHES		MM	
	MIN	MAX	MIN	MAX
A	0.0532	0.0688	1.35	1.75
A1	0.0040	0.0098	0.10	0.25
B	0.0130	0.0200	0.33	0.51
B1	0.050 BSC		1.27 BSC	
C	0.0075	0.0098	0.19	0.25
D	0.1890	0.1968	4.80	5.00
H	0.2284	0.2440	5.80	6.20
E	0.1497	0.1574	3.80	4.00

OUTLINE DRAWING SOT-23-6L



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024