Evaluation Board DB_SY6970

5A, Single Cell Li-Ion DC/DC Switching Charger with I²C Control, USB Detection and OTG JEITA compliant, Power Path Management

Advanced Design Specification

Introduction

The SY6970 is a fully-integrated switching battery charger with system power path management devices for single cell Li-Ion and Li-polymer battery in a wide range of tablet and other portable devices. Its low impedance power path optimizes switching conversion efficiency, reduces battery charging time and extends battery life during the discharging mode. The I²C serial interface with charging and system settings makes the device a truly flexible solution.

The device supports a wide range of input sources, including standard USB host port, USB charging port and non-standard DC adapter. The SY6970 takes the result from the internal USB port identification circuit thru DP/DM compliant with BC1.2. The SY6970 can be compliant with USB 2.0 and USB 3.0 power spec with input current and voltage regulation. Meanwhile, the SY6970 meets USB On-the-go operation power rating specification by supplying 5V on BUS with current limit up to 2.4A.

The power path management regulates the system voltage slightly above battery voltage but does not drop below 3.5V minimum system voltage. With this feature, the switching converter will keep working to support the system load even when the battery is completely depleted or removed. When the input current limit or voltage limit is reached, the power path management will reduce the charging current to zero firstly. If the system load continues to increase, the power path will discharge the battery to provide the power required by system. This supplement mode operation prevents overloading the input source.

The device initiates and completes a charging cycle without software control. It automatically detects the battery voltage and charges the battery in three phases: preconditioning, constant current and constant voltage. At the end of the charging cycle, the charger will automatically be terminated when the charge current is below a preset limit in the constant voltage phase. When the full battery falls below the recharge threshold, the charger will automatically start another charging cycle. The SY6970 can be compliant with JEITA spec for the Li-Ion battery.

The device provides various safety features for battery charging and system operation, including negative thermistor monitoring, charging safety timer and over-voltage/over-current protections. The thermal regulation reduces charge current when the junction temperature exceeds 120℃ (programmable).

The STAT output reports the charging status and any fault conditions. The INT immediately notifies the host when a fault occurs.

Schematic

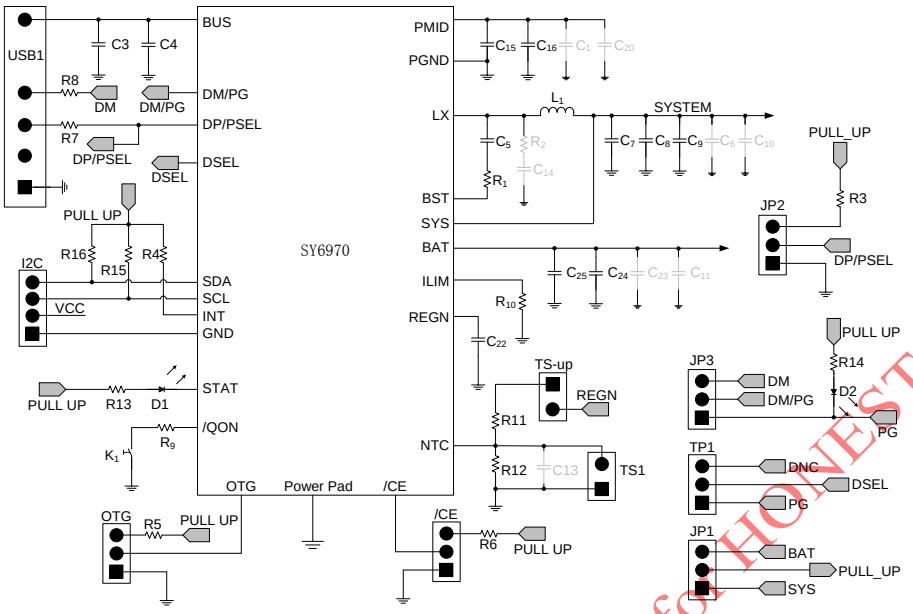
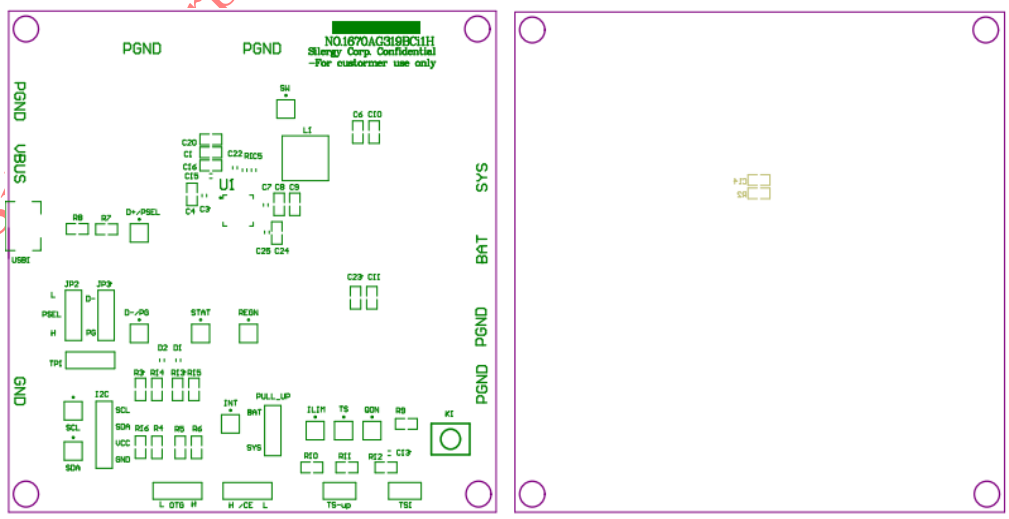


Figure1. Schematic Diagram

Quick Start Guide (Refer to Figure 2)

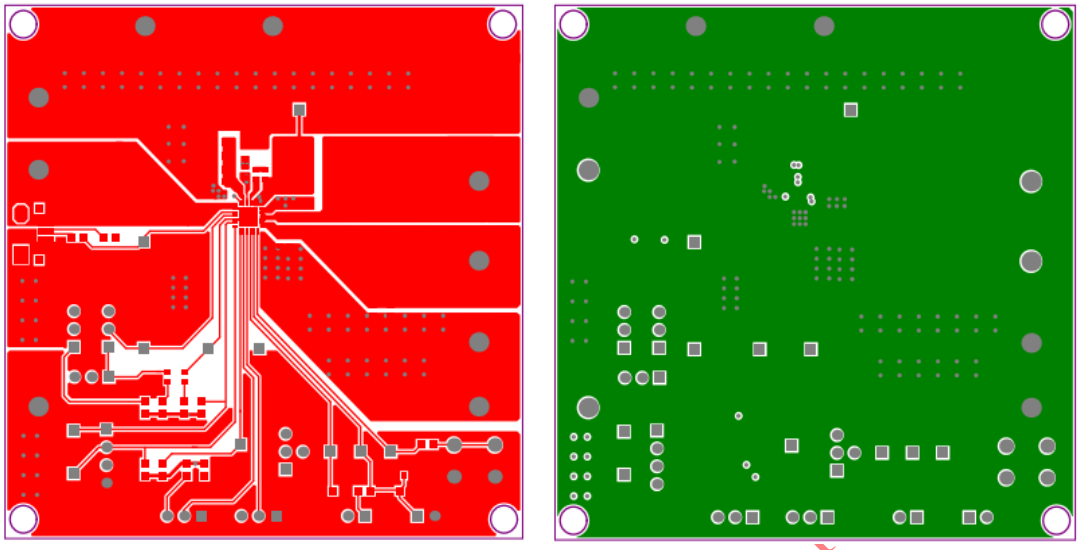
1. Connect Power supply to VBUS and PGND. Measure voltage between SYS and PGND, the voltage should be 3.65V.
2. Connect I^{2}C Tools. The slave address is 0x6A. REG04 is the charge current control register, default value is 2048mA, REG06 is the charge voltage control register, and default value is 4.208V.
3. Write reasonable value to REG04 and REG06, then can disable watchdog by write REG07 bit[5:4] to 00.
4. Connect battery to BAT and GND. D1 ON means charge in process, D1 off means charge done, D1 flashing at 1Hz means charge fault.



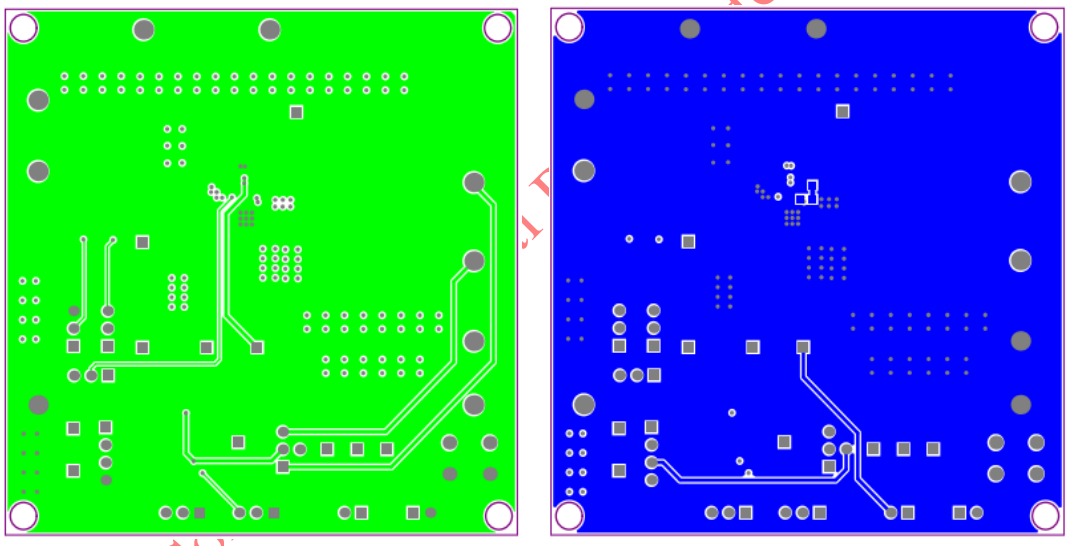
(a) (b)

Figure2. PCB Silkscreen: (a)Top Silkscreen, (b)Bottom Silkscreen

PCB Layout



(a) (b)



(c) (d)

Figure3. PCB Layout Plots: (a) Top layer, (b) Middle layer1, (c) Middle layer2, (d) Bottom layer,

BOM List

Designator	Description	Part Number	Manufacturer
U1	5A, Single Cell Li-Ion DC/DC Switching Charger with I2C Control, USB Detection and OTG, JEITA Compliant, Power Path Management	SY6970	Silergy
L1	Inductor, 1.0μH	SPM5030T-1R0M	TDK
C1, C6, C10, C11, C13, C14, C20, C23	NC		
C3, C7, C15, C25	100nF/50V, 0603	C1608X7R1H104K080AE	TDK
C4	1μF/25V, 0805	CGA4J3X7R1E105K125AB	TDK
C5	47nF/50V, 0603	C1608X7R1H473K080AE	TDK
C8, C9, C24	10μF/10V, 0805	C2012X7R1A106K125AC	TDK
C16	10μF/25V, 0805	C2012X7S1E106K125AC	TDK
C22	4.7μF/10V, 0805	C2012X7R1A475K085AC	TDK
R1, R7, R8, R10	0Ω, 0603, 5%		
R2	NC		
R3, R4, R5, R6, R9, R11, R12, R13, R14, R15, R16	10kΩ, 0603, 5%		
D1, D2	Chip LED 0603		
K1	Press Key		
/CE, JP1, JP2, JP3, OTG, TP1, TS-up, TS1	Jumper		
I2C	Header		
USB1	Micro-USB		

Note: The voltage divider resistor R11, R12 on the EVB is used to set the NTC pin's voltage @50%V_{REGN}, thus can make the IC enter charge mode.