# 1.7A Li-ion Battery Switching Charger with Integrated OTG Boost

## Features

◆ Full Automatic and Efficient Charge Management for Large Capacity Lithium Battery
  - Automatic Conditioning, CC/ CV Charge Control, Termination and Recharge
  - 550-1450mA Programmable Charge Current
  - Support 1.7A Charge Current Using 56mΩ Sensing Resistor
  - 3MHz Synchronous PWM,1µH Low Profile Inductor
  - Input Current Regulation Accuracy:: ±5% (100mA and 500mA)
  - Charge Voltage Regulation Accuracy: -0.25%~0.41%(25°C),±1%(0°C to 85°C),±2%(0°C to 125°C)
  - 20V Input Voltage Tolerance, 6.3V Max Operating Voltage
  - Input Voltage Based Dynamic Power Management( VIN DPM)
  - Optional 32s / 30 Minutes Safety Timer with Reset Control
  - Power Up without Battery
◆ Automatic Adaptor Fault Detection
◆ High Impedance Mode with Low Power Consumption
◆ Comprehensive Protection
  - Reverse Battery Leakage Protection
  - Thermal Regulation and Shut-down
  - Input & Output Over-Voltage Protection
◆ Built-in Input Current and Input Voltage Limit

◆ Integrated Power MOSFET with Max 1.7A Charge Current
◆ Automatic Charge and USB Compliant Start Sequence
◆ Full Range Programmable Charge Parameter through $I^2C$ Compatible Interface
  - Input Current Limit Threshold
  - Input Voltage DPM Threshold
  - Charge Termination Current
  - Charge Termination Voltage
  - Charge Termination Enable
  - Support 3.4MHz $I^2C$ HS Mode
◆ USB OTG Boost
  - Input Voltage Range from Battery: 2.5V~4.5V
  - 5.0V/ 700mA ($V_{BAT}$ ≥ 3.0V)
◆ 1.72mmx1.99mm WLCSP Package

## Applications

- Smart phone
- MP3 player
- Tablet PC

# HL7005D

## Order Information

| Part Number | HL7005D | |
|---|---|---|
| Default Charge Termination Voltage | 4.20V | |
| Maximum Charge Current | 1.7A | |
| OTG Mode Maximum Output Current | 700mA | |
| I²C Address | 6AH | |
| Pre-charge Current | 500mA | 325mA |
| IC_INFO (Vendor Code) | 010 | 010 |
| IC_INFO (REV) | 010 | 011 |
| 30min Safety Timer and 32s Watch-Dog Timer | Yes | |
| Package | WLCSP | |
| Packing Method | Tape and Reel | |
| Marking Information | HL7005DH | HL7005DW |

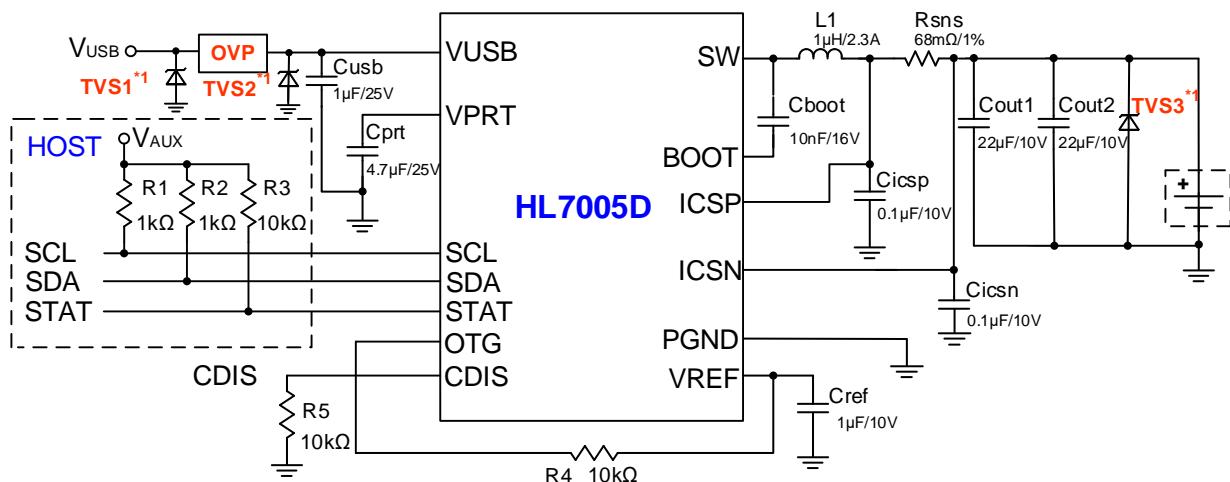## Typical Application Diagram



Figure 1. HL7005D Typical Application Diagram

## Notice

**\*1**. Careful board level surge protection using TVS diode and OVP device on VIN pin, and TVS diode on VBAT pin, is essential to withstand high voltage spikes that may appear in PCB manufacturing process or end user applications. Without such protection, the IC is prone to electrical over-stress damage.

| Component | Part Number | Value | Size | Vendor |
|---|---|---|---|---|
| L1 | LQM2HPN1R0MGH | 1µH/2.3A | 2016 | Murata |
| Cicsp, Cicsn | C1005X5R1A104K | 0.1µF/10V | 0402 | TDK |
| Cboot | C2012X5R1E103K | 10nF/16V | 0805 | TDK |
| Cusb | C2012X5R1E105K | 1µF/25V | 0805 | TDK |

| | | | | |
|---|---|---|---|---|
| Cprt | C2012X5R1E475K | 4.7µF/25V | 0805 | TDK |
| Cref | GRM185R61A105K | 1µF/10V | 0603 | Murata |
| Cout1, Cout2 | GRM319R61A226ME15D | 22µF/10V | 1206 | Murata |
| Rsns | ERJ8BWFR068V | 68mΩ/1% | 1206 | PANASONIC |
| | RL0805FR-070R056L | 56mΩ/1% | 0805 | Yageo |
| R1,R2 | - | 1kΩ | - | - |
| R3,R4,R5 | - | 10kΩ | - | - |
| TVS1/TVS2/TVS3 | See Table2 | - | - | Will SEMI |
| OVP | See Table3 | - | - | Will SEMI |

Table 1. Recommended Component list

| Component | Package | $P_{PK}$(W) tp=8/20 µs | Part Number | $V_{RWM}$ (V) Max | $V_F$(V) $I_F$=20Ma Min | Max | IR(µA) Max | $V_{BR}$ (V) Min | Typ | Max |
|---|---|---|---|---|---|---|---|---|---|---|
| TVS1 | DFN2×2-3L | 4000 | ESD5641D12 | 12.0 | 0.45 | 1.25 | 0.1 | 13.0 | 15.0 | 17.0 |
| TVS2 | DFN2×2-3L | 4000 | ESD5641D07 | 7.5 | 0.45 | 1.25 | 1.0 | 8.0 | 9.0 | 10.0 |
| TVS3 | DFN2×2-3L | 3500 | ESD5616 1D04 | 4.5 | 0.50 | 1.10 | 8.0 | 5.1 | 5.7 | 6.3 |

Table 2. Recommended TVS

| Component | Part Number | VIN(MAX) | RON | Package | Component Dimensions(mm) | | |
|---|---|---|---|---|---|---|---|
| | | | | | L | W | H |
| OVP | WS3210C68 | 30V | 45mΩ | WLCSP-9B | 1.400 | 1.400 | 0.586 |

Table 3. Recommended OVP

## Description

HL7005D is a compact, flexible, high-efficiency, USB compliant switch-mode charge management device for single cell Li-ion and Li-polymer battery used in a wide range of portable applications. The charge parameters can be programmed through I$^2$C interface. HL7005D integrates a synchronous PWM controller, power MOSFET, input current sensing, high-accuracy current and voltage regulation, and charge termination function into a tiny CSP package.

HL7005D provides a complete automatic three-phase battery charging control: trickle charge, constant-current charge (CC) and constant voltage charge (CV) until the battery reaches the charge termination voltage. The input current is automatically limited to the value set by the host. Charging is terminated based on the battery voltage and a user selectable minimum current level. A safety timer with reset control provides a safety backup for I$^2$C interface. During normal operation, the IC automatically restarts the charge cycle if the battery voltage falls below an internal threshold and automatically enters sleep mode or high impedance mode when the input supply is not correctly connected. The charge status can be reported to the host through the I$^2$C interface.

During the charging process, the IC monitors its junction temperature ($T_J$) and reduces the charge current once $T_J$ increases to about 120°C. To support USB OTG device, HL7005D can provide VBUS (5.0V) by boosting the battery voltage.

HL7005D is available in a 20-pin WLCSP package.