Product Specification

QN4058H

38V 1.2A Single-Cell Li-ion Linear Battery Charger

General Description

QN4058H is a cost-effective, high-integration linear charger for single-cell Li-ion or Li-ion polymer batteries. The charging current can be fully programed up to 1.2A with an external resistor. It supports CC/CV charge from a USB (Type-C) or an AC adapter. Low BOM component requirement makes it an ideal choice for portable applications.

The QN4058H features an 6.5V OVP with up to 38V breakdown voltage. No external sense resistor is needed and no reverse-blocking diode is required due to the internal architecture. The final charge voltage is fixed at 4.2V. When the battery reaches 4.2V and the charge current drops to 10% of the set charge value, the chip automatically terminates charging and enters low current .

When the input voltage is removed, the QN4058H enters sleep mode with 0.1uA current , and the charging path is automatically shut off.

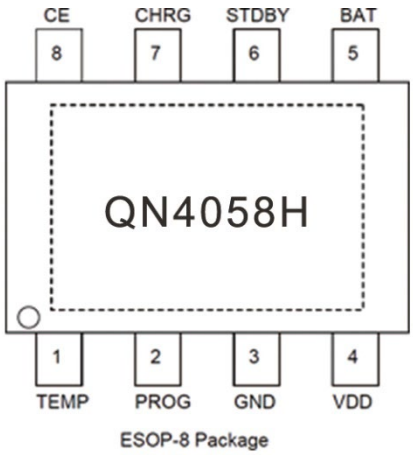
Features

- Integrated 6.5V Over-Voltage Protection (OVP)
- 38V Absolute Maximum Rating for VDD Input
- High-Precision End-of-Charge Voltage
- Supports 0V Battery
- Charging Current up to 1.2A
- Trickle/CC/CV Three Charging states
- Programmable Charging Current with Intelligent Thermal Regulation
- 2.8V trickle voltage and Automatic Recharge
- Status Indicator Output Pins
- Available in 8-pin ESOP, DFN, SOT23-5 and SOT23-6 packages

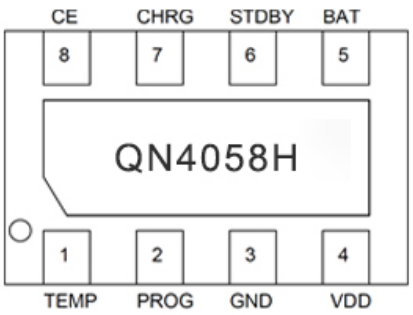
Applications

- USB Power Supply
- E-Cigarettes, ePOS, Wearable devices
- Blue-tooth Headsets,wireless devices
- Single-Battery Portable Devices

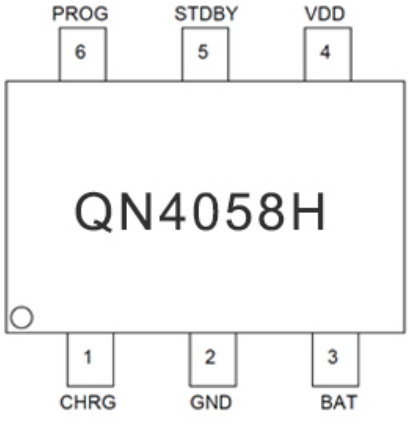
Pin Configuration



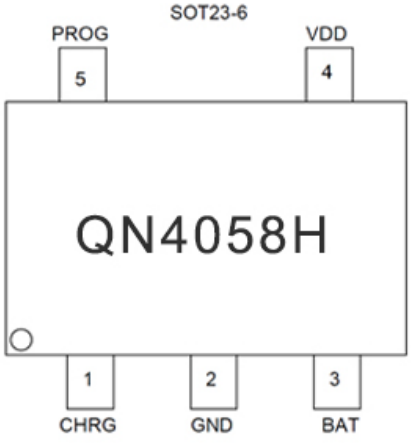
ESOP-8 Package



DFN3*3-8/DFN2*2-8 Package



SOT23-6

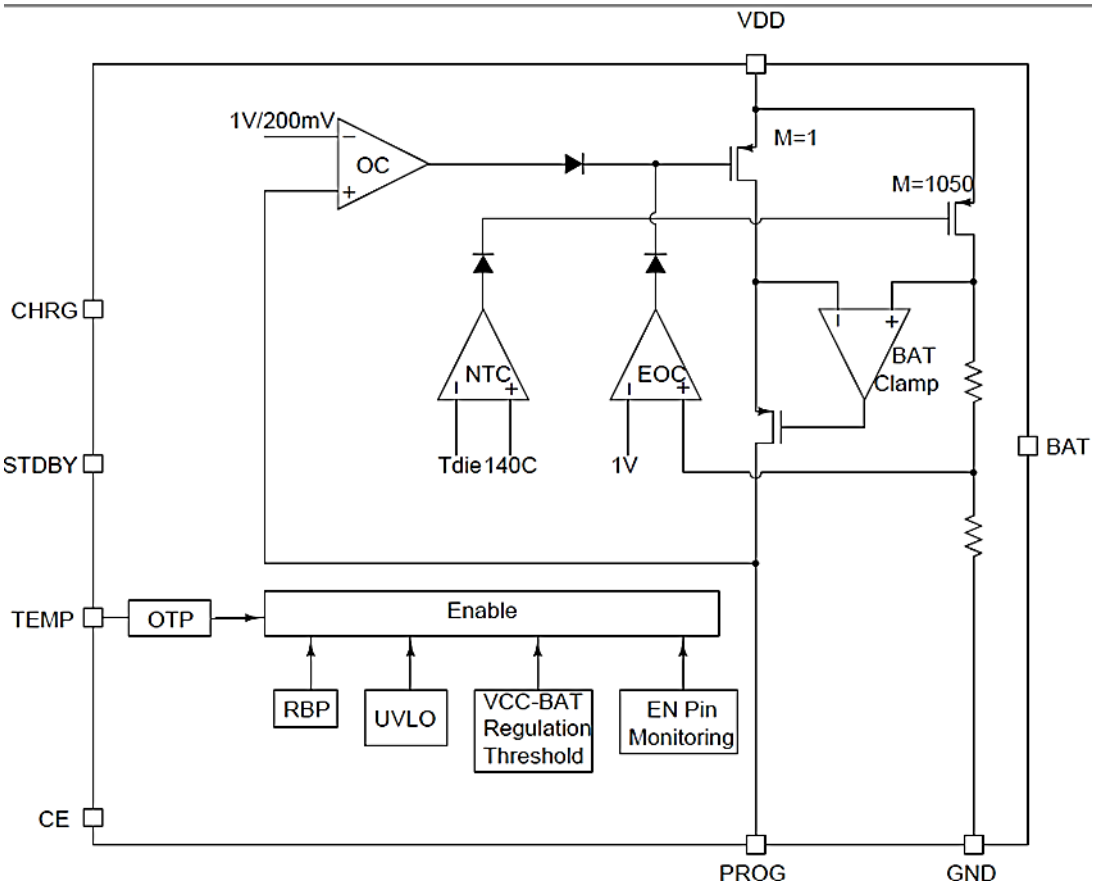


SOT23-5

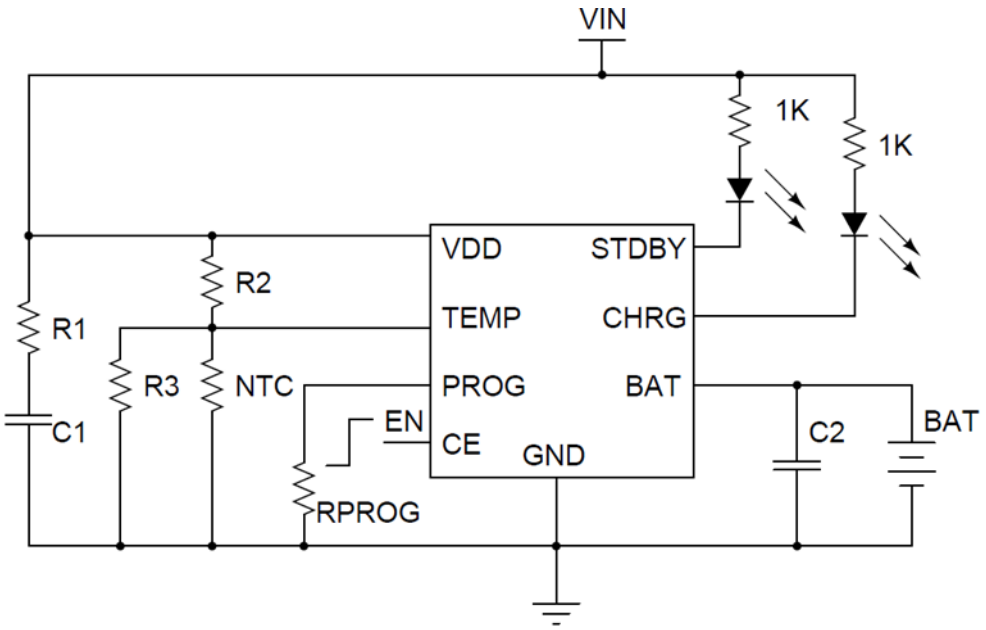
Pin Description

Pin No.			Pin Name	Description
ESOP/DFN	SOT23-6	SOT23-5		
1			TEMP	Temperature monitor Pin. Connect to the battery temperature sensor. Connect to GND if not used
2	6	5	PROG	Charging Current Program Pin. An external resistor programs the charging current.
3	2	2	GND	Chip ground.
4	4	4	VDD	External DC input (5V)
5	3	3	BAT	Battery input
6	5		STDBY	Charge terminal status indicator,LED Cathode.
7	1	1	CHRG	Charging status indicator, LED Cathode.
8			CE	Chip enable pin. The pin is active high by default; pulling it low to disable the chip.

Function Block Diagram



Typical Application Circuit



Note: It is recommended to use SMD capacitors for C1 and C2, rated at 10uF/35V or higher.

Absolute Maximum Ratings

Pin No.	Pin Name	Description	Range	Units
1	TEMP	Temperature Sense Pin Voltage Rating	-0.3~28	V
2	PROG	PROG Pin Voltage Rating	-0.3~6	V
4	VDD	Input Voltage	-0.3~38	V
5	BAT	Battery Terminal Voltage Rating	-5~16	V
6	STDBY	Status Indicator Pin Voltage Rating	-0.3~28	V
7	CHRG	Status Indicator Pin Voltage Rating	-0.3~28	V
8	CE	Enable Pin Voltage Rating	-0.3~36	V
--	T_{OP}	Operating Ambient Temperature Range	-40 ~ +85	℃
--	T_{STG}	Storage Temperature Range	-55 ~ +150	℃
--	ESD	Human Body Model (HBM)	2000	V
		Machine Model (MM)	200	V

Note: If the maximum ratings are exceeded, the device may be permanently damaged.

Electrical Characteristics

(Unless otherwise specified, Ta=25℃)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Power Supply						
V_{DD}	Operating Voltage		4.5	5	6	V
V_{DD_UV}	UVLO Threshold	V_{DD} Falling		3.6		V
$V_{DD_UV_HYS}$	UVLO Hysteresis	V_{DD} Rising		280		mV
V_{DD_OVP}	Over-Voltage Protection		6.1	6.5	6.9	V
$V_{DD_OVP_HYS}$	OVP Recovery Hysteresis			500		mV
Icc	Input Supply Current	Charging Mode (R_{PROG}=1KΩ)		240	360	μA
		Standby Mode, Charging Termination		70	130	μA
		Shutdown Mode（R_{PROG} not connected, V_{CC}<V_{BAT}）		50	120	μA
Charge Current Setting						
V_{PROG}	PROG pin Voltage(Constant-Current Mode)	V_{DD}=5V R_{PROG}=1KΩ	0.9	1	1.1	V
I_{BAT}	Charge Current at BAT pin	V_{DD}=5V, V_{BAT}=3.6V R_{PROG}=1KΩ		1050		mA
		V_{DD} open, V_{BAT}=4V		0.5	1	μA
I_{TRIKL}	Trickle Charge Current	V_{BAT}＜V_{TRIKL}, R_{PROG}=1KΩ		210		mA
I_{TERM}	C/10 Charge Termination Current	R_{PROG}=1KΩ		105		mA
V_{TRKL}	Trickle Charge Detection Voltage	V_{BAT} Rising		2.8		V
V_{TR_HYS}	Trickle Charge Detection Hysteresis	V_{BAT} Falling		350		mV

Battery Charge Termination						
V_{FLOAT}	Full Charge Detection Voltage	V_{DD}=5V R_{PROG}=1KΩ	4.158	4.2	4.242	V
$V_{RECHARG}$	Recharge Battery Voltage	V_{FLOAT}-$V_{RECHARH}$		120		mV
$T_{RECHARG}$	Recharge comparator filter time	VBAT high to low transition	0.8	2	4	mS
R_{DS_ON}	Power MOSFET On-Resistance	V_{BAT}=3.8V R_{PROG}=1KΩ		620		mΩ
Indicator pin status GHRG/STDBY						
I_{CHRG}	CHRG Output Current	V_{DD}=5V;V_{CHRG}=1V	1	2.5	5	mA
I_{STDBY}	STDBY Output Current	V_{DD}=5V;V_{STDBY}=1V	1	2.5	5	mA
Internal temperature compensation						
T_{OTC}	Internal Temperature Compensation			145		℃
T_{OTPH}	Over-Temperature Detection Threshold	TEMP Pin Connected to NTC Resistor	43%V_{DD}	45%V_{DD}		V
T_{OTPL}	Under-Temperature Detection Threshold	TEMP Pin Connected to NTC Resistor		80%V_{DD}	82%V_{DD}	V

Functional Description

QN4058H is a cost-effective, high-integration linear charger for single-cell Li-ion or Li-ion polymer batteries. The charging current can be fully programed up to 1.2A with an external resistor. It supports CC/CV charge from a USB (Type-C) or an AC adapter. Low BOM component requirement makes it an ideal choice for portable applications. The QN4058H features an 6.5V OVP function with up to 38V breakdown voltage.

Normal Charging Cycle

The charging cycle begins when the VDD voltage rises above the UVLO (Under-Voltage Lockout) threshold, and an 1% tolerance setting resistor is connected between the PROG pin and GND, and a battery is connected to the BAT. If the BAT voltage is below 2.8V, the charger enters trickle charger mode. In this mode, the device charges the battery with approximately 1/10 of the programmed charge current to safely raise the battery voltage until the BAT voltage is higher than 2.8V and then enters CC charge mode with the programmed current by the resistor at the PROG pin. When the BAT pin voltage reaches the final float- charge voltage (typically 4.2V), the QN4058H enters constant-voltage(CV) mode, and the charge current begins to decrease. The charging cycle

terminates when the charge current drops to 1/10 of the programmed value.

Charging Current Setting

In constant-current mode, the charging current is calculated using the formula:

$$I_{CH} = 1050/R_{PROG}$$

Here, I_{CH} means the charging current in Amperes (A), and R_{PROG} represents the resistance between the PROG pin and ground in Ohms (Ω). For example, to set a charging current of 1000mA, calculate as follows: R_{PROG} =1050/1000 = 1.05KΩ .

To ensure system stability and wonderful temperature characteristics, it is recommended to use a 1% metal-film resistor for R_{PROG}. In practical applications, the charging current should be set appropriately based on actual system requirements and ambient temperature conditions.

Automatic Recharge

Once a charging cycle is terminated, the QN4058H immediately begins continuously monitoring the BAT Voltage with 2ms recharge blanking time($T_{RECHARGE}$). When the battery voltage falls below 4.05V (approximately corresponding to 80% to 90% of the battery's capacity), a new charging cycle is automatically initiated. This ensures the battery is maintained at (or near) a full-charge state and avoid charging cycle manually .

Intelligent Temperature Control

When the device's temperature is rising close to the preset 145 ℃, the internal thermal feedback loop in the QN4058H will reduce the programmed charging current. This feature prevents the chip from overheating. In order to get better performance, it is based on the typical ambient temperature at some input voltage to set the charging current.

Under-Voltage Lockout (UVLO)

An internal UVLO circuit is designed in the QN4058H, to continuously monitor the VDD voltage. The chip remains in shutdown mode until VDD is above the UVLO threshold. Once the VDD is lower than 3.6V and then UVLO is triggered, the chip will be in standby mode until VDD is higher than 3.88V whose hysteresis is 280mV.

Input Over-Voltage Protection

The QN4058H features input overvoltage protection with a built-in protection switch. When the VDD voltage exceeds the overvoltage protection threshold, the chip enters shutdown mode. Once the input voltage VDD falls back within the normal operating range, the chip exits protection mode and resumes normal charging.

Status Indicators

The QN4058H provides two open-drain status indicator outputs, CHRG and STDBY. When the charger is in the charging state, CHRG is pulled low while STDBY remains in a high- impedance

state. If the battery is reverse-connected or short-circuited, both CHRG and STDBY enter a high-impedance state, turning off both indicator lights. When the status indicator function is not required, the unused output pin should be connected to ground.

Operating Status	CHRG LED	STDBY LED
Normal Charging: Trickle/CC/CV	On	Off
Battery Fully Charged	Off	On
Fault Conditions (Under-voltage, Over-voltage, Battery Temperature Too High or Too Low, etc.) –TEMP Enabled	Off	Off
VDD Connected but No Battery Connected	Flashing	On

Ordering information

Ordering Part Number	Float Voltage	Package	Packaging
QN4058HES8-420	V_{FLOAT}=4.2V	ESOP8	4000 pieces per reel
QN4058HES8-435	V_{FLOAT}=4.35V	ESOP8	4000 pieces per reel
QN4058HS5-420	V_{FLOAT}=4.2V	SOT23-5	3000 pieces per reel
QN4058HS5-435	V_{FLOAT}=4.35V	SOT23-5	3000 pieces per reel
QN4058HS6-420	V_{FLOAT}=4.2V	SOT23-6	3000 pieces per reel
QN4058HS6-435	V_{FLOAT}=4.35V	SOT23-6	3000 pieces per reel
QN4057HD2-420	V_{FLOAT}=4.2V	DFN2*2-8	4000 pieces per reel
QN4057HD2-435	V_{FLOAT}=4.35V	DFN2*2-8	4000 pieces per reel
QN4057HD3-420	V_{FLOAT}=4.2V	DFN3*3-8	4000 pieces per reel
QN4057HD3-435	V_{FLOAT}=4.35V	DFN3*3-8	4000 pieces per reel