



1A Single Chip Li-Ion and Li-Polymer Charger

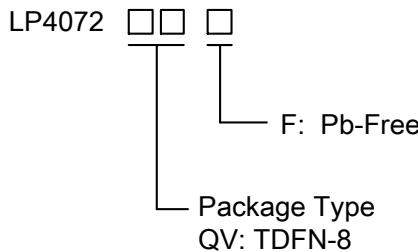
General Description

The LP4072 is highly integrated Single-Cell linear charger, it offers integrated MOSFET, high-accuracy voltage regulation, temperature regulator, charge termination and charge indicator.

The battery is charged in three phases: trickle current, constant current and constant voltage. It automatically recharge if battery voltage falls below an internal recharge voltage threshold.

The charger supports charge current up to 1A, the device accepts an input voltage up to 28V, but it is disabled while the input voltage exceeds the input over voltage protection threshold, typically 7V. And accepts a battery voltage up to 15V, which designed for protect the chip from over-shoot voltage in single-cell Li-Ion/Li-Pol application.

Order Information



Features

- ◆ Input Voltage up to 28V
- ◆ Input Over Voltage Protection : 7V
- ◆ Short-circuit protection
- ◆ Programmable Charge Current up to 1A
- ◆ 1µA Battery Reverse Current
- ◆ Over temperature Sensing Protection
- ◆ Protection of Reverse Connection of Battery
- ◆ Constant-Current/Constant-Voltage Operation with Thermal Regulation
- ◆ TDFN-8 Package
- ◆ RoHS Compliant and 100% Lead (Pb)-Free

Applications

- ✧ Portable Media Players/Game
- ✧ Power Bank
- ✧ Bluetooth Applications
- ✧ PDA/MID

Marking Information

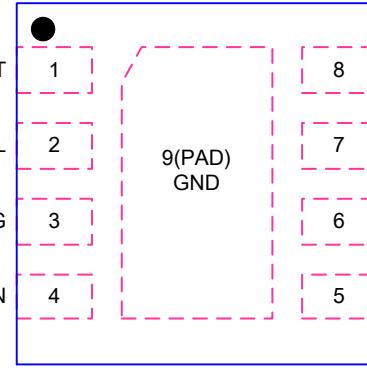
Device	Marking	Package	Shipping
LP4072QVF	LPS LP4072 YWX	TDFN-8	5K/REEL

Marking indication:

Y:Production year W:Production week X: Series Number



Functional Pin Description

Package Type	Pin Configurations
TDFN-8	 <p>TDFN-8 (Top View)</p>

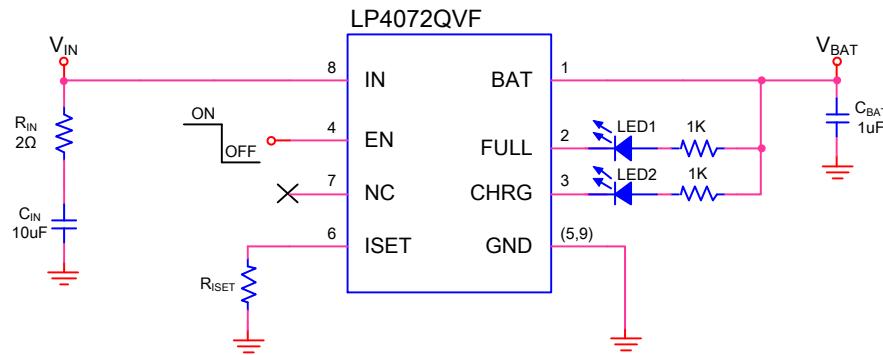
Pin Description

No.	NAME	DESCRIPTION
1	BAT	BAT is the connection to the battery. Typically a 10µF Tantalum capacitor is needed for stability when there is no battery attached. When a battery is attached, only a 1uF ceramic capacitor is required.
2	FULL	Open-Drain Charge Status Output. When the battery is charging, the FULL pin could be pulled High by an external pull high resistor. When the charge cycle is completed, the pin is pulled Low by an internal N-MOS.
3	CHRG	Open-Drain Charge Status Output. When the battery is charging, the CHRG pin is pulled low by an internal N-MOS. When the charge cycle is completed, the pin could be pulled High by an external pull high resistor.
4	EN	Charge Enable Input (Active high).
5,9	GND	Ground.
6	ISET	Charge Current Program. The charge current is programmed by connecting a 1% resistor (R_{ISET}) to ground.
7	NC	No Connector.
8	IN	IN is the input power source. Connect to a wall adapter.

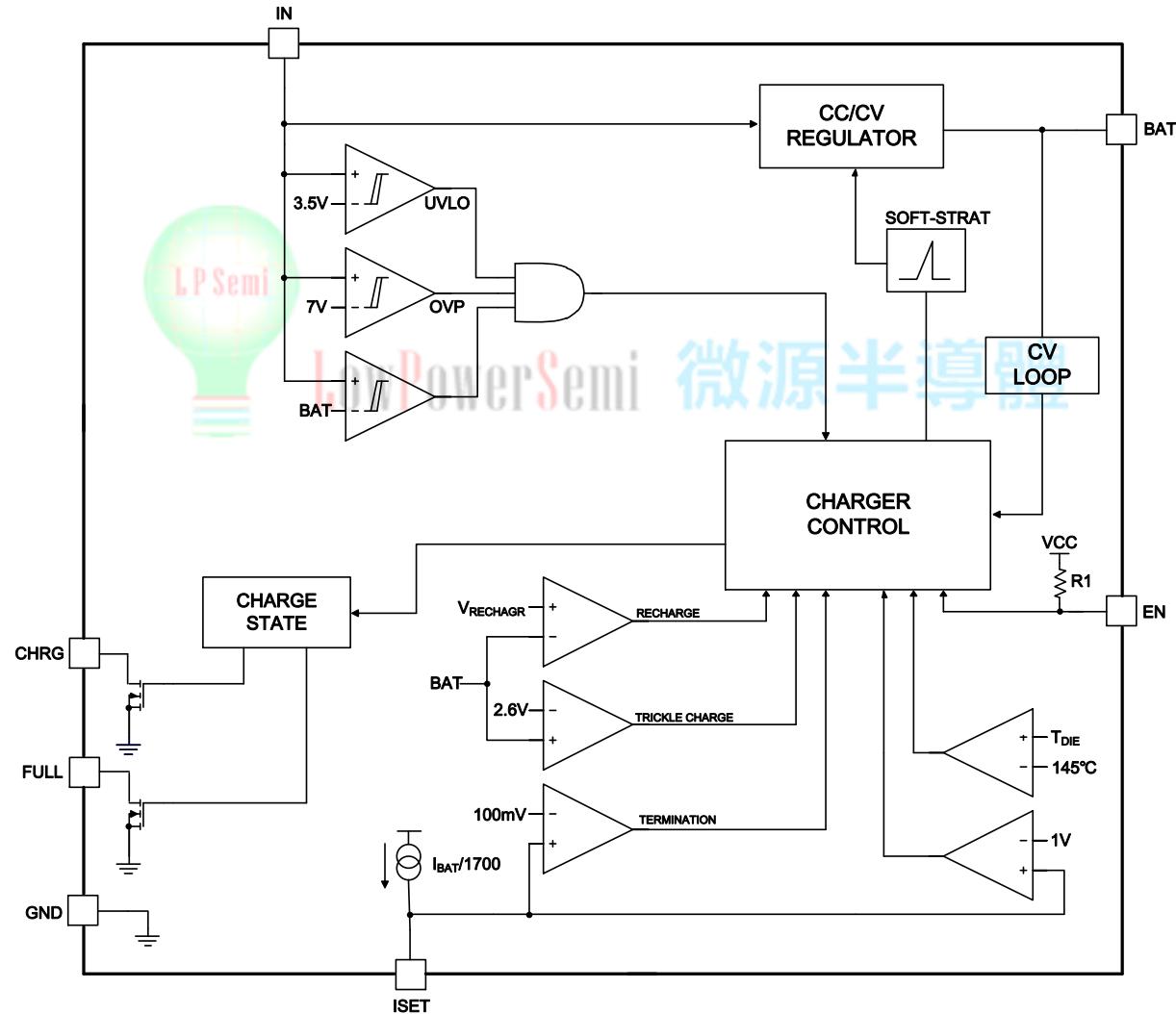
$$I_{BAT} = \frac{1700 \times V_{ISET}}{R_{ISET}}$$



Typical Application Circuit



Functional Block Diagram





Absolute Maximum Ratings Note 1

- ◊ Input Voltage to GND ----- -0.3V to 28V
- ◊ BAT Voltage to GND ----- -5V to 15V
- ◊ Other pin to GND ----- -0.3V to 6.5V
- ◊ Maximum Junction Temperature(T_J) ----- 150°C
- ◊ Maximum Soldering Temperature (at leads, 10 sec) ----- 260°C
- ◊ Operating Junction Temperature Range ----- -20°C to 85°C
- ◊ Storage Temperature ----- -65°C to 165°C

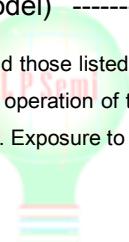
Thermal Information

- ◊ Maximum Power Dissipation ($P_D, T_A=25^\circ\text{C}$) ----- 1.5W
- ◊ Thermal Resistance (θ_{JA}) ----- 65°C/W

ESD Susceptibility

- ◊ HBM(Human Body Model) ----- 2KV
- ◊ MM(Machine Model) ----- 200V

Note 1. Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.





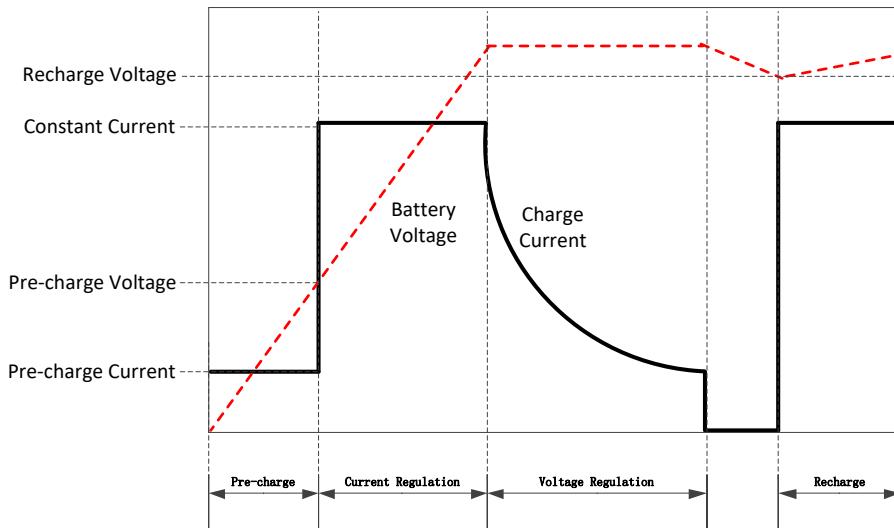
Electrical Characteristics

($T_A=25^\circ\text{C}$, $V_{IN}=5\text{V}$, unless otherwise noted.)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP.	MAX	UNITS
V_{IN}	Input Voltage		4.5	5	6.5	V
I_{IN}	Input Supply Current	$R_{ISET}=17\text{K}$, Charge Mode		300		μA
		$V_{BAT}=4.2\text{V}$, Charge Terminated		160		μA
		$R_{ISET}=\text{NC}$, Shutdown Mode		200		μA
V_{FLOAT}	Regulated Output (Float) Voltage	$I_{BAT}=40\text{mA}$,	4.158	4.2	4.242	V
V_{UV}	V_{IN} Under Voltage Lockout Threshold	From V_{IN} Low to High		3.5		V
V_{UV_HYS}	Under Voltage Lockout Hysteresis			110		mV
V_{OVP}	Input Voltage OVP	V_{IN} Rising		7		V
V_{OVP_HYS}	OVP Hysteresis			150		mV
I_{BAT}	BAT Pin Current	$R_{ISET}=3.4\text{k}$, Current Mode		500		mA
		$R_{ISET}=17\text{k}$, Current Mode		100		mA
		$V_{BAT}=4.2\text{V}$ ($V_{IN}=\text{float or } 0\text{V}$)		1		μA
I_{TRIKL}	Trickle Charge Current	$V_{BAT} < V_{TRIKL}$, $R_{ISET}=10\text{k}$, Charge Mode		10		% I_{BAT}
V_{TRIKL}	Trickle Charge Threshold Voltage	V_{BAT} Rising		2.6		V
V_{TRIKL_HYS}	Trickle Charge Hysteresis Voltage			150		mV
I_{TERM}	Termination Current Threshold			10		% I_{BAT}
V_{ISET}	ISET Pin Voltage	$R_{ISET}=10\text{k}$, Current Mode		1		V
I_{CHRG}	CHRG Pin Sink Current	$V_{CHRG}=5\text{V}$			1	μA
I_{FULL}	FULL Pin Sink Current					μA
V_{CHRG}	CHRG Pin Output Low Voltage	$I_{CHRG}=5\text{mA}$			0.5	V
V_{FULL}	FULL Pin Output Low Voltage	$I_{FULL}=5\text{mA}$			0.5	V
ΔV_{RECHRG}	Recharge Battery Threshold Voltage	$V_{FLOAT}-V_{RECHRG}$		150		mV
V_{ASD}	$V_{IN}-V_{BAT}$ Lockout Threshold Voltage	$V_{BAT}=3.5\text{V}$, V_{IN} Rising		150		mV
V_{EN_ON}	EN Logic-High Voltage Threshold		1.4			
V_{EN_OFF}	EN Logic-Low Voltage Threshold				0.4	V
t_{TERM}	Charge termination Filtering Time			1		ms
T_{CTM}	Junction Temperature in Constant Temperature Mode			145		°C

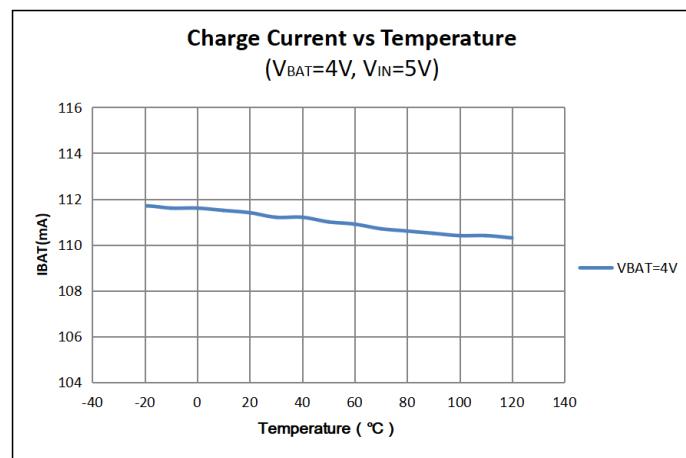
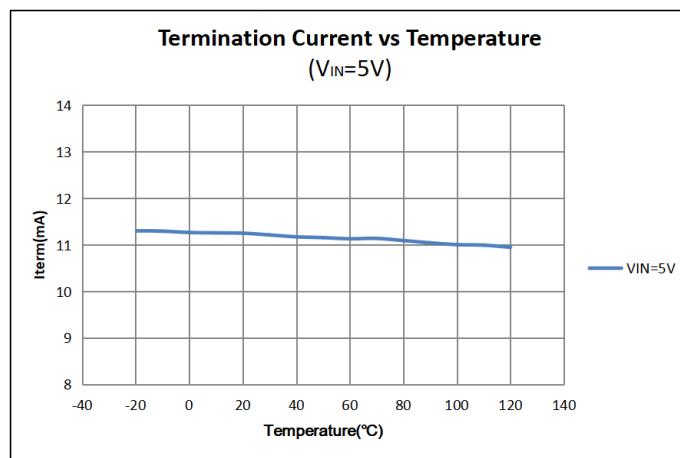
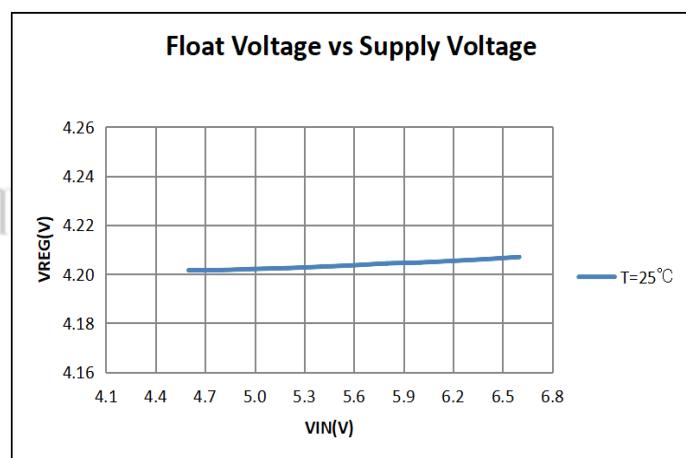
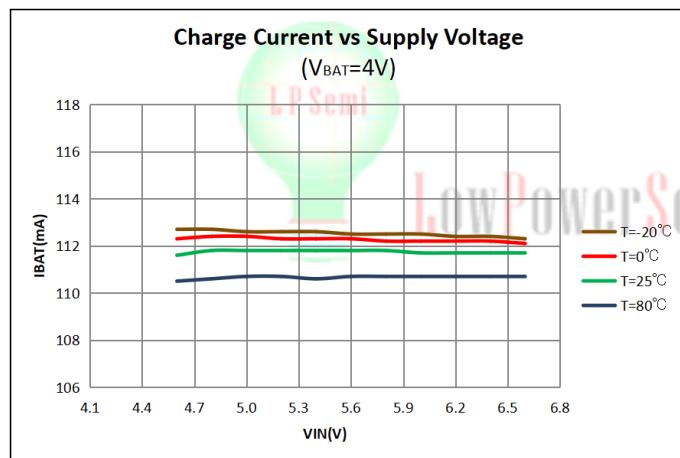


Typical Charging Profile



Typical Performance Characteristics

(C_{IN}=C_{OUT}=10uF, R_{SET}=16.5K, unless otherwise noted)





Application Information

The LP4072 has built-in input voltage surge protection as high as +28V. The charger IC will be automatically disabled when the input voltage is higher than 7V. A charge cycle begins when V_{EN} is high level, the voltage at the IN pin rises above the UVLO threshold level and a program resistor is connected from the ISET pin to ground. If the V_{BAT} is less than trickle voltage threshold, the charger enters trickle charge mode. In this mode, it supplies approximately 1/10 the ISET programmed charge current to bring the battery voltage up to a safe level for full current charging. When the V_{BAT} rises above trickle voltage threshold, the charger enters constant-current mode, where the ISET programmed charge current is supplied to the battery. When the Battery Voltage approaches the final float voltage, the device enters constant-voltage mode and the charge current begins to decrease, the FULL pin goes high impedance when the charge current falls below the termination current threshold.

Charge Termination

A charge cycle is terminated when the charge current falls to 1/10th the ISET programmed value after the final float voltage is reached. This condition is detected by using an internal, filtered comparator to monitor the ISET pin. When the ISET pin voltage falls below 100mV for longer than t_{TERM} (typically 1ms), charging is terminated.

Charge Current Program

The charge current (I_{BAT}) programmed by a resistor (R_{ISET}) connecting from the ISET pin to GND. The relationship of the charge current and the programming resistance is established by the following equations ($V_{ISET}=1V$).

$$I_{BAT} = \frac{1700 \times V_{ISET}}{R_{ISET}}$$

Automatic Recharge

Once the charge cycle is terminated, the LP4072 continuously monitors the voltage on the BAT pin. A charge cycle restarts when the battery voltage falls below V_{RECHRG} (which corresponds to approximately 80% to 90% battery capacity). This ensures that the battery is kept at or near a fully charged condition and eliminates the need for periodic charge cycle initiations.

Charge Status Indicator

After application of a 5V source, the input voltage rises above the UVLO and sleep thresholds ($V_{IN} > V_{BAT} + V_{ASD}$), but is less than OVP ($V_{IN} < V_{OVP}$), CHRG and FULL has two different states: strong pull-down (~5mA) and high impedance. The relationship between charge status and indicator status is as follows:

Function	CHRG	FULL
Charging	Low	Hi-Z
Charge Finish	Hi-Z	Low

微源半導體

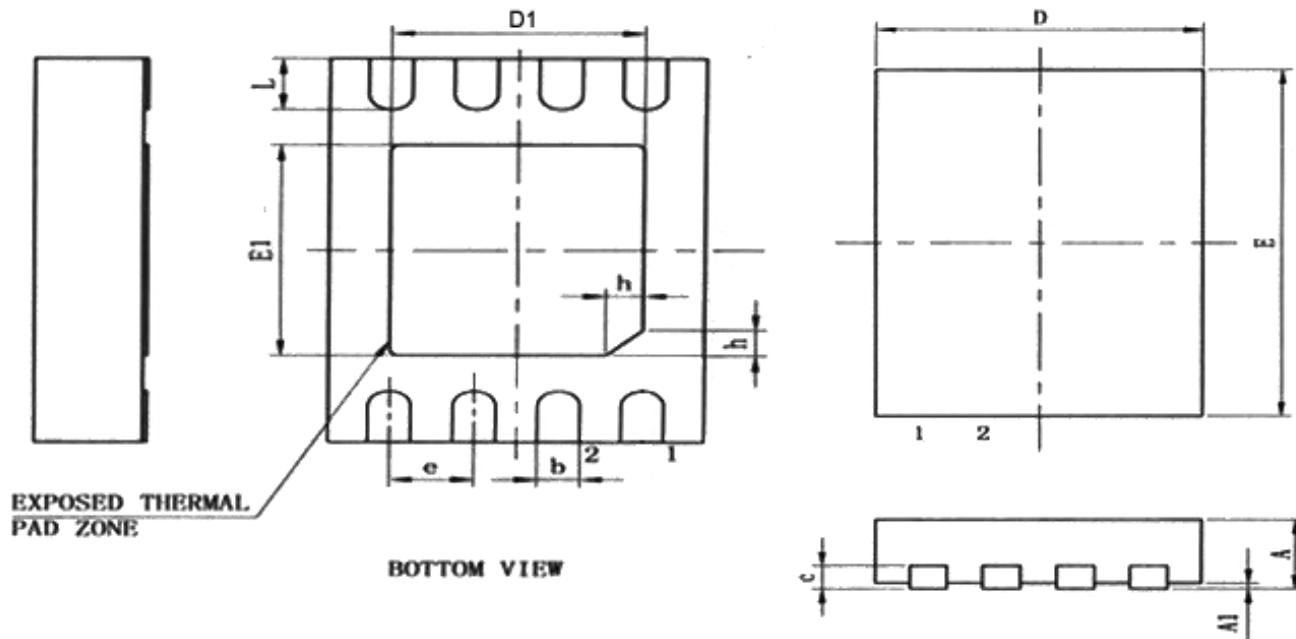
Thermal Limit

An internal thermal feedback loop reduces charge current if junction temperature attempts to rise above a preset value of approximately 145°C. This feature protects the device from excessive temperature and allows the user to push the limits of the power handling capability of a given circuit board without risk of damaging the device. The charge current can be set according to typical (not worst-case) ambient temperature with the assurance that the charger will automatically reduce the current in worst-case conditions.



Packaging Information

TDFN-8



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.26	0.28	0.31
c	0.19	0.20	0.23
D	2.90	3.00	3.10
D1	2.25	2.30	2.35
e	0.65BSC		
E	2.90	3.00	3.10
E1	1.45	1.50	1.60
L	0.25	0.30	0.35
h	0.20	0.25	0.30