1.0A Lithium-ion Linear Charger with Thermal Regulation

PRELIMINARY DATASHEET

Description

FH4056 is a complete constant-current/constant voltage linear charger for single cell lithium-ion batteries. With a thermally enhanced 8-Pin ESOP package on the bottom and low external component count make the FH4056 ideally suited for portable applications.

Furthermore the FH4056 is specifically designed to work within USB power specifications.

No external sense resistor is needed and no blocking diode is required due to the internal PMOSFET architecture. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature. The charge voltage is fixed at 4.20V /4.34V/4.4V, and the charge current can be programmed current can be programmed externally with a single resistor. The FH4056 automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.

When the input supply (wall adapter or USB supply) is removed the FH4056 automatically enters a low current state dropping the battery drain current to less than 2uA. The FH4056 can be put into shutdown mode reducing the supply current to 30μA(Typ.).

Other features include battery temperature monitor, under-voltage lockout, automatic recharge and two status pins to indicate charge and charge termination.

Features

- Protection of battery cell reverse connection
- Programmable charge current up to 1.0A
- No MOSFET sense resistor or blocking diode required
- Complete linear Charger in ESOP8 Package for single Cell Lithium-ion batteries.
- Constant-Current/Constant-Voltage operation with thermal regulation to maximize Rate Without risk of overheating.
- Preset battery charging voltage with ±1% accuracy 4.20V(FH4056A) / 4.35V(FH4056H)
- Automatic Recharge
- Two Status Indication for Charge status, no battery and battery failure indicators
- C/10 charge termination
- 30μA(Typ.) supply current in shutdown
- 2.9V trickle current charge threshold
- Soft-Start limits inrush current
- Battery Temperature Sensing

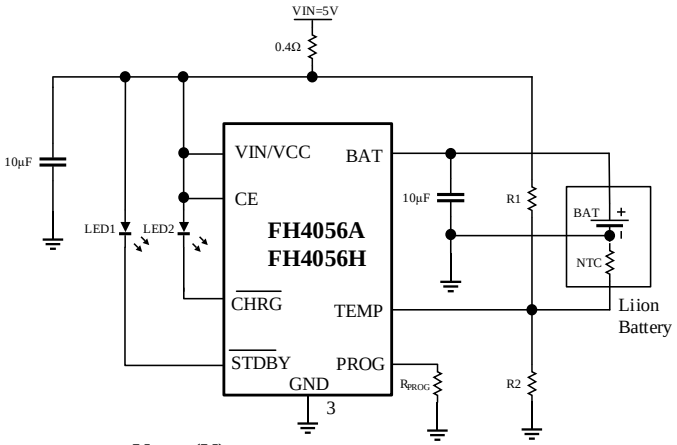
Typical Applications

- MP3 Players
- Portable Devices
- Cellular Telephones
- Digital Still Cameras
- Bluetooth Applications
- USB Bus-Powered Chargers

Package Type

- 8-Pin ESOP8
- 8-Pin DFN2*2

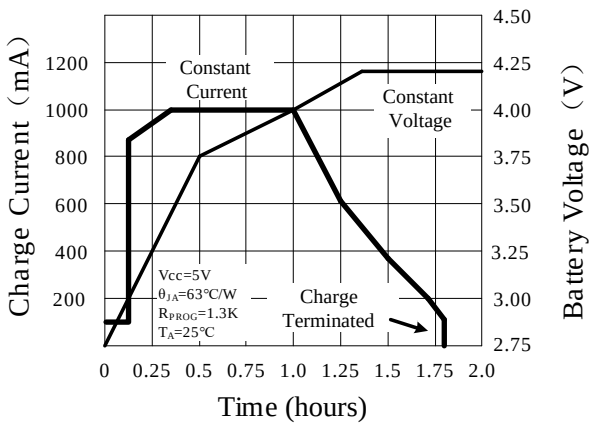
Typical Applications



$$I_{CHG}(mA) = \frac{V_{PROG}(V)}{R_{PROG}(k\Omega)} \times 1100$$

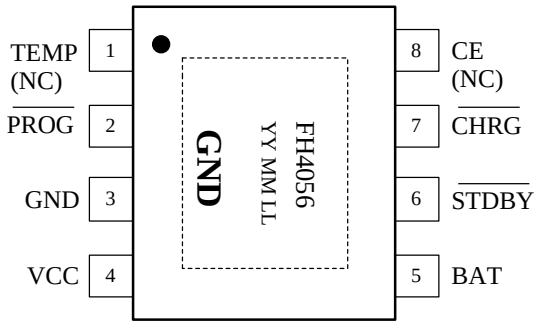
Figure 1. Basic Application Circuit

Typical charge cycle (1000mAh battery)



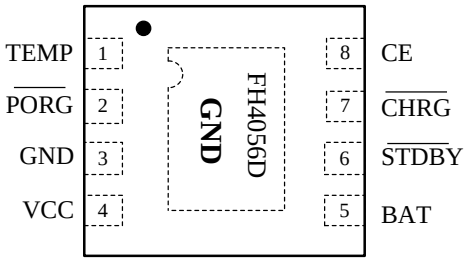
Pin Configuration

(TOP VIEW)



ESOP-8L (Exposed Pad)

(TOP VIEW)



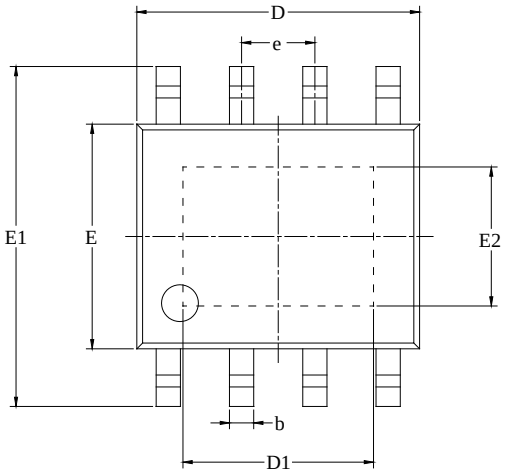
DFN-2×2-8L

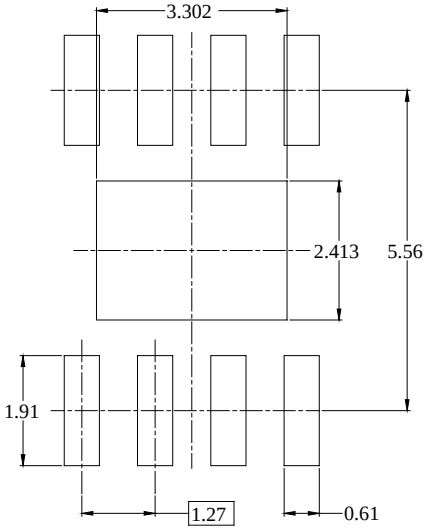
Pin Assignment

Pin Num.	Symbol	Function
1	TEMP (NC)	**Temperature sense input (or not connected)** Connecting TEMP pin to NTC termistor's output in Lithium-ion battery pack. If TEMP pin's voltage is below 45% or above 80% of supply voltage VCC, this means that battery's temperature is too low or too high, charging is suspended. The temperature sense function can be disabled by grounding the TEMP pin.
2	PROG	**Constant Charge Current Setting and Charge Current Monitor Pin** The charge current is programmed by connecting a resistor R_{PROG} from this pin to GND. When in precharge mode, the PROG pin's voltae is regulated to 0.1V. When charging in constant-current mode this pin's voltage is regulated to 1V. In all modes during charging, the voltage on this pin can be used to measure the charge current using the following formula: $I_{BAT} = \frac{V_{PROG}}{R_{PROG}} * 1100$
3	GND	**Ground**
4	VCC	**Positive input supply voltage** Provides power to the internal circuit. When VCC drops to within 80mV of the BAT pin voltage, the FH4056 enters low power sleep mode, dropping I_{BAT} to less than 2μA.
5	BAT	**Battery connection Pin** Connect the positive terminal of the battery to this pin. Dropping BAT pin's current to less than 2μA when IC in disable mode or in sleep mode. BAT pin provides charge current to the battery and provides regulation voltage of 4.2V/4.35V.
6	$\overline{\text{STDBY}}$	**Charge terminated status output** $\overline{\text{STDBY}}$ is pulled low by an internal switch to indicate a battery charge terminated; this means Charge termination. Otherwise $\overline{\text{STDBY}}$ pin is in high impedance state.
7	$\overline{\text{CHRG}}$	**Open-Drain charge status output** When the battery is being charged, the $\overline{\text{CHRG}}$ pin is pulled low by an internal switch, otherwise, $\overline{\text{CHRG}}$ pin is in high impedance state.
8	CE (NC)	**Chip enable input (or not connected)** A high input will put the device in the normal operating mode. Pulling the CE pin to low level will put the FH4056 into disable mode. The CE pin can be driven by TTL or CMOS logic level.

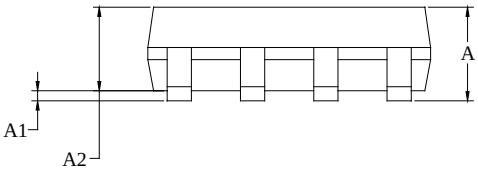
Packaging Information

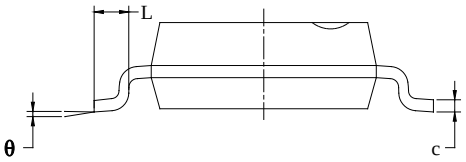
- **Packaging Type: ESOP-8L**





RECOMMENDED LAND PATTERN(Unit: mm)

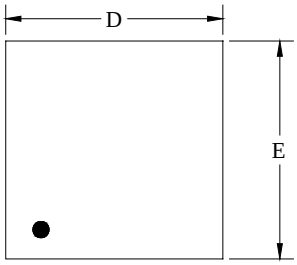




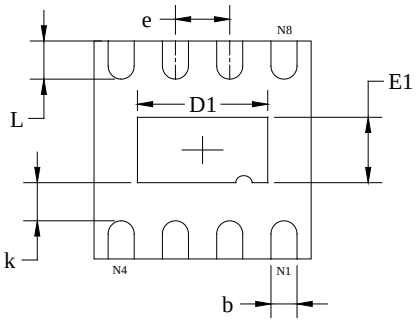
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.700		0.067
A1	0.000	0.100	0.000	0.004
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.202	3.402	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

Packaging Information

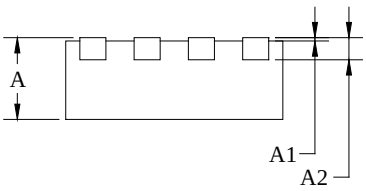
- **Packaging Type: DFN2x2-8L**



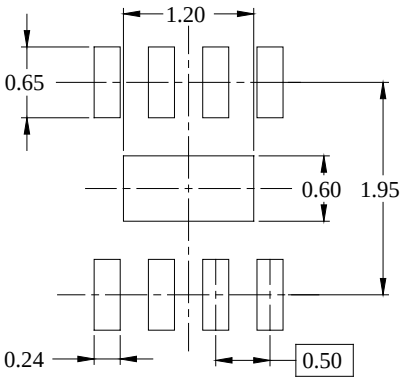
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN(Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	1.900	2.100	0.075	0.083
D1	1.100	1.300	0.043	0.051
E	1.900	2.100	0.075	0.083
E1	0.500	0.700	0.020	0.028
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.250	0.450	0.010	0.018

Order Information

Part Number	Float Voltage	Features	Operating Temperature	Package Type	Top Mark	SPQ
FH4056AS8	4.20V	● Linear Charger ● Vin: 4.25V ~ 6.5V ● Charger current up 1.0A ● C/10 charger ● 2.9V trickle current threshold voltage ● NTC Sensing	-40°C to 85°C	ESOP-8L	NF Y M L	3000PCS/Reel
FH4056HS8	4.35V		-40°C to 85°C	ESOP-8L	4056H YY MM LL	3000PCS/Reel
FH4056AD8	4.20V		-40°C to 85°C	DFN2*2-8L	4056AD YY MM LL	3000PCS/Reel
FH4056HD8	4.35V		-40°C to 85°C	DFN2*2-8L	4056HD YY MM LL	3000PCS/Reel

Note:

- **FH4056A/FH4056H** devices are Pb-free and RoHs compliant.
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ESD SENSITIVITY CAUTION

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

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▲ Update by Jun.2022