1-A Single Cell Battery Linear Charger with High-Input Voltage

Features

- Single-Chip Charger for 1-cell Li-Ion or Polymer Battery
- Constant-Current/Constant-Voltage Battery Charge
- Maximum 1000-mA Programmable Charge Current
  - Protection
  - Wide Input from 4.55 V to 6.8 V or 10.5 V, up to 26.5 V
- Charging Current Monitor and Thermal Foldback
- Power Presence Indication
- Soft Start for Inrush Current Limitation
- Automatic Battery Recharge
- No External MOSFET, Current Sensor, or Diode Required
- Operation Temperature: −40°C to +85°C
- Package Options: ESOP8, DFN2×2

Applications

- Portable Devices, GPS, ePOS, e-Cigarette, Walkie-Talkie
- Wireless Devices, Bluetooth Headset
- Personal Electronics, Personal Healthcare
- Wearable Devices

Description

The TPB4056A is a cost-effective, high-integration linear charger for single-cell Li-ion or Li-ion polymer batteries. The device supports CC/CV charge from either a USB port or an AC adapter. The low BOM component requirement makes the whole system small in size. The high input voltage range with over-voltage protection supports low-cost unregulated adapters.

The charge current of the TPB4056A is fully programmable up to 1000 mA with an external resistor. The TPB4056A automatically terminates the charge cycle when the charge current drops below a programmable minimal charging current of the set charge current value after reaching the float voltage.

The TPB4056A implements two indication pins, $\overline{PPR}$ and $\overline{CHG}$, allowing connection to a microcontroller or LED to show the status of the device. With the open-drain structure, the $\overline{PPR}$ pin stays low while the input voltage is within the operation range, and the $\overline{CHG}$ pin stays low during the charging state. Else pins are in the high impedance state.

The TPB4056A features the thermal foldback function to limit the charge current and protect the device from over-junction temperature faults. The TPB4056A also integrates the current monitor, UVLO, and OVP function to prevent the device from damage.

Typical Application Circuit

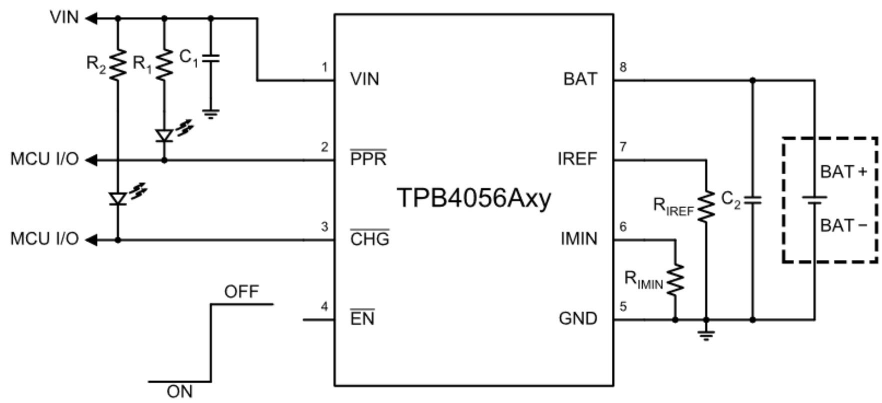


Table of Contents

Revision History

Date	Revision	Notes
2020-12-25	Rev.A.0	First released version.
2021-02-25	Rev.A.1	Changed the wide vin voltage from 4 V to 4.55 V in Features.
2021-04-06	Rev.A.2	Updated EOC Rising Threshold Min and Max.
2021-08-10	Rev.A.3	Modified ISD Parameter and Tape and Reel Information. Changed the max rating of 26.5 V, and added the test condition if ISD. Updated the DFN2×3-6 package.
2022-04-25	Rev.A.4	Added the note in the product family table.
2024-10-23	Rev.A.5	Removed the DFN2x3 and DFN3x3 packages. Updated with a new datasheet format.

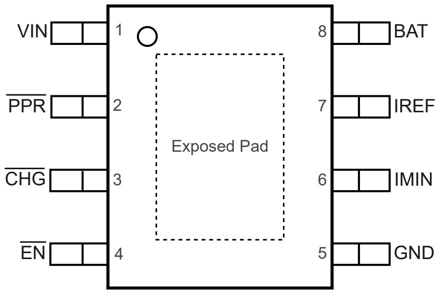
Product Family Table

Order Number	Float Voltage (V)	OVP (V)	Trickle Voltage (V)	Package
TPB4056A20-ES1R (1)	4.200	6.8	2.5	ESOP8
TPB4056A2X-ES1R	4.200	10.5	2.5	ESOP8
TPB4056A20-DFGR	4.200	6.8	2.5	DFN2×2-8
TPB4056A2X-DFGR (1)	4.200	10.5	2.5	DFN2×2-8
TPB4056A3X-ES1R (1)	4.350	10.5	2.6	ESOP8
TPB4056A3X-DFGR (1)	4.350	10.5	2.6	DFN2×2-8

(1) For future products, contact the 3PEAK factory for more information and samples.

Pin Configuration and Functions

TPB4056A
ESOP8
Top View



TPB4056A
DFN2×2-8L
Top View

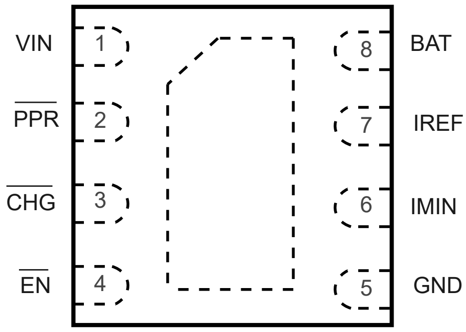


Table 1. Pin Functions

Pin No.	Name	I/O	Description
1	VIN	I	Power supply voltage input pin. Connect VIN to GND with a 1-μF or greater capacitor.
2	$\overline{PPR}$	O	Input voltage good indication pin. Open-drain output is low while the input supply voltage is within the POR and OVP voltage range and high impedance otherwise.
3	$\overline{CHG}$	O	Charge state indication pin. Open-drain output is low when the device is charging, while high impedance when end-of-charge (EOC) is qualified, or the charger is disabled.
4	$\overline{EN}$	I	Enable input pin with active low. Pull this pin to low or left floating to enable charge, while pulling high to disable charge.
5	GND		Ground.
6	IMIN	I	Minimal charging current programming pin. For the charging current continues below the minimal charging current I_{MIN}, an end-of-charge (EOC) is qualified. Set I_{MIN} by a resistor connected between this pin and the ground and the below equation: $I_{MIN} = \frac{10000}{R_{IMIN}}$ (mA) where the unit of R_{IMIN} is kΩ.
7	IREF	I	Charge current feedback pin. Connect a resistor between this pin and the GND pin to set charge constant current limitation. The current is the following equation: $I_{REF} = \frac{1200}{R_{IREF}}$ (mA) Where the unit of R_{IREF} is kΩ.
8	BAT	O	Charger output pin. Connect this pin to the positive of the battery with a 1-μF or greater X5R ceramic capacitor for decoupling. The BAT output is disabled, when the pin is pulled high.
E	Pad		The exposed pad must be connected to the PCB ground plane to maximize the thermal performance.

Specifications

Absolute Maximum Ratings (1)

Parameter		Min	Max	Unit
Input Voltage	VIN	−0.3	26.5	V
	IREF, IMIN	−0.3	6	V
	$\overline{EN}$	−0.3	26.5	V
Output Voltage	$\overline{PPR}$, $\overline{CHG}$	−0.3	26.5	V
	BAT	−6	6	V
T_J	Maximum Operating Junction Temperature	−40	125	°C
T_A	Operating Temperature Range	−40	85	°C
T_{STG}	Storage Temperature Range	−65	150	°C
T_L	Lead Temperature (Soldering, 10 sec)		260	°C

(1) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.
(2) This data is taken with the JEDEC low effective thermal conductivity test board.
(3) This data is taken with the JEDEC standard multilayer test boards.

ESD, Electrostatic Discharge Protection

Symbol	Parameter	Condition	Minimum Level	Unit
HBM	Human Body Model ESD	ANSI/ESDA/JEDEC JS-001 (1)	2000	V
CDM	Charged Device Model ESD	ANSI/ESDA/JEDEC JS-002 (2)	1500	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Thermal Information

Package Type	θ_{JA}	θ_{JC}	Unit
ESOP8	148	48	°C/W
DFN2×2-8L	103	55	°C/W

Electrical Characteristics

All test conditions: V_{IN} = 5 V, T_A = +25°C, unless otherwise noted.

Symbol	Parameter		Conditions	Min	Typ	Max	Unit
Supply Voltage and Current							
	Supply Voltage Range					26.5	V
V_{IN}	Operating Supply Voltage	TPB4056A20		4.55		6.10	V
		TPB4056A35					
		TPB4056A2X		4.55		9.35	V
		TPB4056A3X					
	VIN Pin Supply Current		V_{BAT} = 4.4 V, $\overline{EN}$ = Low		180	250	μA
I_{SD}	Shutdown Current		$\overline{EN}$ = High, V_{IN} > UVLO (2)		80	110	μA
			IREF floating, V_{IN} > UVLO (2)		80	110	μA
UVLO	Under Voltage Lockout		V_{IN} rising	3.5	3.7	3.9	V
	Hysteresis		V_{IN} drop	120	200	280	mV
Charge Voltage and Current							
V_{IREF}	IREF Voltage		Constant current mode, R_{IREF} = 1.2 kΩ	0.92	1	1.08	V
I_{IREF}	IREF Source Current		V_{IREF} = 5 V		2		μA
V_{FLOAT}	BAT Pin Float Voltage or Battery End of Charge Voltage	TPB4056A20		4.158	4.2	4.242	V
		TPB4056A2X					
		TPB4056A3X		4.306	4.35	4.394	V
R_{ON}	Power FET Turn on Resistance				650		mΩ
I_{BAT}	BAT Pin Output Charge Current		Constant current range	50		1000	mA
			Constant current mode, R_{IREF} = 2.4 kΩ	450	500	550	mA
			Constant current mode, R_{IREF} = 1.2 kΩ	930	1000	1070	mA
			V_{BAT} = 4.2 V		−4.0	−6	μA
			V_{IN} = 0 V		−3.2	−4	μA
t_{ss}	Soft Start Delay Time		Charge current from 0 mA to I_{BAT}		1		ms
V_{TCK}	Battery Trickle Voltage	TPB4056A20	V_{BAT} < V_{TCK}, R_{IREF} = 1.2 kΩ	2.4	2.5	2.6	V
		TPB4056A2X					
		TPB4056A3X		2.5	2.6	2.7	V
	Hysteresis		R_{IREF} = 1.2 kΩ	50	110	170	mV
I_{TCK}	Battery Trickle Charge Current		V_{BAT} < V_{TCK}, R_{IREF} = 1.2 kΩ	60	100	140	mA
$V_{BAT, LO}$	Battery Charge Lockout Threshold, V_{IN} − V_{BAT}		V_{IN} rising	80	110	140	mV

<table>
<tr><th>Symbol</th><th colspan="2">Parameter</th><th>Conditions</th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td></td><td colspan="2"></td><td>V_{IN} failing</td><td>15</td><td>30</td><td>55</td><td>mV</td></tr>
<tr><td colspan="8">Charge Voltage and Current</td></tr>
<tr><td>I_{MIN}</td><td colspan="2">Minimal Charging Current Threshold</td><td>R_{IMIN} = 243 kΩ</td><td>15</td><td>35</td><td>70</td><td>mA</td></tr>
<tr><td>t_{MIN}</td><td colspan="2">End of Charge Deglitch Time</td><td></td><td></td><td>2</td><td></td><td>ms</td></tr>
<tr><td></td><td colspan="2">EOC Rising Threshold</td><td>R_{IREF} = 2.4 kΩ</td><td>325</td><td>380</td><td>445</td><td>mA</td></tr>
<tr><td>t_{RECHG}</td><td colspan="2">Recharge Deglitch Time</td><td></td><td></td><td>2</td><td></td><td>ms</td></tr>
<tr><td colspan="8">Logic Input and Output</td></tr>
<tr><td>$V_{EN, IH}$</td><td colspan="2">$\overline{EN}$ Logic-Input High Level (Enable)</td><td></td><td>1.6</td><td></td><td></td><td>V</td></tr>
<tr><td>$V_{EN, IL}$</td><td colspan="2">$\overline{EN}$ Logic-Input Low-Level (Disable)</td><td></td><td></td><td></td><td>0.4</td><td>V</td></tr>
<tr><td>R_{EN}</td><td colspan="2">$\overline{EN}$ Pin Internal Pulldown Resistance</td><td>V_{IN} = 5 V</td><td></td><td>200</td><td></td><td>kΩ</td></tr>
<tr><td>$V_{PPR, OL}$</td><td colspan="2">$\overline{PPR}$ Low-Level Output Voltage</td><td>I_{PPR} = 5 mA</td><td></td><td>0.25</td><td>0.6</td><td>V</td></tr>
<tr><td>$V_{CHG, OL}$</td><td colspan="2">$\overline{CHG}$ Low-Level Output Voltage</td><td>I_{CHG} = 5 mA</td><td></td><td>0.25</td><td>0.6</td><td>V</td></tr>
<tr><td colspan="8">Protection</td></tr>
<tr><td rowspan="4">V_{OVP}</td><td rowspan="3">Input Over-Voltage Protection</td><td>TPB4056A20</td><td rowspan="3">V_{IN} Rising</td><td>6.4</td><td>6.8</td><td>7.2</td><td>V</td></tr>
<tr><td>TPB4056A2X</td><td rowspan="2">9.8</td><td rowspan="2">10.5</td><td rowspan="2">11.2</td><td rowspan="2">V</td></tr>
<tr><td>TPB4056A3X</td></tr>
<tr><td colspan="2">Hysteresis</td><td></td><td>140</td><td>200</td><td>260</td><td>mV</td></tr>
<tr><td>$V_{BAT, SP}$</td><td colspan="2">Battery Short to Ground Protection Threshold</td><td></td><td></td><td>1.8</td><td></td><td>V</td></tr>
<tr><td>$I_{BAT, SP}$</td><td colspan="2">Battery Short to Ground Protection</td><td>BAT Short to Ground</td><td></td><td>17</td><td></td><td>mA</td></tr>
<tr><td colspan="8">Junction Temperature Protection</td></tr>
<tr><td>T_{OTP}</td><td colspan="2">Over Temperature Protection Threshold</td><td></td><td></td><td>150</td><td></td><td>℃</td></tr>
</table>

(1) 100% tested at T_A = 25℃.
(2) Only tested at VIN > UVLO.

Typical Performance Characteristics

All test conditions: V_{IN} = 5 V, T_A = +25℃, unless otherwise noted.

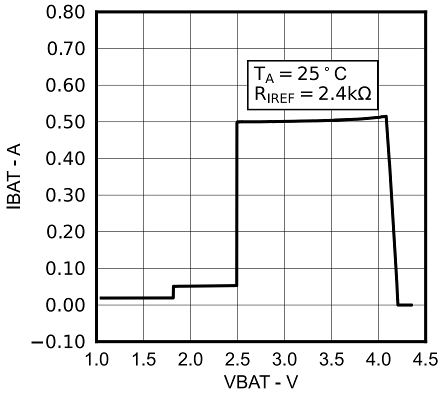


Figure 1. Charging Current I_{BAT} vs. V_{BAT} Voltage

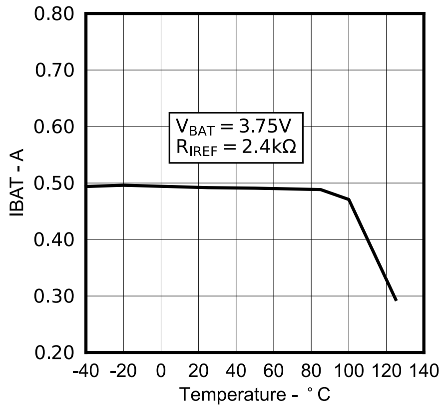


Figure 2. Charging Current I_{BAT} vs. Temperature

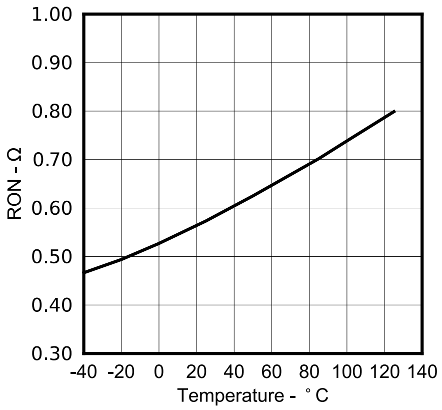


Figure 3. R_{ON} vs. Temperature

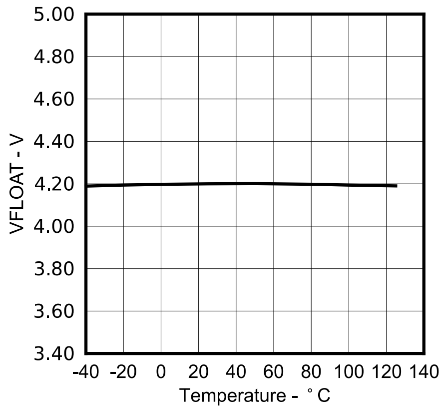


Figure 4. V_{Float} Voltage vs. Temperature

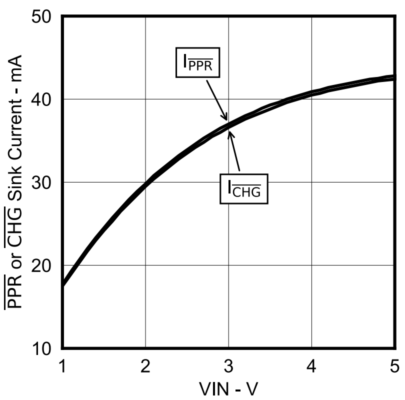


Figure 5. Sink Current of $\overline{PPR}$ or $\overline{CHG}$ vs. V_{IN}

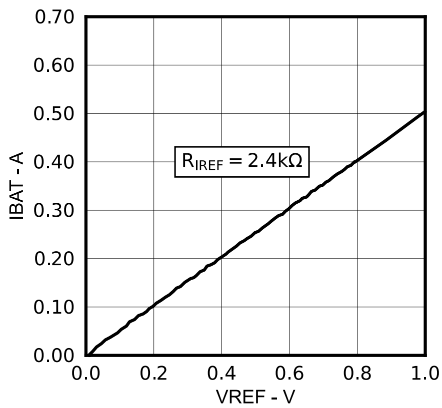


Figure 6. Charging Current I_{BAT} vs. I_{REF} Voltage V_{REF}

Detailed Description

Overview

The TPB4056A is a cost-effective, high-integrated linear charger for single-cell Li-ion or Li-ion polymer batteries. The device supports CC/CV charge from either a USB port or an AC adapter. The low BOM component requirement makes the whole system small in size. The high input voltage range with over-voltage protection supports low-cost unregulated adapters. The TPB4056A charge current is fully programmable from 50 mA to 1000 mA with an external resistor. The charge current can automatically terminate the charge cycle when the charge current drops below a minimal current which is set by the external resistor on the IMIN pin with a range from 5% (or 10 mA, which one is higher) to 50% of constant current set by the IREF pin after reaching the float voltage.

Feature Description

Enable ($\overline{EN}$)

The TPB4056A is in shutdown mode when the chip enable pin ($\overline{EN}$) is high. Connect this pin to the GPIO of an external processor or a digital logic control circuit to enable and disable the device. Or connect this pin to the VIN pin for self-bias applications.

Under-Voltage Lockout (UVLO)

The TPB4056A uses an under-voltage lockout circuit to keep the device in shutdown mode until the supply voltage is higher than the UVLO threshold.

Over-Voltage Protection (OVP)

The TPB4056A uses an over-voltage protection circuit to prevent the device from damage when the supply voltage is higher than the OVP threshold. The internal power FET, if previously on, turns off after a certain deglitch period. After the supply voltage falls below the normal voltage range, the device recovers to the normal operating mode after another deglitch period.

Battery Charge Current Value Setting

The TPB4056A provides a fully programmable charge current from 50 mA to 1000 mA under normal charge conditions. A single current-programming resistor connected from the IREF pin to GND determines the constant battery charge current value at the BAT pin, and no additional block diode or sensing resistor is required. Use Equation 1 to calculate the resistor value.

$$I_{BAT} = \frac{1200}{R_{IREF}} \quad (1)$$

Where,

I_{BAT} is the desired constant charge current;

R_{IREF} is the external current setting resistor.

The TPB4056A implements the IREF pin short protection function. When the R_{IREF} resister is set too small or short to GND unintentionally, short protection occurs, and the battery charge current is limited to 1.5 A, which is the IREF short protection charge current. Meanwhile, the thermal foldback and over-temperature protection still limit the constant current I_{BAT}.

When the TPB4056A is powered up, the whole battery charging process can be divided into five sections below:

Trickle Current Battery Charge

The TPB4056A operates in the trickle charge mode when detects the battery voltage below the trickle charge threshold, V_{TCK}. In trickle charge mode, the battery charge current is limited to a small current range, I_{TCK}, to protect the battery.

Constant Current Battery Charge

The TPB4056A enters the constant current (CC) battery charge mode when the battery voltage ramps higher than the trickle charge threshold V_{TCK}. In this mode, the constant current, determined by the resistor from I_{REF} to GND, flows out from the BAT pin to the positive side of the load battery.

Constant Voltage Battery Charge

The TPB4056A enters the constant voltage (CV) battery charge mode when the battery voltage reaches the floating voltage V_{FLOAT}. In this mode, the battery charge current decreases from the constant current value, and the BAT pin voltage keeps constant at V_{FLOAT}.

Battery Charge Termination

When the charge current falls below I_{MIN}, the TPB4056A terminates the battery charge cycle after a deglitch period with the $\overline{CHG}$ pin going to high. Meanwhile, the TPB4056A keeps a very small charging current to force the battery to stay fully charged.

Battery Recharge

In the battery charge standby mode, the TPB4056A monitors the battery voltage continuously. Figure 7 shows the typical behavior during one battery charging cycle.

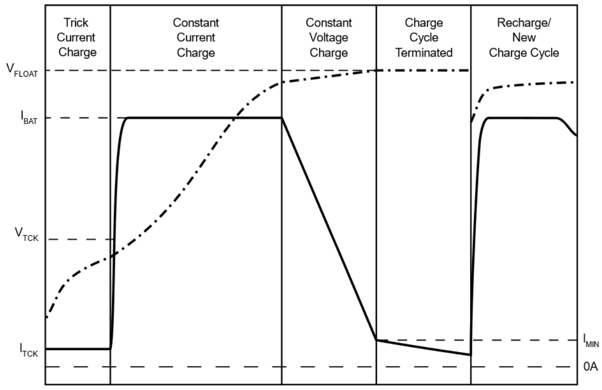


Figure 7. Current and Voltage During One Charging Cycle

Soft-Start

The TPB4056A integrates a soft-start circuit to reduce the inrush current after the new charge cycle starts. When one new charge cycle starts, the battery charge current is limited to ramp up from 0 to set value in 20 µs.

Battery Short Circuit and Reverse Polarity Protection

The TPB4056A features the BAT output short-to-ground protection and the battery reverse polarity protection.

When the TPB4056A detects the BAT output voltage below the short-to-ground protection threshold, the BAT output short-to-ground protection works after a deglitch period, and the BAT output current is limited to 20 mA.

When the TPB4056A detects the BAT output voltage below the reverse protection threshold, the battery reverse protection works after a deglitch period, and the leakage current of the BAT pin is limited to 100 µA.

Battery Charge Status Indication

The TPB4056A has two pins to indicate the power present status and the battery charge status: $\overline{PPR}$ and $\overline{CHG}$. Connect these two pins to the GPIO of a microcontroller to read the working status of the TPB4056A or to connect with LEDs pull-up circuit as the status indicators. Pull down these two pins to the ground directly when the status indication function is not used.

Table 2. Battery Charge Status Indication

<table>
<tr><th>Conditions</th><th>$\overline{\text{CHG}}$ Pin/LED</th></tr>
<tr><td>Battery Charging</td><td>Low/On</td></tr>
<tr><td>Battery Fully Charged</td><td rowspan="6">High-Z/Off</td></tr>
<tr><td>No Battery Connected or Battery Reverse Connected</td></tr>
<tr><td>$\overline{\text{EN}}$ = High</td></tr>
<tr><td>IREF Floating</td></tr>
<tr><td>V_{IN} > OVP or V_{IN} < UVLO or $V_{IN} – V_{BAT} < V_{BAT, LO}$</td></tr>
<tr><td>Over-Temperature Protection</td></tr>
<tr><th>Conditions</th><th>$\overline{\text{PPR}}$ Pin/LED</th></tr>
<tr><td>V_{IN} < UVLO</td><td rowspan="3">High-Z/Off</td></tr>
<tr><td>V_{IN} > OVP</td></tr>
<tr><td>$V_{IN} – V_{BAT} < V_{BAT, LO}$</td></tr>
<tr><td>UVLO < V_{IN} < OVP & $V_{IN} – V_{BAT} > V_{BAT, LO}$</td><td>Low/On</td></tr>
</table>

Over Temperature Protection (OTP)

The TPB4056A integrates the foldback circuit and the over-temperature protection to prevent the device from over-heated and damage. When the junction temperature is higher than T_{OTP}, 150°C, a current thermal foldback circuit starts to work and decreases the output charge current of the device gradually with T_J rise. If T_J still rises and reaches 180°C, the device shuts down the charging loop until T_J drops below 100°C.

Application and Implementation

Note

Information in the following application sections is not part of the 3PEAK's component specification and 3PEAK does not warrant its accuracy or completeness. 3PEAK's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

Application Information

The TPB4056A is a cost-effective, high-integrated linear charger for single-cell Li-ion or Li-ion polymer batteries. The device supports the CC/CV charge from either a USB port or an AC adapter. The low BOM component requirement makes the whole system small in size. The following sections show the typical application of the TPB4056A.

Typical Application

Figure 8 shows the typical application schematic of the TPB4056A.

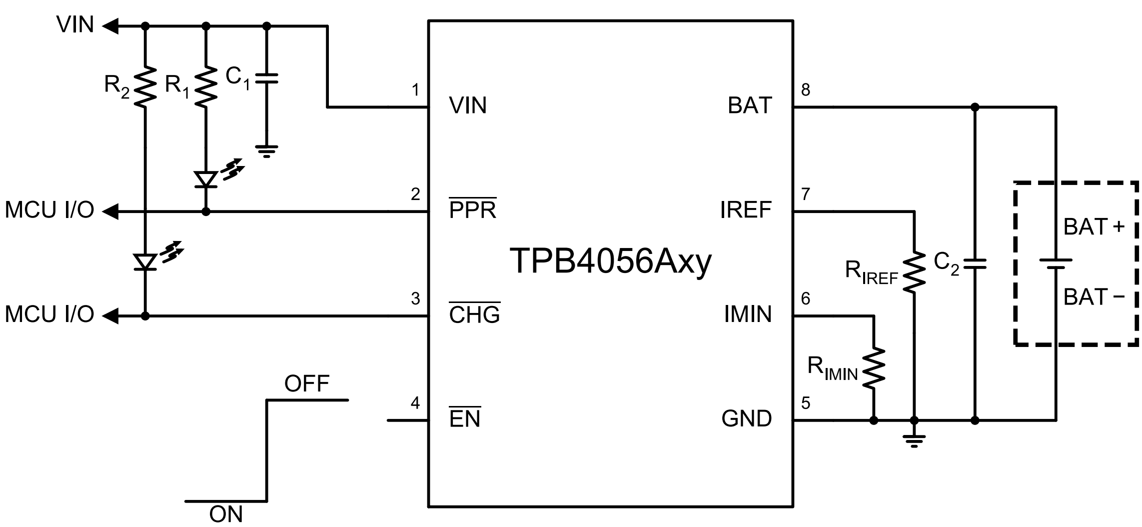


Figure 8. Typical Application Circuit

V_{IN} Input Capacitor and BAT Output Capacitor

3PEAK recommends adding a 1-μF to 10-μF capacitor with a 0.1-μF bypass capacitor in parallel at V_{IN} to keep the input voltage stable. The voltage rating must be greater than the maximum power supply voltage.

3PEAK recommends selecting an X5R- or X7R-type 1-μF to 10-μF high-frequency decoupling ceramic capacitor at the BAT output.

Both input and output capacitors must be placed as close to the device pins as possible.

Power Dissipation and Thermal Consideration

During normal operation, the junction temperature limitation is 150°C. When the junction temperature exceeds 150°C, the charge current decreases with the temperature value. Use Equation 2 and Equation 3 to calculate the power dissipation and estimate the junction temperature.

The maximum power dissipation can be calculated using Equation 2.

$$P_D = (V_{IN} - V_{BAT}) \times I_{BAT} = \frac{T_{J,\ max} - T_A}{\theta_{JA}} \tag{2}$$

Where,

$T_{J,\ max}$ is the junction temperature limitation, 150°C;

T_A is the ambient temperature;

θ_{JA} is the junction-to-ambient thermal resistance.

Solve Equation 2, the constant charge current value is calculated in Equation 3.

$$I_{BAT} = \frac{150℃ - T_A}{(V_{IN} - V_{BAT}) \times \theta_{JA}} \tag{3}$$

Layout

Layout Guideline

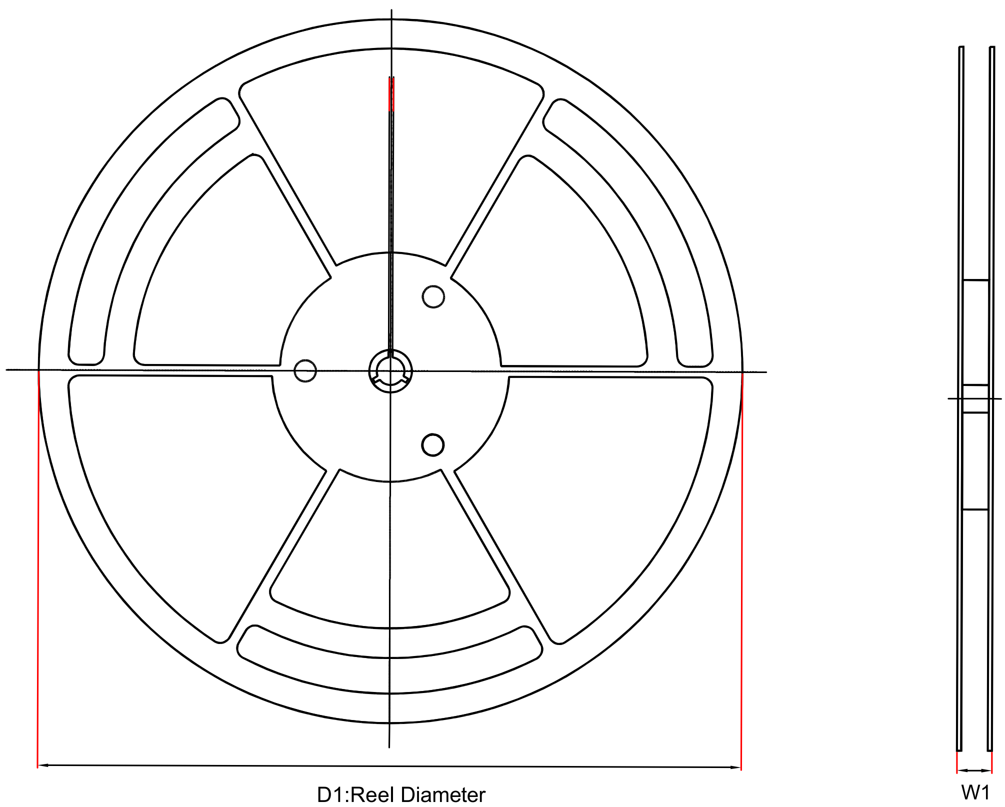
Both input and output capacitors must be placed as close to the device pins as possible.

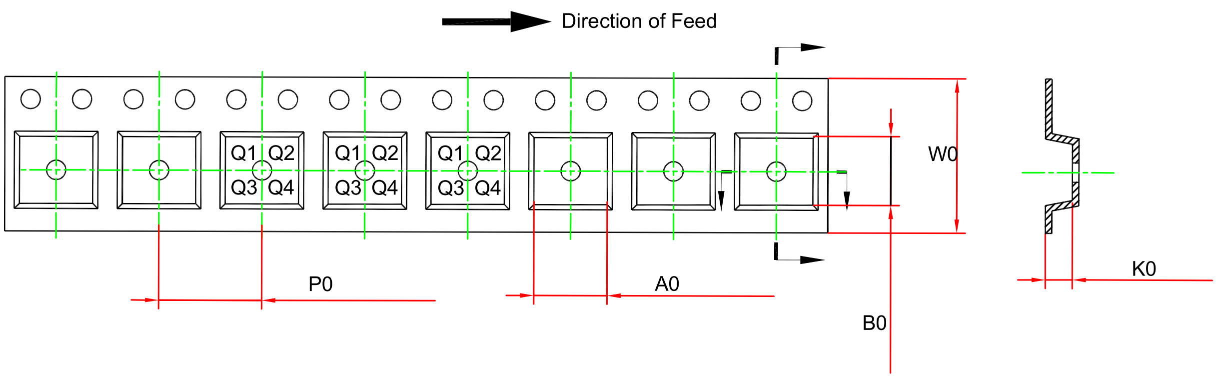
It is recommended to bypass the input pin to ground with a 0.1-μF bypass capacitor. The loop area formed by the bypass capacitor connection, the IN pin, and the GND pin of the system must be as small as possible.

It is recommended to use wide and thick traces to minimize the I×R drop and heat dissipation.

The exposed pad must be connected to the PCB ground plane directly, and the copper area must be as large as possible. To get the best thermal performance, thermal vis should be placed under and around the exposed pad with enough number and size.

Tape and Reel Information





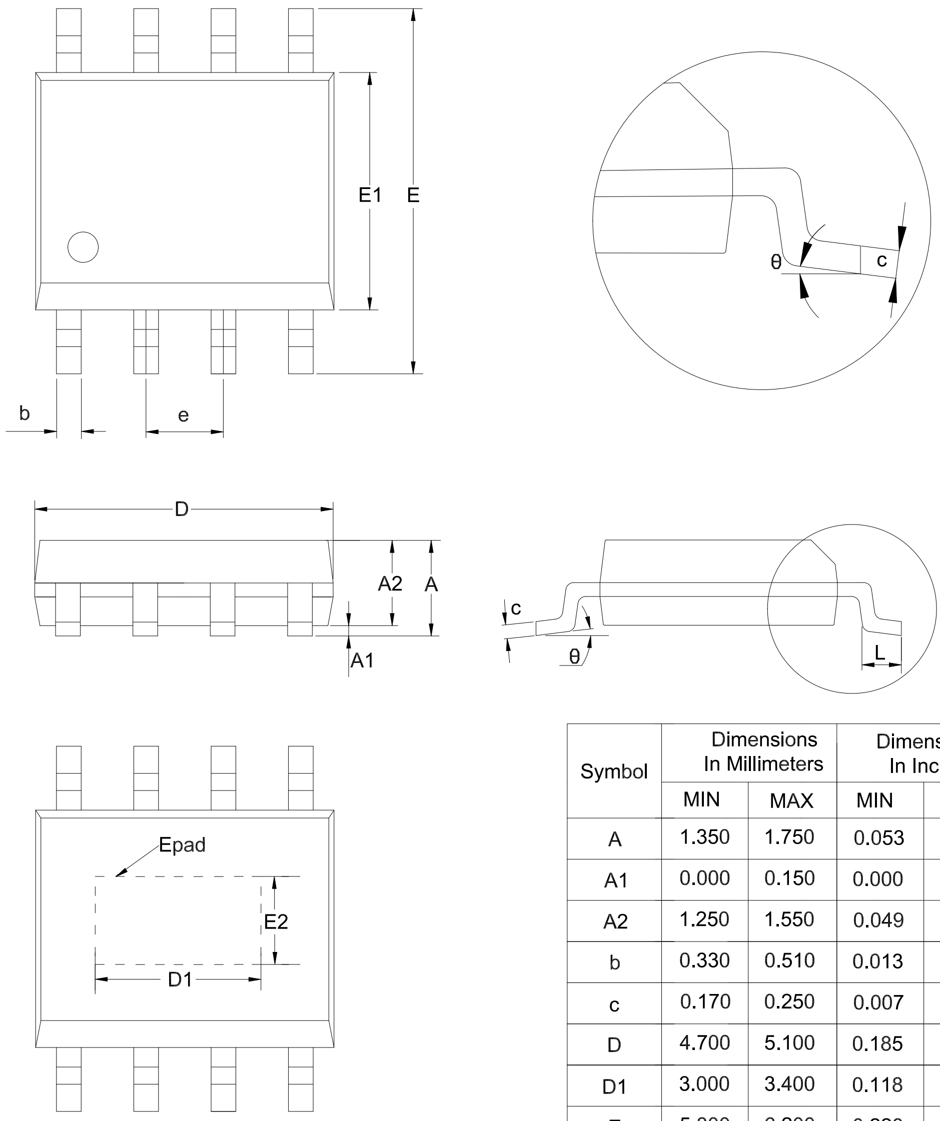
Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPB4056A20-ES1R	ESOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPB4056A2X-ES1R	ESOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPB4056A20-DFGR	DFN2×2-8	180.0	13.1	2.3	2.3	1.1	4.0	8.0	Q1

Order Number	Package	D1 (mm)	W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	W0 (mm)	Pin1 Quadrant
TPB4056A2X-DFGR	DFN2×2-8	180.0	13.1	2.3	2.3	1.1	4.0	8.0	Q1
TPB4056A3X-ES1R	ESOP8	330.0	17.6	6.4	5.4	2.1	8.0	12.0	Q1
TPB4056A3X-DFGR	DFN2×2-8	180.0	13.1	2.3	2.3	1.1	4.0	8.0	Q1

Package Outline Dimensions

ESOP8

Package Outline Dimensions ES1(ESOP-8-A)



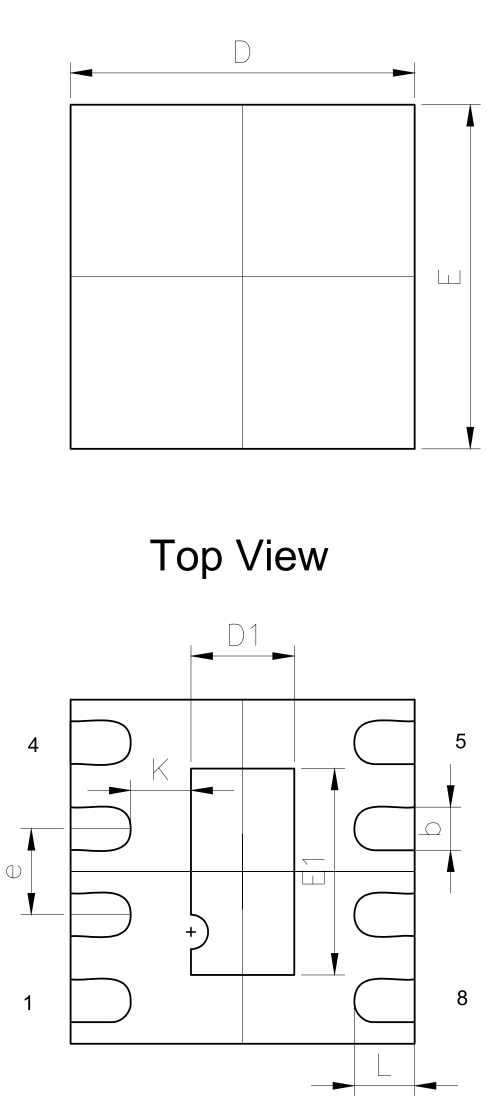
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.000	0.150	0.000	0.006
A2	1.250	1.550	0.049	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
D1	3.000	3.400	0.118	0.134
E	5.800	6.200	0.228	0.244
E1	3.800	4.000	0.150	0.157
E2	2.000	2.400	0.079	0.094
e	1.270 BSC		0.050 BSC	
L	0.400	1.000	0.016	0.039
θ	0	8°	0	8°

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

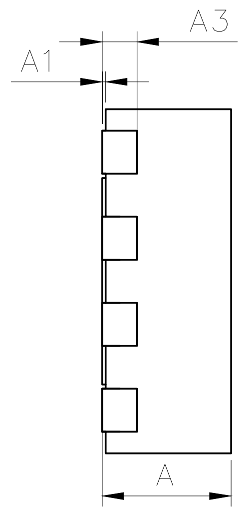
DFN2×2-8

Package Outline Dimensions DF4(DFN2X2-8-A)



Top View

Bottom View



Side View

NOTES

1. Do not include mold flash or protrusion.
2. This drawing is subject to change without notice.

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
b	0.200	0.300	0.008	0.012
A3	0.150	0.250	0.006	0.010
D	1.900	2.100	0.075	0.083
D1	0.500	0.700	0.020	0.028
E	1.900	2.100	0.075	0.083
E1	1.100	1.300	0.043	0.051
e	0.500 BSC		0.020BSC	
L	0.274	0.426	0.011	0.017

Order Information

Order Number	Operating Temperature Range	Package	Marking Information	MSL	Transport Media, Quantity	Eco Plan
TPB4056A20-ES1R (1)	−40 to 85°C	ESOP8	6A20	3	Tape and Reel, 4000	Green
TPB4056A2X-ES1R	−40 to 85°C	ESOP8	6A2X	3	Tape and Reel, 4000	Green
TPB4056A20-DFGR	−40 to 85°C	DFN2×2-8	A20	3	Tape and Reel, 3000	Green
TPB4056A2X-DFGR (1)	−40 to 85°C	DFN2×2-8	A2X	3	Tape and Reel, 3000	Green
TPB4056A3X-ES1R (1)	−40 to 85°C	ESOP8	6A3X	3	Tape and Reel, 4000	Green
TPB4056A3X-DFGR (1)	−40 to 85°C	DFN2×2-8	A3X	3	Tape and Reel, 3000	Green

(1) For future products, contact the 3PEAK factory for more information and samples.

Green: 3PEAK defines "Green" to mean RoHS compatible and free of halogen substances.

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