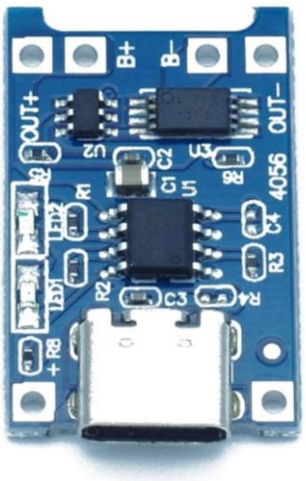
Kleine-Teile

TP4056

Datenblatt



Günstiges 1A Lademodul für eine Li-Ion Zelle

Vermeidet Schäden beim Laden und Entladen von Li-Ion Zellen

Erklärung

Dieses TP4056 1A linear Lademodul für Li-Ion und LiPo's, lädt deine Akkus schonend und schnell. Außerdem hat es eine eingebaute Überwachung, die das sichere Laden deiner Akkus ermöglicht.
Das Modul kann über USB C oder Micro USB sowie über die Lötkontakte (je nach Version) mit Strom versorgt werden.

Achtung !

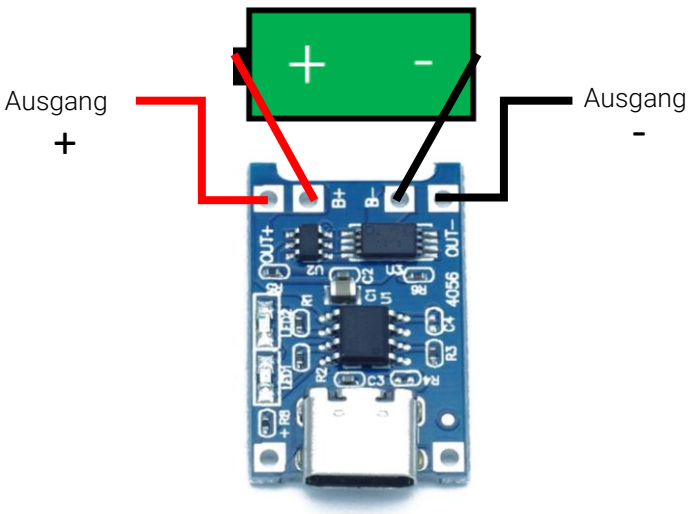
Li-Ionen Akkus sind gefährlich, sei dir bitte sicher, dass du dich ausreichend mit der Materie auskennst.

Verwende immer Zellen welche die gleiche Spannung besitzen um eventuelle Fehler zu vermeiden.

Schließe die Zellen nur wie auf dem abgebildeten Schaubild an das BMS an.

Technische Daten

Eingangsspannung	4,50 – 6,0 V
Ladespannung	4,2 V +- 1,5 %
Ladestrom	1 A
Entladeschutz Release Spannung	2,4 V +- 100 mV 3,0 V +- 100 mV
Überspannungsschutz	3 A
Maße	28 x 17 mm LB



TP4056 1A Standalone Linear Li-Ion Battery Charger with Thermal Regulation in SOP-8

DESCRIPTION

The TP4056 is a complete constant-current/constant-voltage linear charger for single cell lithium-ion batteries. Its SOP package and low external component count make the TP4056 ideally suited for portable applications. Furthermore, the TP4056 can work within USB and wall adapter.

No blocking diode is required due to the internal PMOSFET architecture and have prevent to negative Charge Current Circuit. 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 4.2V, and the charge current can be programmed externally with a single resistor. The TP4056 automatically terminates the charge cycle when the charge current drops to 1/10th the programmed value after the final float voltage is reached.

TP4056 Other features include current monitor, under voltage lockout, automatic recharge and two status pin to indicate charge termination and the presence of an input voltage.

FEATURES

- Programmable Charge Current Up to 1000mA
- No MOSFET, Sense Resistor or Blocking Diode Required
- Complete Linear Charger in SOP-8 Package for Single Cell Lithium-Ion Batteries
- Constant-Current/Constant-Voltage
- Charges Single Cell Li-Ion Batteries Directly from USB Port
- Preset 4.2V Charge Voltage with 1.5% Accuracy
- Automatic Recharge
- two Charge Status Output Pins
- C/10 Charge Termination
- 2.9V Trickle Charge Threshold (TP4056)
- Soft-Start Limits Inrush Current
- Available Radiator in 8-Lead SOP Package, the Radiator need connect GND or impending

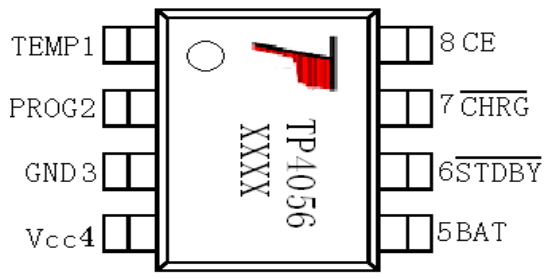
ABSOLUTE MAXIMUM RATINGS

- Input Supply Voltage(V_{CC})：-0.3V～8V
- TEMP：**-0.3V**～10V
- CE：**-0.3V**～10V
- BAT Short-Circuit Duration：Continuous
- BAT Pin Current：1200mA
- PROG Pin Current：1200uA
- Maximum Junction Temperature：145℃
- Operating Ambient Temperature Range：-40℃～85℃
- Lead Temp.(Soldering, 10sec)：260℃

APPLICATIONS

- Cellular Telephones, PDAs, GPS
- Charging Docks and Cradles
- Digital Still Cameras, Portable Devices
- USB Bus-Powered Chargers,Chargers

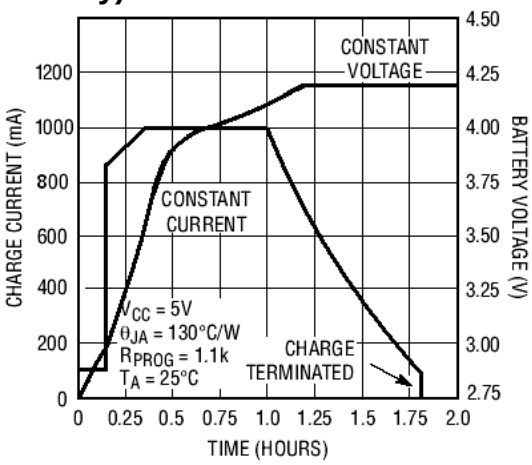
PACKAGE/ORDER INFORMATION



SOP－8

photo	ORDER PART NUMBER
	TP4056-42-SOP8-PP
	PART MARKING TP4056

Complete Charge Cycle (1000mAh Battery)



TEMP(Pin 1) :Temperature Sense Input Connecting TEMP pin to NTC thermistor's output in Lithium ion battery pack. If TEMP pin's voltage is below 45% or above 80% of supply voltage V_{IN} for more than 0.15S, this means that battery's temperature is too high or too low, charging is suspended. The temperature sense function can be disabled by grounding the TEMP pin.

PROG(Pin 2): Constant Charge Current Setting and Charge Current Monitor Pin charge current is set by connecting a resistor R_{ISET} from this pin to GND. When in precharge mode, the ISET pin's voltage is regulated to 0.2V. When in constant charge current mode, the ISET pin's voltage is regulated to 2V.In all modes during charging, the voltage on ISET pin can be used to measure the charge current as follows:

$$I_{BAT} = \frac{V_{PROG}}{R_{PROG}} \times 1200 \quad (V_{PROG}=1V)$$

GND(Pin3): Ground Terminal

Vcc(Pin 4): Positive Input Supply Voltage V_{IN} is the power supply to the internal circuit. When V_{IN} drops to within 30mv of the BAT pin voltage, TP4056 enters low power sleep mode, dropping BAT pin's current to less than 2uA.

BAT(Pin5): Battery Connection Pin. Connect the positive terminal of the battery to BAT pin. BAT pin draws less than 2uA current in chip disable mode or in sleep mode. BAT pin provides charge current to the battery and provides regulation voltage of 4.2V.

$\overline{\text{STDBY}}$(Pin6): Open Drain Charge Status Output When the battery Charge Termination, the $\overline{\text{STDBY}}$ pin is pulled low by an internal switch, otherwise $\overline{\text{STDBY}}$ pin is in high impedance state.

$\overline{\text{CHRG}}$ (Pin7): 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.

CE(Pin8): Chip Enable Input. A high input will put the device in the normal operating mode. Pulling the CE pin to low level will put the YP4056 into disable mode. The CE pin can be driven by TTL or CMOS logic level.

ELECTRICAL CHARACTERISTICS

The ● denotes specifications which apply over the full operating temperature range, otherwise specifications are at **T_A=25℃， V_{CC}=5V**， unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
V_{CC}	Input Supply Voltage		●	4.0	5	8.0	V
I_{CC}	Input Supply Current	Charge Mode, R_{PROG} = 1.2k	●		150	500	μA
		StandbyMode(Charge	●		55	100	μA
		Terminated)	●		55	100	μA
		Shutdown Mode (R_{PROG} Not Connected,V_{CC} < V_{BAT}, or V_{CC} < V_{UV})					
V_{FLOAL}	Regulated Output (Float) Voltage	0℃≤T_A≤85℃， I_{BAT}=40mA		4.137	4.2	4.263	V
I_{BAT}	BAT Pin Current	R_{PROG} = 2.4k, Current Mode	●	450	500	550	mA
	Text condition:VBAT=4.0V	R_{PROG} = 1.2k, Current Mode	●	950	1000	1050	mA
		Standby Mode, V_{BAT} = 4.2V	●	0	−2.5	−6	μA
I_{TRIKL}	Trickle Charge Current	V_{BAT}<V_{TRIKL}, R_{PROG}=1.2K	●	120	130	140	mA
V_{TRIKL}	Trickle Charge Threshold Voltage	R_{PROG}=1.2K, V_{BAT} Rising		2.8	2.9	3.0	V
V_{TRHYS}	Trickle Charge Hysteresis Voltage	R_{PROG}=1.2K		60	80	100	mV
T_{LIM}	Junction Temperature in Constant Temperature Mode				145		℃

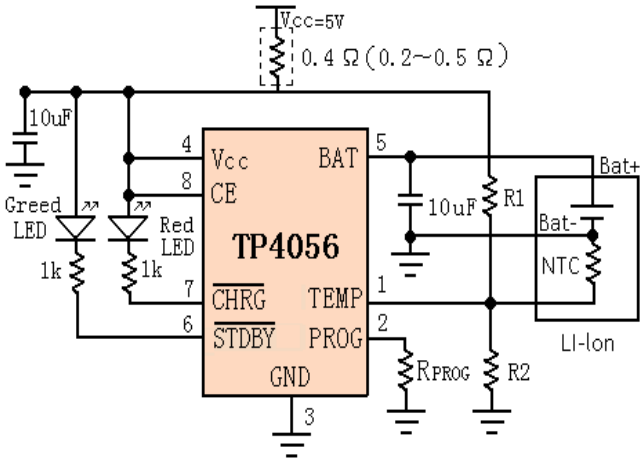
indicator light state

Charge state	Red LED $\overline{CHRG}$	Greed LED $\overline{STDBY}$
charging	bright	extinguish
Charge Termination	extinguish	bright
Vin too low; Temperature of battery too low or too high; no battery	extinguish	extinguish
BAT PIN Connect 10u Capacitance; No battery	Greed LED bright，Red LED Coruscate T=1-4 S	

Rprog Current Setting

R_{PROG} (k)	I_{BAT} (mA)
10	130
5	250
4	300
3	400
2	580
1.66	690
1.5	780
1.33	900
1.2	1000

TYPICAL APPLICATIONS



DW01-P

One Cell Lithium-ion/Polymer Battery Protection IC

General Description

The DW01-P battery protection IC is designed to protect lithium-ion/polymer battery from damage or degrading the lifetime due to overcharge, overdischarge, and/or overcurrent for one-cell lithium-ion/polymer battery powered systems, such as cellular phones.

The ultra-small package and less required external components make it ideal to integrate the DW01-P into the limited space of battery pack. The accurate ±50mV overcharging detection voltage ensures safe and full utilization charging. The very low standby current drains little current from the cell while in storage.

Ordering Information

DW01-P

PACKAGE TYPE
SOT-23-6 (Pb-free)

TEMPERATURE RANGE
-40°C~+85°C

OVERCHARGE PROTECTION
4.25V± 50mV

Features

- **Reduction in Board Size due to Miniature Package SOT-23-6.**
- **Ultra-Low Quiescent Current at 3 μ A (Vcc=3.9V).**
- **Ultra-Low Power-Down Current at 0.1 μ A (Vcc=2.0V).**
- **Precision Overcharge Protection Voltage 4.25V ± 50mV**
- **Load Detection Function during Overcharge Mode.**
- **Two Detection Levels for Overcurrent Protection.**
- **Delay times are generated by internal circuits. No external capacitors required.**

Applications

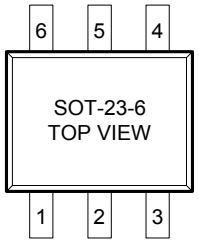
- **Protection IC for One-Cell Lithium-Ion / Lithium-Polymer Battery Pack**

Product Name List

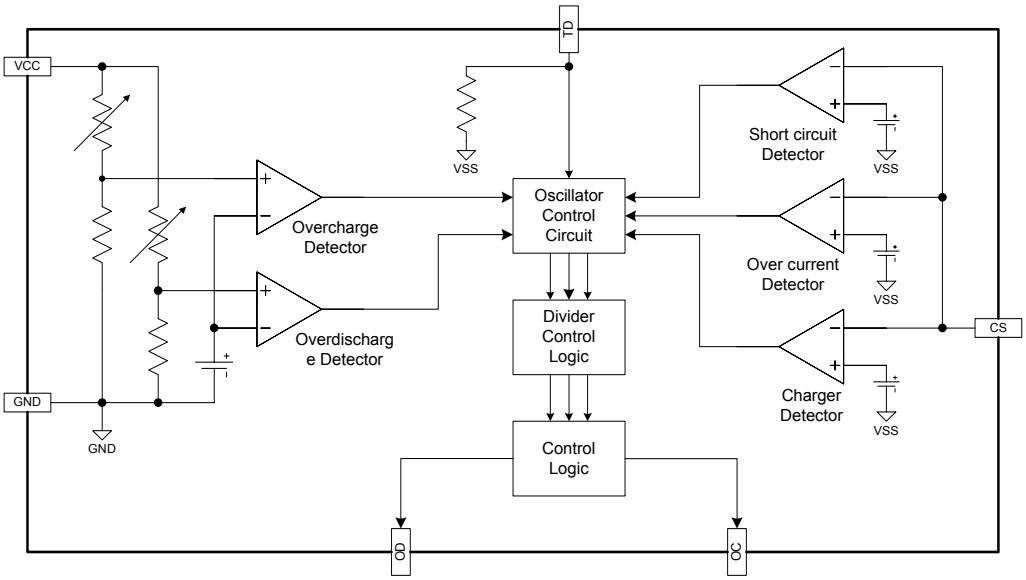
Model	Package	Overcharge detection voltage [V_{OCP}] (V)	Overcharge release voltage [V_{OCR}] (V)	Overdischarge detection voltage [V_{ODP}] (V)	Overdischarge release voltage [V_{ODR}] (V)	Overcurrent detection voltage [V_{OI1}] (mV)
	SOT-23-6					
DW01-P	DW01-P	4.250±0.050	4.050±0.050	2.40±0.100	3.0±0.100	150±30

Pin Configuration

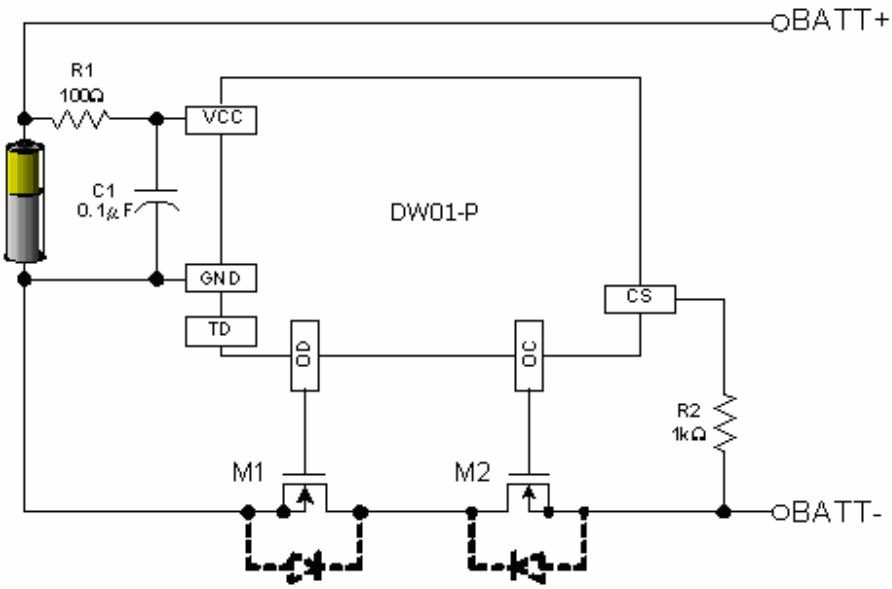
Pin No.	Symbol	Description
1	OD	MOSFET gate connection pin for discharge control
2	CS	Input pin for current sense, charger detect
3	OC	MOSFET gate connection pin for charge control
4	TD	Test pin for reduce delay time
5	VCC	Power supply, through a resistor (R1)
6	GND	Ground pin



Functional Block Diagram



Typical Application Circuit



Absolute Maximum Ratings

(GND=0V, Ta=25°C unless otherwise specified)

Item	Symbol	Rating	Unit
Input voltage between VCC and GND *	VCC	GND-0.3 to GND+10	V
OC output pin voltage	VOC	VCC -24 to VCC +0.3	V
OD output pin voltage	VOD	GND-0.3 to VCC +0.3	V
CS input pin voltage	VCS	VCC -24 to VCC +0.3	V
Operating Temperature Range	TOP	-40 to +85	°C
Storage Temperature Range	TST	-40 to +125	°C

Note: DW01-P contains a circuit that will protect it from static discharge; but please take special care that no excessive static electricity or voltage which exceeds the limit of the protection circuit will be applied to it.

Electrical Characteristics

(Ta=25°C unless otherwise specified)

PARAMETER	TEST CONDITIONS	SYMBOL	Min	Typ	Max	UNIT
Supply Current	V_{CC}=3.9V	I_{CC}		3.0	6.0	μA
Power-Down Current	V_{CC}=2.0V	I_{PD}			0.1	μA
Overcharge Protection Voltage	DW01-P	V_{OCP}	4.20	4.25	4.30	V
Overcharge Release Voltage		V_{OCR}	4.00	4.05	4.10	V
Overdischarge Protection Voltage		V_{ODP}	2.30	2.40	2.50	V
Overdischarge Release Voltage		V_{ODR}	2.90	3.00	3.10	V
Overcurrent Protection Voltage		V_{OIP} (V_{OI1})	120	150	180	mV
Short Current Protection Voltage	V_{CC}=3.6V	V_{SIP} (V_{OI2})	1.00	1.35	1.70	V
Overcharge Delay Time		T_{OC}		80	200	ms
Overdischarge Delay Time	V_{CC}=3.6V to 2.0V	T_{OD}		40	100	ms
Overcurrent Delay Time (1)	V_{CC}=3.6V	T_{OI1}		10	20	ms
Overcurrent Delay Time (2)	V_{CC}=3.6V	T_{OI2}			500	μs
Charger Detection Threshold Voltage		V_{CHA}	-1.2	-0.7	-0.2	V
OD Pin Output “H” Voltage		V_{DH}	V_{CC}-0.1	V_{CC}-0.02		V
OD Pin Output “L” Voltage		V_{DL}		0. 1	0.5	V
OC Pin Output “H” Voltage		V_{CH}	V_{CC}-0.1	V_{CC}-0.02		V
OC Pin Output “L” Voltage		V_{CL}		0.1	0.5	V

Description of Operation

1. Overcharge Protection

When the voltage of the battery cell exceeds the overcharge protection voltage (V_{OCP}) beyond the overcharge delay time (T_{OC}) period, charging is inhibited by turning off of the charge control MOSFET. The overcharge condition is released in two cases:

1) The voltage of the battery cell becomes lower than the overcharge release voltage (V_{OCR}) through self-discharge.
2) The voltage of the battery cell falls below the overcharge protection voltage (V_{OCP}) and a load is connected.

When the battery voltage is above V_{OCP}, the overcharge condition will not release even a load is connected to the pack.

2. Overdischarge Protection

When the voltage of the battery cell goes below the overdischarge protection voltage (V_{ODP}) beyond the overdischarge delay time (T_{OD}) period, discharging is inhibited by turning off the discharge control MOSFET. The default of overdischarge delay time is 10ms. Inhibition of discharging is immediately released when the voltage of the battery cell becomes higher than overdischarge release voltage (V_{ODR}) through charging.

3. Overcurrent Protection

In normal mode, the DW01-P continuously monitors the discharge current by sensing the voltage of CS pin. If the voltage of CS pin exceeds the overcurrent protection voltage (V_{OIP}) beyond the overcurrent delay time (T_{OI1}) period, the overcurrent protection circuit operates and discharging is inhibited by turning off the discharge control MOSFET. The overcurrent condition returns to the normal mode when the load is released or the impedance between BATT+ and BATT- is larger than 500kΩ. The DW01-P provides two overcurrent detection levels (0.15V and 1.35V) with two overcurrent delay time (T_{OI1} and T_{OI2}) corresponding to each overcurrent detection level.

4. Charge Detection after Overdischarge

When overdischarge occurs, the discharge control MOSFET turns off and discharging is inhibited. However, charging is still permitted through the parasitic diode of MOSFET. Once the charger is connected to the battery pack, the DW01-P immediately turns on all the timing generation and detection circuitry. Charging progress is sensed if the voltage between CS and GND is below charge detection threshold voltage (V_{CH}).

5. Power-Down after Overdischarge

When overdischarge occurs, the DW01-P will enter into power-down mode, turning off all the timing generation and detection circuitry to reduce the quiescent current to 0.1 μA (VCC=2.0V). At the same time, the CS pin is pull-up to V_{CC} through an internal resistor.

Design Guide

1. Selection of External Control MOSFET

Because the overcurrent protection voltage is preset, the threshold current for overcurrent detection is determined by the turn-on resistance of the charge and discharge control MOSFETs. The turn-on resistance of the external control MOSFETs can be determined by the equation: $R_{ON}=V_{OIP}/(2 \times I_T)$ (I_T is the overcurrent threshold current). For example, if the overcurrent threshold current I_T is designed to be 3A, the turn-on resistance of the external control MOSFET must be 25mΩ. Be aware that turn-on resistance of the MOSFET changes with temperature variation due to heat dissipation. It changes with the voltage between gate and source as well. (Turn-on resistance of MOSFET increases as the voltage between gate and source decreases). As the turn-on resistance of the external MOSFET changes, the design of the overcurrent threshold current changes accordingly.

2. Suppressing the Ripple and Disturbance from Charger

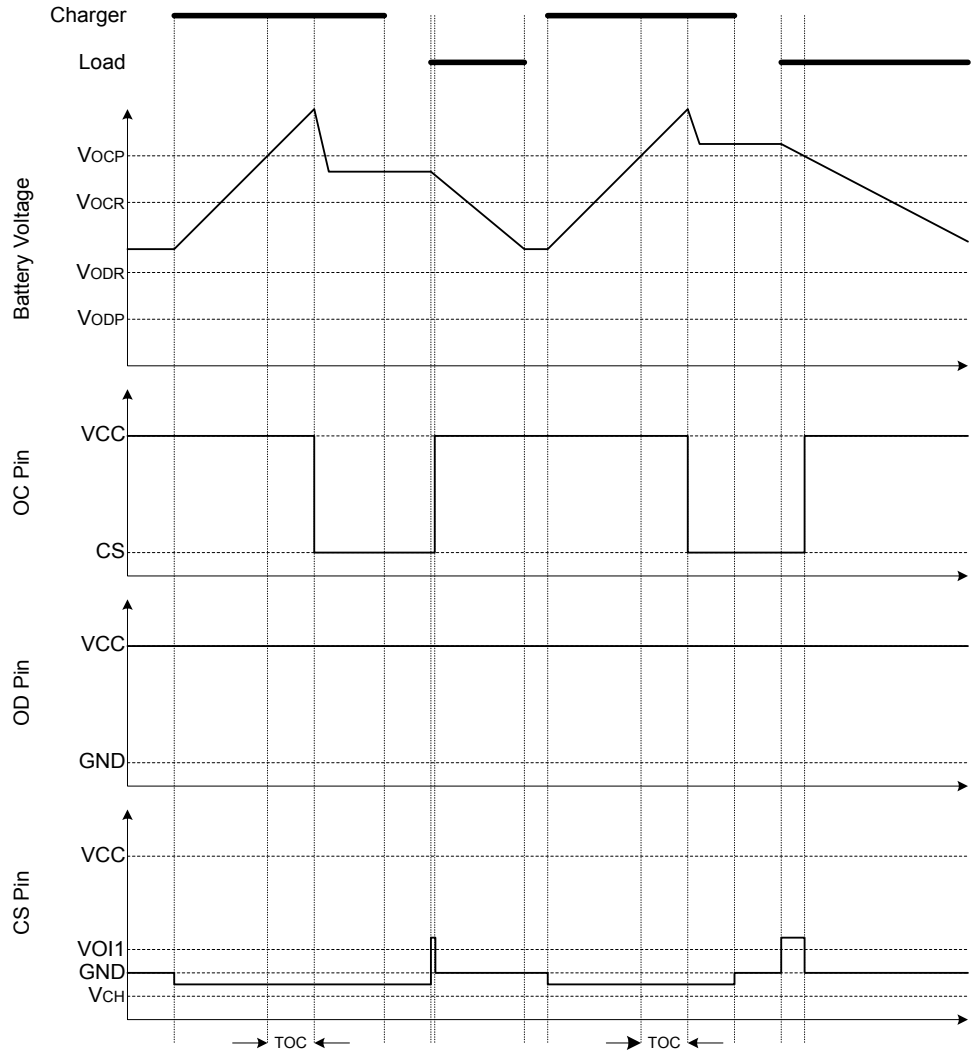
To suppress the ripple and disturbance from charger, connecting R1 and C1 to V_{CC} is recommended.

3. Protection the CS pin

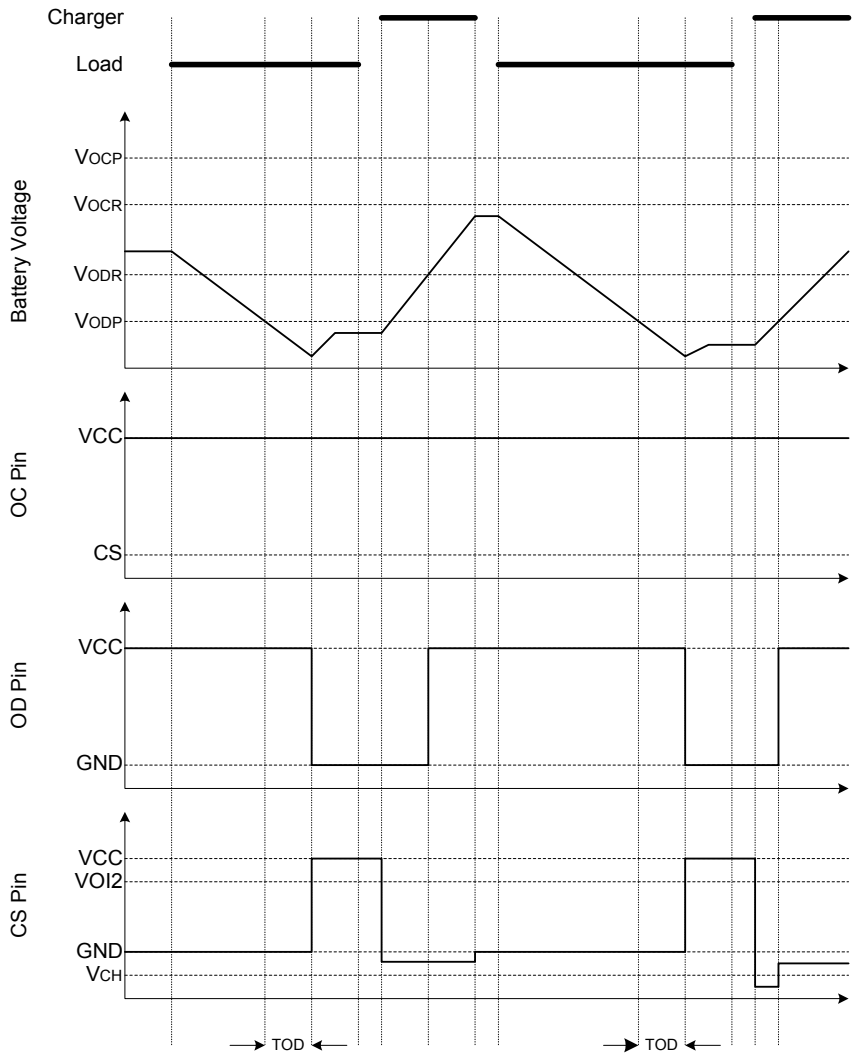
R2 is used for latch-up protection when charger is connected under overdischarge condition and overstress protection at reverse connecting of a charger.

Timing Diagram

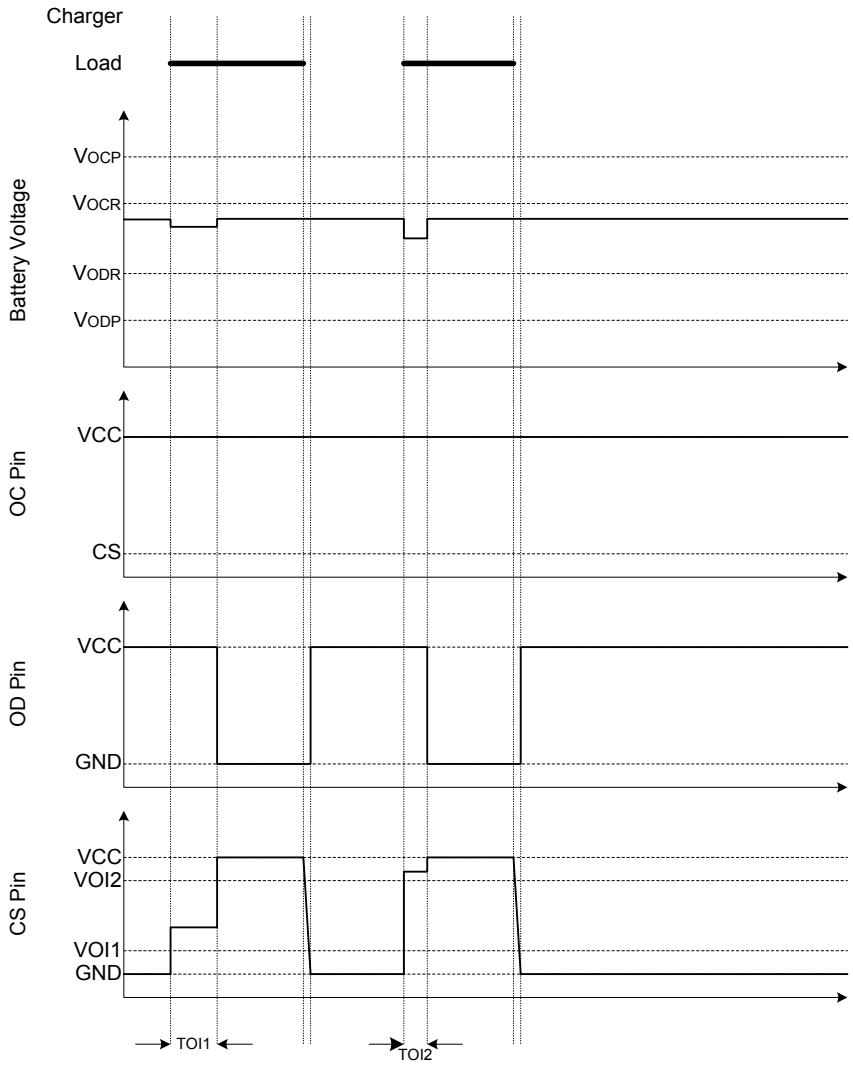
1. Overcharge Condition →Load Discharging → Normal Condition



2. Overdischarge Condition → Charging by a Charger →Normal Condition

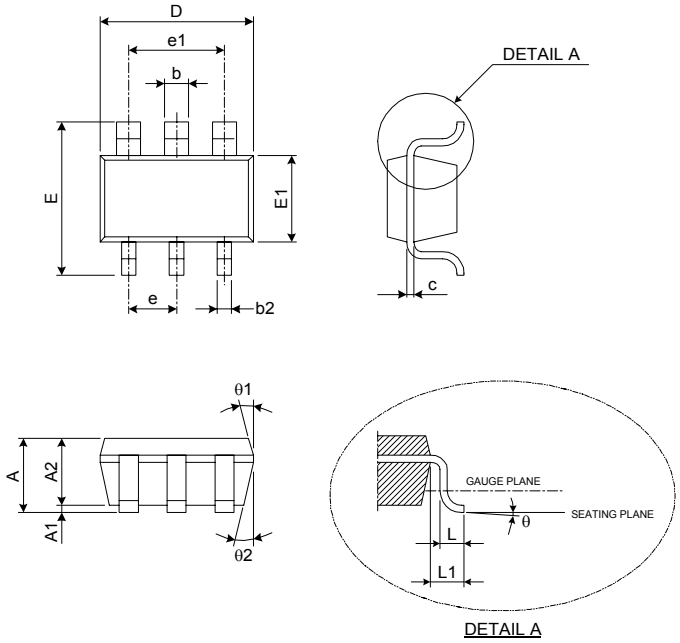


3. Over Current Condition → Normal Condition



Package Outline

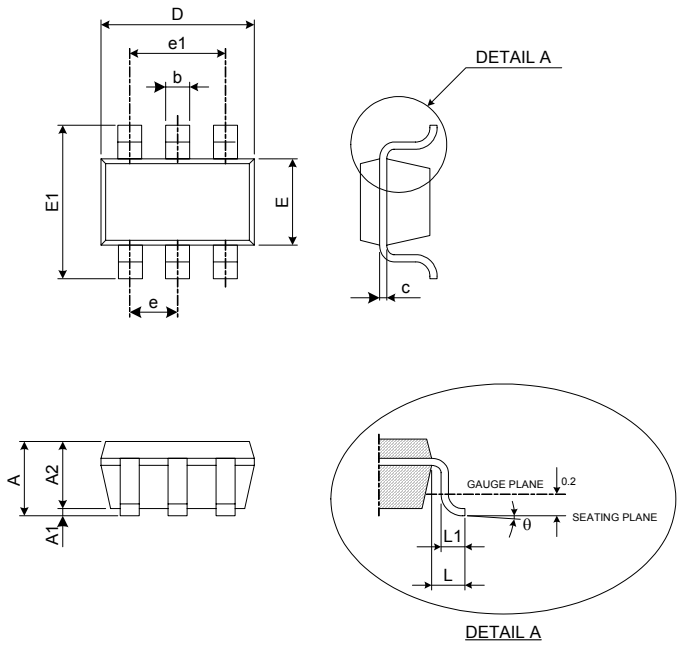
Dimension (Package A)



Unit : mm

SYMBOL	MIN.	TYP.	MAX.
A	1.05	-	1.35
A1	0.05	-	0.15
A2	1.00	1.10	1.20
b	0.40	-	0.55
b2	0.25	-	0.40
c	0.08	-	0.20
D	2.70	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
L	0.35	0.45	0.55
L1	0.60 REF.		
e	0.95 BSC.		
e1	1.90 BSC.		
θ	0°	5°	10°
θ1	3°	5°	7°
θ2	6°	8°	10°

Dimension (Package B)



Unit : mm

SYMBOL	MIN.	TYP.	MAX.
A	1.050	-	1.250
A1	0.000	-	0.100
A2	1.050	-	1.150
b	0.300	-	0.400
c	0.100	-	0.200
D	2.820	-	3.020
E	1.500	-	1.700
E1	2.650	-	2.950
e	0.950 TYP		
e1	1.800	-	2.000
L	0.700REF		
L1	0.300	-	0.600
θ	0°	-	8°