ETA4034

Li+ Charger Front-End Protection IC With OVP, OCP and NTC

DESCRIPTION

ETA4034 is an over-voltage protection(OVP) and over-current protection(OCP) IC with NTC. The OVP function includes Input OVP and Battery OVP(BVOVP). The input OVP can sustain input voltage as high as 30V, protecting downstream devices from high voltage surge.

When input voltage of ETA4034 exceeds the input OVP threshold, it responses quickly and shuts off the MOSFET. The OVP threshold 6.15V is fixed internally. When Battery voltage at ETA4034 BAT pin exceeds the BVOVP threshold, it also responses quickly and shuts off the MOSFET, The BVOVP threshold 4.35V is fixed internally. There is also an over-current-protection feature for the switch. When overload condition occurs, it goes into a hiccup mode to protect the IC from over-heating. It also has an over-temperature protection feature that turns off the MOSFET.

ETA4034 also can provide status information to HOST through fault conditions.
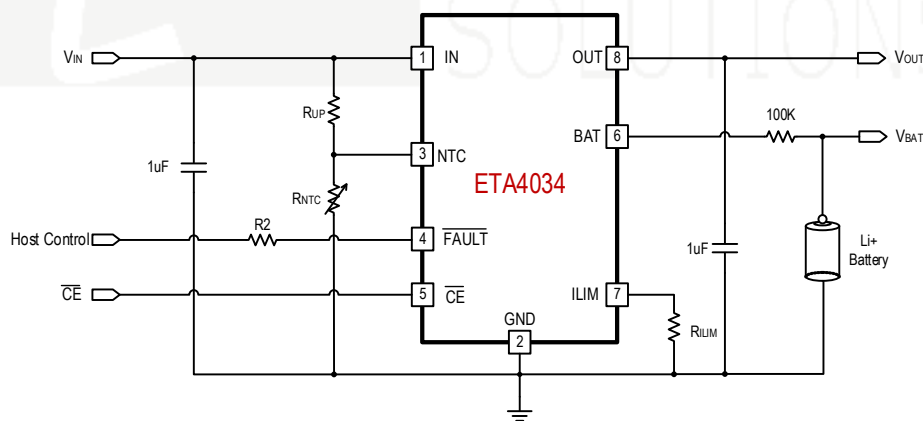
ETA4034 is available in a compact package DFN2x2-8.

FEATURES

- Support up to 30V Input Voltage
- Support up to 2A Input Current
- 70ns Fast Transient Response
- OVP Function
  - Input Overvoltage Protection
  - Battery Overvoltage Protection
- OCP Function
  - Current Limit Set by External Resistor
- Status Indication – Fault Condition
- Thermal Shutdown
- DFN2x2-8 Package
- RoHS Compliant

APPLICATIONS

- Tablet
- MID
- Smart Phone
- Power bank

TYPICAL APPLICATION

Typical Application Circuit

ORDERING INFORMATION

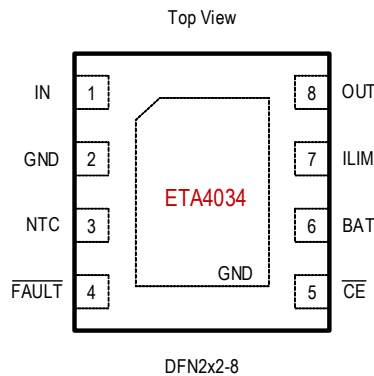| PART No.	PACKAGE	TOP MARK	Pcs/Reel
ETA4034D2I	DFN2x2-8	GqYW.	3000

ETA4034

PIN CONFIGURATION

Top View

```
        ┌──────────────┐
  IN  1 │              │ 8  OUT
        │              │
 GND  2 │   ETA4034    │ 7  ILIM
        │              │
 NTC  3 │              │ 6  BAT
        │         GND  │
FAULT 4 │              │ 5  CE
        └──────────────┘
```

DFN2x2-8

ABSOLUTE MAXIMUM RATINGS

(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

IN Voltage ....–0.3V to 32V

OUT Voltage ....–0.3V to IN+0.3V

All Other PIN Voltage…...............................–0.3V to 6V

Operating Temperature Range…………...–40°C to 85°C

Storage Temperature Range………......–55°C to 150°C

Thermal Resistance θ_{JA} θ_{JC}

DFN2X2-8………………….....58.6….….7.6……... °C /W

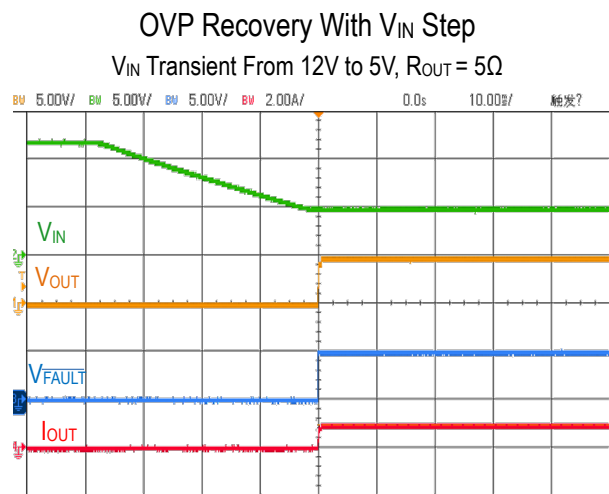ESD HBM (Human Body Mode)……………..……….2KV

ELECTRICAL CHARACTERISTICS

(V_{IN}= 5V, unless otherwise specified. Typical values are at TA = 25°C)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage Range		3.5		30	V
Input UVLO	Rising, HYS = 200mV		2.7		V
Input Quiescent Current	V_{IN} = 5V,V_{OUT} Floating		250		µA
Input Shutdown Current	V_{IN} = 5V,$V_{\overline{CE}}$ = 5V		47		µA
Input Overvoltage Protection Threshold(OVP)	Input voltage over voltage trip level, rising	5.95	6.15	6.38	V
Input OVP HYS			0.1		V
Resistance Between IN and OUT	V_{IN} = 5V, I_{OUT} = 0.5A		130		mΩ
Current limit	Switch current limit, R_{ILIM}=50K	0.45	0.5	0.55	A
Output Discharge Resistance			4.3		KΩ
Thermal shutdown	V_{IN} = 5V, V_{OUT} floating		145		°C
Thermal shutdown hysteresis	V_{IN} = 5V, V_{OUT} floating		20		°C
$T_{POWER-ON}$	V_{IN} > V_{UVLO} to 90% V_{OUT}		8		ms
T_{OVP}	Over-voltage response time. V_{IN}>V_{OVP} to V_{OUT} stop rising		70		ns
BAT Overvoltage Protection Threshold (BVOVP)	Battery voltage at BAT pin over-voltage trip level, rising	4.306	4.35	4.394	V
BVOVP HYS			0.275		V
Input Bias Current On BAT pin				1	uA
$\overline{CE}$ input current	V_{IN} = $V_{\overline{CE}}$ =5V		5		uA
$\overline{CE}$ Input rising		1.4			V
$\overline{CE}$ Input falling				0.4	V
NTC_COLD			66.7%		V_{IN}
NTC_HOT			36.4%		V_{IN}
$\overline{FAULT}$ Low Voltage	I_{SINK} = 5mA		0.1	0.2	V

PIN DESCRIPTION

PIN #	NAME	DESCRIPTION
1	IN	Input Voltage Pin. Bypass with a 1uF capacitor to GND
2	GND	Ground Pin
3	NTC	NTC Pin. Connect R_{UP} from this pin to the IN pin and R_{NTC} from this pin to ground. If NTC function is not used, Connecting this pin to GND
4	$\overline{FAULT}$	FAULT Indicate Pin. $V_{\overline{FAULT}}$ = Low indicates that the MOSFET has been turned off due to OVP, OCP, BAT OVP, OTP , or NTC
5	$\overline{CE}$	Chip Enable Pin. Low to turn on, High to turn off
6	BAT	Battery Voltage Detect Pin. This pin is used for battery voltage detection, a 100K resistor is needed between BAT pin and Battery
7	ILIM	Current Limit Pin. Connect a resistor to GND
8	OUT	Output Voltage Pin. Connect an external 1uF cap to GND

TYPICAL CHARACTERISTICS

R_{DSON} Vs I_{OUT}

I_{OCP} Vs R_{ILIM}

OVP With V_{IN} Step

V_{IN} Transient From 5V to 12V, R_{OUT} = 5Ω

OVP Recovery With V_{IN} Step

V_{IN} Transient From 12V to 5V, R_{OUT} = 5Ω

TYPICAL CHARACTERISTICS (cont')

OCP with Short V$_{OUT}$
V$_{IN}$ = 5V, R$_{ILIM}$ = 25K, R$_{OUT}$ = 5Ω

POWER ON with V$_{OUT}$ Short
V$_{IN}$ rising from 0V to 5V, R$_{ILIM}$ = 25K, R$_{OUT}$ = 5Ω

BVOVP with V$_{BAT}$ Step
V$_{BAT}$ Transient From 4V to 4.5V

BVOVP Recovery with V$_{BAT}$ Step
V$_{BAT}$ Transient From 4V to 4.5V
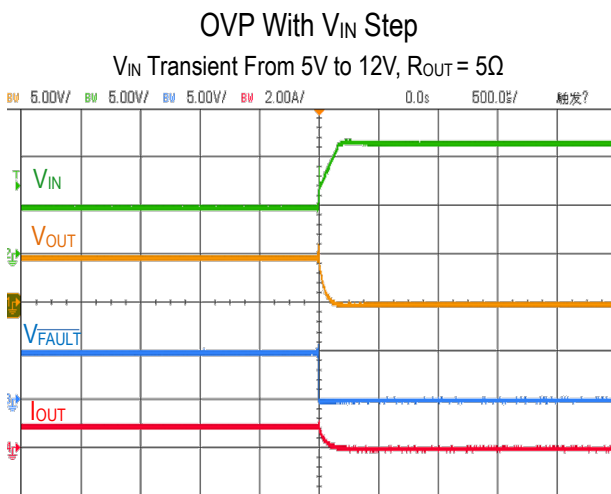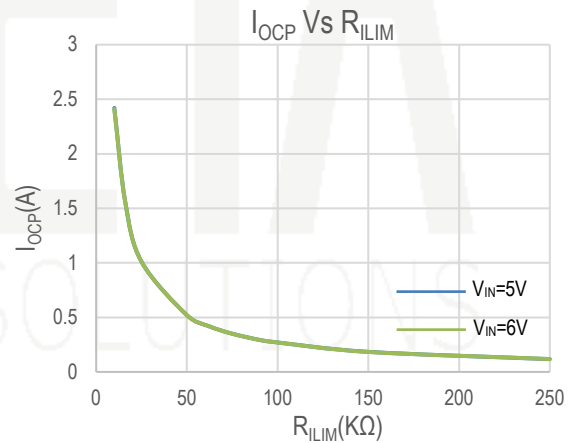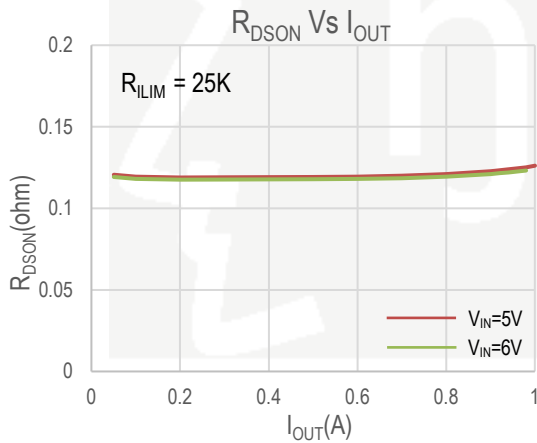
FUNCTIONAL DECRIPTIONS

ETA4034 is an over-voltage protection (OVP) and over-current protection (OCP) IC with NTC. The OVP include Input OVP and Battery OVP(BVOVP). When input voltage of ETA4034 exceeds the OVP threshold, it responses quickly and shuts off the MOSFET. The input OVP threshold 6.15V is fixed internally. When Battery voltage at ETA4034 BAT pin exceeds the BVOVP threshold, it also responses quickly and shuts off the MOSFET, The BVOVP threshold 4.35V is fixed internally. There is also an over-current-protection feature for the switch. When overload condition occurs, it goes into a hiccup mode to protect the IC from over-heating. It also has an over-temperature protection feature that turns off the MOSFET.

Input OVP Protection

When Input voltage rises above 6.15V, the switch is turned off, removing power from circuit, and $\overline{FAULT}$ pin will be driven low. During input voltage fall below 6.05V, the switch will turn on again after a deglitch time, $\overline{FAULT}$ pin will be driven high to show recovery from input OVP.

Input OCP Protection

Over current limit threshold as a function of R_{ILIM}, and it is programmed by a resistor R_{ILIM} connected from ILIM pin to GND

$$I_{OCP}(A) = \frac{25}{R_{ILIM}(K)}$$

If load current tries to exceed the I_{OCP} threshold, the device limits the current for a blanking duration of 180us. If the load current returns to less than I_{OCP} before 180us times out, the device continues to operate. However, if the overcurrent situation persists for 180us, the switch is turned off for a duration of 64ms, and the $\overline{FAULT}$ pin is driven low. The switch is then turned on again after 64ms and the current is monitored all over again. If 15 OCP faults occur in one charge cycle, the switch is turned off permanently. The counter is cleared either by removing and reapplying input power, or by disabling and re-enabling the device with the $\overline{CE}$ pin. To prevent the input voltage from spiking up due to the inductance of the input cable, the switch is turned off slowly, resulting in a soft-start.

Battery Overvoltage Protection

The battery overvoltage threshold BVOVP is internally set to 4.35 V. If the battery voltage exceeds the BVOVP threshold, the switch is turned off, and the $\overline{FAULT}$ pin is driven low. The switch is turned back on once the battery voltage drops to 4.075V. Each time a battery overvoltage fault occurs, an internal counter is incremented. If 15 such faults occur in one charge cycle, the switch is turned off permanently. The counter is cleared either by removing and re-applying input power, or by disabling and re-enabling the device with the $\overline{CE}$ pin.

Thermal Protection

If the junction temperature of the device exceeds 145°C, the switch is turned off, and the $\overline{FAULT}$ pin is driven low. The switch is turned back on when the junction temperature falls below 125°C.
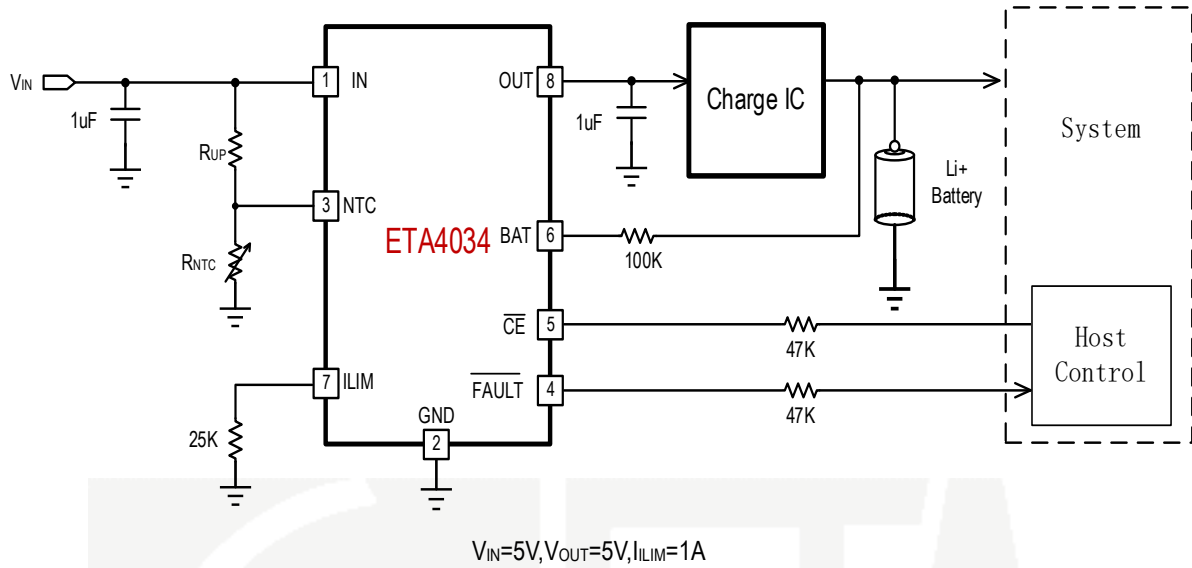
NTC Function

ETA4034 continuously monitors temperature by measuring the voltage of NTC pin. A negative or positive temperature coefficient thermistor and an external voltage divider typically develop this voltage. ETA4034 compares this voltage against its internal 66.7%V_{IN} and 36.4%V_{IN} thresholds to determine if charging is allowed. The temperature sensing circuit is immune to any fluctuation in V_{IN}, since both the external voltage divider and the internal thresholds 66.7%V_{IN} and 36.4%V_{IN} are referenced to V_{IN}. If the NTC pin is connected to GND , the temperature-sensing feature will disable.
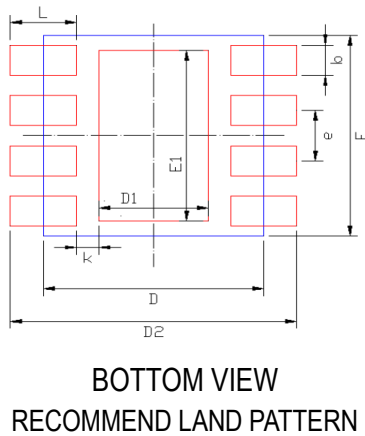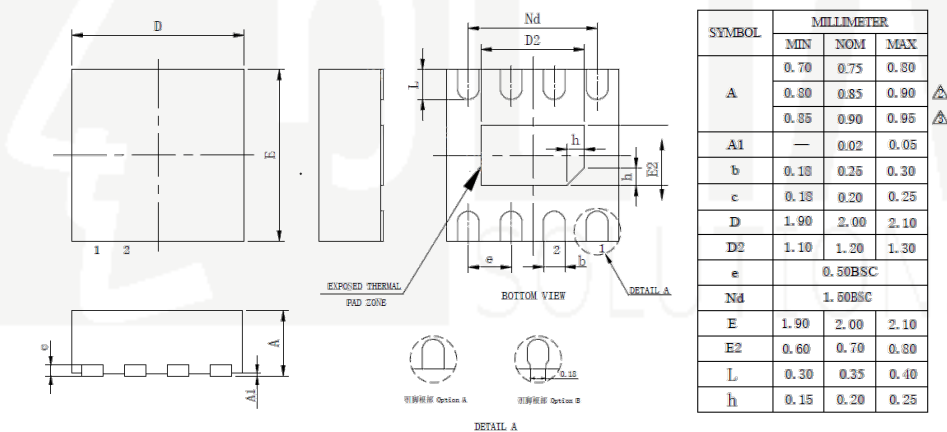
Fault Indication

The $\overline{FAULT}$ pin is an active-low open-drain output. It is in a high-impedance state when operating conditions are safe, or when the device is disabled by setting $\overline{CE}$ high. With $\overline{CE}$ low, the $\overline{FAULT}$ pin goes low whenever any of these events occurs:
- OVP(Input OVP and BVOVP)
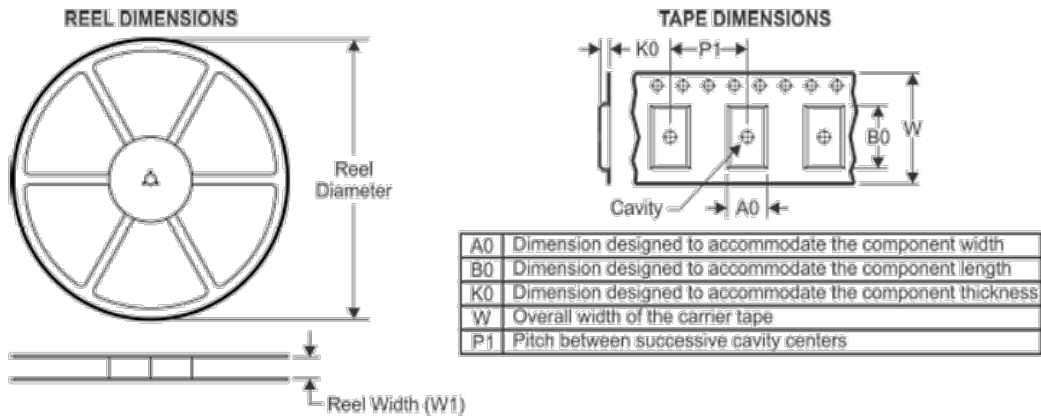- Input OCP
- IC OTP
- NTC

Typical Application

$V_{IN}=5V, V_{OUT}=5V, I_{ILIM}=1A$

PACKAGE OUTLINE

SYMBOL	MILLIMETER			
	MIN	NOM	MAX	
A	0.70	0.75	0.80	
	0.80	0.85	0.90	
	0.85	0.90	0.95	
A1	—	0.02	0.05	
b	0.18	0.25	0.30	
c	0.18	0.20	0.25	
D	1.90	2.00	2.10	
D2	1.10	1.20	1.30	
e	0.50BSC			
Nd	1.50BSC			
E	1.90	2.00	2.10	
E2	0.60	0.70	0.80	
L	0.30	0.35	0.40	
h	0.15	0.20	0.25	

BOTTOM VIEW
RECOMMEND LAND PATTERN

Dimensions	Value (in mm)
D	2
E	2
D1	1
E1	1.7
D2	2.6
e	0.5
b	0.3
k	0.2 (≥0.2)
L	0.6

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE
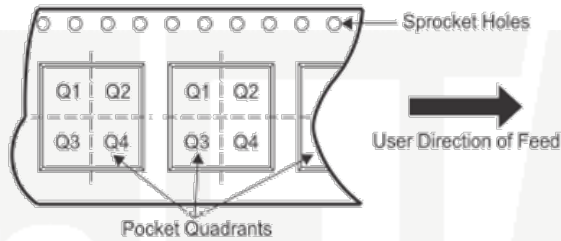
Device	Package Type	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ETA4034D2I	DFN2x2-8	8	3000	180	9.5	2.3	2.3	1.1	4	8	Q1