NT1777A

2/3/4/5-Cell Lithium-Ion/Polymer Protector

Features

- High accuracy voltage detection circuit
  - Over-charge detection : ±25mV
  - Over-discharge detection : ±80mV
  - Discharge over-current-1 detection : ±10%
  - Discharge over-current-2 detection : ±10%
  - Load short-circuiting detection : ±10%
  - Charge over-current detection : ±8mV/±10mV
  - Temperature detection : ±4℃
- High withstand voltage
  - Absolute maximum rating: 30V
  - Operating voltage range: 3.5V to 25V
- Low power consumption
  - Supply current: 6.6uA max. (Ta=+25℃)
- Delay times of over-charge, load short-circuiting, charge over-current and over/under temperature are generated by an internal circuit (fixed).
- Delay times of over-discharge, discharge over-current-1 and -2 are controlled by external capacitors.
- Built-in breaking wire detector function
- Package: 16 pin TSSOP
- Lead-free, Sn 100%, Halogen-free

Applications

- Lithium-ion rechargeable battery pack
- Lithium-polymer rechargeable battery pack
- Lithium-iron phosphate rechargeable battery pack

Description

The NT1777 series are the 2/3/4/5-cell protection IC with temperature protection for lithium-ion/lithium-polymer/lithium-iron phosphate rechargeable battery pack. The high accuracy voltage, current detector and delay time circuits are built in NT1777 series with state-of-the-art design and process.
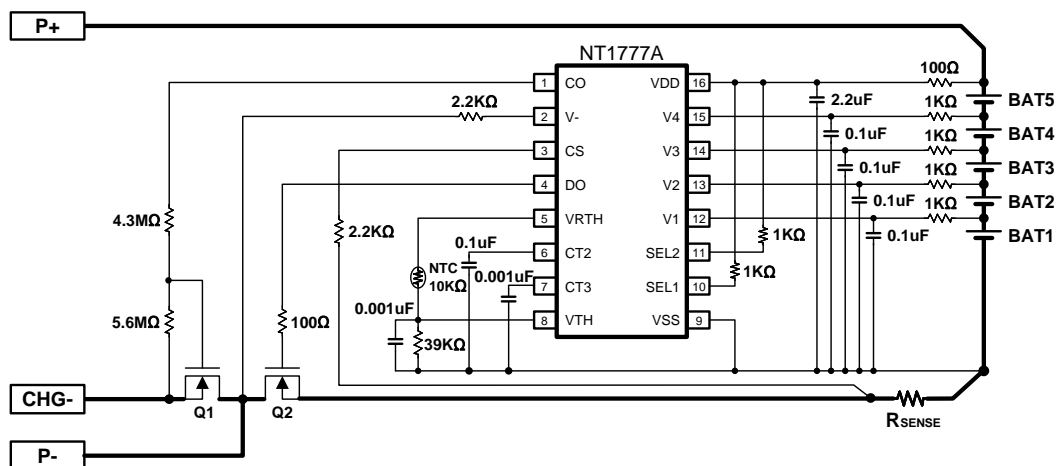
The NT1777 series have three types of discharge over-current protection and one type of charge over-current protection.

The NT1777 series have three types of over-temperature during charging, over-temperature during discharging and under-temperature during charging protection.
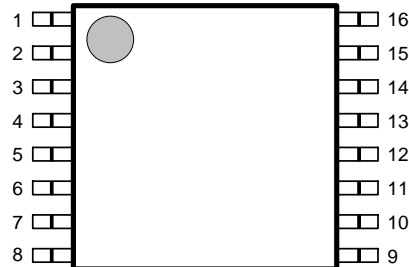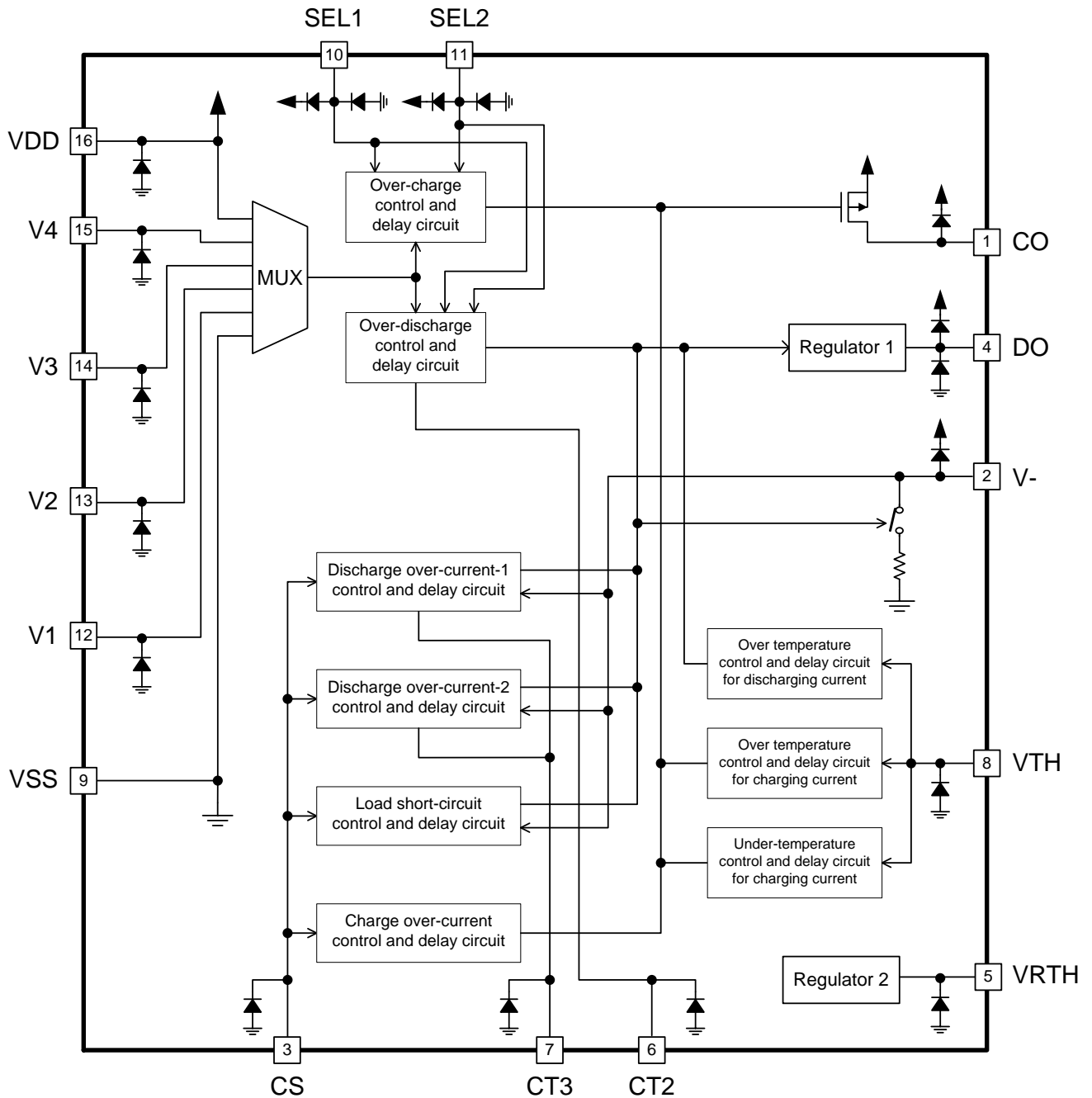
Typical Application Circuit

These devices have limited build-in ESD protection. The leads must be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.
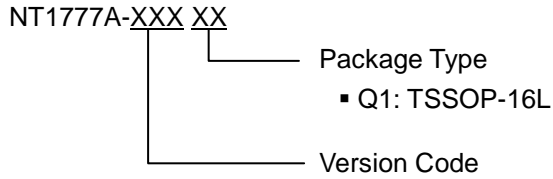
Package and Pin Configurations

TSSOP-16L
Top view

Pin No.	Symbol	Pin description
1	CO	FET gate control pin for charging path (Pch open-drain output). ● Normal mode　　　: High ● Over-charge mode　: Hi-impedance
2	V-	Input terminal connected to charger negative voltage. Discharge over-current and load short-circuiting release detector.
3	CS	Input of overcurrent detection. Detected overcurrent by sense resistor between CS pin and VSS pin. Detected charger and load connection.
4	DO	FET gate control pin for discharging path (CMOS output) ● Normal mode　　　: High ● Over-discharge mode　: Low
5	VRTH	Voltage regulator output pin
6	CT2	Capacitor connection for over-discharge detection delay time.
7	CT3	Capacitor connection for discharge over-current-1 and -2 detection delay time.
8	VTH	Temperature detection terminal.
9	VSS	Cell V1 negative voltage input pin. The input terminal of the ground of IC.
10	SEL1	For 2, 3, 4 or 5-cell in series. SEL1/SEL2 application table below
11	SEL2	(see table)
12	V1	Cell V1 positive voltage and cell V2 negative voltage input pin
13	V2	Cell V2 positive voltage and cell V3 negative voltage input pin
14	V3	Cell V3 positive voltage and cell V4 negative voltage input pin
15	V4	Cell V4 positive voltage and cell V5 negative voltage input pin
16	VDD	Power supply input pin and cell V5 positive voltage

SEL1 pin	SEL2 pin	Application
VDD	VDD	5 cells application
VDD	VSS	4 cells application (Connect V5=VDD)
VSS	VDD	3 cells application (Connect V5=VDD, V1=VSS)
VSS	VSS	2 cells application (Connect V5=VDD, V2=V1=VSS)

Block Diagram

Ordering Information

NT1777A-<u>XXX</u> <u>XX</u>

    Package Type
       ▪ Q1: TSSOP-16L

    Version Code

Product version code:

Table 1: Detection threshold level

Product Name	Version Code	Package Type	Over-charge detection voltage V_{DET1} (V)	Over-charge release voltage V_{REL1} (V)	Over-discharge detection voltage V_{DET2} (V)	Over-discharge release voltage V_{REL2} (V)	Discharge over-current-1 detection voltage V_{DET31} (V)	Discharge over-current-2 detection voltage V_{DET32} (V)	Charge over-current detection voltage V_{DET4} (V)	Load short-circuiting detection voltage V_{SHORT} (V)
NT1777A	TDA	Q1	3.750	3.600	2.200	2.700	−	0.100	-0.025	0.400
NT1777A	FKA	Q1	4.250	4.150	2.500	3.000	−	0.100	-0.025	0.250
NT1777A	FWA	Q1	4.250	4.150	2.750	3.000	−	0.100	-0.025	0.400
NT1777A	FQA	Q1	4.250	4.150	2.800	3.000	0.100	0.400	-0.100	0.600

Remark: Please contact our sales for the products with detection voltage value other than those specified above.

Table 2: Temperature detection threshold

Product Name	Version Code	Package Type	Discharge over temperature TH1 (℃)	Discharge over temperature release RELTH1 (℃)	Charge over temperature TH2 (℃)	Charge over temperature release RELTH2 (℃)	Charge under temperature TH3 (℃)	Charge under temperature release RELTH3 (℃)
NT1777A	TDA	Q1	70	60	50	45	0	5
NT1777A	FKA	Q1	70	60	50	45	0	5
NT1777A	FWA	Q1	70	60	50	45	0	5
NT1777A	FQA	Q1	70	60	50	45	-10	-5

Table 3: Function

Product Name	Version Code	Package Type	Over-charge release condition	Over-discharge release condition	0 V battery charge function	Built-in breaking wire detector function	Delay time (Table 4)
NT1777A	TDA	Q1	(a) Voltage release or (b) Discharge current release	(a) Voltage release or (b) Charge current release	Available	Yes	(1)
NT1777A	FKA	Q1			Available	Yes	(1)
NT1777A	FWA	Q1			Available	Yes	(1)
NT1777A	FQA	Q1			Available	Yes	(1)

Remark: For the details, please refer to the description of "**Operations**"

Table 4: Delay time

Delay time	Over-charge detection delay time t_{VDET1} (s)	Over-discharge detection delay time t_{VDET2} (s) (at C_{CT2}=0.1uF)	Discharge over-current-1 detection delay time t_{VDET31} (ms) (at C_{CT3}=0.001uF)	Discharge over-current-2 detection delay time t_{VDET32} (ms) (at C_{CT3}=0.001uF)	Load short-circuiting detection delay time t_{SHORT} (us)	Charge over-current detection delay time t_{VDET4} (ms)	Temperature detection delay time t_{VTH} (s)
(1)	1 ±30%	1 ±50%	60 ±50%	10 ±50%	250 +60/-40%	100 ±30%	1 +100%/-50%