

Features

- High accuracy voltage detection circuit
 - Overcharge detection : $\pm 25\text{mV}$
 - Over-discharge detection : $\pm 50\text{mV}$
 - Discharge overcurrent-1 detection : $\pm 10\%$
 - Discharge overcurrent-2 detection : $\pm 10\%$
 - Load short-circuiting detection : $\pm 10\%$
 - Charge overcurrent detection : $\pm 8\text{mV}/\pm 10\text{mV}$
 - Temperature detection : $\pm 3^\circ\text{C}/\pm 4^\circ\text{C}$
- Low power consumption
 - Supply current: 6.6 μA max. ($T_a=+25^\circ\text{C}$)
- Delay times of overcharge, load short-circuiting, charge overcurrent and over/under-temperature are generated by an internal circuit (fixed).
- Delay times of over-discharge, discharge overcurrent-1 and -2 are controlled by external capacitors.
- 0V battery charge available or unavailable function
- Built-in breaking wire detector function
- Package: 48 pin LQFP、64 pin LQFP、80 pin LQFP
- Lead-free, Sn 100%, Halogen-free

Applications

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

Description

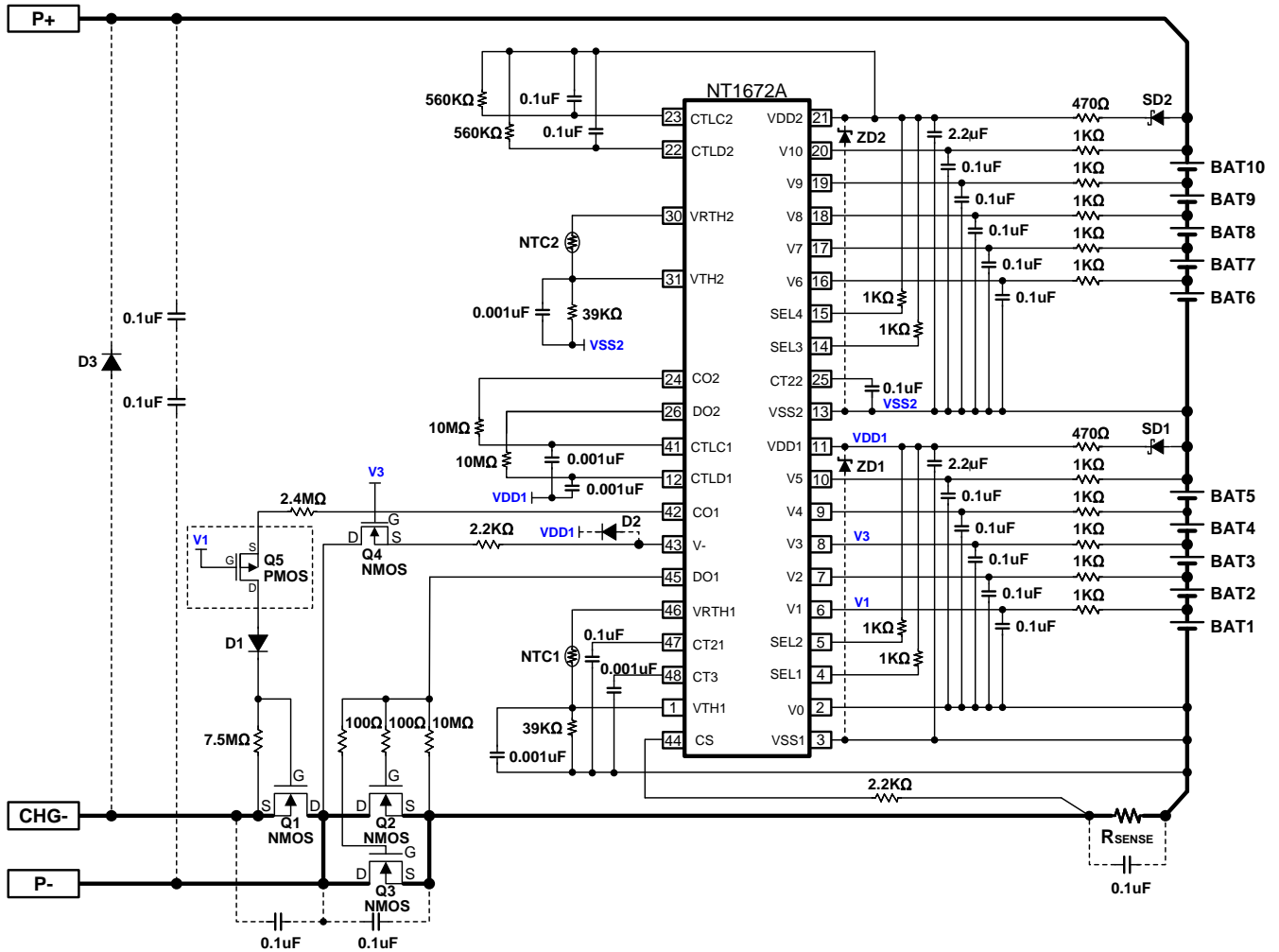
The NT1672/NT1673/NT1674 series are the 4~20-cell protection IC with temperature protection for lithium-ion /lithium-polymer /lithium-iron phosphate rechargeable battery pack. The high accuracy voltage, current detector and delay time circuits are built in NT1672/NT1673/NT1674 series with state-of-the-art design and process.

The NT1672/NT1673/NT1674 series have three types of discharge overcurrent protection and one type of charge overcurrent protection.

The NT1672/NT1673/NT1674 series have three types of over-temperature during charging, over-temperature during discharging and under-temperature during charging protection.

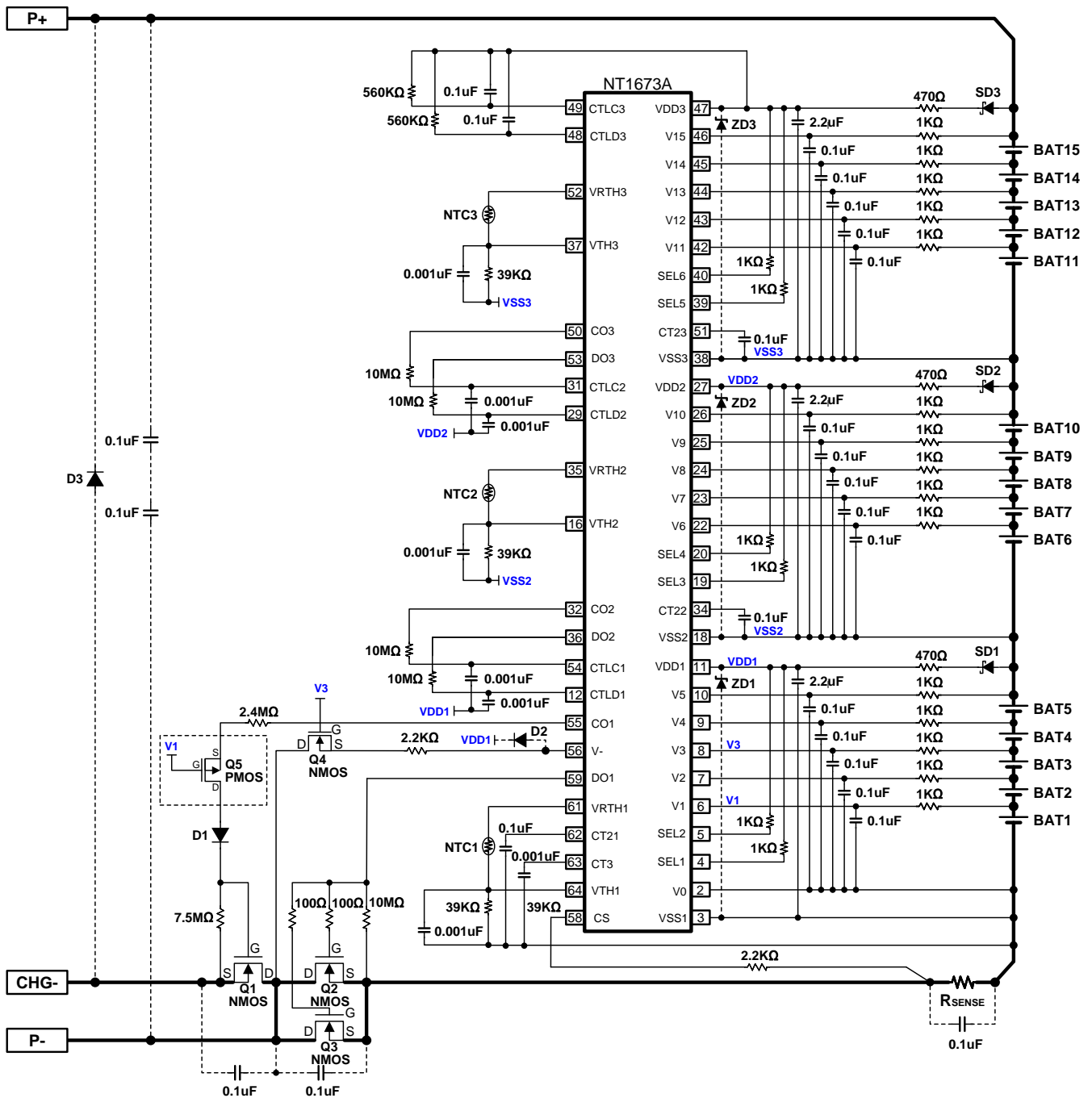
Typical Application Circuit

■ NT1672A



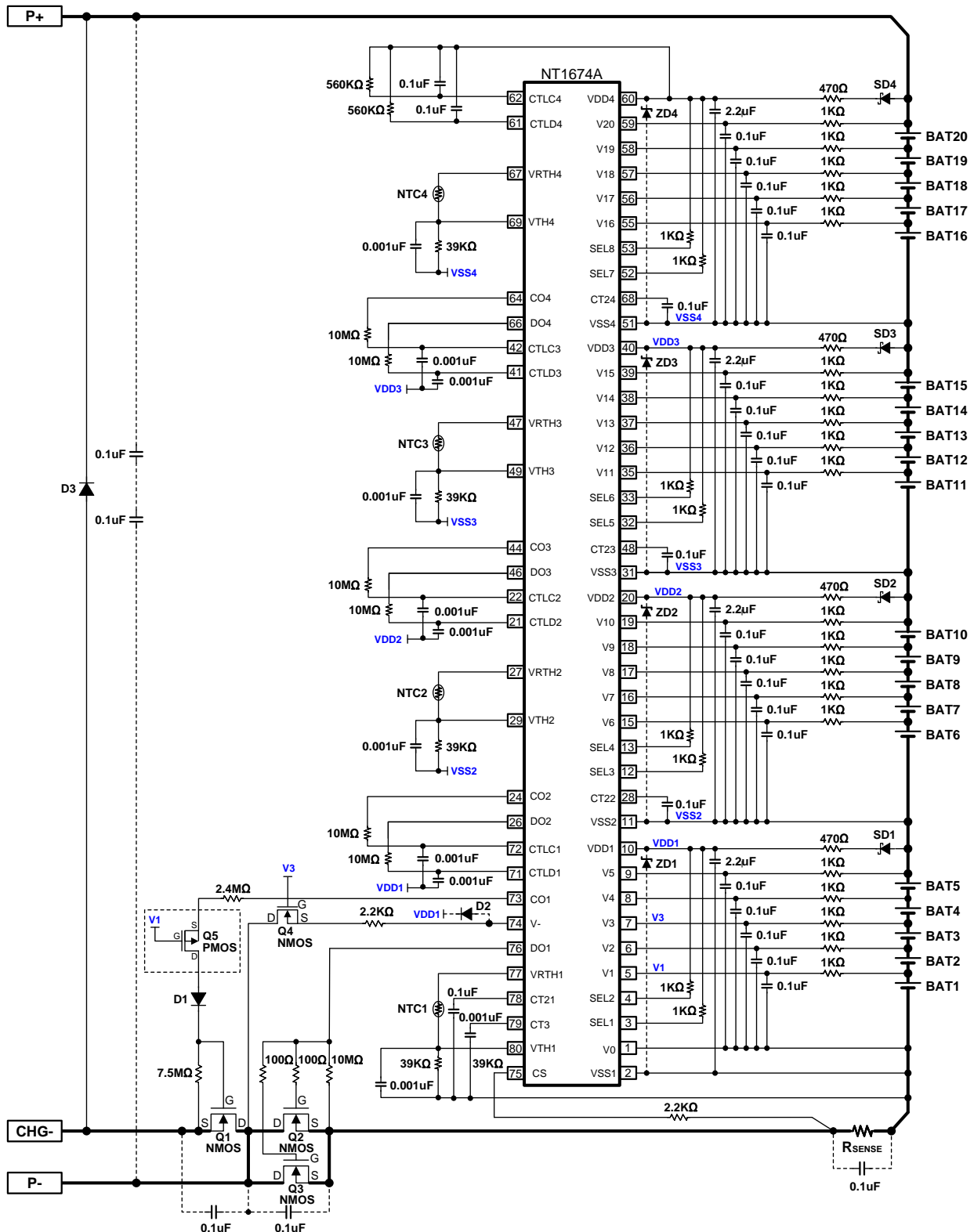
These devices have limited built-in ESD protection. The leads must be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

■ NT1673A



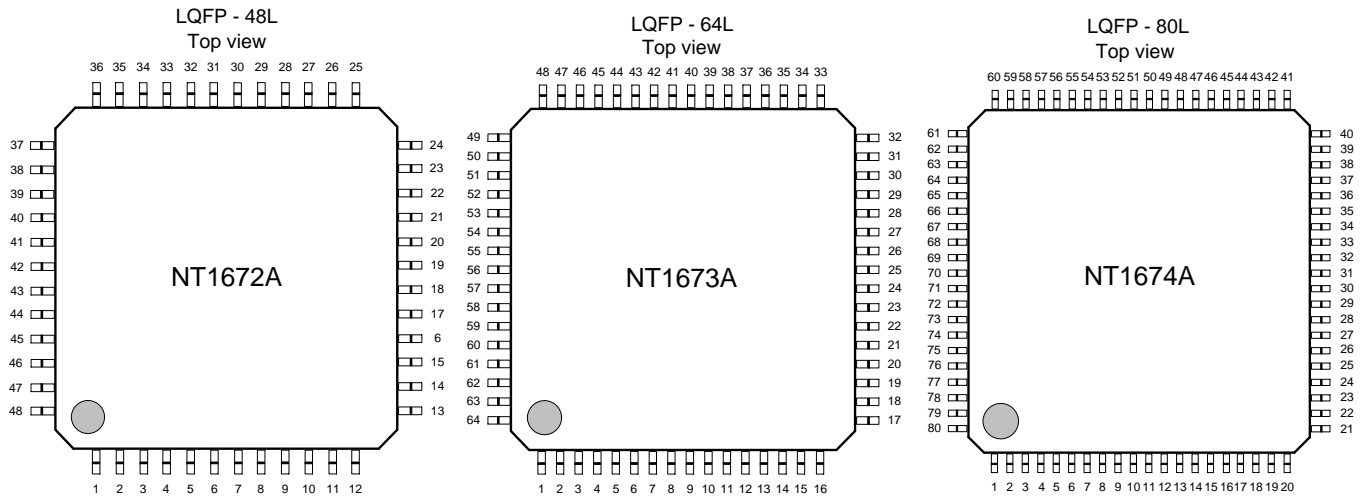
These devices have limited build-in ESD protection. The leads must be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

■ NT1674A



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



Pin No.			Symbol	Pin description
NT1672A	NT1673A	NT1674A		
11	11	10	VDD1	Power supply input pin -1
21	27	20	VDD2	Power supply input pin -2
-	47	40	VDD3	Power supply input pin -3
-	-	60	VDD4	Power supply input pin -4
3	3	2	VSS1	Reference voltage -1
13	18	11	VSS2	Reference voltage -2
-	38	31	VSS3	Reference voltage -3
-	-	51	VSS4	Reference voltage -4
2	2	1	V0	The input terminal of the negative voltage of cell BAT1.
6	6	5	V1	Cell BAT1 positive voltage and cell BAT2 negative voltage input pin.
7	7	6	V2	Cell BAT2 positive voltage and cell BAT3 negative voltage input pin.
8	8	7	V3	Cell BAT3 positive voltage and cell BAT4 negative voltage input pin.
9	9	8	V4	Cell BAT4 positive voltage and cell BAT5 negative voltage input pin.
10	10	9	V5	Cell BAT5 positive voltage and cell BAT6 negative voltage input pin.
16	22	15	V6	Cell BAT6 positive voltage and cell BAT7 negative voltage input pin.
17	23	16	V7	Cell BAT7 positive voltage and cell BAT8 negative voltage input pin.
18	24	17	V8	Cell BAT8 positive voltage and cell BAT9 negative voltage input pin.
19	25	18	V9	Cell BAT9 positive voltage and cell BAT10 negative voltage input pin.

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Pin No.			Symbol	Pin description
NT1672A	NT1673A	NT1674A		
20	26	19	V10	Cell BAT10 positive voltage and cell BAT11 negative voltage input pin.
-	42	35	V11	Cell BAT11 positive voltage and cell BAT12 negative voltage input pin.
-	43	36	V12	Cell BAT12 positive voltage and cell BAT13 negative voltage input pin.
-	44	37	V13	Cell BAT13 positive voltage and cell BAT14 negative voltage input pin.
-	45	38	V14	Cell BAT14 positive voltage and cell BAT15 negative voltage input pin.
-	46	39	V15	Cell BAT15 positive voltage and cell BAT16 negative voltage input pin.
-	-	55	V16	Cell BAT16 positive voltage and cell BAT17 negative voltage input pin.
-	-	56	V17	Cell BAT17 positive voltage and cell BAT18 negative voltage input pin.
-	-	57	V18	Cell BAT18 positive voltage and cell BAT19 negative voltage input pin.
-	-	58	V19	Cell BAT19 positive voltage and cell BAT20 negative voltage input pin.
-	-	59	V20	Cell BAT20 positive voltage.
46	61	77	VRTH1	Voltage regulator output pin -1.
30	35	27	VRTH2	Voltage regulator output pin -2.
-	52	47	VRTH3	Voltage regulator output pin -3.
-	-	67	VRTH4	Voltage regulator output pin -4.
1	64	80	VTH1	Temperature detection terminal -1.
31	16	29	VTH2	Temperature detection terminal -2.
-	37	49	VTH3	Temperature detection terminal -3.
-	-	69	VTH4	Temperature detection terminal -4.
4	4	3	SEL1	Serial switch pins -1.
5	5	4	SEL2	Serial switch pins -2.
14	19	12	SEL3	Serial switch pins -3.
15	20	13	SEL4	Serial switch pins -4.
-	39	32	SEL5	Serial switch pins -5.
-	40	33	SEL6	Serial switch pins -6.
-	-	52	SEL7	Serial switch pins -7.
-	-	53	SEL8	Serial switch pins -8.

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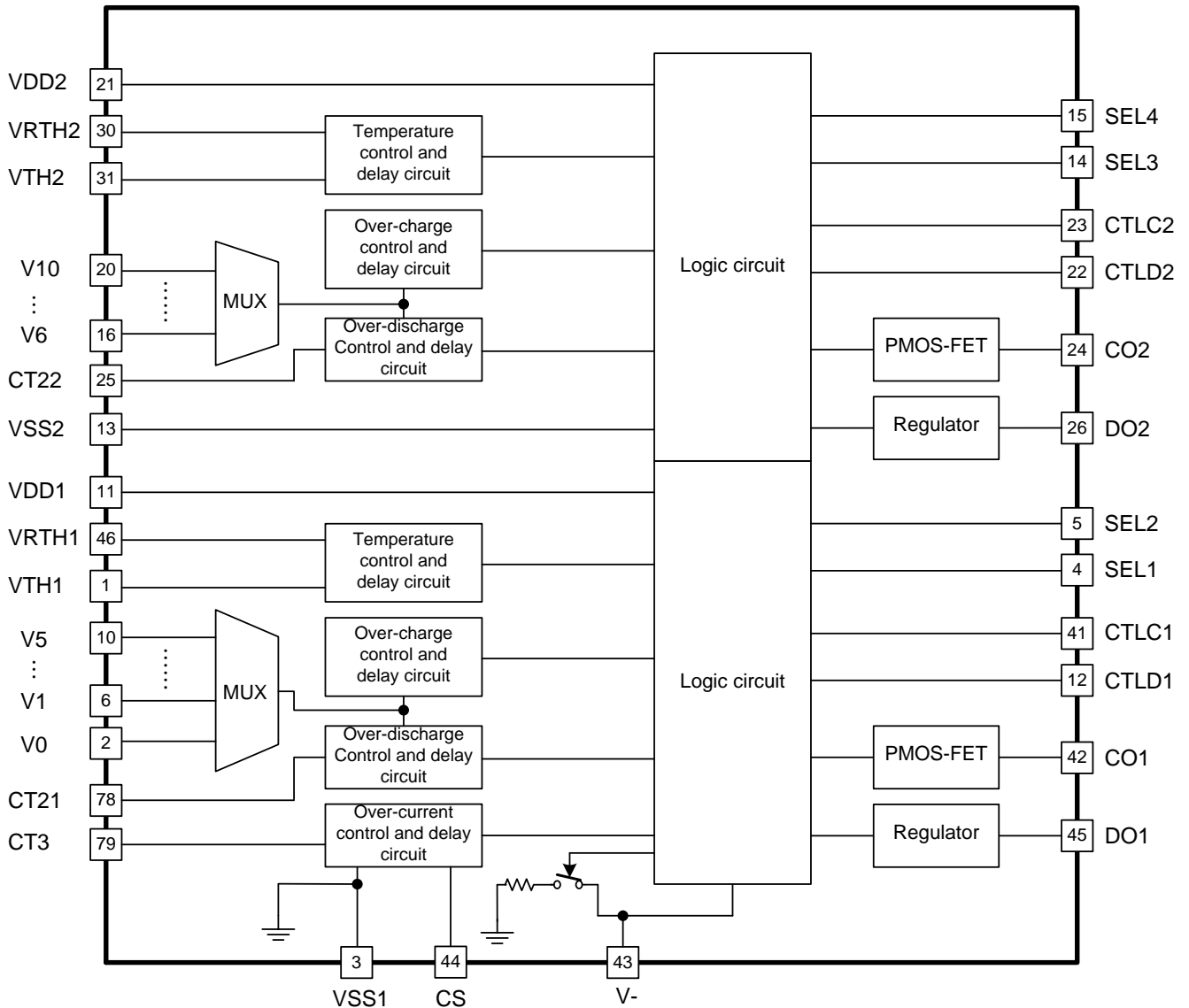
Pin No.			Symbol	Pin description
NT1672A	NT1673A	NT1674A		
47	62	78	CT21	Capacitor connection for over-discharge detection delay time -1.
25	34	28	CT22	Capacitor connection for over-discharge detection delay time -2.
-	51	48	CT23	Capacitor connection for over-discharge detection delay time -3.
-	-	68	CT24	Capacitor connection for over-discharge detection delay time -4.
48	63	79	CT3	Capacitor connection for discharge overcurrent-1 and -2 detection delay time.
43	56	74	V-	Input terminal connected to charger negative voltage. Discharge overcurrent and load short-circuiting release detector.
44	58	75	CS	Input of overcurrent detection. Detected overcurrent by sense resistor between CS pin and VSS1 pin. Detected charger and load connection.
42	55	73	CO1	FET gate control pin for charging path -1 (Pch open-drain output). <ul style="list-style-type: none"> ● Normal mode : High ● Overcharge mode : Hi-impedance
24	32	24	CO2	FET gate control pin for charging path -2 (Pch open-drain output). <ul style="list-style-type: none"> ● Normal mode : High ● Overcharge mode : Hi-impedance
-	50	44	CO3	FET gate control pin for charging path -3 (Pch open-drain output). <ul style="list-style-type: none"> ● Normal mode : High ● Overcharge mode : Hi-impedance
-	-	64	CO4	FET gate control pin for charging path -4 (Pch open-drain output). <ul style="list-style-type: none"> ● Normal mode : High ● Overcharge mode : Hi-impedance
45	59	76	DO1	FET gate control pin for discharging path -1 <ul style="list-style-type: none"> ● Normal mode : High ● Over-discharge mode : Low
26	36	26	DO2	FET gate control pin for discharging path -2 <ul style="list-style-type: none"> ● Normal mode : High ● Over-discharge mode : Low
-	53	46	DO3	FET gate control pin for discharging path -3 <ul style="list-style-type: none"> ● Normal mode : High ● Over-discharge mode : Low
-	-	66	DO4	FET gate control pin for discharging path -4 <ul style="list-style-type: none"> ● Normal mode : High ● Over-discharge mode : Low

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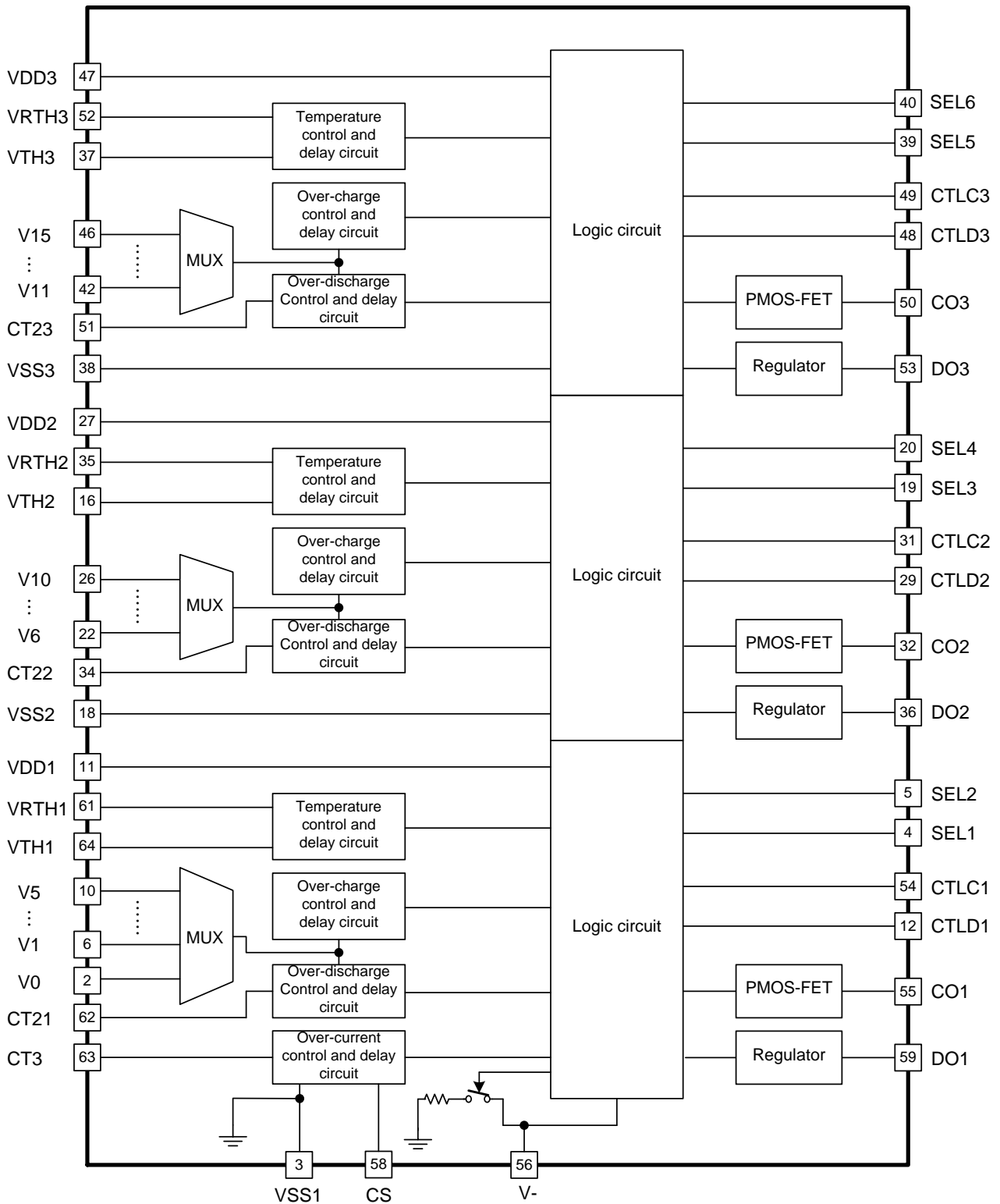
Pin No.			Symbol	Pin description
NT1672A	NT1673A	NT1674A		
12	12	71	CTLD1	The control terminal of output over-discharge detection -1. <ul style="list-style-type: none"> ● $I_{CTLD} > I_{CTLDH}$ DO pin : Normal mode ● $I_{CTLD} < I_{CTLDL}$ DO pin : Low level
22	29	21	CTLD2	The control terminal of output over-discharge detection -2. <ul style="list-style-type: none"> ● $I_{CTLD} > I_{CTLDH}$ DO pin : Normal mode ● $I_{CTLD} < I_{CTLDL}$ DO pin : Low level
-	48	41	CTLD3	The control terminal of output over-discharge detection -3. <ul style="list-style-type: none"> ● $I_{CTLD} > I_{CTLDH}$ DO pin : Normal mode ● $I_{CTLD} < I_{CTLDL}$ DO pin : Low level
-	-	61	CTLD4	The control terminal of output over-discharge detection -4. <ul style="list-style-type: none"> ● $I_{CTLD} > I_{CTLDH}$ DO pin : Normal mode ● $I_{CTLD} < I_{CTLDL}$ DO pin : Low level
41	54	72	CTL1	The control terminal of output overcharge detection -1. <ul style="list-style-type: none"> ● $I_{CTL1} > I_{CTL1H}$ CO pin : Normal mode ● $I_{CTL1} < I_{CTL1L}$ CO pin : Hi-impedance
23	31	22	CTL2	The control terminal of output overcharge detection -2. <ul style="list-style-type: none"> ● $I_{CTL2} > I_{CTL2H}$ CO pin : Normal mode ● $I_{CTL2} < I_{CTL2L}$ CO pin : Hi-impedance
-	49	42	CTL3	The control terminal of output overcharge detection -3. <ul style="list-style-type: none"> ● $I_{CTL3} > I_{CTL3H}$ CO pin : Normal mode ● $I_{CTL3} < I_{CTL3L}$ CO pin : Hi-impedance
-	-	62	CTL4	The control terminal of output overcharge detection -4. <ul style="list-style-type: none"> ● $I_{CTL4} > I_{CTL4H}$ CO pin : Normal mode ● $I_{CTL4} < I_{CTL4L}$ CO pin : Hi-impedance
27-29, 32-40	1,13-15, 17,21,28,30, 33,41,57,60	14,23,25,30, 34,43,45,50, 54,63,65,70	NC	No Connect. (Floating)

Block Diagram

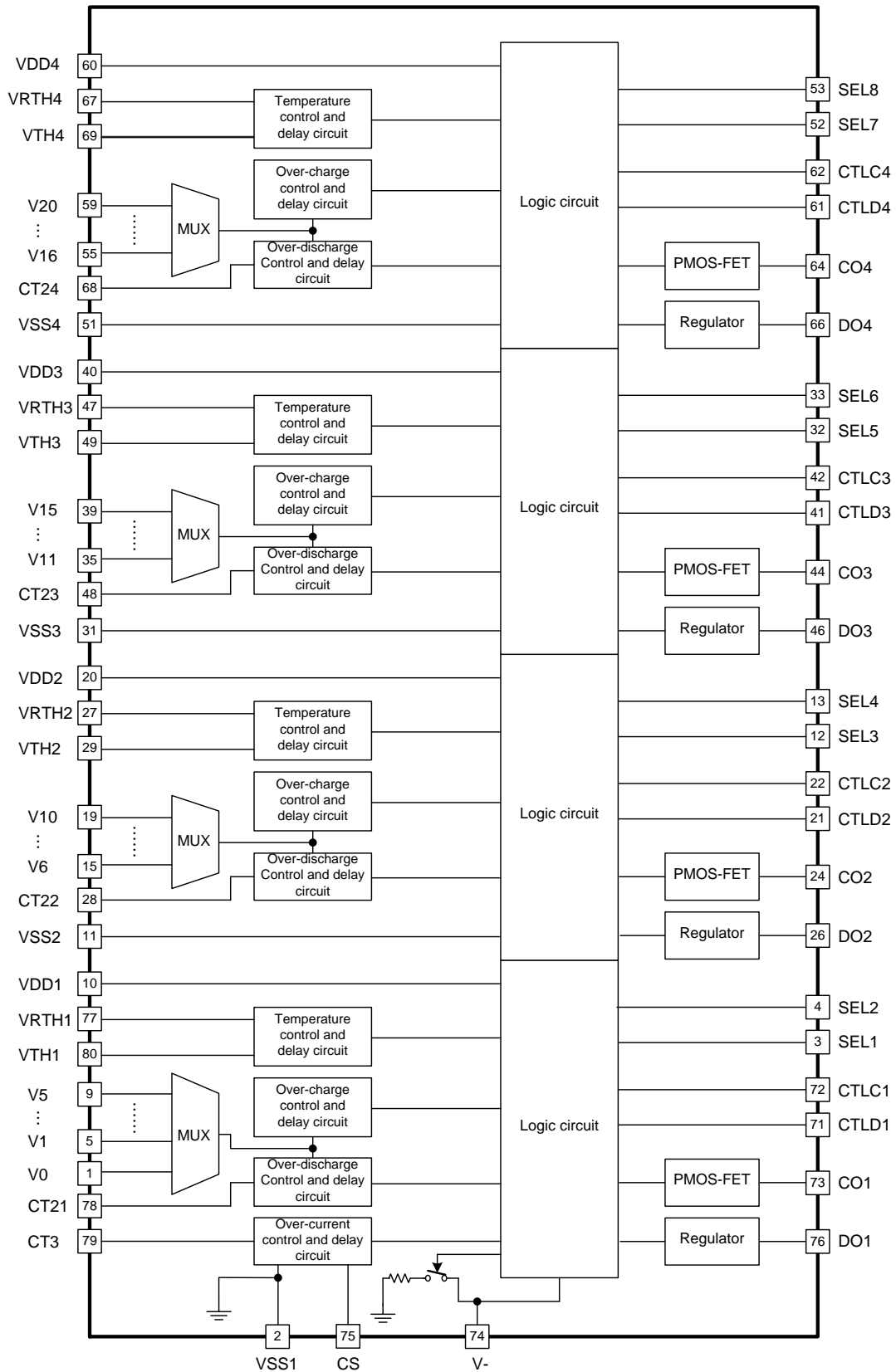
■ NT1672A



■ NT1673A



■ NT1674A



Ordering Information

NT167xA(x=2,3,4)-XXX XX

Package Type

- L1: LQFP-48L(NT1672A)
- L2: LQFP-64L(NT1673A)
- L3: LQFP-80L(NT1674A)

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)	Load short-circuiting detection voltage V_{SHORT} (V)	Charge over-current detection voltage V_{DET4} (V)
NT1672A	TDA	L1	3.750	3.600	2.200	2.700	—	0.100	0.400	-0.025
NT1672A	DQA	L1	4.200	4.100	2.800	3.000	0.100	0.200	0.400	-0.025
NT1672A	FPA	L1	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.025
NT1672A	FPB	L1	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.025
NT1672A	FPC	L1	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.050
NT1673A	TDA	L2	3.750	3.600	2.200	2.700	—	0.100	0.400	-0.025
NT1673A	DQA	L2	4.200	4.100	2.800	3.000	0.100	0.200	0.400	-0.025
NT1673A	FPA	L2	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.025
NT1673A	FPB	L2	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.025
NT1673A	FPC	L2	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.050
NT1674A	TDA	L3	3.750	3.600	2.200	2.700	—	0.100	0.400	-0.025
NT1674A	DQA	L3	4.200	4.100	2.800	3.000	0.100	0.200	0.400	-0.025
NT1674A	FPA	L3	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.025
NT1674A	FPB	L3	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.025
NT1674A	FPC	L3	4.250	4.150	2.700	3.000	0.100	0.200	0.400	-0.050

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

Table 2: Function

Product Name	Version Code	Package Type	Overcharge release condition	Over-discharge release condition	0 V battery charge function	Built-in breaking wire detector function	Delay time (Table 3)
NT1672A	All version	L1	Voltage release	(a) Voltage release or (b) Charge current release	Available	Yes	(1)
NT1673A	All version	L2			Available	Yes	(1)
NT1674A	All version	L3			Available	Yes	(1)

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

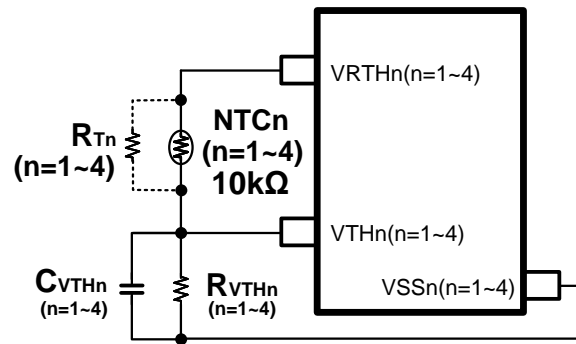
Table 3: Delay time

Delay time	Overcharge detection delay time t_{VDET1} (s)	Over-discharge detection delay time t_{VDET2} (s) (at $C_{CT2n(n=1-4)}=0.1\mu F$)	Discharge overcurrent-1 detection delay time t_{VDET31} (ms) (at $C_{CT3}=0.001\mu F$)	Discharge overcurrent-2 detection delay time t_{VDET32} (ms) (at $C_{CT3}=0.001\mu F$)	Load short-circuiting detection delay time t_{SHORT} (us)	Charge overcurrent 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%

Table 4: Temperature detection threshold

Product Name	Version Code	Package Type	Discharge over-temperature detection TH1 (°C)	Discharge over-temperature release RELTH1 (°C)	Charge over-temperature detection TH2 (°C)	Charge over-temperature release RELTH2 (°C)	Charge under-temperature detection TH3 (°C)	Charge under-temperature release RELTH3 (°C)	R _{VTH} resistor vs. Temperature detection threshold
NT1672A	TDA	L1	70	60	50	45	0	5	Table 5
NT1672A	DQA	L1	70	60	50	45	0	5	Table 5
NT1672A	FPA	L1	70	60	50	45	-10	-5	Table 6
NT1672A	FPB	L1	70	60	50	45	0	5	Table 5
NT1672A	FPC	L1	70	60	50	45	-10	-5	Table 6
NT1673A	TDA	L2	70	60	50	45	0	5	Table 5
NT1673A	DQA	L2	70	60	50	45	0	5	Table 5
NT1673A	FPA	L2	70	60	50	45	-10	-5	Table 6
NT1673A	FPB	L2	70	60	50	45	0	5	Table 5
NT1673A	FPC	L2	70	60	50	45	-10	-5	Table 6
NT1674A	TDA	L3	70	60	50	45	0	5	Table 5
NT1674A	DQA	L3	70	60	50	45	0	5	Table 5
NT1674A	FPA	L3	70	60	50	45	-10	-5	Table 6
NT1674A	FPB	L3	70	60	50	45	0	5	Table 5
NT1674A	FPC	L3	70	60	50	45	-10	-5	Table 6

Remark: For resistance matching, please refer to the recommended value of the BOM table



- If you don't need to use temperature protection function, you can use 10KΩ instead of NTC.

Table 5 : $R_{VTHn(n=1\sim4)}$ resistor vs. temperature detection threshold

NTC Thermistor ($\pm 1\%$) (Ω) 103AT(B25/85=3435K) or Panasonic_ERTJ0EG 103FA_BRT	R_{VTHn} ($n=1\sim4$) ($\pm 1\%$) (Ω)	Discharge over- temperature detection TH1 ($^{\circ}\text{C}$)	Discharge over- temperature release RELTH1 ($^{\circ}\text{C}$)	Charge over- temperature TH2 ($^{\circ}\text{C}$)	Charge over- temperature release RELTH2 ($^{\circ}\text{C}$)	Charge under- temperature TH3 ($^{\circ}\text{C}$)	Charge under- temperature release RELTH3 ($^{\circ}\text{C}$)
10K(NTC)	45.5K (91K//91K)	64.1	54.7	45.0	40.2	-3.4	1.4
	39K	69.5	59.8	49.8	44.8	0	4.9
10K(NTC) //180K(R_T)	39K	69.1	59.3	49.1	44.0	-3.7	1.9
10K(NTC) //100K(R_T)	39K	68.8	58.9	48.6	43.4	-7.1	-0.9
10K(NTC) //75K(R_T)	39K	68.5	58.5	48.1	42.8	-10.1	-3.1
10K(NTC) //150K(R_T)	33K	75.2	65.0	54.5	49.2	0.0	5.8
10K(NTC) //82K(R_T)	33K	74.9	64.5	53.8	48.5	-3.7	2.8
10K(NTC) //62K(R_T)	33K	74.6	64.2	53.4	47.9	-6.7	0.5
10K(NTC) //51K(R_T)	33K	74.4	63.9	53.0	47.5	-9.7	-1.8
10K(NTC) //82K(R_T)	30K	78.5	68.0	57.1	51.7	-0.7	5.7
10K(NTC) //62K(R_T)	30K	78.3	67.7	56.7	51.2	-3.4	3.6
10K(NTC) //47K(R_T)	30K	78.0	67.3	56.1	50.5	-7.4	0.6
10K(NTC) //39K(R_T)	30K	77.7	66.9	55.7	50.0	-11.3	-2.2



Table 6 : $R_{VTHn(n=1-4)}$ resistor vs. temperature detection threshold

NTC Thermistor (±1%) (Ω) 103AT(B25/85=3435K) or Panasonic_ERTJ0EG 103FA_BRT	R_{VTHn} (n=1~4) (±1%) (Ω)	Discharge over- temperature detection TH1 (°C)	Discharge over- temperature release RELTH1 (°C)	Charge over- temperature TH2 (°C)	Charge over- temperature release RELTH2 (°C)	Charge under- temperature TH3 (°C)	Charge under- temperature release RELTH3 (°C)
10K(NTC)	45.5K (91K//91K)	64.1	54.7	45.0	40.2	-13.1	-8.4
	39K	69.5	59.8	49.8	44.8	-9.9	-5.1
	34K (68K//68K)	74.6	64.5	54.2	49.1	-6.9	-2.0
	30K	79.3	68.9	58.4	53.1	-4.1	0.9
	26.7K (51K//56K)	83.8	73.2	62.3	56.9	-1.5	3.6