TECHNICAL SPECIFICATION
(Inatech)

CTNS_16S9P_BAT.PACK
(WORK CODE B24-0839)

Rev. 0

11 & 2024

1	2025.08.25.	REVISED FOR SPECIFICATION UPDATE	DU CHOI	SY LEE	TS MIN
0	2024.11.28.	ISSUED FOR TECH. SPEC.	DU CHOI	SY LEE	KEVIN YOO
Rev.	**Date**	**Description**	**Prepared by**	**Verified by**	**Approved by**

HISTORY

Rev.	Date	Description	Page
1	2025.08.25.	Specification update(2D DRAWING)	6

1. PRODUCT NAME: B24-0839_BATTERY PACK

2. MODEL N.: CTNS-16S9P- B24-0839

3. CLIENT: INATECH

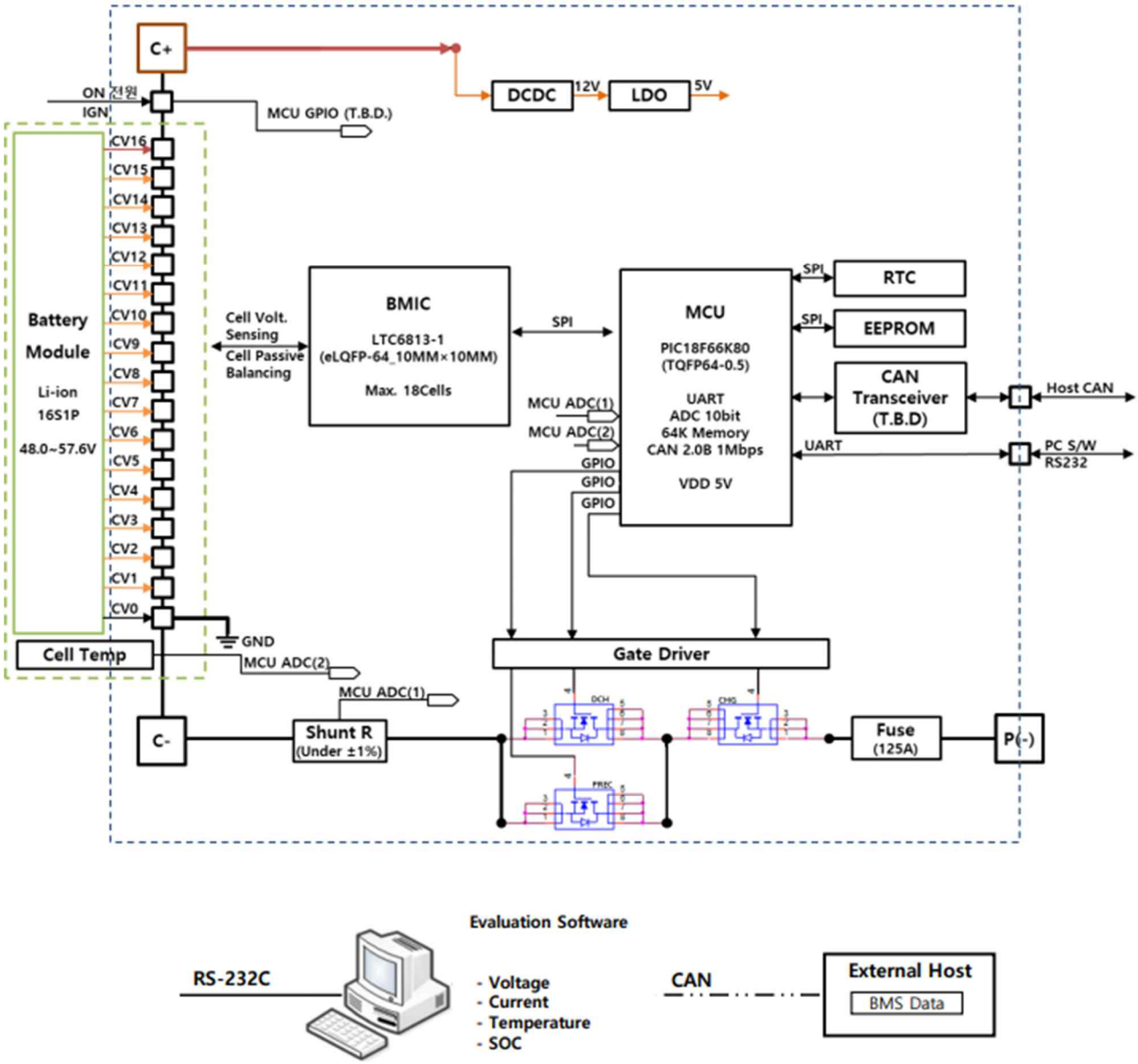
4. SPECIFICATION

No.	Subject	Confirmation	비고
1	적용 Application	Battery Pack for Inatech	Robot
2	Pack Size	W 520 * L 420 * H 110 (mm)	
3	Weight	abt. 33.45 kg	
4	IP Grade	-	
5	Enclosure material	Steel	
6	BMS 시스템 전원공급방식	■배터리전원□외부전원	
7	전원 On 방법 여부	□Push (self_reset), ■Push (Latch), □Remote □무	Sleep mode
8	통신 유무 및 방식	Protocol - CAN 2.0A Bitrate – 250Kbps Data Format –Intel (Big endian) Data Length – 8 Bytes Connector Type: DSub 9pin	-
9	적용 Battery Cell	Lithium-Iron Phosphate Cell(LFP 32700)	
10	Pack 구성(직/병렬)	16S9P (3.2V*16S*6Ah*9P = 2,764.8Wh)	공칭전압 기준
11	셀 용량/전압	Typ. 6Ah/3.2V	공칭전압 기준
12	Pack 사용 전압 범위	1) 최저전압 16S*3.0V = 48.0V 2) 공칭전압 16S*3.2V = 51.2V 3) 최대전압 16S*3.5V = 56.0V	
13	SOC, DOD 제한 범위	SOC 100%(56V) DOD 96.0%(48V)	
14	Cell Balancing 유무	적용	
15	Cell Balancing Type	■Passive, □Active	
16	개별 Cell 전압 Sensing 유무	■있음, □없음	
17	사용 온도 조건	5°C~50°C	
18	Normal 충전 전류(연속)	10.8A (0.2C)	
19	Normal 방전 전류(연속)	10.8A (0.2C)	
20	Max 사용 전류 및 Time	45A(Continuous) / 162A/1s	
21	Max 충전 전류	24A	
22	충전 Cut-off 전류	2.7A	
23	충방전 Path 분리 유무	□유, ■무	
24	기타 요청사항	-	

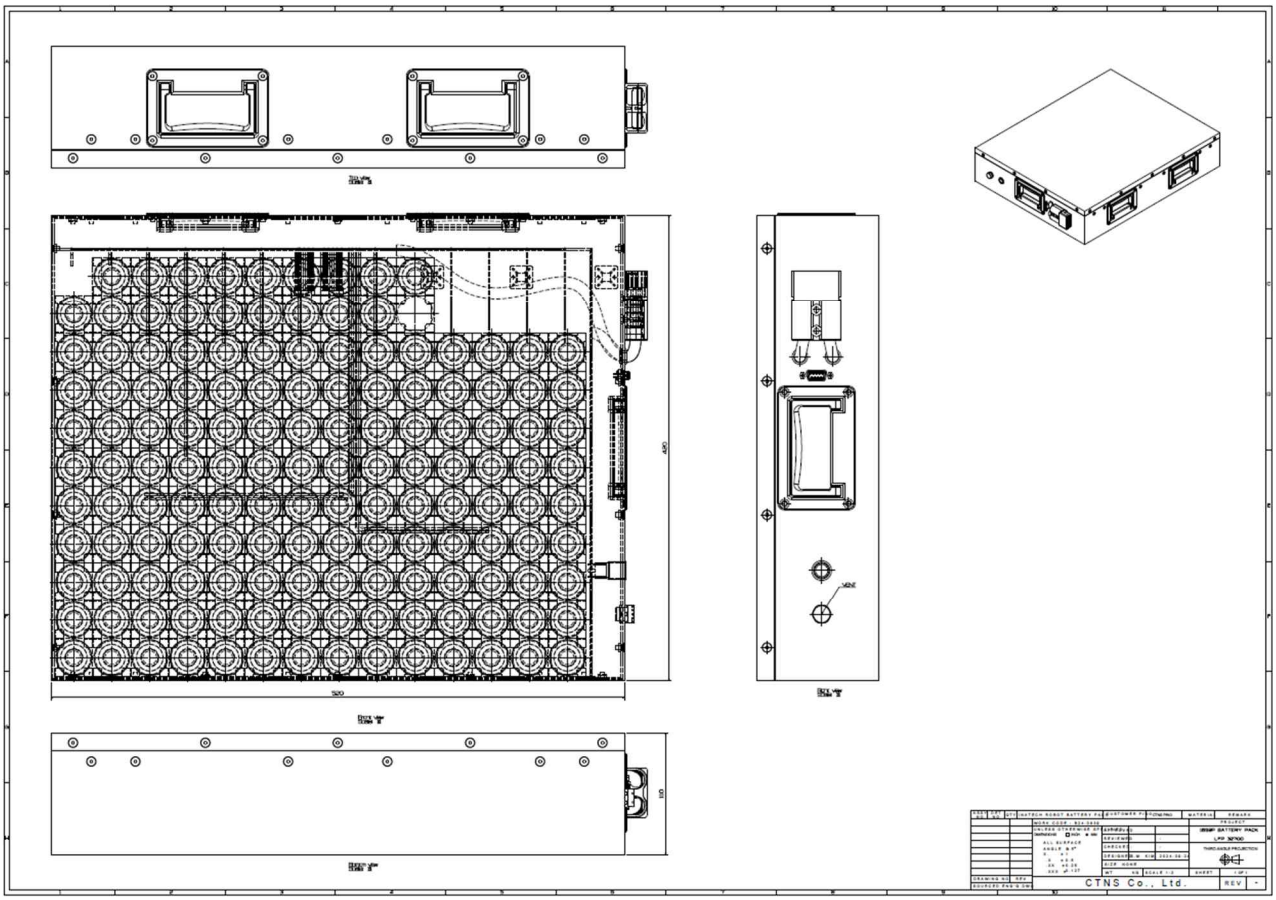
5. PROTECTION MATRIX

Description	Threshold	Delay	Action	Recovery
Pack over-voltage	57.6V	2sec	Cut-off & Protection Flag Set	< 56.0V
Pack under-voltage	46.4V	4sec		> 48.0V
Cell over-voltage	3.6V	2sec		< 3.55V
Cell under-voltage	2.9V	4sec		< 3.0V
Charge over-current (0.5C)	27A	2sec		충전 해제
Discharge over-current (1C)	54A	2sec		충전
Short Circuit	290A	20ms		충전
Over-temperature	60℃	2sec		55℃
Under-temperature	-5℃	2sec		2℃
Cell Imbalance	Diff. 200mV	2sec		< 50mV
Pack over-voltage	56.8V	2sec	Warning Flag Set	< 56.0V
Pack under-voltage	47.2V	4sec		> 48.0V
Cell over-voltage	3.55V	2sec		< 3.65V
Cell under-voltage	2.95V	4sec		< 3.0V
Charge over-current (0.4C)	22.0A	2sec		< 19.0A
Discharge over-current (0.9C)	49A	2sec		< 43A
Over-temperature	55℃	5sec		50℃
Under-temperature	0℃	5sec		2℃
Cell Imbalance	Diff. 100mV	2sec		< 50mV

6. BLOCK DIAGRAM



7. DRAWING



8. Communication

1) General
- Protocol type : CAN 2.0A
- Bitrate : 250Kbps
- Data length : 8bytes
- Message 전송 주기 : 1sec
- Connector : DSub-9pin Female (Pin2 – Can L / Pin7 – Can H)
- Data Format : Big Endian

2) CAN Protocol

► 배터리 정보 전송 (Battery → Master)

No.	Msg ID(1)	Description	Offset	Unit	Range
1	0x101	Hardware version	Byte[0]	0.1	0 ~ 255
		Firmware version	Byte[1]	0.1	0 ~ 255
		팩 전체 용량	Byte[3:2]	0.1Ah	0 ~ 65535
		팩 잔여 용량	Byte[5:4]	0.1Ah	0 ~ 65535
		Cycle count	Byte[7:6]	Count	0 ~ 65535
2	0x102	팩 전압	Byte[1:0]	0.1V	0 ~ 65535

		팩 전류(2)	Byte[3:2]	0.1A	-32768 ~ 32767
		SOC	Byte[5:4]	0.1%	0 ~ 1000
		SOH	Byte[6]	1%	0 ~ 100
		직렬 셀 수	Byte[7]	-	7, 10, 13
3	0x103	Battery status(NOTE)	Byte[0]	-	0, 1, 2
		Reserved	Byte[1]	-	-
		Protection Flag(NOTE)	Byte[3:2]	-	-
		Warning Flag(NOTE)	Byte[5:4]	-	-
		Balancing Status	Byte[7:6]	-	-
4	0x104	셀 온도 #1	Byte[1:0]	0.1℃	-32768 ~ 32767
		셀 온도 #2	Byte[3:2]	0.1℃	-32768 ~ 32767
		Reserved	Byte[5:4]	-	-
		Reserved	Byte[7:6]	-	-
5	0x105	셀 전압 #1	Byte[1:0]	mV	0 ~ 65535
		셀 전압 #2	Byte[3:2]	mV	0 ~ 65535
		셀 전압 #3	Byte[5:4]	mV	0 ~ 65535
		셀 전압 #4	Byte[7:6]	mV	0 ~ 65535
6	0x106	셀 전압 #5	Byte[1:0]	mV	0 ~ 65535
		셀 전압 #6	Byte[3:2]	mV	0 ~ 65535
		셀 전압 #7	Byte[5:4]	mV	0 ~ 65535
		Reserved	Byte[7:6]	-	-
7	0x107	셀 전압 #8	Byte[1:0]	mV	0 ~ 65535
		셀 전압 #9	Byte[3:2]	mV	0 ~ 65535
		셀 전압 #10	Byte[5:4]	mV	0 ~ 65535
		Reserved	Byte[7:6]	-	-
8	0x108	셀 전압 #11	Byte[1:0]	mV	0 ~ 65535
		셀 전압 #12	Byte[3:2]	mV	0 ~ 65535
		셀 전압 #13	Byte[5:4]	mV	0 ~ 65535
		Reserved	Byte[7:6]	-	
9	0x109	셀 전압 #14	Byte[1:0]	mV	0 ~ 65535
		셀 전압 #15	Byte[3:2]	mV	0 ~ 65535
		셀 전압 #16	Byte[5:4]	mV	0 ~ 65535
		Reserved	Byte[7:6]	-	-

(1) 배터리 ID가 '1'인 경우 Message ID는 0x101 ~ 0x108, 배터리 ID가 '7'인 경우 Message ID는 0x701 ~ 0x708 (ID x 0x100 + 1 ~ 8)

(2) 팩 전류는 Signed 데이터로 충전은 양수, 방전은 음수로 표기

NOTE

☞ **Battery Status**: 0: Idle(Ready) / 1: Discharge / 2: Charge

☞ **Protection Flag**

Bit	Description
Bit[0]	Pack over-voltage
Bit[1]	Pack under-voltage

Bit[2]	Cell over-voltage
Bit[3]	Cell under-voltage
Bit[4]	Discharge over-current
Bit[5]	Charge over-current
Bit[6]	Discharge over-temperature
Bit[7]	Charge over-temperature
Bit[8]	Discharge under-temperature
Bit[9]	Charge under-temperature
Bit[10]	Short circuit
Bit[11]	Cell imbalance
Bit[12]	BMS IC Error
Bit[13]	MOSFET Failure
Bit[15:14]	Reserved

☛ **Warning Flag**

Bit	Description
Bit[0]	Pack over-voltage
Bit[1]	Pack under-voltage
Bit[2]	Cell over-voltage
Bit[3]	Cell under-voltage
Bit[4]	Discharge over-current
Bit[5]	Charge over-current
Bit[6]	Over-temperature
Bit[7]	Under-temperature
Bit[15:8]	Reserved

3) Sleep Mode

- 배터리는 소비 전력을 줄이기 위해 셀 전압 2.5V 이하에서 Sleep Mode 에 진입한다.
- Sleep Mode 에서 배터리 출력은 차단되고, 통신은 중지된다.
- 배터리 스위치 RESET 시 sleep mode 로부터 Wake-up 된다.

9. Manufacturing

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