

X3 Series Battery Management System

ERX3-NMC16S30A, ERX3-NMC16S50A, ERX3-NMC16S70A, ERX3-NMC16S100A

1 Features

- Industrial grade BMS for 59.2V NMC battery
- Positive terminal (high side) switch
- AIS-156-A3 compliant
- Ultra-fast current response time: 8μS
- High tolerance to transient voltages
- Typical cell voltage accuracy of 1mV
- Supports 4 battery temperature sensors
- Onboard flash memory for up to 3 months of battery data storage
- Integrated audio alarm for fault indication
- Isolated CAN and RS-485 communication
- Dedicated peripheral attachment port with support for Display, GPRS, GPS and Bluetooth
- Parameter configuration through PC and mobile application

2 Applications

- Energy storage battery for inverters, UPS
- Low speed two-wheeler and three-wheeler electric vehicle
- Solar grade batteries up to 10kWhr



3 Description

ERX3 battery management system (BMS) is a robust, precise and extremely reliable industrial grade BMS device with best-in-class surge current handling and short circuit protection capability. An ultra-fast current response time along with an advanced short circuit detection mechanism enables the BMS to handle even direct shorting of battery terminals with thick conductor cables.

Unlike most other BMS solution where the protection switch is present on the negative terminal of the battery, ERX3 BMS implements positive terminal (high side) switch. In case of a fault, the positive terminal of the battery is disconnected.

During over load or short circuit conditions when the BMS protection switch turns – OFF, the BMS is subjected to large flyback voltage spike, especially if the load is inductive in nature. ERX3 BMS has an extremely high flyback current immunity and can successfully break over 600% rated current with inductive loads.

Other reliability features include isolated communication channels consisting of Iso-CAN, Iso-RS-485 and Iso-UART. This ensures that the BMS system can function safely even if the communication line is subjected to abnormal electrical conditions.

ERX3-NMC16S	
Cell Chemistry	LiNiMnCo ₂
Nominal Cell Voltage	3.7V
Series Cells	16
Nominal battery voltage	59.2V

4.1 General Specification

SN	PARAMETER	VALUE	UNIT	REMARKS
1	Nominal battery voltage	59.2	V	16S cell configuration
2	Operating current – active	8	mA	Battery voltage 60V
3	Operating current – Sleep	500	μA	Battery voltage 60V
4	Power MOSFET configuration	SPST	–	Positive terminal, High side
5	Internal resistance (Terminal to terminal)	5.0 3.0 1.5 1.1	mΩ	ERX3-NMC16S30A ERX3-NMC16S50A ERX3-NMC16S70A ERX3- NMC16S100A Max resistance $T_{BMS} = 50^{\circ}\text{C}$
6	Battery temperature sensors	4	–	
7	Onboard data logging period	90	Days	
8	Communication			CAN, RS-485
9	Communication isolation	YES	–	Isolated channels

4.2 Absolute Maximum Rating

SN	PARAMETER	MIN	MAX	UNIT
1	Battery voltage	–1	95	V
2	Cell voltage $V_N - V_{N-1}$	–0.2	5	V
3	Operating ambient temperature	–20	70	°C
4	Maximum load inductance ^{#1}		100	μH

Operation beyond the absolute maximum rating may cause immediate damage to the device.

4.3 Measurement Accuracy

SN	PARAMETER	TYP	MAX	TEST CONDITION
1	Cell voltage accuracy	1mV	1.6mV	–10°C to 60°C, 0V to 4.5V
2	Battery voltage accuracy	0.05%	0.01%	–10°C to 60°C, 10V to 30V
3	Current accuracy (0A – 120%)	2% ± 0.1A	4% ± 0.2A	25°C ambient, $T_{BMS} < 60^{\circ}\text{C}$
4	Current accuracy (> 120%)	3%	5%	25°C ambient, $T_{BMS} < 60^{\circ}\text{C}$
5	Current thermal drift	–	0.03%/°C	T_{BMS} 25°C to 90°C
6	Temperature accuracy	1°C	3°C	–10°C to 60°C
7	Measurement bandwidth ^{#2}	5Hz		
8	Data readout frequency	1Hz		

#1 Maximum load inductance is limited by the ability of the BMS to successfully interrupt currents as high as the short circuit limit without failure. If the nature of load is highly inductive, external TVS must be installed across the load. The clamping voltage of the TVS must not exceed the absolute maximum rated voltage of the BMS

#2 Measurement bandwidth refers to the bandwidth of current and voltage signal provided by the BMS to the external host after internal digital filtering. The actual acquisition and measurement bandwidth of the BMS is much higher. High bandwidth data is used only for internal functioning of the BMS.

4.4 Electrical Specification

SN	PARAMETER	VALUE	UNIT	REMARKS	
PACK VOLTAGE SPECIFICATION					
1	Over-charge entry threshold	67.7	V	Equivalent to 4.23V/Cell	
2	Over-charge exit threshold	64.0	V	Equivalent to 4.0V/Cell	
3	Over-discharge entry threshold	44.8	V	Equivalent to 2.80V/Cell	
4	Over-discharge exit threshold	48.0	V	Equivalent to 3.00V/Cell	
5	Sleep mode entry threshold	41.6	V	Equivalent to 2.60V/Cell	
6	Sleep mode exit threshold	44.0	V	Equivalent to 2.75V/Cell	
CELL VOLTAGE SPECIFICATION					
7	High voltage entry threshold	4.25	V		
8	High voltage exit threshold	4.10	V		
9	Low voltage entry threshold	2.75	V		
10	Low voltage exit threshold	2.90	V		
CURRENT SPECIFICATION					
11	Continuous current rating Discharge Charge	30	15	A	ERX3-NMC16S30A ERX3-NMC16S50A ERX3-NMC16S70A ERX3-NMC16S100A
		50	25		
		70	35		
		100	50		
12	Over current capacity	120 150 300	%	Overload duration: 60s Overload duration: 20s Overload duration: 1s	
13	Short circuit current threshold	550	%	% of continuous rating	
14	Short circuit reaction time	8	μs		
15	Short circuit auto-restart time	3	s	Auto restart after short removal	
16	Over load auto-restart time	10	s		
17	Max output load for successful hot-start after a fault trip	70	%	% of rated load current	
PRECHARGE SPECIFICATION					
18	Precharge resistance	30	Ω		
19	Maximum precharge duration	2	s		
20	Precharge repeat time	5	s		
	Maximum load capacitance for successful one shot precharge	3,500	μF		
BALANCER SPECIFICATION					
21	Balancer type	Passive			
22	Typical balancing current	50	mA		
23	Balancer ON ΔV_{Cell} threshold	30	mV	Coarse balancing	
		10	mV	Fine balancing	
24	Balancer OFF ΔV_{Cell} threshold	5	mV		
25	Low V_{Cell} stop threshold	3.30	V	Balancing stops below this voltage	
26	High V_{Cell} discharge threshold	3.65	V	Forced discharge is initiated on cells above this voltage regardless of cell voltage differential	

4.5 Thermal Specification

SN	PARAMETER	VALUE	UNIT	REMARKS
1	Maximum heat dissipation at rated current	5 8 10 12	W	ERX3-NMC16S30A ERX3-NMC16S50A ERX3-NMC16S70A ERX3-NMC16S100A
2	Thermal resistance $R\theta_{CA}$ Case to ambient (vertical mounting)	3.0	°C/W	
3	ΔT max at rated current	< 40	°C	
4	Working temperature range (ambient temperature)	-20 to 60	°C	Derate maximum permissible current above 50°C

4.6 Mechanical Specification

SN	PARAMETER	VALUE	UNIT	REMARKS
1	Dimensions	144x78x17.5	mm	
2	Weight	250	g	
3	Waterproofing	IP51		Protected from limited dust and water droplets

X3 BMS Mechanical Drawing

