Battery Monitoring IC for Automotive

KA84933UA
Product Brief

For additional information or question, please contact Nuvoton Technology Corporation Japan.
www.nuvoton.co.jp

■ IMPORTANT NOTICE

Regarding the specifications of this product, it is considered that you have agreed to the quality level and disclaimer described below.

Support for industry standards and quality standards

Functional safety standards for automobiles ISO26262	**Yes**
AECQ-100	**Yes**
Market failure rate	**10Fit**

Disclaimer

1. When the application system is designed using this IC, please design the system at your own risk. Please read, consider, and apply appropriate usage notes and description in this standard.

2. When designing your application system, please take into the consideration of break down and failure mode occurrence and possibility in semiconductor products. Measures on the systems such as, but not limited to, redundant design, mitigating the spread of fire, or preventing glitch, are recommended in order to prevent physical injury, fire, social damages, etc. in using the Nuvoton Technology Japan Corporation (hereinafter referred to as NTCJ) products.

3. When using this IC, for each actual application systems, verify the systems and the all functionality of this IC as intended in application systems and the safety including the long-term reliability at your own risk

4. Please use this IC in compliance with all applicable laws, regulations and safety-related requirements that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. NTCJ shall not be held responsible for any damage incurred as a result of this IC being used not in compliance with the applicable laws, regulations and safety-related requirements.

5. This IC does not have any security functions using cryptographic algorithms, such as authentication, encryption, tampering detection.

6. Unless this IC is indicated by NTCJ to be used in applications as meeting the requirements of a particular industry standard (e.g., ISO 9001, IATF 16949, ISO 26262, etc.), this IC is neither designed nor intended for use in such environments for that applications. NTCJ shall not be held responsible for not meeting the requirements of a particular industry standard.

7. Using IC that have been indicated as compliant with industry functional safety standards does not warrant that the application meets the requirements of industry functional safety standards. NTCJ shall not be held responsible for the application compliance with requirements of the particular industry functional safety standard.

8. Unless this IC is indicated by NTCJ to be used in applications as meeting the requirements of a particular quality standard (e.g., AECQ-100, etc.), this IC is neither designed nor intended for use in such the environments for that applications. NTCJ shall not be held responsible for not meeting the requirements of a particular quality standard.

9. In case of damages, costs, losses, and/or liabilities incurred by NTCJ arising from customer's non-compliance with above from 1 to 8, customer will indemnify NTCJ against every damages, costs, losses and responsibility.

Automotive Battery Management IC for Multi-cell Stacked Battery System

Characteristics

- Supports up to 20 battery cells connected in series
- Measurement accuracy: less than 1.5 mV (before shipment)
- Redundant measurement system for functional safety
- Support both event-driven and free-run measurement mode
- Low shutdown current less than 1uA
- 2.5 MHz serial interface with packet error check function
- 63 ICs daisy chain connection using twisted pair cables for propagation of differential signals
- Bi-directional daisy communication
- Alarm function for detecting overcharging (OV) or over-discharging (UV)
- Options for cell-balance function
  - Internal 200mA cell-balance by built-in MOS
  - External cell-balance by driving external NMOS
- 16-bit ADC
- Capable of Busbar connection and negative voltage measurement
- 13 CH of general purpose input/output (GPIO) which can be configured as analog input or digital input/output
- I^2C serial bus interface
- Designed for ISO26262-compliant systems
- AEC-Q100 compliance
- Package: TQFP80L 14x14x1mm^3, Lead_Pitch 0.65mm

Overview

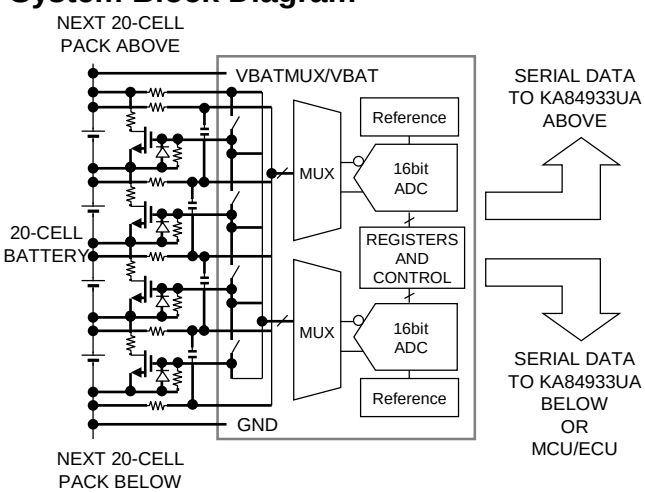
KA84933UA series comprises 20 channel multi-cell stacked battery management ICs which measure up to 100 V. This makes it ideal for applications that require the control of high voltages, such as those used in electric vehicle systems.

Another important feature of this IC is system redundancy, which is built in to support functional safety. Cell voltage is measured with two separate independent systems: a highly precise data acquisition system and a fault surveillance system.

Applications

- Electric and Hybrid Electric Vehicles (EV, PHEV, HEV)
- Other power applications which utilize multi stacked battery cells

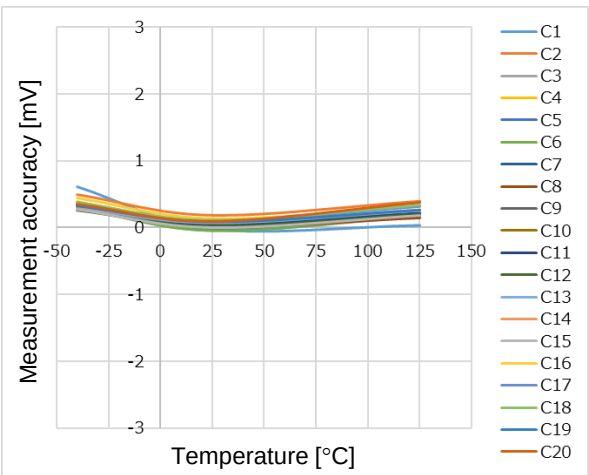
System Block Diagram



Notes: This is just an example of a circuit set: it is not guaranteed to function identically to the final production version.
When designing a set for production, make sure to carefully evaluate and verify the circuitry.

Representative Characteristics

Measurement accuracy



Application circuit example (20cells connection), VBAT=74V , cell voltage ΔCn (C_n-C_{n-1}) = 3.7V

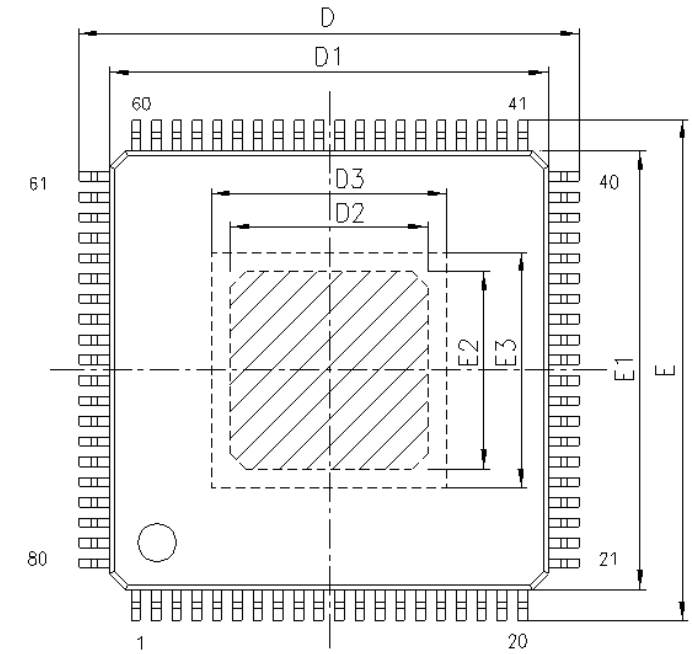
Part Numbers List

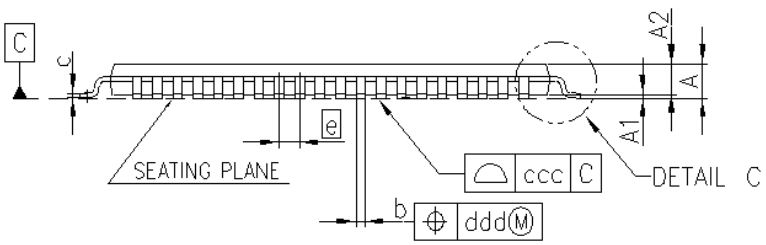
Part number		Functional Safety		Voltage meas.	Aging accuracy	Negative voltage meas.	Bi-directional comm.	Daisy SPI
		RANK	GPIO *1	*2	*3	*4		
Advanced grade								
	KA84933UA	Standard	No	EV+FR	Yes	Yes	Yes	1.1Mbps 2.5Mbps
	KA84939UA	Enhanced	Yes	EV+FR	Yes	Yes	Yes	1.1Mbps 2.5Mbps
Basic grade								
	KA84923UA	Standard	No	FR	No	No	No	1.1Mbps 2.5Mbps

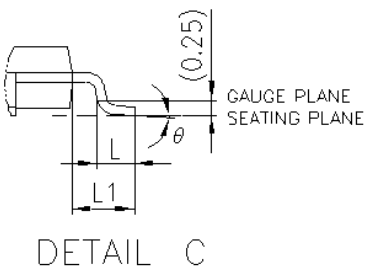
*1 : Enhanced safety mechanism including redundant GPIO voltage measurement is available.
*2 : EV (event-driven measurement sequence) / FR (free-run sequence)
*3 : Ensured measurement accuracy after soldering (MSL3 preconditioning) and aging (1000h HTOL at Tj=150˚C) at IC level.
*4 : Supported busbar connection with negative voltage measurement. .

Dimensions

TQFP80L 14x14mm², Thickness 1.00mm, Lead_Pitch 0.65mm, Lead_Length 1.00mm, EP_Size 6.3x6.3mm²







VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

SYMBOLS	MIN.	NOM.	MAX.
A	–	–	1.20
A1	0.05	0.10	0.20
A2		1.00REF	
D	15.80	16.00	16.20
D1	13.90	14.00	14.10
D2	6.30	–	–
D3	–	–	7.50
E	15.80	16.00	16.20
E1	13.90	14.00	14.10
E2	6.30	–	–
E3	–	–	7.50
L	0.45	0.60	0.75
L1		1.00REF	
b	0.25	0.30	0.35
c	0.10	0.15	0.20
e		0.65BSC	
ccc		0.10	
ddd		0.13	
θ	0.0°	–	8.0°

Usage Notes

1. Pay attention to the direction of the IC. When mounting it in the wrong direction onto the PCB (printed-circuit-board), it might be damaged.
2. Pay attention in the PCB (printed-circuit-board) pattern layout in order to prevent damage due to short circuit between pins. In addition, refer to the Pin Description for the pin configuration.
3. Perform visual inspection on the PCB before applying power, otherwise damage might happen due to problems such as solder-bridge between the pins of the IC. Also, perform full technical verification on the assembly quality, because the same damage possibly can happen due to conductive substances, such as solder ball, that adhere to the IC during transportation.
4. Take notice in the use of this IC that it might be damaged when an abnormal state occurs such as output pin - VBAT short, output pin – CVDD fault (Power supply fault), output pin-GND short (Ground fault), output-to-output-pin short (load short), or leakage current between pins. Safety measures such as installation of fuses are recommended because the extent of the above-mentioned damage will depend on the current capability of the power supply.
5. The protection circuit is for maintaining safety against abnormal operation. Therefore, the protection circuit should not work during normal operation.
   Especially for the thermal protection circuit, if the area of safe operation or the absolute maximum rating is momentarily exceeded due to output pin to VBAT short, output pin to CVDD short (Power supply fault), or output pin to GND short (Ground fault), the IC might be damaged before the thermal protection circuit could operate.
6. Verify the risks which might be caused by the malfunctions of external components.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, "Insecure Usage".

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer's risk, and in the event that third parties lay claims to Nuvoton as a result of customer's Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.