

Automotive HV battery pack monitor



TQFP48L
7x7x1 mm


Product status link

[L9965C](#)

Product summary

Order code	Package	Packing
L9965C-TR	TQFP48L	Tape and reel

Features

- AEC-Q100 qualification ongoing 
- Temperature grade 1: -40 °C to +125 °C operating temperature range
- HBM ESD classification level 2
- CDM ESD classification level C4B
- Full ISO26262 compliant, ASIL-D systems ready, documentation available
- 2 independent current sense ADCs
 - 18-bit resolution
 - Input range = ± 100 mV
 - < 0.1% gain error, < 1 LSB offset
 - Integrated programmable digital filtering with cutoff frequency from 3.5 kHz to 5 Hz for instantaneous current measurement
 - Fully redundant architecture with cross-check on every current sample
- Integrated coulomb counter
- Fully redundant short circuit detector with programmable threshold and ultrafast reaction time
- 2 programmable (level/PWM encoded) FAULT outputs
- Programmable DC-DC converter controller to enable fast and flexible DC-link precharge
- 10 gate predrivers also compatible with optocouplers
- 11 fully differential analog inputs
- 7 configurable GPIO
- SPI and I²C controller peripherals to interface up to two external EEPROM, L9965P pyro driver, sensors
- SPI target for direct MCU interface
- 3.3 V (VTREF) and 5 V (V5V) LDOs for external sensors supply and biasing
- Embedded NVM for configuration parameters storage and runtime configuration integrity check
- Ultrafast vertical interface peripheral for isolated communication
- Compatible with 18S L9965A cell monitoring chip with a max desynchronization time of 7 μ s at system level

Application

- Automotive battery monitoring systems
- Energy storage systems
- UPS

Description

The L9965C is a current, voltage, charge and isolation monitor for HV battery packs. It is part of the L9965 chipset for battery management systems and can be inserted as an addressable element of the same isolated daisy chain (VIF).

1 Overview

The L9965C is a highly integrated pack monitor, providing several functionalities of the battery junction box.

It monitors instantaneous pack current by means of an external shunt resistor and provides current measurements synchronized with battery cells voltage when used with L9965A cell monitoring chip. Current is also integrated over time to accumulate pack charge information.

L9965C also monitors pack current to detect overcurrent and short-circuit events.

Current measurement function and short-circuit detection are fully redundant and embed safety checks, targeting ASIL-D systems.

The IC also features 10 gate predrivers to drive external FETs and optocouplers.

They can be used with 11 analog inputs to perform fully differential voltage measurements, monitoring several key voltages in the HV system (for example DC-Link connectors, charger connectors, etc.) and the isolation between battery terminals and chassis, with ASIL-A compliance.

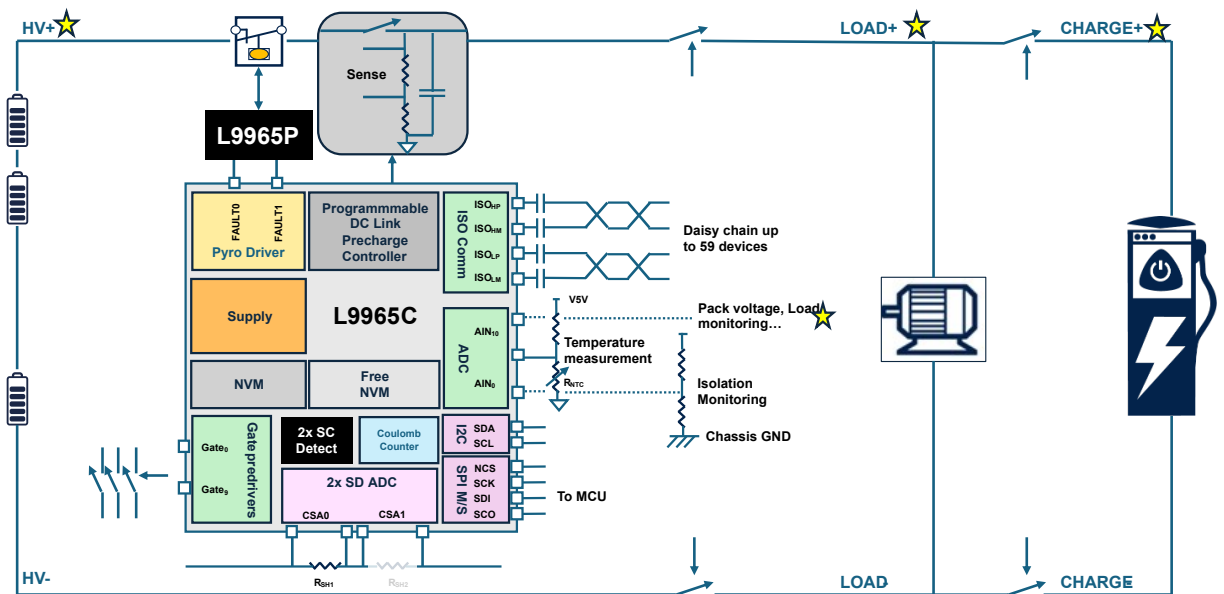
Voltage ADC supports both absolute and ratiometric measurements to provide maximum flexibility and accuracy for temperature measurement via external NTCs.

The L9965C integrates 5 V and 3.3 V LDOs available for biasing external sensors and supplying companion chips such as ST automotive EEPROMs. A SPI controller and an I²C controller allow interfacing the IC with external sensors and EEPROMs.

L9965C has been designed to enable easy and reliable interaction with the L9965P companion pyro-switch driver. The chipset has been designed to achieve ultrafast detection and reaction to short-circuit failures.

The device embeds a fully configurable DC-link precharge controller algorithm to implement fast active charge of the DC-Link. The active precharge controller provides an alternative and cost-effective solution to the traditional passive RC network that requires a very large high-power resistor, with a saving in the BOM and in the PCB space.

Figure 1. L9965C battery pack controller



The L9965C embeds a functional state machine to optimize system power consumption without compromising safety functions:

- **NORMAL:** full operation mode.
- **CYCLIC WAKEUP:** low-power mode triggered by L9965T companion chip, to perform cyclic diagnostics during low-power operation. In this state the device is sensitive to wake up tones both from the VIF in case of fault and from the SPI by the MCU.
- **STANDBY:** low-power mode for managing battery idle state, with charge/discharge control for leakage detection. In this state the device is sensitive to wake up tones both from the VIF in case of fault and from the SPI by the MCU.

- DEEP SLEEP: Ultralow power state for managing long inactivity periods. In this state the device is sensitive to wakeup tones both from the VIF in case of fault and from the SPI by the MCU.

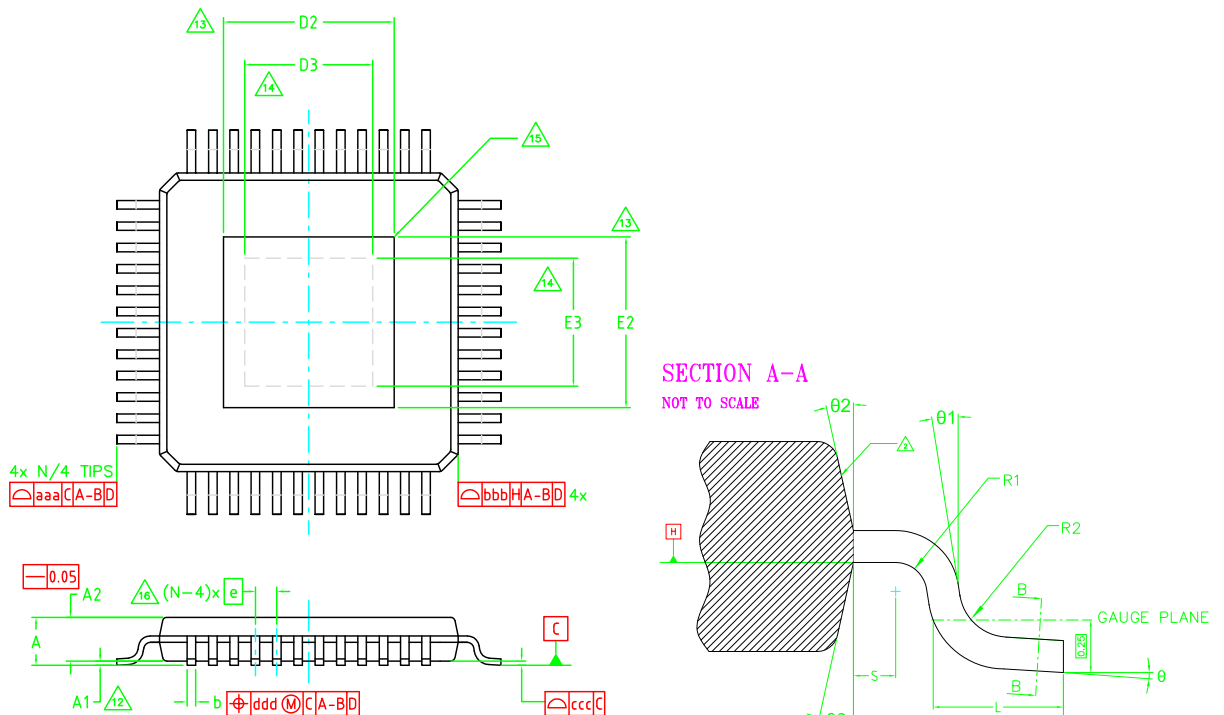
2 Package information

To meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions, and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 TQFP48L (7x7x1 mm exposed pad down) package information

Figure 2. TQFP48L (7x7x1 mm exposed pad down) package outline

BOTTOM VIEW



TOP VIEW

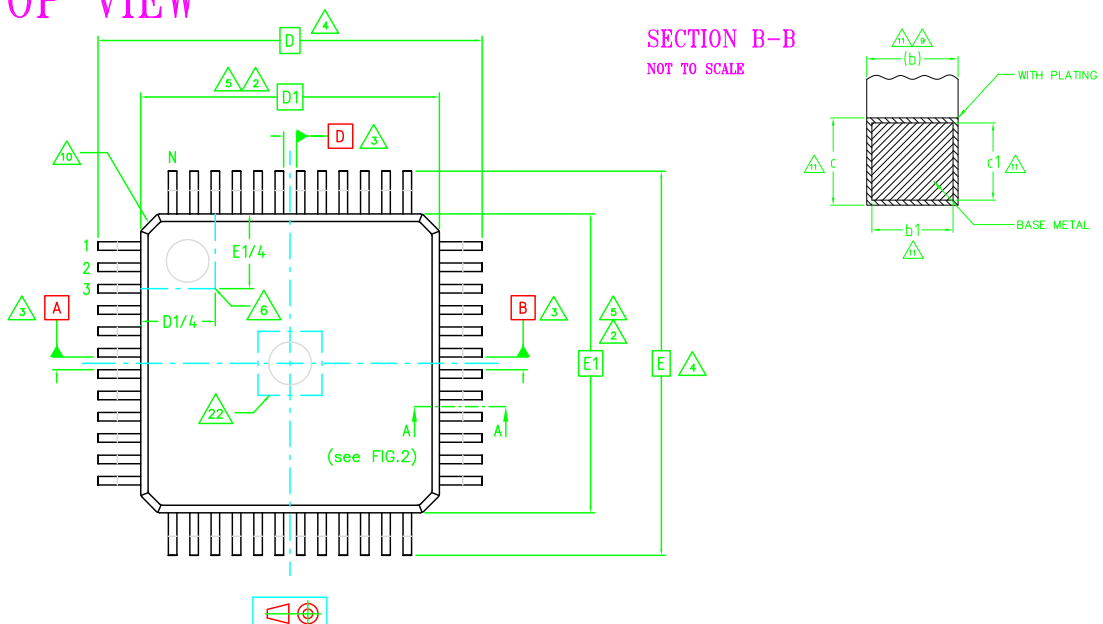


Table 1. TQFP48L (7x7x1 mm exposed pad down) package mechanical data

Symbol	Dimensions in mm		
	Min.	Typ.	Max.
θ	0°	3.5°	7°
$\theta 1$	0°	-	-
$\theta 2$	10°	12°	14°
$\theta 3$	10°	12°	14°
A	-	-	1.20
A1	0.05	-	0.15
A2	0.95	1.00	1.05
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
c	0.09	-	0.16
c1	0.09	-	0.16
D	9.00 BSC		
D1	7.00 BSC		
D2	-	-	5.37
D3	3.40	-	-
e	0.50 BSC		
E	9.00 BSC		
E1	7.00 BSC		
E2	-	-	5.37
E3	3.40	-	-
L	0.45	0.60	0.75
L1	1.00 REF		
N	48		
R1	0.08	-	-
R1	0.08	-	0.20
S	0.20	-	-
Tolerance of form and position			
aaa	0.20		
bbb	0.20		
ccc	0.08		
ddd	0.08		

Revision history

Table 2. Document revision history

Date	Version	Changes
10-Oct-2024	1	Initial release.
06-Nov-2024	2	Removed watermark "Restricted".

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