FW device driver manual

Introduction

This document describes the software stack for the **L9962** battery management IC, including device driver, interface, hardware abstraction layers, and utility macros. The stack provides a robust and portable solution for cell monitoring, current sensing, balancing, diagnostics, and configuration via I2C, with STM32 HAL as the reference platform.

1 Main modules description

1.1 Modules and dependencies overview

Figure 1. **Drivers architecture**

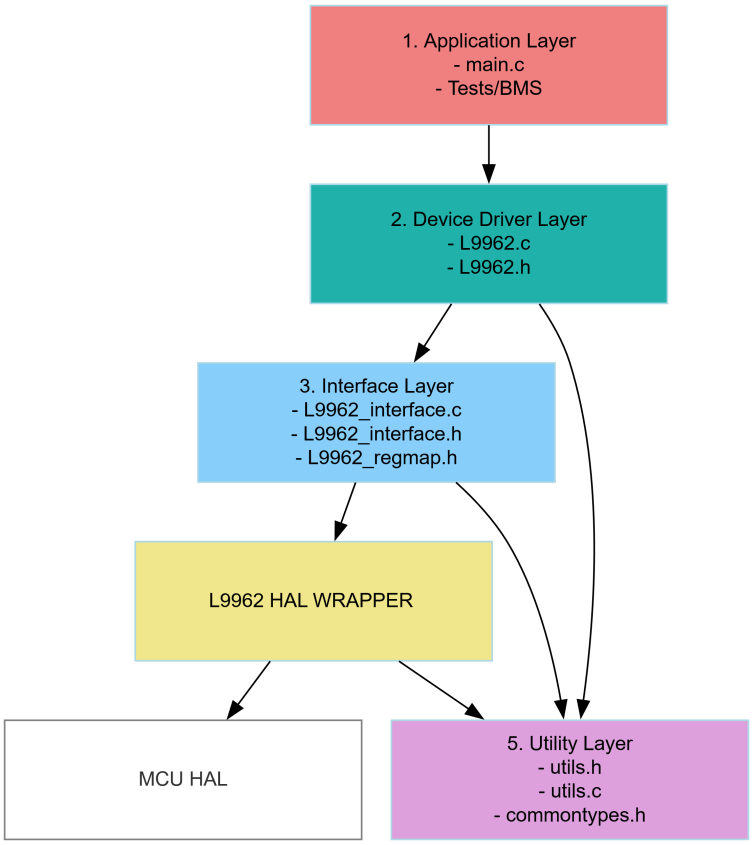
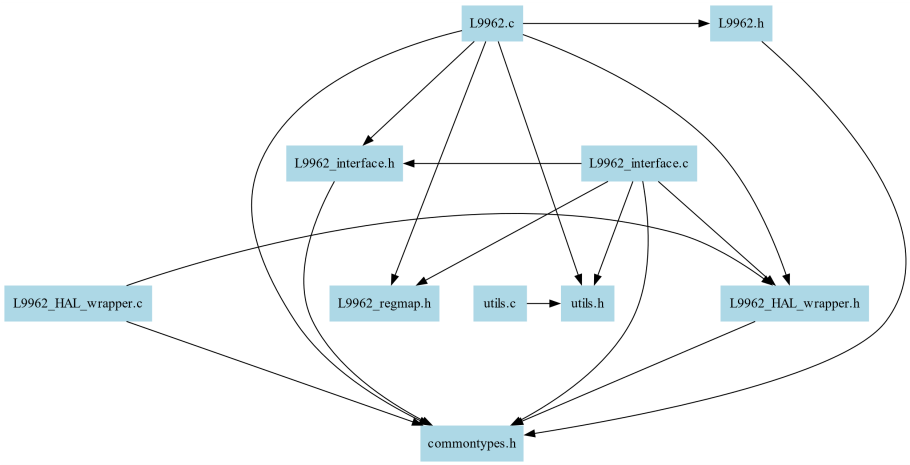


Table 1. **Dependencies table**

Module	Depends On
L9962 Driver	L9962_interface, L9962_regmap, utils, commontypes, L9962_HAL_wrapper
L9962 Interface	L9962_HAL_wrapper, commontypes, utils, L9962_regmap
L9962 HAL Wrapper	STM32 HAL, main.h, commontypes
utils	-
commontypes	-

Figure 2. **Dependencies diagram**



Files:

- L9962.c, L9962.h, L9962_regmap.h

Description:

Implements all device-specific logic for the L9962, including cell monitoring, current measurement, balancing, threshold configuration, diagnostics, and NVM operations.

Key data structures & types:

- CELL_FILTER_T, CURR_FILTER_T, SC_FILTER_T, HS_LS_T, etc.
- Mask enums for VB, die temp, current, balancing, NTC, and cell events.

Important functions:

Initialization, enable/disable, configuration, measurement, diagnostics, NVM, FSM, and mask management.

1.2 L9962 interface module

Files:

- L9962_interface.c, L9962_interface.h

Description:

Handles I²C protocol, CRC calculation, register read/write, and device address management. Abstracts low-level communication for the driver.

Key functions:

- L9962_write_reg, L9962_read_reg, L9962_crc_use, L9962_i2c_crc_check_set/get, etc.

1.3 L9962 HAL wrapper module

Files:

- L9962_HAL_wrapper.c, L9962_HAL_wrapper.h

Description:

Microcontroller (MCU) abstraction layer for I²C, GPIO, and delay. Only this file needs to be ported for a new MCU.

Key Functions:

- HALWRP_I2C_write/read, HALWRAP_read_pin, HALWRAP_write_pin, HALWRP_delay_ms

Hardware Resources:

- I²C interface (e.g., hi2c2)
- GPIOs: WKP, NSHIP, FLTN, RDY

1.4 Utility macros module

Files:

- utils.h, utils.c (currently empty)

Description:

Provides essential macros for register and bitfield manipulation, used throughout the driver and interface layers.

Key Macros:

- UTILS_mask_data(width, offset): Create a bitmask for a field.
- UTILS_set_field_in_reg(reg, field, field_width, field_offset): Set a field in a register.
- UTILS_get_field_from_reg(reg, field_width, field_offset): Extract a field from a register.
- UTILS_SignExtendINT(data, dataSize): Sign-extend an integer value.

Usage Example:

```
uint16_t reg;
UTILS_set_field_in_reg(reg,value, 3, 5); // Set a 3-bit field at offset 5
uint8_t field = UTILS_get_field_from_reg(reg,3, 5);  // Extract the same field
```

Note:

- utils.c is currently a placeholder for future utility function implementations.

2 L9962 driver function descriptions

2.1 Summary table

Table 2. **Summary table**

Function name	Purpose
L9962_CELL_enable_set	Enable monitoring for selected cells via bitmask
L9962_CELL_enable_get	Get current enabled cell bitmask
L9962_CELL_filter_set	Set cell voltage filter time constant
L9962_CELL_filter_get	Get cell voltage filter time constant
L9962_CELL_UV_set	Set cell undervoltage thresholds and counter
L9962_CELL_UV_get	Get cell undervoltage thresholds and counter
L9962_CELL_OV_set	Set cell overvoltage thresholds and counter
L9962_CELL_OV_get	Get cell overvoltage thresholds and counter
L9962_VB_enable_set	Enable/disable VB monitoring and UVLO
L9962_VB_enable_get	Get VB monitoring and UVLO enable status
L9962_NTC_enable_set	Enable/disable NTC monitoring
L9962_NTC_enable_get	Get NTC monitoring enable status
L9962_tmeas_set	Set measurement period in ms
L9962_tmeas_get	Get measurement period in ms
L9962_CURR_enable_set	Enable/disable current measurement and Coulomb counter
L9962_CURR_enable_get	Get current measurement and Coulomb counter enable status
L9962_CURR_filter_set	Set current filter time constant
L9962_CURR_filter_get	Get current filter time constant
L9962_BAL_en_set	Enable balancing for selected cells
L9962_BAL_en_get	Get balancing enable bitmask
L9962_CB_enable_set	Enable/disable charge/discharge circuit breaker
L9962_CB_enable_get	Get charge/discharge circuit breaker enable status
L9962_VB_UV_set	Set VB undervoltage threshold and counter
L9962_VB_OV_set	Set VB overvoltage threshold and counter
L9962_VB_UV_get	Get VB undervoltage threshold and counter
L9962_VB_OV_get	Get VB overvoltage threshold and counter
L9962_NTC_OT_set	Set NTC overtemperature thresholds and counter
L9962_NTC_OT_get	Get NTC overtemperature thresholds and counter
L9962_NTC_UT_set	Set NTC undertemperature threshold and counter
L9962_NTC_UT_get	Get NTC undertemperature threshold and counter
L9962_VB_vs_sum_set	Set VB vs sum threshold
L9962_VB_vs_sum_get	Get VB vs sum threshold
L9962_NTC_MEAS_get	Get NTC measurement value
L9962_VB_diag_get	Get VB diagnostic flags
L9962_NTC_diag_get	Get NTC diagnostic flags

Function name	Purpose
L9962_VB_meas_get	Get VB voltage measurement
L9962_Vcell_meas_get	Get cell voltage measurement
L9962_DIE_TEMP_meas_C_get	Get die temperature in Celsius
L9962_chipid_get	Get silicon and metal ID
L9962_devaddr_get	Get device address
L9962_CELL_sum_meas_get	Get sum of all cell voltages
L9962_CELL_diag_get	Get cell diagnostic flags
L9962_CURR_inst_meas_get	Get instantaneous current measurement
L9962_CURR_overcurr_set	Set overcurrent thresholds and enable
L9962_CURR_overcurr_get	Get overcurrent thresholds and enable
L9962_BAL_threshold_set	Set balancing undervoltage threshold and counter
L9962_BAL_threshold_get	Get balancing undervoltage threshold and counter
L9962_OVC_diag_get	Get overcurrent diagnostic flags
L9962_VB_mask_set	Set VB event/fault mask
L9962_VB_mask_get	Get VB event/fault mask
L9962_DIE_T_mask_set	Set die temperature event/fault mask
L9962_DIE_T_mask_get	Get die temperature event/fault mask
L9962_CURR_mask_set	Set current event/fault mask
L9962_CURR_mask_get	Get current event/fault mask
L9962_DIE_TEMP_diag_get	Get die temperature diagnostic flags
L9962_BAL_mask_set	Set balancing event/fault mask
L9962_BAL_mask_get	Get balancing event/fault mask
L9962_BAL_diag_get	Get balancing diagnostic flags
L9962_CB_mode_set	Set charge/discharge circuit breaker mode (HS/LS)
L9962_CB_mode_get	Get charge/discharge circuit breaker mode (HS/LS)
L9962_NTC_mask_set	Set NTC event/fault mask
L9962_NTC_mask_get	Get NTC event/fault mask
L9962_FUSE_ext_get	Get fuse deployment status
L9962_CELLS_mask_set	Set cell event/fault mask
L9962_CELLS_mask_get	Get cell event/fault mask
L9962_CURR_short_set	Set short-circuit detection parameters
L9962_CURR_short_get	Get short-circuit detection parameters
L9962_CURR_short_diag_get	Get short-circuit diagnostic flags
L9962_FUSE_deploy	Deploy fuse
L9962_global_diag_get	Get global diagnostic status
L9962_NVM_operation	Perform NVM upload/download operation
L9962_NVM_upload_cnt_get	Get NVM upload counter
L9962_CURR_ADC_correction_get	Get current ADC gain correction factor
L9962_CURR_ADC_correction_set	Set current ADC gain correction factor
L9962_i2c_crc_check_set	Enable/disable I2C CRC check
L9962_i2c_crc_check_get	Get I2C CRC check enable status

Function name	Purpose
L9962_CURR_cc_meas_get	Get Coulomb counter measurement
L9962_WAKEUP_set	Enable/disable wake-up function
L9962_NSHIP_get	Get nSHIP pin status
L9962_RDY_get	Get RDY pin status
L9962_FLTN_get	Get FLTN pin status
L9962_FSM_go_to	Set device to FSM state

2.2 Detailed descriptions

L9962_CELL_enable_set

- **Purpose:** Enable monitoring for selected cells using a bitmask.
- **Parameters:** *bit_msk* (bitmask of cells to enable)
- **Returns:** Result code indicating success or error.

L9962_CELL_enable_get

- **Purpose:** Get the current enabled cell bitmask.
- **Parameters:** *bit_msk* (pointer to store bitmask)
- **Returns:** Result code indicating success or error.

L9962_CELL_filter_set

- **Purpose:** Set the filter time constant for cell voltage measurements.
- **Parameters:** *Cell_filter* (filter time constant)
- **Returns:** Result code indicating success or error.

L9962_CELL_filter_get

- **Purpose:** Get the current filter time constant for cell voltage measurements.
- **Parameters:** *Cell_filter* (pointer to store filter time constant)
- **Returns:** Result code indicating success or error.

L9962_CELL_UV_set

- **Purpose:** Set undervoltage thresholds and counter for cell monitoring.
- **Parameters:** *th_uV* (threshold in uV), *severe_th_uV* (severe threshold in uV), *cnt_th* (counter threshold)
- **Returns:** Result code indicating success or error.

L9962_CELL_UV_get

- **Purpose:** Get undervoltage thresholds and counter for cell monitoring.
- **Parameters:** *th_uV*, *severe_th_uV*, *cnt_th* (pointers to store values)
- **Returns:** Result code indicating success or error.

L9962_CELL_OV_set

- **Purpose:** Set overvoltage thresholds and counter for cell monitoring.
- **Parameters:***th_uV*, *severe_th_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_CELL_OV_get

- **Purpose:** Get overvoltage thresholds and counter for cell monitoring.
- **Parameters:***th_uV*, *severe_th_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_VB_enable_set

- **Purpose:** Enable or disable VB (battery voltage) monitoring and UVLO.
- **Parameters:***en* (enable), *uvlo_en* (UVLO enable)
- **Returns:** Result code indicating success or error.

L9962_VB_enable_get

- **Purpose:** Get VB monitoring and UVLO enable status.
- **Parameters:***en*, *uvlo_en* (pointers to store status)
- **Returns:** Result code indicating success or error.

L9962_NTC_enable_set

- **Purpose:** Enable or disable NTC (temperature sensor) monitoring.
- **Parameters:***en* (enable)
- **Returns:** Result code indicating success or error.

L9962_NTC_enable_get

- **Purpose:** Get NTC monitoring enable status.
- **Parameters:***en* (pointer to store status)
- **Returns:** Result code indicating success or error.

L9962_tmeas_set

- **Purpose:** Set the measurement period in milliseconds.
- **Parameters:***time_ms* (measurement period)
- **Returns:** Result code indicating success or error.

L9962_tmeas_get

- **Purpose:** Get the measurement period in milliseconds.
- **Parameters:***time_ms* (pointer to store period)
- **Returns:** Result code indicating success or error.

L9962_CURR_enable_set

- **Purpose:** Enable or disable current measurement and Coulomb counter.
- **Parameters:***inst_en* (instantaneous current enable), *coulomb_cnt* (Coulomb counter enable)
- **Returns:** Result code indicating success or error.

L9962_CURR_enable_get

- **Purpose:** Get current measurement and Coulomb counter enable status.
- **Parameters:** *inst_en*, *coulomb_cnt* (pointers to store status)
- **Returns:** Result code indicating success or error.

L9962_CURR_filter_set

- **Purpose:** Set the filter time constant for current measurements.
- **Parameters:***Curr_filter* (filter time constant)
- **Returns:** Result code indicating success or error.

L9962_CURR_filter_get

- **Purpose:** Get the filter time constant for current measurements.
- **Parameters:***Curr_filter* (pointer to store filter time constant)
- **Returns:** Result code indicating success or error.

L9962_BAL_en_set

- **Purpose:** Enable balancing for selected cells using a bitmask.
- **Parameters:***bit_mask* (bitmask of cells)
- **Returns:** Result code indicating success or error.

L9962_BAL_en_get

- **Purpose:** Get balancing enable bitmask.
- **Parameters:***bit_mask* (pointer to store bitmask)
- **Returns:** Result code indicating success or error.

L9962_CB_enable_set

- **Purpose:** Enable or disable charge/discharge circuit breaker.
- **Parameters:***chg_en* (charge enable), *dchg_en* (discharge enable)
- **Returns:** Result code indicating success or error.

L9962_CB_enable_get

- **Purpose:** Get charge/discharge circuit breaker enable status.
- **Parameters:***chg_en*, *dchg_en* (pointers to store status)
- **Returns:** Result code indicating success or error.

L9962_VB_UV_set

- **Purpose:** Set VB undervoltage threshold and counter.
- **Parameters:***th_uV* (threshold in uV), *cnt_th* (counter threshold)
- **Returns:** Result code indicating success or error.

L9962_VB_OV_set

- **Purpose:** Set VB overvoltage threshold and counter.
- **Parameters:** *th_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_VB_UV_get

- **Purpose:** Get VB undervoltage threshold and counter.
- **Parameters:***th_uV*, *cnt_th* (pointers to store values)
- **Returns:** Result code indicating success or error.

L9962_VB_OV_get

- **Purpose:** Get VB overvoltage threshold and counter.
- **Parameters:***th_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_NTC_OT_set

- **Purpose:** Set NTC overtemperature thresholds and counter.
- **Parameters:***th_uV*, *th_severe_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_NTC_OT_get

- **Purpose:** Get NTC overtemperature thresholds and counter.
- **Parameters:***th_uV*, *th_severe_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_NTC_UT_set

- **Purpose:** Set NTC undertemperature threshold and counter.
- **Parameters:***th_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_NTC_UT_get

- **Purpose:** Get NTC undertemperature threshold and counter.
- **Parameters:***th_uV*, *th_severe_uV*, *cnt_th*
- **Returns:** Result code indicating success or error.

L9962_VB_vs_sum_set

- **Purpose:** Set VB vs sum threshold.
- **Parameters:***th_uV* (threshold in uV)
- **Returns:** Result code indicating success or error.

L9962_VB_vs_sum_get

- **Purpose:** Get VB vs sum threshold.
- **Parameters:** *th_uV* (pointer to store threshold)
- **Returns:** Result code indicating success or error.

L9962_NTC_MEAS_get

- **Purpose:** Get NTC measurement value.
- **Parameters:***NTC_uV* (pointer to store value)
- **Returns:** Result code indicating success or error.

L9962_VB_diag_get

- **Purpose:** Get VB diagnostic flags (UV, OV, UVLO, vs_sum).
- **Parameters:***UV*, *OV*, *UVLO*, *vs_sum* (pointers to store flags)
- **Returns:** Result code indicating success or error.

L9962_NTC_diag_get

- **Purpose:** Get NTC diagnostic flags (UT, OT, OT_severe).
- **Parameters:***UT* (pointer to undertemperature flag), *OT* (pointer to overtemperature flag), *OT_severe* (pointer to severe overtemperature flag)
- **Returns:** Result code indicating success or error.

L9962_VB_meas_get

- **Purpose:** Get VB (battery voltage) measurement.
- **Parameters:***voltage_uV* (pointer to store measured voltage in microvolts)
- **Returns:** Result code indicating success or error.

L9962_Vcell_meas_get

- **Purpose:** Get voltage measurement for a specific cell.
- **Parameters:***cell_idx* (cell index), *voltage_uV* (pointer to store measured voltage)
- **Returns:** Result code indicating success or error.

L9962_DIE_TEMP_meas_C_get

- **Purpose:** Get die temperature in Celsius.
- **Parameters:***Tj_X* (pointer to store temperature in Celsius)
- **Returns:** Result code indicating success or error.

L9962_chipid_get

- **Purpose:** Get silicon and metal ID of the device.
- **Parameters:***silicon* (pointer to silicon ID), *metal* (pointer to metal ID)
- **Returns:** Result code indicating success or error.

L9962_devaddr_get

- **Purpose:** Get device address.
- **Parameters:** *devaddr* (pointer to store device address)
- **Returns:** Result code indicating success or error.

L9962_CELL_sum_meas_get

- **Purpose:** Get sum of all cell voltages.
- **Parameters:***voltage_uV* (pointer to store sum voltage)
- **Returns:** Result code indicating success or error.

L9962_CELL_diag_get

- **Purpose:** Get cell diagnostic flags (UV, OV, OV_severe, UV_severe).
- **Parameters:***UV*, *OV*, *OV_severe*, *UV_severe* (pointers to store flags)
- **Returns:** Result code indicating success or error.

L9962_CURR_inst_meas_get

- **Purpose:** Get instantaneous current measurement.
- **Parameters:***voltage_uV* (pointer to store measured current in microvolts)
- **Returns:** Result code indicating success or error.

L9962_CURR_overcurr_set

- **Purpose:** Set overcurrent detection thresholds and enable.
- **Parameters:***en* (enable), *chg_th_nV* (charge threshold in nV), *dchg_th_nV* (discharge threshold in nV), *th_persist_nV* (persistence threshold in nV)
- **Returns:** Result code indicating success or error.

L9962_CURR_overcurr_get

- **Purpose:** Get overcurrent detection thresholds and enable.
- **Parameters:***en*, *chg_th_nV*, *dchg_th_nV*, *th_persist_nV* (pointers to store values)
- **Returns:** Result code indicating success or error.

L9962_BAL_threshold_set

- **Purpose:** Set balancing undervoltage threshold and counter.
- **Parameters:***UV_uV* (undervoltage threshold in uV), *cnt* (counter threshold)
- **Returns:** Result code indicating success or error.

L9962_BAL_threshold_get

- **Purpose:** Get balancing undervoltage threshold and counter.
- **Parameters:** *UV_uV*, *cnt* (pointers to store values)
- **Returns:** Result code indicating success or error.

L9962_OVC_diag_get

- **Purpose:** Get overcurrent diagnostic flags.
- **Parameters:***ovc_chg*, *ovc_dchg*, *persistent_ovc_chg*, *persistent_ovc_dchg* (pointers to store flags)
- **Returns:** Result code indicating success or error.

L9962_VB_mask_set

- **Purpose:** Set VB event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (enable)
- **Returns:** Result code indicating success or error.

L9962_VB_mask_get

- **Purpose:** Get VB event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_DIE_T_mask_set

- **Purpose:** Set die temperature event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (enable)
- **Returns:** Result code indicating success or error.

L9962_DIE_T_mask_get

- **Purpose:** Get die temperature event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_CURR_mask_set

- **Purpose:** Set current event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (enable)
- **Returns:** Result code indicating success or error.

L9962_CURR_mask_get

- **Purpose:** Get current event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_DIE_TEMP_diag_get

- **Purpose:** Get die temperature diagnostic flags.
- **Parameters:** *ot* (pointer to overtemperature flag)
- **Returns:** Result code indicating success or error.

L9962_BAL_mask_set

- **Purpose:** Set balancing event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (enable)
- **Returns:** Result code indicating success or error.

L9962_BAL_mask_get

- **Purpose:** Get balancing event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_BAL_diag_get

- **Purpose:** Get balancing diagnostic flags.
- **Parameters:***cell_UV* (pointer to store cell undervoltage flags)
- **Returns:** Result code indicating success or error.

L9962_CB_mode_set

- **Purpose:** Set charge/discharge circuit breaker mode (High-Side/Low-Side).
- **Parameters:***chg_mode* (charge mode), *dchg_mode* (discharge mode)
- **Returns:** Result code indicating success or error.

L9962_CB_mode_get

- **Purpose:** Get charge/discharge circuit breaker mode (High-Side/Low-Side).
- **Parameters:***chg_mode*, *dchg_mode* (pointers to store modes)
- **Returns:** Result code indicating success or error.

L9962_NTC_mask_set

- **Purpose:** Set NTC event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (enable)
- **Returns:** Result code indicating success or error.

L9962_NTC_mask_get

- **Purpose:** Get NTC event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_FUSE_ext_get

- **Purpose:** Get fuse deployment status.
- **Parameters:** *deploy* (pointer to store deployment status)
- **Returns:** Result code indicating success or error.

L9962_CELLS_mask_set

- **Purpose:** Set cell event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (enable)
- **Returns:** Result code indicating success or error.

L9962_CELLS_mask_get

- **Purpose:** Get cell event/fault mask.
- **Parameters:***mask_sel* (mask selection), *en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_CURR_short_set

- **Purpose:** Set short-circuit detection parameters.
- **Parameters:***en* (enable), *th_uV* (threshold in uV), *sc_filter* (filter selection), *th_persist_uV* (persistence threshold)
- **Returns:** Result code indicating success or error.

L9962_CURR_short_get

- **Purpose:** Get short-circuit detection parameters.
- **Parameters:***en*, *th_uV*, *sc_filter*, *th_persist_uV* (pointers to store values)
- **Returns:** Result code indicating success or error.

L9962_CURR_short_diag_get

- **Purpose:** Get short-circuit diagnostic flags.
- **Parameters:***sc_dchg*, *persist_sc_dchg* (pointers to store flags)
- **Returns:** Result code indicating success or error.

L9962_FUSE_deploy

- **Purpose:** Deploy the fuse.
- **Parameters:** None
- **Returns:** Result code indicating success or error.

L9962_global_diag_get

- **Purpose:** Get global diagnostic status.
- **Parameters:** *sel* (diagnostic selection), *value* (pointer to store value)
- **Returns:** Result code indicating success or error.

L9962_NVM_operation

- **Purpose:** Perform NVM upload or download operation.
- **Parameters:***OP* (operation: upload or download)
- **Returns:** Result code indicating success or error.

L9962_NVM_upload_cnt_get

- **Purpose:** Get NVM upload counter.
- **Parameters:***value* (pointer to store counter)
- **Returns:** Result code indicating success or error.

L9962_CURR_ADC_correction_get

- **Purpose:** Get current ADC gain correction factor.
- **Parameters:***gain_factor* (pointer to store gain factor)
- **Returns:** Result code indicating success or error.

L9962_CURR_ADC_correction_set

- **Purpose:** Set current ADC gain correction factor.
- **Parameters:***gain_factor* (gain correction value)
- **Returns:** Result code indicating success or error.

L9962_i2c_crc_check_set

- **Purpose:** Enable or disable I2C CRC check.
- **Parameters:***en* (enable)
- **Returns:** Result code indicating success or error.

L9962_i2c_crc_check_get

- **Purpose:** Get I2C CRC check enable status.
- **Parameters:***en* (pointer to store enable status)
- **Returns:** Result code indicating success or error.

L9962_CURR_cc_meas_get

- **Purpose:** Get Coulomb counter measurement.
- **Parameters:***voltage_nV* (pointer to store measured value in nV), *smp_cnt* (pointer to sample count), *cc_sat* (pointer to saturation flag)
- **Returns:** Result code indicating success or error.

L9962_WAKEUP_set

- **Purpose:** Enable or disable wake-up function.
- **Parameters:** *wkup_en* (enable)
- **Returns:** Result code indicating success or error.

L9962_NSHIP_get

- **Purpose:** Get nSHIP pin status.
- **Parameters:***nship_en* (pointer to store status)
- **Returns:** Result code indicating success or error.

L9962_RDY_get

- **Purpose:** Get RDY pin status.
- **Parameters:***rdy* (pointer to store status)
- **Returns:** Result code indicating success or error.

L9962_FLTN_get

- **Purpose:** Get FLTN pin status.
- **Parameters:***fltn* (pointer to store status)
- **Returns:** Result code indicating success or error.

L9962_FSM_go_to

- **Purpose:** Set device finite state machine (FSM) state.
- **Parameters:***sts* (desired state)
- **Returns:** Result code indicating success or error.

Additional notes

- All functions return a RESULT_T type, which indicates the success or failure of the operation. Typical values are implementation-specific but usually include codes for success, invalid parameters, or hardware communication errors.
- For functions that use pointers as parameters, the caller must ensure that the pointers are valid and point to sufficient memory to store the results.
- Many functions use bitmasks or enumerated types to select channels, features, or configuration options. Refer to the corresponding enum definitions in the header for valid values.
- Measurement functions typically return values in microvolts (uV), nanovolts (nV), or degrees Celsius (°C), depending on the context.
- Mask and diagnostic functions allow fine-grained control and monitoring of fault and event reporting for safety-critical applications.
- NVM (Non-Volatile Memory) operations are used to save or restore configuration settings to or from the internal device memory.

Example usage

```c uint16_t cell_mask = 0x0F; // Enable first 4 cells
RESULT_T res = L9962_CELL_enable_set(cell_mask);
if (res == RESULT_OK) { // Cells enabled successfully }
uint32_t cell_voltage;
res = L9962_Vcell_meas_get(2, &cell_voltage); // Get voltage for cell 2
if (res == RESULT_OK) { // Use cell_voltage }
```

3 L9962 driver functions description

3.1 Summary table

Table 3. **Summary table**

Function Name	Purpose/Description
L9962_CELL_enable_set/get	Enable/disable cells (bitmask)
L9962_CELL_filter_set/get	Set/get cell filter
L9962_CELL_UV_set/get	Set/get cell undervoltage threshold
L9962_CELL_OV_set/get	Set/get cell overvoltage threshold
L9962_VB_enable_set/get	Enable/disable VB and UVLO
L9962_NTC_enable_set/get	Enable/disable NTC
L9962_tmeas_set/get	Set/get measurement time
L9962_CURR_enable_set/get	Enable/disable current measurement, coulomb counter
L9962_CURR_filter_set/get	Set/get current filter
L9962_BAL_en_set/get	Enable/disable cell balancing (bitmask)
L9962_CB_enable_set/get	Enable/disable charge/discharge
L9962_VB_UV_set/get	Set/get VB undervoltage threshold
L9962_VB_OV_set/get	Set/get VB overvoltage threshold
L9962_NTC_OT_set/get	Set/get NTC overtemperature threshold
L9962_NTC_UT_set/get	Set/get NTC undertemperature threshold
L9962_VB_vs_sum_set/get	Set/get VB vs sum threshold
L9962_NTC_MEAS_get	Get NTC voltage measurement
L9962_VB_diag_get	Get VB diagnostic flags
L9962_NTC_diag_get	Get NTC diagnostic flags
L9962_VB_meas_get	Get VB voltage measurement
L9962_Vcell_meas_get	Get cell voltage measurement
L9962_DIE_TEMP_meas_C_get	Get die temperature (Celsius)
L9962_chipid_get	Get chip silicon and metal ID
L9962_devaddr_get	Get device address
L9962_CELL_sum_meas_get	Get sum of all cell voltages
L9962_CURR_inst_meas_get	Get instantaneous current measurement
L9962_CURR_overcurr_set/get	Set/get overcurrent protection
L9962_BAL_threshold_set/get	Set/get balancing undervoltage threshold
L9962_OVC_diag_get	Get overcurrent diagnostic flags
L9962_CURR_cc_meas_get	Get current accumulator measurement
L9962_CURR_short_set/get	Set/get short-circuit protection
L9962_CURR_short_diag_get	Get short-circuit diagnostic flags
L9962_FUSE_deploy	Deploy fuse
L9962_FUSE_ext_get	Get fuse deployment status
L9962_global_diag_get	Get global diagnostic (e.g., CRC config fail)

Function Name	Purpose/Description
L9962_NVM_operation	Perform NVM upload/download
L9962_NVM_upload_cnt_get	Get NVM upload count
L9962_CURR_ADC_correction_set/get	Set/get current ADC correction gain
L9962_i2c_crc_check_set/get	Enable/disable I2C CRC check
L9962_WAKEUP_set	Set WKP pin
L9962_NSHIP_get	Get NSHIP pin status
L9962_RDY_get	Get RDY pin status
L9962_FLTN_get	Get FLTN pin status
L9962_FSM_go_to	Set device FSM state
Mask management functions	Set/get event masks (VB, Die T, Current, etc.)

3.2 Detailed descriptions

See previous detailed section in Chapter 2.2 for function-by-function descriptions, parameters, and return values.

4 General notes

- **Portability:** Only L9962_HAL_wrapper needs to be ported for a new MCU.
- **Communication:** All register access is via I2C, with optional CRC checking.
- **Device Abstraction:** All device logic is in the driver, with clear separation from hardware.
- **Error Handling:** All functions return a RESULT_T code for robust error detection.
- **Masking:** Fine-grained event masking for all major protection/diagnostic events.
- **NVM:** Upload/download and upload count supported.
- **FSM:** Shipment, Standby, and Normal states supported.

5 Error codes

```
typedef enum {
RES_OK,
RES_FAIL,
RES_HAL_ERR,
RES_CRC_ERR,
RES_INVALID_PARAM,
} RESULT_T;
```

6 Bitfield macros and register map

All register addresses and bitfield offsets/widths are defined in `L9962_regmap.h`. Use utility macros for bitfield manipulation (e.g., `UTILS_set_field_in_reg`, `UTILS_get_field_from_reg`).

Revision history

Table 4. **Document revision history**

Date	Version	Changes
08-Jan-2026	1	Initial release.

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