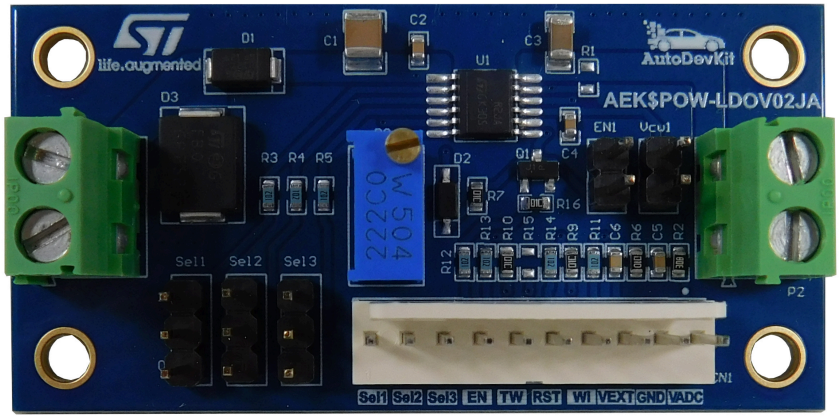
Getting started with the AEK-POW-LDOV02J automotive-grade LDO with configurable output voltage

Introduction

The AEK-POW-LDOV02J evaluation board host the L99VR02J voltage regulator IC.

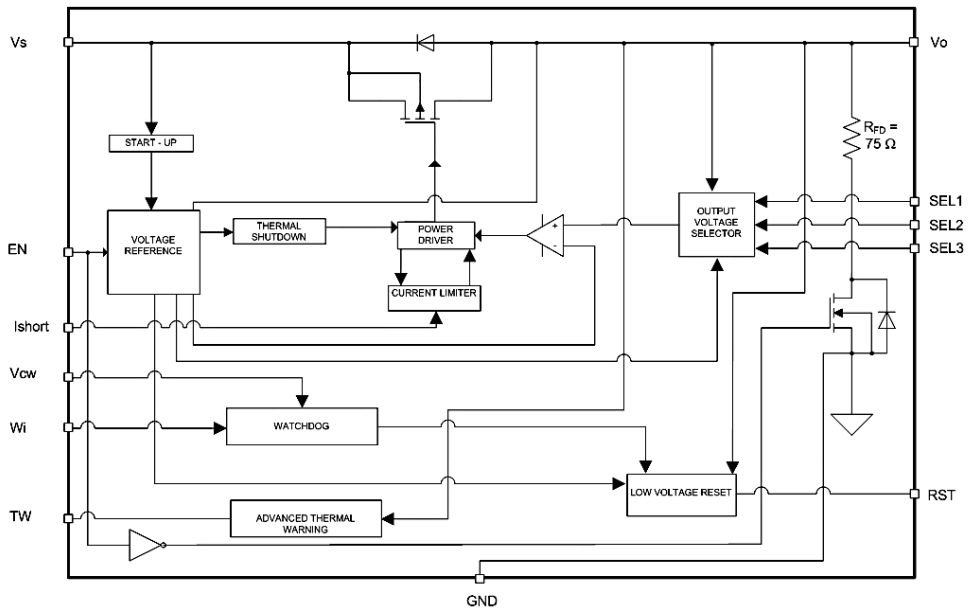
Figure 1. AEK-POW-LDOV02J evaluation board



The L99VR02J is a DC-DC voltage regulator designed for automotive applications (AEC-Q100 qualified). It can deliver up to 500 mA of load current and consumes around 1 µA when the regulator is disabled.

The operating input voltage is between 2.15 and 28 V, while a fixed selectable output voltage (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.8 V, 3.3 V, or 5 V) is configurable.

Figure 2. L99VR02J functional block



The AEK-POW-LDOV02J board can be used in a standalone configuration or with an external microcontroller. In the latter case, the MCU provides a watchdog signal to the regulator to monitor the active connection.

The board is included in the AutoDevKit ecosystem to enable a quick and easy prototyping for automotive and transportation applications.

Warning: *The AEK-POW-LDOV02J is an evaluation tool for R&D laboratory use only. It is not intended to be used inside a vehicle.*

1 Getting started

1.1 Safety and protection mechanisms

The AEK-POW-LDOV02J evaluation board implements the following automotive safety mechanisms:

- **Output voltage monitoring**
  It supervises the generated output voltage (V_O). If the V_O output voltage falls below the V_{OTH} threshold (equal to V_O-10% V_O), the RST pin is pulled low.
- **Active connection monitoring (MCU connected configuration only)**
  For a continuous monitoring of the connection between the LDO and the MCU, a watchdog is used. The watchdog signal (generated by the MCU and applied to the AEK-POW-LDOV02J WI pin) is a square wave with a duty cycle equal to 50%. The frequency value depends on both the output voltage and the chosen C4 capacitor value (see the L99VR02J schematics). The LDO device monitors the watchdog signal provided by the MCU. If the signal frequency is outside the range described above, the RST pin is pulled low. You can disable the watchdog through a jumper on the AEK-POW-LDOV02J Vcw1 pin.
- **Regulator enabling and disabling**
  The L99VR02J voltage regulator is enabled/disabled through the EN signal input.
- **Overcurrent monitoring and lost ground protection**
  The overcurrent limit is set by regulating a current on the Ishort through an external potentiometer available on the AEK-POW-LDOV02J. If the overcurrent limit is reached, the RST pin is pulled low.
- **Thermal warning detection**
  To warn the microcontroller about a severe temperature increase of the LDO, a thermal warning output has been implemented. If the device detects a junction temperature above 150°C, the thermal warning (TW) output pin is pulled low, while the voltage regulator and all its features remain active.
- **Overvoltage warning detection**
  The TW pin also provides diagnostics about the output overvoltage. To distinguish between a thermal and an overvoltage warning event, two different signals are generated on the same TW output pin. A thermal warning event detection sets the TW pin to low, whereas an output overvoltage event generates a square wave (duty cycle 50% and period 300 microseconds) on the TW pin.

1.2 MCU connected configuration

In this configuration, the external MCU performs the following actions:

- generates signals (3.3 or 5 V) to control the output voltage selection through the SELx pin;
- generates a signal to control the EN input pin (3 or 5 V);
- generates a square wave (3.3 or 5 V) to control the watchdog logic;
- reads the TW pin to detect the thermal warning or overvoltage events;
- reads the RST pin to detect if the V_O output voltage is below a given threshold or to detect a wrong watchdog frequency;
- uses an ADC to monitor the voltage generated by the LDO;
- generates a fixed voltage reference (V_{EXT} - 3.3 or 5 V) to read the LDO signals properly.

Note: If the AEK-POW-LDOV02J is connected to an external MCU, remove all the on-board jumpers.

1.3 Standalone configuration

In the standalone configuration:

- select the output voltage by using the Sel1, Sel2, or Sel3 jumpers;
- insert the EN1 jumper to enable the L99VR02J and remove it right after the power-up sequence;
- insert the Vcw1 jumper to disable the watchdog requirement.

2 Hardware architecture

The AEK-POW-LDOV02J evaluation board is equipped with:

- CN1 connector: used only if the board is connected to an external microcontroller.

Table 1. CN1 pin description

Pin	Description
Sel1 Sel2, Sel3	Output voltage selectors
EN	Enable input
TW	Thermal warning output and overvoltage warning output
WI	Watchdog input
RST	Reset output
VEXT	Input external voltage reference (3.3 or 5 V)
GND	Ground reference
VADC	Output voltage. This pin can be used to read the output voltage via a configured external ADC peripheral that belongs to the MCU.

- Jumpers: to be used in standalone working mode only.

Table 2. Jumper pin description

Pin	Description
Sel1 Sel2, Sel3	Output voltage selectors. To set SELx to high, put a jumper between the central position and ‘1’ position. To set SELx to low, put a jumper between the central position and ‘0’ position.
EN1	Enable jumper. To enable the board, mount the jumper and remove it right after.
Vcw1	Watchdog disable jumper. In standalone mode, disable the watchdog by applying a jumper on Vcw1.

- Voltage connectors

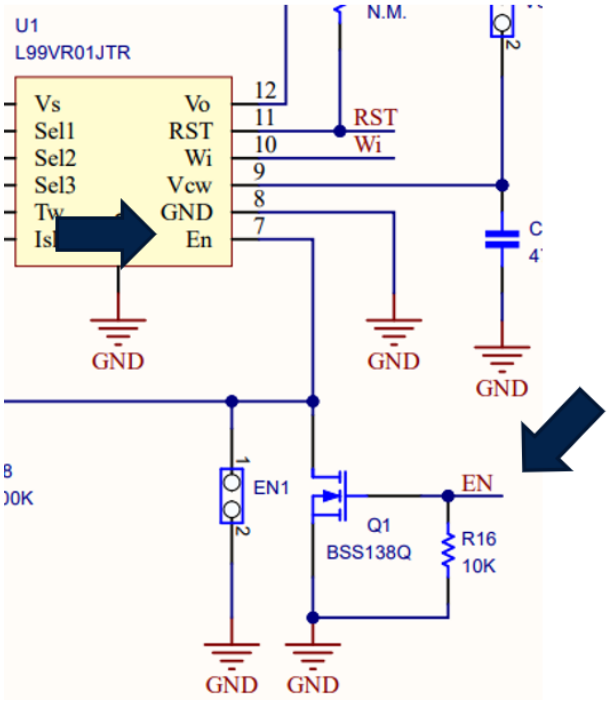
Table 3. Voltage connector details

Connector	Description
VS	Operating DC power supply voltage range from 2.15 to 28 V
V_O	LDO output voltage

2.1 Enable pin

The enable input (EN) enables/disables the L99VR02J. A high-voltage signal switches the regulator on. When the enable pin is set to low, the output is switched off. Then, the current consumption of the device is about 1 µA.

Figure 3. Enable and disable signals

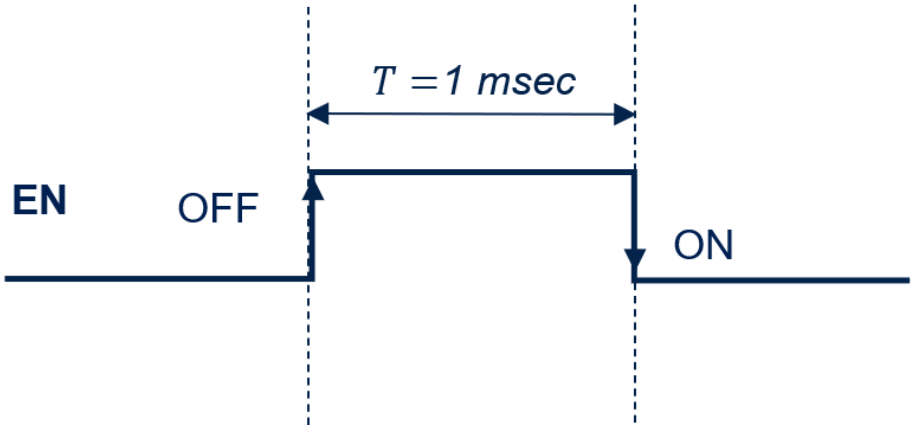


The EN input pin or the EN1 jumper enable/disable the AEK-POW-LDOV02J, as follows:

- when the EN pin is set to high, it is forced to low and the output is switched off;
- when the EN pin is set to low, it is forced to high and the output is switched on;
- when the EN1 jumper is applied, the EN pin is forced to low and the output is switched off.

To change the output voltage while the regulator is on, apply a pulse signal to the EN input pin after the SELx pin setting.

Figure 4. Pulse signal in case of output voltage changing



2.2 Output voltage selection

The L99VR02J provides up to eight different output voltage options. The combination of its three digital input selectors (SELx) determines the output voltage according to the following truth table.

Table 4. SELx pins: truth table

V_O (volt)	SEL1	SEL2	SEL3
5	1	1	1
3.3	1	1	0
2.8	1	0	1
2.5	1	0	0
1.8	0	1	1
1.5	0	1	0
1.2	0	0	1
0.8 (default)	0	0	0

The SELx pin configuration is acquired at the device startup (about 500 microseconds). Once the configuration is set, the output voltage cannot be changed until the next EN pin transition. If all SELx pins are left unconnected, the default configuration is selected.

2.3 Watchdog

The watchdog is an automotive safety mechanism used to monitor a continuous connection with an external MCU.

The watchdog signal (generated by the MCU and applied to the AEK-POW-LDOV02J WI pin) is a square wave with a duty cycle equal to 50%. Its frequency value depends on both the output voltage and the chosen C4 capacitor value (see the L99VR02J schematics).

The table below lists the watchdog frequencies (Hz) related to the selectable output voltage.

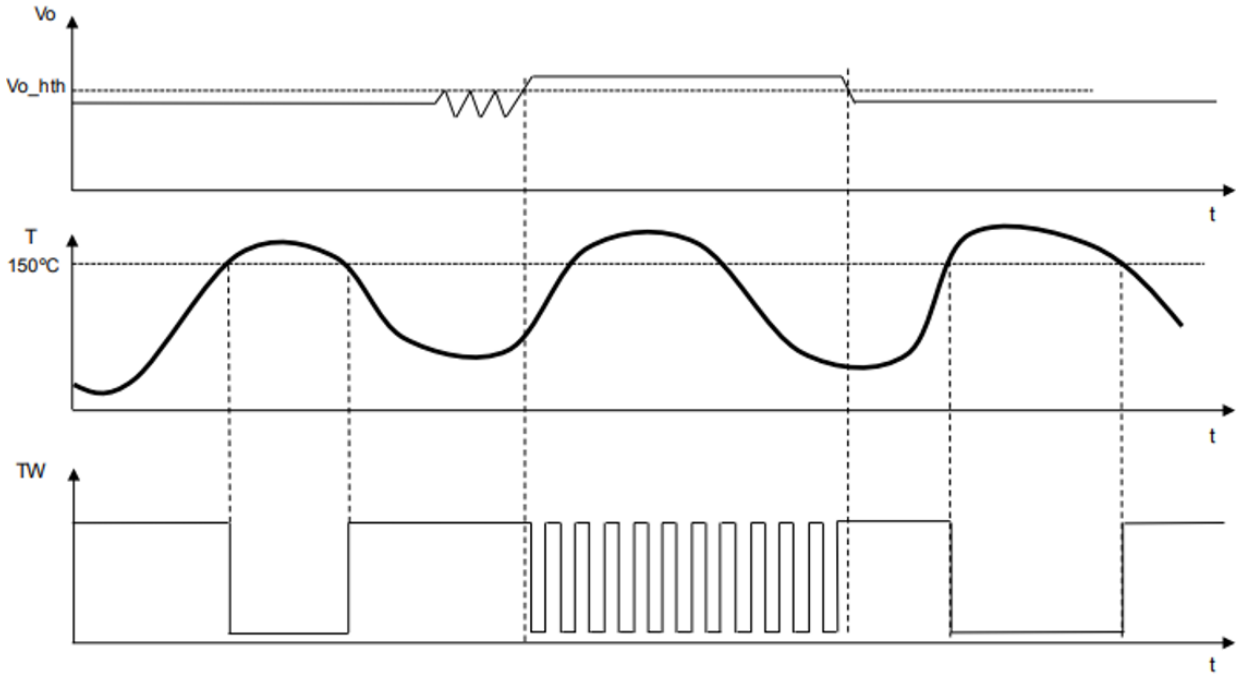
Table 5. WI frequencies in Hz

V_O (volt)	WI frequency (Hz)
5	172
3.3	114
2.8	94
2.5	76
1.8	55
1.5	49
1.2	42
0.8 (default)	28

2.4 Overvoltage warning

The TW pin provides the output overvoltage (OV) diagnostic. To distinguish between a thermal warning and an output overvoltage event, two different signals are generated on the same TW output pin. A thermal warning event detection sets the TW pin low. An output overvoltage event generates a square wave on the TW pin. The overvoltage detection has a higher priority than the thermal warning detection. Therefore, if both protections are triggered, the generated signal is a square wave.

Figure 5. Overvoltage warning



3 Software architecture

According to the AutoDevKit paradigm, several MCU boards can be connected to the AEK-POW-LDOV02J evaluation board. The smallest available MCU is the SPC582B Chorus 1M.

The AutoDevKit ecosystem fully supports the hardware. This ecosystem consists of:

- the SPC5-STUDIO development environment;
- the SPC5-UDESTK debug and firmware download tool;
- the STSW-AUTODEVKIT Eclipse plugin.

The AutoDevKit software includes a dedicated driver for the AEK-POW-LDOV02J as well as demo codes.

3.1 SPC5-STUDIO

SPC5-STUDIO is an integrated development environment (IDE) based on Eclipse designed to assist the development of embedded applications based on SPC5 Power Architecture 32-bit microcontrollers.

The package includes an application wizard to initiate projects with all the relevant components and key elements required to generate the final application source code. It also contains straightforward software examples for each MCU peripheral.

SPC5-STUDIO also features:

- the possibility of integrating other software products from the standard Eclipse marketplace
- free license GCC GNU C Compiler component
- support for industry-standard compilers
- support for multi-core microcontrollers
- PinMap editor to facilitate MCU pin configuration

Download the SPC5-UDESTK software to run and debug applications created with SPC5-STUDIO.

3.2 STSW-AUTODEVKIT

The STSW-AUTODEVKIT plug-in for Eclipse extends SPC5-STUDIO for automotive and transportation applications.

STSW-AUTODEVKIT features:

- integrated hardware and software components, component compatibility checking, and MCU and peripheral configuration tools
- the possibility of creating new system solutions from existing ones by adding or removing compatible function boards
- new code can be generated immediately for any compatible MCU
- high-level application APIs to control each functional component, including the ones for the AEK-POW-LDOV02J board

The GUI helps configure interfaces, including SPI, and can automatically manage all relevant pin allocation and deallocation operations.

3.3 AEK-POW-LDOV02J software library architecture

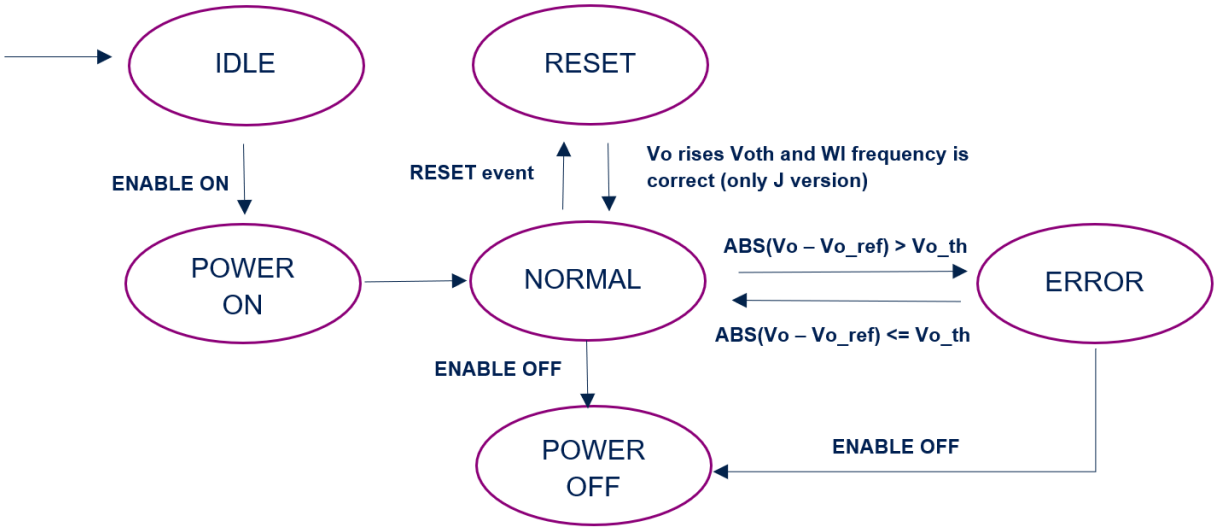
The drivers related to the AEK-POW-LDOV02J are included in a component belonging to the AutoDevKit Studio software (STSW-AUTODEVKIT) version 1.0 (or higher). The library is written in C and the target software is generated automatically according to the code generation and pin allocation paradigm included in the AutoDevKit design flow.

The AEK-POW-LDOV02J software library is based on a finite state machine (AEK-POWLDOV02J_fsm) called by a timer (PIT peripheral on SPC58 microcontrollers). The minimum value selectable for the FSM frequency is equal to 10 kHz, which ensures the correct detection of thermal and overvoltage warnings.

The AEK-POW-LDOV02J software library supports a multiple board allocation configured inside the dedicated AutoDevKit GUI.

To simplify the management of multiple boards, a unique FSM is used in the driver for all allocated boards. For each allocated board, the current status is recorded.

Figure 6. LDO driver finite state machine



The AEK-POW-LDOV02J states are:

- **IDLE**: initial state at power-up
- **POWER ON**: this state is reached when the AEK-POW-LDOV02J is enabled (through the pulse signal applied to the EN pin)
- **POWER OFF**: this state is reached when the AEK-POW-LDOV02J is disabled (through the high signal applied to the EN pin)
- **RESET**: this state detects a falling reset signal. It returns to the normal state when the V_O output voltage rises above V_{OTH} and the watchdog frequency value is correct
- **ERROR**: the FSM enters this state when the absolute value of the difference between the V_O voltage output (read by the SARADC-12 bit) and the voltage output reference (selected by the SELx pin) is greater than a voltage threshold equal to 5% of the voltage reference. In this state, the system is in a dangerous condition and the LDO should be disabled
- **NORMAL**: this is the state of normal operating conditions. In this state, the AEK-POW-LDOV02J software library is able to detect the thermal and overvoltage warning events. When the normal state is active, the AEK-POW-LDOV02J software library generates a WI (watchdog) signal by using the E-MIOS peripheral with a fixed frequency whose value depends on the SELx configuration pin.

3.3.1 Init device

At power-up, the AEK-POW-LDOV02J initializes the E-MIOS peripheral in the microcontroller to generate the WI signal. The second step consists in initializing the ADC (SARADC-12bit) used to read and monitor the V_O output voltage provided by the voltage regulator.

The AEK-POW-LDOV02J software library includes a unique `Init` instruction with the following prototype:

`void AEK_POW_LDOV02J_init(uint8_t AEK_POW_LDOV02J_n_device);` where the `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board.

Note: You can invoke `void AEK_POW_LDOV02J_initAll()` to initiate all the boards allocated.

3.3.2 Power on

The AEK-POW-LDOV02J activation requires an enable on transition of the FSM (see Section 2.2).

The AEK-POW-LDOV02J software library includes the following power on instruction:

`void AEK_POW_LDOV02J_power_on(uint8_t AEK_POW_LDOV02J_n_device);`, where the `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board.

Note: Before proceeding with the power on, set the output voltage by using the SELx pins.

3.3.3 Power off

To turn the AEK-POW-LDOV02J off, an enable off transition is required.

The AEK-POW-LDOV02J software library includes the following power off instruction:
`void AEK_POW_LDOV02J_power_off (uint8_t AEK_POW_LDOV02J_n_device);`, where the `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board.

3.3.4 Setting the output voltage

To set the AEK-POW-LDOV02J output voltage, configure the SELx pins.
The AEK-POW-LDOV02J software library includes an instruction for the output voltage setting:
`void AEK_POW_LDOV02J_setOperationMode(AEK_POW_LDOV02J_op_mode_t op_mode, uint8_t AEK_POW_LDOV02J_n_device);`, where:

- `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board;
- `AEK_POW_LDOV02J_op_mode_t` is an `enum typedef` structure (_0_8V, _1_2V, _1_5V, _1_8V, _2_5V, _2_8_V, _3_3V, and _5_0V) used for the output voltage selection.

Note: Before proceeding with the power on, set the operating voltage by using the SELx pins.

3.3.5 Get device status

The AEK-POW-LDOV02J software library includes a `get FSM status` instruction:
`AEK_POW_LDOV02J_sts_t AEK_POW_LDOV02J_getDeviceSts (uint8_t AEK_POW_LDOV02J_n_device);`, where:

- `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board;
- `AEK_POW_LDOV02J_sts_t` is an `enum typedef` structure (`IDLE, POWER_OFF, POWER_ON, RESET, ERROR, NORMAL`).

3.3.6 Get warning status

The AEK-POW-LDOV02J software library includes a `get warning status` instruction to detect the warning events while the FSM is in the normal status:
`AEK_POW_LDOV02J_warning_sts_t AEK_POW_LDOV02J_getWarningStatus (uint8_t AEK_POW_LDOV02J_n_device);`, where:

- `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board;
- `AEK_POW_LDOV02J_warning_sts_t` is an `enum typedef` structure (`THERMAL_WARNING, OVERVOLTAGE_WARNING, NO_WARNING`).

3.3.7 Get output voltage

The AEK-POW-LDOV02J software library includes an instruction to get the output voltage value read from the SARADC:
`float AEK_POW_LDOV02J_getVout (uint8_t AEK_POW_LDOV02J_n_device);`, where:

- `AEK_POW_LDOV02J_n_device` represents the allocated AEK-POW-LDOV02J board.

4 Demo in the AutoDevKit

4.1 How to create a sample application for the AEK-POW-LDOV02J

This example explains how to create an application for the AEK-POW-LDOV02J. The microcontroller board used is the AEK-MCU-C1MLIT1.

Step 1. Create a new SPC5-STUDIO application for the SPC582B series microcontroller and add the following components:

- SPC582Bxx Init Package Component RLA
- SPC582Bxx Low Level Drivers Component RLA

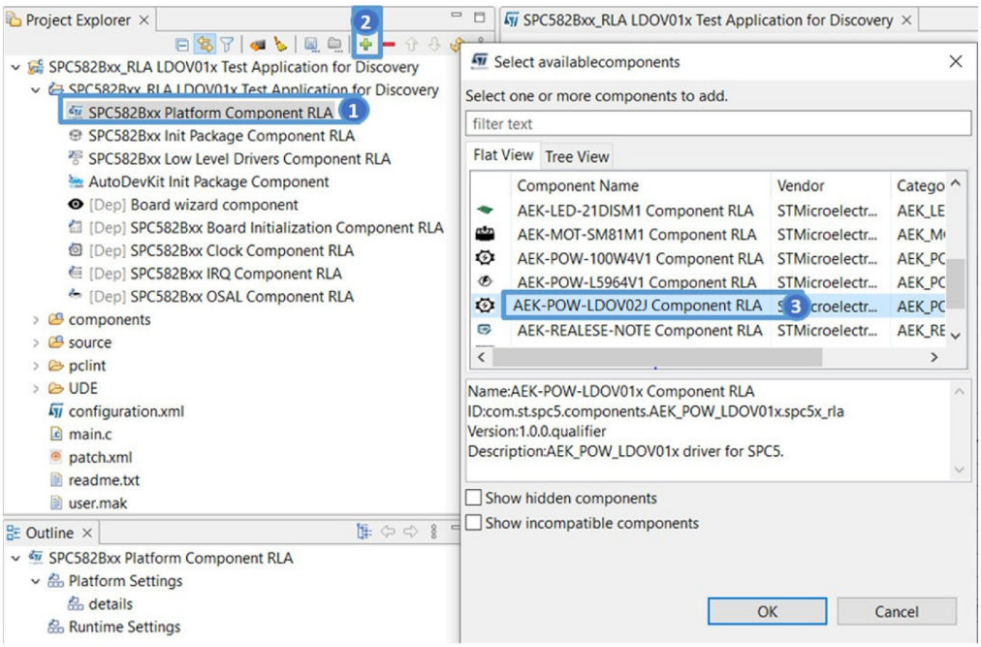
Important: Add these components immediately. Otherwise, the other components are not visible.

Step 2. Add the following additional components:

- AutoDevKit Init Package Component
- SPC582Bxx Platform Component RLA
- AEK-POW-LDOV02J Component RLA

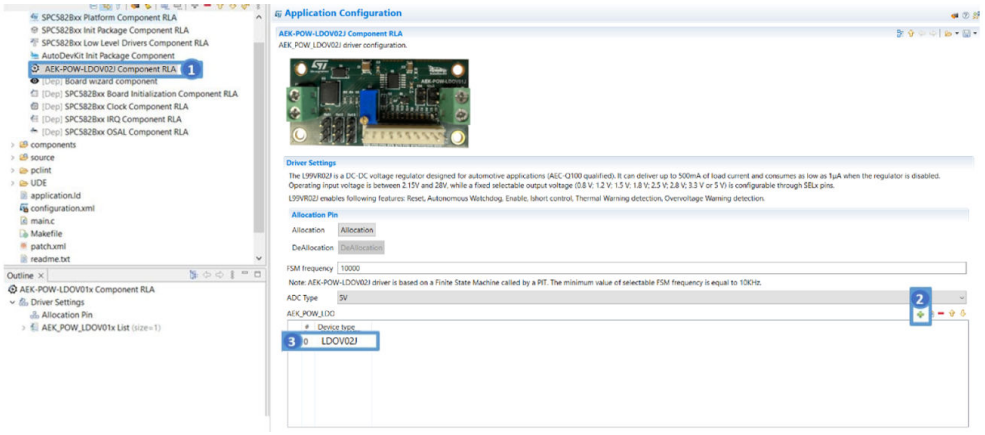
Step 3. Select [**AEK-POW-LDOV02J Component RLA**] to open the [**Application Configuration**] window.

Figure 7. [AEK-POW-LDOV02J Component RLA] selection



Step 4. Click on [**+**] to add a new element to the board list.

Figure 8. Adding a new element



Step 5. Double-click on the newly added element to configure the board.

Step 6. Select the FSM frequency (the default value is 10 kHz).

Step 7. Select the ADC voltage reference (the default value is 5 V).

Step 8. Click the [**Allocation**] button below the AEK-POW-LDOV02J list and click [**OK**] in the confirmation window.

This operation delegates the automatic pin allocation to the AutoDevKit.

Step 9. Generate and build the application using the appropriate icons in SPC5-STUDIO.

The project folder is then populated with new files, including the main.c and the component folder with the AEK-POW-LDOV02J drivers.

Step 10. Open the main.c file and include the AEK_POW_LDOV02J.h file.

Step 11. Save, generate, and compile the application.

Step 12. Open the [**Board View Editor**] provided by the AutoDevKit.

This editor offers a graphical point-to-point guide on how to wire the boards.

Step 13. Connect the AEK-MCU-C1MLIT1 to a USB port on your PC using a mini-USB to USB cable.

Step 14. Launch SPC5-UDESTK-SW and open the *debug.wsx* file in the chosen application name UDE folder.

Step 15. Run and debug your code.

4.2 Available demos for the AEK-POW-LDOV02J

The AutoDevKit includes some voltage regulator demos available for the SPC58EC Chorus 4M (SPC58ECxx_RLA AEK-POW-LDOV02J – DC – DC Voltage Regulator - Test Application) and SPC582B Chorus 1M (SPC582Bxx_RLA AEK-POW-LDOV02J – DC – DC Voltage Regulator - Test Application). The demos are identical, but they are controlled by different MCUs.

These demo goal is to generate a fixed output voltage (5 V). If an overvoltage warning or thermal warning event occurs, the regulator is switched off.

Figure 9. Demo code

```
#include "components.h"
#include "AEK_POW_LDOV02J.h"
/*
 * Application entry point.
 */
int main(void) {

  /* Initialization of all the imported components in the order specified in
     the application wizard. The function is generated automatically.*/
  componentsInit();

  irqIsrEnable();

  /*
   * Init AEK_POW_LDOV02J_DEV0
   */
  AEK_POW_LDOV02J_init(AEK_POW_LDOV02J_DEV0);
  AEK_POW_LDOV02J_setOperationMode(_5_0_V,AEK_POW_LDOV02J_DEV0);
  AEK_POW_LDOV02J_power_on(AEK_POW_LDOV02J_DEV0);

  /* Application main loop.*/
  for ( ; ; ) {
      if(AEK_POW_LDOV02J_getWarningStatus(AEK_POW_LDOV02J_DEV0)!=NO_WARNING){
          AEK_POW_LDOV02J_power_off(AEK_POW_LDOV02J_DEV0);
      }
  }

  /*
   * DeInit AEK_POW_LDOV02J_DEV0
   */
  AEK_POW_LDOV02J_Deinit(AEK_POW_LDOV02J_DEV0);
}
```

Note: If the AEK-POW-LDOV02J is connected to the load, set the correct V_O output voltage by using the `AEK_POW_LDOV02J_setOperationMode` API.

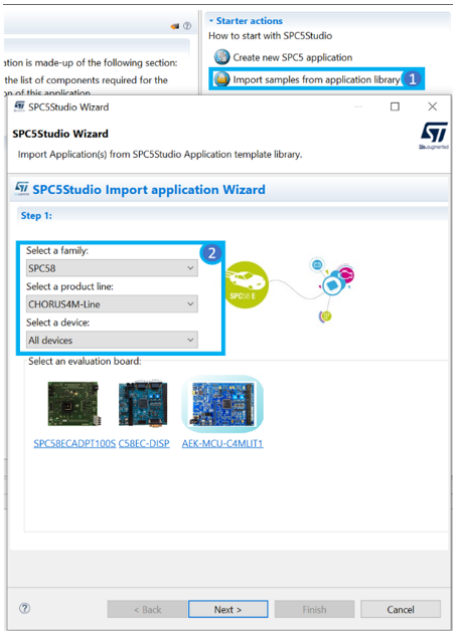
4.2.1 How to upload the demos

Follow the procedure below to import the demos into SPC5-STUDIO.

Step 1. Select [**Import samples from application library**] from the [**Common tasks**] panel. An [**Import application Wizard**] appears.

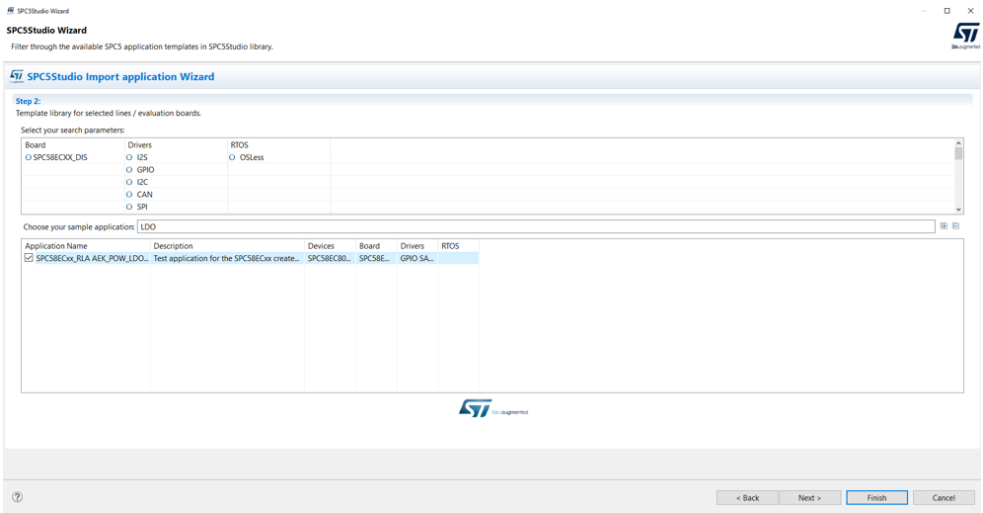
Step 2. Insert the appropriate MCU family details.

Figure 10. MCU family selection



Step 3. Select the desired application from the library.

Figure 11. Application selection



Step 4. Click the [**Finish**] button.

5 APIs

void AEK_POW_LDOV02J_init(uint8_t AEK_POW_LDOV02J_n_device);

This function initializes the AEK-POW-LDOV02J.

void AEK_POW_LDOV02J_initAll();

This function initializes all the AEK-POW-LDOV02J.

void AEK_POW_LDOV02J_power_on(uint8_t AEK_POW_LDOV02J_n_device);

This function turns on the AEK-POW-LDOV02J.

void AEK_POW_LDOV02J_power_off(uint8_t AEK_POW_LDOV02J_n_device);

This function turns off the AEK-POW-LDOV02J.

void AEK_POW_LDOV02J_setOperationMode(AEK_POW_LDOV02J_op_mode_t op_mode, uint8_t AEK_POW_LDOV02J_n_device);

This function sets the output voltage (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V, 2.8 V, 3.3 V, or 5 V) for the AEK-POW-LDOV02J.

AEK_POW_LDOV02J_sts_t AEK_POW_LDOV01x_getDeviceSts(uint8_t AEK_POW_LDOV02J_n_device);

This function gets the AEK-POW-LDOV02J status (`IDLE, POWER_OFF, POWER_ON, RESET, ERROR, NORMAL`)

AEK_POW_LDOV02J_warning_sts_t AEK_POW_LDOV02J_getWarningStatus(uint8_t AEK_POW_LDOV02J_n_device);

This function gets the AEK-POW-LDOV02J warning status (`THERMAL_WARNING, OVERVOLTAGE_WARNING, NO_WARNING`).

float AEK_POW_LDOV02J_getVout(uint8_t AEK_POW_LDOV02J_n_device);

This function gets the output voltage read from the SAR ADC when the AEK-POW-LDOV02J is connected to an external MCU.

6 Test results

Figure 12. **Enable pulse signal waveform generated by an external MCU connected to the AEK-POW-LDOV02J**

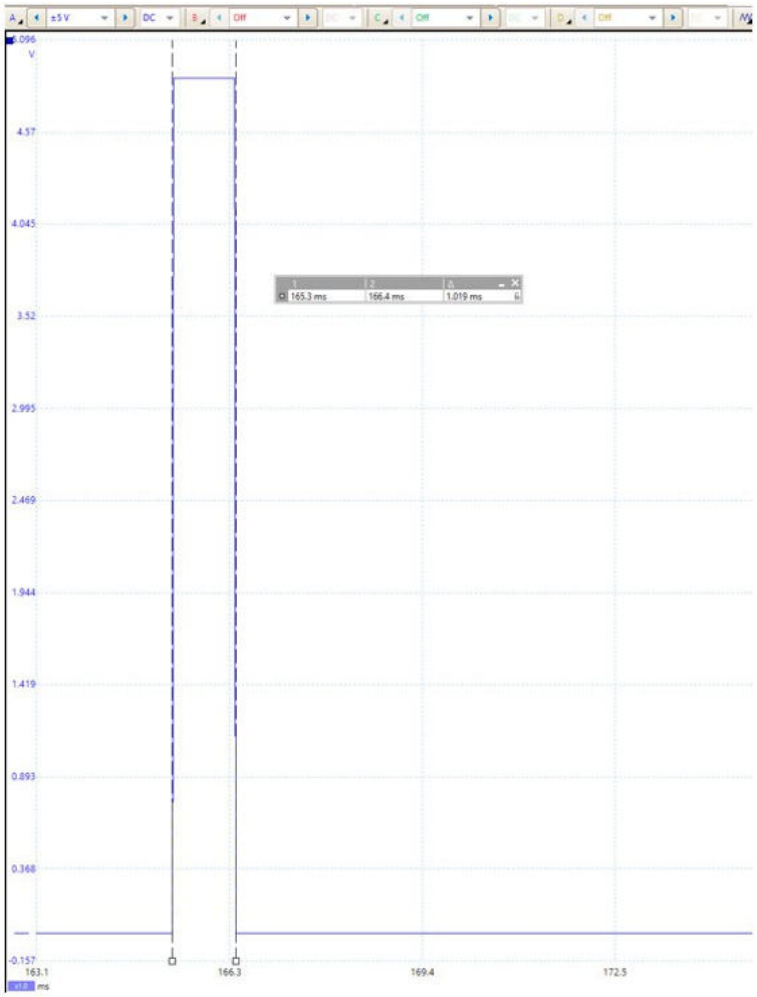


Figure 13. **Watchdog signal waveform generated by an external MCU connected to the AEK-POW-LDOV02J (operating voltage selected = 5 V)**

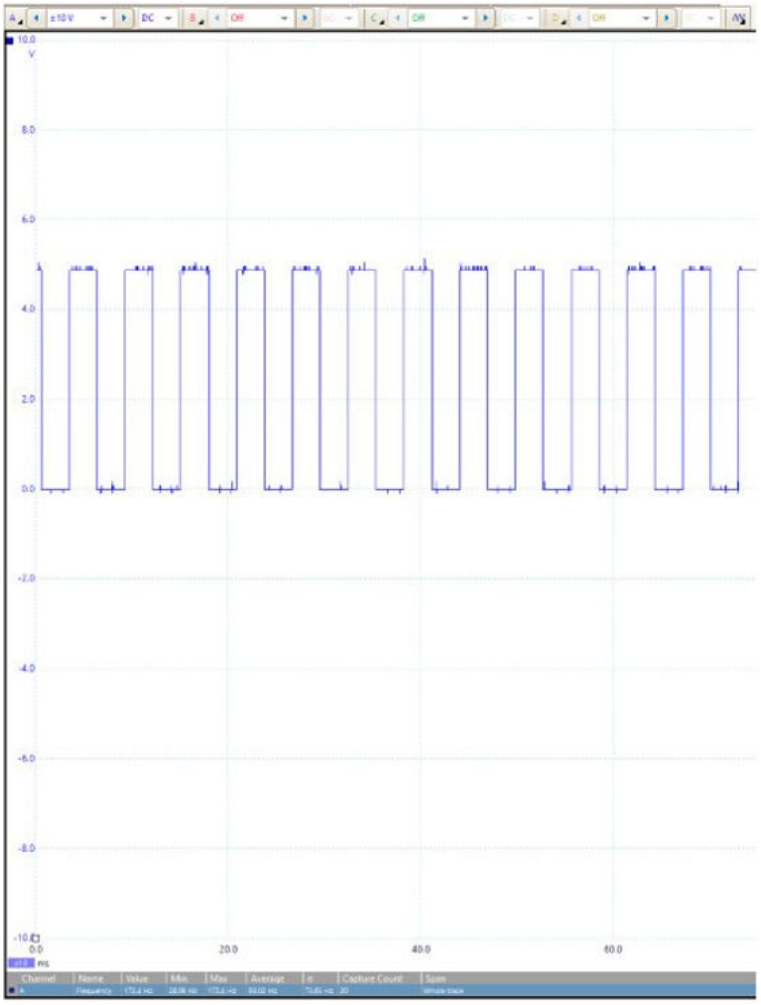


Figure 14. **Output voltage waveform generated by the AEK-POW-LDOV02J after power on (operating voltage selected = 5 V)**

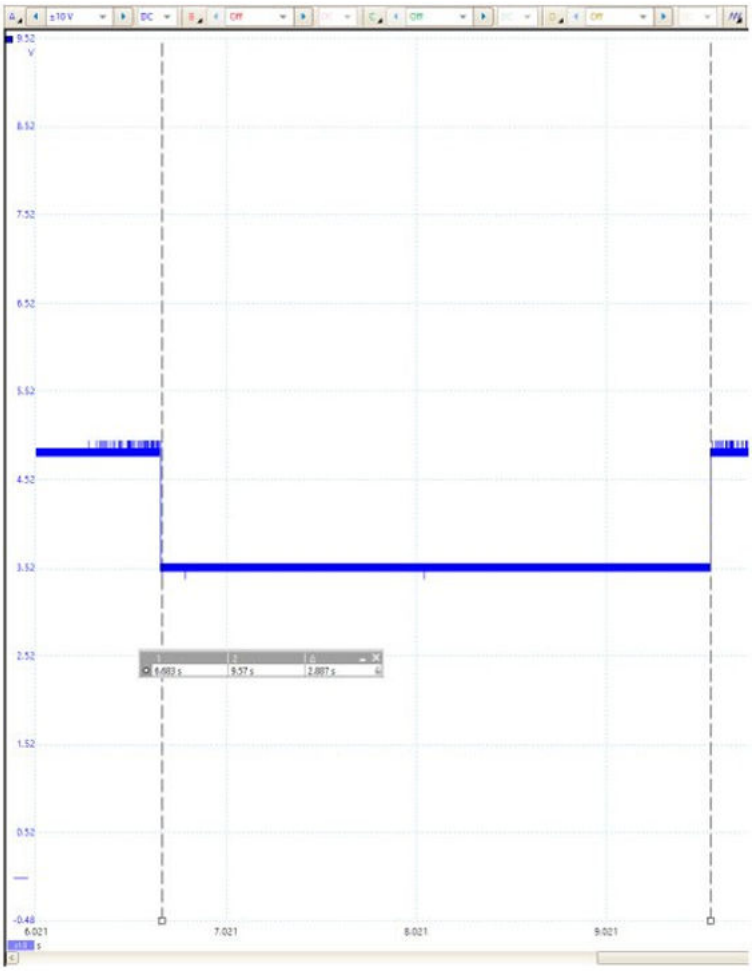


Figure 15. Thermal warning waveform generated by the AEK-POW-LDOV02J after power on (operating voltage selected = 5 V)

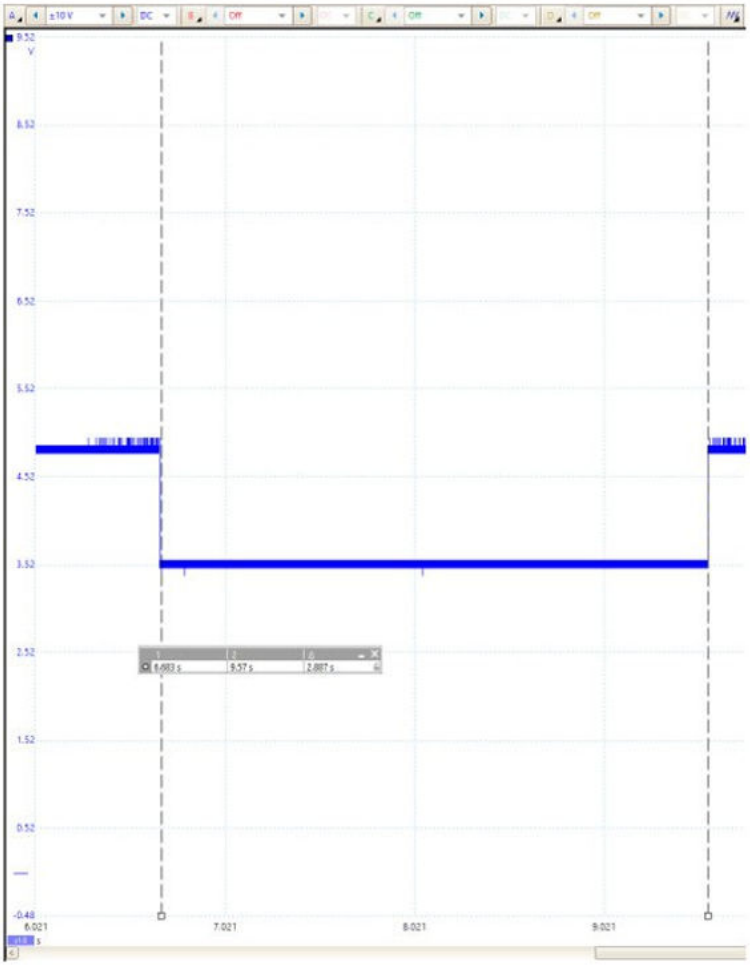


Figure 16. Overvoltage warning waveform generated by the AEK-POW-LDOV02J (operating voltage selected = 5 V)

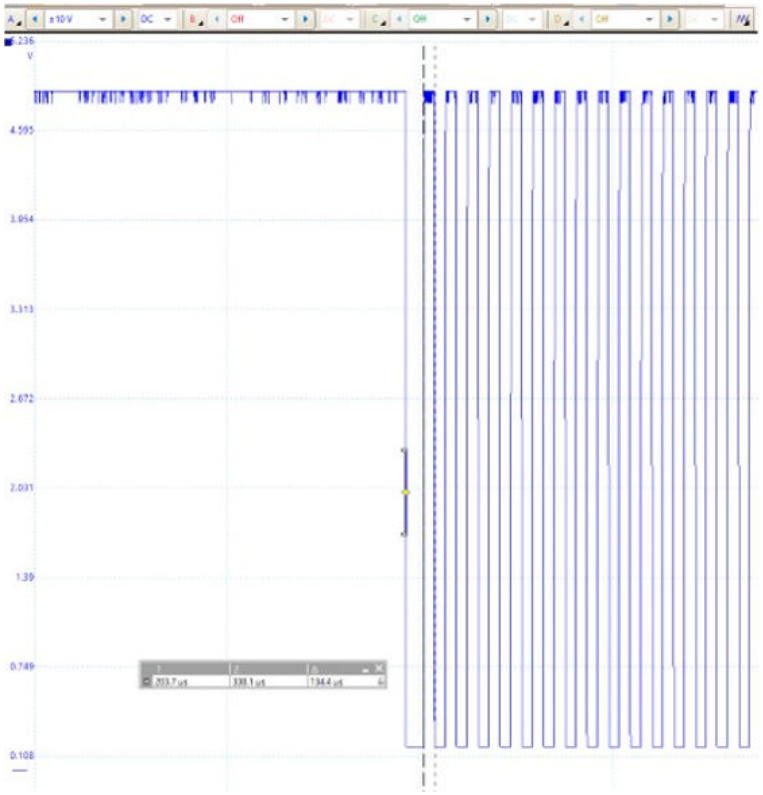
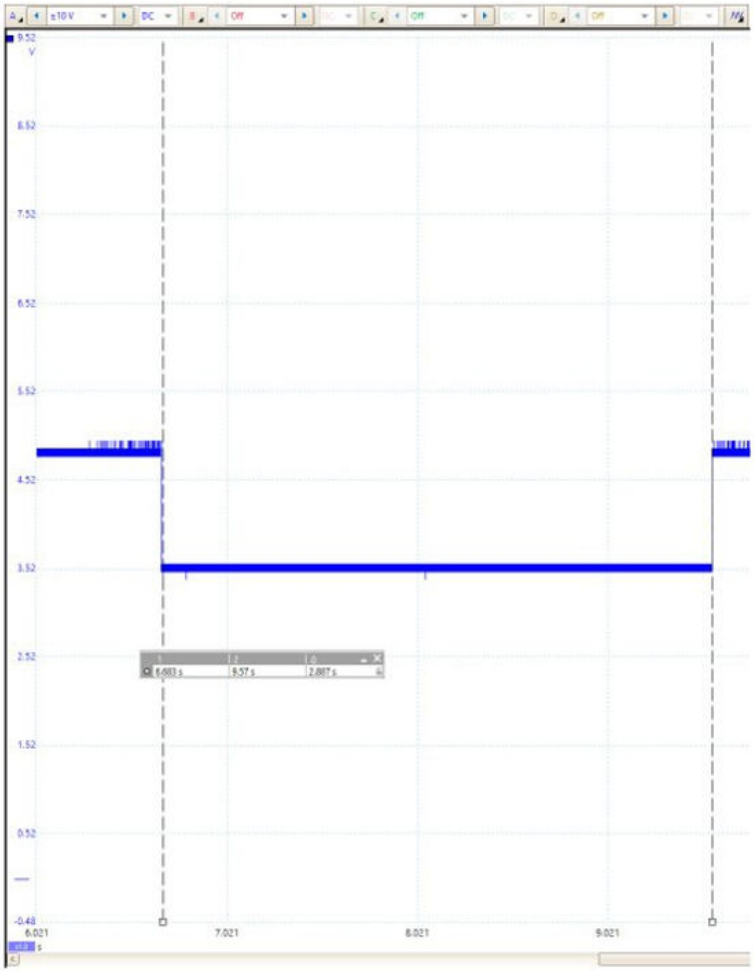
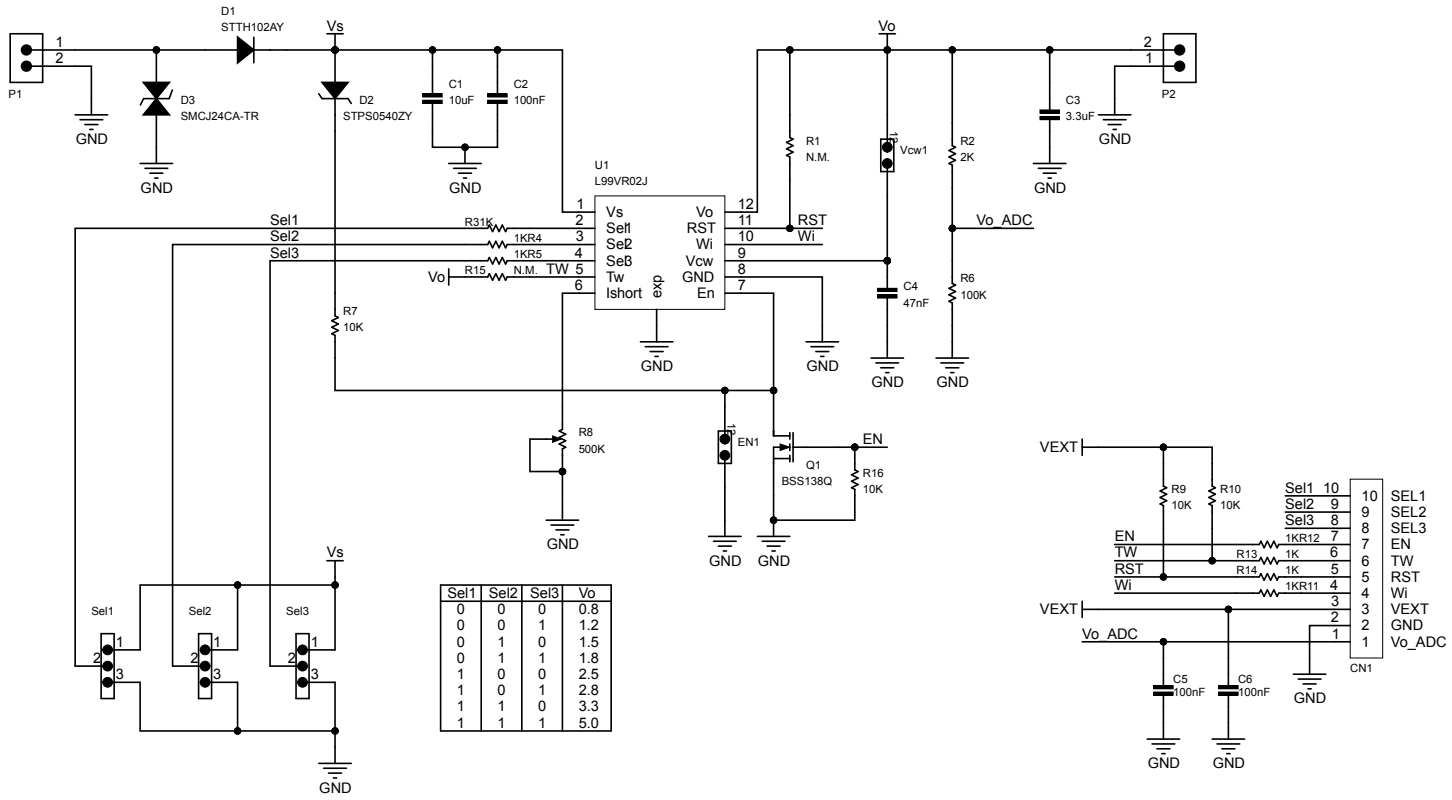


Figure 17. **Reset signal waveform generated by the AEK-POW-LDOV02J if the V_O output voltage is lower than the V_{th} threshold**



7 Schematic diagrams

Figure 18. **AEK-POW-LDOV02J circuit schematic**



Sel1	Sel2	Sel3	Vo
0	0	0	0.8
0	0	1	1.2
0	1	0	1.5
0	1	1	1.8
1	0	0	2.5
1	0	1	2.8
1	1	0	3.3
1	1	1	5.0

8 Bill of materials

Table 6. **AEK-POW-LDOV02J bill of materials**

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
1	1	C1	10uF, 1210C, 50V, ±10%	1210 capacitor - X7R Class II	Wurth Elektronik	885012209073
2	3	C2, C5, C6	100nF, 0603C, 50V, ±10%	0603 capacitor - X7R Class II	Wurth Elektronik	885012206095
3	1	C3	3.3uF, 1206C, 25V, ±10%	1206 capacitor - X7R Class II	Wurth Elektronik	885012208067
4	1	C4	47nF, 0603C, 50V, ±10%	0603 capacitor - X7R Class II	Wurth Elektronik	885012206093
5	1	CN1	Connector M KK254	Conn, header, 10-pos, 1 row, 2.54 mm	Wurth Elektronik	61901011121
6	1	D1	STTH102AY, SMA	Automotive 200 V, 1 A ultrafast diode	ST	STTH102AY
7	1	D2	STPS0540ZY, SOD-123	Automotive 40 V, 0.5 A power Schottky rectifier	ST	STPS0540ZY
8	1	D3	SMCJ24CA-TR, SMC	1500 W, 24 V TVS in SMC	ST	SMCJ24CA-TR
9	2	EN1, Vcw1	Jumper, SIP2	Header, 2-Pin, Single row	Wurth Elektronik	61300211121
10	2	P1, P2	691213510002, RisingCageClamp - 2p-5.08mm	WR-TBL series 2135 - 5.08 mm horizontal entry modular w. rising cage clamp	Wurth Elektronik	691213510002
11	1	Q1	BSS138Q, SOT23	N-channel enhancement mode automotive vertical DMOS FET	Diodes	BSS138Q-7-F
12	2	R1, R15	N.M., 0603R	0603 Resistor - ±1%	Any	Any
13	1	R2	2K, 0603R, 0.2W, +/-1%	0603 Resistor - ±1%	Panasonic	ERJP03F2001V
14	7	R3, R4, R5, R11, R12, R13, R14	1K, 0603R, 0.2W, +/-1%	0603 Resistor - ±1% -	Panasonic	ERJPA3F1001V
15	1	R6	100K, 0603R, 0.2W, +/-1%	0603 Resistor - ±1%	Panasonic	ERJP03F1003V
16	4	R7, R9, R10, R16	10K, 0603R, 0.2W, +/-1%	0603 Resistor - ±1%	Panasonic	ERJP03F1002V
17	1	R8	500K, 3296W Trimmer THT, 0.5W, +/-10%	Trimmer - ±10%	Bourns	3296W-1-504LF
18	3	Sel1, Sel2, Sel3	Jumper SIP3	Header, 3-pin, single row	Wurth Elektronik	61300311121

Item	Q.ty	Ref.	Part/value	Description	Manufacturer	Order code
19	1	U1	L99VR02J, PowerSSO-12	Automotive linear voltage regulator with configurable output voltage and 500 mA current capability	ST	L99VR02J
20	4		60900213421	Jumper 2.54 mm	Wurth Elektronik	60900213421
21	4		970100365	Nylon spacer M3x10mmF/F	Wurth Elektronik	970100365
22	4		97790603111	Nylon screw M3x6mm	Wurth Elektronik	97790603111
23	1		61901011621	2.54 mm female terminal housing	Wurth Elektronik	61901011621
24	10		61900113722DEC	WR-WTB 2.54 mm female crimp contact	Wurth Elektronik	61900113722DEC

9 Board versions

Table 7. **AEK-POW-LDOV02J versions**

PCB version	Schematic diagrams	Bill of materials
AEK$POW-LDOV02JA (1)	AEK$POW-LDOV02JA schematic diagrams	AEK$POW-LDOV02JA bill of materials

1. *This code identifies the AEK-POW-LDOV02J evaluation board first version. It is printed on the board PCB.*

10 Regulatory compliance information

Formal Notice Required by the U.S. Federal Communications Commission

For evaluation only; not FCC approved for resale

FCC NOTICE

This kit is designed to allow:

(1) Product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and

(2) Software developers to write software applications for use with the end product.

This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter 3.1.2.

Formal Product Notice Required by Industry Canada Innovation, Science and Economic Development

Canada compliance:

For evaluation purposes only. This kit generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to Industry Canada (IC) rules.

À des fins d'évaluation uniquement. Ce kit génère, utilise et peut émettre de l'énergie radiofréquence et n'a pas été testé pour sa conformité aux limites des appareils informatiques conformément aux règles d'Industrie Canada (IC).

Formal product notice required by EU

This device is in conformity with the essential requirements of the Directive 2014/30/EU (EMC) and of the Directive 2015/863/EU (RoHS).

Revision history

Table 8. **Document revision history**

Date	Revision	Changes
11-May-2023	1	Initial release.

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