EV-VNF9D5F

Data brief

VNF9D5F evaluation board

Product status link
EV-VNF9D5F

Features

Channel	V_{CC}	RDS(on) (typ.)	$I_{LIMH\ (typ.)}$
0-1	28 V	5.9 mΩ	75 A

- AEC-Q100 qualified
- General
  - Dual channel with 24-bit ST-SPI for full diagnostics and digital current sense feedback
  - Integrated 10-bit ADC for digital current sense
  - Integrated PWM engine with independent phase shift and frequency generation for each channel
  - Programmable Bulb/LED mode for all channels
  - Advanced limp-home functions for robust fail-safe system
  - Very low standby current
  - Optimized electromagnetic emissions
  - Very low electromagnetic susceptibility
  - Control via direct inputs and/or SPI
  - Compliant with European directive 2002/95/EC
  - Capacitive load charging mode
- Diagnostic functions
  - Digital proportional load current sense
  - Synchronous diagnostics of overload, short to GND and harness protection
  - Asynchronous diagnostics of output shorted to VCC and OFF-state open-load
  - Built-in self-test for ADC and harness protection
  - Programmable case overtemperature warning
- Protections
  - Full configurable wire harness protection (STi²Fuse)
  - Load current limitation
  - Self-limiting of fast thermal transients
  - Latch-off or programmable time-limited auto-restart (power limitation and overtemperature shutdown)
  - Undervoltage shutdown
  - Overvoltage clamp
  - Load dump protection
  - Protection against loss of ground

Applications

- 2-channel high-side driver with STi²Fuse protection, for automotive power distribution applications

Description

The EV-VNF9D5F board provides an easy way to connect an ST VIPower technology device into an existing system.

1 Overview

The board comes pre-assembled with a VNF9D5F high-side driver. It includes a minimum set of electrical components (as recommended in the device datasheet), enabling the user to connect the load directly, the power supply, and the microcontroller without any additional effort in external component design and connection.

The VNF9D5F is a device built using STMicroelectronics VIPower technology. It is designed to drive resistive or inductive loads directly connected to the ground.

The device is protected against voltage transients on the VCC pin. Programming, control, and diagnostics are implemented via the SPI bus. A digital current sense feedback for each channel is provided through an integrated 10-bit ADC. Dedicated trimming bits allow adjustment of the ADC reference current.

The device is equipped with two outputs, which can be controlled via SPI or 2-OTP assignable direct inputs. Real-time diagnostics are available through the SPI bus (open-load, output short to VCC, overtemperature, communication error, power limitation or latch off). The device detects open-load in OFF-state conditions.

The VNF9D5F embeds the STMicroelectronics proprietary I²t functionality, featuring an intelligent circuit breaking system aimed at protecting PCB traces, connectors and wire harnesses from overheating, with no impact on load transients like inrush currents and capacitance charging. This function is set by two parameters called INOM and tNOM. There are three dedicated bits for each parameter to configure INOM (nominal current) and tNOM (nominal timing) respectively. The I²t curve parameters can be individually set for each channel.

The VNF9D5F can limit dissipated power to a safe level until thermal shutdown intervention. Thermal shutdown can be configured as latched off or programmable time-limited auto-restart.

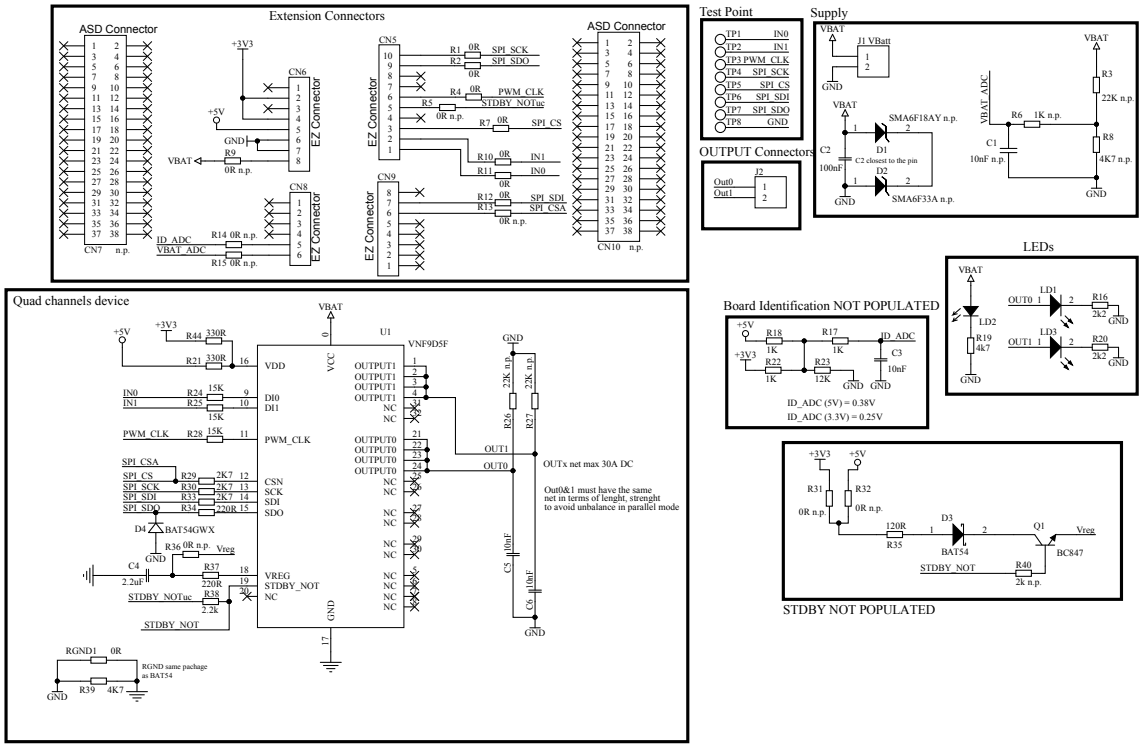
The output current limitation protects the device in case of overload.

In case of communication loss with the microcontroller, digital memory reset or watchdog monitoring time-out, the device enters a fail-safe mode. In fail-safe mode, the two outputs can be directly controlled via dedicated, assignable direct inputs.

It is also possible to configure the VNF9D5F in parallel mode (CH0//CH1) through a dedicated OTP bit.

The VNF9D5F features an operative condition called capacitive charging mode (CCM), which is available in both fail-safe and normal device states, and with channels configured in bulb mode.

Figure 1. Board schematics



2 Board connections

Figure 2. Evaluation board connections shows the placement of the connectors to be used for supplying the evaluation board, connecting the load, and controlling the functionality and diagnostics of the device.

Figure 2. Evaluation board connections

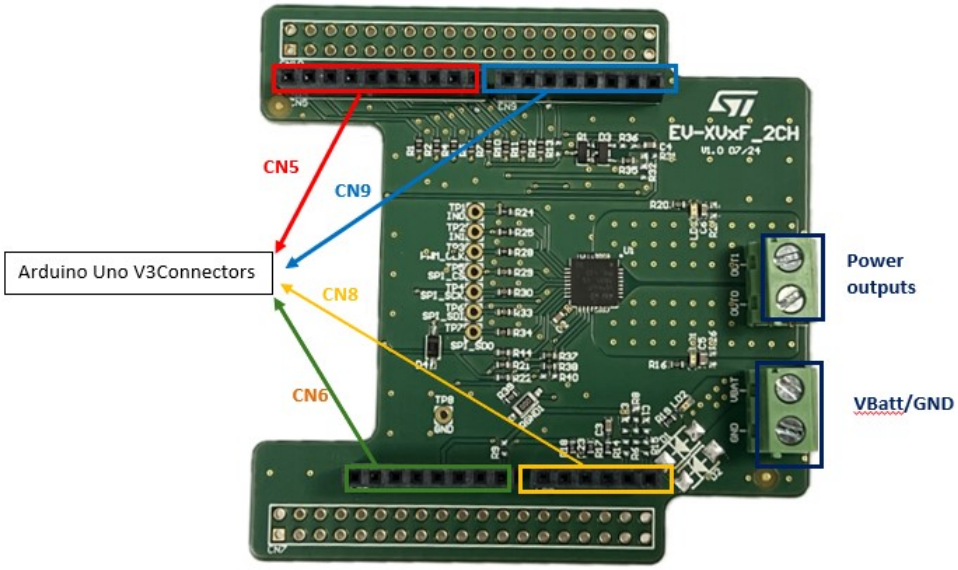


Table 1. CN connectors: pin functions

Connector	Pin number	Pin function
CN5	1	IN0
CN5	2	IN1
CN5	3	SPI_CS
CN5	6	PWM_CLK
CN5	9	SPI_SD0
CN5	10	SPI_SCK
CN6	2	VDD_uC
CN6	6	GND
CN6	7	GND
CN6	8	VBAT
CN8	5	ID_ADC
CN8	6	VBAT_ADC
CN9	6	SPI_CSA
CN9	7	SPI_SDI

3 Thermal data

Table 2. Thermal data

Symbol	Parameter	Max	Unit
$R_{thj\text{-}amb}$	Thermal resistance junction-to-ambient (max.)	43.4	°C/W

Table 3. PCB specifications

Parameter	Value
Board dimensions	70 mm x 70 mm
Number of Cu layers	2
Cu Layer thickness	70 µm
Board finish thickness	1.6 mm +/- 10%
Board material	FR4
Thermal vias diameter	0.3 mm

Revision history

Table 4. **Document revision history**

Date	Version	Changes
25-Jun-2025	1	Initial release.
16-Jul-2025	2	Updated to public.
21-Jul-2025	3	Cover image and schematics update.

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