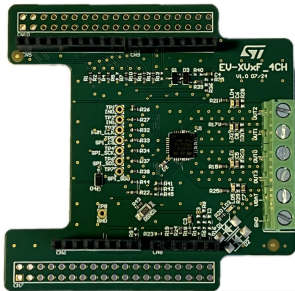


## VNF9Q20F evaluation board




EV-VNF9Q20F

## Product status link

[EV-VNF9Q20F](#)

## Features

Channel	V <sub>CC</sub>	R <sub>DS(on)</sub> (typ.)	I <sub>LIMH</sub> (typ.)
0, 1, 2, 3	28 V	21.5 mΩ	34.5 A

- AEC-Q100 qualified 
- General
  - Quad channel with 24-bit ST-SPI for full diagnostic 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 through direct inputs and/or SPI
  - Compliant with European directive 2002/95/EC
  - Capacitive loads charging mode
- Diagnostic functions
  - Digital proportional load current sense
  - Synchronous diagnostic of overload, short to GND and harness protection
  - Asynchronous diagnostic of output shorted to V<sub>CC</sub> and OFF-state open-load
  - Built In Self-Test for ADC and harness protection
  - Programmable case overtemperature warning
- Protections
  - Full configurable wire harness protection (STi<sup>2</sup>Fuse)
  - 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 protected
  - Protection against loss of ground

## Application

- 4-channel high-side driver with STi<sup>2</sup>Fuse protection for automotive power distribution applications

## Description

The EV-VNF9Q20F board provides an easy way to connect ST VIPower technology device into existing system.

# 1 Overview

It comes preassembled with EV-VNF9Q20F high-side driver. On board a minimum set of electrical components (as for device datasheet recommendation) is enabling the user to directly connect the load, the power supply and the microcontroller without any additional effort in external component design and connection.

The VNF9Q20F is a device made using STMicroelectronics VIPower technology. It is intended for driving 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 adjusting the ADC reference current.

The device is equipped with 4 outputs controllable via SPI or 2-OTP assignable direct inputs. Real-time diagnostic is available through the SPI bus (open-load, output short to V<sub>CC</sub>, overtemperature, communication error, power limitation or latch off). The device detects open-load in OFF-state conditions.

The VNF9Q20F embeds the STMicroelectronics proprietary I<sup>2</sup>t functionality, featuring an intelligent circuit breaking aimed at protecting PCB traces, connectors and wire harness from overheating, with no impact on load transients like inrush currents and capacitance charging. This function is set by two parameters called I<sub>NOM</sub> and t<sub>NOM</sub>: there are 3 dedicated bits, per each parameter, to set respectively I<sub>NOM</sub> (nominal current) and t<sub>NOM</sub> (nominal timing). The I<sup>2</sup>t curve parameters can be individually set per each channel.

The VNF9Q20F can limit the dissipated power to a safe level up to thermal shutdown intervention. Thermal shutdown can be configured as latched off or programmable time limited auto restart.

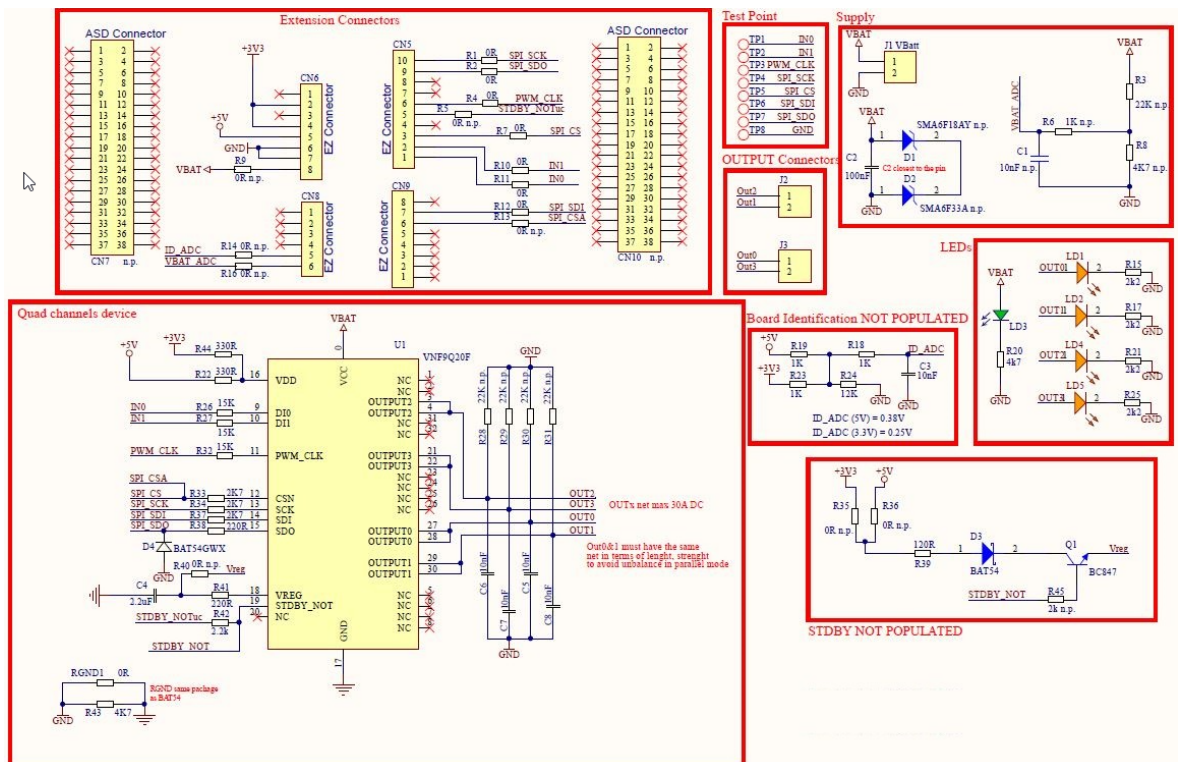
The output current limitation protects the device in case of overload.

The device enters a fail-safe mode in case of communication loss with the microcontroller, reset of digital memory or watchdog monitoring time-out event. In fail-safe mode, the 4 outputs can be directly controlled by dedicated, assignable direct inputs.

It is also possible to configure the VNF9Q20F in parallel mode (CH0//CH1 only) through a dedicated OTP bit.

The VNF9Q20F 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.

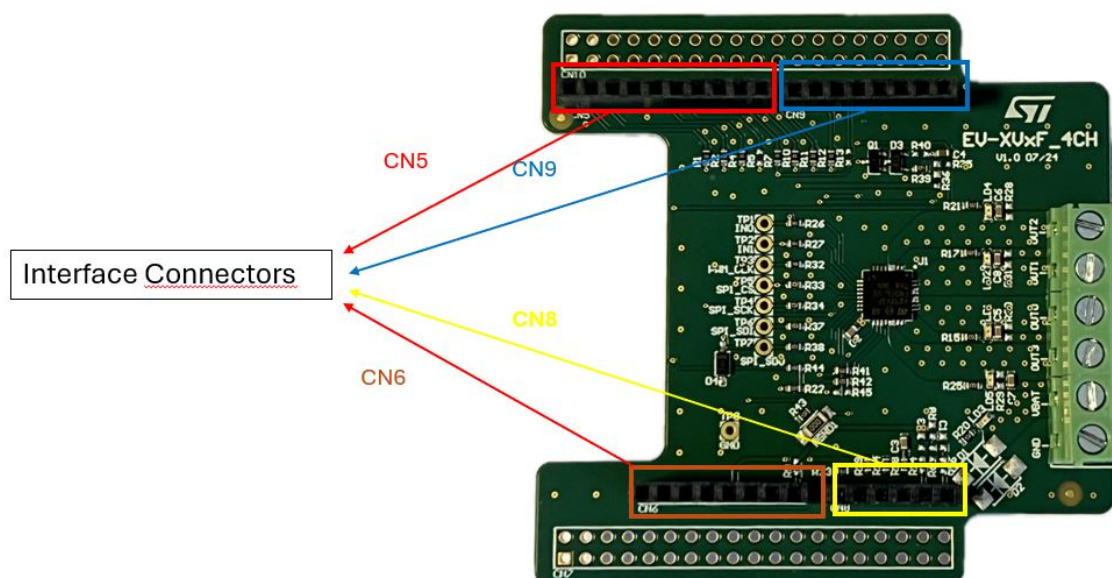
Figure 1. Board schematics



## 2 Board connections

The following figure shows the placement of the connectors to be used for supplying the evaluation board, connecting the load and controlling the functionality and diagnostic 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_SDO
CN5	10	SPI_SCK
CN6	2	VDD_μC
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 <sub>thj-amb</sub>	Thermal resistance junction-ambient (max.)	45.2	°C/W

**Table 3. PCB specifications**

Parameter	Value
Board dimensions	70 mm x 70 mm
Number of Cu layer	2
Layer Cu 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	Revision	Changes
18-Sep-2024	1	Initial release.

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