AN4862
Application note

STEVAL-IFP032V1 evaluation board for the VNI8200 octal high side driver

Introduction

The STEVAL-IFP032V1 is an evaluation board for the IPS VNI8200XP and VNI8200XP-32 monolithic 8-channel high side drivers featuring very low supply current, an integrated SPI interface and a high efficiency 100 mA micropower step-down switching regulator. Only the 0.7 A for VNI8200XP and 1.2 A for VNI8200XP-32 operating current differentiates the two.

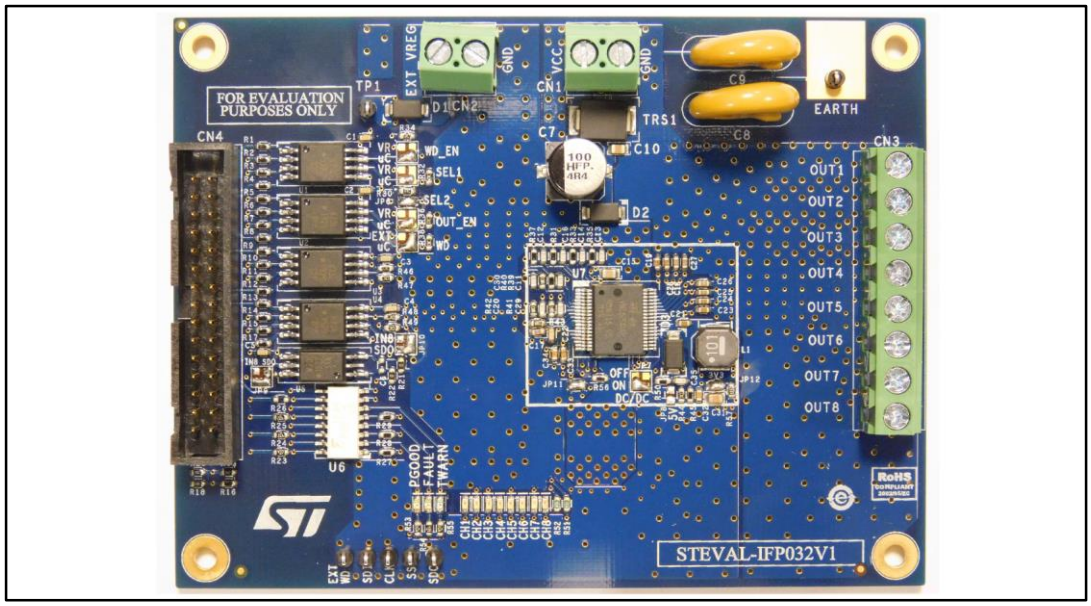
The STEVAL-IFP032V1 provides a 4-row, 2-column LED matrix to signal the status of each output line. The LED matrix is supplied by the step-down regulator integrated in the VNI8200 devices. The same integrated regulator supplies the external high-speed optocouplers, which provide the isolated interface required by industrial standards between the IPS and the host controller.

The four-layer structure of the board with dedicated copper areas on each layer improves the distribution of power dissipation, for optimized thermal performance.

The STEVAL-IFP032V1 meets EFT standard requirements IEC 61000-4-2, IEC 61000-4-4 and IEC 61000-4-5.

The STEVAL-IFP032V1 can be controlled via a dedicated, user-friendly GUI for Windows operating systems when a STEVAL-PCC009V2 communication board is connected between the evaluation board and the PC.

Figure 1: STEVAL-IFP032V1 evaluation board



Contents

1 Features

- Operating voltage from 10.5 to 33 V
- Operating current: 1.2 A
- Reverse polarity protection
- High speed opto-isolation for SPI and parallel communication
- Low speed opto-isolation for device fault signaling
- Step-down converter for 3.3 V or 5 V
- Digital supply voltage
- LED matrix for channel status signaling
- Microcontroller interface
- Designed to meet EMC standard requirements: IEC 61000-4-2, IEC 61000-4-4, and IEC 61000-4-5

2 Evaluation board characteristics

Figure 2: Schematic diagram - interface section

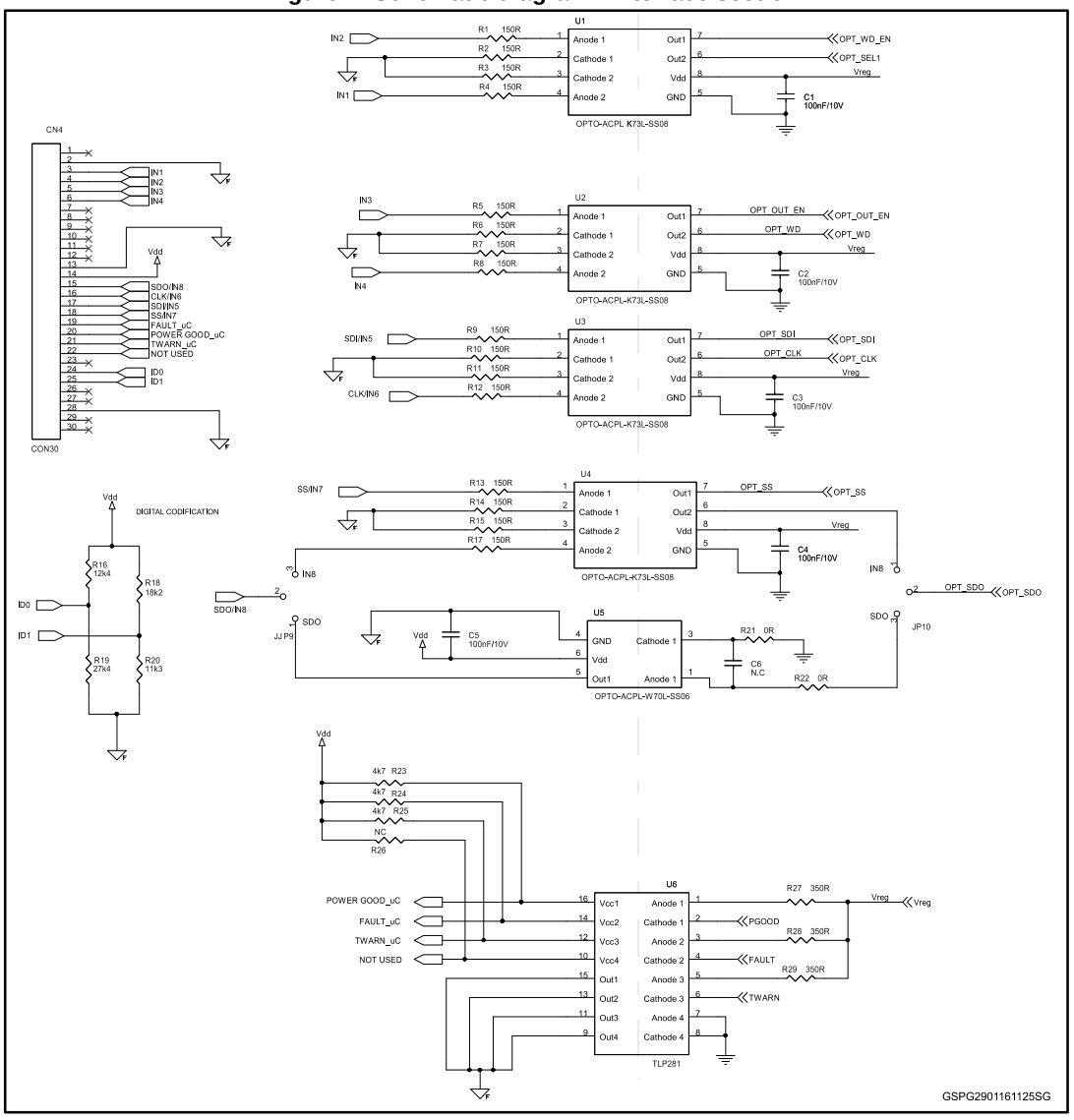


Figure 3: Schematic diagram - power section

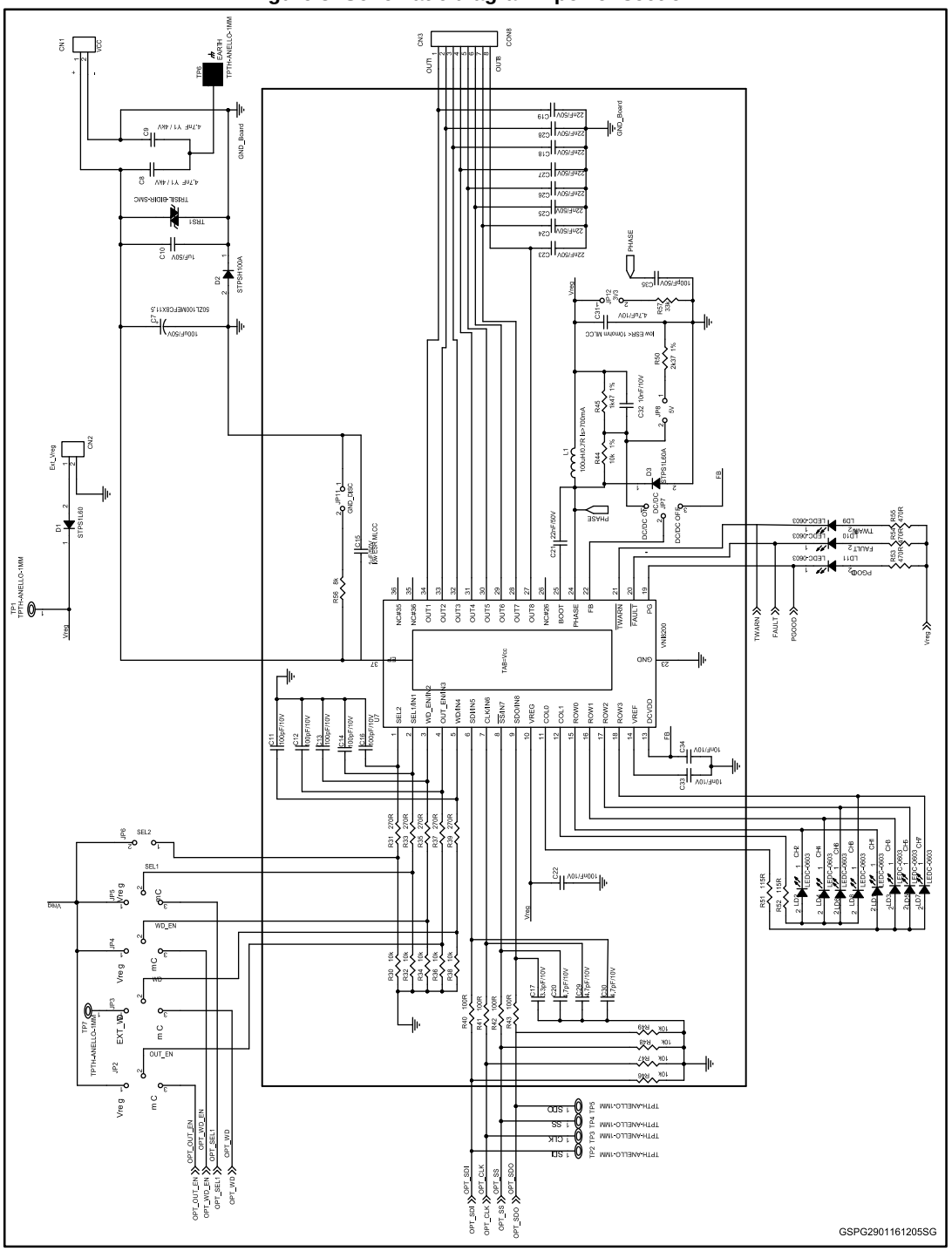


Table 1: "STEVAL-IFP032V1 connector and jumper description" summarizes the board connectors and jumpers for device driving.

Table 1: STEVAL-IFP032V1 connector and jumper description

Name	Type	Function
J6	Drop jumper	Drop jumper to select parallel or SPI interface
CN2	Digital supply	External 3.3 - 5 V supply
CN1	Power supply	Supply voltage
JP2,JP3,JP4,JP5,JP6	Drop jumpers	Drop jumper to select external reference or microcontroller driving
JP7	Drop jumper	DC-DC disable
JP8	Drop jumper	DC-DC 5 V regulation
CN3	Power outputs	Device power outputs
CN4	30-pin connector	Microcontroller interface

Table 2: STEVAL-IFP032V1 30-pin signal connector description

Pin number	Description
1	3.3 V communication board digital output voltage
2	GND reference
3	Parallel Input pin IN1
4	Parallel input pin IN2
5	Parallel input pin IN3
6	Parallel input pin IN4
7-12	NC
13	GND reference
14	V_{dd}
15	SPI device data out/parallel input 8
16	SPI CLK/ parallel input 6
17	SPI device data in/parallel input 5
18	Chip select/parallel input 7
19	Fault feedback for improper communication or thermal junction protection intervention
20	Power Good feedback
21	Thermal case feedback information
22	Not used
23	NC
24,25	Reserved
26,27	NC
28	GND reference
29,30	NC

3 PCB layout

Figure 4: STEVAL-IFP032V1: component placement

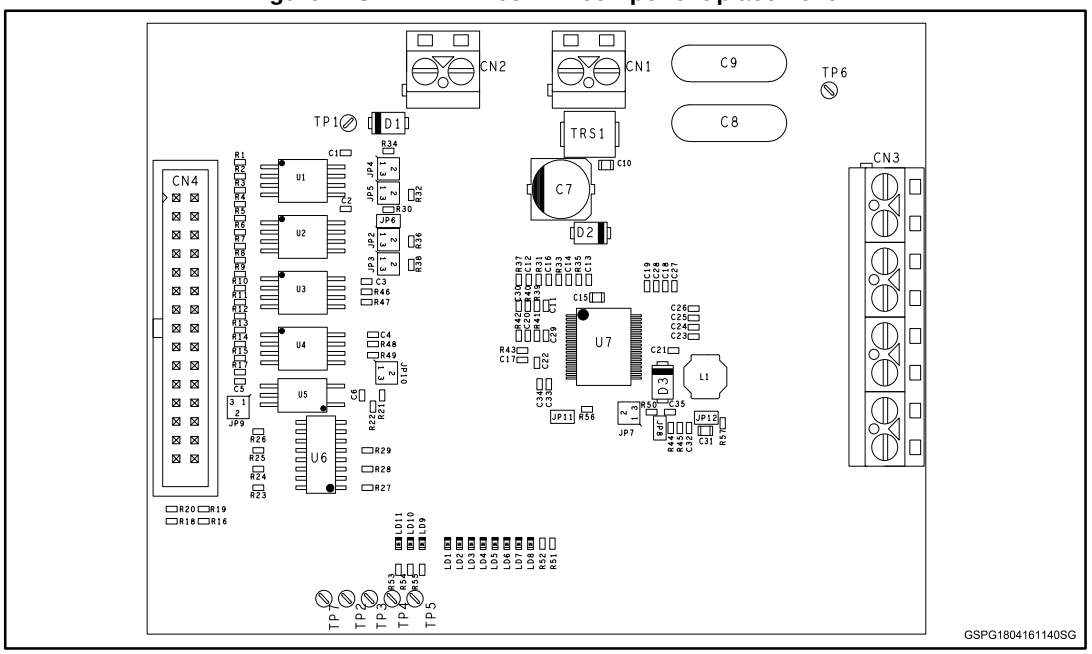


Figure 5: STEVAL-IFP032V1: top side layout

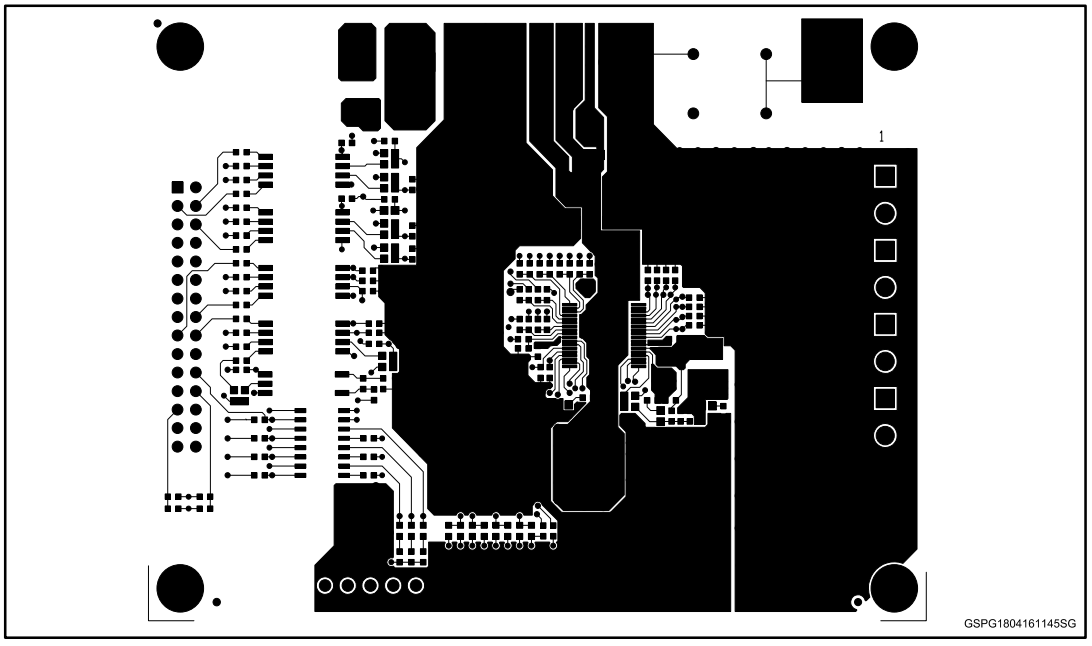


Figure 6: STEVAL-IFP032V1 internal layer 1

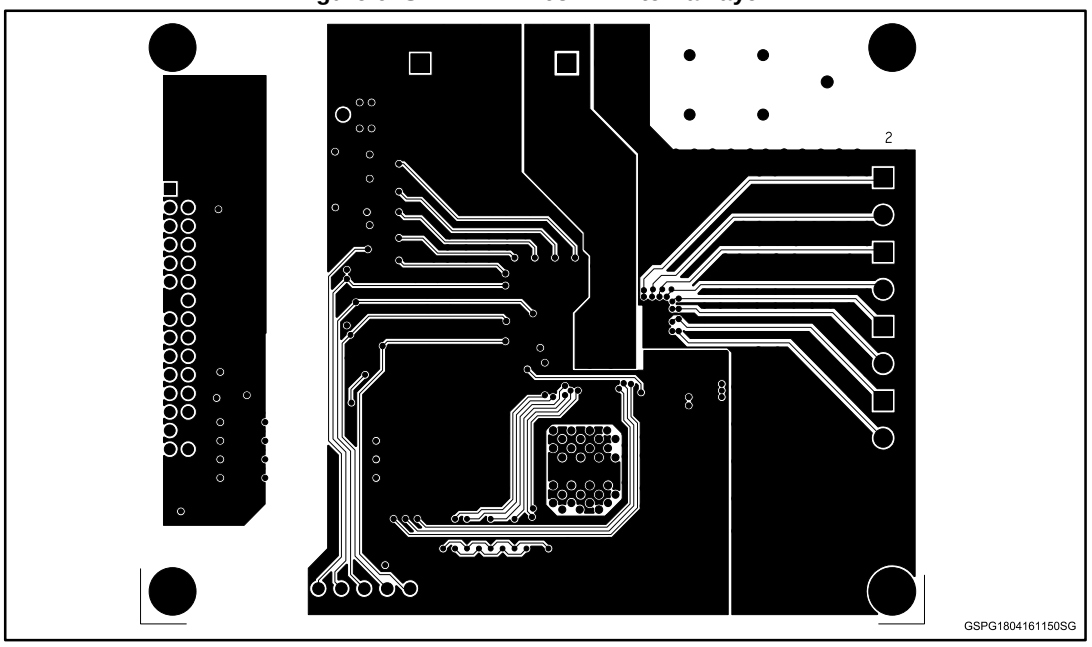


Figure 7: STEVAL-IFP032V1 internal layer 2

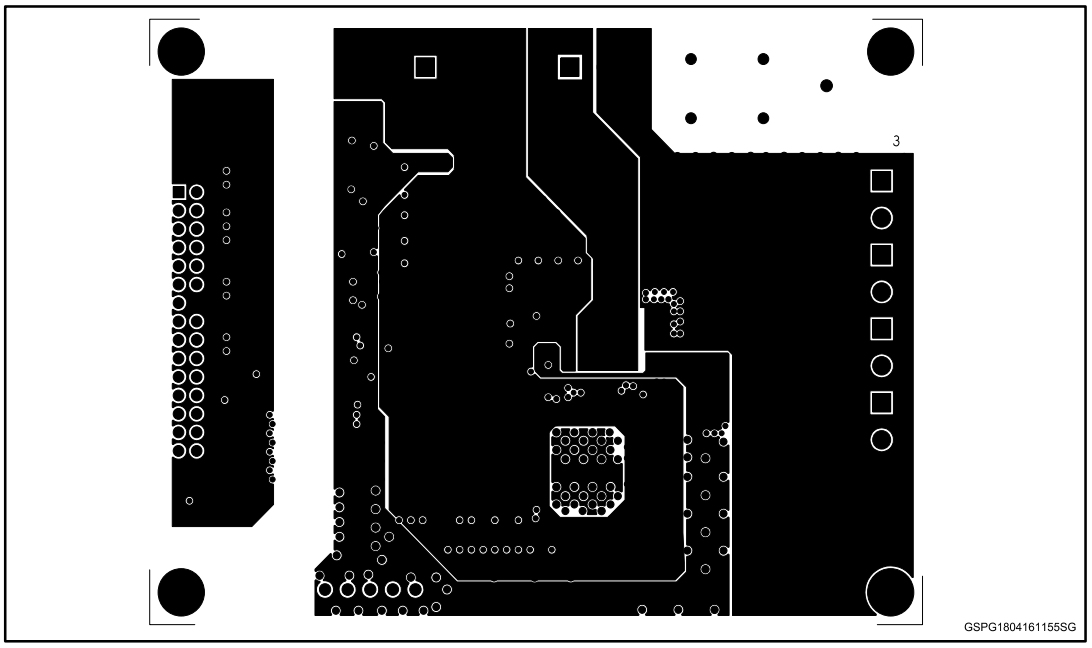
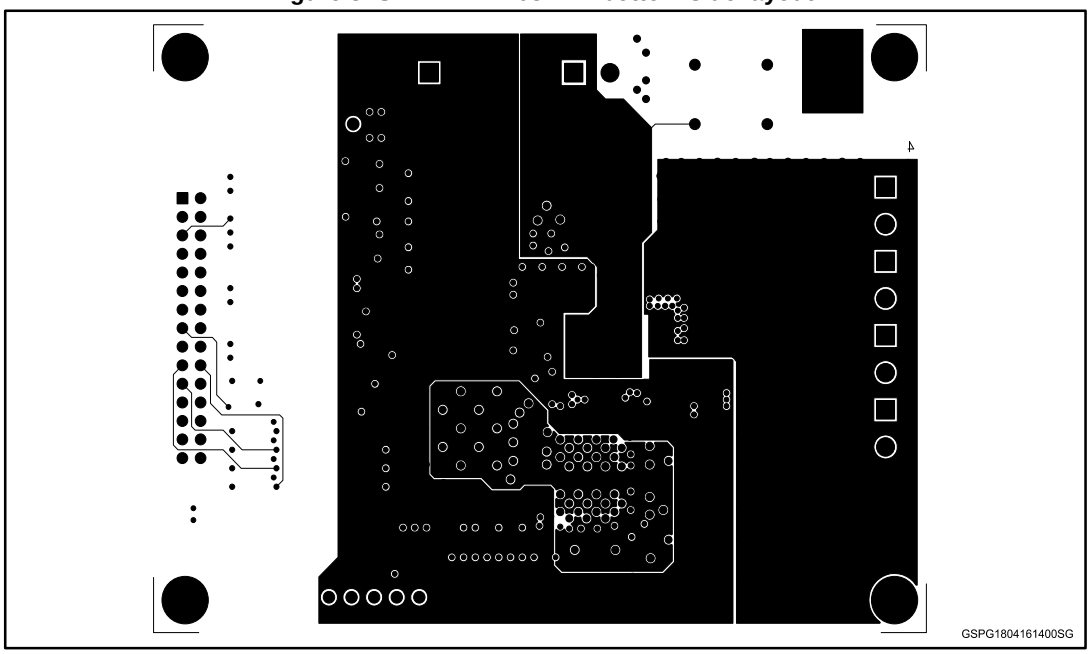


Figure 8: STEVAL-IFP032V1: bottom side layout



3.1 Power section

Set the main voltage between 18 and 33 V to avoid overheating of the Transil diode due to high reverse voltage. A digital supply voltage may be provided via the on-board DC-DC converter or the CN2 connector. This evaluation board also provides reverse polarity protection through a Schottky diode and surge protection through a Transil diode with 45 V clamp voltage.

Table 3: STEVAL-IFP032V1 electrical specifications (recommended values)

Parameter	Description	Test Condition	Typ	Unit
V_{CC}	Main supply voltage		24	V
V_{reg}	Digital voltage supply		5	V
I_{Vcc}	Current consumption	DC-DC OFF V_{reg} = 5 V SPI OFF channel OFF	5	mA
		DC-DC ON V_{reg} = 5 V SPI ON channel OFF	15	mA
V_{clamp}	Supply voltage clamp		48	V
R_{th}	Thermal resistance		15	°C/W

3.2 Step-down converter

The step-down converter is designed to generate a regulated 3.3 V/5 V voltage for internal circuitry, the optocoupler and other VNI8200 devices (by bypassing diode D1) if necessary.

To set regulated voltage, open drop jumper JP8 for 3.3 V regulation and close it for 5 V regulation.

To turn on or turn off the DC-DC converter, close JP7 on the appropriate side; moreover, in case of 3.3 V regulation, jumper JP12 must be closed. The regulated voltage can be measured at test point TP1.

3.3 Digital interface

The STEVAL-IFP032V1 allows device driving with a maximum 4.5 MHz parallel or synchronous communication through a 30-pin connector. The steps required to manage the evaluation tool are described below.

3.3.1 Parallel interface

To select the parallel interface, the drop jumper JP6 should be left open, whereas JP10 has to be soldered on the side identified with the label “IN8”.

After this, you can manage all signals for parallel communication through the 30-pin connector. In parallel configuration, the input pin connected to drop jumpers JP2, JP4, JP5 and JP3 can be managed by a microcontroller or kept fixed to a reference.

By leaving the drop jumpers open, the corresponding input is pulled down, while soldering on the other reference it is possible to always have a high input or provide a square wave at different periods for a WD signal.

3.3.2 SPI communication

For SPI communication, close jumper JP6 and solder jumpers JP10 and JP9 on the side with the “SDO” label.

In this mode, the watchdog reset function is available.

This functionality can be controlled by a microcontroller by soldering drop jumpers JP3 and JP4 on side with the “µC” label, or controlled externally by soldering JP3 and JP4 on the opposite side, fixing these signals to another reference.

The above also applies to drop jumpers “OUT_EN” and “SEL1”.

3.4 Thermal management

Thermal management is facilitated by distributing power dissipation on V_{CC} over four layers. This solution allows an R_{th} of 15 °C/W with an approximate 16 cm² copper area on the bottom layer and 6 cm² on the other layers. The copper thickness is 70 µm.

3.5 EMC robustness

The STEVAL-IFP032V1 satisfies all IEC 61000-4-2, IEC 61000-4-4, and IEC 61000-4-5 requirements for ESD (air discharge and contact discharge), burst on outputs and supply line and surge tests on output and supply line respectively.

4 PC communication using STEVAL-PCC009V2 connection and HSD GUI interface

This evaluation board has a 30-pin connector which can be used to interface with the STEVAL-PCC009V2 board, which allows communication and driving of the STEVAL-IFP032V1 board in parallel and serial mode via GUI interface.

Figure 9: GUI interface SPI 16-bit communication

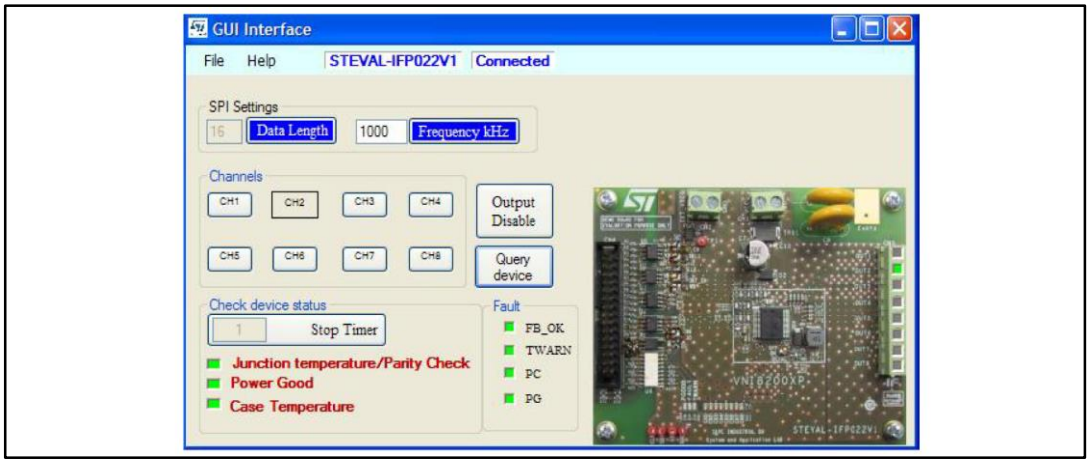
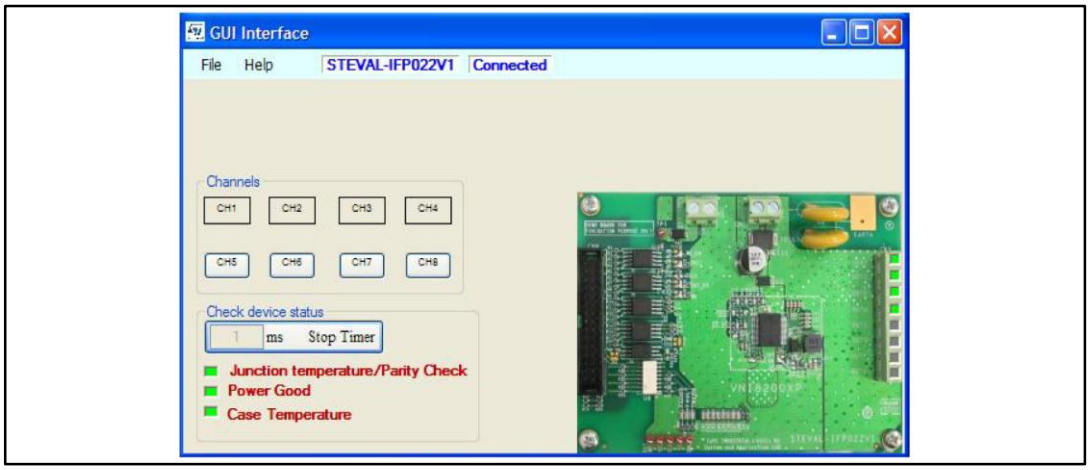


Figure 10: GUI interface parallel communication



5 Bill of material

Table 4: Bill of material - interface section

Components	Description	Type	Part number	Manufacturer
C1, C2, C3, C4, C5	100 nF/10 V	Ceramic SMT 0603	GRM188R71H104JA93D	Murata
C6	NC	Ceramic SMT 0603	GRM188R71H104JA93D	Murata
J1	CON30	30-pin connector		
J2	IN8	Drop jumper		
J3	SDO	Drop jumper		
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R17	150R	Resistor		
R16	12K4	Resistor		
R23, R24, R25,	4K7	Resistor		
R26	NC	Resistor		
R18	18K2	Resistor		
R19	27K4	Resistor		
R20	11K3	Resistor		
R21	0R	Resistor		
R22	0R	Resistor		
R27, R28, R29	350R	Resistor		
U1, U2, U3, U4	ACPL-K73L-000E	Optocoupler SMD	ACPL-K73L-000E	Avago Technologies
U5	ACPL- W070L-000E	Optocoupler SMD	ACPL-W070L-000E	Avago Technologies
U6	TLP281	Optocoupler SMD	TLP281-4	Toshiba

Table 5: Bill of material - power section

Components	Description	Type	Part number	Manufacturer
D4, D5, D6, D7, D8, D9, D10, D11	Green LED	LED SMD		
C7	100 µF/50 V	Electrolytic capacitor	EEEFP1H101AP	Panasonic
C8, C9	4.7 nF Y1 / 4 kV 500 V_{ac}	Ceramic single layer	VY1472M63Y5UQ6*V0	Vishay
C15	1 µF/50 V	Ceramic SMT	GRM31MR71H105KA88L	Murata
C10	1 µF/50 V	Ceramic		
C11, C12, C13, C14, C16,	100 pF/10 V	Ceramic		
C17	3.3 pF/10 V	Ceramic		

Components	Description	Type	Part number	Manufacturer
C18, C19, C21, C23, C24, C25, C26, C27, C28	22 nF/50 V	Ceramic		
C20, C29, C30	4.7 pF/10 V	Ceramic		
C22	100 nF/10 V	Ceramic		
C31	4.7 µF/10 V	Ceramic SMT	GRM21BR71A475KA73L	Murata
C32, C33, C34	10 nF/10 V	Ceramic		
C35	100 pF/50 V	Ceramic		
D1, D3	STPS1L60A	Schottky diode SMD		ST
D2	STPS1H100A	Schottky diode SMD		ST
D12, D13, D14	RED LED	LED SMD		
CN2	Ext_{reg}	2-way screw connector		
CN1	V_{CC}	2-way screw connector		
JP2	OUT_EN	Drop jumper		
JP3	WD	Drop jumper		
JP4	WD_EN	Drop jumper		
JP5	SEL1	Drop jumper		
JP6	SEL2	Drop jumper		
CN3	CON8	8-way screw connector		
J8	5 V	Drop jumper		
J7	DC-DC	Drop jumper		
JP11	GND_DISC	Drop jumper		
JP12	3V3	Drop jumper		
L1	100 µH/0.7R Is > 700 mA	Inductor	LQH6PPN101M43L	Murata
R30, R32, R34, R36, R38, R46, R47, R48, R49	10 k	Resistor		
R31, R33, R35, R37, R39,	270R	Resistor		
R40, R41, R42, R43	100R	Resistor		
R56	8 k	Resistor		
R44	10 k 1%	Resistor		
R45	1k47 1%	Resistor		
R50	2k37 1%	Resistor		
R51, R52	115R	Resistor		
R53, R54, R55	470R	Resistor		
R57	33 k	Resistor		
TP1	Vreg	Test point 1 mm		

Components	Description	Type	Part number	Manufacturer
TP2	SDI	Test point 1 mm		
TP3	CLK	Test point 1 mm		
TP4	SS	Test point 1 mm		
TP5	SDO	Test point 1 mm		
TP7	WD	Test point 1 mm		
TRS1	SM15T33CA	Transil		ST
U7	VNI8200XP-32			ST

6 Reference documents

- VNI8200XP-32 datasheet
- IEC 61000-4-4 standard
- IEC 61000-4-5 standard
- IEC 61000-4-2 standard

7 Revision history

Table 6: Document revision history

Date	Revision	Changes
27-Apr-2016	1	Initial release.

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