

Eval-iSSI20B02FCS user guide

Infineon coreless-transformer advanced solid-state isolator

About this document

Scope and purpose

This user guide describes the functionalities and key features of Infineon's coreless-transformer advanced solid-state isolator.

Infineon's solid state isolator evaluation board EVAL-iSSI20B02FCS features the coreless-transformer advanced solid-state isolator, iSSI20B02F. This user guide covers the design revision 1.0 of this evaluation board.

iSSI20B02F is certified as per UL 1577.

Intended audience

- Engineers who want to learn how to use Infineon's SSI advanced iSSI20B02F
- Experienced design engineers who design circuits with photovoltaic isolators (PVI), IGBTs, and MOSFETs
- Design engineers who develop solid-state relays

About this product group

Target applications

- [Solid-state relay \(SSR\) modules](#)
- [Low voltage building automation](#)
- [Laboratory power supplies](#)
- [Telecom infrastructure](#)
- [Industrial automation - PLC I/O](#)
- Test and measurement systems
- Photovoltaic isolator Replacement

Product family

Infineon's iSSI20B03F belongs to the advanced solid-state isolator (SSI) family, using coreless-transformer technology. The Infineon SSI family provides powerful energy transmission over a galvanic isolation barrier to drive the gates of MOS-controlled power transistors, such as CoolMOS™, OptiMOS™, or TRENCHSTOP™ IGBT. The output side of the Infineon SSI family does not require a dedicated voltage supply to drive the power transistor's gate. The output side offers advanced control functions such as fast turn-on, fast turn-off, overcurrent protection and over-temperature protection to easily and safely build up solid-state relays for various applications.

Evaluation board

The Evaluation board EVAL-iSSI20B02FCS is designed based on the environmental conditions described in this document. It has been tested as described in this document, but not qualified regarding manufacturing, lifetime, or over the full range of ambient operating conditions. The boards provided by Infineon are not subject to full production tests.

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About this product group

Evaluation boards are not subject to the same procedures as regular products regarding returned material analysis (RMA), process change notification (PCN), and product discontinuation (PD). Evaluation boards are intended to be used under laboratory conditions and by trained specialists only.

Note: PCB and auxiliary circuits are NOT optimized for final customer design.

Safety precautions

Safety precautions

Note: The following warnings regarding the hazards associated with development systems

Table 1 Safety precautions

	Warning: The DC link potential of this board is up to 1000 VDC. When measuring voltage waveforms by oscilloscope, high voltage differential probes must be used. Failure to do so may result in personal injury or death.
	Warning: The evaluation or reference board contains DC bus capacitors which take time to discharge after removal of the main supply. Before working on the drive system, wait five minutes for capacitors to discharge to safe voltage levels. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.
	Warning: The evaluation or reference board is connected to the grid input during testing. Hence, high-voltage differential probes must be used when measuring voltage waveforms by oscilloscope. Failure to do so may result in personal injury or death. Darkened display LEDs are not an indication that capacitors have discharged to safe voltage levels.
	Warning: Remove or disconnect power from the drive before you disconnect or reconnect wires, or perform maintenance work. Wait five minutes after removing power to discharge the bus capacitors. Do not attempt to service the drive until the bus capacitors have discharged to zero. Failure to do so may result in personal injury or death.
	Caution: The heat sink and device surfaces of the evaluation or reference board may become hot during testing. Hence, necessary precautions are required while handling the board. Failure to comply may cause injury.
	Caution: Only personnel familiar with the drive, power electronics and associated machinery should plan, install, commission and subsequently service the system. Failure to comply may result in personal injury and/or equipment damage.
	Caution: The evaluation or reference board contains parts and assemblies sensitive to electrostatic discharge (ESD). Electrostatic control precautions are required when installing, testing, servicing or repairing the assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with electrostatic control procedures, refer to the applicable ESD protection handbooks and guidelines.
	Caution: A drive that is incorrectly applied or installed can lead to component damage or reduction in product lifetime. Wiring or application errors such as undersizing the motor, supplying an incorrect or inadequate AC supply, or excessive ambient temperatures may result in system malfunction.
	Caution: The evaluation or reference board is shipped with packing materials that need to be removed prior to installation. Failure to remove all packing materials that are unnecessary for system installation may result in overheating or abnormal operating conditions.

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1 Overview and key features

1 Overview and key features

EVAL-iSSI20B02FCS is intended for evaluating the product features of Infineon's SSI iSSI20B02F, in an application circuit. The key features of the board and the iSSI20B02F are as follows:

- Evaluation board with iSSI20B02F and two **OptiMOS™ ISC015N06NM5LF** MOSFETs in an AC switch configuration
- Ultra-fast overcurrent detection that is triggered at the typical peak current of 20 A
- Over-temperature protection with PTC resistor (optional)
- Standard turn-on
- Fast turn-off after overcurrent and over-temperature protection
- Dynamic miller clamping

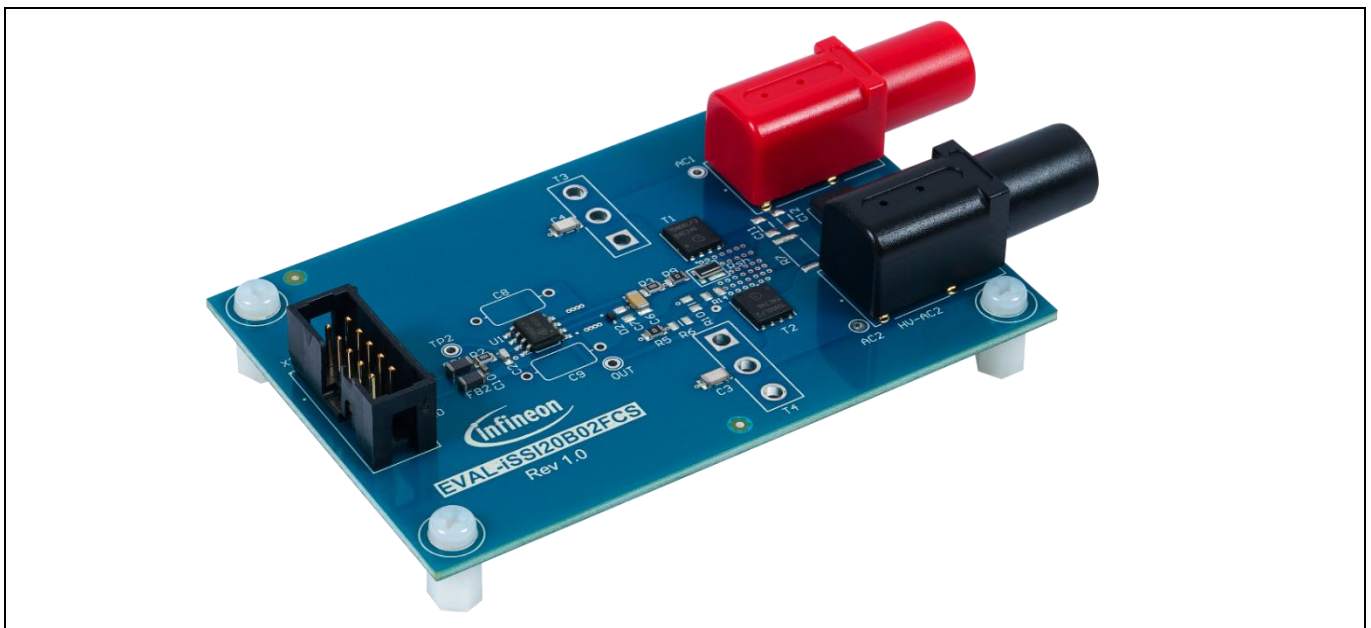


Figure 1 EVAL-iSSI20B02FCS evaluation board

This board is best suited for testing the switching performance of Infineon SSI and OptiMOS™ ISC035N10NM5LF with a resistive load as described in section 3. It requires additional considerations about thermal and power balance for continuous operation.

The control interface can be connected to a pulse generator, a microcontroller, or other digital circuits with appropriate driving capability of at least 25 mA.

2 Absolute maximum ratings, operating conditions, and supply voltages

2 Absolute maximum ratings, operating conditions, and supply voltages

Some components on the evaluation boards as well as Infineon's SSI have defined operating conditions and maximum ratings to avoid damage to individual parts and the overall evaluation board.

Table 2 Absolute maximum ratings

Pin name / parameter	Connector / symbol	Minimum	Maximum	Unit	Note
INP	X2.5, X2.6	-10	5.3	V	Input, Infineon SSI voltage supply
HV-AC1 HV-AC2	HV-AC1 HV-AC2	-60	60	V	Input, high-voltage power supply. For 42 V and above, a special high-voltage lab environment is strongly recommended
RMS current	HV-AC1/2	–	7	A	–
DC current	HV-AC1/2	–	10	A	–
AC1 peak current AC2 peak current	HV-AC1 HV-AC2	–	20	A	Phase peak current for overcurrent protection test (tpulse < 20 μs)
Switching frequency	f _{sw}	–	1	Hz	Maximum switching frequency for continuous operation. Power dissipation required for power transistor and Infineon SSI has been carefully considered
Ambient temperature	T _a	–	30	°C	–

The PCB assembly is optimized for an INP voltage supply of 5 V. Higher supply voltages may require adjustments to the current limiting resistor, R1.

Table 3 Operating conditions and supply voltages

Pin name / parameter	Min.	Typ.	Max.	Unit	Note
INP	4.8	5	5.2	V	Input voltage supply
HV-AC1	-40	–	40	V	Input, high-voltage power supply, referenced to HV-AC2. For 42 V and above, a special high-voltage lab environment is strongly recommended
Inductive load	–	–	15	μH	–
Ambient temperature	–	25	30	°C	–

3 Getting started with EVAL-iSSI20B02FCS

3 Getting started with EVAL-iSSI20B02FCS

Follow the steps given in this chapter to set up and power up the board, and to perform initial evaluations.

Prerequisites

- Have a low voltage supply ready for the input supply voltage (INP), with a current capability of at least 25 mA. For repetitive switching operation, a suitable function generator can also be used
- Have a power supply V_{HV} , in series with a suitable load (Z_{Load}), ready to connect HV-AC1 and HV-AC2

To adapt the circuit to application requirements, resistor or capacitor values can be changed to optimize performance.

Steps to power up the board

1. Connect the INP to connector X2.5 with +5 V and GND to connector X2.7
2. Connect the power supply, V_{HV} to connector HV-AC1
3. Connect the ground of power supply, V_{HV} , to one end of the load, Z_{Load} , and the other end to connector HV-AC2

The board is now ready to evaluate switching.

Steps to safely power down the board

1. Turn off the power supply, V_{HV}
2. Discharge the DC-link capacitor (if available) and check the DC-link voltage for example, a digital multimeter or an oscilloscope (for DC operation)
3. Turn off the low-voltage supply

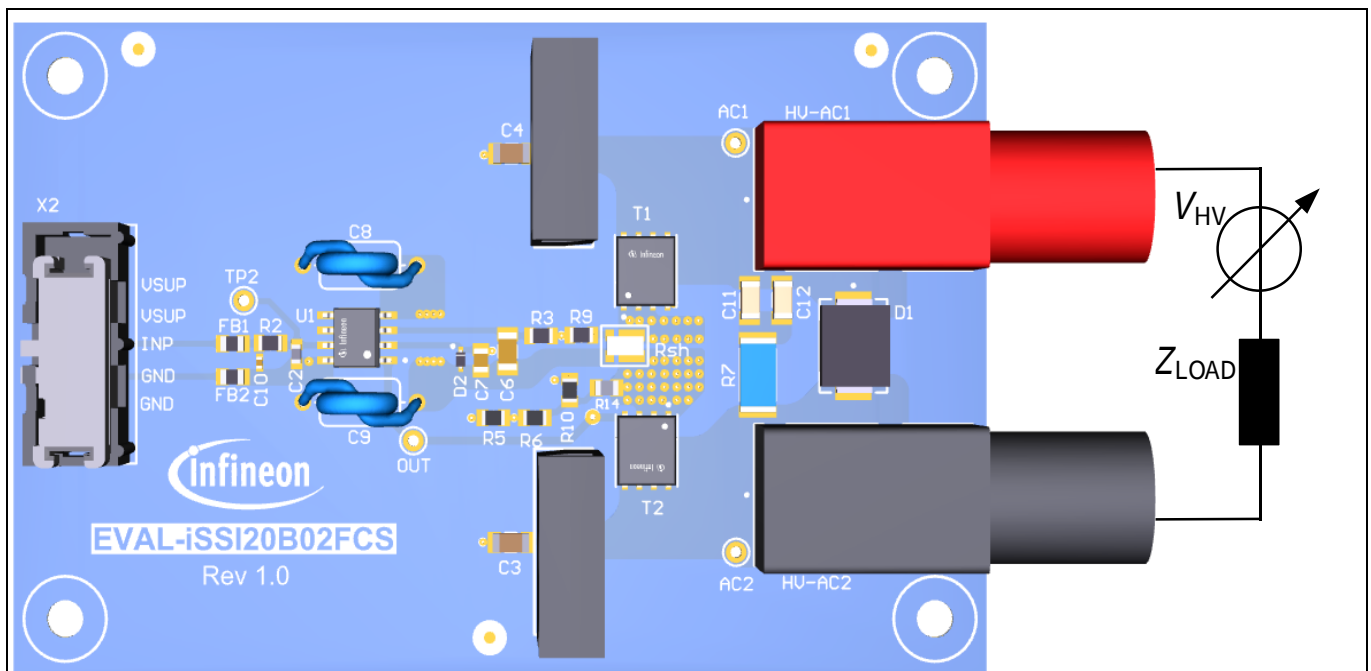


Figure 2 Connection of load Z_{Load} , for tests

3 Getting started with EVAL-iSSI20B02FCS

3.1 Overcurrent protection

The detection circuit monitors the voltage across shunt resistor, R_{sh} . This signal passes noise to RC filter, consisting of R_3 and C_6 . The integrated comparator of the Infineon SSI compares it to a fixed threshold voltage $V_{CS,th}$ at terminal CS of iSSI20B02F. The maximum peak current can be adapted to application requirements by changing R_{sh} , using the following equation:

$$R_{sh} = \frac{V_{CS,th}}{I_{pk,max}}$$

Equation 1 Shunt resistor calculation

Once triggered, the protection reacts quickly and can turn off, for example, OptiMOS™ ISC015N06NM5LF in a very short time.

The triggering of overcurrent protection leads to the latched turn-off of the power switch with a sinking current, $I_{off, fast, sat}$. To return to normal operation, apply 0 V to INP.

3.2 Over-temperature protection

The over-temperature feature is not given by default. iSSI20B02F provides a constant bias current, $I_{TS,bias}$, biasing a positive temperature coefficient (PTC) resistor. The constant current generates a voltage at the PTC that is connected to terminal TS, and the terminal voltage is compared to the threshold voltage $V_{TS,th}$. The integrated comparator includes a noise filter of duration $t_{TS,filter}$ for safely detecting the sensor signal.

The triggering of the over-temperature protection can be forced by externally heating of the temperature sensor, as well.

3.3 Connectors and pin assignment

Table 4 Connectors and pin assignment

Connector	Pin	Marking/ function	Note
X2	1, 2, 3, 4	<i>VSUP</i>	Not in use
	5, 6	<i>INP</i>	Infineon SSI input and supply signal
	7, 8, 9, 10	<i>GND1</i>	Infineon SSI reference
HV-AC1	1	<i>HV-AC1</i>	High-voltage power supply
HV-AC2	1	<i>HV-AC2</i>	High-voltage power supply

3.4 Board options

The evaluation board offers functional options implemented by parts that are not populated. These options are:

- Realization of a snubber circuit (C_{11} , C_{12} , R_7)
- Drive switches (T3 and T4) with another package TO-247
- Implement an over-temperature protection using PTC resistor R14. This option requires the following actions:
 1. Short shunt resistor R_{sh}
 2. Depopulate resistor R_9
 3. Populate 0 Ω resistor R10

3 Getting started with EVAL-iSSI20B02FCS

4. Populate PTC resistor R14

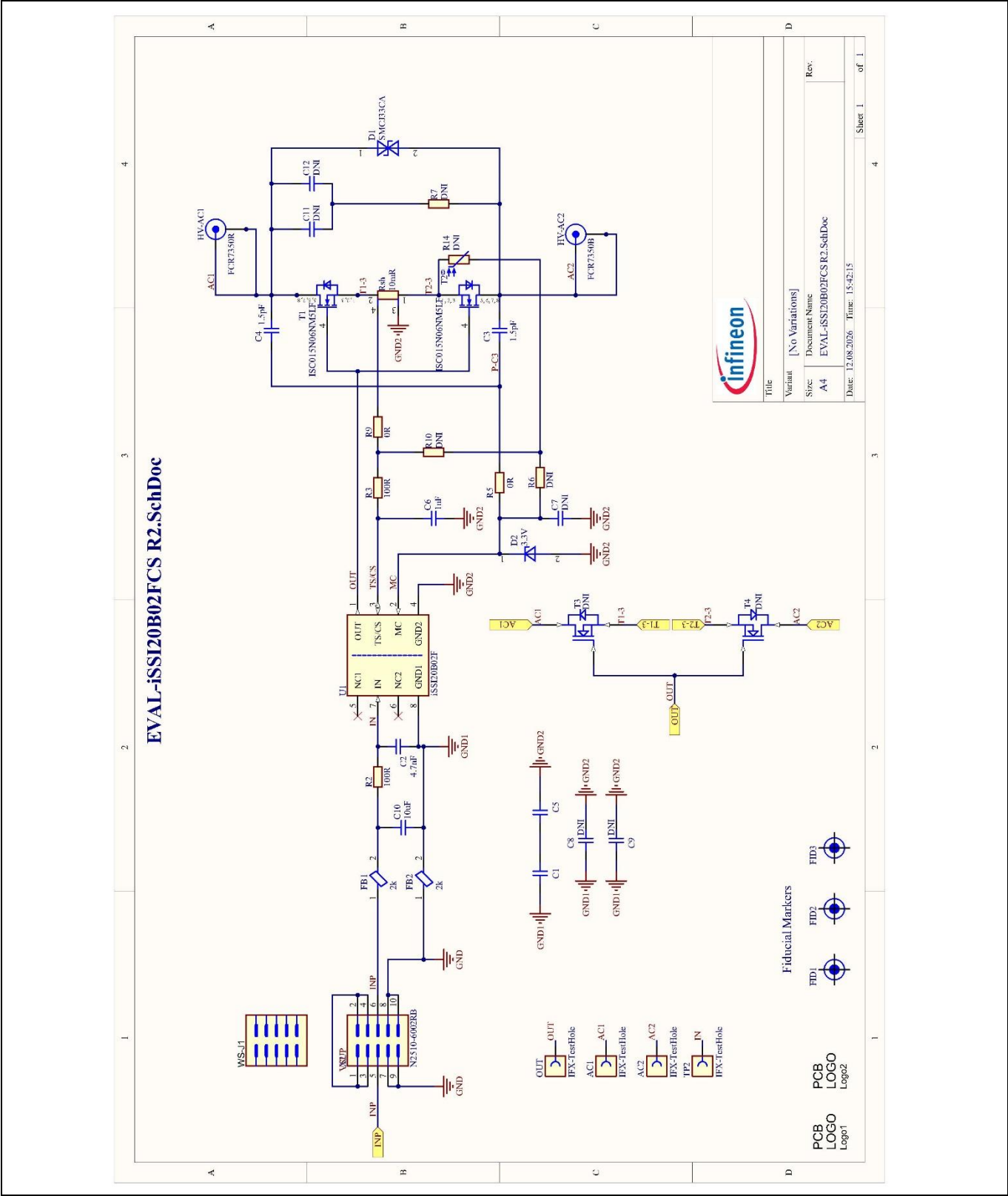
3.5 EMI options

Different EMI mitigation schemes can be applied to the evaluation board to meet the EMC standards under test. Standalone or a combination of the mitigation techniques usually work together to meet EMI.

- **Capacitive return paths:** Use a discrete Y capacitor between the primary ground and secondary ground. The board offers options for surface-mount components C8 and C9 (default assembly) and for through-hole components C10 and C13 (not assembled). Sometimes the system design requires a Y capacitor for safety purposes as a capacitive return path. For functional isolation a normal capacitor with sufficient voltage rating can be used
- **Inductive components:** A pair of ferrite beads with a high frequency impedance is assembled on the input side. Alternatively, a CM choke may be placed on the same footprint for the supply or ground system

4 Schematic diagram

4 Schematic diagram



5 Layout

5 Layout

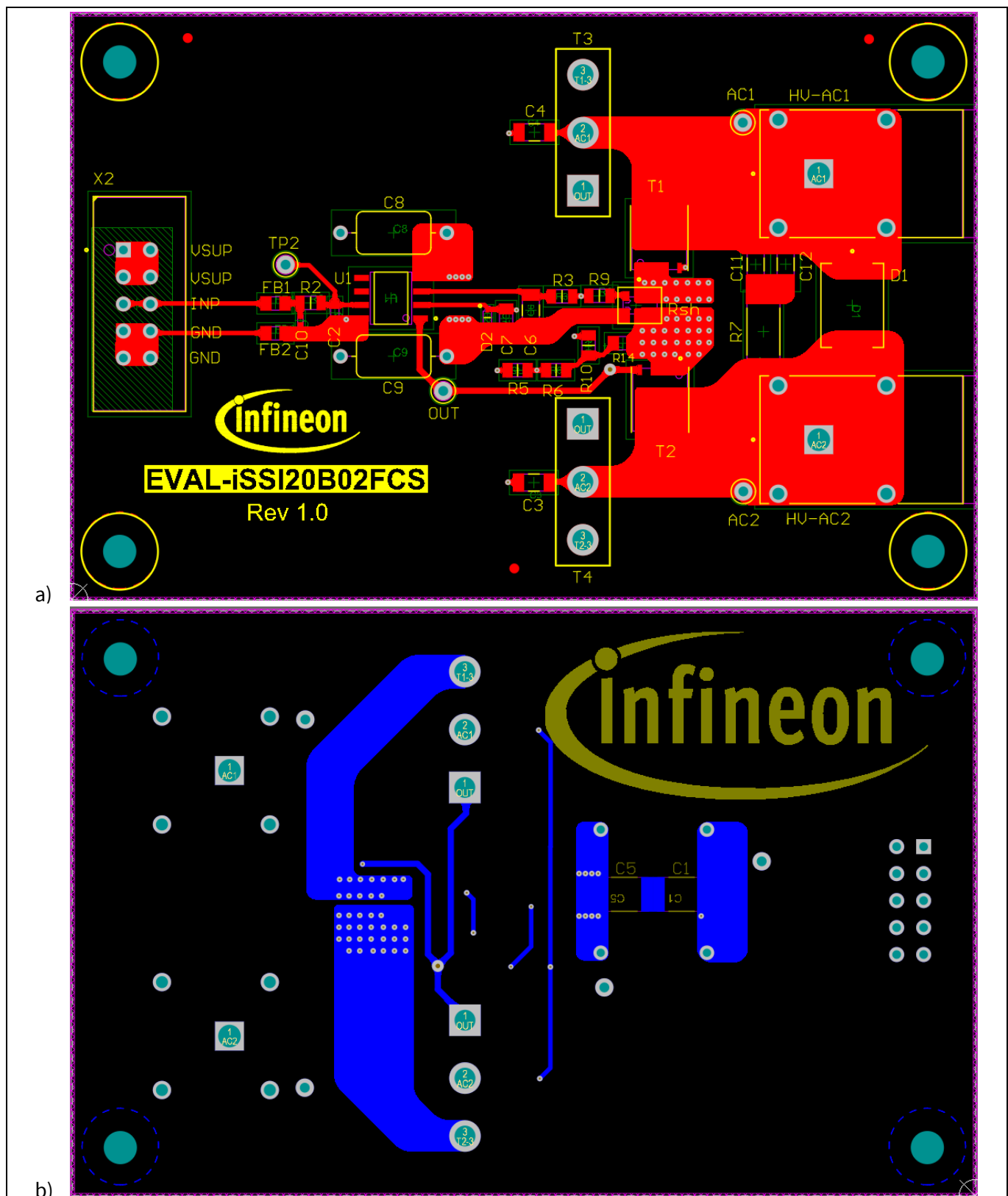


Figure 4 Top (a) and bottom (b) layers of EVAL-iSSI20B02FCS

6 Bill of materials

6 Bill of materials

Table 5 EVAL-iSSI20B02FCS bill of materials

Component	Value	Description	Manufacturer	Part number
C1, C5	4.7 nF	Multilayer ceramic capacitors MLCC - SMD/SMT 4700PF 250V 10% 1812	Knowles Syfer	1812YA250472KJTSYX
C2	4.7 nF	CAP / CERA / 4.7nF / 25V / 1% / C0G (EIA) / NP0 / -55°C to 125°C / 0603(1608) / SMD / -	Kemet	C0603C472F3GAC
C3, C4	1.5 pF	CAP / CERA / 1.5pF / 2kV / 0.1% / C0G (EIA) / NP0 / -55°C to 125°C / 3.20mm L × 1.60mm W × 0.9mm H / SMD / -	Walsin	1206N1R5B202CT
C6	1 nF	CAP / CERA / 1nF / 50V / 10% / X7R (EIA) / -55°C to 125°C / 1206(3216) / SMD / -	MuRata	GRM319R71H102KA01
C10	10 µF	Multilayer ceramic capacitors MLCC - SMD/SMT 10 µF 6.3 VDC 20% 0402 X5R	MuRata	GRJ155R60J106ME11D
D1	SMCJ33CA	Surface mount TVS diode, 33V, 1µA	Littelfuse	SMCJ33CA
D2	3.3V	Zener diode 3.3V 500MW SOD523	onsemi	SZMM5Z3V3T1G
FB1, FB2	2k	2 kΩ at 100 MHz 1 signal line ferrite bead 1206 (3216 Metric) 200mA 600mΩ	Max Echo	EBMS321611DB202
HV-AC1	FCR7350R	Banana test connector, 4mm, socket, PCB mount, 24 A, 1 kV, gold plated contacts, red	CLIFF Electronics Component Limited	FCR7350R
HV-AC2	FCR7350B	Banana test connector, 4mm, socket, PCB mount, 24 A, 1 kV, gold plated contacts, black	CLIFF Electronics Component Limited	FCR7350B
R2, R3	100R	RES / STD / 100R / 125mW / 1% / 100ppm/K / -55°C to 155°C / 0805(2012) / SMD / -	Vishay	CRCW0805100RFK
R5	0R	RES / - / 0R / 125mW / - / - / - / 0805(2012) / SMD / -	Multicomp	MCMR08X000 PTL
R9	0R	RES / STD / 0R / - / 0% / - / - 55°C to 155°C / 0805(2012) / SMD / -	Vishay	CRCW08050000Z0EA
Rsh	10mR	RES / STD / 10mR / 1W / 1% / 35ppm/K / -55°C to 155°C / 1206(3216) / SMD / -	Susumu	KRL3216T4A-M-R010-F-T1
T1, T2	ISC015N06NM5LF	OptiMOSTM 5 Linear FET with the features of very low $R_{ds(on)}$	Infineon Technologies	ISC015N06NM5LF
U1	iSSI20B02F	Coreless-transformer advanced solid-state isolators	Infineon Technologies	iSSI20B02F

6 Bill of materials

Component	Value	Description	Manufacturer	Part number
WS-J1	–	Wire mount socket, 100mil, 5x2, Gray	3M	3473-6600
X2	N2510-6002RB	Header, 4-Wall Lo-PRO, .100, straight, 10 pin, 2.54mm pitch	3M	N2510-6002RB

7 Related resources

7 Related resources

- [Solid state isolators](#)
- [Evaluation board](#)
- [Developer Community](#)

References

References

- [1] Infineon Technologies AG: *iSSI20B02F, iSSI20B03F and iSSI20B11F datasheet*; [Available online](#)
- [2] Infineon Technologies AG: *ISC035N10NM5LF2 datasheet*; [Available online](#)

Revision history

Revision history

Document revision	Date	Description of changes
1.0	2026-09-21	Initial version

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Safety & Operating Instructions:

Customer shall check the Evaluation Board for any physical damage which may have occurred during transport. If customer detects any damages or defects in the Evaluation Board, customer shall not connect the Evaluation Board to a power source. Customer shall contact Infineon for further support. If customer observes unusual operating behavior during the evaluation process, customer shall immediately shut off the power supply to the Evaluation Board and consult Infineon for support.

Customer shall not touch the Evaluation Board during operation and keep a safe distance.

Customer shall not touch the Evaluation Board after disconnecting the power supply, several components may still store electrical voltage and can discharge through physical contact. Several parts, like heat sinks and transformers, may still be very hot. Allow the components to cool before touching or servicing. The electrical installation must be completed in accordance with the appropriate safety requirements.