AN2008-05

2ED250E12-F_EVAL

Evaluation Driver Board for 1200V PrimePACK™

IFAG IMM INP M

Edition 2009-07-03

Published by
Infineon Technologies AG
59568 Warstein, Germany

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AN2008-05		
Revision History:	2008-05	V1.0
Previous Version:	none	

Page	Subjects (major changes since last revision)

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Part number explanation:

2ED 250 E12 -F

-F – Functional or Basic isolation
12 – For 1200 V applications
Evaluation Board
250 – 25 A output driver peak current
ED – EiceDRIVER™
2 channel Driver

1 Introduction

The 2ED250E12-F evaluation driver board shown in Fig. 1 was developed to support customers during their first design steps with the 1200V PrimePACK™ IGBT module. The evaluation driver board is a fully functional IGBT module driver where two 1ED020I12-F driver IC process control and feedback signals and provide galvanic insulation. An embedded isolated DC/DC converter supplies gate drive power to both IGBTs of a halbridge configuration.

The 2ED250E12-F Evaluation driver boards are available from Infineon in small quantities. Functions and properties of these parts are described in the datasheet chapter of this document whereas the remaining paragraphs provide information intended to enable the customer to copy, modify and qualify the design for production according to his specific requirements.

The design of the 2ED250E12-F was performed with respect to the environmental conditions described as design target in this document. The requirements for leadfree reflow soldering have been considered when components were selected. The design was tested as described in this documentation but not qualified regarding manufacturing and operation in the whole operating ambient temperature range or lifetime.

The boards provided by Infineon are subjected to functional testing only.

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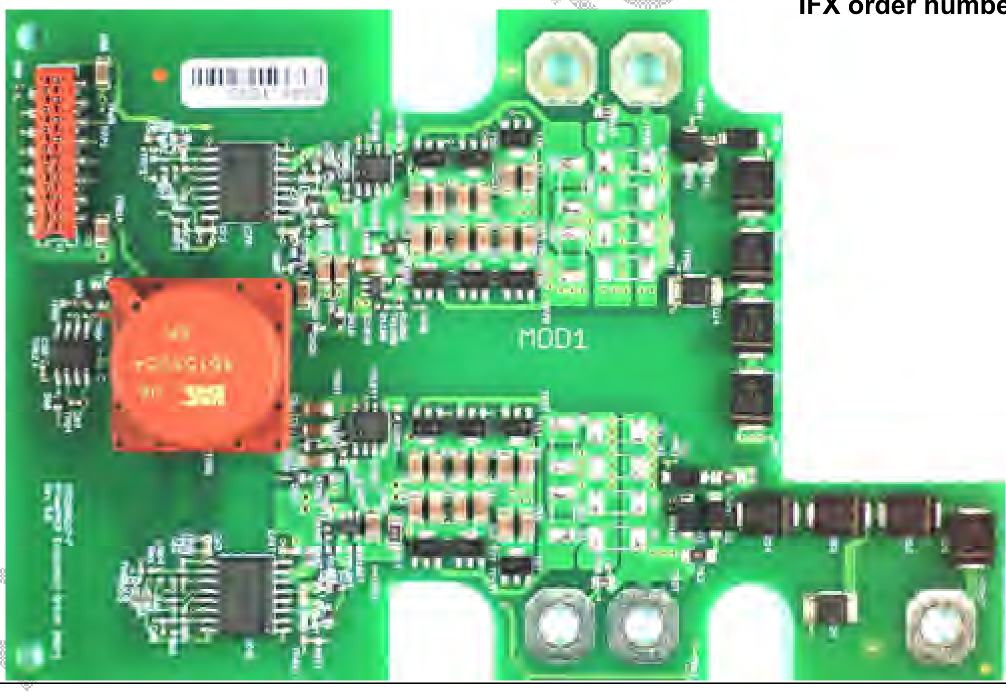

Figure 1 The 2ED250E12-F Evaluation Driver Board

2 Design features

Electric features of the evaluation board and mechanical dimensions including interface connections are presented in following sections.

2.1 Main features

The 2ED250E12-F Evaluation Driver Board offers the following features:

- Dual channel IGBT driver utilising the 1ED020I12-F[1] driver IC
- Electrically and mechanically suitable for PrimePACK™ modules 1200V family
- Integrated isolated DC/DC power supply
- Integrated protection against DC/DC power supply short circuit
- Under Voltage Lockout
- Positive logic with CMOS logic level (5V) for PWM and Fault signals. Can be converted to negative logic
- Separated fault output and ready signal for Top and Bottom IGBT
- Separated ground potential for DC/DC power supply and input logic
- Different gate resistor values for turning-on and -off are possible
- IGBTs are protected against temporary V_{CE} overvoltages during turn-off (Active Clamping)
- Diodes for IGBT desaturation monitoring implemented (short circuit protection)
- All components, except DC/DC transformer, are surface mount devices (SMD) with lead free 260°C soldering profile
- PCB is designed to fulfil the requirements of IEC61800-5-1, pollution degree 2, overvoltage category III

2.2 Key data

All values given in the table bellow are typical values, measured at T_A = 25 °C.

Table 3 General key data and characteristic values

Parameter	Value	Unit
$\mathbf{V_{DC}}$ – primary DC/DC voltage supply	+15 (±5%)	V
$\mathbf{V_{DC+5V}}$ – logic power supply	+5 (±0.1V)	V
Control signals (PWM, Fault, RDY, RST)	0/+5	V
$\mathbf{I_{DC}}$ – primary DC/DC current drawn (idle mode/max load)	22/250	mA
$\mathbf{I_{DC+5V}}$ – current drawn by primary logic (idle mode)[2]	16	mA
$\mathbf{I_G}$ – max. peak output current	±25	A
$\mathbf{P_{DC/DC}}$ – max. DC/DC output power (total)	3	W
$\mathbf{t_{pd(on)}}$, $\mathbf{t_{pd(off)}}$ – propagation delay time	<350	ns
$\mathbf{t_{md}}$ – minimum pulse suppression for turn-on and turn-off	40	ns
$\mathbf{d_{max}}$ – max. duty cycle	100	%
$\mathbf{V_{CES}}$ – max. collector – emitter voltage on IGBT	1200	V
$\mathbf{T_{op}}$ – operating temperature (design target)[3]	-40…+85	°C
$\mathbf{V_{IORM}}$ – max. working insulation voltage[4]	500	V_{AC}

[1] The 1ED020I12-F datasheet available on the Infineon website www.infineon.com

[2] Without external loads (no signals connected)

[3] Max. ambient temperature strictly depends on load and cooling conditions. For detailed description see chapter 2.3

[4] Values defined in datasheets: T60403-D4615-X054 (date: 21.03.2000)

2.3 Mechanical dimensions and mounting procedure

The 2ED250E12-F should be screwed to the PrimePACK™ auxiliary terminals according to AN2006-09. In that way necessary connections between evaluation driver board and module itself are done correctly (Figure 3). PCB outline and relevant dimensions needed for better system integration are shown in Figure 4.

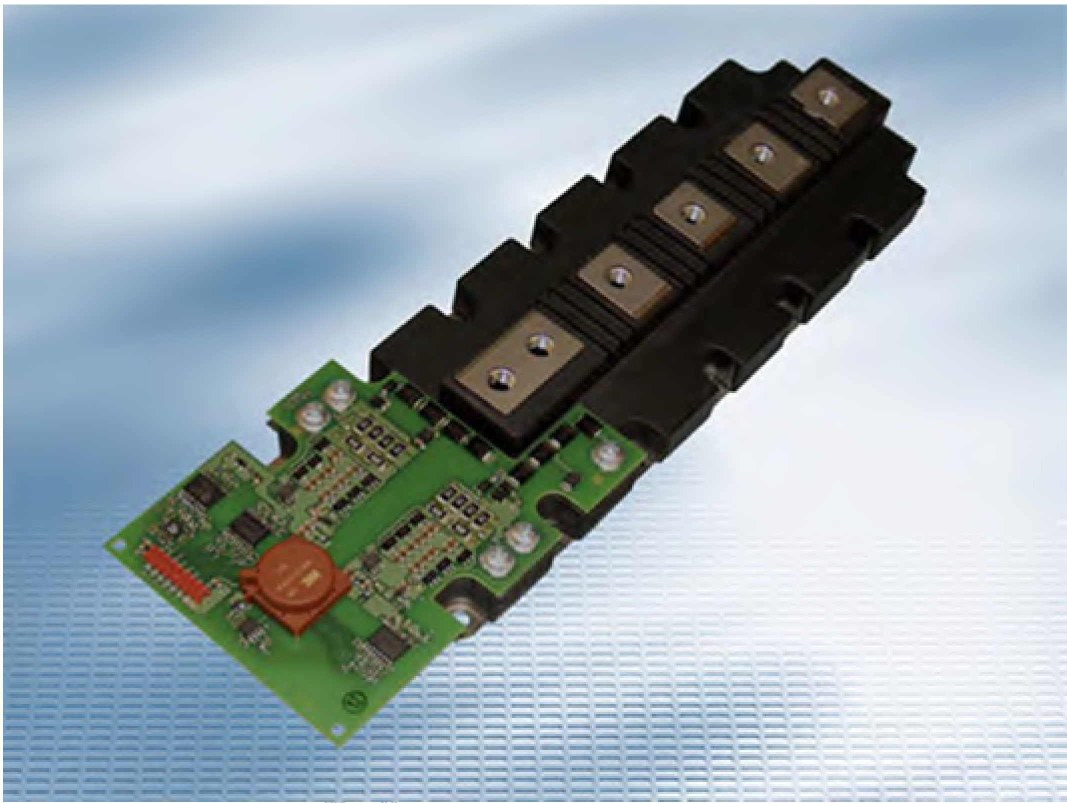

Figure 2 The 2ED250E12-F correctly mounted on PrimePACK™ module

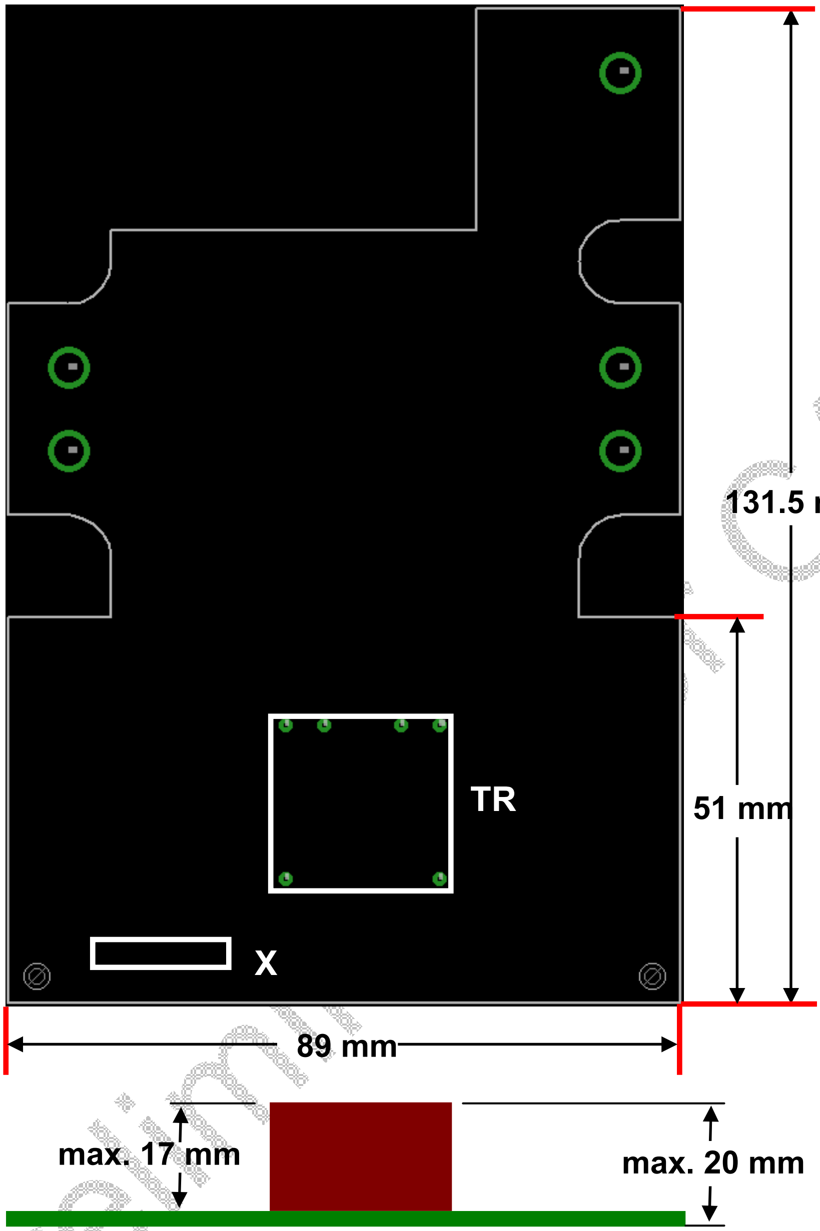

Figure 3 Dimensions of the 2ED250E12-F Evaluation Driver Board

2.4 Pin assignment

After the evaluation driver board has been correctly mounted to the PrimePACK™ module all external electrical control signals should be applied to connector X1 as shown on Fig. 4 and listed in Table 2.

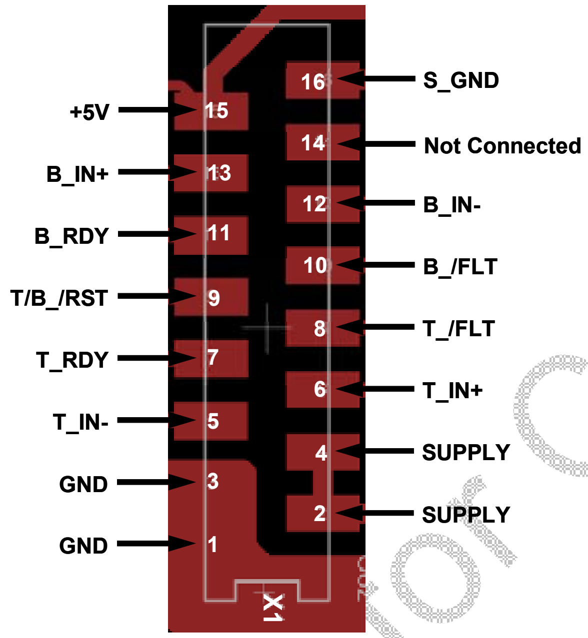

Figure 4 2ED250E12-F Evaluation Driver Board and external electrical connections (X1)

Table 2 2ED250E12-F external electrical signals description

Pin	Label	Function
X1.1	**GND**	Primary ground for DC/DC converter supply voltage
X1.2	**SUPPLY**	Primary voltage supply for DC/DC converter (+15V)
X1.3	**GND**	Primary ground for DC/DC converter supply voltage
X1.4	**SUPPLY**	Primary voltage supply for DC/DC converter
X1.5	**T_IN-**	/PWM input signal for high side IGBT transistor (negative logic)
X1.6	**T_IN+**	PWM input signal for high side IGBT transistor (positive logic)
X1.7	**T_RDY**	Output signal for ready status of the high side IGBT
X1.8	**T_/FLT**	Output signal for desaturation protection of the high side IGBT
X1.9	**T/B_/RST**	Input for the Reset signal
X1.10	**B_/FLT**	Output signal for desaturation protection of the low side IGBT
X1.11	**B_RDY**	Output signal for ready status of the low side IGBT
X1.12	**B_IN-**	/PWM input signal for low side IGBT transistor (negative logic)
X1.13	**B_IN+**	PWM input signal for low side IGBT transistor (positive logic)
X1.14	**NC**	Not connected
X1.15	**+5V**	Primary voltage supply for input/output signals
X1.16	**S_GND**	Primary ground of voltage supply input/output signals

NOTE: The S_GND as signal ground is NOT connected internally to the GND witch is the DC/DC converter power supply ground!

3 Application Note

3.1 Functionality on board

The 2ED250E12-F evaluation driver board supports only PrimePACK™ IGBT modules in 1200V class. For proper IGBT module operation the 1ED020I12-F IC driver has been complemented by additional components and functions:

- Selectable gate resistors (after soldering)
- Gate signal amplifier / emitter follower - booster
- V_{CE} monitoring for short circuit detection
- Active voltage clamping
- DC/DC isolated power supply

Picture bellow (Figure 5) depicts the 2ED250E12-F with already mentioned functions and shows their physical location.

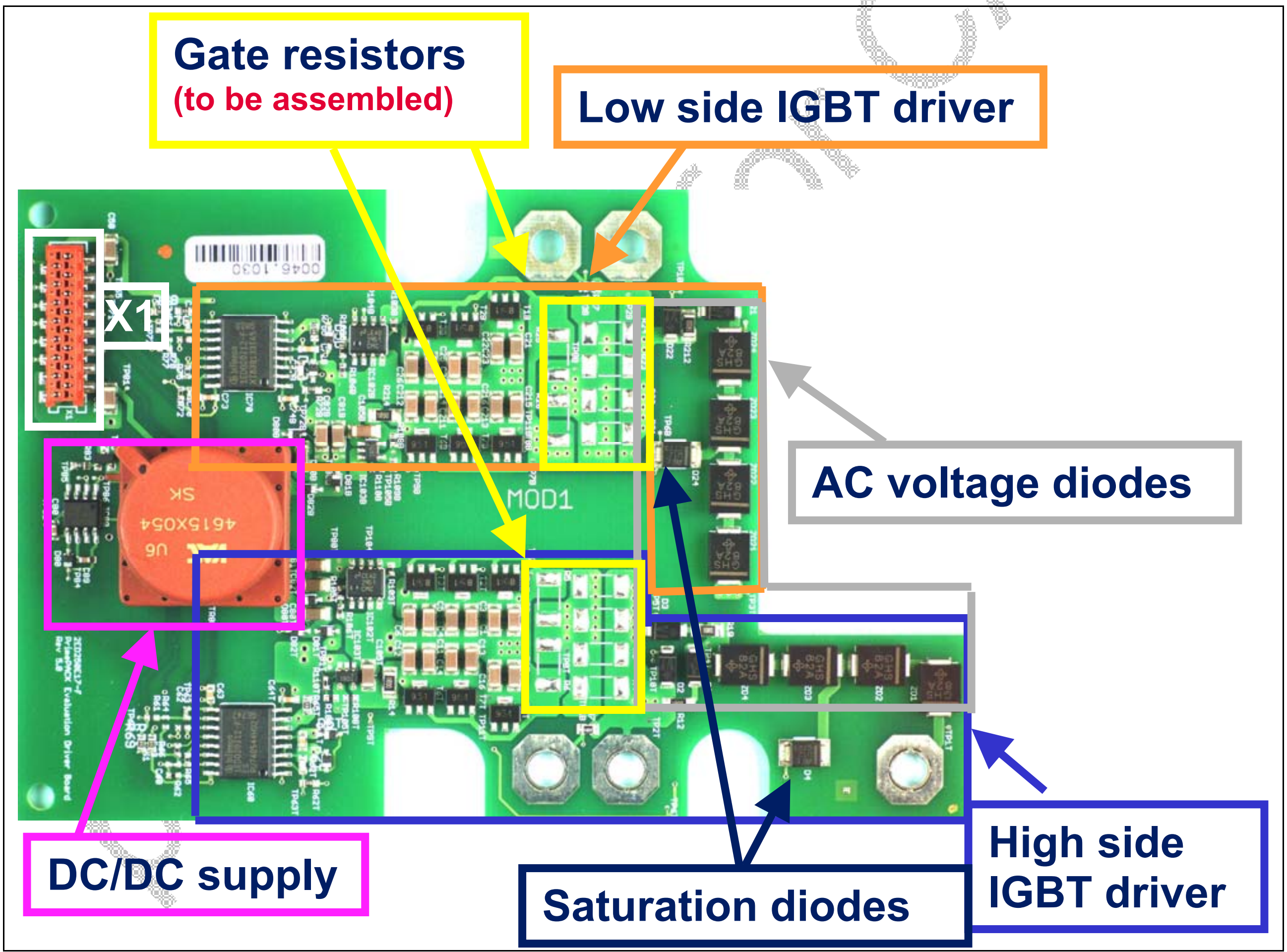

Figure 5 The 2ED250E12-F with marked functions

3.2 Power supply

The 2ED250E12-F has an integrated DC/DC converter, which generates the required secondary isolated unsymmetrical supply voltage (+15V/-7V). High and low side IGBT driver voltages are independently generated by using one unipolar input voltage of 15V. Additionally, the power supply is protected against gate – emitter short circuit of the IGBTs. In case a DC/DC overcurrent is detected, the output voltage drops down, the IGBT is protected by Undervoltage lockout function and the fault is reported to the isolated input side.

3.3 Input / Output logic – control signals

The Evaluation Driver Board is dedicated for a half-bridge PrimePACK™ IGBT configuration, therefore it is necessary to connect two separate PWM signals for high (T_INx) and low (B_INx) side IGBT. Deadtime generation has to be provided externally. Positive or negative logic for PWM signals can be selected by part assembly. By default the evaluation driver board has the logic inputs set up for positive logic. Information on parts assembly is given in Table 3 where Fig. 6 depicts schematic of input circuits.

Remaining signals like RDY, /RST, /FLT as output signals have the same logic as the 1ED020I12-F driver IC and can't be modified by assembly selection on the 2ED250E12-F evaluation driver board. Logic level translation or inversion has to be provided outside of the evaluation driver board if needed.

Table 3 Assembly parts for negative or positive PWM logic selection

Parts	Assembly for positive logic (as delivered)	Assembly for negative logic
R_{64}, R_{74}	no	yes
R_{62}, R_{72}	yes	no

Not used terminals of X1 may be left unconnected.

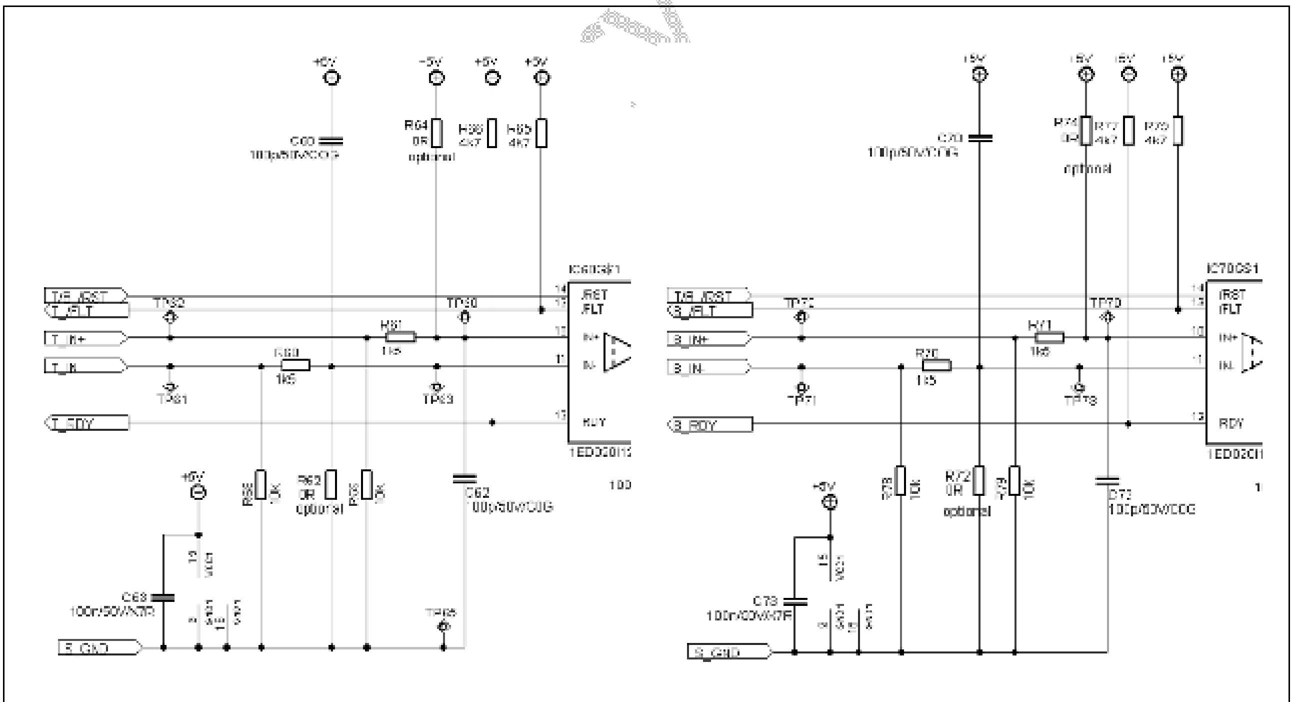

Figure 6 Schematic of the input circuit

3.4 Gate signal amplifier and gate resistors

When an IGBT transistor switches -on and -off a high peak of gate current has to be provided by the driver. As the 1ED020i12-F has the maximum current capability of 2 A and the PrimePACK™ module requires a value much higher the implementation of a booster stage (emitter follower) was necessary. In this way a peak gate current exceeding 25 A can be supplied.

The 2ED250E12-F evaluation driver board uses an unsymmetrical gate voltage. For turning on a positive value has +15 V is used, for turning off a voltage of -7 V is provided. The gate amplifier is located close by the gate terminals. Switching losses and switching times of an IGBT strongly depend on DC-link stray inductance (Ls) and driving conditions like gate resistor, gate drive voltage and parasitic inductance in the gate drive circuit[5]. As long as the di/dt given in the IGBT datasheet is not exceeded, Rg may be adjusted to achieve datasheet values of IGBT dynamic losses. The value for new gate resistor for turn off basically can be calculated using formula (1).

$$R_{Goffnew} = \frac{V_M - V_{NR}}{V_M - V_N} \cdot (R_{Goff} + R_{G\text{int}}) - R_{G\text{int}} \qquad (1)$$

where:

V_M – Miller plateau equal to 9.8 V for FF900R12IP4D @I_C=900 A, T_j=25°C

V_N – negative deriver voltage as during characterization (-15V)

V_{NR} – reduced negative voltage (-7 V for 2ED250E12-F evaluation driver voltage)

R_{Goff} – external gate resistor value (as in datasheet)

R_{Gint} – internal gate resistor value (as in datasheet)

Example: Gate resistance calculation for FF900R12IP4D PrimePACK™ IGBT module using Formula 2.

$$R_{Goffnew} = \left(\frac{9.8+7}{9.8+15} \cdot (1.6+1.2) - 1.2\right)\Omega \approx 0.7\Omega \qquad (2)$$

NOTE: Reducing the value of R_{Goff} according to this formula mainly is done to avoid an increase in turn-off delay time. There is only little impact of driving conditions on turn-off losses. The new value for the turn-on gate resistor R_{Gonnew} is more diffiult to determine and depends on the value of DC-link stray inductance L_s. The test setup using a FF900R12IP4D was measured to have a DC-link stray inductance of L_s=42 nH. The value of L_s has significant influence on the di/dt at turn-on and on turn-on losses. Keeping the same L_s is difficult, as every design is unique. The turn-on gate resistors value given in table 4 therefore is just a proposition and the choice of R_{gonnew} has to be practically evaluated in every design.

Propositions of R_{Gon} and R_{Goff} resistor values to be used together with 2ED250E12-F evaluation driver board are shown in Table 4.

Table 4 External gate resistor proposition for 1200 V PrimePACK™ IGBT modules

Module	R_{Gon} [Ω] (datasheet value)	R_{Gonnew} [Ω] (new value)	R_{Goff} [Ω] (datasheet value)	$R_{Goffnew}$ [Ω] (new value)
FF450R12IE4	2.5	0.92	3.1	1.33
FF600R12IE4 /IP4	2.2	0.91	2.2	0.91
FF900R12IE4	1.3	0.49	1.5	0.63
FF900R12IP4 / IP4D	1.6	0.7	1.6	0.7
FF1400R12IP4	1	0.42	1	0.42

NOTE: The 2ED250E12-F evaluation driver is delivered without gate resistors soldered. In that way the PCB design is flexible and ready to be utilised with all PrimePACK™ modules in 1200 V class. Physical place for the gate resistors is shown in Fig. 5, where the value has to be splitted between resistors R_1, R_2, R_3, R_4, R_5 for the high side IGBT and R_{21}, R_{22}, R_{23}, R_{24}, R_{25} for the low side IGBT. The scheme is shown in Figure 7.

[5] This phenomenon is widely described in paper: 'Unsymmetrical Gate Voltage Drive for High Power 1200V IGBT[4] Modules Based on Coreless Transformer Technology Driver' presented on EPE-PEMC 2008 conference. Paper available on www.infineon.com

In many cases the new resistor values R_{Gon} and R_{Goff} can be equal but as good practice the practical investigation should be started from higher gate resistor value. If testing with $R_{gon} \neq R_{goff}$ is required a Schottky diode e.g. BYM13-40 may be soldered on one of the resistor footprints.

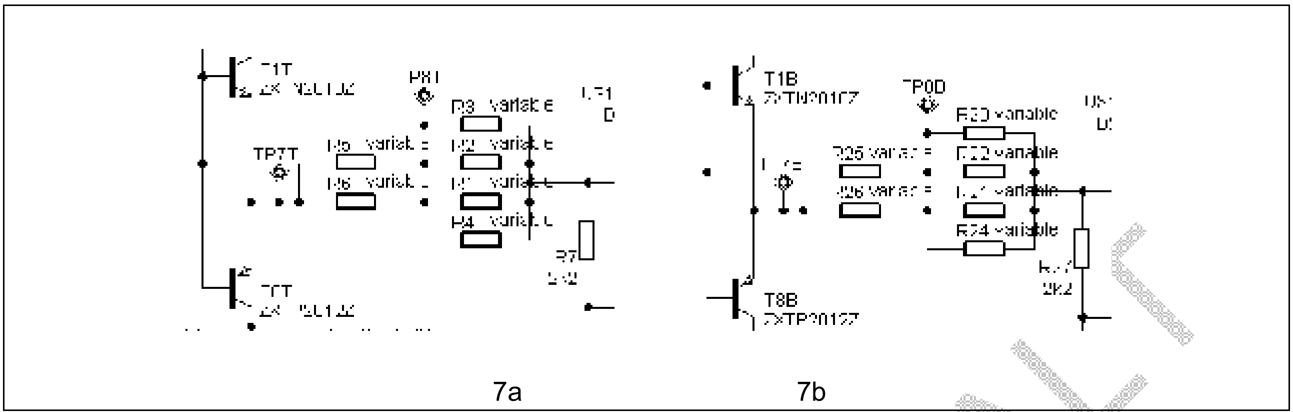

Figure 7 Scheme schowing gate resistors connection where: high side IGBT - 7a, low side IGBT – 7b

3.5 V_{CE} monitoring for short circuit detection

If the IGBT conducts current several times higher than nominal current the V_{CE} voltage desaturates (increases close to DC-link voltage level). This behaviour can be used for short circuit detection. Protection can be achieved by turning off the IGBT in this case. The short circuit duration time for Infineon high power IGBT modules must not exceed 10µs. During this time the short circuit should be detected and the IGBT switched off without exciding V_{CES}.

Figure 8 shows the FF900R12IP4 PrimePACK™ modules switching under short circuit. High dI_C/dt during switching off creates large overvoltage spike which is limited by active voltage clamping. This function is described in detail in chapter 3.6. After the short circuit is detected and the IGBT is switched off, the event is reported to the input side of the driver – the /FLT signal falls close to 0V level. The fault signal is separated for high and low side IGBT.

NOTE: After the Short circuit event the evaluation driver board has to be reseted by providing /RST signal at low state for time specified in 1ED020I12-F Driver IC datasheet.

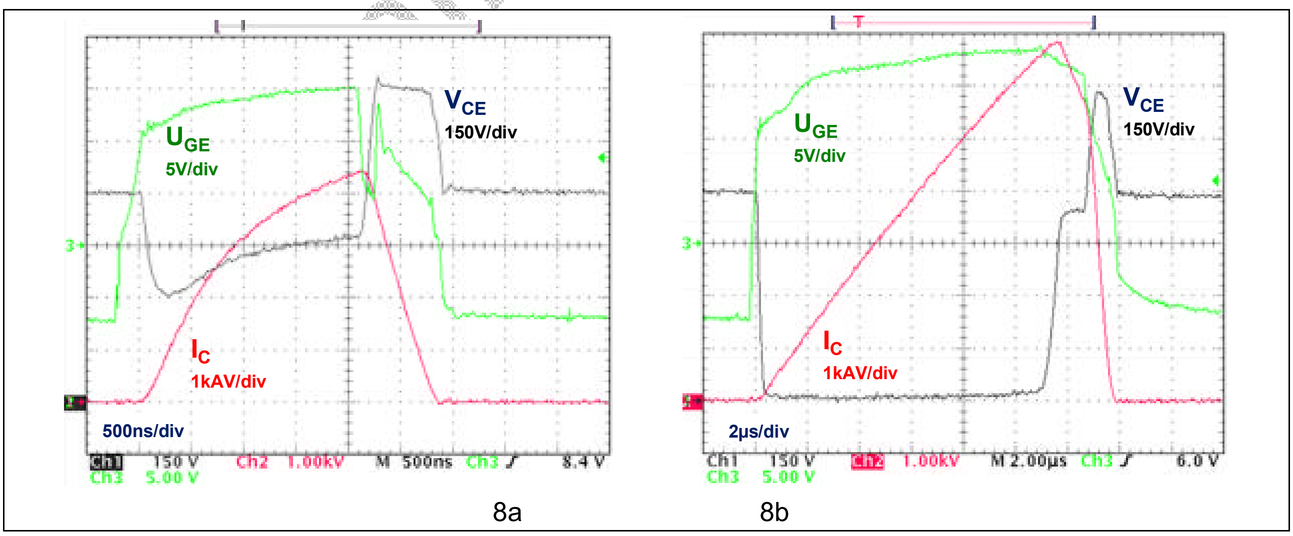

Figure 8 Switching behaviour of the FF900R12IP4 PrimePACK™ module under short circuit where hard short circuit (SC1) - 8a short circuit with inductance (SC2) – 8b

3.6 Active voltage clamping

Active voltage clamping is a technique which keeps temporary V_{CE} overvoltages below V_{CES} when the IGBT turns off. In the classic approach a chain of TVS-diodes (Transient Voltage Suppressor) is connected between auxilliary collector and gate of an IGBT module. As soon as the V_{CE} voltage exceeds the sum of the diode breadown voltages the diode current is shared between IGBT gate and the driver output. Due to increased gate-emitter voltage the transistor is operated in linear mode and the switching off process is interrupted. The dI_C/dt slows down to a value which results with limited V_{CE} overshoot. TVS diodes conduct high peak current during time periode in which V_{CE} overvoltage is limited[6]. For a proper designed DC-bus and correctly selected IGBT module the V_{CE} voltage should not be limited by active clamping for turn off events within the normal current range. The V_{CE} voltage limitation should occure only occasionally e.g. during short circuit current switch off. Typical overvoltage protection is shown in Fig. 8a. Additional energy losses in this case should be considered. Furthermore it has to be considered, that active clamping as implemented here requires to limit the maximum DC-link voltage to 850 V.

3.7 Maximum switching frequency

The IGBT switching frequency of the 2ED250E12-F is limited by the available DC/DC power and by PCB temperature. According to theory the power losses generated in gate resistors are a function of gate charge, voltage step at the driver output and switching frequency. The energy is dissipated mainly through the PCB and increases the temperature around the gate resistors. When the available power of the DC/DC converter (1.5W per IGBT) is not reached, the limiting factor for the IGBT's switching frequency is the absolute maximum temperature for the FR4 material. The temperature limit is 105°C and shall not be exceeded.

Generally the power losses generated in the external gate resistor can be calculated according to following formula (3):

$$P_{loss} = P_{DC/DC} = P(R_{EXT}) + P(R_{INT}) = \Delta V_{out} \cdot f_s \cdot Q_G \qquad (3)$$

where:

P_{los} – power losses dissipated in gate rseistors, ΔV_{out} – voltage step at the driver output

f_s – switching frequency, Q_G – IGBT gate charge (for the given gate voltage range - ΔV_{out})

The losses are shared between the internal – $P(R_{INT})$ and the external - $P(R_{EXT})$ gate resistors. Due to the PCB temperature criteria maximum switching frequency for a given ambient and baseplate temperature can be calculated using $P(R_{EXT})$ and thermal resistances. The simple PCB temperature model is shown in Fig. 9 and dissipated power in external gate resistors can be calculated by using Formula 4.

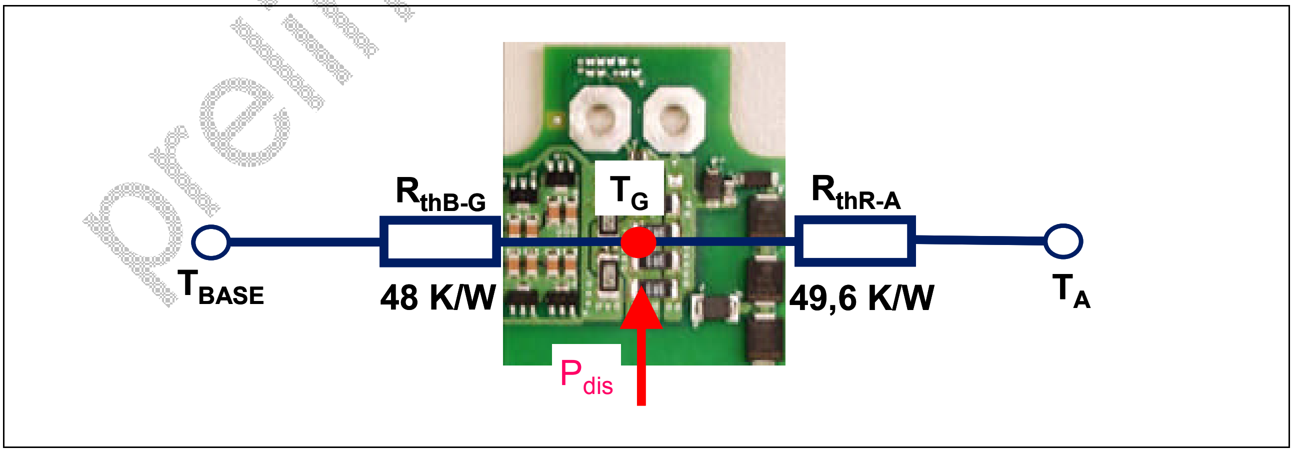

Figure 9 Simple thermal model used for gate resistors temperature calculation.

[6] Detailed description of the Active Clamping system function available in AN2007-06

$$P_{dis} = \frac{T_G - T_{BASE}}{R_{thB-G}} + \frac{T_G - T_A}{R_{thG-A}} \qquad (4)$$

where:

P_{dis} – power dissipated in external gate resistors, T_G – external gate resistors temperature,

T_{BASE} – IGBT baseplate temperature, T_A – evaluation driver board ambient temperature

R_{thB-G} – thermal resistance which couples thermally the IGBT baseplate and external gate resistors

R_{thG-A} - thermal resistance which couples external gate resistors and ambient

NOTE: Thermal resistances used in Formula 4 are unique for every PCB design. For the 2ED250E12-F Formula 4 can be converted to Formula 5 where FR4 material is used as PCB.

$$\frac{P_{dis}}{W} = \frac{(105°C - T_{BASE})\frac{K}{°C}}{48\frac{K}{W}} + \frac{(105°C - T_A)\frac{K}{°C}}{49.6\frac{K}{W}} \qquad (5)$$

Afterwards, the maximum IGBT switching frequency for evaluation driver board can be calculated using Formula (6)

$$f_s = \frac{P_{dis}\cdot(R_{G\text{int}} + R_{Gext})}{\Delta V_{GE}\cdot R_{Gext}\cdot Q_G\cdot k} \qquad (6)$$

where:

R_{Gint} – Internal gate resistor value, R_{Gext} – external gate resistor value

Q_G – IGBT gate charge, Datasheet value to be convertet to -7/15V [7], k=1.2 – tolerance factor

Finally, for the 2ED250E12-F evaluaton driver board Formula 6 can be converter to formula 7.

$$\frac{fs}{kHz} = \frac{\frac{P_{dis}\cdot(R_{INT} + R_{EXT})}{22\cdot R_{EXT}\cdot 0.7\cdot Q_G\cdot 1.2}}{\mu C}\cdot 1000 \qquad (7)$$

Example: Maximum switching frequency for the 2ED250E12-F where T_{BASE}=90°C and T_A=70°C[8]

Step 1. Calculation of possible dissipated power losses in external gate resistors based on Formula (5)

$$P_{dis} = \frac{105-90}{48}W + \frac{105-70}{49.6}W = 0.82W \qquad (8)$$

Step 2. Maximum switching frequency calculation for FF900R12IP4D IGBT using Fomula 7 where external gate resistor value are the new value taken from Table 4.

$$f_S = \frac{0.82\cdot(1.2+0.7)}{22\cdot 0.7\cdot 0.7\cdot 6.4\cdot 1.2}\cdot 1000kHz = 18.8kHz \qquad (9)$$

Step 3. Checking if power from DC/DC power supply is sufficient

$$P_{DC/DC} = \Delta V_{out}\cdot f_s\cdot 0.7\cdot Q_G\cdot k = 22\cdot 0.0188\cdot 0.7\cdot 6.4\cdot 1.2W = 2.22W \qquad (10)$$

[7] Due to changed negative gate emitter voltage in 2ED250E12-F evaluation driver board from -15V to -7V the IGBT gate charge given in datasheet has to be multiplied by factor 0.7

[8] Baseplate and ambient temperatures given in calculation example are assumed to be typical for many applications

Knowing that maximum power form DC/DC power supply is 1.5W per driver channel the maximum switching frequency calculated by formula 9 is too high. In this case the maximum IGBT switching frequency can be calculated using Formula 11.

$$f_s = \frac{P_{DC/DC}}{\Delta V_{out} \cdot 0.7 \cdot Q_G \cdot k} = \frac{1.5}{22 \cdot 0.7 \cdot 6.4 \cdot 1.2} \cdot 1000\,kHz \approx 12{,}7\,kHz$$

By following above calculation example the switching frequency for every PrimePACK™ 1200V and the 2ED250E12-F can be calculated even for customised ambient and baseplate temperatures.

4 Schematic and Layout of 2ED250E12-F

To meet the individual customer requirement and make the evaluation board simple starting point for further development or modification, all necessary technical data like schematic, layout and components are included in this chapter.

4.1 Schematic

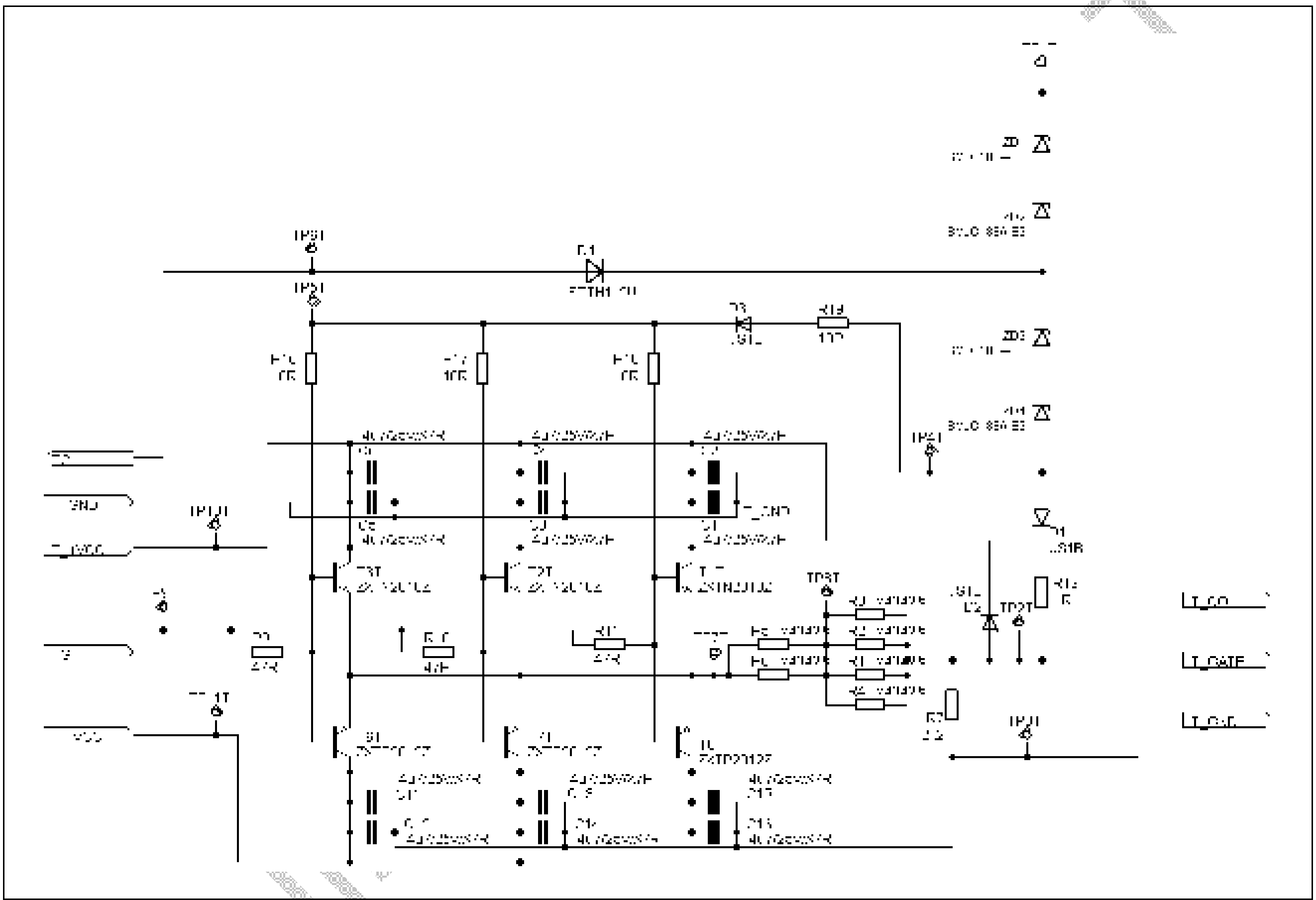

Figure 10 The 2ED250E12-F – top transistor

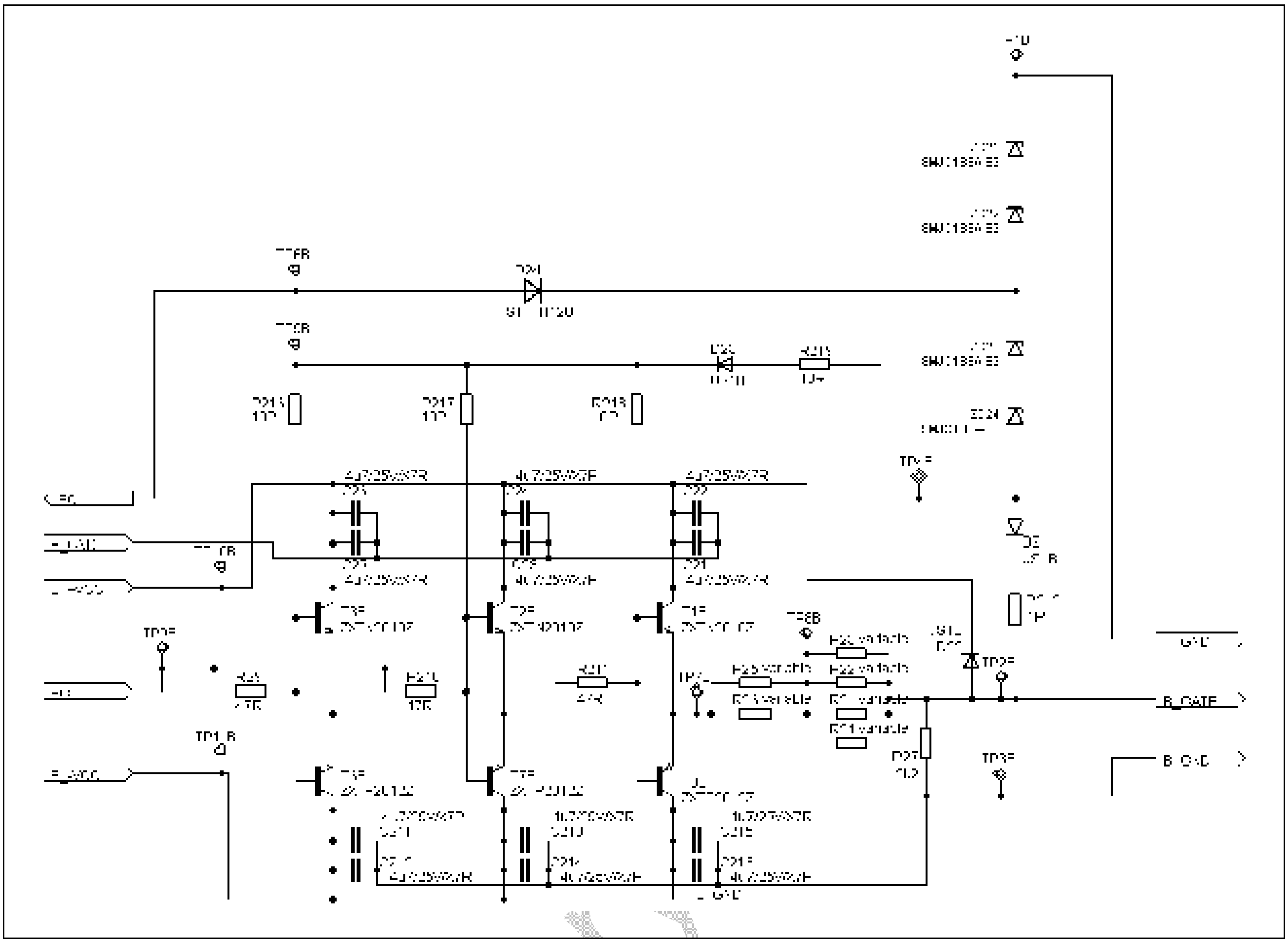

Figure 11 The 2ED250E12-F – bottom transistor

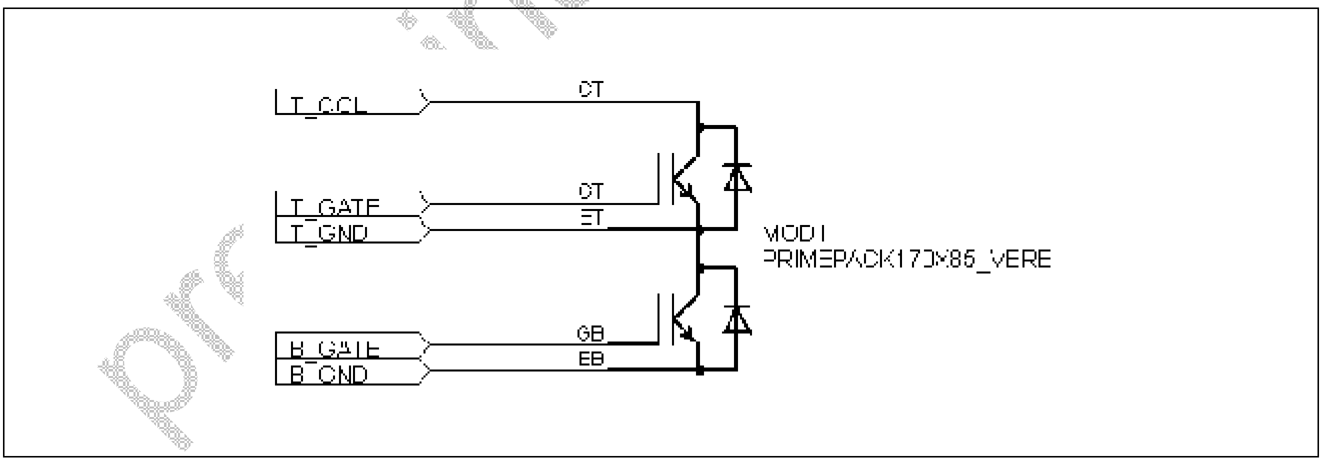

Figure 12 The 2ED250E12-F – main connectors

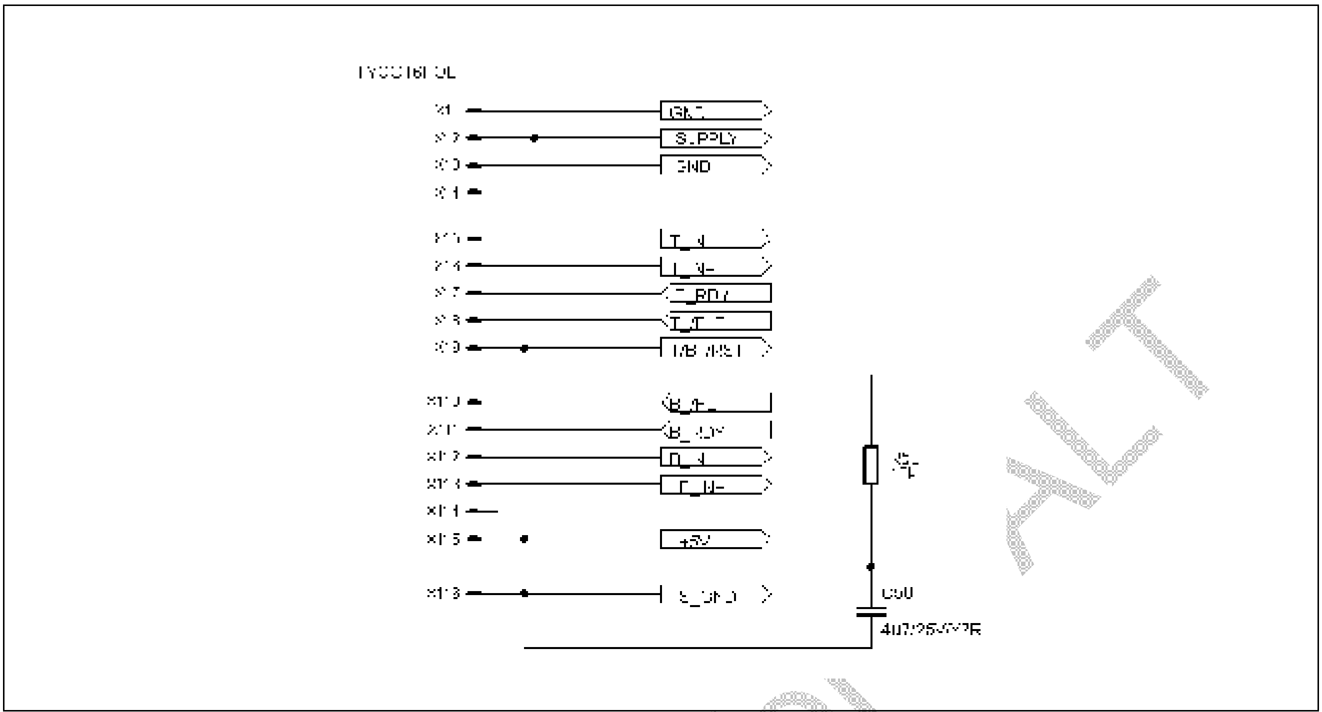

Figure 13 The 2ED250E12-F – external connectors

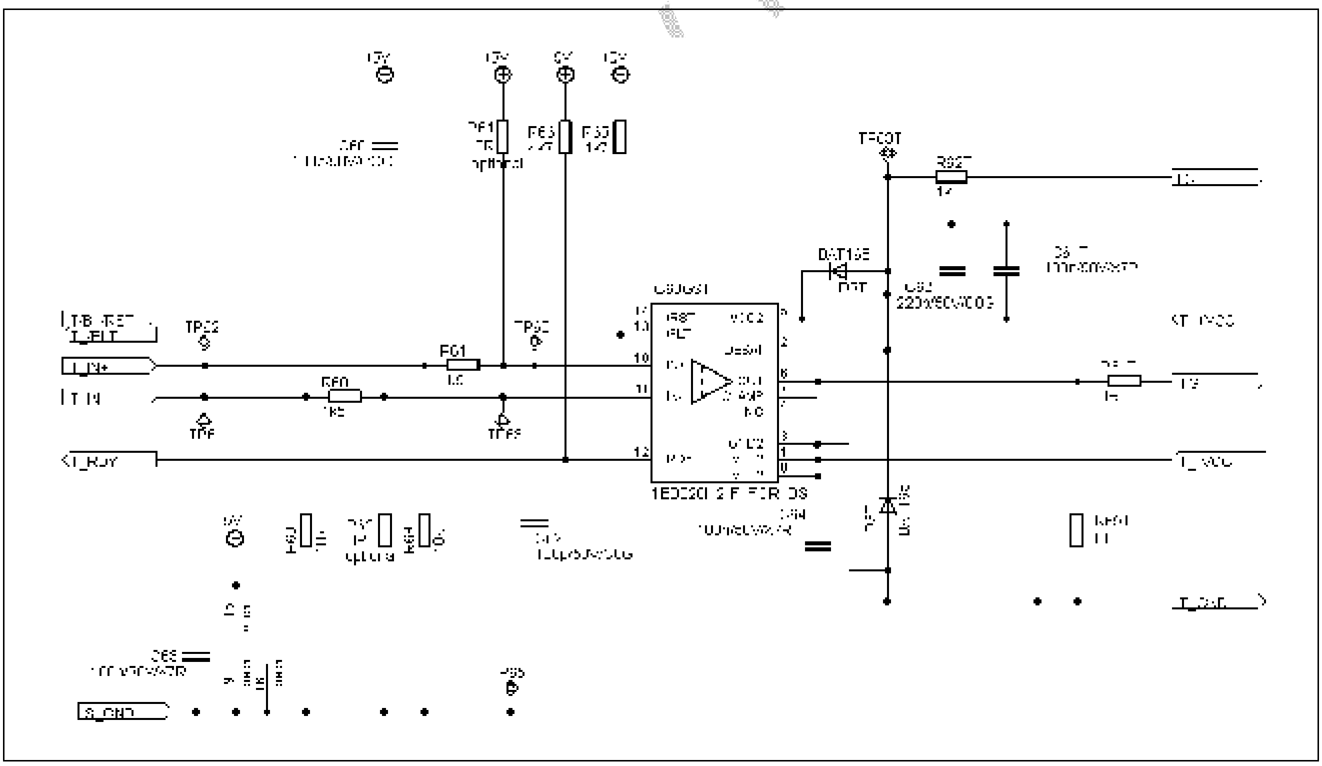

Figure 14 The 2ED250E12-F – high side IGBT driver

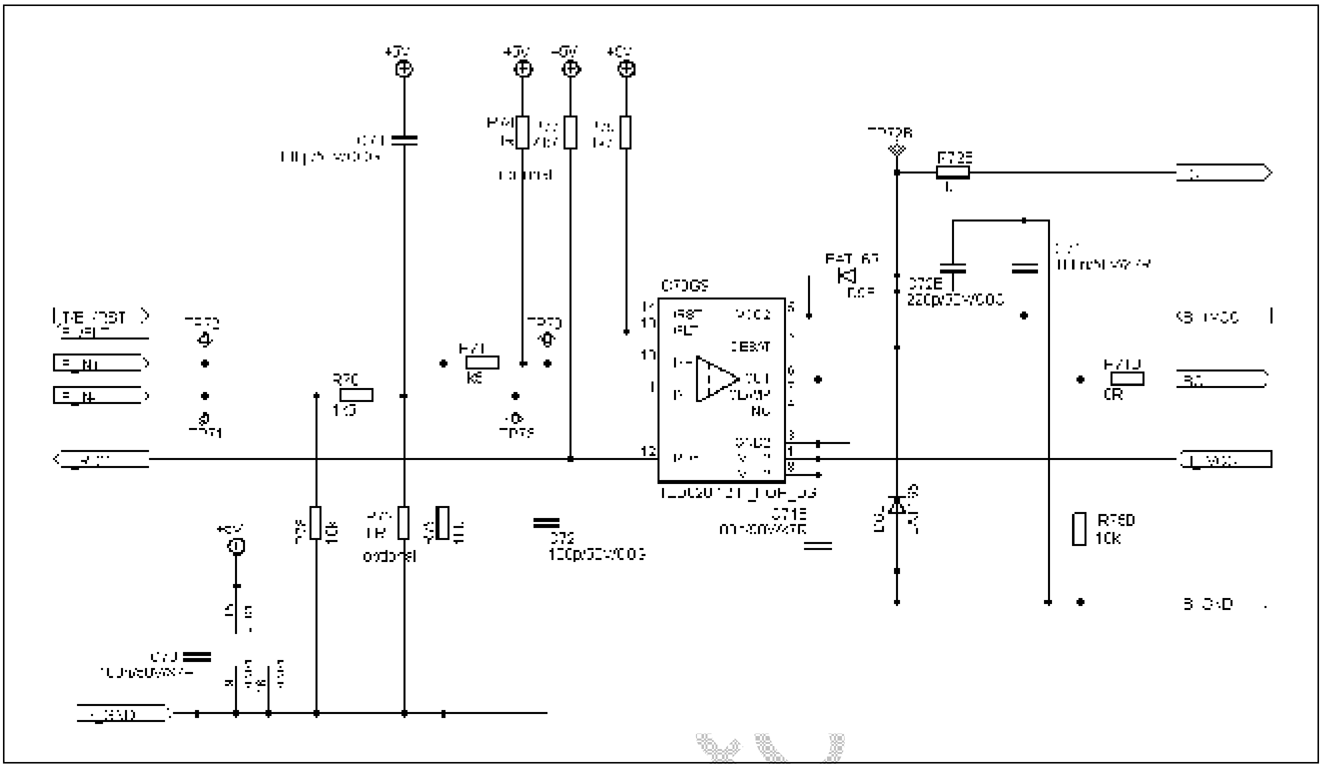

Figure 15 The 2ED250E12-F – low side IGBT driver

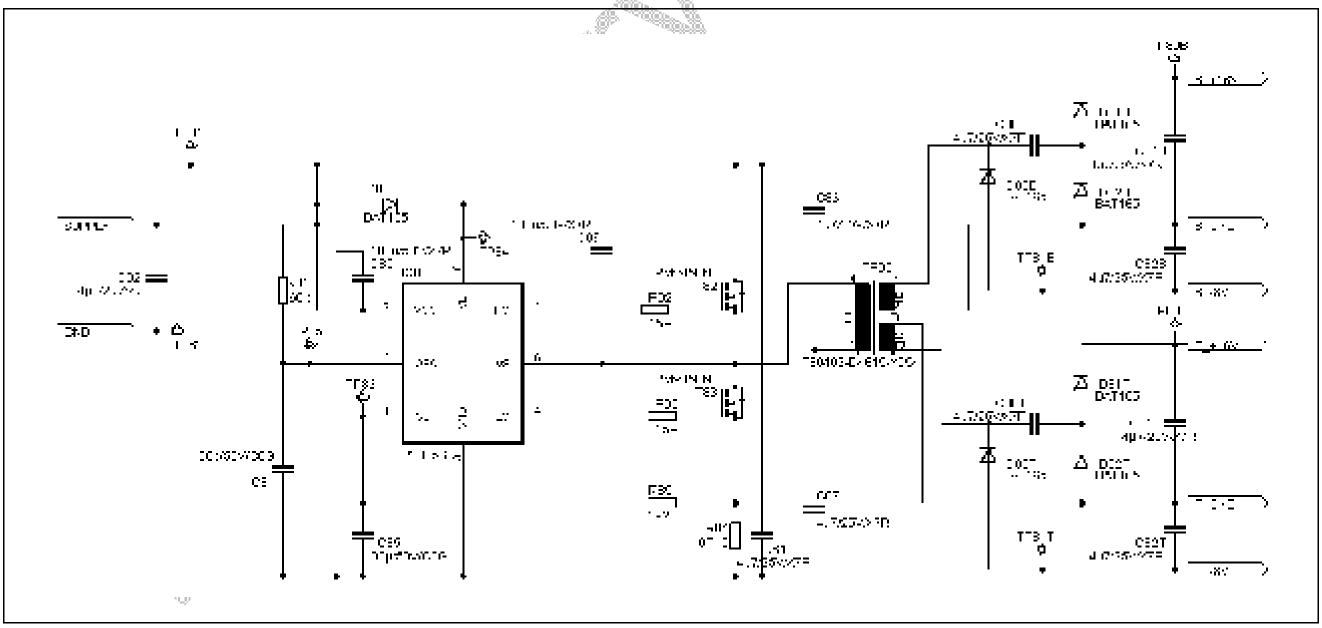

Figure 16 The 2ED250E12-F – DC/DC power supply

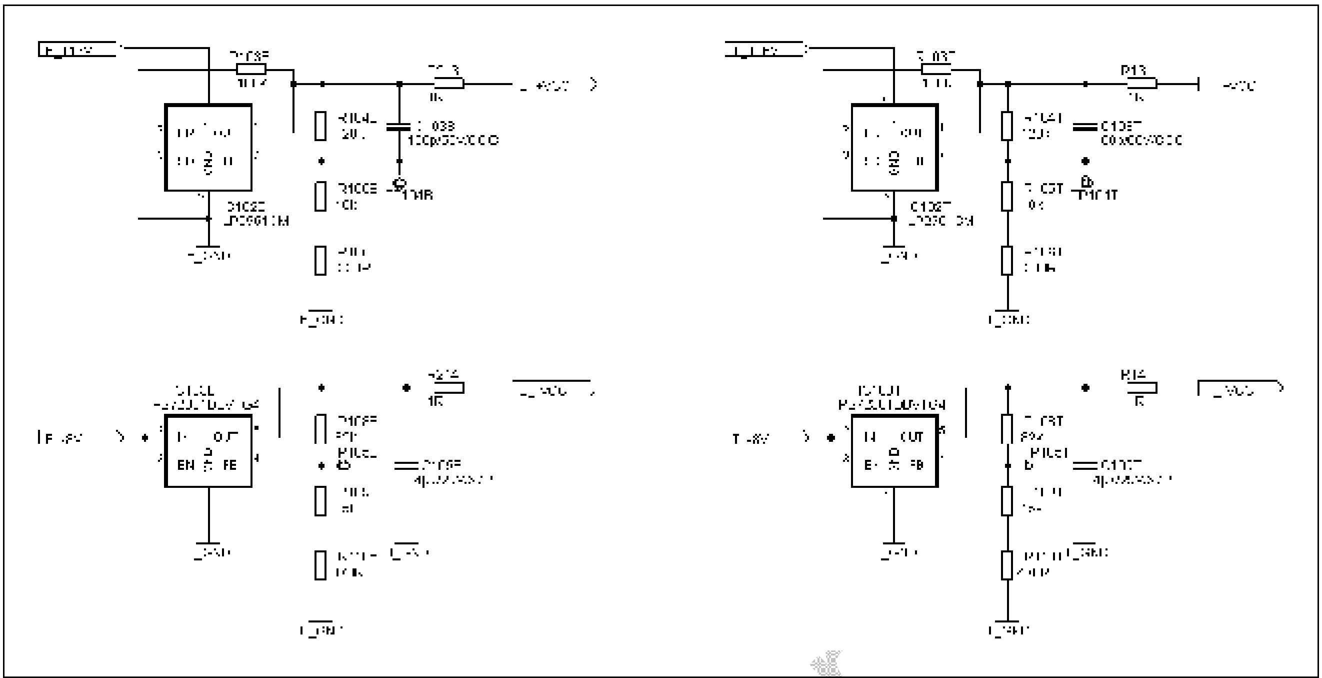

Figure 17 The 2ED250E12-F – DC/DC voltage regulators

4.2 Assembly drawing

Bill of material and detailed information about assembly separately for 2ED250E12-F are given in chapter 4.4.

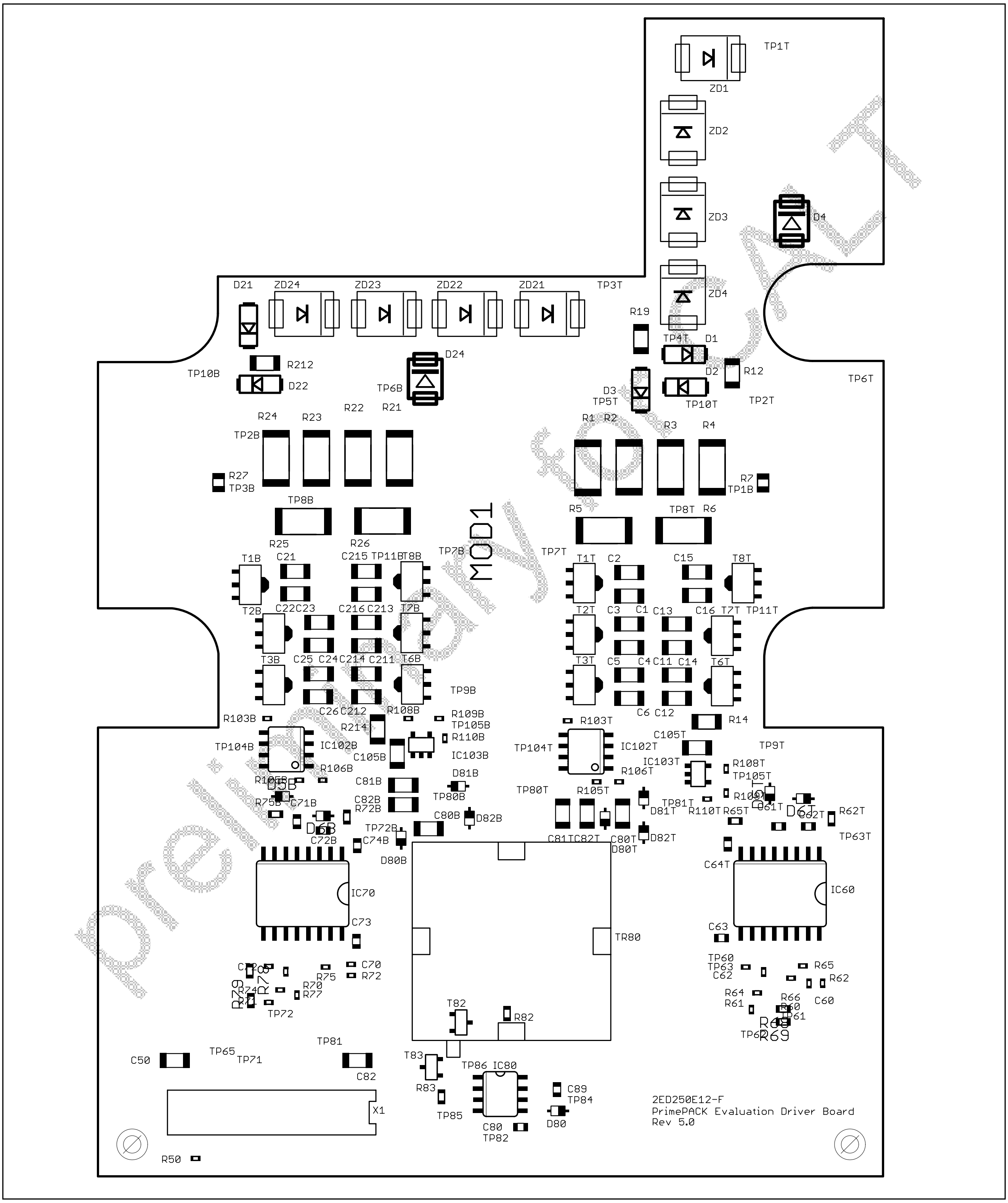

Figure 18 **The 2ED250E12-F – assembly drawing**

Layout

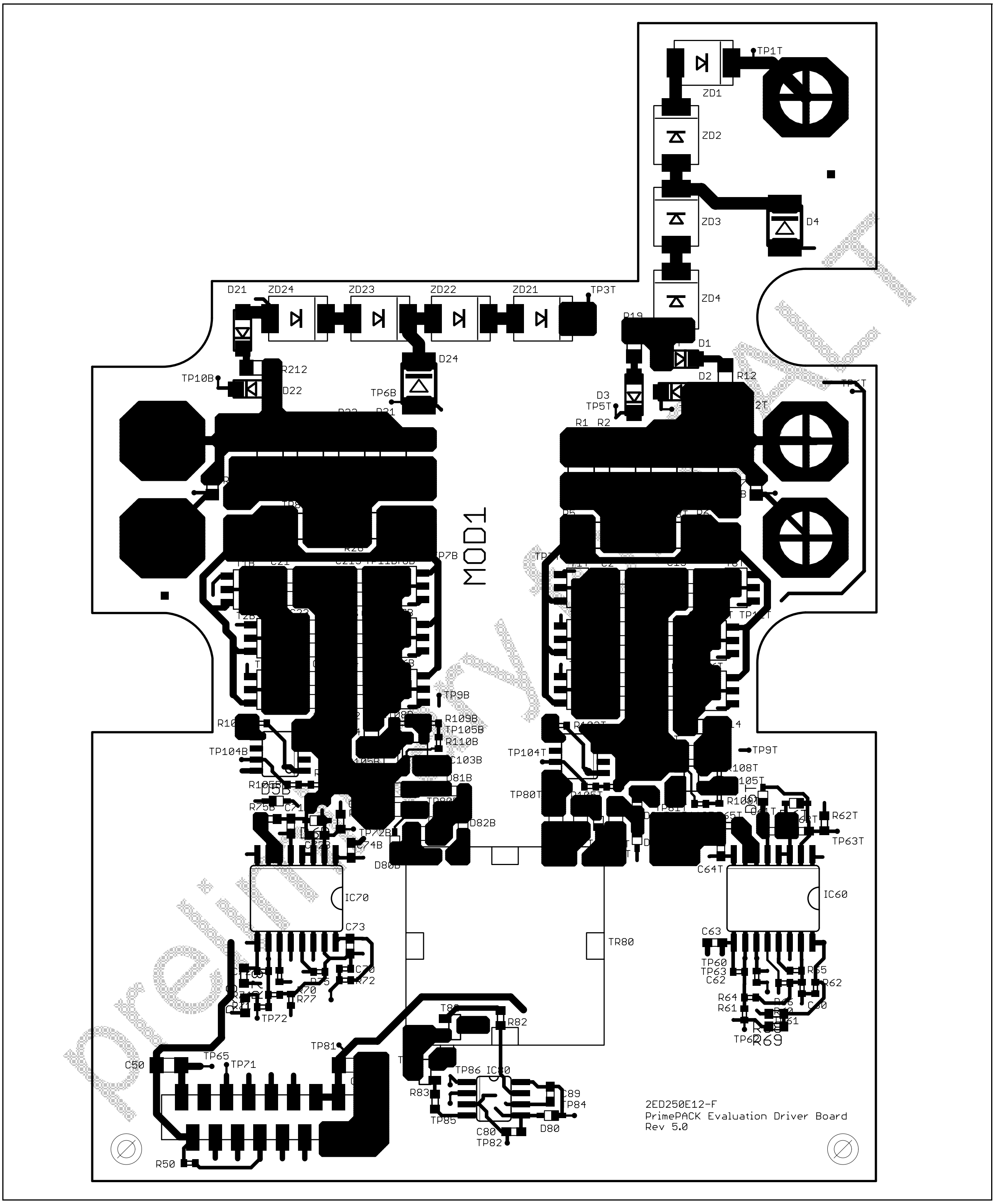

Figure 19 The 2ED250E12-F – Layer 1 (Top)

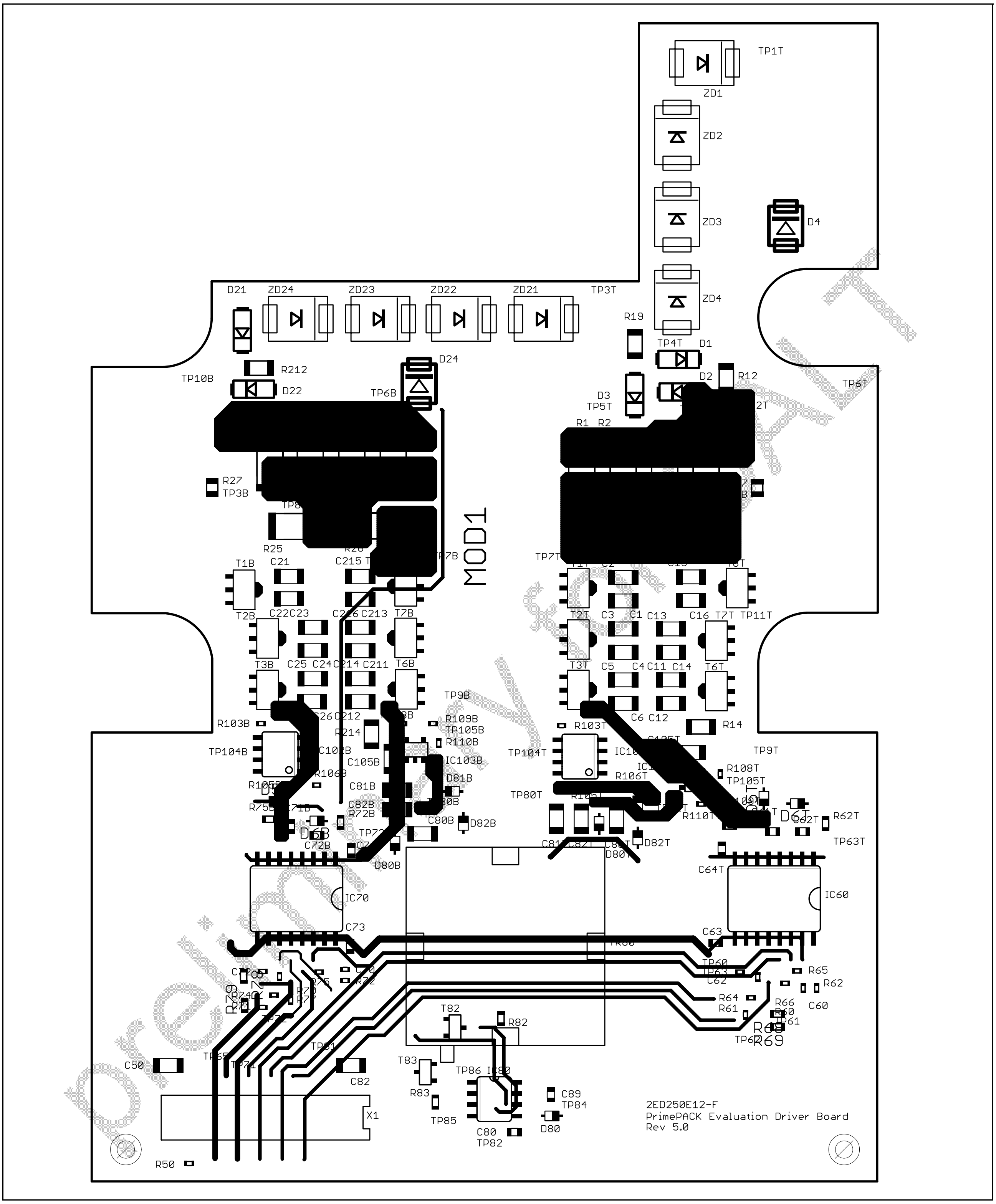

Figure 20 The 2ED250E12-F – Layer 2

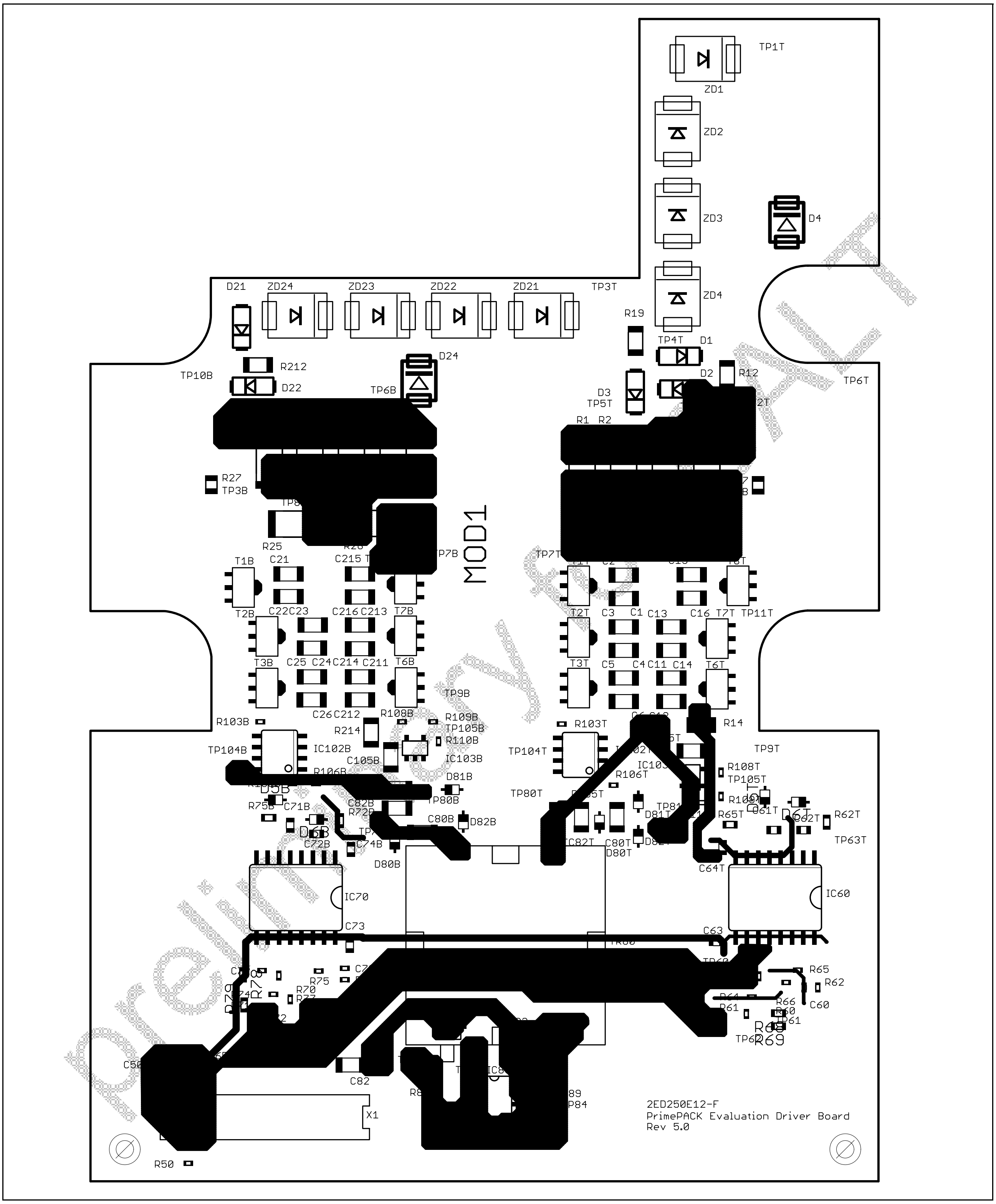

Figure 21 The 2ED250E12-F – Layer 3

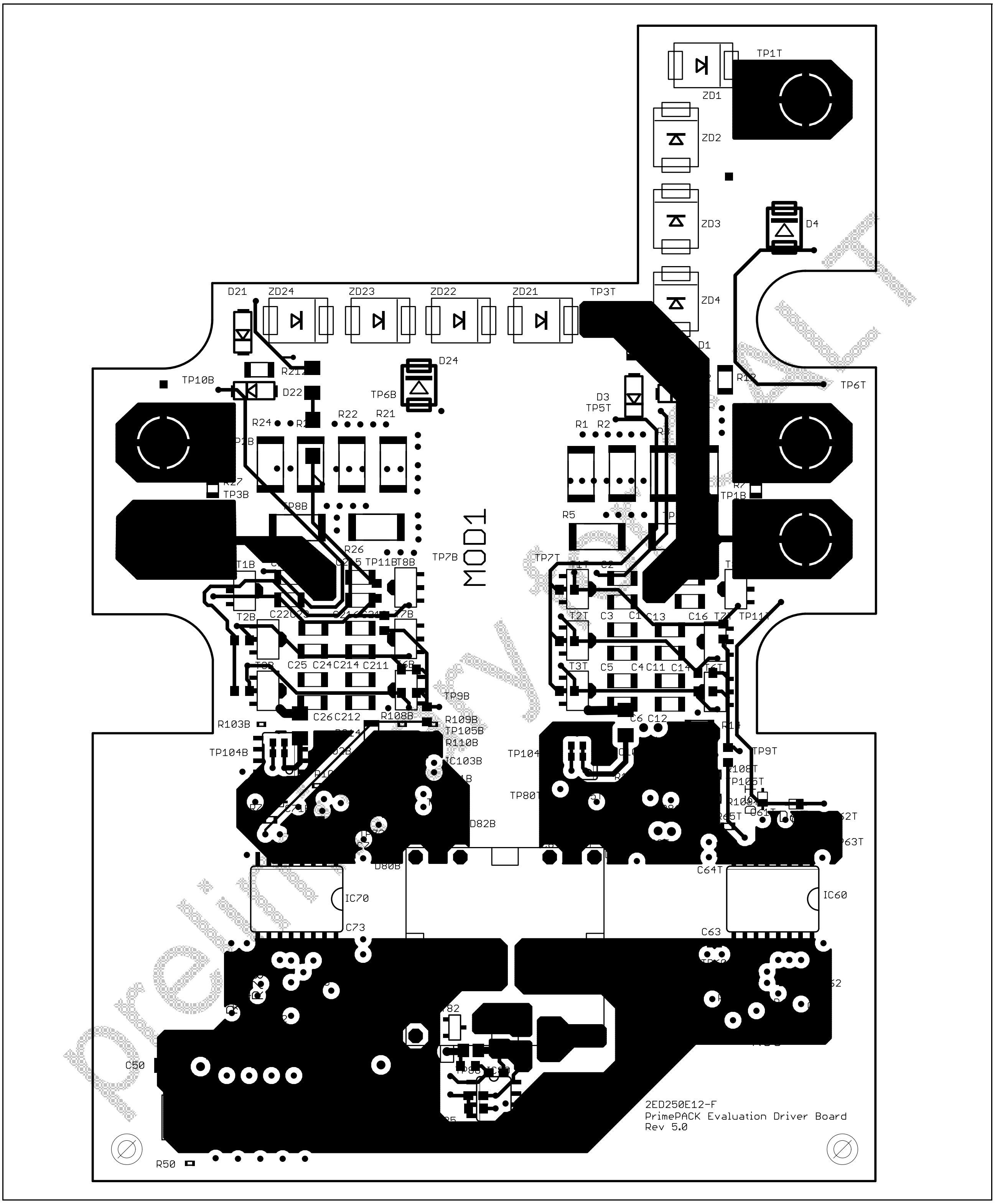

Figure 22 The 2ED250E12-F – Layer 4 (Bottom)

4.3 Bill of Material

The bill of material not only includes a part list, but also assembly notes.

The tolerances for resistors should be less or equal ±1 %, for capacitors of the type C0G less or equal ±5 % and for capacitors of the type X7R less or equal ±10 %.

Table 5 Bill of Material for 2ED250E12-F Evaluation Driver Board

Type	Value / Type	Package size imperal	QTY	Name Part	Recommended Manufacturer	Assembly
Resistor	variable	2512	12	R1, R2, R3, R4, R5, R6, R21, R22, R23, R24, R25, R26	Special *	no
Resistor	0R	0603	2	R61T, R71B	no special	yes
Resistor	0R	0402	2	R64, R74 (if negative input logic)	no special	no
Resistor	0R	0402	2	R62, R72 (if positive input logic)	no special	yes
Resistor	0R15	0805	1	R84	no special	yes
Resistor	1R	1206	6	R12, R13, R14, R212, R213, R214	no special	yes
Resistor	10R	0603	6	R16, R17, R18, R216, R217, R218	no special	yes
Resistor	10R	1206	2	R19, R219	no special	yes
Resistor	15R	0603	2	R82, R83	no special	yes
Resistor	47R	0603	6	R9, R10, R11, R29, R210, R211	no special	yes
Resistor	330R	0402	2	R106B, R106T	no special	yes
Resistor	470R	0402	2	R110B, R110T	no special	yes
Resistor	1k	0603	2	R62T, R72B	no special	yes
Resistor	1k5	0402	4	R60, R61, R70, R71	no special	yes
Resistor	2k2	0603	1	R85	no special	yes
Resistor	2k2	0805	2	R7, R27	no special	yes
Resistor	4k7	0402	4	R65, R66, R75, R77	no special	yes
Resistor	10k	0402	3	R50, R105B, R105T	no special	yes
Resistor	10k	0603	6	R65T, R68, R69, R75B, R78, R79	no special	yes
Resistor	15k	0402	2	R109B, R109T	no special	yes
Resistor	68k	0603	1	R81	no special	yes
Resistor	82k	0402	2	R108B, R108T	no special	yes
Resistor	100k	0402	2	R103B, R103T	no special	yes
Resistor	120k	0402	2	R104B, R104T	no special	yes
Capacitor	100p/50V/COG	0402	6	C62, C72, C60, C70, C103B, C103T	no special	yes
Capacitor	100p/50V/COG	0603	2	C81, C85	no special	yes
Capacitor	220p/50V/COG	0603	2	C62T, C72B	no special	yes
Capacitor	100n/50V/X7R	0603	8	C61T, C63, C64T, C71B, C73, C74B, C80, C89	no special	yes
Capacitor	4µ7/25V/X7R	1206	37	C80B, C80T, C81B, C81T, C82, C82B, C82T, C84, C86, C87, C105B, C105T, C1, C2, C3, C4, C5, C6, C11, C12, C13, C14, C15, C16, C21, C22, C23, C24, C25, C26, C50, C211, C212, C213, C214, C215, C216	Murata	yes

Type	Value / Type	Package size imperal	QTY	Name Part	Recommended Manufacturer	Assembly
Semiconductor	ZXTN2010Z	SOT89	6	T1B, T1T, T2B, T2T, T3B, T3T	Zetex	yes
Semiconductor	ZXTP2012Z	SOT89	6	T6B, T6T, T7B, T7T, T8B, T8T	Zetex	yes
Semiconductor	ES1B	SMA	6	D1, D2, D3, D21, D22, D23	Vishay	yes
Semiconductor	STTH112U	SMB	2	D4, D24	STM	yes
Semiconductor	SMJC188A-E3	SMC	8	ZD1, ZD2, ZD3, ZD4, ZD21, ZD22, ZD23, ZD24	Vishay	yes
Semiconductor	BAT165	SOD323	11	D5B, D5T, D6B, D6T, D80, D80B, D80T, D81B, D81T, D82B, D82T	Infineon	yes
Semiconductor	IR2085SPbF	SO8	1	IC80	TI	yes
Semiconductor	1ED020I12-F	PG-DSO-16	2	IC60, IC70	Infineon	yes
Semiconductor	PMV45EN	SOT23	2	T82, T83	Philips	yes
Semiconductor	LP2951CM	SOIC8	2	IC102B, IC102T	National	yes
Semiconductor	TPS72301DBVTG4	SOT23-5	2	IC103B, IC103T	TI	yes
Connector	Tyco16POL		1	X1	Tyco (8-188275-6)	yes
Transformer	T60403-D4615-X054		1	TR80	VAC	yes
PCB			1	Size: 89x131.5x1.5mm; material:FR4; Layers - Cu : 4x35µm; Isolation: 3x0,5mm; flammability: UV94V0		

*Pulse power rated types

5 How to order Evaluation Driver Boards

Every Evaluation Driver Board has its own IFX order number and can be ordered via your Infineon Sales Partner.

Information can also be found at the Infineons Web Page: www.infineon.com

CAD-data for the board decribed here are available on request. The use of this data is subjected to the disclaimer given in this AN. Please contact: IGBT.Application@infineon.com

IFX order number for 2ED250E12-F_EVAL: 32418

6 Errata

Boards from early production lots of this board may be erroneously designated as 2ED250E17-F in the marking print.

http://www.infineon.com

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