

User Manual - evaluation board

650 V TRENCHSTOP™ 5 D2Pak IGBT on insulated metal substrate (IMS)

About this document

Scope and purpose

The evaluation board for the 650 V TRENCHSTOP™ 5 D2Pak IGBT on insulated metal substrate enables an easy and rapid test setup for evaluation of D2Pak IGBTs on an IMS solution.

Specifically, the evaluation board consists of a new D2Pak 40 A 650 V TRENCHSTOP™ 5 IGBT, co-packed with a 40 A diode, assembled on IMS in a half-bridge configuration.

Two versions, 40 A and 80 A, are available featuring a single D2Pak IGBT or 2 x D2Pak IGBTs in parallel per switch.

The evaluation board provides pin lead connections for IGBT gate signals, collector and emitter power signals, and additional NTC sensor signals to monitor the IMS temperature performance. The evaluation board design allows for an evaluation of the operating performance of the D²Pak IGBT and co-packed diode in topologies such as half-bridge, buck, and boost converter or merely as a single switch.

In summary, the evaluation board for the 650 V TRENCHSTOP™ 5 D2Pak IGBT on insulated metal substrate saves the user time and effort by providing a quick board solution to evaluate D2Pak IGBTs on an IMS solution.

Intended audience

This application note is intended for all technical specialists working with the 650 V TRENCHSTOP™ 5 D2Pak IGBT on IMS.

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1 Evaluation board specifications

1.1 40 A evaluation board general specifications, layout and dimensions

| Parameter | Test conditions | Unit | Value |
|----------------------|---------------------------|-------|--------|
| Thermal conductivity | ASTM D5470 | W/m-K | 2.0 |
| Thermal resistance | ASTM D5470 | °C/W | 0.55 |
| Thermal stress | 288°C, solder dipping | s | 120 |
| Peel strength | IPC-TM-650, 2.4.8 | N/mm | 1.5 |
| Volume resistivity | IPC-TM-650, 2.5.17 | MΩ-cm | 108 |
| Surface resistivity | IPC-TM-650, 2.5.17 | MΩ-cm | 107 |
| Dielectric constant | IPC-TM-650, 2.5.5.3, 1MHz | - | 4.9 |
| Dissipation factor | IPC-TM-650, 2.5.5.3, 1MHz | - | ≤ 0.02 |
| Breakdown voltage | ASTM D149 | kV DC | 3 |
| Flammability | UL94 | class | V-0 |
| CTI | IEC60112 | V | 600 |
| TG | DSC | °C | 130 |
| Halogen | Cl, Br | ppm | ≤ 900 |
| | Cl, +Br | ppm | ≤ 1500 |

Figure 1.1. Specifications of 40 A evaluation board

IMS Material - 3 oz/ft² copper foil layer, 100 μm dielectric layer thickness and 1.6 mm aluminum base thickness

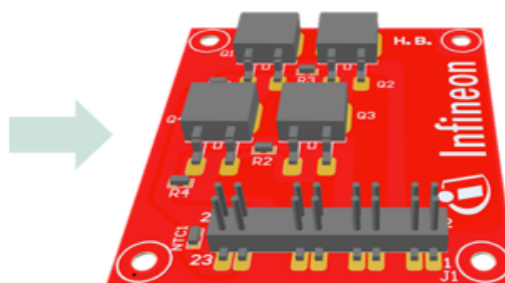
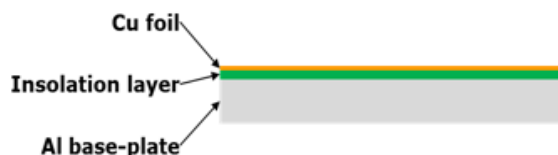
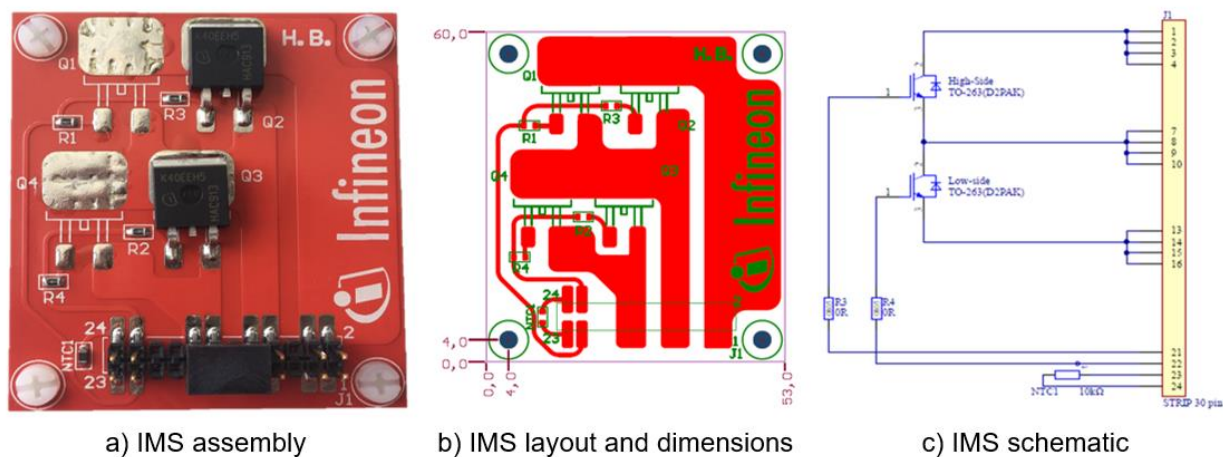


Figure 1.2. Description of the IMS material

General parameters

| | |
|--|--|
| Product name | EVAL-IGBT-D2PAK-40A |
| Product description | 2 x 40 A 650 V D2Pak IGBT assembled on IMS |
| Configuration | Half-bridge |
| Maximum DC collector current per switch (D2Pak $T_{case} = 100^{\circ}\text{C}$) | 46.0 A |
| Maximum power dissipation per switch (D2Pak $T_{case} = 100^{\circ}\text{C}$) | 125 W |
| Dimensions | 60 mm x 53 mm x 1.8 mm |
| Target application | PV solar inverters Industrial power supplies (UPS, SMPS) Welding converters Energy storage EV chargers |

Figure 1.3. General parameters of 40 A evaluation board



- > 1 phase, half-bridge topology
- > 2x IKB40N65EH5 TRENCHSTOP™ 5 D2Pak
- > 2x Rg (gate resistor) with the value of $22 \Omega \pm 1\%$, package 0805, 200mW
- > NTC thermistor with the value of 10 k Ω , part number - Murata NCP21XV103J03RA
- > Dimensions: 60 x 53 x 18 mm³

Figure 1.4. Image and description of 40 A evaluation board

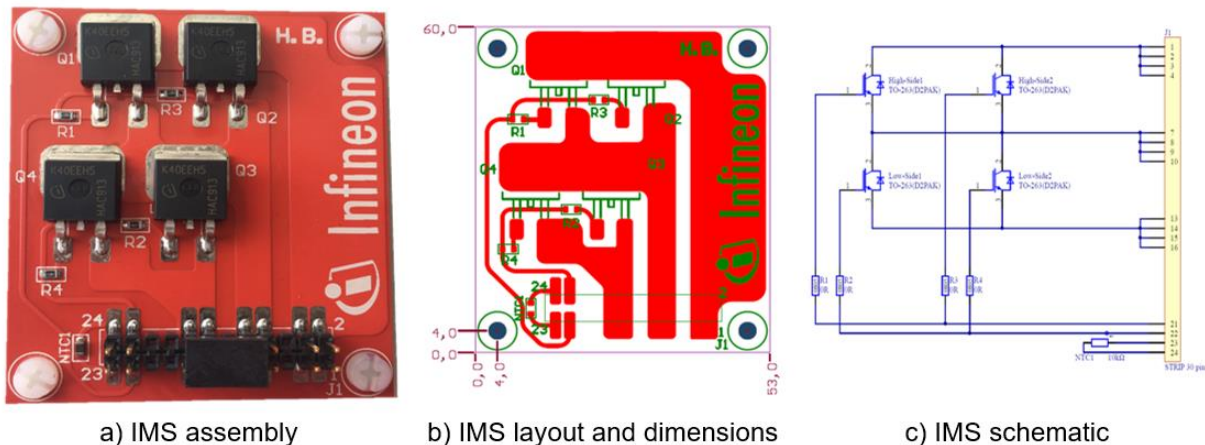
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650 V TRENCHSTOP™ 5 D2Pak IGBT on insulated metal substrate (IMS)

1.2 General specifications, layout and dimensions of 80 A evaluation board

| General parameters | |
|--|--|
| Product name | EVAL-IGBT-D2PAK-80A |
| Product description | 4 x 40 A 650 V D2Pak IGBT assembled on IMS |
| Configuration | Half-bridge with 2 x D2Pak IGBT in parallel per switch |
| Maximum DC collector current per switch, 2 x IGBT in parallel (D2Pak $T_{case} = 100^{\circ}\text{C}$) | 92.0 A |
| Maximum power dissipation per switch, 2 x IGBT in parallel (D2Pak $T_{case} = 100^{\circ}\text{C}$) | 250 W |
| Dimensions | 60 mm x 53 mm x 1.8 mm |
| Target application | PV solar inverters Industrial power supplies (UPS, SMPS) Welding converters Energy storage EV chargers |

Figure 1.5. General parameters of 40 A evaluation board



- › 1 phase, half-bridge topology
- › 4x IKB40N65EH5 TRENCHSTOP™ 5 D2Pak
- › 4x Rg (gate resistor) with the value of $22\ \Omega \pm 1\%$, package 0805, 200mW
- › NTC thermistor with the value of 10 k Ω , part number - Murata NCP21XV103J03RA
- › Dimensions: 60 x 53 x 18 mm³

Figure 1.6. Image and description of 80 A evaluation board

2 Thermal performance

2.1 D2Pak on IMS vs. TO-247 with Sil-Pad K-4 insulation foil

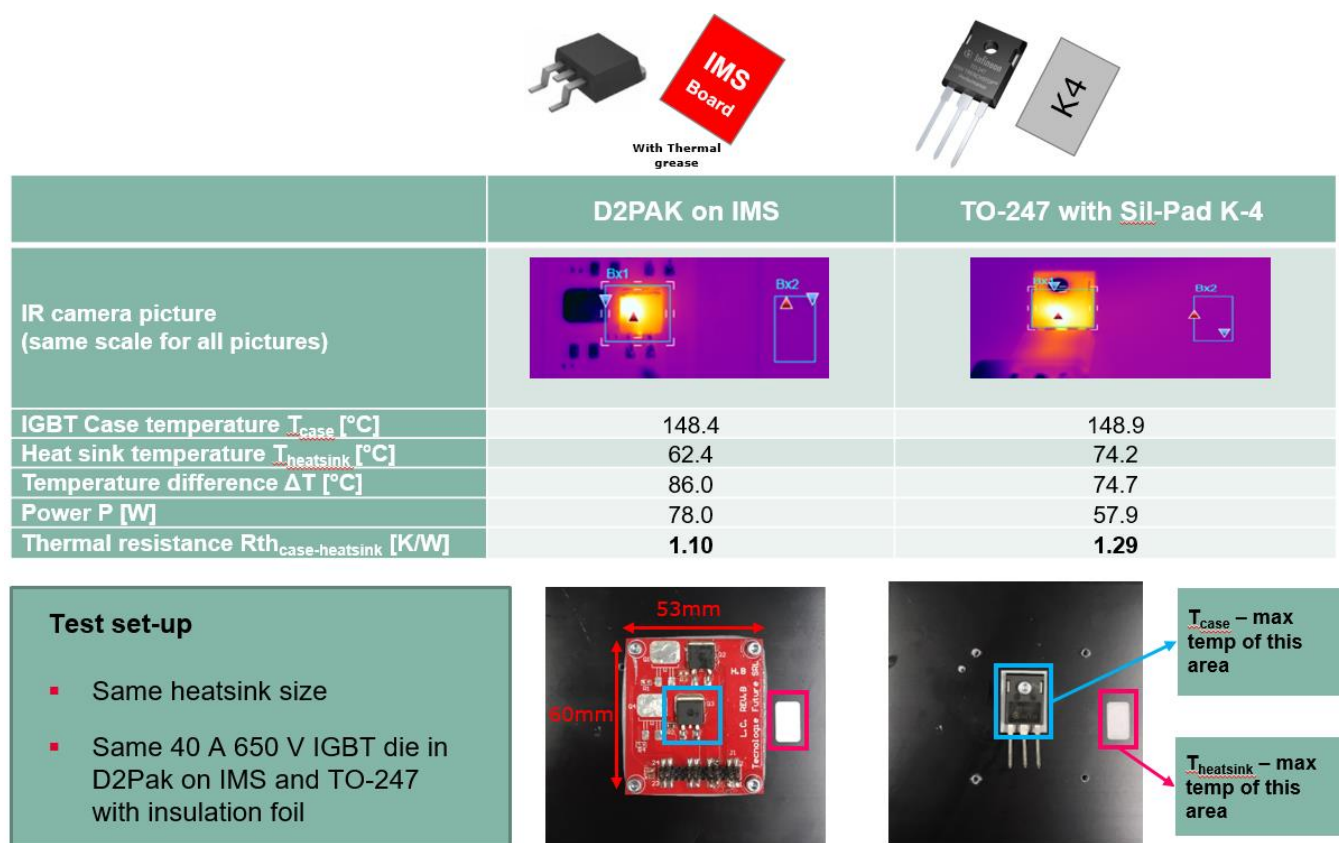


Figure 2.1. Test results comparing 40 A duopack TRENCHSTOP™ 5 IGBT in D2Pak vs TO-247-3 using 40 A evaluation board

3 Summary - Improving system designs performance using 650 V TRENCHSTOP™ 5 D2Pak IGBT on IMS

The recently released TRENCHSTOP™ 5 IGBT in a surface-mounted D2Pak package, optimized for switching frequencies over 30 kHz, perfectly complements the previously released portfolio of TRENCHSTOP™ 5 IGBT in through-hole TO-247 packages.

The new TRENCHSTOP™ 5 IGBT in the D2Pak portfolio is a 40 A, 650 V IGBT, co-packed with a 40 A diode, the best-in-class and unique highest power density 650 V IGBT on the market in a D2Pak package.

The new TRENCHSTOP™ 5 IGBT in a D2Pak package enables designers to take advantage of the SMD package features for improving the performance and cost of system designs that typically use the TO-247 package IGBTs.

For instance, Infineon's 4 kW welding machine power supply demo board based on a half-bridge converter topology using SMD on an IMS solution demonstrates the improved efficiency of the power converter, delivering lower operating temperatures and reliable switching performance with lower turn-off voltage overshoot on IGBT.

In summary, the system's design with SMD IGBTs assembled on IMS provides not only improved electrical and thermal performance, but also reduces the system's size and weight.

For more information related to 650 V TRENCHSTOP™ 5 D2Pak IGBT on IMS application, please refer to Infineon's application note AN2018-23:

https://www.infineon.com/dgdl/Infineon-650V_TRENCHSTOP_5_D2Pak_IGBT-AN-v01_00-EN.pdf?fileId=5546d46265f064ff0166435041e50bab

4 References

[1] AN2018-23 - 650 V TRENCHSTOP™ 5 D2Pak IGBT - Improving performance of a portable welding machine power supply using SMD on IMS https://www.infineon.com/dgdl/Infineon-650V_TRENCHSTOP_5_D2Pak_IGBT-ApplicationNotes-v01_00-EN.pdf?fileId=5546d46265f064ff0166435041e50bab

[2] AN2019-10 - TO-247PLUS IGBT discrete device enhances power density in welding machines extending the range of use of discrete IGBTs to power levels typically achieved by standard IGBT modules https://www.infineon.com/dgdl/Infineon-TO-247PLUS_IGBT_discrete_device_enhances_power_density_in_welding_machines-ApplicationNotes-v01_00-EN.pdf?fileId=5546d4626b2d8e69016bacf10e2c2515

Note: All listed reference materials are available for download on Infineon's website www.infineon.com/.

5 Revision History

Major changes since the last revision

| Page or Reference | Description of change |
|-------------------|---|
| | Revision 1.0 – First Release – Blaz Klobucar / Jorge Cerezo / Tetiana Kolosenko |
| | |
| | |

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