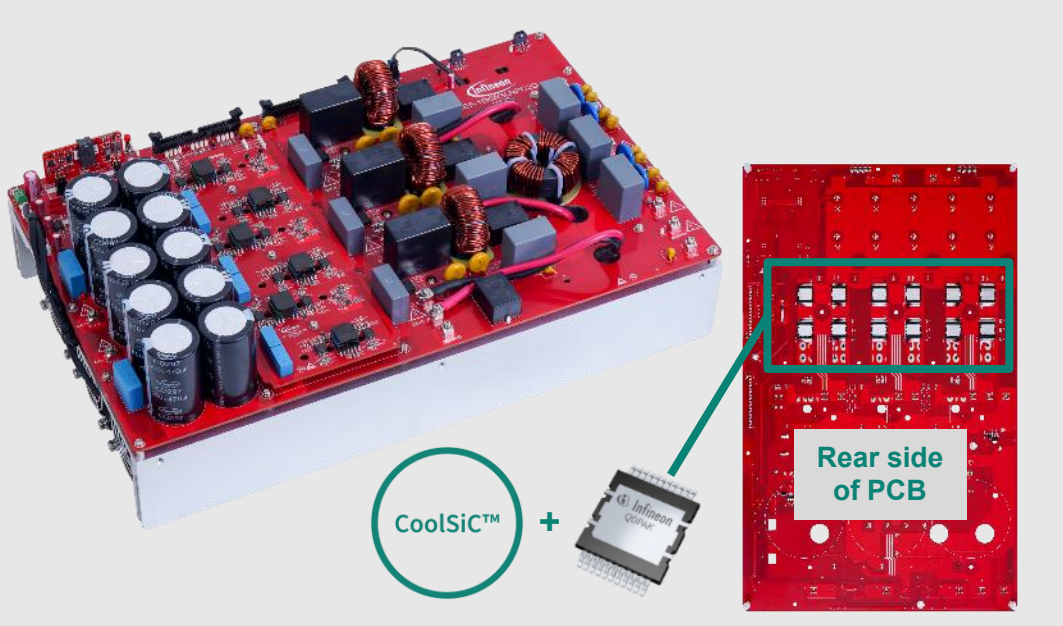
10 kW 3-level NPC2 power conversion reference design with CoolSiC™ QDPAK products

April 2026

Reference design for highly efficient and bidirectional 3-level NPC2 inverter stages with up to 10 kW

REF-10KW3LNPC2Q



Target Applications

Solar

Storage

DC-AC

Ordering Information

SP Number:
SP006162553

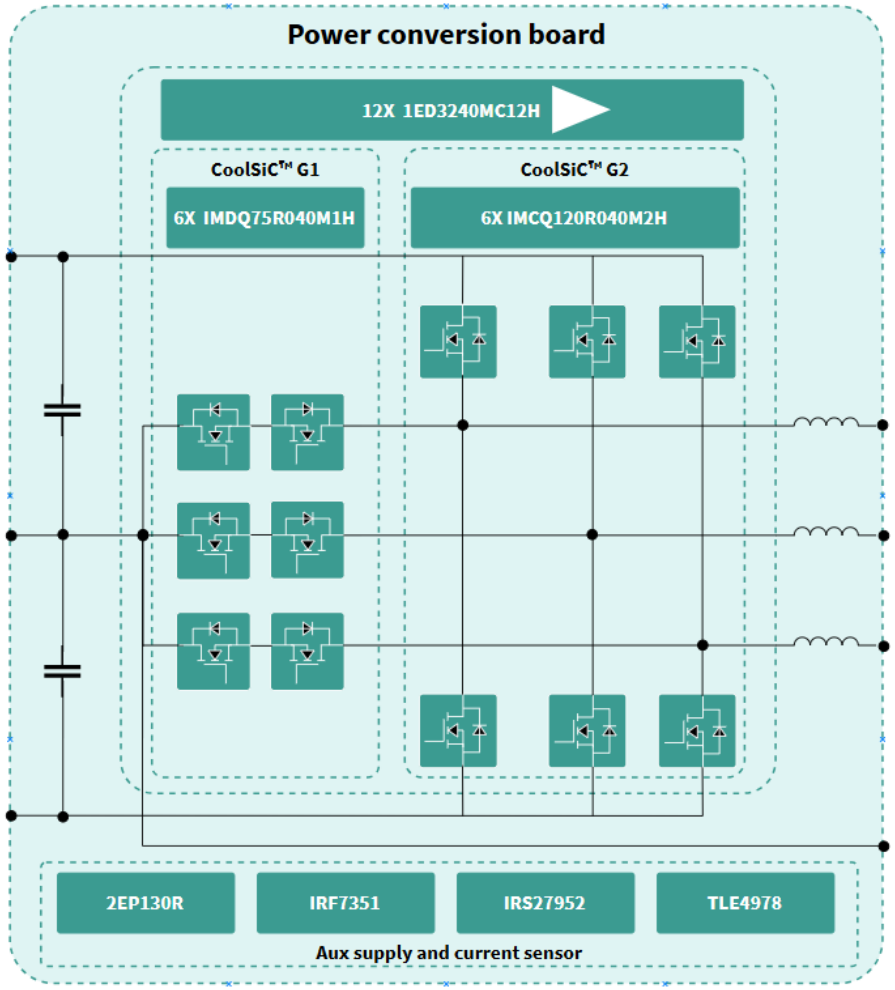
OPN:
REF10KW3LNPC2QTOBO1

Key Technical Features and top-level specification

- Power conversion design blueprint to build highly efficient and bidirectional 3-level NPC2 inverter stages with up to 10 kW
- Latest 2nd CoolSiC™ MOSFET in top-side cooled QDPAK package, combined with best fitting EiceDRIVER™ gate drivers
- Main power board mounted on heatsink with fans and gate driver and auxiliary power supply cards on top
- Integrated optimized DC capacitor bank, AC filter and AC EMI filter

Target Application	Solar/ESS Hybrid Inverter
Input voltage range	600 – 1000 V
Output voltage range	220/380 V & 230/400 V
Output current nom./max.	15 A / 18 A
Output power max.	10 kW @ Ta <= 45°C; derating up to 60°C
Peak/Weighted efficiency (at 650 V)	99.2% / 99.0% (before AC filter)
Topology / Switching frequency	3-level NPC2 / 48 kHz
Additional technical parameters	PF: 0.8 leading … 0.8 Lagging, THD: <3%, OCP, OTP, OVP & Soft turn off

REF-10KW3LNPC2 (SiC in QDPAK): Key Infineon products on the reference design



Key featured Infineon products:

Power Switches
1200V CoolSiC™ MOSFET in Q-DPAK: IMCQ120R040M2H
750V CoolSiC™ MOSFET in Q-DPAK: IMDQ75R040M1H

Gate Drivers
EiceDRIVER™ 2L-SRC Compact single-channel isolated gate driver: 1ED3240MC12H

Current sensors
XENSIV™: TLE4978

Power Switches (Aux)
60V Dual N-Channel HEXFET Power MOSFET: IRF7351

Gate Drivers (Aux)
Full-bridge transformer driver IC: 2EP130R

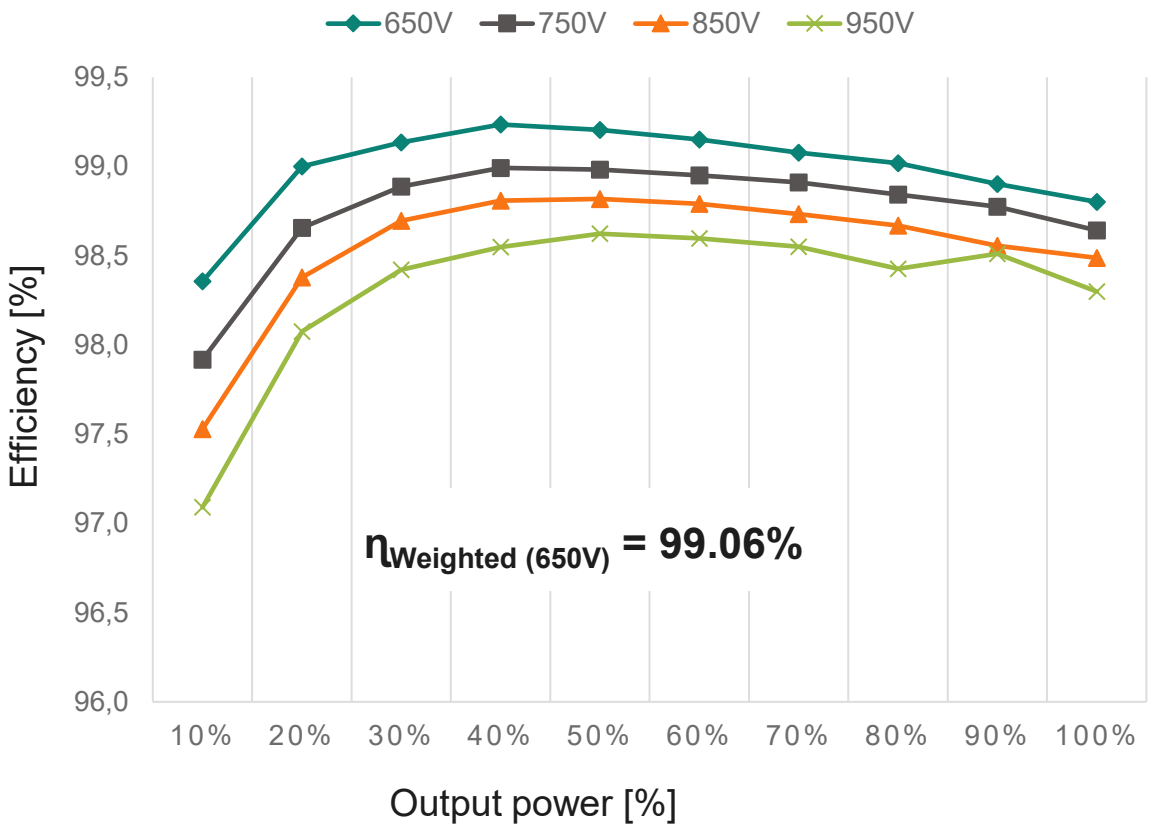
Controller IC (Aux)
600V Half Bridge High Voltage Controller IC: IRS27952

Demonstrated System Level Benefits

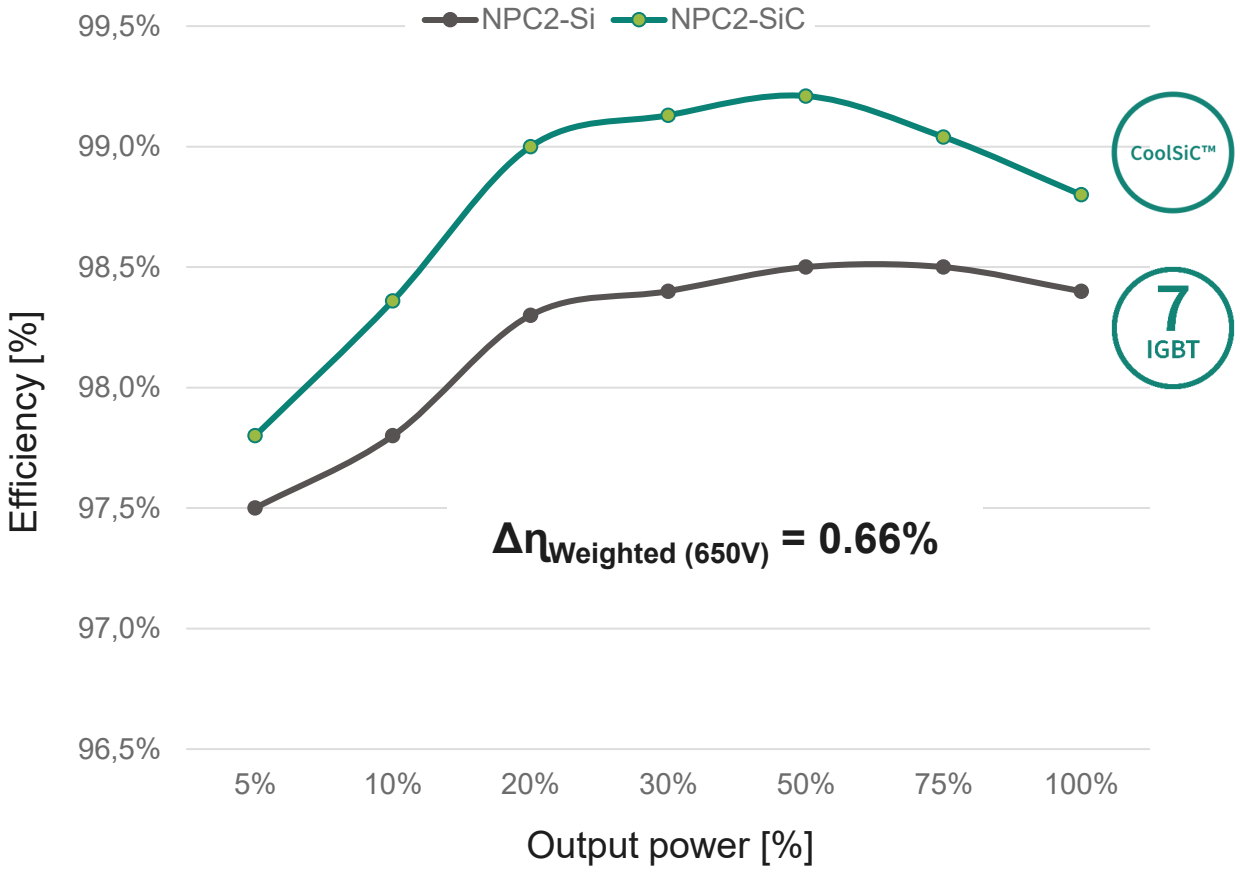
NPC2 inverter with SiC technology delivers 0.66% higher efficiency at 2x faster switching frequency

Efficiency measurement (SiC)

V_{OUT} = 380 V, F_{SW} = 48 kHz, P_{OUT} = 10 kW, MI = 0.9 (Efficiency measured before AC filter)

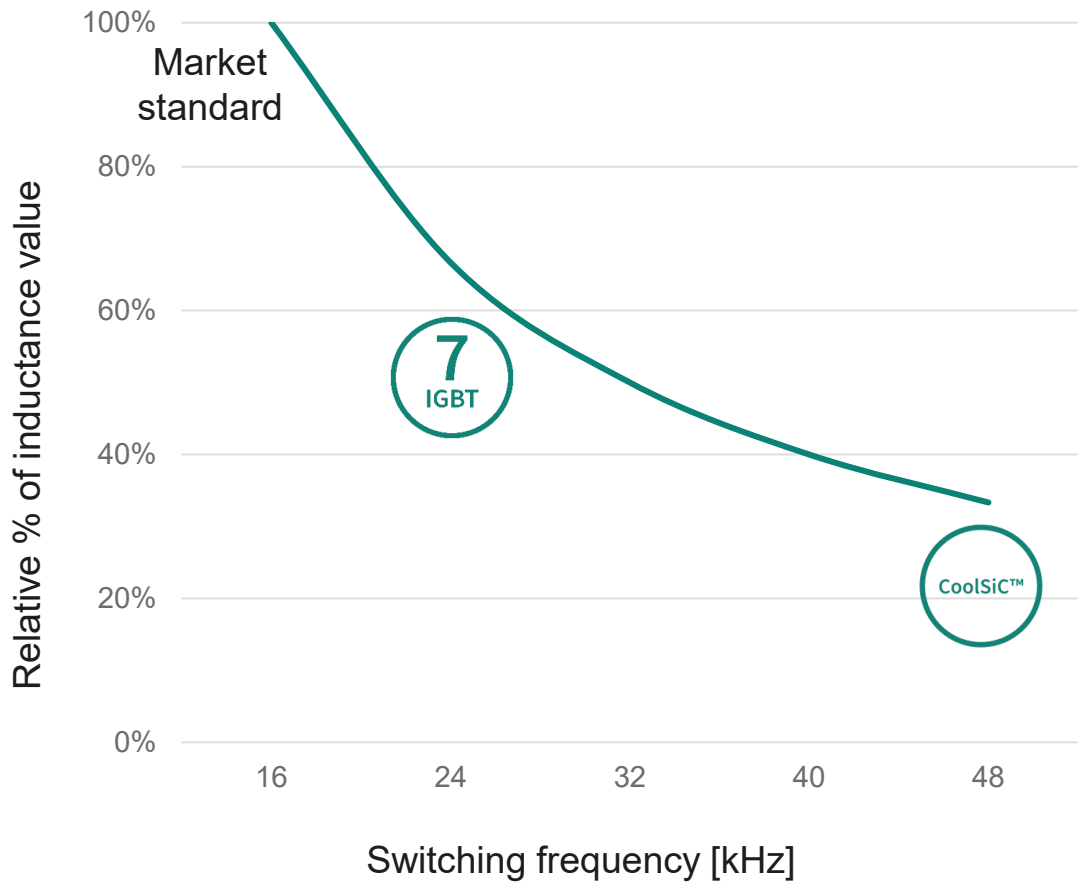


Efficiency measurement (Si vs SiC at 650Vdc)

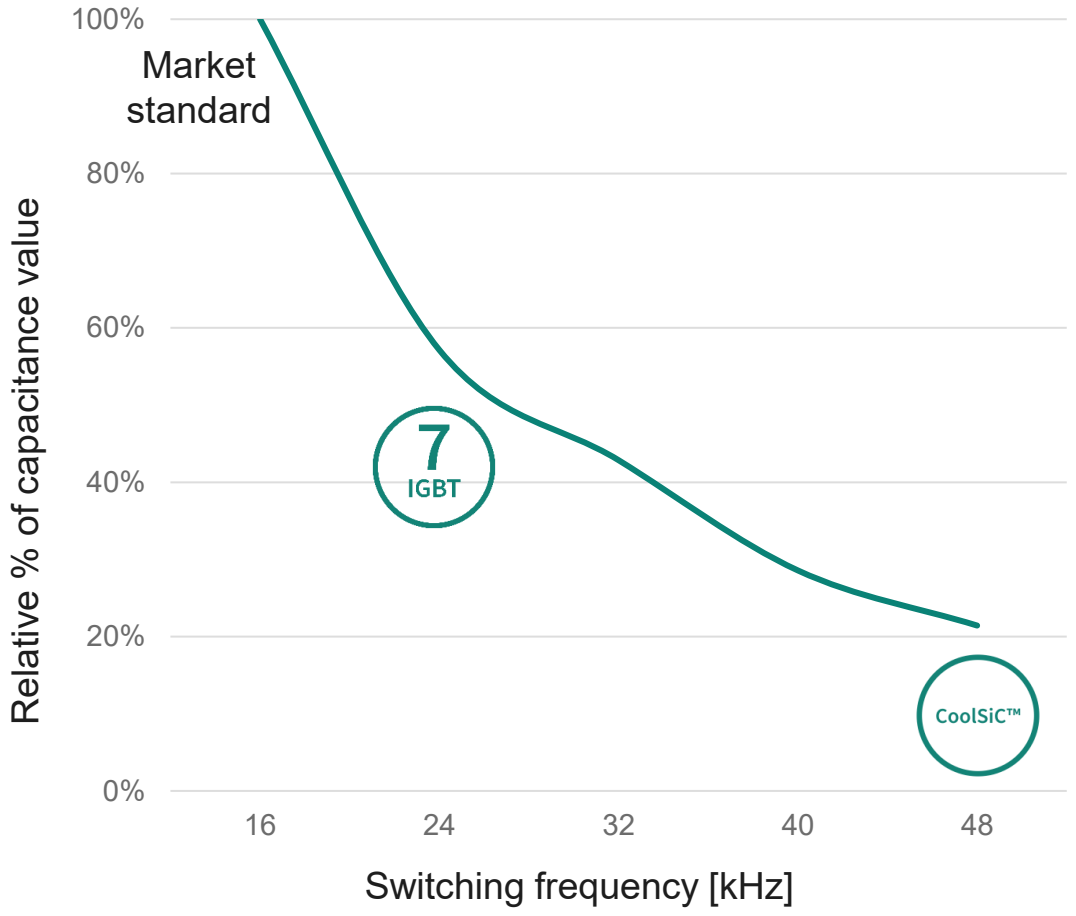


Paving the way for significant system level cost-down: Influence of higher switching frequency on LCL filter design

Impact of f_{sw} to filter inductance

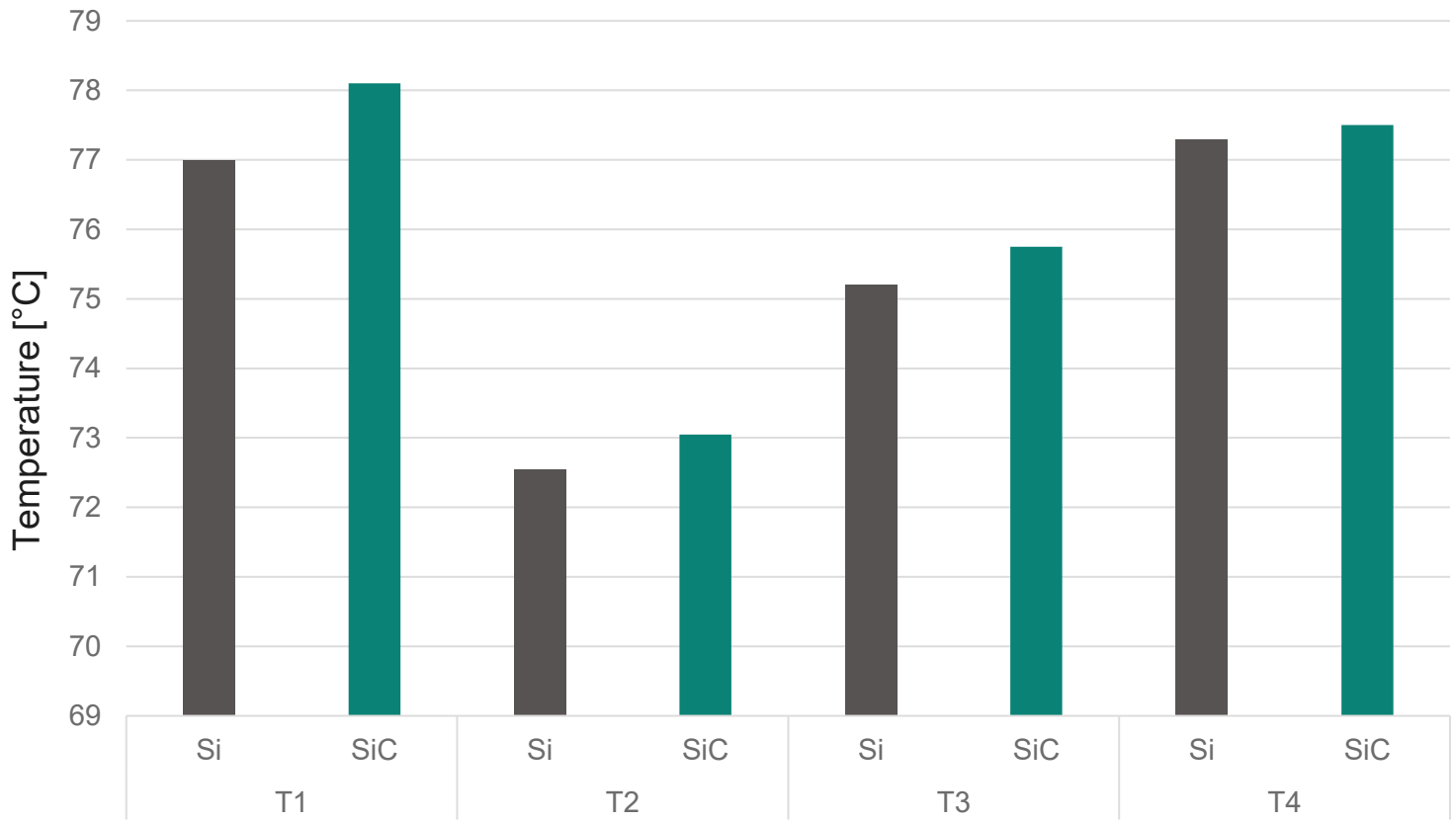


Impact of f_{sw} to filter capacitance



QDPAK with SiC technology matches TO-247's thermal performance despite smaller size

Thermal performance (Si vs SiC)

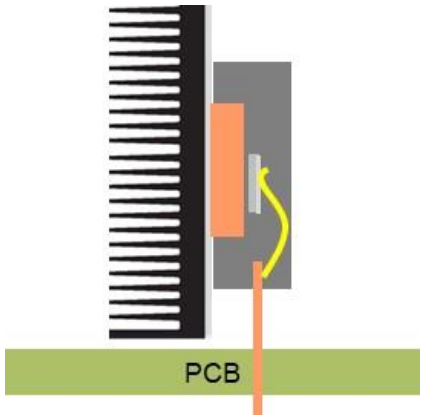


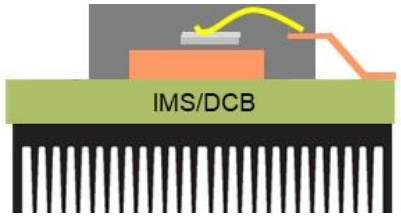
- Silicon and SiC NPC2 reference board tested with passive cooling
- Comparable or similar thermal performance observed between QDPAK with SiC and TO-247-4 with Silicon IGBT

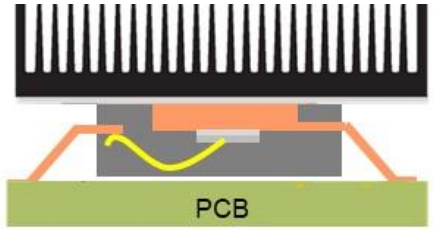
Control Algorithm: SPWM, V_{OUT} = 380V, F_{SW} = 24kHz (for Si) & 48kHz (for SiC), P_{OUT} = 10kW, I_{OUT} = 15.2A & Ta = 25°C

Product Highlight: CoolSiC™ MOSFET G2 1200 V in Q-DPAK

Infineon Q-DPAK:
Enabling high volume assembly and PCB design improvements





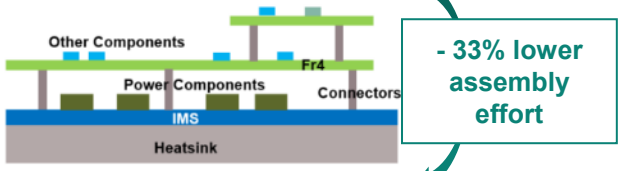


THD – Through Hole Device	SMD bottom side cooling	SMD top side cooling
– Robust thermal performance	– Medium thermal performance	– **Optimal** thermal performance
– Manual handling	– Fully automatic handling	– **Fully automatic** handling
– Low pin count	– High pin count	– **High** pin count

Advantages of SMD top-side cooling

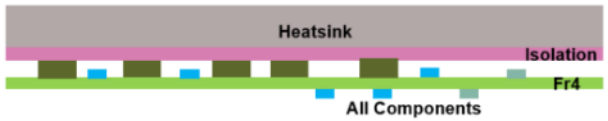
Power density

Bottom side cooled (BSC)



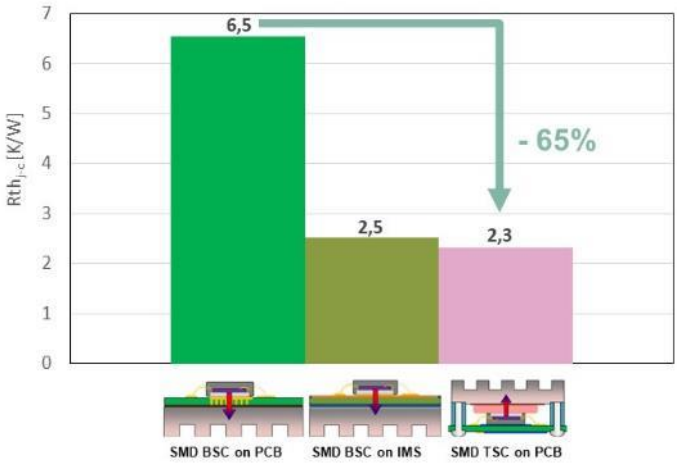
- 33% lower assembly effort

Top-side cooled (TSC)



- Complexity reduction
- Simplified assembly

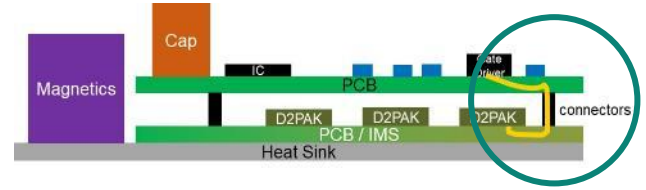
Thermal performance



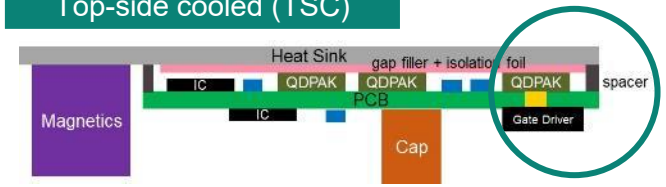
- Lower thermal resistance
- Overcomes PCB thermal limits
- IMS board eliminated

Electrical design

Bottom side cooled (BSC)



Top-side cooled (TSC)



- Lower stray inductance
- Improved gate control
- Double sided PCB assembly

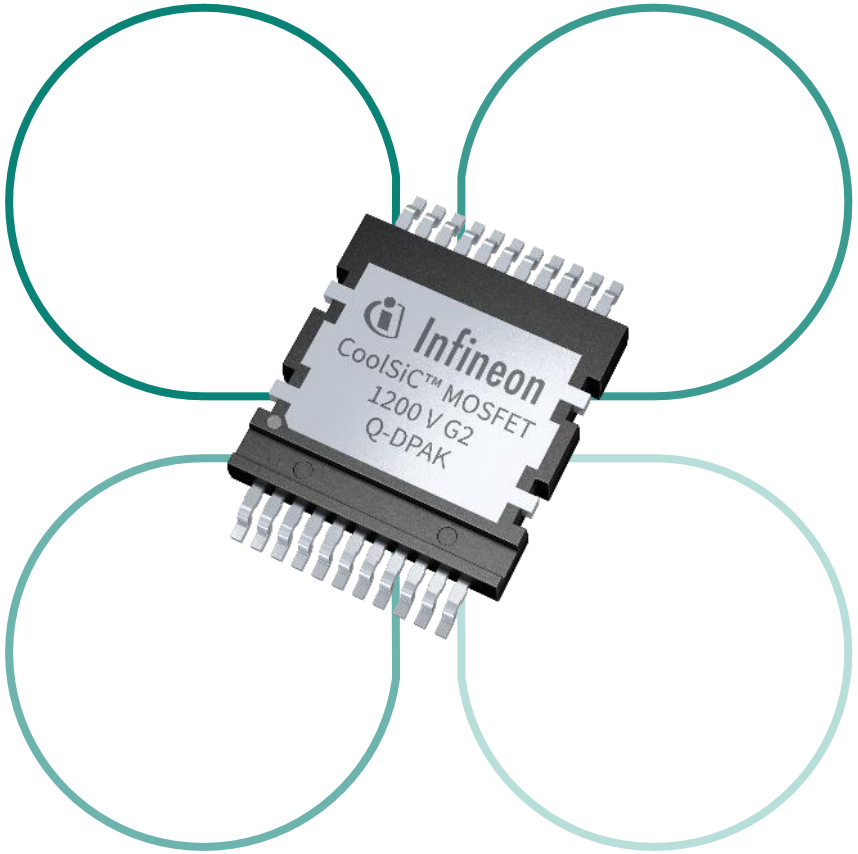
CoolSiC™ MOSFET G2 1200 V in Q-DPAK: Addressing major power conversion requirements with a highly competitive solution

Power density

- Enabling highest PCB utilization, combining top-side cooling
- Up to 50 W power dissipation capability
- Optimized construction with low Ohmic properties and ultra-low parasitic inductance to enable high power design with lower component count

Efficiency

- Infineon's CoolSiC™ G2 technology offers up to 25% lower switching losses compared to SiC products available from other vendors
- Best-in-Class $R_{DS(on)}$ of 4 mΩ in 1200 V CoolSiC™ G2 in Q-DPAK reducing total system losses



Reliability

- .XT interconnection technology
- High creepage and clearance package with CTI>600V mould compound supporting 950 Vrms and PD 2 designs
- Humidity robustness based on HV-H3TRB tests
- Robust short-circuit rating 2 µs

Ease of Design

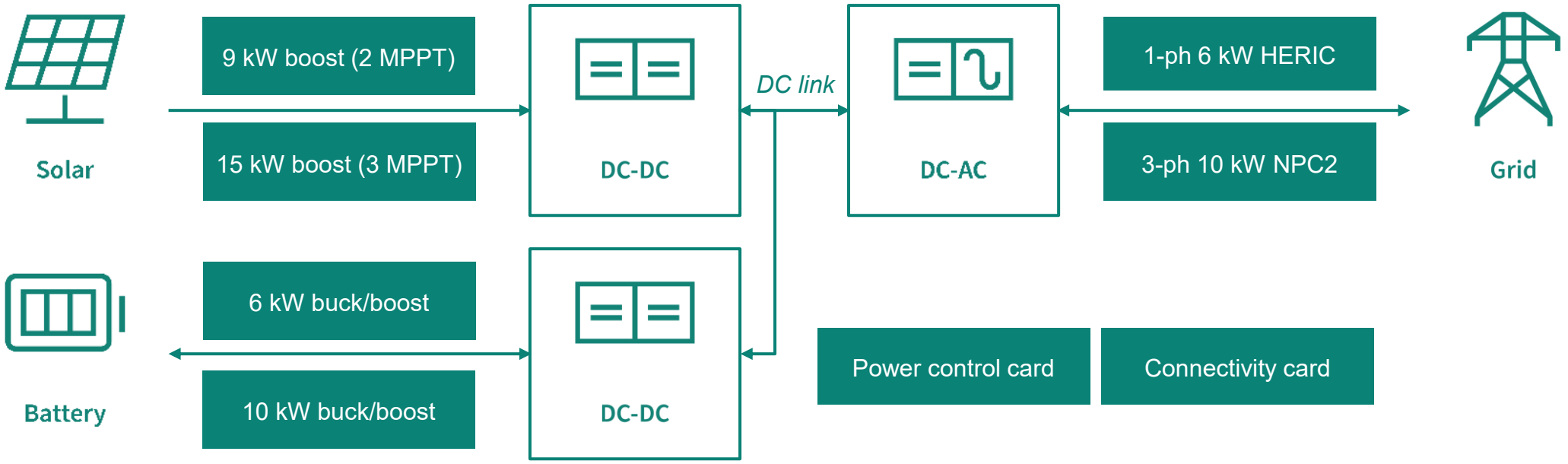
- Complementing a large X-DPAK platform of top-side-cooled SMD from Infineon, ranging from 400 V to 1200 V, from Si to SiC and GaN devices, all at the same package height
- Automated assembly

* JEDEC registered under the name MO-354

Modular Hybrid Inverter Reference Design Platform

Modular hybrid inverter platform at a glance

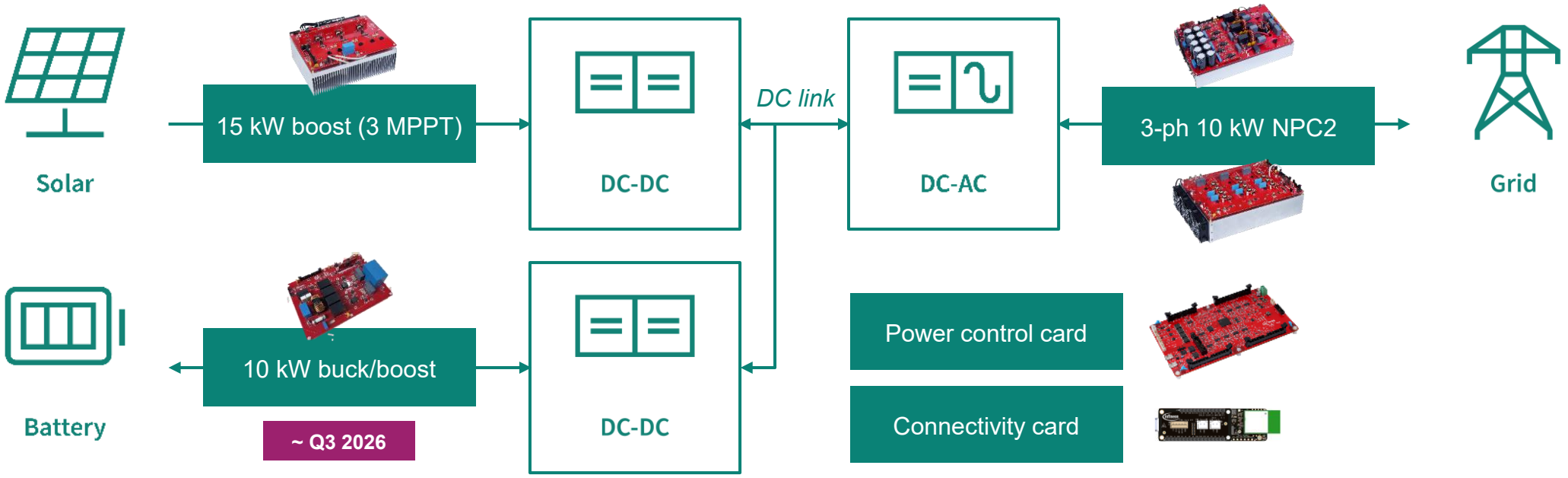
Infineon is developing a modular set of power conversion, control and connectivity blocks to enable the fast prototyping of residential and small commercial hybrid inverter solutions.



Customers will be able to choose and combine state-of-the-art technologies such as TRENCHSTOP™ IGBT H7 or CoolSiC™ MOSFETs in innovative packages like Q-DPAK and TO-247-4 to build different topologies such as HERIC or NPC2.

Modular design kit for 3-phase 10 kW hybrid inverters

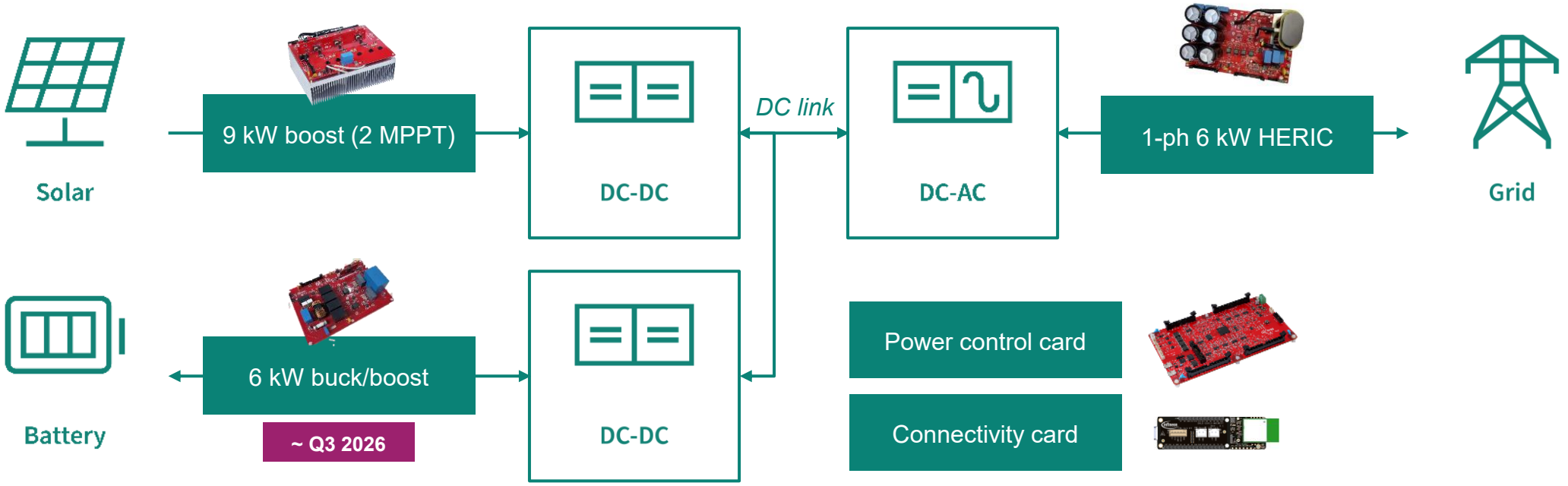
The following diagram shows the preferred building blocks to realize 3-phase hybrid inverters with up to 10 kW:



For the NPC2 inverter stage there are two options: one with IGBT7 in TO247 and one with SiC in the new top-side cooling package Q-DPAK

Modular design kit for 1-phase 6 kW hybrid inverters

The diagram shows the preferred building blocks for 1-phase hybrid inverters with up to 6 kW, using a 1-phase HERIC inverter stage with SiC in the new top-side cooling package Q-DPAK:



Stay tuned and contact us for support

To find more latest information, please visit the dedicated web page of this reference design:

REF-10KW3LNPC2Q

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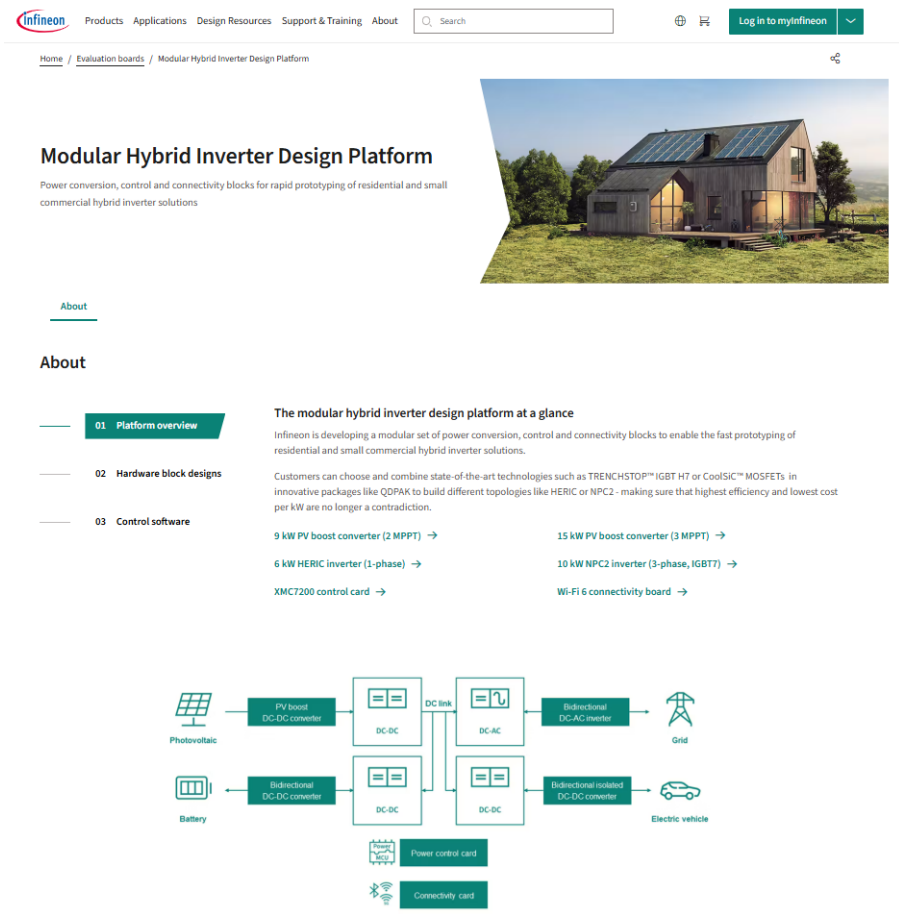
Active and preferred RoHS Compliant

REF-10KW3LNPC2Q

Compact and highly efficient NPC2 power conversion reference design for inverter stages with up to 10 kW

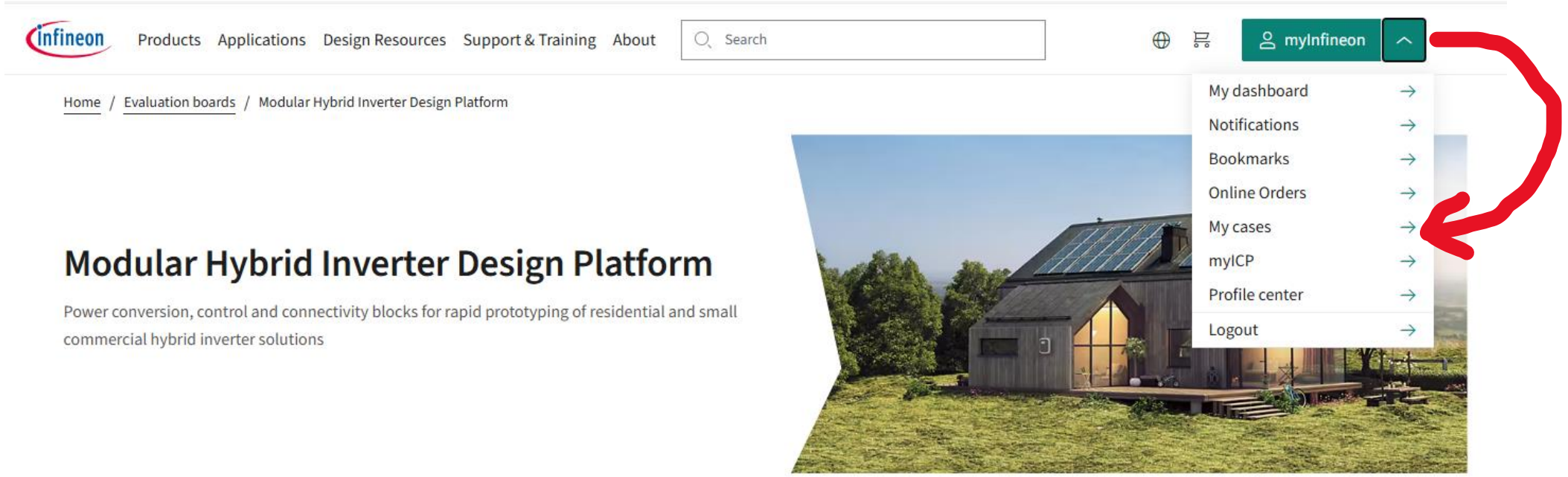
Have a look at our modular reference design platform web page

www.infineon.com/mhi



Contact us for support

https://mycases.infineon.com

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