

TRENCHSTOP™ 5

A breakthrough in IGBT innovation

Infineon Redefines „Best in class“ IGBT



Mark Thomas

Discrete IGBT Product Marketing



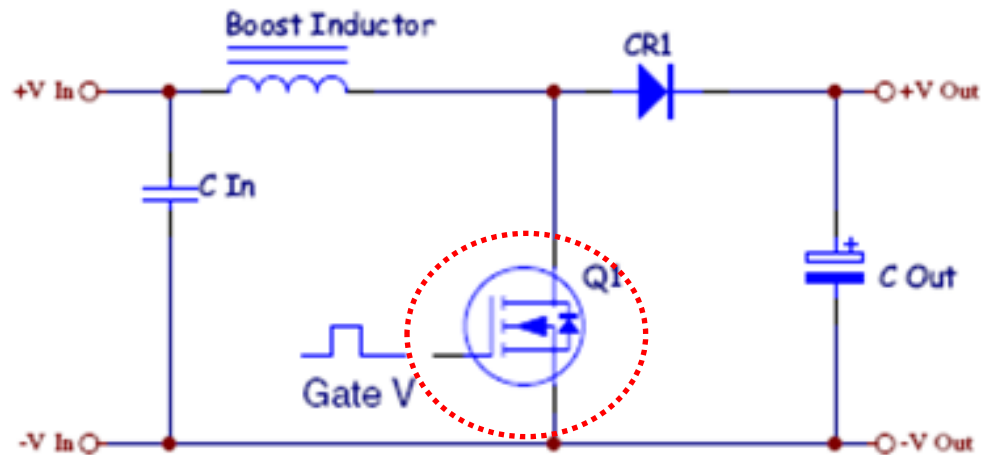
TRENCHSTOP™5 Target applications



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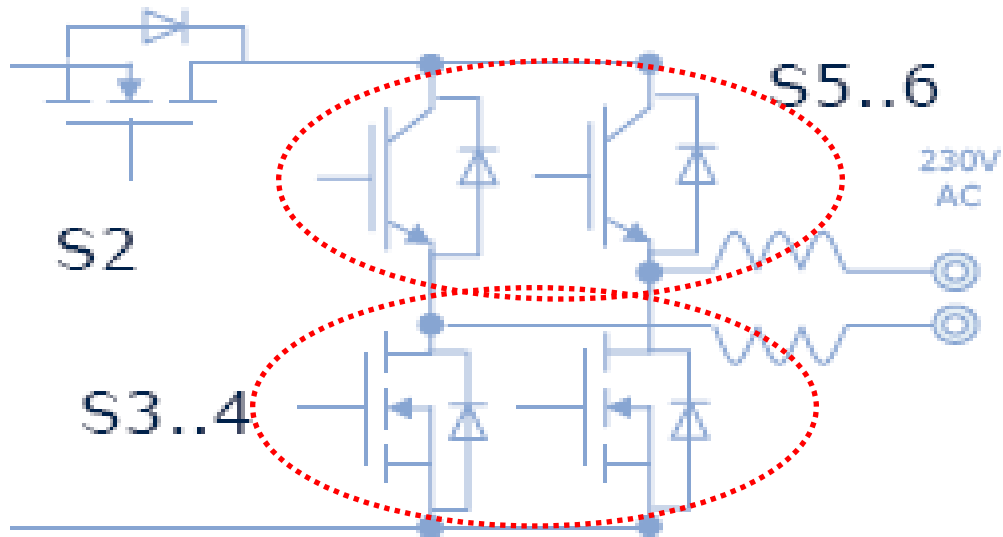
Boost PFC



TRENCHSTOP™5 Target applications



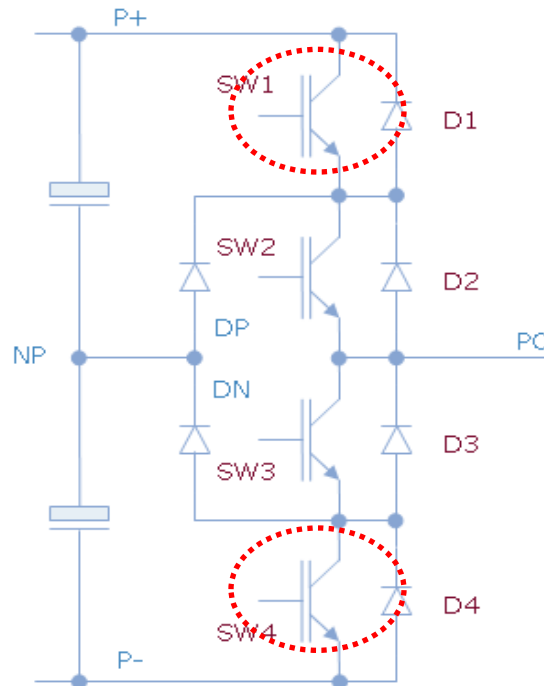
H4 Inverter



TRENCHSTOP™ 5 Target applications



3-Level Inverter

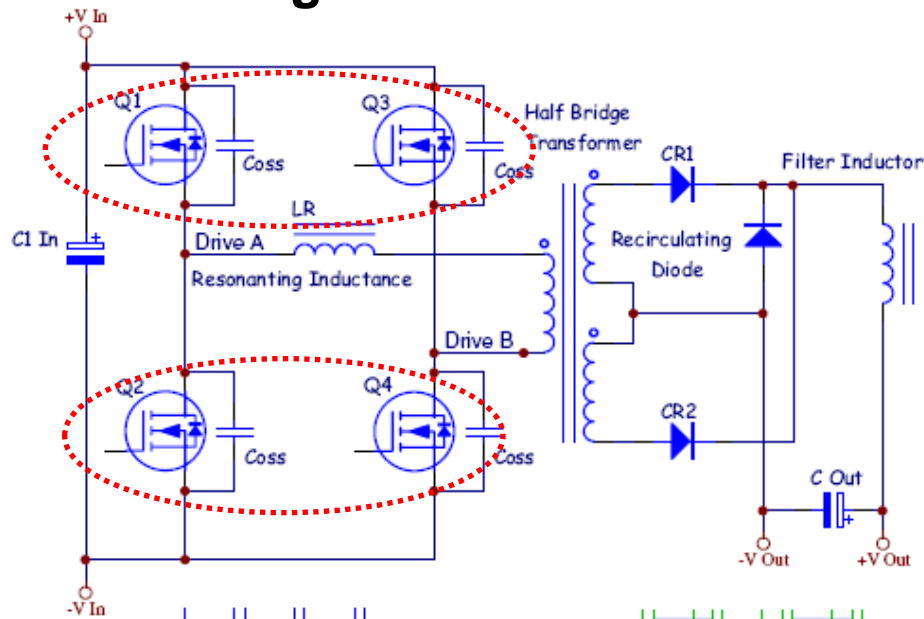


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TRENCHSTOP™ 5 Target applications



Full Bridge ZVS resonant



TRENCHSTOP™ 5

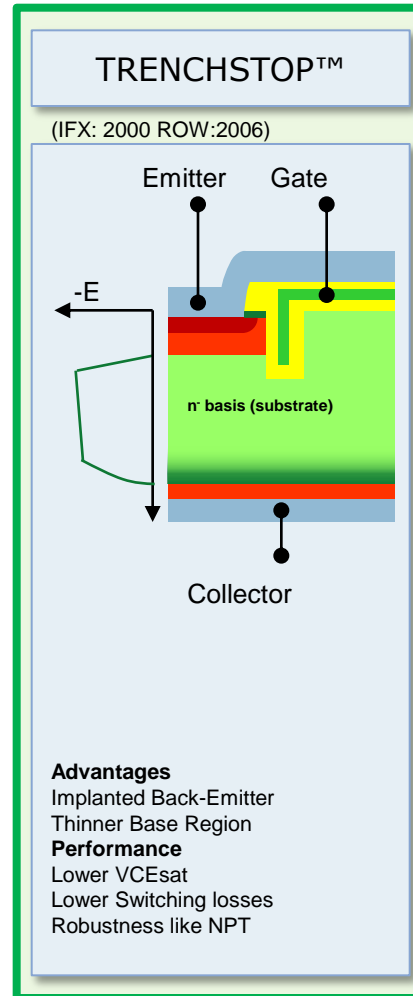
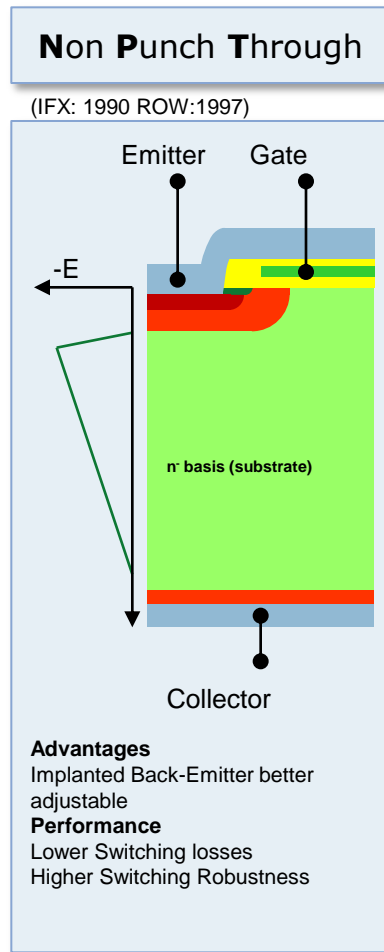
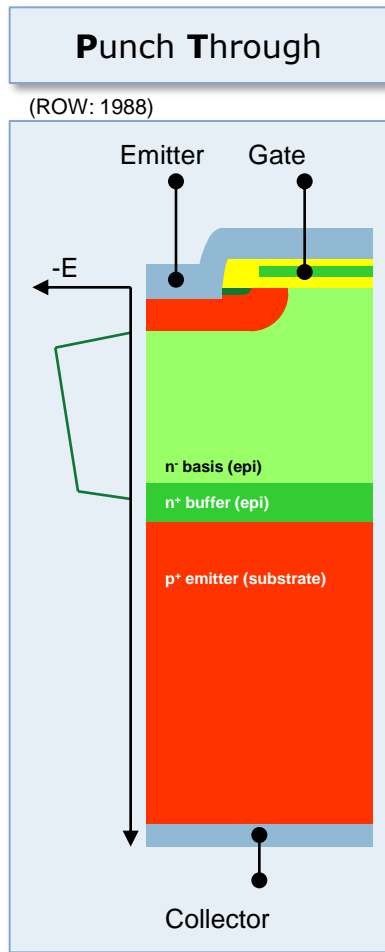
A breakthrough in IGBT innovation

*Introducing a technology to match tomorrow's
high efficiency demands*



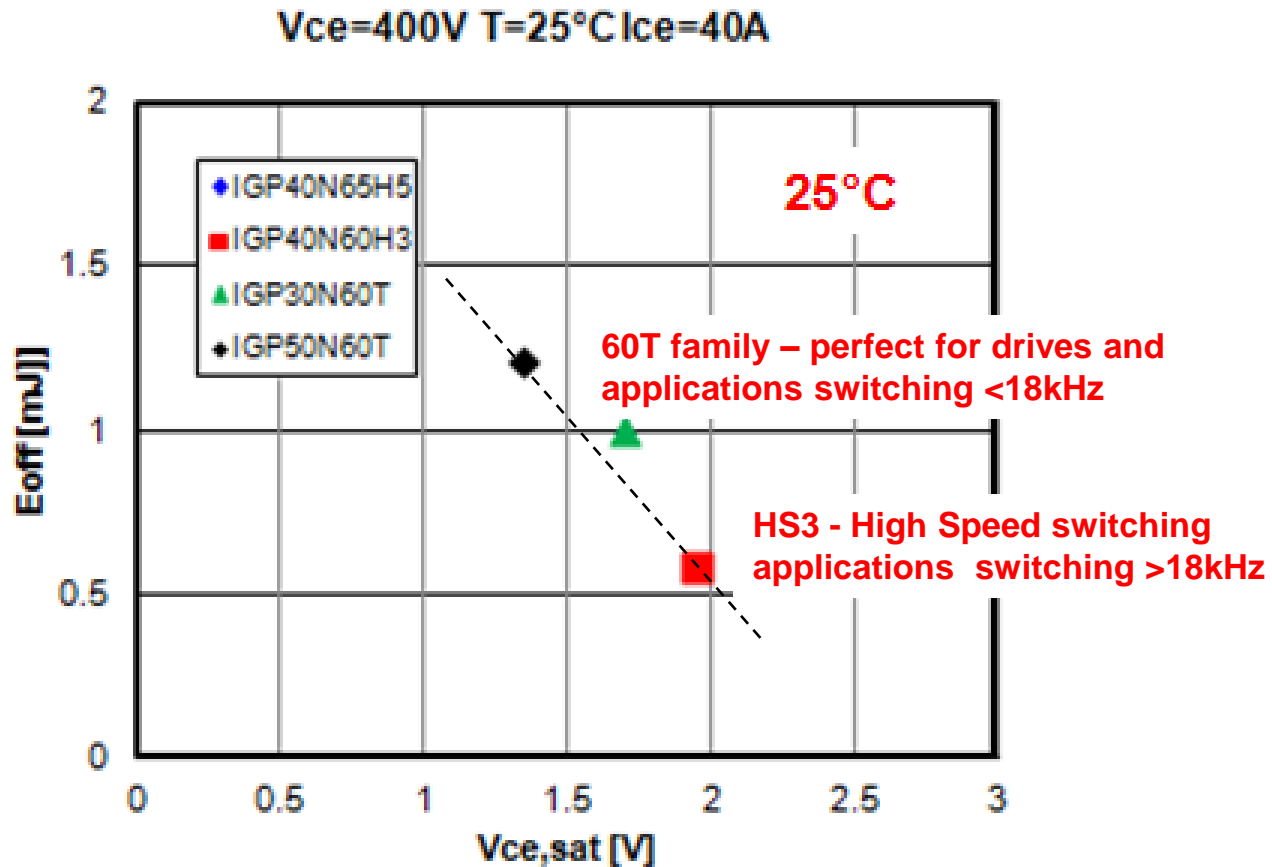
Infineon is the IGBT Performance World Leader

- Coming from a solid history of IGBT innovation
- Infineon already provides the highest performance IGBTs.



TRENCHSTOP - Trade-off curve

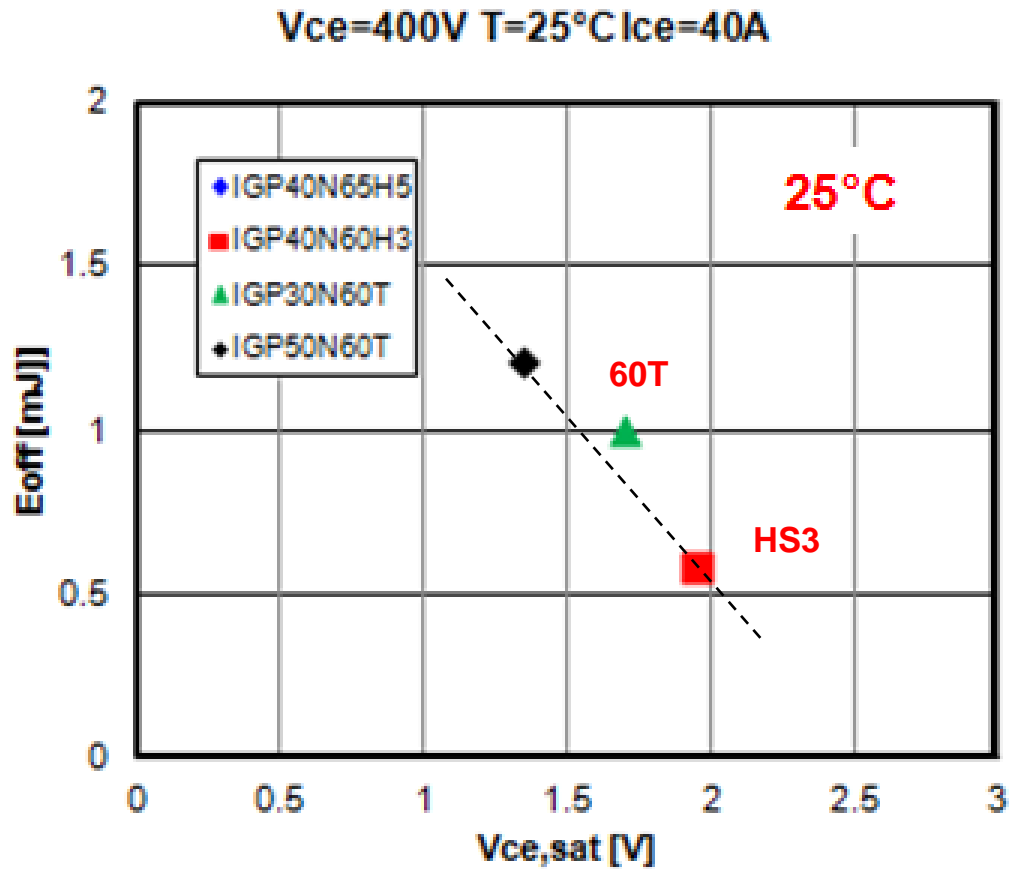
Vce(sat) versus Eoff



- With the highest efficiency and quality, Infineon's current portfolio is defined to match target application requirements
- Groundbreaking innovation makes Infineon the worlds leading IGBT supplier

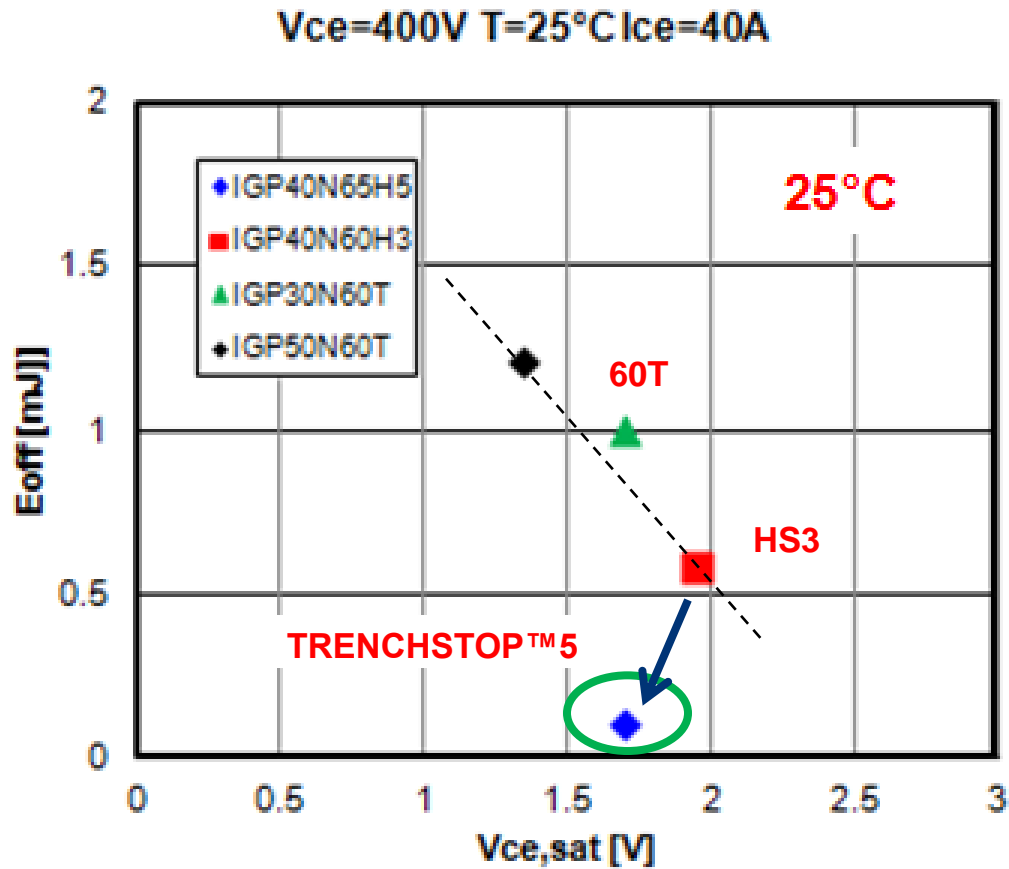
TRENCHSTOP™ - 25°C Trade-off curve

Vce(sat) versus Eoff

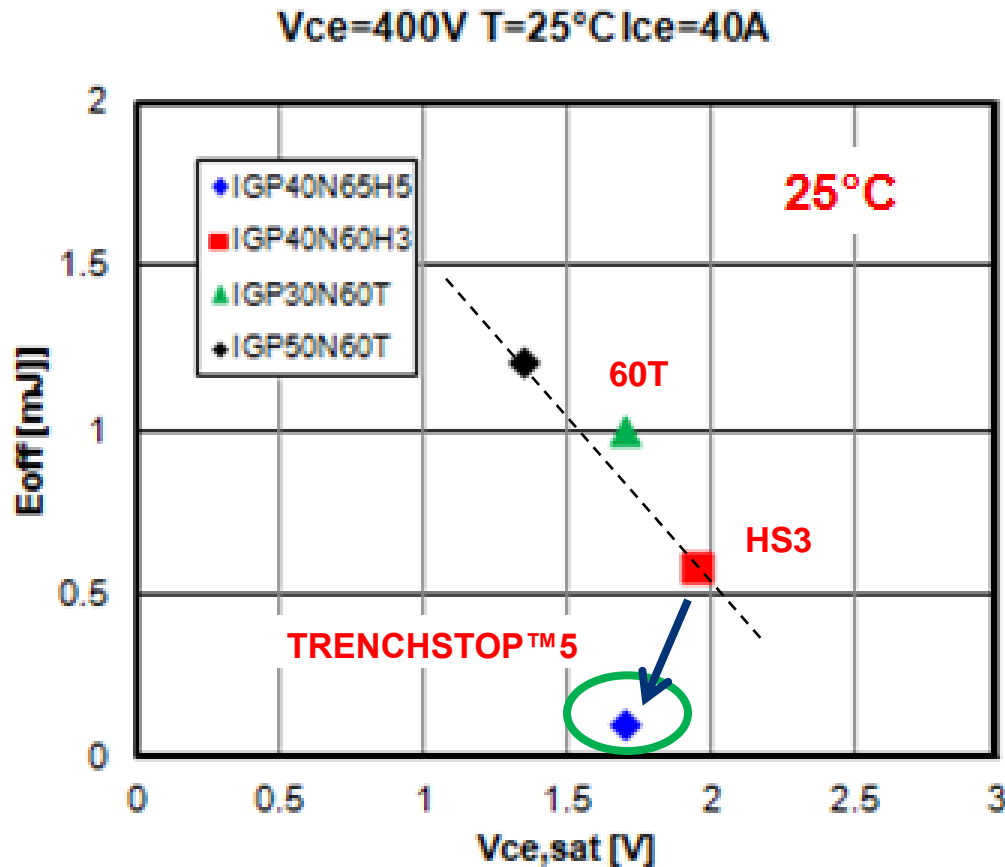


TRENCHSTOP™5 - 25°C Trade-off curve

Vce(sat) versus Eoff



TRENCHSTOP™5 - 25°C Trade-off curve Vce(sat) versus Eoff



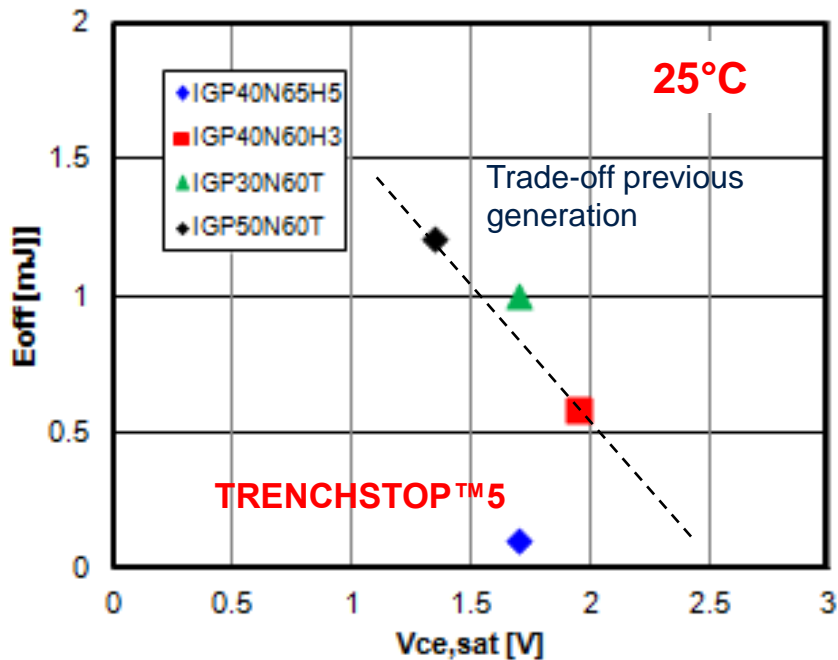
- Compared to Infineon's BiC HS3, TRENCHSTOP™5 offers:
 - >60% lower switching losses
 - 10% lower conduction losses

all the efficiency benefits are offered with 650V Vbr

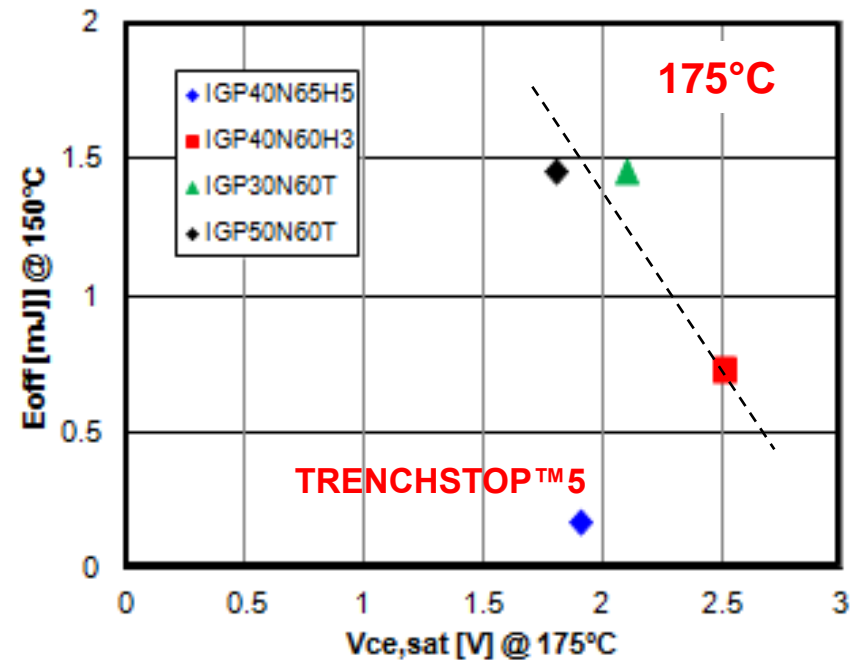
TRENCHSTOP™5 - Trade off Vcesat – Eoff Temperature stability



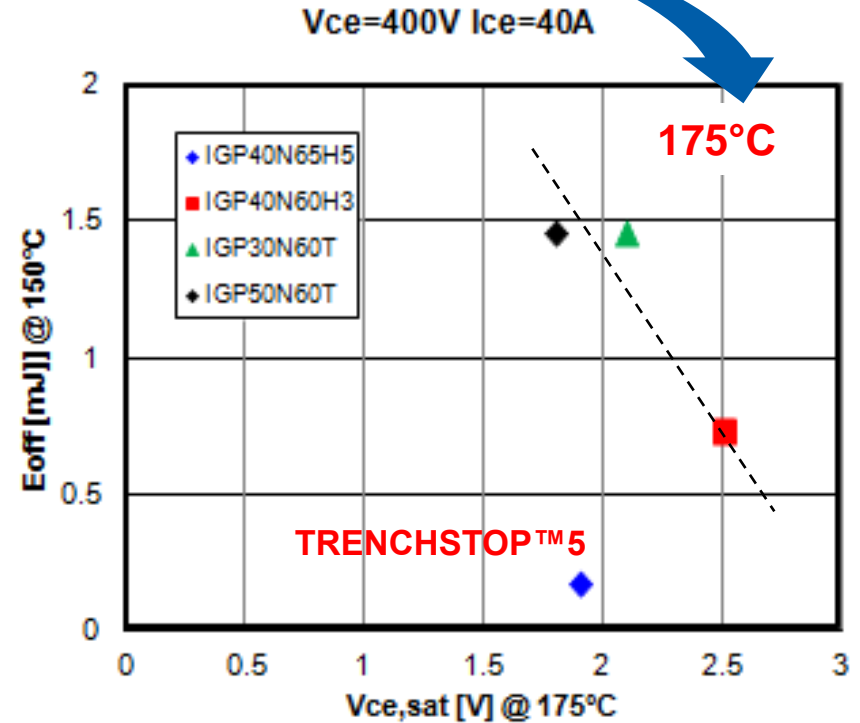
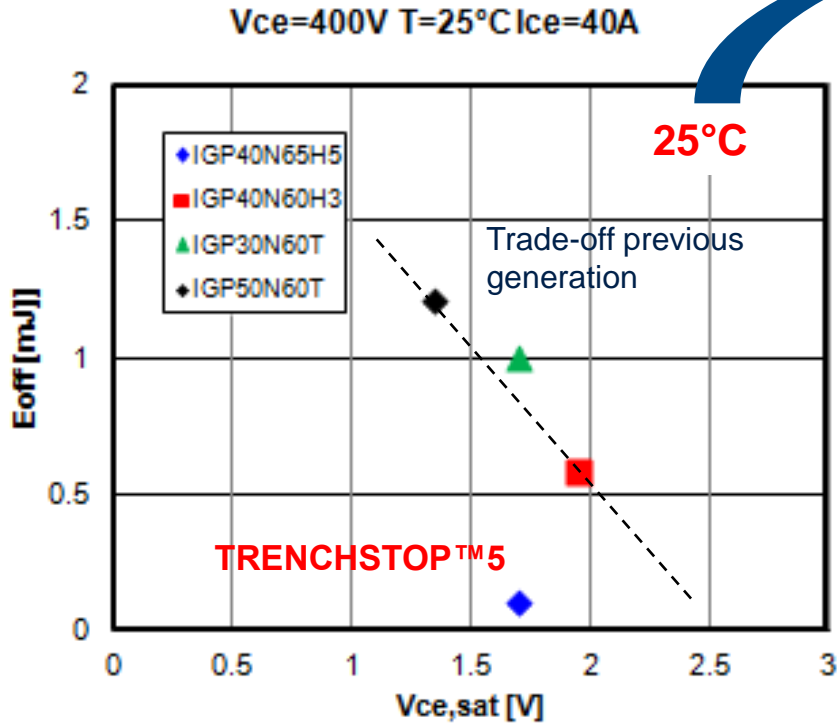
Vce=400V T=25°C Ice=40A



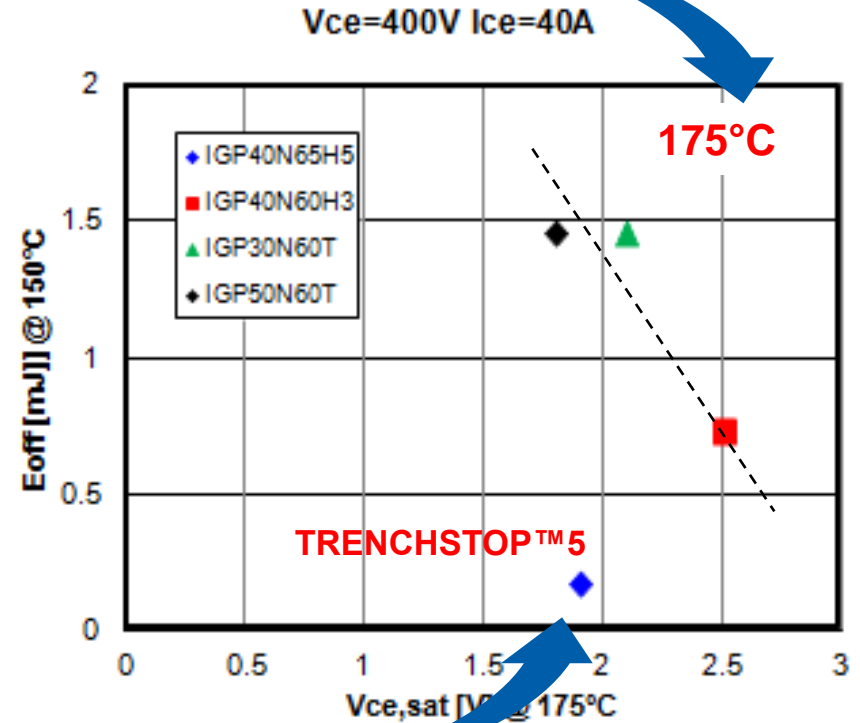
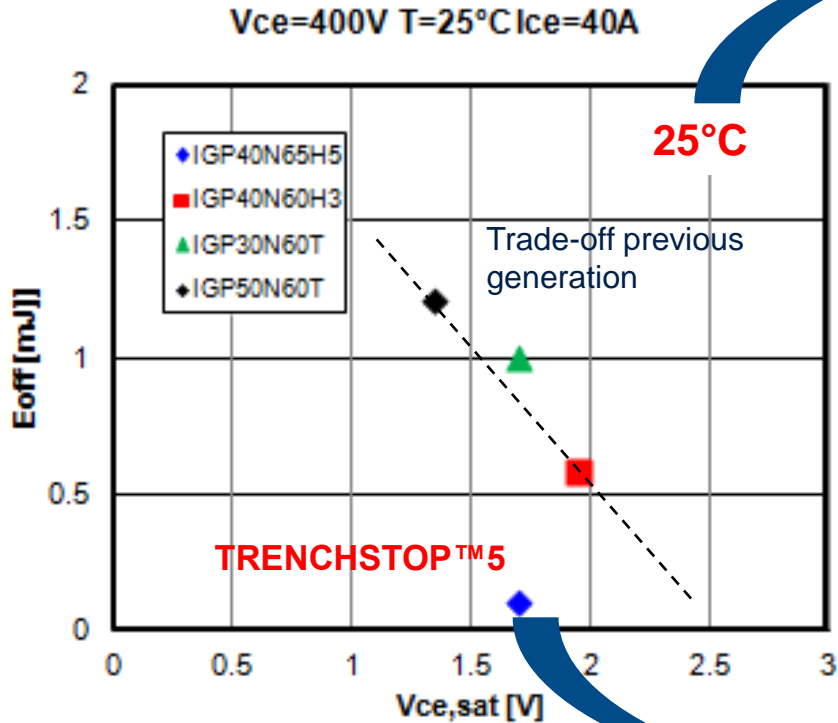
Vce=400V Ice=40A



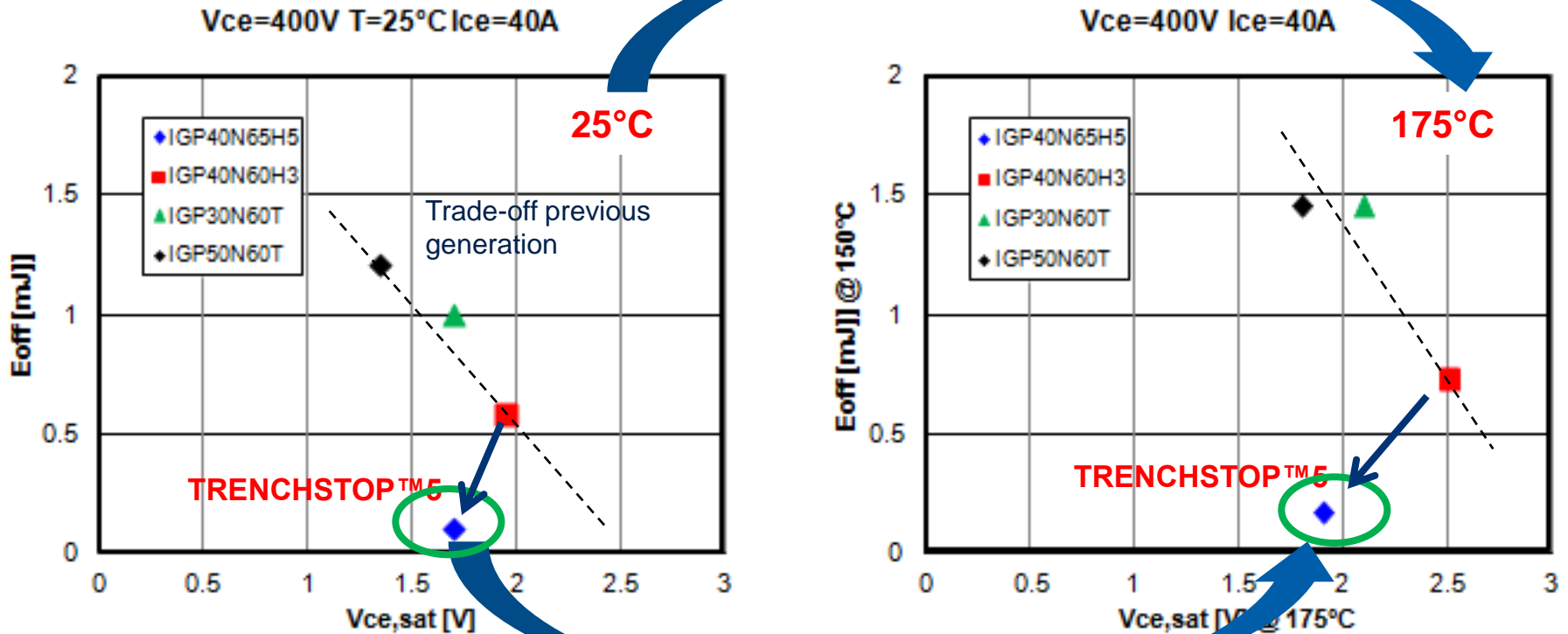
TRENCHSTOP™5 - Trade off Vcesat – Eoff Temperature stability



TRENCHSTOP™5 - Trade off Vcesat – Eoff Temperature stability



TRENCHSTOP™5 - Trade off Vcesat – Eoff Temperature stability



- At 175°C junction temperature the TRENCHSTOP™5 offers:
 - The same Vce(sat) value at the TRENCHSTOP™ family
 - >75% lower switching losses that HS3

TRENCHSTOP™5 has a mild positive temperature coefficient

TRENCHSTOP™ 5

A breakthrough in IGBT innovation

*Introducing a portfolio that gives the designer
more options*



TRENCHSTOP™5 Compliments Existing Portfolio

TRENCHSTOP™1 / HS3

5us short circuit capability*

600V breakthrough voltage*

FWD trr >140ns*

60T Vce(sat) optimised
HS3 switching loss optimized

TRENCHSTOP™5

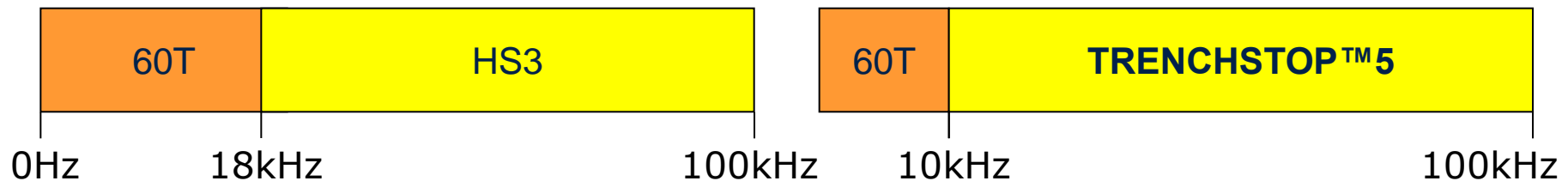
no short circuit capability

650V breakthrough voltage*

FWD trr <50ns*

Vce(sat) = 60T*
Eoff >60% lower then HS3*

Recommended Switching Frequency per Technology



*datasheet values at 25°C

TRENCHSTOP™5 compliments the High Speed 3 family

The TRENCHSTOP™5 is available in 2 Flavors

TRENCHSTOP™5

High speed 5 (H5)
High speed variant

Plug & Play / Ease of use

Soft high speed IGBT, optimised for gate resistor values down to 5Ω

Designed for ease of use implementation to easily replace existing IGBTs in designs or where redesign resources are not available

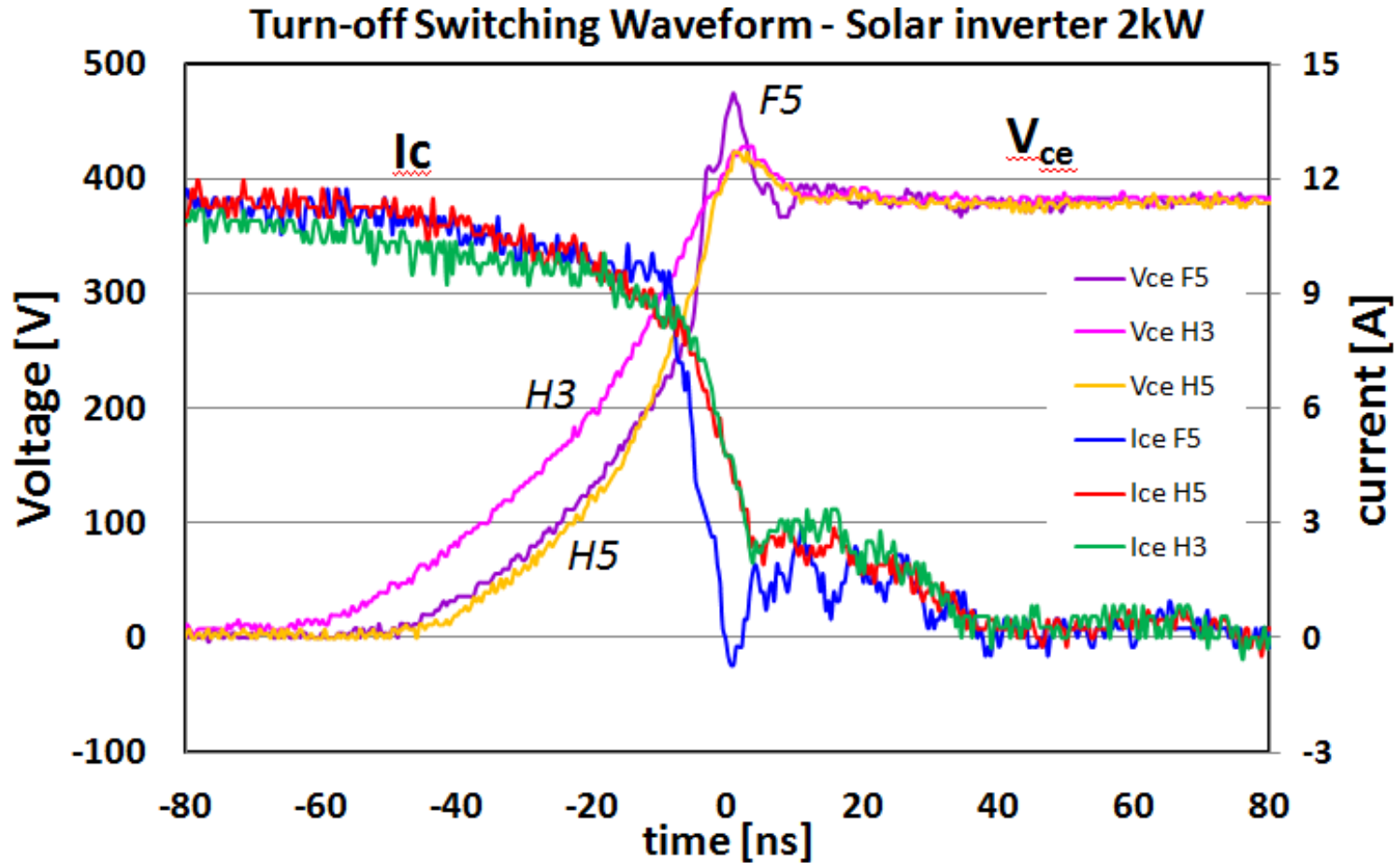
High speed 5 FAST (F5)
Highest efficiency

Performance optimized

Snappier IGBT compared to H5, but with low inductance designs and in combination with SiC diodes, the F5 can offer 1% higher efficiency compared to the H5

Requires higher design in effort, but rewards are higher

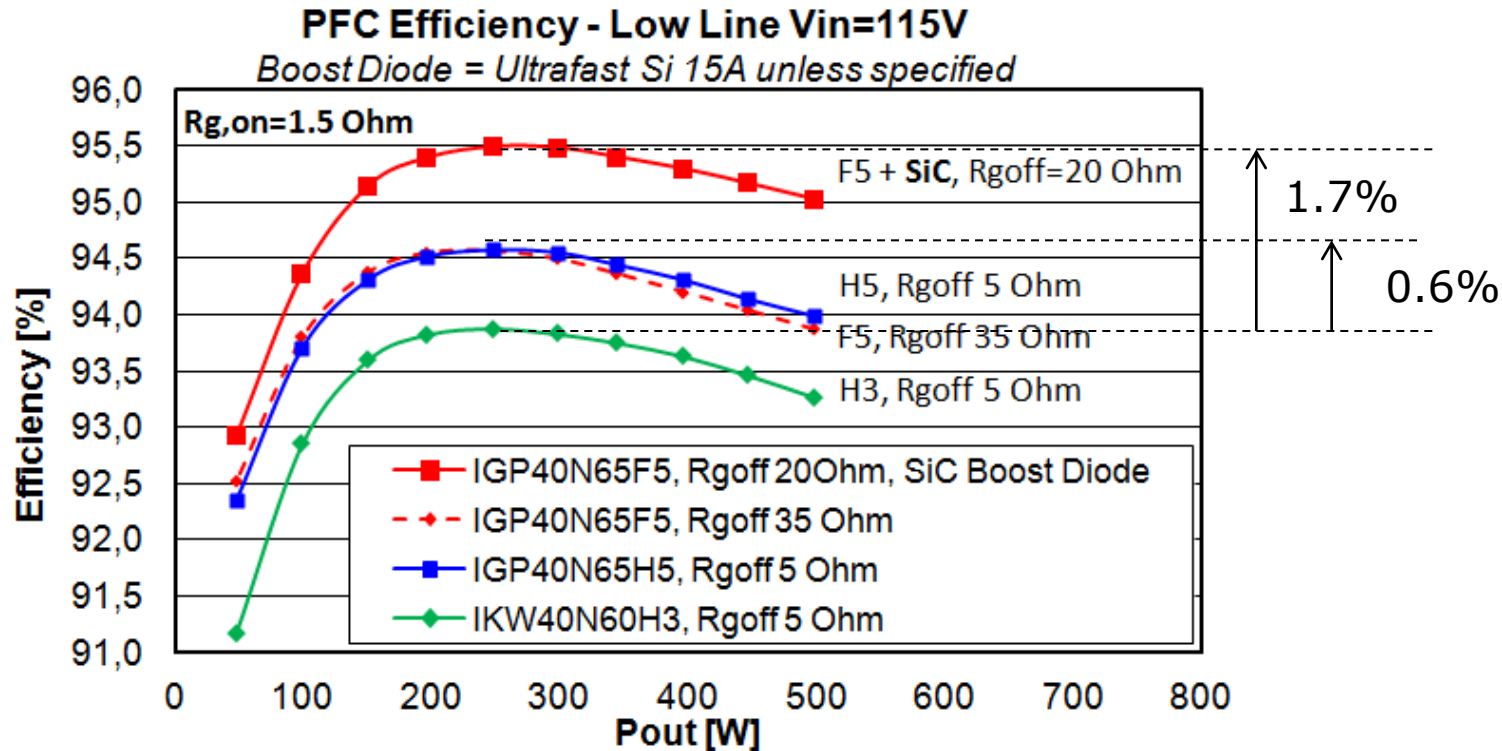
Switching Waveforms H5 and F5 vs H3



- F5 shows steeper dI/dt and dV/dt , higher V_{cemax} , lower turn-off losses than H3 and H5!

Look at the x-axis ... nano seconds!

PFC 70 kHz: Device selection for best efficiency

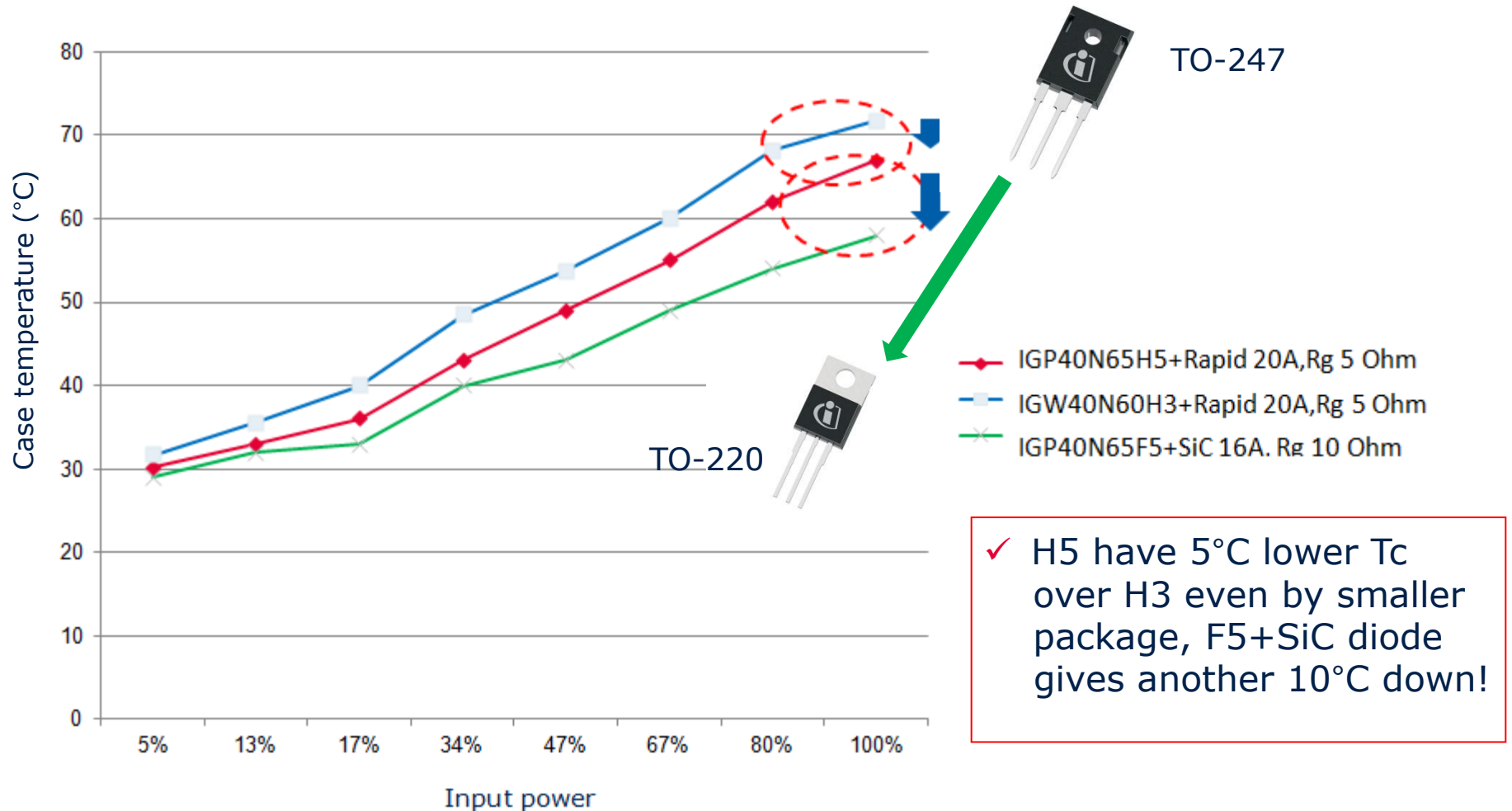


- F5 + SiC: High performance, need split Rg
- H5 + Rapid Diode: Plug and Play, Rgon=Rgoff
- F5 + Rapid: best fit for low inductive design, still needs split Rg

Just replacing the HS3 with H5 brings 0.6% efficiency improvement

Case temperature

■ Single IGBT + SiC / Rapid diode (all TRENCHSTOP™5 devices in TO220, H3 in TO247)



✓ H5 have 5°C lower T_c over H3 even by smaller package, F5+SiC diode gives another 10°C down!

TRENCHSTOP™5 Product Spectrum - First Wave



TO-220

TO-220FP

TO-247

Continuous
collector
current
at $T_c = 100^\circ\text{C}$



| | | TO-220 | TO-220FP | TO-247 |
|--------------------|------------|------------------------|------------------------|------------------------|
| Single IGBT | 40A | IGP40N65F5 / H5 | | IGW40N65F5 / H5 |
| | 50A | | | IGW50N65F5 / H5 |
| DuoPak | 8A | IKP08N65F5 / H5 | IKA08N65F5 / H5 | |
| | 15A | IKP15N65F5 / H5 | IKA15N65F5 / H5 | |
| | 40A | IKP40N65F5 / H5 | | IKW40N65F5 / H5 |
| | 50A | | | IKW50N65F5 / H5 |

Portfolio released with 650V breakthrough voltage

Summary TRENCHSTOP™5 IGBT

- New benchmark in terms of switching losses for IGBT based technologies
- Technology platform available in two flavours
 - H5 plug & play replacement of previous IGBTs
 - Soft IGBT requiring low design in efforts
 - F5 requires low commutation loop inductance
 - best used in combination with SiC diodes
- 650V breakthrough voltage as standard
- $V_{ce(sat)}$ with mild positive temperature coefficient
- Temperature stable V_F value of the free wheeling diode
- 1.7% efficiency PFC efficiency improvement seen over previous best in class IGBT

Can you afford to wait for the competition to catch up?



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