



New

CoolSiC™





CoolSiC™ MOSFET 1200 V in D²PAK-7 for servo drives and others









Peter Friedrichs, Vice President Silicon Carbide @ IPC
5 November 2020

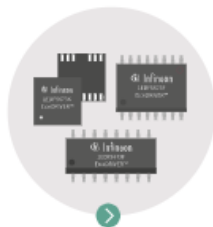


1200 V SiC MOSFET in SMD package is the latest addition in Infineon's CoolSiC™ discrete portfolio

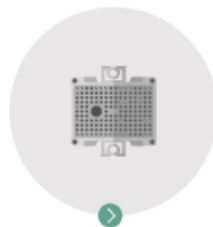


| SiC MOSFETs | TO-247-4 | TO-247-3 | D ² PAK-7 |
|-------------|---|---|---|
| |  |  |  1200 V  1700 V ext. creepage |
| 650 V | 27,48, 72,107 mΩ | 27, 48, 72, 107 mΩ | |
| 1200 V | 30, 45, 60, 90, 140, 220, 350 mΩ | 30, 45, 60, 90, 140, 220, 350 mΩ | New 30, 45, 60, 90, 140, 220, 350 mΩ |
| 1700 V | | | 450, 650, 1000 mΩ |

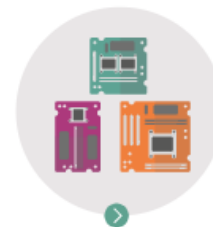
| SiC Schottky diodes | TO-220 R2L | DDPAK | TO-247-3 | TO-247 | D ² PAK R2L | ThinPAK 8x8 | TO-247 dual die | DDPAK R2L |
|---------------------|---|---|---|---|---|---|---|---|
| |  |  |  |  |  |  |  |  |
| 650 V | 2,-20 A | 2,4,6,8,10,12, 16,20 A | 10,12,16, 20, 30, 40 A | 10,12,16,20, 30, 40 A | 2,3,4,5,6,8,9, 10,12 A | 2,4,6,8,10, 12 A | 20,24,32, 40 A | 3,4,5,6,8,9, 10,12 A |
| 1200 V | 2,5,8,10,16,20 A | | 10,15, 20,30,40 A | 10,15,20,30,40 A | 2,5,8,10,16,20 A | | 10,15, 20,30,40 A | 2,4,8,10 A |



Gate driver ICs

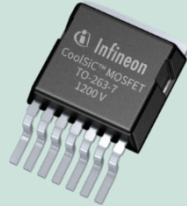




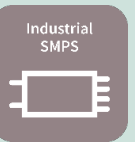



Modules



Evaluation boards

Main target markets for the additions

|  | R _{ds(on)} [mΩ] |  |  |  |  |  | Typical application power |
|---|-----------------------------|---|---|--|---|---|---|
| IMBG120R030M1H | 30 | ✓ | ✓ | ✓ | ✓ | ✓ |  |
| IMBG120R045M1H | 45 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| IMBG120R060M1H | 60 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| IMBG120R090M1H | 90 | ✓ | ✓ | ✓ | ✓ | ✓ | |
| IMBG120R140M1H | 140 | ✓ | ✓ | ✓ | | ✓ | |
| IMBG120R220M1H | 220 | | | | | ✓ | |
| IMBG120R350M1H | 350 | | | | | ✓ | ~100 W |

CoolSiC™ trench MOSFET technology: combines performance, robustness and easy design-in



Best in class – Infineon's advanced trench technology delivers:

- › Reliability comparable to Si power transistors by Infineon^{1,2}
- › Lowest switching losses
- › Exclusive 3 μ s short circuit withstand time
- › Highest robustness against parasitic turn-on effects
- › 0 V turn-off can be applied, for simple unipolar gate drive
- › Robust body diode rated for hard commutation

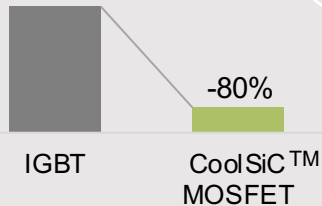
- 1) Whitepaper „How Infineon controls and assures the reliability of SiC based power semiconductors“ 08-2020
https://www.infineon.com/dgdlac/Infineon-Reliability_of_SiC_power_semiconductors-Whitepaper-v01_02-EN.pdf?fileId=5546d46272e49d2a01735723745d3f14,
2) Sievers et al: „Monitoring of Parameter Stability of SiC MOSFETs in Real Application Tests“, ESREF proceedings, March 2020

A new look at servo drives with CoolSiC™ MOSFET



**1200 V optimized
SMD package**

- › Simplified assembly



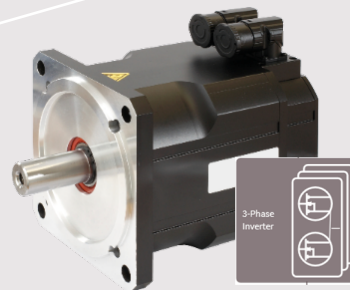
**Loss reduction in all
operating modes**

- › Up to 80% system loss reduction even at same EMC level as for IGBT solution



Fanless drive

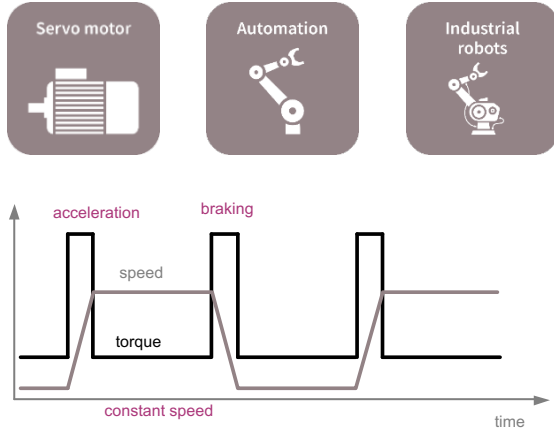
- › Zero maintenance in the field



**Inverter and motor
compact integration**

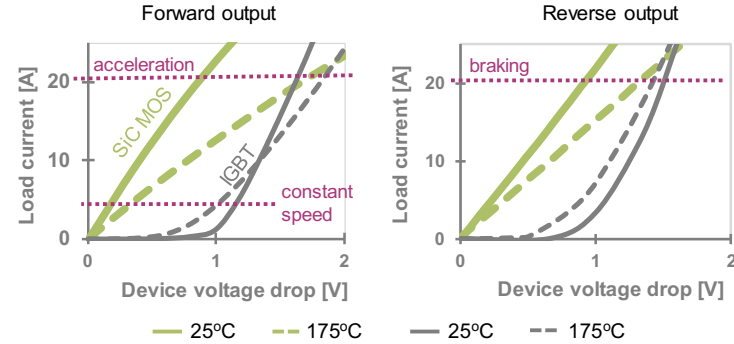
- › No inverter cabinet or complex cabling needed anymore

Resistive behavior of SiC MOSFETs and the load profile of servo drive inverters is a perfect match



- › High torque (current) in acceleration and braking period
- › Low torque (current) in constant speed period
- › Typically 90% time in low torque operation, i.e. constant speed mode

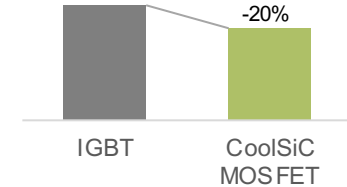
CoolSiC MOSFET 30mOhm (IMBG120R030M1H) vs. Si IGBT 40A (IKW40N120H3)



Constant speed mode:
conduction losses at low T_{vj}

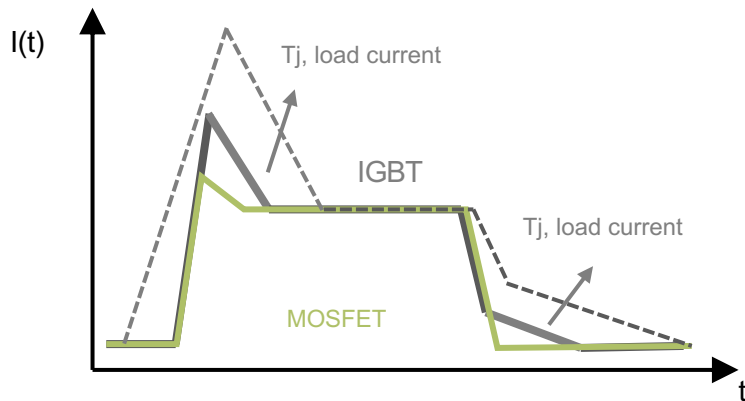


Acceleration & braking modes:
conduction losses at high T_{vj}



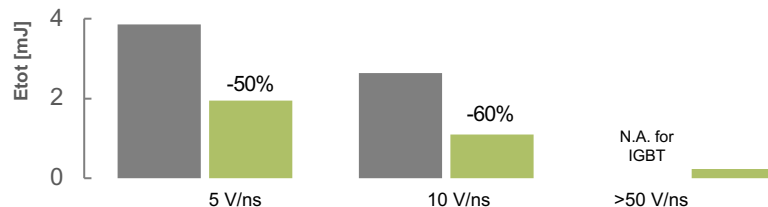
Conduction loss reduction in all operating modes

For low dv/dt range, 5-10 V/ns, CoolSiC™ MOSFET still shows up to 60% lower switching losses

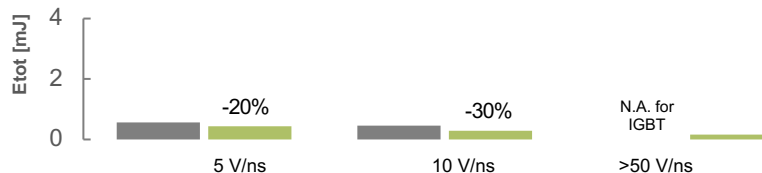


- › CoolSiC™ MOSFET:
 - › Negligible Q_{rr}
 - › No tail current
 - › Temperature independent switching behavior

Total switching losses at 150°C, **acceleration and braking** (20 A)



Total switching losses at 25°C, **constant speed operation** (5 A)



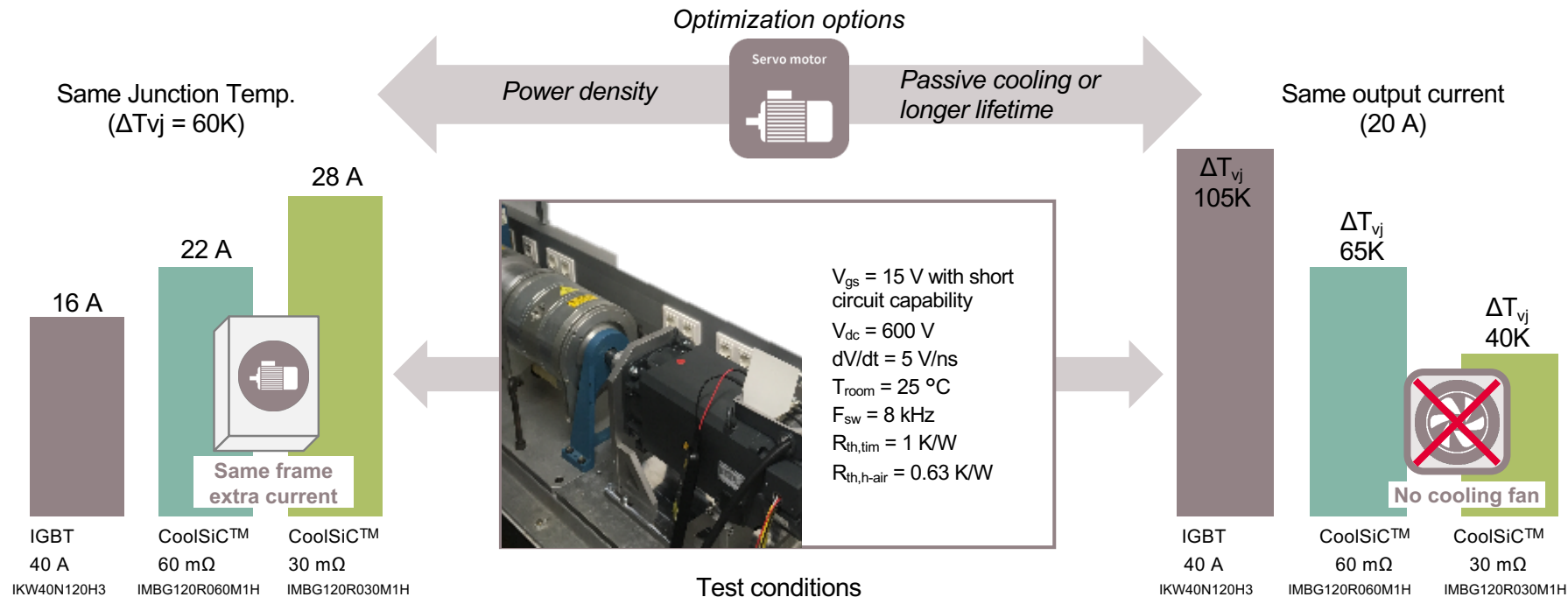
IGBT Si IGBT 40 A,
IKW40N120H3

CoolSiC™ MOSFET 30 mOhm,
IMBG120R030M1H

Switching loss reduction in all operating modes, even at the same EMC level as IGBT solution



$R_{DS(on)}$ selection example for various target requirements in a servo drive solution



CoolSiC™ MOSFET enables fanless drives, higher currents for a given frame size, and more...



First CoolSiC™ MOSFET portfolio using .XT interconnection technology

CoolSiC™ trench MOSFET chip

- › The most reliable SiC technology with lowest switching losses in operation



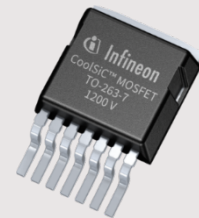
.XT interconnection technology

- › Enhancement of thermal capabilities in small package form factor
- › Increased cycling capabilities



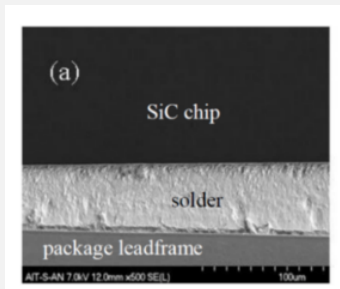
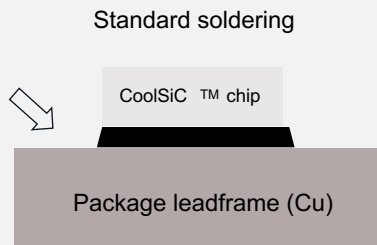
1200 V optimized SMD

- › >6 mm creepage and clearance distances
- › Extra source pin for optimized switching



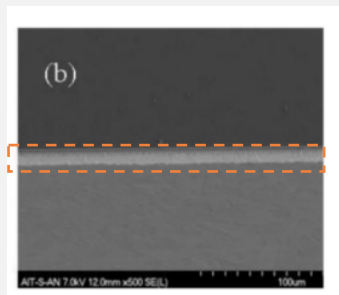
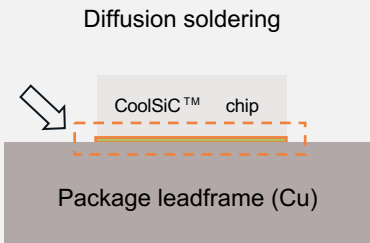
Significant improvement of thermal capabilities by .XT interconnection

Standard interconnection



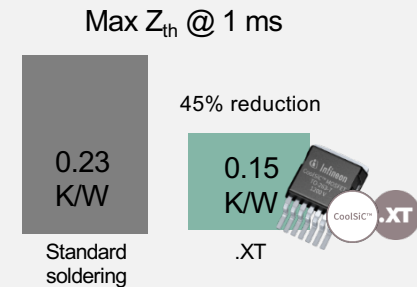
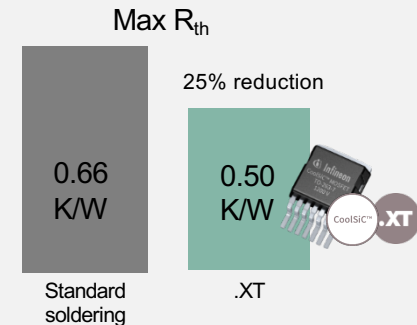
Standard soldering

.XT interconnection in TO-263-7

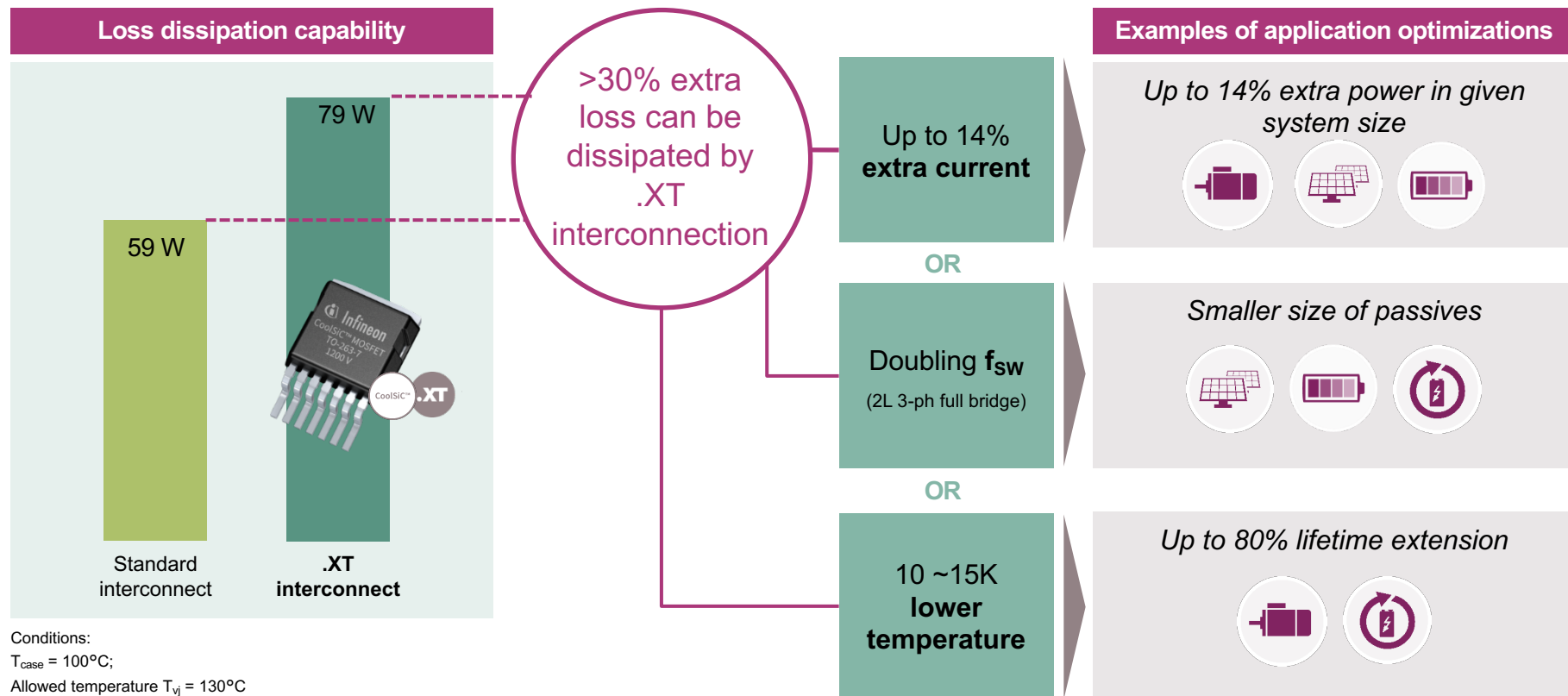


Elimination of solder joint drawbacks by diffusion soldering

Thermal performance in small form factor



.XT extends optimization potential for SiC based designs even further



Conditions:

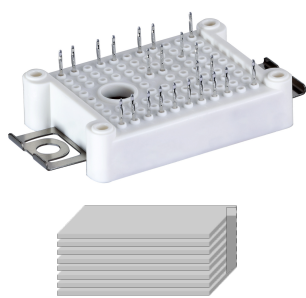
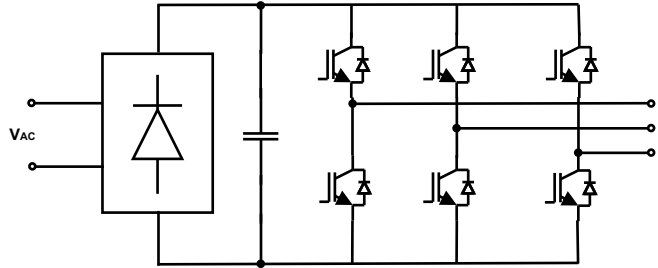
$T_{case} = 100^{\circ}\text{C}$;

Allowed temperature $T_{vj} = 130^{\circ}\text{C}$

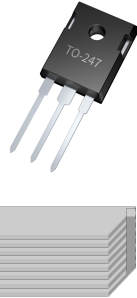
CoolSiC™ MOSFET: 30 mΩ, IMBG120R030M1H

Three-phase voltage source inverter (B6) in servo drives: IGBT exchanged into SiC MOSFET in same topology

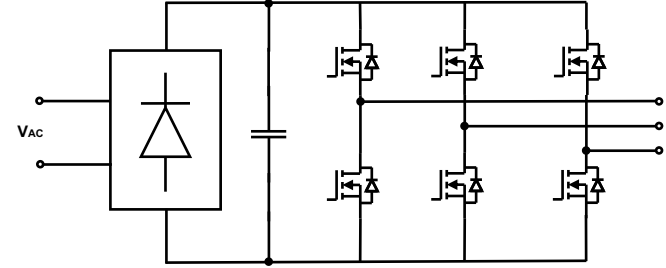
Si IGBT solution, discretes or modules



OR



CoolSiC™ MOSFET solution

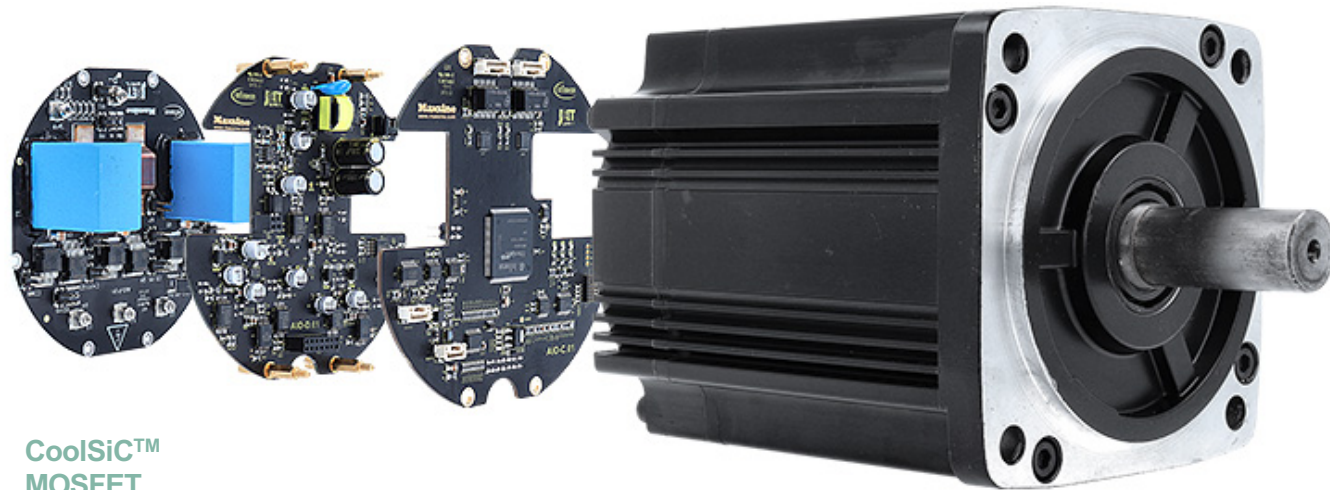
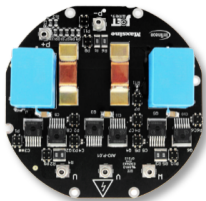


**CoolSiC™ MOSFET in SMD can replace
both module and discrete IGBT based solutions**



Inverter motor integration powered by Infineon products

A4 paper



CoolSiC™
MOSFET
IMBG120R030M1H

This reference design orderable in Q4 2020:

- REF-DR3KIMBGSICMA

Also Evaluation boards orderable in Q4 2020:

- REF_SIC_D2pak_MC, with Miller Clamp function
- REF_SIC_D2pak_BP, with bipolar power supply and separated sink/source output

Summary



CoolSiC™

.XT

CoolSiC™ MOSFETs 1200 V in SMD with .XT for Servo Drives

- › Highest efficiency in servo drives
- › Enable passive cooling solutions – Fanless drives
- › Allow compact solutions by reducing part count and form factors

For more product information, please visit

Webpage

www.infineon.com/coolsic-mosfet

Forum

[www.infineonforums.com/forums/34-silicon-carbide-\(SiC\)-forum](http://www.infineonforums.com/forums/34-silicon-carbide-(SiC)-forum)



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