

New 1200 V SiC MOSFET-based CIPOS™ Maxi Intelligent Power Module for High-Efficiency Motor Drives

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Introduction

In response to increasing environmental concerns and stricter global energy regulations, the demand for energy-efficiency and compact motor drive solutions is rapidly growing. Infineon’s new **CIPOS™ Maxi IPM** integrates advanced **CoolSiC™ trench-type SiC MOSFETs**, rugged **SOI-based gate drivers**, and **high-performance Direct Copper Bonding (DCB) substrate** in a fully transfer-molded dual-in-line package. This combination delivers exceptional **power density**, **thermal performance**, and **EMI robustness**, ensuring reliable operation under harsh industrial **HVAC** (Heating, Ventilating and Air-conditioning) applications.

The **new CIPOS™ 1200 V IM12SxxEA2** family incorporates high-speed variants of the first-generation CoolSiC™ MOSFETs to meet these demands.

- It combines the benefits of 1200 V CoolSiC™ trench-type SiC MOSFET technologies with low conduction and switching power losses, and smooth and stable rectification
- It is optimized for applications that require the short circuit safe operating area (SCSOA) functionality and offers exceptional robustness under harsh conditions
- The series offers $R_{DS(On)}$ values ranging from 60 mΩ to 90 mΩ, providing flexible design options for diverse load requirements.

Key features

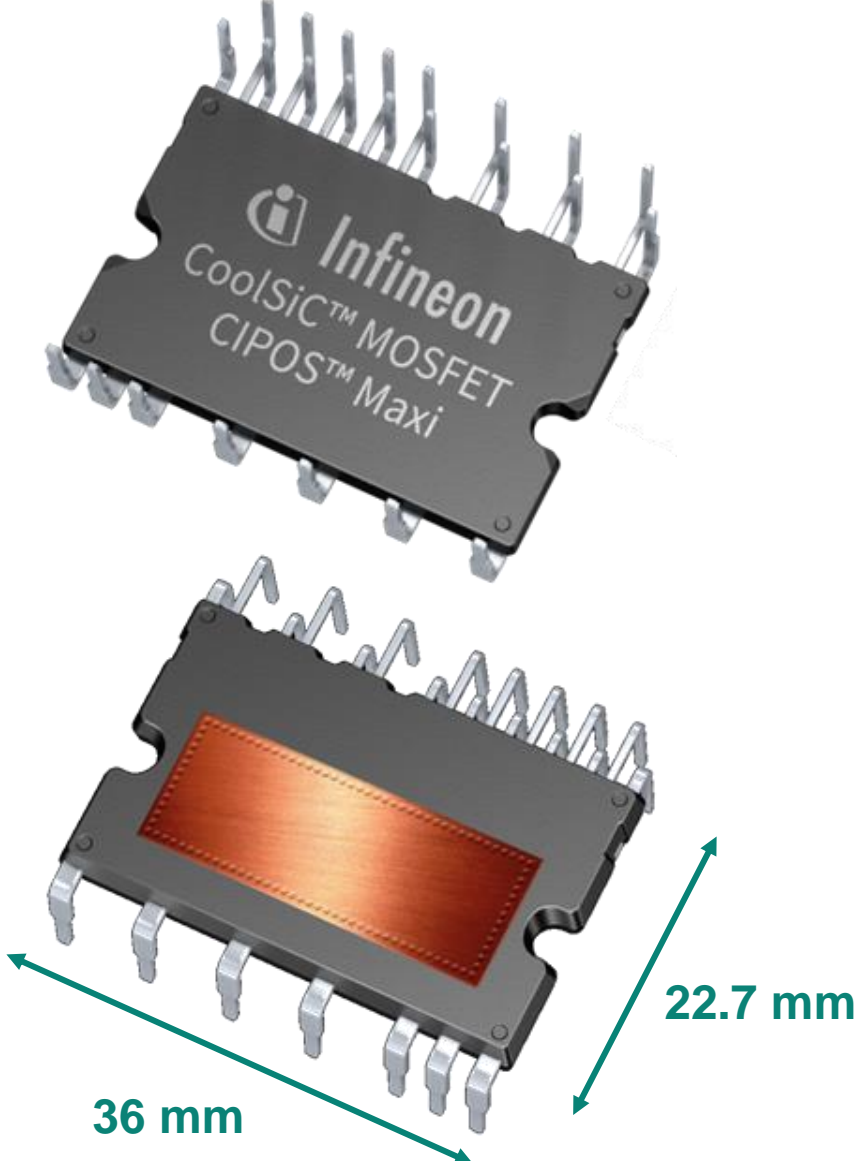
- 1200 V CoolSiC™ trench-type MOSFET Technology**
- 1200 V 6-channel SOI single gate driver IC**
 - Rugged SOI gate driver technology with stability against transient and negative voltage
 - Integrated bootstrap functionality
 - Overcurrent shutdown
 - Undervoltage lockout at all channels
 - Multifunctional RFE pin
 - All the six switches turn off during protection operation
 - Allowable negative VS potential of up to -11 V for signal transmission at $V_{BS} = 15\text{ V}$
- Built-in NTC thermistor for temperature monitoring
- Low side emitter pins accessible for phase current sensing (open emitter type)
- Fully isolated, dual-in-line molded DCB package

Product overview

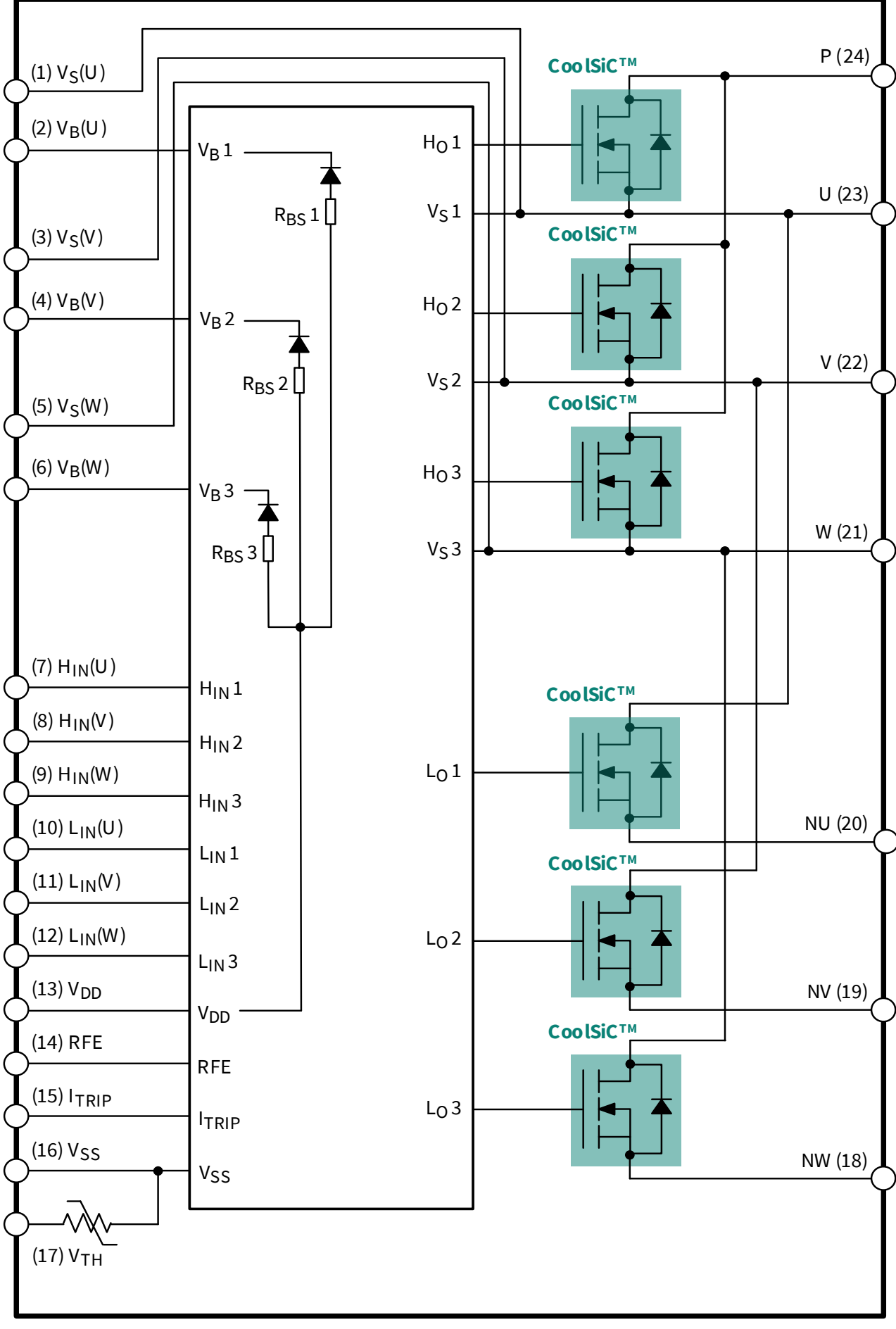
Product lineup

Product	$R_{DS(On)}$	Applications
IM828-XCC	45 mΩ	Motor drives for industrial applications (HVAC, Active filter)
IM12S60EA2	60 mΩ	
IM12S90EA2	90 mΩ	

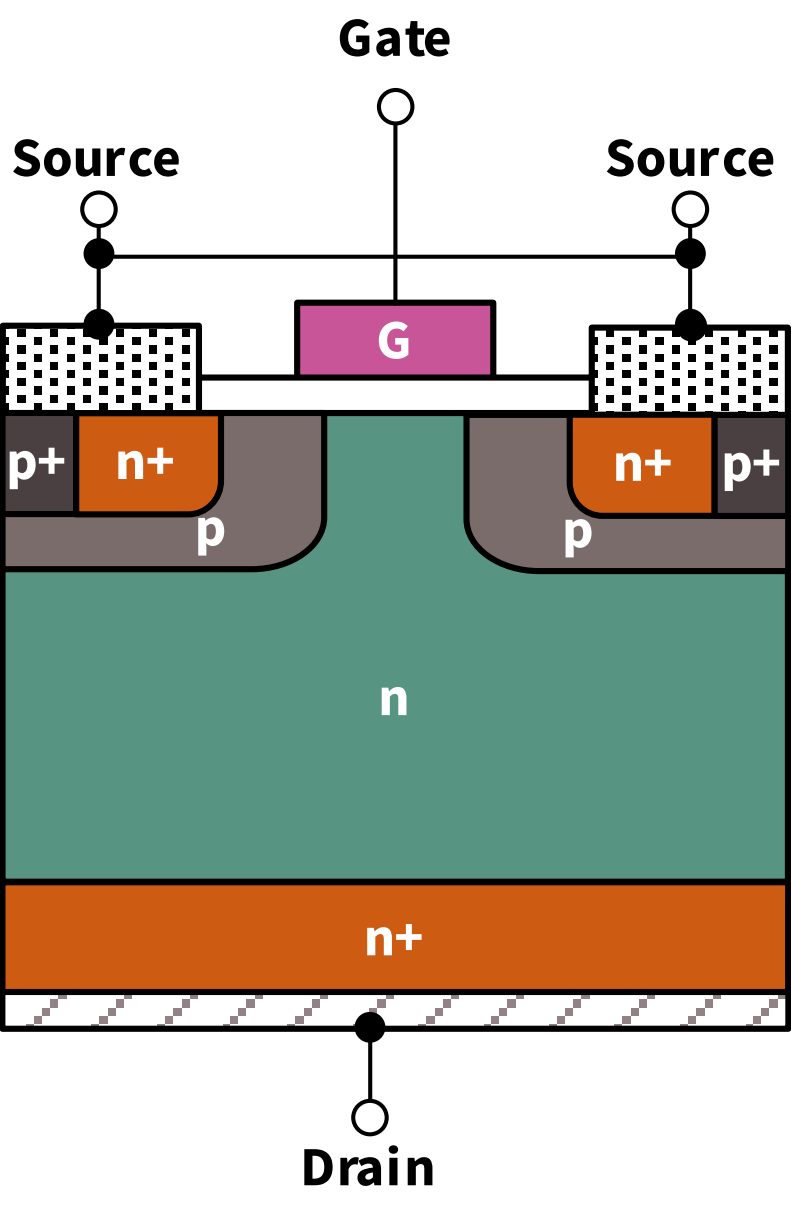
Package overview



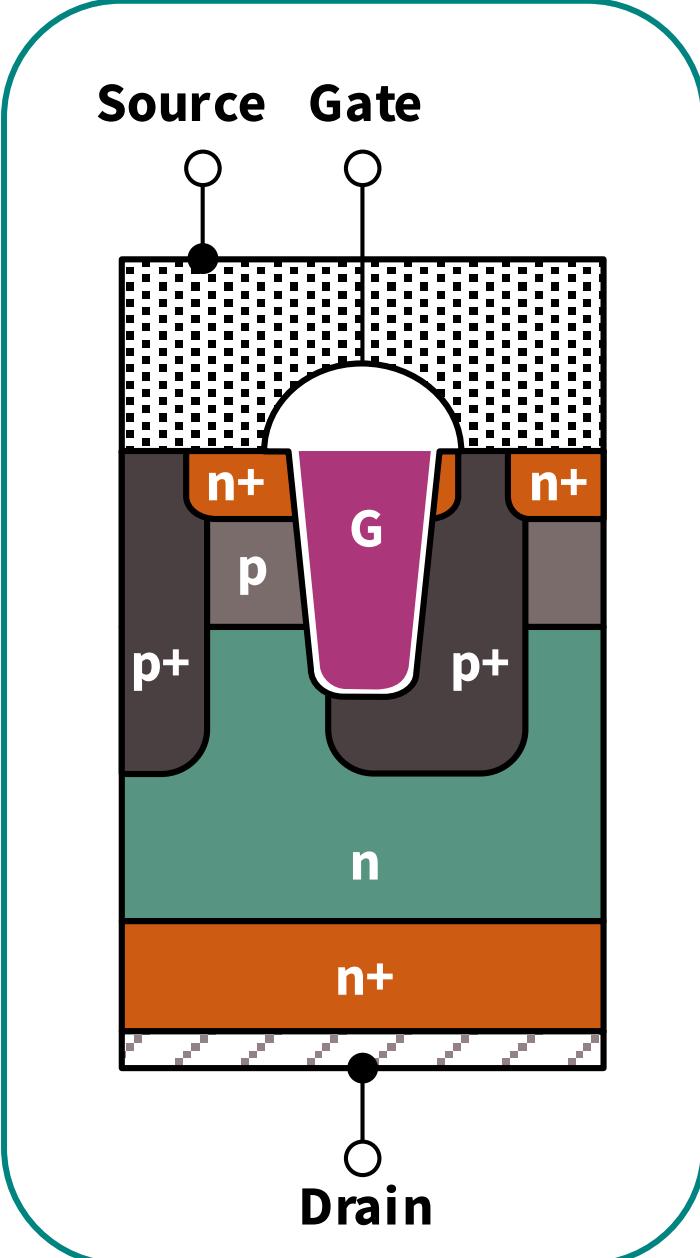
Internal block diagram



Semiconductor (CoolSiC™)



Planar channel



Asymmetric channel (Infineon)

Performance

Static behavior

Resistance per area ($R_{DS(on)} \times A$)
 $R_{DS(on)}$ dependency with temperature

Dynamic behavior

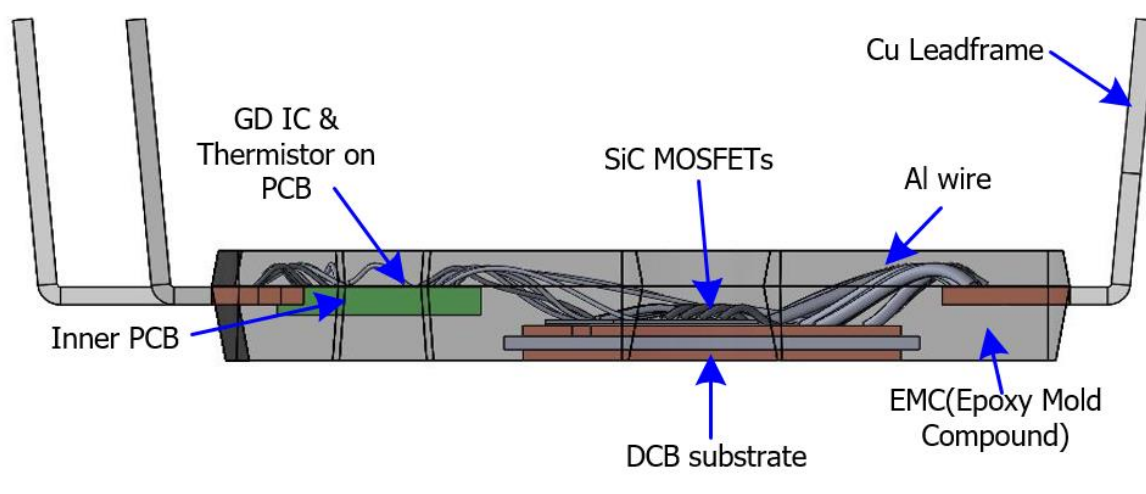
Total E_{oss}
Device capacitances
Gate and recovery charges

Robustness, reliability & ease-of-use

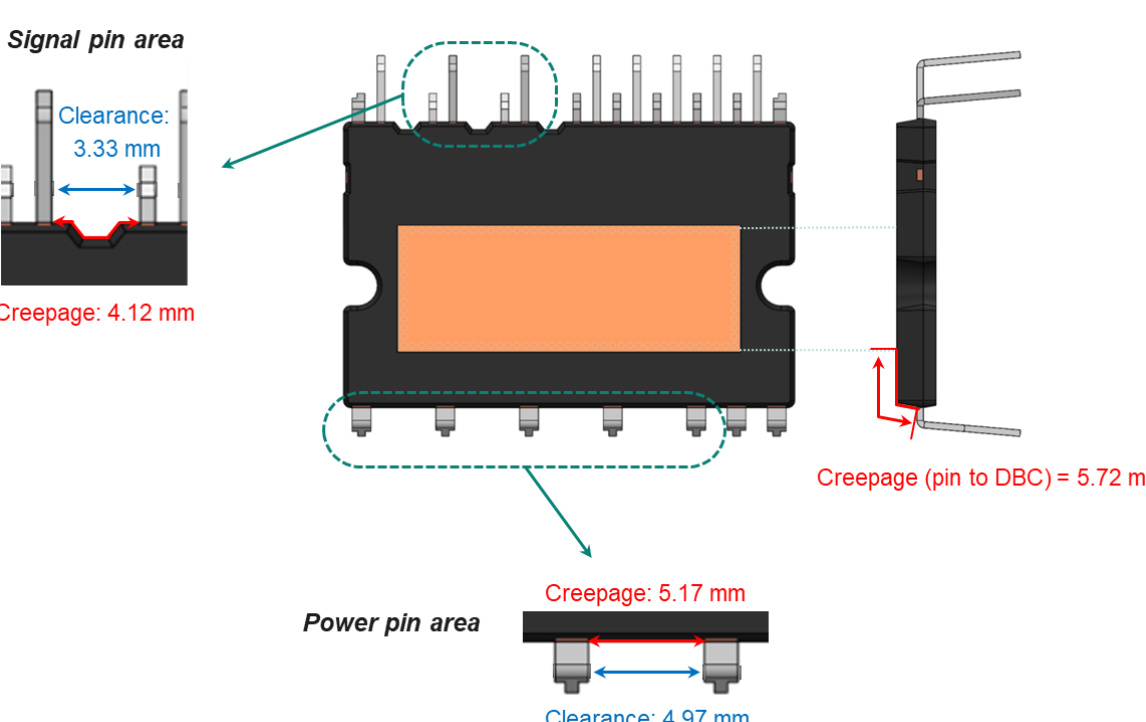
Robustness and reliability	Gate oxide reliability IGBT or CoolMOS™ -like FIT rates
	Robustness against parasitic turn-on $V_{GS(th)} > 4\text{ V}$
	Body diode rated for hard commutation
Ease-of-use	Avalanche capability
	Short-circuit capability
Wide V_{GS} range	
0 V turn-off V_{GS}	

Package

Internal Structure



Insulation distance

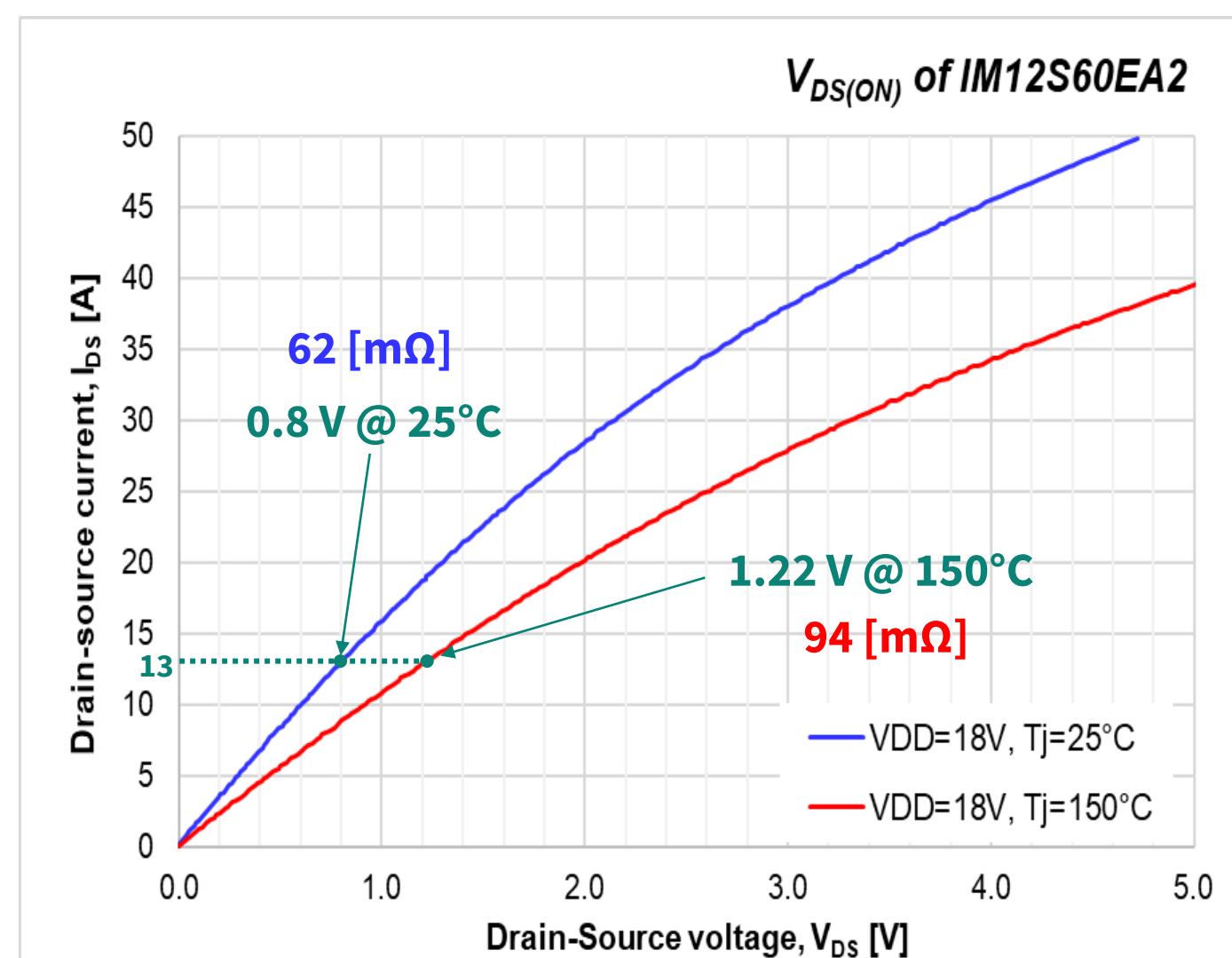


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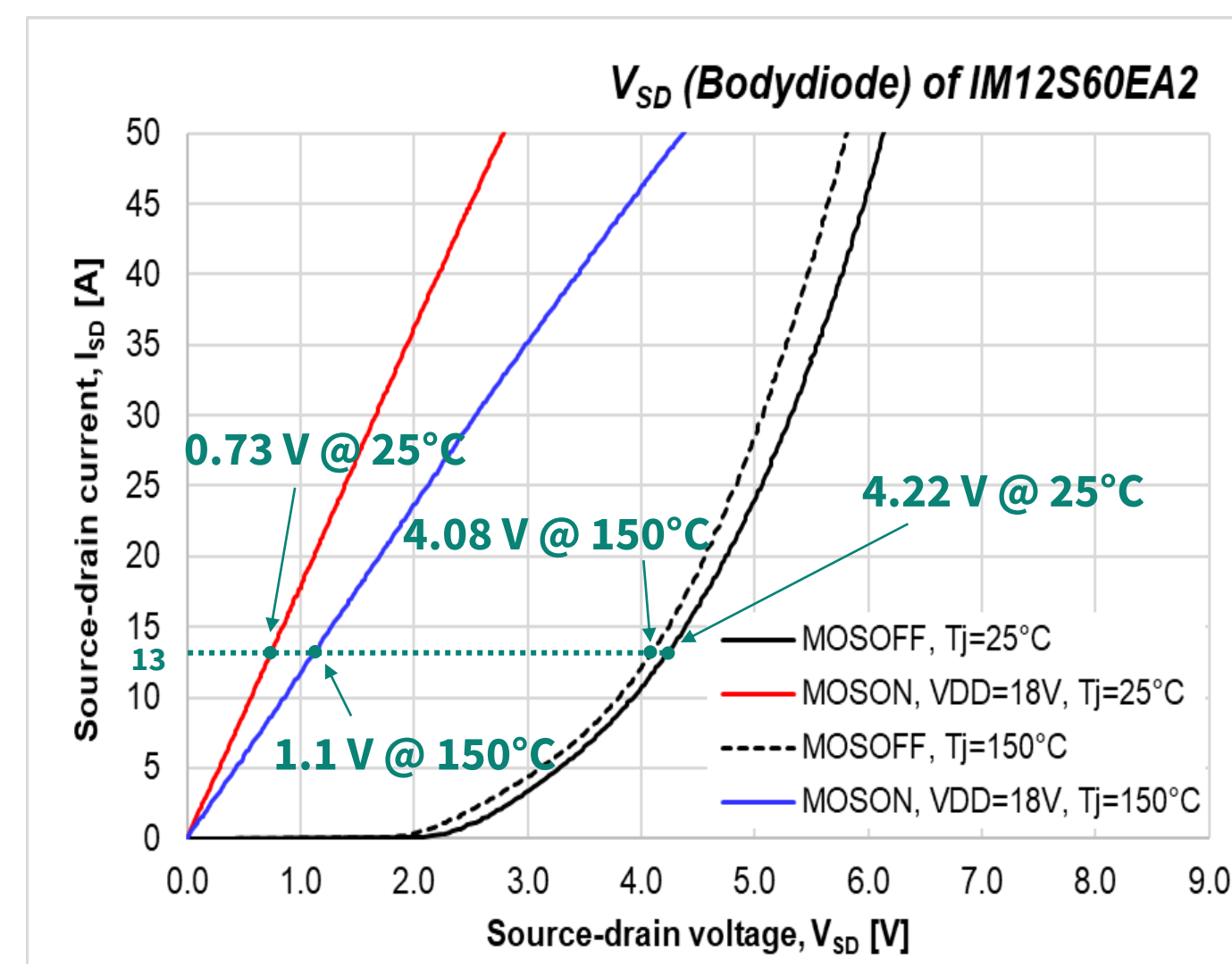
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Electrical characteristics

Static characteristics (IM12S60EA2, 1200 V, 60 mΩ rating)

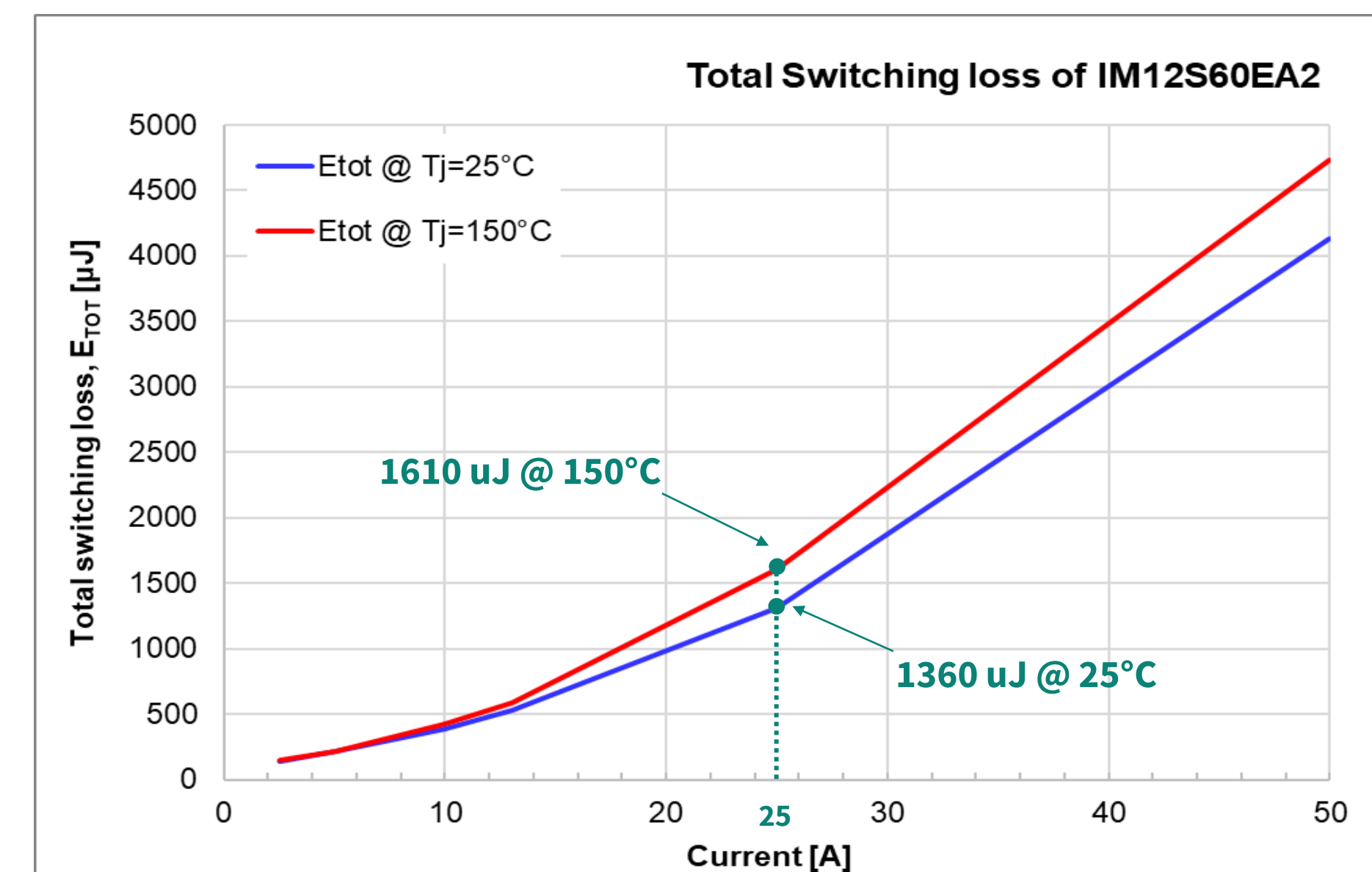


(a) MOSFET Drain-source voltage, V_{DS} [V]



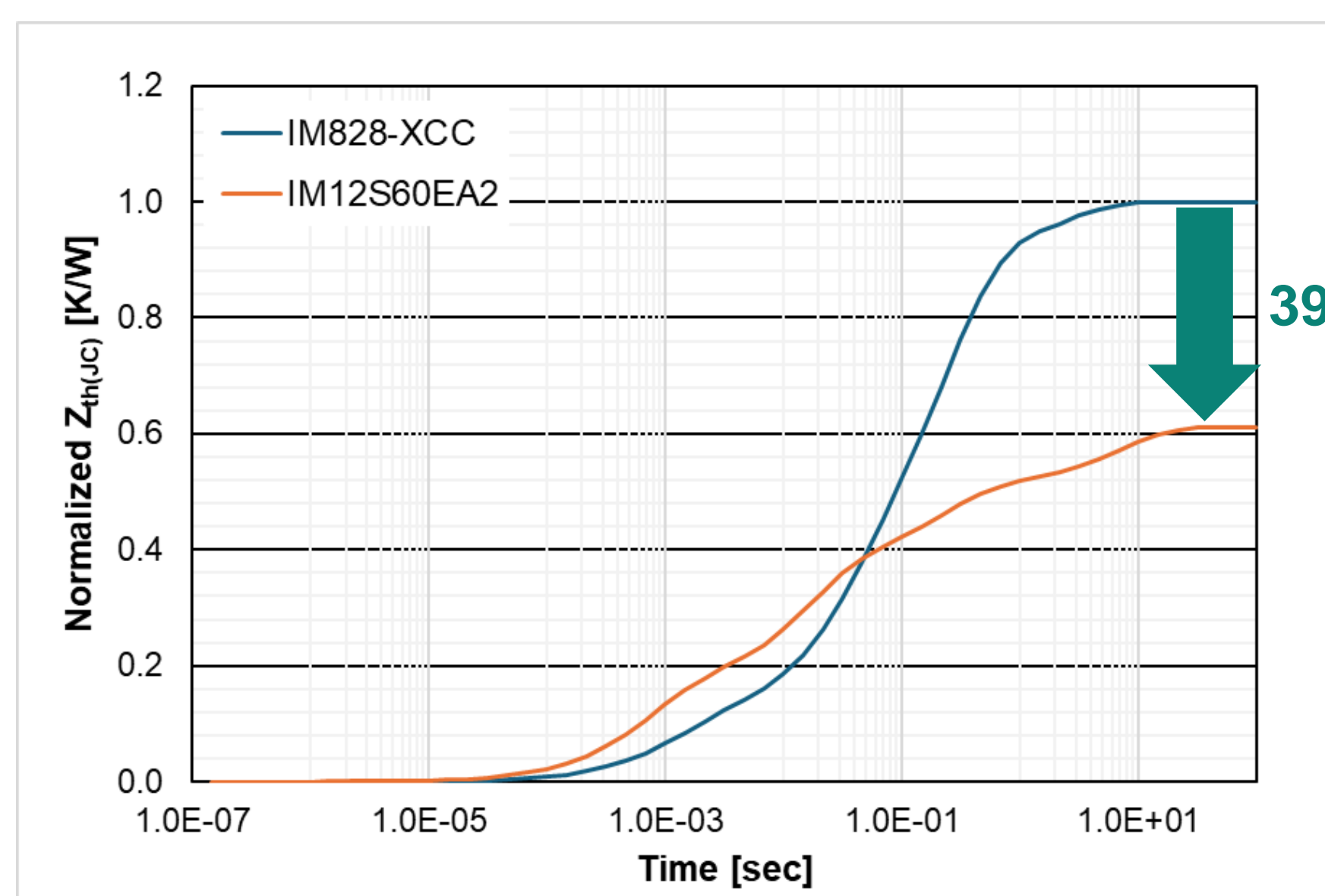
(b) Source-drain voltage, V_{SD} [V]

Dynamic characteristics ($V_{DC} = 600$ V, $V_{DD} = 18$ V, $T_C = 150^\circ\text{C}$)



Transient thermal impedance and package advantage

Normalized transient thermal impedance



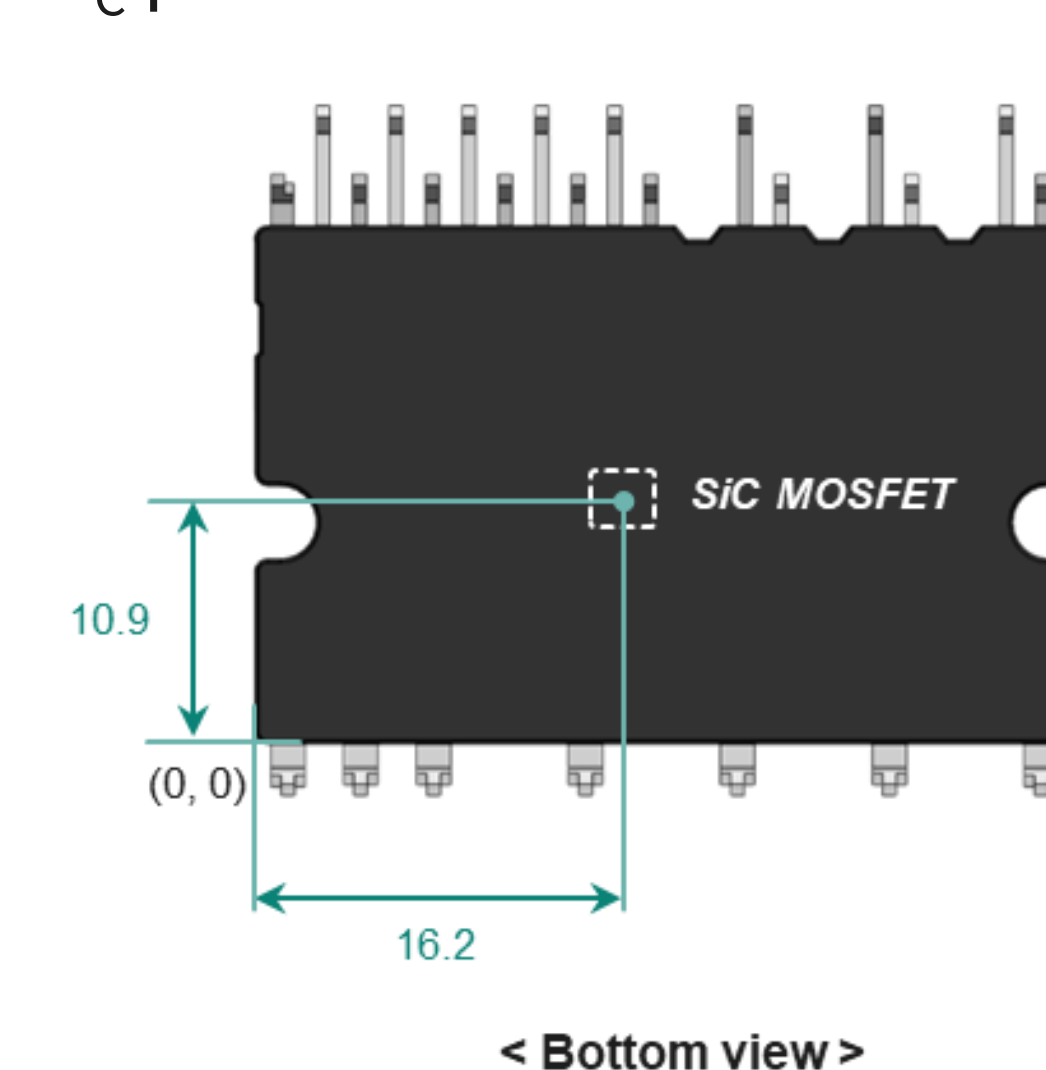
39 % Lower thermal resistance

Product	Normalized $Z_{thJC, max}$	Unit
IM828-XCC	1.00	K/W
IM12S60EA2	0.61	K/W

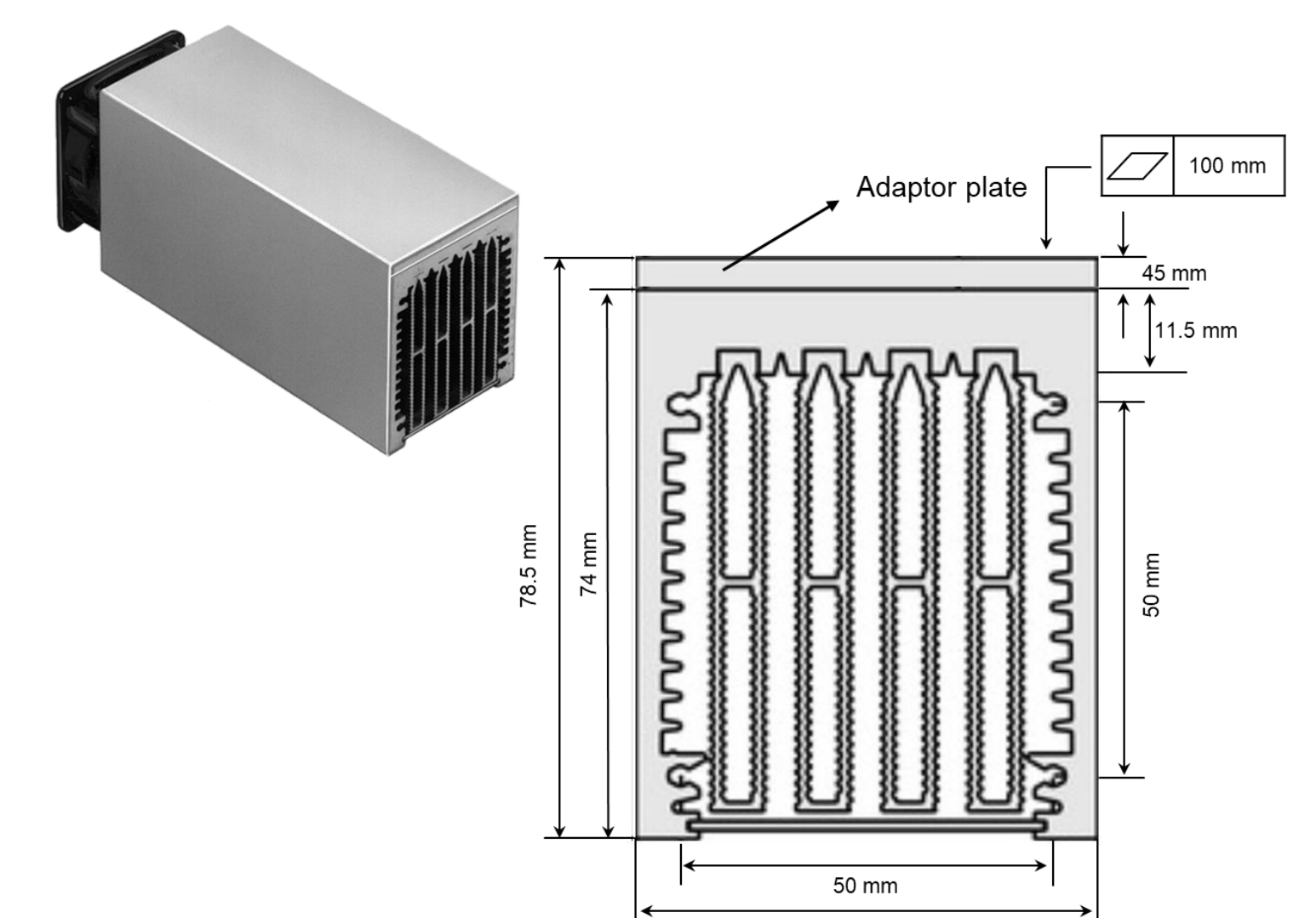
Test condition of thermal performance

Thermal performance environment

T_C point and heatsink



(a) Temperature measurement point



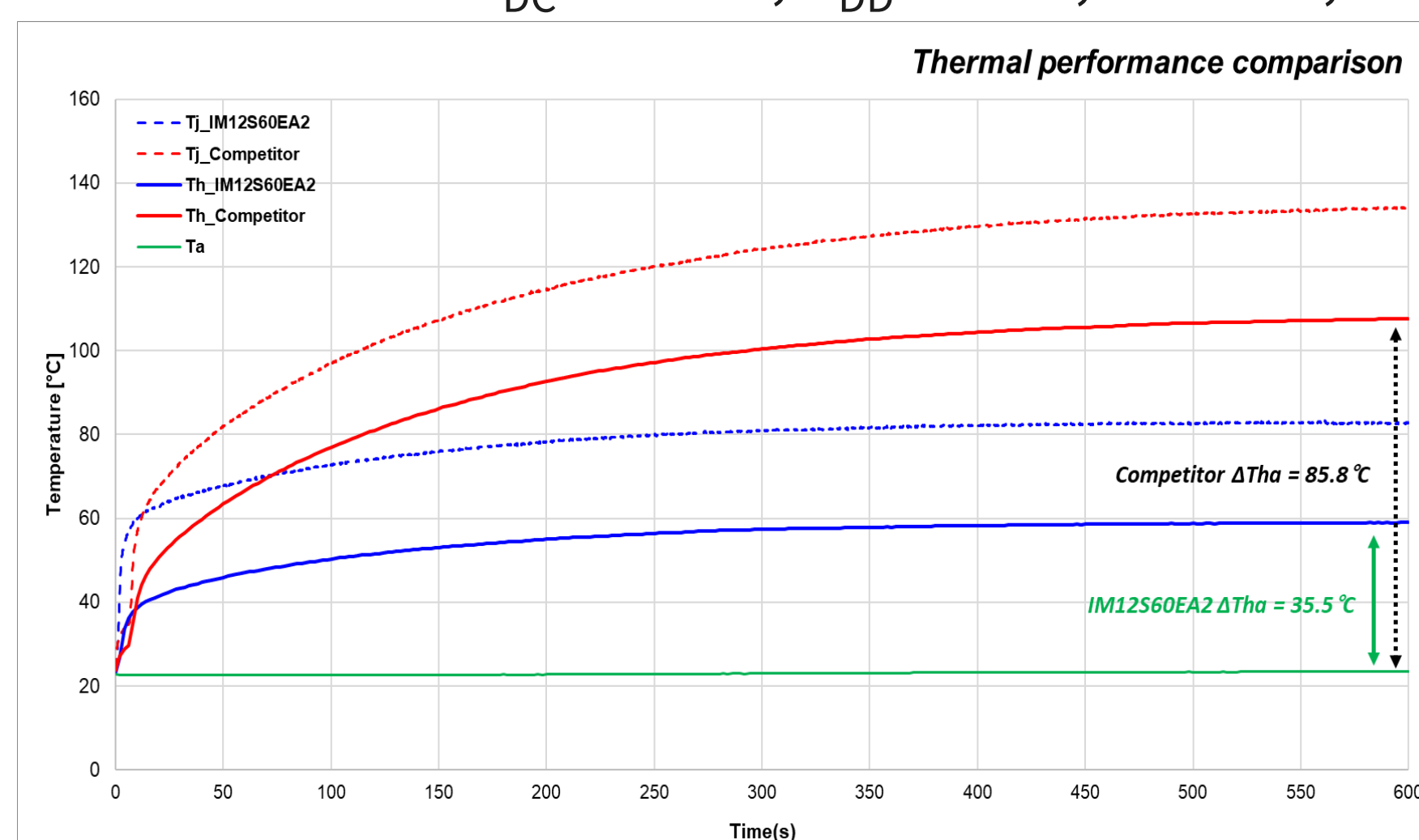
(b) Heatsink information

- Case temperature: T_C /Ambient temperature: T_A
- T_C and T_A were measured using a thermocouple

Thermal performance

ΔT_{CA} measurement result for 1200 V, 60 mΩ rating

Test conditions: $V_{DC} = 600$ V, $V_{DD} = 18$ V, SVPWM, P.F. = 0.86, M.I. = 0.78, $I_O = 20$ A_{peak}, $f_{SW} = 15$ kHz, $f_O = 120$ Hz, $T_A = 23.5^\circ\text{C}$



$f_{SW} = 15$ kHz					
Product	T_J	T_A	ΔT_{JA}	Unit	Remark
IM12S60EA2	134.03	23.5	110.53	$^\circ\text{C}$	
Competitor (Si IPM)	82.81	23.5	59.31	$^\circ\text{C}$	Package size 300% larger than IM12S60EA2

Summary

The new CIPOS™ Maxi 1200 V IPM family with CoolSiC™ MOSFETs and C5SOI gate driver technology delivers outstanding efficiency, thermal performance, and compactness for next-generation high-speed motor drives. This integration not only meets the rising demand for energy savings but also supports system miniaturization, making it an ideal solution for high-performance HVAC and industrial drive applications.