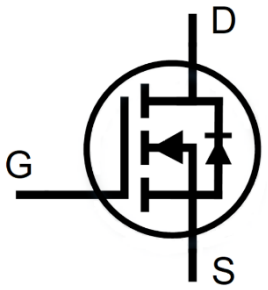
Automotive CoolSiC™ Gen2pE MOSFET

Quality Requirement Category: Automotive

Features

- Blocking voltage 1200V (rated)
- Low $R_{DS(ON)}$
- Low switching losses
- Low Q_G and C_{rss}
- Extended operation at 200°C up to 100h
- Integrated gate resistor
- Easy paralleling of MOSFET
- Short circuit rugged technology



Applications

- Motor drive traction inverter

Description

- Recommended for power modules

Product Validation

- Technology qualified for automotive applications. Product validation according to AEC-Q101.

Key Performance Parameters

Chip Type	V_{DSS}	I_{DDC}	$R_{DS(on)}$	Die Size (total)
AIMC120R011D21M2P1	1200V	118A[a]	11.1mΩ	25mm^2

[a] Chip capability with appropriate assembly. Calculated based on theoretical R_{thJC} = 0.4 [K/W]

Table of Contents

1 Maximum Ratings [b]

Parameter	Symbol	Conditions	Value	Unit
Drain-source voltage	V_{DSS}	-40°C ≤ T_{vj} ≤ 200°C	1200	V
Continuous DC drain current, limited by $T_{vj\,max}$	I_{DDC}	V_{GS} = 18V, T_c = 25°C	92[c] 118[d]	A
Peak reverse drain current	I_{SM}	V_{GS} = -3V, T_c = 25°C, T_{pulse} = 2µs	175	A
Maximum gate-source voltage	V_{GS}		-10 … +23	V
Operating virtual junction temperature	T_{vj}	over lifetime	-40 ... +185	°C
		100 hours	+185 … +200	°C

2 Recommended Values

Parameter	Symbol	Conditions	Value	Unit
Recommended turn-on gate voltage	$V_{GS(on)}$		18	V
Recommended turn-off gate voltage	$V_{GS(off)}$		-3	V

[b] Not subject to production test, verified by design/characterization.
[c] Chip capability with appropriate assembly. Calculated based on theoretical R_{thJC} = 0.66 [K/W].
[d] Chip capability with appropriate assembly. Calculated based on theoretical R_{thJC} = 0.4 [K/W].

3 Electrical Characteristics

Specification limits valid over product lifetime if not stated otherwise.

Parameter	Symbol	Conditions		Value			Unit
				min.	typ.	max.	
Drain-source breakdown voltage	$V_{(BR)DSS}$	I_D = 1mA	T_{vj} = -40°C [e]	1200	-	-	V
			T_{vj} = 25°C	1200	-	-	
			T_{vj} = 200°C [e]	1200	-	-	
Gate-source threshold voltage [f] (tested after 1ms pulse at V_{GS} = +20V)	$V_{GS(th)}$	I_D = 19mA, V_{GS} = V_{DS}	T_{vj} = 25°C	4.49	5.09	5.69	V
			T_{vj} = 175°C [e]	3.29	3.89	4.49	
			T_{vj} = 185°C [e]	3.24	3.84	4.44	
			T_{vj} = 200°C [e]	-	3.79	-	
Drain-source resistance	$R_{DS(on)}$	V_{GS} = 18V, I_D = 78A	T_{vj} = 25°C	-	11.1	14.0 [f]	mΩ
						14.4	
			T_{vj} = 175°C [e]	-	21.7	26.7 [f]	
						27.0	
			T_{vj} = 185°C [e]	-	22.8	28.3 [f]	
						28.6	
			T_{vj} = 200°C [e]	-	24.6	30.4 [f]	
						30.8	
Source-drain resistance	$R_{SD(on)}$	V_{GS} = 18V, I_D = -78A	T_{vj} = 25°C [e]	-	10.6	-	mΩ
			T_{vj} = 175°C [e]	-	21.2	-	
			T_{vj} = 185°C [e]	-	22.3	-	
			T_{vj} = 200°C [e]	-	24.1	-	
Zero gate-voltage drain current	I_{DSS}	V_{DS} = 1200V, V_{GS} = 0V	T_{vj} = 25°C	-	2	50	µA
			T_{vj} = 175°C [e]	-	17	100	
			T_{vj} = 185°C [e]	-	21	100	
			T_{vj} = 200°C [e]	-	24	-	
Positive gate-source leakage current	I_{GSS+}	V_{DS} = 0V, V_{GS} = 23V	T_{vj} = 25°C	-	1	200	nA
			T_{vj} = 175°C [e]	-	4	400	
			T_{vj} = 185°C [e]	-	8	400	
			T_{vj} = 200°C [e]	-	11	-	

[e] Not subject to production test, verified by design/characterization.
[f] Values specified for zero hour not according to AEC-Q101.

Parameter	Symbol	Conditions		Value			Unit
				min.	typ.	max.	
Negative gate-source leakage current	I_{GSS-}	V_{DS} = 0V, V_{GS} = -10V	T_{vj} = 25°C	-	0.1	100	nA
			T_{vj} = 175°C [g]	-	0.4	100	
			T_{vj} = 185°C [g]	-	0.8	100	
			T_{vj} = 200°C [g]	-	1.1	-	
Internal gate resistor [g, h]	$R_{G,int}$	f = 100kHz, dV = 25mV, T_{vj} = 25°C		-	2	-	Ω
Forward transconductance [g]	g_{fs}	V_{DS} = 20V, I_D = 78A, T_{vj} = 25°C		-	52	-	S
Input capacitance [g]	C_{iss}	V_{DS} = 800V, f = 100kHz, dV = 25mV, T_{vj} = 25°C		-	5500	-	pF
Output capacitance [g]	C_{oss}			-	210	-	
Reverse transfer capacitance [g]	C_{rss}			-	19	-	
Gate charge [g]	Q_G	V_{DS} = 800V, I_D = 78A, $V_{GS(on)}$ = 18V, $V_{GS(off)}$ = -3V, T_{vj} = 25°C		-	183	-	nC
Gate-to-source charge [g]	Q_{GS}			-	69	-	
Gate-to-drain charge [g]	Q_{GD}			-	35	-	
Turn-on energy [i, j]	E_{on}	V_{DS} = 800V, I_D = 78A, $V_{GS(on)}$ = 18V, $V_{GS(off)}$ = -3V, L_s = 20nH, dV_{DS}/dt = 20V/ns, T_{vj} = 25°C		-	1.6	-	mJ
Turn-off energy [i]	E_{off}			-	1.4	-	

[g] Not subject to production test, verified by design/characterization.
[h] The internal gate resistor includes the implemented and layout dependent gate resistance.
[i] Not subject to production test, characterized in TO-247-4 package on a reference test setup.
[j] Body diode E_{rec} included.

4 Body Diode Characteristics

Specification limits valid over product lifetime if not stated otherwise.

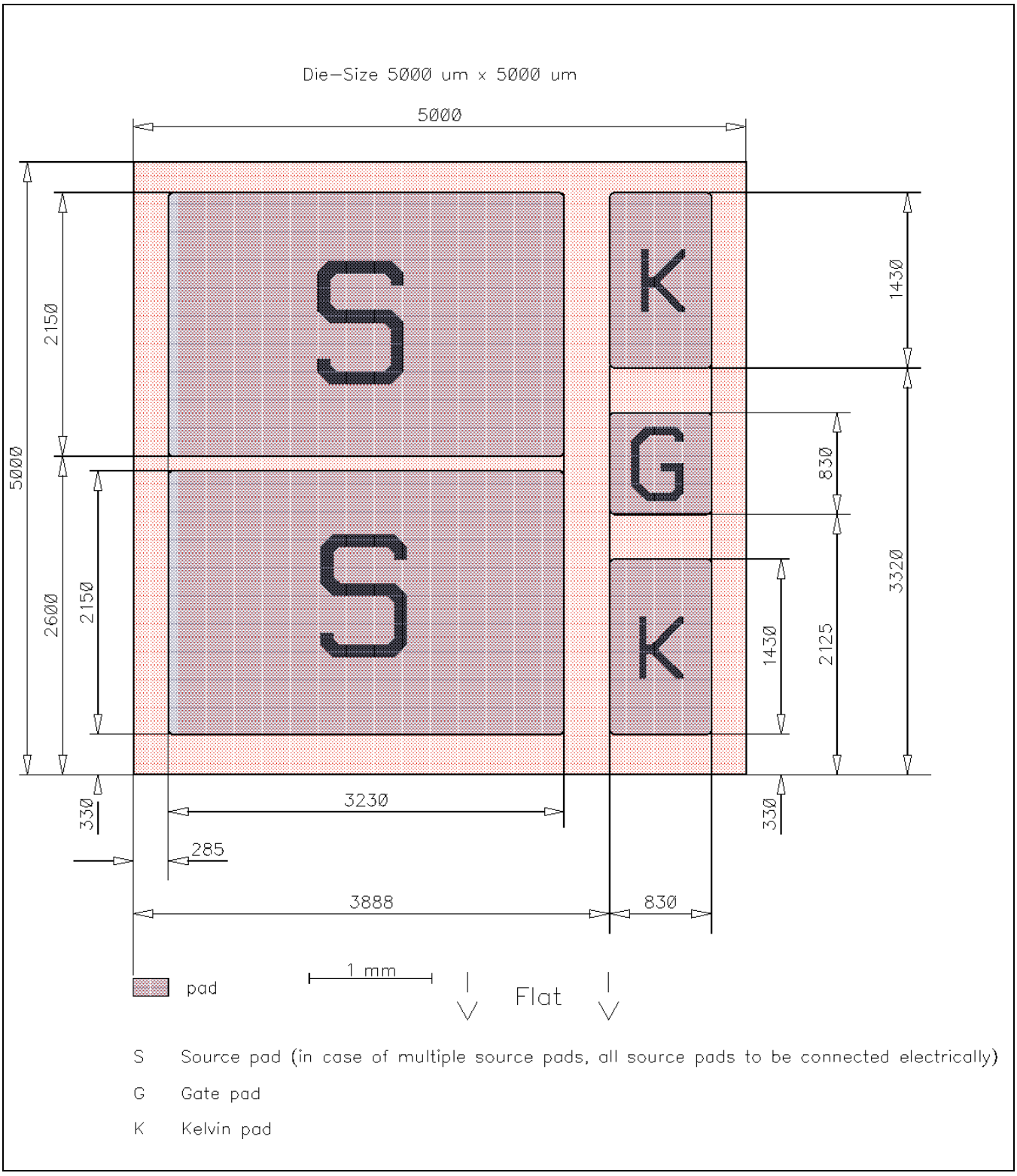
Parameter	Symbol	Conditions		Value			Unit
				min.	typ.	max.	
Drain-source reverse voltage	V_{SD}	I_F = 78A, V_{GS} = -3V	T_{vj} = 25°C	3.9	4.7	5.5	V
			T_{vj} = 175°C [k]	3.45	4.25	5.05	
			T_{vj} = 185°C [k]	3.4	4.2	5.0	
			T_{vj} = 200°C [k]	-	4.15	-	
Reverse recovery charge [k]	Q_{rr}	V_{DS} = 800V, I_D = 78A, $V_{GS(on)}$ = 18V, $V_{GS(off)}$ = -3V, di/dt = 1kA/µs, T_{vj} = 25°C		-	175	-	nC
Reverse recovery time [k]	t_{rr}			-	24	-	ns
Peak reverse recovery current [k]	I_{rrm}			-	13	-	A

[k] Not subject to production test, verified by design/characterization

5 Mechanical Parameters

Chip size after sawing	x = 4.97mm, y = 4.97mm	
Raster size	x = 5.00mm, y = 5.00mm	
Area total	25	mm^2
Source pad size	See die drawing	
Gate pad size	See die drawing	
SiC thickness	110	µm
Chip thickness (incl. Imide)	130	µm
Passivation front side	Photoimide	
Pad metal	NiP/Pd	
Backside metal	NiV/Ag - system	
Storage environment (<6 months) for original and sealed MBB bags	Ambient atmosphere air, temperature 17°C – 25°C	
Storage environment (<6 months) for open MBB bags	Acc. IEC 62258-3; Section 9.4 Storage Environment	

6 Die Drawing



Legend:

- S = Source
- G = Gate
- K = Kelvin pad

7 Bare Die Product Specifics

Note: The MOSFET wafer level test cannot cover the full range of customer application conditions. Therefore it is the responsibility of the customer to test all performance characteristics, which are relevant for their specific application, at the package level.

Description

- AQL 0.1 for visual inspection according to failure catalogue

Revision History

Document version	Date of release	Description of changes
V1.0	2025-12-05	Initial Data Sheet

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