

Highly insulated module

Features

- Electrical features
 - $V_{CES} = 4500\text{ V}$
 - $I_{C\text{nom}} = 400\text{ A} / I_{CRM} = 800\text{ A}$
 - High DC stability
 - High surge current capability
 - High dynamic robustness
- Mechanical features
 - High creepage and clearance distances
 - ALSiC base plate for increased thermal cycling capability
 - Package with enhanced insulation of 10.4 kV AC 60 s
 - Package with CTI > 600



Potential applications

- Motor drives
- Multi-level inverter
- Traction drives
- Wind turbines
- Medium-voltage converters
- High-power converters

Product validation

- Qualified for industrial applications according to the relevant tests of IEC 60747, 60749 and 60068

Description

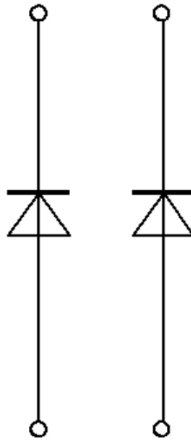


Table of contents

	Description	1
	Features	1
	Potential applications	1
	Product validation	1
	Table of contents	2
1	Package	3
2	Diode, Inverter	3
3	Characteristics diagrams	5
4	Circuit diagram	7
5	Package outlines	8
6	Module label code	9
	Revision history	10
	Disclaimer	11

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50$ Hz, $t = 60$ s	10.4	kV
Partial discharge extinction voltage	V_{isol}	RMS, $f = 50$ Hz, Q_{PD} typ. 10 pC	3.5	kV
DC stability	$V_{CE(D)}$	$T_{vj}=25^{\circ}C$, 100 Fit	3000	V
Material of module baseplate			AlSiC	
Internal isolation		basic insulation (class 1, IEC 61140)	AlN	
Creepage distance	d_{Creep}	terminal to heatsink	64.0	mm
Creepage distance	d_{Creep}	terminal to terminal	56.0	mm
Clearance	d_{Clear}	terminal to heatsink	40.0	mm
Clearance	d_{Clear}	terminal to terminal	26.0	mm
Comparative tracking index	CTI		> 600	

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	L_{sCE}			25		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	$T_C=25^{\circ}C$, per switch		0.37		mΩ
Storage temperature	T_{stg}		-55		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M6, Screw	4.25	5.75	Nm
Terminal connection torque	M	- Mounting according to valid application note	M8, Screw	8	10	Nm
Weight	G			1000		g

Note: Dynamic data valid in conjunction with FZ400R45KL3_B5 module

2 Diode, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = -40^{\circ}C$	4500	V
		$T_{vj} = 25^{\circ}C$	4500	
		$T_{vj} = 125^{\circ}C$	4500	

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Continuous DC forward current	I_F		400	A	
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$	800	A	
I^2t - value	I^2t	$t_P = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ }^\circ\text{C}$	65	kA^2s
Maximum power dissipation	P_{RQM}		$T_{vj} = 125 \text{ }^\circ\text{C}$	800	kW
Minimum turn-on time	t_{onmin}		10	μs	

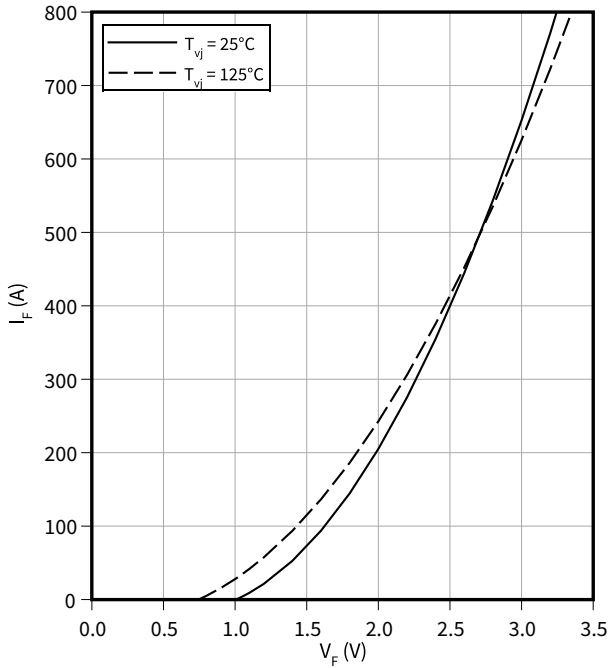
Table 4 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 400 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	2.50	3.10	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	2.50	3.00	
Peak reverse recovery current	I_{RM}	$V_R = 2800 \text{ V}, I_F = 400 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 1670 \text{ A}/\mu\text{s} (T_{vj} = 125 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	500		A
			$T_{vj} = 125 \text{ }^\circ\text{C}$	570		
Recovered charge	Q_r	$V_R = 2800 \text{ V}, I_F = 400 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 1670 \text{ A}/\mu\text{s} (T_{vj} = 125 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	390		μC
			$T_{vj} = 125 \text{ }^\circ\text{C}$	700		
Reverse recovery energy	E_{rec}	$V_R = 2800 \text{ V}, I_F = 400 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 1670 \text{ A}/\mu\text{s} (T_{vj} = 125 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	590		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1200		
Thermal resistance, junction to case	R_{thJC}	per diode			51.0	K/kW
Thermal resistance, case to heat sink	R_{thCH}	per diode		42.0		K/kW
Temperature under switching conditions	$T_{vj op}$		-50		125	$^\circ\text{C}$

3 Characteristics diagrams

Forward characteristic (typical), Diode, Inverter

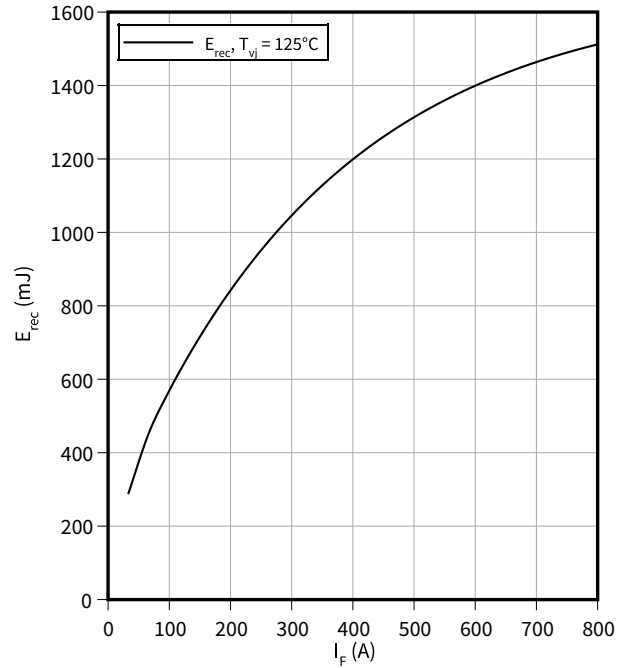
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

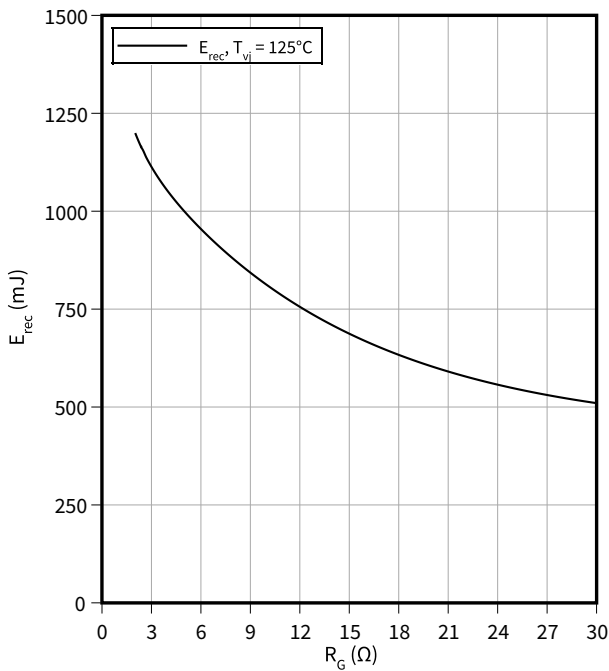
$V_{CE} = 2800\text{ V}, R_{Gon} = R_{Gon}(\text{IGBT})$



Switching losses (typical), Diode, Inverter

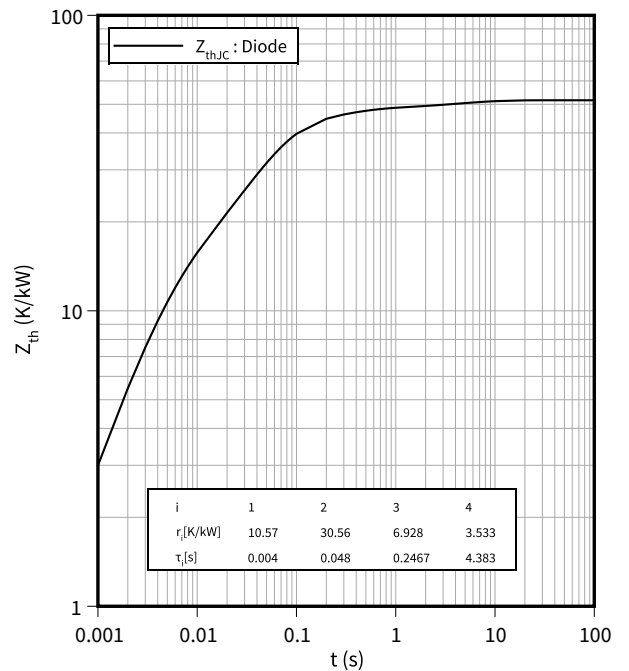
$E_{rec} = f(R_G)$

$V_{CE} = 2800\text{ V}, I_F = 400\text{ A}$



Transient thermal impedance, Diode, Inverter

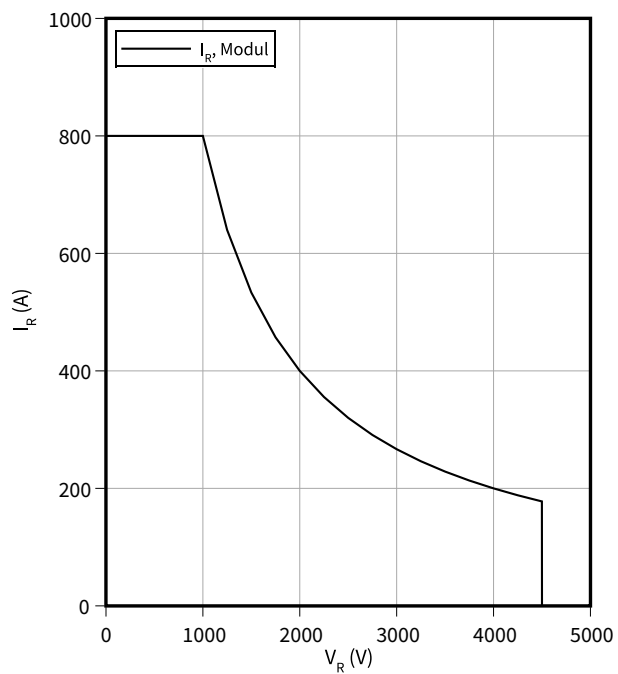
$Z_{th} = f(t)$



Safe operating area (SOA), Diode, Inverter

$$I_R = f(V_R)$$

$$T_{vj} = 125\text{ °C}$$



4 Circuit diagram

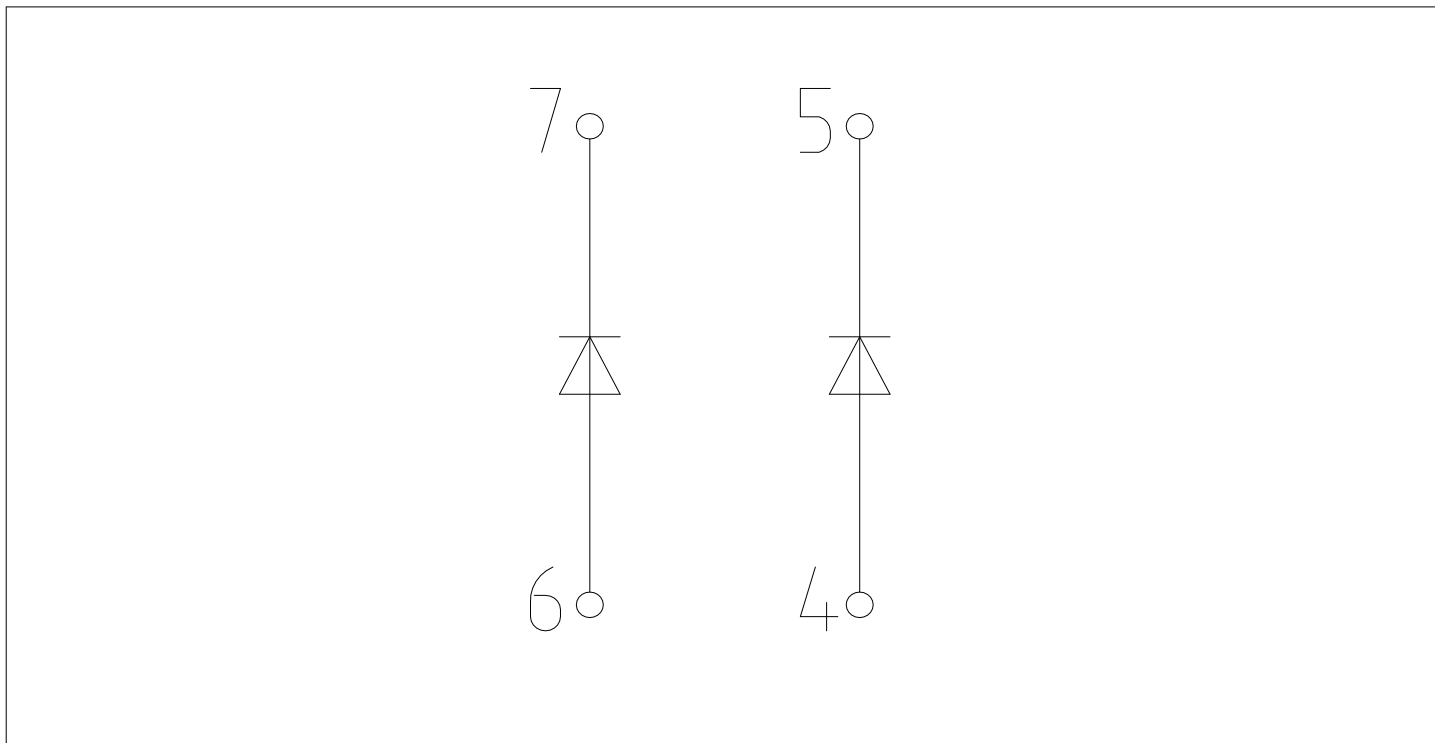


Figure 1

5 Package outlines

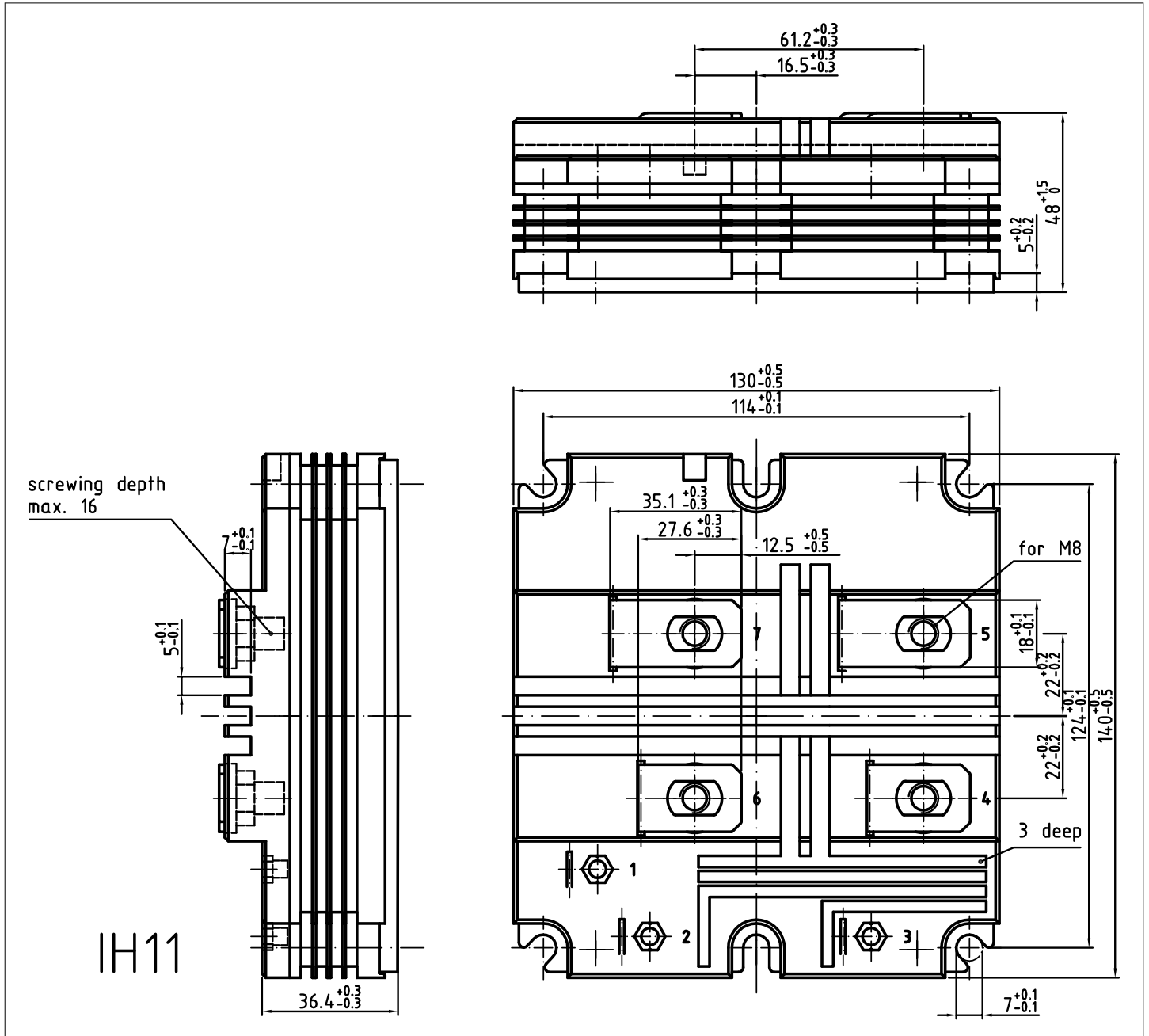


Figure 2

6 Module label code


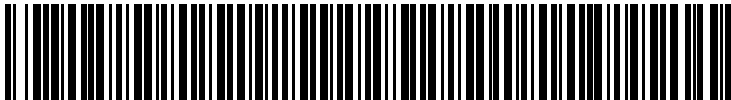
Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	Module serial number	1 - 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 19	55054991
	Date code (production year)	20 - 21	15
	Date code (production week)	22 - 23	30
Example	 		
	71549142846550549911530		71549142846550549911530

Figure 3

Revision history

Document revision	Date of release	Description of changes
V1.0	2012-09-07	Target datasheet
V2.0	2013-06-12	Preliminary datasheet
V3.0	2013-07-29	Final datasheet
V3.1	2018-01-15	Final datasheet
n/a	2020-09-01	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.10	2022-04-12	Final datasheet

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