

## 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



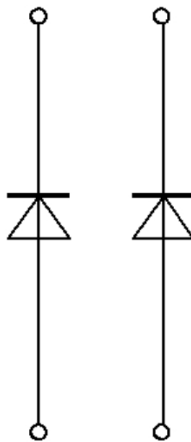
### Potential applications

- 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



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## 1 Package

**Table 1** Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	$V_{ISOL}$	RMS, $f = 50 \text{ Hz}$ , $t = 60 \text{ s}$	10.4	kV
Partial discharge extinction voltage	$V_{isol}$	RMS, $f = 50 \text{ Hz}$ , $Q_{PD}$ typ. 10 pC	3.5	kV
DC stability	$V_{CE(D)}$	$T_{vj}=25^{\circ}\text{C}$ , 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	$R_{AA'+CC'}$	$T_C=25^{\circ}\text{C}$ , 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	$V_{RRM}$	$T_{vj} = -40^{\circ}\text{C}$	4500	V
		$T_{vj} = 25^{\circ}\text{C}$	4500	
		$T_{vj} = 125^{\circ}\text{C}$	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	$\text{kA}^2\text{s}$
Maximum power dissipation	$P_{RQM}$		$T_{vj} = 125 \text{ }^\circ\text{C}$	800	kW
Minimum turn-on time	$t_{onmin}$		10	$\mu\text{s}$	

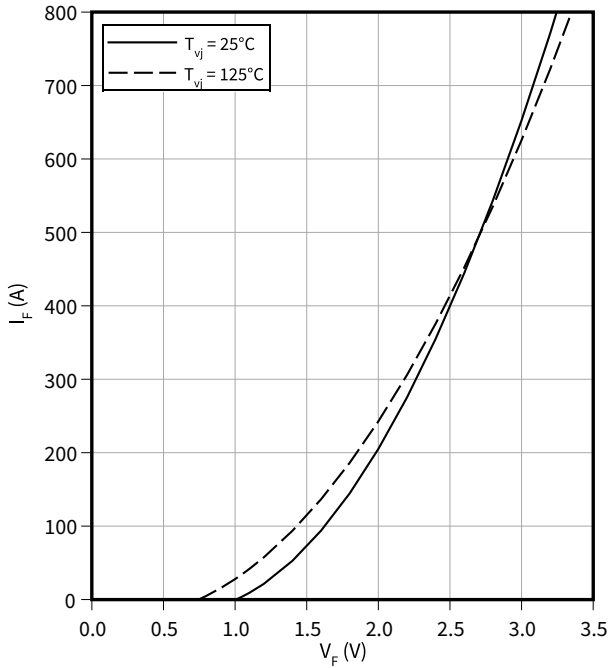
**Table 4 Characteristic values**

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		$\mu\text{C}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	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**

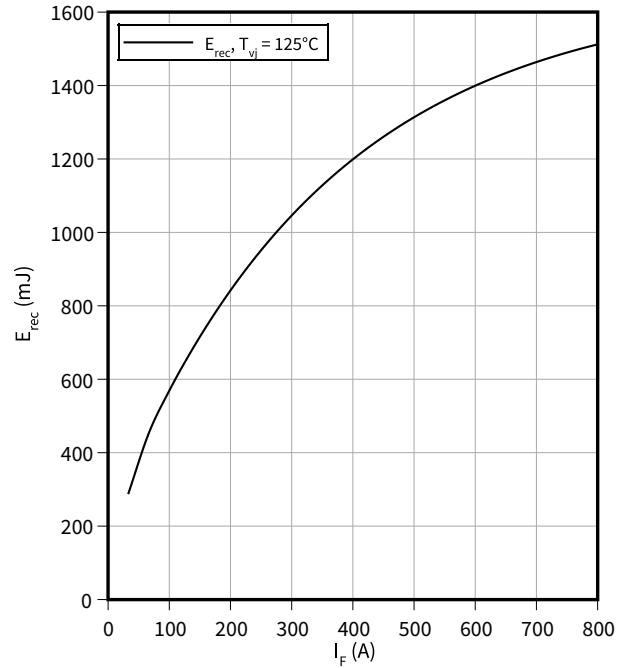
$I_F = f(V_F)$



**Switching losses (typical), Diode, Inverter**

$E_{rec} = f(I_F)$

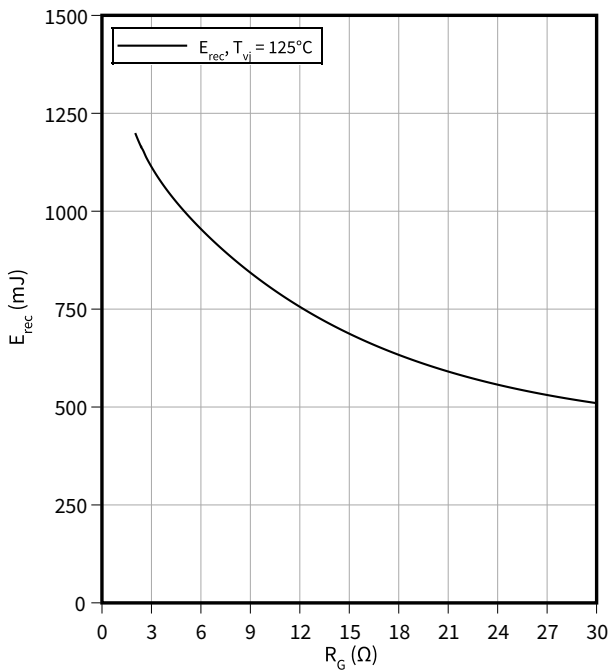
$V_{CE} = 2800\text{ V}, R_{Gon} = R_{Gon}(\text{IGBT})$



**Switching losses (typical), Diode, Inverter**

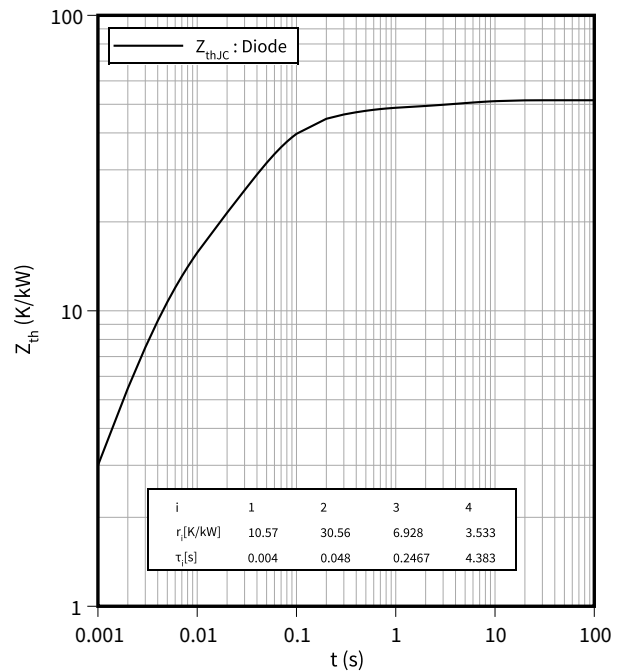
$E_{rec} = f(R_G)$

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



**Transient thermal impedance, Diode, Inverter**

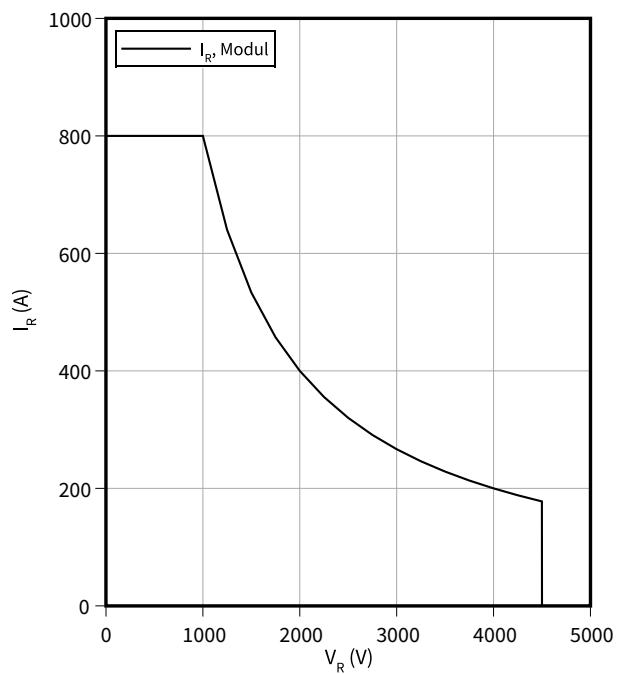
$Z_{th} = f(t)$



**Safe operating area (SOA), Diode, Inverter**

$$I_R = f(V_R)$$

$$T_{vj} = 125\text{ °C}$$



## 4 Circuit diagram

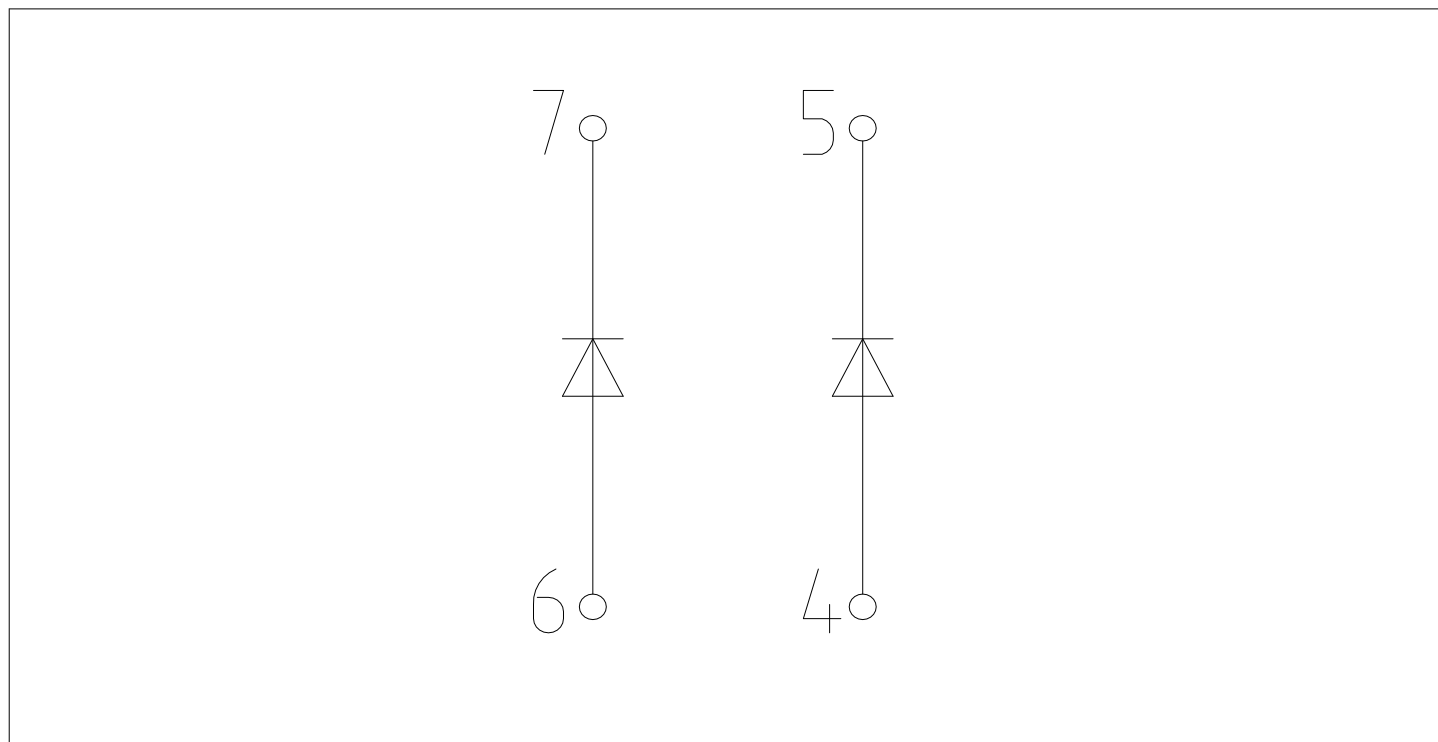


Figure 1

## 5 Package outlines

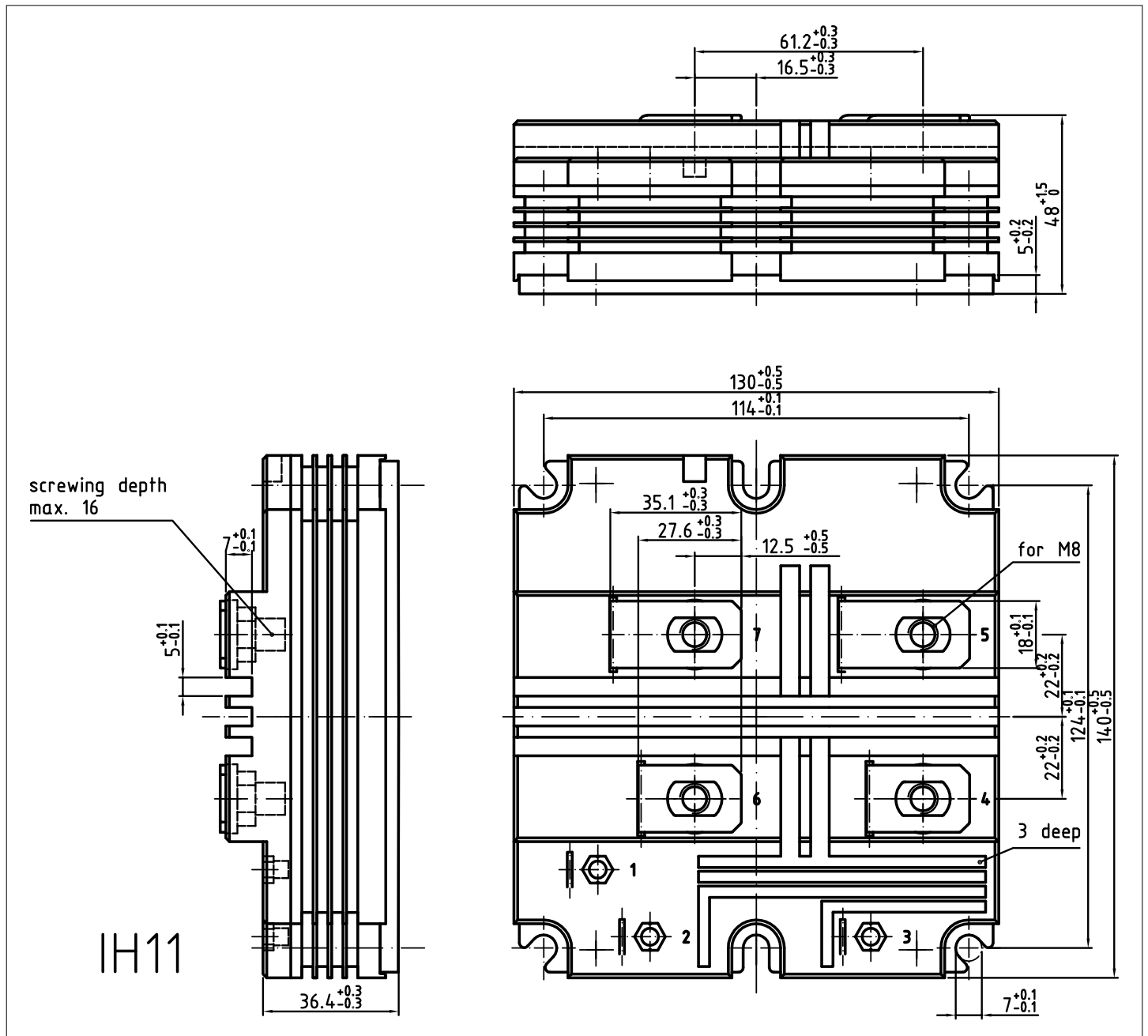

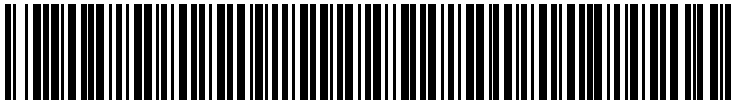


Figure 2



## 6 Module label code

<b>Module label code</b>			
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> Module serial number Module material number Production order number Date code (production year) Date code (production week)	<i>Digit</i> 1 - 5 6 - 11 12 - 19 20 - 21 22 - 23	<i>Example</i> 71549 142846 55054991 15 30
Example	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">   71549142846550549911530 </div> <div style="text-align: center;">   71549142846550549911530 </div> </div>		

**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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