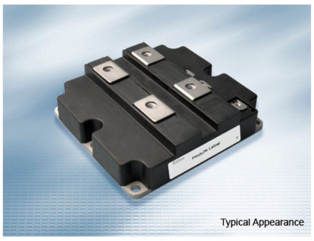
IHM-B module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode

Features



- Electrical features
  - V_{CES} = 3300 V
  - $I_{C\ nom}$ = 825 A / I_{CRM} = 1650 A
  - Low Qg and Cres
  - High DC stability
  - High short-circuit capability
  - Low switching losses
  - Low V_{CEsat}
  - $T_{vj\ op}$ = 150 °C
  - Trench IGBT 4
  - Unbeatable robustness
  - V_{CEsat} with positive temperature coefficient
  - High current density
- Mechanical features
  - AlSiC base plate for increased thermal cycling capability
  - High power density
  - Isolated base plate
  - Package with CTI > 600
  - RoHS compliant

Potential applications

- High power converters
- Medium voltage converters
- Motor drives
- Traction drives
- UPS systems
- Active frontend (energy recovery)
- Commercial Agriculture Vehicles

Product validation

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

Description

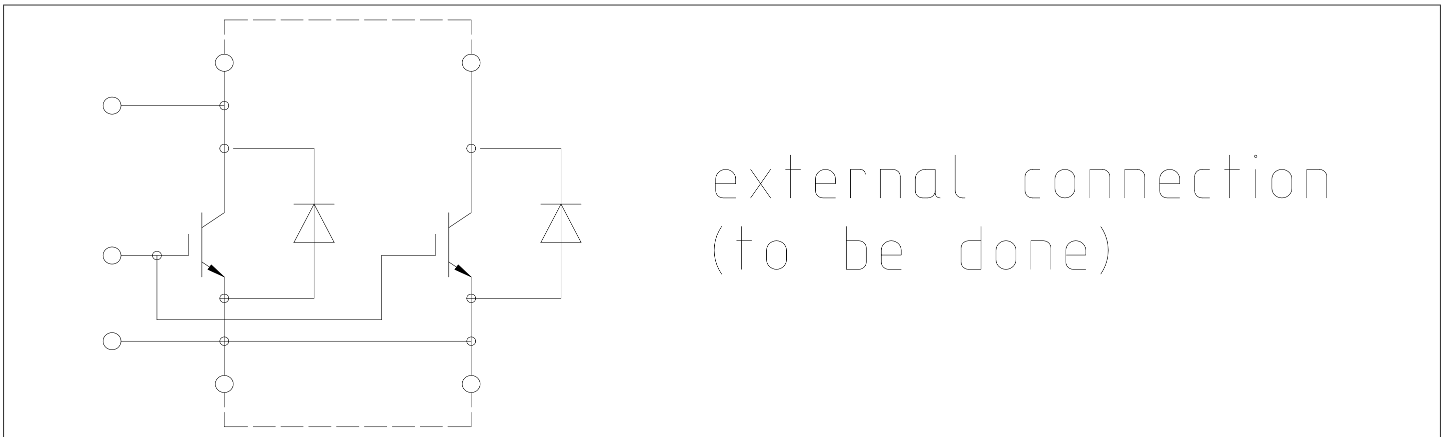


Table of contents

1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz	6.0	kV
Partial discharge extinction voltage	V_{isol}	RMS, f = 50 Hz, Q_{PD} ≤ 10 pC	2.6	kV
DC stability	$V_{CE(D)}$	T_{vj}=25°C, 100 Fit	2100	V
Material of module baseplate			AlSiC	
Creepage distance	d_{Creep}	terminal to heatsink	32.2	mm
Clearance	d_{Clear}	terminal to heatsink	19.1	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}				9		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C=25°C, per switch			0.12		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C=25°C, per switch			0.2		mΩ
Storage temperature	T_{stg}			-40		150	°C
Mounting torque for modul 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	M4, Screw	1.8		2.1	Nm
			M8, Screw	8		10	
Weight	G				800		g

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = -40 °C	3300	V
			T_{vj} = 150 °C	3300	
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 150 °C	T_C = 105 °C	825	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		1650	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 4 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	I_C = 825 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.40	2.65	V
			T_{vj} = 125 °C		3.00		
			T_{vj} = 150 °C		3.13	3.28	
Gate threshold voltage	V_{GEth}	I_C = 32 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.20	5.80	6.40	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CE} = 1800 V			14		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1.5		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			93.5		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			2.67		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 3300 V, V_{GE} = 0 V	T_{vj} = 25 °C			5	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				400	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 825 A, V_{CE} = 1800 V, V_{GE} = ±15 V, R_{Gon} = 0.5 Ω	T_{vj} = 25 °C		0.560		µs
			T_{vj} = 125 °C		0.605		
			T_{vj} = 150 °C		0.615		
Rise time (inductive load)	t_r	I_C = 825 A, V_{CE} = 1800 V, V_{GE} = ±15 V, R_{Gon} = 0.5 Ω	T_{vj} = 25 °C		0.130		µs
			T_{vj} = 125 °C		0.150		
			T_{vj} = 150 °C		0.160		
Turn-off delay time (inductive load)	t_{doff}	I_C = 825 A, V_{CE} = 1800 V, V_{GE} = ±15 V, R_{Goff} = 7 Ω	T_{vj} = 25 °C		3.200		µs
			T_{vj} = 125 °C		3.450		
			T_{vj} = 150 °C		3.500		
Fall time (inductive load)	t_f	I_C = 825 A, V_{CE} = 1800 V, V_{GE} = ±15 V, R_{Goff} = 7 Ω	T_{vj} = 25 °C		0.900		µs
			T_{vj} = 125 °C		1.450		
			T_{vj} = 150 °C		1.650		
Turn-on energy loss per pulse	E_{on}	I_C = 825 A, V_{CE} = 1800 V, L_σ = 85 nH, V_{GE} = ±15 V, R_{Gon} = 0.5 Ω, di/dt = 4700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		920		mJ
			T_{vj} = 125 °C		1450		
			T_{vj} = 150 °C		1630		
Turn-off energy loss per pulse	E_{off}	I_C = 825 A, V_{CE} = 1800 V, L_σ = 85 nH, V_{GE} = ±15 V, R_{Goff} = 7 Ω, dv/dt = 1700 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1100		mJ
			T_{vj} = 125 °C		1470		
			T_{vj} = 150 °C		1580		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 2400 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 10 µs, T_{vj} ≤ 150 °C		3600		A
Thermal resistance, junction to case	R_{thJC}	per IGBT				18.0	K/kW

Table 4 **Characteristic values (continued)**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, λ_{grease}= 1 W/(m*K)		7.17		K/kW
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

3 Diode, Inverter

Table 5 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = -40 °C	3300	V
			T_{vj} = 150 °C	3300	
Continous DC forward current	I_F			825	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1650	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	280	kA^2s
			T_{vj} = 150 °C	253	
Maximum power dissipation	P_{RQM}	T_{vj} = 150 °C		2400	kW
Minimum turn-on time	t_{onmin}			10	µs

Table 6 **Characteristic values**

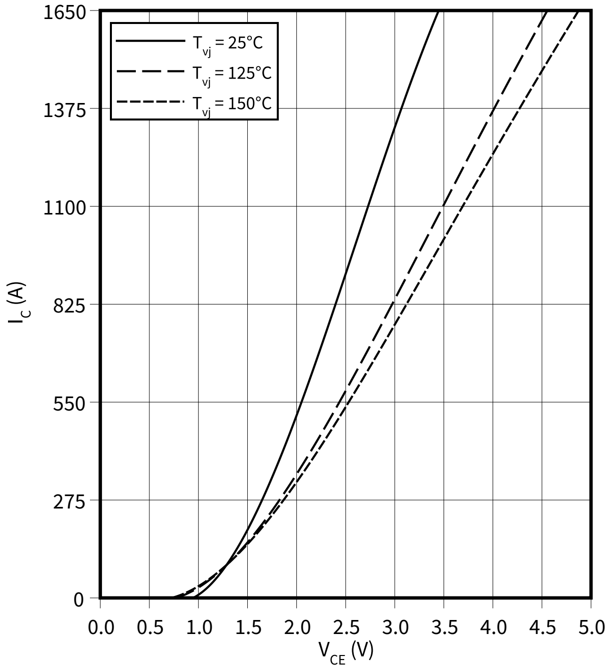
Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 825 A, V_{GE} = 0 V	T_{vj} = 25 °C		2.55	2.95	V
			T_{vj} = 125 °C		2.30		
			T_{vj} = 150 °C		2.20	2.50	
Peak reverse recovery current	I_{RM}	V_R = 1800 V, I_F = 825 A, V_{GE} = -15 V, -di$_F$/dt = 4700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1180		A
			T_{vj} = 125 °C		1240		
			T_{vj} = 150 °C		1250		
Recovered charge	Q_r	V_R = 1800 V, I_F = 825 A, V_{GE} = -15 V, -di$_F$/dt = 4700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		430		µC
			T_{vj} = 125 °C		830		
			T_{vj} = 150 °C		970		
Reverse recovery energy	E_{rec}	V_R = 1800 V, I_F = 825 A, V_{GE} = -15 V, -di$_F$/dt = 4700 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		390		mJ
			T_{vj} = 125 °C		875		
			T_{vj} = 150 °C		1050		

Table 6 **Characteristic values (continued)**

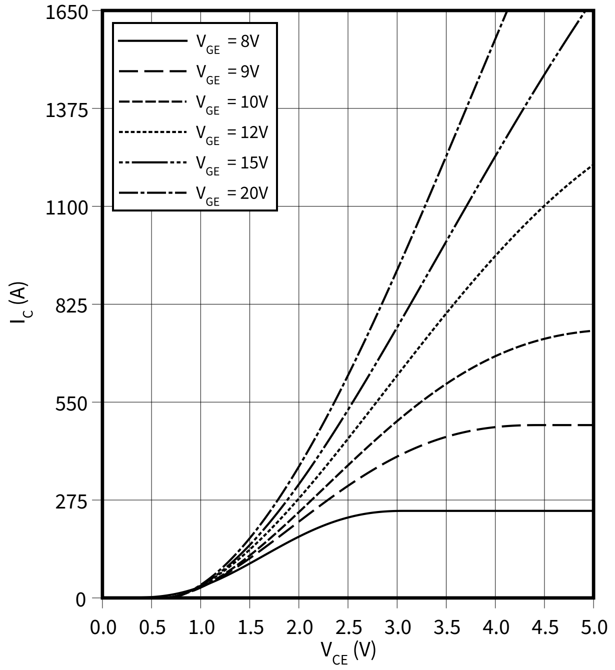
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction to case	R_{thJC}	per diode			25.2	K/kW
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)		9.43		K/kW
Temperature under switching conditions	$T_{vj\ op}$		-40		150	°C

4 Characteristics diagrams

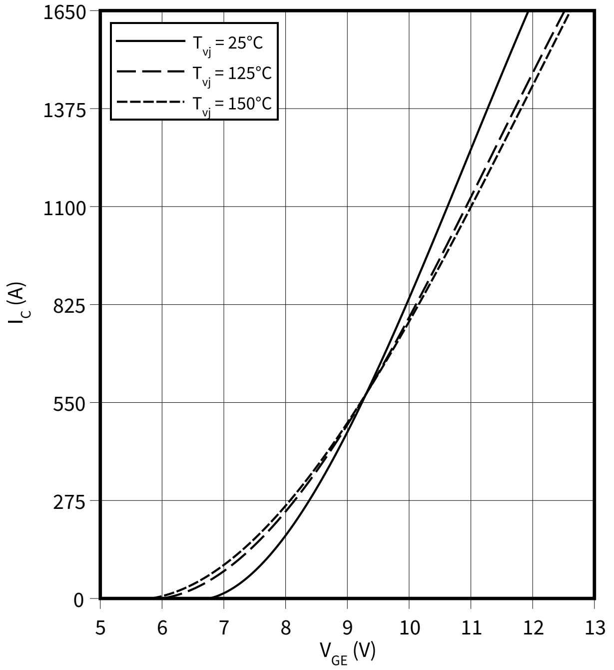
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



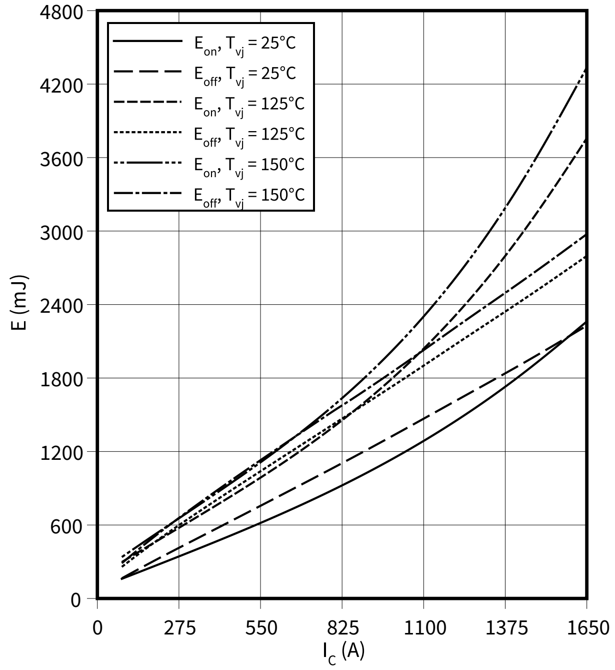
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



transfer characteristic (typical), IGBT, Inverter
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



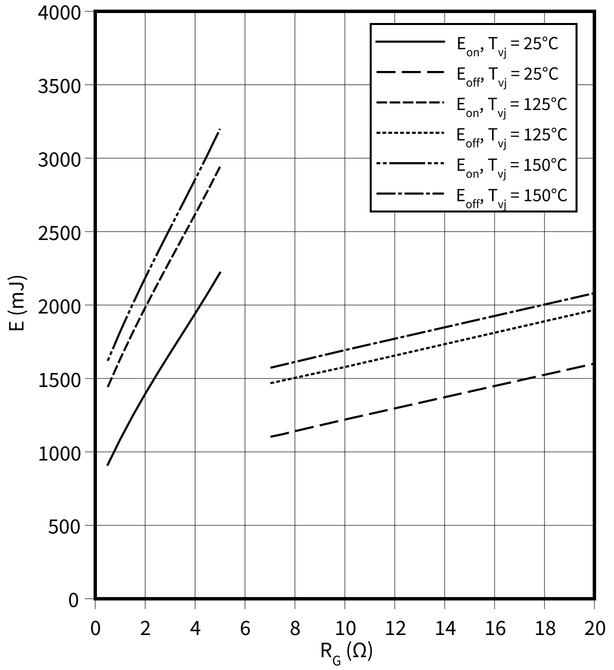
switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 7\ \Omega$, $R_{Gon} = 0.5\ \Omega$, $V_{CE} = 1800\ V$, $V_{GE} = \pm\ 15\ V$



switching losses (typical), IGBT, Inverter

$E = f(R_G)$

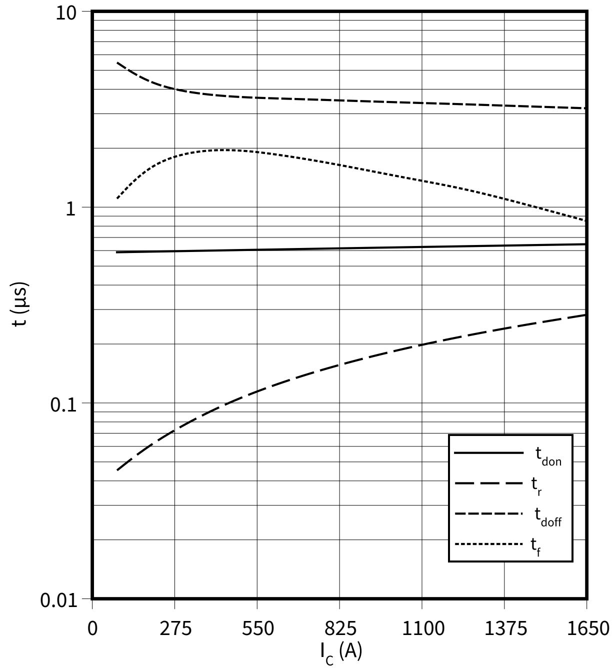
$I_C = 825$ A, $V_{CE} = 1800$ V, $V_{GE} = \pm 15$ V



switching times (typical), IGBT, Inverter

$t = f(I_C)$

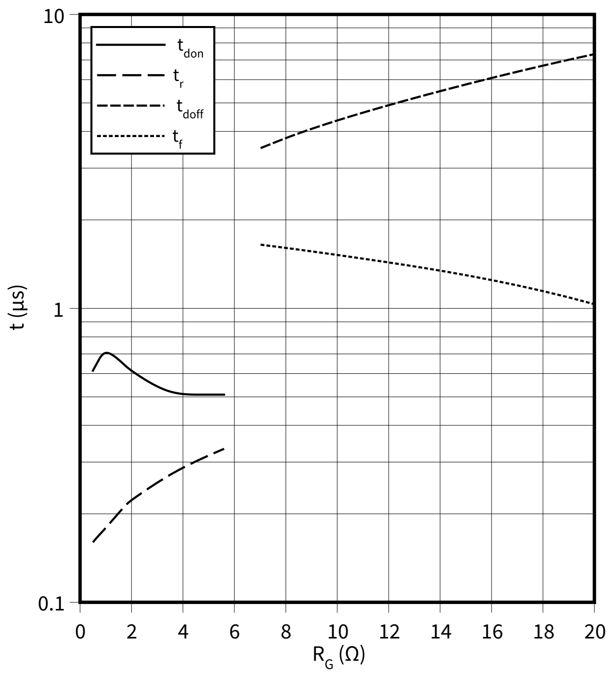
$R_{Goff} = 7$ Ω, $R_{Gon} = 0.5$ Ω, $V_{CE} = 1800$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



switching times (typical), IGBT, Inverter

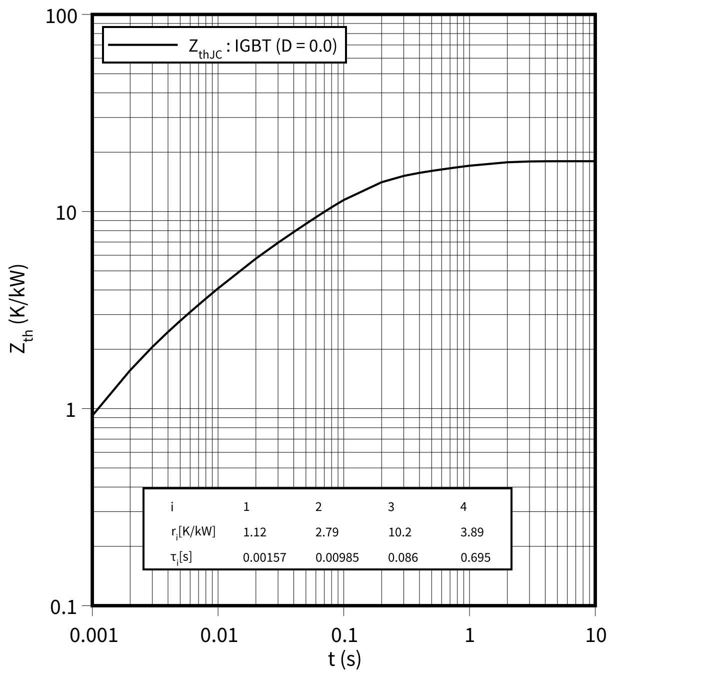
$t = f(R_G)$

$I_C = 825$ A, $V_{CE} = 1800$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



transient thermal impedance , IGBT, Inverter

$Z_{th} = f(t)$

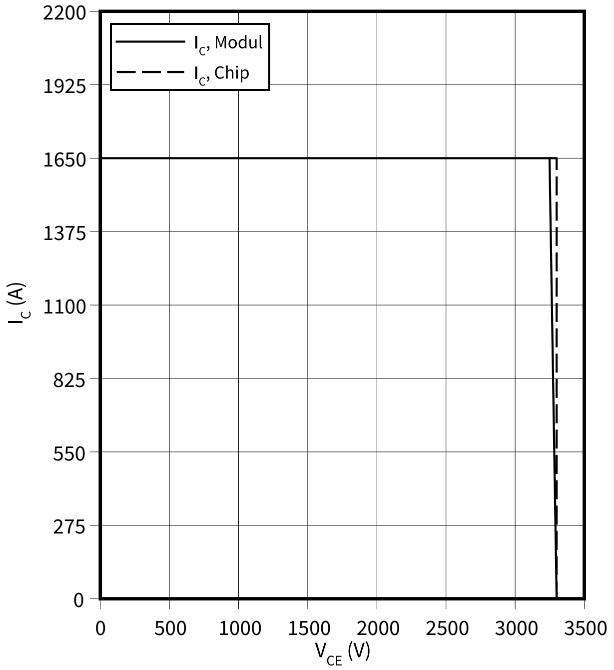


i	1	2	3	4
r_i[K/kW]	1.12	2.79	10.2	3.89
τ_i[s]	0.00157	0.00985	0.086	0.695

reverse bias safe operating area (RBSOA), IGBT, Inverter

$I_C = f(V_{CE})$

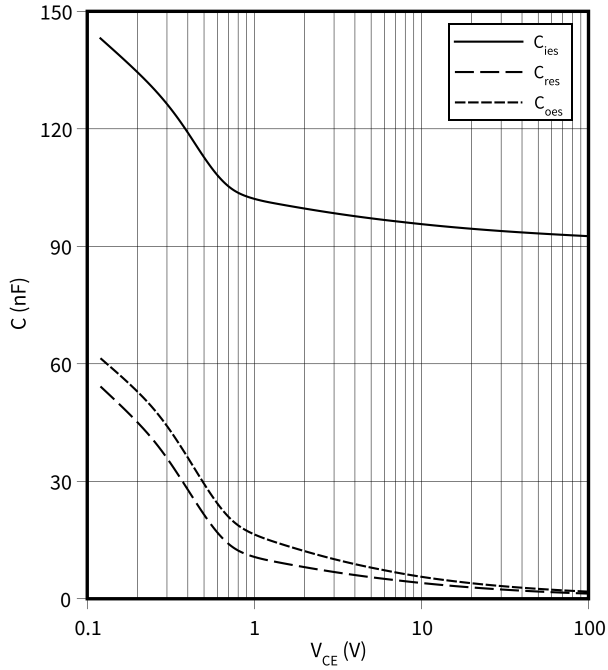
$R_{Goff} = 7\ \Omega$, $V_{GE} = 15\ V$, $T_{vj} = 150\ °C$



capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

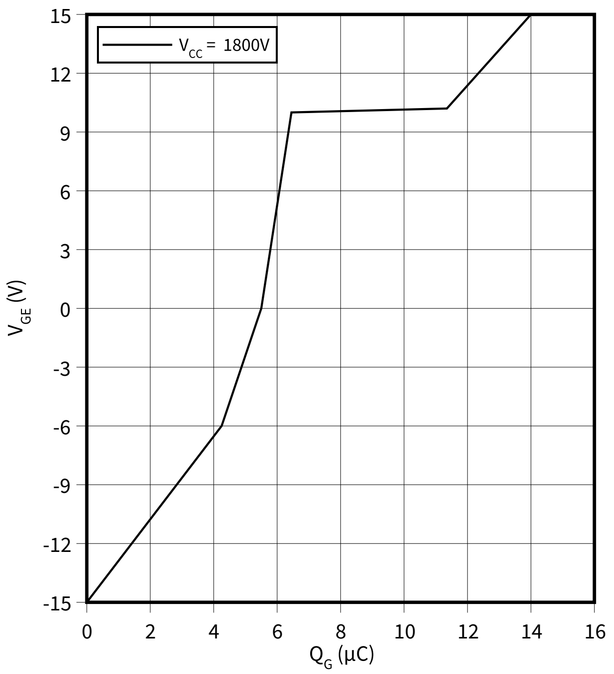
$f = 1000\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



gate charge characteristic (typical), IGBT, Inverter

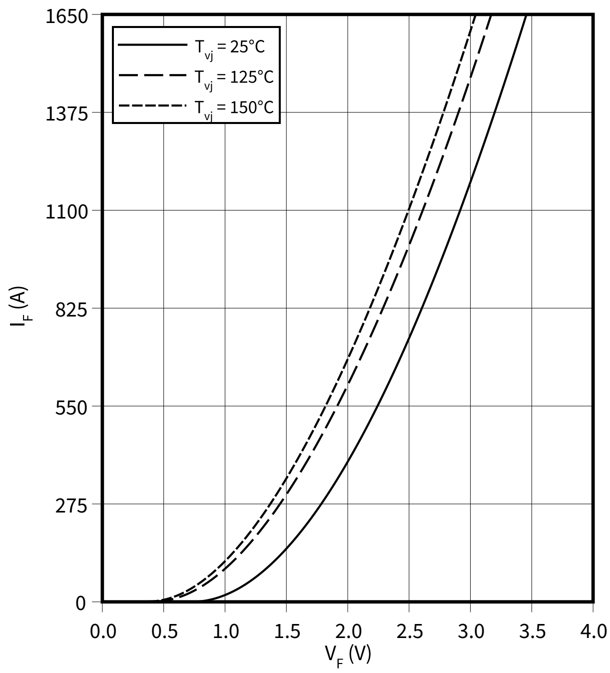
$V_{GE} = f(Q_G)$

$I_C = 825\ A$, $T_{vj} = 25\ °C$



forward characteristic of (typical), Diode, Inverter

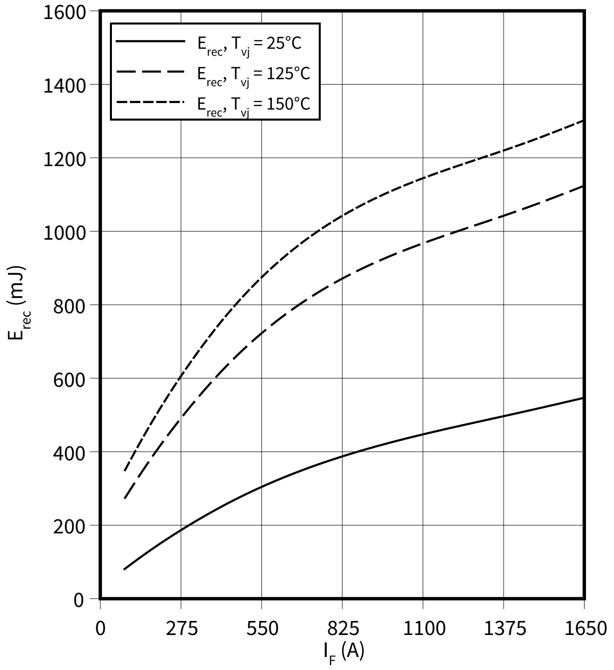
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

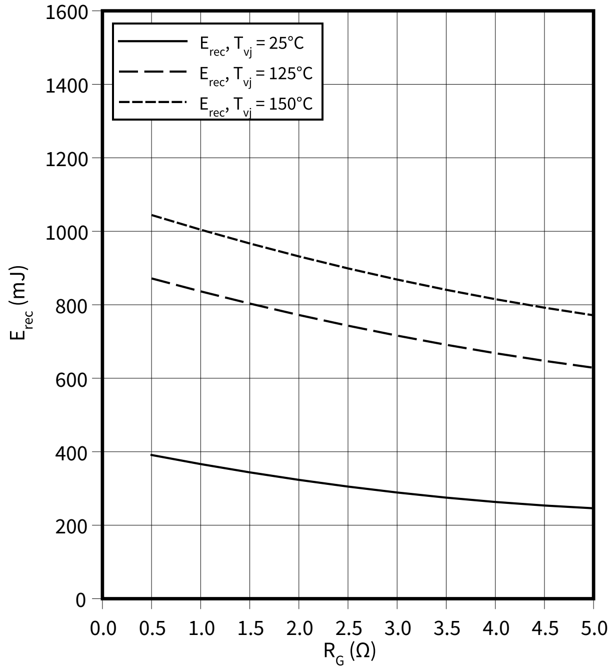
$V_{CE} = 1800\ V$, $R_{Gon} = R_{Gon}(IGBT)$



switching losses (typical), Diode, Inverter

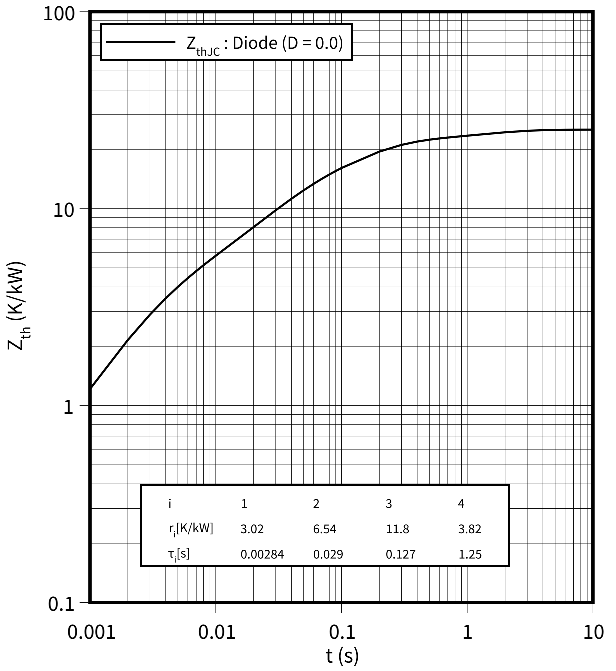
$E_{rec} = f(R_G)$

$V_{CE} = 1800\ V$, $I_F = 825\ A$



transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$

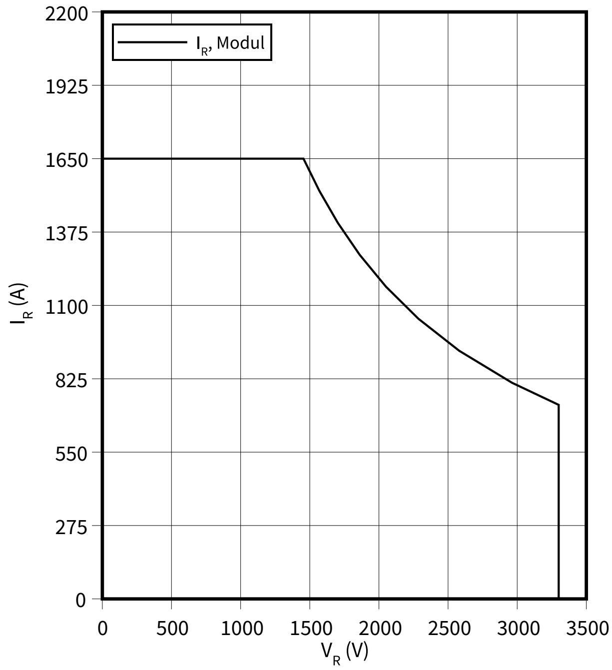


i	1	2	3	4
r_i[K/kW]	3.02	6.54	11.8	3.82
τ_i[s]	0.00284	0.029	0.127	1.25

safe operation area (SOA), Diode, Inverter

$I_R = f(V_R)$

$T_{vj} = 150\ °C$



5 Circuit diagram

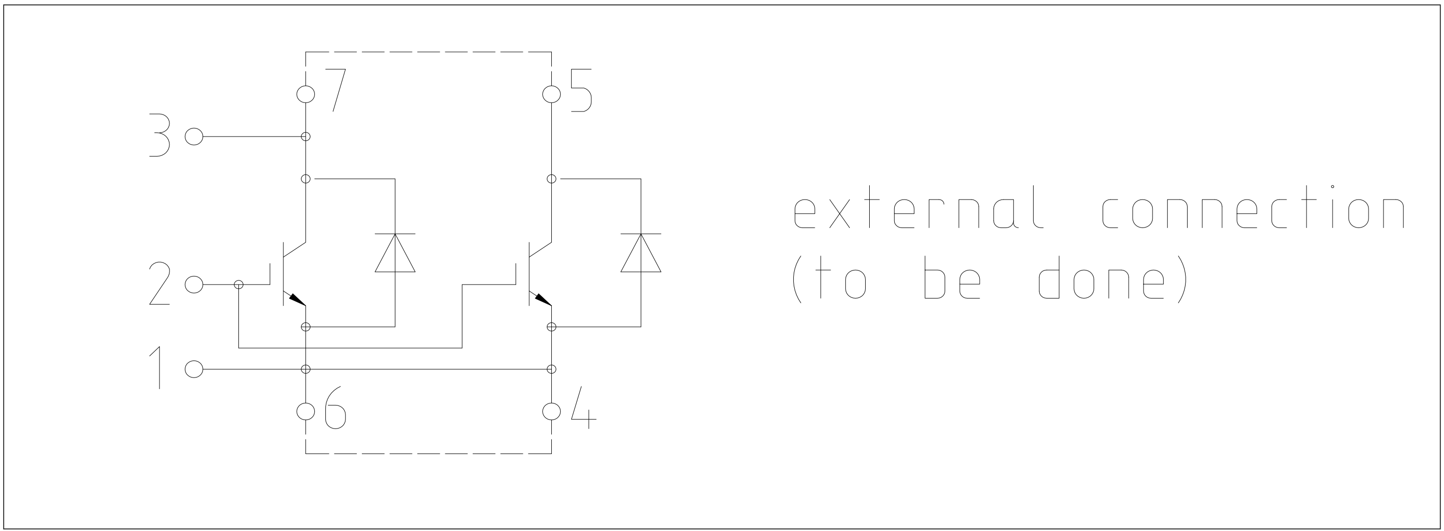


Figure 2

6 Package outlines

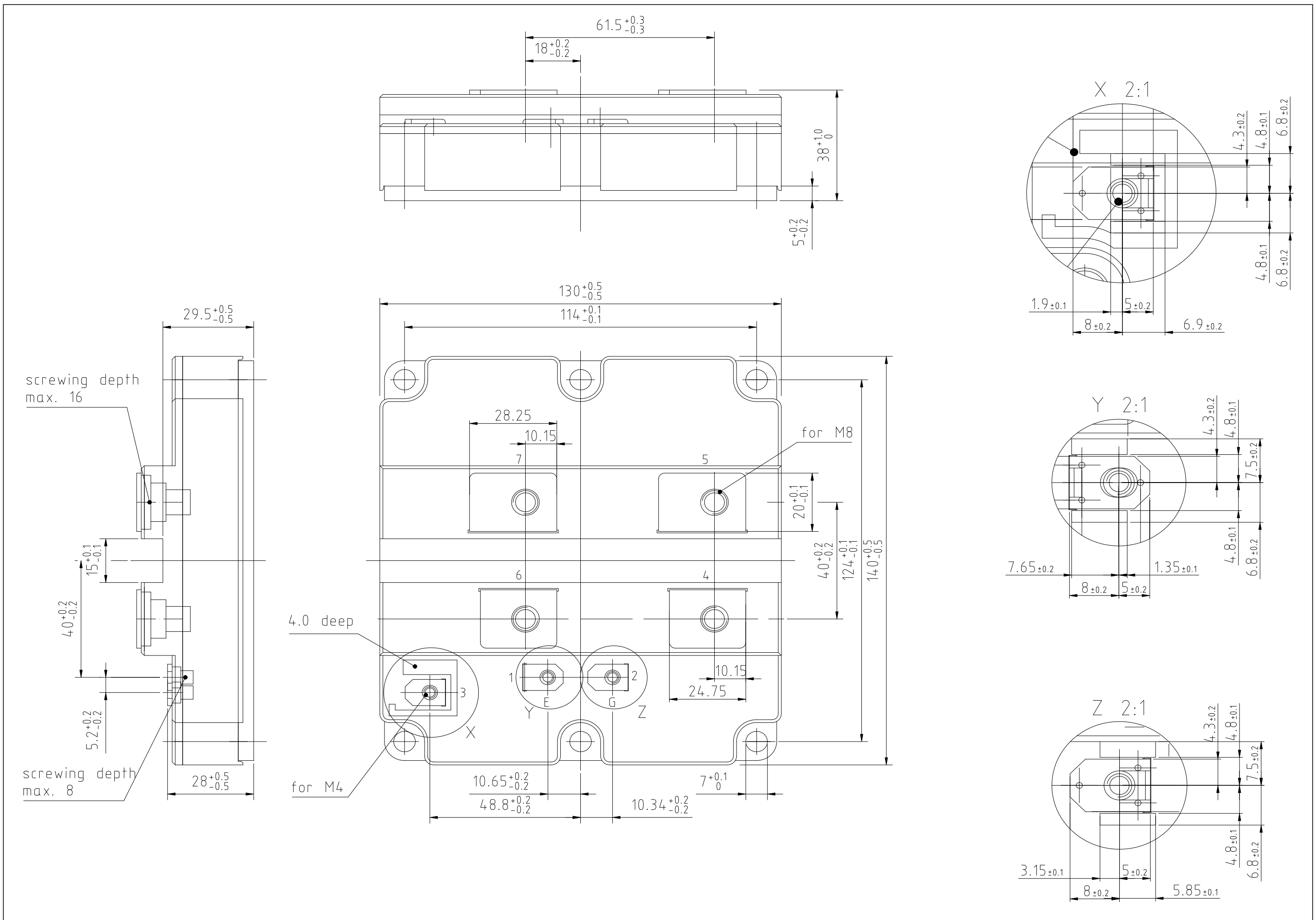


Figure 3

7 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	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	71549142846550549911530		71549142846550549911530

Figure 4

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