

Preliminary datasheet

62 mm C-Series module with Trench/Fieldstop IGBT4 and Emitter Controlled 4 diode

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{nom}} = 600\text{ A} / I_{CRM} = 1200\text{ A}$
 - Unbeatable robustness
 - Extended operating temperature $T_{vj\text{op}}$
 - Low switching losses
 - Low V_{CESat}
 - V_{CESat} with positive temperature coefficient
- Mechanical features
 - 4 kV AC 1 min insulation
 - Package with CTI > 400
 - High creepage and clearance distances
 - High power density
 - Isolated base plate
 - Standard housing



Potential applications

- High power converters
- Motor drives
- UPS systems
- Wind turbines

Product validation

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

Description

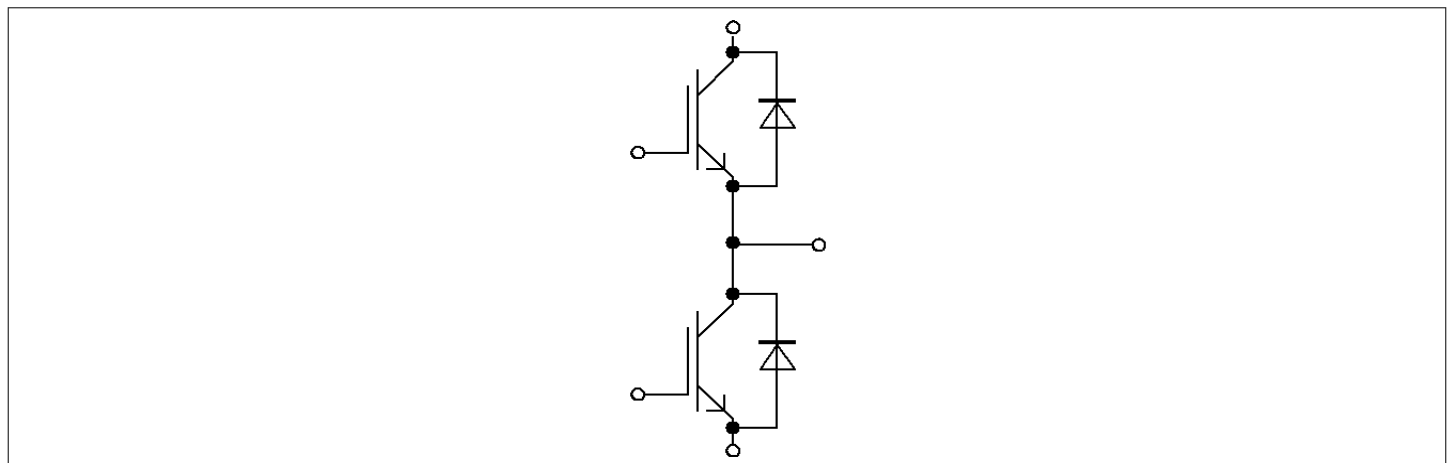


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Material of module baseplate			Cu	
Internal Isolation		basic insulation (class 1, IEC 61140)	Al2O3	
Comparative tracking index	CTI		> 400	
RTI Elec.	RTI	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	L_{sCE}			20		nH
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for modul mounting	M	- Mounting according to M6, Screw valid application note	3		6	Nm
Terminal connection torque	M	- Mounting according to M6, Screw valid application note	2.5		5	Nm

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	V_{CES}	$T_{vj} = 25\text{ °C}$	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\ max} = 175\text{ °C}$ $T_C = 100\text{ °C}$	600	A
Repetitive peak collector current	I_{CRM}	$t_P = 1\text{ ms}$	1200	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	$V_{CE\ sat}$	$I_C = 600\text{ A}, V_{GE} = 15\text{ V}$ $T_{vj} = 25\text{ °C}$ $T_{vj} = 125\text{ °C}$ $T_{vj} = 150\text{ °C}$		1.75	2.20	V
				2.00		
				2.05		
Gate threshold voltage	V_{GEth}	$I_C = 22.8\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25\text{ °C}$	5.25	5.80	6.35	V
Gate charge	Q_G	$V_{GE} = \pm 15\text{ V}, V_{CE} = 600\text{ V}$		5		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\text{ °C}$		1.3		Ω

Table 4 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Input capacitance	C_{ies}	$f = 1000 \text{ kHz}, T_{vj} = 25 \text{ }^\circ\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$		38		nF
Reverse transfer capacitance	C_{res}	$f = 1000 \text{ kHz}, T_{vj} = 25 \text{ }^\circ\text{C}, V_{CE} = 25 \text{ V}, V_{GE} = 0 \text{ V}$		1.4		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200 \text{ V}, V_{GE} = 0 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$			5	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0 \text{ V}, V_{GE} = 20 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$			400	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.62 \text{ } \Omega$		$T_{vj} = 25 \text{ }^\circ\text{C}$	0.170	μs
				$T_{vj} = 125 \text{ }^\circ\text{C}$	0.180	
				$T_{vj} = 150 \text{ }^\circ\text{C}$	0.180	
Rise time (inductive load)	t_r	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.62 \text{ } \Omega$		$T_{vj} = 25 \text{ }^\circ\text{C}$	0.046	μs
				$T_{vj} = 125 \text{ }^\circ\text{C}$	0.048	
				$T_{vj} = 150 \text{ }^\circ\text{C}$	0.052	
Turn-off delay time (inductive load)	t_{doff}	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 0.62 \text{ } \Omega$		$T_{vj} = 25 \text{ }^\circ\text{C}$	0.400	μs
				$T_{vj} = 125 \text{ }^\circ\text{C}$	0.500	
				$T_{vj} = 150 \text{ }^\circ\text{C}$	0.530	
Fall time (inductive load)	t_f	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 0.62 \text{ } \Omega$		$T_{vj} = 25 \text{ }^\circ\text{C}$	0.070	μs
				$T_{vj} = 125 \text{ }^\circ\text{C}$	0.160	
				$T_{vj} = 150 \text{ }^\circ\text{C}$	0.190	
Turn-on energy loss per pulse	E_{on}	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.62 \text{ } \Omega, di/dt = 11000 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ }^\circ\text{C})$		$T_{vj} = 25 \text{ }^\circ\text{C}$	16	mJ
				$T_{vj} = 125 \text{ }^\circ\text{C}$	29.5	
				$T_{vj} = 150 \text{ }^\circ\text{C}$	35.5	
Turn-off energy loss per pulse	E_{off}	$I_C = 600 \text{ A}, V_{CE} = 600 \text{ V}, L_\sigma = 35 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 0.62 \text{ } \Omega, dv/dt = 3600 \text{ V}/\mu\text{s} (T_{vj} = 150 \text{ }^\circ\text{C})$		$T_{vj} = 25 \text{ }^\circ\text{C}$	50	mJ
				$T_{vj} = 125 \text{ }^\circ\text{C}$	74	
				$T_{vj} = 150 \text{ }^\circ\text{C}$	82	
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}, V_{CC} = 800 \text{ V}, V_{CEmax} = V_{CES} - L_{sCE} * di/dt$	$t_p \leq 10 \text{ } \mu\text{s}, T_{vj} = 150 \text{ }^\circ\text{C}$		2600	A
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.0460	K/W
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m}^*\text{K})$			0.0226	K/W
Temperature under switching conditions	T_{vjop}			-40	150	$^\circ\text{C}$

3 Diode, Inverter

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25\text{ °C}$	1200	V	
Continuous DC forward current	I_F		600	A	
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$	1200	A	
I^2t - value	I^2t	$t_P = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$	35000	A^2s
			$T_{vj} = 150\text{ °C}$	33000	

Table 6 Characteristic values

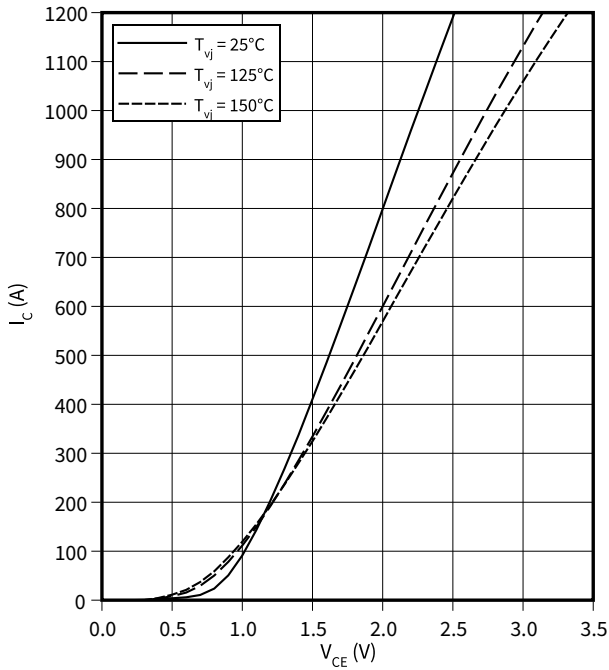
Parameter	Symbol	Note or test condition	Values			Unit			
			Min.	Typ.	Max.				
Forward voltage	V_F	$I_F = 600\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		1.85	2.45	V		
					$T_{vj} = 125\text{ °C}$			1.80	
						$T_{vj} = 150\text{ °C}$			1.75
Peak reverse recovery current	I_{RM}	$V_R = 600\text{ V}, I_F = 600\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11000\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$	535		A			
			$T_{vj} = 125\text{ °C}$	655					
			$T_{vj} = 150\text{ °C}$	680					
Recovered charge	Q_r	$V_R = 600\text{ V}, I_F = 600\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11000\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$	50.5		μC			
			$T_{vj} = 125\text{ °C}$	94					
			$T_{vj} = 150\text{ °C}$	110					
Reverse recovery energy	E_{rec}	$V_R = 600\text{ V}, I_F = 600\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11000\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$	27		mJ			
			$T_{vj} = 125\text{ °C}$	48.5					
			$T_{vj} = 150\text{ °C}$	54.5					
Thermal resistance, junction to case	R_{thJC}	per diode			0.0929	K/W			
Thermal resistance, case to heatsink	R_{thCH}	per diode, $\lambda_{grease} = 1\text{ W}/(\text{m}^*\text{K})$		0.0303		K/W			
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		150	$^{\circ}\text{C}$			

4 Characteristics diagrams

output characteristic (typical), IGBT, Inverter

$$I_C = f(V_{CE})$$

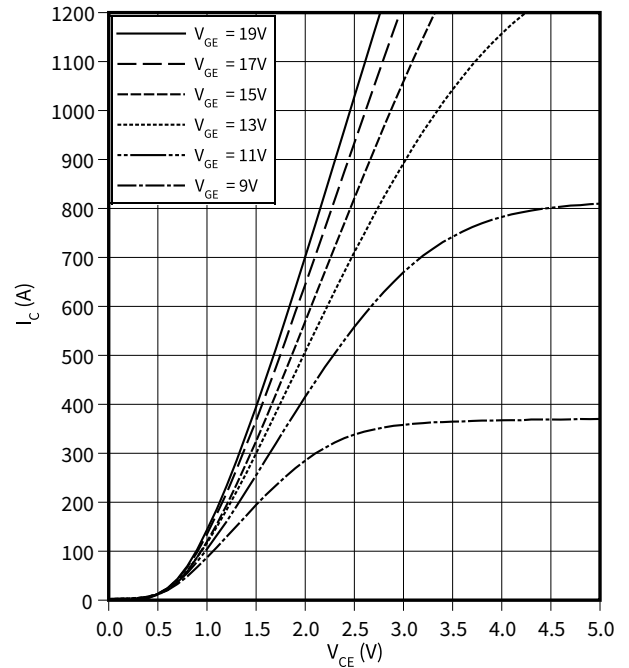
$$V_{GE} = 15 \text{ V}$$



output characteristic (typical), IGBT, Inverter

$$I_C = f(V_{CE})$$

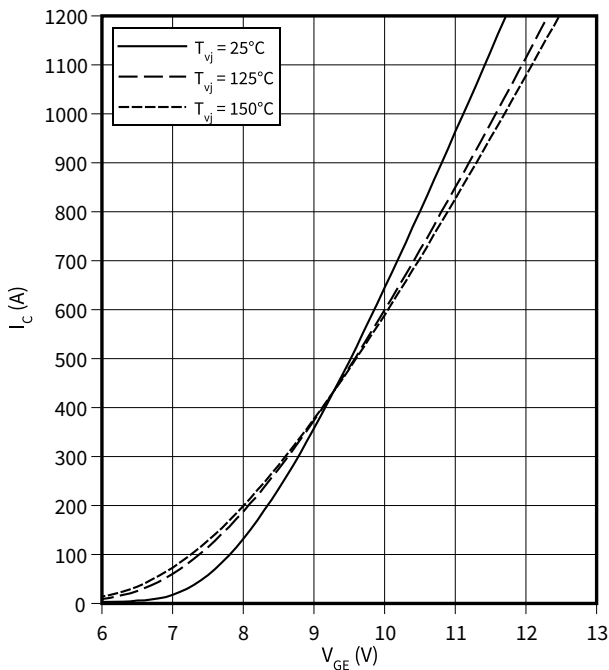
$$T_{vj} = 150 \text{ °C}$$



transfer characteristic (typical), IGBT, Inverter

$$I_C = f(V_{GE})$$

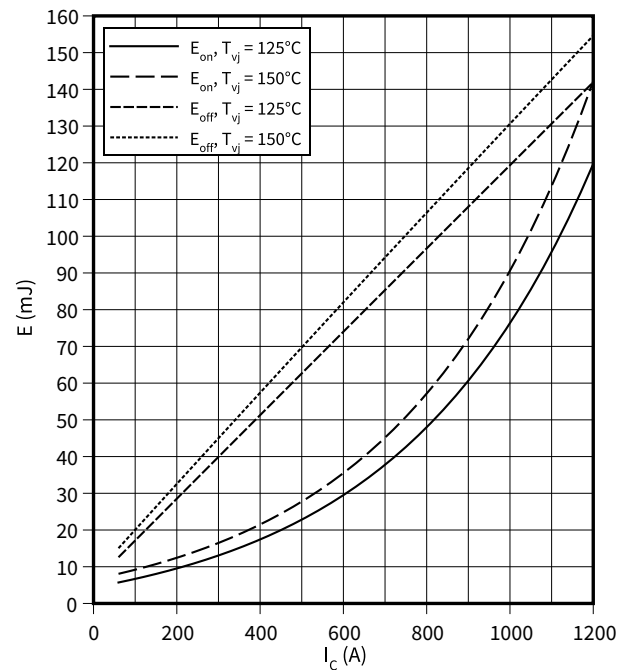
$$V_{CE} = 20 \text{ V}$$



switching losses (typical), IGBT, Inverter

$$E = f(I_C)$$

$$R_{Goff} = 0.62 \text{ } \Omega, R_{Gon} = 0.62 \text{ } \Omega, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$$

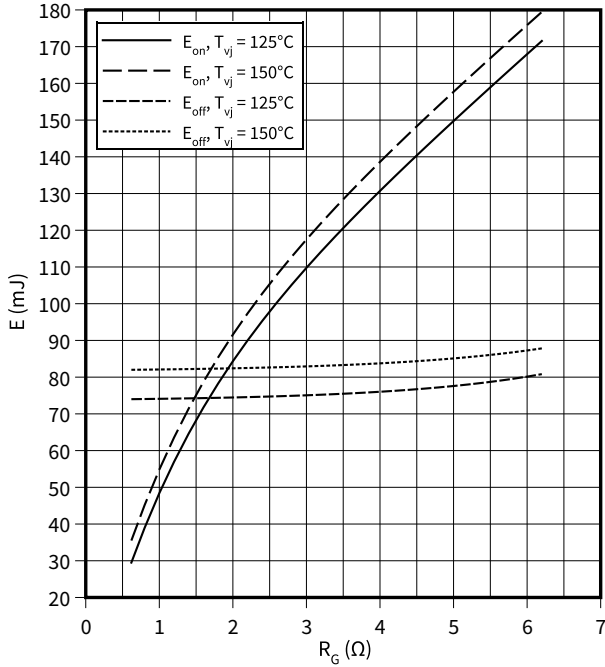


4 Characteristics diagrams

switching losses (typical), IGBT, Inverter

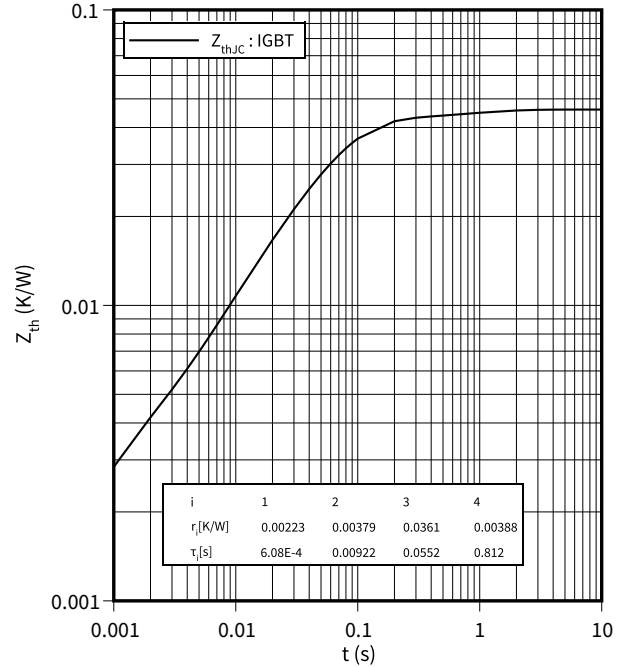
$E = f(R_G)$

$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



transient thermal impedance, IGBT, Inverter

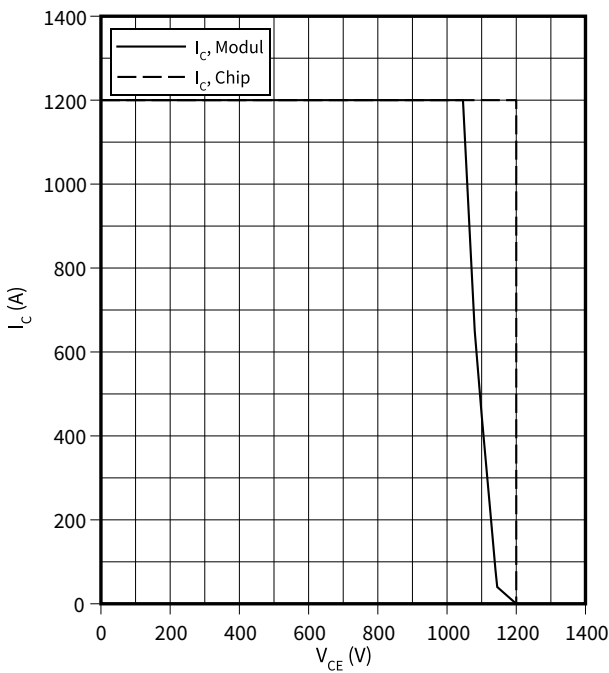
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

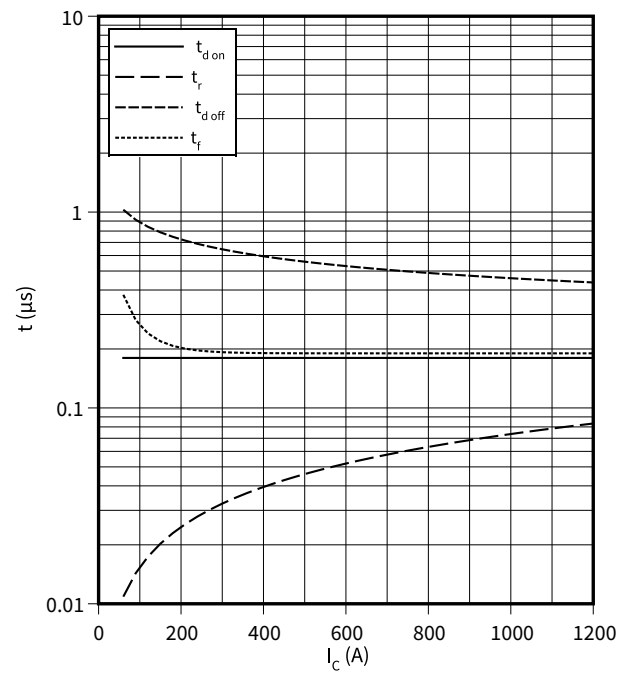
$R_{Goff} = 0.62 \Omega$, $V_{GE} = \pm 15.0 \text{ V}$, $T_{vj} = 150 \text{ °C}$



switching times (typical), IGBT, Inverter

$t = f(I_C)$

$R_{Goff} = 0.62 \Omega$, $R_{Gon} = 0.62 \Omega$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 150 \text{ °C}$

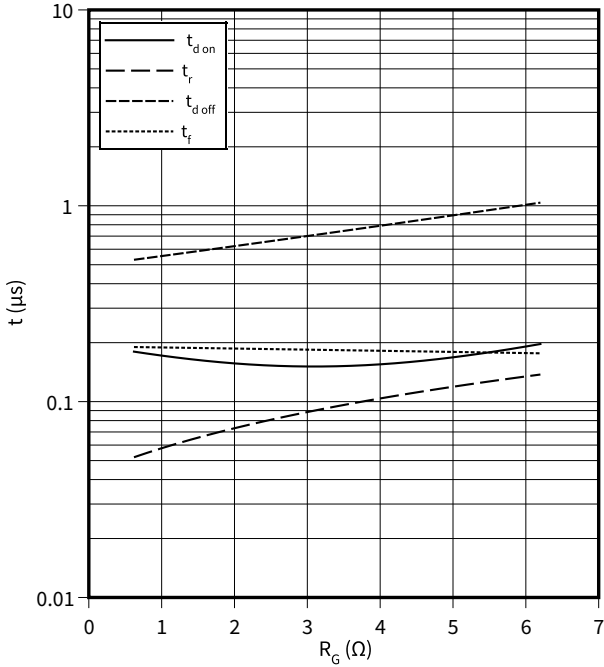


4 Characteristics diagrams

switching times (typical), IGBT, Inverter

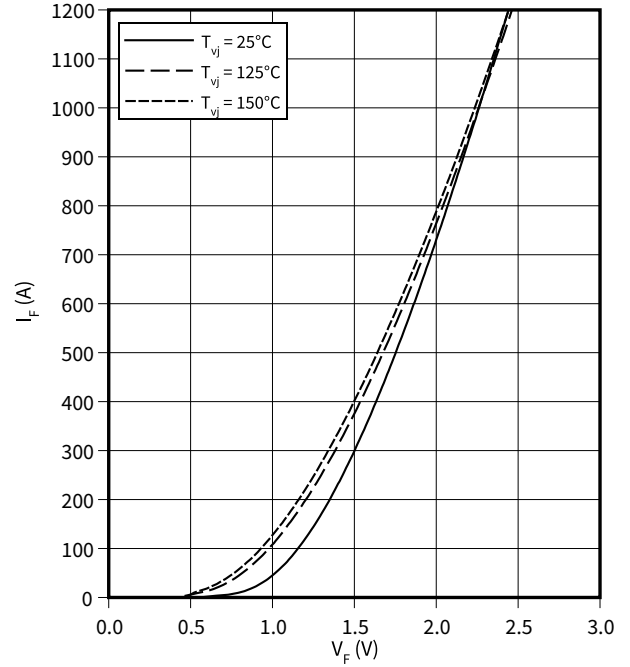
$t = f(R_G)$

$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 150 \text{ }^\circ\text{C}$



forward characteristic (typical), Diode, Inverter

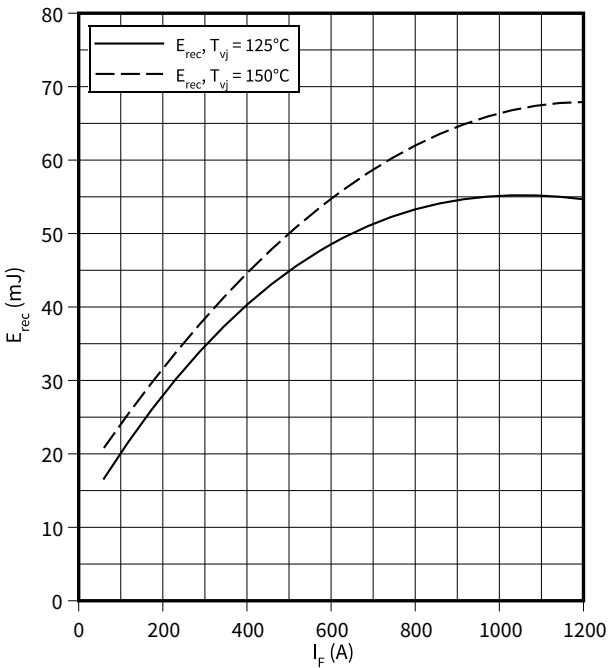
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

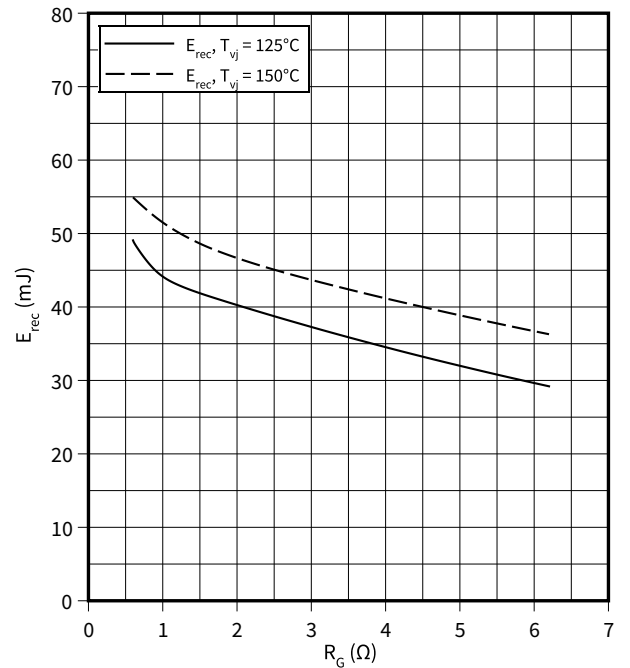
$V_{CE} = 600 \text{ V}$, $R_{Gon} = R_{Gon}(\text{IGBT})$



switching losses (typical), Diode, Inverter

$E_{rec} = f(R_G)$

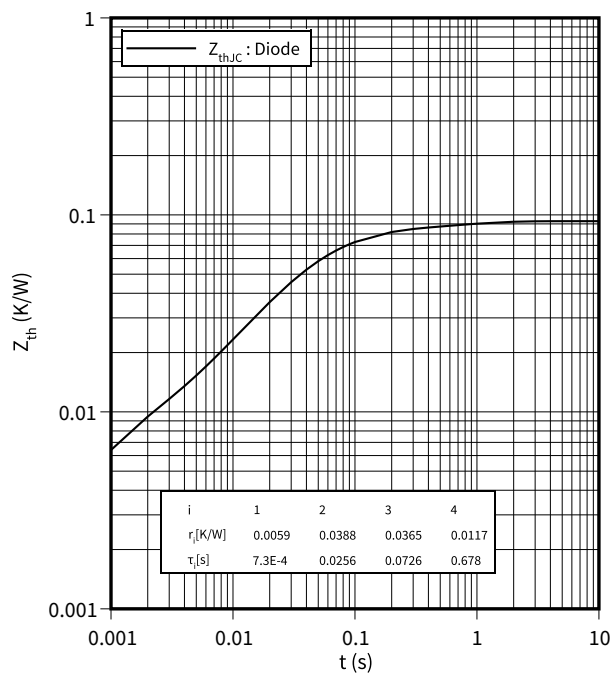
$V_{CE} = 600 \text{ V}$, $I_F = 600 \text{ A}$



4 Characteristics diagrams

transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



5 Circuit diagram

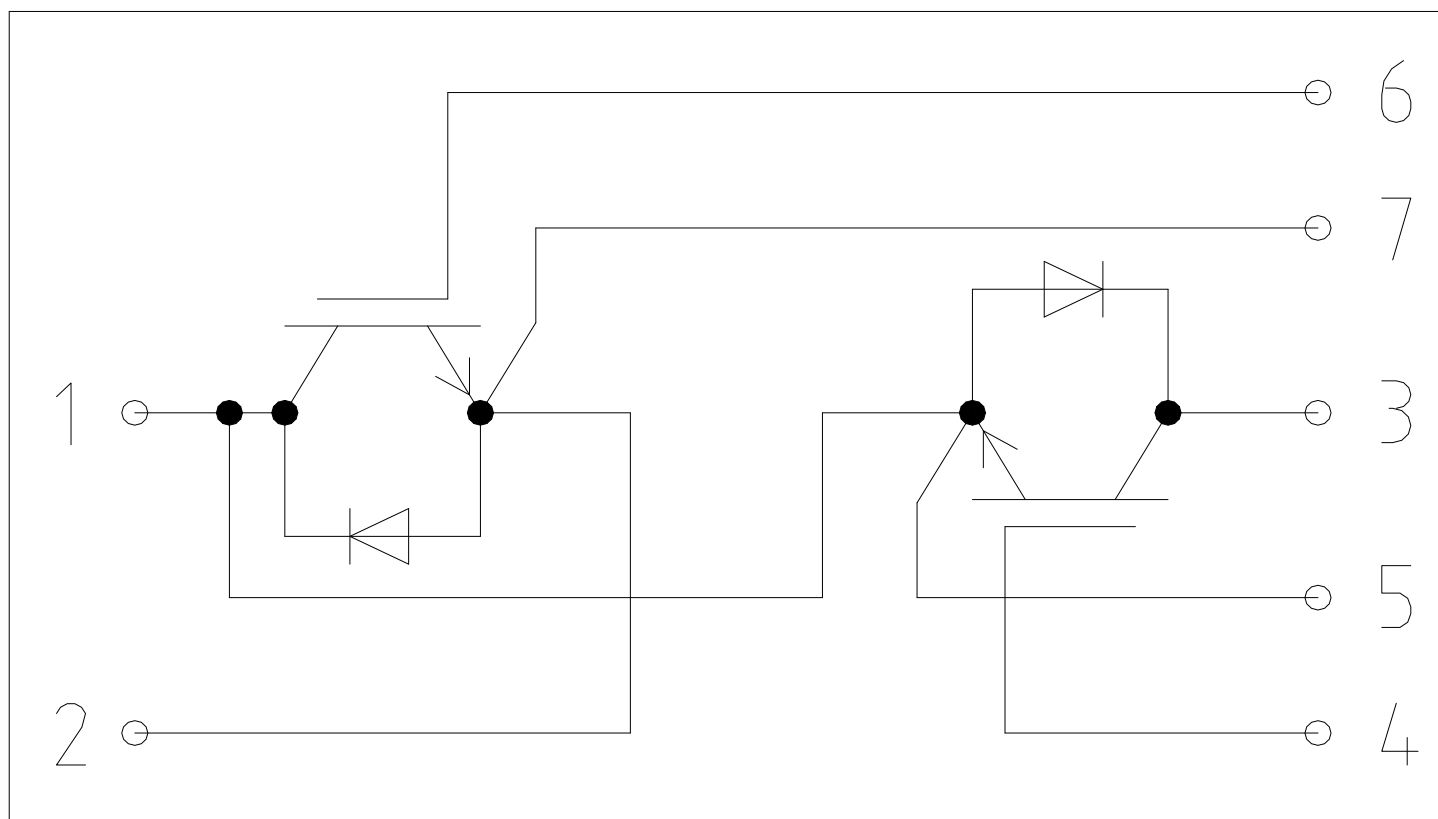


Figure 2

6 Package outlines

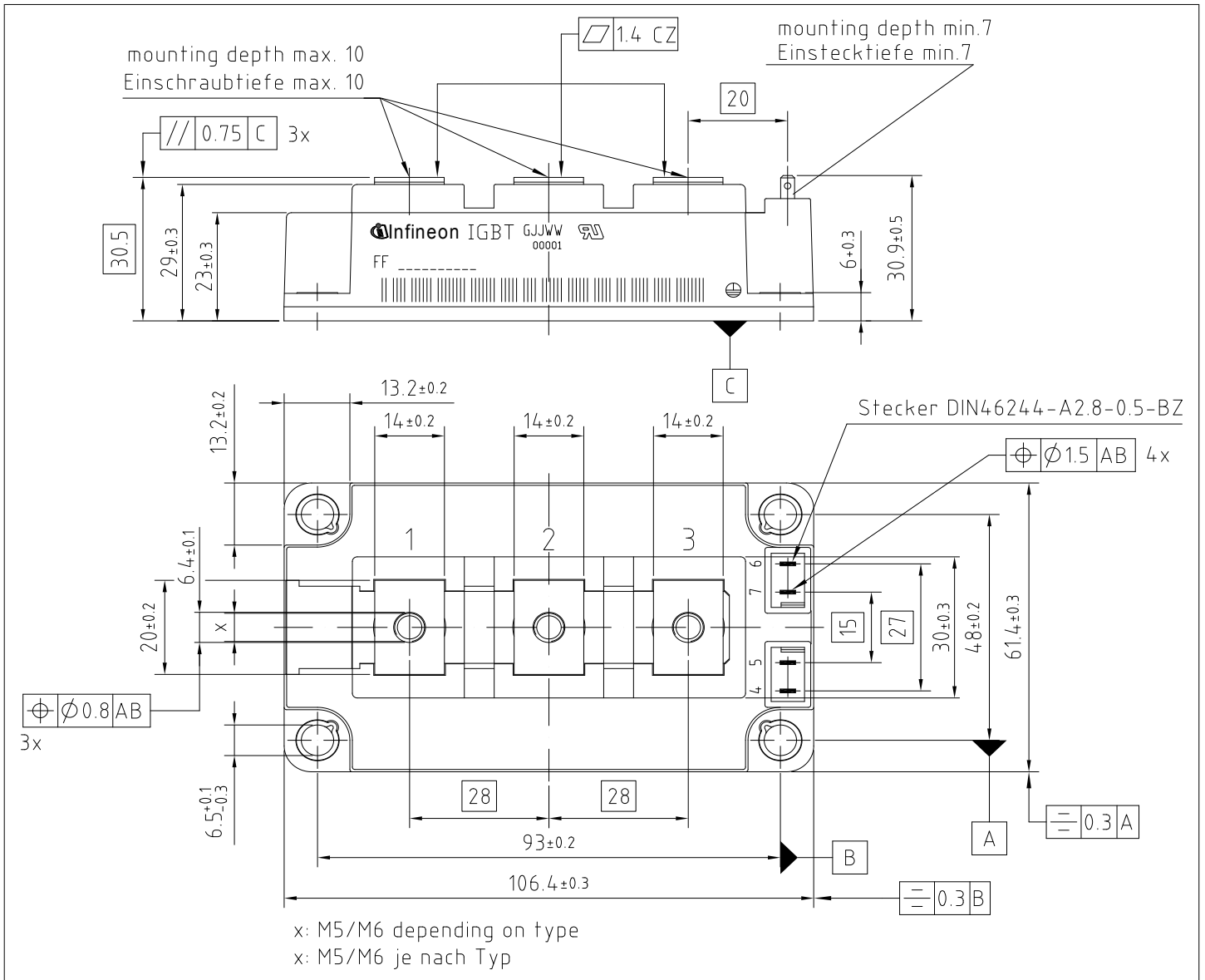


Figure 3

7 Module label code


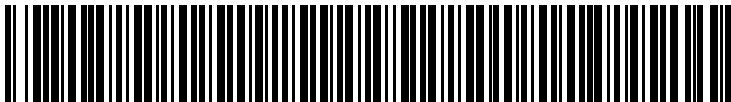
Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	Module serial number	1 - 5	71549
	Module material number	6 - 11	142846
	Production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

Figure 4

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[FF150R12KE3G](#) [FF200R06KE3](#) [FF200R06YE3](#) [FF300R06KE3_B2](#) [FF300R17ME4](#) [FF600R12IP4V](#) [FF800R17KP4_B2](#) [FF900R12IE4V](#)
[FP06R12W1T4_B3](#) [FP100R07N3E4](#) [FP100R07N3E4_B11](#) [FP10R06W1E3_B11](#) [FP10R12W1T4_B11](#) [FP10R12YT3](#) [FP15R12W2T4](#)
[FP15R12YT3](#) [FP20R06W1E3](#) [FP30R06W1E3](#) [FP40R12KT3G](#) [FP75R06KE3](#) [FS10R12YE3](#) [FS150R07PE4](#) [FS150R12PT4](#)
[FS150R17N3E4_B11](#) [FS20R06W1E3_B11](#) [FS30R06W1E3_B11](#) [FS75R12KE3G](#) [FS75R12W2T4_B11](#) [FZ1600R17HP4_B2](#)
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[25R12KT4G](#) [F3L200R12W2H3_B11](#) [F3L300R12ME4_B22](#) [F3L75R07W2E3_B11](#) [F4-150R12KS4](#) [F475R07W1H3B11ABOMA1](#)
[FD1400R12IP4D](#)