

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

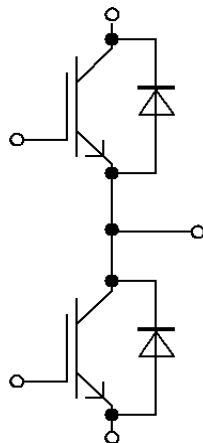


Table of contents

	Description	1
	Features	1
	Potential applications	1
	Product validation	1
	Table of contents	2
1	Package	3
2	IGBT, Inverter	3
3	Diode, Inverter	5
4	Characteristics diagrams	6
5	Circuit diagram	10
6	Package outlines	11
7	Module label code	12
	Disclaimer	13

1 Package

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)	Al ₂ O ₃	
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
Continuous DC collector current	I_{CDC}	$T_{vj\text{ max}} = 175\text{ °C}$ $T_C = 100\text{ °C}$	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	$V_{CE\text{ sat}}$	$I_C = 600\text{ A}$, $V_{GE} = 15\text{ V}$ $T_{vj} = 25\text{ °C}$ $T_{vj} = 125\text{ °C}$ $T_{vj} = 150\text{ °C}$		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}	$f = 1000 \text{ kHz}$, $T_{vj} = 25^\circ\text{C}$, $V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$		38		nF
Reverse transfer capacitance	C_{res}	$f = 1000 \text{ kHz}$, $T_{vj} = 25^\circ\text{C}$, $V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$		1.4		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200 \text{ V}$, $V_{GE} = 0 \text{ V}$ $T_{vj} = 25^\circ\text{C}$			5	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = 20 \text{ V}$, $T_{vj} = 25^\circ\text{C}$			400	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.62 \Omega$		$T_{vj} = 25^\circ\text{C}$ 0.170		μs
				$T_{vj} = 125^\circ\text{C}$ 0.180		
				$T_{vj} = 150^\circ\text{C}$ 0.180		
Rise time (inductive load)	t_r	$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.62 \Omega$		$T_{vj} = 25^\circ\text{C}$ 0.046		μs
				$T_{vj} = 125^\circ\text{C}$ 0.048		
				$T_{vj} = 150^\circ\text{C}$ 0.052		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 0.62 \Omega$		$T_{vj} = 25^\circ\text{C}$ 0.400		μs
				$T_{vj} = 125^\circ\text{C}$ 0.500		
				$T_{vj} = 150^\circ\text{C}$ 0.530		
Fall time (inductive load)	t_f	$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 0.62 \Omega$		$T_{vj} = 25^\circ\text{C}$ 0.070		μs
				$T_{vj} = 125^\circ\text{C}$ 0.160		
				$T_{vj} = 150^\circ\text{C}$ 0.190		
Turn-on energy loss per pulse	E_{on}	$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $L_\sigma = 35 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.62 \Omega$, $di/dt = 11000 \text{ A}/\mu\text{s}$ ($T_{vj} = 150^\circ\text{C}$)		$T_{vj} = 25^\circ\text{C}$ 16		mJ
				$T_{vj} = 125^\circ\text{C}$ 29.5		
				$T_{vj} = 150^\circ\text{C}$ 35.5		
Turn-off energy loss per pulse	E_{off}	$I_C = 600 \text{ A}$, $V_{CE} = 600 \text{ V}$, $L_\sigma = 35 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 0.62 \Omega$, $dv/dt = 3600 \text{ V}/\mu\text{s}$ ($T_{vj} = 150^\circ\text{C}$)		$T_{vj} = 25^\circ\text{C}$ 50		mJ
				$T_{vj} = 125^\circ\text{C}$ 74		
				$T_{vj} = 150^\circ\text{C}$ 82		
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$ $t_P \leq 10 \mu\text{s}$, $T_{vj} = 150^\circ\text{C}$		2600		A
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.0460	K/W
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, $\lambda_{grease} = 1 \text{ W}/(\text{m}^2\text{K})$		0.0226		K/W
Temperature under switching conditions	$T_{vj op}$		-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	$t_P = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$	A^2s
			$T_{vj} = 150\text{ °C}$	
			35000	
			33000	

Table 6 Characteristic values

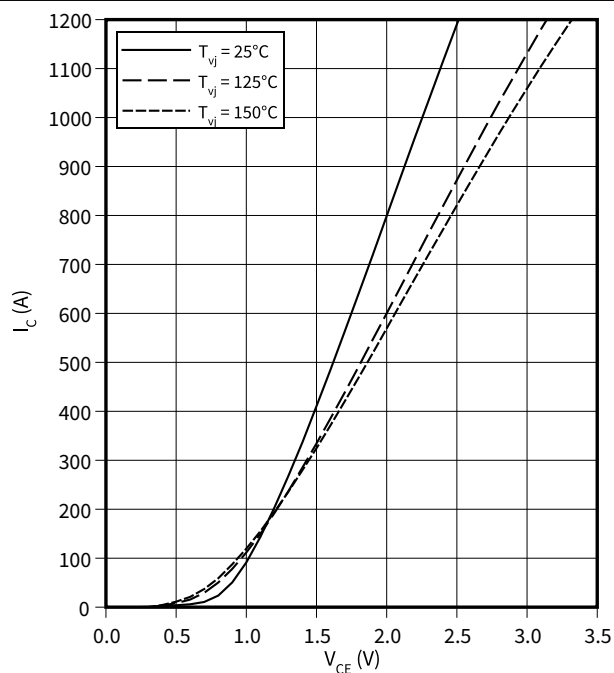
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 600\text{ A}, V_{GE} = 0\text{ V}$		$T_{vj} = 25\text{ °C}$	1.85	V
				$T_{vj} = 125\text{ °C}$	2.45	
				$T_{vj} = 150\text{ °C}$	1.80	
Peak reverse recovery current	I_{RM}	$V_R = 600\text{ V}, I_F = 600\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11000\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$		$T_{vj} = 25\text{ °C}$	1.75	A
				$T_{vj} = 125\text{ °C}$	535	
				$T_{vj} = 150\text{ °C}$	655	
Recovered charge	Q_r	$V_R = 600\text{ V}, I_F = 600\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11000\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$		$T_{vj} = 25\text{ °C}$	680	μC
				$T_{vj} = 125\text{ °C}$	50.5	
				$T_{vj} = 150\text{ °C}$	94	
Reverse recovery energy	E_{rec}	$V_R = 600\text{ V}, I_F = 600\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11000\text{ A}/\mu\text{s} (T_{vj} = 150\text{ °C})$		$T_{vj} = 25\text{ °C}$	110	mJ
				$T_{vj} = 125\text{ °C}$	27	
				$T_{vj} = 150\text{ °C}$	48.5	
Thermal resistance, junction to case	R_{thJC}	per diode			0.0929	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, $\lambda_{grease} = 1\text{ W}/(\text{m}^2\text{K})$			0.0303	K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		150	°C

4 Characteristics diagrams

output characteristic (typical), IGBT, Inverter

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

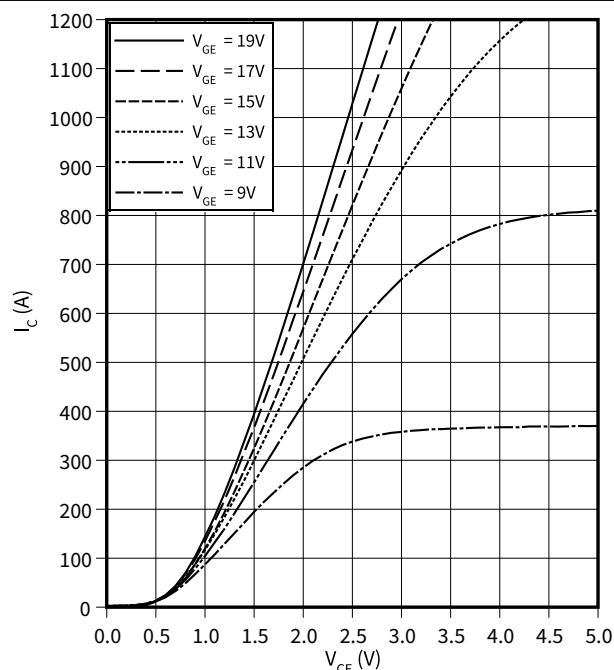
$$V_{GE} = 15 \text{ V}$$



output characteristic (typical), IGBT, Inverter

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

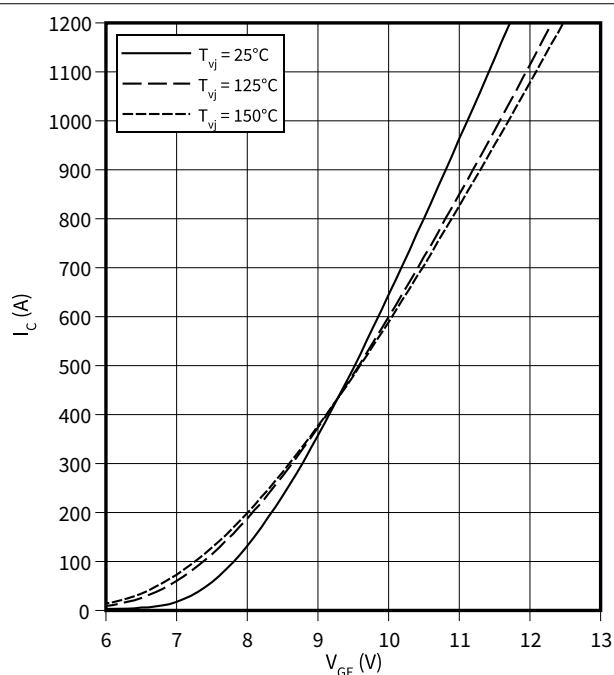
$$T_{vj} = 150^\circ\text{C}$$



transfer characteristic (typical), IGBT, Inverter

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

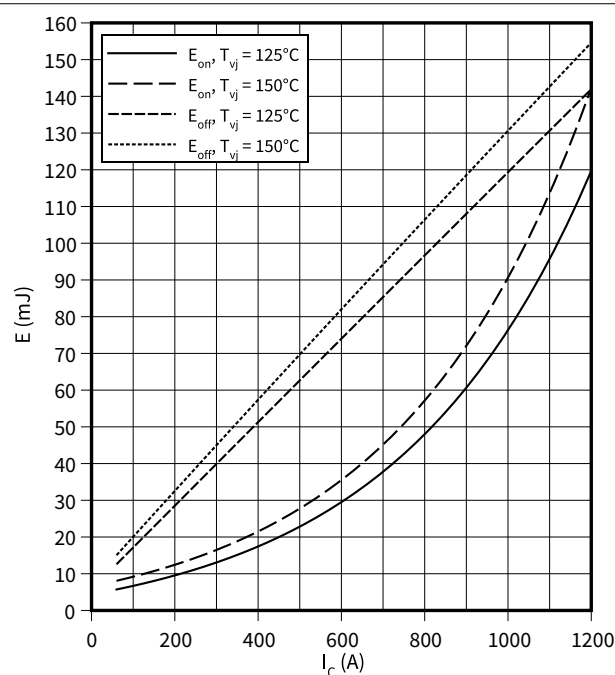
$$V_{CE} = 20 \text{ V}$$



switching losses (typical), IGBT, Inverter

$$E = f(I_C)$$

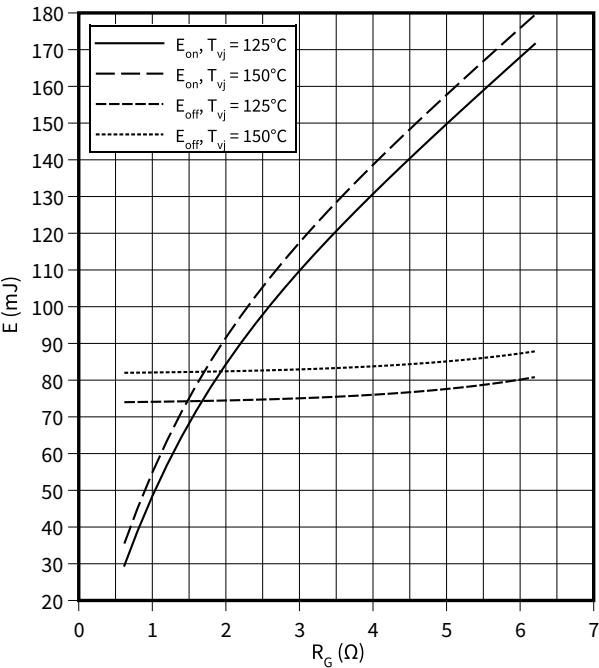
$$R_{Goff} = 0.62 \Omega, R_{Gon} = 0.62 \Omega, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$$



4 Characteristics diagrams

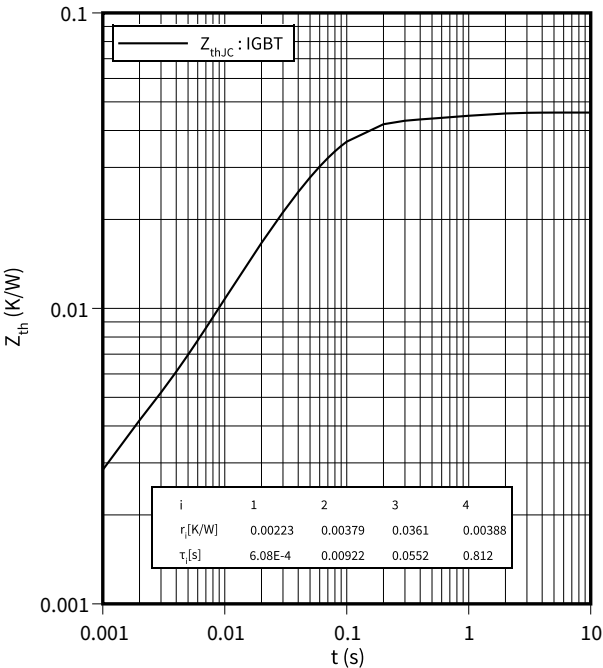
switching losses (typical), IGBT, Inverter

$E = f(R_G)$
 $I_C = 600\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$



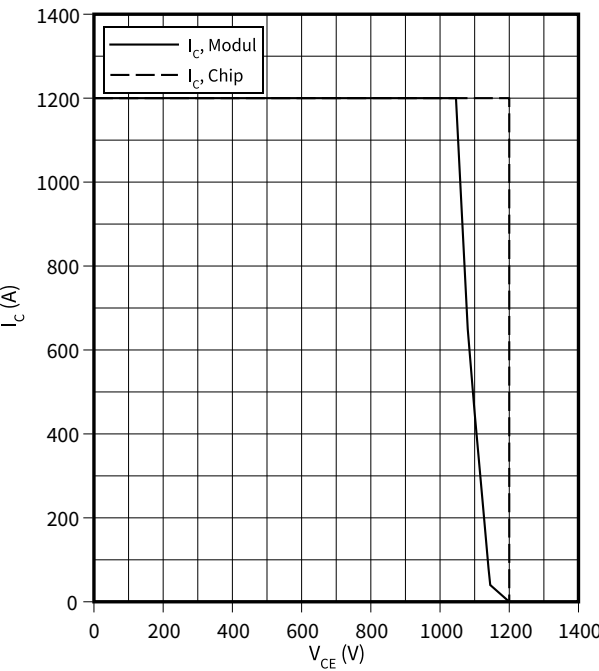
transient thermal impedance , IGBT, Inverter

$Z_{th} = f(t)$



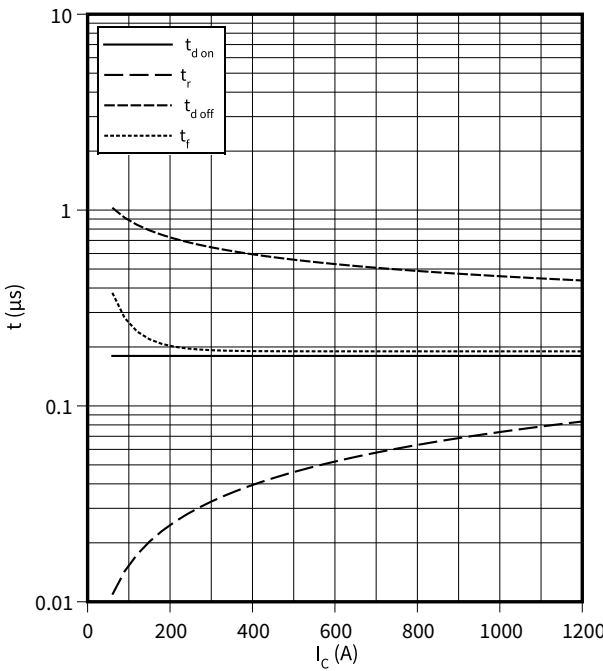
reverse bias safe operating area (RBSOA), IGBT, Inverter

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



switching times (typical), IGBT, Inverter

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

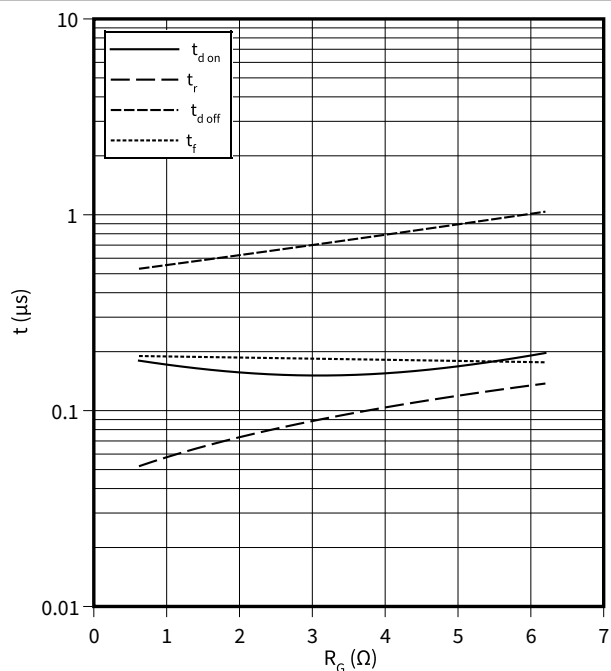


4 Characteristics diagrams

switching times (typical), IGBT, Inverter

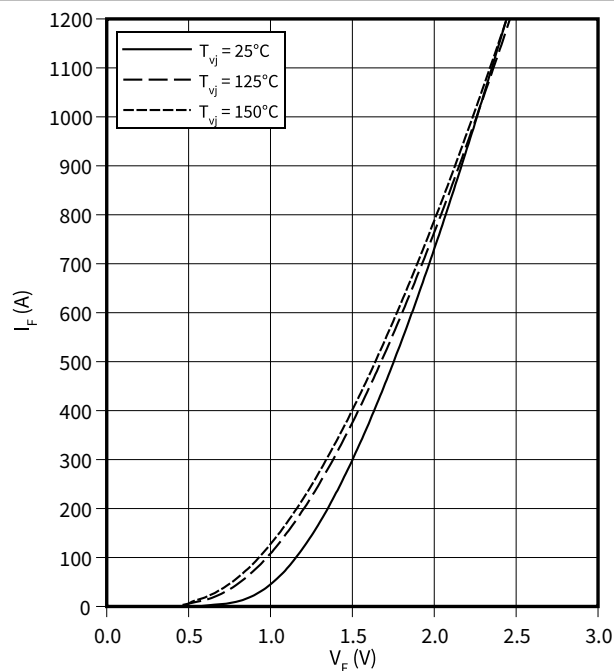
$$t = f(R_G)$$

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



forward characteristic (typical), Diode, Inverter

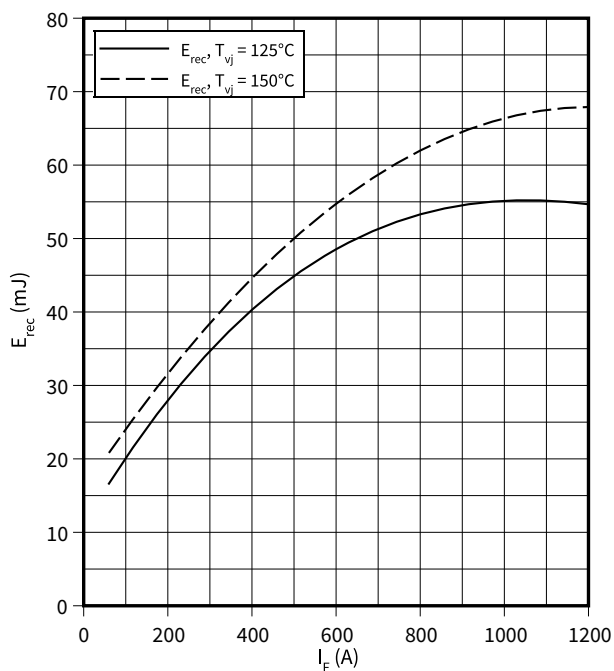
$$I_F = f(V_F)$$



switching losses (typical), Diode, Inverter

$$E_{\text{rec}} = f(I_F)$$

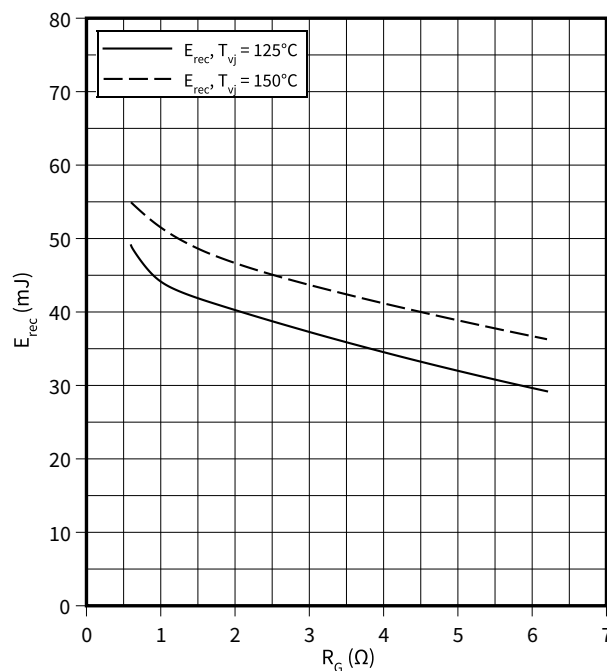
$V_{CE} = 600 \text{ V}$, $R_{Gon} = R_{Gon}(\text{IGBT})$



switching losses (typical), Diode, Inverter

$$E_{\text{rec}} = f(R_G)$$

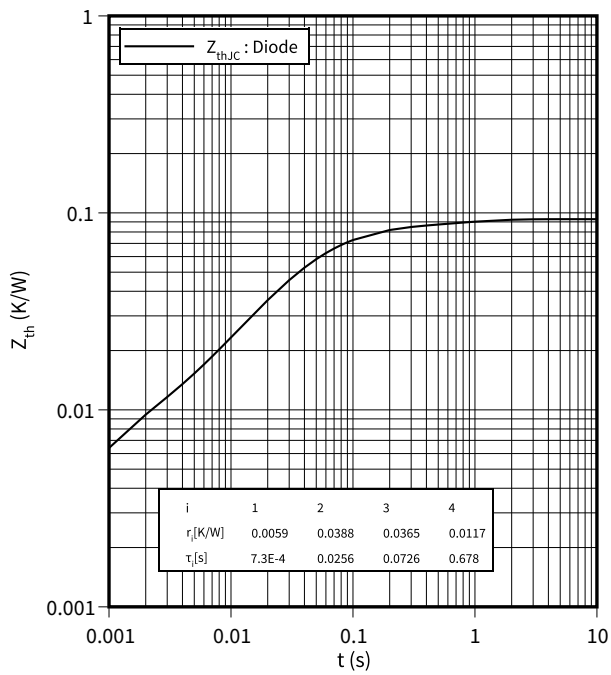
$V_{CE} = 600 \text{ V}$, $I_F = 600 \text{ A}$



4 Characteristics diagrams

transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



5 **Circuit diagram**

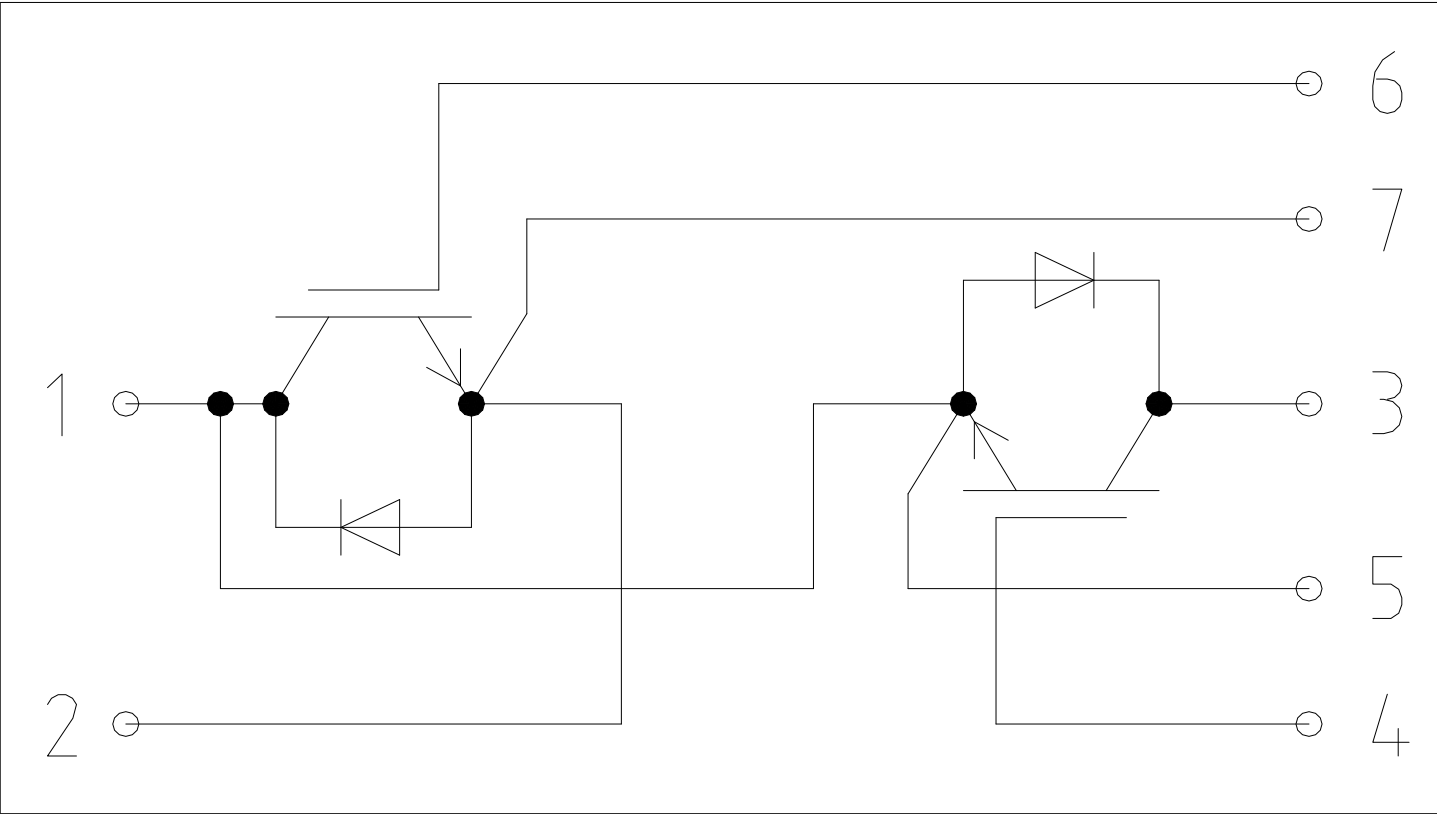


Figure 2

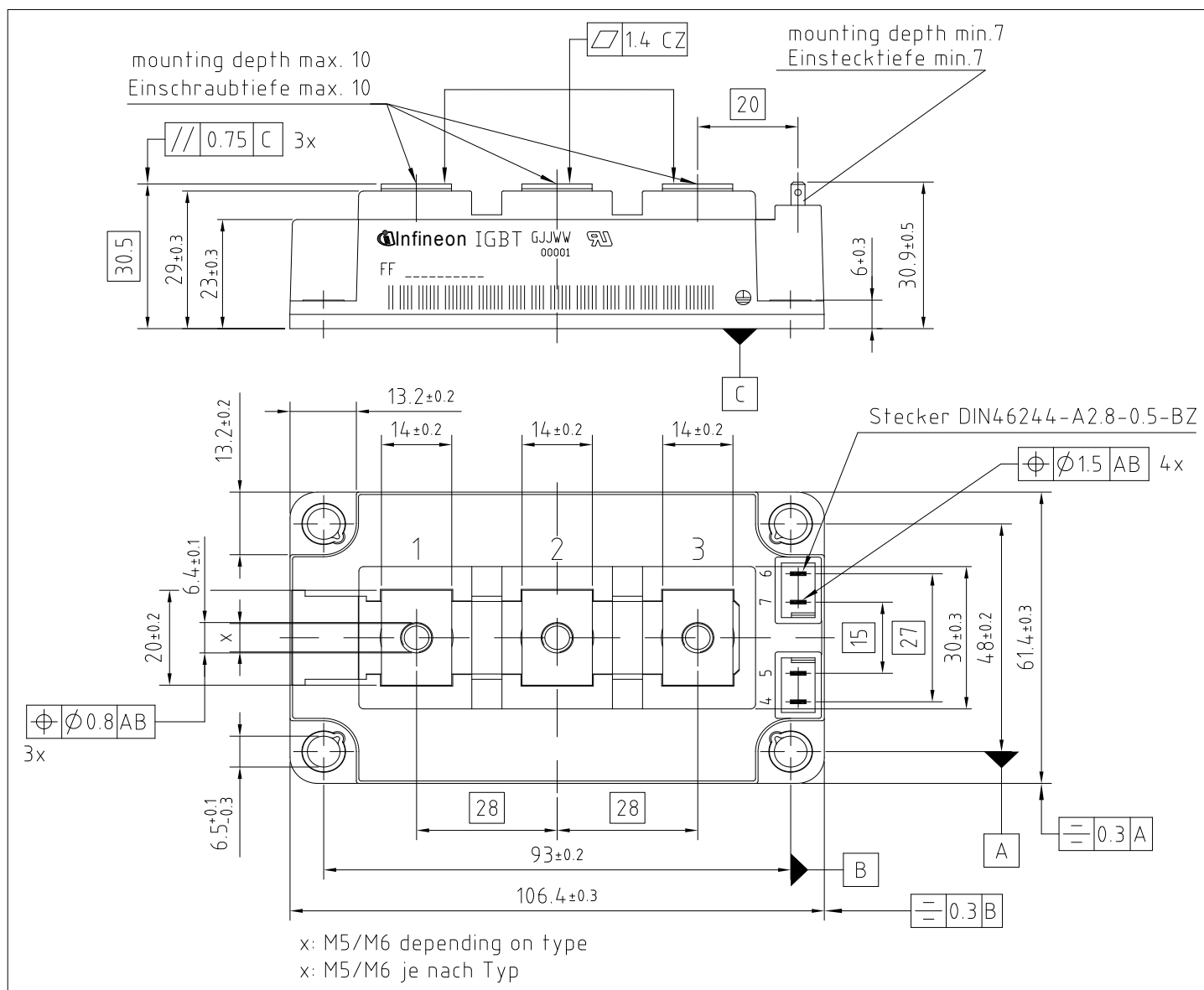


Figure 4

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