

62 mm C-Series module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{nom}} = 600\text{ A} / I_{CRM} = 1200\text{ A}$
 - TRENCHSTOP™ IGBT7
 - $V_{CE,\text{sat}}$ with positive temperature coefficient
- Mechanical features
 - 4 kV AC 1 min insulation
 - High creepage and clearance distances
 - High power density
 - Isolated base plate
 - Package with CTI > 400
 - Standard housing



Potential applications

- Servo drives
- Solar applications
- UPS systems
- Motor drives
- High-power converters
- Commercial agriculture vehicles
- Three-level applications

Product validation

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

Description

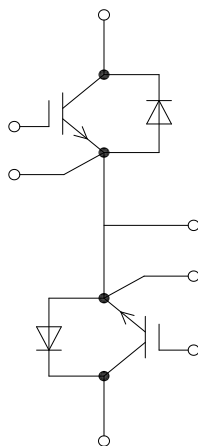


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 60 \text{ s}$	4.0	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	29.0	mm
Creepage distance	d_{Creep}	terminal to terminal	23.0	mm
Clearance	d_{Clear}	terminal to heatsink	23.0	mm
Clearance	d_{Clear}	terminal to terminal	11.0	mm
Comparative tracking index	CTI		> 400	
Relative thermal index (electrical)	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
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25 \text{ °C}$, per switch		0.5		mΩ
Storage temperature	T_{stg}		-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}				125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	M5, Screw	3	6	Nm
Terminal connection torque	M	- Mounting according to valid application note	M6, Screw	2.5	5	Nm
Weight	G			340		g

Note: Storage and shipment of modules with TIM => see AN2012-07

2 IGBT, T1 / T2

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

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Continuous DC collector current	I_{CDC}	$T_{vj\ max} = 175\ ^\circ\text{C}$ $T_H = 50\ ^\circ\text{C}$	600	A
Maximum RMS module DC-terminal current	I_{tRMS}		$T_{Terminal} = 115\ ^\circ\text{C}$, $T_C = 90\ ^\circ\text{C}$	650
			$T_{Terminal} = 115\ ^\circ\text{C}$, $T_C = 115\ ^\circ\text{C}$	600
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$	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	$V_{CE\ sat}$	$I_C = 600\ \text{A}$, $V_{GE} = 15\ \text{V}$	$T_{vj} = 25\ ^\circ\text{C}$		1.50	1.75	V
			$T_{vj} = 125\ ^\circ\text{C}$		1.65		
			$T_{vj} = 150\ ^\circ\text{C}$		1.70		
			$T_{vj} = 175\ ^\circ\text{C}$		1.75		
Gate threshold voltage	V_{GETh}	$I_C = 12\ \text{mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25\ ^\circ\text{C}$	5.15	5.80	6.45	V	
Gate charge	Q_G	$V_{GE} = \pm 15\ \text{V}$, $V_{CC} = 600\ \text{V}$		9.66		μC	
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ\text{C}$		0.6		Ω	
Input capacitance	C_{ies}	$f = 100\ \text{kHz}$, $T_{vj} = 25\ ^\circ\text{C}$, $V_{CE} = 25\ \text{V}$, $V_{GE} = 0\ \text{V}$		92.3		nF	
Reverse transfer capacitance	C_{res}	$f = 100\ \text{kHz}$, $T_{vj} = 25\ ^\circ\text{C}$, $V_{CE} = 25\ \text{V}$, $V_{GE} = 0\ \text{V}$		0.462		nF	
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ \text{V}$, $V_{GE} = 0\ \text{V}$ $T_{vj} = 25\ ^\circ\text{C}$			0.1	mA	
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\ \text{V}$, $V_{GE} = 20\ \text{V}$, $T_{vj} = 25\ ^\circ\text{C}$			100	nA	
Turn-on delay time (inductive load)	t_{don}	$I_C = 600\ \text{A}$, $V_{CC} = 600\ \text{V}$, $V_{GE} = \pm 15\ \text{V}$, $R_{Gon} = 0.51\ \Omega$	$T_{vj} = 25\ ^\circ\text{C}$		0.435		μs
			$T_{vj} = 125\ ^\circ\text{C}$		0.447		
			$T_{vj} = 150\ ^\circ\text{C}$		0.451		
			$T_{vj} = 175\ ^\circ\text{C}$		0.454		
Rise time (inductive load)	t_r	$I_C = 600\ \text{A}$, $V_{CC} = 600\ \text{V}$, $V_{GE} = \pm 15\ \text{V}$, $R_{Gon} = 0.51\ \Omega$	$T_{vj} = 25\ ^\circ\text{C}$		0.051		μs
			$T_{vj} = 125\ ^\circ\text{C}$		0.058		
			$T_{vj} = 150\ ^\circ\text{C}$		0.060		
			$T_{vj} = 175\ ^\circ\text{C}$		0.062		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time (inductive load)	t_{doff}	$I_C = 600\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.490		μs
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.558		
			$T_{vj} = 150\text{ }^\circ\text{C}$	0.578		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.597		
Fall time (inductive load)	t_f	$I_C = 600\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.119		μs
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.249		
			$T_{vj} = 150\text{ }^\circ\text{C}$	0.295		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.340		
Turn-on energy loss per pulse	E_{on}	$I_C = 600\text{ A}, V_{CC} = 600\text{ V}, L_\sigma = 25\text{ nH}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 0.51\ \Omega, di/dt = 7700\text{ A}/\mu\text{s} (T_{vj} = 175\text{ }^\circ\text{C})$	$T_{vj} = 25\text{ }^\circ\text{C}$	17		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	25.1		
			$T_{vj} = 150\text{ }^\circ\text{C}$	28.6		
			$T_{vj} = 175\text{ }^\circ\text{C}$	32		
Turn-off energy loss per pulse	E_{off}	$I_C = 600\text{ A}, V_{CC} = 600\text{ V}, L_\sigma = 25\text{ nH}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega, dv/dt = 3150\text{ V}/\mu\text{s} (T_{vj} = 175\text{ }^\circ\text{C})$	$T_{vj} = 25\text{ }^\circ\text{C}$	53.2		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	80.5		
			$T_{vj} = 150\text{ }^\circ\text{C}$	89.7		
			$T_{vj} = 175\text{ }^\circ\text{C}$	98.9		
SC data	I_{SC}	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}, V_{CEmax} = V_{CES} - L_{sCE} * di/dt$	$t_p \leq 8\ \mu\text{s}, T_{vj} = 150\text{ }^\circ\text{C}$	2250		A
			$t_p \leq 6\ \mu\text{s}, T_{vj} = 175\text{ }^\circ\text{C}$	2000		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material			0.101	K/W
Temperature under switching conditions	$T_{vj\ op}$		-40		175	$^\circ\text{C}$

Note: $T_{vj\ op} > 150\text{ }^\circ\text{C}$ is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

3 Diode, D1 / D2

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25\text{ }^\circ\text{C}$	1200	V
Continuous DC forward current	I_F		600	A

(table continues...)

Table 5 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$	1200	A	
I^2t - value	I^2t	$t_p = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ }^\circ\text{C}$	29900	A^2s
			$T_{vj} = 175 \text{ }^\circ\text{C}$	23200	

Table 6 Characteristic values

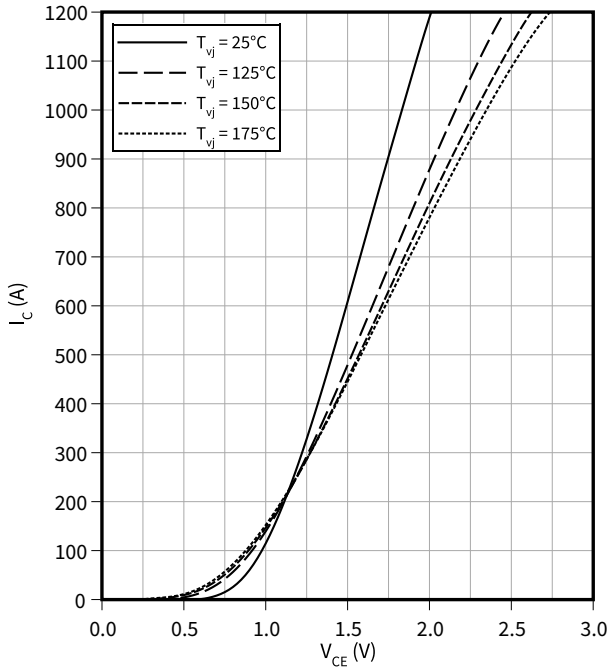
Parameter	Symbol	Note or test condition	Values			Unit	
			Min.	Typ.	Max.		
Forward voltage	V_F	$I_F = 600 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$		1.80	2.10	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$		1.70		
			$T_{vj} = 150 \text{ }^\circ\text{C}$		1.65		
			$T_{vj} = 175 \text{ }^\circ\text{C}$		1.60		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}, I_F = 600 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 7700 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		448		A
			$T_{vj} = 125 \text{ }^\circ\text{C}$		583		
			$T_{vj} = 150 \text{ }^\circ\text{C}$		616		
			$T_{vj} = 175 \text{ }^\circ\text{C}$		648		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}, I_F = 600 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 7700 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		49.4		μC
			$T_{vj} = 125 \text{ }^\circ\text{C}$		85.7		
			$T_{vj} = 150 \text{ }^\circ\text{C}$		100		
			$T_{vj} = 175 \text{ }^\circ\text{C}$		115		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}, I_F = 600 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 7700 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$		27.9		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$		45.6		
			$T_{vj} = 150 \text{ }^\circ\text{C}$		51.8		
			$T_{vj} = 175 \text{ }^\circ\text{C}$		58		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material			0.158	K/W	
Temperature under switching conditions	$T_{vj\text{op}}$		-40		175	$^\circ\text{C}$	

Note: $T_{vj\text{op}} > 150 \text{ }^\circ\text{C}$ is only allowed for operation at overload conditions. For detailed specifications please refer to AN 2018-14.

4 Characteristics diagrams

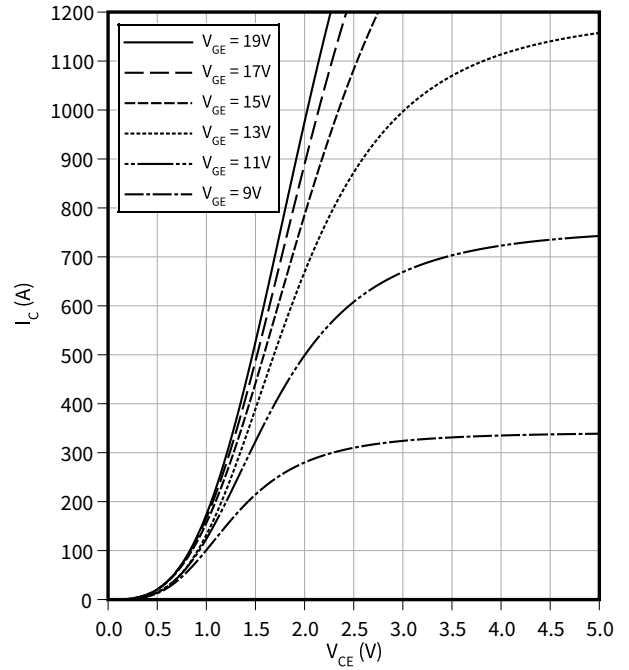
Output characteristic (typical), IGBT, T1 / T2

$I_C = f(V_{CE})$
 $V_{GE} = 15 \text{ V}$



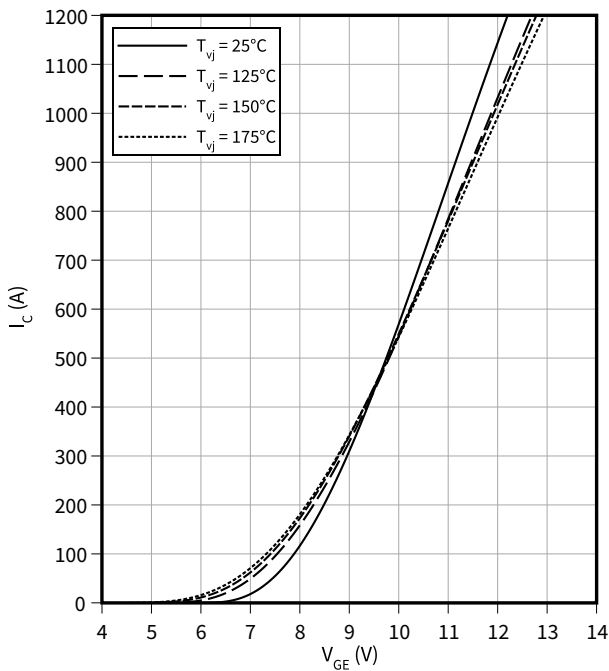
Output characteristic field (typical), IGBT, T1 / T2

$I_C = f(V_{CE})$
 $T_{vj} = 175 \text{ °C}$



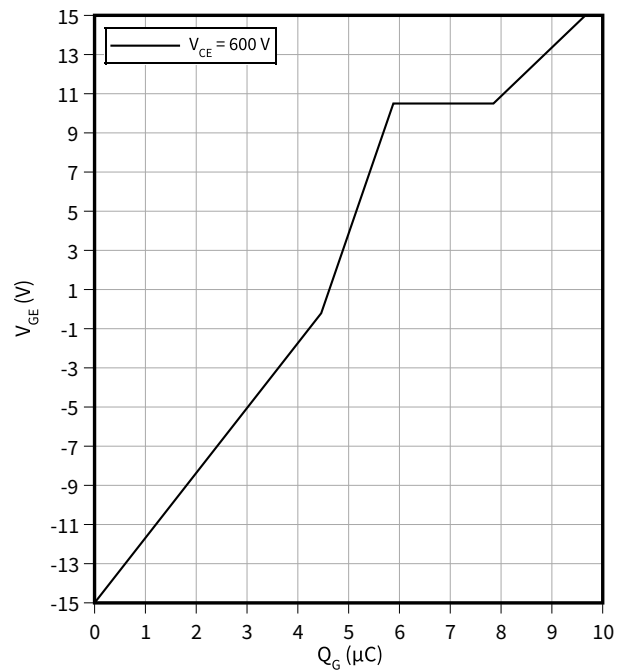
Transfer characteristic (typical), IGBT, T1 / T2

$I_C = f(V_{GE})$
 $V_{CE} = 20 \text{ V}$



Gate charge characteristic (typical), IGBT, T1 / T2

$V_{GE} = f(Q_G)$
 $I_C = 600 \text{ A}, T_{vj} = 25 \text{ °C}$

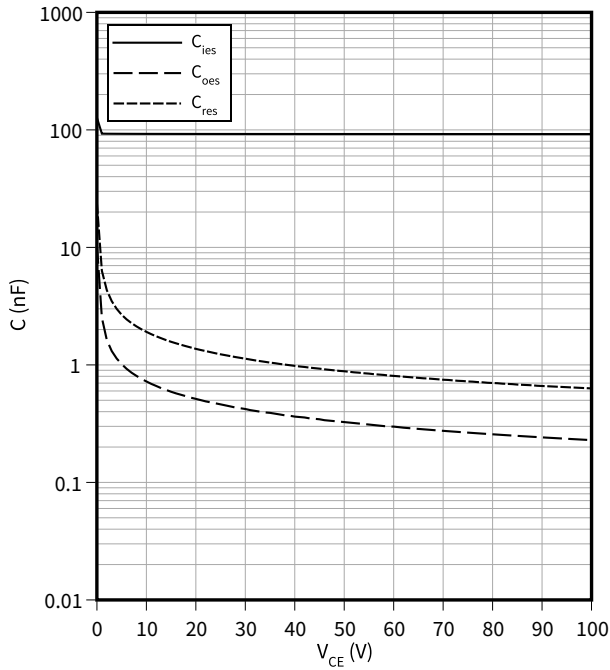


4 Characteristics diagrams

Capacity characteristic (typical), IGBT, T1 / T2

$C = f(V_{CE})$

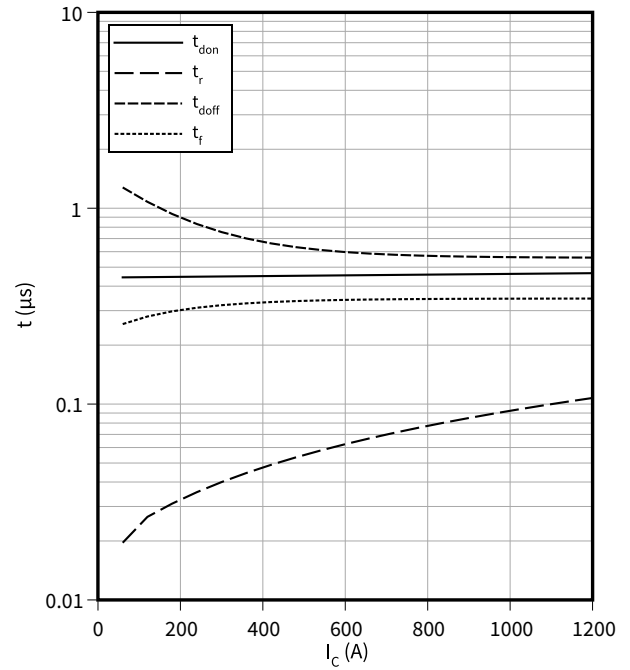
$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$



Switching times (typical), IGBT, T1 / T2

$t = f(I_C)$

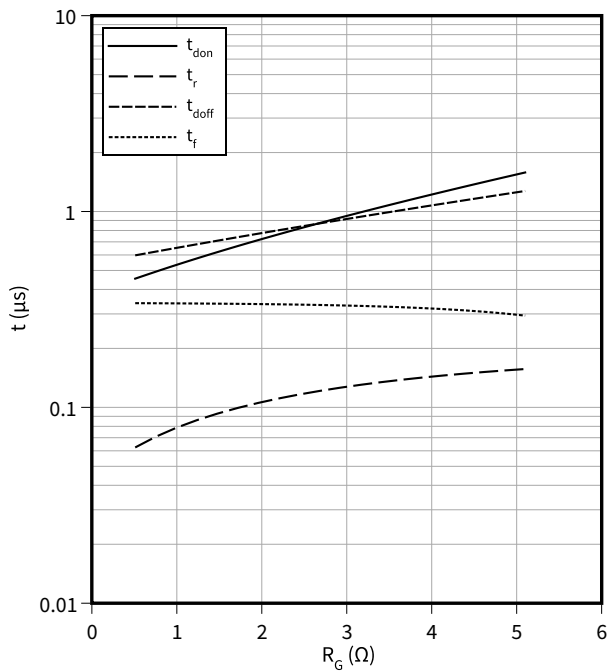
$R_{Goff} = 0.51 \text{ } \Omega, R_{Gon} = 0.51 \text{ } \Omega, V_{CC} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



Switching times (typical), IGBT, T1 / T2

$t = f(R_G)$

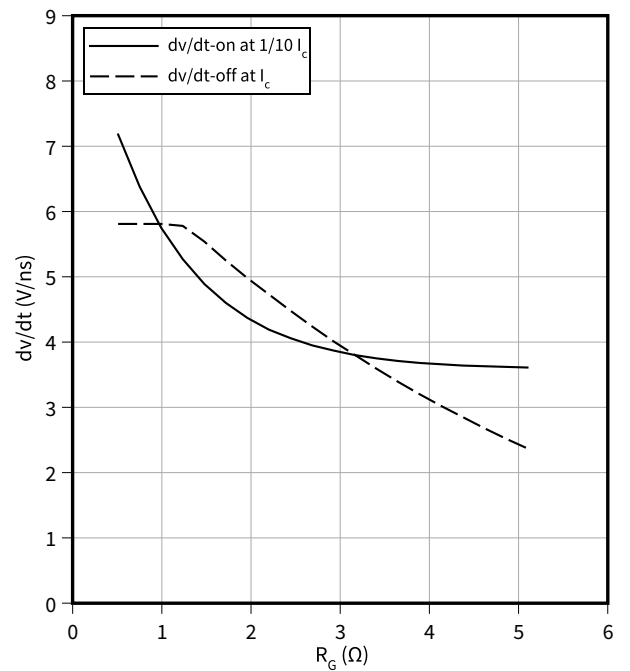
$I_C = 600 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$



Voltage slope (typical), IGBT, T1 / T2

$dv/dt = f(R_G)$

$I_C = 600 \text{ A}, V_{CC} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$

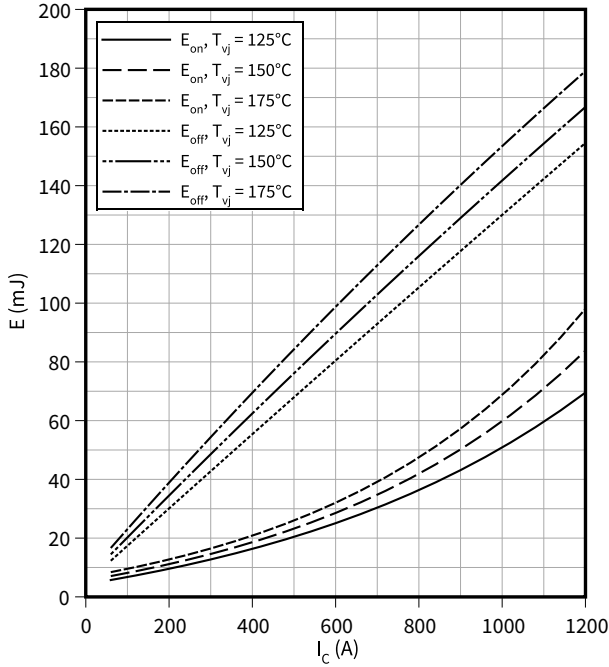


4 Characteristics diagrams

Switching losses (typical), IGBT, T1 / T2

$E = f(I_C)$

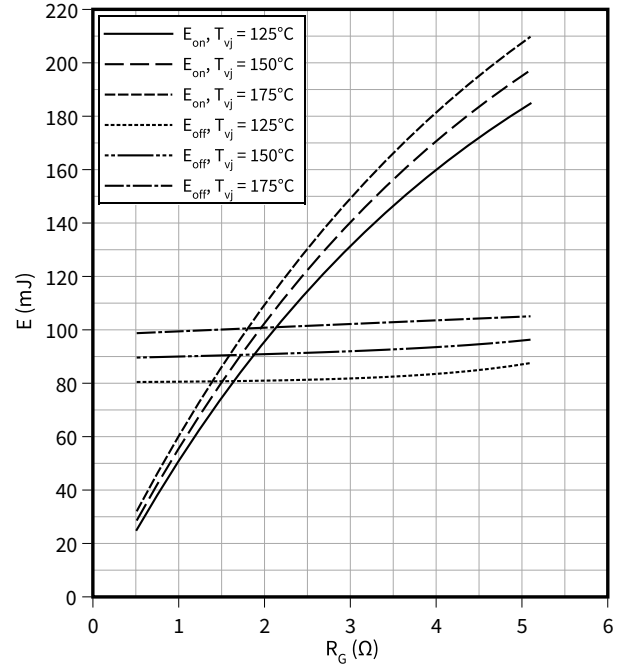
$R_{Goff} = 0.51 \Omega$, $R_{Gon} = 0.51 \Omega$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



Switching losses (typical), IGBT, T1 / T2

$E = f(R_G)$

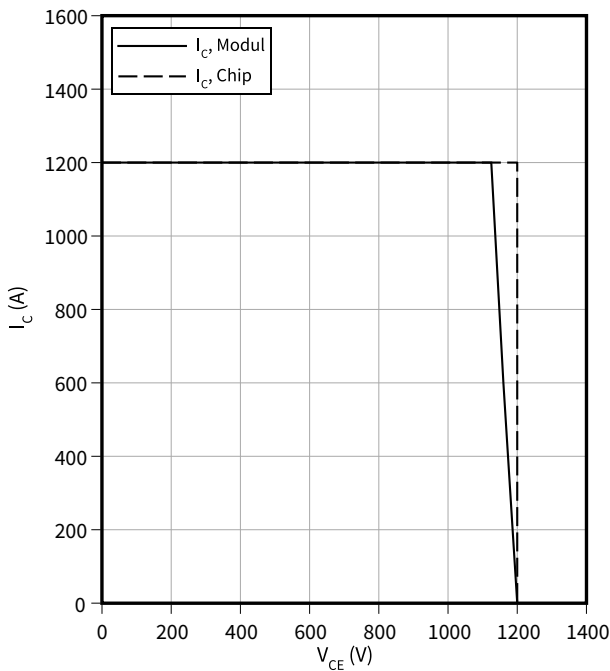
$I_C = 600 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$



Reverse bias safe operating area (RBSOA), IGBT, T1 / T2

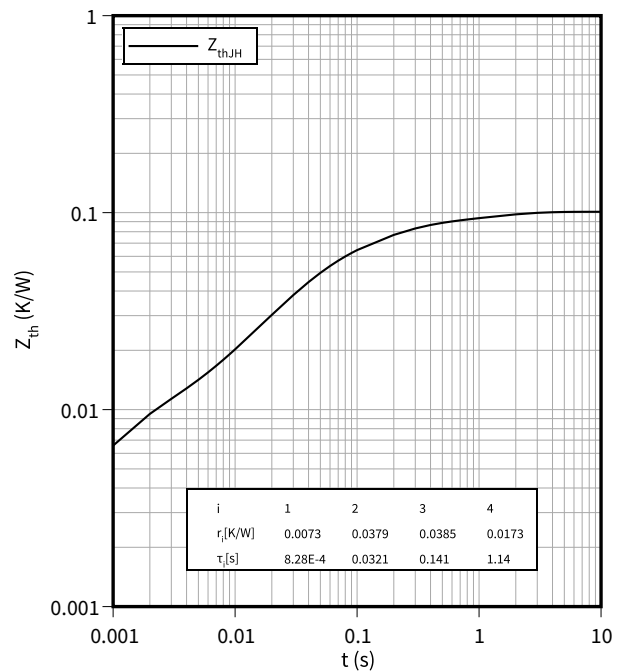
$I_C = f(V_{CE})$

$R_{Goff} = 0.51 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Transient thermal impedance, IGBT, T1 / T2

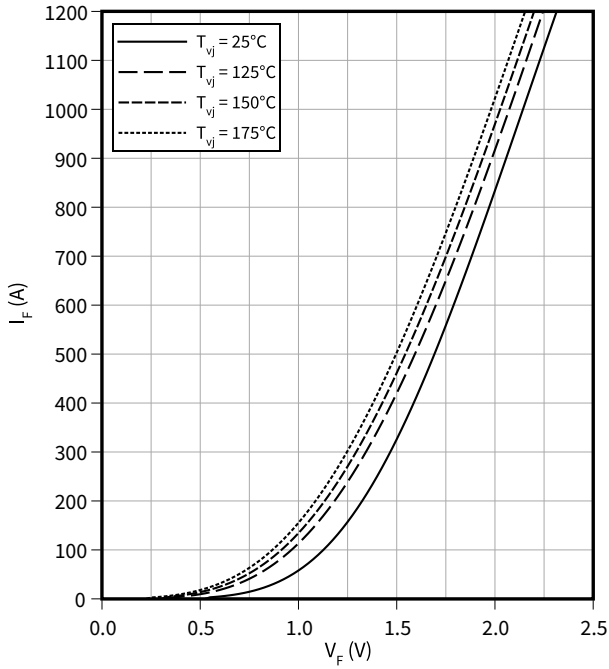
$Z_{th} = f(t)$



4 Characteristics diagrams

Forward characteristic (typical), Diode, D1 / D2

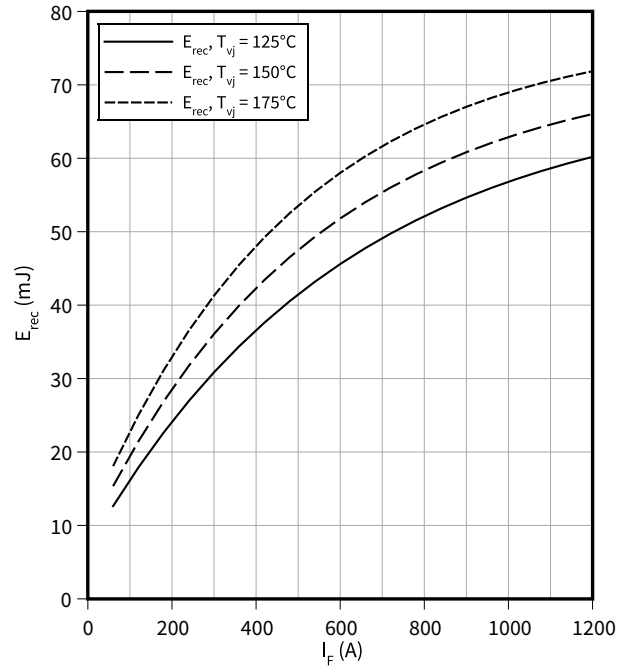
$I_F = f(V_F)$



Switching losses (typical), Diode, D1 / D2

$E_{rec} = f(I_F)$

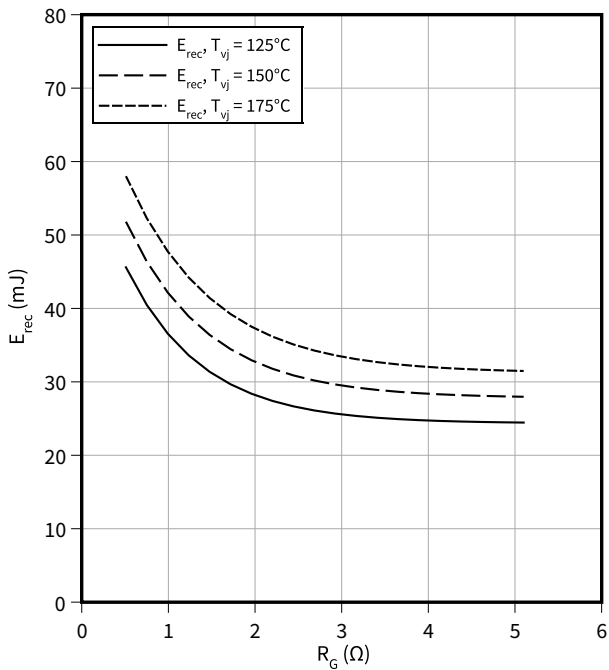
$R_{Gon} = 0.51 \Omega, V_{CC} = 600 V$



Switching losses (typical), Diode, D1 / D2

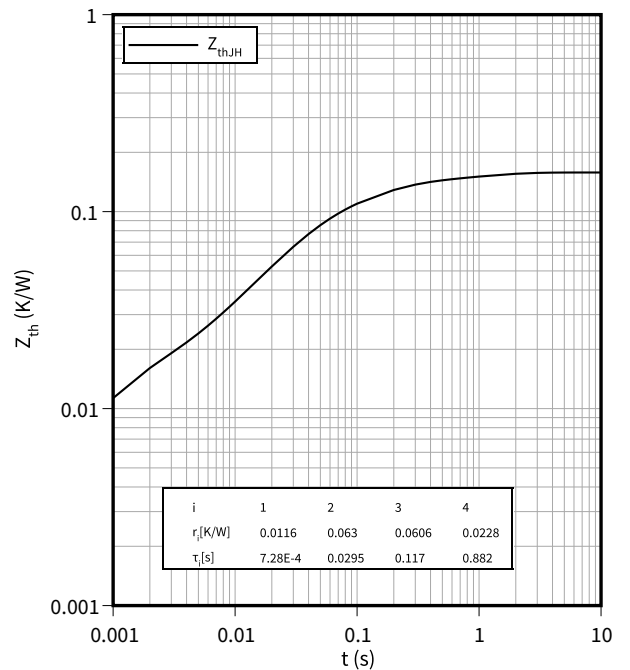
$E_{rec} = f(R_G)$

$I_F = 600 A, V_{CC} = 600 V$



Transient thermal impedance, Diode, D1 / D2

$Z_{th} = f(t)$



5 Circuit diagram

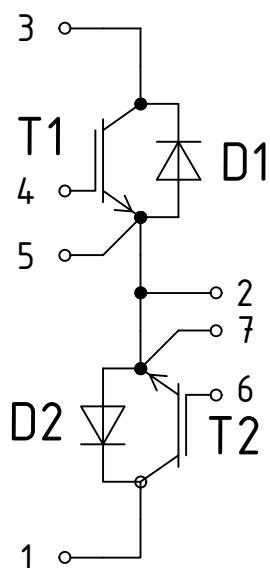


Figure 1

6 Package outlines

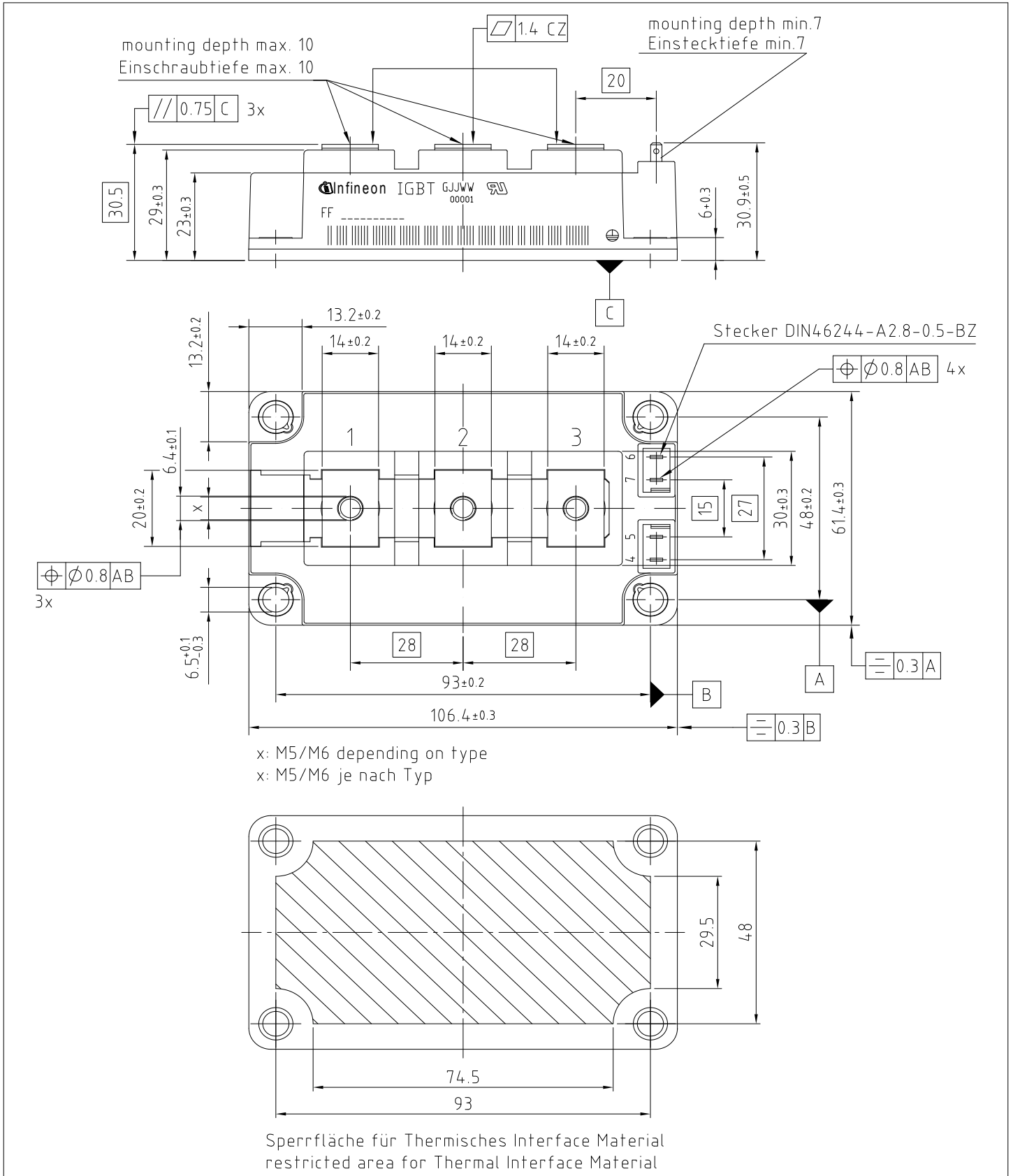


Figure 2

7 Module label code


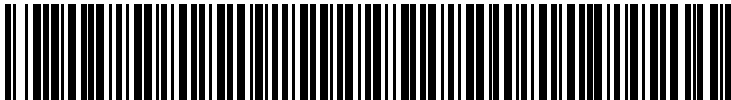
Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	Content	Digit	Example
	Module serial number	1 - 5	71549
	Module material number	6 - 11	142846
	Production order number	12 - 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
1.00	2023-05-31	Initial version

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