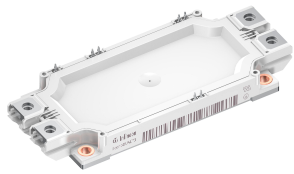
Final datasheet

EconoDUAL™3 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and NTC / pre-applied thermal interface material



Features

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 900 A / I_{CRM} = 1800 A
  - Integrated temperature sensor
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - High power density
  - Isolated base plate
  - Pre-applied thermal interface material
  - PressFIT contact technology
  - Standard housing

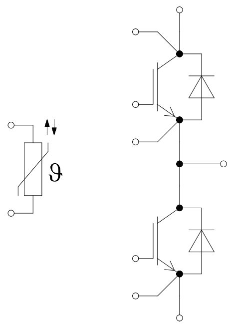
Potential applications

- UPS systems
- Servo drives
- Motor drives
- Commercial agriculture vehicles
- 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 Hz, t = 1 min	3.4	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	$d_{Creep\ nom}$	terminal to baseplate, nom.	> 15	mm
Creepage distance	$d_{Creep\ min}$	terminal to baseplate, min.	14.7	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom.	12.1	mm
Creepage distance	$d_{Creep\ min}$	terminal to terminal, min.	11.5	mm
Clearance	$d_{Clear\ nom}$	terminal to baseplate, nom.	> 12.5	mm
Clearance	$d_{Clear\ min}$	terminal to baseplate, min.	12.5	mm
Clearance	$d_{Clear\ nom}$	terminal to terminal, nom.	10.0	mm
Clearance	$d_{Clear\ min}$	terminal to terminal, min.	9.6	mm
Comparative tracking index	CTI		> 200	
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 °C, per switch			0.8		mΩ
Storage temperature	T_{stg}			-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}					150	°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	3		6	Nm
Weight	G				345		g

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

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Implemented collector current	I_{CN}			900	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 45 °C	875	A
Maximum RMS module DC-terminal current	I_{tRMS}		$T_{Terminal}$ = 90 °C, T_C = 90 °C	580	A
			$T_{Terminal}$ = 105 °C, T_C = 90 °C	565	
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		1800	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 = 900 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.50	1.80	V
			T_{vj} = 125 °C		1.65		
			T_{vj} = 175 °C		1.75		
Gate threshold voltage	V_{GEth}	I_C = 18 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.15	5.80	6.45	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 600 V			14.3		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.5		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			122		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.72		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.1	mA
Gate-emitter leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
Turn-on delay time (inductive load)	t_{don}	I_C = 900 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.410		µs
			T_{vj} = 125 °C		0.460		
			T_{vj} = 175 °C		0.490		
Rise time (inductive load)	t_r	I_C = 900 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω	T_{vj} = 25 °C		0.100		µs
			T_{vj} = 125 °C		0.110		
			T_{vj} = 175 °C		0.120		

(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 = 900 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω	T_{vj} = 25 °C		0.550		µs
			T_{vj} = 125 °C		0.630		
			T_{vj} = 175 °C		0.690		
Fall time (inductive load)	t_f	I_C = 900 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω	T_{vj} = 25 °C		0.110		µs
			T_{vj} = 125 °C		0.230		
			T_{vj} = 175 °C		0.330		
Turn-on energy loss per pulse	E_{on}	I_C = 900 A, V_{CC} = 600 V, $L_σ$ = 25 nH, V_{GE} = ±15 V, R_{Gon} = 0.51 Ω, di/dt = 6200 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		89		mJ
			T_{vj} = 125 °C		138		
			T_{vj} = 175 °C		170		
Turn-off energy loss per pulse	E_{off}	I_C = 900 A, V_{CC} = 600 V, $L_σ$ = 25 nH, V_{GE} = ±15 V, R_{Goff} = 0.51 Ω, dv/dt = 3000 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		89		mJ
			T_{vj} = 125 °C		130		
			T_{vj} = 175 °C		158		
SC data	I_{SC}	V_{GE} ≤ 15 V, V_{CC} = 800 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 8 µs, T_{vj}=150 °C		3200		A
			t_P ≤ 6 µs, T_{vj}=175 °C		3000		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				0.0720	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

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

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 °C	1200	V
Continuous DC forward current	I_F			900	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1800	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	35000	A^2s
			T_{vj} = 175 °C	30000	

Table 6 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 900 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.80	2.05	V
			T_{vj} = 125 °C		1.70		
			T_{vj} = 175 °C		1.65		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 900 A, V_{GE} = -15 V, -di_F/dt = 6200 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		389		A
			T_{vj} = 125 °C		511		
			T_{vj} = 175 °C		578		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 900 A, V_{GE} = -15 V, -di_F/dt = 6200 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		65		µC
			T_{vj} = 125 °C		127		
			T_{vj} = 175 °C		171		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 900 A, V_{GE} = -15 V, -di_F/dt = 6200 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		29		mJ
			T_{vj} = 125 °C		52		
			T_{vj} = 175 °C		68		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				0.126	K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

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

4 NTC-Thermistor

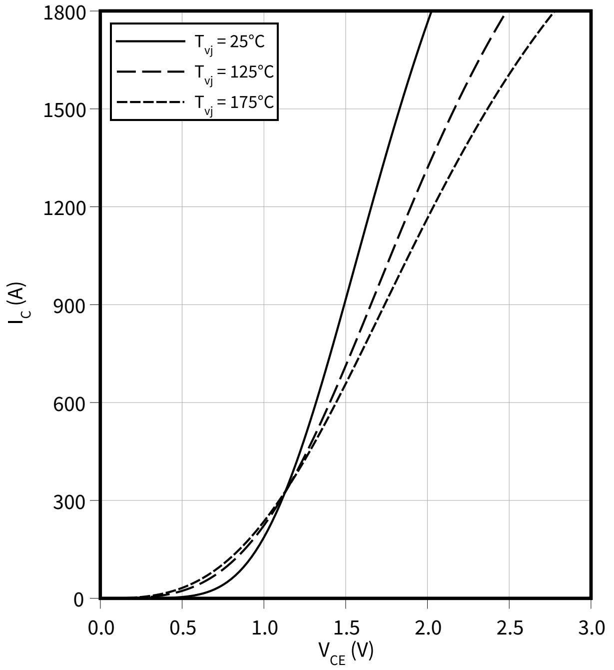
Table 7 **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	T_{NTC} = 25 °C		5		kΩ
Deviation of R_{100}	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
Power dissipation	P_{25}	T_{NTC} = 25 °C			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15\ K))]$		3433		K

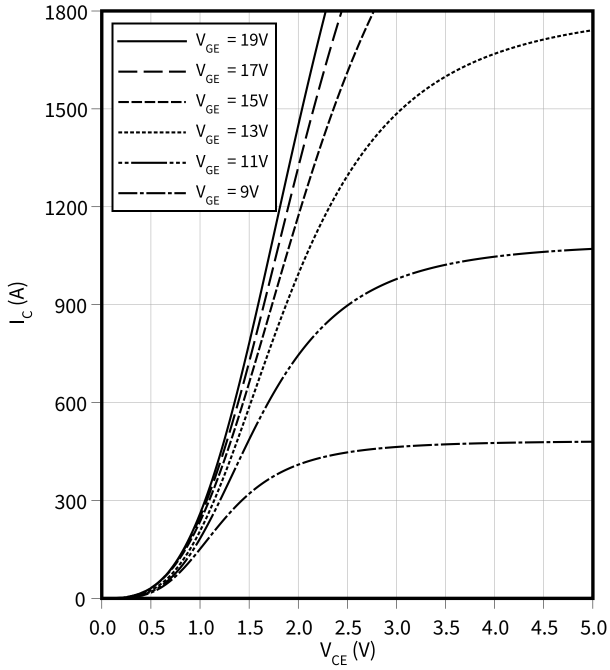
Note: *For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4*

5 Characteristics diagrams

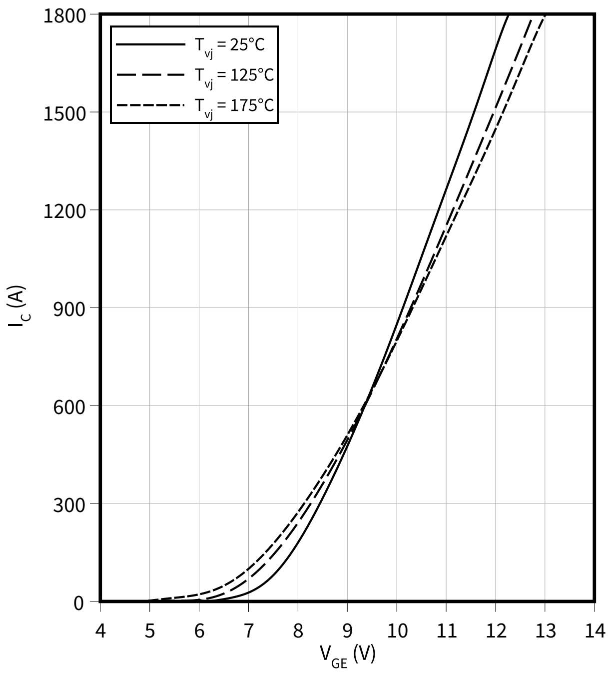
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



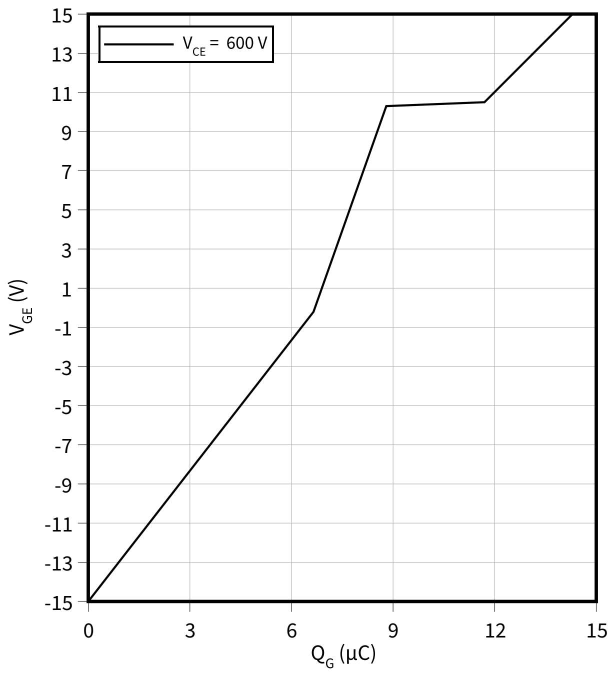
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



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



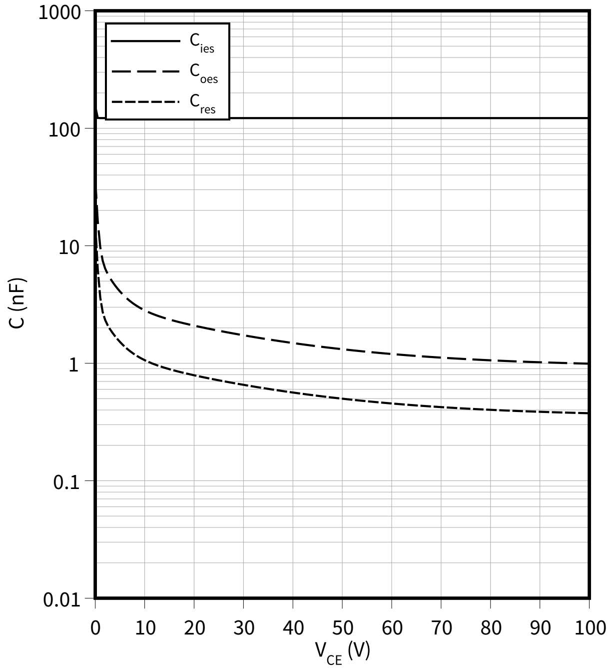
Gate charge characteristic (typical), IGBT, Inverter
$V_{GE} = f(Q_G)$
$T_{vj} = 25$ °C, $I_C = 900$ A



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

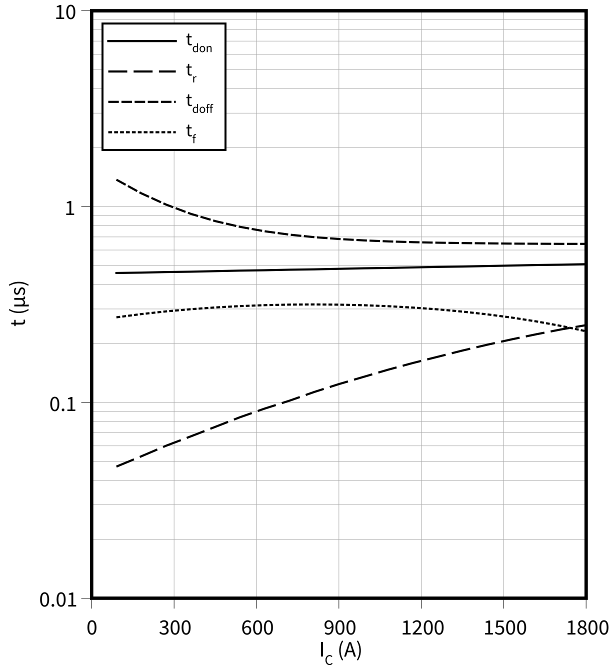
$f = 100$ kHz, $T_{vj} = 25$ °C, $V_{GE} = 0$ V



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

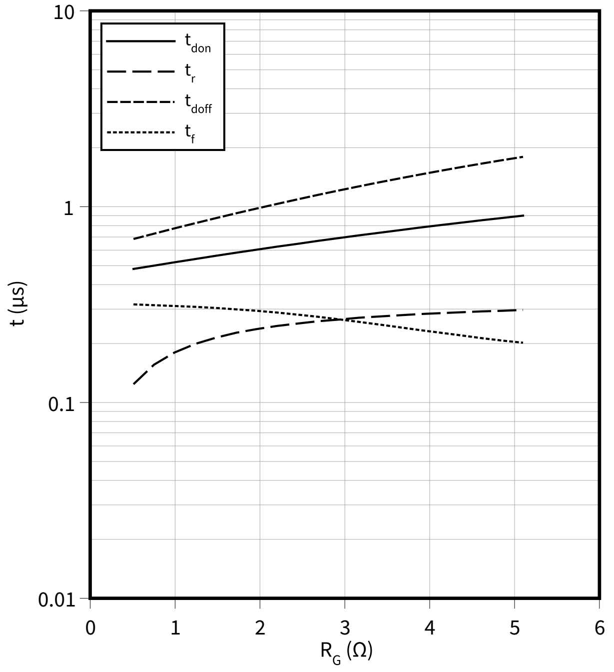
$R_{Goff} = 0.51\ \Omega$, $R_{Gon} = 0.51\ \Omega$, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

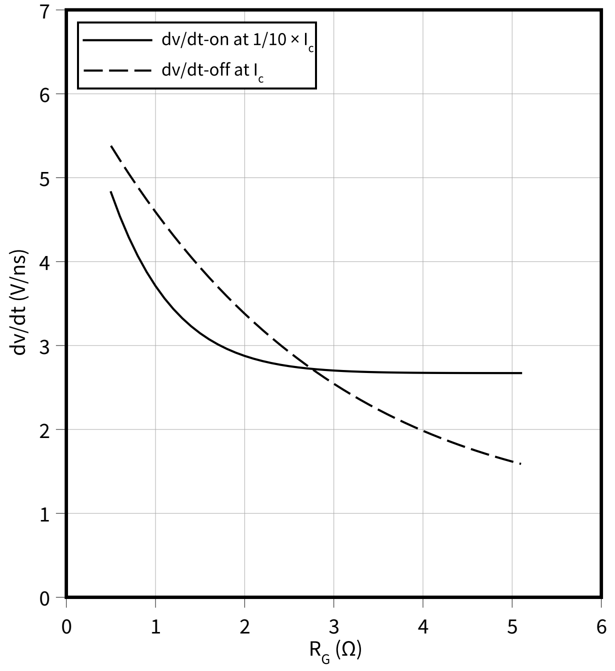
$I_C = 900$ A, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Voltage slope (typical), IGBT, Inverter

$dv/dt = f(R_G)$

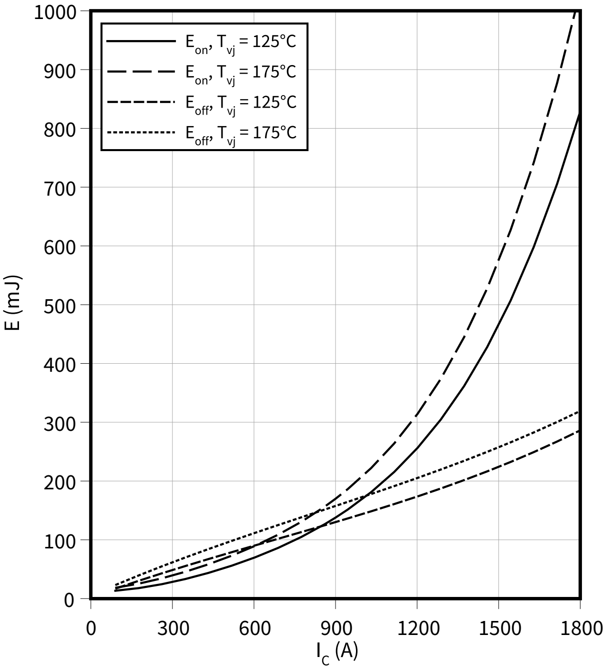
$I_C = 900$ A, $V_{CC} = 600$ V, $V_{GE} = \pm 15$ V, $T_{vj} = 25$ °C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

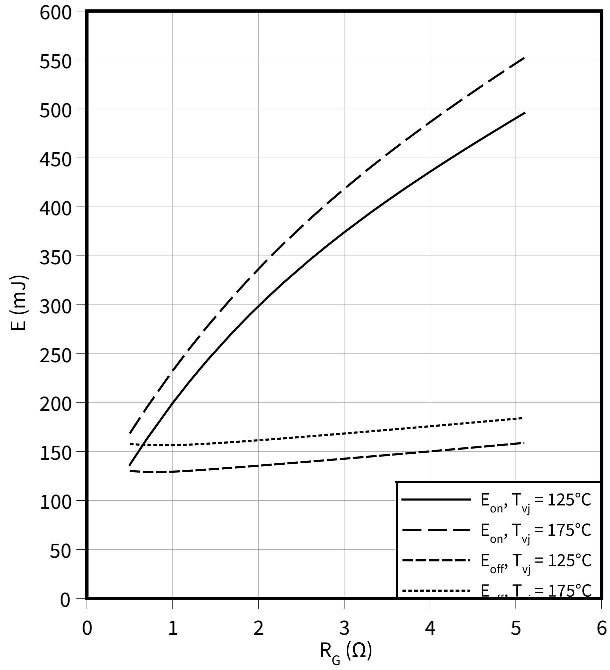
$V_{GE} = \pm 15$ V, $V_{CC} = 600$ V, $R_{Gon} = 0.51\ \Omega$, $R_{Goff} = 0.51\ \Omega$



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

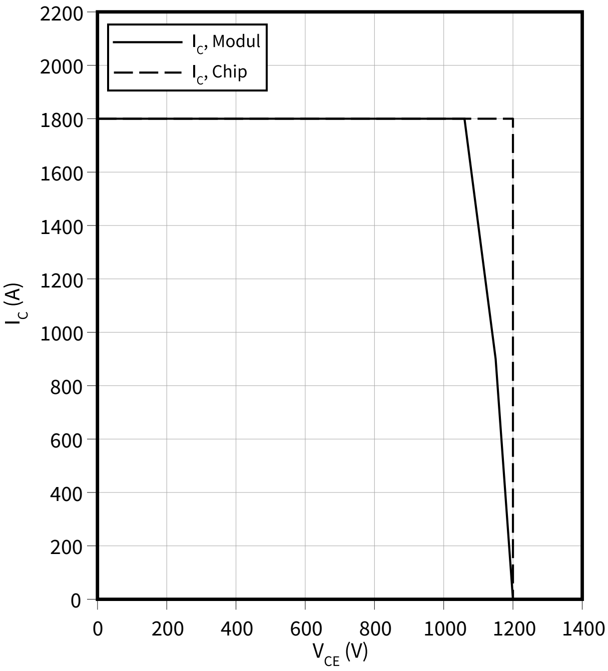
$I_C = 900$ A, $V_{GE} = \pm 15$ V, $V_{CC} = 600$ V



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

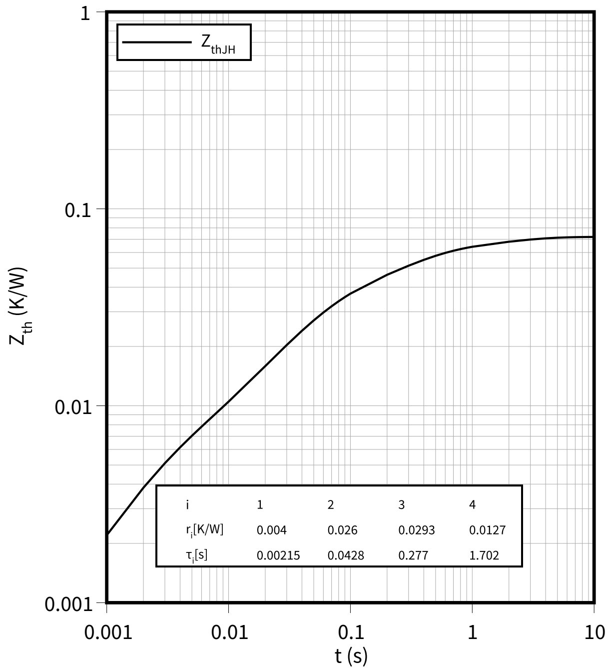
$I_C = f(V_{CE})$

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



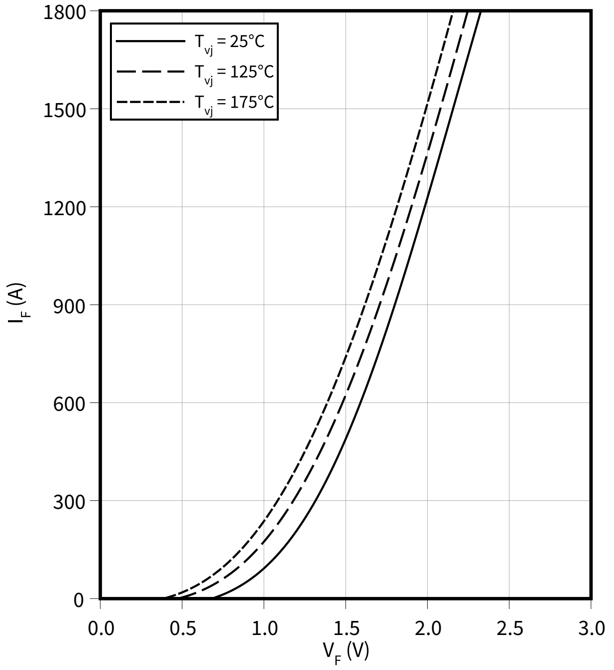
Transient thermal impedance, IGBT, Inverter

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, Inverter

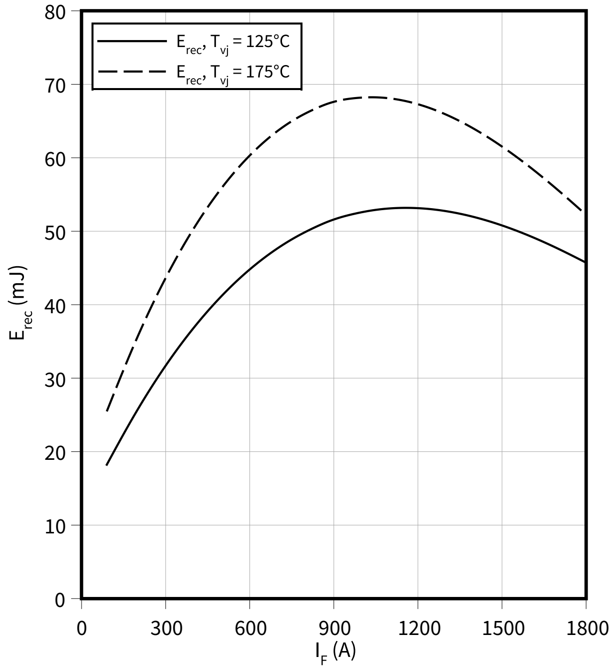
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

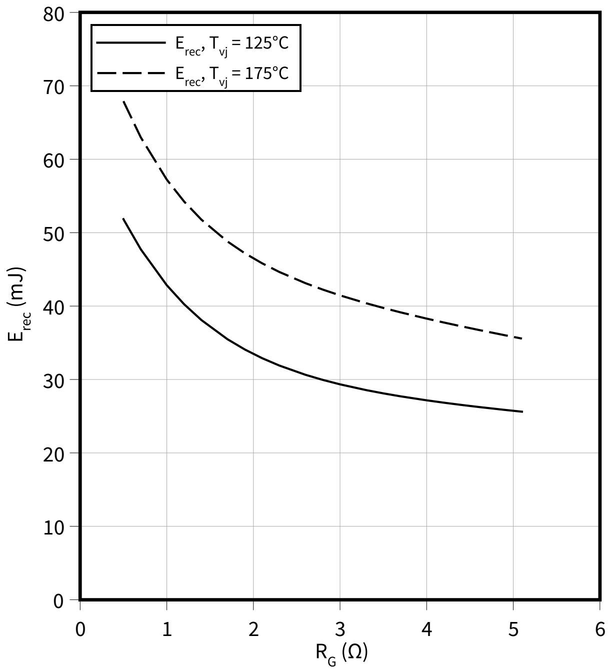
$R_{Gon} = R_{Gon}$(IGBT) , V_{CC} = 600 V



Switching losses (typical), Diode, Inverter

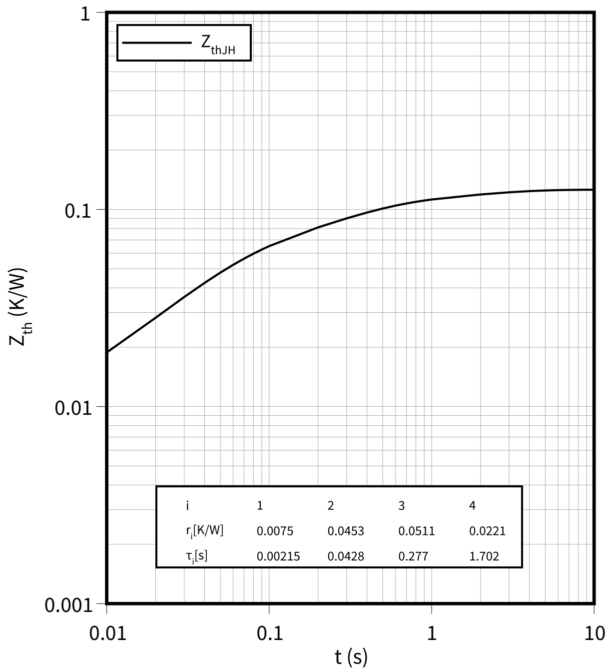
$E_{rec} = f(R_G)$

I_F = 900 A, V_{CC} = 600 V



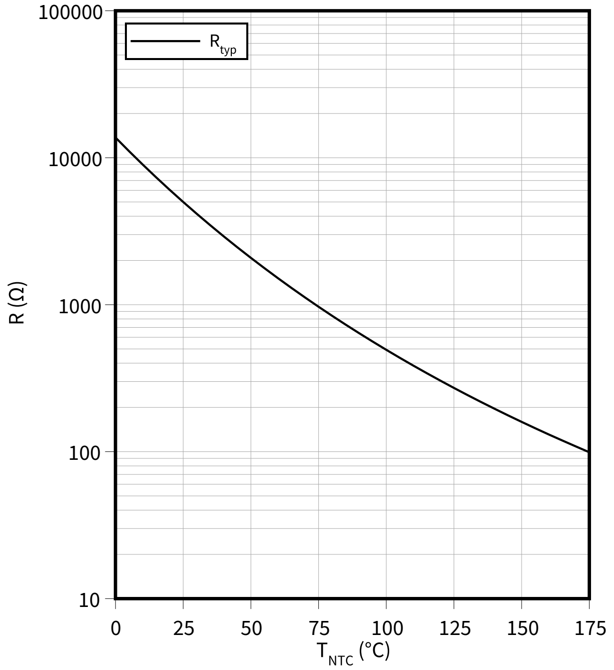
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.0075	0.0453	0.0511	0.0221
τ_i[s]	0.00215	0.0428	0.277	1.702

Temperature characteristic (typical), NTC-Thermistor
$R = f(T_{NTC})$



6 Circuit diagram

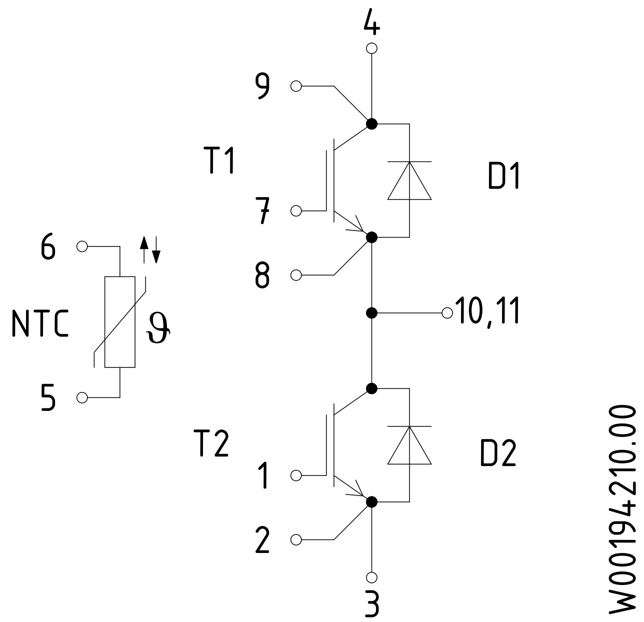


Figure 1

7 Package outlines

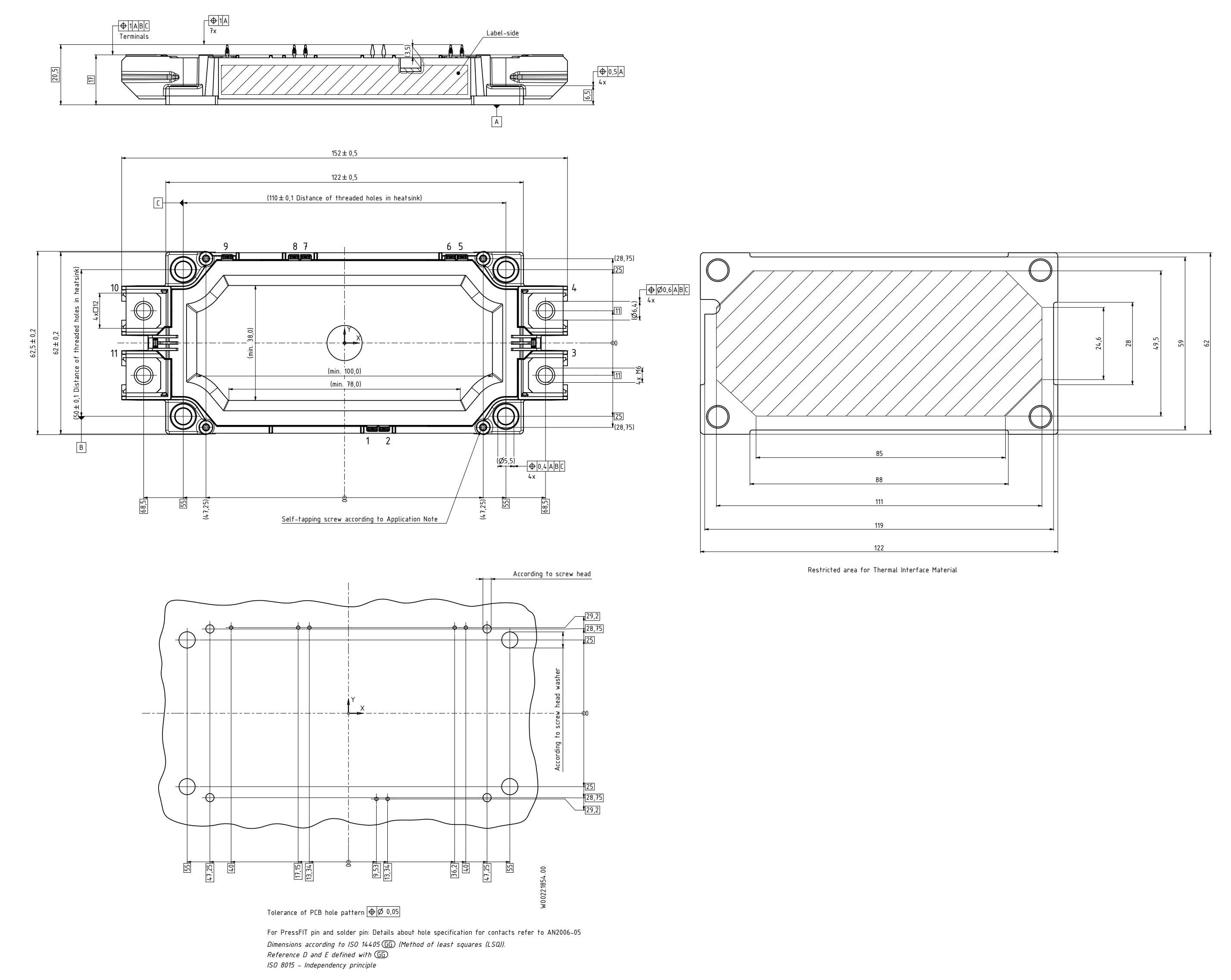


Figure 2

8 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 3

Revision history

Document revision	Date of release	Description of changes
V2.0	2020-04-24	Preliminary 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
0.20	2022-01-19	Preliminary datasheet
1.00	2024-03-06	Final datasheet

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