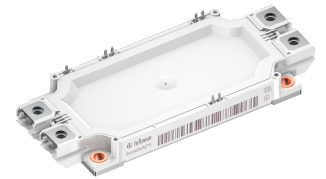


Final datasheet

EconoDUAL™3 module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and NTC

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 900\text{ A} / I_{CRM} = 1800\text{ A}$
 - Integrated temperature sensor
 - TRENCHSTOP™ IGBT7
 - $V_{CE,\text{sat}}$ with positive temperature coefficient
 - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
 - Standard housing
 - Solder contact technology
 - Isolated base plate
 - High power density



Potential applications

- Commercial agriculture vehicles
- High-power converters
- Motor drives
- Servo drives
- UPS systems

Product validation

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

Description

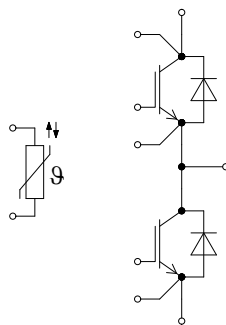


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1 Package

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
Isolation test voltage NTC	$V_{ISOL(NTC)}$	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., (PD2, IEC 60664-1, Ed. 3.0)	> 15	mm
Creepage distance	$d_{Creep\ min}$	terminal to baseplate, min., (PD2, IEC 60664-1, Ed. 3.0)	14.7	mm
Creepage distance	$d_{Creep\ nom}$	terminal to terminal, nom., (PD2, IEC 60664-1, Ed. 3.0)	12.1	mm
Creepage distance	$d_{Creep\ min}$	terminal to terminal, min., (PD2, IEC 60664-1, Ed. 3.0)	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	$R_{CC'+EE'}$	$T_C = 25$ °C, per switch		0.8		mΩ
Storage temperature	T_{stg}		-40		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	3	6	Nm
Weight	G			345		g

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter voltage	V_{CES}	$T_{vj} = 25\text{ °C}$		1200		V
Continuous DC collector current	I_{CDC}	$T_{vj\text{ max}} = 175\text{ °C}$ $T_C = 90\text{ °C}$		900		A
Maximum RMS module DC-terminal current	I_{tRMS}	$T_{\text{Terminal}} \leq 90\text{ °C}$, $T_C = 90\text{ °C}$		580		A
			$T_{\text{Terminal}} \leq 105\text{ °C}$, $T_C = 90\text{ °C}$		565	
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\text{ op}}$		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	$V_{CE\text{ sat}}$	$I_C = 900\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$		1.50	1.80	V
			$T_{vj} = 125\text{ °C}$		1.65		
			$T_{vj} = 175\text{ °C}$		1.75		
Gate threshold voltage	V_{GEth}	$I_C = 18\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25\text{ °C}$	5.15	5.80	6.45	V	
Gate charge	Q_G	$V_{GE} = \pm 15\text{ V}$, $V_{CC} = 600\text{ V}$		14.3		μC	
Internal gate resistor	R_{Gint}	$T_{vj} = 25\text{ °C}$		0.5		Ω	
Input capacitance	C_{ies}	$f = 100\text{ kHz}$, $T_{vj} = 25\text{ °C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$		122		nF	
Reverse transfer capacitance	C_{res}	$f = 100\text{ kHz}$, $T_{vj} = 25\text{ °C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$		0.72		nF	
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$ $T_{vj} = 25\text{ °C}$			0.1	mA	
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$, $T_{vj} = 25\text{ °C}$			100	nA	
Turn-on delay time (inductive load)	t_{don}	$I_C = 900\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.51\text{ Ω}$	$T_{vj} = 25\text{ °C}$		0.410		μs
			$T_{vj} = 125\text{ °C}$		0.460		
			$T_{vj} = 175\text{ °C}$		0.490		
Rise time (inductive load)	t_r	$I_C = 900\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.51\text{ Ω}$	$T_{vj} = 25\text{ °C}$		0.100		μs
			$T_{vj} = 125\text{ °C}$		0.110		
			$T_{vj} = 175\text{ °C}$		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}	$I_C = 900\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.550		μs
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.630		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.690		
Fall time (inductive load)	t_f	$I_C = 900\text{ A}, V_{CC} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.110		μs
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.230		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.330		
Turn-on energy loss per pulse	E_{on}	$I_C = 900\text{ A}, V_{CC} = 600\text{ V}, L_\sigma = 25\text{ nH}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 0.51\ \Omega, di/dt = 6200\text{ A}/\mu\text{s} (T_{vj} = 175\text{ }^\circ\text{C})$	$T_{vj} = 25\text{ }^\circ\text{C}$	89		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	138		
			$T_{vj} = 175\text{ }^\circ\text{C}$	170		
Turn-off energy loss per pulse	E_{off}	$I_C = 900\text{ A}, V_{CC} = 600\text{ V}, L_\sigma = 25\text{ nH}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 0.51\ \Omega, dv/dt = 3000\text{ V}/\mu\text{s} (T_{vj} = 175\text{ }^\circ\text{C})$	$T_{vj} = 25\text{ }^\circ\text{C}$	89		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	130		
			$T_{vj} = 175\text{ }^\circ\text{C}$	158		
SC data	I_{SC}	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}, V_{CEmax} = V_{CES} - L_{SCE} * di/dt$	$t_p \leq 8\ \mu\text{s}, T_{vj} = 150\text{ }^\circ\text{C}$	3200		A
			$t_p \leq 6\ \mu\text{s}, T_{vj} = 175\text{ }^\circ\text{C}$	3000		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.0452	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 1\text{ W}/(\text{m}\cdot\text{K})$		0.0269		K/W
Temperature under switching conditions	T_{vjop}		-40		175	$^\circ\text{C}$

Note: $T_{vjop} > 150\text{ }^\circ\text{C}$ is 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}	$T_{vj} = 25\text{ }^\circ\text{C}$	1200	V
Continuous DC forward current	I_F		900	A
Repetitive peak forward current	I_{FRM}	$t_p = 1\text{ ms}$	1800	A

(table continues...)

Table 5 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
I ² t - value	I ² t	t _p = 10 ms, V _R = 0 V	T _{vj} = 125 °C	35000		A ² s
			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 case	R _{thJC}	per diode			0.0868	K/W	
Thermal resistance, case to heat sink	R _{thCH}	per diode, λ _{grease} = 1 W/(m·K)		0.0342		K/W	
Temperature under switching conditions	T _{vj op}		-40		175	°C	

Note: T_{vj op} > 150°C is 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	ΔR/R	T _{NTC} = 100 °C, R ₁₀₀ = 493 Ω	-5		5	%
Power dissipation	P ₂₅	T _{NTC} = 25 °C			20	mW

(table continues...)

Table 7 (continued) **Characteristic values**

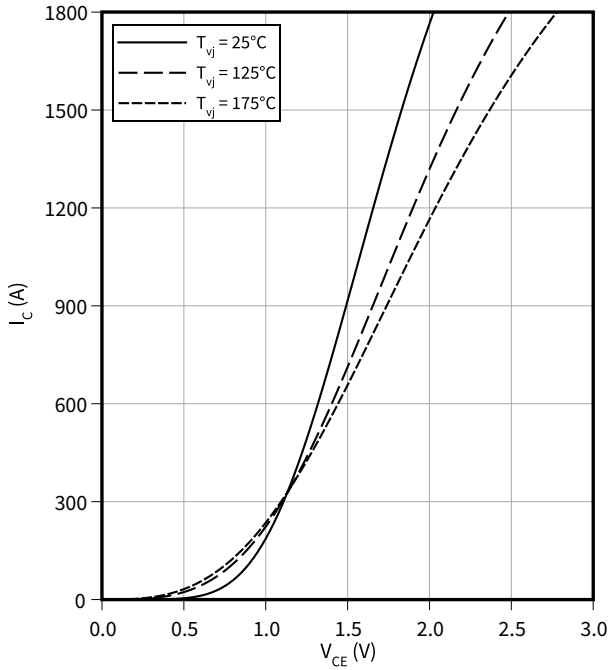
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$		3433		K

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

5 Characteristics diagrams

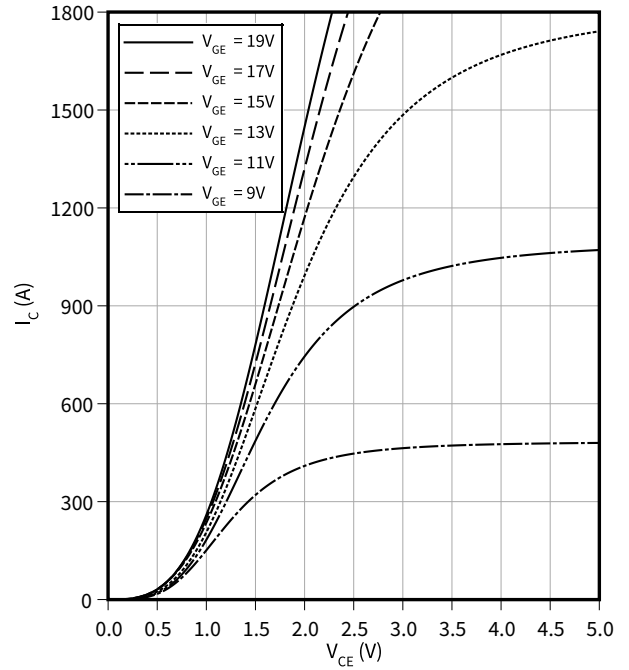
Output characteristic (typical), IGBT, Inverter

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



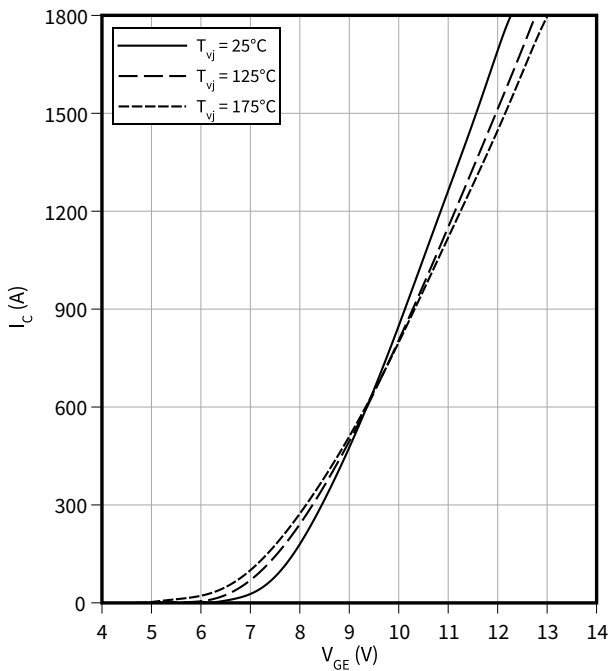
Output characteristic field (typical), IGBT, Inverter

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



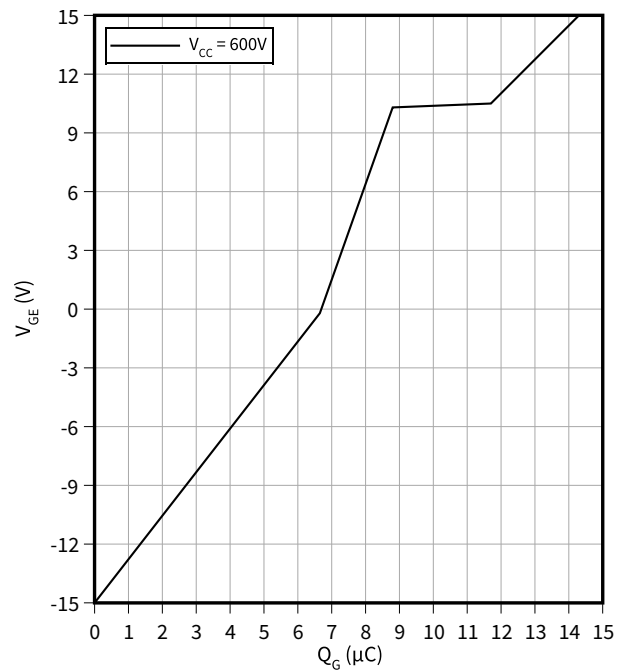
Transfer characteristic (typical), IGBT, Inverter

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



Gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$
 $I_C = 900 \text{ A}, T_{vj} = 25 \text{ °C}$

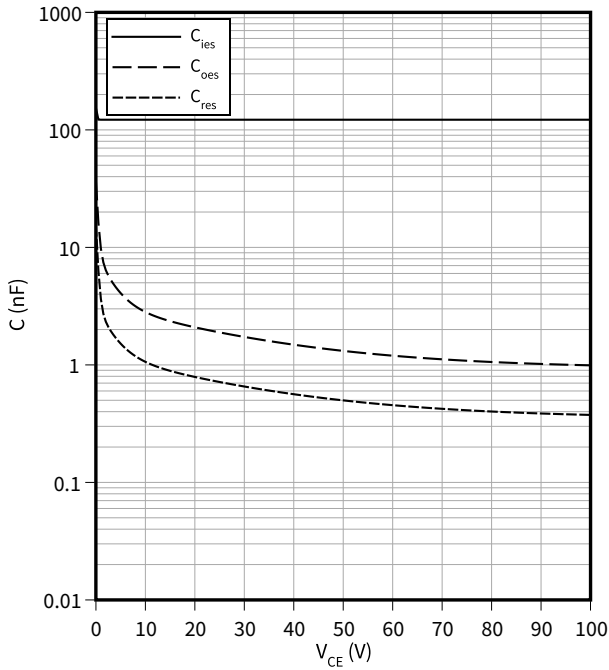


5 Characteristics diagrams

Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

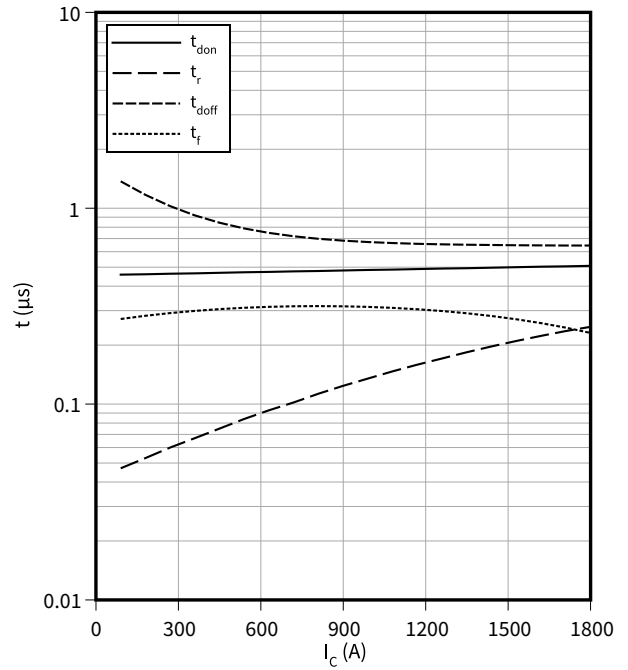
$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

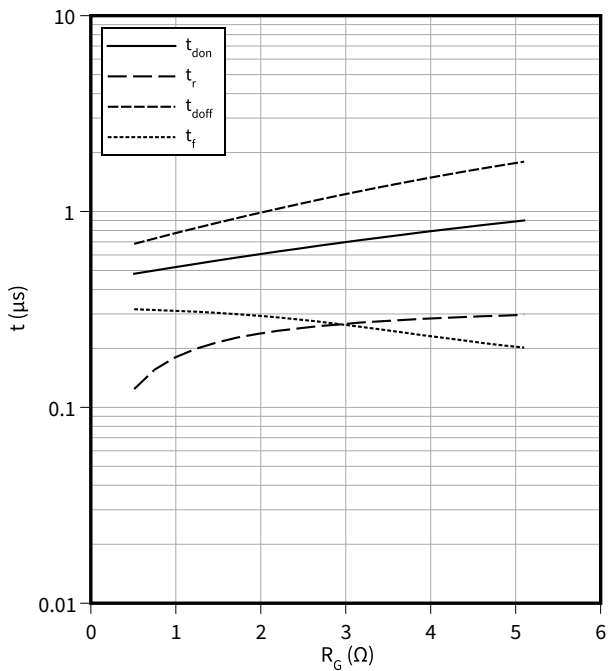
$R_{Goff} = 0.51 \text{ } \Omega, R_{Gon} = 0.51 \text{ } \Omega, V_{GE} = \pm 15 \text{ V}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

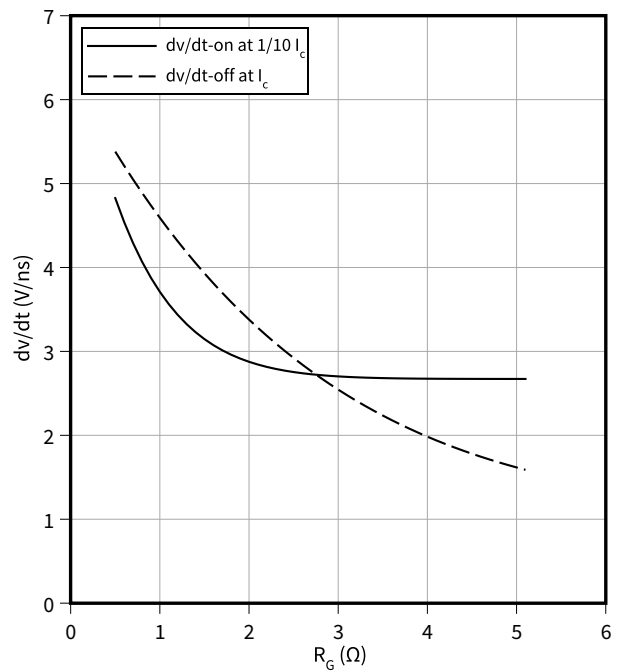
$V_{GE} = \pm 15 \text{ V}, I_C = 900 \text{ A}, V_{CC} = 600 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



Voltage slope (typical), IGBT, Inverter

$dv/dt = f(R_G)$

$I_C = 900 \text{ A}, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$

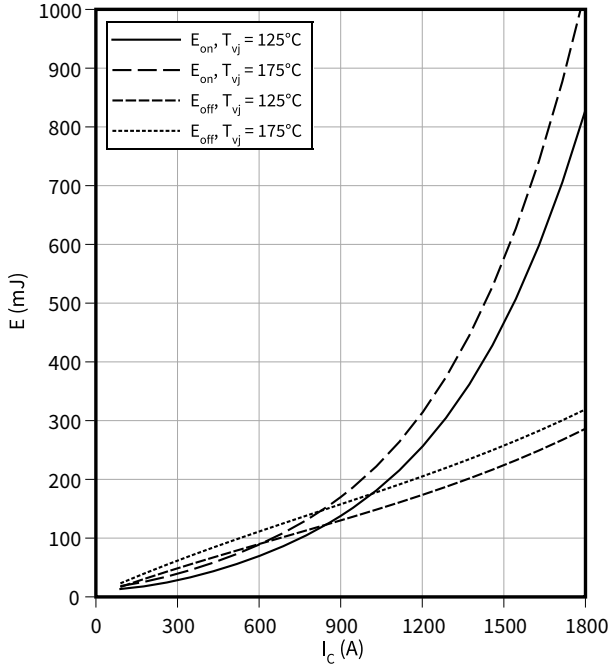


5 Characteristics diagrams

Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

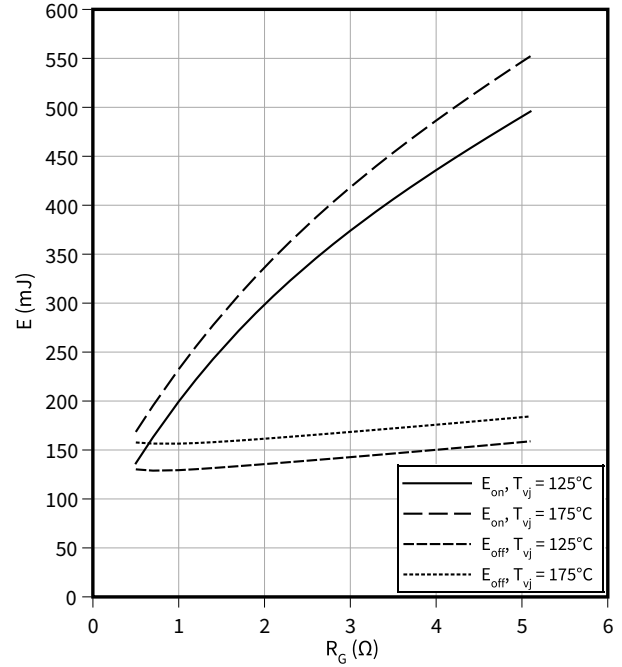
$R_{Goff} = 0.51 \Omega, R_{Gon} = 0.51 \Omega, V_{GE} = \pm 15 V, V_{CC} = 600 V$



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

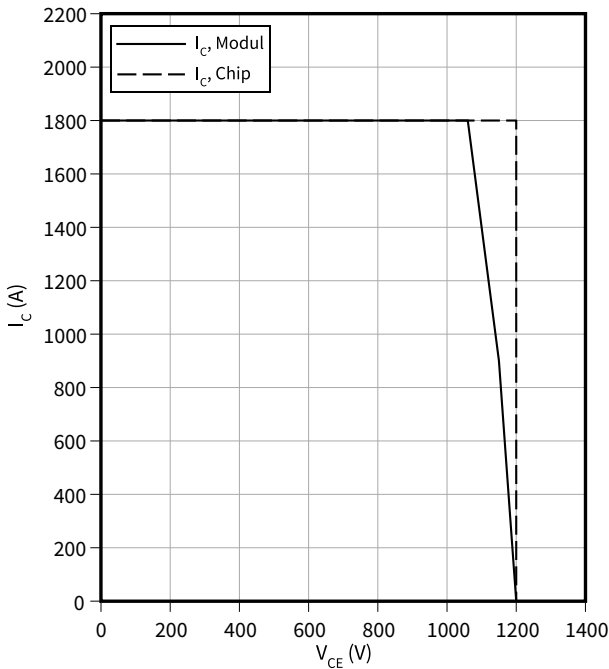
$V_{GE} = \pm 15 V, I_C = 900 A, V_{CC} = 600 V$



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

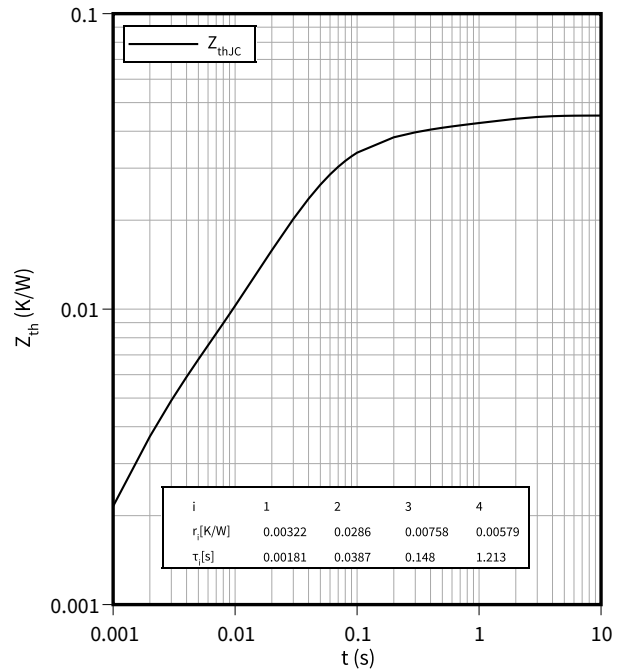
$I_C = f(V_{CE})$

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



Transient thermal impedance, IGBT, Inverter

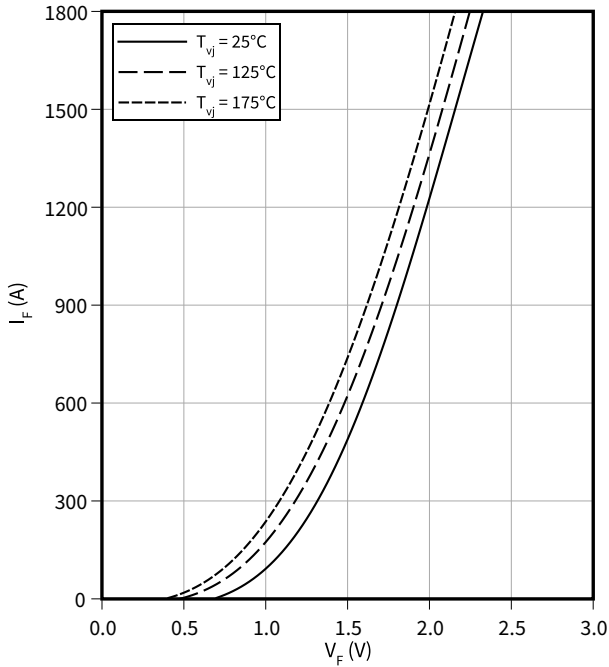
$Z_{th} = f(t)$



5 Characteristics diagrams

Forward characteristic (typical), Diode, Inverter

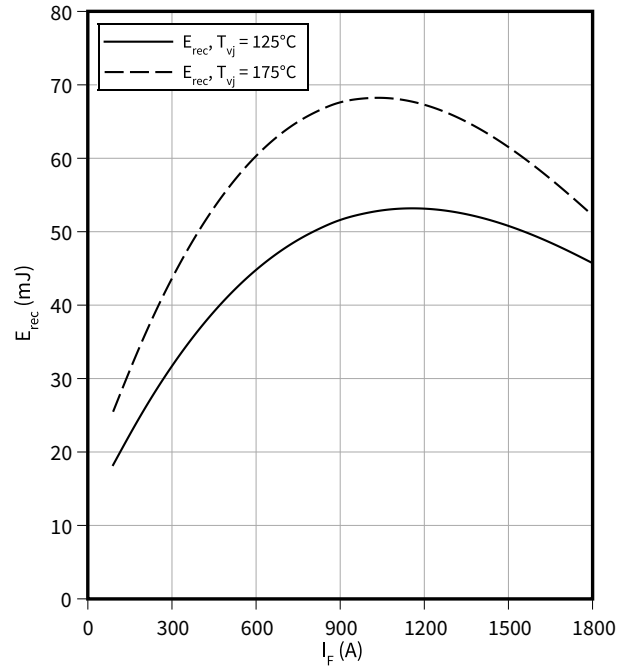
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

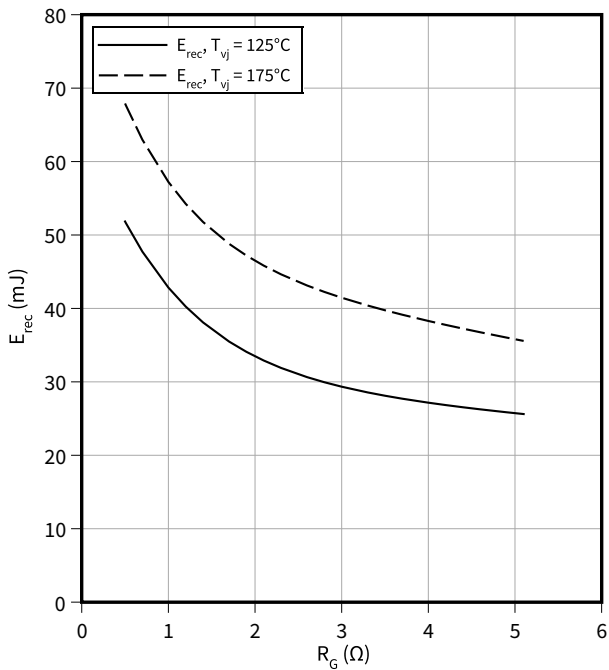
$R_{Gon} = 0.51 \Omega, V_{CE} = 600 V$



Switching losses (typical), Diode, Inverter

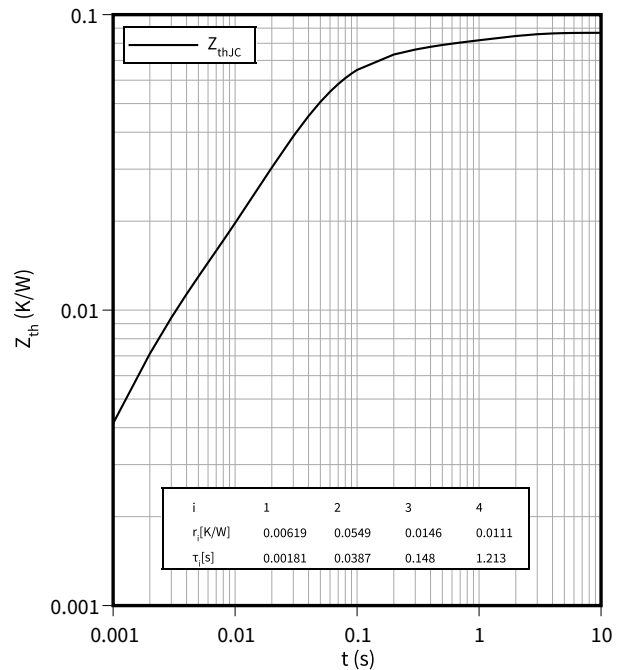
$E_{rec} = f(R_G)$

$V_{CE} = 600 V, I_F = 900 A$



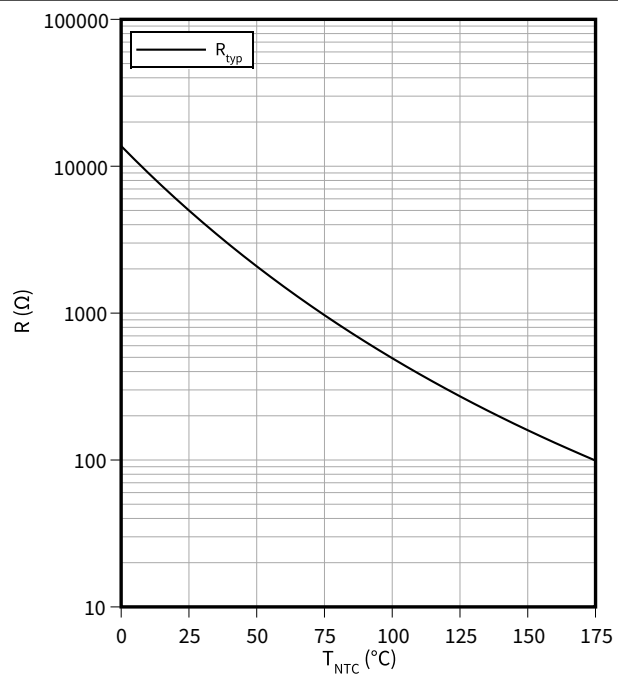
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$$R = f(T_{NTC})$$



6 Circuit diagram

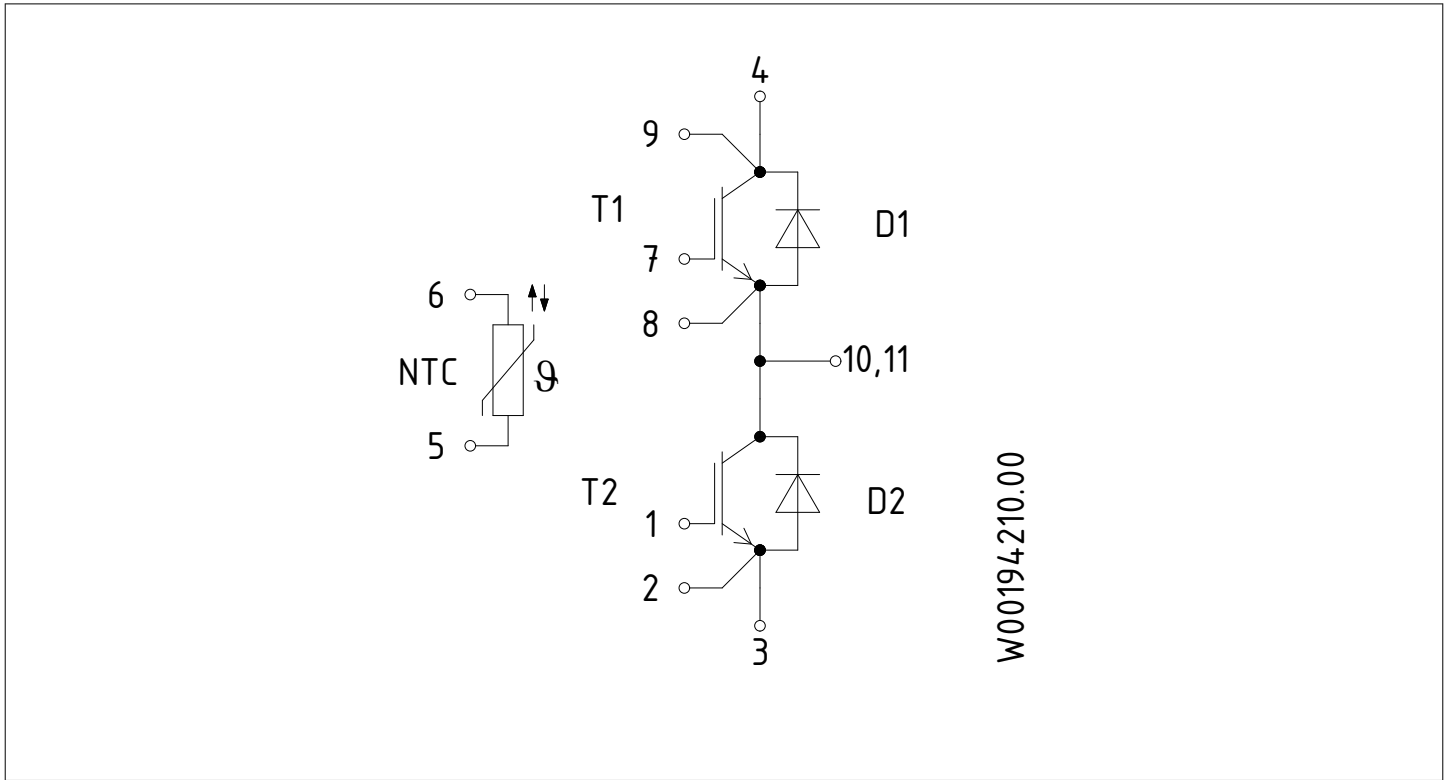


Figure 1

7 Package outlines

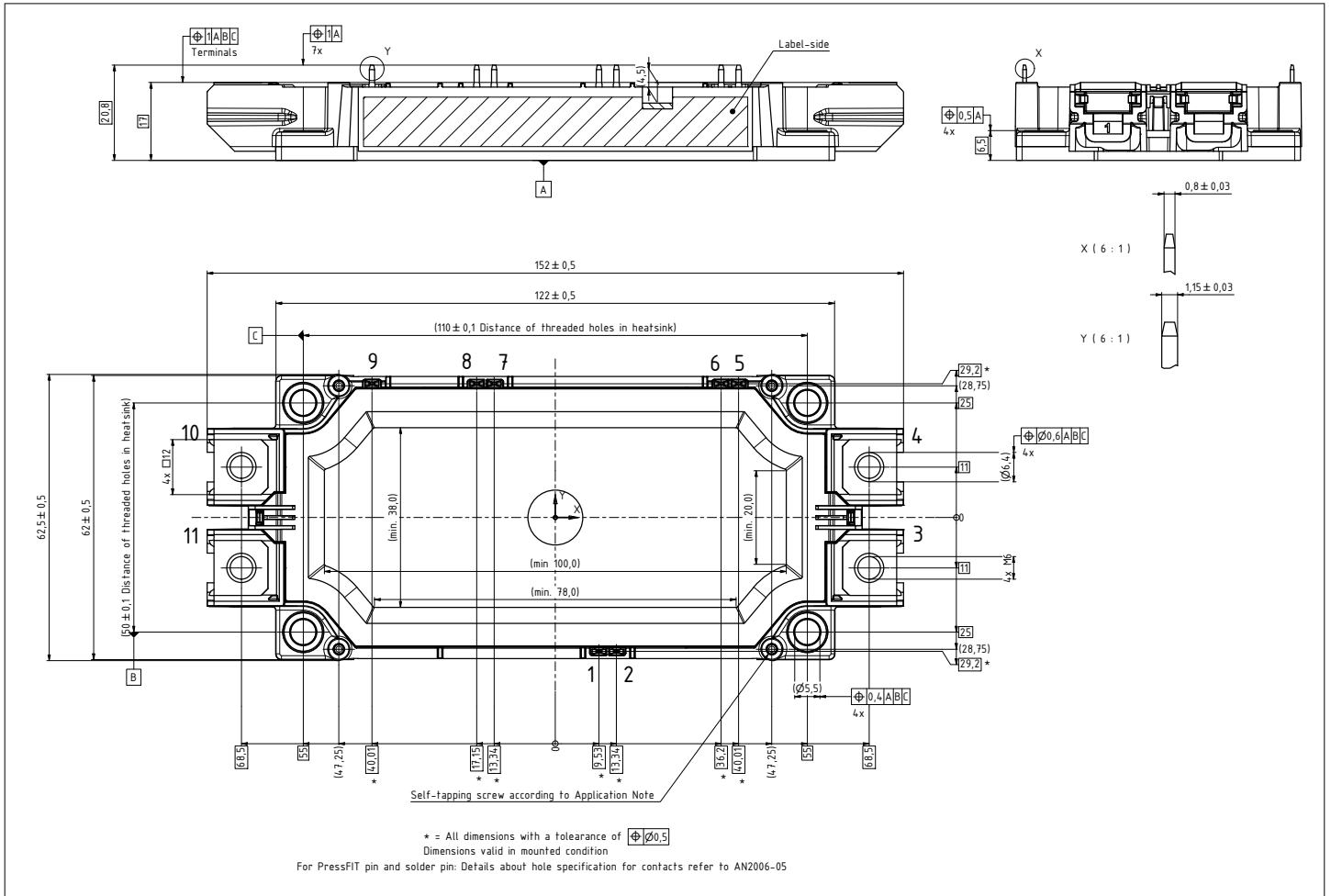


Figure 2

8 Module label code


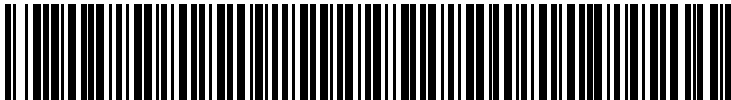
Module label code			
Code format	Data Matrix	Barcode Code128	
Encoding	ASCII text	Code Set A	
Symbol size	16x16	23 digits	
Standard	IEC24720 and IEC16022	IEC8859-1	
Code content	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	Module serial number	1 - 5	71549
	Module material number	6 - 11	142846
	Production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

Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2023-12-07	Initial version
1.10	2024-03-04	Final datasheet

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Edition 2024-03-04

Published by

Infineon Technologies AG

81726 Munich, Germany

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IFX-ABI668-002

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