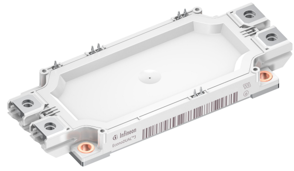
EconoDUAL™3 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and NTC



Features

- Electrical features
  - V_{CES} = 1700 V
  - $I_{C\ nom}$ = 900 A / I_{CRM} = 1800 A
  - Integrated temperature sensor
  - High current density
  - Low $V_{CE,sat}$
  - Overload operation up to 175°C
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - High power density
  - Isolated base plate
  - PressFIT contact technology
  - Standard housing

Potential applications

- High-power converters
- Medium-voltage converters
- Motor drives
- Wind turbines

Product validation

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

Description

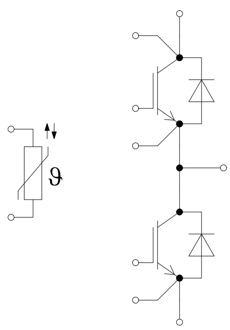


Table of contents

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)	Al2O3	
Creepage distance	d_{Creep}	terminal to heatsink	15.0	mm
Creepage distance	d_{Creep}	terminal to terminal	13.0	mm
Clearance	d_{Clear}	terminal to heatsink	12.5	mm
Clearance	d_{Clear}	terminal to terminal	10.0	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=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
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1700	V
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 80 °C	900	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	

(table continues...)

Table 3 **(continued) Maximum rated values**

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	I_{CRM}	t_P = 1 ms	1800	A
Gate-emitter peak voltage	V_{GES}		±20	V

Table 4 **Characteristic values**

Parameter	Symbol	Note or test condition		Values Min.	Typ.	Max.	Unit
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 900 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.70	1.85	V
			T_{vj} = 125 °C		1.95		
			T_{vj} = 150 °C		2.05		
			T_{vj} = 175 °C		2.10		
Gate threshold voltage	V_{GEth}	I_C = 18.8 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_{CE} = 900 V			8.59		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.28		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			93.8		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.33		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			5	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_{CE} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.33 Ω	T_{vj} = 25 °C		0.174		µs
			T_{vj} = 125 °C		0.195		
			T_{vj} = 150 °C		0.202		
			T_{vj} = 175 °C		0.207		
Rise time (inductive load)	t_r	I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Gon} = 0.33 Ω	T_{vj} = 25 °C		0.054		µs
			T_{vj} = 125 °C		0.060		
			T_{vj} = 150 °C		0.061		
			T_{vj} = 175 °C		0.065		
Turn-off delay time (inductive load)	t_{doff}	I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Goff} = 3 Ω	T_{vj} = 25 °C		0.738		µs
			T_{vj} = 125 °C		0.828		
			T_{vj} = 150 °C		0.850		
			T_{vj} = 175 °C		0.865		

(table continues...)

Table 4 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Fall time (inductive load)	t_f	I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, R_{Goff} = 3 Ω	T_{vj} = 25 °C		0.202		µs
			T_{vj} = 125 °C		0.432		
			T_{vj} = 150 °C		0.504		
			T_{vj} = 175 °C		0.573		
Turn-on energy loss per pulse	E_{on}	I_C = 900 A, V_{CE} = 900 V, $L_σ$ = 25 nH, V_{GE} = ±15 V, R_{Gon} = 0.33 Ω, di/dt = 12300 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		54.6		mJ
			T_{vj} = 125 °C		138		
			T_{vj} = 150 °C		172		
			T_{vj} = 175 °C		205		
Turn-off energy loss per pulse	E_{off}	I_C = 900 A, V_{CE} = 900 V, $L_σ$ = 25 nH, V_{GE} = ±15 V, R_{Goff} = 3 Ω, dv/dt = 3800 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		163		mJ
			T_{vj} = 125 °C		245		
			T_{vj} = 150 °C		271		
			T_{vj} = 175 °C		297		
SC data	I_{SC}	V_{GE} = 15 V, V_{CC} = 1000 V, V_{CEmax}=V_{CES}-L_{sCE}*di/dt	t_P ≤ 8 µs, T_{vj}=150 °C		3000		A
			t_P ≤ 6 µs, T_{vj}=175 °C		2900		
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.0460	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $λ_{grease}$= 1 W/(m*K)			0.0270		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

Note: *T_{vjop} > 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	1700	V
Continuous DC forward current	I_F			900	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1800	A

(table continues...)

Table 5 **(continued) Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	40200	A^2s
			T_{vj} = 175 °C	27000	

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		2.35	2.50	V
			T_{vj} = 125 °C		2.25		
			T_{vj} = 150 °C		2.20		
			T_{vj} = 175 °C		2.10		
Peak reverse recovery current	I_{RM}	V_R = 900 V, I_F = 900 A, V_{GE} = -15 V, -di$_F$/dt = 12900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		992		A
			T_{vj} = 125 °C		1130		
			T_{vj} = 150 °C		1140		
			T_{vj} = 175 °C		1170		
Recovered charge	Q_r	V_R = 900 V, I_F = 900 A, V_{GE} = -15 V, -di$_F$/dt = 12900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		119		µC
			T_{vj} = 125 °C		210		
			T_{vj} = 150 °C		240		
			T_{vj} = 175 °C		272		
Reverse recovery energy	E_{rec}	V_R = 900 V, I_F = 900 A, V_{GE} = -15 V, -di$_F$/dt = 12900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		86		mJ
			T_{vj} = 125 °C		141		
			T_{vj} = 150 °C		159		
			T_{vj} = 175 °C		176		
Thermal resistance, junction to case	R_{thJC}	per diode				0.0885	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)			0.0370		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		175	°C

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

4 NTC-Thermistor

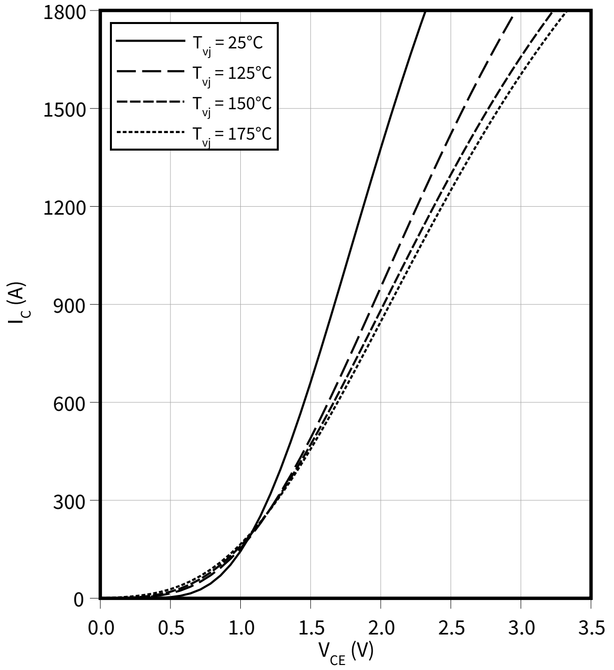
Table 7 Characteristic values

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

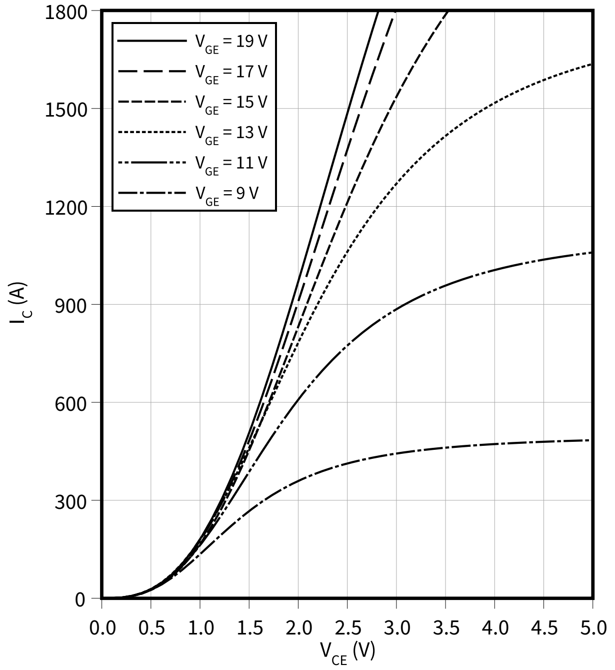
Note: Specification according to the valid application note.

5 Characteristics diagrams

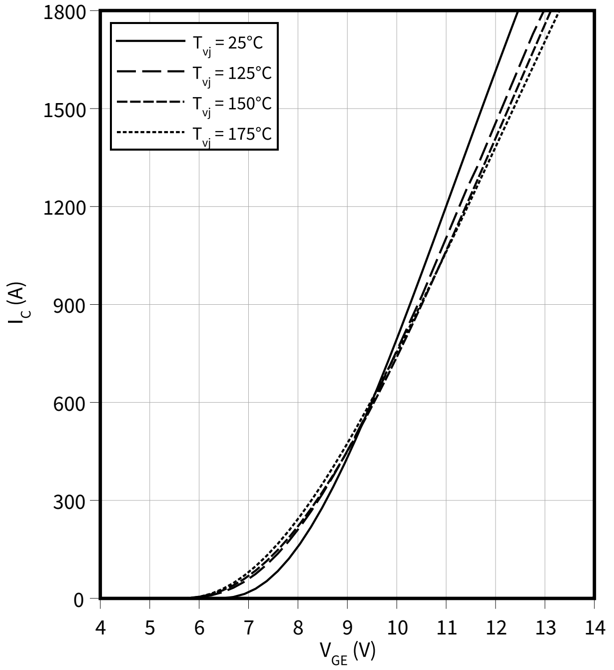
Output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



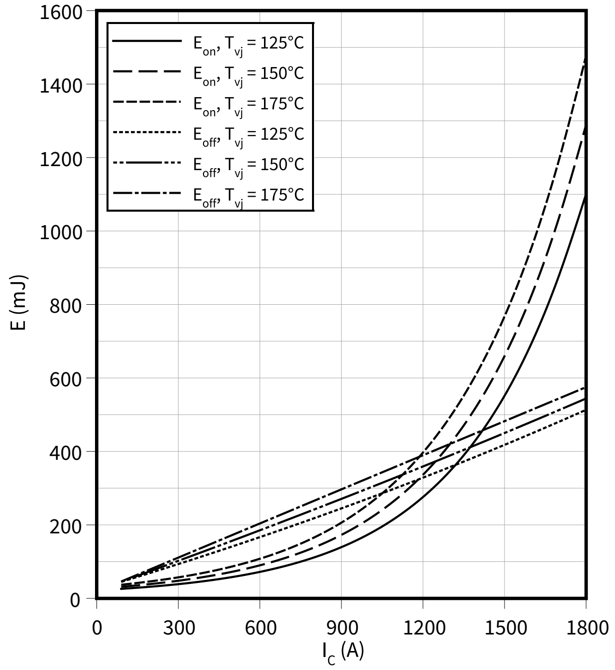
Output characteristic field (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



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



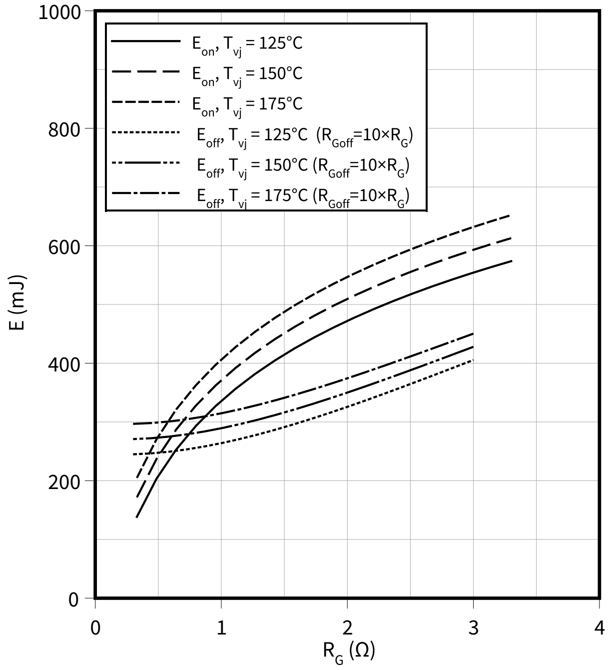
Switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 3\ \Omega$, $R_{Gon} = 0.33\ \Omega$, $V_{CE} = 900$ V, $V_{GE} = \pm 15$ V



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

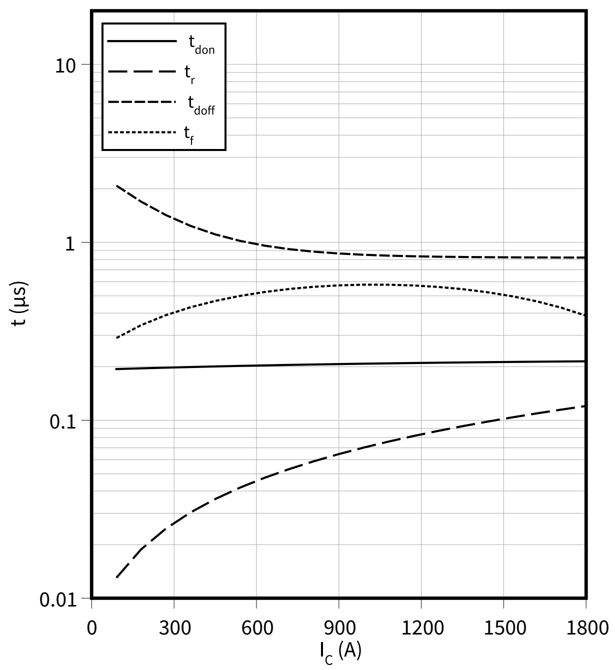
I_C = 900 A, V_{CE} = 900 V, V_{GE} = ± 15 V



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

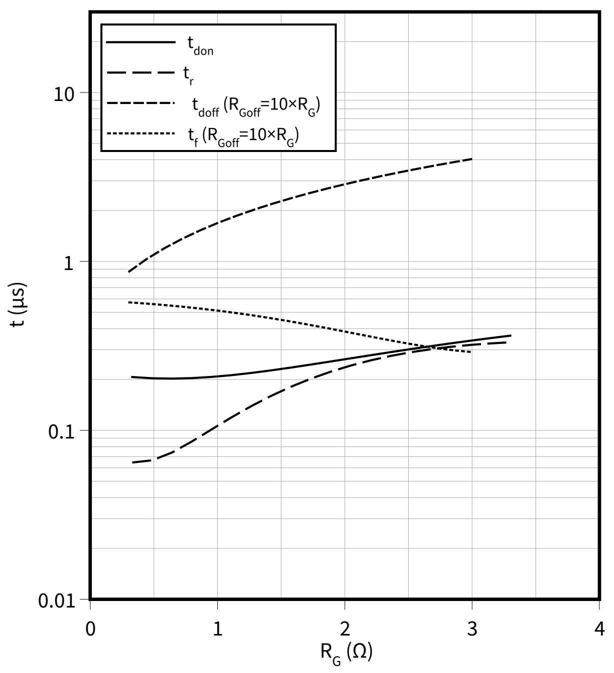
R_{Goff} = 3 Ω, R_{Gon} = 0.33 Ω, V_{CE} = 900 V, V_{GE} = ± 15 V, T_{vj} = 175 °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

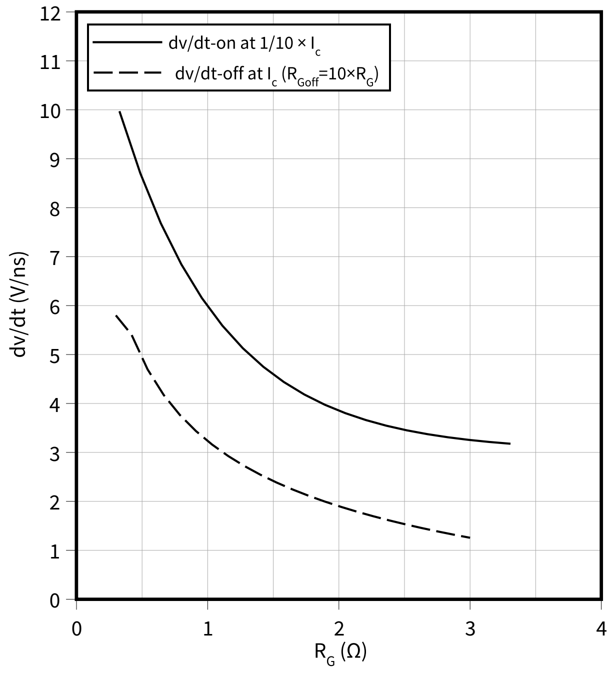
I_C = 900 A, V_{CE} = 900 V, V_{GE} = ± 15 V, T_{vj} = 175 °C



Voltage slope (typical), IGBT, Inverter

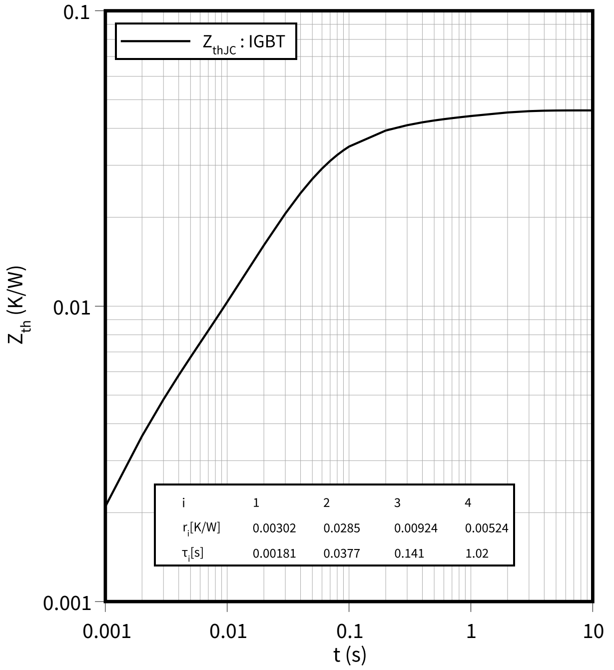
$dv/dt = f(R_G)$

I_C = 900 A, V_{CE} = 900 V, V_{GE} = ±15 V, T_{vj} = 25 °C



Transient thermal impedance , IGBT, Inverter

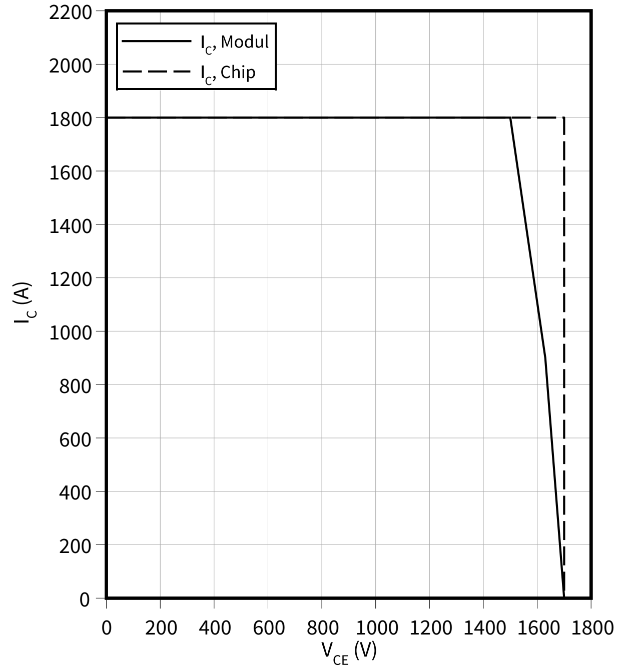
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

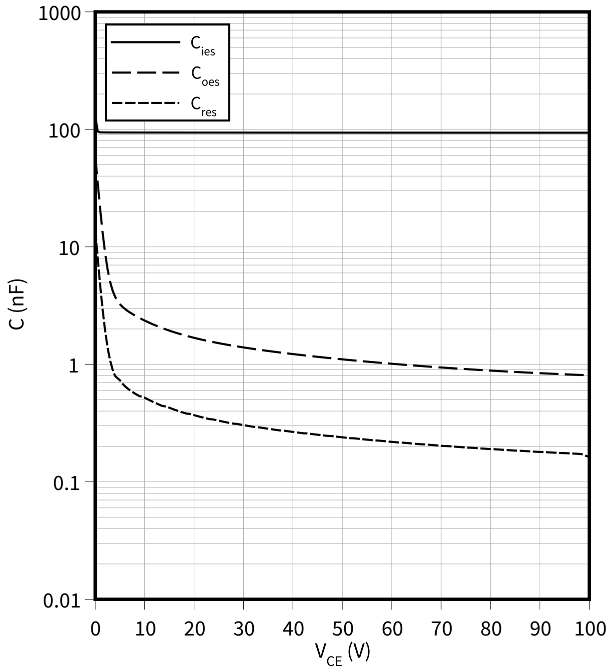
$R_{Goff} = 3\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

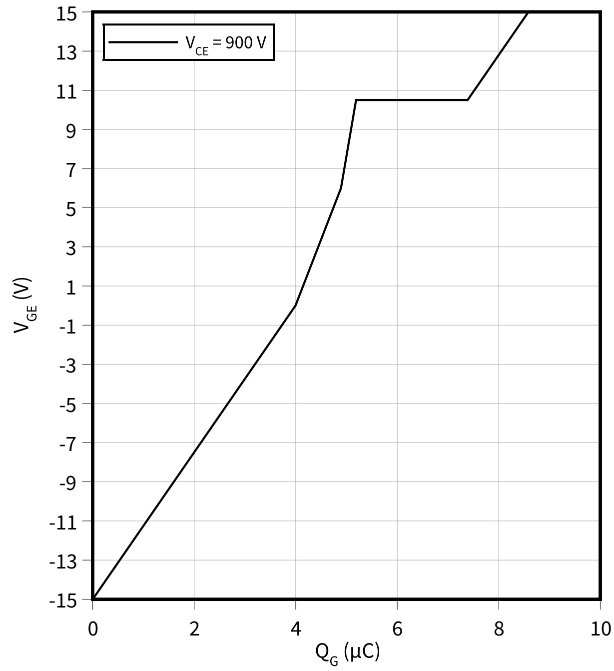
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Gate charge characteristic (typical), IGBT, Inverter

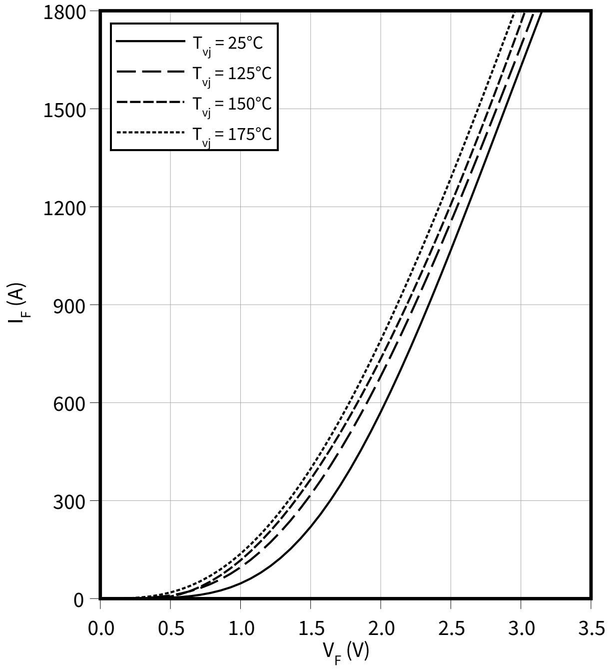
$V_{GE} = f(Q_G)$

$I_C = 900$ A, $T_{vj} = 25$ °C



Forward characteristic (typical), Diode, Inverter

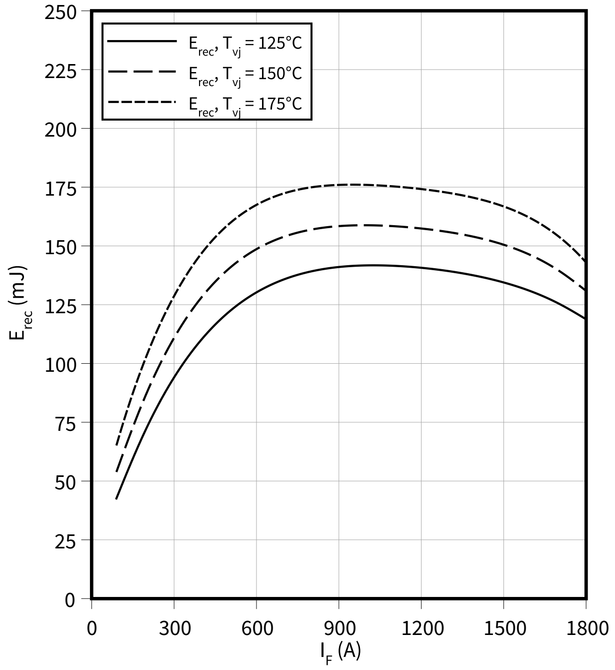
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

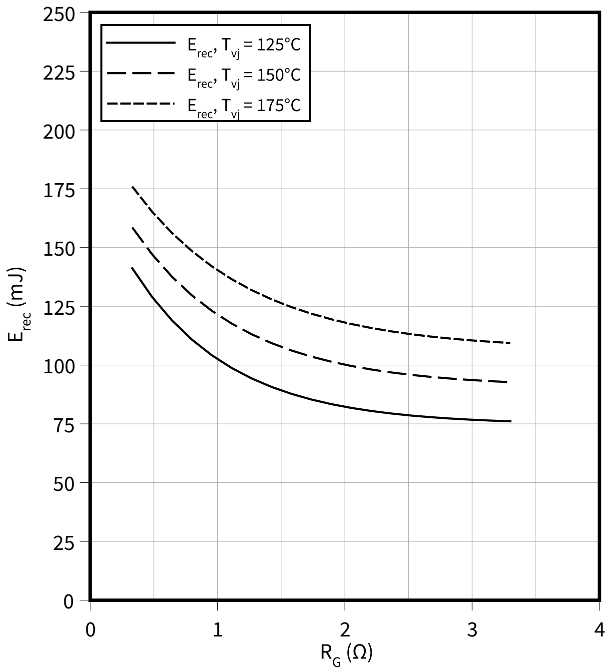
$R_{Gon} = 0.33\ \Omega$, $V_{CE} = 900$ V



Switching losses (typical), Diode, Inverter

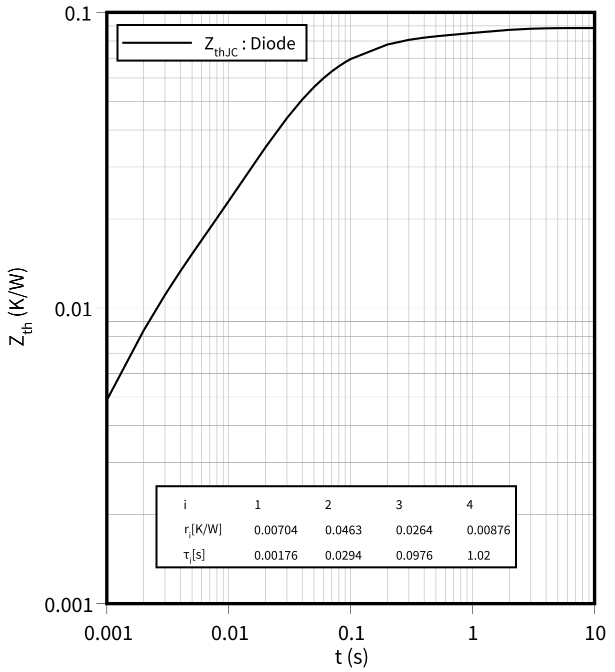
$E_{rec} = f(R_G)$

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

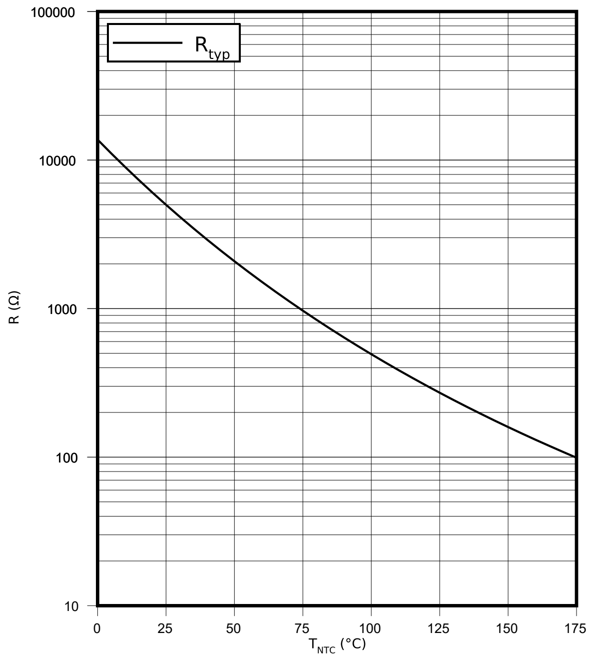


Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



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



6 Circuit diagram

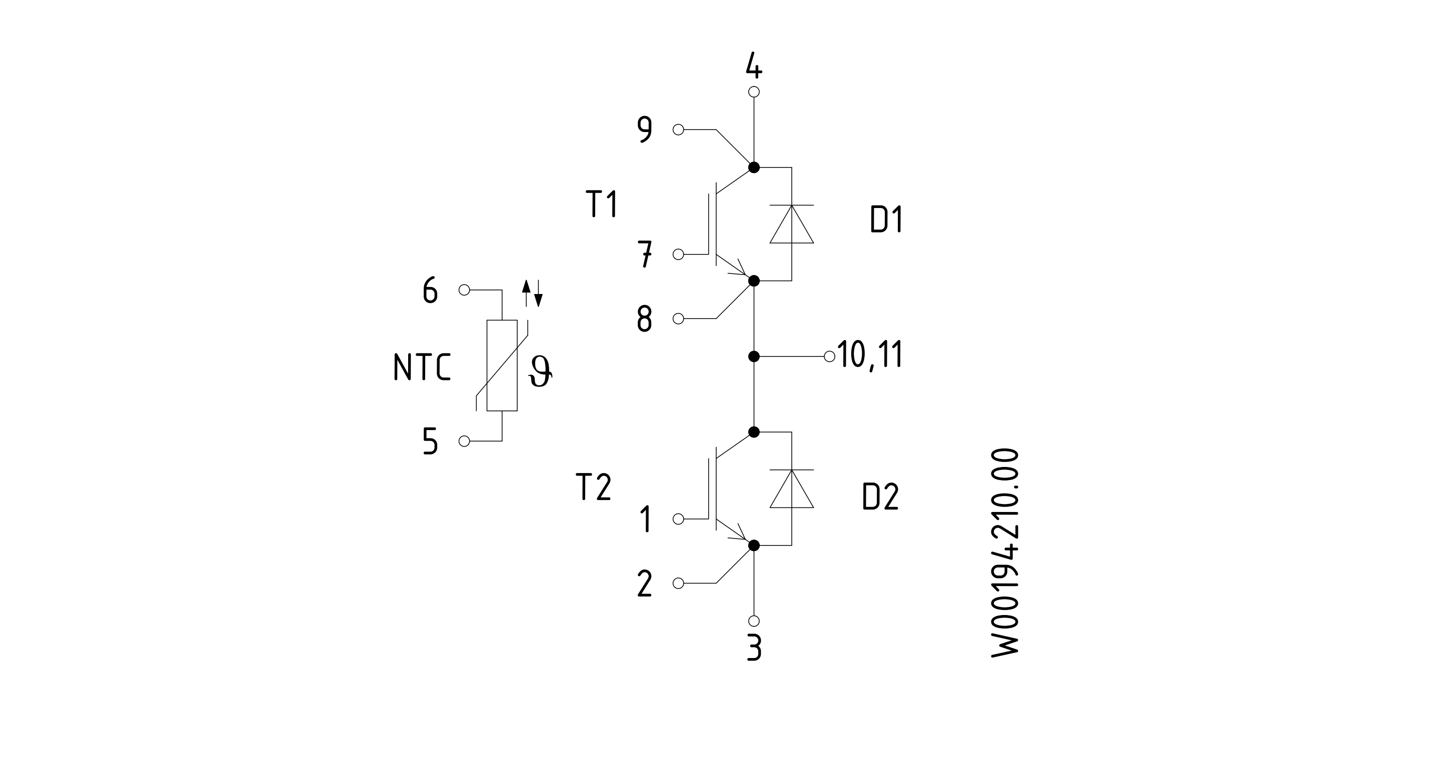


Figure 1

7 Package outlines

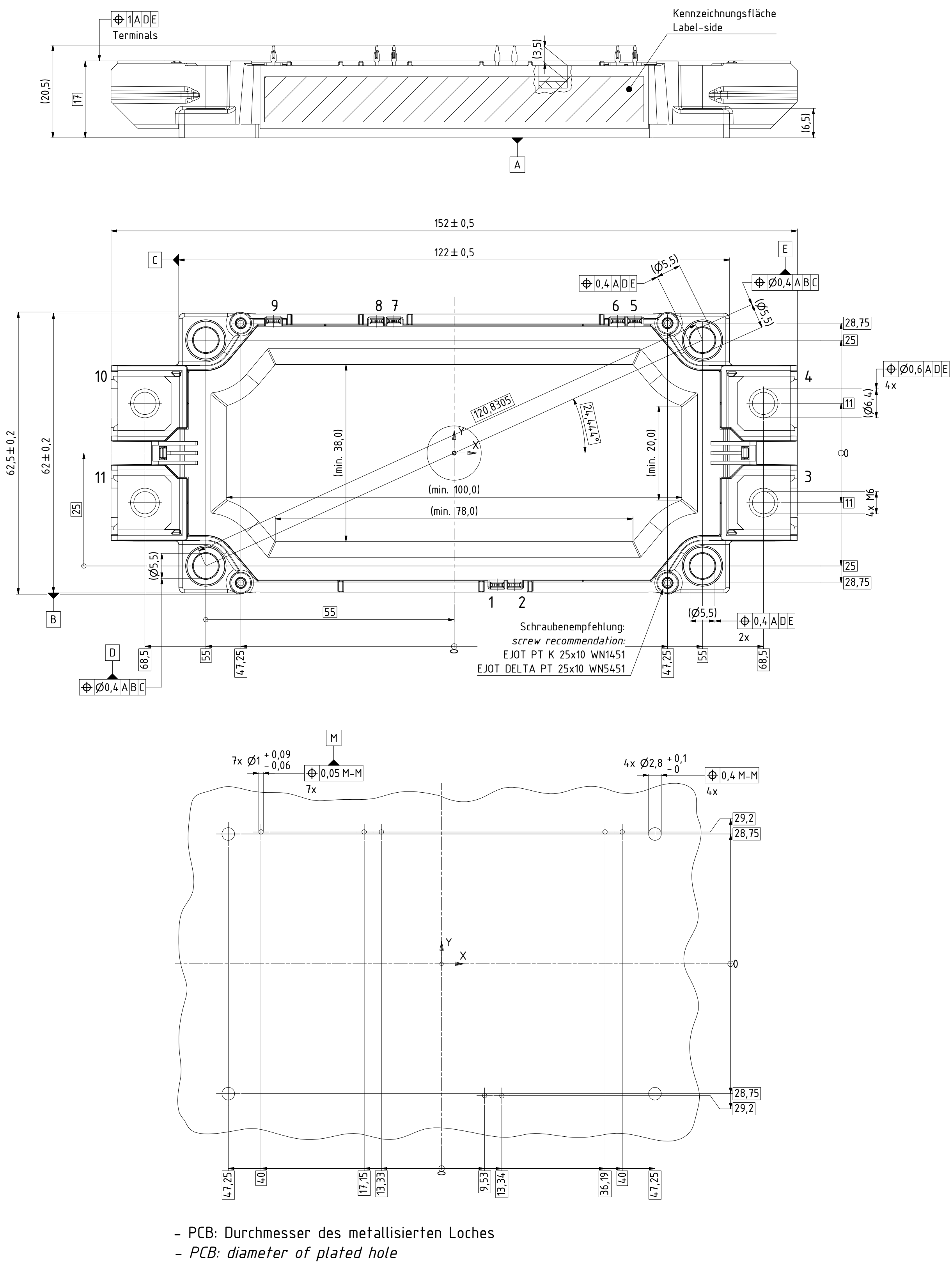


Figure 2

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	*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
0.10	2020-11-12	Target datasheet
0.20	2021-01-14	Target datasheet
1.00	2022-02-01	Final datasheet

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