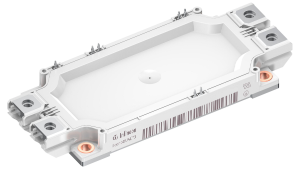
EconoDUAL™3 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and NTC



Features

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 750 A / I_{CRM} = 1500 A
  - Integrated temperature sensor
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
- Mechanical features
  - PressFIT contact technology
  - Standard housing
  - 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

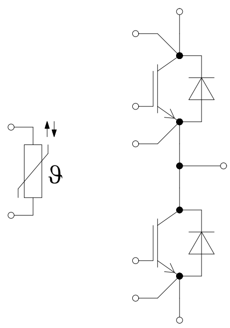


Table of contents

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)	Al_2O_3	
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_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
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 90 °C	750	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	1500	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 = 750 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.50	1.75	V
			T_{vj} = 125 °C		1.65		
			T_{vj} = 175 °C		1.75		
Gate threshold voltage	V_{GEth}	I_C = 15 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} = 600 V			12		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			115		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.58		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			45	µA
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 = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.5 Ω	T_{vj} = 25 °C		0.300		µs
			T_{vj} = 125 °C		0.320		
			T_{vj} = 175 °C		0.340		
Rise time (inductive load)	t_r	I_C = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 0.5 Ω	T_{vj} = 25 °C		0.079		µs
			T_{vj} = 125 °C		0.086		
			T_{vj} = 175 °C		0.090		
Turn-off delay time (inductive load)	t_{doff}	I_C = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.5 Ω	T_{vj} = 25 °C		0.470		µs
			T_{vj} = 125 °C		0.550		
			T_{vj} = 175 °C		0.600		
Fall time (inductive load)	t_f	I_C = 750 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 0.5 Ω	T_{vj} = 25 °C		0.110		µs
			T_{vj} = 125 °C		0.240		
			T_{vj} = 175 °C		0.350		
Turn-on energy loss per pulse	E_{on}	I_C = 750 A, V_{CE} = 600 V, L_σ = 25 nH, V_{GE} = ±15 V, R_{Gon} = 0.5 Ω, di/dt = 7000 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		53		mJ
			T_{vj} = 125 °C		86		
			T_{vj} = 175 °C		107		

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Turn-off energy loss per pulse	E_{off}	I_C = 750 A, V_{CE} = 600 V, L_σ = 25 nH, V_{GE} = ±15 V, R_{Goff} = 0.5 Ω, dv/dt = 3100 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		65		mJ
			T_{vj} = 125 °C		97.5		
			T_{vj} = 175 °C		121		
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		2900		A
			t_P ≤ 6 µs, T_{vj} = 175 °C		2800		
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.0520	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, λ_{grease}= 1 W/(m*K)			0.0260		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		175	°C

Note: Tvj op > 150°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 °C	1200	V
Continuous DC forward current	I_F			750	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		1500	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	28700	A^2s
			T_{vj} = 175 °C	20500	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Forward voltage	V_F	I_F = 750 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.80	2.10	V
			T_{vj} = 125 °C		1.70		
			T_{vj} = 175 °C		1.60		

(table continues...)

Table 6 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current	I_{RM}	V_R = 600 V, I_F = 750 A, V_{GE} = -15 V, $-di_F/dt$ = 7000 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		400		A
			T_{vj} = 125 °C		485		
			T_{vj} = 175 °C		561		
Recovered charge	Q_r	V_R = 600 V, I_F = 750 A, V_{GE} = -15 V, $-di_F/dt$ = 7000 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		48		µC
			T_{vj} = 125 °C		84		
			T_{vj} = 175 °C		131		
Reverse recovery energy	E_{rec}	V_R = 600 V, I_F = 750 A, V_{GE} = -15 V, $-di_F/dt$ = 7000 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		20		mJ
			T_{vj} = 125 °C		32		
			T_{vj} = 175 °C		53		
Thermal resistance, junction to case	R_{thJC}	per diode				0.101	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)			0.0380		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		175	°C

Note: *Tvj op > 150°C is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.*

4 NTC-Thermistor

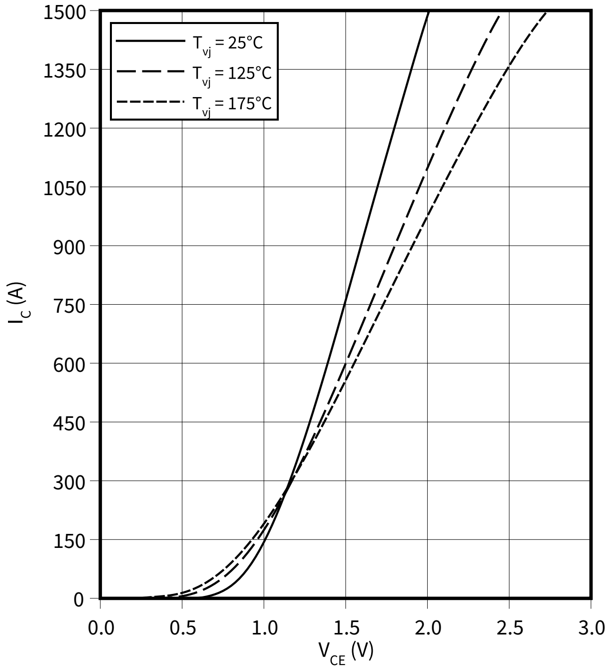
Table 7 **Characteristic values**

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}	$\Delta R/R$	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

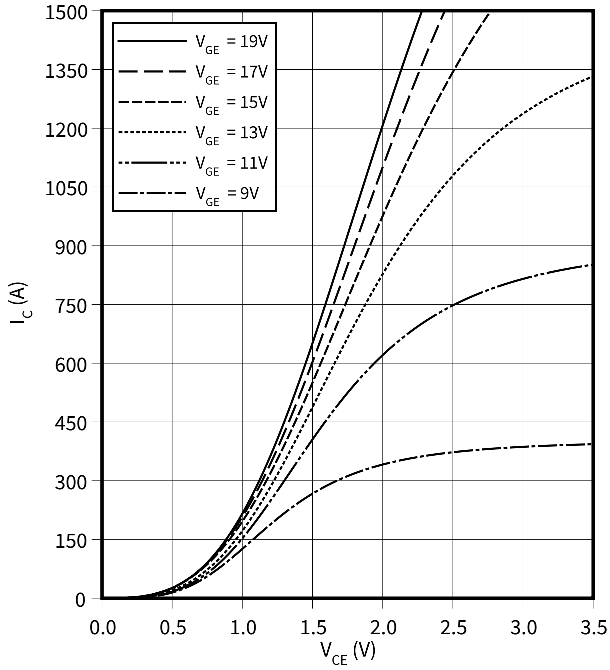
Note: *Specification according to the valid application note.*

5 Characteristics diagrams

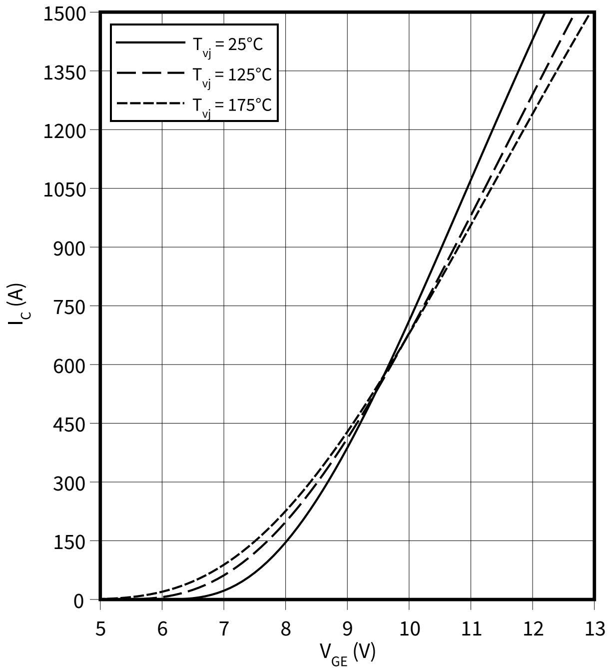
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



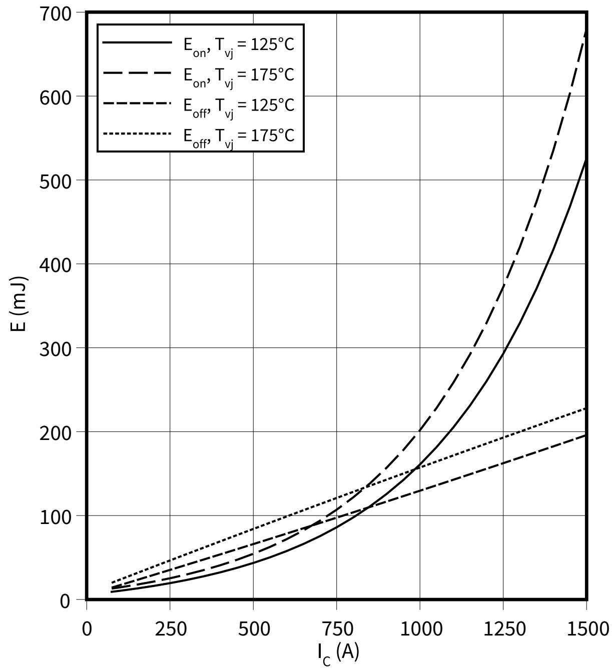
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175\ °C$



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



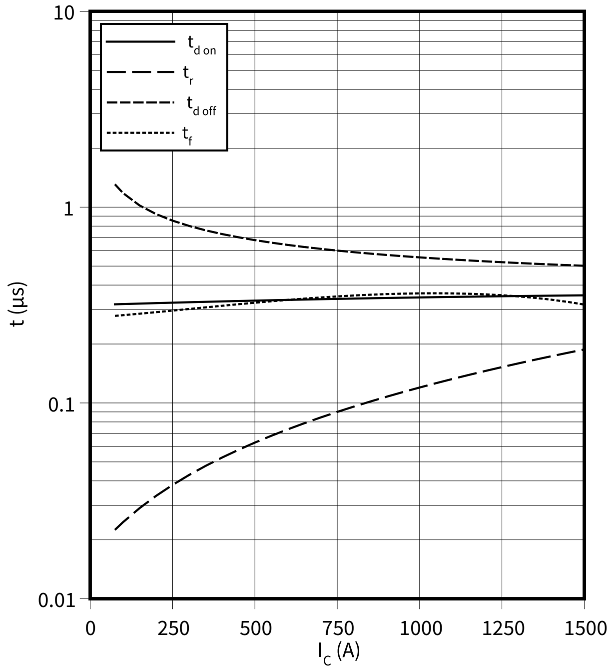
switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 0.5\ \Omega$, $R_{Gon} = 0.5\ \Omega$, $V_{CE} = 600\ V$, $V_{GE} = -15 / 15\ V$



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

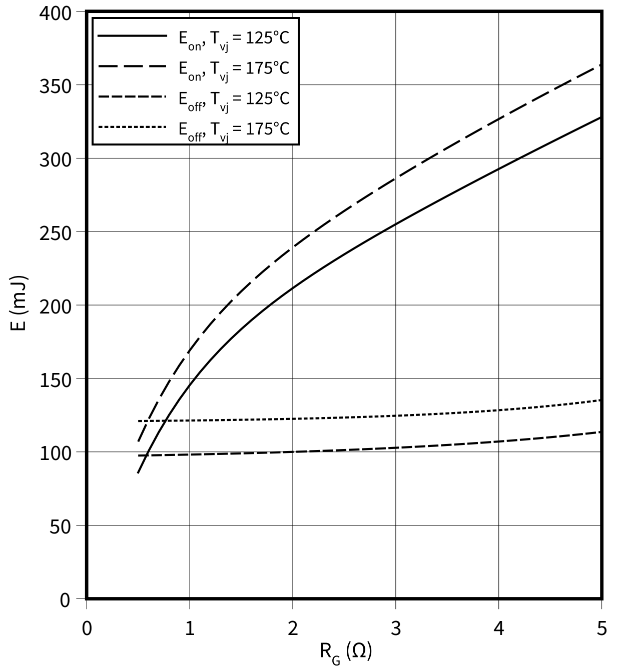
$R_{Goff} = 0.5\ \Omega$, $R_{Gon} = 0.5\ \Omega$, $V_{GE} = \pm15$ V, $V_{CE} = 600$ V, $T_{vj} = 175$ °C



switching losses (typical), IGBT, Inverter

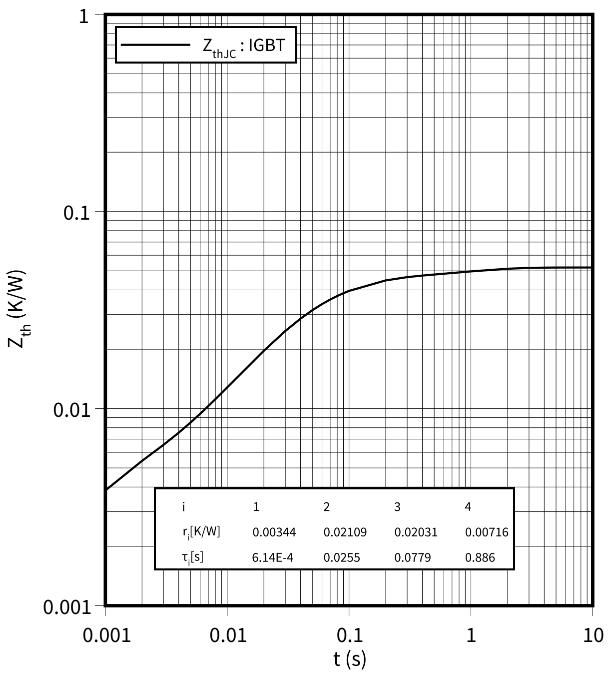
$E = f(R_G)$

$I_C = 750$ A, $V_{CE} = 600$ V, $V_{GE} = -15$ / 15 V



transient thermal impedance , IGBT, Inverter

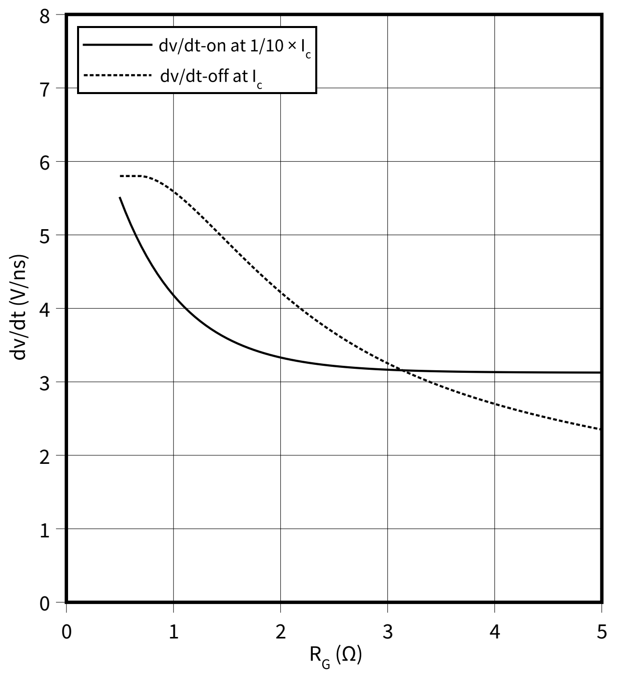
$Z_{th} = f(t)$



Voltage slope (typical), IGBT, Inverter

$dv/dt = f(R_G)$

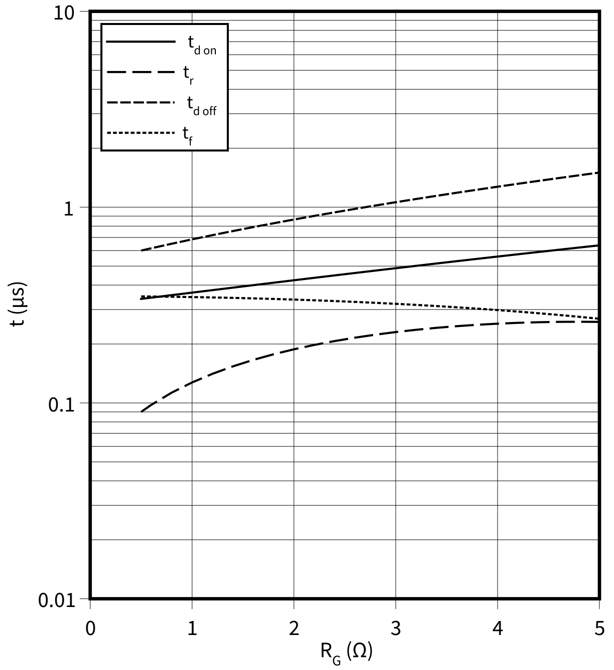
$I_C = 750$ A, $V_{CE} = 600$ V, $V_{GE} = \pm15$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

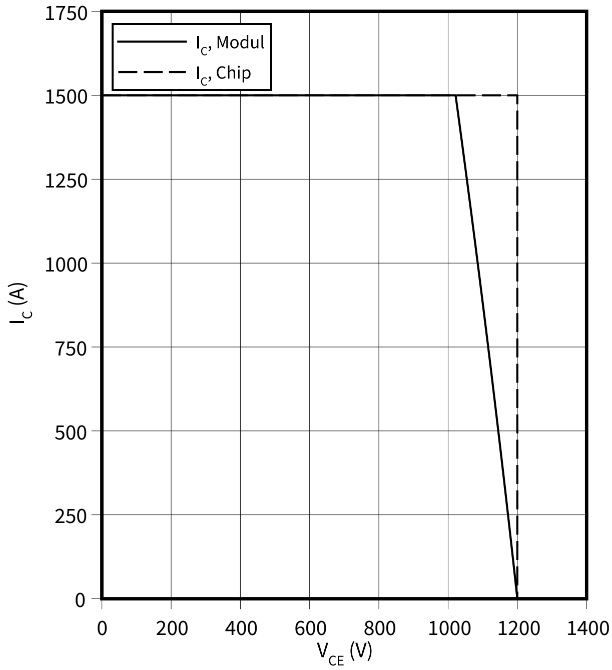
$V_{GE} = \pm15$ V, $I_C = 750$ A, $V_{CE} = 600$ V, $T_{vj} = 175$ °C



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

$I_C = f(V_{CE})$

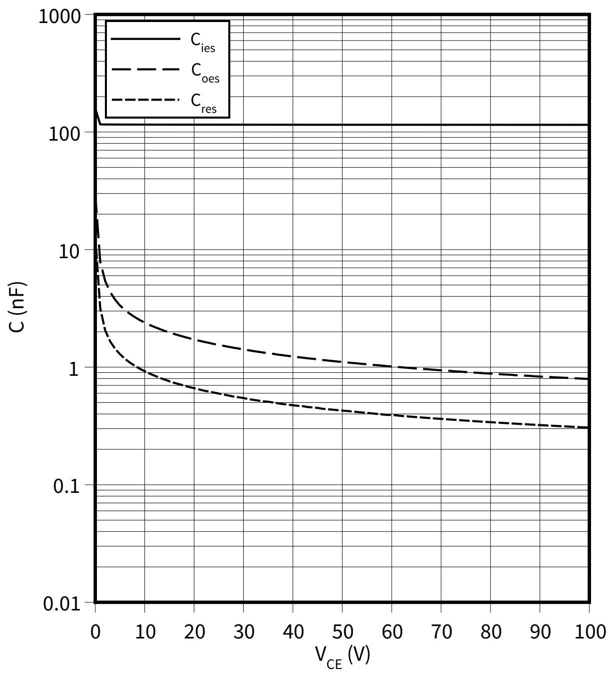
$R_{Goff} = 0.5$ Ω, $V_{GE} = \pm15$ V, $T_{vj} = 175$ °C



capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

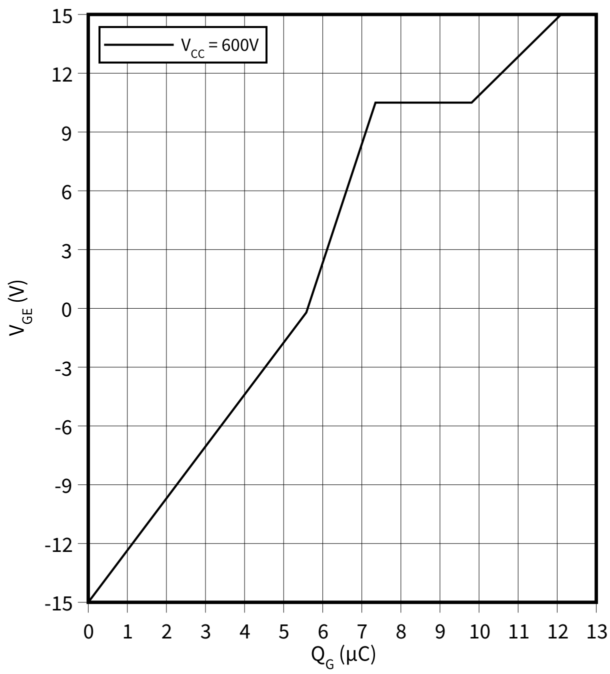
f = 100 kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



gate charge characteristic (typical), IGBT, Inverter

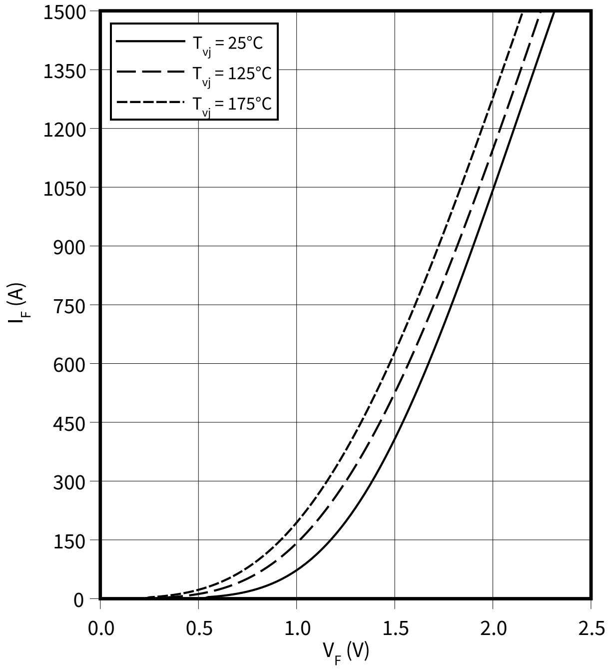
$V_{GE} = f(Q_G)$

$I_C = 750$ A, $T_{vj} = 25$ °C



forward characteristic (typical), Diode, Inverter

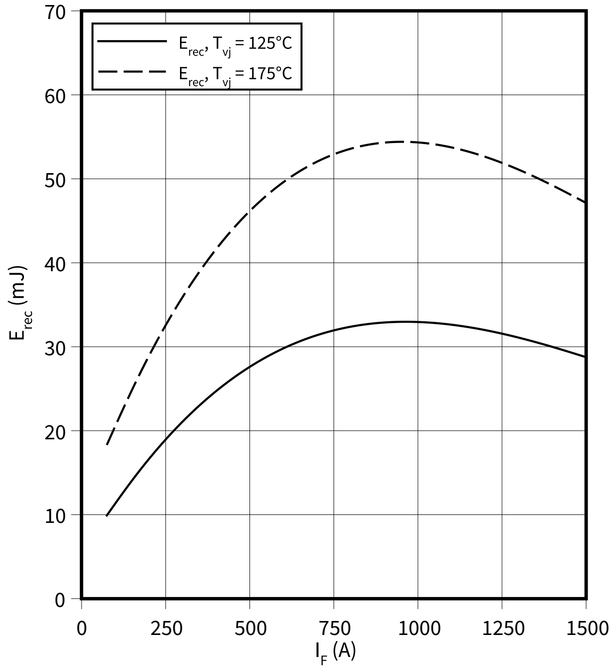
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

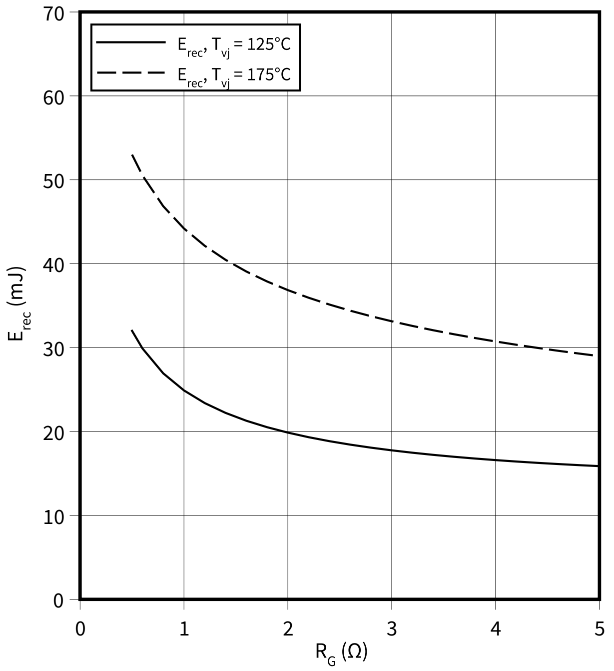
$V_{CE} = 600$ V, $R_{Gon} = R_{Gon}$(IGBT)



switching losses (typical), Diode, Inverter

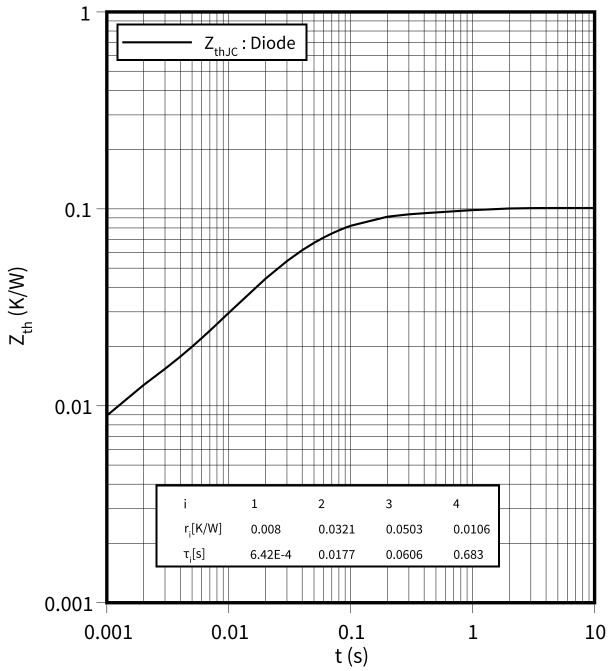
$E_{rec} = f(R_G)$

$V_{CE} = 600$ V, $I_F = 750$ A

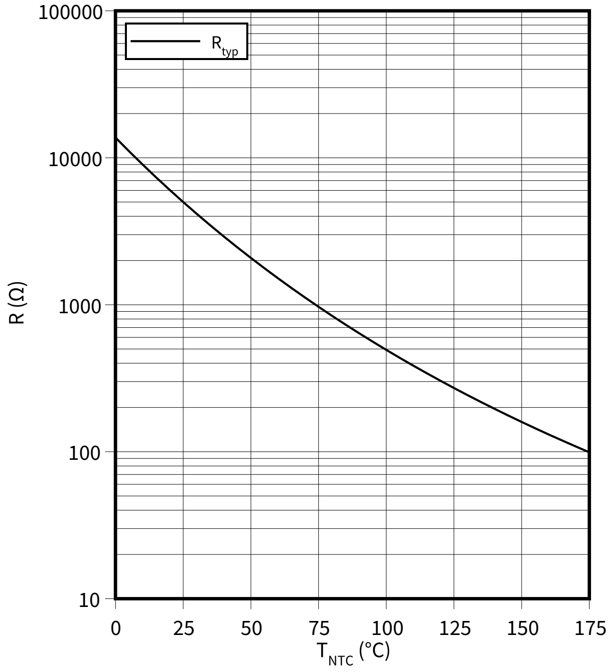


transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



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



6 Circuit diagram

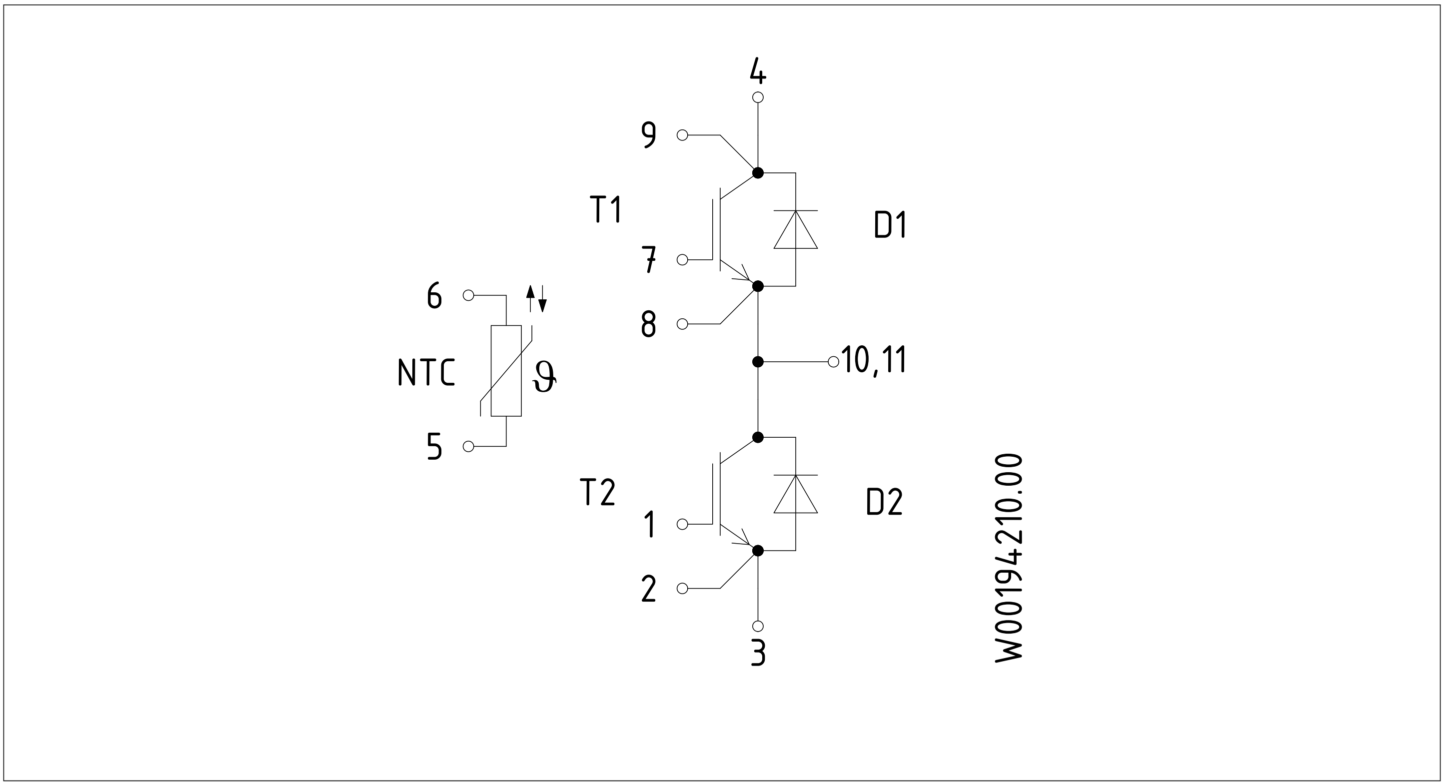


Figure 1

7 Package outlines

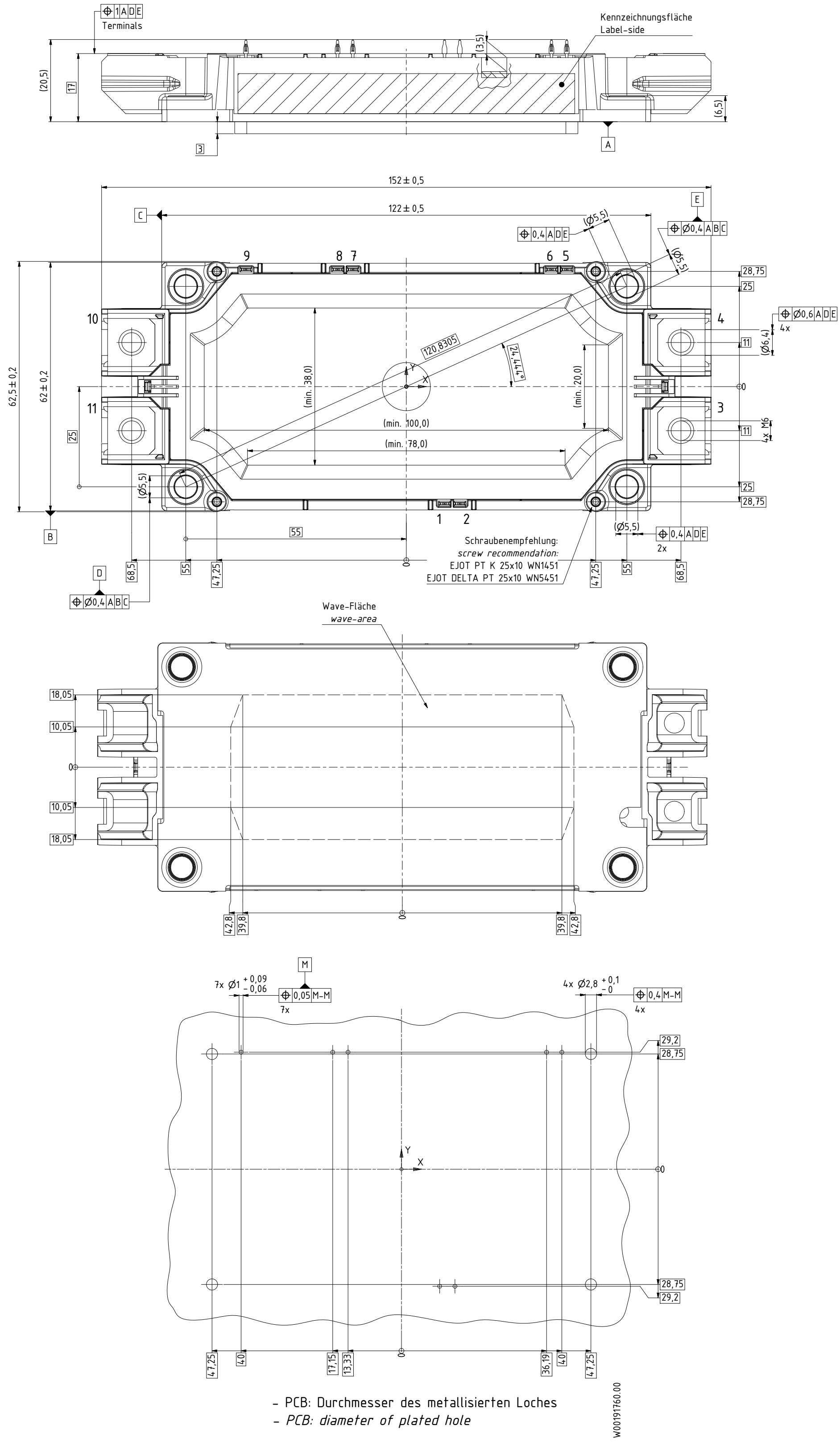


Figure 2

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
V1.0	2019-11-06	Target datasheet
0.11	2020-11-24	Target datasheet
1.00	2021-05-27	Final datasheet
1.10	2021-10-11	Final datasheet

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