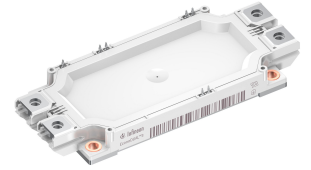


## Final datasheet

### EconoDUAL™3 module with TRENCHSTOP™ IGBT7 and emitter controlled 7 diode and PressFIT / NTC / TIM

#### Features

- Electrical features
  - $V_{CES} = 1700\text{ V}$
  - $I_{C\text{ nom}} = 750\text{ A} / I_{CRM} = 1500\text{ A}$
  - Integrated temperature sensor
  - High current density
  - Low  $V_{CE,sat}$
  - Overload operation up to  $175^{\circ}\text{C}$
  - TRENCHSTOP™ IGBT7
  - $V_{CE,sat}$  with positive temperature coefficient
  - Enlarged diode for regenerative operation
  - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
  - High power density
  - Isolated base plate
  - PressFIT contact technology
  - Standard housing
  - Pre-applied thermal interface material



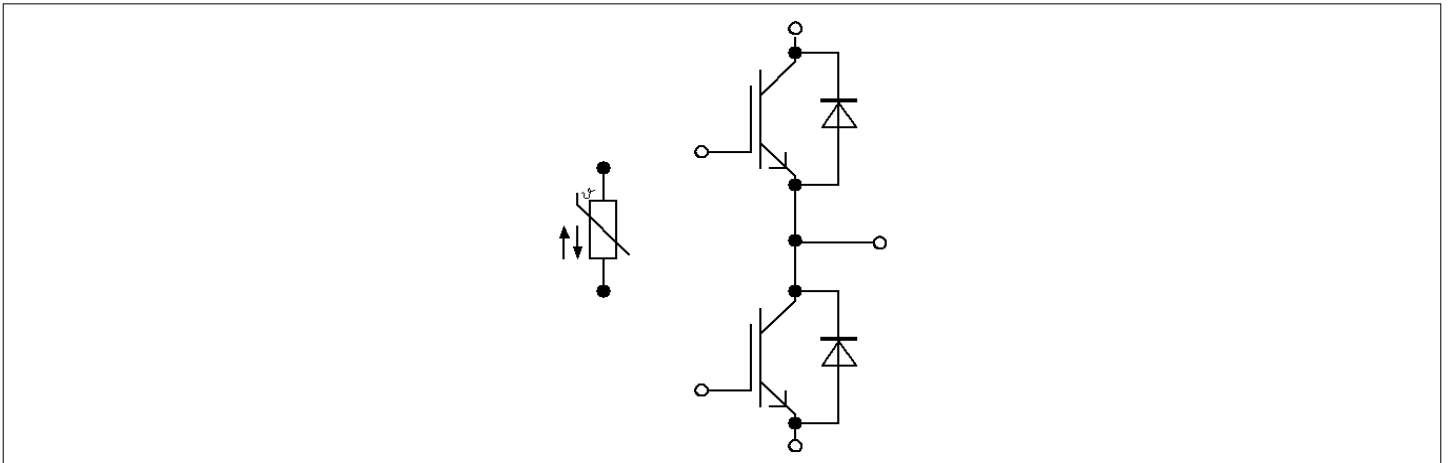
#### Potential applications

- High-power converters
- Medium-voltage converters
- Motor drives
- Wind turbines
- Power transmission and distribution

#### 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
			Min.	Typ.	Max.	
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)	Al2O3			
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	$R_{CC'+EE'}$	$T_H = 25$ °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
			Min.	Typ.	Max.	
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25\text{ °C}$		1700		V
Continuous DC collector current	$I_{CDC}$	$T_{vj\text{ max}} = 175\text{ °C}$ $T_H = 45\text{ °C}$		650		A
Maximum RMS module DC-terminal current	$I_{tRMS}$	$T_{\text{Terminal}} = 90\text{ °C}$ , $T_C = 90\text{ °C}$		580		A
			$T_{\text{Terminal}} = 105\text{ °C}$ , $T_C = 90\text{ °C}$		565	
Repetitive peak collector current	$I_{CRM}$	$t_p$ limited by $T_{vj\text{ op}}$		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	$V_{CE\text{ sat}}$	$I_C = 750\text{ A}$ , $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.70	1.85	V
			$T_{vj} = 125\text{ °C}$	1.95		
			$T_{vj} = 150\text{ °C}$	2.05		
			$T_{vj} = 175\text{ °C}$	2.10		
Gate threshold voltage	$V_{G\text{Eth}}$	$I_C = 15.7\text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25\text{ °C}$	5.15	5.80	6.45	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\text{ V}$ , $V_{CC} = 900\text{ V}$		7.15		μC
Internal gate resistor	$R_{G\text{int}}$	$T_{vj} = 25\text{ °C}$		0.33		Ω
Input capacitance	$C_{ies}$	$f = 100\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$		78.1		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\text{ kHz}$ , $T_{vj} = 25\text{ °C}$ , $V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$		0.275		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1700\text{ V}$ , $V_{GE} = 0\text{ V}$ $T_{vj} = 25\text{ °C}$			5	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)	$t_{don}$	$I_C = 750\text{ A}$ , $V_{CC} = 900\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ , $R_{Gon} = 0.51\text{ Ω}$	$T_{vj} = 25\text{ °C}$	0.158		μs
			$T_{vj} = 125\text{ °C}$	0.172		
			$T_{vj} = 150\text{ °C}$	0.178		
			$T_{vj} = 175\text{ °C}$	0.184		

(table continues...)

**Table 4 (continued) Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rise time (inductive load)	$t_r$	$I_C = 750 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.51 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.046		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.053		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.055		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.057		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 750 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 2.2 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.536		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.613		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.631		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.648		
Fall time (inductive load)	$t_f$	$I_C = 750 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 2.2 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.231		$\mu\text{s}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.450		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.525		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.599		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 750 \text{ A}, V_{CC} = 900 \text{ V}, L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Gon} = 0.51 \Omega, di/dt = 11.1 \text{ kA}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	74		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	171		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	204		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	238		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 750 \text{ A}, V_{CC} = 900 \text{ V}, L_\sigma = 25 \text{ nH}, V_{GE} = \pm 15 \text{ V}, R_{Goff} = 2.2 \Omega, dv/dt = 3600 \text{ V}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	132		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	208		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	224		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	239		
SC data	$I_{SC}$	$V_{GE} = 15 \text{ V}, V_{CC} = 1000 \text{ V}, V_{CEmax} = V_{CES} - L_{sCE} * di/dt$	$t_p \leq 8 \mu\text{s}, T_{vj} = 150 \text{ }^\circ\text{C}$	2600		A
			$t_p \leq 6 \mu\text{s}, T_{vj} = 175 \text{ }^\circ\text{C}$	2500		
Thermal resistance, junction to heat sink	$R_{thJH}$	per IGBT, Valid with IFX pre-applied Thermal Interface Material			0.0935	K/W
Temperature under switching conditions	$T_{vjop}$		-40		175	$^\circ\text{C}$

**Note:**  $T_{vjop} > 150 \text{ }^\circ\text{C}$  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
				Min.	Typ.	Max.	
Repetitive peak reverse voltage	$V_{RRM}$		$T_{vj} = 25\text{ °C}$		1700		V
Implemented forward current	$I_{FN}$				1200		A
Continuous DC forward current	$I_F$				750		A
Repetitive peak forward current	$I_{FRM}$	$t_p = 1\text{ ms}$			1500		A
$I^2t$ - value	$I^2t$	$t_p = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$		48300		$A^2s$
			$T_{vj} = 175\text{ °C}$		37200		

**Table 6** Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 750\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$		2.00	2.15	V
			$T_{vj} = 125\text{ °C}$		1.85		
			$T_{vj} = 150\text{ °C}$		1.80		
			$T_{vj} = 175\text{ °C}$		1.75		
Peak reverse recovery current	$I_{RM}$	$V_{CC} = 900\text{ V}, I_F = 750\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11.8\text{ kA}/\mu\text{s} (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$		950		A
			$T_{vj} = 125\text{ °C}$		1020		
			$T_{vj} = 150\text{ °C}$		1020		
			$T_{vj} = 175\text{ °C}$		1020		
Recovered charge	$Q_r$	$V_{CC} = 900\text{ V}, I_F = 750\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11.8\text{ kA}/\mu\text{s} (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$		115		$\mu\text{C}$
			$T_{vj} = 125\text{ °C}$		218		
			$T_{vj} = 150\text{ °C}$		255		
			$T_{vj} = 175\text{ °C}$		292		
Reverse recovery energy	$E_{rec}$	$V_{CC} = 900\text{ V}, I_F = 750\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 11.8\text{ kA}/\mu\text{s} (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$		76		mJ
			$T_{vj} = 125\text{ °C}$		132		
			$T_{vj} = 150\text{ °C}$		152		
			$T_{vj} = 175\text{ °C}$		171		
Thermal resistance, junction to heat sink	$R_{thJH}$	per diode, Valid with IFX pre-applied Thermal Interface Material				0.111	K/W
Temperature under switching conditions	$T_{vj\text{ op}}$			-40		175	°C

**Note:**  $T_{vj\ op} > 150^{\circ}\text{C}$  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	$R_{25}$	$T_{NTC} = 25^{\circ}\text{C}$		5		k $\Omega$
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC} = 100^{\circ}\text{C}$ , $R_{100} = 493\ \Omega$	-5		5	%
Power dissipation	$P_{25}$	$T_{NTC} = 25^{\circ}\text{C}$			20	mW
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

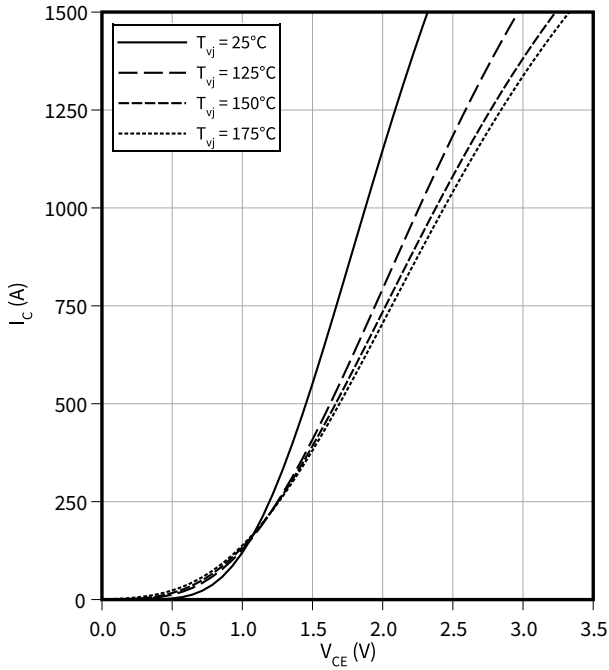
**Note:** For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4

## 5 Characteristics diagrams

### Output characteristic (typical), IGBT, Inverter

$$I_C = f(V_{CE})$$

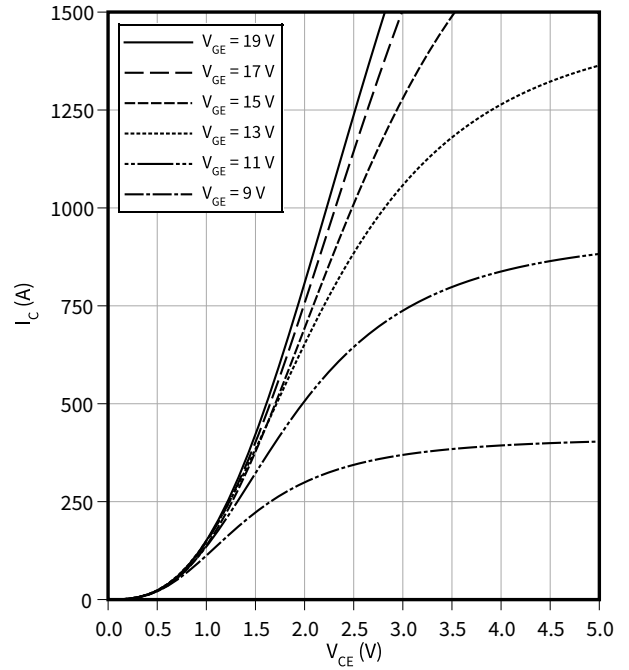
$$V_{GE} = 15 \text{ V}$$



### Output characteristic field (typical), IGBT, Inverter

$$I_C = f(V_{CE})$$

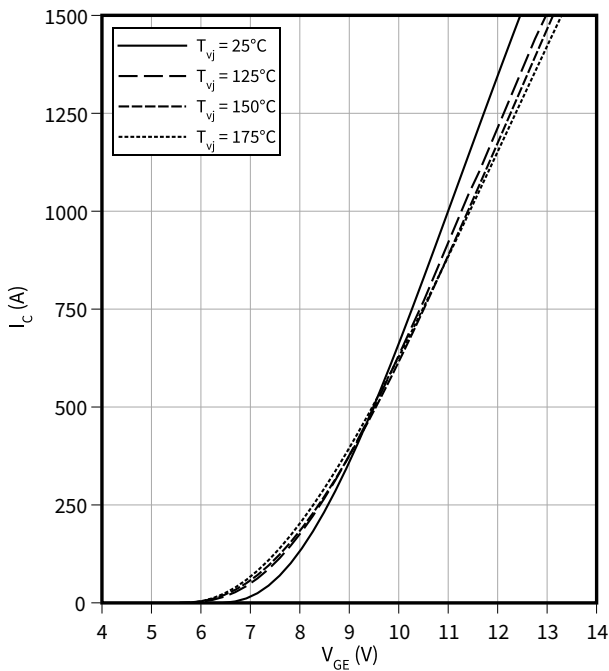
$$T_{vj} = 175 \text{ °C}$$



### Transfer characteristic (typical), IGBT, Inverter

$$I_C = f(V_{GE})$$

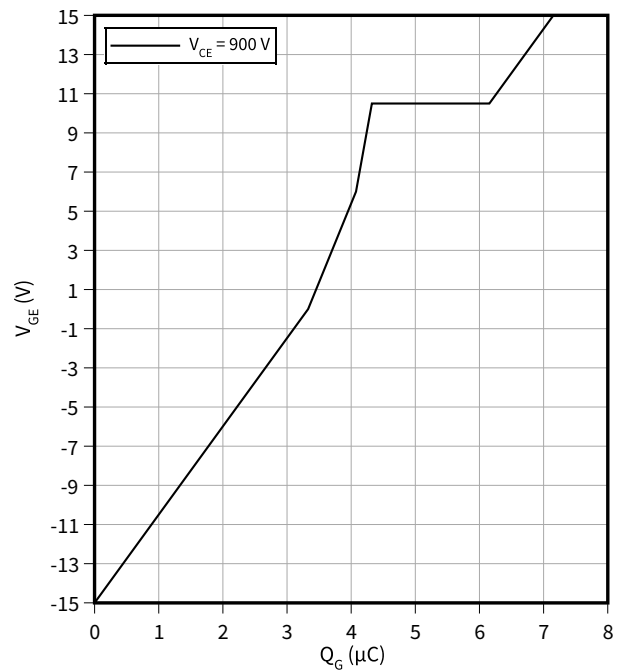
$$V_{CE} = 20 \text{ V}$$



### Gate charge characteristic (typical), IGBT, Inverter

$$V_{GE} = f(Q_G)$$

$$I_C = 750 \text{ A}, T_{vj} = 25 \text{ °C}$$



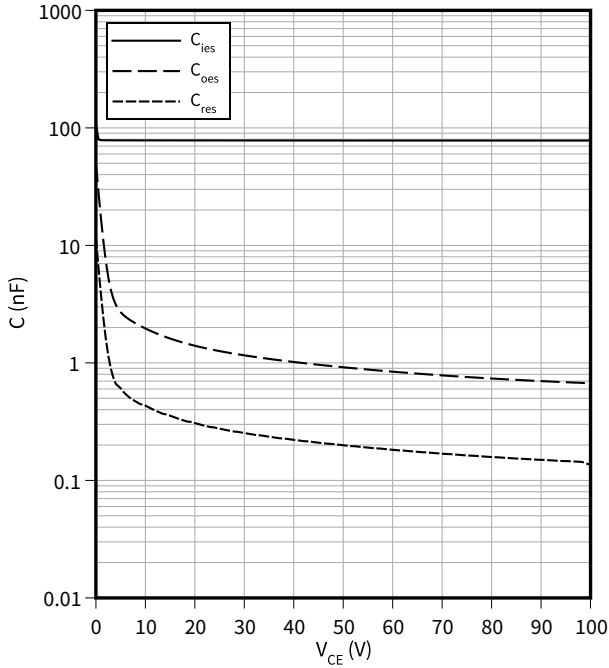


**5 Characteristics diagrams**

**Capacity characteristic (typical), IGBT, Inverter**

$C = f(V_{CE})$

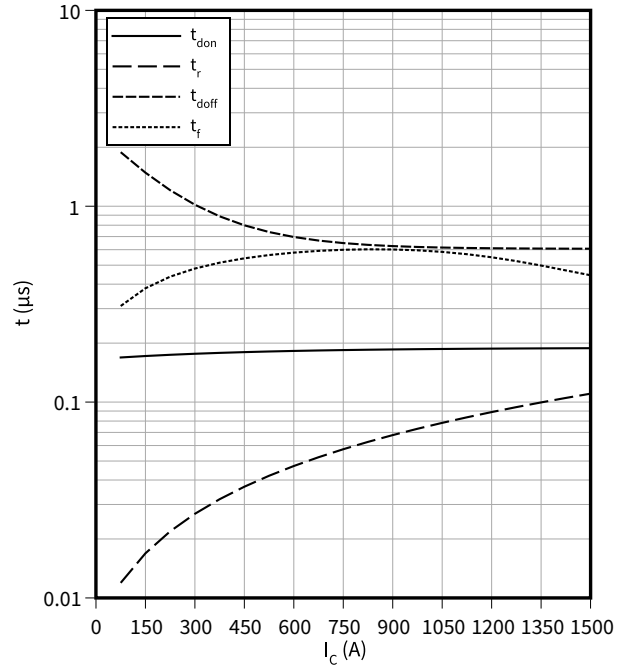
$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}, T_{vj} = 25 \text{ }^\circ\text{C}$



**Switching times (typical), IGBT, Inverter**

$t = f(I_C)$

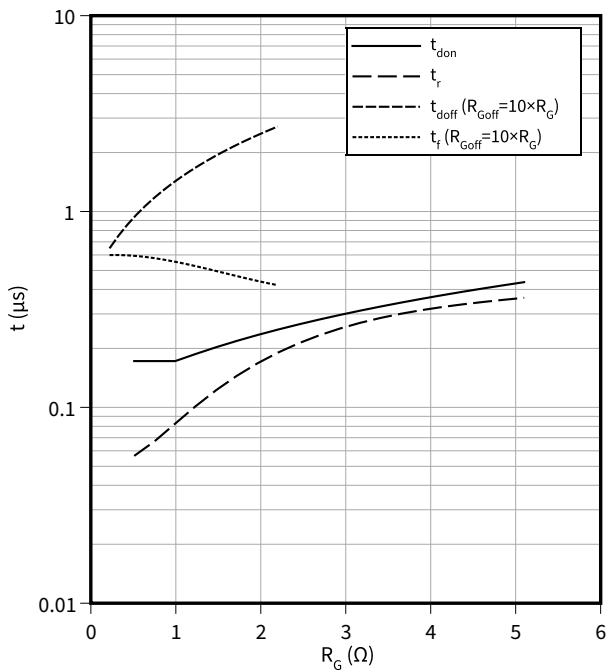
$R_{Goff} = 2.2 \text{ } \Omega, R_{Gon} = 0.51 \text{ } \Omega, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



**Switching times (typical), IGBT, Inverter**

$t = f(R_G)$

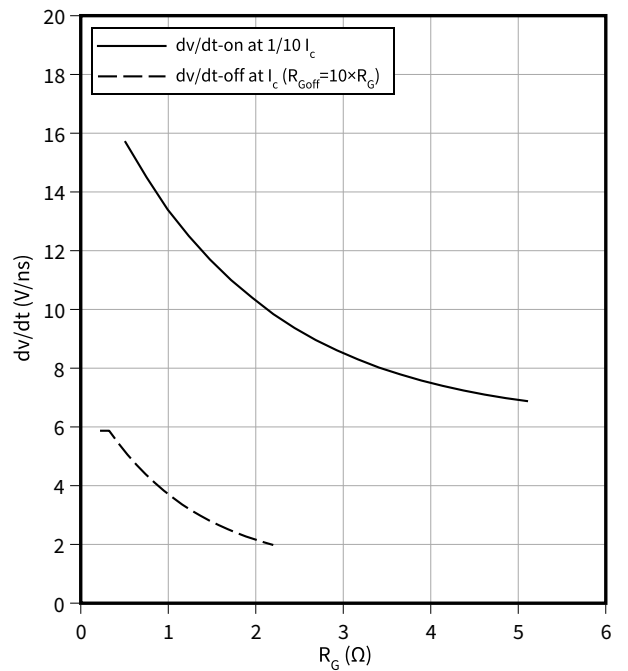
$I_C = 750 \text{ A}, V_{CC} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, T_{vj} = 175 \text{ }^\circ\text{C}$



**Voltage slope (typical), IGBT, Inverter**

$dv/dt = f(R_G)$

$V_{CE} = 900 \text{ V}, V_{GE} = \pm 15 \text{ V}, I_C = 750 \text{ A}, T_{vj} = 25 \text{ }^\circ\text{C}$

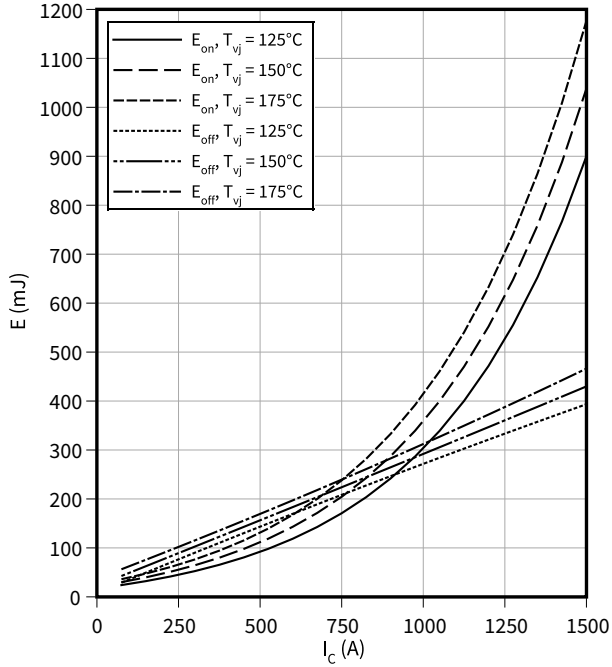


**5 Characteristics diagrams**

**Switching losses (typical), IGBT, Inverter**

$E = f(I_C)$

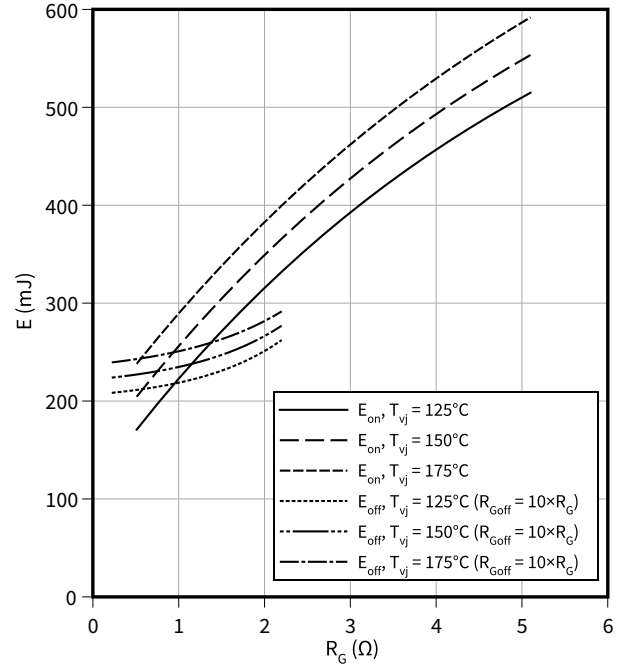
$R_{Goff} = 2.2 \Omega$ ,  $R_{Gon} = 0.51 \Omega$ ,  $V_{CC} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



**Switching losses (typical), IGBT, Inverter**

$E = f(R_G)$

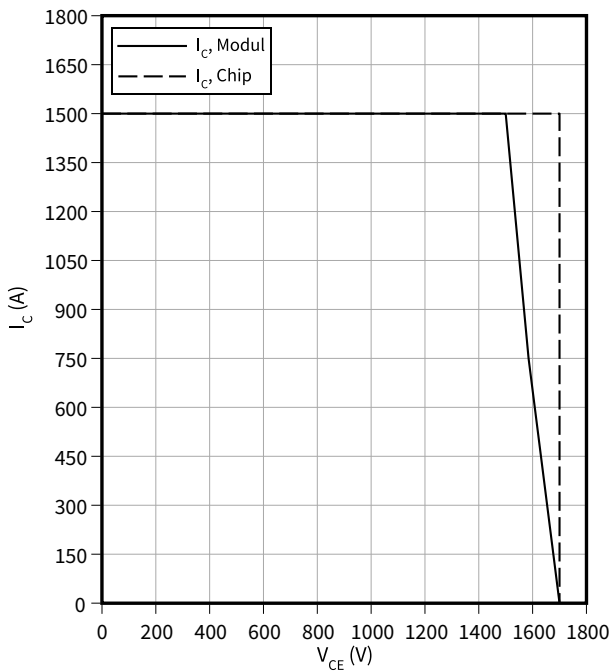
$I_C = 750 \text{ A}$ ,  $V_{CC} = 900 \text{ V}$ ,  $V_{GE} = \pm 15 \text{ V}$



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

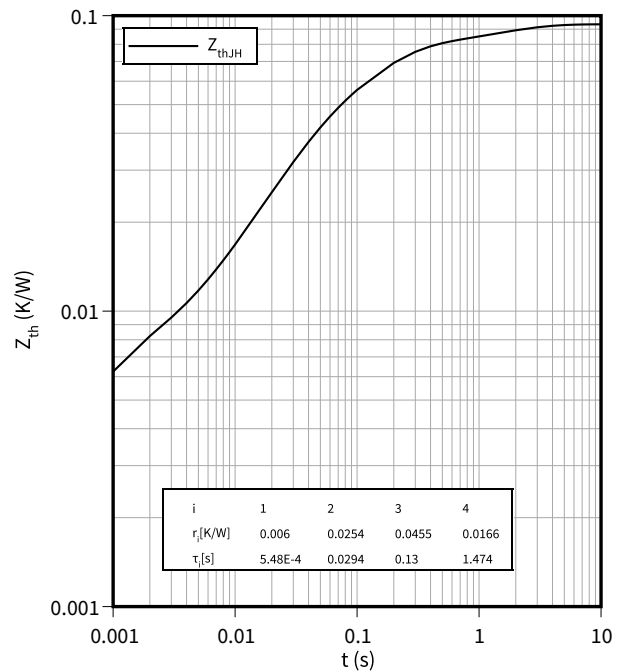
$I_C = f(V_{CE})$

$R_{Goff} = 2.2 \Omega$ ,  $V_{GE} = \pm 15 \text{ V}$ ,  $T_{vj} = 175 \text{ °C}$



**Transient thermal impedance, IGBT, Inverter**

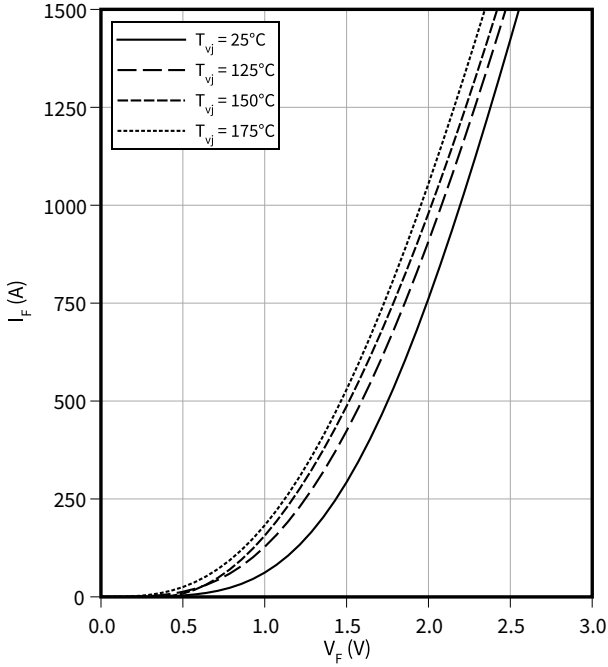
$Z_{th} = f(t)$



5 Characteristics diagrams

**Forward characteristic (typical), Diode, Inverter**

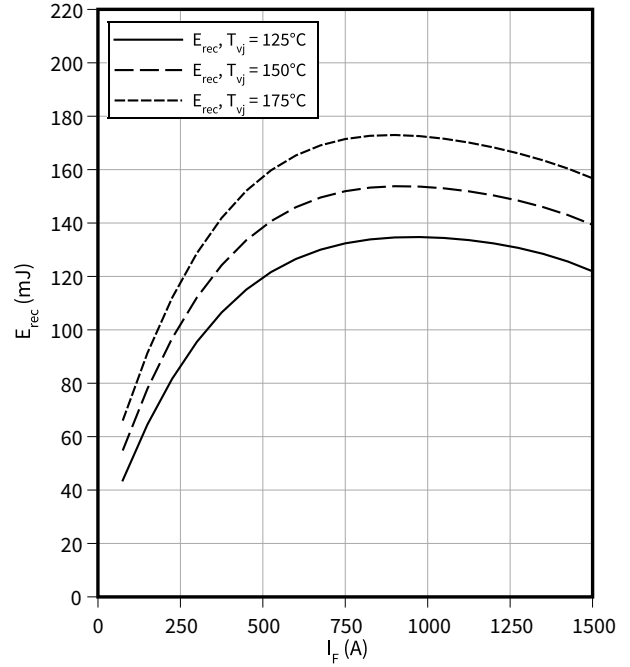
$I_F = f(V_F)$



**Switching losses (typical), Diode, Inverter**

$E_{rec} = f(I_F)$

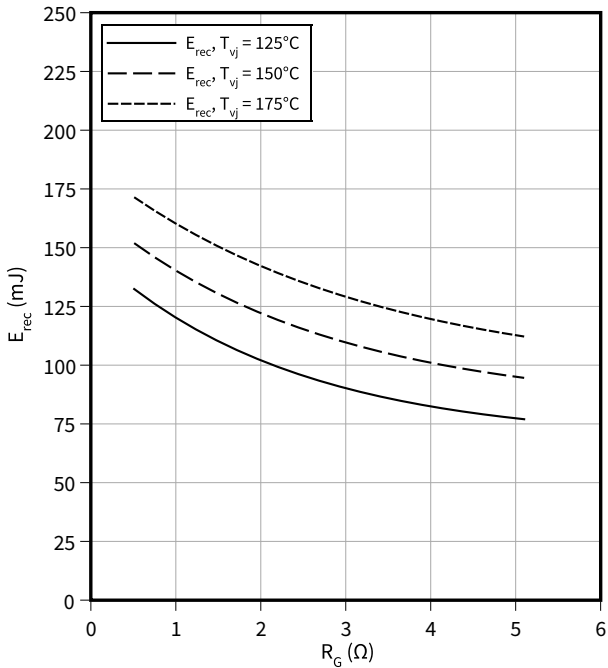
$R_{Gon} = 0.51 \Omega, V_{CC} = 900 V$



**Switching losses (typical), Diode, Inverter**

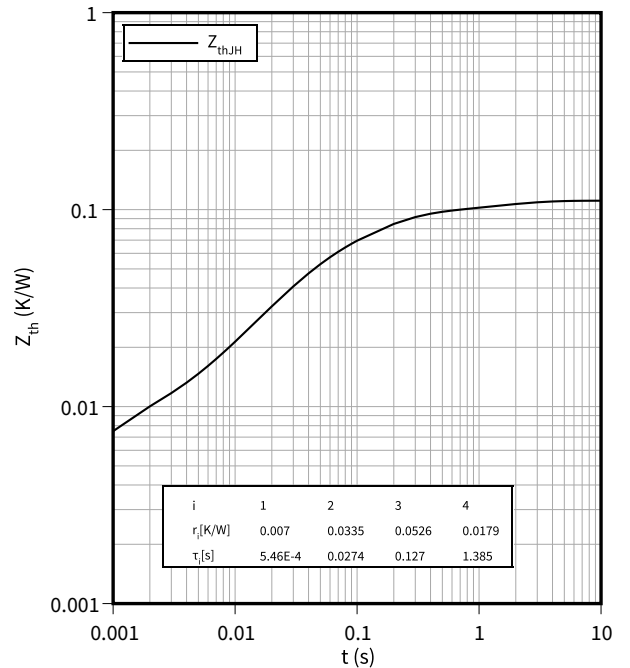
$E_{rec} = f(R_G)$

$I_F = 750 A, V_{CC} = 900 V$



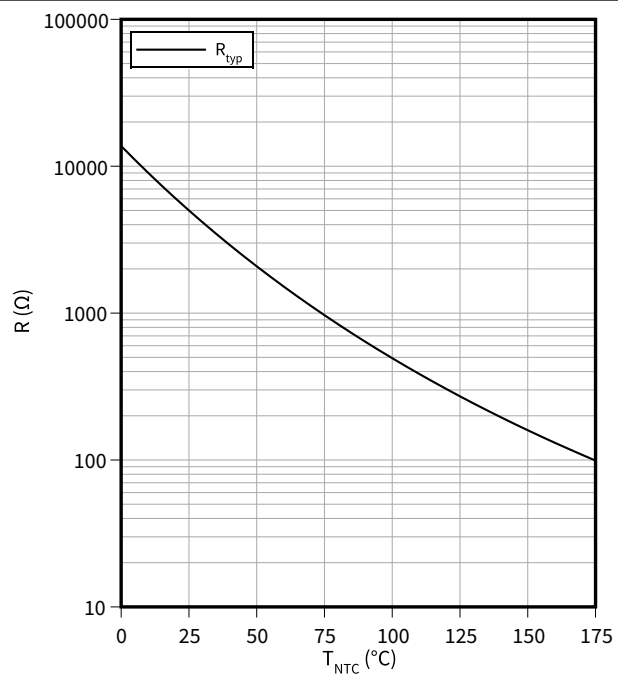
**Transient thermal impedance, Diode, Inverter**

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

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



## 6 Circuit diagram

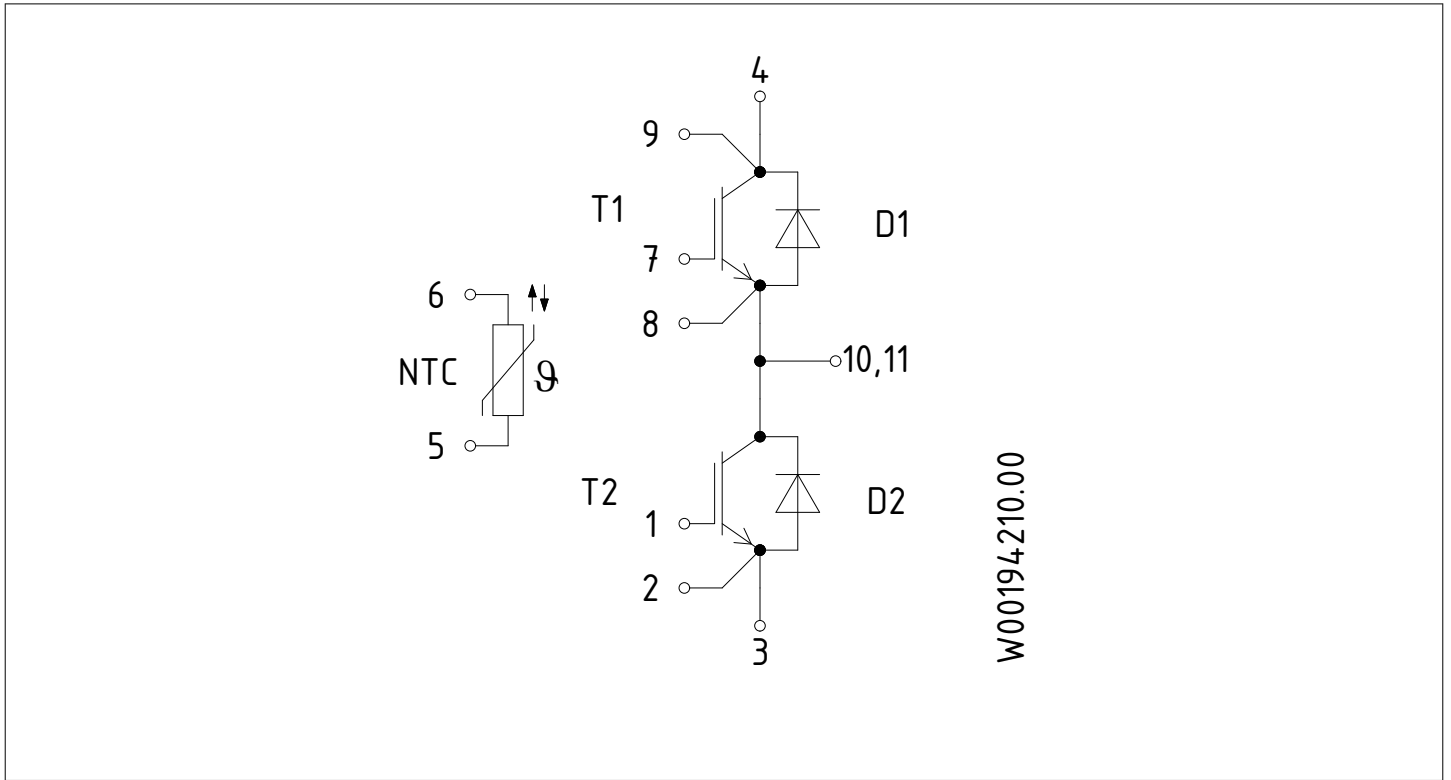

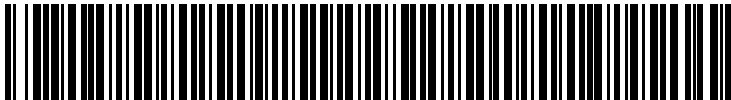


Figure 1



## 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	2024-05-28	Initial version



## Trademarks

All referenced product or service names and trademarks are the property of their respective owners.

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