

## Preliminary datasheet

### EasyPIM™ module with TRENCHSTOP™ IGBT7 and Emitter Controlled 7 diode and NTC / pre-applied Thermal Interface Material

#### Features

- Electrical features
  - Low  $V_{CEsat}$
  - Overload operation up to 175°C
  - TRENCHSTOP™ IGBT7
- Mechanical features
  - Solder contact technology
  - Pre-applied Thermal Interface Material
  - High power density
  - 2.5 kV AC 1 min insulation
  - Al<sub>2</sub>O<sub>3</sub> substrate with low thermal resistance
  - Compact design



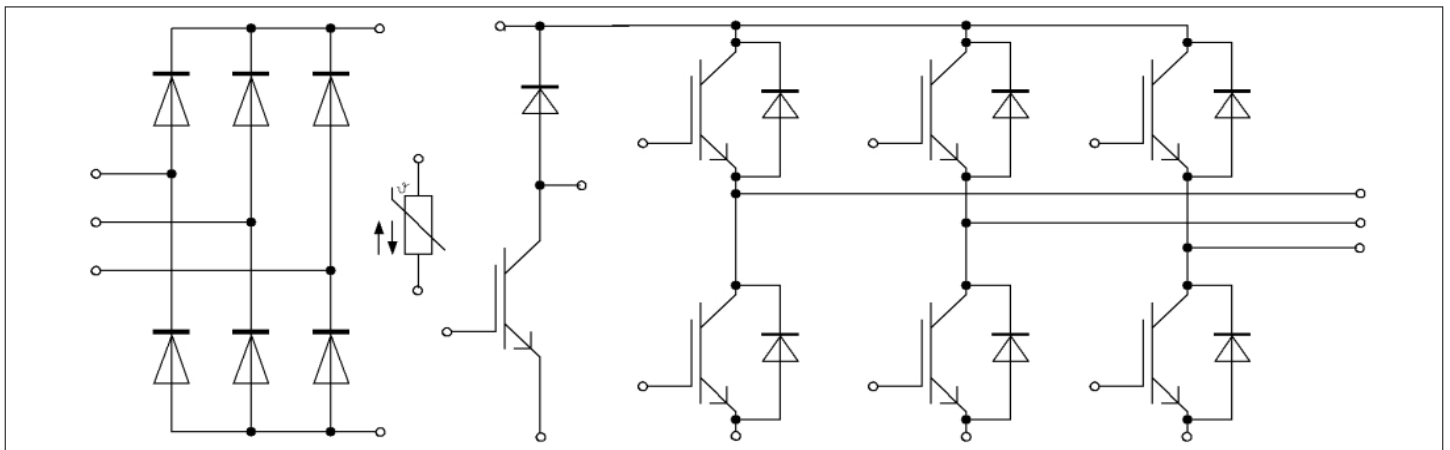
#### Potential applications

- Motor drives
- Air conditioning
- Auxiliary inverters

#### 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, $f = 50 \text{ Hz}$ , $t = 1 \text{ min}$	2.5	kV
Internal Isolation		basic insulation (class 1, IEC 61140)	$Al_2O_3$	
Creepage distance	$d_{Creep}$	terminal to heatsink	11.5	mm
Creepage distance	$d_{Creep}$	terminal to terminal	6.3	mm
Clearance	$d_{Clear}$	terminal to heatsink	10.0	mm
Clearance	$d_{Clear}$	terminal to terminal	5.0	mm
Comparative tracking index	$CTI$		> 200	
RTI Elec.	$RTI$	housing	140	°C

**Table 2** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	$L_{SCE}$			30		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	$T_H = 25^\circ\text{C}$ , per switch		6		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25^\circ\text{C}$ , per switch		8		mΩ
Storage temperature	$T_{stg}$		-40		125	°C
Maximum baseplate operation temperature	$T_{BPmax}$				125	°C
Mounting force per clamp	$F$		20		50	N
Weight	$G$			24		g

Note: The current under continuous operation is limited to 30A rms per connector pin.  
Storage and shipment of modules with TIM => see AN 2012-07

## 2 IGBT, Inverter

**Table 3** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25^\circ\text{C}$	1200	V
Continuous DC collector current	$I_{CDC}$	$T_{vj \text{ max}} = 175^\circ\text{C}$ $T_H = 110^\circ\text{C}$	15	A
Repetitive peak collector current	$I_{CRM}$	$t_p = 1 \text{ ms}$	30	A

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

Parameter	Symbol	Note or test condition	Values	Unit
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	$V_{CE\ sat}$	$I_C = 15\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.60	TBD	V
			$T_{vj} = 125\ ^\circ C$	1.74		
			$T_{vj} = 175\ ^\circ C$	1.82		
Gate threshold voltage	$V_{GEth}$	$I_C = 0.553\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	5.15	5.80	6.45	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\ V, V_{CE} = 600\ V$		0.234		$\mu C$
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\ ^\circ C$		0		$\Omega$
Input capacitance	$C_{ies}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		2.82		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.0099		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1200\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			0.003 mA
Gate-emitter leakage current	$I_{GES}$	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$			100	nA
Turn-on delay time (inductive load)	$t_{don}$	$I_C = 15\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 7.5\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.023		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.025		
			$T_{vj} = 175\ ^\circ C$	0.026		
Rise time (inductive load)	$t_r$	$I_C = 15\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 7.5\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.012		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.015		
			$T_{vj} = 175\ ^\circ C$	0.016		
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 15\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 7.5\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.144		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.190		
			$T_{vj} = 175\ ^\circ C$	0.256		
Fall time (inductive load)	$t_f$	$I_C = 15\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 7.5\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.199		$\mu s$
			$T_{vj} = 125\ ^\circ C$	0.301		
			$T_{vj} = 175\ ^\circ C$	0.329		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 15\ A, V_{CE} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 7.5\ \Omega, di/dt = 750\ A/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	0.87		mJ
			$T_{vj} = 125\ ^\circ C$	1.21		
			$T_{vj} = 175\ ^\circ C$	1.45		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 15\ A, V_{CE} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 7.5\ \Omega, dv/dt = 4000\ V/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	0.922		mJ
			$T_{vj} = 125\ ^\circ C$	1.44		
			$T_{vj} = 175\ ^\circ C$	1.8		

**Table 4** Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
SC data	$I_{SC}$	$V_{GE} \leq 15 \text{ V}, V_{CC} = 800 \text{ V}, V_{CEmax} = V_{CES} - L_{SCE} \cdot di/dt$	$t_p \leq 8 \mu\text{s}, T_{vj} = 150 \text{ }^\circ\text{C}$		48	A
			$t_p \leq 7 \mu\text{s}, T_{vj} = 175 \text{ }^\circ\text{C}$		45	
Thermal resistance, junction to heatsink	$R_{thJH}$	per IGBT, Valid with IFX pre-applied Thermal Interface Material			1.86	K/W
Temperature under switching conditions	$T_{vj\text{op}}$		-40		175	$^\circ\text{C}$

Note:  $T_{vj\text{op}} > 150^\circ\text{C}$  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	$I_F$		10	A	
Repetitive peak forward current	$I_{FRM}$	$t_p = 1 \text{ ms}$	20	A	
$I^2t$ - value	$I^2t$	$V_R = 0 \text{ V}, t_p = 10 \text{ ms}$	$T_{vj} = 125 \text{ }^\circ\text{C}$	27.5	$\text{A}^2\text{s}$
			$T_{vj} = 175 \text{ }^\circ\text{C}$	24	

**Table 6** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 10 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.72	TBD	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1.59		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	1.52		
Peak reverse recovery current	$I_{RM}$	$I_F = 10 \text{ A}, V_R = 600 \text{ V}, V_{GE} = -15 \text{ V}, -di_F/dt = 700 \text{ A}/\mu\text{s} (T_{vj} = 175 \text{ }^\circ\text{C})$	$T_{vj} = 25 \text{ }^\circ\text{C}$	15.5		A
			$T_{vj} = 125 \text{ }^\circ\text{C}$	19.2		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	22.5		

**Table 6** Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Recovered charge	$Q_r$	$I_F = 10\text{ A}$ , $V_R = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $-di_F/dt = 700\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	0.82		$\mu\text{C}$
			$T_{vj} = 125\text{ °C}$	1.46		
			$T_{vj} = 175\text{ °C}$	2.05		
Reverse recovery energy	$E_{rec}$	$I_F = 10\text{ A}$ , $V_R = 600\text{ V}$ , $V_{GE} = -15\text{ V}$ , $-di_F/dt = 700\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	0.31		mJ
			$T_{vj} = 125\text{ °C}$	0.57		
			$T_{vj} = 175\text{ °C}$	0.82		
Thermal resistance, junction to heatsink	$R_{thJH}$	per diode, Valid with IFX pre-applied Thermal Interface Material			2.68	K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^{\circ}\text{C}$

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

## 4 Diode, Rectifier

**Table 7** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit	
Repetitive peak reverse voltage	$V_{RRM}$	$T_{vj} = 25\text{ °C}$	1600	V	
Maximum RMS forward current per chip	$I_{FRMSM}$	$T_H = 100\text{ °C}$	25	A	
Maximum RMS current at rectifier output	$I_{RMSM}$	$T_H = 100\text{ °C}$	25	A	
Surge forward current	$I_{FSM}$	$t_p = 10\text{ ms}$	$T_{vj} = 25\text{ °C}$	300	A
			$T_{vj} = 150\text{ °C}$	245	
$I^2t$ - value	$I^2t$	$t_p = 10\text{ ms}$	$T_{vj} = 25\text{ °C}$	450	$\text{A}^2\text{s}$
			$T_{vj} = 150\text{ °C}$	300	

**Table 8** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 10\text{ A}$ , $T_{vj} = 150\text{ °C}$		0.80		V
Reverse current	$I_r$	$T_{vj} = 150\text{ °C}$ , $V_R = 1600\text{ V}$		1		mA
Thermal resistance, junction to heatsink	$R_{thJH}$	per diode, Valid with IFX pre-applied Thermal Interface Material			1.58	K/W

**Table 8** Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj, op}$		-40		150	°C

## 5 IGBT, Brake-Chopper

**Table 9** Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	$V_{CES}$	$T_{vj} = 25\text{ °C}$	1200	V
Continuous DC collector current	$I_{CDC}$	$T_{vj\ max} = 175\text{ °C}$ $T_H = 110\text{ °C}$	15	A
Repetitive peak collector current	$I_{CRM}$	$t_p = 1\text{ ms}$	30	A
Gate-emitter peak voltage	$V_{GES}$		±20	V

**Table 10** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 15\text{ A}, V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.60	TBD	V
			$T_{vj} = 125\text{ °C}$	1.74		
			$T_{vj} = 175\text{ °C}$	1.82		
Gate threshold voltage	$V_{GEth}$	$I_C = 0.553\text{ mA}, V_{CE} = V_{GE}, T_{vj} = 25\text{ °C}$	5.15	5.80	6.45	V
Gate charge	$Q_G$	$V_{GE} = \pm 15\text{ V}, V_{CE} = 600\text{ V}$		0.234		μC
Internal gate resistor	$R_{Gint}$	$T_{vj} = 25\text{ °C}$		0		Ω
Input capacitance	$C_{ies}$	$f = 100\text{ kHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		2.82		nF
Reverse transfer capacitance	$C_{res}$	$f = 100\text{ kHz}, T_{vj} = 25\text{ °C}, V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}$		0.0099		nF
Collector-emitter cut-off current	$I_{CES}$	$V_{CE} = 1200\text{ V}, V_{GE} = 0\text{ V}$			0.003	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)	$t_{don}$	$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 7.5\text{ Ω}$	$T_{vj} = 25\text{ °C}$	0.023		μs
			$T_{vj} = 125\text{ °C}$	0.025		
			$T_{vj} = 175\text{ °C}$	0.026		
Rise time (inductive load)	$t_r$	$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 7.5\text{ Ω}$	$T_{vj} = 25\text{ °C}$	0.012		μs
			$T_{vj} = 125\text{ °C}$	0.015		
			$T_{vj} = 175\text{ °C}$	0.016		

**Table 10** Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time (inductive load)	$t_{doff}$	$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 7.5\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.144		$\mu\text{s}$
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.190		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.256		
Fall time (inductive load)	$t_f$	$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 7.5\ \Omega$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.199		$\mu\text{s}$
			$T_{vj} = 125\text{ }^\circ\text{C}$	0.301		
			$T_{vj} = 175\text{ }^\circ\text{C}$	0.329		
Turn-on energy loss per pulse	$E_{on}$	$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, L_\sigma = 35\text{ nH}, V_{GE} = \pm 15\text{ V}, R_{Gon} = 7.5\ \Omega, di/dt = 750\text{ A}/\mu\text{s} (T_{vj} = 175\text{ }^\circ\text{C})$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.87		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	1.21		
			$T_{vj} = 175\text{ }^\circ\text{C}$	1.45		
Turn-off energy loss per pulse	$E_{off}$	$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, L_\sigma = 35\text{ nH}, V_{GE} = \pm 15\text{ V}, R_{Goff} = 7.5\ \Omega, dv/dt = 4000\text{ V}/\mu\text{s} (T_{vj} = 175\text{ }^\circ\text{C})$	$T_{vj} = 25\text{ }^\circ\text{C}$	0.922		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	1.44		
			$T_{vj} = 175\text{ }^\circ\text{C}$	1.8		
SC data	$I_{SC}$	$V_{GE} \leq 15\text{ V}, V_{CC} = 800\text{ V}, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_p \leq 8\ \mu\text{s}, T_{vj} = 150\text{ }^\circ\text{C}$	48		A
			$t_p \leq 7\ \mu\text{s}, T_{vj} = 175\text{ }^\circ\text{C}$	45		
Thermal resistance, junction to heatsink	$R_{thJH}$	per IGBT, Valid with IFX pre-applied Thermal Interface Material			1.86	K/W
Temperature under switching conditions	$T_{vj\ op}$		-40		175	$^\circ\text{C}$

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

## 6 Diode, Brake-Chopper

**Table 11** 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	$I_F$		10	A	
Repetitive peak forward current	$I_{FRM}$	$t_p = 1\text{ ms}$	20	A	
$I^2t$ - value	$I^2t$	$V_R = 0\text{ V}, t_p = 10\text{ ms}$	$T_{vj} = 125\text{ }^\circ\text{C}$	27.5	$\text{A}^2\text{s}$
			$T_{vj} = 175\text{ }^\circ\text{C}$	24	



**Table 12** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	$V_F$	$I_F = 10\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	1.72	TBD	V
			$T_{vj} = 125\text{ °C}$	1.59		
			$T_{vj} = 175\text{ °C}$	1.52		
Peak reverse recovery current	$I_{RM}$	$I_F = 10\text{ A}, V_R = 600\text{ V},$ $-di_F/dt = 700\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	15.5		A
			$T_{vj} = 125\text{ °C}$	19.2		
			$T_{vj} = 175\text{ °C}$	22.5		
Recovered charge	$Q_r$	$I_F = 10\text{ A}, V_R = 600\text{ V},$ $-di_F/dt = 700\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	0.82		$\mu\text{C}$
			$T_{vj} = 125\text{ °C}$	1.46		
			$T_{vj} = 175\text{ °C}$	2.05		
Reverse recovery energy	$E_{rec}$	$I_F = 10\text{ A}, V_R = 600\text{ V},$ $-di_F/dt = 700\text{ A}/\mu\text{s}$ ( $T_{vj} = 175\text{ °C}$ )	$T_{vj} = 25\text{ °C}$	0.31		mJ
			$T_{vj} = 125\text{ °C}$	0.57		
			$T_{vj} = 175\text{ °C}$	0.82		
Thermal resistance, junction to heatsink	$R_{thJH}$	per diode, Valid with IFX pre-applied Thermal Interface Material			2.68	K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^{\circ}\text{C}$

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

## 7 NTC-Thermistor

**Table 13** Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	$R_{25}$	$T_{NTC} = 25\text{ °C}$		5		k $\Omega$
Deviation of $R_{100}$	$\Delta R/R$	$T_{NTC} = 100\text{ °C}, R_{100} = 493\text{ }\Omega$	-5		5	%
Power dissipation	$P_{25}$	$T_{NTC} = 25\text{ °C}$			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

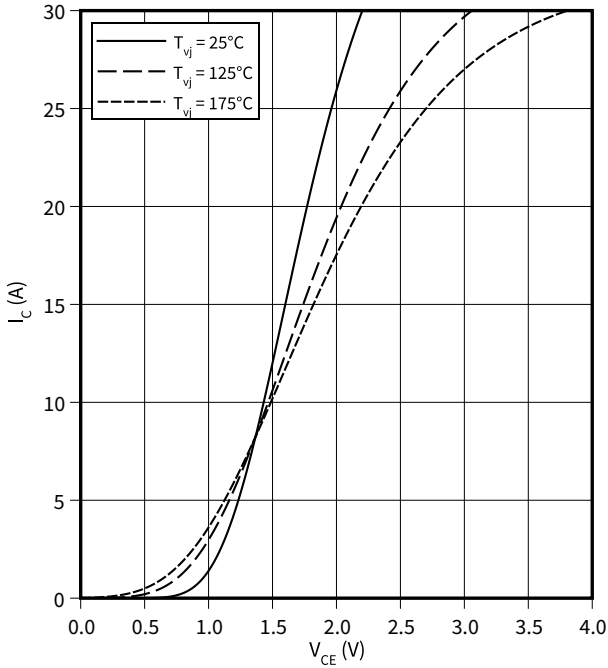
Note: Specification according to the valid application note.

## 8 Characteristics diagrams

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

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

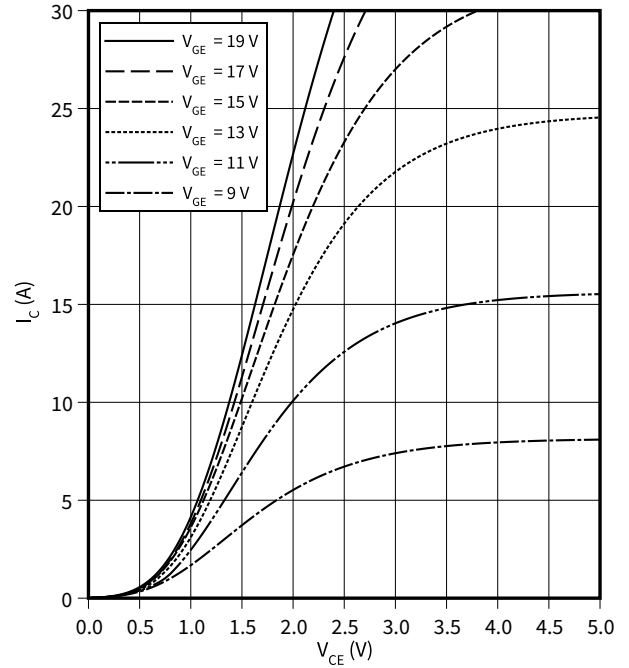
$$V_{GE} = 15 \text{ V}$$



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

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

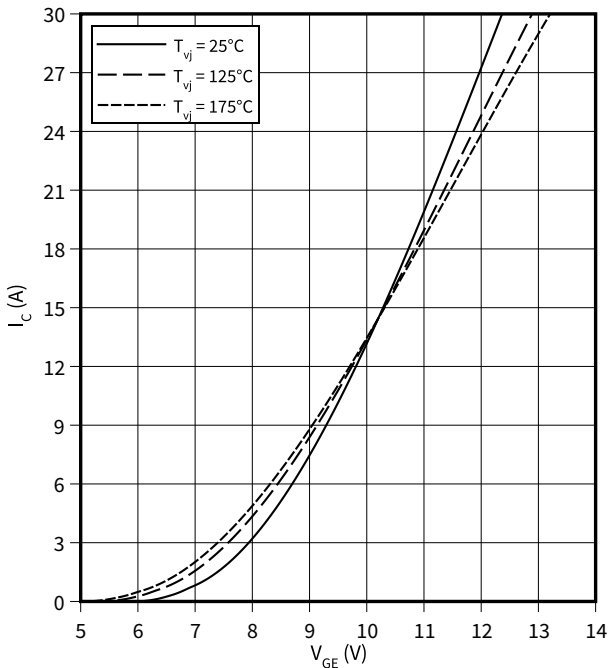
$$T_{vj} = 175 \text{ °C}$$



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

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

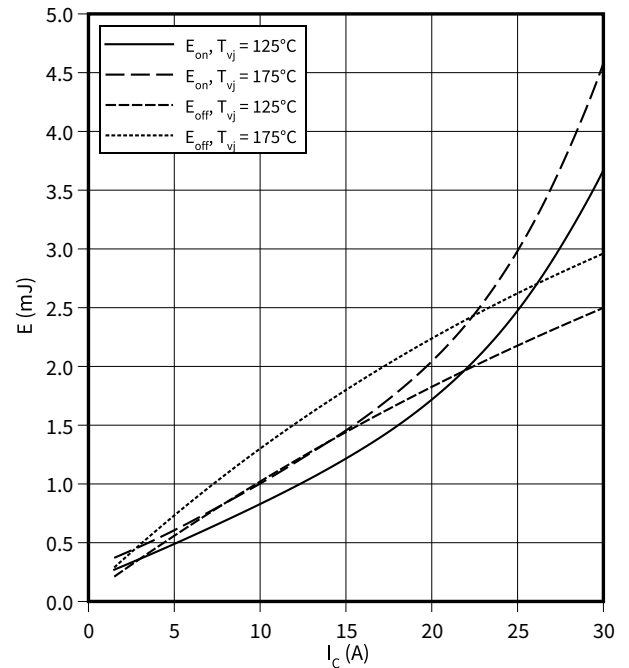
$$V_{CE} = 20 \text{ V}$$



### switching losses (typical), IGBT, Inverter

$$E = f(I_C)$$

$$R_{Goff} = 7.5 \text{ } \Omega, R_{Gon} = 7.5 \text{ } \Omega, V_{CE} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$$

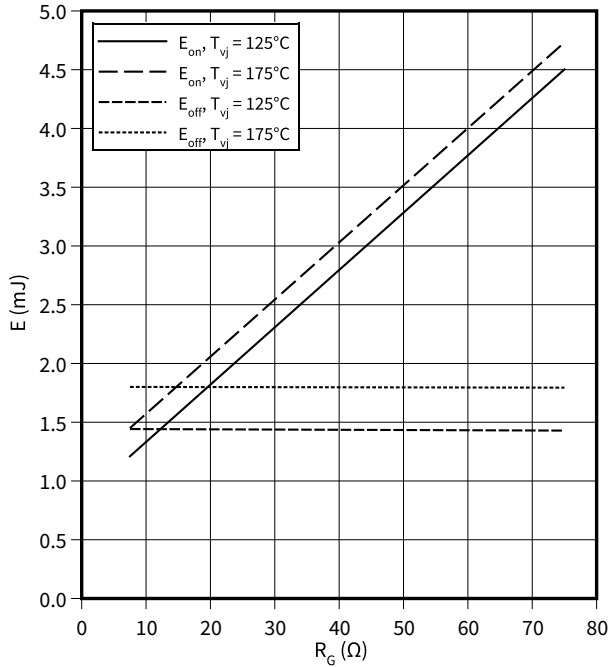


8 Characteristics diagrams

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

$E = f(R_G)$

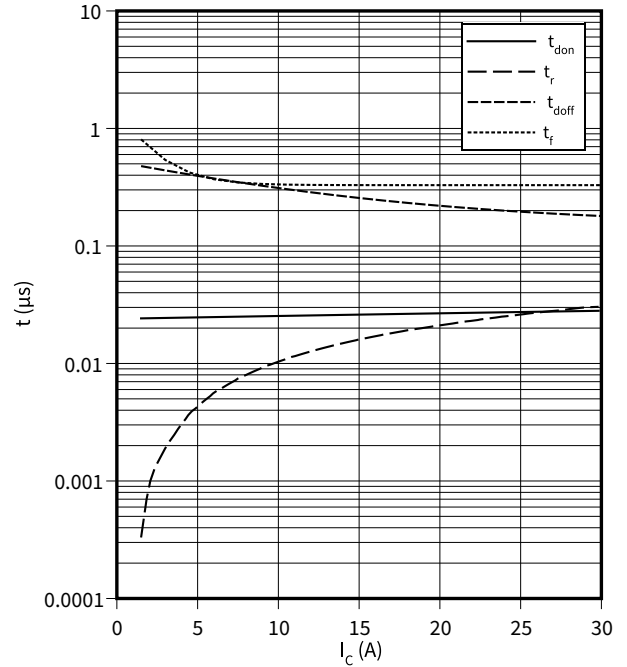
$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}$



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

$t = f(I_C)$

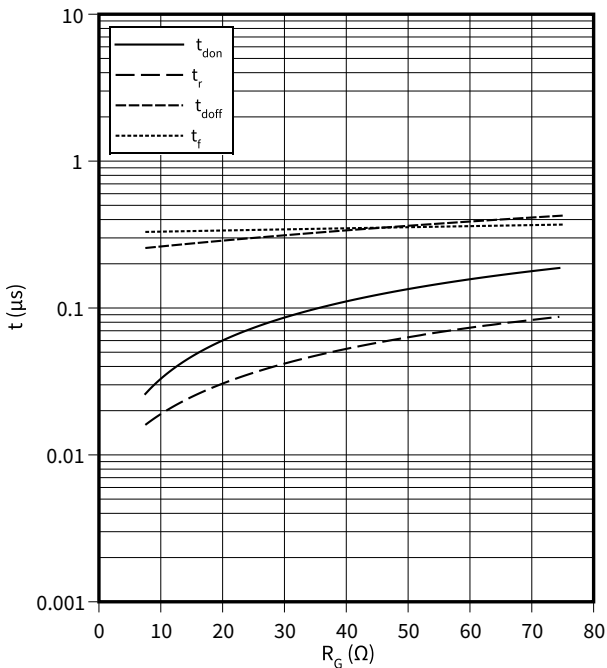
$R_{Goff} = 7.5\ \Omega, R_{Gon} = 7.5\ \Omega, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}$



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

$t = f(R_G)$

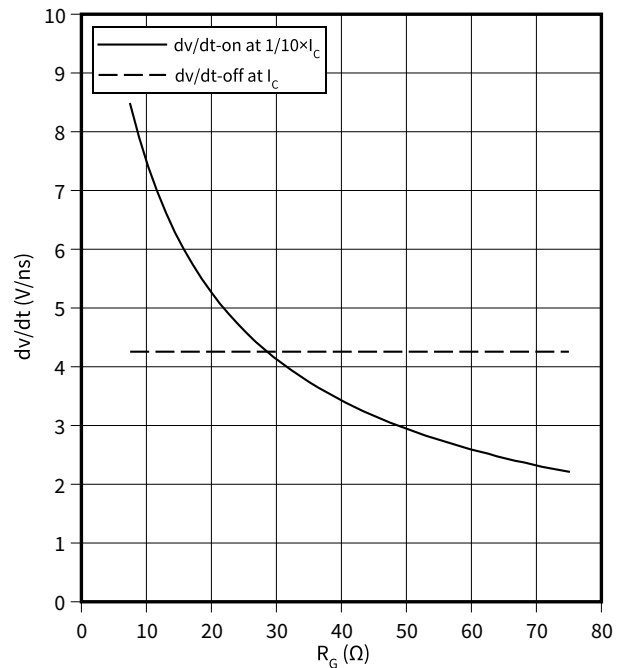
$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, T_{vj} = 175\text{ }^\circ\text{C}$



**dv/dt (typical), IGBT, Inverter**

$dv/dt = f(R_G)$

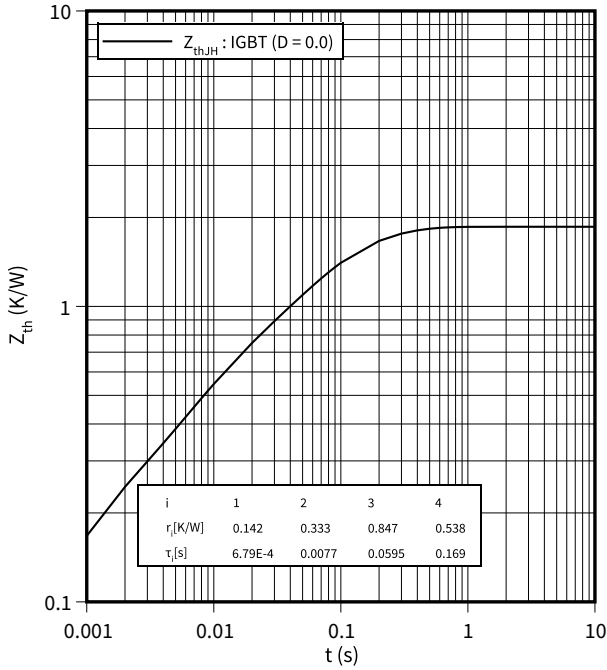
$I_C = 15\text{ A}, V_{CE} = 600\text{ V}, V_{GE} = \pm 15\text{ V}, T_{vj} = 25\text{ }^\circ\text{C}$



8 Characteristics diagrams

**transient thermal impedance , IGBT, Inverter**

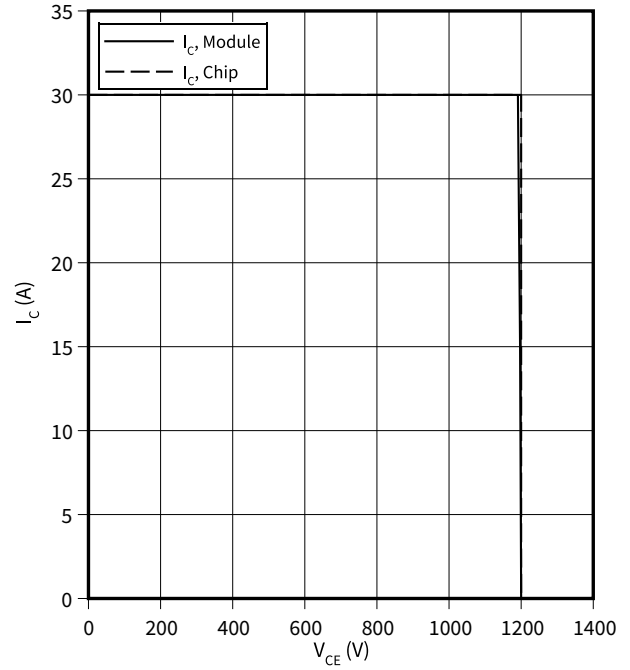
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

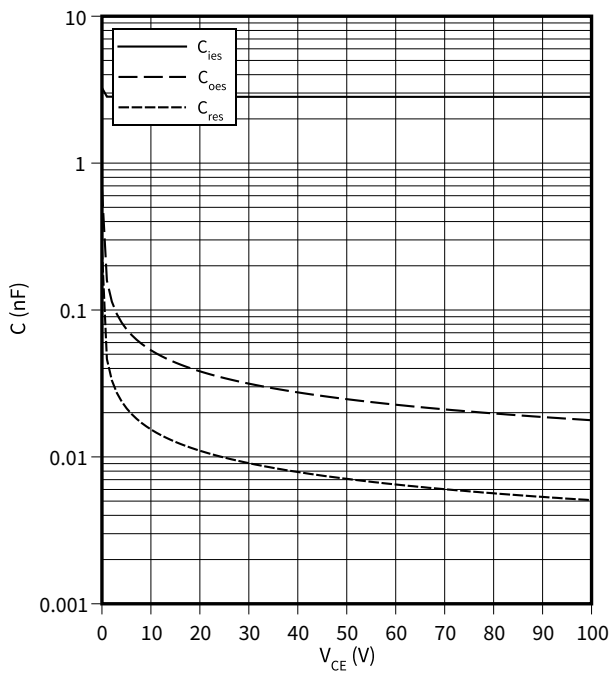
$R_{Goff} = 7.5 \Omega, V_{GE} = \pm 15 V, T_{vj} = 175 \text{ }^\circ\text{C}$



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

$C = f(V_{CE})$

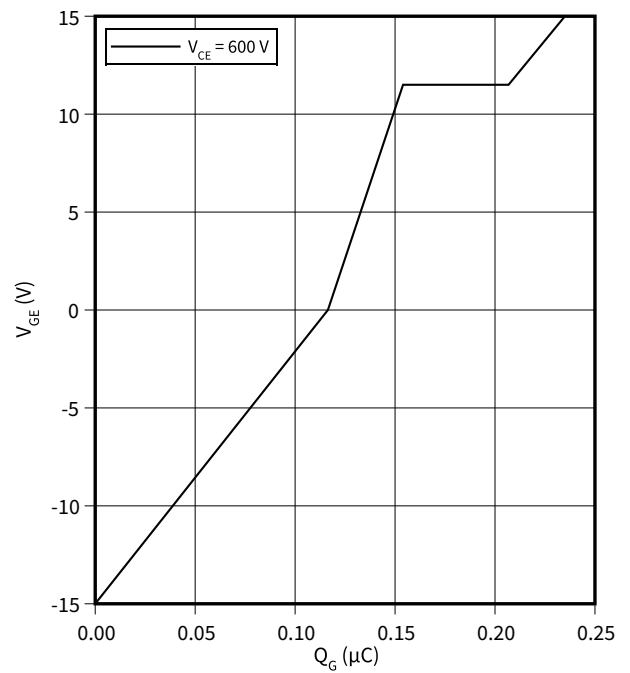
$V_{GE} = 0 V, T_{vj} = 25 \text{ }^\circ\text{C}, f = 100 \text{ kHz}$



**gate charge characteristic (typical), IGBT, Inverter**

$V_{GE} = f(Q_G)$

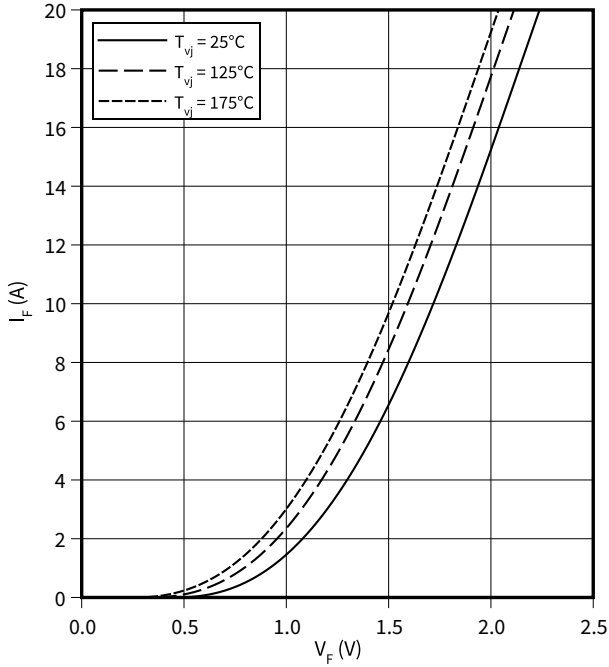
$T_{vj} = 25 \text{ }^\circ\text{C}, I_C = 15 \text{ A}$



8 Characteristics diagrams

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

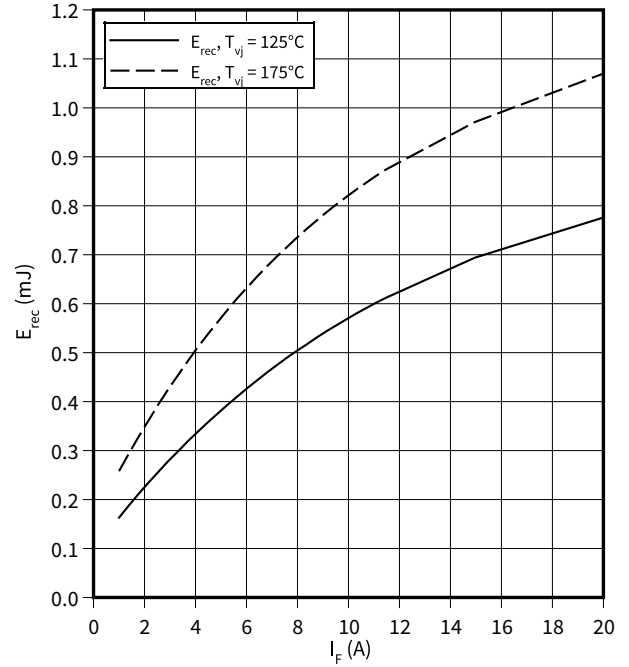
$I_F = f(V_F)$



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

$E_{rec} = f(I_F)$

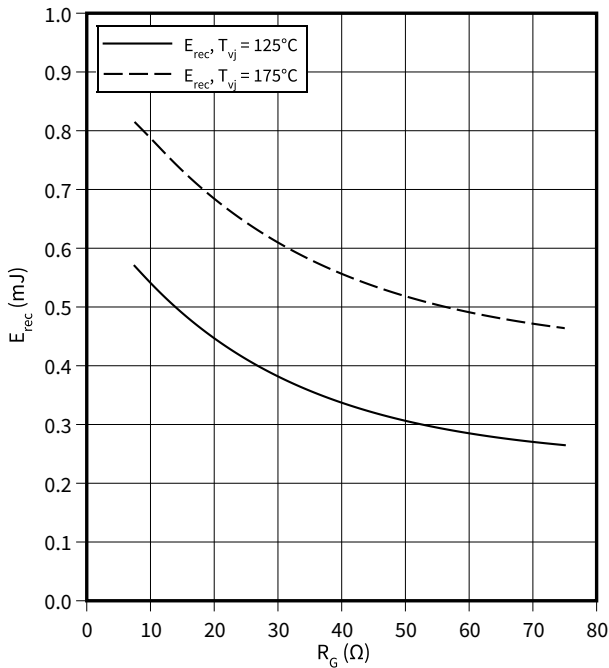
$R_{Gon} = 7.5 \Omega, V_{CE} = 600 \text{ V}$



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

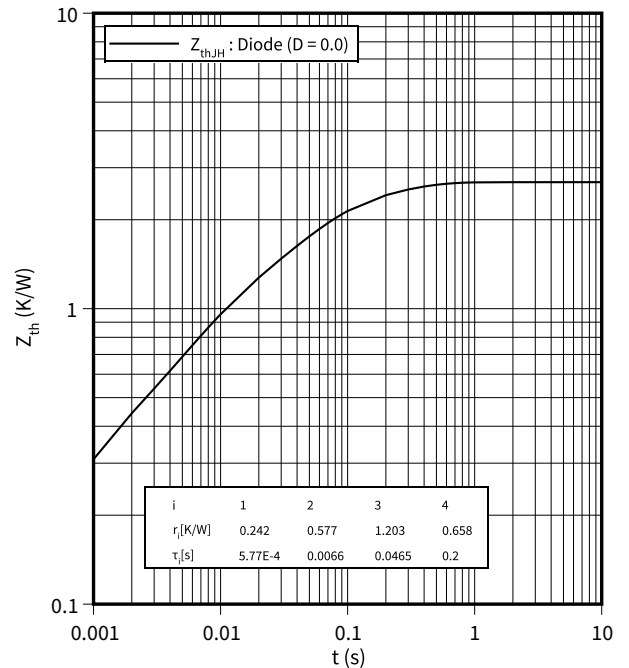
$E_{rec} = f(R_G)$

$V_{CE} = 600 \text{ V}, I_F = 10 \text{ A}$



**transient thermal impedance, Diode, Inverter**

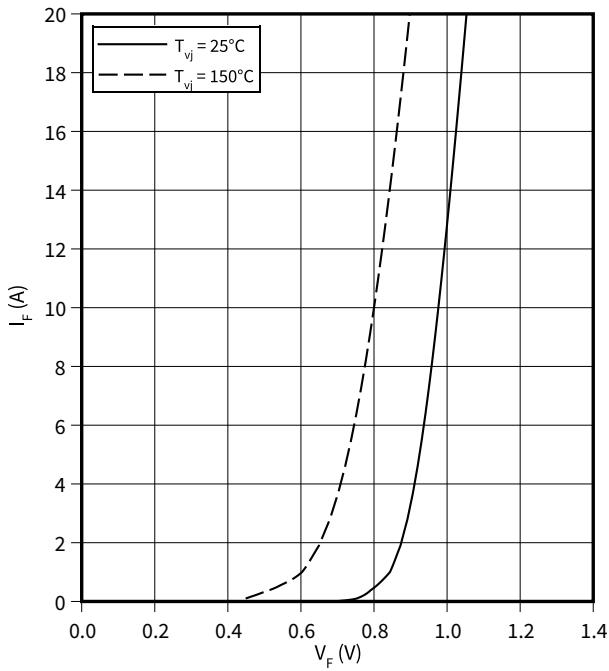
$Z_{th} = f(t)$



8 Characteristics diagrams

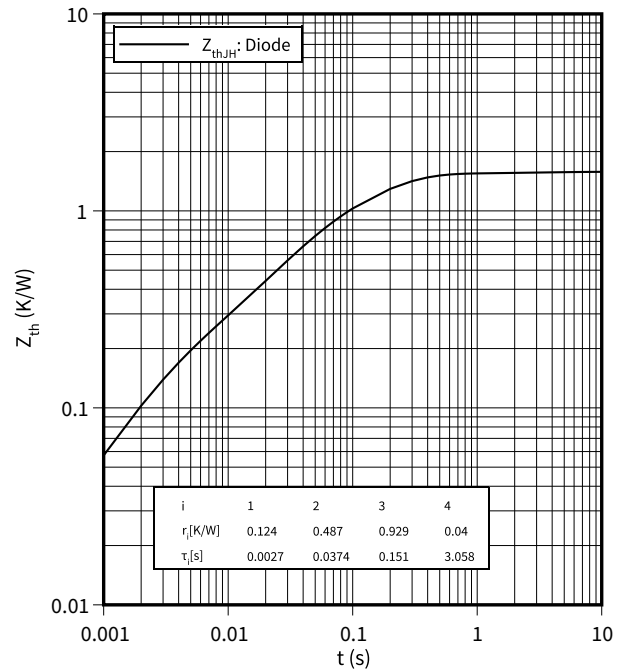
**forward characteristic (typical), Diode, Rectifier**

$I_F = f(V_F)$



**transient thermal impedance, Diode, Rectifier**

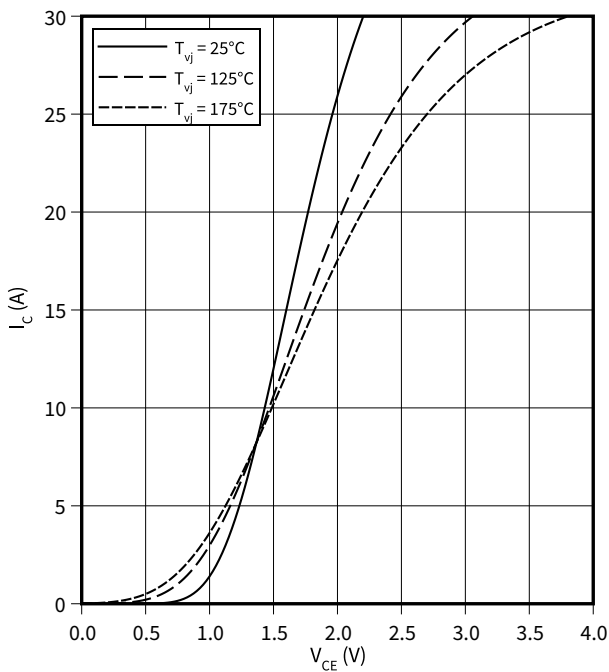
$Z_{th} = f(t)$



**output characteristic (typical), IGBT, Brake-Chopper**

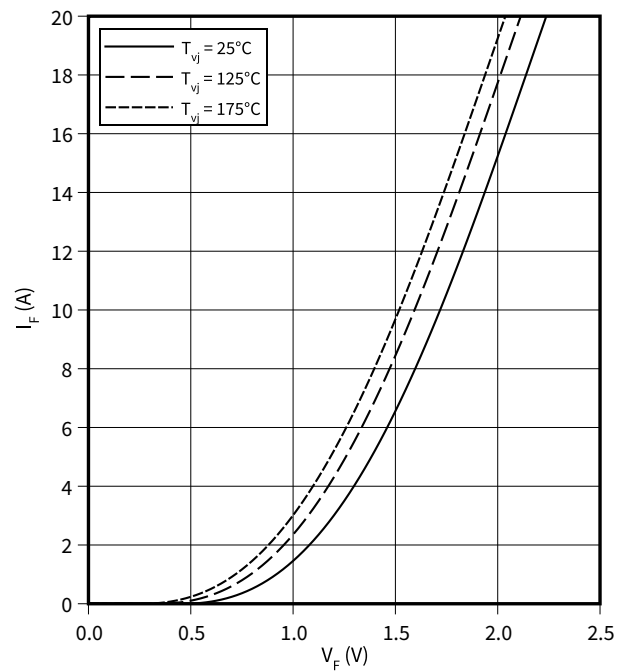
$I_C = f(V_{CE})$

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



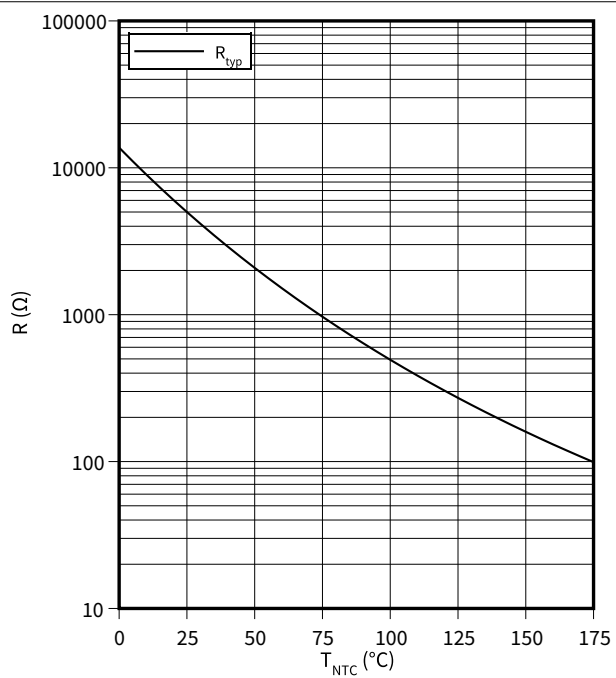
**forward characteristic (typical), Diode, Brake-Chopper**

$I_F = f(V_F)$

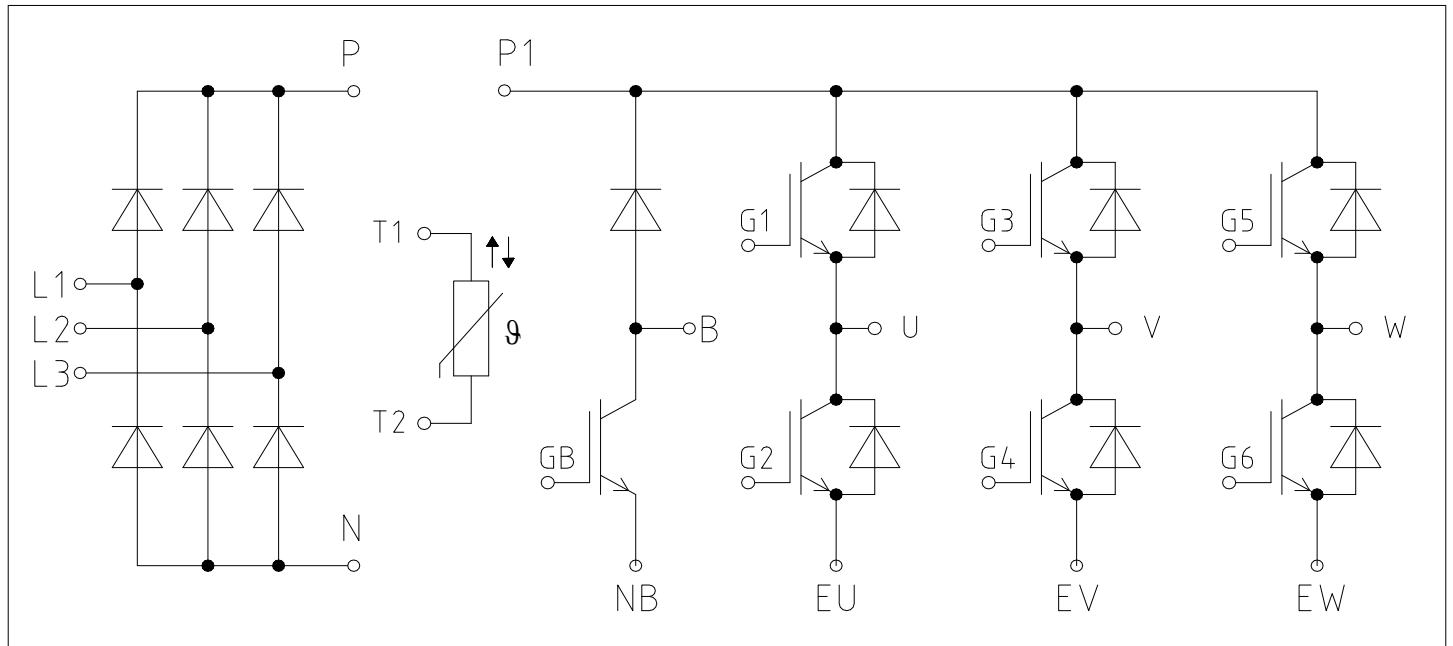


**temperature characteristic (typical), NTC-Thermistor**

$R = f(T_{NTC})$



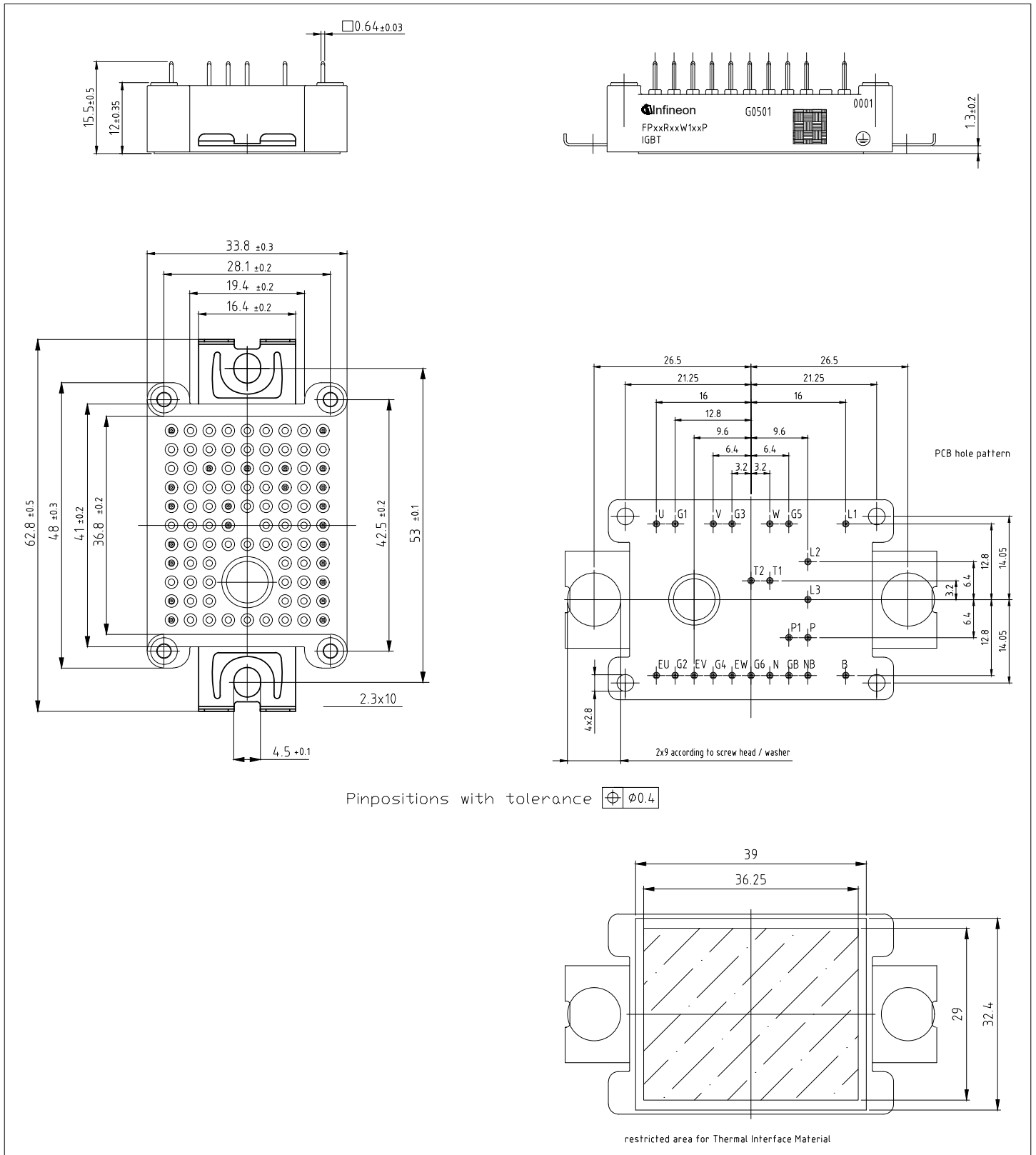
**9**      **Circuit diagram**



**Figure 2**





**10 Package outlines**



**Figure 3**

## 11 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 4**

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