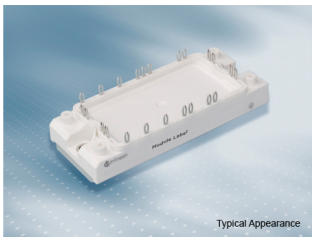
EconoPIM™2 module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and PressFIT / NTC / TIM

Features



- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 50 A / I_{CRM} = 100 A
  - TRENCHSTOP™ IGBT7
  - Low $V_{CE,sat}$
  - Overload operation up to 175°C
- Mechanical features
  - High power and thermal cycling capability
  - Integrated NTC temperature sensor
  - Copper base plate
  - Al_2O_3 substrate with low thermal resistance
  - PressFIT contact technology
  - Pre-applied thermal interface material

Potential applications

- Auxiliary inverters
- Motor drives
- Servo drives

Product validation

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

Description

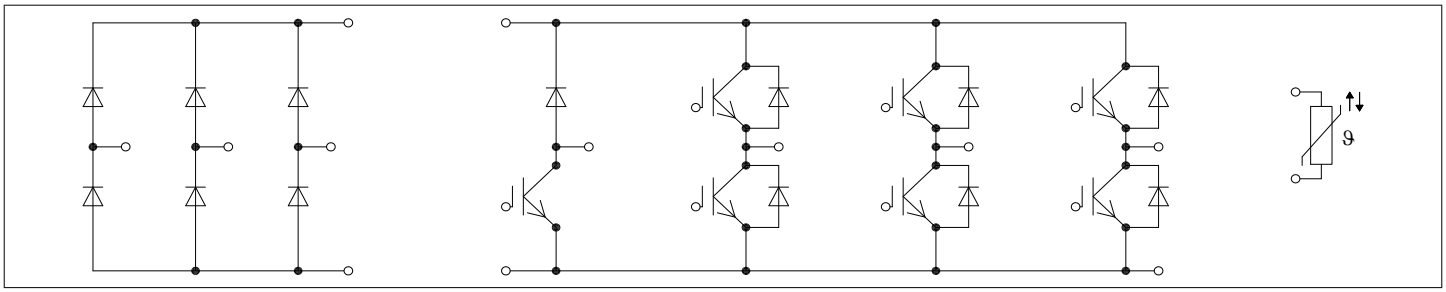


Table of contents

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	2.5	kV
Material of module baseplate			Cu	
Internal Isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	10.0	mm
Clearance	d_{Clear}	terminal to heatsink	7.5	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}				35		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_H=25°C, per switch			5.5		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H=25°C, per switch			4.8		mΩ
Storage temperature	T_{stg}			-40		125	°C
Maximum baseplate operation temperature	T_{BPmax}					125	°C
Mounting torque for modul mounting	*M*	- Mounting according to valid application note	M5, Screw	3		6	Nm
Weight	*G*				180		g

Note: The current under continuous operation is limited to 50 A rms per connector pin.
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
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 95 °C	50	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		100	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 = 50 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.50	1.80	V
			T_{vj} = 125 °C		1.64		
			T_{vj} = 175 °C		1.72		
Gate threshold voltage	V_{GEth}	I_C = 2 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			0.92		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			11.1		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.039		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.01	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 = 50 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.059		µs
			T_{vj} = 125 °C		0.061		
			T_{vj} = 175 °C		0.062		
Rise time (inductive load)	t_r	I_C = 50 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.043		µs
			T_{vj} = 125 °C		0.047		
			T_{vj} = 175 °C		0.049		
Turn-off delay time (inductive load)	t_{doff}	I_C = 50 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.290		µs
			T_{vj} = 125 °C		0.380		
			T_{vj} = 175 °C		0.420		
Fall time (inductive load)	t_f	I_C = 50 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.110		µs
			T_{vj} = 125 °C		0.200		
			T_{vj} = 175 °C		0.270		
Turn-on energy loss per pulse	E_{on}	I_C = 50 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω, di/dt = 900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		5.07		mJ
			T_{vj} = 125 °C		6.76		
			T_{vj} = 175 °C		7.72		
Turn-off energy loss per pulse	E_{off}	I_C = 50 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω, dv/dt = 2900 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		3.37		mJ
			T_{vj} = 125 °C		5.31		
			T_{vj} = 175 °C		6.58		

Table 4 Characteristic values (continued)

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
SC data	I_{SC}	$V_{GE} \leq$ 15 V, V_{CC} = 800 V, $V_{CEmax}=V_{CES}-L_{sCE}*di/dt$	$t_P \leq$ 8 µs, T_{vj} = 150 °C		190		A
			$t_P \leq$ 7 µs, T_{vj} = 175 °C		180		
Thermal resistance, junction to heatsink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				0.777	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.

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
Continous DC forward current	I_F			50	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		100	A
I^2t - value	I^2t	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	465	A^2s
			T_{vj} = 175 °C	420	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 50 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.72	2.10	V
			T_{vj} = 125 °C		1.59		
			T_{vj} = 175 °C		1.52		
Peak reverse recovery current	I_{RM}	I_F = 35 A, V_R = 600 V, V_{GE} = -15 V, $-di_F/dt$ = 900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		31		A
			T_{vj} = 125 °C		39		
			T_{vj} = 175 °C		45		

Table 6 Characteristic values (continued)

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Recovered charge	Q_r	I_F = 50 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		3.96		µC
			T_{vj} = 125 °C		7.37		
			T_{vj} = 175 °C		9.89		
Reverse recovery energy	E_{rec}	I_F = 50 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 900 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		1.31		mJ
			T_{vj} = 125 °C		2.52		
			T_{vj} = 175 °C		3.46		
Thermal resistance, junction to heatsink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				1.13	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 Diode, Rectifier

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	T_{vj} = 25 °C		1600	V
Maximum RMS forward current per chip	I_{FRMSM}	T_H = 60 °C		70	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 60 °C		100	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	560	A
			T_{vj} = 150 °C	435	
I^{2}t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	1570	A^{2}s
			T_{vj} = 150 °C	945	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 50 A	T_{vj} = 150 °C		1.05		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1600 V			1		mA
Thermal resistance, junction to heatsink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				1.10	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-Chopper

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 110 °C	25	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		50	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 = 25 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.60	1.85	V
			T_{vj} = 125 °C		1.74		
			T_{vj} = 175 °C		1.82		
Gate threshold voltage	V_{GEth}	I_C = 0.525 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			0.395		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0		Ω
Input capacitance	C_{ies}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			4.77		nF
Reverse transfer capacitance	C_{res}	f = 1000 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.017		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.004	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 = 25 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 9.1 Ω	T_{vj} = 25 °C		0.041		µs
			T_{vj} = 125 °C		0.043		
			T_{vj} = 175 °C		0.044		
Rise time (inductive load)	t_r	I_C = 25 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 9.1 Ω	T_{vj} = 25 °C		0.025		µs
			T_{vj} = 125 °C		0.028		
			T_{vj} = 175 °C		0.030		

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 = 25 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 9.1 Ω	T_{vj} = 25 °C		0.230		µs
			T_{vj} = 125 °C		0.320		
			T_{vj} = 175 °C		0.350		
Fall time (inductive load)	t_f	I_C = 25 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 9.1 Ω	T_{vj} = 25 °C		0.140		µs
			T_{vj} = 125 °C		0.220		
			T_{vj} = 175 °C		0.280		
Turn-on energy loss per pulse	E_{on}	I_C = 25 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 9.1 Ω, di/dt = 780 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		1.47		mJ
			T_{vj} = 125 °C		2.05		
			T_{vj} = 175 °C		2.39		
Turn-off energy loss per pulse	E_{off}	I_C = 25 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 9.1 Ω, dv/dt = 3120 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		1.65		mJ
			T_{vj} = 125 °C		2.58		
			T_{vj} = 175 °C		3.13		
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		90		A
			t_P ≤ 7 µs, T_{vj} = 175 °C		85		
Thermal resistance, junction to heatsink	R_{thJH}	per IGBT, Valid with IFX pre-applied Thermal Interface Material				1.19	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.

6 Diode, Chopper

Table 11 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		T_{vj} = 25 °C	1200	V
Continous DC forward current	I_F			25	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		50	A
I^2t - value	I^2t	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	125	A^2s
			T_{vj} = 175 °C	95	

Table 12 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 25 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.83	2.28	V
			T_{vj} = 125 °C		1.70		
			T_{vj} = 175 °C		1.63		
Peak reverse recovery current	I_{RM}	I_F = 25 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 395 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		18		A
			T_{vj} = 125 °C		25		
			T_{vj} = 175 °C		29		
Recovered charge	Q_r	I_F = 25 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 395 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.79		µC
			T_{vj} = 125 °C		3.36		
			T_{vj} = 175 °C		4.41		
Reverse recovery energy	E_{rec}	I_F = 25 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 395 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		1.36		mJ
			T_{vj} = 125 °C		1.54		
			T_{vj} = 175 °C		2.03		
Thermal resistance, junction to heatsink	R_{thJH}	per diode, Valid with IFX pre-applied Thermal Interface Material				1.63	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.

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 °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	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2\text{-}1/(298{,}15\ K))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2\text{-}1/(298{,}15\ K))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2\text{-}1/(298{,}15\ K))]$		3433		K

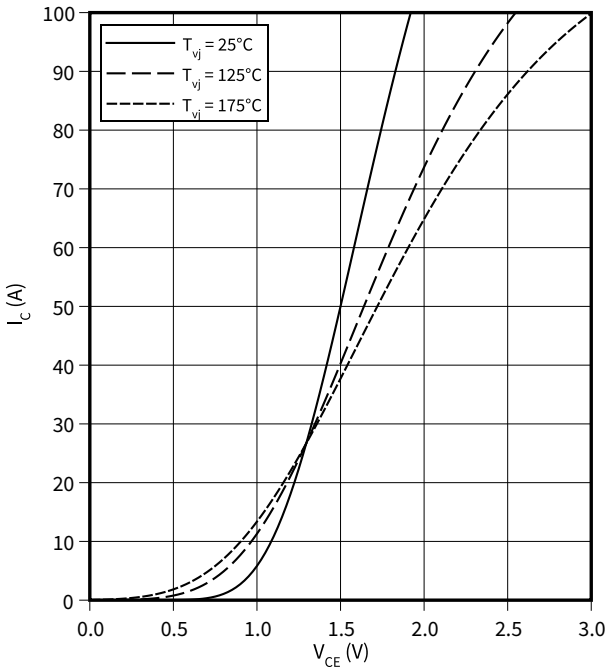
Note: Specification according to the valid application note.

8 Characteristics diagrams

output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

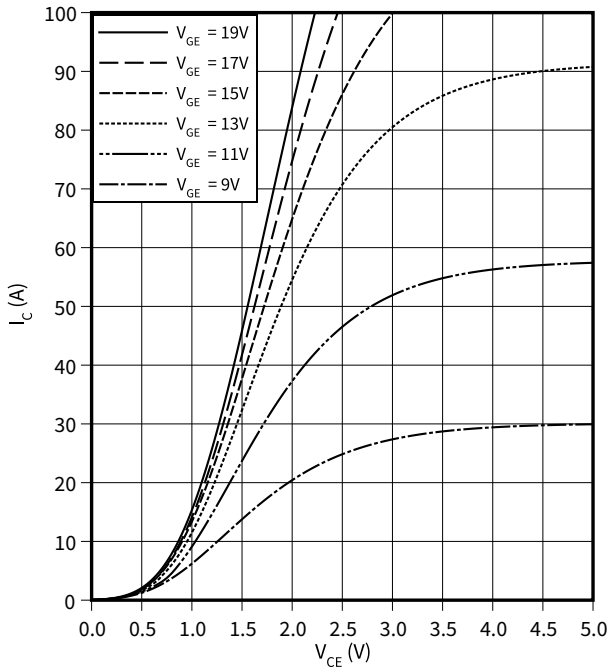
V_{GE} = 15 V



output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

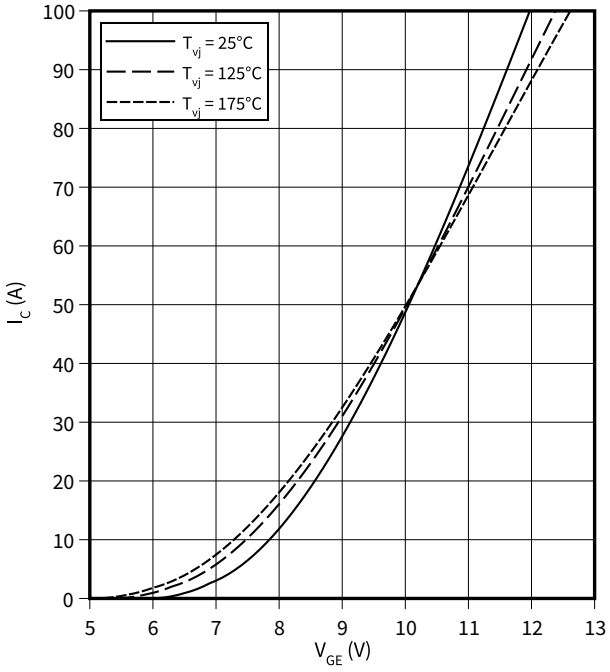
T_{vj} = 175 °C



transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

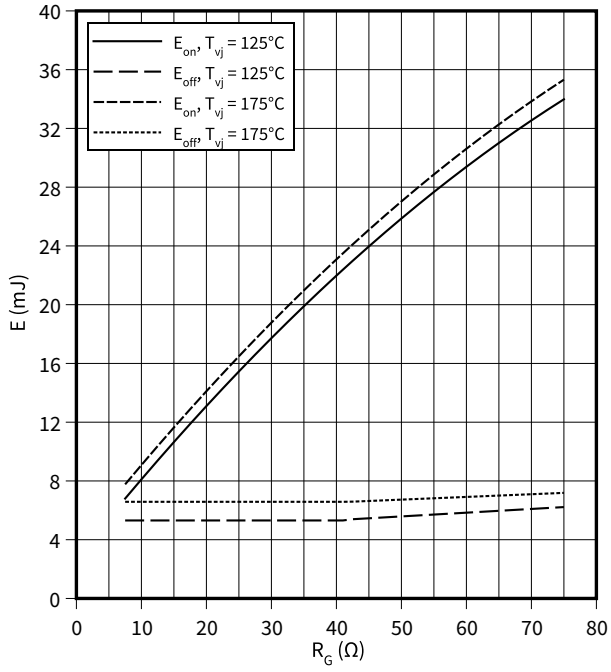
V_{CE} = 20 V



switching losses (typical), IGBT, Inverter

$E = f(R_G)$

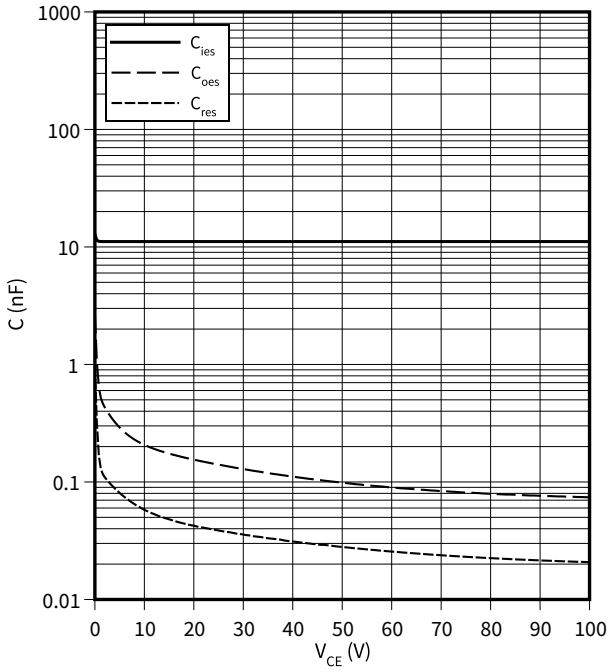
I_C = 50 A, V_{CE} = 600 V, V_{GE} = ± 15 V



capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

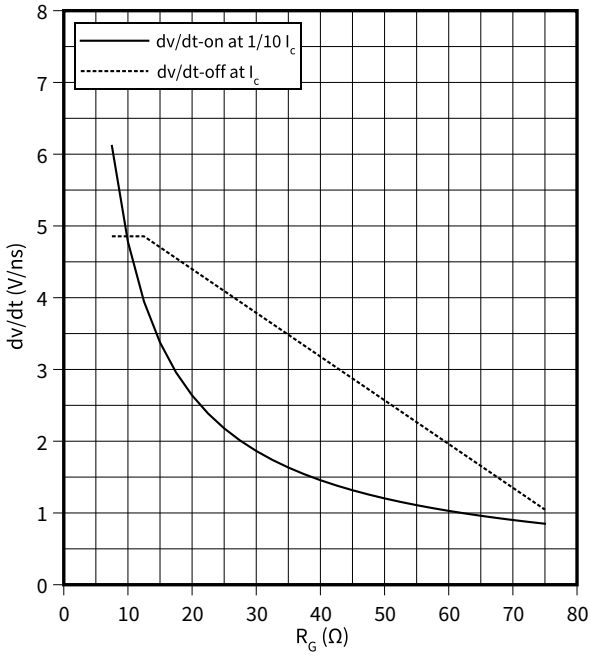
$f = 100\ kHz$, $V_{GE} = 0\ V$, $T_{vj} = 25\ °C$



dv/dt (typical), IGBT, Inverter

$dv/dt = f(R_G)$

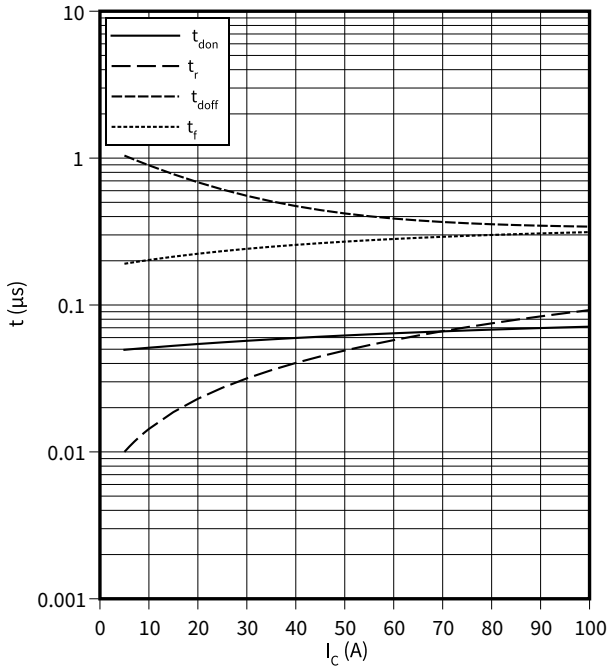
$I_C = 50\ A$, $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 25\ °C$



switching times (typical), IGBT, Inverter

$t = f(I_C)$

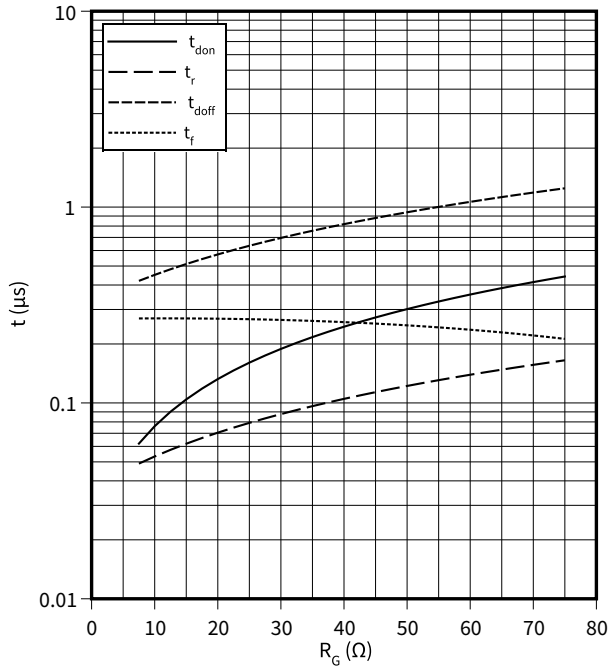
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 7.5\ \Omega$, $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



switching times (typical), IGBT, Inverter

$t = f(R_G)$

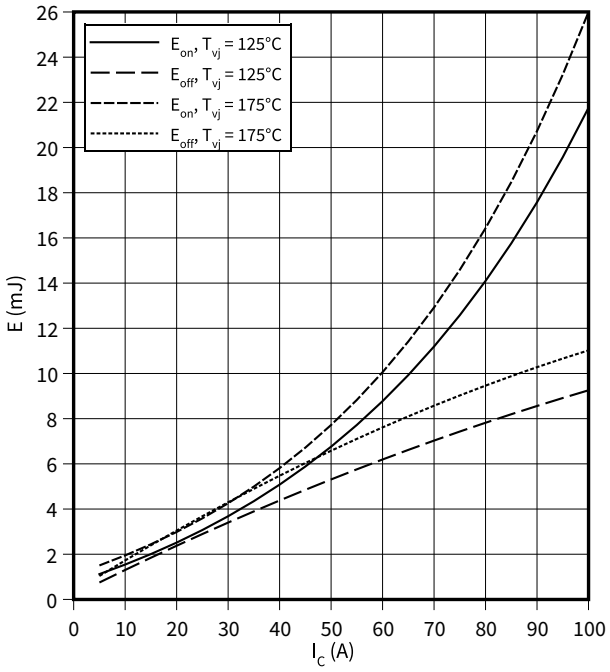
$I_C = 50\ A$, $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



switching losses (typical), IGBT, Inverter

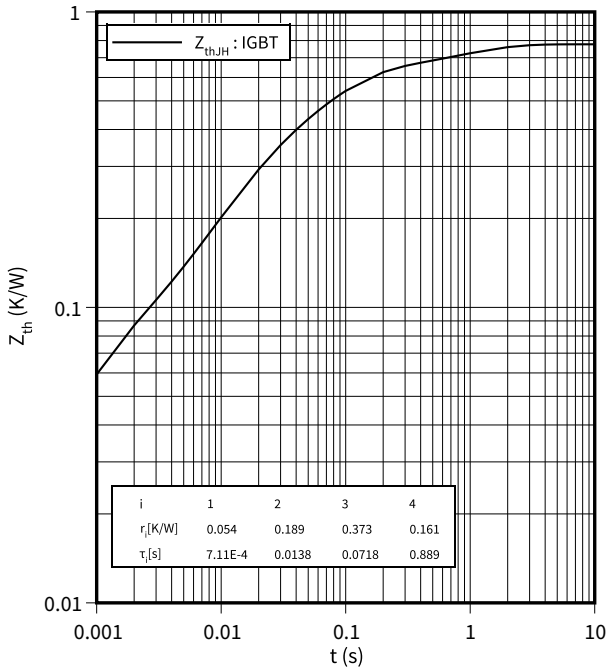
$E = f(I_C)$

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



transient thermal impedance , IGBT, Inverter

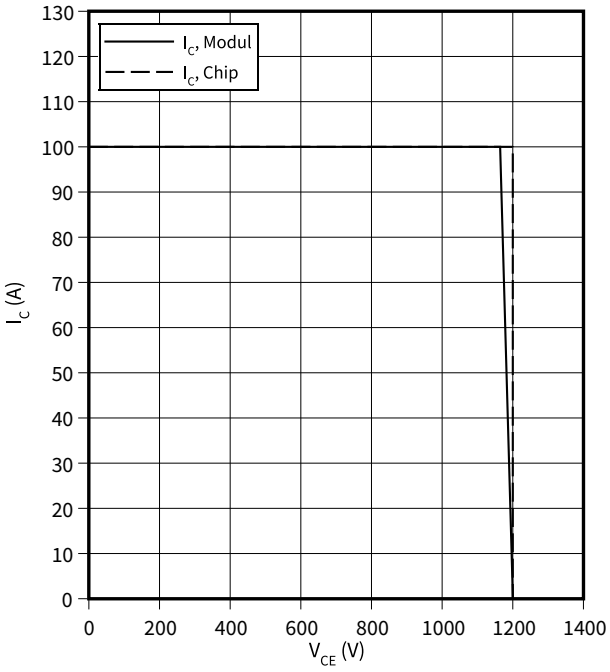
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

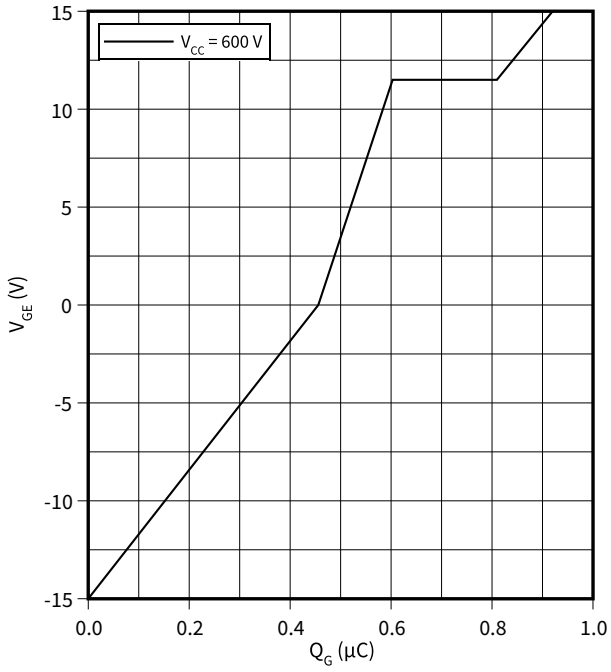
$R_{Goff} = 7.5\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



gate charge characteristic (typical), IGBT, Inverter

$V_{GE} = f(Q_G)$

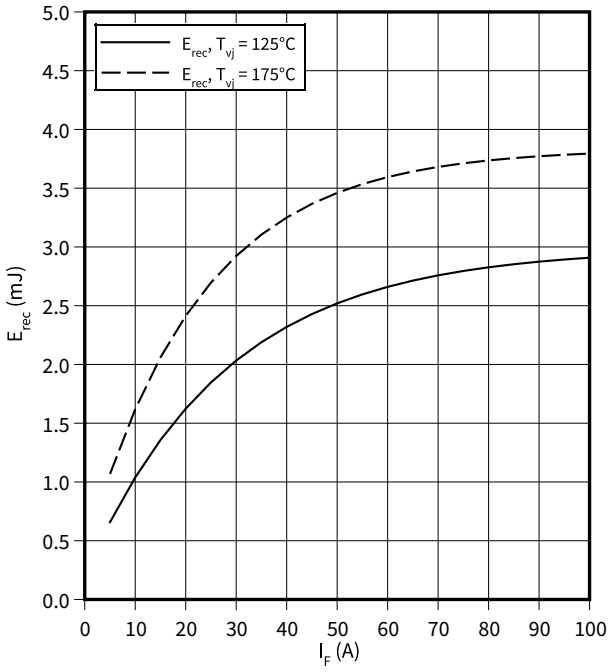
$I_C = 50\ A$, $T_{vj} = 25\ °C$



switching losses (typical), Diode, Inverter

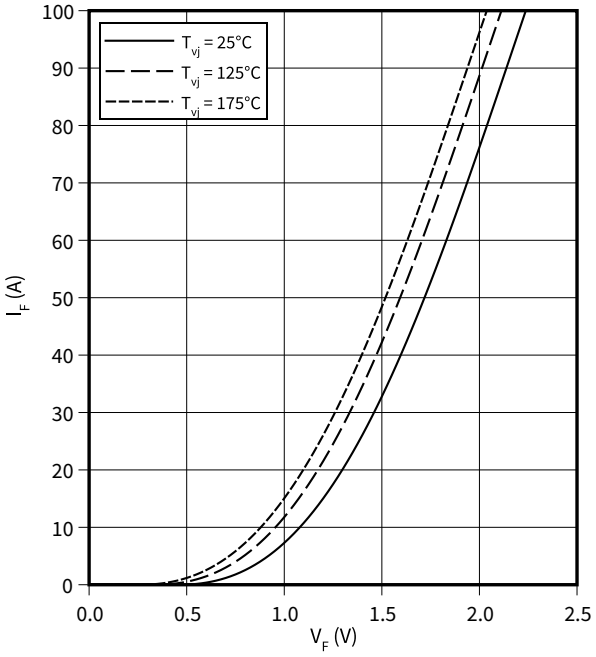
$E_{rec} = f(I_F)$

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



forward characteristic (typical), Diode, Inverter

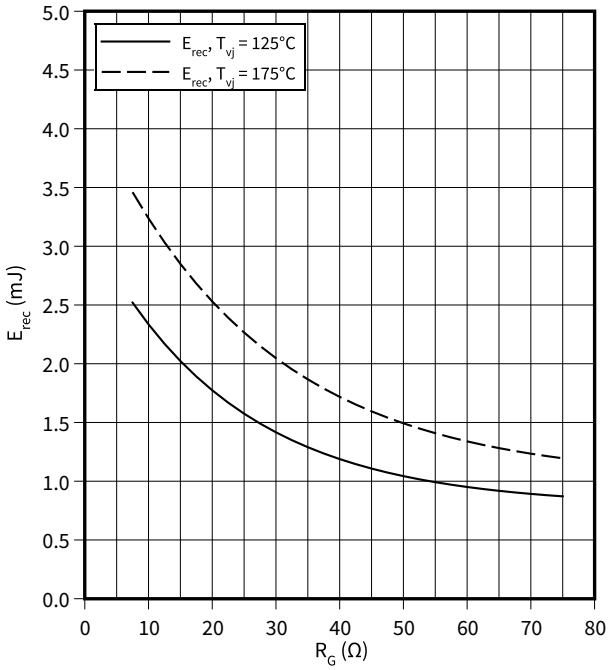
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

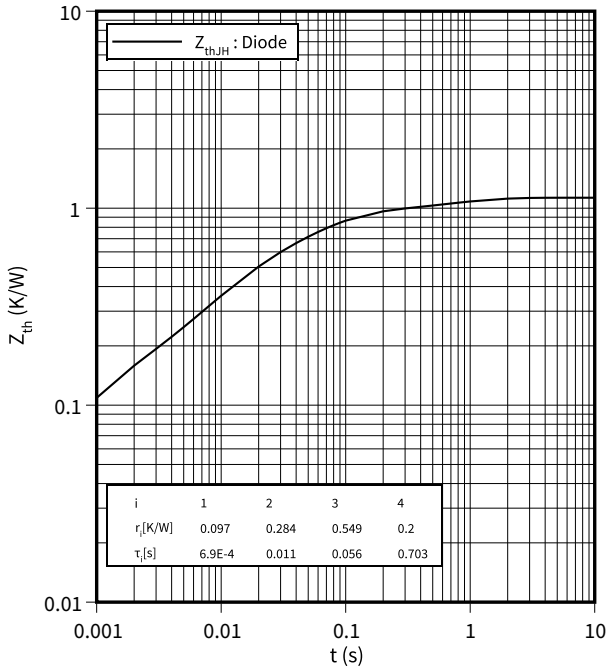
$E_{rec} = f(R_G)$

$V_{CE} = 600\ V$, $I_F = 50\ A$



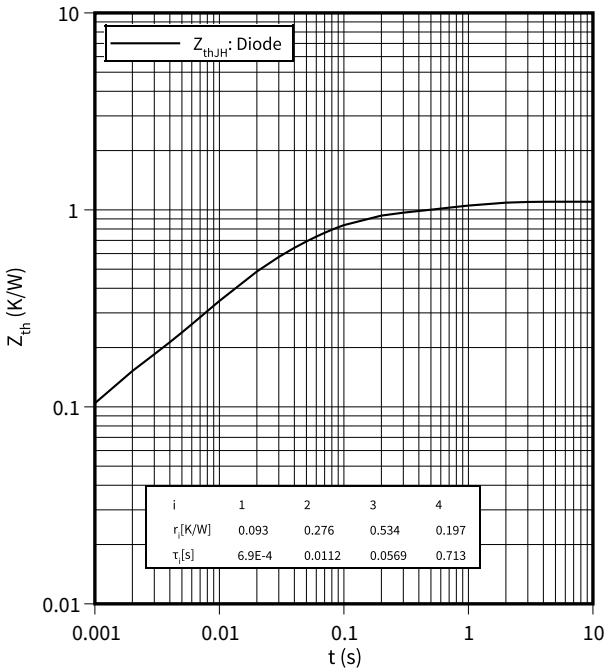
transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



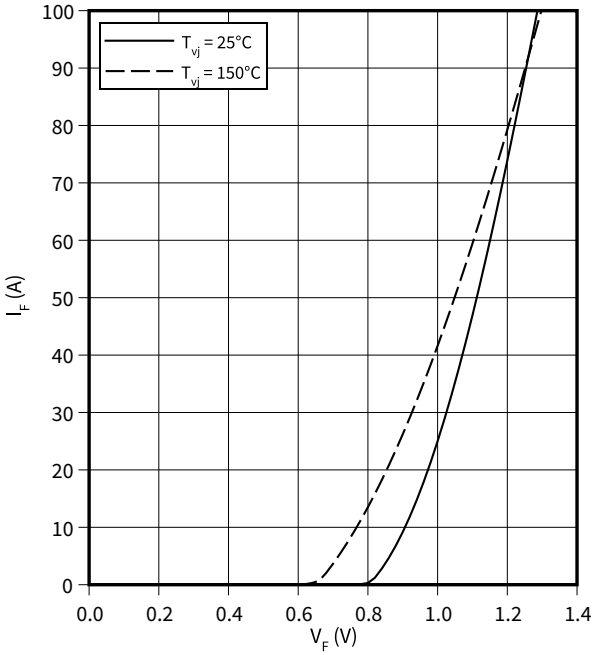
transient thermal impedance , Diode, Rectifier

$Z_{th} = f(t)$



forward characteristic (typical), Diode, Rectifier

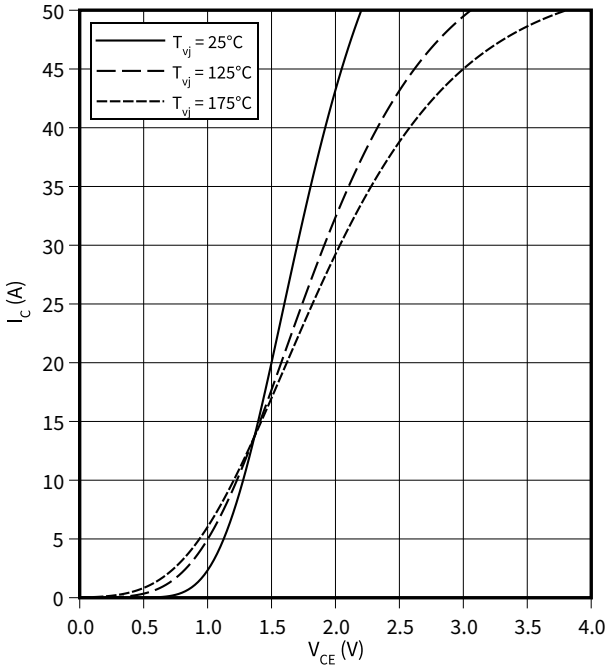
$I_F = f(V_F)$



output characteristic (typical), IGBT-Chopper

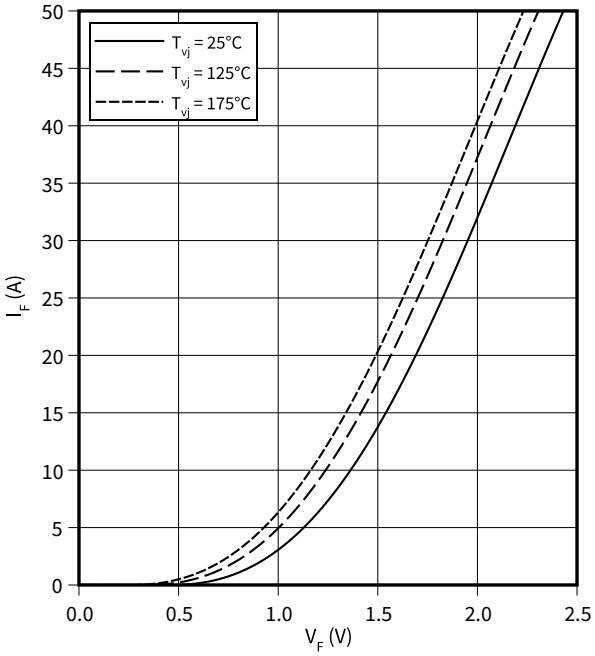
$I_C = f(V_{CE})$

$V_{GE} = 15\ V$



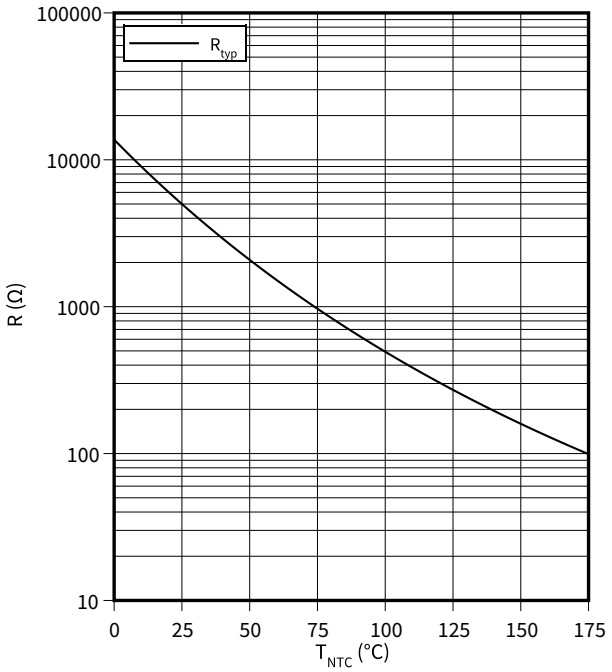
forward characteristic (typical), Diode, Chopper

$I_F = f(V_F)$



temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

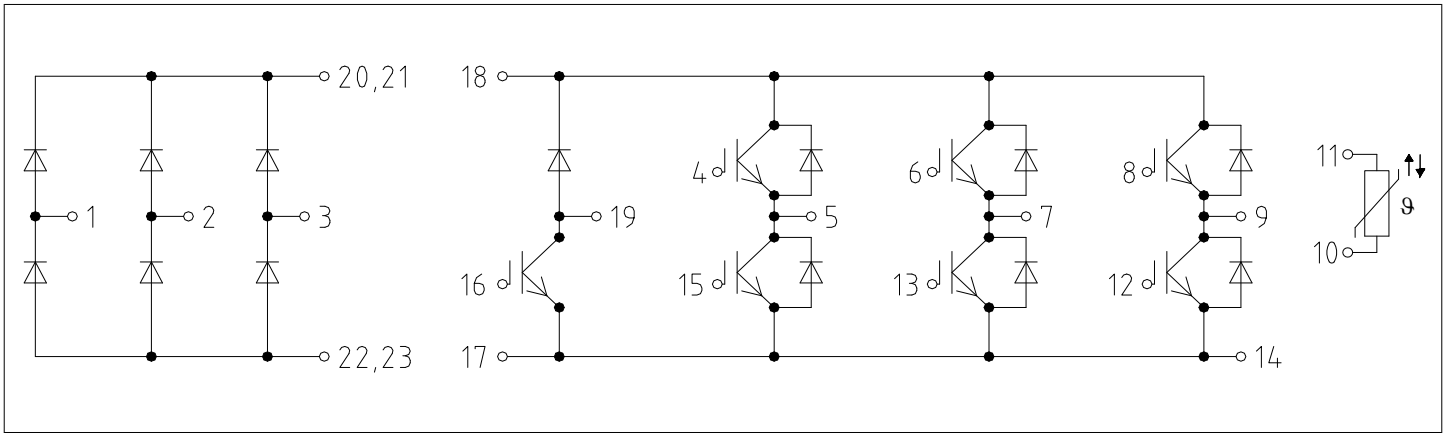


Figure 2

10 Package outlines

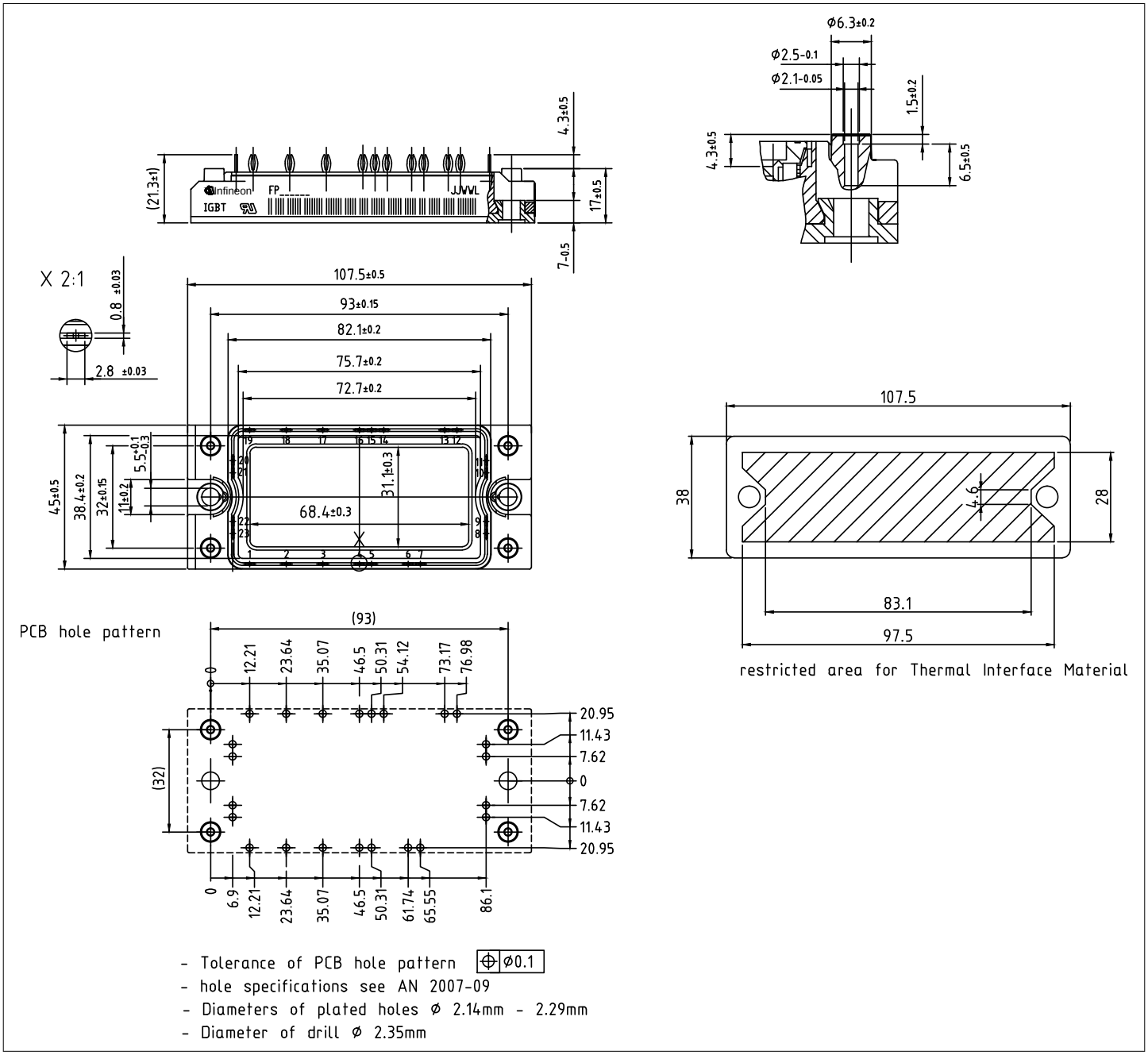


Figure 3

Revision history

Document revision	Date of release	Description of changes
1.00	2021-09-22	Initial version

Trademarks

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

Edition 2021-09-22

Published by

Infineon Technologies AG

81726 Munich, Germany

Do you have a question about any aspect of this document?

Email: erratum@infineon.com

Document reference
IFX-ABB324-001

IMPORTANT NOTICE

The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics ("Beschaffenheitsgarantie").

With respect to any examples, hints or any typical values stated herein and/or any information regarding the application of the product, Infineon Technologies hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights of any third party.

In addition, any information given in this document is subject to customer's compliance with its obligations stated in this document and any applicable legal requirements, norms and standards concerning customer's products and any use of the product of Infineon Technologies in customer's applications.

The data contained in this document is exclusively intended for technically trained staff. It is the responsibility of customer's technical departments to evaluate the suitability of the product for the intended application and the completeness of the product information given in this document with respect to such application.

WARNINGS

Due to technical requirements products may contain dangerous substances. For information on the types in question please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by Infineon Technologies in a written document signed by authorized representatives of Infineon Technologies, Infineon Technologies' products may not be used in any applications where a failure of the product or any consequences of the use thereof can reasonably be expected to result in personal injury.