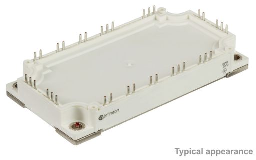
Preliminary datasheet

EconoPIM™3 module with TRENCHSTOP™IGBT7 and Emitter Controlled 7 diode and NTC

Features



- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 200 A / I_{CRM} = 400 A
  - TRENCHSTOP™ IGBT7
  - Overload operation up to 175°C
  - Low V_{CEsat}
- Mechanical features
  - Integrated NTC temperature sensor
  - Solder contact technology
  - Copper base plate
  - Al_2O_3 substrate with low thermal resistance

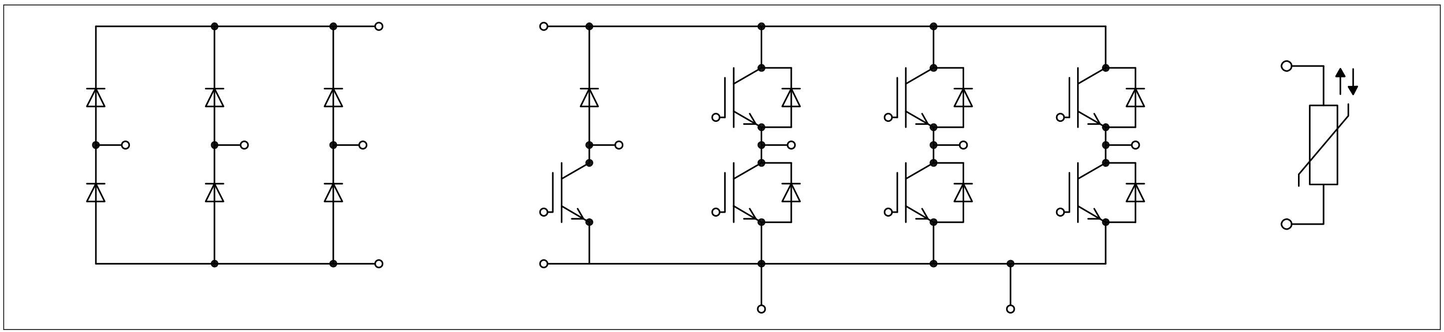
Potential applications

- Auxiliary inverters
- Motor drives
- Servo drives

Product validation

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

Description



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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 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}				25		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_C=25°C, per switch			1.1		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_C=25°C, per switch			1.6		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for modul mounting	M	- Mounting according to valid application note	M5, Screw	3		6	Nm
Weight	G				300		g

Note: The current under continuous operation is limited to 50A rms per connector pin.

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_C = 70 °C	200	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		400	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 = 200 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.55	TBD	V
			T_{vj} = 125 °C		1.69		
			T_{vj} = 175 °C		1.77		
Gate threshold voltage	V_{GEth}	I_C = 4.6 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			3.34		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0.75		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			40.3		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.14		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.02	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 = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω	T_{vj} = 25 °C		0.203		µs
			T_{vj} = 125 °C		0.226		
			T_{vj} = 175 °C		0.239		
Rise time (inductive load)	t_r	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω	T_{vj} = 25 °C		0.094		µs
			T_{vj} = 125 °C		0.097		
			T_{vj} = 175 °C		0.099		
Turn-off delay time (inductive load)	t_{doff}	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 2.7 Ω	T_{vj} = 25 °C		0.351		µs
			T_{vj} = 125 °C		0.414		
			T_{vj} = 175 °C		0.433		
Fall time (inductive load)	t_f	I_C = 200 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 2.7 Ω	T_{vj} = 25 °C		0.103		µs
			T_{vj} = 125 °C		0.198		
			T_{vj} = 175 °C		0.262		
Turn-on energy loss per pulse	E_{on}	I_C = 200 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω, di/dt = 2050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		25.1		mJ
			T_{vj} = 125 °C		38.3		
			T_{vj} = 175 °C		45.9		
Turn-off energy loss per pulse	E_{off}	I_C = 200 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 2.7 Ω, dv/dt = 3250 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		12.9		mJ
			T_{vj} = 125 °C		20.5		
			T_{vj} = 175 °C		23.8		
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		640		A
			t_P ≤ 7 µs, T_{vj} = 175 °C		600		

Table 4 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values Min.	Values Typ.	Values Max.	Unit
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.231	K/W
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, λ_{grease}= 1 W/(m*K)		0.0670		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			200	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		400	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	3700	A^2s
			T_{vj} = 175 °C	3050	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Forward voltage	V_F	I_F = 200 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.72	TBD	V
			T_{vj} = 125 °C		1.59		
			T_{vj} = 175 °C		1.52		
Peak reverse recovery current	I_{RM}	V_R = 600 V, I_F = 200 A, V_{GE} = -15 V, -di_F/dt = 2050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		79.6		A
			T_{vj} = 125 °C		105		
			T_{vj} = 175 °C		118		
Recovered charge	Q_r	V_R = 600 V, I_F = 200 A, V_{GE} = -15 V, -di_F/dt = 2050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		15.7		µC
			T_{vj} = 125 °C		27.7		
			T_{vj} = 175 °C		35.6		

Table 6 **Characteristic values (continued)**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Reverse recovery energy	E_{rec}	V_R = 600 V, I_F = 200 A, V_{GE} = -15 V, -di_F/dt = 2050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		4.85		mJ
			T_{vj} = 125 °C		9.64		
			T_{vj} = 175 °C		12.2		
Thermal resistance, junction to case	R_{thJC}	per diode				0.376	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)			0.0730		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_C = 110 °C		150	A
Maximum RMS current at rectifier output	I_{RMSM}	T_C = 110 °C		150	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	1800	A
			T_{vj} = 150 °C	1600	
I^2t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	16200	A^2s
			T_{vj} = 150 °C	12800	

Table 8 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 200 A	T_{vj} = 150 °C		1.01		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1600 V			1.4		mA
Thermal resistance, junction to case	R_{thJC}	per diode				0.278	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)			0.0690		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 °C	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_C = 75 °C	150	A
Repetitive peak collector current	I_{CRM}	t_P = 1 ms		300	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 = 150 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.55	TBD	V
			T_{vj} = 125 °C		1.69		
			T_{vj} = 175 °C		1.77		
Gate threshold voltage	V_{GEth}	I_C = 3.5 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			2.5		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			1		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			30.1		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.105		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.005	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 = 150 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 5.6 Ω	T_{vj} = 25 °C		0.197		µs
			T_{vj} = 125 °C		0.208		
			T_{vj} = 175 °C		0.215		
Rise time (inductive load)	t_r	I_C = 150 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 5.6 Ω	T_{vj} = 25 °C		0.085		µs
			T_{vj} = 125 °C		0.090		
			T_{vj} = 175 °C		0.093		

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 = 150 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 5.6 Ω	T_{vj} = 25 °C		0.419		µs
			T_{vj} = 125 °C		0.502		
			T_{vj} = 175 °C		0.521		
Fall time (inductive load)	t_f	I_C = 150 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 5.6 Ω	T_{vj} = 25 °C		0.113		µs
			T_{vj} = 125 °C		0.208		
			T_{vj} = 175 °C		0.272		
Turn-on energy loss per pulse	E_{on}	I_C = 150 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 5.6 Ω, di/dt = 1150 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		12.2		mJ
			T_{vj} = 125 °C		19.1		
			T_{vj} = 175 °C		23.1		
Turn-off energy loss per pulse	E_{off}	I_C = 150 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 5.6 Ω, dv/dt = 3100 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		10.5		mJ
			T_{vj} = 125 °C		16.1		
			T_{vj} = 175 °C		20.1		
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		480		A
			$t_P \leq$ 7 µs, T_{vj} = 175 °C		450		
Thermal resistance, junction to case	R_{thJC}	per IGBT				0.290	K/W
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, λ_{grease}= 1 W/(m*K)			0.0700		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, Brake-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			75	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		150	A

Table 11 **Maximum rated values (continued)**

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	450	A^2s
			T_{vj} = 175 °C	370	

Table 12 **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 75 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.72	TBD	V
			T_{vj} = 125 °C		1.59		
			T_{vj} = 175 °C		1.52		
Peak reverse recovery current	I_{RM}	V_R = 600 V, I_F = 75 A, V_{GE} = -15 V, -di_F/dt = 1050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		38.2		A
			T_{vj} = 125 °C		50.9		
			T_{vj} = 175 °C		58.9		
Recovered charge	Q_r	V_R = 600 V, I_F = 75 A, V_{GE} = -15 V, -di_F/dt = 1050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		5.43		µC
			T_{vj} = 125 °C		10.4		
			T_{vj} = 175 °C		14.1		
Reverse recovery energy	E_{rec}	V_R = 600 V, I_F = 75 A, V_{GE} = -15 V, -di_F/dt = 1050 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		10		mJ
			T_{vj} = 125 °C		10		
			T_{vj} = 175 °C		10		
Thermal resistance, junction to case	R_{thJC}	per diode				0.728	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, λ_{grease}= 1 W/(m*K)			0.0870		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

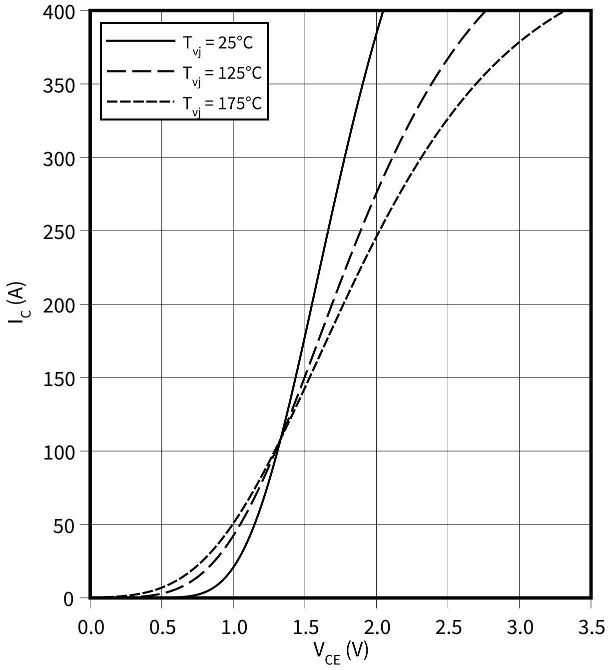
Table 13 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
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

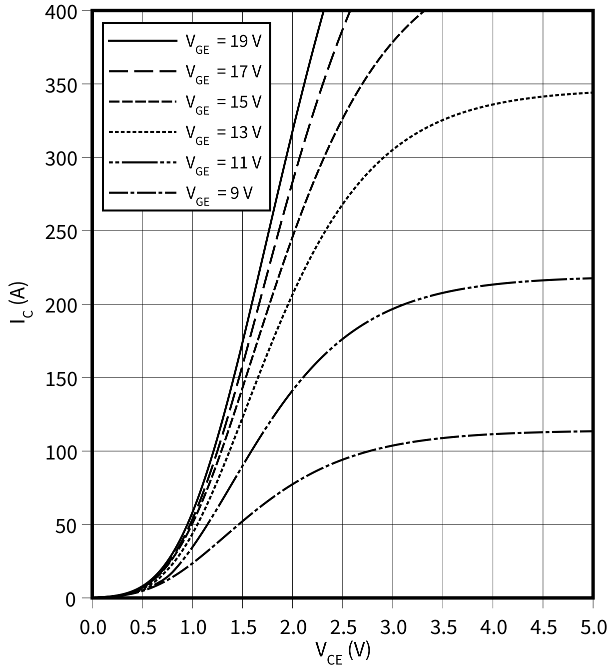
Note: Specification according to the valid application note.

8 Characteristics diagrams

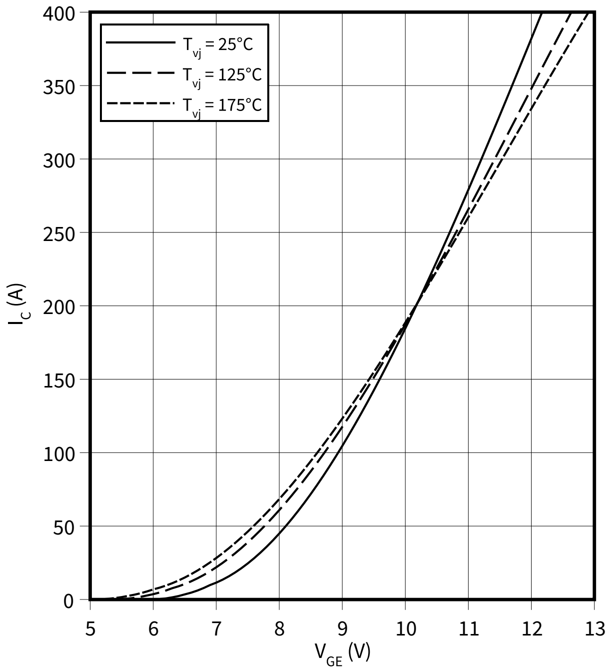
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$V_{GE} = 15$ V



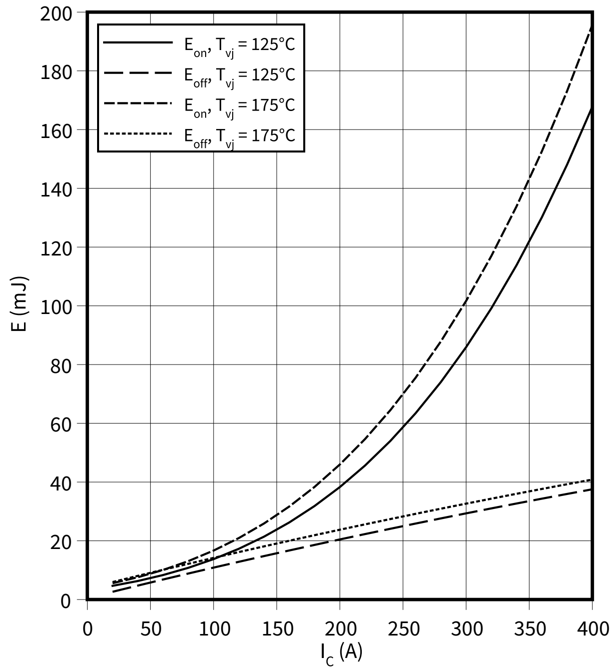
output characteristic (typical), IGBT, Inverter
$I_C = f(V_{CE})$
$T_{vj} = 175$ °C



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



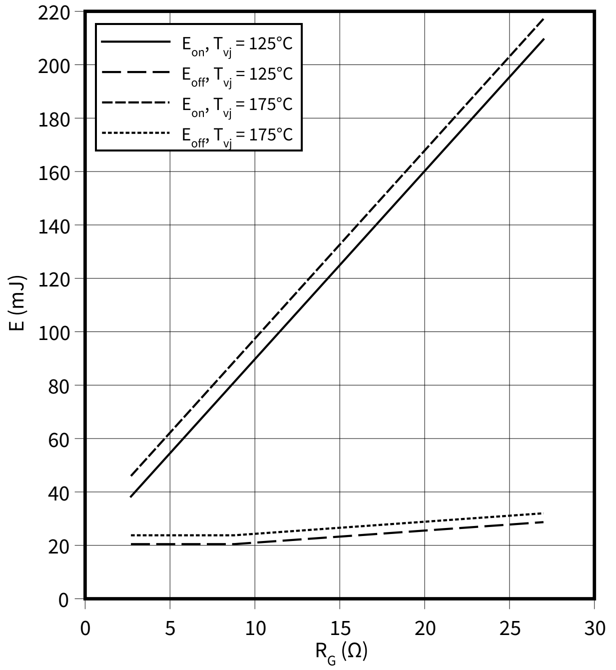
switching losses (typical), IGBT, Inverter
$E = f(I_C)$
$R_{Goff} = 2.7\ \Omega$, $R_{Gon} = 2.7\ \Omega$, $V_{CE} = 600$ V, $V_{GE} = \pm 15$ V



switching losses (typical), IGBT, Inverter

$E = f(R_G)$

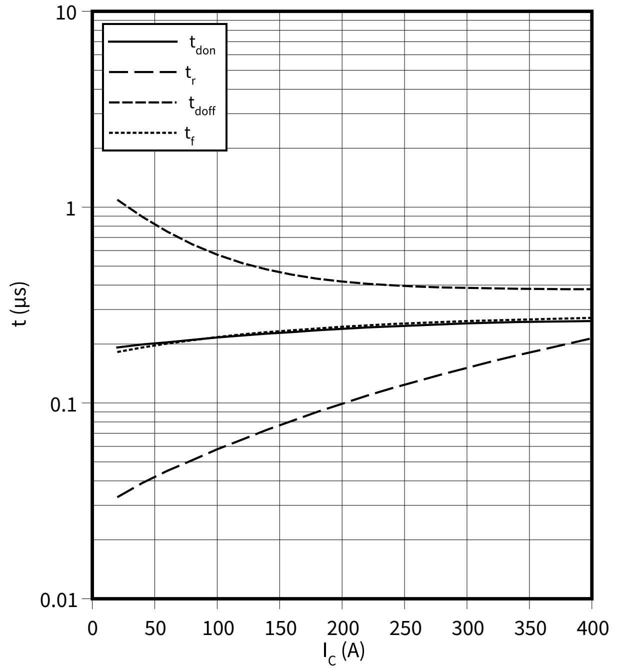
I_C = 200 A, V_{CE} = 600 V, V_{GE} = ± 15 V



switching times (typical), IGBT, Inverter

$t = f(I_C)$

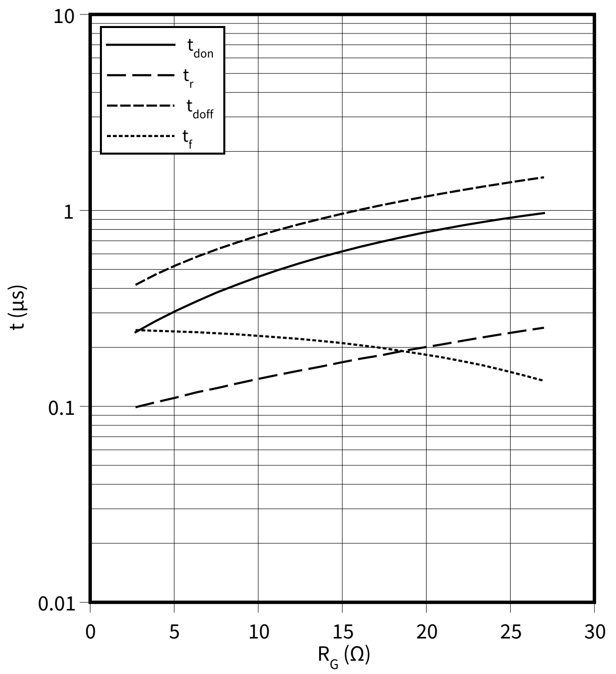
R_{Goff} = 2.7 Ω, R_{Gon} = 2.7 Ω, V_{CE} = 600 V, V_{GE} = ± 15 V, T_{vj} = 175 °C



switching times (typical), IGBT, Inverter

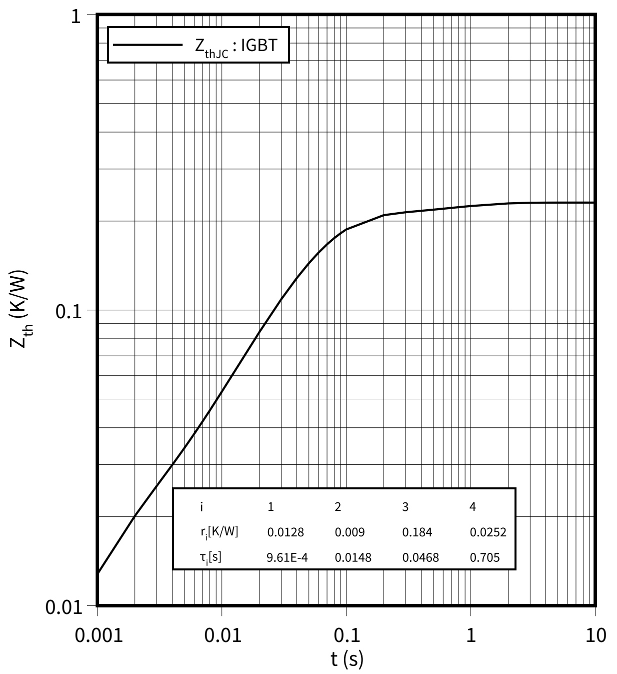
$t = f(R_G)$

I_C = 200 A, V_{CE} = 600 V, V_{GE} = ± 15 V, T_{vj} = 175 °C



transient thermal impedance , IGBT, Inverter

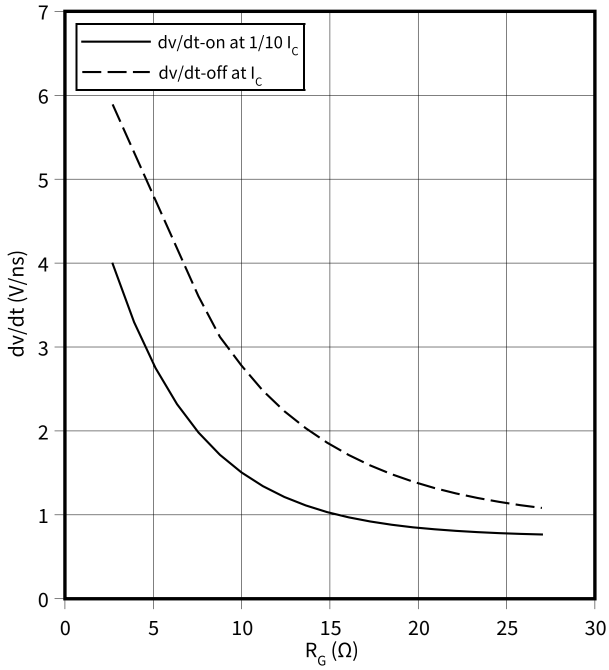
$Z_{th} = f(t)$



Voltage slope (typical), IGBT, Inverter

dv/dt = f(R_G)

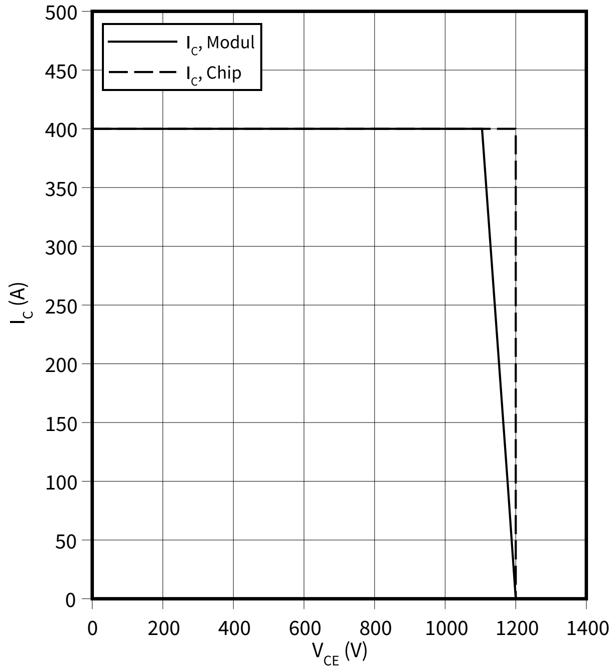
I_C = 200 A, V_{CE} = 600 V, V_{GE} = ± 15 V, T_{vj} = 25 °C



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

I_C = f(V_{CE})

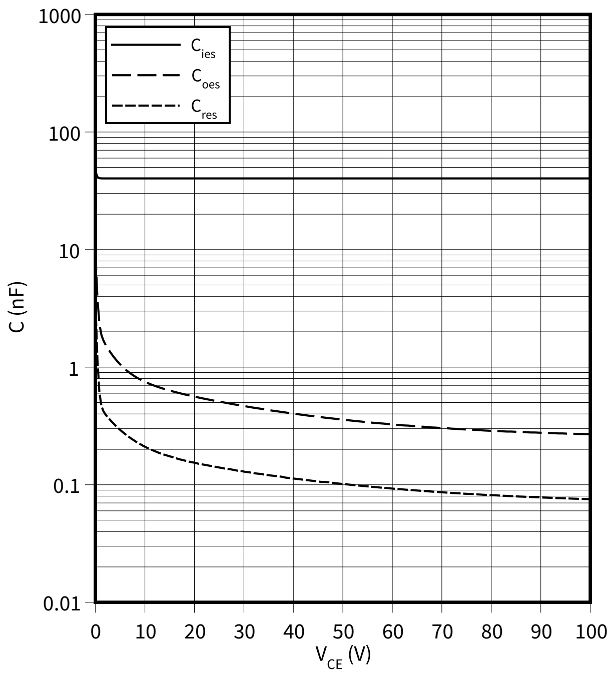
R_{Goff} = 2.7 Ω, V_{GE} = ± 15 V, T_{vj} = 175 °C



capacity characteristic (typical), IGBT, Inverter

C = f(V_{CE})

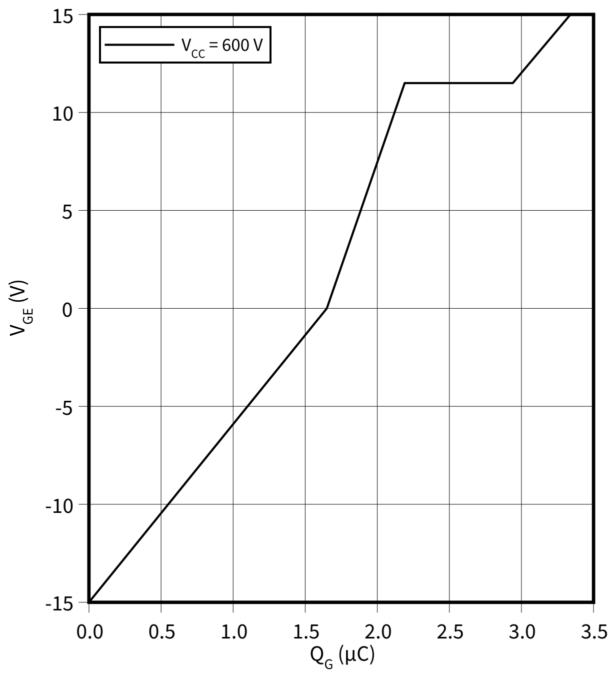
f = 100 kHz, V_{GE} = 0 V, T_{vj} = 25 °C



gate charge characteristic (typical), IGBT, Inverter

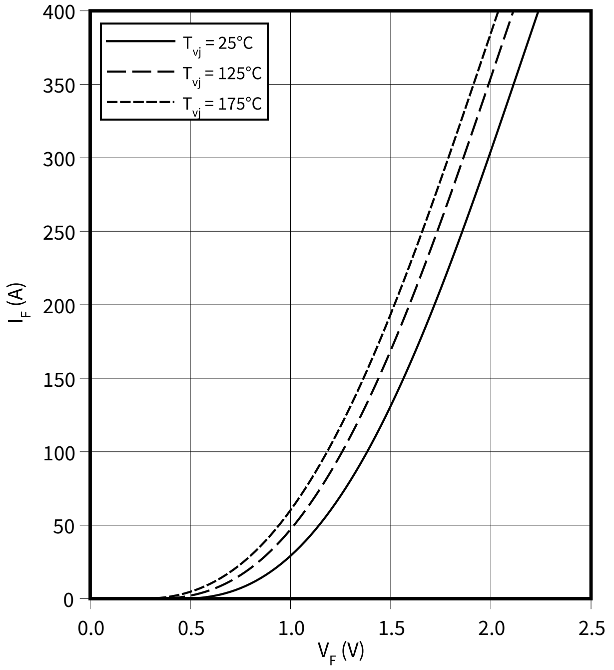
V_{GE} = f(Q_G)

I_C = 200 A, T_{vj} = 25 °C



forward characteristic (typical), Diode, Inverter

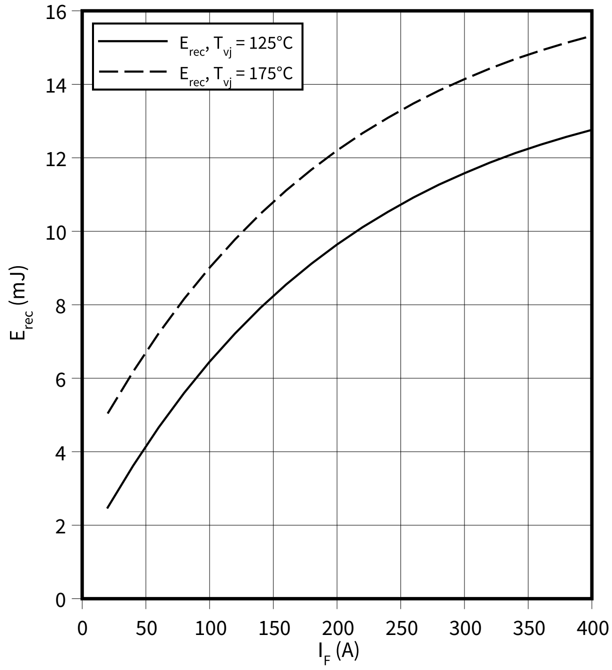
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

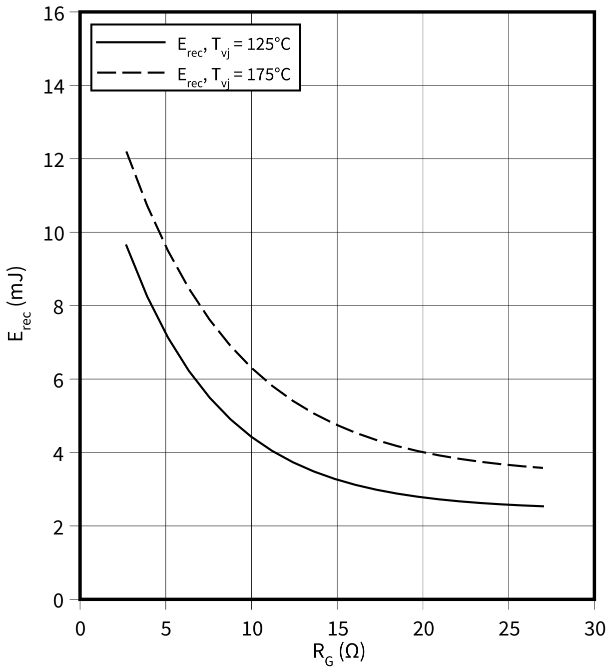
$R_{Gon} = 2.7\ \Omega$, $V_{CE} = 600$ V



switching losses (typical), Diode, Inverter

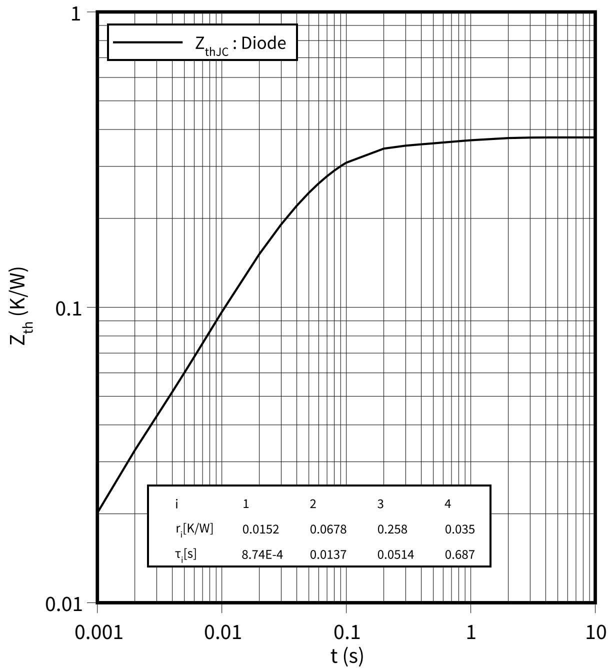
$E_{rec} = f(R_G)$

$V_{CE} = 600$ V, $I_F = 200$ A



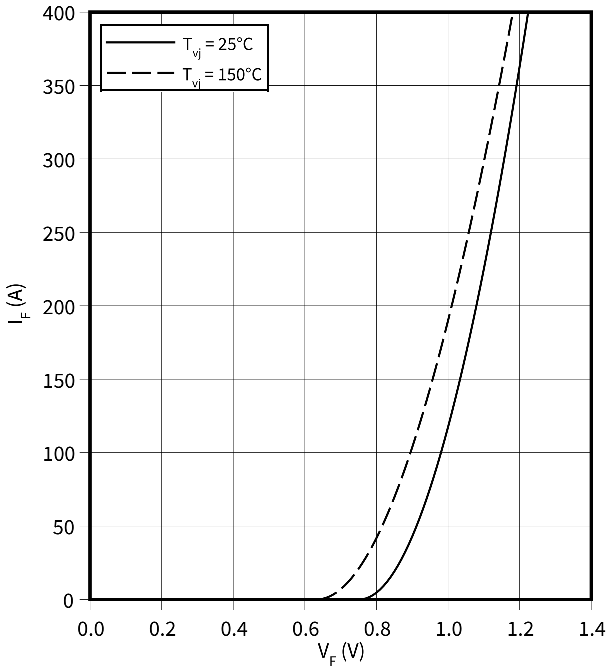
transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



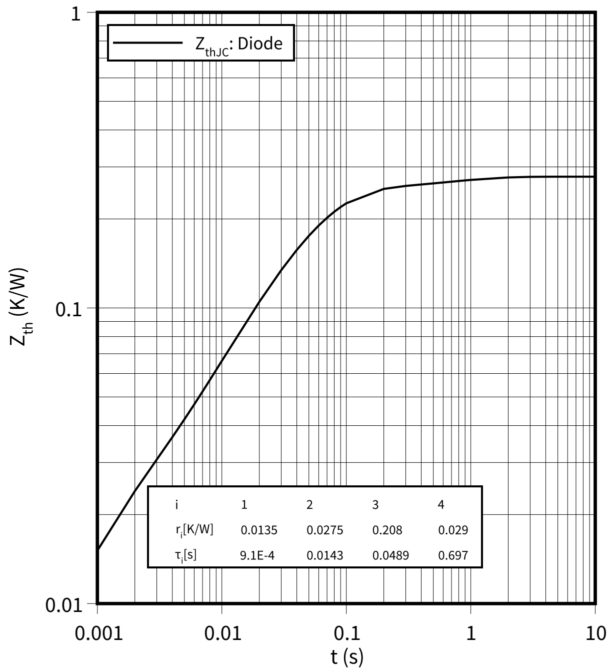
forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



transient thermal impedance , Diode, Rectifier

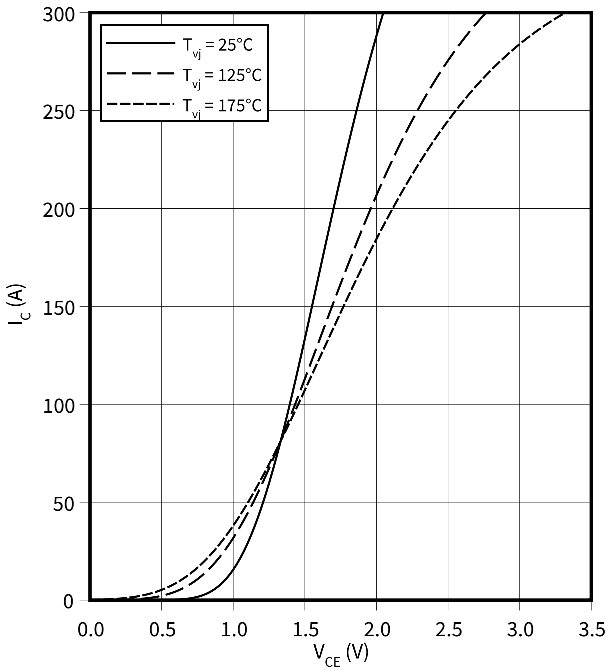
$Z_{th} = f(t)$



output characteristic (typical), IGBT, Brake-Chopper

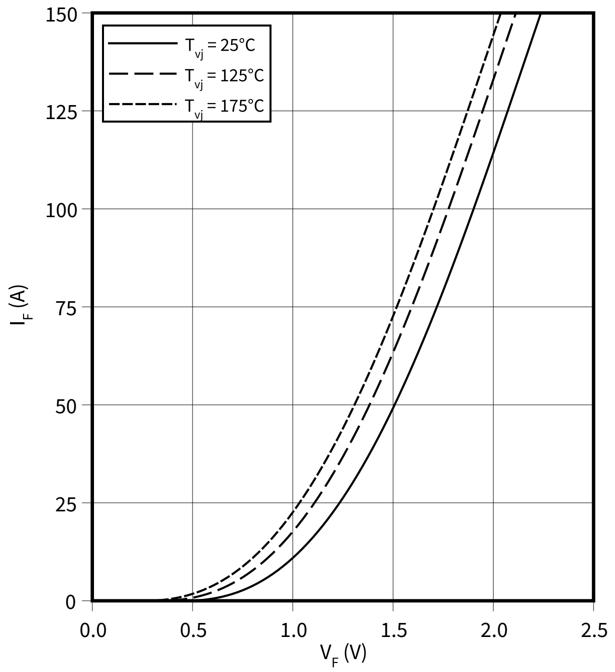
$I_C = f(V_{CE})$

$V_{GE} = 15$ V

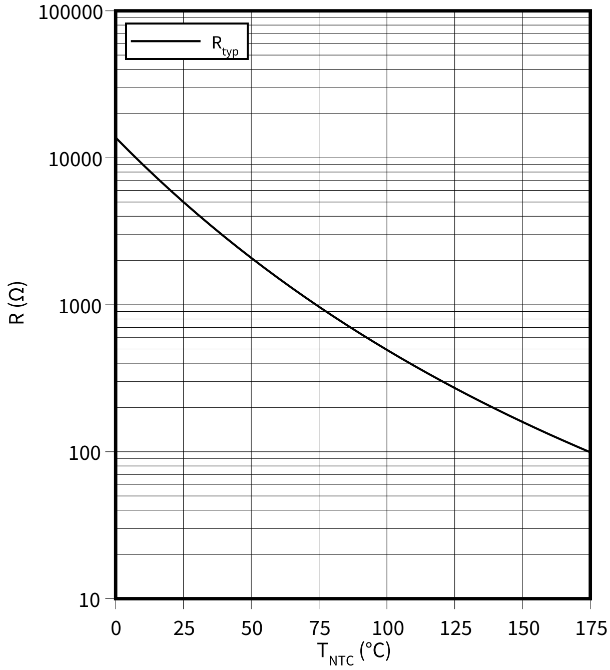


forward characteristic (typical), Diode, Brake-Chopper

$I_F = f(V_F)$



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



9 Circuit diagram

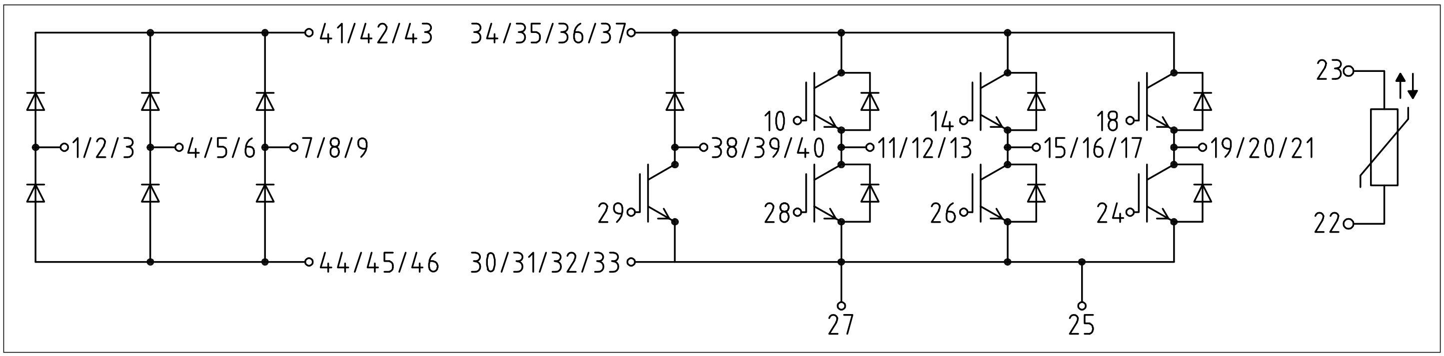


Figure 2

10 Package outlines

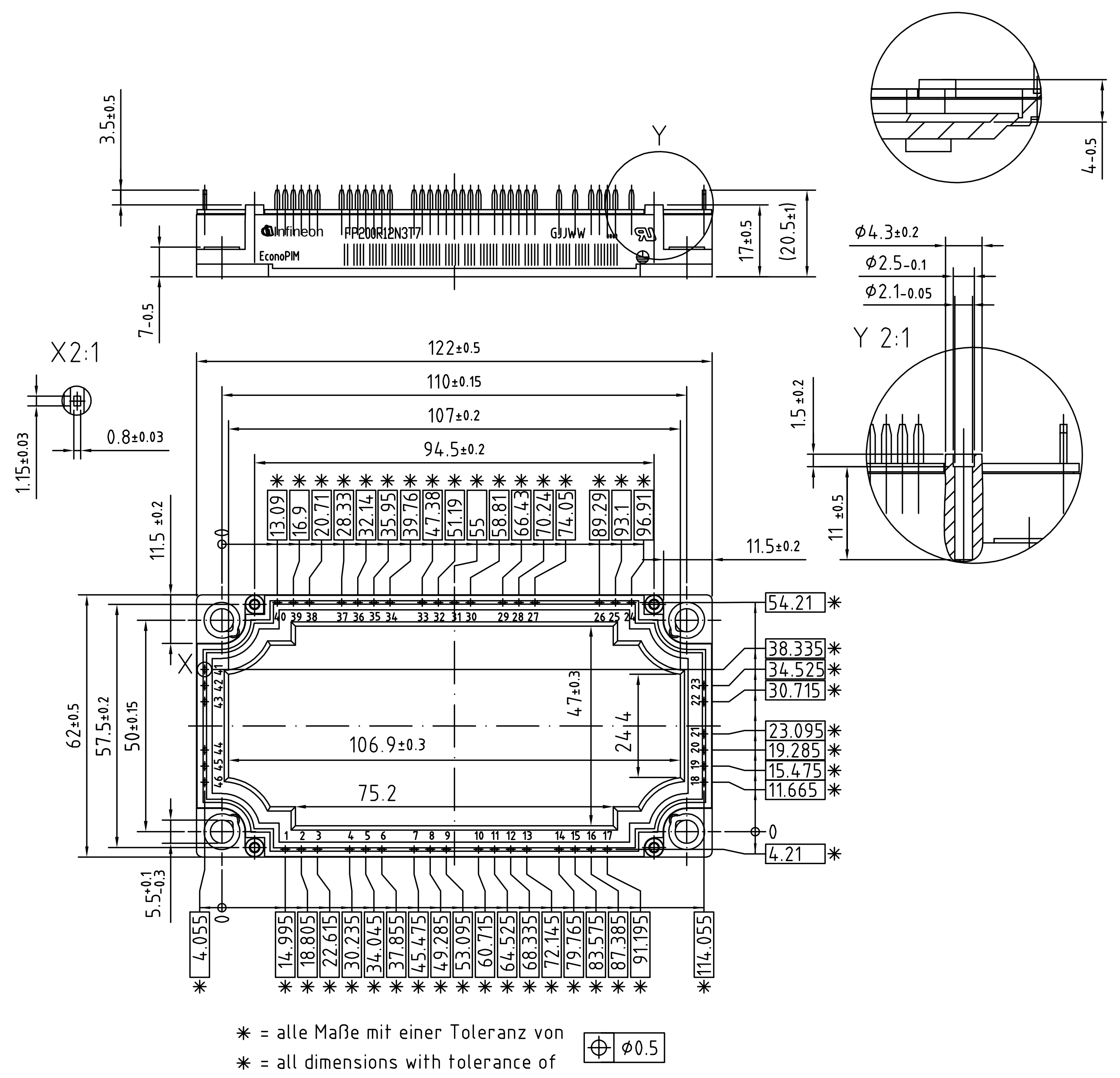


Figure 3

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	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 – 5 6 - 11 12 - 19 20 – 21 22 – 23	*Example* 71549 142846 55054991 15 30
Example	71549142846550549911530		71549142846550549911530

Figure 4