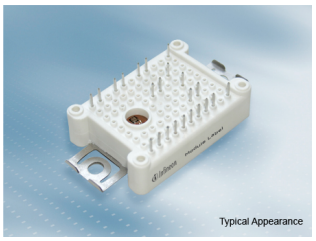
Preliminary datasheet

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_2O_3 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

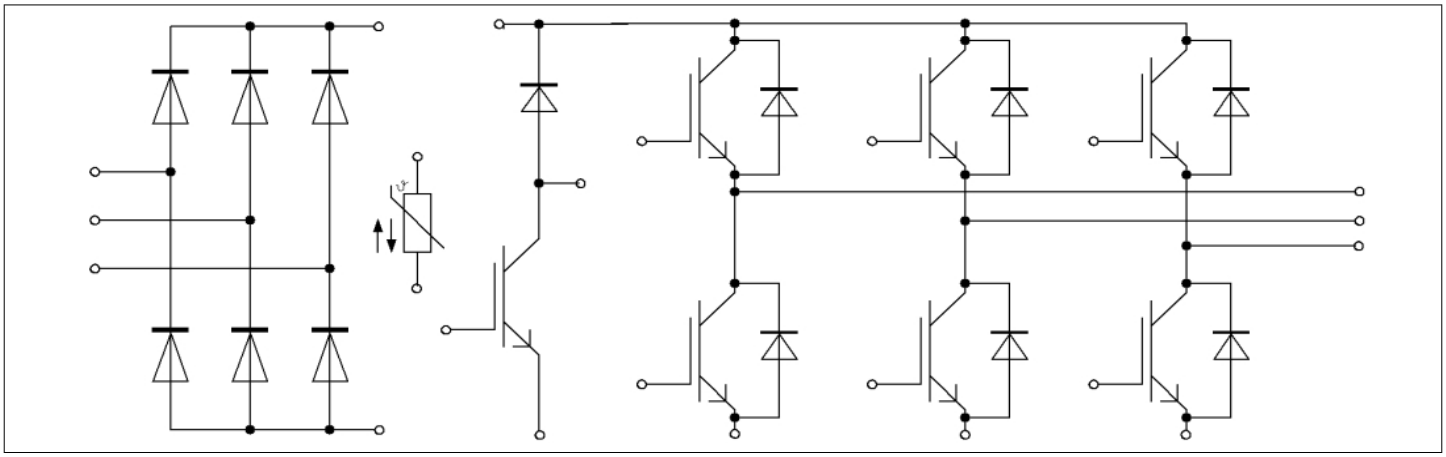


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, f = 50 Hz, *t* = 1 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°C, per switch		6		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H=25°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 °C	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 110 °C	15	A
Repetitive peak collector current	I_{CRM}	t_P = 1 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 °C		1.60	TBD	V
			T_{vj} = 125 °C		1.74		
			T_{vj} = 175 °C		1.82		
Gate threshold voltage	V_{GEth}	I_C = 0.553 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			0.234		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			2.82		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °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 °C			0.003	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 = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.023		µs
			T_{vj} = 125 °C		0.025		
			T_{vj} = 175 °C		0.026		
Rise time (inductive load)	t_r	I_C = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.012		µs
			T_{vj} = 125 °C		0.015		
			T_{vj} = 175 °C		0.016		
Turn-off delay time (inductive load)	t_{doff}	I_C = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.144		µs
			T_{vj} = 125 °C		0.190		
			T_{vj} = 175 °C		0.256		
Fall time (inductive load)	t_f	I_C = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.199		µs
			T_{vj} = 125 °C		0.301		
			T_{vj} = 175 °C		0.329		
Turn-on energy loss per pulse	E_{on}	I_C = 15 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω, di/dt = 750 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.87		mJ
			T_{vj} = 125 °C		1.21		
			T_{vj} = 175 °C		1.45		
Turn-off energy loss per pulse	E_{off}	I_C = 15 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω, dv/dt = 4000 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.922		mJ
			T_{vj} = 125 °C		1.44		
			T_{vj} = 175 °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 V, V_{CC} = 800 V, $V_{CEmax}=V_{CES}-L_{sCE}*di/dt$	$t_P \leq$ 8 µs, T_{vj} = 150 °C		48		A
			$t_P \leq$ 7 µs, T_{vj} = 175 °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	°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			10	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		20	A
I^2t - value	I^2t	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	27.5	A^2s
			T_{vj} = 175 °C	24	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 10 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}	I_F = 10 A, V_R = 600 V, V_{GE} = -15 V, $-di_F/dt$ = 700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		15.5		A
			T_{vj} = 125 °C		19.2		
			T_{vj} = 175 °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 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.82		µC
			T_{vj} = 125 °C		1.46		
			T_{vj} = 175 °C		2.05		
Reverse recovery energy	E_{rec}	I_F = 10 A, V_R = 600 V, V_{GE} = -15 V, -di$_F$/dt = 700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.31		mJ
			T_{vj} = 125 °C		0.57		
			T_{vj} = 175 °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	$T_{vj\,op}$			-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 = 100 °C		25	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 100 °C		25	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	300	A
			T_{vj} = 150 °C	245	
I^2t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	450	A^2s
			T_{vj} = 150 °C	300	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 10 A	T_{vj} = 150 °C		0.80		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				1.58	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 °C	1200	V
Continous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 110 °C	15	A
Repetitive peak collector current	I_{CRM}	t_P = 1 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 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.60	TBD	V
			T_{vj} = 125 °C		1.74		
			T_{vj} = 175 °C		1.82		
Gate threshold voltage	V_{GEth}	I_C = 0.553 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			0.234		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			0		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			2.82		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °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 °C			0.003	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 = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.023		µs
			T_{vj} = 125 °C		0.025		
			T_{vj} = 175 °C		0.026		
Rise time (inductive load)	t_r	I_C = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω	T_{vj} = 25 °C		0.012		µs
			T_{vj} = 125 °C		0.015		
			T_{vj} = 175 °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 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.144		µs
			T_{vj} = 125 °C		0.190		
			T_{vj} = 175 °C		0.256		
Fall time (inductive load)	t_f	I_C = 15 A, V_{CE} = 600 V, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω	T_{vj} = 25 °C		0.199		µs
			T_{vj} = 125 °C		0.301		
			T_{vj} = 175 °C		0.329		
Turn-on energy loss per pulse	E_{on}	I_C = 15 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 7.5 Ω, di/dt = 750 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.87		mJ
			T_{vj} = 125 °C		1.21		
			T_{vj} = 175 °C		1.45		
Turn-off energy loss per pulse	E_{off}	I_C = 15 A, V_{CE} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 7.5 Ω, dv/dt = 4000 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.922		mJ
			T_{vj} = 125 °C		1.44		
			T_{vj} = 175 °C		1.8		
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		48		A
			t_P ≤ 7 µs, T_{vj} = 175 °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	°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			10	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		20	A
I^2t - value	I^2t	V_R = 0 V, t_P = 10 ms	T_{vj} = 125 °C	27.5	A^2s
			T_{vj} = 175 °C	24	

Table 12 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 10 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}	I_F = 10 A, V_R = 600 V, -di$_F$/dt = 700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		15.5		A
			T_{vj} = 125 °C		19.2		
			T_{vj} = 175 °C		22.5		
Recovered charge	Q_r	I_F = 10 A, V_R = 600 V, -di$_F$/dt = 700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.82		µC
			T_{vj} = 125 °C		1.46		
			T_{vj} = 175 °C		2.05		
Reverse recovery energy	E_{rec}	I_F = 10 A, V_R = 600 V, -di$_F$/dt = 700 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.31		mJ
			T_{vj} = 125 °C		0.57		
			T_{vj} = 175 °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	$T_{vj\,op}$			-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

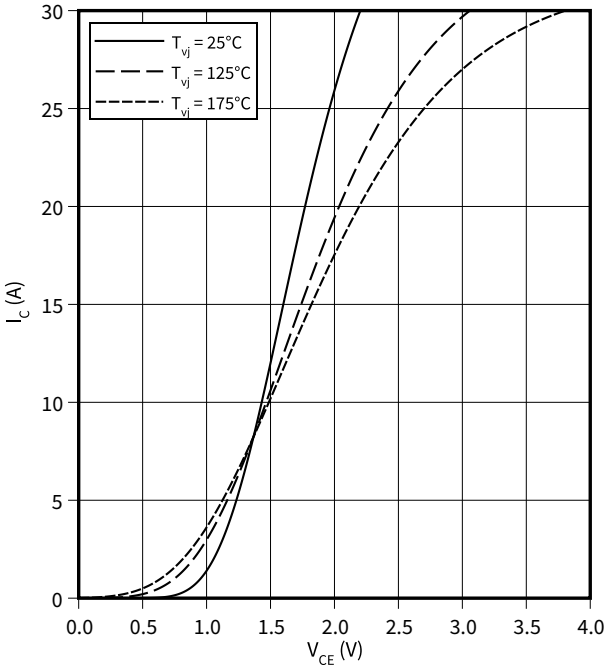
Note: Specification according to the valid application note.

8 Characteristics diagrams

output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

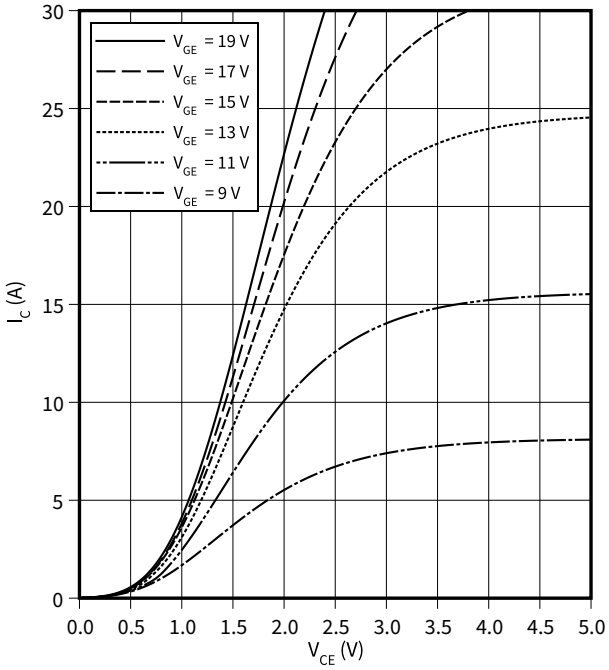
$V_{GE} = 15$ V



output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

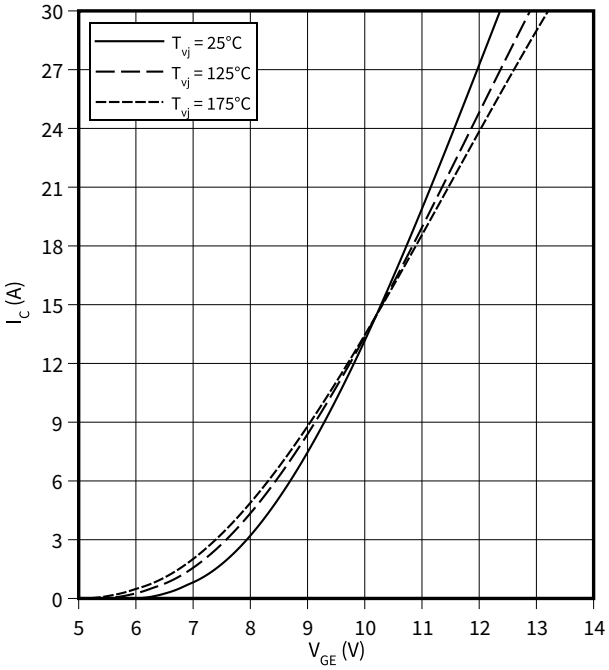
$T_{vj} = 175$ °C



transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

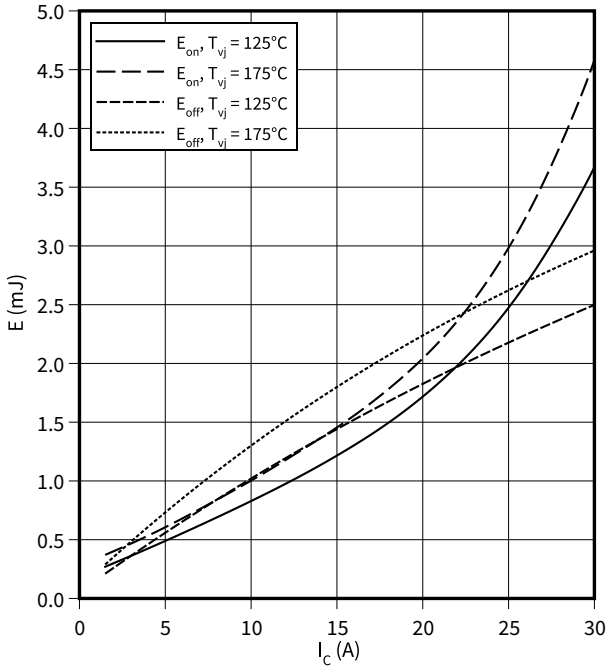
$V_{CE} = 20$ V



switching losses (typical), IGBT, Inverter

$E = f(I_C)$

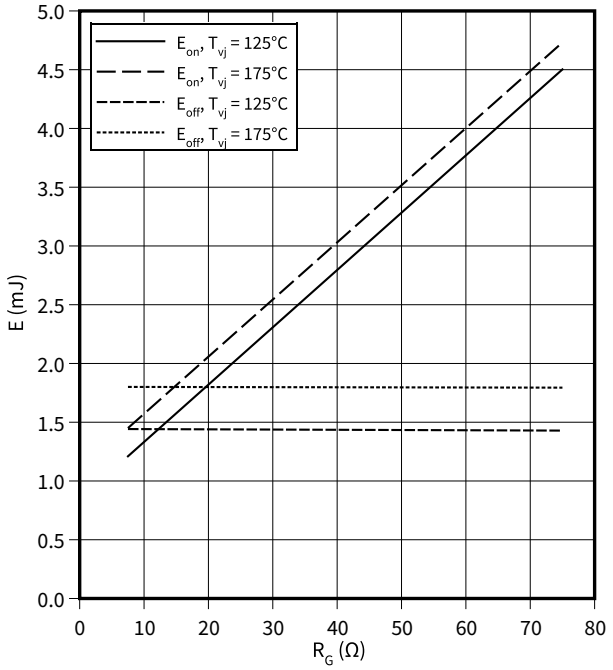
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 7.5\ \Omega$, $V_{CE} = 600$ V, $V_{GE} = \pm 15$ V



switching losses (typical), IGBT, Inverter

$E = f(R_G)$

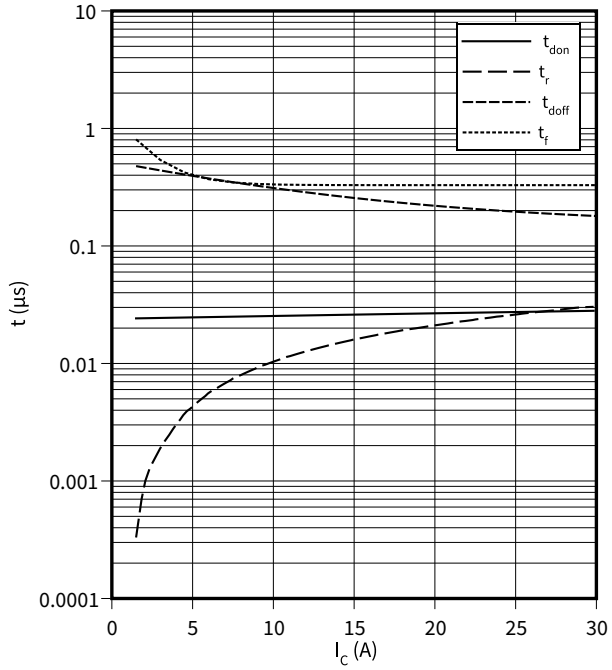
$I_C = 15\ A$, $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$



switching times (typical), IGBT, Inverter

$t = f(I_C)$

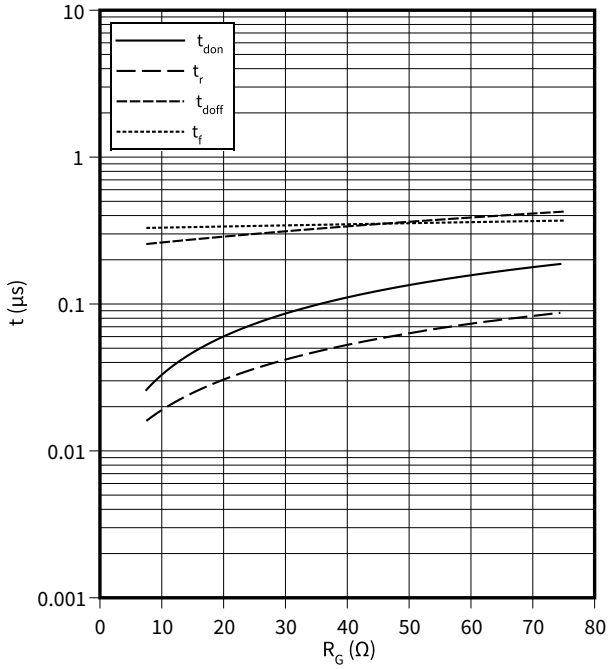
$R_{Goff} = 7.5\ \Omega$, $R_{Gon} = 7.5\ \Omega$, $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



switching times (typical), IGBT, Inverter

$t = f(R_G)$

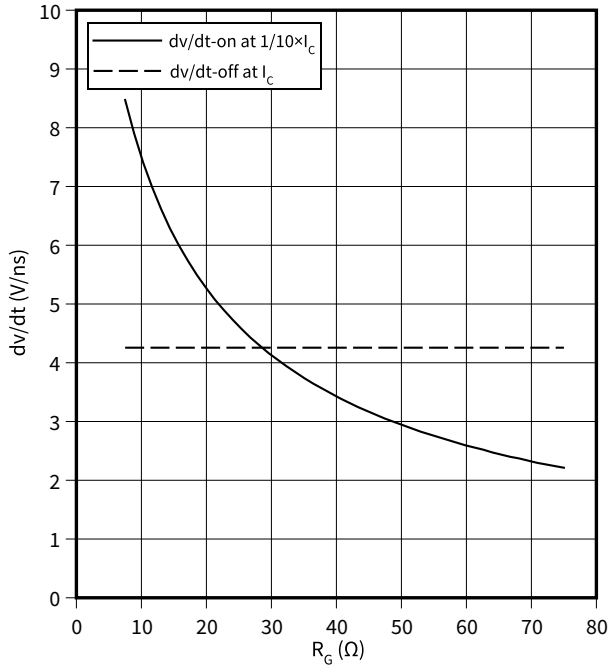
$I_C = 15\ A$, $V_{CE} = 600\ V$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ °C$



dv/dt (typical), IGBT, Inverter

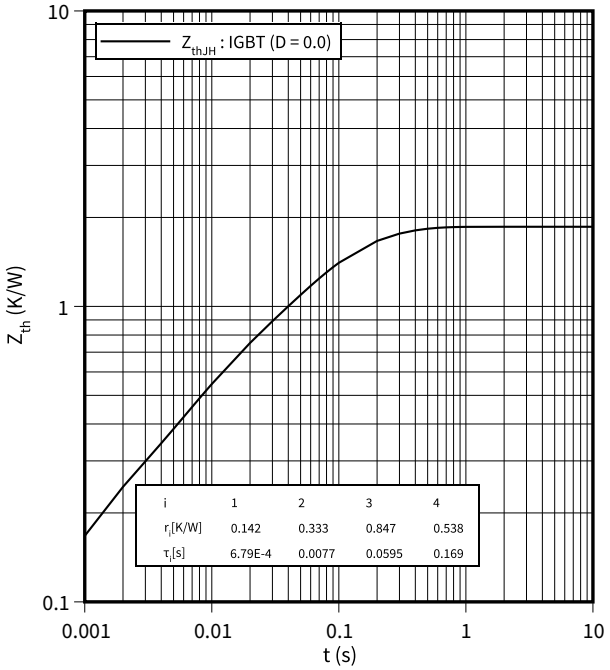
$dv/dt = f(R_G)$

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



transient thermal impedance , IGBT, Inverter

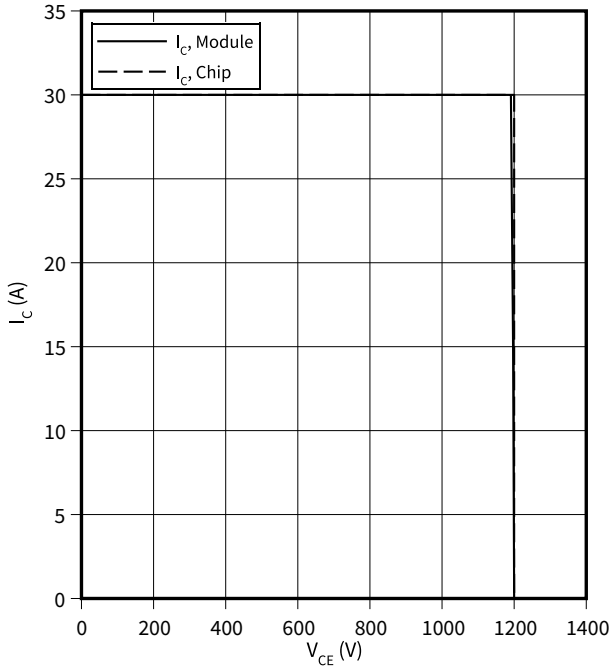
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

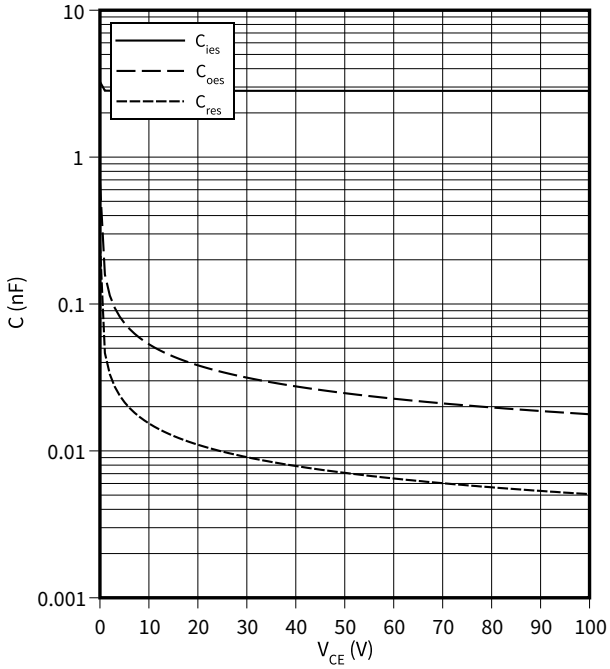
$R_{Goff} = 7.5\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

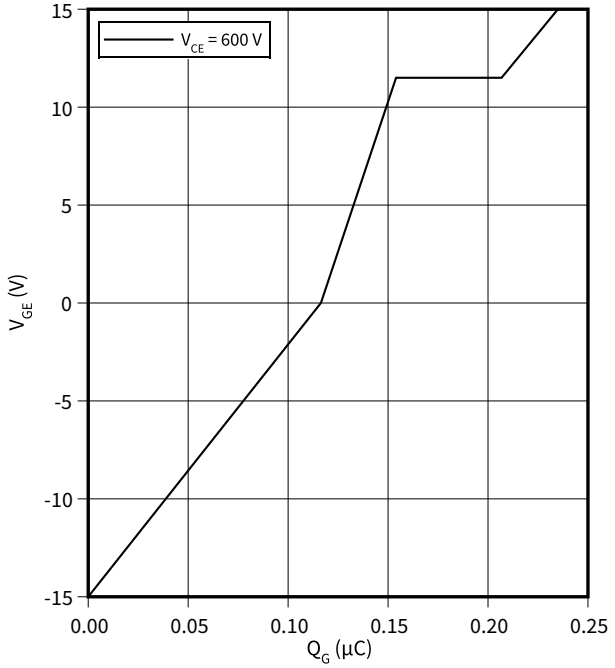
$V_{GE} = 0$ V, $T_{vj} = 25$ °C, $f = 100$ kHz



gate charge characteristic (typical), IGBT, Inverter

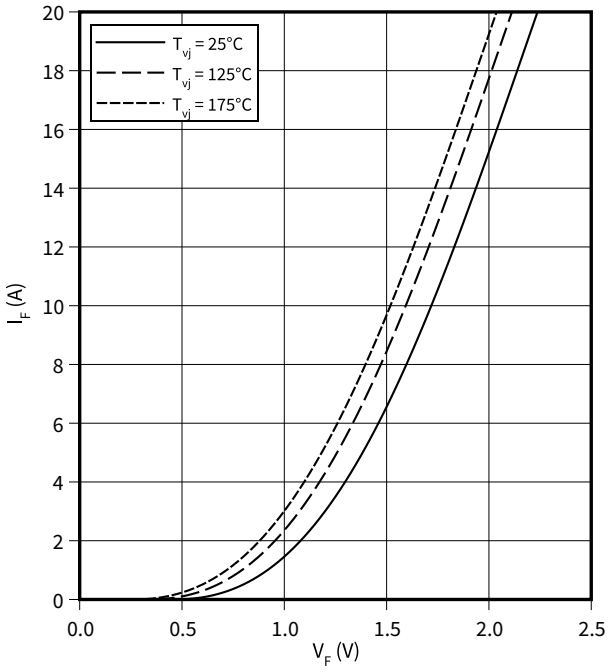
$V_{GE} = f(Q_G)$

$T_{vj} = 25$ °C, $I_C = 15$ A



forward characteristic (typical), Diode, Inverter

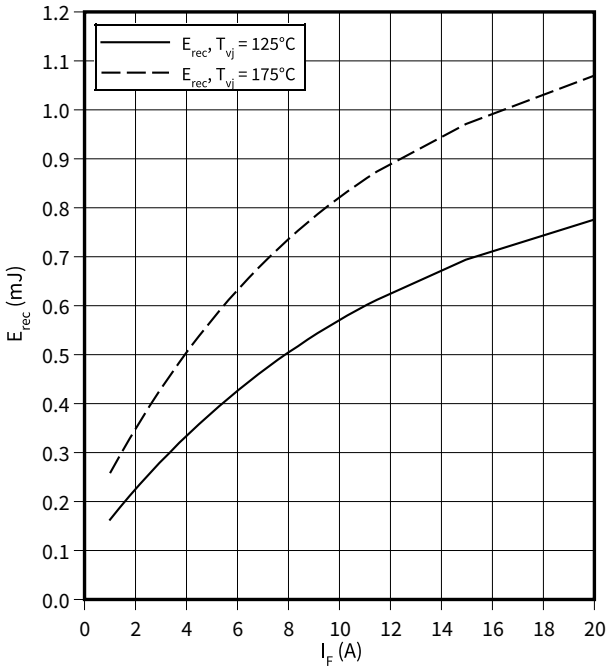
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

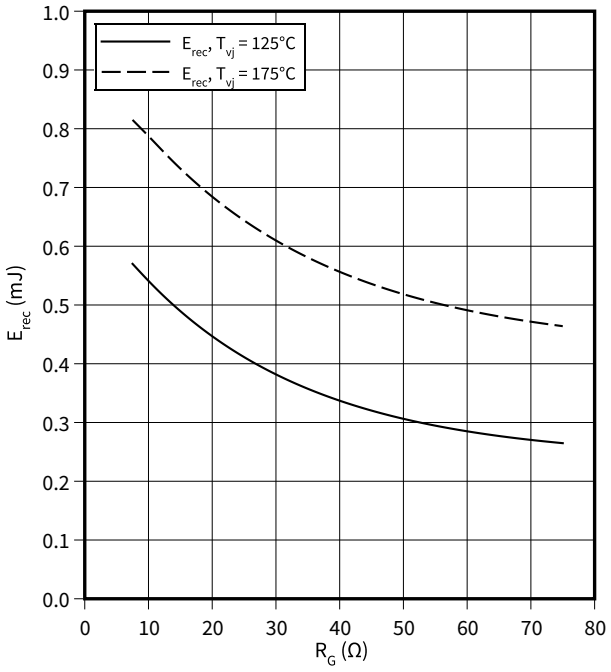
$R_{Gon} = 7.5\ \Omega$, $V_{CE} = 600\ V$



switching losses (typical), Diode, Inverter

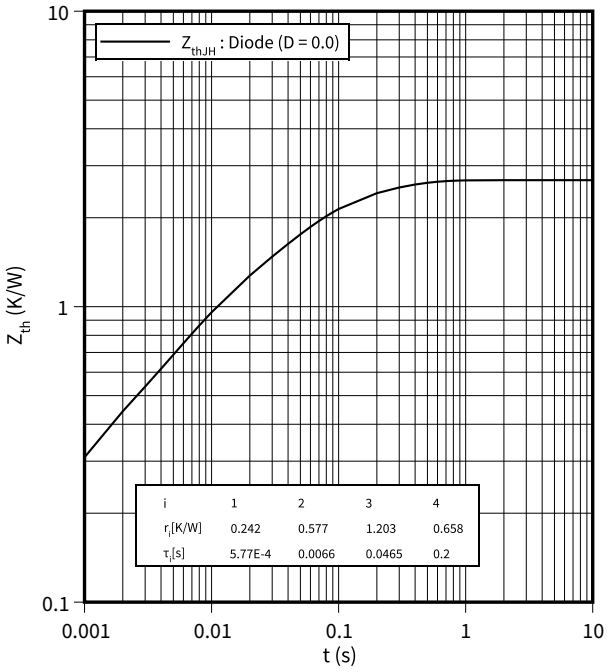
$E_{rec} = f(R_G)$

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



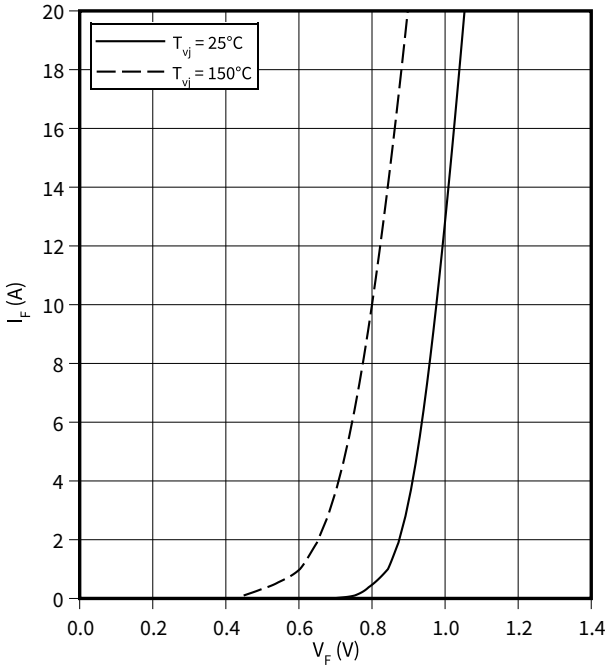
transient thermal impedance , Diode, Inverter

$Z_{th} = f(t)$



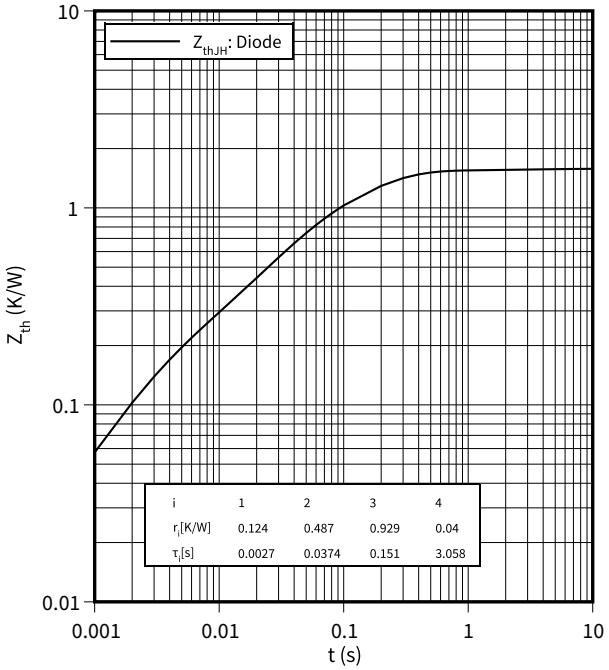
forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



transient thermal impedance , Diode, Rectifier

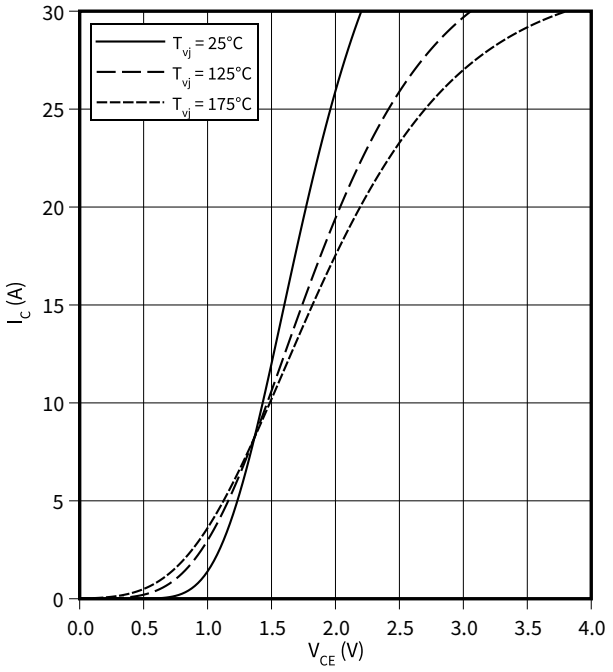
$Z_{th} = f(t)$



output characteristic (typical), IGBT, Brake-Chopper

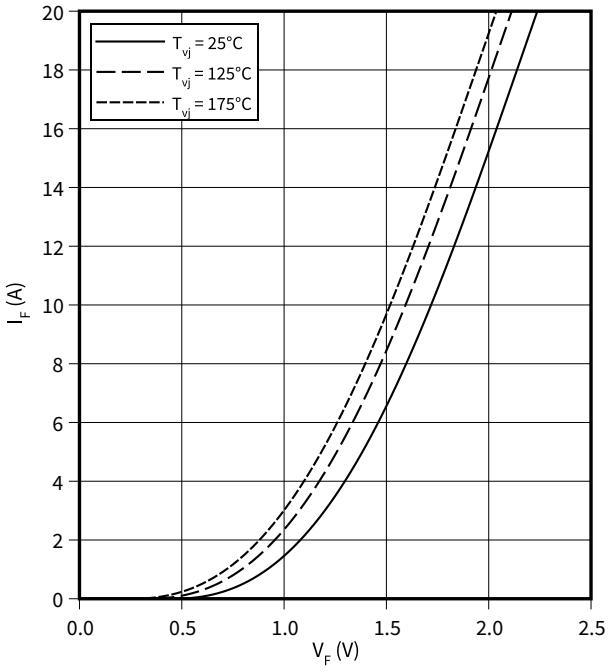
$I_C = f(V_{CE})$

$V_{GE} = 15\ V$



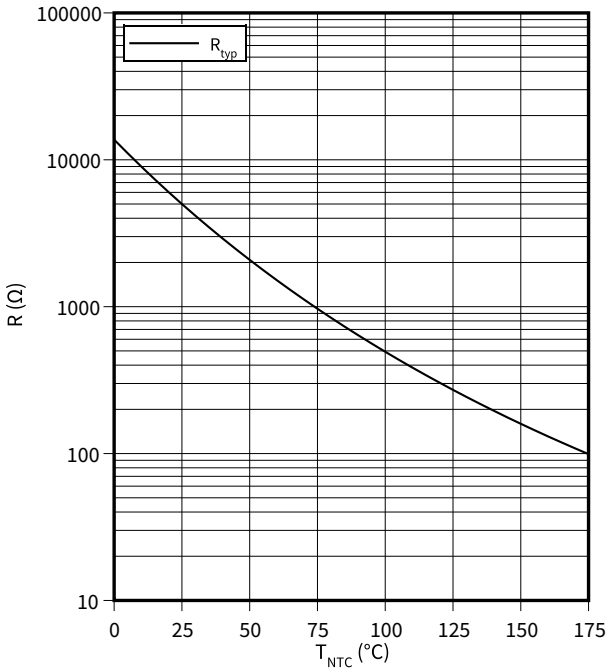
forward characteristic (typical), Diode, Brake-Chopper

$I_F = f(V_F)$



temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

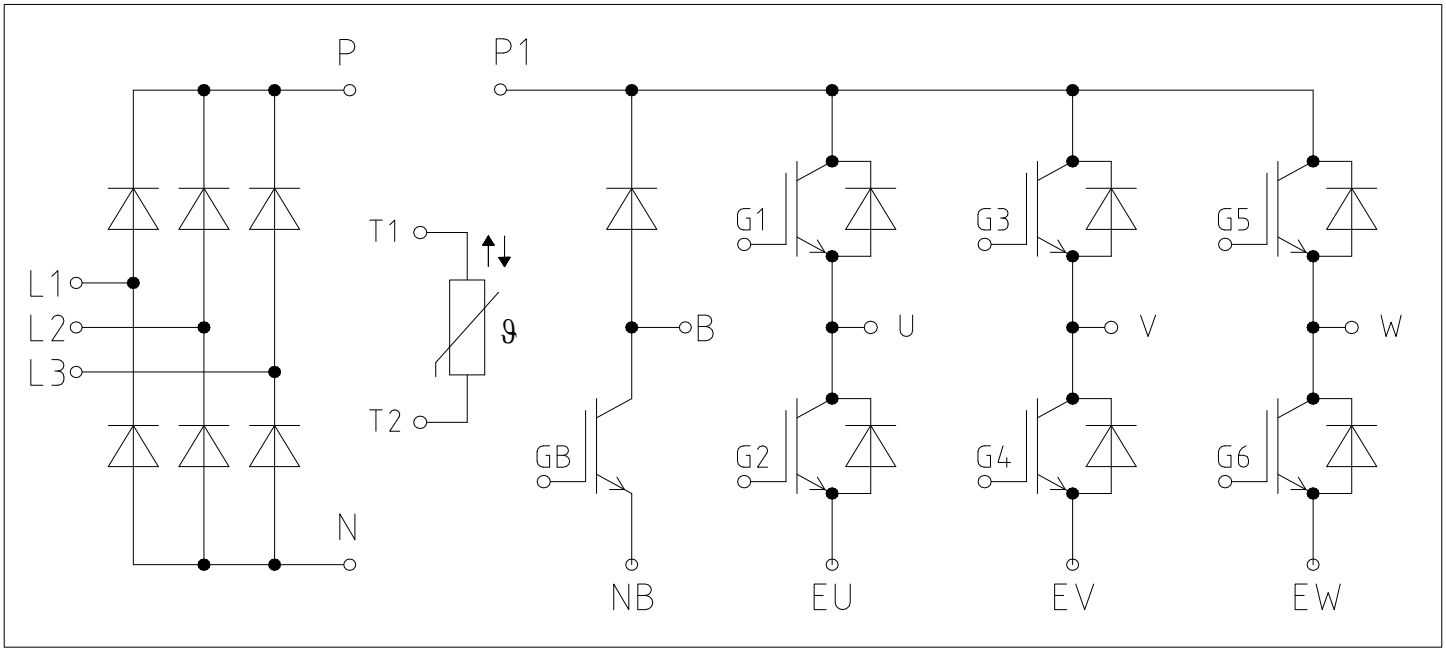


Figure 2

10 Package outlines

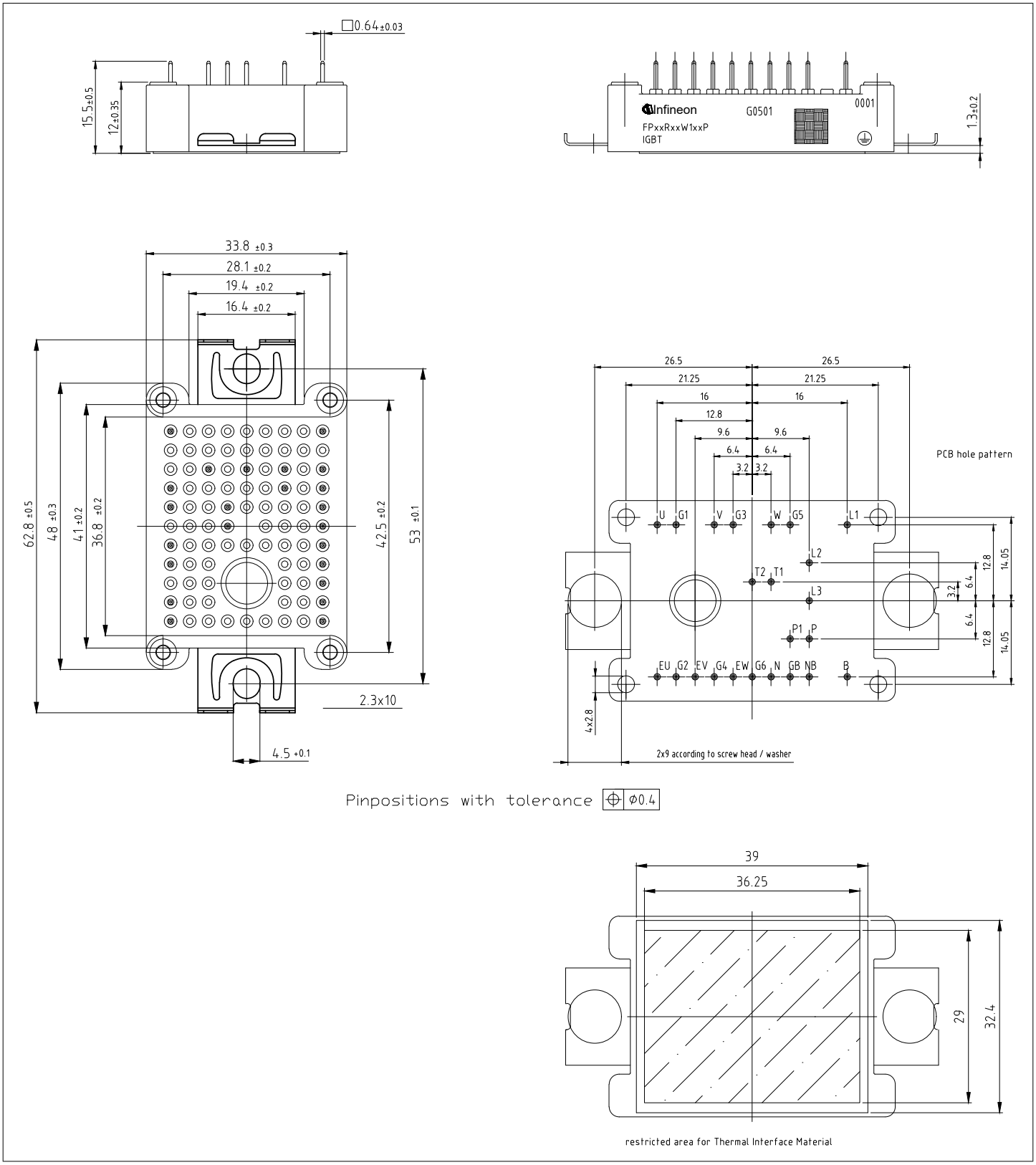


Figure 3

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	7154914284655054991530		7154914284655054991530

Figure 4

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