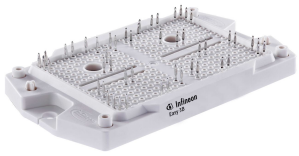
EasyPIM™ module with TRENCHSTOP™IGBT7 and emitter controlled 7 diode and PressFIT / NTC



Features

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 75 A / I_{CRM} = 150 A
  - Low $V_{CE,sat}$
  - Overload operation up to 175°C
  - TRENCHSTOP™ IGBT7
- Mechanical features
  - PressFIT contact technology
  - Package with CTI > 400
  - High power density
  - 2.5 kV AC 1 minute insulation
  - Al_2O_3 substrate with low thermal resistance
  - Compact design

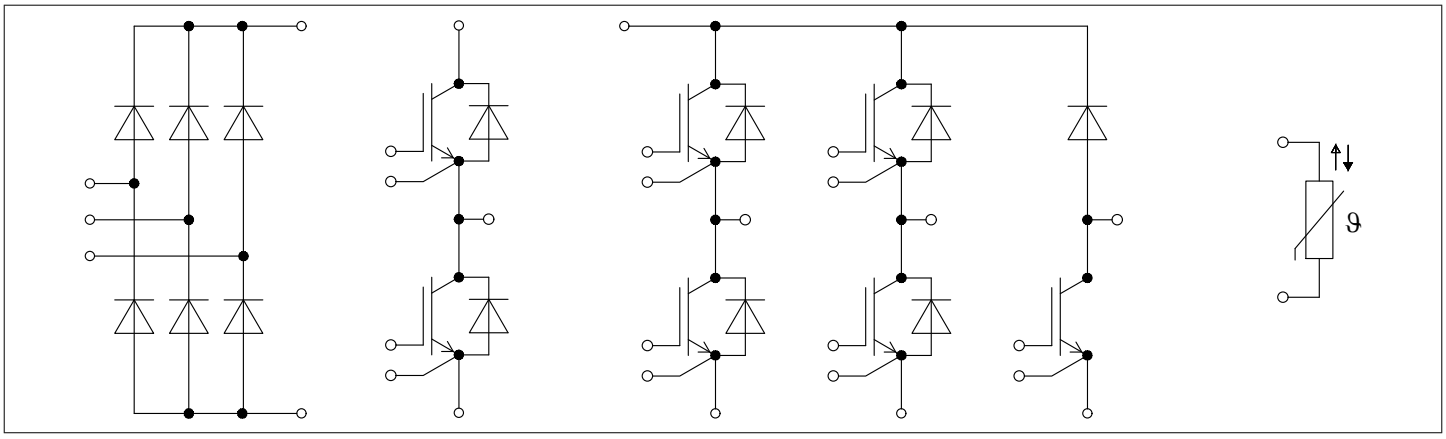
Potential applications

- Air conditioning
- Auxiliary inverters
- Motor 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
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	11.2	mm
Creepage distance	d_{Creep}	terminal to terminal	6.8	mm
Clearance	d_{Clear}	terminal to heatsink	9.4	mm
Clearance	d_{Clear}	terminal to terminal	5.5	mm
Comparative tracking index	*CTI*		> 400	
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}				35		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	T_H = 25 °C, per switch			2.8		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch			2.2		mΩ
Storage temperature	T_{stg}			-40		125	°C
Mounting torque for module mounting	*M*	- Mounting according to valid application note	M5, Screw	1.3		1.5	Nm
Weight	*G*				78		g

Note: The current under continuous operation is limited to 25 A 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
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 85 °C	75	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		150	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 = 75 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.55	1.80	V
			T_{vj} = 125 °C		1.69		
			T_{vj} = 175 °C		1.77		
Gate threshold voltage	V_{GEth}	I_C = 1.7 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_{CC} = 600 V			1.25		µC
Internal gate resistor	R_{Gint}	T_{vj} = 25 °C			2		Ω
Input capacitance	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			15.1		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.053		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.018	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 = 75 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω	T_{vj} = 25 °C		0.137		µs
			T_{vj} = 125 °C		0.151		
			T_{vj} = 175 °C		0.159		
Rise time (inductive load)	t_r	I_C = 75 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω	T_{vj} = 25 °C		0.041		µs
			T_{vj} = 125 °C		0.046		
			T_{vj} = 175 °C		0.049		
Turn-off delay time (inductive load)	t_{doff}	I_C = 75 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 2.7 Ω	T_{vj} = 25 °C		0.253		µs
			T_{vj} = 125 °C		0.327		
			T_{vj} = 175 °C		0.356		
Fall time (inductive load)	t_f	I_C = 75 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 2.7 Ω	T_{vj} = 25 °C		0.118		µs
			T_{vj} = 125 °C		0.196		
			T_{vj} = 175 °C		0.262		
Turn-on energy loss per pulse	E_{on}	I_C = 75 A, V_{CC} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 2.7 Ω, di/dt = 1360 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		7.48		mJ
			T_{vj} = 125 °C		10.4		
			T_{vj} = 175 °C		11.7		
Turn-off energy loss per pulse	E_{off}	I_C = 75 A, V_{CC} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 2.7 Ω, dv/dt = 3230 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		4.8		mJ
			T_{vj} = 125 °C		7.59		
			T_{vj} = 175 °C		9.33		

(table continues...)

Table 4 **(continued) Characteristic values**

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		240		A
			$t_P \leq 7$ µs, $T_{vj}=175$ °C		225		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3$ W/(m·K)			0.576		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
Continuous DC forward current	I_F			75	A
Repetitive peak forward current	I_{FRM}	$t_P = 1$ ms		150	A
I^2t - value	I^2t	$t_P = 10$ ms, $V_R = 0$ V	$T_{vj} = 125$ °C	1150	A^2s
			$T_{vj} = 175$ °C	740	

Table 6 **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	2.10	V
			$T_{vj} = 125$ °C		1.59		
			$T_{vj} = 175$ °C		1.52		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600$ V, $I_F = 75$ A, $V_{GE} = -15$ V, $-di_F/dt = 1360$ A/µs ($T_{vj} = 175$ °C)	$T_{vj} = 25$ °C		62.6		A
			$T_{vj} = 125$ °C		80.2		
			$T_{vj} = 175$ °C		91.7		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 75 A, V_{GE} = -15 V, -di$_F$/dt = 1360 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		6.27		µC
			T_{vj} = 125 °C		10.6		
			T_{vj} = 175 °C		14		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 75 A, V_{GE} = -15 V, -di$_F$/dt = 1360 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		2.35		mJ
			T_{vj} = 125 °C		4.06		
			T_{vj} = 175 °C		5.31		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 3.3 W/(m·K)			0.820		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 = 95 °C		75	A
Maximum RMS current at rectifier output	I_{RMSM}	T_H = 95 °C		100	A
Surge forward current	I_{FSM}	t_P = 10 ms	T_{vj} = 25 °C	720	A
			T_{vj} = 150 °C	565	
I^2t - value	I^2t	t_P = 10 ms	T_{vj} = 25 °C	2590	A^2s
			T_{vj} = 150 °C	1600	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Forward voltage	V_F	I_F = 75 A	T_{vj} = 150 °C		1.00		V
Reverse current	I_r	T_{vj} = 150 °C, V_R = 1600 V			1		mA
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 3.3 W/(m·K)			0.943		K/W

(table continues...)

Table 8 **(continued) Characteristic values**

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
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 85 °C	50	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		100	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 = 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 = 1.28 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_{CC} = 600 V			0.92		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			11.1		nF
Reverse transfer capacitance	C_{res}	f = 100 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_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 5.1 Ω	T_{vj} = 25 °C		0.045		µs
			T_{vj} = 125 °C		0.047		
			T_{vj} = 175 °C		0.048		
Rise time (inductive load)	t_r	I_C = 50 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 5.1 Ω	T_{vj} = 25 °C		0.031		µs
			T_{vj} = 125 °C		0.034		
			T_{vj} = 175 °C		0.035		

(table continues...)

Table 10 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time (inductive load)	t_{doff}	I_C = 50 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 5.1 Ω	T_{vj} = 25 °C		0.255		µs
			T_{vj} = 125 °C		0.340		
			T_{vj} = 175 °C		0.382		
Fall time (inductive load)	t_f	I_C = 50 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 5.1 Ω	T_{vj} = 25 °C		0.107		µs
			T_{vj} = 125 °C		0.195		
			T_{vj} = 175 °C		0.255		
Turn-on energy loss per pulse	E_{on}	I_C = 50 A, V_{CC} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Gon} = 5.1 Ω, di/dt = 1200 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		3.21		mJ
			T_{vj} = 125 °C		4.03		
			T_{vj} = 175 °C		4.46		
Turn-off energy loss per pulse	E_{off}	I_C = 50 A, V_{CC} = 600 V, L_σ = 35 nH, V_{GE} = ±15 V, R_{Goff} = 5.1 Ω, dv/dt = 2900 V/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		3.23		mJ
			T_{vj} = 125 °C		5.22		
			T_{vj} = 175 °C		6.45		
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		185		A
			t_P ≤ 7 µs, T_{vj}=175 °C		175		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 3.3 W/(m·K)			0.850		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
Continuous DC forward current	I_F			25	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		50	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	72.5	A^2s
			T_{vj} = 175 °C	63	

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	2.30	V
			T_{vj} = 125 °C		1.70		
			T_{vj} = 175 °C		1.63		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 25 A, V_{GE}=-15 V, -di$_F$/dt = 1100 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		27.4		A
			T_{vj} = 125 °C		31.2		
			T_{vj} = 175 °C		34.1		
Recovered charge	Q_r	V_{CC} = 600 V, I_F = 25 A, V_{GE}=-15 V, -di$_F$/dt = 1100 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		1.93		µC
			T_{vj} = 125 °C		3.51		
			T_{vj} = 175 °C		4.51		
Reverse recovery energy	E_{rec}	V_{CC} = 600 V, I_F = 25 A, V_{GE}=-15 V, -di$_F$/dt = 1100 A/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		0.74		mJ
			T_{vj} = 125 °C		1.42		
			T_{vj} = 175 °C		1.85		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 3.3 W/(m·K)			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.

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

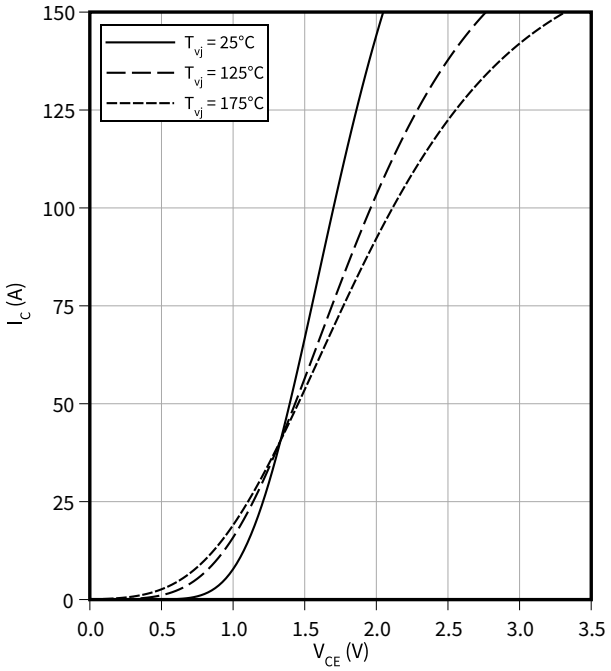
Note: Specification according to the valid application note.

8 Characteristics diagrams

Output characteristic (typical), IGBT, Inverter

$I_C = f(V_{CE})$

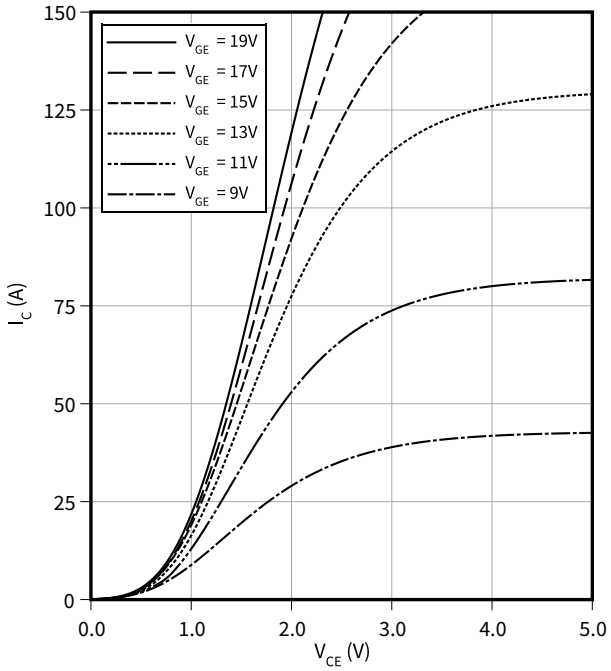
V_{GE} = 15 V



Output characteristic field (typical), IGBT, Inverter

$I_C = f(V_{CE})$

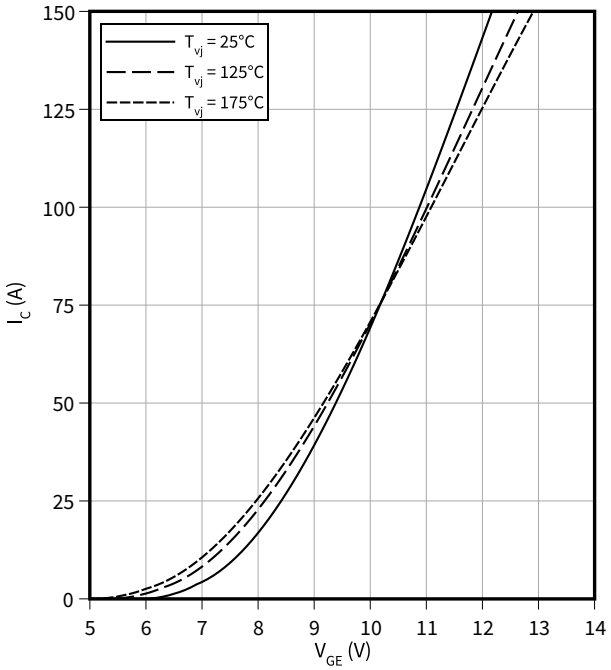
T_{vj} = 175 °C



Transfer characteristic (typical), IGBT, Inverter

$I_C = f(V_{GE})$

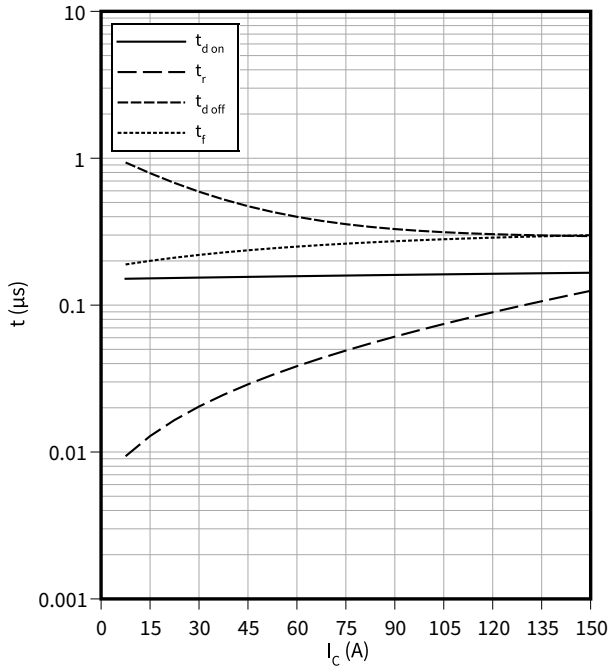
V_{CE} = 20 V



Switching times (typical), IGBT, Inverter

$t = f(I_C)$

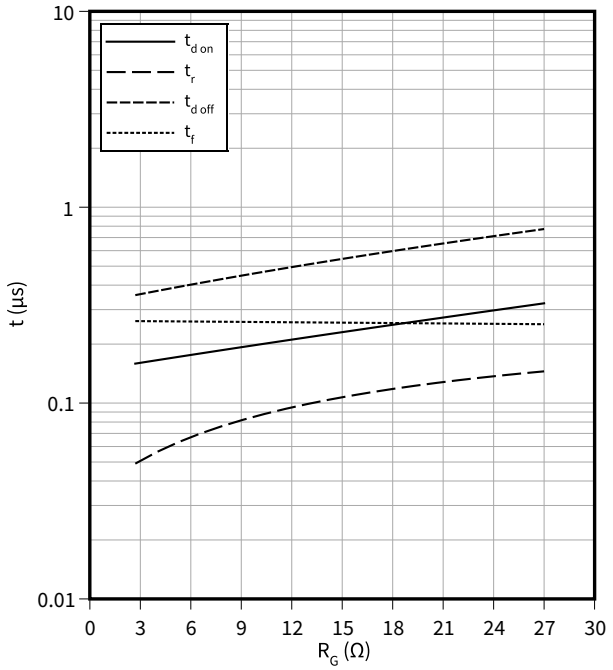
R_{Goff} = 2.7 Ω, R_{Gon} = 2.7 Ω, V_{GE} = ±15 V, V_{CC} = 600 V, T_{vj} = 175 °C



Switching times (typical), IGBT, Inverter

$t = f(R_G)$

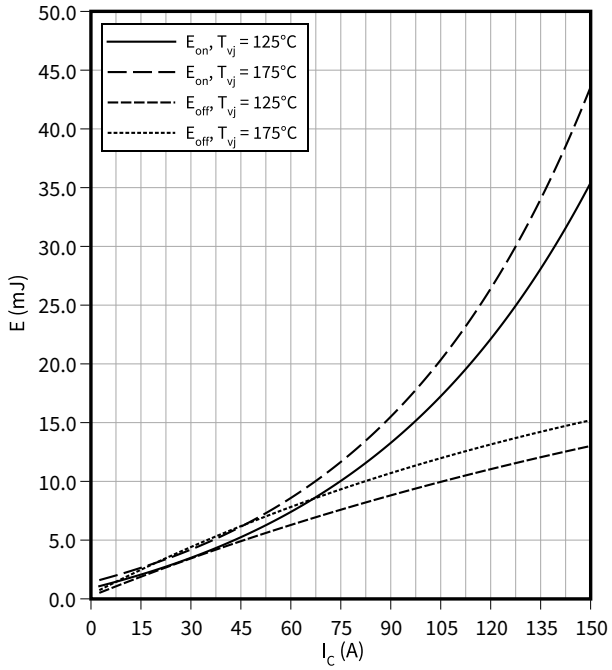
V_{GE} = ±15 V, I_C = 75 A, V_{CC} = 600 V, T_{vj} = 175 °C



Switching losses (typical), IGBT, Inverter

$E = f(I_C)$

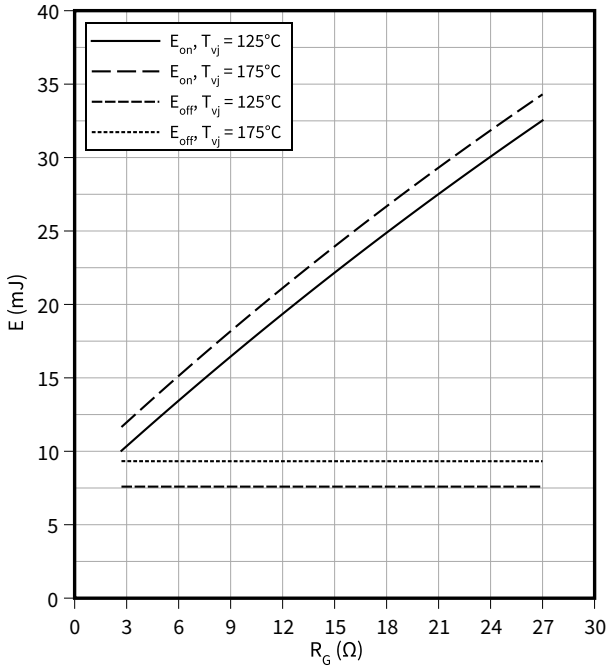
V_{CC} = 600 V, V_{GE} = ± 15 V, R_{Goff} = 2.7 Ω, R_{Gon} = 2.7 Ω



Switching losses (typical), IGBT, Inverter

$E = f(R_G)$

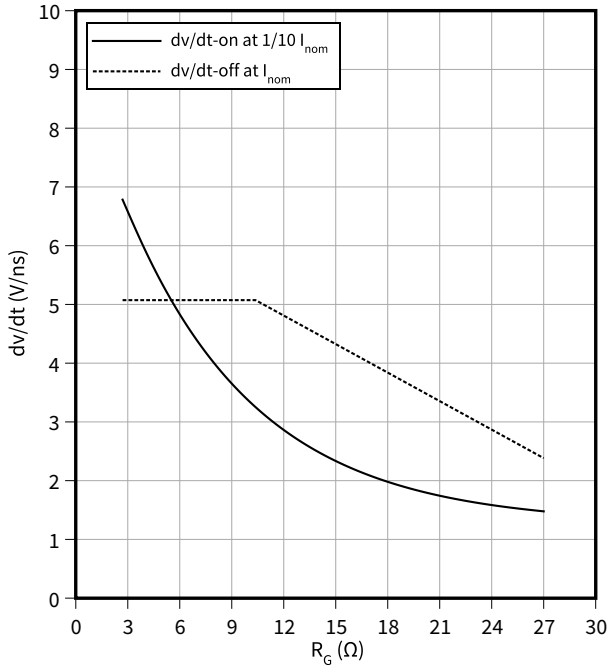
I_C = 75 A, V_{CC} = 600 V, V_{GE} = ± 15 V



Voltage slope (typical), IGBT, Inverter

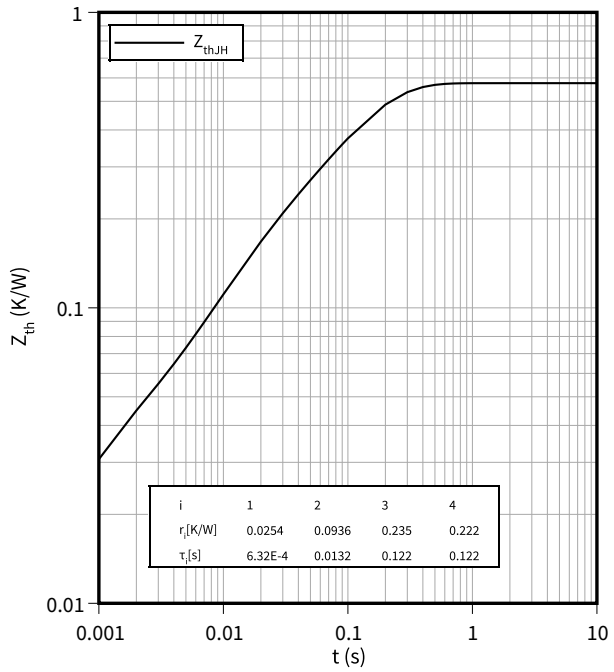
$dv/dt = f(R_G)$

I_C = 75 A, V_{CC} = 600 V, V_{GE} = ±15 V, T_{vj} = 25 °C



Transient thermal impedance , IGBT, Inverter

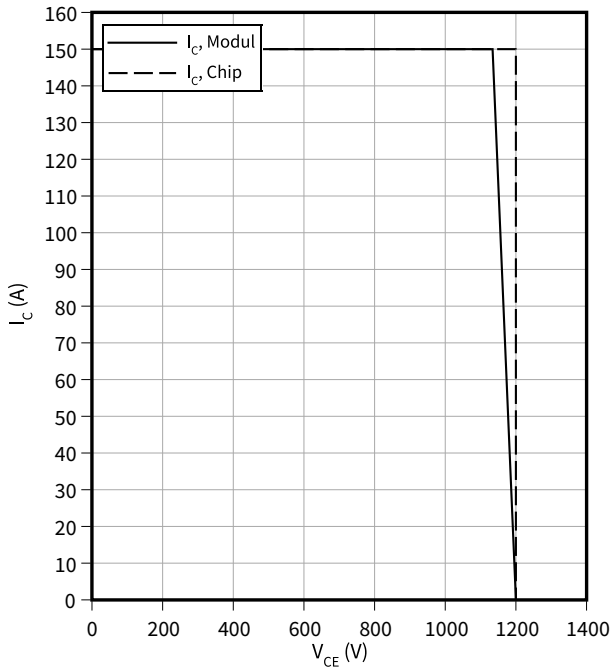
$Z_{th} = f(t)$



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

$I_C = f(V_{CE})$

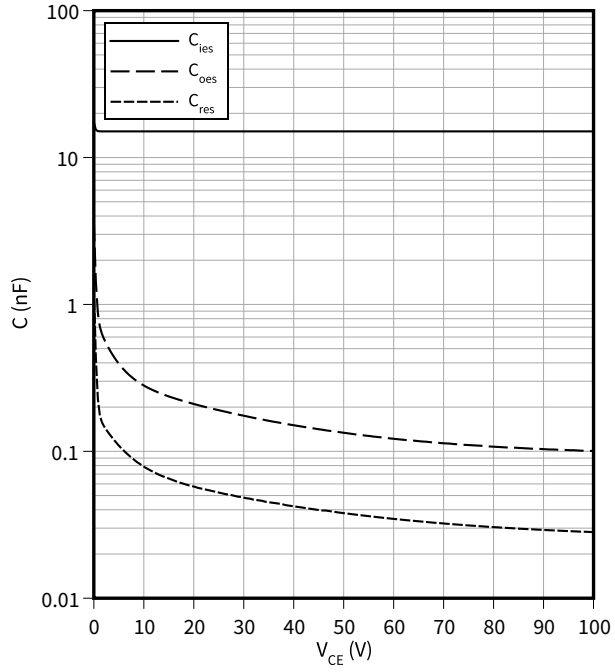
$R_{Goff} = 2.7\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 175$ °C



Capacity characteristic (typical), IGBT, Inverter

$C = f(V_{CE})$

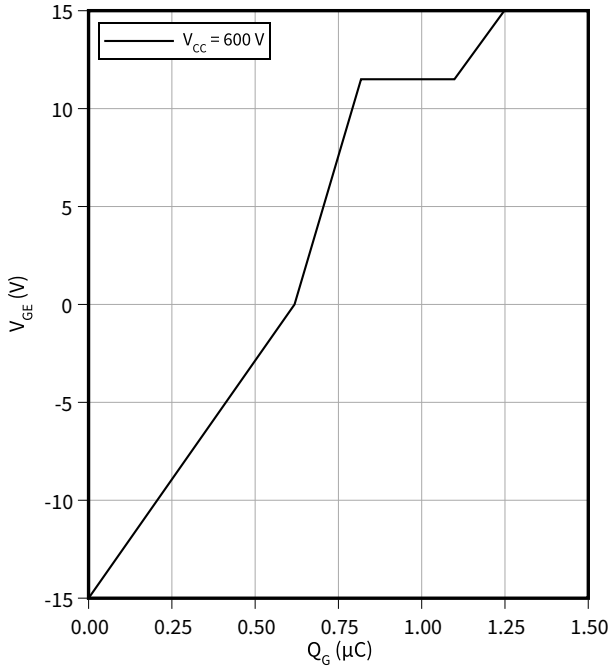
f = 100 kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Gate charge characteristic (typical), IGBT, Inverter

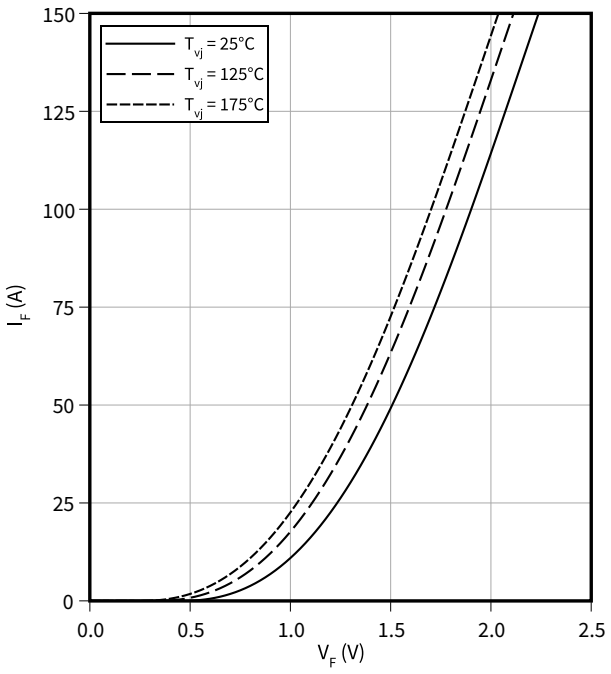
$V_{GE} = f(Q_G)$

$I_C = 75$ A, $T_{vj} = 25$ °C



Forward characteristic (typical), Diode, Inverter

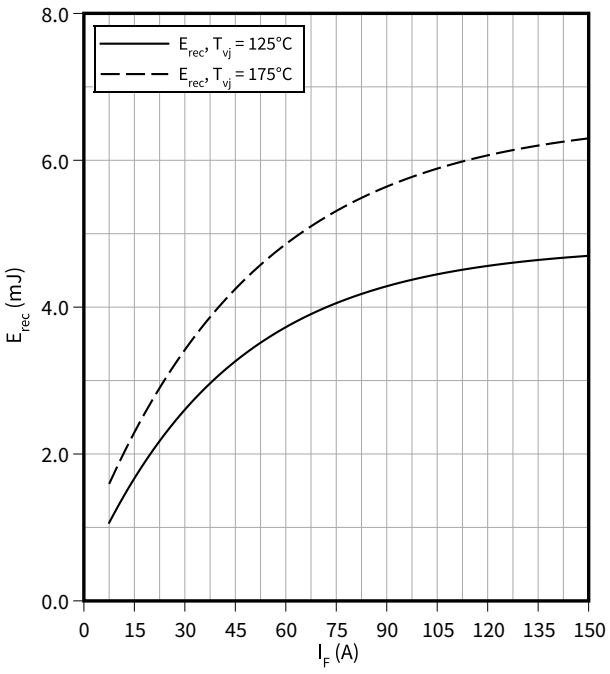
$I_F = f(V_F)$



Switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

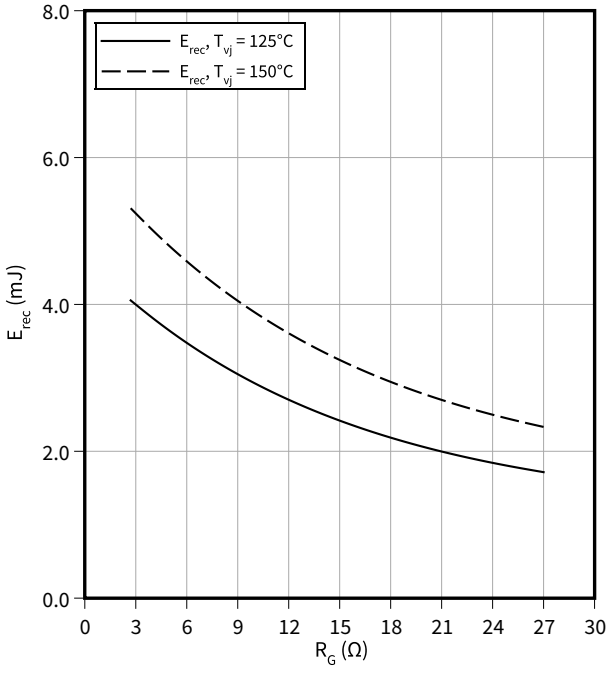
$R_{Gon} = 2.7\ \Omega$, $V_{CC} = 600\ V$



Switching losses (typical), Diode, Inverter

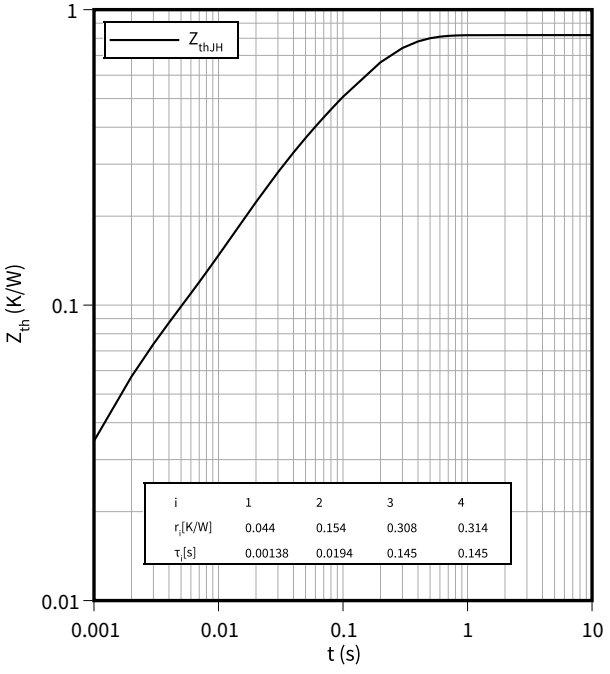
$E_{rec} = f(R_G)$

$I_F = 75\ A$, $V_{CC} = 600\ V$



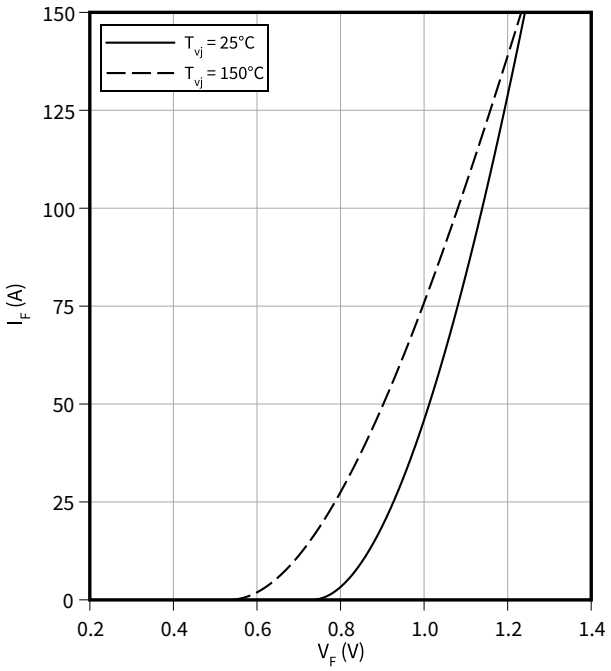
Transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$



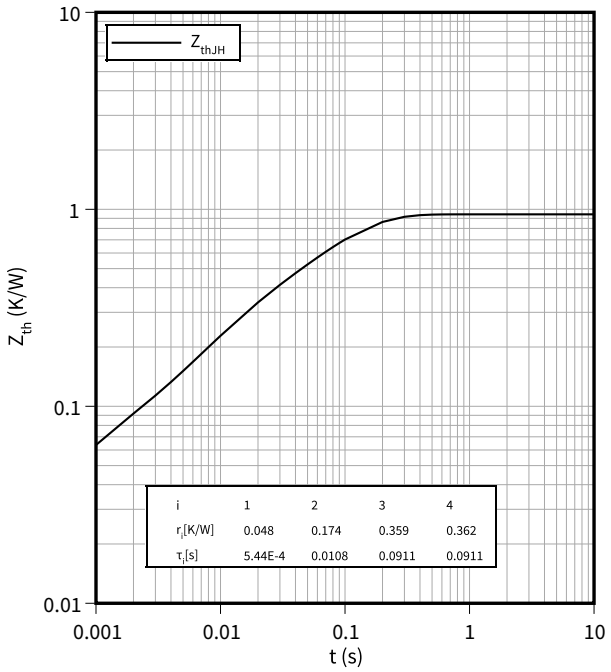
Forward characteristic (typical), Diode, Rectifier

$I_F = f(V_F)$



Transient thermal impedance, Diode, Rectifier

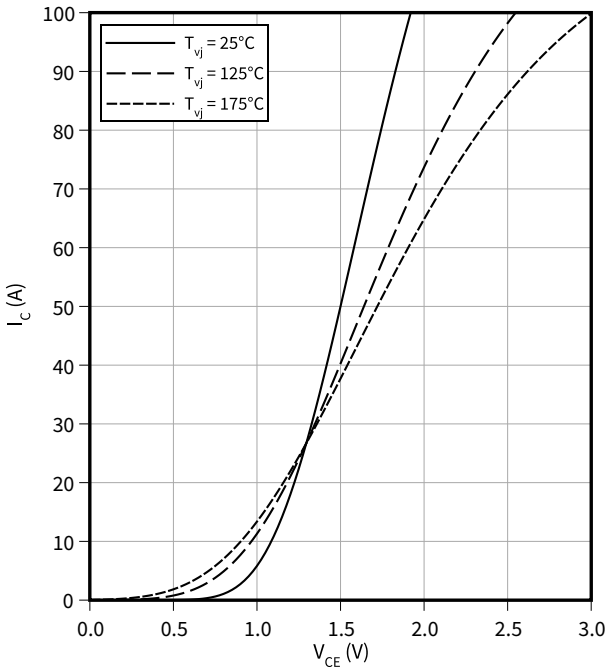
$Z_{th} = f(t)$



Output characteristic (typical), IGBT, Brake-Chopper

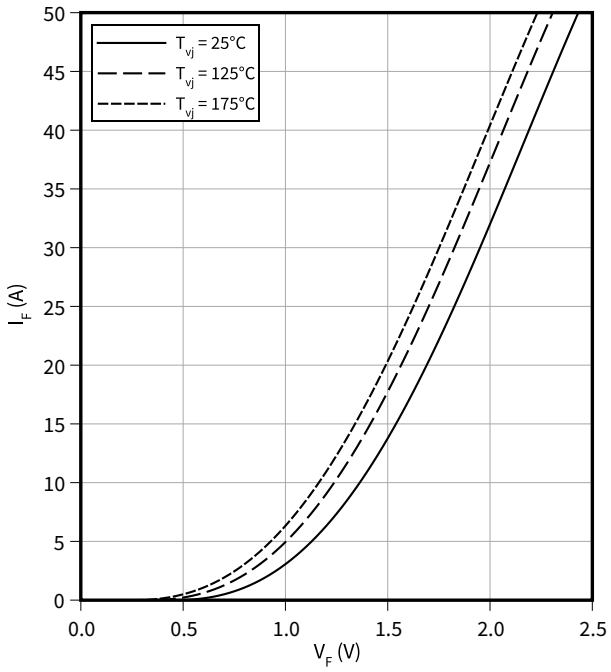
$I_C = f(V_{CE})$

$V_{GE} = 15\ V$



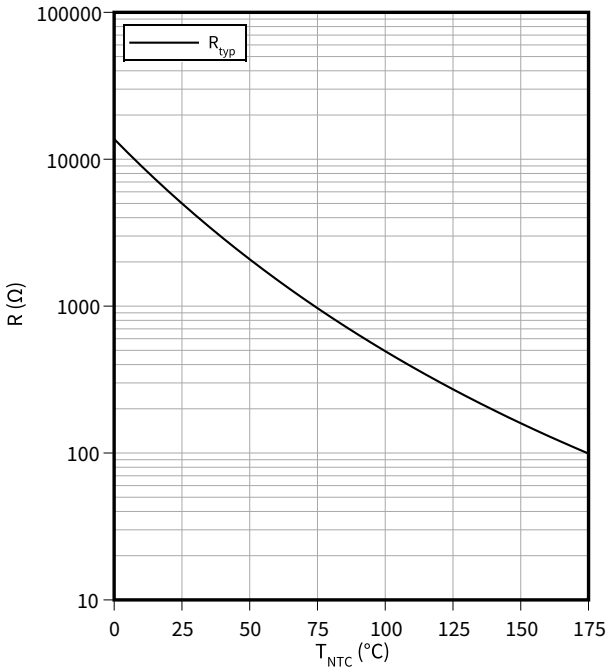
Forward characteristic (typical), Diode, Brake-Chopper

$I_F = f(V_F)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

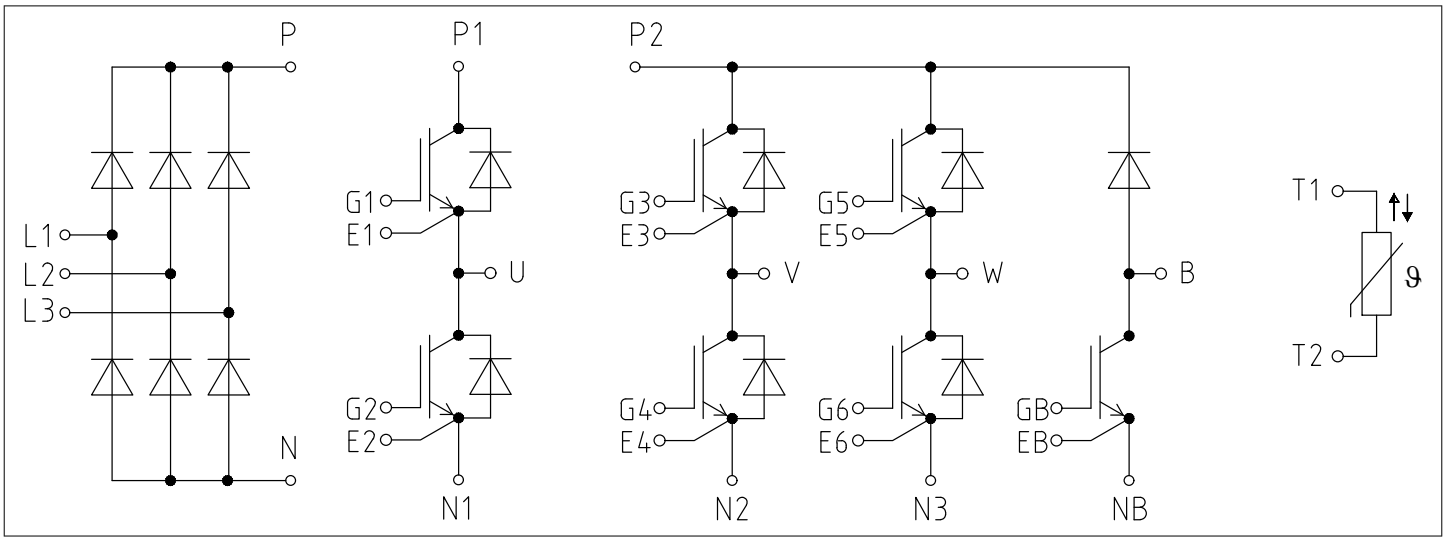


Figure 1

10 Package outlines

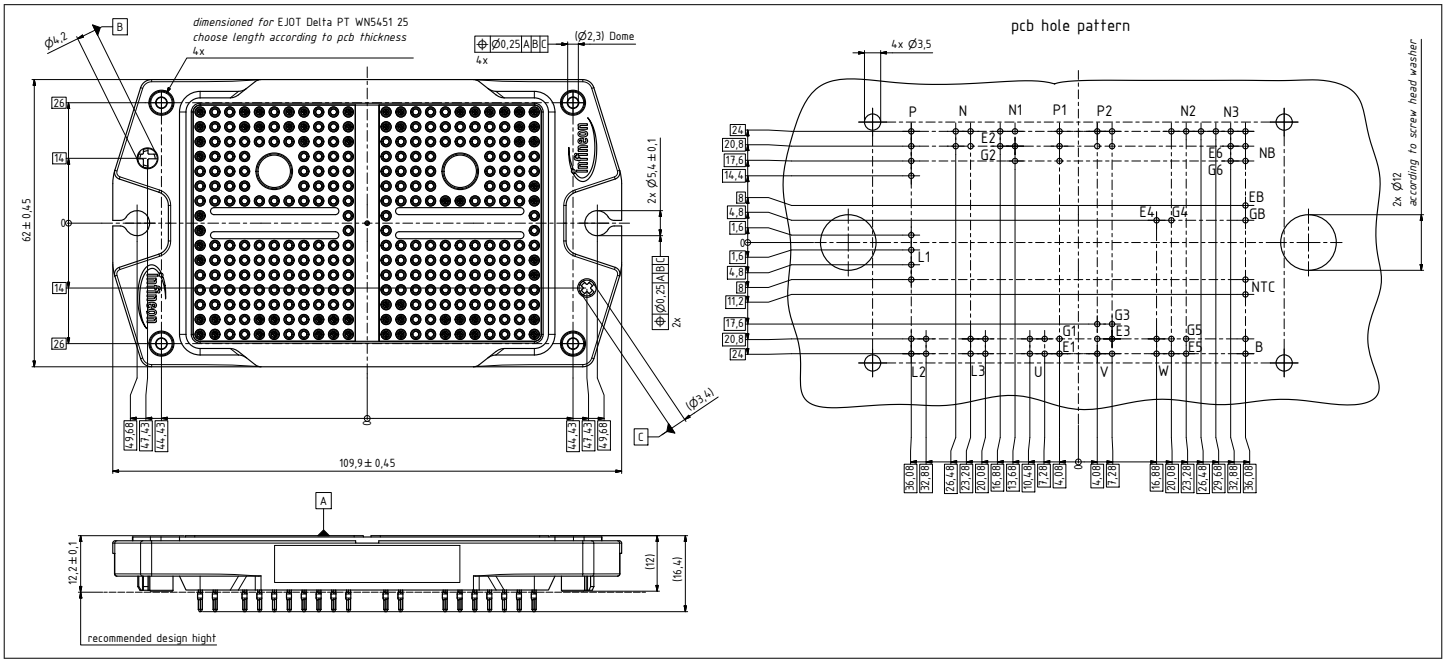


Figure 2

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 3

Revision history

Document revision	Date of release	Description of changes
V1.0	2020-04-16	Target datasheet
n/a	2020-09-01	Datasheet migrated to a new system with a new layout and new revision number schema: target or preliminary datasheet = 0.xy; final datasheet = 1.xy
1.00	2022-12-06	Final datasheet
1.10	2022-12-13	Final datasheet

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