Final datasheet

EasyPACK™ module with TRENCHSTOP™ IGBT7/4 and emitter controlled 7 diode and PressFIT / NTC

Typical appearance

Features

- Electrical features
  - V_{CES} = 1200 V
  - $I_{C\ nom}$ = 35 A / I_{CRM} = 70 A
  - Low switching losses
  - Low $V_{CE,sat}$
  - TRENCHSTOPTM IGBT4
  - TRENCHSTOPTM IGBT7
  - $V_{CE,sat}$ with positive temperature coefficient
  - Suitable Infineon gate drivers can be found under https://www.infineon.com/gdfinder
- Mechanical features
  - Al_2O_3 substrate with low thermal resistance
  - Compact design
  - PressFIT contact technology
  - Rugged mounting due to integrated mounting clamps

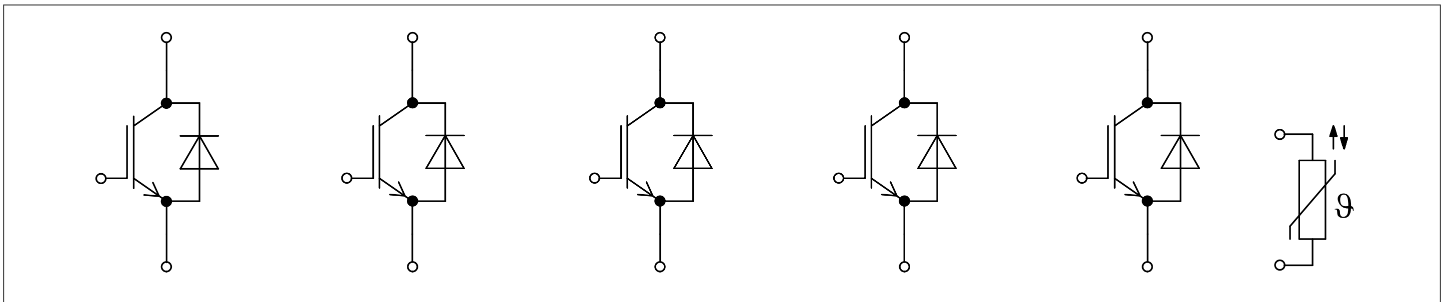
Potential applications

- PTC heater
- Module for slow switching resistive-capacitive load
- (Hybrid) electrical vehicles (H)EV

Product validation

- Qualified according to AQG 324, release no.: 03.1/2021

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
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, t = 1 min	1.4	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Comparative tracking index	*CTI*		> 200	
Relative thermal index (electrical)	*RTI*		140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	L_{sCE}			21		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	T_H = 25 °C, per switch		6		mΩ
Storage temperature	T_{stg}		-40		125	°C
Weight	G			24		g

2 IGBT, T1

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Implemented collector current	I_{CN}			50	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 80 °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 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} = 150 °C		1.68		

(table continues...)

Table 4 **(continued) Characteristic values**

Parameter	Symbol	Note or test condition		Values Min.	Typ.	Max.	Unit
Gate threshold voltage	V_{GEth}	I_C = 1.3 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, T_{vj} = 25 °C			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			3	µA
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		0.047		µs
			T_{vj} = 125 °C		0.048		
			T_{vj} = 150 °C		0.049		
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		0.036		µs
			T_{vj} = 125 °C		0.039		
			T_{vj} = 150 °C		0.041		
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		0.259		µs
			T_{vj} = 125 °C		0.324		
			T_{vj} = 150 °C		0.342		
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		0.117		µs
			T_{vj} = 125 °C		0.181		
			T_{vj} = 150 °C		0.206		
Turn-on energy loss per pulse	E_{on}	I_C = 50 A, V_{CC} = 600 V, L_σ = 30 nH, V_{GE} = 15 V, R_{Gon} = 5.1 Ω, di/dt = 990 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		2.54		mJ
			T_{vj} = 125 °C		2.56		
			T_{vj} = 150 °C		2.57		
Turn-off energy loss per pulse	E_{off}	I_C = 50 A, V_{CC} = 600 V, L_σ = 30 nH, V_{GE} = 15 V, R_{Goff} = 5.1 Ω, dv/dt = 3300 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		3.31		mJ
			T_{vj} = 125 °C		4.84		
			T_{vj} = 150 °C		5.31		
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		190		A
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			0.92		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	°C

***Note**: The electrical characterization was performed with external discrete Schottky diode IDWD40G120C5 as freewheeling diode. It has to be considered, that the commutation takes place between this module and the external FWD.*

3 IGBT, T2-T5

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		T_{vj} = 25 °C	1200	V
Implemented collector current	I_{CN}			35	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max}$ = 150 °C	T_H = 65 °C	30	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		70	A
Gate-emitter peak voltage	V_{GES}			±20	V

Table 6 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\,sat}$	I_C = 35 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.85	2.25	V
			T_{vj} = 125 °C		2.15		
			T_{vj} = 150 °C		2.25		
Gate threshold voltage	V_{GEth}	I_C = 1.3 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.25	5.80	6.35	V
Gate charge	Q_G	V_{GE} = ±15 V, V_{CC} = 600 V, T_{vj} = 25 °C			0.22		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			1.95		nF
Reverse transfer capacitance	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.1		nF
Collector-emitter cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			4	µA
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 = 35 A, V_{CC} = 600 V, V_{GE} = 15 V, R_{Gon} = 12 Ω	T_{vj} = 25 °C		0.036		µs
			T_{vj} = 125 °C		0.034		
			T_{vj} = 150 °C		0.034		
Rise time (inductive load)	t_r	I_C = 35 A, V_{CC} = 600 V, V_{GE} = 15 V, R_{Gon} = 12 Ω	T_{vj} = 25 °C		0.063		µs
			T_{vj} = 125 °C		0.063		
			T_{vj} = 150 °C		0.063		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition		Values Min.	Values Typ.	Values Max.	Unit
Turn-off delay time (inductive load)	t_{doff}	I_C = 35 A, V_{CC} = 600 V, V_{GE} = 15 V, R_{Goff} = 12 Ω	T_{vj} = 25 °C		0.283		µs
			T_{vj} = 125 °C		0.314		
			T_{vj} = 150 °C		0.340		
Fall time (inductive load)	t_f	I_C = 35 A, V_{CC} = 600 V, V_{GE} = 15 V, R_{Goff} = 12 Ω	T_{vj} = 25 °C		0.133		µs
			T_{vj} = 125 °C		0.208		
			T_{vj} = 150 °C		0.231		
Turn-on energy loss per pulse	E_{on}	I_C = 35 A, V_{CC} = 600 V, L_σ = 30 nH, V_{GE} = 15 V, R_{Gon} = 12 Ω, di/dt = 445 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		1.68		mJ
			T_{vj} = 125 °C		1.79		
			T_{vj} = 150 °C		1.83		
Turn-off energy loss per pulse	E_{off}	I_C = 35 A, V_{CC} = 600 V, L_σ = 30 nH, V_{GE} = 15 V, R_{Goff} = 12 Ω, dv/dt = 3130 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		2.29		mJ
			T_{vj} = 125 °C		3.43		
			T_{vj} = 150 °C		3.85		
SC data	I_{SC}	V_{GE} = 15 V, V_{CC} = 800 V, $V_{CEmax}=V_{CES}-L_{sCE}$*di/dt	t_P ≤ 12 µs, T_{vj} = 125 °C		160		A
			t_P ≤ 10 µs, T_{vj} = 150 °C		130		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, λ_{grease} = 1 W/(m·K)			1.01		K/W
Temperature under switching conditions	$T_{vj\,op}$			-40		150	°C

Note: *The electrical characterization was performed with external discrete Schottky diode IDWD40G120C5 as freewheeling diode. It has to be considered, that the commutation takes place between this module and the external FWD.*

4 Diode, D1-D5

Table 7 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			10	A
Repetitive peak forward current	I_{FRM}	t_P = 1 ms		20	A
I^2t - value	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	24.5	A^2s
			T_{vj} = 150 °C	22.8	

Table 8 **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	2.10	V
			T_{vj} = 125 °C		1.59		
			T_{vj} = 150 °C		1.56		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, λ_{grease} = 1 W/(m·K)			2.73		K/W
Temperature under switching conditions	$T_{vj\ op}$			-40		150	°C

5 NTC-Thermistor

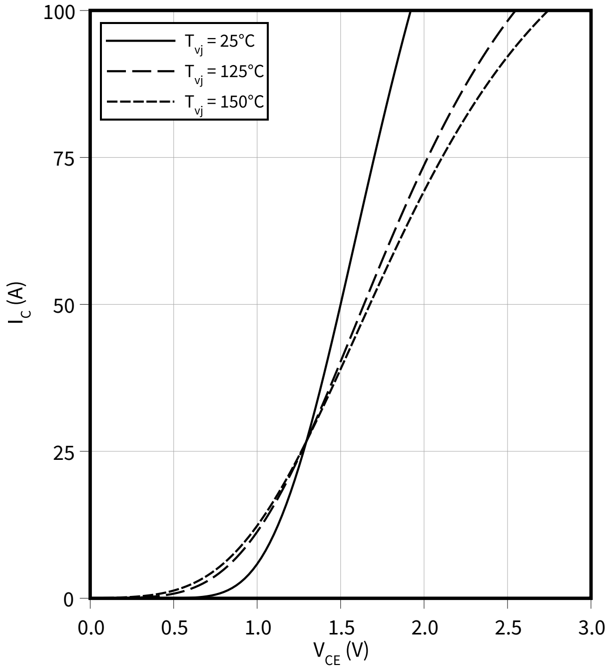
Table 9 **Characteristic values**

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	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298,15\ K))]$		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

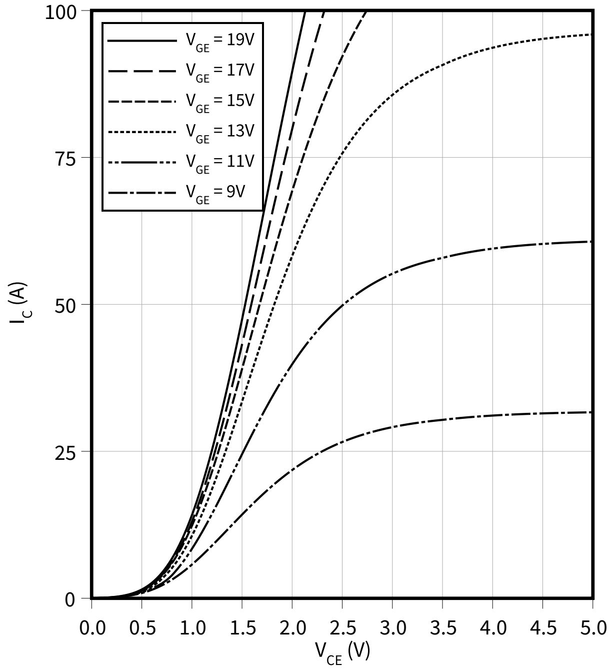
Note: *For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4*

6 Characteristics diagrams

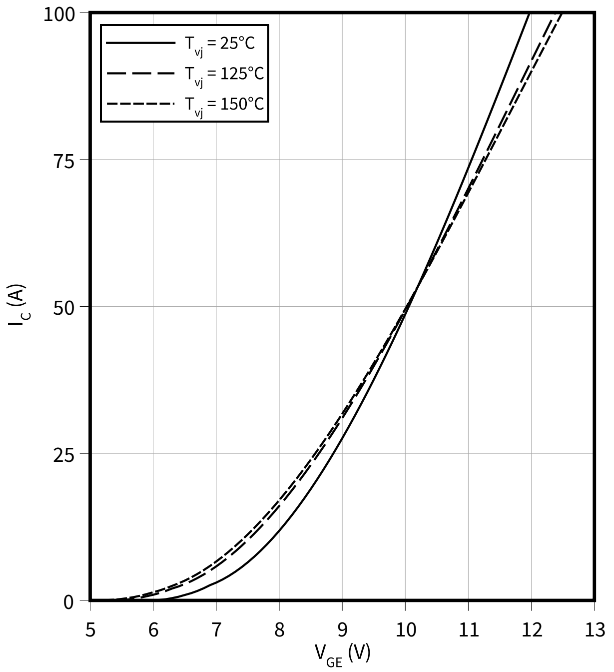
Output characteristic (typical), IGBT, T1
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



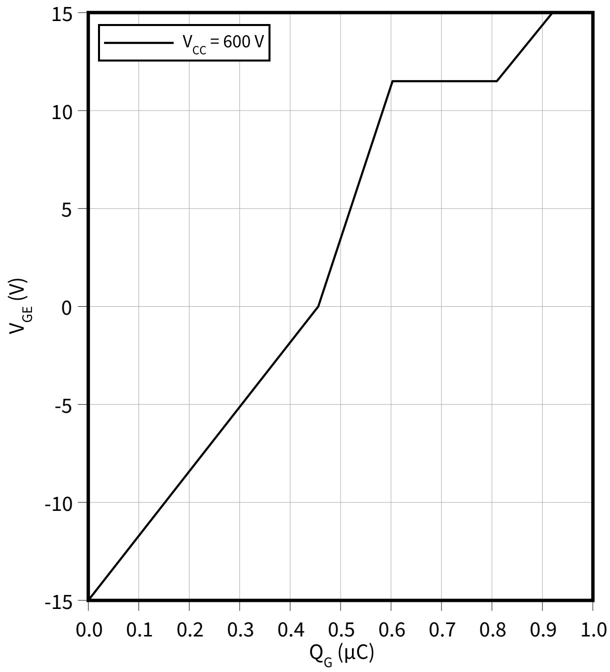
Output characteristic field (typical), IGBT, T1
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



Transfer characteristic (typical), IGBT, T1
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



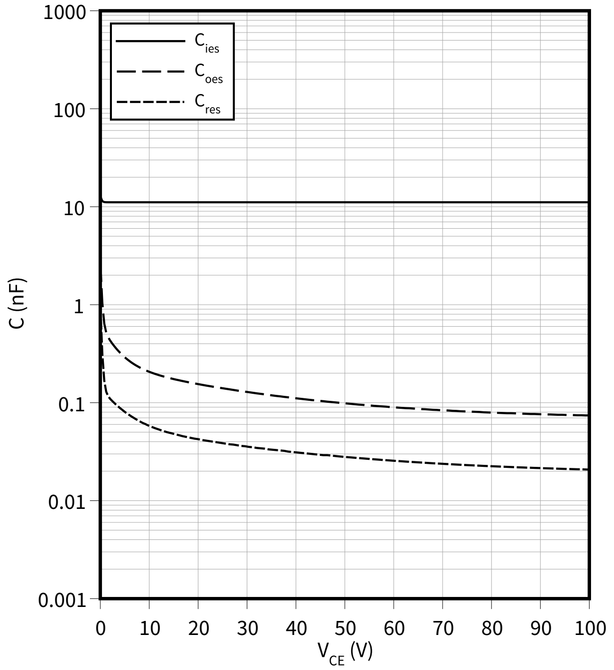
Gate charge characteristic (typical), IGBT, T1
$V_{GE} = f(Q_G)$
$I_C = 50\ A,\ T_{vj} = 25\ °C$



Capacity characteristic (typical), IGBT, T1

$C = f(V_{CE})$

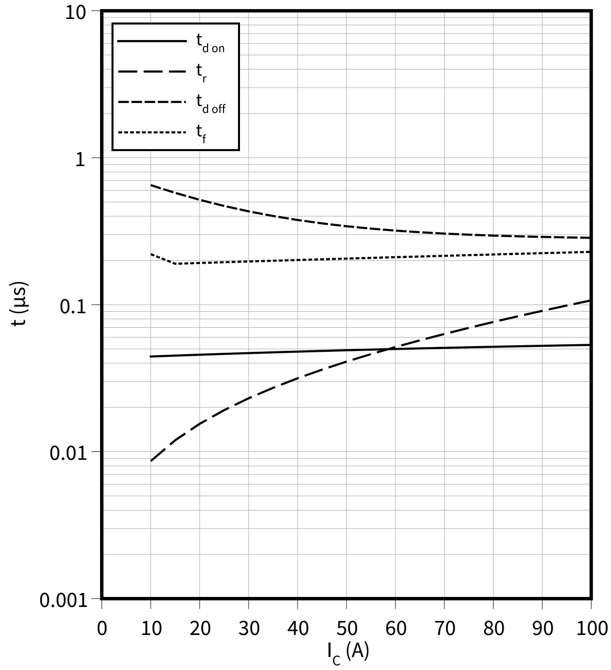
$T_{vj} = 25$ °C, f = 100 kHz, $V_{GE} = 0$ V



Switching times (typical), IGBT, T1

$t = f(I_C)$

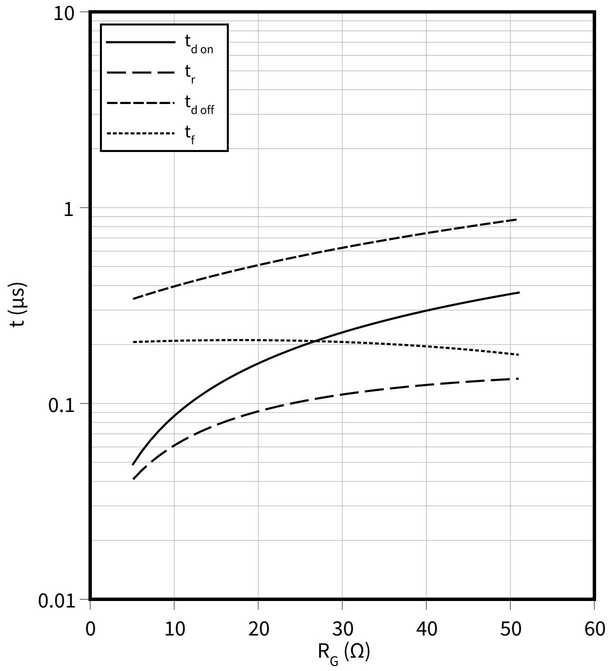
$R_{Goff} = 5.1\ \Omega$, $R_{Gon} = 5.1\ \Omega$, $V_{GE} = \pm15$ V, $V_{CC} = 600$ V, $T_{vj} = 150$ °C



Switching times (typical), IGBT, T1

$t = f(R_G)$

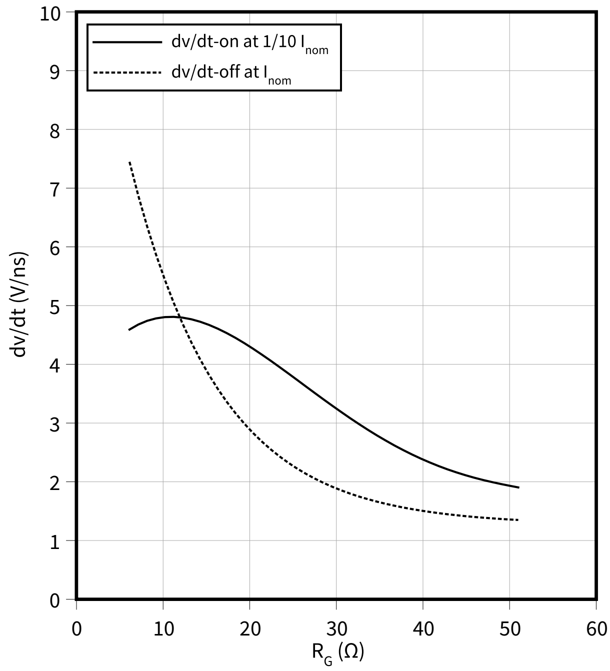
$V_{GE} = \pm15$ V, $I_C = 50$ A, $V_{CC} = 600$ V, $T_{vj} = 150$ °C



Voltage slope (typical), IGBT, T1

$dv/dt = f(R_G)$

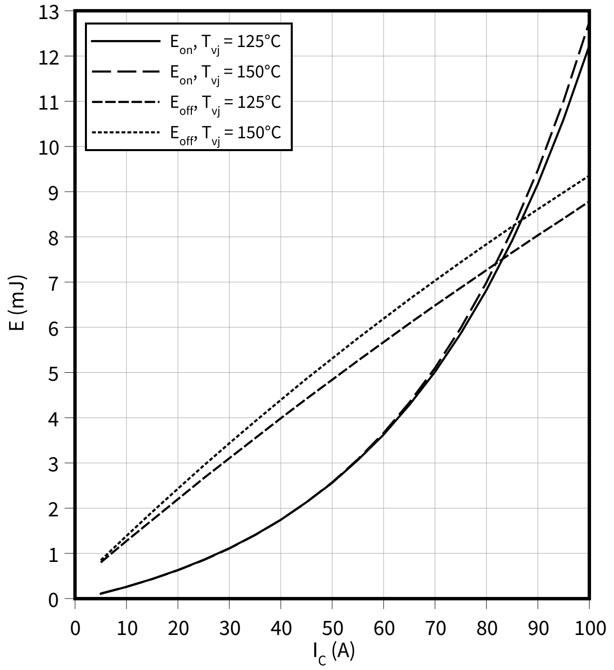
$I_C = 50$ A, $V_{CC} = 600$ V, $V_{GE} = \pm15$ V, $T_{vj} = 25$ °C



Switching losses (typical), IGBT, T1

$E = f(I_C)$

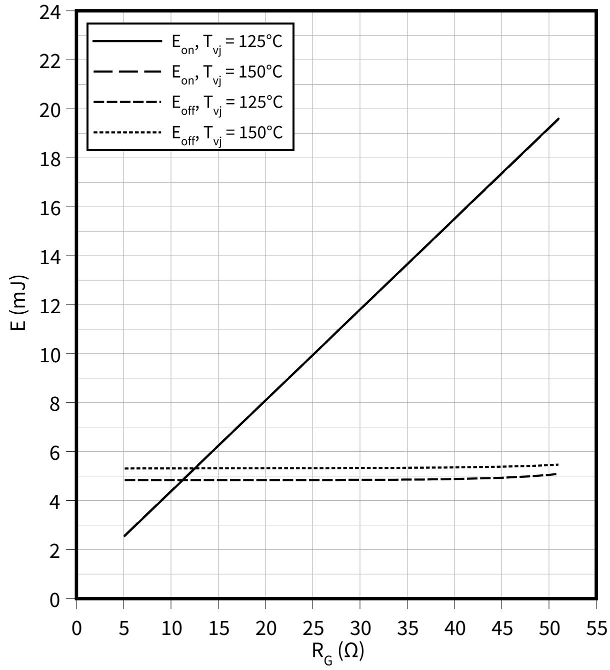
$R_{Goff} = 5.1\ \Omega$, $R_{Gon} = 5.1\ \Omega$, $V_{GE} = \pm 15$ V, $V_{CC} = 600$ V



Switching losses (typical), IGBT, T1

$E = f(R_G)$

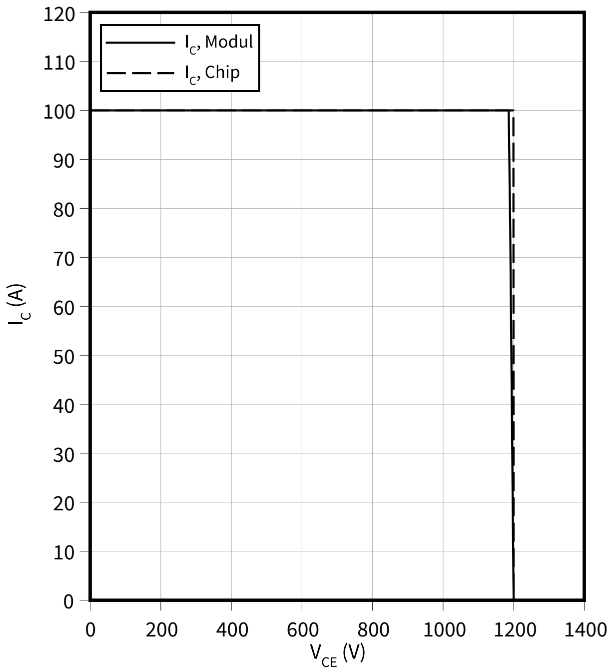
$V_{GE} = \pm 15$ V, $I_C = 50$ A, $V_{CC} = 600$ V



Reverse bias safe operating area (RBSOA), IGBT, T1

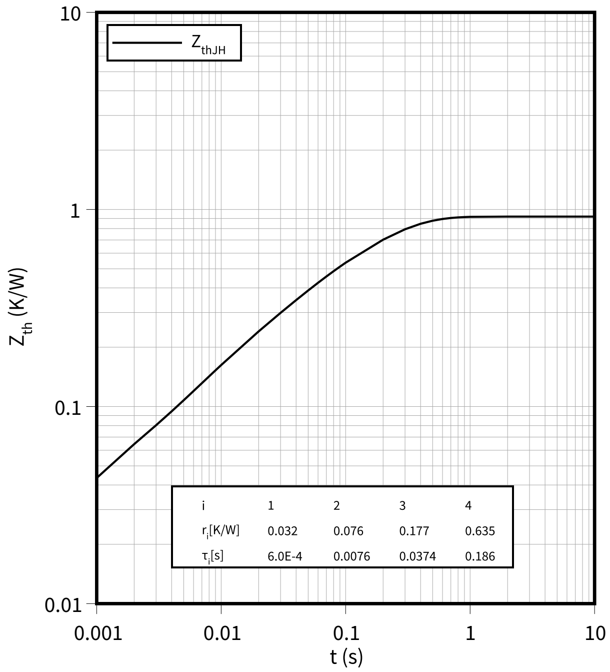
$I_C = f(V_{CE})$

$R_{Goff} = 5.1\ \Omega$, $V_{GE} = \pm 15$ V, $T_{vj} = 150$ °C



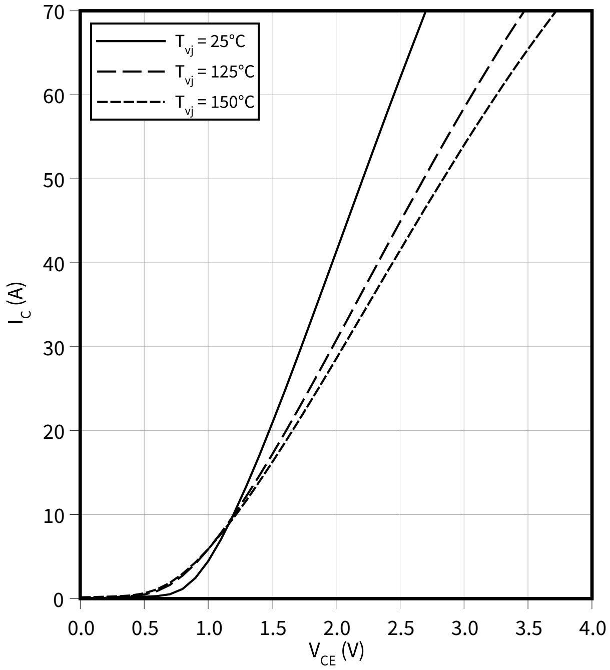
Transient thermal impedance, IGBT, T1

$Z_{th} = f(t)$

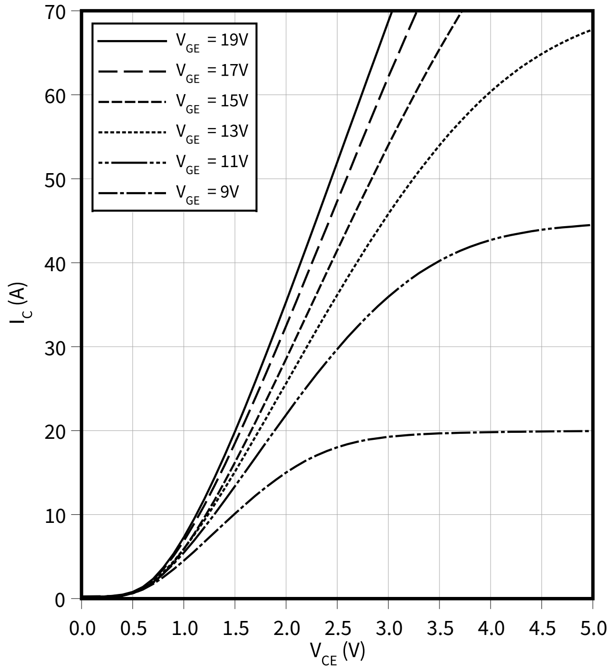


i	1	2	3	4
r_i[K/W]	0.032	0.076	0.177	0.635
τ_i[s]	6.0E-4	0.0076	0.0374	0.186

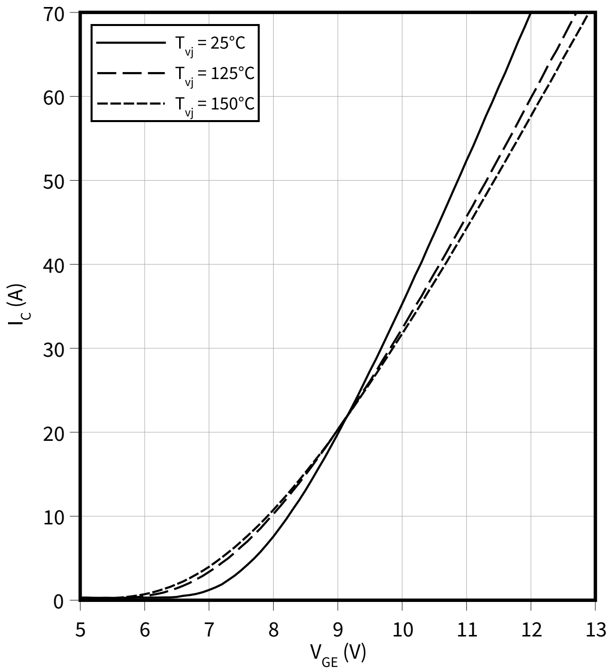
Output characteristic (typical), IGBT, T2-T5
$I_C = f(V_{CE})$
$V_{GE} = 15\ V$



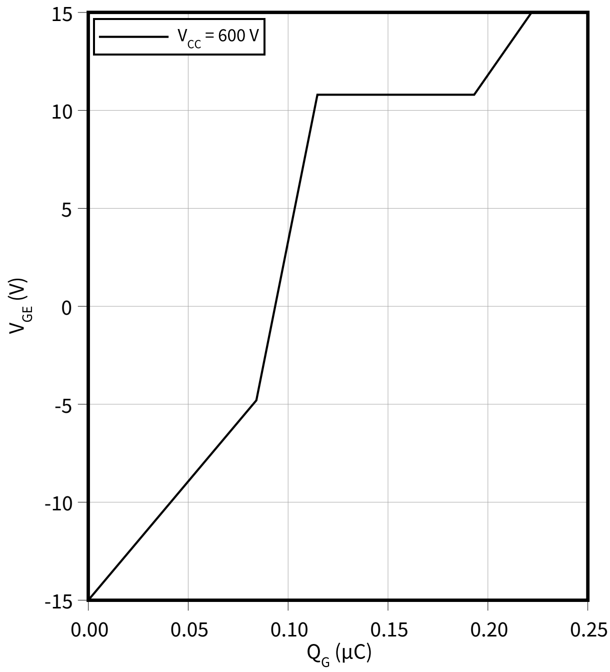
Output characteristic field (typical), IGBT, T2-T5
$I_C = f(V_{CE})$
$T_{vj} = 150\ °C$



Transfer characteristic (typical), IGBT, T2-T5
$I_C = f(V_{GE})$
$V_{CE} = 20\ V$



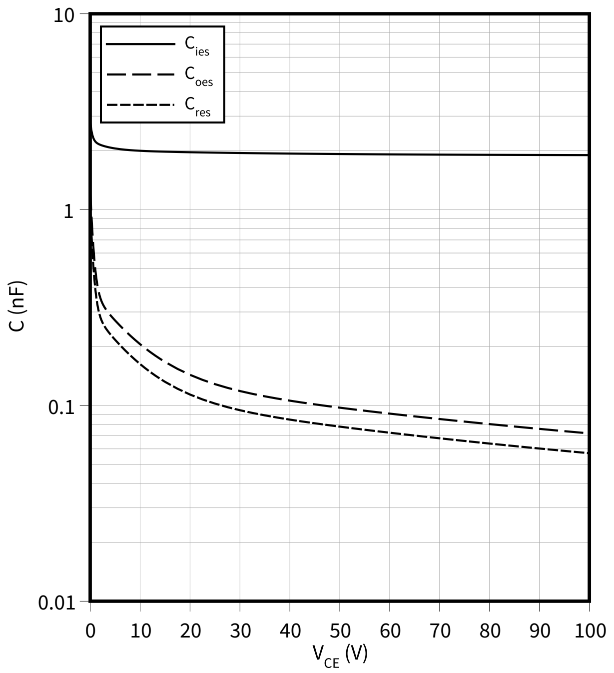
Gate charge characteristic (typical), IGBT, T2-T5
$V_{GE} = f(Q_G)$
$I_C = 35\ A$, $T_{vj} = 25\ °C$



Capacity characteristic (typical), IGBT, T2-T5

$C = f(V_{CE})$

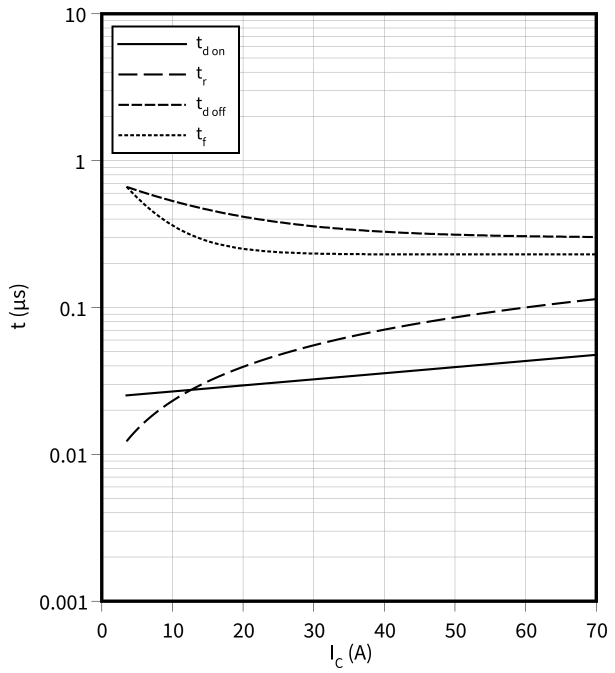
$f = 100$ kHz, $V_{GE} = 0$ V, $T_{vj} = 25$ °C



Switching times (typical), IGBT, T2-T5

$t = f(I_C)$

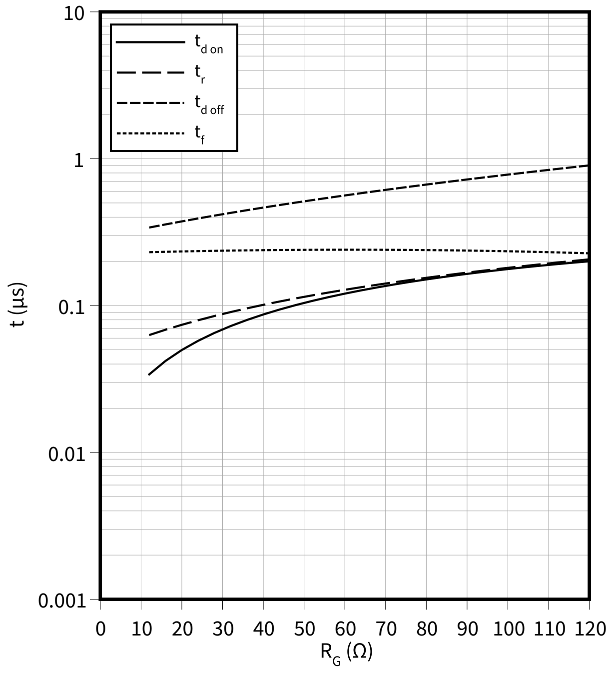
$R_{Goff} = 12$ Ω, $R_{Gon} = 12$ Ω, $V_{GE} = ±15$ V, $V_{CC} = 600$ V, $T_{vj} = 150$ °C



Switching times (typical), IGBT, T2-T5

$t = f(R_G)$

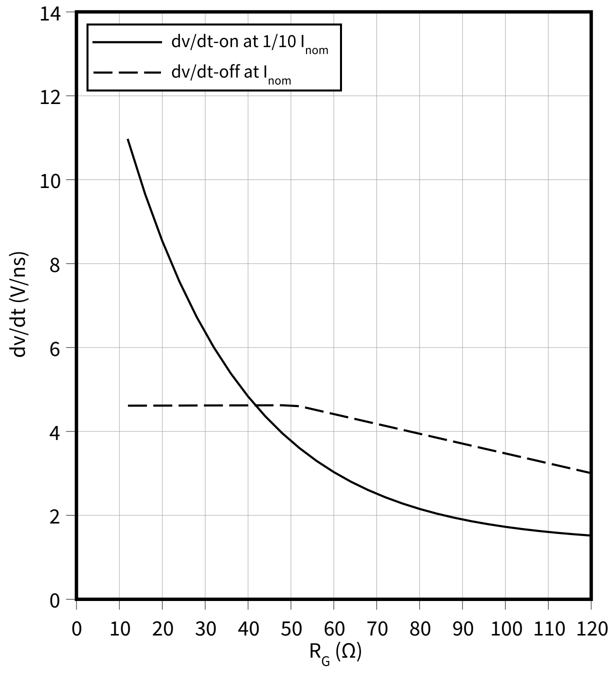
$V_{GE} = ±15$ V, $I_C = 35$ A, $V_{CC} = 600$ V, $T_{vj} = 150$ °C



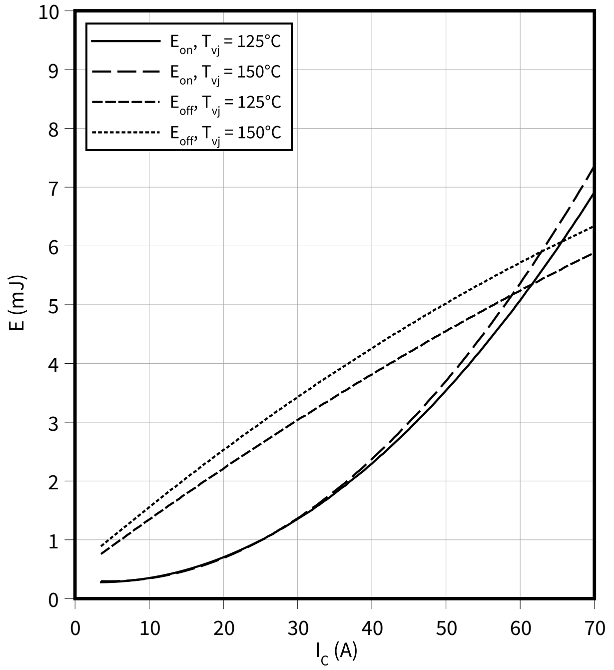
Voltage slope (typical), IGBT, T2-T5

$dv/dt = f(R_G)$

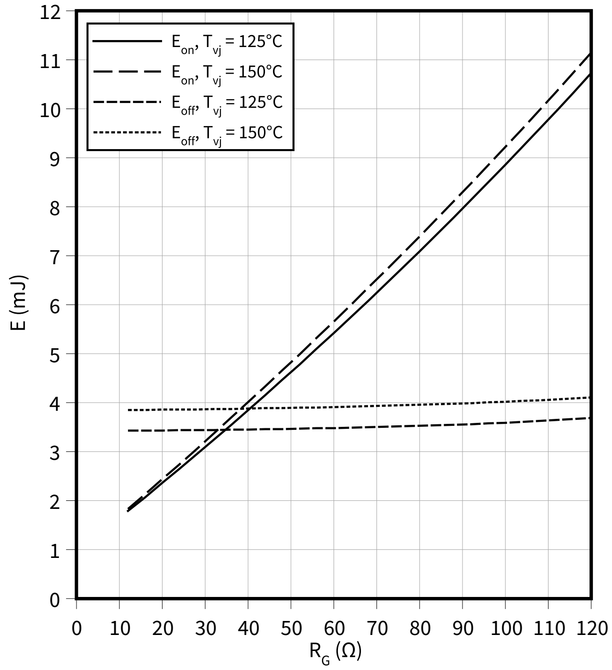
$I_C = 35$ A, $V_{CC} = 600$ V, $V_{GE} = ±15$ V, $T_{vj} = 25$ °C



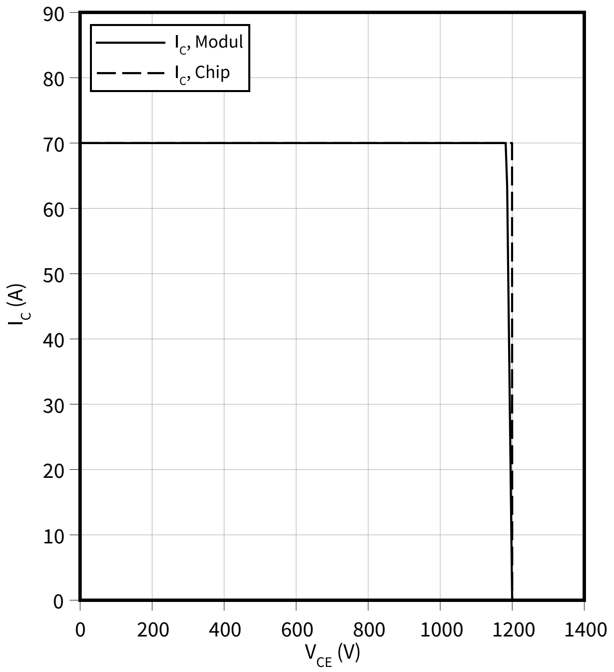
Switching losses (typical), IGBT, T2-T5
$E = f(I_C)$
$R_{Goff} = 12\ \Omega$, $R_{Gon} = 12\ \Omega$, $V_{GE} = \pm15$ V, $V_{CC} = 600$ V



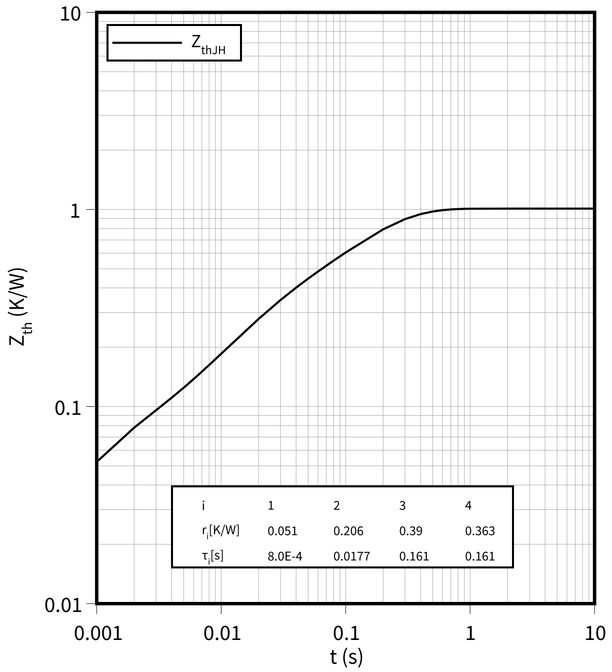
Switching losses (typical), IGBT, T2-T5
$E = f(R_G)$
$V_{GE} = 15$ V, $I_C = 35$ A, $V_{CC} = 600$ V



Reverse bias safe operating area (RBSOA), IGBT, T2-T5
$I_C = f(V_{CE})$
$R_{Goff} = 12\ \Omega$, $V_{GE} = \pm15$ V, $T_{vj} = 150$ °C

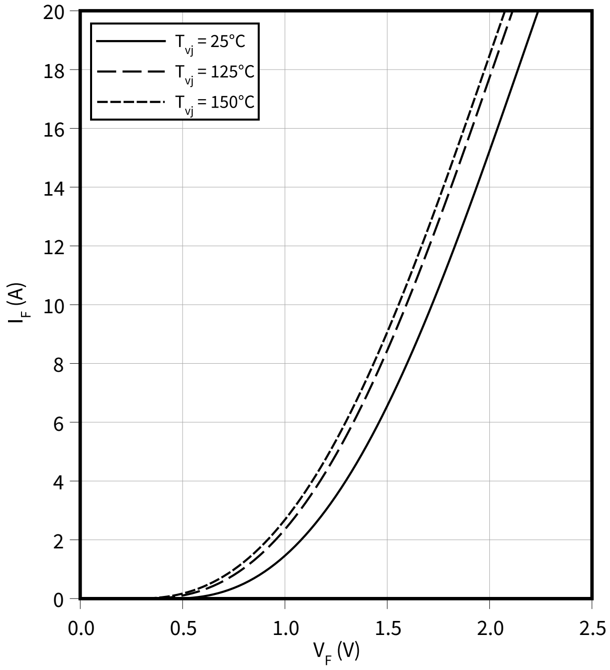


Transient thermal impedance, IGBT, T2-T5
$Z_{th} = f(t)$



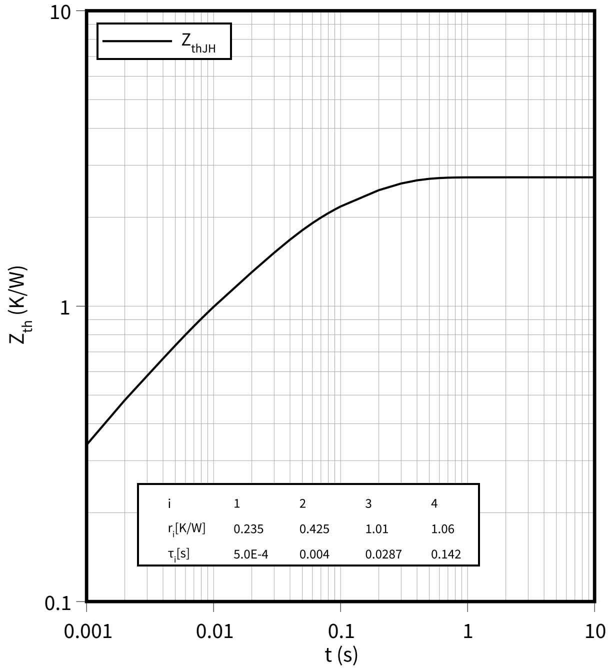
Forward characteristic (typical), Diode, D1-D5

$I_F = f(V_F)$



Transient thermal impedance, Diode, D1-D5

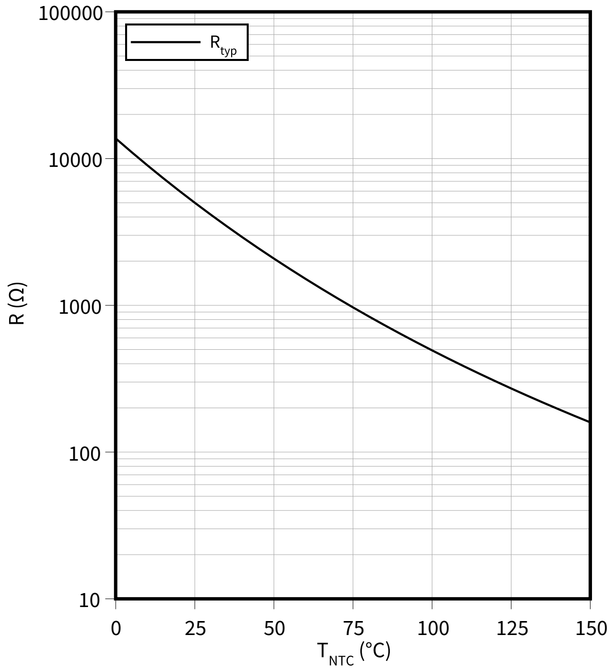
$Z_{th} = f(t)$



i	1	2	3	4
r_i[K/W]	0.235	0.425	1.01	1.06
τ_i[s]	5.0E-4	0.004	0.0287	0.142

Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



7 Circuit diagram

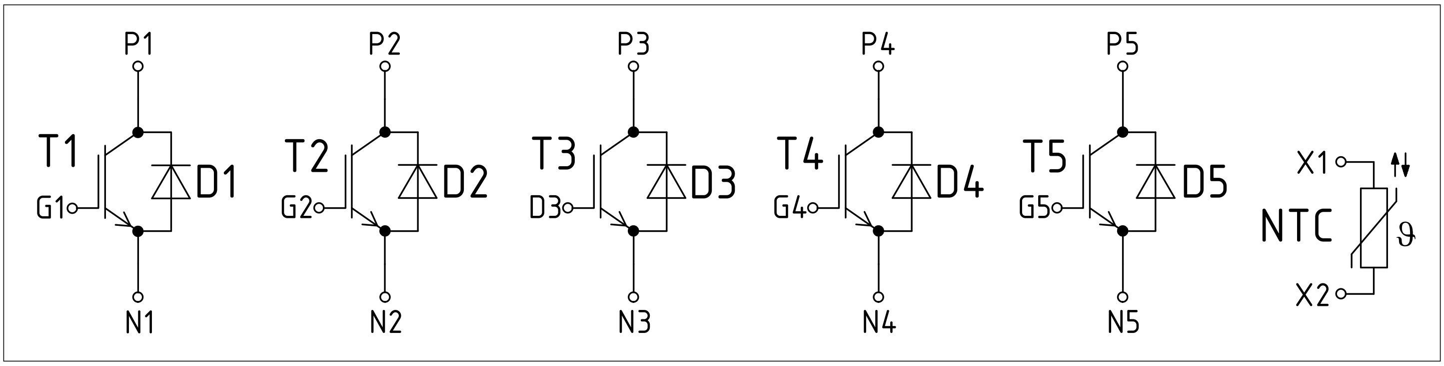


Figure 1

8 Package outlines

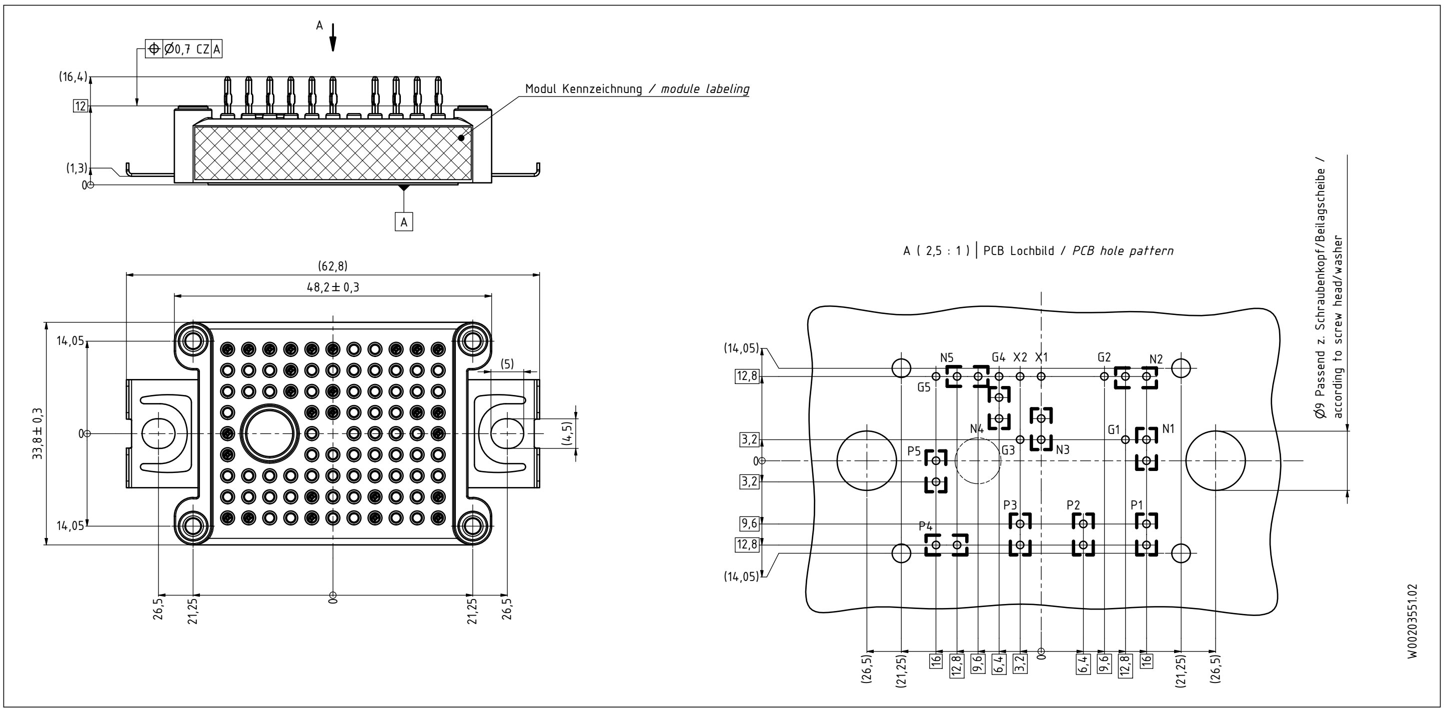


Figure 2

9 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*	*Digit*	*Example*
	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 3

Revision history

Document revision	Date of release	Description of changes
0.10	2022-11-02	Initial version
1.00	2023-10-30	Final datasheet
1.10	2024-09-11	Final datasheet
1.11	2025-03-18	Final datasheet
1.12	2025-07-02	Final datasheet

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