

EasyPACK™ module with TRENCHSTOP™ IGBT7 and CoolSiC™ Schottky diode and PressFIT / NTC**Features**

- Electrical features
 - $V_{CES} = 950\text{ V}$
 - $I_{C\text{ nom}} = 600\text{ A} / I_{CRM} = 800\text{ A}$
 - CoolSiC™ Schottky diode gen 5
 - TRENCHSTOP™ IGBT7
 - $T_{vj,op} = 150^{\circ}\text{C}$
- Mechanical features
 - Package with CTI > 400
 - PressFIT contact technology
 - Integrated NTC temperature sensor

**Potential applications**

- Solar applications
- Three-level applications

Product validation

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

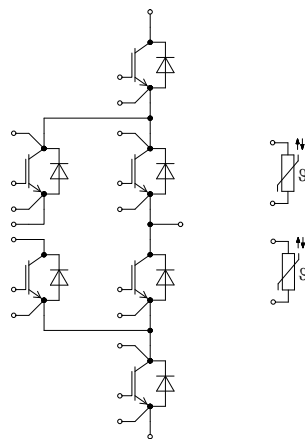
Description

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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	3.2	kV
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	11.0	mm
Clearance	d_{Clear}	terminal to heatsink	9.2	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}			20		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25^\circ\text{C}$, per switch		1.8		mΩ
Storage temperature	T_{stg}		-40		125	°C
Terminal connection torque	M	- Mounting according to valid application note	M5, Screw	1.3	1.5	Nm
Weight	G			112		g

Note: The current under continuous operation is limited to 25A rms per connector pin.

2 IGBT, T1 / T4

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25^\circ\text{C}$	950	V
Implemented collector current	I_{CN}			600	A
Continuous DC collector current	I_{CDC}	$T_{vj \max} = 175^\circ\text{C}$	$T_H = 65^\circ\text{C}$	310	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj \text{ op}}$		800	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	$V_{CE\ sat}$	$I_C = 400\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.63	1.89	V
			$T_{vj} = 125\ ^\circ C$		1.79		
			$T_{vj} = 150\ ^\circ C$		1.82		
Gate threshold voltage	V_{GETh}	$I_C = 9.25\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		4.35	5.10	5.85	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CE} = 600\ V$			1.35		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			0.5		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			37.9		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.117		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 950\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			0.1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$				100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.145		μs
			$T_{vj} = 125\ ^\circ C$		0.145		
			$T_{vj} = 150\ ^\circ C$		0.145		
Rise time (inductive load)	t_r	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 5\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.068		μs
			$T_{vj} = 125\ ^\circ C$		0.068		
			$T_{vj} = 150\ ^\circ C$		0.068		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 18\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.914		μs
			$T_{vj} = 125\ ^\circ C$		0.967		
			$T_{vj} = 150\ ^\circ C$		0.991		
Fall time (inductive load)	t_f	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 18\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.054		μs
			$T_{vj} = 125\ ^\circ C$		0.059		
			$T_{vj} = 150\ ^\circ C$		0.061		
Turn-on energy loss per pulse	E_{on}	$I_C = 400\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 5\ \Omega, di/dt = 4800\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		19.3		mJ
			$T_{vj} = 125\ ^\circ C$		19.3		
			$T_{vj} = 150\ ^\circ C$		19.3		
Turn-off energy loss per pulse	E_{off}	$I_C = 400\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 18\ \Omega, dv/dt = 3200\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		22.8		mJ
			$T_{vj} = 125\ ^\circ C$		24.5		
			$T_{vj} = 150\ ^\circ C$		25.4		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3\ W/(m \cdot K)$			0.182		K/W

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

3 IGBT, T2 / T3

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25\,^{\circ}\text{C}$	950	V
Implemented collector current	I_{CN}			400	A
Continuous DC collector current	I_{CDC}	$T_{vj\,max} = 175\,^{\circ}\text{C}$	$T_H = 65\,^{\circ}\text{C}$	320	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\,op}$		800	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	$V_{CE\,sat}$	$I_C = 400\,\text{A}$, $V_{GE} = 15\,\text{V}$	$T_{vj} = 25\,^{\circ}\text{C}$		1.30	1.40	V
			$T_{vj} = 125\,^{\circ}\text{C}$		1.35		
			$T_{vj} = 150\,^{\circ}\text{C}$		1.35		
Gate threshold voltage	V_{GEth}	$I_C = 6.5\,\text{mA}$, $V_{CE} = 20\,\text{V}$, $T_{vj} = 25\,^{\circ}\text{C}$		4.15	4.90	5.65	V
Gate charge	Q_G	$V_{GE} = \pm 15\,\text{V}$, $V_{CE} = 600\,\text{V}$			4.1		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\,^{\circ}\text{C}$			0.75		Ω
Input capacitance	C_{ies}	$f = 100\,\text{kHz}$, $T_{vj} = 25\,^{\circ}\text{C}$, $V_{CE} = 25\,\text{V}$, $V_{GE} = 0\,\text{V}$			49.2		nF
Reverse transfer capacitance	C_{res}	$f = 100\,\text{kHz}$, $T_{vj} = 25\,^{\circ}\text{C}$, $V_{CE} = 25\,\text{V}$, $V_{GE} = 0\,\text{V}$			0.228		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 950\,\text{V}$, $V_{GE} = 0\,\text{V}$	$T_{vj} = 25\,^{\circ}\text{C}$			0.1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\,\text{V}$, $V_{GE} = 20\,\text{V}$, $T_{vj} = 25\,^{\circ}\text{C}$				100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 400\,\text{A}$, $V_{CE} = 500\,\text{V}$, $V_{GE} = \pm 15\,\text{V}$, $R_{Gon} = 12\,\Omega$	$T_{vj} = 25\,^{\circ}\text{C}$		0.445		μs
			$T_{vj} = 125\,^{\circ}\text{C}$		0.409		
			$T_{vj} = 150\,^{\circ}\text{C}$		0.400		

(table continues...)

Table 6 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rise time (inductive load)	t_r	$I_C = 400 \text{ A}$, $V_{CE} = 500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 12 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.099		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.113		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.117		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 400 \text{ A}$, $V_{CE} = 500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 27 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	2.293		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	2.409		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	2.439		
Fall time (inductive load)	t_f	$I_C = 400 \text{ A}$, $V_{CE} = 500 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 27 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.203		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.396		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.452		
Turn-on energy loss per pulse	E_{on}	$I_C = 400 \text{ A}$, $V_{CE} = 500 \text{ V}$, $L_\sigma = 64 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 12 \Omega$, $di/dt = 2700 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	13.9		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	14.5		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	14.9		
Turn-off energy loss per pulse	E_{off}	$I_C = 400 \text{ A}$, $V_{CE} = 500 \text{ V}$, $L_\sigma = 64 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 27 \Omega$, $dv/dt = 2060 \text{ V}/\mu\text{s}$ ($T_{vj} = 150 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	60.6		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	74.3		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	78.1		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3 \text{ W}/(\text{m}\cdot\text{K})$		0.254		K/W
Temperature under switching conditions	$T_{vj op}$		-40		150	$^\circ\text{C}$

4 IGBT, T5 / T6

Table 7 **Maximum rated values**

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25 \text{ }^\circ\text{C}$	950	V
Implemented collector current	I_{CN}			400	A
Continuous DC collector current	I_{CDC}	$T_{vj max} = 175 \text{ }^\circ\text{C}$	$T_H = 65 \text{ }^\circ\text{C}$	200	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj op}$		800	A
Gate-emitter peak voltage	V_{GES}			± 20	V

Table 8 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE\ sat}$	$I_C = 400\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.85	2.25	V
			$T_{vj} = 125\ ^\circ C$		2.10		
			$T_{vj} = 150\ ^\circ C$		2.15		
Gate threshold voltage	V_{GETh}	$I_C = 6.5\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		4.35	5.10	5.85	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CE} = 600\ V$			0.9		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			0.75		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			25.2		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.078		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 950\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			1	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\ V, V_{GE} = 20\ V, T_{vj} = 25\ ^\circ C$				100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 8\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.167		μs
			$T_{vj} = 125\ ^\circ C$		0.169		
			$T_{vj} = 150\ ^\circ C$		0.170		
Rise time (inductive load)	t_r	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Gon} = 8\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.096		μs
			$T_{vj} = 125\ ^\circ C$		0.102		
			$T_{vj} = 150\ ^\circ C$		0.104		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 27\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.862		μs
			$T_{vj} = 125\ ^\circ C$		0.919		
			$T_{vj} = 150\ ^\circ C$		0.940		
Fall time (inductive load)	t_f	$I_C = 400\ A, V_{CE} = 500\ V, V_{GE} = \pm 15\ V, R_{Goff} = 27\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.054		μs
			$T_{vj} = 125\ ^\circ C$		0.058		
			$T_{vj} = 150\ ^\circ C$		0.060		
Turn-on energy loss per pulse	E_{on}	$I_C = 400\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 8\ \Omega, di/dt = 3100\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		40.8		mJ
			$T_{vj} = 125\ ^\circ C$		38		
			$T_{vj} = 150\ ^\circ C$		37.8		
Turn-off energy loss per pulse	E_{off}	$I_C = 400\ A, V_{CE} = 500\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 27\ \Omega, dv/dt = 3050\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		25.2		mJ
			$T_{vj} = 125\ ^\circ C$		28		
			$T_{vj} = 150\ ^\circ C$		29.1		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3\ W/(m \cdot K)$			0.281		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 Diode, D1 / D4

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25\,^{\circ}\text{C}$	950	V
Continuous DC forward current	I_F		300	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\,\text{ms}$	600	A
I^2t - value	I^2t	$t_P = 10\,\text{ms}, V_R = 0\,\text{V}$	$T_{vj} = 125\,^{\circ}\text{C}$	A^2s
			$T_{vj} = 150\,^{\circ}\text{C}$	

Table 10 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 300\,\text{A}, V_{GE} = 0\,\text{V}$	$T_{vj} = 25\,^{\circ}\text{C}$	2.60	2.90	V
			$T_{vj} = 125\,^{\circ}\text{C}$	2.40		
			$T_{vj} = 150\,^{\circ}\text{C}$	2.35		
Peak reverse recovery current	I_{RM}	$V_R = 500\,\text{V}, I_F = 300\,\text{A}, V_{GE} = -15\,\text{V}, -di_F/dt = 3000\,\text{A}/\mu\text{s} (T_{vj} = 150\,^{\circ}\text{C})$	$T_{vj} = 25\,^{\circ}\text{C}$	102		A
			$T_{vj} = 125\,^{\circ}\text{C}$	147		
			$T_{vj} = 150\,^{\circ}\text{C}$	163		
Recovered charge	Q_r	$V_R = 500\,\text{V}, I_F = 300\,\text{A}, V_{GE} = -15\,\text{V}, -di_F/dt = 3000\,\text{A}/\mu\text{s} (T_{vj} = 150\,^{\circ}\text{C})$	$T_{vj} = 25\,^{\circ}\text{C}$	11.3		μC
			$T_{vj} = 125\,^{\circ}\text{C}$	20.3		
			$T_{vj} = 150\,^{\circ}\text{C}$	24.1		
Reverse recovery energy	E_{rec}	$V_R = 500\,\text{V}, I_F = 300\,\text{A}, V_{GE} = -15\,\text{V}, -di_F/dt = 3000\,\text{A}/\mu\text{s} (T_{vj} = 150\,^{\circ}\text{C})$	$T_{vj} = 25\,^{\circ}\text{C}$	3.37		mJ
			$T_{vj} = 125\,^{\circ}\text{C}$	5.93		
			$T_{vj} = 150\,^{\circ}\text{C}$	7.06		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3\,\text{W}/(\text{m}\cdot\text{K})$		0.597		K/W
Temperature under switching conditions	$T_{vj\,op}$		-40		150	°C

6 Diode, D2 / D3

Table 11 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\text{ °C}$	950	V
Continuous DC forward current	I_F			300	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		600	A
I^2t - value	I^2t	$t_P = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$	3100	A^2s
			$T_{vj} = 150\text{ °C}$	2900	

Table 12 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 300\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	2.60	2.90	V
			$T_{vj} = 125\text{ °C}$	2.40		
			$T_{vj} = 150\text{ °C}$	2.35		
Peak reverse recovery current	I_{RM}	$V_R = 500\text{ V}, I_F = 300\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 2200\text{ A}/\mu s (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$	146		A
			$T_{vj} = 125\text{ °C}$	194		
			$T_{vj} = 150\text{ °C}$	207		
Recovered charge	Q_r	$V_R = 500\text{ V}, I_F = 300\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 2200\text{ A}/\mu s (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$	8.45		μC
			$T_{vj} = 125\text{ °C}$	17.9		
			$T_{vj} = 150\text{ °C}$	21.3		
Reverse recovery energy	E_{rec}	$V_R = 500\text{ V}, I_F = 300\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 2200\text{ A}/\mu s (T_{vj} = 150\text{ °C})$	$T_{vj} = 25\text{ °C}$	4.22		mJ
			$T_{vj} = 125\text{ °C}$	8.19		
			$T_{vj} = 150\text{ °C}$	9.6		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3\text{ W}/(m \cdot K)$		0.393		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$			-40	150	°C

7 Diode, D5 / D6

Table 13 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\text{ °C}$	1200	V

(table continues...)

Table 13 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Continuous DC forward current	I_F		160	A
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$	320	A
I^2t - value	I^2t	$t_P = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ °C}$	A^2s
			$T_{vj} = 150 \text{ °C}$	

Table 14 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 160 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	1.45	1.75	V
			$T_{vj} = 125 \text{ °C}$	1.75		
			$T_{vj} = 150 \text{ °C}$	1.85		
Peak reverse recovery current	I_{RM}	$V_R = 500 \text{ V}, I_F = 160 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 3500 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	71.4		A
			$T_{vj} = 125 \text{ °C}$	71.4		
			$T_{vj} = 150 \text{ °C}$	71.4		
Recovered charge	Q_r	$V_R = 500 \text{ V}, I_F = 160 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 3500 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	1.29		μC
			$T_{vj} = 125 \text{ °C}$	1.29		
			$T_{vj} = 150 \text{ °C}$	1.29		
Reverse recovery energy	E_{rec}	$V_R = 500 \text{ V}, I_F = 160 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 3500 \text{ A}/\mu\text{s} (T_{vj} = 150 \text{ °C})$	$T_{vj} = 25 \text{ °C}$	0.66		mJ
			$T_{vj} = 125 \text{ °C}$	0.66		
			$T_{vj} = 150 \text{ °C}$	0.66		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3 \text{ W}/(\text{m} \cdot \text{K})$		0.430		K/W
Temperature under switching conditions	$T_{vj op}$		-40		150	°C

8 NTC-Thermistor

Table 15 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25 \text{ °C}$		5		kΩ
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100 \text{ °C}, R_{100} = 493 \text{ Ω}$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25 \text{ °C}$			20	mW
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$		3375		K

(table continues...)

Table 15 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$		3433		K

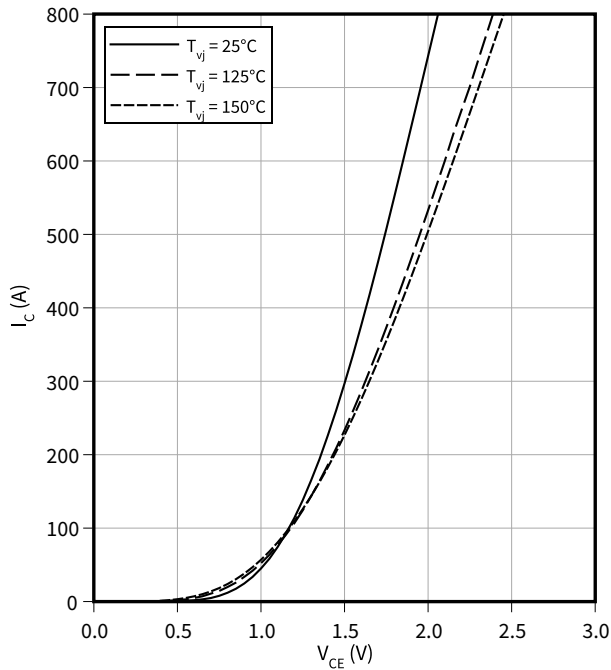
Note: Specification according to the valid application note.

9 Characteristics diagrams

Output characteristic (typical), IGBT, T1 / T4

$I_C = f(V_{CE})$

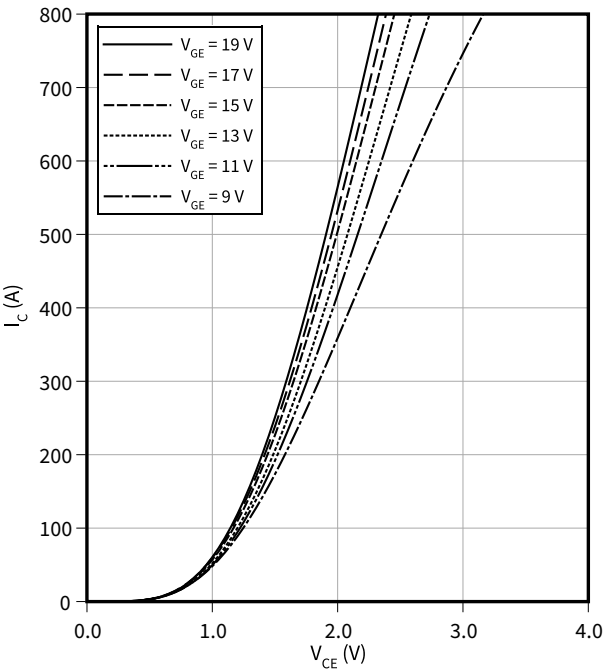
$V_{GE} = 15\text{ V}$



Output characteristic field (typical), IGBT, T1 / T4

$I_C = f(V_{CE})$

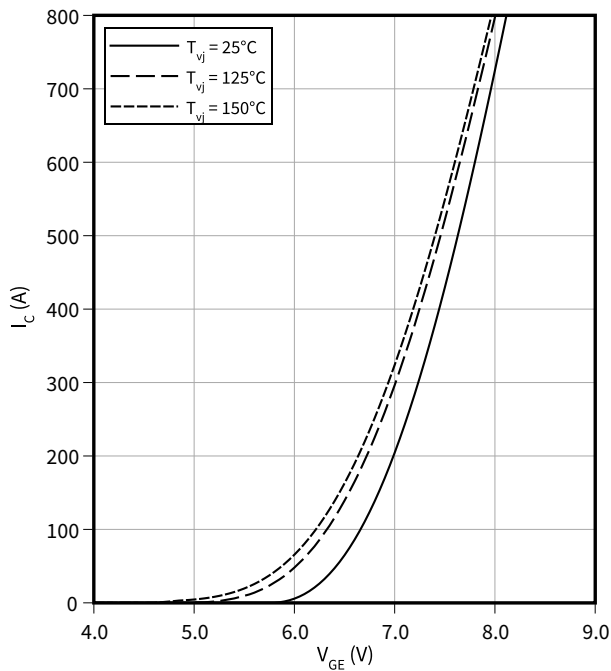
$T_{vj} = 150^\circ\text{C}$



Transfer characteristic (typical), IGBT, T1 / T4

$I_C = f(V_{GE})$

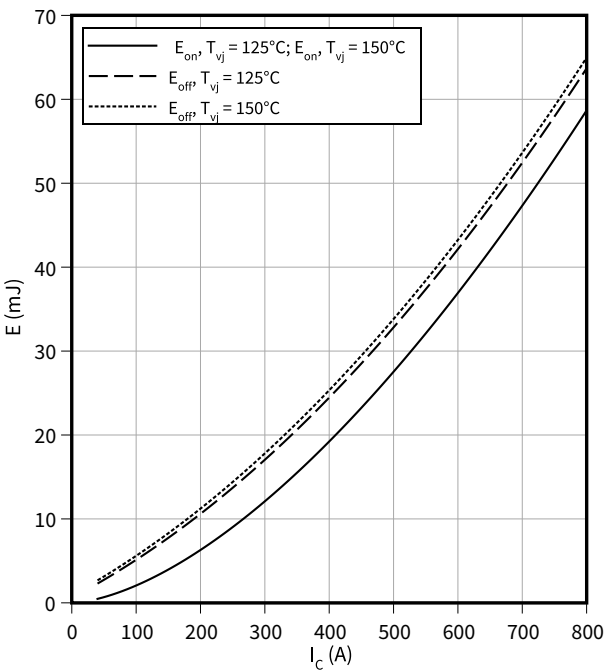
$V_{CE} = 20\text{ V}$



Switching losses (typical), IGBT, T1 / T4

$E = f(I_C)$

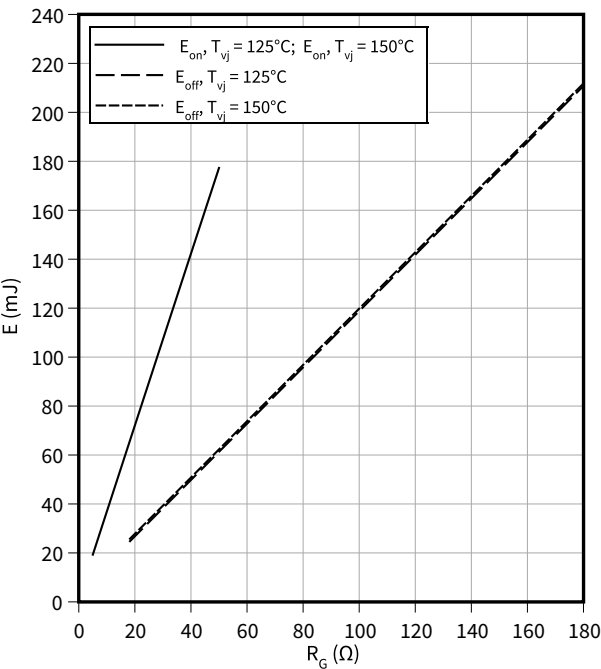
$R_{Goff} = 18\ \Omega$, $R_{Gon} = 5\ \Omega$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



9 Characteristics diagrams

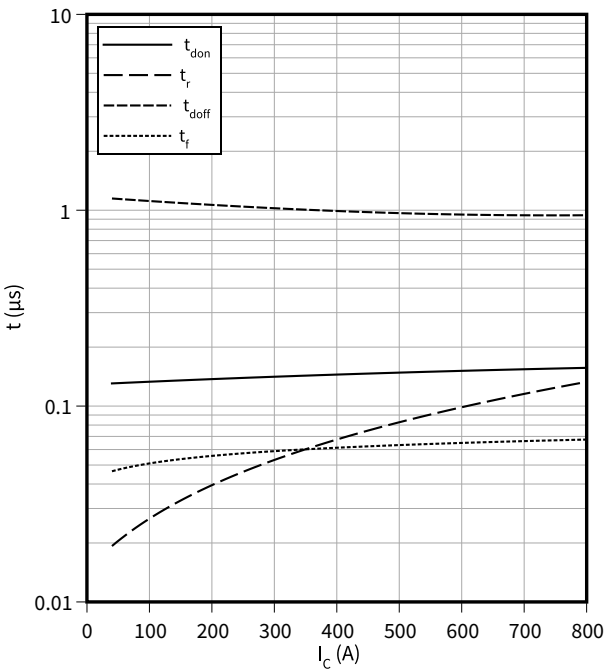
Switching losses (typical), IGBT, T1 / T4

$E = f(R_G)$
 $I_C = 400\text{ A}$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



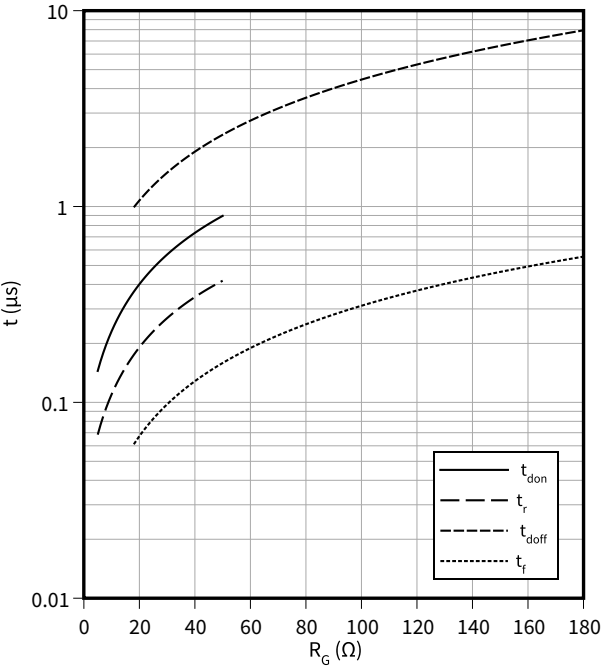
Switching times (typical), IGBT, T1 / T4

$t = f(I_C)$
 $R_{Goff} = 18\text{ }\Omega$, $R_{Gon} = 5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $V_{CE} = 500\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$



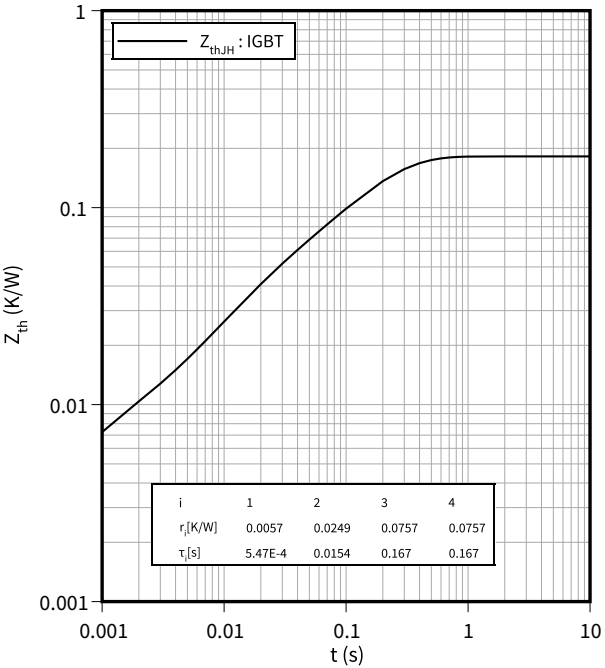
Switching times (typical), IGBT, T1 / T4

$t = f(R_G)$
 $I_C = 400\text{ A}$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$



Transient thermal impedance , IGBT, T1 / T4

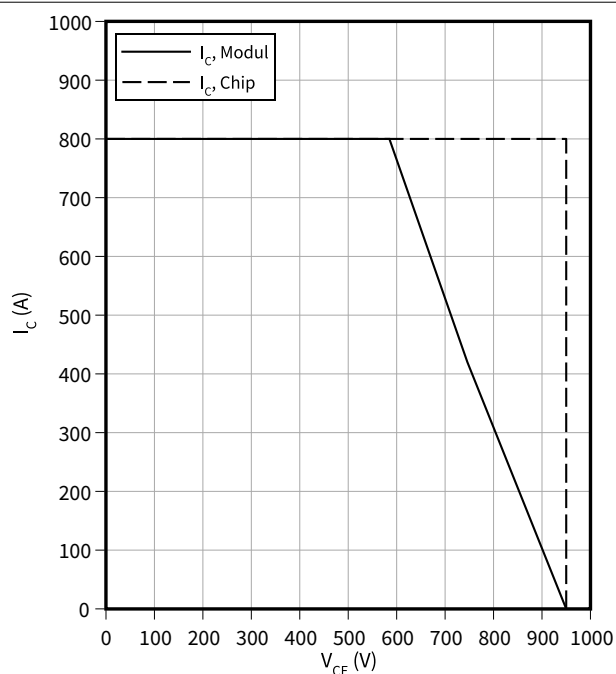
$Z_{th} = f(t)$



Reverse bias safe operating area (RBSOA), IGBT, T1 / T4

$$I_C = f(V_{CE})$$

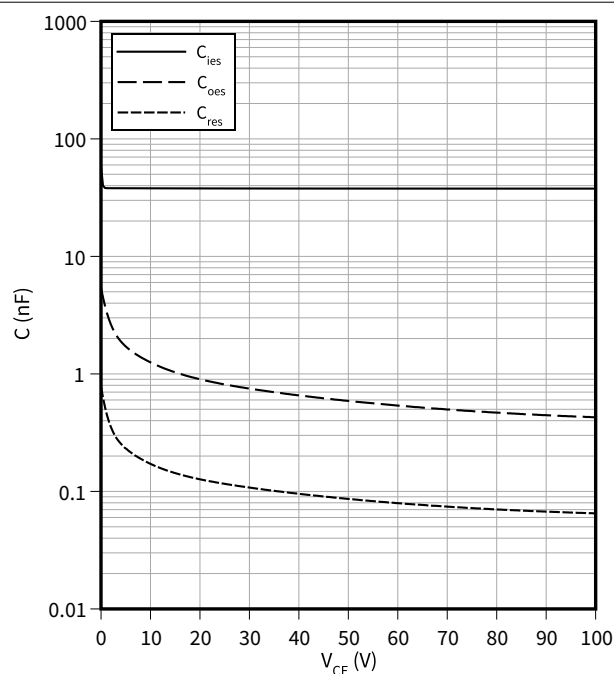
$$R_{Goff} = 18 \Omega, V_{GE} = \pm 15 \text{ V}, T_{vj} = 150^\circ \text{C}$$



Capacity characteristic (typical), IGBT, T1 / T4

$$C = f(V_{CE})$$

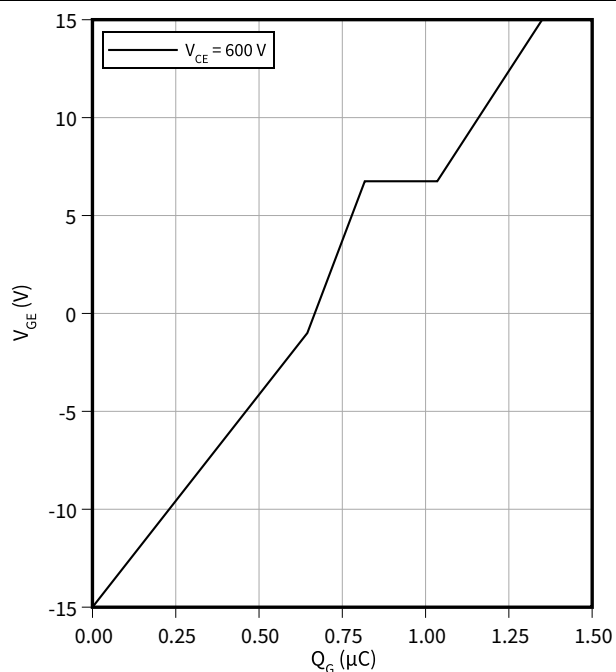
$$f = 100 \text{ kHz}, V_{GE} = 0 \text{ V}, T_{vj} = 25^\circ \text{C}$$



Gate charge characteristic (typical), IGBT, T1 / T4

$$V_{GE} = f(Q_G)$$

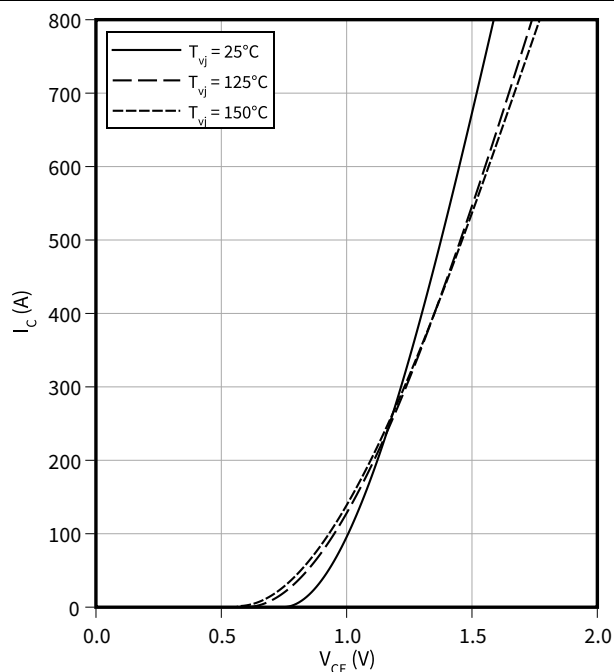
$$I_C = 600 \text{ A}, T_{vj} = 25^\circ \text{C}$$



Output characteristic (typical), IGBT, T2 / T3

$$I_C = f(V_{CE})$$

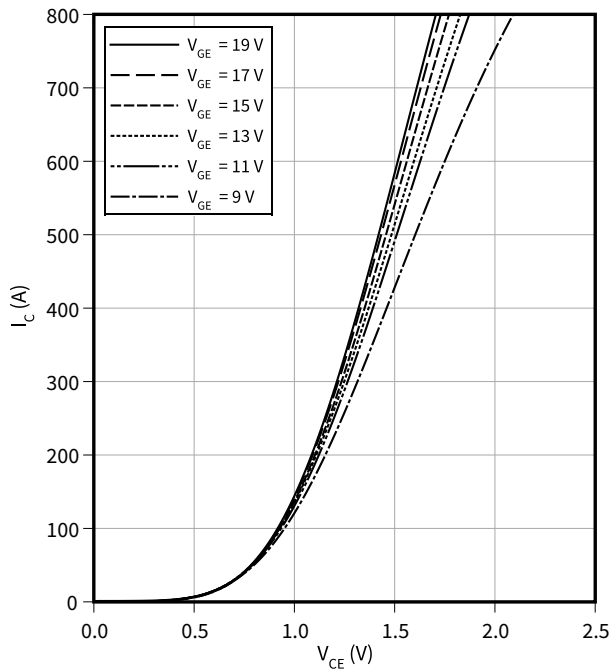
$$V_{GE} = 15 \text{ V}$$



9 Characteristics diagrams

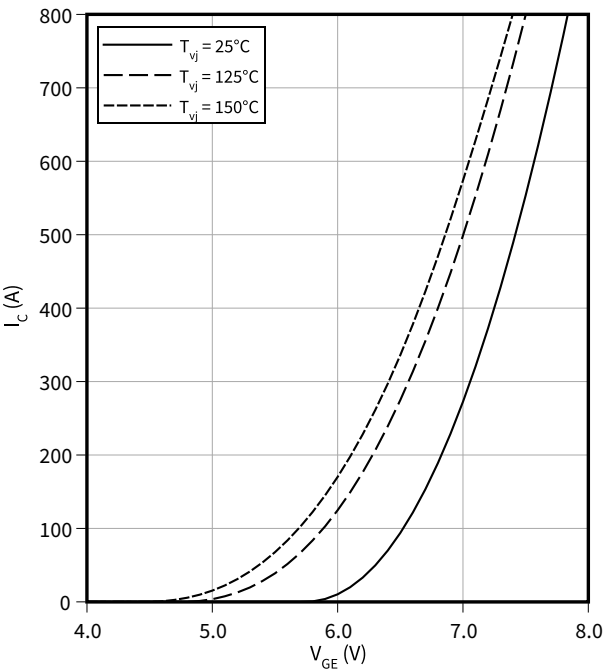
Output characteristic field (typical), IGBT, T2 / T3

$I_C = f(V_{CE})$
 $T_{vj} = 150\text{ }^{\circ}\text{C}$



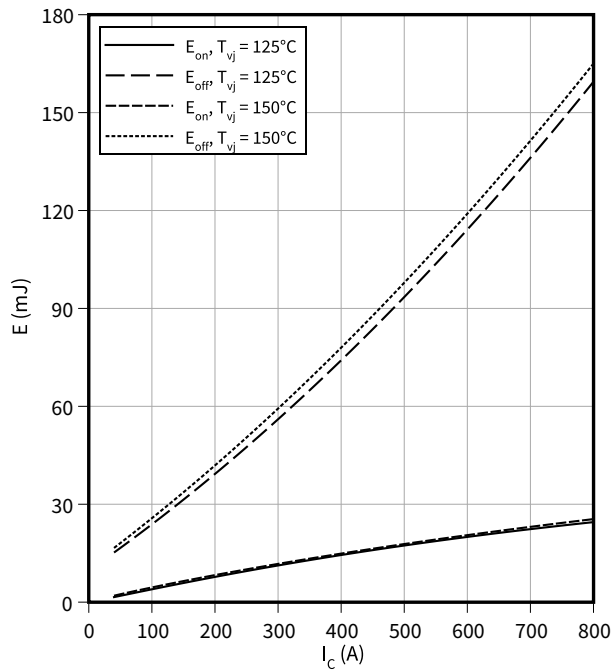
Transfer characteristic (typical), IGBT, T2 / T3

$I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



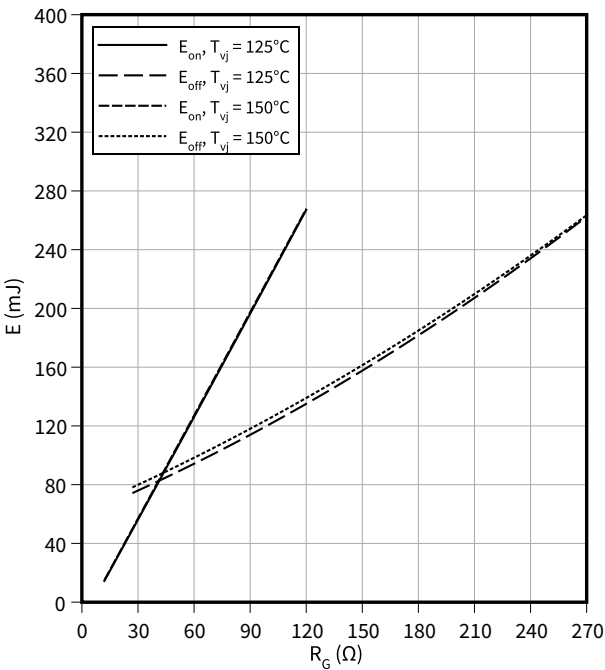
Switching losses (typical), IGBT, T2 / T3

$E = f(I_C)$
 $R_{Goff} = 27\text{ }\Omega$, $R_{Gon} = 12\text{ }\Omega$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



Switching losses (typical), IGBT, T2 / T3

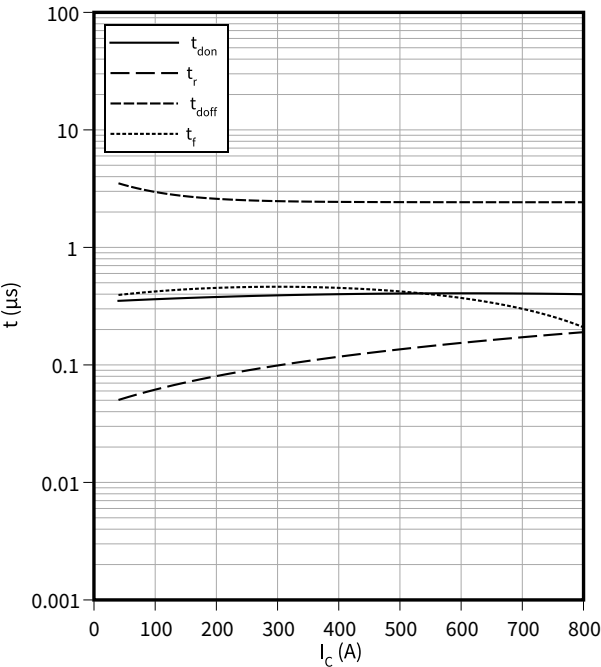
$E = f(R_G)$
 $I_C = 400\text{ A}$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



9 Characteristics diagrams

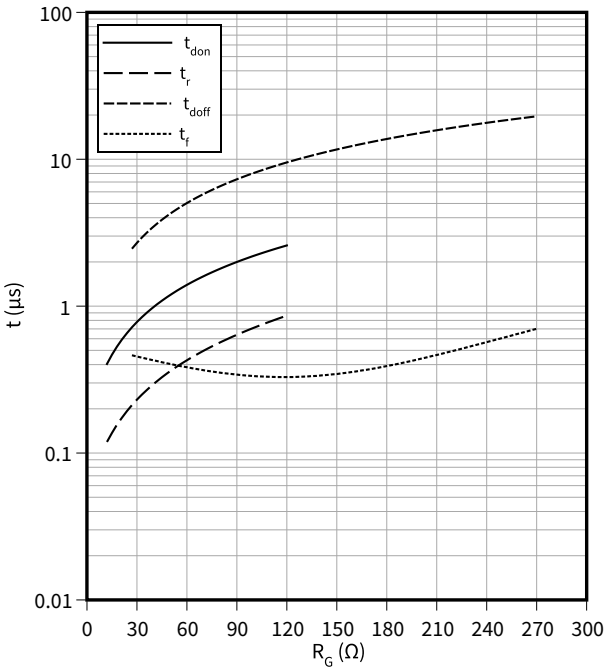
Switching times (typical), IGBT, T2 / T3

$t = f(I_C)$
 $R_{Goff} = 27 \Omega$, $R_{Gon} = 12 \Omega$, $V_{CE} = 500 \text{ V}$, $V_{GE} = -15 / 15 \text{ V}$, $T_{vj} = 150^\circ\text{C}$



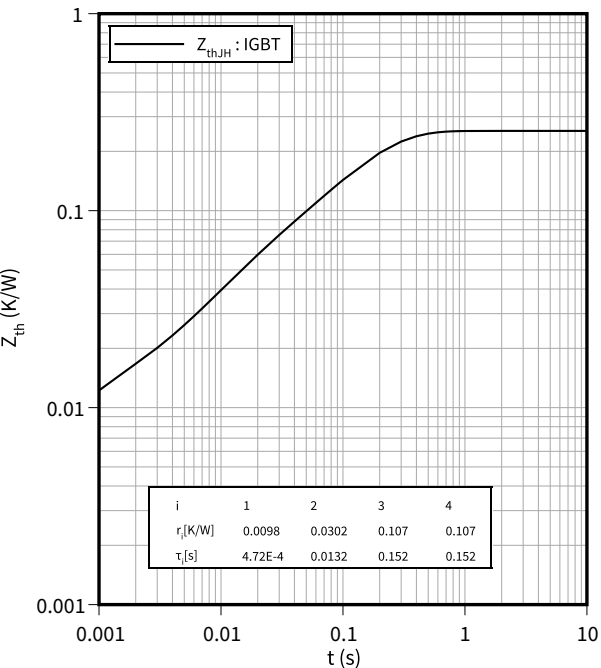
Switching times (typical), IGBT, T2 / T3

$t = f(R_G)$
 $I_C = 400 \text{ A}$, $V_{CE} = 500 \text{ V}$, $V_{GE} = -15 / 15 \text{ V}$, $T_{vj} = 150^\circ\text{C}$



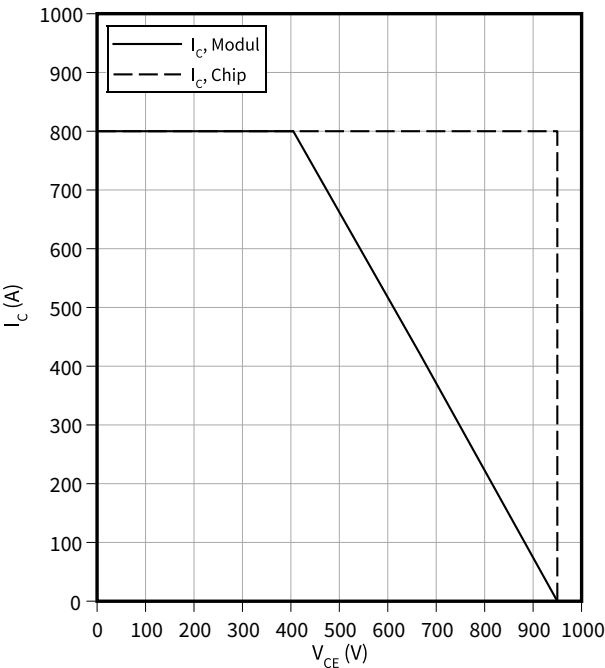
Transient thermal impedance , IGBT, T2 / T3

$Z_{th} = f(t)$



Reverse bias safe operating area (RBSOA), IGBT, T2 / T3

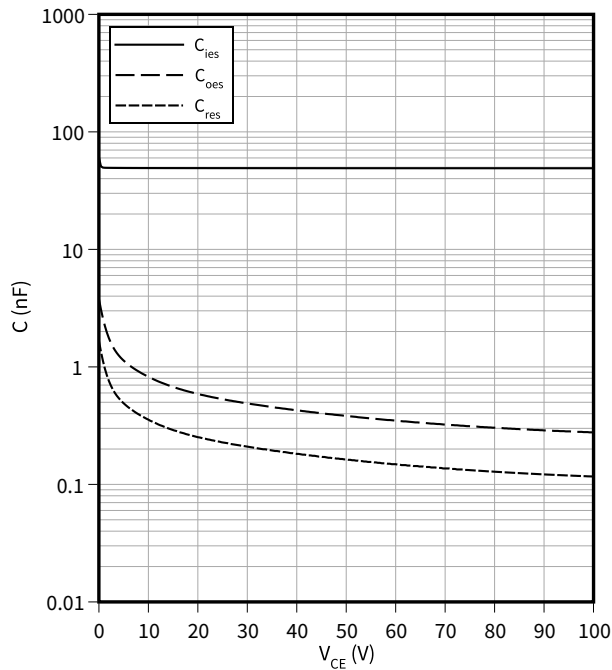
$I_C = f(V_{CE})$
 $R_{Goff} = 27 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 150^\circ\text{C}$



9 Characteristics diagrams

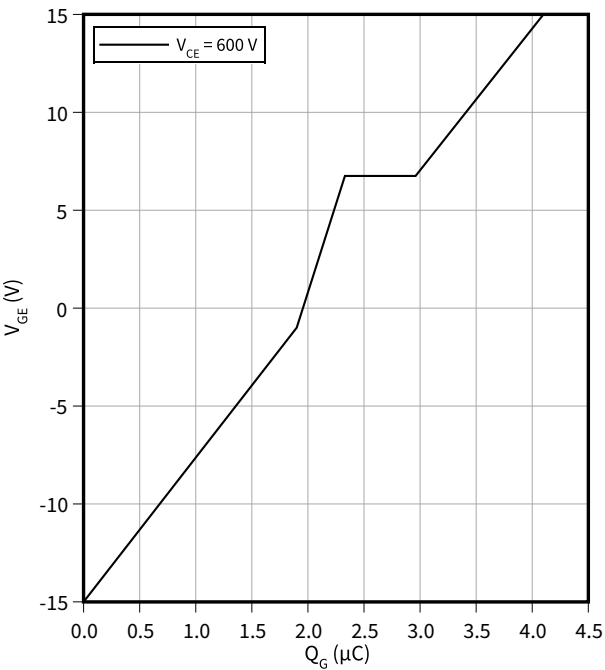
Capacity characteristic (typical), IGBT, T2 / T3

$C = f(V_{CE})$
 $f = 100 \text{ kHz}$, $V_{GE} = 0 \text{ V}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$



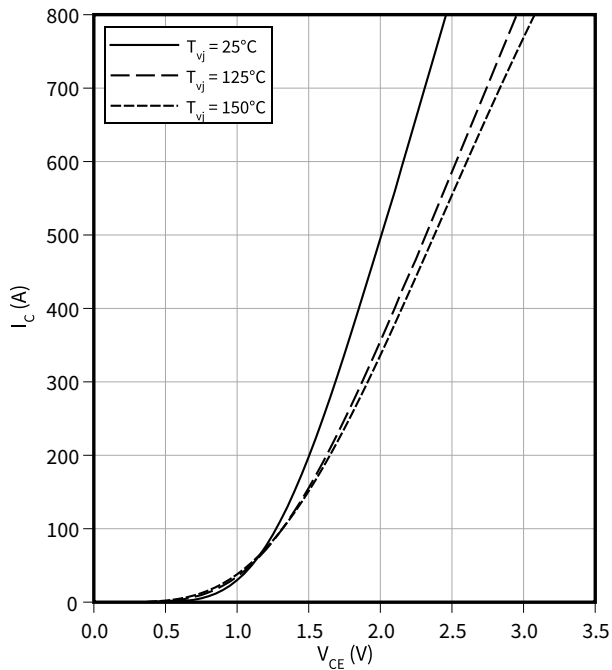
Gate charge characteristic (typical), IGBT, T2 / T3

$V_{GE} = f(Q_G)$
 $I_C = 400 \text{ A}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$



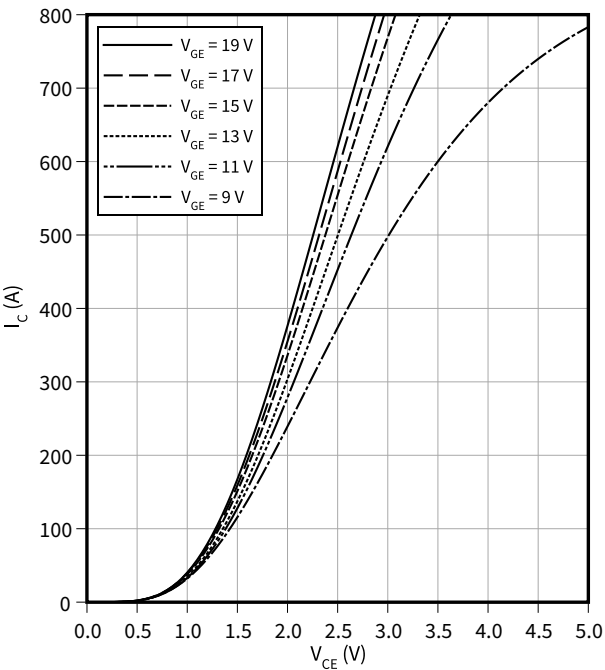
Output characteristic (typical), IGBT, T5 / T6

$I_C = f(V_{CE})$
 $V_{GE} = 15 \text{ V}$



Output characteristic field (typical), IGBT, T5 / T6

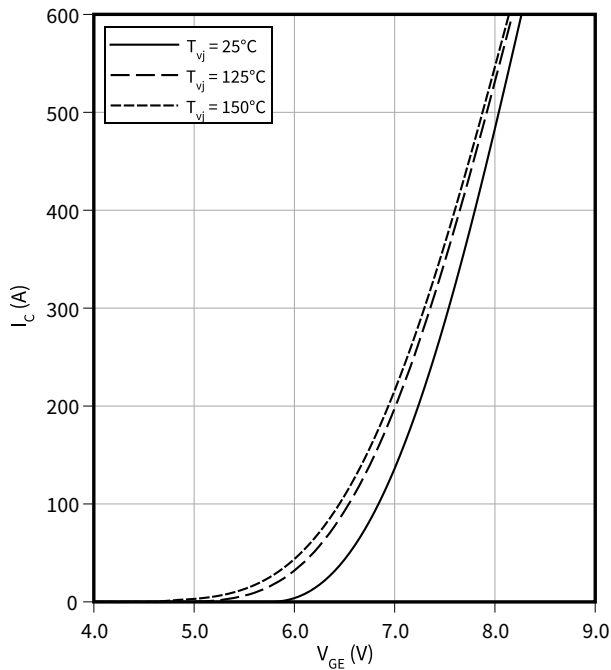
$I_C = f(V_{CE})$
 $T_{vj} = 150 \text{ }^{\circ}\text{C}$



9 Characteristics diagrams

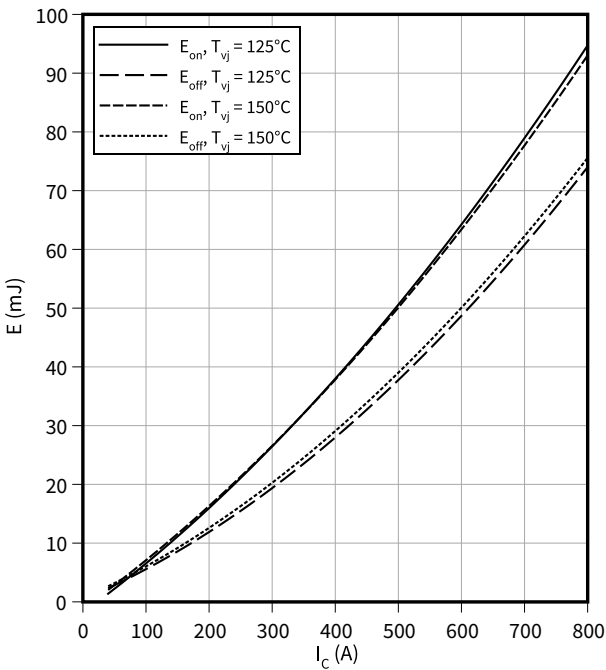
Transfer characteristic (typical), IGBT, T5 / T6

$I_C = f(V_{GE})$
 $V_{CE} = 20\text{ V}$



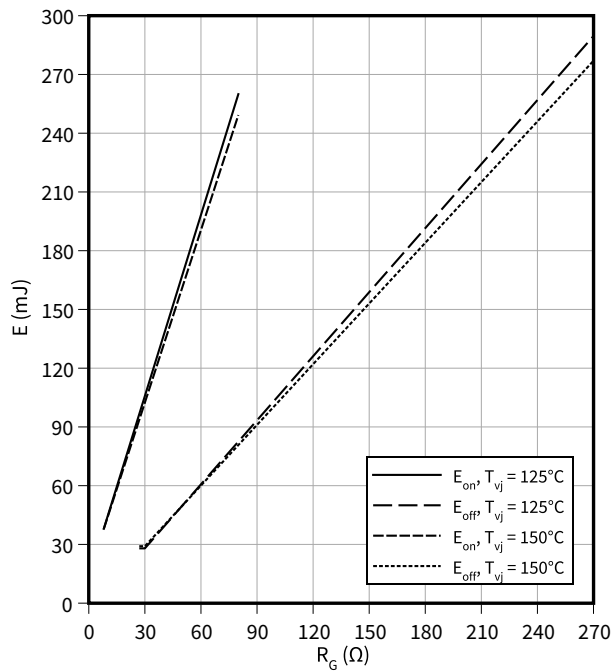
Switching losses (typical), IGBT, T5 / T6

$E = f(I_C)$
 $R_{Goff} = 27\ \Omega$, $R_{Gon} = 8\ \Omega$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



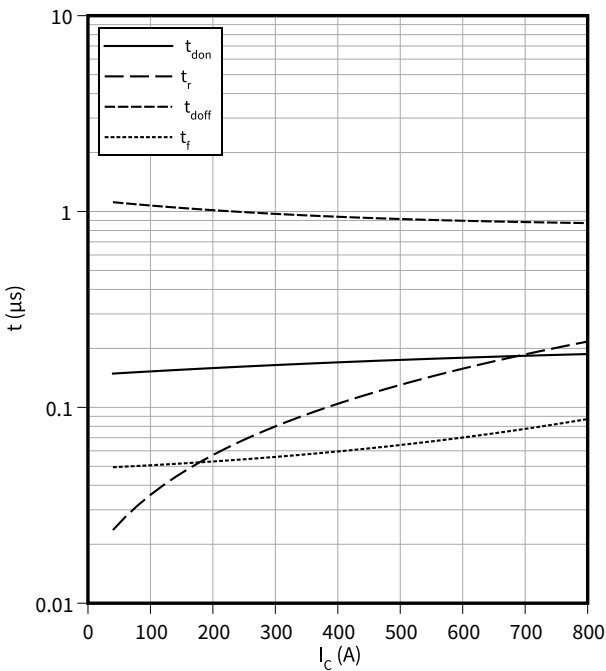
Switching losses (typical), IGBT, T5 / T6

$E = f(R_G)$
 $I_C = 400\text{ A}$, $V_{CE} = 500\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



Switching times (typical), IGBT, T5 / T6

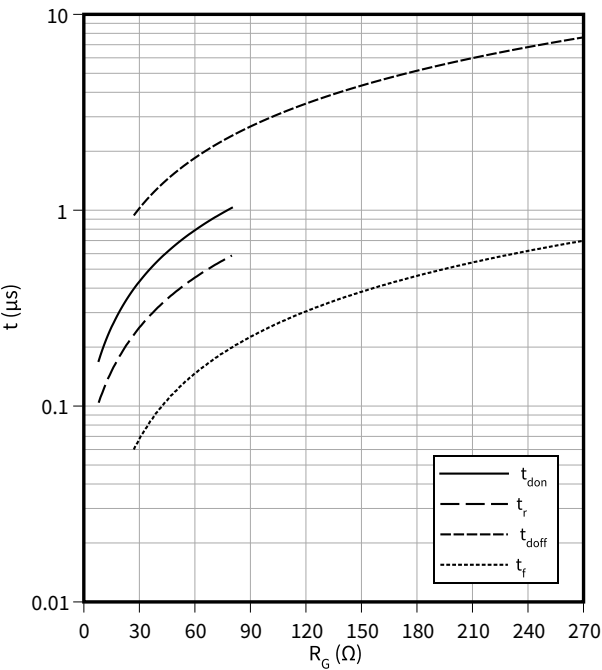
$t = f(I_C)$
 $R_{Goff} = 27\ \Omega$, $R_{Gon} = 8\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $V_{CE} = 500\text{ V}$, $T_{vj} = 150^\circ\text{C}$



9 Characteristics diagrams

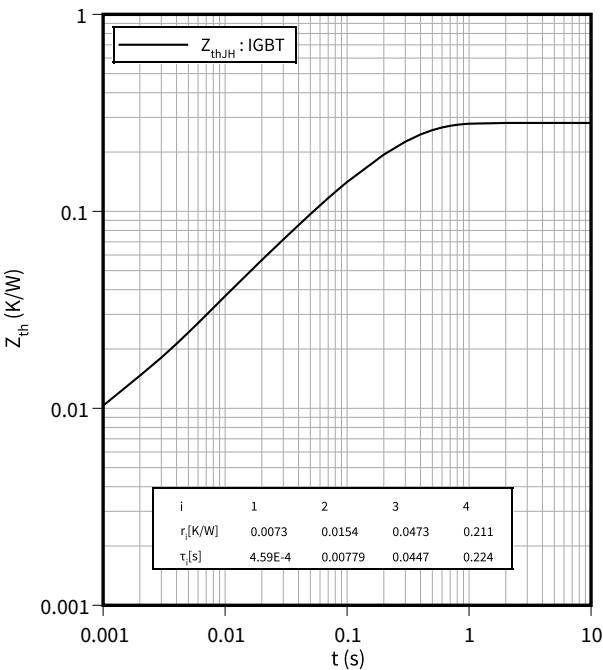
Switching times (typical), IGBT, T5 / T6

$t = f(R_G)$
 $I_C = 400\text{ A}$, $V_{CE} = 500\text{ V}$, $T_{vj} = 150\text{ °C}$, $V_{GE} = \pm 15\text{ V}$



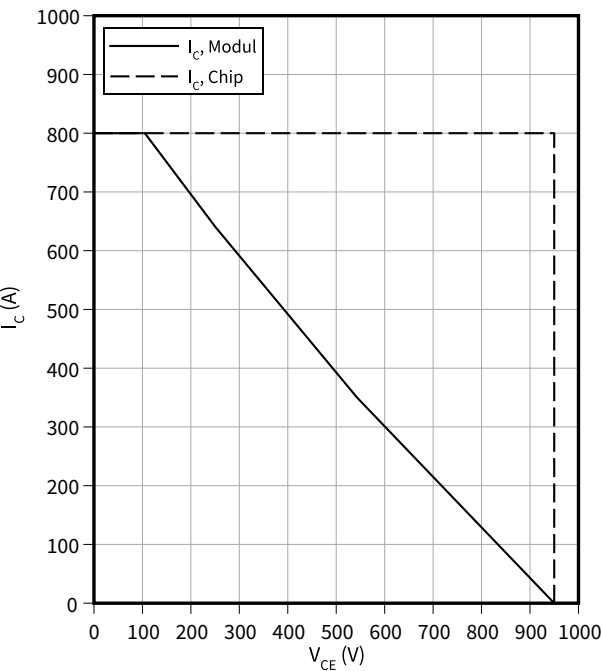
Transient thermal impedance , IGBT, T5 / T6

$Z_{th} = f(t)$



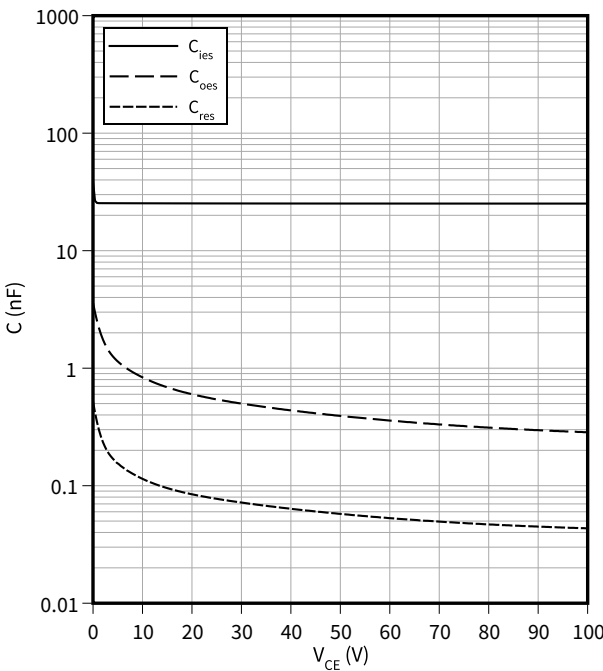
Reverse bias safe operating area (RBSOA), IGBT, T5 / T6

$I_C = f(V_{CE})$
 $R_{Goff} = 27\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 150\text{ °C}$



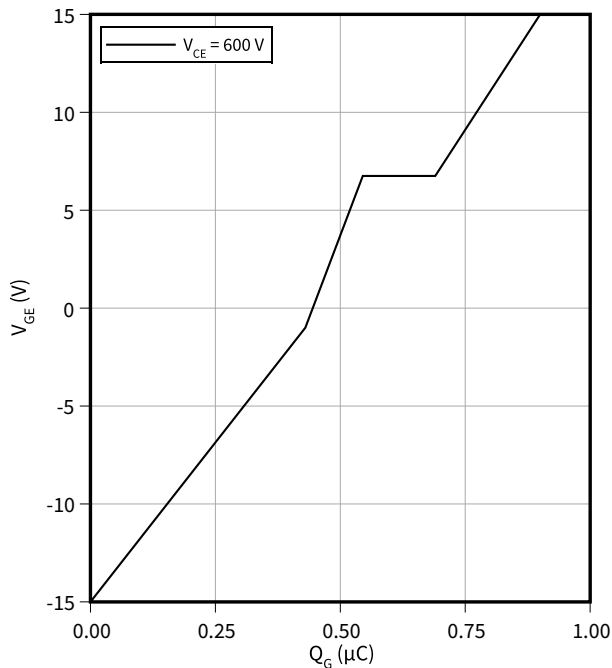
Capacity characteristic (typical), IGBT, T5 / T6

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



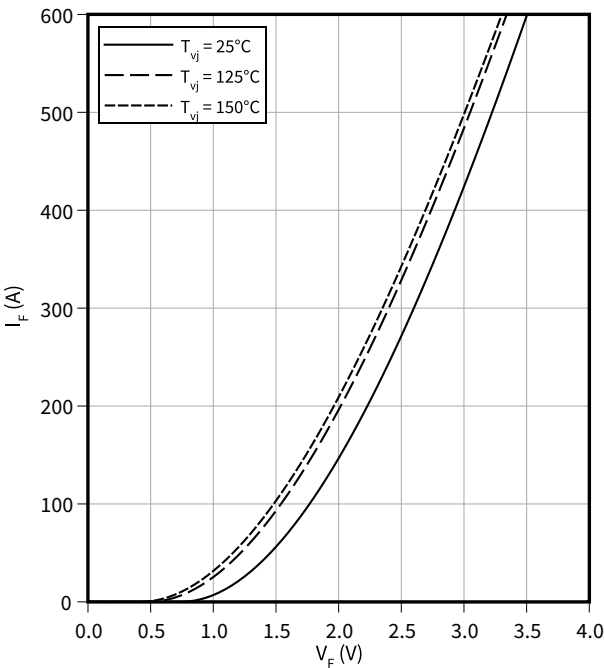
Gate charge characteristic (typical), IGBT, T5 / T6

$V_{GE} = f(Q_G)$
 $I_C = 400\text{ A}$, $T_{vj} = 25\text{ °C}$



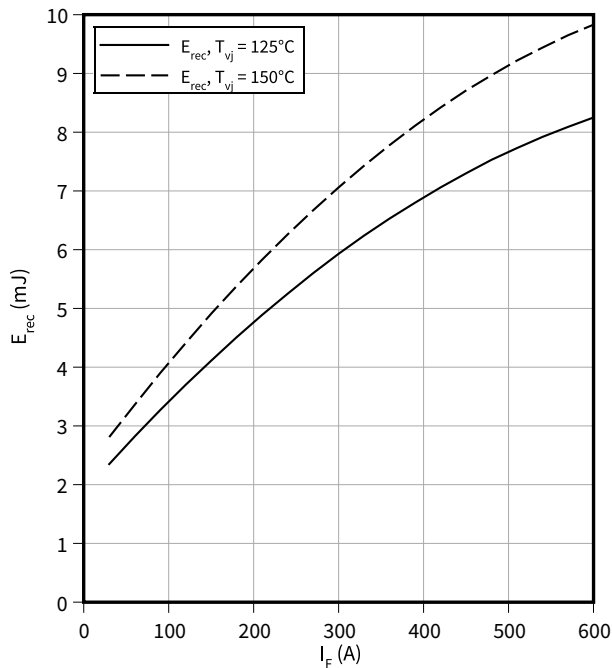
Forward characteristic (typical), Diode, D1 / D4

$I_F = f(V_F)$



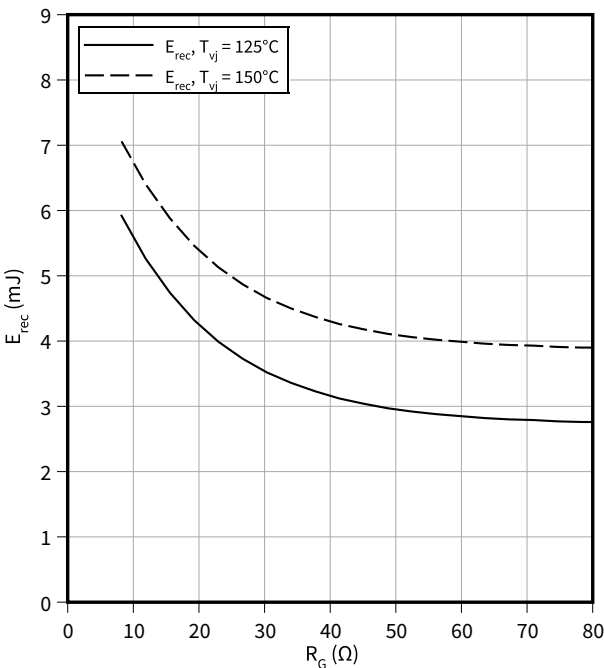
Switching losses (typical), Diode, D1 / D4

$E_{rec} = f(I_F)$
 $R_G = 8\text{ }\Omega$, $V_R = 500\text{ V}$



Switching losses (typical), Diode, D1 / D4

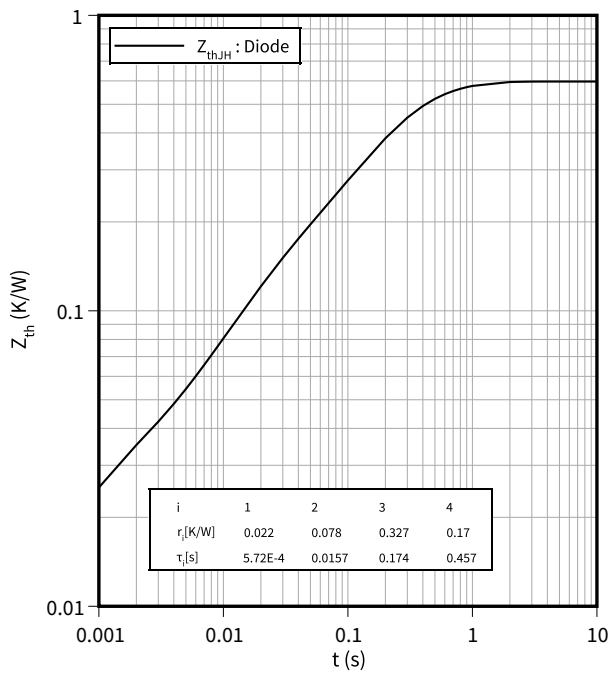
$E_{rec} = f(R_G)$
 $I_F = 300\text{ A}$, $V_R = 500\text{ V}$



9 Characteristics diagrams

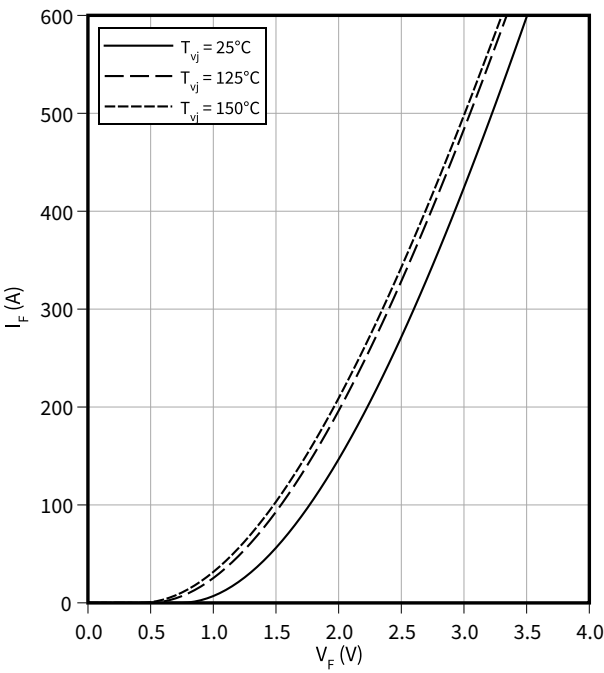
Transient thermal impedance, Diode, D1 / D4

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D2 / D3

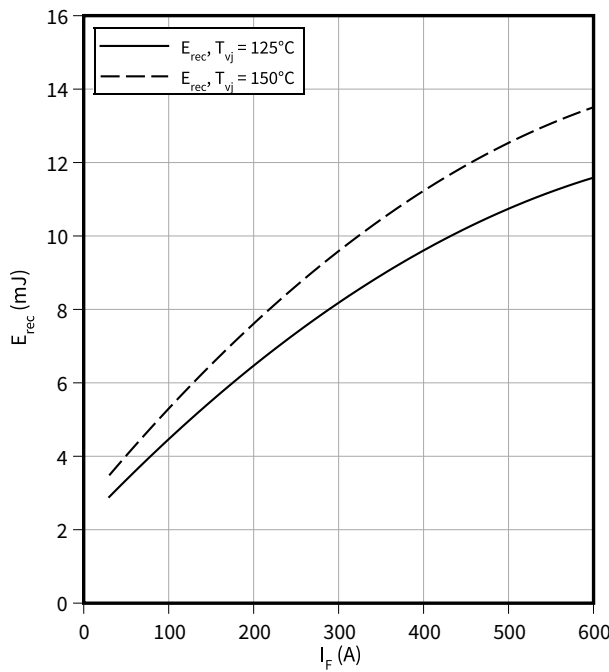
$I_F = f(V_F)$



Switching losses (typical), Diode, D2 / D3

$E_{rec} = f(I_F)$

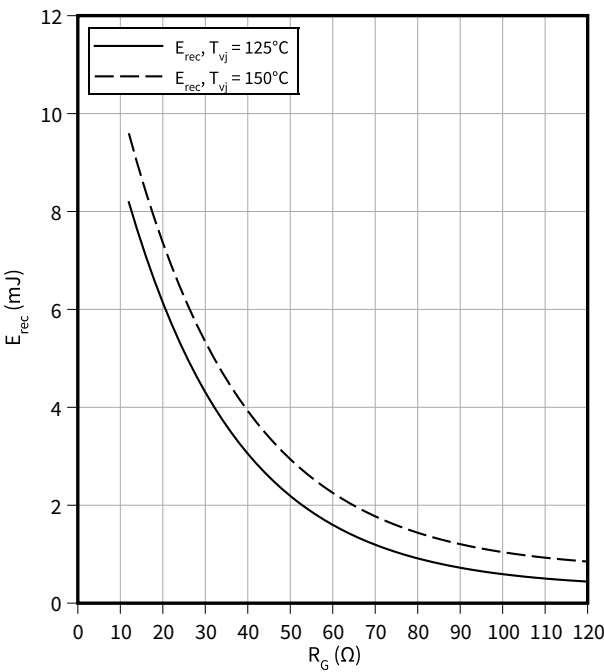
$R_G = 12 \Omega, V_R = 500 V$



Switching losses (typical), Diode, D2 / D3

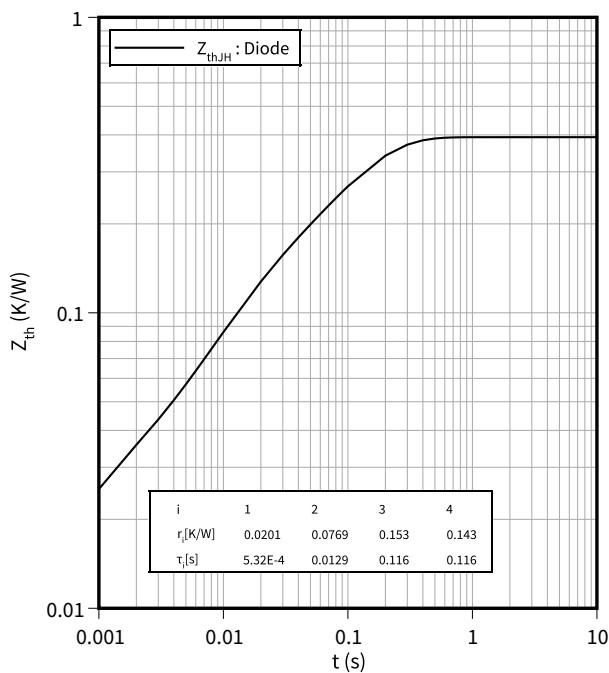
$E_{rec} = f(R_G)$

$I_F = 300 A, V_R = 500 V$



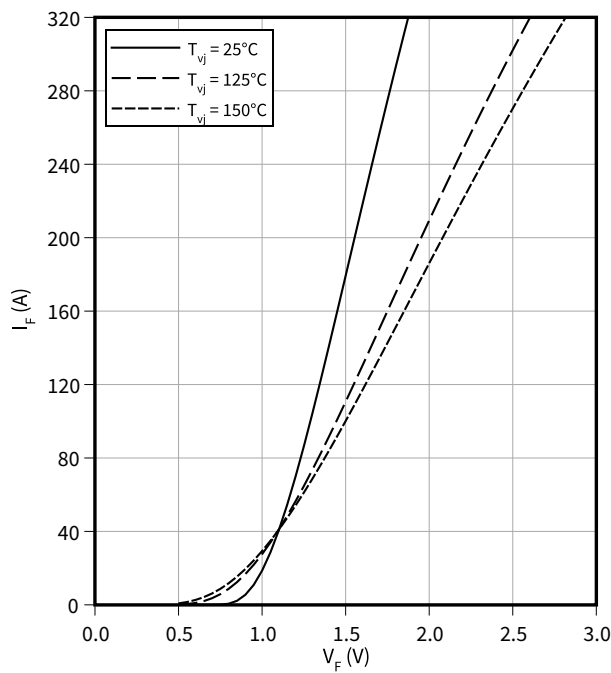
Transient thermal impedance, Diode, D2 / D3

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D5 / D6

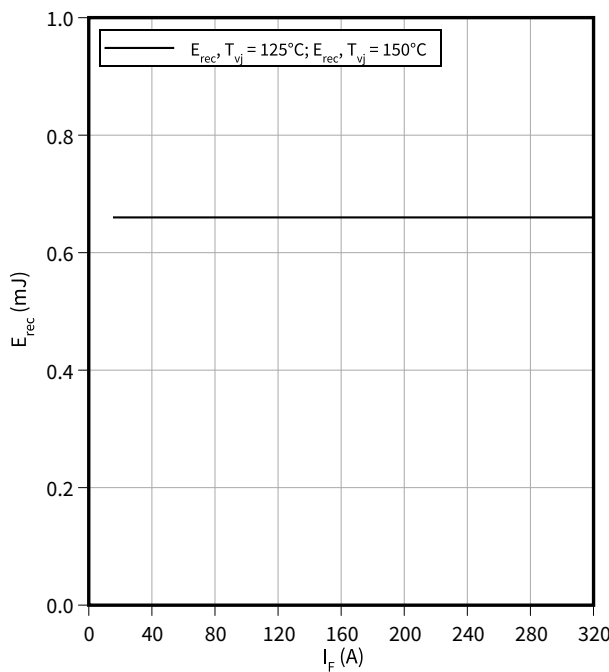
$I_F = f(V_F)$



Switching losses (typical), Diode, D5 / D6

$E_{rec} = f(I_F)$

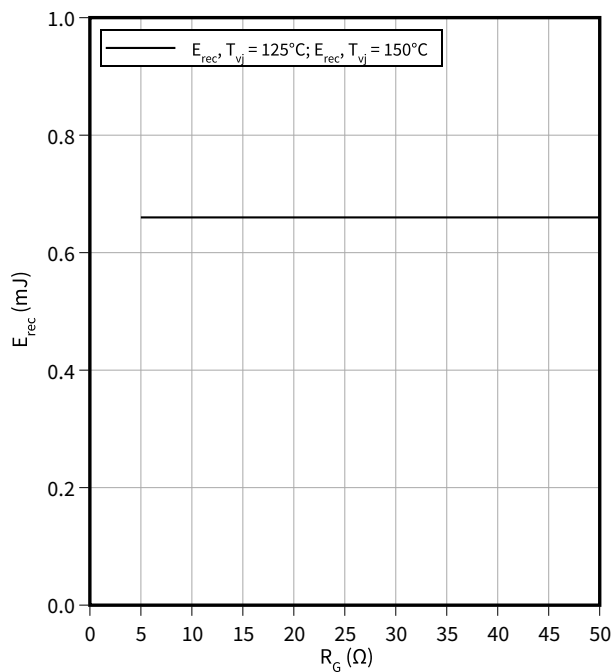
$R_G = 5 \Omega, V_R = 500 V$



Switching losses (typical), Diode, D5 / D6

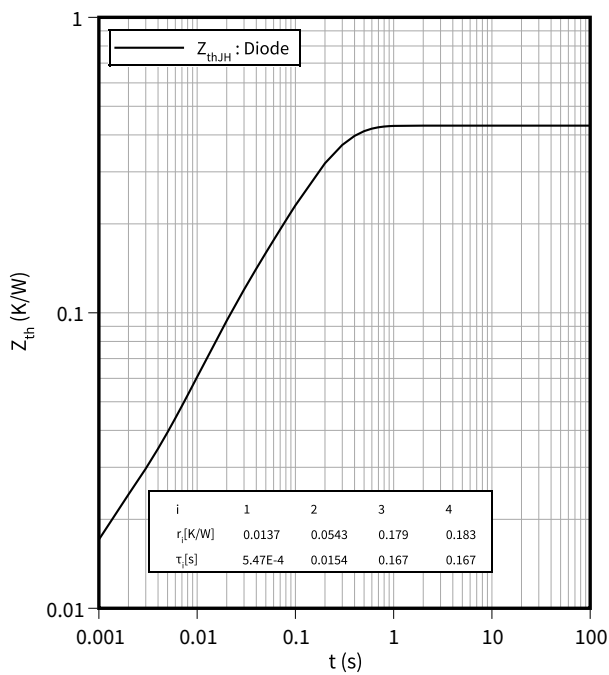
$E_{rec} = f(R_G)$

$I_F = 160 A, V_R = 500 V$



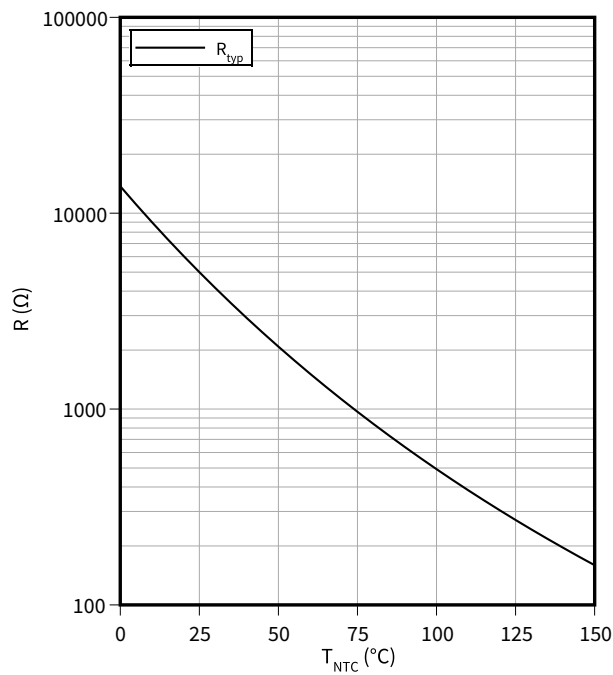
Transient thermal impedance, Diode, D5 / D6

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



10 Circuit diagram

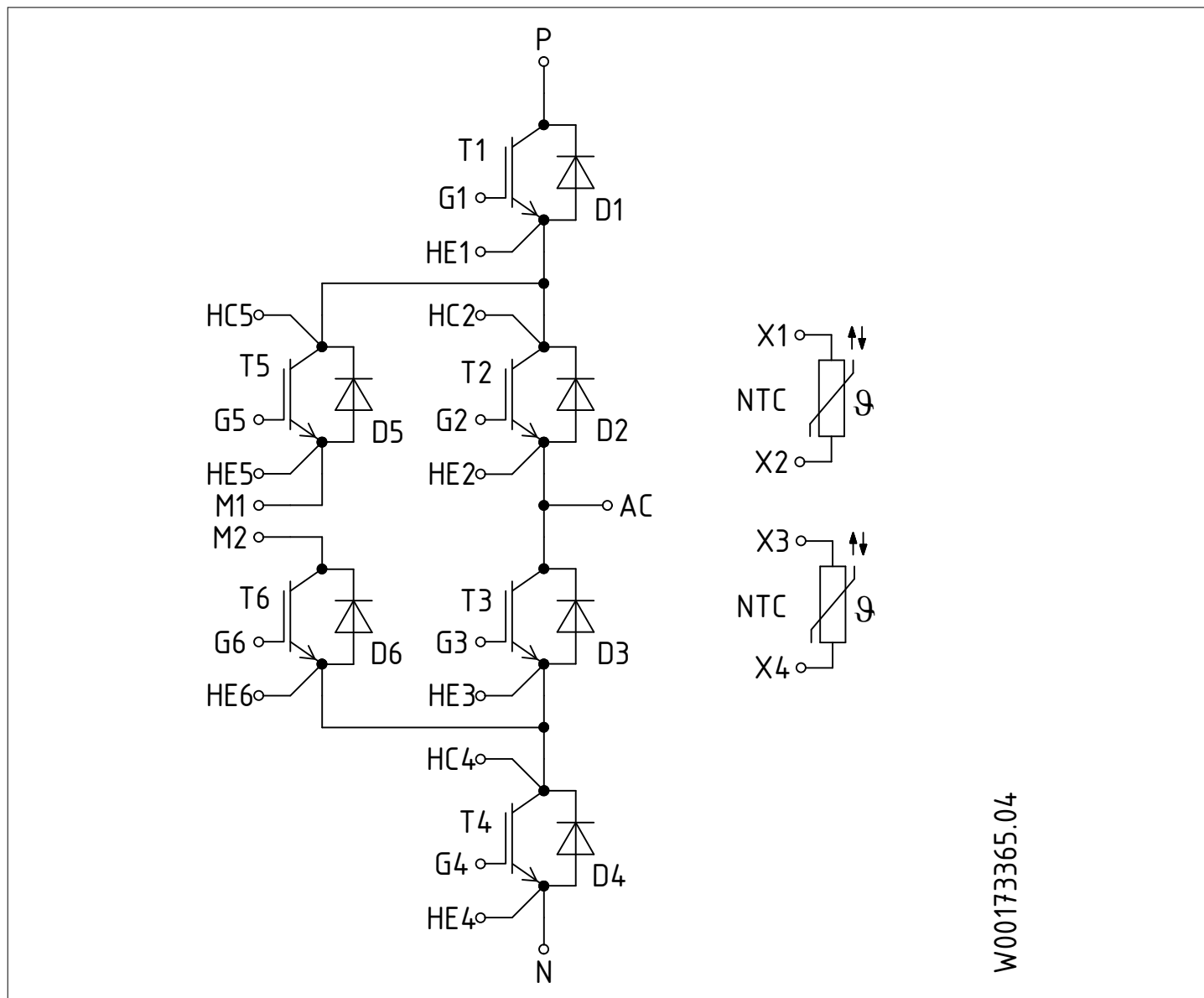


Figure 1

11 Package outlines

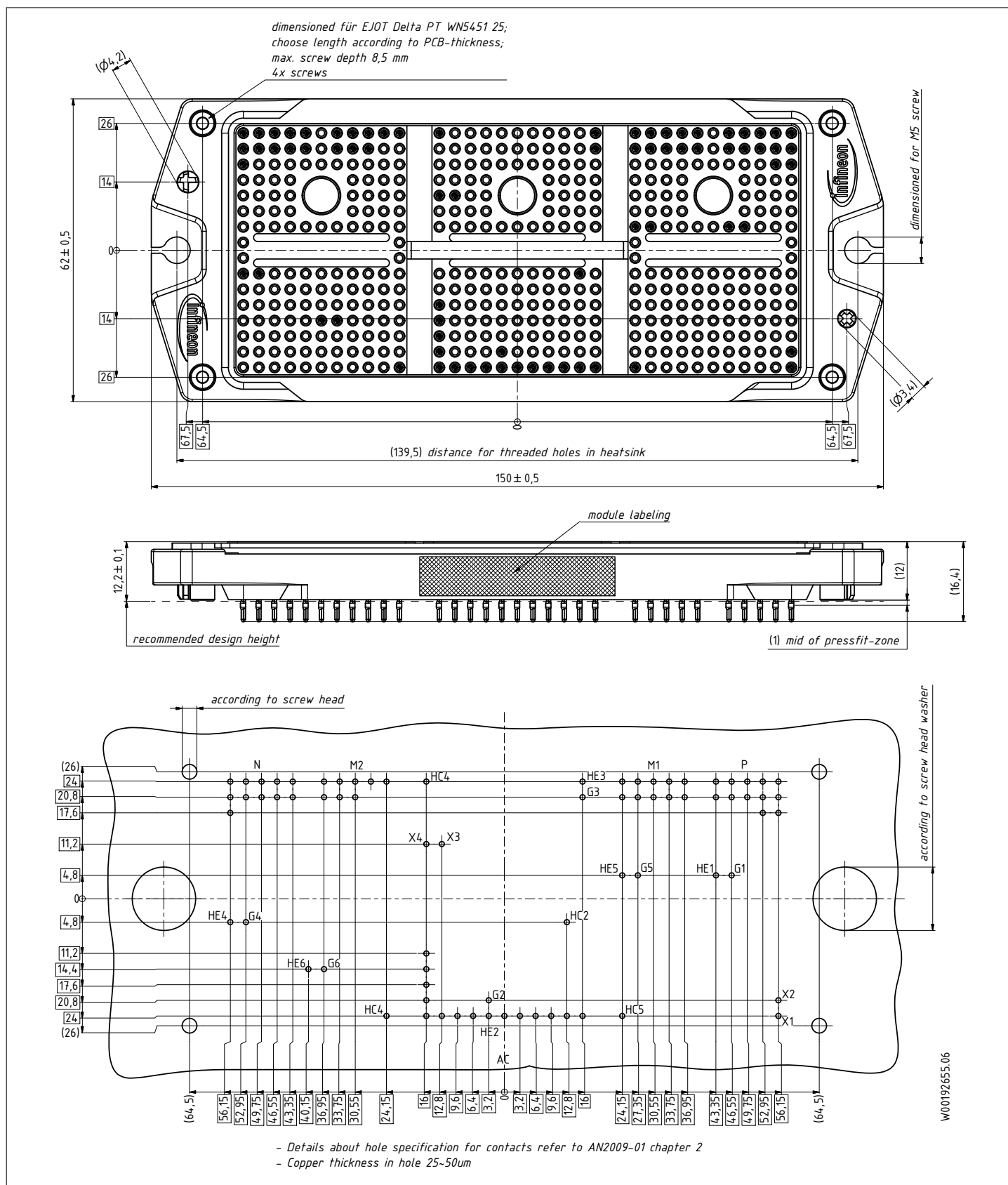


Figure 2

12 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	<i>Content</i>	<i>Digit</i>	<i>Example</i>
	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	2021-08-17	Target datasheet
1.00	2022-05-06	Final datasheet

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