

Final datasheet

EconoPACK™3 module with TRENCHSTOP™ IGBT7 and CoolSiC™ Schottky diode and NTC

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 510\text{ A} / I_{CRM} = 1020\text{ A}$
 - Low switching losses
 - TRENCHSTOP™ IGBT7
 - CoolSiC™ Schottky diode gen 5
 - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
 - 3.2 kV AC 1 minute insulation
 - Copper base plate
 - Integrated NTC temperature sensor
 - High power density



Typical appearance

Potential applications

- Solar applications
- Three-level applications
- Energy storage systems (ESS)

Product validation

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

Description

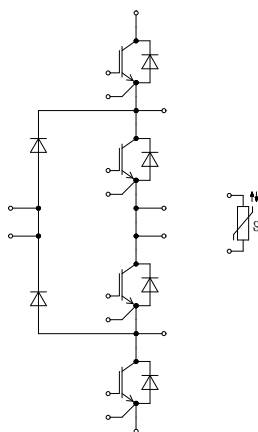


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1 Package

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
Isolation test voltage NTC	$V_{ISOL(NTC)}$	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	3.2	kV
Material of module baseplate			Cu	
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	$d_{Creep \text{ nom}}$	terminal to baseplate, nom.	10.0	mm
Clearance	$d_{Clear \text{ nom}}$	terminal to baseplate, nom.	7.5	mm
Comparative tracking index	CTI		> 200	
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}			16		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	$T_C = 25 \text{ °C}$, per switch		0.5		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_C = 25 \text{ °C}$, per switch		0.4		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for module mounting	M	- Mounting according to valid application note	3		6	Nm
Weight	G			300		g

Note: The current under continuous operation is limited to 50A 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}		$T_{vj} = 25 \text{ °C}$	1200	V
Implemented collector current	I_{CN}			510	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$	$T_C = 80 \text{ °C}$	255	A

(table continues...)

Table 3 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj\ op}$	1020	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	$V_{CE\ sat}$	$I_C = 500\ A, V_{GE} = 15\ V$		$T_{vj} = 25\ ^\circ C$	1.69	V
				$T_{vj} = 125\ ^\circ C$	1.89	
				$T_{vj} = 150\ ^\circ C$	1.93	
				$T_{vj} = 175\ ^\circ C$	1.98	
Gate threshold voltage	V_{GEth}	$I_C = 8.16\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	4.85	5.50	6.15	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V, T_{vj} = 25\ ^\circ C$		7.52		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$		1.7		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		57.9		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.37		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V, T_{vj} = 25\ ^\circ C$		10		μA
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}	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.22\ \Omega$		$T_{vj} = 25\ ^\circ C$	0.353	μs
				$T_{vj} = 125\ ^\circ C$	0.391	
				$T_{vj} = 150\ ^\circ C$	0.401	
				$T_{vj} = 175\ ^\circ C$	0.413	
Rise time (inductive load)	t_r	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.22\ \Omega$		$T_{vj} = 25\ ^\circ C$	0.029	μs
				$T_{vj} = 125\ ^\circ C$	0.033	
				$T_{vj} = 150\ ^\circ C$	0.034	
				$T_{vj} = 175\ ^\circ C$	0.036	
Turn-off delay time (inductive load)	t_{doff}	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 15\ \Omega$		$T_{vj} = 25\ ^\circ C$	2.165	μs
				$T_{vj} = 125\ ^\circ C$	2.288	
				$T_{vj} = 150\ ^\circ C$	2.319	
				$T_{vj} = 175\ ^\circ C$	2.351	

(table continues...)

Table 4 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Fall time (inductive load)	t_f	$I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 15 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.043		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.035		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.040		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.047		
Turn-on energy loss per pulse	E_{on}	$I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 15 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 0.22 \Omega$, $di/dt = 14.6 \text{ kA}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	8.95		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	10.5		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	10.6		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	11.1		
Turn-off energy loss per pulse	E_{off}	$I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 15 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 15 \Omega$, $dv/dt = 4080 \text{ V}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	23.3		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	29.7		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	30.8		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	32.9		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.138	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 5 \text{ W}/(\text{m}\cdot\text{K})$		0.023		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	$^\circ\text{C}$

Note: $T_{vj op} > 150^\circ\text{C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

3 IGBT, T2 / T3

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Collector-emitter voltage	V_{CES}		$T_{vj} = 25 \text{ }^\circ\text{C}$	1200	V
Implemented collector current	I_{CN}			510	A
Continuous DC collector current	I_{CDC}	$T_{vj max} = 175 \text{ }^\circ\text{C}$	$T_C = 80 \text{ }^\circ\text{C}$	255	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj op}$		1020	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	$V_{CE\ sat}$	$I_C = 500\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.69	2.23	V
			$T_{vj} = 125\ ^\circ C$		1.89		
			$T_{vj} = 150\ ^\circ C$		1.93		
			$T_{vj} = 175\ ^\circ C$		1.98		
Gate threshold voltage	V_{GEth}	$I_C = 8.16\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$		4.85	5.50	6.15	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V, T_{vj} = 25\ ^\circ C$			7.52		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			1.7		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			57.9		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.37		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$		25		μA
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}	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.22\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.356		μs
			$T_{vj} = 125\ ^\circ C$		0.393		
			$T_{vj} = 150\ ^\circ C$		0.403		
			$T_{vj} = 175\ ^\circ C$		0.415		
Rise time (inductive load)	t_r	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 0.22\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.030		μs
			$T_{vj} = 125\ ^\circ C$		0.035		
			$T_{vj} = 150\ ^\circ C$		0.036		
			$T_{vj} = 175\ ^\circ C$		0.037		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 18\ \Omega$	$T_{vj} = 25\ ^\circ C$		2.538		μs
			$T_{vj} = 125\ ^\circ C$		2.681		
			$T_{vj} = 150\ ^\circ C$		2.719		
			$T_{vj} = 175\ ^\circ C$		2.756		
Fall time (inductive load)	t_f	$I_C = 500\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 18\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.030		μs
			$T_{vj} = 125\ ^\circ C$		0.033		
			$T_{vj} = 150\ ^\circ C$		0.036		
			$T_{vj} = 175\ ^\circ C$		0.042		

(table continues...)

Table 6 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-on energy loss per pulse	E_{on}	$I_C = 500\text{ A}$, $V_{CC} = 600\text{ V}$, $L_\sigma = 15\text{ nH}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 0.22\text{ }\Omega$, $di/dt = 10.9\text{ kA}/\mu\text{s}$ ($T_{vj} = 175\text{ }^\circ\text{C}$)	$T_{vj} = 25\text{ }^\circ\text{C}$	11.5		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	14.7		
			$T_{vj} = 150\text{ }^\circ\text{C}$	16		
			$T_{vj} = 175\text{ }^\circ\text{C}$	17.3		
Turn-off energy loss per pulse	E_{off}	$I_C = 500\text{ A}$, $V_{CC} = 600\text{ V}$, $L_\sigma = 15\text{ nH}$, $V_{GE} = \pm 15\text{ V}$, $R_{Goff} = 18\text{ }\Omega$, $dv/dt = 3670\text{ V}/\mu\text{s}$ ($T_{vj} = 175\text{ }^\circ\text{C}$)	$T_{vj} = 25\text{ }^\circ\text{C}$	28.7		mJ
			$T_{vj} = 125\text{ }^\circ\text{C}$	32.3		
			$T_{vj} = 150\text{ }^\circ\text{C}$	36.2		
			$T_{vj} = 175\text{ }^\circ\text{C}$	37.5		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.138	K/W
Thermal resistance, case to heat sink	R_{thCH}	per IGBT, $\lambda_{grease} = 5\text{ W}/(\text{m}\cdot\text{K})$		0.023		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^\circ\text{C}$

Note: $T_{vj\text{ op}} > 150\text{ }^\circ\text{C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

4 Diode, D1 / D4

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\text{ }^\circ\text{C}$	1200	V
Continuous DC forward current	I_F			250	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		500	A
I^2t - value	I^2t	$t_P = 10\text{ ms}$, $V_R = 0\text{ V}$	$T_{vj} = 125\text{ }^\circ\text{C}$	4460	A^2s
			$T_{vj} = 175\text{ }^\circ\text{C}$	2760	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 250 \text{ A}$, $V_{GE} = 0 \text{ V}$		$T_{vj} = 25 \text{ °C}$	1.44	V
				$T_{vj} = 125 \text{ °C}$	1.72	
				$T_{vj} = 150 \text{ °C}$	1.83	
				$T_{vj} = 175 \text{ °C}$	1.97	
Reverse current	I_R	$V_R = 1200 \text{ V}$	$T_{vj} = 25 \text{ °C}$		17.2	mA
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}$, $I_F = 250 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 11.3 \text{ kA}/\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	106		A
			$T_{vj} = 125 \text{ °C}$	106		
			$T_{vj} = 150 \text{ °C}$	106		
			$T_{vj} = 175 \text{ °C}$	106		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}$, $I_F = 250 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 11.3 \text{ kA}/\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	2.1		μC
			$T_{vj} = 125 \text{ °C}$	2.1		
			$T_{vj} = 150 \text{ °C}$	2.1		
			$T_{vj} = 175 \text{ °C}$	2.1		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}$, $I_F = 250 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 11.3 \text{ kA}/\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	0.73		mJ
			$T_{vj} = 125 \text{ °C}$	0.73		
			$T_{vj} = 150 \text{ °C}$	0.73		
			$T_{vj} = 175 \text{ °C}$	0.73		
Thermal resistance, junction to case	R_{thJC}	per diode			0.241	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 5 \text{ W}/(\text{m}\cdot\text{K})$		0.024		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	°C

Note: $T_{vj\text{ op}} > 150 \text{ °C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

5 Diode, D2 / D3

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25 \text{ °C}$	1200	V
Continuous DC forward current	I_F		300	A

(table continues...)

Table 9 (continued) Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
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
			$T_{vj} = 175^\circ\text{C}$	

Table 10 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 300 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.72	2.10	V
			$T_{vj} = 125^\circ\text{C}$	1.59		
			$T_{vj} = 150^\circ\text{C}$	1.56		
			$T_{vj} = 175^\circ\text{C}$	1.52		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}, I_F = 300 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 10 \text{ kA}/\mu\text{s} (T_{vj} = 175^\circ\text{C})$	$T_{vj} = 25^\circ\text{C}$	328		A
			$T_{vj} = 125^\circ\text{C}$	423		
			$T_{vj} = 150^\circ\text{C}$	447		
			$T_{vj} = 175^\circ\text{C}$	500		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}, I_F = 300 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 10 \text{ kA}/\mu\text{s} (T_{vj} = 175^\circ\text{C})$	$T_{vj} = 25^\circ\text{C}$	21.8		μC
			$T_{vj} = 125^\circ\text{C}$	42		
			$T_{vj} = 150^\circ\text{C}$	48.1		
			$T_{vj} = 175^\circ\text{C}$	55.7		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}, I_F = 300 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 10 \text{ kA}/\mu\text{s} (T_{vj} = 175^\circ\text{C})$	$T_{vj} = 25^\circ\text{C}$	9.79		mJ
			$T_{vj} = 125^\circ\text{C}$	19.4		
			$T_{vj} = 150^\circ\text{C}$	22.3		
			$T_{vj} = 175^\circ\text{C}$	25.7		
Thermal resistance, junction to case	R_{thJC}	per diode			0.252	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 5 \text{ W}/(\text{m}\cdot\text{K})$		0.027		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	$^\circ\text{C}$

Note: Note: $T_{vj op} > 150^\circ\text{C}$ is allowed for operation at overload conditions. For detailed specifications, please refer to AN 2018-14.

6 Diode, D5 / D6

Table 11 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25\text{ °C}$	1200	V
Continuous DC forward current	I_F			200	A
Repetitive peak forward current	I_{FRM}	$t_P = 1\text{ ms}$		400	A
I^2t - value	I^2t	$t_P = 10\text{ ms}, V_R = 0\text{ V}$	$T_{vj} = 125\text{ °C}$	2110	A^2s
			$T_{vj} = 175\text{ °C}$	1210	

Table 12 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 200\text{ A}, V_{GE} = 0\text{ V}$	$T_{vj} = 25\text{ °C}$	1.44	1.75	V
			$T_{vj} = 125\text{ °C}$	1.72		
			$T_{vj} = 150\text{ °C}$	1.83		
			$T_{vj} = 175\text{ °C}$	1.97		
Reverse current	I_R	$V_R = 1200\text{ V}$	$T_{vj} = 25\text{ °C}$		15.7	mA
Peak reverse recovery current	I_{RM}	$V_{CC} = 600\text{ V}, I_F = 200\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 12.8\text{ kA}/\mu s (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$	112		A
			$T_{vj} = 125\text{ °C}$	112		
			$T_{vj} = 150\text{ °C}$	112		
			$T_{vj} = 175\text{ °C}$	112		
Recovered charge	Q_r	$V_{CC} = 600\text{ V}, I_F = 200\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 12.8\text{ kA}/\mu s (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$	1.6		μC
			$T_{vj} = 125\text{ °C}$	1.6		
			$T_{vj} = 150\text{ °C}$	1.6		
			$T_{vj} = 175\text{ °C}$	1.6		
Reverse recovery energy	E_{rec}	$V_{CC} = 600\text{ V}, I_F = 200\text{ A}, V_{GE} = -15\text{ V}, -di_F/dt = 12.8\text{ kA}/\mu s (T_{vj} = 175\text{ °C})$	$T_{vj} = 25\text{ °C}$	0.57		mJ
			$T_{vj} = 125\text{ °C}$	0.57		
			$T_{vj} = 150\text{ °C}$	0.57		
			$T_{vj} = 175\text{ °C}$	0.57		
Thermal resistance, junction to case	R_{thJC}	per diode			0.316	K/W
Thermal resistance, case to heat sink	R_{thCH}	per diode, $\lambda_{grease} = 5\text{ W}/(m \cdot K)$		0.032		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	°C

Note: $T_{j op} > 150^{\circ}\text{C}$ 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}	$T_{NTC} = 25^{\circ}\text{C}$		5		k Ω
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100^{\circ}\text{C}$, $R_{100} = 493 \Omega$	-5		5	%
Power dissipation	P_{25}	$T_{NTC} = 25^{\circ}\text{C}$			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
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

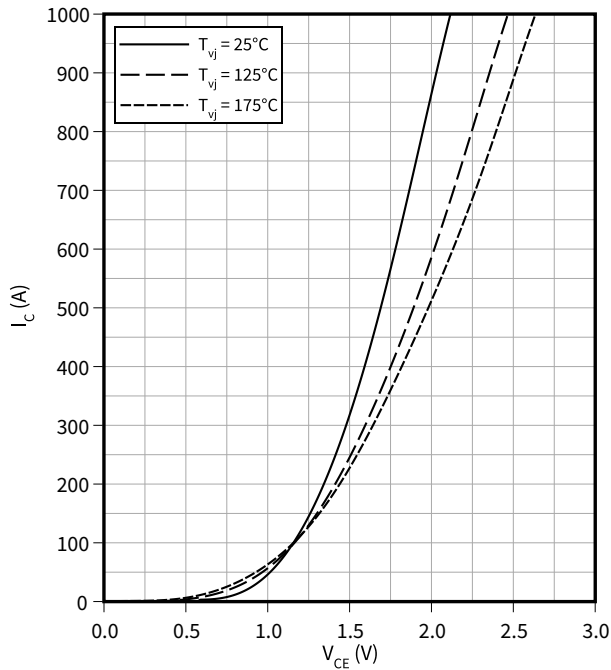
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.

8 Characteristics diagrams

Output characteristic (typical), IGBT, T1 / T4

$I_C = f(V_{CE})$

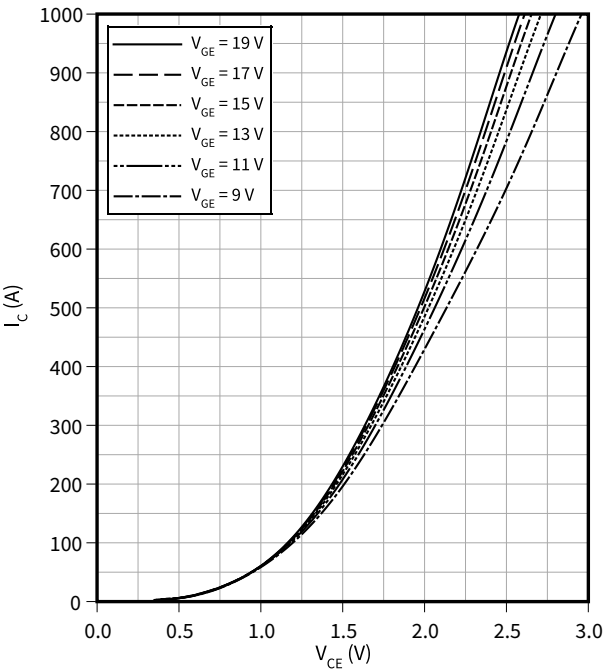
$V_{GE} = 15\text{ V}$



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

$I_C = f(V_{CE})$

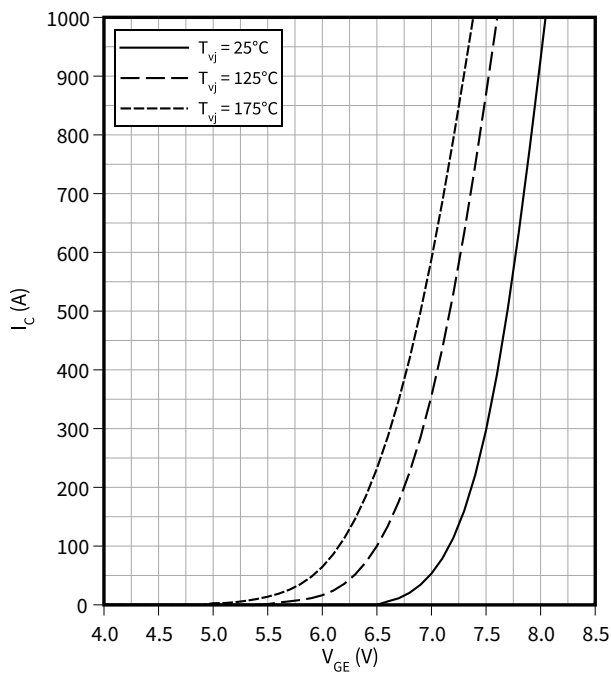
$T_{vj} = 175^\circ\text{C}$



Transfer characteristic (typical), IGBT, T1 / T4

$I_C = f(V_{GE})$

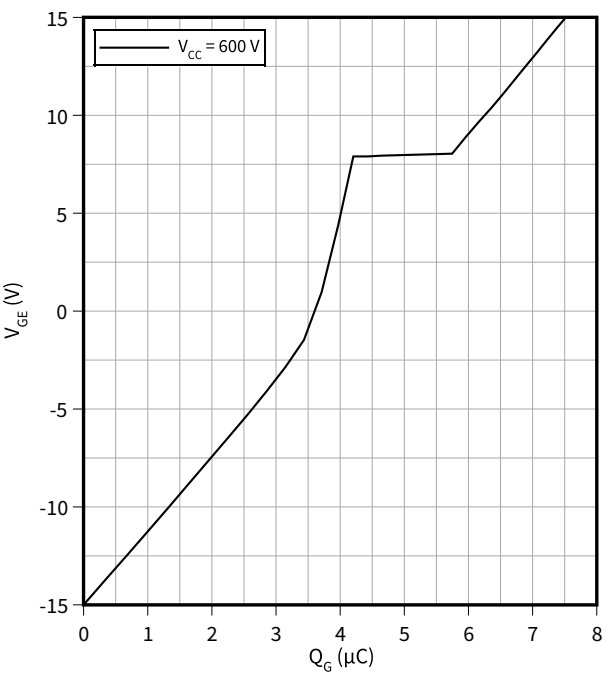
$V_{CE} = 20\text{ V}$



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

$V_{GE} = f(Q_G)$

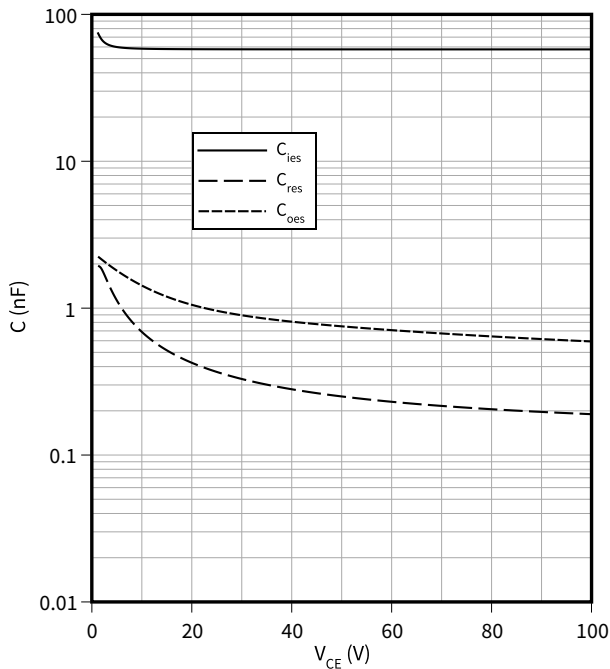
$I_C = 500\text{ A}, T_{vj} = 25^\circ\text{C}$



8 Characteristics diagrams

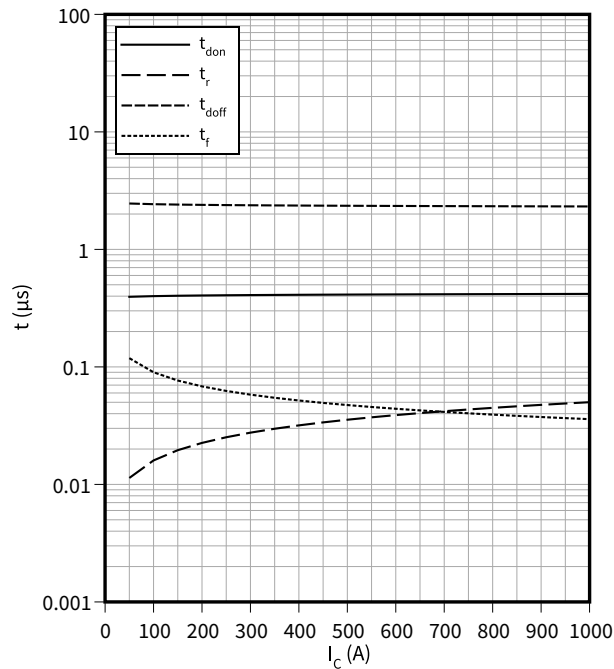
Capacity characteristic (typical), IGBT, T1 / T4

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



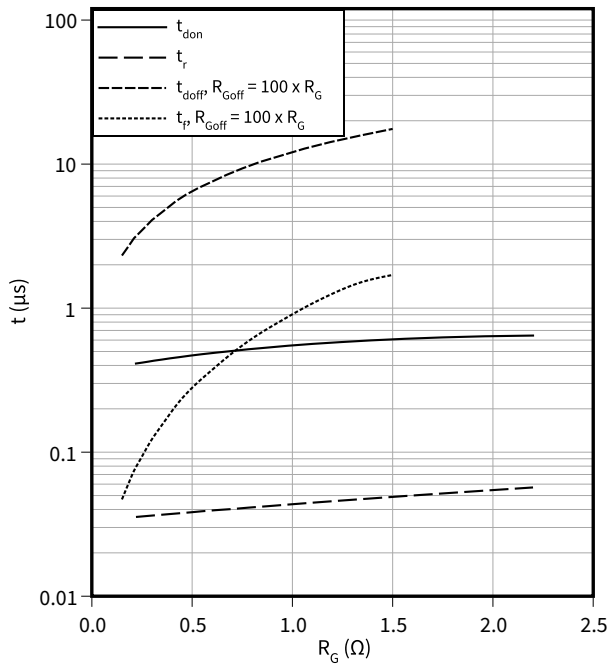
Switching times (typical), IGBT, T1 / T4

$t = f(I_C)$
 $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$, $R_{Goff} = 15 \text{ } \Omega$, $R_{Gon} = 0.22 \text{ } \Omega$, $V_{GE} = \pm 15 \text{ V}$



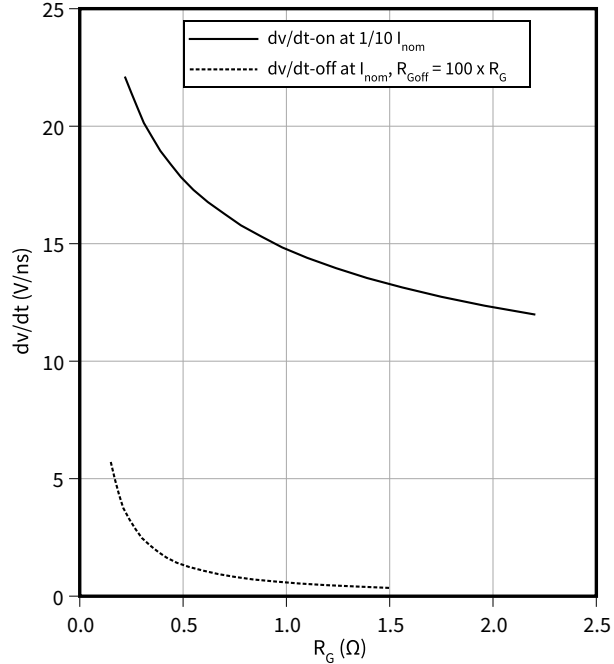
Switching times (typical), IGBT, T1 / T4

$t = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$



Voltage slope (typical), IGBT, T1 / T4

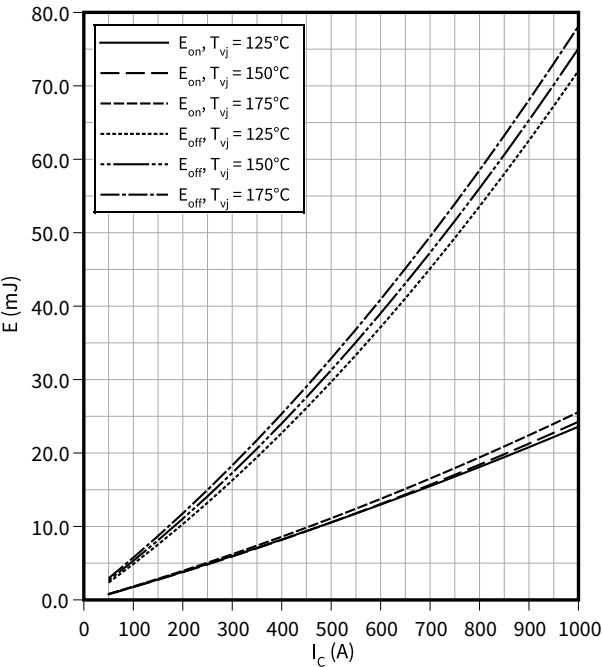
$dv/dt = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$



8 Characteristics diagrams

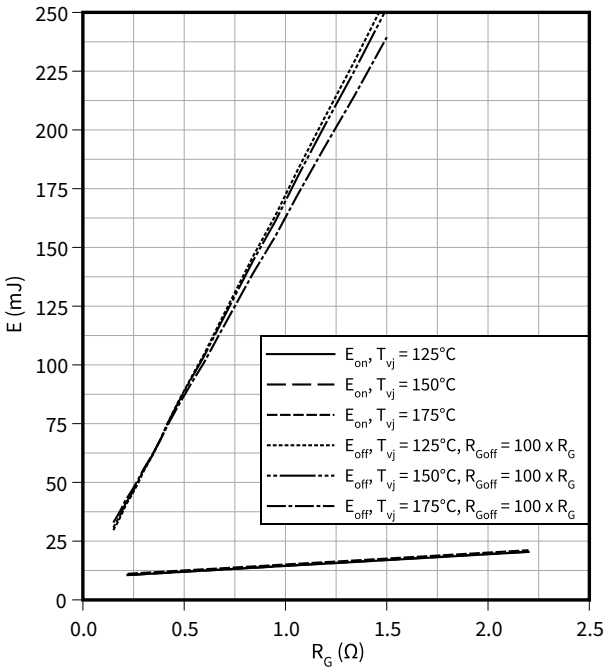
Switching losses (typical), IGBT, T1 / T4

$E = f(I_C)$
 $R_{Goff} = 15\ \Omega$, $R_{Gon} = 0.22\ \Omega$, $V_{GE} = \pm 15\ V$, $V_{CC} = 600\ V$, $T_{vj} = 175\ ^\circ C$



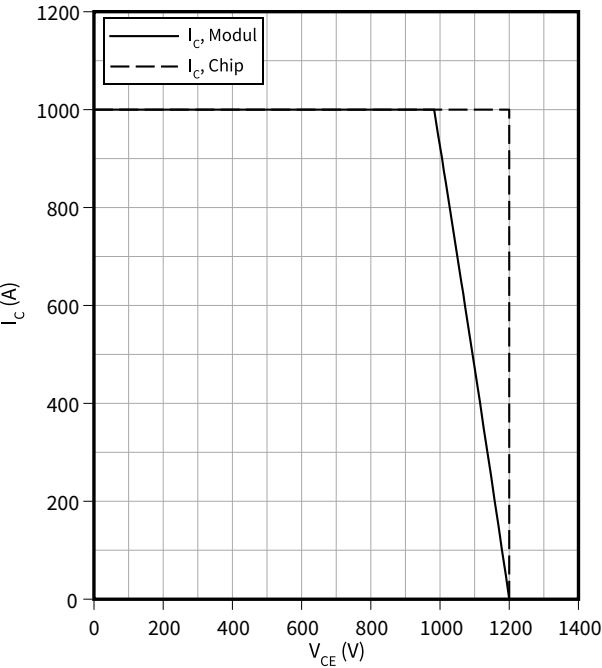
Switching losses (typical), IGBT, T1 / T4

$E = f(R_G)$
 $V_{GE} = \pm 15\ V$, $I_C = 500\ A$, $V_{CC} = 600\ V$, $T_{vj} = 175\ ^\circ C$



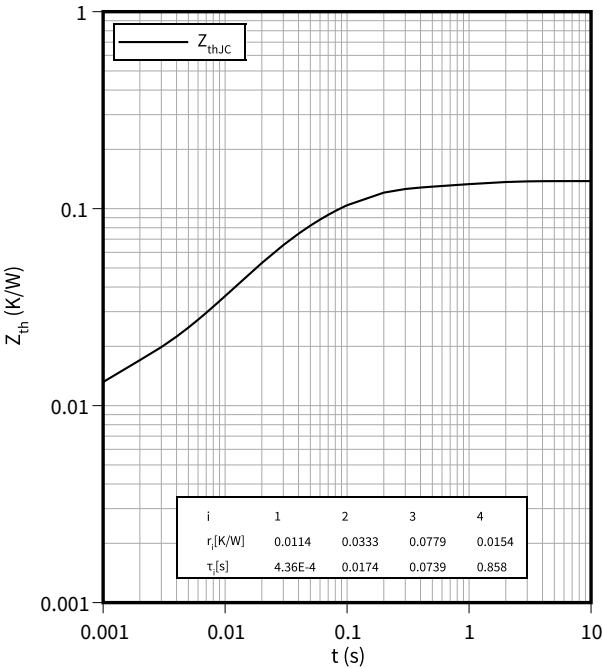
Reverse bias safe operating area (RBSOA), IGBT, T1 / T4

$I_C = f(V_{CE})$
 $R_{Goff} = 15\ \Omega$, $V_{GE} = \pm 15\ V$, $T_{vj} = 175\ ^\circ C$



Transient thermal impedance, IGBT, T1 / T4

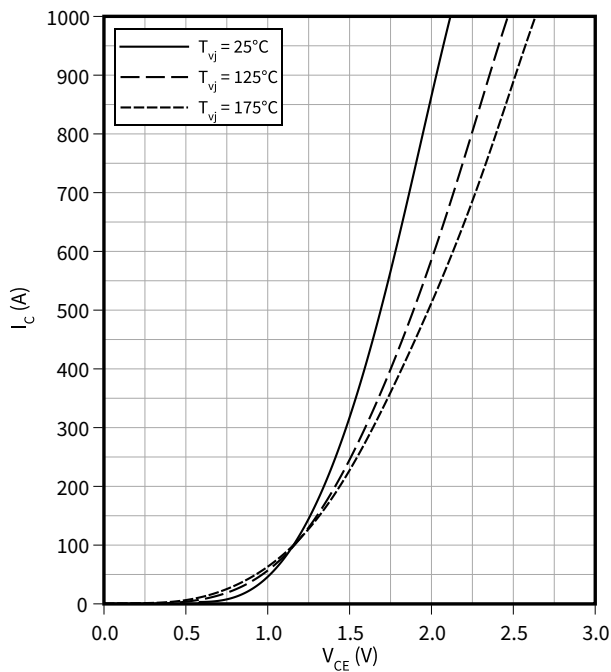
$Z_{th} = f(t)$



8 Characteristics diagrams

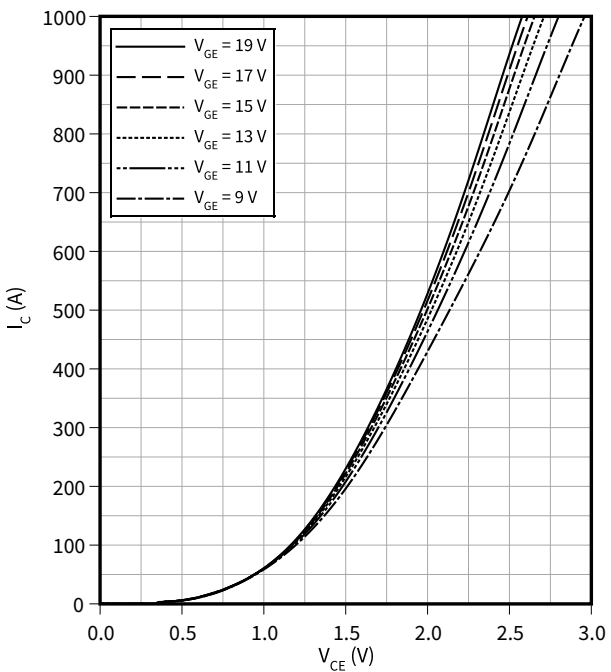
Output characteristic (typical), IGBT, T2 / T3

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



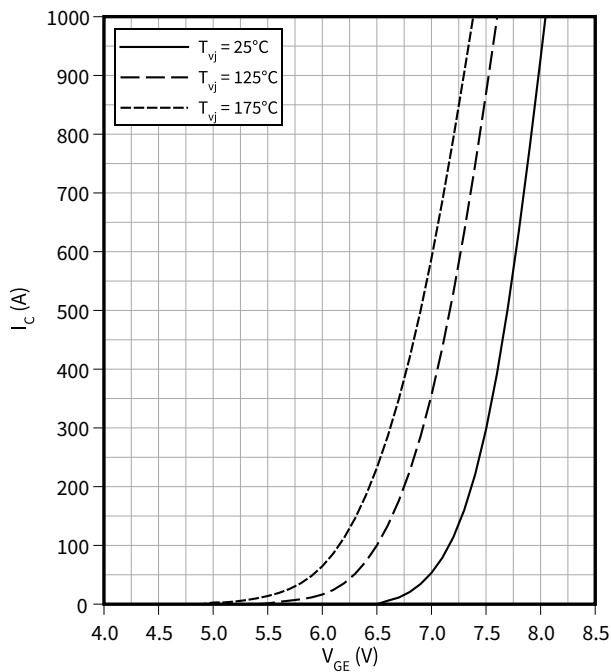
Output characteristic field (typical), IGBT, T2 / T3

$I_C = f(V_{CE})$
 $T_{vj} = 175\text{ °C}$



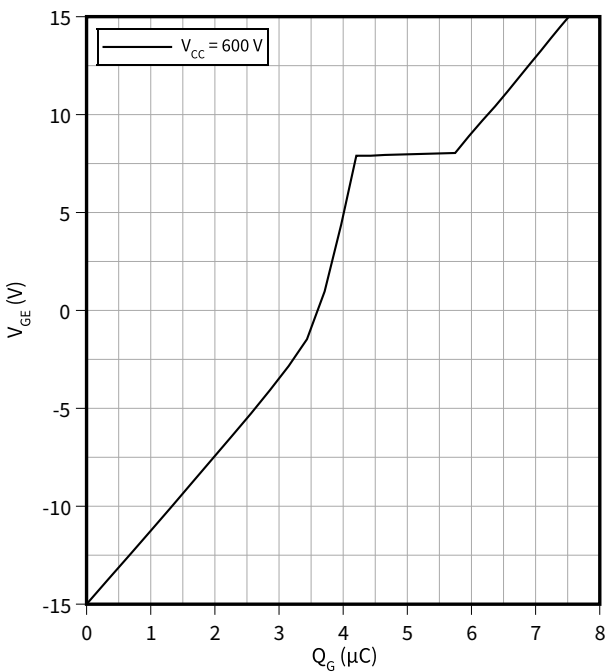
Transfer characteristic (typical), IGBT, T2 / T3

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



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

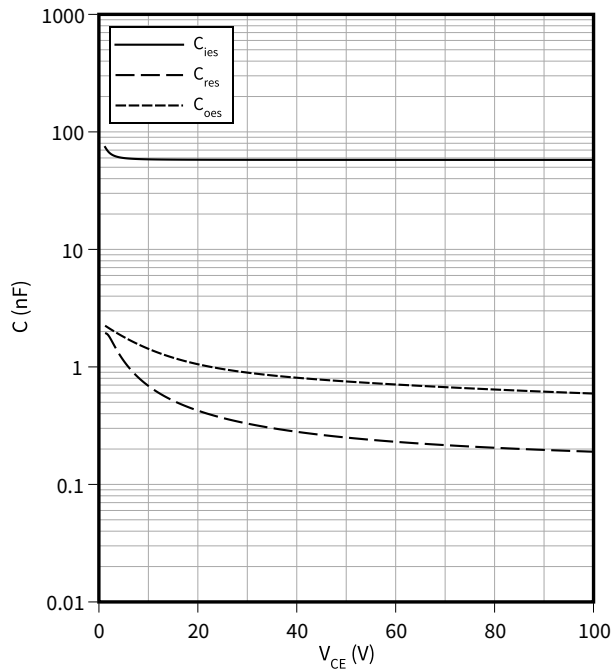
$V_{GE} = f(Q_G)$
 $I_C = 500\text{ A}, T_{vj} = 25\text{ °C}$



8 Characteristics diagrams

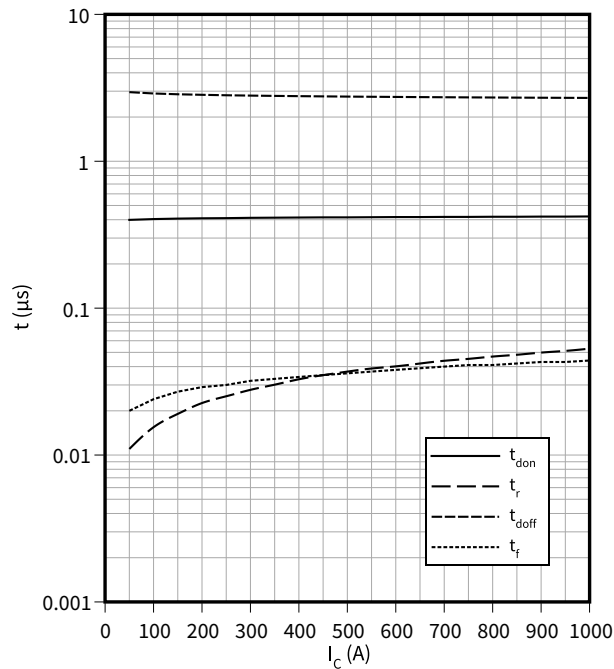
Capacity characteristic (typical), IGBT, T2 / T3

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



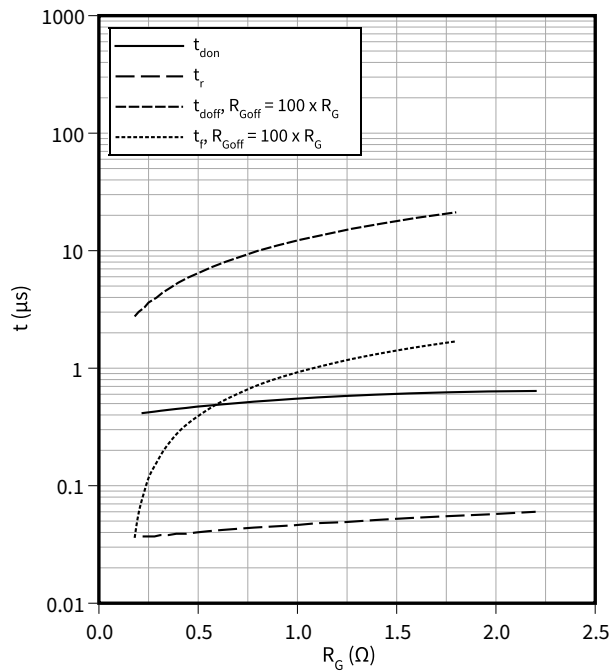
Switching times (typical), IGBT, T2 / T3

$t = f(I_C)$
 $R_{Goff} = 18 \text{ } \Omega$, $R_{Gon} = 0.22 \text{ } \Omega$, $V_{GE} = \pm 15 \text{ V}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$



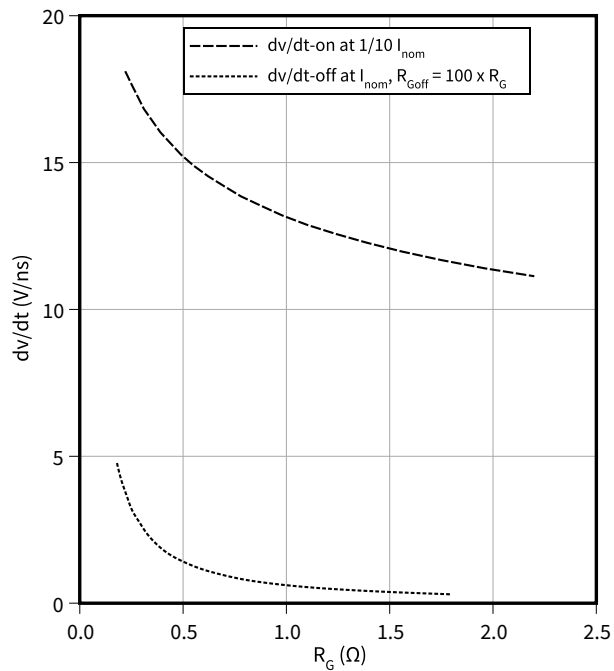
Switching times (typical), IGBT, T2 / T3

$t = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 175 \text{ }^{\circ}\text{C}$



Voltage slope (typical), IGBT, T2 / T3

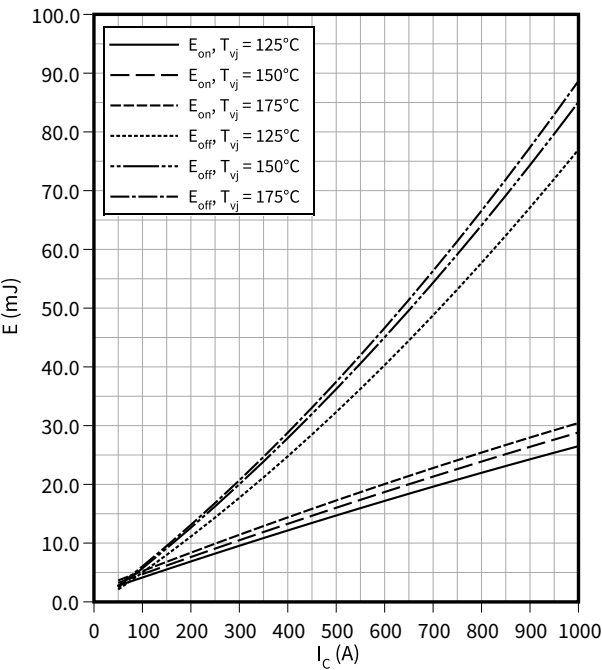
$dv/dt = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$



8 Characteristics diagrams

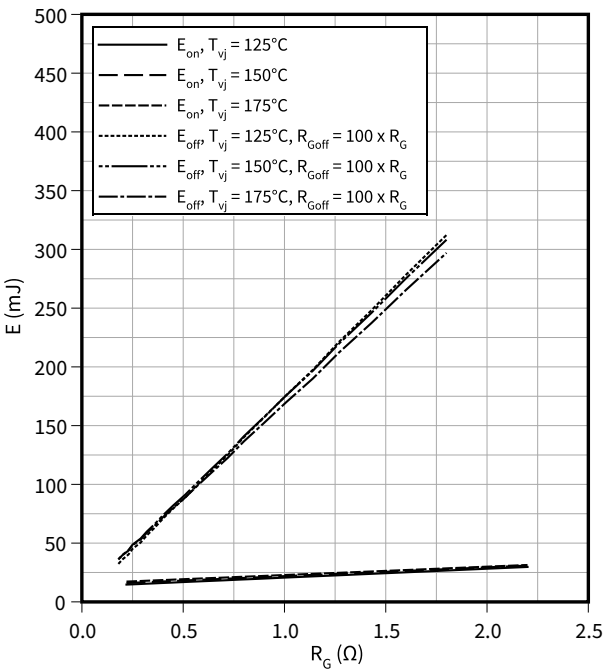
Switching losses (typical), IGBT, T2 / T3

$E = f(I_C)$
 $R_{Goff} = 18 \Omega$, $R_{Gon} = 0.22 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $V_{CC} = 600 \text{ V}$



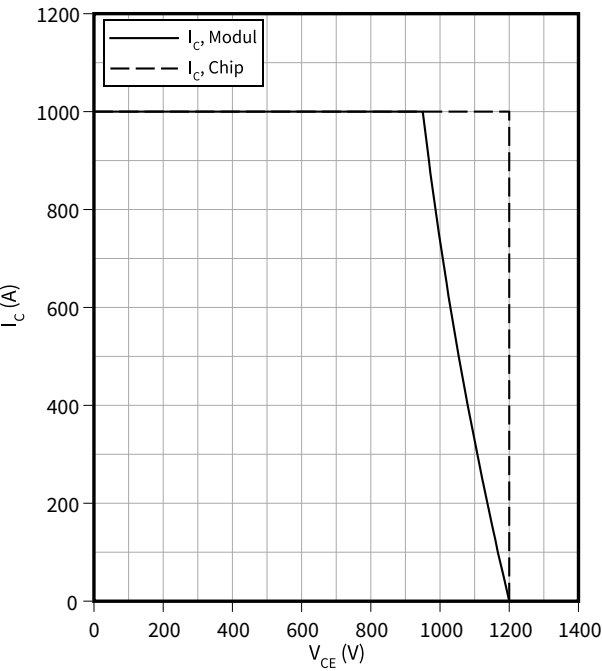
Switching losses (typical), IGBT, T2 / T3

$E = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}$, $I_C = 500 \text{ A}$, $V_{CC} = 600 \text{ V}$



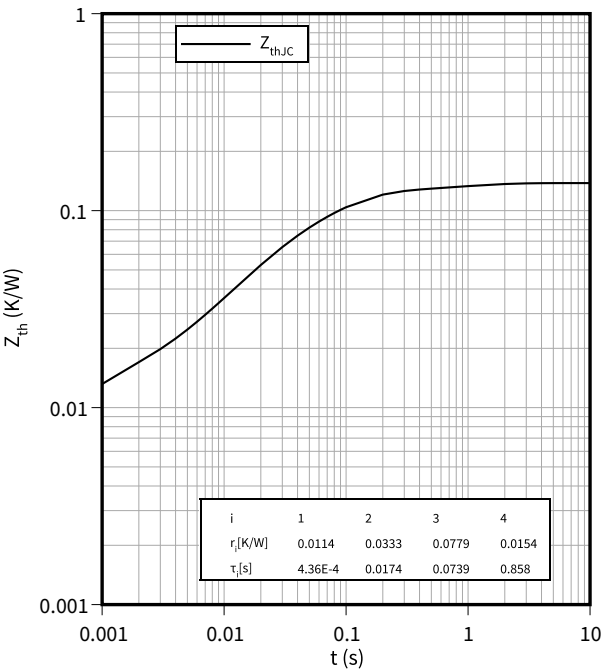
Reverse bias safe operating area (RBSOA), IGBT, T2 / T3

$I_C = f(V_{CE})$
 $R_{Goff} = 18 \Omega$, $V_{GE} = \pm 15 \text{ V}$, $T_{vj} = 175 \text{ °C}$



Transient thermal impedance, IGBT, T2 / T3

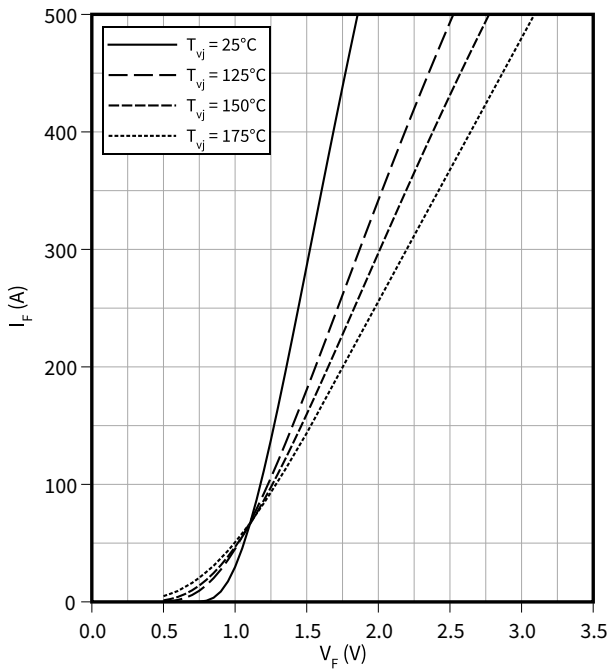
$Z_{th} = f(t)$



8 Characteristics diagrams

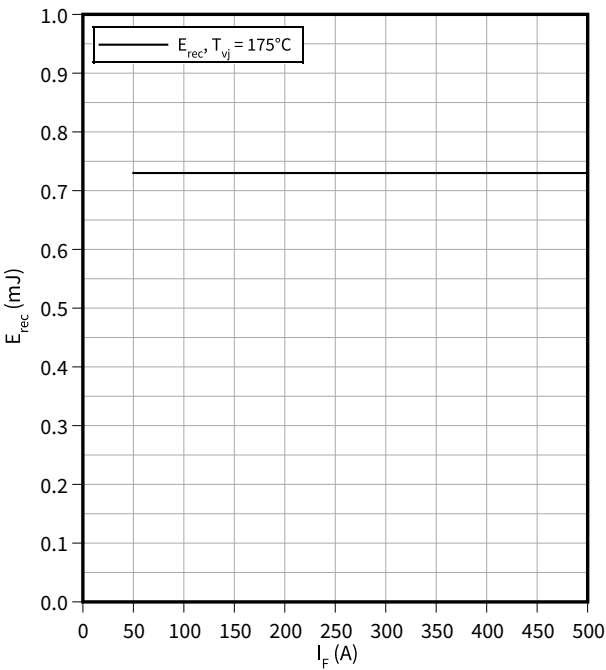
Forward characteristic (typical), Diode, D1 / D4

$I_F = f(V_F)$



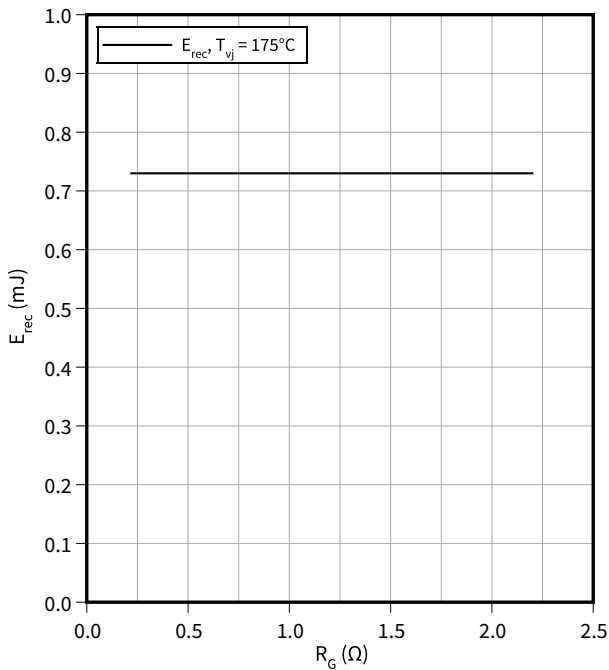
Switching losses (typical), Diode, D1 / D4

$E_{rec} = f(I_F)$
 $R_G = 0.22\ \Omega$, $V_{CC} = 600\ \text{V}$



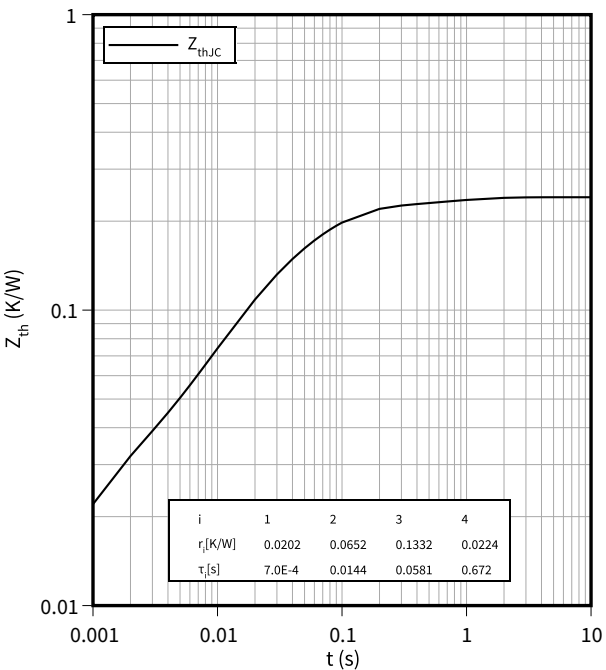
Switching losses (typical), Diode, D1 / D4

$E_{rec} = f(R_G)$
 $I_F = 250\ \text{A}$, $V_{CC} = 600\ \text{V}$



Transient thermal impedance, Diode, D1 / D4

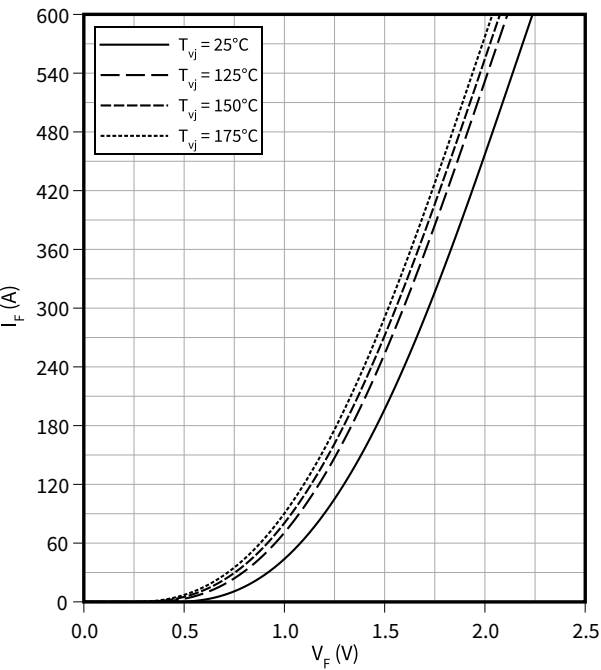
$Z_{th} = f(t)$



8 Characteristics diagrams

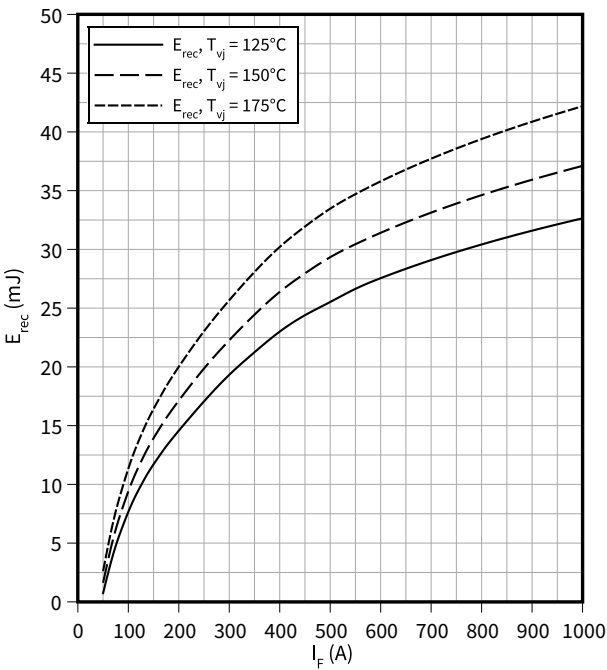
Forward characteristic (typical), Diode, D2 / D3

$I_F = f(V_F)$



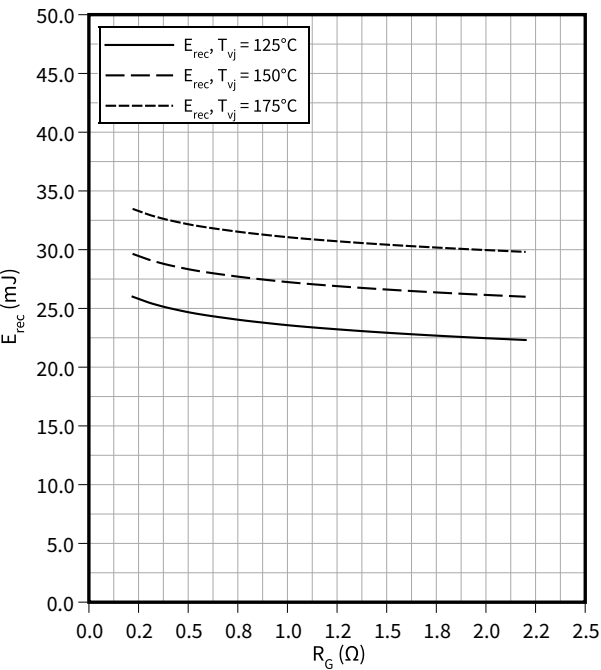
Switching losses (typical), Diode, D2 / D3

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.22\ \Omega$, $V_{CE} = 600\ \text{V}$



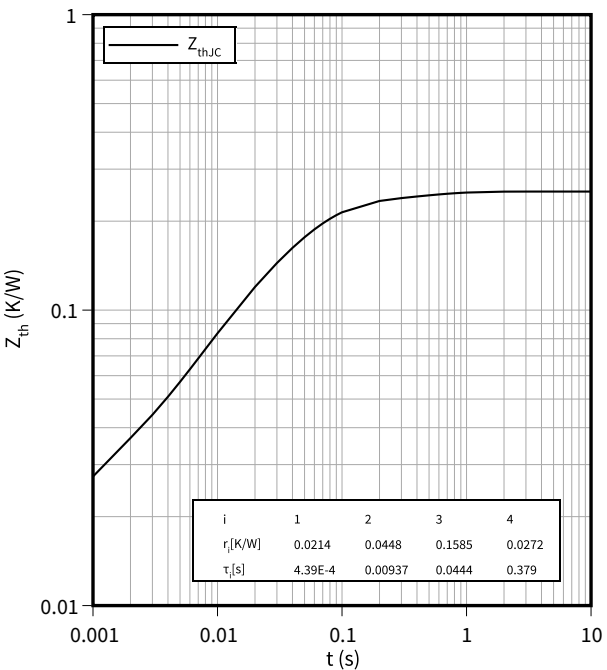
Switching losses (typical), Diode, D2 / D3

$E_{rec} = f(R_G)$
 $V_{CE} = 600\ \text{V}$, $I_F = 500\ \text{A}$



Transient thermal impedance, Diode, D2 / D3

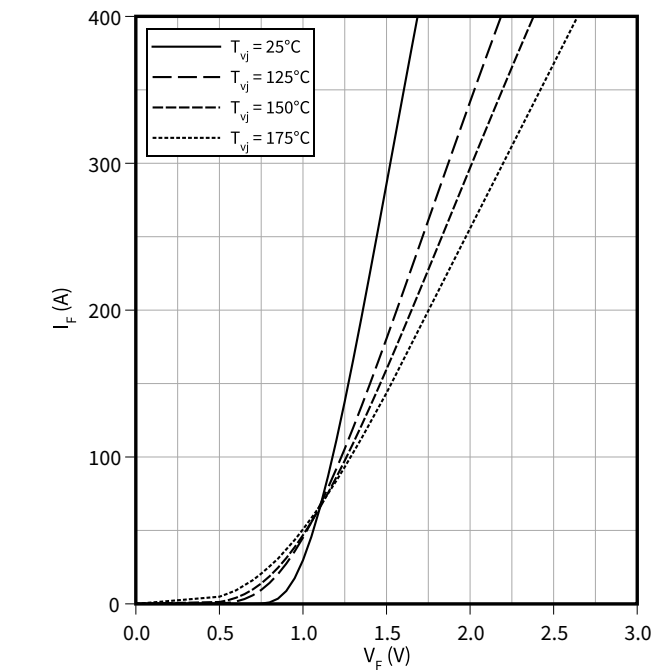
$Z_{th} = f(t)$



8 Characteristics diagrams

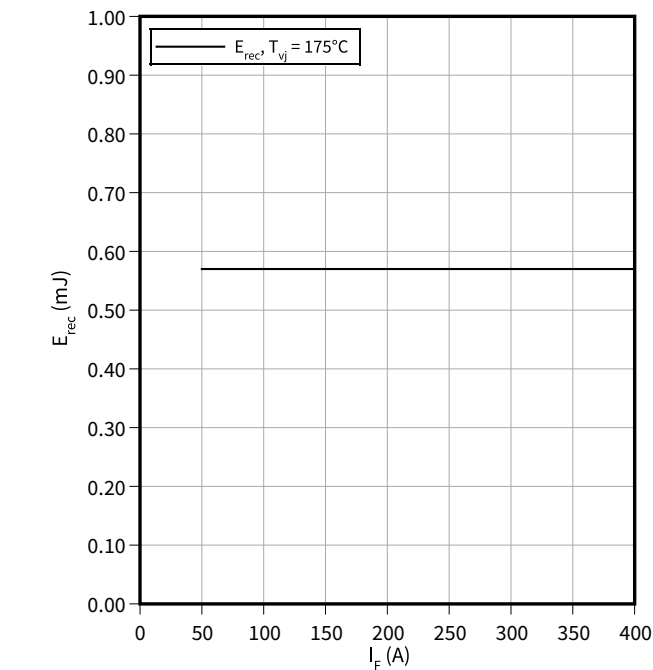
Forward characteristic (typical), Diode, D5 / D6

$I_F = f(V_F)$



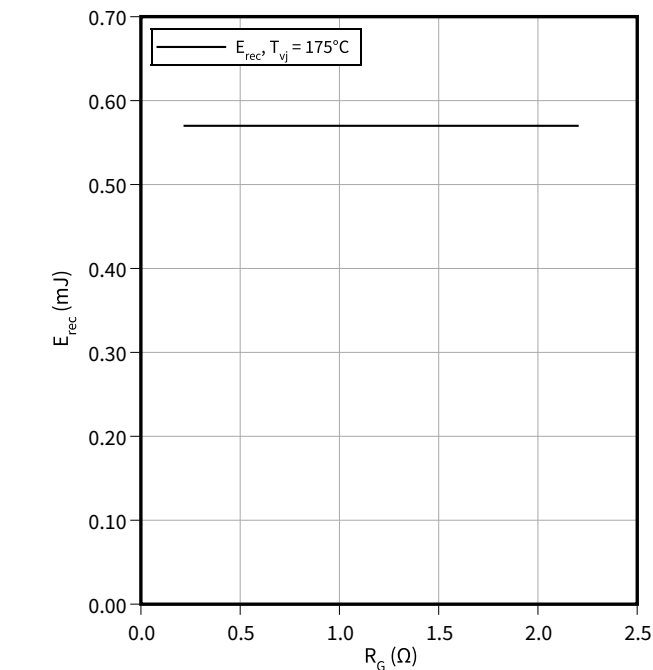
Switching losses (typical), Diode, D5 / D6

$E_{rec} = f(I_F)$
 $R_{Gon} = 0.22 \Omega, V_{CE} = 600 V$



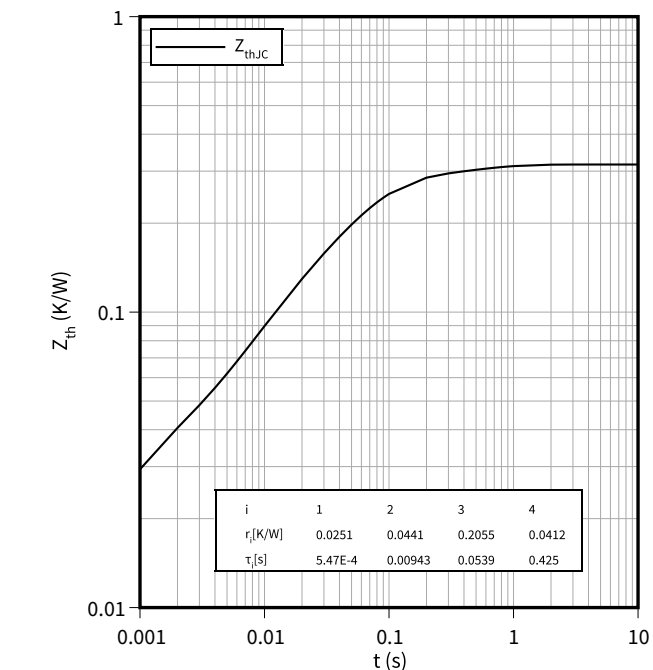
Switching losses (typical), Diode, D5 / D6

$E_{rec} = f(R_G)$
 $V_{CE} = 600 V, I_F = 200 A$



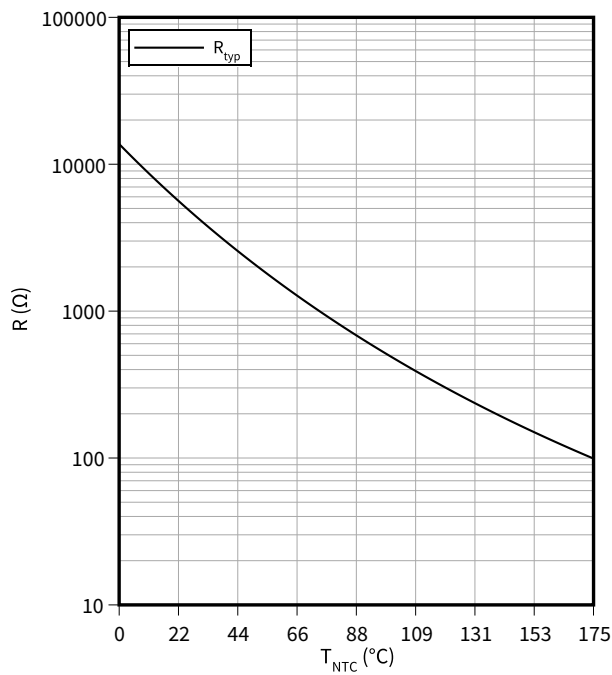
Transient thermal impedance, Diode, D5 / D6

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 Circuit diagram

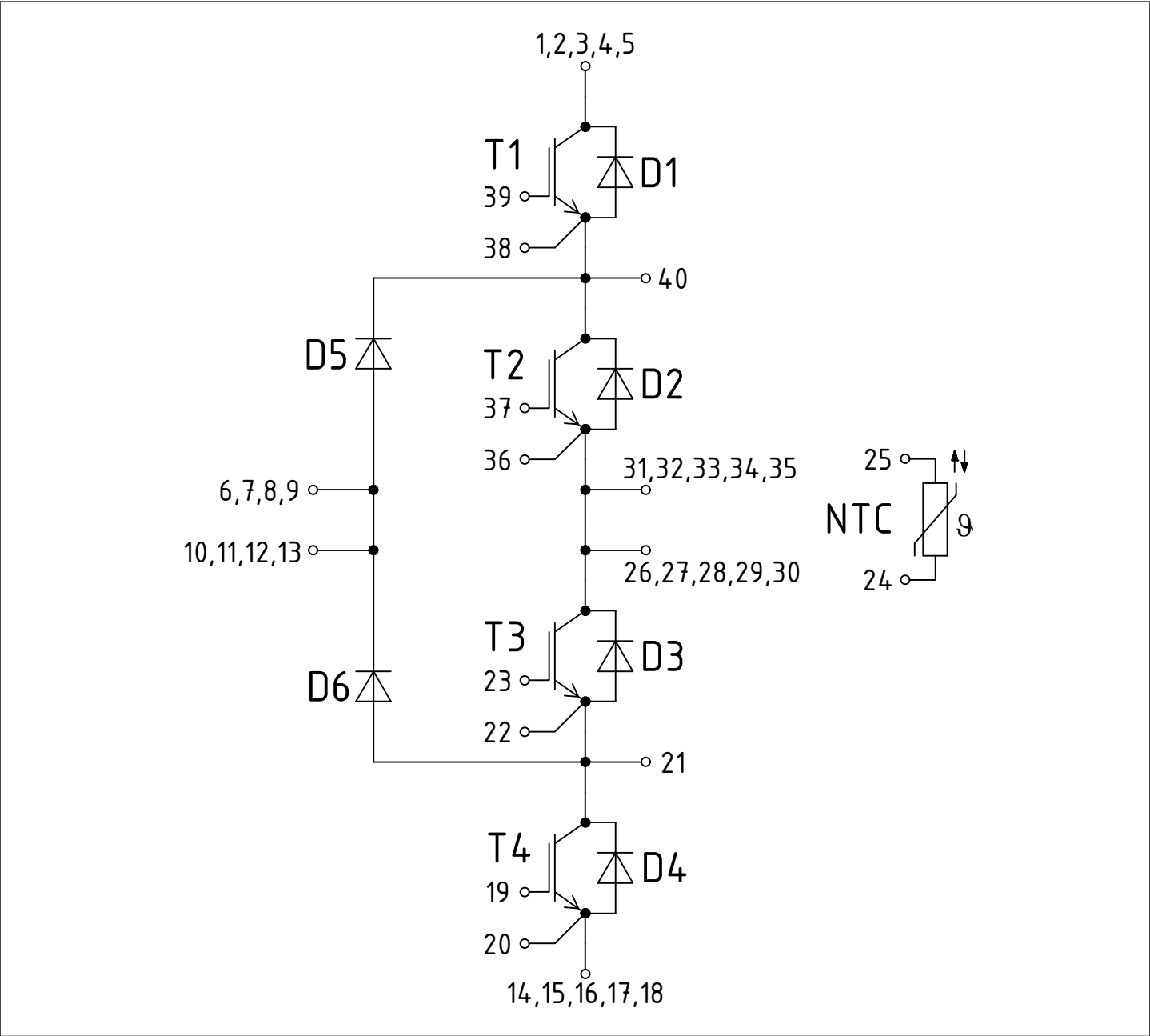


Figure 1



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	<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	 7154914284655054991153071549142846550549911530		

Figure 3



Revision history

Revision history

Document revision	Date of release	Description of changes
0.10	2024-09-11	Initial version
0.20	2025-03-14	Preliminary datasheet
1.00	2025-05-28	Final datasheet
1.10	2025-08-12	Final datasheet

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