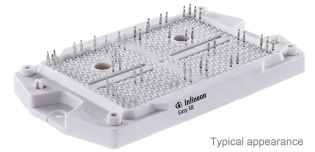


Final datasheet**EasyPACK™ module with CoolSiC™ Trench MOSFET and PressFIT / NTC****Features**

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 200\text{ A} / I_{CRM} = 400\text{ A}$
 - Increased DC-link voltage
 - High current density
 - Low switching losses
 - Suitable Infineon gate drivers can be found under <https://www.infineon.com/gdfinder>
- Mechanical features
 - High current pin
 - Integrated NTC temperature sensor
 - PressFIT contact technology
 - Rugged mounting due to integrated mounting clamps

**Potential applications**

- Three-level applications
- High-frequency switching application
- Solar applications

Product validation

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

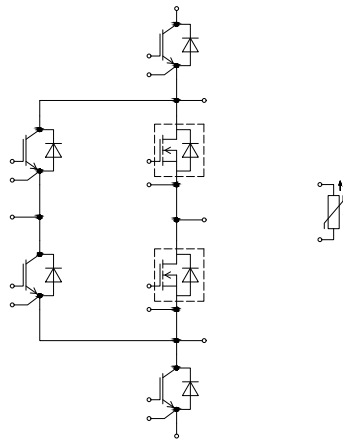
Description

Table of contents

	Description	1
	Features	1
	Potential applications	1
	Product validation	1
	Table of contents	2
1	Package	3
2	IGBT, T1 / T4	3
3	MOSFET, T2 / T3	5
4	Body diode (MOSFET, T2 / T3)	7
5	IGBT, T5 / T6	8
6	Diode, D1 / D4	9
7	Diode, D5 / D6	10
8	NTC-Thermistor	11
9	Characteristics diagrams	12
10	Circuit diagram	27
11	Package outlines	28
12	Module label code	29
	Revision history	30
	Disclaimer	31

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
Internal isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
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}			39		nH
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_H = 25 \text{ °C}$, per switch		2.4		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 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}		$T_{vj} = 25 \text{ °C}$	950	V
Implemented collector current	I_{CN}			200	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ °C}$	$T_H = 65 \text{ °C}$	180	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj \text{ op}}$		400	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	$V_{CE\ sat}$	$I_C = 200\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$		1.30	1.40	V
			$T_{vj} = 125\ ^\circ C$		1.35		
			$T_{vj} = 150\ ^\circ C$		1.35		
Gate threshold voltage	V_{GETh}	$I_C = 3.25\ mA, V_{CE} = 20\ V, T_{vj} = 25\ ^\circ C$		4.15	4.9	5.65	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CC} = 600\ V, T_{vj} = 25\ ^\circ C$			2.05		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$			1.5		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			24.6		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$			0.114		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 950\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$			37	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}	$I_C = 200\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 18\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.298		μs
			$T_{vj} = 125\ ^\circ C$		0.268		
			$T_{vj} = 150\ ^\circ C$		0.254		
Rise time (inductive load)	t_r	$I_C = 200\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 18\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.045		μs
			$T_{vj} = 125\ ^\circ C$		0.056		
			$T_{vj} = 150\ ^\circ C$		0.059		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 200\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 82\ \Omega$	$T_{vj} = 25\ ^\circ C$		3.390		μs
			$T_{vj} = 125\ ^\circ C$		3.580		
			$T_{vj} = 150\ ^\circ C$		3.590		
Fall time (inductive load)	t_f	$I_C = 200\ A, V_{CC} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 82\ \Omega$	$T_{vj} = 25\ ^\circ C$		0.212		μs
			$T_{vj} = 125\ ^\circ C$		0.372		
			$T_{vj} = 150\ ^\circ C$		0.443		
Turn-on energy loss per pulse	E_{on}	$I_C = 200\ A, V_{CC} = 600\ V, L_\sigma = 7\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 18\ \Omega, di/dt = 2800\ A/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		21.9		mJ
			$T_{vj} = 125\ ^\circ C$		27		
			$T_{vj} = 150\ ^\circ C$		28.5		
Turn-off energy loss per pulse	E_{off}	$I_C = 200\ A, V_{CC} = 600\ V, L_\sigma = 7\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 82\ \Omega, dv/dt = 1600\ V/\mu s (T_{vj} = 150\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$		32		mJ
			$T_{vj} = 125\ ^\circ C$		40.3		
			$T_{vj} = 150\ ^\circ C$		42.8		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{grease} = 3.3\ W/(m \cdot K)$			0.439		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 MOSFET, T2 / T3

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Drain-source voltage	V_{DSS}		$T_{vj} = 25\,^{\circ}\text{C}$	1200	V
Implemented drain current	I_{DN}			240	A
Continuous DC drain current	I_{DDC}	$T_{vj} = 175\,^{\circ}\text{C}$, $V_{GS} = 18\,\text{V}$	$T_H = 65\,^{\circ}\text{C}$	215	A
Repetitive peak drain current	I_{DRM}	verified by design, t_p limited by $T_{vj\,max}$		400	A
Gate-source voltage, max. transient voltage	V_{GS}	$D < 0.01$		-10/23	V
Gate-source voltage, max. static voltage	V_{GS}			-7/20	V

Table 6 Recommended values

Parameter	Symbol	Note or test condition	Values	Unit
On-state gate voltage	$V_{GS(on)}$		15...18	V
Off-state gate voltage	$V_{GS(off)}$		-5...0	V

Table 7 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Drain-source on-resistance	$R_{DS(on)}$	$I_D = 240\,\text{A}$	$V_{GS}=18\,\text{V}$, $T_{vj} = 25\,^{\circ}\text{C}$		2.91	3.82	mΩ
			$V_{GS}=18\,\text{V}$, $T_{vj} = 125\,^{\circ}\text{C}$		4.7		
			$V_{GS}=18\,\text{V}$, $T_{vj} = 175\,^{\circ}\text{C}$		6.24		
			$V_{GS}=15\,\text{V}$, $T_{vj} = 25\,^{\circ}\text{C}$		3.4		
Gate threshold voltage	$V_{GS(th)}$	$I_D = 112\,\text{mA}$, $V_{DS} = V_{GS}$, $T_{vj} = 25\,^{\circ}\text{C}$, (tested after 1ms pulse at $V_{GS} = +20\,\text{V}$)		3.45	4.3	5.15	V
Total gate charge	Q_G	$V_{DD}=800\,\text{V}$, $V_{GS} = -3/18\,\text{V}$, $T_{vj} = 25\,^{\circ}\text{C}$			0.8		μC

(table continues...)

Table 7 (continued) **Characteristic values**

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Internal gate resistor	R_{Gint}	$T_{vj}=25\text{ °C}$			1.9		Ω
Input capacitance	C_{ISS}	$f = 100\text{ kHz}$, $V_{DS}=800\text{ V}$, $V_{GS}=0\text{ V}$	$T_{vj}=25\text{ °C}$		24.2		nF
Output capacitance	C_{OSS}	$f = 100\text{ kHz}$, $V_{DS}=800\text{ V}$, $V_{GS}=0\text{ V}$	$T_{vj}=25\text{ °C}$		1.2		nF
Reverse transfer capacitance	C_{rss}	$f = 100\text{ kHz}$, $V_{DS}=800\text{ V}$, $V_{GS}=0\text{ V}$	$T_{vj}=25\text{ °C}$		0.079		nF
C_{OSS} stored energy	E_{OSS}	$V_{DS}=800\text{ V}$, $V_{GS} = -3/18\text{ V}$, $T_{vj} = 25\text{ °C}$			473		μJ
Drain-source leakage current	I_{DSS}	$V_{DS} = 1200\text{ V}$, $V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ °C}$		0.16	378	μA
Gate-source leakage current	I_{GSS}	$V_{DS} = 0\text{ V}$, $T_{vj} = 25\text{ °C}$	$V_{GS}=20\text{ V}$			400	nA
Turn-on delay time (inductive load)	t_{don}	$I_D = 240\text{ A}$, $R_{Gon} = 4.7\text{ }\Omega$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3/18\text{ V}$, $t_{dead} = 1000\text{ ns}$, $0.1\text{ }V_{GS}$ to $0.1\text{ }I_D$	$T_{vj} = 25\text{ °C}$		78		ns
			$T_{vj} = 125\text{ °C}$		78		
			$T_{vj} = 175\text{ °C}$		78		
Rise time (inductive load)	t_r	$I_D = 240\text{ A}$, $R_{Gon} = 4.7\text{ }\Omega$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3/18\text{ V}$, $t_{dead} = 1000\text{ ns}$, $0.1\text{ }I_D$ to $0.9\text{ }I_D$	$T_{vj} = 25\text{ °C}$		122		ns
			$T_{vj} = 125\text{ °C}$		115		
			$T_{vj} = 175\text{ °C}$		114		
Turn-off delay time (inductive load)	t_{doff}	$I_D = 240\text{ A}$, $R_{Goff} = 1\text{ }\Omega$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3/18\text{ V}$, $0.9\text{ }V_{GS}$ to $0.9\text{ }I_D$	$T_{vj} = 25\text{ °C}$		100		ns
			$T_{vj} = 125\text{ °C}$		111		
			$T_{vj} = 175\text{ °C}$		117		
Fall time (inductive load)	t_f	$I_D = 240\text{ A}$, $R_{Goff} = 1\text{ }\Omega$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3/18\text{ V}$, $0.9\text{ }I_D$ to $0.1\text{ }I_D$	$T_{vj} = 25\text{ °C}$		25		ns
			$T_{vj} = 125\text{ °C}$		26		
			$T_{vj} = 175\text{ °C}$		27		
Turn-on energy loss per pulse	E_{on}	$I_D = 240\text{ A}$, $V_{DD} = 600\text{ V}$, $L_\sigma = 7\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Gon} = 4.7\text{ }\Omega$, $di/dt = 5.7\text{ kA}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$), $t_{dead} = 1000\text{ ns}$	$T_{vj} = 25\text{ °C}$		7.08		mJ
			$T_{vj} = 125\text{ °C}$		7.15		
			$T_{vj} = 175\text{ °C}$		7.16		
Turn-on energy loss per pulse, optimized	$E_{on,o}$	$I_D = 240\text{ A}$, $V_{DD} = 600\text{ V}$, $L_\sigma = 7\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Gon,o} = 3\text{ }\Omega$, $di/dt = 7.1\text{ kA}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$), $t_{dead} = 100\text{ ns}$	$T_{vj} = 25\text{ °C}$		4.51		mJ
			$T_{vj} = 125\text{ °C}$		4.54		
			$T_{vj} = 175\text{ °C}$		4.55		

(table continues...)

Table 7 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off energy loss per pulse	E_{off}	$I_D = 240\text{ A}$, $V_{DD} = 600\text{ V}$, $L_\sigma = 7\text{ nH}$, $V_{GS} = -3/18\text{ V}$, $R_{Goff} = 1\ \Omega$, $dv/dt = 17.5\text{ kV}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$)	$T_{vj} = 25\text{ °C}$	3.02		mJ
			$T_{vj} = 125\text{ °C}$	3.51		
			$T_{vj} = 175\text{ °C}$	3.68		
Thermal resistance, junction to heat sink	R_{thJH}	per MOSFET, $\lambda_{grease} = 3.3\text{ W}/(\text{m}\cdot\text{K})$		0.283		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	°C

Note: The selection of positive and negative gate-source voltages impacts losses and the long-term behavior of the MOSFET and body diode. The design guidelines described in Application Note AN 2018-09 and AN 2021-13 must be considered to ensure sound operation of the device over the planned lifetime.

$T_{vj,op} > 150\text{ °C}$ is allowed for operation at overload conditions for MOSFET and body diode. For detailed specifications, please refer to AN 2021-13

4 Body diode (MOSFET, T2 / T3)

Table 8 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
DC body diode forward current	I_{SD}	$T_{vj} = 175\text{ °C}$, $V_{GS} = -3\text{ V}$, $T_H = 65\text{ °C}$	95	A

Table 9 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_{SD}	$I_{SD} = 240\text{ A}$, $V_{GS} = -3\text{ V}$	$T_{vj} = 25\text{ °C}$	4.11	5.35	V
			$T_{vj} = 125\text{ °C}$	3.85		
			$T_{vj} = 175\text{ °C}$	3.75		
Peak reverse recovery current	I_{rrm}	$I_{SD} = 240\text{ A}$, $di_s/dt = 5.5\text{ kA}/\mu\text{s}$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3\text{ V}$, $t_{dead} = 1000\text{ ns}$	$T_{vj} = 25\text{ °C}$	74		A
			$T_{vj} = 125\text{ °C}$	109		
			$T_{vj} = 175\text{ °C}$	134		
Recovered charge	Q_{rr}	$I_{SD} = 240\text{ A}$, $di_s/dt = 5.5\text{ kA}/\mu\text{s}$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3\text{ V}$, $t_{dead} = 1000\text{ ns}$	$T_{vj} = 25\text{ °C}$	1.3		μC
			$T_{vj} = 125\text{ °C}$	2.7		
			$T_{vj} = 175\text{ °C}$	3.9		
Reverse recovery energy	E_{rec}	$I_{SD} = 240\text{ A}$, $di_s/dt = 5.5\text{ kA}/\mu\text{s}$ ($T_{vj} = 175\text{ °C}$), $V_{DD} = 600\text{ V}$, $V_{GS} = -3\text{ V}$, $t_{dead} = 1000\text{ ns}$	$T_{vj} = 25\text{ °C}$	0.38		mJ
			$T_{vj} = 125\text{ °C}$	0.89		
			$T_{vj} = 175\text{ °C}$	1.16		

(table continues...)

Table 9 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Reverse recovery energy, optimized	$E_{rec,o}$	$I_{SD} = 240 \text{ A}$, $di_s/dt = 6.9 \text{ kA}/\mu\text{s}$ ($T_{vj} = 175 \text{ }^\circ\text{C}$), $V_{DD} = 600 \text{ V}$, $V_{GS} = -3 \text{ V}$, $t_{dead} = 100 \text{ ns}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.46		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.64		
			$T_{vj} = 175 \text{ }^\circ\text{C}$	0.91		

5 IGBT, T5 / T6

Table 10 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}			200	A
Continuous DC collector current	I_{CDC}	$T_{vj \text{ max}} = 175 \text{ }^\circ\text{C}$	$T_H = 65 \text{ }^\circ\text{C}$	160	A
Repetitive peak collector current	I_{CRM}	t_p limited by $T_{vj \text{ op}}$		400	A
Gate-emitter peak voltage	V_{GES}			± 20	V

Table 11 Characteristic values

Parameter	Symbol	Note or test condition		Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{\text{CE sat}}$	$I_{\text{C}} = 200 \text{ A}$, $V_{\text{GE}} = 15 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$		1.30	1.40	V
			$T_{\text{vj}} = 125 \text{ }^{\circ}\text{C}$		1.35		
			$T_{\text{vj}} = 150 \text{ }^{\circ}\text{C}$		1.35		
Gate threshold voltage	V_{GEth}	$I_{\text{C}} = 3.25 \text{ mA}$, $V_{\text{CE}} = 20 \text{ V}$, $T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$		4.15	4.9	5.65	V
Gate charge	Q_{G}	$V_{\text{GE}} = \pm 15 \text{ V}$, $V_{\text{CC}} = 600 \text{ V}$, $T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$			2.05		μC
Internal gate resistor	R_{Gint}	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$			1.5		Ω
Input capacitance	C_{ies}	$f = 100 \text{ kHz}$, $T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$, $V_{\text{CE}} = 25 \text{ V}$, $V_{\text{GE}} = 0 \text{ V}$			24.6		nF
Reverse transfer capacitance	C_{res}	$f = 100 \text{ kHz}$, $T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$, $V_{\text{CE}} = 25 \text{ V}$, $V_{\text{GE}} = 0 \text{ V}$			0.114		nF
Collector-emitter cut-off current	I_{CES}	$V_{\text{CE}} = 950 \text{ V}$, $V_{\text{GE}} = 0 \text{ V}$	$T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$			32	μA
Gate-emitter leakage current	I_{GES}	$V_{\text{CE}} = 0 \text{ V}$, $V_{\text{GE}} = 20 \text{ V}$, $T_{\text{vj}} = 25 \text{ }^{\circ}\text{C}$				100	nA

(table continues...)

Table 11 (continued) Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-on delay time (inductive load)	t_{don}	$I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 18 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.269		ns
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.255		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.235		
Rise time (inductive load)	t_r	$I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 18 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.052		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.065		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.066		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 82 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	3.420		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	3.580		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	3.590		
Fall time (inductive load)	t_f	$I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 82 \Omega$	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.174		μs
			$T_{vj} = 125 \text{ }^\circ\text{C}$	0.332		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	0.363		
Turn-on energy loss per pulse	E_{on}	$I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 7 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Gon} = 18 \Omega$, $di/dt = 2500$ $\text{A}/\mu\text{s}$ ($T_{vj} = 150 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	25.6		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	31.5		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	34.2		
Turn-off energy loss per pulse	E_{off}	$I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $L_\sigma = 7 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{Goff} = 82 \Omega$, $dv/dt = 1600$ $\text{V}/\mu\text{s}$ ($T_{vj} = 150 \text{ }^\circ\text{C}$)	$T_{vj} = 25 \text{ }^\circ\text{C}$	29.9		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	37.7		
			$T_{vj} = 150 \text{ }^\circ\text{C}$	40.1		
Thermal resistance, junction to heat sink	R_{thJH}	per IGBT, $\lambda_{\text{grease}} = 3.3 \text{ W}/(\text{m}\cdot\text{K})$		0.517		K/W
Temperature under switching conditions	$T_{vj\text{op}}$		-40		150	$^\circ\text{C}$

6 Diode, D1 / D4

Table 12 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		300	A
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$	600	A
I^2t - value	I^2t	$t_P = 10 \text{ ms}$, $V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ }^\circ\text{C}$	A^2s
			$T_{vj} = 150 \text{ }^\circ\text{C}$	

Table 13 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 160 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	1.41	1.64	V
			$T_{vj} = 125 \text{ °C}$	1.28		
			$T_{vj} = 150 \text{ °C}$	1.25		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}$, $I_F = 160 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2500 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	99		A
			$T_{vj} = 125 \text{ °C}$	143		
			$T_{vj} = 150 \text{ °C}$	155		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}$, $I_F = 160 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2500 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	15		μC
			$T_{vj} = 125 \text{ °C}$	30		
			$T_{vj} = 150 \text{ °C}$	35		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}$, $I_F = 160 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2500 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	4.47		mJ
			$T_{vj} = 125 \text{ °C}$	9.81		
			$T_{vj} = 150 \text{ °C}$	11.8		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3 \text{ W}/(\text{m}\cdot\text{K})$		0.402		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		150	°C

7 Diode, D5 / D6

Table 14 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	$t_p = 10 \text{ ms}$, $V_R = 0 \text{ V}$	$T_{vj} = 125 \text{ °C}$	5060	A^2s
			$T_{vj} = 150 \text{ °C}$	4920	

Table 15 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 200 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$	1.72	2.10	V
			$T_{vj} = 125 \text{ °C}$	1.59		
			$T_{vj} = 150 \text{ °C}$	1.56		
Peak reverse recovery current	I_{RM}	$V_{CC} = 600 \text{ V}$, $I_F = 200 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2800 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	101		A
			$T_{vj} = 125 \text{ °C}$	126		
			$T_{vj} = 150 \text{ °C}$	134		
Recovered charge	Q_r	$V_{CC} = 600 \text{ V}$, $I_F = 200 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2800 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	12		μC
			$T_{vj} = 125 \text{ °C}$	25		
			$T_{vj} = 150 \text{ °C}$	30		
Reverse recovery energy	E_{rec}	$V_{CC} = 600 \text{ V}$, $I_F = 200 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 2800 \text{ A}/\mu\text{s}$ ($T_{vj} = 150 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	3.57		mJ
			$T_{vj} = 125 \text{ °C}$	8.51		
			$T_{vj} = 150 \text{ °C}$	10.3		
Thermal resistance, junction to heat sink	R_{thJH}	per diode, $\lambda_{grease} = 3.3 \text{ W}/(\text{m} \cdot \text{K})$		0.447		K/W
Temperature under switching conditions	$T_{vj \text{ op}}$		-40		150	°C

8 NTC-Thermistor

Table 16 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Rated resistance	R_{25}	$T_{NTC} = 25 \text{ °C}$		5		k Ω
Deviation of R_{100}	$\Delta R/R$	$T_{NTC} = 100 \text{ °C}$, $R_{100} = 493 \text{ }\Omega$	-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
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

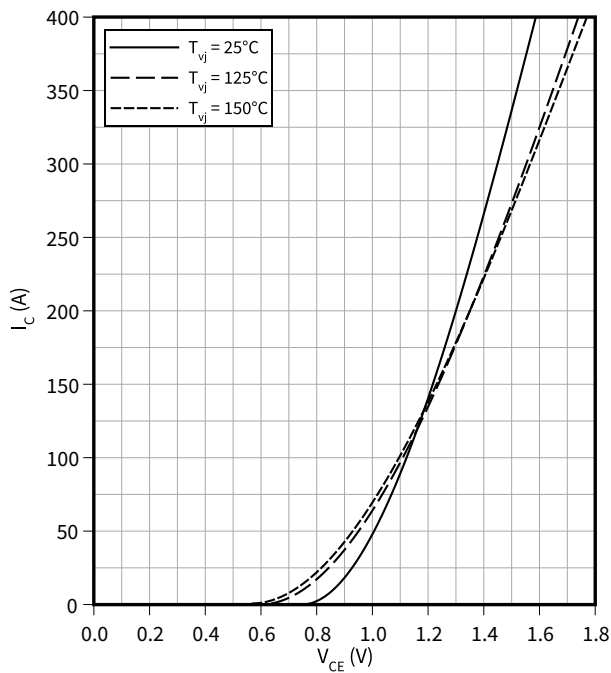
Note: For an analytical description of the NTC characteristics please refer to AN2009-10, chapter 4.

9 Characteristics diagrams

Output characteristic (typical), IGBT, T1 / T4

$I_C = f(V_{CE})$

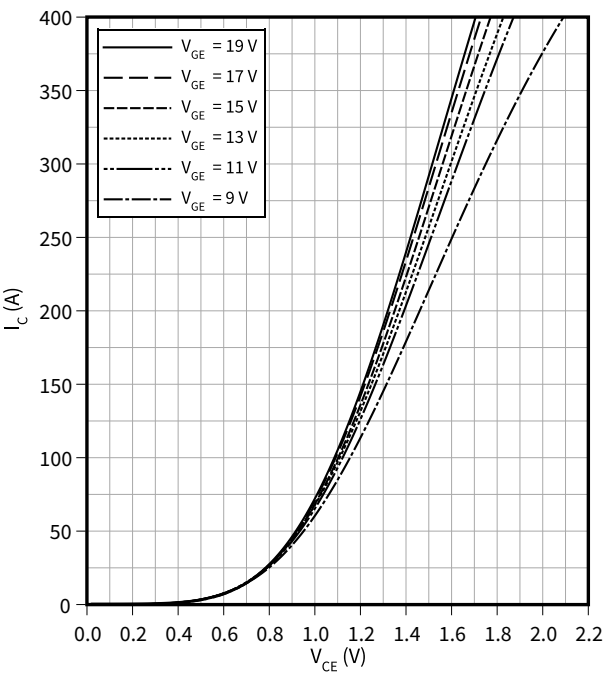
$V_{GE} = 15\text{ V}$



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

$I_C = f(V_{CE})$

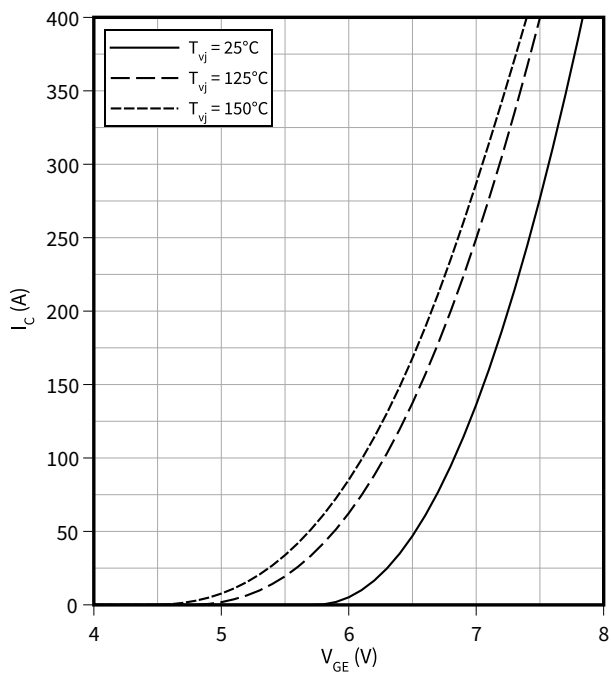
$T_{vj} = 150^\circ\text{C}$



Transfer characteristic (typical), IGBT, T1 / T4

$I_C = f(V_{GE})$

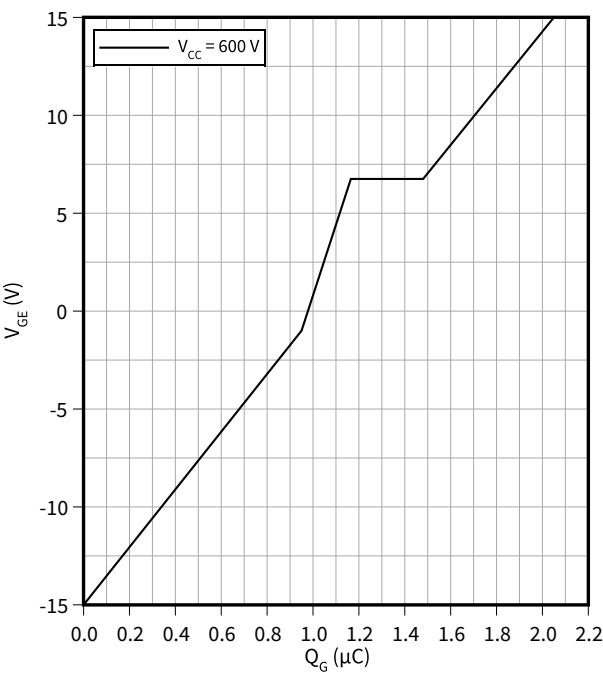
$V_{CE} = 20\text{ V}$



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

$V_{GE} = f(Q_G)$

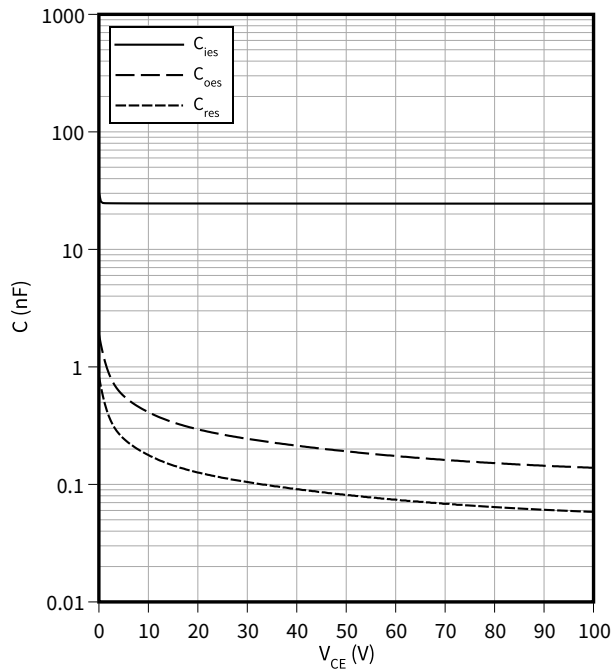
$I_C = 200\text{ A}, T_{vj} = 25^\circ\text{C}$



9 Characteristics diagrams

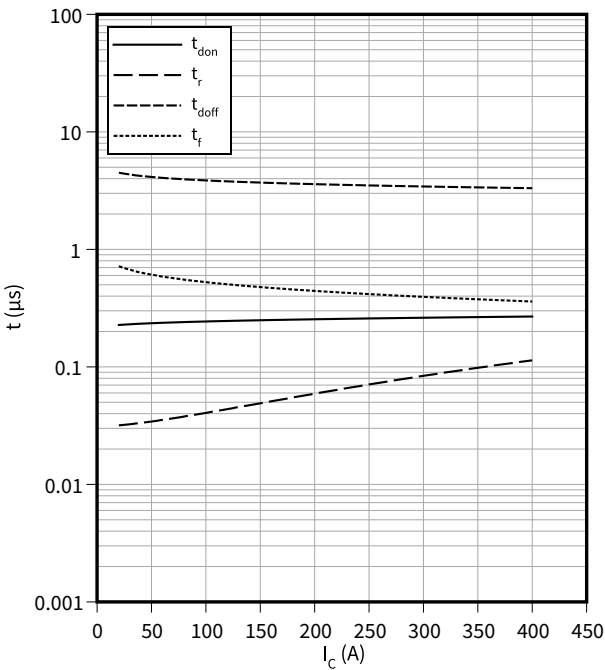
Capacity characteristic (typical), IGBT, T1 / T4

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



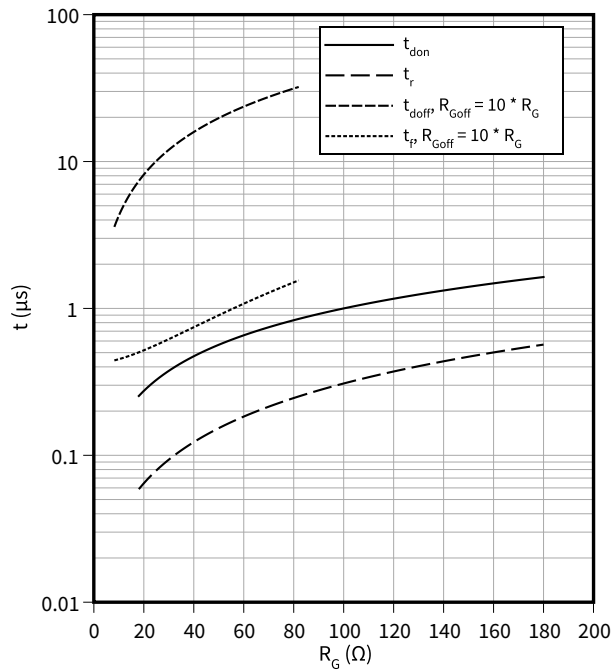
Switching times (typical), IGBT, T1 / T4

$t = f(I_C)$
 $R_{Goff} = 82 \text{ } \Omega$, $R_{Gon} = 18 \text{ } \Omega$, $V_{CC} = 600 \text{ V}$, $-15 / 15 \text{ V}$, $T_{vj} = 150 \text{ }^{\circ}\text{C}$



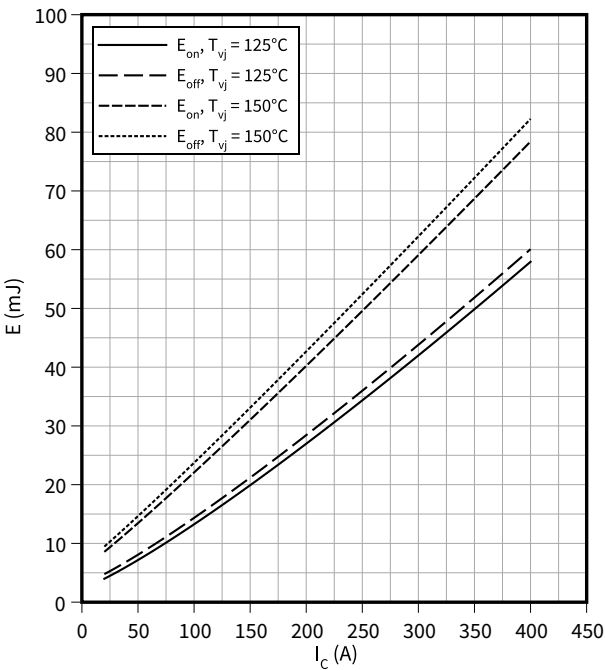
Switching times (typical), IGBT, T1 / T4

$t = f(R_G)$
 $I_C = 200 \text{ A}$, $V_{CC} = 600 \text{ V}$, $V_{GE} = -15 / 15 \text{ V}$, $T_{vj} = 150 \text{ }^{\circ}\text{C}$



Switching losses (typical), IGBT, T1 / T4

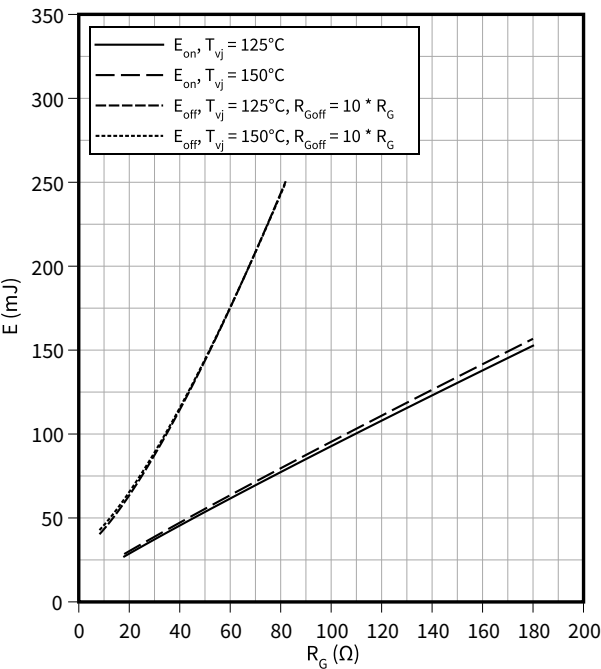
$E = f(I_C)$
 $R_{Goff} = 82 \text{ } \Omega$, $R_{Gon} = 18 \text{ } \Omega$, $V_{CC} = 600 \text{ V}$, $R_{GE} = -15 / 15 \text{ V}$



9 Characteristics diagrams

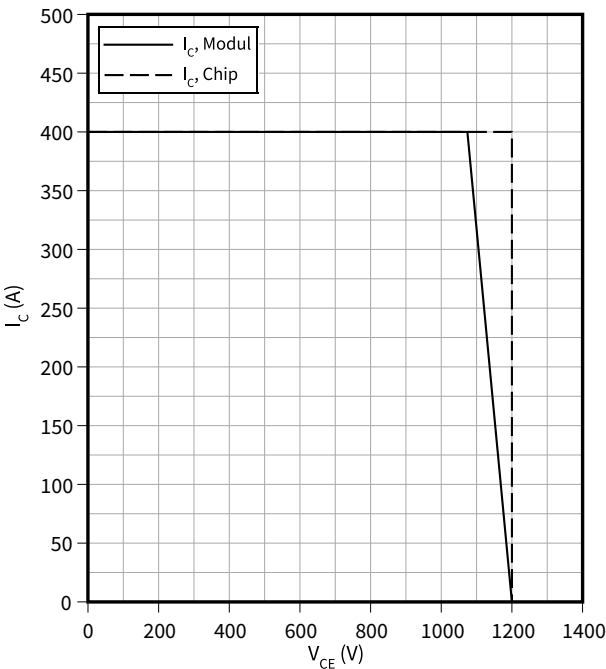
Switching losses (typical), IGBT, T1 / T4

$E = f(R_G)$
 $I_C = 200\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



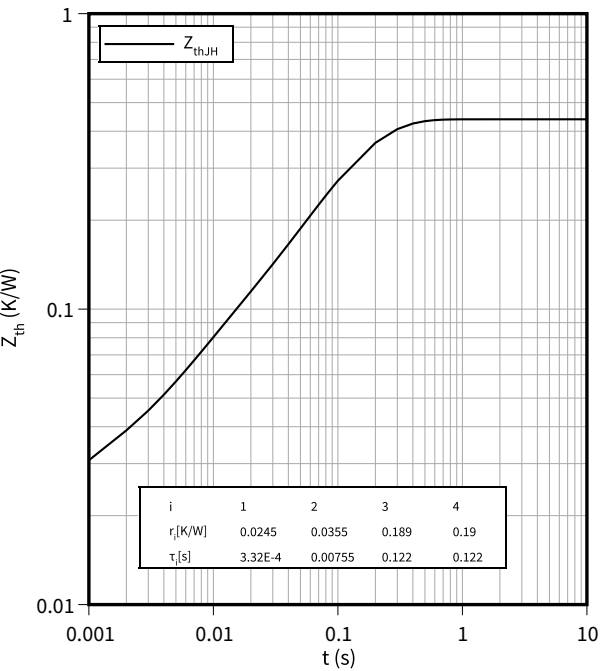
Reverse bias safe operating area (RBSOA), IGBT, T1 / T4

$I_C = f(V_{CE})$
 $R_{Goff} = 82\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$



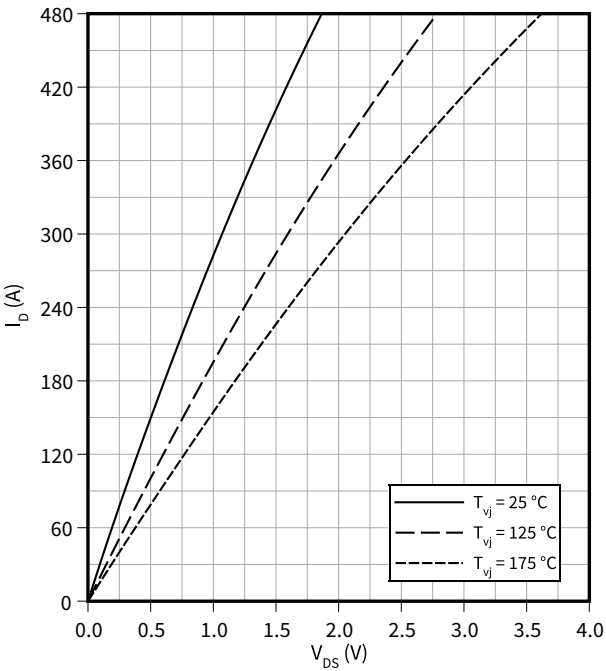
Transient thermal impedance, IGBT, T1 / T4

$Z_{th} = f(t)$



Output characteristic (typical), MOSFET, T2 / T3

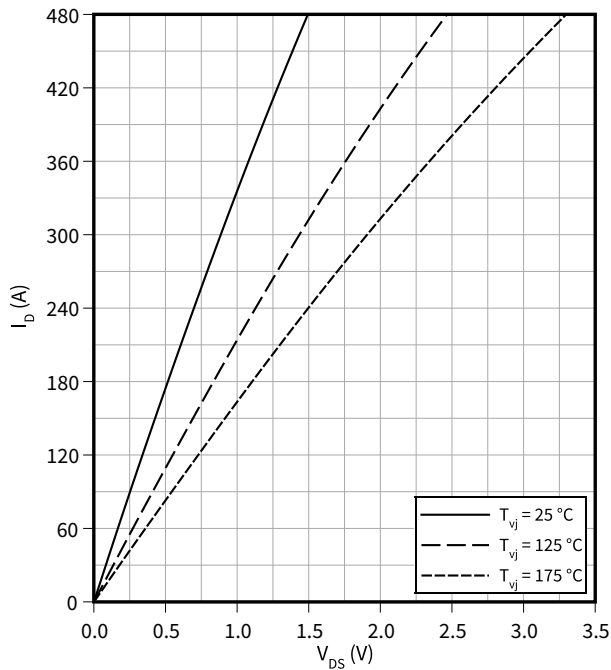
$I_D = f(V_{DS})$
 $V_{GS} = 15\text{ V}$



9 Characteristics diagrams

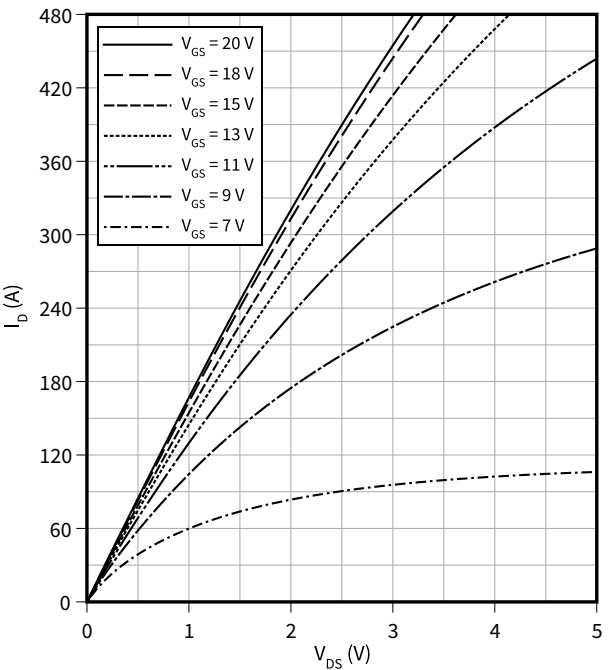
Output characteristic (typical), MOSFET, T2 / T3

$I_D = f(V_{DS})$
 $V_{GS} = 18\text{ V}$



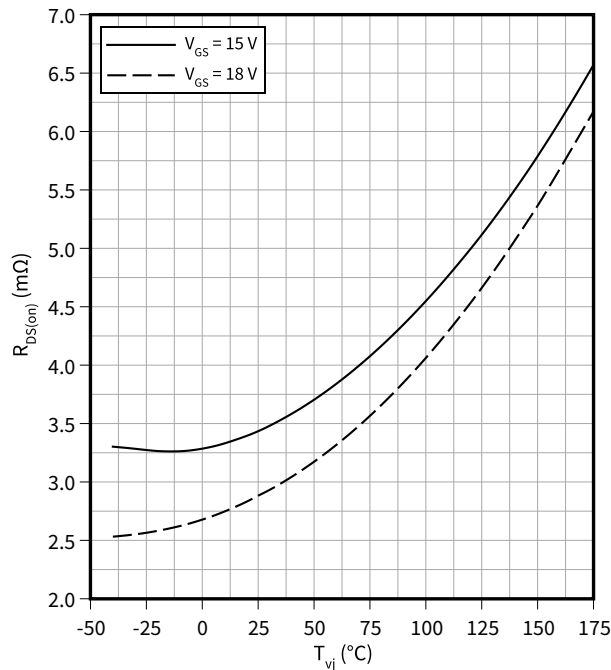
Output characteristic field (typical), MOSFET, T2 / T3

$I_D = f(V_{DS})$
 $T_{vj} = 175^\circ\text{C}$



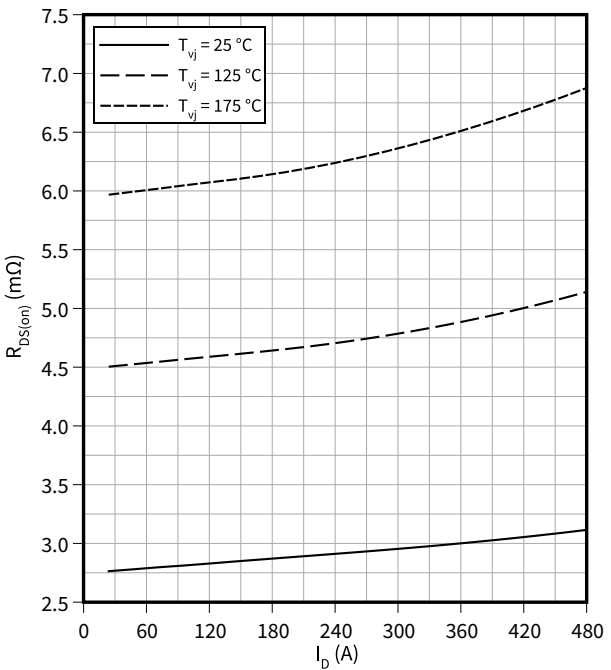
Drain source on-resistance (typical), MOSFET, T2 / T3

$R_{DS(on)} = f(T_{vj})$
 $I_D = 240\text{ A}$



Drain source on-resistance (typical), MOSFET, T2 / T3

$R_{DS(on)} = f(I_D)$
 $V_{GS} = 18\text{ V}$

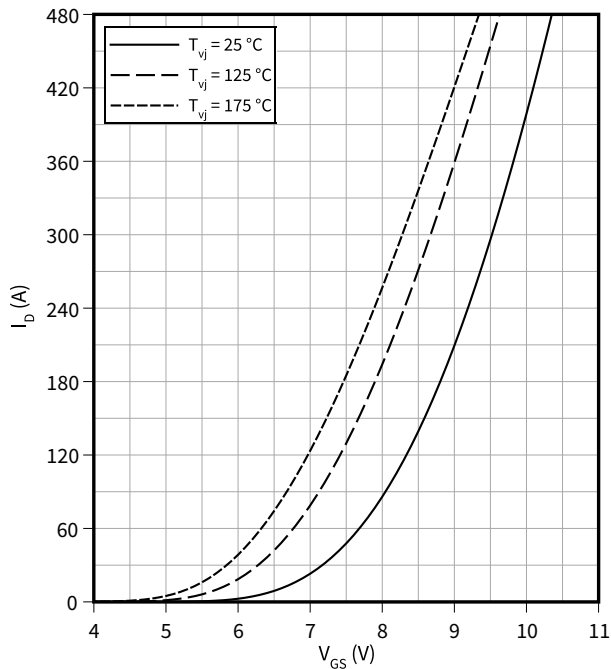


9 Characteristics diagrams

Transfer characteristic (typical), MOSFET, T2 / T3

$I_D = f(V_{GS})$

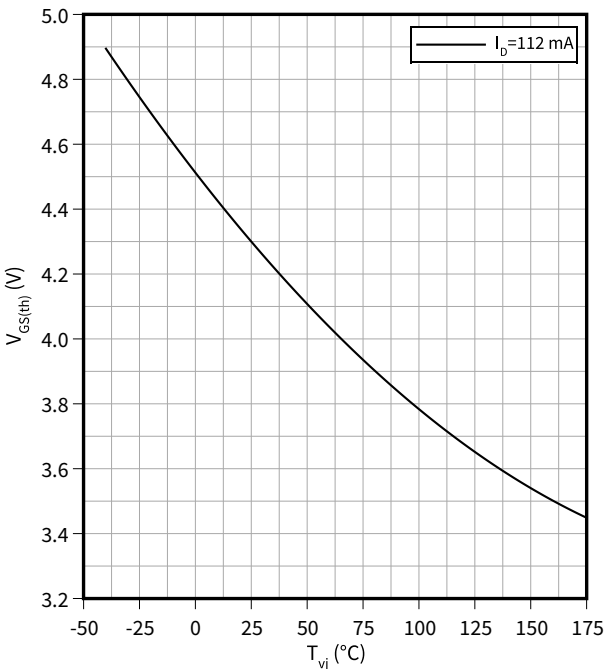
$V_{DS} = 20\text{ V}$



Gate-source threshold voltage (typical), MOSFET, T2 / T3

$V_{GS(th)} = f(T_{vj})$

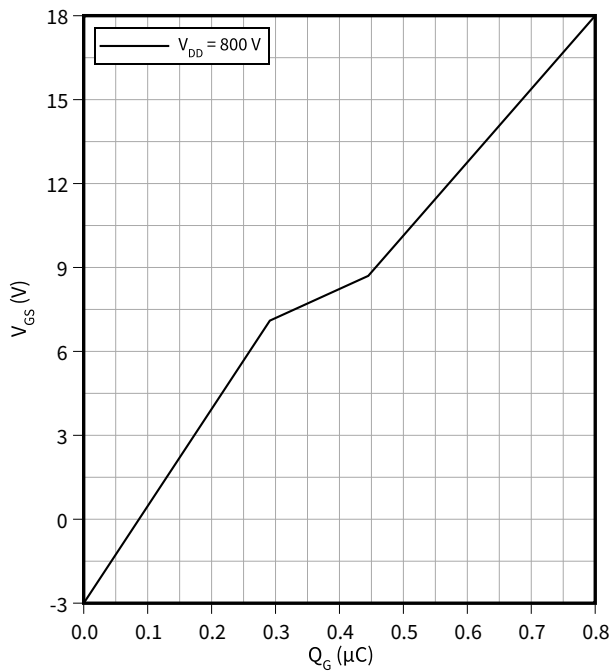
$V_{GS} = V_{DS}, I_D = 112\text{ mA}$



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

$V_{GS} = f(Q_G)$

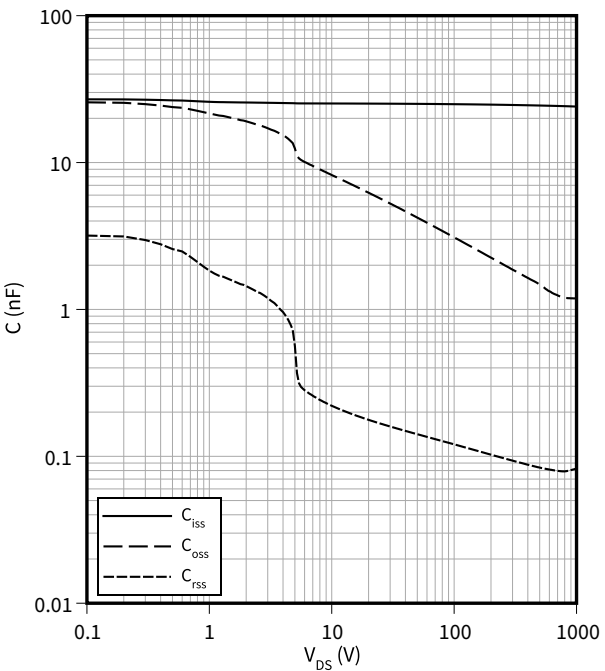
$I_D = 240\text{ A}, T_{vj} = 25\text{ °C}$



Capacity characteristic (typical), MOSFET, T2 / T3

$C = f(V_{DS})$

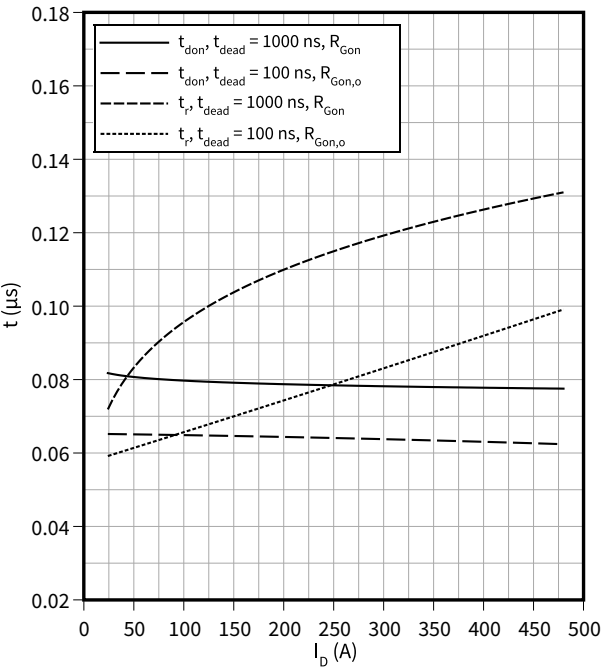
$f = 100\text{ kHz}, T_{vj} = 25\text{ °C}, V_{GS} = 0\text{ V}$



9 Characteristics diagrams

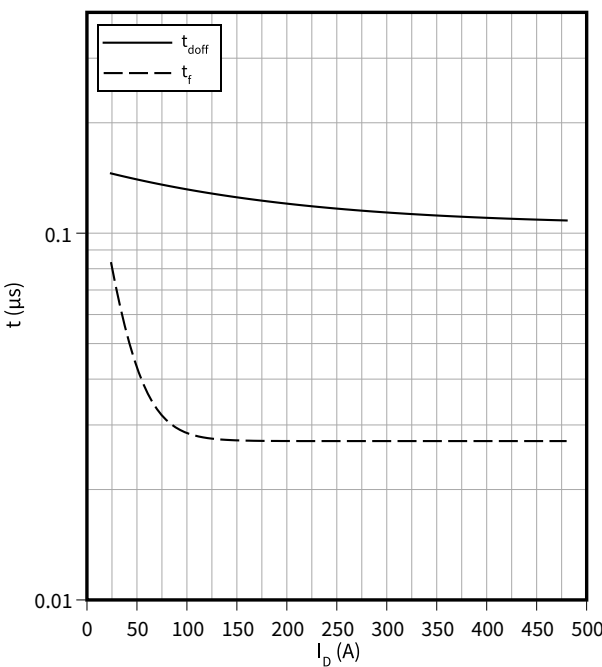
Switching times (typical), MOSFET, T2 / T3

$t = f(I_D)$
 $V_{DD} = 600\text{ V}$, $R_{Gon} = 4.7\text{ }\Omega$, $R_{Gon,o} = 3\text{ }\Omega$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GS} = -3/18\text{ V}$



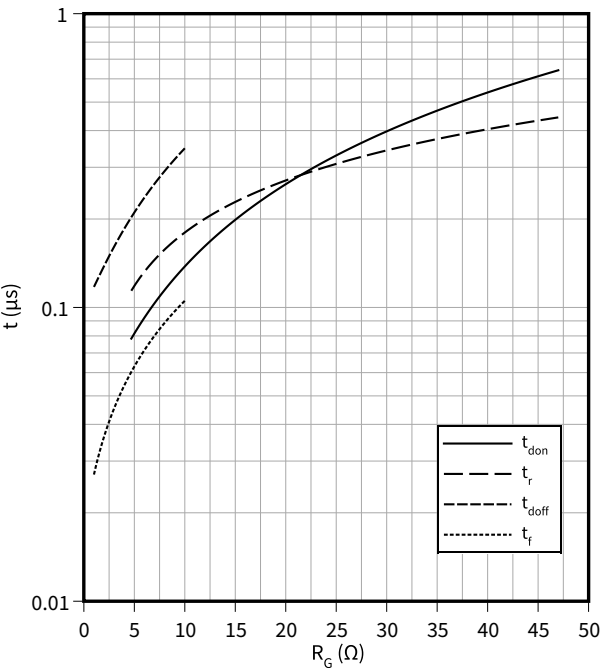
Switching times (typical), MOSFET, T2 / T3

$t = f(I_D)$
 $R_{Goff} = 1\text{ }\Omega$, $V_{DD} = 600\text{ V}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GS} = -3/18\text{ V}$



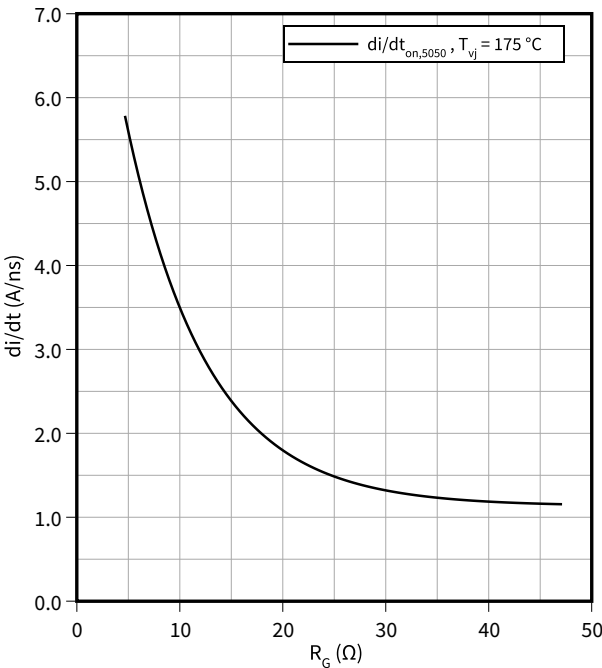
Switching times (typical), MOSFET, T2 / T3

$t = f(R_G)$
 $V_{DD} = 600\text{ V}$, $t_{dead} = 1000\text{ ns}$, $I_D = 240\text{ A}$, $T_{vj} = 175\text{ }^\circ\text{C}$, $V_{GS} = -3/18\text{ V}$



Current slope (typical), MOSFET, T2 / T3

$di/dt = f(R_G)$
 $V_{DD} = 600\text{ V}$, $t_{dead} = 1000\text{ ns}$, $I_D = 240\text{ A}$, $V_{GS} = -3/18\text{ V}$

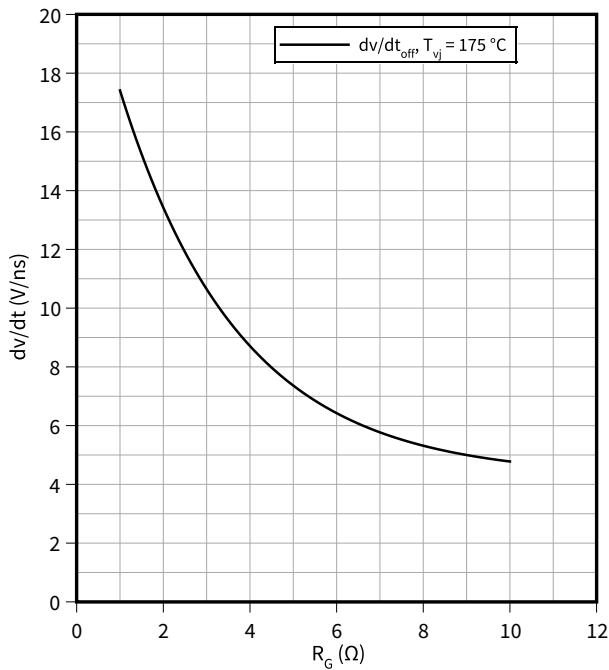


9 Characteristics diagrams

Voltage slope (typical), MOSFET, T2 / T3

$dv/dt = f(R_G)$

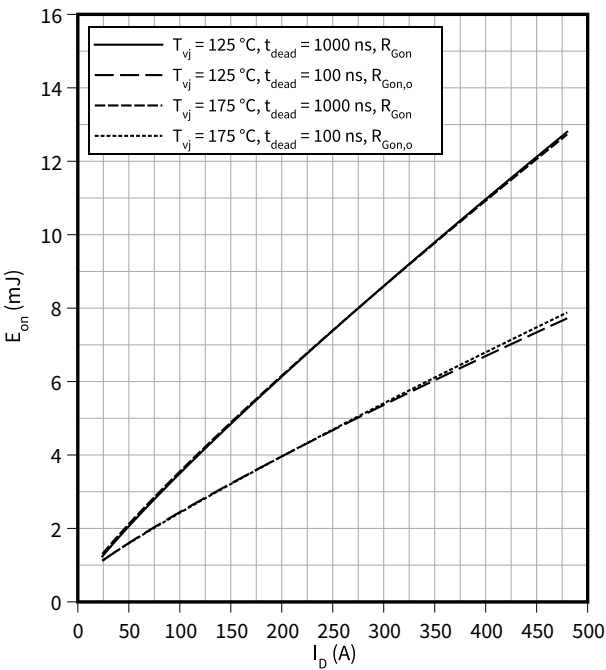
$V_{DD} = 600\text{ V}, I_D = 240\text{ A}, V_{GS} = -3/18\text{ V}$



Switching losses (typical), MOSFET, T2 / T3

$E_{on} = f(I_D)$

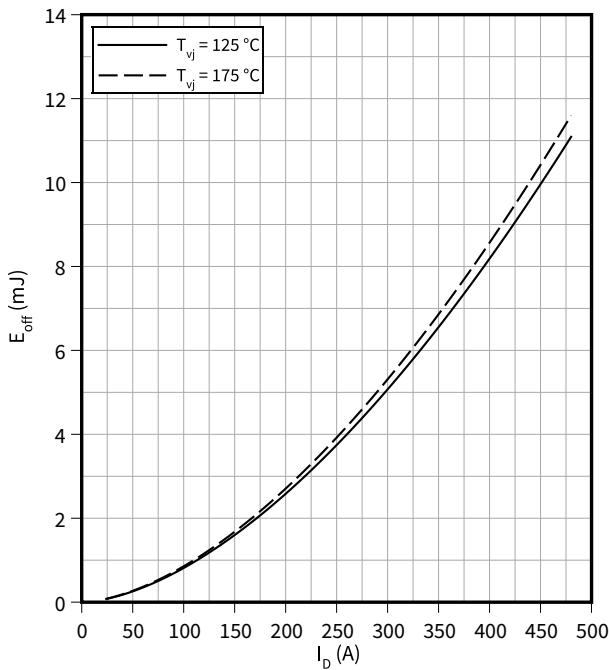
$R_{Gon} = 4.7\text{ }\Omega, V_{DD} = 600\text{ V}, R_{Gon,o} = 3\text{ }\Omega, V_{GS} = -3/18\text{ V}$



Switching losses (typical), MOSFET, T2 / T3

$E_{off} = f(I_D)$

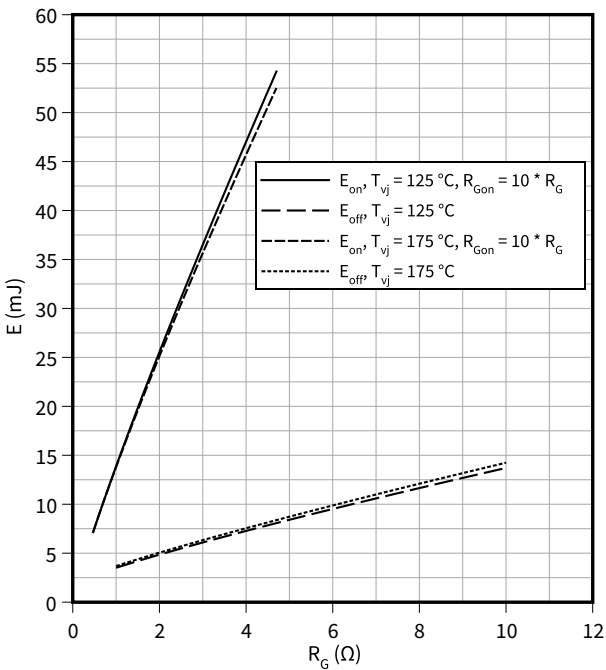
$R_{Goff} = 1\text{ }\Omega, V_{DD} = 600\text{ V}, V_{GS} = -3/18\text{ V}$



Switching losses (typical), MOSFET, T2 / T3

$E = f(R_G)$

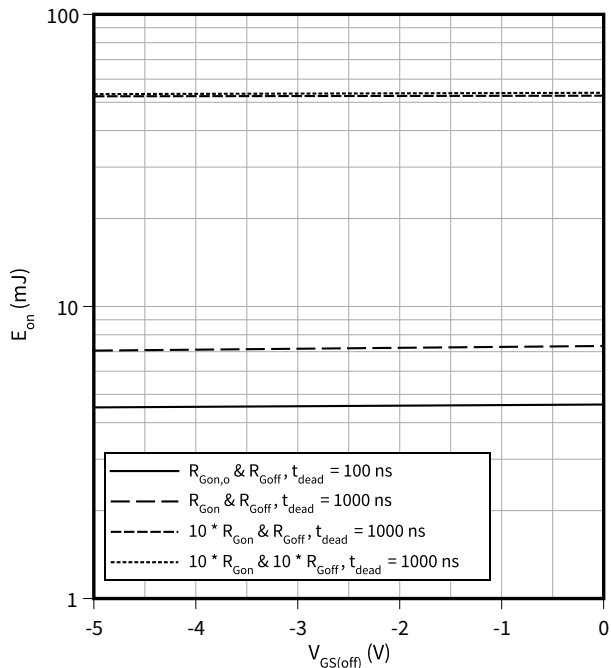
$V_{DD} = 600\text{ V}, t_{dead} = 1000\text{ ns}, I_D = 240\text{ A}, V_{GS} = -3/18\text{ V}$



9 Characteristics diagrams

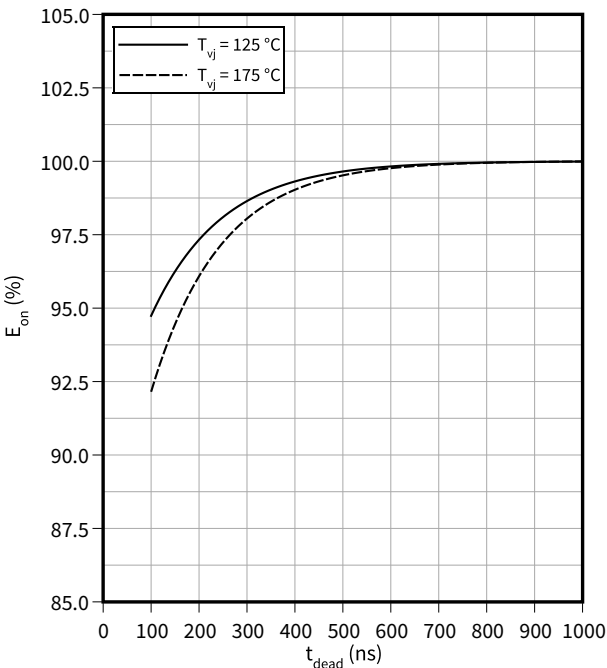
Switching losses (typical), MOSFET, T2 / T3

$E_{on} = f(V_{GS(off)})$
 $V_{DD} = 600\text{ V}$, $V_{GS(on)} = 18\text{ V}$, $I_D = 240\text{ A}$, $T_{vj} = 175\text{ °C}$



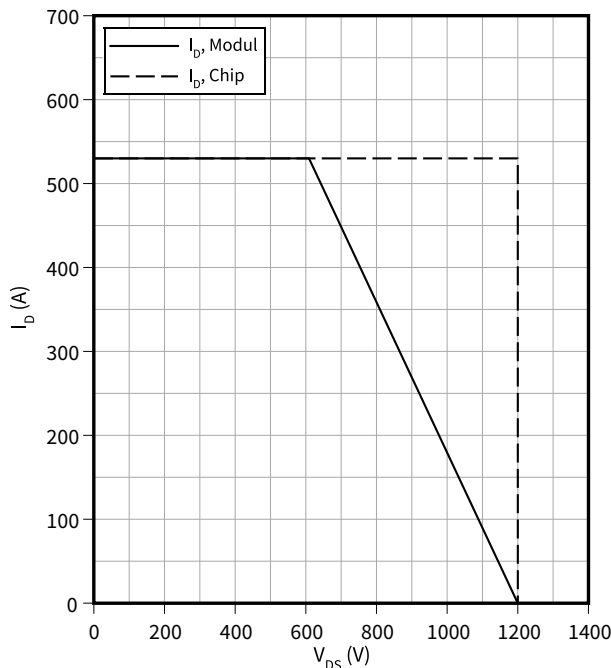
Switching losses (typical), MOSFET, T2 / T3

$E_{on} = f(t_{dead})$
 $R_{Gon} = 4.7\text{ }\Omega$, $I_D = 240\text{ A}$, $V_{DD} = 600\text{ V}$, $V_{GS} = -3/18\text{ V}$



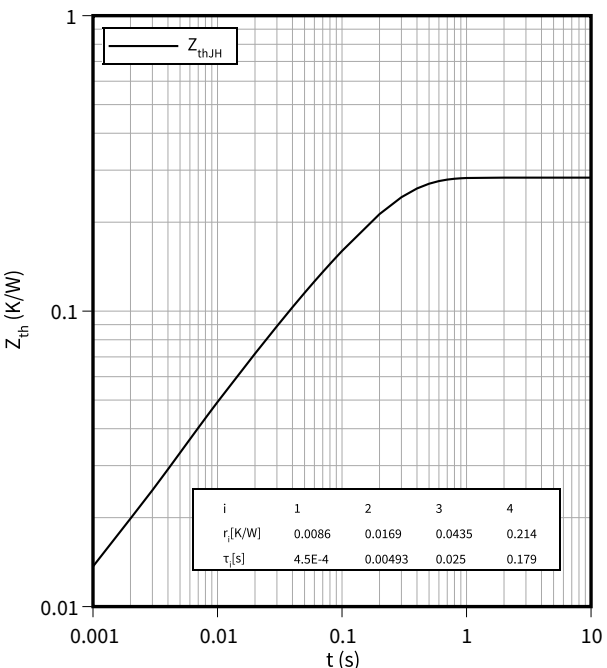
Reverse bias safe operating area (RBSOA), MOSFET, T2 / T3

$I_D = f(V_{DS})$
 $R_{Goff} = 1\text{ }\Omega$, $T_{vj} = 175\text{ °C}$, $V_{GS} = -3/18\text{ V}$



Transient thermal impedance, MOSFET, T2 / T3

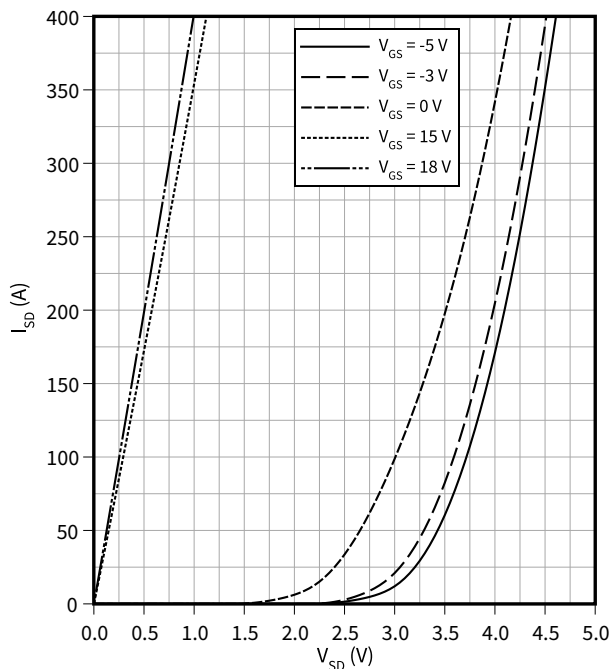
$Z_{th} = f(t)$



9 Characteristics diagrams

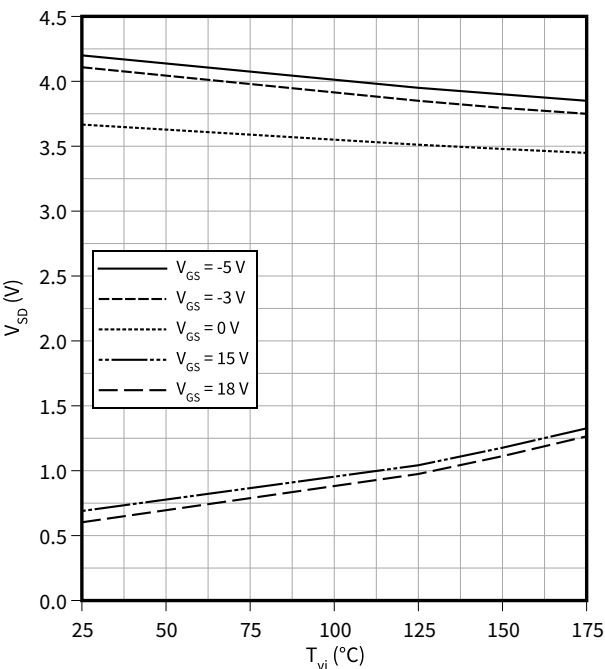
Forward characteristic body diode (typical), MOSFET, T2 / T3

$I_{SD} = f(V_{SD})$
 $T_{vj} = 25\text{ °C}$



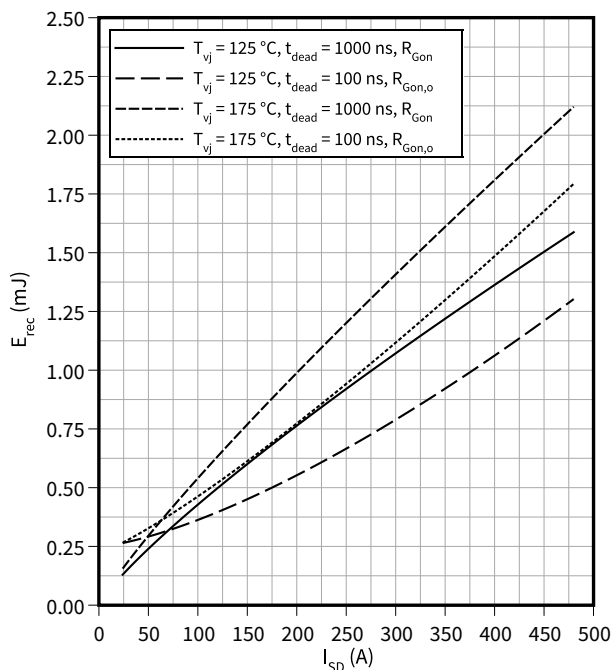
Forward voltage of body diode (typical), MOSFET, T2 / T3

$V_{SD} = f(T_{vj})$
 $I_{SD} = 240\text{ A}$



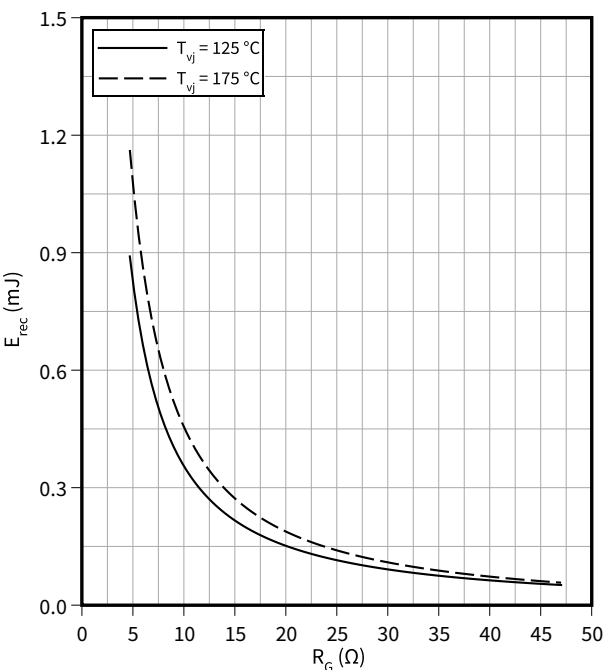
Switching losses body diode (typical), MOSFET, T2 / T3

$E_{rec} = f(I_{SD})$
 $R_{Gon} = 4.7\text{ }\Omega$, $R_{Gon,o} = 3\text{ }\Omega$, $V_{DD} = 600\text{ V}$



Switching losses body diode (typical), MOSFET, T2 / T3

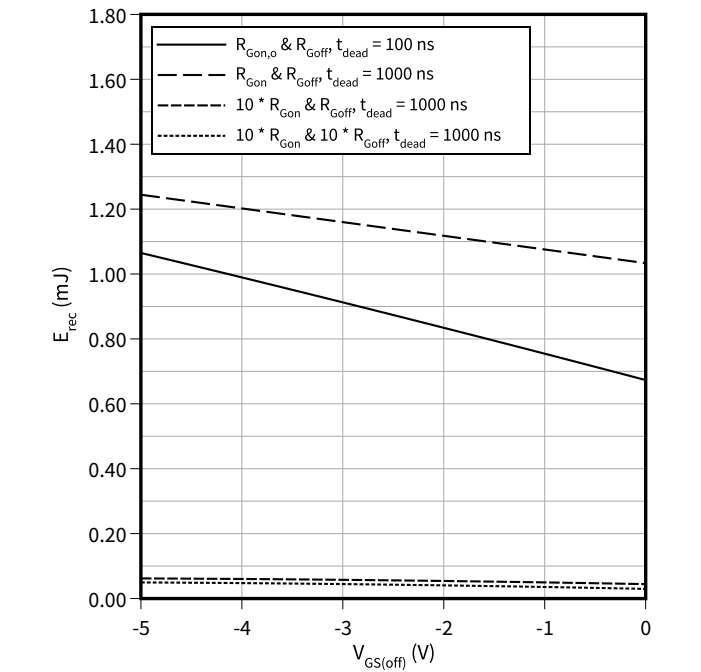
$E_{rec} = f(R_G)$
 $t_{dead} = 1000\text{ ns}$, $I_{SD} = 240\text{ A}$, $V_{DD} = 600\text{ V}$



9 Characteristics diagrams

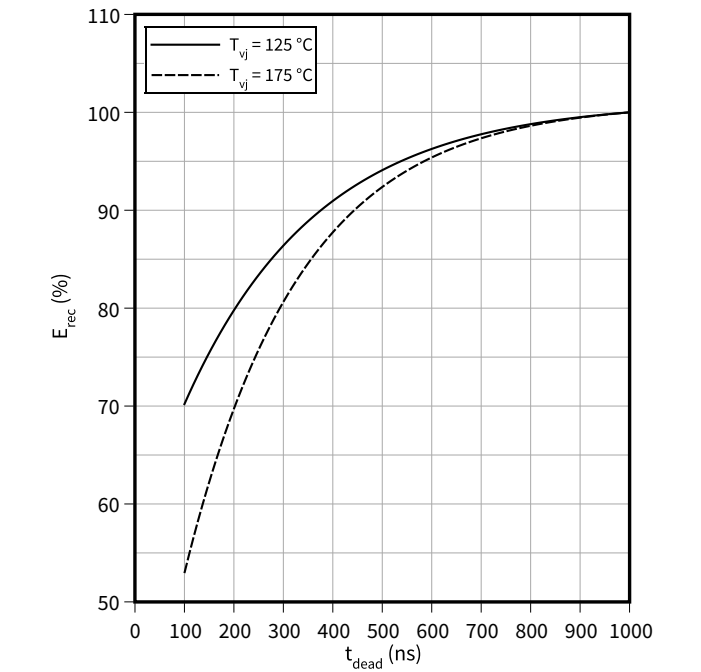
Switching losses body diode (typical), MOSFET, T2 / T3

$E_{rec} = f(V_{GS(off)})$
 $R_{Goff} = 1\ \Omega$, $R_{Gon} = 4.7\ \Omega$, $V_{GS(on)} = 18\ V$, $I_{SD} = 240\ A$, $R_{Gon,o} = 3\ \Omega$, $V_{DD} = 600\ V$, $T_{vj} = 175\ ^\circ C$



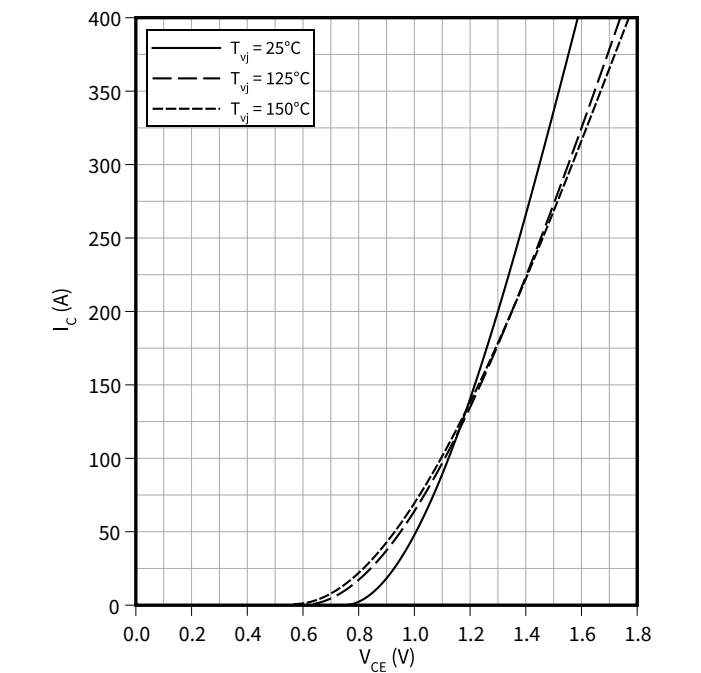
Switching losses body diode (typical), MOSFET, T2 / T3

$E_{rec} = f(t_{dead})$
 $R_{Gon} = 4.7\ \Omega$, $I_D = 240\ A$, $V_{DD} = 600\ V$, $V_{GS} = -3/18\ V$



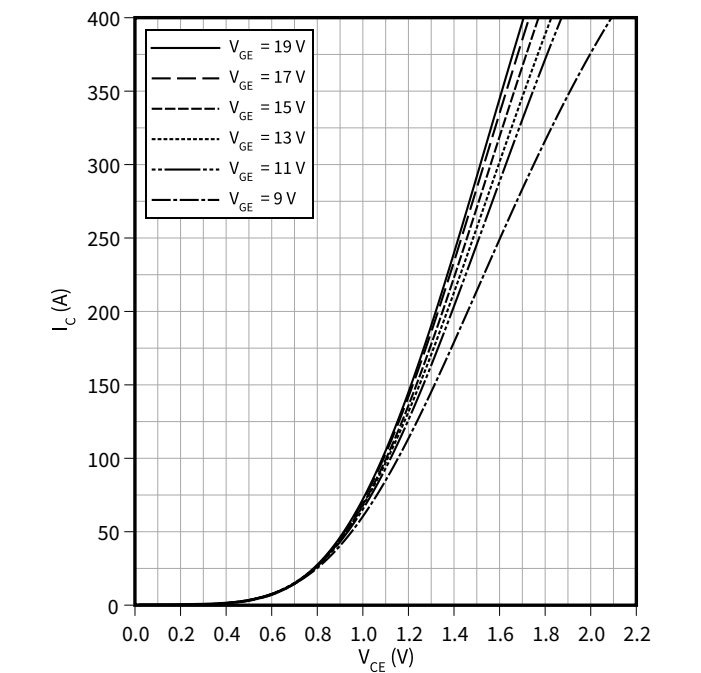
Output characteristic (typical), IGBT, T5 / T6

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



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

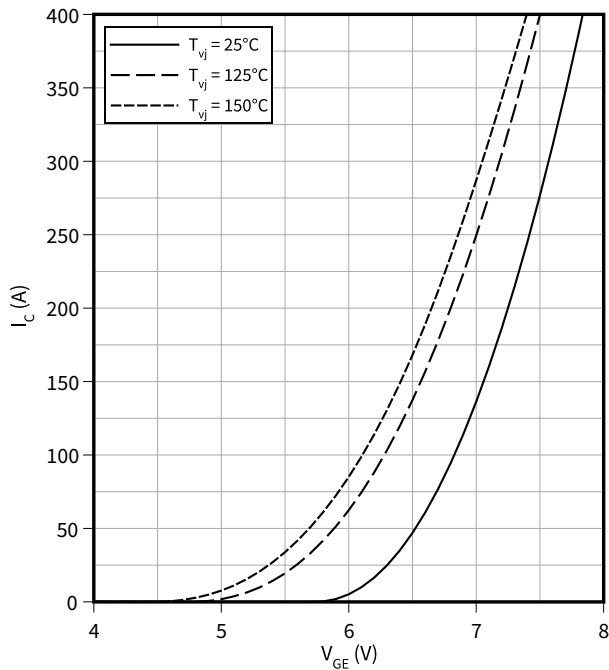
$I_C = f(V_{CE})$
 $T_{vj} = 150\ ^\circ C$



9 Characteristics diagrams

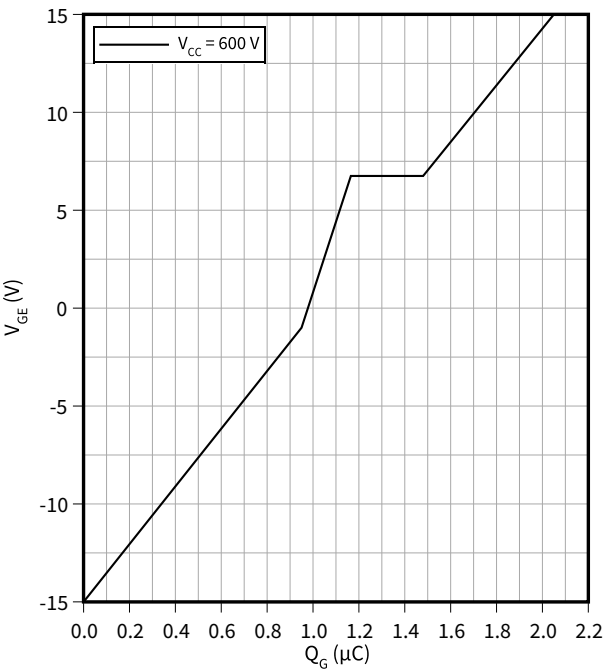
Transfer characteristic (typical), IGBT, T5 / T6

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



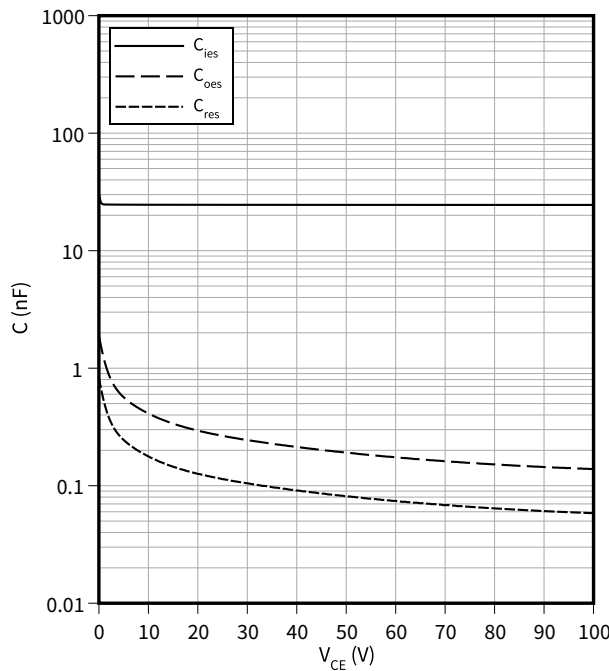
Gate charge characteristic (typical), IGBT, T5 / T6

$V_{GE} = f(Q_G)$
 $I_C = 200\text{ A}$, $T_{vj} = 25\text{ °C}$



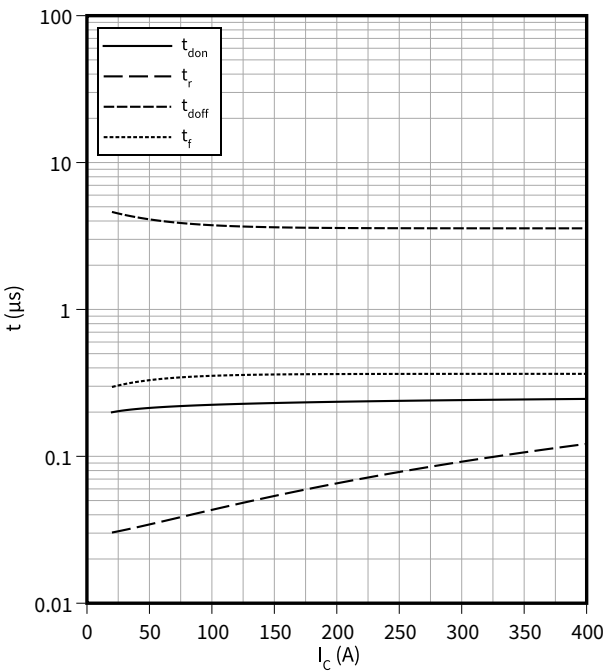
Capacity characteristic (typical), IGBT, T5 / T6

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



Switching times (typical), IGBT, T5 / T6

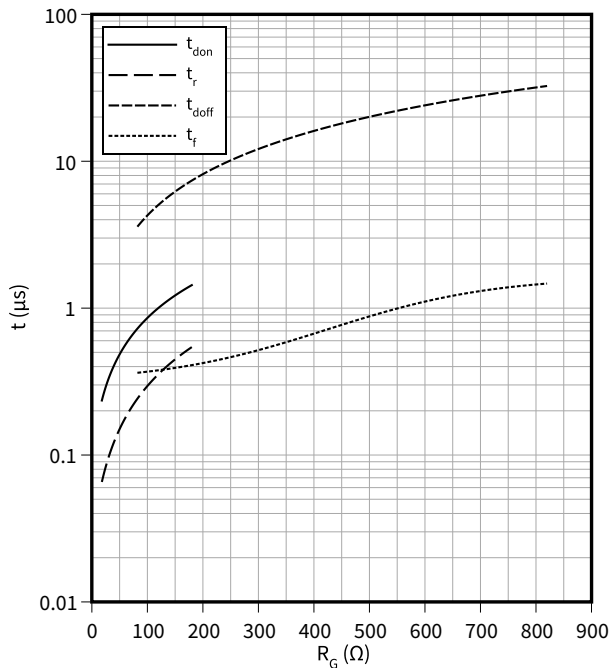
$t = f(I_C)$
 $R_{Goff} = 82\text{ }\Omega$, $R_{Gon} = 18\text{ }\Omega$, $V_{CC} = 600\text{ V}$, $V_{GE} = -15 / 15\text{ V}$, $T_{vj} = 150\text{ °C}$



9 Characteristics diagrams

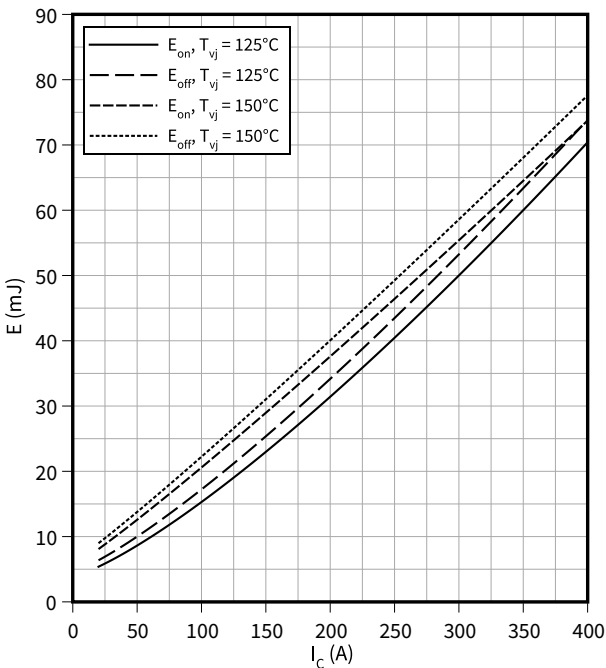
Switching times (typical), IGBT, T5 / T6

$t = f(R_G)$
 $I_C = 200\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = -15 / 15\text{ V}$, $T_{vj} = 150\text{ °C}$



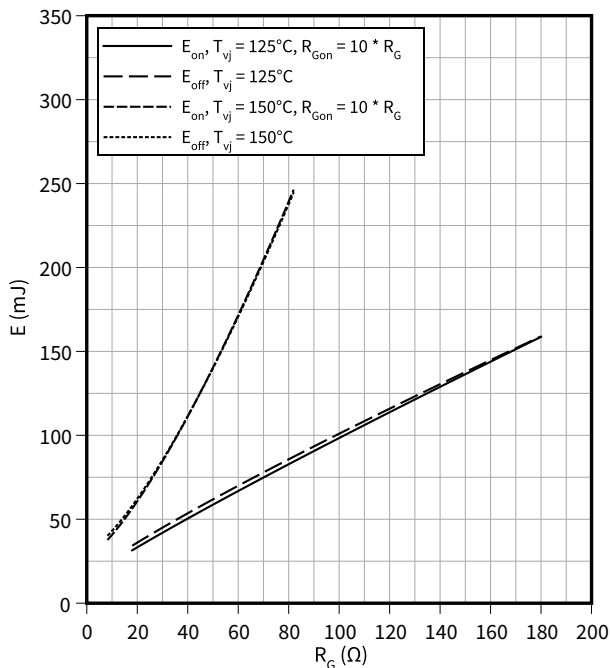
Switching losses (typical), IGBT, T5 / T6

$E = f(I_C)$
 $R_{Goff} = 82\text{ }\Omega$, $R_{Gon} = 18\text{ }\Omega$, $V_{CC} = 600\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



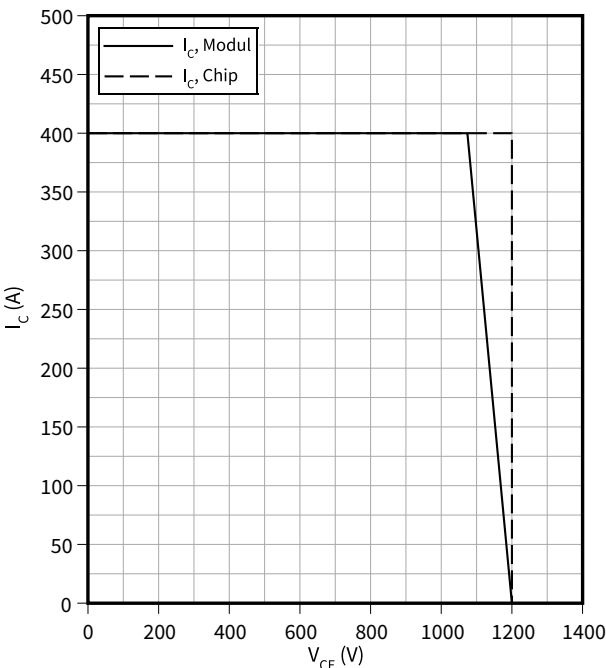
Switching losses (typical), IGBT, T5 / T6

$E = f(R_G)$
 $I_C = 200\text{ A}$, $V_{CC} = 600\text{ V}$, $V_{GE} = -15 / 15\text{ V}$



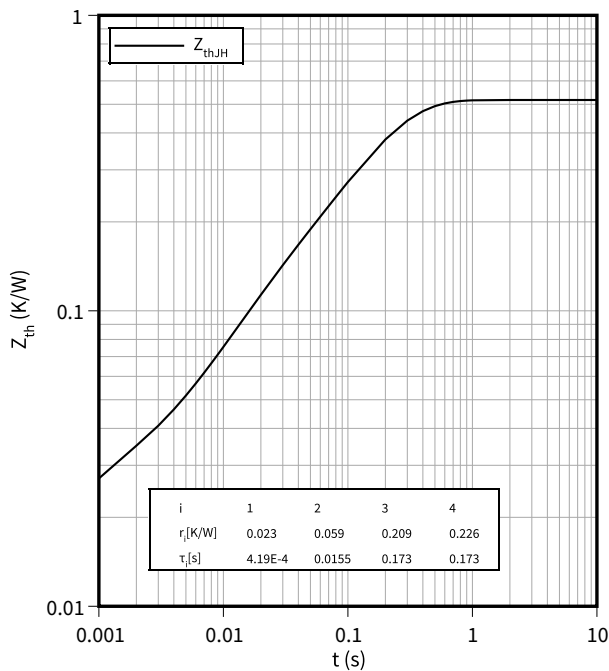
Reverse bias safe operating area (RBSOA), IGBT, T5 / T6

$I_C = f(V_{CE})$
 $R_{Goff} = 82\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $T_{vj} = 150\text{ °C}$



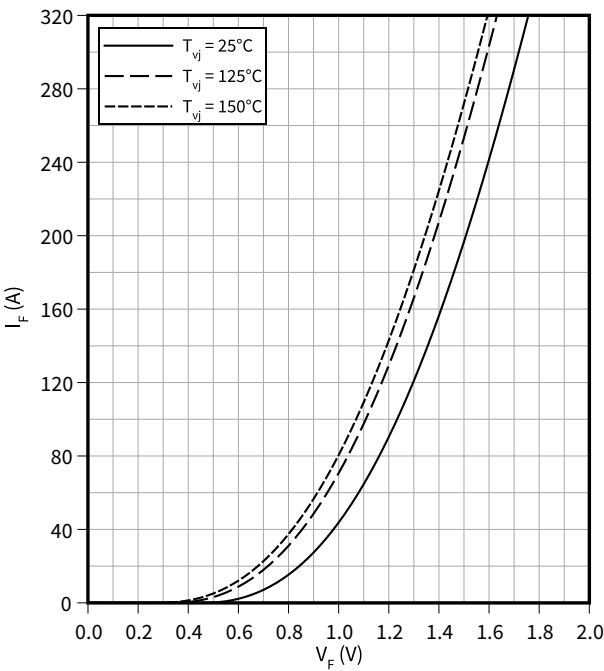
Transient thermal impedance, IGBT, T5 / T6

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D1 / D4

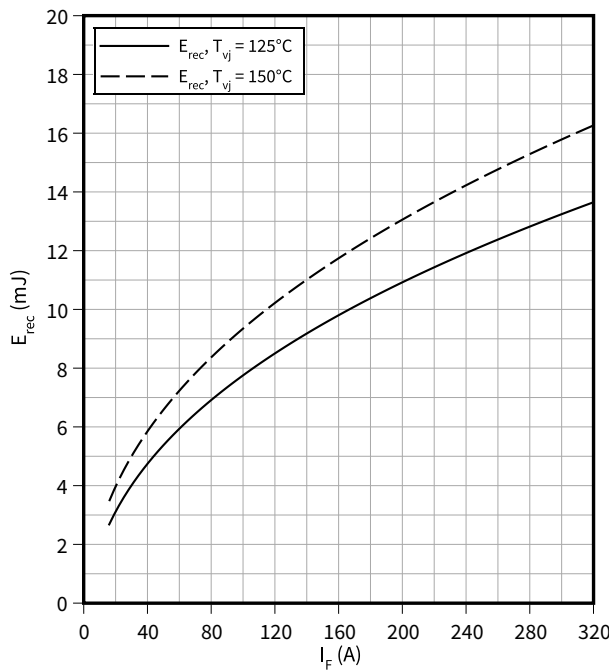
$I_F = f(V_F)$



Switching losses (typical), Diode, D1 / D4

$E_{rec} = f(I_F)$

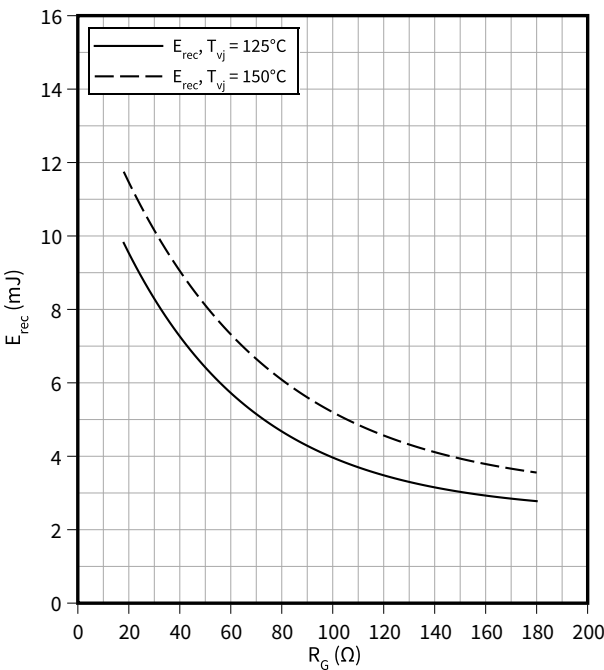
$R_G = 18 \Omega, V_{CC} = 600 V$



Switching losses (typical), Diode, D1 / D4

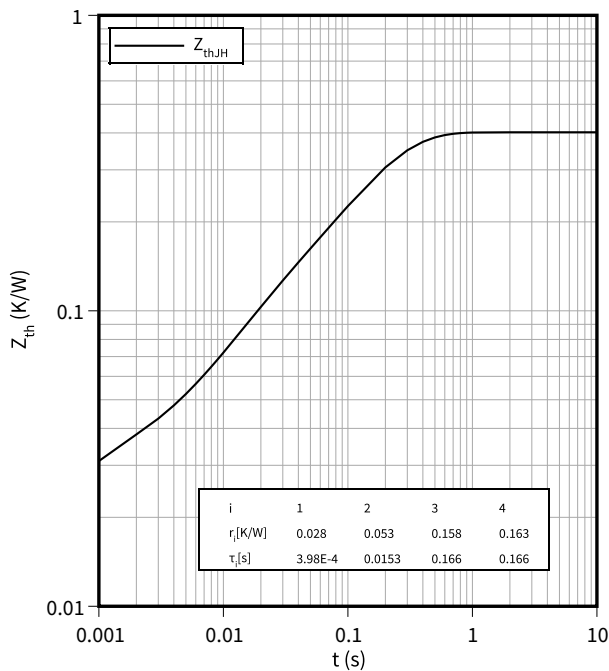
$E_{rec} = f(R_G)$

$I_F = 160 A, V_{CC} = 600 V$



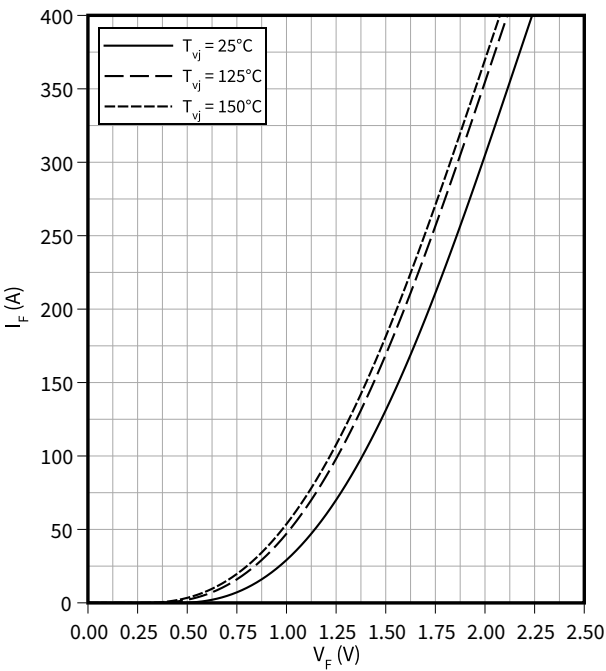
Transient thermal impedance, Diode, D1 / D4

$Z_{th} = f(t)$



Forward characteristic (typical), Diode, D5 / D6

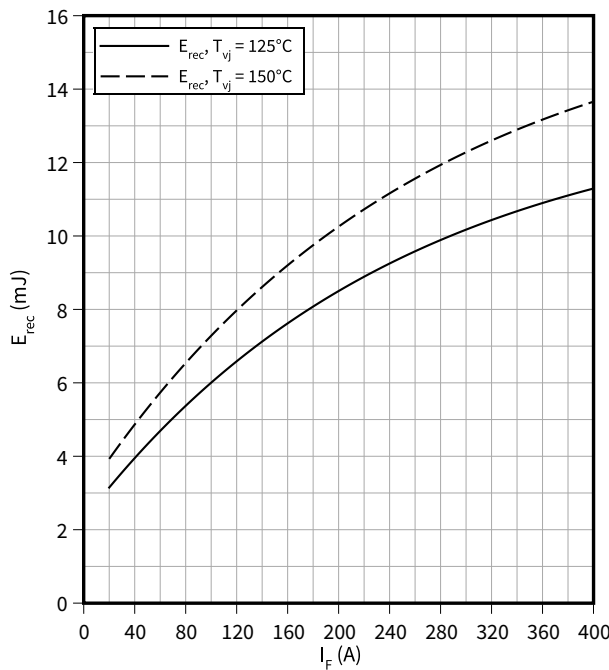
$I_F = f(V_F)$



Switching losses (typical), Diode, D5 / D6

$E_{rec} = f(I_F)$

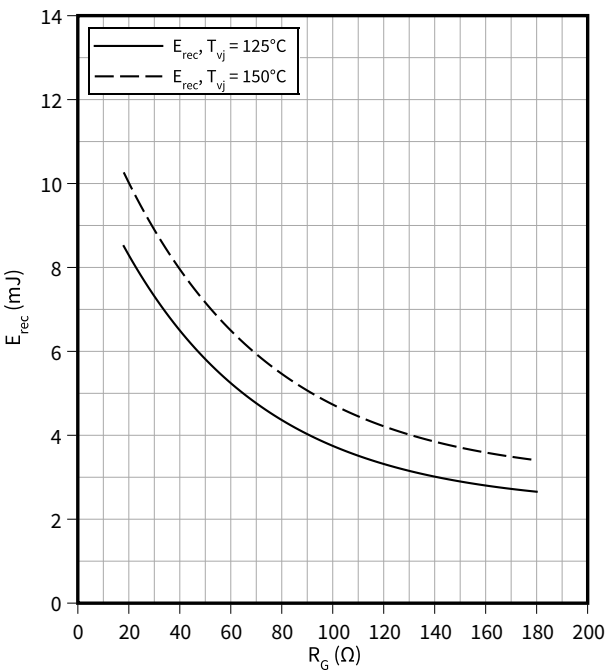
$R_{Gon} = 18 \Omega, V_{CC} = 600 V$



Switching losses (typical), Diode, D5 / D6

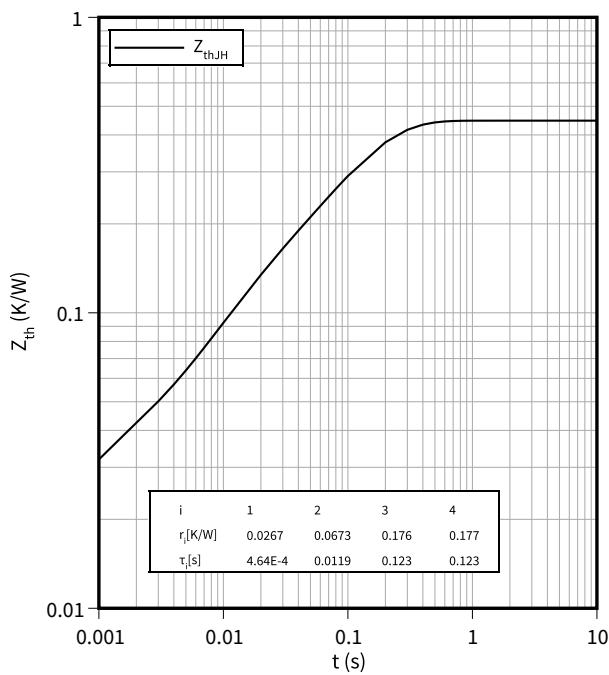
$E_{rec} = f(R_G)$

$I_F = 200 A, V_{CC} = 600 V$



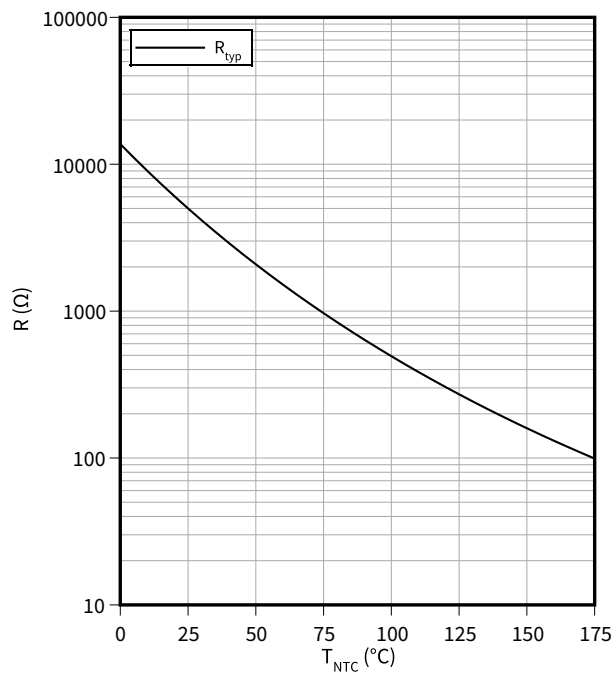
Transient thermal impedance, Diode, D5 / D6

$Z_{th} = f(t)$



Temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



10 Circuit diagram

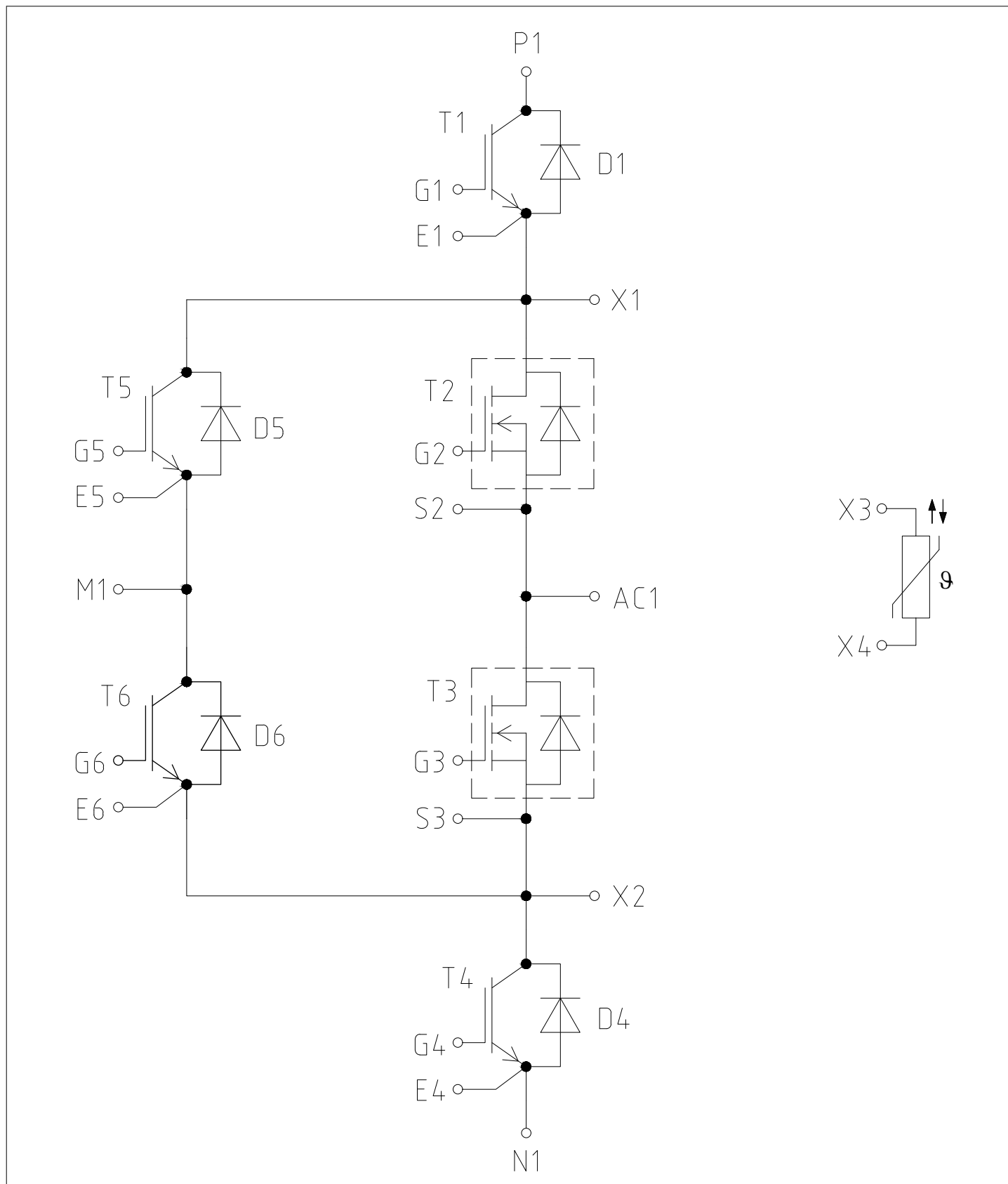


Figure 1

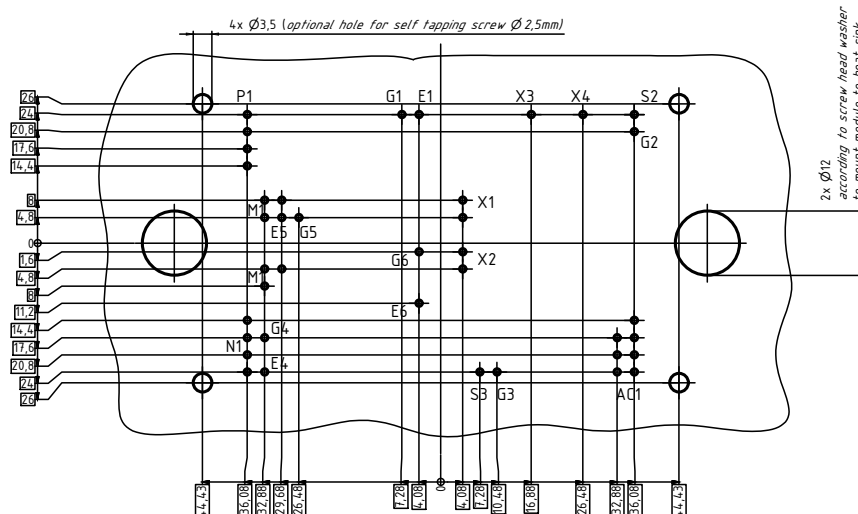
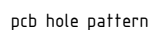


Figure 2

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 version	Date of release	Description of changes
0.10	2023-12-20	Initial version
1.00	2024-11-12	Final datasheet

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