

Preliminary datasheet

EconoPIM™3 module with TRENCHSTOP™ IGBT7 and Emitter Controlled 7 diode and PressFIT / NTC

Features

- Electrical features
 - $V_{CES} = 1200\text{ V}$
 - $I_{C\text{ nom}} = 100\text{ A} / I_{CRM} = 200\text{ A}$
 - TRENCHSTOP™ IGBT7
 - Low V_{CESat}
 - Overload operation up to 175°C
- Mechanical features
 - High power and thermal cycling capability
 - Integrated NTC temperature sensor
 - Copper base plate
 - Al_2O_3 substrate with low thermal resistance
 - PressFIT contact technology



Typical appearance

Potential applications

- Auxiliary inverters
- Motor drives
- Servo drives

Product validation

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

Description

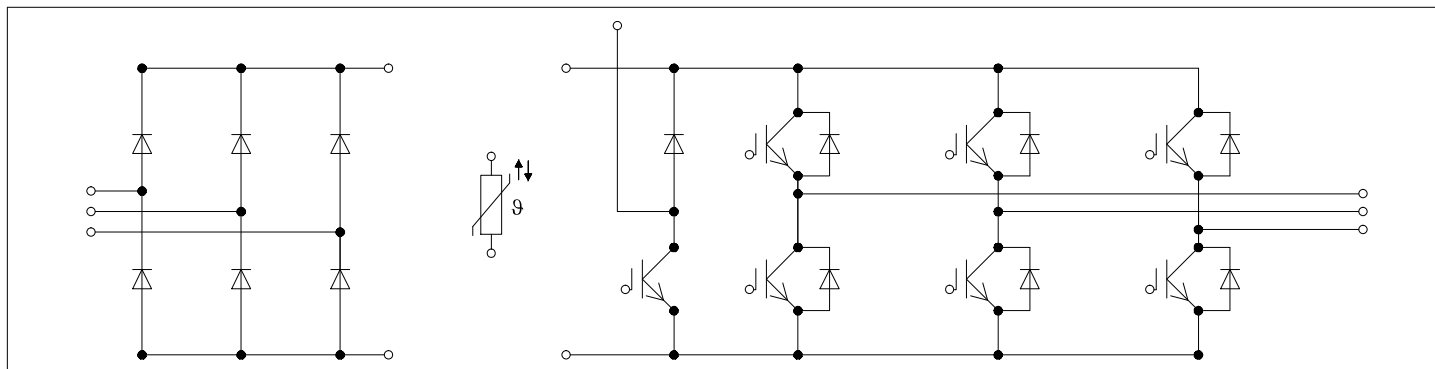


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1 Package

Table 1 Insulation coordination

Parameter	Symbol	Note or test condition	Values	Unit
Isolation test voltage	V_{ISOL}	RMS, $f = 50 \text{ Hz}$, $t = 1 \text{ min}$	2.5	kV
Material of module baseplate			Cu	
Internal Isolation		basic insulation (class 1, IEC 61140)	Al_2O_3	
Creepage distance	d_{Creep}	terminal to heatsink	10.0	mm
Clearance	d_{Clear}	terminal to heatsink	7.5	mm
Comparative tracking index	CTI		> 200	
RTI Elec.	RTI	housing	140	°C

Table 2 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Stray inductance module	L_{sCE}			35		nH
Module lead resistance, terminals - chip	$R_{AA'+CC'}$	$T_C = 25^\circ\text{C}$, per switch		4.1		mΩ
Module lead resistance, terminals - chip	$R_{CC'+EE'}$	$T_C = 25^\circ\text{C}$, per switch		3.9		mΩ
Storage temperature	T_{stg}		-40		125	°C
Mounting torque for modul mounting	M	- Mounting according to valid application note	M5, Screw	3	6	Nm
Weight	G			300		g

2 IGBT, Inverter

Table 3 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	V_{CES}	$T_{vj} = 25^\circ\text{C}$	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj\max} = 175^\circ\text{C}$ $T_C = 100^\circ\text{C}$	100	A
Repetitive peak collector current	I_{CRM}	$t_P = 1 \text{ ms}$	200	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	$V_{CE\ sat}$	$I_C = 100\ A, V_{GE} = 15\ V$	$T_{vj} = 25\ ^\circ C$	1.50	TBD	V
			$T_{vj} = 125\ ^\circ C$	1.64		
			$T_{vj} = 175\ ^\circ C$	1.72		
Gate threshold voltage	V_{GEth}	$I_C = 2.5\ mA, V_{CE} = V_{GE}, T_{vj} = 25\ ^\circ C$	5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm 15\ V, V_{CE} = 600\ V$		1.8		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\ ^\circ C$		1.5		Ω
Input capacitance	C_{ies}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		21.7		nF
Reverse transfer capacitance	C_{res}	$f = 100\ kHz, T_{vj} = 25\ ^\circ C, V_{CE} = 25\ V, V_{GE} = 0\ V$		0.076		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\ V, V_{GE} = 0\ V$	$T_{vj} = 25\ ^\circ C$		0.01	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}	$I_C = 100\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 3.6\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.159		μs
			$T_{vj} = 125\ ^\circ C$	0.176		
			$T_{vj} = 175\ ^\circ C$	0.184		
Rise time (inductive load)	t_r	$I_C = 100\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Gon} = 3.6\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.054		μs
			$T_{vj} = 125\ ^\circ C$	0.058		
			$T_{vj} = 175\ ^\circ C$	0.062		
Turn-off delay time (inductive load)	t_{doff}	$I_C = 100\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 3.6\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.330		μs
			$T_{vj} = 125\ ^\circ C$	0.420		
			$T_{vj} = 175\ ^\circ C$	0.460		
Fall time (inductive load)	t_f	$I_C = 100\ A, V_{CE} = 600\ V, V_{GE} = \pm 15\ V, R_{Goff} = 3.6\ \Omega$	$T_{vj} = 25\ ^\circ C$	0.100		μs
			$T_{vj} = 125\ ^\circ C$	0.190		
			$T_{vj} = 175\ ^\circ C$	0.260		
Turn-on energy loss per pulse	E_{on}	$I_C = 100\ A, V_{CE} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Gon} = 3.6\ \Omega, di/dt = 1350\ A/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	11.5		mJ
			$T_{vj} = 125\ ^\circ C$	15.1		
			$T_{vj} = 175\ ^\circ C$	17.2		
Turn-off energy loss per pulse	E_{off}	$I_C = 100\ A, V_{CE} = 600\ V, L_\sigma = 35\ nH, V_{GE} = \pm 15\ V, R_{Goff} = 3.6\ \Omega, dv/dt = 2900\ V/\mu s (T_{vj} = 175\ ^\circ C)$	$T_{vj} = 25\ ^\circ C$	6.95		mJ
			$T_{vj} = 125\ ^\circ C$	10.9		
			$T_{vj} = 175\ ^\circ C$	13.4		
SC data	I_{SC}	$V_{GE} \leq 15\ V, V_{CC} = 800\ V, V_{CEmax} = V_{CES} - L_{sCE} \cdot di/dt$	$t_P \leq 8\ \mu s, T_{vj} = 150\ ^\circ C$	370		A
			$t_P \leq 7\ \mu s, T_{vj} = 175\ ^\circ C$	350		

Table 4 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.373	K/W
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, $\lambda_{grease} = 1 \text{ W/(m}^2\text{K)}$		0.0680		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	°C

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

3 Diode, Inverter

Table 5 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}		$T_{vj} = 25^\circ\text{C}$	1200	V
Continuous DC forward current	I_F			100	A
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$		200	A
I^2t - value	I^2t	$t_P = 10 \text{ ms}, V_R = 0 \text{ V}$	$T_{vj} = 125^\circ\text{C}$	1980	A^2s
			$T_{vj} = 175^\circ\text{C}$	1710	

Table 6 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 100 \text{ A}, V_{GE} = 0 \text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.72	TBD	V
			$T_{vj} = 125^\circ\text{C}$	1.59		
			$T_{vj} = 175^\circ\text{C}$	1.52		
Peak reverse recovery current	I_{RM}	$V_R = 600 \text{ V}, I_F = 100 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 1350 \text{ A}/\mu\text{s} (T_{vj} = 175^\circ\text{C})$	$T_{vj} = 25^\circ\text{C}$	51		A
			$T_{vj} = 125^\circ\text{C}$	68		
			$T_{vj} = 175^\circ\text{C}$	78		
Recovered charge	Q_r	$V_R = 600 \text{ V}, I_F = 100 \text{ A}, V_{GE} = -15 \text{ V}, -di_F/dt = 1350 \text{ A}/\mu\text{s} (T_{vj} = 175^\circ\text{C})$	$T_{vj} = 25^\circ\text{C}$	6.9		μC
			$T_{vj} = 125^\circ\text{C}$	13.5		
			$T_{vj} = 175^\circ\text{C}$	18.3		

Table 6 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Reverse recovery energy	E_{rec}	$V_R = 600 \text{ V}$, $I_F = 100 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 1350 \text{ A}/\mu\text{s}$ ($T_{vj} = 175 \text{ °C}$)	$T_{vj} = 25 \text{ °C}$	2.05		mJ
			$T_{vj} = 125 \text{ °C}$	4.31		
			$T_{vj} = 175 \text{ °C}$	6.05		
Thermal resistance, junction to case	R_{thJC}	per diode			0.612	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}^*\text{K})$		0.0770		K/W
Temperature under switching conditions	$T_{vj op}$		-40		175	°C

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

4 Diode, Rectifier

Table 7 Maximum rated values

Parameter	Symbol	Note or test condition		Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25\text{ }^{\circ}\text{C}$		1600	V
Maximum RMS forward current per chip	I_{FRMSM}	$T_C = 110\text{ }^{\circ}\text{C}$		100	A
Maximum RMS current at rectifier output	I_{RMSM}	$T_C = 110\text{ }^{\circ}\text{C}$		150	A
Surge forward current	I_{FSM}	$t_P = 10\text{ ms}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	1250	A
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	990	
I^2t - value	I^2t	$t_P = 10\text{ ms}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	8250	A^2s
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	4950	

Table 8 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 100 \text{ A}$, $T_{vj} = 150 \text{ °C}$		1.02		V
Reverse current	I_r	$T_{vj} = 150 \text{ °C}$, $V_R = 1600 \text{ V}$		1		mA
Thermal resistance, junction to case	R_{thJC}	per diode			0.498	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}^*\text{K})$		0.0710		K/W

Table 8 Characteristic values (continued)

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

5 IGBT, Brake-Chopper

Table 9 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Collector-emitter voltage	V_{CES}	$T_{vj} = 25\text{ °C}$	1200	V
Continuous DC collector current	I_{CDC}	$T_{vj, max} = 175\text{ °C}$ $T_C = 115\text{ °C}$	50	A
Repetitive peak collector current	I_{CRM}	$t_P = 1\text{ ms}$	100	A
Gate-emitter peak voltage	V_{GES}		±20	V

Table 10 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Collector-emitter saturation voltage	$V_{CE sat}$	$I_C = 50\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25\text{ °C}$	1.50	TBD	V
			$T_{vj} = 125\text{ °C}$	1.64		
			$T_{vj} = 175\text{ °C}$	1.72		
Gate threshold voltage	V_{GETh}	$I_C = 1.28\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25\text{ °C}$	5.15	5.80	6.45	V
Gate charge	Q_G	$V_{GE} = \pm 15\text{ V}$, $V_{CE} = 600\text{ V}$		0.92		μC
Internal gate resistor	R_{Gint}	$T_{vj} = 25\text{ °C}$		0		Ω
Input capacitance	C_{ies}	$f = 100\text{ kHz}$, $T_{vj} = 25\text{ °C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$		11.1		nF
Reverse transfer capacitance	C_{res}	$f = 100\text{ kHz}$, $T_{vj} = 25\text{ °C}$, $V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$		0.039		nF
Collector-emitter cut-off current	I_{CES}	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$ $T_{vj} = 25\text{ °C}$			0.007	mA
Gate-emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = 20\text{ V}$, $T_{vj} = 25\text{ °C}$			100	nA
Turn-on delay time (inductive load)	t_{don}	$I_C = 50\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 7.5\text{ Ω}$	$T_{vj} = 25\text{ °C}$	0.059		μs
			$T_{vj} = 125\text{ °C}$	0.061		
			$T_{vj} = 175\text{ °C}$	0.062		
Rise time (inductive load)	t_r	$I_C = 50\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 7.5\text{ Ω}$	$T_{vj} = 25\text{ °C}$	0.041		μs
			$T_{vj} = 125\text{ °C}$	0.046		
			$T_{vj} = 175\text{ °C}$	0.048		

Table 10 Characteristic values (continued)

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Turn-off delay time (inductive load)	t_{doff}	$I_C = 50 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{\text{Goff}} = 7.5 \Omega$	$T_{vj} = 25^\circ \text{C}$	0.290		μs
			$T_{vj} = 125^\circ \text{C}$	0.380		
			$T_{vj} = 175^\circ \text{C}$	0.420		
Fall time (inductive load)	t_f	$I_C = 50 \text{ A}$, $V_{CE} = 600 \text{ V}$, $V_{GE} = \pm 15 \text{ V}$, $R_{\text{Goff}} = 7.5 \Omega$	$T_{vj} = 25^\circ \text{C}$	0.110		μs
			$T_{vj} = 125^\circ \text{C}$	0.200		
			$T_{vj} = 175^\circ \text{C}$	0.270		
Turn-on energy loss per pulse	E_{on}	$I_C = 50 \text{ A}$, $V_{CE} = 600 \text{ V}$, $L_\sigma = 35 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{\text{Gon}} = 7.5 \Omega$, $di/dt = 785 \text{ A}/\mu\text{s}$ ($T_{vj} = 175^\circ \text{C}$)	$T_{vj} = 25^\circ \text{C}$	4.78		mJ
			$T_{vj} = 125^\circ \text{C}$	6.12		
			$T_{vj} = 175^\circ \text{C}$	6.78		
Turn-off energy loss per pulse	E_{off}	$I_C = 50 \text{ A}$, $V_{CE} = 600 \text{ V}$, $L_\sigma = 35 \text{ nH}$, $V_{GE} = \pm 15 \text{ V}$, $R_{\text{Goff}} = 7.5 \Omega$, $dv/dt = 2950 \text{ V}/\mu\text{s}$ ($T_{vj} = 175^\circ \text{C}$)	$T_{vj} = 25^\circ \text{C}$	3.29		mJ
			$T_{vj} = 125^\circ \text{C}$	5.2		
			$T_{vj} = 175^\circ \text{C}$	6.4		
SC data	I_{SC}	$V_{GE} \leq 15 \text{ V}$, $V_{CC} = 800 \text{ V}$, $V_{CE\text{max}} = V_{CES} - L_{sCE} \cdot di/dt$	$t_P \leq 8 \mu\text{s}$, $T_{vj} = 150^\circ \text{C}$	190		A
			$t_P \leq 7 \mu\text{s}$, $T_{vj} = 175^\circ \text{C}$	180		
Thermal resistance, junction to case	R_{thJC}	per IGBT			0.598	K/W
Thermal resistance, case to heatsink	R_{thCH}	per IGBT, $\lambda_{\text{grease}} = 1 \text{ W}/(\text{m}^2\text{K})$		0.0760		K/W
Temperature under switching conditions	$T_{vj \text{ op}}$		-40		175	$^\circ \text{C}$

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

6 Diode, Brake-Chopper

Table 11 Maximum rated values

Parameter	Symbol	Note or test condition	Values	Unit
Repetitive peak reverse voltage	V_{RRM}	$T_{vj} = 25^\circ \text{C}$	1200	V
Continuous DC forward current	I_F		35	A
Repetitive peak forward current	I_{FRM}	$t_P = 1 \text{ ms}$	70	A

Table 11 Maximum rated values (continued)

Parameter	Symbol	Note or test condition	Values	Unit
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 12 Characteristic values

Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
Forward voltage	V_F	$I_F = 35 \text{ A}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.72	TBD	V
			$T_{vj} = 125^\circ\text{C}$	1.59		
			$T_{vj} = 175^\circ\text{C}$	1.52		
Peak reverse recovery current	I_{RM}	$V_R = 600 \text{ V}$, $I_F = 35 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 755 \text{ A}/\mu\text{s}$ ($T_{vj} = 175^\circ\text{C}$)	$T_{vj} = 25^\circ\text{C}$	20		A
			$T_{vj} = 125^\circ\text{C}$	26		
			$T_{vj} = 175^\circ\text{C}$	30		
Recovered charge	Q_r	$V_R = 600 \text{ V}$, $I_F = 35 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 755 \text{ A}/\mu\text{s}$ ($T_{vj} = 175^\circ\text{C}$)	$T_{vj} = 25^\circ\text{C}$	2.36		μC
			$T_{vj} = 125^\circ\text{C}$	4.7		
			$T_{vj} = 175^\circ\text{C}$	6.22		
Reverse recovery energy	E_{rec}	$V_R = 600 \text{ V}$, $I_F = 35 \text{ A}$, $V_{GE} = -15 \text{ V}$, $-di_F/dt = 755 \text{ A}/\mu\text{s}$ ($T_{vj} = 175^\circ\text{C}$)	$T_{vj} = 25^\circ\text{C}$	0.75		mJ
			$T_{vj} = 125^\circ\text{C}$	1.64		
			$T_{vj} = 175^\circ\text{C}$	2.24		
Thermal resistance, junction to case	R_{thJC}	per diode			1.06	K/W
Thermal resistance, case to heatsink	R_{thCH}	per diode, $\lambda_{grease} = 1 \text{ W}/(\text{m}^*\text{K})$		0.137		K/W
Temperature under switching conditions	$T_{vj\text{ op}}$		-40		175	$^\circ\text{C}$

Note: $T_{vj\text{ op}} > 150^\circ\text{C}$ 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

Table 13 **Characteristic values (continued)**

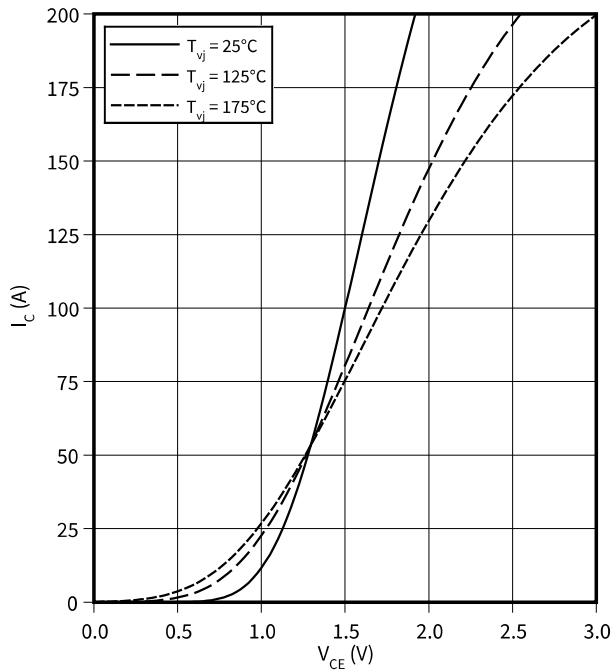
Parameter	Symbol	Note or test condition	Values			Unit
			Min.	Typ.	Max.	
B-value	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$		3375		K
B-value	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$		3411		K
B-value	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$		3433		K

Note: *Specification according to the valid application note.*

8 Characteristics diagrams

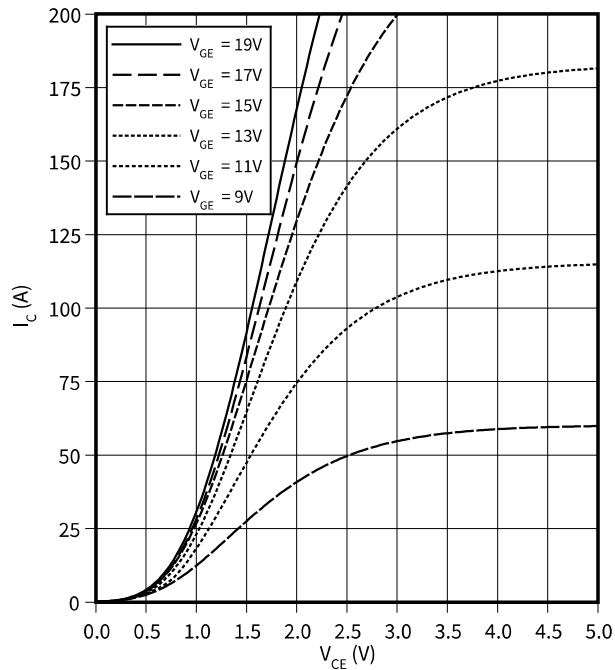
output characteristic (typical), IGBT, Inverter

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



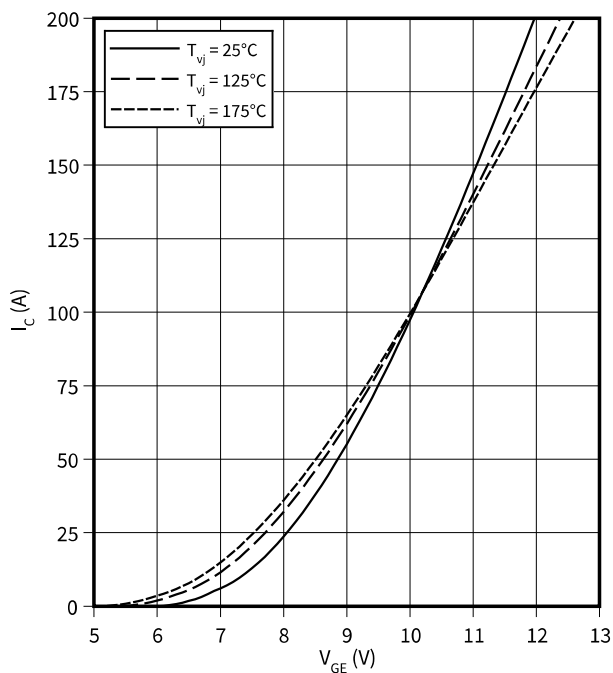
output characteristic (typical), IGBT, Inverter

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



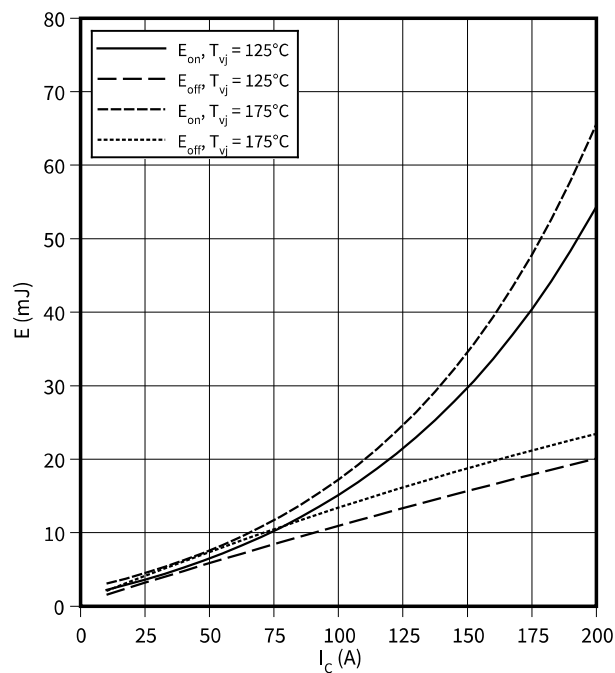
transfer characteristic (typical), IGBT, Inverter

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



switching losses (typical), IGBT, Inverter

$E = f(I_C)$
 $R_{Goff} = 3.6\ \Omega$, $R_{Gon} = 3.6\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $V_{CE} = 600\text{ V}$

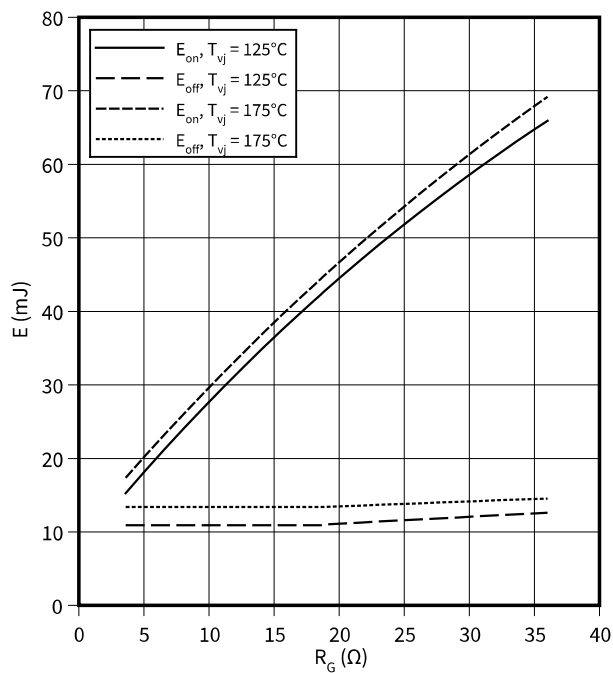


8 Characteristics diagrams

switching losses (typical), IGBT, Inverter

$E = f(R_G)$

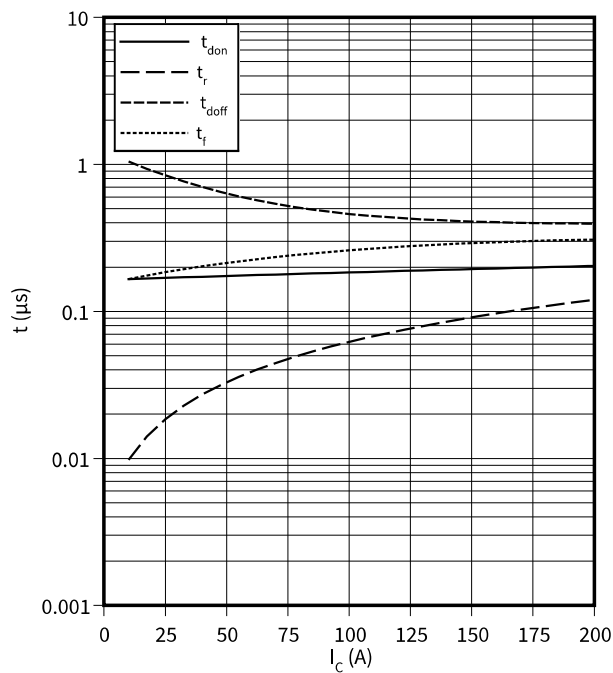
$I_C = 100\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = \pm 15\text{ V}$



switching times (typical), IGBT, Inverter

$t = f(I_C)$

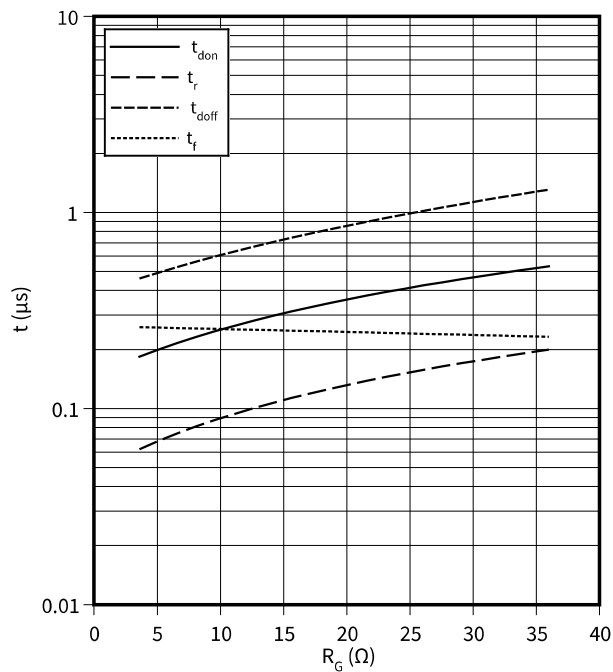
$R_{Goff} = 3.6\ \Omega$, $R_{Gon} = 3.6\ \Omega$, $V_{GE} = \pm 15\text{ V}$, $V_{CE} = 600\text{ V}$, $T_{vj} = 175\text{ °C}$



switching times (typical), IGBT, Inverter

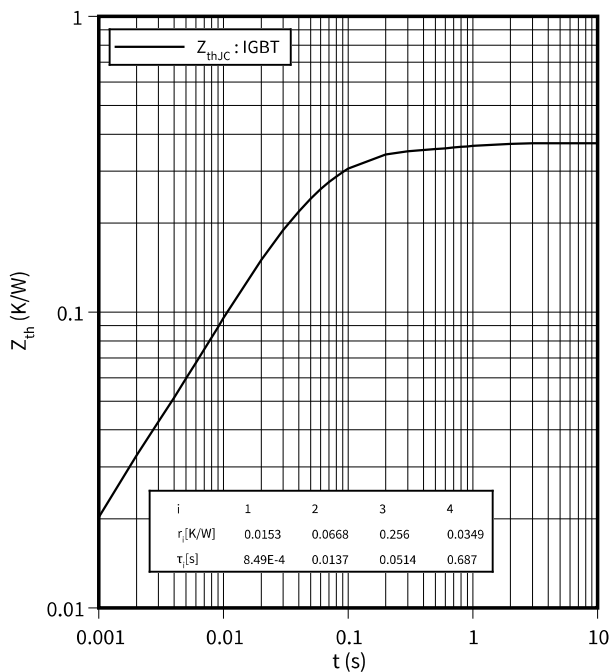
$t = f(R_G)$

$V_{GE} = \pm 15\text{ V}$, $I_C = 100\text{ A}$, $V_{CE} = 600\text{ V}$, $T_{vj} = 175\text{ °C}$



transient thermal impedance , IGBT, Inverter

$Z_{th} = f(t)$

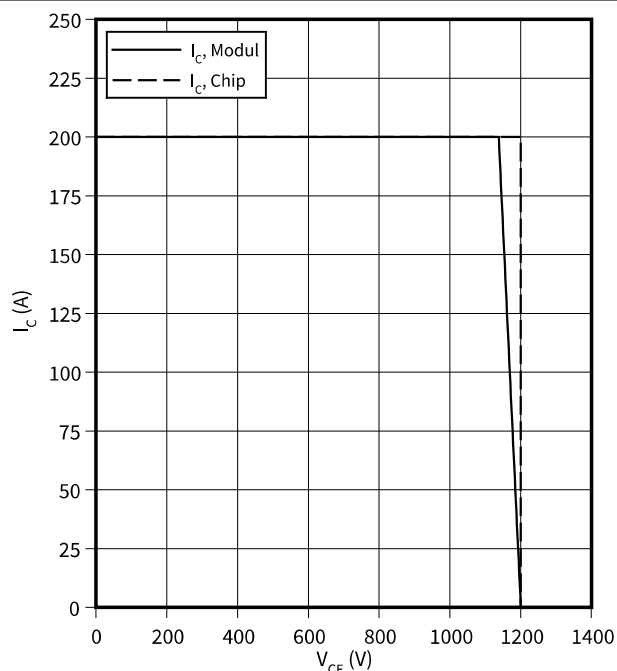


8 Characteristics diagrams

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

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

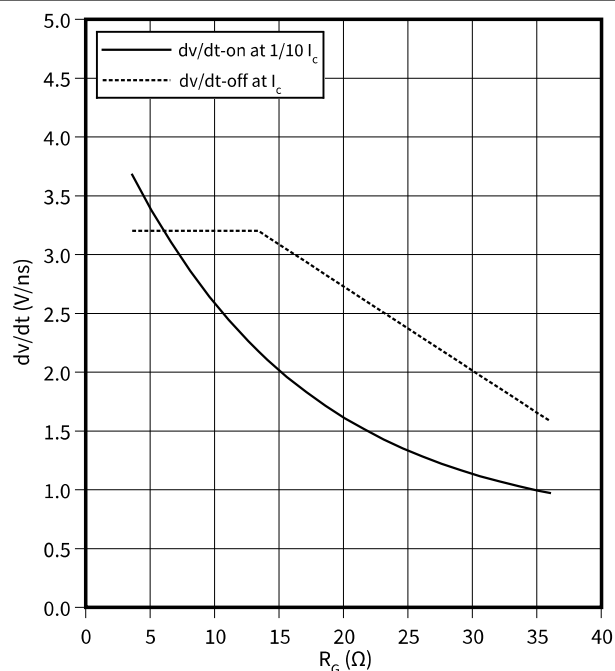
$$R_{Goff} = 3.6 \, \Omega, V_{GE} = \pm 15 \, V, T_{vj} = 175 \, ^\circ C$$



Voltage slope (typical), IGBT, Inverter

$$dv/dt = f(R_G)$$

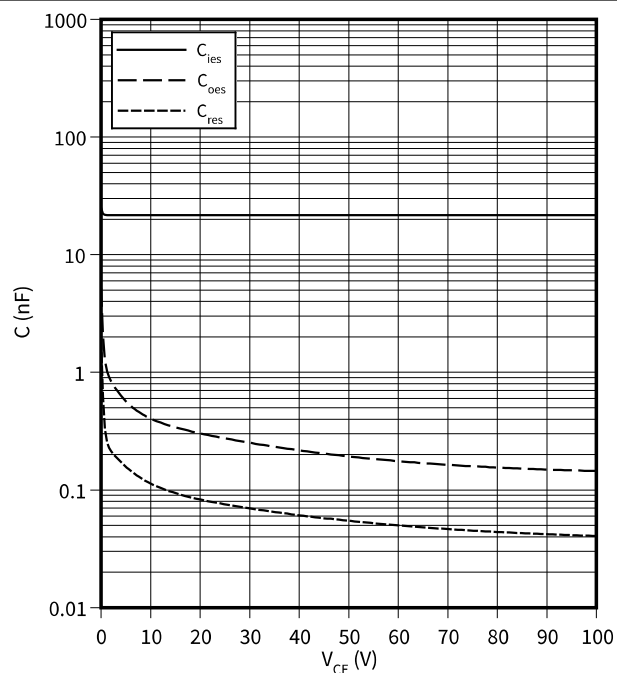
$$I_C = 100 \, A, V_{CE} = 600 \, V, V_{GE} = \pm 15 \, V, T_{vj} = 25 \, ^\circ C$$



capacity characteristic (typical), IGBT, Inverter

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

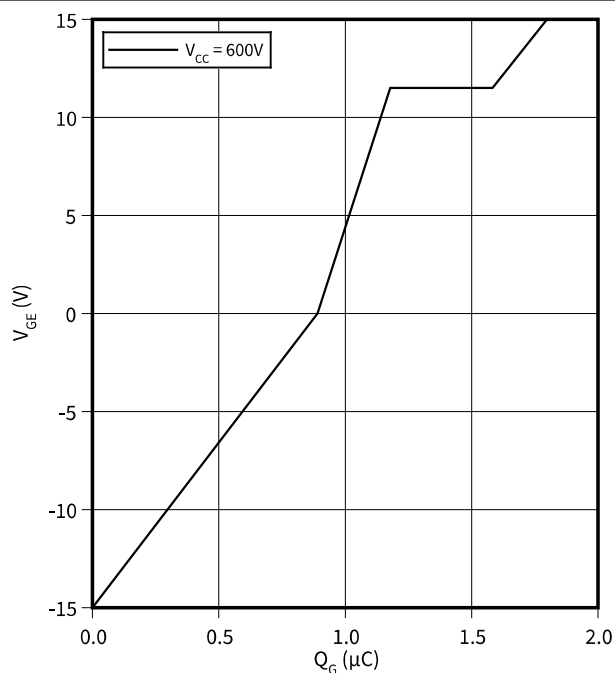
$$f = 100 \, kHz, V_{GE} = 0 \, V, T_{vj} = 25 \, ^\circ C$$



gate charge characteristic (typical), IGBT, Inverter

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

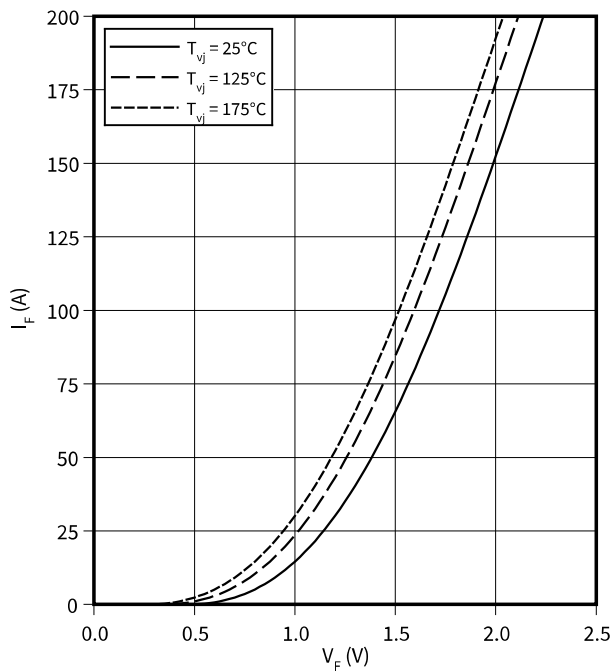
$$I_C = 100 \, A, T_{vj} = 25 \, ^\circ C$$



8 Characteristics diagrams

forward characteristic (typical), Diode, Inverter

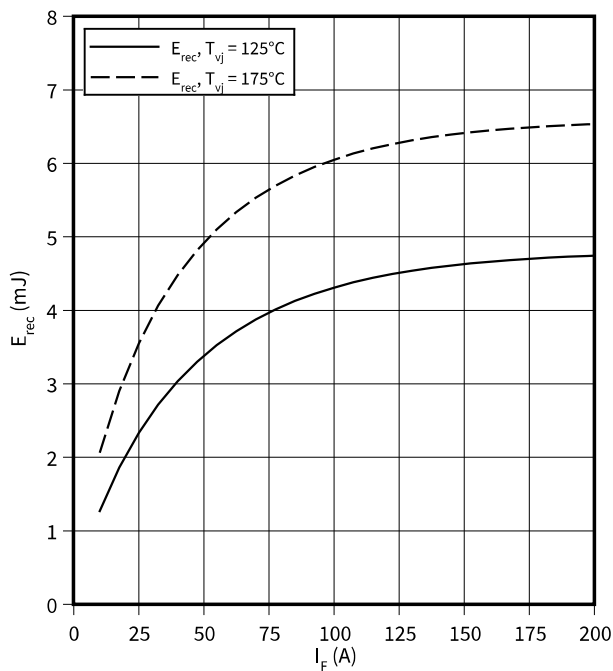
$I_F = f(V_F)$



switching losses (typical), Diode, Inverter

$E_{rec} = f(I_F)$

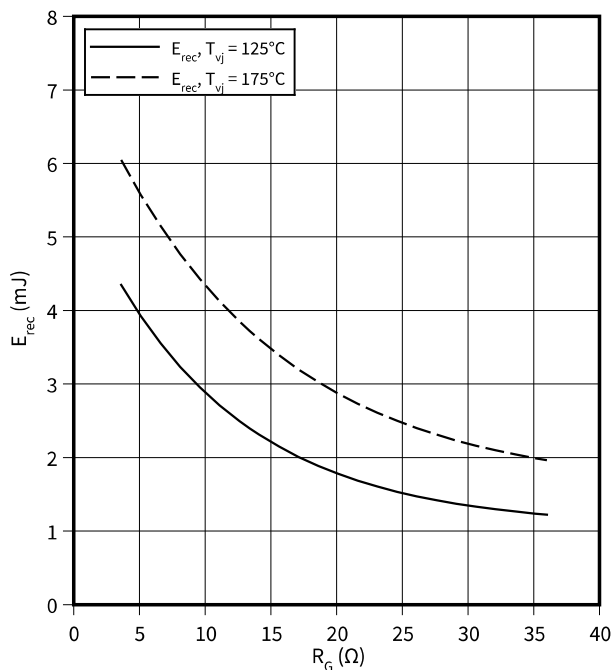
$R_{Gon} = 3.6 \Omega, V_{CE} = 600 \text{ V}$



switching losses (typical), Diode, Inverter

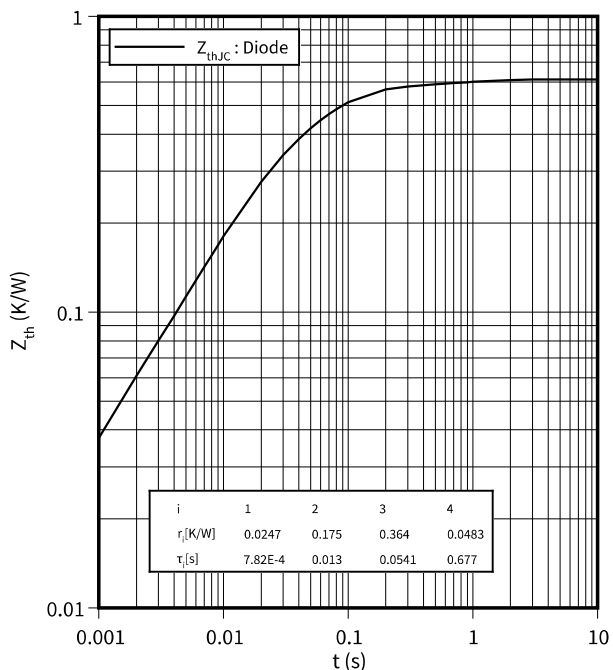
$E_{rec} = f(R_G)$

$V_{CE} = 600 \text{ V}, I_F = 100 \text{ A}$



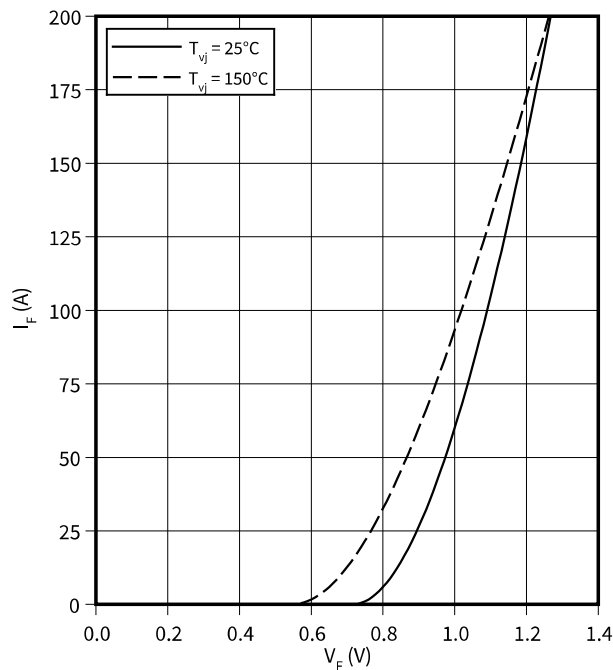
transient thermal impedance, Diode, Inverter

$Z_{th} = f(t)$

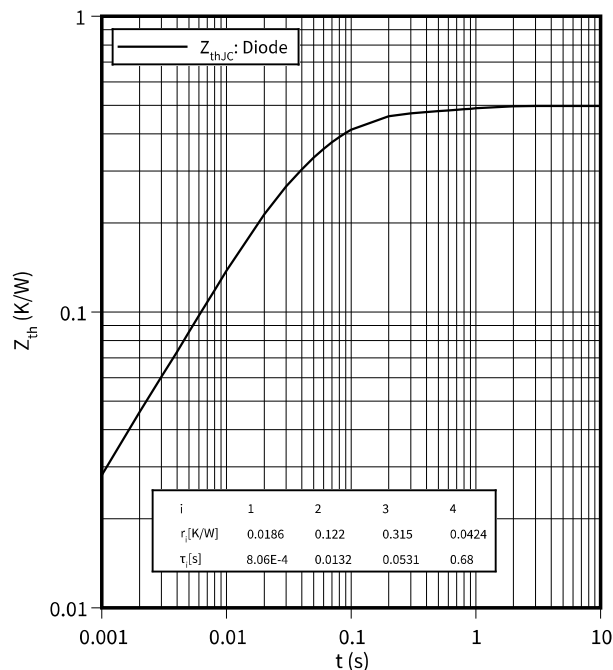


8 Characteristics diagrams

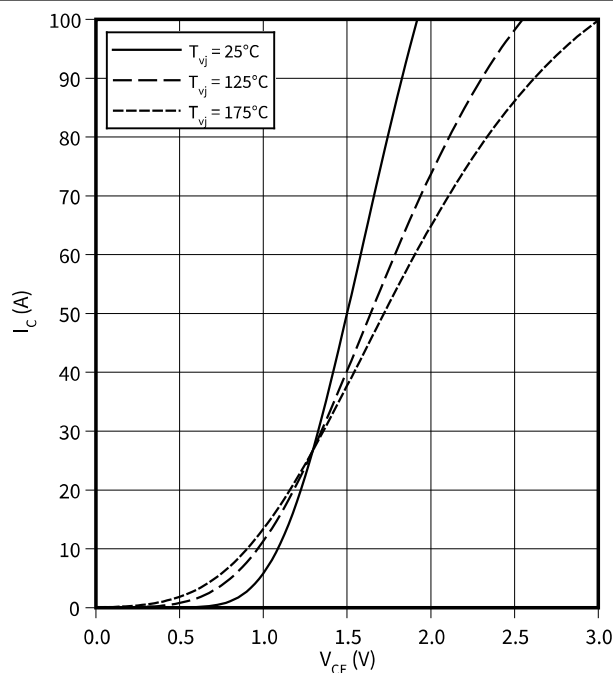
forward characteristic (typical), Diode, Rectifier
 $I_F = f(V_F)$



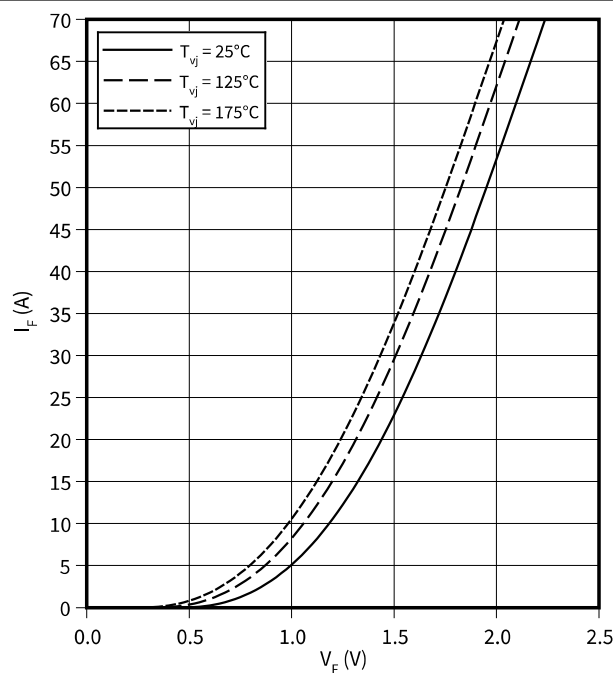
transient thermal impedance , Diode, Rectifier
 $Z_{th} = f(t)$



output characteristic (typical), IGBT, Brake-Chopper
 $I_C = f(V_{CE})$
 $V_{GE} = 15 \text{ V}$



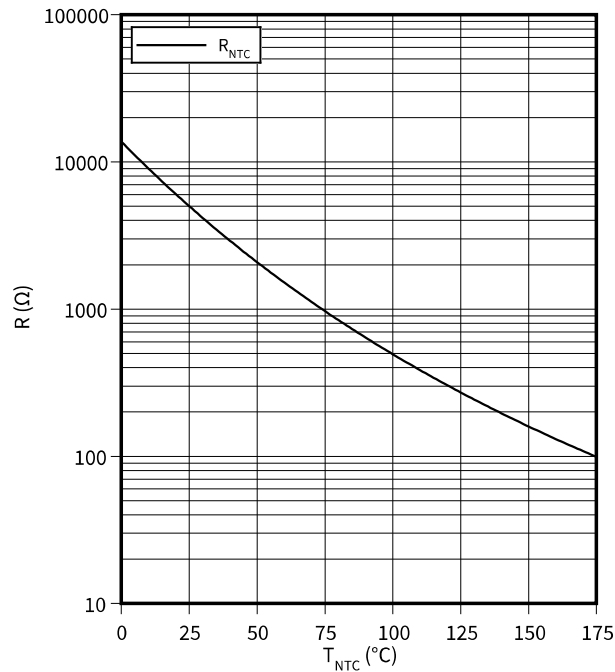
forward characteristic (typical), Diode, Brake-Chopper
 $I_F = f(V_F)$



8 Characteristics diagrams

temperature characteristic (typical), NTC-Thermistor

$R = f(T_{NTC})$



9 **Circuit diagram**

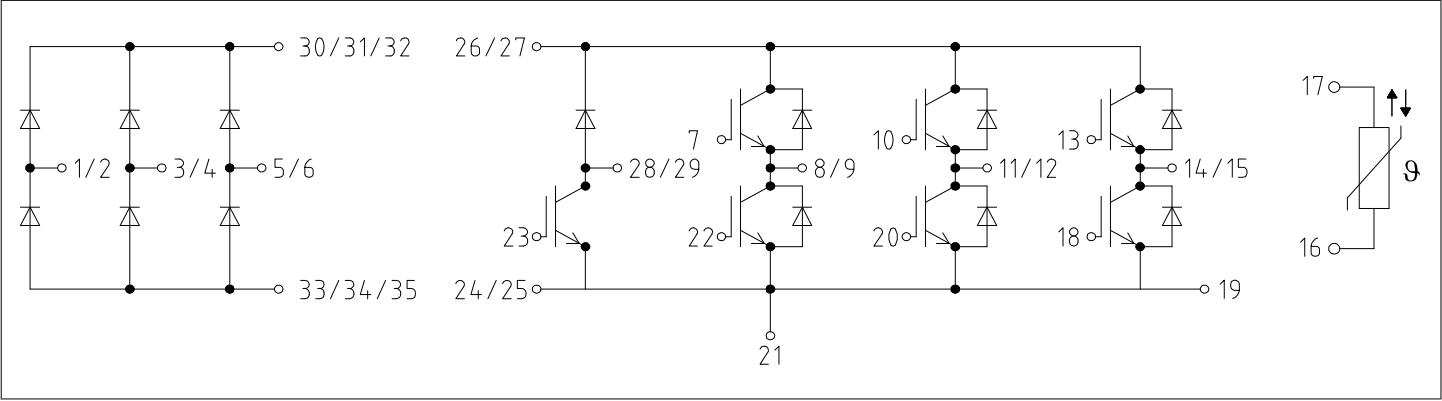


Figure 2



11 Module label code

Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	<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 4

Revision history

Revision history

Document revision	Date of release	Description of changes
0.10	2021-06-17	Initial version

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