

1200V 75A ECPIM 3A IGBT Module

Features

- Trench Field Stop technology
- Low saturation voltage
- 10μs Short Circuit current
- Low turn-off losses
- Positive temperature coefficient



Applications

- AC Motor Drives
- Motion / Servo Drives
- Inverter and Power supplies

■ Absolute Maximum Ratings $T_J = 25^\circ\text{C}$ unless otherwise noted

Item	Symbol	Parameter	Conditions	Value	Units
Diode Rectifier	VRRM	Repetitive Peak Reverse Voltage		1800	V
	IFAV	Forward Current per Diode	@ $T_J = 150^\circ\text{C}$, $T_C = 80^\circ\text{C}$	50	A
	IFSM	Surge Forward Current (Chip level)	@ $t_P = 10\text{ ms}$, half sine wave	600	A
	I _{2t}	I _{2t} - Value (Chip level)	@ $t_P = 10\text{ ms}$, half sine wave	1800	A ² S
	T _J	Operating Junction Temperature *(1)	-	-40 ~ 150	°C
IGBT Inverter	VCES	Collector-Emitter Breakdown Voltage	-	1200	V
	VGES	Gate-Emitter Peak Voltage	-	± 20	V
	IC	DC Collector Current	@ $T_J = 150^\circ\text{C}$, $T_C = 80^\circ\text{C}$	75	A
			@ $T_J = 150^\circ\text{C}$, $T_C = 25^\circ\text{C}$	150	A
	ICM	Repetitive Peak Forward Current	$t_P = 1\text{ ms}$	150	A
	PD	Maximum Power Dissipation	@ $T_J = 175^\circ\text{C}$, $T_C = 80^\circ\text{C}$	540	W
	T _J	Operating Junction Temperature *(2)	-	-40 ~ 150	°C
Diode Inverter	VRRM	Repetitive Peak Reverse Voltage	-	1200	V
	IF	DC Forward Current	@ $T_J = 150^\circ\text{C}$, $T_C = 80^\circ\text{C}$	75	A
	IFRM	Repetitive Peak Forward Current	@ $t_P = 1\text{ ms}$	150	A
	I ² _t		@ $T_J = 125^\circ\text{C}$, $t = 10\text{ ms}$, $V_R = 0\text{ V}$	300	A ² S
	T _J	Operating Junction Temperature *(1)	-	-40 ~ 150	°C
IGBT Brake	VCES	Collector-Emitter Breakdown Voltage	-	1200	V
	VGES	Gate-Emitter Peak Voltage	-	± 20	V
	IC	DC Collector Current	@ $T_J = 150^\circ\text{C}$, $T_C = 80^\circ\text{C}$	50	A
	I _{Cpulse}	Repetitive Peak Collector Current	@ $t_P = 1\text{ ms}$	100	A
	PD	Maximum Power Dissipation	@ $T_J = 150^\circ\text{C}$, $T_C = 25^\circ\text{C}$	400	W
	T _J	Operating Junction Temperature *(2)	-	-40 ~ 150	°C
Diode Brake	VRRM	Repetitive Peak Reverse Voltage	-	1200	V
	IF	DC Forward Current	@ $T_J = 150^\circ\text{C}$, $T_C = 80^\circ\text{C}$	50	A
	IFRM	Repetitive Peak Forward Current	@ $t_P = 1\text{ ms}$	100	A
	I ² _t		@ $T_J = 125^\circ\text{C}$, $t = 10\text{ ms}$, $V_R = 0\text{ V}$	200	A ² S
	T _J	Operating Junction Temperature *(1)	-	-40 ~ 150	°C
Module	T _{stg}	Storage Temperature	-	-40~125	°C
	V _{iso}	Isolation Voltage	@ AC 1minute	2500	V
	W	Weight	-	300	g

■ Electrical Characteristics of IGBT and Diode T_J = 25°C unless otherwise noted

□ Diode Rectifier Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _F	Forward Voltage	I _F =50A, T _J =25°C	-	1.10	-	V
		I _F =50A, T _J =150°C	-	1.00	-	V
I _R	Reverse Leakage Current	V _R =1900V, T _J =25°C	-	-	-	uA
		V _R =1900V, T _J =150°C	-	-	10	uA

□ IGBT-Inverter Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV _{CES}	C-E Breakdown Voltage	V _{GE} = 0 V, I _C = 250 μA	1200	-	-	
I _{CES}	C-E Cut-Off Current	V _{CE} = V _{CES} , V _{GE} = 0 V	-	-	1.0	mA
I _{GES}	G-E Leakage Current	V _{GE} = V _{GES} , V _{CE} = 0 V	-	-	± 500	nA
V _{GE(th)}	G-E Threshold Voltage	V _{GE} = V _{CE} , I _C = 2.6mA	5.0	-	6.8	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 75 A, V _{GE} = 15 V, T _J = 25 °C	-	1.65	1.95	V
		I _C = 75 A, V _{GE} = 15 V, T _J = 125 °C	-	1.9	-	V
I _{SC}	Short Current	V _{GE} ≤ 15 V, V _{CC} = 600 V V _{CE} ≤ V _{CES} , T _J = 125, TP ≤ 10us	-	60	-	A
C _{ies}	Input Capacitance	V _{CE} = 25 V, V _{GE} = 0 V f = 1 MHz, T _J = 25 °C	-	6.000	-	nF
C _{oes}	Output Capacitance		-	-	-	nF
C _{res}	Reverse Transfer Capacitance		-	0.210	-	nF
t _{d(on)}	Turn-On Delay Time	T _J = 25 °C, R _G = 2.2 Ω L = 100 nH, V _{DC} = 600 V V _{GE} = 15 V ~ -15 V I _C = 75 A	-	110	-	ns
t _r	Rise Time		-	28	-	ns
t _{d(off)}	Turn-Off Delay Time		-	270	-	ns
t _f	Fall Time		-	170	-	ns
E _{on}	Turn-On Switching Loss		-	2.30	-	mJ
E _{off}	Turn-Off Switching Loss		-	5.50	-	mJ
Q _g	Total Gate Charge	V _{GE} = 15 V ~ -15 V	-	120	-	nC
Q _{ge}	Gate-Emitter Charge		-	-	-	nC
Q _{gc}	Gate-Collector Charge		-	-	-	nC

□ Diode-Inverter Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
VF	Diode Forward Voltage	IF = 75 A VGE = 0V	TJ = 25 °C	-	1.70	2.10	V
			TJ = 125 °C	-	1.65	-	
trr	Diode Reverse Recovery Time	IF= 75 A diF/dt = 2900A/μs VR = 600 V VGE = 15 V	TJ = 25 °C	-	95	-	ns
			TJ = 125 °C	-	-	-	
IRRM	Diode Peak Reverse Recovery Current		TJ = 25 °C	-	15	-	A
			TJ = 125 °C	-	-	-	
Qrr	Diode Reverse Recovery Charge		TJ = 25 °C	-	1.70	-	μC
			TJ = 125 °C	-	-	-	
Err	Diode Reverse Recovery Energy		TJ = 25 °C	-	3.20	-	mJ
			TJ = 125 °C	-	-	-	

■ Electrical Characteristics of IGBT and Diode T_j = 25°C unless otherwise noted

□ IGBT-Brake Chopper Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV _{CES}	C-E Breakdown Voltage	V _{GE} = 0 V, I _C = 250 μA	1200	-		
I _{CES}	C-E Cut-Off Current	V _{CE} = V _{CES} , V _{GE} = 0 V	-	-	1.0	mA
I _{GES}	G-E Leakage Current	V _{GE} = V _{GES} , V _{CE} = 0 V	-	-	± 500	nA
V _{GE(th)}	G-E Threshold Voltage	V _{GE} = V _{CE} , I _C = 1.7mA	5.0	-	6.8	V
V _{CE(sat)}	Collector to Emitter Saturation Voltage	I _C = 50 A, V _{GE} = 15 V, T _j = 25 °C	-	1.65	1.95	V
		I _C = 50 A, V _{GE} = 15 V, T _j = 125 °C	-	1.85	-	V
I _{SC}	Short Current	V _{GE} ≤ 15 V, V _{CC} = 600 V V _{CE} ≤ V _{CES} , T _j = 125, TP ≤ 10us	-	150	-	A
C _{ies}	Input Capacitance	V _{CE} = 25 V, V _{GE} = 0 V f = 1 MHz, T _j = 25 °C	-	3.800	-	nF
C _{oes}	Output Capacitance		-	-	-	nF
C _{res}	Reverse Transfer Capacitance		-	0.140	-	nF
t _{d(on)}	Turn-On Delay Time	T _j = 25 °C, R _G = 15 Ω L = 100 nH, V _{DC} = 600 V V _{GE} = 15 V ~ -15 V I _C = 50 A	-	95	-	ns
t _r	Rise Time		-	26	-	ns
t _{d(off)}	Turn-Off Delay Time		-	240	-	ns
t _f	Fall Time		-	175	-	ns
E _{on}	Turn-On Switching Loss		-	2.20	-	mJ
E _{off}	Turn-Off Switching Loss		-	3.40	-	mJ
Q _g	Total Gate Charge	V _{GE} = 15 V ~ -15 V	-	-	-	nC
Q _{ge}	Gate-Emitter Charge		-	-	-	nC
Q _{gc}	Gate-Collector Charge		-	-	-	nC

□ Diode-Brake Chopper Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units	
VF	Diode Forward Voltage	IF = 50 A VGE = 0V	Tj = 25 °C	-	1.70	2.10	V	
			Tj = 125 °C	-	1.65	-		
trr	Diode Reverse Recovery Time	IF= 50 A diF/dt = 2900A/μs VR = 600 V VGE = 15 V	Tj = 25 °C	-	85	-	ns	
			Tj = 125 °C	-	-	-		
I _{RRM}	Diode Peak Reverse Recovery Current		Tj = 25 °C	-	15	-	A	
			Tj = 125 °C	-	-	-		
Qrr	Diode Reverse Recovery Charge		Tj = 25 °C	-	1.70	-	μC	
			Tj = 125 °C	-	-	-		
Err	Diode Reverse Recovery Energy		Tj = 25 °C	-	2.00	-	mJ	
			Tj = 125 °C	-	-	-		

NTC Thermistor Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
R25	Rated resistance	TC = 25°C	-	5.00		kΩ
ΔR/R	Deviation of R100	TC = 10°C, R100 = 493 Ω	-5	-	5	%
P25	Power Dissipation	TC = 25°C	-	-	20.0	mW
B _{25/50}	B-Value	$R_2 = R_{25} \exp[B_{25/50}(1/T_2 - 1/(298.15K))]$	-	3375	-	K
B _{25/80}		$R_2 = R_{25} \exp[B_{25/80}(1/T_2 - 1/(298.15K))]$	-	3411	-	K
B _{25/100}		$R_2 = R_{25} \exp[B_{25/100}(1/T_2 - 1/(298.15K))]$	-	3433	-	K

Thermal Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Rth(J-C)	Thermal Resistance (J-C)	Junction-to-Case	-	-	3.60	K/W
Rth(C-H)	Thermal Resistance (C-H)	Case-to-Heatsink	-	0.045	-	°C/W

Figure1. Output characteristic IGBT, Inverter (typical)
 $I_C = f(V_{CE})$ $V_{GE} = 15\text{ V}$

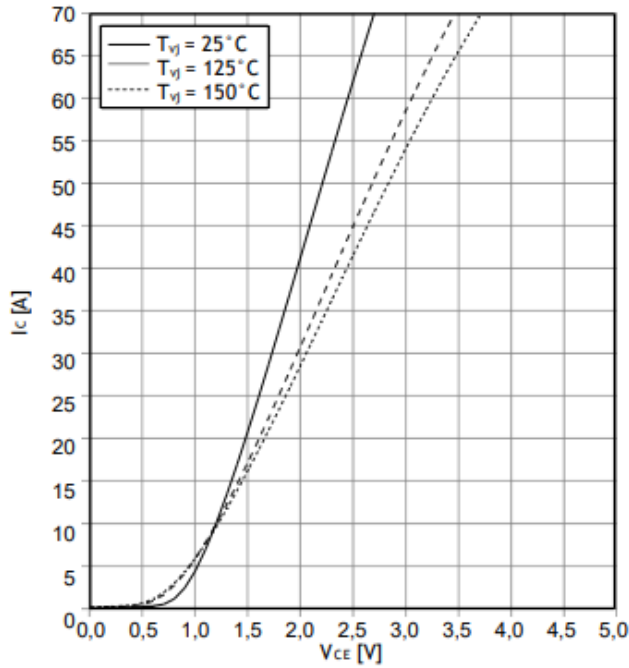


Figure2. Output characteristic IGBT, Inverter (typical)
 $I_C = f(V_{CE})$ $T_{vj} = 150^\circ\text{C}$

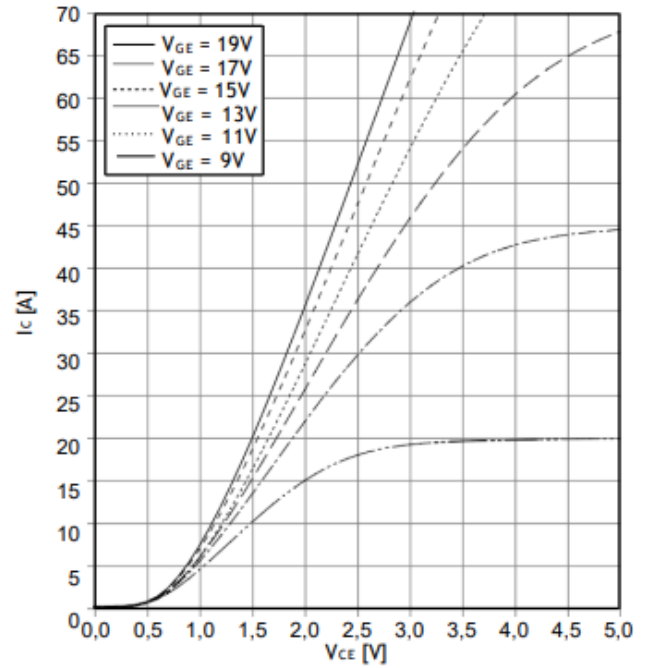


Figure3. Transfer characteristic IGBT, Inverter (typical)
 $I_C = f(V_{GE})$ $V_{CE} = 20\text{ V}$

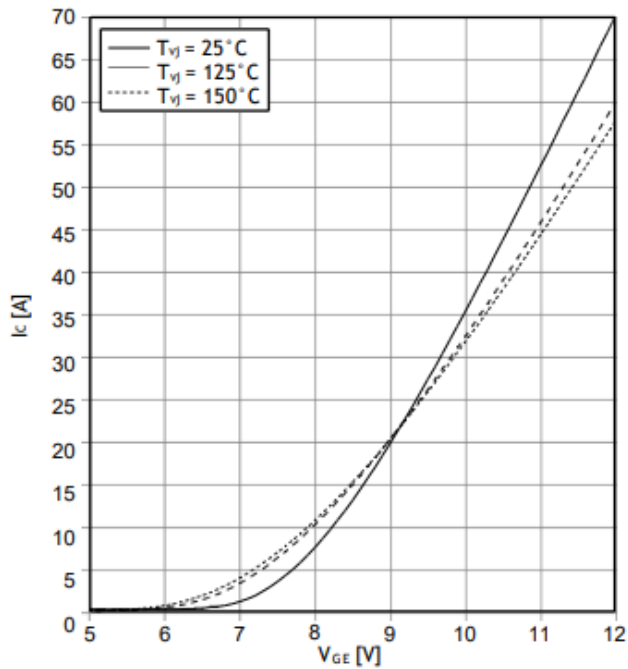


Figure4. Switching losses IGBT, Inverter (typical)
 $E_{on} = f(I_C)$, $E_{off} = f(I_C)$
 $V_{GE} = \pm 15\text{ V}$, $R_{Gon} = 2.2\ \Omega$, $R_{Goff} = 2.2\ \Omega$, $V_{CE} = 600\text{ V}$

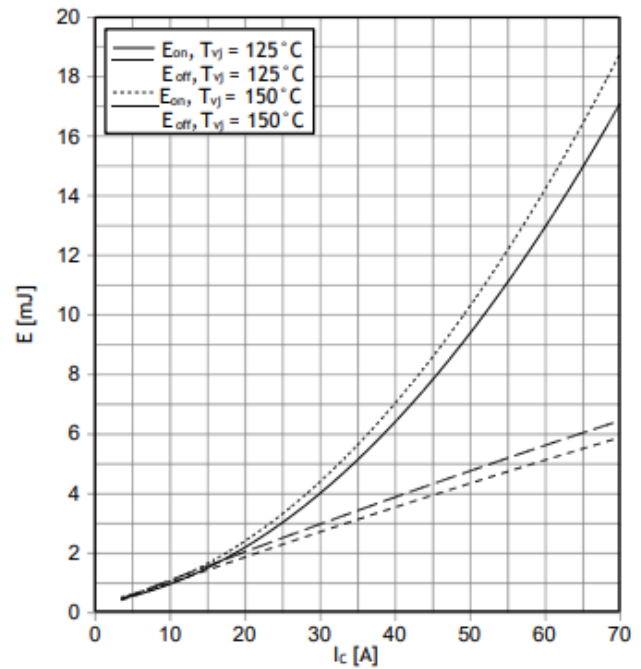


Figure5. Switching losses IGBT, Inverter (typical)

$E_{on} = f(R_G), E_{off} = f(R_G)$
 $V_{GE} = \pm 15 \text{ V}, I_C = 40 \text{ A}, V_{CE} = 600 \text{ V}$

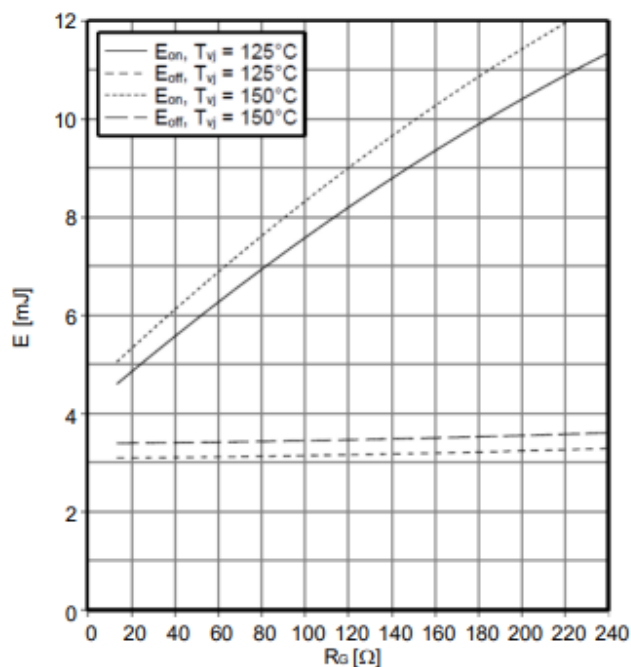


Figure6. Transient thermal impedance IGBT, Inverter

$Z_{thJC} = f(t)$

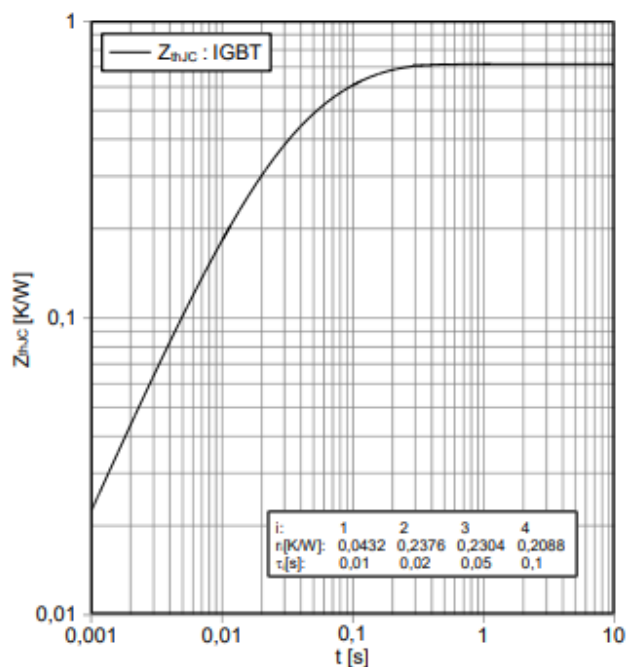


Figure7. Reverse bias safe operating area IGBT, Inverter (RBSOA)

$I_C = f(V_{CE})$
 $V_{GE} = \pm 15 \text{ V}, R_{Goff} = 2.2 \Omega, T_{vj} = 150^\circ\text{C}$

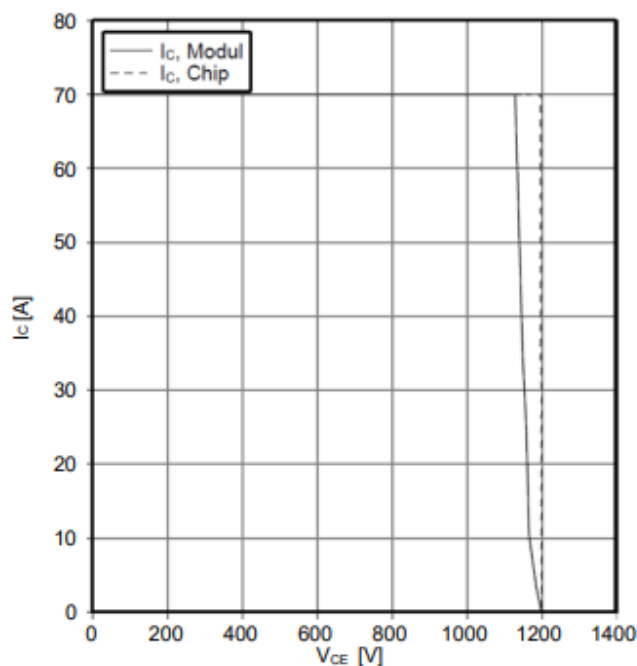


Figure8. Forward characteristic of Diode, Inverter (typical)

$I_F = f(V_F)$

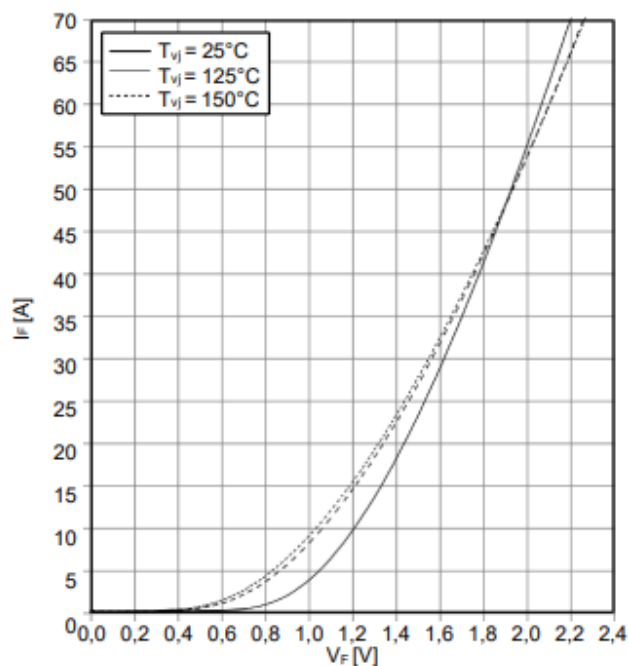


Figure9. Switching losses Diode, Inverter (typical)

$$E_{rec} = f(I_F)$$

$$R_{Gon} = 2.2 \Omega, V_{CE} = 600 V$$

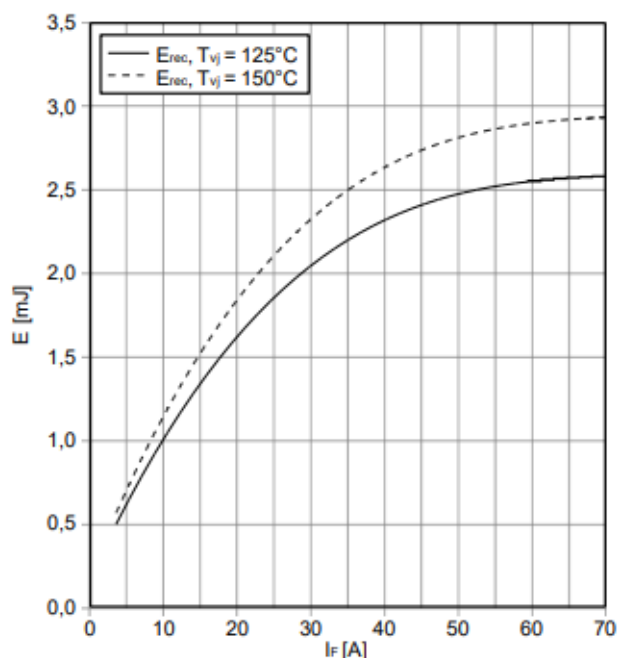


Figure10. Switching losses Diode, Inverter (typical)

$$E_{rec} = f(R_G)$$

$$I_F = 50 A, V_{CE} = 600 V$$

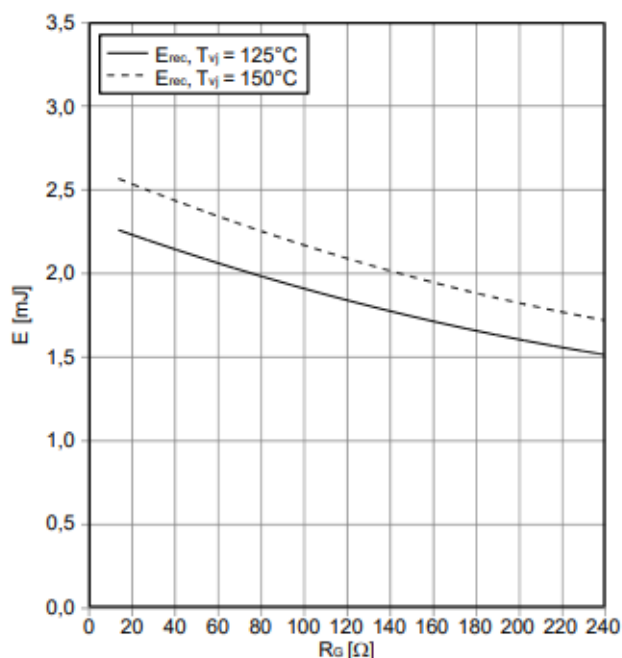


Figure11. Transient thermal impedance Diode, Inverter

$$Z_{thJC} = f(t)$$

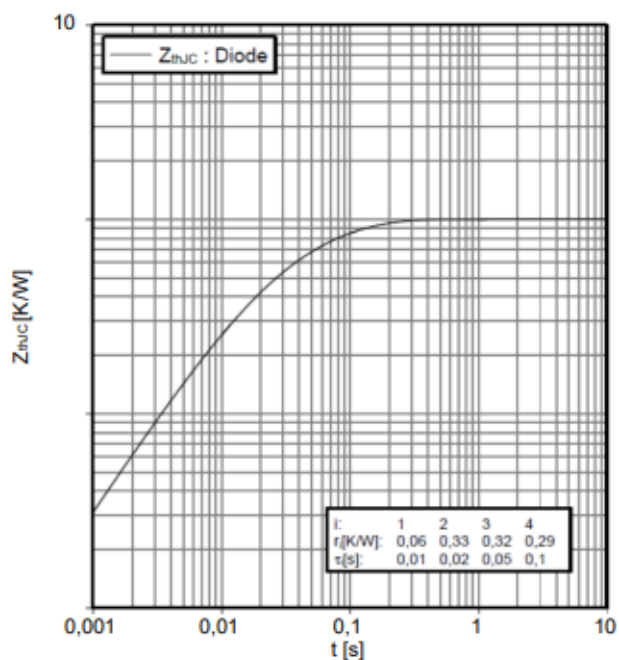


Figure12. Forward characteristic of Diode, Rectifier (typical)

$$I_F = f(V_F)$$

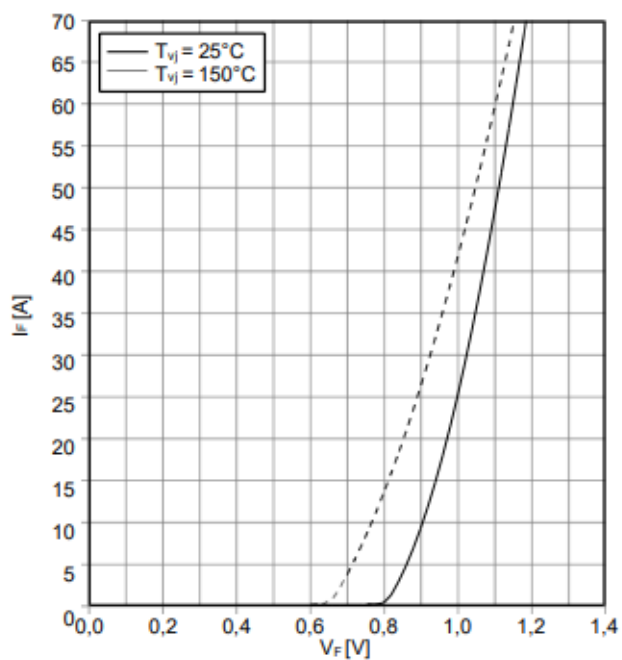


Figure13. Output characteristic IGBT, Brake-Chopper (typical)
 $I_C = f(V_{CE})$ $V_{GE} = 15\text{ V}$

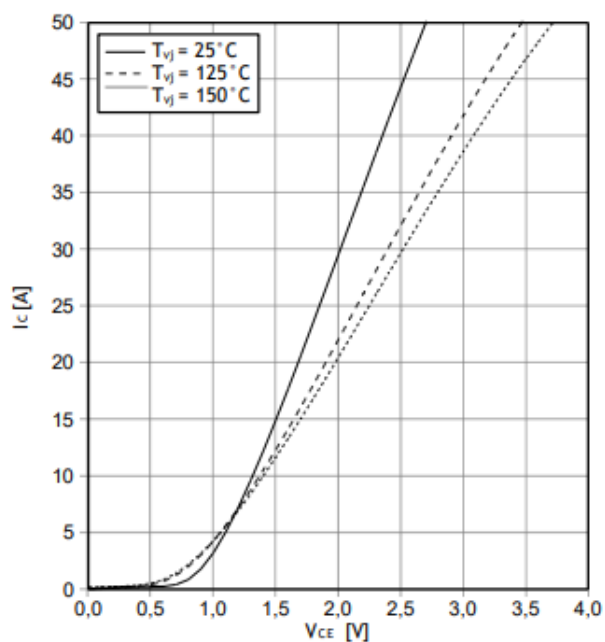


Figure14. Forward characteristic of Diode, Brake-Chopper (typical)
 $I_F = f(V_F)$

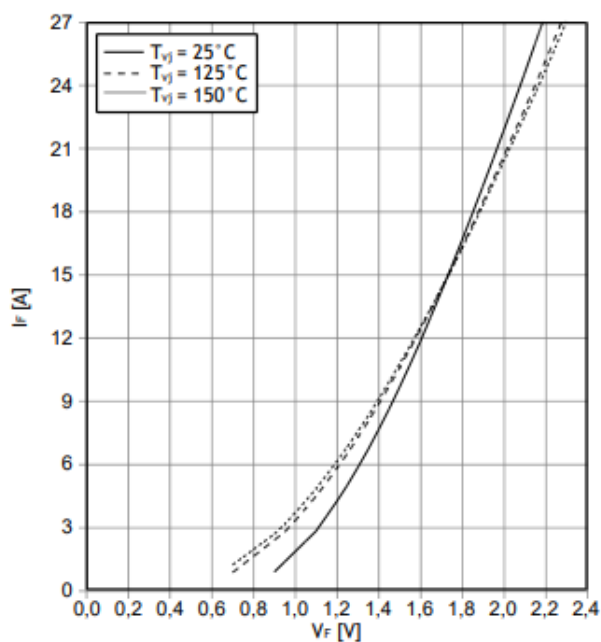
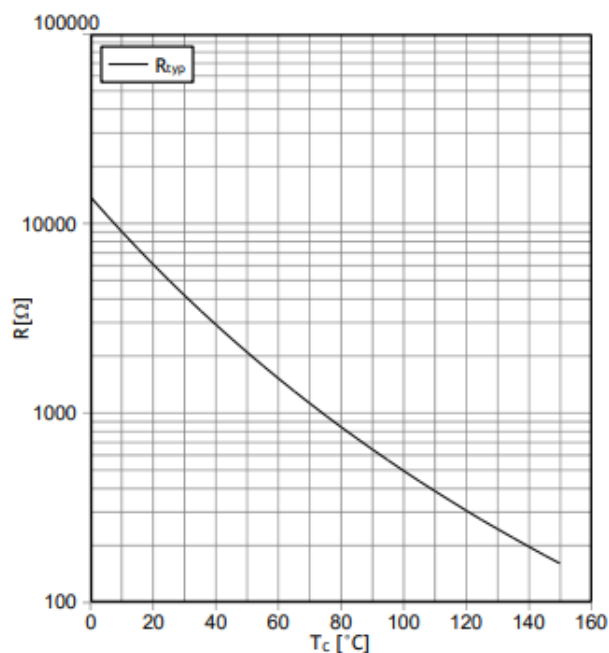
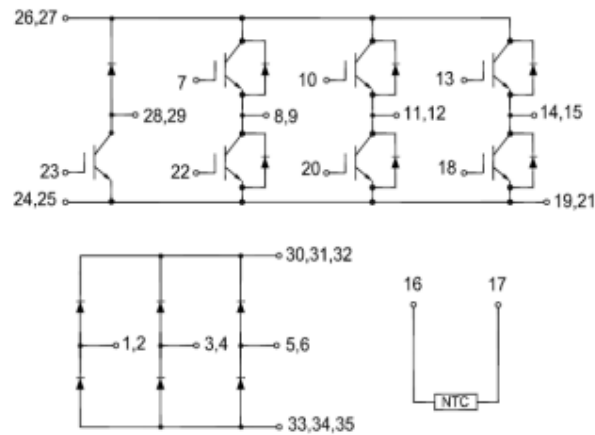


Figure15. NTC-Thermistor-temperature characteristic (typical)
 $R = f(T)$



Internal Circuit:



Package Outline (Unit: mm):

