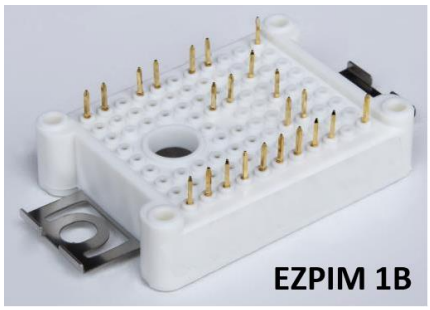
1200V 15A PIM IGBT Module

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°C unless otherwise noted

Item	Symbol	Parameter	Conditions	Value	Units
Diode Rectifier	V_{RRM}	Repetitive Peak Reverse Voltage		1600	V
	I_{FAV}	Forward Current per Diode	@ T_j = 150 °C, T_C = 100 °C	16	A
	I_{FSM}	Surge Forward Current (Chip level)	@ t_P = 10 ms, half sine wave	150	A
	I2t	I2t - Value (Chip level)	@ t_P = 10 ms, half sine wave	381	A2S
	T_j	Operating Junction Temperature *(1)	-	-40 ~ 150	°C
IGBT Inverter	V_{CES}	Collector-Emitter Breakdown Voltage	-	1200	V
	V_{GES}	Gate-Emitter Peak Voltage	-	± 20	V
	I_C	DC Collector Current	@ T_j = 150 °C, T_C = 100 °C	15	A
			@ T_j = 150 °C, T_C = 25 °C	28	A
	I_{CM}	Repetitive Peak Forward Current	tp = 1ms	30	A
	P_D	Maximum Power Dissipation	@ T_j = 150 °C, T_C = 25 °C	176	W
	T_j	Operating Junction Temperature *(2)	-	-40 ~ 150	°C
Diode Inverter	V_{RRM}	Repetitive Peak Reverse Voltage	-	1200	V
	I_F	DC Forward Current	@ T_j = 150 °C,T_C = 100 °C	15	A
	I_{FRM}	Repetitive Peak Forward Current	@ t_P = 1 ms	30	A
	I^2t		@ T_j = 125 °C, t = 10ms,V_R=0V	16.5	A^2S
	T_j	Operating Junction Temperature *(1)	-	-40 ~ 150	°C
IGBT Brake	V_{CES}	Collector-Emitter Breakdown Voltage	-	1200	V
	V_{GES}	Gate-Emitter Peak Voltage	-	± 20	V
	I_C	DC Collector Current	@ T_j = 150 °C, T_C = 100 °C	15	A
	I_{cpulse}	Repetitive Peak Collector Current	@ t_P = 1 ms	30	A
	P_D	Maximum Power Dissipation	@ T_j = 150 °C, T_C = 25 °C	176	W
	T_j	Operating Junction Temperature *(2)	-	-40 ~ 150	°C
Diode Brake	V_{RRM}	Repetitive Peak Reverse Voltage	-	1200	V
	I_F	DC Forward Current	@ T_j = 150 °C, T_C = 100 °C	10	A
	I_{FRM}	Repetitive Peak Forward Current	@ t_P = 1 ms	20	A
	I^2t		@ T_j = 125 °C, t = 10ms,V_R=0V	16.5	A^2S
	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	-	24	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=16A , T_J=25℃	-	1.05	-	V
		I_F=16A , T_J=150℃	-	-		V
I_R	Reverse Leakage Current	V_R=1600V, T_J=25℃	-	-	100	uA
		V_R=1900V, T_J=150℃	-	-	-	mA

◘ IGBT-Inverter Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BVCES	C-E Breakdown Voltage	VGE = 0 V, IC = 250 µA	1200	-		
ICES	C-E Cut-Off Current	VCE = VCES, VGE = 0 V	-	-	1.0	µA
IGES	G-E Leakage Current	VGE = VGES, VCE = 0 V	-	-	± 100	nA
VGE(th)	G-E Threshold Voltage	VGE = VCE, IC = 1.0mA	5.1	-	6.7	V
VCE(sat)	Collector to Emitter Saturation Voltage	IC = 15 A, VGE = 15 V, Tj = 25 °C	1.30	1.95	2.40	V
		IC = 15 A, VGE = 15 V, Tj = 125 °C	-	-	-	V
ISC	Short Current	VGE ≤15 V, VCC = 600 V VCE ≤ VCES, Tj = 150°C, TP ≤ 10us	-	53	-	A
Cies	Input Capacitance	VCE = 25 V, VGE = 0 V f = 1 MHz, Tj = 25 °C	-	2.70	-	nF
Coes	Output Capacitance		-	-	-	nF
Cres	Reverse Transfer Capacitance		-	0.04	-	nF
td(on)	Turn-On Delay Time	Tj = 25 °C, RG = 2.6 Ω L = 100 nH, VDC = 600 V VGE = 15 V ~ -15 V IC = 15 A	-	90	-	ns
tr	Rise Time		-	30	-	ns
td(off)	Turn-Off Delay Time		-	130	-	ns
tf	Fall Time		-	20	-	ns
Eon	Turn-On Switching Loss		-	1.35	-	mJ
Eoff	Turn-Off Switching Loss		-	0.85	-	mJ
Qg	Total Gate Charge	VGE = 15 V ~ -15 V	-	100	-	nC
Qge	Gate-Emitter Charge		-	-	-	nC
Qgc	Gate-Collector Charge		-	-	-	nC

◘ Diode-Inverter Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
VF	Diode Forward Voltage	IF = 15 A VGE = 0V	Tj = 25 °C	-	1.95	-	V
			Tj = 125 °C	-	-	-	
trr	Diode Reverse Recovery Time	IF= 15 A diF/dt = 575 A/µs VR = 600 V VGE = 15 V	Tj = 25 °C	-	213	-	ns
			Tj = 125 °C	-	-	-	
I_{RRM}	Diode Peak Reverse Recovery Current		Tj = 25 °C	-	15.8	-	A
			Tj = 125 °C	-	-	-	
Qrr	Diode Reverse Recovery Charge		Tj = 25 °C	-	1.57	-	µC
			Tj = 125 °C	-	-	-	
Err	Diode Reverse Recovery Energy		Tj = 25 °C	-	0.37	-	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
BVCES	C-E Breakdown Voltage	VGE = 0 V, IC = 250 μA	1200	-		
ICES	C-E Cut-Off Current	VCE = VCES, VGE = 0 V	-	-	1.0	mA
IGES	G-E Leakage Current	VGE = VGES, VCE = 0 V	-	-	± 400	nA
VGE(th)	G-E Threshold Voltage	VGE = VCE, IC = 2.3mA	4.5	-	7.0	V
VCE(sat)	Collector to Emitter Saturation Voltage	IC = 15 A, VGE = 15 V, Tj = 25 °C	-	1.7	2.1	V
		IC = 15 A, VGE = 15 V, Tj = 125 °C	-	-	-	V
ISC	Short Current	VGE ≤15 V, VCC = 600 V VCE ≤ VCES, Tj = 125, TP ≤ 10us	-	48	-	A
Cies	Input Capacitance	VCE = 25 V, VGE = 0 V f = 1 MHz, Tj = 25 °C	-	2.7	-	nF
Coes	Output Capacitance		-	-	-	nF
Cres	Reverse Transfer Capacitance		-	0.04	-	nF
td(on)	Turn-On Delay Time	Tj = 25 °C, RG = 2.6 Ω L = 100 nH, VDC = 600 V VGE = 15 V ~ -15 V IC = 15 A	-	90	-	ns
tr	Rise Time		-	30	-	ns
td(off)	Turn-Off Delay Time		-	130	-	ns
tf	Fall Time		-	20	-	ns
Eon	Turn-On Switching Loss		-	1.35	-	mJ
Eoff	Turn-Off Switching Loss		-	0.85	-	mJ
Qg	Total Gate Charge	VGE = 15 V ~ -15 V	-	100	-	nC
Qge	Gate-Emitter Charge		-	-	-	nC
Qgc	Gate-Collector Charge		-	-	-	nC

◘ Diode-Brake Chopper Characteristics

Symbol	Parameter	Test Conditions		Min	Typ	Max	Units
VF	Diode Forward Voltage	IF = 10 A VGE = 0V	Tj = 25 °C	-	1.95	2.13	V
			Tj = 125 °C	-	-	-	
trr	Diode Reverse Recovery Time	IF= 10 A diF/dt = 575 A/μs VR = 600 V VGE = 15 V	Tj = 25 °C	-	213	-	ns
			Tj = 125 °C	-	-	-	
I_{RRM}	Diode Peak Reverse Recovery Current		Tj = 25 °C	-	15.8	-	A
			Tj = 125 °C	-	-	-	
Qrr	Diode Reverse Recovery Charge		Tj = 25 °C	-	0.88	-	μC
			Tj = 125 °C	-	-	-	
Err	Diode Reverse Recovery Energy		Tj = 25 °C	-	0.37	-	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	$R_2=R_{25}exp[B_{25/50}(1/T2-1/(298.15K))]$	-	3375	-	K
$B_{25/80}$		$R_2=R_{25}exp[B_{25/80}(1/T2-1/(298.15K))]$	-	3411	-	K
$B_{25/100}$		$R_2=R_{25}exp[B_{25/100}(1/T2-1/(298.15K))]$	-	3433	-	K

Thermal Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Rth(J-C)	Thermal Resistance (J-C)	Junction-to-Case	-	-	0.85	K/W
Rth(C-H)	Thermal Resistance (C-H)	Case-to-Heatsink	-	0.045	-	°C/W

Fig1. Output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$ V_{GE} = 15 V

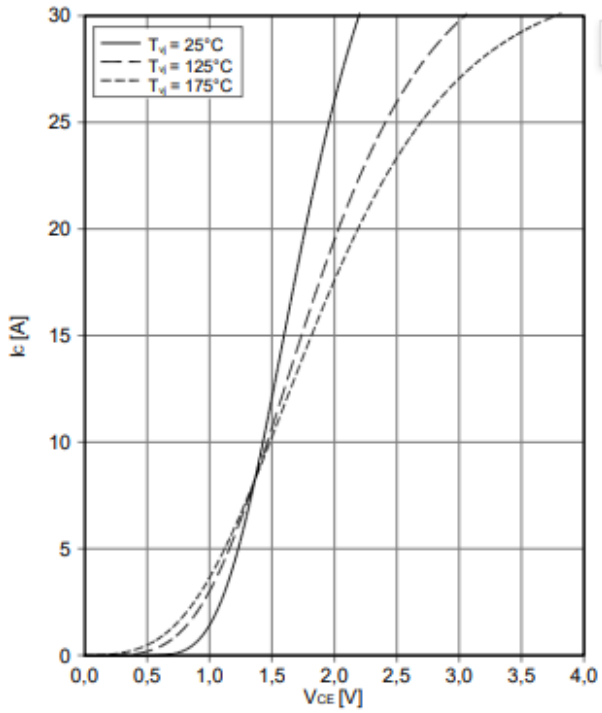


Fig2. Output characteristic IGBT,Inverter (typical)
$I_C = f(V_{CE})$ T_{vj} = 175°C

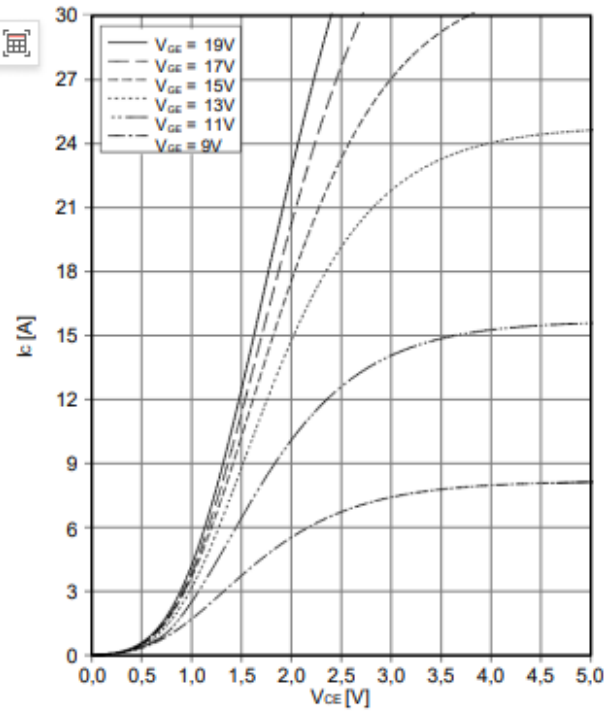


Fig3. Transfer characteristic IGBT,Inverter (typical)
$I_C = f(V_{GE})$ V_{CE} = 20 V

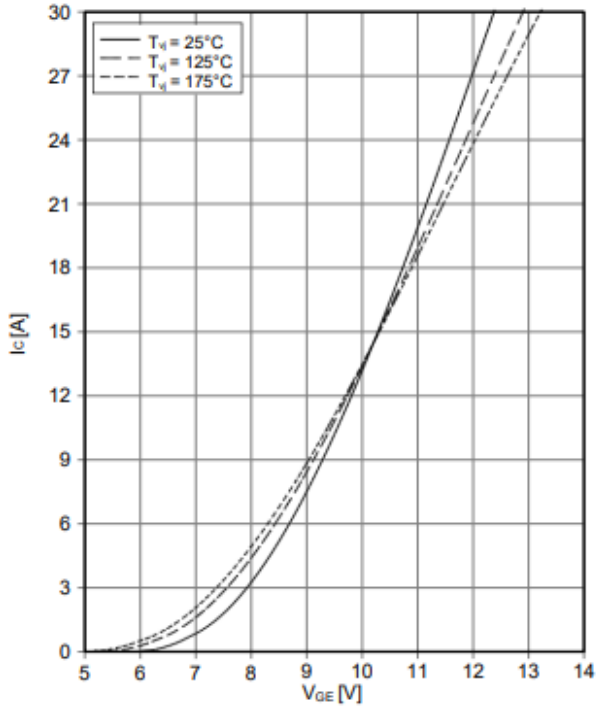


Fig4. Switching losses IGBT,Inverter (typical)
$E_{on} = f(I_C)$, $E_{off} = f(I_C)$
V_{GE} = ±15 V, R_{Gon} = 2.6 Ω, R_{Goff} = 2.6 Ω, V_{CE} = 600 V

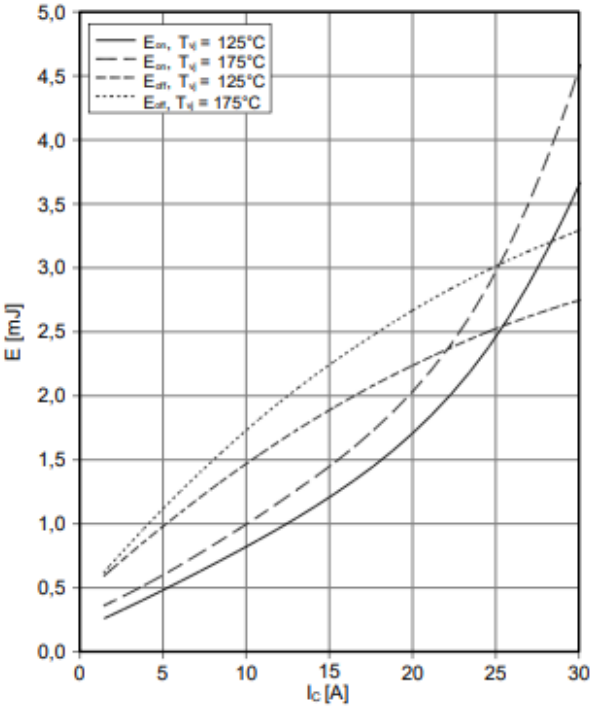


Fig5. Switching losses IGBT,Inverter (typical)
$E_{on} = f(R_G)$, $E_{off} = f(R_G)$
$V_{GE} = \pm 15$ V, $I_C = 15$ A, $V_{CE} = 600$ V

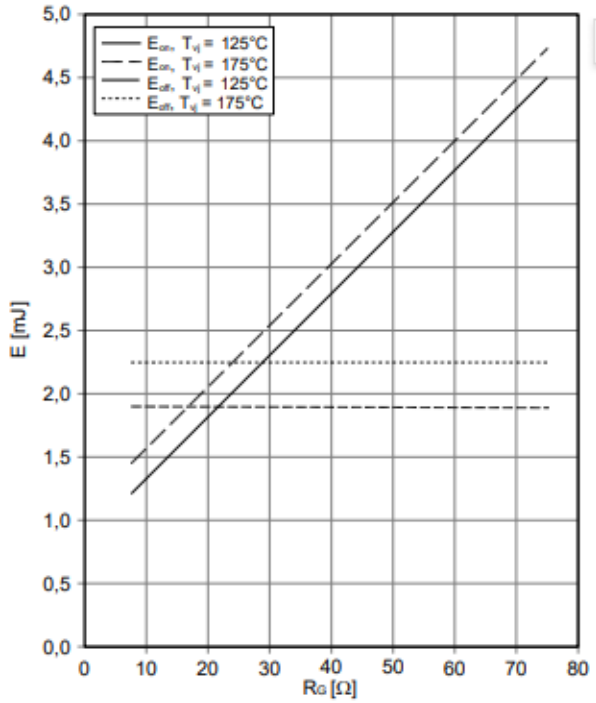


Fig6. Switching times IGBT,Inverter (typical)
$t_{don} = f(I_C)$, $t_r = f(I_C)$, $t_{doff} = f(I_C)$, $t_f = f(I_C)$
$V_{GE} = \pm 15$ V, $R_{Gon} = 2.6\ \Omega$, $R_{Goff} = 2.6\ \Omega$, $V_{CE} = 600$ V, $T_{vj} = 175°C$

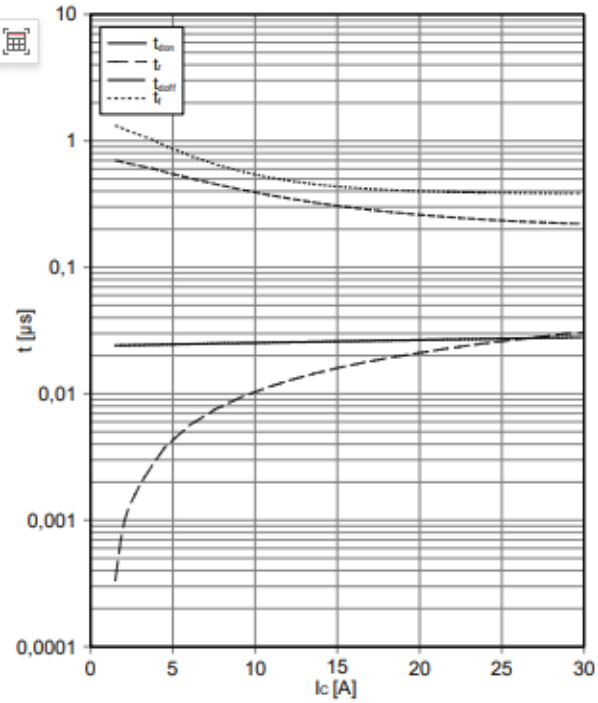


Fig7. Switching times IGBT,Inverter (typical)
$t_{don} = f(R_G)$, $t_r = f(R_G)$, $t_{doff} = f(R_G)$, $t_f = f(R_G)$ $V_{GE} = \pm 15$ V,
$I_C = 15$ A, $V_{CE} = 600$ V, $T_{vj} = 175°C$

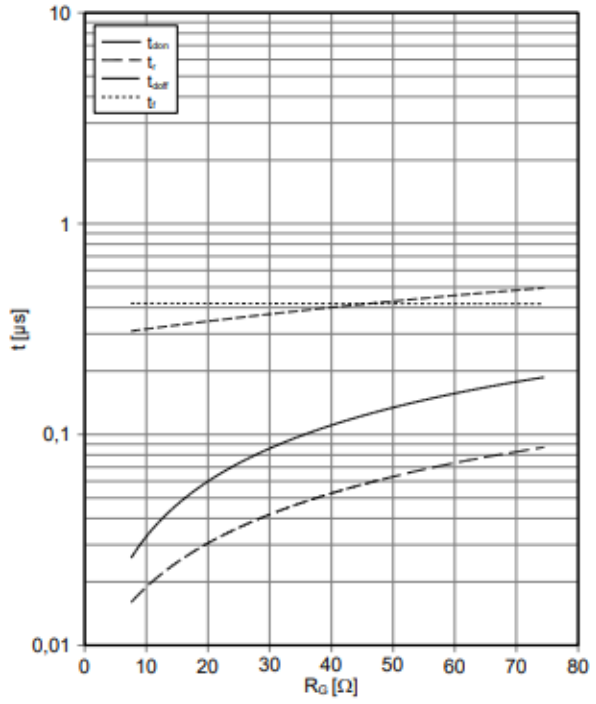


Fig8. dv/dt IGBT,Inverter (typical)
$dv/dt = f(R_G)$, $V_{GE} = \pm 15$ V, $I_C = 15$ A, $V_{CE} = 600$ V, $T_{vj} = 25°C$

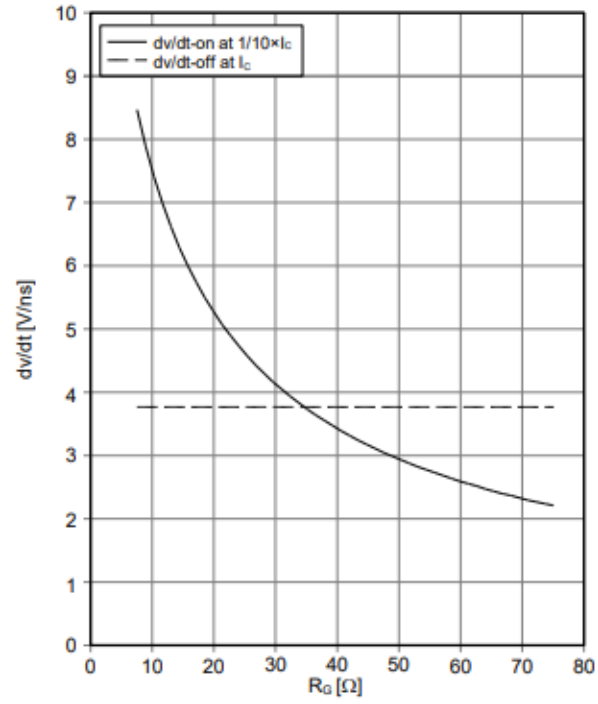


Fig9. Transient thermal impedance IGBT,Inverter
$Z_{thJH} = f(t)$

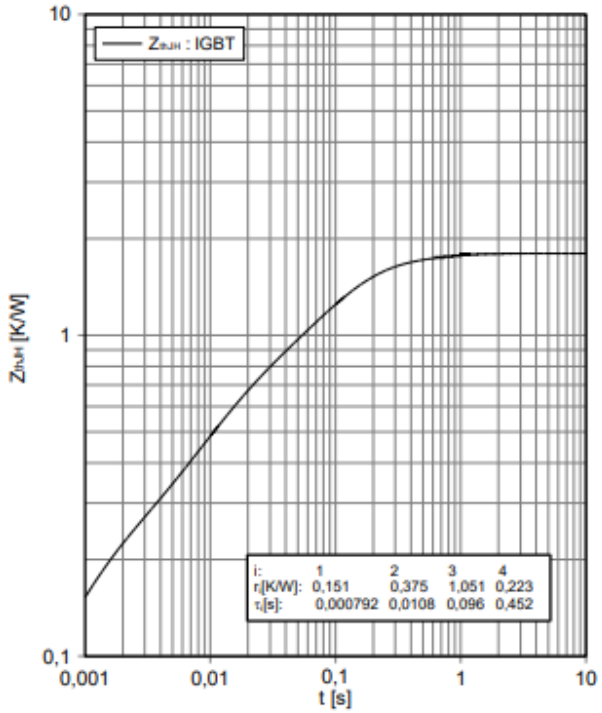


Fig10. Reverse bias safe operating area IGBT,Inverter (RBSOA)
$I_C = f(V_{CE})$
$V_{GE} = \pm 15$ V, $R_{Goff} = 10\ \Omega$, $T_{vj} = 175°C$

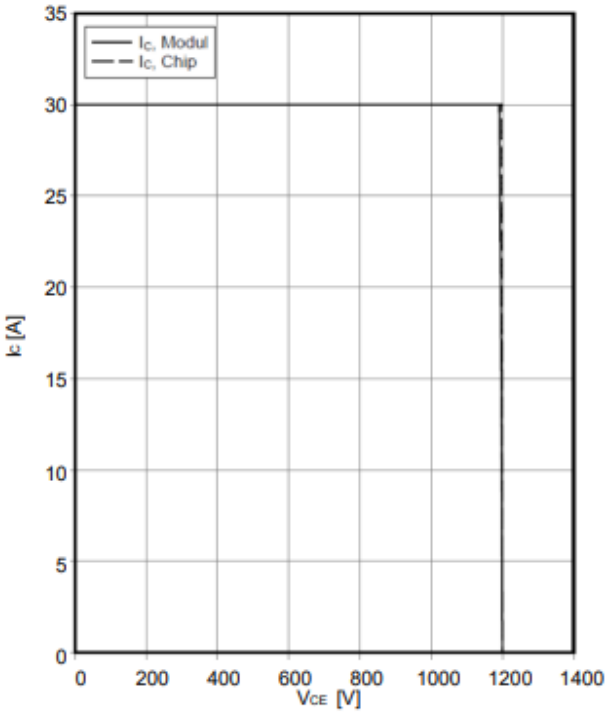


Fig11. Capacity characteristic IGBT,Inverter (typical)
$C = f(V_{CE})$
$V_{GE} = 0$ V, $T_{vj} = 25°C$, f = 1kHz

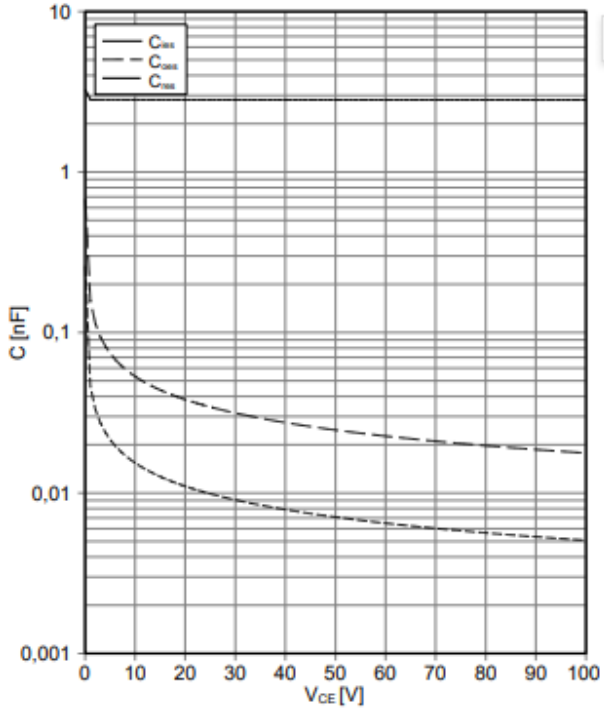


Fig12. Gate charge characteristic IGBT,Inverter (typical)
$V_{GE} = f(Q_G)$
$I_C = 15$ A, $T_{vj} = 25°C$

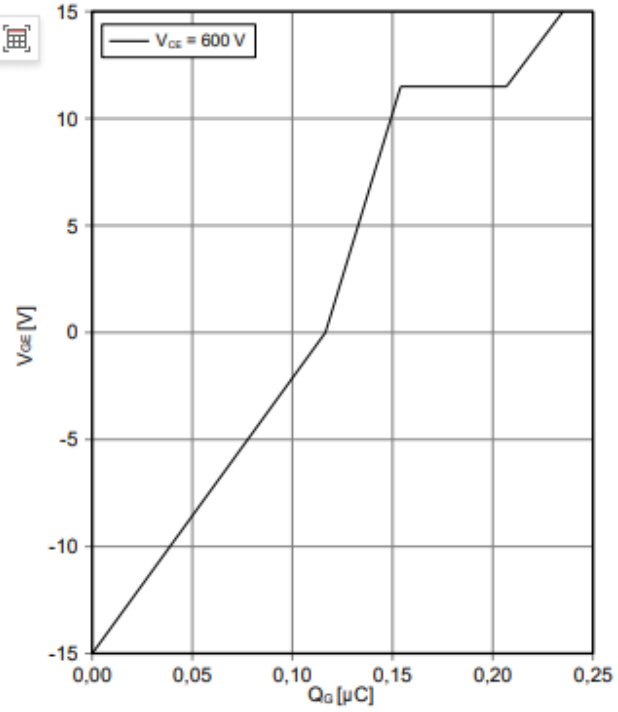


Fig13. Forward characteristic of Diode, Inverter (typical)
$I_F = f(V_F)$

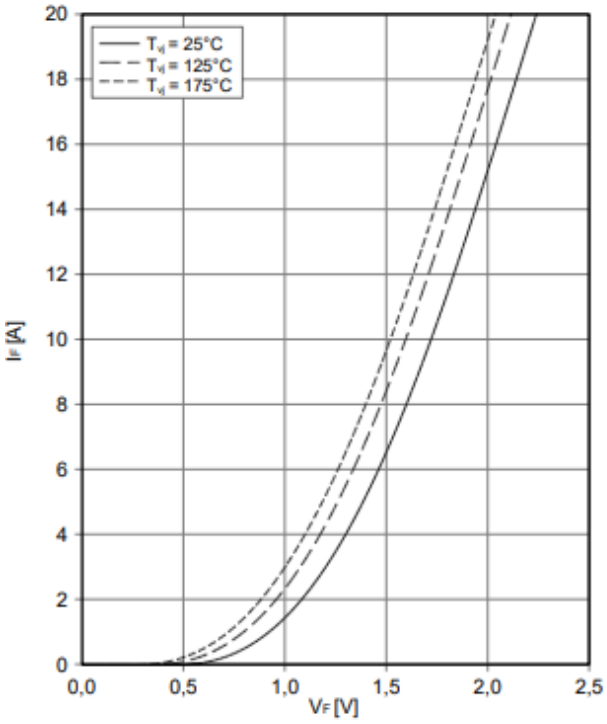


Fig14. Switching losses Diode, Inverter (typical)
$E_{rec} = f(I_F)$
R_{Gon} = 10 Ω, V_{CE} = 600 V

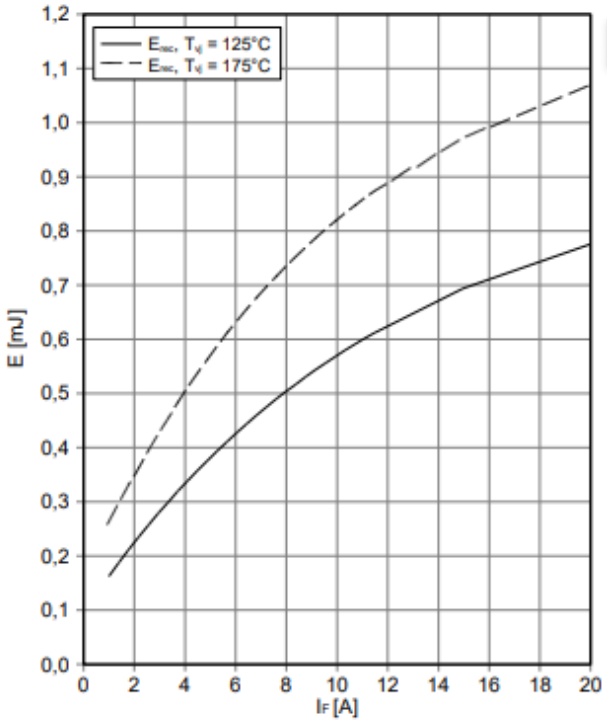


Fig15. Switching losses Diode, Inverter (typical)
$E_{rec} = f(R_G)$
I_F = 10 A, V_{CE} = 600 V

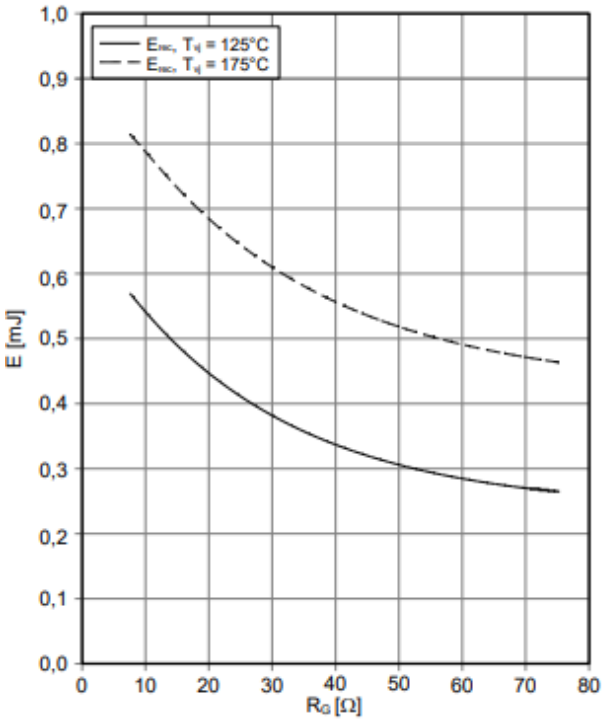


Fig16. Transient thermal impedance Diode, Inverter
$Z_{thJH} = f(t)$

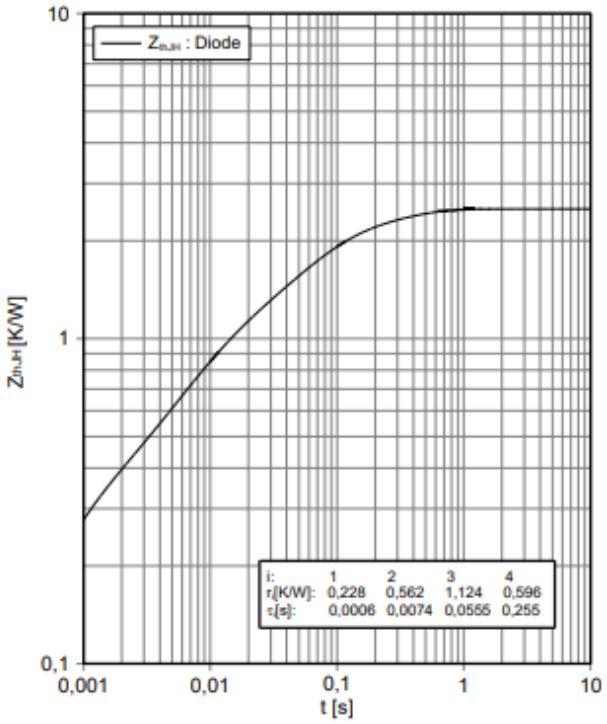


Fig17. Forward characteristic of Diode, Rectifier (typical)
$I_F = f(V_F)$

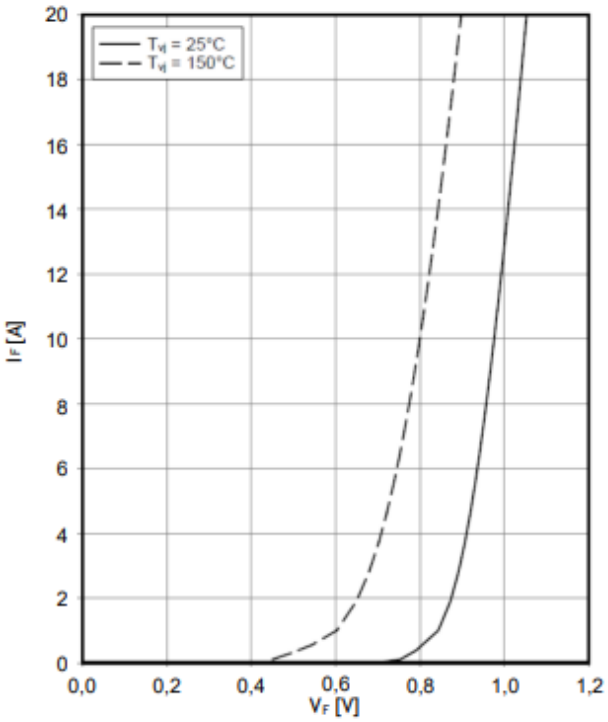


Fig18. Transient thermal impedance Diode, Rectifier
$Z_{thJH} = f(t)$

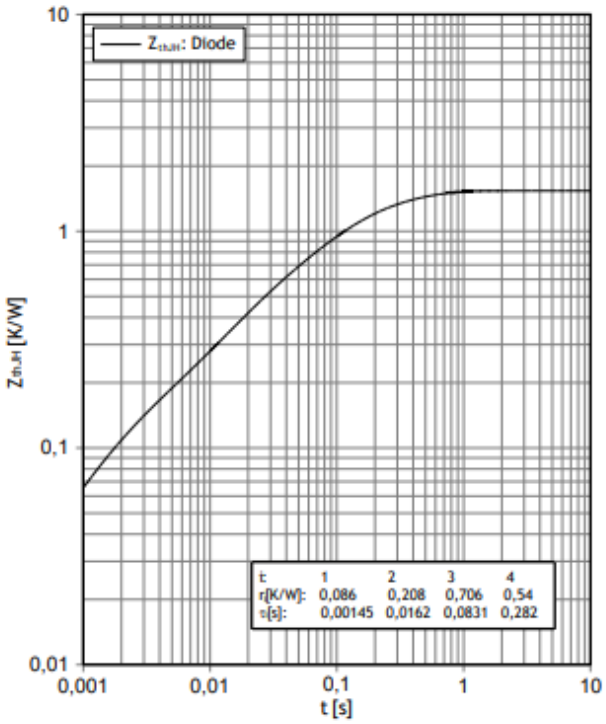


Fig19. Output characteristic IGBT, Brake-Chopper (typical)
$I_C = f(V_{CE})V_{GE} = 15\ V$

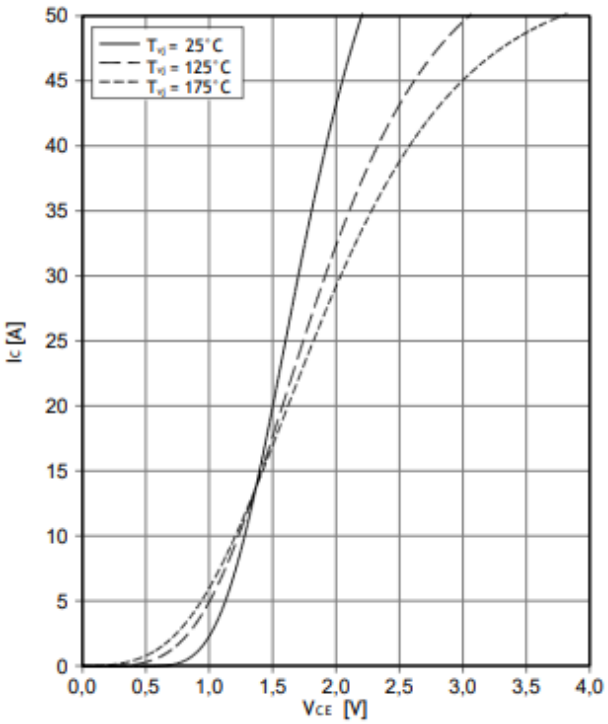


Fig20. Forward characteristic of Diode, Brake-Chopper (typical)
$I_F = f(V_F)$

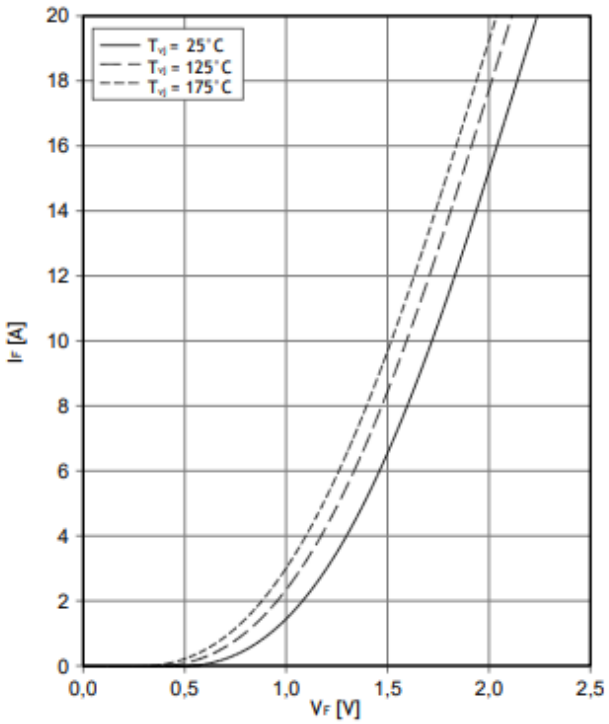
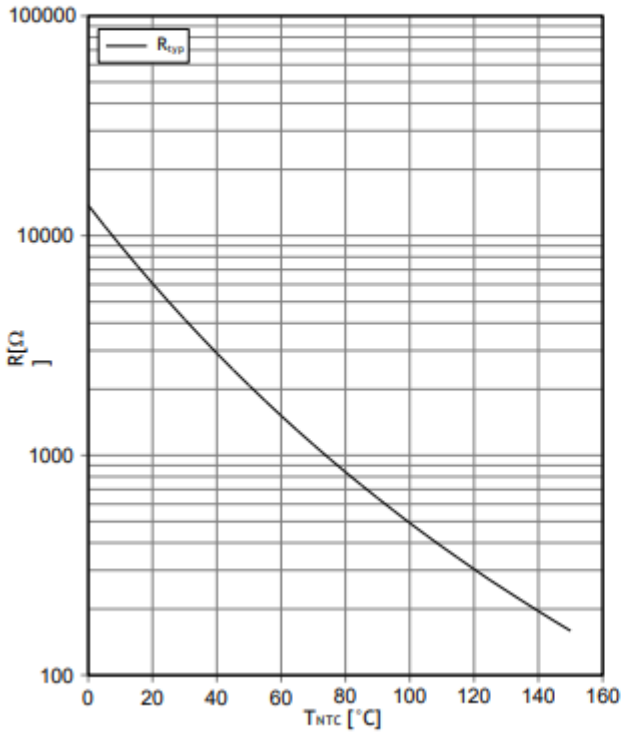
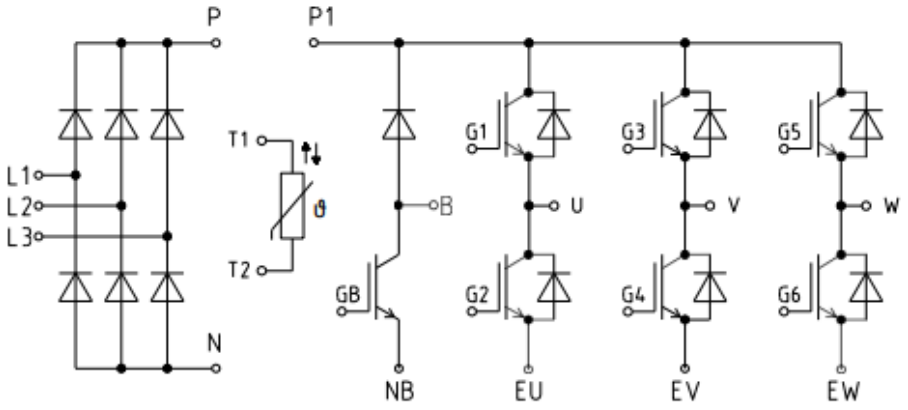


Fig21. NTC-Thermistor-temperature characteristic (typical)
R = f (T)



■Internal Circuit Diagram



■Package Dimension (Dimension in mm)