1. Product Features

1.1 Electrical features

- V_{CES}=1200V
- $I_{C\,nom}$=40A / I_{CRM}=80A
- Low switching losses
- Low inductance
- Fast switching and short tail current
- Integrated NTC temperature sensor
- High power and thermal cycling capability

Figure1 IGBT Module

1.2 Mechanical features

- Integrated NTC temperature sensor
- High power and thermal cycling capability
- Al_2O_3 substrate with low thermal resistance

2. Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- power supply

3. Description

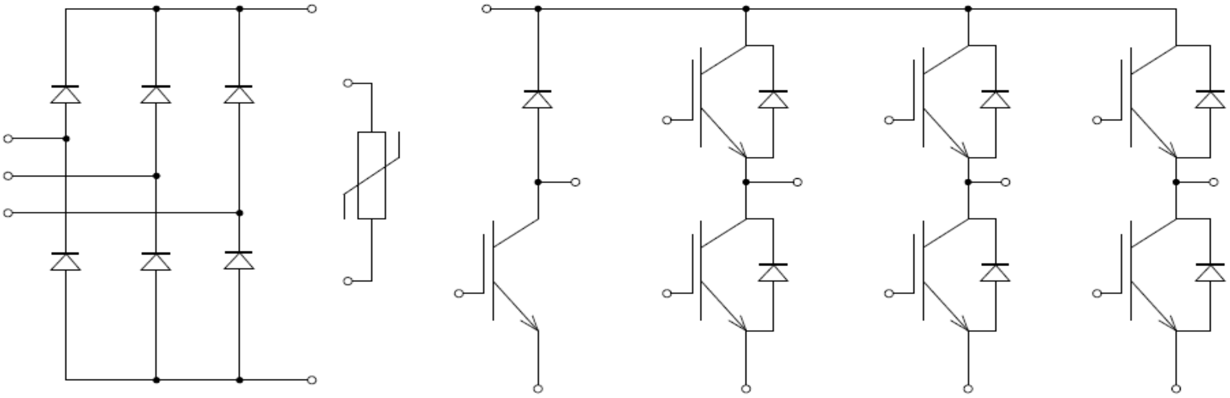


Figure 2 3 Phase Bridge +Rectifier+Brake

4. IGBT, Inverter

4.1 Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Collector-emitter voltage 集电极—发射极间电压	T_{vj} = 25°C	V_{CES}	1200	V
Continuous DC collector current 连续集电极电流	T_C = 100°C, $T_{vj,\,max}$ = 150°C	$I_{C\,nom}$	40	A
Repetitive peak collector current 集电极峰值电流	t_P = 1 ms	I_{CRM}	80	A
Total power dissipation 总功率损耗	T_C = 25°C, $T_{vj,\,max}$ = 175 °C	P_{tot}	180	W
Gate-emitter peak voltage 栅极－发射极峰值电压		V_{GES}	+/- 20	V

4.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage 集电极－发射极饱和电压	I_C = 40 A, V_{GE} = 15 V	T_{vj} = 25°C	$V_{CE,sat}$		1.7		V
		T_{vj} = 125°C			1.9		V
		T_{vj} = 150°C			2.0		V
Gate threshold voltage 栅极阈值电压	I_C = 0.25mA, V_{CE} = V_{GE}, T_{vj} = 25°C		$V_{GE,th}$	5.0	5.8	6.5	V
Gate charge 栅极电荷	V_{GE} = -15 V ... +15 V		Q_G		0.44		μC
Internal gate resistor 内部栅极电阻	T_{vj} = 25°C		R_{Gint}		2.2		Ω
Input capacitance 输入电容	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{ies}		6.15		nF
Reverse transfer capacitance 反向传输电容	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{res}		0.08		nF
Collector-emitter cut-off current 集电极-发射极截止电流	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			1	mA
Gate-emitter leakage current 栅极-发射极漏电流	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			100	nA
Turn-on delay time, inductive load 开通延迟时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	$t_{d,on}$		0.038		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.036		us
	$R_{G,on}$ = 6.8Ω	T_{vj} = 150°C			0.037		us
Rise time, inductive load 上升时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	t_r		0.028		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.029		us
	$R_{G,on}$ = 6.8Ω	T_{vj} = 150°C			0.030		us

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	$t_{d,off}$		0.157		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.188		us
	$R_{G,off}$ = 6.8Ω	T_{vj} = 150°C			0.196		us
Fall time, inductive load 下降时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	t_f		0.163		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.285		us
	$R_{G,off}$ = 6.8Ω	T_{vj} = 150°C			0.311		us
Turn-on energy loss per pulse 开通损耗能量	I_C = 40A, V_{CE} = 600V, L_s=35nH	T_{vj} = 25°C	E_{on}		3.39		mJ
	V_{GE} = +15/-15V, di/dt =1340A/µs	T_{vj} = 125°C			4.24		mJ
	$R_{G,on}$ = 6.8Ω (T_{vj} = 150°C)	T_{vj} = 150°C			4.68		mJ
Turn-off energy loss per pulse 关断损耗能量	I_C = 40A, V_{CE} = 600V, L_s=35nH	T_{vj} = 25°C	E_{off}		3.32		mJ
	V_{GE} = +15/-15V, dv/dt =5800V/µs	T_{vj} = 125°C			4.26		mJ
	$R_{G,off}$ = 6.8Ω (T_{vj} = 150°C)	T_{vj} = 150°C			5.17		mJ
SC data 短路数据	V_{GE} ≤15V, V_{CC}=600 V, t_P ≤ 8 µs, T_{vj} = 150°C , C_{GE} = 0.0uF , V_{CEmax} = V_{CES} -L_{sCE} · di/dt		I_{SC}		300		A
Thermal resistance, junction to case 结一外壳热阻	Per IGBT		$R_{th,JH}$			0.72	K/W

5. Diode, Inverter

5.1 Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	T_{vj} = 25°C	V_{RRM}	1200	V
Continuous DC forward current 连续正向直流电流		I_F	40	A
Repetitive peak forward current 正向重复峰值电流	t_P = 1 ms	I_{FRM}	100	A

5.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	I_F = 40 A, V_{GE} = 0 V	T_{vj} = 25°C	V_F		2.35		V
		T_{vj} = 125°C			2.50		V
		T_{vj} = 150°C			2.50		V

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current 反向恢复峰值电流	I_F = 40A, V_R = 600V	T_{vj} = 25°C	I_{RM}		61		A
	V_{GE} = -15V , - di_F/dt = 2060 A/µs	T_{vj} = 125°C			76		A
	(T_{vj}=150°C)	T_{vj} = 150°C			80		A
Recovered charge 恢复电荷	I_F = 40A, V_R = 600V	T_{vj} = 25°C	Q_r		3.30		µC
	V_{GE} = -15V , - di_F/dt = 2060 A/µs	T_{vj} = 125°C			5.06		µC
	(T_{vj}=150°C)	T_{vj} = 150°C			6.05		µC
Reverse recovery energy 反向恢复损耗（每脉冲）	I_F = 40A, V_R = 600V	T_{vj} = 25°C	E_{rec}		0.79		mJ
	V_{GE} = -15V , - di_F/dt = 2060 A/µs	T_{vj} = 125°C			1.57		mJ
	(T_{vj}=150°C)	T_{vj} = 150°C			2.03		mJ
Thermal resistance, junction to case 结一外壳热阻	Per diode		$R_{th,JH}$			0.92	K/W

6. Diode, Rectifier

6.1 Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	T_{vj} = 25°C	V_{RRM}	1600	V
Average Rectified Output current 整流器输出均方根电流	V_F = 1.2, T_{vj} = 150°C	I_F	40	A
Surge forward current 正向浪涌电流	t_p = 10 ms, T_{vj} = 150°C	I_{FSM}	350	A
I^2t - value I^2t-值	t_p = 10 ms, T_{vj} = 150°C	I^2t	1225	A^2s

6.2 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Forward voltage 正向电压	T_{vj} = 150°C, I_F = 40 A	V_F		1.1		V
Reverse current 反向电流	T_{vj} = 150°C, V_R = 1600 V	I_R		1		mA
Thermal resistance, junction to case 结一外壳热阻	Per diode	R_{thJH}			?	K/W

7. IGBT, Brake-Chopper

7.1 Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Collector-emitter voltage 集电极—发射极间电压	T_{vj} = 25°C	V_{CES}	1200	V
Continuous DC collector current 连续集电极电流	T_C = 100°C, T_{vj} max = 150°C	$I_{C\ nom}$	40	A
Repetitive peak collector current 集电极峰值电流	t_P = 1 ms	I_{CRM}	100	A
Gate-emitter peak voltage 栅极一发射极峰值电压		V_{GES}	+/- 20	V

7.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Collector-emitter saturation voltage 集电极一发射极饱和电压	I_C = 40 A, V_{GE} = 15 V	T_{vj} = 25°C	$V_{CE,sat}$		1.7		V
		T_{vj} = 125°C			1.9		V
		T_{vj} = 150°C			2.0		V
Gate threshold voltage 栅极阈值电压	I_C = 0.25mA, V_{CE} = V_{GE}, T_{vj} = 25°C		$V_{GE,th}$	5.0	5.8	6.5	V
Gate charge 栅极电荷	V_{GE} = -15 V ... +15 V		Q_G		0.44		µC
Internal gate resistor 内部栅极电阻	T_{vj} = 25°C		R_{Gint}		2.2		Ω
Input capacitance 输入电容	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{ies}		6.15		nF
Reverse transfer capacitance 反向传输电容	f=1MHz, T_{vj}=25°C, V_{CE}=25V, V_{GE}=0V		C_{res}		0.08		nF
Collector-emitter cut-off current 集电极-发射极截止电流	V_{CE} = 1200 V, V_{GE} = 0 V, T_{vj} = 25°C		I_{CES}			1	mA
Gate-emitter leakage current 栅极-发射极漏电流	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25°C		I_{GES}			100	nA
Turn-on delay time, inductive load 开通延迟时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	$t_{d,on}$		0.063		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.067		us
	$R_{G,on}$ = 10Ω	T_{vj} = 150°C			0.073		us
Rise time, inductive load 上升时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	t_r		0.037		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.042		us
	$R_{G,on}$ = 10Ω	T_{vj} = 150°C			0.044		us

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Turn-off delay time, inductive load 关断延迟时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	$t_{d,off}$		0.167		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.200		us
	$R_{G,off}$ = 10Ω	T_{vj} = 150°C			0.207		us
Fall time, inductive load 下降时间	I_C = 40A, V_{CE} = 600V	T_{vj} = 25°C	t_f		0.245		us
	V_{GE} = +15/-15V	T_{vj} = 125°C			0.310		us
	$R_{G,off}$ = 10Ω	T_{vj} = 150°C			0.081		us
Turn-on energy loss per pulse 开通损耗能量	I_C = 40A, V_{CE} = 600V, L_s=30nH	T_{vj} = 25°C	E_{on}		4.53		mJ
	V_{GE} = +15/-15V, di/dt =920A/µs	T_{vj} = 125°C			5.77		mJ
	$R_{G,on}$ = 10Ω (T_{vj} = 150°C)	T_{vj} = 150°C			6.07		mJ
Turn-off energy loss per pulse 关断损耗能量	I_C = 40A, V_{CE} = 600V, L_s=30nH	T_{vj} = 25°C	E_{off}		3.10		mJ
	V_{GE} = +15/-15V, dv/dt =5930A/µs	T_{vj} = 125°C			4.81		mJ
	$R_{G,off}$ = 10Ω (T_{vj} = 150°C)	T_{vj} = 150°C			5.02		mJ
SC data 短路数据	V_{GE} ≤15V, V_{CC} =600 V, t_P ≤ 8 µs, T_{vj} = 150°C , C_{GE} = 0.0uF , V_{CEmax} = V_{CES} - L_{sCE} · di/dt		I_{SC}		300		A
Thermal resistance, junction to case 结－外壳热阻	Per IGBT		$R_{th,JH}$			0.90	K/W

8. Diode, Brake-Chopper

8.1 Maximum Rated Values

Parameter	Note or test condition	Symbol	Values	Unit
Repetitive peak reverse voltage 反向重复峰值电压	T_{vj} = 25°C	V_{RRM}	1200	V
Continuous DC forward current 连续正向直流电流		I_F	50	A
Repetitive peak forward current 正向重复峰值电流	t_P = 1 ms	I_{FRM}	100	A

8.2 Characteristic value

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Forward voltage 正向电压	I_F = 40 A, V_{GE} = 0 V	T_{vj} = 25°C	V_F		2.35		V
		T_{vj} = 125°C			2.50		V
		T_{vj} = 150°C			2.50		V

(table continues...) 待续

Parameter	Note or test condition		Symbol	Values			Unit
				Min.	Typ.	Max.	
Peak reverse recovery current 反向恢复峰值电流	I_F = 40A, V_R = 600V	T_{vj} = 25°C	I_{RM}		20.68		A
	V_{GE} = -15V , - di_F/dt = 75 A/µs	T_{vj} = 125°C			22.10		A
	(T_{vj}=150°C)	T_{vj} = 150°C			23.85		A
Recovered charge 恢复电荷	I_F = 40A, V_R = 600V	T_{vj} = 25°C	Q_r		2.54		µC
	V_{GE} = -15V , - di_F/dt = 75 A/µs	T_{vj} = 125°C			4.52		µC
	(T_{vj}=150°C)	T_{vj} = 150°C			5.27		µC
Reverse recovery energy 反向恢复损耗（每脉冲）	I_F = 40A, V_R = 600V	T_{vj} = 25°C	E_{rec}		0.64		mJ
	V_{GE} = -15V , - di_F/dt = 75 A/µs	T_{vj} = 125°C			1.42		mJ
	(T_{vj}=150°C)	T_{vj} = 150°C			1.67		mJ
Thermal resistance, junction to case 结一外壳热阻	Per diode		$R_{th,JH}$			1.208	K/W

9. NTC-Thermistor

9.1 Characteristic value

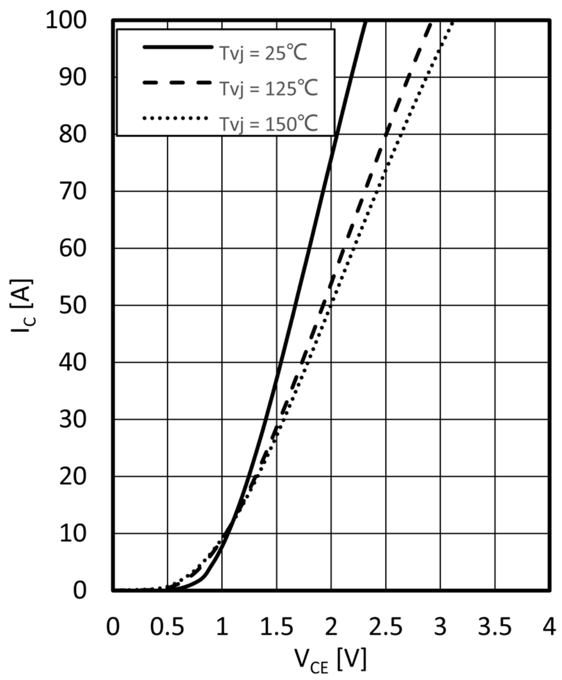
Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Rated resistance 额定电阻值	Tc = 25°C	R_{25}		5.00		KΩ
Power dissipation 耗散功耗	Tc = 25°C	P_{25}			20	mW
B-value B-Z 值	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298, 15K))]$	B_{25}/B_{50}		3400		K
B-value B-Z 值	$R_2=R_{25}\exp[B_{25/75}(1/T_2-1/(298, 15K))]$	B_{25}/B_{75}		3430		K
B-value B-Z 值	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298, 15K))]$	B_{25}/B_{100}		3445		K

10. Module

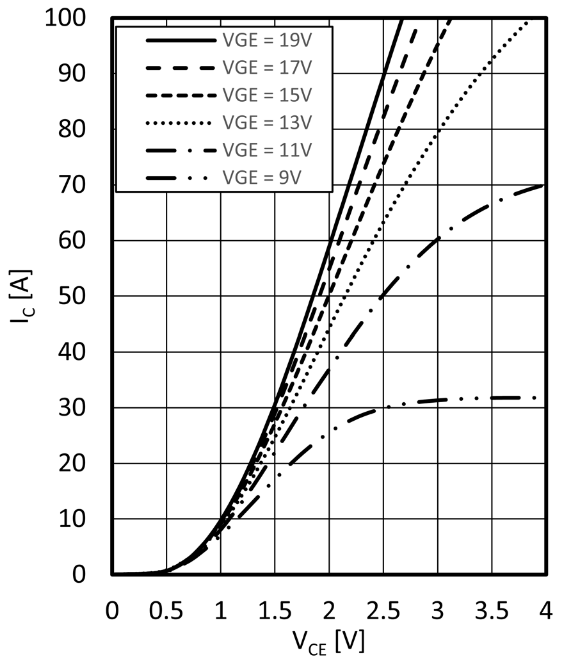
10.1 Characteristic value

Parameter	Note or test condition	Symbol	Values			Unit
			Min.	Typ.	Max.	
Isolation Voltage 隔离电压	RMS, f=50HZ,1min	V_{ISOL}			2500	V
Stray inductance module 杂散电感		L_{sCE}		30		nH
Operation Junction Temperature 结温		T_{jop}	-40		150	˚C
Storage Temperature Range 存储温度范围		T_{stg}	-40		125	˚C
Mounting Torque 安装扭矩	Screw M4	M	2		2.3	N.m
Weight of Module 重量		G		42		g

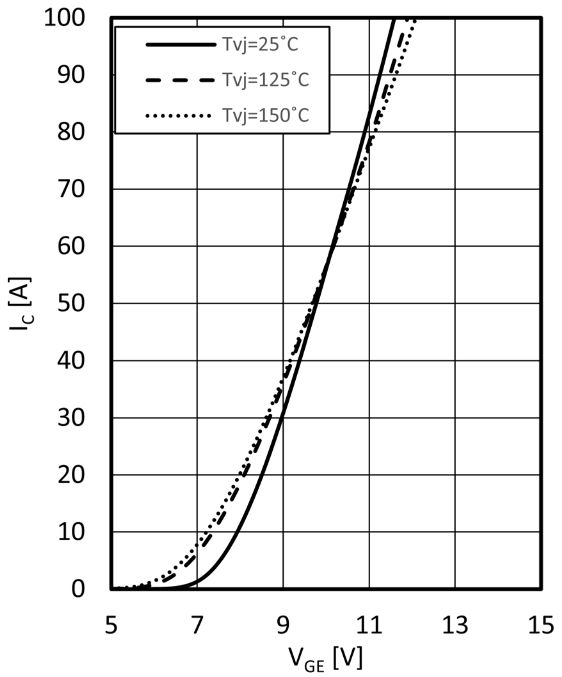
11. Characteristics diagrams



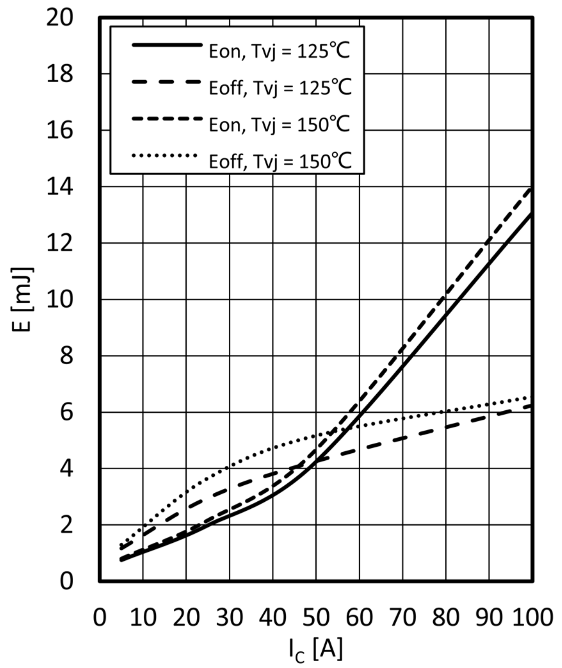
Output characteristic IGBT, Inverter (typical)
$I_C = f\ (V_{CE})$ $V_{GE} = 15V$



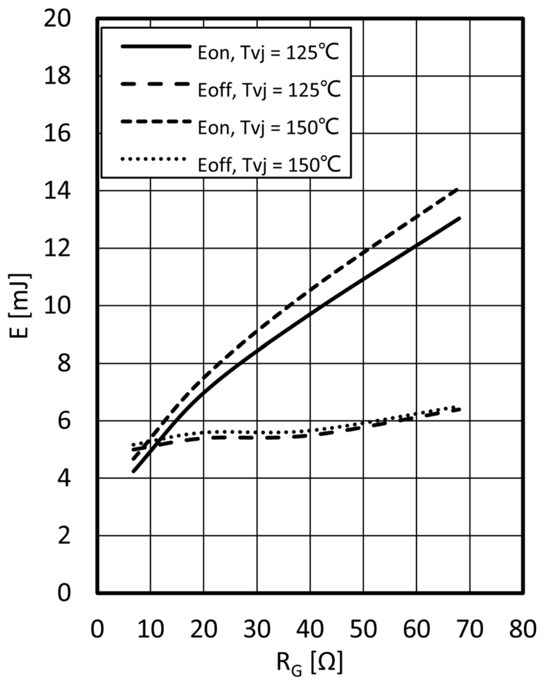
Output characteristic IGBT, Inverter (typical)
$I_C = f\ (V_{CE})$ $T_{vj} = 150°C$



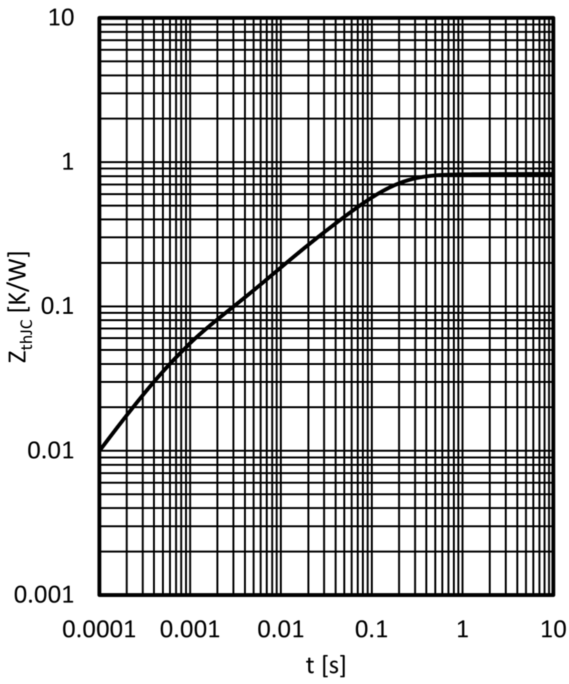
Transfer characteristic IGBT, Inverter (typical)
$I_C = f\ (V_{GE})$ $V_{CE} = 20V$



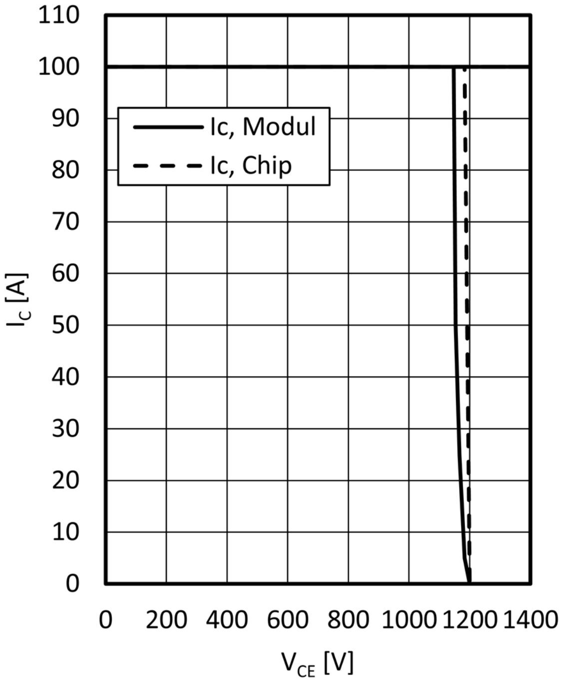
Switching losses IGBT, Inverter (typical)
$E_{on}=f\ (I_C)$, $E_{off} = f\ (I_C)$ $V_{GE} = \pm 15V$, $R_{Gon} = 6.8\ \Omega$ $R_{Goff} = 6.8\ \Omega$, $V_{CE} = 600V$



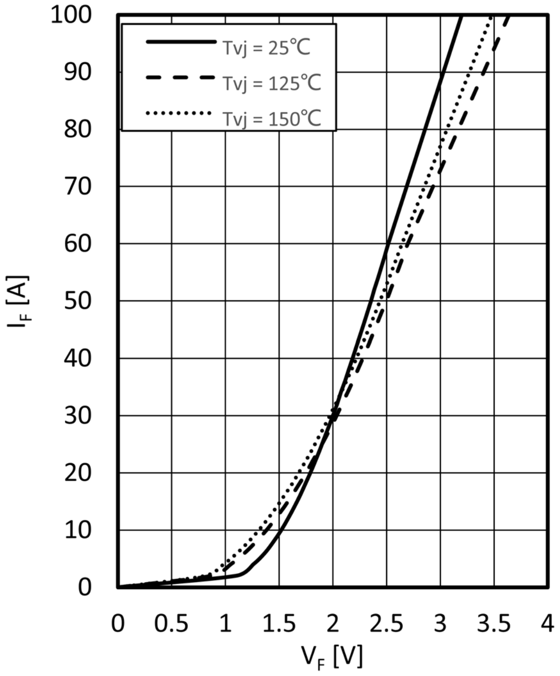
Switching losses IGBT, Inverter (typical)
E_{on} = f (R_G), E_{off} = f (R_G) V_{GE} = ±15V, I_C = 40A, V_{CE} = 600V



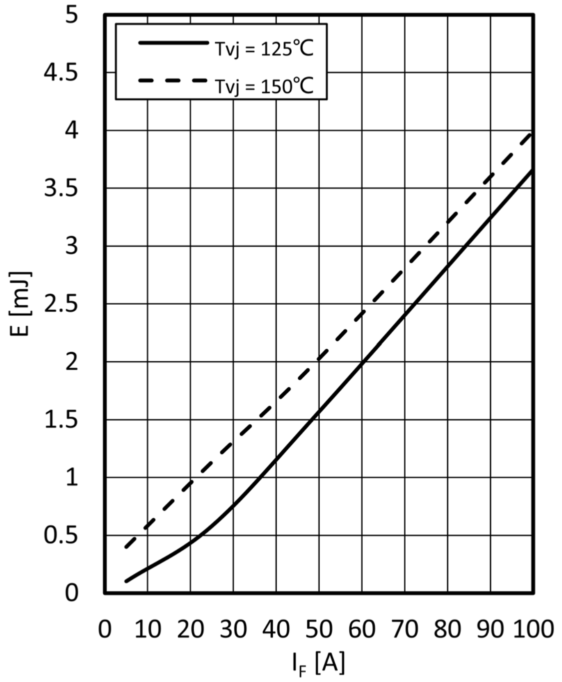
Transient thermal impedance IGBT, Inverter
Z_{thJC} = f (t)

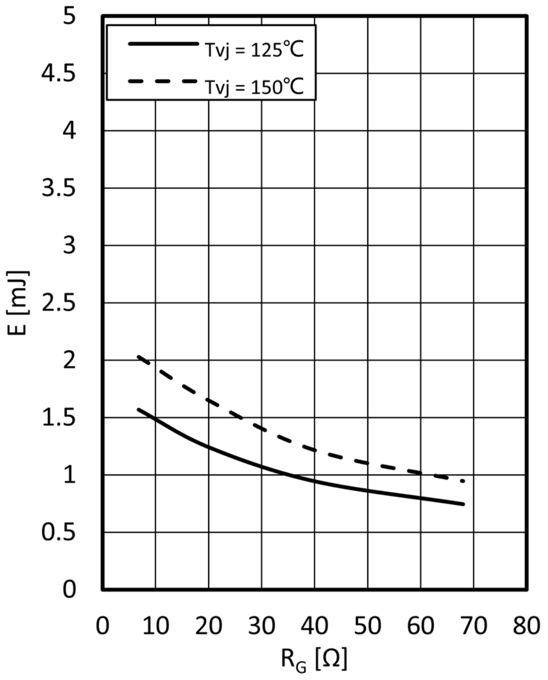


Reverse bias safe operating area IGBT, Inverter (RBSOA)
I_C = f (V_{CE}) V_{GE} = ±15V R_{Goff} = 6.8Ω, T_{vj} = 150°C



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



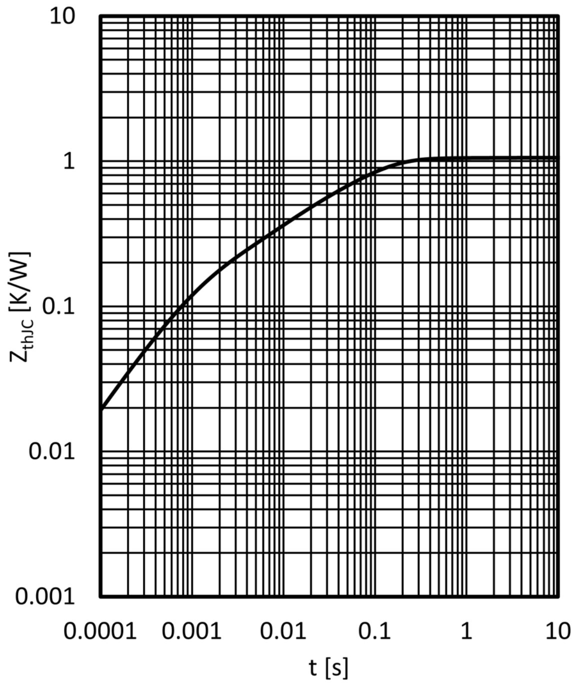


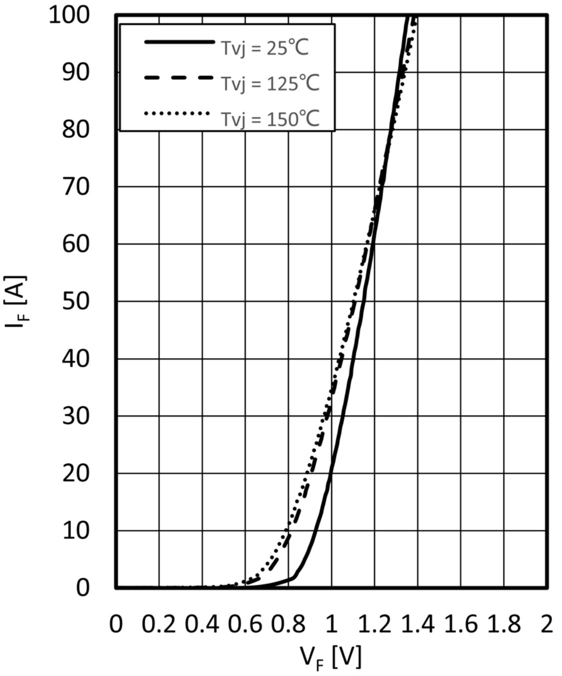
Switching losses Diode, Inverter (typical)

$E_{rec} = f(I_F)$ $R_{Gon} = 6.8\ \Omega$, $V_{CC} = 600V$

Switching losses Diode, Inverter (typical)

$E_{rec} = f(R_G)$ $I_F = 40$ A, $V_{CC} = 600V$



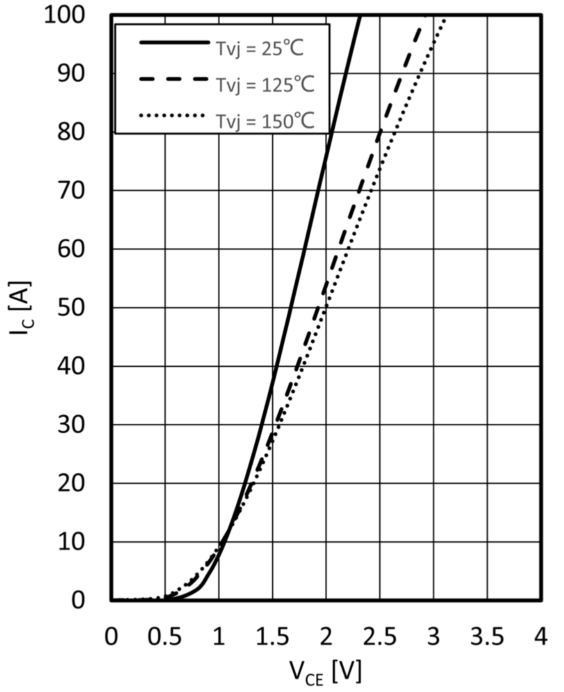


Transient thermal impedance Diode Inverter

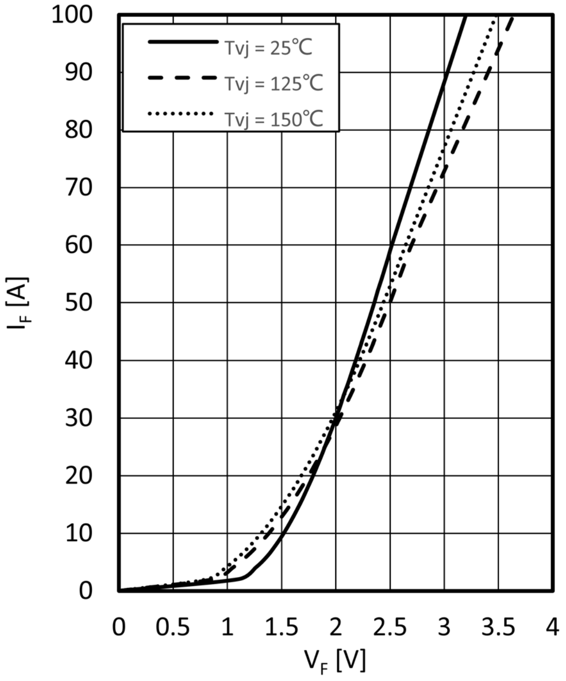
$Z_{thJC} = f(t)$

Forward characteristic of Diode, Rectifier (typical)

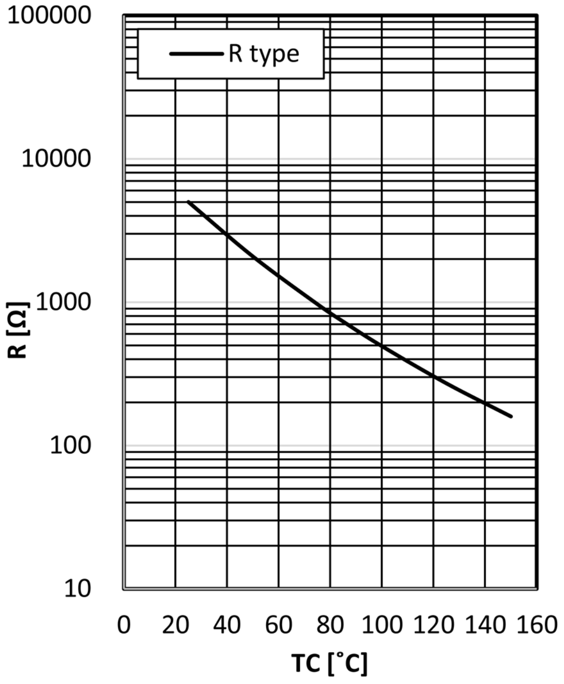
$I_F = f(V_F)$



Output characteristic IGBT, Brake-Chopper (typical)



Forward characteristic of Diode, Brake-Chopper (typical)



NTC-Thermistor-temperature characteristic (typical)

12. Circuit Diagram

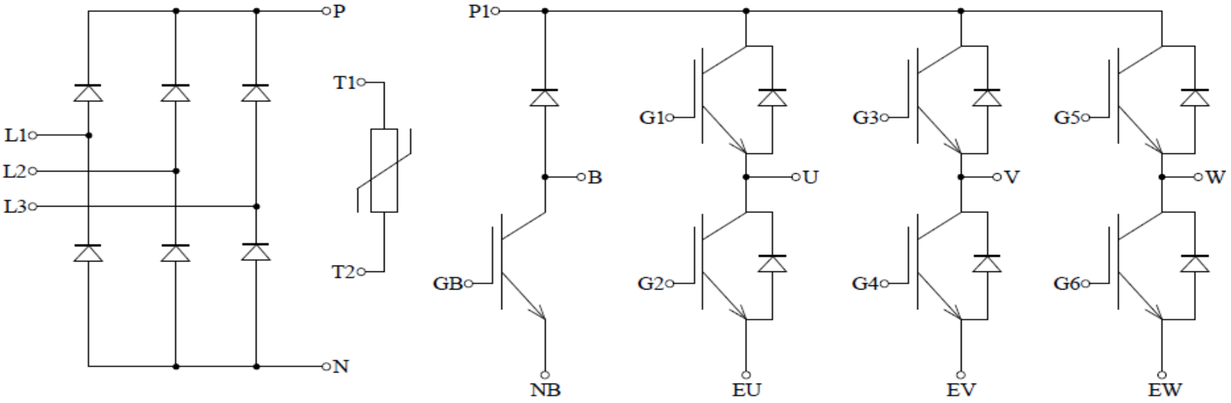


Figure 3

13. Package Outlines

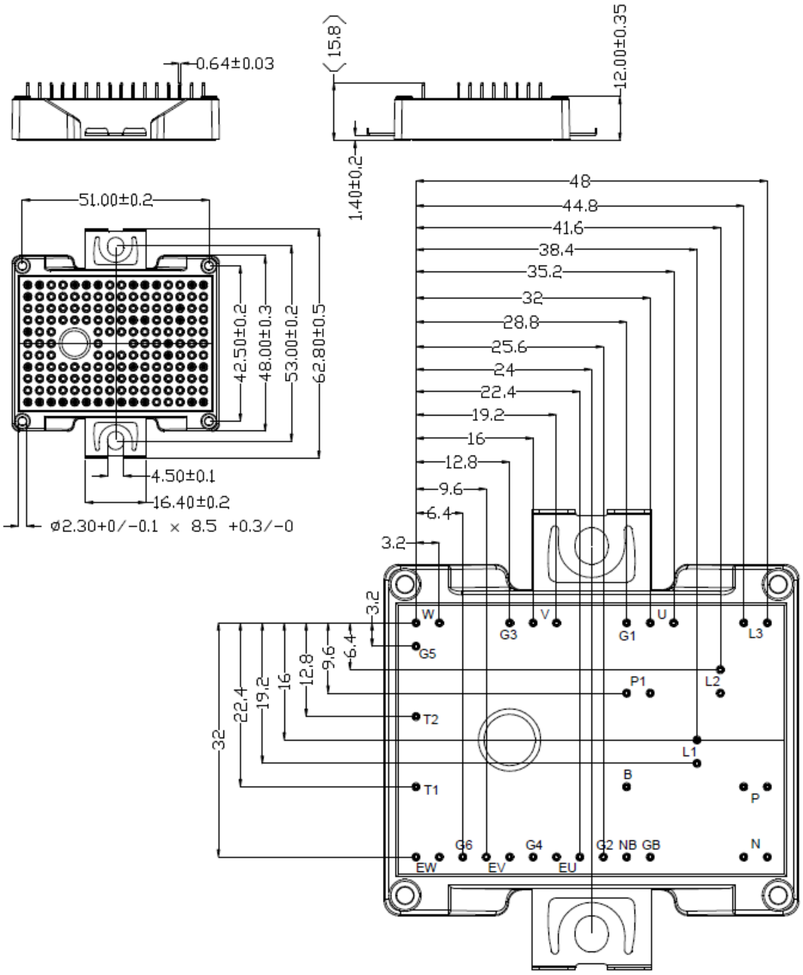


Figure 4