STARPOWER

SEMICONDUCTOR **IGBT**

GD1000HFA75N5HT

750V/1000A 2 in one-package

General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as hybrid and electric vehicle.

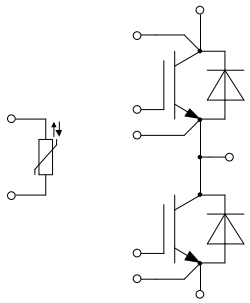
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- 6μs short circuit capability
- $V_{CE(sat)}$ with positive temperature coefficient
- Maximum junction temperature 175°C
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper pinfin baseplate using Si_3N_4 AMB technology

Typical Applications

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings T_F=25°C unless otherwise noted

IGBT

Symbol	Description	Values	Unit
V_{CES}	Collector-Emitter Voltage	750	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_{CN}	Implemented Collector Current	1000	A
I_C	Collector Current T_{vj}=175°C	680	A
I_{CM}	Pulsed Collector Current t_p=1ms	1360	A
P_D	Maximum Power Dissipation @ T_F=75°C T_{vj}=175°C	1086	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_{FN}	Implemented Collector Current	1000	A
I_F	Diode Continuous Forward Current	680	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1360	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°C
T_{vjop}	Operating Junction Temperature continuous	-40 to +150	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V

IGBT Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=680A,V_{GE}=15V, T_{vj}=25°C		1.25	1.50	V
		I_C=680A,V_{GE}=15V, T_{vj}=150°C		1.35		
		I_C=680A,V_{GE}=15V, T_{vj}=175°C		1.40		
		I_C=1000A,V_{GE}=15V, T_{vj}=25°C		1.45		
		I_C=1000A,V_{GE}=15V, T_{vj}=175°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.60mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.5	6.5	7.0	V
		I_C=9.60mA,V_{CE}=V_{GE}, T_{vj}=175°C		3.5		
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_{vj}=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_{vj}=25°C			400	nA
R_{Gint}	Internal Gate Resistance			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=50V,f=100kHz, V_{GE}=0V		72.3		nF
C_{oes}	Output Capacitance			1.51		nF
C_{res}	Reverse Transfer Capacitance			0.32		nF
Q_G	Gate Charge	V_{CE} =400V, I_C=680A, V_{GE}=-10…+15V		4.10		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=680A, R_G=0.22Ω,L_S=16nH, V_{GE}=-10V/+15V, T_{vj}=25°C		196		ns
t_r	Rise Time			50		ns
$t_{d(off)}$	Turn-Off Delay Time			407		ns
t_f	Fall Time			125		ns
E_{on}	Turn-On Switching Loss			11.1		mJ
E_{off}	Turn-Off Switching Loss			29.1		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=680A, R_G=0.22Ω,L_S=16nH, V_{GE}=-10V/+15V, T_{vj}=150°C		222		ns
t_r	Rise Time			63		ns
$t_{d(off)}$	Turn-Off Delay Time			471		ns
t_f	Fall Time			178		ns
E_{on}	Turn-On Switching Loss			19.7		mJ
E_{off}	Turn-Off Switching Loss			37.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=680A, R_G=0.22Ω,L_S=16nH, V_{GE}=-10V/+15V, T_{vj}=175°C		224		ns
t_r	Rise Time			68		ns
$t_{d(off)}$	Turn-Off Delay Time			490		ns
t_f	Fall Time			194		ns
E_{on}	Turn-On Switching Loss			21.7		mJ
E_{off}	Turn-Off Switching Loss			39.5		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V,		4000		A

		T_{vj}=25°C,V_{CC}=450V, V_{CEM}≤750V				
		t_P≤3μs,V_{GE}=15V, T_{vj}=175°C,V_{CC}=450V, V_{CEM}≤750V		3300		

Diode Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=680A,V_{GE}=0V,T_{vj}=25°C		1.60	2.05	V
		I_F=680A,V_{GE}=0V,T_{vj}=150°C		1.60		
		I_F=680A,V_{GE}=0V,T_{vj}=175°C		1.55		
		I_F=1000A,V_{GE}=0V,T_{vj}=25°C		1.80		
		I_F=1000A,V_{GE}=0V,T_{vj}=175°C		1.75		
Q_r	Recovered Charge	V_R=400V,I_F=680A, -di/dt=15030A/μs,V_{GE}=-10V, L_S=16nH,T_{vj}=25°C		19.9		μC
I_{RM}	Peak Reverse Recovery Current			458		A
E_{rec}	Reverse Recovery Energy			6.10		mJ
Q_r	Recovered Charge	V_R=400V,I_F=680A, -di/dt=12360A/μs,V_{GE}=-10V, L_S=16nH,T_{vj}=150°C		29.7		μC
I_{RM}	Peak Reverse Recovery Current			504		A
E_{rec}	Reverse Recovery Energy			9.70		mJ
Q_r	Recovered Charge	V_R=400V,I_F=680A, -di/dt=11740A/μs,V_{GE}=-10V, L_S=16nH,T_{vj}=175°C		34.5		μC
I_{RM}	Peak Reverse Recovery Current			526		A
E_{rec}	Reverse Recovery Energy			11.0		mJ

PTC Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R	Nominal Resistance	T_C=0 °C T_C=150 °C		1000 1573		Ω Ω
T_{CR}	Temperature Coefficient			0.38		%/K
T_{SH}	Self Heating	T_C=0 °C I_m=0.1...0.3mA		0.4		K/mW

Module Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		5		nH
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) $\triangle V/\triangle t$=8.0dm^3/min,T_F=65°C		0.080 0.115		K/W
M	Terminal Connection Torque, Screw M5 Mounting Torque, Screw M5	5.4 5.4		6.6 6.6	N.m
G	Weight of Module		220		g

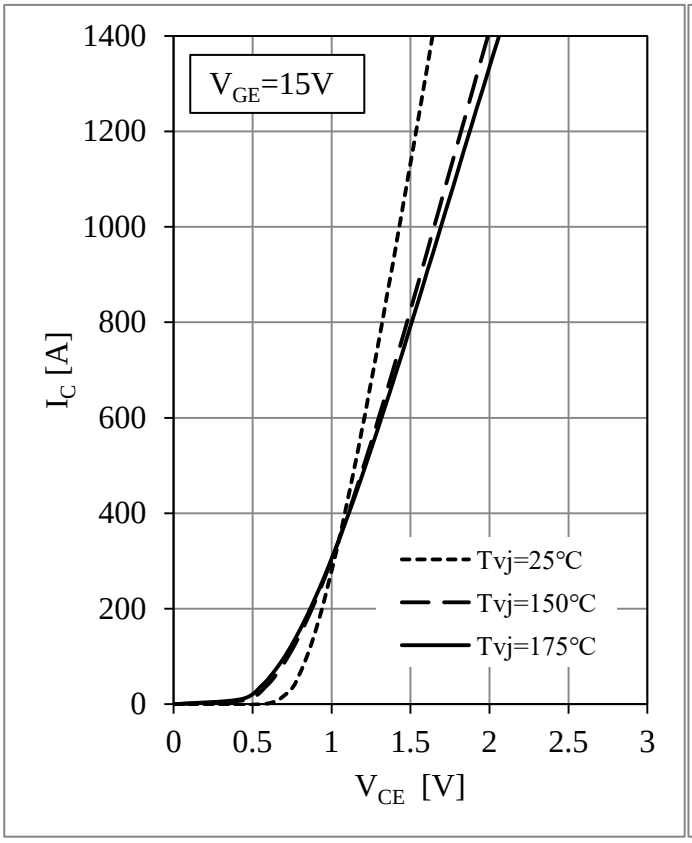


Fig 1. IGBT Output Characteristics

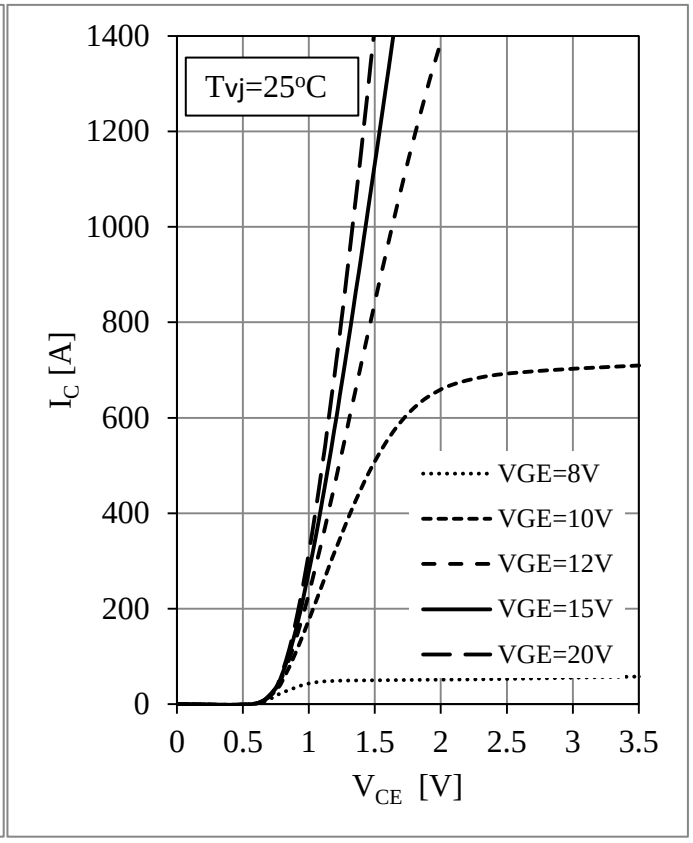


Fig 2. IGBT Output Characteristics

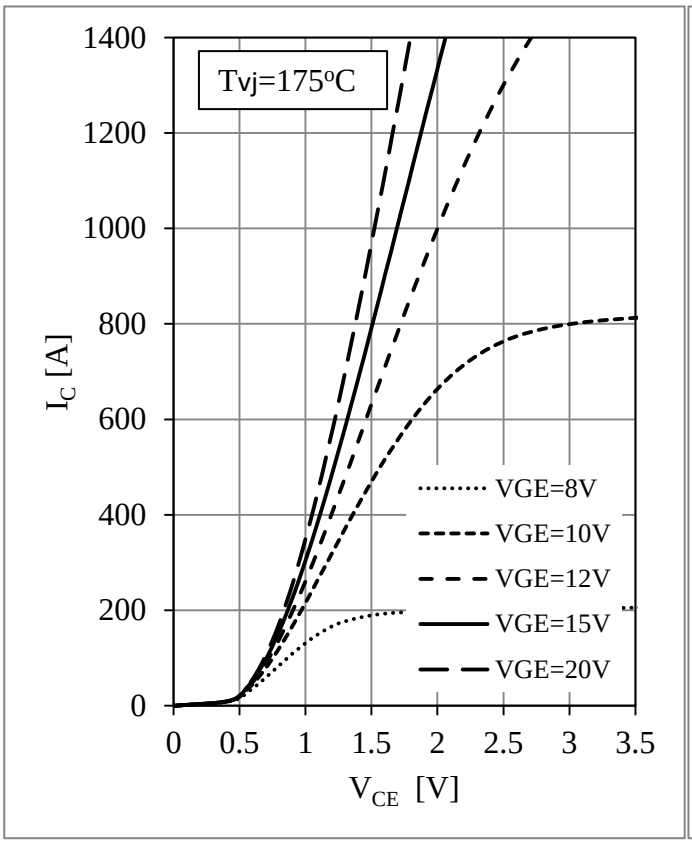


Fig 3. IGBT Output Characteristics

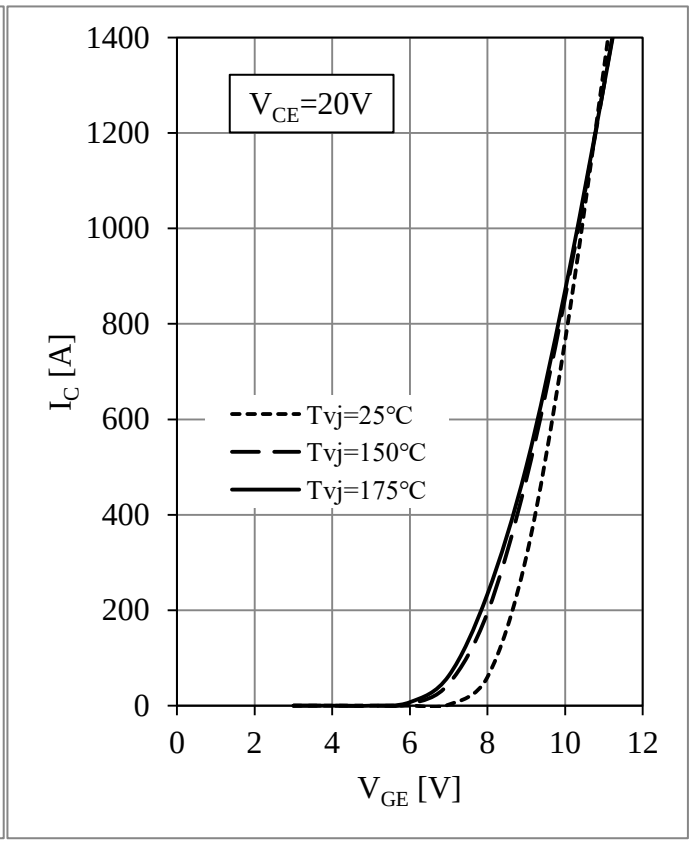


Fig 4. IGBT Transfer Characteristics

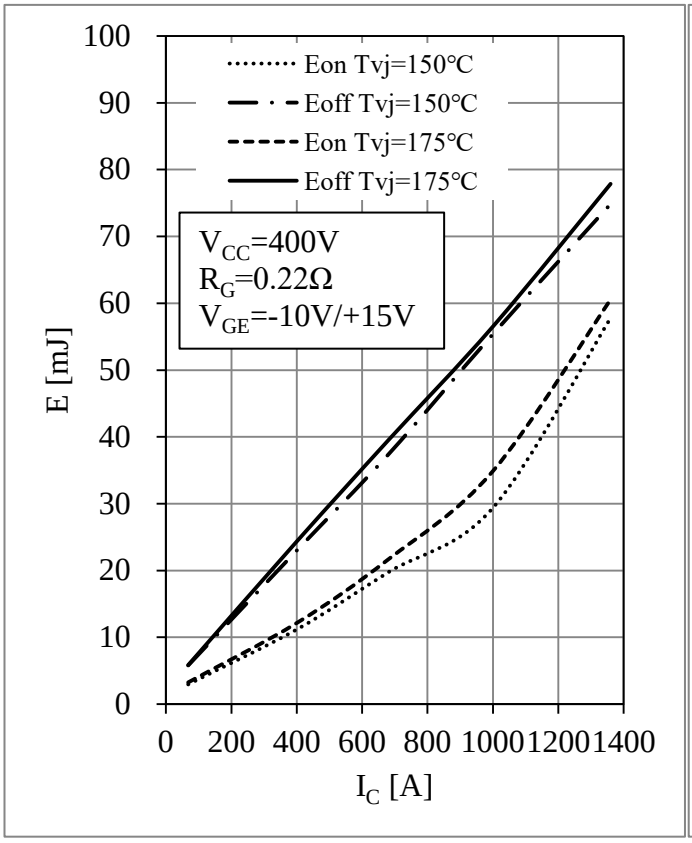


Fig 5. IGBT Switching Loss vs. I_C

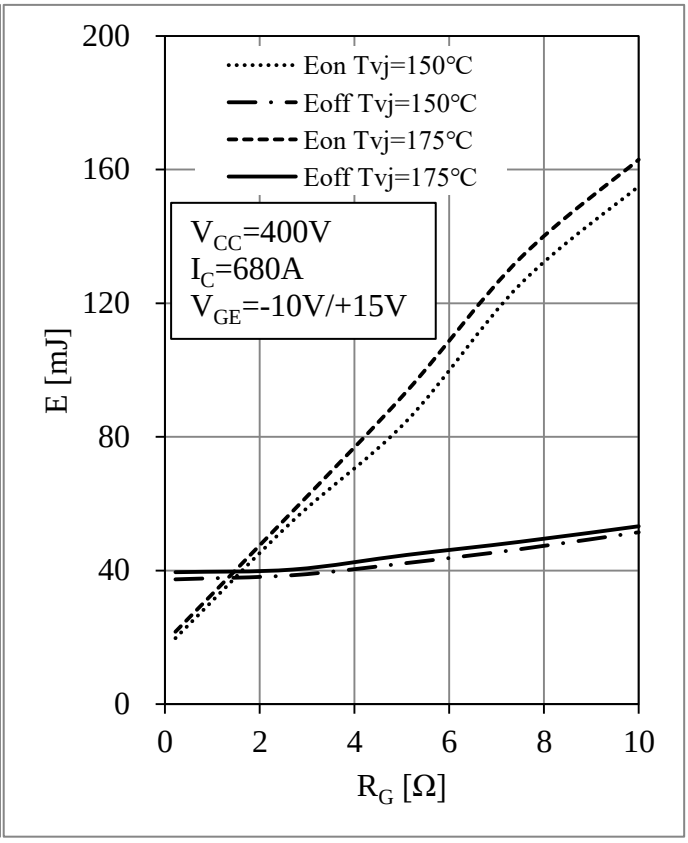


Fig 6. IGBT Switching Loss vs. R_G

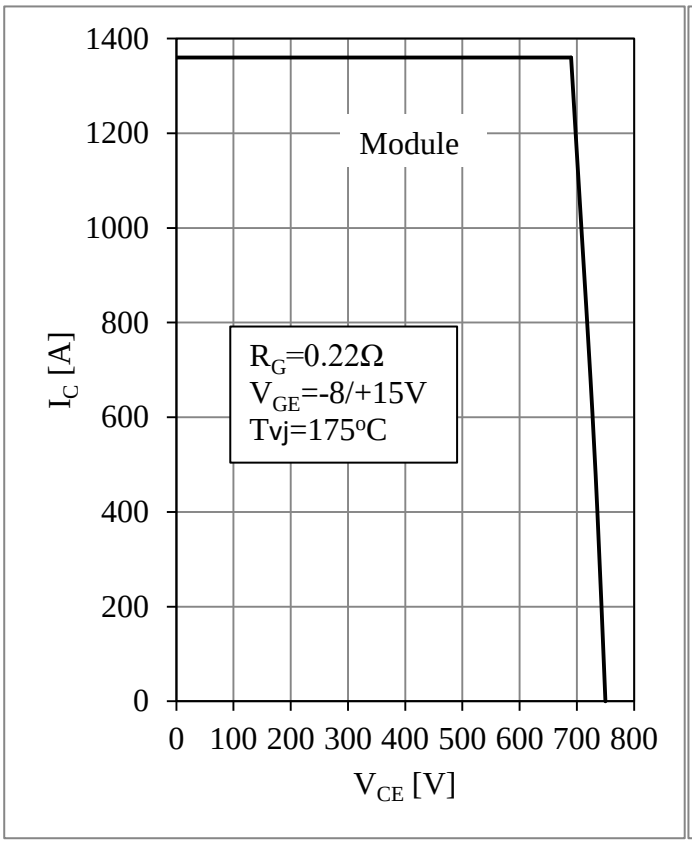


Fig 7. RBSOA

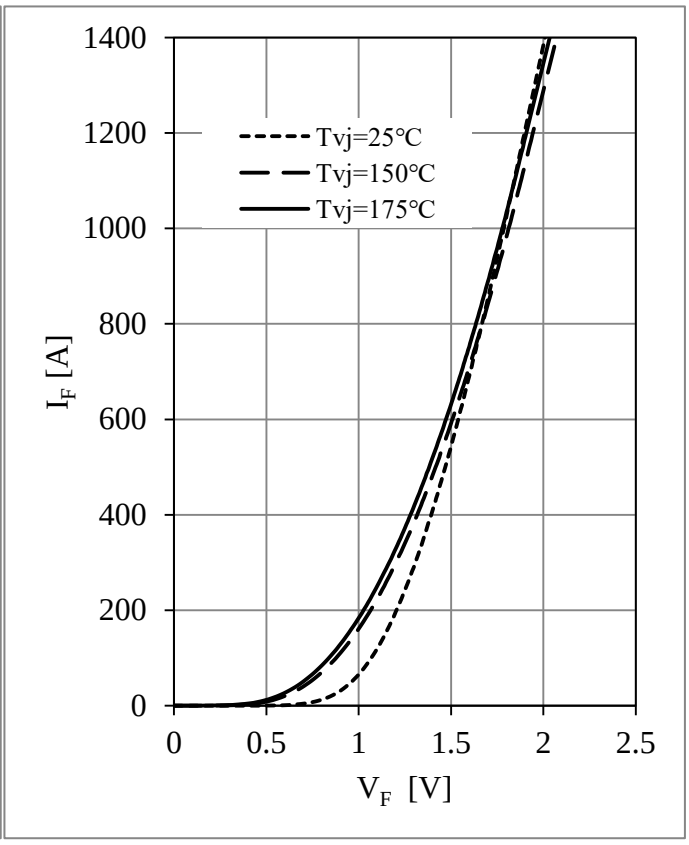


Fig 8. Diode Forward Characteristics

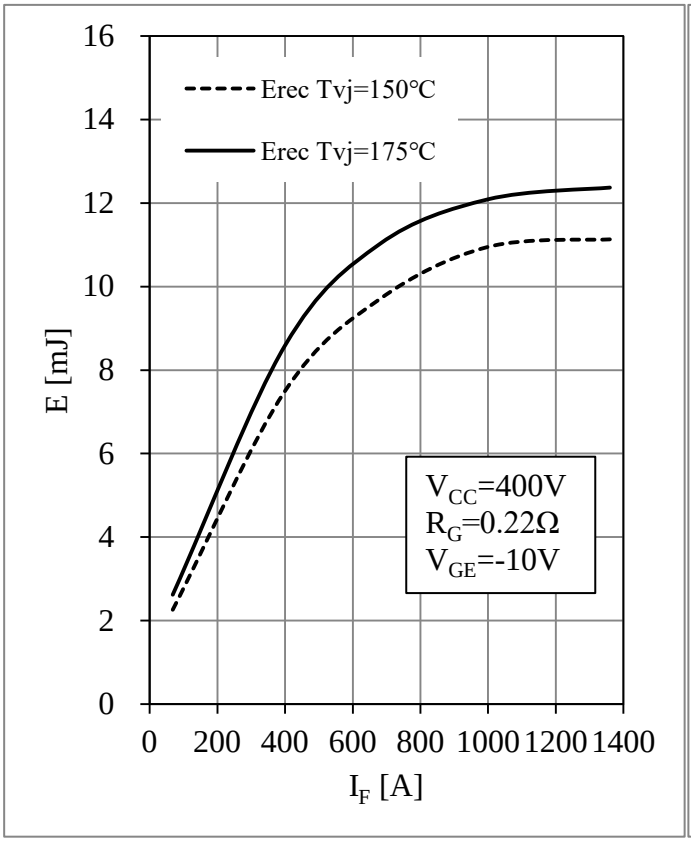


Fig 9. Diode Switching Loss vs. I_F

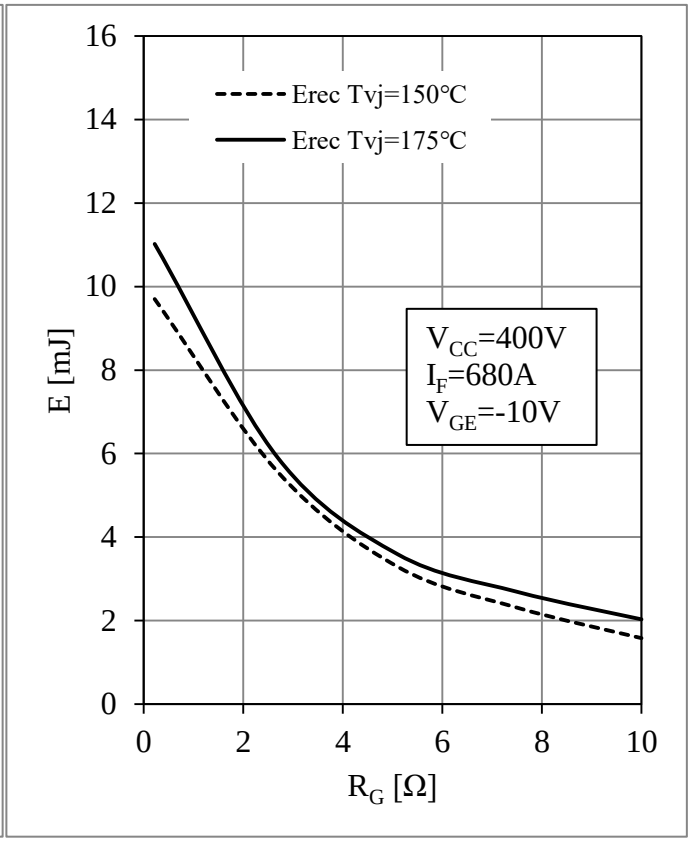


Fig 10. Diode Switching Loss vs. R_G

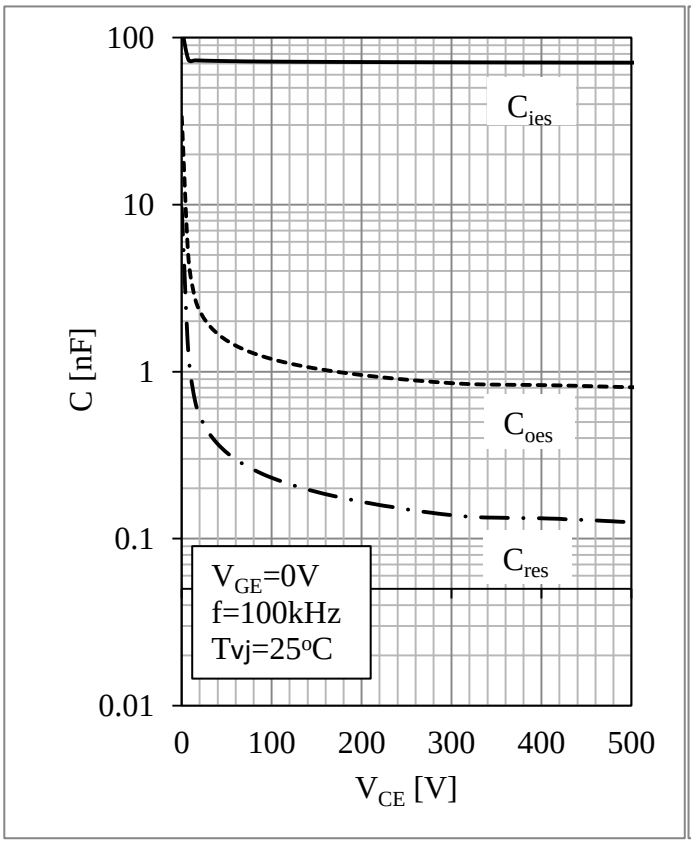


Fig 11. IGBT Capacity Charcteristic

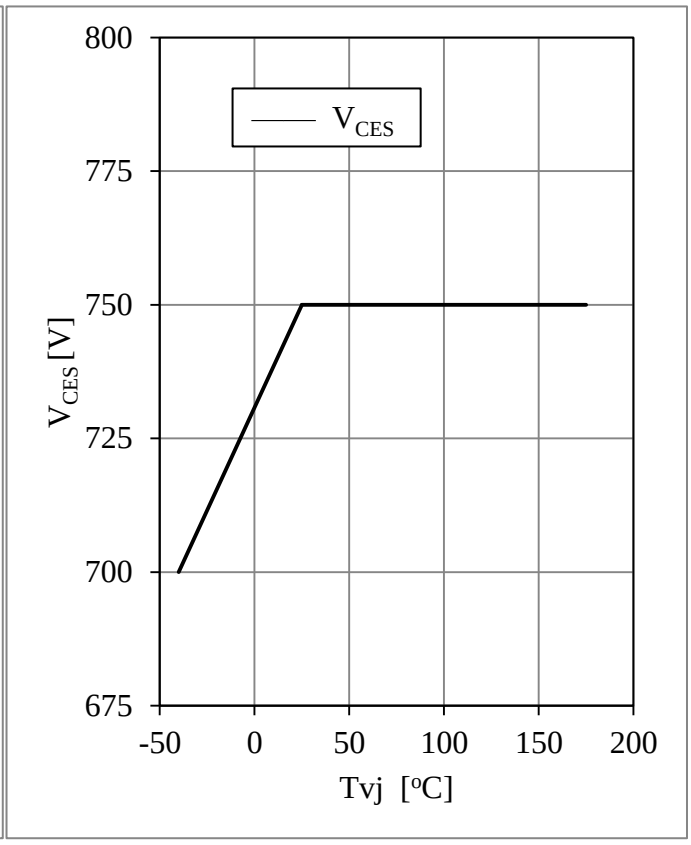
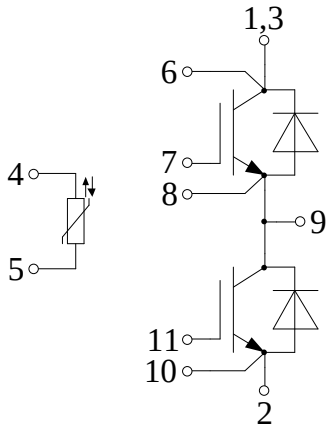


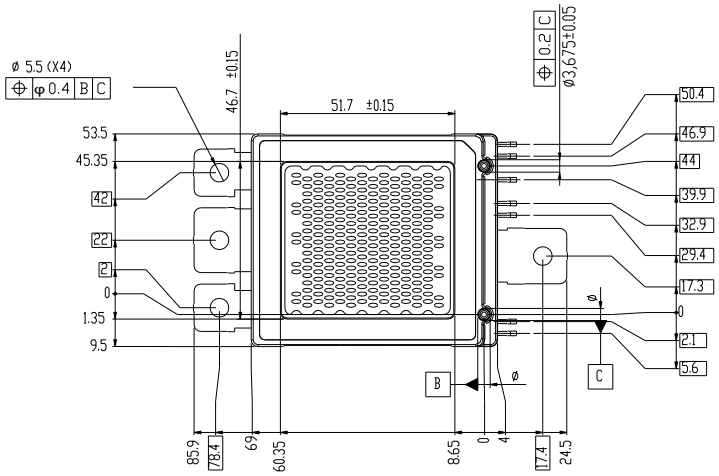
Fig 12. Maximum Allowed Collector-Emitter Voltage

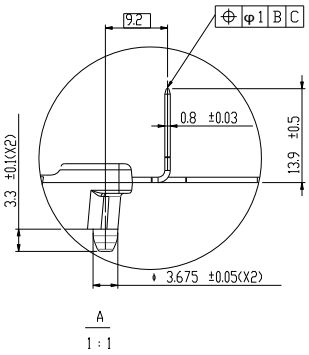
Circuit Schematic

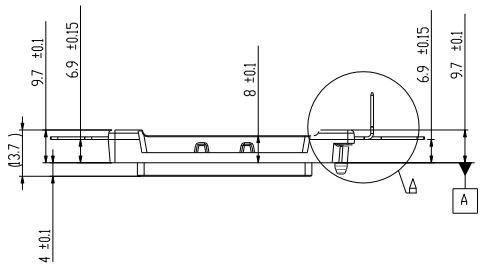


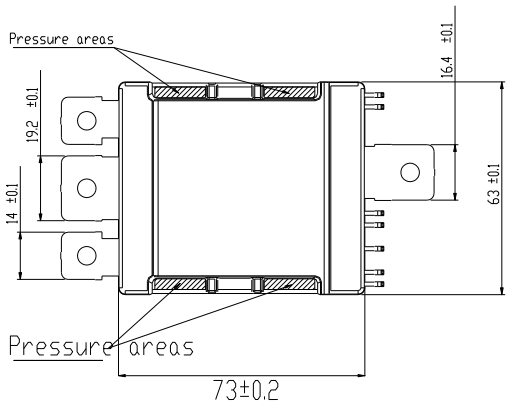
Package Dimensions

Dimensions in Millimeters









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