STARPOWER

SEMICONDUCTOR **IGBT**

GD660HFX75C6H

750V/660A 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.

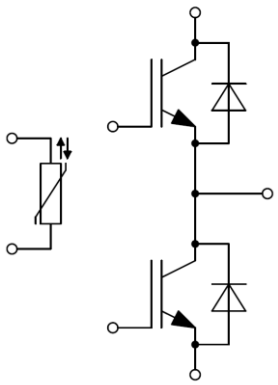
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 3μs 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 baseplate using DBC technology

Typical Applications

- Hybrid and electric vehicle
- Inverter for motor drive
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=25°C unless otherwise noted

IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	750	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_C=25°C @ T_C=75°C	870 660	A
I_{CM}	Pulsed Collector Current t_p=1ms	1320	A
P_D	Maximum Power Dissipation @ T_j=175°C	2239	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_F	Diode Continuous Forward Current	660	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1320	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-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_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=450A,V_{GE}=15V, T_j=25°C		1.35	1.80	V
		I_C=450A,V_{GE}=15V, T_j=150°C		1.60		
		I_C=450A,V_{GE}=15V, T_j=175°C		1.65		
		I_C=660A,V_{GE}=15V, T_j=25°C		1.55		
		I_C=660A,V_{GE}=15V, T_j=175°C		1.95		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.60mA,V_{CE}=V_{GE}, T_j=25°C	4.9	5.8	6.5	V
		I_C=9.60mA,V_{CE}=V_{GE}, T_j=175°C		4.1		
I_{CES}	Collector Cut-Off Current	V_{CE}=V_{CES},V_{GE}=0V, T_j=25°C			1.0	mA
I_{GES}	Gate-Emitter Leakage Current	V_{GE}=V_{GES},V_{CE}=0V, T_j=25°C			400	nA
R_{Gint}	Internal Gate Resistance			0.7		Ω
C_{ies}	Input Capacitance	V_{CE}=50V,f=100kHz, V_{GE}=0V		69.1		nF
C_{oes}	Output Capacitance			2.31		nF
C_{res}	Reverse Transfer Capacitance			1.05		nF
Q_G	Gate Charge	V_{CE} =400V,I_C =450A, V_{GE}=-8…+15V		3.29		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.4Ω, V_{GE}=-8V/+15V, L_S=40nH,T_j=25°C		296		ns
t_r	Rise Time			127		ns
$t_{d(off)}$	Turn-Off Delay Time			519		ns
t_f	Fall Time			87		ns
E_{on}	Turn-On Switching Loss			21.6		mJ
E_{off}	Turn-Off Switching Loss			21.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.4Ω, V_{GE}=-8V/+15V, L_S=40nH,T_j=150°C		302		ns
t_r	Rise Time			138		ns
$t_{d(off)}$	Turn-Off Delay Time			577		ns
t_f	Fall Time			146		ns
E_{on}	Turn-On Switching Loss			29.3		mJ
E_{off}	Turn-Off Switching Loss			24.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.4Ω, V_{GE}=-8V/+15V, L_S=40nH,T_j=175°C		306		ns
t_r	Rise Time			141		ns
$t_{d(off)}$	Turn-Off Delay Time			596		ns
t_f	Fall Time			166		ns
E_{on}	Turn-On Switching Loss			31.5		mJ
E_{off}	Turn-Off Switching Loss			25.6		mJ
I_{SC}		t_P≤3μs,V_{GE}=15V,		2600		

		T_j=175°C,V_{CC}=400V, V_{CEM}≤750V				

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=450A,V_{GE}=0V,T_j=25°C		1.45	1.90	V
		I_F=450A,V_{GE}=0V,T_j=150°C		1.40		
		I_F=450A,V_{GE}=0V,T_j=175°C		1.35		
		I_F=660A,V_{GE}=0V,T_j=25°C		1.60		
		I_F=660A,V_{GE}=0V,T_j=175°C		1.55		
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=3200A/μs,V_{GE}=-8V L_S=40nH,T_j=25°C		13.0		μC
I_{RM}	Peak Reverse Recovery Current			139		A
E_{rec}	Reverse Recovery Energy			3.47		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=2950A/μs,V_{GE}=-8V L_S=40nH,T_j=150°C		30.4		μC
I_{RM}	Peak Reverse Recovery Current			197		A
E_{rec}	Reverse Recovery Energy			7.89		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=2850A/μs,V_{GE}=-8V L_S=40nH,T_j=175°C		35.8		μC
I_{RM}	Peak Reverse Recovery Current			212		A
E_{rec}	Reverse Recovery Energy			9.51		mJ

NTC Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_C=100 °C,R_{100}=493.3Ω	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	R_2=R_{25}exp[$B_{25/50}$(1/T_2-1/(298.15K))]		3375		K
$B_{25/80}$	B-value	R_2=R_{25}exp[$B_{25/80}$(1/T_2-1/(298.15K))]		3411		K
$B_{25/100}$	B-value	R_2=R_{25}exp[$B_{25/100}$(1/T_2-1/(298.15K))]		3433		K

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.067 0.113	K/W
R_{thCH}	Case-to-Heatsink (per IGBT) Case-to-Heatsink (per Diode) Case-to-Heatsink (per Module)		0.029 0.048 0.009		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M5	3.0 3.0		6.0 6.0	N.m
G	Weight of Module		350		g

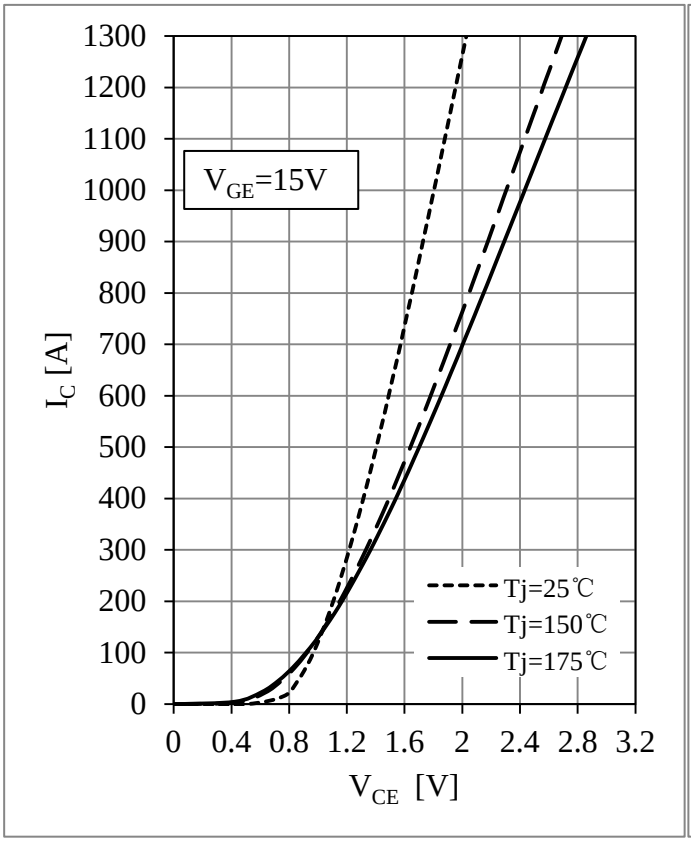


Fig 1. IGBT Output Characteristics

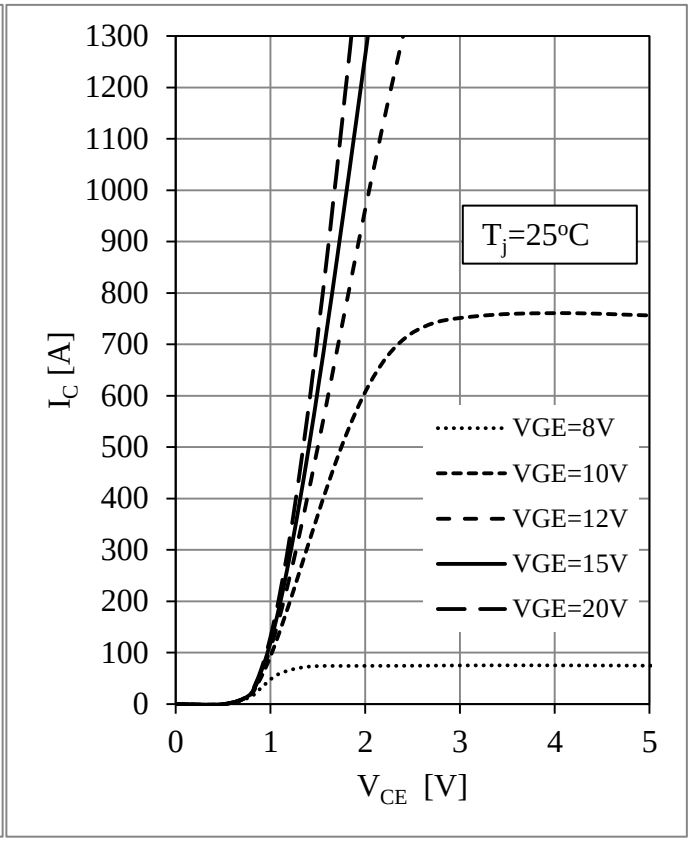


Fig 2. IGBT Output Characteristics

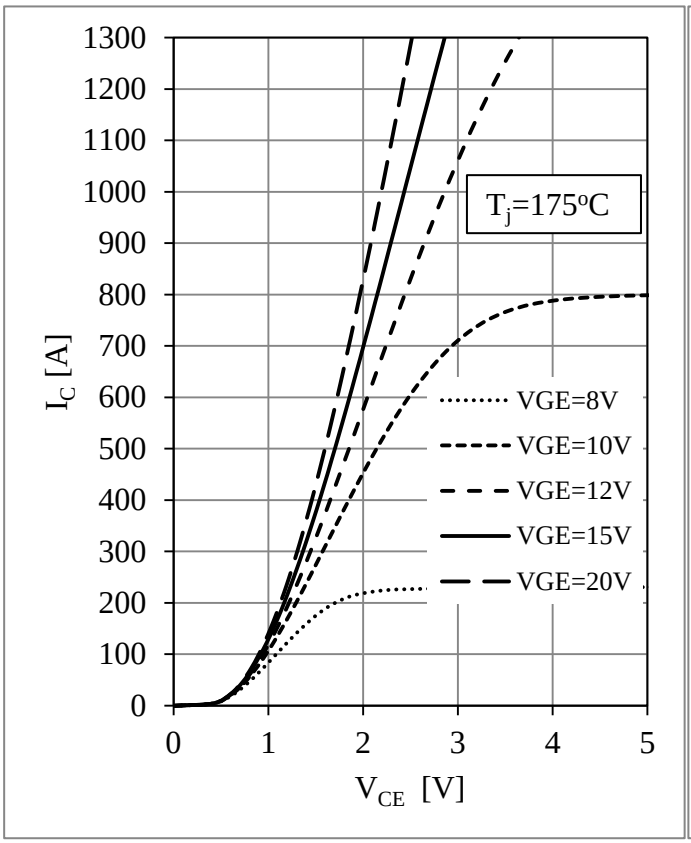


Fig 3. IGBT Output Characteristics

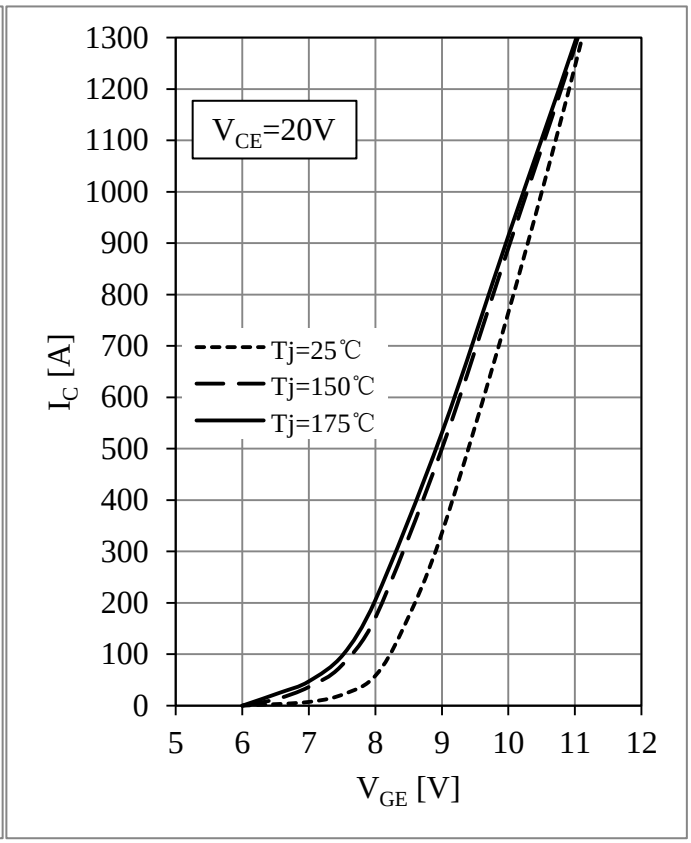


Fig 4. IGBT Transfer Characteristics

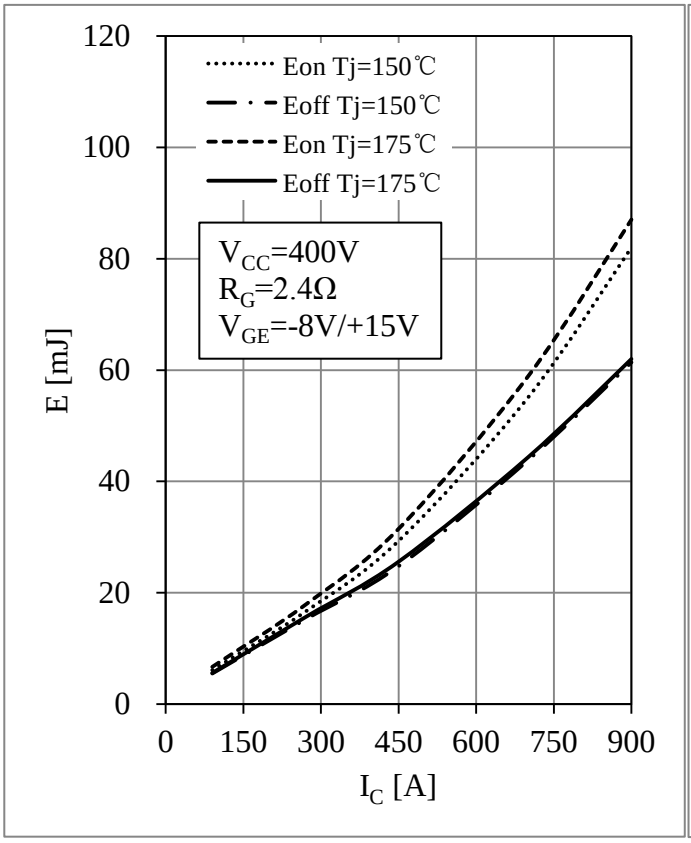


Fig 5. IGBT Switching Loss vs. I_C

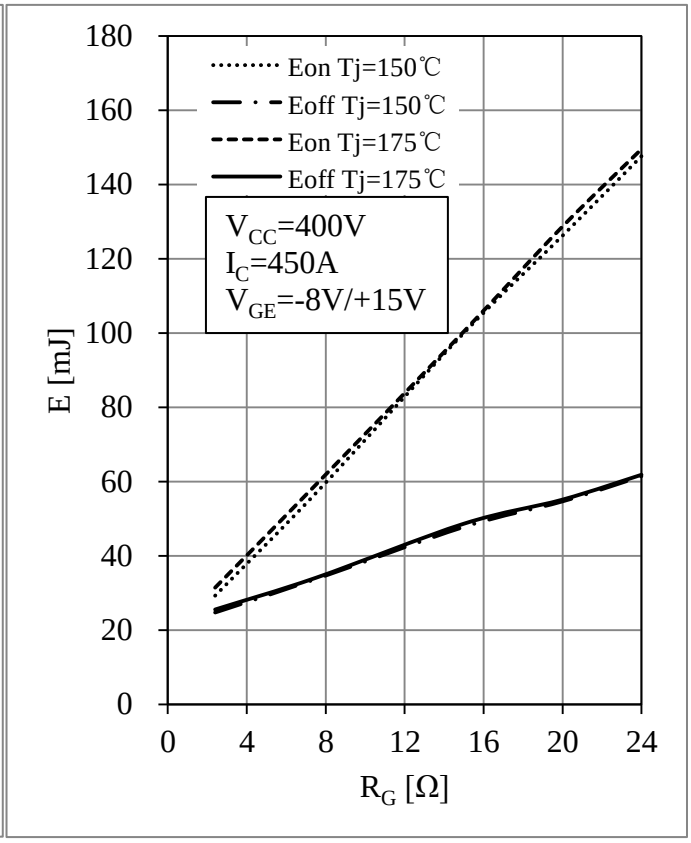


Fig 6. IGBT Switching Loss vs. R_G

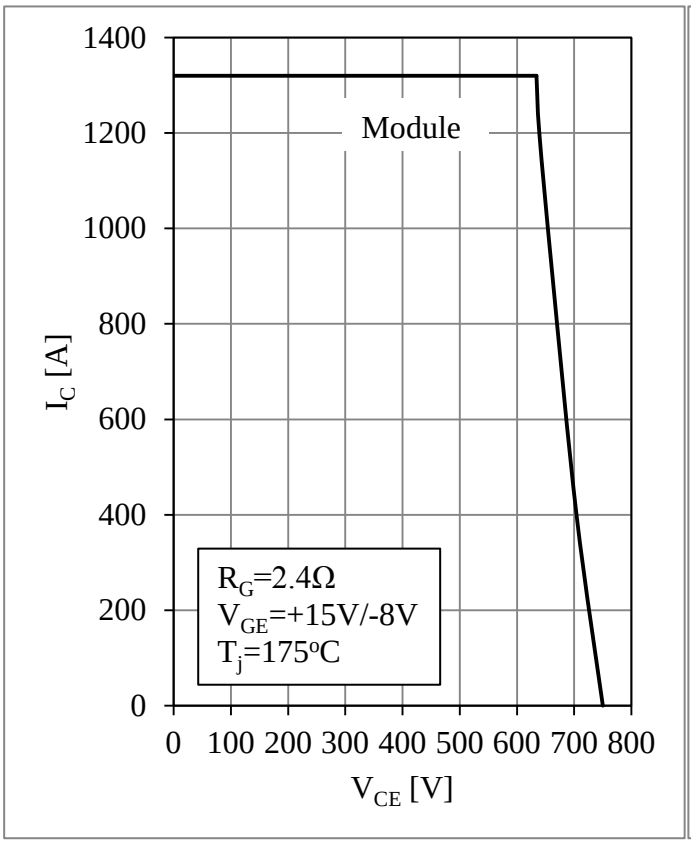


Fig 7. RBSOA

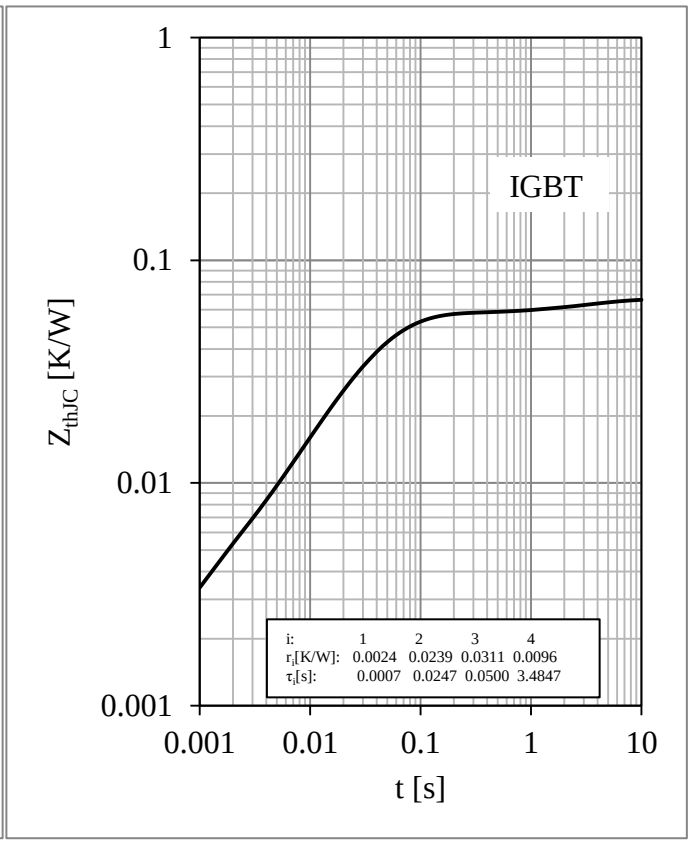


Fig 8. IGBT Transient Thermal Impedance

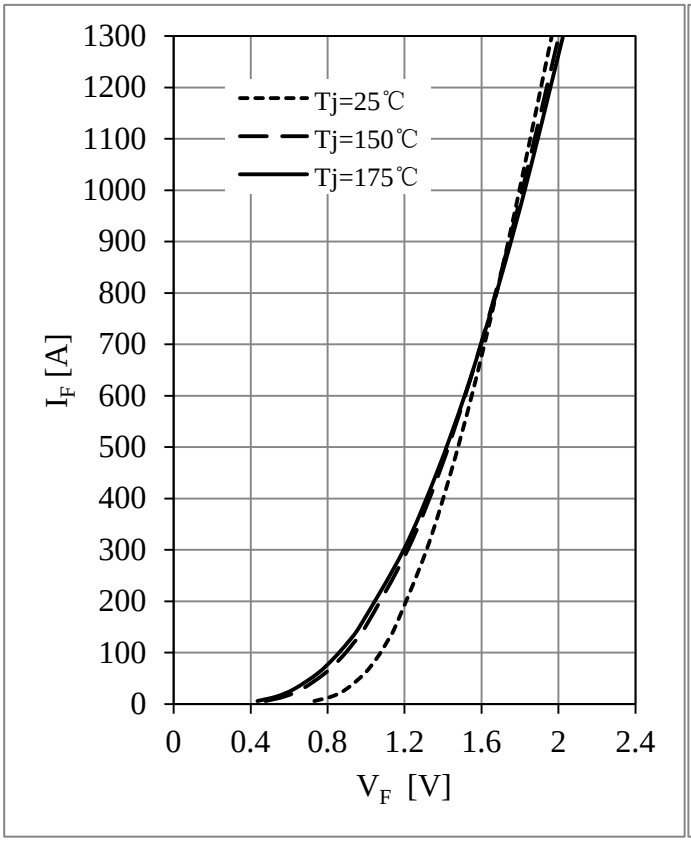


Fig 9. Diode Forward Characteristics

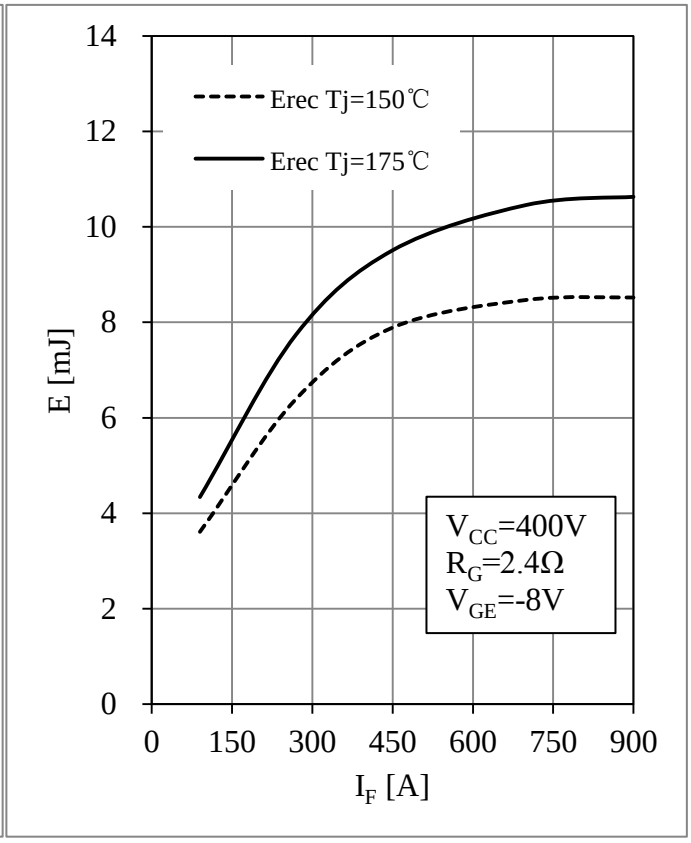


Fig 10. Diode Switching Loss vs. I_F

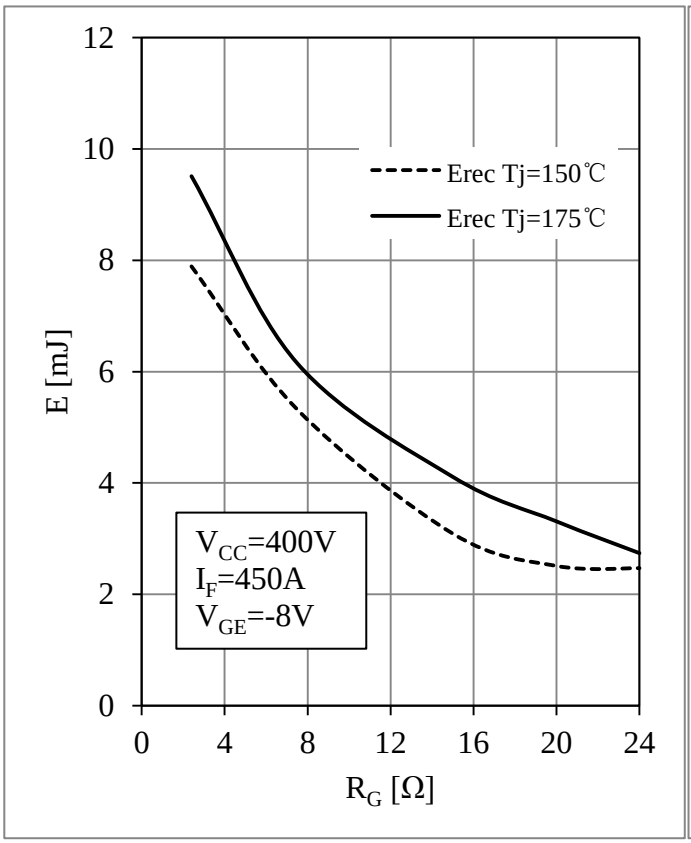


Fig 11. Diode Switching Loss vs. R_G

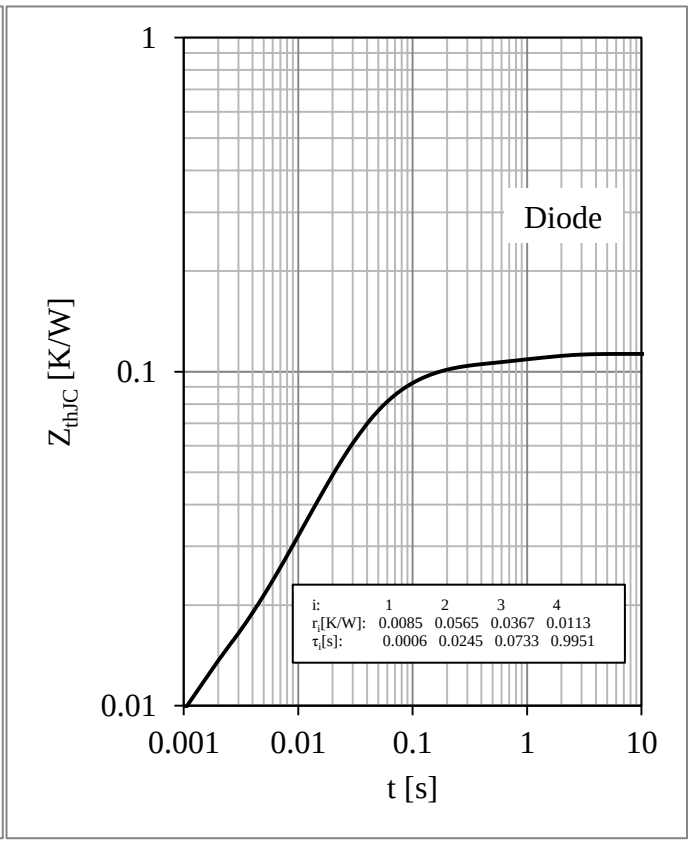


Fig 12. Diode Transient Thermal Impedance

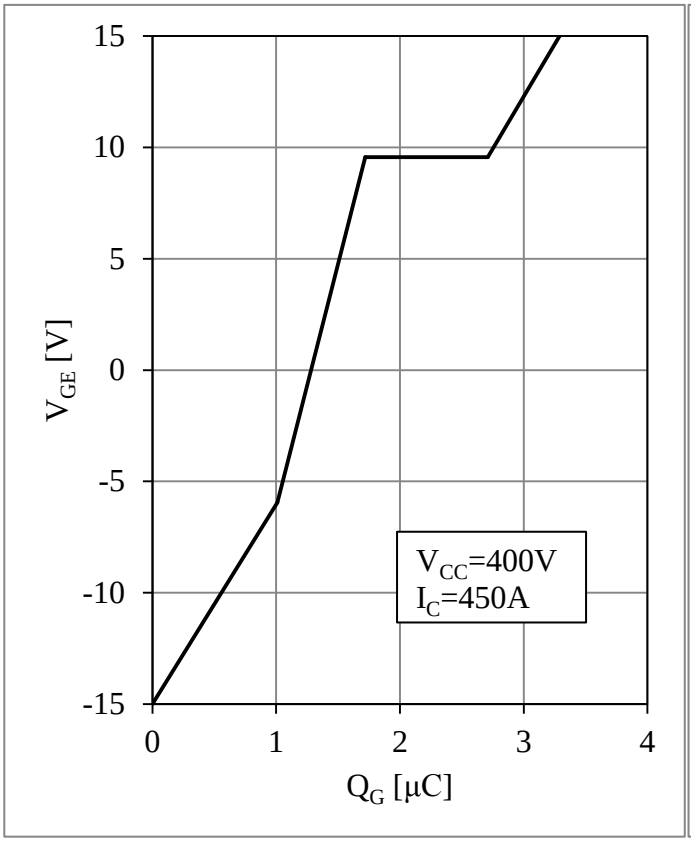


Fig 13. IGBT Gate Charge Characteristic

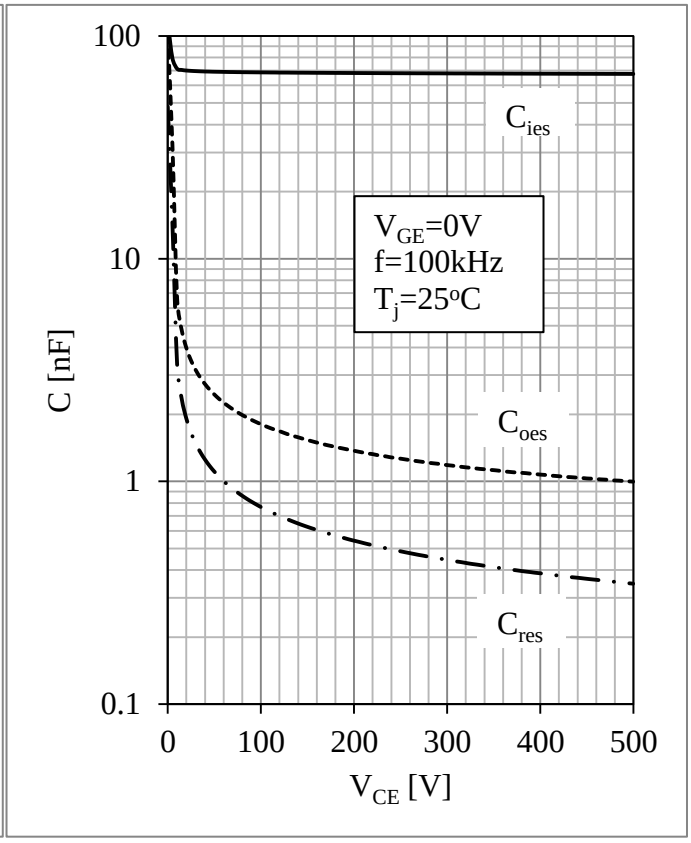


Fig 14. IGBT Capacity Charcteristic

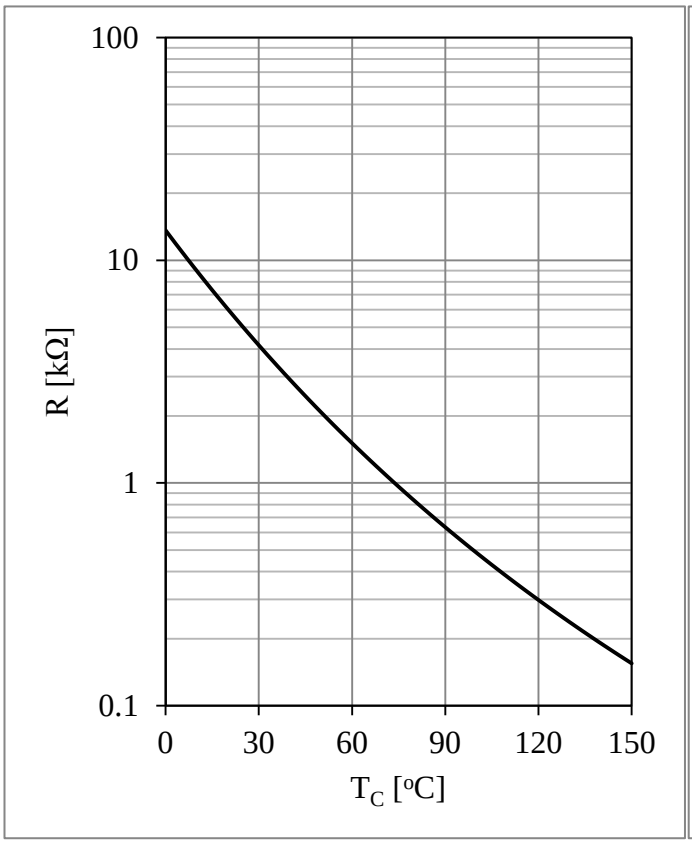


Fig 15. NTC Temperature Characteristic

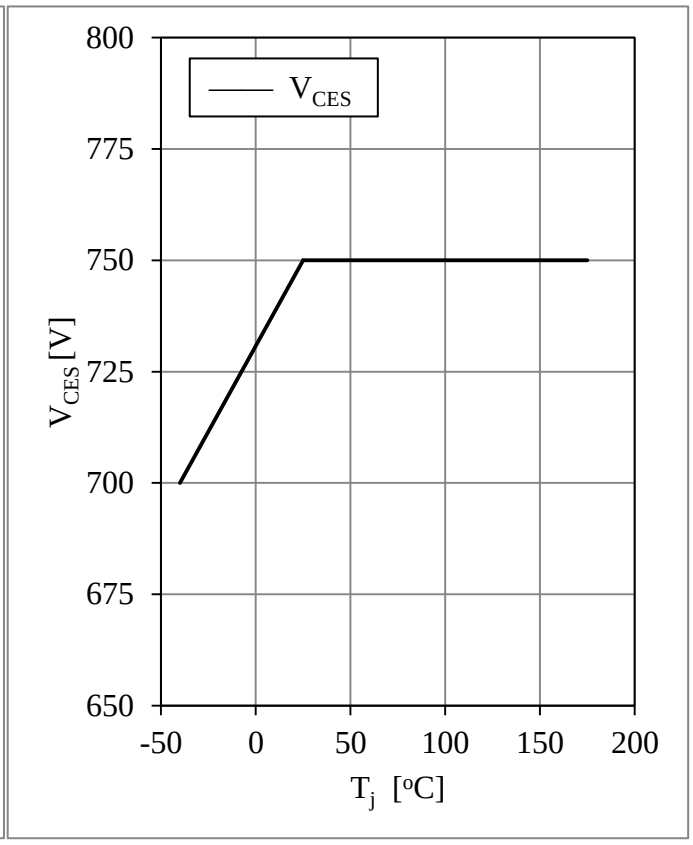
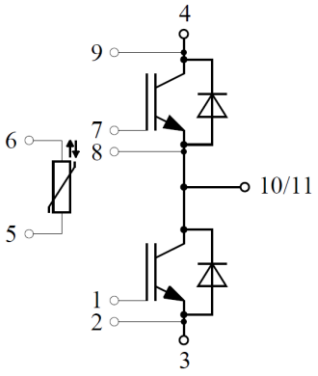


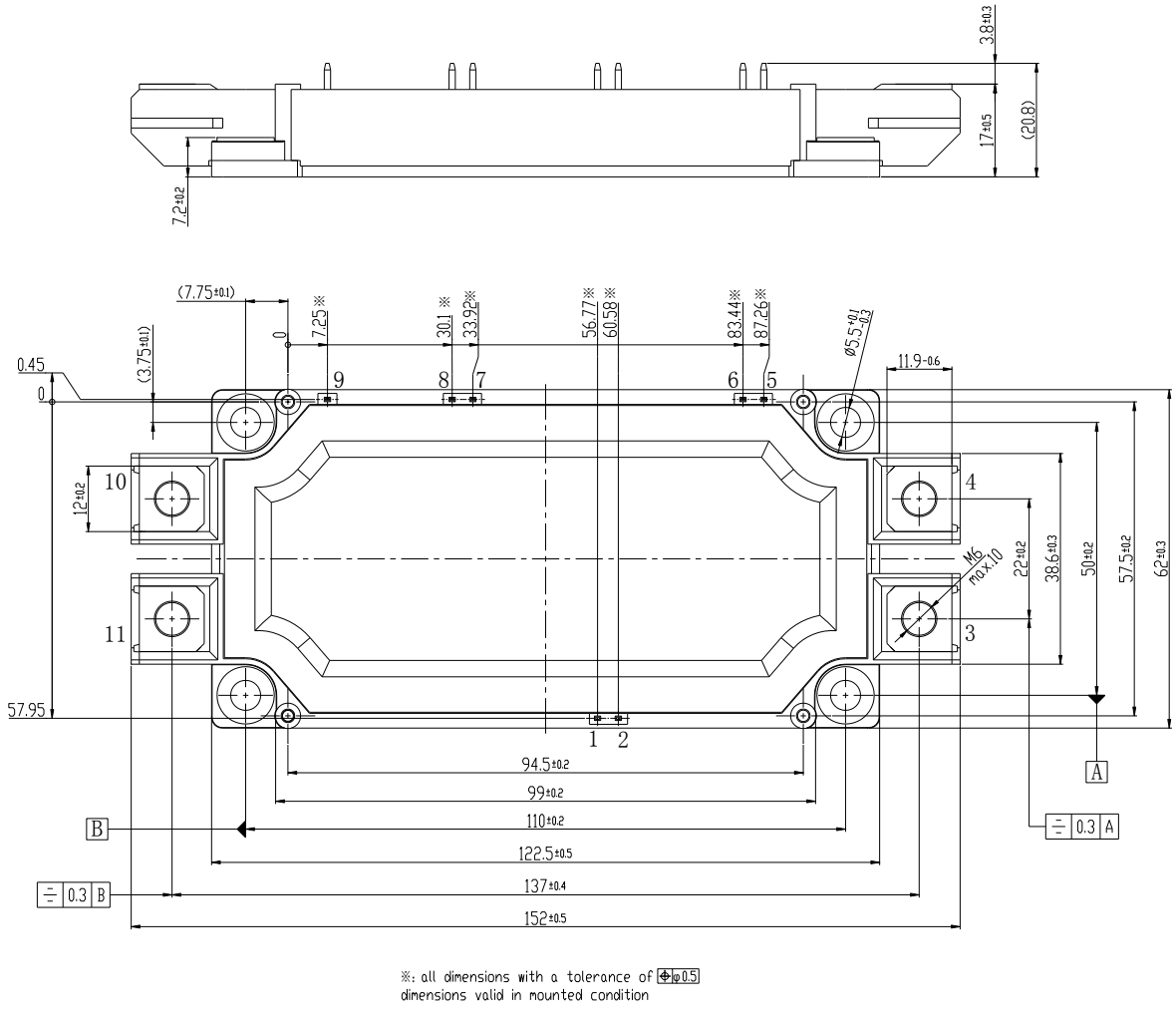
Fig 16. Maximum Allowed Collector-Emitter Voltage

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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