STARPOWER

SEMICONDUCTOR **IGBT**

GD660HFA75N5HY_B29

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.

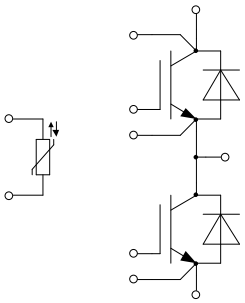
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 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_j=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	660	A
I_C	Collector Current @ T_F=65°C T_{vj}=175°C	500	A
I_{CM}	Pulsed Collector Current t_p=1ms	1320	A
P_D	Maximum Power Dissipation @ T_F=65°C T_{vj}=175°C	846	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_{FN}	Implemented Collector Current	660	A
I_F	Diode Continuous Forward Current @ T_F=65°C T_{vj}=175°C	335	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1320	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature continuous For 10s within a period of 30s,occurrence maximum 3000 times over lifetime	-40 to +150 +150 to +175	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=1min	2500	V
d_{Creep}	Terminal to Heatsink Terminal to Terminal	8.7 5.6	mm
d_{Clear}	Terminal to Heatsink Terminal to Terminal	6.8 3.0	mm

IGBT Characteristics T_j=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=300A,V_{GE}=15V, T_{vj}=25°C		1.10	1.35	V
		I_C=300A,V_{GE}=15V, T_{vj}=150°C		1.15		
		I_C=300A,V_{GE}=15V, T_{vj}=175°C		1.15		
		I_C=660A,V_{GE}=15V, T_{vj}=25°C		1.45		
		I_C=660A,V_{GE}=15V, T_{vj}=175°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=8.60mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.5	6.5	7.0	V
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			2.0		Ω
C_{ies}	Input Capacitance	V_{CE}=50V,f=100kHz, V_{GE}=0V		48.2		nF
C_{oes}	Output Capacitance			1.01		nF
C_{res}	Reverse Transfer Capacitance			0.21		nF
Q_G	Gate Charge	V_{CE} =400V, I_C=300A, V_{GE}=±15V		3.18		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=420A, R_G=2.0Ω, V_{GE}=±15V, L_S=16nH, T_{vj}=25°C		377		ns
t_r	Rise Time			58		ns
$t_{d(off)}$	Turn-Off Delay Time			412		ns
t_f	Fall Time			116		ns
E_{on}	Turn-On Switching Loss			17.9		mJ
E_{off}	Turn-Off Switching Loss			16.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=420A, R_G=2.0Ω, V_{GE}=±15V, L_S=16nH, T_{vj}=150°C		409		ns
t_r	Rise Time			71		ns
$t_{d(off)}$	Turn-Off Delay Time			468		ns
t_f	Fall Time			182		ns
E_{on}	Turn-On Switching Loss			22.4		mJ
E_{off}	Turn-Off Switching Loss			21.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=420A, R_G=2.0Ω, V_{GE}=±15V, L_S=16nH, T_{vj}=175°C		416		ns
t_r	Rise Time			78		ns
$t_{d(off)}$	Turn-Off Delay Time			485		ns
t_f	Fall Time			214		ns
E_{on}	Turn-On Switching Loss			25.3		mJ
E_{off}	Turn-Off Switching Loss			23.0		mJ
I_{SC}	SC Data	t_P≤3μs,V_{GE}=15V, T_{vj}=175°C,V_{CC}=450V, V_{CEM}≤750V		2600		A

Diode Characteristics T_j=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=300A,V_{GE}=0V,T_{vj}=25°C		1.40	1.65	V
		I_F=300A,V_{GE}=0V,T_{vj}=150°C		1.35		
		I_F=300A,V_{GE}=0V,T_{vj}=175°C		1.30		
		I_F=660A,V_{GE}=0V,T_{vj}=25°C		1.80		
		I_F=660A,V_{GE}=0V,T_{vj}=175°C		1.75		
Q_r	Recovered Charge	V_R=400V,I_F=420A, -di/dt=8350A/µs,V_{GE}=-15V, L_S=16nH,T_{vj}=25°C		9.60		µC
I_{RM}	Peak Reverse Recovery Current			240		A
E_{rec}	Reverse Recovery Energy			2.80		mJ
Q_r	Recovered Charge	V_R=400V,I_F420A, -di/dt=7480A/µs,V_{GE}=-15V, L_S=16nH,T_{vj}=150°C		18.1		µC
I_{RM}	Peak Reverse Recovery Current			280		A
E_{rec}	Reverse Recovery Energy			5.00		mJ
Q_r	Recovered Charge	V_R=400V,I_F=420A, -di/dt=7170A/µs,V_{GE}=-15V, L_S=16nH,T_{vj}=175°C		23.6		µC
I_{RM}	Peak Reverse Recovery Current			301		A
E_{rec}	Reverse Recovery Energy			6.10		mJ

NTC Characteristics T_j=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_j=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		6.5		nH
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) △V/△t=3.3 L/min,T_F=65°C		0.113 0.164	0.130 0.189	K/W
M	Terminal Connection Torque, Screw M5 Mounting Torque, Screw M5	3.6 5.4		4.4 6.6	N.m
G	Weight of Module		220		g

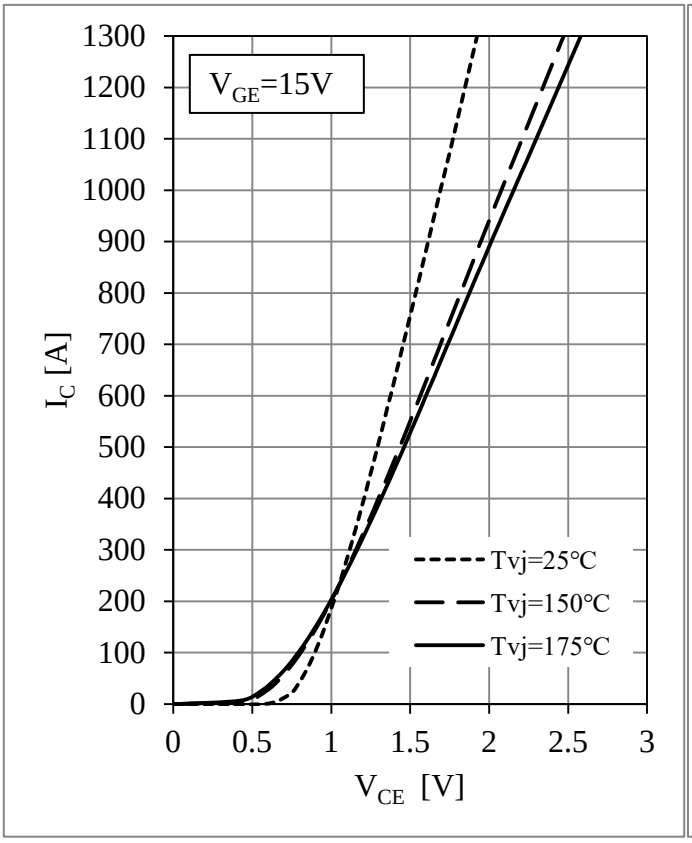


Fig 1. IGBT Output Characteristics

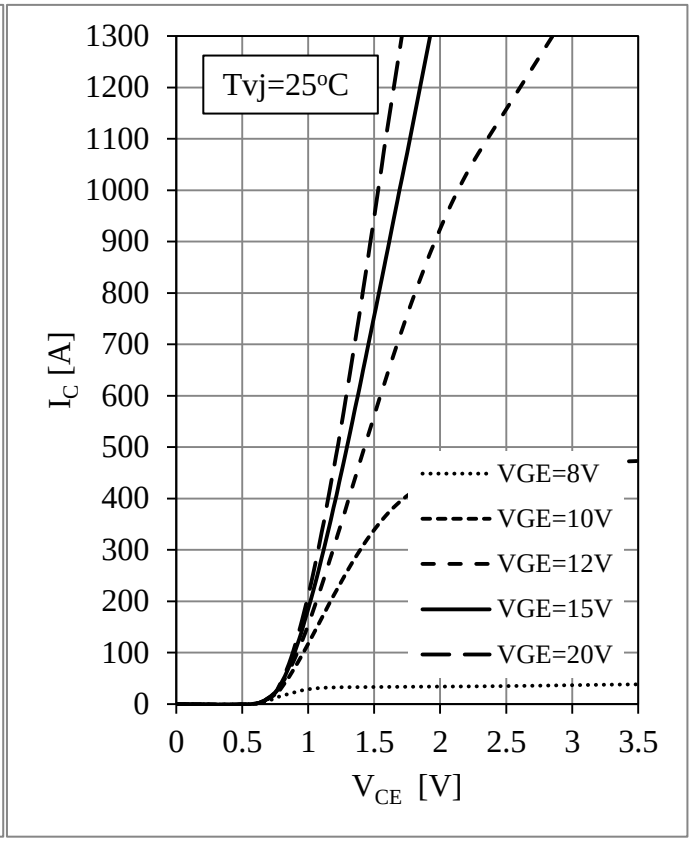


Fig 2. IGBT Output Characteristics

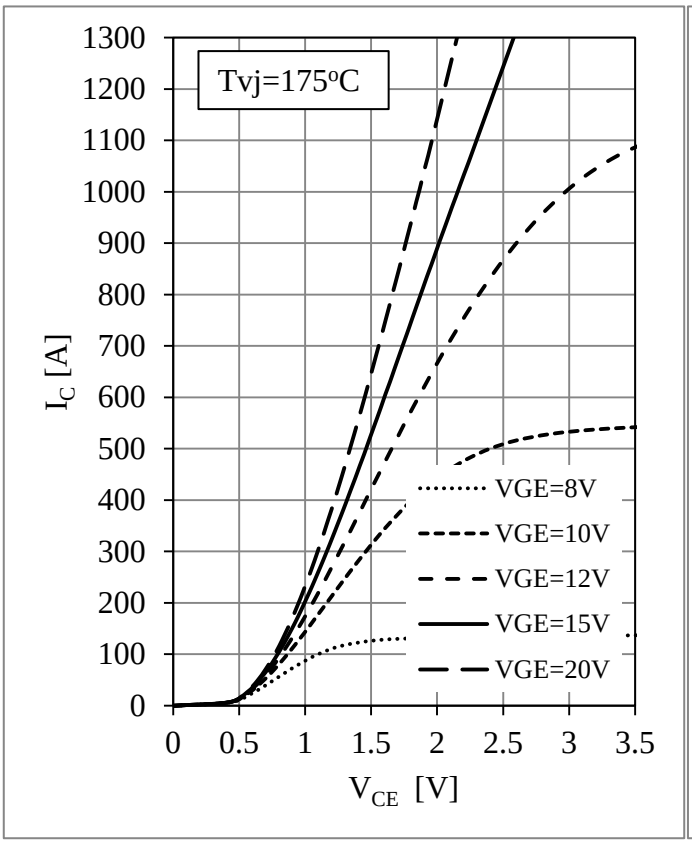


Fig 3. IGBT Output Characteristics

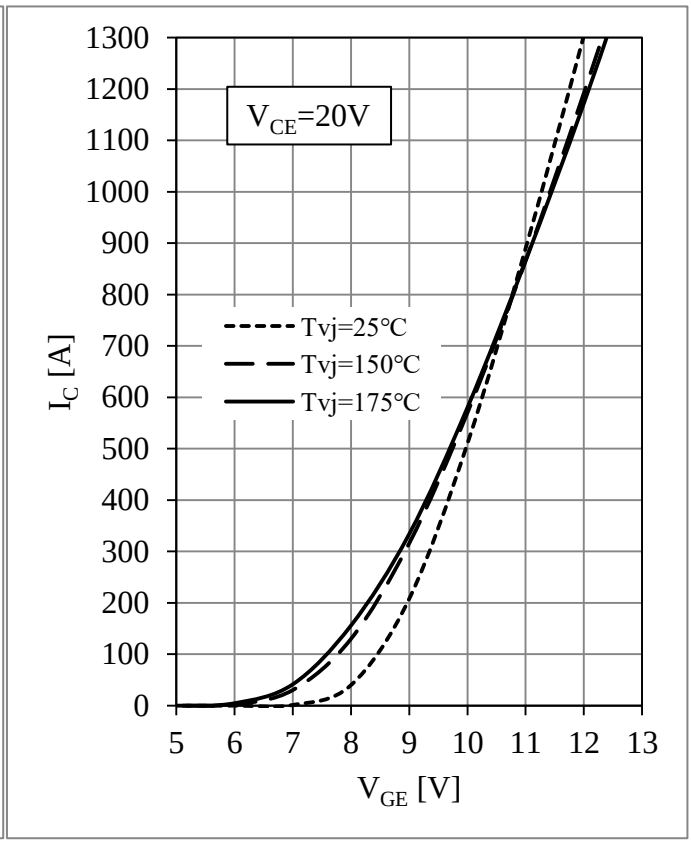


Fig 4. IGBT Transfer Characteristics

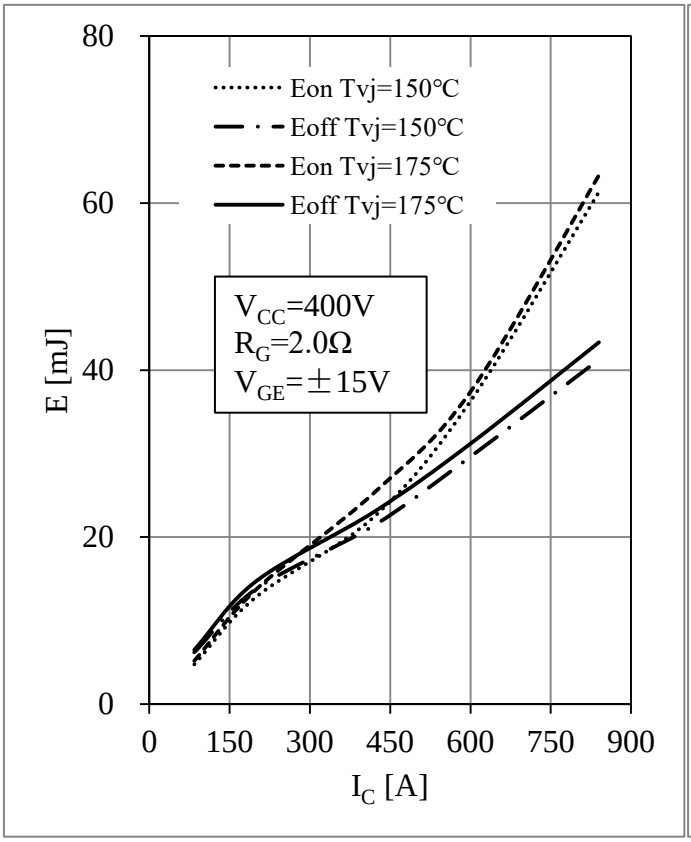


Fig 5. IGBT Switching Loss vs. I_C

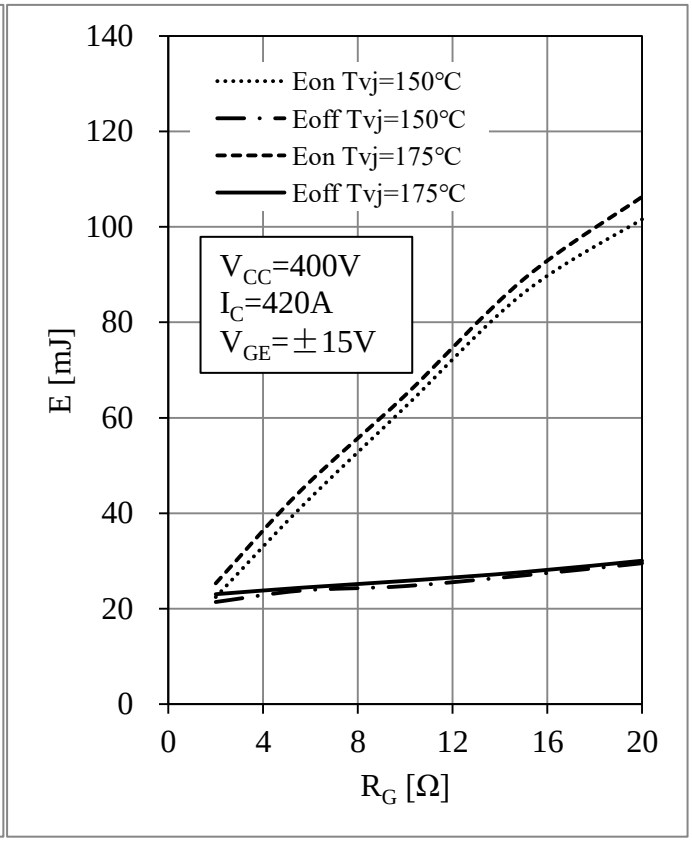


Fig 6. IGBT Switching Loss vs. R_G

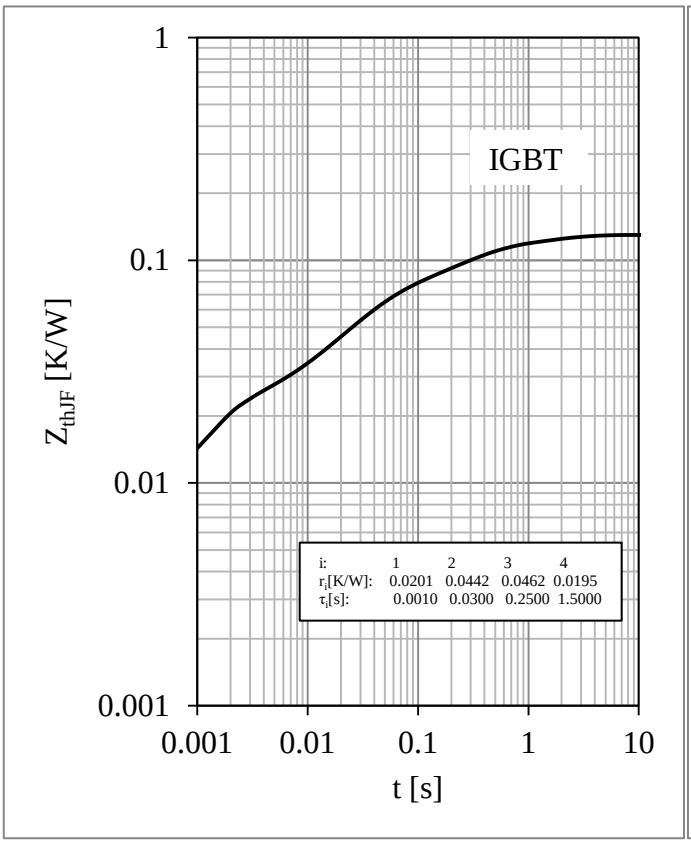


Fig 7. IGBT Transient Thermal Impedance

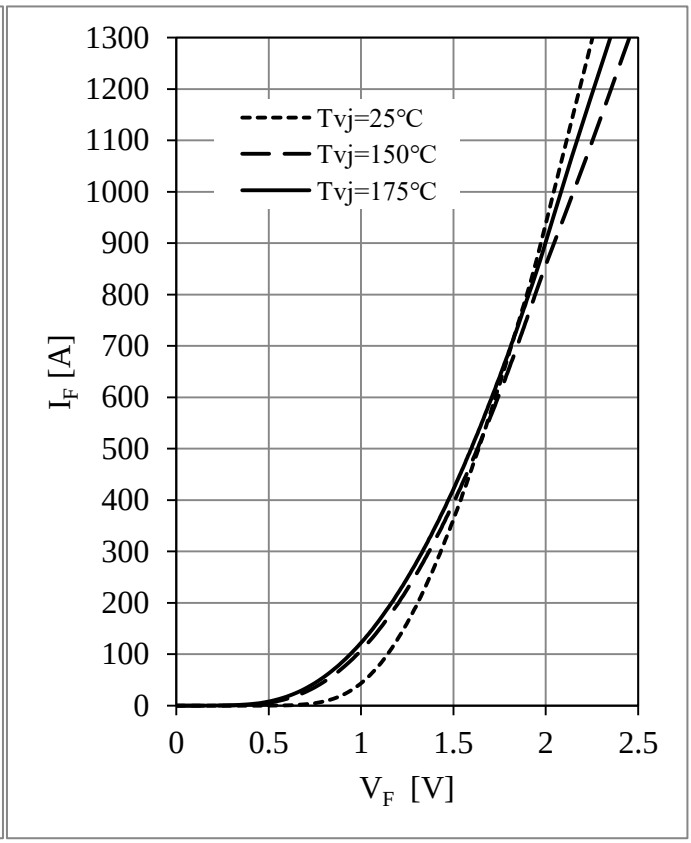


Fig 8. Diode Forward Characteristics

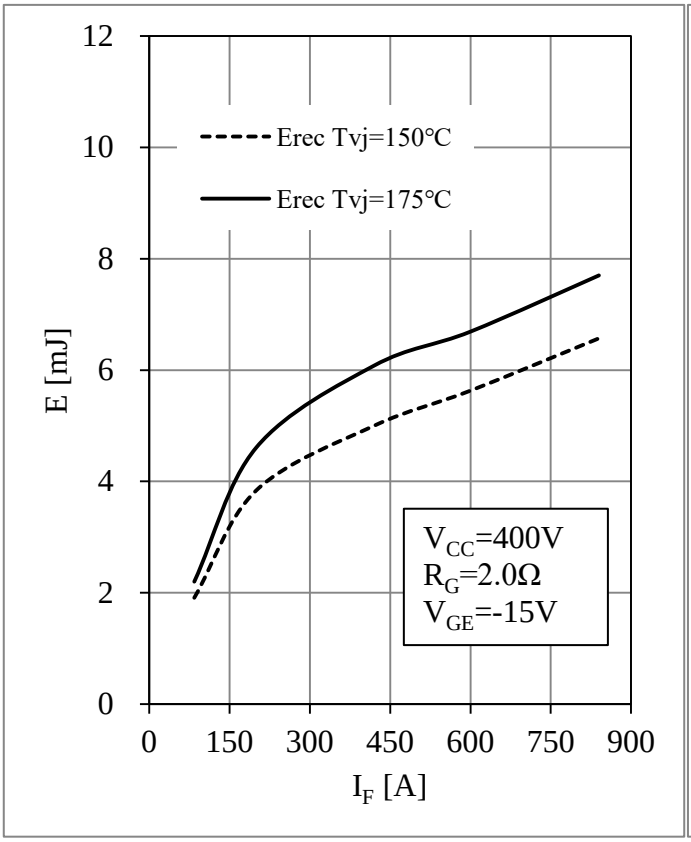


Fig 9. Diode Switching Loss vs. I_F

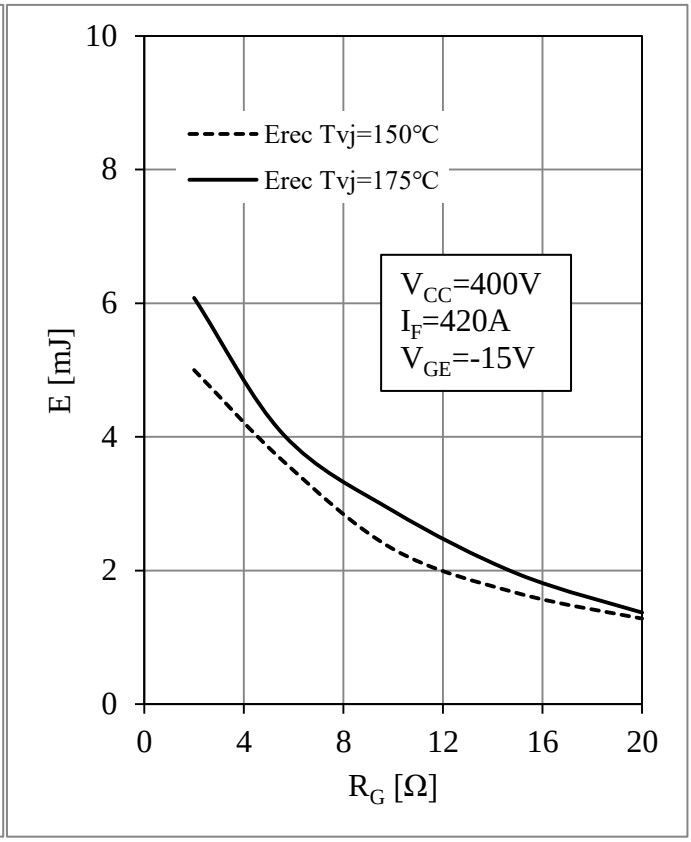


Fig 10. Diode Switching Loss vs. R_G

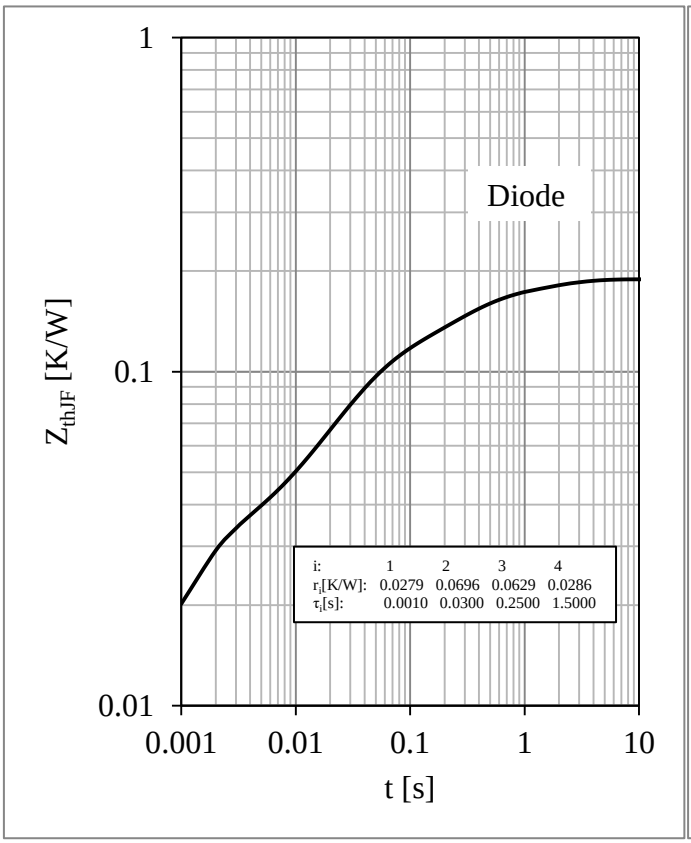


Fig 11. Diode Transient Thermal Impedance

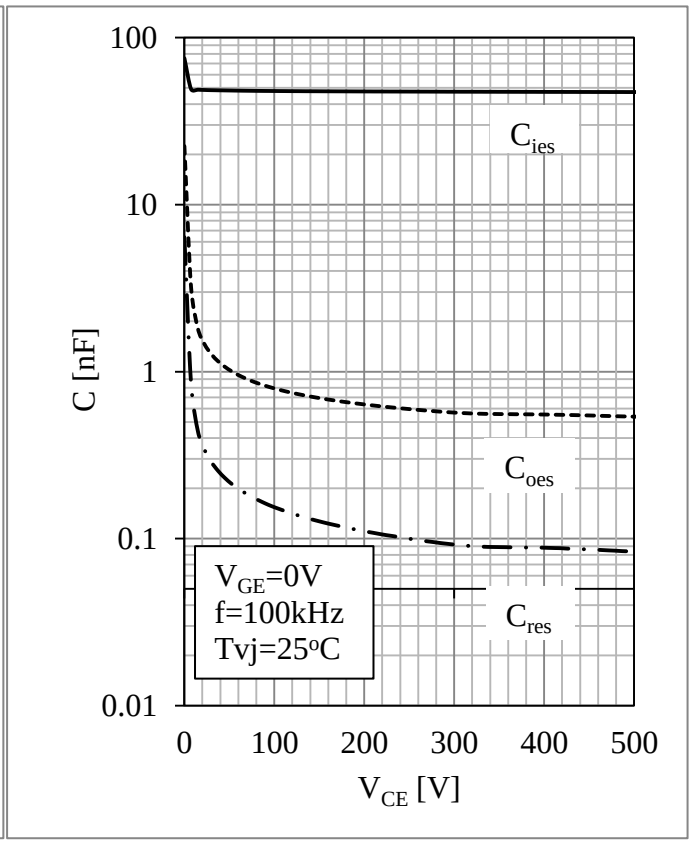


Fig 12. IGBT Capacity Characteristic

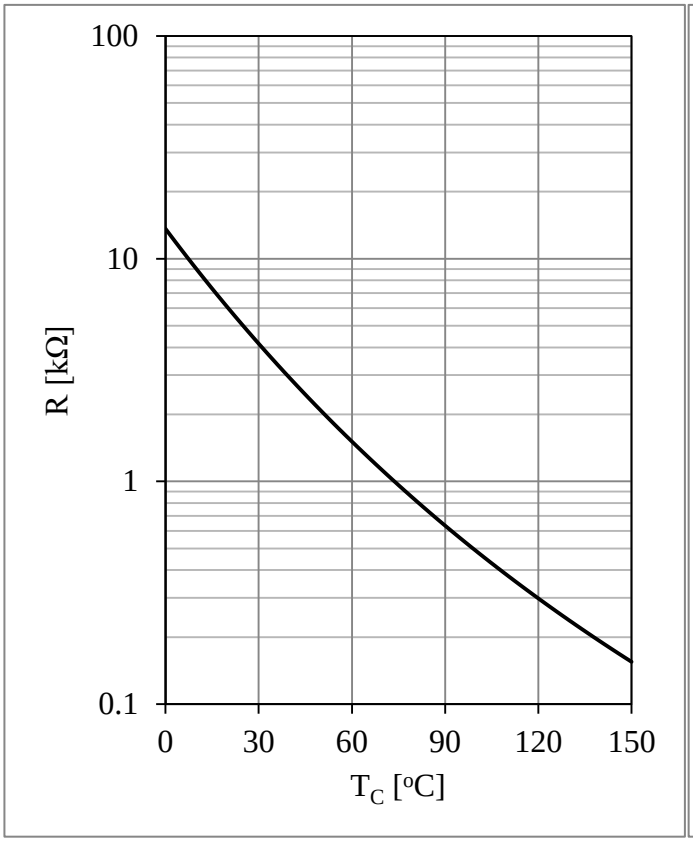


Fig 13.NTC Temperature Characteristic

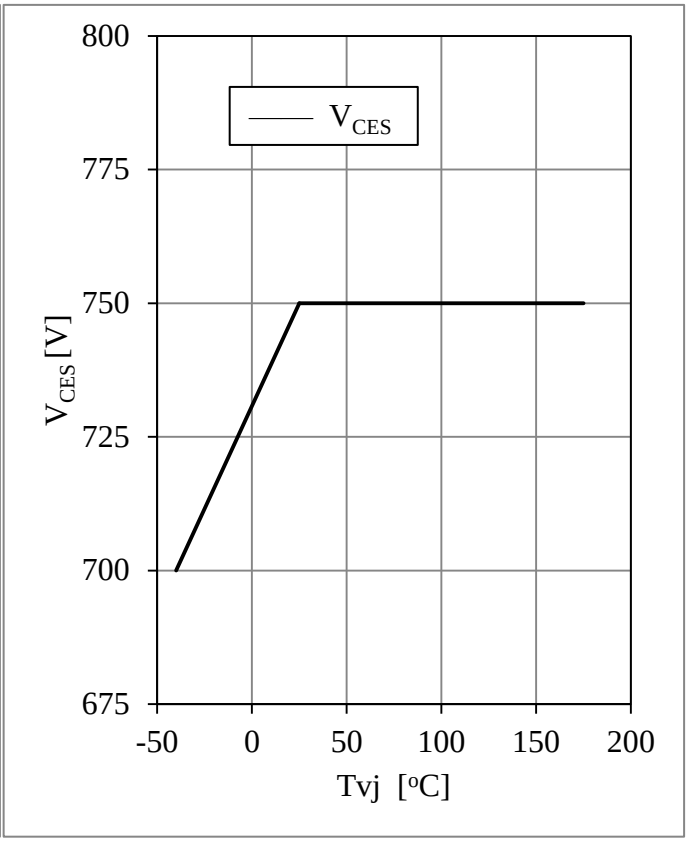
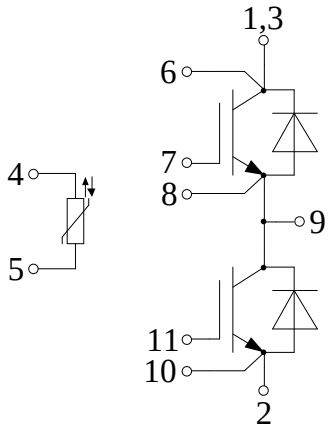


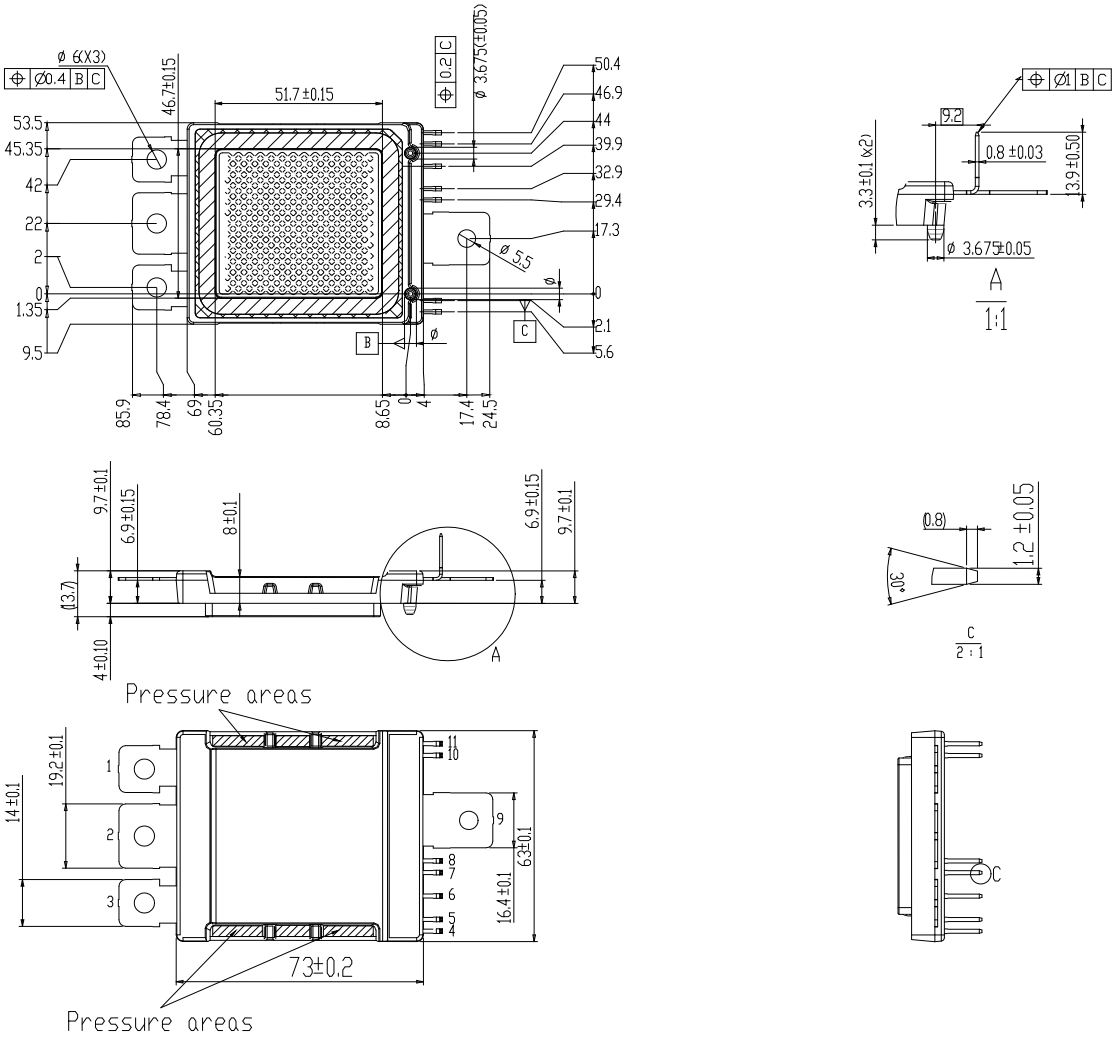
Fig 14. Maximum Allowed Collector-Emitter Voltage

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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