STARPOWER

SEMICONDUCTOR **IGBT**

GD820HTA75P6HFL_M

750V/820A 6 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.

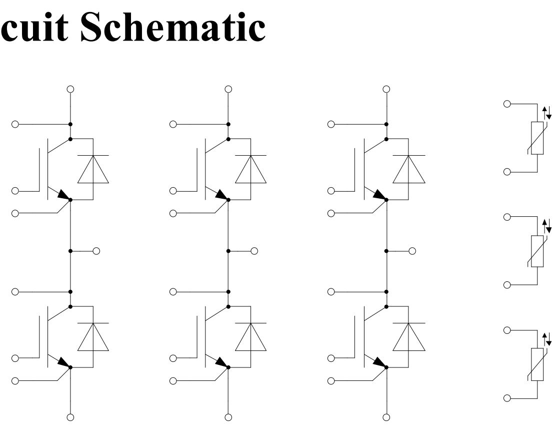
Features

- 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 DBC 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	820	A
I_C	Collector Current @ T_F=90°C	450	A
I_{CM}	Pulsed Collector Current t_p=1ms	1640	A
P_D	Maximum Power Dissipation @ T_F=75°C T_{vj}=175°C	751	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_{FN}	Implemented Collector Current	820	A
I_F	Diode Continuous Forward Current	450	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	1640	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°C
T_{vjop}	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	9.0 9.0	mm
d_{Clear}	Terminal to Heatsink Terminal to Terminal	4.5 4.5	mm

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=450A,V_{GE}=15V, T_{vj}=25°C		1.10	1.35	V
		I_C=450A,V_{GE}=15V, T_{vj}=150°C		1.10		
		I_C=450A,V_{GE}=15V, T_{vj}=175°C		1.15		
		I_C=820A,V_{GE}=15V, T_{vj}=25°C		1.30		
		I_C=820A,V_{GE}=15V, T_{vj}=175°C		1.50		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=9.60mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.5	6.4	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			1.6		Ω
C_{ies}	Input Capacitance	V_{CE}=50V,f=100kHz, V_{GE}=0V		69.3		nF
C_{oes}	Output Capacitance			1.58		nF
C_{res}	Reverse Transfer Capacitance			0.33		nF
Q_G	Gate Charge	V_{CE} =400V,I_C =450A, V_{GE}=-8…+15V		3.56		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.4Ω, L_S=24nH, V_{GE}=-8V/+15V, T_{vj}=25°C		395		ns
t_r	Rise Time			67		ns
$t_{d(off)}$	Turn-Off Delay Time			705		ns
t_f	Fall Time			64		ns
E_{on}	Turn-On Switching Loss			11.8		mJ
E_{off}	Turn-Off Switching Loss			19.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.4Ω, L_S=24nH, V_{GE}=-8V/+15V, T_{vj}=150°C		406		ns
t_r	Rise Time			86		ns
$t_{d(off)}$	Turn-Off Delay Time			819		ns
t_f	Fall Time			129		ns
E_{on}	Turn-On Switching Loss			22.9		mJ
E_{off}	Turn-Off Switching Loss			27.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.4Ω, L_S=24nH, V_{GE}=-8V/+15V, T_{vj}=175°C		413		ns
t_r	Rise Time			90		ns
$t_{d(off)}$	Turn-Off Delay Time			850		ns
t_f	Fall Time			144		ns
E_{on}	Turn-On Switching Loss			25.7		mJ
E_{off}	Turn-Off Switching Loss			28.2		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V,		4000		A

		T_{vj}=25°C,V_{CC}=400V, V_{CEM}≤750V				
		t_P≤3μs,V_{GE}=15V, T_{vj}=175°C,V_{CC}=400V, V_{CEM}≤750V		3000		

Diode Characteristics T_F=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_{vj}=25°C		1.35	1.60	V
		I_F=450A,V_{GE}=0V,T_{vj}=150°C		1.30		
		I_F=450A,V_{GE}=0V,T_{vj}=175°C		1.25		
		I_F=820A,V_{GE}=0V,T_{vj}=25°C		1.55		
		I_F=820A,V_{GE}=0V,T_{vj}=175°C		1.55		
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=7200A/μs,V_{GE}=-8V, L_S=24nH,T_{vj}=25°C		9.67		μC
I_{RM}	Peak Reverse Recovery Current			225		A
E_{rec}	Reverse Recovery Energy			3.71		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=5450A/μs,V_{GE}=-8V, L_S=24nH,T_{vj}=150°C		24.7		μC
I_{RM}	Peak Reverse Recovery Current			265		A
E_{rec}	Reverse Recovery Energy			8.17		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=5050A/μs,V_{GE}=-8V, L_S=24nH,T_{vj}=175°C		28.6		μC
I_{RM}	Peak Reverse Recovery Current			274		A
E_{rec}	Reverse Recovery Energy			8.86		mJ

NTC Characteristics T_F=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_F=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		8		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.75		mΩ
$\triangle p$	$\triangle V/\triangle t=10.0dm^3/min, T_F=75^{\circ}C$		64		mbar
p	Maximum Pressure In Cooling Circuit $T_{baseplate}<40^{\circ}C$ $T_{baseplate}>40^{\circ}C$ (relative pressure)			 2.5 2.0	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) $\triangle V/\triangle t=10.0dm^3/min, T_F=75^{\circ}C$		0.116 0.160	0.133 0.184	K/W
M	Terminal Connection Torque, Screw M5 Mounting Torque, Screw M4	3.6 1.8		4.4 2.2	N.m
G	Weight of Module		750		g

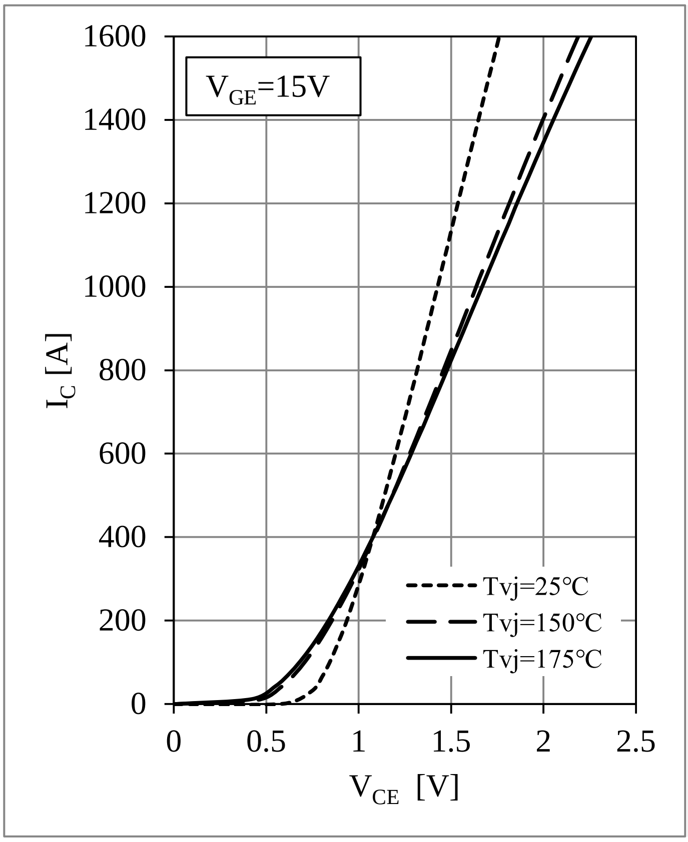


Fig 1. IGBT Output Characteristics

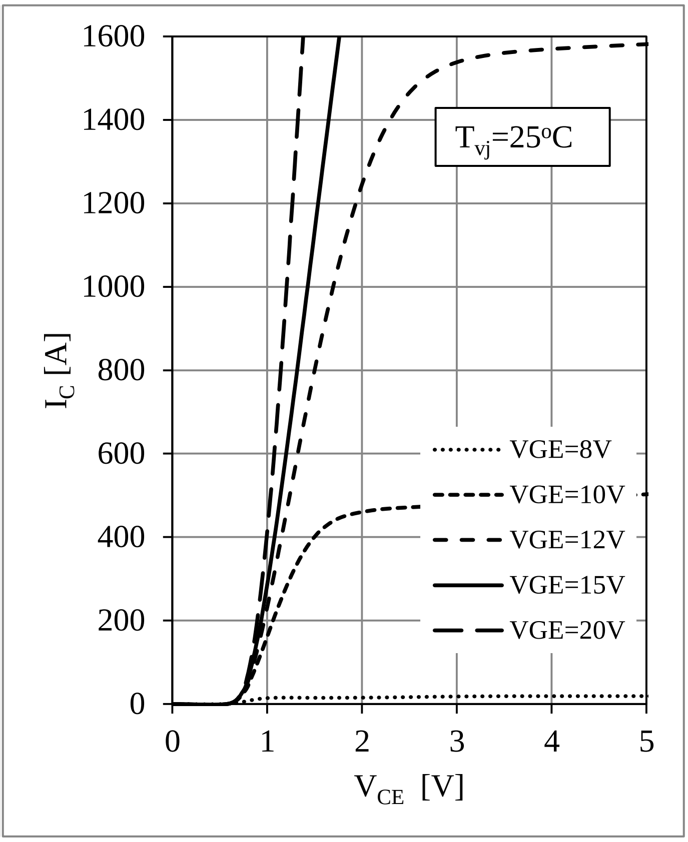


Fig 2. IGBT Output Characteristics

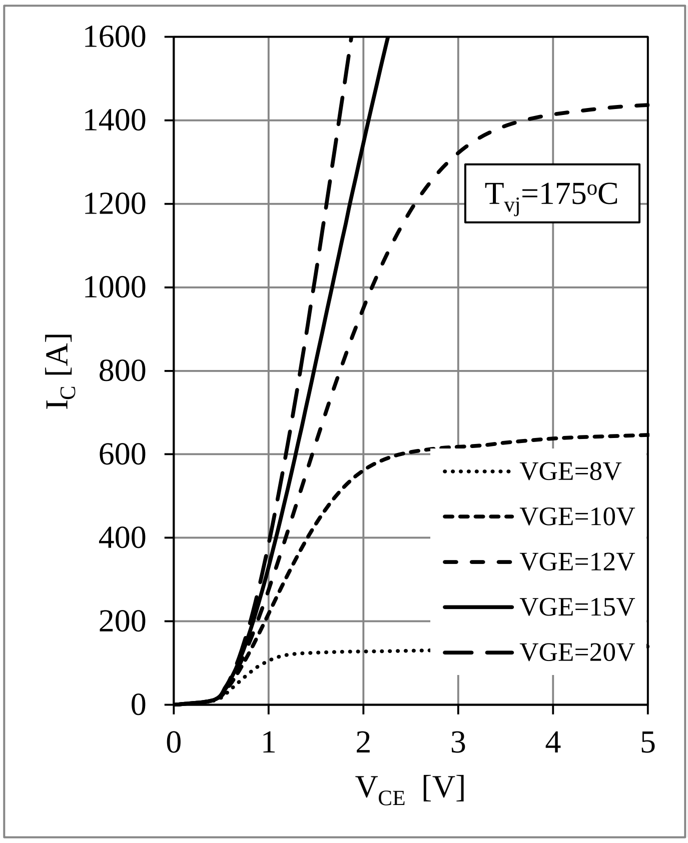


Fig 3. IGBT Output Characteristics

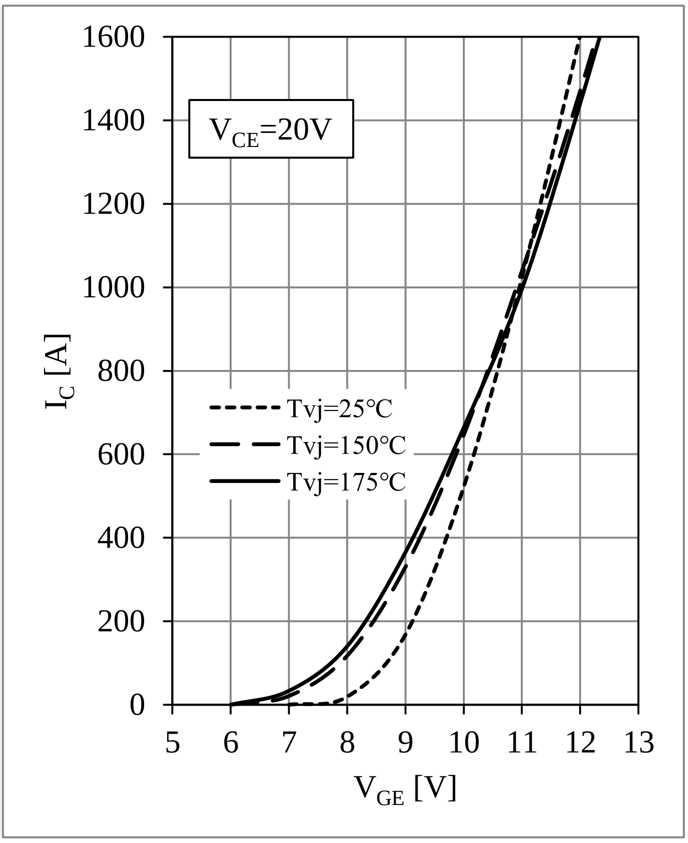


Fig 4. IGBT Transfer Characteristics

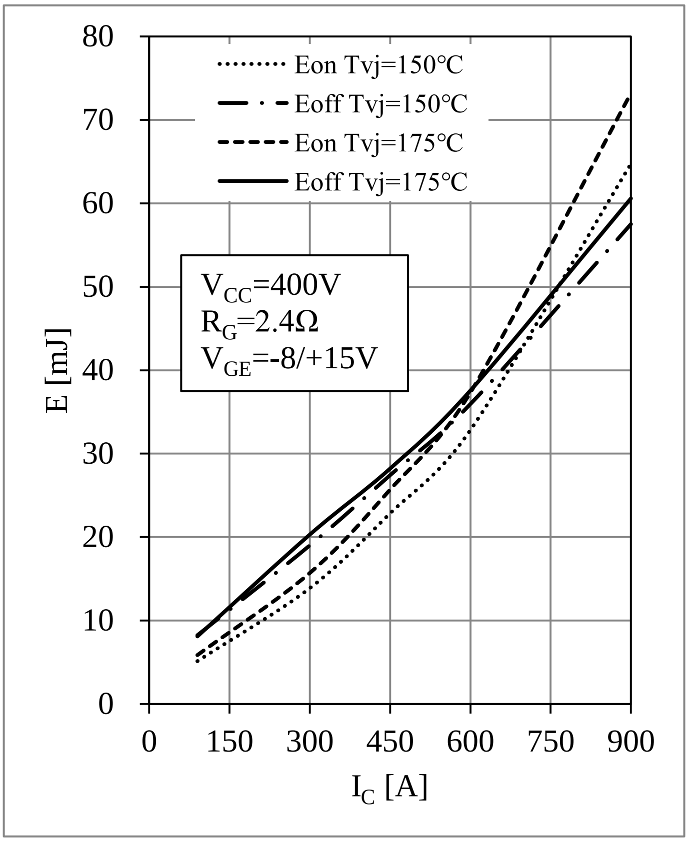


Fig 5. IGBT Switching Loss vs. I_C

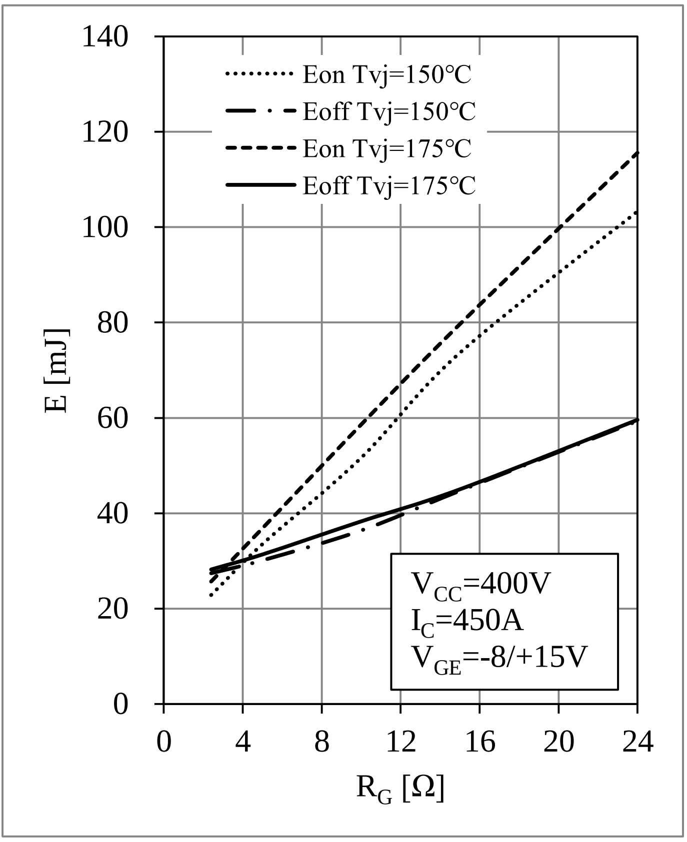


Fig 6. IGBT Switching Loss vs. R_G

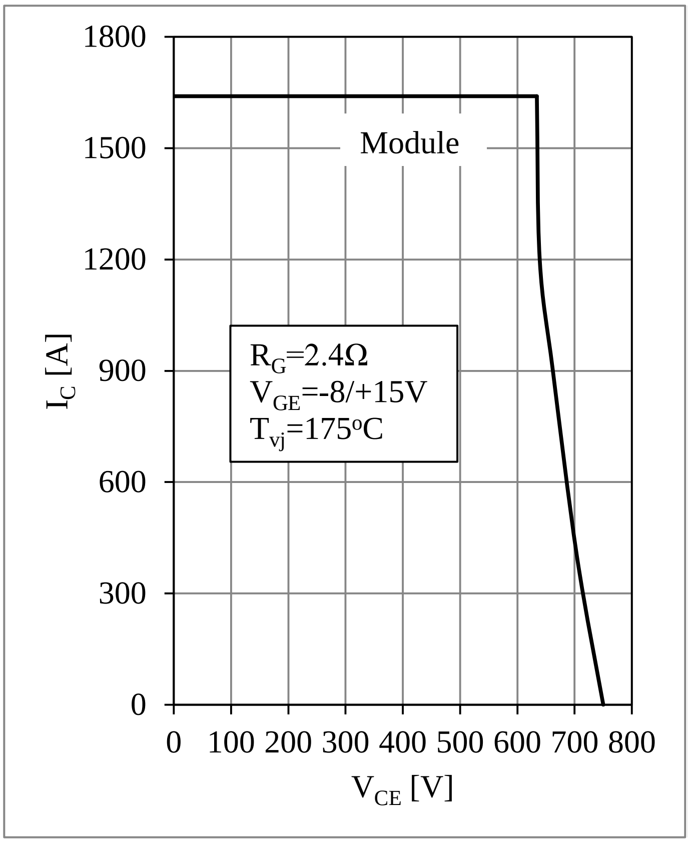
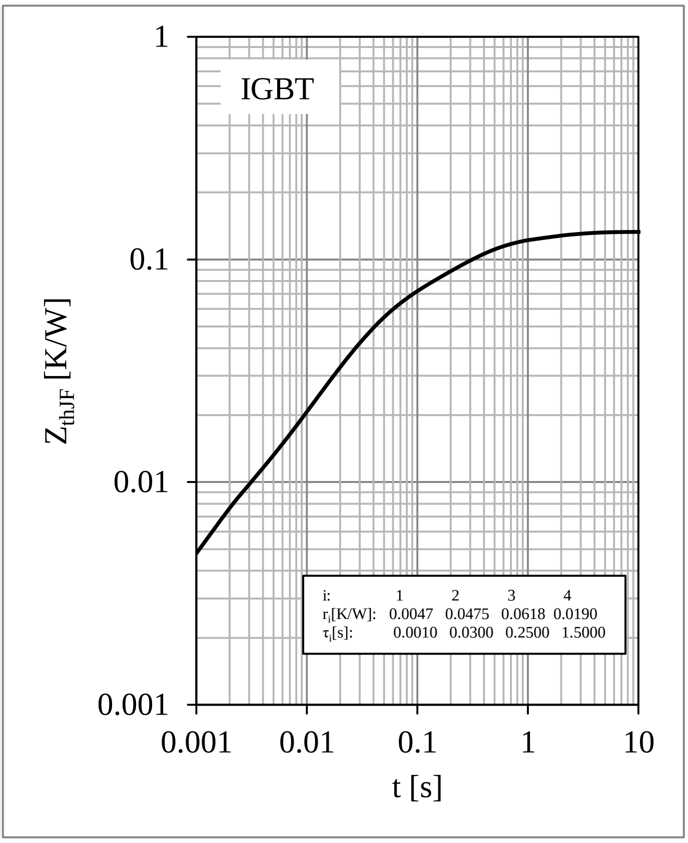


Fig 7. RBSOA



i:	1	2	3	4
r_i[K/W]:	0.0047	0.0475	0.0618	0.0190
τ_i[s]:	0.0010	0.0300	0.2500	1.5000

Fig 8. IGBT Transient Thermal Impedance

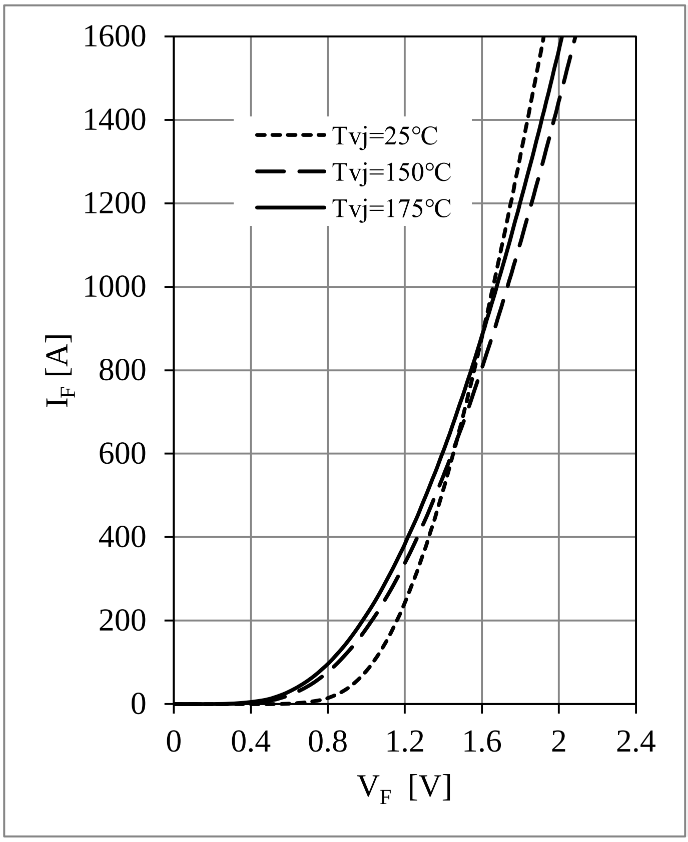


Fig 9. Diode Forward Characteristics

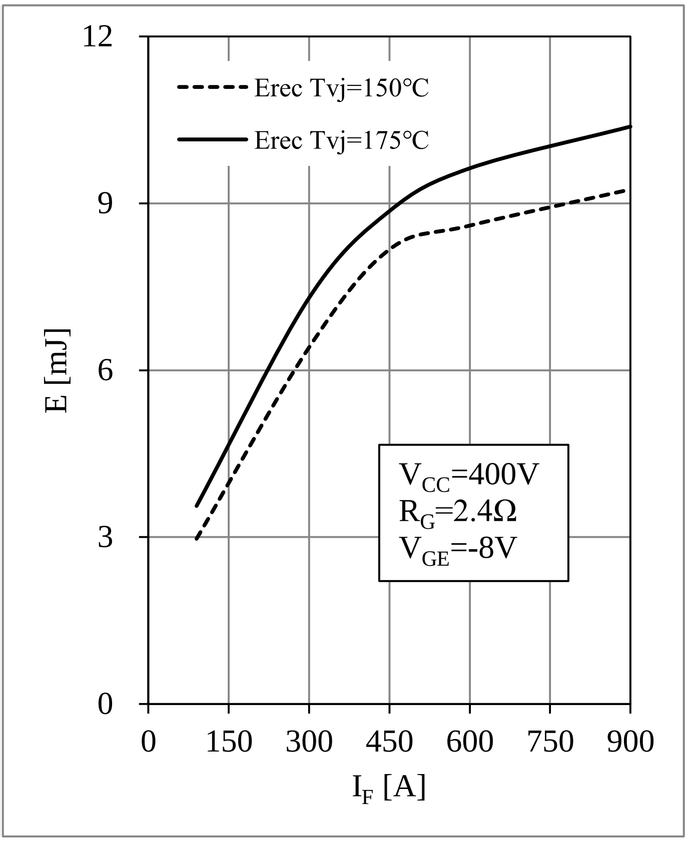


Fig 10. Diode Switching Loss vs. I_F

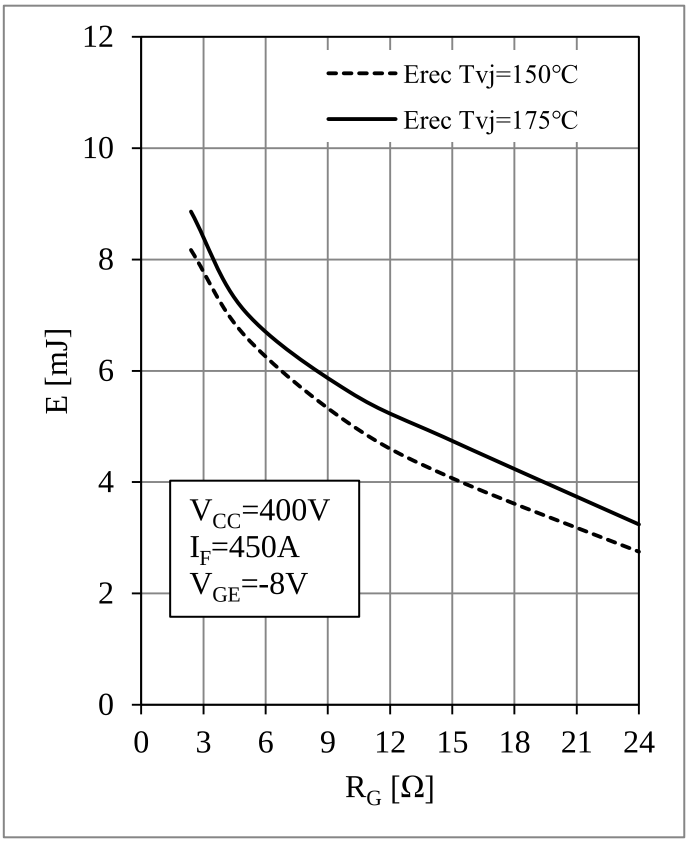
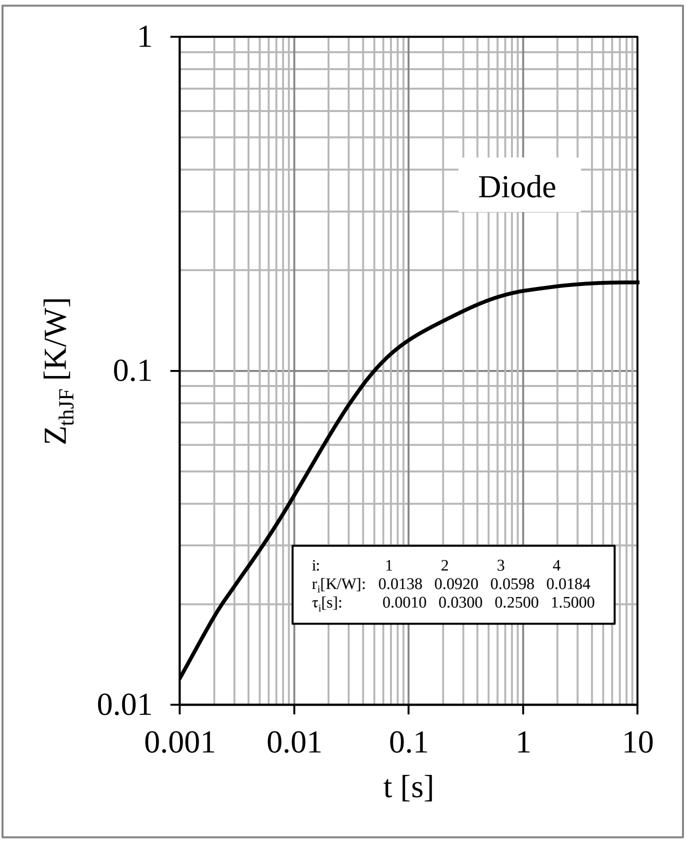


Fig 11. Diode Switching Loss vs. R_G



i:	1	2	3	4
r_i[K/W]:	0.0138	0.0920	0.0598	0.0184
τ_i[s]:	0.0010	0.0300	0.2500	1.5000

Fig 12. Diode Transient Thermal Impedance

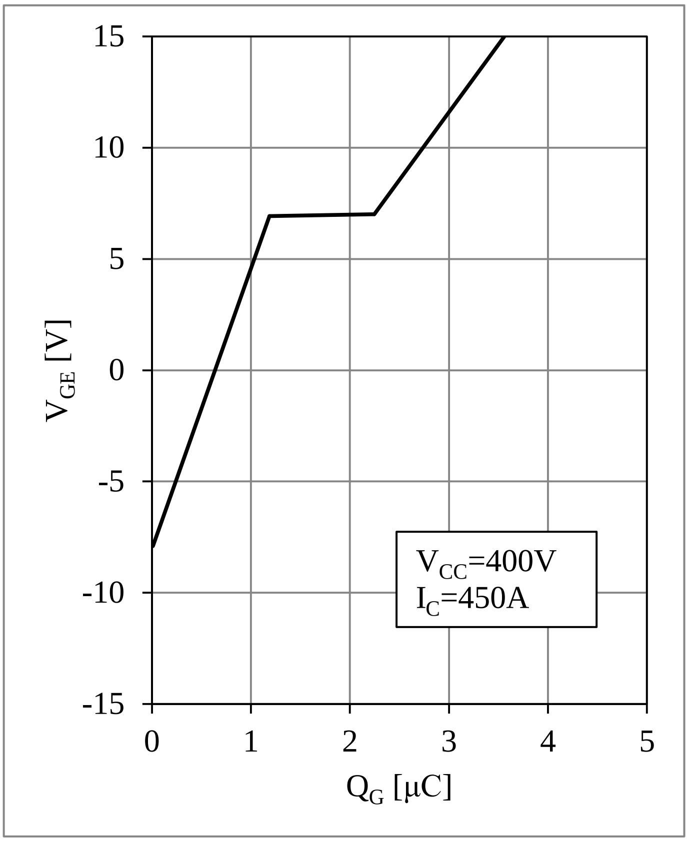


Fig 13. IGBT Gate Charge Characteristic

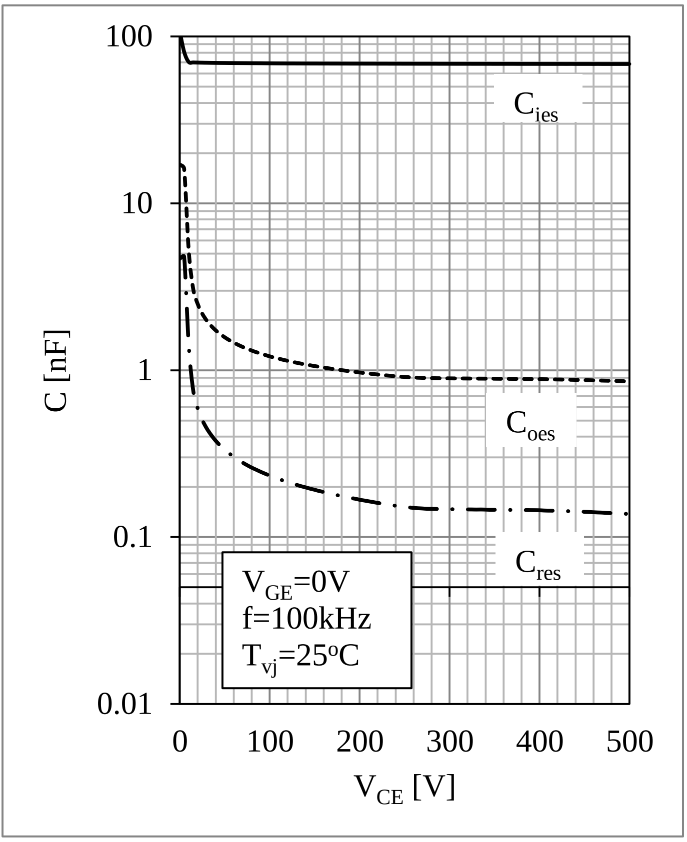


Fig 14. IGBT Capacity Charcteristic

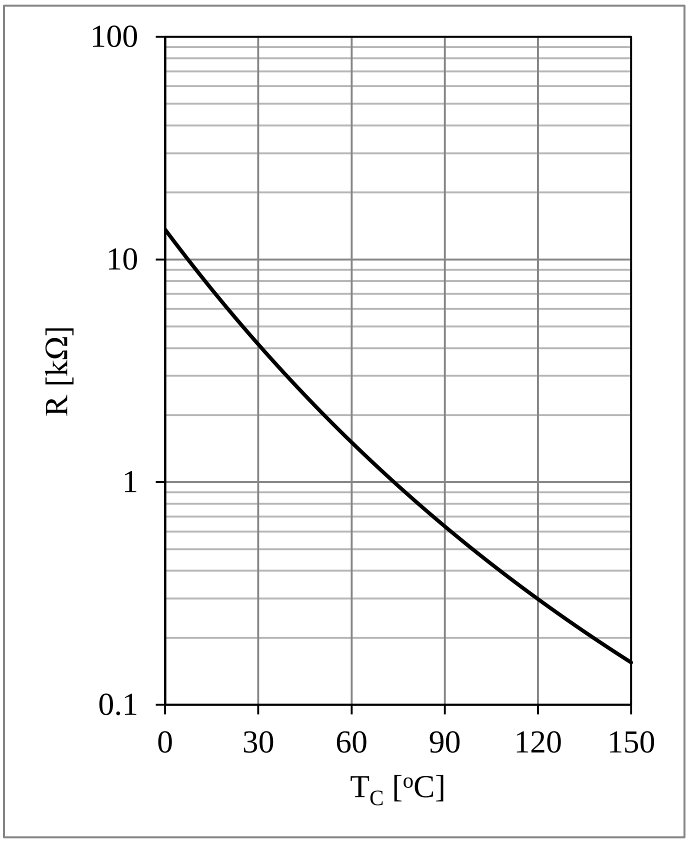


Fig 15. NTC Temperature Characteristic

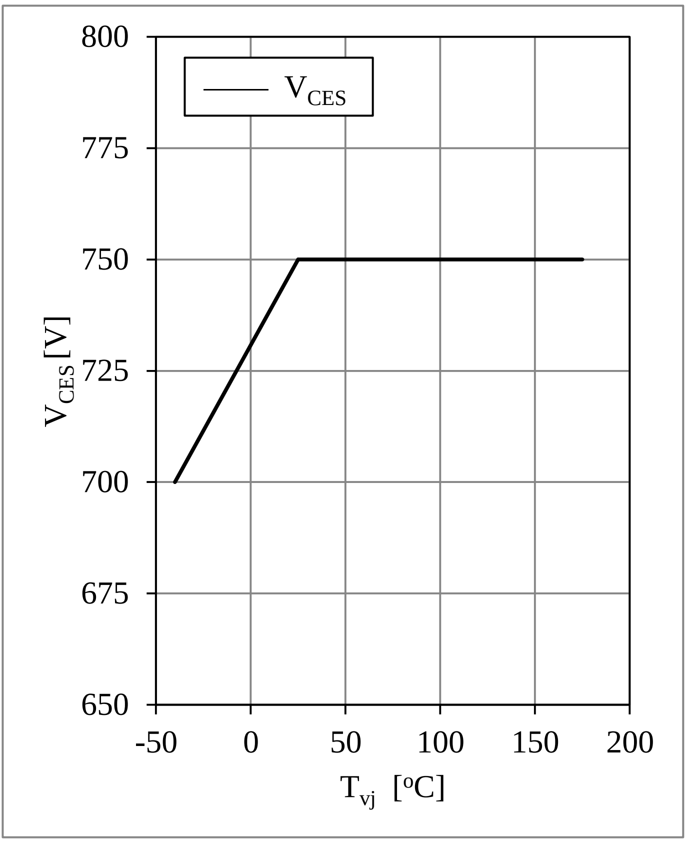
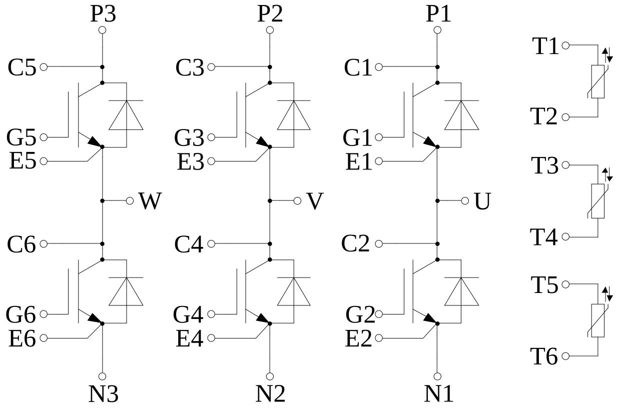


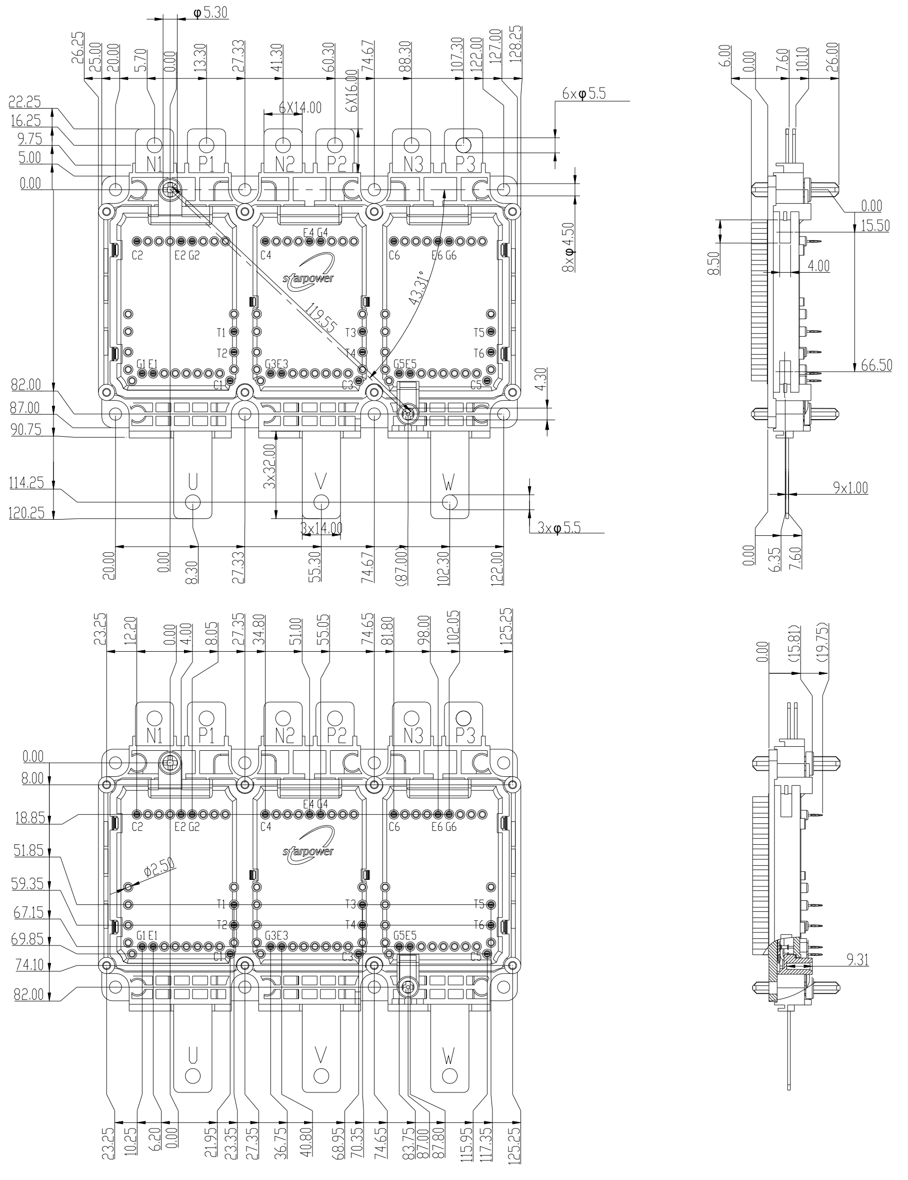
Fig 16. Maximum Allowed Collector-Emitter Voltage

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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