STARPOWER

SEMICONDUCTOR **IGBT**

GD660HTA75P7H_T

750V/660A 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.

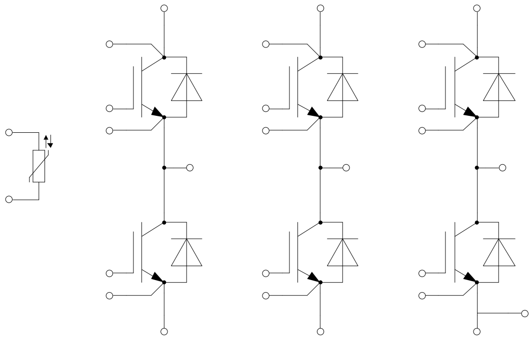
Features

- 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 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	660	A
I_C	Collector Current @ T_F=110°C	300	A
I_{CM}	Pulsed Collector Current t_p=1ms	1320	A
P_D	Maximum Power Dissipation @ T_F=75°C T_j=175°C	714	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	300	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 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=300A,V_{GE}=15V, T_j=25°C		1.10	1.35	V
		I_C=300A,V_{GE}=15V, T_j=150°C		1.15		
		I_C=300A,V_{GE}=15V, T_j=175°C		1.15		
		I_C=660A,V_{GE}=15V, T_j=25°C		1.45		
		I_C=660A,V_{GE}=15V, T_j=175°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=8.60mA,V_{CE}=V_{GE}, T_j=25°C	5.5	6.5	7.0	V
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			1.0		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}=-15…+15V		3.18		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.0Ω,Ls=40nH, V_{GE}=±15V, T_j=25°C		350		ns
t_r	Rise Time			71		ns
$t_{d(off)}$	Turn-Off Delay Time			413		ns
t_f	Fall Time			82		ns
E_{on}	Turn-On Switching Loss			16.3		mJ
E_{off}	Turn-Off Switching Loss			18.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.0Ω,Ls=40nH, V_{GE}=±15V, T_j=150°C		393		ns
t_r	Rise Time			81		ns
$t_{d(off)}$	Turn-Off Delay Time			482		ns
t_f	Fall Time			131		ns
E_{on}	Turn-On Switching Loss			26.8		mJ
E_{off}	Turn-Off Switching Loss			23.3		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.0Ω,Ls=40nH, V_{GE}=±15V, T_j=175°C		400		ns
t_r	Rise Time			85		ns
$t_{d(off)}$	Turn-Off Delay Time			494		ns
t_f	Fall Time			144		ns
E_{on}	Turn-On Switching Loss			28.5		mJ
E_{off}	Turn-Off Switching Loss			24.0		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_j=150°C,V_{CC}=450V, V_{CEM}≤750V		2000		A

Diode Characteristics T_F=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_j=25°C		1.35	1.60	V
		I_F=300A,V_{GE}=0V,T_j=150°C		1.30		
		I_F=300A,V_{GE}=0V,T_j=175°C		1.25		
		I_F=660A,V_{GE}=0V,T_j=25°C		1.70		
		I_F=660A,V_{GE}=0V,T_j=175°C		1.70		
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=6090A/μs,V_{GE}=-15V, Ls=40nH,T_j=25°C		22.9		μC
I_{RM}	Peak Reverse Recovery Current			275		A
E_{rec}	Reverse Recovery Energy			5.84		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=5120A/μs,V_{GE}=-15V, Ls=40nH,T_j=150°C		40.5		μC
I_{RM}	Peak Reverse Recovery Current			314		A
E_{rec}	Reverse Recovery Energy			11.0		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=4870A/μs,V_{GE}=-15V, Ls=40nH,T_j=175°C		48.5		μC
I_{RM}	Peak Reverse Recovery Current			335		A
E_{rec}	Reverse Recovery Energy			11.7		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
Δp	Pressure Drop Cooling Circuit ΔV/Δt=10.0dm³/min;T_F=25°C;Cooling Fluid=50% Water/50% Ethylene Glycol		50		mbar
p	Maximum Pressure In Cooling Circuit			2.0	bar
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) △V/△t=10.0dm³/min,T_F=75°C		0.122 0.184	0.140 0.212	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		685		g

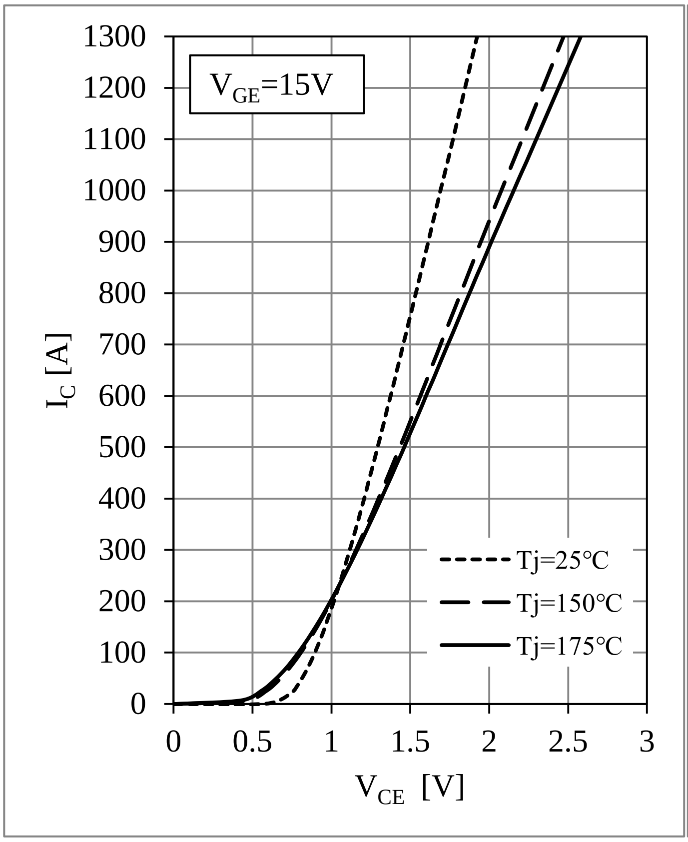


Fig 1. IGBT Output Characteristics

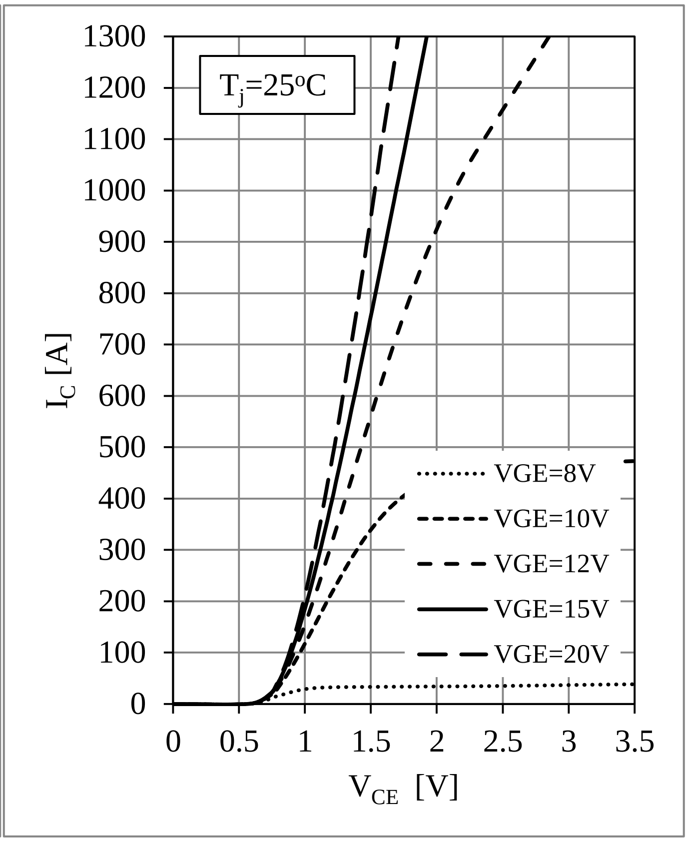


Fig 2. IGBT Output Characteristics

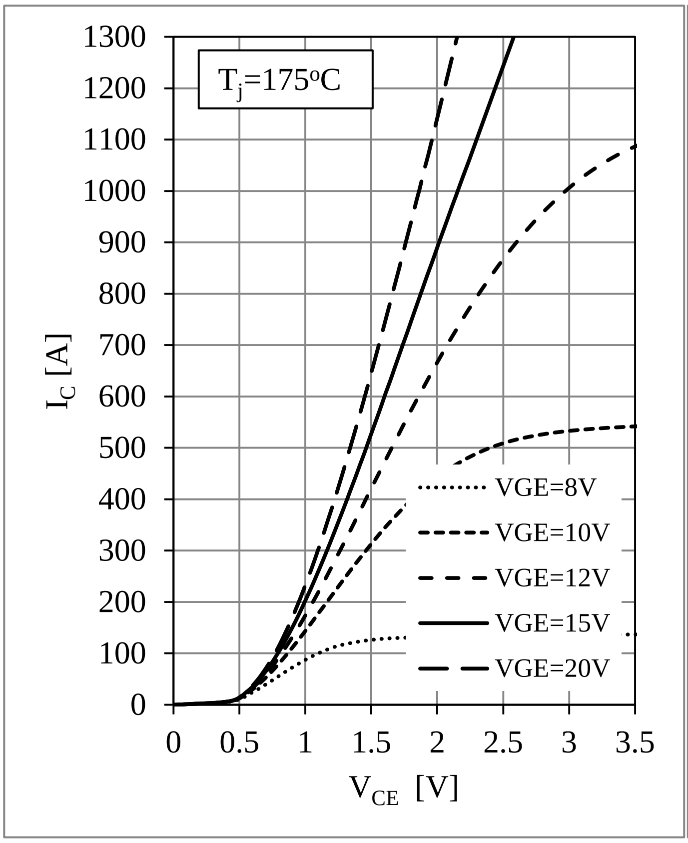


Fig 3. IGBT Output Characteristics

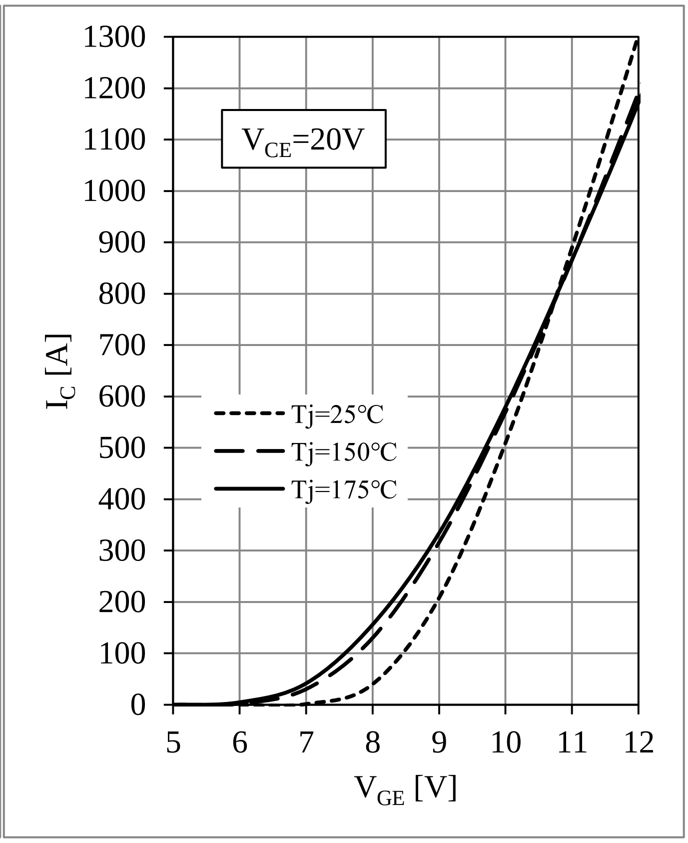


Fig 4. IGBT Transfer Characteristics

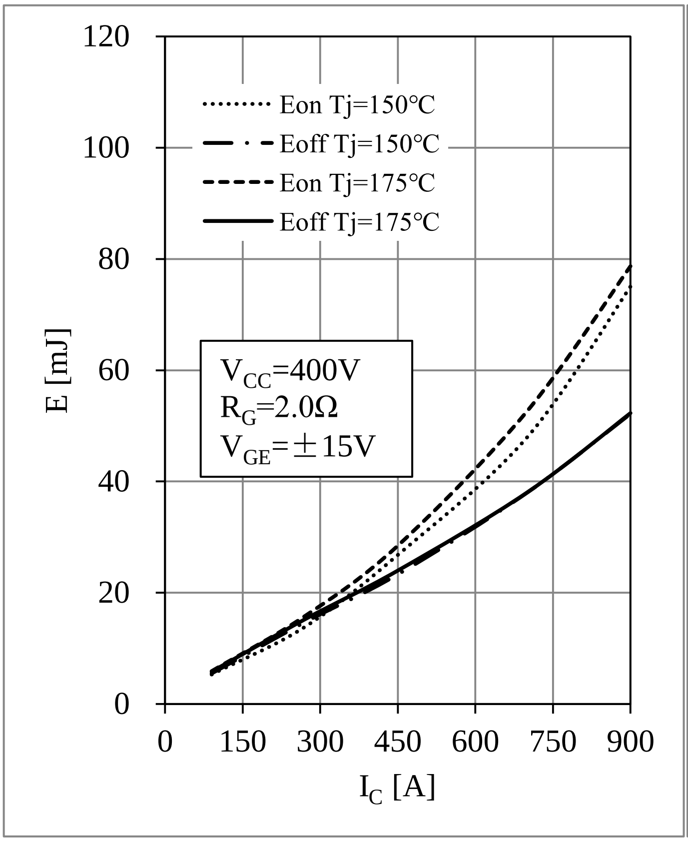


Fig 5. IGBT Switching Loss vs. I_C

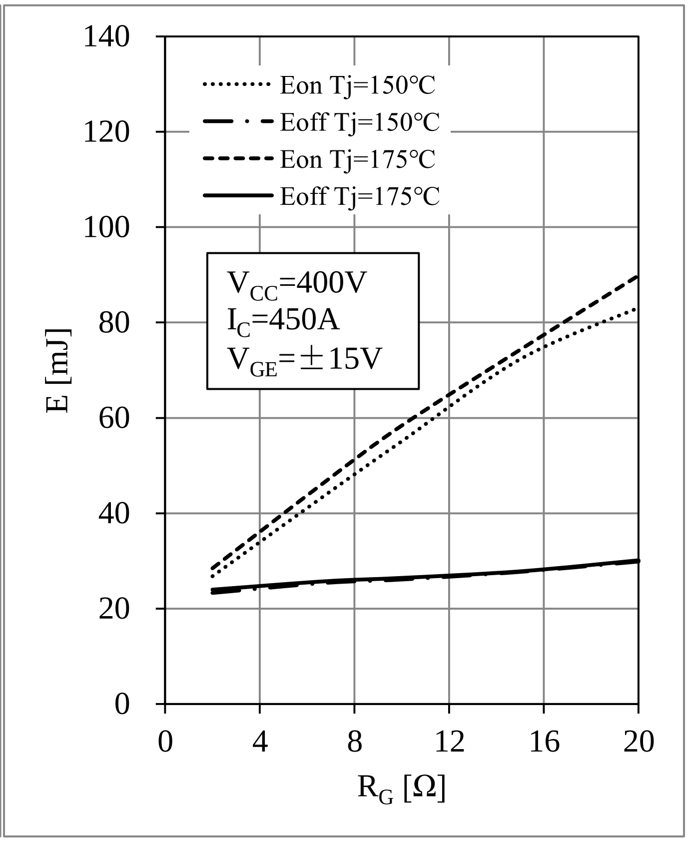


Fig 6. IGBT Switching Loss vs. R_G

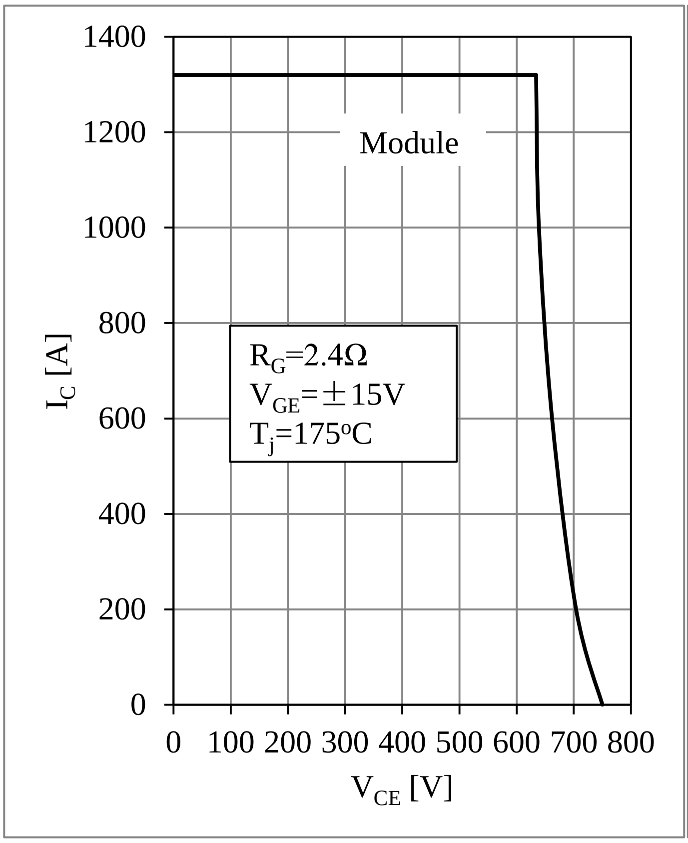


Fig 7. RBSOA

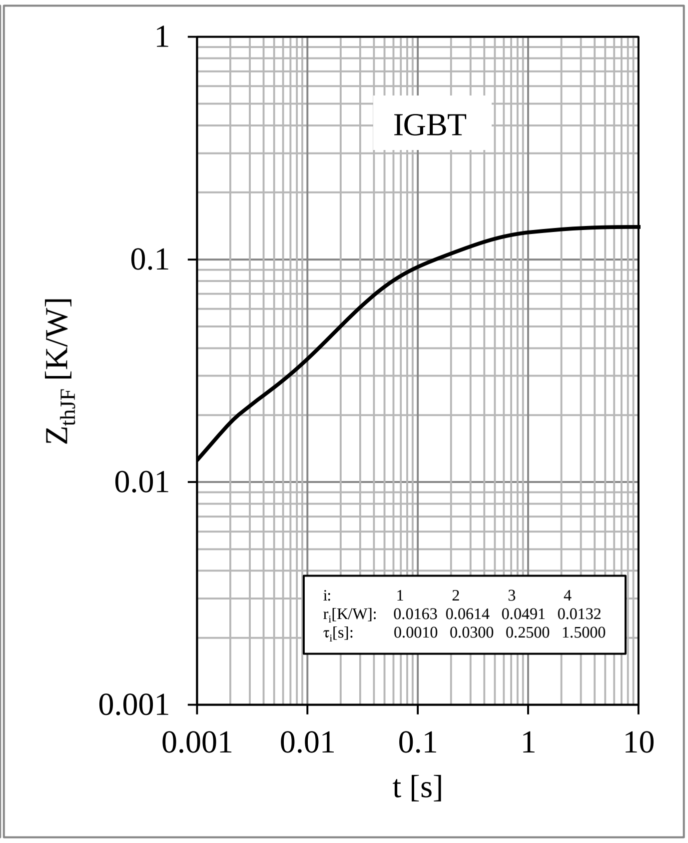


Fig 8. IGBT Transient Thermal Impedance

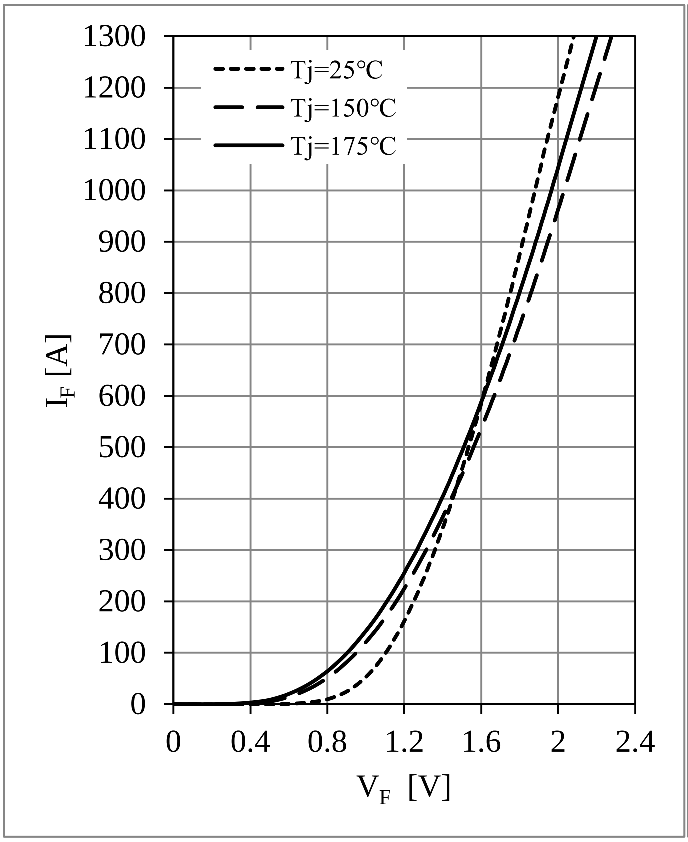


Fig 9. Diode Forward Characteristics

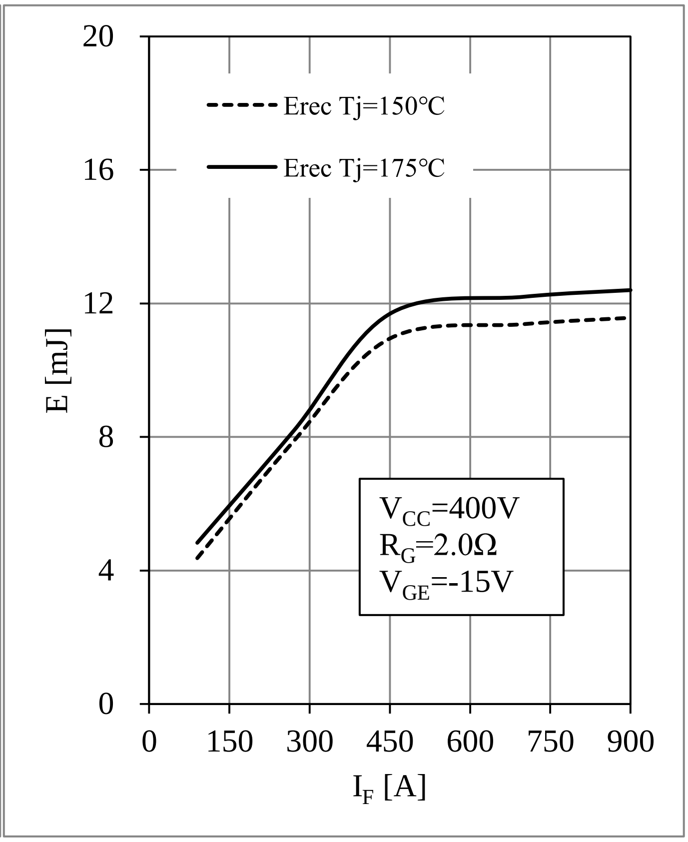


Fig 10. Diode Switching Loss vs. I_F

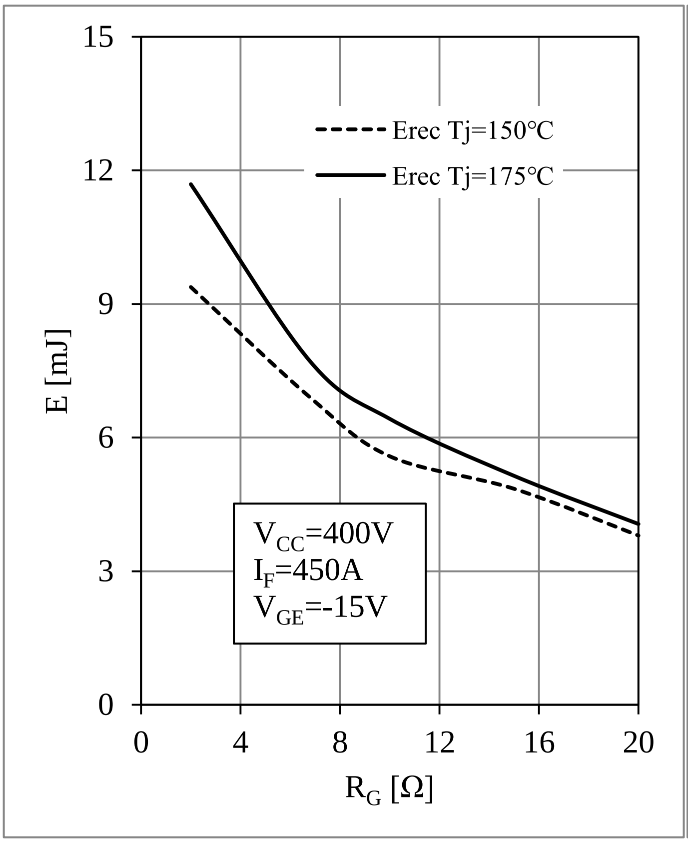


Fig 11. Diode Switching Loss vs. R_G

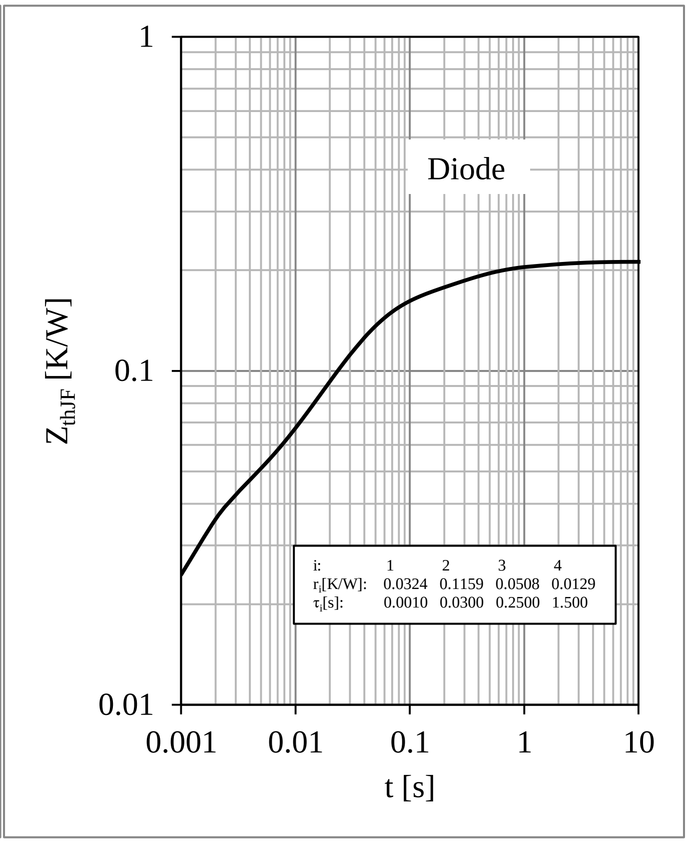


Fig 12. Diode Transient Thermal Impedance

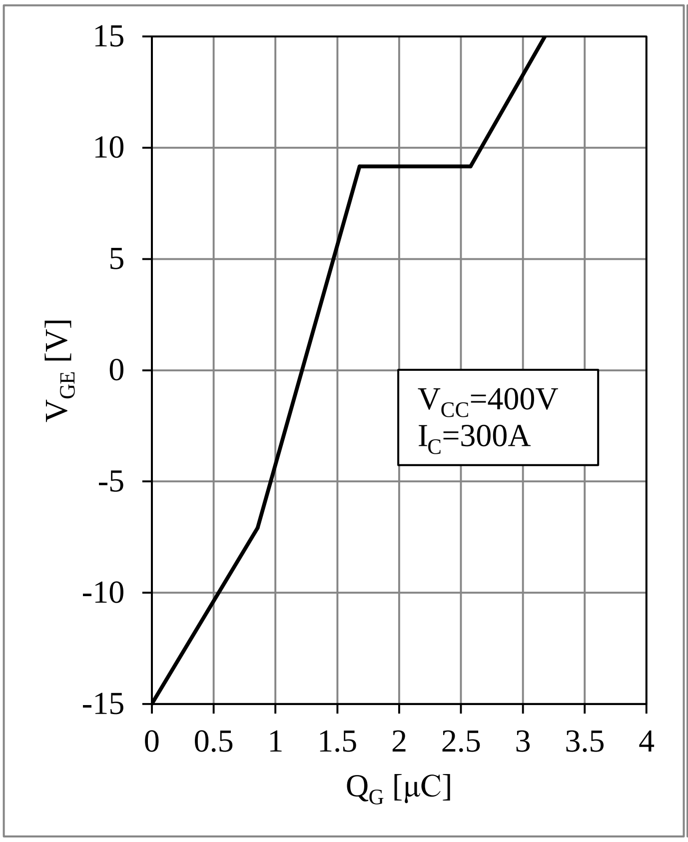


Fig 13. IGBT Gate Charge Characteristic

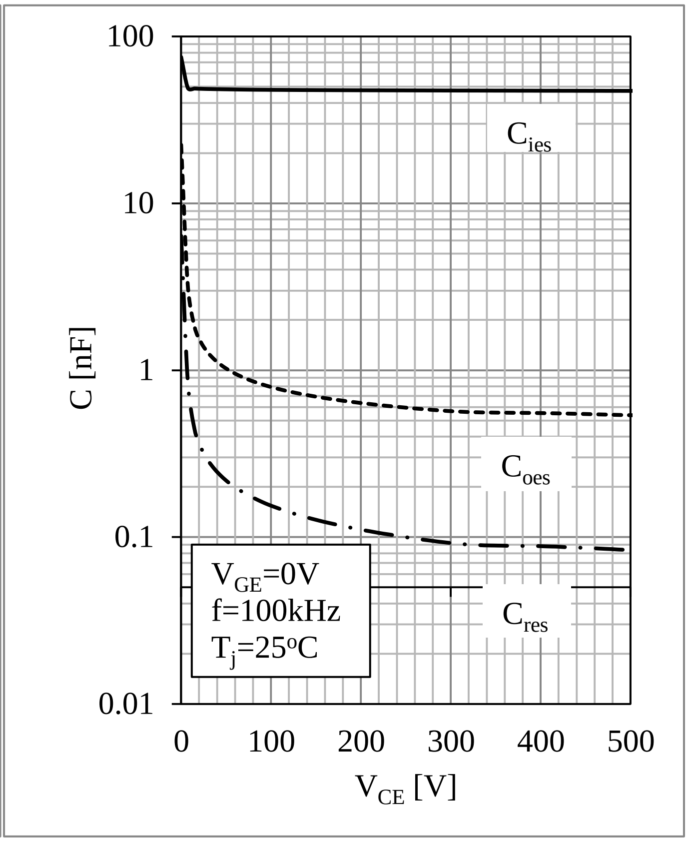


Fig 14. IGBT Capacity Charcteristic

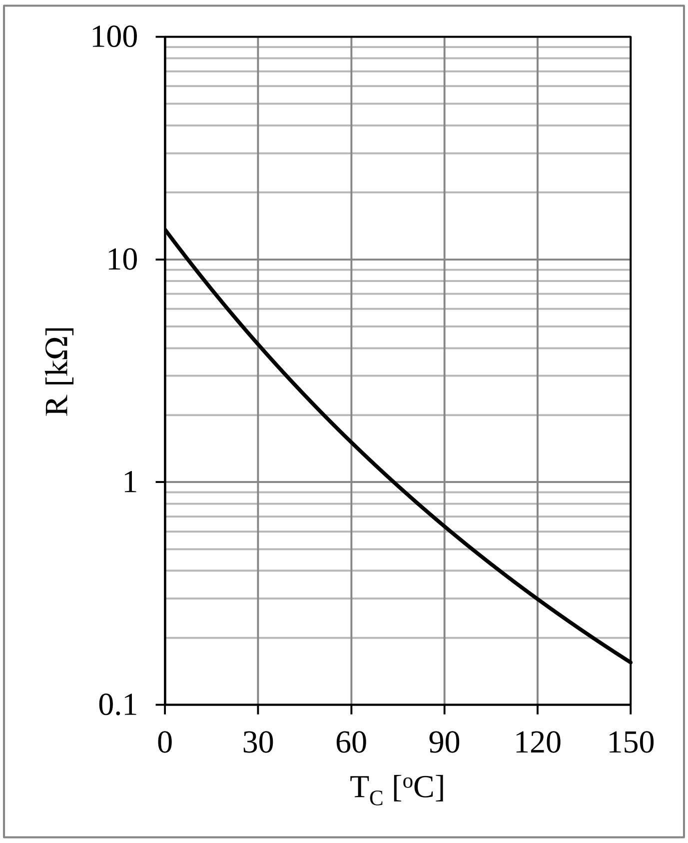
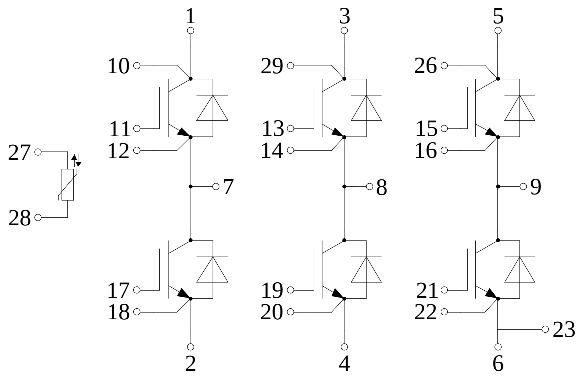


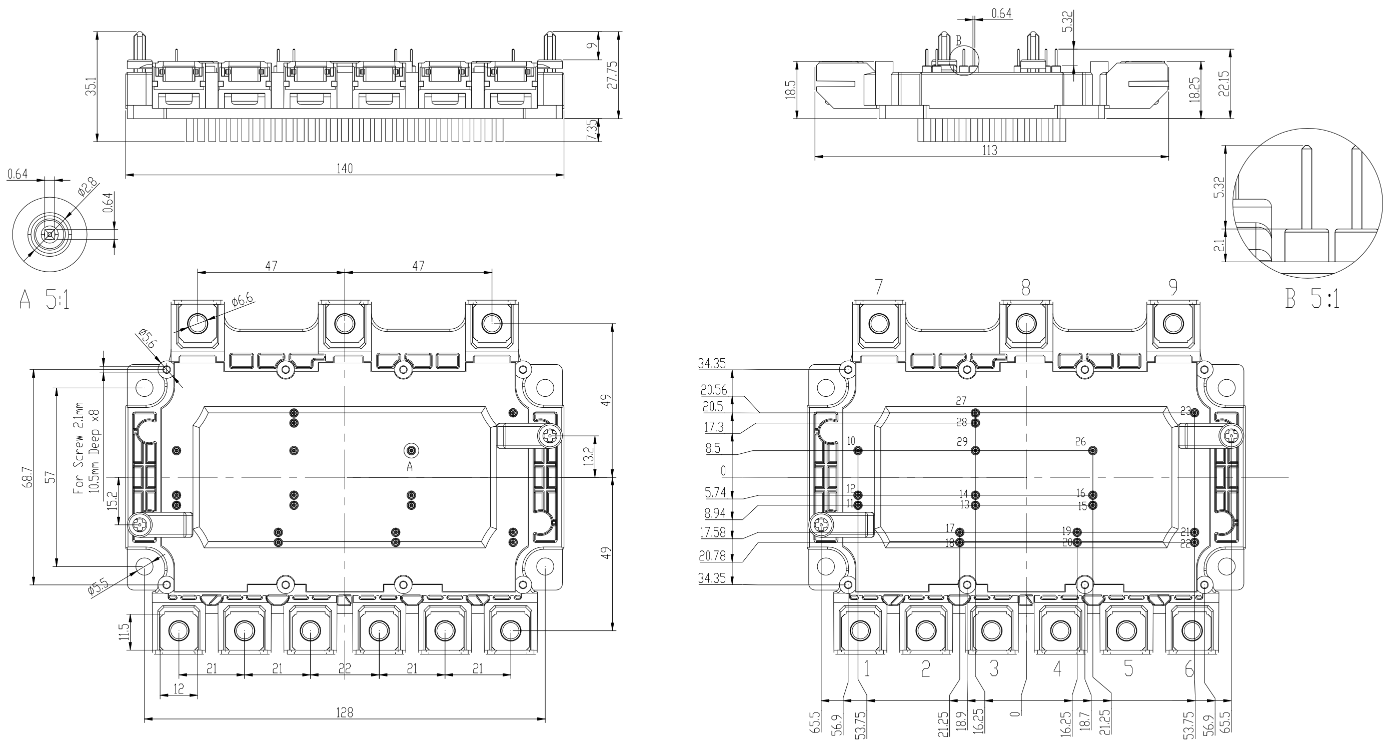
Fig 15. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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