STARPOWER

SEMICONDUCTOR **IGBT**

GD650HTA75P8HFT

750V/650A 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.

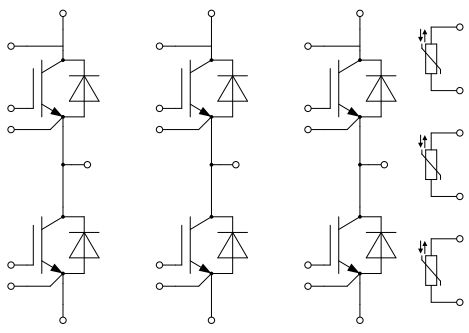
Features

- 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
- PressFIT contact 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	650	A
I_C	Collector Current @ T_F=80°C	420	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjmax}	1300	A
P_D	Maximum Power Dissipation @ T_F=80°C T_{vj}=175°C	742	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_{FN}	Implemented Collector Current	650	A
I_F	Diode Continuous Forward Current	420	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjmax}	1300	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	°C
T_{vjop}	Operating Junction Temperature continuous	-40 to +175	°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=420A,V_{GE}=15V, T_{vj}=25°C		1.20	1.65	V
		I_C=420A,V_{GE}=15V, T_{vj}=150°C		1.25		
		I_C=420A,V_{GE}=15V, T_{vj}=175°C		1.30		
		I_C=650A,V_{GE}=15V, T_{vj}=25°C		1.40		
		I_C=650A,V_{GE}=15V, T_{vj}=175°C		1.60		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=8.60mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.7	6.5	7.4	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			1.7		Ω
C_{ies}	Input Capacitance	V_{CE}=50V,f=100kHz, V_{GE}=0V		28.7		nF
C_{oes}	Output Capacitance			1.00		nF
C_{res}	Reverse Transfer Capacitance			0.12		nF
Q_G	Gate Charge	V_{CE} =400V,I_C =540A, V_{GE}=-15…+15V		1.63		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=450V,I_C=420A, R_{Gon}=3.6Ω,R_{Goff}=7.5Ω, L_S=20nH, V_{GE}=-8/+15V, T_{vj}=25°C		199		ns
t_r	Rise Time			57		ns
$t_{d(off)}$	Turn-Off Delay Time			673		ns
t_f	Fall Time			116		ns
E_{on}	Turn-On Switching Loss			11.3		mJ
E_{off}	Turn-Off Switching Loss			21.0		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=450V,I_C=420A, R_{Gon}=3.6Ω,R_{Goff}=7.5Ω, L_S=20nH, V_{GE}=-8/+15V, T_{vj}=150°C		208		ns
t_r	Rise Time			65		ns
$t_{d(off)}$	Turn-Off Delay Time			737		ns
t_f	Fall Time			216		ns
E_{on}	Turn-On Switching Loss			17.1		mJ
E_{off}	Turn-Off Switching Loss			31.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=450V,I_C=420A, R_{Gon}=3.6Ω,R_{Goff}=7.5Ω, L_S=20nH, V_{GE}=-8/+15V, T_{vj}=175°C		212		ns
t_r	Rise Time			67		ns
$t_{d(off)}$	Turn-Off Delay Time			758		ns
t_f	Fall Time			236		ns
E_{on}	Turn-On Switching Loss			19.0		mJ
E_{off}	Turn-Off Switching Loss			33.1		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_{vj}=25°C,V_{CC}=450V, V_{CEM}≤750V		3400		A

		$t_P \leq 3\mu s, V_{GE}=15V,$ $T_{vj}=175^oC, V_{CC}=450V,$ $V_{CEM} \leq 750V$		2600		

Diode Characteristics $T_F=25^oC$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=420A, V_{GE}=0V, T_{vj}=25^oC$		1.55	2.00	V
		$I_F=420A, V_{GE}=0V, T_{vj}=150^oC$		1.55		
		$I_F=420A, V_{GE}=0V, T_{vj}=175^oC$		1.50		
		$I_F=650A, V_{GE}=0V, T_{vj}=25^oC$		1.75		
		$I_F=650A, V_{GE}=0V, T_{vj}=175^oC$		1.75		
Q_r	Recovered Charge	$V_R=450V, I_F=420A,$ $-di/dt=8203A/\mu s, L_S=20nH,$ $V_{GE}=-8V, T_{vj}=25^oC$		15.0		μC
I_{RM}	Peak Reverse Recovery Current			271		A
E_{rec}	Reverse Recovery Energy			3.33		mJ
Q_r	Recovered Charge	$V_R=450V, I_F=420A,$ $-di/dt=7182A/\mu s, L_S=20nH,$ $V_{GE}=-8V, T_{vj}=150^oC$		28.2		μC
I_{RM}	Peak Reverse Recovery Current			327		A
E_{rec}	Reverse Recovery Energy			6.92		mJ
Q_r	Recovered Charge	$V_R=450V, I_F=420A,$ $-di/dt=6918A/\mu s, L_S=20nH,$ $V_{GE}=-8V, T_{vj}=175^oC$		31.7		μC
I_{RM}	Peak Reverse Recovery Current			339		A
E_{rec}	Reverse Recovery Energy			7.78		mJ

NTC Characteristics $T_F=25^oC$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		kΩ
$\Delta R/R$	Deviation of R_{100}	$T_C=100^oC, R_{100}=493.3\Omega$	-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		13		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.83		mΩ
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode) △V/△t=10.0dm^3/min,T_F=75°C			0.128 0.114	K/W
G	Weight of Module		550		g

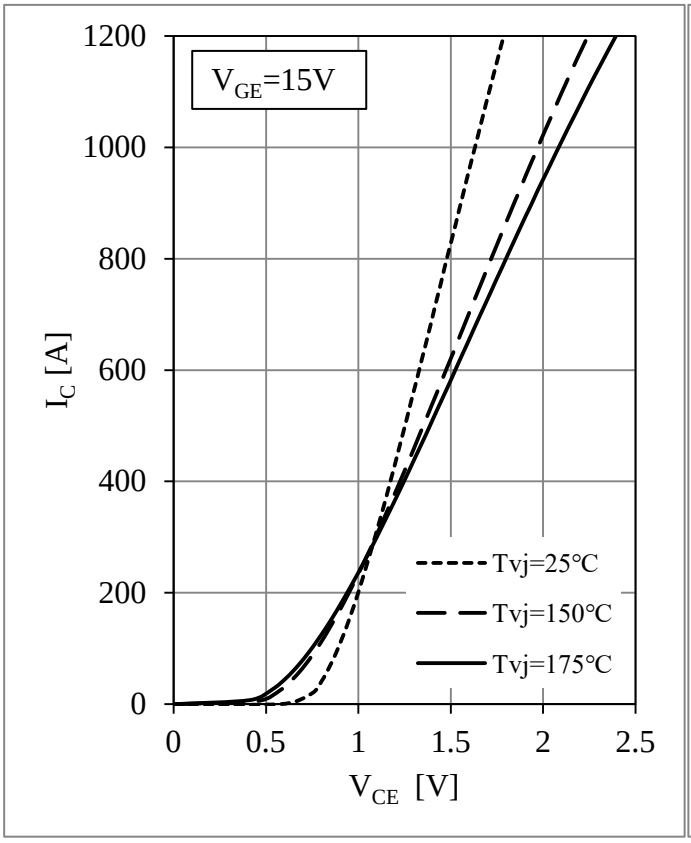


Fig 1. IGBT Output Characteristics

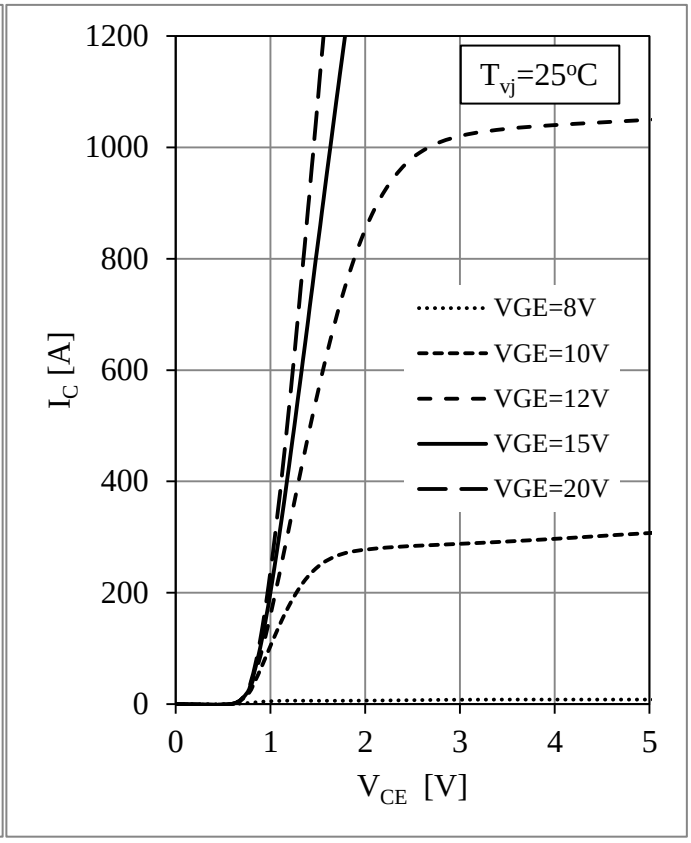


Fig 2. IGBT Output Characteristics

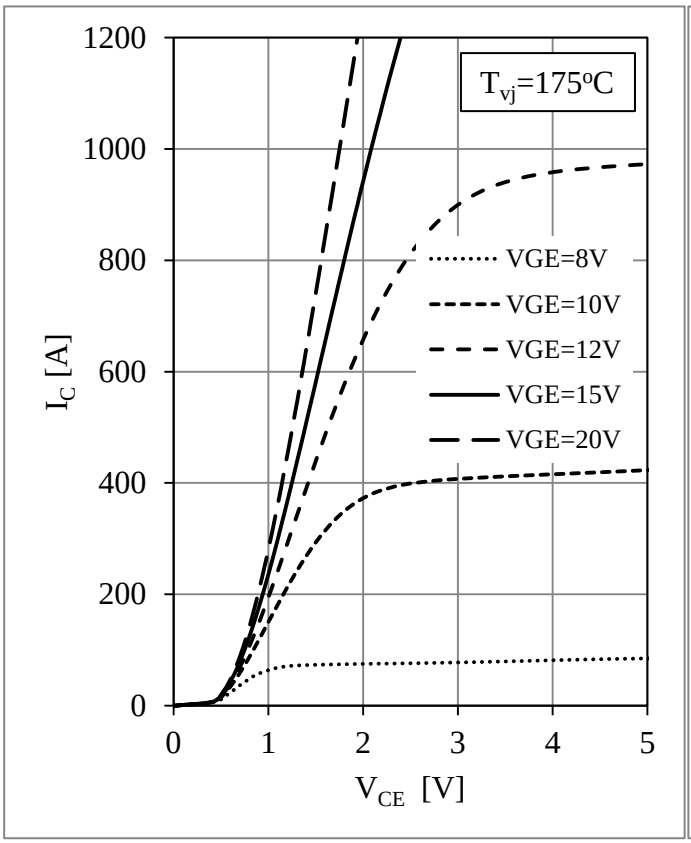


Fig 3. IGBT Output Characteristics

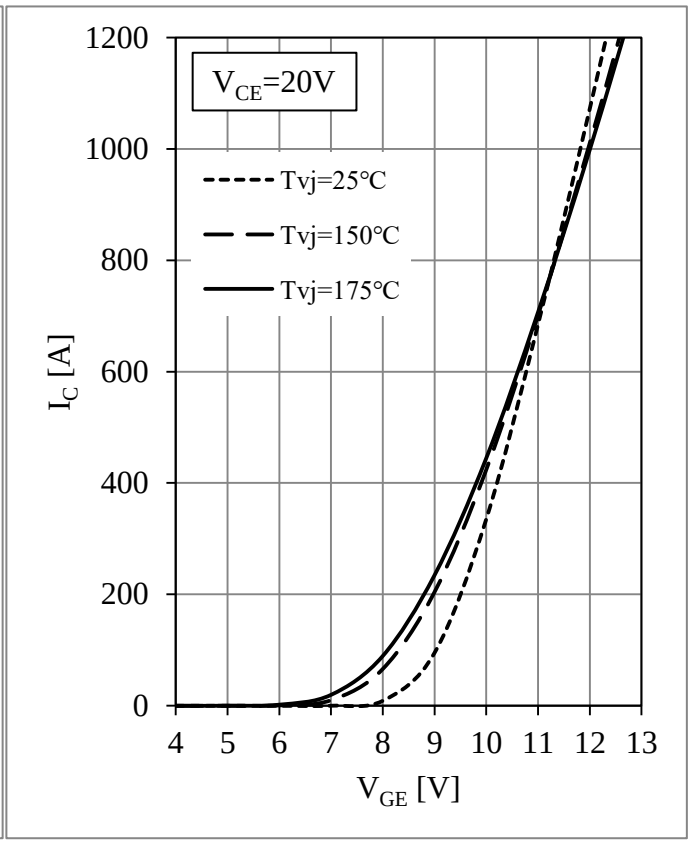


Fig 4. IGBT Transfer Characteristics

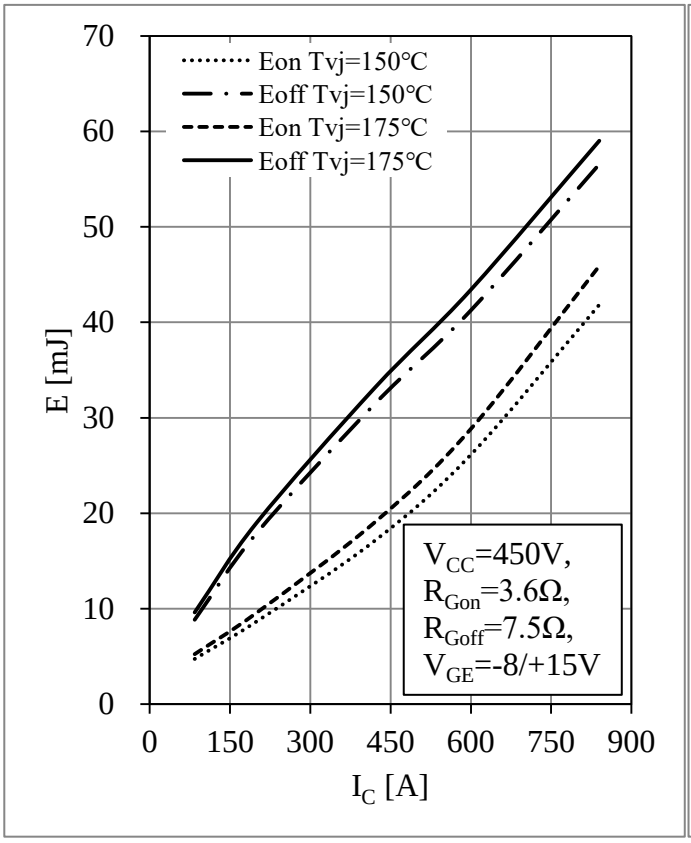


Fig 5. IGBT Switching Loss vs. I_C

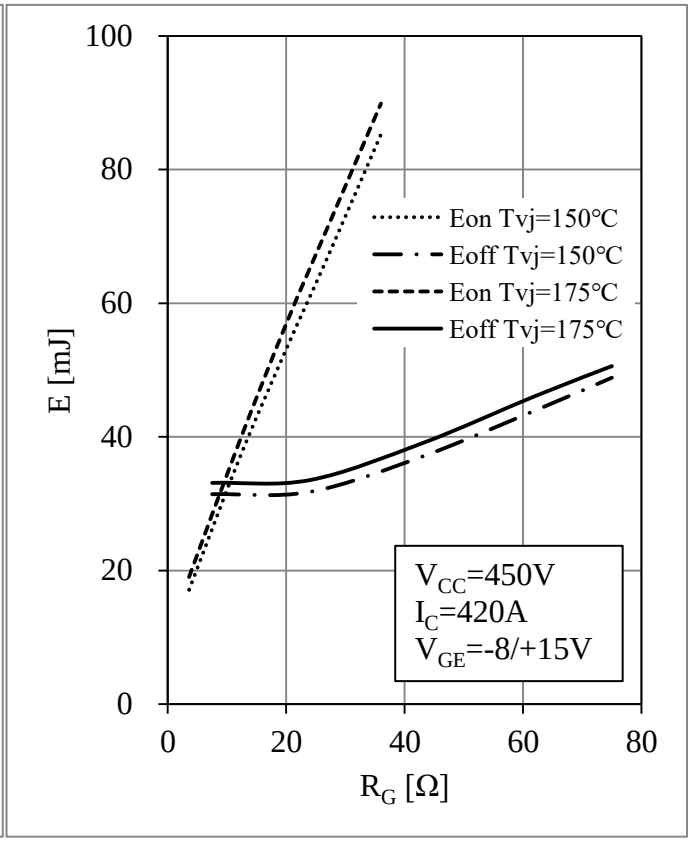


Fig 6. IGBT Switching Loss vs. R_G

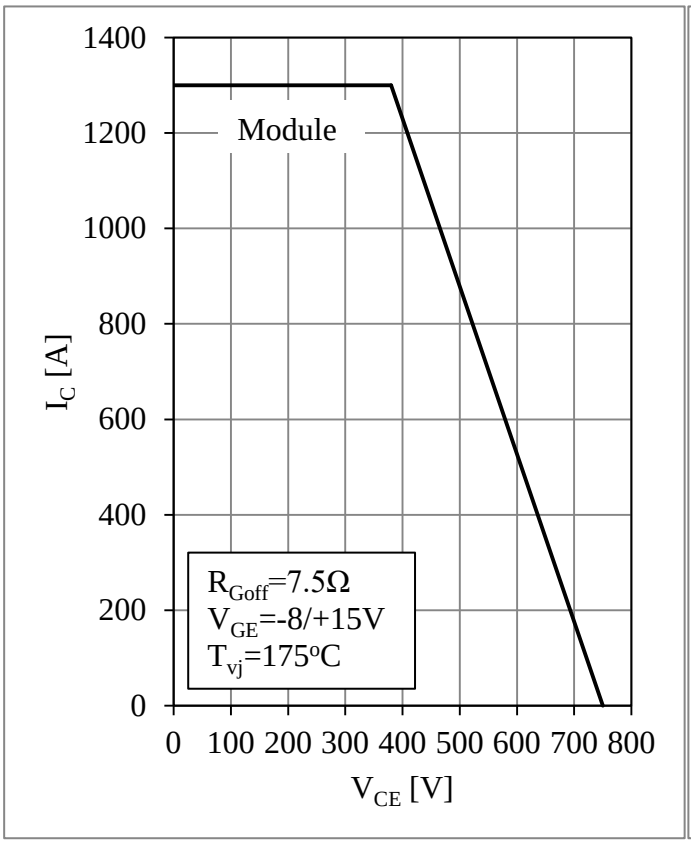


Fig 7. RBSOA

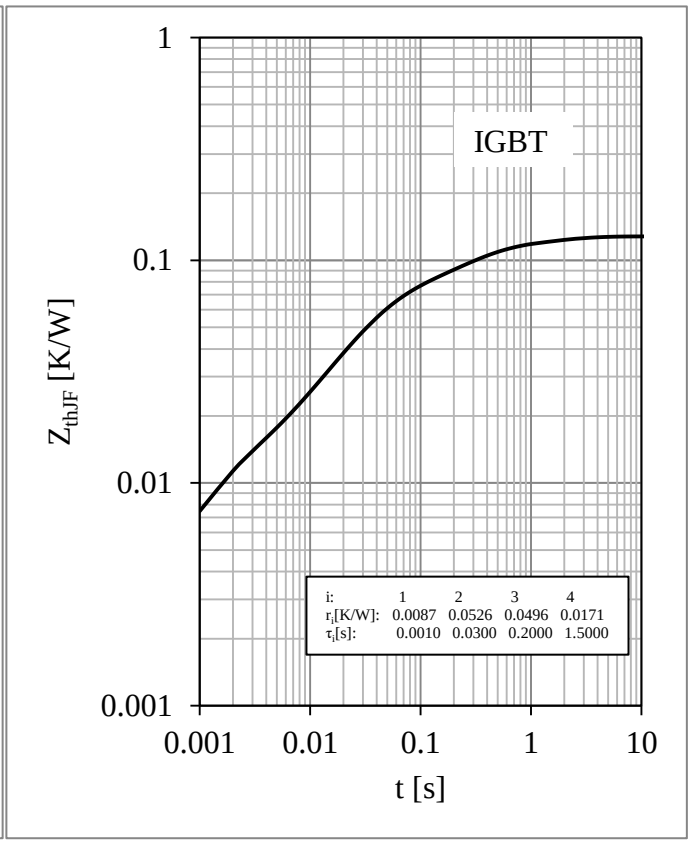


Fig 8. IGBT Transient Thermal Impedance

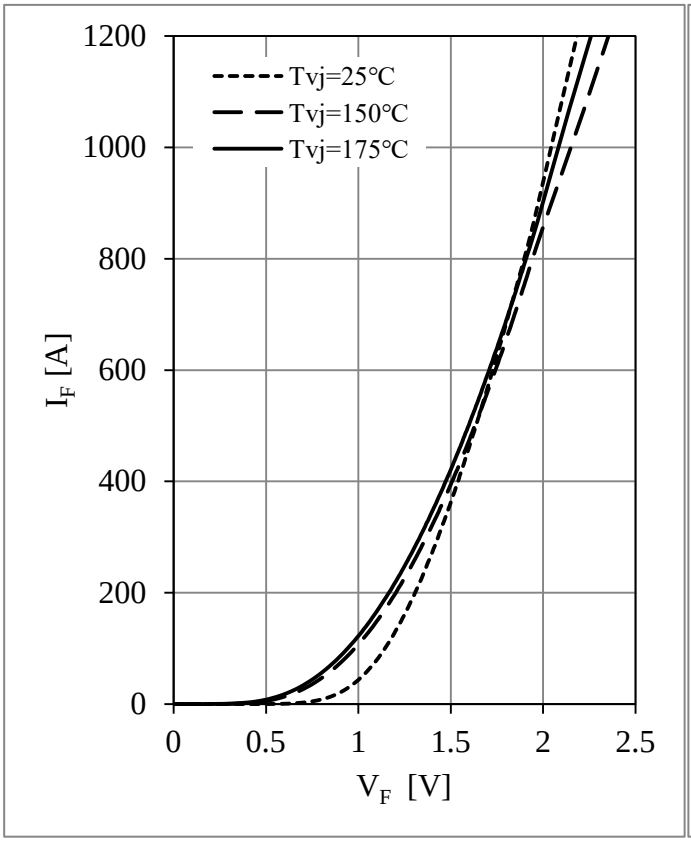


Fig 9. Diode Forward Characteristics

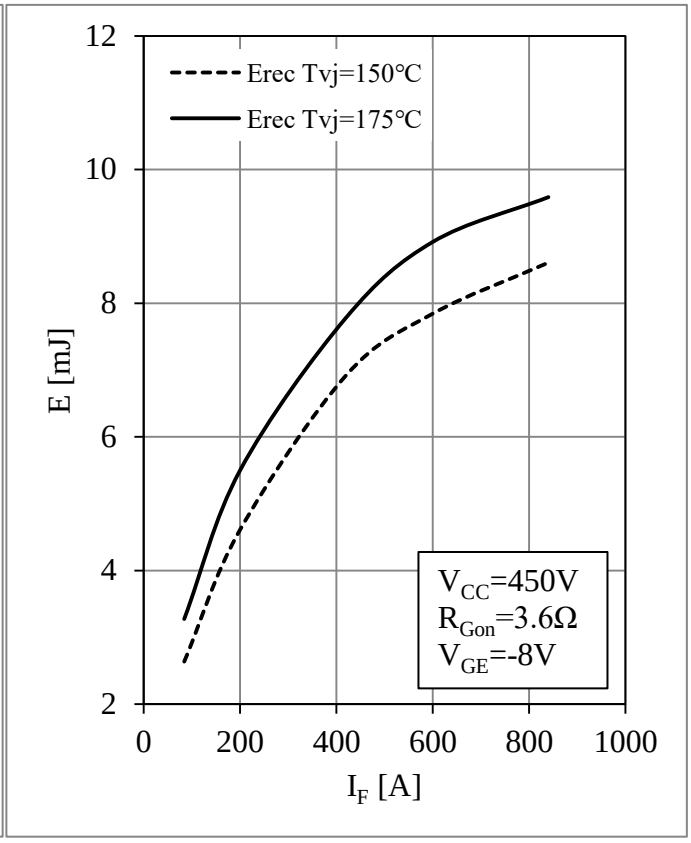


Fig 10. Diode Switching Loss vs. I_F

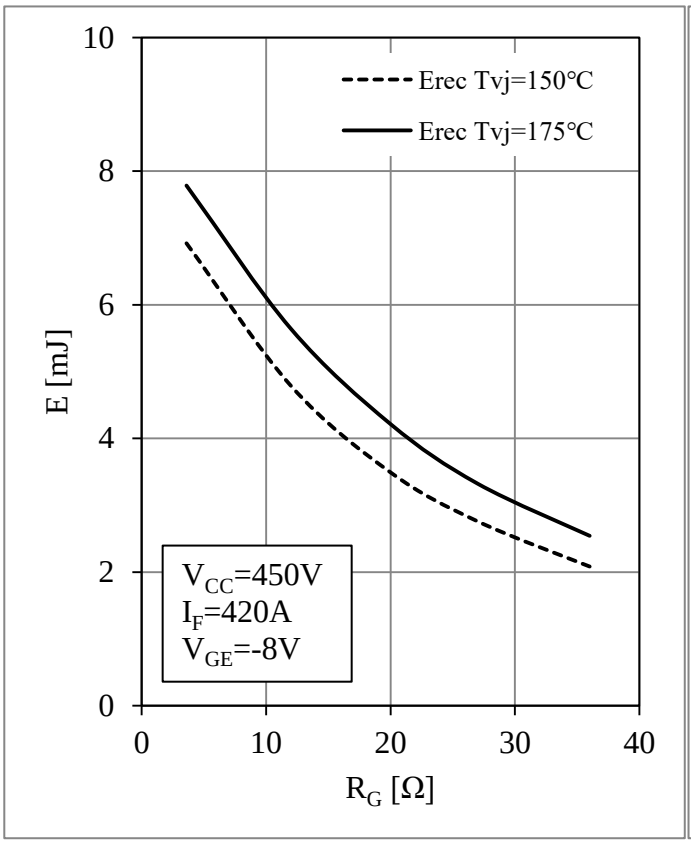


Fig 11. Diode Switching Loss vs. R_G

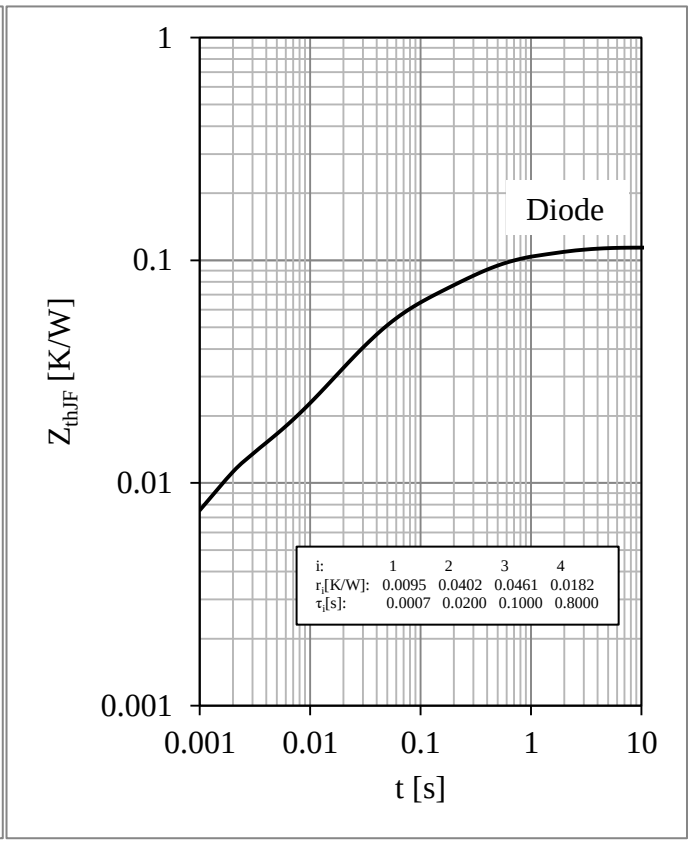


Fig 12. Diode Transient Thermal Impedance

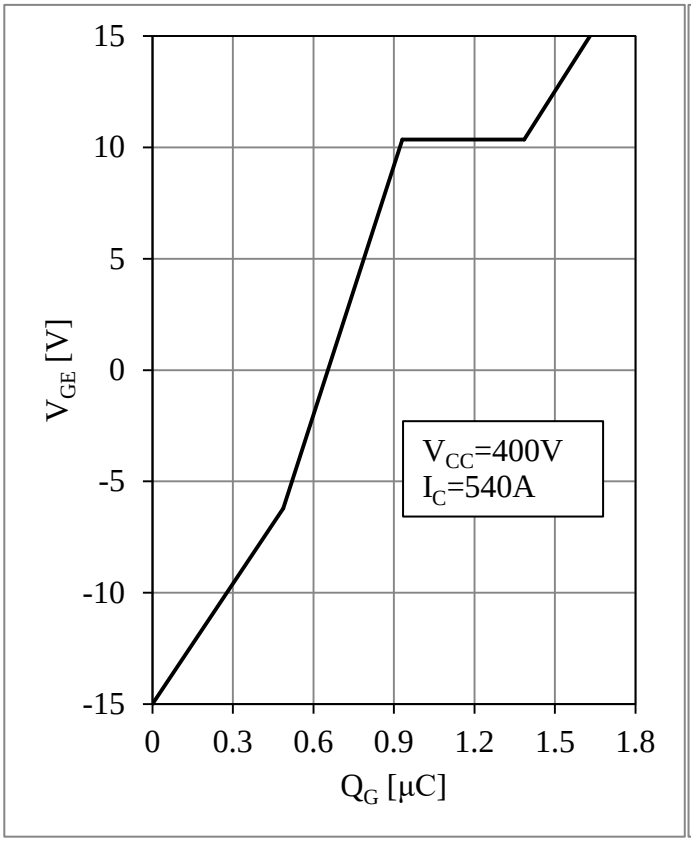


Fig 13. IGBT Gate Charge Characteristic

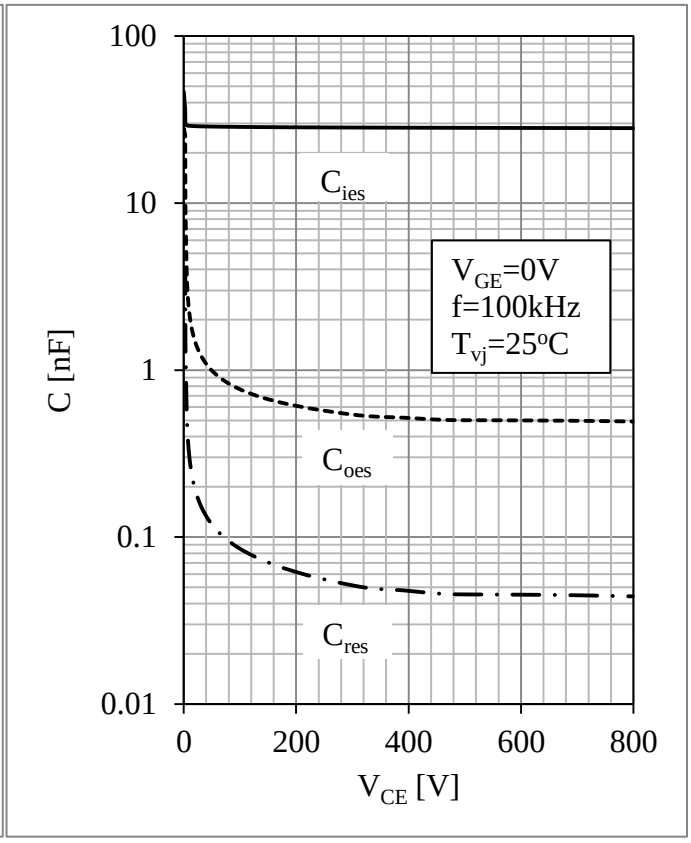


Fig 14. IGBT Capacity Characteristic

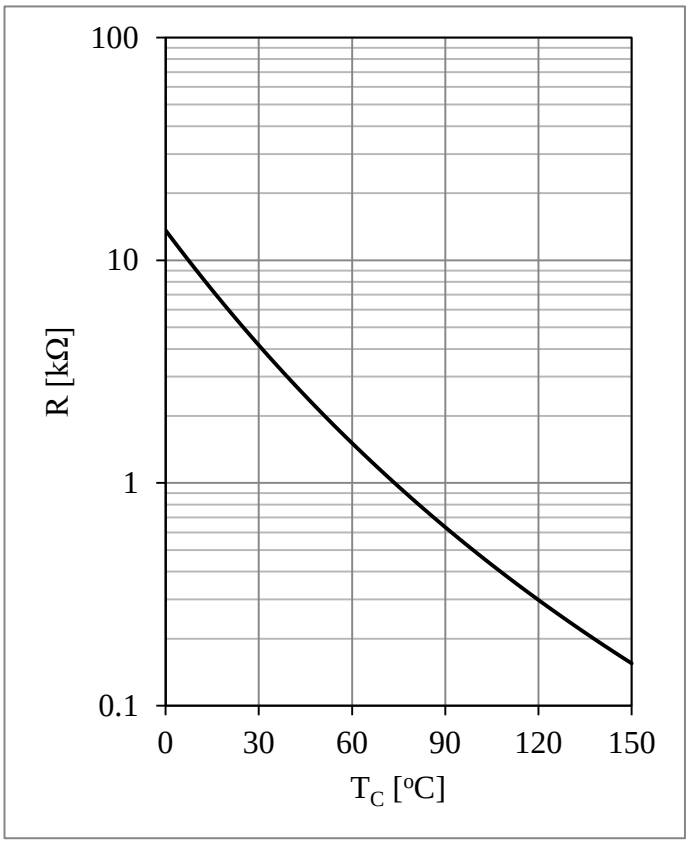
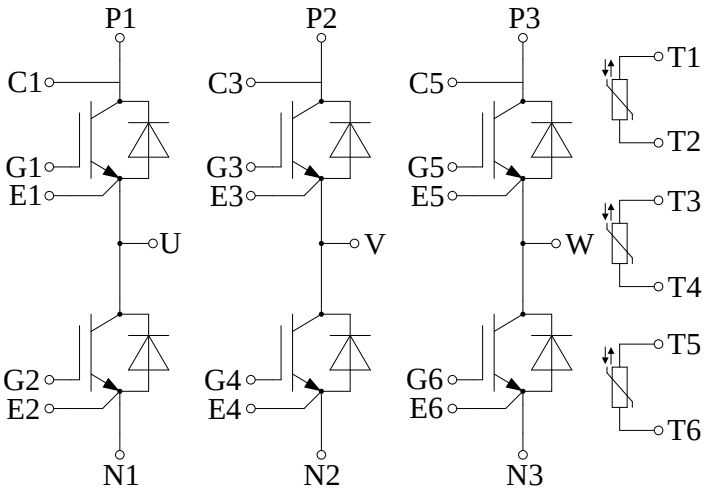


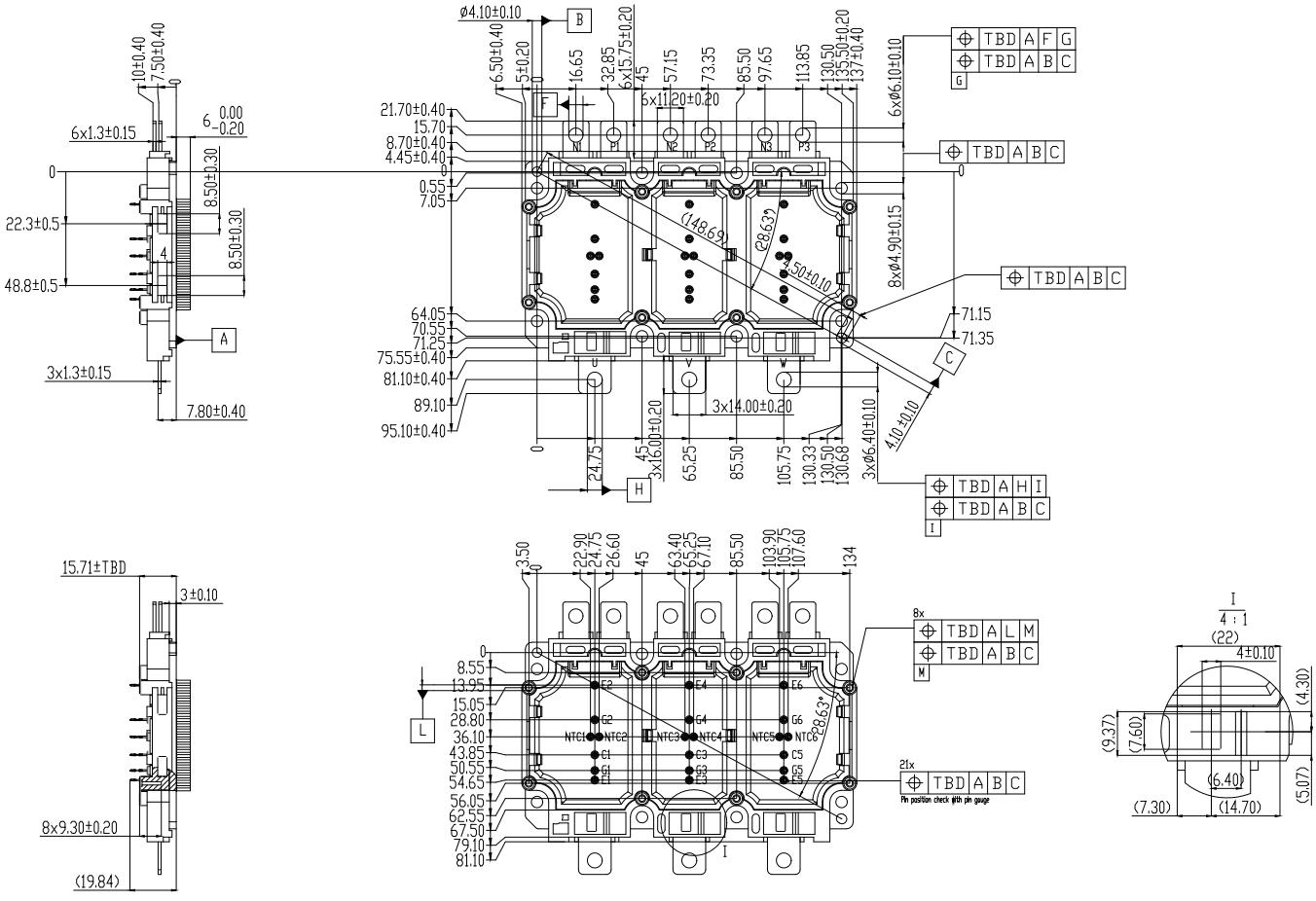
Fig 15. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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