STARPOWER

SEMICONDUCTOR **IGBT**

GD500HTA75P7S_C

750V/500A 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.

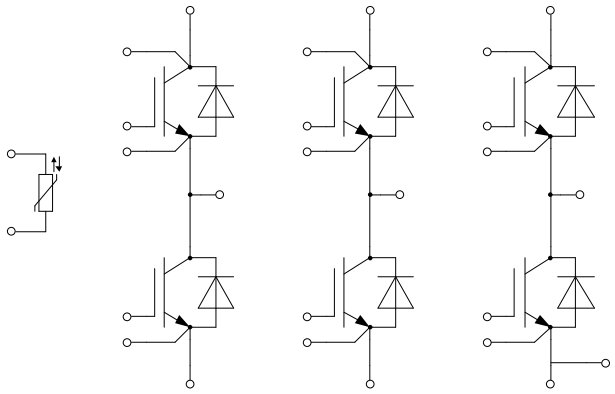
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- $V_{CE(sat)}$ 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

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings T_C=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_C	Collector Current @ T_C=25°C @ T_C=60°C	610 500	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	1000	A
P_D	Maximum Power Dissipation @ T_{vj}=175°C	1127	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_F	Diode Continuous Forward Current	500	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	1000	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

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=500A,V_{GE}=15V, T_{vj}=25°C		1.30	1.55	V
		I_C=500A,V_{GE}=15V, T_{vj}=150°C		1.40		
		I_C=500A,V_{GE}=15V, T_{vj}=175°C		1.45		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=8.64mA,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			1.5		Ω
C_{ies}	Input Capacitance	V_{CE}=50V,f=100kHz, V_{GE}=0V		48.2		nF
C_{oes}	Output Capacitance			1.07		nF
C_{res}	Reverse Transfer Capacitance			0.21		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		3.18		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.0Ω,L_S=20nH, V_{GE}=-8V/+15V, T_{vj}=25°C		296		ns
t_r	Rise Time			78		ns
$t_{d(off)}$	Turn-Off Delay Time			536		ns
t_f	Fall Time			66		ns
E_{on}	Turn-On Switching Loss			14.8		mJ
E_{off}	Turn-Off Switching Loss			18.0		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.0Ω,L_S=20nH, V_{GE}=-8V/+15V, T_{vj}=150°C		314		ns
t_r	Rise Time			82		ns
$t_{d(off)}$	Turn-Off Delay Time			617		ns
t_f	Fall Time			111		ns
E_{on}	Turn-On Switching Loss			21.5		mJ
E_{off}	Turn-Off Switching Loss			22.5		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=450A, R_G=2.0Ω,L_S=20nH, V_{GE}=-8V/+15V, T_{vj}=175°C		315		ns
t_r	Rise Time			88		ns
$t_{d(off)}$	Turn-Off Delay Time			640		ns
t_f	Fall Time			122		ns
E_{on}	Turn-On Switching Loss			25.0		mJ
E_{off}	Turn-Off Switching Loss			23.5		mJ
I_{SC}	SC Data	t_P≤3μs,V_{GE}=15V, T_{vj}=175°C,V_{CC}=450V, V_{CEM}≤750V		2400		A

Diode Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	I_F=500A,V_{GE}=0V,T_{vj}=25°C		1.45	1.70	V
		I_F=500A,V_{GE}=0V,T_{vj}=150°C		1.40		
		I_F=500A,V_{GE}=0V,T_{vj}=175°C		1.35		
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=6170A/μs,L_S=20nH, V_{GE}=-8V,T_{vj}=25°C		14.1		μC
I_{RM}	Peak Reverse Recovery Current			234		A
E_{rec}	Reverse Recovery Energy			3.73		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=5460A/μs,L_S=20nH, V_{GE}=-8V,T_{vj}=150°C		30.8		μC
I_{RM}	Peak Reverse Recovery Current			306		A
E_{rec}	Reverse Recovery Energy			8.01		mJ
Q_r	Recovered Charge	V_R=400V,I_F=450A, -di/dt=5200A/μs,L_S=20nH, V_{GE}=-8V,T_{vj}=175°C		36.1		μC
I_{RM}	Peak Reverse Recovery Current			324		A
E_{rec}	Reverse Recovery Energy			8.90		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
L_{CE}	Stray Inductance			17	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.35		mΩ
R_{thJC}	Junction-to-Case (per IGBT) Junction-to-Case (per Diode)			0.133 0.170	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		485		g

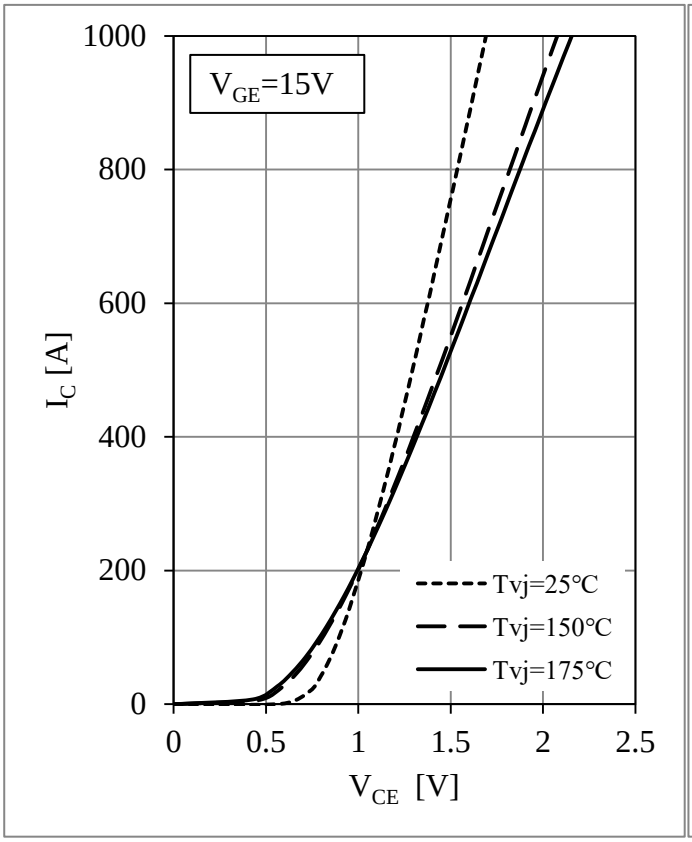


Fig 1. IGBT Output Characteristics

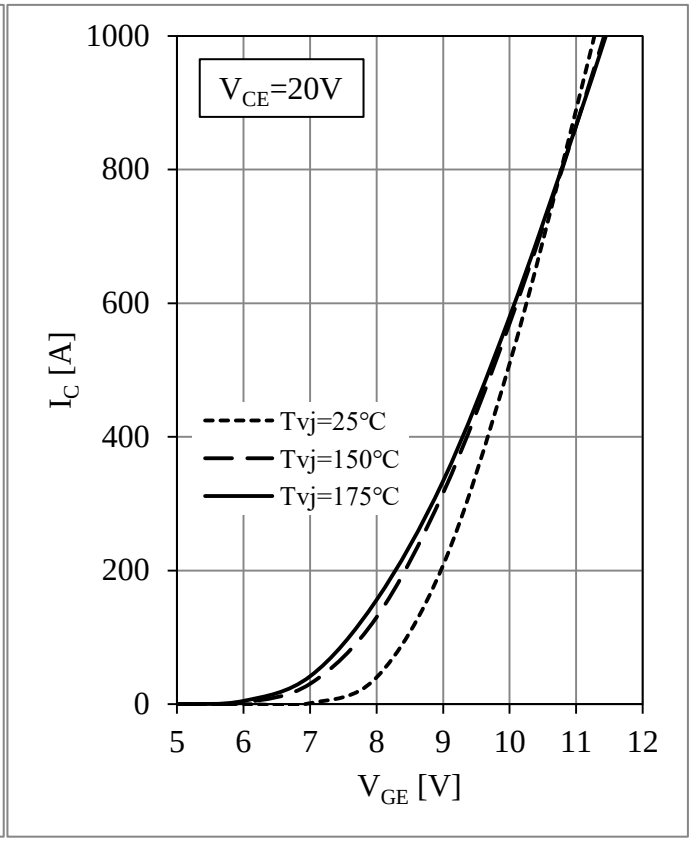


Fig 2. IGBT Transfer Characteristics

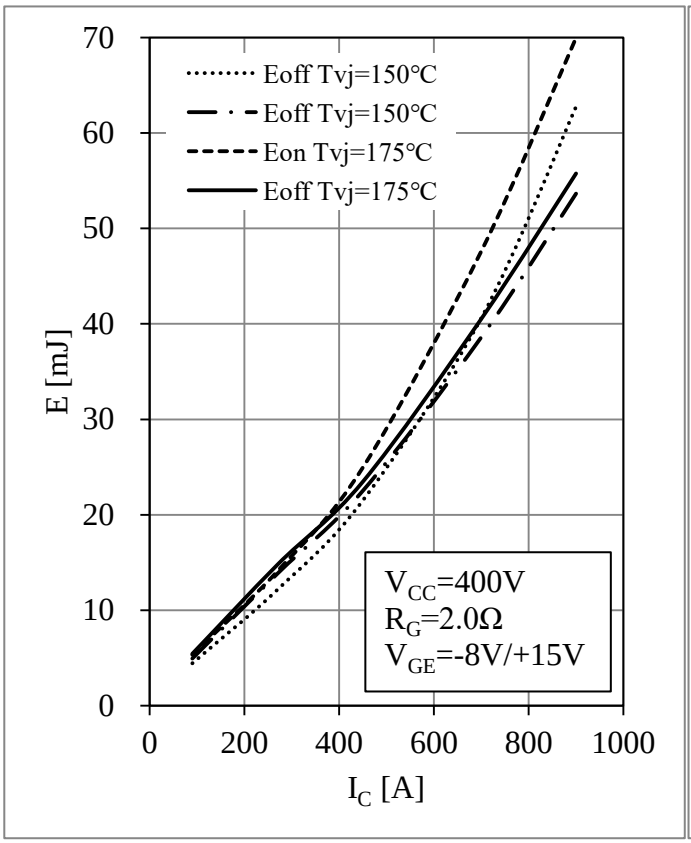


Fig 3. IGBT Switching Loss vs. I_C

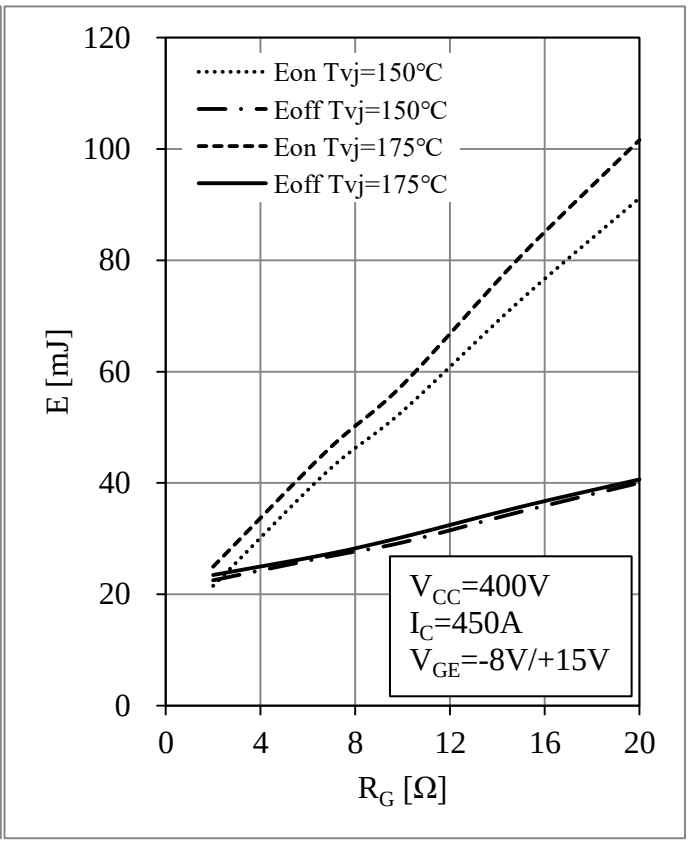


Fig 4. IGBT Switching Loss vs. R_G

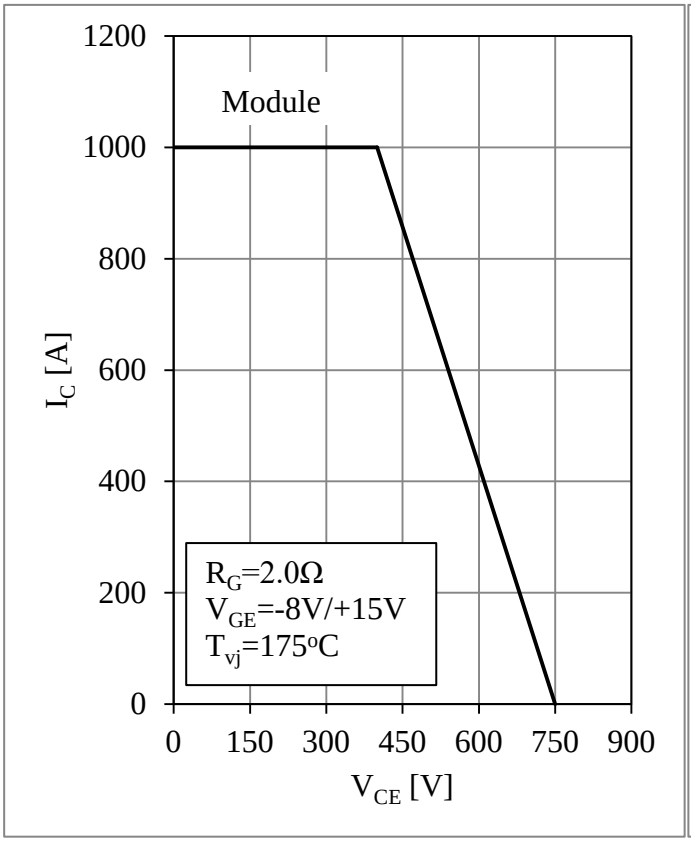


Fig 5. RBSOA

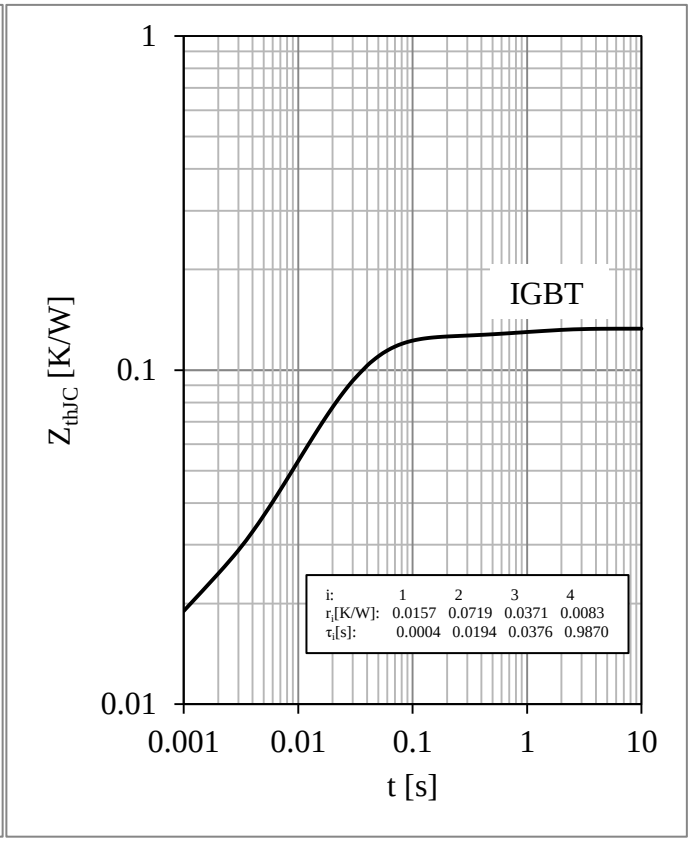


Fig 6. IGBT Transient Thermal Impedance

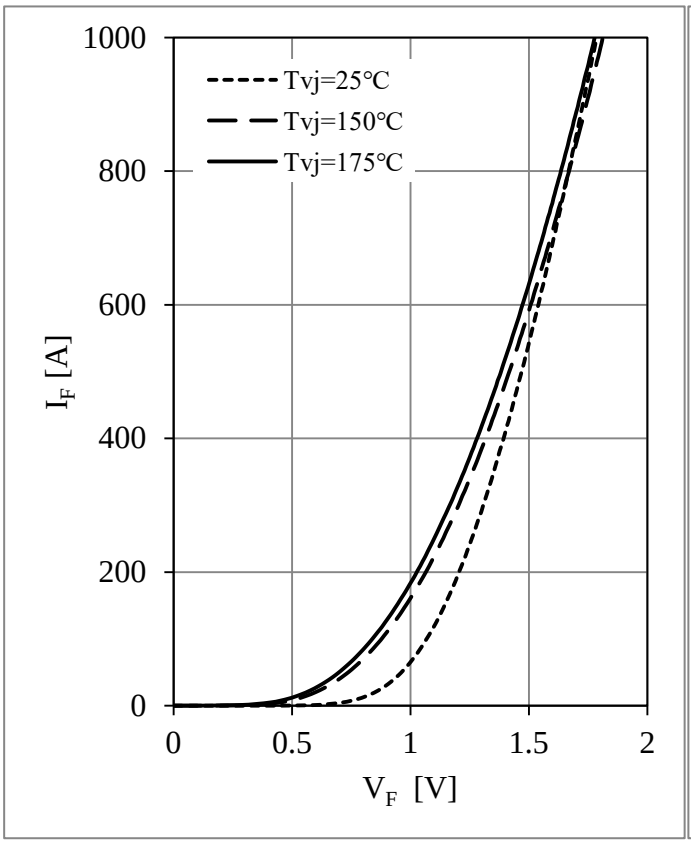


Fig 7. Diode Forward Characteristics

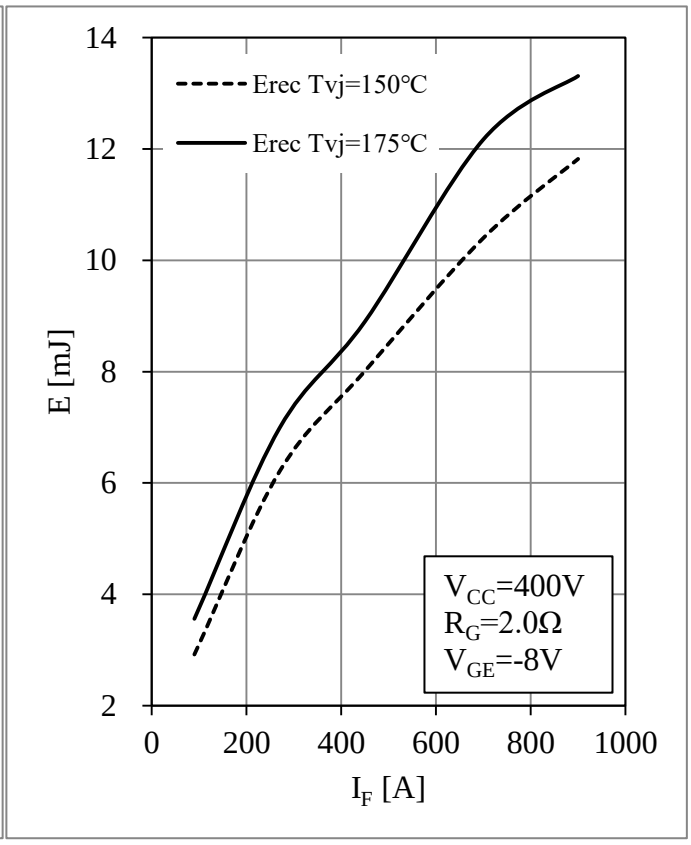


Fig 8. Diode Switching Loss vs. I_F

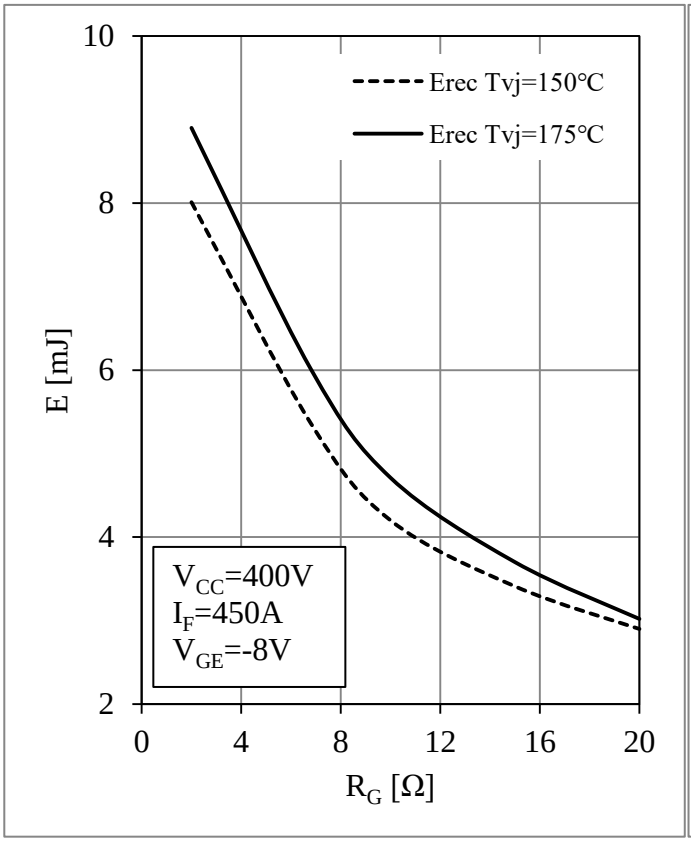


Fig 9. Diode Switching Loss vs. R_G

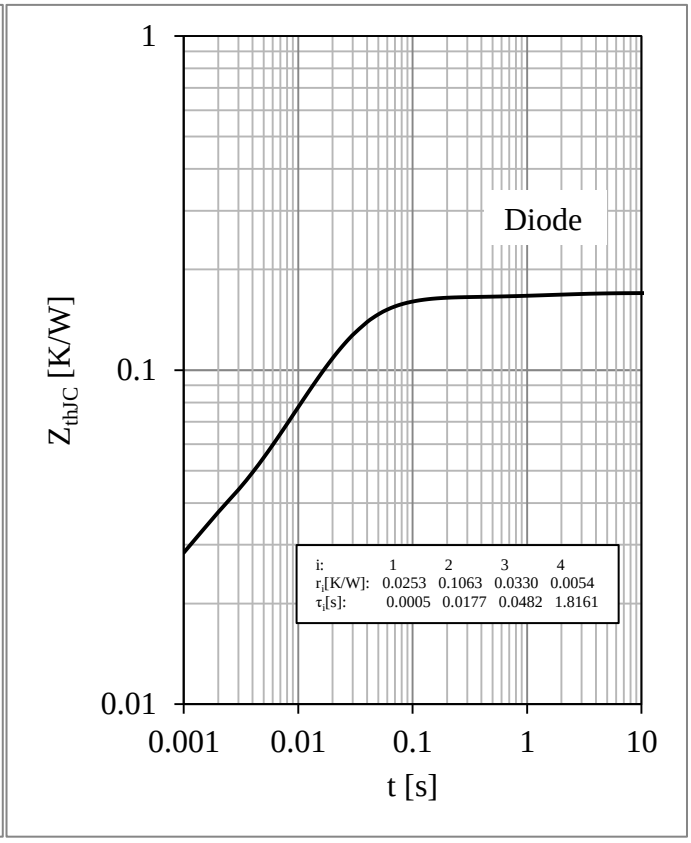


Fig 10. Diode Transient Thermal Impedance

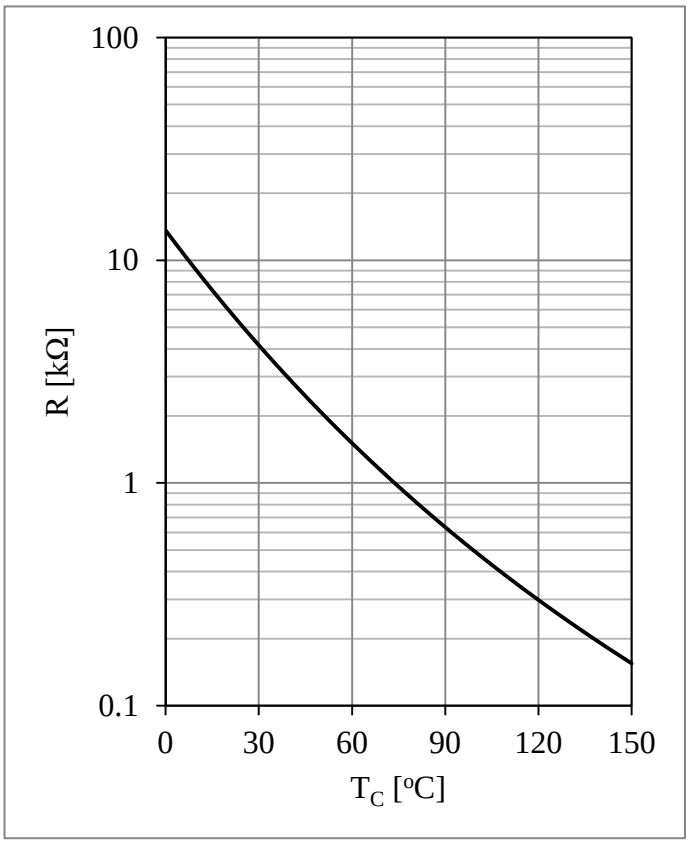
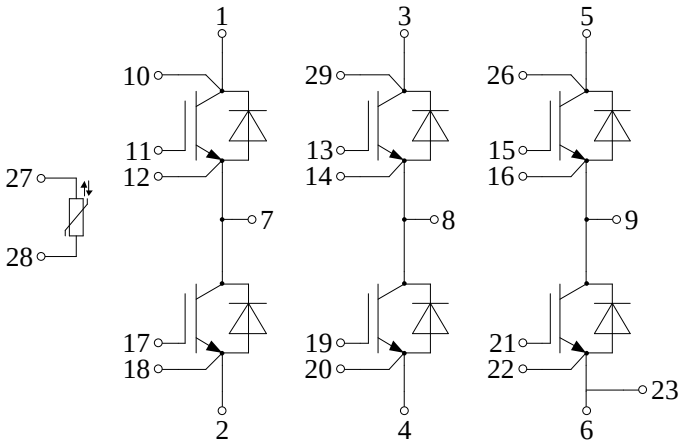


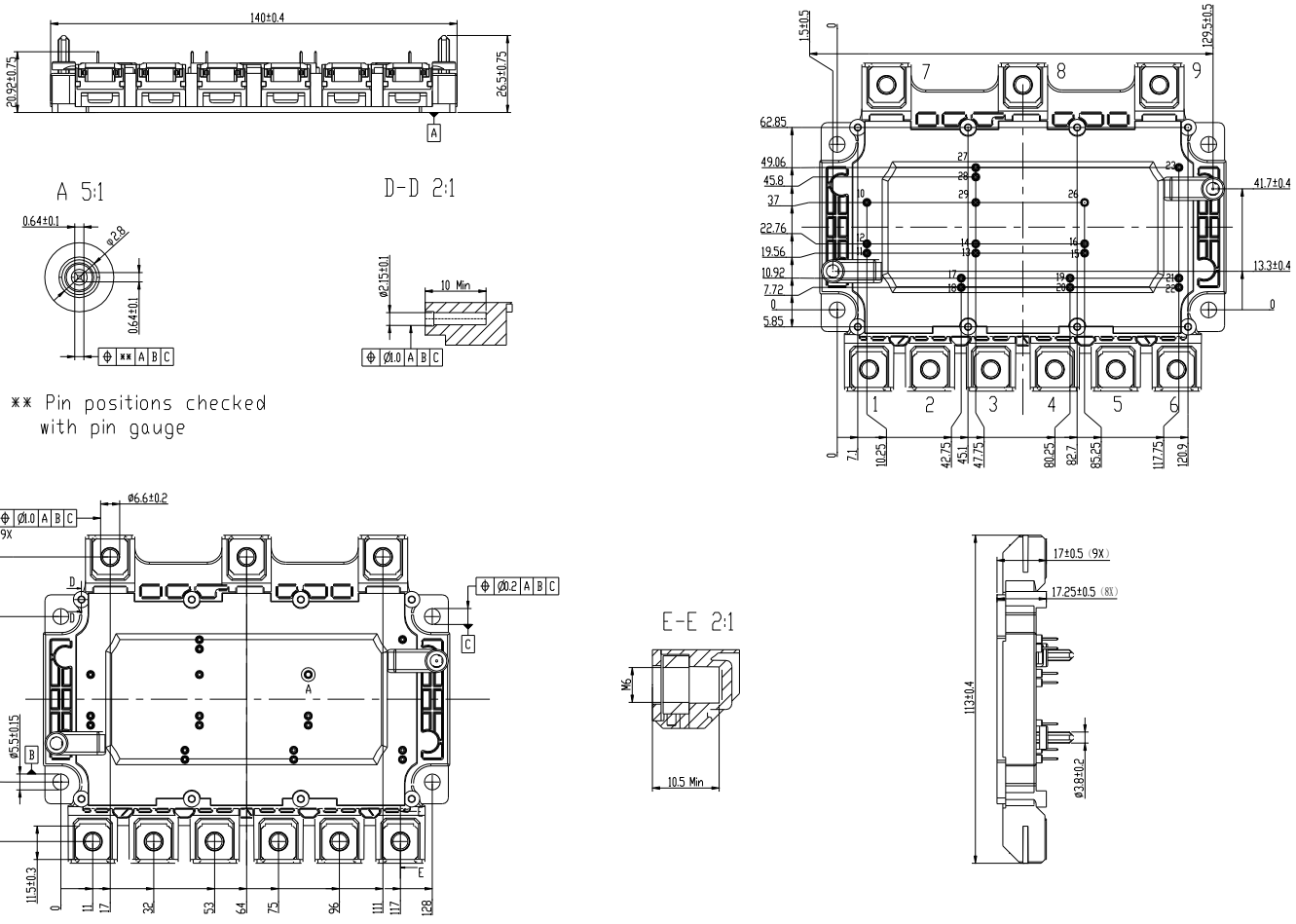
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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