STARPOWER

SEMICONDUCTOR **IGBT**

GD400HTX75P7H

750V/400A 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 vehicles.

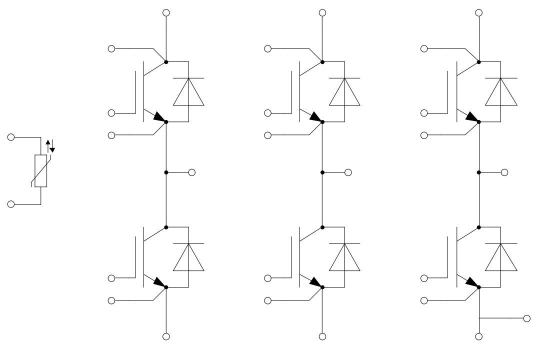
Features

- 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	Value	Unit
V_{CES}	Collector-Emitter Voltage	750	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_C	Collector Current @ T_F=25°C @ T_F=75°C	500 400	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_F=175°C	725	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	750	V
I_F	Diode Continuous Forward Current	400	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	800	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_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	I_C=400A,V_{GE}=15V, T_{vj}=25°C		1.40	1.85	V
		I_C=400A,V_{GE}=15V, T_{vj}=150°C		1.65		
		I_C=400A,V_{GE}=15V, T_{vj}=175°C		1.70		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=6.40mA,V_{CE}=V_{GE}, T_{vj}=25°C	5.1	5.8	6.5	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			1.0		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		28.2		nF
C_{res}	Reverse Transfer Capacitance			1.04		nF
Q_G	Gate Charge	V_{GE}=-15…+15V		2.64		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_{vj}=25°C		195		ns
t_r	Rise Time			60		ns
$t_{d(off)}$	Turn-Off Delay Time			326		ns
t_f	Fall Time			116		ns
E_{on}	Turn-On Switching Loss			8.66		mJ
E_{off}	Turn-Off Switching Loss			16.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_{vj}=150°C		203		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			378		ns
t_f	Fall Time			189		ns
E_{on}	Turn-On Switching Loss			14.3		mJ
E_{off}	Turn-Off Switching Loss			22.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=400V,I_C=400A, R_G=2.0Ω,V_{GE}=±15V, T_{vj}=175°C		206		ns
t_r	Rise Time			66		ns
$t_{d(off)}$	Turn-Off Delay Time			387		ns
t_f	Fall Time			203		ns
E_{on}	Turn-On Switching Loss			15.7		mJ
E_{off}	Turn-Off Switching Loss			23.7		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_{vj}=175°C,V_{CC}=450V, V_{CEM}≤750V		1700		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=400A,V_{GE}=0V,T_{vj}=25°C		1.55	2.00	V
		I_F=400A,V_{GE}=0V,T_{vj}=150°C		1.50		
		I_F=400A,V_{GE}=0V,T_{vj}=175°C		1.50		
Q_r	Recovered Charge	V_R=400V,I_F=400A, -di/dt=6120A/μs,V_{GE}=-15V T_{vj}=25°C		7.90		μC
I_{RM}	Peak Reverse Recovery Current			192		A
E_{rec}	Reverse Recovery Energy			3.66		mJ
Q_r	Recovered Charge	V_R=400V,I_F=400A, -di/dt=5450A/μs,V_{GE}=-15V T_{vj}=150°C		20.1		μC
I_{RM}	Peak Reverse Recovery Current			240		A
E_{rec}	Reverse Recovery Energy			7.10		mJ
Q_r	Recovered Charge	V_R=400V,I_F=400A, -di/dt=5270A/μs,V_{GE}=-15V T_{vj}=175°C		24.2		μC
I_{RM}	Peak Reverse Recovery Current			258		A
E_{rec}	Reverse Recovery Energy			8.16		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=10.0dm^3/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)			0.207 0.291	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

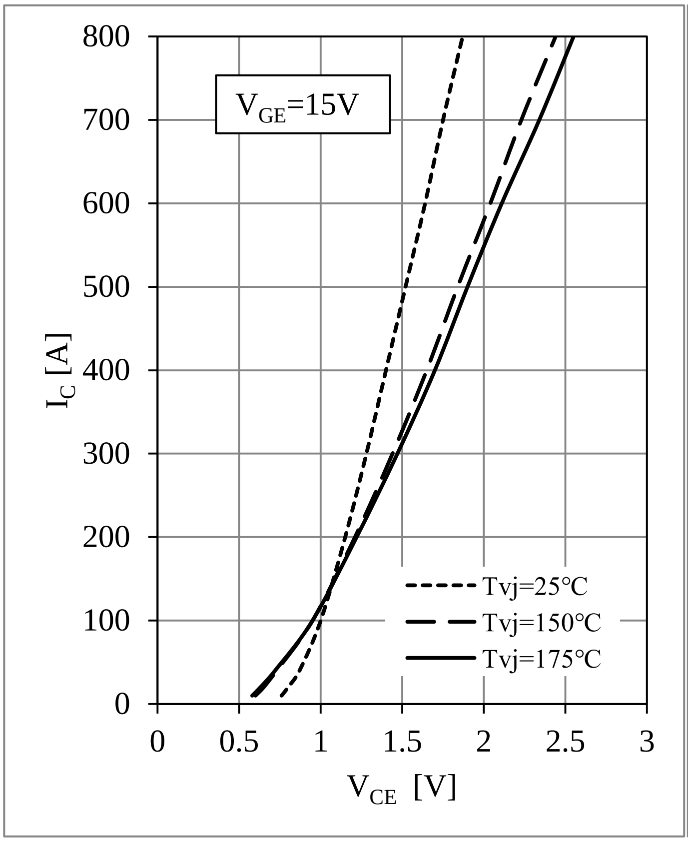


Fig 1. IGBT Output Characteristics

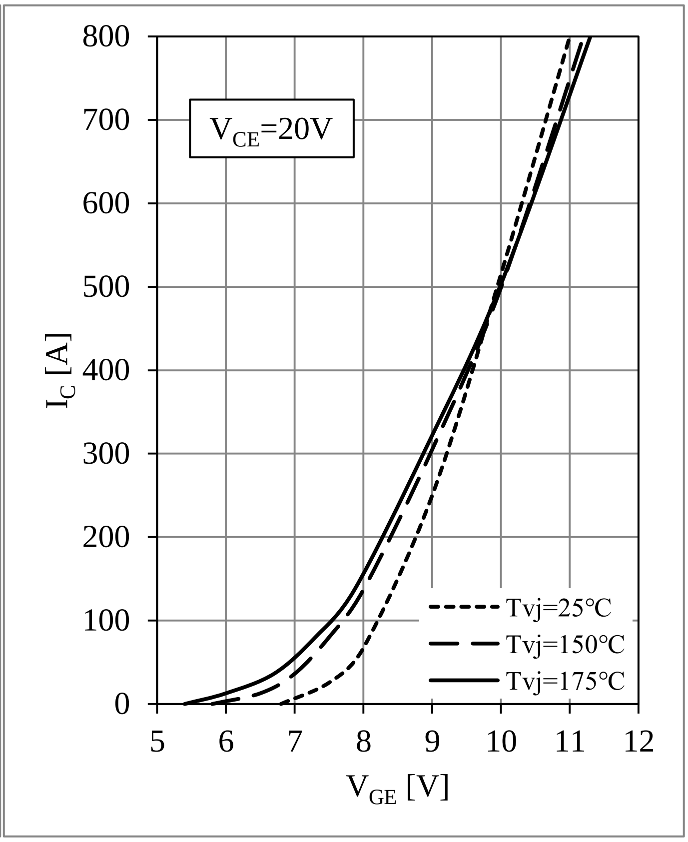


Fig 2. IGBT Transfer Characteristics

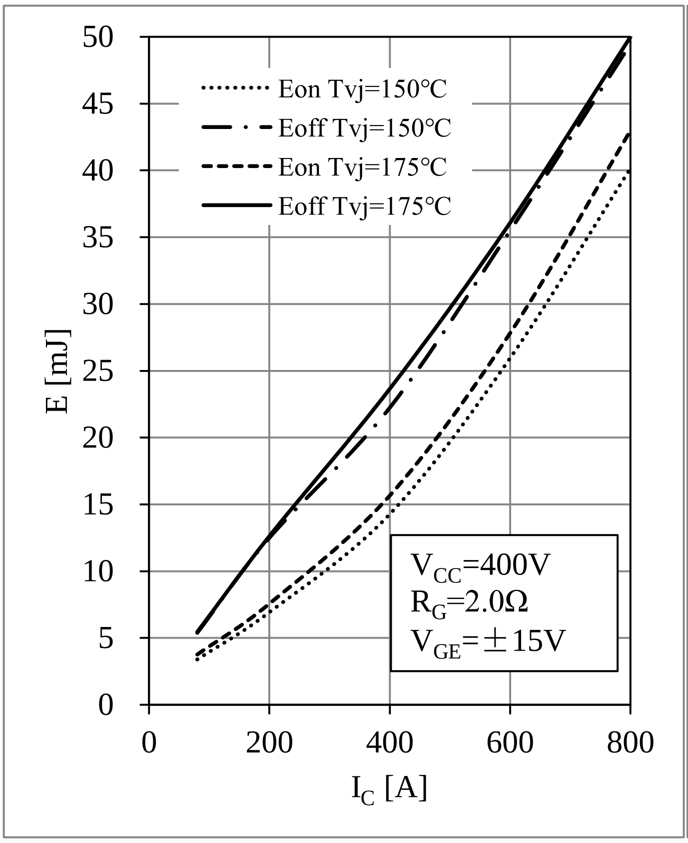


Fig 3. IGBT Switching Loss vs. I_C

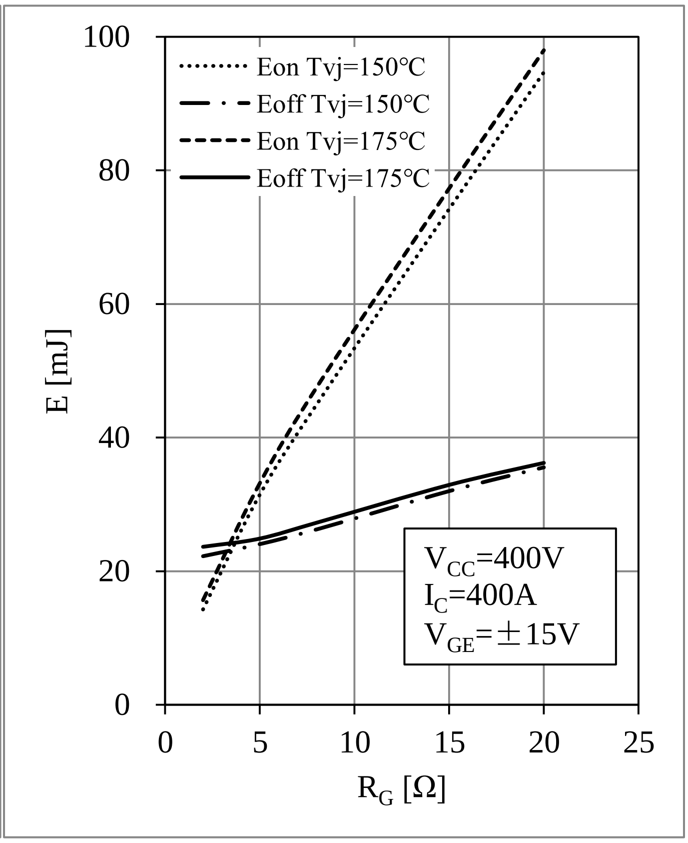


Fig 4. IGBT Switching Loss vs. R_G

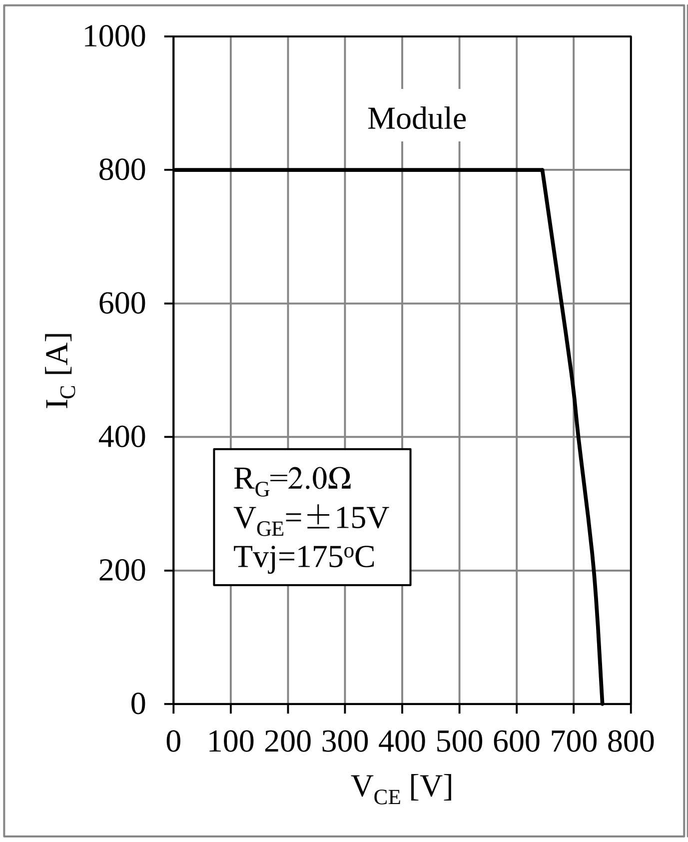


Fig 5. RBSOA

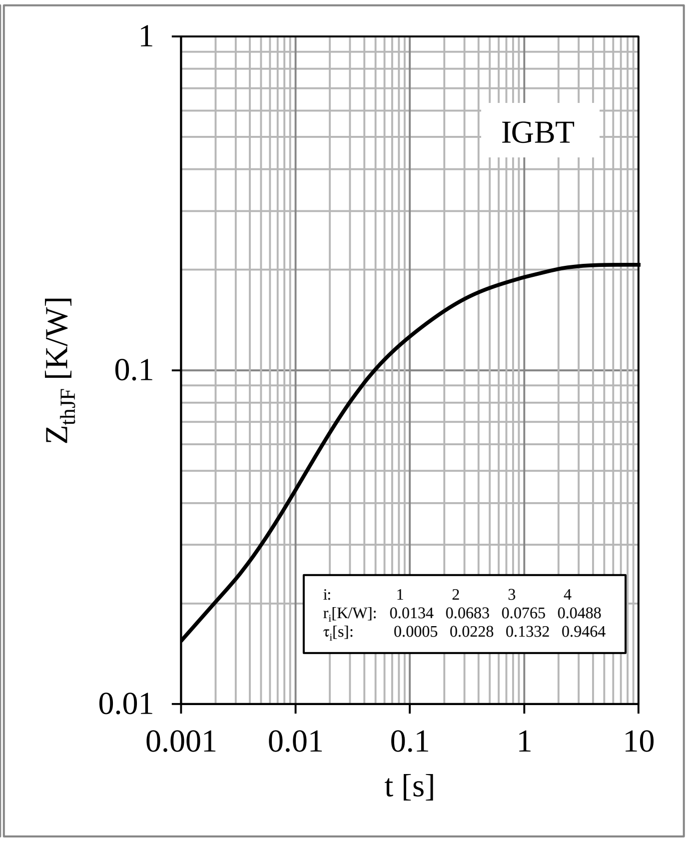


Fig 6. IGBT Transient Thermal Impedance

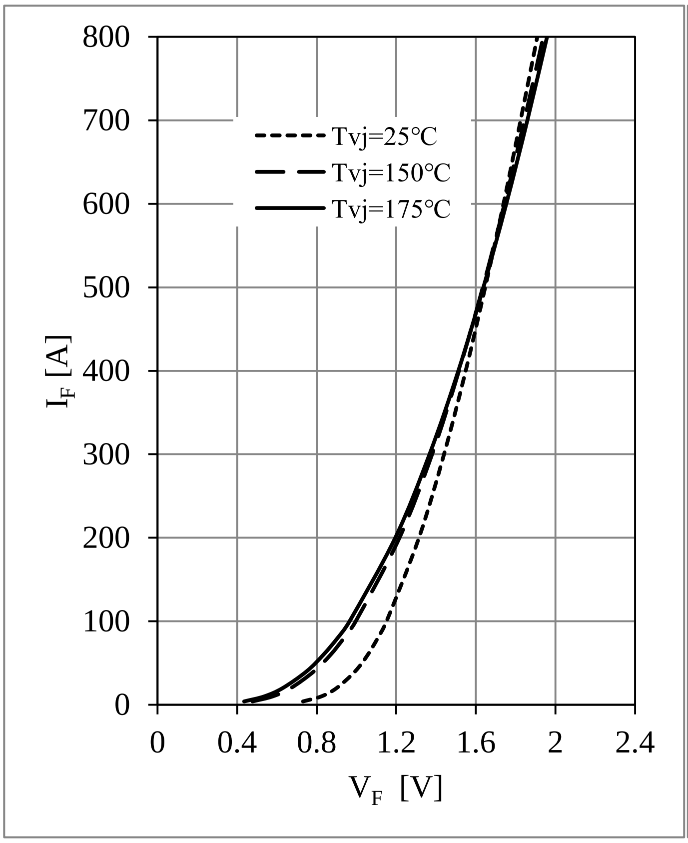


Fig 7. Diode Forward Characteristics

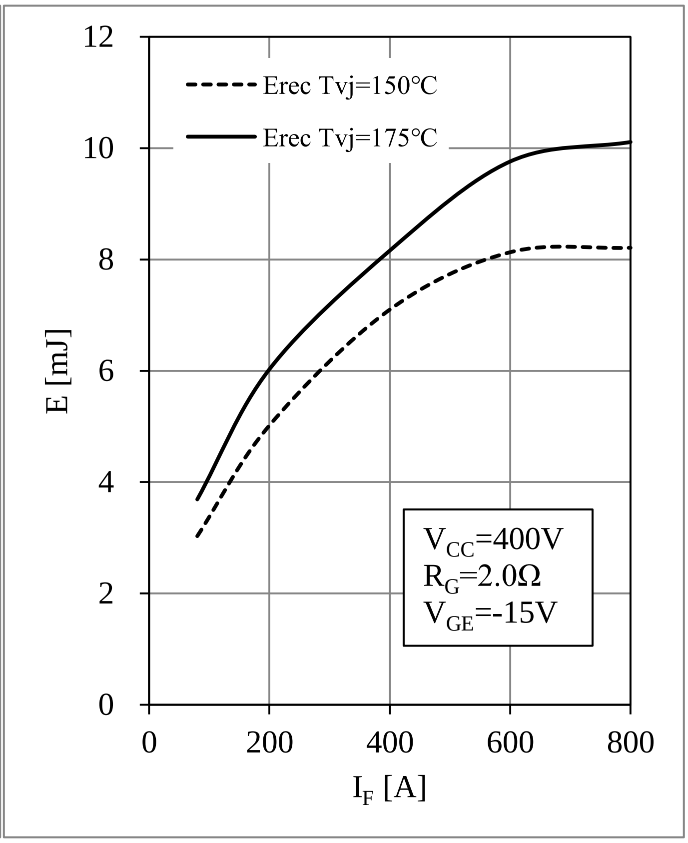


Fig 8. Diode Switching Loss vs. I_F

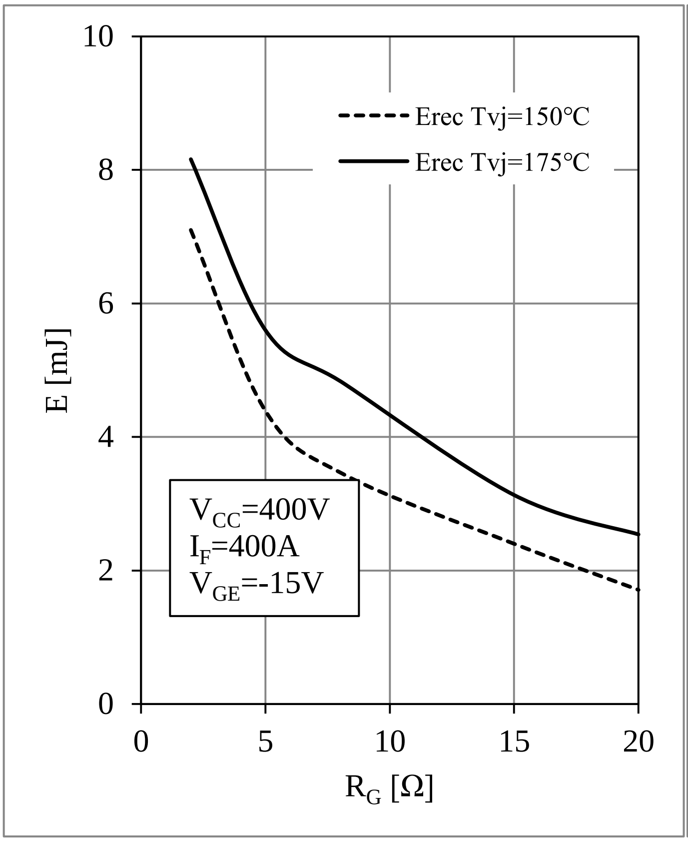


Fig 9. Diode Switching Loss vs. R_G

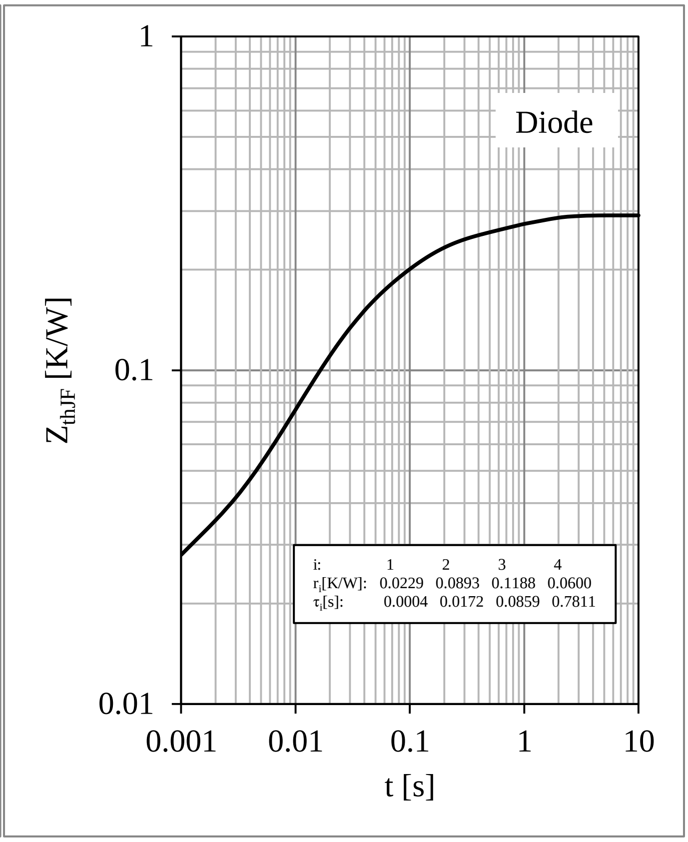


Fig 10. Diode Transient Thermal Impedance

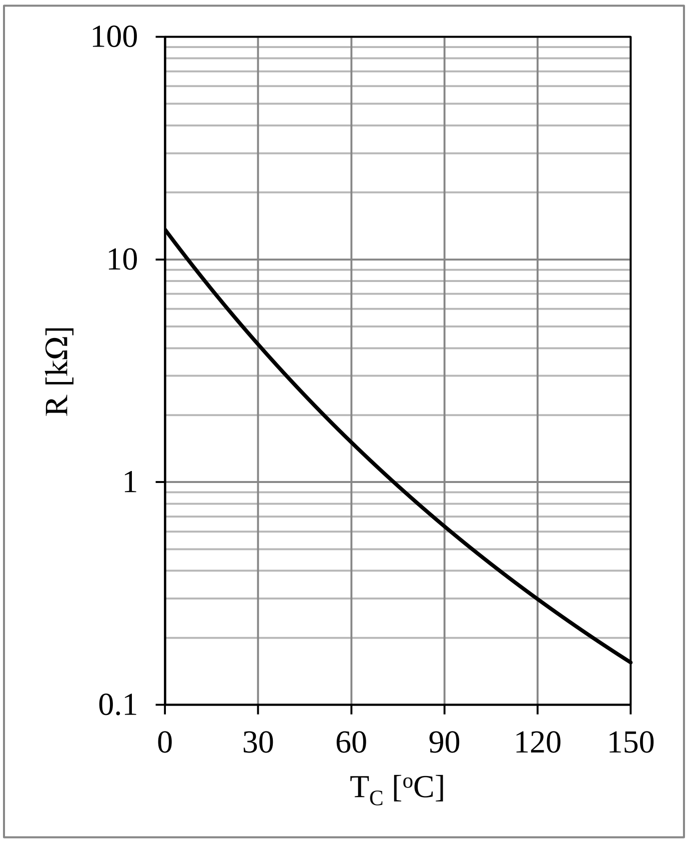
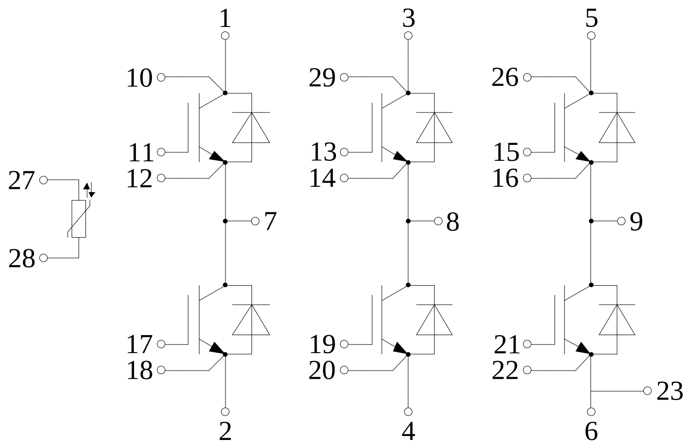


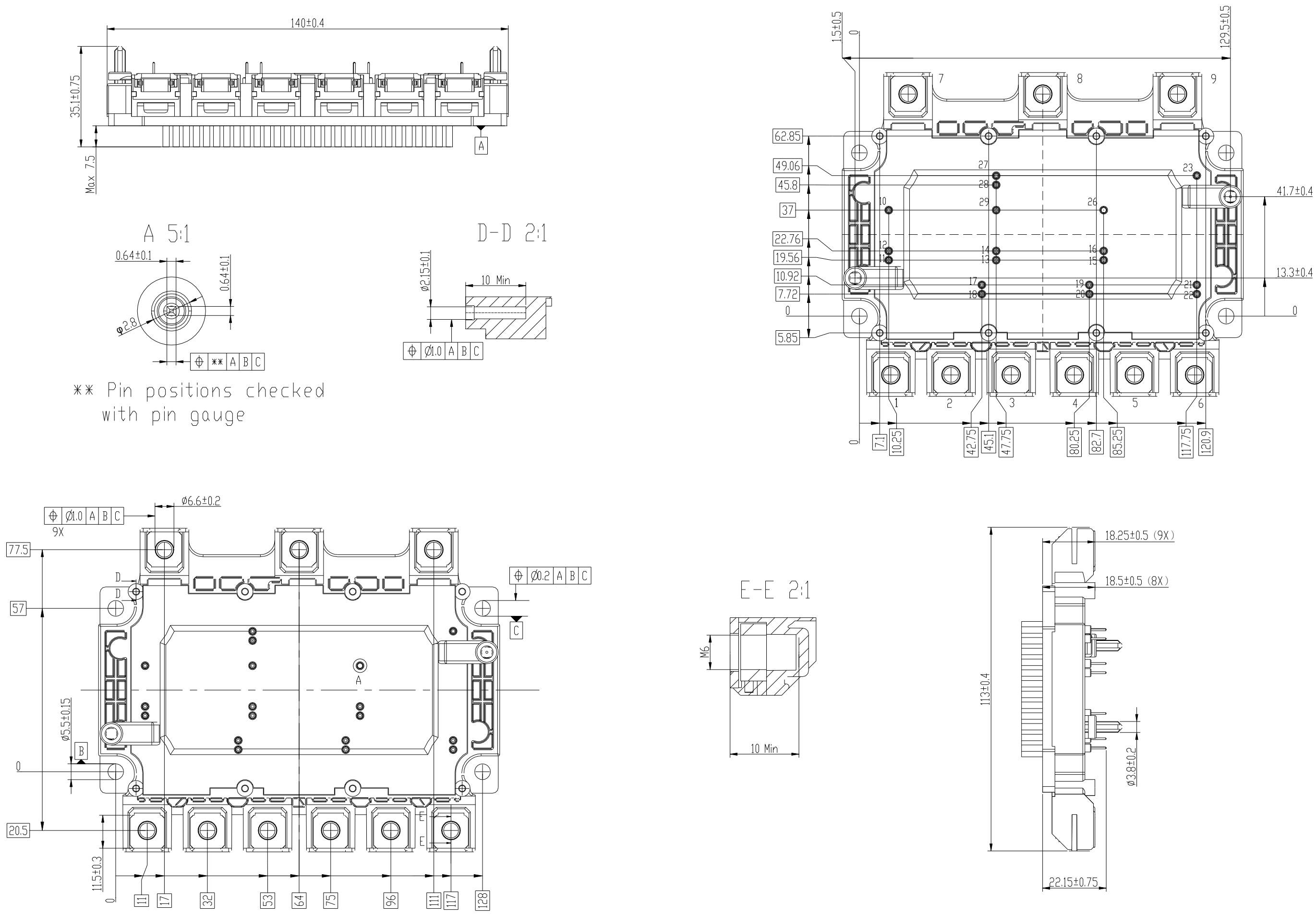
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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