STARPOWER

SEMICONDUCTOR **IGBT**

GD400HTX120P4S

1200V/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 vehicle.

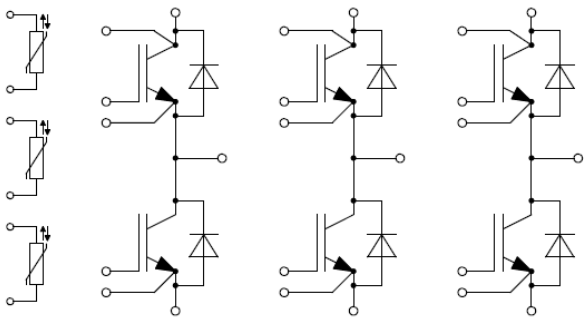
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- 10μs 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

- Hybrid and electric vehicle
- Inverter for motor drive
- Uninterruptible power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings T_F=25°C unless otherwise noted

IGBT

Symbol	Description	Value	Unit
V_{CES}	Collector-Emitter Voltage	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_{CN}	Implemented Collector Current	400	A
I_C	Collector Current @ T_F=25°C @ T_F=75°C	400 300	A
I_{CM}	Pulsed Collector Current t_p=1ms	800	A
P_D	Maximum Power Dissipation @ T_j=175°C	1500	W

Diode

Symbol	Description	Value	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Forward Current	400	A
I_F	Diode Continuous Forward Current	300	A
I_{FM}	Diode Maximum Forward Current t_p=1ms	800	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-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		1.50	1.95	V
		I_C=300A,V_{GE}=15V, T_j=125°C		1.60		
		I_C=300A,V_{GE}=15V, T_j=150°C		1.65		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=16.0mA,V_{CE}=V_{GE}, T_j=25°C	5.3	5.8	6.3	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			0.5		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=1MHz, V_{GE}=0V		41.4		nF
C_{res}	Reverse Transfer Capacitance			1.16		nF
Q_G	Gate Charge	V_{GE}=15V		3.11		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=500V,I_C=300A, R_G=1.5Ω,V_{GE}=±15V, T_j=25°C		171		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			433		ns
t_f	Fall Time			41		ns
E_{on}	Turn-On Switching Loss			18.2		mJ
E_{off}	Turn-Off Switching Loss			13.4		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=500V,I_C=300A, R_G=1.5Ω,V_{GE}=±15V, T_j=125°C		193		ns
t_r	Rise Time			54		ns
$t_{d(off)}$	Turn-Off Delay Time			546		ns
t_f	Fall Time			93		ns
E_{on}	Turn-On Switching Loss			25.7		mJ
E_{off}	Turn-Off Switching Loss			26.8		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=500V,I_C=300A, R_G=1.5Ω,V_{GE}=±15V, T_j=150°C		203		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			628		ns
t_f	Fall Time			93		ns
E_{on}	Turn-On Switching Loss			27.8		mJ
E_{off}	Turn-Off Switching Loss			30.9		mJ
I_{SC}	SC Data	t_P≤10μs,V_{GE}=15V, T_j=150°C,V_{CC}=900V, V_{CEM}≤1200V		1600		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_i=25°C		1.55	1.80	V
		I_F=300A,V_{GE}=0V,T_j=125°C		1.50		
		I_F=300A,V_{GE}=0V,T_j=150°C		1.45		
Q_r	Recovered Charge	V_R=500V,I_F=300A, -di/dt=3150A/μs,V_{GE}=-15V T_j=25°C		25.7		μC
I_{RM}	Peak Reverse Recovery Current			229		A
E_{rec}	Reverse Recovery Energy			6.7		mJ
Q_r	Recovered Charge	V_R=500V,I_F=300A, -di/dt=3150A/μs,V_{GE}=-15V T_j=125°C		49.0		μC
I_{RM}	Peak Reverse Recovery Current			380		A
E_{rec}	Reverse Recovery Energy			17.1		mJ
Q_r	Recovered Charge	V_R=500V,I_F=300A, -di/dt=3150A/μs,V_{GE}=-15V T_j=150°C		57.0		μC
I_{RM}	Peak Reverse Recovery Current			380		A
E_{rec}	Reverse Recovery Energy			20.0		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
△p	Pressure Drop Cooling Circuit △V/△t=10.0dm^3/min;T_F=25°C;Cooling Fluid=50% Water/50% Ethylene Glycol		100		mbar
p	Maximum Pressure In Cooling Circuit			2.5	bar
L_{CE}	Stray Inductance		14		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.80		mΩ
R_{thJF}	Junction-to-Cooling Fluid (per IGBT) Junction-to-Cooling Fluid (per Diode)			0.100 0.125	K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 3.0		5.0 6.0	N.m
G	Weight of Module		1250		g

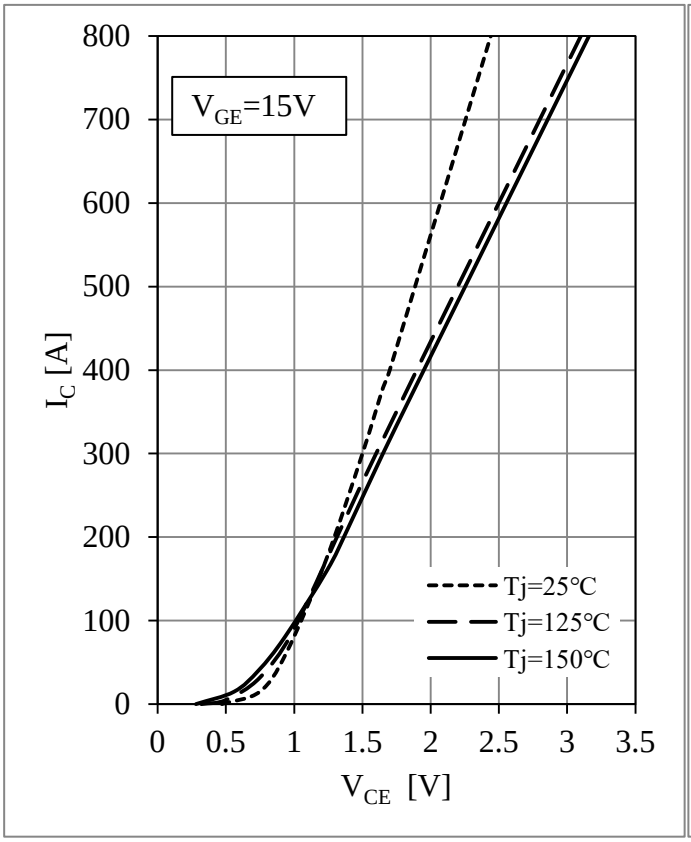


Fig 1. IGBT Output Characteristics

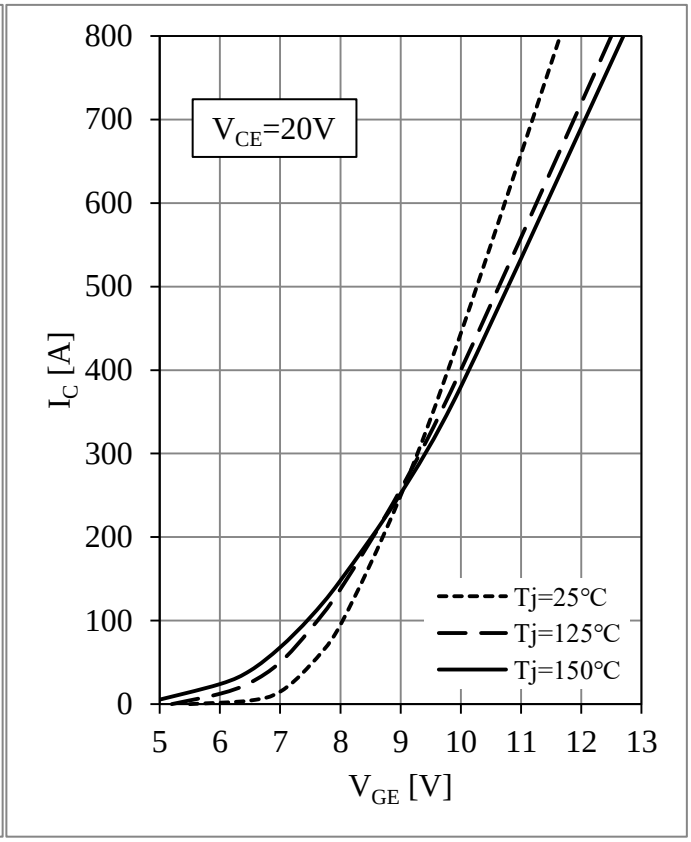


Fig 2. IGBT Transfer Characteristics

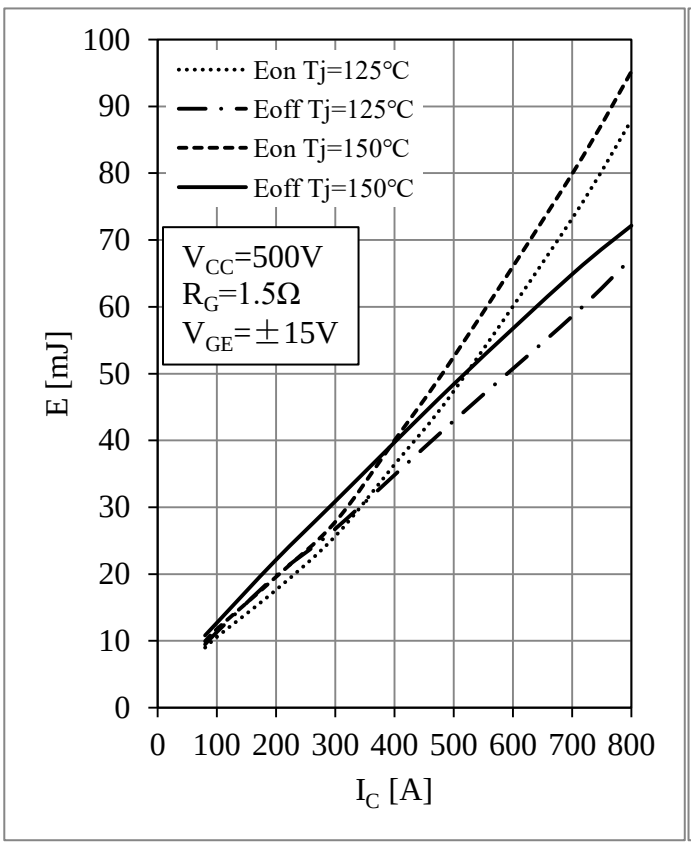


Fig 3. IGBT Switching Loss vs. I_C

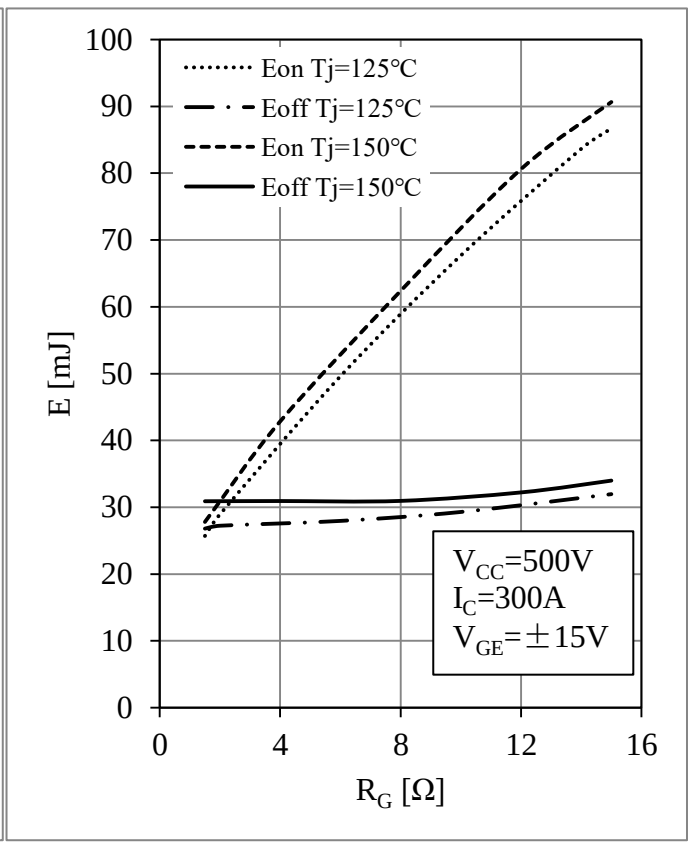


Fig 4. IGBT Switching Loss vs. R_G

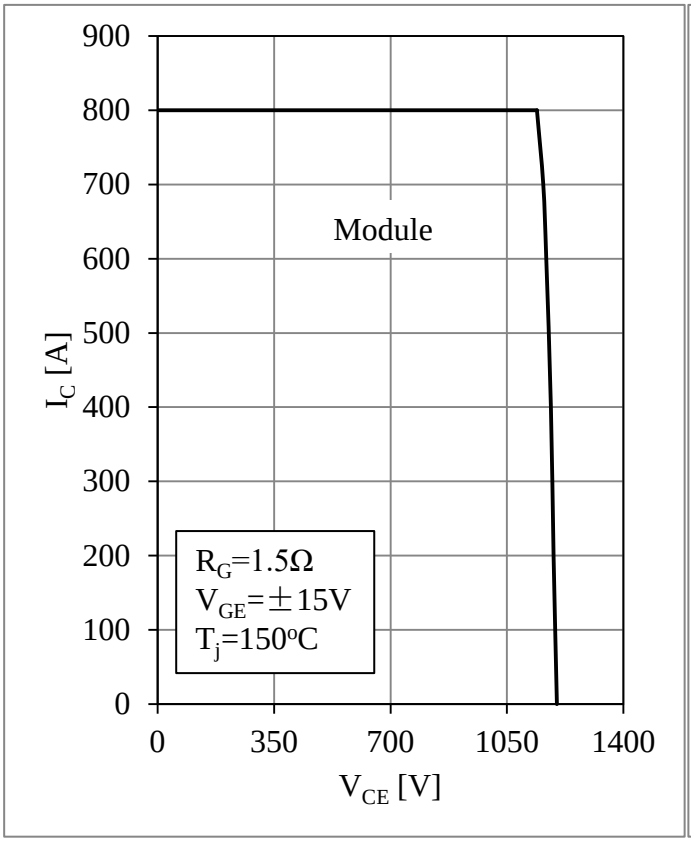


Fig 5. RBSOA

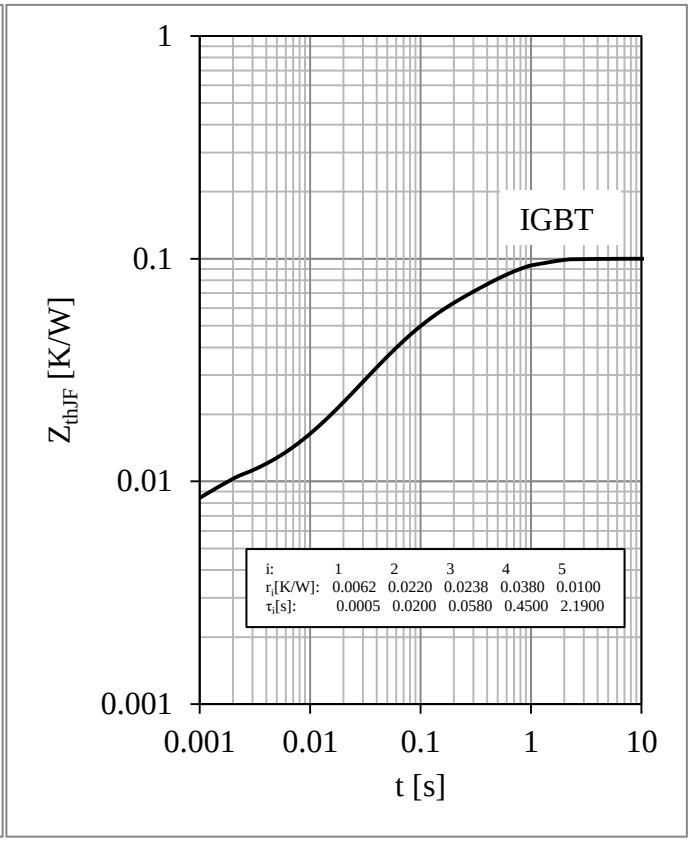


Fig 6. IGBT Transient Thermal Impedance

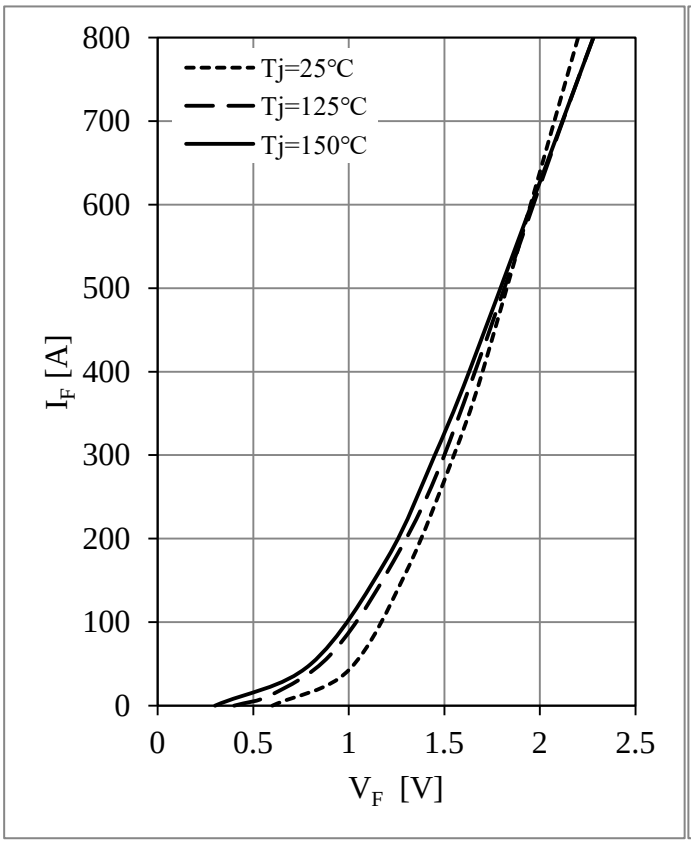


Fig 7. Diode Forward Characteristics

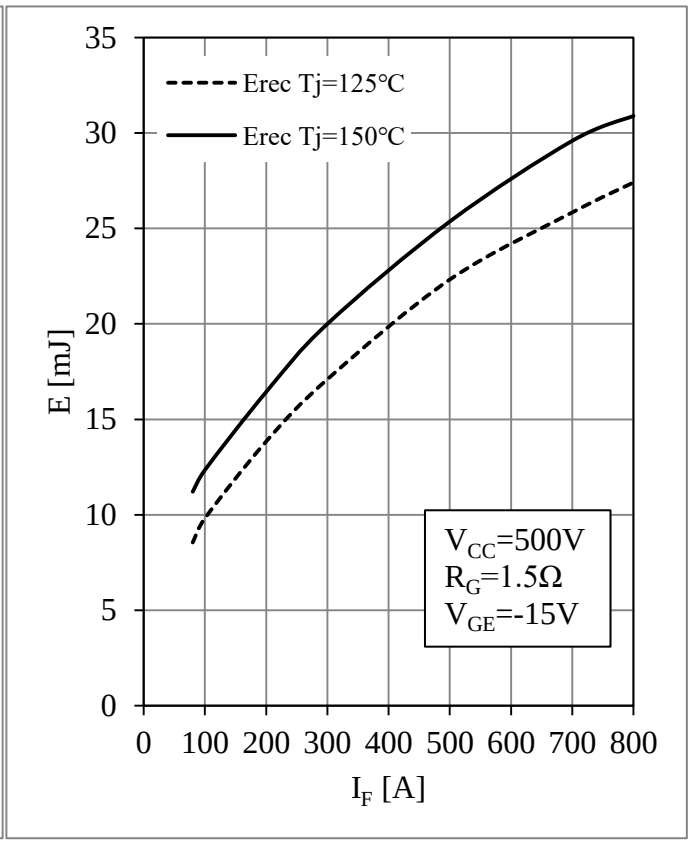


Fig 8. Diode Switching Loss vs. I_F

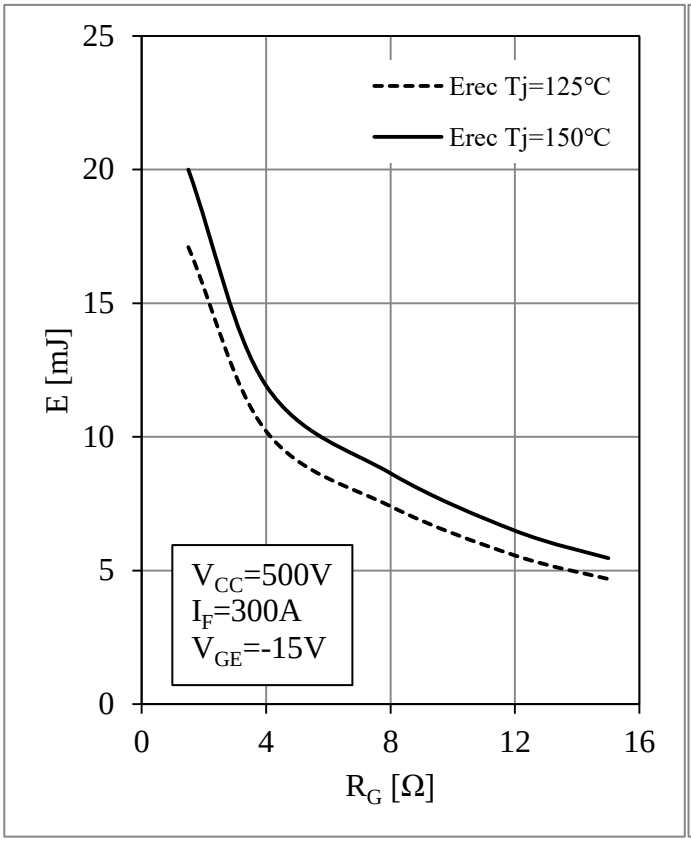


Fig 9. Diode Switching Loss vs. R_G

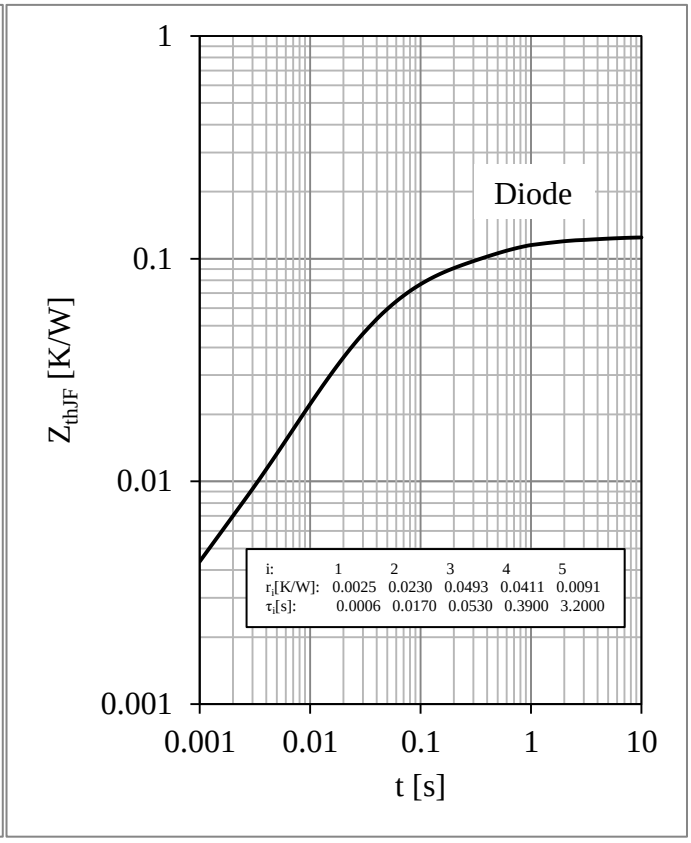


Fig 10. Diode Transient Thermal Impedance

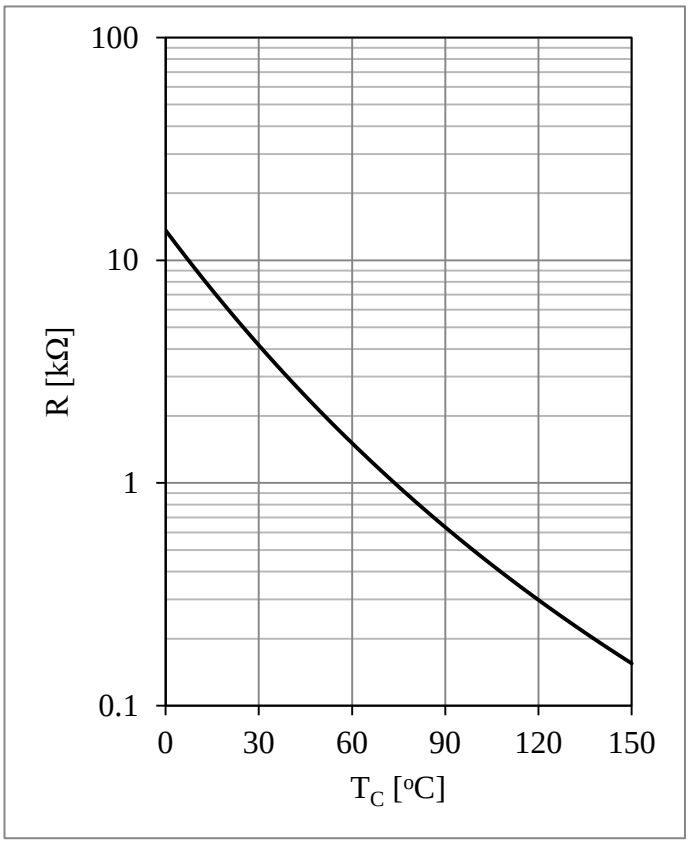
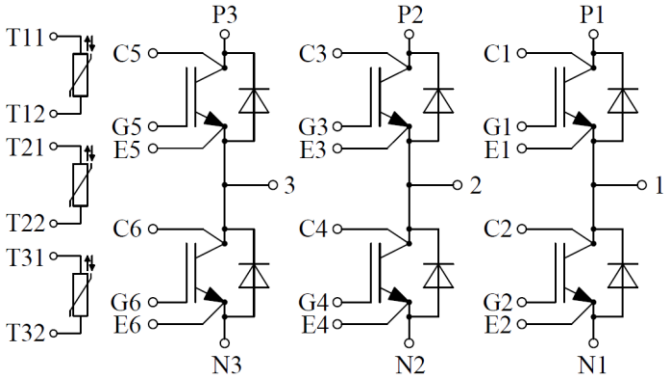


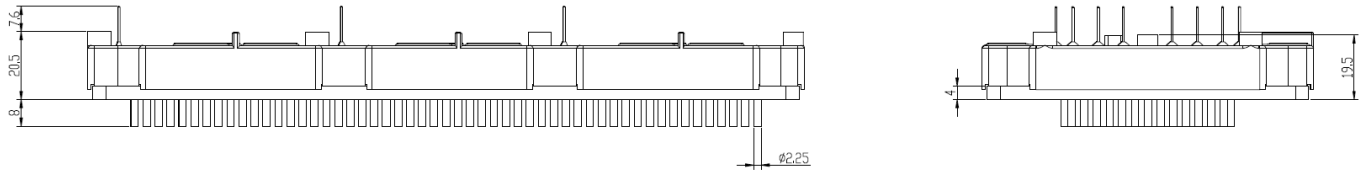
Fig 11. NTC Temperature Characteristic

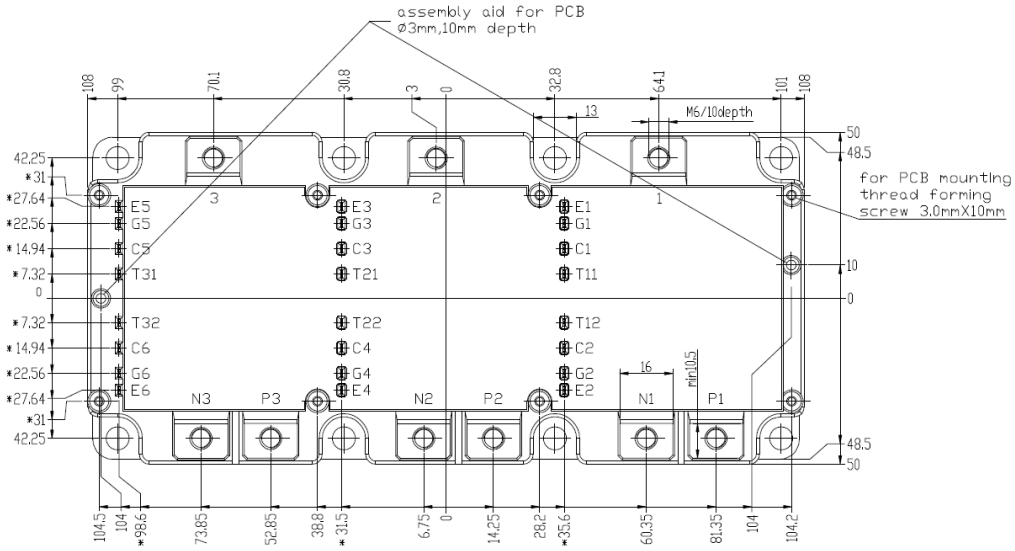
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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