STARPOWER

SEMICONDUCTOR **IGBT**

GD400HTA120P7H_T1

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.

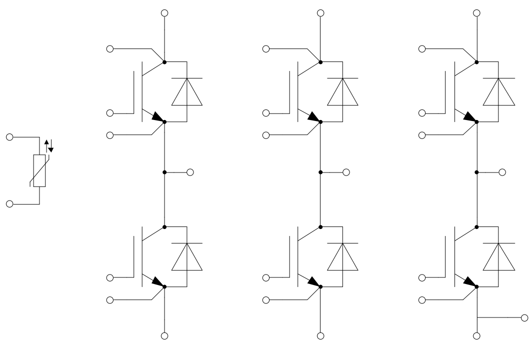
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- 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	1200	V
V_{GES}	Gate-Emitter Voltage	±20	V
I_{CN}	Implemented Collector Current	400	A
I_C	Collector Current @ T_F=75°C	315	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	800	A
P_D	Maximum Power Dissipation @ T_F=75°C T_{vj}=175°C	690	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Collector Current	400	A
I_F	Diode Continuous Forward Currentt @ T_F=75°C	230	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	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=150A,V_{GE}=15V, T_{vj}=25°C		1.15	1.60	V
		I_C=150A,V_{GE}=15V, T_{vj}=125°C		1.20		
		I_C=150A,V_{GE}=15V, T_{vj}=150°C		1.20		
		I_C=260A,V_{GE}=15V, T_{vj}=25°C		1.35		
		I_C=260A,V_{GE}=15V, T_{vj}=150°C		1.55		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	I_C=10.4mA,V_{CE}=V_{GE}, T_{vj}=25°C		6.4		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			2.50		Ω
C_{ies}	Input Capacitance	V_{CE}=25V,f=100kHz, V_{GE}=0V		54.1		nF
C_{oes}	Output Capacitance			1.04		nF
C_{res}	Reverse Transfer Capacitance			0.35		nF
Q_G	Gate Charge	V_{CE} =600V,I_C =260A, V_{GE}=-8…+15V		3.54		μC
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=3.3Ω,L_S=20nH, V_{GE}=-8/+15V, T_{vj}=25°C		325		ns
t_r	Rise Time			87		ns
$t_{d(off)}$	Turn-Off Delay Time			929		ns
t_f	Fall Time			135		ns
E_{on}	Turn-On Switching Loss			47.4		mJ
E_{off}	Turn-Off Switching Loss			32.5		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=3.3Ω,L_S=20nH, V_{GE}=-8/+15V, T_{vj}=125°C		362		ns
t_r	Rise Time			107		ns
$t_{d(off)}$	Turn-Off Delay Time			1039		ns
t_f	Fall Time			218		ns
E_{on}	Turn-On Switching Loss			65.1		mJ
E_{off}	Turn-Off Switching Loss			41.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{CC}=600V,I_C=400A, R_G=3.3Ω,L_S=20nH, V_{GE}=-8/+15V, T_{vj}=150°C		368		ns
t_r	Rise Time			112		ns
$t_{d(off)}$	Turn-Off Delay Time			1062		ns
t_f	Fall Time			233		ns
E_{on}	Turn-On Switching Loss			68.5		mJ
E_{off}	Turn-Off Switching Loss			43.4		mJ
I_{SC}	SC Data	t_P≤6μs,V_{GE}=15V, T_{vj}=150°C,V_{CC}=800V, 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=150A,V_{GE}=0V,T_{vj}=25°C		1.45	1.90	V
		I_F=150A,V_{GE}=0V,T_{vj}=125°C		1.40		
		I_F=150A,V_{GE}=0V,T_{vj}=150°C		1.35		
		I_F=260A,V_{GE}=0V,T_{vj}=25°C		1.65		
		I_F=260A,V_{GE}=0V,T_{vj}=150°C		1.65		
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=4038A/μs, L_S=20nH, V_{GE}=-8V,T_{vj}=25°C		26.6		μC
I_{RM}	Peak Reverse Recovery Current			196		A
E_{rec}	Reverse Recovery Energy			7.19		mJ
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=3319A/μs, L_S=20nH, V_{GE}=-8V,T_{vj}=125°C		42.5		μC
I_{RM}	Peak Reverse Recovery Current			210		A
E_{rec}	Reverse Recovery Energy			11.9		mJ
Q_r	Recovered Charge	V_R=600V,I_F=400A, -di/dt=3202A/μs, L_S=20nH, V_{GE}=-8V,T_{vj}=150°C		47.0		μC
I_{RM}	Peak Reverse Recovery Current			217		A
E_{rec}	Reverse Recovery Energy			13.3		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 ΔV/Δt=10.0dm3/min;TF=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=10.0dm^3/min,T_F=75°C		0.126 0.188	0.145 0.216	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

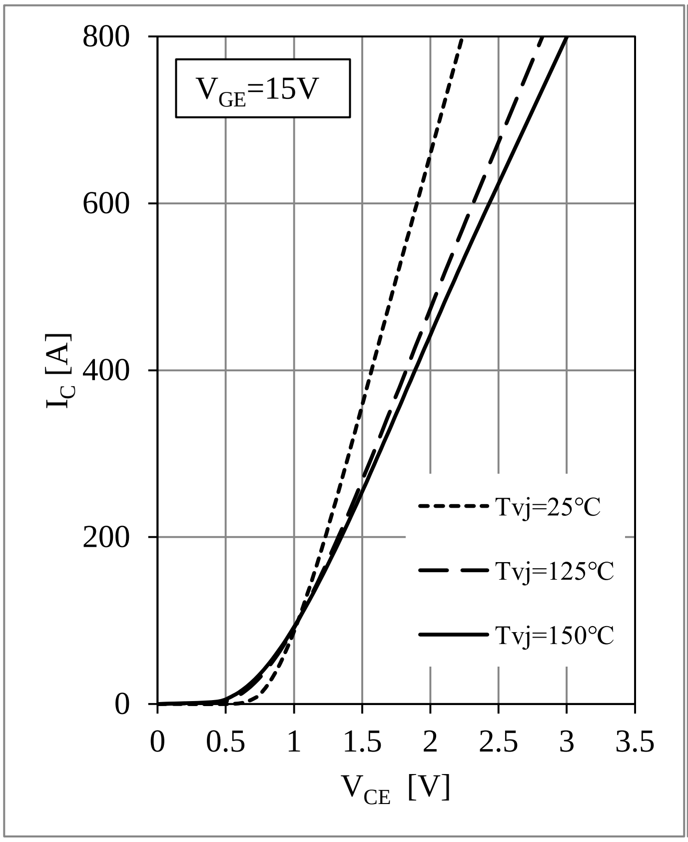


Fig 1. IGBT Output Characteristics

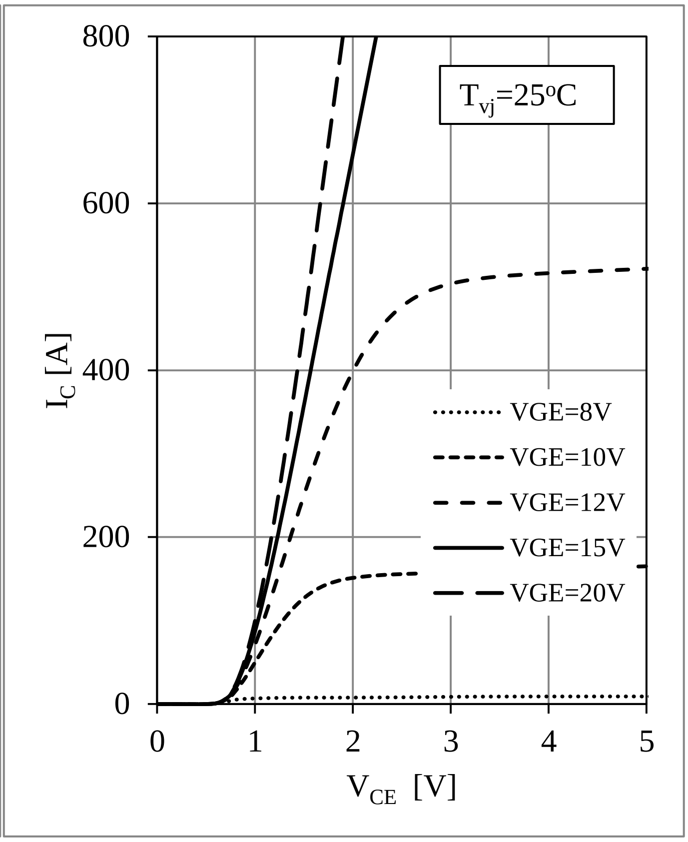


Fig 2. IGBT Output Characteristics

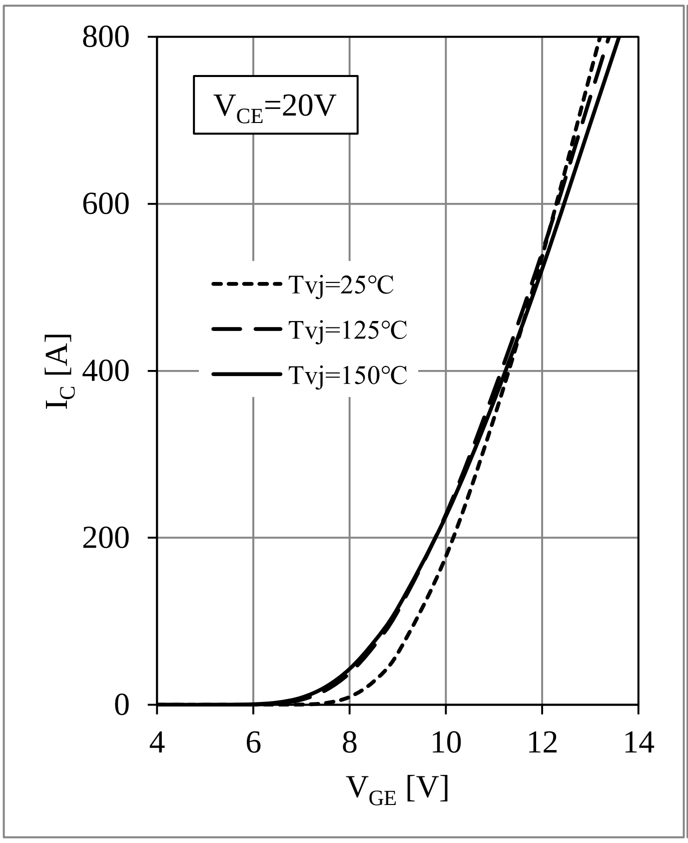


Fig 3. IGBT Transfer Characteristics

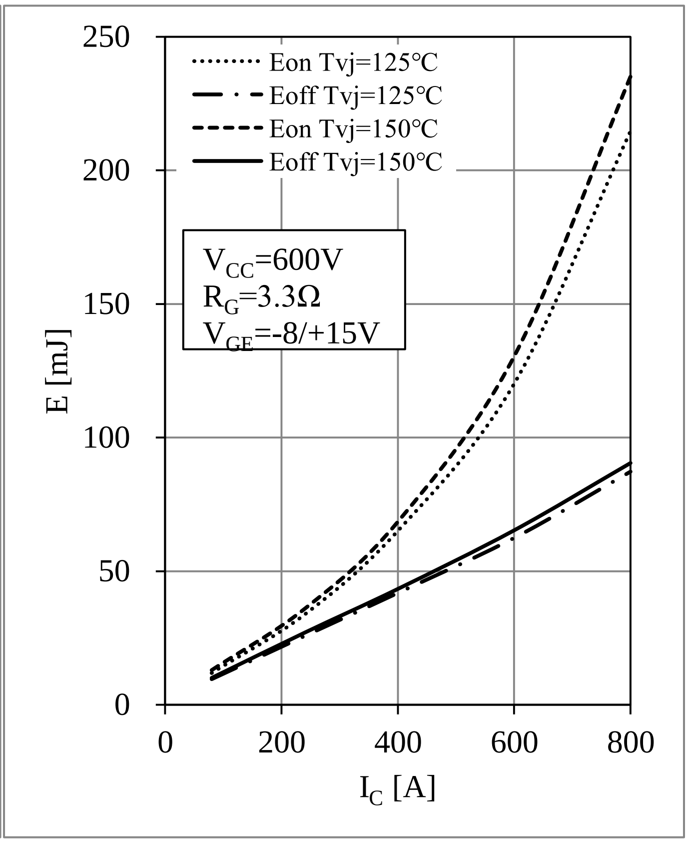


Fig 4. IGBT Switching Loss vs. I_C

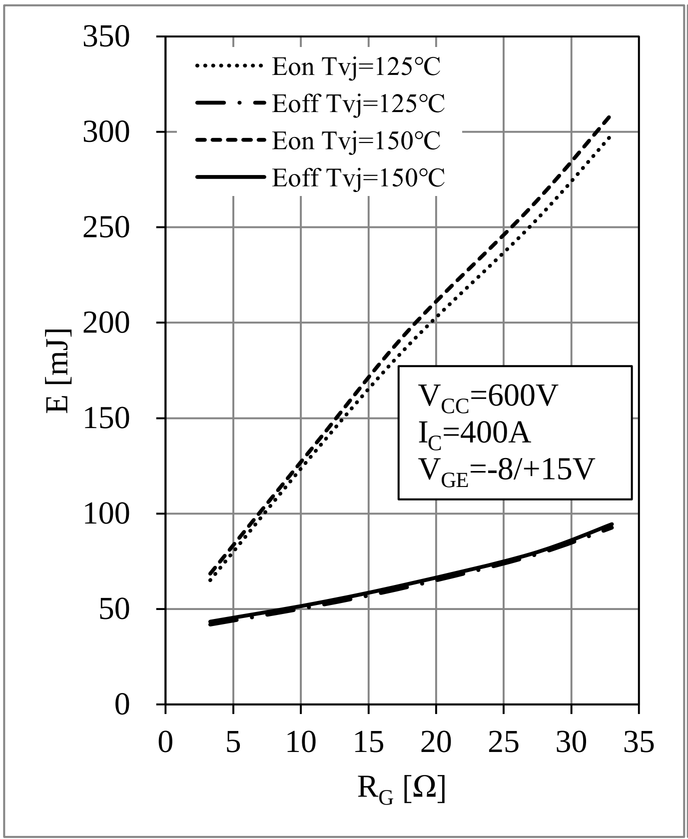


Fig 5. IGBT Switching Loss vs. R_G

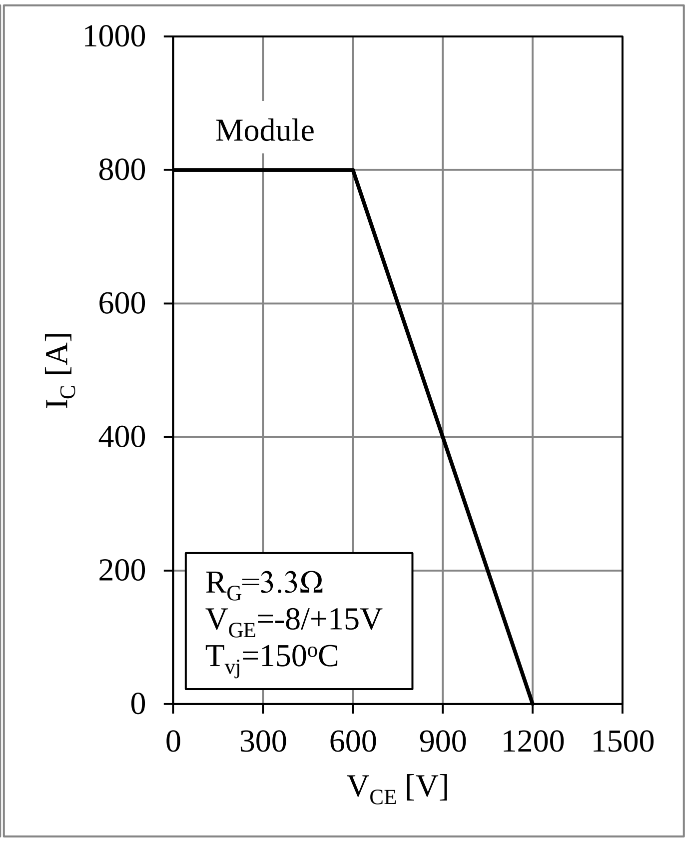


Fig 6. RBSOA

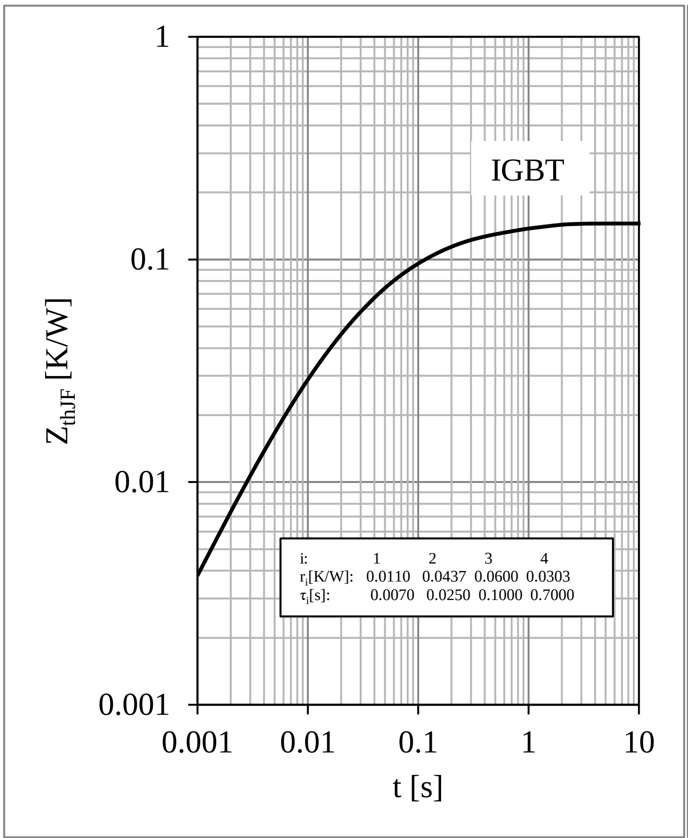


Fig 7. IGBT Transient Thermal Impedance

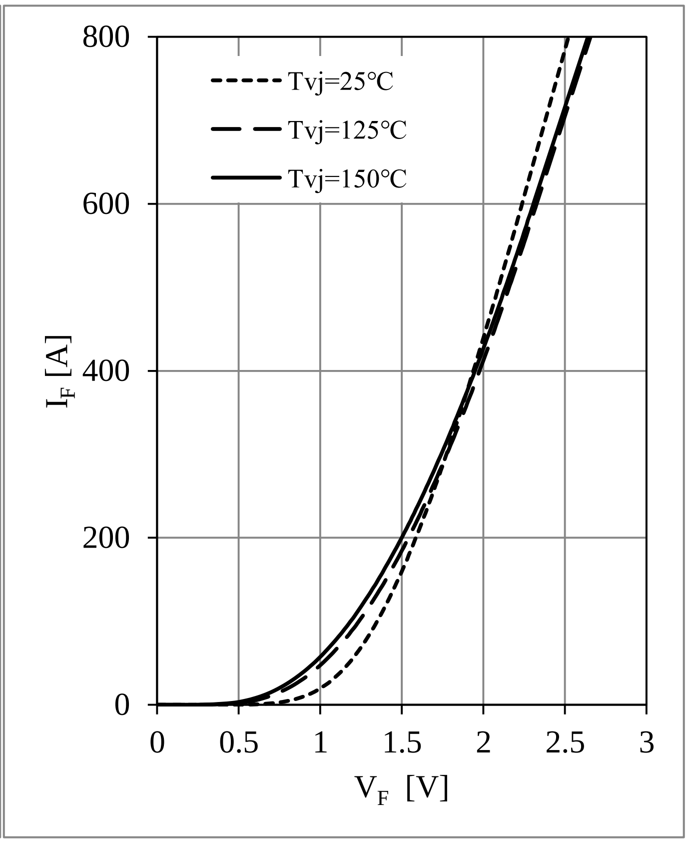


Fig 8. Diode Forward Characteristics

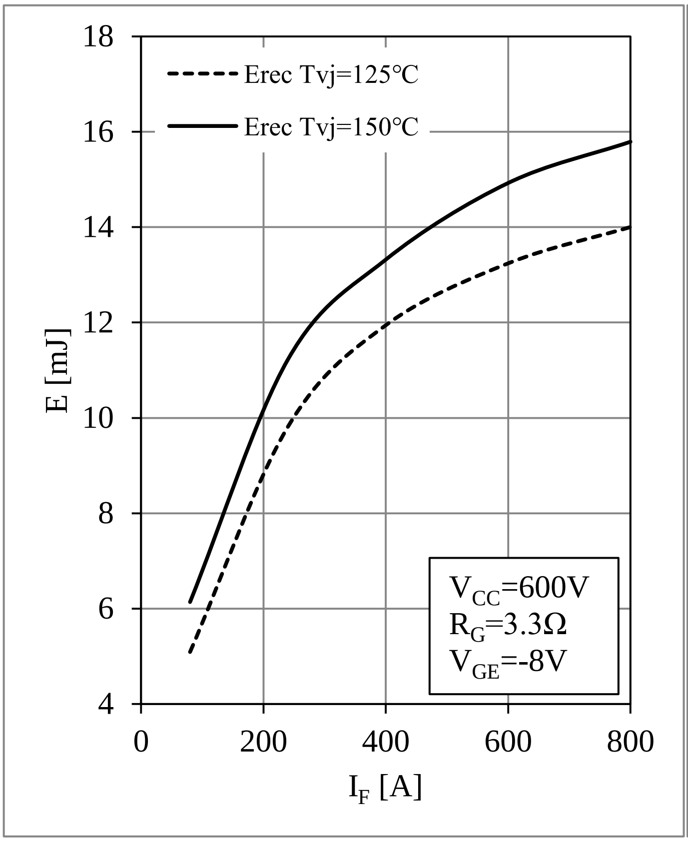


Fig 9. Diode Switching Loss vs. I_F

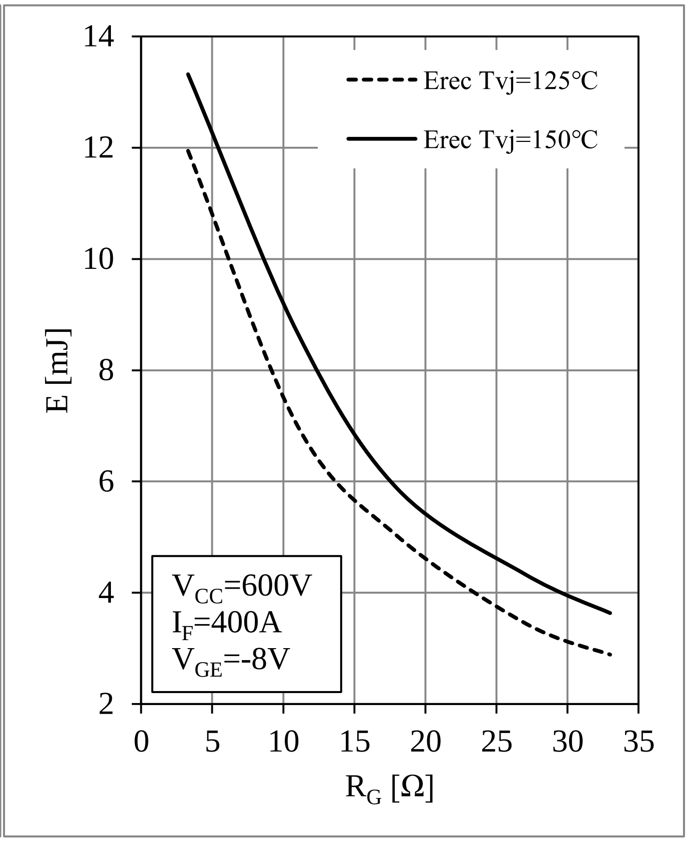


Fig 10. Diode Switching Loss vs. R_G

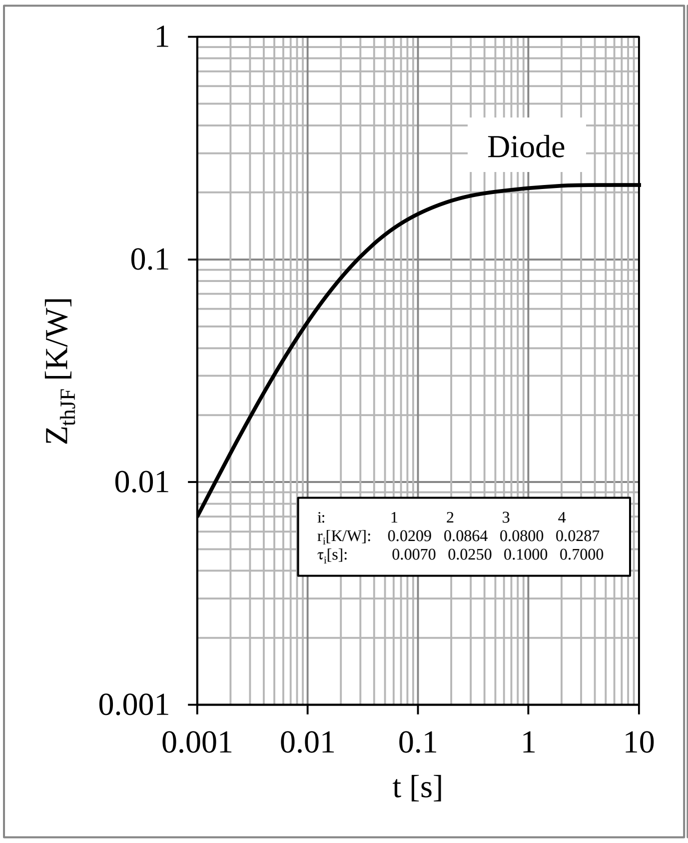


Fig 11. Diode Transient Thermal Impedance

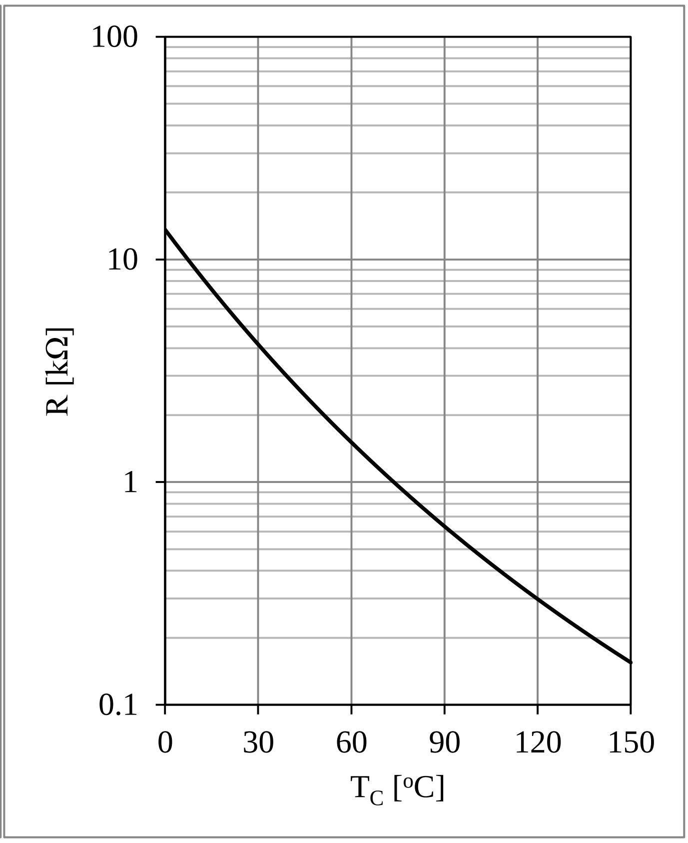
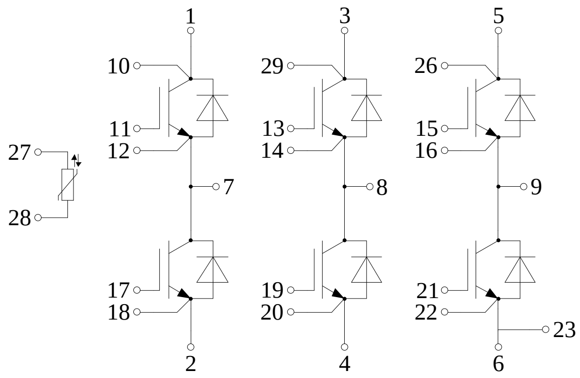


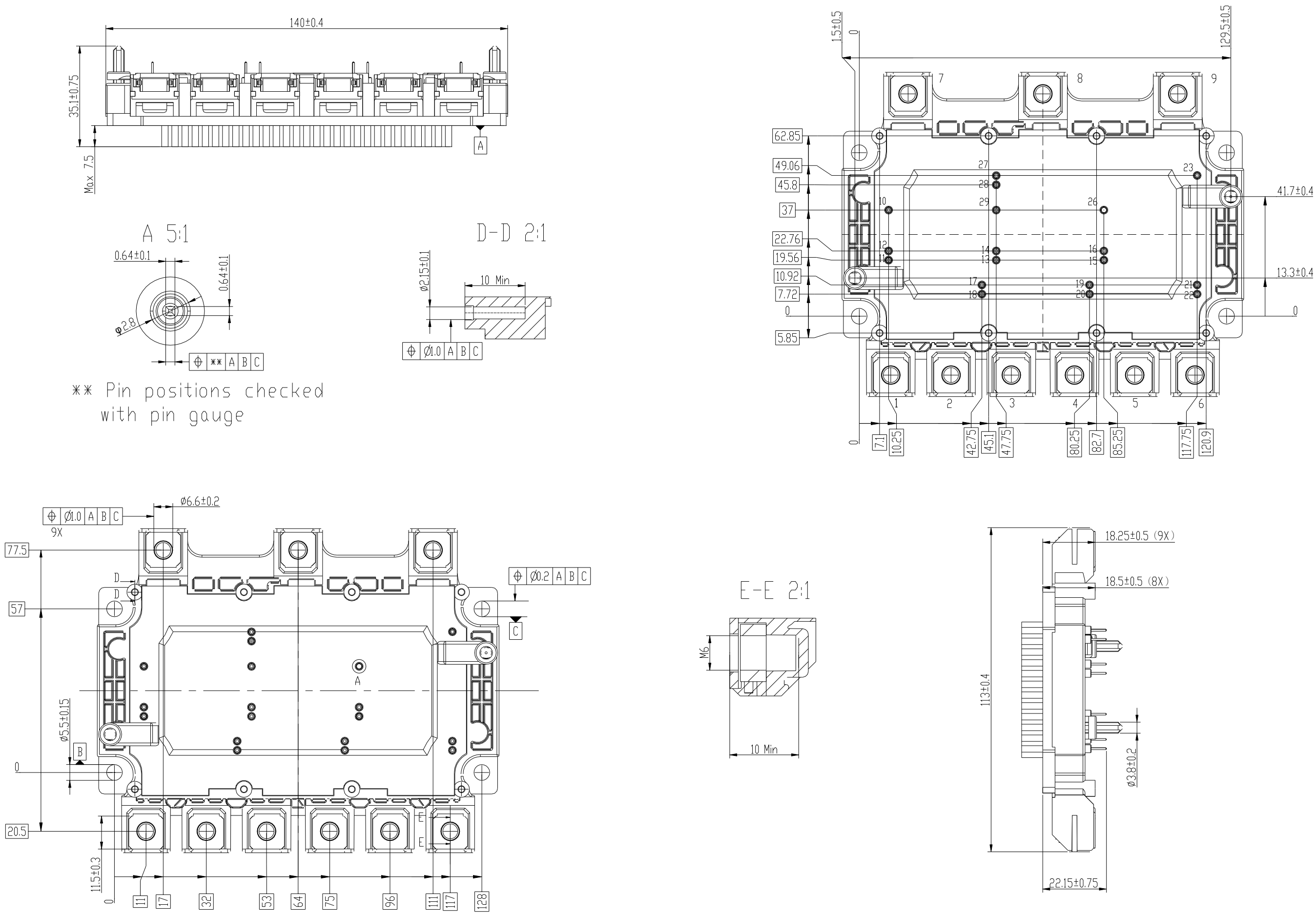
Fig 12. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.