

STARPOWER

SEMICONDUCTOR

IGBT

GD480HTA120P8HT

1200V/480A 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.

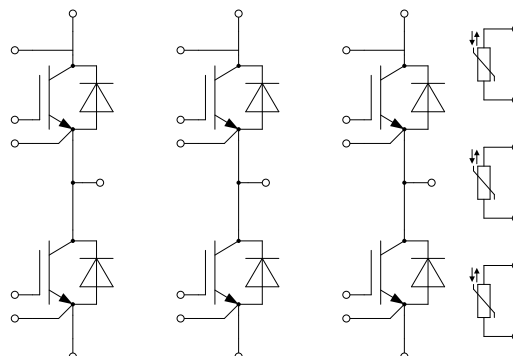
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- Low switching losses
- 5 μ s 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 Si₃N₄ AMB technology

Typical Applications

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

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_F=25^{\circ}\text{C}$ 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	480	A
I_C	Collector Current @ $T_F=75^{\circ}\text{C}$	360	A
I_{CRM}	Repetitive Peak Collector Current tp limited by T_{vjop}	960	A
P_D	Maximum Power Dissipation @ $T_F=75^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$	746	W

Diode

Symbol	Description	Values	Unit
V_{RRM}	Repetitive Peak Reverse Voltage	1200	V
I_{FN}	Implemented Collector Current	480	A
I_F	Diode Continuous Forward Current	360	A
I_{FRM}	Repetitive Peak Forward Current tp limited by T_{vjop}	960	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	Operating Junction Temperature continuous	-40 to +175	$^{\circ}\text{C}$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
V_{ISO}	Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$	2500	V

IGBT Characteristics $T_F=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=360\text{A}, V_{GE}=15\text{V}, T_{vj}=25^\circ\text{C}$		1.45	1.90	V	
		$I_C=360\text{A}, V_{GE}=15\text{V}, T_{vj}=125^\circ\text{C}$		1.65			
		$I_C=360\text{A}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}$		1.70			
		$I_C=480\text{A}, V_{GE}=15\text{V}, T_{vj}=25^\circ\text{C}$		1.60			
		$I_C=480\text{A}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}$		1.95			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=10.4\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^\circ\text{C}$		6.0		V	
I_{CES}	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$			1.0	mA	
I_{GES}	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^\circ\text{C}$			400	nA	
R_{Gint}	Internal Gate Resistance			1.5		Ω	
C_{ies}	Input Capacitance			32.5		nF	
C_{oes}	Output Capacitance	$V_{CE}=50\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		1.03		nF	
C_{res}	Reverse Transfer Capacitance	$V_{GE}=0\text{V}$		0.17		nF	
Q_G	Gate Charge	$V_{CE}=800\text{V}, I_C=400\text{A}, V_{GE}=-15\dots+15\text{V}$		2.34		μC	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=800\text{V}, I_C=360\text{A}, R_{Gon}=4.3\Omega, R_{Goff}=1.5\Omega, L_S=20\text{nH}, T_{vj}=25^\circ\text{C}$		183		ns	
t_r	Rise Time			48		ns	
$t_{d(off)}$	Turn-Off Delay Time			669		ns	
t_f	Fall Time			100		ns	
E_{on}	Turn-On Switching Loss			31.3		mJ	
E_{off}	Turn-Off Switching Loss			37.1		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=800\text{V}, I_C=360\text{A}, R_{Gon}=4.3\Omega, R_{Goff}=1.5\Omega, L_S=20\text{nH}, T_{vj}=125^\circ\text{C}$		198		ns
t_r	Rise Time				55		ns
$t_{d(off)}$	Turn-Off Delay Time				712		ns
t_f	Fall Time				178		ns
E_{on}	Turn-On Switching Loss			47.5		mJ	
E_{off}	Turn-Off Switching Loss			48.3		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=800\text{V}, I_C=360\text{A}, R_{Gon}=4.3\Omega, R_{Goff}=1.5\Omega, L_S=20\text{nH}, T_{vj}=150^\circ\text{C}$			202		ns
t_r	Rise Time				58		ns
$t_{d(off)}$	Turn-Off Delay Time				730		ns
t_f	Fall Time				200		ns
E_{on}	Turn-On Switching Loss			52.4		mJ	
E_{off}	Turn-Off Switching Loss			51.2		mJ	
I_{SC}	SC Data		$t_p \leq 5\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		1900		A

Diode Characteristics $T_F=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_F	Diode Forward Voltage	$I_F=360\text{A}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$		1.90	2.35	V
		$I_F=360\text{A}, V_{GE}=0\text{V}, T_{vj}=125^\circ\text{C}$		1.90		
		$I_F=360\text{A}, V_{GE}=0\text{V}, T_{vj}=150^\circ\text{C}$		1.85		
		$I_F=480\text{A}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$		2.05		
		$I_F=480\text{A}, V_{GE}=0\text{V}, T_{vj}=150^\circ\text{C}$		2.10		
Q_r	Recovered Charge			31.6		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=800\text{V}, I_F=360\text{A},$ $-di/dt=7670\text{A}/\mu\text{s}, L_S=20\text{nH},$ $V_{GE}=-8\text{V}, T_{vj}=25^\circ\text{C}$		310		A
E_{rec}	Reverse Recovery Energy			13.0		mJ
Q_r	Recovered Charge			48.5		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=800\text{V}, I_F=360\text{A},$ $-di/dt=6561\text{A}/\mu\text{s}, L_S=20\text{nH},$ $V_{GE}=-8\text{V}, T_{vj}=125^\circ\text{C}$		332		A
E_{rec}	Reverse Recovery Energy			21.0		mJ
Q_r	Recovered Charge			54.2		μC
I_{RM}	Peak Reverse Recovery Current	$V_R=800\text{V}, I_F=360\text{A},$ $-di/dt=6242\text{A}/\mu\text{s}, L_S=20\text{nH},$ $V_{GE}=-8\text{V}, T_{vj}=150^\circ\text{C}$		338		A
E_{rec}	Reverse Recovery Energy			23.6		mJ

NTC Characteristics $T_F=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		$\text{k}\Omega$
$\Delta R/R$	Deviation of R_{100}	$T_C=100^\circ\text{C}, R_{100}=493.3\Omega$	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$		3433		K

Module Characteristics $T_F=25^\circ\text{C}$ 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		$\text{m}\Omega$
R_{thJF}	Junction-to-Cooling Fluid (per IGBT)			0.134	K/W
	Junction-to-Cooling Fluid (per Diode)			0.191	
G	Weight of Module		550		g

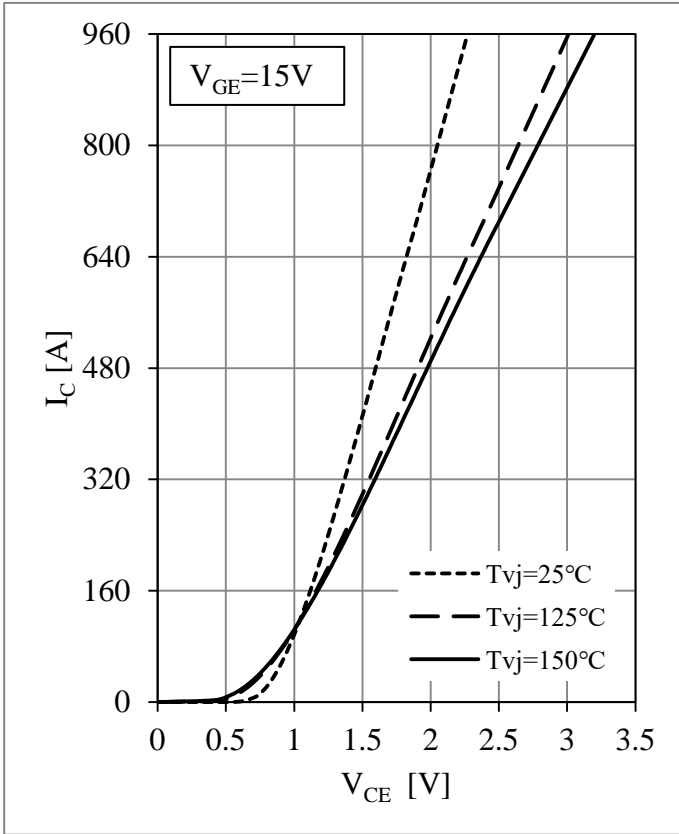


Fig 1. IGBT Output Characteristics

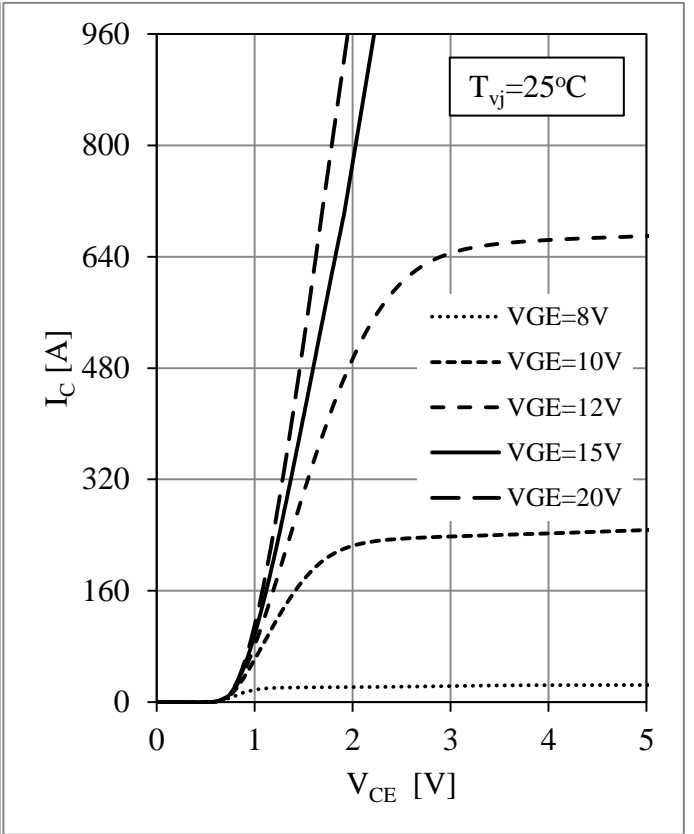


Fig 2. IGBT Output Characteristics

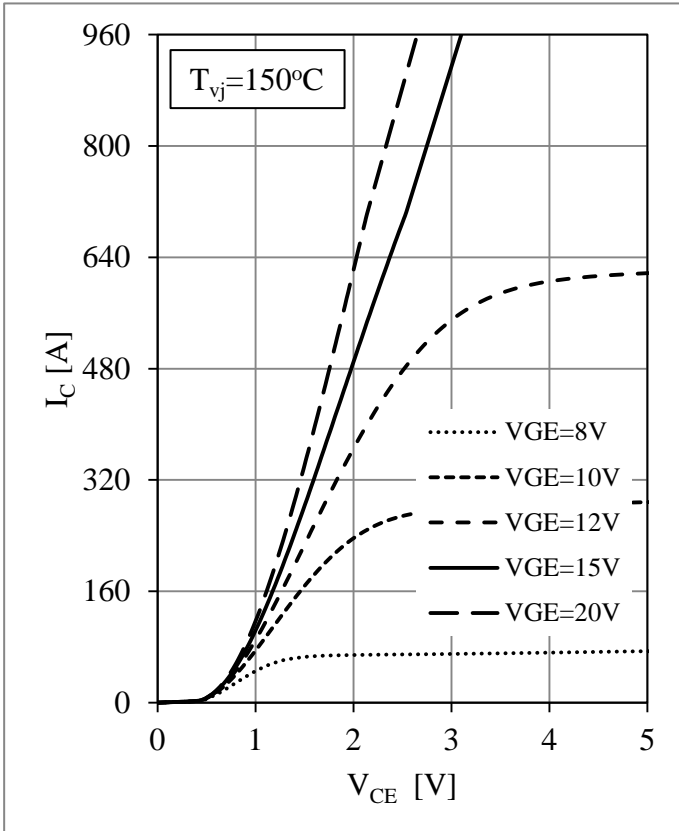


Fig 3. IGBT Output Characteristics

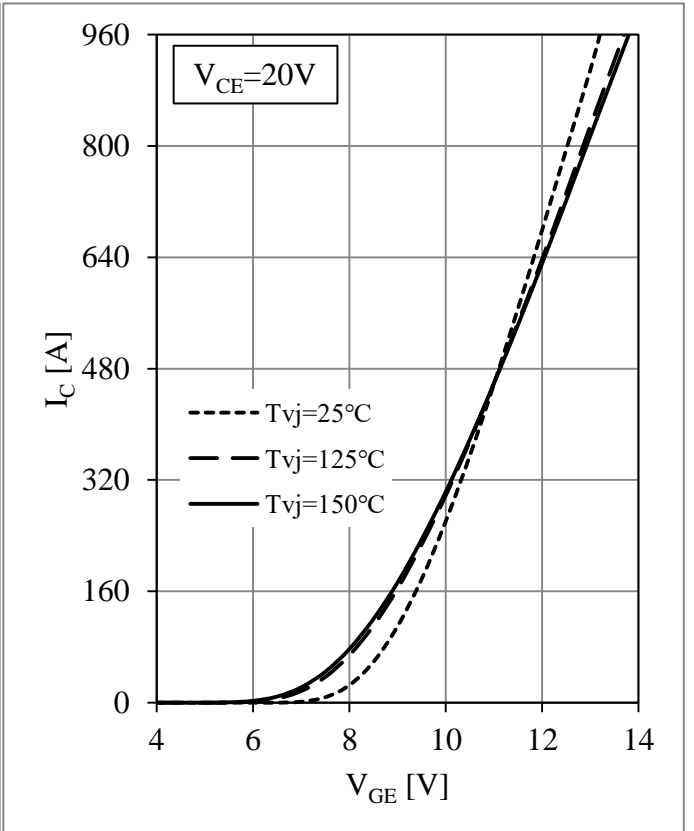


Fig 4. IGBT Transfer Characteristics

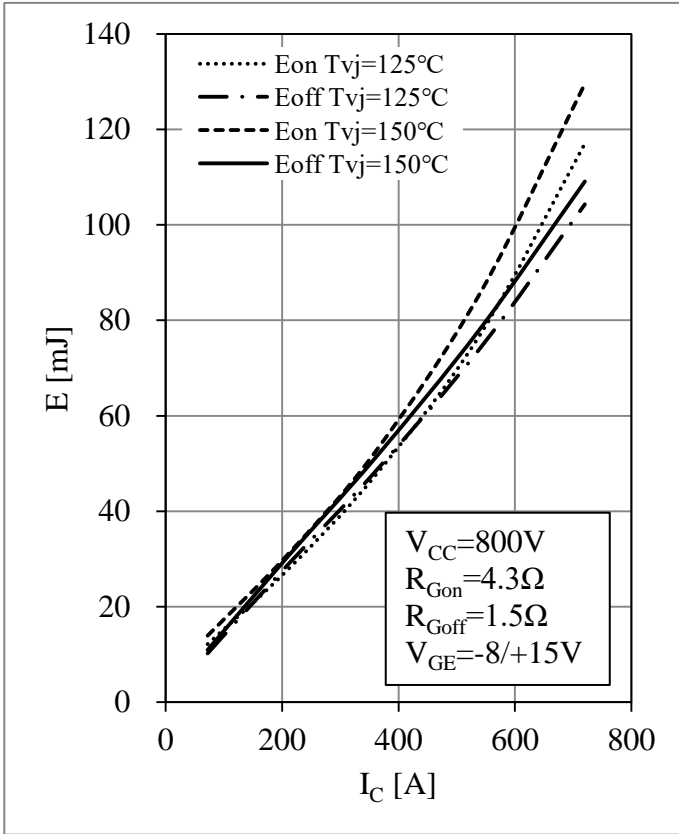


Fig 5. IGBT Switching Loss vs. I_C

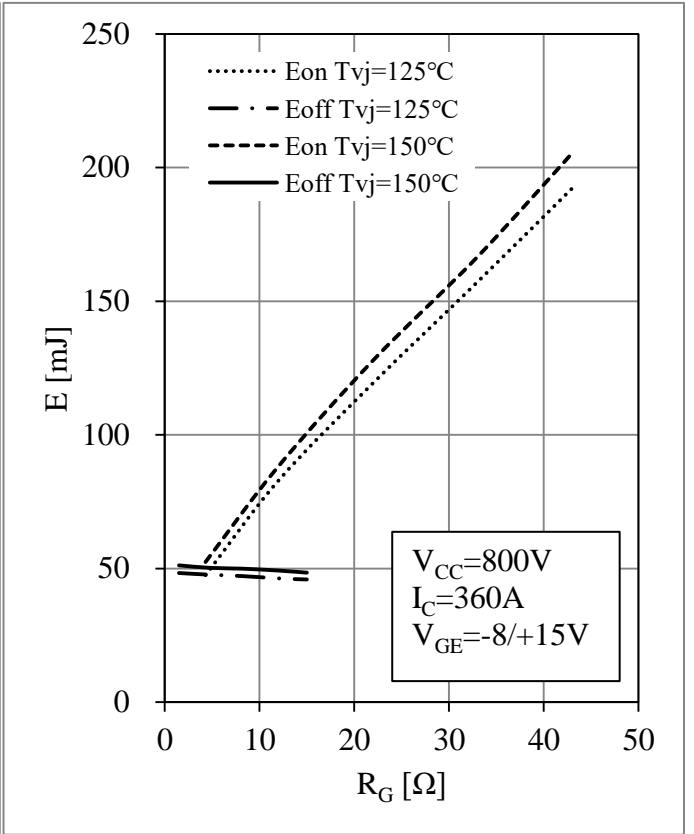


Fig 6. IGBT Switching Loss vs. R_G

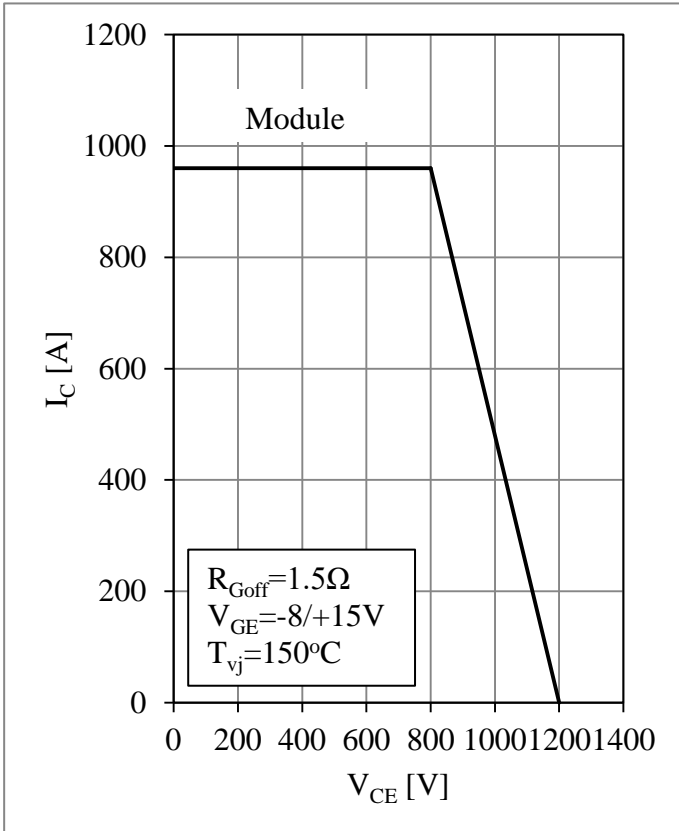


Fig 7. RBSOA

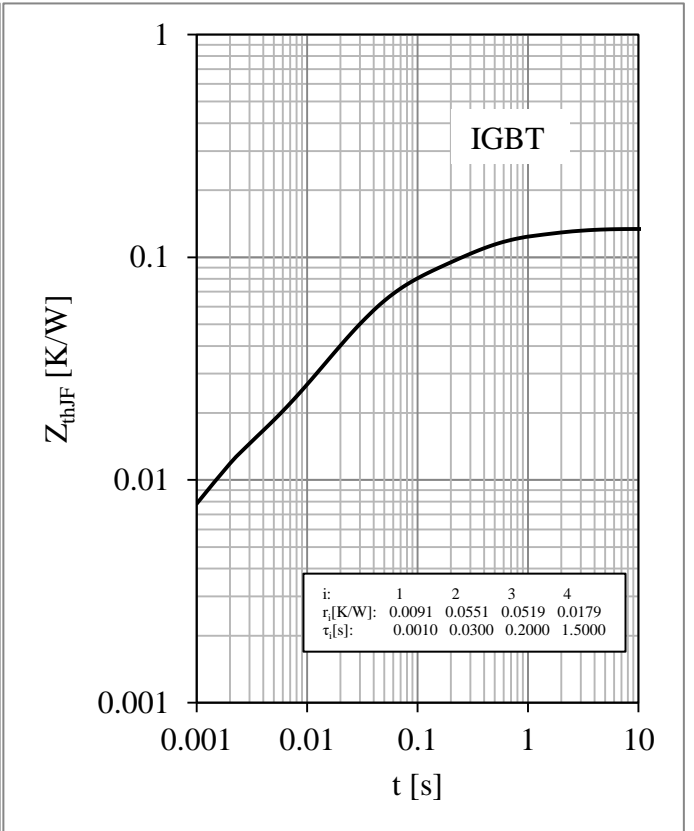


Fig 8. IGBT Transient Thermal Impedance

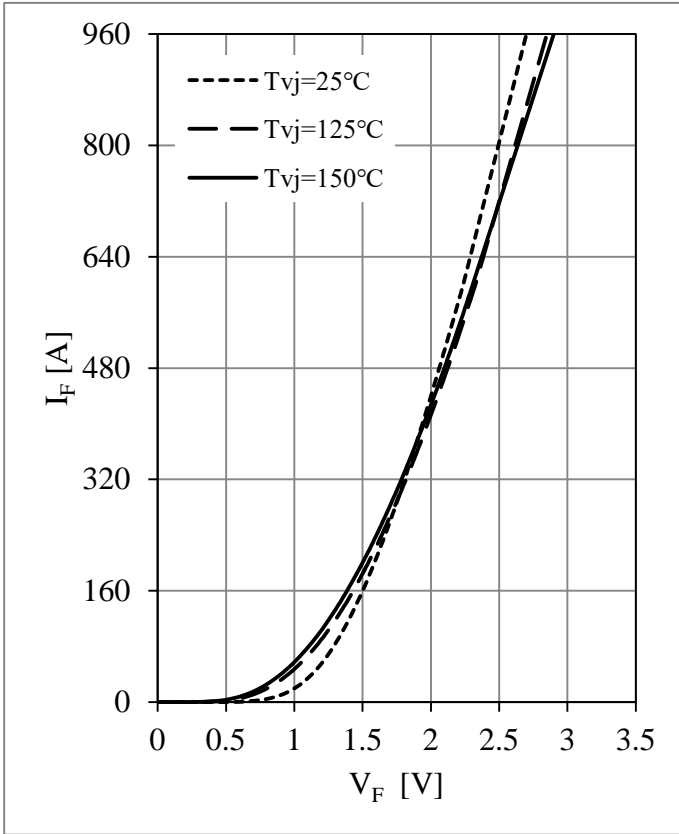


Fig 9. Diode Forward Characteristics

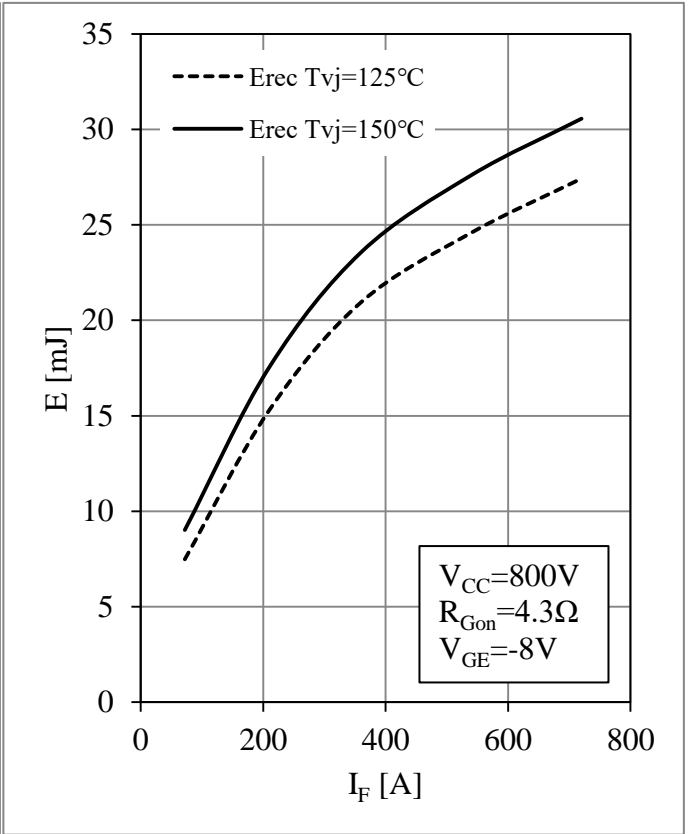


Fig 10. Diode Switching Loss vs. I_F

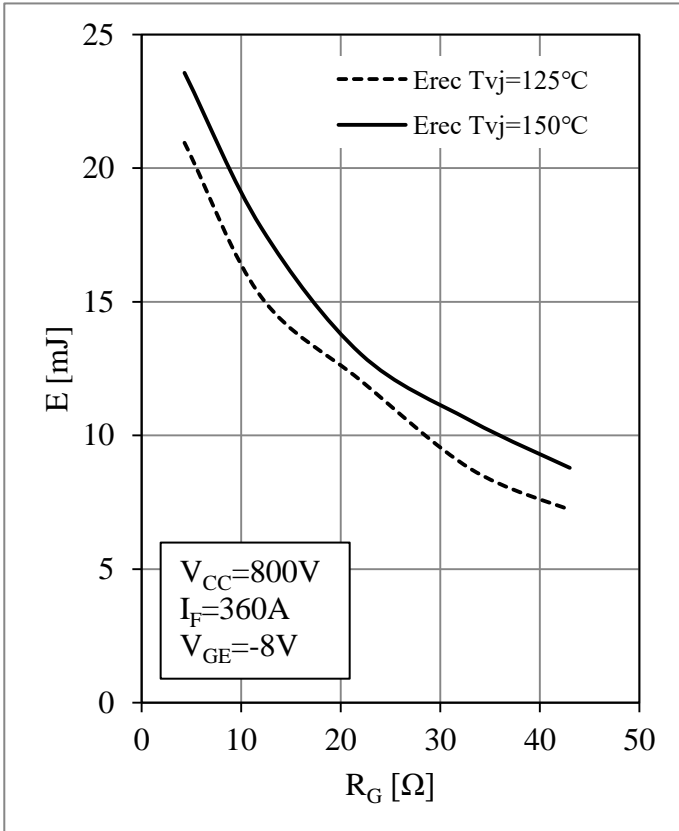


Fig 11. Diode Switching Loss vs. R_G

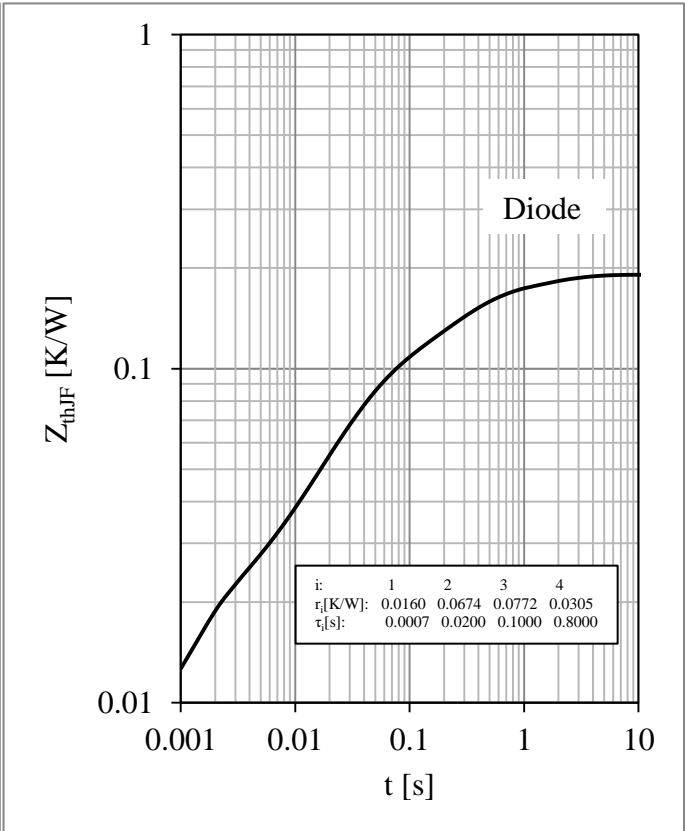


Fig 12. Diode Transient Thermal Impedance

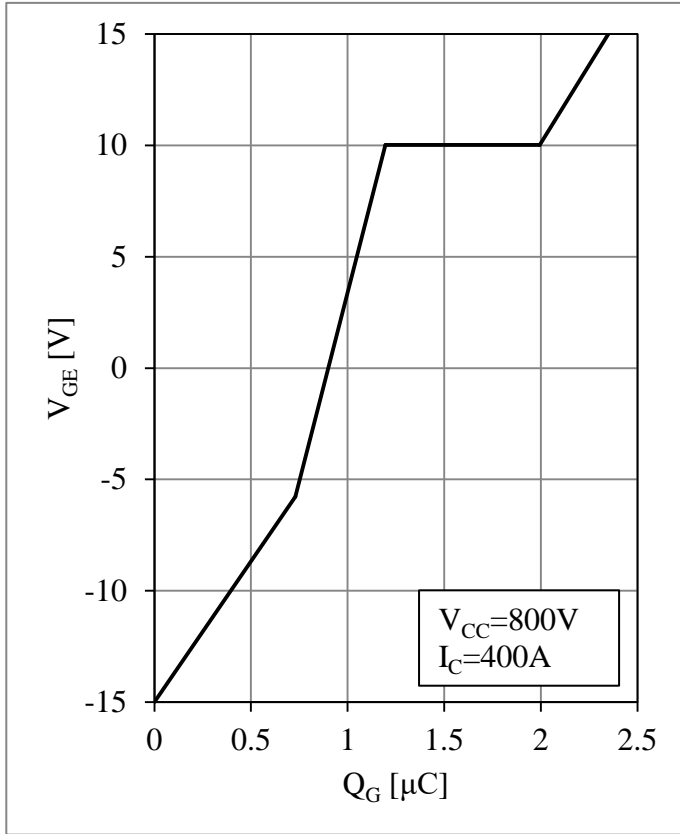


Fig 13. IGBT Gate Charge Characteristic

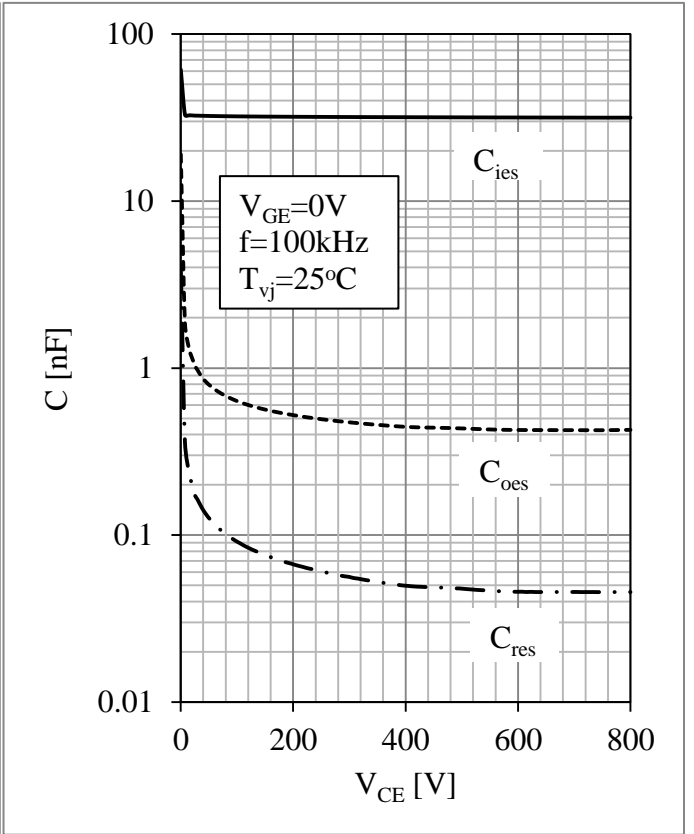


Fig 14. IGBT Capacity Characteristic

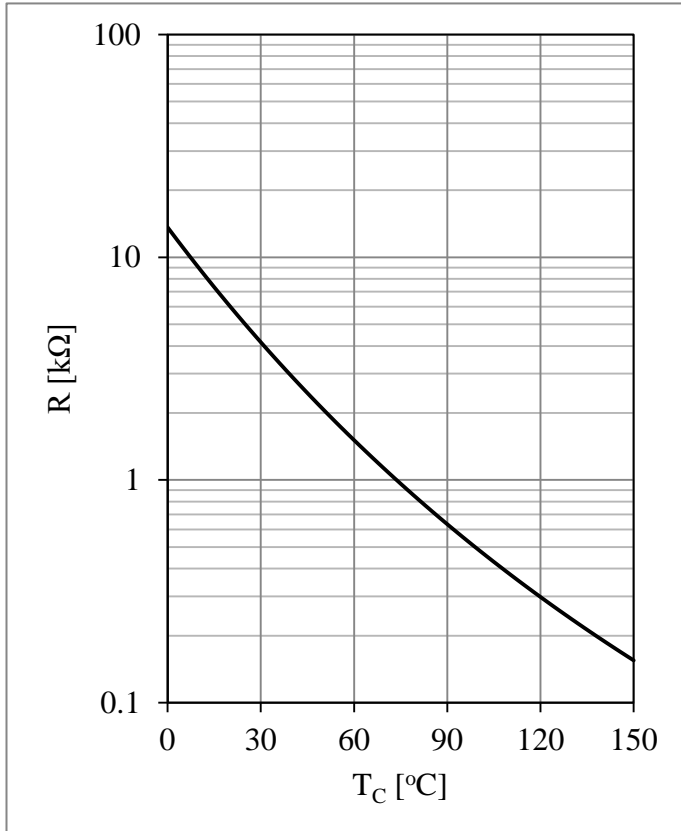


Fig 15. NTC Temperature Characteristic

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.