

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD200HFQ120C2SD

**1200V/200A 2 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 electronic welder and inductive heating.

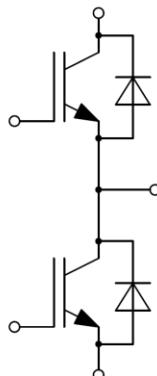
### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- 10 $\mu$ 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 baseplate using DBC technology

### Typical Applications

- Switching mode power supply
- Inductive heating
- Electronic welder

### Equivalent Circuit Schematic



**Absolute Maximum Ratings**  $T_C=25^{\circ}\text{C}$  unless otherwise noted**IGBT**

Symbol	Description	Values	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$	324	A
	@ $T_C=100^{\circ}\text{C}$	200	
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	400	A
$P_D$	Maximum Power Dissipation @ $T_{vj}=175^{\circ}\text{C}$	1181	W

**Diode**

Symbol	Description	Values	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	200	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	400	A

**Module**

Symbol	Description	Value	Unit
$T_{vjmax}$	Maximum Junction Temperature	175	$^{\circ}\text{C}$
$T_{vjop}$	Operating Junction Temperature	-40 to +150	$^{\circ}\text{C}$
$T_{STG}$	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**  $T_c=25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=200\text{A}, V_{GE}=15\text{V}, T_{vj}=25^\circ\text{C}$		1.85	2.30	V
		$I_C=200\text{A}, V_{GE}=15\text{V}, T_{vj}=125^\circ\text{C}$		2.25		
		$I_C=200\text{A}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}$		2.35		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=8.00\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^\circ\text{C}$	5.6	6.2	6.8	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			3.8		$\Omega$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		21.6		nF
$C_{res}$	Reverse Transfer Capacitance				0.59	
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		1.68		$\mu\text{C}$
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=200\text{A}, R_G=4.7\Omega, L_S=45\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^\circ\text{C}$		100		ns
$t_r$	Rise Time			72		ns
$t_{d(off)}$	Turn-Off Delay Time			303		ns
$t_f$	Fall Time			71		ns
$E_{on}$	Turn-On Switching Loss			26.0		mJ
$E_{off}$	Turn-Off Switching Loss			6.11		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=200\text{A}, R_G=4.7\Omega, L_S=45\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^\circ\text{C}$		99		ns
$t_r$	Rise Time			76		ns
$t_{d(off)}$	Turn-Off Delay Time			325		ns
$t_f$	Fall Time			130		ns
$E_{on}$	Turn-On Switching Loss			33.5		mJ
$E_{off}$	Turn-Off Switching Loss			8.58		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=200\text{A}, R_G=4.7\Omega, L_S=45\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^\circ\text{C}$		98		ns
$t_r$	Rise Time			80		ns
$t_{d(off)}$	Turn-Off Delay Time			345		ns
$t_f$	Fall Time			121		ns
$E_{on}$	Turn-On Switching Loss			36.2		mJ
$E_{off}$	Turn-Off Switching Loss			9.05		mJ
$I_{SC}$	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^\circ\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		750		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units		
$V_F$	Diode Forward Voltage	$I_F=200\text{A}, V_{GE}=0\text{V}, T_{vj}=25^\circ\text{C}$		1.85	2.30	V		
		$I_F=200\text{A}, V_{GE}=0\text{V}, T_{vj}=125^\circ\text{C}$		1.90				
		$I_F=200\text{A}, V_{GE}=0\text{V}, T_{vj}=150^\circ\text{C}$		1.95				
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=200\text{A}, -di/dt=1890\text{A}/\mu\text{s}, V_{GE}=-15\text{V}, L_S=45\text{nH}, T_{vj}=25^\circ\text{C}$		19.4		$\mu\text{C}$		
$I_{RM}$	Peak Reverse Recovery Current			96		A		
$E_{rec}$	Reverse Recovery Energy			5.66		mJ		
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=200\text{A}, -di/dt=1680\text{A}/\mu\text{s}, V_{GE}=-15\text{V}, L_S=45\text{nH}, T_{vj}=125^\circ\text{C}$		29.5		$\mu\text{C}$		
			$I_{RM}$	Peak Reverse Recovery Current		106		A
			$E_{rec}$	Reverse Recovery Energy		8.56		mJ
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=200\text{A}, -di/dt=1600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}, L_S=45\text{nH}, T_{vj}=150^\circ\text{C}$		32.2		$\mu\text{C}$		
			$I_{RM}$	Peak Reverse Recovery Current		107		A
			$E_{rec}$	Reverse Recovery Energy		9.24		mJ

**Module Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
$L_{CE}$	Stray Inductance			20	nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.35		m $\Omega$
$R_{thJC}$	Junction-to-Case (per IGBT)			0.127	K/W
	Junction-to-Case (per Diode)			0.163	
$R_{thCH}$	Case-to-Heatsink (per IGBT)		0.036		K/W
	Case-to-Heatsink (per Diode)		0.046		
	Case-to-Heatsink (per Module)		0.010		
M	Terminal Connection Torque, Screw M6	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		300		g

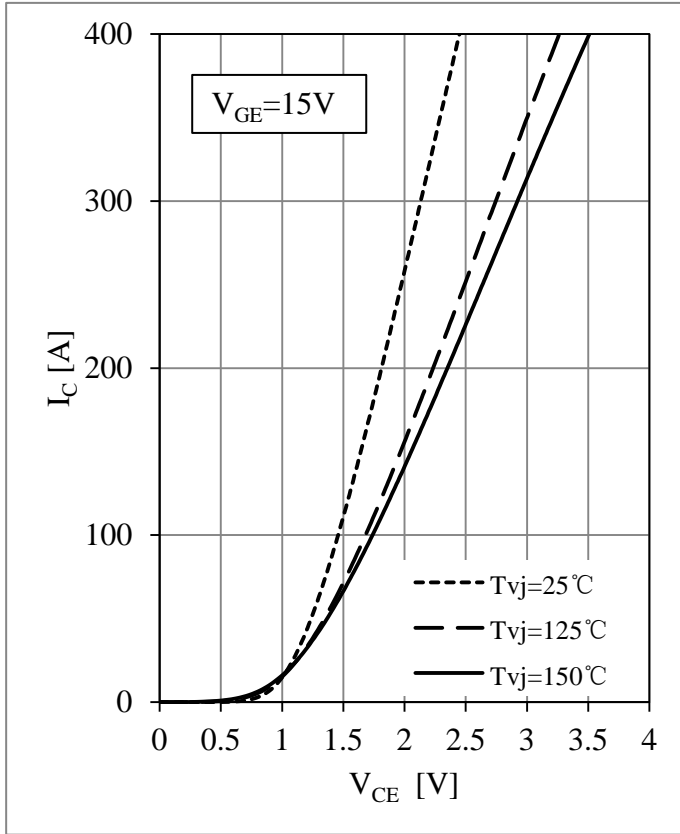


Fig 1. IGBT Output Characteristics

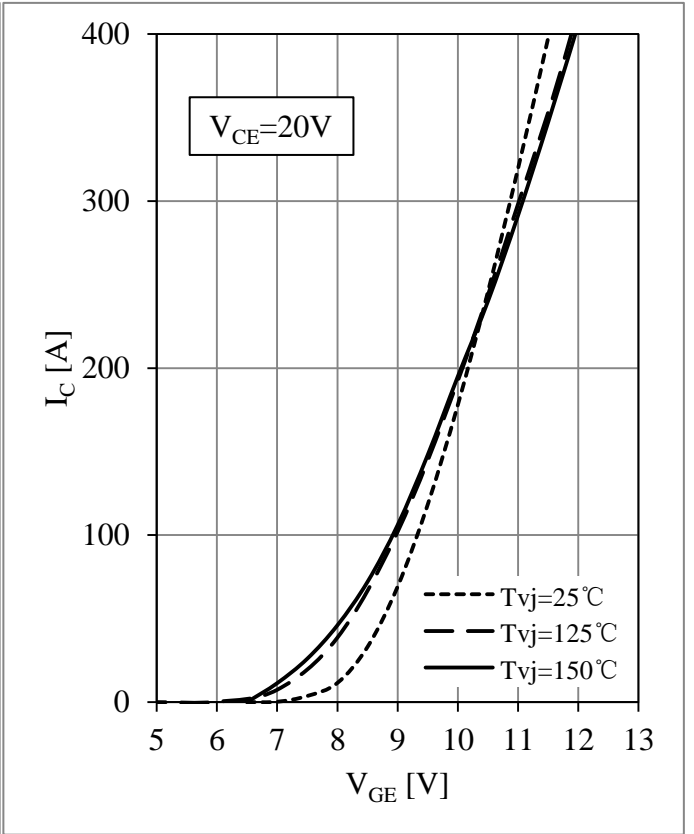


Fig 2. IGBT Transfer Characteristics

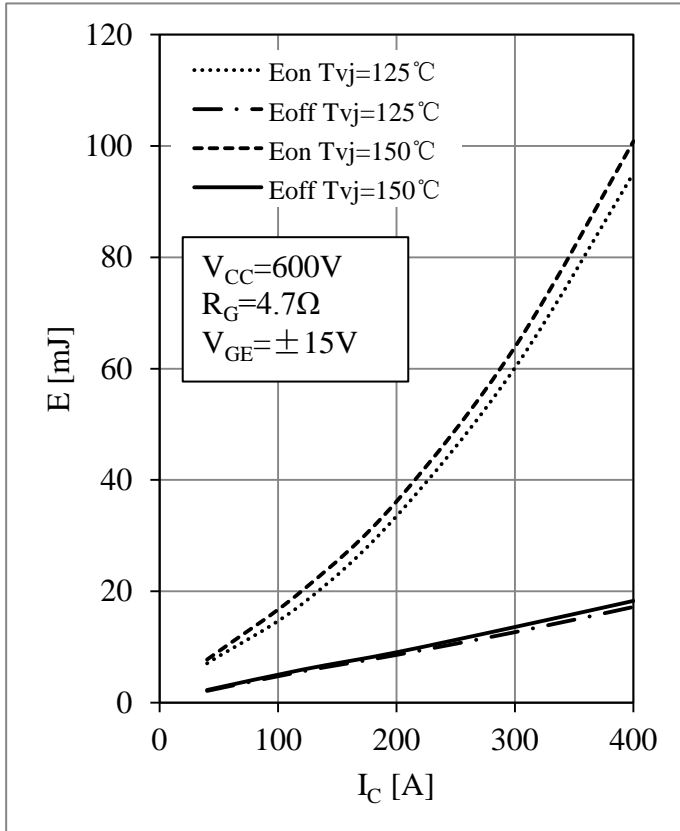


Fig 3. IGBT Switching Loss vs.  $I_c$

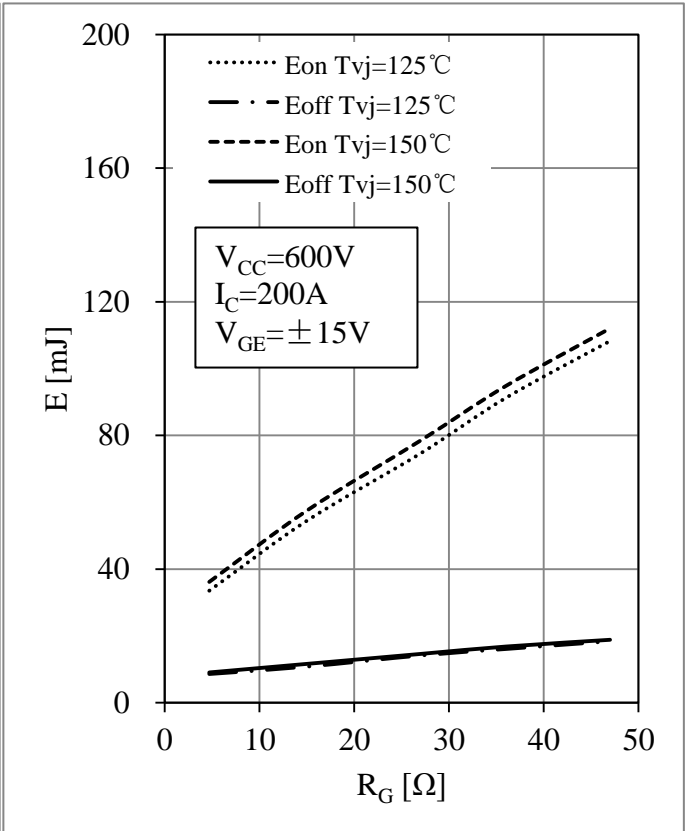


Fig 4. IGBT Switching Loss vs.  $R_g$

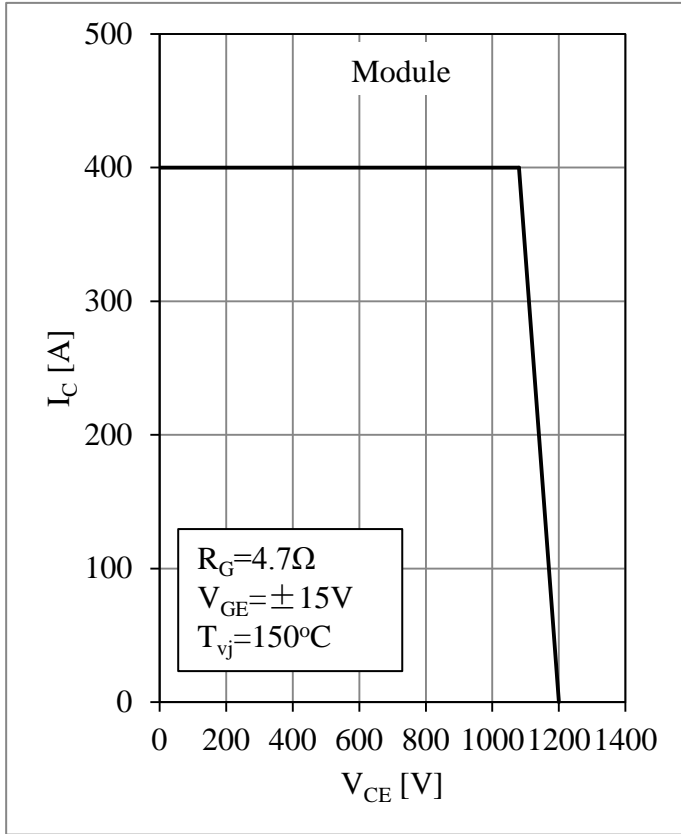


Fig 5. RBSOA

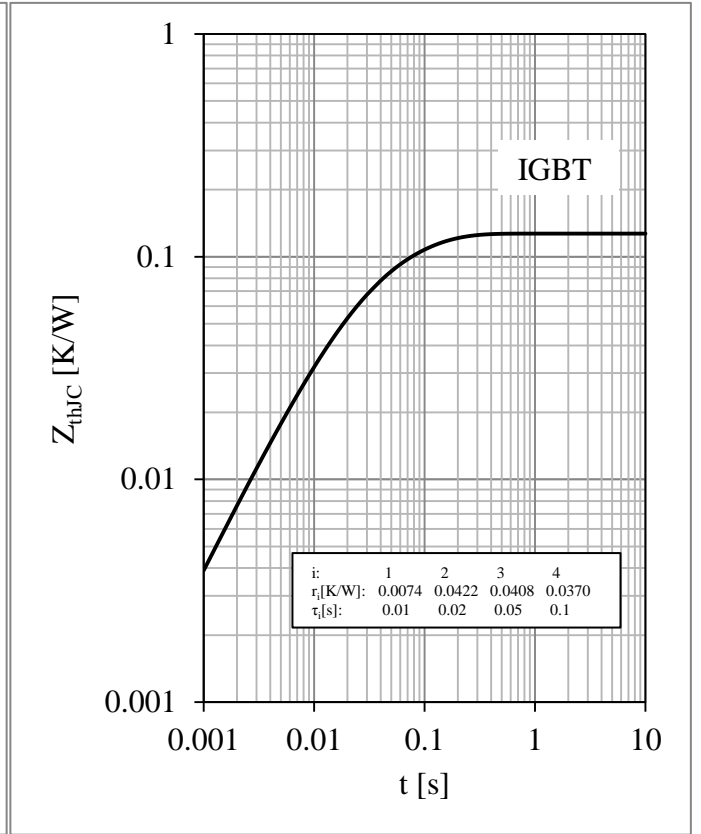


Fig 6. IGBT Transient Thermal Impedance

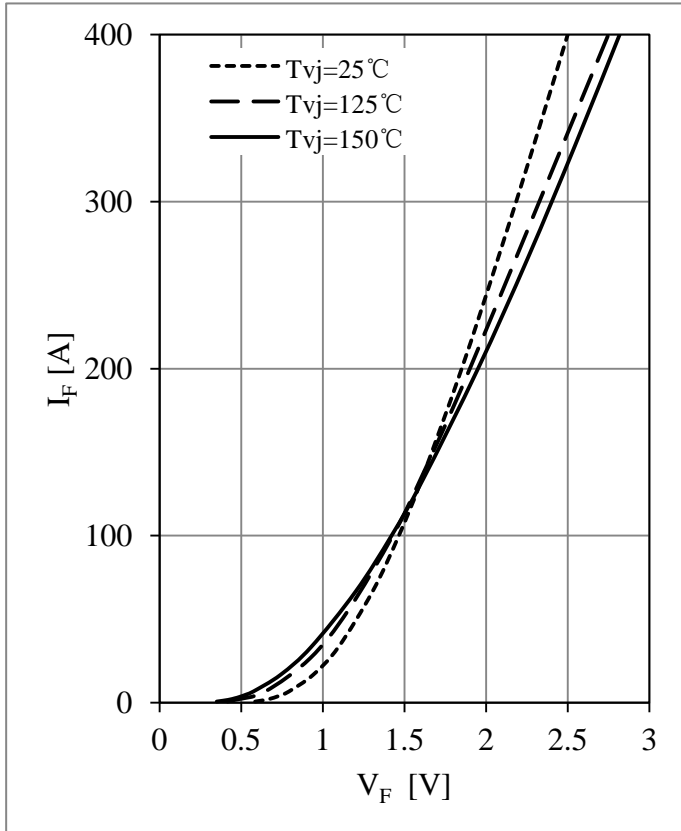


Fig 7. Diode Forward Characteristics

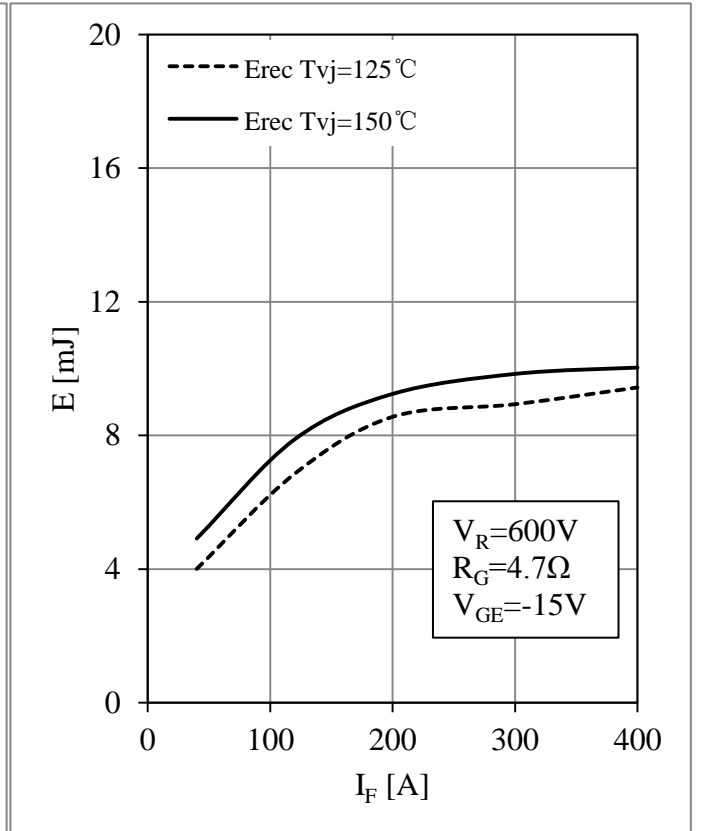


Fig 8. Diode Switching Loss vs.  $I_F$

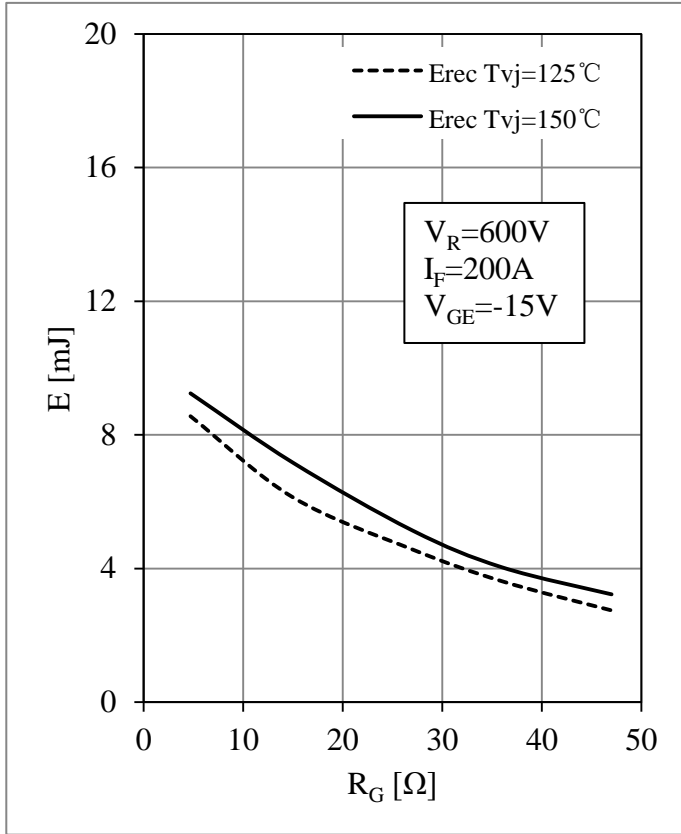


Fig 9. Diode Switching Loss vs.  $R_G$

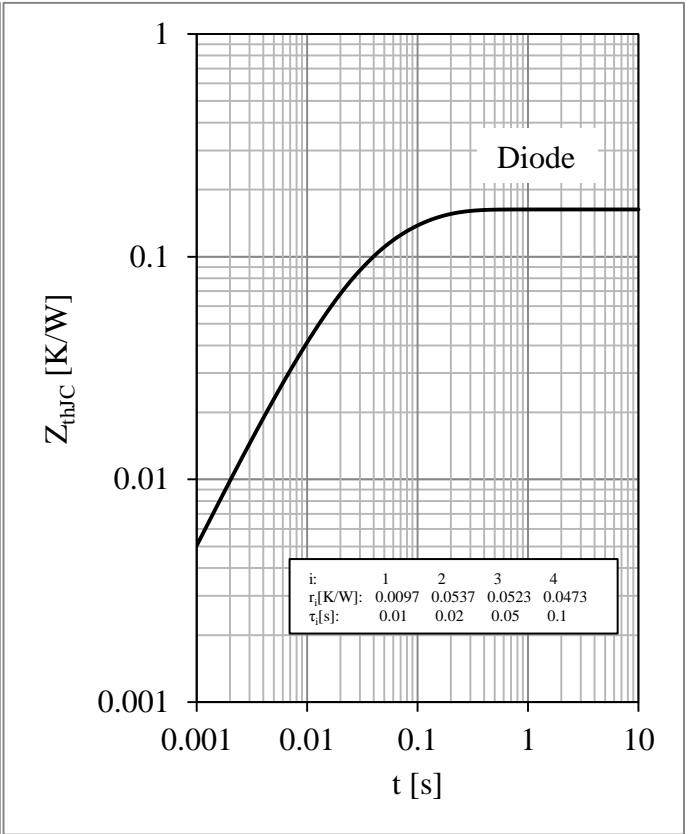


Fig 10. Diode Transient Thermal Impedance





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