

# STARPOWER

SEMICONDUCTOR

# IGBT

## GD2400SGT170C4S

Molding Type Module

1700V/2400A 1 in one-package

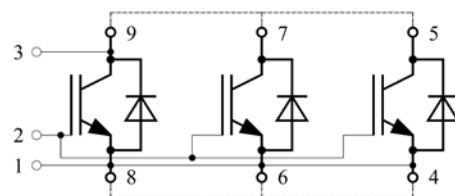
### General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as high power converters.



### 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



external connection to be done  
Equivalent Circuit Schematic

### Typical Applications

- High Power Converters
- Motor Drivers
- AC Inverter Drives

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

Symbol	Description	GD2400SGT170C4S	Units
$V_{CES}$	Collector-Emitter Voltage	1700	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^\circ\text{C}$ @ $T_C=95^\circ\text{C}$	3600 2400	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	4800	A
$I_F$	Diode Continuous Forward Current	2400	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	4800	A
$P_D$	Maximum Power Dissipation @ $T_j=175^\circ\text{C}$	14.6	kW
$T_{jmax}$	Maximum Junction Temperature	175	$^\circ\text{C}$
$T_{jop}$	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, $f=50\text{Hz}$ , $t=1\text{min}$	4000	V
$M$	Signal Terminal Torque, Screw:M4 Power Terminal Torque, Screw:M8 Mounting Torque, Screw:M6	1.8 to 2.1 8.0 to 10 4.25 to 5.75	N.m
$G$	Weight of Module	2300	g

**Electrical Characteristics of IGBT**  $T_C=25^\circ\text{C}$  unless otherwise noted**Off Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{(BR)CES}$	Collector-Emitter Breakdown Voltage	$T_j=25^\circ\text{C}$	1700			V
$I_{CES}$	Collector Cut-Off Current	$V_{CE}=V_{CES}$ , $V_{GE}=0\text{V}$ , $T_j=25^\circ\text{C}$			5.0	mA
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}$ , $V_{CE}=0\text{V}$ , $T_j=25^\circ\text{C}$			400	nA

**On Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=96\text{mA}$ , $V_{CE}=V_{GE}$ , $T_j=25^\circ\text{C}$	5.2	5.8	6.4	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=2400\text{A}$ , $V_{GE}=15\text{V}$ , $T_j=25^\circ\text{C}$		2.00	2.45	V
		$I_C=2400\text{A}$ , $V_{GE}=15\text{V}$ , $T_j=125^\circ\text{C}$		2.40		

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=2400A,$ $R_{Gon}=0.6\Omega,$ $R_{Goff}=0.8\Omega,$ $V_{GE}=\pm 15V, T_j=25^\circ C$		648		ns
$t_r$	Rise Time			161		ns
$t_{d(off)}$	Turn-Off Delay Time			1320		ns
$t_f$	Fall Time			178		ns
$E_{on}$	Turn-On Switching Loss			417		mJ
$E_{off}$	Turn-Off Switching Loss			628		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=900V, I_C=2400A,$ $R_{Gon}=0.6\Omega,$ $R_{Goff}=0.8\Omega,$ $V_{GE}=\pm 15V, T_j=125^\circ C$		698		ns
$t_r$	Rise Time			205		ns
$t_{d(off)}$	Turn-Off Delay Time			1580		ns
$t_f$	Fall Time			290		ns
$E_{on}$	Turn-On Switching Loss			610		mJ
$E_{off}$	Turn-Off Switching Loss			920		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=25V, f=1MHz,$ $V_{GE}=0V$		212		nF
$C_{oes}$	Output Capacitance			8.78		nF
$C_{res}$	Reverse Transfer Capacitance			7.01		nF
$I_{SC}$	SC Data	$t_p \leq 10\mu s, V_{GE}=15V,$ $T_j=125^\circ C, V_{CC}=1000V,$ $V_{CEM} \leq 1700V$		9600		A
$Q_G$	Gate Charge	$V_{GE}=-15 \dots +15V$		28.1		$\mu C$
$R_{Gint}$	Internal Gate Resistance			0.73		$\Omega$
$L_{CE}$	Stray Inductance			10		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal To Chip			0.12		m $\Omega$

**Electrical Characteristics of Diode**  $T_C=25^\circ C$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_F$	Diode Forward Voltage	$I_F=2400A$	$T_j=25^\circ C$	1.80	2.20	V
			$T_j=125^\circ C$	1.90		
$Q_r$	Recovered Charge	$I_F=2400A,$	$T_j=25^\circ C$	598		$\mu C$
			$T_j=125^\circ C$	992		
$I_{RM}$	Peak Reverse Recovery Current	$V_R=900V,$ $R_G=0.6\Omega,$	$T_j=25^\circ C$	2145		A
			$T_j=125^\circ C$	2360		
$E_{rec}$	Reverse Recovery Energy	$V_{GE}=-15V$	$T_j=25^\circ C$	386		mJ
			$T_j=125^\circ C$	680		

**Thermal Characteristics**

<b>Symbol</b>	<b>Parameter</b>	<b>Typ.</b>	<b>Max.</b>	<b>Units</b>
$R_{\theta JC}$	Junction-to-Case (per IGBT)		10.3	K/kW
$R_{\theta JC}$	Junction-to-Case (per Diode)		18.4	K/kW
$R_{\theta CS}$	Case-to-Sink (Conductive grease applied)	4		K/kW

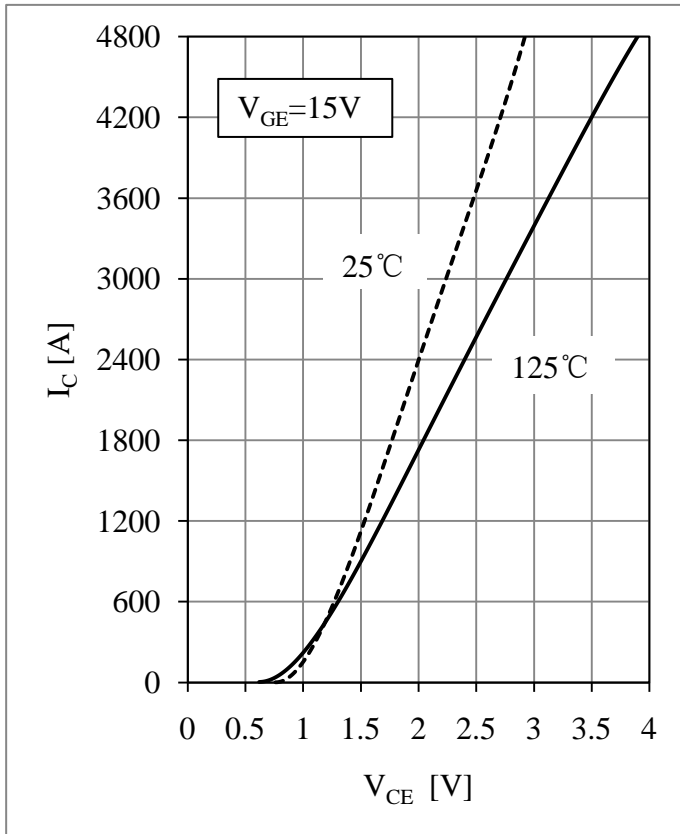


Fig 1. IGBT Output Characteristics

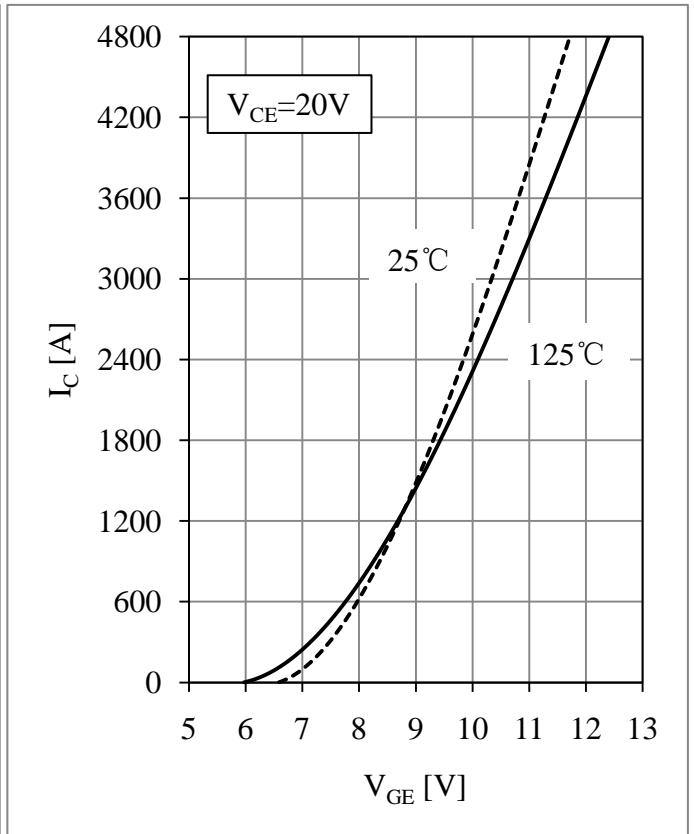


Fig 2. IGBT Transfer Characteristics

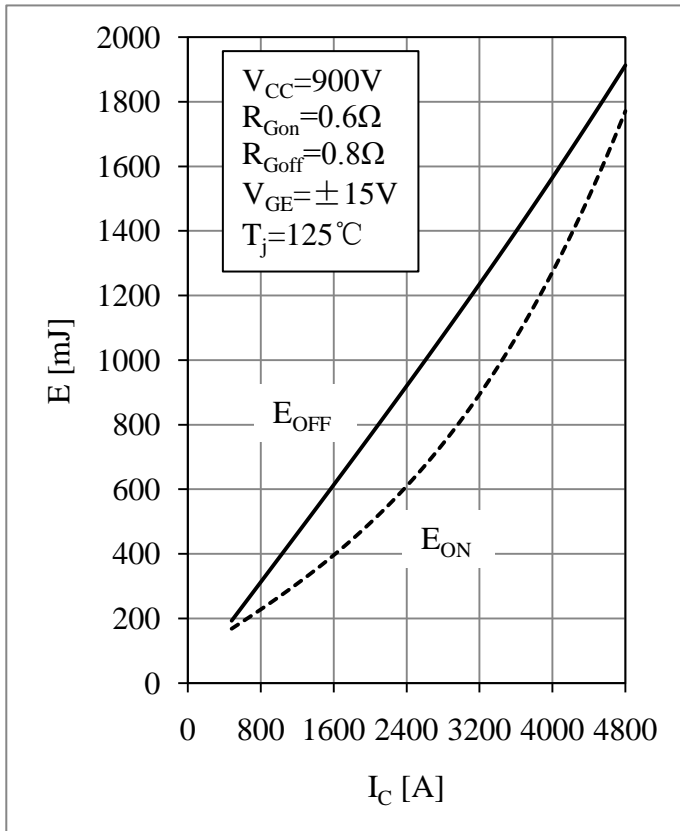


Fig 3. IGBT Switching Loss vs.  $I_C$

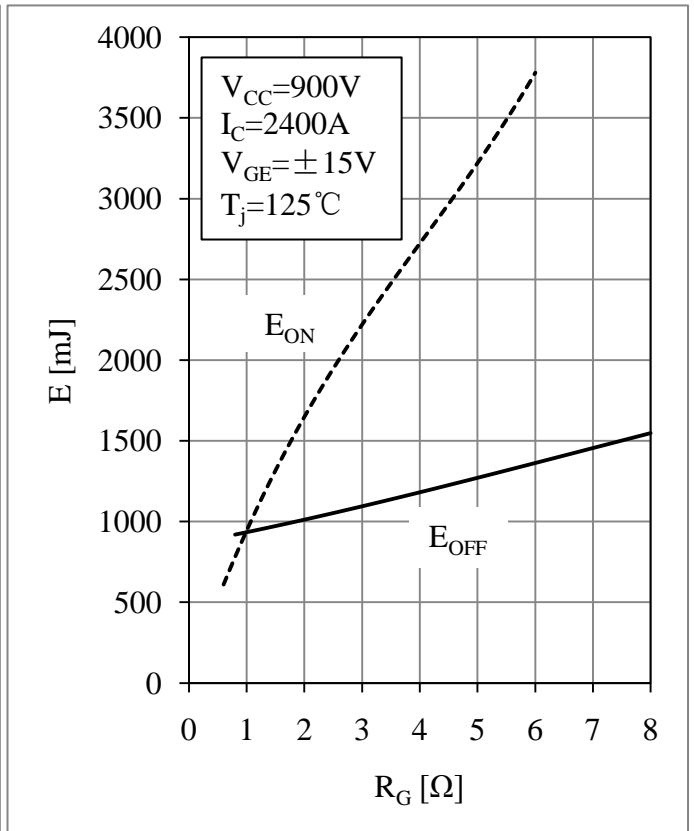


Fig 4. IGBT Switching Loss vs.  $R_G$

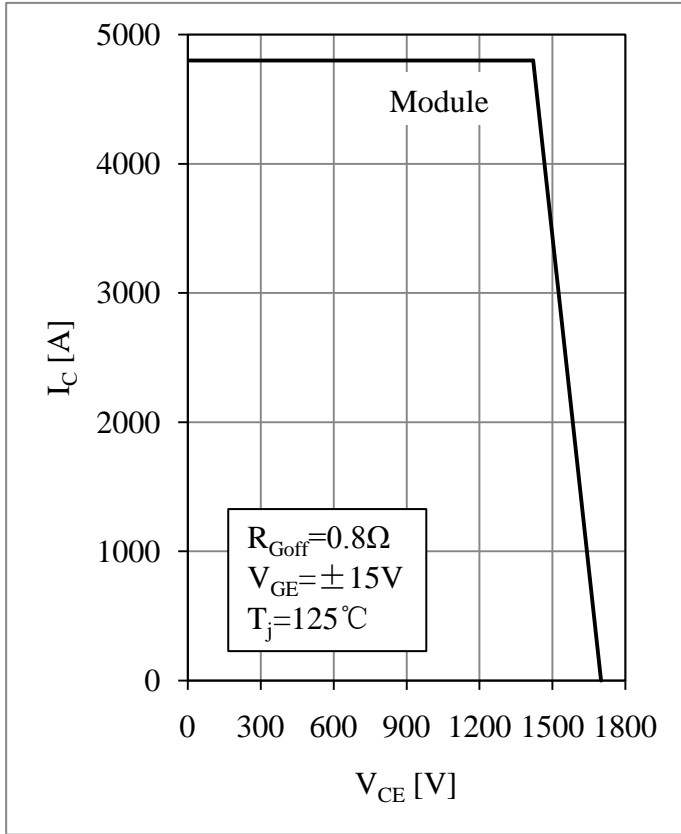


Fig 5. RBSOA

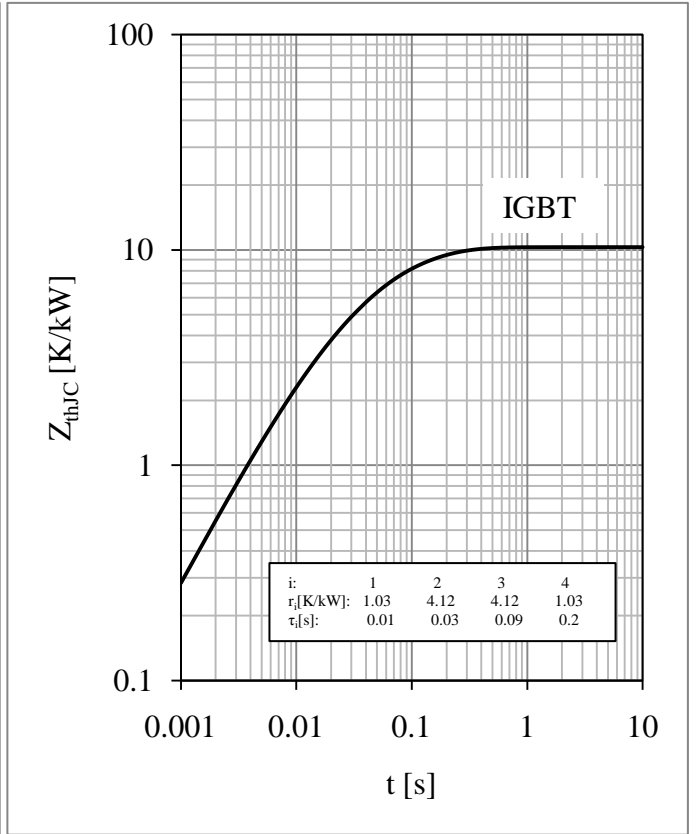


Fig 6. IGBT Transient Thermal Impedance

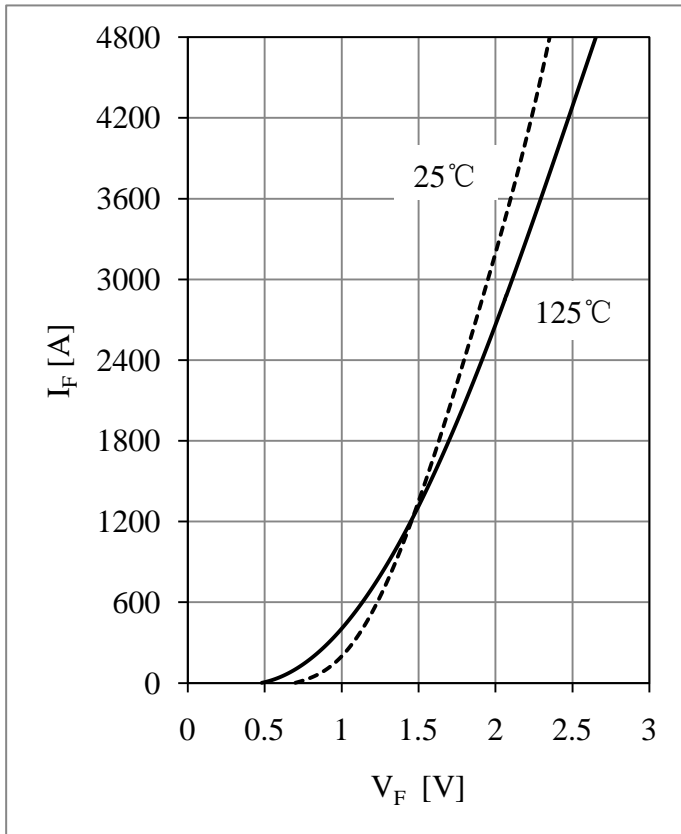


Fig 7. Diode Forward Characteristics

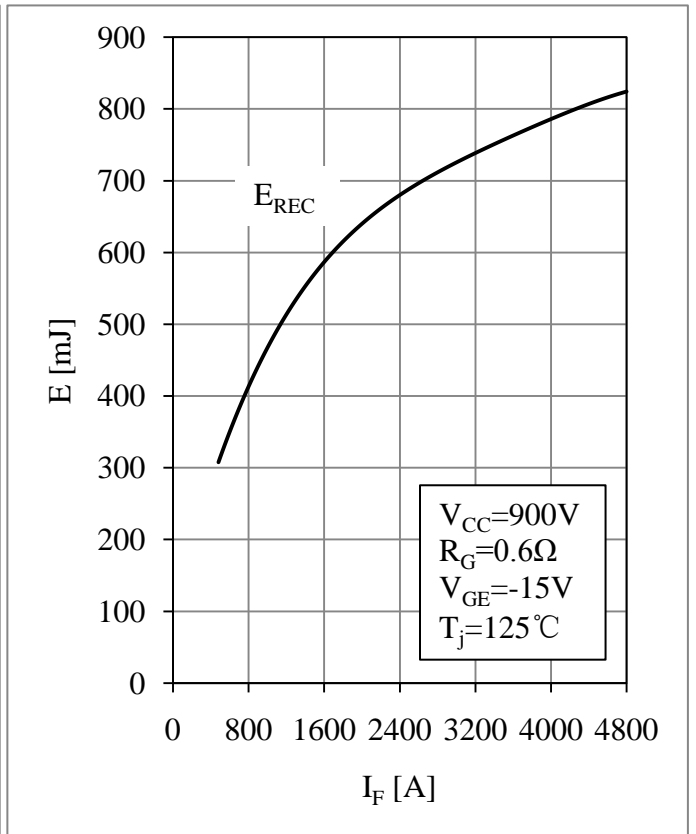


Fig 8. Diode Switching Loss vs.  $I_F$

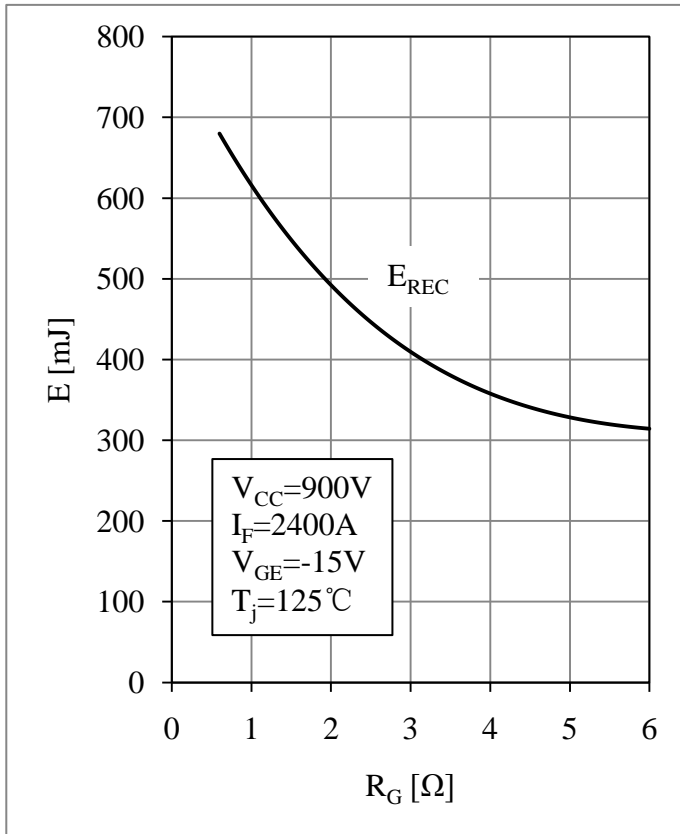


Fig 9. Diode Switching Loss vs.  $R_G$

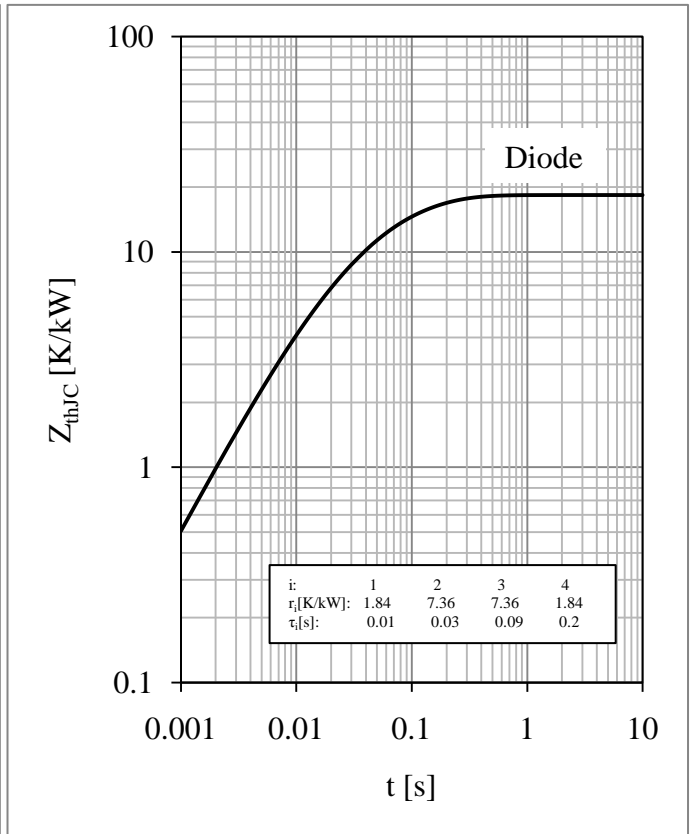


Fig 10. Diode Transient Thermal Impedance





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