

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD75FSA120L3S

**1200V/75A 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 general inverters and UPS.

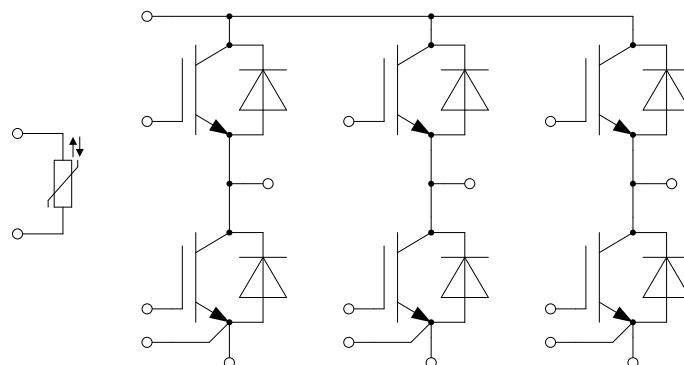
### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- 8 $\mu$ 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 heatsink using DBC technology

### Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

### Equivalent Circuit Schematic



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

Symbol	Description	Value	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_{CN}$	Implemented Collector Current	75	A
$I_C$	Collector Current @ $T_H=65^{\circ}\text{C}$	65	A
$I_{CRM}$	Repetitive Peak Collector Current tp limited by $T_{vjop}$	150	A

**Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	75	A
$I_{FRM}$	Repetitive Peak Forward Current tp limited by $T_{vjop}$	150	A

**Module**

Symbol	Description	Value	Unit
$T_{vjmax}$	Maximum Junction Temperature	175	$^{\circ}\text{C}$
$T_{vjop}$	Operating Junction Temperature	-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

Note:  $T_{vjop} > 150^{\circ}\text{C}$  is allowed for operation at overload conditions.

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=75\text{A}, V_{GE}=15\text{V}, T_{vj}=25^{\circ}\text{C}$		1.50	1.95	V	
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_{vj}=125^{\circ}\text{C}$		1.70			
		$I_C=75\text{A}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		1.80			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.50\text{mA}, V_{CE}=V_{GE}, T_{vj}=25^{\circ}\text{C}$	5.3	6.2	7.0	V	
$I_{CES}$	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			50	$\mu\text{A}$	
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			100	nA	
$R_{Gint}$	Internal Gate Resistance			0		$\Omega$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		6.63		nF	
$C_{res}$	Reverse Transfer Capacitance				0.06		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.48		$\mu\text{C}$	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=75\text{A}, R_G=5.6\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=25^{\circ}\text{C}$		55		ns	
$t_r$	Rise Time				21		ns
$t_{d(off)}$	Turn-Off Delay Time				269		ns
$t_f$	Fall Time				184		ns
$E_{on}$	Turn-On Switching Loss				3.70		mJ
$E_{off}$	Turn-Off Switching Loss				6.29		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=75\text{A}, R_G=5.6\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=125^{\circ}\text{C}$		59		ns	
$t_r$	Rise Time				24		ns
$t_{d(off)}$	Turn-Off Delay Time				320		ns
$t_f$	Fall Time				287		ns
$E_{on}$	Turn-On Switching Loss				5.05		mJ
$E_{off}$	Turn-Off Switching Loss				8.38		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=75\text{A}, R_G=5.6\Omega, L_S=35\text{nH}, V_{GE}=\pm 15\text{V}, T_{vj}=150^{\circ}\text{C}$		60		ns	
$t_r$	Rise Time				26		ns
$t_{d(off)}$	Turn-Off Delay Time				330		ns
$t_f$	Fall Time				315		ns
$E_{on}$	Turn-On Switching Loss				5.49		mJ
$E_{off}$	Turn-Off Switching Loss				8.88		mJ
$I_{SC}$	SC Data	$t_p \leq 8\mu\text{s}, V_{GE}=15\text{V}, T_{vj}=150^{\circ}\text{C}, V_{CC}=600\text{V}, V_{CEM} \leq 1200\text{V}$		225		A	

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=75\text{A}, V_{GE}=0\text{V}, T_{vj}=25^{\circ}\text{C}$		1.60	2.05	V
		$I_F=75\text{A}, V_{GE}=0\text{V}, T_{vj}=125^{\circ}\text{C}$		1.65		
		$I_F=75\text{A}, V_{GE}=0\text{V}, T_{vj}=150^{\circ}\text{C}$		1.65		
$Q_r$	Recovered Charge			7.60		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=75\text{A},$ $-di/dt=3749\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=25^{\circ}\text{C}$		104		A
$E_{rec}$	Reverse Recovery Energy			3.75		mJ
$Q_r$	Recovered Charge			11.6		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=75\text{A},$ $-di/dt=3203\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=125^{\circ}\text{C}$		109		A
$E_{rec}$	Reverse Recovery Energy			5.48		mJ
$Q_r$	Recovered Charge			12.6		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current	$V_R=600\text{V}, I_F=75\text{A},$ $-di/dt=3101\text{A}/\mu\text{s}, L_S=35\text{nH},$ $V_{GE}=-15\text{V}, T_{vj}=150^{\circ}\text{C}$		108		A
$E_{rec}$	Reverse Recovery Energy			5.89		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
$L_{CE}$	Stray Inductance		30		nH
$R_{CC'+EE'}$ $R_{AA'+CC'}$	Module Lead Resistance, Terminal to Chip		5.00 6.00		m $\Omega$
$R_{thJH}$	Junction-to-Heatsink (per IGBT) Junction-to-Heatsink (per Diode)		0.803 1.120		K/W
F	Mounting Force Per Clamp	40		80	N
G	Weight of Module		39		g

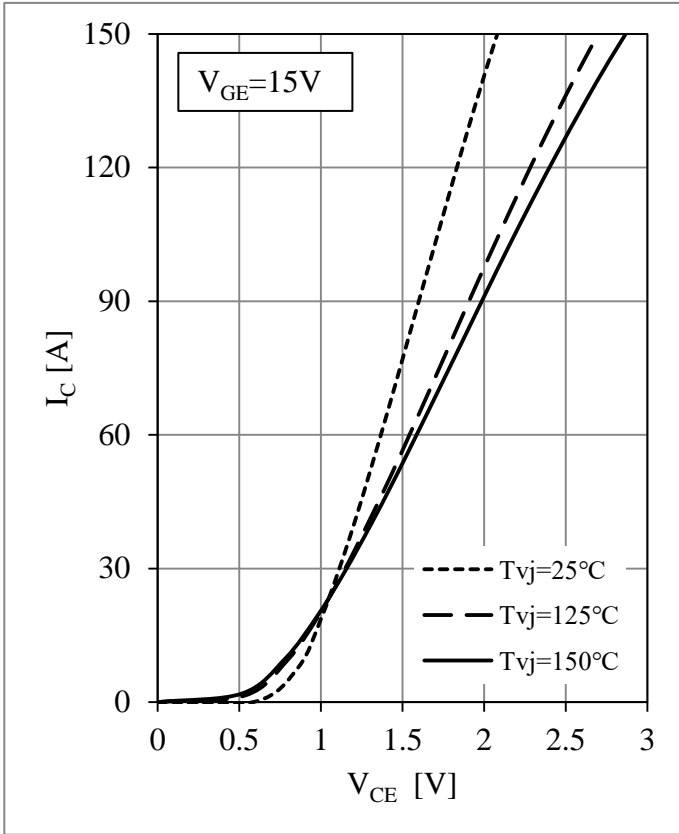


Fig 1. IGBT Output Characteristics

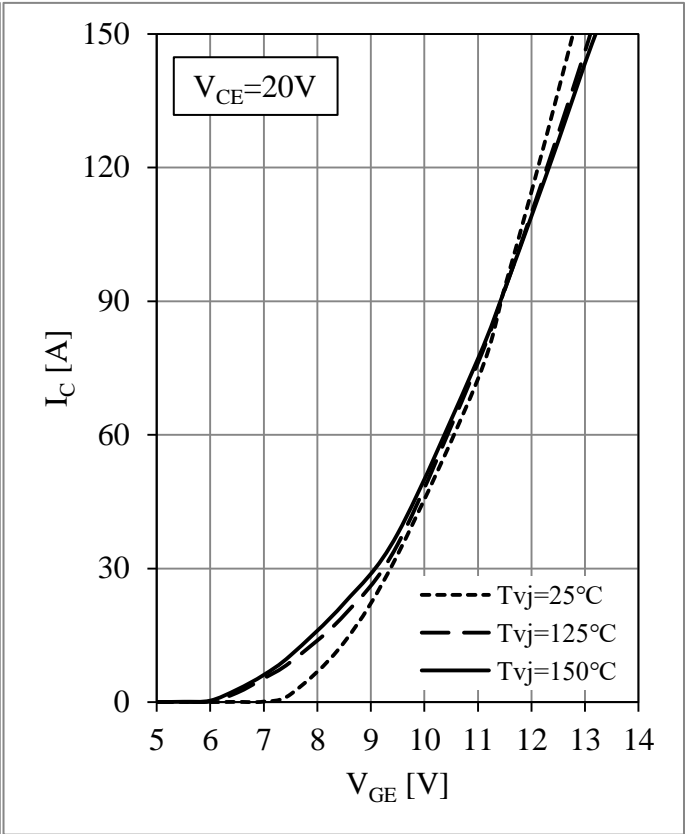


Fig 2. IGBT Transfer Characteristics

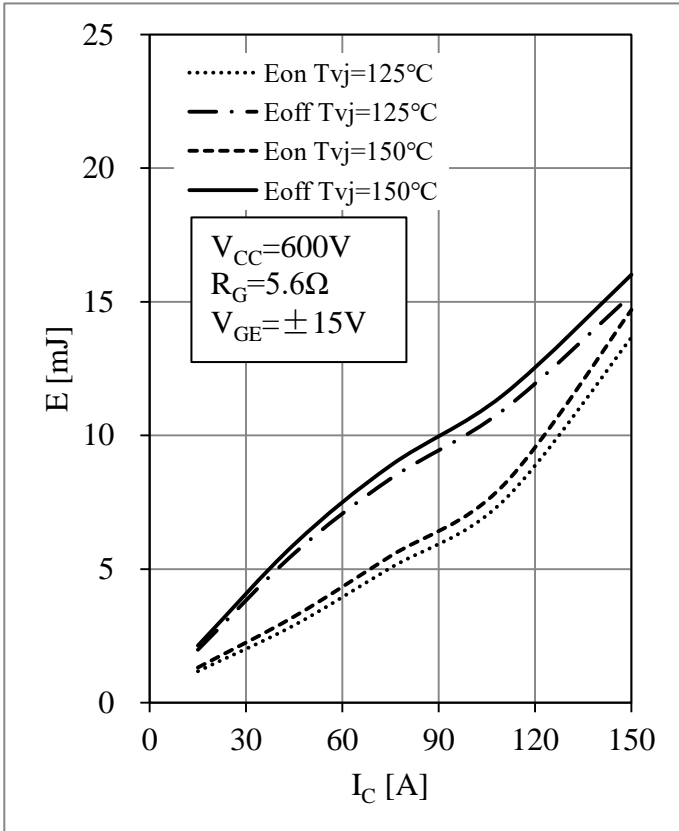


Fig 3. IGBT Switching Loss vs.  $I_C$

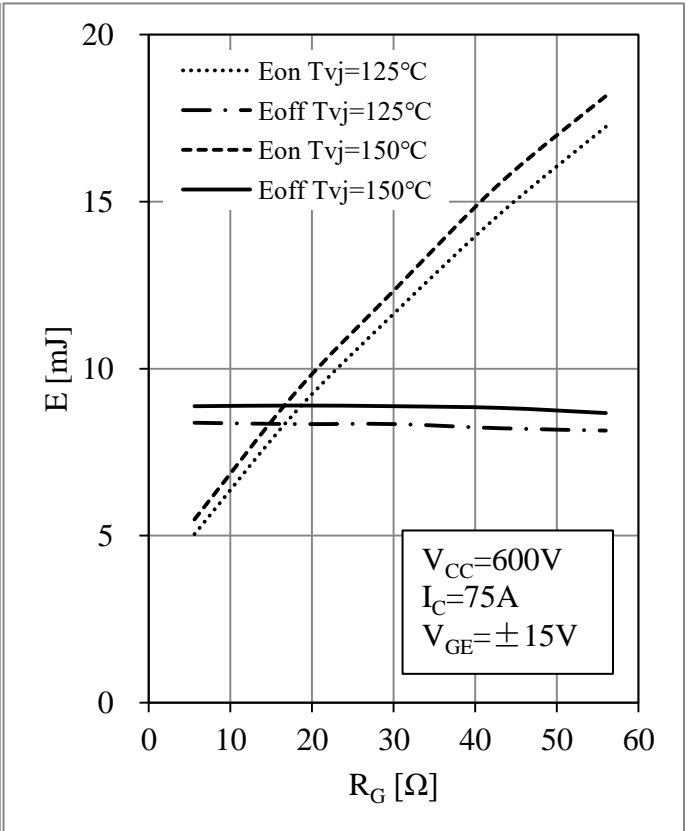


Fig 4. IGBT Switching Loss vs.  $R_G$

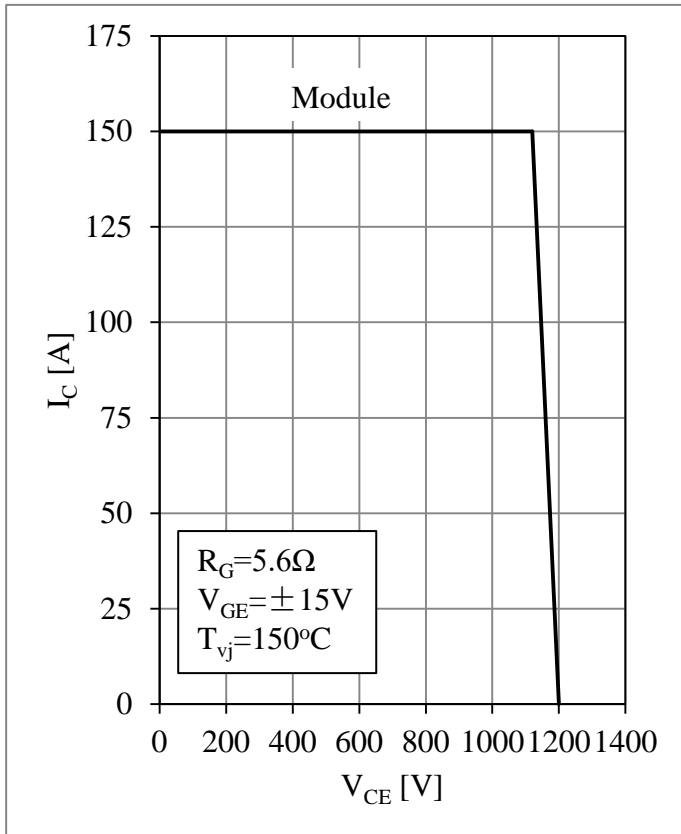


Fig 5. RBSOA

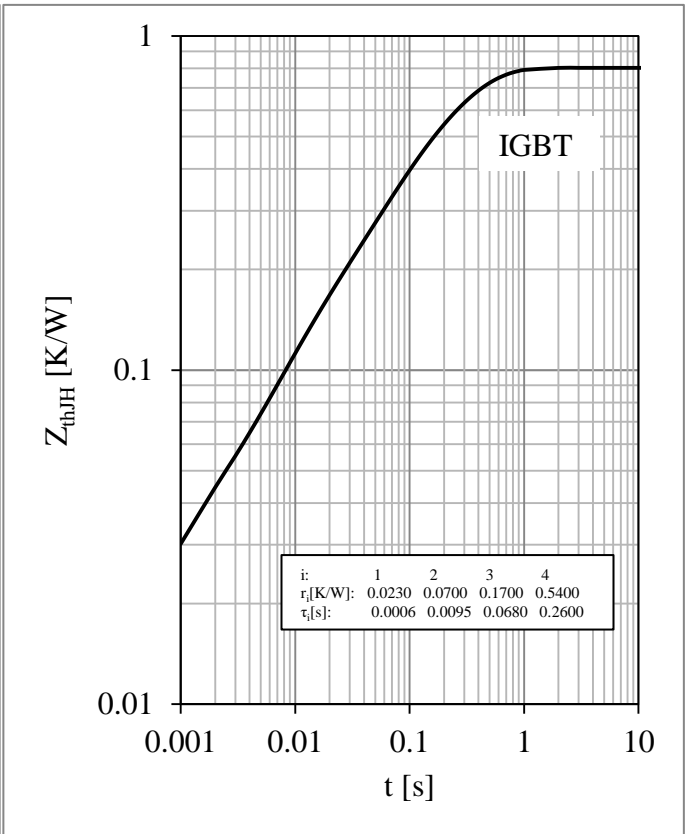


Fig 6. IGBT Transient Thermal Impedance

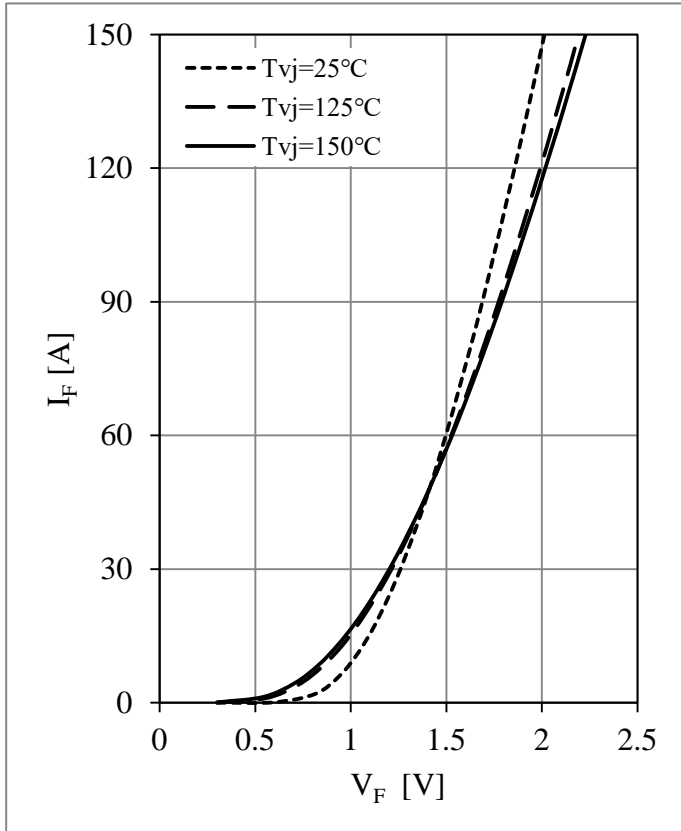


Fig 7. Diode Forward Characteristics

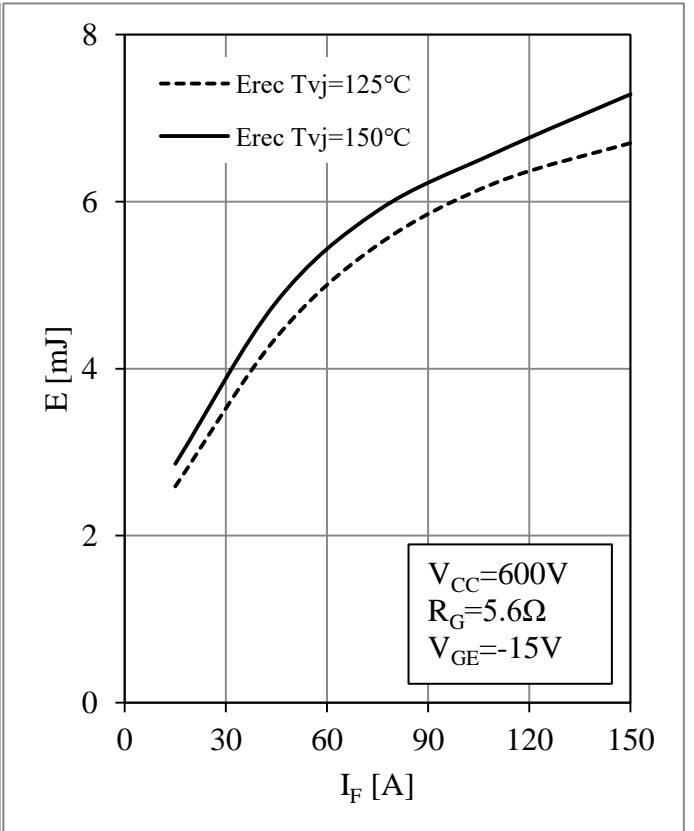


Fig 8. Diode Switching Loss vs.  $I_F$

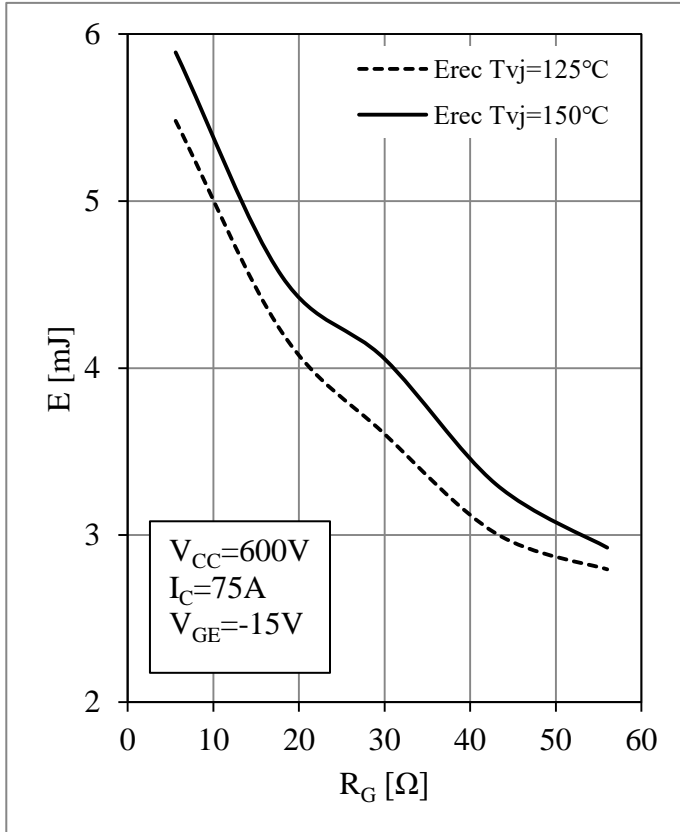


Fig 9. Diode Switching Loss vs.  $R_G$

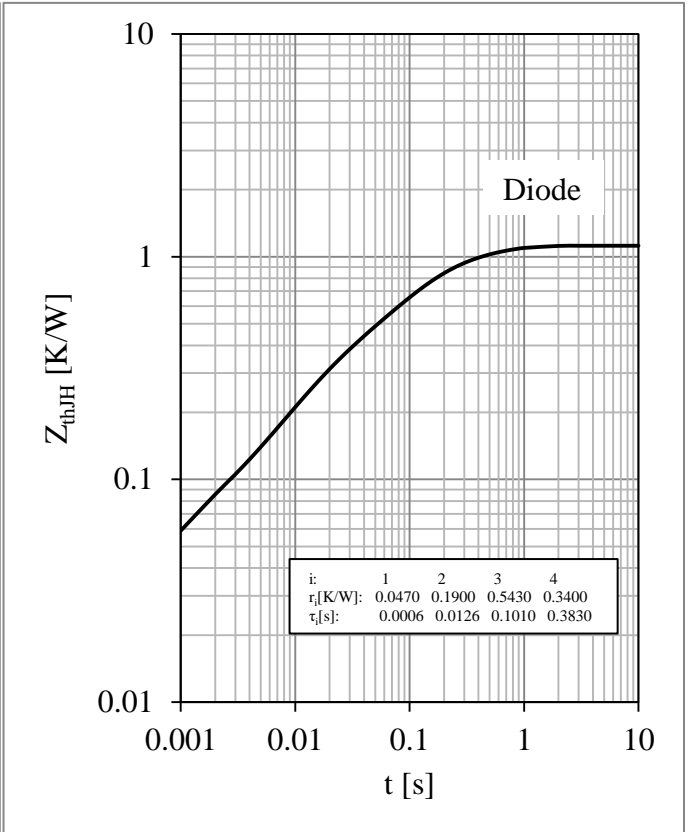


Fig 10. Diode Transient Thermal Impedance

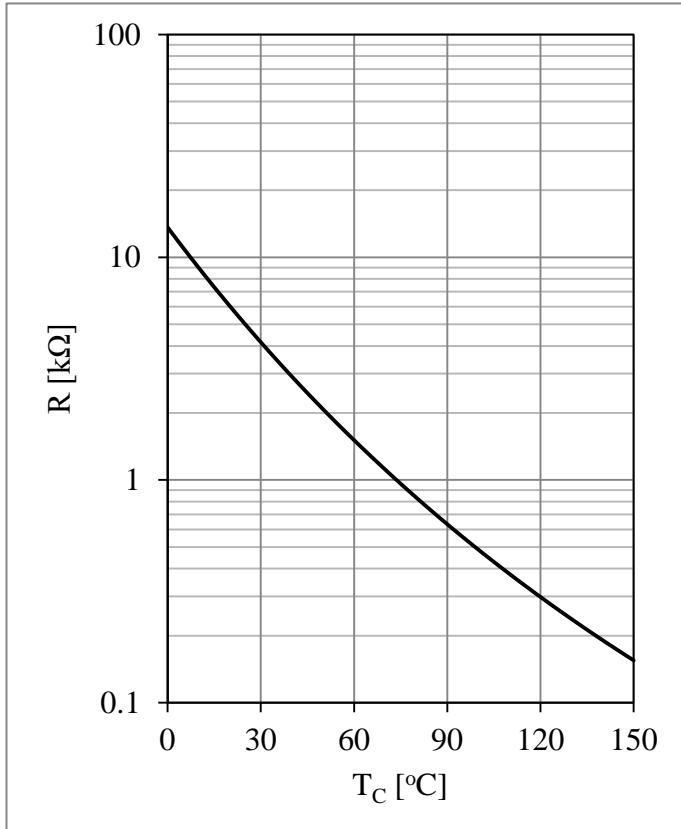
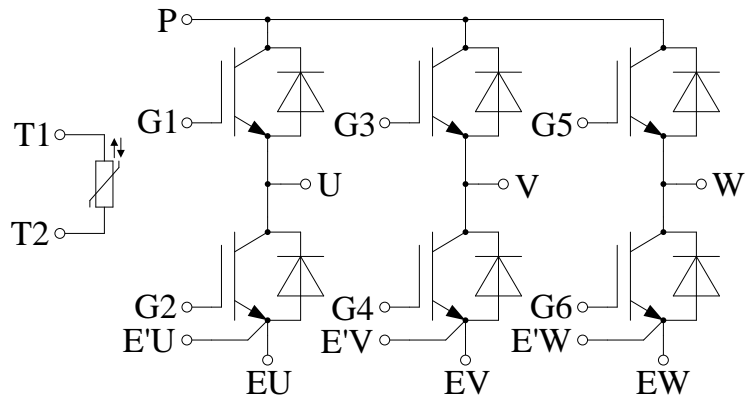


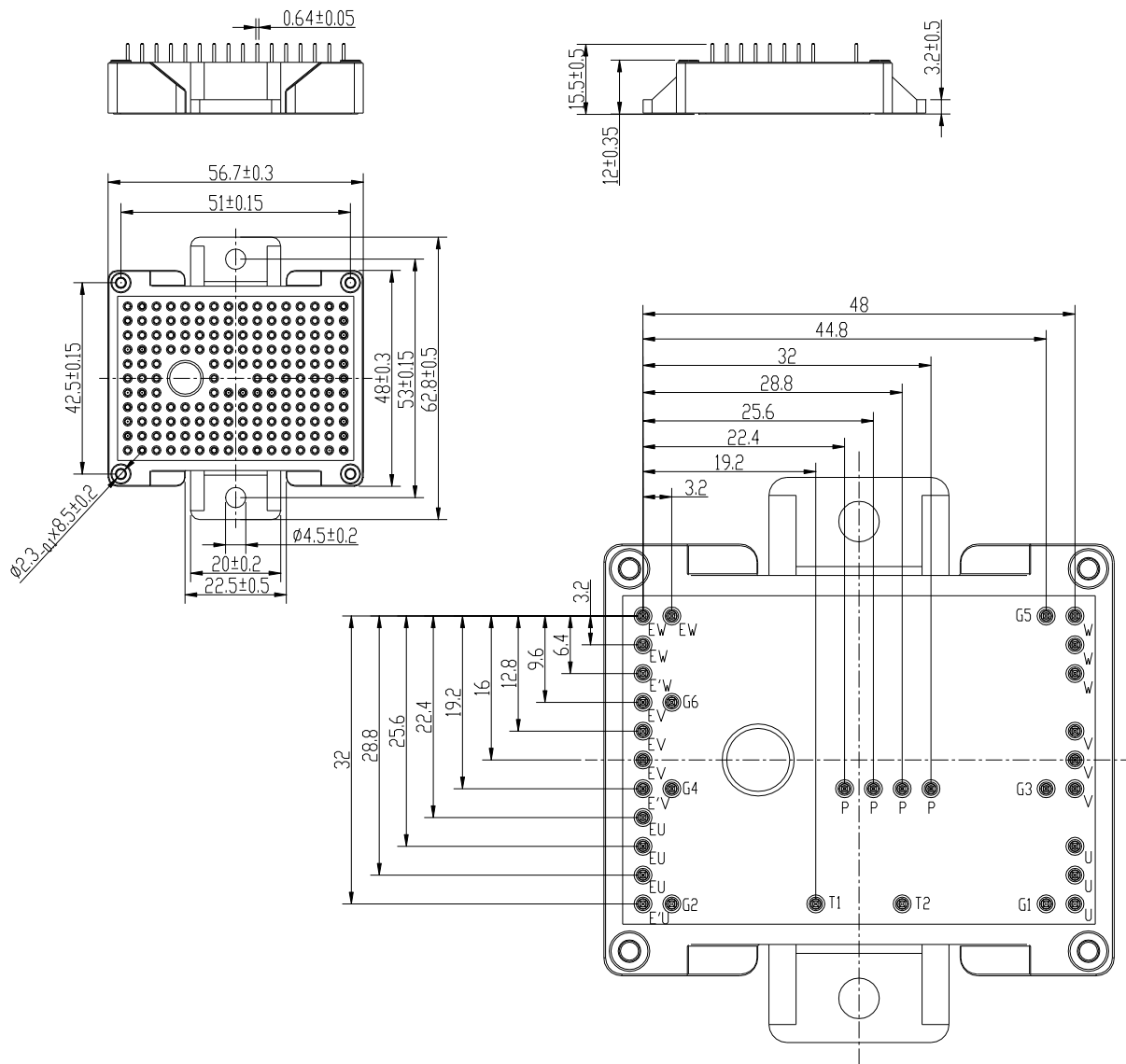
Fig 11. NTC Temperature Characteristic

**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters



Pinpositions with tolerance  $\pm 0.1$



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