

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD10FSY120L4S

**1200V/10A 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.



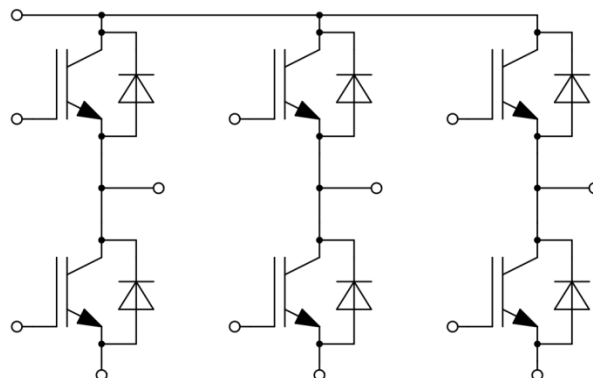
### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- 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 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**  $T_C=25^{\circ}\text{C}$  unless otherwise noted**IGBT**

Symbol	Description	Value	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$	20	A
	@ $T_C=100^{\circ}\text{C}$	10	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	20	A
$P_D$	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	102	W

**Diode**

Symbol	Description	Value	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	10	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	20	A

**Module**

Symbol	Description	Value	Unit
$T_{jmax}$	Maximum Junction Temperature(inverter,brake)	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=50Hz,t=1min	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	$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V	
		$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95			
		$I_C=10\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.00			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=0.25\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.2	6.0	6.8	V	
$I_{CES}$	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			1.0	mA	
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			400	nA	
$R_{Gint}$	Internal Gate Resistance			0		$\Omega$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		0.70		nF	
$C_{res}$	Reverse Transfer Capacitance				0.04		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.10		$\mu\text{C}$	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=47\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		48		ns	
$t_r$	Rise Time			47		ns	
$t_{d(off)}$	Turn-Off Delay Time			185		ns	
$t_f$	Fall Time			170		ns	
$E_{on}$	Turn-On Switching Loss			0.96		mJ	
$E_{off}$	Turn-Off Switching Loss			0.57		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=47\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		48		ns
$t_r$	Rise Time				65		ns
$t_{d(off)}$	Turn-Off Delay Time			252		ns	
$t_f$	Fall Time			221		ns	
$E_{on}$	Turn-On Switching Loss			1.44		mJ	
$E_{off}$	Turn-Off Switching Loss			0.82		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=10\text{A}, R_G=47\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			48		ns
$t_r$	Rise Time				67		ns
$t_{d(off)}$	Turn-Off Delay Time			283		ns	
$t_f$	Fall Time			232		ns	
$E_{on}$	Turn-On Switching Loss			1.66		mJ	
$E_{off}$	Turn-Off Switching Loss			0.90		mJ	
$I_{SC}$	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		40		A

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_F$	Diode Forward Voltage	$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		1.85	2.30	V
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		2.05		
		$I_F=10\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		2.10		
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		0.86		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			8		A
$E_{rec}$	Reverse Recovery Energy			0.23		mJ
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		1.6		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			10		A
$E_{rec}$	Reverse Recovery Energy			0.49		mJ
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=10\text{A},$ $-di/dt=500\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		1.8		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			11		A
$E_{rec}$	Reverse Recovery Energy			0.56		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		9.00		m $\Omega$
$R_{thJC}$	Junction-to-Case (per IGBT)		1.488	1.637	K/W
	Junction-to-Case (per Diode)		2.074	2.281	
$R_{thCH}$	Case-to-Heatsink (per IGBT)		0.794		K/W
	Case-to-Heatsink (per Diode)		1.106		
	Case-to-Sink (per Module)		0.077		
M	Mounting Force Per Clamp	30		50	N
G	Weight of Module		10		g

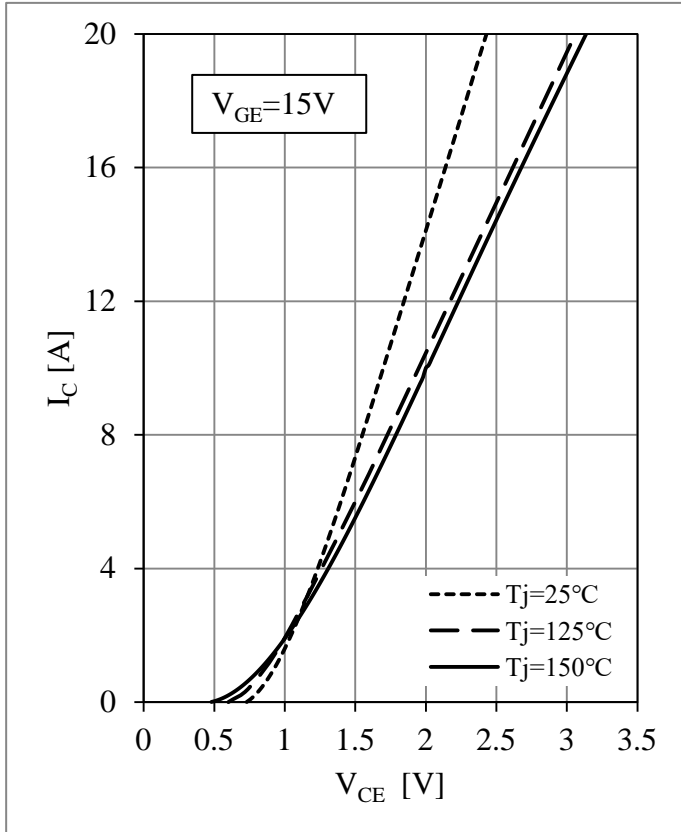


Fig 1. IGBT Output Characteristics

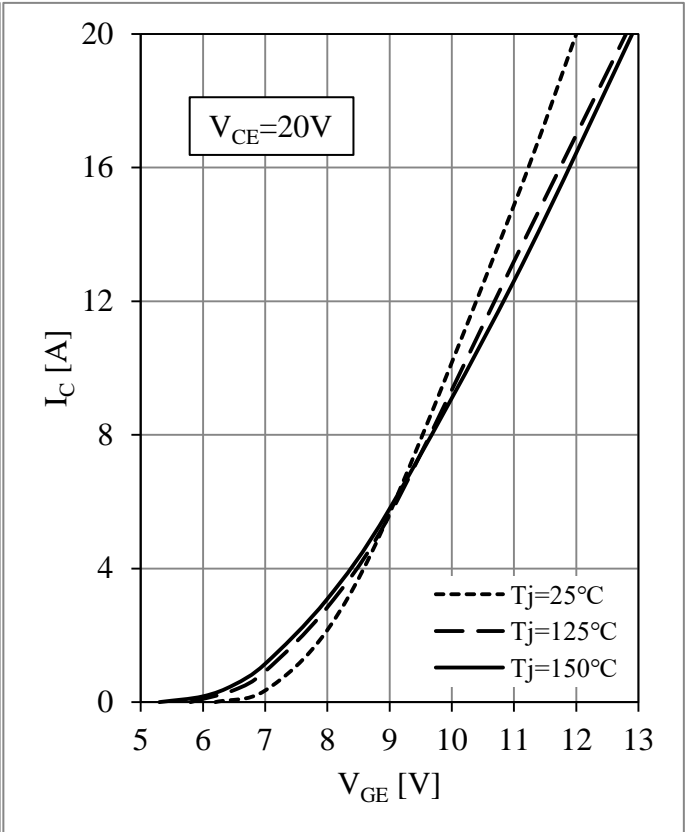


Fig 2. IGBT Transfer Characteristics

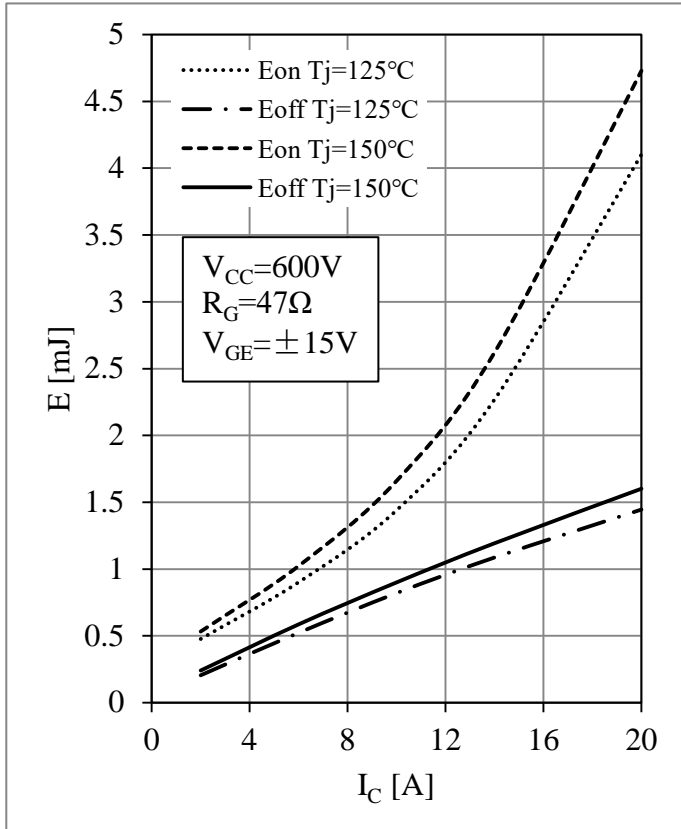


Fig 3. IGBT Switching Loss vs.  $I_C$

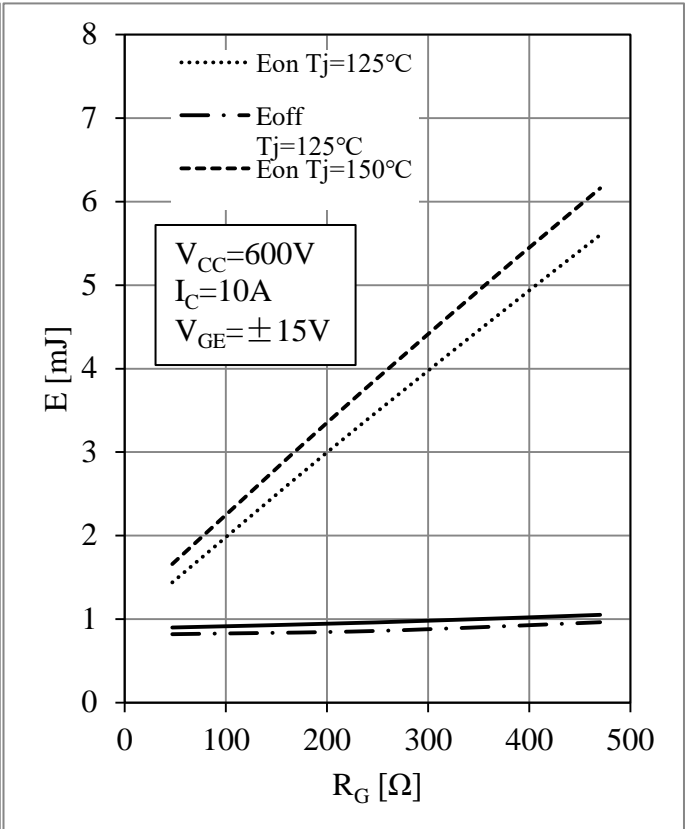


Fig 4. IGBT Switching Loss vs.  $R_G$

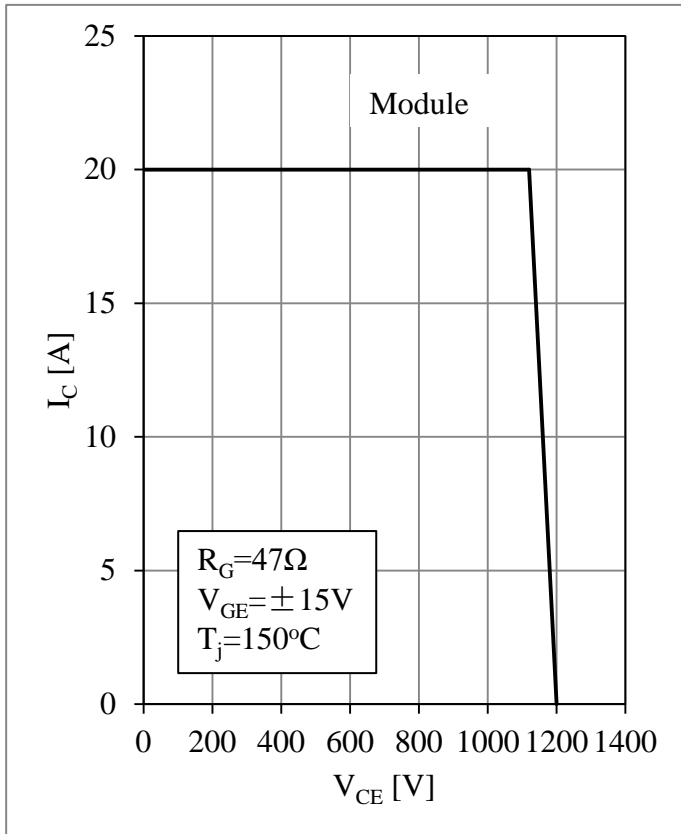


Fig 5. RBSOA

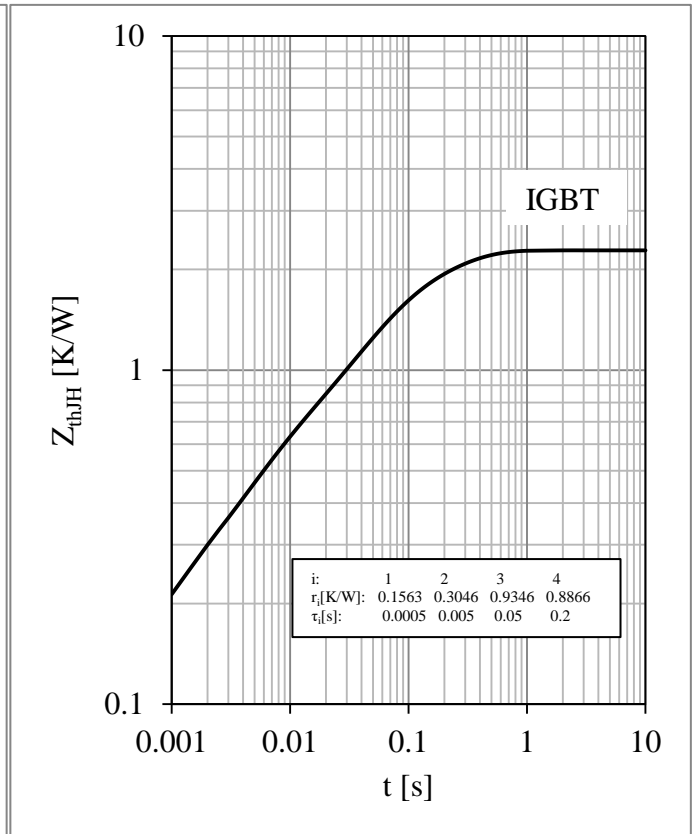


Fig 6. IGBT Transient Thermal Impedance

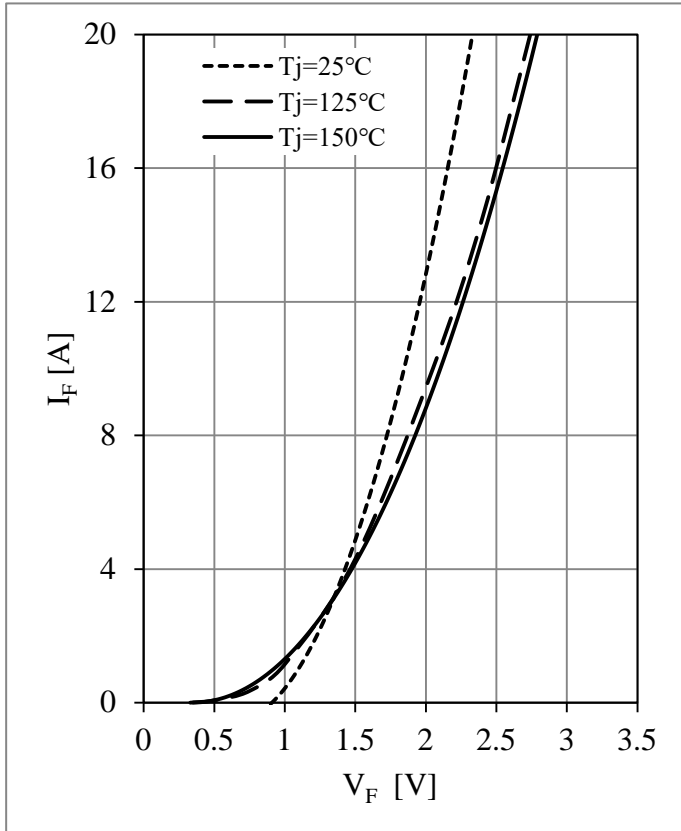


Fig 7. Diode Forward Characteristics

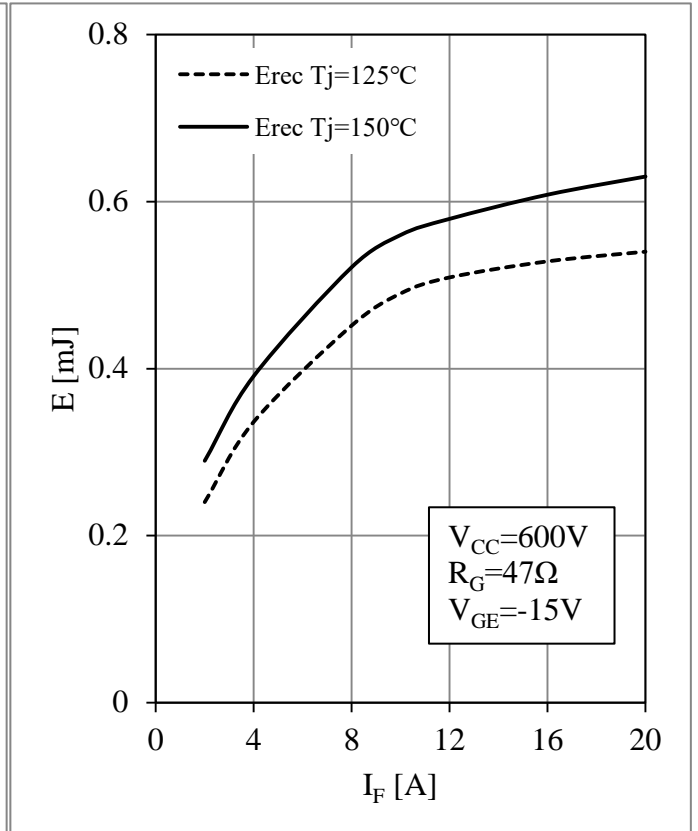


Fig 8. Diode Switching Loss vs.  $I_F$

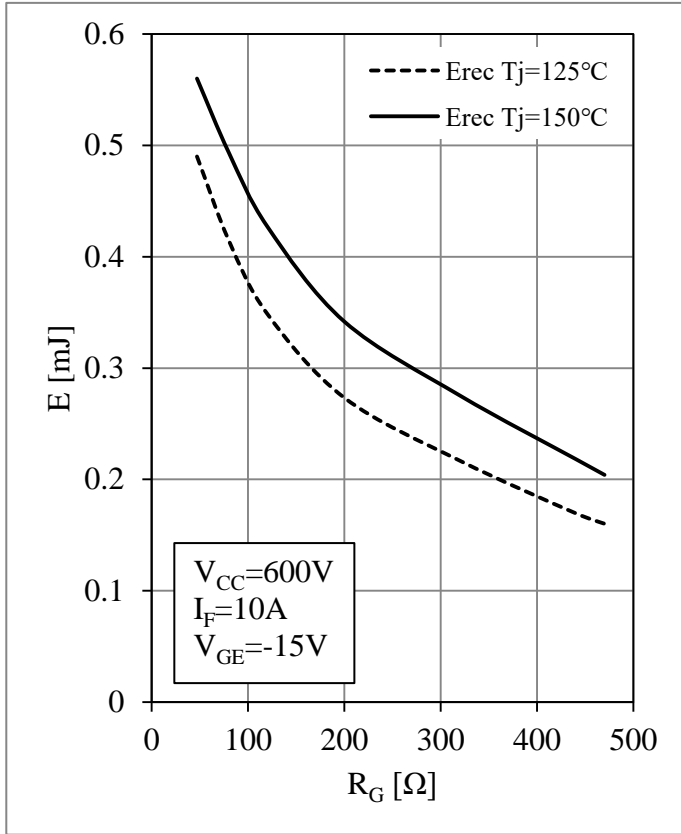


Fig 9. Diode Switching Loss vs.  $R_G$

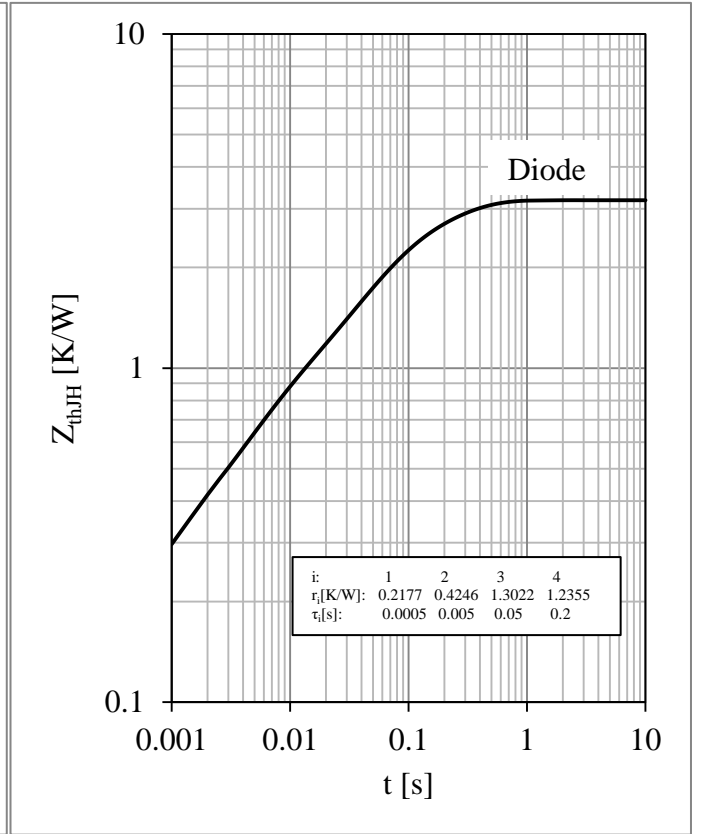
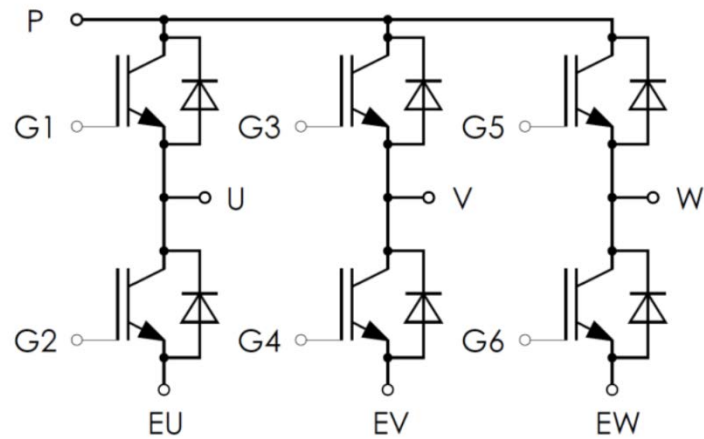


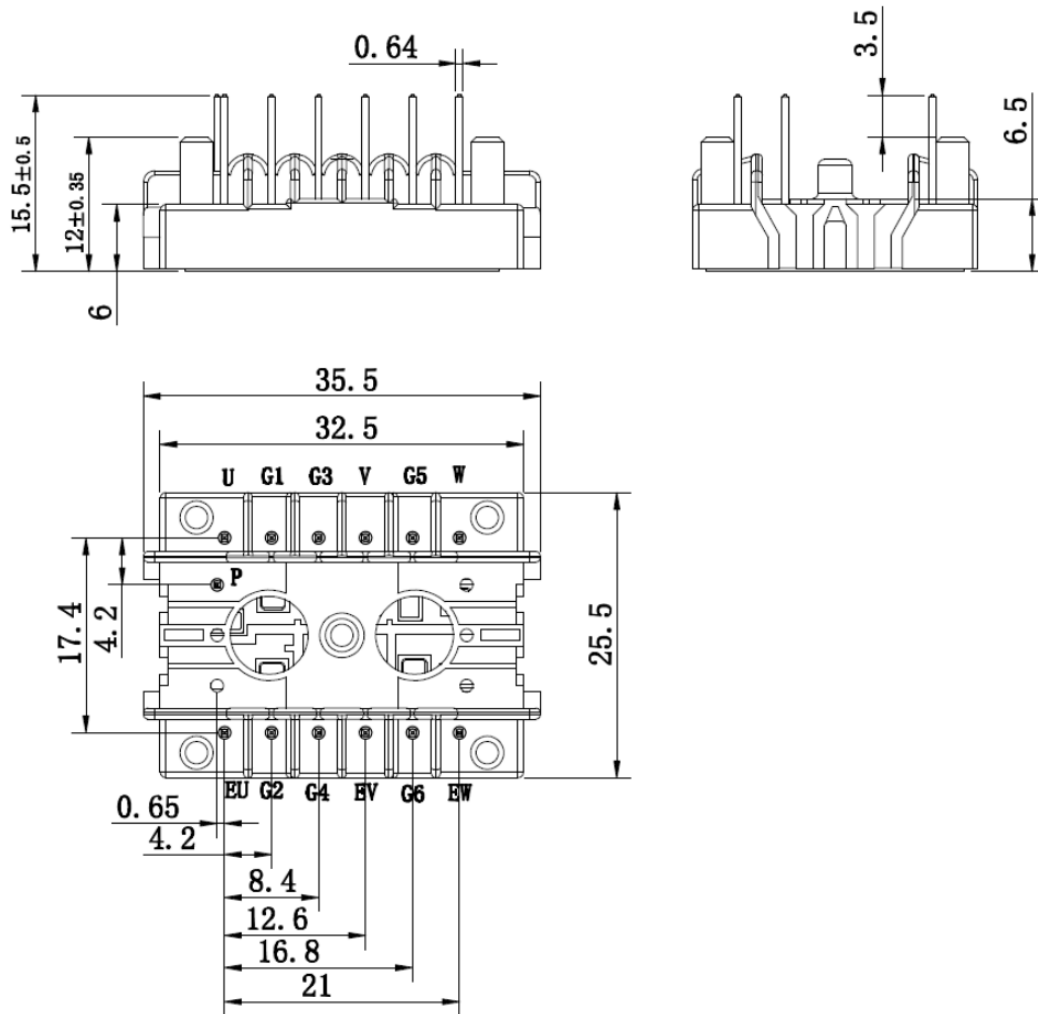
Fig 10. Diode Transient Thermal Impedance

**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters





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