

# DOSEMI

# IGBT

## DG40X12T2

### 1200V/40A IGBT with Diode

### General Description

DOSEMI IGBT Power Discrete provides ultra low conduction loss as well as low switching loss. They are designed for the applications such as general inverters and UPS.

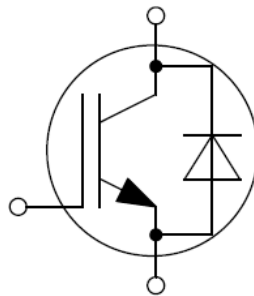
### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- 10 $\mu$ s short circuit capability
- Low switching loss
- Maximum junction temperature 175°C
- Low inductance case
- $V_{CE(sat)}$  with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD
- Lead free package

### 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	Values	Unit
$V_{CES}$	Collector-Emitter Voltage	1200	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=110^{\circ}\text{C}$	80	A
		40	A
$I_{CM}$	Pulsed Collector Current $t_p$ limited by $T_{jmax}$	160	A
$P_D$	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	337	W

**Diode**

Symbol	Description	Values	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current	40	A
$I_{FM}$	Pulsed Collector Current $t_p$ limited by $T_{jmax}$	160	A

**Discrete**

Symbol	Description	Values	Unit
$T_{jop}$	Operating Junction Temperature	-40 to +175	$^{\circ}\text{C}$
$T_{STG}$	Storage Temperature Range	-55 to +150	$^{\circ}\text{C}$
$T_S$	Soldering Temperature, 1.6mm from case for 10s	260	$^{\circ}\text{C}$
M	Mounting Torque, Screw M3	0.6	N.m

**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	$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		1.70	2.15	V	
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$		1.95			
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.00			
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.00\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	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	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			100	nA	
$R_{Gint}$	Internal Gate Resistance			0		$\Omega$	
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$		4.14		nF	
$C_{res}$	Reverse Transfer Capacitance				0.12		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.31		$\mu\text{C}$	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=40\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$		145		ns	
$t_r$	Rise Time			28		ns	
$t_{d(off)}$	Turn-Off Delay Time			194		ns	
$t_f$	Fall Time			295		ns	
$E_{on}$	Turn-On Switching Loss			1.89		mJ	
$E_{off}$	Turn-Off Switching Loss			2.31		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{CC}=600\text{V}, I_C=40\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$		146		ns
$t_r$	Rise Time				30		ns
$t_{d(off)}$	Turn-Off Delay Time			208		ns	
$t_f$	Fall Time			466		ns	
$E_{on}$	Turn-On Switching Loss			2.31		mJ	
$E_{off}$	Turn-Off Switching Loss			3.51		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=40\text{A}, R_G=12\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$			148		ns
$t_r$	Rise Time				32		ns
$t_{d(off)}$	Turn-Off Delay Time			212		ns	
$t_f$	Fall Time			480		ns	
$E_{on}$	Turn-On Switching Loss			2.45		mJ	
$E_{off}$	Turn-Off Switching Loss			3.69		mJ	
$I_{SC}$	SC Data		$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$		160		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	$I_F=40\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		2.35	2.80	V
		$I_F=40\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$		2.50		
		$I_F=40\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		2.45		
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=40\text{A},$ $-di/dt=600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$		3.12		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			28		A
$E_{rec}$	Reverse Recovery Energy			1.58		mJ
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=40\text{A},$ $-di/dt=600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$		5.88		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			32		A
$E_{rec}$	Reverse Recovery Energy			2.96		mJ
$Q_r$	Recovered Charge	$V_R=600\text{V}, I_F=40\text{A},$ $-di/dt=600\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$		6.12		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			35		A
$E_{rec}$	Reverse Recovery Energy			3.08		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{thJC}$	Junction-to-Case (per IGBT)			0.188	K/W
	Junction-to-Case (per Diode)			0.338	
$R_{thJA}$	Junction-to-Ambient		40		K/W

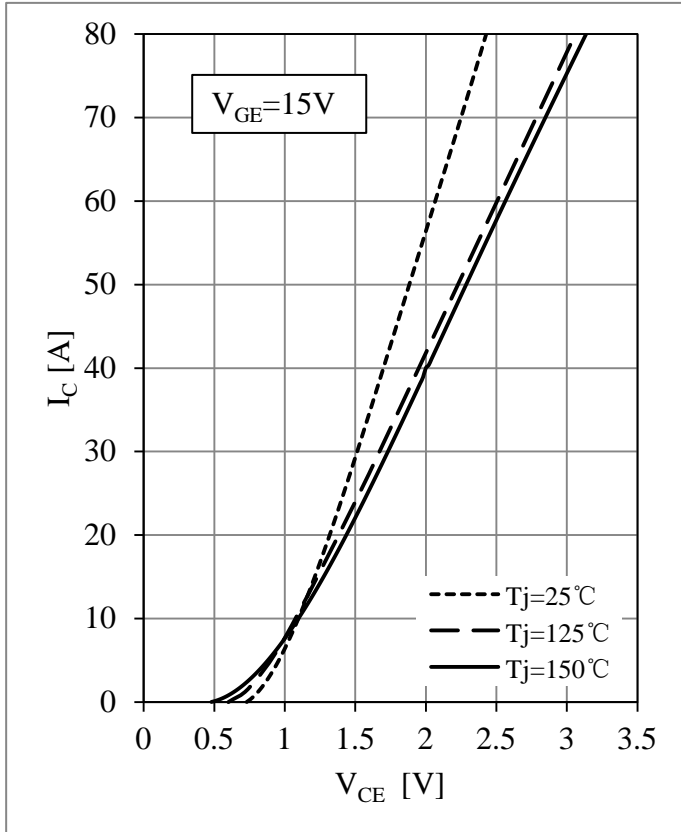


Fig 1. IGBT-inverter Output Characteristics

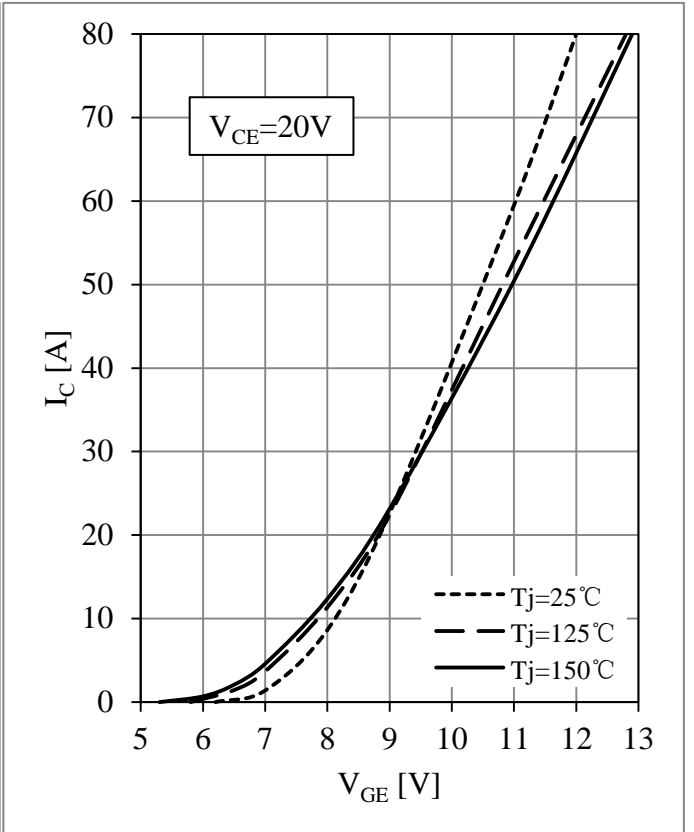


Fig 2. IGBT-inverter Transfer Characteristics

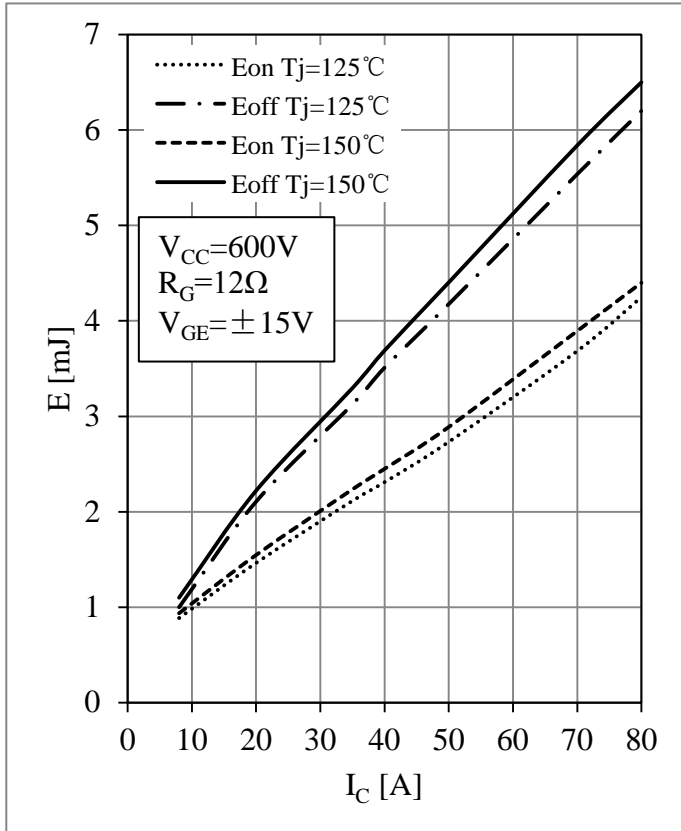


Fig 3. IGBT-inverter Switching Loss vs.  $I_C$

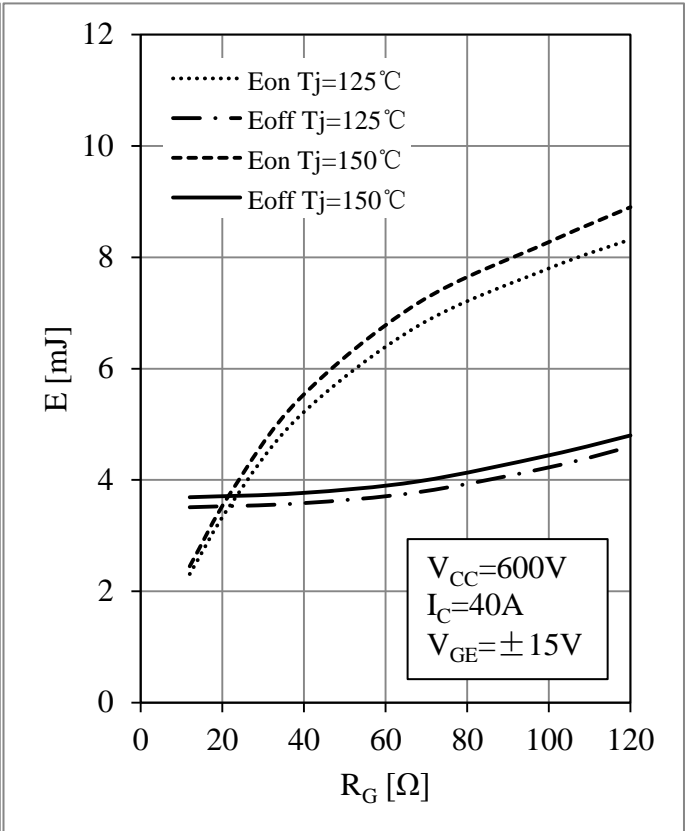


Fig 4. IGBT-inverter Switching Loss vs.  $R_G$

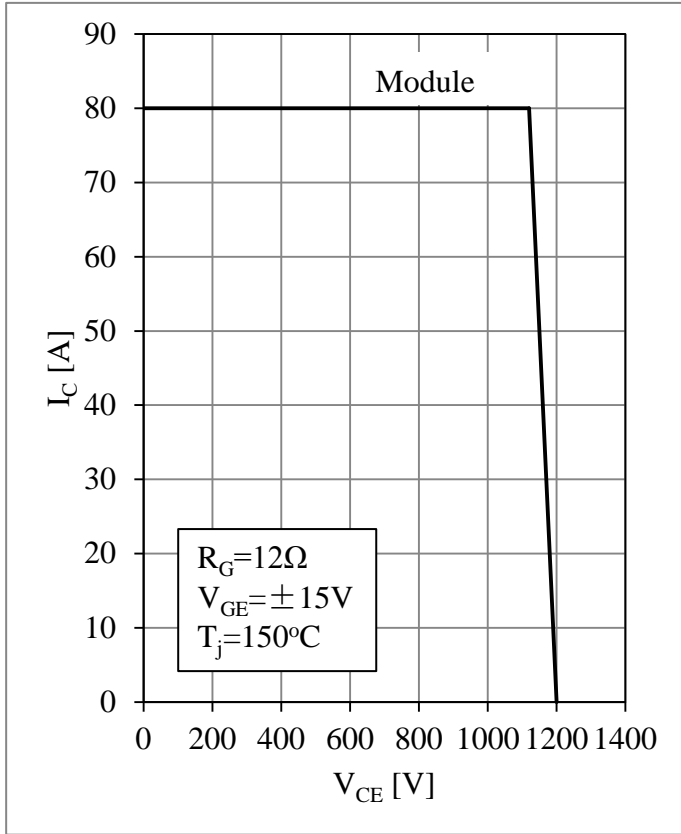


Fig 5. IGBT-inverter RBSOA

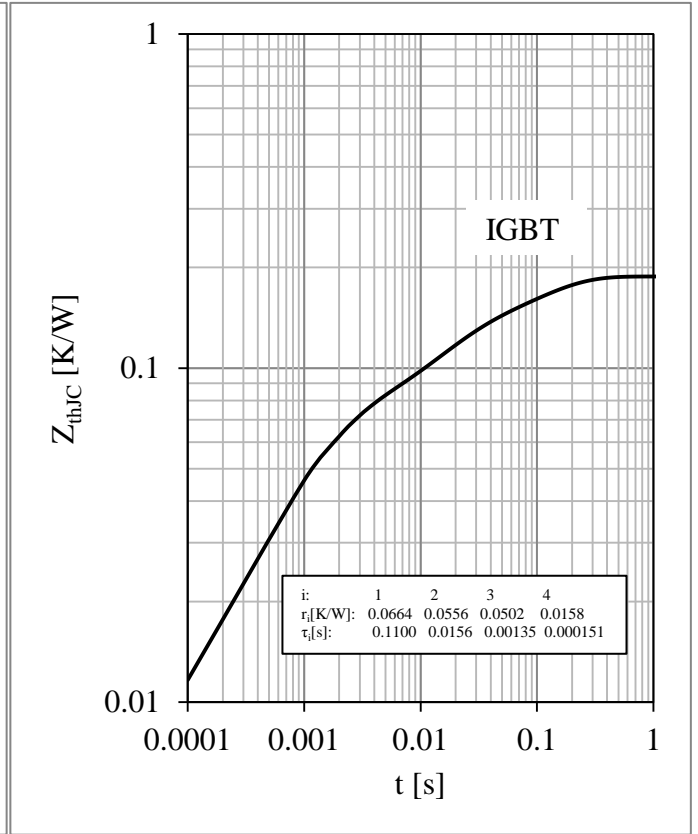


Fig 6. IGBT-inverter Transient Thermal Impedance

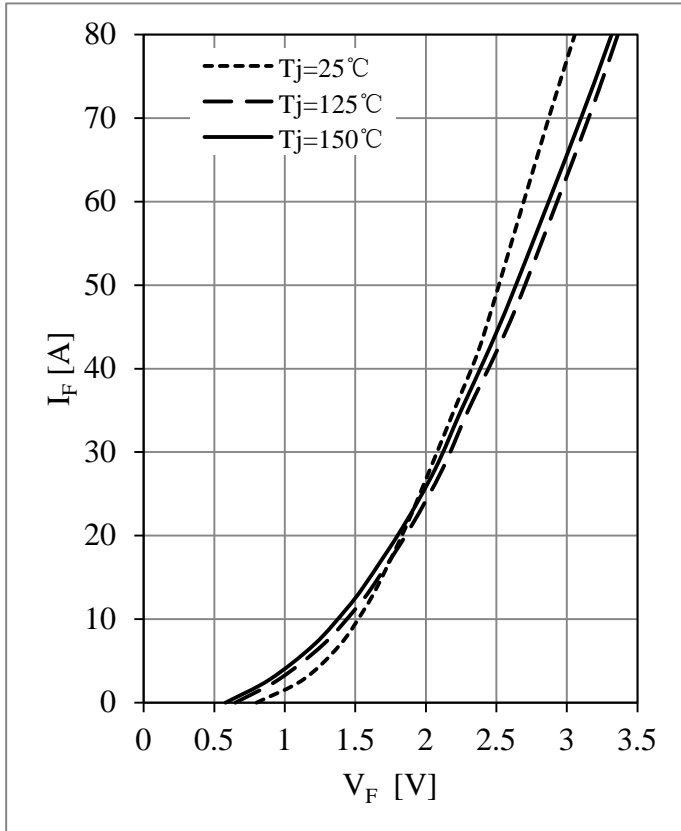


Fig 7. Diode-inverter Forward Characteristics

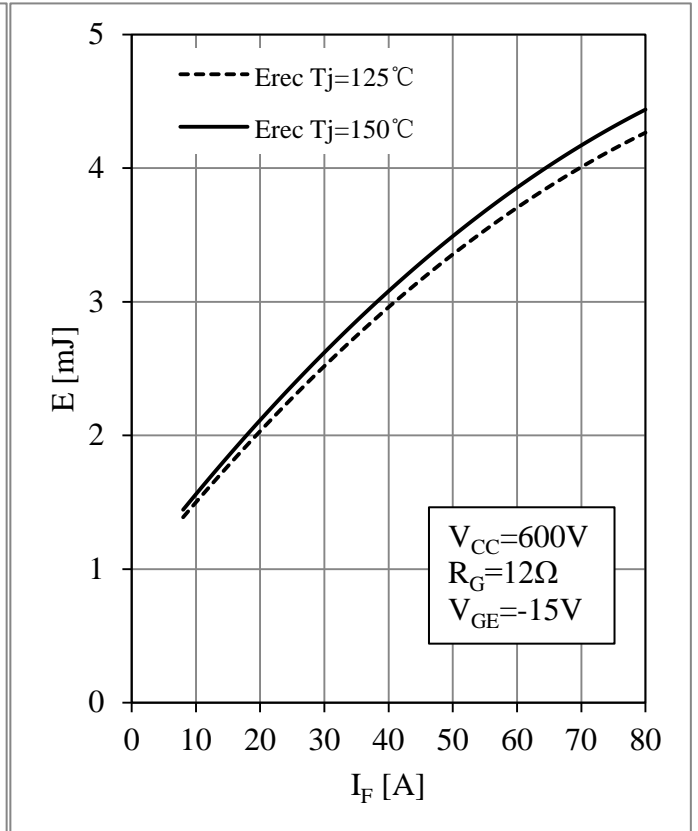


Fig 8. Diode-inverter Switching Loss vs.  $I_F$

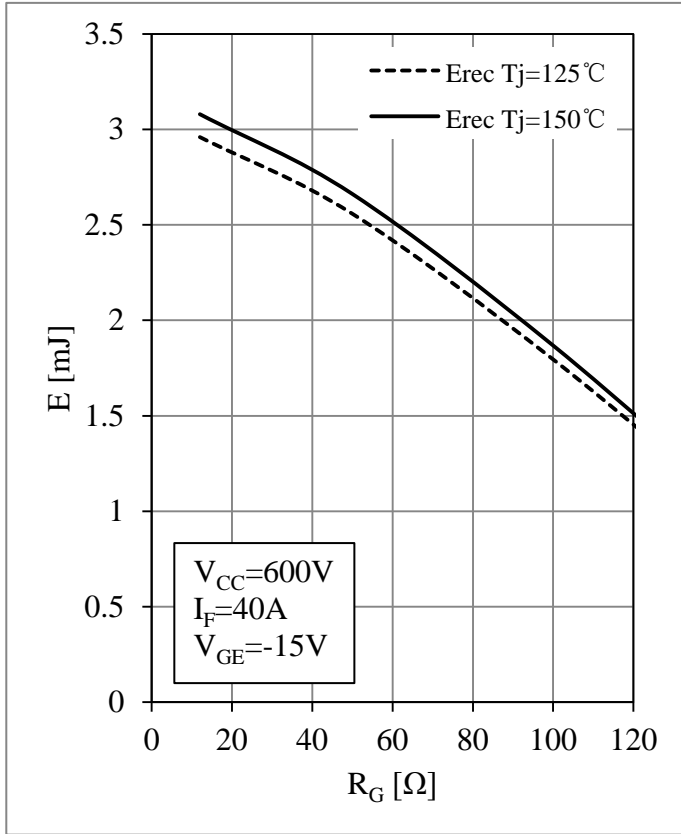


Fig 9. Diode-inverter Switching Loss vs.  $R_G$

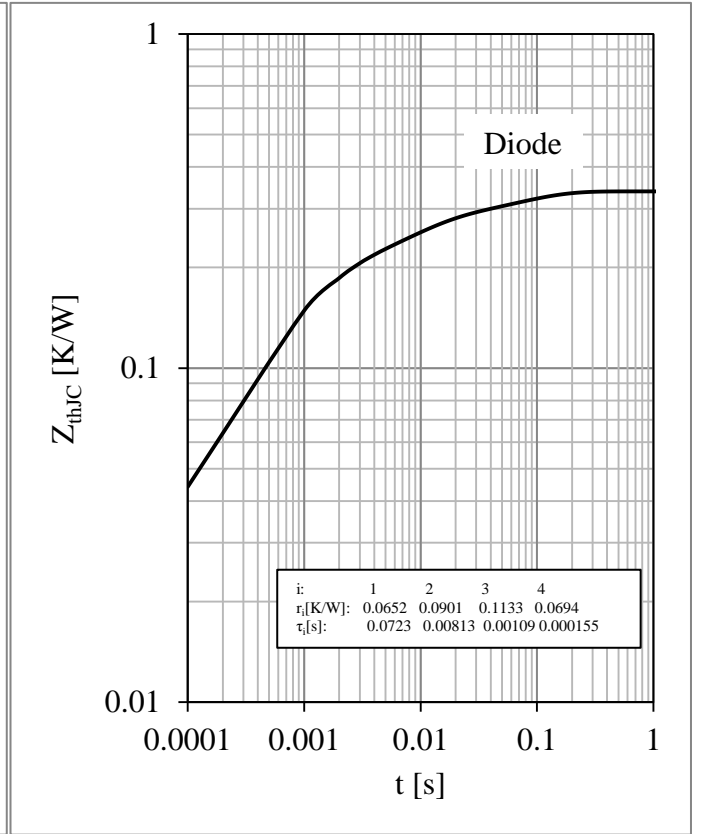
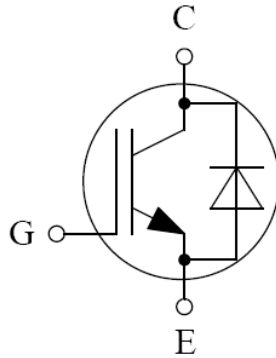


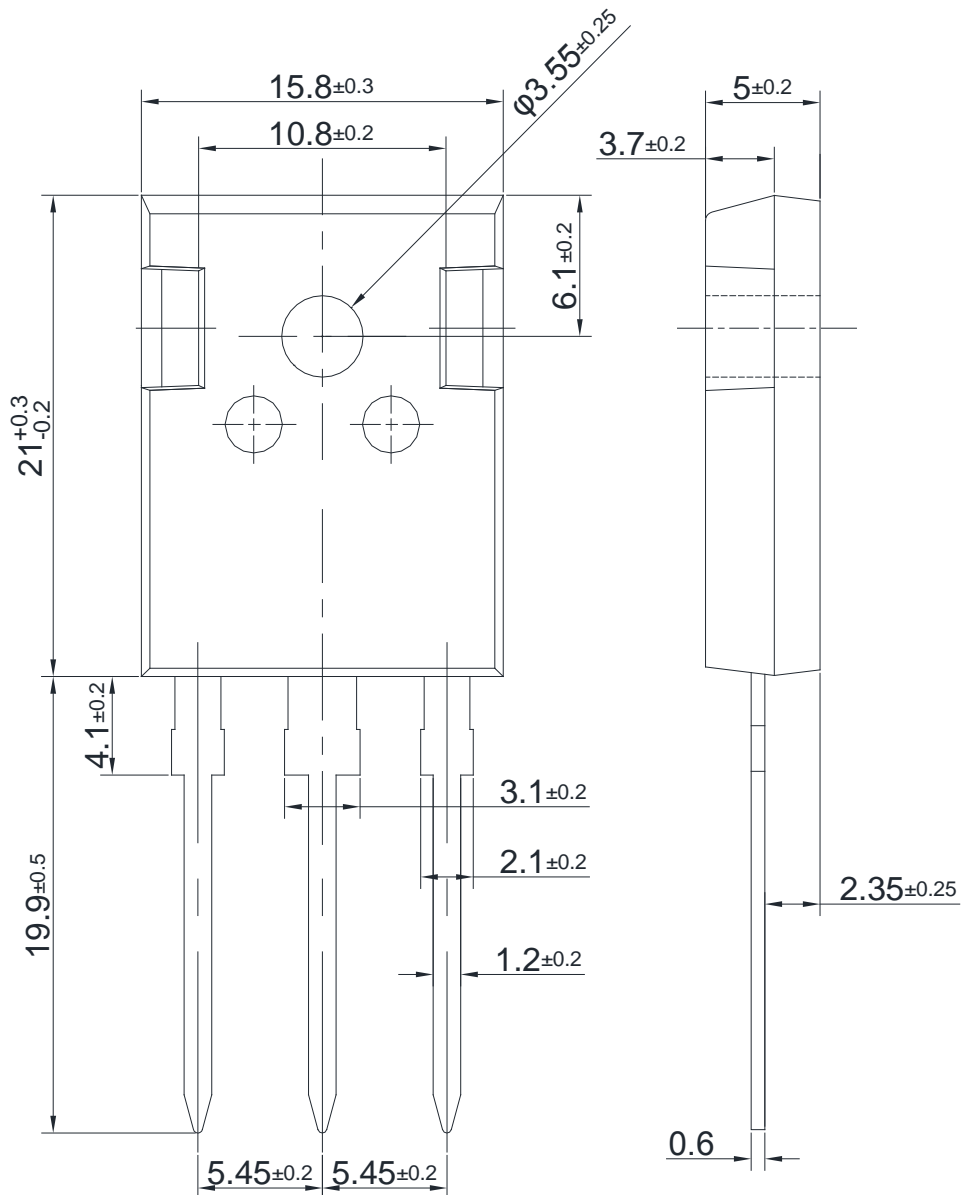
Fig 10. Diode-inverter Transient Thermal Impedance

### Circuit Schematic



### Package Dimensions

Dimensions in Millimeters





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