

# DOSEMI

# IGBT

## DG40Q12T2LZ

**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 solar power.

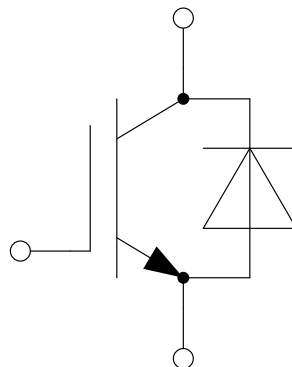
### Features

- Low  $V_{CE(sat)}$  Fast IGBT technology
- Low switching loss
- Maximum junction temperature 175°C
- $V_{CE(sat)}$  with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD
- Lead free package

### Typical Applications

- Solar power
- UPS
- 3-level-application

### 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 Transient Gate-Emitter Voltage	$\pm 20$ -25/+30	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	80 40	A
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	120	A
$P_D$	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	468	W

**Diode**

Symbol	Description	Values	Unit
$V_{RRM}$	Repetitive Peak Reverse Voltage	1200	V
$I_F$	Diode Continuous Forward Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$	70 40	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	120	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	$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$		2.10	2.50	V
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$		2.70		
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=175^\circ\text{C}$		2.80		
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.60\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$	5.0	6.2	6.5	V
$I_{CES}$	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$			0.25	mA
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$			600	nA
$R_{Gint}$	Internal Gate Resistance			0		$\Omega$
$C_{ies}$	Input Capacitance	$V_{CE}=25\text{V}, f=100\text{kHz}, V_{GE}=0\text{V}$		4.21		nF
$C_{oes}$	Output Capacitance			0.27		nF
$C_{res}$	Reverse Transfer Capacitance			0.11		nF
$Q_G$	Gate Charge	$V_{GE}=-15\dots+15\text{V}$		0.32		$\mu\text{C}$
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=40\text{A}, R_G=8.2\Omega, L_S=40\text{nH}, V_{GE}=\pm 15, T_j=25^\circ\text{C}$		32		ns
$t_r$	Rise Time			105		ns
$t_{d(off)}$	Turn-Off Delay Time			105		ns
$t_f$	Fall Time			118		ns
$E_{on}$	Turn-On Switching Loss			4.04		mJ
$E_{off}$	Turn-Off Switching Loss		1.12		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=40\text{A}, R_G=8.2\Omega, L_S=40\text{nH}, V_{GE}=\pm 15, T_j=150^\circ\text{C}$		34		ns
$t_r$	Rise Time			110		ns
$t_{d(off)}$	Turn-Off Delay Time			115		ns
$t_f$	Fall Time			177		ns
$E_{on}$	Turn-On Switching Loss			5.62		mJ
$E_{off}$	Turn-Off Switching Loss		1.69		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=600\text{V}, I_C=40\text{A}, R_G=8.2\Omega, L_S=40\text{nH}, V_{GE}=\pm 15, T_j=175^\circ\text{C}$		37		ns
$t_r$	Rise Time			113		ns
$t_{d(off)}$	Turn-Off Delay Time			118		ns
$t_f$	Fall Time			185		ns
$E_{on}$	Turn-On Switching Loss			5.78		mJ
$E_{off}$	Turn-Off Switching Loss		1.76		mJ	
$I_{SC}$	SC Data	$t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=800\text{V}, V_{CEM} \leq 1200\text{V}$		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	$I_C=40\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$		2.40	2.85	V
		$I_C=40\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$		1.80		
		$I_C=40\text{A}, V_{GE}=0\text{V}, T_j=175^\circ\text{C}$		1.75		
$t_{rr}$	Diode Reverse Recovery Time	$V_R=600\text{V}, I_F=40\text{A},$ $-di/dt=228\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=40\text{nH}, T_j=25^\circ\text{C}$		226		ns
$Q_r$	Recovered Charge			1.12		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			9.35		A
$E_{rec}$	Reverse Recovery Energy			0.41		mJ
$t_{rr}$	Diode Reverse Recovery Time	$V_R=600\text{V}, I_F=40\text{A},$ $-di/dt=250\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=40\text{nH}, T_j=150^\circ\text{C}$		285		ns
$Q_r$	Recovered Charge			2.10		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			12.3		A
$E_{rec}$	Reverse Recovery Energy			0.69		mJ
$t_{rr}$	Diode Reverse Recovery Time	$V_R=600\text{V}, I_F=40\text{A},$ $-di/dt=235\text{A}/\mu\text{s}, V_{GE}=-15\text{V},$ $L_S=40\text{nH}, T_j=175^\circ\text{C}$		304		ns
$Q_r$	Recovered Charge			2.40		$\mu\text{C}$
$I_{RM}$	Peak Reverse Recovery Current			13.6		A
$E_{rec}$	Reverse Recovery Energy			0.76		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)			0.320	K/W
	Junction-to-Case (per Diode)			0.757	
$R_{thJA}$	Junction-to-Ambient		40		K/W

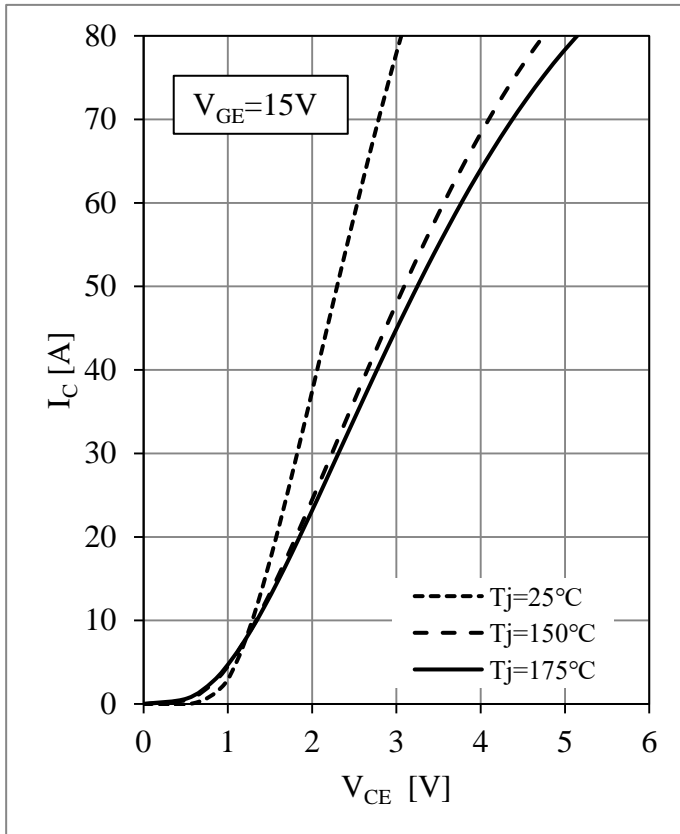


Fig 1. IGBT-inverter Output Characteristics

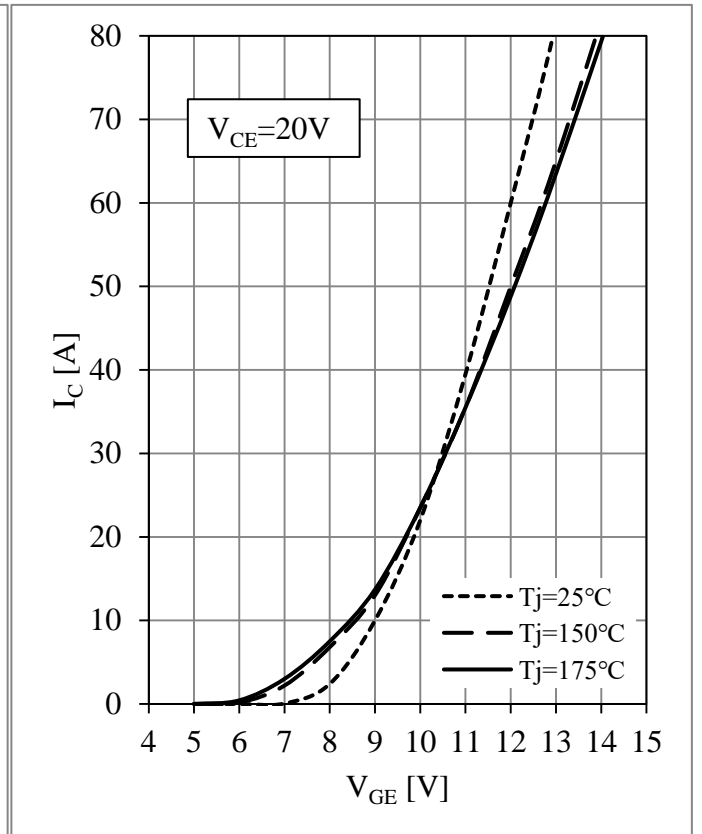


Fig 2. IGBT-inverter Transfer Characteristics

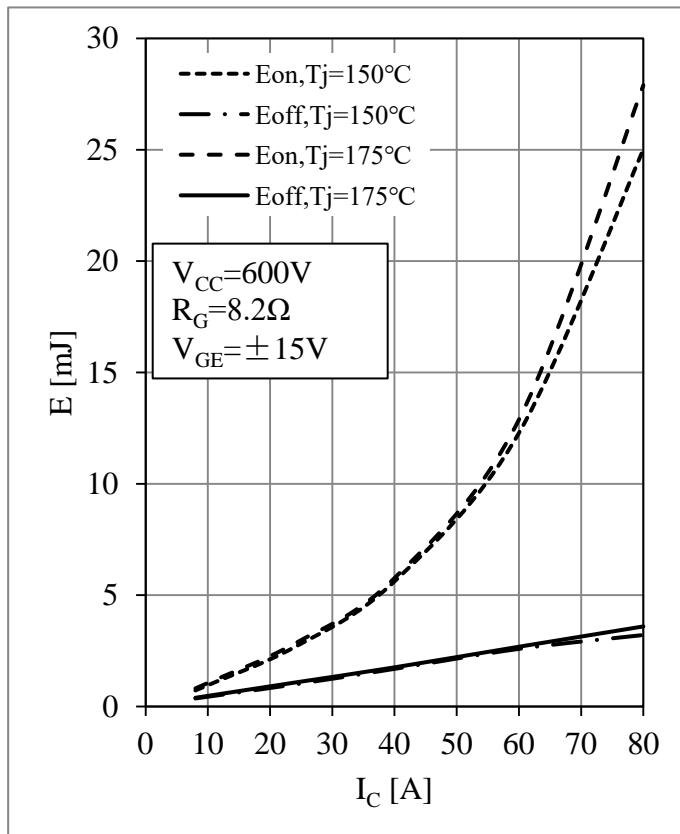


Fig 3. IGBT-inverter Switching Loss vs.  $I_C$

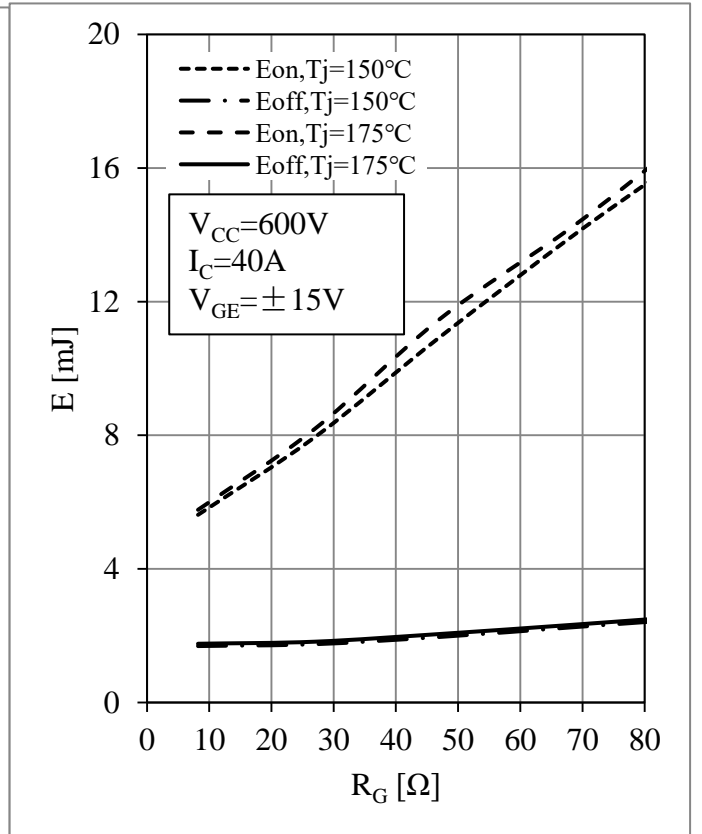


Fig 4. IGBT-inverter Switching Loss vs.  $R_G$

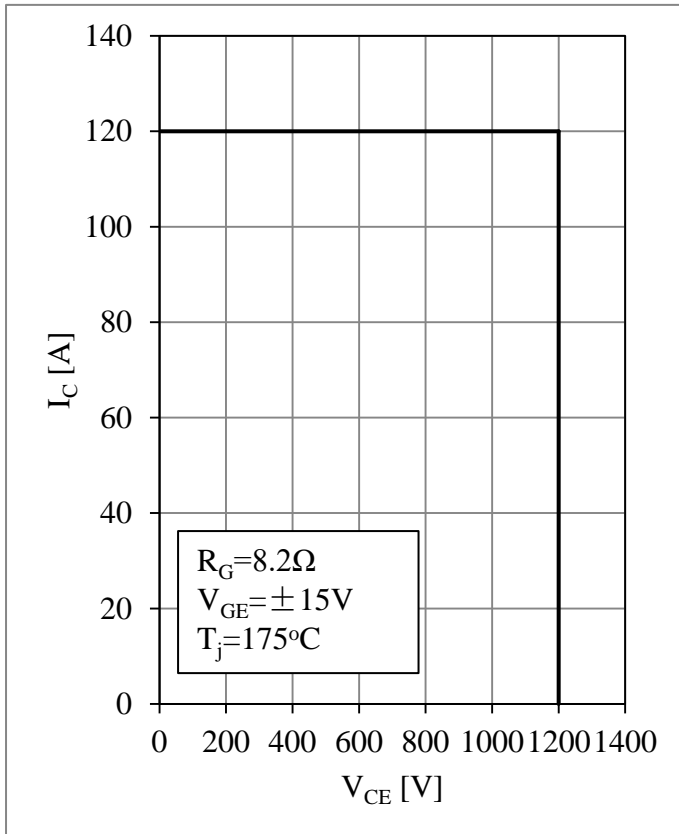


Fig 5. IGBT-inverter RBSOA

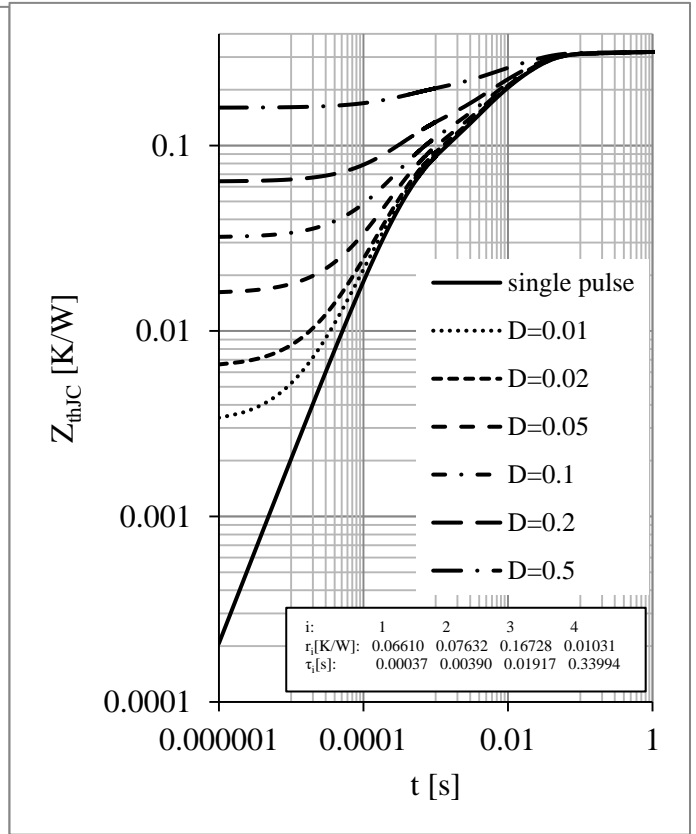


Fig 6. IGBT-inverter Transient Thermal Impedance

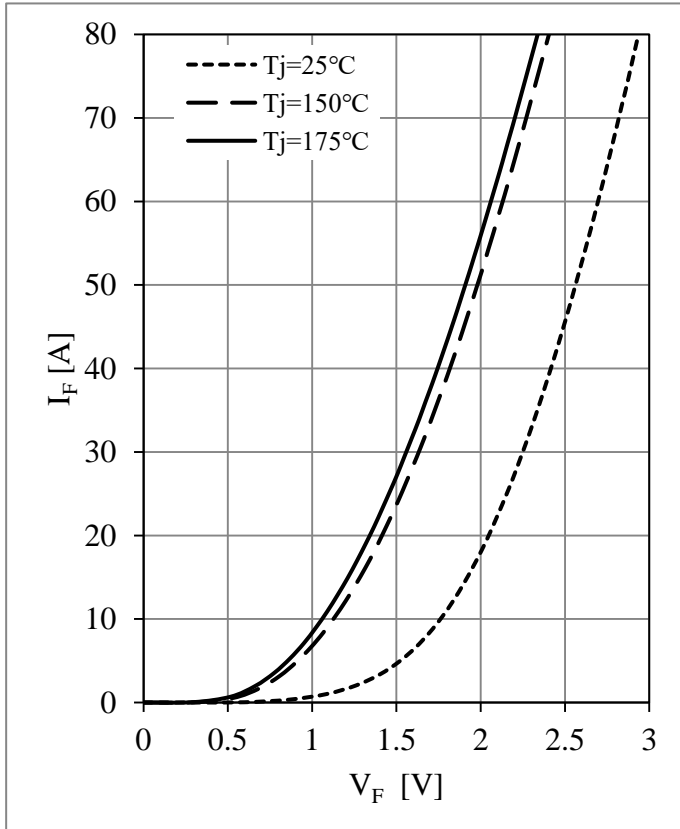


Fig 7. Diode-inverter Forward Characteristics

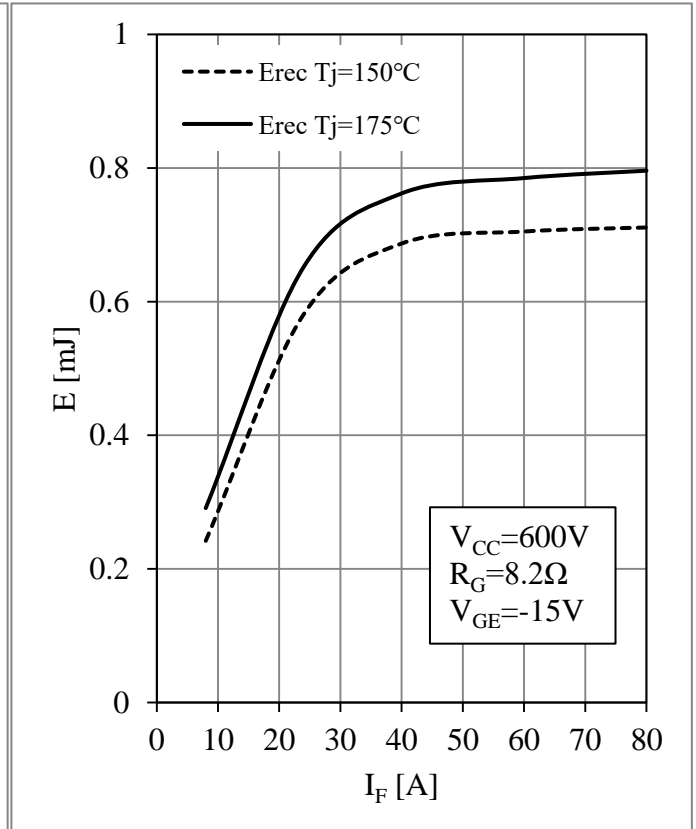


Fig 8. Diode-inverter Switching Loss vs.  $I_F$

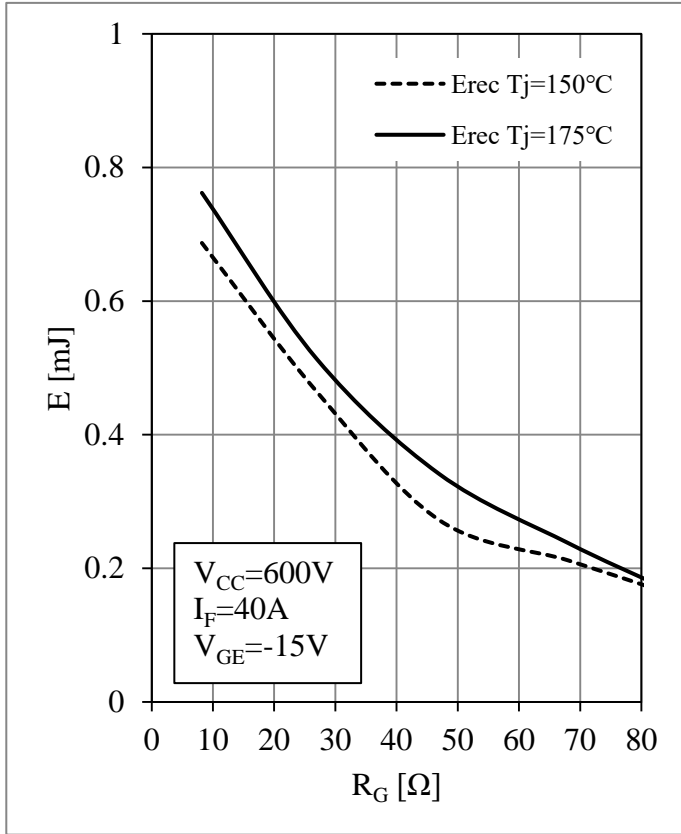


Fig 9. Diode-inverter Switching Loss vs.  $R_G$

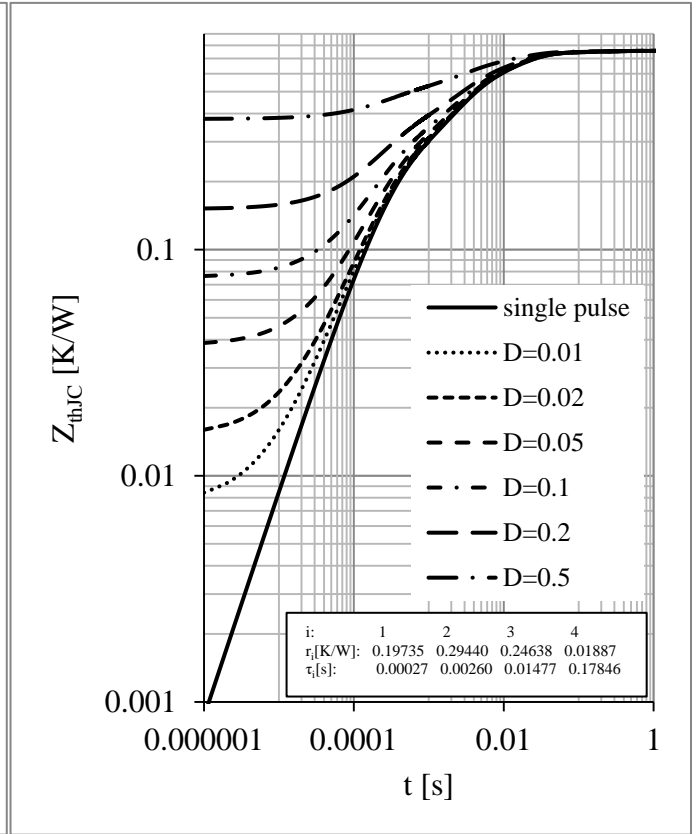
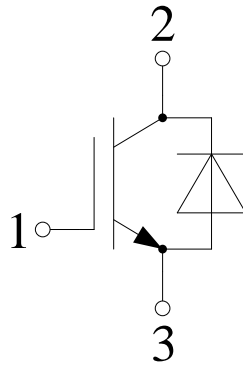


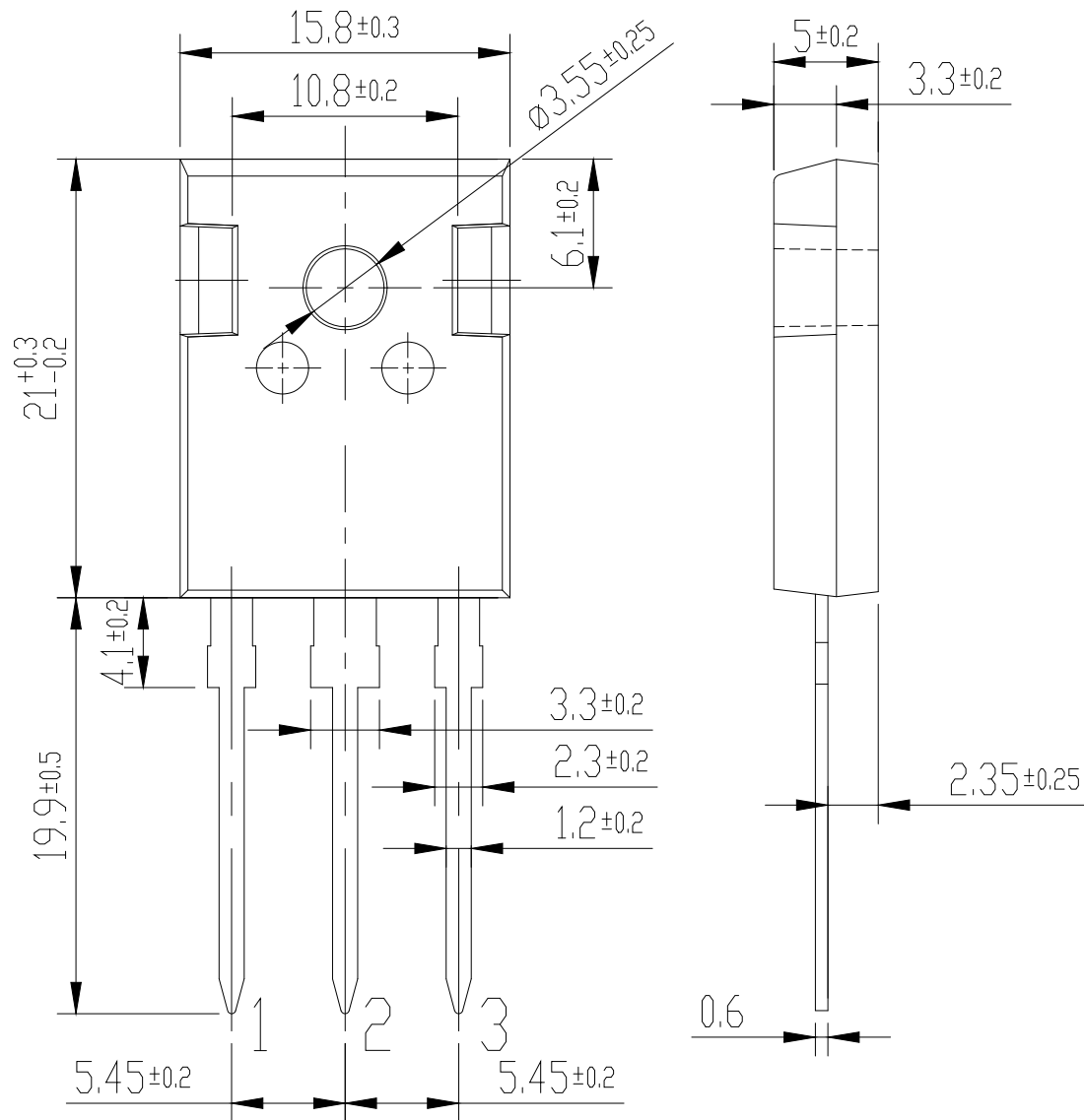
Fig 10. Diode-inverter Transient Thermal Impedance

### Circuit Schematic



### Package Dimensions

Dimensions in Millimeters



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