

# DOSEMI

# IGBT

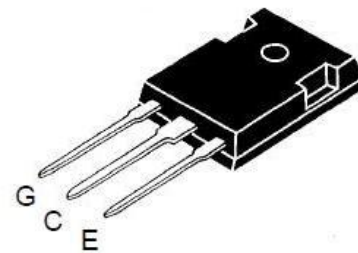
## DG40T06T2

### Molding Type Discretes

### 600V/40A IGBT with Anti-Parallel Diode

### General Description

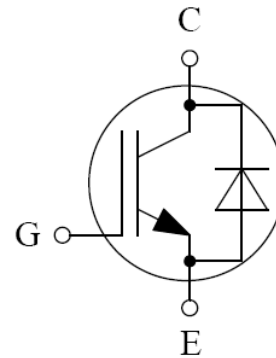
DOSEMI IGBT Power Discretes provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverters and electronic welders.



TO-247

### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- Low switching loss
- Maximum junction temperature 175°C
- 5 $\mu$ s short circuit capability
- Square RBSOA
- $V_{CE(sat)}$  with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD
- Tight parameter distribution
- Lead free package



Equivalent Circuit Schematic

### Typical Applications

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

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

Symbol	Description	DG40T06T2	Units
$V_{CES}$	Collector-Emitter Voltage	600	V
$V_{GES}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current @ $T_C=25^{\circ}\text{C}$	80	A
	@ $T_C=100^{\circ}\text{C}$	40	
$I_{CM}$	Pulsed Collector Current $t_p=1\text{ms}$	80	A
$I_F$	Diode Continuous Forward Current	20	A
$I_{FM}$	Diode Maximum Forward Current $t_p=1\text{ms}$	40	A
$P_D$	Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$	378	W
$T_{jmax}$	Maximum Junction Temperature	175	$^{\circ}\text{C}$
$T_{jop}$	Operating Junction Temperature	-40 to +175	$^{\circ}\text{C}$
$T_{stg}$	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
$T_S$	Soldering Temperature, 1.6mm from case for 10s	260	$^{\circ}\text{C}$

**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	$T_j=25^{\circ}\text{C}$	600			V
$I_{CES}$	Collector Cut-Off Current	$V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^{\circ}\text{C}$			25	$\mu\text{A}$
$I_{GES}$	Gate-Emitter Leakage Current	$V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^{\circ}\text{C}$			100	nA


**On Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GE(th)}$	Gate-Emitter Threshold Voltage	$I_C=1.0\text{mA}, V_{CE}=V_{GE}, T_j=25^{\circ}\text{C}$	4.0	4.8	6.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=25^{\circ}\text{C}$		1.65	2.10	V
		$I_C=40\text{A}, V_{GE}=15\text{V}, T_j=175^{\circ}\text{C}$		2.20		

### Switching Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
 $t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=40A,$ $R_G=10\Omega, V_{GE}=15V,$ $T_j=25^\circ C$		53		ns
 $t_r$	Rise Time			38		ns
 $t_{d(off)}$	Turn-Off Delay Time			120		ns
 $t_f$	Fall Time			50		ns
 $E_{on}$	Turn-On Switching Loss			0.44		mJ
 $E_{off}$	Turn-Off Switching Loss			0.72		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{CC}=400V, I_C=40A,$ $R_G=10\Omega, V_{GE}=15V,$ $T_j=175^\circ C$		55		ns
$t_r$	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			145		ns
$t_f$	Fall Time			70		ns
$E_{on}$	Turn-On Switching Loss			1.16		mJ
$E_{off}$	Turn-Off Switching Loss			1.06		mJ
$C_{ies}$	Input Capacitance	$V_{CE}=30V, f=1MHz,$ $V_{GE}=0V$		2.11		nF
$C_{oes}$	Output Capacitance			0.20		nF
$C_{res}$	Reverse Transfer Capacitance			0.07		nF
 $Q_G$	Gate Charge	$V_{CC}=400V, I_C=40A,$ $V_{GE}=15V$		79		nC
$I_{SC}$	SC Data	$t_p \leq 5\mu s, V_{GE}=15V,$ $T_j=150^\circ C, V_{CC}=400V,$ $V_{CEM} \leq 600V$		350		A
$R_{Gint}$	Internal Gate Resistance			/		$\Omega$

### 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	$I_F=20A, V_{GE}=0V$	$T_j=25^\circ C$		1.60	2.05	V
			$T_j=175^\circ C$		1.60		
 $Q_r$	Recovered Charge	$I_F=20A,$ $V_R=400V,$ $R_G=10\Omega,$ $V_{GE}=-15V$	$T_j=25^\circ C$		0.6		$\mu C$
			$T_j=175^\circ C$		1.5		
$I_{RM}$	Peak Reverse Recovery Current		$T_j=25^\circ C$		15		A
			$T_j=175^\circ C$		22		
$E_{rec}$	Reverse Recovery Energy	$T_j=25^\circ C$		0.09		mJ	
		$T_j=175^\circ C$		0.23			

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{thJC}$	Junction-to-Case (per IGBT)		0.397	K/W
$R_{thJC}$	Junction-to-Case (per Diode)		1.837	K/W
$R_{\theta JA}$	Junction-to-Ambient	40		K/W

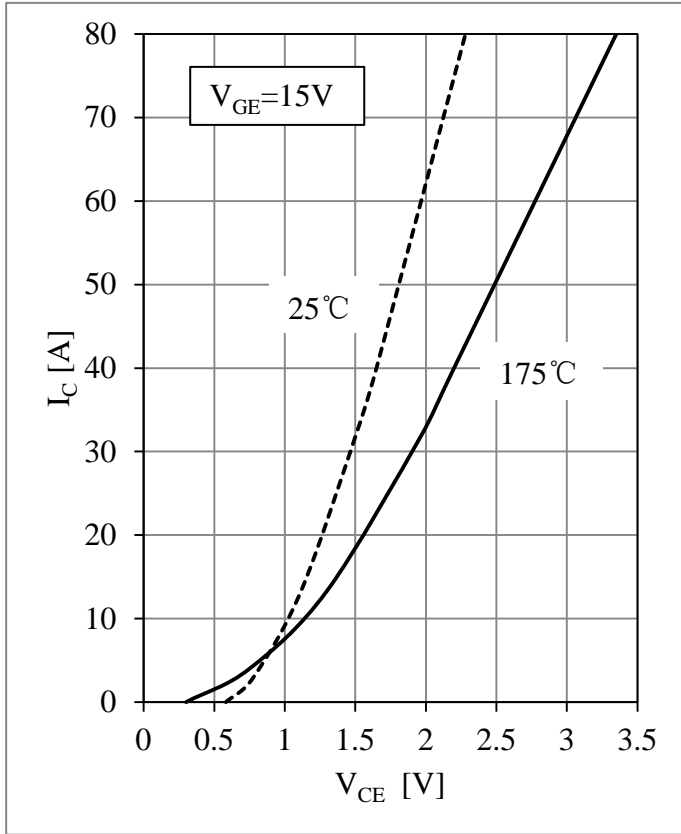


Fig 1. IGBT Output Characteristics

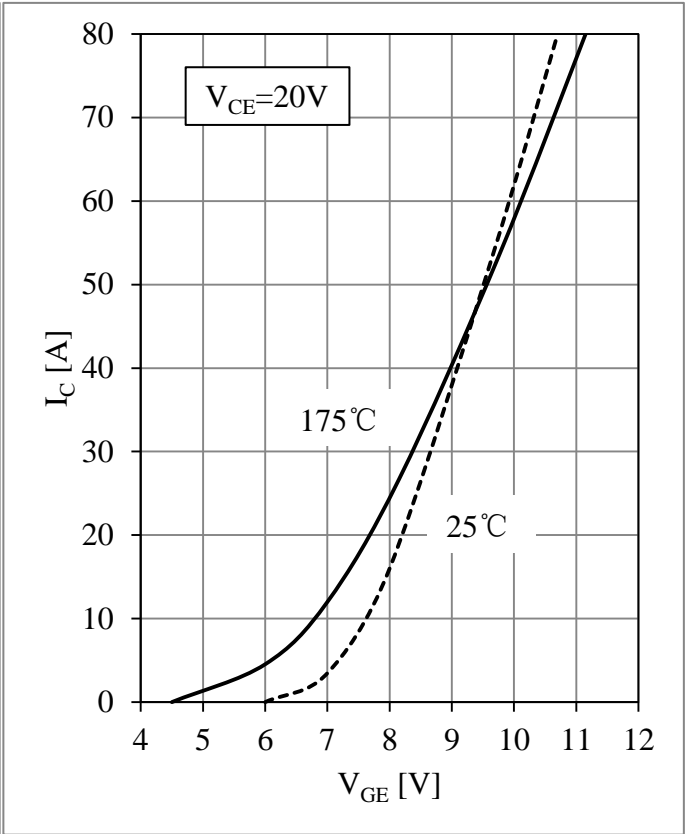


Fig 2. IGBT Transfer Characteristics

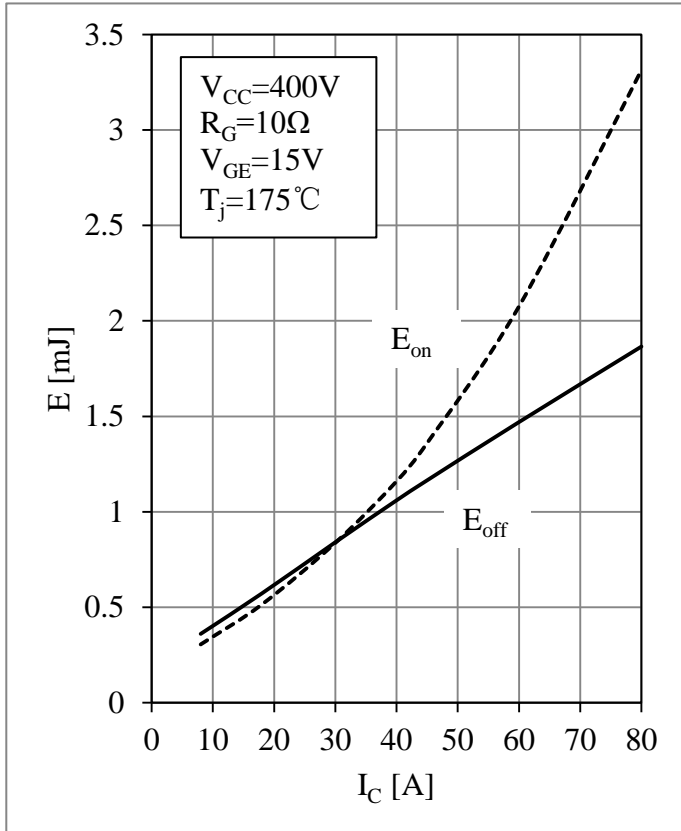


Fig 3. IGBT Switching Loss vs.  $I_C$

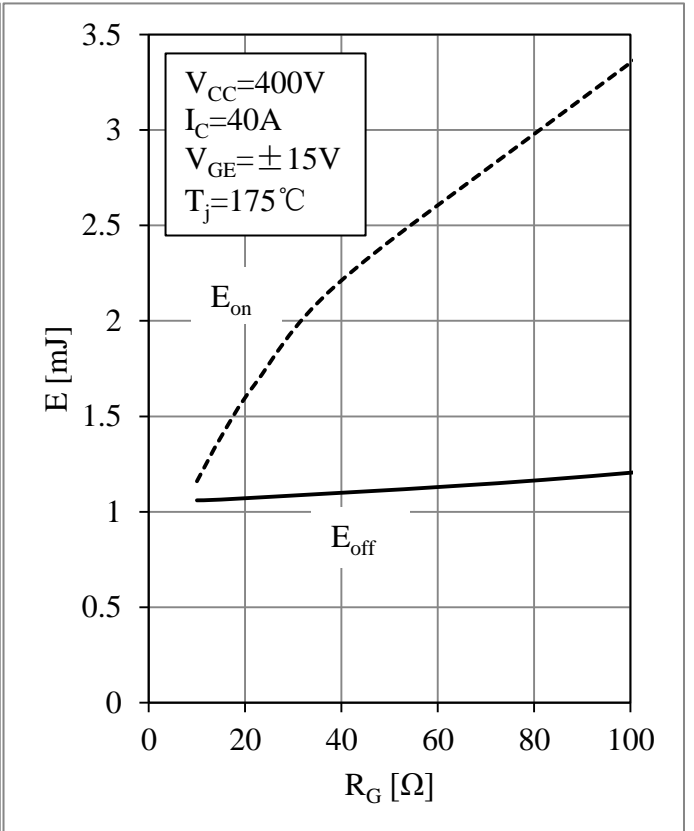


Fig 4. IGBT Switching Loss vs.  $R_G$

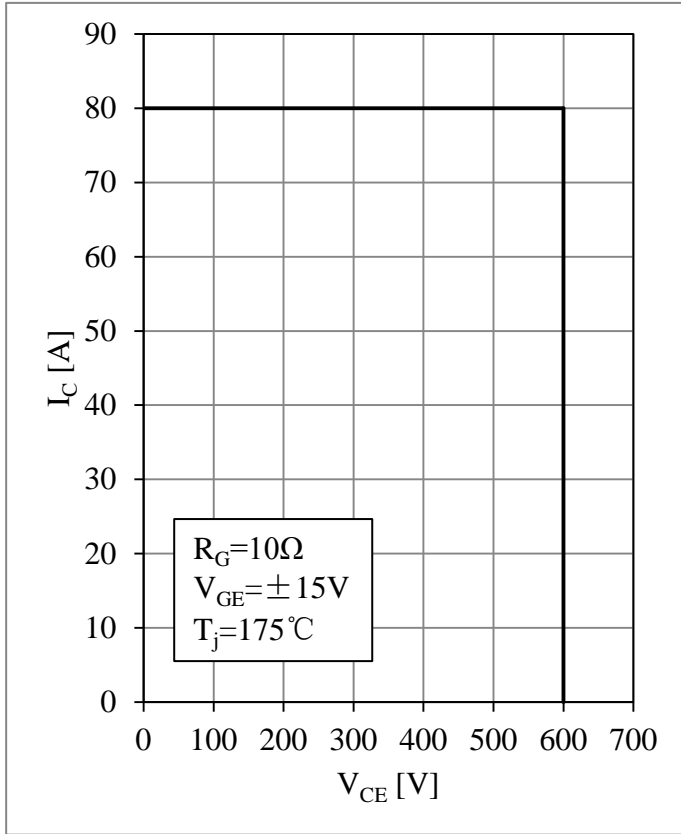


Fig 5. RBSOA

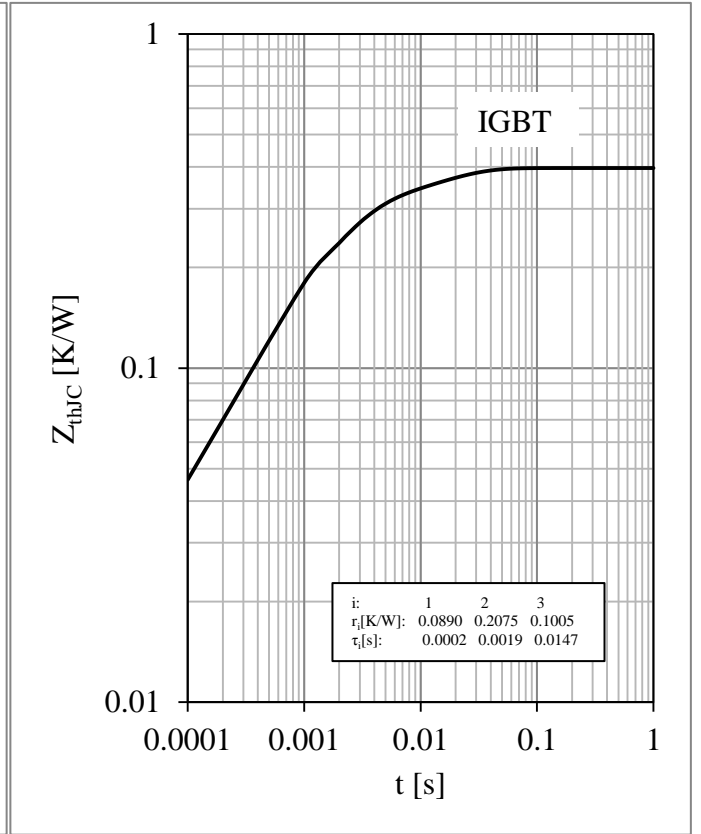


Fig 6. IGBT Transient Thermal Impedance

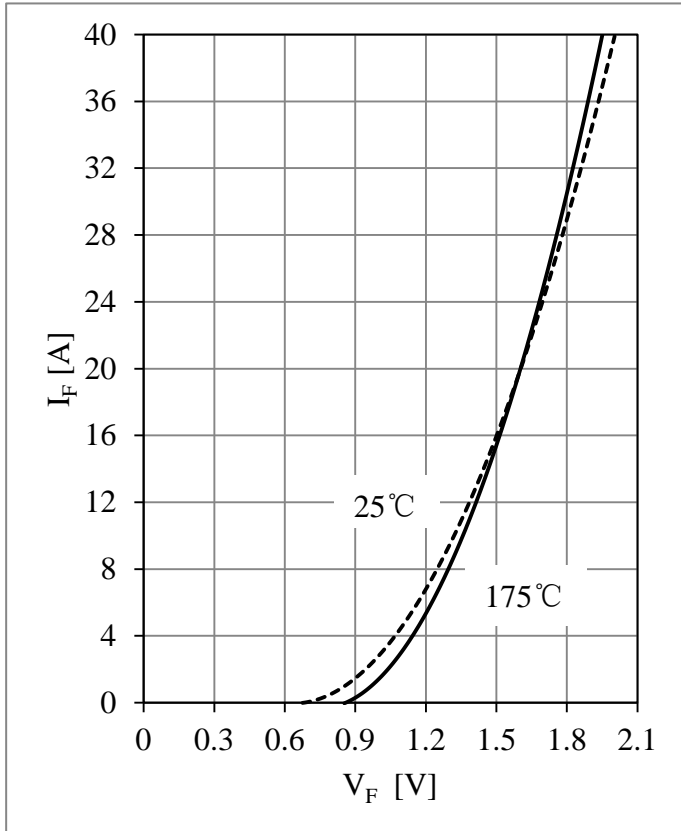


Fig 7. Diode Forward Characteristics

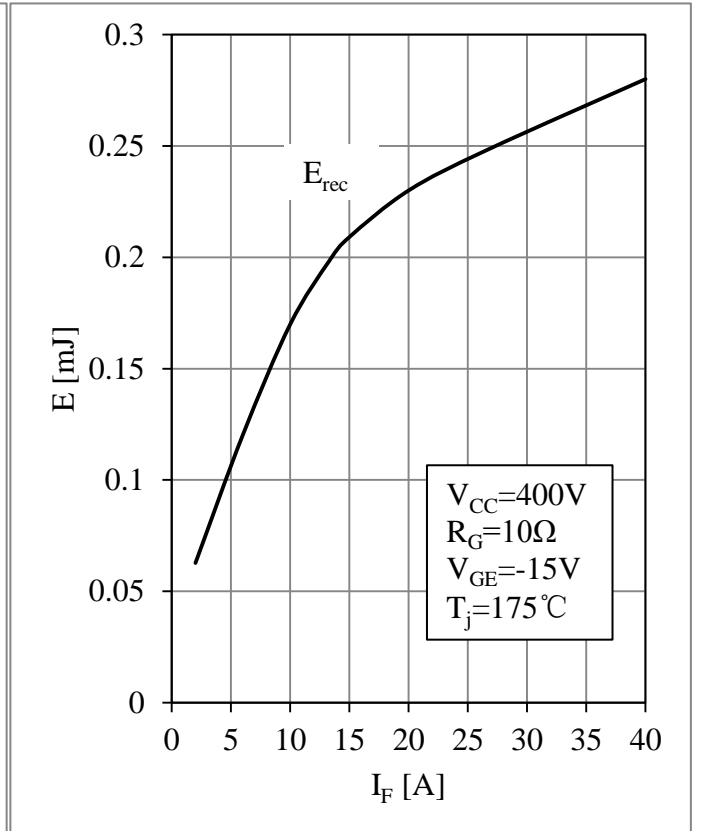


Fig 8. Diode Switching Loss vs.  $I_F$

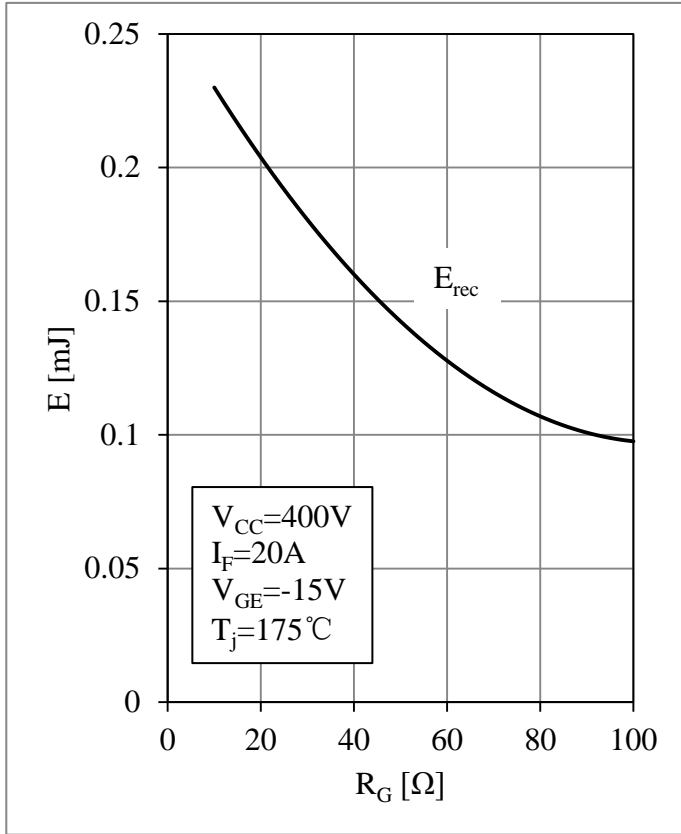


Fig 9. Diode Switching Loss vs.  $R_G$

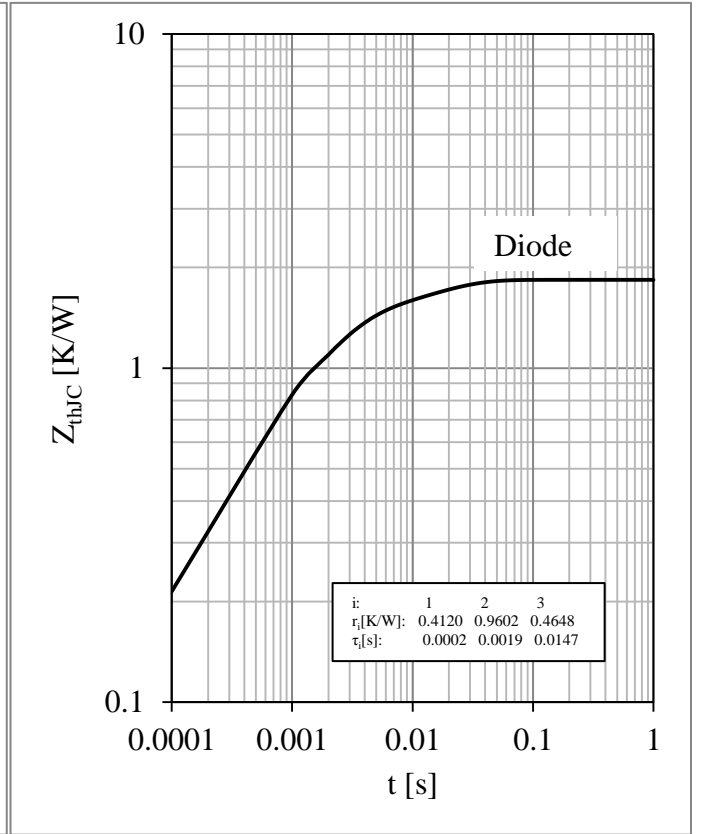
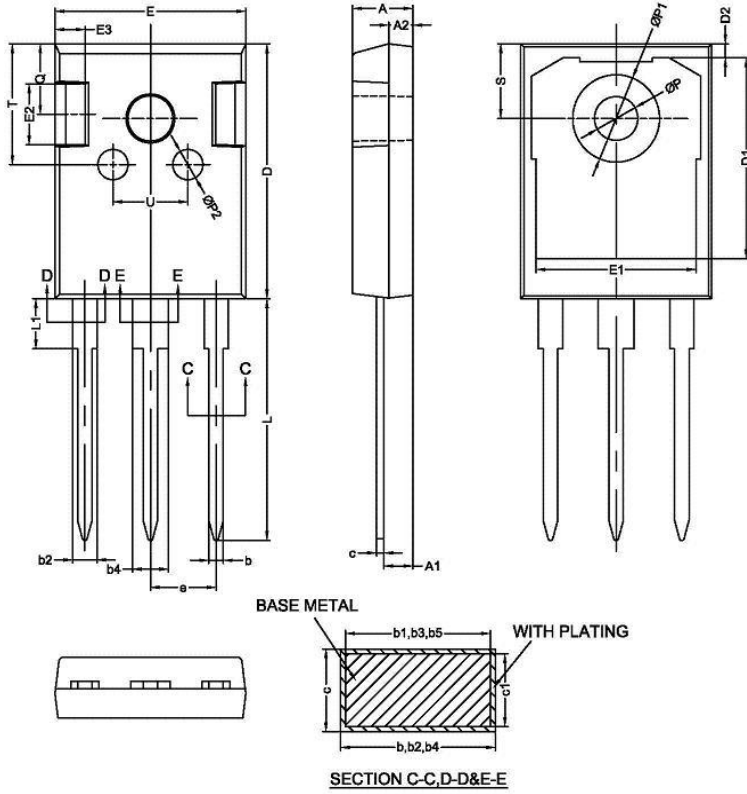


Fig 10. Diode Transient Thermal Impedance

Package Dimensions

Dimensions in Millimeters



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.90	5.00	5.10
A1	2.31	2.41	2.51
A2	1.90	2.00	2.10
b	1.16	-	1.26
b1	1.15	1.2	1.22
b2	1.96	-	2.06
b3	1.95	2.00	2.02
b4	2.96	-	3.06
b5	2.95	3.00	3.02
c	0.59	-	0.66
c1	0.58	0.60	0.62
D	20.90	21.00	21.10
D1	16.25	16.55	16.85
D2	1.05	1.20	1.35
E	15.70	15.80	15.90
E1	13.10	13.30	13.50
E2	4.90	5.00	5.10
E3	2.40	2.50	2.60
e	5.44BSC		
L	19.80	19.92	20.10
L1	-	-	4.30
P	3.50	3.60	3.70
P1	-	-	7.40
P2	2.40	2.50	2.60
Q	5.60	-	6.00
S	6.15BSC		
T	9.80	-	10.20
U	6.00	-	6.40

NOTES:  
 1. ALL DIMENSIONS REFER TO JEDEC STANDARD TO-247 AD DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.  
 2. EJECTION MARK DEPTH 0.10<sup>+0.15</sup><sub>-0.05</sub>.

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