

## Trench Gate, High Speed, IGBTs

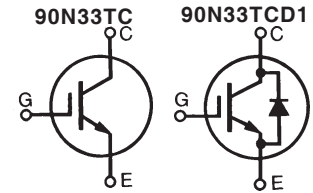
**IXGA90N33TC**  
**IXGQ90N33TC**  
**IXGQ90N33TCD1**

**$V_{CES} = 330V$**   
 **$I_{CP} = 360A$**   
 **$V_{CE(sat)} \leq 1.80V$**

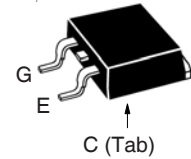
For PDP Applications

| Symbol       | Test Conditions                                                    | Maximum Ratings |            |
|--------------|--------------------------------------------------------------------|-----------------|------------|
| $V_{CES}$    | $T_J = 25^\circ C$ to $150^\circ C$                                | 330             | V          |
| $V_{GES}$    | Continuous                                                         | $\pm 20$        | V          |
| $V_{GEM}$    | Transient                                                          | $\pm 30$        | V          |
| $I_{C25}$    | $T_C = 25^\circ C$ (Chip Capability)                               | 90              | A          |
| $I_{C(RMS)}$ | Lead Current Limit                                                 | 75              | A          |
| $I_{C110}$   | $T_C = 110^\circ C$                                                | 38              | A          |
| $I_{CP}$     | $T_C \leq 150^\circ C$ , $tp \leq 10\mu s$                         | 60              | A          |
| $I_{CP}$     | $T_C \leq 150^\circ C$ , $tp \leq 10\mu s$ , Duty cycle $\leq 1\%$ | 360             | A          |
| $P_C$        | $T_C = 25^\circ C$                                                 | 200             | W          |
| $T_J$        |                                                                    | -55 ... +150    | $^\circ C$ |
| $T_{JM}$     |                                                                    | 150             | $^\circ C$ |
| $T_{stg}$    |                                                                    | -55 ... +150    | $^\circ C$ |
| $T_L$        | Maximum Lead Temperature for Soldering                             | 300             | $^\circ C$ |
| $T_{SOLD}$   | 1.6 mm (0.062in.) from Case for 10s                                | 260             | $^\circ C$ |
| $M_d$        | Mounting Torque (TO-3P)                                            | 1.13/10         | Nm/lb.in.  |
| Weight       | TO-263                                                             | 2.5             | g          |
|              | TO-3P                                                              | 5.5             | g          |

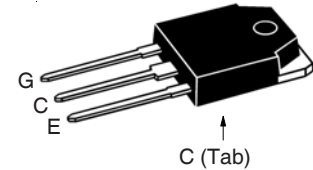
| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified)       | Characteristic Values |      |                          |
|---------------|-----------------------------------------------------------------------------|-----------------------|------|--------------------------|
|               |                                                                             | Min.                  | Typ. | Max.                     |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                            | 330                   |      | V                        |
| $V_{GE(th)}$  | $I_C = 250\mu A$ , $V_{CE} = V_{GE}$                                        | 3.0                   |      | 5.0 V                    |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$                   |                       |      | 1 $\mu A$<br>200 $\mu A$ |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                          |                       |      | $\pm 200$ nA             |
| $V_{CE(sat)}$ | $V_{GE} = 15V$ , $I_C = 20A$ , Note 1<br>$I_C = 45A$<br>$T_J = 125^\circ C$ |                       | 1.54 | 1.40 V<br>1.80 V         |
|               |                                                                             |                       | 1.54 | V                        |
|               | $I_C = 90A$<br>$T_J = 125^\circ C$                                          |                       | 1.82 | V                        |
|               |                                                                             |                       | 1.95 | V                        |



**TO-263 AA (IXGA)**



**TO-3P (IXGQ)**



G = Gate      C = Collector  
E = Emitter    Tab = Collector

### Features

- Low  $V_{CE(sat)}$  - for minimum On-State Conduction Losses
- Fast Switching

### Applications

- PDP Screen Drivers

### Symbol Test Conditions

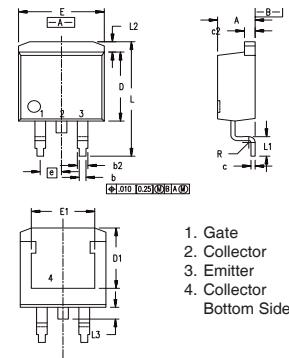
( $T_J = 25^\circ\text{C}$  Unless Otherwise Specified)

### Characteristic Values

Min. Typ. Max.

|              |                                                                                                                                                            |    |      |                    |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|--------------------|
| $g_{fs}$     | $I_C = 45\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                                     | 40 | 65   | S                  |
| $C_{ies}$    | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                 |    | 2320 | pF                 |
| $C_{oes}$    |                                                                                                                                                            |    | 180  | pF                 |
| $C_{res}$    |                                                                                                                                                            |    | 21   | pF                 |
| $Q_g$        | $I_C = 45\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                        |    | 69   | nC                 |
| $Q_{ge}$     |                                                                                                                                                            |    | 15   | nC                 |
| $Q_{gc}$     |                                                                                                                                                            |    | 13   | nC                 |
| $t_{d(on)}$  | <b>Resistive Switching Times, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 45\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 240\text{V}, R_G = 5\Omega$  |    | 13   | ns                 |
| $t_r$        |                                                                                                                                                            |    | 30   | ns                 |
| $t_{d(off)}$ |                                                                                                                                                            |    | 38   | ns                 |
| $t_f$        |                                                                                                                                                            |    | 49   | ns                 |
| $t_{d(on)}$  | <b>Resistive Switching Times, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = 45\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 240\text{V}, R_G = 5\Omega$ |    | 13   | ns                 |
| $t_r$        |                                                                                                                                                            |    | 28   | ns                 |
| $t_{d(off)}$ |                                                                                                                                                            |    | 50   | ns                 |
| $t_f$        |                                                                                                                                                            |    | 74   | ns                 |
| $R_{thJC}$   | TO-3P                                                                                                                                                      |    | 0.62 | $^\circ\text{C/W}$ |
| $R_{thCS}$   |                                                                                                                                                            |    |      | $^\circ\text{C/W}$ |

### TO-263 Outline



| Dim. | Min.  | Max.  | Min. | Max. |
|------|-------|-------|------|------|
| A    | 4.06  | 4.83  | .160 | .190 |
| b    | 0.51  | 0.99  | .020 | .039 |
| b2   | 1.14  | 1.40  | .045 | .055 |
| c    | 0.40  | 0.74  | .016 | .029 |
| c2   | 1.14  | 1.40  | .045 | .055 |
| D    | 8.64  | 9.65  | .340 | .380 |
| D1   | 8.00  | 8.89  | .280 | .320 |
| E    | 9.65  | 10.41 | .380 | .405 |
| E1   | 6.22  | 8.13  | .270 | .320 |
| e    | 2.54  | BSC   | .100 | BSC  |
| L    | 14.61 | 15.88 | .575 | .625 |
| L1   | 2.29  | 2.79  | .090 | .110 |
| L2   | 1.02  | 1.40  | .040 | .055 |
| L3   | 1.27  | 1.78  | .050 | .070 |
| L4   | 0     | 0.13  | 0    | .005 |

### Reverse Diode

### Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  Unless Otherwise Specified)

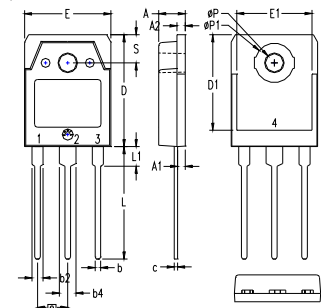
### Characteristic Values

Min. Typ. Max

|            |                                                       |  |     |                    |
|------------|-------------------------------------------------------|--|-----|--------------------|
| $V_F$      | $I_F = 20\text{A}, V_{GE} = 0\text{V}, \text{Note 1}$ |  | 2.0 | V                  |
| $R_{thJC}$ |                                                       |  | 2.5 | $^\circ\text{C/W}$ |

Note: 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

### TO-3P Outline



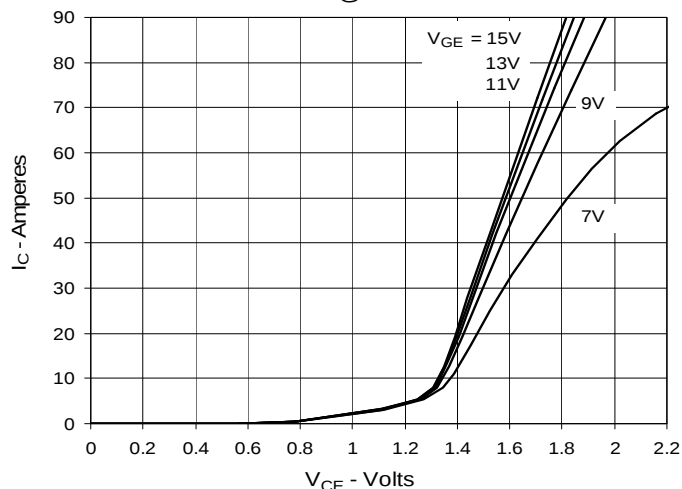
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .185     | .193 | 4.70        | 4.90  |
| A1  | .051     | .059 | 1.30        | 1.50  |
| A2  | .057     | .065 | 1.45        | 1.65  |
| b   | .035     | .045 | 0.90        | 1.15  |
| b2  | .075     | .087 | 1.90        | 2.20  |
| b4  | .114     | .126 | 2.90        | 3.20  |
| c   | .022     | .031 | 0.55        | 0.80  |
| D   | .780     | .799 | 19.80       | 20.30 |
| D1  | .665     | .677 | 16.90       | 17.20 |
| E   | .610     | .622 | 15.50       | 15.80 |
| E1  | .531     | .539 | 13.50       | 13.70 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .779     | .795 | 19.80       | 20.20 |
| L1  | .134     | .142 | 3.40        | 3.60  |
| L2  | .126     | .134 | 3.20        | 3.40  |
| L3  | .272     | .280 | 6.90        | 7.10  |
| L4  | .193     | .201 | 4.90        | 5.10  |

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

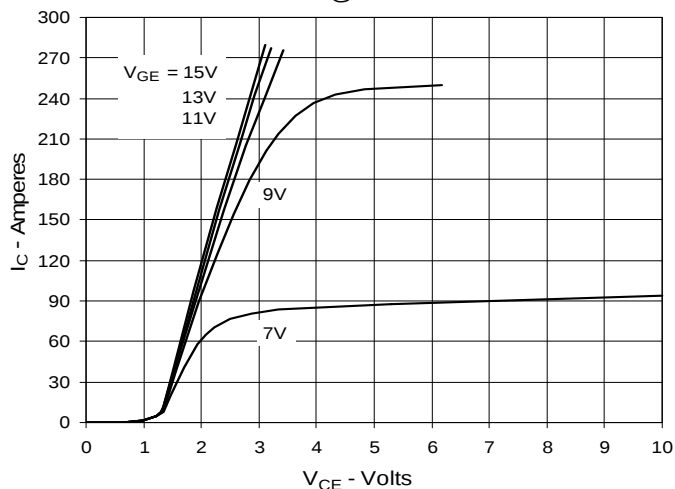
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338B2 |
| 4,850,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692    | 7,063,975 B2 |             |
| 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    | 6,771,478 B2 | 7,071,537    |             |

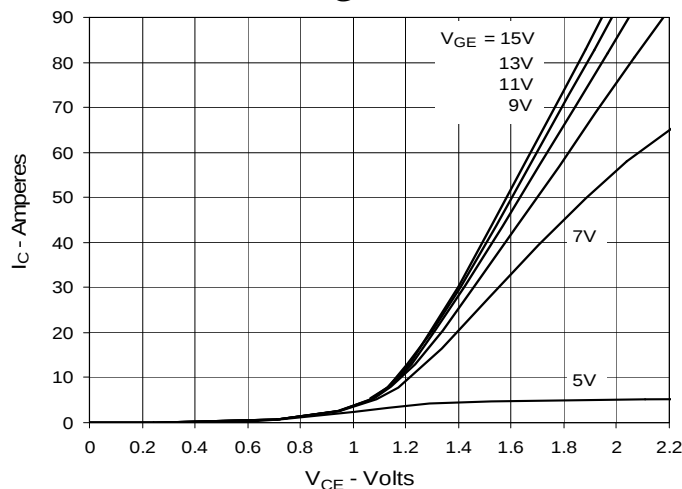
**Fig. 1. Output Characteristics  
@ 25°C**



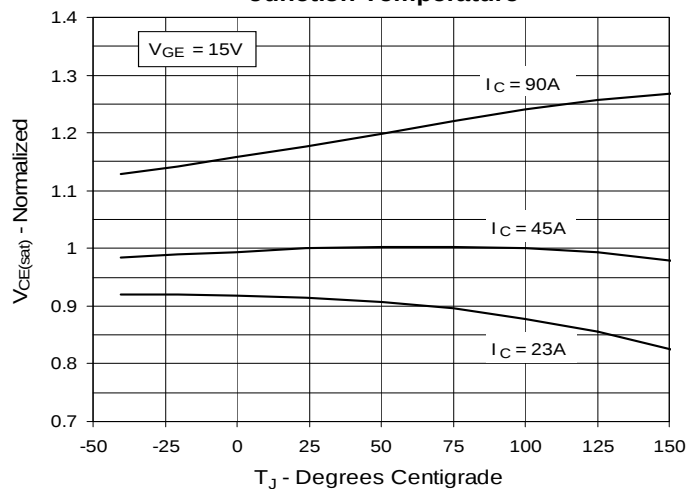
**Fig. 2. Extended Output Characteristics  
@ 25°C**



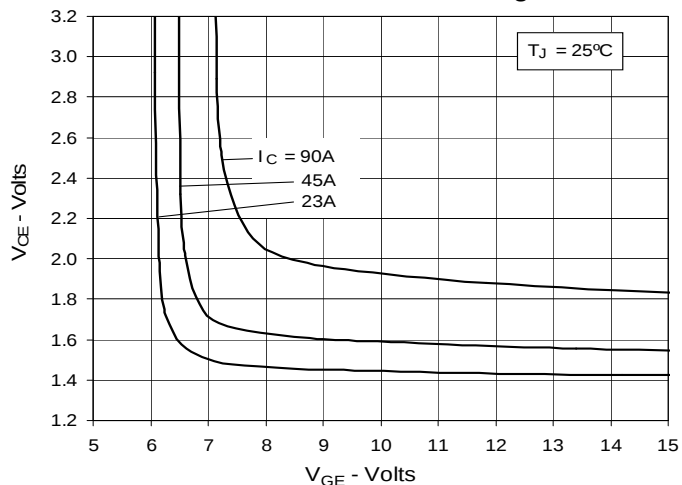
**Fig. 3. Output Characteristics  
@ 125°C**



**Fig. 4. Dependence of  $V_{CE(sat)}$  on  
Junction Temperature**



**Fig. 5. Collector-to-Emitter Voltage  
vs. Gate-to-Emitter Voltage**



**Fig. 6. Input Admittance**

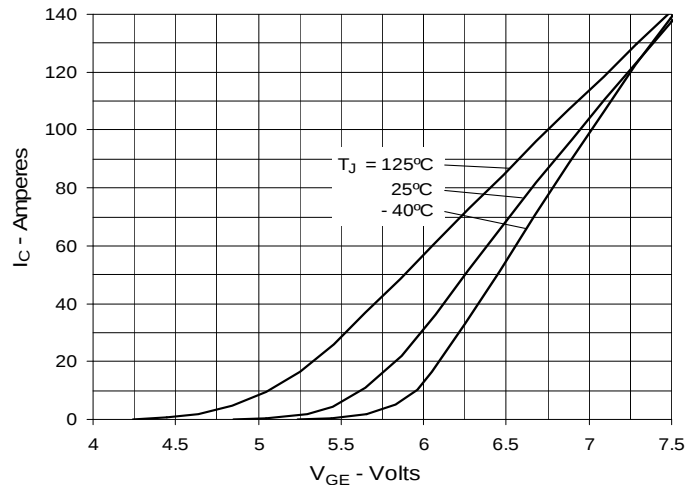


Fig. 7. Transconductance

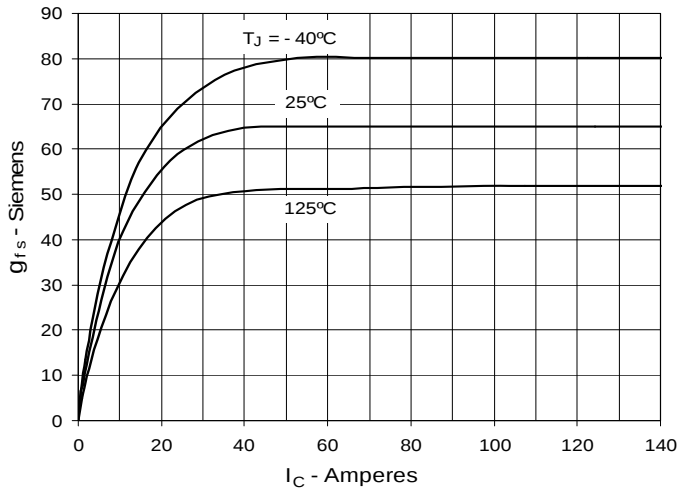


Fig. 8. Gate Charge

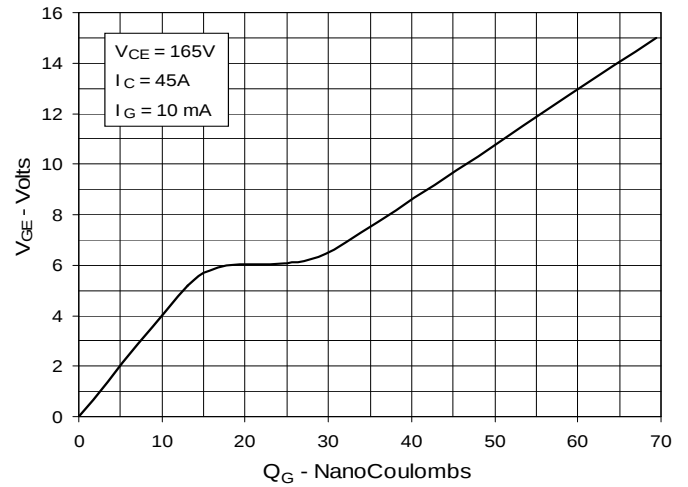


Fig. 9. Reverse-Bias Safe Operating Area

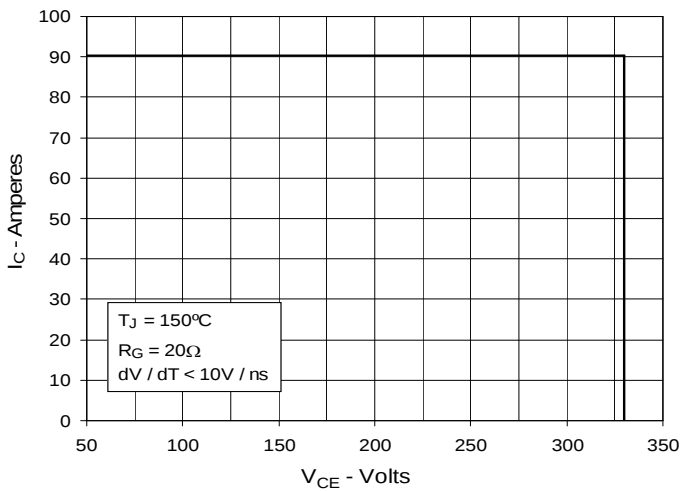


Fig. 10. Capacitance

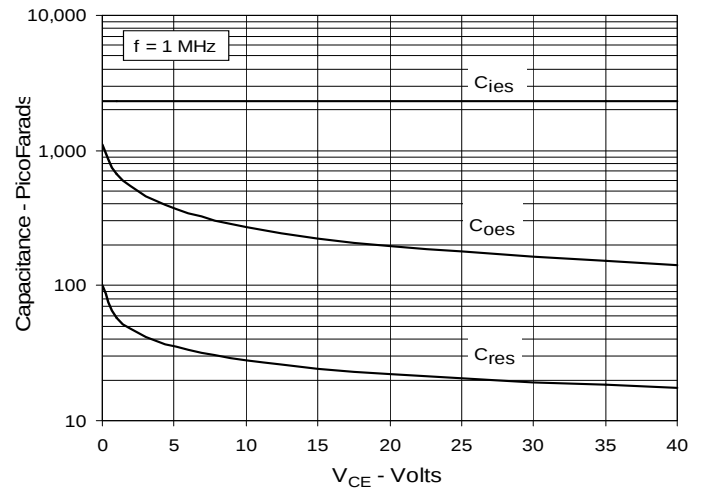


Fig. 11. Forward-Bias Safe Operating Area

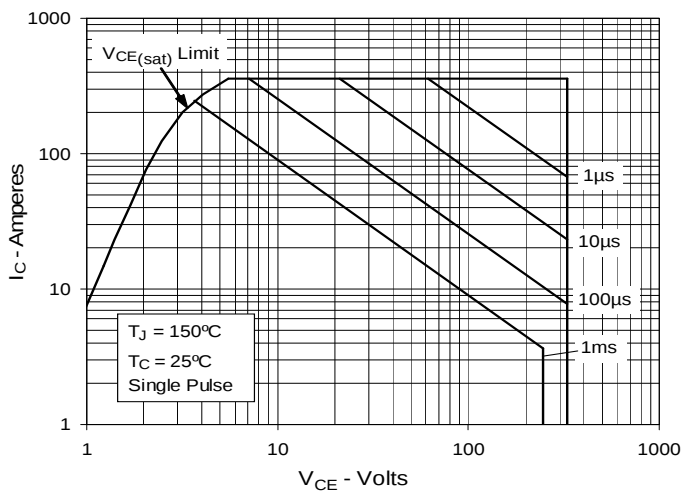
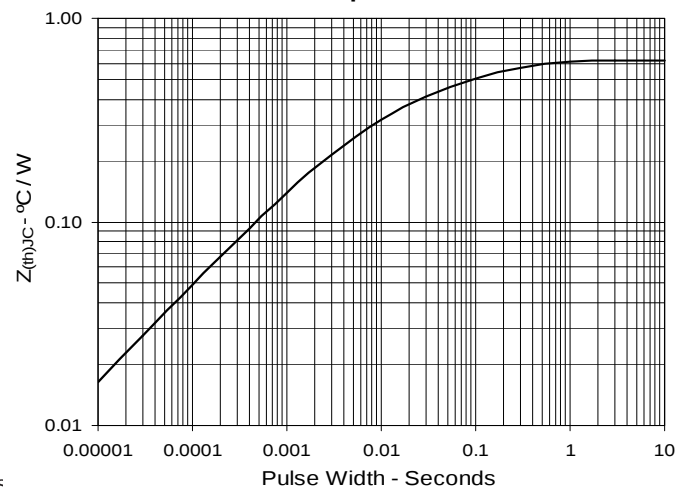
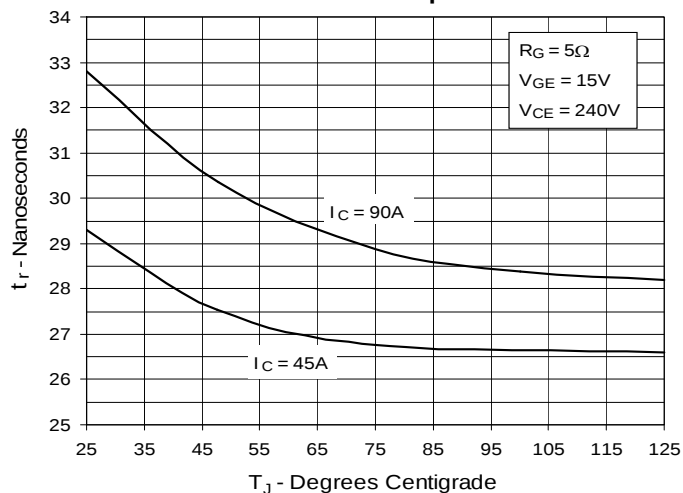


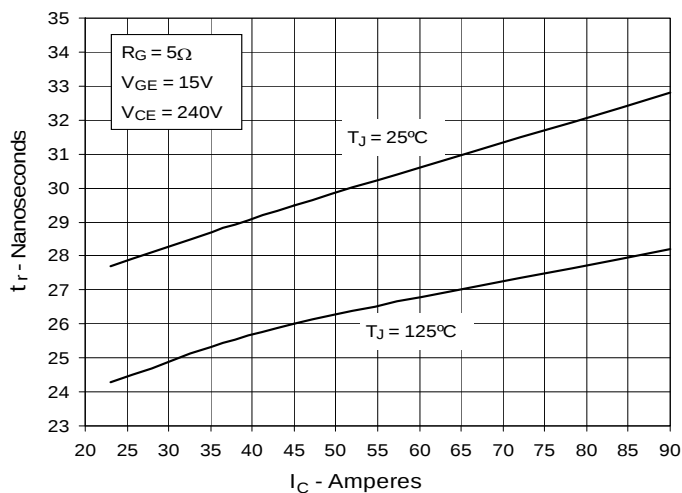
Fig. 12. Maximum Transient Thermal Impedance



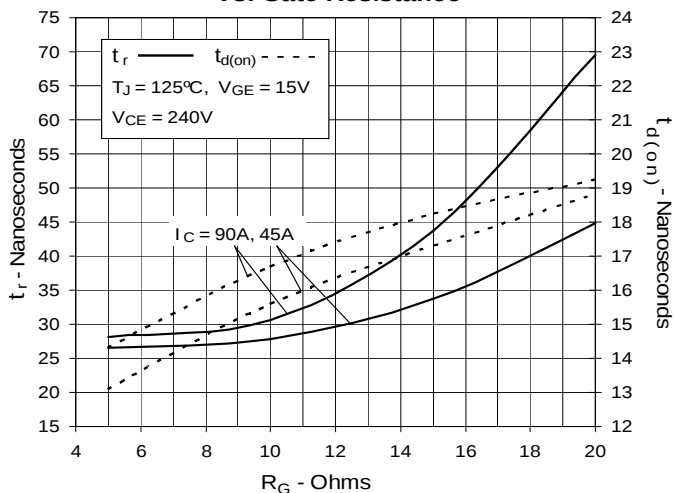
**Fig. 13. Resistive Turn-on Rise Time vs. Junction Temperature**



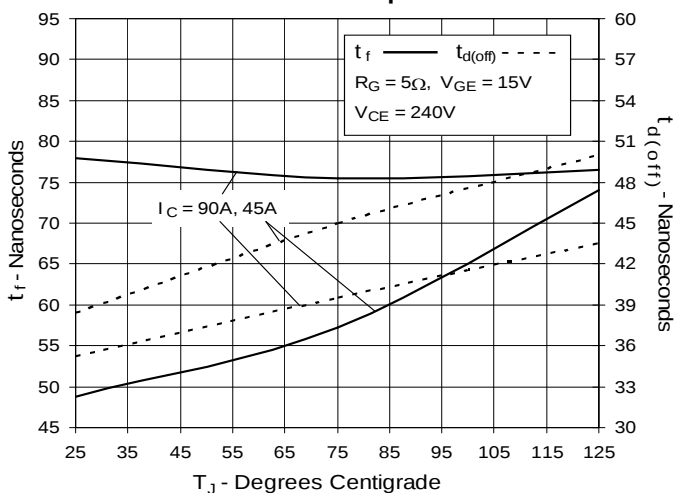
**Fig. 14. Resistive Turn-on Rise Time vs. Collector Current**



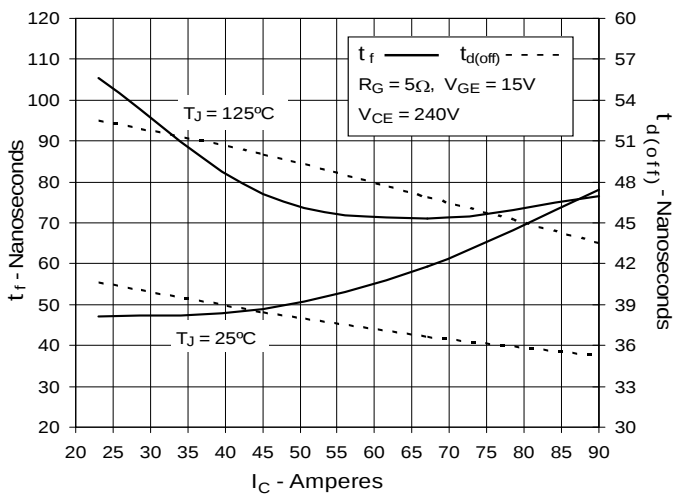
**Fig. 16. Resistive Turn-on Switching Times vs. Gate Resistance**



**Fig. 17. Resistive Turn-off Switching Times vs. Junction Temperature**



**Fig. 18. Resistive Turn-off Switching Times vs. Collector Current**



**Fig. 19. Resistive Turn-off Switching Times vs. Gate Resistance**

