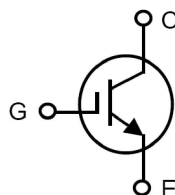


# 1200V XPT™ IGBT GenX4™

## IXYK140N120A4

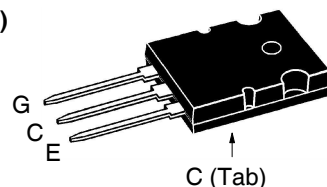
Ultra Low-V<sub>sat</sub> IGBT for  
up to 5kHz Switching



$$\begin{aligned} V_{CES} &= 1200V \\ I_{C110} &= 140A \\ V_{CE(sat)} &\leq 1.70V \\ t_{fi(typ)} &= 320ns \end{aligned}$$

| Symbol         | Test Conditions                                                                | Maximum Ratings     |            |
|----------------|--------------------------------------------------------------------------------|---------------------|------------|
| $V_{CES}$      | $T_J = 25^\circ C$ to $175^\circ C$                                            | 1200                | V          |
| $V_{CGR}$      | $T_J = 25^\circ C$ to $175^\circ C$ , $R_{GE} = 1M\Omega$                      | 1200                | V          |
| $V_{GES}$      | Continuous                                                                     | $\pm 20$            | V          |
| $V_{GEM}$      | Transient                                                                      | $\pm 30$            | V          |
| $I_{C25}$      | $T_C = 25^\circ C$ (Chip Capability)                                           | 480                 | A          |
| $I_{LRMS}$     | Terminal Current Limit                                                         | 160                 | A          |
| $I_{C110}$     | $T_C = 110^\circ C$                                                            | 140                 | A          |
| $I_{CM}$       | $T_C = 25^\circ C$ , 1ms                                                       | 1200                | A          |
| <b>SSOA</b>    | $V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 2\Omega$                      | $I_{CM} = 280$      | A          |
| <b>(RBSOA)</b> | Clamped Inductive Load                                                         | $0.8 \cdot V_{CES}$ | V          |
| $P_C$          | $T_C = 25^\circ C$                                                             | 1500                | W          |
| $T_J$          |                                                                                | -55 ... +175        | $^\circ C$ |
| $T_{JM}$       |                                                                                | 175                 | $^\circ C$ |
| $T_{stg}$      |                                                                                | -55 ... +175        | $^\circ C$ |
| $T_L$          | Maximum Lead Temperature for Soldering<br>1.6 mm (0.062 in.) from Case for 10s | 300                 | $^\circ C$ |
| $M_d$          | Mounting Torque                                                                | 1.13/10             | Nm/lb.in   |
| <b>Weight</b>  |                                                                                | 10                  | g          |

TO-264  
(IXYK)



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

### Features

- Optimized for Low Conduction Losses
- Positive Thermal Coefficient of  $V_{ce(sat)}$
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts
- Inrush Current Protection Circuits

| Symbol        | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |              |                    |
|---------------|-----------------------------------------------------------------------|-----------------------|--------------|--------------------|
|               |                                                                       | Min.                  | Typ.         | Max.               |
| $BV_{CES}$    | $I_C = 250\mu A$ , $V_{GE} = 0V$                                      | 1200                  |              | V                  |
| $V_{GE(th)}$  | $I_C = 4mA$ , $V_{CE} = V_{GE}$                                       | 4.5                   |              | 6.5 V              |
| $I_{CES}$     | $V_{CE} = V_{CES}$ , $V_{GE} = 0V$<br>$T_J = 125^\circ C$             |                       |              | 25 $\mu A$<br>5 mA |
| $I_{GES}$     | $V_{CE} = 0V$ , $V_{GE} = \pm 20V$                                    |                       |              | $\pm 200$ nA       |
| $V_{CE(sat)}$ | $I_C = I_{C110}$ , $V_{GE} = 15V$ , Note 1<br>$T_J = 150^\circ C$     |                       | 1.34<br>1.50 | 1.70 V<br>V        |

| Symbol Test Conditions<br>( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified) |                                                                                                                                                                   | Characteristic Values |      |                         |
|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------------------------|
|                                                                                  |                                                                                                                                                                   | Min.                  | Typ. | Max.                    |
| $g_{fs}$                                                                         | $I_C = 60\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$                                                                                                            | 60                    | 100  | S                       |
| $C_{ies}$                                                                        | $V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$                                                                                                        |                       | 8300 | pF                      |
| $C_{oes}$                                                                        |                                                                                                                                                                   |                       | 470  | pF                      |
| $C_{res}$                                                                        |                                                                                                                                                                   |                       | 300  | pF                      |
| $Q_{g(on)}$                                                                      | $I_C = I_{C110}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$                                                                                                 |                       | 420  | nC                      |
| $Q_{ge}$                                                                         |                                                                                                                                                                   |                       | 68   | nC                      |
| $Q_{gc}$                                                                         |                                                                                                                                                                   |                       | 210  | nC                      |
| $t_{d(on)}$                                                                      | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = 70\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 1.5\Omega$<br>Note 2  |                       | 52   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                   |                       | 47   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                   |                       | 4.9  | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                   |                       | 590  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                   |                       | 320  | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                   |                       | 12.0 | mJ                      |
| $t_{d(on)}$                                                                      | <b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b><br>$I_C = 70\text{A}, V_{GE} = 15\text{V}$<br>$V_{CE} = 0.5 \cdot V_{CES}, R_G = 1.5\Omega$<br>Note 2 |                       | 44   | ns                      |
| $t_{ri}$                                                                         |                                                                                                                                                                   |                       | 42   | ns                      |
| $E_{on}$                                                                         |                                                                                                                                                                   |                       | 7.4  | mJ                      |
| $t_{d(off)}$                                                                     |                                                                                                                                                                   |                       | 710  | ns                      |
| $t_{fi}$                                                                         |                                                                                                                                                                   |                       | 530  | ns                      |
| $E_{off}$                                                                        |                                                                                                                                                                   |                       | 20.0 | mJ                      |
| $R_{thJC}$                                                                       |                                                                                                                                                                   |                       |      | 0.10 $^\circ\text{C/W}$ |
| $R_{thCS}$                                                                       |                                                                                                                                                                   | 0.15                  |      | $^\circ\text{C/W}$      |

## Notes:

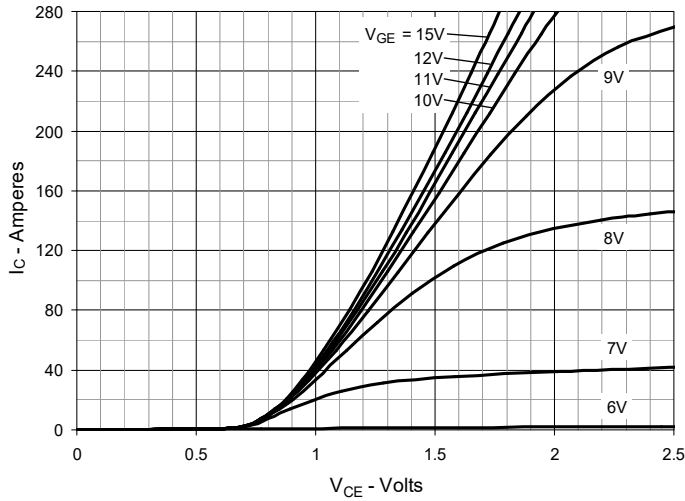
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}(\text{clamp})$ ,  $T_J$  or  $R_G$ .

Littelfuse reserves the right to change limits, test conditions and dimensions.

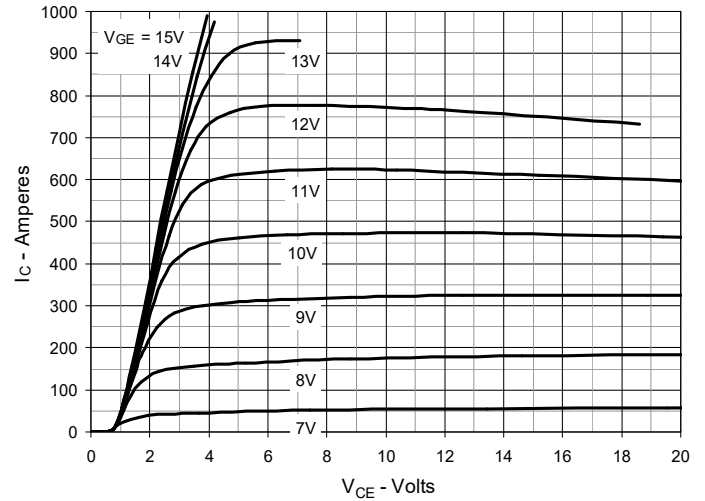
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |              |              |              |              |              |             |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| 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 |
| 4,860,072 | 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    |             |

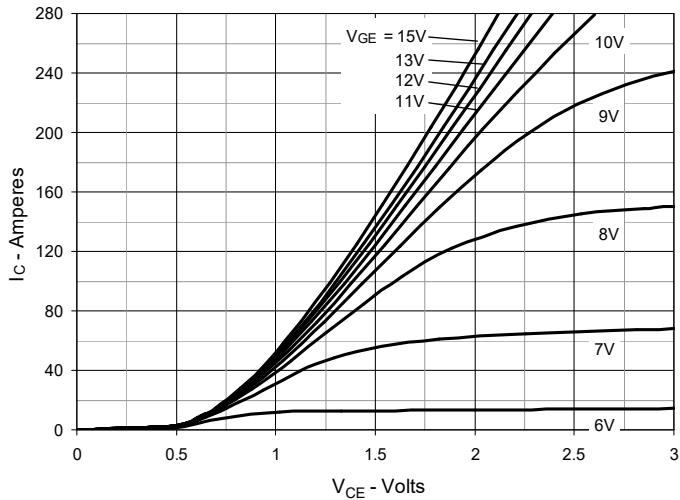
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$**



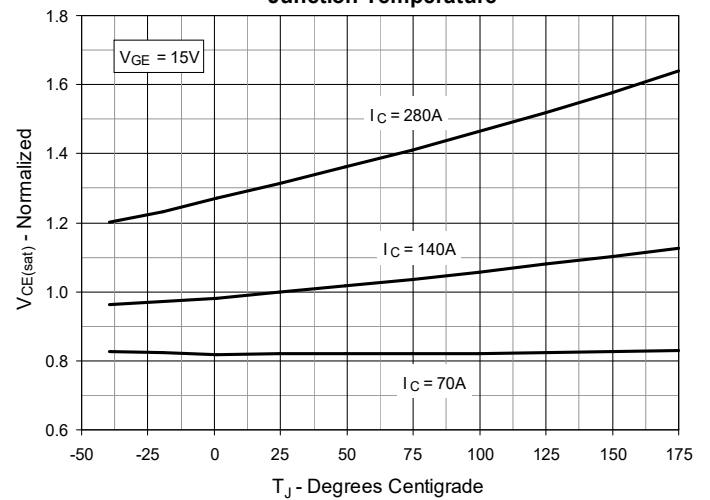
**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$**



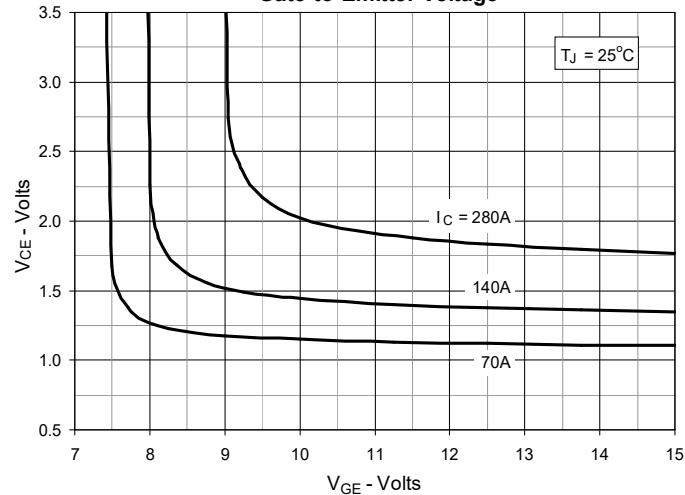
**Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$**



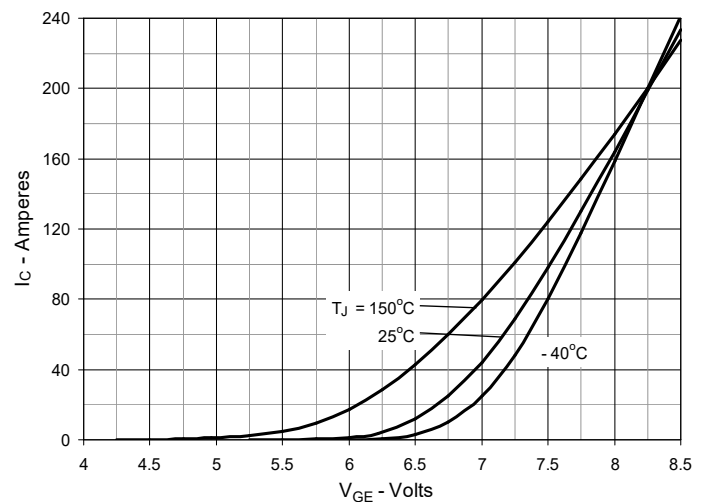
**Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature**



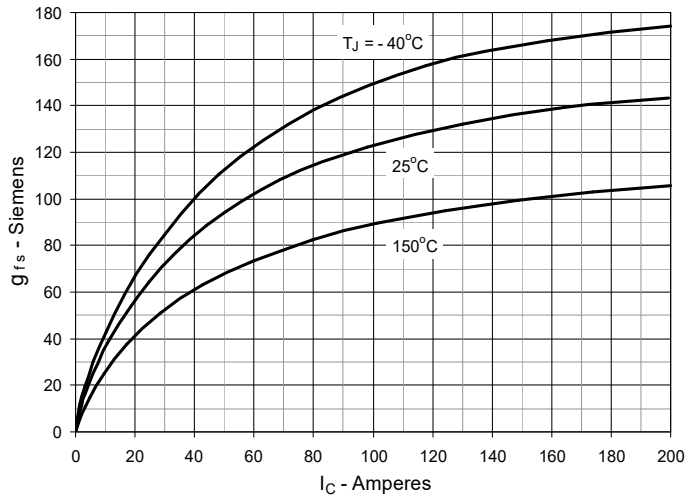
**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**



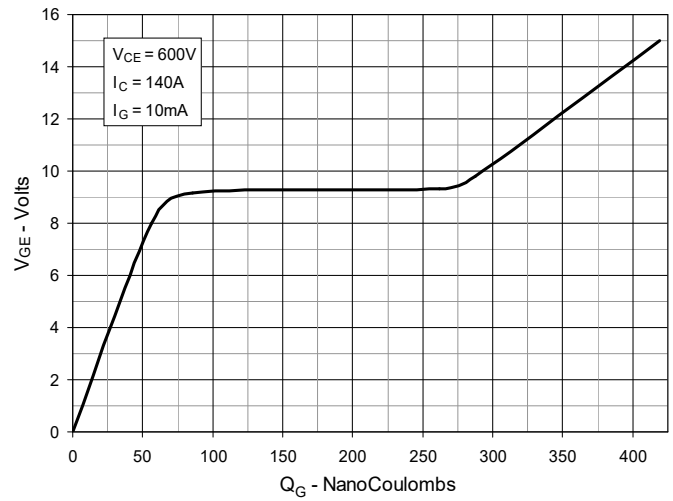
**Fig. 6. Input Admittance**



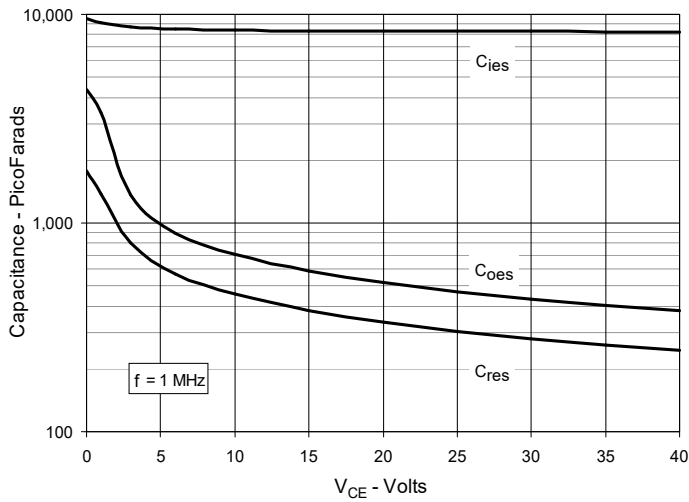
**Fig. 7. Transconductance**



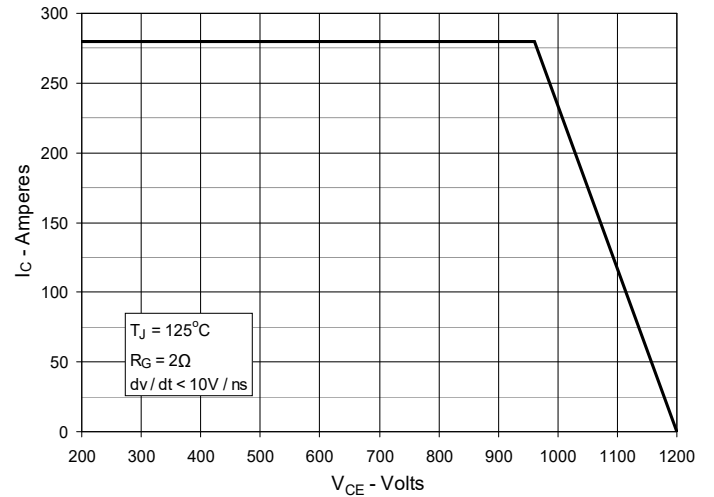
**Fig. 8. Gate Charge**



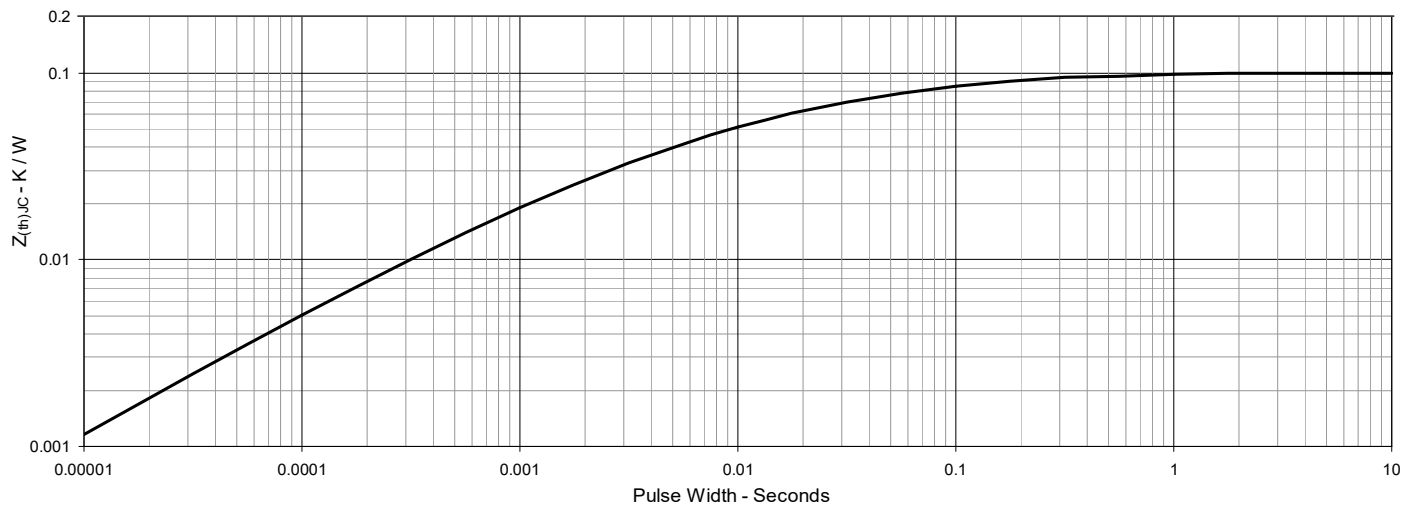
**Fig. 9. Capacitance**



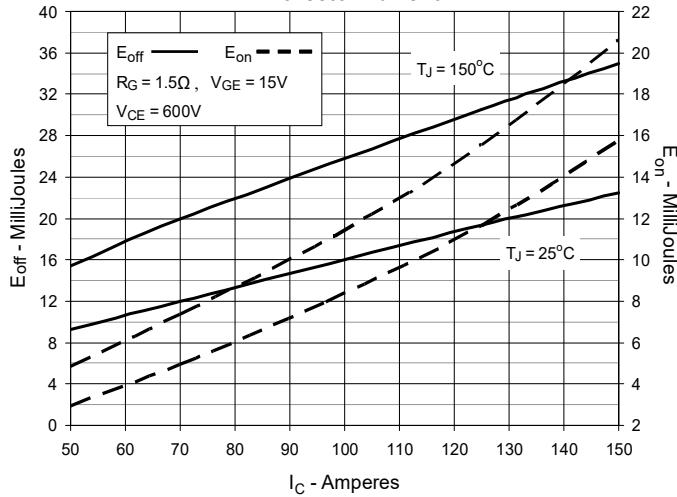
**Fig. 10. Reverse-Bias Safe Operating Area**



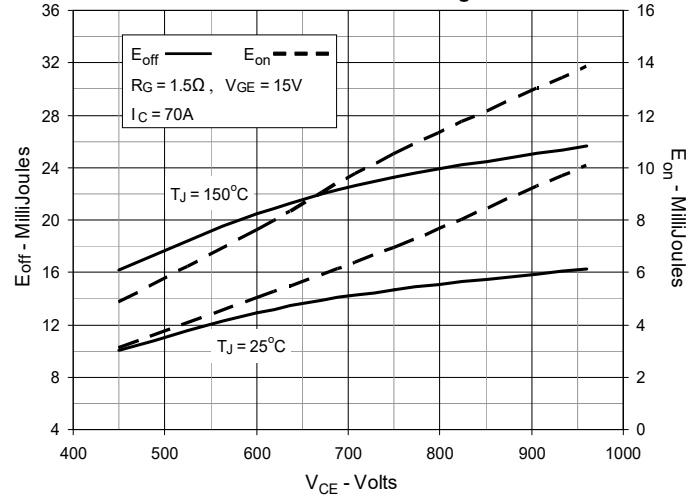
**Fig. 11. Maximum Transient Thermal Impedance**



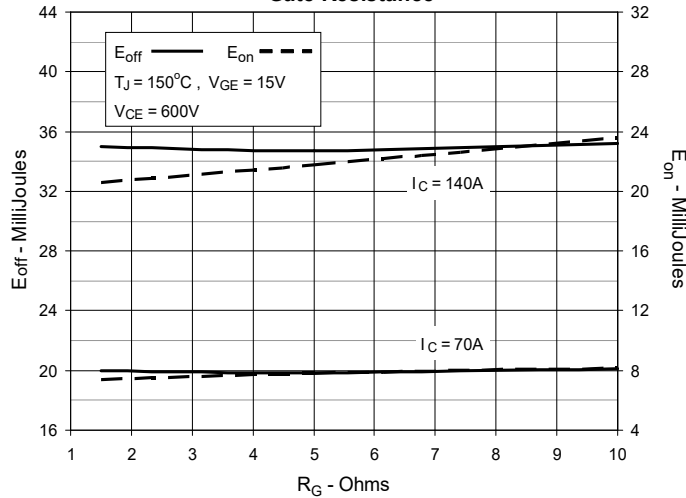
**Fig. 12. Inductive Switching Energy Loss vs. Collector Current**



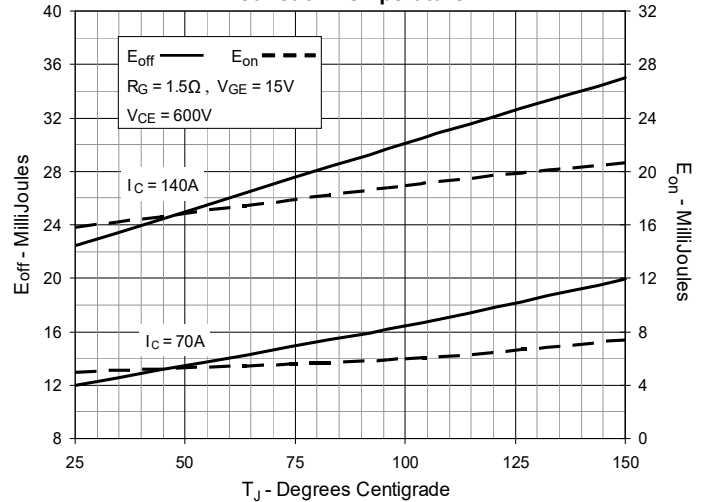
**Fig. 13. Inductive Switching Energy Loss vs. Collector-Emitter Voltage**



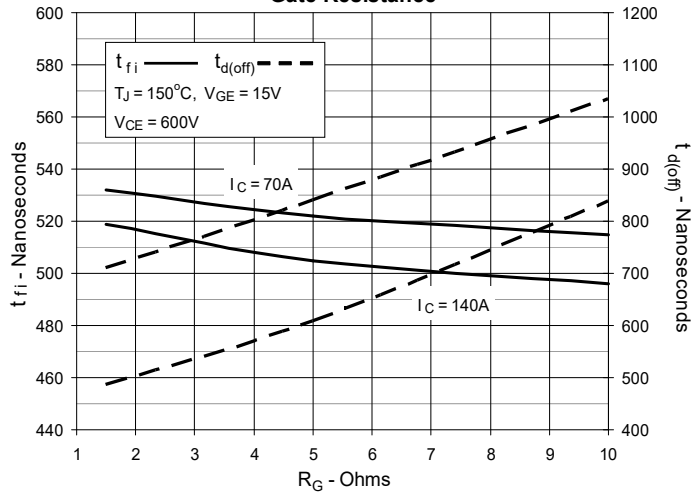
**Fig. 14. Inductive Switching Energy Loss vs. Gate Resistance**



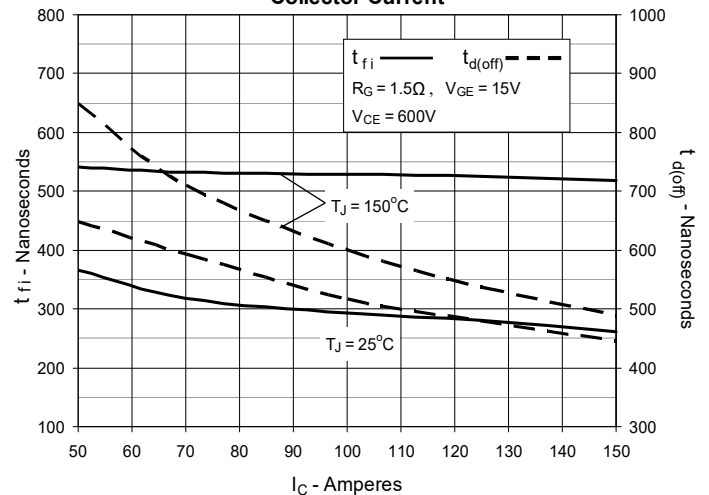
**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**



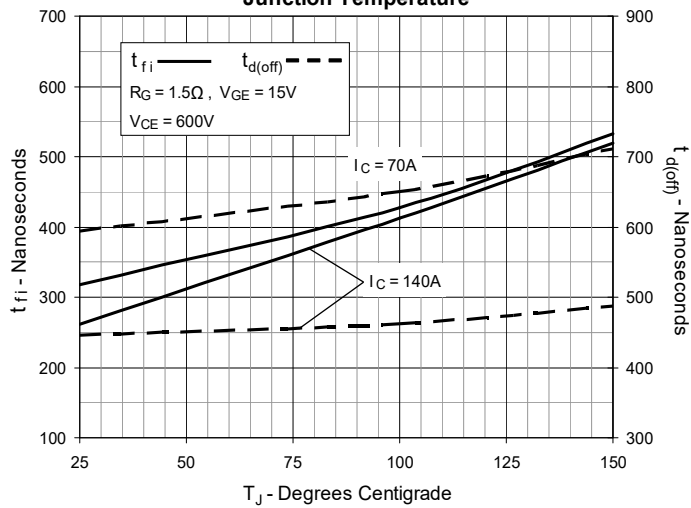
**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**



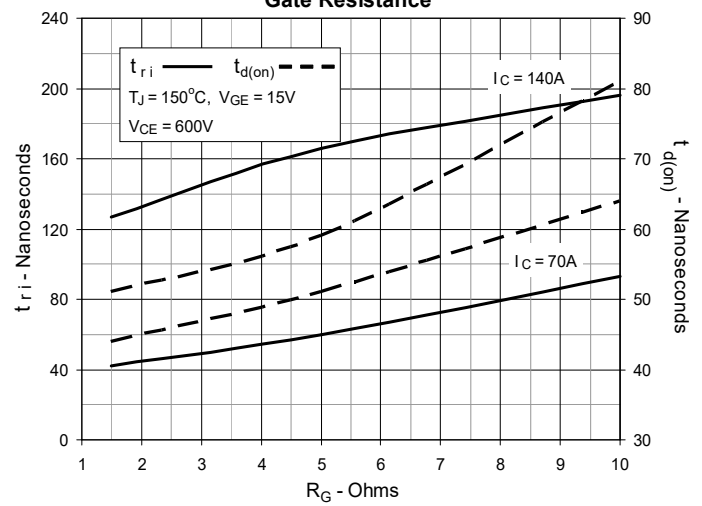
**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**



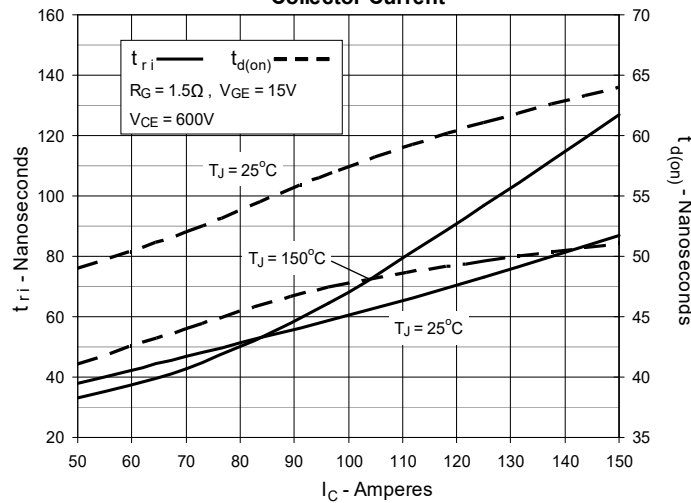
**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**



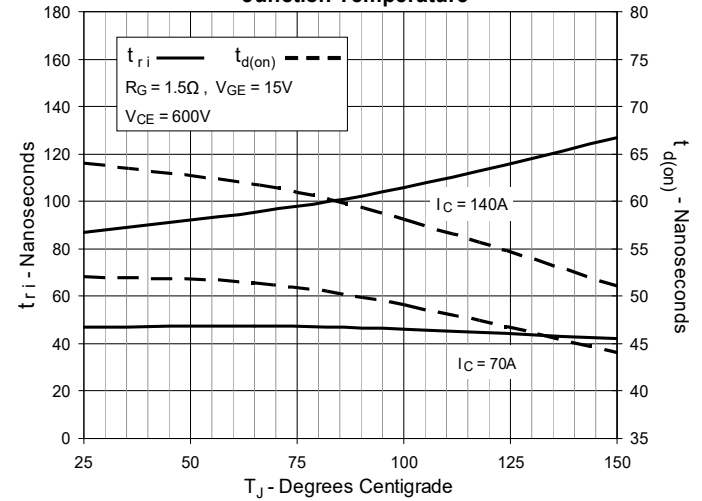
**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**

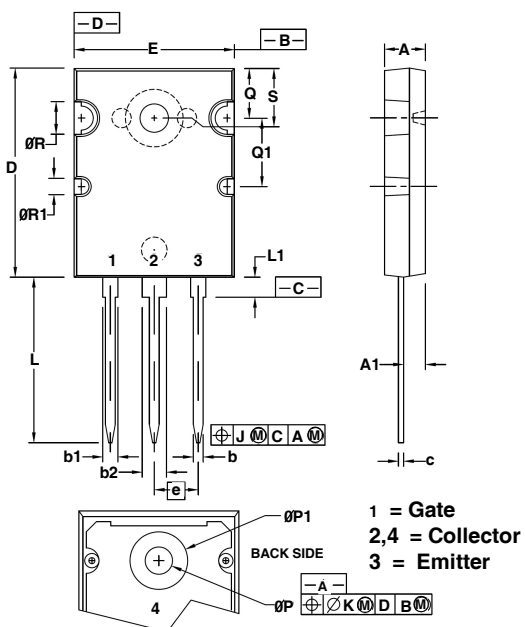


**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**



**TO-264 Outline**


| SYMBOL | INCHES  |       | MILLIMETERS |       |
|--------|---------|-------|-------------|-------|
|        | MIN     | MAX   | MIN         | MAX   |
| A      | .185    | .209  | 4.70        | 5.31  |
| A1     | .102    | .118  | 2.59        | 3.00  |
| b      | .037    | .055  | 0.94        | 1.40  |
| b1     | .087    | .102  | 2.21        | 2.59  |
| b2     | .110    | .126  | 2.79        | 3.20  |
| c      | .017    | .029  | 0.43        | 0.74  |
| D      | 1.007   | 1.047 | 25.58       | 26.59 |
| E      | .760    | .799  | 19.30       | 20.29 |
| e      | .215BSC |       | 5.46 BSC    |       |
| J      | .000    | .010  | 0.00        | 0.25  |
| K      | .000    | .010  | 0.00        | 0.25  |
| L      | .779    | .842  | 19.79       | 21.39 |
| L1     | .087    | .102  | 2.21        | 2.59  |
| ØP     | .122    | .138  | 3.10        | 3.51  |
| ØP1    | .270    | .290  | 6.86        | 7.37  |
| Q      | .240    | .256  | 6.10        | 6.50  |
| Q1     | .330    | .346  | 8.38        | 8.79  |
| ØR     | .155    | .187  | 3.94        | 4.75  |
| ØR1    | .085    | .093  | 2.16        | 2.36  |
| S      | .243    | .253  | 6.17        | 6.43  |

