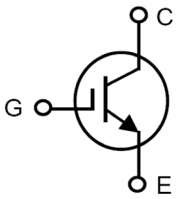
# IXYS

## GenX3™ 600V IGBT

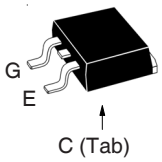
## IXGA36N60A3
## IXGP36N60A3
## IXGH36N60A3

$V_{CES}$ = 600V
$I_{C110}$ = 36A
$V_{CE(sat)}$ ≤ 1.4V

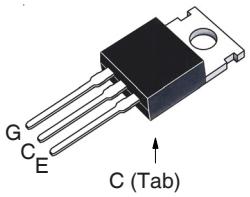
Ultra Low Vsat PT IGBT for up to 5kHz Switching



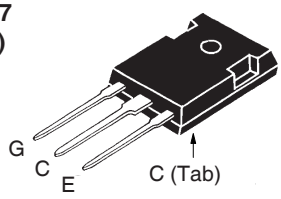

**TO-263 (IXGA)**




**TO-220 (IXGP)**




**TO-247 (IXGH)**




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

| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_C$ = 25°C to 150°C | 600 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 150°C, $R_{GE}$ = 1MΩ | 600 | V |
| $V_{GES}$ | Continuous | ± 20 | V |
| $V_{GEM}$ | Transient | ± 30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 96 | A |
| $I_{C110}$ | $T_C$ = 110°C | 36 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1ms | 200 | A |
| **SSOA (RBSOA)** | $V_{GE}$ = 15V, $T_{VJ}$ = 125°C, $R_G$ = 5Ω<br>Clamped Inductive Load | $I_{CM}$ = 60<br>$V_{CE} \le V_{CES}$ | A |
| $P_C$ | $T_C$ = 25°C | 220 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering | 300 | °C |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s | 260 | °C |
| $F_C$ | Mounting Force (TO-263) | 10..65 / 2.2..14.6 | N/lb |
| $M_d$ | Mounting Torque (TO-220 & TO-247) | 1.13 / 10 | Nm/lb.in |
| **Weight** | TO-263 | 2.5 | g |
| | TO-220 | 3.0 | g |
| | TO-247 | 6.0 | g |

| Symbol | Test Conditions ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 250μA, $V_{GE}$ = 0V | 600 | | | V |
| $V_{GE(th)}$ | $I_C$ = 250μA, $V_{CE}$ = $V_{GE}$ | 3.0 | | 5.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$, $V_{GE}$ = 0V | | | 25 | μA |
| | $T_J$ = 125°C | | | 250 | μA |
| $I_{GES}$ | $V_{CE}$ = 0V, $V_{GE}$ = ±20V | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = 30A, $V_{GE}$ = 15V, Note 1 | | | 1.4 | V |

### Features

- Optimized for Low Conduction Losses
- Square RBSOA
- International Standard Packages

### 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

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| Symbol | Test Conditions ($T_J$ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. |
|---|---|---|---|---|
| $g_{fs}$ | $I_C$ = 30A, $V_{CE}$ = 10V, Note 1 | 25 | 42 | S |
| $C_{ies}$ | $V_{CE}$ = 25V, $V_{GE}$ = 0V, f = 1MHz | | 2380 | pF |
| $C_{oes}$ | | | 115 | pF |
| $C_{res}$ | | | 30 | pF |
| $Q_g$ | $I_C$ = 30A, $V_{GE}$ = 15V, $V_{CE}$ = 0.5 • $V_{CES}$ | | 80 | nC |
| $Q_{ge}$ | | | 12 | nC |
| $Q_{gc}$ | | | 36 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 18 | ns |
| $t_{ri}$ | $I_C$ = 30A, $V_{GE}$ = 15V | | 23 | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 5Ω | | 0.74 | mJ |
| $t_{d(off)}$ | Note 2 | | 330 | ns |
| $t_{fi}$ | | | 325 | ns |
| $E_{off}$ | | | 3.00 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C** | | 18 | ns |
| $t_{ri}$ | $I_C$ = 30A, $V_{GE}$ = 15V | | 25 | ns |
| $E_{on}$ | $V_{CE}$ = 400V, $R_G$ = 5Ω | | 1.50 | mJ |
| $t_{d(off)}$ | Note 2 | | 500 | ns |
| $t_{fi}$ | | | 500 | ns |
| $E_{off}$ | | | 5.30 | mJ |
| $R_{thJC}$ | | | | 0.56 °C/W |
| $R_{thCS}$ | TO-220 | | 0.50 | °C/W |
| | TO-247 | | 0.21 | °C/W |

Notes:

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

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 4,860,072 4,881,106 4,931,844 5,017,508 5,034,796 5,049,961 5,063,307 5,187,117 5,237,481 5,381,025 5,486,715 6,162,665 6,259,123 B1 6,306,728 B1 6,404,065 B1 6,534,343 6,583,505 6,683,344 6,710,405 B2 6,710,463 6,727,585 6,759,692 6,771,478 B2 7,005,734 B2 7,063,975 B2 7,071,537 7,157,338B2

**Fig. 1. Output Characteristics @ $T_J$ = 25°C**

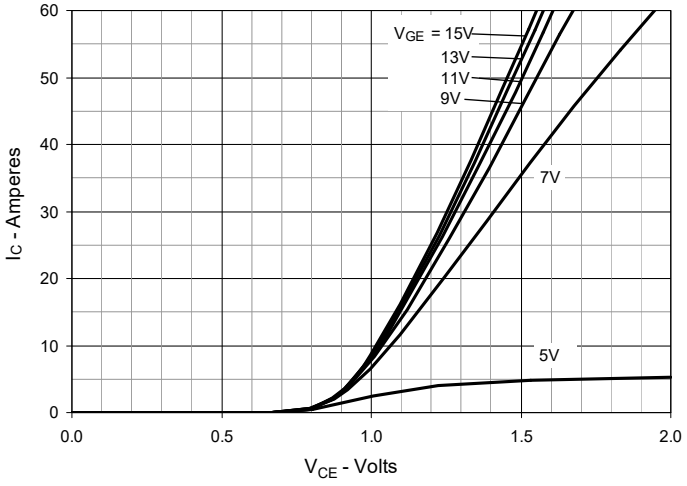



**Fig. 2. Extended Output Characteristics @ $T_J$ = 25°C**

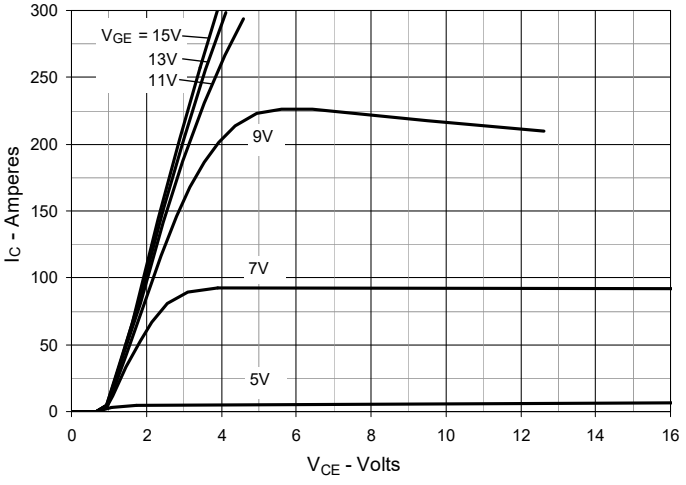



**Fig. 3. Output Characteristics @ $T_J$ = 125°C**

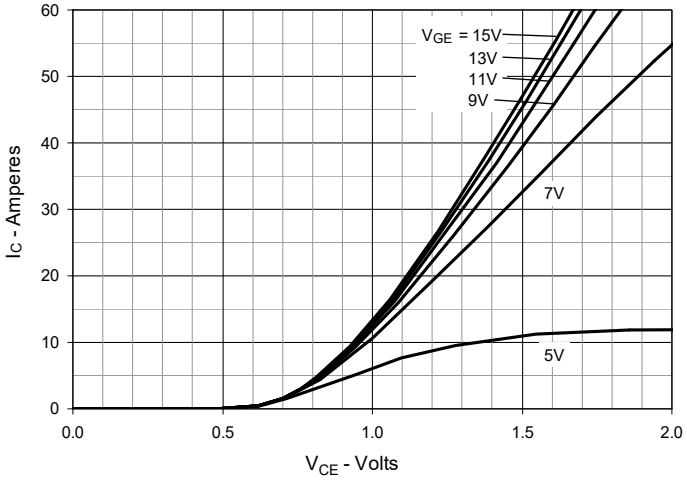



**Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature**

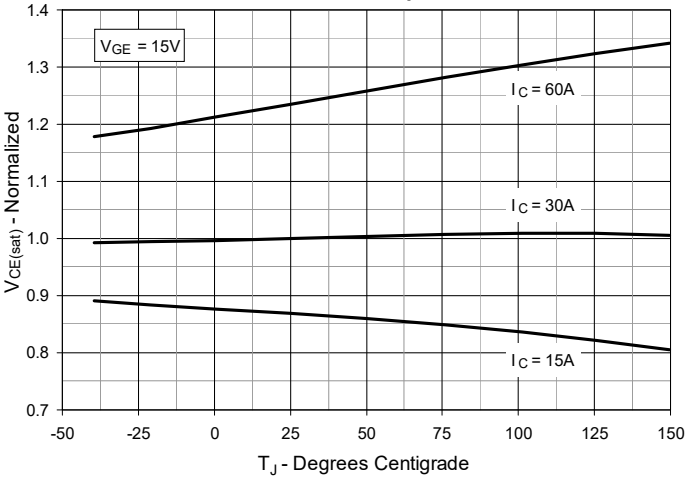



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage**

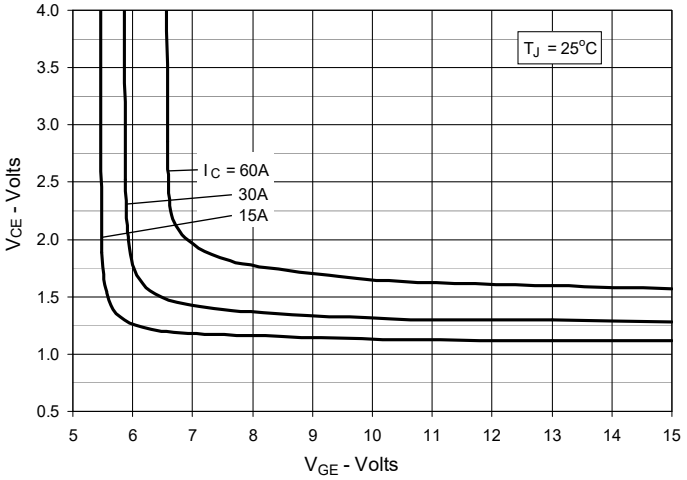
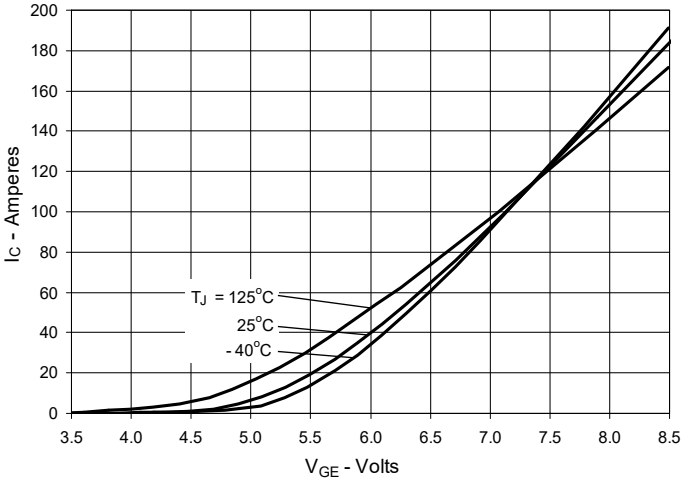



**Fig. 6. Input Admittance**




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**Fig. 7. Transconductance**

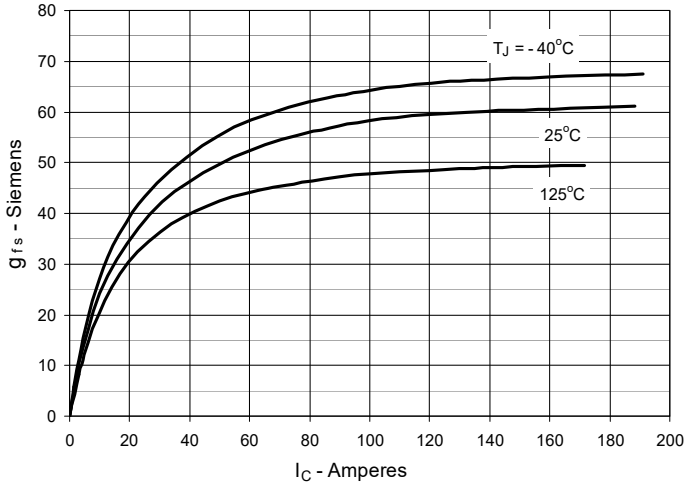



**Fig. 8. Gate Charge**

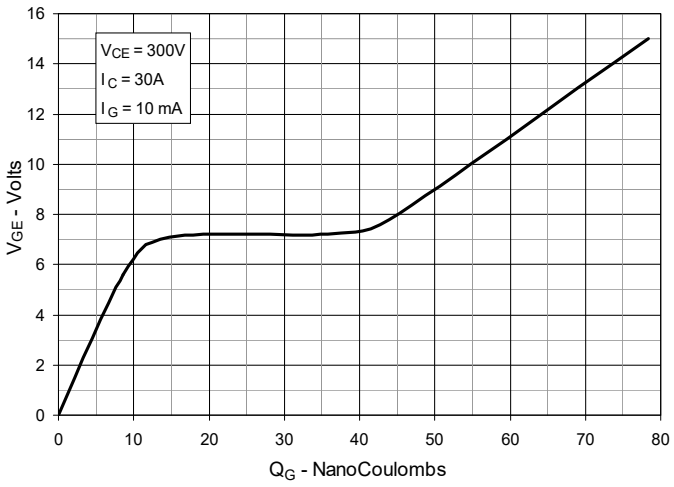



**Fig. 9. Reverse-Bias Safe Operating Area**

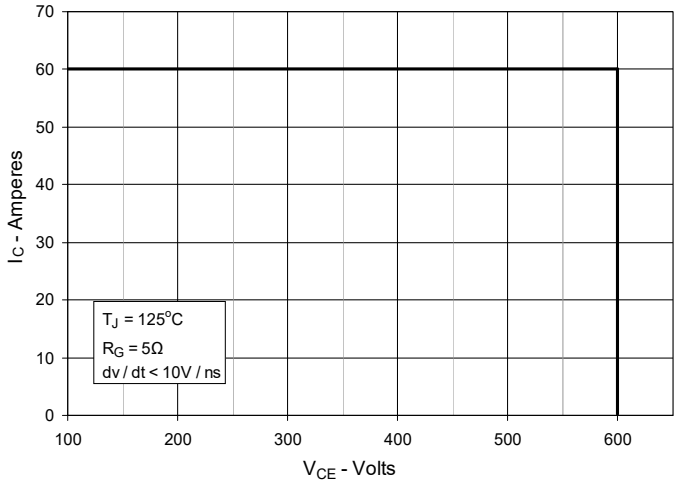



**Fig. 10. Capacitance**

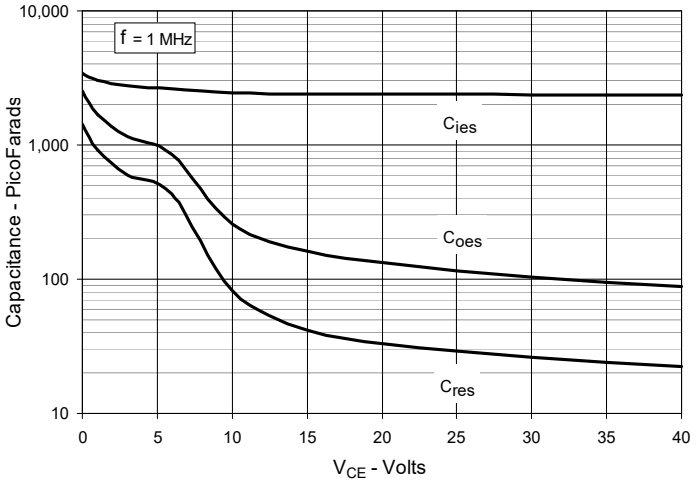
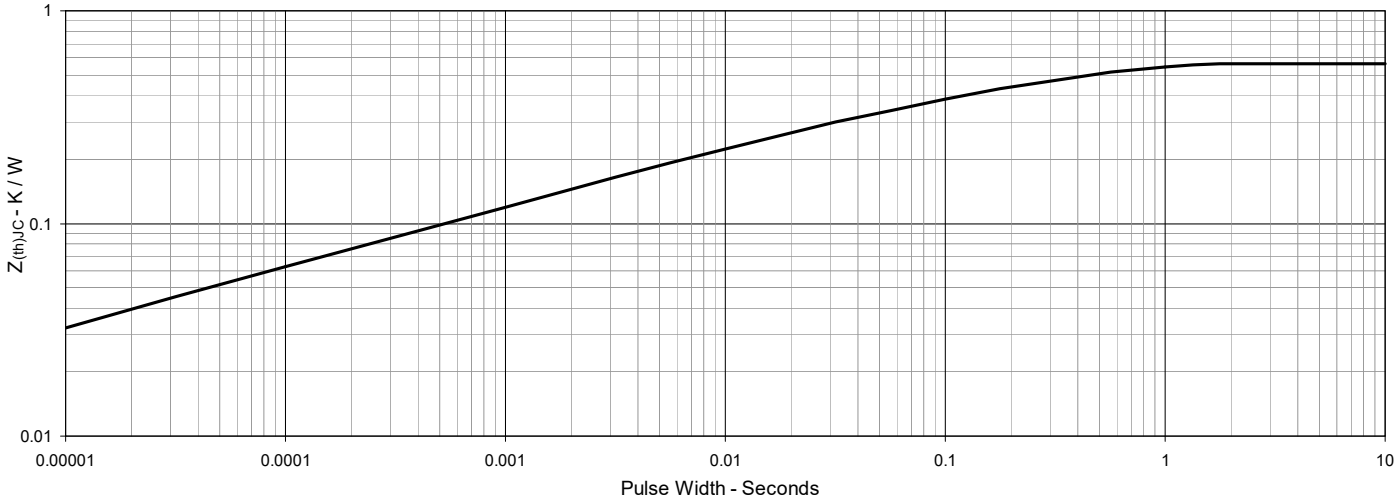



**Fig. 11. Maximum Transient Thermal Impedance**




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**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**

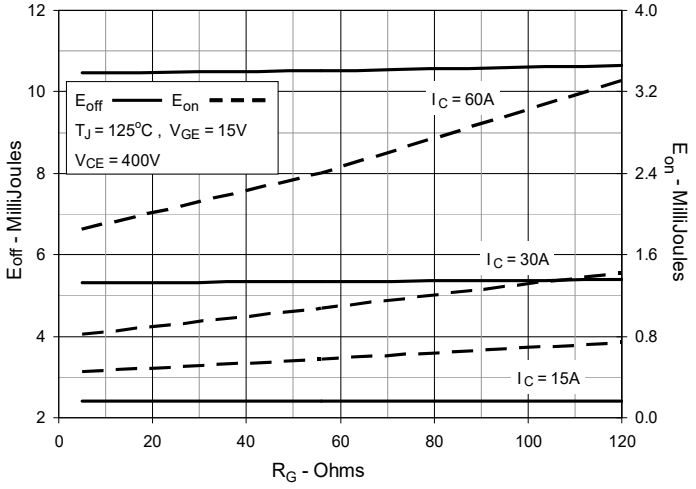



**Fig. 13. Inductive Switching Energy Loss vs. Junction Temperature**

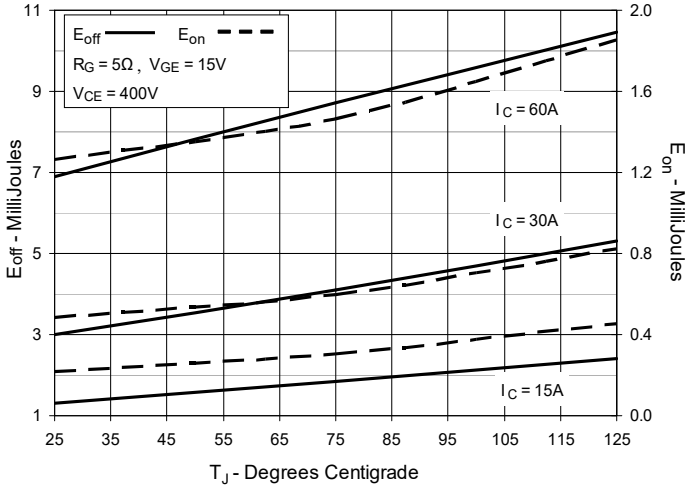



**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**

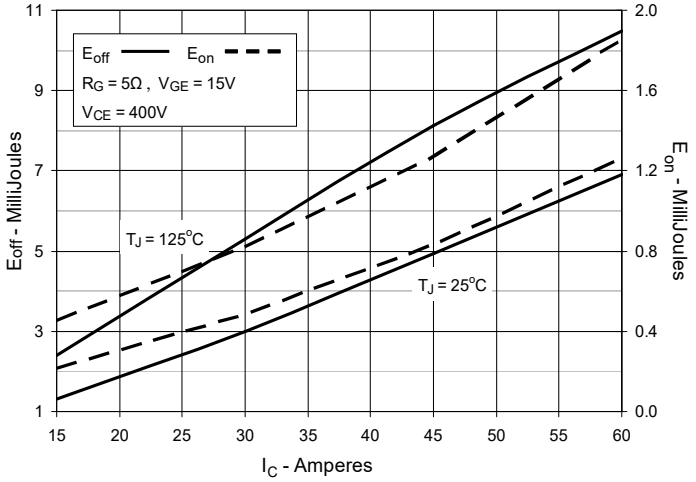



**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**

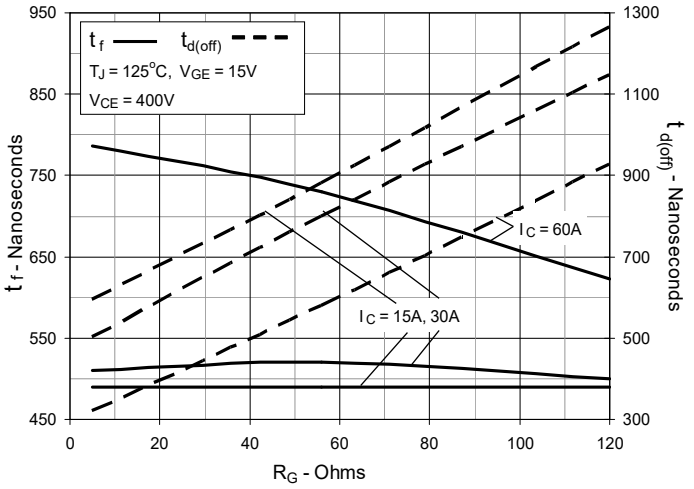



**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**

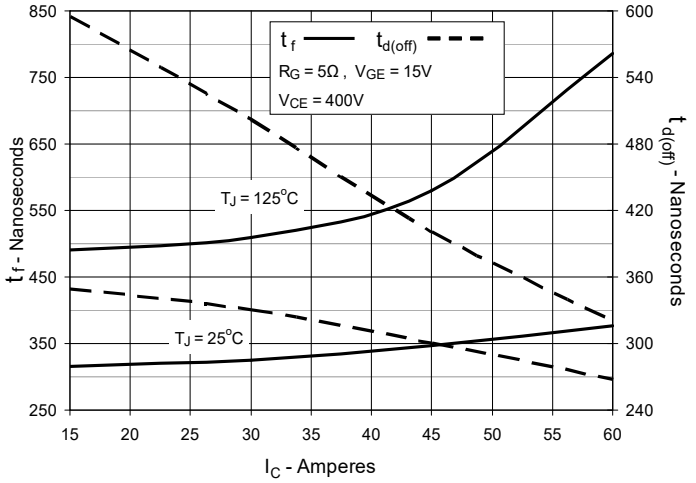
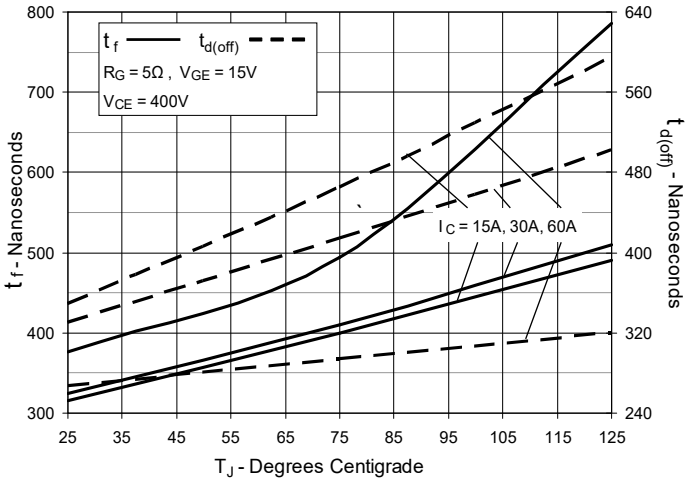



**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**




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**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

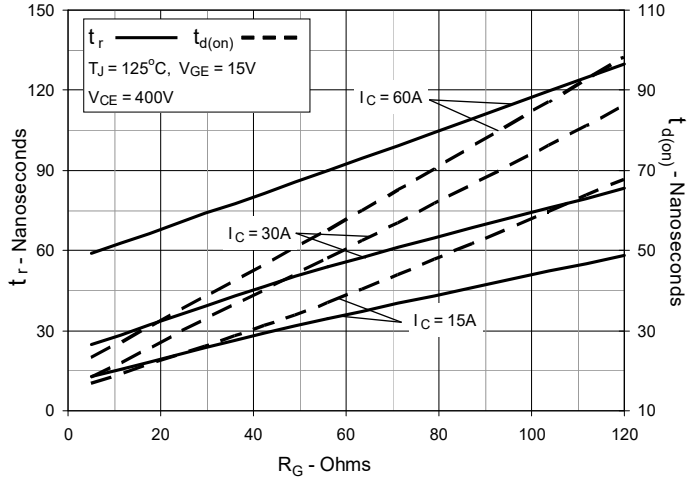



**Fig. 19. Inductive Turn-on Switching Times vs. Junction Temperature**

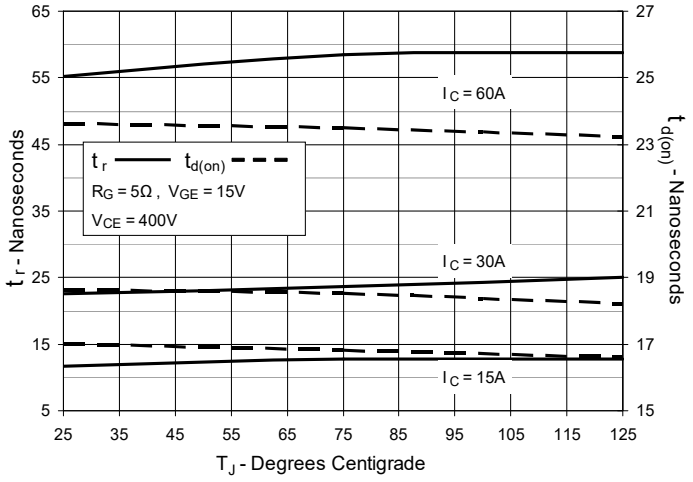
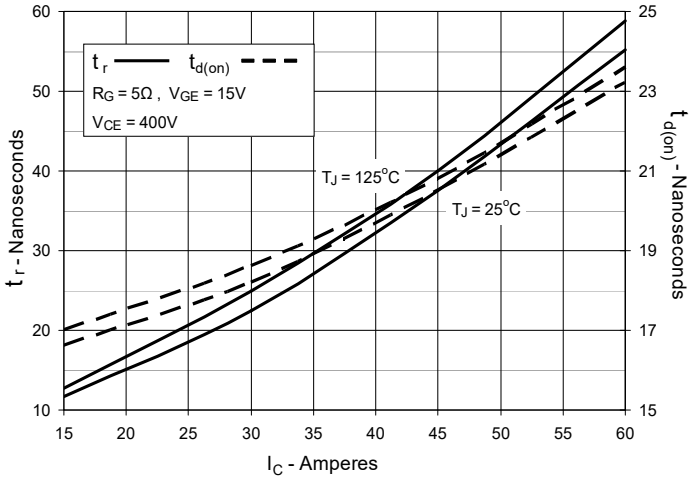
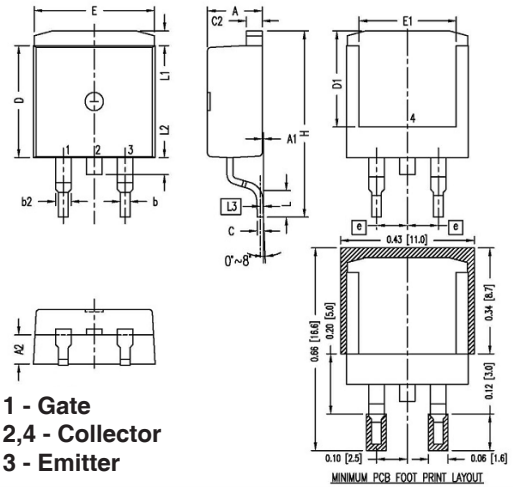



**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



## TO-263 Outline

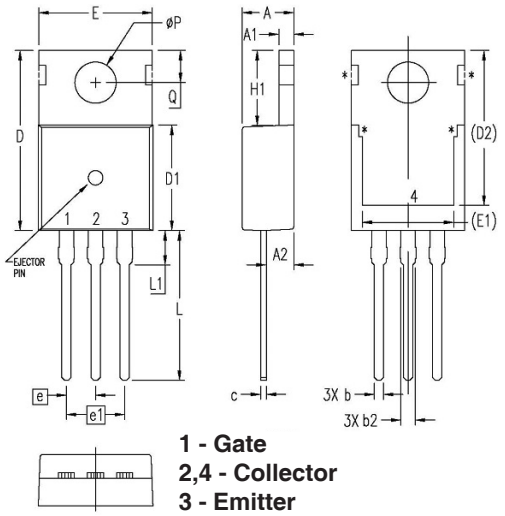



**1 - Gate**
**2,4 - Collector**
**3 - Emitter**

| SYM | INCHES | | MILLIMETER | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .170 | .185 | 4.30 | 4.70 |
| A1 | .000 | .008 | 0.00 | 0.20 |
| A2 | .091 | .098 | 2.30 | 2.50 |
| b | .028 | .035 | 0.70 | 0.90 |
| b2 | .046 | .060 | 1.18 | 1.52 |
| C | .018 | .024 | 0.45 | 0.60 |
| C2 | .049 | .060 | 1.25 | 1.52 |
| D | .340 | .370 | 8.63 | 9.40 |
| D1 | .300 | .327 | 7.62 | 8.30 |
| E | .380 | .410 | 9.65 | 10.41 |
| E1 | .270 | .330 | 6.86 | 8.38 |
| e | .100 BSC | | 2.54 BSC | |
| H | .580 | .620 | 14.73 | 15.75 |
| L | .075 | .105 | 1.91 | 2.67 |
| L1 | .039 | .060 | 1.00 | 1.52 |
| L2 | — | .070 | — | 1.77 |
| L3 | .010 BSC | | 0.254 BSC | |

NOTE:
1. This drawing meets all dimensions requirement of JEDEC outlines TO-263AB.
2. All metal surface are matte pure tin plated except trimmed area.
3. L3 is Gauge plane to measure L.
4. These dimension do not include mold flash and they will not exceed 0.005[0.13] per side.

## TO-220 Outline

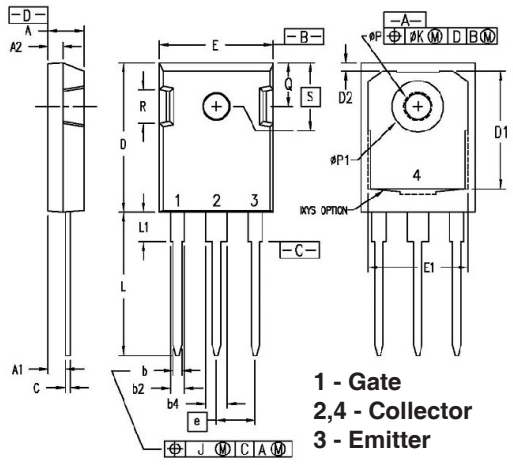



**1 - Gate**
**2,4 - Collector**
**3 - Emitter**

| SYM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .169 | .185 | 4.30 | 4.70 |
| A1 | .047 | .055 | 1.20 | 1.40 |
| A2 | .079 | .106 | 2.00 | 2.70 |
| b | .024 | .039 | 0.60 | 1.00 |
| b2 | .045 | .057 | 1.15 | 1.45 |
| c | .014 | .026 | 0.35 | 0.65 |
| D | .587 | .626 | 14.90 | 15.90 |
| D1 | .335 | .370 | 8.50 | 9.40 |
| (D2) | .500 | .531 | 12.70 | 13.50 |
| E | .382 | .406 | 9.70 | 10.30 |
| (E1) | .283 | .323 | 7.20 | 8.20 |
| e | .100 BSC | | 2.54 BSC | |
| e1 | .200 BSC | | 5.08 BSC | |
| H1 | .244 | .268 | 6.20 | 6.80 |
| L | .492 | .547 | 12.50 | 13.90 |
| L1 | .110 | .154 | 2.80 | 3.90 |
| øP | .134 | .150 | 3.40 | 3.80 |
| Q | .106 | .126 | 2.70 | 3.20 |

NOTE:
1. These dimensions do not inclue mold protusion.
2. Metal finish – Matte pure tin plating except trim area.
3. Pin call out: 1 – GATE 3 – SOURCE (EMITTER for IGBT)
   2 – DRAIN (COLLECTOR for IGBT) 4 – DRAIN (Connected with #2 internally)
4. Ejector pin location & diameter will vary depending on packaging suppliers.
5. * marked area will vary depending on packaging suppliers.

## TO-247 Outline




**1 - Gate**
**2,4 - Collector**
**3 - Emitter**

| SYM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | .190 | .205 | 4.83 | 5.21 |
| A1 | .090 | .100 | 2.29 | 2.54 |
| A2 | .075 | .085 | 1.91 | 2.16 |
| b | .045 | .055 | 1.14 | 1.40 |
| b2 | .075 | .087 | 1.91 | 2.20 |
| b4 | .115 | .126 | 2.92 | 3.20 |
| C | .024 | .031 | 0.61 | 0.80 |
| D | .819 | .840 | 20.80 | 21.34 |
| D1 | .650 | .690 | 16.51 | 17.53 |
| D2 | .035 | .050 | 0.89 | 1.27 |
| E | .620 | .635 | 15.75 | 16.13 |
| E1 | .545 | .565 | 13.84 | 14.35 |
| e | .215 BSC | | 5.45 BSC | |
| J | -- | .010 | -- | 0.25 |
| K | -- | .025 | -- | 0.64 |
| L | .780 | .810 | 19.81 | 20.57 |
| L1 | .150 | .170 | 3.81 | 4.32 |
| øP | .140 | .144 | 3.55 | 3.65 |
| øP1 | .275 | .290 | 6.99 | 7.37 |
| Q | .220 | .244 | 5.59 | 6.20 |
| R | .170 | .190 | 4.32 | 4.83 |
| S | .242 BSC | | 6.15 BSC | |

NOTE: This drawing will meet all dimensions requirement of JEDEC outlines TO-247 AD (R-PSIP-F3)

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