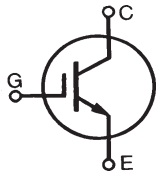
IXYS

# Low $V_{CE(sat)}$ IGBT

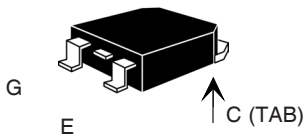
**IXGH 28N60B**
**IXGT 28N60B**

$V_{CES}$ = 600 V
$I_{C25}$ = 40 A
$V_{CE(sat)}$ = 2.0 V

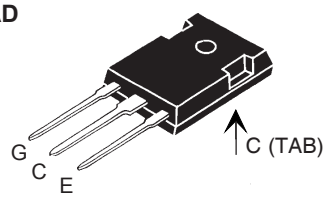



| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{CES}$ | $T_J$ = 25°C to 150°C | 600 | V |
| $V_{CGR}$ | $T_J$ = 25°C to 150°C; $R_{GE}$ = 1 MΩ | 600 | V |
| $V_{GES}$ | Continuous | ±20 | V |
| $V_{GEM}$ | Transient | ±30 | V |
| $I_{C25}$ | $T_C$ = 25°C | 40 | A |
| $I_{C90}$ | $T_C$ = 90°C | 28 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1 ms | 80 | A |
| **SSOA (RBSOA)** | $V_{GE}$ = 15 V, $T_{VJ}$ = 125°C, $R_G$ = 10 Ω<br>Clamped inductive load | $I_{CM}$ = 56<br>@ 0.8 $V_{CES}$ | A |
| $P_C$ | $T_C$ = 25°C | 150 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $M_d$ | Mounting torque (M3) TO-247 | 1.13/10 | Nm/lb.in. |
| Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s | | 300 | °C |
| **Weight** | TO-247<br>TO-268 | 6<br>4 | g<br>g |

**TO-268 (IXGT)**




**TO-247 AD (IXGH)**




G = Gate, C = Collector,
E = Emitter, TAB = Collector

| Symbol | Test Conditions | | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | $I_C$ = 250 μA, $V_{CE}$ = $V_{GE}$ | | 2.5 | | 5.5 | V |
| $I_{CES}$ | $V_{CE}$ = $V_{CES}$<br>$V_{GE}$ = 0 V | $T_J$ = 25°C<br>$T_J$ = 125°C | | | 100<br>500 | μA<br>μA |
| $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = ±20 V | | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = $I_{C90}$, $V_{GE}$ = 15 V | | | | 2.0 | V |

**Features**
- International standard packages
- Low $V_{CE(sat)}$
  - for minimum on-state conduction losses
- High current handling capability
- MOS Gate turn-on
  - drive simplicity

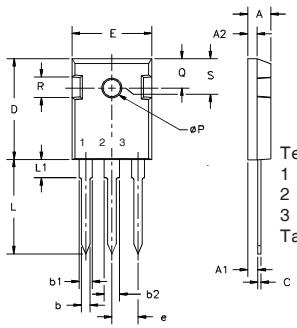
**Applications**
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

**Advantages**
- Easy to mount with 1 screw (isolated mounting screw hole)
- Low losses, high efficiency
- High power density

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| Symbol | Test Conditions | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C = I_{C90}$; $V_{CE}$ = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 % | 15 | 25 | | S |
| $C_{ies}$ | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, f = 1 MHz | | 1500 | | pF |
| $C_{oes}$ | | | 130 | | pF |
| $C_{res}$ | | | 42 | | pF |
| $Q_g$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, $V_{CE}$ = 0.5 $V_{CES}$ | | 68 | 100 | nC |
| $Q_{ge}$ | | | 15 | 30 | nC |
| $Q_{gc}$ | | | 20 | 40 | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** $I_C = I_{C90}$, $V_{GE}$ = 15 V $V_{CE}$ = 0.8 $V_{CES}$, $R_G = R_{off}$ = 10 Ω | | 15 | | ns |
| $t_{ri}$ | | | 25 | | ns |
| $t_{d(off)}$ | | | 175 | 400 | ns |
| $t_{fi}$ | | | 260 | 400 | ns |
| $E_{off}$ | | | 2 | 4 | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C** $I_C = I_{C90}$, $V_{GE}$ = 15 V $V_{CE}$ = 0.8 $V_{CES}$, $R_G = R_{off}$ = 10 Ω | | 15 | | ns |
| $t_{ri}$ | | | 25 | | ns |
| $E_{on}$ | | | 0.2 | | mJ |
| $t_{d(off)}$ | | | 400 | | ns |
| $t_{fi}$ | | | 400 | | ns |
| $E_{off}$ | | | 3 | | mJ |
| $R_{thJC}$ | | | | 0.83 | K/W |
| $R_{thCK}$ | TO-247 | | 0.25 | | K/W |

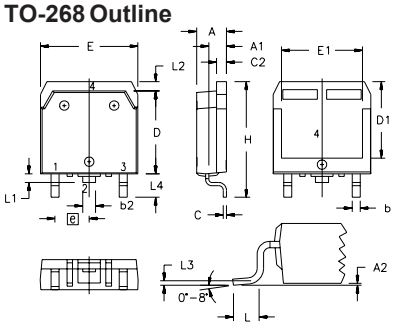
**TO-247 AD Outline**




Terminals:
1 - Gate
2 - Collector
3 - Emitter
Tab-Collector

| Dim. | Millimeter Min. | Max. | Inches Min. | Max. |
|---|---|---|---|---|
| A | 4.7 | 5.3 | .185 | .209 |
| $A_1$ | 2.2 | 2.54 | .087 | .102 |
| $A_2$ | 2.2 | 2.6 | .059 | .098 |
| b | 1.0 | 1.4 | .040 | .055 |
| $b_1$ | 1.65 | 2.13 | .065 | .084 |
| $b_2$ | 2.87 | 3.12 | .113 | .123 |
| C | .4 | .8 | .016 | .031 |
| D | 20.80 | 21.46 | .819 | .845 |
| E | 15.75 | 16.26 | .610 | .640 |
| e | 5.20 | 5.72 | 0.205 | 0.225 |
| L | 19.81 | 20.32 | .780 | .800 |
| L1 | | 4.50 | | .177 |
| ∅P | 3.55 | 3.65 | .140 | .144 |
| Q | 5.89 | 6.40 | 0.232 | 0.252 |
| R | 4.32 | 5.49 | .170 | .216 |
| S | 6.15 BSC | | 242 BSC | |

**TO-268 Outline**




Terminals: 1 - Gate 2 - Collector
3 - Emitter Tab - Collector

| SYM | INCHES MIN | MAX | MILLIMETERS MIN | MAX |
|---|---|---|---|---|
| A | .193 | .201 | 4.90 | 5.10 |
| A1 | .106 | .114 | 2.70 | 2.90 |
| A2 | .001 | .010 | 0.02 | 0.25 |
| b | .045 | .057 | 1.15 | 1.45 |
| b2 | .075 | .083 | 1.90 | 2.10 |
| C | .016 | .026 | 0.40 | 0.65 |
| C2 | .057 | .063 | 1.45 | 1.60 |
| D | .543 | .551 | 13.80 | 14.00 |
| D1 | .488 | .500 | 12.40 | 12.70 |
| E | .624 | .632 | 15.85 | 16.05 |
| E1 | .524 | .535 | 13.30 | 13.60 |
| e | .215 BSC | | 5.45 BSC | |
| H | .736 | .752 | 18.70 | 19.10 |
| L | .094 | .106 | 2.40 | 2.70 |
| L1 | .047 | .055 | 1.20 | 1.40 |
| L2 | .039 | .045 | 1.00 | 1.15 |
| L3 | .010 BSC | | 0.25 BSC | |
| L4 | .150 | .161 | 3.80 | 4.10 |

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 4,881,106 5,017,508 5,049,961 5,187,117 5,486,715 6,306,728B1 6,259,123B1 6,306,728B1
4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025 6,404,065B1 6,162,665 6,534,343

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

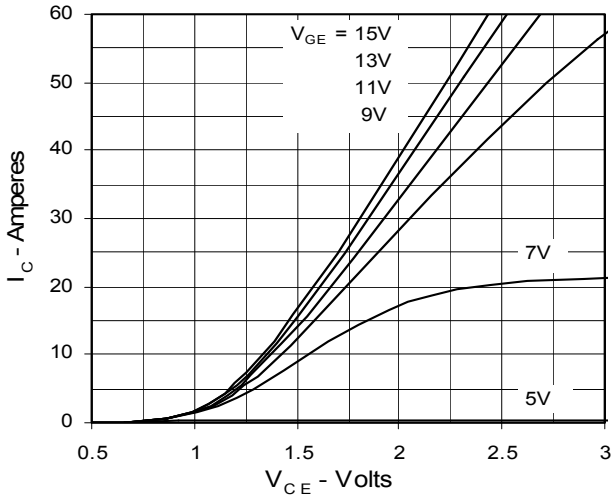



**Fig. 2. Extended Output Characteristics @ 25 deg. C**

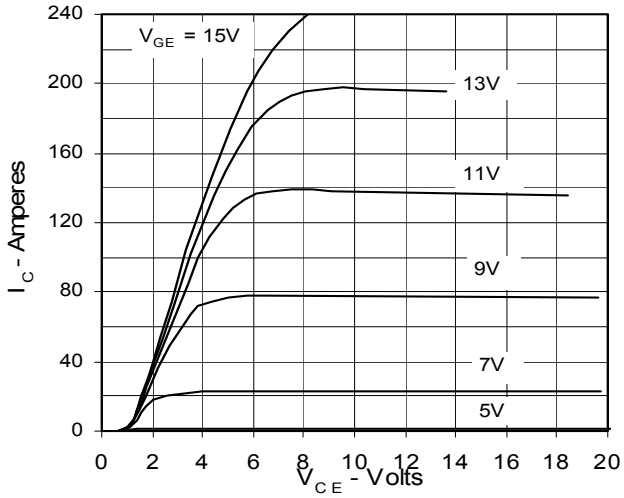



**Fig. 3. Output Characteristics @ 125 Deg. C**

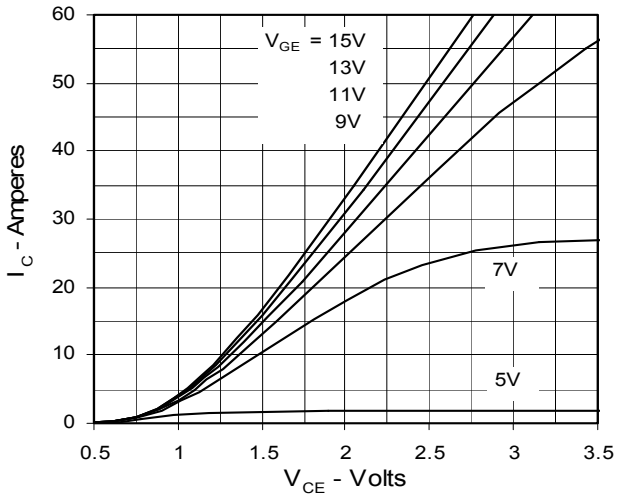



**Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature**

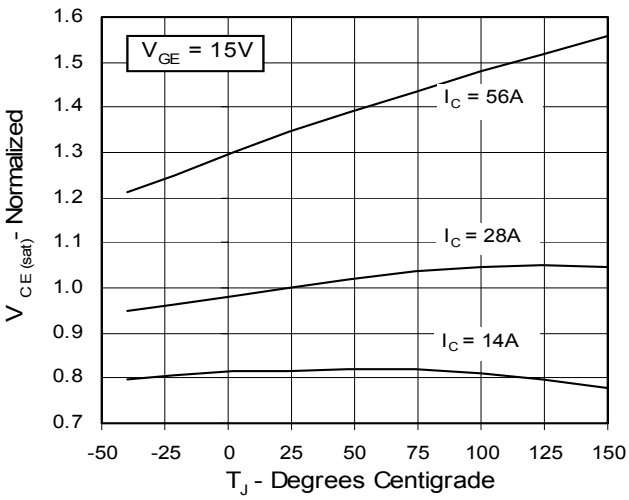



**Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage**

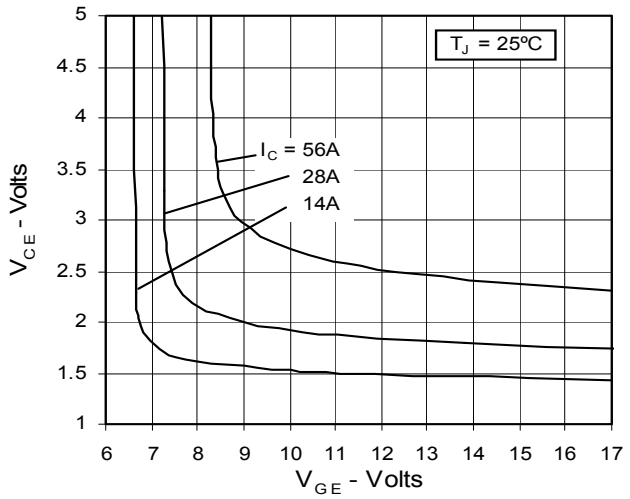
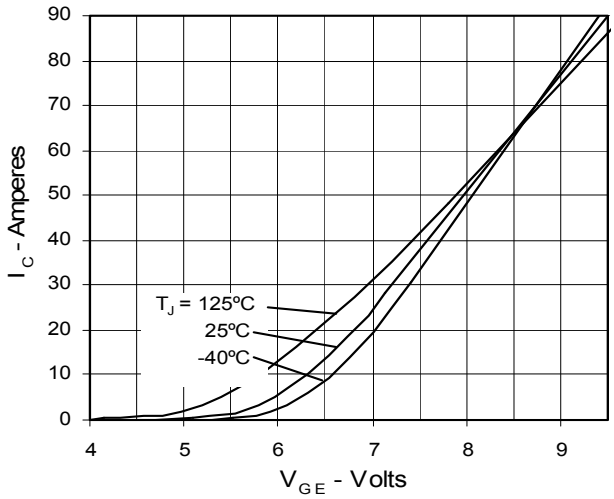



**Fig. 6. Input Admittance**




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**Fig. 7. Transconductance**

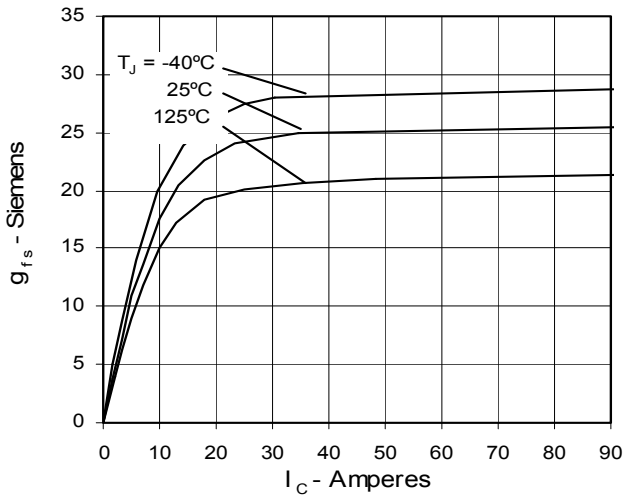



**Fig. 8. Dependence of $E_{off}$ on $R_G$**

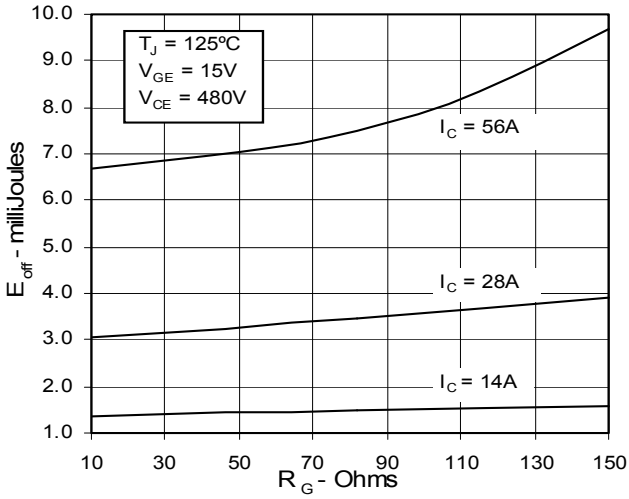



**Fig. 9. Dependence of $E_{off}$ on $I_C$**

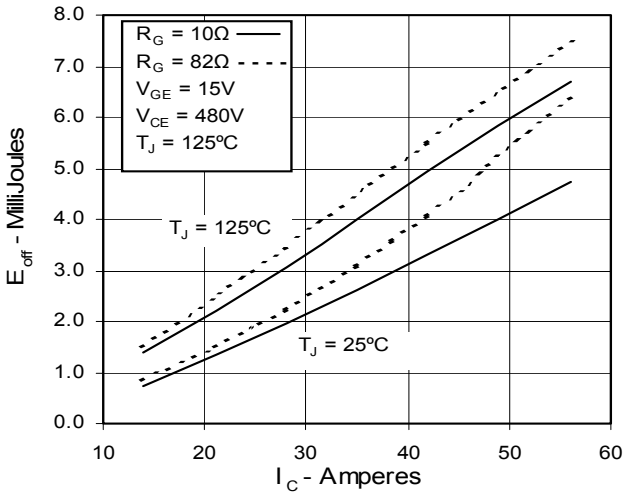



**Fig. 10. Dependence of $E_{off}$ on Temperature**

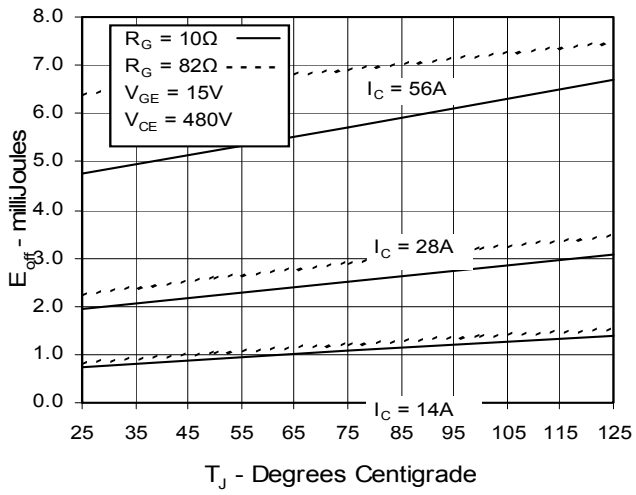



**Fig. 11. Dependence of Switching Time on $R_G$**

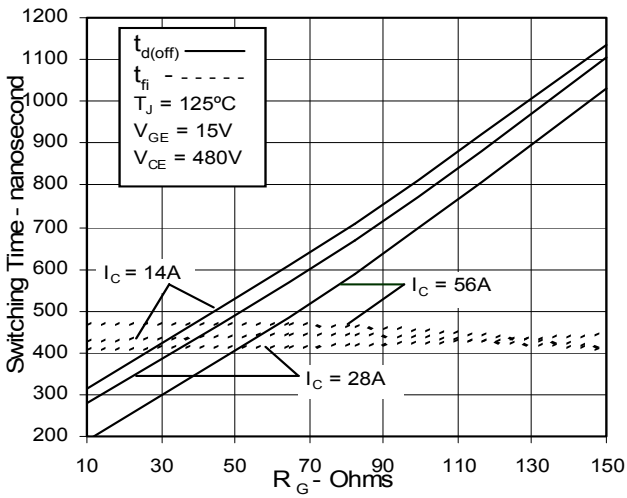
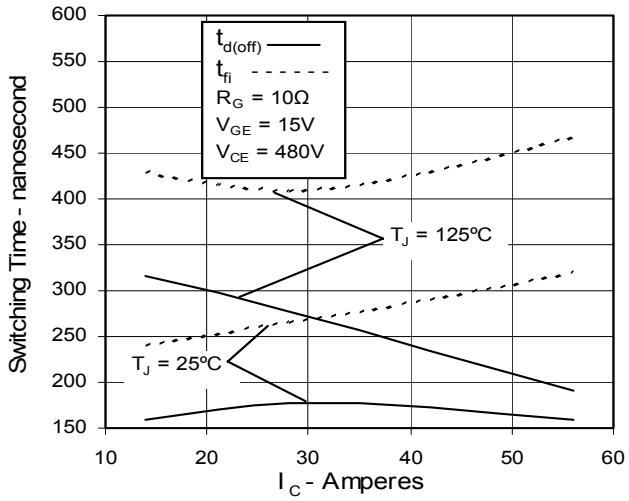



**Fig. 12. Dependence of Switching Time on $I_C$**




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**Fig. 13. Dependence of Switching Time on Temperature**

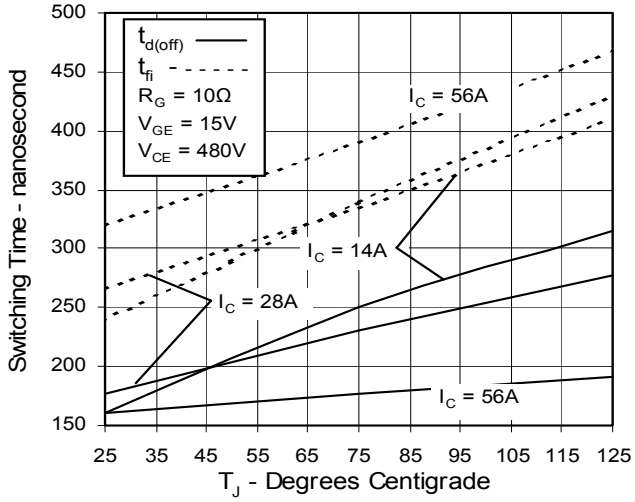



**Fig. 14. Gate Charge**

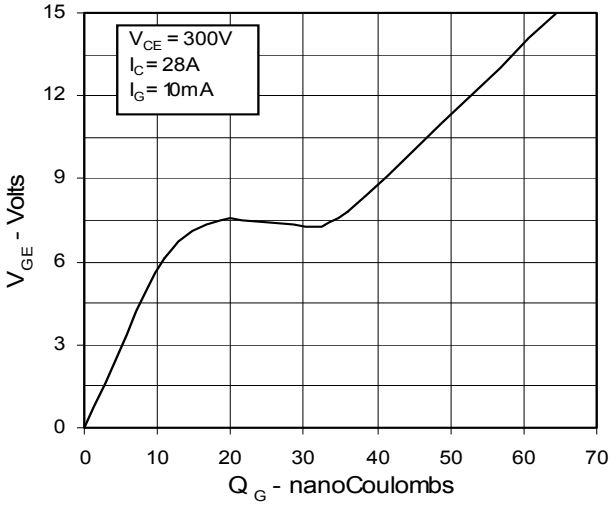



**Fig. 15. Capacitance**

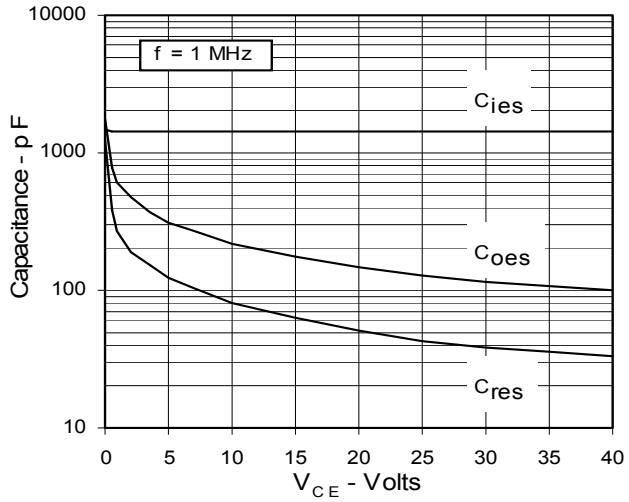
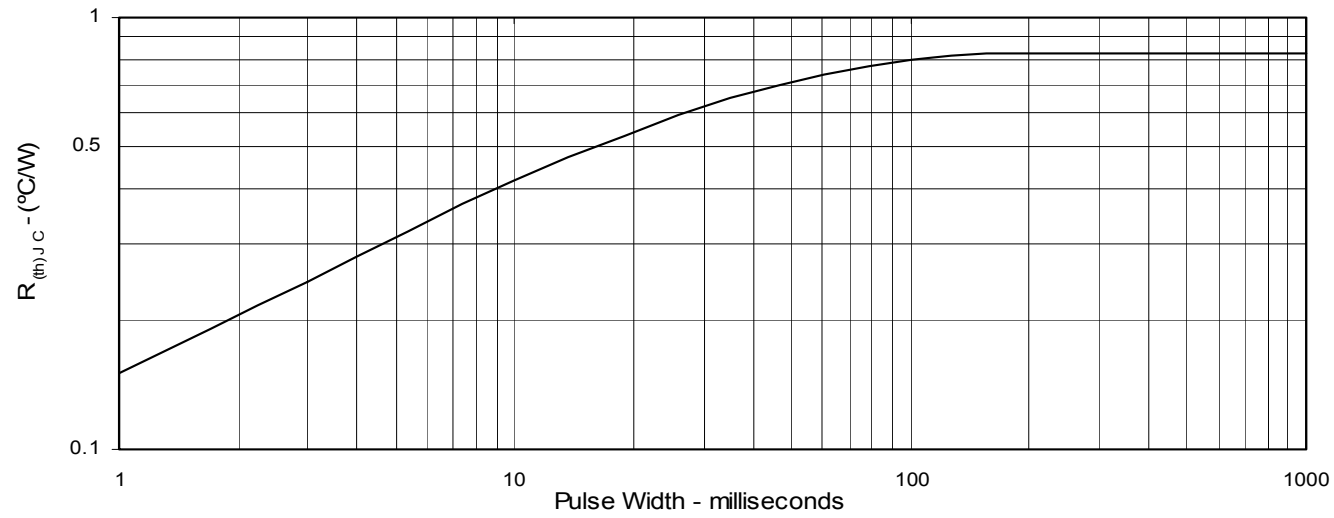



**Fig. 16. Maximum Transient Thermal Resistance**




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