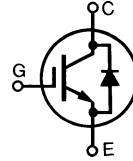


# IGBT

Combi Pack

**IXGA/IXGP12N100U1**  
**IXGA/IXGP12N100AU1**

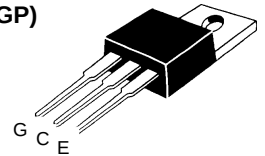


Preliminary Data Sheet

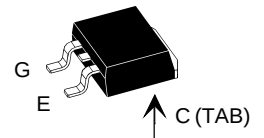
| $V_{CES}$ | $I_{C25}$ | $V_{CE(sat)}$ |
|-----------|-----------|---------------|
| 1000 V    | 24 A      | 3.5 V         |
| 1000 V    | 24 A      | 4.0 V         |

| Symbol                                                                          | Test Conditions                                                                                                               | Maximum Ratings                   |                  |
|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------------------|
| $V_{CES}$                                                                       | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                                                               | 1000                              | V                |
| $V_{CGR}$                                                                       | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GE} = 1\text{ M}\Omega$                                                 | 1000                              | V                |
| $V_{GES}$                                                                       | Continuous                                                                                                                    | $\pm 20$                          | V                |
| $V_{GEM}$                                                                       | Transient                                                                                                                     | $\pm 30$                          | V                |
| $I_{C25}$                                                                       | $T_C = 25^\circ\text{C}$                                                                                                      | 24                                | A                |
| $I_{C90}$                                                                       | $T_C = 90^\circ\text{C}$                                                                                                      | 12                                | A                |
| $I_{CM}$                                                                        | $T_C = 25^\circ\text{C}$ , 1 ms                                                                                               | 48                                | A                |
| <b>SSOA</b><br><b>(RBSOA)</b>                                                   | $V_{GE} = 15\text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 150\ \Omega$<br>Clamped inductive load, $L = 300\ \mu\text{H}$ | $I_{CM} = 24$<br>@ $0.8\ V_{CES}$ | A                |
| $P_C$                                                                           | $T_C = 25^\circ\text{C}$                                                                                                      | 100                               | W                |
| $T_J$                                                                           |                                                                                                                               | $-55 \dots +150$                  | $^\circ\text{C}$ |
| $T_{JM}$                                                                        |                                                                                                                               | 150                               | $^\circ\text{C}$ |
| $T_{stg}$                                                                       |                                                                                                                               | $-55 \dots +150$                  | $^\circ\text{C}$ |
| $M_d$                                                                           | Mounting torque with screw M3<br>Mounting torque with screw M3.5                                                              | 0.45/4<br>0.55/5                  | Nm/lb.in.        |
| <b>Weight</b>                                                                   |                                                                                                                               | 4                                 | g                |
| Maximum lead temperature for soldering<br>1.6 mm (0.062 in.) from case for 10 s |                                                                                                                               | 300                               | $^\circ\text{C}$ |

TO-220AB(IXGP)



TO-263 AA (IXGA)



## Features

- International standard packages JEDEC TO-220AB and TO-263AA
- IGBT with antiparallel FRED in one package
- Second generation HDMOS™ process
- Low  $V_{CE(sat)}$ 
  - for minimum on-state conduction losses
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Expitaxial Diode (FRED)
  - soft recovery with low  $I_{RM}$

## Applications

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

## Advantages

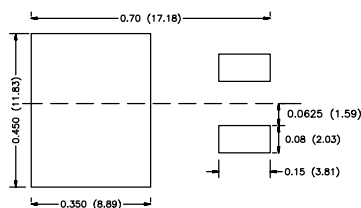
- Easy to mount with one screw
- Space savings (two devices in one package)
- Reduces assembly time and cost
- High power density

| Symbol        | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) | Characteristic Values                                 |      |                           |
|---------------|-----------------------------------------------------------------------------|-------------------------------------------------------|------|---------------------------|
|               |                                                                             | Min.                                                  | Typ. | Max.                      |
| $BV_{CES}$    | $I_C = 3\text{ mA}$ , $V_{GE} = 0\text{ V}$                                 | 1000                                                  |      | V                         |
| $V_{GE(th)}$  | $I_C = 250\ \mu\text{A}$ , $V_{GE} = V_{GE}$                                | 2.5                                                   |      | V                         |
| $I_{CES}$     | $V_{CE} = 0.8$ , $V_{CES}$<br>$V_{GE} = 0\text{ V}$                         | $T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$ |      | 300 $\mu\text{A}$<br>3 mA |
| $I_{GES}$     | $V_{CE} = 0\text{ V}$ , $V_{GE} = \pm 20\text{ V}$                          |                                                       |      | $\pm 100\text{ nA}$       |
| $V_{CE(sat)}$ | $I_C = I_{CE90}$ , $V_{GE} = 15$                                            | 12N100<br>12N100A                                     |      | 3.5 V<br>4.0 V            |

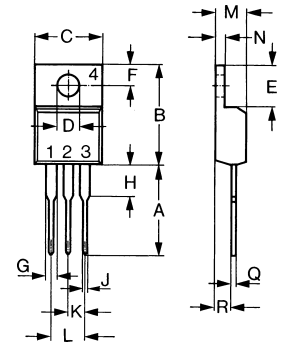
| Symbol       | Test Conditions                                                                                                                                                                                                                                                                                                                    | Characteristic Values |      |          |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|----------|
|              |                                                                                                                                                                                                                                                                                                                                    | Min.                  | Typ. | Max.     |
| $g_{fs}$     | $I_C = I_{C90}$ ; $V_{CE} = 10\text{ V}$ ,<br>Pulse test, $t \leq 300\text{ }\mu\text{s}$ , duty cycle $\leq 2\%$                                                                                                                                                                                                                  | 6                     | 10   | S        |
| $Q_g$        | $I_C = I_{C90}$ ; $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5\text{ V}_{CES}$                                                                                                                                                                                                                                                           |                       | 65   | 90 nC    |
| $Q_{ge}$     |                                                                                                                                                                                                                                                                                                                                    |                       | 8    | 20 nC    |
| $Q_{gc}$     |                                                                                                                                                                                                                                                                                                                                    |                       | 24   | 45 nC    |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b><br>$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 300\text{ }\mu\text{H}$<br>$V_{CE} = 800\text{ V}$ , $R_G = R_{off} = 120\text{ }\Omega$<br>Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8\text{ V}_{CES}$ , higher $T_J$ or increased $R_G$  |                       | 100  | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                                    |                       | 200  | ns       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                                    |                       | 850  | 1000 ns  |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                    | 12N100A               | 500  | 700 ns   |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                    | 12N100                | 800  | 1000 ns  |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                    | 12N100A               | 4    | 6 mJ     |
| $t_{d(on)}$  | <b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b><br>$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 300\text{ }\mu\text{H}$<br>$V_{CE} = 800\text{ V}$ , $R_G = R_{off} = 120\text{ }\Omega$<br>Remarks: Switching times may increase for $V_{CE}(\text{Clamp}) > 0.8\text{ V}_{CES}$ , higher $T_J$ or increased $R_G$ |                       | 100  | ns       |
| $t_{ri}$     |                                                                                                                                                                                                                                                                                                                                    |                       | 200  | ns       |
| $E_{on}$     |                                                                                                                                                                                                                                                                                                                                    |                       | 1.1  | mJ       |
| $t_{d(off)}$ |                                                                                                                                                                                                                                                                                                                                    | 12N100A               | 900  | ns       |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                    | 12N100                | 950  | ns       |
| $t_{fi}$     |                                                                                                                                                                                                                                                                                                                                    | 12N100A               | 1250 | ns       |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                    | 12N100A               | 8    | mJ       |
| $E_{off}$    |                                                                                                                                                                                                                                                                                                                                    | 12N100                | 10   | mJ       |
| $R_{thJC}$   |                                                                                                                                                                                                                                                                                                                                    |                       | 0.25 | 1.25 K/W |
| $R_{thCK}$   |                                                                                                                                                                                                                                                                                                                                    |                       |      | K/W      |

| Reverse Diode (FRED)                                |                                                                                                                       | Characteristic Values |      |         |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------|------|---------|
| (T <sub>J</sub> = 25°C, unless otherwise specified) |                                                                                                                       | Min.                  | Typ. | Max.    |
| Symbol                                              | Test Conditions                                                                                                       |                       |      |         |
| $V_F$                                               | $I_F = 8\text{ A}$ , $V_{GE} = 0\text{ V}$ ,<br>Pulse test, $t \leq 300\text{ }\mu\text{s}$ , duty cycle $d \leq 2\%$ |                       |      | 2.75 V  |
| $I_{RM}$                                            | $I_F = I_{C90}$ , $V_{GE} = 0\text{ V}$ , $-di_F/dt = 100\text{ A}/\mu\text{s}$                                       |                       | 6.5  | A       |
| $t_{rr}$                                            | $V_R = 100\text{ V}$ , $T_J = 125^\circ\text{C}$                                                                      |                       | 140  | ns      |
| $t_{rr}$                                            | $I_F = 1\text{ A}$ , $-di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ , $T_J = 25^\circ\text{C}$            |                       | 50   | 60 ns   |
| $R_{thJC}$                                          |                                                                                                                       |                       |      | 2.5 K/W |

### Min. Recommended Footprint

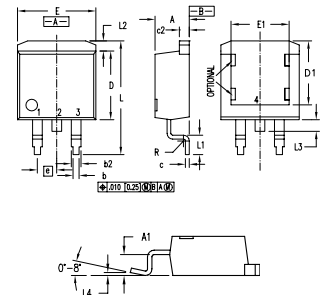


### TO-220 AB (IXGP) Outline



| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | Min.       | Max.  | Min.   | Max.  |
| A    | 12.70      | 13.97 | 0.500  | 0.550 |
| B    | 14.73      | 16.00 | 0.580  | 0.630 |
| C    | 9.91       | 10.66 | 0.390  | 0.420 |
| D    | 3.54       | 4.08  | 0.139  | 0.161 |
| E    | 5.85       | 6.85  | 0.230  | 0.270 |
| F    | 2.54       | 3.18  | 0.100  | 0.125 |
| G    | 1.15       | 1.65  | 0.045  | 0.065 |
| H    | 2.79       | 5.84  | 0.110  | 0.230 |
| J    | 0.64       | 1.01  | 0.025  | 0.040 |
| K    | 2.54       | BSC   | 0.100  | BSC   |
| M    | 4.32       | 4.82  | 0.170  | 0.190 |
| N    | 1.14       | 1.39  | 0.045  | 0.055 |
| Q    | 0.35       | 0.56  | 0.014  | 0.022 |
| R    | 2.29       | 2.79  | 0.090  | 0.110 |

### TO-263 AA (IXGA) Outline



| Dim. | Millimeter |       | Inches |      |
|------|------------|-------|--------|------|
|      | Min.       | Max.  | Min.   | Max. |
| A    | 4.06       | 4.83  | .160   | .190 |
| A1   | 2.03       | 2.79  | .080   | .110 |
| b    | 0.51       | 0.99  | .020   | .039 |
| b2   | 1.14       | 1.40  | .045   | .055 |
| c    | 0.46       | 0.74  | .018   | .029 |
| c2   | 1.14       | 1.40  | .045   | .055 |
| D    | 8.64       | 9.65  | .340   | .380 |
| D1   | 7.11       | 8.13  | .280   | .320 |
| E    | 9.65       | 10.29 | .380   | .405 |
| E1   | 6.86       | 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          | 0.38  | 0      | .015 |
| R    | 0.46       | 0.74  | .018   | .029 |

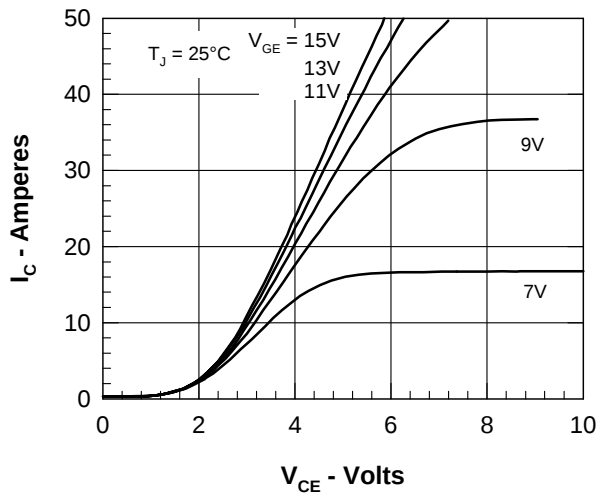


Figure 1. Saturation Voltage Characteristics

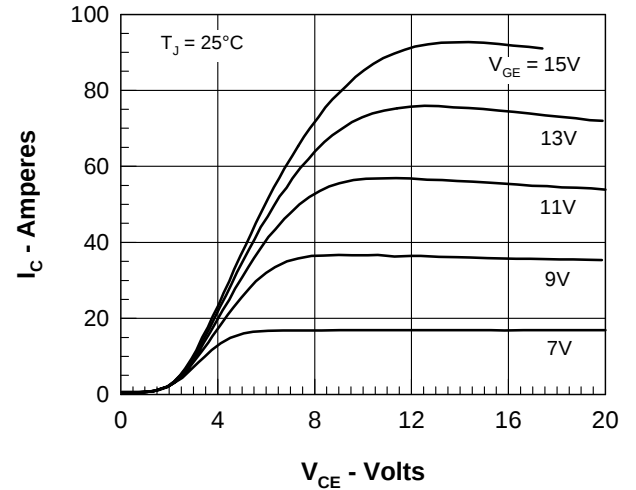


Figure 2. Extended Output Characteristics

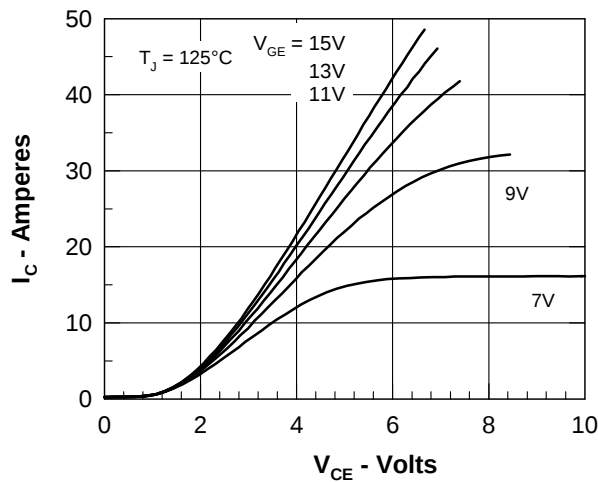


Figure 3. Saturation Voltage Characteristics

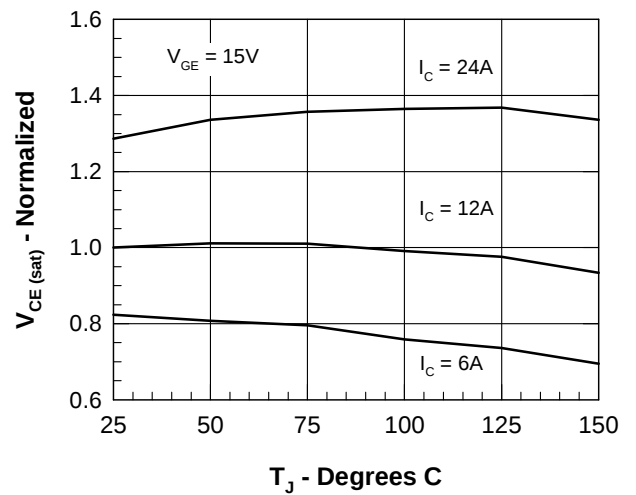
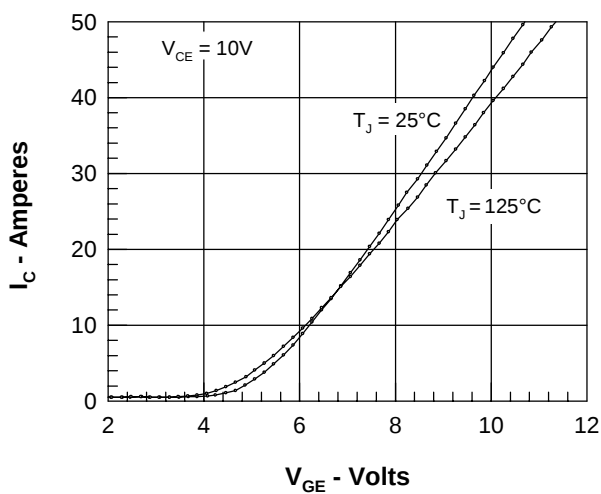

Figure 4. Temperature Dependence of  $V_{CE(sat)}$ 


Figure 5. Admittance Curves

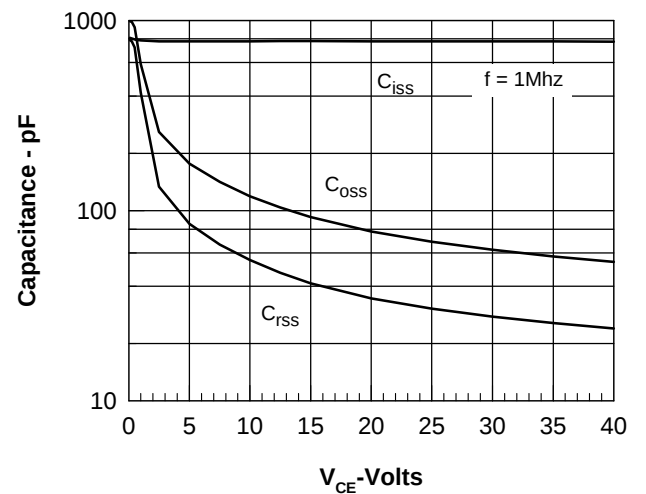


Figure 6. Capacitance Curves

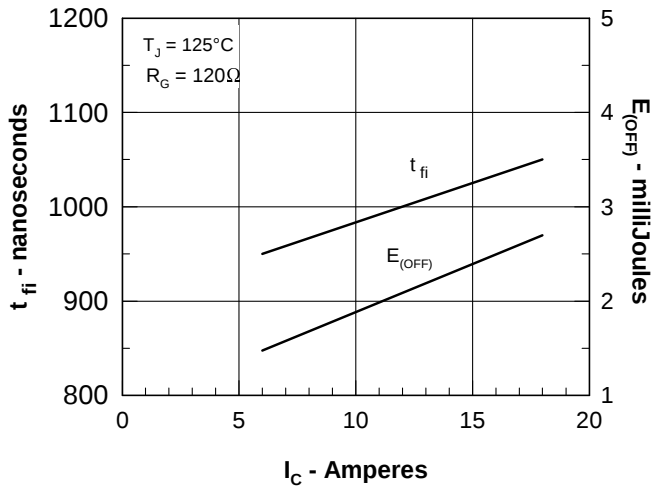


Figure 7. Dependence of  $t_{fi}$  and  $E_{OFF}$  on  $I_C$ .

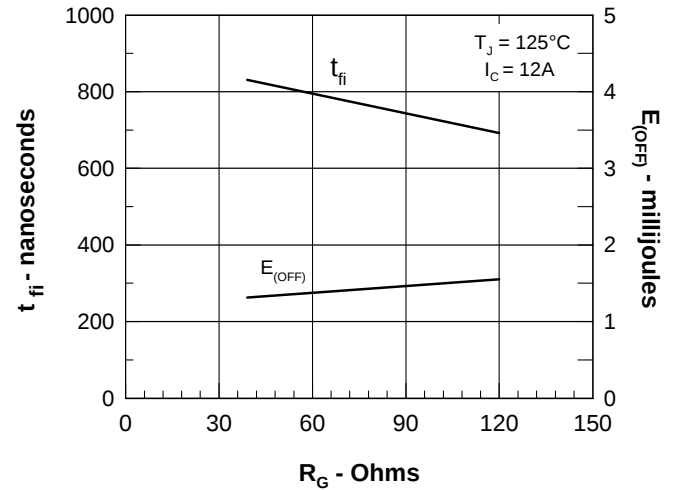


Figure 8. Dependence of  $t_{fi}$  and  $E_{OFF}$  on  $R_G$ .

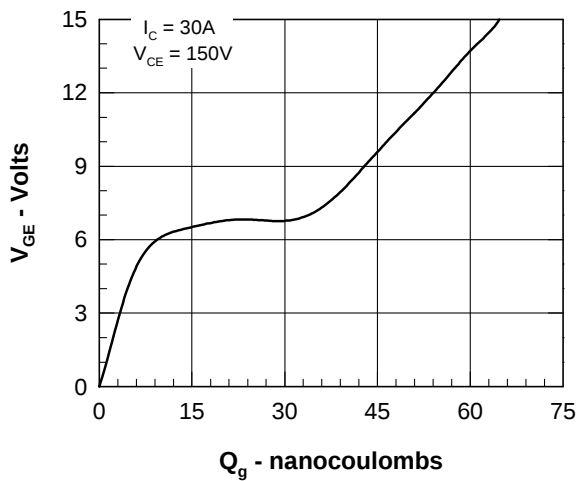


Figure 9. Gate Charge

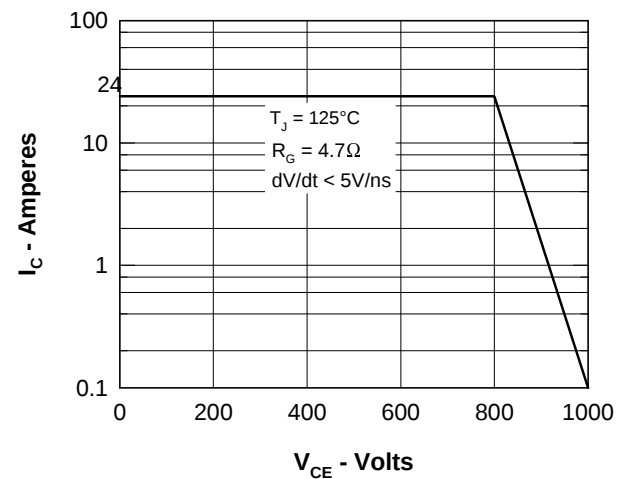


Figure 10. Turn-off Safe Operating Area

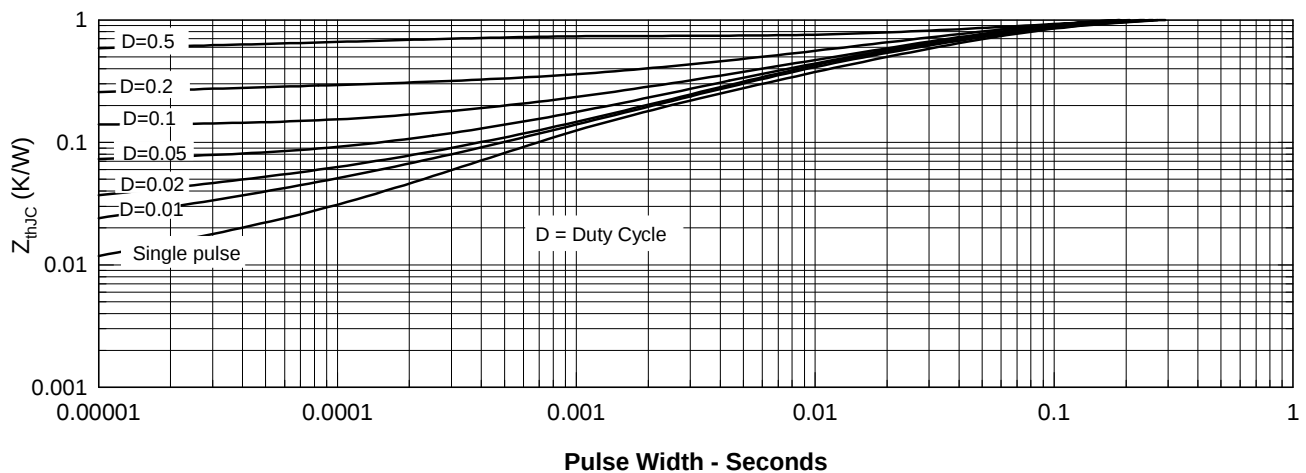


Figure 11. Transient Thermal Resistance

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