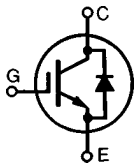
IXYS

# HiPerFAST™ IGBT with Diode

## Combi Pack

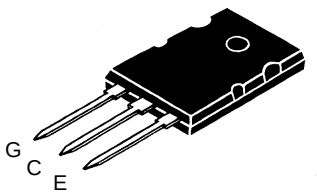
**IXGK 50N60AU1**

$V_{CES}$ = 600 V
$I_{C25}$ = 75 A
$V_{CE(sat)}$ = 2.7 V
$t_{fi}$ = 275 ns




| 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, limited by leads | 75 | A |
| $I_{C90}$ | $T_C$ = 90°C | 50 | A |
| $I_{CM}$ | $T_C$ = 25°C, 1 ms | 200 | A |
| **SSOA (RBSOA)** | $V_{GE}$ = 15 V, $T_{VJ}$ = 125°C, $R_G$ = 10 Ω<br>Clamped inductive load, L = 30 µH | $I_{CM}$ = 100<br>@ 0.8 $V_{CES}$ | A |
| $P_C$ | $T_C$ = 25°C | 300 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $M_d$ | Mounting torque (M4) | 0.9/6 | Nm/lb.in. |
| **Weight** | | 10 | g |
| Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s | | 300 | °C |

**TO-264 AA**




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

### Features

- International standard package JEDEC TO-264 AA
- High frequency IGBT and anti-parallel FRED in one package
- 2nd generation HDMOS™ process
- Low $V_{CE(sat)}$
  - for minimum on-state conduction losses
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Epitaxial 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

- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost
- High power density

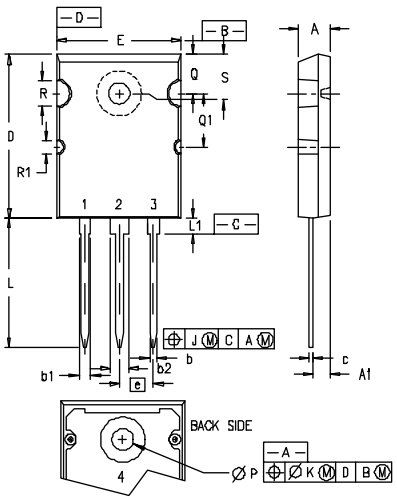
| Symbol | Test Conditions | | Characteristic Values ($T_J$ = 25°C, unless otherwise specified) min. | typ. | max. | |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | $I_C$ = 500 µA, $V_{GE}$ = 0 V | | 600 | | | V |
| $V_{GE(th)}$ | $I_C$ = 500 µA, $V_{CE}$ = $V_{GE}$ | | 2.5 | | 5.5 | V |
| $I_{CES}$ | $V_{CE}$ = 0.8 • $V_{CES}$<br>$V_{GE}$ = 0 V | $T_J$ = 25°C<br>$T_J$ = 125°C | | | 250<br>15 | µA<br>mA |
| $I_{GES}$ | $V_{CE}$ = 0 V, $V_{GE}$ = ±20 V | | | | ±100 | nA |
| $V_{CE(sat)}$ | $I_C$ = $I_{C90}$, $V_{GE}$ = 15 V | | | | 2.7 | V |

| Symbol | Test Conditions ($T_J$ = 25°C, unless otherwise specified) | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|
| $g_{fs}$ | $I_C = I_{C90}$; $V_{CE}$ = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 % | 25 | 35 | | S |
| $Q_g$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, $V_{CE}$ = 0.5 $V_{CES}$ | | 200 | | nC |
| $Q_{ge}$ | | | 50 | | nC |
| $Q_{gc}$ | | | 80 | | nC |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 25°C** | | 50 | | ns |
| $t_{ri}$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, L = 100 µH, | | 210 | | ns |
| $t_{d(off)}$ | $V_{CE}$ = 0.8 $V_{CES}$, $R_G = R_{off}$ = 2.7 Ω | | 200 | | ns |
| $t_{fi}$ | Remarks: Switching times may increase for $V_{CE}$ (Clamp) > 0.8 • $V_{CES}$, higher $T_J$ or | | 275 | 400 | ns |
| $E_{off}$ | increased $R_G$ | | 4.8 | | mJ |
| $t_{d(on)}$ | **Inductive load, $T_J$ = 125°C** | | 50 | | ns |
| $t_{ri}$ | $I_C = I_{C90}$, $V_{GE}$ = 15 V, L = 100 µH | | 240 | | ns |
| $E_{on}$ | $V_{CE}$ = 0.8 $V_{CES}$, $R_G = R_{off}$ = 2.7 Ω | | 3 | | mJ |
| $t_{d(off)}$ | Remarks: Switching times may increase | | 280 | | ns |
| $t_{fi}$ | for $V_{CE}$ (Clamp) > 0.8 • $V_{CES}$, higher $T_J$ or | | 600 | | ns |
| $E_{off}$ | increased $R_G$ | | 9.6 | | mJ |
| $R_{thJC}$ | | | | 0.42 | K/W |
| $R_{thCK}$ | | | 0.15 | | K/W |

**Reverse Diode (FRED)**

| Symbol | Test Conditions ($T_J$ = 25°C, unless otherwise specified) | Characteristic Values min. | typ. | max. | |
|---|---|---|---|---|---|
| $V_F$ | $I_F = I_{C90}$, $V_{GE}$ = 0 V, Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 % | | | 1.7 | V |
| $I_{RM}$ | $I_F = I_{C90}$, $V_{GE}$ = 0 V, -$di_F$/dt = 480 A/µs | | 19 | 33 | A |
| $t_{rr}$ | $V_R$ = 360 V $T_J$ = 125°C | | 175 | | ns |
| | $I_F$ = 1 A; -di/dt = 200 A/µs; $V_R$ = 30 V $T_J$ = 25°C | | 35 | 50 | ns |
| $R_{thJC}$ | | | | 0.75 | K/W |

**TO-264 AA Outline**




| SYM | INCHES MIN | INCHES MAX | MILLIMETERS MIN | MILLIMETERS 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 | .215 BSC | | 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 |
| 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 |

1 – GATE
2, 4 – DRAIN (COLLECTOR)
3 – SOURCE (EMITTER)

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

Fig. 1 Saturation Characteristics

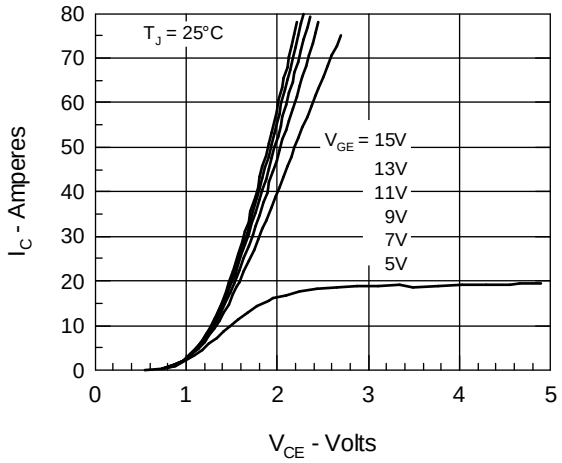



Fig. 2 Output Characterstics

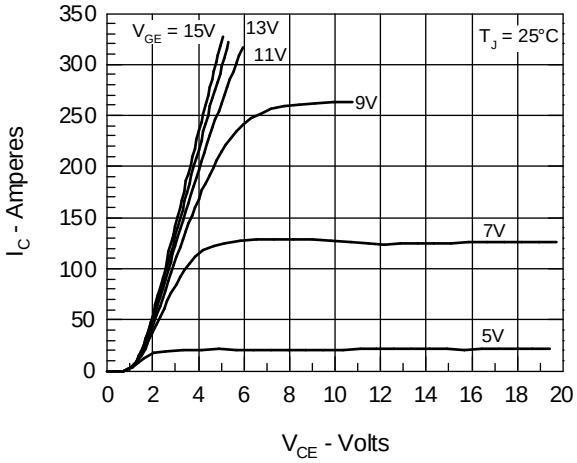



Fig. 3 Collector-Emitter Voltage vs. Gate-Emitter Voltage

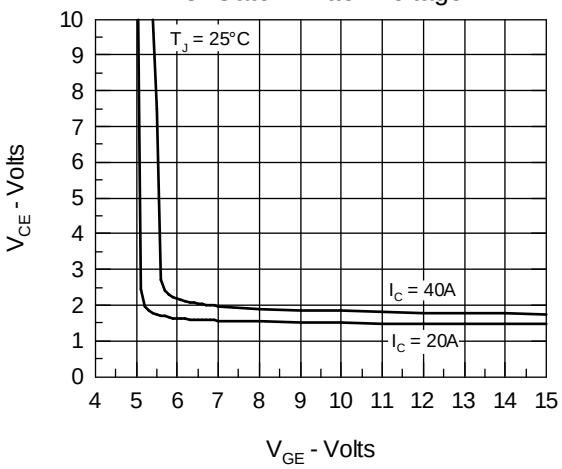



Fig. 4 Temperature Dependence of Output Saturation Voltage

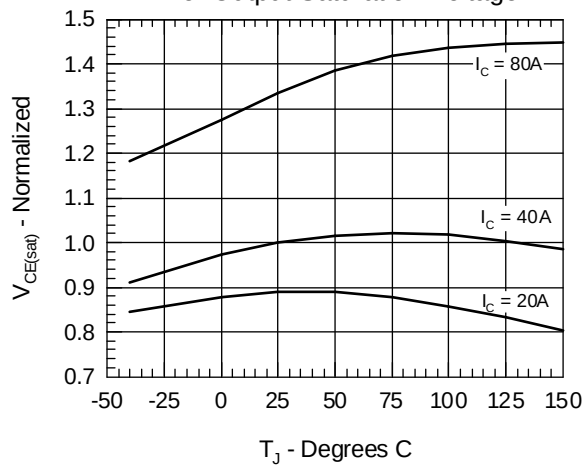



Fig. 5 Input Admittance

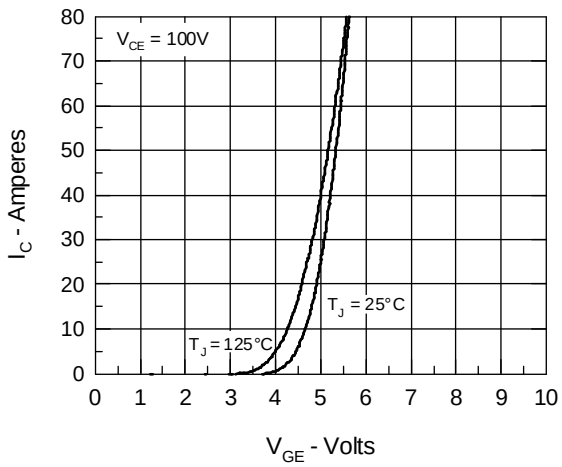



Fig. 6 Temperature Dependence of Breakdown and Threshold Voltage

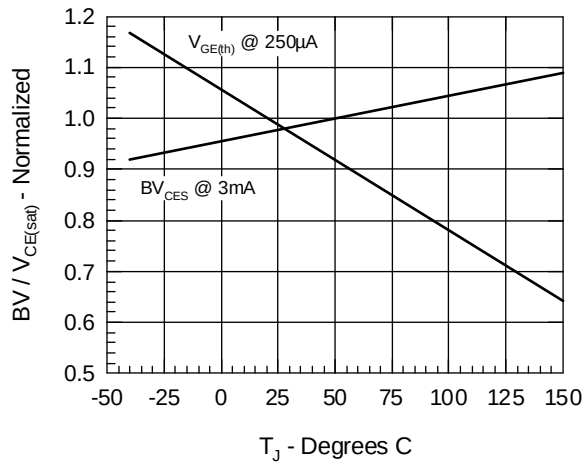


Fig.7 Gate Charge

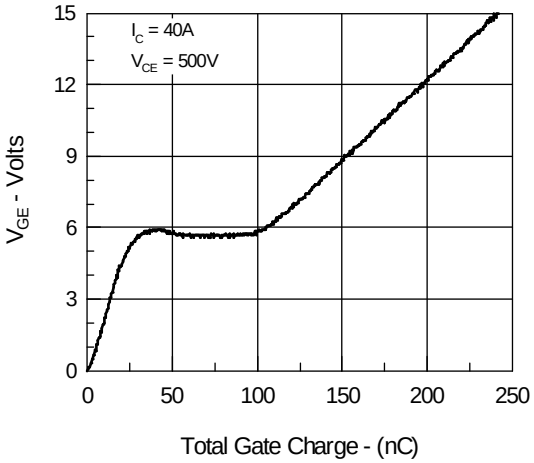



Fig.8 Turn-Off Safe Operating Area

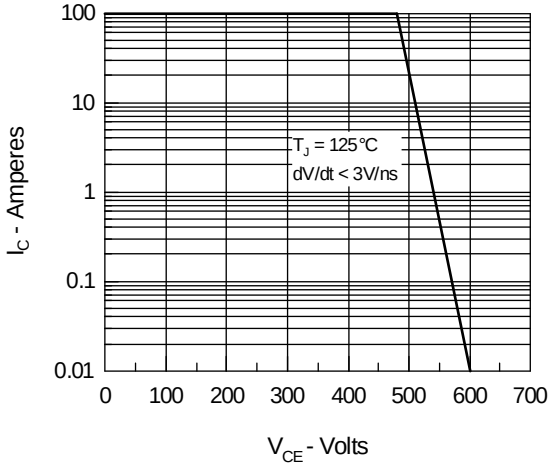



Fig.9 Capacitance Curves

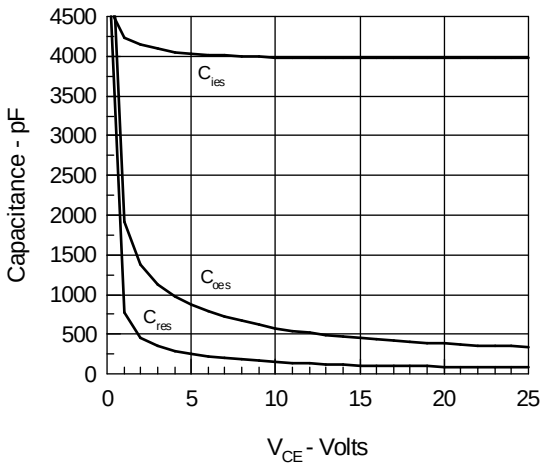



Fig.10 Transient Thermal Impedance

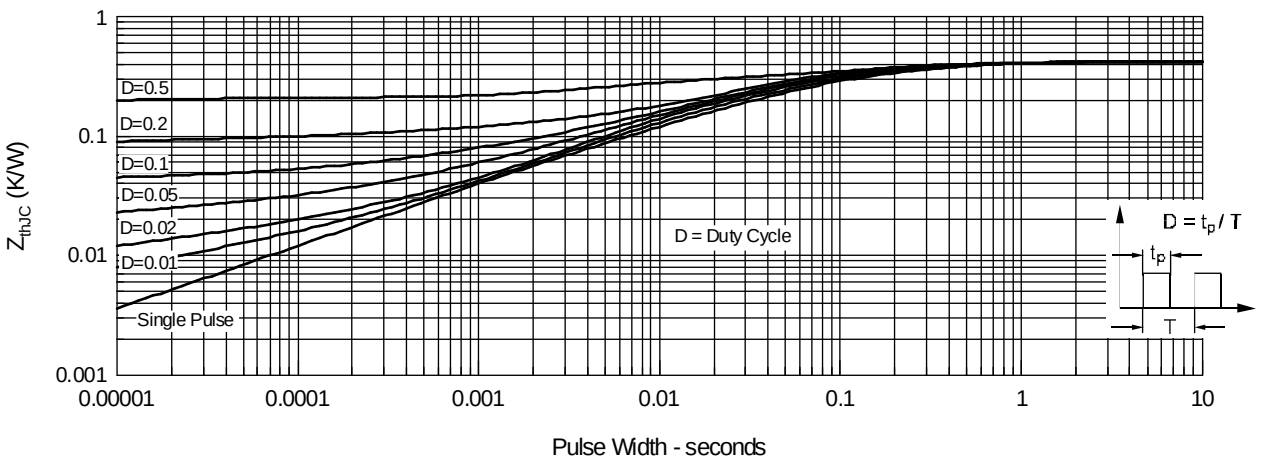


Fig. 12. Maximum Forward Voltage Drop

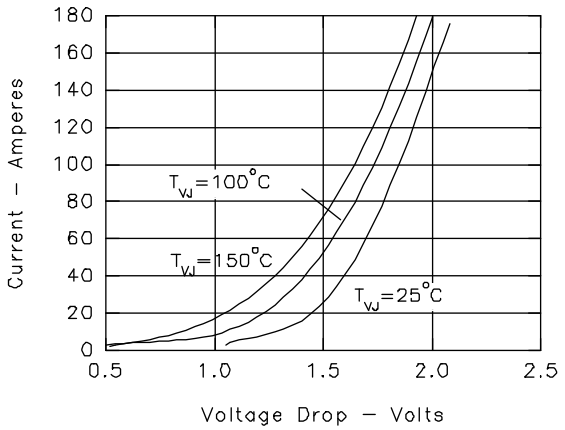



Fig. 13. Peak Forward Voltage $V_{FR}$ and Forward Recovery Time $t_{FR}$.

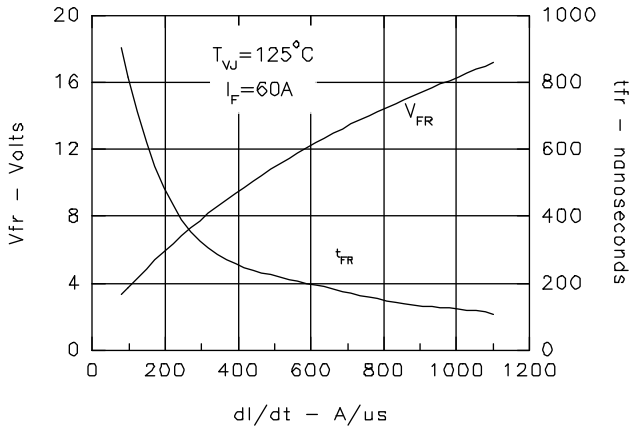



Fig. 14. Junction Temperature Dependence of $I_{RM}$ and $Q_R$.

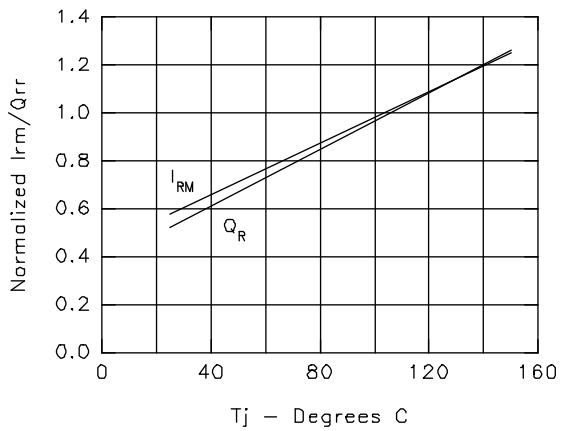



Fig. 15. Maximum Reverse Recovery Charge

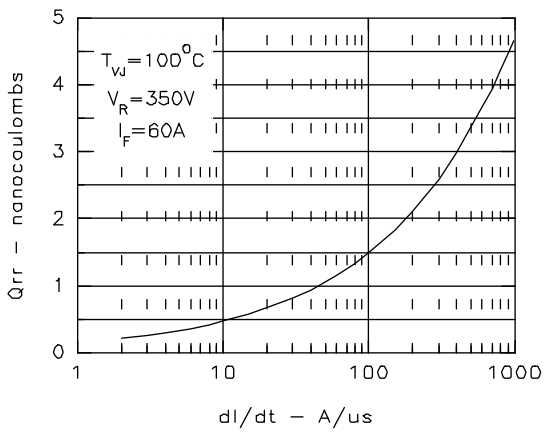



Figure 16. Peak Reverse Recovery Current.

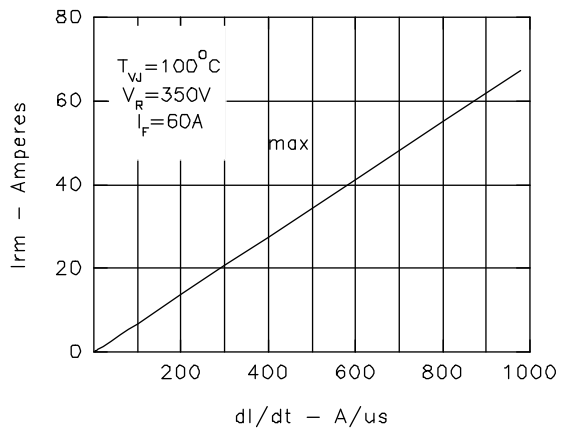
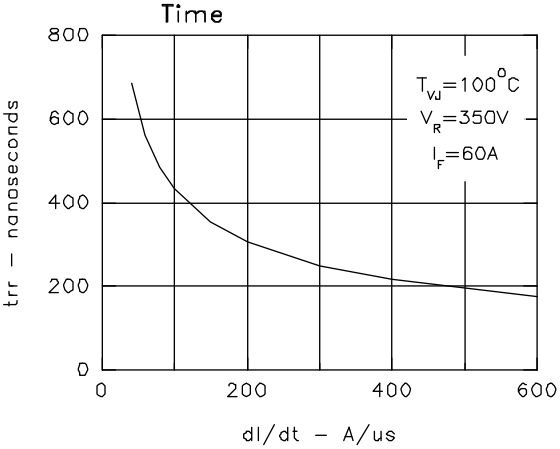



Fig. 17. Maximum Reverse Recovery Time



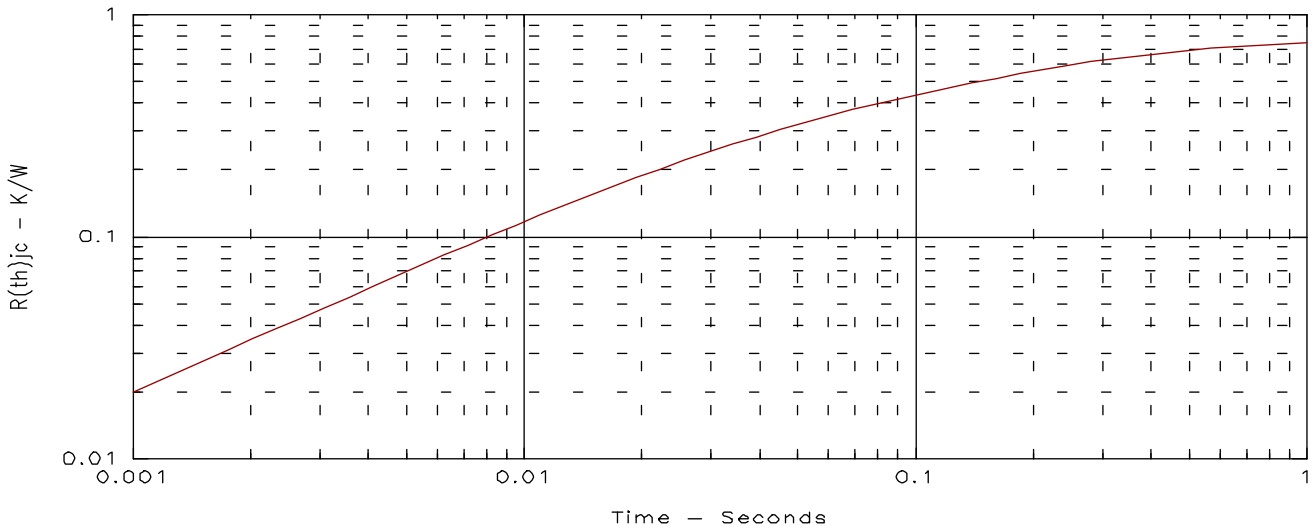



Fig. 18. Diode transient thermal resistance junction–to–case.