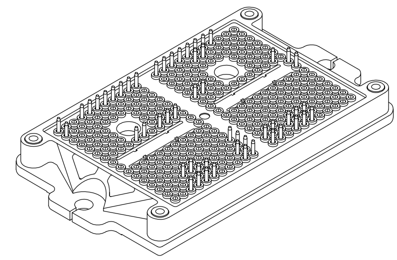
# F5 ANPC Inverter Power Module

# NXH600A100H4F5

The NXH600A100H4F5SNG is a power module containing high−performance IGBTs with rugged anti−parallel diodes. The module also contains an on−board thermistor.



F5 PACKAGE
CASE 180CL
SOLDER PINS

### Features

- Extremely Efficient Trench with Field Stop Technology
- Low Switching Loss Reduces System Power Dissipation
- F5 Package with Solder Pins

### Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies

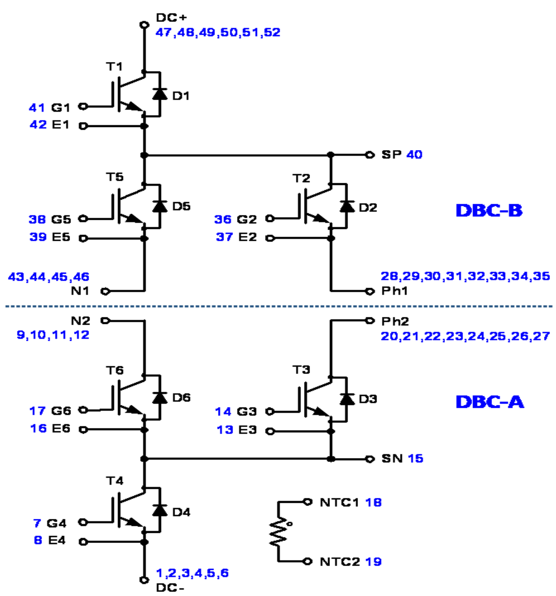
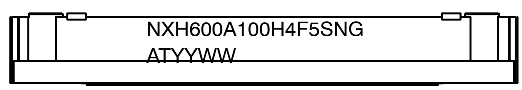


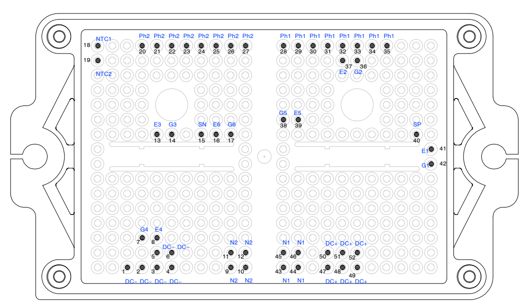

**Figure 1. NXH600A100H4F5SNG Schematic Diagram**

## MARKING DIAGRAM




NXH600A100H4F5SNG = Specific Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

## PIN CONNECTIONS



## ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

**Table 1. ABSOLUTE MAXIMUM RATINGS** (Note 1) $T_J$ = 25°C unless otherwise noted

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **T1, T4** | | | |
| Collector−Emitter Voltage | $V_{CES}$ | 1000 | V |
| Gate−Emitter Voltage<br>Positive Transient Gate−Emitter Voltage ($T_{pulse}$ = 5 μs, D < 0.10 @ $T_J$ ≤ 150°C) | $V_{GE}$ | ±20<br>30 | V |
| Continuous Collector Current @ $T_C$ = 80°C ($T_J$ = 175°C) | $I_C$ | 485 | A |
| Pulsed Collector Current ($T_J$ = 175°C) | $I_{Cpulse}$ | 1455 | A |
| Maximum Power Dissipation @ $T_C$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 1357 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **D1, D4** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ $T_C$ = 80°C ($T_J$ = 175°C) | $I_F$ | 123 | A |
| Repetitive Peak Forward Current ($T_J$ = 175°C, $t_p$ limited by $T_{Jmax}$) | $I_{FRM}$ | 369 | A |
| Power Dissipation Per Diode @ $T_C$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 317 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **T5, T6** | | | |
| Collector−Emitter Voltage | $V_{CES}$ | 1000 | V |
| Gate−Emitter Voltage<br>Positive Transient Gate−Emitter Voltage ($T_{pulse}$ = 5 μs, D < 0.10 @ $T_J$ ≤ 150°C) | $V_{GE}$ | ±20<br>30 | V |
| Continuous Collector Current @ $T_C$ = 80°C ($T_J$ = 175°C) | $I_C$ | 156 | A |
| Pulsed Collector Current ($T_J$ = 175°C) | $I_{Cpulse}$ | 468 | A |
| Maximum Power Dissipation @ $T_C$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 432 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **D5, D6** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ $T_C$ = 80°C ($T_J$ = 175°C) | $I_F$ | 119 | A |
| Repetitive Peak Forward Current ($T_J$ = 175°C, $t_p$ limited by $T_{Jmax}$) | $I_{FRM}$ | 357 | A |
| Power Dissipation Per Diode @ $T_C$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 365 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **T2, T3** | | | |
| Collector−Emitter Voltage | $V_{CES}$ | 1000 | V |
| Gate−Emitter Voltage<br>Positive Transient Gate−Emitter Voltage ($T_{pulse}$ = 5 μs, D < 0.10 @ $T_J$ ≤ 150°C) | $V_{GE}$ | ±20<br>30 | V |
| Continuous Collector Current @ $T_C$ = 80°C ($T_J$ = 175°C) | $I_C$ | 542 | A |
| Pulsed Collector Current ($T_J$ = 175°C) | $I_{Cpulse}$ | 1626 | A |
| Maximum Power Dissipation @ $T_C$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 1188 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |

**Table 1. ABSOLUTE MAXIMUM RATINGS** (Note 1) $T_J$ = 25°C unless otherwise noted

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **D2, D3** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1000 | V |
| Continuous Forward Current @ $T_C$ = 80°C ($T_J$ = 175°C) | $I_F$ | 190 | A |
| Repetitive Peak Forward Current ($T_J$ = 175°C, $t_p$ limited by $T_{Jmax}$) | $I_{FRM}$ | 570 | A |
| Power Dissipation Per Diode @ $T_C$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 432 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **THERMAL PROPERTIES** | | | |
| Storage Temperature range | $T_{stg}$ | −40 to 130 | °C |
| **INSULATION PROPERTIES** | | | |
| Isolation test voltage, t = 1 sec, 50 Hz | Vis | 3000 | $V_{RMS}$ |
| Creepage distance | | 12.7 | mm |
| Comparative Tracking Index | CTI | >500 | |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Refer to ELECTRICAL CHARACTERISTICS, RECOMMENDED OPERATING RANGES and/or APPLICATION INFORMATION for Safe Operating parameters.

**Table 2. RECOMMENDED OPERATING RANGES**

| Rating | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Module Operating Junction Temperature | $T_J$ | −40 | 150 | °C |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

**Table 3. ELECTRICAL CHARACTERISTICS** $T_J$ = 25°C unless otherwise noted

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **T1, T4** | | | | | | |
| Collector−Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1000 V | $I_{CES}$ | – | – | 300 | μA |
| Collector−Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 1.8 | 2.6 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 175°C | | – | 2.2 | – | |
| Gate−Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 600 mA | $V_{GE(TH)}$ | 3.9 | 5 | 6.1 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 2 | μA |
| Turn−on Delay Time | $T_J$ = 25°C<br>$V_{CE}$ = 600 V, $I_C$ = 235 A<br>$V_{GE}$ = −8 V,15 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 190 | – | ns |
| Rise Time | | $t_r$ | – | 64 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 697 | – | |
| Fall Time | | $t_f$ | – | 34 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 8 | – | mJ |
| Turn−off Switching Loss per Pulse | | $E_{off}$ | – | 8.98 | – | |
| Turn−on Delay Time | $T_J$ = 125°C<br>$V_{CE}$ = 600 V, $I_C$ = 235A<br>$V_{GE}$ = −8 V,15 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 174 | – | ns |
| Rise Time | | $t_r$ | – | 71 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 755 | – | |
| Fall Time | | $t_f$ | – | 68 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 8.54 | – | mJ |
| Turn−off Switching Loss per Pulse | | $E_{off}$ | – | 11.54 | – | |

**Table 3. ELECTRICAL CHARACTERISTICS** $T_J$ = 25°C unless otherwise noted

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **T1, T4** | | | | | | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 1 MHz | $C_{ies}$ | – | 39138 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 1518 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 78 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 600 A, $V_{GE}$ = ±15 V | $Q_g$ | – | 1956 | – | nC |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.07 | – | °C/W |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK | $R_{thJH}$ | – | 0.21 | – | °C/W |
| **D1, D4** | | | | | | |
| Diode Forward Voltage | $I_F$ = 150 A, $T_J$ = 25°C | $V_F$ | – | 2.7 | 3.5 | V |
| | $I_F$ = 150 A, $T_J$ = 175°C | | – | 1.9 | – | |
| Reverse Recovery Time | $T_J$ = 25°C<br>$V_{CE}$ = 600 V, $I_C$ = 230A<br>$V_{GE}$ = −8 V, 15 V, $R_G$ = 10Ω | $t_{rr}$ | – | 130 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 4305 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 79 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 1858 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 1334 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125°C<br>$V_{CE}$ = 600 V, $I_C$ = 230 A<br>$V_{GE}$ = −8 V, 15 V, $R_G$ = 10 Ω | $t_{rr}$ | – | 250 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 12241 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 137 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 1747 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 4615 | – | μJ |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.30 | – | °C/W |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK | $R_{thJH}$ | – | 0.58 | – | °C/W |
| **T5, T6** | | | | | | |
| Collector–Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1000 V | $I_{CES}$ | – | – | 700 | μA |
| Collector–Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 200 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 1.8 | 2.6 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 200 A, $T_J$ = 175°C | | – | 2.2 | – | |
| Gate–Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 200 mA | $V_{GE(TH)}$ | 3.9 | 5 | 6.1 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 1 | μA |
| Turn–on Delay Time | $T_J$ = 25°C<br>$V_{CE}$ = 600 V, $I_C$ = 90 A<br>$V_{GE}$ = −8 V, 15 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 139 | – | ns |
| Rise Time | | $t_r$ | – | 27 | – | |
| Turn–off Delay Time | | $t_{d(off)}$ | – | 533 | – | |
| Fall Time | | $t_f$ | – | 17 | – | |
| Turn–on Switching Loss per Pulse | | $E_{on}$ | – | 3.9 | – | mJ |
| Turn–off Switching Loss per Pulse | | $E_{off}$ | – | 1.6 | – | |
| Turn–on Delay Time | $T_J$ = 125°C<br>$V_{CE}$ = 600 V, $I_C$ = 90 A<br>$V_{GE}$ = −8 V, 15 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 140 | – | ns |
| Rise Time | | $t_r$ | – | 27 | – | |
| Turn–off Delay Time | | $t_{d(off)}$ | – | 602 | – | |
| Fall Time | | $t_f$ | – | 48 | – | |
| Turn–on Switching Loss per Pulse | | $E_{on}$ | – | 6.4 | – | mJ |
| Turn–off Switching Loss per Pulse | | $E_{off}$ | – | 3 | – | |

**Table 3. ELECTRICAL CHARACTERISTICS** $T_J$ = 25°C unless otherwise noted

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **T5, T6** | | | | | | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 1 MHz | $C_{ies}$ | – | 13046 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 506 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 52 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 200 A, $V_{GE}$ = ±15 V | $Q_g$ | – | 652 | – | nC |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.22 | – | °C/W |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK | $R_{thJH}$ | – | 0.48 | – | °C/W |
| **D5, D6** | | | | | | |
| Diode Forward Voltage | $I_F$ = 100 A, $T_J$ = 25°C | $V_F$ | – | 1.5 | 2 | V |
| | $I_F$ = 100 A, $T_J$ = 175°C | | – | 2.2 | – | |
| Reverse Recovery Time | $T_J$ = 25°C<br>$V_{CE}$ = 600 V, $I_C$ = 235 A<br>$V_{GE}$ = –8 V,15 V, $R_G$ = 10 Ω | $t_{rr}$ | – | 24 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 488 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 34 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 2981 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 116 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125°C<br>$V_{CE}$ = 600 V, $I_C$ = 235 A<br>$V_{GE}$ = –8 V,15 V, $R_G$ = 10 Ω | $t_{rr}$ | – | 26 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 525 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 33 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 2712 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 120 | – | μJ |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.25 | – | °C/W |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK | $R_{thJH}$ | – | 0.55 | – | °C/W |
| **T2, T3** | | | | | | |
| Collector–Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1000 V | $I_{CES}$ | – | – | 300 | μA |
| Collector–Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 500 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 1.3 | 2.1 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 500 A, $T_J$ = 175°C | | – | 1.4 | – | |
| Gate–Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 500 mA | $V_{GE(TH)}$ | 3.2 | 4.6 | 5.5 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 2 | μA |
| Turn–on Delay Time | $T_J$ = 25°C<br>$V_{CE}$ = 600 V, $I_C$ = 230 A<br>$V_{GE}$ = –8 V, 15 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 304 | – | ns |
| Rise Time | | $t_r$ | – | 101 | – | |
| Turn–off Delay Time | | $t_{d(off)}$ | – | 2925 | – | |
| Fall Time | | $t_f$ | – | 111 | – | |
| Turn–on Switching Loss per Pulse | | $E_{on}$ | – | 15 | – | mJ |
| Turn–off Switching Loss per Pulse | | Eoff | – | 23 | – | |
| Turn–on Delay Time | $T_J$ = 125°C<br>$V_{CE}$ = 600 V, $I_C$ = 230 A<br>$V_{GE}$ = –8 V, 15 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 264 | – | ns |
| Rise Time | | $t_r$ | – | 108 | – | |
| Turn–off Delay Time | | $t_{d(off)}$ | – | 3069 | – | |
| Fall Time | | $t_f$ | – | 134 | – | |
| Turn–on Switching Loss per Pulse | | $E_{on}$ | – | 18 | – | mJ |
| Turn–off Switching Loss per Pulse | | $E_{off}$ | – | 26 | – | |

**Table 3. ELECTRICAL CHARACTERISTICS** $T_J$ = 25°C unless otherwise noted

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **T2, T3** | | | | | | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 1 MHz | $C_{ies}$ | – | 104784 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 1705 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 789 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 500 A, $V_{GE}$ = ±15 V | $Q_g$ | – | 8700 | – | nC |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.08 | – | °C/W |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK | $R_{thJH}$ | – | 0.20 | – | °C/W |
| **D2, D3** | | | | | | |
| Diode Forward Voltage | $I_F$ = 150 A, $T_J$ = 25°C | $V_F$ | – | 2.1 | 2.5 | V |
| | $I_F$ = 150 A, $T_J$ = 175°C | | – | 1.7 | – | |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.22 | – | °C/W |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness ≈ 57 μm, λ = 2.87 W/mK | $R_{thJH}$ | – | 0.44 | – | °C/W |
| **THERMISTOR CHARACTERISTICS** | | | | | | |
| Nominal resistance | | $R_{25}$ | – | 22 | – | kΩ |
| Nominal resistance | T = 100°C | $R_{100}$ | – | 1486 | – | Ω |
| Deviation of R25 | | ΔR/R | −5 | – | 5 | % |
| Power dissipation | | $P_D$ | – | 200 | – | mW |
| Power dissipation constant | | | – | 2 | – | mW/K |
| B–value | B(25/50), tolerance ±3% | | – | 3950 | – | K |
| B–value | B(25/100), tolerance ±3% | | – | 3998 | – | K |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## ORDERING INFORMATION

| Orderable Part Number | Marking | Package | Shipping |
|---|---|---|---|
| NXH600A100H4F5SNG<br>F5 SOLDER PINS | NXH600A100H4F5SNG | F5 – Case 180CL<br>(Pb–Free and Halide–Free, Solder Pins) | 8 Units / Blister Tray |

## TYPICAL DC CHARACTERISTICS – T1, T4 IGBT & D1, D4 INVERSE DIODE

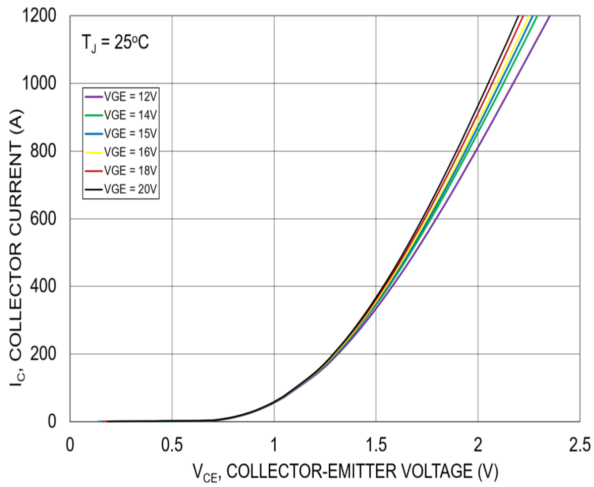



**Figure 2. Typical Output Characteristics**

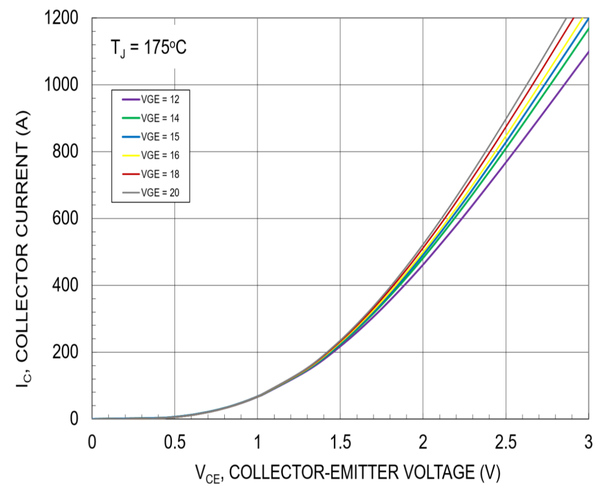



**Figure 3. Typical Output Characteristics**

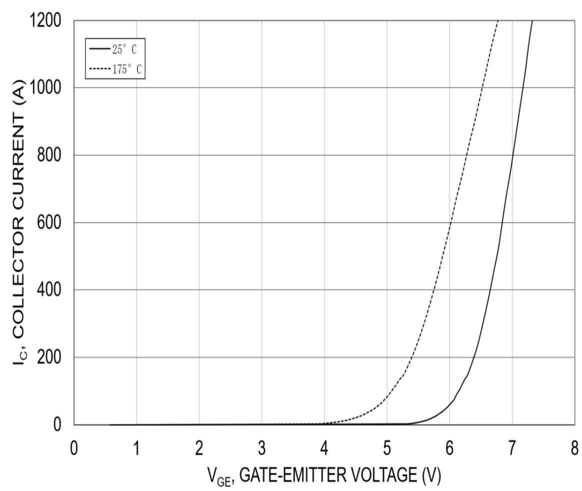



**Figure 4. Typical Transfer Characteristics**

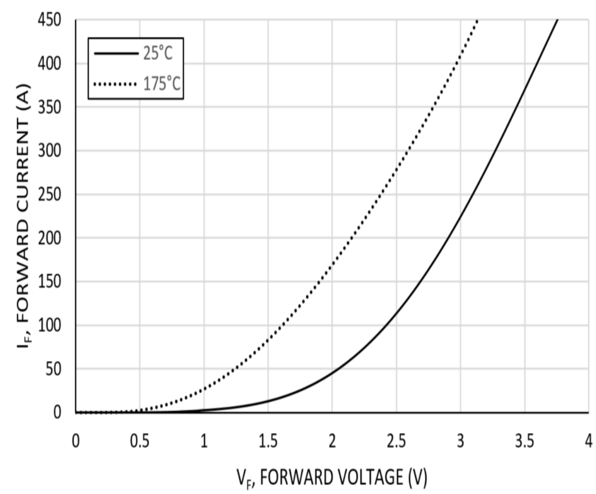



**Figure 5. Inverse Diode Forward Characteristics**

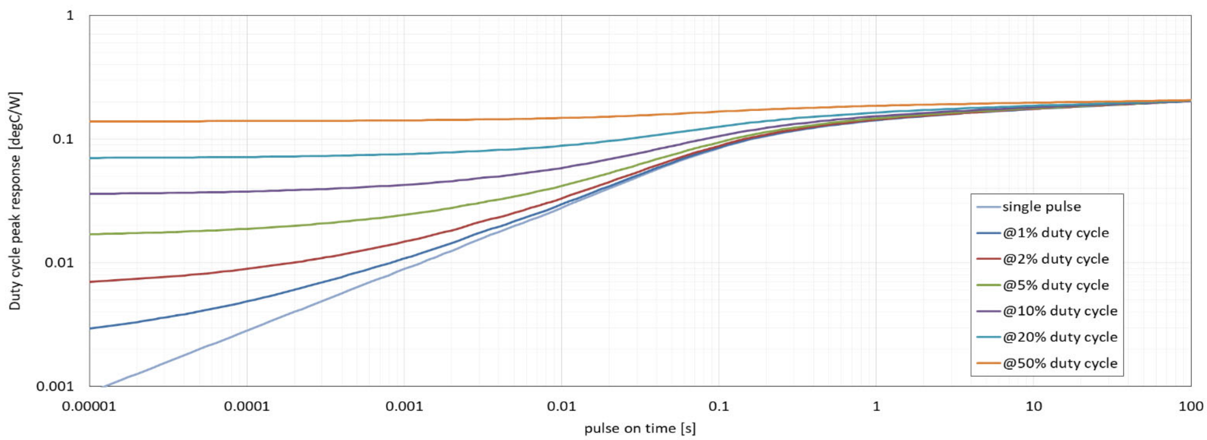



**Figure 6. IGBT Junction−to−Heatsink Transient Thermal Impedance**

## TYPICAL DC CHARACTERISTICS – T1, T4 IGBT & D1, D4 INVERSE DIODE

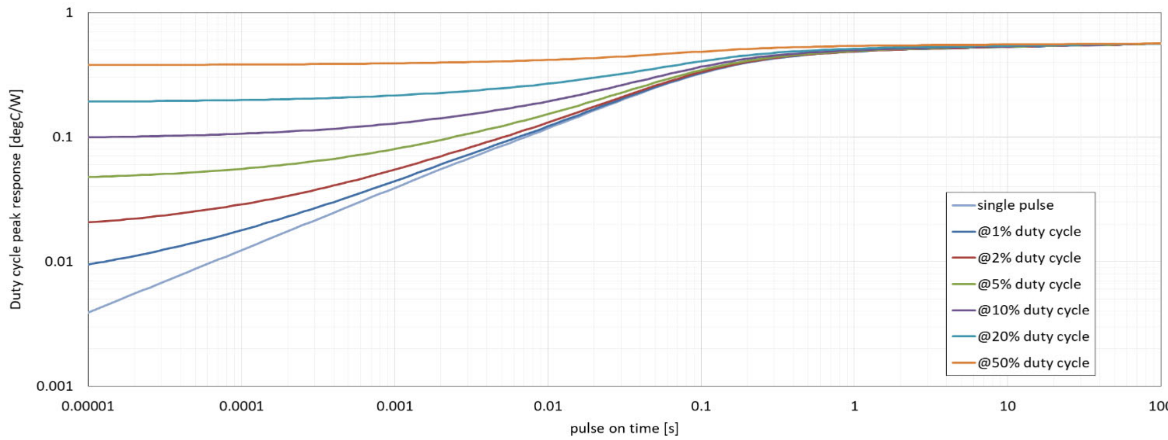



**Figure 7. Inverse Diode Junction−to−Heatsink Transient Thermal Impedance**

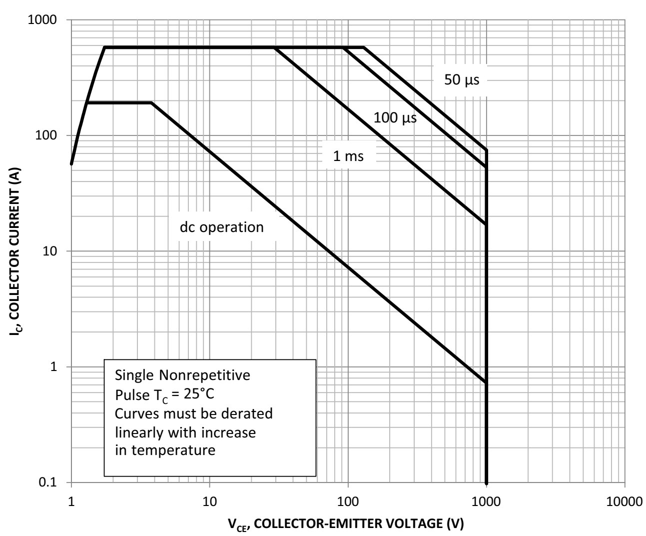



**Figure 8. IGBT FBSOA**

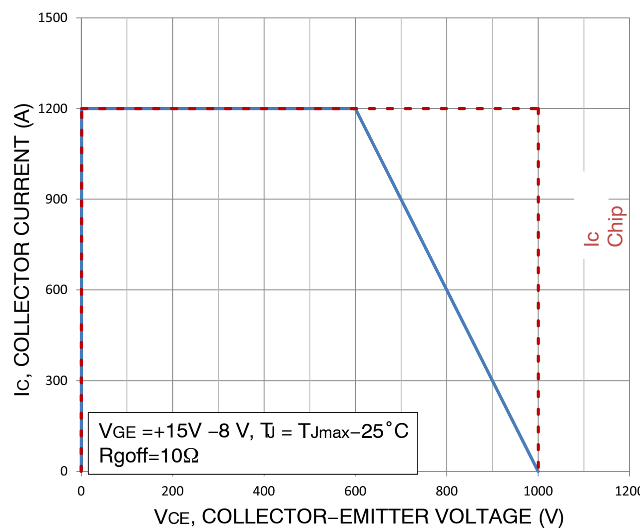



**Figure 9. IGBT RBSOA**

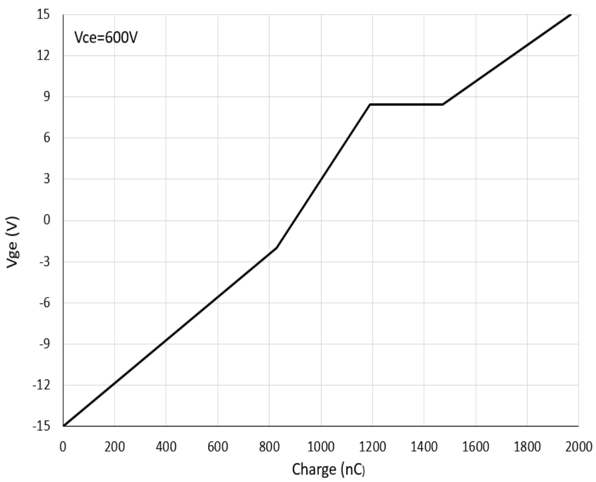



Figure 10. IGBT Gate Voltage vs. Gate Charge

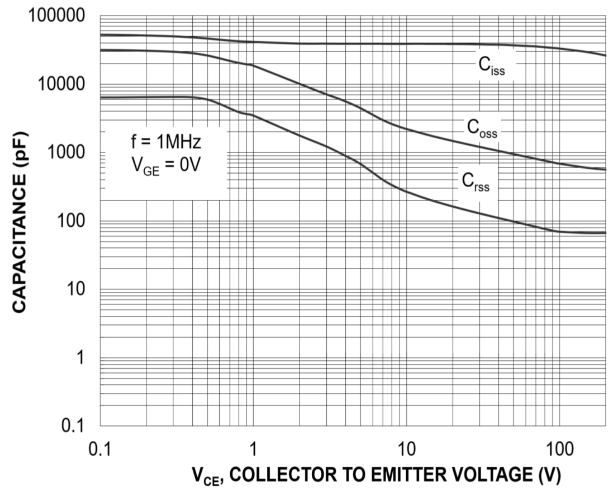



Figure 11. IGBT Capacitance Charge

## TYPICAL DC CHARACTERISTICS – T5, T6 IGBT & D5, D6 INVERSE DIODE

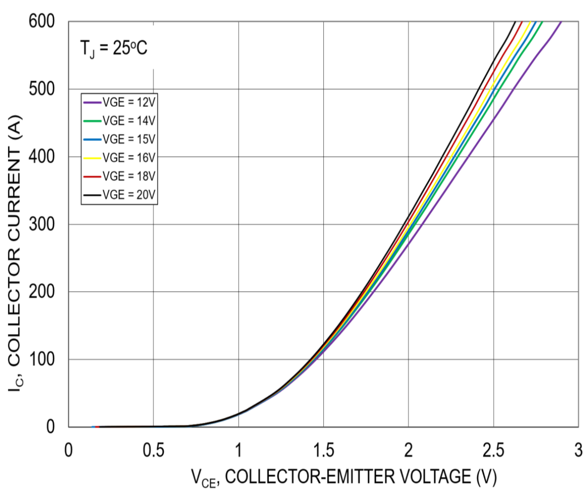



Figure 12. Typical Output Characteristics

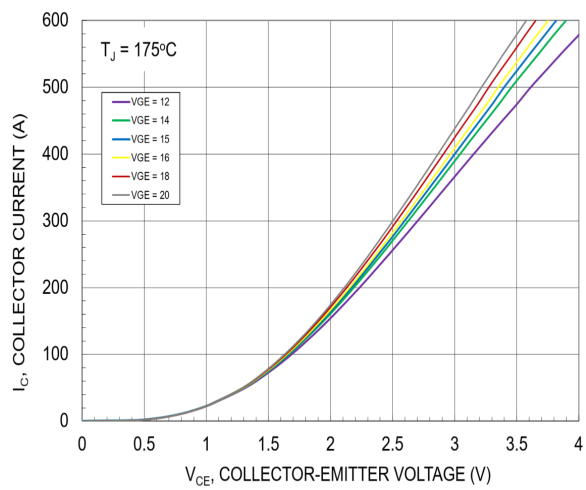



Figure 13. Typical Output Characteristics

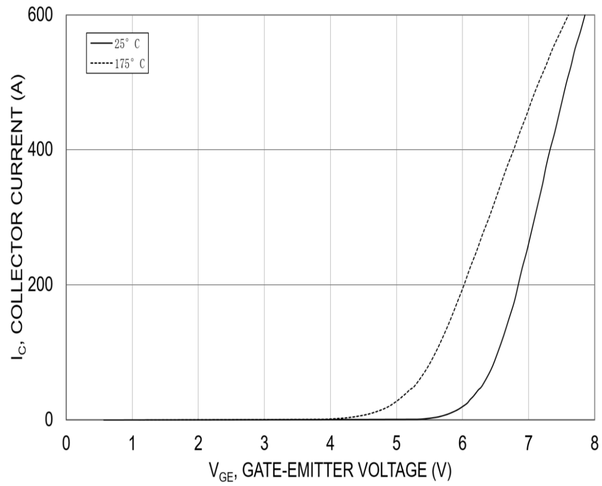



**Figure 14. Typical Transfer Characteristics**

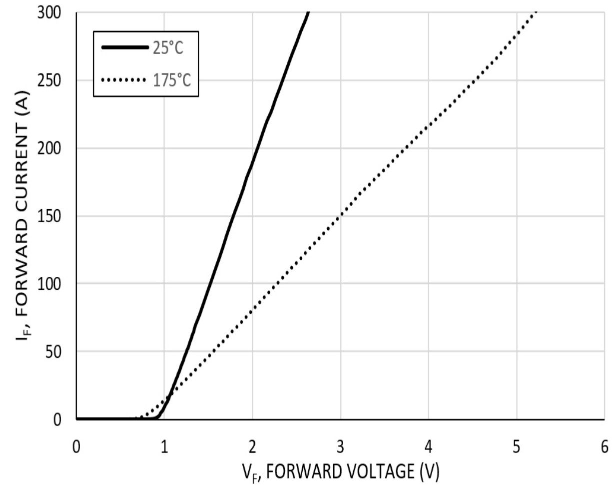



**Figure 15. Inverse Diode Forward Characteristics**

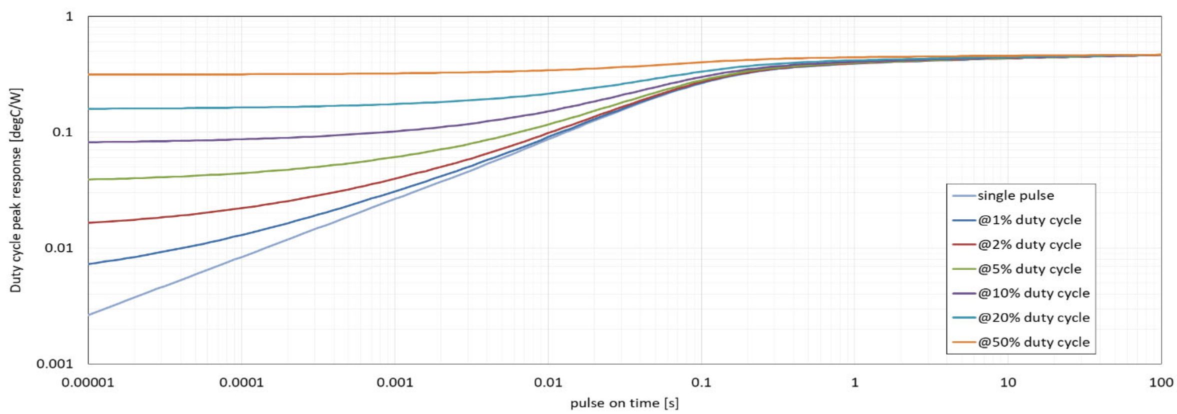



**Figure 16. IGBT Junction−to−Heatsink Transient Thermal Impedance**

## TYPICAL DC CHARACTERISTICS – T5, T6 IGBT & D5, D6 INVERSE DIODE

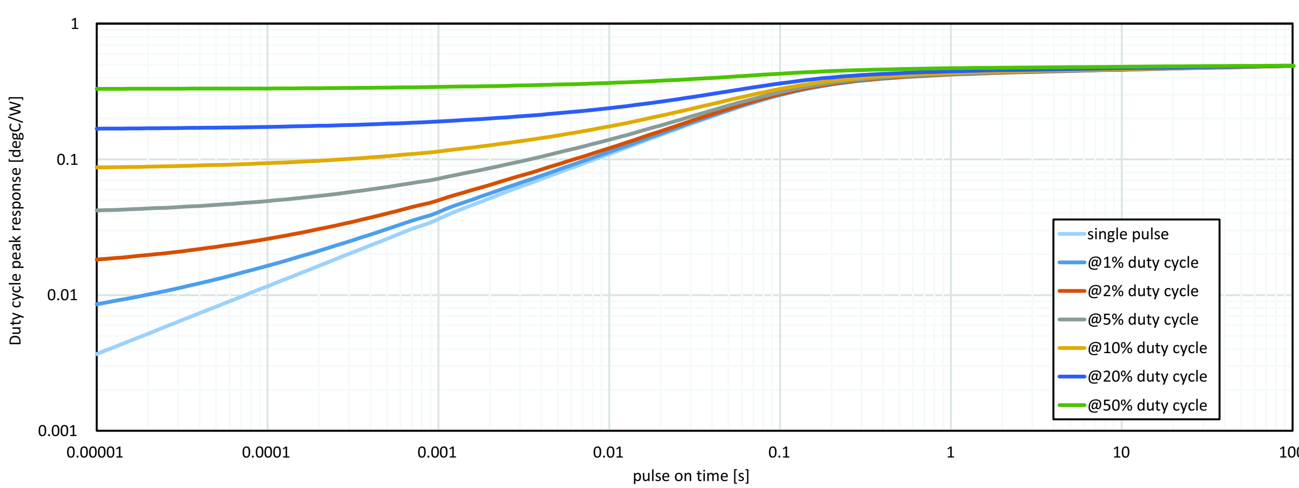



**Figure 17. Inverse Diode Junction−to−Heatsink Transient Thermal Impedance**

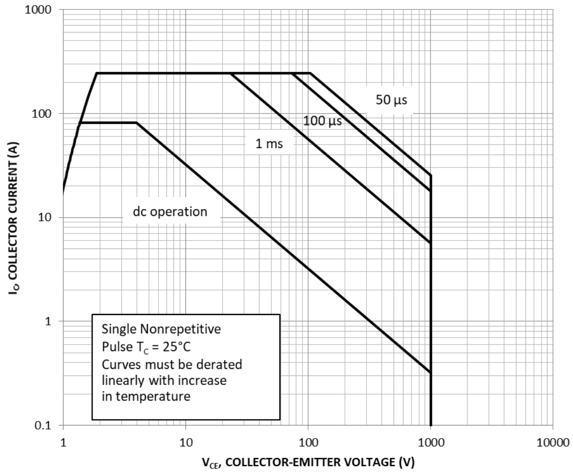



Figure 18. IGBT FBSOA

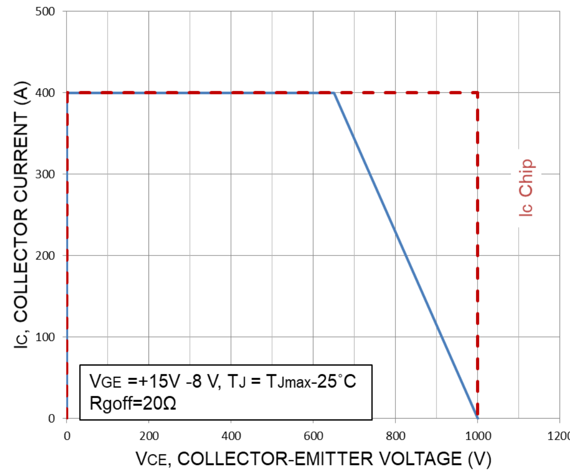



Figure 19. IGBT RBSOA

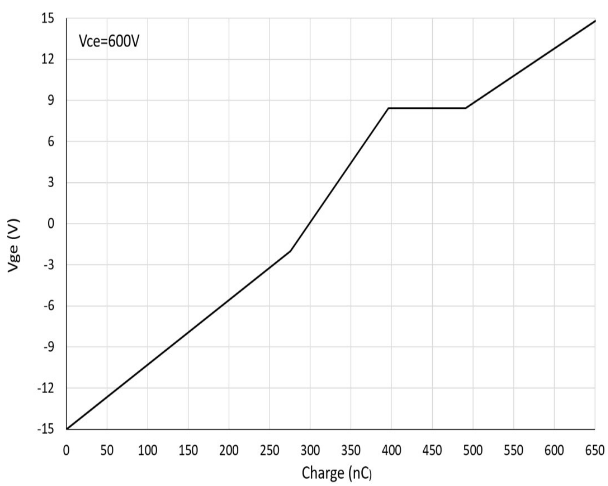



Figure 20. IGBT Gate Voltage vs. Gate Charge

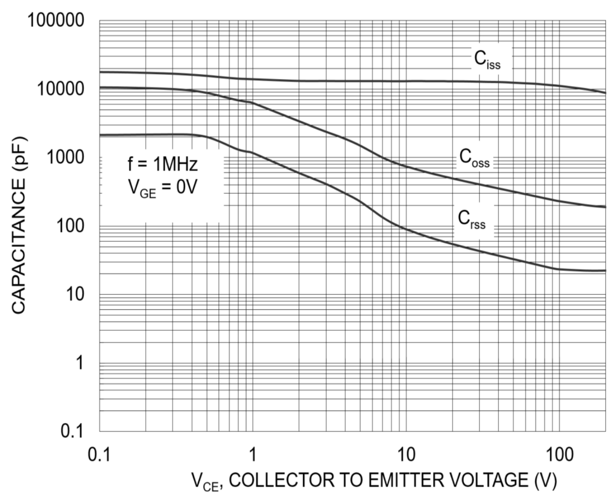



Figure 21. IGBT Capacitance Charge

## TYPICAL DC CHARACTERISTICS – T2, T3 IGBT & D2, D3 INVERSE DIODE

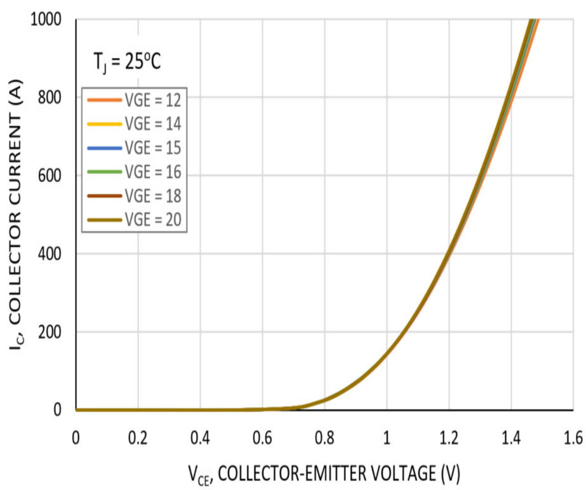



**Figure 22. Typical Output Characteristics**

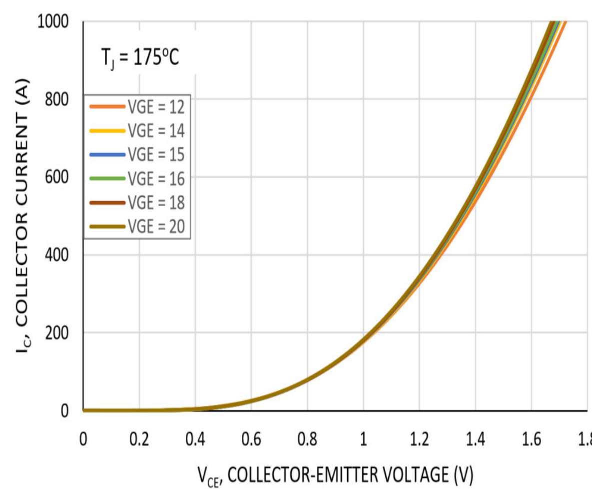



**Figure 23. Typical Output Characteristics**

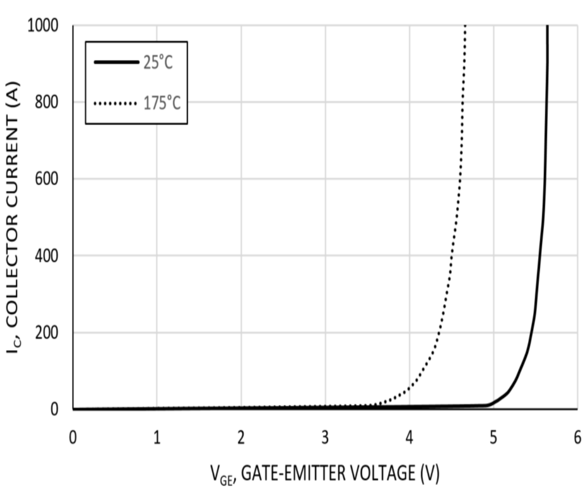



**Figure 24. Typical Transfer Characteristics**

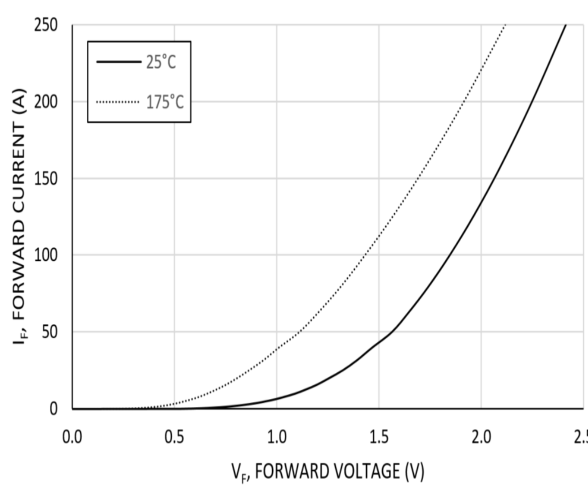



**Figure 25. Inverse Diode Forward Characteristics**

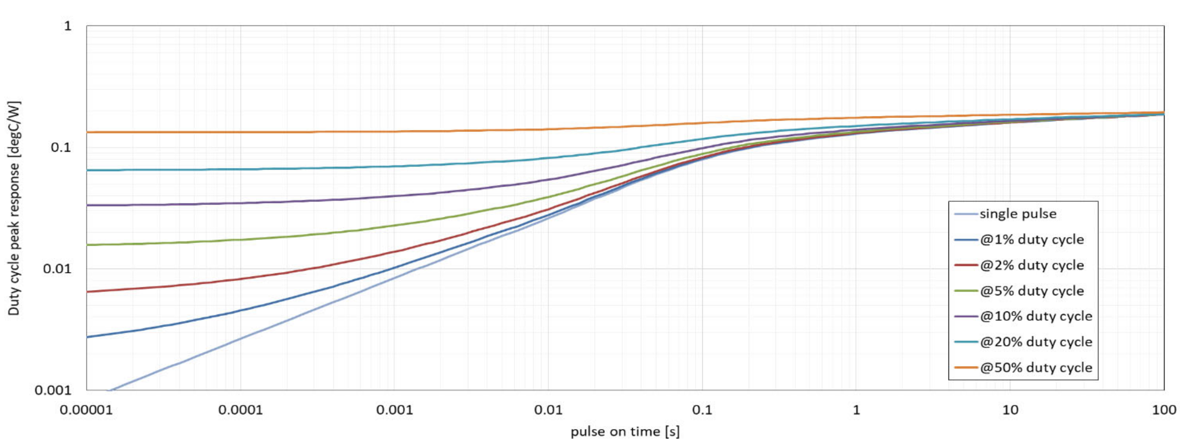



**Figure 26. IGBT Junction−to−Heatsink Transient Thermal Impedance**

## TYPICAL DC CHARACTERISTICS – T2, T3 IGBT & D2, D3 INVERSE DIODE

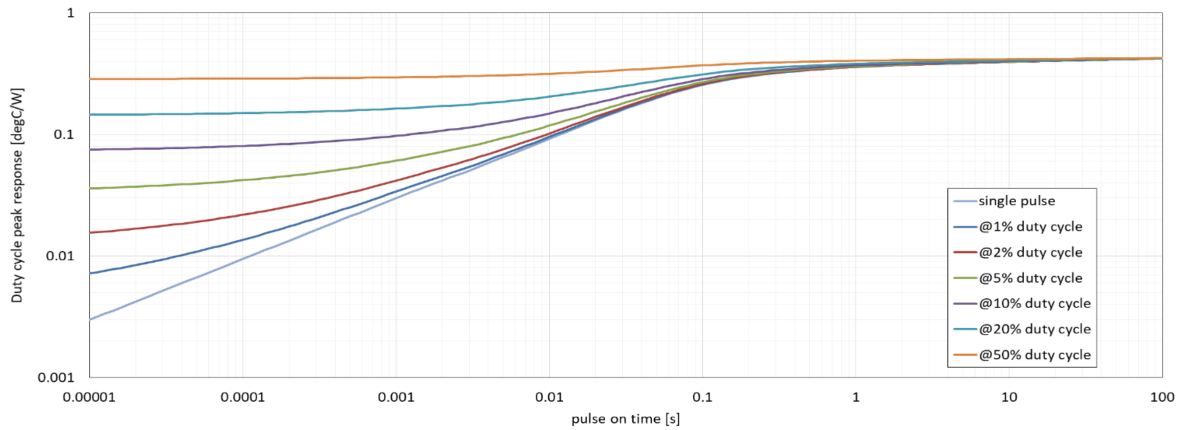



**Figure 27. Inverse Diode Junction−to−Heatsink Transient Thermal Impedance**

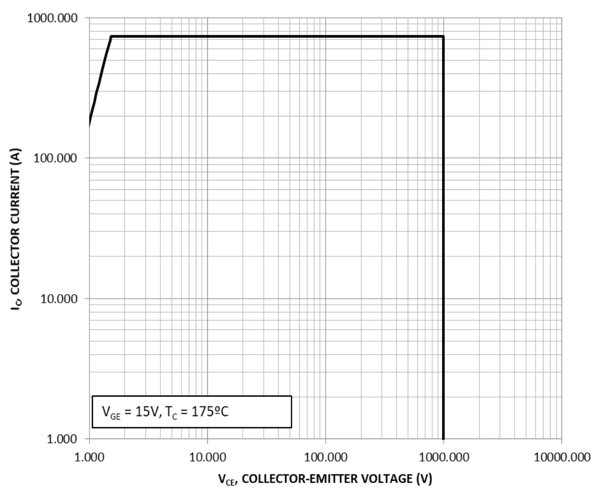



**Figure 28. IGBT FBSOA**

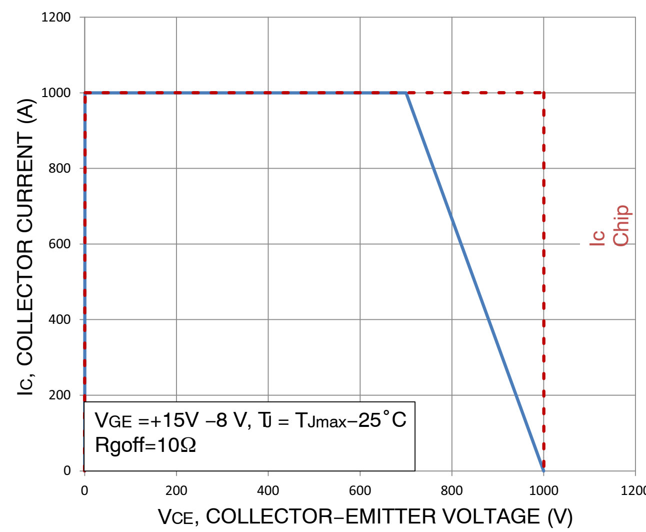



**Figure 29. IGBT RBSOA**

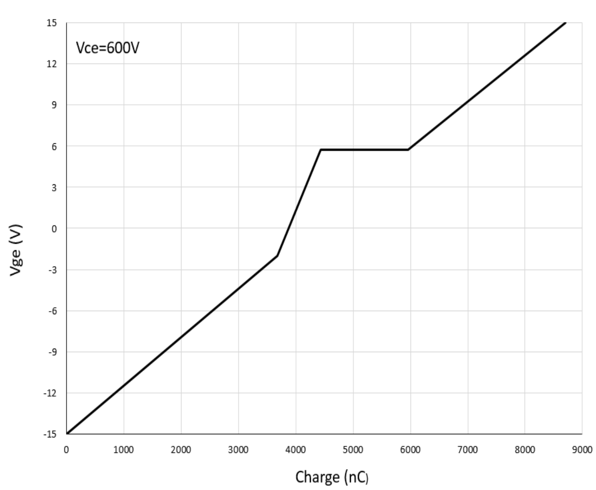



**Figure 30. IGBT Gate Voltage vs. Gate Charge**

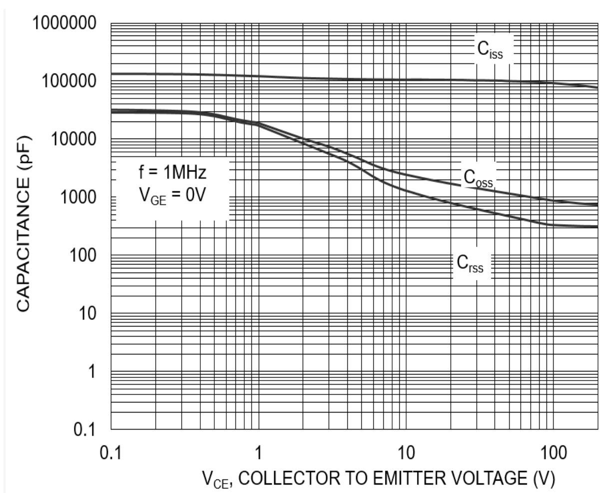



**Figure 31. IGBT Capacitance Charge**

## TYPICAL SWITCHING CHARACTERISTICS – T1, T4 IGBT COMMUTATE D5, D6 INVERSE DIODE

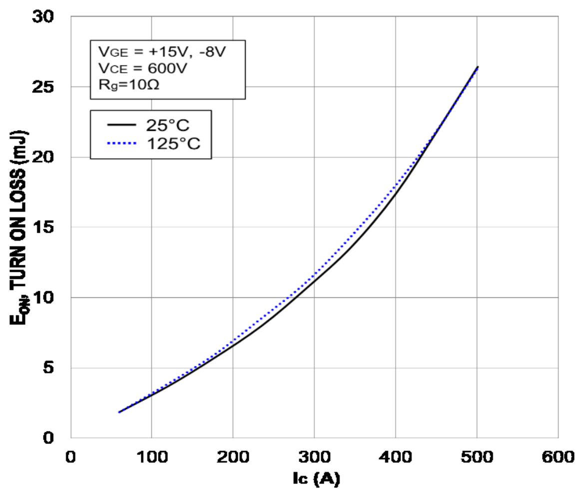



Figure 32. Typical Turn On Loss Versus IC

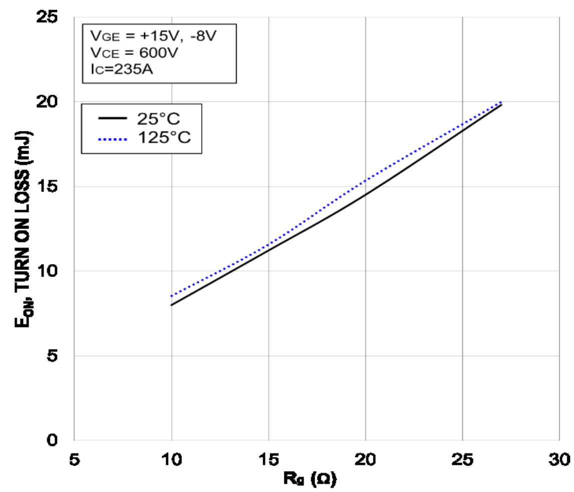



Figure 33. Typical Turn On Loss Versus Rg

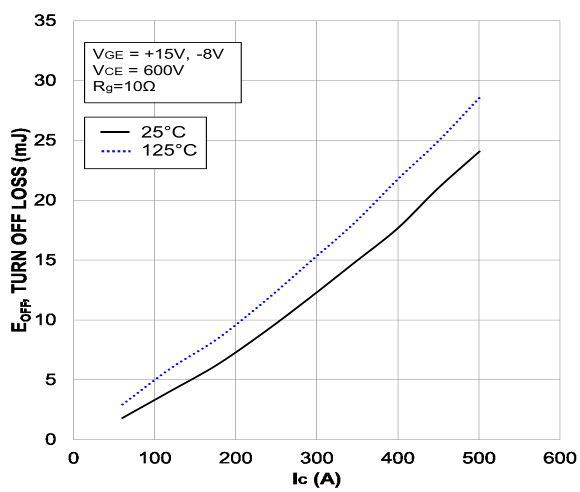



Figure 34. Typical Turn Off Loss vs. IC

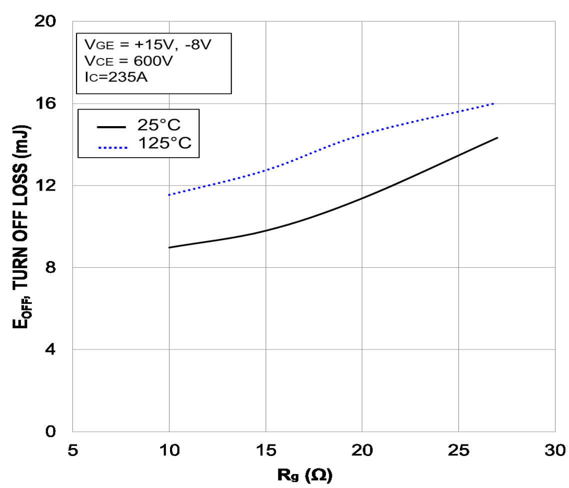



Figure 35. Typical Turn Off Loss vs. Rg

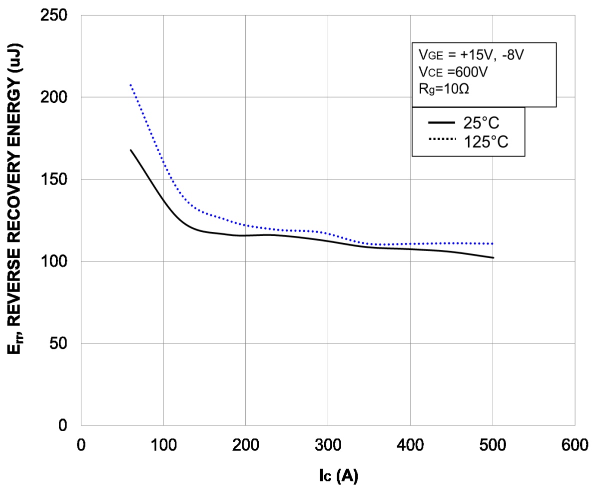



Figure 36. Typical Reverse Recovery Loss vs. IC

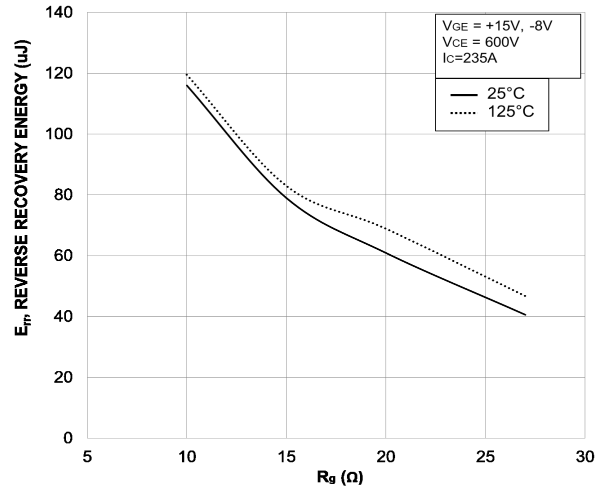



Figure 37. Typical Reverse Recovery Loss vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T1, T4 IGBT COMMUTATE D5, D6 INVERSE DIODE

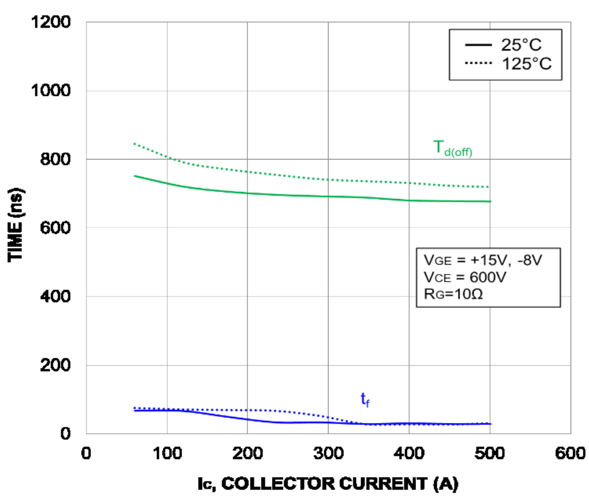



Figure 38. Typical Turn−Off Switching Time vs. IC

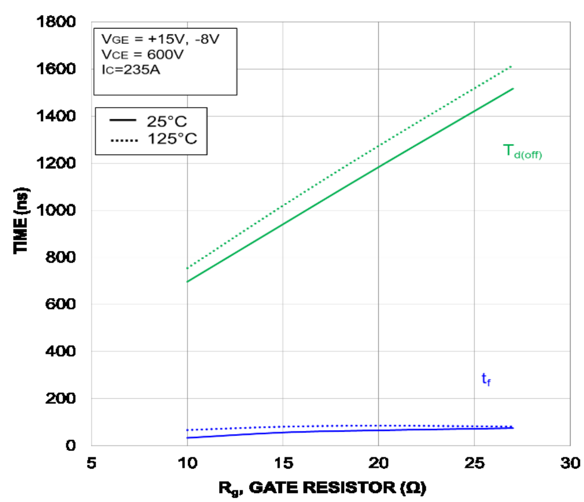



Figure 39. Typical Turn−Off Switching Time vs. Rg

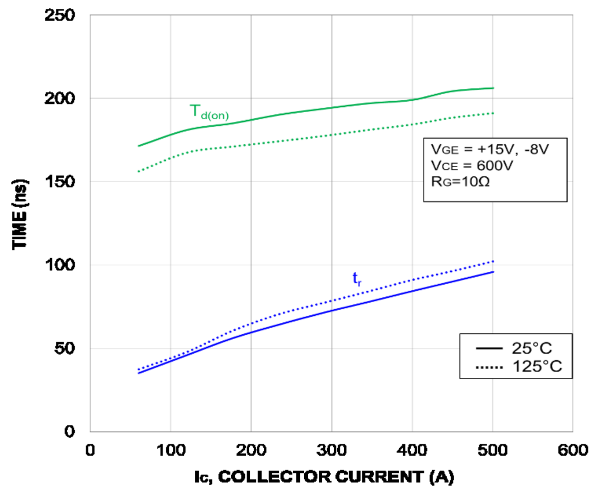



Figure 40. Typical Turn−On Switching Time vs. IC

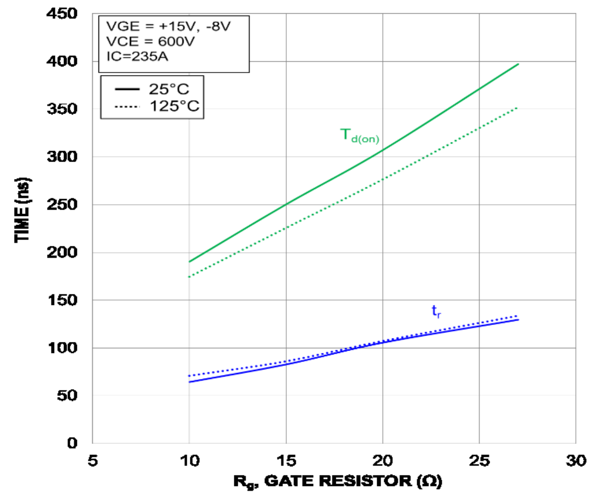



Figure 41. Typical Turn−On Switching Time vs. Rg

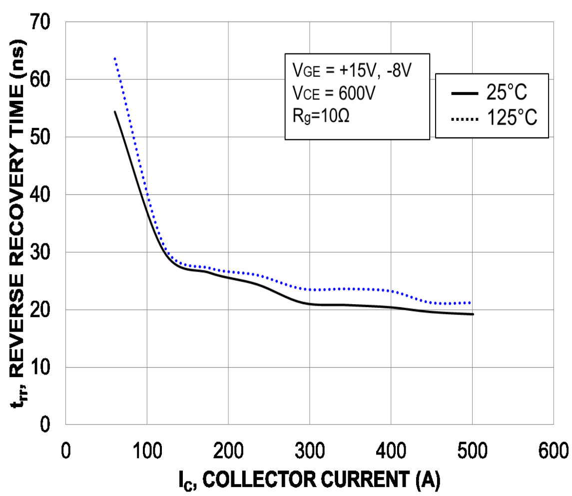



Figure 42. Typical Reverse Recovery Time vs. IC

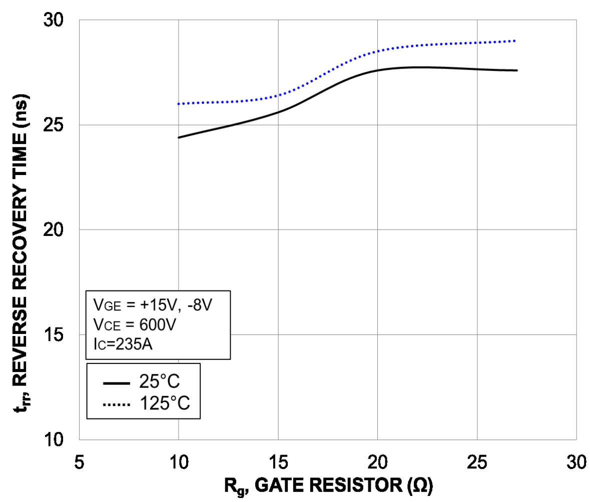



Figure 43. Typical Reverse Recovery Time vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T1, T4 IGBT COMMUTATE D5, D6 INVERSE DIODE

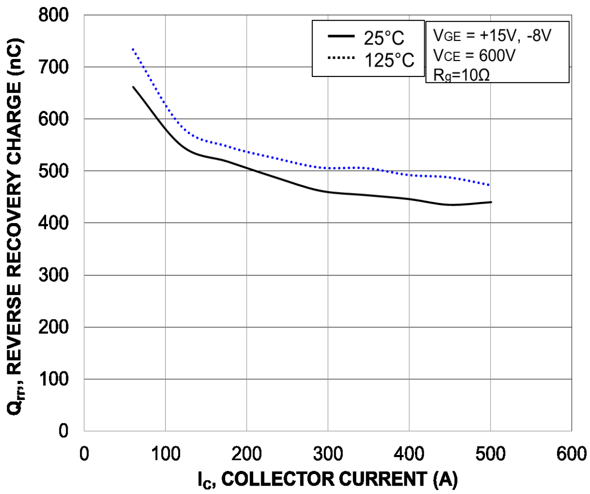



Figure 44. Typical Reverse Recovery Charge vs. IC

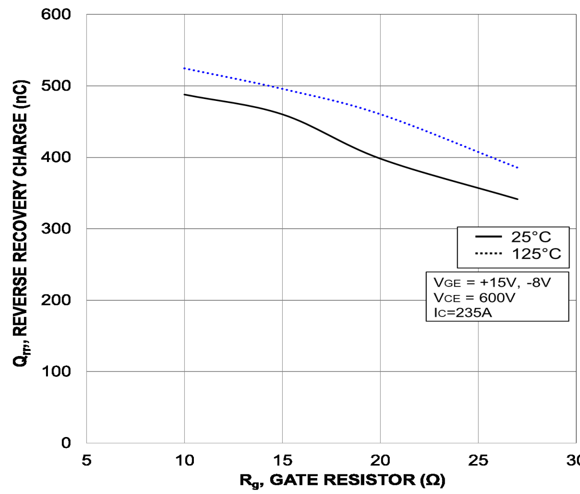



Figure 45. Typical Reverse Recovery Charge vs. Rg

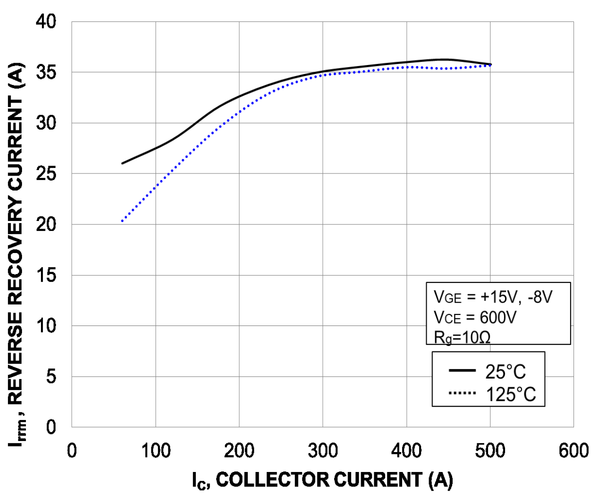



Figure 46. Typical $I_{rrm}$ Current vs. IC

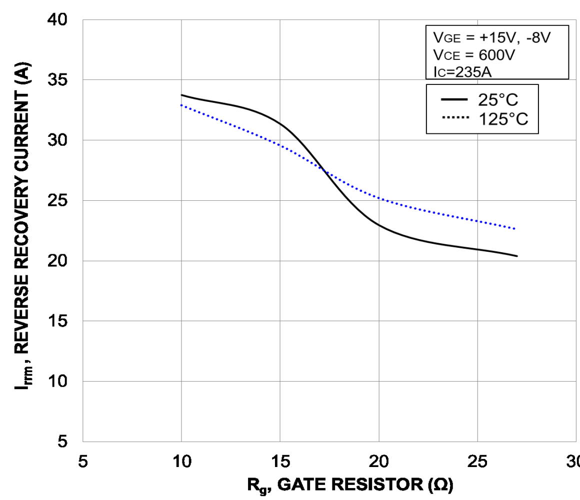



Figure 47. Typical $I_{rrm}$ Current vs. Rg

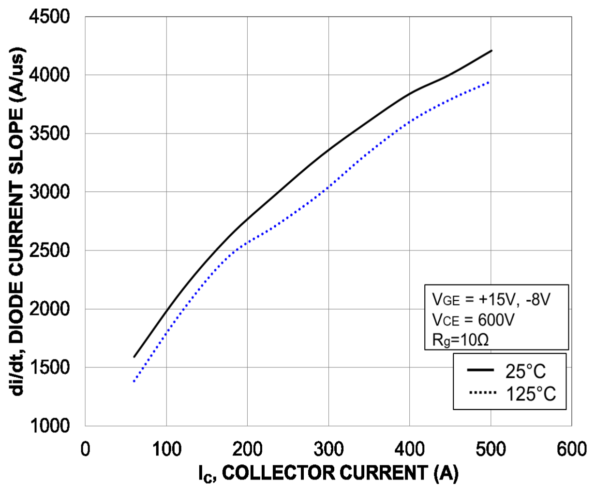



Figure 48. Typical di/dt Current Slope vs. IC

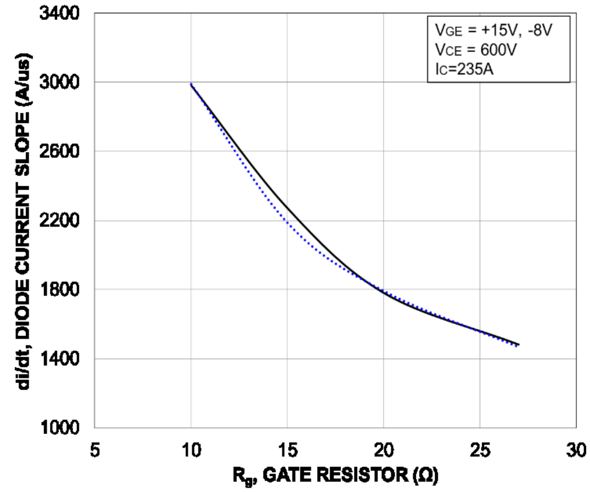



Figure 49. Typical di/dt Current Slope vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T2, T3 IGBT COMMUTATE D1, D4 INVERSE DIODE

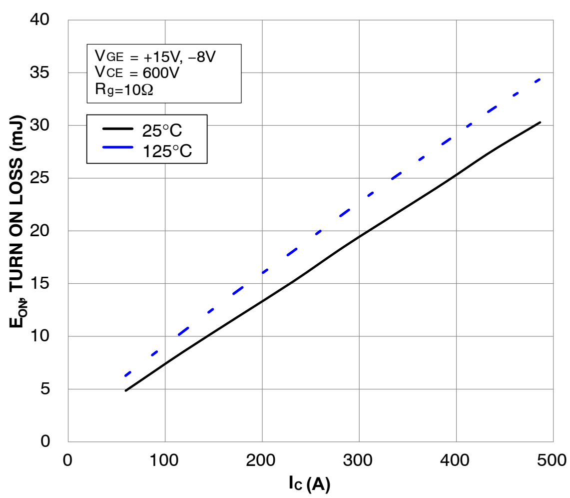



Figure 50. Typical Turn On Loss vs. IC

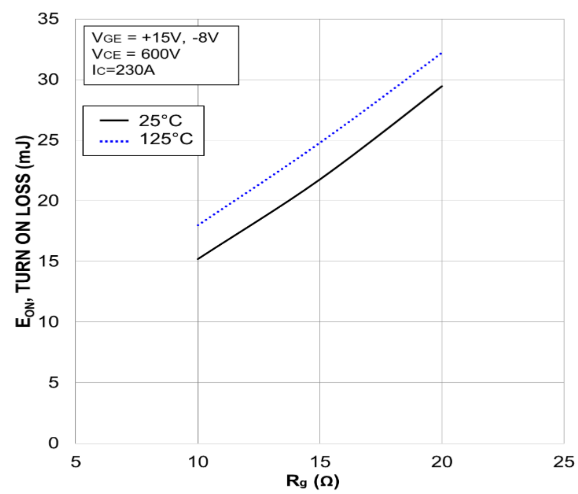



Figure 51. Typical Turn On Loss vs. Rg

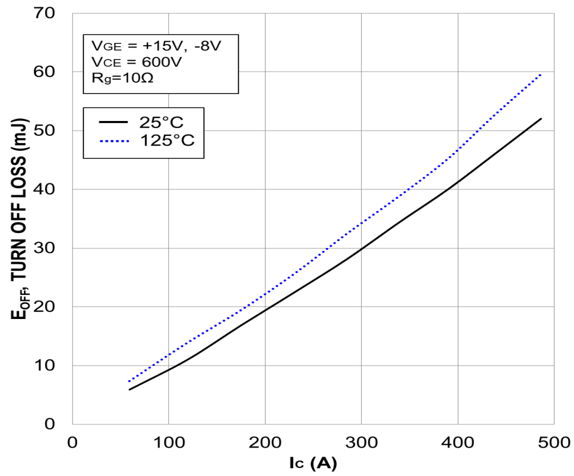



Figure 52. Typical Turn Off Loss vs. IC

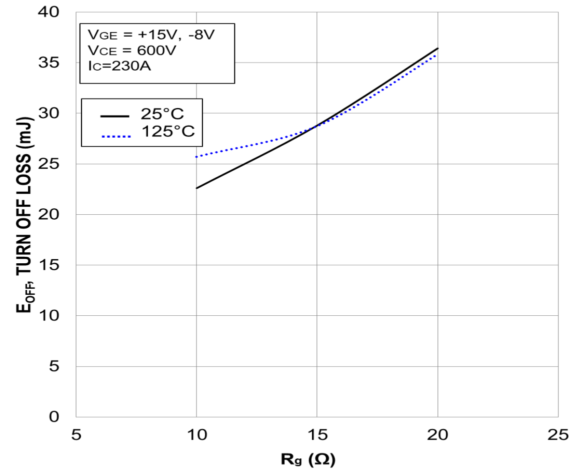



Figure 53. Typical Turn Off Loss vs. Rg

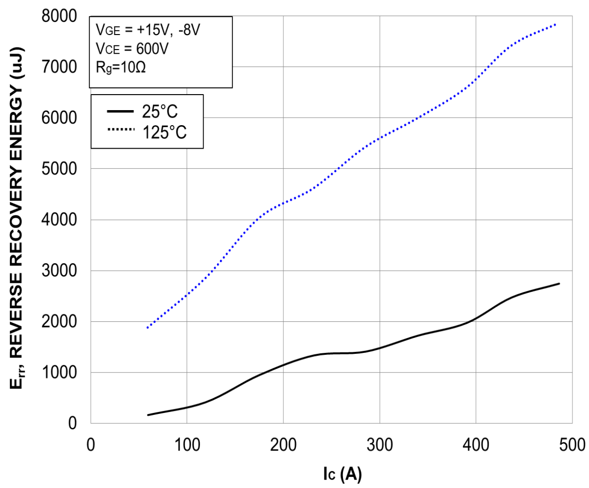



Figure 54. Typical Reverse Recovery Loss vs. IC

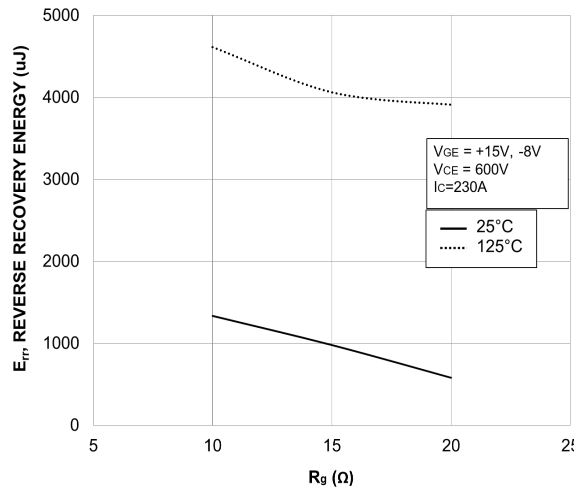



Figure 55. Typical Reverse Recovery Loss vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T2, T3 IGBT COMMUTATE D1, D4 INVERSE DIODE

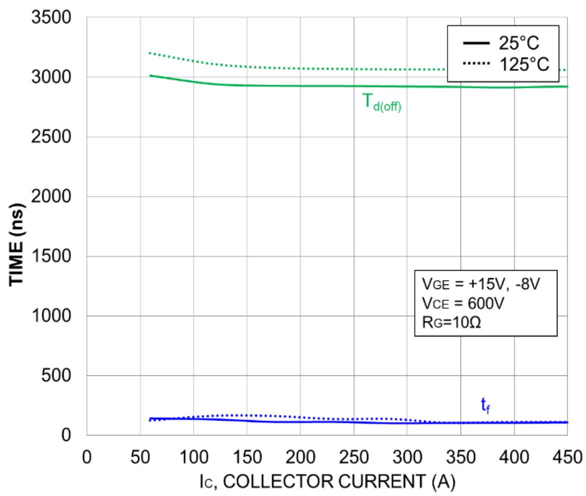



Figure 56. Typical Turn−Off Switching Time vs. IC

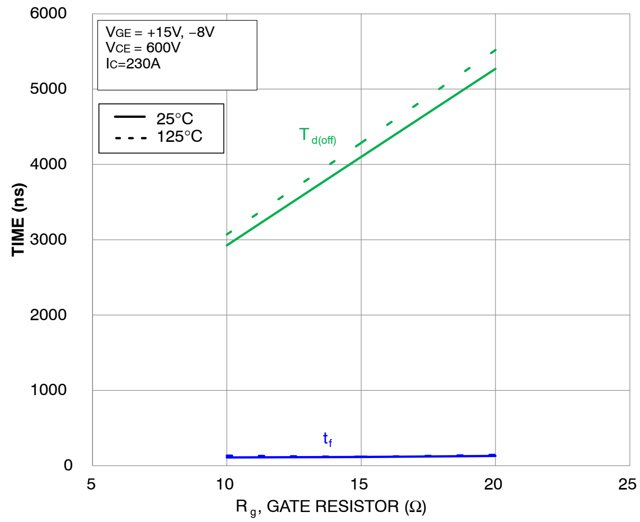



Figure 57. Typical Turn−Off Switching Time vs. Rg

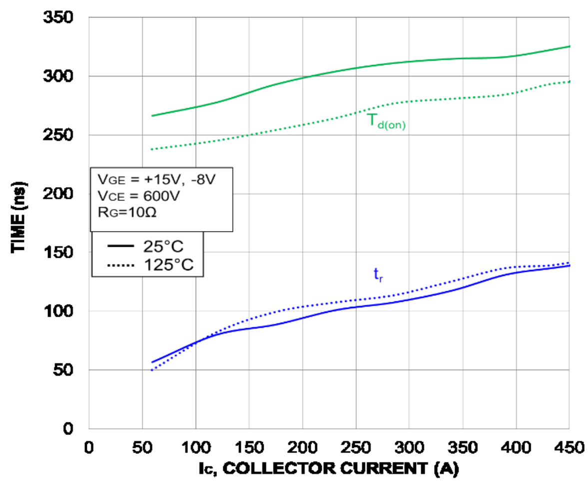



Figure 58. Typical Turn−On Switching Time vs. IC

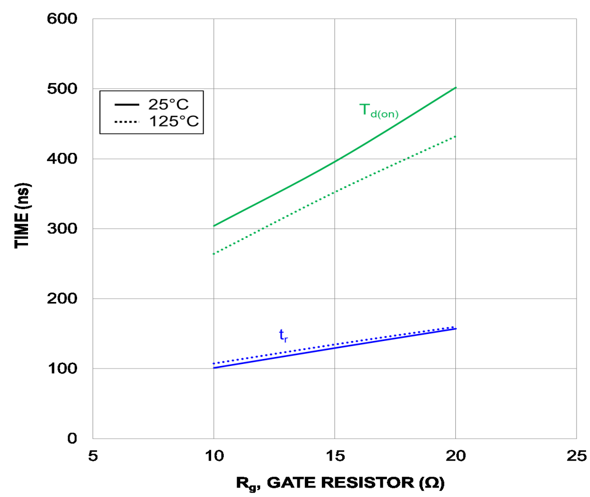



Figure 59. Typical Turn−On Switching Time vs. Rg

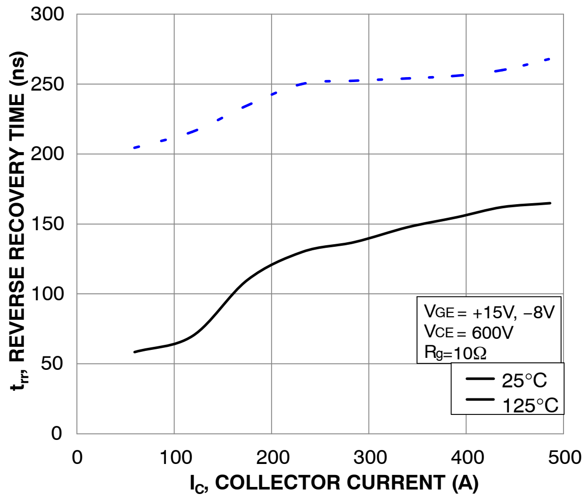



Figure 60. Typical Reverse Recovery Time vs. IC

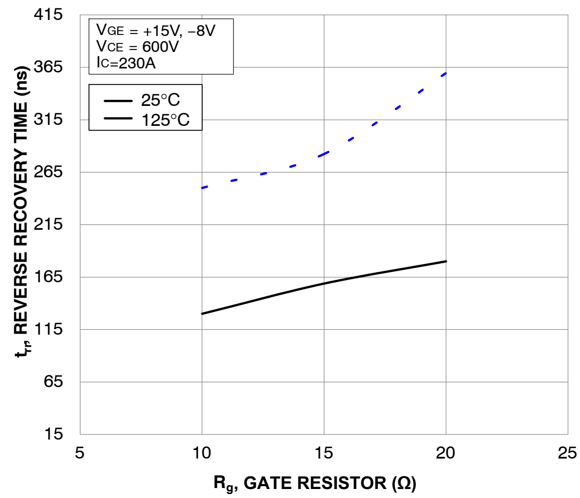



Figure 61. Typical Reverse Recovery Time vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T2, T3 IGBT COMMUTATE D1, D4 INVERSE DIODE

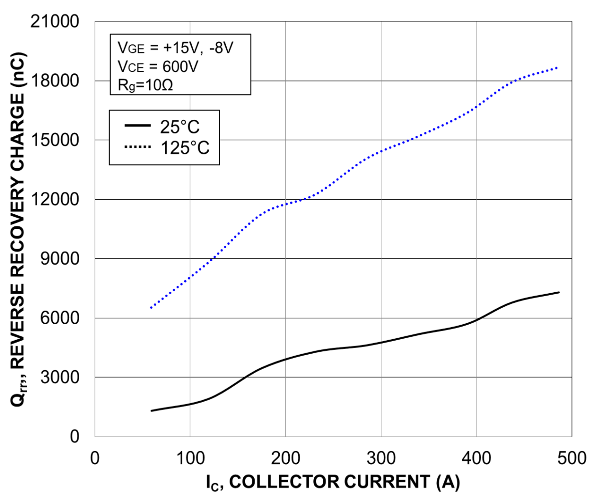



Figure 62. Typical Recovery Charge vs. IC

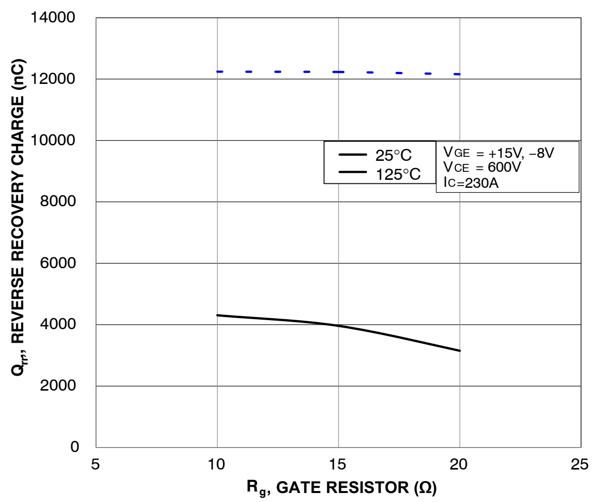



Figure 63. Typical Recovery Charge vs. Rg

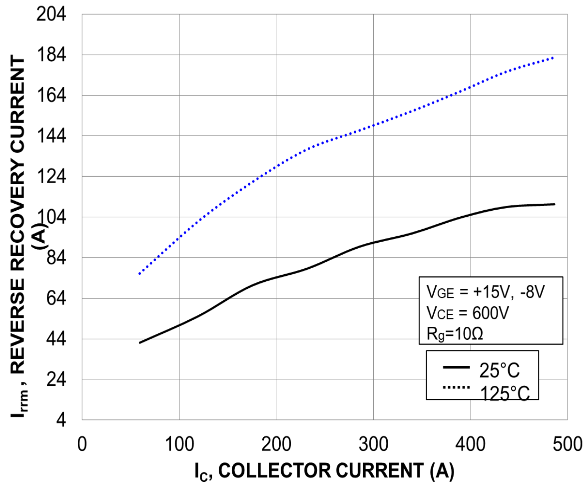



**Figure 64. Typical Recovery Current vs. IC**

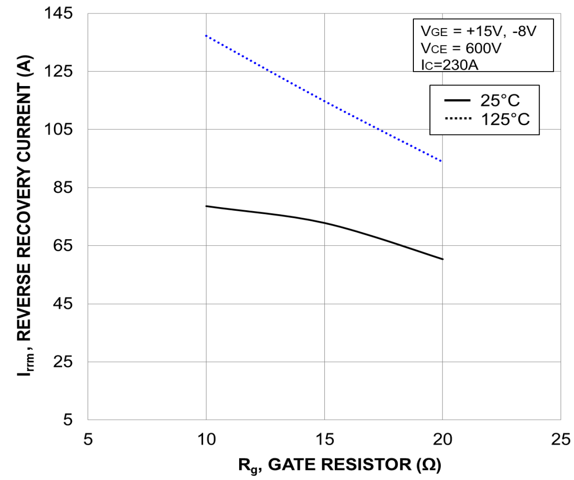



**Figure 65. Typical Recovery Current vs. Rg**

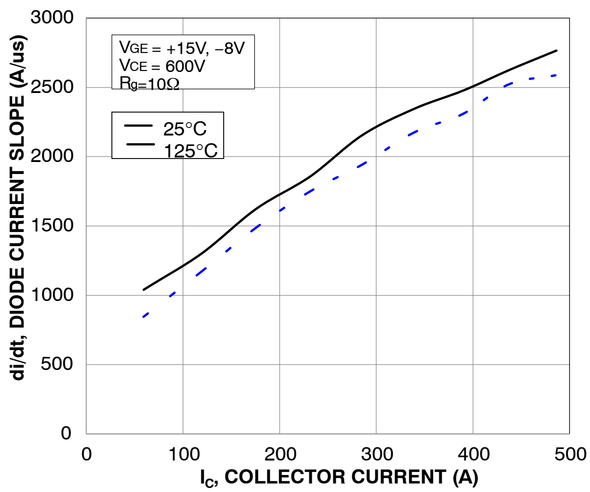



**Figure 66. Typical di/dt Current Slope vs. IC**

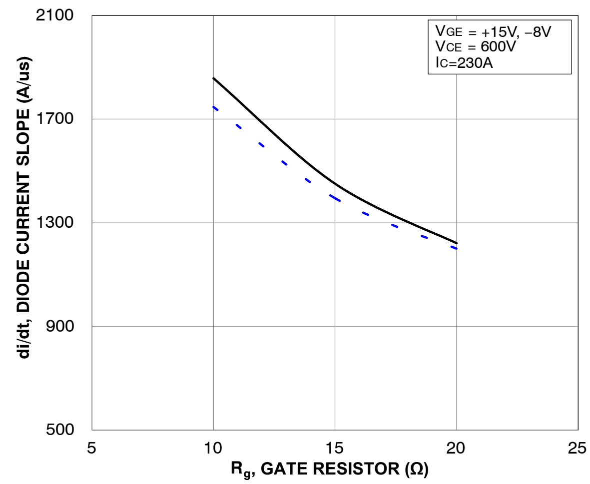



**Figure 67. Typical di/dt Current Slope vs. Rg**

## TYPICAL SWITCHING CHARACTERISTICS – T5, T6 IGBT COMMUTATE D1, D4 INVERSE DIODE

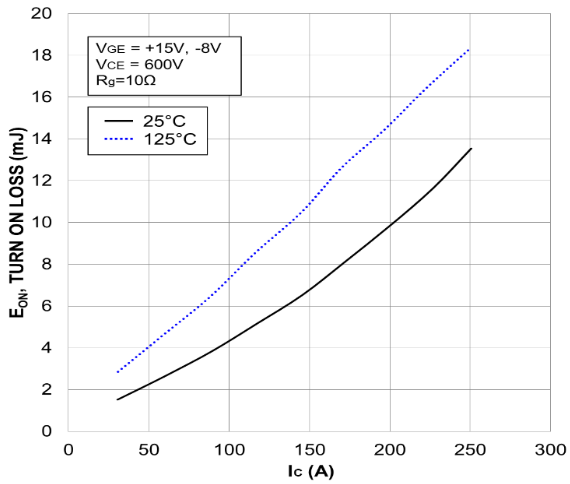



Figure 68. Typical Turn On Loss vs. IC

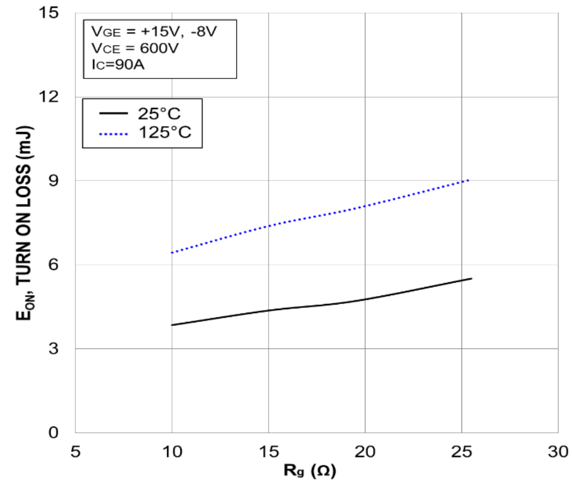



Figure 69. Typical Turn On Loss vs. Rg

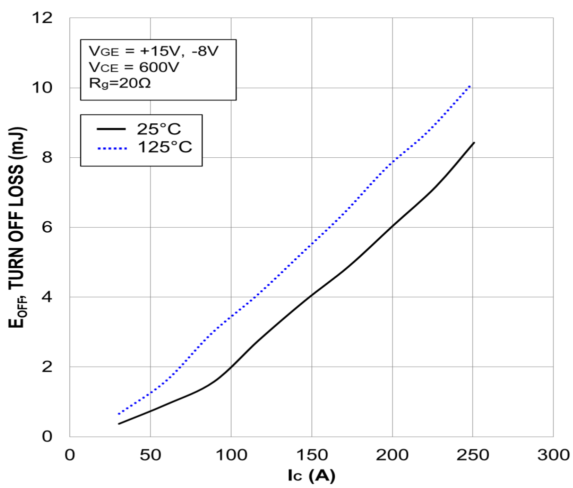



Figure 70. Typical Turn Off Loss vs. IC

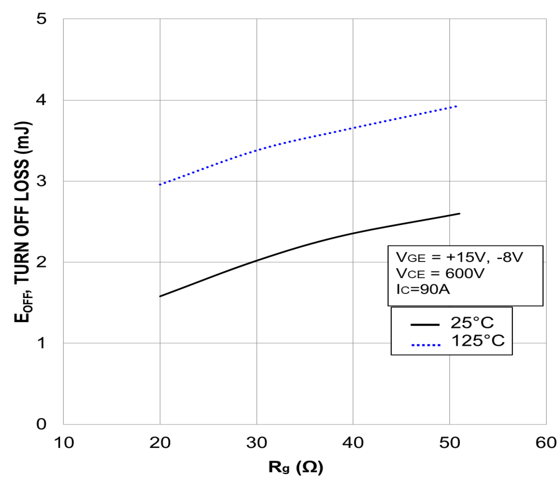



Figure 71. Typical Turn Off Loss vs. Rg

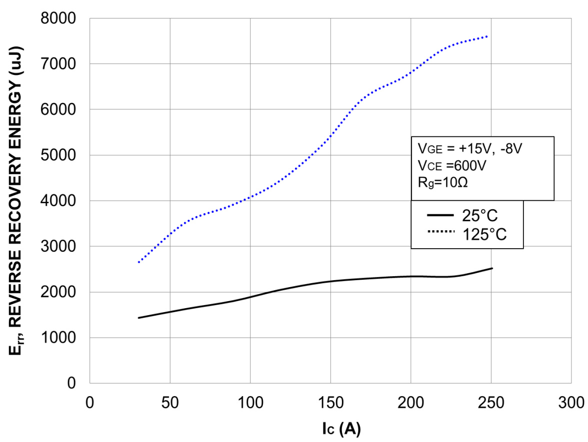



Figure 72. Typical Reverse Recovery Energy vs. IC

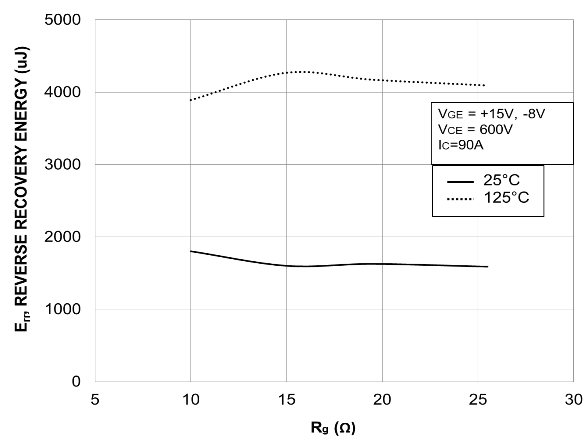



Figure 73. Typical Reverse Recovery Energy vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T5, T6 IGBT COMMUTATE D1, D4 INVERSE DIODE

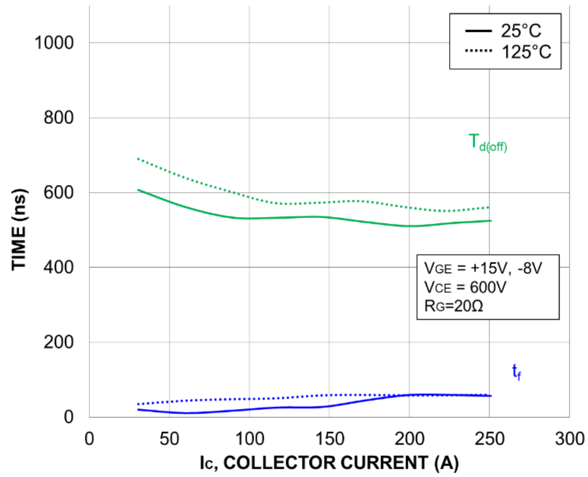



Figure 74. Typical Turn−Off Switching Time vs. IC

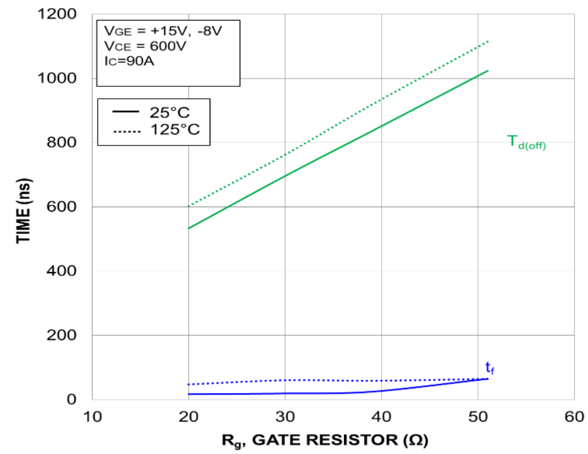



Figure 75. Typical Turn−Off Switching Time vs. Rg

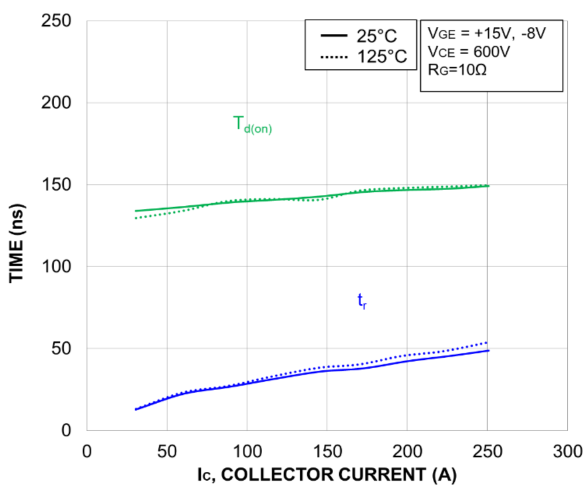



Figure 76. Typical Turn−On Switching Time vs. IC

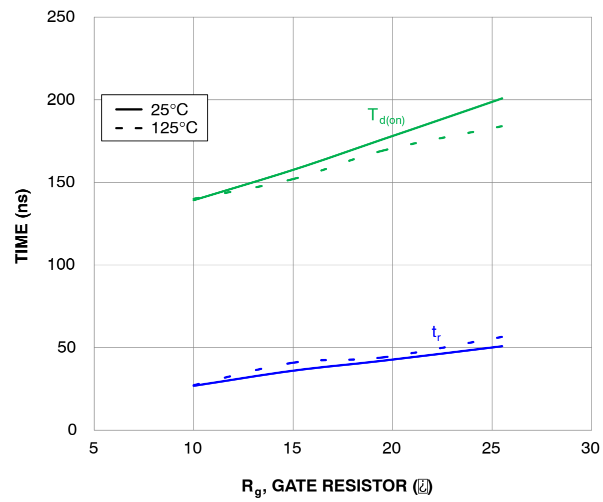



Figure 77. Typical Turn−On Switching Time vs. Rg

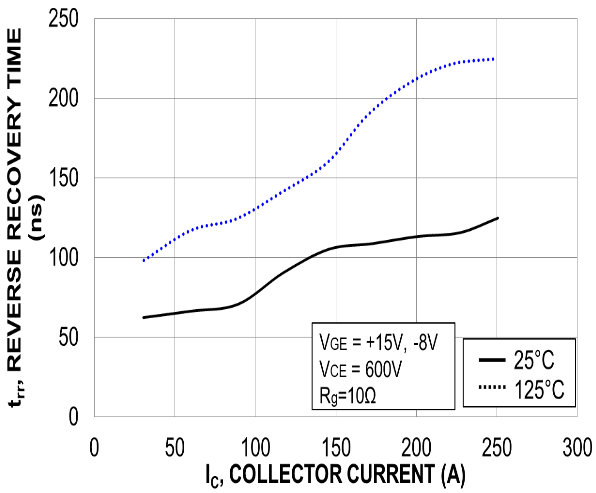



Figure 78. Typical Reverse Recovery Time vs. IC

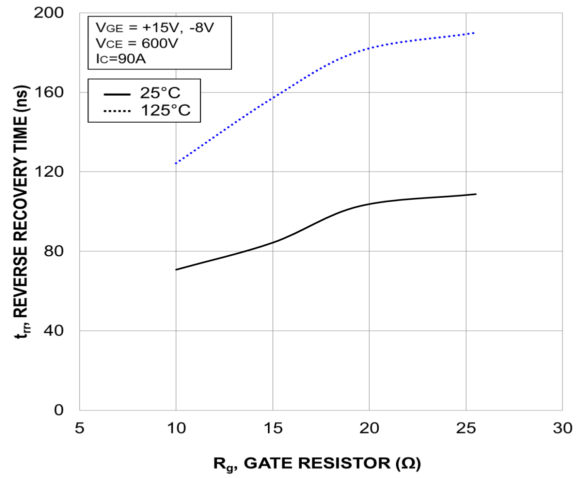



Figure 79. Typical Reverse Recovery Time vs. Rg

## TYPICAL SWITCHING CHARACTERISTICS – T5, T6 IGBT COMMUTATE D1, D4 INVERSE DIODE

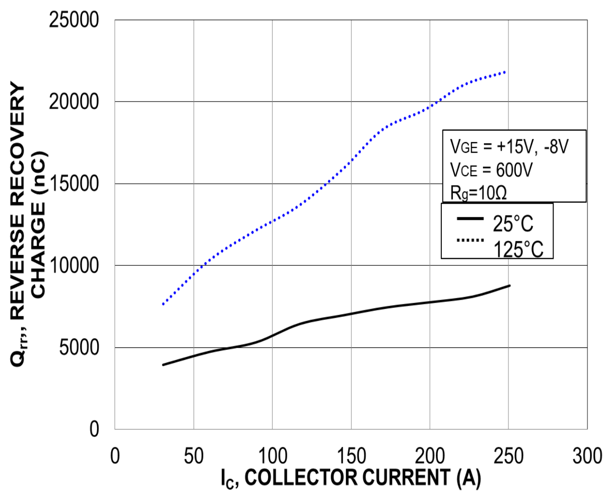



Figure 80. Typical Recovery Charge vs. IC

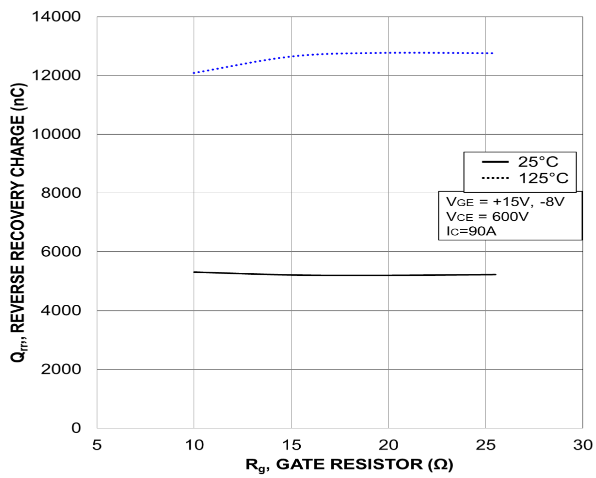



Figure 81. Typical Recovery Charge vs. Rg

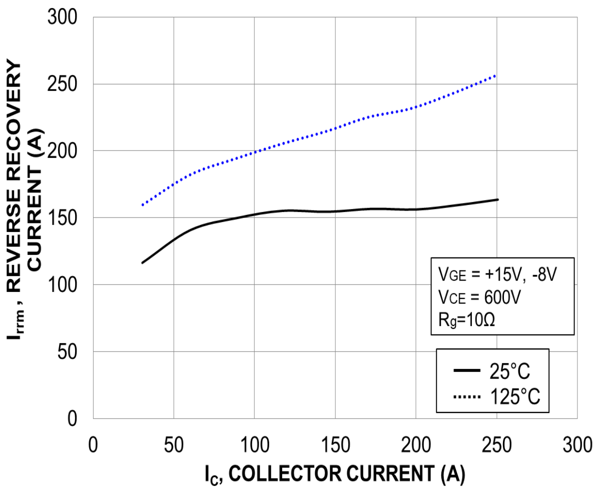



Figure 82. Typical Recovery Current vs. IC

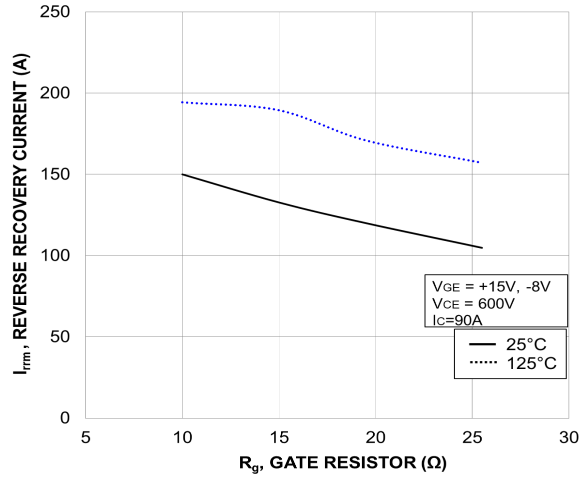



Figure 83. Typical Recovery Current vs. Rg

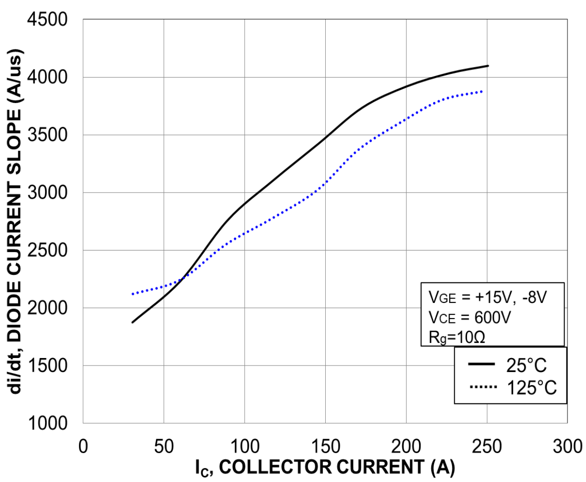



Figure 84. Typical di/dt Current Slope vs. IC

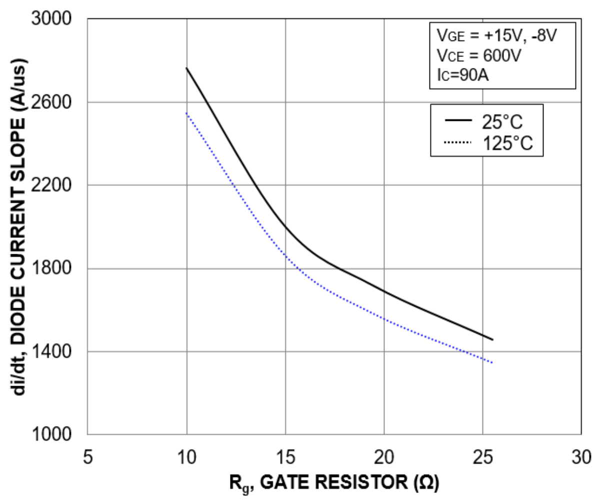
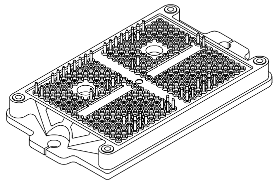
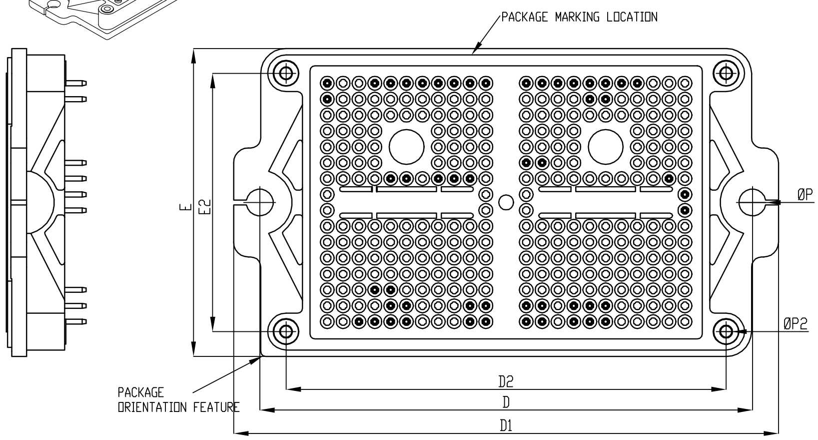



Figure 85. Typical di/dt Current Slope vs. Rg

### PIM52, 99.4x62 (SOLDER PIN)
CASE 180CL
ISSUE B

DATE 23 FEB 2021

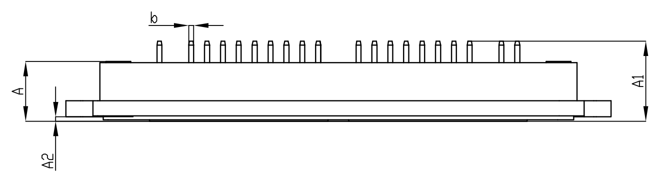


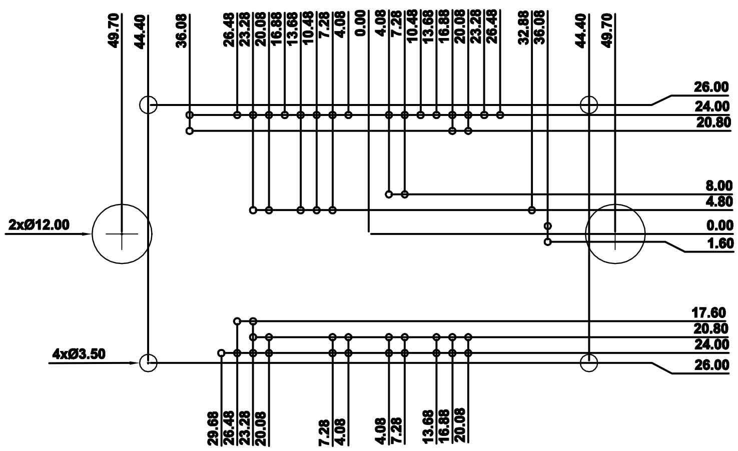



**NOTES:**

1. **CONTROLLING DIMENSION : MILLIMETERS**
2. **PIN POSITION TOLERANCE IS ± 0.4mm**
3. **PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES**

| | MILLIMETERS | | |
|---|---|---|---|
| DIM | MIN. | NOM. | MAX. |
| A | 11.65 | 12.00 | 12.35 |
| A1 | 15.65 | 16.15 | 16.65 |
| A2 | 0.60 | 0.85 | 1.10 |
| b | 0.95 | 1.00 | 1.05 |
| D | 99.15 | 99.4 | 99.65 |
| D1 | 109.50 | 109.90 | 110.30 |
| D2 | 88.60 | 88.80 | 89.0 |
| E | 61.60 | 62.00 | 62.40 |
| E2 | 51.80 | 52.00 | 52.20 |
| P | 5.25 | 5.40 | 5.55 |
| P2 | 2.20 | 2.30 | 2.40 |

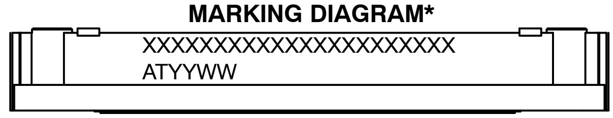



**RECOMMENDED MOUNTING PATTERN**

* For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**GENERIC MARKING DIAGRAM***




XXXXX = Specific Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

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|---|---|---|
| DESCRIPTION: | PIM52, 99.4x62 (SOLDER PIN) | PAGE 1 OF 1 |

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