# 3-Level NPC Inverter Module

## *Product Preview*

## NXH600N105H7F5S1HG, NXH600N105H7F5P1HG

The NXH600N105H7F5S1HG/P1HG is a power module in F5BP containing an I-type neutral point clamped three-level inverter. The integrated field stop trench IGBTs and FRDs provide lower conduction and switching losses, enabling designers to achieve high efficiency, higher power and superior reliability.

### Features

- I-type Neutral Point Clamped Three-level Inverter Module
- 1050 V Field Stop 7 IGBTs
- Low Inductive Layout
- Solder Pins
- Integrated NTC Thermistor
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### Typical Applications

- Energy Storage System
- Solar Inverters

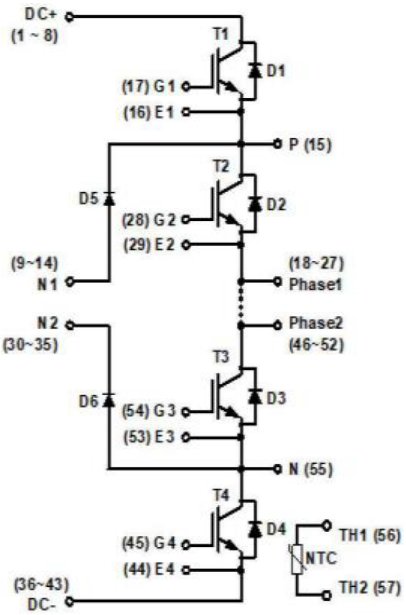
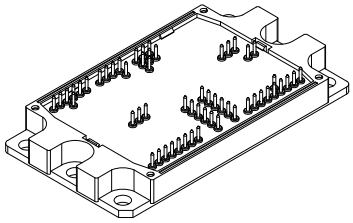
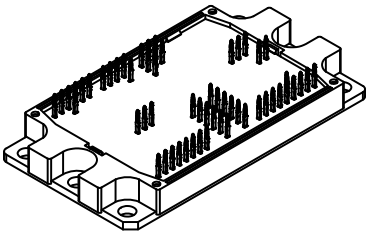



**Figure 1. NXH600N105H7F5S1HG/P1HG Schematic Diagram**

This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

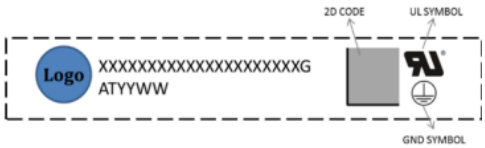


**PIM57 112.00x62.00x12.00 (SOLDER PIN)**
**CASE 180CV**



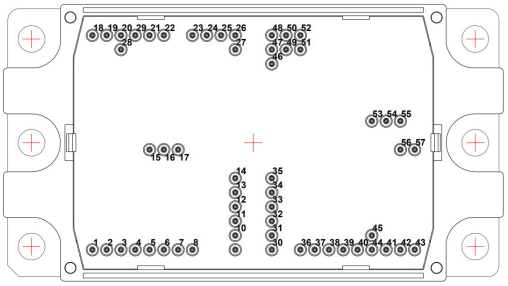
**PIM57 112.00x62.00x12.00 (PRESS FIT PIN)**
**CASE 180JC**

### MARKING DIAGRAM




XXXXX = Device Code
G = Pb-Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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## MODULE CHARACTERISTICS

| | | | |
|---|---|---|---|
| Operating Temperature under Switching Condition | $T_{VJOP}$ | −40 to 150 | °C |
| Storage Temperature Range | $T_{stg}$ | −40 to 125 | °C |
| Isolation Test Voltage, t = 2 s, 50 Hz (Note 1) | $V_{is}$ | 4800 | $V_{RMS}$ |
| Stray Inductance | $L_{sCE}$ | 15 | nH |
| Terminal Connection Torque (M5, Screw) | M | 3 to 5 | Nm |
| Weight | G | 245 | g |
| Creepage Distance (Terminal to Heatsink) | | 17.46 | mm |
| Creepage Distance (Terminal to Terminal) | | 6.48 | mm |
| Clearance Distance (Terminal to Heatsink) | | 15.62 | mm |
| Clearance Distance (Terminal to Terminal) | | 5.05 | mm |
| Comparative Tracking Index | CTI | >600 | |

1. 4800 $VAC_{RMS}$ for 2 second duration is equivalent to 4000 $VAC_{RMS}$ for 1 minute duration.

## ABSOLUTE MAXIMUM RATINGS ($T_J$ = 25 °C unless otherwise noted)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| **OUTER IGBT (T1, T4)** | | | |
| Collector-Emitter Voltage | $V_{CES}$ | 1050 | V |
| Gate-Emitter Voltage<br>Positive Transient Gate-Emitter Voltage ($T_{pulse}$ = 5 μs, D < 0.10) | $V_{GE}$ | ±20<br>30 | V |
| Continuous Collector Current @ $T_c$ = 80 °C ($T_J$ = 175 °C) | $I_C$ | 429 | A |
| Pulsed Peak Collector Current @ Tc = 80 °C ($T_J$ = 175 °C), $T_{pulse}$ = 1 ms | $I_{Cpulse}$ | 1287 | A |
| Power Dissipation ($T_J$ = 175 °C, Tc = 80 °C) | $P_{tot}$ | 1080 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **INNER IGBT (T2, T3)** | | | |
| Collector-Emitter Voltage | $V_{CES}$ | 1050 | V |
| Gate-Emitter Voltage<br>Positive Transient Gate-Emitter Voltage ($T_{pulse}$ = 5 μs, D < 0.10) | $V_{GE}$ | +20<br>30 | V |
| Continuous Collector Current @ $T_c$ = 80 °C ($T_J$ = 175 °C) | $I_C$ | 429 | A |
| Pulsed Peak Collector Current @ Tc = 80 °C ($T_J$ = 175 °C), $T_{pulse}$ = 1 ms | $I_{Cpulse}$ | 1287 | A |
| Power Dissipation ($T_J$ = 175 °C, Tc = 80 °C) | $P_{tot}$ | 1080 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **SiC NEUTRAL POINT DIODE (D5, D6)** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ Tc = 80 °C | $I_F$ | 195 | A |
| Repetitive Peak Forward Current ($T_J$ = 175 °C), $T_{pulse}$ = 1 ms | $I_{FRM}$ | 585 | A |
| Maximum Power Dissipation @ Tc = 80 °C ($T_J$ = 175 °C) | $P_{tot}$ | 419 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **SiC INVERSE DIODES (D1, D4)** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ Tc = 80 °C | $I_F$ | 287 | A |
| Repetitive Peak Forward Current ($T_J$ = 175 °C), $T_{pulse}$ = 1 ms | $I_{FRM}$ | 861 | A |

**ABSOLUTE MAXIMUM RATINGS** ($T_J$ = 25 °C unless otherwise noted) (continued)

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| **SiC INVERSE DIODES (D1, D4)** | | | |
| Maximum Power Dissipation @ Tc = 80 °C ($T_J$ = 175 °C) | $P_{tot}$ | 646 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |
| **INVERSE DIODES (D2, D3)** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1050 | V |
| Continuous Forward Current @ Tc = 80 °C | $I_F$ | 303 | A |
| Repetitive Peak Forward Current ($T_J$ = 175 °C), $T_{pulse}$ = 1 ms | $I_{FRM}$ | 909 | A |
| Maximum Power Dissipation @ Tc = 80 °C ($T_J$ = 175°C) | $P_{tot}$ | 833 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 175 | °C |

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.

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

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25 °C unless otherwise noted)

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OUTER IGBT (T1, T4)** | | | | | | |
| Collector-Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1050 V | $I_{CES}$ | – | – | 500 | μA |
| Collector-Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 25 °C | $V_{CE(sat)}$ | – | 1.6 | 2.3 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 150 °C | | – | 2.0 | – | |
| Gate-Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 600 mA | $V_{GE(TH)}$ | 4.0 | 5.5 | 6.9 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 1 | μA |
| Internal Gate Resistor | | $R_g$ | – | 0.58 | – | Ω |
| Turn-off safe operating area | $V_{CC}$ < 800 V, $R_{G, off}$ ≥ 30 Ω, $T_{vj}$ < 150 °C | | – | 800 | – | A |
| Turn-on Delay Time | $T_J$ = 25 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G, on}$ = 7 Ω,<br>$R_{G, off}$ = 21 Ω | $t_{d(on)}$ | – | 235 | – | ns |
| Rise Time | | $t_r$ | – | 48 | – | |
| Turn-off Delay Time | | $t_{d(off)}$ | – | 1500 | – | |
| Fall Time | | $t_f$ | – | 18 | – | |
| Turn-on Switching Loss per Pulse | | $E_{on}$ | – | 6310 | – | μJ |
| Turn off Switching Loss per Pulse | | $E_{off}$ | – | 9000 | – | |
| Turn-on Delay Time | $T_J$ = 125 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G, on}$ = 7 Ω,<br>$R_{G, off}$ = 21 Ω | $t_{d(on)}$ | – | 212 | – | ns |
| Rise Time | | $t_r$ | – | 52 | – | |
| Turn-off Delay Time | | $t_{d(off)}$ | – | 1641 | – | |
| Fall Time | | $t_f$ | – | 16 | – | |
| Turn-on Switching Loss per Pulse | | $E_{on}$ | – | 6860 | – | μJ |
| Turn-off Switching Loss per Pulse | | $E_{off}$ | – | 12020 | – | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 100 kHz | $C_{ies}$ | – | 48597 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 1836 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 277 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 57 A, $V_{GE}$ = −15/+20 V | $Q_g$ | – | 3048 | – | nC |

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25 °C unless otherwise noted) (continued)

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OUTER IGBT (T1, T4)** | | | | | | |
| Thermal Resistance – Chip-to-heatsink | Thermal grease, Thickness = 2 Mil ±2%, = 2.9 W/mK | $R_{thJH}$ | – | 0.139 | – | °C/W |
| Thermal Resistance – Chip-to-case | | $R_{thJC}$ | – | 0.088 | – | °C/W |
| **SiC NEUTRAL POINT DIODE (D5, D6)** | | | | | | |
| Diode Forward Voltage | $I_F$ = 200 A, $T_J$ = 25 °C | $V_F$ | – | 1.6 | 1.75 | V |
| | $I_F$ = 200 A, $T_J$ = 150 °C | | – | 2.1 | – | |
| Reverse Recovery Time | $T_J$ = 25 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G,\ on}$ =7 Ω | $t_{rr}$ | – | 21 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 595 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 43 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 3.5 | – | A/ns |
| Reverse Recovery Energy | | $E_{rr}$ | – | 117 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G,\ on}$ = 7 Ω | $t_{rr}$ | – | 20 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 602 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 42 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 3.2 | – | A/ns |
| Reverse Recovery Energy | | $E_{rr}$ | – | 150 | – | μJ |
| Thermal Resistance – Chip-to-heatsink | Thermal grease, Thickness = 2 Mil ±2%, = 2.87 W/mK | $R_{thJH}$ | – | 0.297 | – | °C/W |
| Thermal Resistance – Chip-to-case | | $R_{thJC}$ | – | 0.227 | – | °C/W |
| **INNER IGBT (T2, T3)** | | | | | | |
| Collector-Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1050 V | $I_{CES}$ | – | – | 500 | μA |
| Collector-Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 1.6 | 2.3 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 600 A, $T_J$ = 150°C | | – | 2.0 | – | |
| Gate-Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 600 mA | $V_{GE(TH)}$ | 4.0 | 5.5 | 6.9 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 1 | μA |
| Internal Gate Resistor | | $R_g$ | – | 0.58 | – | Ω |
| Turn-off Safe Operating Area | $V_{CC}$ < 800V, $R_{G,\ off}$ ≥ 30 Ω, $T_{vj}$ < 150 °C | | – | 800 | – | A |
| Turn-on Delay Time | $T_J$ = 25 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G,\ on}$ = 7 Ω,<br>$R_{G,\ off}$ = 21 Ω | $t_{d(on)}$ | – | 238 | – | ns |
| Rise Time | | $t_r$ | – | 56 | – | |
| Turn-off Delay Time | | $t_{d(off)}$ | – | 1506 | – | |
| Fall Time | | $t_f$ | – | 7.2 | – | |
| Turn-on Switching Loss per Pulse | | $E_{on}$ | – | 6570 | – | μJ |
| Turn off Switching Loss per Pulse | | $E_{off}$ | – | 9090 | – | |
| Turn-on Delay Time | $T_J$ = 125 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G,\ on}$ = 7 Ω,<br>$R_{G,\ off}$ = 21 Ω | $t_{d(on)}$ | – | 216 | – | ns |
| Rise Time | | $t_r$ | – | 57 | – | |
| Turn-off Delay Time | | $t_{d(off)}$ | – | 1638 | – | |
| Fall Time | | $t_f$ | – | 17 | – | |
| Turn-on Switching Loss per Pulse | | $E_{on}$ | – | 6890 | – | μJ |
| Turn-off Switching Loss per Pulse | | $E_{off}$ | – | 10910 | – | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 100 kHz | $C_{ies}$ | – | 48597 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 1836 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 277 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 57 A, $V_{GE}$ = −15/+20 V | $Q_g$ | – | 3048 | – | nC |

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25 °C unless otherwise noted) (continued)

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **INNER IGBT (T2, T3)** | | | | | | |
| Thermal Resistance – Chip-to-heatsink | Thermal grease, Thickness = 2 Mil ±2%, = 2.87 W/mK | $R_{thJH}$ | – | 0.139 | – | °C/W |
| Thermal Resistance – Chip-to-case | | $R_{thJC}$ | – | 0.088 | – | °C/W |
| **SiC INVERSE DIODES (D1, D4)** | | | | | | |
| Diode Forward Voltage | $I_F$ = 300 A, $T_J$ = 25 °C | $V_F$ | – | 1.6 | 1.75 | V |
| | $I_F$ = 300 A, $T_J$ = 175 °C | | – | 2.1 | – | |
| Reverse Recovery Time | $T_J$ = 25 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G,\,on}$ = 7 Ω | $t_{rr}$ | – | 37 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 1167 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 53 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 2.92 | – | A/ns |
| Reverse Recovery Energy | | $E_{rr}$ | – | 235 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125 °C<br>$V_{CE}$ = 600 V, $I_C$ = 200 A<br>$V_{GE}$ = −9 V to +15 V, $R_{G,\,on}$ = 7 Ω | $t_{rr}$ | – | 40 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 1419 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 61 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 2.84 | – | A/ns |
| Reverse Recovery Energy | | $E_{rr}$ | – | 279 | – | μJ |
| Thermal Resistance – Chip-to-heatsink | Thermal grease, Thickness = 2 Mil ±2%, = 2.87 W/mK | $R_{thJH}$ | – | 0.202 | – | °C/W |
| Thermal Resistance – Chip-to-case | | $R_{thJC}$ | – | 0.147 | – | °C/W |
| **INVERSE DIODES (D2, D3)** | | | | | | |
| Diode Forward Voltage | $I_F$ = 500 A, $T_J$ = 25 °C | $V_F$ | – | 2.8 | 3.4 | V |
| | $I_F$ = 500 A, $T_J$ = 175 °C | | – | 2.2 | – | |
| Thermal Resistance – Chip-to-heatsink | Thermal grease, Thickness = 2 Mil ±2%, = 2.87 W/mK | $R_{thJH}$ | – | 0.194 | – | °C/W |
| Thermal Resistance – Chip-to-case | | $R_{thJC}$ | – | 0.124 | – | °C/W |
| **THERMISTOR CHARACTERISTICS** | | | | | | |
| Nominal Resistance | T = 25 °C | $R_{25}$ | – | 5 | – | kΩ |
| Nominal Resistance | T = 100 °C | $R_{100}$ | – | 492.2 | – | Ω |
| Deviation of R25 | | R/R | −1 | – | 1 | % |
| Power Dissipation | | $P_D$ | – | 5 | – | mW |
| Power Dissipation Constant | | | – | 1.3 | – | mW/K |
| B-value | B(25/85), tolerance ±1% | | – | 3430 | – | 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

| Device | Marking | Package | Shipping |
|---|---|---|---|
| NXH600N105H7F5S1HG | NXH600N105H7F5S1HG | F5 – PIM57 112x62 (Solder Pin)<br>(Pb-Free / Halide Free) | 8 Units / Blister Tray |
| NXH600N105H7F5P1HG | NXH600N105H7F5P1HG | F5 – PIM57 112x62 (Press Fit Pin)<br>(Pb-Free / Halide Free) | 8 Units / Blister Tray |

## TYPICAL CHARACTERISTIC – T1, T2, T3, T4 (IGBT)

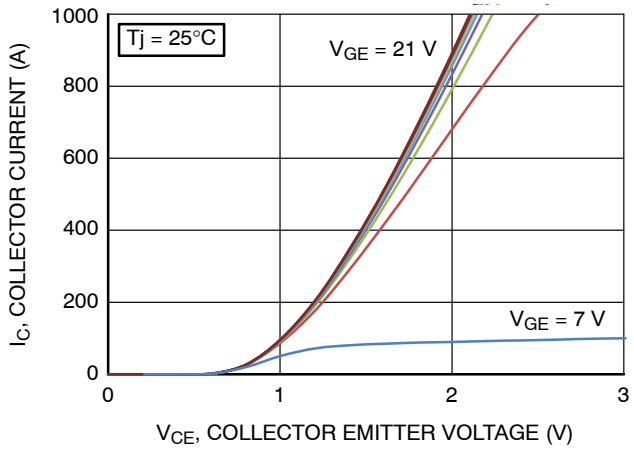



**Figure 2. Typical Output Characteristics – IGBT**

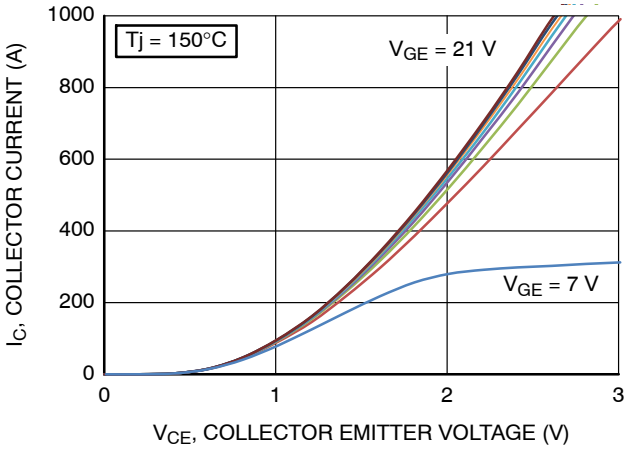



**Figure 3. Typical Output Characteristics – IGBT**

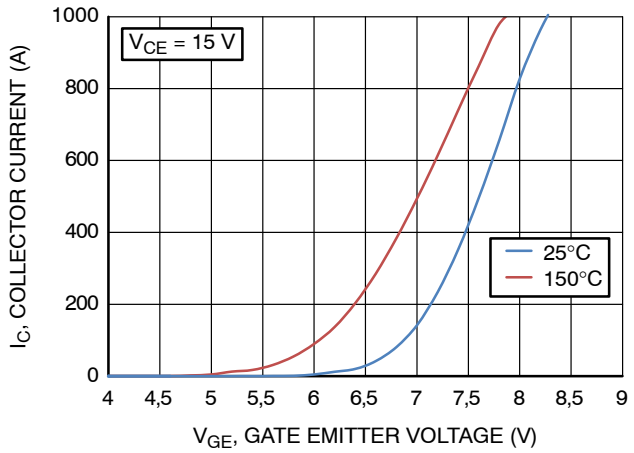



**Figure 4. Transfer Characteristics – IGBT**

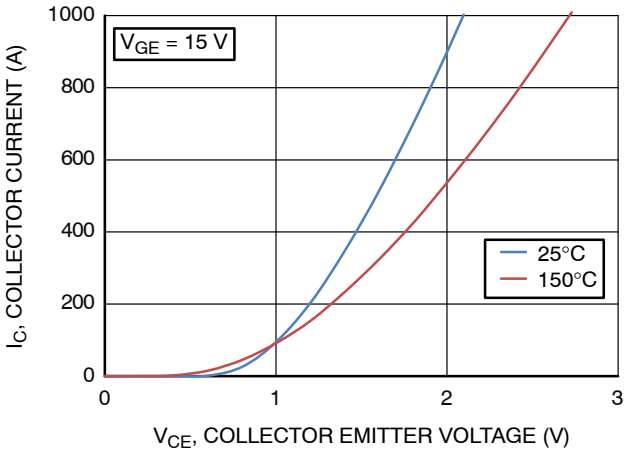



**Figure 5. Saturation Voltage Characteristic – IGBT**

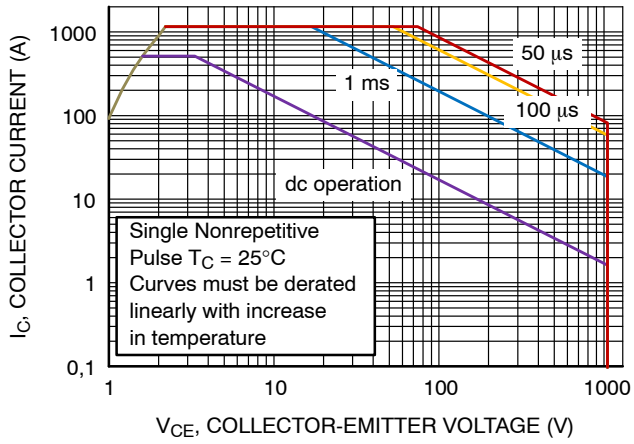



**Figure 6. FBSOA**

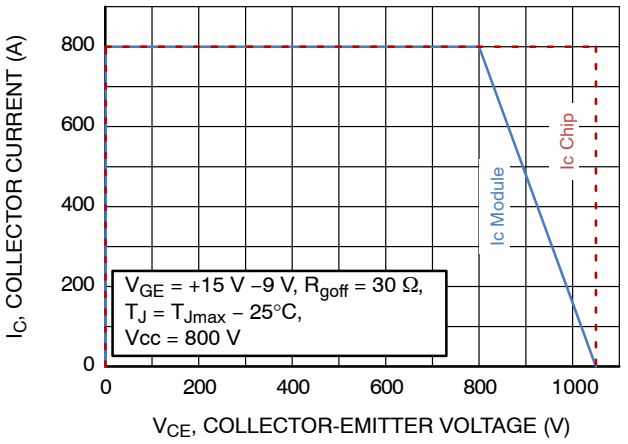



**Figure 7. RBSOA (T1–T4)**

## TYPICAL CHARACTERISTIC – T1, T2, T3, T4 (IGBT) (CONTINUED)

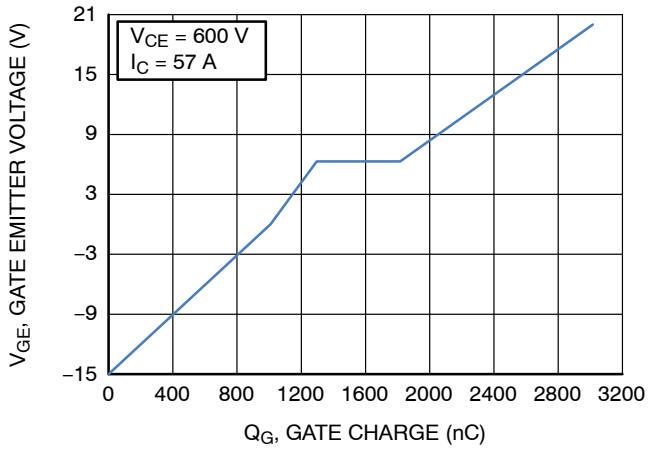



**Figure 8. Gate Voltage vs. Gate Charge**

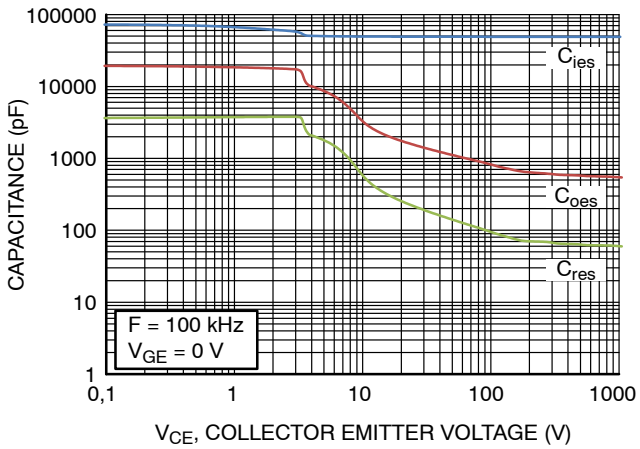



**Figure 9. Capacitance vs. $V_{CE}$**

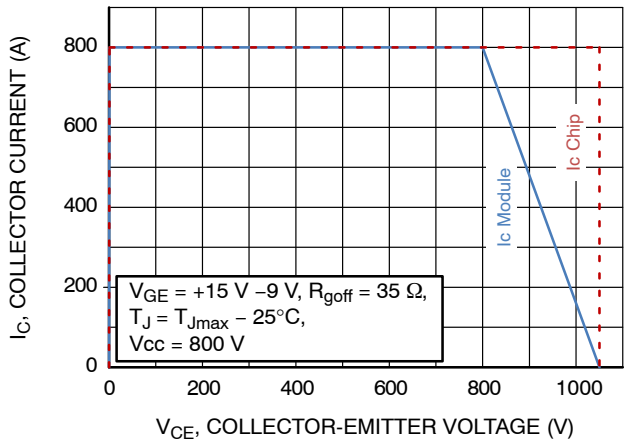



**Figure 10. RBSOA (T2–T3)**

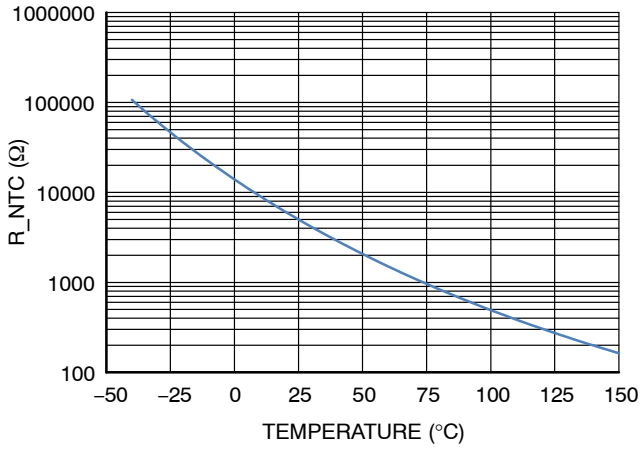



**Figure 11. Temperature vs. NTC Value**

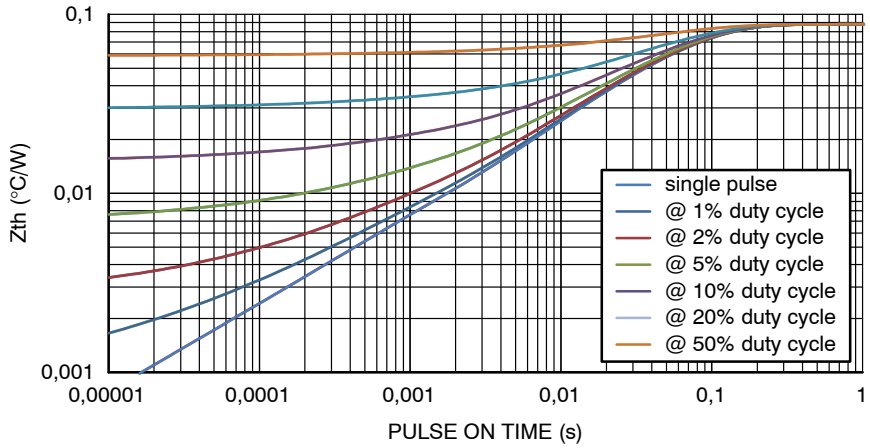



**Figure 12. Transient Thermal Impedance (IGBT Zthjc)**

## TYPICAL CHARACTERISTIC – D1, D4 (SiC INVERSE DIODE)

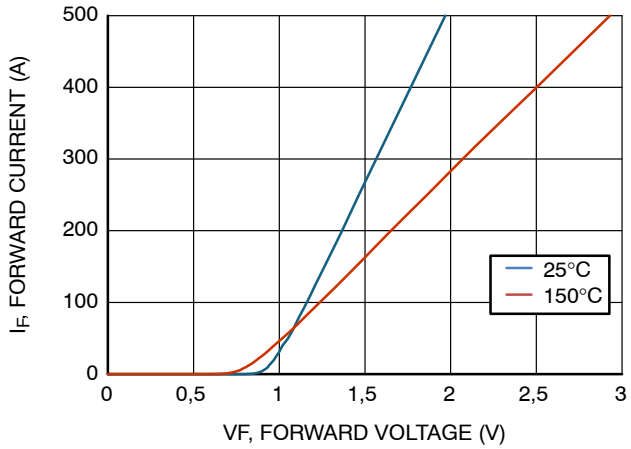



**Figure 13. Inverse Diode Forward Characteristics**

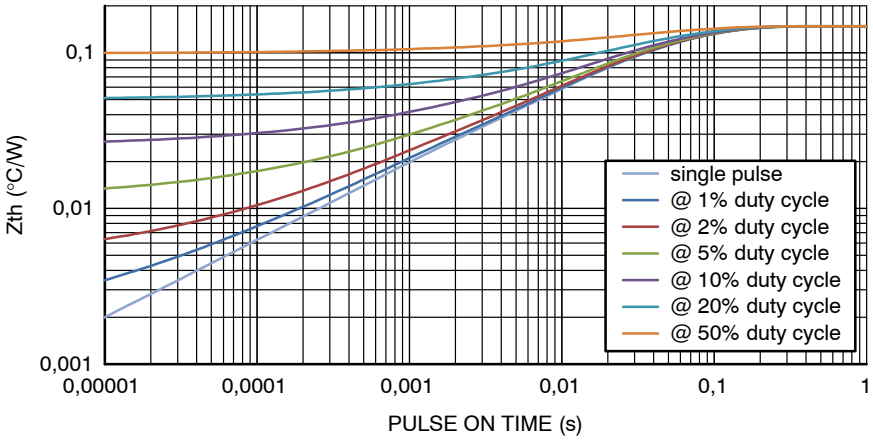



**Figure 14. Transient Thermal Impedance (Inverse Diode Zthjc)**

## TYPICAL CHARACTERISTIC – D2, D3 (INVERSE DIODE)

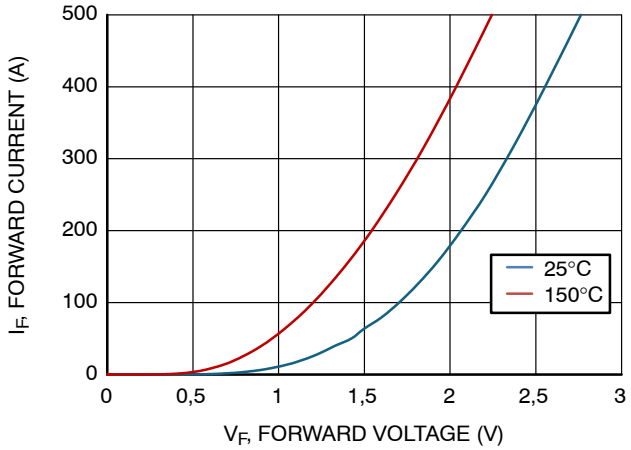



**Figure 15. Inverse Diode Forward Characteristics**

## TYPICAL CHARACTERISTIC – D2, D3 (INVERSE DIODE) (CONTINUED)

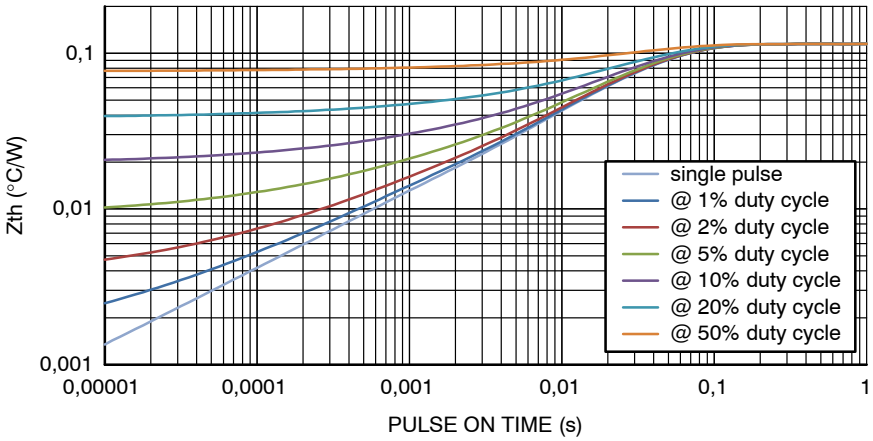



**Figure 16. Transient Thermal Impedance (Inverse Diode Zthjc)**

## TYPICAL CHARACTERISTIC – D5, D6 (SiC NEUTRAL POINT DIODE)

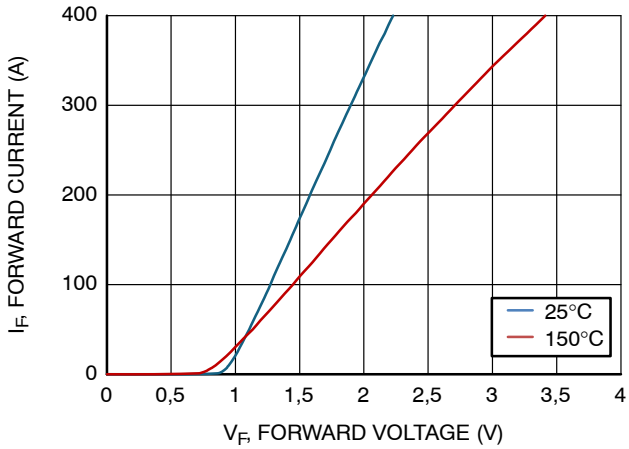



**Figure 17. Neutral Diode Forward Characteristics**

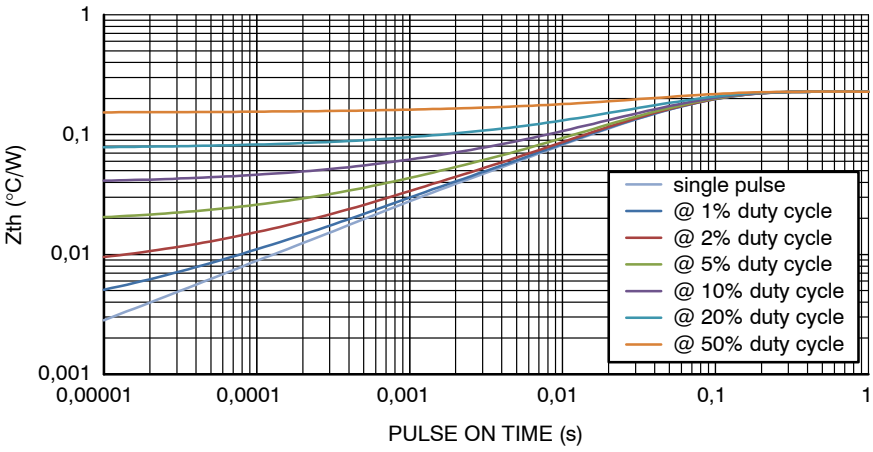



**Figure 18. Transient Thermal Impedance (Neutral Point Diode Zthjc)**

## TYPICAL CHARACTERISTIC – T1 || D5 OR T4 || D6

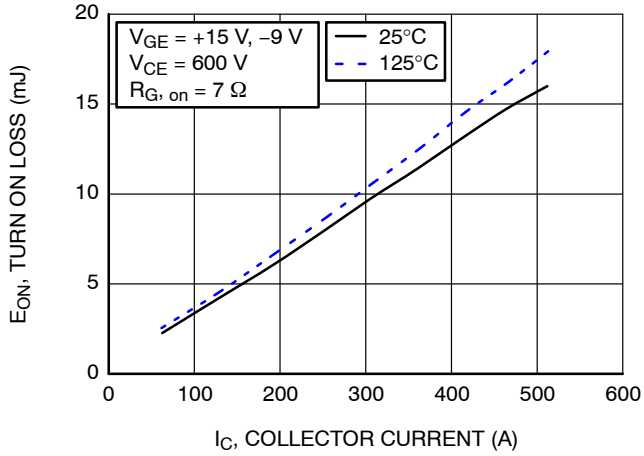



**Figure 19. Typical Turn-On Loss vs. $I_C$**

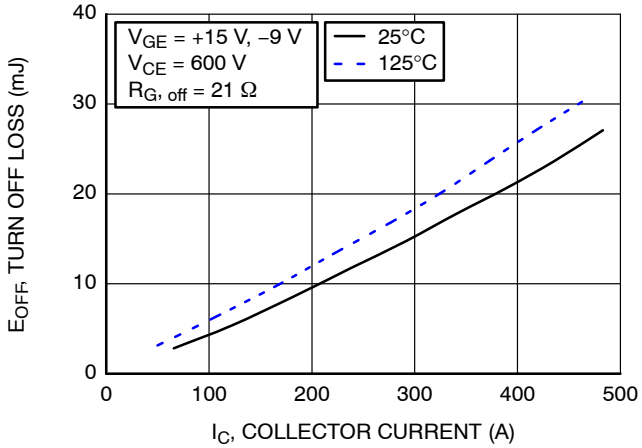



**Figure 20. Typical Turn-Off Loss vs. $I_C$**

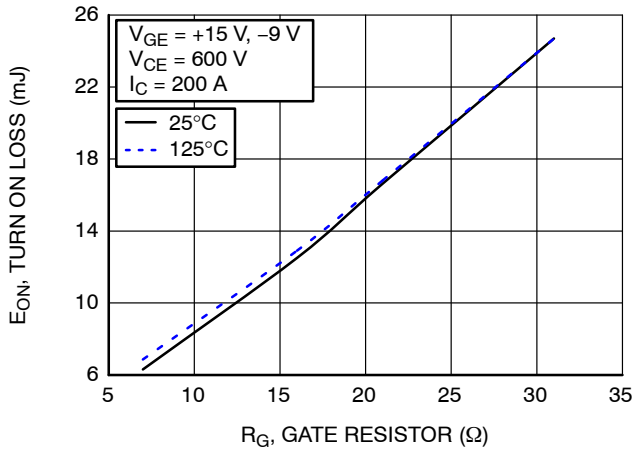



**Figure 21. Typical Turn-On Loss vs. $R_G$**

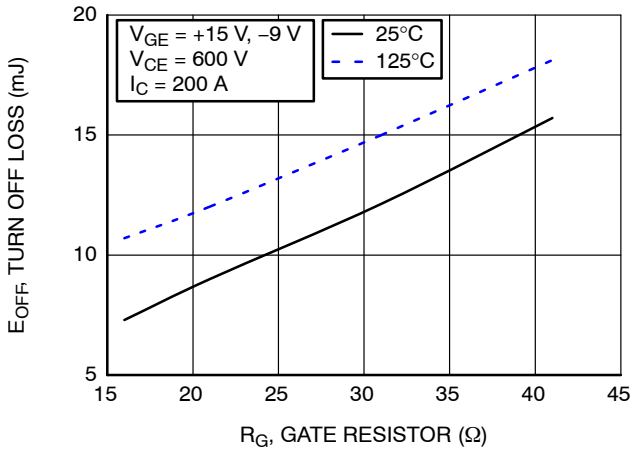



**Figure 22. Typical Turn-Off Loss vs. $R_G$**

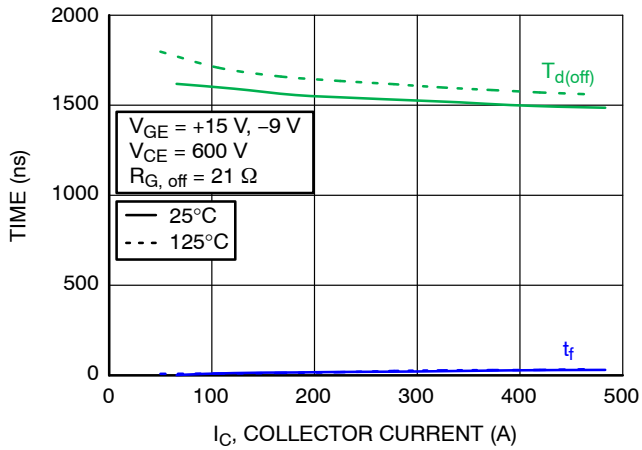



**Figure 23. Typical Turn-Off Switching Time vs. $I_C$**

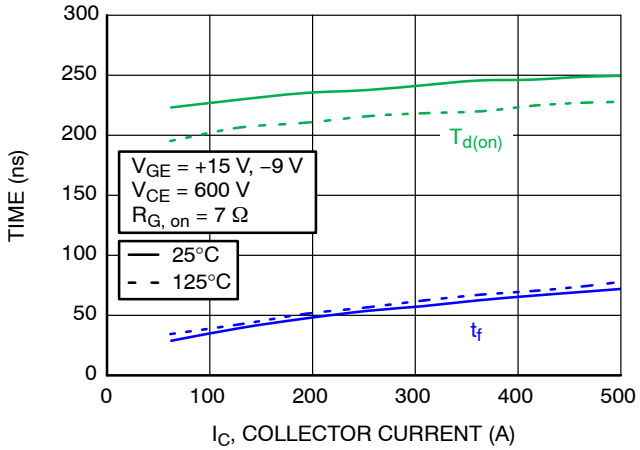



**Figure 24. Typical Turn-On Switching Time vs. $I_C$**

## TYPICAL CHARACTERISTIC – T1 || D5 OR T4 || D6 (CONTINUED)

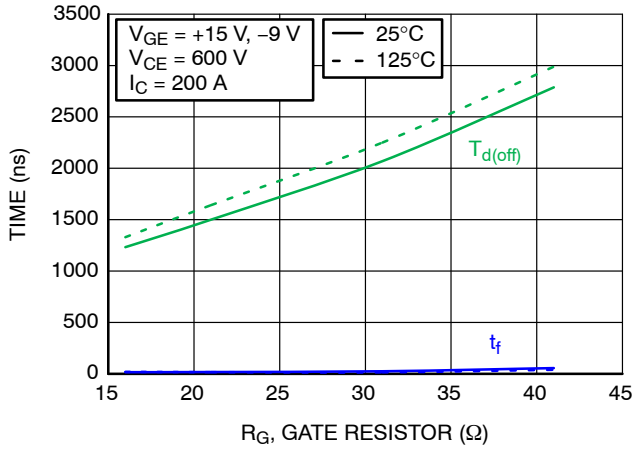



**Figure 25. Typical Turn-Off Switching Time vs. $R_G$**

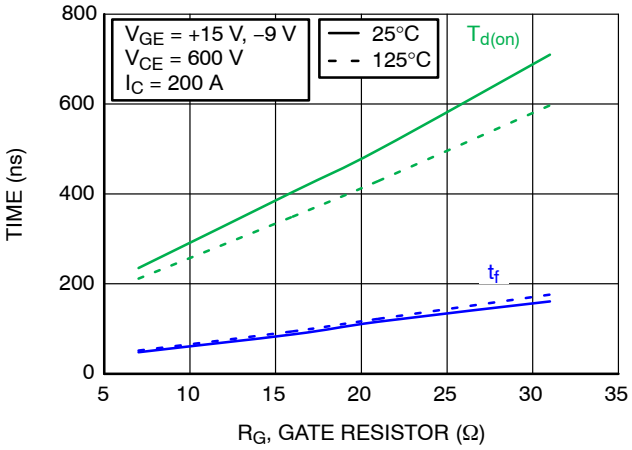



**Figure 26. Typical Turn-On Switching Time vs. $R_G$**

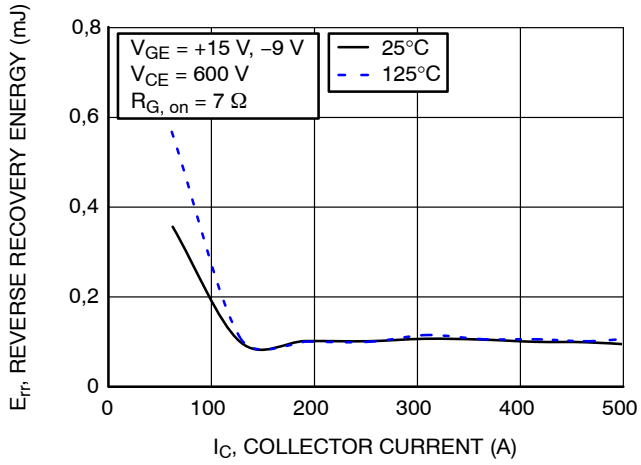



**Figure 27. Typical Reverse Recovery Energy Loss vs. $I_C$**

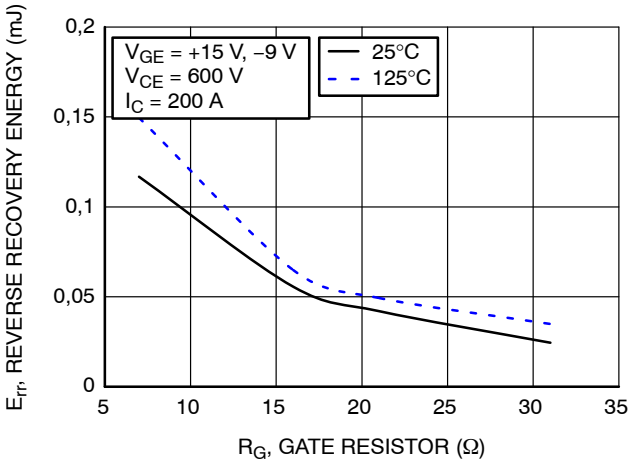



**Figure 28. Typical Reverse Recovery Energy Loss vs. $R_G$**

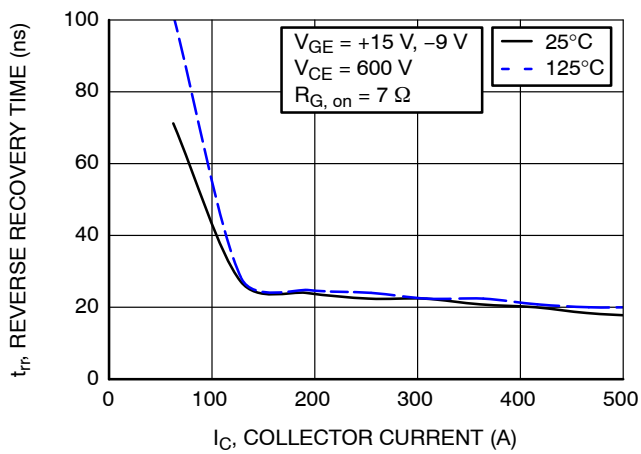



**Figure 29. Typical Reverse Recovery Time vs. $I_C$**

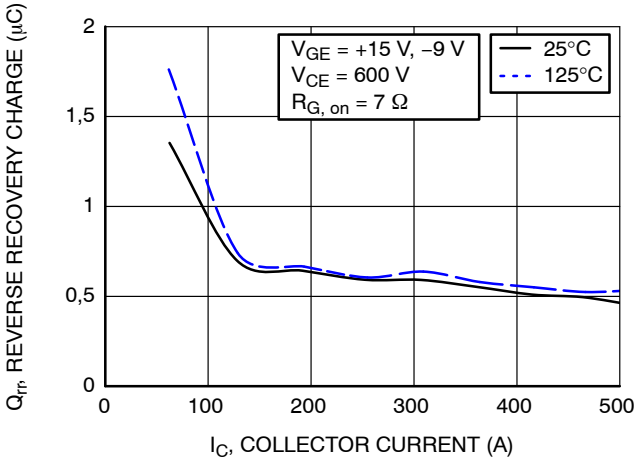



**Figure 30. Typical Reverse Recovery Charge vs. $I_C$**

## TYPICAL CHARACTERISTIC – T1 || D5 OR T4 || D6 (CONTINUED)

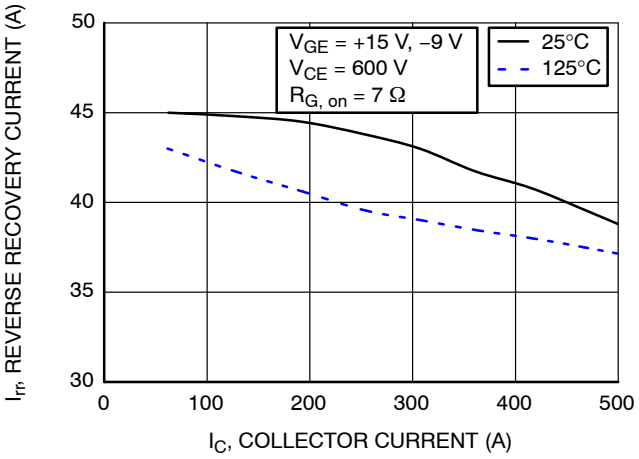



**Figure 31. Typical Reverse Recovery Current vs. $I_C$**

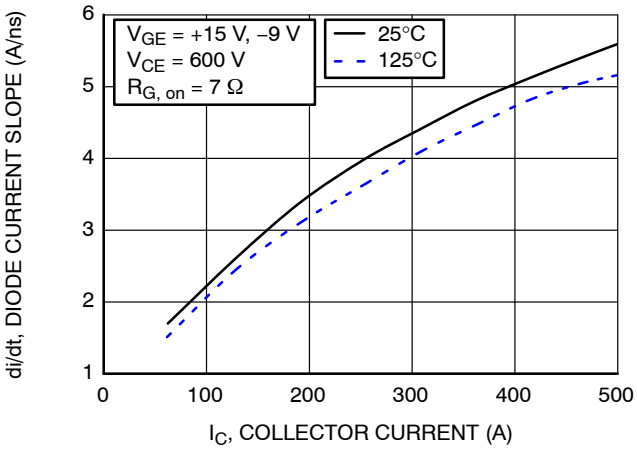



**Figure 32. Typical di/dt vs. $I_C$**

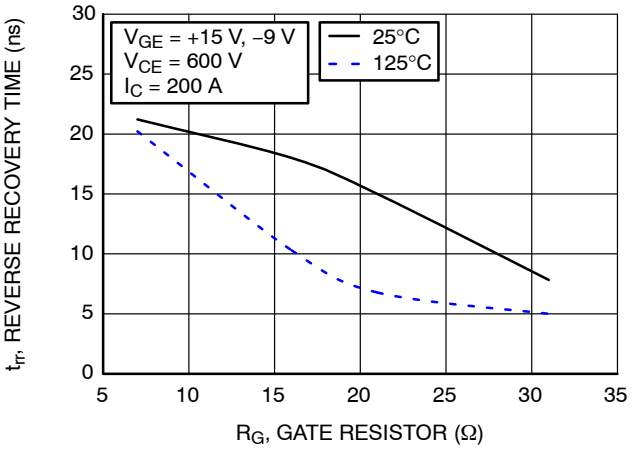



**Figure 33. Typical Reverse Recovery Time vs. $R_G$**

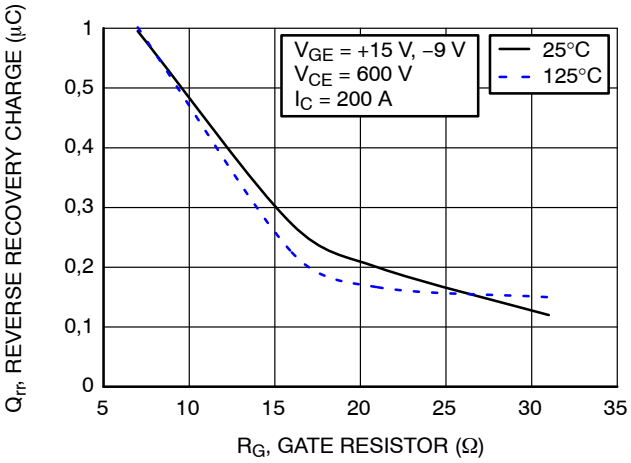



**Figure 34. Typical Reverse Recovery Charge vs. $R_G$**

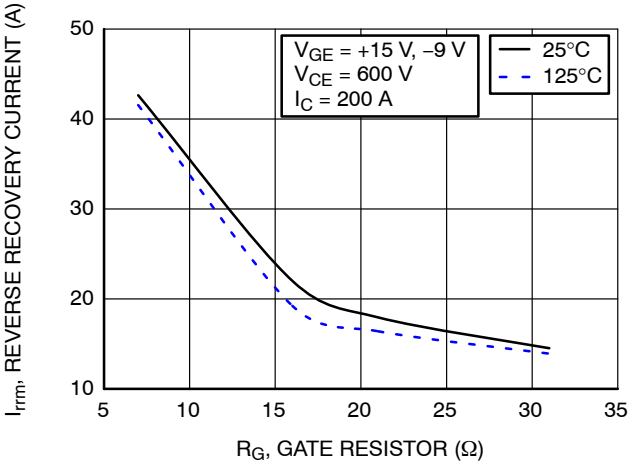



**Figure 35. Typical Reverse Recovery Peak Current vs. $R_G$**

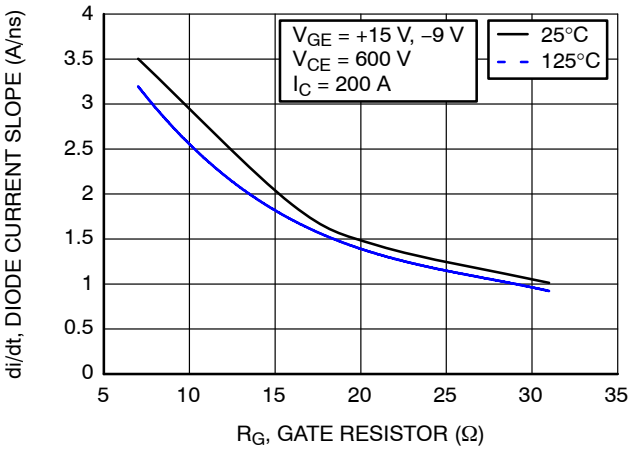



**Figure 36. Typical di/dt vs. $R_G$**

## TYPICAL CHARACTERISTIC – T2 || D3,D4 OR T3 || D1,D2

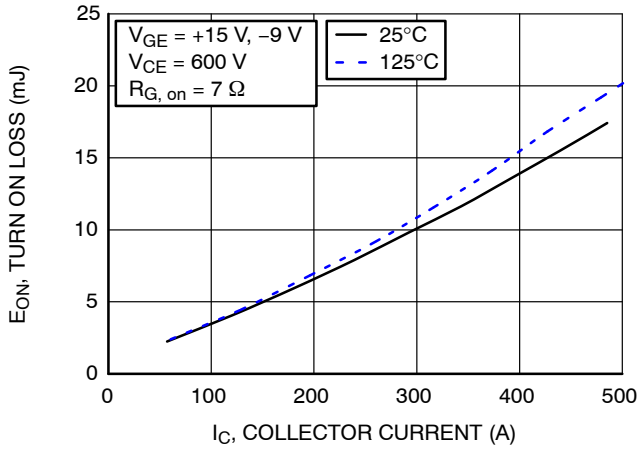



**Figure 37. Typical Turn-On Loss vs. $I_C$**

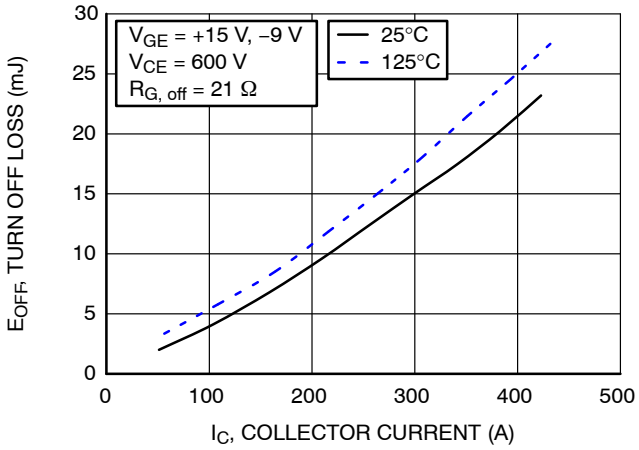



**Figure 38. Typical Turn-Off Loss vs. $I_C$**

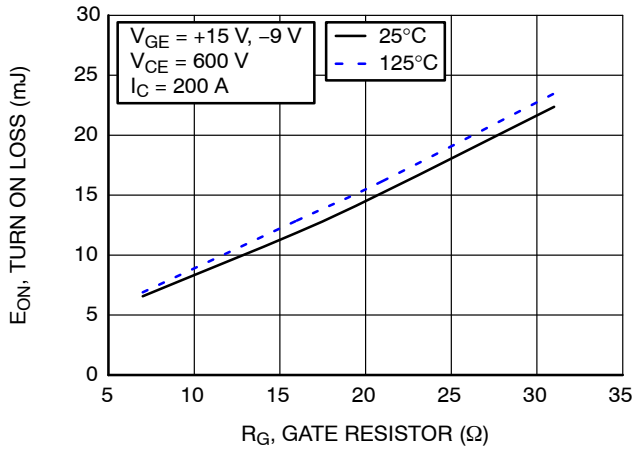



**Figure 39. Typical Turn-On Loss vs. $R_G$**

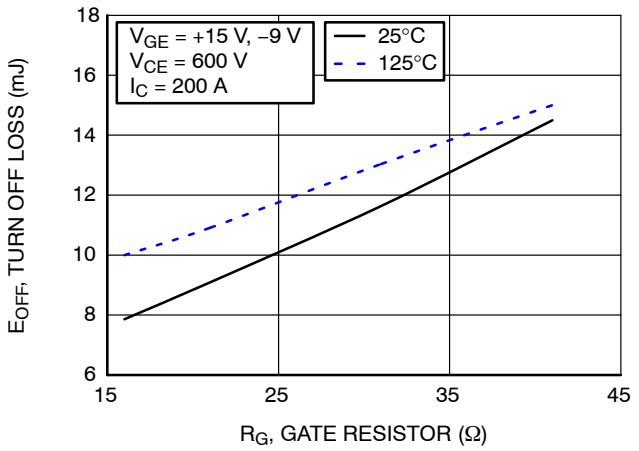



**Figure 40. Typical Turn-Off Loss vs. $R_G$**

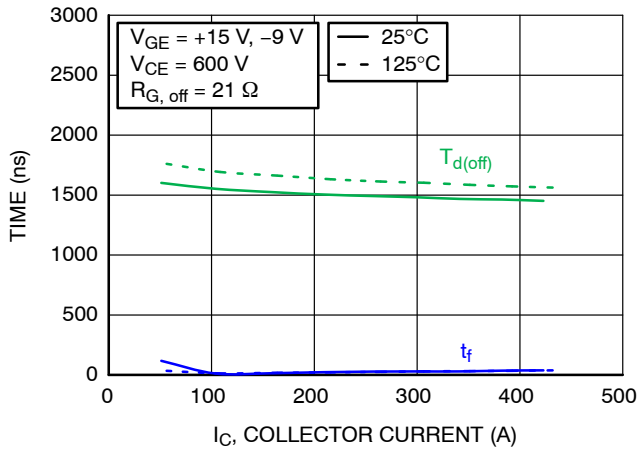



**Figure 41. Typical Turn-Off Switching Time vs. $I_C$**

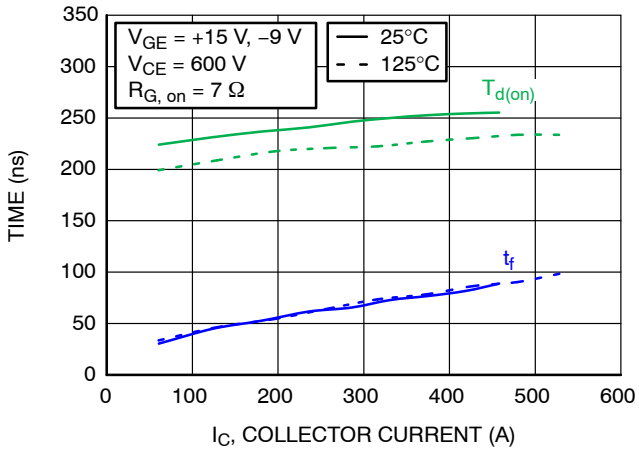



**Figure 42. Typical Turn-On Switching Time vs. $I_C$**

## TYPICAL CHARACTERISTIC – T2 || D3,D4 OR T3 || D1,D2 (CONTINUED)

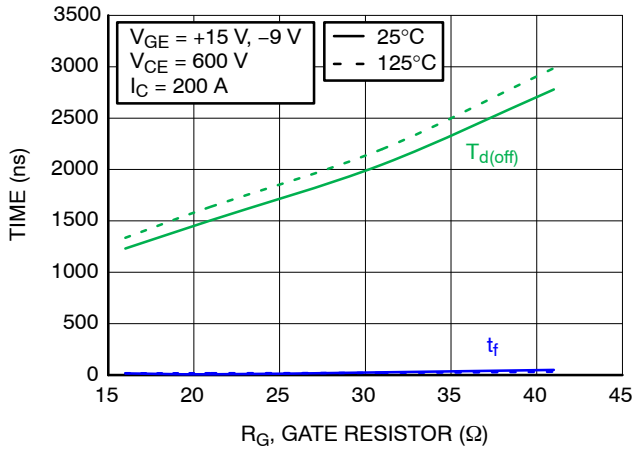



**Figure 43. Typical Turn-Off Switching Time vs. $R_G$**

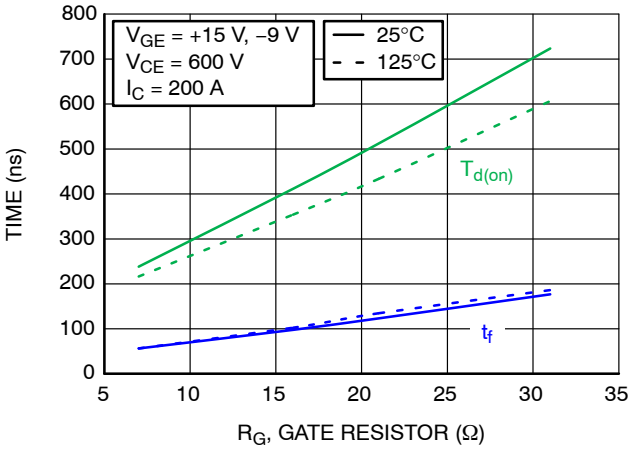



**Figure 44. Typical Turn-On Switching Time vs. $R_G$**

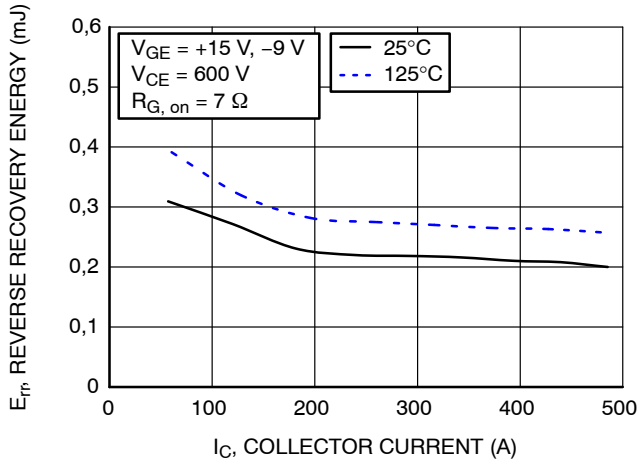



**Figure 45. Typical Reverse Recovery Energy Loss vs. $I_C$**

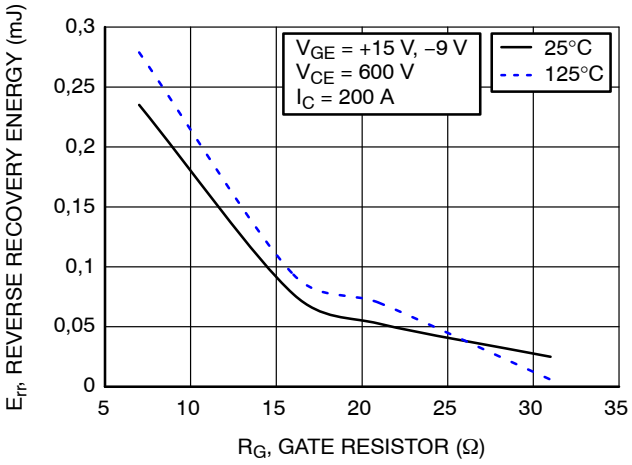



**Figure 46. Typical Reverse Recovery Energy Loss vs. $R_G$**

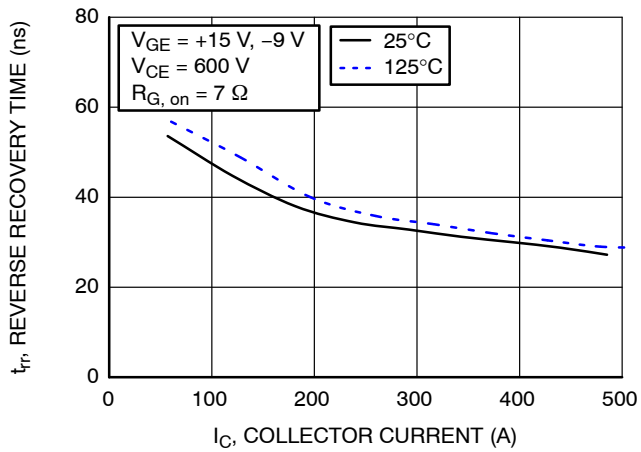



**Figure 47. Typical Reverse Recovery Time vs. $I_C$**

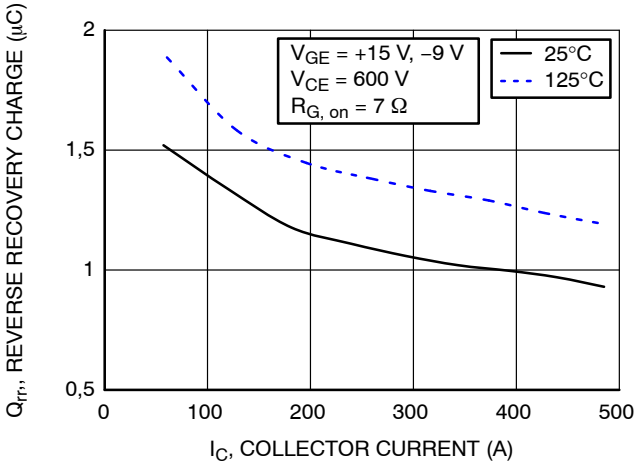



**Figure 48. Typical Reverse Recovery Charge vs. $I_C$**

## TYPICAL CHARACTERISTIC – T2 || D3,D4 OR T3 || D1,D2 (CONTINUED)

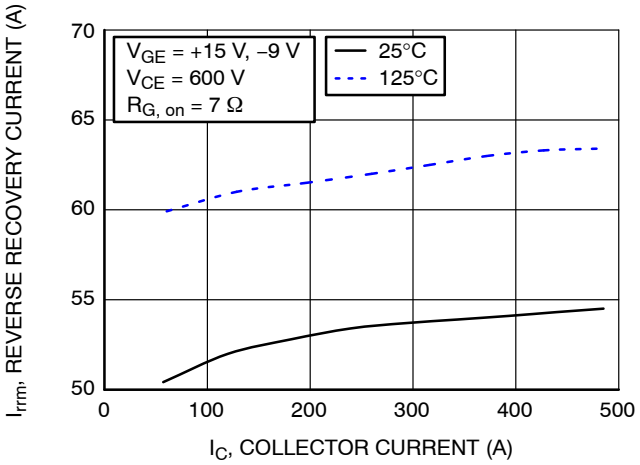



**Figure 49. Typical Reverse Recovery Current vs. $I_C$**

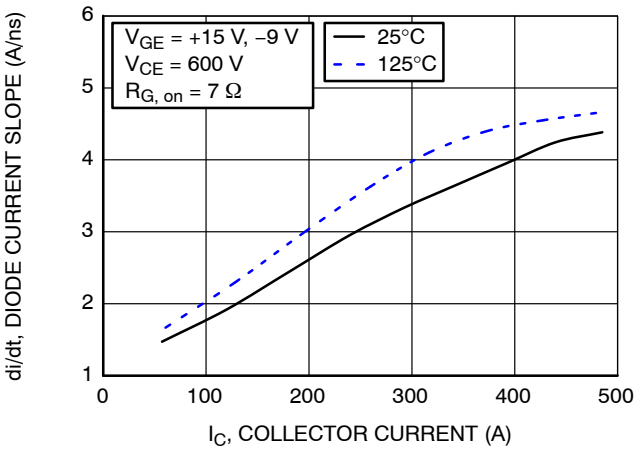



**Figure 50. Typical di/dt vs. $I_C$**

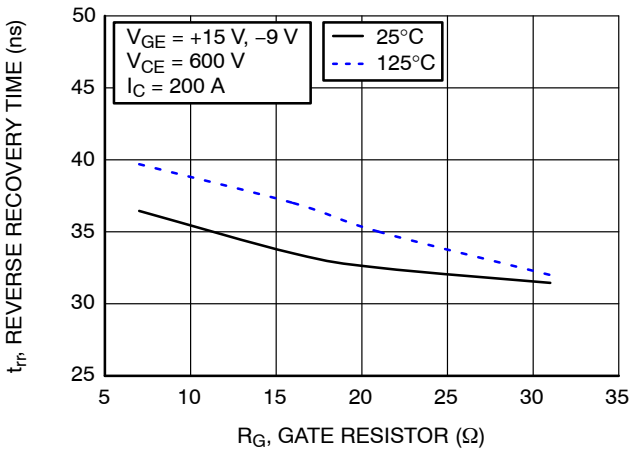



**Figure 51. Typical Reverse Recovery Time vs. $R_G$**

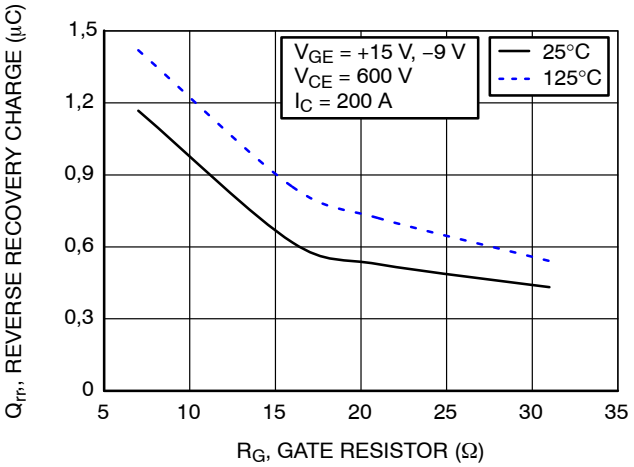



**Figure 52. Typical Reverse Recovery Charge vs. $R_G$**

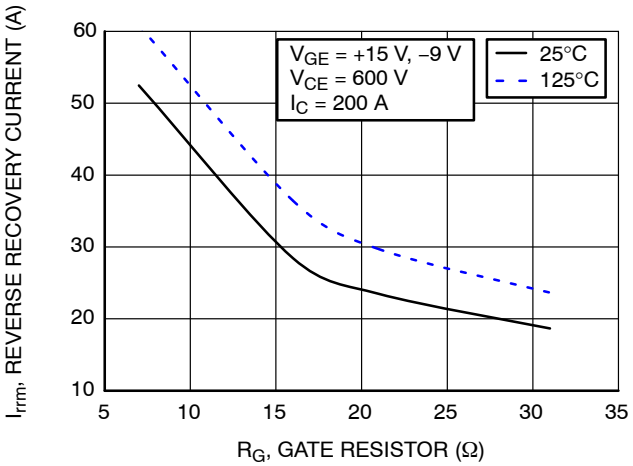



**Figure 53. Typical Reverse Recovery Peak Current vs. $R_G$**

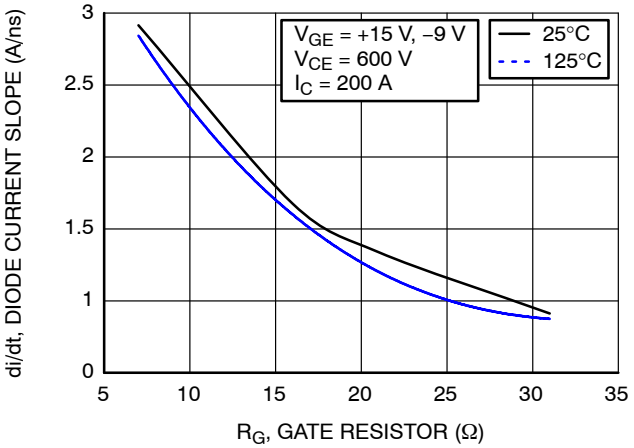
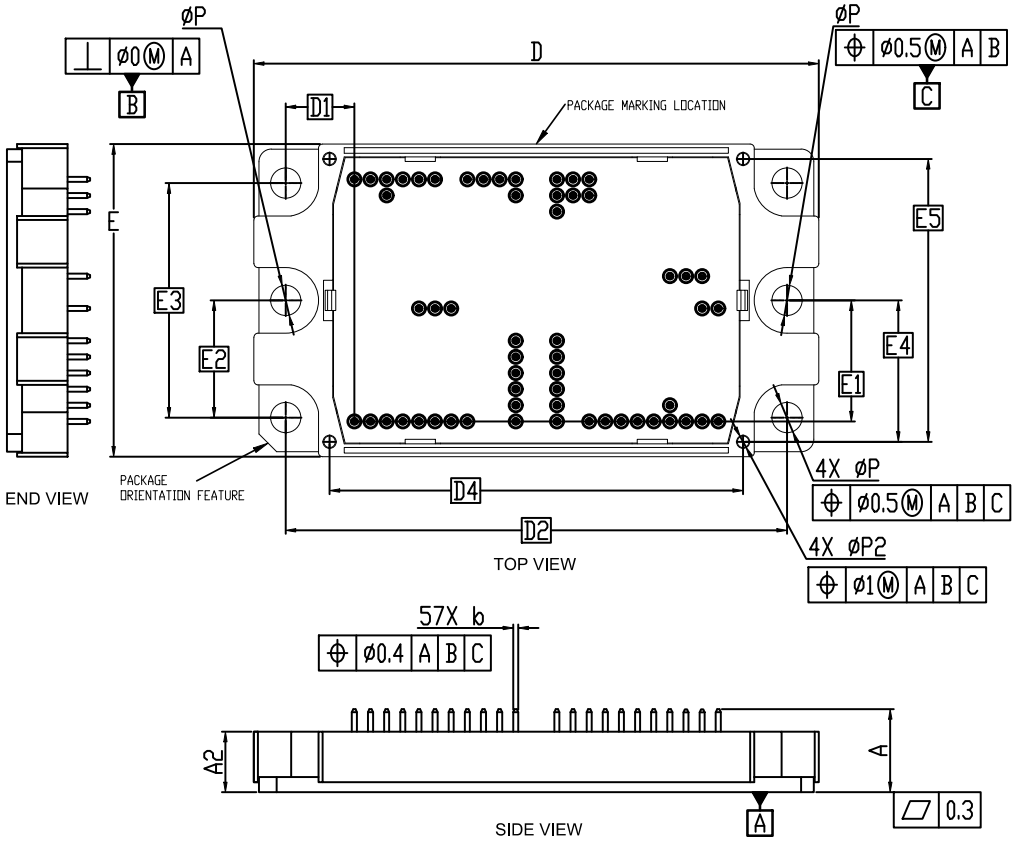



**Figure 54. Typical di/dt vs. $R_G$**

## PACKAGE DIMENSIONS

**PIM57 112.00x62.00x12.00**
CASE 180CV
ISSUE O

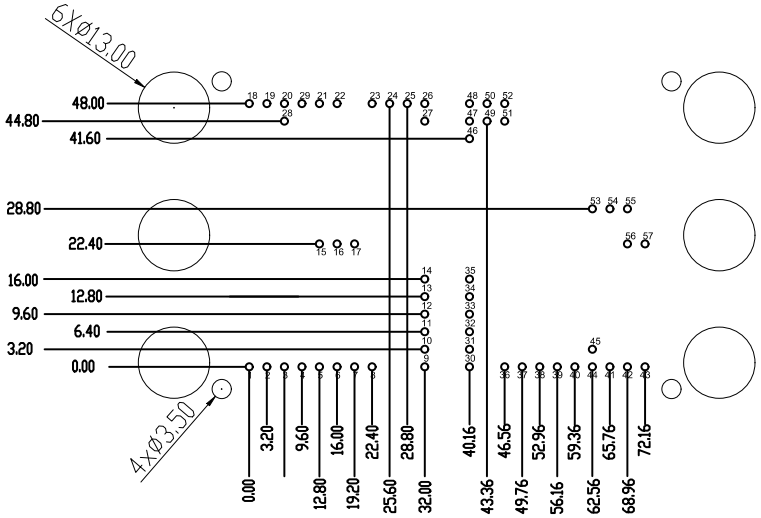
NOTES:
1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Pin-grid is 3.2mm.
4. Package marking is located on the side opposite the package orientation feature.
5. The pins are gold-plated solder pin.




| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 16.10 | 16.50 | 16.90 |
| A2 | 11.70 | 12.00 | 12.30 |
| b | 0.95 | 1.00 | 1.05 |
| D | 111.60 | 112.00 | 112.40 |
| D1 | 13.62 BSC | | |
| D2 | 99.40 BSC | | |
| D4 | 82.00 BSC | | |
| E | 61.60 | 62.00 | 62.40 |
| E1 | 24.00 BSC | | |
| E2 | 23.25 BSC | | |
| E3 | 46.50 BSC | | |
| E4 | 28.05 BSC | | |
| E5 | 56.10 BSC | | |
| P | 5.90 | 6.00 | 6.10 |
| P2 | 2.20 | 2.30 | 2.40 |

## PACKAGE DIMENSIONS

**PIM57 112.00x62.00x12.00**
CASE 180CV
ISSUE O




RECOMMENDED
MOUNTING PATTERN

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

NOTE 2:

| Pin table | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin | X | Y | Pin | X | Y | Pin | X | Y |
| 1 | 0 | 0 | 23 | 22.4 | 48 | 45 | 62.56 | 3.2 |
| 2 | 3.2 | 0 | 24 | 25.6 | 48 | 46 | 40.16 | 41.6 |
| 3 | 6.4 | 0 | 25 | 28.8 | 48 | 47 | 40.16 | 44.8 |
| 4 | 9.6 | 0 | 26 | 32 | 48 | 48 | 40.16 | 48 |
| 5 | 12.8 | 0 | 27 | 32 | 44.8 | 49 | 43.36 | 44.8 |
| 6 | 16 | 0 | 28 | 6.4 | 44.8 | 50 | 43.36 | 48 |
| 7 | 19.2 | 0 | 29 | 9.6 | 48 | 51 | 46.56 | 44.8 |
| 8 | 22.4 | 0 | 30 | 40.16 | 0 | 52 | 46.56 | 48 |
| 9 | 32 | 0 | 31 | 40.16 | 3.2 | 53 | 62.56 | 28.8 |
| 10 | 32 | 3.2 | 32 | 40.16 | 6.4 | 54 | 65.76 | 28.8 |
| 11 | 32 | 6.4 | 33 | 40.16 | 9.6 | 55 | 68.96 | 28.8 |
| 12 | 32 | 9.6 | 34 | 40.16 | 12.8 | 56 | 68.96 | 22.4 |
| 13 | 32 | 12.8 | 35 | 40.16 | 16 | 57 | 72.16 | 22.4 |
| 14 | 32 | 16 | 36 | 46.56 | 0 | | | |
| 15 | 12.8 | 22.4 | 37 | 49.76 | 0 | | | |
| 16 | 16 | 22.4 | 38 | 52.96 | 0 | | | |
| 17 | 19.2 | 22.4 | 39 | 56.16 | 0 | | | |
| 18 | 0 | 48 | 40 | 59.36 | 0 | | | |
| 19 | 3.2 | 48 | 41 | 65.76 | 0 | | | |
| 20 | 6.4 | 48 | 42 | 68.96 | 0 | | | |
| 21 | 12.8 | 48 | 43 | 72.16 | 0 | | | |
| 22 | 16 | 48 | 44 | 62.56 | 0 | | | |

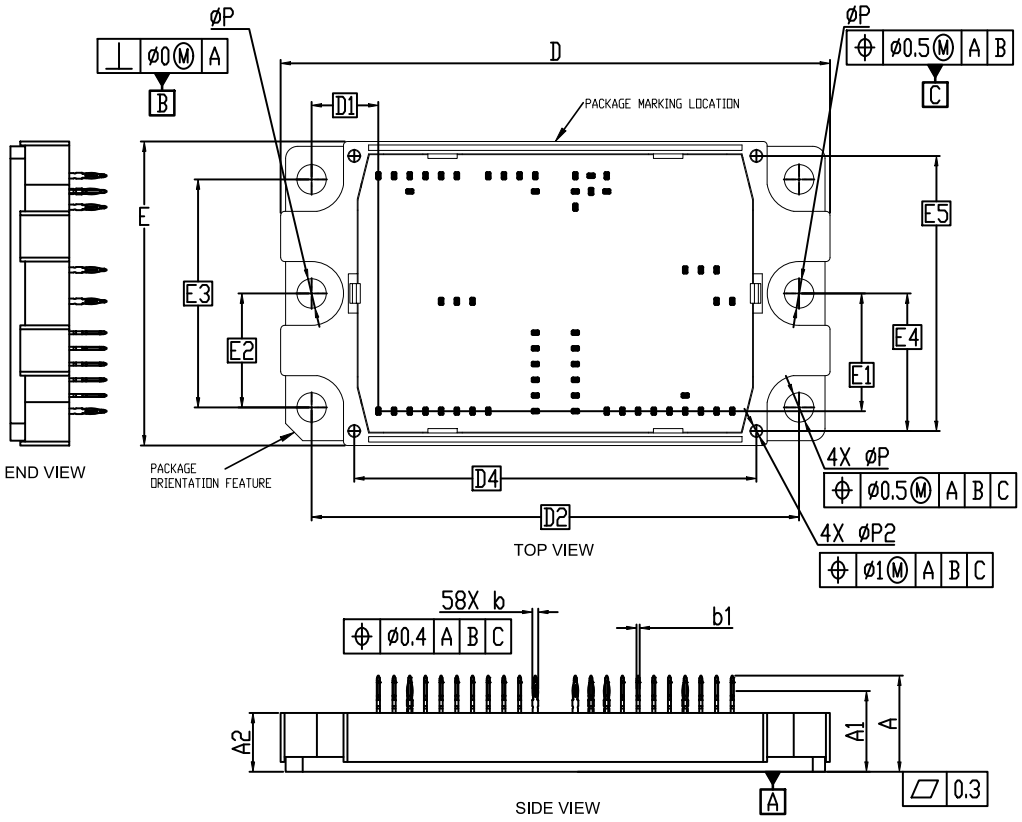
## PACKAGE DIMENSIONS

**PIM57 112.00x62.00x12.00**
CASE 180JC
ISSUE O

NOTES:

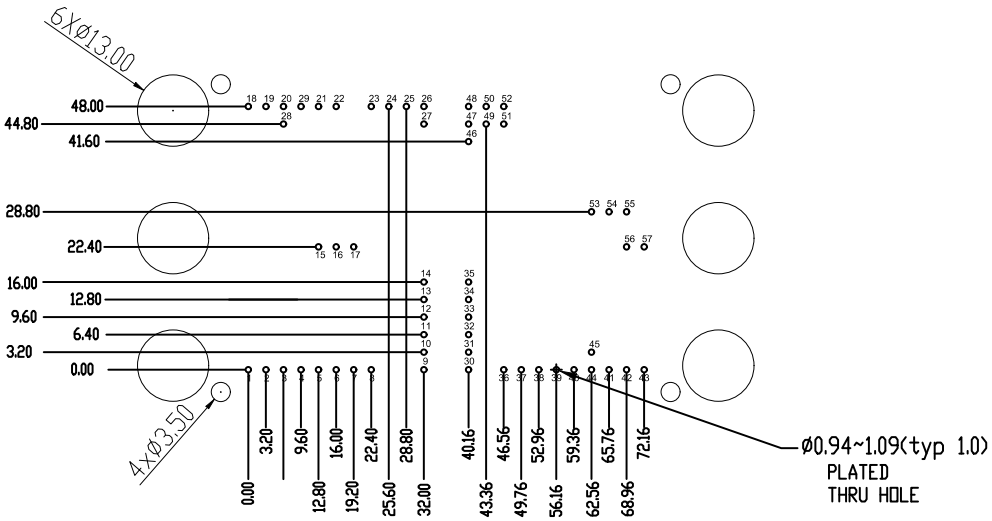
1. Dimensioning and tolerancing conform to ASME Y14.5
2. All dimensions are in millimeters.
3. Dimensions b and b1 apply to the plated terminals and are measured at dimension A1
4. Pin-grid is 3.2mm.
5. Package marking is located on the side opposite the package orientation feature.
6. The pins are Sn plated press fit pin.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 19.20 | 19.60 | 20.00 |
| A1 | 16.25 | 16.45 | 16.65 |
| A2 | 11.70 | 12.00 | 12.30 |
| b | 1.15 | 1.20 | 1.25 |
| b1 | 0.59 | 0.64 | 0.69 |
| D | 111.60 | 112.00 | 112.40 |
| D1 | 13.62 BSC | | |
| D2 | 99.40 BSC | | |
| D4 | 82.00 BSC | | |
| E | 61.60 | 62.00 | 62.40 |
| E1 | 24.00 BSC | | |
| E2 | 23.25 BSC | | |
| E3 | 46.50 BSC | | |
| E4 | 28.05 BSC | | |
| E5 | 56.10 BSC | | |
| P | 5.90 | 6.00 | 6.10 |
| P2 | 2.20 | 2.30 | 2.40 |



## PACKAGE DIMENSIONS

**PIM57 112.00x62.00x12.00**
CASE 180JC
ISSUE O




RECOMMENDED
MOUNTING PATTERN

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

NOTE 2:

| Pin table | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pin | X | Y | Pin | X | Y | Pin | X | Y |
| 1 | 0 | 0 | 23 | 22.4 | 48 | 45 | 62.56 | 3.2 |
| 2 | 3.2 | 0 | 24 | 25.6 | 48 | 46 | 40.16 | 41.6 |
| 3 | 6.4 | 0 | 25 | 28.8 | 48 | 47 | 40.16 | 44.8 |
| 4 | 9.6 | 0 | 26 | 32 | 48 | 48 | 40.16 | 48 |
| 5 | 12.8 | 0 | 27 | 32 | 44.8 | 49 | 43.36 | 44.8 |
| 6 | 16 | 0 | 28 | 6.4 | 44.8 | 50 | 43.36 | 48 |
| 7 | 19.2 | 0 | 29 | 9.6 | 48 | 51 | 46.56 | 44.8 |
| 8 | 22.4 | 0 | 30 | 40.16 | 0 | 52 | 46.56 | 48 |
| 9 | 32 | 0 | 31 | 40.16 | 3.2 | 53 | 62.56 | 28.8 |
| 10 | 32 | 3.2 | 32 | 40.16 | 6.4 | 54 | 65.76 | 28.8 |
| 11 | 32 | 6.4 | 33 | 40.16 | 9.6 | 55 | 68.96 | 28.8 |
| 12 | 32 | 9.6 | 34 | 40.16 | 12.8 | 56 | 68.96 | 22.4 |
| 13 | 32 | 12.8 | 35 | 40.16 | 16 | 57 | 72.16 | 22.4 |
| 14 | 32 | 16 | 36 | 46.56 | 0 | | | |
| 15 | 12.8 | 22.4 | 37 | 49.76 | 0 | | | |
| 16 | 16 | 22.4 | 38 | 52.96 | 0 | | | |
| 17 | 19.2 | 22.4 | 39 | 56.16 | 0 | | | |
| 18 | 0 | 48 | 40 | 59.36 | 0 | | | |
| 19 | 3.2 | 48 | 41 | 65.76 | 0 | | | |
| 20 | 6.4 | 48 | 42 | 68.96 | 0 | | | |
| 21 | 12.8 | 48 | 43 | 72.16 | 0 | | | |
| 22 | 16 | 48 | 44 | 62.56 | 0 | | | |

## REVISION HISTORY

| Revision | Description of Changes | Date |
|---|---|---|
| P6 | Update of Pin Connections picture on p.1, Addition of the 2nd page of the 180CV Case outline. | 8/6/2025 |
| P7 | Addition of the NXH600N105H7F5P1HG part to the data sheet and addition of the related 180JC Case outline. | 8/12/2025 |

This document has undergone updates prior to the inclusion of this revision history table. The changes tracked here only reflect updates made on the noted approval dates.

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