# NXH25T120L2Q1PG

## Q1 3-Phase TNPC Module

The NXH25T120L2Q1PG/PTG is a case power module containing a three channel T−type neutral−point clamped (TNPC) circuit. Each channel has a two 1200 V, 25 A IGBTs with inverse diodes and two 650 V, 20 A IGBTs with inverse diodes. The module contains an NTC thermistor.

### Features

- Low Package Height
- Compact 82.5 mm x 37.4 mm x 12 mm Package
- Press−fit Pins
- Options with Pre−applied Thermal Interface Material (TIM) and Without Pre−applied TIM
- Thermistor

### Typical Applications

- Solar Inverters
- UPS

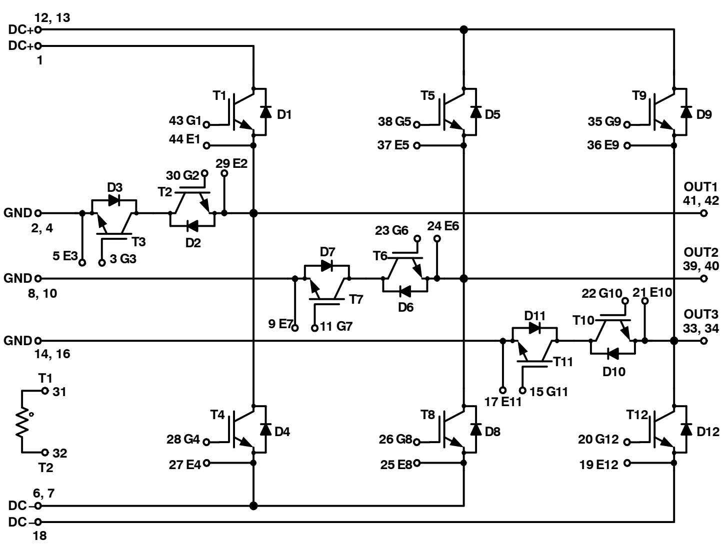


**Figure 1. NXH25T120L2Q1PG/PTG Schematic Diagram**

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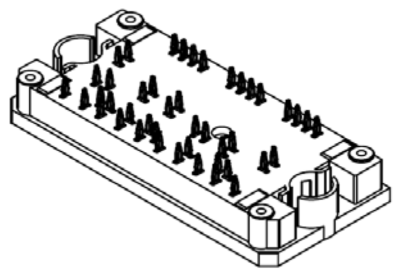
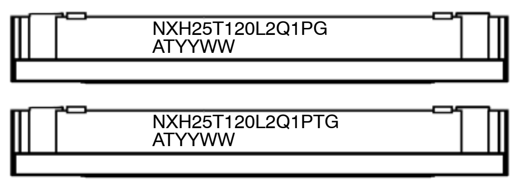


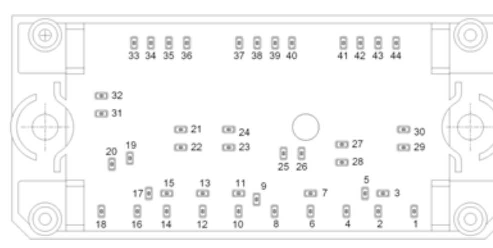
**Q1 3−TNPC**
**PRESS FIT**
**CASE 180AS**

### DEVICE MARKING




NXH25T120L2Q1P or
NXH25T120L2Q1PT
= Specific Device Code
G = Pb−Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

### PIN ASSIGNMENTS



### ORDERING INFORMATION

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





October, 2018 − Rev. 0

Publication Order Number:
NXH25T120L2Q1PG/D

**Table 1. MAXIMUM RATINGS** (Note 1)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **HALF BRIDGE IGBT** | | | |
| Collector−Emitter Voltage | $V_{CES}$ | 1200 | V |
| Gate−Emitter Voltage | $V_{GE}$ | ±20 | V |
| Continuous Collector Current @ $T_c$ = 80°C ($T_J$ = 175°C) | $I_C$ | 25 | A |
| Pulsed Collector Current ($T_J$ = 175°C) | $I_{Cpulse}$ | 75 | A |
| Maximum Power Dissipation ($T_J$ = 175°C) | $P_{tot}$ | 81 | W |
| Short Circuit Withstand Time @ $V_{GE}$ = 15 V, $V_{CE}$ = 600 V, $T_J \leq$ 150°C | $T_{sc}$ | 5 | μs |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 150 | °C |
| **NEUTRAL POINT IGBT** | | | |
| Collector−Emitter Voltage | $V_{CES}$ | 650 | V |
| Gate−Emitter Voltage | $V_{GE}$ | ±20 | V |
| Continuous Collector Current @ $T_c$ = 80°C ($T_J$ = 175°C) | $I_C$ | 20 | A |
| Pulsed Collector Current ($T_J$ = 175°C) | $I_{Cpulse}$ | 60 | A |
| Maximum Power Dissipation ($T_J$ = 175°C) | $P_{tot}$ | 50 | W |
| Short Circuit Withstand Time @ $V_{GE}$ = 15 V, $V_{CE}$ = 400 V, $T_J \leq$ 150°C | $T_{sc}$ | 5 | μs |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 150 | °C |
| **HALF BRIDGE DIODE** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ $T_c$ = 80°C ($T_J$ = 175°C) | $I_F$ | 15 | A |
| Repetitive Peak Forward Current ($T_J$ = 175°C) | $I_{FRM}$ | 45 | A |
| Maximum Power Dissipation ($T_J$ = 175°C) | $P_{tot}$ | 43 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 150 | °C |
| **NEUTRAL POINT DIODE** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 650 | V |
| Continuous Forward Current @ $T_c$ = 80°C ($T_J$ = 175°C) | $I_F$ | 15 | A |
| Repetitive Peak Forward Current ($T_J$ = 175°C) | $I_{FRM}$ | 45 | A |
| Maximum Power Dissipation ($T_J$ = 175°C) | $P_{tot}$ | 39 | W |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 150 | °C |
| **THERMAL PROPERTIES** | | | |
| Storage Temperature range | $T_{stg}$ | −40 to 125 | °C |
| **INSULATION PROPERTIES** | | | |
| Isolation test voltage, t = 1 sec, 60Hz | $V_{is}$ | 3000 | $V_{RMS}$ |
| Creepage distance | | 12.7 | mm |

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 |
|---|---|---|---|---|---|---|
| **HALF BRIDGE IGBT CHARACTERISTICS** | | | | | | |
| Collector−Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V | $I_{CES}$ | – | – | 300 | μA |
| Collector−Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 25 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 1.90 | 2.50 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 25 A, $T_J$ = 125°C | | – | 1.96 | – | |
| Gate−Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 1.5 mA | $V_{GE(TH)}$ | 4.90 | 5.49 | 6.50 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 300 | nA |
| Turn−on Delay Time | $T_J$ = 25°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{d(on)}$ | – | 59 | – | ns |
| Rise Time | | $t_r$ | – | 26 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 242 | – | |
| Fall Time | | $t_f$ | – | 52 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 220 | – | μJ |
| Turn off Switching Loss per Pulse | | $E_{off}$ | – | 240 | – | |
| Turn−on Delay Time | $T_J$ = 125°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{d(on)}$ | – | 48 | – | ns |
| Rise Time | | $t_r$ | – | 29 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 293 | – | |
| Fall Time | | $t_f$ | – | 258 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 400 | – | μJ |
| Turn off Switching Loss per Pulse | | $E_{off}$ | – | 710 | – | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V. f = 10 kHz | $C_{ies}$ | – | 8502 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 187 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 154 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 25 A, $V_{GE}$ = ±15 V | $Q_g$ | – | 352 | – | nC |
| Thermal Resistance − chip−to−heatsink | Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK | $R_{thJH}$ | – | 1.17 | – | °C/W |
| **NEUTRAL POINT DIODE CHARACTERISTICS** | | | | | | |
| Diode Forward Voltage | $I_F$ = 15 A, $T_J$ = 25°C | $V_F$ | – | 2.43 | – | V |
| | $I_F$ = 15 A, $T_J$ = 125°C | | – | 1.60 | – | |
| Combined IGBT + Diode Voltage Drop | $I_F$ = 15 A, $T_J$ = 25°C | $V_{DT}$ | – | 3.76 | 4.60 | V |
| Reverse Recovery Time | $T_J$ = 25°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{rr}$ | – | 59 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 0.21 | – | μC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 7 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 106 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 40 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{rr}$ | – | 67 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 0.69 | – | μC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 19 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 451 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 100 | – | μJ |
| Thermal Resistance − chip−to−heatsink | Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK | $R_{thJH}$ | – | 2.45 | – | °C/W |

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

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **NEUTRAL POINT IGBT CHARACTERISTICS** | | | | | | |
| Collector−Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V | $I_{CES}$ | – | – | 200 | μA |
| Collector−Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 20 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 1.49 | – | V |
| | $V_{GE}$ = 15 V, $I_C$ = 20 A, $T_J$ = 125°C | | – | 1.61 | – | |
| Gate−Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 1.65 mA | $V_{GE(TH)}$ | 4.70 | 5.68 | 6.50 | V |
| Gate Leakage Current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 200 | nA |
| Turn−on Delay Time | $T_J$ = 25°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15V, $R_G$ = 15 Ω | $t_{d(on)}$ | – | 33 | – | ns |
| Rise Time | | $t_r$ | – | 18 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 126 | – | |
| Fall Time | | $t_f$ | – | 43 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 250 | – | μJ |
| Turn off Switching Loss per Pulse | | $E_{off}$ | – | 180 | – | |
| Turn−on Delay Time | $T_J$ = 125°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{d(on)}$ | – | 31 | – | ns |
| Rise Time | | $t_r$ | – | 19 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 138 | – | |
| Fall Time | | $t_f$ | – | 72 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 390 | – | uJ |
| Turn off Switching Loss per Pulse | | $E_{off}$ | – | 300 | – | |
| Input Capacitance | $V_{CE}$ = 20 V, $V_{GE}$ = 0 V, f = 10 kHz | $C_{ies}$ | – | 3837 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 127 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 104 | – | |
| Total Gate Charge | $V_{CE}$ = 480 V, $I_C$ = 20 A, $V_{GE}$ = ±15 V | $Q_g$ | – | 166 | – | nC |
| Thermal Resistance − chip−to−heatsink | Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK | $R_{thJH}$ | – | 1.90 | – | °C/W |
| **HALF BRIDGE DIODE CHARACTERISTICS** | | | | | | |
| Diode Forward Voltage | $I_F$ = 15 A, $T_J$ = 25°C | $V_F$ | – | 2.47 | 3 | V |
| | $I_F$ = 15 A, $T_J$ = 125°C | | – | 1.97 | – | |
| Reverse Recovery Time | $T_J$ = 25°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{rr}$ | – | 63 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 0.45 | – | μC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 17 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 313 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 70 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125°C<br>$V_{CE}$ = 350 V, $I_C$ = 15 A<br>$V_{GE}$ = ±15 V, $R_G$ = 15 Ω | $t_{rr}$ | – | 233 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 1.55 | – | μC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 22 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 76 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 360 | – | μJ |
| Thermal Resistance − chip−to−heatsink | Thermal grease, Thickness ≤ 2.25 Mil, λ = 2.9 W/mK | $R_{thJH}$ | – | 2.21 | – | °C/W |

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

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **THERMISTOR CHARACTERISTICS** | | | | | | |
| Nominal resistance | T = 25°C | $R_{25}$ | – | 22 | – | kΩ |
| Nominal resistance | T = 100°C | $R_{100}$ | – | 1468 | – | 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 |

## ORDERING INFORMATION

| Orderable Part Number | Marking | Package | Shipping |
|---|---|---|---|
| NXH25T120L2Q1PG | NXH25T120L2Q1PG | Q1 3−Phase TNPC − Case 180AS<br>Press−fit Pins<br>(Pb − Free) | 21 Units / Blister Tray |
| NXH25T120L2Q1PTG | NXH25T120L2Q1PTG | Q1 3−Phase TNPC − Case 180AS<br>Press−fit Pins<br>with pre−applied thermal interface material (TIM)<br>(Pb − Free) | 21 Units / Blister Tray |

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT AND DIODE

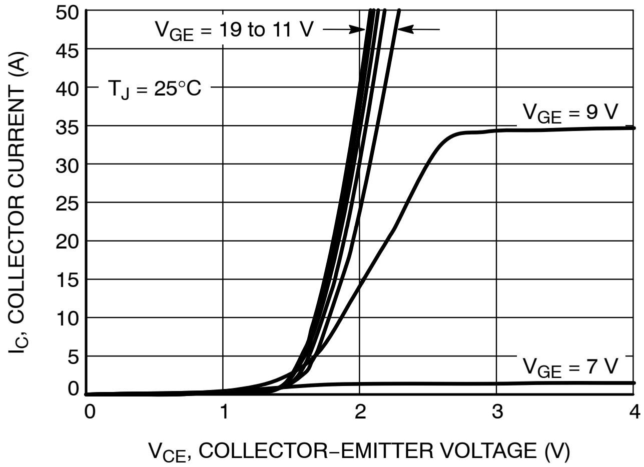



**Figure 2. Typical Output Characteristics**

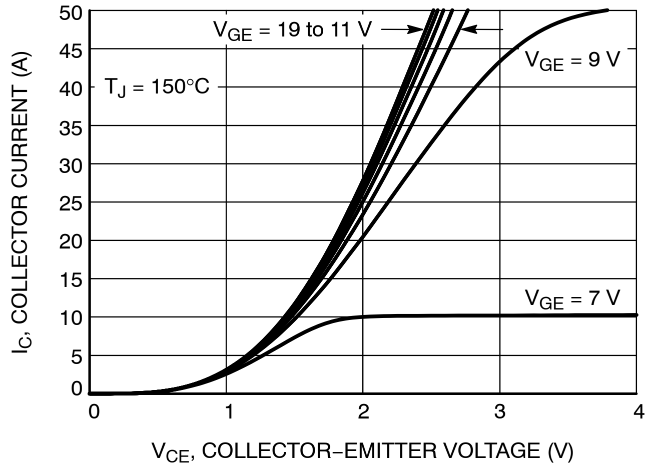



**Figure 3. Typical Output Characteristics**

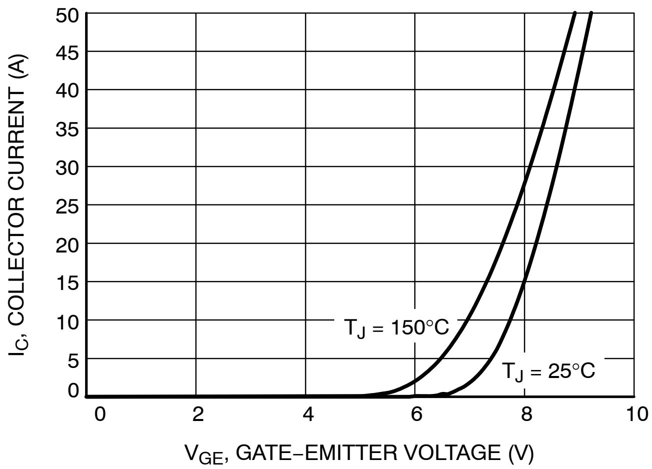



**Figure 4. Typical Transfer Characteristics**

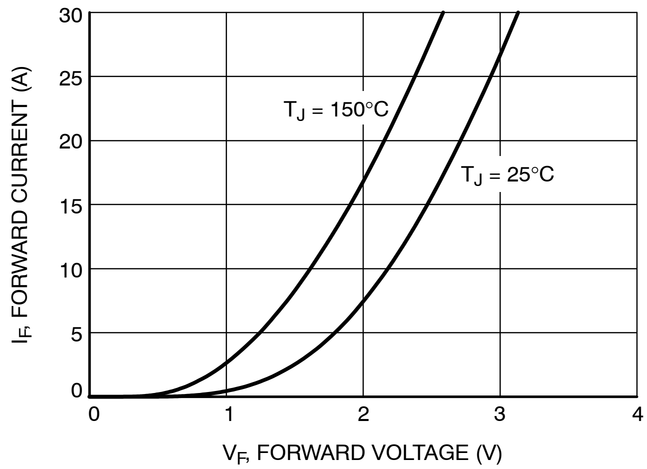



**Figure 5. Diode Forward Characteristics**

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT AND DIODE

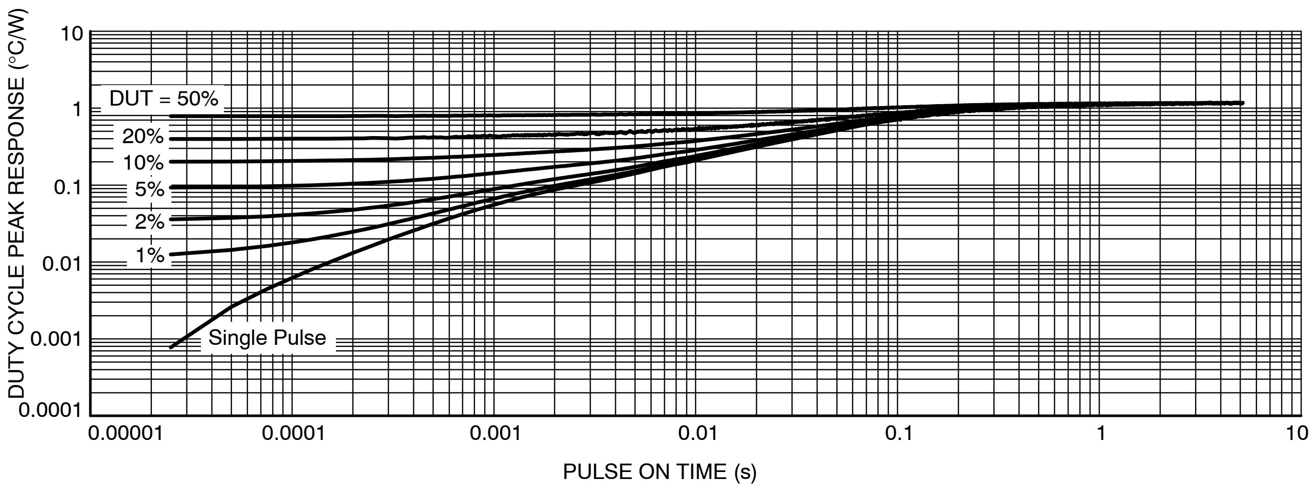



**Figure 6. Transient Thermal Impedance (Half Bridge IGBT)**

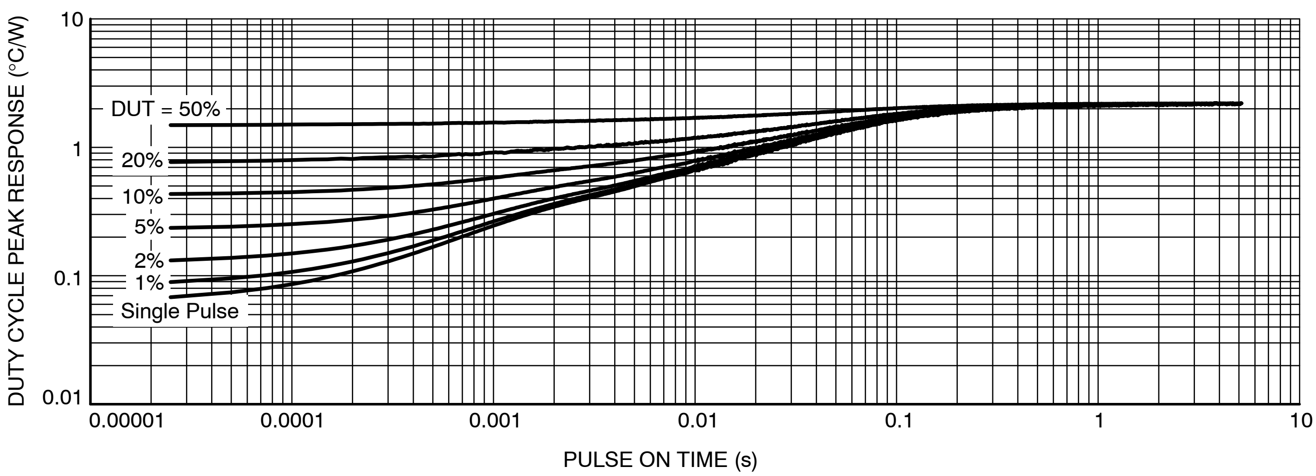



**Figure 7. Transient Thermal Impedance (Half Bridge Diode)**

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT AND DIODE

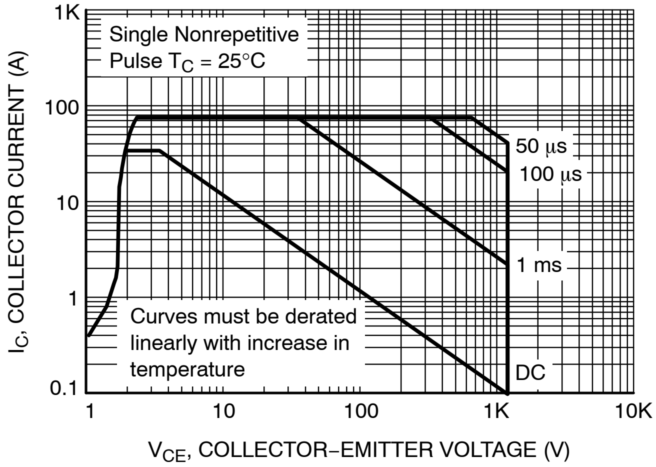



**Figure 8. FBSOA**

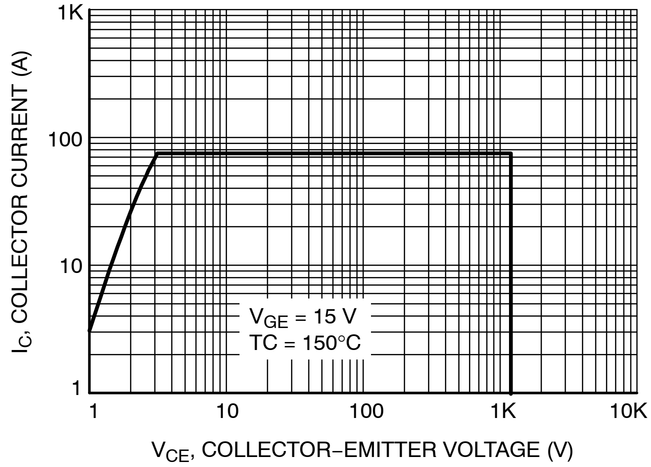



**Figure 9. RBSOA**

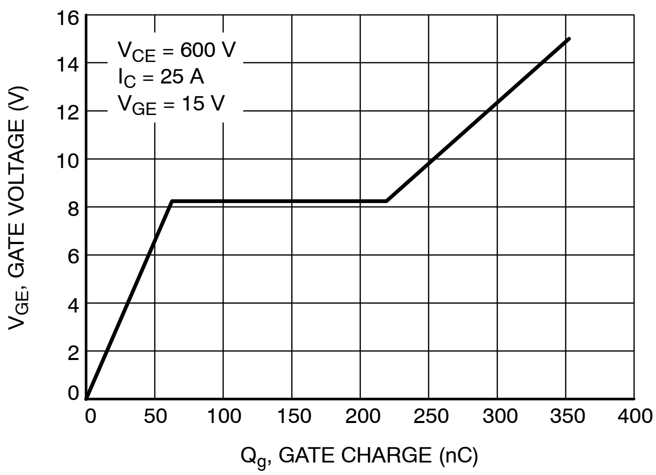



**Figure 10. Gate Voltage vs. Gate Charge**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT AND DIODE

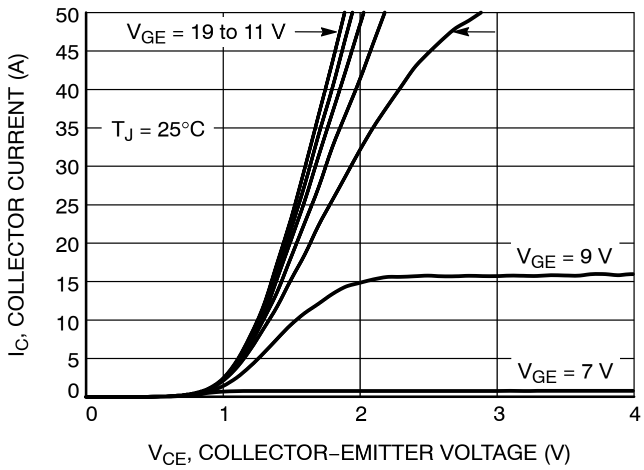



**Figure 11. Typical Output Characteristics**

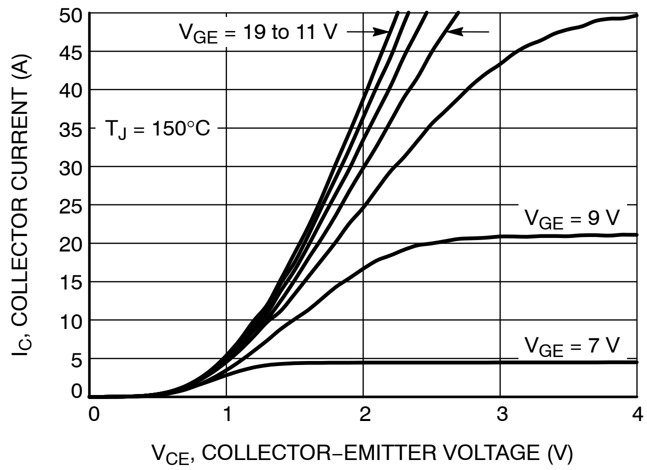



**Figure 12. Typical Output Characteristics**

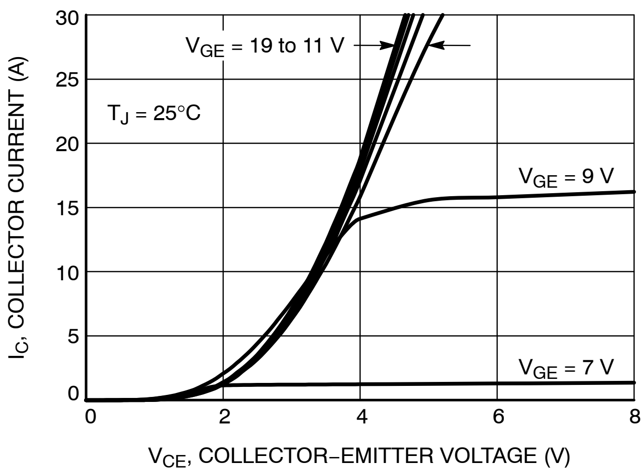



**Figure 13. Typical Output Characteristics ($I_C$ vs. $V_{DT}$)**

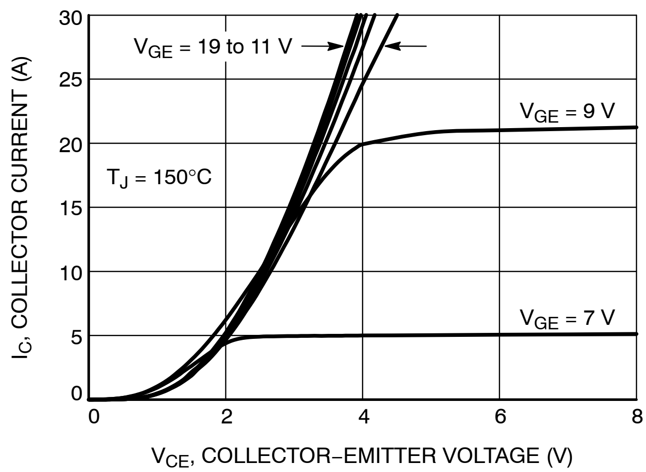



**Figure 14. Typical Output Characteristics ($I_C$ vs. $V_{DT}$)**

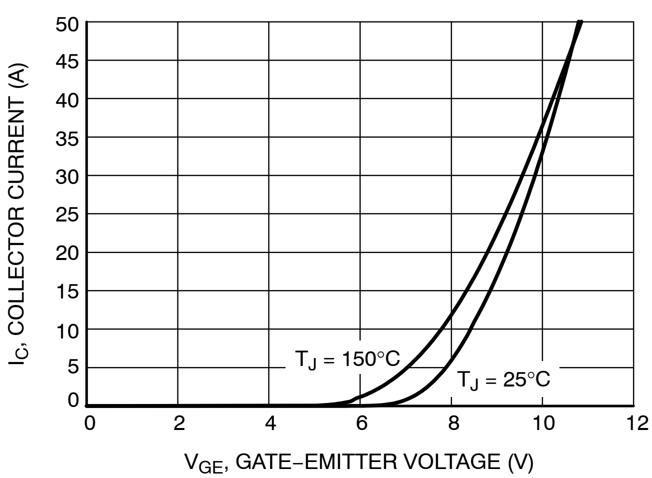



**Figure 15. Typical Transfer Characteristics**

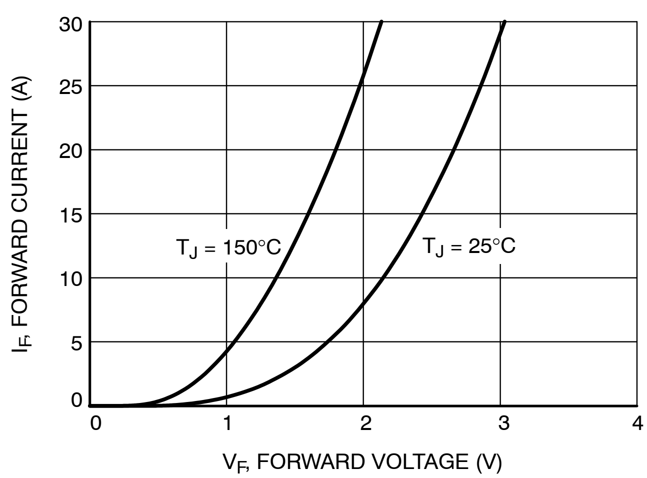



**Figure 16. Diode Forward Characteristics**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT AND DIODE

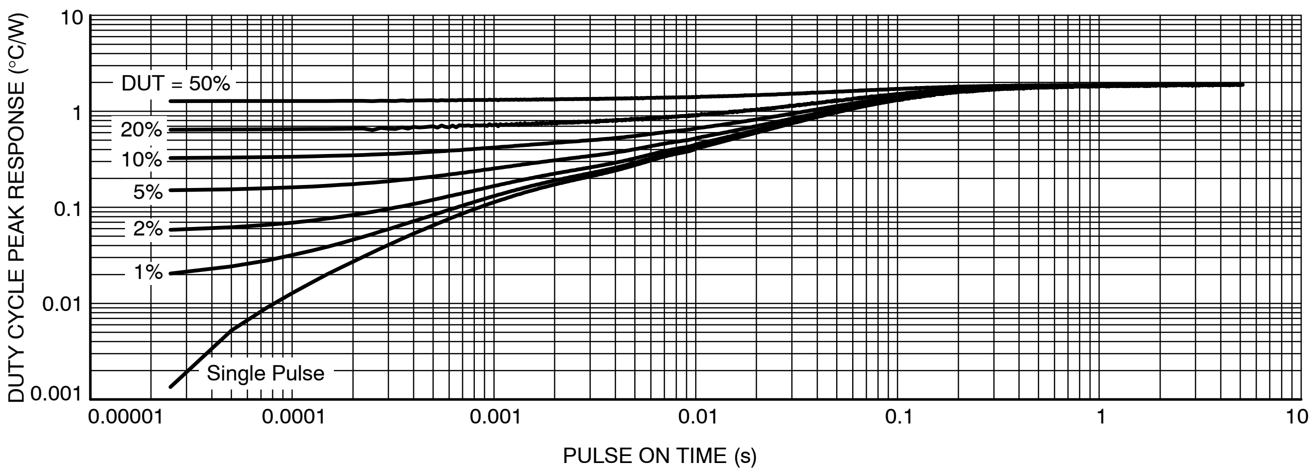



**Figure 17. Transient Thermal Impedance (Neutral Point IGBT)**

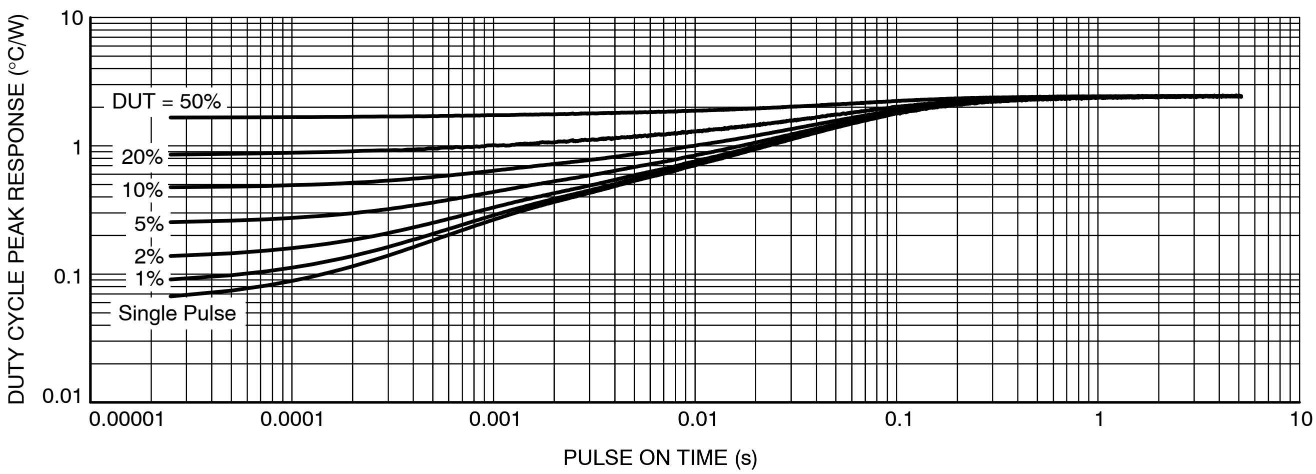



**Figure 18. Transient Thermal Impedance (Neutral Point Diode)**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT AND DIODE

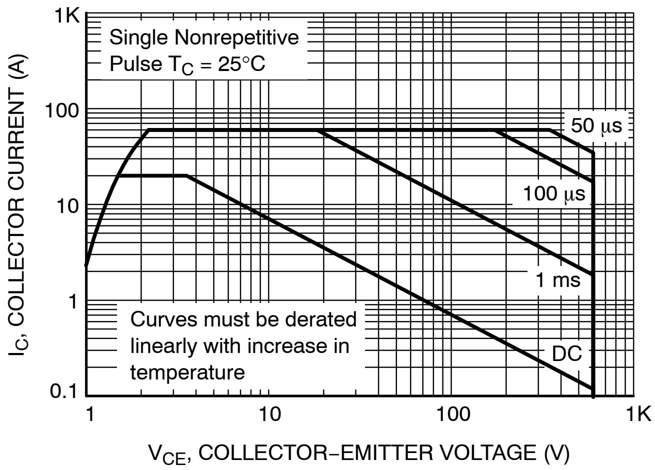



**Figure 19. FBSOA**

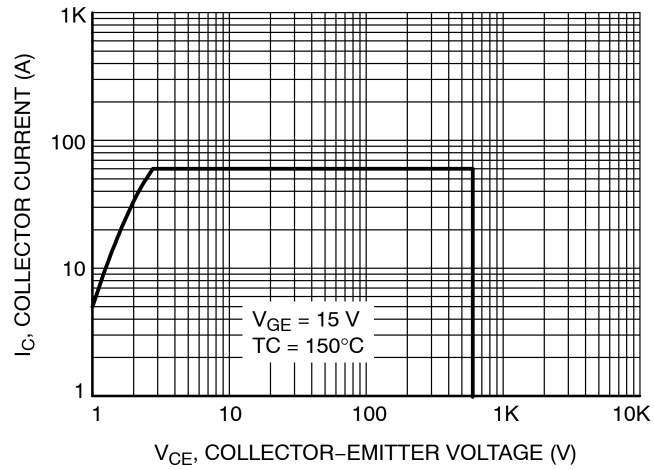



**Figure 20. RBSOA**

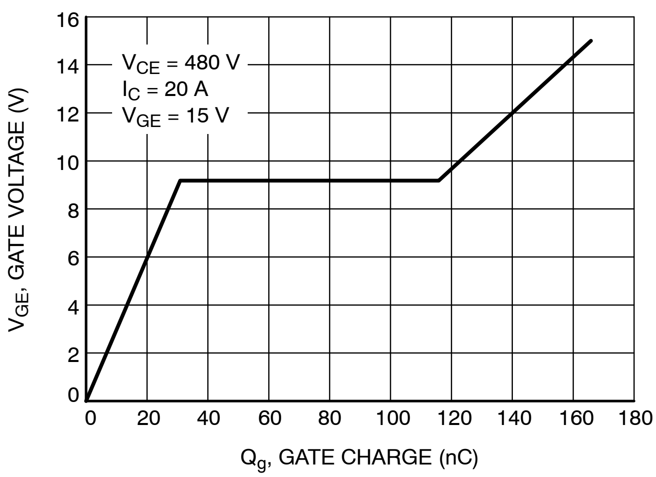



**Figure 21. Gate Voltage vs. Gate Charge**

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT COMUTATES NEUTRAL POINT DIODE

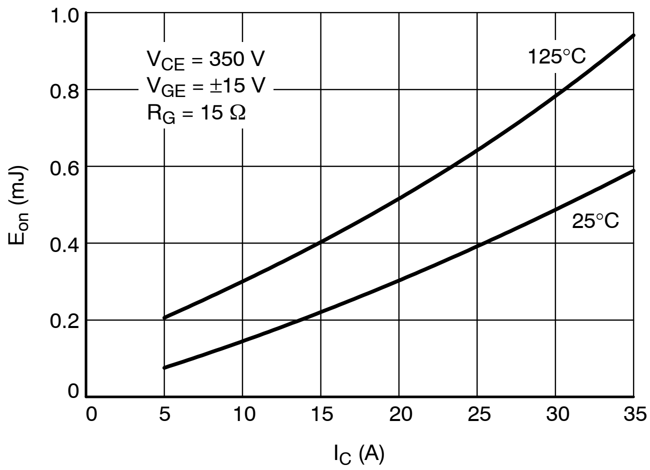



**Figure 22. Typical Switching Loss $E_{on}$ vs. $I_C$**

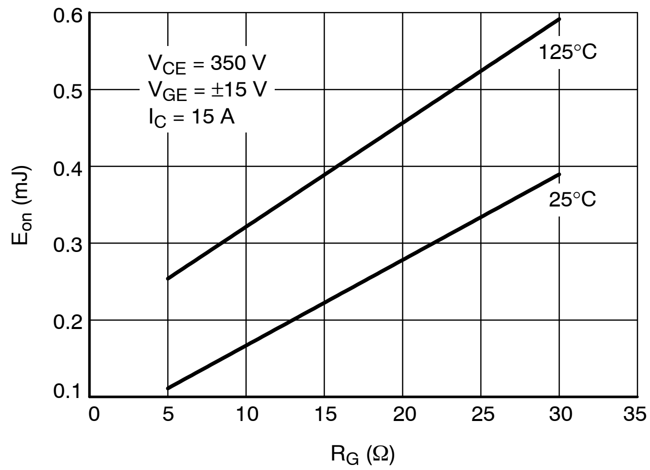



**Figure 23. Typical Switching Loss $E_{on}$ vs. $R_G$**

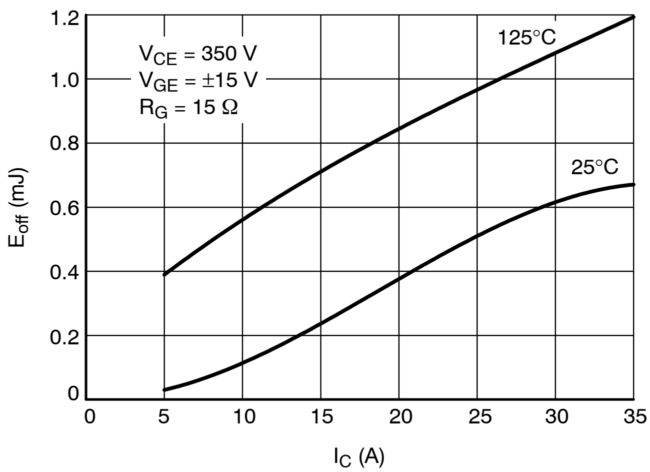



**Figure 24. Typical Switching Loss $E_{off}$ vs. $I_C$**

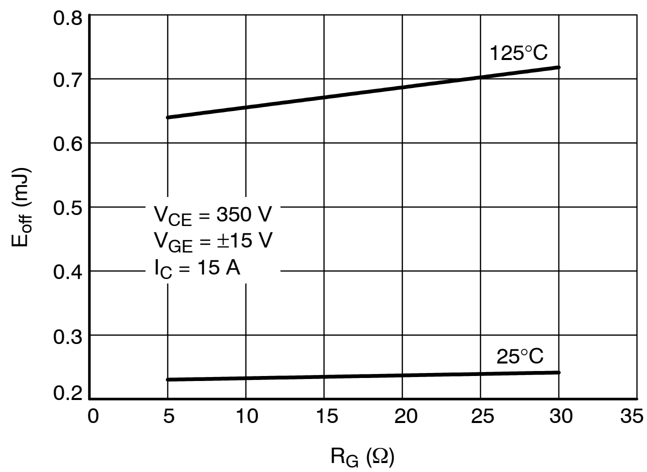



**Figure 25. Typical Switching Loss $E_{off}$ vs. $R_G$**

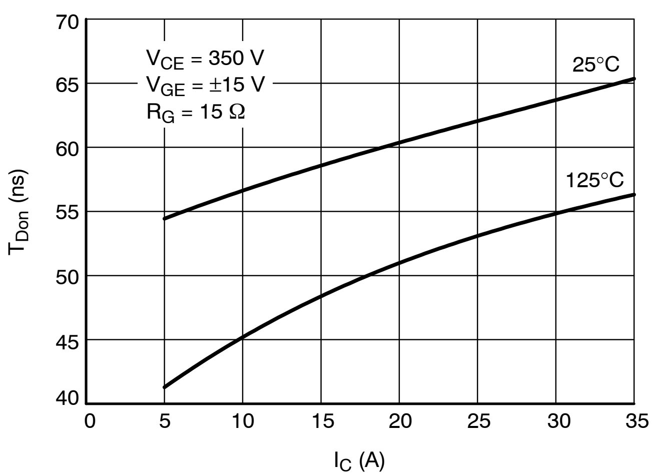



**Figure 26. Typical Switching Time $T_{Don}$ vs. $I_C$**

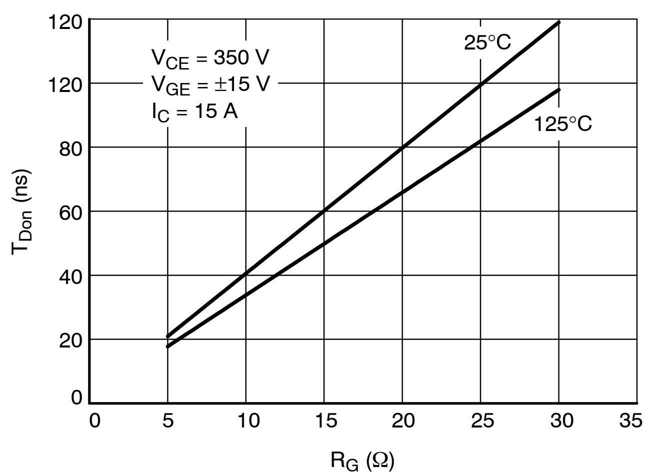



**Figure 27. Typical Switching Time $T_{Don}$ vs. $R_G$**

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT COMUTATES NEUTRAL POINT DIODE

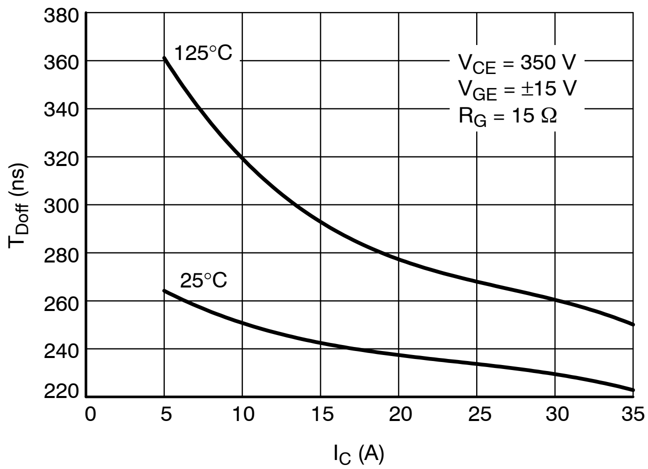



**Figure 28. Typical Switching Time $T_{Doff}$ vs. $I_C$**

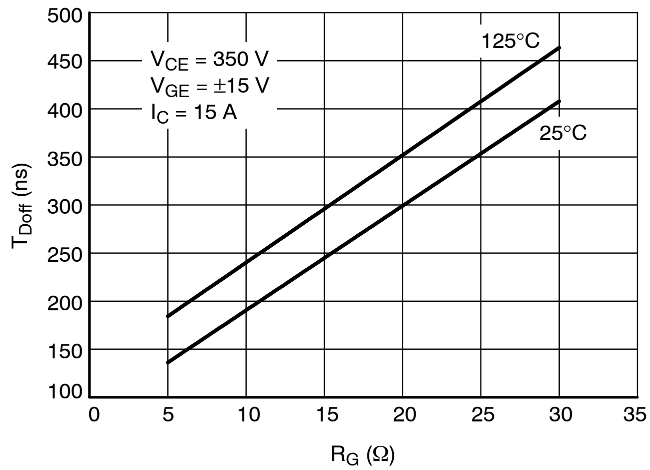



**Figure 29. Typical Switching Time $T_{Doff}$ vs. $R_G$**

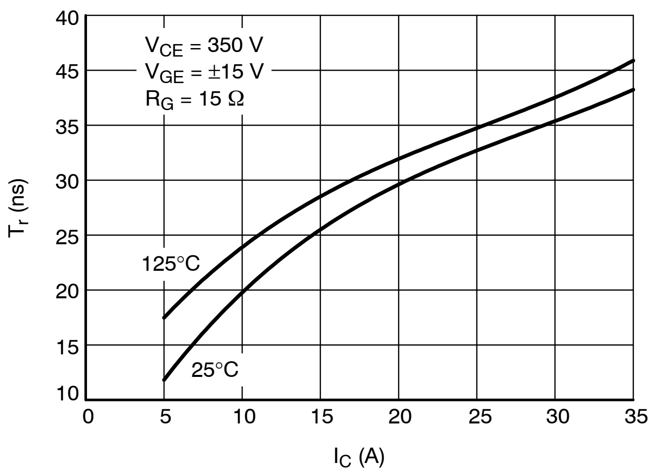



**Figure 30. Typical Switching Time $T_r$ vs. $I_C$**

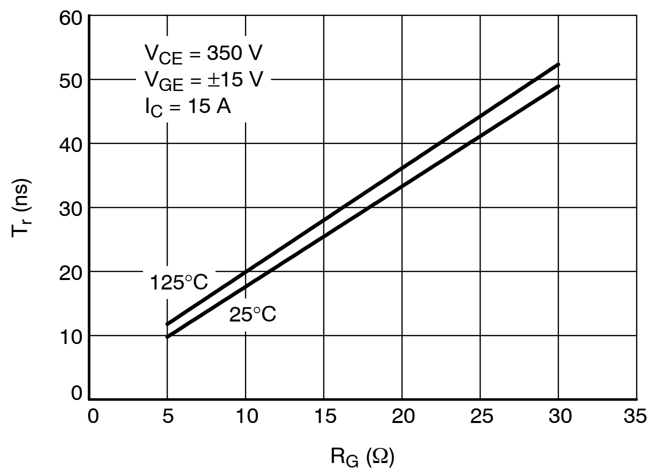



**Figure 31. Typical Switching Time $T_r$ vs. $R_G$**

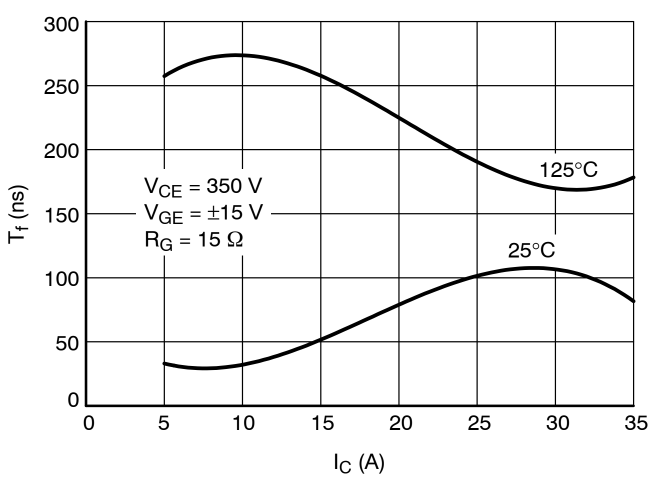



**Figure 32. Typical Switching Time $T_f$ vs. $I_C$**

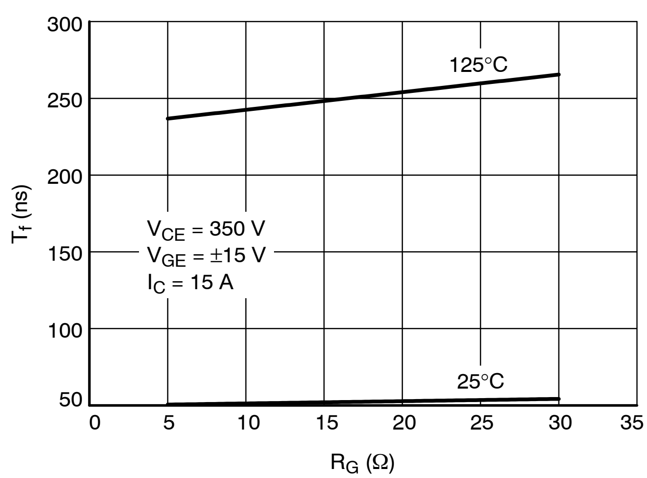



**Figure 33. Typical Switching Time $T_f$ vs. $R_G$**

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT COMUTATES NEUTRAL POINT DIODE

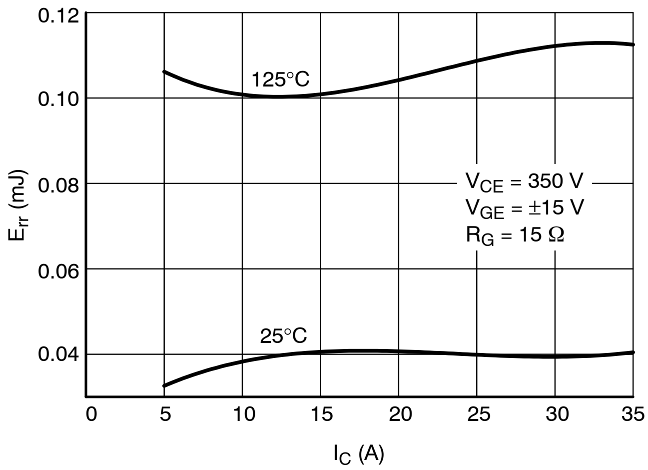



**Figure 34. Typical Reverse Recovery Energy vs. $I_C$**

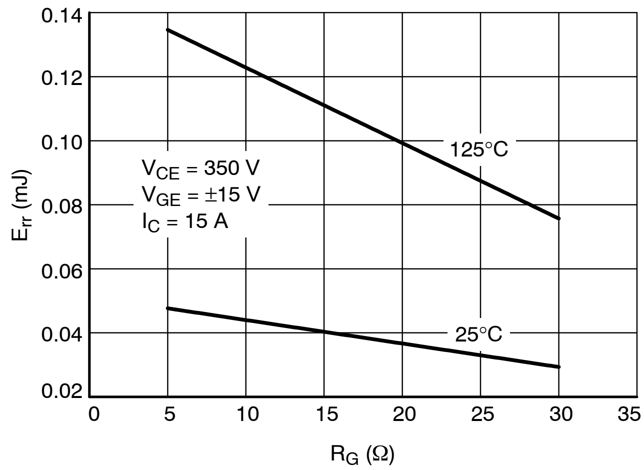



**Figure 35. Typical Reverse Recovery Energy vs. $R_G$**

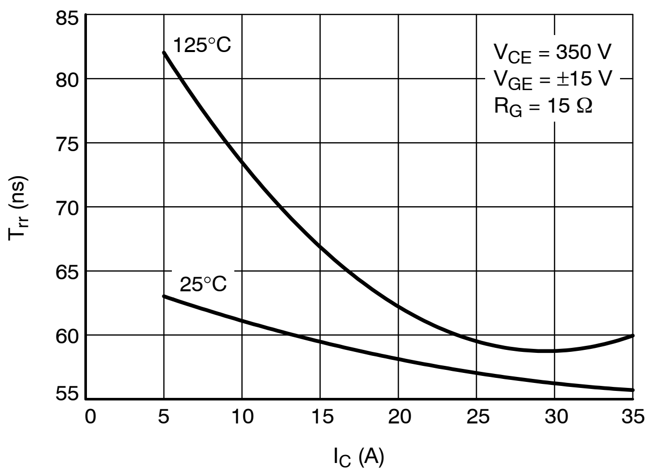



**Figure 36. Typical Reverse Recovery Time vs. $I_C$**

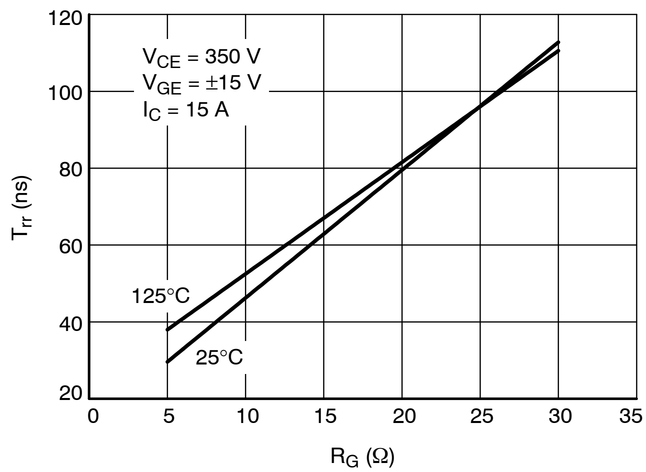



**Figure 37. Typical Reverse Recovery Time vs. $R_G$**

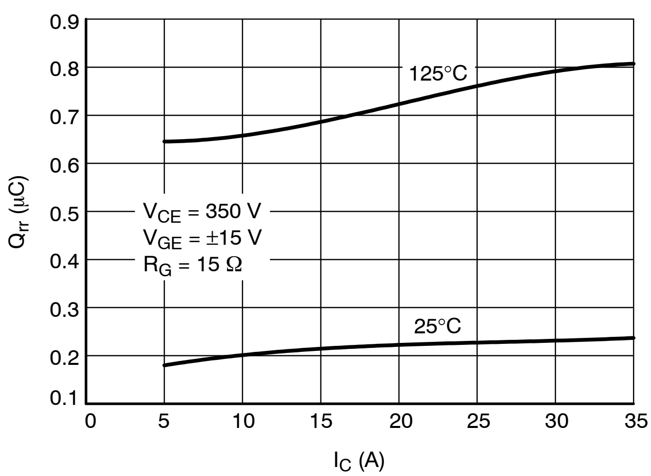



**Figure 38. Typical Reverse Recovery Charge vs. $I_C$**

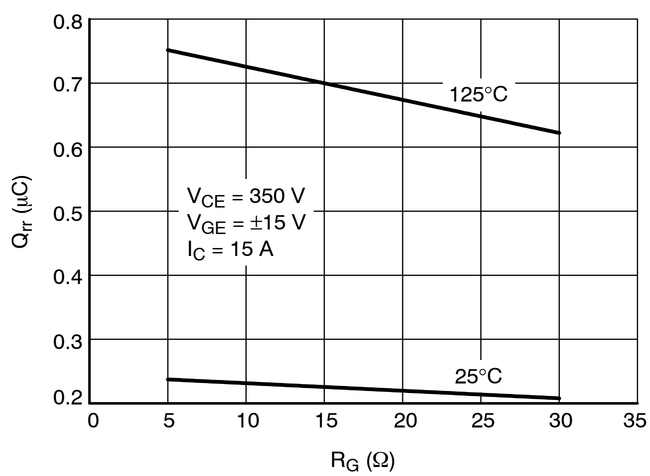



**Figure 39. Typical Reverse Recovery Charge vs. $R_G$**

## TYPICAL CHARACTERISTICS – HALF BRIDGE IGBT COMUTATES NEUTRAL POINT DIODE

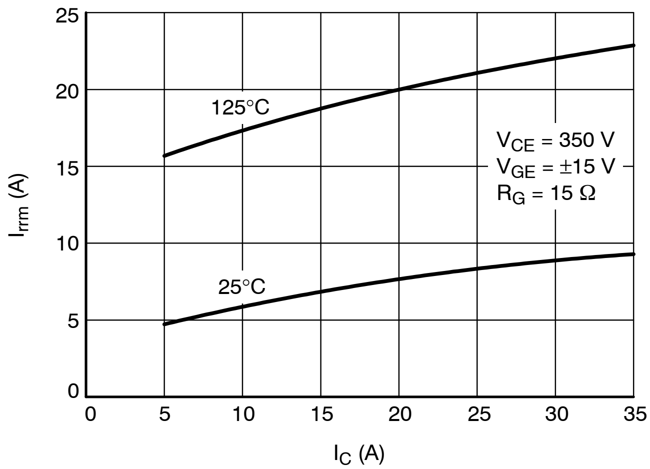



**Figure 40. Typical Reverse Recovery Current vs. $I_C$**

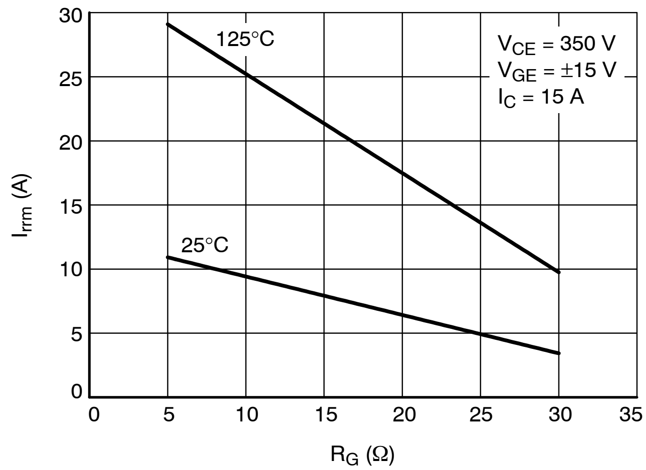



**Figure 41. Typical Reverse Recovery Current vs. $R_G$**

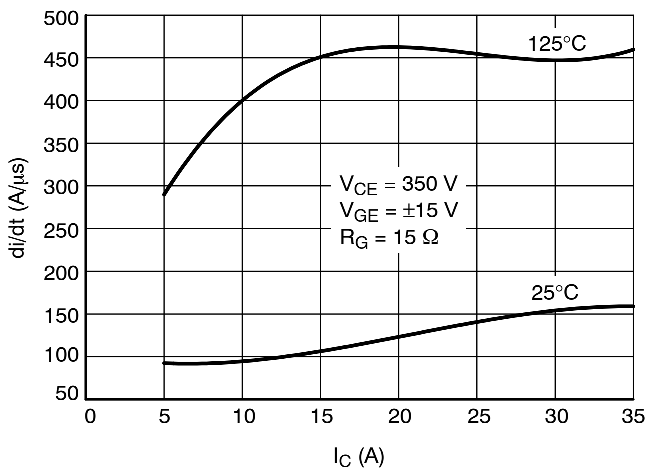



**Figure 42. Typical di/dt vs. $I_C$**

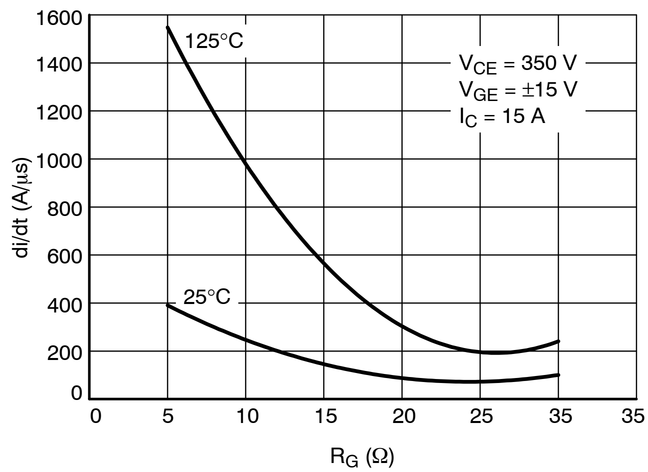



**Figure 43. Typical di/dt vs. $R_G$**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT COMUTATES HALF BRIDGE DIODE

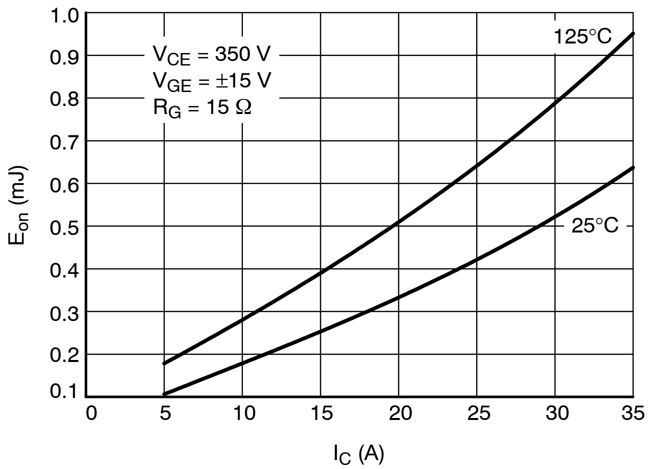



**Figure 44. Typical Switching Energy $E_{on}$ vs. $I_C$**

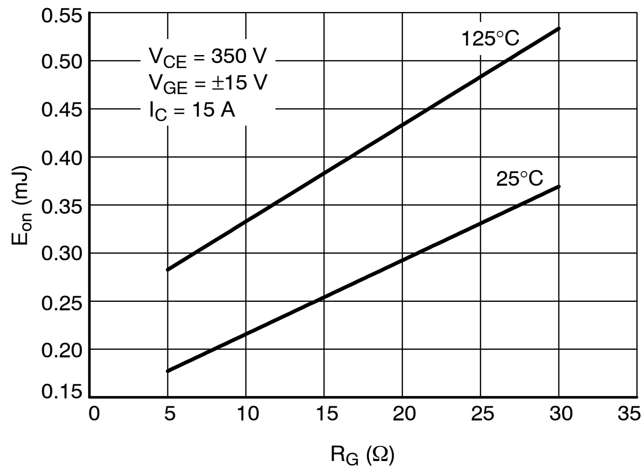



**Figure 45. Typical Switching Energy $E_{on}$ vs. $R_G$**

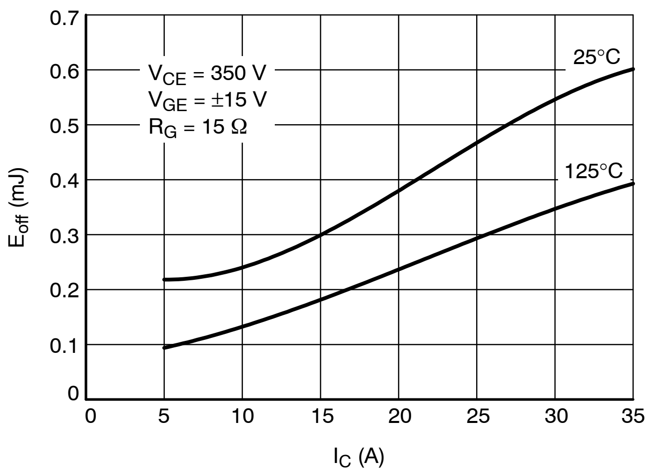



**Figure 46. Typical Switching Energy $E_{off}$ vs. $I_C$**

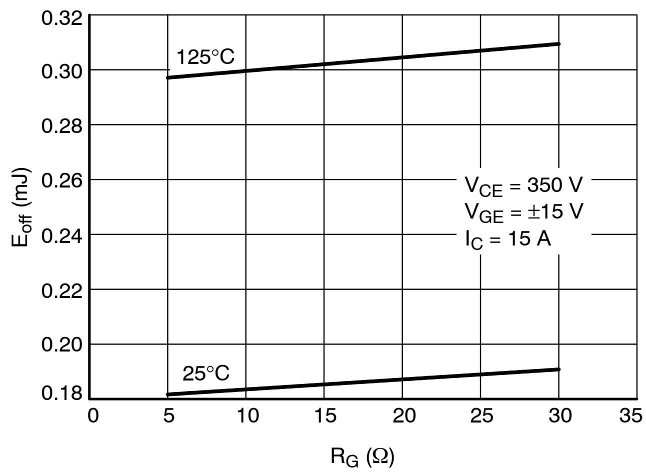



**Figure 47. Typical Switching Energy $E_{off}$ vs. $R_G$**

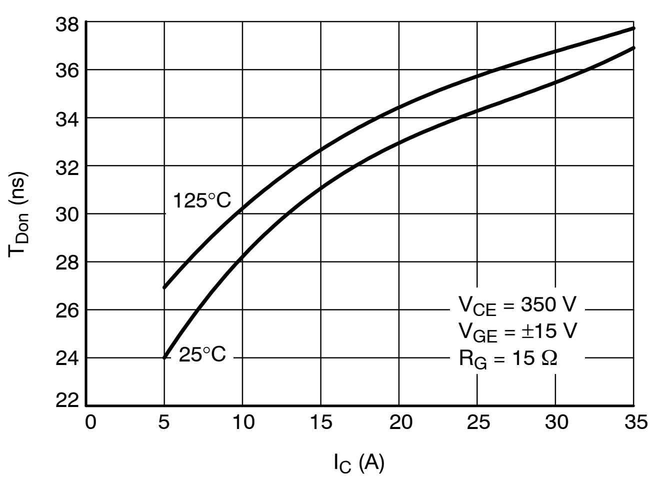



**Figure 48. Typical Switching Time $T_{Don}$ vs. $I_C$**

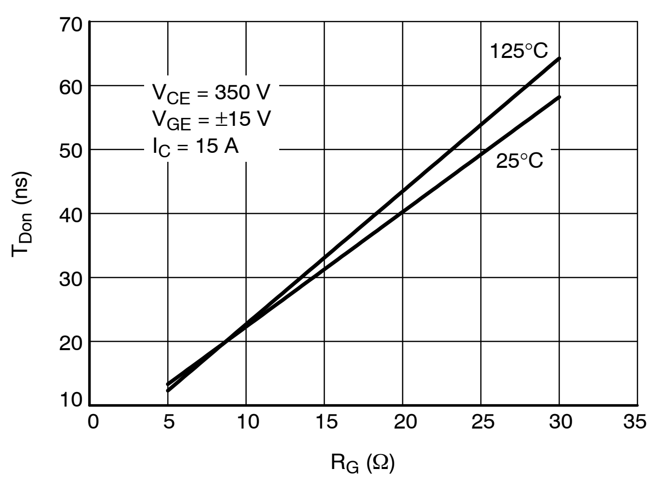



**Figure 49. Typical Switching Time $T_{Don}$ vs. $R_G$**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT COMUTATES HALF BRIDGE DIODE

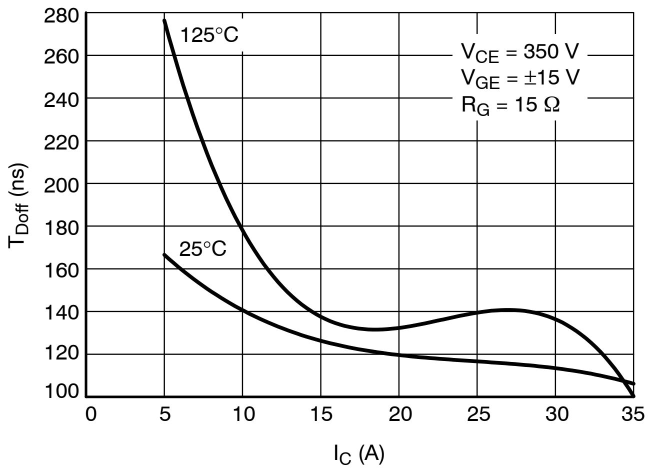



**Figure 50. Typical Switching Time $T_{Doff}$ vs. $I_C$**

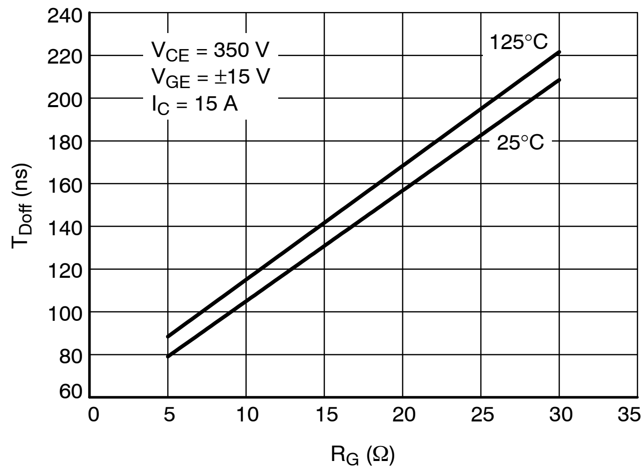



**Figure 51. Typical Switching Time $T_{Doff}$ vs. $R_G$**

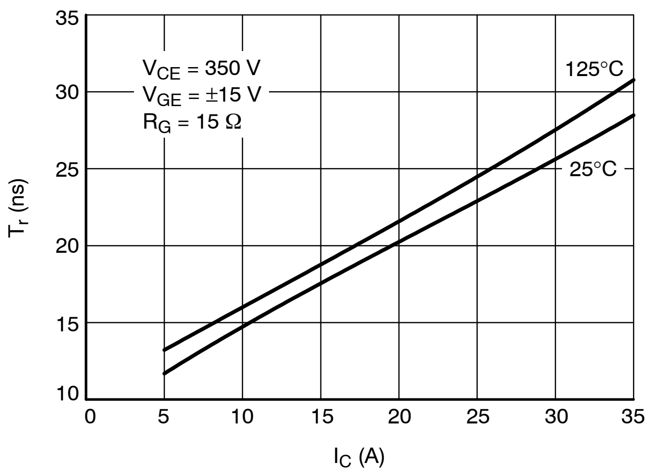



**Figure 52. Typical Switching Time $T_r$ vs. $I_C$**

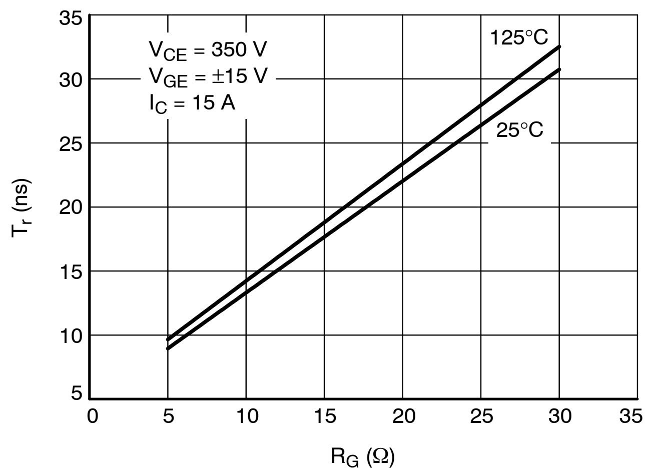



**Figure 53. Typical Switching Time $T_r$ vs. $R_G$**

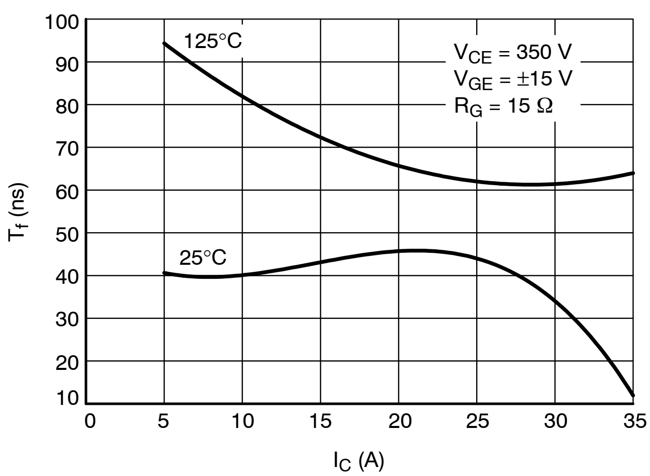



**Figure 54. Typical Switching Time $T_f$ vs. $I_C$**

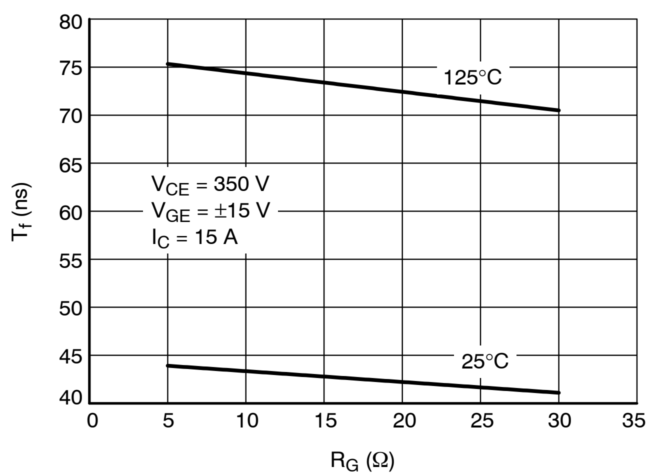



**Figure 55. Typical Switching Time $T_f$ vs. $R_G$**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT COMUTATES HALF BRIDGE DIODE

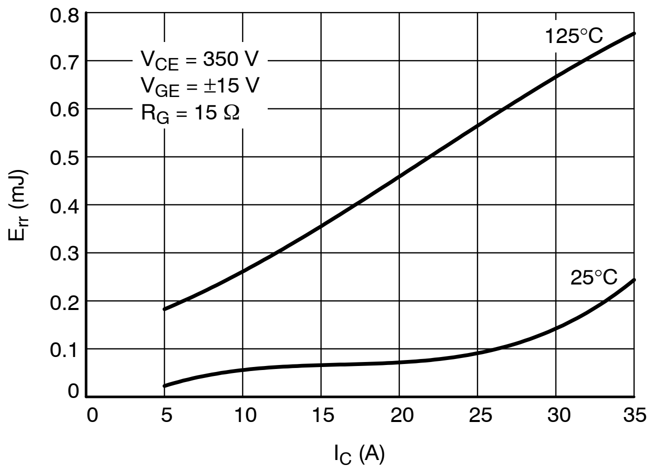



**Figure 56. Typical Reverse Recovery Energy vs. $I_C$**

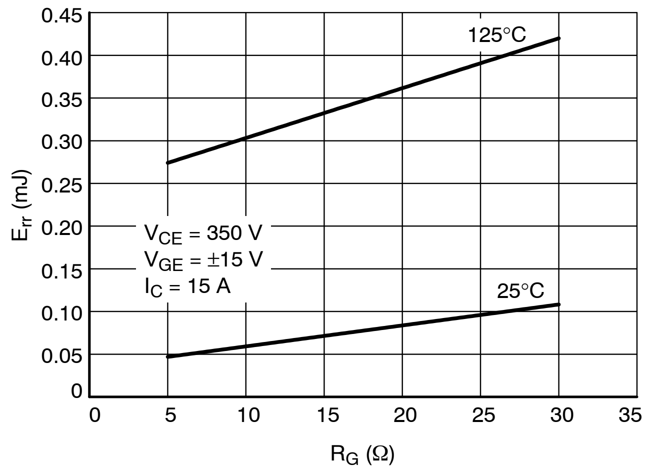



**Figure 57. Typical Reverse Recovery Energy vs. $R_G$**

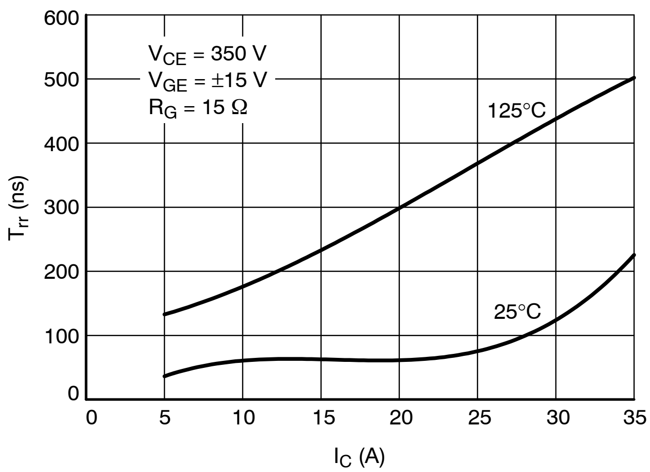



**Figure 58. Typical Reverse Recovery Time vs. $I_C$**

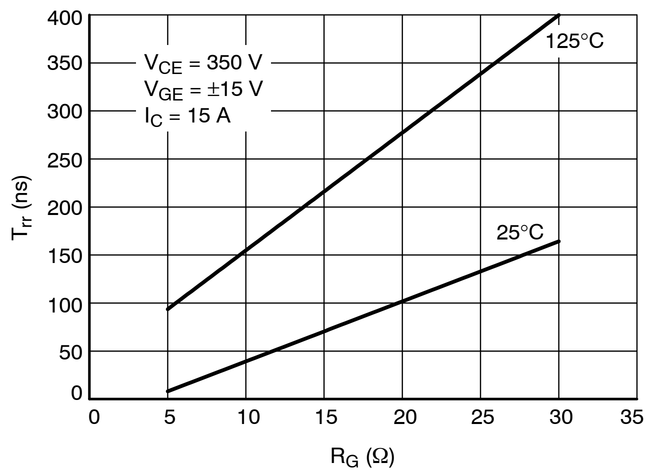



**Figure 59. Typical Reverse Recovery Time vs. $R_G$**

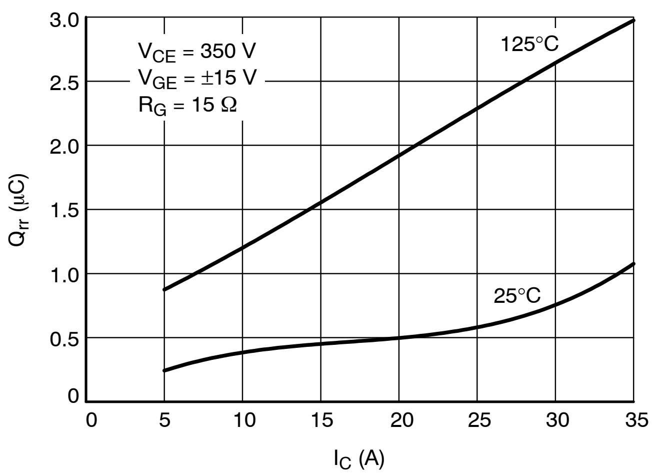



**Figure 60. Typical Reverse Recovery Charge vs. $I_C$**

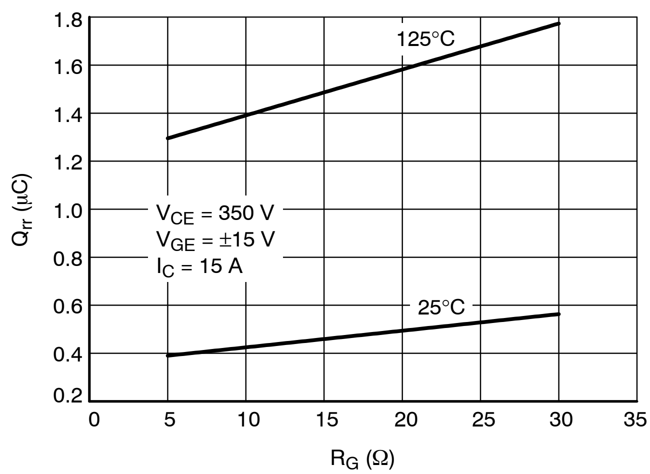



**Figure 61. Typical Reverse Recovery Charge vs. $R_G$**

## TYPICAL CHARACTERISTICS – NEUTRAL POINT IGBT COMUTATES HALF BRIDGE DIODE

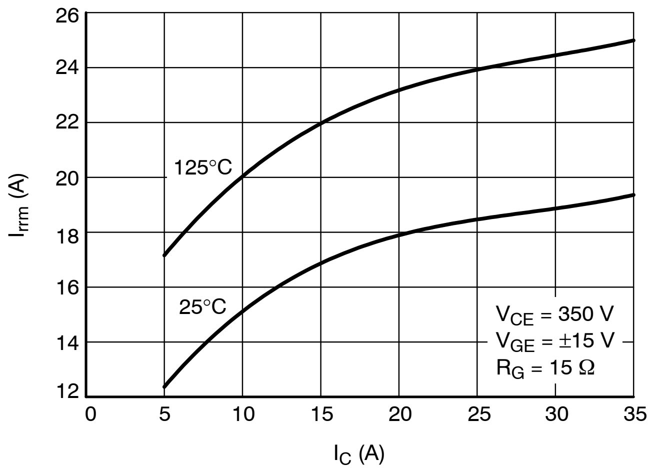



**Figure 62. Typical Reverse Recovery Current vs. $I_C$**

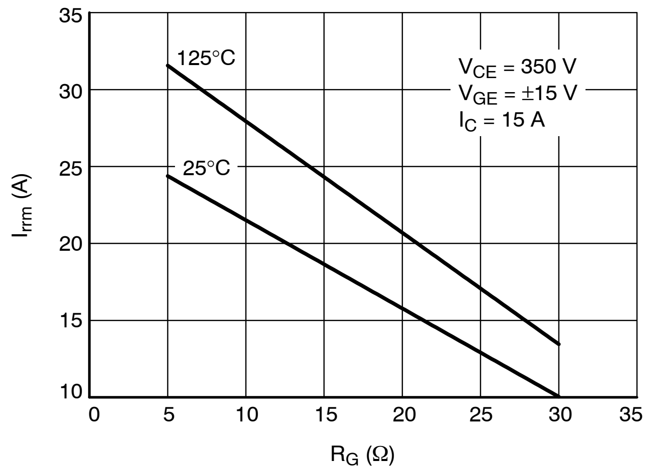



**Figure 63. Typical Reverse Recovery Current vs. $R_G$**

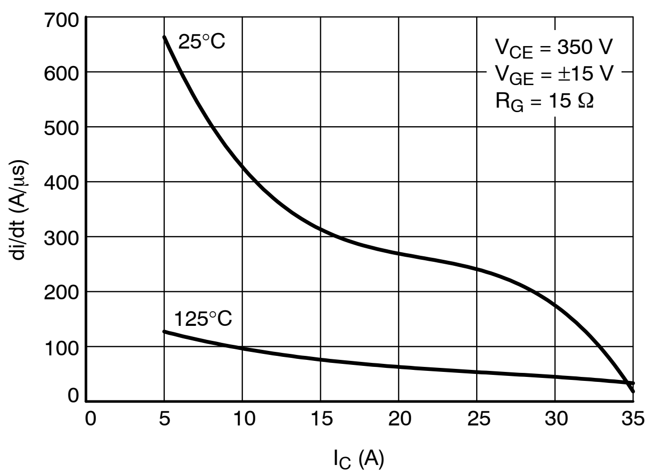



**Figure 64. Typical di/dt vs. $I_C$**

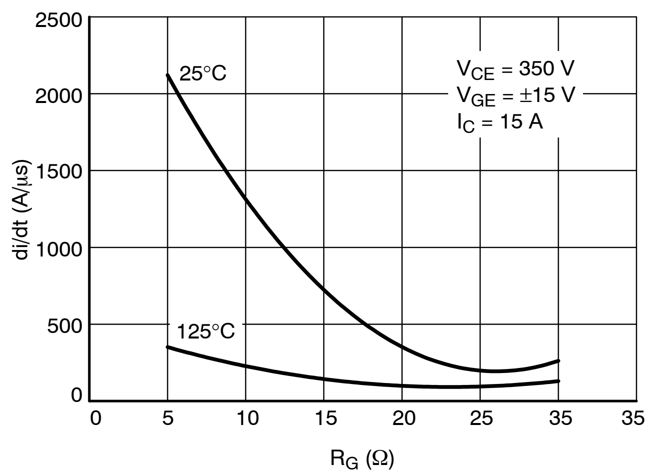
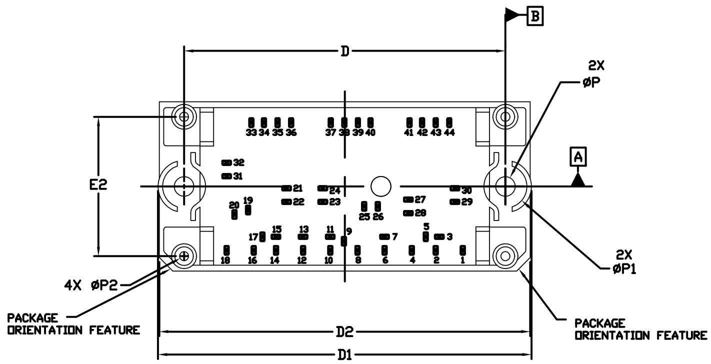


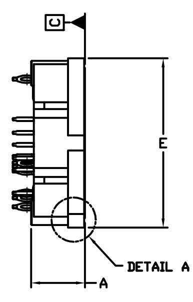

**Figure 65. Typical di/dt vs. $R_G$**

**PIM44, 71x37.4**
CASE 180AS
ISSUE O

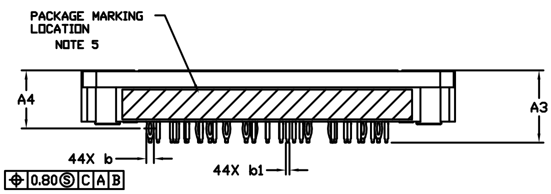
DATE 25 JUN 2018



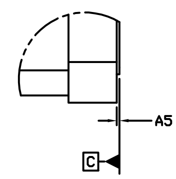

TOP VIEW




END VIEW



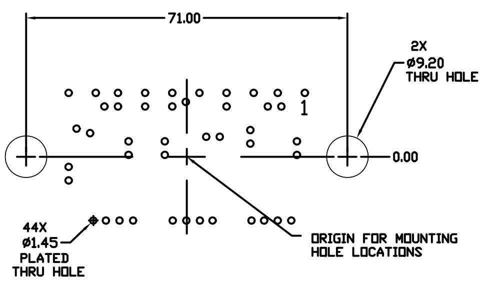

SIDE VIEW




DETAIL A

| PIN | PIN POSITION X | PIN POSITION Y | PIN | PIN POSITION X | PIN POSITION Y |
|---|---|---|---|---|---|
| 1 | 26.10 | 14.10 | 23 | −4.85 | 3.40 |
| 2 | 20.10 | 14.10 | 24 | −4.85 | 0.40 |
| 3 | 20.90 | 11.10 | 25 | 4.30 | 4.40 |
| 4 | 14.80 | 14.10 | 26 | 7.30 | 4.40 |
| 5 | 17.90 | 11.10 | 27 | 14.05 | 2.90 |
| 6 | 8.80 | 14.10 | 28 | 14.05 | 5.90 |
| 7 | 8.80 | 11.10 | 29 | 24.35 | 3.40 |
| 8 | 2.80 | 14.10 | 30 | 24.35 | 0.40 |
| 9 | −0.20 | 12.10 | 31 | −26.10 | −2.25 |
| 10 | −3.20 | 14.10 | 32 | −26.10 | −5.25 |
| 11 | −3.20 | 11.10 | 33 | −20.65 | −14.10 |
| 12 | −9.20 | 14.10 | 34 | −17.85 | −14.10 |
| 13 | −9.20 | 11.10 | 35 | −14.85 | −14.10 |
| 14 | −15.20 | 14.10 | 36 | −11.85 | −14.10 |
| 15 | −15.20 | 11.10 | 37 | −3.10 | −14.10 |
| 16 | −20.10 | 14.10 | 38 | −0.10 | −14.10 |
| 17 | −18.20 | 11.10 | 39 | 2.90 | −14.10 |
| 18 | −26.10 | 14.10 | 40 | 5.70 | −14.10 |
| 19 | −21.35 | 5.20 | 41 | 14.30 | −14.10 |
| 20 | −24.35 | 6.20 | 42 | 17.10 | −14.10 |
| 21 | −12.85 | 0.40 | 43 | 20.10 | −14.10 |
| 22 | −12.85 | 3.40 | 44 | 23.10 | −14.10 |

NOTE 4




RECOMMENDED MOUNTING PATTERN

| DIM | MILLIMETERS MIN. | NOM. | MAX. |
|---|---|---|---|
| A | 11.50 | 12.00 | 12.50 |
| A3 | 15.50 | 16.00 | 16.50 |
| A4 | 12.83 BSC | | |
| A5 | 0.10 | 0.20 | 0.30 |
| b | 1.61 | 1.66 | 1.71 |
| b1 | 0.75 | 0.80 | 0.85 |
| D | 70.50 | 71.00 | 71.50 |
| D1 | 82.00 | 82.50 | 83.00 |
| D2 | 81.50 | 82.00 | 82.50 |
| E | 36.90 | 37.40 | 37.90 |
| E2 | 30.30 | 30.80 | 31.30 |
| P | 4.10 | 4.30 | 4.50 |
| P1 | 9.30 | 9.50 | 9.70 |
| P2 | 1.80 | 2.00 | 2.20 |

| PIN | PIN POSITION X | PIN POSITION Y | PIN | PIN POSITION X | PIN POSITION Y |
|---|---|---|---|---|---|
| 1 | 26.10 | −14.10 | 23 | −4.85 | −3.40 |
| 2 | 20.10 | −14.10 | 24 | −4.85 | −0.40 |
| 3 | 20.90 | −11.10 | 25 | 4.30 | −4.40 |
| 4 | 14.80 | −14.10 | 26 | 7.30 | −4.40 |
| 5 | 17.90 | −11.10 | 27 | 14.05 | −2.90 |
| 6 | 8.80 | −14.10 | 28 | 14.05 | −5.90 |
| 7 | 8.80 | −11.10 | 29 | 24.35 | −3.40 |
| 8 | 2.80 | −14.10 | 30 | 24.35 | −0.40 |
| 9 | −0.20 | −12.10 | 31 | −26.10 | 2.25 |
| 10 | −3.20 | −14.10 | 32 | −26.10 | 5.25 |
| 11 | −3.20 | −11.10 | 33 | −20.65 | 14.10 |
| 12 | −9.20 | −14.10 | 34 | −17.85 | 14.10 |
| 13 | −9.20 | −11.10 | 35 | −14.85 | 14.10 |
| 14 | −15.20 | −14.10 | 36 | −11.85 | 14.10 |
| 15 | −15.20 | −11.10 | 37 | −3.10 | 14.10 |
| 16 | −20.10 | −14.10 | 38 | −0.10 | 14.10 |
| 17 | −18.20 | −11.10 | 39 | 2.90 | 14.10 |
| 18 | −26.10 | −14.10 | 40 | 5.70 | 14.10 |
| 19 | −21.35 | −5.20 | 41 | 14.30 | 14.10 |
| 20 | −24.35 | −6.20 | 42 | 17.10 | 14.10 |
| 21 | −12.85 | −0.40 | 43 | 20.10 | 14.10 |
| 22 | −12.85 | −3.40 | 44 | 23.10 | 14.10 |

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A4.
4. POSITION OF THE CENTER OF THE TERMINALS IS DETERMINED FROM DATUM B THE CENTER OF DIMENSION D, X DIRECTION, AND FROM DATUM A, Y DIRECTION. POSITIONAL TOLERANCE, AS NOTED IN DRAWING, APPLIES TO EACH TERMINAL IN BOTH DIRECTIONS.
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES.

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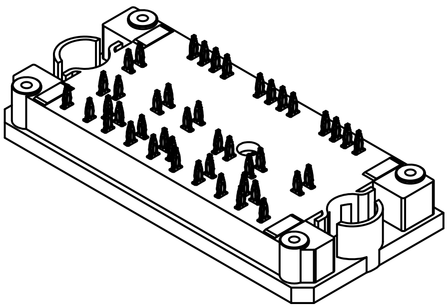
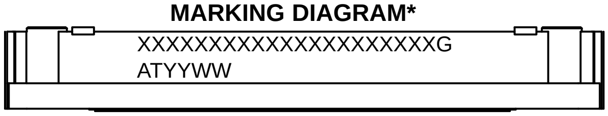
|---|---|---|
| DESCRIPTION: | PIM44, 71x37.4 | PAGE 1 OF 2 |



**PIM44, 71x37.4**
CASE 180AS
ISSUE O

DATE 15 JUN 2018

**GENERIC**
**MARKING DIAGRAM***




XXXXX = Specific Device Code
G = Pb−Free Package
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:** | **PIM44, 71x37.4** | **PAGE 2 OF 2** |

## ADDITIONAL INFORMATION

**TECHNICAL PUBLICATIONS**:
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