# NXH80B120H2Q0

# Dual Boost Power Module

The NXH80B120H2Q0 is a high−density, integrated power module combines high−performance IGBTs with rugged anti−parallel diodes including on−board thermistor.

### Features

- Dual Boost 40 A / 1200 V IGBT + SiC Rectifier Hybrid Module
- 1200 V FSII IGBT $V_{CE(SAT)}$ = 2.2 V
- 1200 V SiC Diode $V_F$ = 1.4 V
- Low Inductive Layout
- Solderable Pins
- Thermistor
- Bare Copper and Nickel−Plated DBC Options

### Typical Applications

- Solar Inverter
- Uninterruptible Power Supplies
- Energy Storage Systems

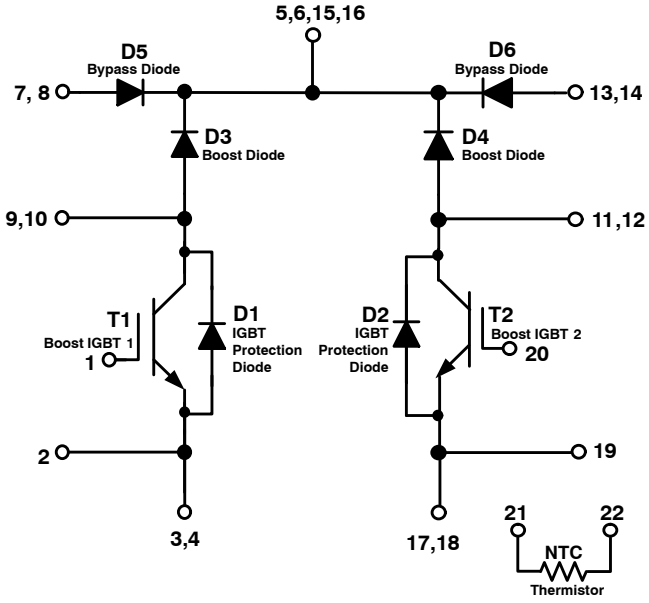
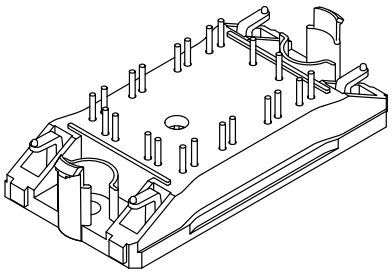



**Figure 1. NXH80B120H2Q0SG Schematic Diagram**

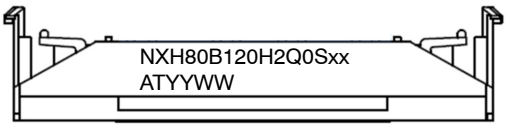
**ON Semiconductor®**

www.onsemi.com



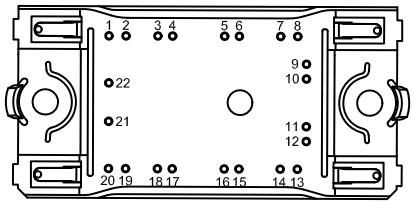
**Q0BOOST**
**CASE 180AJ**

### MARKING DIAGRAM




NXH80B120H2Q0Sxx = Device Code
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

### PIN CONNECTIONS




### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 4 of this data sheet.

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

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **BOOST IGBT** | | | |
| Collector−Emitter Voltage | $V_{CES}$ | 1200 | V |
| Gate−Emitter Voltage | $V_{GE}$ | ±20 | V |
| Continuous Collector Current @ $T_h$ = 80°C ($T_J$ = 175°C) | $I_C$ | 41 | A |
| Pulsed Collector Current ($T_J$ = 175°C) | $I_{Cpulse}$ | 123 | A |
| Maximum Power Dissipation @ $T_h$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 103 | W |
| Short Circuit Withstand Time @ $V_{GE}$ = 15 V, $V_{CE}$ = 600 V, $T_J \le$ 150°C | $T_{sc}$ | 5 | μs |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 150 | °C |
| **BOOST DIODE** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ $T_h$ = 80°C ($T_J$ = 175°C) | $I_F$ | 28 | A |
| Repetitive Peak Forward Current (limited by $T_J$, duty cycle = 10%) | $I_{FRM}$ | 75 | A |
| Maximum Power Dissipation @ $T_h$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 79 | W |
| Surge Forward Current (60 Hz single half−sine wave) ($T_J$ = 25°C) | $I_{FSM}$ | 69 | A |
| $I^2t$ − value (60 Hz single half−sine wave) ($T_J$ = 150°C) | $I^2t$ | 19 | $A^2s$ |
| Minimum Operating Junction Temperature | $T_{JMIN}$ | −40 | °C |
| Maximum Operating Junction Temperature | $T_{JMAX}$ | 150 | °C |
| **BYPASS DIODE / IGBT PROTECTION DIODE** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 1600 | V |
| Continuous Forward Current @ $T_h$ = 80°C ($T_J$ = 175°C) | $I_F$ | 46 | A |
| Repetitive Peak Forward Current ($T_J$ = 175°C, $t_p$ limited by $T_{Jmax}$) | $I_{FRM}$ | 130 | A |
| Power Dissipation Per Diode @ $T_h$ = 80°C ($T_J$ = 175°C) | $P_{tot}$ | 66 | 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, 60 Hz | $V_{is}$ | 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 | ($T_{jmax}$ −25) | °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 |
|---|---|---|---|---|---|---|
| **BOOST IGBT CHARACTERISTICS** | | | | | | |
| Collector−Emitter Cutoff Current | $V_{GE}$ = 0 V, $V_{CE}$ = 1200 V | $I_{CES}$ | – | – | 200 | μA |
| Collector−Emitter Saturation Voltage | $V_{GE}$ = 15 V, $I_C$ = 40 A, $T_J$ = 25°C | $V_{CE(sat)}$ | – | 2.20 | 2.5 | V |
| | $V_{GE}$ = 15 V, $I_C$ = 40 A, $T_J$ = 150°C | | – | 2.16 | – | |
| Gate−Emitter Threshold Voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 1.5 mA | $V_{GE(TH)}$ | – | 5.45 | 6.4 | 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>$V_{CE}$ = 700 V, $I_C$ = 40 A<br>$V_{GE}$ = ±15 V, $R_G$ = 4 Ω | $t_{d(on)}$ | – | 27 | – | ns |
| Rise Time | | $t_r$ | – | 19 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 94 | – | |
| Fall Time | | $t_f$ | – | 78 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 540 | – | μJ |
| Turn−off Switching Loss per Pulse | | $E_{off}$ | – | 1640 | – | |
| Turn−on Delay Time | $T_J$ = 125°C<br>$V_{CE}$ = 700 V, $I_C$ = 40 A<br>$V_{GE}$ = ±15 V, $R_G$ = 4 Ω | $t_{d(on)}$ | – | 27 | – | ns |
| Rise Time | | $t_r$ | – | 20 | – | |
| Turn−off Delay Time | | $t_{d(off)}$ | – | 110 | – | |
| Fall Time | | $t_f$ | – | 189 | – | |
| Turn−on Switching Loss per Pulse | | $E_{on}$ | – | 620 | – | μJ |
| Turn−off Switching Loss per Pulse | | $E_{off}$ | – | 3590 | – | |
| Input Capacitance | $V_{CE}$ = 25 V, $V_{GE}$ = 0 V, f = 10 kHz | $C_{ies}$ | – | 9700 | – | pF |
| Output Capacitance | | $C_{oes}$ | – | 200 | – | |
| Reverse Transfer Capacitance | | $C_{res}$ | – | 170 | – | |
| Total Gate Charge | $V_{CE}$ = 600 V, $I_C$ = 40 A, $V_{GE}$ = 15 V | $Q_g$ | – | 400 | – | nC |
| Thermal Resistance − chip−to−heatsink | Thermal grease, Thickness < 100 μm,<br>λ = 0.84 W/mK | $R_{thJH}$ | – | 0.92 | – | °C/W |
| **BOOST DIODE CHARACTERISTICS** | | | | | | |
| Diode Reverse Leakage Current | $V_R$ = 1200 V | $I_R$ | – | – | 300 | μA |
| Diode Forward Voltage | $I_F$ = 15 A, $T_J$ = 25°C | $V_F$ | – | 1.42 | 1.7 | V |
| | $I_F$ = 15 A, $T_J$ = 150°C | | – | 1.95 | – | |
| Reverse Recovery Time | $T_J$ = 25°C<br>$V_{CE}$ = 700 V, $I_C$ = 40 A<br>$V_{GE}$ = ±15 V, $R_G$ = 4 Ω | $t_{rr}$ | – | 27 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 280 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 16 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 1080 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 130 | – | μJ |
| Reverse Recovery Time | $T_J$ = 125°C<br>$V_{CE}$ = 700 V, $I_C$ = 40 A<br>$V_{GE}$ = ±15 V, $R_G$ = 4 Ω | $t_{rr}$ | – | 28 | – | ns |
| Reverse Recovery Charge | | $Q_{rr}$ | – | 250 | – | nC |
| Peak Reverse Recovery Current | | $I_{RRM}$ | – | 15 | – | A |
| Peak Rate of Fall of Recovery Current | | di/dt | – | 940 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 110 | – | μJ |
| Thermal Resistance − chip−to−heatsink | Thermal grease, Thickness < 100 μm,<br>λ = 0.84 W/mK | $R_{thJH}$ | – | 1.21 | – | °C/W |
| **BYPASS DIODE/IGBT PROTECTION DIODE CHARACTERISTICS** | | | | | | |
| Diode Reverse Leakage Current | $V_R$ = 1600 V, $T_J$ = 25°C | $I_R$ | – | – | 100 | μA |

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

| Parameter | Test Conditions | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **BYPASS DIODE/IGBT PROTECTION DIODE CHARACTERISTICS** | | | | | | |
| Diode Forward Voltage | $I_F$ = 25 A, $T_J$ = 25°C | $V_F$ | – | 1.0 | 1.4 | V |
| | $I_F$ = 25 A, $T_J$ = 150°C | | – | 0.90 | – | |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness < 100 μm, λ = 0.84 W/mK | $R_{thJH}$ | – | 1.44 | – | °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 |
|---|---|---|---|
| NXH80B120H2Q0SG | NXH80B120H2Q0SG | Q0BOOST – Case 180AJ<br>Bare Copper DBC, Solder Pins<br>(Pb–Free and Halide–Free) | 24 Units / Blister Tray |
| NXH80B120H2Q0SNG | NXH80B120H2Q0SNG | Q0BOOST – Case 180AJ<br>Nickel–Plated DBC, Solder Pins<br>(Pb–Free and Halide–Free) | 24 Units / Blister Tray |

## TYPICAL CHARACTERISTICS – Boost IGBT & Boost Diode

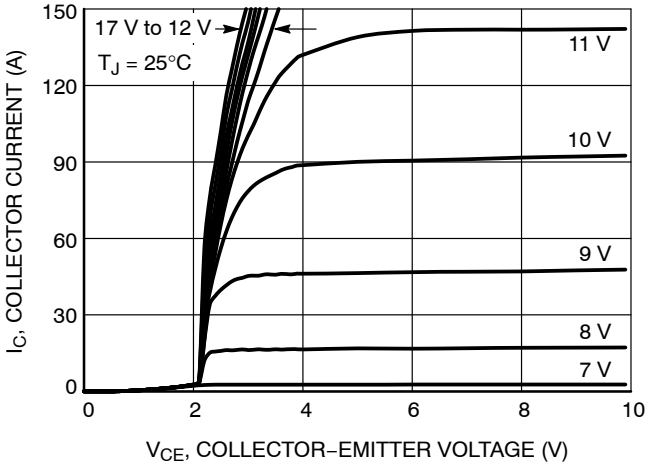



**Figure 1. IGBT Typical Output Characteristics**

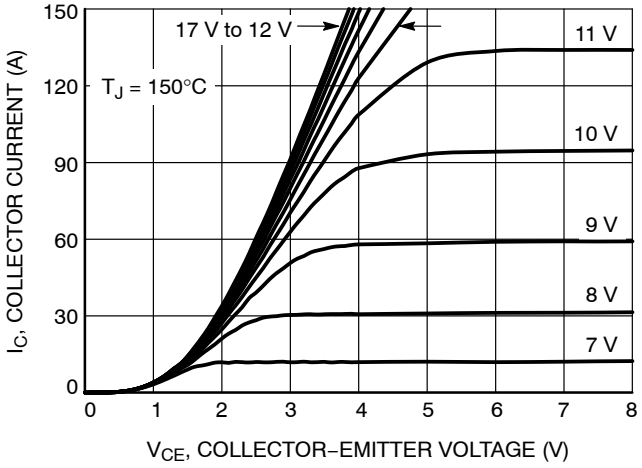



**Figure 2. IGBT Typical Output Characteristics**

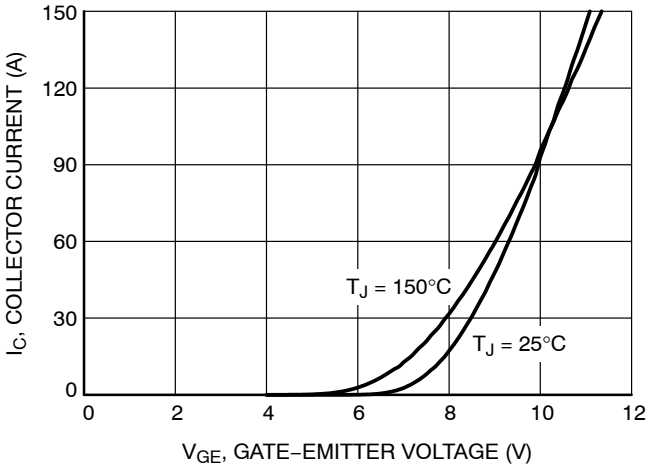



**Figure 3. IGBT Typical Transfer Characteristics**

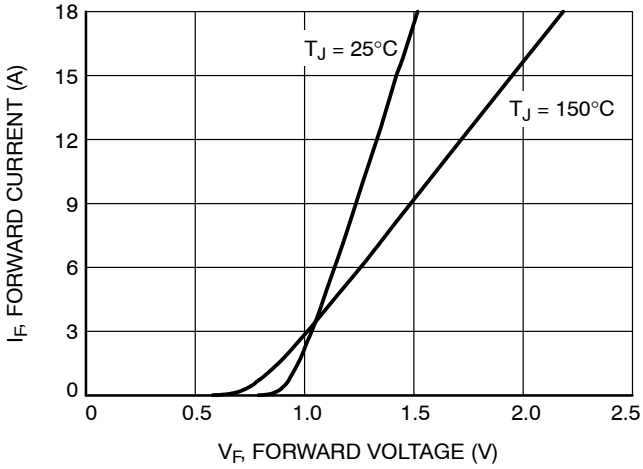



**Figure 4. Diode Forward Characteristic**

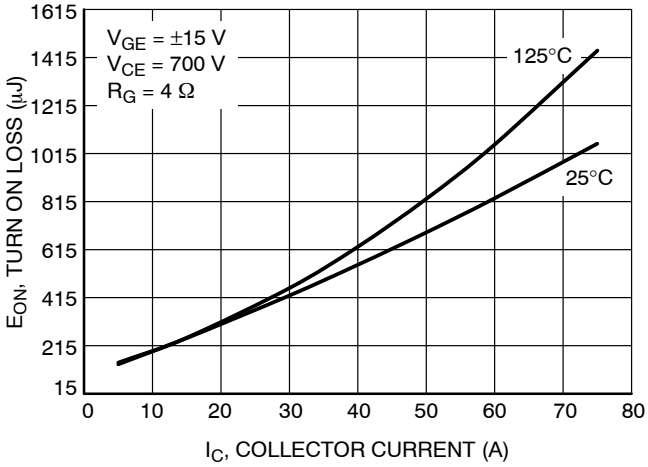



**Figure 5. Typical Turn On Loss vs. IC**

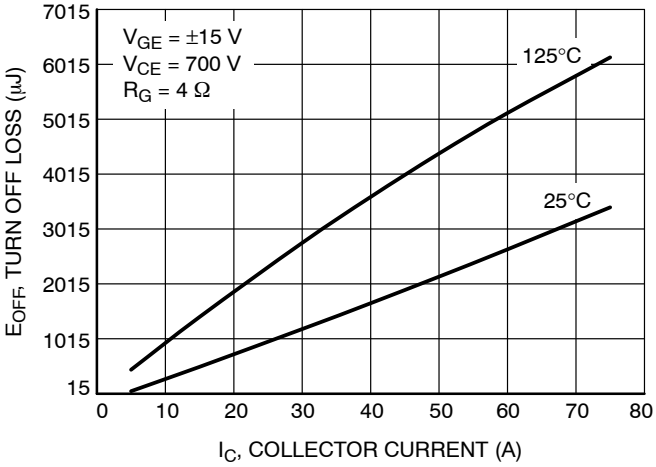



**Figure 6. Typical Turn Off Loss vs. IC**

## TYPICAL CHARACTERISTICS – Boost IGBT & Boost Diode

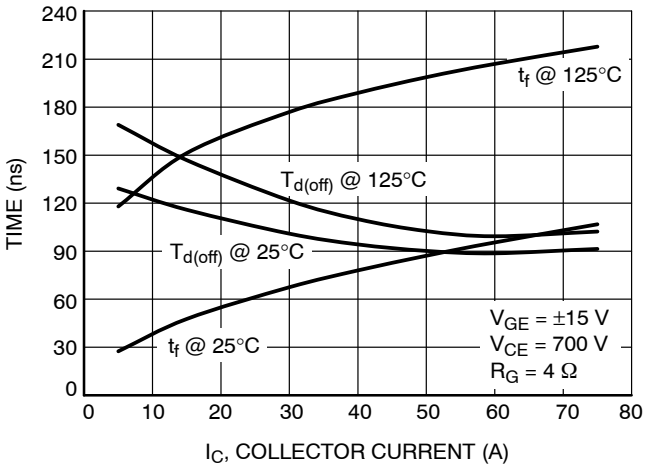



**Figure 7. Typical Switching Times vs. IC**

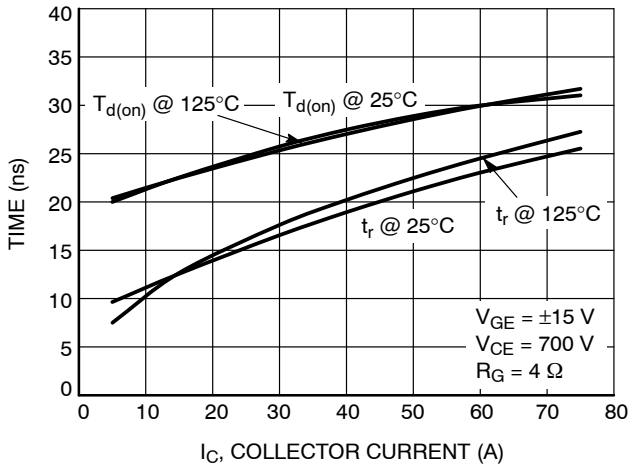



**Figure 8. Typical Switching Times vs. IC**

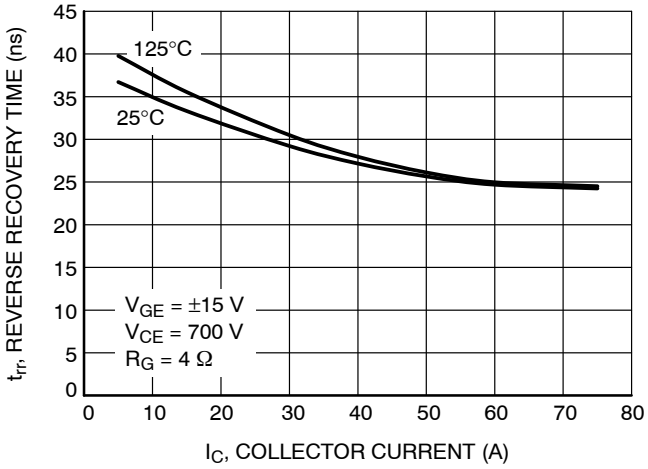



**Figure 9. Typical Reverse Recovery Time vs. IC**

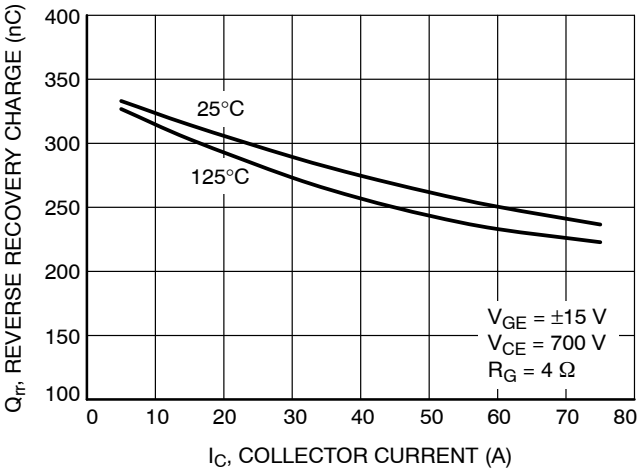



**Figure 10. Typical Reverse Recovery Charge vs. IC**

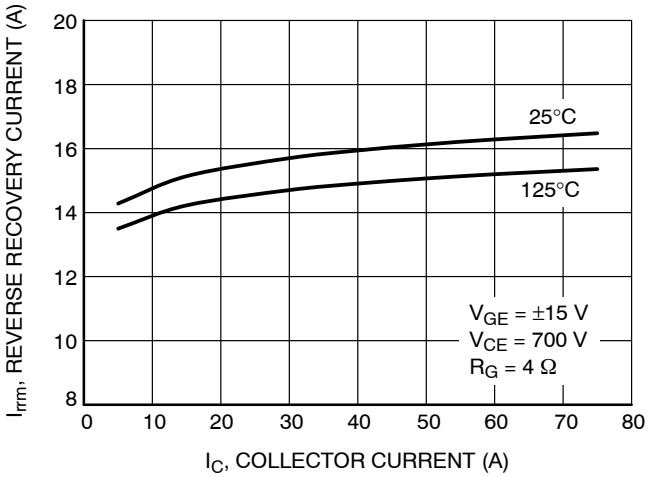



**Figure 11. Typical Reverse Recovery Peak Current vs. IC**

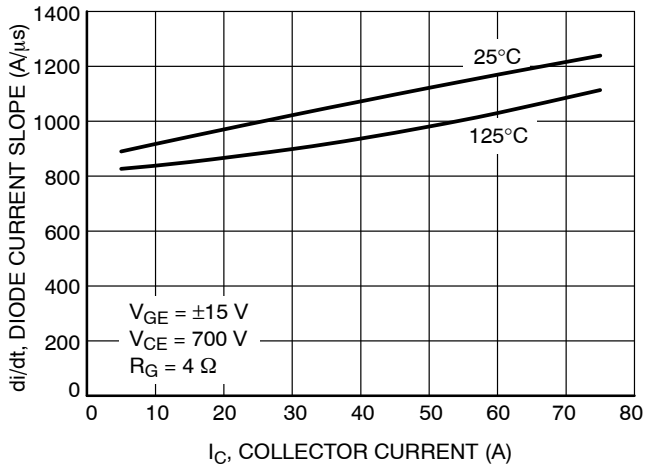



**Figure 12. Typical Diode Current Slope vs. IC**

## TYPICAL CHARACTERISTICS – Boost IGBT & Boost Diode

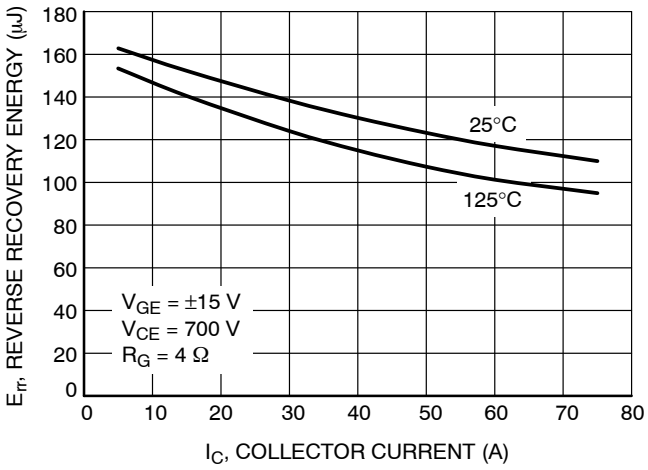



**Figure 13. Typical Reverse Recovery Energy vs. IC**

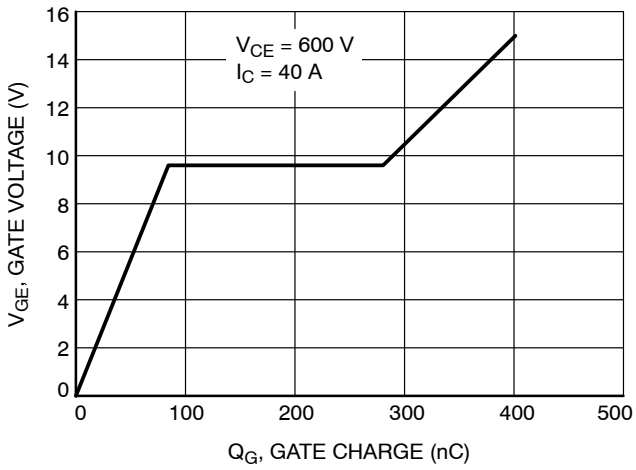



**Figure 14. Gate Voltage vs. Gate Charge**

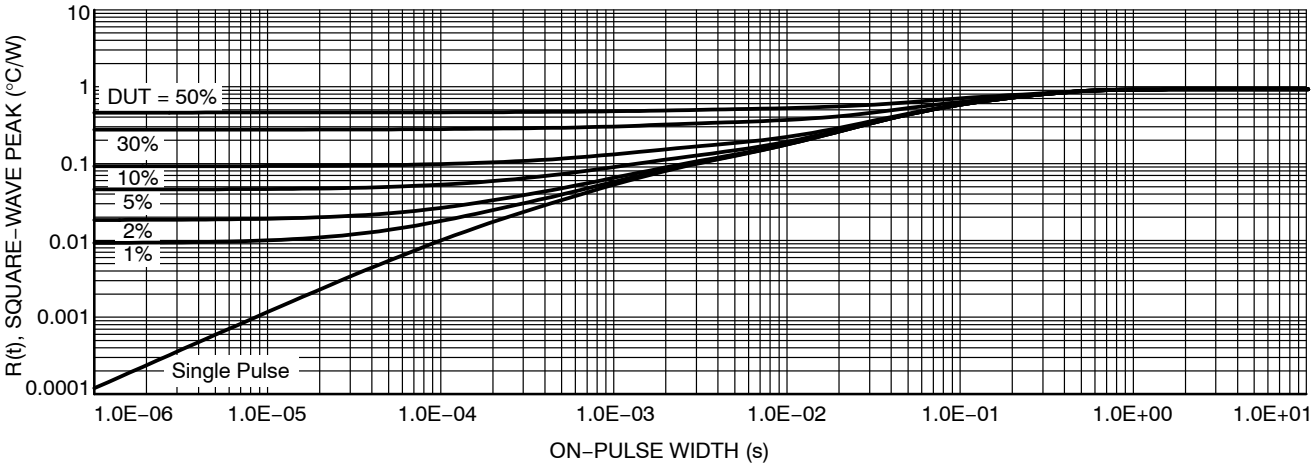



**Figure 15. IGBT Transient Thermal Impedance**

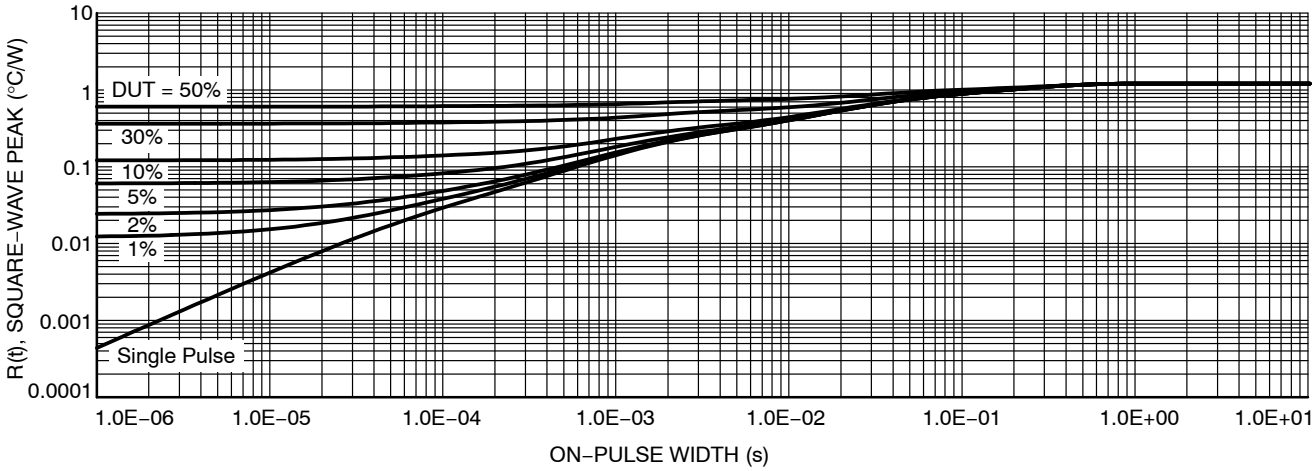



**Figure 16. Diode Transient Thermal Impedance Boost Diode**

## TYPICAL CHARACTERISTICS − Boost IGBT & Boost Diode

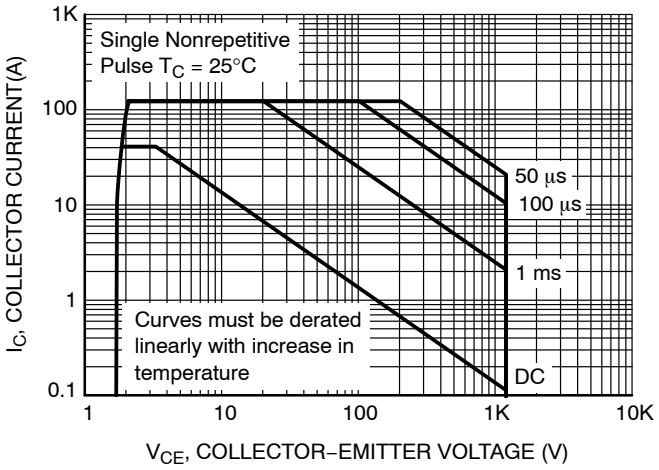



**Figure 17. T1 & T2 FBSOA**

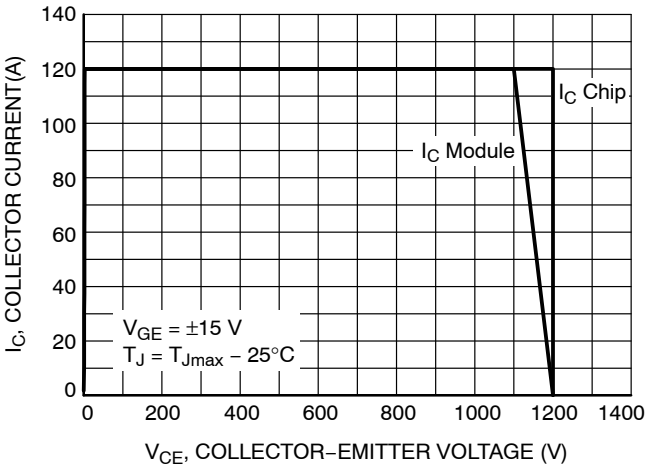



**Figure 18. T1 & T2 RBSOA**

## TYPICAL CHARACTERISTICS – IGBT Protection Diode and Bypass Diode

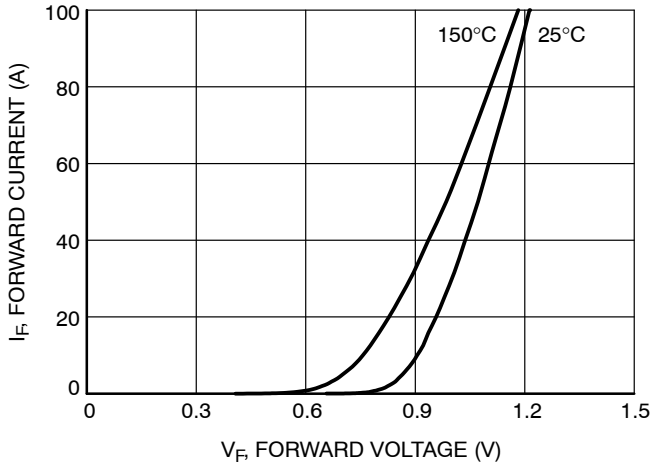



**Figure 19. Diode Forward Characteristic**

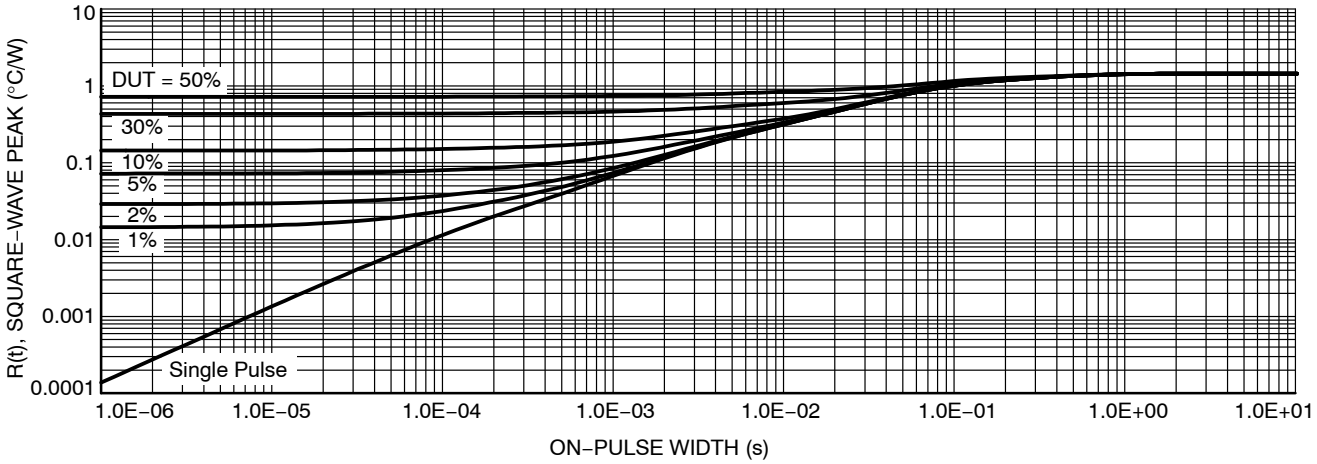



**Figure 20. Diode Transient Thermal Impedance Bypass Diode / IGBT Protection Diode**

## TYPICAL CHARACTERISTICS – Thermistor

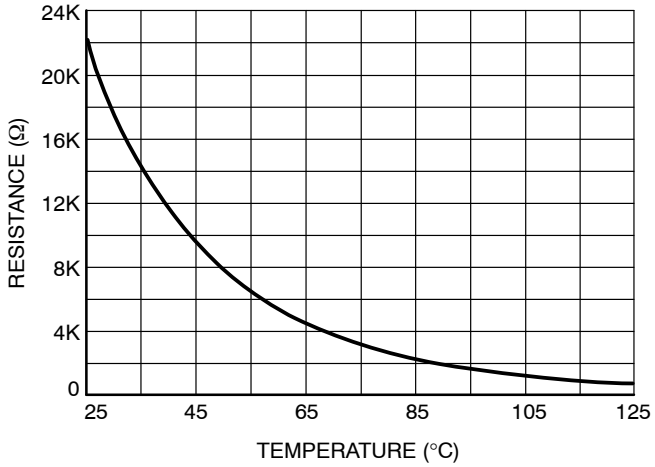
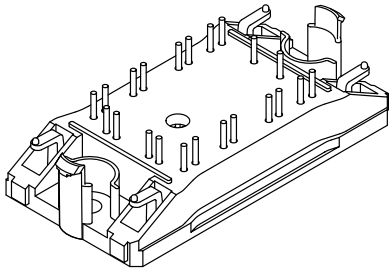
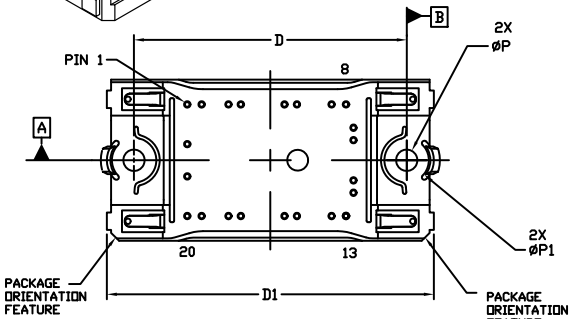



**Figure 21. Thermistor Characteristic**

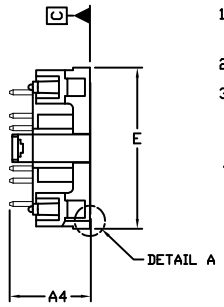
**PIM22, 55x32.5 / Q0BOOST**
CASE 180AJ
ISSUE B

DATE 08 NOV 2017





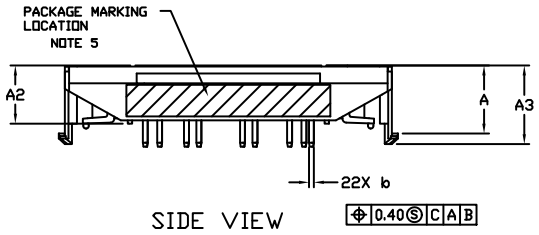

TOP VIEW



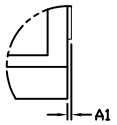

END VIEW

NOTES:

1. DIMENSIONING AND TOLERANCING PER. ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSION b APPLIES TO THE PLATED TERMINALS AND IS MEASURED BETWEEN 1.00 AND 3.00 FROM THE TERMINAL TIP.
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.




SIDE VIEW




DETAIL A

| DIM | MILLIMETERS | |
|---|---|---|
| | MIN. | NOM. |
| A | 13.50 | 13.90 |
| A1 | 0.10 | 0.30 |
| A2 | 11.50 | 11.90 |
| A3 | 15.65 | 16.05 |
| A4 | 16.35 REF | |
| b | 0.95 | 1.05 |
| D | 54.80 | 55.20 |
| D1 | 65.60 | 66.20 |
| E | 32.20 | 32.80 |
| P | 4.20 | 4.40 |
| P1 | 8.90 | 9.10 |

MOUNTING HOLE POSITION

NOTE 4

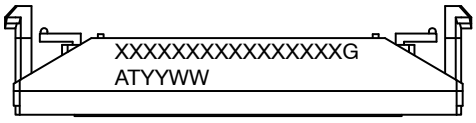
| PIN | HOLE POSITION | |
|---|---|---|
| | X | Y |
| 1 | -16.75 | -11.25 |
| 2 | -13.85 | -11.25 |
| 3 | -8.45 | -11.25 |
| 4 | -5.95 | -11.25 |
| 5 | 2.85 | -11.25 |
| 6 | 5.35 | -11.25 |
| 7 | 12.35 | -11.25 |
| 8 | 15.25 | -11.25 |
| 9 | 16.75 | -6.55 |
| 10 | 16.75 | -4.05 |
| 11 | 16.75 | 4.05 |

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 12 | 16.75 | 6.55 |
| 13 | 15.25 | 11.25 |
| 14 | 12.35 | 11.25 |
| 15 | 5.35 | 11.25 |
| 16 | 2.85 | 11.25 |
| 17 | -5.95 | 11.25 |
| 18 | -8.45 | 11.25 |
| 19 | -13.85 | 11.25 |
| 20 | -16.75 | 11.25 |
| 21 | -16.75 | 3.25 |
| 22 | -16.75 | -3.25 |

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 1 | -16.75 | 11.25 |
| 2 | -13.85 | 11.25 |
| 3 | -8.45 | 11.25 |
| 4 | -5.95 | 11.25 |
| 5 | 2.85 | 11.25 |
| 6 | 5.35 | 11.25 |
| 7 | 12.35 | 11.25 |
| 8 | 15.25 | 11.25 |
| 9 | 16.75 | 6.55 |
| 10 | 16.75 | 4.05 |
| 11 | 16.75 | -4.05 |

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 12 | 16.75 | -6.55 |
| 13 | 15.25 | -11.25 |
| 14 | 12.35 | -11.25 |
| 15 | 5.35 | -11.25 |
| 16 | 2.85 | -11.25 |
| 17 | -5.95 | -11.25 |
| 18 | -8.45 | -11.25 |
| 19 | -13.85 | -11.25 |
| 20 | -16.75 | -11.25 |
| 21 | -16.75 | -3.25 |
| 22 | -16.75 | 3.25 |

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



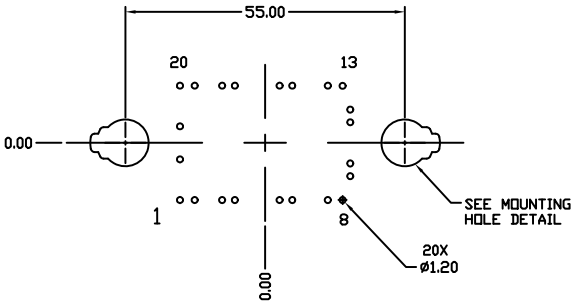

XXXXX = Specific Device Code
G = Pb−Free Package
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

*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.

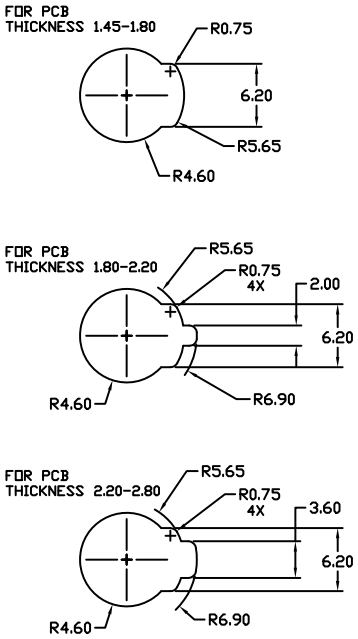
| DOCUMENT NUMBER: | 98AON63481G | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. |
|---|---|---|
| DESCRIPTION: | PIM22 55X32.5 / Q0BOOST (SOLDER PIN) | PAGE 1 OF 2 |

**PIM22, 55x32.5 / Q0BOOST**
CASE 180AJ
ISSUE B

DATE 08 NOV 2017




RECOMMENDED
MOUNTING PATTERN




MOUNTING HOLE DETAIL

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98AON63481G** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. | |
| **DESCRIPTION:** | **PIM22 55X32.5 / Q0BOOST (SOLDER PIN)** | | **PAGE 2 OF 2** |

## PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
**Email Requests to:** orderlit@onsemi.com

**onsemi Website:** www.onsemi.com

**TECHNICAL SUPPORT**
**North American Technical Support:**
Voice Mail: 1 800−282−9855 Toll Free USA/Canada
Phone: 011 421 33 790 2910

**Europe, Middle East and Africa Technical Support:**
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

◊