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# Half-Bridge IGBT Module, Qdual3

1200 V, 800 A

**NXH800H120L7QDSG**

## General Description

The NXH800H120L7QDSG is a 1200 V 800 A rated half bridge IGBT power module. The integrated Field Stop Trench 7 IGBTs and Gen. 7 diodes provide lower conduction losses and switching losses, enabling designers to achieve high efficiency and superior reliability.

## Features

- 1200 V, 800 A 2 in 1 Half Bridge Configuration IGBT Power Module
- Field Stop Trench 7 IGBTs & Gen.7 Diodes
- NTC Thermistor
- Isolated Base Plate
- Solderable Pins
- Low Inductive Layout
- This is a Pb-Free Device

## Typical Applications

- Motor Drives
- Servo Drives
- Solar Drives
- Uninterruptible Power Supply Systems (UPS)

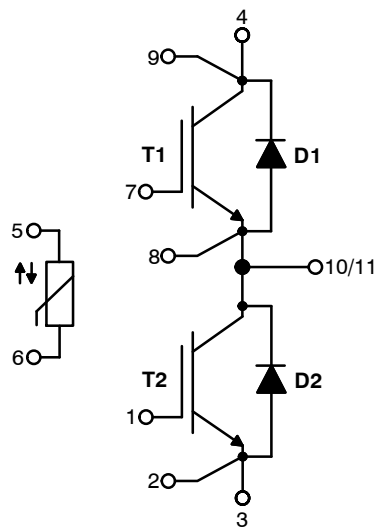
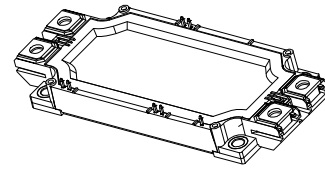


Figure 1. Schematic



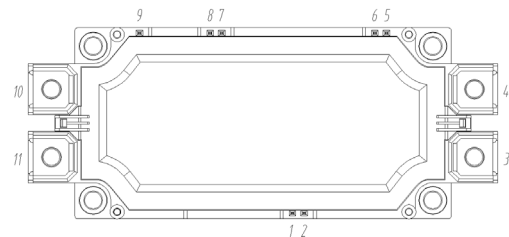
PIM11, 152.00 x 62.15 x 20.80  
CASE 180HT

## MARKING DIAGRAM



NXH800H120L7QDSG = Device Code  
AT = Assembly & Test Site Code  
YYWW = Year and Work Week Code

## PIN ASSIGNMENTS



## ORDERING INFORMATION

| Device           | Package            | Shipping                  |
|------------------|--------------------|---------------------------|
| NXH800H120L7QDSG | PIM11<br>(Pb-Free) | 8 Units /<br>Blister Tray |

## PIN DESCRIPTION

| Pin | Name | Description                 |
|-----|------|-----------------------------|
| 1   | G2   | T2 Gate                     |
| 2   | E2   | T2 Emitter                  |
| 3   | DC-  | DC Negative Bus Connection  |
| 4   | DC+  | DC Positive Bus Connection  |
| 5   | TH2  | Thermistor Connection 2     |
| 6   | TH1  | Thermistor Connection 1     |
| 7   | G1   | T1 Gate                     |
| 8   | E1   | T1 Emitter                  |
| 9   | CS1  | T1 Collector Sensing        |
| 10  | OUT  | Center Point of Half Bridge |
| 11  | OUT  | Center Point of Half Bridge |

# NXH800H120L7QDSG

**Table 1. ABSOLUTE MAXIMUM RATINGS** ( $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified)

| Symbol               | Parameter                                    | Conditions                                              | Value          | Unit               |
|----------------------|----------------------------------------------|---------------------------------------------------------|----------------|--------------------|
| <b>IGBT // Diode</b> |                                              |                                                         |                |                    |
| $V_{CES}$            | Collector–Emitter Voltage                    | Gate–emitter = 0 V                                      | 1200           | V                  |
| $V_{GES}$            | Gate–Emitter Voltage                         | Collector–emitter = 0 V                                 | $\pm 20$       | V                  |
| $I_C$                | Continuous Collector Current                 | $T_C = 90^{\circ}\text{C}$                              | $\pm 800$      | A                  |
| $I_{PULSE}$          | Repetitive Pulsed Collector Current          | $T_C = 25^{\circ}\text{C}$ , $t_p = 1\text{ ms}$        | $\pm 1600$     | A                  |
| $T_{vjop}$           | Operating Junction Temperature               |                                                         | $-40 \sim 175$ | $^{\circ}\text{C}$ |
| $T_{SCWT}$           | Short Circuit Withstand Time, Non Repetitive | $V_{GE} \leq 15\text{ V}$ , $V_{DC+} \leq 800\text{ V}$ | 8              | $\mu\text{s}$      |

## MODULE

|           |                                            |                                              |                |                    |
|-----------|--------------------------------------------|----------------------------------------------|----------------|--------------------|
| $V_{ISO}$ | Isolation Voltage                          | RMS, $f = 60\text{ HZ}$ , pins to base plate | 3.4            | kV                 |
| $T_{STG}$ | Storage Temperature                        |                                              | $-40 \sim 125$ | $^{\circ}\text{C}$ |
| $M_T$     | Mounting torque to main terminals (Note 1) | M6 screw                                     | 6.0            | N·m                |
| $M_H$     | Mounting torque to heat sink (Note 1)      | M5 screw                                     |                |                    |

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. Recommendable value: 3.0 ~ 6.0 N·m

**Table 2. THERMAL RESISTANCE CHARACTERISTICS**

| Symbol      | Parameter                                     | Condition                           | Min | Typ    | Max    | Unit                 |
|-------------|-----------------------------------------------|-------------------------------------|-----|--------|--------|----------------------|
| $R_{thJCQ}$ | Junction to Case Thermal Resistance (Note 2)  | Per IGBT                            | –   | –      | 0.0498 | $^{\circ}\text{C/W}$ |
| $R_{thJCD}$ |                                               | Per diode                           | –   | –      | 0.0889 |                      |
| $R_{thCHQ}$ | Case to Heat–Sink Thermal Resistance (Note 2) | Per IGBT, 1 W/(m·K) thermal grease  | –   | 0.0282 | –      |                      |
| $R_{thCHD}$ |                                               | Per diode, 1 W/(m·K) thermal grease | –   | 0.0342 | –      |                      |

2. Data from characterization.

**Table 3. THERMISTOR CHARACTERISTICS**

| Symbol       | Parameter                             | Condition                        | Min | Typ   | Max  | Unit                   |
|--------------|---------------------------------------|----------------------------------|-----|-------|------|------------------------|
| $R_{25}$     | Nominal Resistance                    | $T_{NTC} = 25^{\circ}\text{C}$   | –   | 5     | –    | k $\Omega$             |
| $R_{100}$    |                                       | $T_{NTC} = 100^{\circ}\text{C}$  | –   | 493.3 | –    | $\Omega$               |
| $\Delta R/R$ | Deviation on $R_{100}$                | $T_{NTC} = 100^{\circ}\text{C}$  | –5  | –     | 5    | %                      |
| $P_D$        | Power Dissipation – Recommended Limit | 0.15 mA, non–self–heating effect | –   | 0.1   | –    | mW                     |
|              | Power Dissipation – Absolute Maximum  | 5 mA                             | –   | –     | 34.2 | mW                     |
|              | Power Dissipation Constant            |                                  | –   | 1.4   | –    | mW/ $^{\circ}\text{C}$ |
| $B_{25/50}$  | B–Value                               | B(25/50), tolerance $\pm 2\%$    | –   | 3375  | –    | K                      |
| $B_{25/100}$ | B–Value                               | B(25/100), tolerance $\pm 2\%$   | –   | 3436  | –    | K                      |

# NXH800H120L7QDSG

**Table 4. ELECTRICAL CHARACTERISTICS** (T<sub>vj</sub> = 25°C unless otherwise specified)

| Symbol                                     | Parameter                            | Test Conditions                                                                                                        |                         | Min | Typ   | Max  | Unit |
|--------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-------|------|------|
| <b>IGBT</b>                                |                                      |                                                                                                                        |                         |     |       |      |      |
| V <sub>CE(SAT)</sub><br>(Pin 8–9)          | Collector–Emitter Saturation Voltage | V <sub>GE</sub> = 15 V, I <sub>C</sub> = 800 A                                                                         | T <sub>vj</sub> = 25°C  | –   | 1.65  | 2.05 | V    |
| V <sub>CE(SAT)</sub><br>(Chip)<br>(Note 3) |                                      |                                                                                                                        | T <sub>vj</sub> = 25°C  | –   | 1.44  | 1.85 |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 1.63  | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 1.75  | –    |      |
| V <sub>GE(TH)</sub>                        | Gate–Emitter Threshold Voltage       | V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 80 mA                                                             |                         | 4.5 | 5.5   | 6.5  | V    |
| Q <sub>g</sub>                             | Gate Charge                          | V <sub>CE</sub> = 600 V, V <sub>GE</sub> = ±15 V, I <sub>C</sub> = 800 A                                               |                         | –   | 5.6   | –    | μC   |
| R <sub>gint</sub>                          | Internal Gate Resistor               |                                                                                                                        |                         | –   | 1.5   | –    | Ω    |
| C <sub>ies</sub>                           | Input Capacitance                    | V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V, f = 100 kHz,<br>T <sub>vj</sub> = 25°C                                  |                         | –   | 94.3  | –    | nF   |
| C <sub>oes</sub>                           | Output Capacitance                   |                                                                                                                        |                         | –   | 3.9   | –    |      |
| C <sub>res</sub>                           | Reverse Transfer Capacitance         |                                                                                                                        |                         | –   | 0.58  | –    |      |
| I <sub>CES</sub>                           | Collector–Emitter Cut Off Current    | V <sub>CE</sub> = 1200 V, V <sub>GE</sub> = 0 V                                                                        |                         | –   | –     | 100  | μA   |
| I <sub>GES</sub>                           | Gate–Emitter Leakage Current         | V <sub>CE</sub> = 0 V, V <sub>GE</sub> = 20 V                                                                          |                         | –   | –     | 80   | nA   |
| t <sub>don</sub>                           | Turn-on Delay Time                   | V <sub>CE</sub> = 600 V, V <sub>GE</sub> = ±15 V,<br>R <sub>g</sub> = 0.5 Ω, I <sub>C</sub> = 800 A,<br>Inductive load | T <sub>vj</sub> = 25°C  | –   | 0.37  | –    | μs   |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 0.41  | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 0.42  | –    |      |
| t <sub>r</sub>                             | Rise Time                            |                                                                                                                        | T <sub>vj</sub> = 25°C  | –   | 0.14  | –    | μs   |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 0.15  | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 0.15  | –    |      |
| t <sub>doff</sub>                          | Turn-off Delay Time                  |                                                                                                                        | T <sub>vj</sub> = 25°C  | –   | 0.4   | –    | μs   |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 0.42  | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 0.44  | –    |      |
| t <sub>f</sub>                             | Fall Time                            |                                                                                                                        | T <sub>vj</sub> = 25°C  | –   | 0.1   | –    | μs   |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 0.17  | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 0.21  | –    |      |
| E <sub>on</sub>                            | Turn-on Energy Loss per Pulse        |                                                                                                                        | T <sub>vj</sub> = 25°C  | –   | 87.4  | –    | mJ   |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 112   | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 132.6 | –    |      |
| E <sub>off</sub>                           | Turn-off Energy Loss per Pulse       |                                                                                                                        | T <sub>vj</sub> = 25°C  | –   | 69.8  | –    | mJ   |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 125°C | –   | 90.1  | –    |      |
|                                            |                                      |                                                                                                                        | T <sub>vj</sub> = 175°C | –   | 102.0 | –    |      |

# NXH800H120L7QDSG

**Table 4. ELECTRICAL CHARACTERISTICS** ( $T_{vj} = 25^{\circ}\text{C}$  unless otherwise specified) (continued)

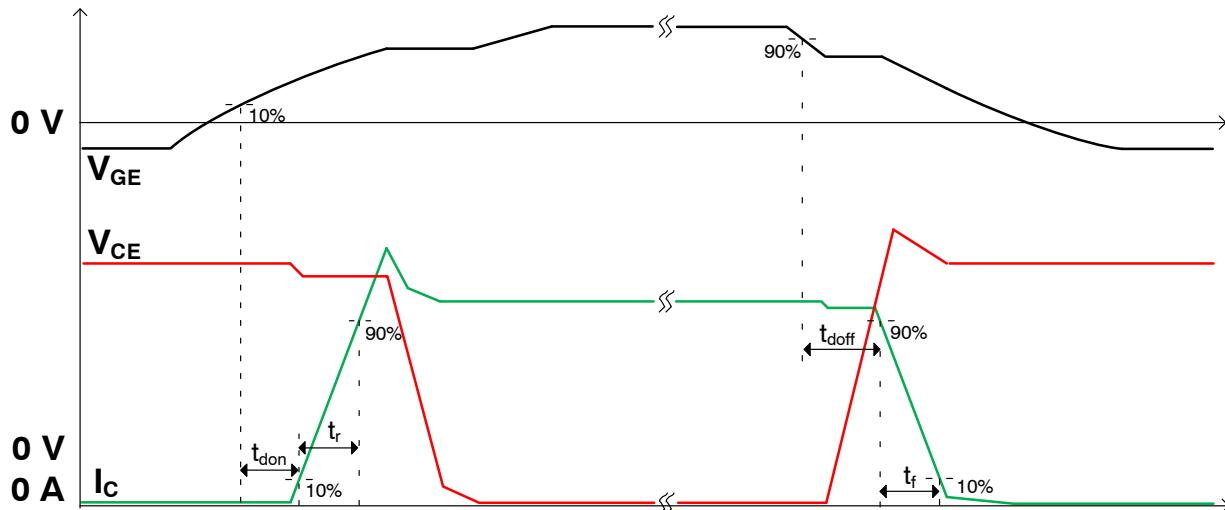
| Symbol                      | Parameter                              | Test Conditions                                                                                                        |                                | Min | Typ   | Max  | Unit          |
|-----------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----|-------|------|---------------|
| <b>DIODE</b>                |                                        |                                                                                                                        |                                |     |       |      |               |
| $V_F$<br>(Pin 8-9)          | Diode Forward Voltage                  | $V_{GE} = 0\text{ V}$ , $I_F = 800\text{ A}$                                                                           | $T_{vj} = 25^{\circ}\text{C}$  | —   | 1.86  | 2.25 | V             |
| $V_F$<br>(Chip)<br>(Note 3) |                                        |                                                                                                                        | $T_{vj} = 25^{\circ}\text{C}$  | —   | 1.64  | 2.05 |               |
|                             |                                        |                                                                                                                        | $T_{vj} = 125^{\circ}\text{C}$ | —   | 1.62  | —    |               |
|                             |                                        |                                                                                                                        | $T_{vj} = 175^{\circ}\text{C}$ | —   | 1.57  | —    |               |
| $I_{RRM}$                   | Peak Reverse Recovery Current          | $V_{CE} = 600\text{ V}$ , $V_{GE} = \pm 15\text{ V}$ ,<br>$R_g = 0.5\ \Omega$ , $I_C = 800\text{ A}$<br>Inductive load | $T_{vj} = 25^{\circ}\text{C}$  | —   | 229   | —    | A             |
|                             |                                        |                                                                                                                        | $T_{vj} = 125^{\circ}\text{C}$ | —   | 346   | —    |               |
|                             |                                        |                                                                                                                        | $T_{vj} = 175^{\circ}\text{C}$ | —   | 399   | —    |               |
| $Q_{rr}$                    | Reverse Recovery Charge                |                                                                                                                        | $T_{vj} = 25^{\circ}\text{C}$  | —   | 37.6  | —    | $\mu\text{C}$ |
|                             |                                        |                                                                                                                        | $T_{vj} = 125^{\circ}\text{C}$ | —   | 90.5  | —    |               |
|                             |                                        |                                                                                                                        | $T_{vj} = 175^{\circ}\text{C}$ | —   | 126.6 | —    |               |
| $E_{rec}$                   | Reverse Recovery Energy Loss per Pulse |                                                                                                                        | $T_{vj} = 25^{\circ}\text{C}$  | —   | 14.0  | —    | mJ            |
|                             |                                        |                                                                                                                        | $T_{vj} = 125^{\circ}\text{C}$ | —   | 36.4  | —    |               |
|                             |                                        |                                                                                                                        | $T_{vj} = 175^{\circ}\text{C}$ | —   | 52.6  | —    |               |

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.

3. This parameter is only guaranteed by design.

**Table 5. MODULE AND MECHANICAL CHARACTERISTICS**

| Symbol   | Parameter                  | Condition            | Min  | Typ  | Max | Unit |
|----------|----------------------------|----------------------|------|------|-----|------|
| CTI      | Comparative Tracking Index |                      | >175 | —    | —   |      |
| $D_{CR}$ | Creepage Distance          | Terminal to terminal | —    | 13.0 | —   | mm   |
|          |                            | Terminal to heatsink | —    | 15.0 | —   | mm   |
| $D_{CL}$ | Clearance Distance         | Terminal to terminal | —    | 10.0 | —   | mm   |
|          |                            | Terminal to heatsink | —    | 12.5 | —   | mm   |
| $M_{LS}$ | Module Stray Inductance    |                      | —    | 20   | —   | nH   |
| $M_W$    | Module Weight              |                      | —    | 330  | —   | g    |



**Figure 2. Switching Time Definition**

TYPICAL CHARACTERISTICS

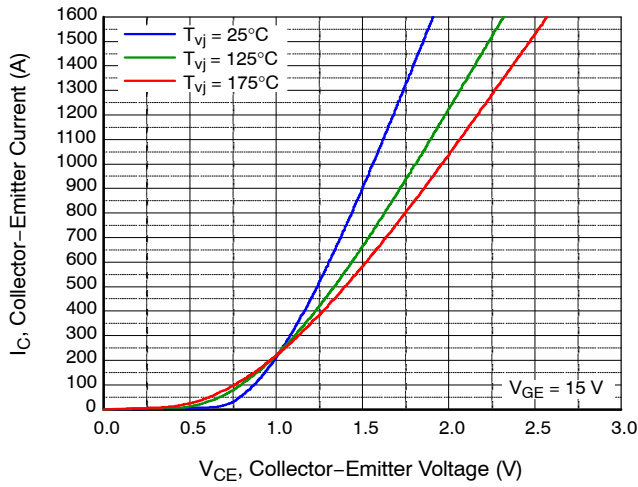


Figure 1. Output Characteristic, IGBT (Typ.)

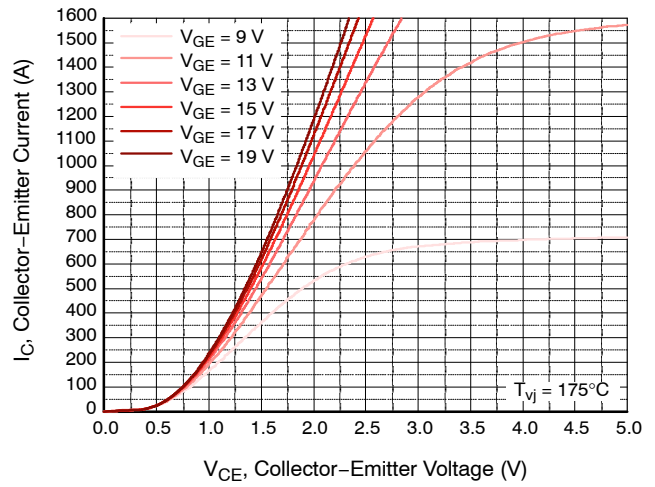


Figure 2. Output Characteristic, IGBT (Typ.)

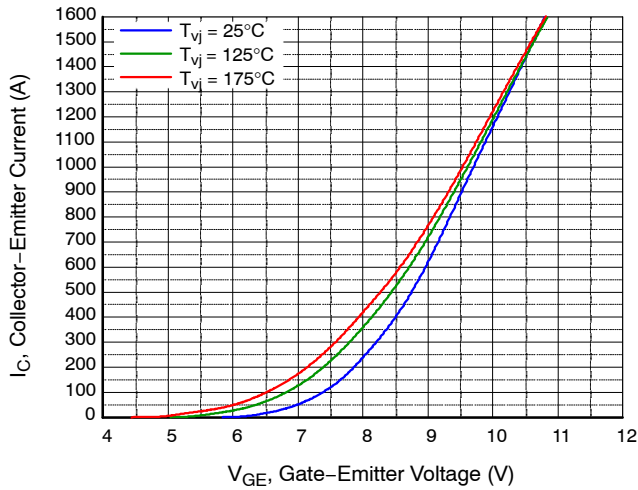


Figure 3. Transfer Characteristic, IGBT (Typ.)

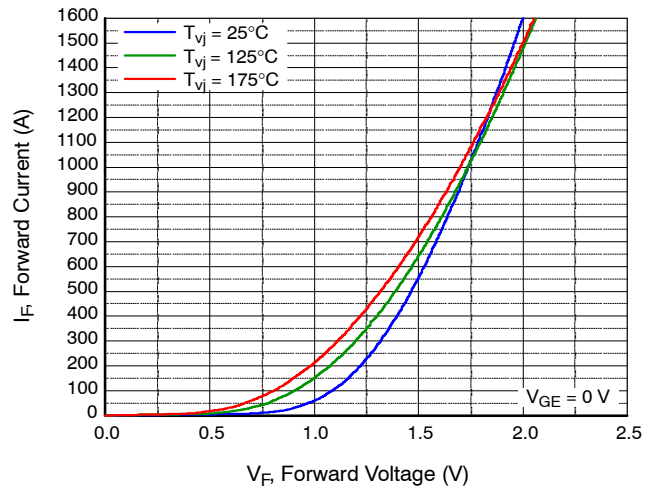


Figure 4. Forward Characteristic, Diode (Typ.)

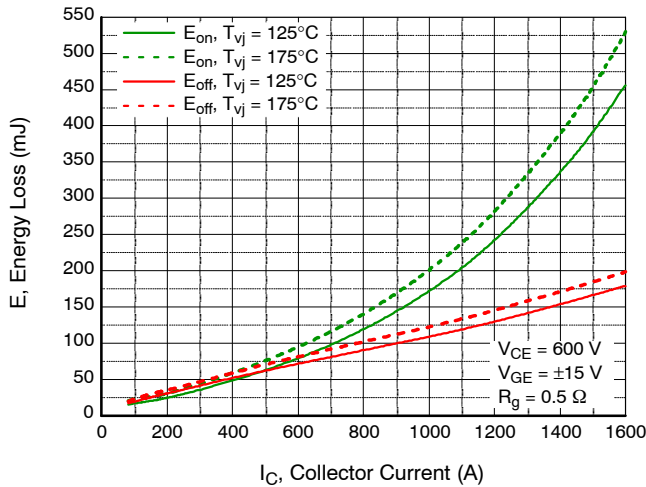


Figure 5. Switching Losses Characteristic, IGBT (Typ.)

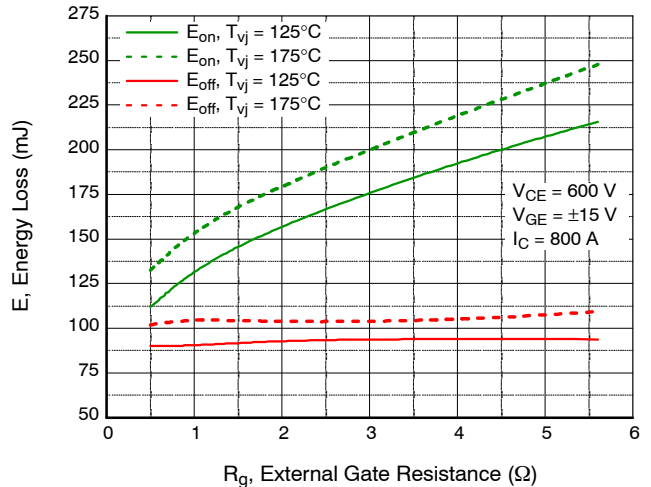
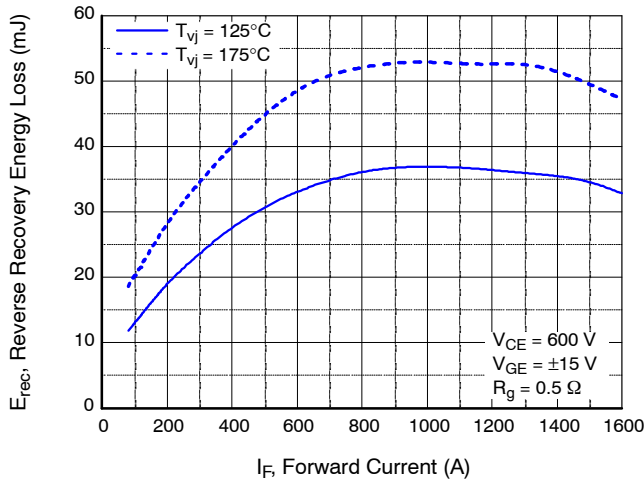
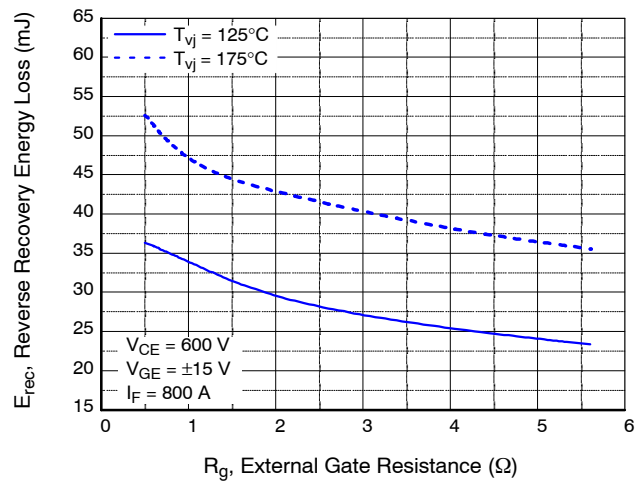


Figure 6. Switching Losses Characteristic, IGBT (Typ.)

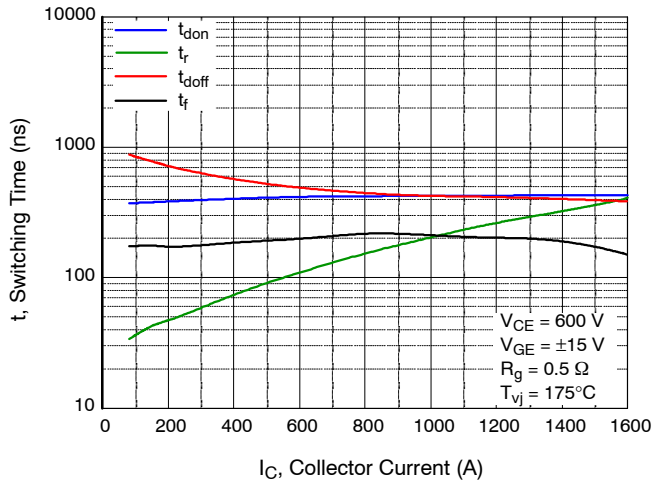
## TYPICAL CHARACTERISTICS (continued)



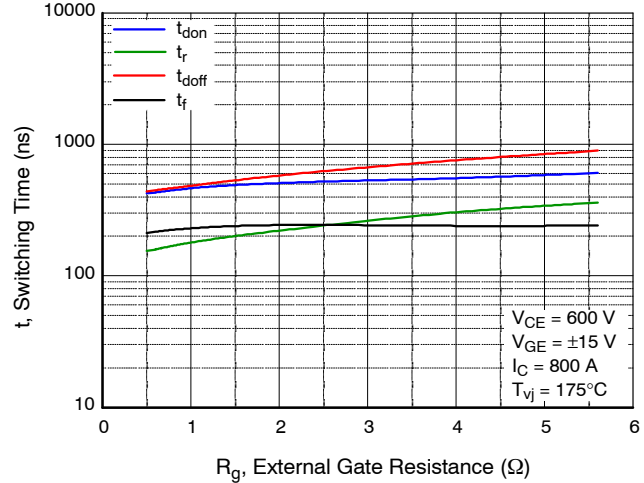
**Figure 7. Switching Losses Characteristic, Diode (Typ.)**



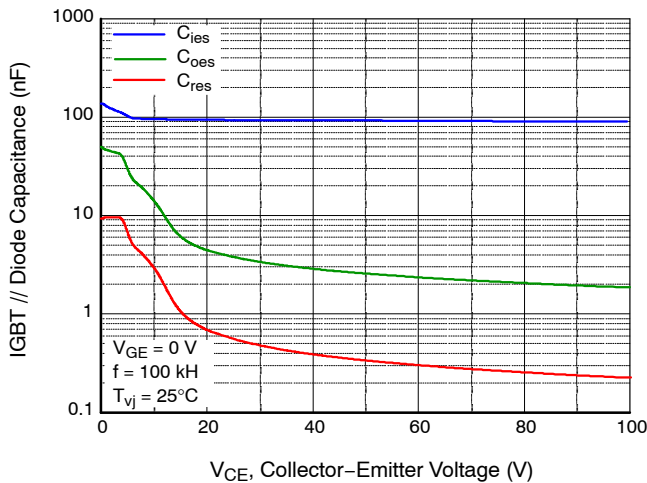
**Figure 8. Switching Losses Characteristic, Diode (Typ.)**



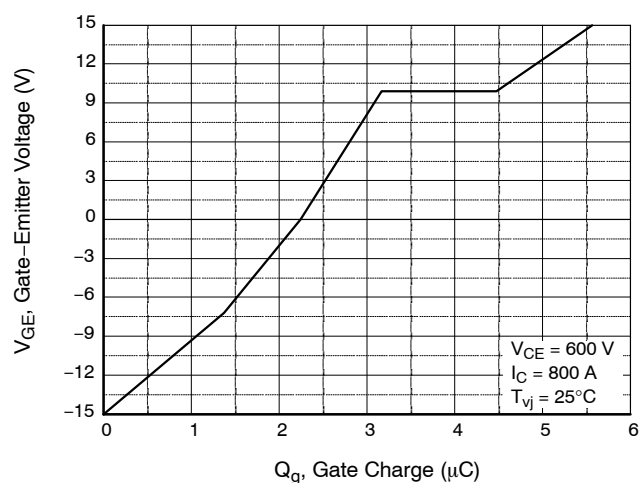
**Figure 9. Switching Time Characteristic, IGBT (Typ.)**



**Figure 10. Switching Time Characteristic, IGBT (Typ.)**

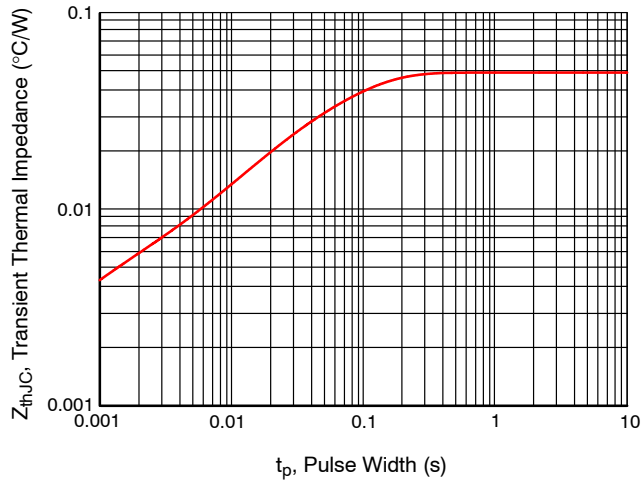


**Figure 11. Capacity Characteristic, IGBT // Diode (Typ.)**

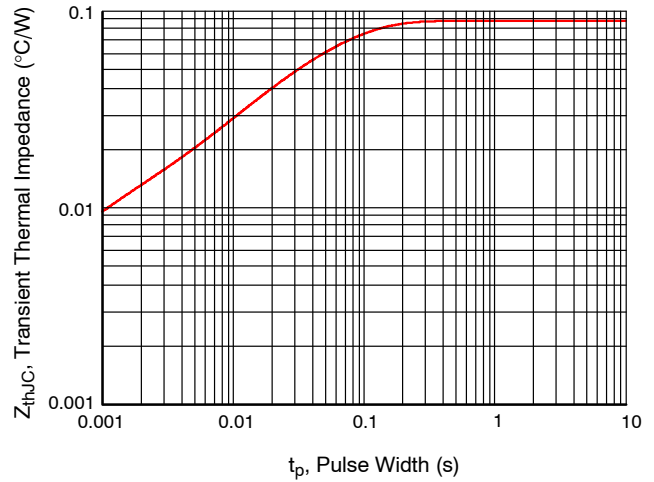


**Figure 12. Gate Charge Characteristic, IGBT (Typ.)**

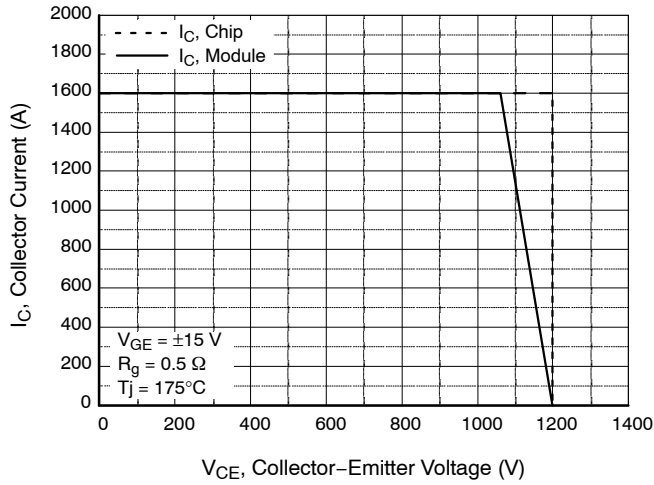
## TYPICAL CHARACTERISTICS (continued)



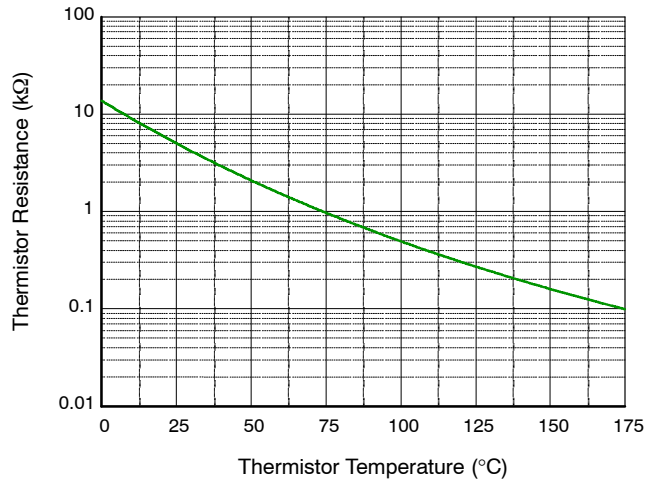
**Figure 13. Transient Thermal Impedance, IGBT (Max.)**



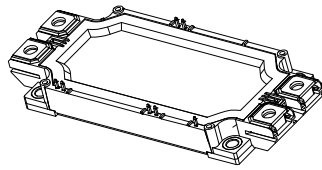
**Figure 14. Transient Thermal Impedance, Diode (Max.)**



**Figure 15. Reverse Bias Safe Operating Area, IGBT // Diode**



**Figure 16. NTC Thermistor R-T Value (Typ.)**

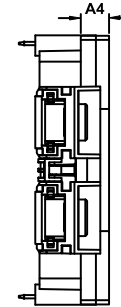
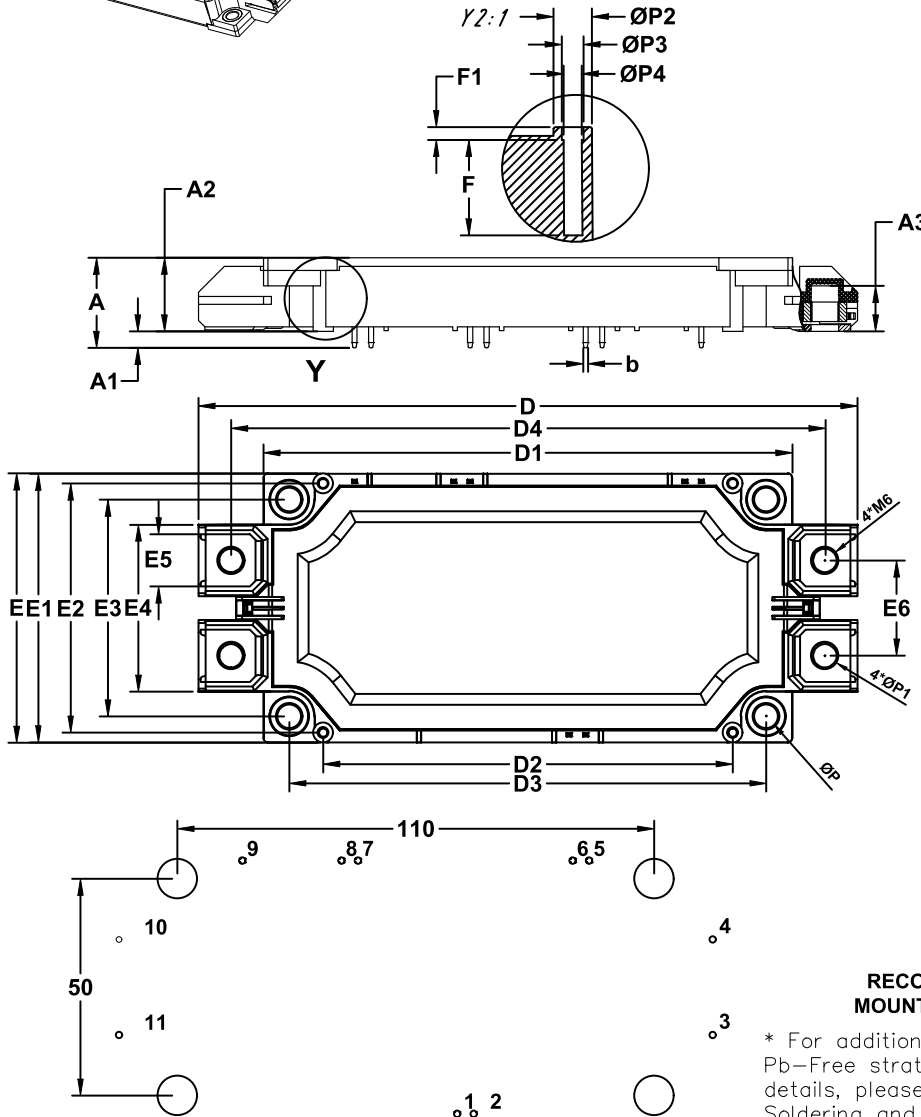


PIM11, 152.00x62.15x17.00  
CASE 180HT  
ISSUE E

DATE 28 MAY 2024

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5-2018.
2. CONTROLLING DIMENSION : MILLIMETERS
3. DIMENSIONS b AND b1 APPLY TO THE PLATED TERMINALS AND ARE MEASURED AT DIMENSION A1
4. PIN POSITION TOLERANCE IS  $\pm 0.25$  mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES
6. SOLDER PIN



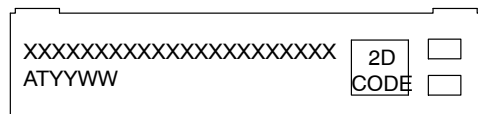
| DIM | MILLIMETERS |        |        |
|-----|-------------|--------|--------|
|     | MIN.        | NOM.   | MAX.   |
| A   | 20.00       | 20.80  | 21.60  |
| A1  | 3.50        | 3.80   | 4.10   |
| A2  | 16.50       | 17.00  | 17.50  |
| A3  | 10.00       | 10.5   | 11.00  |
| A4  | 6.30        | 6.50   | 6.70   |
| b   | 1.12        | 1.15   | 1.18   |
| D   | 151.5       | 152.00 | 152.50 |
| D1  | 121.50      | 122.00 | 122.50 |
| D2  | 94.30       | 94.50  | 94.70  |
| D3  | 109.80      | 110.00 | 110.20 |
| E   | 61.95       | 62.15  | 62.35  |
| E1  | 61.80       | 62.00  | 62.20  |
| E2  | 57.30       | 57.50  | 57.70  |
| E3  | 49.80       | 50.00  | 50.20  |
| E4  | 38.40       | 38.60  | 38.80  |
| E5  | 11.80       | 12.00  | 12.20  |
| F   | 11.00       | 11.00  | 11.20  |
| F1  | 1.40        | 1.45   | 1.50   |
| P   | 5.20        | 5.50   | 5.60   |
| P1  | 6.40        | 6.40   | 6.60   |
| P2  | 4.45        | 4.65   | 4.85   |
| P3  | 2.40        | 2.50   | 2.50   |
| P4  | 2.05        | 2.10   | 2.10   |
| D4  | 136.40      | 137.00 | 137.60 |
| E6  | 21.60       | 22.00  | 22.40  |

| Pin | Pin table |       |          |
|-----|-----------|-------|----------|
|     | X         | Y     | Function |
| 1   | 9.52      | -29.2 | T2       |
| 2   | 13.33     | -29.2 | DC-      |
| 3   | 68.5      | -11.0 | DC-      |
| 4   | 68.5      | 11.0  | DC+      |
| 5   | 40.0      | 29.2  | T2       |
| 6   | 36.19     | 29.2  | T2       |
| 7   | -13.33    | 29.2  | T1       |
| 8   | -17.14    | 29.2  | AC       |
| 9   | -40.0     | 29.2  | DC+      |
| 10  | -68.5     | 11.0  | AC       |
| 11  | -68.5     | -11.0 | AC       |

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.

GENERIC  
MARKING DIAGRAM\*



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

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

|                  |                           |                                                                                                                                                                                  |
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