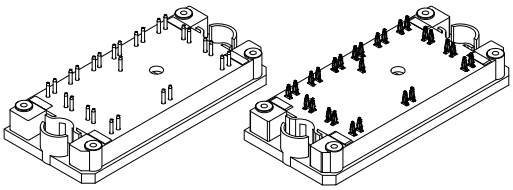
# Q1PACK Module

# NXH75M65L4Q1SG, NXH75M65L4Q1PTG

**75 A, 650 V Module**

This high−density, integrated power module combines high−performance IGBTs with rugged anti−parallel diodes.



**PIM27, 71x37.4 (SOLDER PIN) CASE 180CA**

**PIM27, 71x37.4 (PRESSFIT PIN) CASE 180CP**

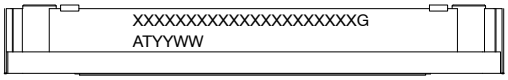
### Features

- Extremely Efficient Trench with Fieldstop Technology
- Low Switching Loss Reduces System Power Dissipation
- Module Design Offers High Power Density
- Low Inductive Layout
- Q1PACK Packages with Solder and Pressfit Pins

### Typical Applications

- Solar Inverters
- Uninterruptable Power Supplies

### MARKING DIAGRAM




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

### ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

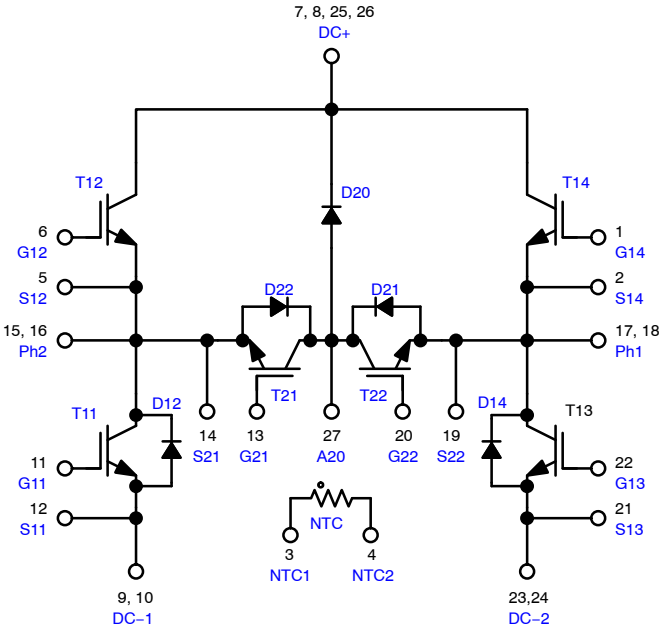



**Figure 1. Schematic**

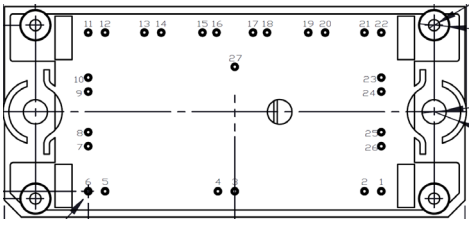


**Figure 2. Pin Assignments**

## ABSOLUTE MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| **IGBT (T11, T12, T13, T14, T21, T22)** | | | |
| Collector−emitter voltage | $V_{CES}$ | 650 | V |
| Collector current @ $T_h$ = 80°C (per IGBT) | $I_C$ | 59 | A |
| Pulsed collector current, $T_{pulse}$ limited by $T_{jmax}$ | $I_{CM}$ | 176 | A |
| Power Dissipation Per IGBT<br>$T_j = T_{jmax}$, $T_h$ = 80°C | $P_{tot}$ | 83 | W |
| Gate−emitter voltage | $V_{GE}$ | ±20 | V |
| Maximum Junction Temperature | $T_J$ | 175 | °C |
| **DIODE (D12, D14, D20, D21, D22)** | | | |
| Peak Repetitive Reverse Voltage | $V_{RRM}$ | 650 | V |
| Forward Current, DC @ $T_h$ = 80°C (per Diode) | $I_F$ | 50 | A |
| Nonrepetitive Peak Surge Current<br>(Surge applied at rated load conditions halfwave, single phase, 60 Hz) | $I_{FSM}$ | 225 | A |
| Power Dissipation Per Diode<br>$T_j = T_{jmax}$, $T_h$ = 80°C | $P_{tot}$ | 86 | W |
| Maximum Junction Temperature | $T_J$ | 175 | °C |
| **THERMAL PROPERTIES** | | | |
| Operating Temperature under switching condition | $T_{VJ\ OP}$ | −40 to ($T_{jmax}$ − 25) | °C |
| Storage Temperature range | $T_{stg}$ | −40 to 125 | °C |
| **INSULATION PROPERTIES** | | | |
| Isolation test voltage, t = 2 min, 60 Hz | $V_{is}$ | 4000 | Vac |
| 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.

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise specified)

| Parameter | Test Condition | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **IGBT (T11, T12, T13, T14, T21, T22)** | | | | | | |
| Collector−emitter cutoff current | $V_{GE}$ = 0 V, $V_{CE}$ = 650 V | $I_{CES}$ | – | – | 300 | μA |
| Collector−emitter saturation voltage | $V_{GE}$ = 15 V, $I_C$ = 75 A, $T_j$ = 25°C<br>$V_{GE}$ = 15 V, $I_C$ = 75 A, $T_j$ = 150°C | $V_{CE(sat)}$ | –<br>– | 1.56<br>1.76 | 2.22<br>– | V |
| Gate−emitter threshold voltage | $V_{GE}$ = $V_{CE}$, $I_C$ = 75mA | $V_{GE(TH)}$ | 3.1 | 4.45 | 5.2 | V |
| Gate leakage current | $V_{GE}$ = 20 V, $V_{CE}$ = 0 V | $I_{GES}$ | – | – | 400 | nA |
| Turn−on delay time | $T_j$ = 25°C<br>$V_{CE}$ =350 V, $I_C$ = 80 A<br>$V_{GE}$ = 15 V, −9 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 38 | – | ns |
| Rise time | | $t_r$ | – | 34 | – | |
| Turn−off delay time | | $t_{d(off)}$ | – | 129 | – | |
| Fall time | | $t_f$ | – | 17 | – | |
| Turn on switching loss | | $E_{on}$ | – | 0.606 | – | mJ |
| Turn off switching loss | | $E_{off}$ | – | 0.903 | – | |
| Turn−on delay time | $T_j$ = 125°C<br>$V_{CE}$ = 350 V, $I_C$ = 80 A<br>$V_{GE}$ = 15 V, −9 V, $R_G$ = 10 Ω | $t_{d(on)}$ | – | 37 | – | ns |
| Rise time | | $t_r$ | – | 34 | – | |
| Turn−off delay time | | $t_{d(off)}$ | – | 139 | – | |
| Fall time | | $t_f$ | – | 23 | – | |
| Turn on switching loss | | $E_{on}$ | – | 1.024 | – | mJ |
| Turn off switching loss | | $E_{off}$ | – | 1.141 | – | |

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

| Parameter | Test Condition | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **IGBT (T11, T12, T13, T14, T21, T22)** | | | | | | |
| Input capacitance | $V_{CE}$ = 30 V, $V_{GE}$ = 0 V, f = 1 MHz | $C_{ies}$ | – | 5665 | – | pF |
| Output capacitance | | $C_{oes}$ | – | 205 | – | |
| Reverse transfer capacitance | | $C_{res}$ | – | 100 | – | |
| Gate charge total | $V_{CE}$ = 480 V, $I_C$ = 50 A, $V_{GE}$ = ±15 V | $Q_g$ | – | 550 | – | nC |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness = 2.1 Mil ±2%<br>λ = 2.9 W/mK | $R_{thJH}$ | – | 1.15 | – | °C/W |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.75 | – | °C/W |
| **IGBT INVERSE DIODE (D12, D14, D21, D22)** | | | | | | |
| Forward voltage | $I_F$ = 50 A, $T_j$ = 25°C<br>$I_F$ = 50 A, $T_j$ = 175°C | $V_F$ | –<br>– | 2.25<br>1.7 | 2.7<br>– | V |
| Reverse Recovery Time | $T_j$ = 25°C<br>$V_{CE}$ = 350 V, $I_C$ = 80 A<br>$V_{GE}$ = 15 V, –9 V, $R_G$ = 10 Ω | $t_{rr}$ | – | 63 | – | ns |
| Reverse Recovery Current | | $Q_{rr}$ | – | 552 | – | nc |
| Peak Reverse Recovery Current | | $I_{rrm}$ | – | 25 | – | A |
| Peak Rate of Fall of Recovery Current | | $Di/dt_{max}$ | – | 1.80 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 136 | – | μJ |
| Reverse Recovery Time | $T_j$ = 125°C<br>$V_{CE}$ = 350 V, $I_C$ = 50 A<br>$V_{GE}$ = 15 V, –9 V, $R_G$ = 10 Ω | $t_{rr}$ | – | 135 | – | ns |
| Reverse Recovery Current | | $Q_{rr}$ | – | 1538 | – | nc |
| Peak Reverse Recovery Current | | $I_{rrm}$ | – | 43 | – | A |
| Peak Rate of Fall of Recovery Current | | $Di/dt_{max}$ | – | 1.60 | – | A/μs |
| Reverse Recovery Energy | | $E_{rr}$ | – | 346 | – | μJ |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness = 2.1 Mil ±2%<br>λ = 2.9 W/mK | $R_{thJH}$ | – | 1.10 | – | °C/W |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.79 | – | °C/W |
| **DIODE (D20)** | | | | | | |
| Forward voltage | $I_F$ = 50 A, $T_j$ = 25°C<br>$I_F$ = 50 A, $T_j$ = 175°C | $V_F$ | –<br>– | 2.25<br>1.7 | 2.7<br>– | V |
| Reverse leakage current | $V_{CE}$ = 650 V, $V_{GE}$ = 0 V | $I_r$ | – | – | 300 | μA |
| Thermal Resistance – chip–to–heatsink | Thermal grease, Thickness = 2.1 Mil ±2%<br>λ = 2.9 W/mK | $R_{thJH}$ | – | 1.10 | – | °C/W |
| Thermal Resistance – chip–to–case | | $R_{thJC}$ | – | 0.79 | – | °C/W |
| **THERMISTOR CHARACTERISTICS** | | | | | | |
| Nominal resistance | T = 25°C | $R_{25}$ | – | 22 | – | kΩ |
| Nominal resistance | T = 100°C | $R_{100}$ | – | 1486 | – | Ω |
| Deviation of R25 | | R/R | –5 | – | 5 | % |
| Power dissipation | | $P_D$ | – | 200 | – | mW |
| Power dissipation constant | | | – | 2 | – | mW/°C |
| B–value | B (25/50), tol ±3% | | – | – | 3950 | °C |
| B–value | B (25/100), tol ±3% | | – | – | 3998 | °C |
| NTC reference | | | – | – | B | |

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.

## TYPICAL CHARACTERISTICS – IGBT (T11, T12, T13, T14, T21, T22)

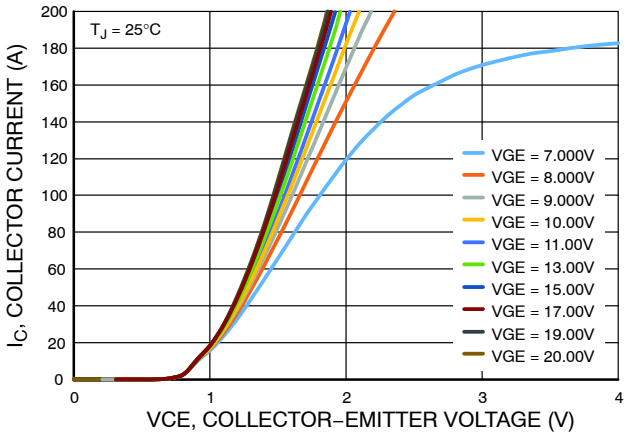



**Figure 3. Typical Output Characteristics**

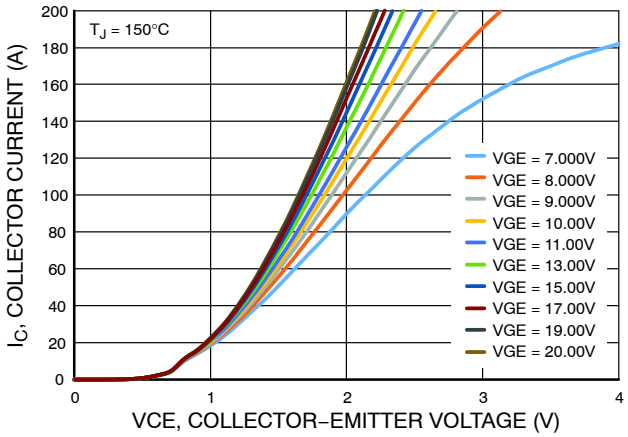



**Figure 4. Typical Output Characteristics**

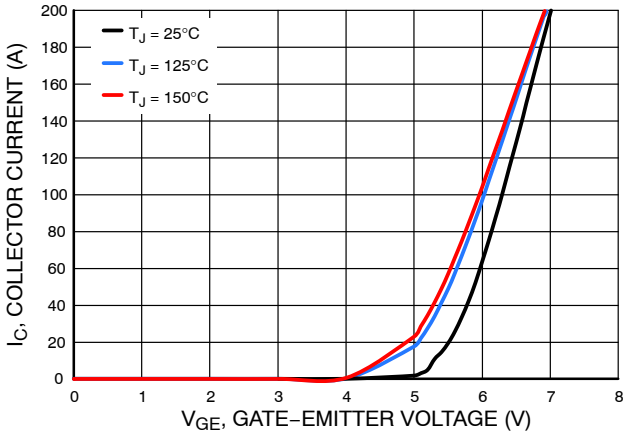



**Figure 5. Typical Transfer Characteristics**

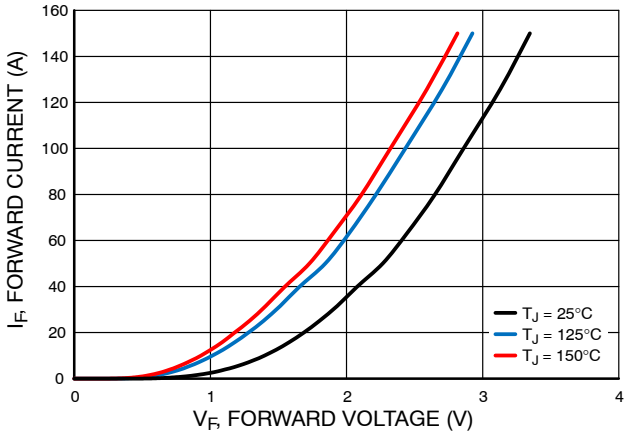



**Figure 6. Diode Forward Characteristics**

## TYPICAL CHARACTERISTICS – (T11, T12, T13, T14) IGBT COMMUTATES D21, D22 DIODE

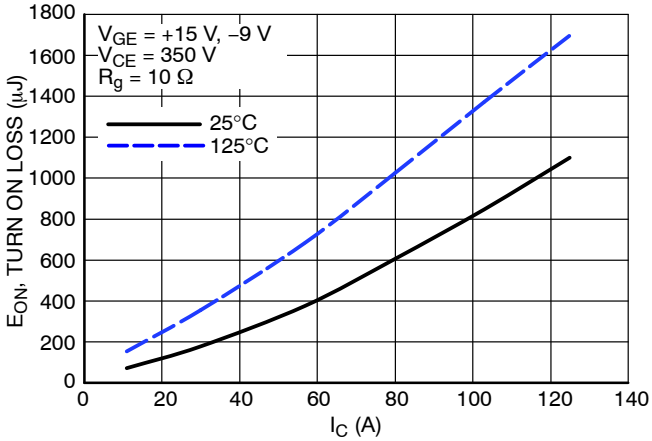



**Figure 7. Typical Turn ON Loss vs. IC**

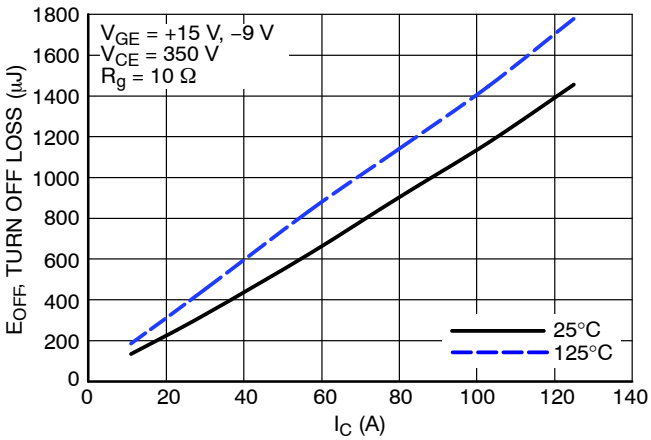



**Figure 8. Typical Turn OFF Loss vs. IC**

## TYPICAL CHARACTERISTICS – (T11, T12, T13, T14) IGBT COMMUTATES D21, D22 DIODE (CONTINUED)

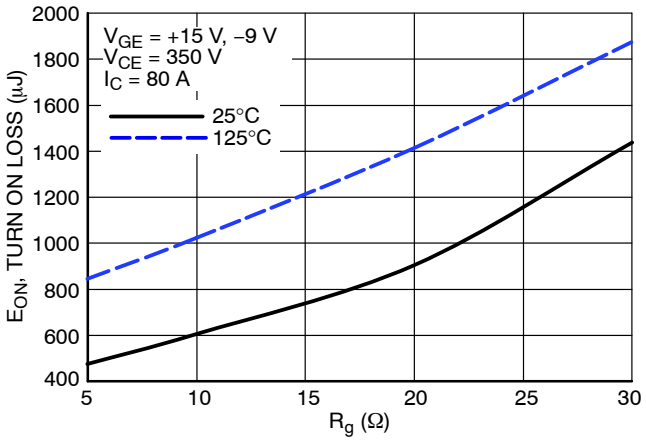



**Figure 9. Typical Turn ON Loss vs. RG**

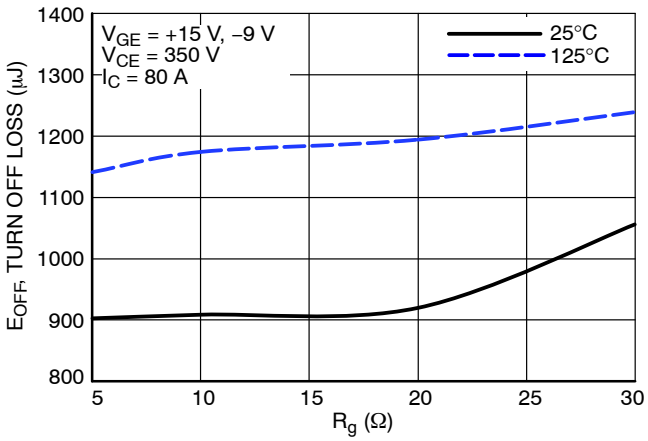



**Figure 10. Typical Turn OFF Loss vs. RG**

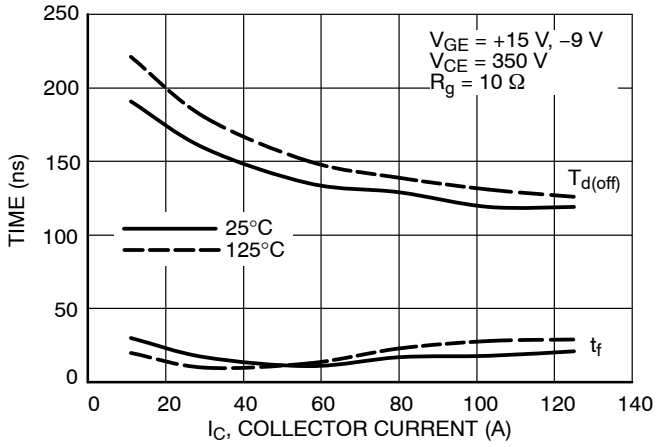



**Figure 11. Typical Turn−Off Switching Time vs. IC**

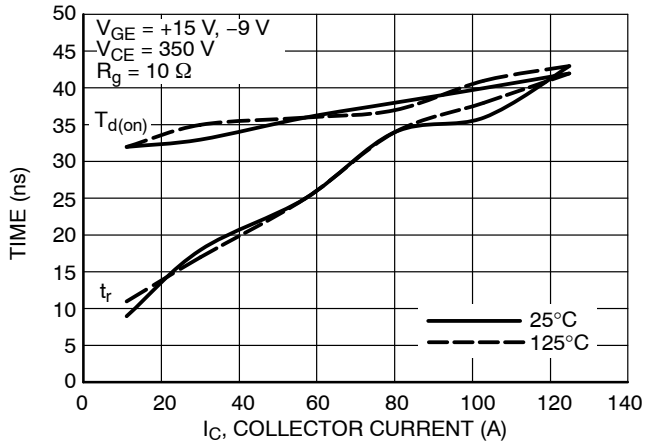



**Figure 12. Typical Turn−On Switching Time vs. IC**

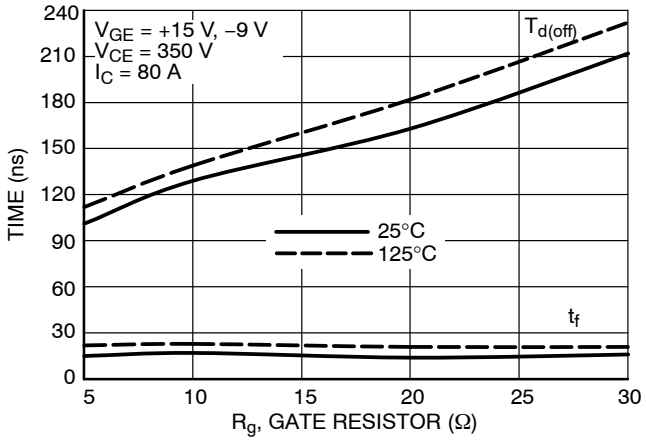



**Figure 13. Typical Turn−Off Switching Time vs. Rg**

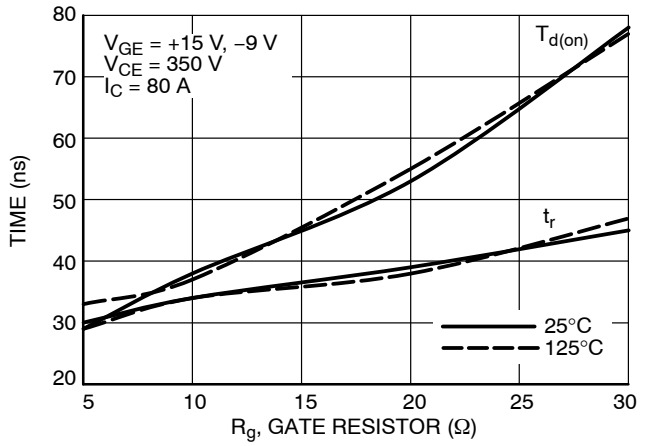



**Figure 14. Typical Turn−On Switching Time vs. Rg**

## TYPICAL CHARACTERISTICS – (T21, T22) IGBT COMMUTATES D20 DIODE

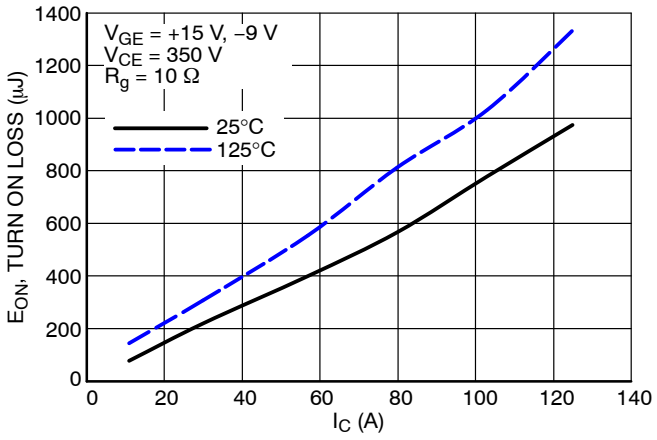



**Figure 15. Typical Turn ON Loss vs. IC**

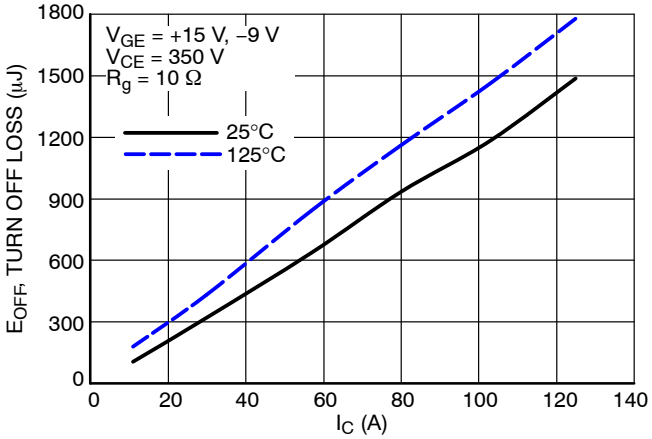



**Figure 16. Typical Turn OFF Loss vs. IC**

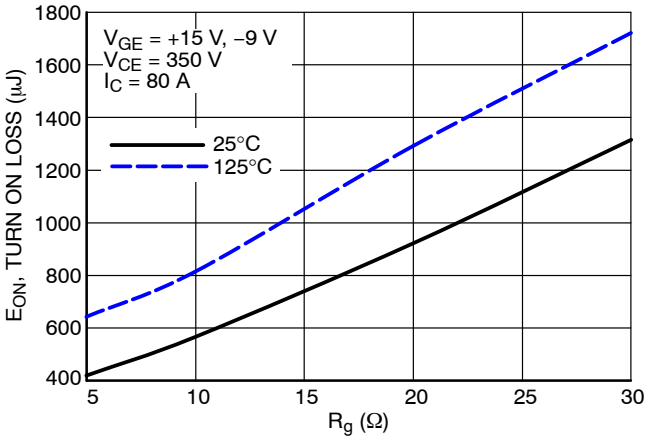



**Figure 17. Typical Turn ON Loss vs. RG**

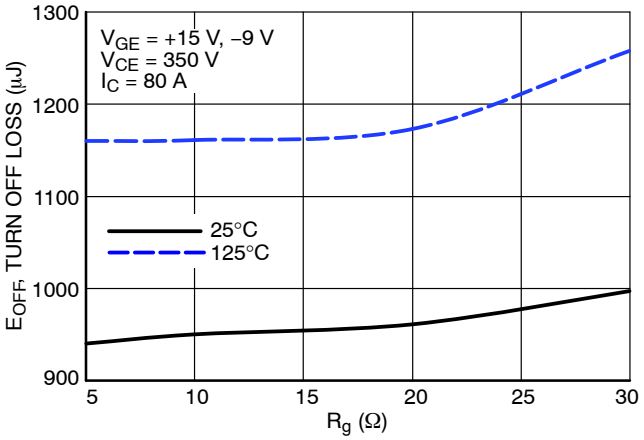



**Figure 18. Typical Turn OFF Loss vs. RG**

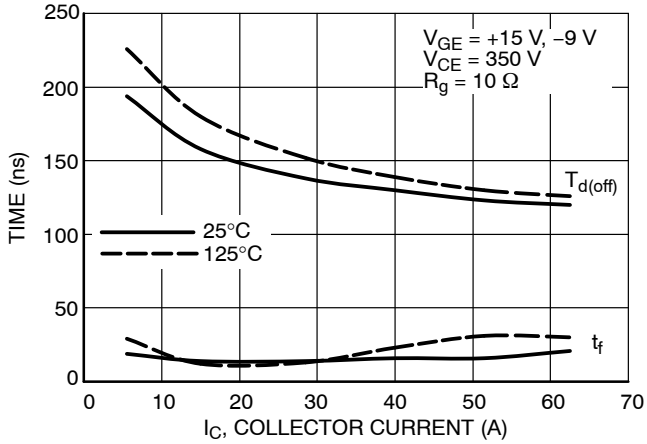



**Figure 19. Typical Turn−Off Switching Time vs. IC**

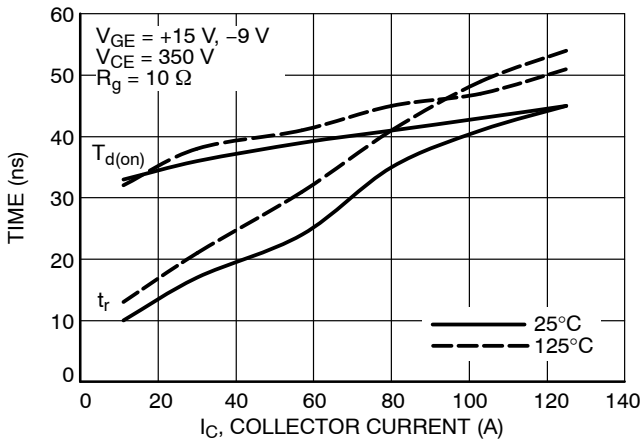



**Figure 20. Typical Turn−On Switching Time vs. IC**

## TYPICAL CHARACTERISTICS – (T21, T22) IGBT COMMUTATES D20 DIODE (CONTINUED)

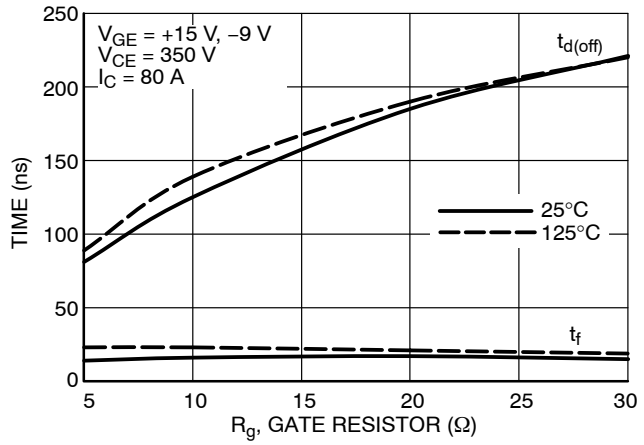



**Figure 21. Typical Turn−Off Switching Time vs. Rg**

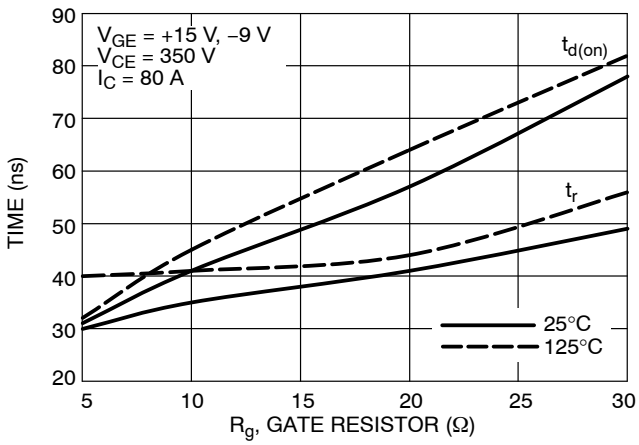



**Figure 22. Typical Turn−On Switching Time vs. Rg**

## TYPICAL CHARACTERISTICS – DIODE

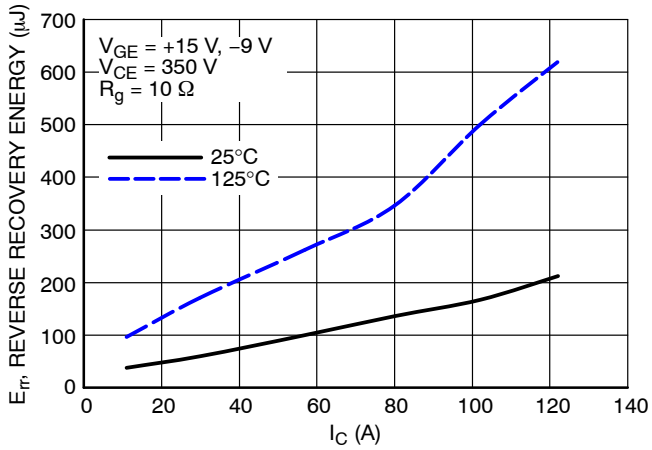



**Figure 23. Typical Reverse Recovery Energy Loss vs. IC**

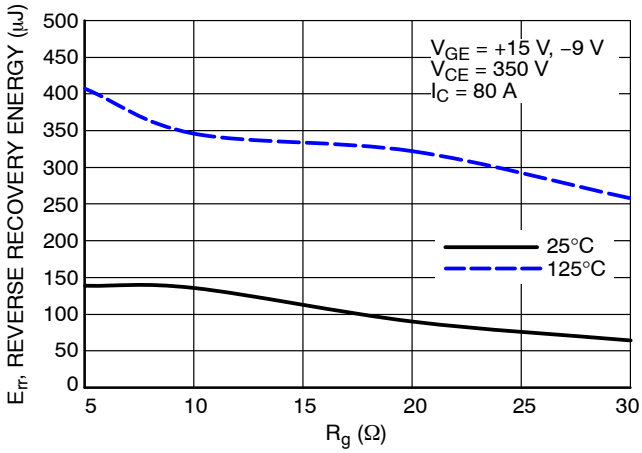



**Figure 24. Typical Reverse Recovery Energy Loss vs. RG**

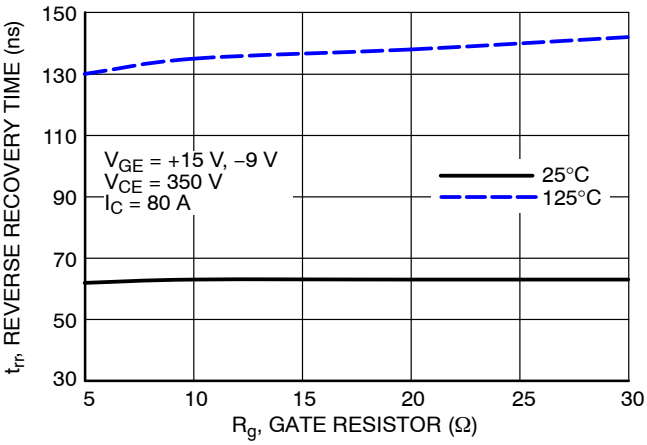



**Figure 25. Typical Reverse Recovery Time vs. Rg**

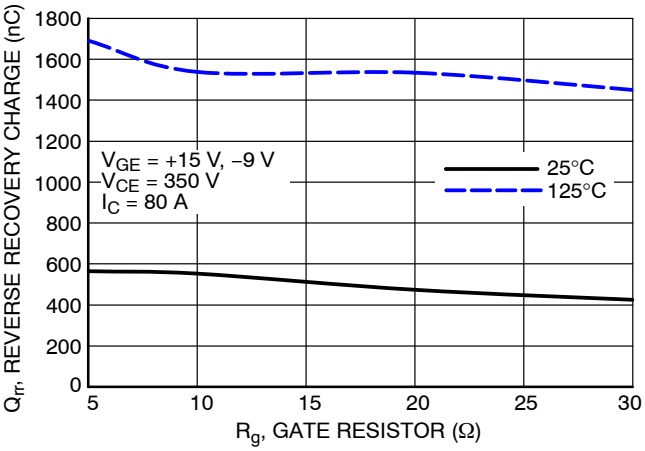



**Figure 26. Typical Reverse Recovery Charge vs. Rg**

## TYPICAL CHARACTERISTICS – DIODE (CONTINUED)

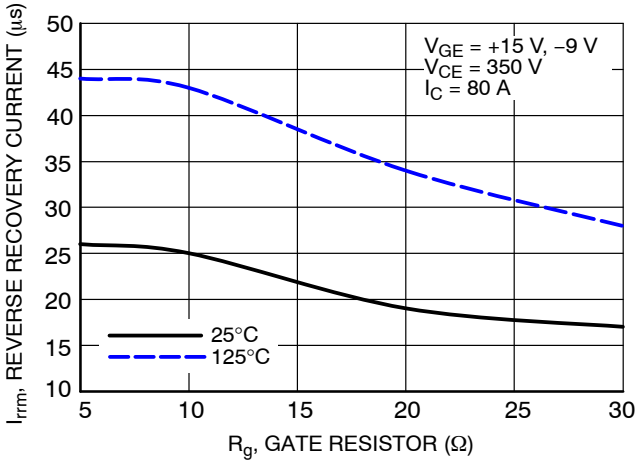



**Figure 27. Typical Reverse Recovery Peak Current vs. Rg**

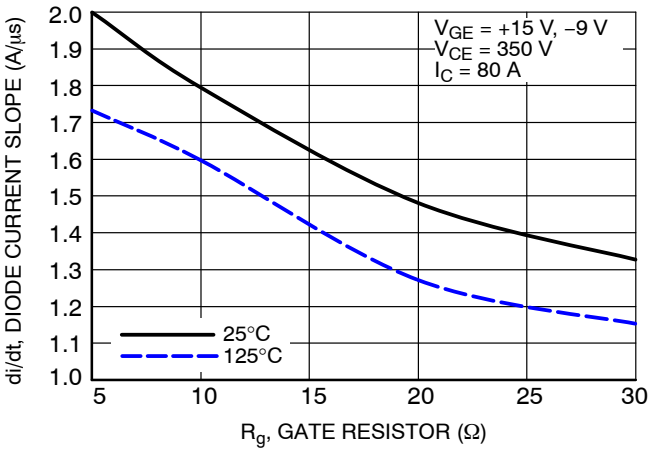



**Figure 28. Typical di/dt vs. Rg**

## TYPICAL CHARACTERISTICS

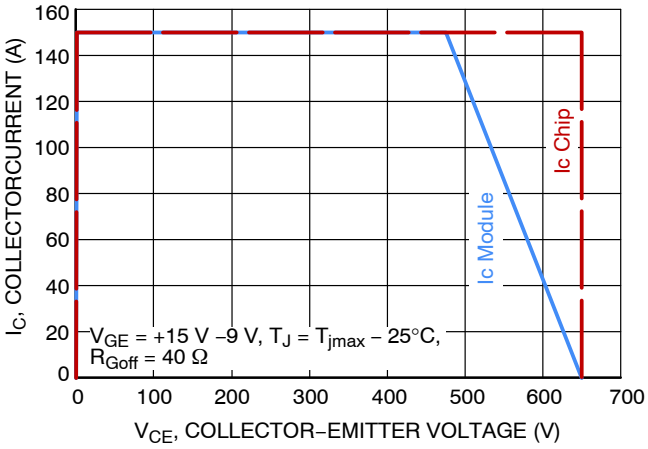



**Figure 29. RBSOA Reverse Safe Operating Area**

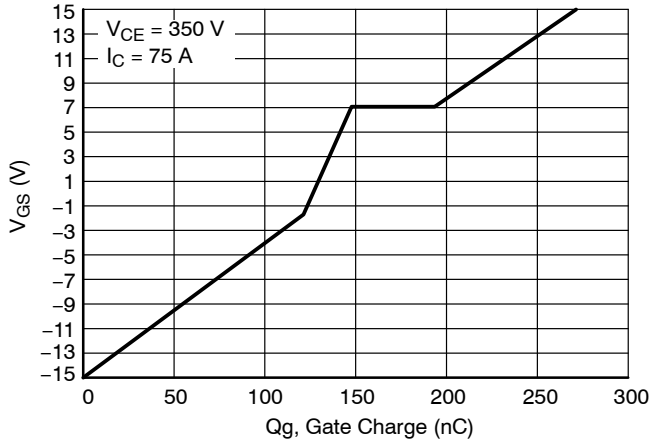



**Figure 30. IGBT Gate Charge**

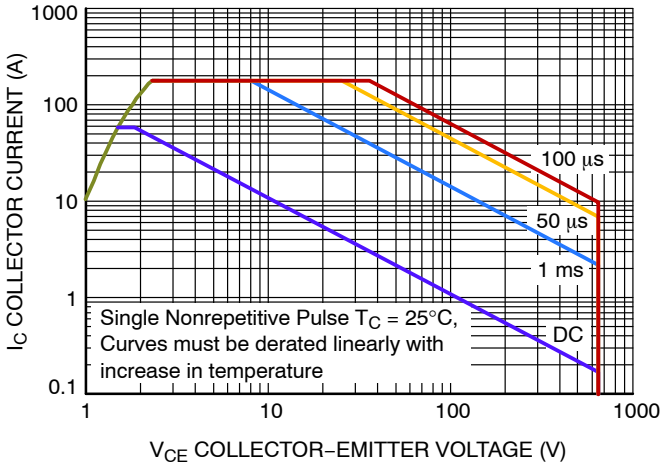



**Figure 31. IGBT Safe Operating Area**

## TYPICAL THERMAL CHARACTERISTICS

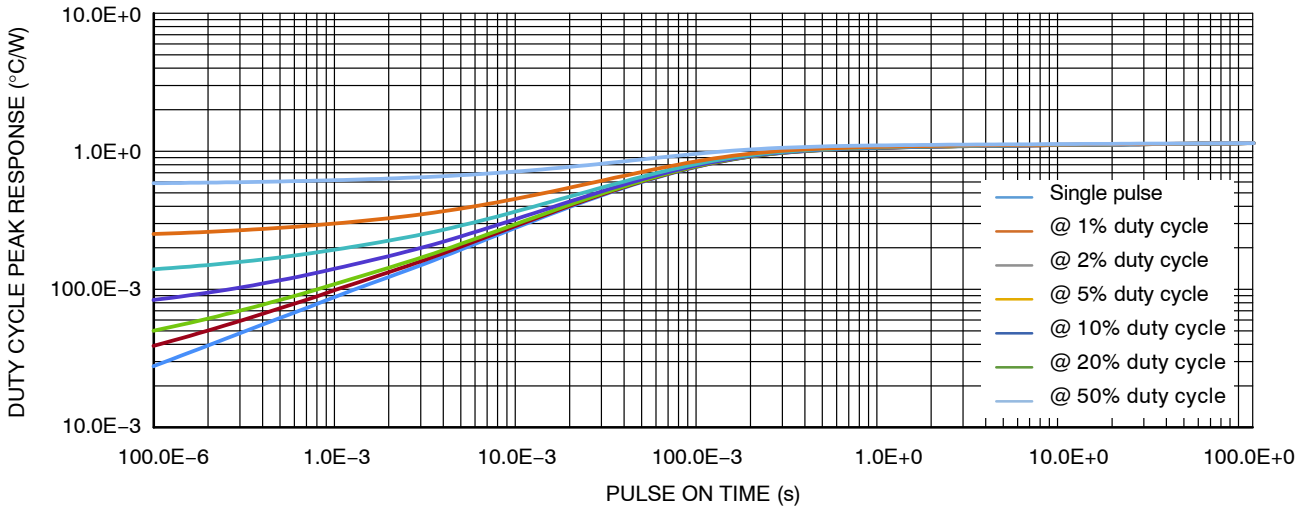



**Figure 32. Transient Thermal Impedance – IGBT**

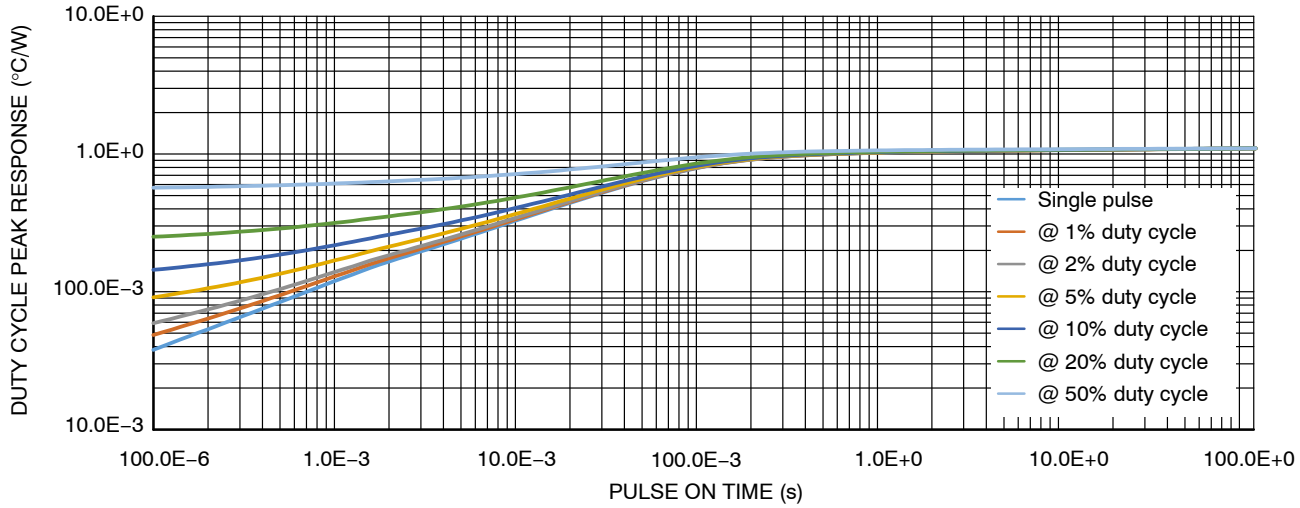
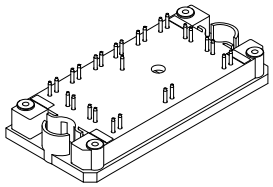



**Figure 33. Transient Thermal Impedance – Diode**

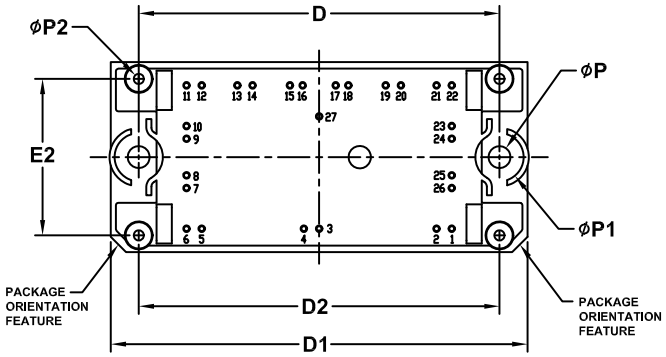
## ORDERING INFORMATION

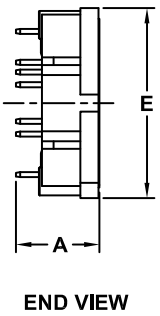
| Device | Package Type | Shipping |
|---|---|---|
| NXH75M65L4Q1SG (Solder Pin) | PIM27, 71x37.4<br>Q1PACK | 21 Units / BTRAY |
| NXH75M65L4Q1PTG (Pressfit Pin) | PIM27, 71x37.4<br>Q1PACK | 21 Units / BTRAY |



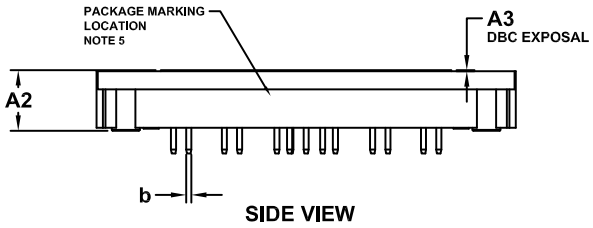
**PIM27, 71x37.4 (SOLDER PIN)**
CASE 180CA
ISSUE B

DATE 14 DEC 2022




| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 15.90 | 16.40 | 16.90 |
| A2 | 11.70 | 11.90 | 12.10 |
| A3 | 0.00 | 0.20 | 0.60 |
| b | 0.95 | 1.00 | 1.05 |
| b1 | 0.75 | 0.80 | 0.85 |
| D | 70.80 | 71.00 | 71.20 |
| D1 | 81.70 | 82.00 | 82.30 |
| D2 | 70.80 | 71.00 | 71.20 |
| E | 37.10 | 37.40 | 37.70 |
| E2 | 30.60 | 30.80 | 31.00 |
| P | 4.10 | 4.30 | 4.50 |
| P1 | 9.30 | 9.50 | 9.70 |
| P2 | 1.80 | 2.00 | 2.20 |




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 A1
4. PIN POSITION TOLERANCE IS ± 0.4mm
5. PACKAGE MARKING IS LOCATED AS SHOWN ON THE SIDE OPPOSITE THE PACKAGE ORIENTATION FEATURES

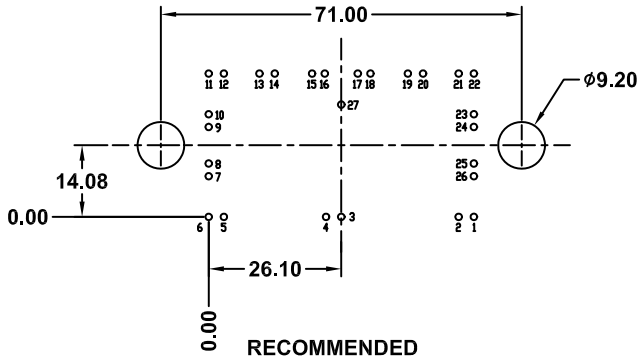
NOTE 4

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 1 | 52.20 | 0.00 |
| 2 | 49.20 | 0.00 |
| 3 | 26.10 | 0.00 |
| 4 | 23.10 | 0.00 |
| 5 | 3.00 | 0.00 |
| 6 | 0.00 | 0.00 |
| 7 | 0.00 | 8.00 |
| 8 | 0.00 | 10.50 |
| 9 | 0.00 | 17.70 |
| 10 | 0.00 | 20.20 |
| 11 | 0.00 | 28.20 |
| 12 | 3.00 | 28.20 |
| 13 | 10.00 | 28.20 |
| 14 | 13.00 | 28.20 |

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 15 | 20.35 | 28.20 |
| 16 | 22.85 | 28.20 |
| 17 | 29.35 | 28.20 |
| 18 | 31.85 | 28.20 |
| 19 | 39.20 | 28.20 |
| 20 | 42.20 | 28.20 |
| 21 | 49.20 | 28.20 |
| 22 | 52.20 | 28.20 |
| 23 | 52.20 | 20.20 |
| 24 | 52.20 | 17.70 |
| 25 | 52.20 | 10.50 |
| 26 | 52.20 | 8.00 |
| 27 | 26.10 | 22.10 |

**PIM27, 71x37.4 (SOLDER PIN)**
CASE 180CA
ISSUE B

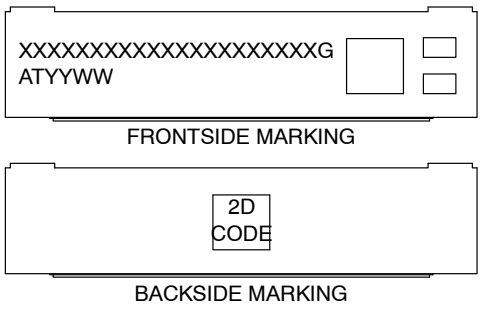
DATE 14 DEC 2022




**RECOMMENDED MOUNTING PATTERN**

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

**GENERIC MARKING DIAGRAM***



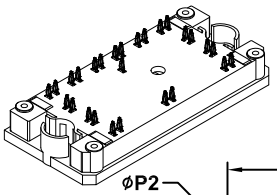

XXXXX = Specific Device Code
G = Pb−Free Device
AT = Assembly & Test Site Code
YYWW = Year and Work Week Code

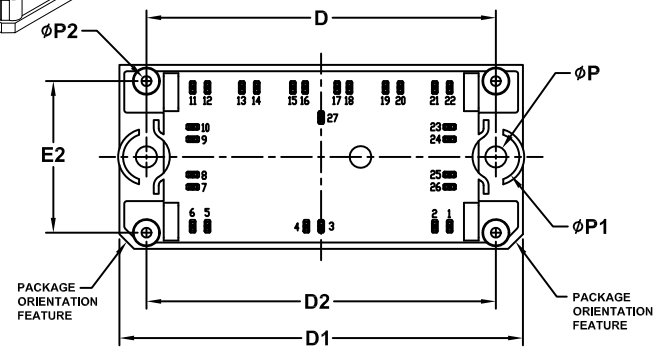
*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “ ▪”, may or may not be present. Some products may not follow the Generic Marking.

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

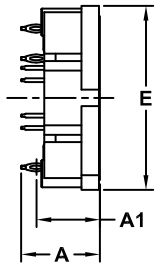
**PIM27, 71x37.4 (PRESSFIT PIN)**
CASE 180CP
ISSUE A

DATE 20 DEC 2022



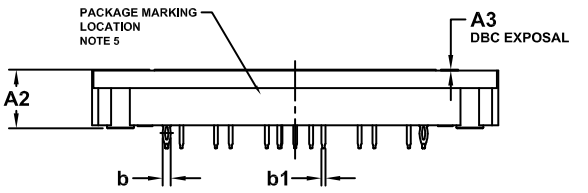



TOP VIEW




END VIEW

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 15.50 | 16.00 | 16.50 |
| A1 | 12.38 | 12.88 | 13.38 |
| A2 | 11.70 | 11.90 | 12.10 |
| A3 | 0.00 | 0.20 | 0.60 |
| b | 1.61 | 1.66 | 1.71 |
| b1 | 0.75 | 0.80 | 0.85 |
| D | 70.80 | 71.00 | 71.20 |
| D1 | 81.70 | 82.00 | 82.30 |
| D2 | 70.80 | 71.00 | 71.20 |
| E | 37.10 | 37.40 | 37.70 |
| E2 | 30.60 | 30.80 | 31.00 |
| P | 4.10 | 4.30 | 4.50 |
| P1 | 9.30 | 9.50 | 9.70 |
| P2 | 1.80 | 2.00 | 2.20 |

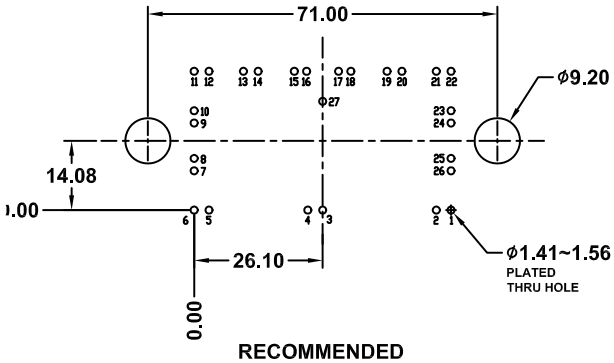



SIDE VIEW

NOTE 4

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 1 | 52.20 | 0.00 |
| 2 | 49.20 | 0.00 |
| 3 | 26.10 | 0.00 |
| 4 | 23.10 | 0.00 |
| 5 | 3.00 | 0.00 |
| 6 | 0.00 | 0.00 |
| 7 | 0.00 | 8.00 |
| 8 | 0.00 | 10.50 |
| 9 | 0.00 | 17.70 |
| 10 | 0.00 | 20.20 |
| 11 | 0.00 | 28.20 |
| 12 | 3.00 | 28.20 |
| 13 | 10.00 | 28.20 |
| 14 | 13.00 | 28.20 |

| PIN | PIN POSITION | |
|---|---|---|
| | X | Y |
| 15 | 20.35 | 28.20 |
| 16 | 22.85 | 28.20 |
| 17 | 29.35 | 28.20 |
| 18 | 31.85 | 28.20 |
| 19 | 39.20 | 28.20 |
| 20 | 42.20 | 28.20 |
| 21 | 49.20 | 28.20 |
| 22 | 52.20 | 28.20 |
| 23 | 52.20 | 20.20 |
| 24 | 52.20 | 17.70 |
| 25 | 52.20 | 10.50 |
| 26 | 52.20 | 8.00 |
| 27 | 26.10 | 22.10 |




**RECOMMENDED MOUNTING PATTERN**

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**NOTES:**

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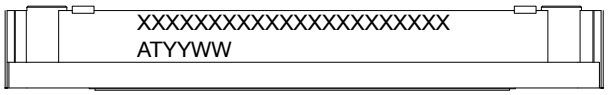
**GENERIC MARKING DIAGRAM***




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

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

| | | |
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| **DESCRIPTION:** | **PIM27, 71X37.4 (PRESSFIT PIN)** | **PAGE 1 OF 1** |

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