

# TMPIM 35 A Enhances CIB Module

## NXH35C120L2C2ESG

The NXH35C120L2C2ESG is a transfer-molded power module with low thermal resistance substrate containing a converter-inverter-brake circuit consisting of six 35 A, 1600 V rectifiers, six 35 A, 1200 V IGBTs with inverse diodes, one 35 A, 1200 V brake IGBT with brake diode and an NTC thermistor.

### Features

- Low Thermal Resistance Substrate for Low Thermal Resistance
- 6 mm Clearance Distance between Pin to Heatsink
- Compact 73 mm × 40 mm × 8 mm Package
- Solderable Pins
- Thermistor
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- Industrial Motor Drives
- Servo Drives

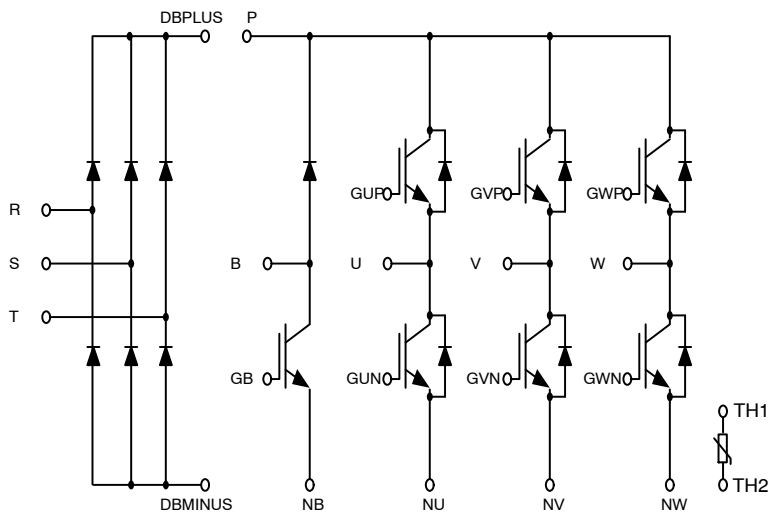
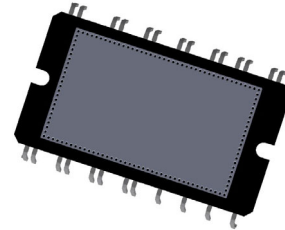


Figure 1. NXH35C120L2C2ESG Schematic Diagram



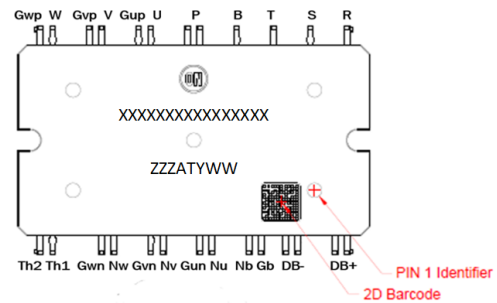
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DIP26 67.8x40  
CASE 181AD

### MARKING DIAGRAM



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

### ORDERING INFORMATION

| Device           | Package            | Shipping†         |
|------------------|--------------------|-------------------|
| NXH35C120L2C2ESG | DIP26<br>(Pb-Free) | 6 Units /<br>Tube |

# NXH35C120L2C2ESG

## MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--------|--------|-------|------|
|--------|--------|-------|------|

### IGBT

|                                                                                                |              |          |   |
|------------------------------------------------------------------------------------------------|--------------|----------|---|
| Collector–Emitter Voltage                                                                      | $V_{CES}$    | 1200     | V |
| Gate–Emitter Voltage                                                                           | $V_{GE}$     | $\pm 20$ | V |
| Continuous Collector Current @ $T_C = 80^\circ\text{C}$ ( $T_{V_{Jmax}} = 175^\circ\text{C}$ ) | $I_C$        | 35       | A |
| Pulsed Collector Current                                                                       | $I_{Cpulse}$ | 105      | A |

### DIODE

|                                                                                              |           |      |   |
|----------------------------------------------------------------------------------------------|-----------|------|---|
| Peak Repetitive Reverse Voltage                                                              | $V_{RRM}$ | 1200 | V |
| Continuous Forward Current @ $T_C = 80^\circ\text{C}$ ( $T_{V_{Jmax}} = 175^\circ\text{C}$ ) | $I_F$     | 35   | A |
| Repetitive Peak Forward Current                                                              | $I_{FRM}$ | 105  | A |

### RECTIFIER DIODE

|                                                                                                                        |           |             |                      |
|------------------------------------------------------------------------------------------------------------------------|-----------|-------------|----------------------|
| Peak Repetitive Reverse Voltage                                                                                        | $V_{RRM}$ | 1600        | V                    |
| Continuous Forward Current @ $T_C = 80^\circ\text{C}$ ( $T_{V_{Jmax}} = 150^\circ\text{C}$ )                           | $I_F$     | 35          | A                    |
| Repetitive Peak Forward Current                                                                                        | $I_{FRM}$ | 105         | A                    |
| $I^2t$ value (10 ms single half-sine wave) @ $25^\circ\text{C}$<br>(10 ms single half-sine wave) @ $150^\circ\text{C}$ | $I^2t$    | 1126<br>510 | $\text{A}^2\text{t}$ |
| Surge current (10 ms sin180°) @ $25^\circ\text{C}$                                                                     | $I_{FSM}$ | 520         | A                    |

### THERMAL PROPERTIES

|                           |           |            |                  |
|---------------------------|-----------|------------|------------------|
| Storage Temperature range | $T_{stg}$ | –40 to 125 | $^\circ\text{C}$ |
|---------------------------|-----------|------------|------------------|

### INSULATION PROPERTIES

|                                           |          |       |           |
|-------------------------------------------|----------|-------|-----------|
| Isolation test voltage, $t = 1$ sec, 50Hz | $V_{is}$ | 3000  | $V_{RMS}$ |
| Internal isolation                        |          | HPS   |           |
| Creepage distance                         |          | 6.0   | mm        |
| Clearance distance                        |          | 6.0   | mm        |
| Comperative Tracking Index                | CTI      | > 400 |           |

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.

# NXH35C120L2C2ESG

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

| Parameter                              | Test Conditions                                                                                                            | Symbol               | Min | Typ  | Max | Unit |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------|-----|------|-----|------|
| <b>IGBT CHARACTERISTICS</b>            |                                                                                                                            |                      |     |      |     |      |
| Collector–Emitter Cutoff Current       | V <sub>GE</sub> = 0 V, V <sub>CE</sub> = 1200 V                                                                            | I <sub>CES</sub>     | –   | –    | 250 | μA   |
| Collector–Emitter Saturation Voltage   | V <sub>GE</sub> = 15 V, I <sub>C</sub> = 35 A, T <sub>J</sub> = 25°C                                                       | V <sub>CE(sat)</sub> | –   | 1.8  | 2.4 | V    |
|                                        | V <sub>GE</sub> = 15 V, I <sub>C</sub> = 35 A, T <sub>J</sub> = 150°C                                                      |                      | –   | 1.9  | –   |      |
| Gate–Emitter Threshold Voltage         | V <sub>GE</sub> = V <sub>CE</sub> , I <sub>C</sub> = 4.25 mA                                                               | V <sub>GE(TH)</sub>  | 4.8 | 6    | 6.8 | V    |
| Gate Leakage Current                   | V <sub>GE</sub> = 20 V, V <sub>CE</sub> = 0 V                                                                              | I <sub>GES</sub>     | –   | –    | 400 | nA   |
| Turn-on Delay Time                     | T <sub>J</sub> = 25 °C<br>V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A<br>V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω | t <sub>d(on)</sub>   | –   | 104  | –   | ns   |
| Rise Time                              |                                                                                                                            | t <sub>r</sub>       | –   | 64   | –   |      |
| Turn-off Delay Time                    |                                                                                                                            | t <sub>d(off)</sub>  | –   | 277  | –   |      |
| Fall Time                              |                                                                                                                            | t <sub>f</sub>       | –   | 53   | –   |      |
| Turn-on Switching Loss per Pulse       |                                                                                                                            | E <sub>on</sub>      | –   | 2900 | –   | μJ   |
| Turn off Switching Loss per Pulse      |                                                                                                                            | E <sub>off</sub>     | –   | 1200 | –   |      |
| Turn-on Delay Time                     | T <sub>J</sub> = 150°C<br>V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A<br>V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω | t <sub>d(on)</sub>   | –   | 168  | –   | ns   |
| Rise Time                              |                                                                                                                            | t <sub>r</sub>       | –   | 72   | –   |      |
| Turn-off Delay Time                    |                                                                                                                            | t <sub>d(off)</sub>  | –   | 320  | –   |      |
| Fall Time                              |                                                                                                                            | t <sub>f</sub>       | –   | 165  | –   |      |
| Turn-on Switching Loss per Pulse       |                                                                                                                            | E <sub>on</sub>      | –   | 4030 | –   | μJ   |
| Turn off Switching Loss per Pulse      |                                                                                                                            | E <sub>off</sub>     | –   | 2200 | –   |      |
| Input Capacitance                      | V <sub>CE</sub> = 20 V, V <sub>GE</sub> = 0 V<br>f = 100 kHz                                                               | C <sub>ies</sub>     | –   | 8333 | –   | pF   |
| Output Capacitance                     |                                                                                                                            | C <sub>oes</sub>     | –   | 298  | –   |      |
| Reverse Transfer Capacitance           |                                                                                                                            | C <sub>res</sub>     | –   | 175  | –   |      |
| Total Gate Charge                      | V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A,<br>V <sub>GE</sub> = 0 V ~ +15 V                                           | Q <sub>g</sub>       | –   | 360  | –   | nC   |
| Temperature under switching conditions |                                                                                                                            | T <sub>vj op</sub>   | –40 |      | 150 | °C   |
| Thermal Resistance – chip-to–heatsink  | Thermal grease,<br>Thickness – 3 mil,<br>λ = 2.8 W/mK                                                                      | R <sub>thJH</sub>    | –   | 0.83 | –   | °C/W |

## DIODE CHARACTERISTICS

|                                        |                                                                                                                             |                    |     |      |     |      |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------------|-----|------|-----|------|
| Brake Diode Reverse Leakage Current    | V <sub>R</sub> = 1200 V                                                                                                     | I <sub>R</sub>     | –   | –    | 200 | μA   |
| Diode Forward Voltage                  | I <sub>F</sub> = 35 A, T <sub>J</sub> = 25°C                                                                                | V <sub>F</sub>     | –   | 2.2  | 2.7 | V    |
|                                        | I <sub>F</sub> = 35 A, T <sub>J</sub> = 150°C                                                                               |                    | –   | 2    | –   |      |
| Reverse Recovery Time                  | T <sub>J</sub> = 25°C<br>V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A<br>V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω   | t <sub>rr</sub>    |     | 224  |     | ns   |
| Reverse Recovery Charge                |                                                                                                                             | Q <sub>rr</sub>    | –   | 1.51 | –   | μC   |
| Peak Reverse Recovery Current          |                                                                                                                             | I <sub>RRM</sub>   | –   | 18   | –   | A    |
| Reverse Recovery Energy                |                                                                                                                             | E <sub>rr</sub>    | –   | 410  | –   | μJ   |
| Reverse Recovery Time                  | T <sub>J</sub> = 150 °C<br>V <sub>CE</sub> = 600 V, I <sub>C</sub> = 35 A<br>V <sub>GE</sub> = ±15 V, R <sub>G</sub> = 15 Ω | t <sub>rr</sub>    |     | 532  |     | ns   |
| Reverse Recovery Charge                |                                                                                                                             | Q <sub>rr</sub>    | –   | 5.36 | –   | μC   |
| Peak Reverse Recovery Current          |                                                                                                                             | I <sub>RRM</sub>   | –   | 30   | –   | A    |
| Reverse Recovery Energy                |                                                                                                                             | E <sub>rr</sub>    | –   | 1983 | –   | μJ   |
| Temperature under switching conditions |                                                                                                                             | T <sub>vj op</sub> | –40 |      | 150 | °C   |
| Thermal Resistance – chip-to–heatsink  | Thermal grease,<br>Thickness – 3mil,<br>λ = 2.8 W/mK                                                                        | R <sub>thJH</sub>  | –   | 1.4  | –   | °C/W |

# NXH35C120L2C2ESG

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified) (continued)

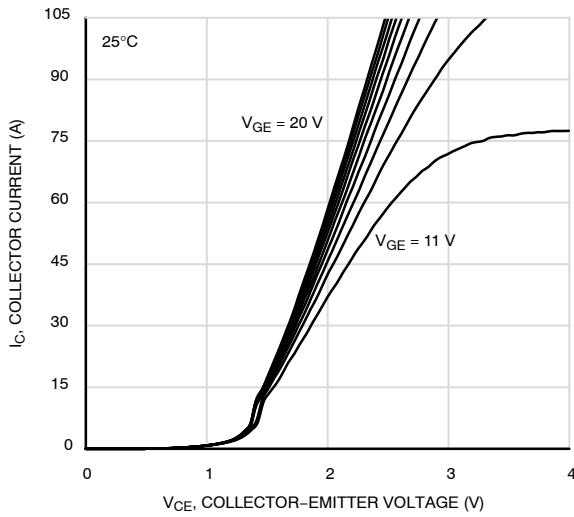
| Parameter                              | Test Conditions                                       | Symbol             | Min | Typ  | Max | Unit |
|----------------------------------------|-------------------------------------------------------|--------------------|-----|------|-----|------|
| <b>RECTIFIER DIODE CHARACTERISTICS</b> |                                                       |                    |     |      |     |      |
| Rectifier Reverse Leakage Current      | V <sub>R</sub> = 1600 V                               | I <sub>R</sub>     | –   | –    | 200 | μA   |
| Rectifier Forward Voltage              | I <sub>F</sub> = 35 A, T <sub>J</sub> = 25°C          | V <sub>F</sub>     | –   | 1.1  | 1.5 | V    |
|                                        | I <sub>F</sub> = 35 A, T <sub>J</sub> = 150°C         |                    | –   | 1    | –   |      |
| Temperature under switching conditions |                                                       | T <sub>vj op</sub> | –40 |      | 150 | °C   |
| Thermal Resistance – chip-to-heatsink  | Thermal grease,<br>Thickness – 3 mil,<br>λ = 2.8 W/mK | R <sub>thJH</sub>  | –   | 1.25 | –   | °C/W |

## THERMISTOR CHARACTERISTICS

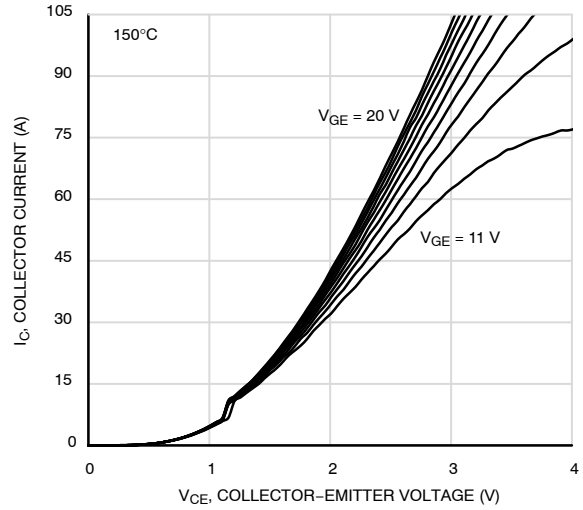
|                            |                          |                  |    |       |   |      |
|----------------------------|--------------------------|------------------|----|-------|---|------|
| Nominal resistance         | T = 25°C                 | R <sub>25</sub>  | –  | 5     | – | kΩ   |
| Nominal resistance         | T = 100°C                | R <sub>100</sub> | –  | 493.3 | – | Ω    |
| Deviation of R25           |                          | ΔR/R             | –5 | –     | 5 | %    |
| Power dissipation          |                          | P <sub>D</sub>   | –  | 20    | – | mW   |
| Power dissipation constant |                          |                  | –  | 1.4   | – | mW/K |
| B-value                    | B(25/50), tolerance ±2%  |                  | –  | 3375  | – | K    |
| B-value                    | B(25/100), tolerance ±2% |                  | –  | 3433  | – | 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.

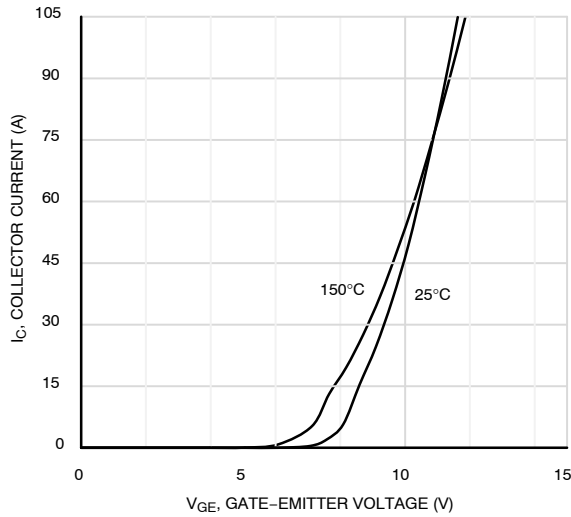
## TYPICAL CHARACTERISTICS – INVERTER/BRAKE IGBT & DIODE



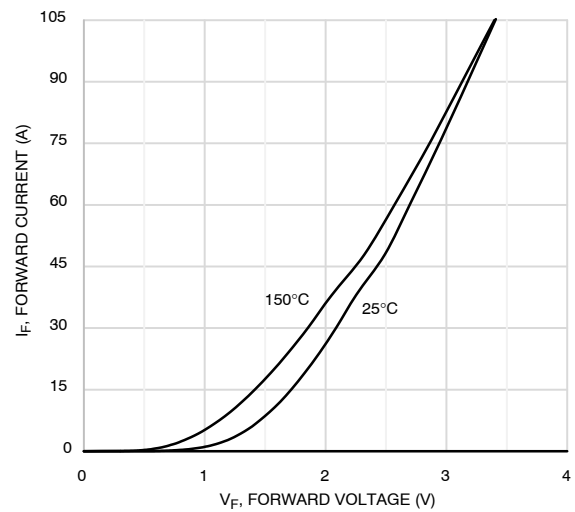
**Figure 2. IGBT Typical Output Characteristic**



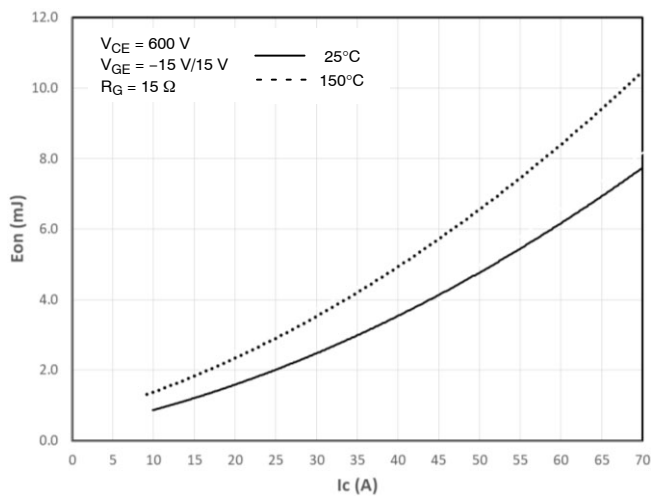
**Figure 3. IGBT Typical Output Characteristic**



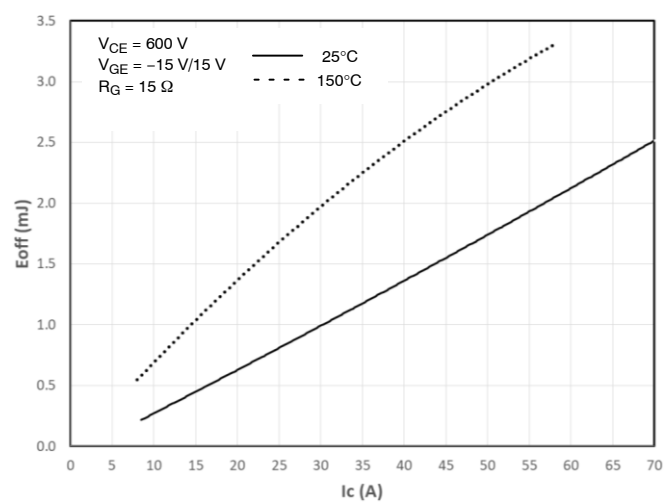
**Figure 4. IGBT Typical Output Characteristic**



**Figure 5. Diode Typical Forward Characteristic**



**Figure 6. Typical Turn On Loss vs Ic**



**Figure 7. Typical Turn Off Loss vs Ic**

# NXH35C120L2C2ESG

## TYPICAL CHARACTERISTICS – INVERTER/BRAKE IGBT & DIODE

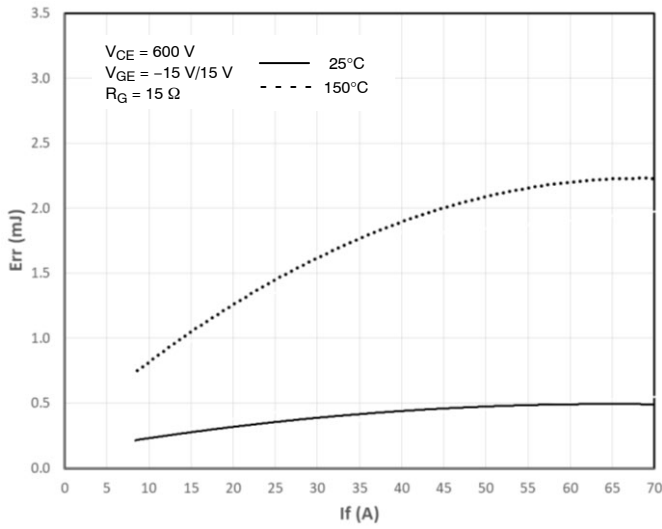


Figure 8. Typical Reverse Recovery Energy vs Ic

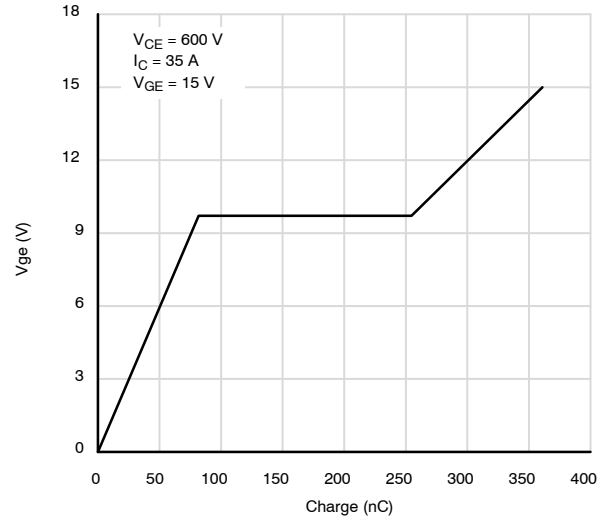


Figure 9. Gate Voltage vs. Gate Charge

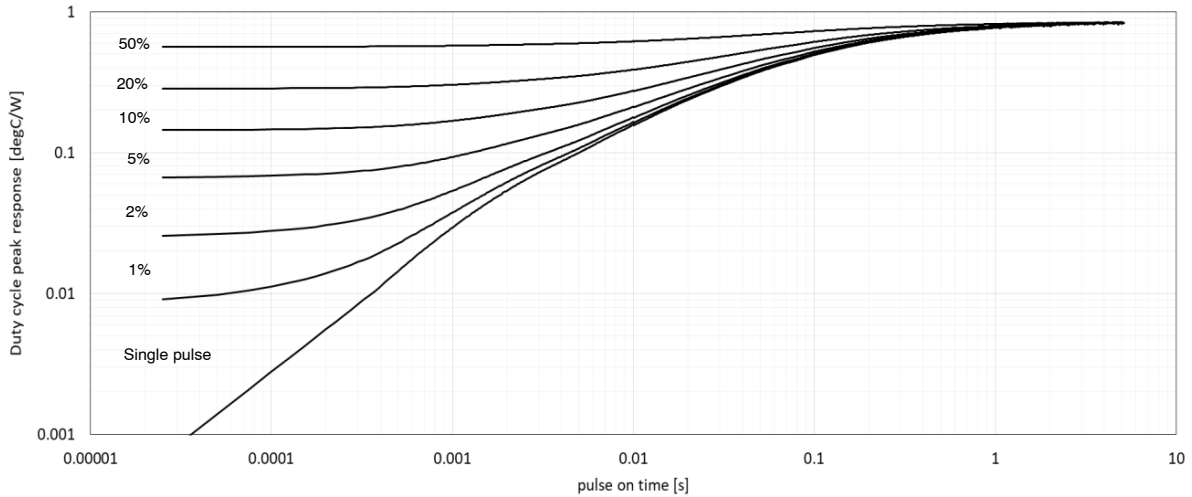


Figure 10. IGBT Junction-to-Heatsink Transient Thermal Impedance

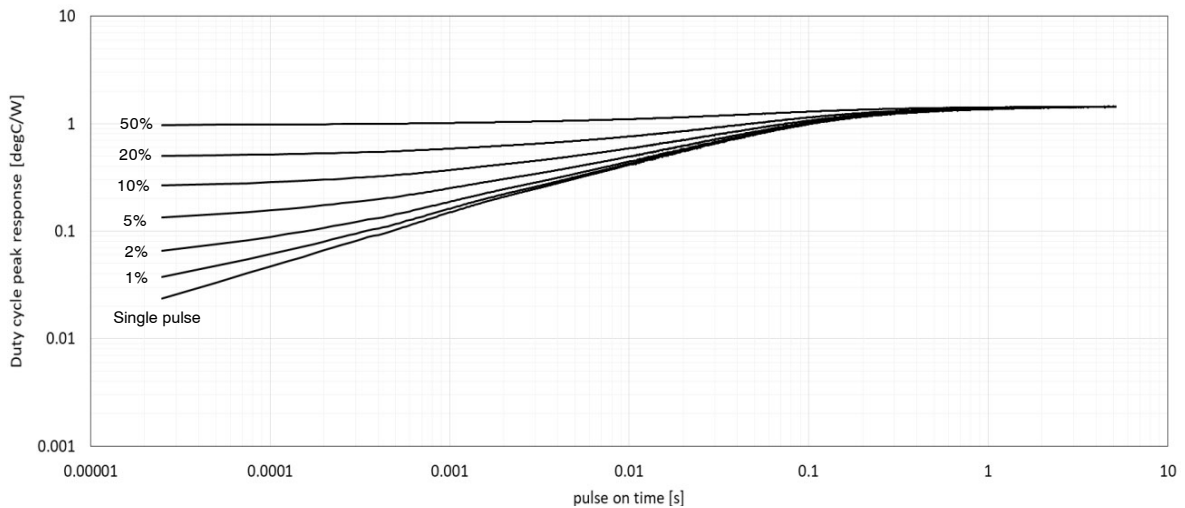


Figure 11. Diode Junction-to-Heatsink Transient Thermal Impedance

# NXH35C120L2C2ESG

## TYPICAL CHARACTERISTICS – RECTIFIER

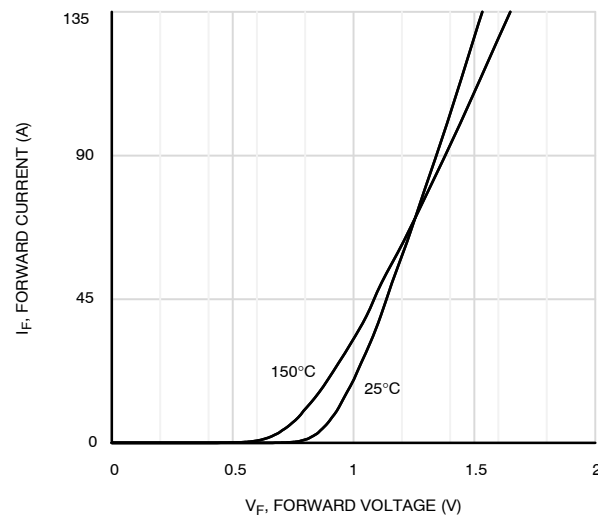


Figure 12. Rectifier Typical Forward Characteristic

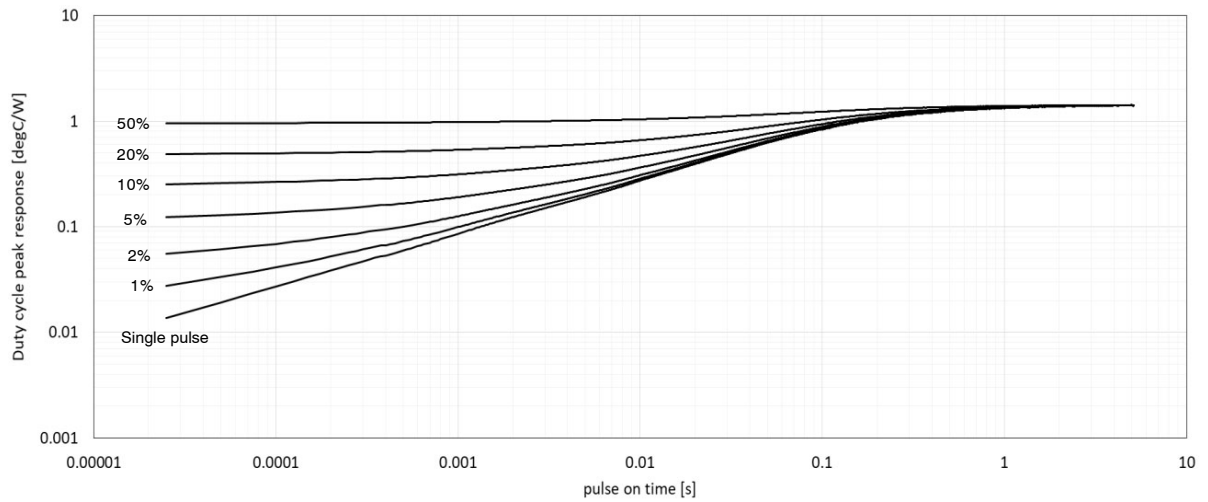
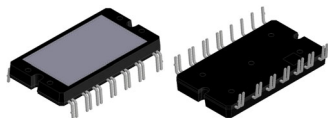


Figure 13. Rectifier Junction-to-Heatsink Transient Thermal Impedance

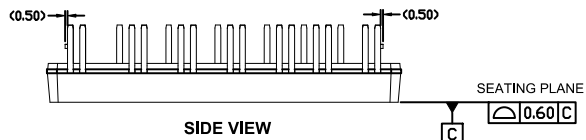
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS

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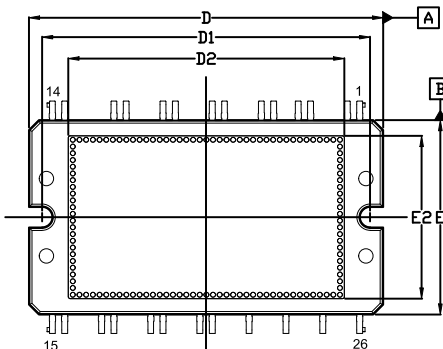


**DIP26 67.8x40**  
**CASE 181AD**  
**ISSUE B**

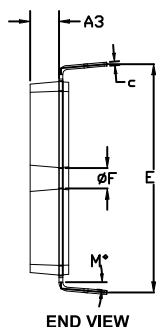
DATE 05 AUG 2021



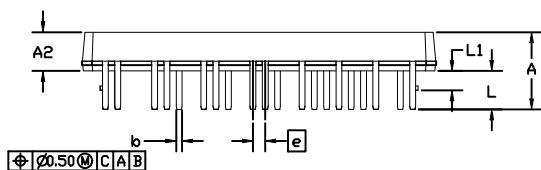
SIDE VIEW



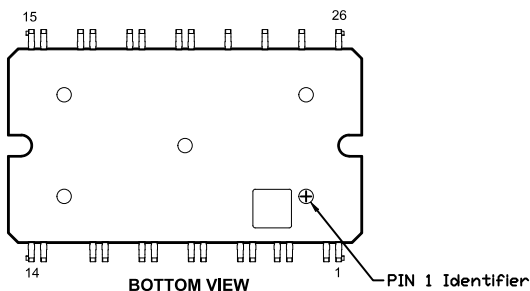
TOP VIEW



END VIEW



SIDE VIEW



BOTTOM VIEW

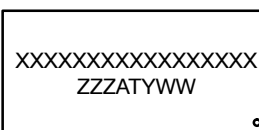
PIN 1 Identifier

## NOTES:

1. Dimensioning and tolerancing as per ASME Y14.5M, 2009
2. Controlling Dimension: Millimeters
3. Dimensions are exclusive of Burrs, Mold Flash, and Tiebar extrusions
4. Dimensions "b" and "c" apply to plated leads
5. Position of the leads is determine at the root of the lead where it exits the package body

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN         | NOM   | MAX   |
| A   | 15.50       | 16.00 | 16.50 |
| A2  | 7.80        | 8.00  | 8.20  |
| A3  | 6.00 REF    |       |       |
| b   | 1.10        | 1.20  | 1.30  |
| c   | 0.70        | 0.80  | 0.90  |
| D   | 72.70       | 73.20 | 73.70 |
| D1  | 67.30       | 67.80 | 68.30 |
| D2  | 57.30 REF   |       |       |
| E   | 39.70       | 40.20 | 40.70 |
| E1  | 46.70       | 47.20 | 47.70 |
| E2  | 33.87 REF   |       |       |
| e   | 2.54 BSC    |       |       |
| F   | 4.00        | 4.20  | 4.40  |
| L   | 8.00 REF    |       |       |
| L1  | 3.50        | 4.00  | 4.50  |
| M   | 4°          | 5°    | 6°    |

## GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
ZZZ = Assembly Lot Code  
AT = Assembly & Test Location  
Y = Year  
WW = Work Week

\*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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| <b>DESCRIPTION:</b>     | <b>DIP26 67.8x40</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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