

# Enhancement Mode Gallium Nitride (GaN) HEMT

650 V, 16 mΩ, 92 A, PDSO-F9

Preliminary Document  
**NTBL023N65GN1**

## Features

- Low  $R_{DS(ON)}$  to Minimize Conduction Losses
- Ultra Low Gate Charge for High Speed Switching
- $FOM-Q_G = 282 \text{ nC} \cdot \text{m}\Omega$
- Small Footprint for High Density PCB Design
- Pb-Free, Halogen Free and RoHS Compliant

## Typical Applications

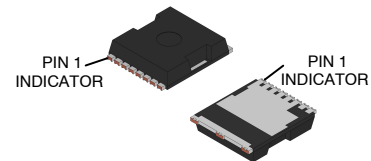
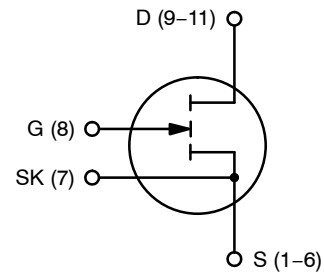
- High Density Power Modules
- High Frequency AC-DC and DC-DC Converters
- High Performance PSU for Datacenter and Industrial
- Resonant Conversion

## MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Parameter                                                                                                  | Symbol          | Value      | Unit             |
|------------------------------------------------------------------------------------------------------------|-----------------|------------|------------------|
| Drain-to-Source Voltage                                                                                    | $V_{DSS}$       | 650        | V                |
| Drain-to-Source Transient Voltage,<br>$t_p < 200 \mu\text{s}$                                              | $V_{DS(TRAN)}$  | 800        | V                |
| Gate-to-Source Voltage                                                                                     | $V_{GS}$        | -6 to 7    | V                |
| Gate-to-Source Transient Voltage,<br>$t_p = 50 \text{ ns}$ , $f_p = 100 \text{ kHz}$ , open drain          | $V_{GS(PULSE)}$ | -20 to 10  | V                |
| Continuous Drain Current,<br>$T_{CASE} = 25^\circ\text{C}$<br>$T_{CASE} = 100^\circ\text{C}$               | $I_{DS}$        | 92<br>66   | A                |
| Pulsed Drain Current,<br>$t_p < 10 \mu\text{s}$ ,<br>$T_J = 25^\circ\text{C}$<br>$T_J = 125^\circ\text{C}$ | $I_{DS(PULSE)}$ | 175<br>104 | A                |
| Power Dissipation, $V_{GS} = 6 \text{ V}$ ,<br>$T_{CASE} = 25^\circ\text{C}$                               | $P_{TOT}$       | 390        | W                |
| Operating Junction Temperature                                                                             | $T_J$           | -55 to 150 | $^\circ\text{C}$ |
| Storage Temperature                                                                                        | $T_{STG}$       | -55 to 150 | $^\circ\text{C}$ |

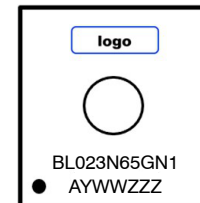
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ TYP | $I_{DS}$ MAX |
|---------------|------------------|--------------|
| 650 V         | 16 mΩ            | 92 A         |



PDSO-F9 10.38 x 9.90 x 2.30, 1.20P  
CASE 207AA

## MARKING DIAGRAM



BL023N65GN1 = Specific Device Code  
A = Assembly Site  
Y = Year of Production  
WW = Work Week Number  
ZZZ = Assembly Lot Number

## ORDERING INFORMATION

See detailed ordering and shipping information on page 3 of this data sheet.

This Preliminary document is for informational purposes only. onsemi may update or withdraw it without notice. Content and referenced products are under development and subject to change.

# NTBL023N65GN1

## THERMAL CHARACTERISTICS

| Parameter                            | Symbol          | Value | Unit                 |
|--------------------------------------|-----------------|-------|----------------------|
| Junction-to-Case                     | $R_{\theta JC}$ | 0.32  | $^{\circ}\text{C/W}$ |
| Junction-to-Ambient (Note 1)         | $R_{\theta JA}$ | 56    | $^{\circ}\text{C/W}$ |
| Maximum Soldering Temperature (MSL3) | $T_{SLD}$       | 260   | $^{\circ}\text{C}$   |

1. Device on 1 in<sup>2</sup>, 2 oz copper pad on single layer FR-4 PCB

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^{\circ}\text{C}$ unless otherwise specified)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Unit |
|-----------|--------|-----------------|-----|-----|-----|------|
|-----------|--------|-----------------|-----|-----|-----|------|

### OFF CHARACTERISTICS

|                                   |               |                                                                         |     |     |     |               |
|-----------------------------------|---------------|-------------------------------------------------------------------------|-----|-----|-----|---------------|
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}$                                                   | 650 |     |     | V             |
| Drain-to-Source Leakage Current   | $I_{DSS}$     | $V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$                            |     | 10  | TBD | $\mu\text{A}$ |
|                                   |               | $V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}, T_J = 125^{\circ}\text{C}$ |     | 113 |     |               |
| Gate-to-Source Leakage Current    | $I_{GSS}$     | $V_{GS} = 6\text{ V}, V_{DS} = 0\text{ V}$                              |     | 284 | TBD | $\mu\text{A}$ |
|                                   |               | $V_{GS} = 6\text{ V}, V_{DS} = 0\text{ V}, T_J = 125^{\circ}\text{C}$   |     | TBD |     | $\mu\text{A}$ |

### ON CHARACTERISTICS

|                               |              |                                                                        |  |     |     |                  |
|-------------------------------|--------------|------------------------------------------------------------------------|--|-----|-----|------------------|
| Drain-to-Source On Resistance | $R_{DS(ON)}$ | $V_{GS} = 6\text{ V}, I_{DS} = 26\text{ A}$                            |  | 16  | 21  | $\text{m}\Omega$ |
|                               |              | $V_{GS} = 6\text{ V}, I_{DS} = 26\text{ A}, T_J = 125^{\circ}\text{C}$ |  | 31  |     |                  |
| Gate Threshold Voltage        | $V_{GS(TH)}$ | $V_{DS} = V_{GS}, I_{DS} = 100\text{ mA}, T_J = 25^{\circ}\text{C}$    |  | 1.6 | 2.5 | V                |
|                               |              | $V_{DS} = V_{GS}, I_{DS} = 100\text{ mA}, T_J = 125^{\circ}\text{C}$   |  | 1.5 |     |                  |

### DYNAMIC CHARACTERISTICS

|                                    |               |                                                                      |  |      |  |               |
|------------------------------------|---------------|----------------------------------------------------------------------|--|------|--|---------------|
| Input Capacitance                  | $C_{ISS}$     | $V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$       |  | 791  |  | $\text{pF}$   |
| Output Capacitance                 | $C_{OSS}$     |                                                                      |  | 266  |  |               |
| Reverse Transfer Capacitance       | $C_{RSS}$     |                                                                      |  | 2.5  |  |               |
| Output Capacitance, Energy Related | $C_{OSS(ER)}$ | $V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$          |  | 386  |  | $\text{pF}$   |
| Output Capacitance, Time Related   | $C_{OSS(TR)}$ |                                                                      |  | 503  |  |               |
| Output Charge                      | $Q_{OSS}$     |                                                                      |  | 201  |  | $\text{nC}$   |
| Output Capacitance Stored Energy   | $E_{OSS}$     |                                                                      |  | 30.9 |  | $\mu\text{J}$ |
| Gate Resistance                    | $R_G$         | $f = 5\text{ MHz}$                                                   |  | 4    |  | $\Omega$      |
| Gate Charge                        | $Q_G$         | $V_{DS} = 400\text{ V}, I_{DS} = 26\text{ A}, V_{GS} = 0/6\text{ V}$ |  | 17.6 |  | $\text{nC}$   |
| Gate-to-Source Charge              | $Q_{GS}$      |                                                                      |  | 1.7  |  |               |
| Gate-to-Drain Charge               | $Q_{GD}$      |                                                                      |  | 6.3  |  |               |
| Gate Plateau Voltage               | $V_{PLAT}$    |                                                                      |  | 2.1  |  | V             |

### SWITCHING CHARACTERISTICS

|                     |              |                                                                                                                  |  |     |  |    |
|---------------------|--------------|------------------------------------------------------------------------------------------------------------------|--|-----|--|----|
| Turn-On Delay Time  | $t_{D(ON)}$  | $V_{DS} = 400\text{ V}, I_{DS} = 26\text{ A}, V_{GS} = 0/6\text{ V}, R_{G,ON} = 10\Omega, R_{G,OFF} = 2.2\Omega$ |  | TBD |  | ns |
| Turn-Off Delay Time | $t_{D(OFF)}$ |                                                                                                                  |  | TBD |  | ns |
| Turn-On Rise Time   | $t_R$        |                                                                                                                  |  | TBD |  | ns |
| Turn-Off Fall Time  | $t_F$        |                                                                                                                  |  | TBD |  | ns |

### REVERSE CONDUCTION CHARACTERISTICS

|                                 |          |                                              |  |     |  |   |
|---------------------------------|----------|----------------------------------------------|--|-----|--|---|
| Source-to-Drain Reverse Voltage | $V_{SD}$ | $V_{GS} = -2\text{ V}, I_{SD} = 26\text{ A}$ |  | 4.4 |  | V |
|                                 |          | $V_{GS} = 0\text{ V}, I_{SD} = 26\text{ A}$  |  | 2.4 |  |   |
|                                 |          | $V_{GS} = 6\text{ V}, I_{SD} = 26\text{ A}$  |  | 0.4 |  |   |

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.



## NTBL023N65GN1

### Gate Drive Guidelines

This GaN device utilizes a Schottky gate structure, which behaves similarly to a MOSFET with a purely capacitive input and does not require continuous gate current during the on-state. For optimal performance, apply a low-impedance gate driver with appropriate gate resistance to control switching speed and limit ringing. A typical gate voltage of

6 V is recommended, with optional negative gate bias for hard-switching applications to improve dv/dt immunity and prevent false turn-on. Minimize gate loop inductance (<1 nH) through careful PCB layout and short connections. For additional robustness, Zener clamps may be used to limit gate voltage in both polarities.

### ORDERING INFORMATION

| Device Order Number | Package Type                       | Shipping <sup>†</sup> |
|---------------------|------------------------------------|-----------------------|
| ENGNTBL023N65GN1TXG | PDSO-F9 10.38 x 9.90 x 2.30, 1.20P | 1200 / Tape & Reel    |

<sup>†</sup> For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, [BRD8011/D](#).



## NTBL023N65GN1

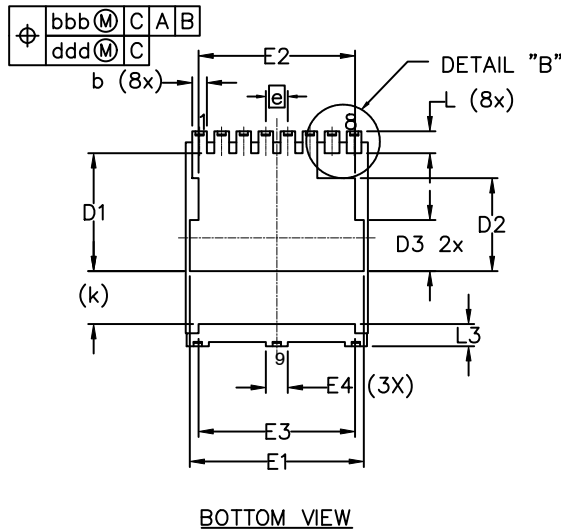
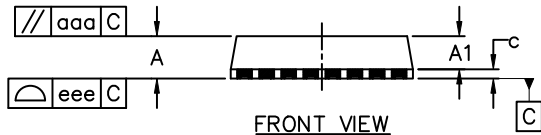
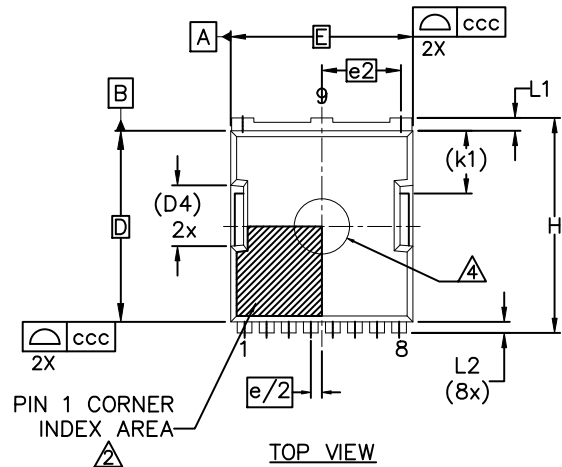
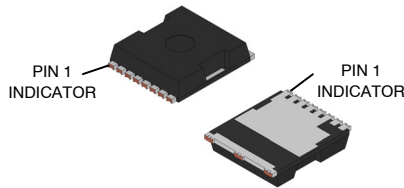
### REVISION HISTORY

| Revision | Description of Changes                                                                                                                 | Date     |
|----------|----------------------------------------------------------------------------------------------------------------------------------------|----------|
| P0       | Initial Preliminary Document release.                                                                                                  | 5/4/2026 |
| P1       | Updated case outline and package information; added the marking diagram, added shipping information to the Ordering Information table. | 7/3/2026 |

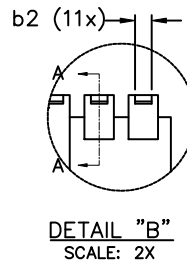
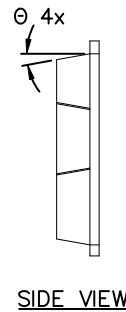
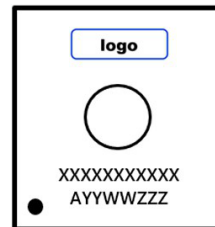


**PDSO-F9 10.38x9.90x2.30, 1.20P**  
**CASE 207AA**  
**ISSUE 0**

DATE 25 FEB 2026

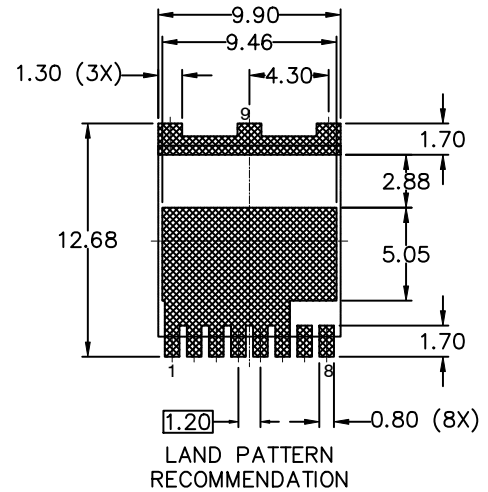

**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. A VISUAL INDEX FEATURE MUST BE LOCATED WITHIN THE HATCHED AREA.
3. DIMENSIONS DO NOT INCLUDE MOLD FLASH AND BURR.
4. THE LOCATION AND SIZE OF EJECTOR MARKS ARE OPTIONAL.


**SECTION "A-A"**  
**SCALE: 4X**
**GENERIC MARKING DIAGRAM\***


XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZZ = Assembly Lot 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.



\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| DIM | MILLIMETERS |       |       |
|-----|-------------|-------|-------|
|     | MIN.        | NOM.  | MAX.  |
| A   | 2.15        | 2.30  | 2.45  |
| A1  | 1.65        | 1.80  | 1.95  |
| b   | 0.70        | 0.80  | 0.90  |
| b2  | 0.31        | 0.43  | 0.55  |
| c   | 0.40        | 0.50  | 0.60  |
| c2  | 0.10        | —     | —     |
| D   | 10.38 BSC   |       |       |
| D1  | 6.20        | 6.40  | 6.60  |
| D2  | 4.85        | 5.05  | 5.25  |
| D3  | 2.57        | 2.77  | 3.97  |
| D4  | 3.30 REF    |       |       |
| E   | 9.90 BSC    |       |       |
| E1  | 9.26        | 9.46  | 9.66  |
| E2  | 8.30        | 8.50  | 8.70  |
| E3  | 8.30        | 8.50  | 8.70  |
| E4  | 1.10        | 1.20  | 1.30  |
| e   | 1.20 BSC    |       |       |
| e/2 | 0.60 BSC    |       |       |
| e2  | 4.30 BSC    |       |       |
| H   | 11.48       | 11.68 | 11.88 |
| L   | 1.00        | 1.20  | 1.40  |
| L1  | 0.50        | 0.70  | 0.90  |
| L2  | 0.50        | 0.60  | 0.70  |
| L3  | 1.00        | 1.20  | 1.40  |
| L4  | 0.23 REF    |       |       |
| k   | 2.88 REF    |       |       |
| k1  | 3.41 REF    |       |       |
| θ   | 10° REF     |       |       |
| aaa | 0.20        |       |       |
| bbb | 0.25        |       |       |
| ccc | 0.20        |       |       |
| ddd | 0.20        |       |       |
| eee | 0.20        |       |       |

**DOCUMENT NUMBER:** 98AON70698H

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**DESCRIPTION:** PDSO-F9 10.38x9.90x2.30, 1.20P

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