

# Enhancement Mode Gallium Nitride (GaN) HEMT

## 650 V, 39 mΩ, 40 A, PDSO-F9

### Preliminary Document NTBL050N65GN1

#### Features

- Low  $R_{DS(ON)}$  to Minimize Conduction Losses
- Ultra Low Gate Charge for High Speed Switching
- FOM- $Q_G = 367 \text{ nC} \cdot \text{m}\Omega$
- Small Footprint for High Density PCB Design
- Pb-Free, Halogen Free and RoHS Compliant

#### Typical Applications

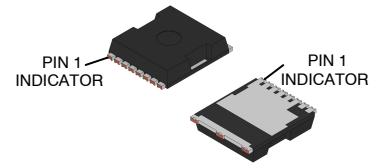
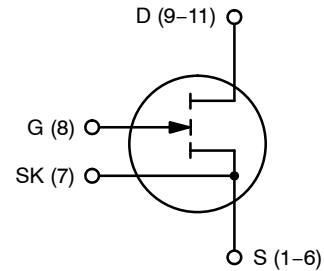
- High Density Power Modules
- High Frequency AC-DC and DC-DC Converters
- High Performance PSU for Datacenter and Industrial
- Resonant Conversion

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	650	V
Drain-to-Source Transient Voltage, $t_p < 200 \text{ } \mu\text{s}$	$V_{DS(TRAN)}$	800	V
Gate-to-Source Voltage	$V_{GS}$	-6 to 7	V
Gate-to-Source Transient Voltage, $t_p = 50 \text{ ns}$ , $f_p = 100 \text{ kHz}$ , open drain	$V_{GS(PULSE)}$	-20 to 10	V
Continuous Drain Current, $T_{CASE} = 25 \text{ }^\circ\text{C}$ $T_{CASE} = 100 \text{ }^\circ\text{C}$	$I_{DS}$	40 30	A
Pulsed Drain Current, $t_p < 10 \text{ } \mu\text{s}$ , $T_J = 25 \text{ }^\circ\text{C}$ $T_J = 125 \text{ }^\circ\text{C}$	$I_{DS(PULSE)}$	77 40	A
Power Dissipation, $V_{GS} = 6 \text{ V}$ , $T_{CASE} = 25 \text{ }^\circ\text{C}$	$P_{TOT}$	250	W
Operating Junction Temperature	$T_J$	-55 to 150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55 to 150	$^\circ\text{C}$

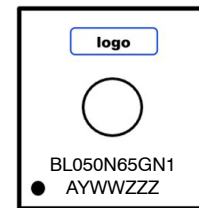
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

$V_{(BR)DSS}$	$R_{DS(ON)}$ TYP	$I_{DS}$ MAX
650 V	39 mΩ	40 A



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

#### MARKING DIAGRAM



BL050N65GN1 = 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.

# NTBL050N65GN1

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Junction-to-Case	$R_{\theta JC}$	0.5	$^{\circ}\text{C}/\text{W}$
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	56	$^{\circ}\text{C}/\text{W}$
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
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$	650			V
Drain-to-Source Leakage Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$		8	TBD	$\mu\text{A}$
		$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}, T_J = 125^{\circ}\text{C}$		20		
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{GS} = 6\text{ V}, V_{DS} = 0\text{ V}$		250	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	$R_{DS(ON)}$	$V_{GS} = 6\text{ V}, I_{DS} = 18\text{ A}$		39	50	$\text{m}\Omega$
		$V_{GS} = 6\text{ V}, I_{DS} = 18\text{ A}, T_J = 125^{\circ}\text{C}$		75		
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_{DS} = 50\text{ mA}, T_J = 25^{\circ}\text{C}$		1.7		V
		$V_{DS} = V_{GS}, I_{DS} = 50\text{ mA}, T_J = 125^{\circ}\text{C}$		1.6		

### DYNAMIC CHARACTERISTICS

Input Capacitance	$C_{ISS}$	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		342		$\text{pF}$
Output Capacitance	$C_{OSS}$			125		
Reverse Transfer Capacitance	$C_{RSS}$			1.5		
Output Capacitance, Energy Related	$C_{OSS(ER)}$	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		189		$\text{pF}$
Output Capacitance, Time Related	$C_{OSS(TR)}$			269		
Output Charge	$Q_{OSS}$			107		$\text{nC}$
Output Capacitance Stored Energy	$E_{OSS}$			15		$\mu\text{J}$
Gate Resistance	$R_G$		$f = 5\text{ MHz}$		1.5	
Gate Charge	$Q_G$	$V_{DS} = 400\text{ V}, I_{DS} = 18\text{ A}, V_{GS} = 0/6\text{ V}$		9.4		$\text{nC}$
Gate-to-Source Charge	$Q_{GS}$			0.9		
Gate-to-Drain Charge	$Q_{GD}$			4.0		
Gate Plateau Voltage	$V_{PLAT}$			2.5		V

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{D(ON)}$	$V_{DS} = 400\text{ V}, I_{DS} = 18\text{ A}, V_{GS} = 0/6\text{ V},$ $R_{G,ON} = 10\ \Omega, R_{G,OFF} = 2.2\ \Omega$		9.6		ns
Turn-Off Delay Time	$t_{D(OFF)}$			10.5		ns
Turn-On Rise Time	$t_R$			13.3		ns
Turn-Off Fall Time	$t_F$			9		ns

### REVERSE CONDUCTION CHARACTERISTICS

Source-to-Drain Reverse Voltage	$V_{SD}$	$V_{GS} = -2\text{ V}, I_{SD} = 18\text{ A}$		4.9		V
		$V_{GS} = 0\text{ V}, I_{SD} = 18\text{ A}$		2.9		
		$V_{GS} = 6\text{ V}, I_{SD} = 18\text{ A}$		0.7		

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.

# NTBL050N65GN1

## 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>
ENGNTBL050N65GN1TXG	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](#).

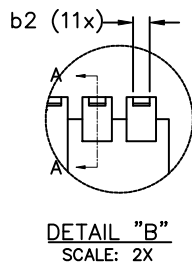
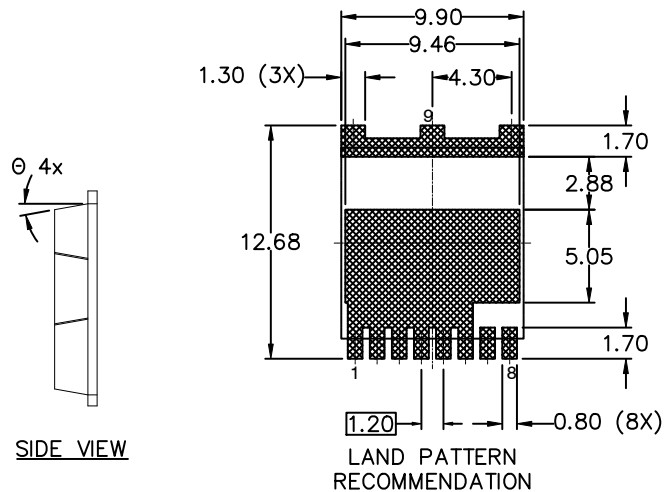
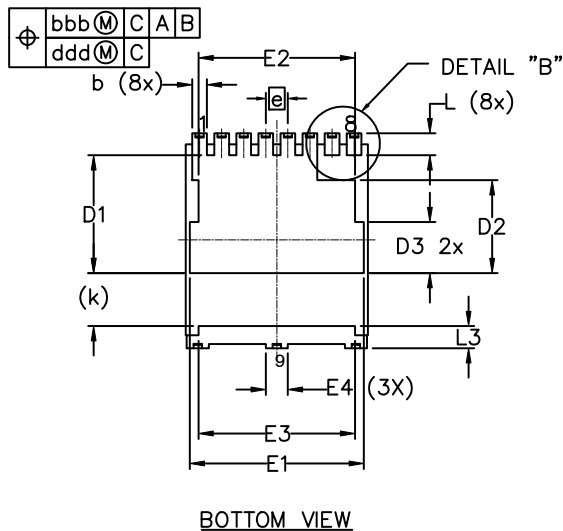
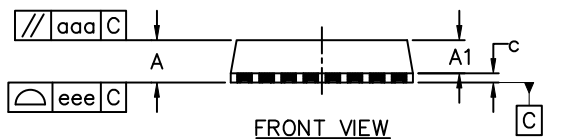
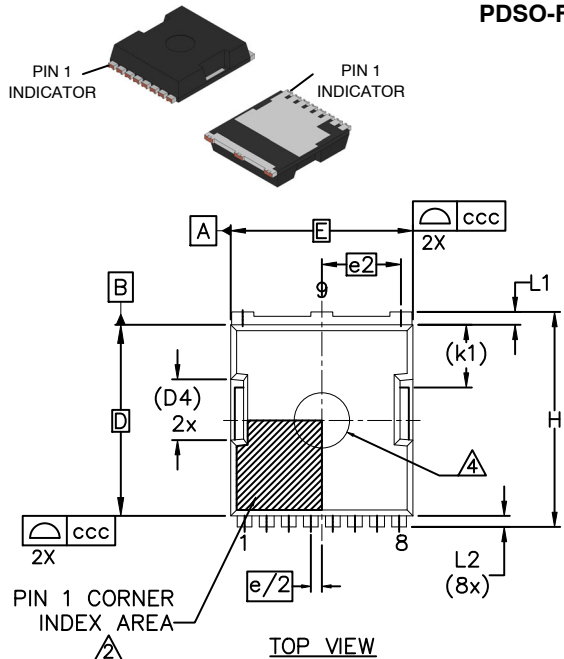
# NTBL050N65GN1

## REVISION HISTORY

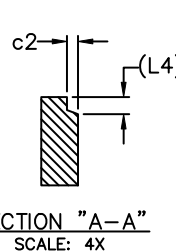
Revision	Description of Changes	Date
P0	Initial Preliminary Document release.	5/4/2026
P1	Updated case outline and package information; added the marking diagram, added shipping information to the Ordering Information table.	7/3/2026

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

DATE 25 FEB 2026



\*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		

- 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.

\*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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