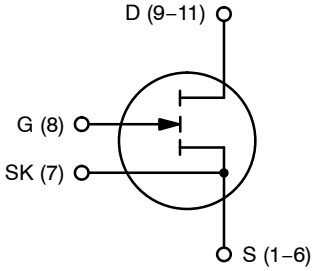
Enhancement Mode Gallium Nitride (GaN) HEMT

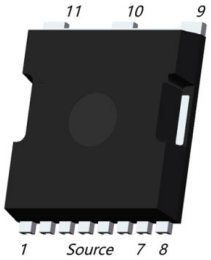
650 V, 16 mΩ, 92 A, TOLL 10x12

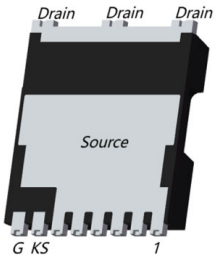
Preliminary Document

NTBL023N65GN1

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







Features

- Low $R_{DS(ON)}$ to Minimize Conduction Losses
- Ultra Low Gate Charge for High Speed Switching
- FOM-Q_G = 282 nC*mΩ
- 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 °C unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	650	V
Drain-to-Source Transient Voltage, t_P < 200 μs	$V_{DS(TRAN)}$	800	V
Gate-to-Source Voltage	V_{GS}	−6 to 7	V
Gate-to-Source Transient Voltage, t_P = 50 ns, f_P = 100 kHz, open drain	$V_{GS(PULSE)}$	−20 to 10	V
Continuous Drain Current, T_{CASE} = 25 °C T_{CASE} = 100 °C	I_{DS}	 92 66	A
Pulsed Drain Current, t_P < 10 μs, T_J = 25 °C T_J = 125 °C	$I_{DS(PULSE)}$	 175 104	A
Power Dissipation, V_{GS} = 6 V, T_{CASE} = 25 °C	P_{TOT}	390	W
Operating Junction Temperature	T_J	−55 to 150	°C
Storage Temperature	T_{STG}	−55 to 150	°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.

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.

THERMAL CHARACTERISTICS

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

1. Device on 1 in^2, 2 oz copper pad on single layer FR-4 PCB

ELECTRICAL CHARACTERISTICS (T_J = 25 °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 V	650			V
Drain-to-Source Leakage Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 650 V		10	TBD	μA
		V_{GS} = 0 V, V_{DS} = 650 V, T_J = 125 °C		113		
Gate-to-Source Leakage Current	I_{GSS}	V_{GS} = 6 V, V_{DS} = 0 V		284	TBD	μA
		V_{GS} = 6 V, V_{DS} = 0 V, T_J = 125 °C		TBD		μA
ON CHARACTERISTICS						
Drain-to-Source On Resistance	$R_{DS(ON)}$	V_{GS} = 6 V, I_{DS} = 26 A		16	21	mΩ
		V_{GS} = 6 V, I_{DS} = 26 A, T_J = 125 °C		31		
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS} = V_{GS}, I_{DS} = 100 mA, T_J = 25 °C		1.6	2.5	V
		V_{DS} = V_{GS}, I_{DS} = 100 mA, T_J = 125 °C		1.5		
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	V_{DS} = 400 V, V_{GS} = 0 V, f = 1 MHz		791		pF
Output Capacitance	C_{OSS}			266		
Reverse Transfer Capacitance	C_{RSS}			2.5		
Output Capacitance, Energy Related	$C_{OSS(ER)}$	V_{DS} = 0 V to 400 V, V_{GS} = 0 V		386		pF
Output Capacitance, Time Related	$C_{OSS(TR)}$			503		
Output Charge	Q_{OSS}			201		nC
Output Capacitance Stored Energy	E_{OSS}			30.9		μJ
Gate Resistance	R_G	f = 5 MHz		4		Ω
Gate Charge	Q_G	V_{DS} = 400 V, I_{DS} = 26 A, V_{GS} = 0/6 V		17.6		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 V, I_{DS} = 26 A, V_{GS} = 0/6 V, $R_{G,ON}$ = 10 Ω, $R_{G,OFF}$ = 2.2 Ω		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 V, I_{SD} = 26 A		4.4		V
		V_{GS} = 0 V, I_{SD} = 26 A		2.4		
		V_{GS} = 6 V, I_{SD} = 26 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.

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

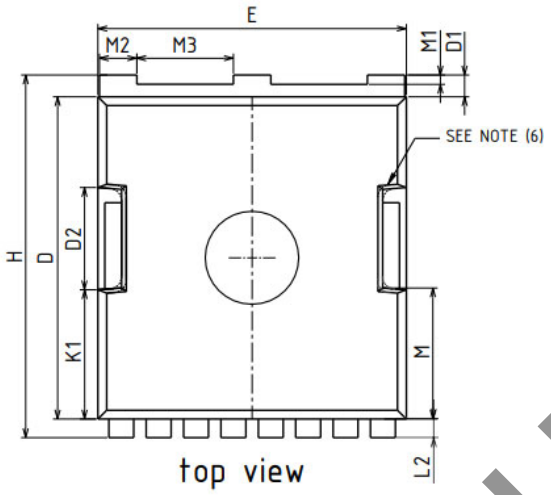
Device Order Number	Package Type	Shipping
ENGNTBL023N65GN1TXG	TOLL 10.0 x 12.0	TBD

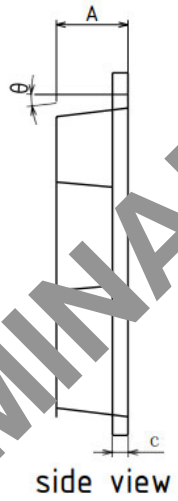
REVISION HISTORY

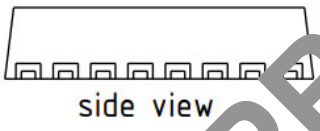
Revision	Description of Changes	Date
P0	Initial Preliminary Document release.	5/4/2026

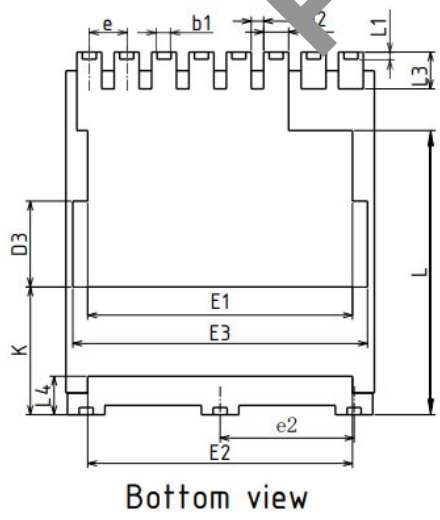
PACKAGE DIMENSIONS

TOLL 10 x 12 mm
CASE TBD
ISSUE O







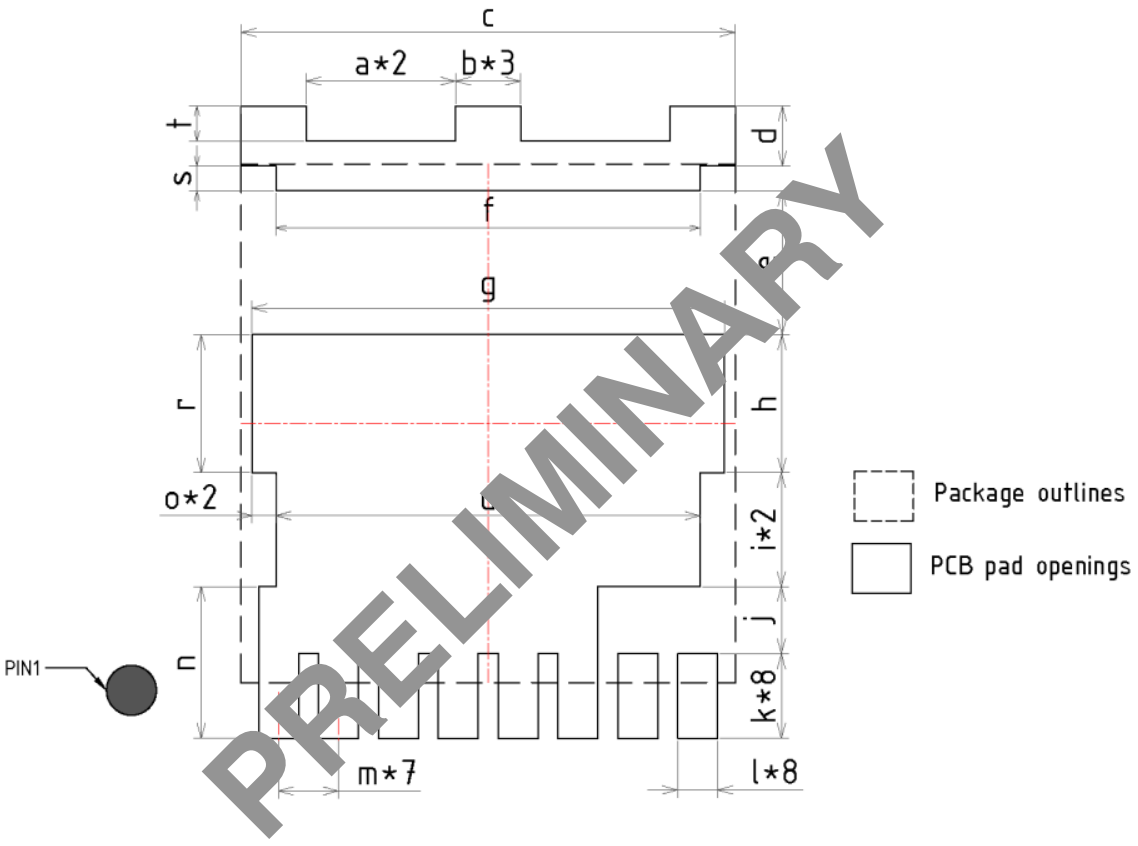


SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	2.15	2.30	2.45
b	0.30	0.40	0.50
b1	0.31	0.43	0.55
b2	0.65	0.80	0.90
c	0.40	0.50	0.60
D	10.18	10.38	10.58
D1	0.50	0.70	0.90
D2	3.30REF		
D3	2.77REF		
E	9.70	9.90	10.10
E1	8.50REF		
E2	8.50REF		
E3	9.46REF		
e	1.10	1.20	1.30
e2	4.20	4.30	4.40
H	11.48	11.68	11.88
K	4.08REF		
K1	4.18REF		
L	9.13REF		
L1	0.23REF		
L2	0.50	0.60	0.70
L3	1.00	1.20	1.40
L4	1.00	1.20	1.40
M	4.18REF		
M1	0.26REF		
M2	1.10	1.20	1.30
M3	3.10REF		
Θ	10.00REF		

All Dimensions in mm

PACKAGE DIMENSIONS

LAND PATTERN



SYMBOL	DIMENSION	SYMBOL	DIMENSION
a	3.00	k	1.70
b	1.30	l	0.80
c	9.90	m	1.20
d	1.20	n	3.05
e	2.88	o	0.48
f	8.50	r	2.77
g	9.46	s	0.50
h	2.77	t	0.70
i	2.28	u	8.50
j	1.35	/	/

All Dimensions in mm

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
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