NPT2022 *Preliminary*

NITRONEX

Gallium Nitride 48V, 100W, DC-2.2 GHz HEMT

Built using the SIGANTIC® process - A proprietary GaN-on-Silicon technology

Features

- Suitable for linear and saturated applications
- Tunable from DC-2.2 GHz
- 48V Operation
- Industry Standard Plastic Package
- High Drain Efficiency (>60%)

Applications

- Defense Communications
- Land Mobile Radio
- Avionics
- Wireless Infrastructure
- ISM Applications
- VHF/UHF/L-Band Radar

DC-2.2 GHz
100W
GaN HEMT

RoHS

Product Description

The NPT2010 GaN HEMT is a wideband transistor optimized for DC-2.2 GHz operation. This device has been designed for CW, pulsed, and linear operation with output power levels to 100W (50 dBm) in an industry standard plastic package with a bolt down flange.

RF Specifications (CW, 900 MHz): V_{DS} = 48V, I_{DQ} = 600mA, T_C= 25°C

Symbol	Parameter	Min	Typ	Max	Units
G_{SS}	Small-signal Gain	-	19	-	dB
P_{SAT}	Saturated Output Power	-	50.5	-	dBm
η_{SAT}	Efficiency at Saturated Output Power	-	64	-	%
G_P	Gain at P_{OUT} = 100W	-	17	-	dB
η	Drain Efficiency at P_{OUT} = 100W	-	60	-	%
V_{DS}	Drain Voltage	-	48	-	V
Ψ	Ruggedness: Output Mismatch, all phase angles	VSWR = TBD:1, No Device Damage			

DC Specifications: T_C = 25°C

Symbol	Parameter	Min	Typ	Max	Units
Off Characteristics					
I_{DLK}	Drain-Source Leakage Current (V_{GS}=-8V, V_{DS}=160V)	-	-	24	mA
I_{GLK}	Gate-Source Leakage Current (V_{GS}=-8V, V_{DS}=0V)	-	-	12	mA
On Characteristics					
V_T	Gate Threshold Voltage (V_{DS}=48V, I_D=24mA)	-2.5	-1.5	-0.5	V
V_{GSQ}	Gate Quiescent Voltage (V_{DS}=48V, I_D=600mA)	-2.1	-1.2	-0.3	V
R_{ON}	On Resistance (V_{DS}=2V, I_D=180mA)	-	0.2	-	Ω
$I_{D, MAX}$	Maximum Drain Current (V_{DS}=7V pulsed, 300μS pulse width, 0.2% Duty Cycle)	-	14	-	A

Thermal Resistance Specification:

Symbol	Parameter	Typ	Units
$R_{\theta JC}$	Thermal Resistance (Junction-to-Case), T_J = 180 °C	1.7	°C/W

Junction Temperature (T_J) measured using IR Microscopy, Case Temperature (T_C) measured using a thermocouple embedded in heatsink.

Absolute Maximum Ratings: Not simultaneous, T_C = 25°C unless otherwise noted

Symbol	Parameter	Max	Units
V_{DS}	Drain-Source Voltage	160	V
V_{GS}	Gate-Source Voltage	-10 to 3	V
I_G	Gate Current	48	mA
P_T	Total Device Power Dissipation (Derated above 25°C)	117	W
T_{STG}	Storage Temperature Range	-65 to 150	°C
T_J	Operating Junction Temperature	225	°C
HBM	Human Body Model ESD Rating (per JESD22-A114)	TBD	
MSL	Moisture sensitivity level (per IPC/JEDEC J-STD-020)	TBD	

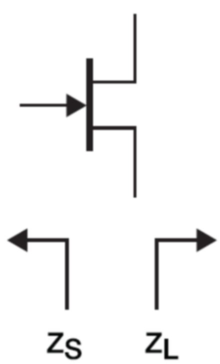
Load-Pull Data, Reference Plane at Device Leads

V_{DS}=48V, I_{DQ}=600mA, T_C=25°C unless otherwise noted

Optimum Source and Load Impedances:

(CW Drain Efficiency and Output Power Tradeoff Impedance)

Frequency (MHz)	Z_S (Ω)	Z_L (Ω)	P_{SAT} (W)	G_{SS} (dB)	Drain Efficiency @ P_{SAT} (%)
500	1.3 + j0.2	5.8 + j2.0	147	26	70
900	1.1 - j2.2	5.0 + j1.9	134	21	67



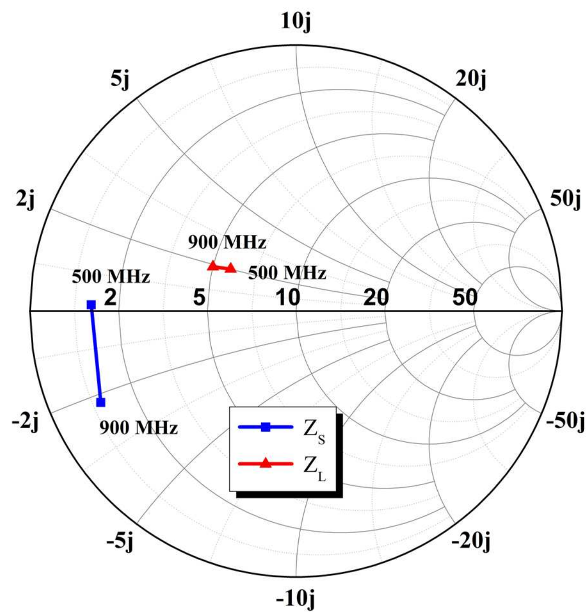


Figure 1: CW Power/Drain Efficiency Tradeoff Impedances, Z_O=10Ω

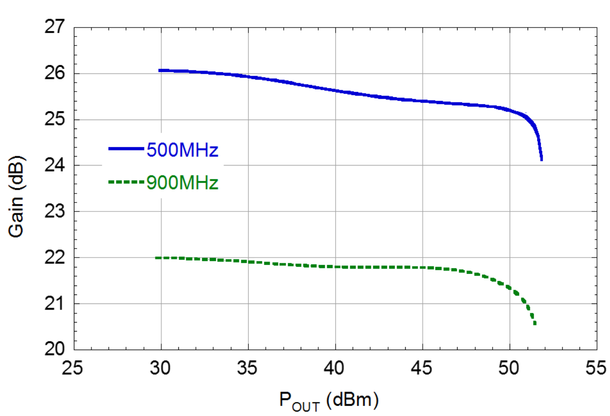


Figure 2: Gain vs. P_{OUT}

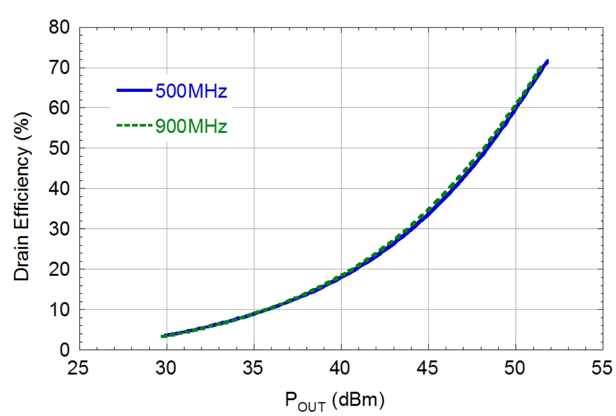


Figure 3: Efficiency vs. P_{OUT}

130-700 MHz Broadband Circuit

(CW, V_{DS}=48V, I_{DQ}=600mA, T_C=25°C, unless otherwise noted)

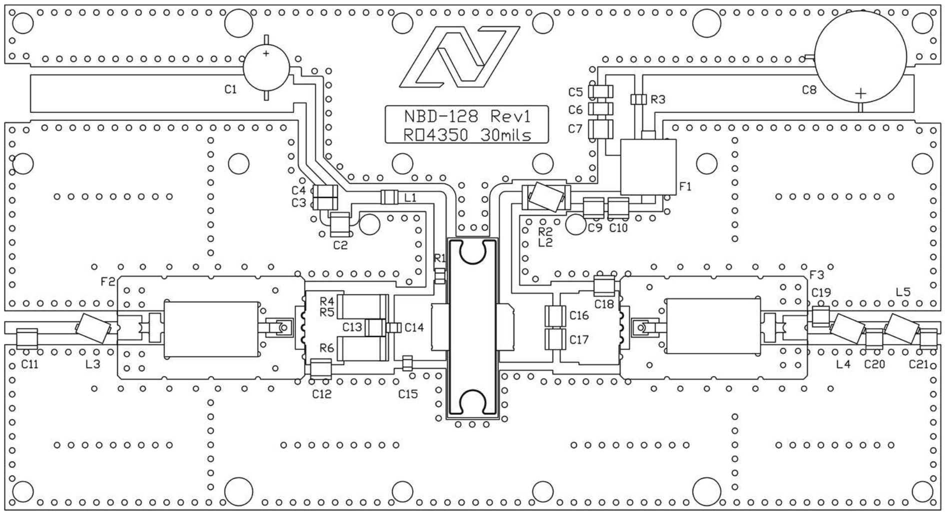


Figure 4: Component Placement of 130-700 MHz Broadband Circuit for NPT2022

Reference	Value	Manufacturer	Part Number
C1	150µF	Nichicon	UPW1C151MED
C2, C7	1µF	AVX	1210C105KAT2A
C3, C6	0.1µF	Kemet	C1206C104K1RACTU
C4, C5	0.01µF	AVX	12061C103KAT2A
C8	270µF	United Chemi-Con	ELXY 630ELL271MK25S
C9	18pF	ATC	ATC100B180
C10	1000pF	ATC	ATC100B102
C11	1.5pF	ATC	ATC100B1R5
C12	5.6pF	ATC	ATC100B5R6
C13	15pF	ATC	ATC100B150
C14	220pF	ATC	600F221FT
C15	12pF	ATC	600F120FT
C16, C17	82pF	ATC	ATC100B820
C18	4.7pF	ATC	ATC100B4R7
C19	2.4pF	ATC	ATC100B2R4
C20	3.9pF	ATC	ATC100B3R9
C21	1.0pF	ATC	ATC100B1R0
R1	49.9Ω	Panasonic	ERJ-6ENF49R9V
R2	470Ω	Panasonic	ERJ-1TNF4700U
R3	0.33Ω	Panasonic	ERJ-6RQFR33V
R4, R5, R6	24.9Ω	Panasonic	ERJ-1TNF24R9U
F1	Material 73	Fair-Rite	2673000801
F2, F3	4:1 Transformer	Anaren	XMT031B5012
L1	25nH	Coilcraft	0908SQ-25NJL
L2, L4	8nH	Coilcraft	A03TJL
L3, L5	5nH	Coilcraft	A02TJL
PCB	RO4350, ε_r=3.5, 0.020”	Rogers	Nitronex NBD-128r1

Typical Performance in 130-700 MHz Broadband Circuit

(CW, V_{DS}=48V, I_{DQ}=600mA, T_C=25°C, unless otherwise noted)

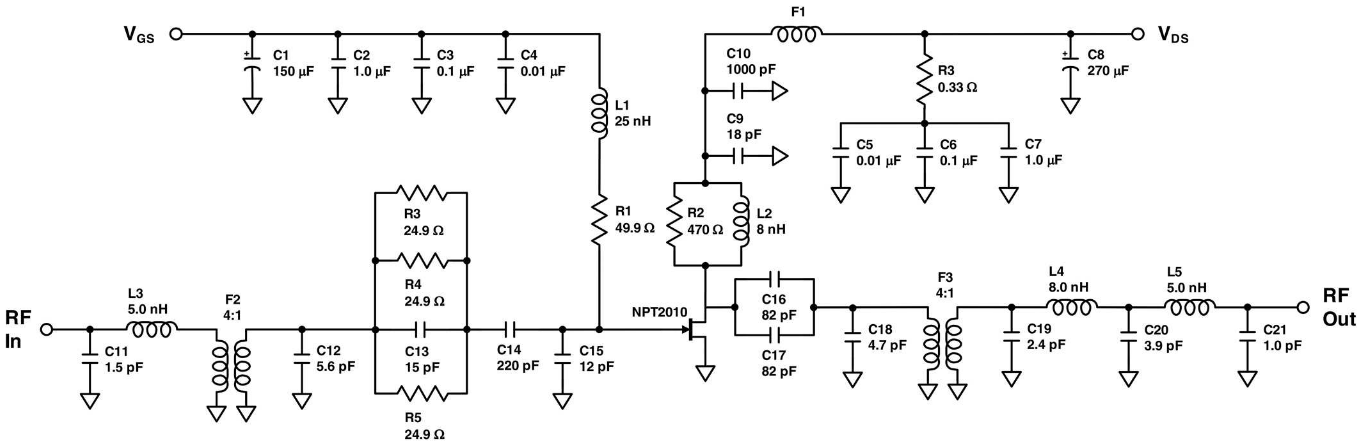


Figure 5. Electrical Schematic of 130-700 MHz Broadband Circuit for NPT2022
(For RF Tuning details see Component Placement Diagram Figure 4)

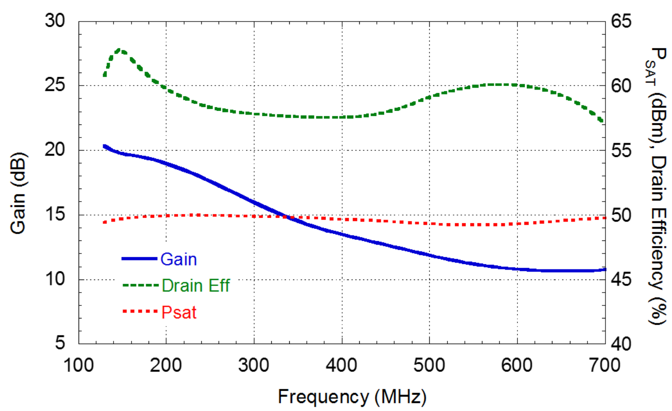


Figure 6: Performance vs. Frequency at (P_{OUT} = P_{SAT})

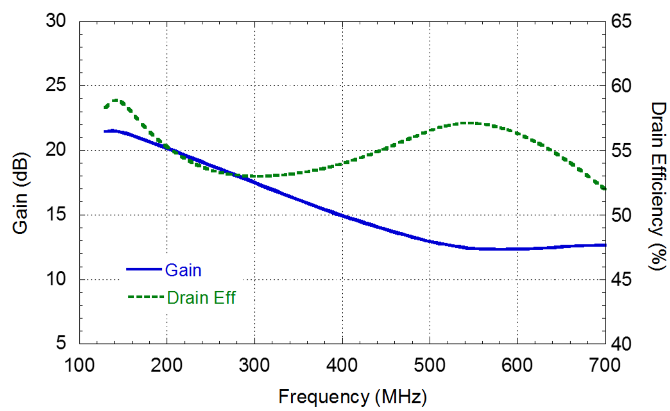


Figure 7: Performance vs. Frequency (P_{OUT} = 49dBm)

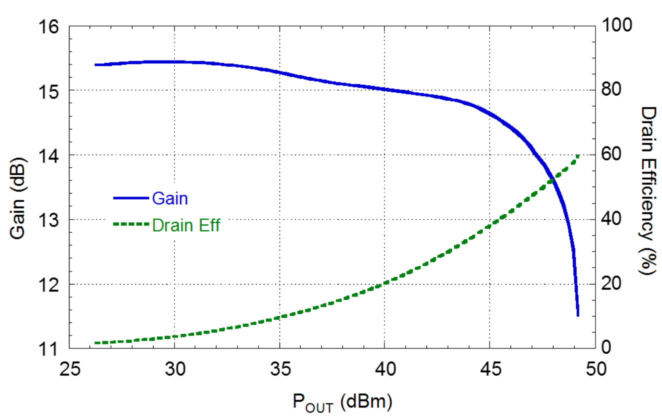


Figure 8: Performance vs. P_{OUT} (f = 520MHz)

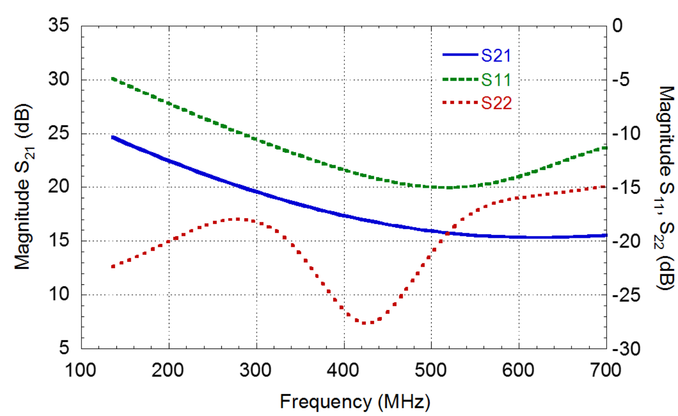


Figure 9: Small Signal s-parameters vs. Frequency

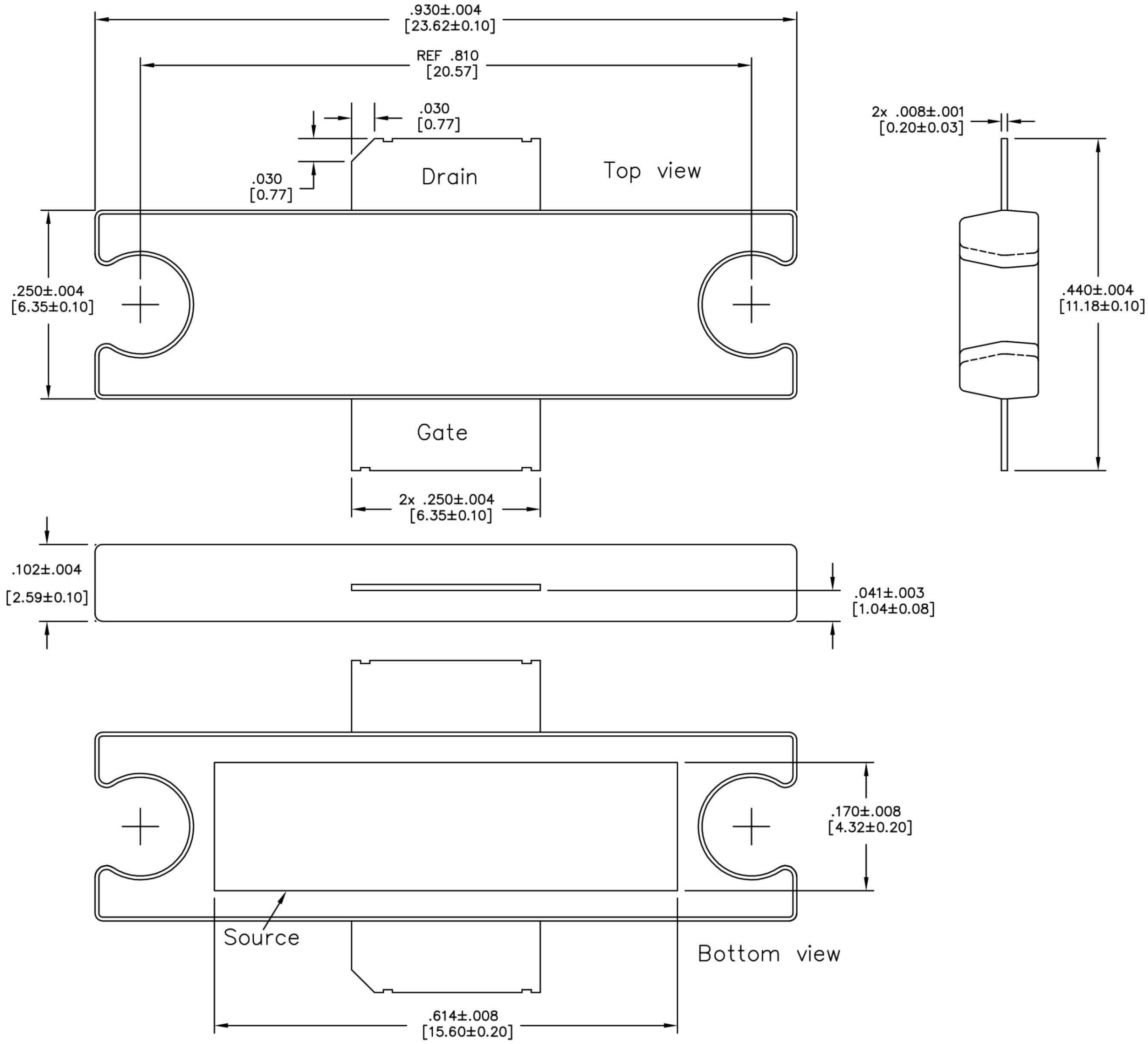


Figure 10 - TO272-2 Bolt-Down Plastic Package Dimensions (all dimensions in inches [millimeters])

Function
Gate — RF Input
Drain — RF Output (Cut lead)
Source — Ground (Flange)

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Additional Information

This part is lead-free and is compliant with the RoHS directive
(Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

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