NPT2020 *Preliminary*

NITRONEX

Gallium Nitride 48V, 50W, DC-3.5 GHz HEMT

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

Features

- Suitable for linear and saturated applications
- Tunable from DC-3.5 GHz
- 48V Operation
- Industry Standard Package
- High Drain Efficiency (>60%)

Applications

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

DC-3.5 GHz
50W
GaN HEMT

RoHS

Product Description

The NPT2020 GaN HEMT is a wideband transistor optimized for DC-3.5 GHz operation. This device has been designed for CW, pulsed, and linear operation with output power levels exceeding 50W (47 dBm) in an industry standard metal-ceramic package with a bolt down flange.

RF Specifications (CW, 3.5 GHz): V_{DS} = 48V, I_{DQ} = 350mA, T_C= 25°C

Symbol	Parameter	Min	Typ	Max	Units
G_{SS}	Small-signal Gain	-	17	-	dB
P_{SAT}	Saturated Output Power	-	48	-	dBm
η_{SAT}	Efficiency at Saturated Output Power	-	60	-	%
G_P	Gain at P_{OUT} = 50W	-	11	-	dB
η	Drain Efficiency at P_{OUT} = 50W	-	52	-	%
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)	-	-	14	mA
I_{GLK}	Gate-Source Leakage Current (V_{GS}=-8V, V_{DS}=0V)	-	-	7	mA
On Characteristics					
V_T	Gate Threshold Voltage (V_{DS}=48V, I_D=14mA)	-2.5	-1.5	-0.5	V
V_{GSQ}	Gate Quiescent Voltage (V_{DS}=48V, I_D=350mA)	-2.1	-1.2	-0.3	V
R_{ON}	On Resistance (V_{DS}=2V, I_D=105mA)	-	0.34	-	Ω
$I_{D,\ MAX}$	Maximum Drain Current (V_{DS}=7V pulsed, 300µS pulse width, 0.2% Duty Cycle)	-	8.2	-	A

Thermal Resistance Specification:

Symbol	Parameter	Typ	Units
$R_{\theta JC}$	Thermal Resistance (Junction-to-Case), T_J = 200 °C	2.3	°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	28	mA
P_T	Total Device Power Dissipation (Derated above 25°C)	87	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	

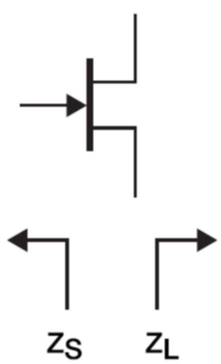
Load-Pull Data, Reference Plane at Device Leads

V_{DS}=48V, I_{DQ}=350mA, T_C=25°C unless otherwise noted

Optimum Source and Load Impedances:

(CW Drain Efficiency and Output Power Tradeoff Impedance)

Frequency (GHz)	Z_S (Ω)	Z_L (Ω)	P_{SAT} (W)	G_{SS} (dB)	Drain Efficiency @ P_{SAT} (%)
2.7	1.8 - j9.6	3.3 - j1.3	76	15	65
3.1	2.7 - j12	3.1 - j2.8	70	14	62
3.5	2.5 - j15	3.1 - j5.3	67	14	60



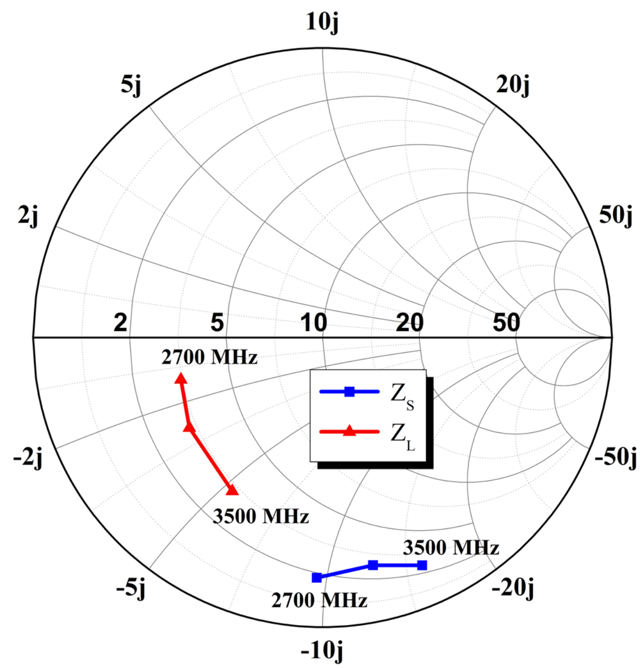


Figure 1: CW Power/Drain Efficiency Tradeoff Impedances, Z_O=10Ω

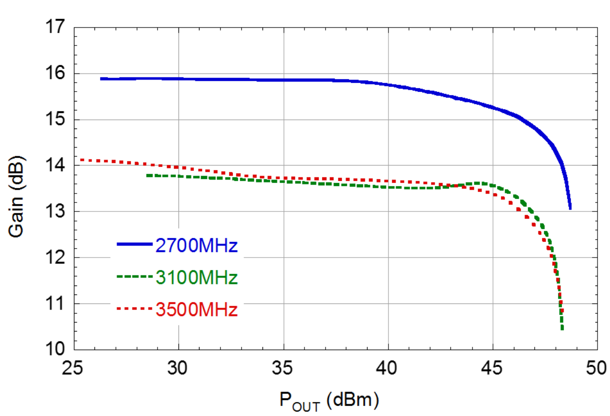


Figure 2: Gain vs. P_{OUT}

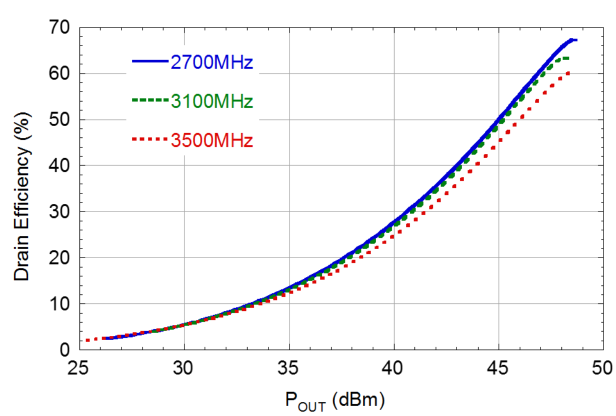


Figure 3: Efficiency vs. P_{OUT}

3.5 GHz Narrowband Circuit

(CW, V_{DS}=48V, I_{DQ}=350mA, T_C=25°C, unless otherwise noted)

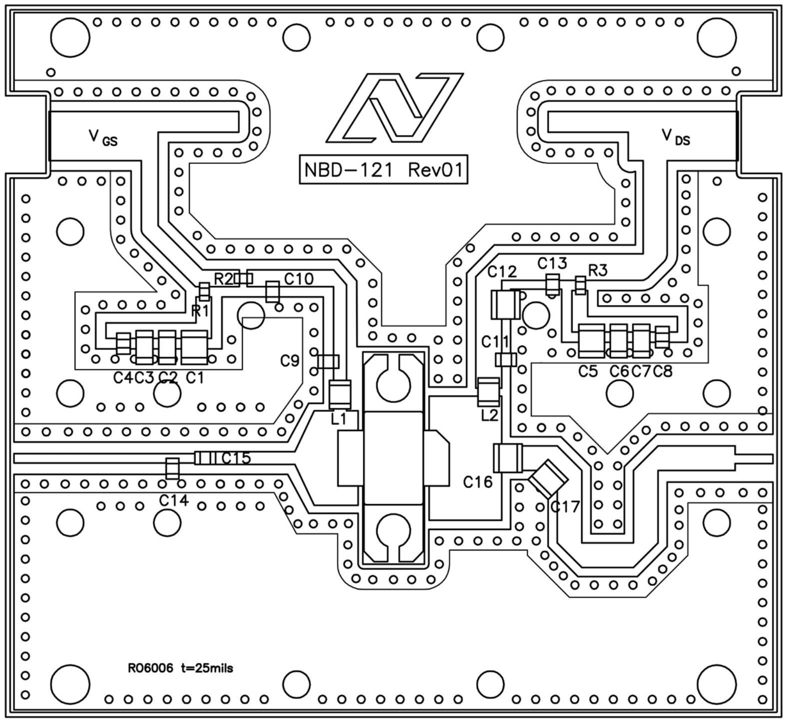


Figure 4: Component Placement of 3.5 GHz Narrowband Circuit for NPT2020

Reference	Value	Manufacturer	Part Number
C1, C5	1µF	AVX	1210C105KAT2A
C2, C6	0.1µF	Kemet	C1206C104K1RACTU
C3, C7	0.01µF	AVX	12061C103KAT2A
C4, C8	1000pF	Kemet	C0805C102K1RACTU
C9, C11	5.6pF	ATC	600F5R6FT
C10, C13, C15	12pF	ATC	600F120FT
C12	10pF	ATC	ATC800B100FT
C14	1.2pF	ATC	600F1R2FT
C16	5.6pF	ATC	ATC800B5R6FT
C17	1.2pF	ATC	ATC800B1R2FT
R1, R3	0Ω	Panasonic	ERJ-6GEY0R00V
R2	20.5Ω	Panasonic	ERJ-6ENF20R5V
L1	12.3nH	Coilcraft	0806SQ_12N_L
L2	15.7nH	Coilcraft	0806SQ_16N_L
PCB	RO6006, ε_r=6.15, 0.025”	Rogers	Nitronex NBD-121r1

Typical Performance in 3.5 GHz Narrowband Circuit

(CW, V_{DS}=48V, I_{DQ}=350mA, f=3.5GHz, T_C=25°C, unless otherwise noted)

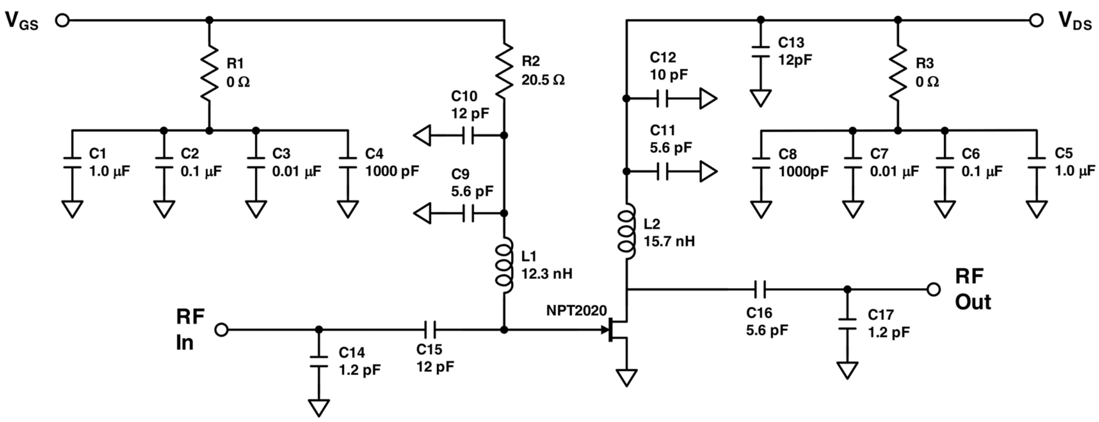


Figure 5. Electrical Schematic of 3.5 GHz Narrowband Circuit for NPT2020
(For RF Tuning details see Component Placement Diagram Figure 4)

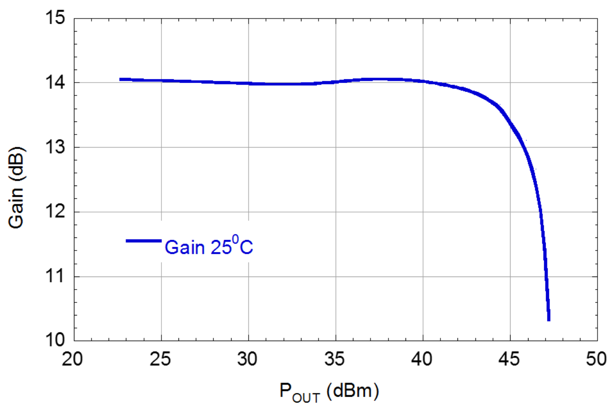


Figure 6: Gain vs. P_{OUT}

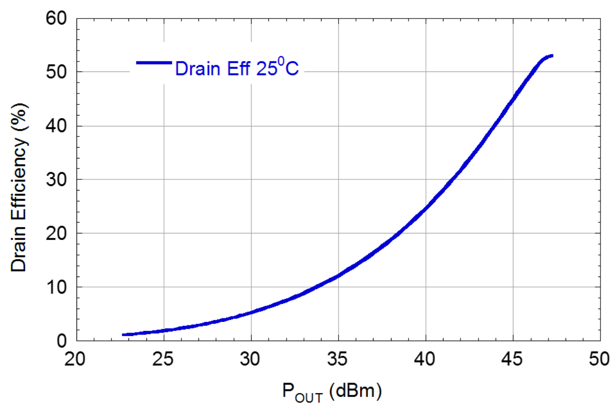


Figure 7: Drain Efficiency vs. P_{OUT}

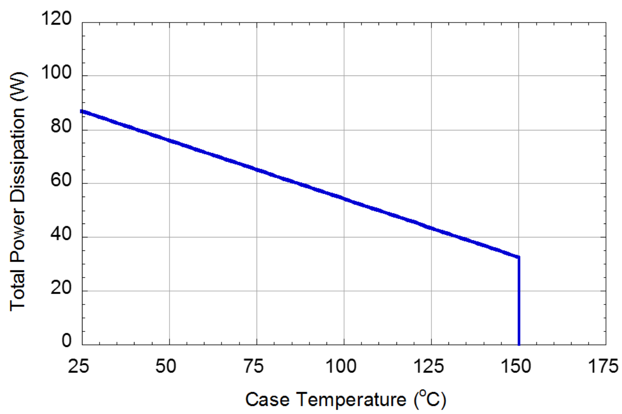


Figure 8: Power De-rating Curve
(T_J = 225°C, T_C > 25°C)

Typical Performance in 3.5 GHz Narrowband Circuit

(CW, V_{DS}=48V, I_{DQ}=350mA, f=3.5GHz, T_C=25°C, unless otherwise noted)

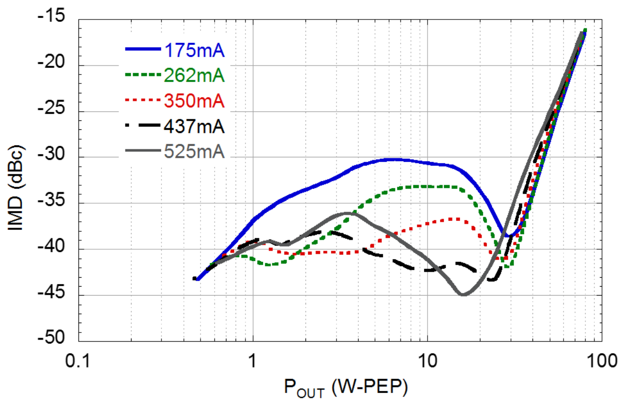


Figure 9: 2-Tone IMD3 vs. P_{OUT} vs. I_{DQ} (1MHz Tone Spacing)

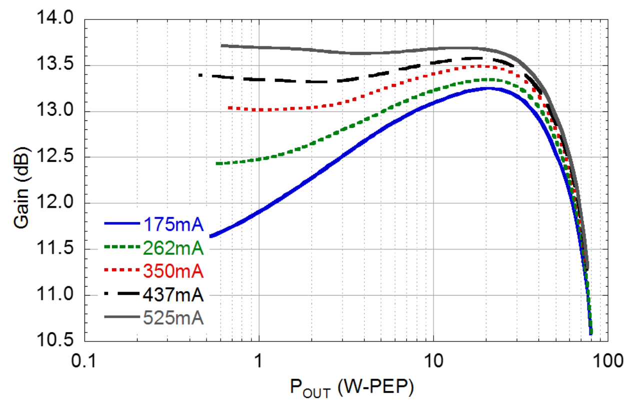


Figure 10: 2-Tone Gain vs. P_{OUT} vs. I_{DQ} (1MHz Tone Spacing)

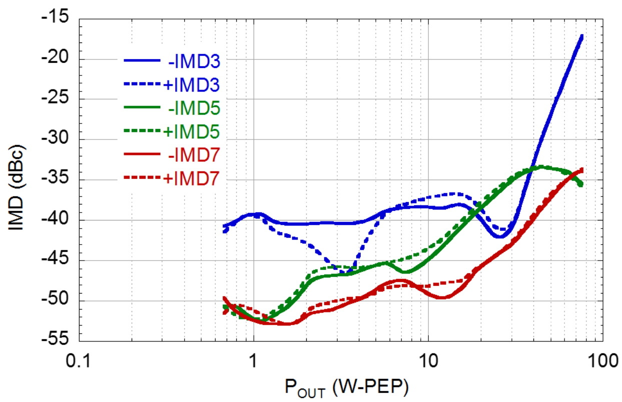


Figure 11: 2-Tone IMD vs. P_{OUT} (1MHz Tone Spacing)

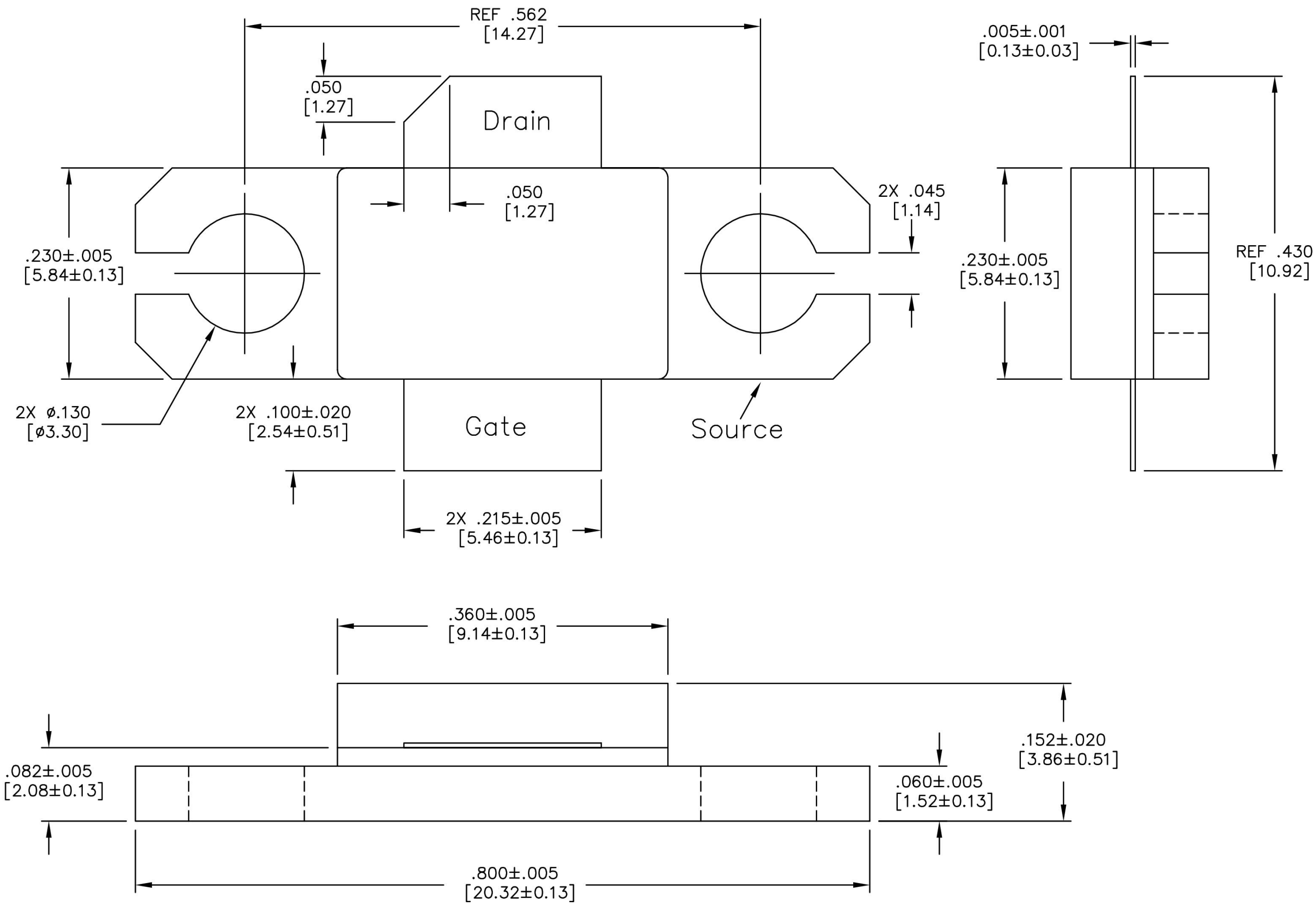


Figure 12 - AC360B-2 Metal-Ceramic Package Dimensions (all dimensions in inches [millimeters])

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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