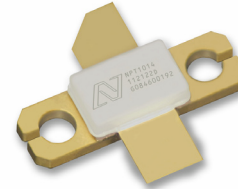


Gallium Nitride 28V, 50W RF Power Transistor

Built using the SIGANTIC[®] NRF1 process - A proprietary GaN-on-Silicon technology

FEATURES

- Optimized for broadband operation from DC – 2500MHz
- 60W P_{SAT} CW power at 2500MHz
- >60 W P_{SAT} CW power from 1200-1800MHz in broadband application design
- 12dB gain at 60W of output power at 2500MHz
- 1.8 °C/W R_{TH} with maximum T_J rating of 200°C
- Subject to export restrictions



DC – 2500 MHz
GaN HEMT



RF Specifications (CW, 2200MHz): V_{DS} = 28V, I_{DQ} = 500mA, T_A = 25°C, Measured in Nitronex Test Fixture

Symbol	Parameter	Min	Typ	Max	Units
G _{SS}	Small Signal Gain	-	15.0	-	dB
P _{SAT}	Saturated Output Power	47.0	48.0	-	dBm
P _{1dB}	Average Output Power at 1dB Gain Compression	-	46.0	-	dBm
G _P	Gain at Output Power at P _{SAT}	9.5	11.0	-	dB
η	Drain Efficiency at P _{SAT}	50	60	-	%
VSWR	10:1 VSWR at all phase angles	No damage to the device			

RF Performance in 1200-1800MHz Broadband Application Circuit

V_{DS}=28V, I_{DQ}=500mA, T_A=25°C unless otherwise noted

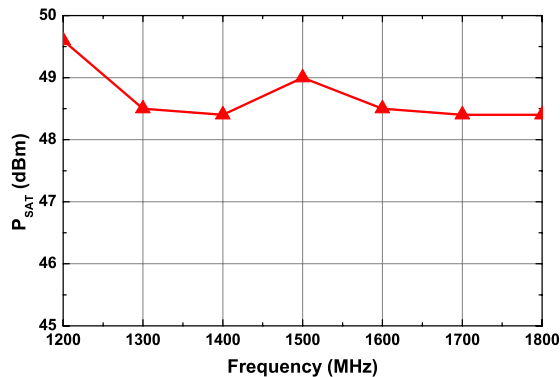


Figure 1 - CW Performance in broadband circuit.

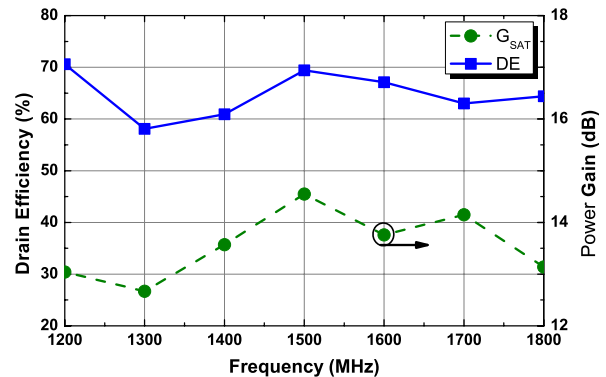


Figure 2 - CW Performance in broadband circuit.

NPT1014 Preliminary Datasheet



DC Specifications: $T_A = 25^\circ\text{C}$

Symbol	Parameter	Min	Typ	Max	Units
Off Characteristics					
V_{BDS}	Drain-Source Breakdown Voltage ($V_{GS} = -8\text{V}$, $I_{DS} = 24\text{mA}$)	100	-	-	V
I_{DLK}	Drain-Source Leakage Current ($V_{GS} = -8\text{V}$, $V_{DS} = 60\text{V}$)	-	6	12	mA
On Characteristics					
V_T	Gate Threshold Voltage ($V_{DS} = 28\text{V}$, $I_D = 24\text{mA}$)	-2.0	-1.5	-1.0	V
V_{GSQ}	Gate Quiescent Voltage ($V_{DS} = 28\text{V}$, $I_D = 500\text{mA}$)	-1.8	-1.3	-0.8	V
R_{ON}	On Resistance ($V_{GS} = 2\text{V}$, $I_D = 270\text{mA}$)	-	0.16	-	Ω
$I_{D,MAX}$	Drain Current ($V_{DS} = 7\text{V}$ pulsed, 300 μs pulse width, 0.2% duty cycle)	-	16.0	-	A

Thermal Resistance Specification

Symbol	Parameter	Min	Typ	Max	Units
θ_{JC}	Thermal Resistance (Junction-to-Case), $T_J = 180^\circ\text{C}$	-	1.8	-	$^\circ\text{C}/\text{W}$

Absolute Maximum Ratings: Not simultaneous, $T_C = 25^\circ\text{C}$ unless otherwise noted

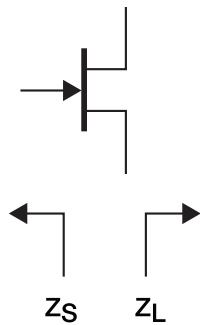
Symbol	Parameter	Max	Units
V_{DS}	Drain-Source Voltage	100	V
V_{GS}	Gate-Source Voltage	-10 to 3	V
I_G	Gate Current	120	mA
P_T	Total Device Power Dissipation (Derated above 25°C) for $T_J = 200^\circ\text{C}$	97	W
T_{STG}	Storage Temperature Range	-65 to 150	$^\circ\text{C}$
T_J	Operating Junction Temperature	200	$^\circ\text{C}$
HBM	Human Body Model ESD Rating (per JESD22-A114)	Class 1B (>500V)	
CDM	Charge Device Model ESD Rating (per JESD22-C101)	Class IV (>1000V)	

Load-Pull Data, Reference Plane at Device Leads

$V_{DS}=28V$, $I_{DQ}=500mA$, $T_A=25^\circ C$ unless otherwise noted

Table 1: Optimum Source and Load Impedances for CW Gain, Drain Efficiency, and Output Power Performance

Frequency (GHz)	V_{DS} (V)	Z_S (Ω)	Z_L (Ω)	P_{SAT} (dBm)	G_P (dB)	Drain Efficiency @ P_{SAT} (%)
0.5	28	15.0 + j2.0	6.0 + j4.8	47.7	16.8	79
0.9	28	7.0 - j2.0	4.8 + j1.8	48.2	14.8	76
1.1	28	4.7 - j1.6	3.8 + j0.3	48.5	14.8	73
1.3	28	3.5 - j3.0	3.3 - j1.0	48.6	13.4	70
1.5	28	3.3 - j3.0	3.2 - j1.2	48.3	13.0	73
1.7	28	3.0 - j5.8	3.1 - j1.8	48.3	13.5	71
1.9	28	2.2 - j5.5	2.9 - j2.3	48.0	13.2	66
2.1	28	3.4 - j6.7	2.1 - j2.6	47.0	12.5	57
2.2	28	2.5 - j8.0	2.1 - j3.5	47.0	13.0	56
2.5	28	2.8 - j10.0	2.0 - j4.5	48.0	13.0	60
Optimum Source and Load Impedance Over Voltage						
1.3	14	4.1 - j4.1	2.0 - j2.3	45.0	12.0	64
1.3	22	3.5 - j3.0	2.2 - j1.4	47.0	13.3	66
1.3	28	3.5 - j3.0	3.3 - j1.0	48.6	13.4	70



Z_S is the source impedance presented to the device.
 Z_L is the load impedance presented to the device.

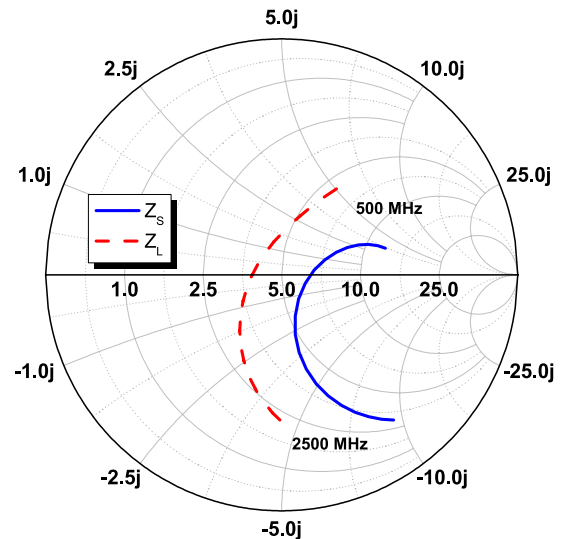


Figure 3 - Optimum Impedances for CW Performance. $Z_0 = 5 \Omega$

Load-Pull Data, Reference Plane at Device Leads

$V_{DS}=28V$, $I_{DQ}=500mA$, $T_A=25^\circ C$ unless otherwise noted.

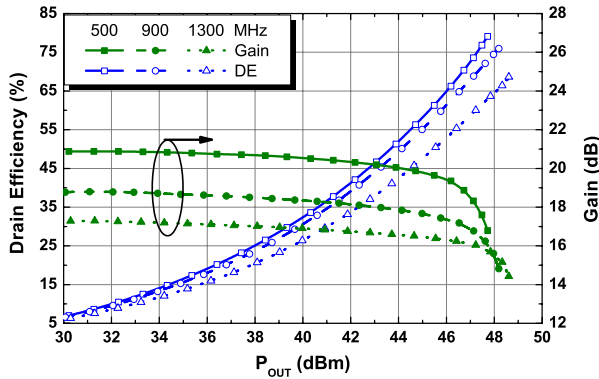


Figure 4 - Typical CW Performance in Load-Pull

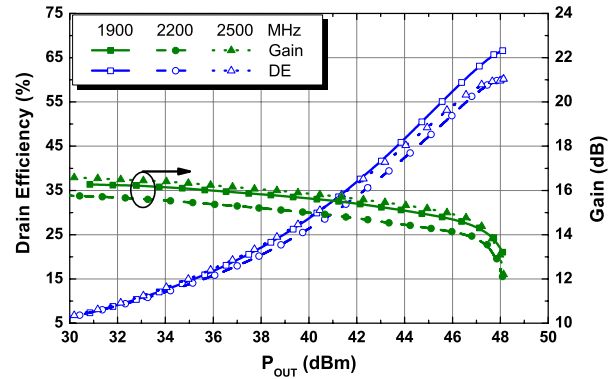


Figure 5 - Typical CW Performance in Load-Pull

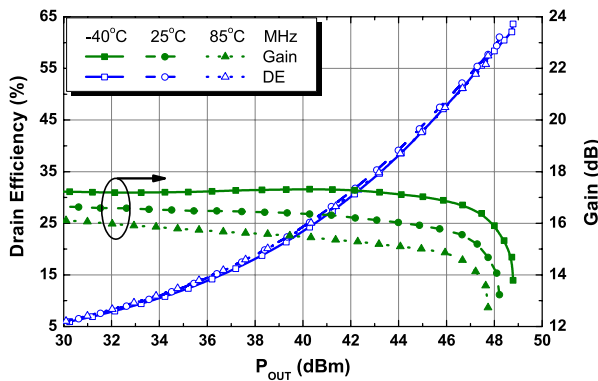


Figure 6 - Typical CW Performance Over Temperature in Nitronex Test Fixture, 1500MHz

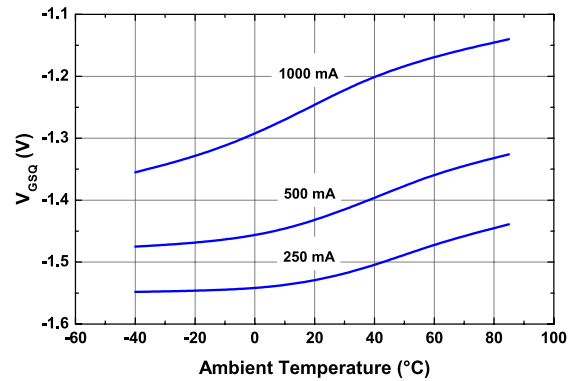


Figure 7 - Quiescent Gate Voltage (V_{GSQ}) Required to Reach I_{DQ} as a Function of Ambient Temperature, $V_{DS} = 28V$

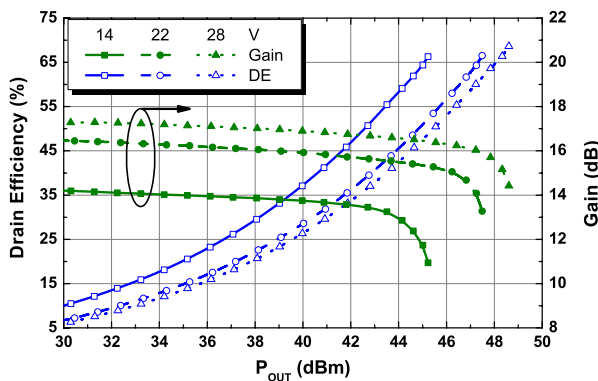


Figure 8 - Typical CW Performance Over Voltage in Load-Pull, 1300MHz

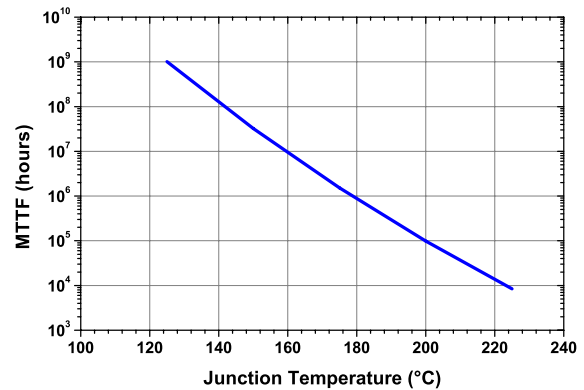


Figure 9 - MTTF of NRF1 Devices as a Function of Junction Temperature

RF Performance in 1200-1800MHz Broadband Application Circuit

$V_{DS}=28V$, $I_{DQ}=500mA$, $T_A=25^\circ C$ unless otherwise noted

Table 2: Power, gain, efficiency and $T_{J,RISE}$ across frequency in the 1200-1800MHz application circuit

Frequency (MHz)	P_{SAT} (dBm)	P_{SAT} (W)	Drain Efficiency @ P_{SAT} (%)	G_P (dB)	$T_{J,RISE}$ ($^\circ C$) ¹
1200	49.6	91	71	13.0	77
1300	48.5	71	58	12.7	100
1400	48.4	69	61	13.6	85
1500	49.0	79	69	14.6	68
1600	48.5	71	67	13.8	68
1700	48.4	69	63	14.2	77
1800	48.4	69	64	13.1	75

Note 1: Junction temperature rise was calculated from the dissipated power using an R_{TH} value of $1.8^\circ C/W$.

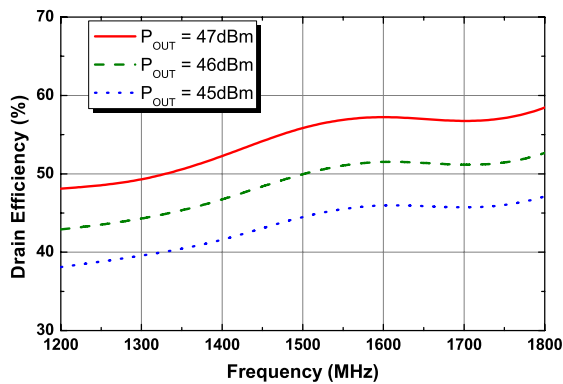


Figure 10 - CW Performance in broadband circuit at different output powers connected by a smoothing function

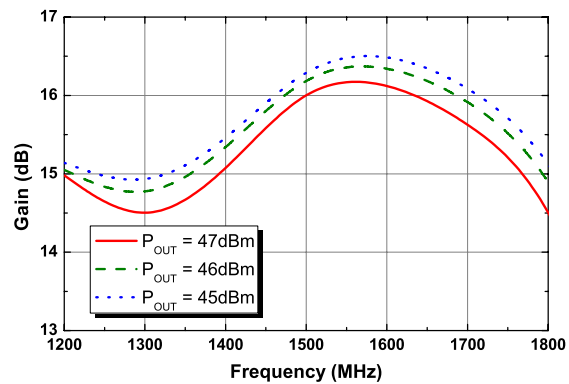


Figure 11 - CW Performance in broadband circuit at different output powers connected by a smoothing function

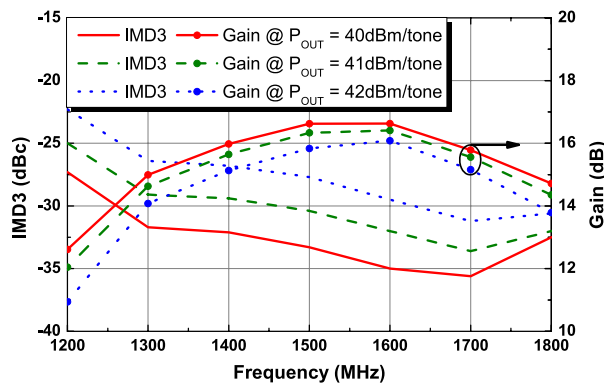


Figure 12 - 2-tone IMD measurements in the 1200-1800MHz broadband application circuit, 1MHz tone spacing

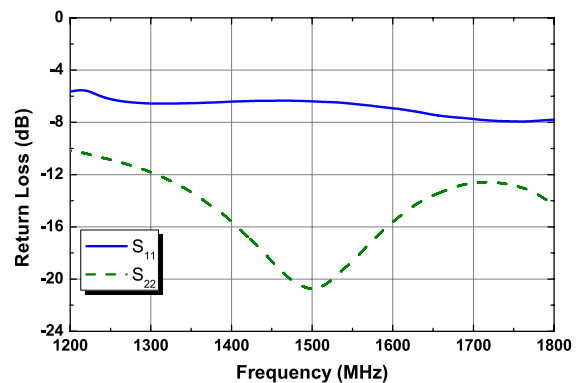


Figure 13 - Input and output return loss of the 1200-1800MHz broadband application circuit, $P_{IN} = -17dBm$

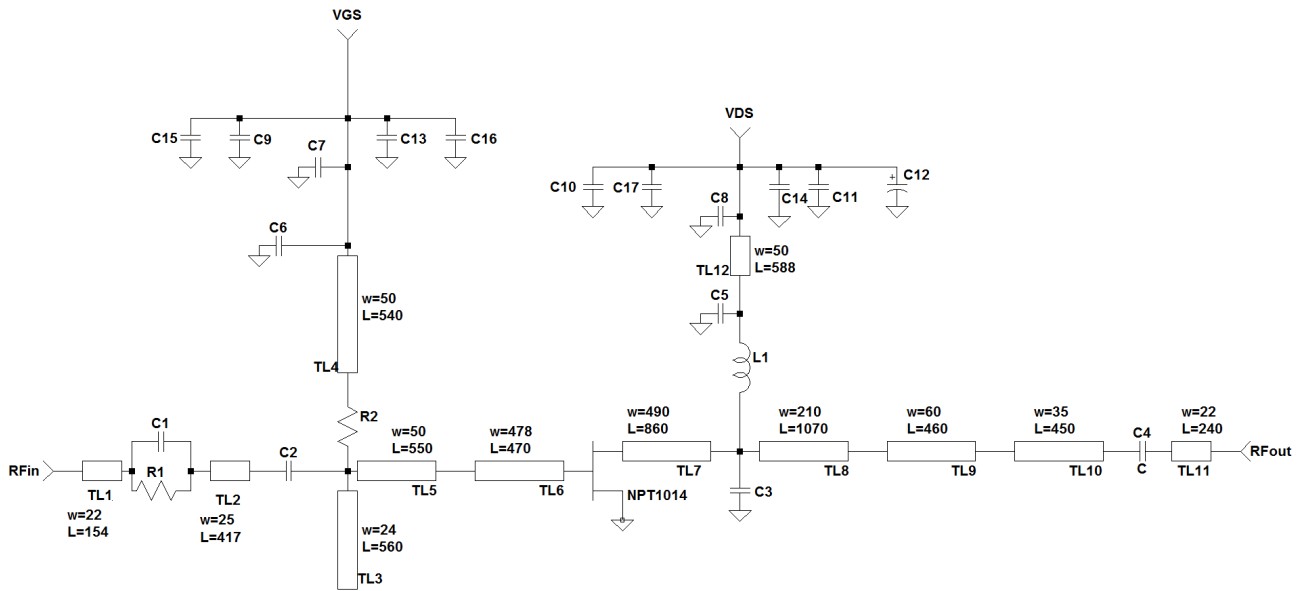


Figure 14 - Schematic of 1200-1800MHz application board for NPT1014.
All dimensions are in mils.

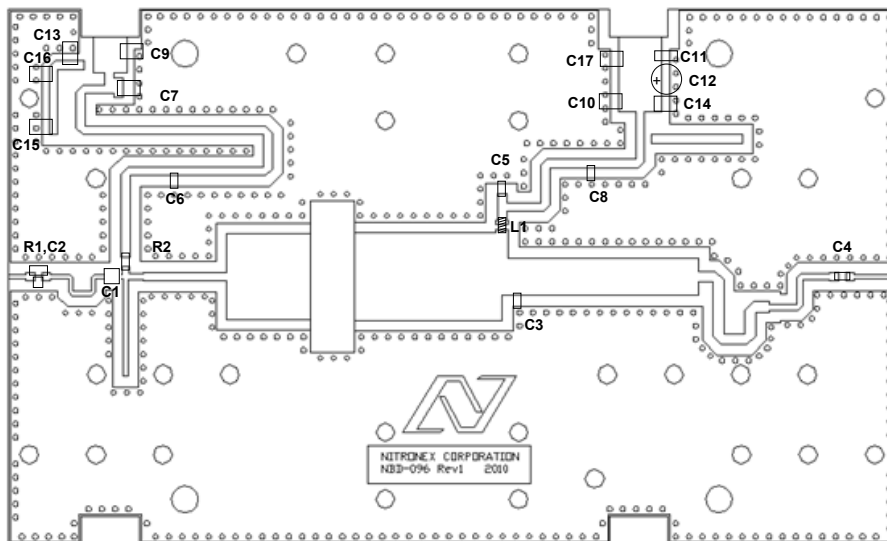


Figure 15 - Layout of 1200-1800MHz application board for NPT1014

NPT1014 Preliminary Datasheet



Table 3: NPT1014 1200-1800MHz Application Board Build of Materials

Name	Value	Tolerance	Size	Vendor	Vendor Number
C1,C5,C6	100pF	5%	0603	ATC	ATC 600F 600F101JT250XT
C2	82pF	5%	0603	ATC	ATC600F 600F820JT250XT
C3	4.7pF	5%	0603	ATC	ATC600F 600F4R7JT250XT
C7,C8	120pF	5%	0603	ATC	ATC600F 600F121JT250XT
C4	56pF	5%	0603	ATC	ATC600F 600F560JT250XT
C10, C15	1000pF	10%	0805	Kemet	C0805C102K1RACTU
C9, C11	1µF	20%	1210	Kemet	C1210C105KAT2A
C13, C14	0.1µF	20%	1210	Kemet	C1210C104K5RACTU
C16, C17	0.01µF	20%	1210	Kemet	1206K103KAT2A
C12	100uF /63v	20%	Electrolytic 325x825mils	Nichicon	UPW1J101MPD6
R1	10Ω	10%	0603	Panasonic	
R2	240Ω	10%	0603	Panasonic	
L1	12nH	N/A	60X120mils	Coilcraft	SQIND0908SQ12N
SMA RF Connectors		N/A	N/A	Tyco Electronics	1052566-1
NBD--096 REV1				Rogers	R4350B 10mil, 1oz, Cr=3.66
BNC power ports		N/A	N/A	Amphenol- Connex	112290
Metric hardware	2-M2			Brikksen	0912A22X6

NPT1014 Preliminary Datasheet



Ordering Information¹

Part Number	Description
NPT1014B	NPT1014 in AC360BM-F2 Bolt-Down Package

1: To find a Nitronex contact in your area, visit our website at <http://www.nitronex.com>

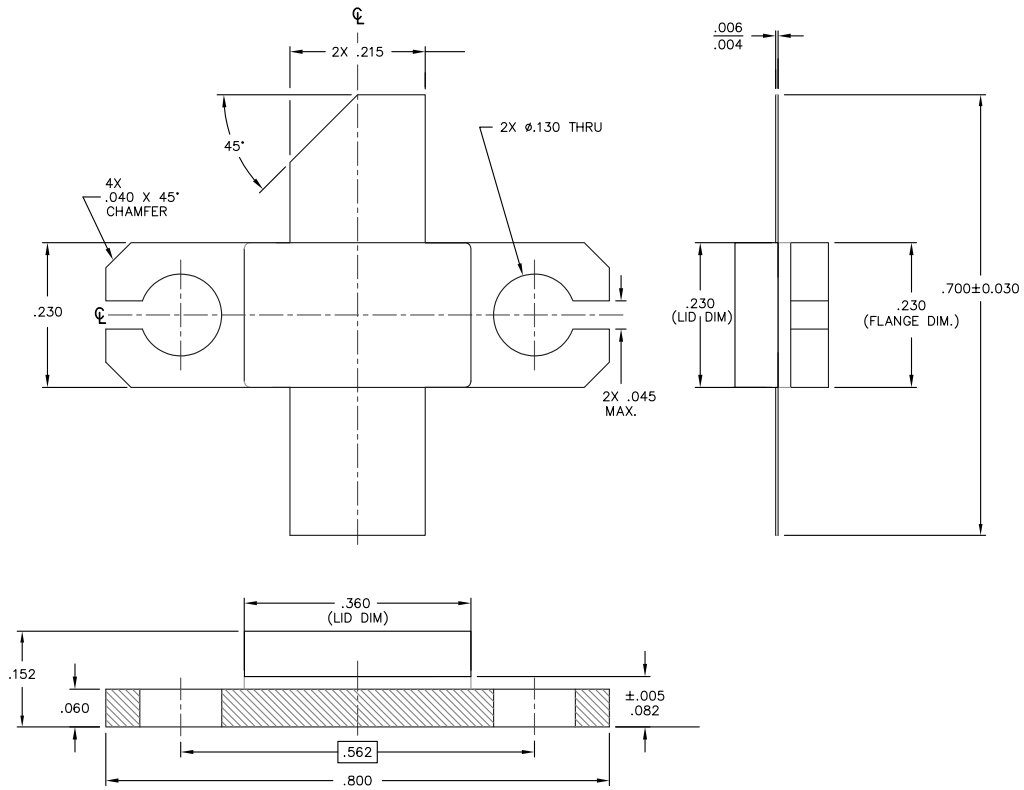


Figure 16 - AC360BM-F2 Package Dimensions and Pinout (all dimensions are in inches)

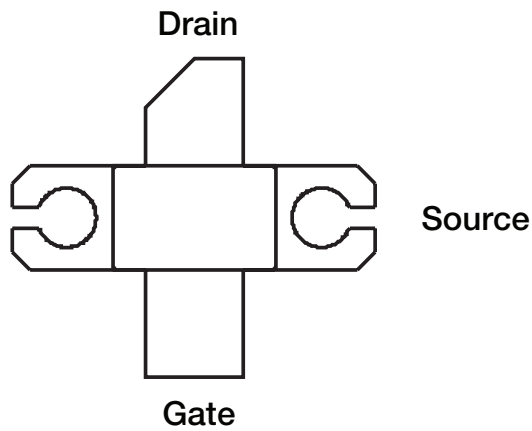


Figure 17 - Terminal Identification

Nitronex Corporation

2305 Presidential Drive
Durham, NC 27703 USA
+1.919.807.9100 (telephone)
+1.919.807.9200 (fax)
info@nitronex.com
www.nitronex.com

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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