MAGX-003135-120L00

GaN HEMT Pulsed Power Transistor
3.1 - 3.5 GHz, 120W Peak, 300us Pulse, 10% Duty

Preliminary
28 Sept 11

Features

- GaN depletion mode HEMT microwave transistor
- Common source configuration
- Broadband Class AB operation
- Thermally enhanced Cu/Mo/Cu package
- RoHS Compliant
- +50V Typical Operation
- MTTF of 114 years (Channel Temperature < 200°C)
- **EAR99 Export Classification**

Application

- Civilian and Military Pulsed Radar

Product Description

The MAGX-003135-120L00 is a gold metalized matched Gallium Nitride (GaN) on Silicon Carbide RF power transistor optimized for civilian and military radar pulsed applications between 3100 - 3500 MHz. Using state of the art wafer fabrication processes, these high performance transistors provide high gain, efficiency, bandwidth, ruggedness over a wide bandwidth for today's demanding application needs. The MAGX-003135-120L00 is constructed using a thermally enhanced Cu/Mo/Cu flanged ceramic package which provides excellent thermal performance. High breakdown voltages allow for reliable and stable operation in extreme mismatched load conditions unparalleled with older semiconductor technologies.

Typical Peak RF Performance

50V, 300us, 10%

Freq. (MHz)	Pin (W Peak)	Pout (W Peak)	Pout (W Ave)	Gain (dB)	RL (dB)	Eff (%)
3100	10	129	12.9	11.1	-9	50.1
3300	10	136	13.6	11.3	-11	51.5
3500	10	132	13.2	11.2	-16	50.8

50V, 100us, 10%

Freq. (MHz)	Pin (W Peak)	Pout (W Peak)	Pout (W Ave)	Gain (dB)	RL (dB)	Eff (%)
3100	10	135	13.5	11.3	-9	51.5
3300	10	140	14.0	11.5	-11	52.4
3500	10	139	13.9	11.4	-16	51.3

Typical RF performance measured in M/A-COM RF test fixture. Devices tested in common source Class-AB configuration as follows: Vdd=50V, Idq=300mA (pulsed gate bias), F=3.1 - 3.5 GHz, Pulse Width=300us, Duty=10%.

Ordering Information

MAGX-003135-120L00	120W GaN Power Transistor
MAGX-003135-SB5PPR	Evaluation Fixture

- **North America** Tel: 800.366.2266 / Fax: 978.366.2266
- **Europe** Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- **Asia/Pacific** Tel: 81.44.844.8296 / Fax: 81.44.844.8298

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Absolute Maximum Ratings Table (1, 2, 3)

Supply Voltage (Vdd)	+65V
Supply Voltage (Vgg)	-8 to 0V
Supply Current (Id1)	6700 mA
Input Power (Pin)	+36 dBm
Absolute Max. Junction/Channel Temp	200 ºC
MTTF (T_J<200°C)	114 years
Pulsed Power Dissipation (Pavg) at 85 ºC	170 W (100us) 144 W (300us)
Thermal Resistance, (Tchannel = 200 ºC) V_{DD} = 50V, I_{DQ} = 300mA, Pin = 9Wpk,Pulse Width 100uS, Duty 10%	0.5 °C/W
Thermal Resistance, (Tchannel = 200 ºC) V_{DD} = 50V, I_{DQ} = 300mA, Pin = 9Wpk, Pulse width 300uS, Duty 10%	0.8 °C/W
Operating Temp	-40 to +95C
Storage Temp	-65 to +150C
Mounting Temperature	See solder reflow profile
ESD Min. - Machine Model (MM)	50 V
ESD Min. - Human Body Model (HBM)	>250 V
MSL Level	MSL1

(1) Operation of this device above any one of these parameters may cause permanent damage.

(2) Channel temperature directly affects a device's MTTF. Channel temperature should be kept as low as possible to maximize lifetime.

(3) For saturated performance it recommended that the sum of (3*Vdd + abs(Vgg)) <175

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
DC CHARACTERISTICS						
Drain-Source Leakage Current	V_{GS} = -8V, V_{DS} = 175V	I_{DS}	-	0.5	9	mA
Gate Threshold Voltage	V_{DS} = 5V, I_D = 23mA	$V_{GS\,(th)}$	-5	-3	-2	V
Forward Transconductance	V_{DS} = 5V, I_D = 9A	G_M	3.3	-	-	S
DYNAMIC CHARACTERISTICS						
Input Capacitance	Not applicable - Input internally matched	C_{GS}	N/A	N/A	N/A	pF
Output Capacitance	V_{DS} = 50V, V_{GS} = -8V, F = 1MHz	C_{OSS}	-	13.4	16	pF
Reverse Transfer Capacitance	V_{DS} = 50V, V_{GS} = -8V, F = 1MHz	C_{RSS}	-	1.4	2.2	pF

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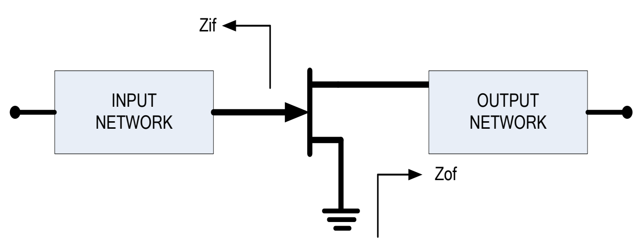
Electrical Specifications: T_C = 25 ± 5°C (Room Ambient)

Parameter	Test Conditions	Symbol	Min	Typ	Max	Units
RF FUNCTIONAL TESTS (V_{DD} = 50V, I_{DQ} = 300mA, 300us pulse / 10% duty, 3.1 - 3.5 GHz)						
Output Power	Pin = 10W Peak, 1W Ave	P_{OUT}	120 12	135 13.5	-	W Peak W Ave
Power Gain	Pin = 10W Peak, 1W Ave	G_P	10.8	11.8	-	dB
Drain Efficiency	Pin = 10W Peak, 1W Ave	η_D	45	52	-	%
Load Mismatch Stability	Pin = 10W Peak, 1W Ave	VSWR-S	5:1	-		-
Load Mismatch Tolerance	Pin = 10W Peak, 1W Ave	VSWR-T	10:1	-		-

Test Fixture Impedance

F (MHz)	Z_{IF} (Ω)	Z_{OF} (Ω)
3100	5.9 - j4.2	4.1 - j2.4
3300	5.2 - j4.8	4.0 - j2.8
3500	3.9 - j5.0	2.6 - j2.6



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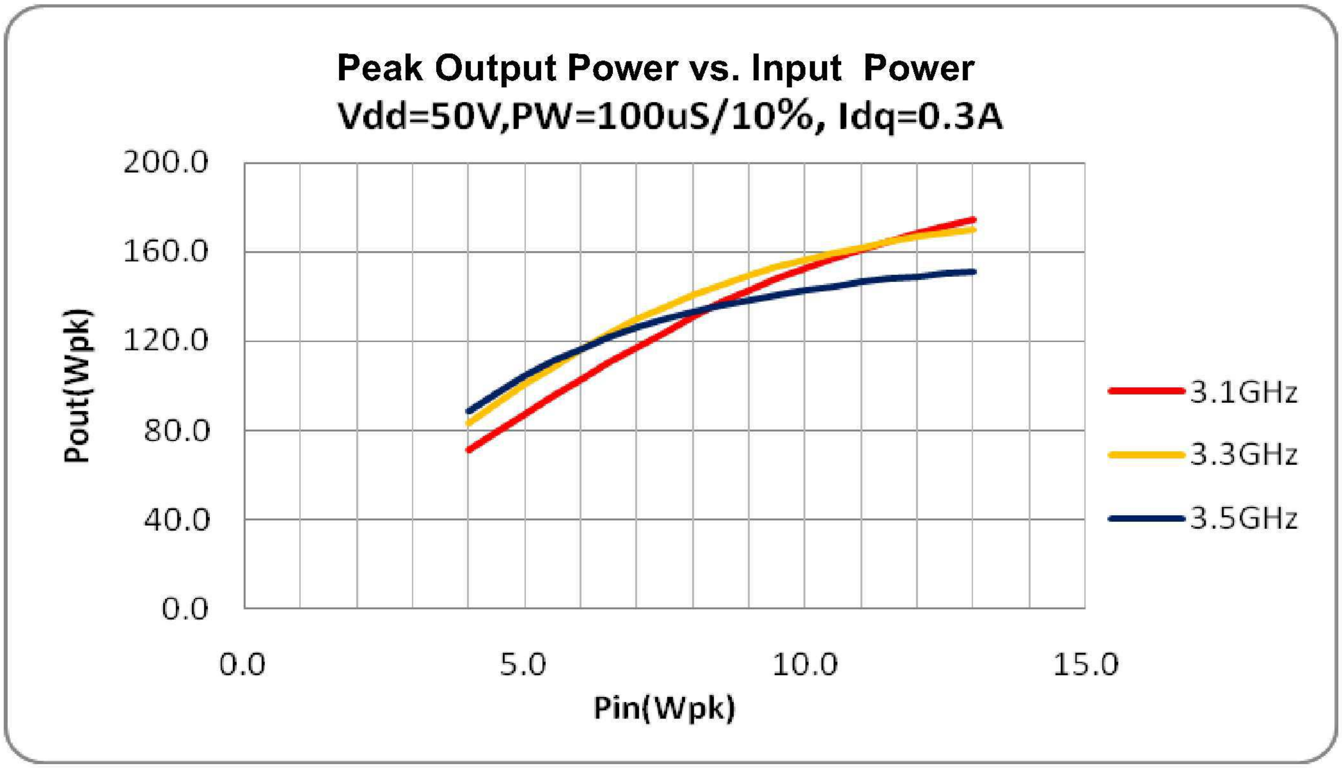

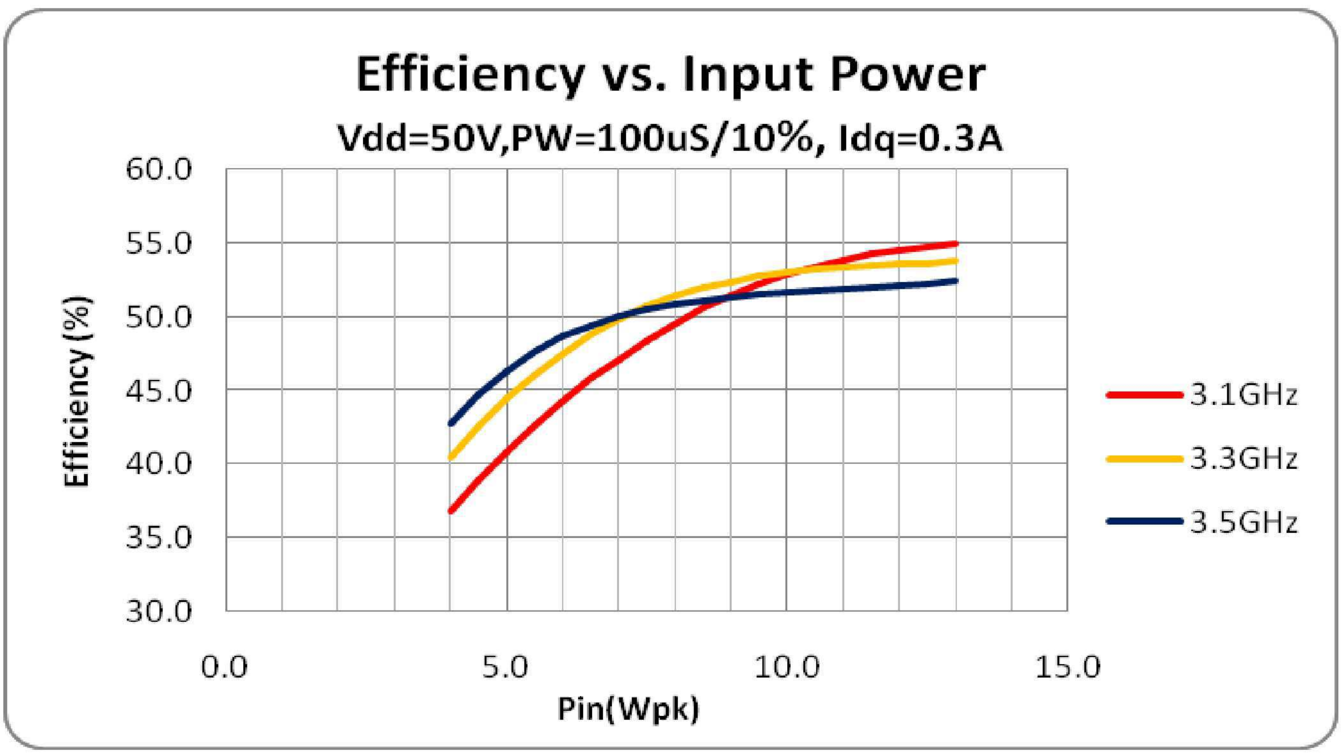

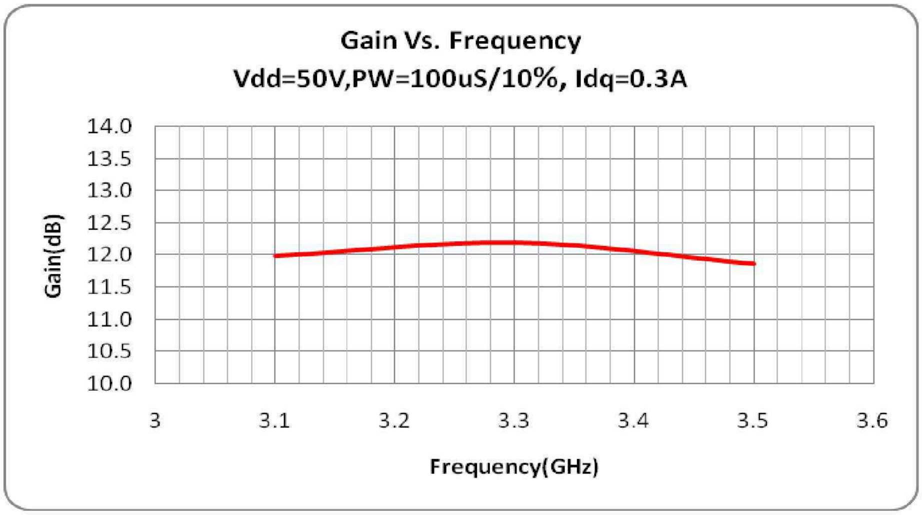

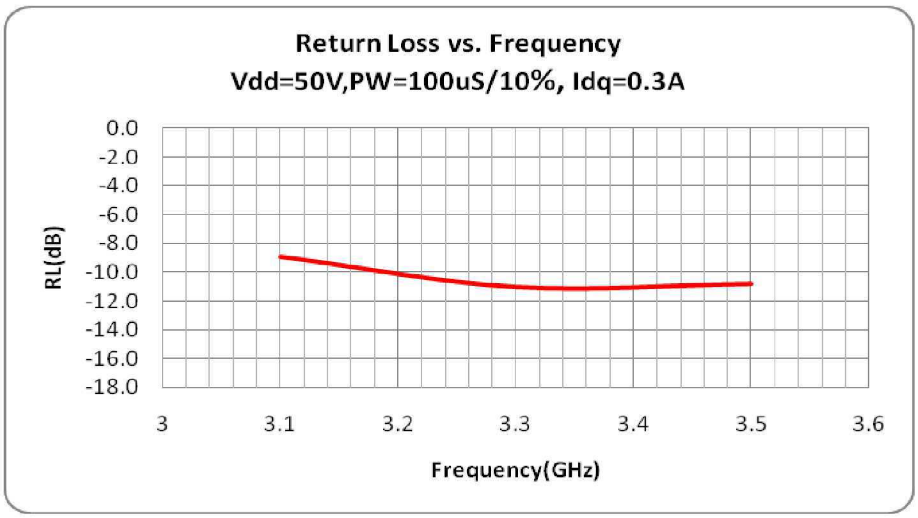

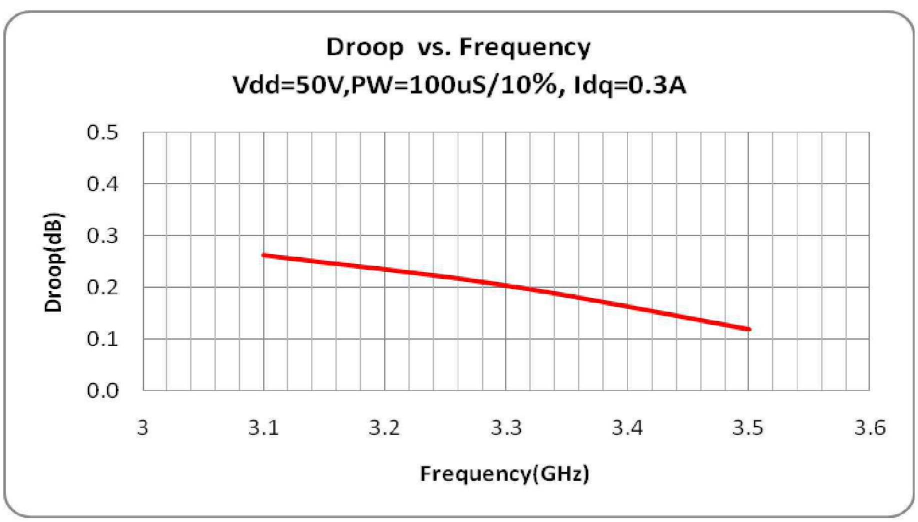

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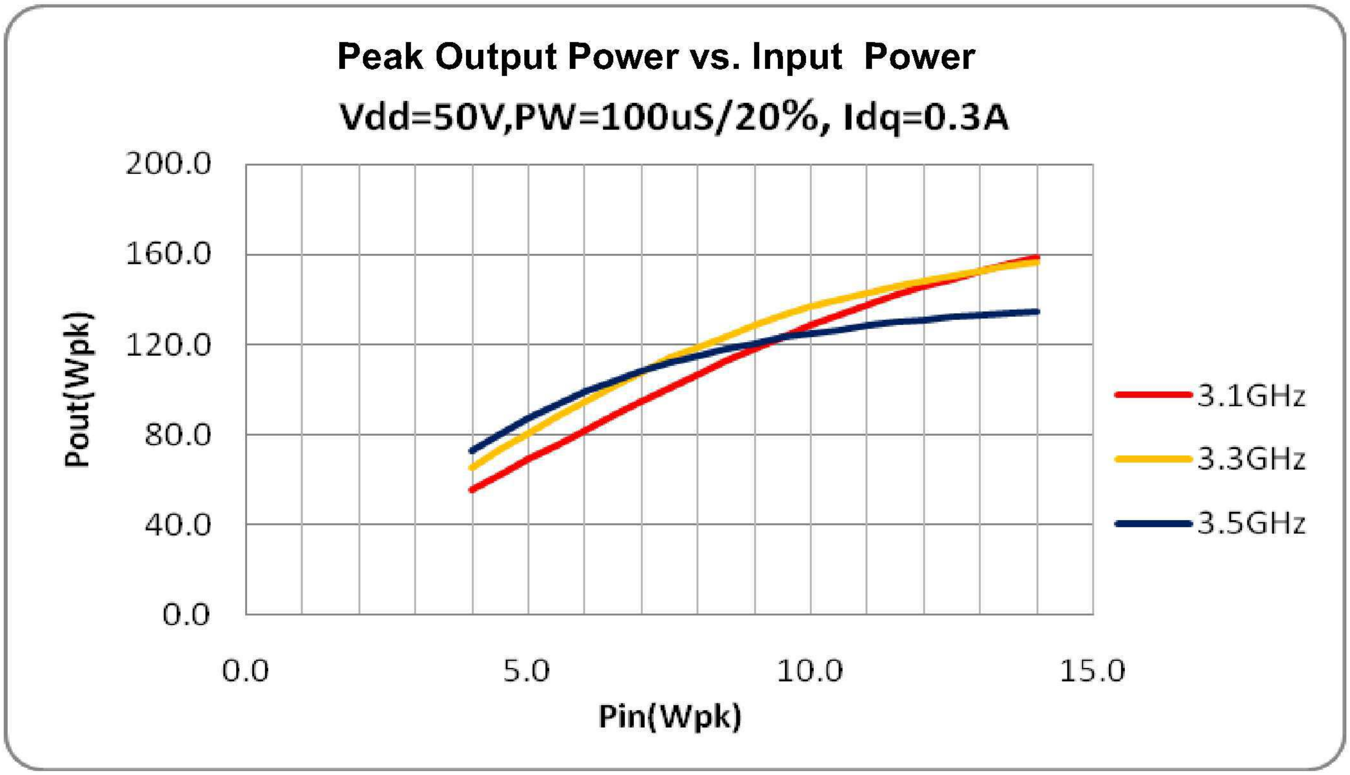
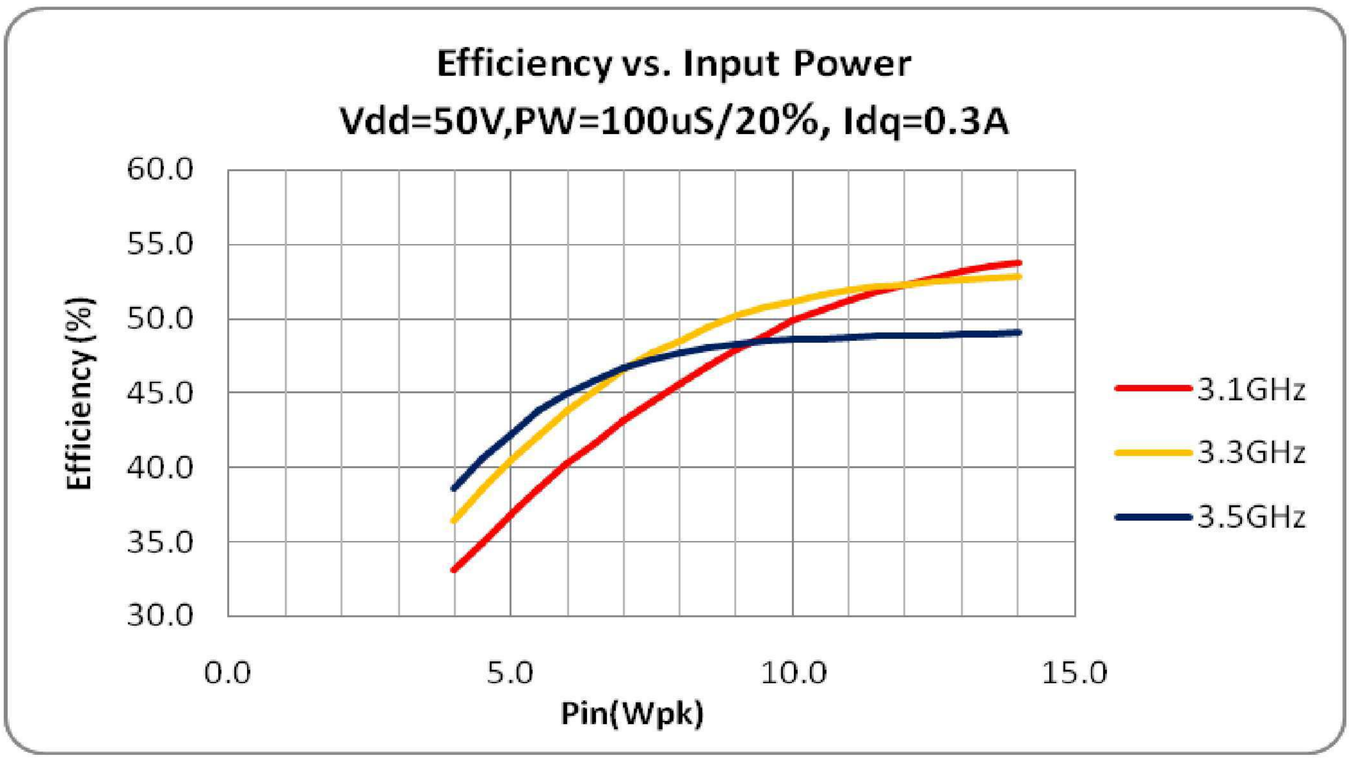
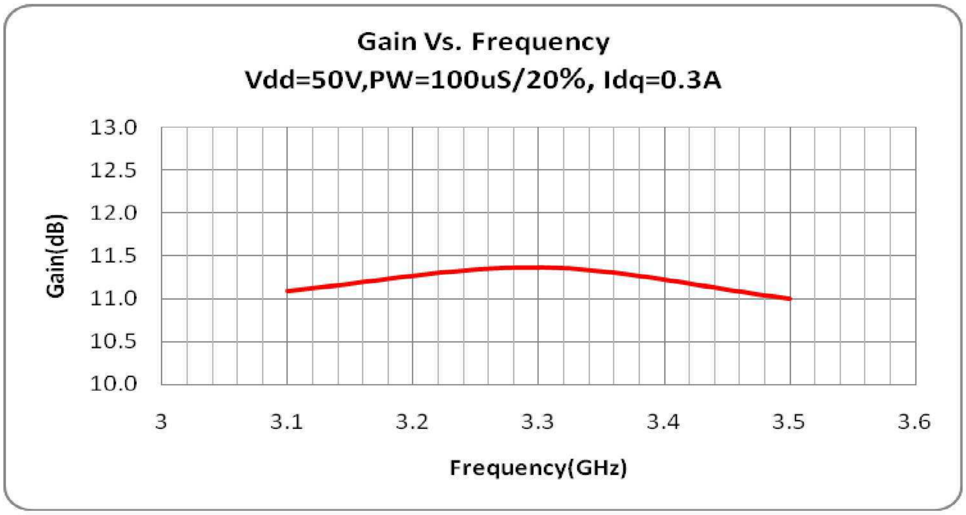
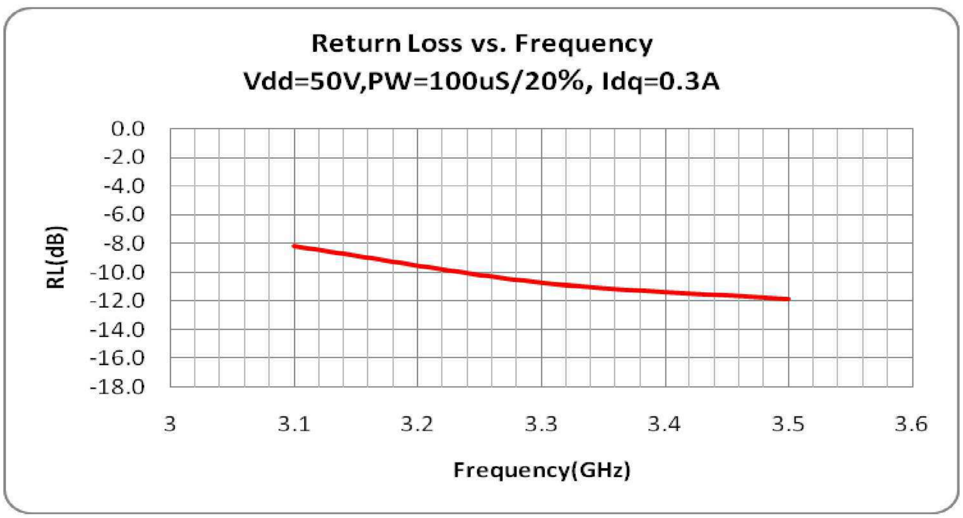
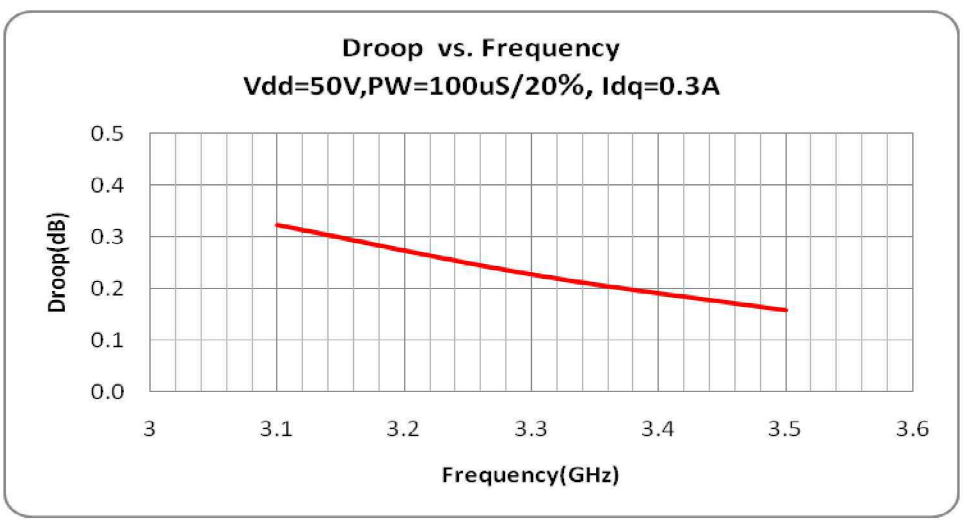

Peak Output Power vs. Input Power
Vdd=50V,PW=100uS/20%, Idq=0.3A
200.0
160.0
120.0
80.0
40.0
0.0
Pout(Wpk)
0.0
5.0
10.0
15.0
Pin(Wpk)
3.1GHz
3.3GHz
3.5GHz


Efficiency vs. Input Power
Vdd=50V,PW=100uS/20%, Idq=0.3A
60.0
55.0
50.0
45.0
40.0
35.0
30.0
Efficiency (%)
0.0
5.0
10.0
15.0
Pin(Wpk)
3.1GHz
3.3GHz
3.5GHz







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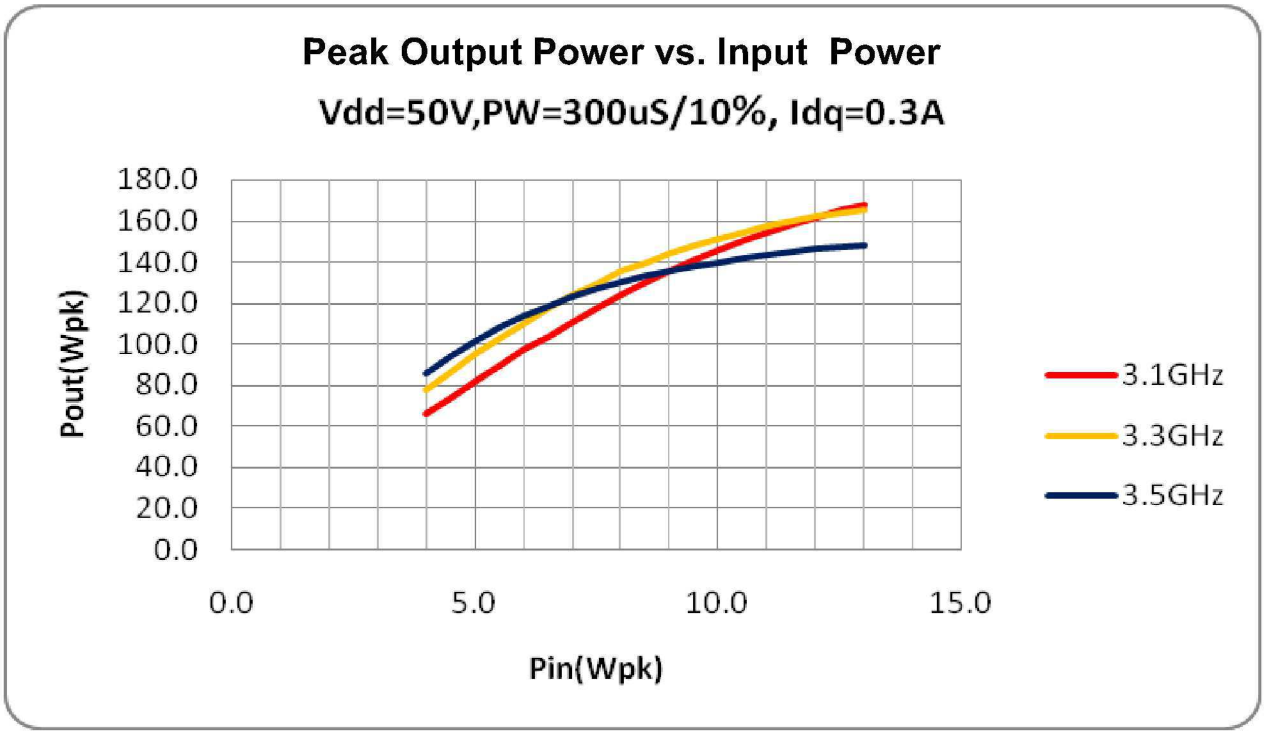
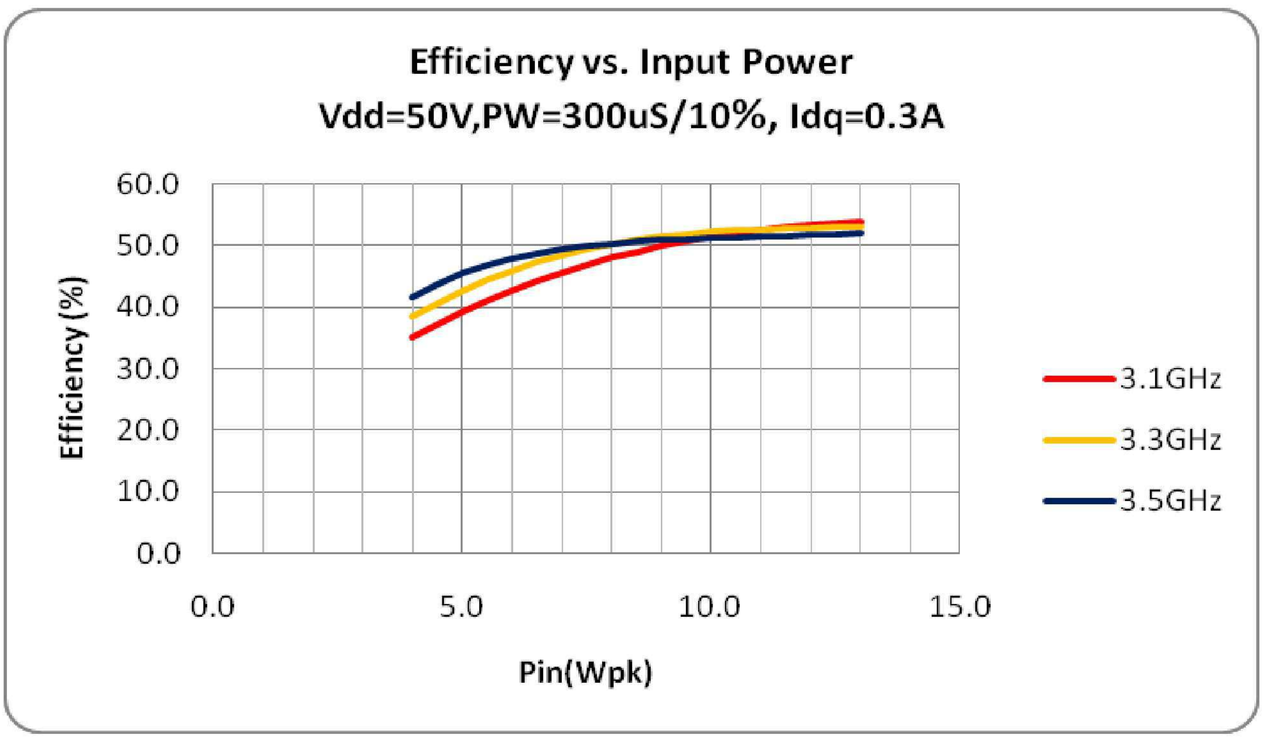
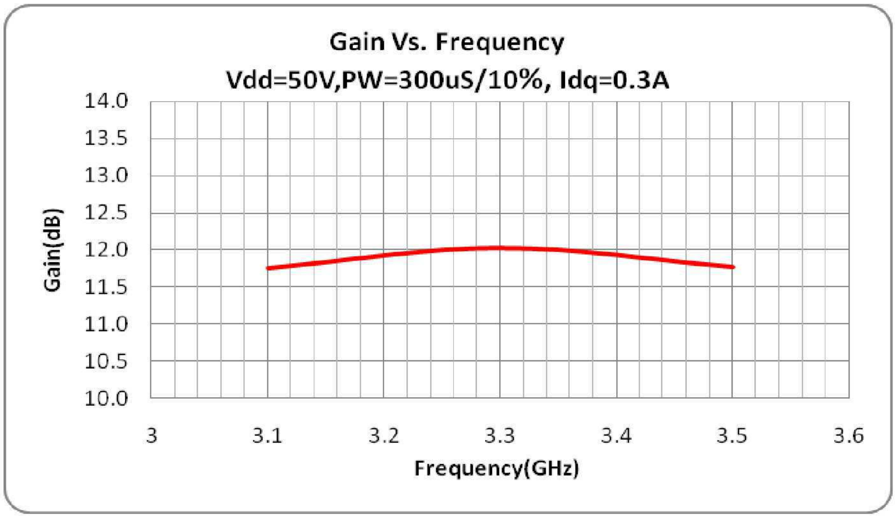
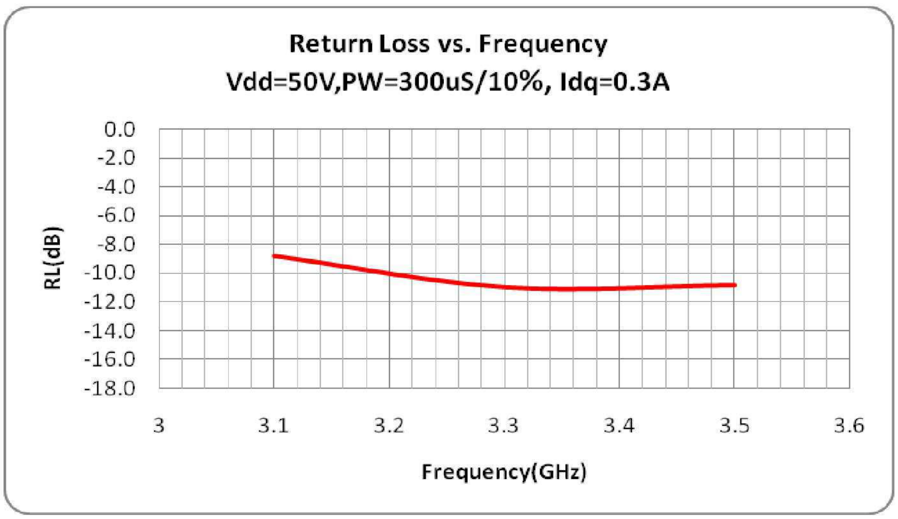
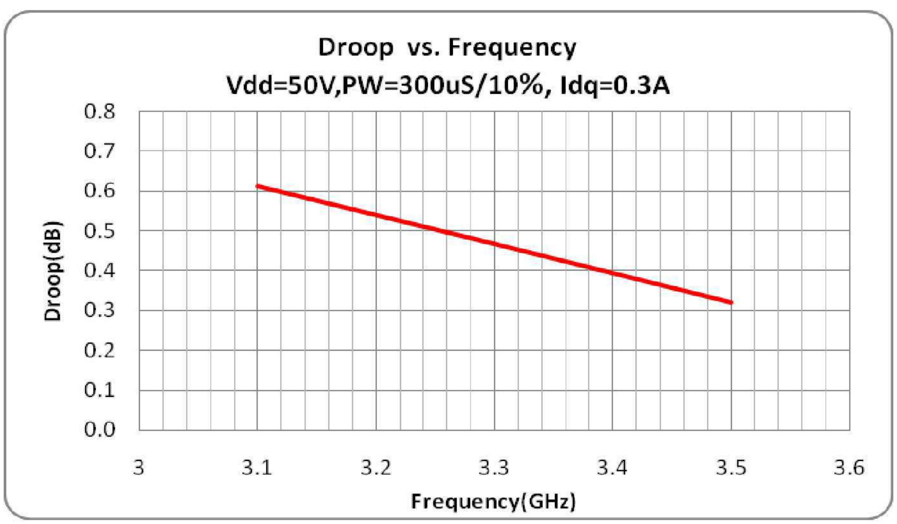

Peak Output Power vs. Input Power
Vdd=50V,PW=300uS/10%, Idq=0.3A
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Pout(Wpk)
0.0
5.0
10.0
15.0
Pin(Wpk)
3.1GHz
3.3GHz
3.5GHz


Efficiency vs. Input Power
Vdd=50V,PW=300uS/10%, Idq=0.3A
60.0
50.0
40.0
30.0
20.0
10.0
0.0
Efficiency (%)
0.0
5.0
10.0
15.0
Pin(Wpk)
3.1GHz
3.3GHz
3.5GHz


Gain Vs. Frequency
Vdd=50V,PW=300uS/10%, Idq=0.3A
Gain(dB)
14.0
13.5
13.0
12.5
12.0
11.5
11.0
10.5
10.0
3
3.1
3.2
3.3
3.4
3.5
3.6
Frequency(GHz)


Return Loss vs. Frequency
Vdd=50V,PW=300uS/10%, Idq=0.3A
RL(dB)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
-18.0
3
3.1
3.2
3.3
3.4
3.5
3.6
Frequency(GHz)


Droop vs. Frequency
Vdd=50V,PW=300uS/10%, Idq=0.3A
Droop(dB)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
3
3.1
3.2
3.3
3.4
3.5
3.6
Frequency(GHz)

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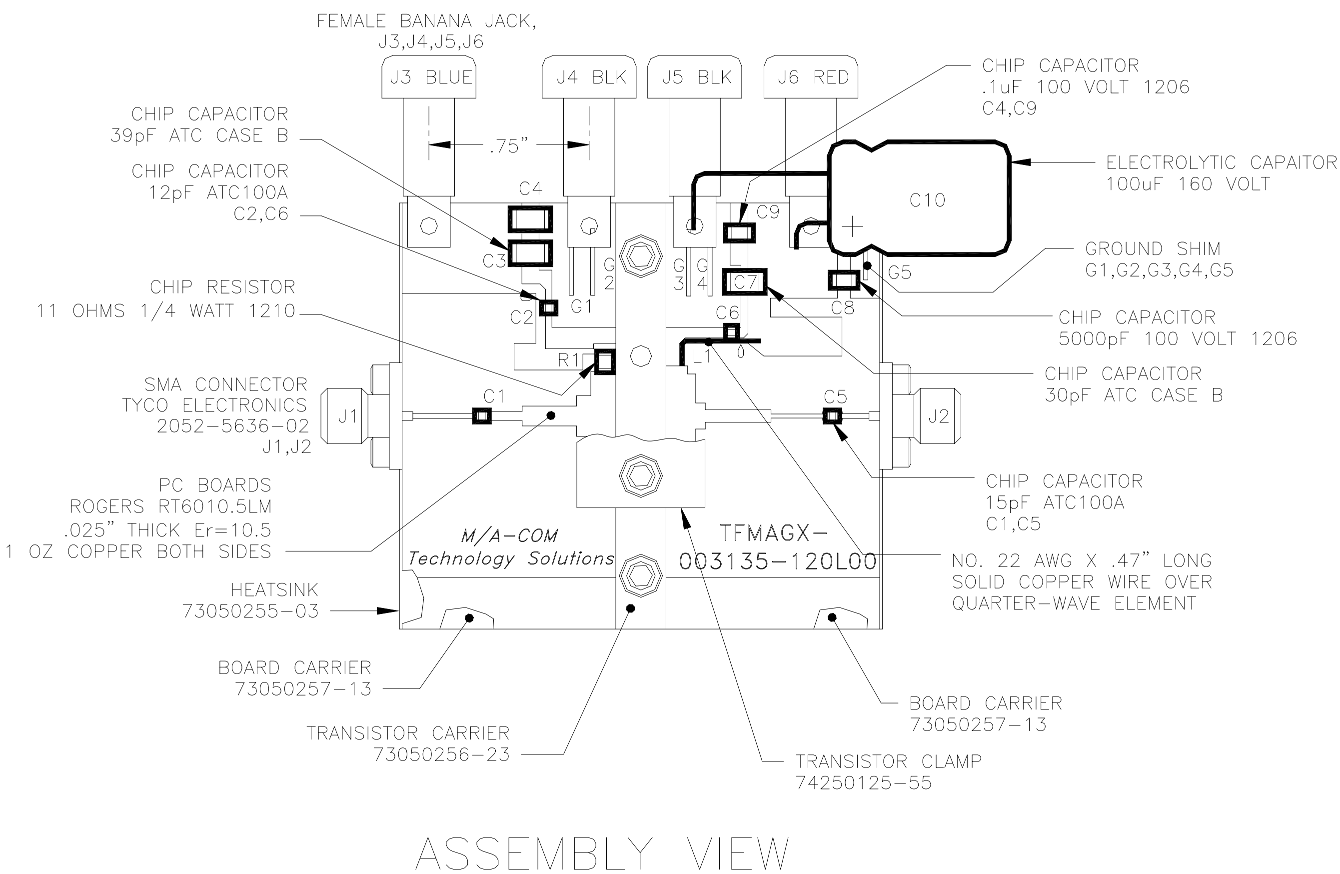
Test Fixture Assembly



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M/A-COM Technology Solutions

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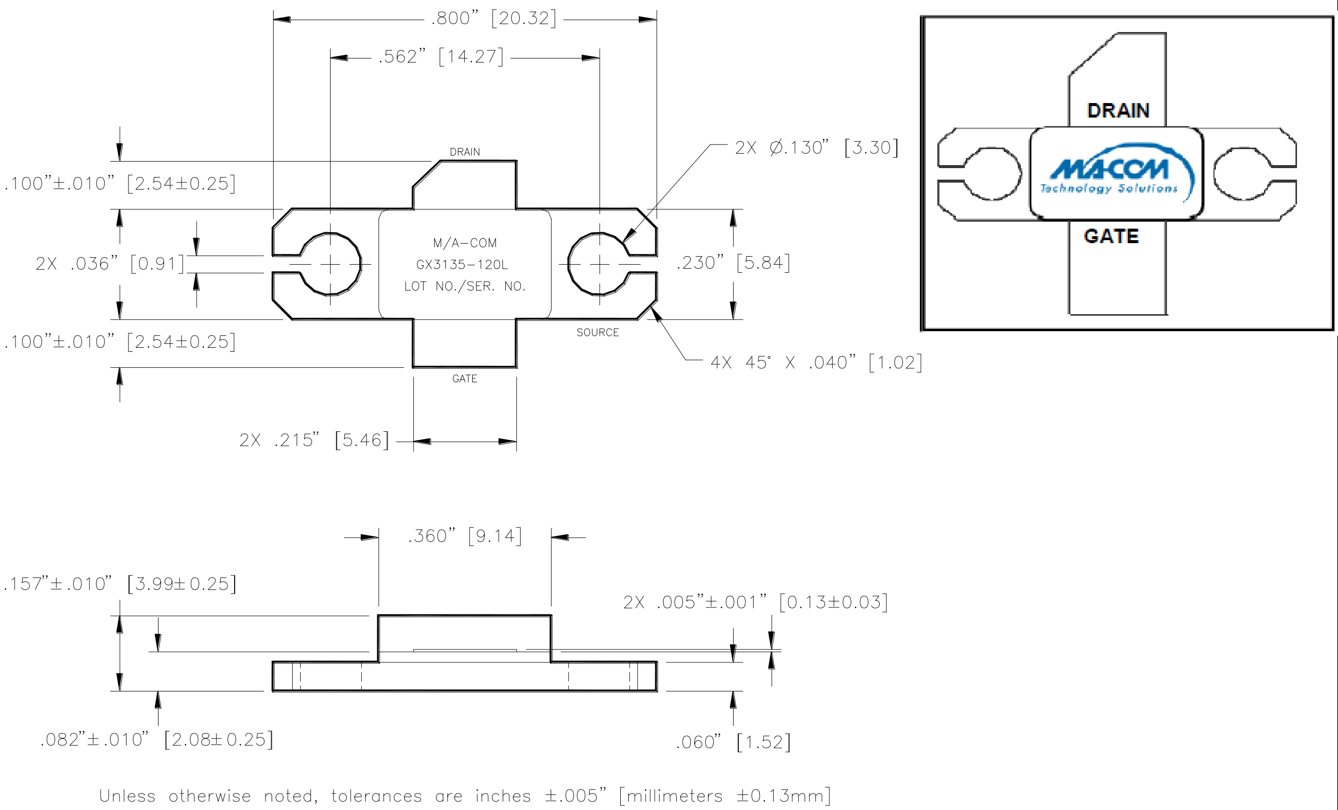
Outline Drawing



CORRECT DEVICE SEQUENCING

TURNING THE DEVICE ON

1. Set V_{GS} to the pinch-off (V_P), typically -5V
2. Turn on V_{DS} to nominal voltage (60V)
3. Increase V_{GS} until the I_{DS} current is reached
4. Apply RF power to desired level

TURNING THE DEVICE OFF

1. Turn the RF power off
2. Decrease V_{GS} down to V_P
3. Decrease V_{DS} down to 0V
4. Turn off V_{GS}

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