

## High Voltage - High Power GaN-HEMT Driver for Radar

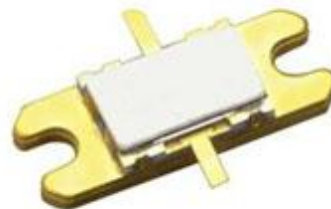
### FEATURES

- High Voltage Operation :  $V_{DS}=50V$
- High Power : 35W (min.) @ P3dB
- High Linear Gain : 13B(typ.) @  $f=3.1GHz$
- Tunable within 2.7 to 3.5 GHz

### DESCRIPTION

Sumitomo GaN-HEMT EGN31B030MK offers high efficiency, ease of matching, greater consistency and broad bandwidth for S-band radar applications with 50V operation. This part can easily be tuned for 400MHz bandwidth anywhere with the range 2.7 to 3.5GHz.

The device is suitable for the driver stage of Sumitomo S-band High Power Radar device series.



### ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Rating	Unit
Drain-Source Voltage	$V_{DS}$	$V_{GS}=-5V$	120	V
Gate-Source Voltage	$V_{GS}$		- 5	V
Total Power Dissipation	$P_t$	$T_c=25^{\circ}C$	93.75	W
Storage Temperature	$T_{stg}$		-65 to +175	$^{\circ}C$
Channel Temperature	$T_{ch}$		250	$^{\circ}C$

### RECOMMENDED OPERATING CONDITION(Case Temperature $T_c=25^{\circ}C$ )

Item	Symbol	Condition	Limit	Unit
DC Input Voltage	$V_{DS}$		$\leq 50$	V
Forward Gate Current	$I_{GF}$	$R_G=15\ \Omega$	$\leq 23$	mA
Reverse Gate Current	$I_{GR}$	$R_G=15\ \Omega$	$\geq -2.2$	mA

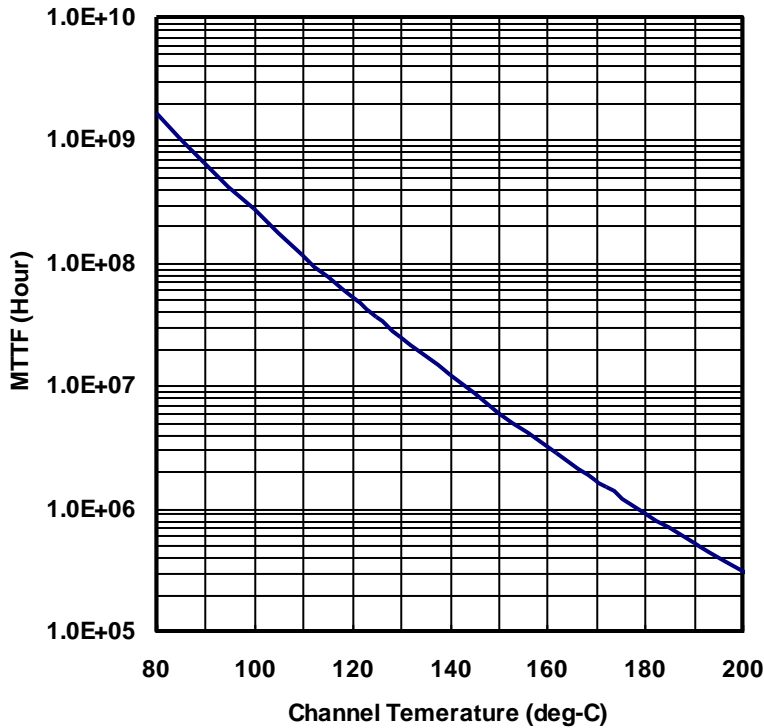
### ELECTRICAL CHARACTERISTICS (Case Temperature $T_c=25^{\circ}C$ )

Item	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Pinch-Off Voltage	$V_p$	$V_{DS}=50V\ I_{DS}=11mA$	-1.0	-2.0	-3.5	V
Output Power	$P_{3dB}$	$V_{DS}=50V$	45.5	46.5	-	W
Drain Efficiency	$\eta_d$	$I_{DS(DC)}=200mA$	-	45	-	%
Linear Gain	$G_L$	$f=3.1GHz\ CW$	12	13	-	dB
Thermal Resistance	$R_{th}$	Channel to Case Measured w/CW at 57W $P_{DC}$	-	2.0	2.4	$^{\circ}C/W$

**RoHS COMPLIANCE**

Yes

## High Voltage - High Power GaN-HEMT Driver for Radar



Confidence Level=60%

Channel Temp (deg. C)	MTTF (years)
125	3796
150	640
180	98
200	32

Figure 1. MTTF Calculation - Estimated MTTF -

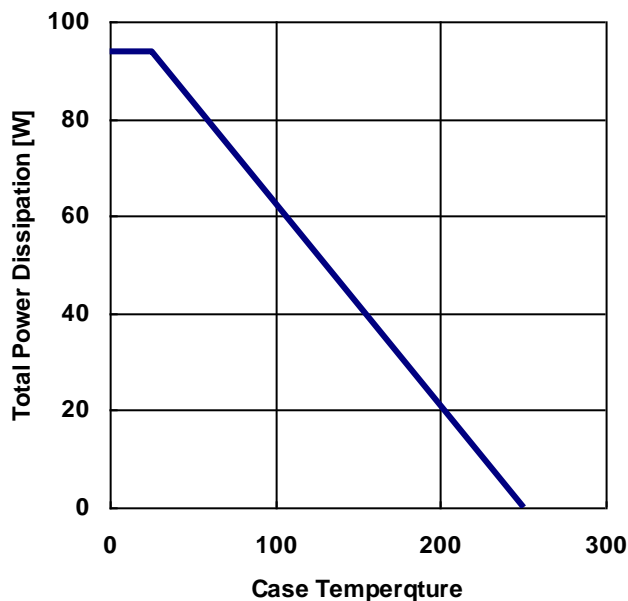
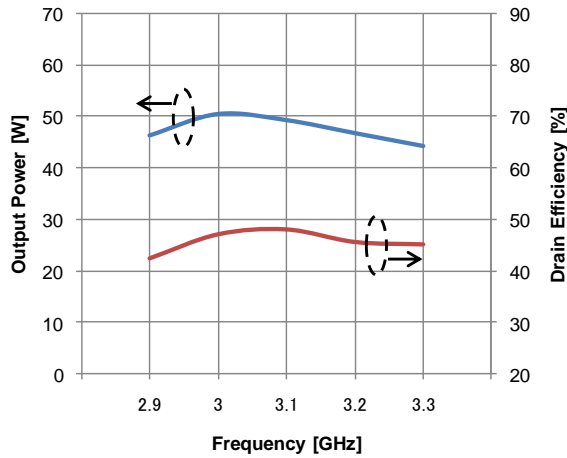


Figure 2. Power Derating Curve (CW Operation)

### ESD characteristic

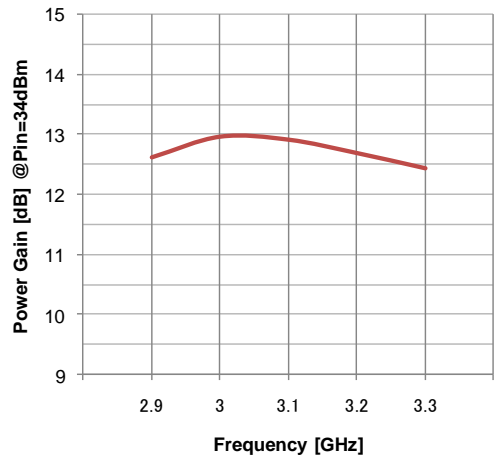
Test Methodology	Class
Human Body Model (per JESD22-A114)	0
Machine Model (per JEIA/ESD22-A115)	A

## High Voltage - High Power GaN-HEMT Driver for Radar



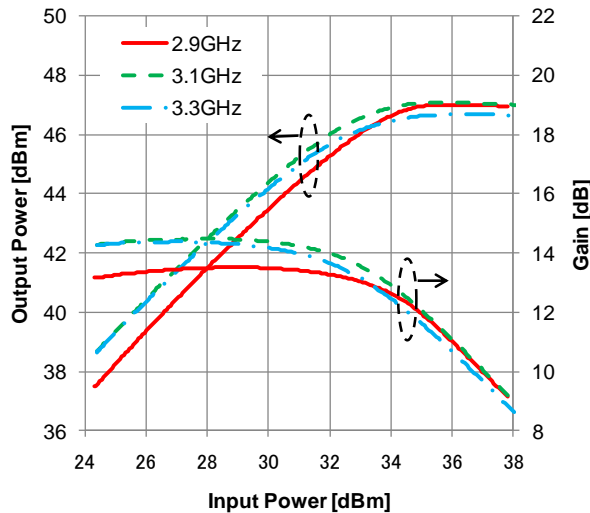
$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  $P_{in}=2.5W$ ,  
 $PW=200\mu sec$ , Duty 10%

**Figure 3. Output Power and Drain Efficiency vs Frequency**



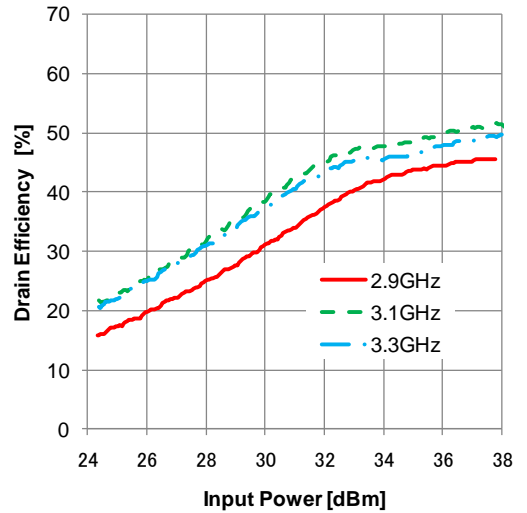
$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  $P_{in}=2.5W$ ,  
 $PW=200\mu sec$ , Duty 10%

**Figure 4. Power Gain vs Frequency**



$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  
 $PW=200\mu sec$ , Duty 10%

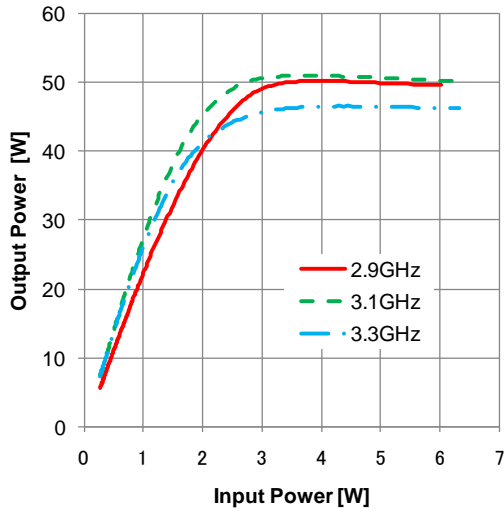
**Figure 5. Output Power and Gain vs Input Power**



$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  
 $PW=200\mu sec$ , Duty 10%

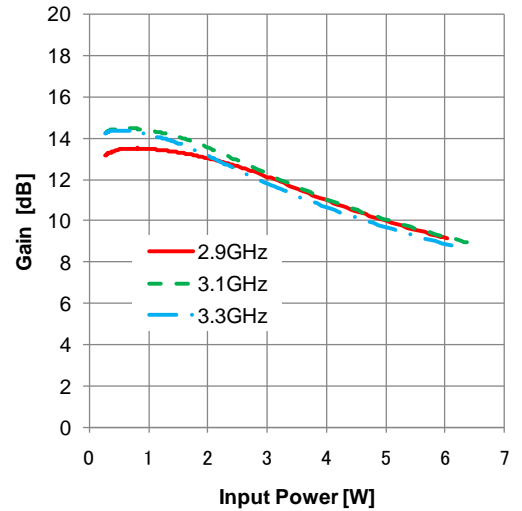
**Figure 6. Drain Efficiency vs Input Power**

## High Voltage - High Power GaN-HEMT Driver for Radar



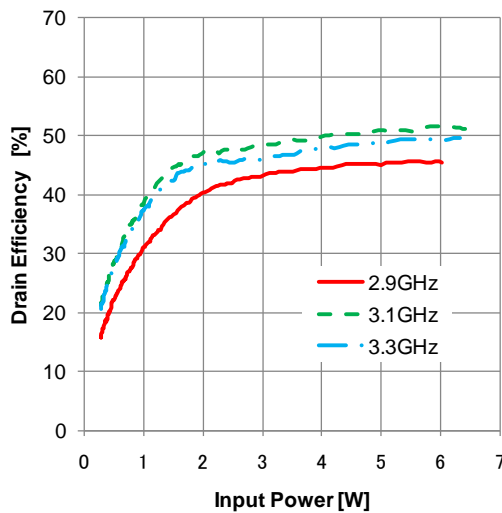
$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  
 PW=200 $\mu$ sec, Duty 10%

Figure 7. Output Power vs Input Power



$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  
 PW=200 $\mu$ sec, Duty 10%

Figure 8. Gain vs Input Power



$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  
 PW=200 $\mu$ sec, Duty 10%

Figure 9. Drain Efficiency vs Input Power

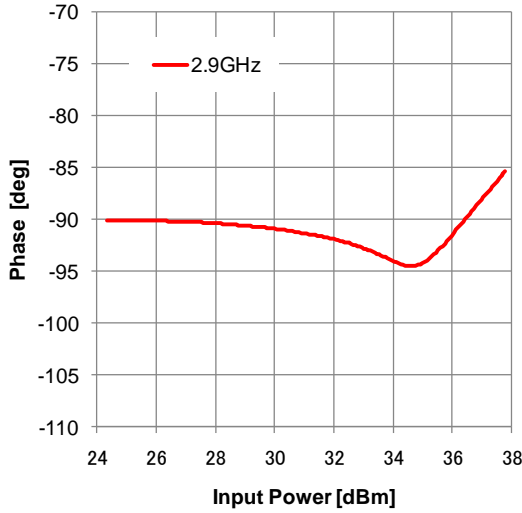


Figure 10. a) f=2.9GHz

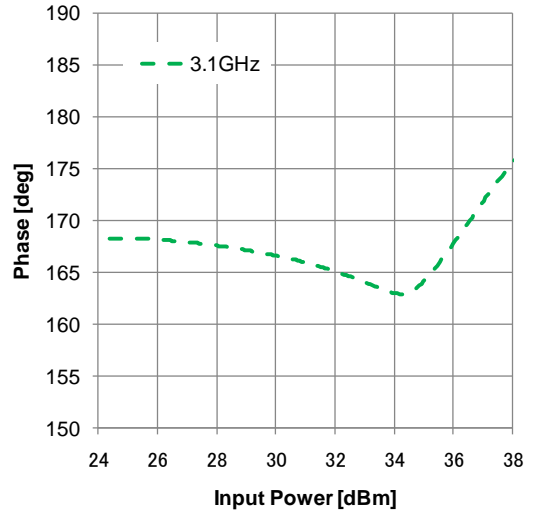


Figure 10. b) f=3.1GHz

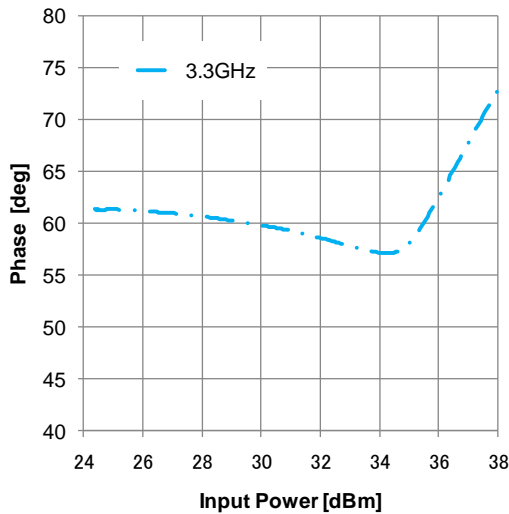


Figure 10. c) f=3.3GHz

$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  
 $PW=200\mu sec$ , Duty 10%

Figure 10. Insertion Phase shift vs Input Power

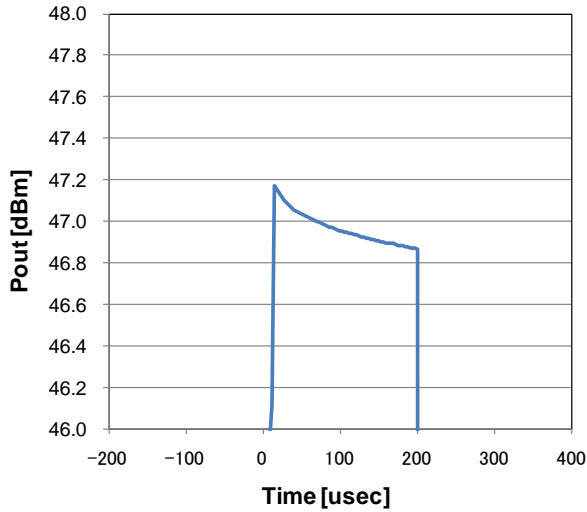


Figure 11. a)  $f=2.9\text{GHz}$

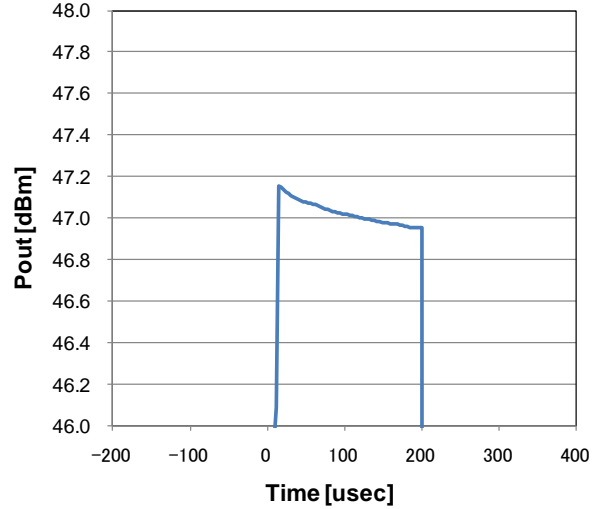


Figure 11. b)  $f=3.1\text{GHz}$

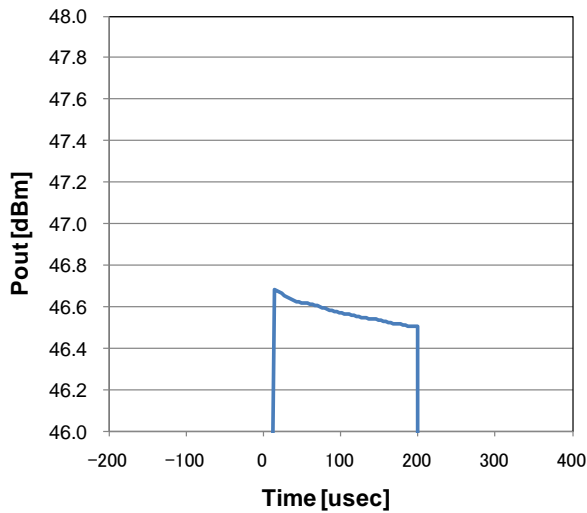


Figure 11. c)  $f=3.3\text{GHz}$

$V_{DS}=50\text{V}$ ,  $I_{DS(DC)}=200\text{mA}$ ,  $P_{in}=2.5\text{W}$   
 $PW = 200\mu\text{sec}$ , Duty 10%

Figure 11. Pulse Performance (Power)

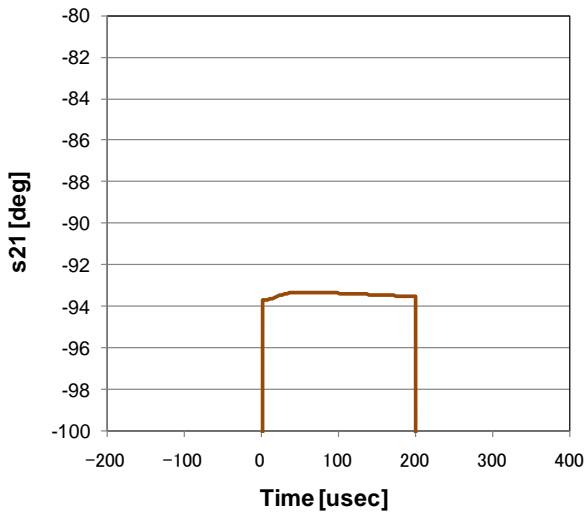


Figure 12. a) f=2.9GHz

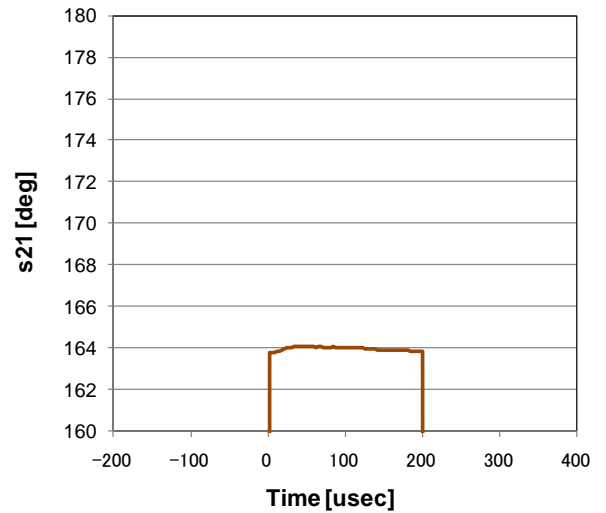


Figure 12. b) f=3.1GHz

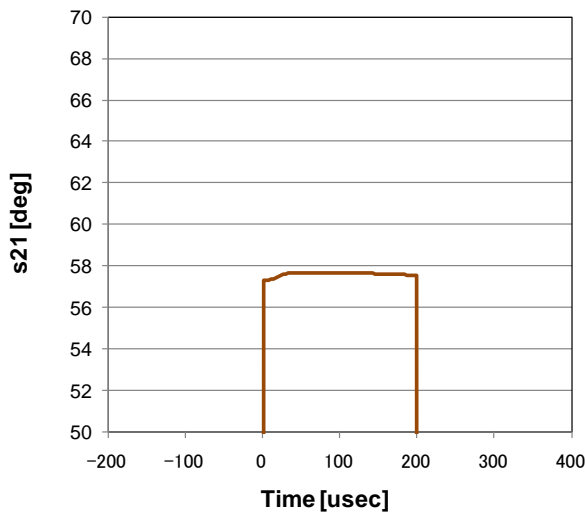
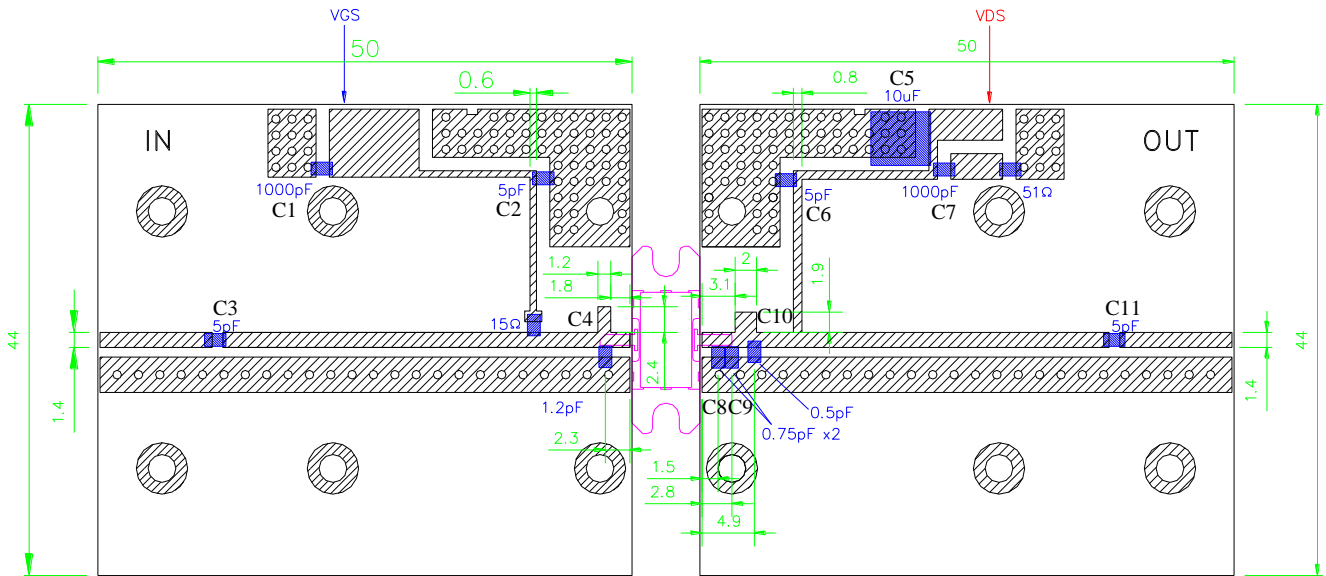


Figure 12. c) f=3.3GHz

$V_{DS}=50V$ ,  $I_{DS(DC)}=200mA$ ,  $P_{in}=2.5W$   
 PW = 200 $\mu$ sec, Duty 10%

Figure 12. Pulse Performance  
(Insertion Phase Shift)

### TEST FIXTURE for 2.9-3.3GHz



Unit: mm

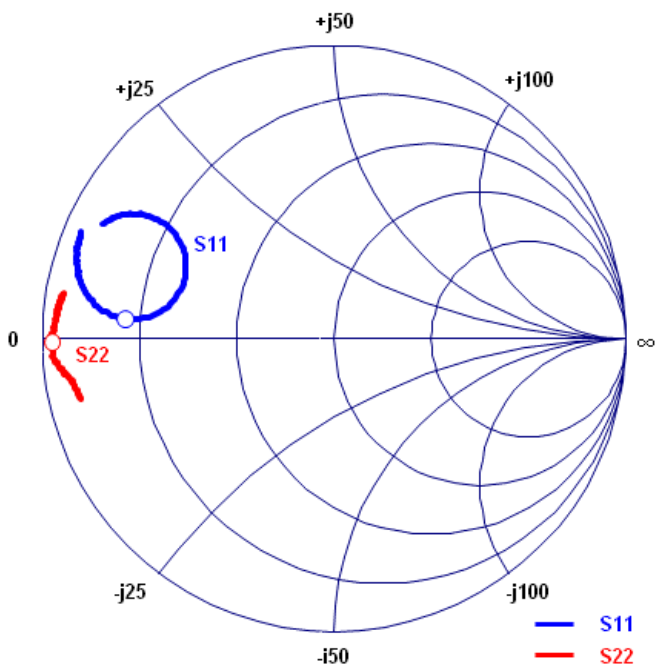
$\epsilon_r = 3.3$   
 $h = 0.6\text{mm}$   
 $C_u = 18\mu\text{m}$

Capacitor	Value	Part No.	Manufacturer
C1	1nF	GRM2192C2A102JA01D	MURATA MANUFACTURING CO., LTD
C2	5pF	ERB21A6C2D5R0CD01L	MURATA MANUFACTURING CO., LTD
C3	5pF	ERB21A6C2D5R0CD01L	MURATA MANUFACTURING CO., LTD
C4	1.2pF	GOM1875C2E1R2BB12D	MURATA MANUFACTURING CO., LTD
C5	10uF	GRM55DB31H106KA87L	MURATA MANUFACTURING CO., LTD
C6	5pF	ERB21A6C2D5R0CD01L	MURATA MANUFACTURING CO., LTD
C7	1nF	GRM2192C2A102JA01D	MURATA MANUFACTURING CO., LTD
C8	0.75pF	GRM1875C2ER75BB12D	MURATA MANUFACTURING CO., LTD
C9	0.75pF	GRM1875C2ER75BB12D	MURATA MANUFACTURING CO., LTD
C10	0.5pF	GQM1875C2ER50BB12D	MURATA MANUFACTURING CO., LTD
C11	5pF	ERB21A6C2D5R0CD01L	MURATA MANUFACTURING CO., LTD

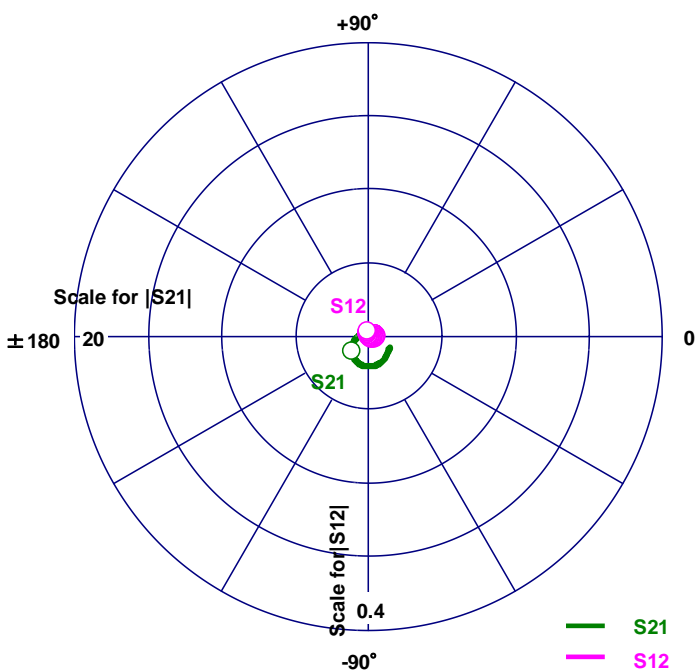
## High Voltage - High Power GaN-HEMT Driver for Radar

### S-parameters

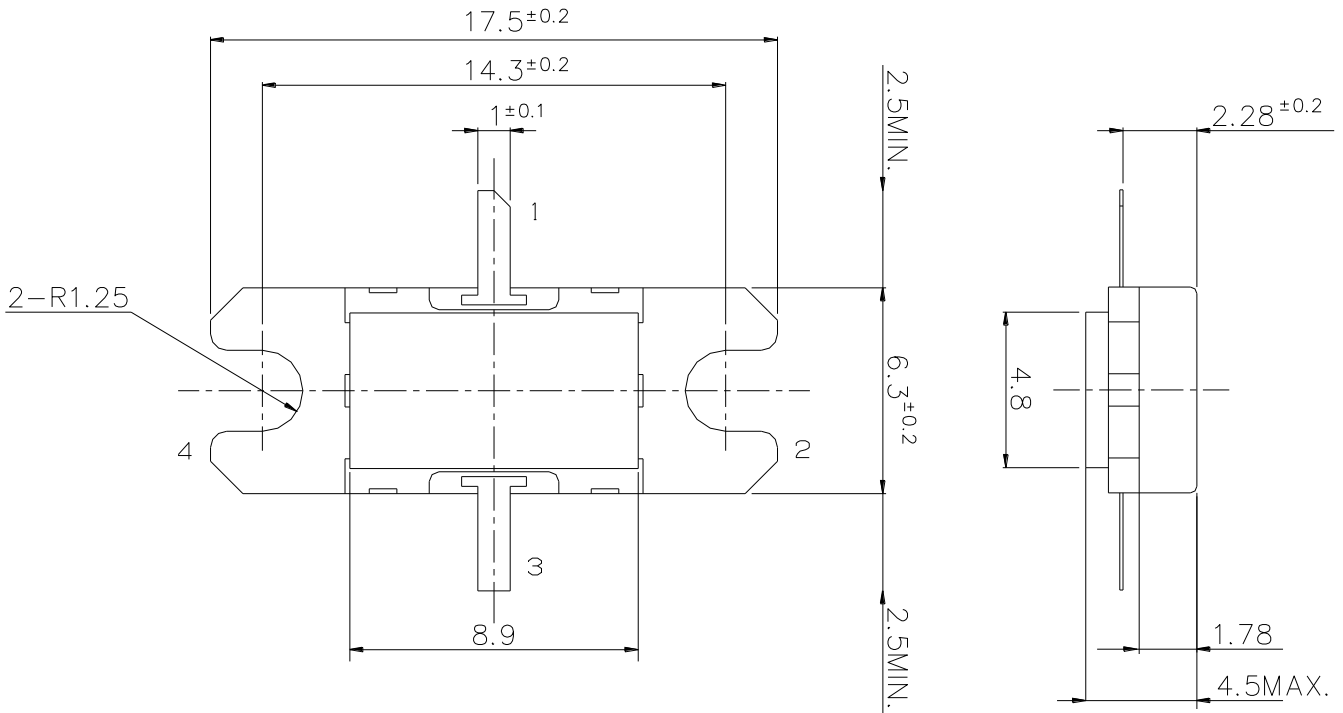
@V<sub>DS</sub>=50V I<sub>DS(DC)</sub>=200mA f=2.2 to 4.0GHz  
 Z<sub>1</sub> = Z<sub>s</sub> = 50ohm Marker: 3.1GHz



Freq. GHz	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
2.20	0.89	153.7	1.60	-28.1	0.01	43.4	0.89	-166.6
2.25	0.88	152.57	1.62	-31.1	0.01	39.7	0.89	-167.4
2.30	0.86	151.6	1.64	-33.9	0.01	39.2	0.90	-168.2
2.35	0.85	150.5	1.67	-37.6	0.01	40.8	0.90	-168.9
2.40	0.83	149.4	1.71	-40.8	0.01	36.2	0.90	-169.4
2.45	0.81	148.5	1.75	-44.9	0.01	33.4	0.91	-169.9
2.50	0.79	147.3	1.81	-49.2	0.01	31.3	0.91	-170.5
2.55	0.76	146.6	1.87	-53.8	0.01	27.6	0.91	-171.3
2.60	0.73	146.1	1.91	-59.7	0.01	23.4	0.92	-171.8
2.65	0.69	146.1	1.98	-65.8	0.01	19.6	0.93	-172.3
2.70	0.65	146.8	2.04	-72.3	0.01	14.0	0.93	-172.6
2.75	0.61	148.7	2.09	-80.0	0.01	7.1	0.94	-173.3
2.80	0.57	152.4	2.11	-88.5	0.01	-0.2	0.95	-174.0
2.85	0.55	158.0	2.09	-97.3	0.01	-6.7	0.95	-174.9
2.90	0.56	163.9	2.04	-106.6	0.01	-15.9	0.96	-175.5
2.95	0.58	168.9	1.95	-115.7	0.01	-26.6	0.96	-176.7
3.00	0.62	172.4	1.83	-124.5	0.01	-33.1	0.97	-177.5
3.05	0.67	174.2	1.69	-132.9	0.01	-42.4	0.97	-178.3
3.10	0.72	174.7	1.54	-140.1	0.00	-51.6	0.97	-179.3
3.15	0.76	174.1	1.40	-146.7	0.00	-54.6	0.97	-179.9
3.20	0.79	173.1	1.27	-152.5	0.00	-64.2	0.97	-179.0
3.25	0.82	172.1	1.15	-157.7	0.00	-77.3	0.96	-178.4
3.30	0.85	170.8	1.04	-162.5	0.00	-93.5	0.96	-177.7
3.35	0.87	169.6	0.94	-166.5	0.00	-141.6	0.96	-177.1
3.40	0.88	168.4	0.86	-170.2	0.00	-160.0	0.96	-176.5
3.45	0.89	167.1	0.78	-173.9	0.00	-136.2	0.96	-175.9
3.50	0.91	165.9	0.72	-177.0	0.00	-161.6	0.96	-175.4
3.55	0.91	164.9	0.66	-179.3	0.00	-143.0	0.96	-174.9
3.60	0.92	163.9	0.61	-177.8	0.00	-133.1	0.95	-174.3
3.65	0.92	163.0	0.56	-175.3	0.00	-128.1	0.95	-173.8
3.70	0.92	161.9	0.53	-173.4	0.00	-133.3	0.95	-173.3
3.75	0.93	161.1	0.49	-171.2	0.00	-127.9	0.95	-172.7
3.80	0.93	160.2	0.46	-168.8	0.01	-127.8	0.95	-172.2
3.85	0.93	159.5	0.43	-166.8	0.01	-122.0	0.95	-172.0
3.90	0.94	158.7	0.40	-165.4	0.01	-119.7	0.94	-171.4
3.95	0.94	158.1	0.38	-163.9	0.01	-116.2	0.94	-170.9
4.00	0.94	157.3	0.36	-161.6	0.01	-112.8	0.94	-170.5



### MK Package Outline Metal-Ceramic Hermetic Package



**PIN ASSIGNMENT**  
 1 : GATE  
 2 : SOURCE(Flange)  
 3 : DRAIN

Unit : mm



# **EGN31B030MK**

***High Voltage - High Power GaN-HEMT Driver for Radar***

**For further information please contact:**

<http://global-sei.com/Electro-optic/about/office.html>