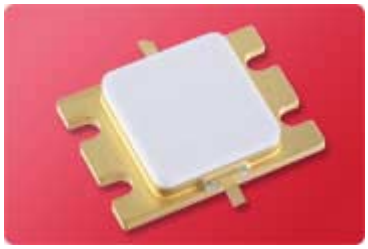
EGN13B200IV-R

High Voltage - High Power GaN-HEMT for Radar



FEATURES

- High Voltage Operation : V_{DS}=50V
- High Power : 170W (min.) @ P_{in}=4W (36dBm)
- High Efficiency: 55%(typ.) @ P_{in}=4W (36dBm)

DESCRIPTION

Sumitomo GaN-HEMT EGN13B200IV-R offers high power, high efficiency, ease of matching and greater consistency covering 1.2 to 1.4GHz for L-band radar applications with 50V operation.
The low thermal resistance allows to use long pulse up to 3 msec pulse width with duty of 10%.

ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Condition	Rating	Unit
Operating Voltage	V_{DS}		50	V
Drain-Source Voltage	V_{DS}	V_{GS}=-5V	120	V
Gate-Source Voltage	V_{GS}		- 5	V
Storage Temperature	T_{stg}		-65 to +100	°C
Channel Temperature	T_{ch}		250	°C

RECOMMENDED OPERATING CONDITION(Case Temperature T_c= 25°C)

Item	Symbol	Condition	Limit	Unit
DC Input Voltage	V_{DS}		≤ 50	V
Forward Gate Current	I_{GF}	R_G=5.1 Ω	≤ 100	mA
Reverse Gate Current	I_{GR}	R_G=5.1 Ω	≥ -14.4	mA
Pulse Width	PW	Duty 10%	≤ 3000	μsec
		Duty 25%	≤ 750	μsec
Peak Channel Temperature	$T_{ch\text{-}peak}$	Duty 10%	≤ 220	°C
		Duty 25%	≤ 205	°C

ELECTRICAL CHARACTERISTICS (Case Temperature T_c=25°C)

Item	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Pinch-Off Voltage	V_p	V_{DS}=50V I_{DS}=72mA	-1.0	-2.0	-3.5	V
Output Power	P_{out}	V_{DS}=50V	170	-	-	W
Drain Efficiency	η_d	$I_{DS(DC)}$=1000mA	-	55	-	%
Power Gain	G_p	P_{in}=4W (36dBm)	16.3	-	-	dB
Gain Flatness	GF	f=1.2, 1.3, 1.4GHz	-	0.8	1.2	dB
		PW=200μsec, Duty 10%				
Thermal Resistance	R_{th}	Channel to Case	-	0.7	0.85	°C/W
		Measured w/CW at 90W P_{DC}				

THERMAL CHARACTERISTICS IN PULSED RF OPERATION

Transient Thermal Resistance, Channel to Case,	Typ.	Unit
Case Temperature 75°C, Pulse Width 200μsec , Duty 10%	0.19	°C/W
Case Temperature 75°C, Pulse Width 3000μsec , Duty 10%	0.42	°C/W
Case Temperature 75°C, Pulse Width 750μsec , Duty 25%	0.39	°C/W

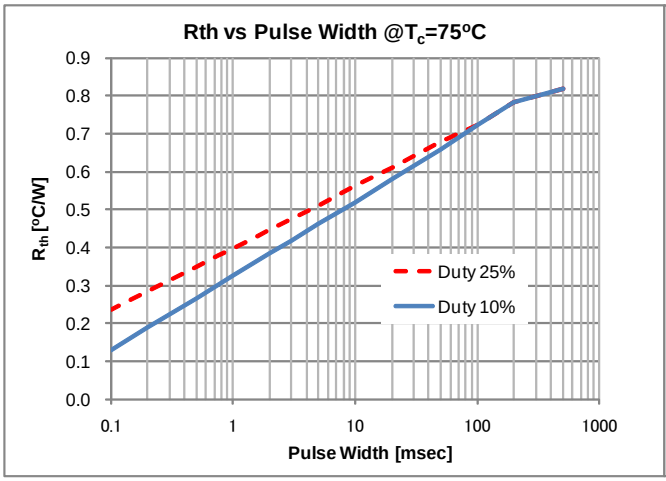
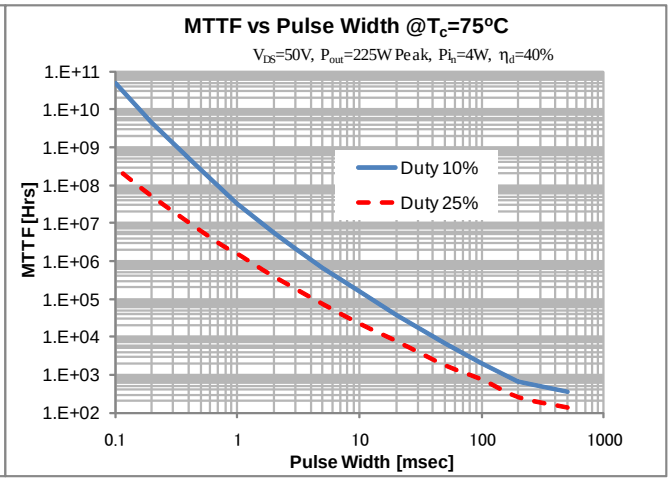


Figure 1. Transient Thermal Resistance vs Pulse Width @T_c = 75ºC

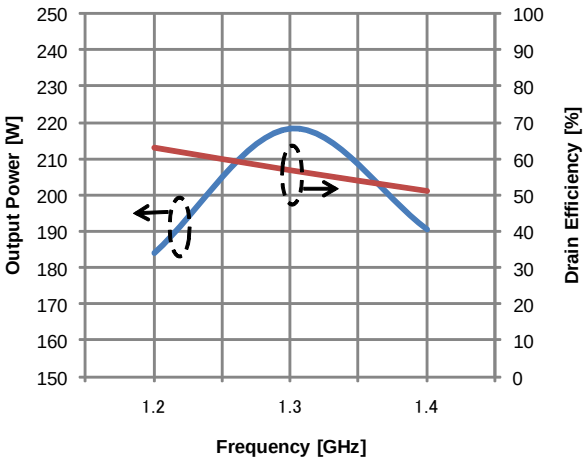


V_{DS}=50V, P_{out}=225W peak, P_{in}=4W, η_d=40%, T_c=75ºC

Figure 2. MTTF vs Pulse Width @T_c = 75ºC

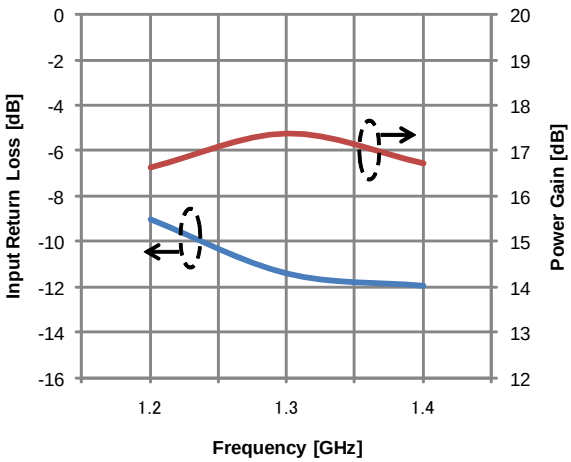
ESD characteristic

Test Methodology	Class
Human Body Model (per JESD22-A114)	1B
Machine Model (per JEIA/ESD22-A115)	B



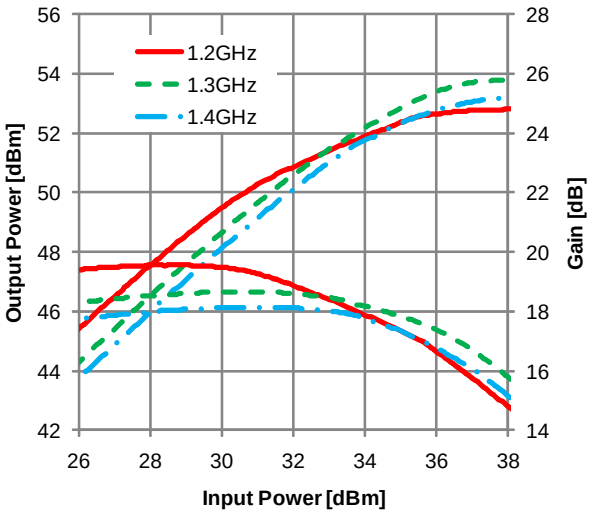
V_{DS}=50V, $I_{DS(DC)}$=1A, P_{in}=4W,
PW=200µsec, Duty 10%

Figure 3. Output Power and Drain Efficiency vs Frequency



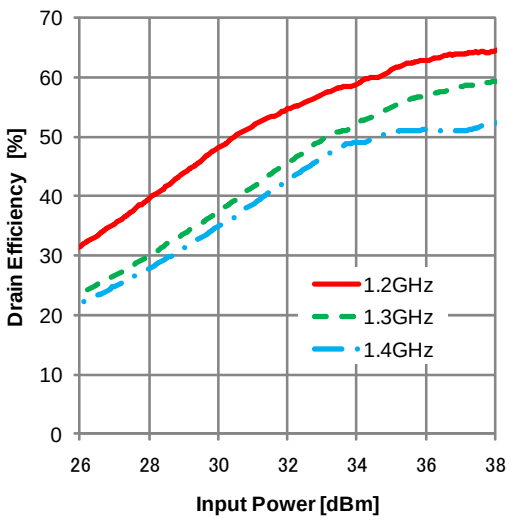
V_{DS}=50V, $I_{DS(DC)}$=1A, P_{in}=4W,
PW=200µsec, Duty 10%

Figure 4. Input Return Loss and Power Gain vs Frequency



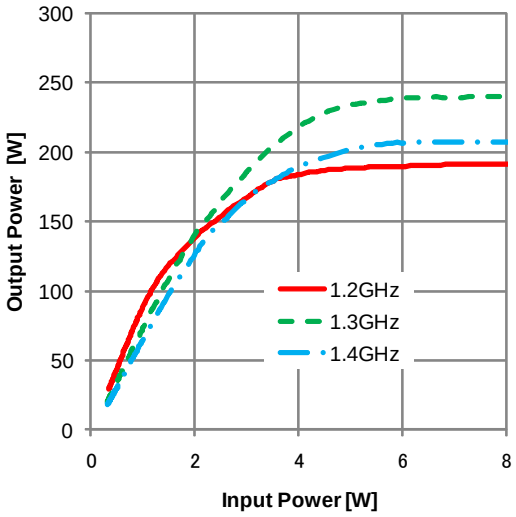
V_{DS}=50V, $I_{DS(DC)}$=1A,
PW=200µsec, Duty 10%

Figure 5. Output Power and Gain vs Input Power



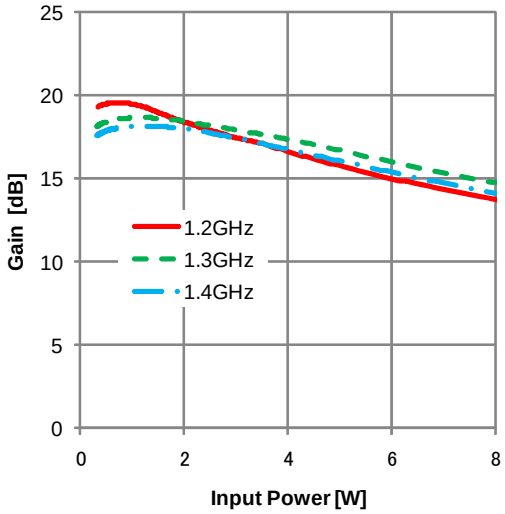
V_{DS}=50V, $I_{DS(DC)}$=1A,
PW=200µsec, Duty 10%

Figure 6. Drain Efficiency vs Input Power



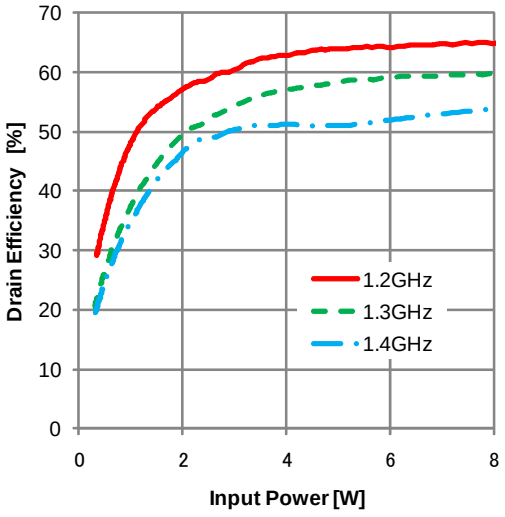
V_{DS}=50V, $I_{DS(DC)}$=1A,
PW=200µsec, Duty 10%

Figure 7. Output Power vs Input Power



V_{DS}=50V, $I_{DS(DC)}$=1A,
PW=200µsec, Duty 10%

Figure 8. Gain vs Input Power



V_{DS}=50V, $I_{DS(DC)}$=1A,
PW=200µsec, Duty 10%

Figure 9. Drain Efficiency vs Input Power

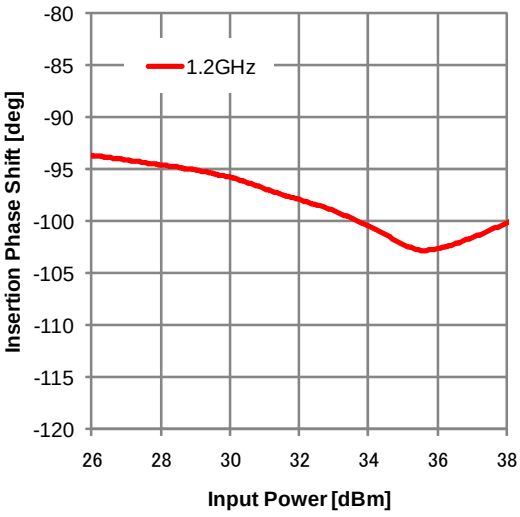


Figure 10. a) f=1.2GHz

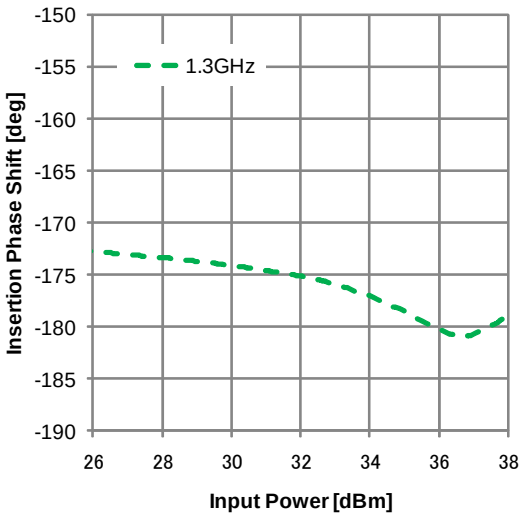


Figure 10. b) f=1.3GHz

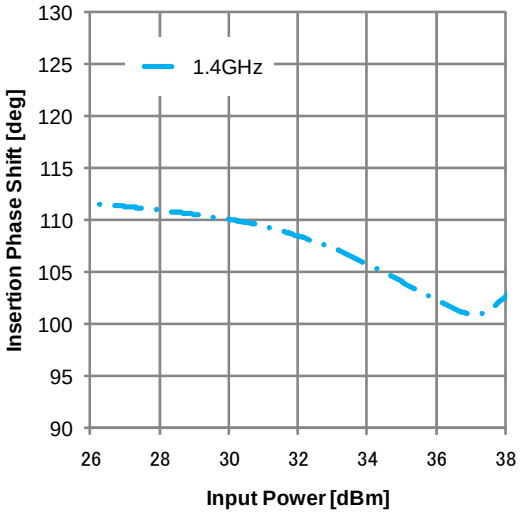


Figure 10. c) f=1.4GHz

V_{DS}=50V, $I_{DS(DC)}$=1A,
PW=200µsec, Duty 10%

Figure 10. Insertion Phase shift vs Input Power

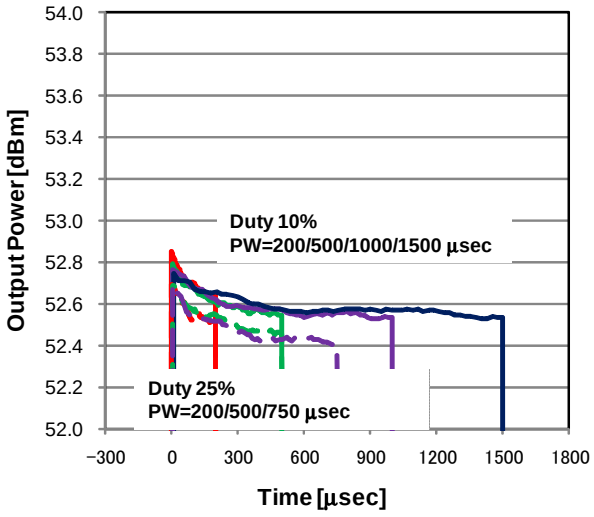


Figure 11. a) f=1.2GHz

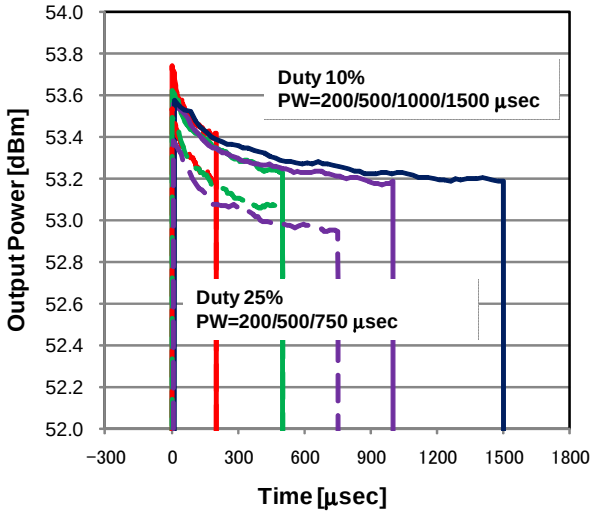


Figure 11. b) f=1.3GHz

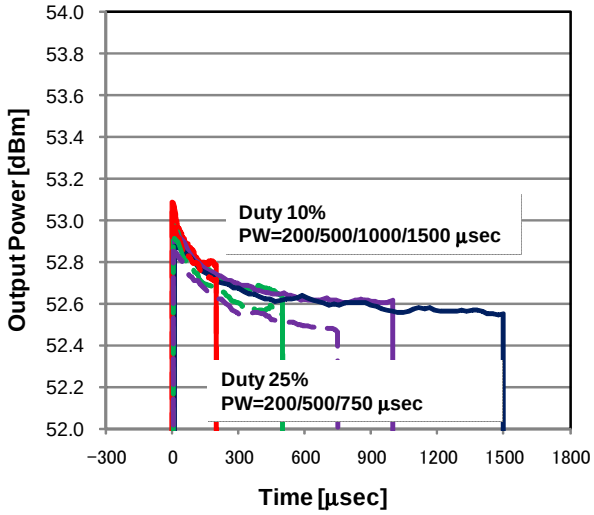


Figure 11. c) f=1.4GHz

V_{DS}=50V, $I_{DS(DC)}$=1A, P_{in}=4W
PW/Duty = 200/10, 500/10, 1000/10, 1500/10, 200/25, 500/25, 750µsec/25%

Solid Line : Duty 10%
Dashed Line : Duty 25%

Figure 11. Pulse Performance (Power) with various Pulse Condition

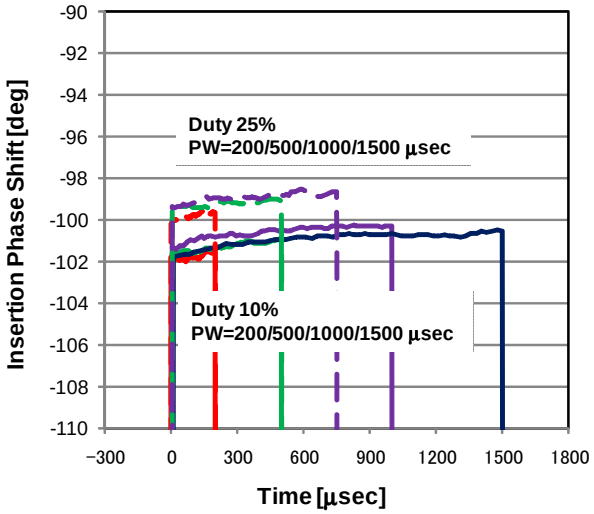


Figure 12. a) f=1.2GHz

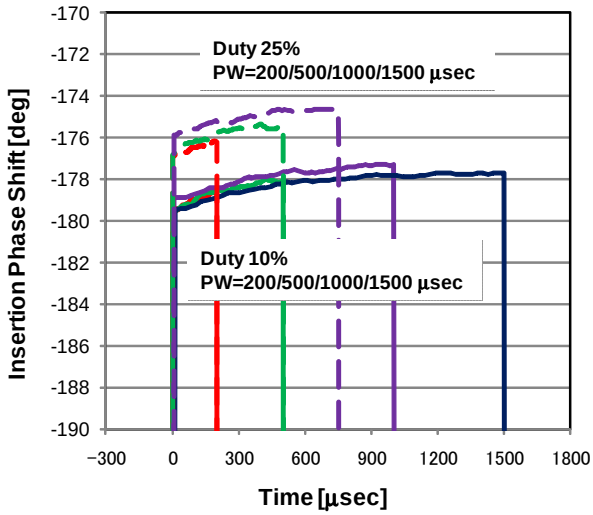


Figure 12. b) f=1.3GHz

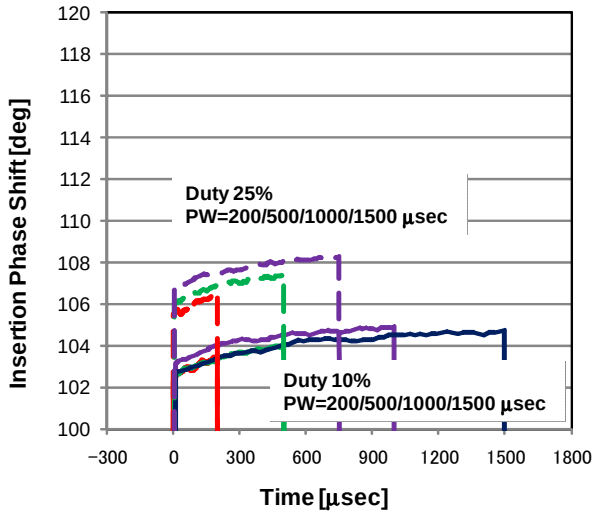


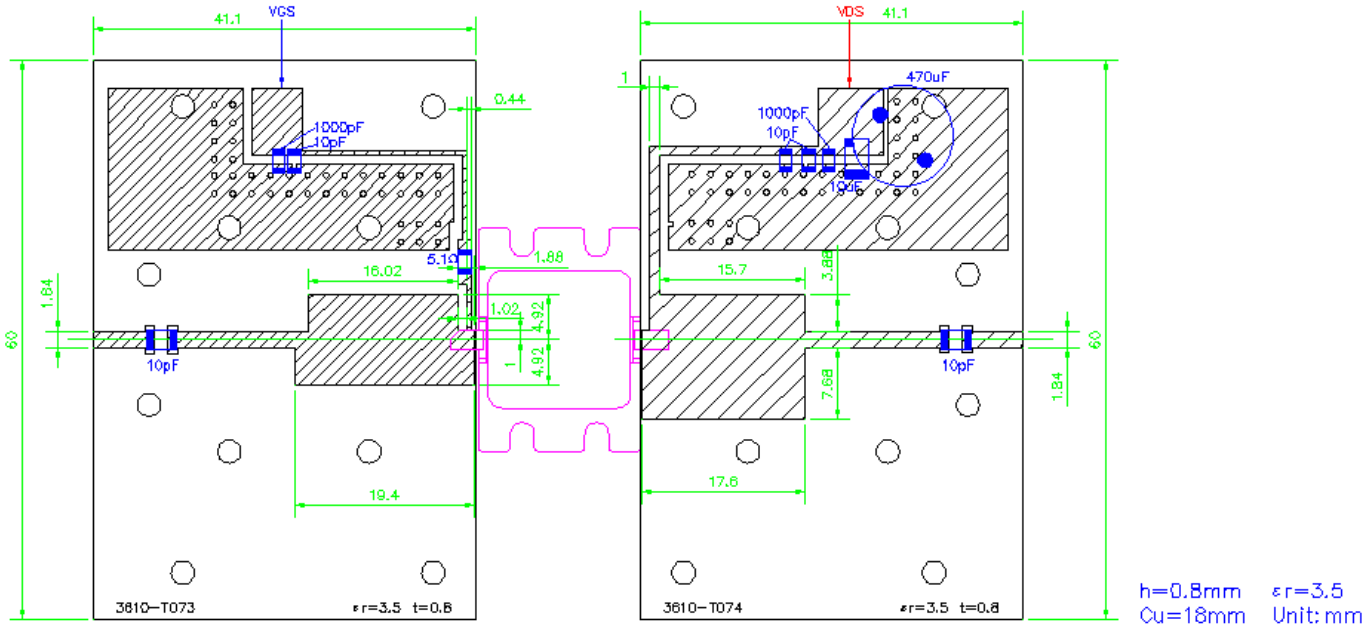
Figure 12. c) f=1.4GHz

V_{DS}=50V, $I_{DS(DC)}$=1A, P_{in}=4W
PW/Duty = 200/10, 500/10, 1000/10, 1500/10, 200/25, 500/25, 750µsec/25%

Solid Line : Duty 10%
Dashed Line : Duty 25%

Figure 12. Pulse Performance (Insertion Phase Shift) with various Pulse Condition

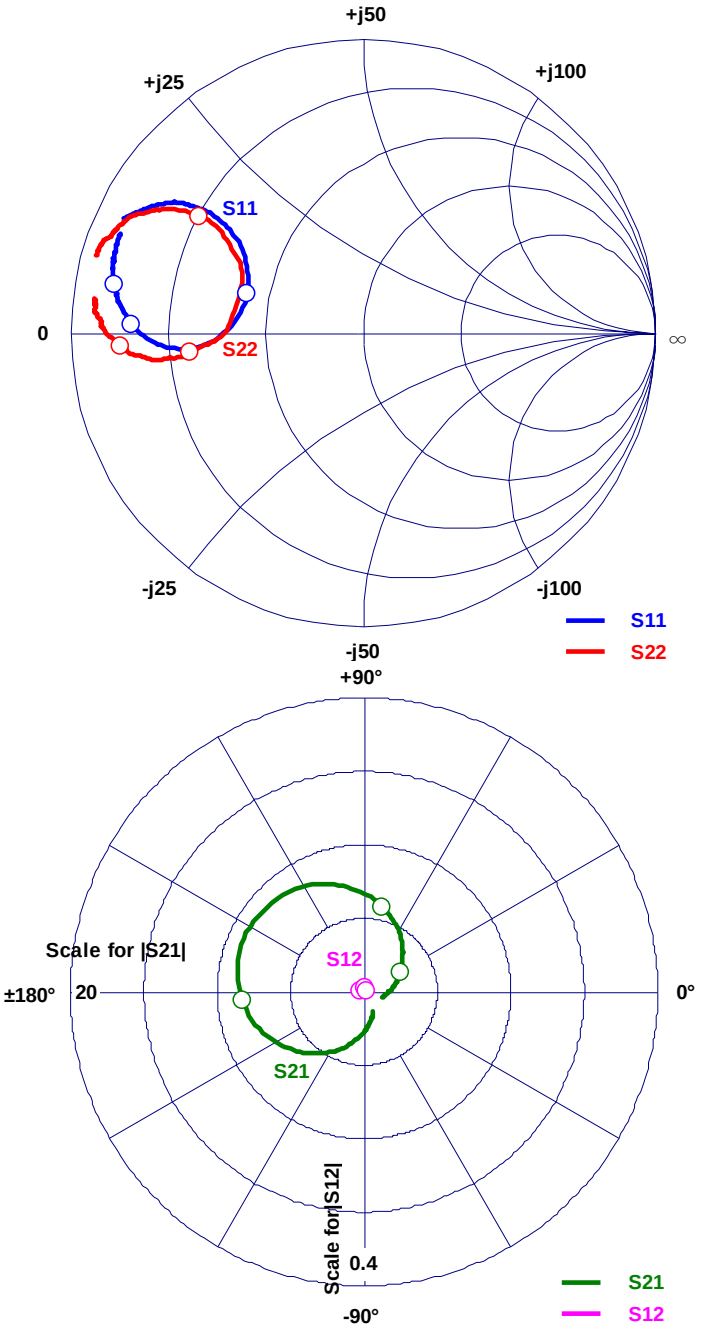
TEST FIXTURE



High Voltage - High Power GaN-HEMT for Radar

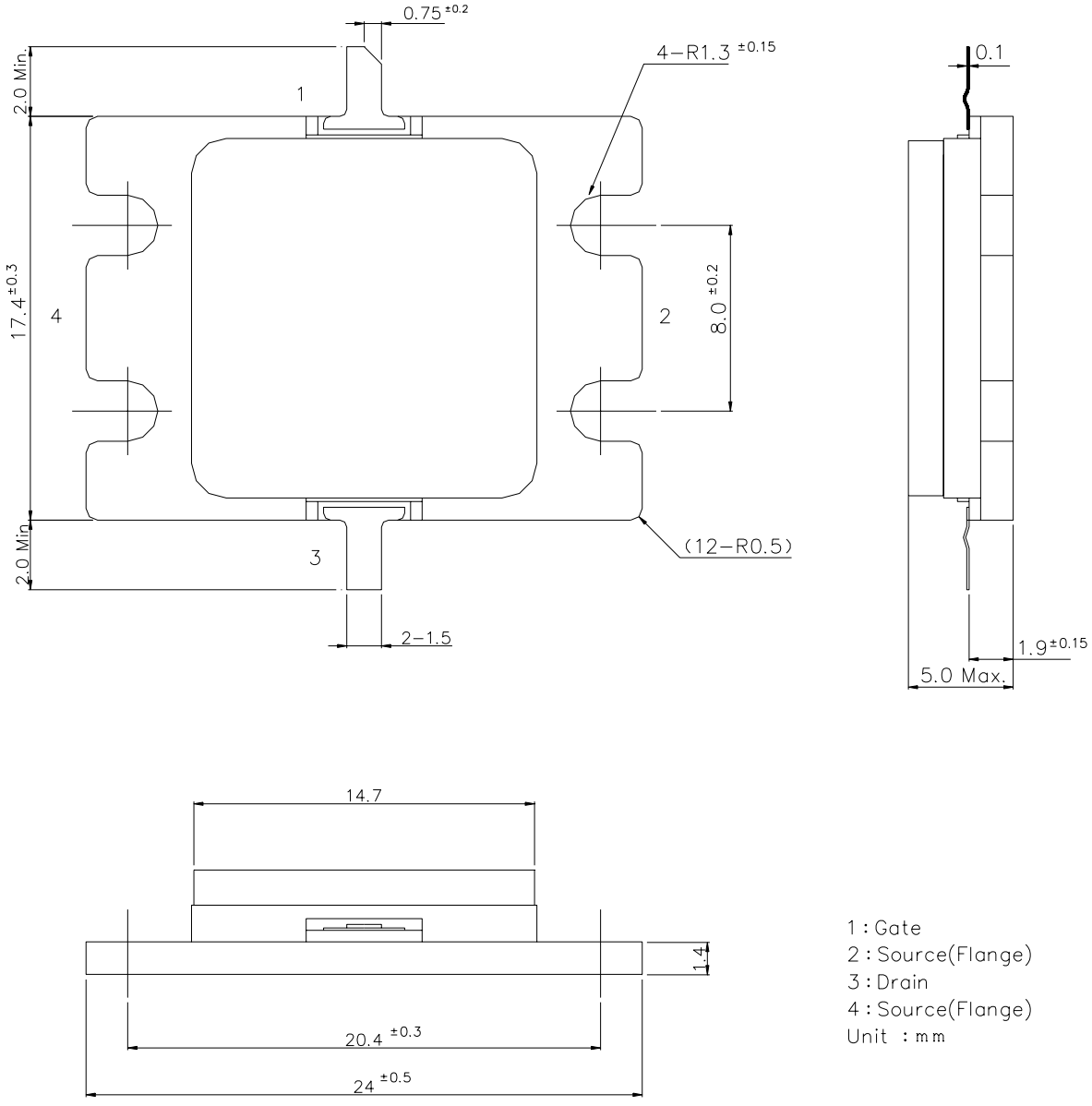
S-parameters

@V_{DS}=50V $I_{DS(DC)}$=1A f=1.0 to 1.6GHz
$Z_l = Z_s$ = 50ohm Marker: 1.2, 1.3, 1.4GHz



Freq.	S11		S21		S12		S22	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.00	0.91	154.6	1.46	-66.1	0.00	-70.3	0.95	164.0
1.01	0.90	153.8	1.58	-68.5	0.00	-90.9	0.95	163.7
1.02	0.89	153.1	1.76	-71.9	0.00	-75.7	0.95	163.4
1.03	0.88	152.3	1.89	-74.7	0.00	-84.9	0.95	162.7
1.04	0.87	151.6	1.99	-77.1	0.00	-90.4	0.95	162.0
1.05	0.86	150.8	2.18	-80.7	0.00	-93.3	0.95	161.3
1.06	0.85	149.9	2.36	-84.0	0.00	-90.5	0.94	160.8
1.07	0.84	149.0	2.49	-86.6	0.00	-98.0	0.94	160.1
1.08	0.83	148.0	2.76	-90.7	0.00	-107.4	0.93	159.6
1.09	0.81	146.9	3.05	-95.1	0.00	-110.5	0.92	158.9
1.10	0.79	145.7	3.26	-98.6	0.00	-117.3	0.92	157.9
1.11	0.77	144.6	3.59	-103.8	0.00	-117.5	0.91	157.0
1.12	0.74	143.7	4.07	-110.4	0.00	-124.3	0.91	155.7
1.13	0.70	142.9	4.47	-116.2	0.00	-128.3	0.90	154.5
1.14	0.67	142.1	4.87	-122.0	0.00	-140.2	0.89	153.2
1.15	0.62	142.0	5.44	-129.4	0.00	-142.6	0.87	152.0
1.16	0.58	142.3	6.01	-137.2	0.00	-152.7	0.84	150.7
1.17	0.53	143.9	6.59	-145.1	0.00	-163.5	0.81	149.1
1.18	0.48	147.5	7.27	-155.3	0.00	-172.1	0.78	147.1
1.19	0.44	153.6	7.88	-165.9	0.01	-179.2	0.74	145.8
1.20	0.42	161.0	8.27	-175.8	0.01	168.3	0.69	144.6
1.21	0.43	170.6	8.70	171.8	0.01	158.6	0.63	144.1
1.22	0.46	178.3	8.97	159.3	0.01	147.2	0.56	145.9
1.23	0.52	-177.1	8.92	147.6	0.01	133.5	0.50	149.4
1.24	0.57	-175.2	8.73	135.8	0.01	120.2	0.46	155.6
1.25	0.64	-175.1	8.44	124.0	0.01	109.7	0.44	164.1
1.26	0.68	-176.3	8.00	113.5	0.01	101.9	0.45	171.9
1.27	0.72	-177.7	7.47	103.6	0.01	86.9	0.47	178.9
1.28	0.75	-179.4	6.98	94.7	0.01	78.9	0.51	-177.0
1.29	0.78	179.2	6.48	86.2	0.01	75.0	0.56	-175.2
1.30	0.79	177.7	5.93	78.2	0.01	66.9	0.60	-173.6
1.31	0.81	176.5	5.48	71.0	0.01	59.0	0.63	-172.6
1.32	0.82	175.2	5.06	64.5	0.00	54.7	0.67	-172.8
1.33	0.83	174.4	4.61	58.1	0.00	47.1	0.70	-172.6
1.34	0.84	173.5	4.23	52.6	0.00	40.7	0.73	-172.6
1.35	0.85	172.6	3.95	48.3	0.00	38.4	0.75	-173.7
1.36	0.85	171.7	3.66	43.9	0.00	36.3	0.77	-174.5
1.37	0.85	170.9	3.37	39.5	0.00	29.6	0.79	-174.7
1.38	0.86	170.1	3.17	35.8	0.00	30.8	0.81	-175.7
1.39	0.86	169.4	3.00	32.3	0.00	31.1	0.82	-176.6
1.40	0.87	169.0	2.75	27.8	0.00	30.3	0.83	-177.1
1.41	0.87	168.4	2.62	24.7	0.00	24.2	0.84	-177.7
1.42	0.87	167.8	2.50	21.7	0.00	27.4	0.85	-178.4
1.43	0.88	167.2	2.33	17.9	0.00	26.0	0.87	-179.1
1.44	0.88	166.7	2.20	14.7	0.00	22.5	0.88	-179.7
1.45	0.89	165.9	2.14	12.4	0.00	19.3	0.89	179.5
1.46	0.89	165.4	2.05	9.9	0.00	16.8	0.89	178.9
1.47	0.89	164.8	1.92	6.9	0.00	17.1	0.90	178.5
1.48	0.89	164.2	1.84	4.8	0.00	15.9	0.90	178.0
1.49	0.89	163.8	1.78	2.8	0.00	19.6	0.90	177.5
1.50	0.89	163.4	1.66	-0.3	0.00	16.2	0.90	177.1
1.51	0.89	162.8	1.62	-2.0	0.00	11.8	0.91	176.7
1.52	0.89	162.3	1.58	-4.0	0.00	19.1	0.91	176.1
1.53	0.89	161.9	1.50	-6.2	0.00	14.0	0.92	175.5
1.54	0.90	161.3	1.44	-8.1	0.00	13.4	0.92	175.1
1.55	0.90	160.8	1.45	-9.2	0.00	10.2	0.92	174.7
1.56	0.90	160.2	1.42	-10.7	0.00	14.1	0.92	174.5
1.57	0.90	159.7	1.37	-12.5	0.00	8.7	0.92	174.3
1.58	0.90	159.1	1.37	-13.9	0.00	9.5	0.92	173.9
1.59	0.90	158.6	1.36	-15.4	0.00	11.5	0.92	173.5
1.60	0.90	158.0	1.30	-17.9	0.00	10.0	0.93	172.8

IV Package Outline
Metal-Ceramic Hermetic Package



1 : Gate
2 : Source(Flange)
3 : Drain
4 : Source(Flange)
Unit : mm

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For further information please contact:

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

CAUTION

Sumitomo Electric Device Innovations, Inc. products contain **gallium arsenide (GaAs)** which can be hazardous to the human body and the environment. For safety, observe the following procedures:

・Do not put these products into the mouth.

・Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.

・Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.