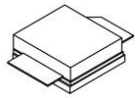
SG4020VS GaN TRANSISTOR

Document Number: SG4020VS
Preliminary Datasheet V1.0

GaN 50V, 170W,2-4GHz Full band RF Transistor

SG4020VS



Earless

Description

The SG4020VS is a 170-watt, internally matched GaN HEMT, designed for pulsed amplifier applications with frequencies from 2000 to 4000MHz, covering the full S band.

There is no guarantee of performance when this part is used in applications designed outside of these frequencies.

It is recommended to use this device only at pulse condition, and power rating will be different according to different pulse width and duty cycle

- Typical **pulse** Performance (On Innogration fixture with device soldered):

V_{DD} = 50 Volts, I_{DQ} = 100 mA, Pulse CW, Pulse width=100us, Duty cycle=10%.

Freq(MHz)	Pin(dBm)	Pout(dBm)	Pout(W)	Ids (A)	Gain(dB)	Eff(%)
2000	45.36	52.5	177.8	0.80	7.1	44.5
2100	42.72	52.5	177.8	0.73	9.8	48.7
2200	42.87	52.5	177.8	0.75	9.6	47.4
2300	44.9	52.5	177.8	0.78	7.6	45.6
2400	43.66	52.5	177.8	0.90	8.8	39.5
2500	46.21	52.5	177.8	0.95	6.3	37.4
2600	44.93	52.5	177.8	0.96	7.6	37.0
2700	46	52.5	177.8	0.85	6.5	41.8
2800	45.93	52.5	177.8	0.83	6.6	42.9
2900	44.06	52.5	177.8	0.83	8.4	42.9
3000	42.32	52.5	177.8	0.87	10.2	40.9
3100	42.09	52.5	177.8	0.90	10.4	39.5
3200	43.96	52.5	177.8	0.89	8.5	40.0
3300	44.92	52.5	177.8	0.84	7.6	42.3
3400	44.97	52.5	177.8	0.86	7.5	41.4
3500	44.8	52.5	177.8	0.81	7.7	43.9
3600	44.69	52.5	177.8	0.80	7.8	44.5
3700	44.84	52.5	177.8	0.84	7.7	42.3
3800	44.26	52.5	177.8	0.85	8.2	41.8
3900	44.23	52.5	177.8	0.94	8.3	37.8
4000	46.08	52.5	177.8	0.98	6.4	36.3

- Recommended driver:SU4005VS

Applications and Features

- Suitable for broad band application in S band pulse amplifier applications.
- Thermally Enhanced Industry Standard Package
- High Reliability Metallization Process
- Excellent thermal Stability and Excellent Ruggedness
- Compliant to Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC

Important Note: Proper Biasing Sequence for GaN HEMT Transistors

■ **Turning the device ON**

1) Set VGS to the pinch--off (VP) voltage, typically –5 V
2) Turn on VDS to nominal supply voltage (50 V)
3) Increase VGS until IDS current is attained
4) Apply RF input power to desired level

■ **Turning the device OFF**

1) Turn RF power off
2) Reduce VGS down to VP, typically –5 V
3) Reduce VDS down to 0 V
4) Turn off VGS

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain--Source Voltage	V_{DSS}	+200	Vdc
Gate--Source Voltage	V_{GS}	-8 to +0	Vdc
Operating Voltage	V_{DD}	0 to 55	Vdc
Maximum Forward Gate Current @ T_C = 25°C	Igmax	36	mA
Storage Temperature Range	T_{stg}	-65 to +150	°C
Case Operating Temperature	T_C	+150	°C
Operating Junction Temperature	T_J	+225	°C

Table 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Thermal Resistance, Junction to Case,P_{OUT}=170W @3GHz by FEA 100us/10%, Tcase=85°C, 50 Vdc, I_{DQ} =100 mA	$R_{\theta JC}$	0.7	°C/W

Table 3. Electrical Characteristics (TA = 25℃ unless otherwise noted)

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{GS}=-8V; I_{DS}=36mA	V_{DSS}	——	200	——	V
Gate Threshold Voltage	V_{DS} = 10V, I_D = 36mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	V_{DS} =50V, I_{DS}=100mA, Measured in Functional Test	$V_{GS(Q)}$	——	-3.29	——	V

Functional Tests (In Innogration Test Fixture, 50 ohm system) : V_{DD} = 50Vdc, I_{DQ} =100 mA, f = 3000MHz, Pulse CW, Pulse width=100us, Duty cycle=10%.

Characteristic	Symbol	Min	Typ	Max	Unit
Power Gain @ $P_{\_3dB}$	G_P	6	7	——	dB
Drain Efficiency@P_{3dB}	η_D	——	35	——	%
3dB compression Power	P_{3dB}	——	170	——	W

Load Mismatch (In Innogration Test Fixture, 50 ohm system): V_{DD} = 50 Vdc, I_{DQ} = 200 mA, f = 3000 MHz

VSWR 10:1 at 350W pulse CW Output Power	No Device Degradation

TYPICAL CHARACTERISTICS

Figure 2. Network analyzer output S11/S21 VDS=50V IDQ=500mA VGS=-3.18V

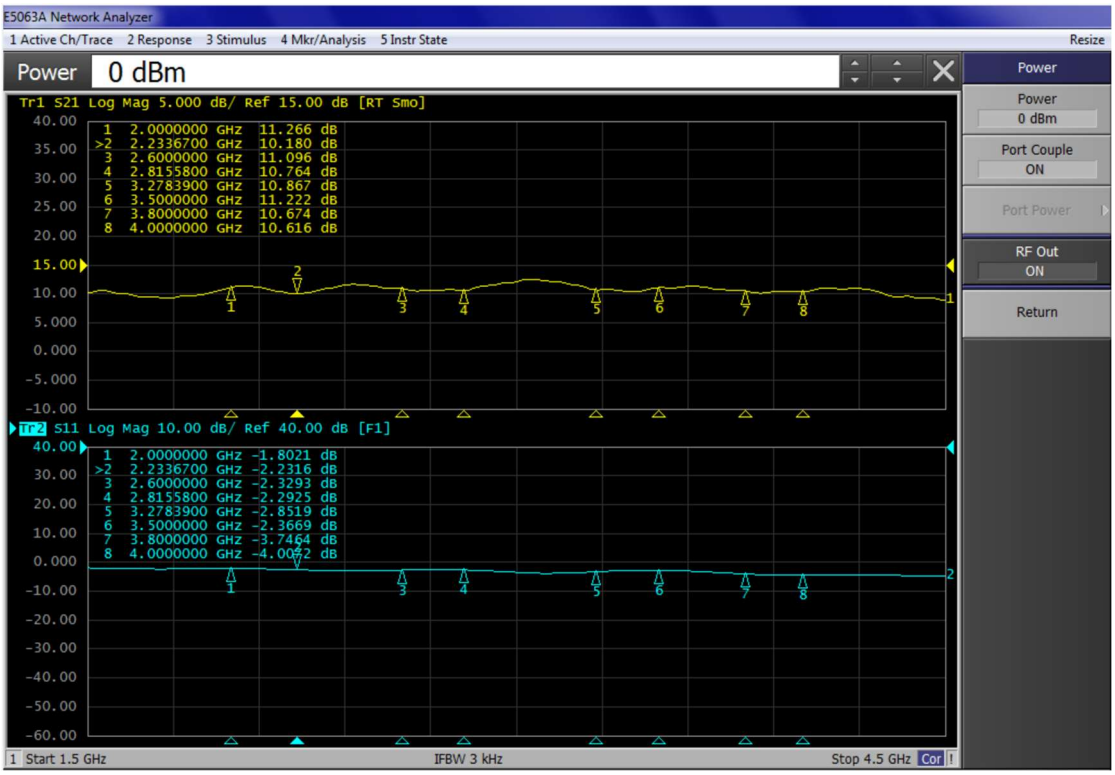


Figure 3. Test Circuit Component Layout

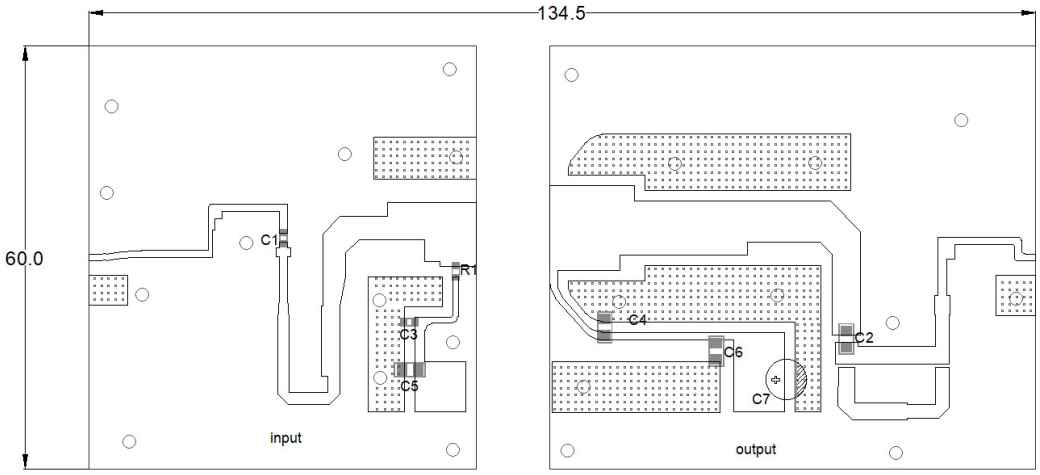
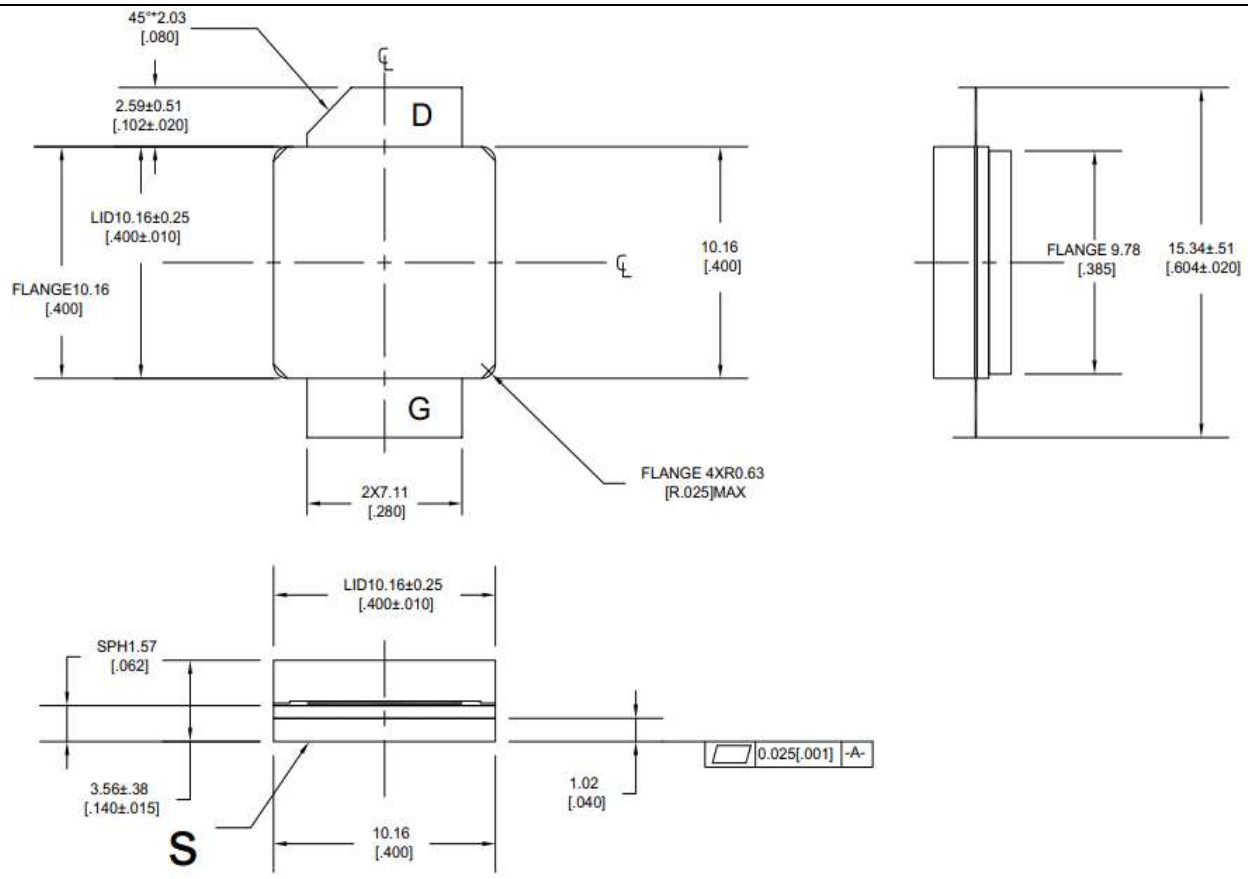


Table 4. Test Circuit Component Designations and Values

Component	Description	Suggested Manufacturer
C1,C2,C3,C4	8.2pF	MQ200805C0G2E6R8NDB
C5,C6	Ceramic multilayer capacitor, 10uF, 100V	10uF/100V
C7	470uF	63V/470uF
R1	Chip Resistor,9.1 Ω	
PCB	20mil thick, εr=3.48, Rogers RO4350B, 1 oz. copper	



Unit: mm [inch]

Tolerance .xx +/- 0.01 .xxx +/- 0.005 inches

Revision history

Table 5. Document revision history

Date	Revision	Datasheet Status
2022/8/1	**Rev 1.0**	**Preliminary Datasheet based on SDBV technology**

Application data based on YHG-22-19

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