Gallium Nitride 50V, 150W,DC-4GHz RF Power Transistor

S3L4015VS

Description

The S3L4015VS is a 150W, **single ended** GaN HEMT, designed for multiple applications with Frequencies up to 4GHz. It is optimized thermally to support wideband CW application.

In typical 3-4GHz or 0.4-3GHz wideband CW application, it can deliver 150W with high efficiency.

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

- Typical broadband RF performance across 3-4GHz
  Vds= 48V, Idq=180 mA Vgs=-3.30V，CW，with device solded

Freq (MHz)	Power gain (dB)	Pout (W)	Id (A)	Eff (%)
3000	9.73	192	8.37	48.0
3500	9.09	180	7.56	50.1
4000	8.52	159	6.72	49.30

- Typical broadband RF performance across 0.4-3GHz
  Vds= 48V, Idq=180 mA Vgs=-3.30V，CW，with device solded

Freq (MHz)	Power gain (dB)	Pout (W)	Pin (dBm)	Eff (%)
400	13.2	160	38.8	47.0
1000	11.3	180	41.0	50.0
1500	13.4	180	39.0	40.0
2000	11.0	200	42.0	56.0
2500	14.0	180	38.4	56.0
3000	10.0	160	42.0	52.0

Applications

- S/L/P band power amplifier application
- Ultrawide band power amplifier application

Important Note: Proper Biasing Sequence for GaN HEMT Transistors

Turning the device ON

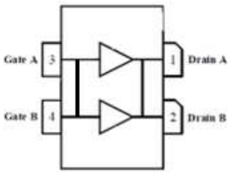
1. Set VGS to the pinch--off (VP) voltage, typically –5 V
2. Turn on VDS to nominal supply voltage
3. Increase VGS until IDS current is attained
4. Apply RF input power to desired level

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

Figure 1: Pin Connection definition

Transparent top view (Backside grounding for source)



***Notice: Both leads at input and output are internally connected, device is only usable as single ended**

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain--Source Voltage	V_{DSS}	+200	Vdc
Gate--Source Voltage	V_{GS}	-8 to +0.5	Vdc
Operating Voltage	V_{DD}	32	Vdc
Maximum gate current	Igs	21	mA
Storage Temperature Range	Tstg	-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 by FEA T_C= 25°C, at Pd=160W,	RθJC	0.9	°C /W

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

DC Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	VGS=-8V; IDS=21mA	V_{DSS}		200		V
Gate Threshold Voltage	VDS =10V, ID = 21mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	VDS =50V, IDS=200mA, Measured in Functional Test	$V_{GS(Q)}$		-2.9		V

Ruggedness Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	50V 4GHz, Pout=150W pulsed CW, All phase, No device damages	VSWR		10:1		

3-4GHz

Figure 2: Network analyzer output, S11 and S21 of 3-4GHz Class AB

```
Tr1 S21 Log Mag 10.00 dB / Ref 0.000 dB [RT D&M]
  1   3.0000000 GHz  11.264 dB
  2   3.2000000 GHz  11.963 dB
 >3   3.5000000 GHz  11.687 dB
  4   3.6000000 GHz  11.742 dB
  5   3.8000000 GHz  12.847 dB
  6   3.9000000 GHz  12.536 dB
  7   4.0000000 GHz  11.547 dB
```

```
Tr2 S11 Log Mag 10.00 dB / Ref 0.000 dB [F1 D&M]
  1   3.0000000 GHz -1.6693 dB
  2   3.2000000 GHz -2.1874 dB
 >3   3.5000000 GHz -2.8236 dB
  4   3.6000000 GHz -3.2348 dB
  5   3.8000000 GHz -3.7836 dB
  6   3.9000000 GHz -3.9860 dB
  7   4.0000000 GHz -3.5214 dB
```

1 Start 10 MHz   IFBW 70 kHz   Stop 5 GHz

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Figure 4: Picture of application board for 3-4GHz Class AB

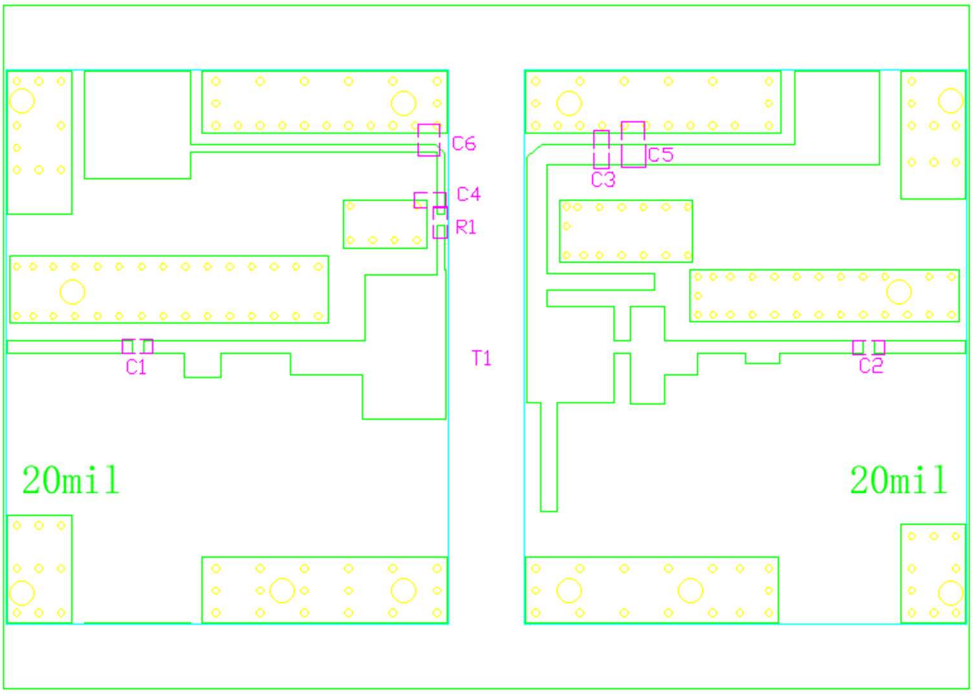
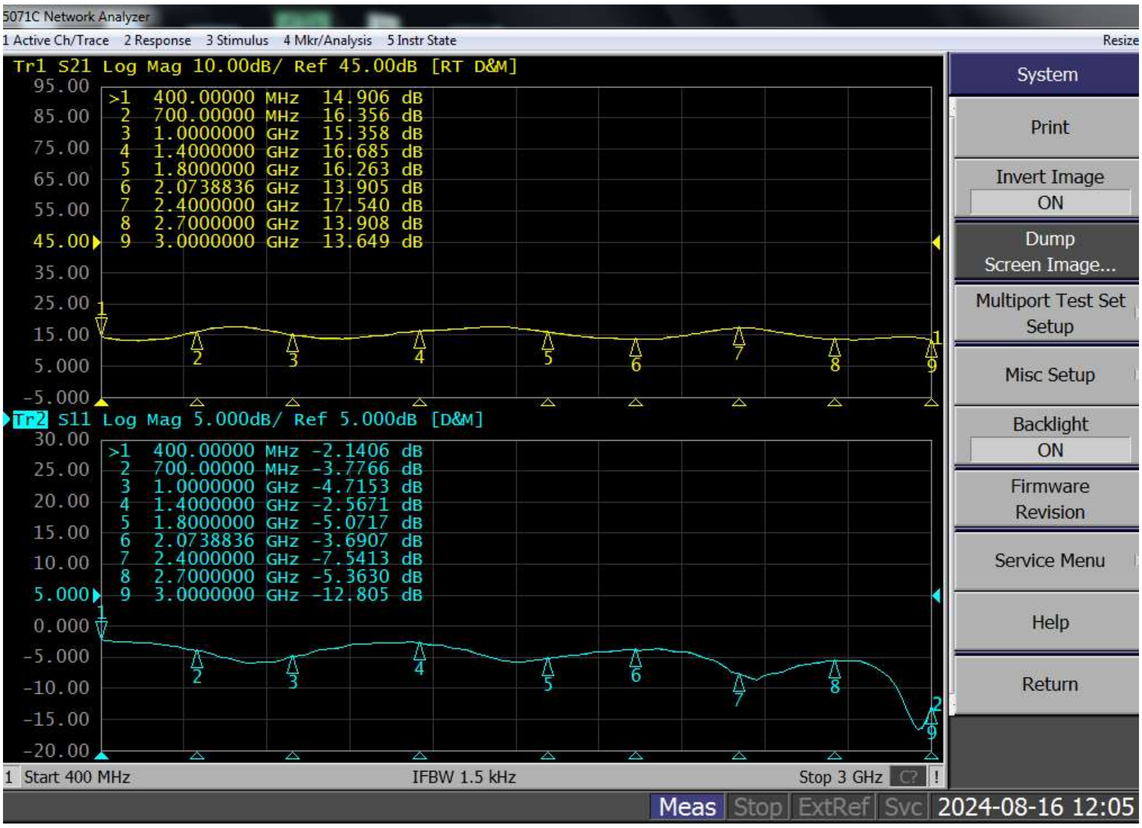


Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 20Mils)

Part	Quantity	Description	Part Number	Manufacturer
C1,C2,C3,C4	4	8.2pFHigh Q Capacitor	251SHS8R2BSE	TEMEX
R1	1	10Ω Power Resistor	ESR03EZPF100	ROHM
C5,C6	2	10uF MLCC	GRM32EC72A106ME05	Murata
T1	1	150W GaN Dual Transistor	S3L4015VS	Innogration

0.4-3GHz

Figure 5: Network analyzer output, S11 and S21 of 0.4-3GHz Class AB



```
Tr1 S21 Log Mag 10.00dB/ Ref 45.00dB [RT D&M]
>1  400.00000 MHz  14.906 dB
 2  700.00000 MHz  16.356 dB
 3  1.0000000 GHz  15.358 dB
 4  1.4000000 GHz  16.685 dB
 5  1.8000000 GHz  16.263 dB
 6  2.0738836 GHz  13.905 dB
 7  2.4000000 GHz  17.540 dB
 8  2.7000000 GHz  13.908 dB
 9  3.0000000 GHz  13.649 dB
```

```
Tr2 S11 Log Mag 5.000dB/ Ref 5.000dB [D&M]
>1  400.00000 MHz -2.1406 dB
 2  700.00000 MHz -3.7766 dB
 3  1.0000000 GHz -4.7153 dB
 4  1.4000000 GHz -2.5671 dB
 5  1.8000000 GHz -5.0717 dB
 6  2.0738836 GHz -3.6907 dB
 7  2.4000000 GHz -7.5413 dB
 8  2.7000000 GHz -5.3630 dB
 9  3.0000000 GHz -12.805 dB
```

```
1  Start 400 MHz          IFBW 1.5 kHz          Stop 3 GHz
```

Figure 6: Picture of application board for 0.4-3GHz Class AB

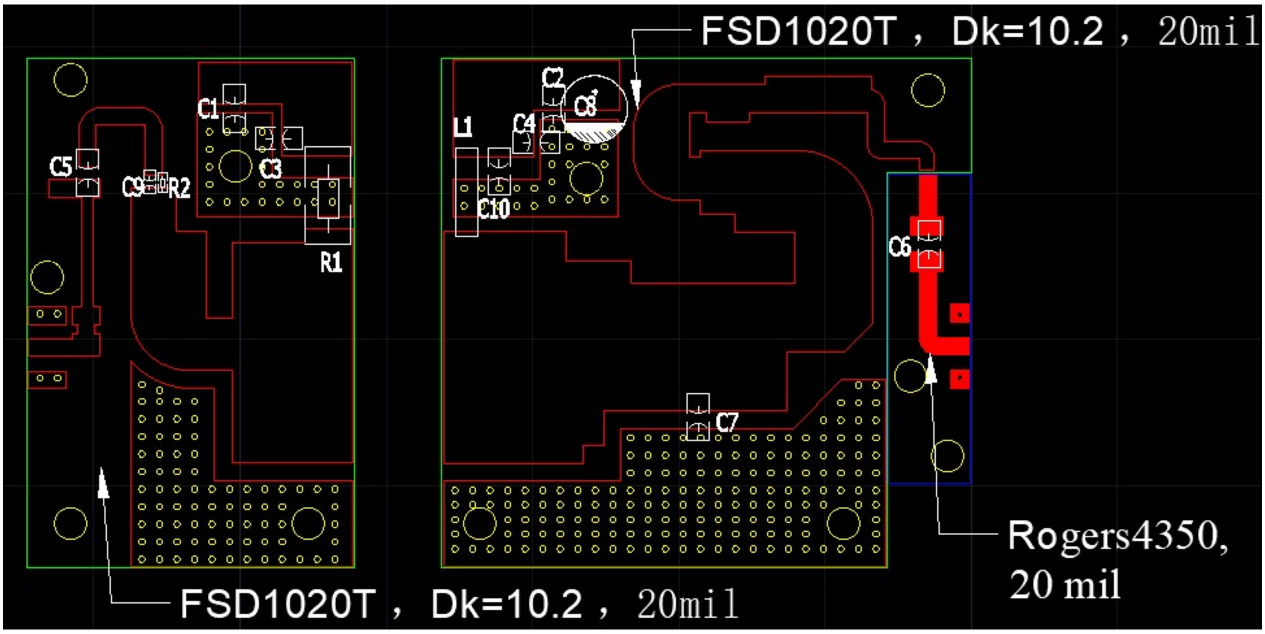
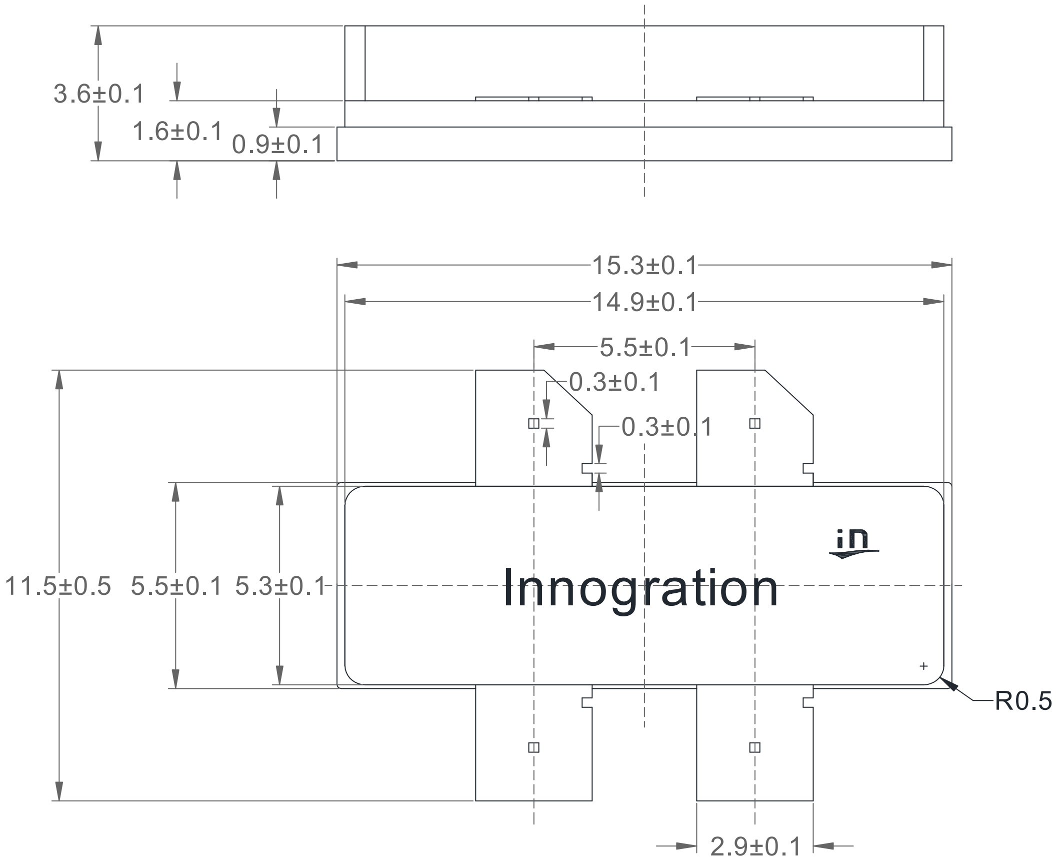


Table 5. Bill of materials of application board (PCB layout upon request, RO4350B 20Mils)

Component	Description	Suggestion
C1,C2,C10	10uF/200V-1210	Ceramic multilayer capacitor
C3	47pF	BEIJING YUANLU HONGYUAN ELECTRONIC TECHNOLOGY CO., LTD.MQ301111
C4	20pF	BEIJING YUANLU HONGYUAN ELECTRONIC TECHNOLOGY CO., LTD.MQ301111
C5,C6	36pf	BEIJING YUANLU HONGYUAN ELECTRONIC TECHNOLOGY CO., LTD.MQ300709
C7	0.5pF	BEIJING YUANLU HONGYUAN ELECTRONIC TECHNOLOGY CO., LTD.MQ101111
C8	470uF/63V	Electrolytic Capacitor
C9	24pF	BEIJING YUANLU HONGYUAN ELECTRONIC TECHNOLOGY CO., LTD.MQ100505
L1	1.5mm wire	DIY
R1	51Ω-2512	Chip Resistor
R2	10Ω*4（1206*1；0805*3）	Chip Resistor
PCB	FSD1020T ， Dk=10.2 ， 20mil ; Rogers 4350 20mil	

Earless Flanged Ceramic Package; 4 leads



Unit: mm

Revision history

Table 4. Document revision history

Date	Revision	Datasheet Status
2024/7/5	**V1.0**	**Production Datasheet Creation**
2024/8/16	**V1.1**	**Add 0.4-3GHz full band data**

Application data based on LWH-24-26/TC-24-51

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