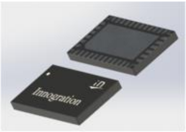
GaN 28V, 40W, HF to L band RF Power Transistor

STBH20040C6



Description

The STBH20040C6 is a 40W GaN HEMT, designed for multiple applications, up to 2GHz.

The transistor is available in a highly cost effective 10*6mm, surface mount, QFN package with 100% DC production test to ensure the quality and consistency.

It can be used in CW, Pulse and any other modulation modes.

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

- Typical 1.1-1.7G CW RF Performance with device soldered through high density and plated grounding vias
  Vds = 28V, Idq = 25mA,Vgs=-2.37V

Freq (MHz)	P1dB (dBm)	P1dB (W)	P1dB Eff(%)	P1dB Gain(dB)	P3dB (dBm)	P3dB (W)	P3dB Eff(%)
1100	45.30	33.92	65.57	15.97	46.35	43.10	73.29
1200	45.33	34.15	68.99	16.48	46.33	42.91	76.64
1300	45.40	34.69	70.58	17.49	46.38	43.46	77.34
1400	45.43	34.92	70.06	17.23	46.52	46.52	78.14
1500	45.37	34.47	66.10	16.67	46.57	45.40	73.29
1600	45.13	32.60	62.88	16.74	46.57	45.42	70.98
1700	44.72	29.67	64.38	16.65	46.16	41.31	72.57

- Typical 0.3-0.8G CW RF Performance with **2pcs devices configured as push-Pull** soldered through high density and plated grounding vias Vds = 28V, Idq = 300mA,Vgs=-3.2V

Freq (MHz)	Psat (W)	Ids (A)	Pin (dBm)	Gain (dB)	Eff (%)	2nd (dBc)	3^{rd}(dBc)
300	60.0	2.99	31.23	16.55	71.64	-18.6	-21.7
400	61.1	3.33	31.66	16.2	65.52	-23.5	-15.1
500	61.0	3.84	33.69	16.55	56.69	-17.5	-11
600	61.5	3.89	32.18	15.71	56.48	-18.4	-9
700	61.5	3.93	31.99	15.9	55.90	-18.5	-13
800	63.4	4.35	33.77	14.25	52.04	-27	-17

Applications

- HF to UHF band power amplifier
- L band power amplifier
- ISM/RF Energy power amplifier

Important Note: Proper Biasing Sequence for GaN HEMT Transistors

Turning the device ON

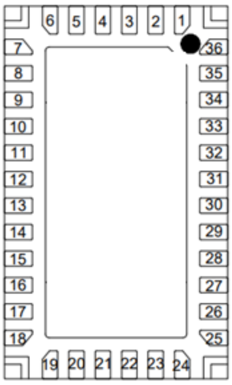
1. Set VGS to the pinch--off (VP) voltage, typically –5 V
2. Turn on VDS to nominal supply voltage
3. Increase VGS until IDS current is attained
4. Apply RF input power to desired level

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)



Pin No.	Symbol	Description
8,9,10,11,14,15,16,17	RF IN/Vgs	RF Input, Vgs bias
26,27,28,29,32,33,34,35	RF OUT/VDD	RFOutput, Drain bias
Rest Pins and Package Base	GND	DC/RF Ground. Must be soldered directly to heatsink or copper coin for CW application.

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}	36	Vdc
Maximum gate current	Igs	10	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= 85°C, at Pdiss=20W	$R_{\theta JC}$	4	°C /W

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

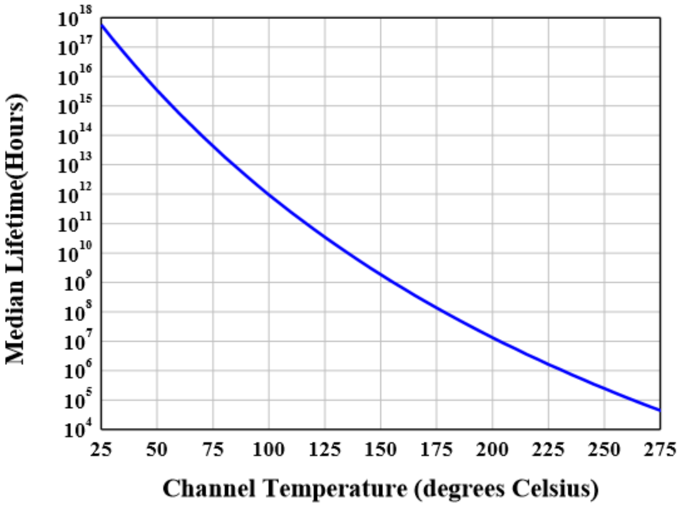
DC Characteristics (main path, measured on wafer prior to packaging)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	VGS=-8V; IDS=10mA	V_{DSS}		200		V
Gate Threshold Voltage	VDS =10V, ID = 10mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	VDS =28V, IDS=100mA, Measured in Functional Test	$V_{GS(Q)}$		-3.3		V

Ruggedness Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	1.6GHz, Pout=40W Pulsed CW All phase, No device damages	VSWR		10:1		

Figure 2: Median Lifetime vs. Channel Temperature



1.1-1.7GHz

Typical performance

Figure 3: Efficiency and power gain as function of Pout

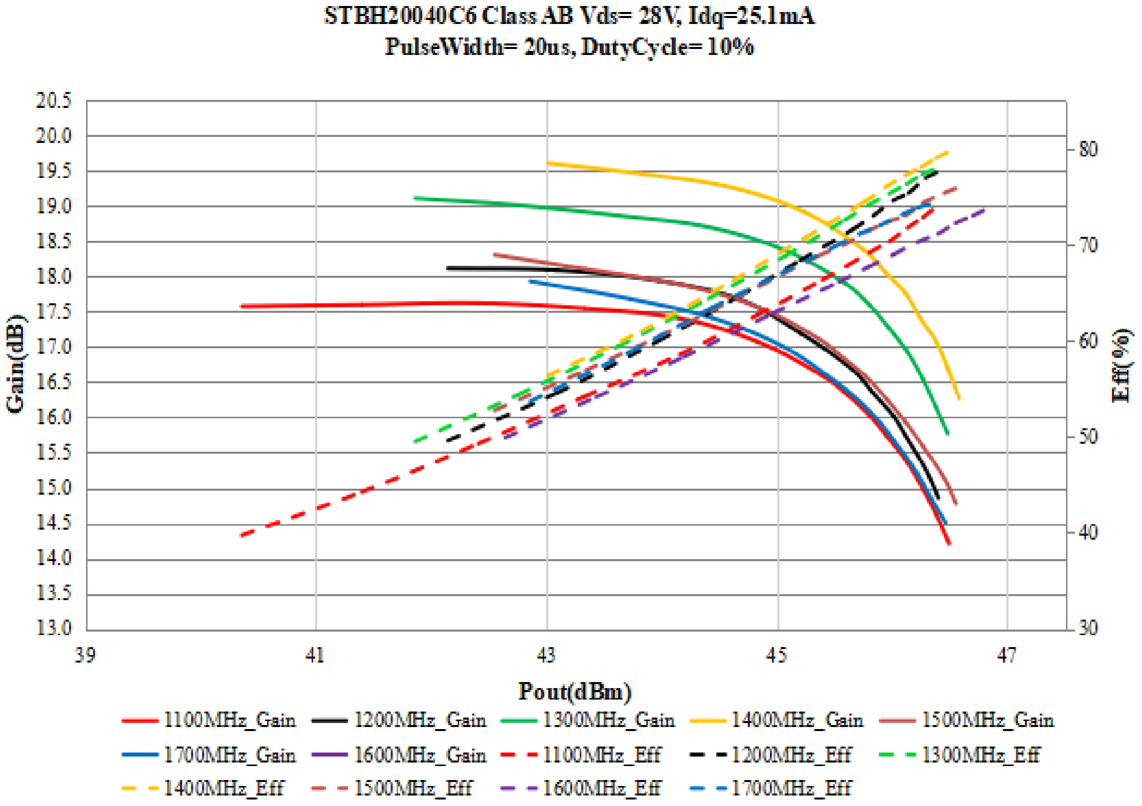
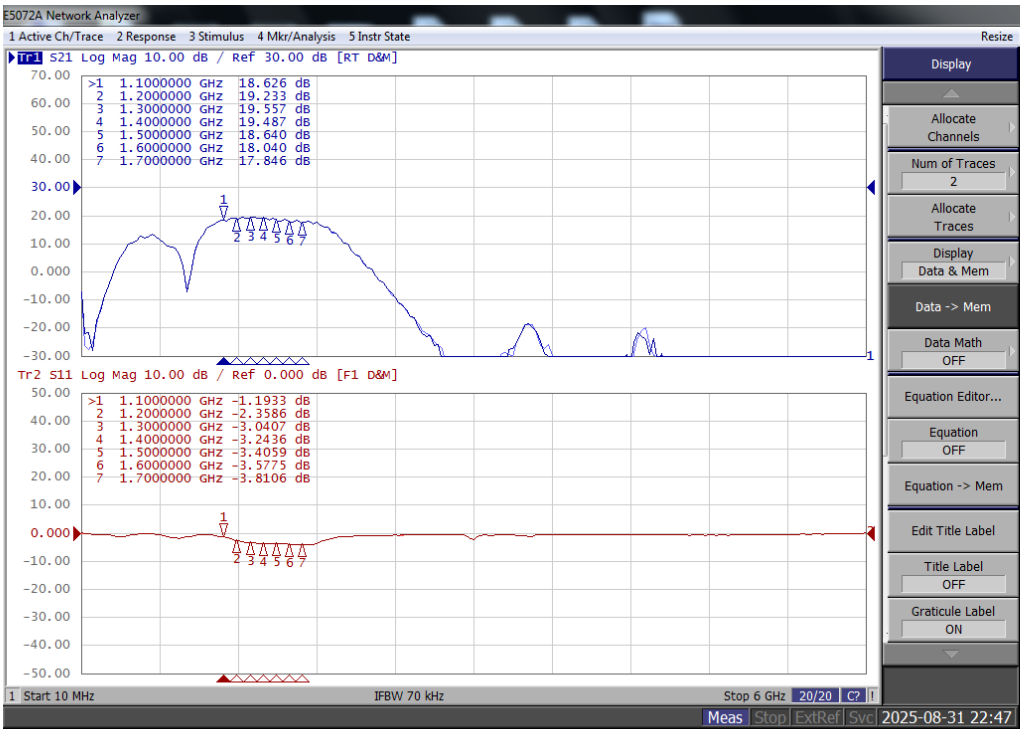


Figure 4: Network analyzer output S11/S21



```
Tr1 S21 Log Mag 10.00 dB / Ref 30.00 dB [RT D&M]
>1  1.1000000 GHz  18.626 dB
 2  1.2000000 GHz  19.233 dB
 3  1.3000000 GHz  19.557 dB
 4  1.4000000 GHz  19.487 dB
 5  1.5000000 GHz  18.640 dB
 6  1.6000000 GHz  18.040 dB
 7  1.7000000 GHz  17.846 dB
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```
Tr2 S11 Log Mag 10.00 dB / Ref 0.000 dB [F1 D&M]
>1  1.1000000 GHz -1.1933 dB
 2  1.2000000 GHz -2.3586 dB
 3  1.3000000 GHz -3.0407 dB
 4  1.4000000 GHz -3.2436 dB
 5  1.5000000 GHz -3.4059 dB
 6  1.6000000 GHz -3.5775 dB
 7  1.7000000 GHz -3.8106 dB
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Figure 5: Picture of application board

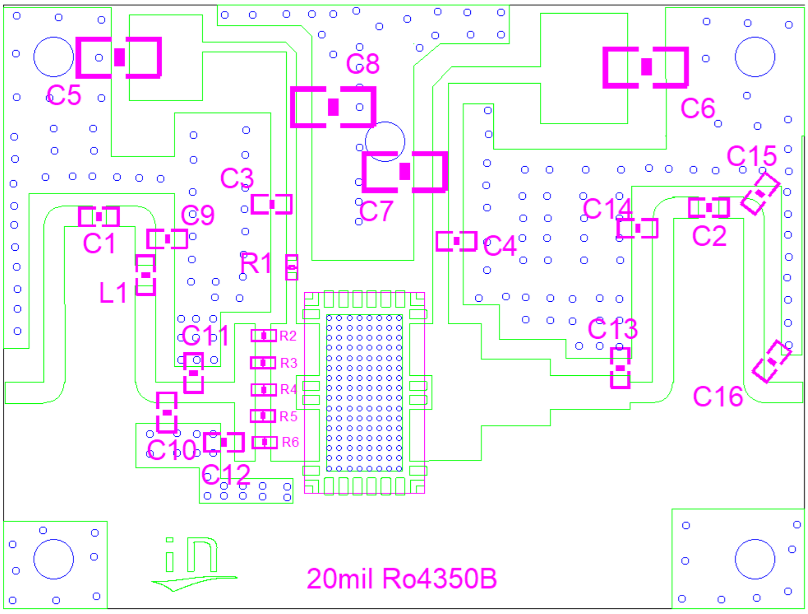


Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

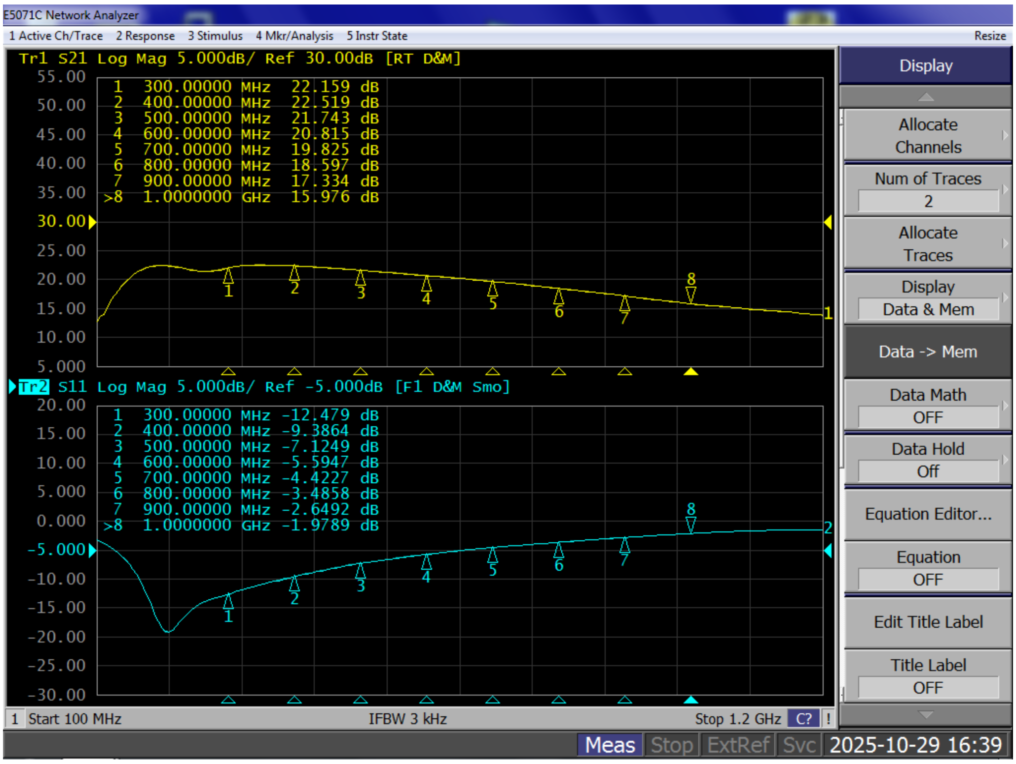
C1	1	3.9pFHigh Q Capacitor	251SHS3R9BSE	TEMEX
C2,C3,C4	3	30pFHigh Q Capacitor	251SHS30BSE	TEMEX
C9	1	1.0pFHigh Q Capacitor	251SHS1R0BSE	TEMEX
C10	1	3pFHigh Q	251SHS3R0BSE	TEMEX

		Capacitor		
C11	1	5.1pFHigh Q Capacitor	251SHS5R1BSE	TEMEX
C12	1	1.8pFHigh Q Capacitor	251SHS1R8BSE	TEMEX
C13	1	3.9pFHigh Q Capacitor	251SHS3R9BSE	TEMEX
C14	1	0.5pFHigh Q Capacitor	251SHS0R5BSE	TEMEX
C15	1	0.2pFHigh Q Capacitor	251SHS0R2BSE	TEMEX
C16	1	0.6pFHigh Q Capacitor	251SHS0R6BSE	TEMEX
C5,C6,C7,C8	4	10uF MLCC	GRM32EC72A106ME05	Murata
L1	1	1.5nH Inductance	/	/
R1	1	10Ω Power Resistor	ESR03EZPF100	ROHM
R2,R3,R4,R5,R6	1	5Ω Power Resistor	ESR03EZPF100	ROHM
T1	1	GaN Transistor	STBH20040C6	Innogration

300-800M with 2pcs push pull

Typical performance

Figure 6: Network analyzer output S11/S21



```
Tr1 S21 Log Mag 5.000dB/ Ref 30.00dB [RT D&M]
 1  300.00000 MHz  22.159 dB
 2  400.00000 MHz  22.519 dB
 3  500.00000 MHz  21.743 dB
 4  600.00000 MHz  20.815 dB
 5  700.00000 MHz  19.825 dB
 6  800.00000 MHz  18.597 dB
 7  900.00000 MHz  17.334 dB
>8  1.0000000 GHz  15.976 dB

Tr2 S11 Log Mag 5.000dB/ Ref -5.000dB [F1 D&M Smo]
 1  300.00000 MHz -12.479 dB
 2  400.00000 MHz -9.3864 dB
 3  500.00000 MHz -7.1249 dB
 4  600.00000 MHz -5.5947 dB
 5  700.00000 MHz -4.4227 dB
 6  800.00000 MHz -3.4858 dB
 7  900.00000 MHz -2.6492 dB
>8  1.0000000 GHz -1.9789 dB
```

Figure 7: Picture of application board

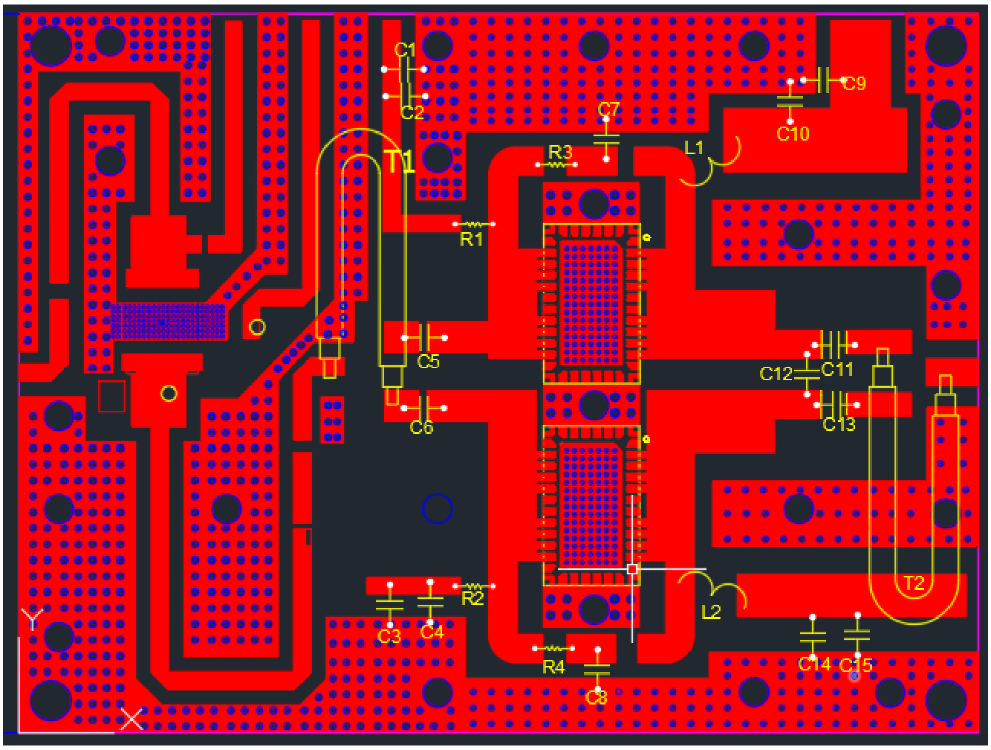
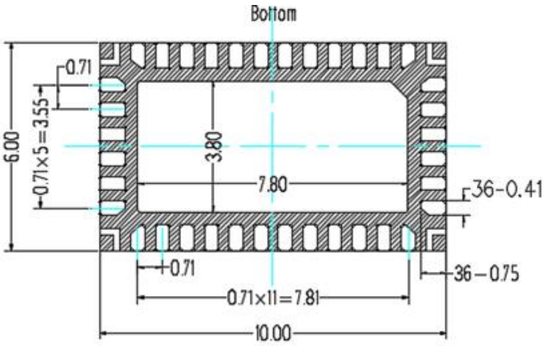
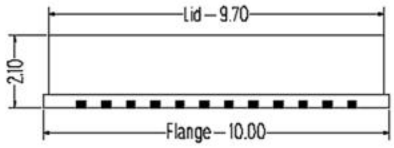


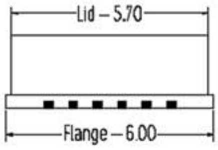
Table 5. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

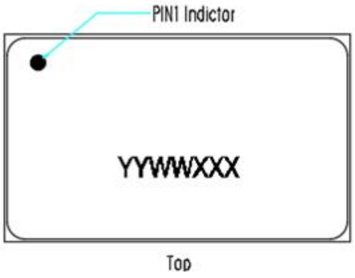
C1,C3,C7,C8,C9,C15	10uF	/
C10,C14	1000pF/MQ301111	BEIJING YUANLU HONGYUAN ELECTRONICTECHNOLOGY CO., LTD
C5,C6,C11,C13	47pF/MQ301111	BEIJING YUANLU HONGYUAN ELECTRONICTECHNOLOGY CO., LTD
C2,C4	47pF/MQ40-0805	BEIJING YUANLU HONGYUAN ELECTRONICTECHNOLOGY CO., LTD
C12	3pF/MQ301111	BEIJING YUANLU HONGYUAN ELECTRONICTECHNOLOGY CO., LTD
R1,R2	300Ω/1206	/
R3,R4	10Ω/0805	/
T1,T2	50ohm,50mm,	RFSFBU-086-50

10*6 Plastic Package









Notes:

1. All dimensions are in mm;
2. The tolerances unless specified are ±0.2mm.

Revision history

Table 4. Document revision history

Date	Revision	Datasheet Status
2025/9/1	V1.0	Preliminary Datasheet Creation
2025/11/8	V1.1	Add 0.3-0.8G push pull application info

Application data based on: HZH-25-08/SJJ-25-34

Notice