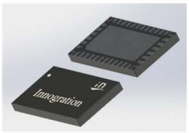
GaN HEMT 50V, 100W, 0.6-1GHz Power Transistor

STAV10100C6



Description

The STAV10100C6 is a dual path 100W, internal matched GaN HEMT, operated from 0.6-1GHz.

It features high gain, high efficiency, wide band and low cost, in 10*6mm open cavity plastic package.

It can be configured as a single stage Doherty capable of delivering Pavg of 10-16W according to normal 8-10dB back off

There is no guarantee of performance when this part is used outside of stated frequencies.

- Typical wideband Doherty 1C WCDMA Performance(On innogration broadband board with device soldered):

V_{DD} = 50 Vdc, I_{DQA} = 50 mA, V_{GSB} = –5.5Vdc, Input Signal PAR = 10 dB @ 0.01% Probability on CCDF

Freq (MHz)	Pout (dBm)	ACPR (dBc)	Gain (dB)	Efficiency (%)
617	40.00	-31.8	19.6	40.4
635	40.00	-33.0	19.6	41.0
652	40.00	-33.7	19.7	41.7
728	40.00	-31.4	20.1	45.9
748	40.00	-32.1	20.0	48.8
768	40.00	-29.5	18.9	49.2
862	40.00	-31.2	18.2	39.7
878	40.00	-29.3	18.0	38.4
894	40.00	-27.2	17.9	39.6

- Typical wideband Doherty 1C WCDMA Performance(On innogration broadband board with device soldered):

V_{DD} = 50 Vdc, I_{DQA} = 40mA, V_{GSB} = –5.5Vdc, Input Signal PAR = 10 dB @ 0.01% Probability on CCDF

Freq (MHz)	Pout (dBm)	ACPR (dBc)	Gain (dB)	Efficiency (%)
758	42.0	-31.6	18.8	54.6
780	42.0	-31.3	18.8	51.1
803	42.0	-30.4	19.0	51.2
821	42.0	-31.4	19.2	51.4
860	42.0	-35.0	19.4	51.7
900	42.0	-32.7	19.3	50.4
930	42.0	-29.1	19.1	49.6
945	42.0	-29.2	19.1	50.2
960	42.0	-27.5	19.1	50.8

- Typical wideband Doherty 1C WCDMA Performance(On innogration narrow band board with device soldered):

V_{DD} = 50 Vdc, I_{DQA} = 40 mA, V_{GSB} = –6Vdc, Input Signal PAR = 10 dB @ 0.01% Probability on CCDF

Freq (MHz)	Pout (dBm)	CCDF (dB)	ACPR (dBc)	Gain (dB)	Eff (%)
758	40	9.11	-31.8	19.4	52.9
780	40	9.37	-32.2	19.1	52.5
803	40	9.22	-30.7	18.4	50.7

Applications

- 4G/5G Doherty amplifier within 0.6-1GHz either as driver or as final
- UHF TV

Important Note: Proper Biasing Sequence for GaN HEMT Transistors

Turning the device ON

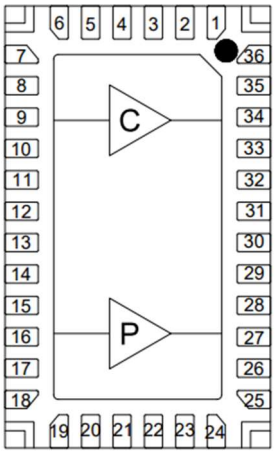
1. Set VGS to the pinch--off (VP) voltage, typically –5 V
2. Turn on VDS to nominal supply voltage
3. Increase VGS until IDS current is attained
4. Apply RF input power to desired level

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
9,10	RF IN/Vgs1	RF Input, Vgs bias for main path
14,15,16	RF IN/Vgs2	RF Input, Vgs bias for peak path
33,34	RF OUT/VDD1	RF Output, VDD bias for Main path
27,28,29	RF OUT/VDD2	RF Output, VDD bias for Peak path
Rest pins	NC	No connection
2,5,7,12,13,18,20,23,25,30,31,36, 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}	55	Vdc
Maximum gate current	Igs	9	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, Pdiss=15W at Pavg=40dBm WCDMA 1 carrier	$R_{\theta JC}$	4	°C /W

Notes: Based on expected carrier amplifier efficiency of Doherty, Pavg assumes 10% peaking amplifier contribution of total average Doherty rated power. Thermal resistance is measured to package backside

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=5mA	V_{DSS}		200		V
Gate Threshold Voltage	VDS =10V, ID = 5mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	VDS =50V, IDS=50mA, Measured in Functional Test	$V_{GS(Q)}$		-3.1		V

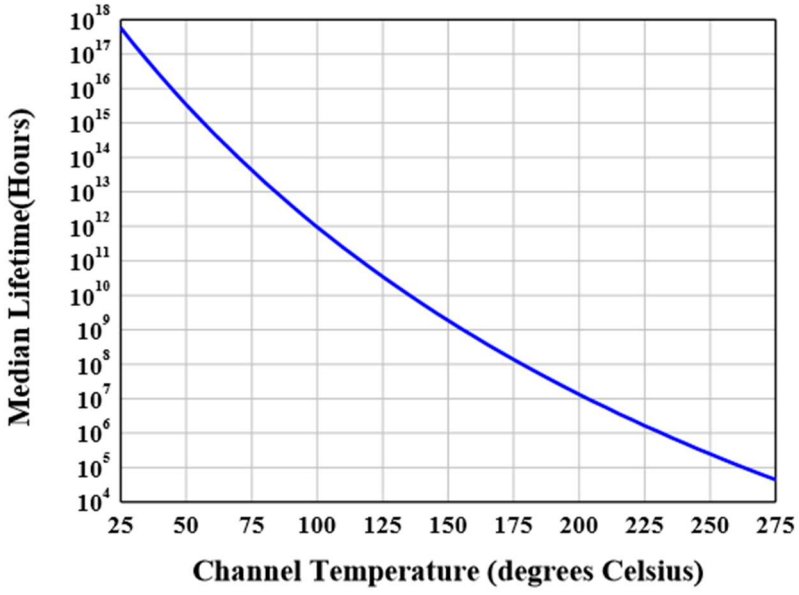
DC Characteristics (peak path, measured on wafer prior to packaging)

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	VGS=-8V; IDS=7.5mA	V_{DSS}		200		V
Gate Threshold Voltage	VDS =10V, ID = 7.5mA	$V_{GS(th)}$	-4		-2	V
Gate Quiescent Voltage	VDS =50V, IDS=75mA, Measured in Functional Test	$V_{GS(Q)}$		-3.1		V

Ruggedness Characteristics

Characteristic	Conditions	Symbol	Min	Typ	Max	Unit
Load mismatch capability	1GHz, Pout=40dBm WCDMA 1 Carrier, All phase, No device damages	VSWR		10:1		

Figure 2: Median Lifetime vs. Channel Temperature



Typical performance
0.6-0.9GHz broadband Doherty

Table 3: Efficiency and power gain as function of Pout (0.6-0.9GHz Doherty)

Freq (MHz)	P3dB Gain(dB)	P5dB (dBm)	P5dB (W)	P5dB Eff(%)
617	18	49.89	97.6	60.6
635	17.98	50.02	100.5	58.1
652	17.99	49.83	96.3	56.1
728	18.26	50.53	112.9	62.2
748	18.25	50.37	108.8	60.6
768	17.59	49.21	83.4	50.8
862	15.67	50.24	105.6	54.1
878	15.81	50.35	108.4	54.4
894	16.01	50.39	109.3	57.3

Figure 4: Network analyzer output, S11 and S21 (0.6-0.9GHz Doherty)

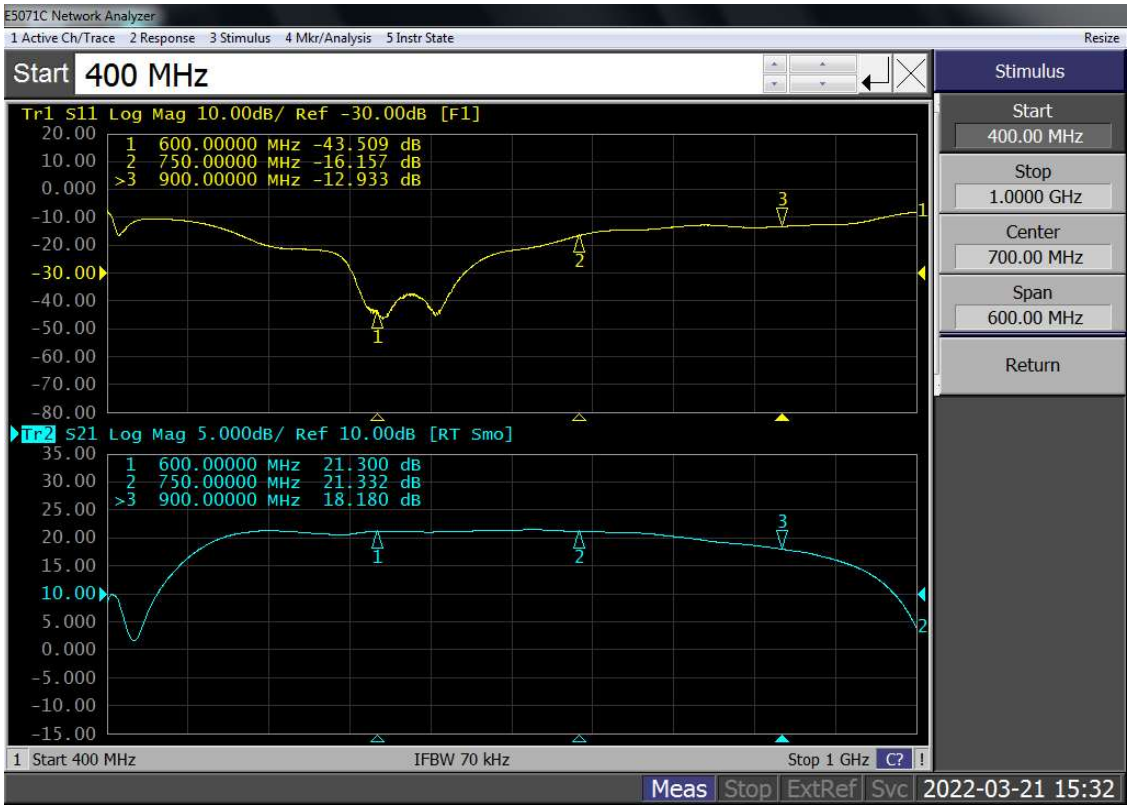


Figure 5: Picture of application board Doherty circuit for 0.6-0.9GHz

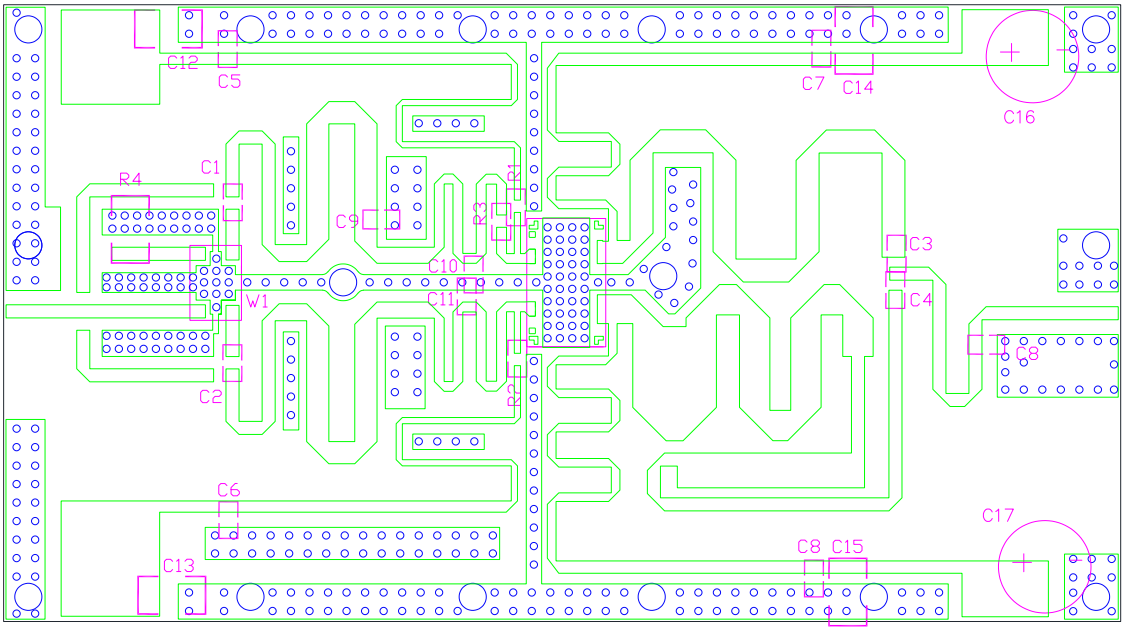


Table 4. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

Designator	Comment	Footprint	Quantity
C1, C2, C3, C4, C5, C6, C7, C8	68pF	0603	8
C9	1.0 pF	0603	1
C10, C11	8.2 pF	0603	2
C18	3.3 pF	0603	1
C12, C13, C14, C15	10 uF/100V	1210	4
C16, C17	100 uF/63V		2
R1, R2	10 Ω	0603	2
R3	5.6 Ω	0603	1
R4	51 Ω	1206	1
W1	HC07F03 (700-1000 MHz)	5.08x3.18mm	1

Typical performance
758-803MHz narrow band Doherty

Figure 5: Efficiency and power gain as function of Pout

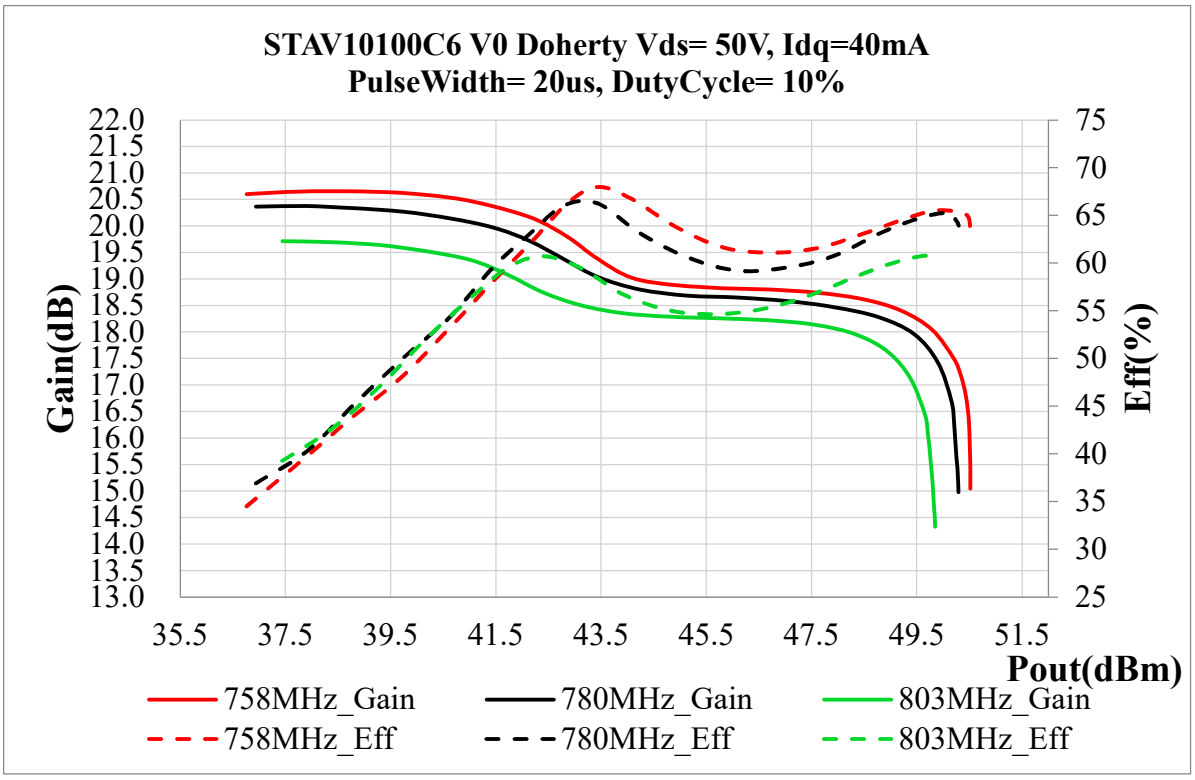


Figure 6: Network analyzer output, S11 and S21

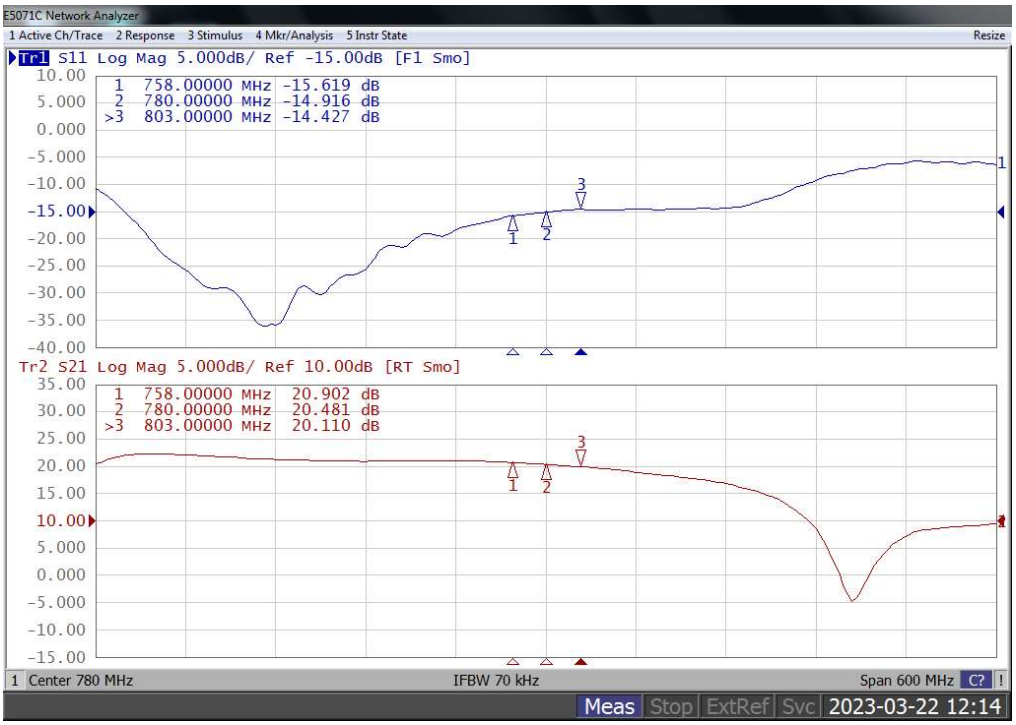


Figure 7: Picture of application board Doherty circuit for 758-803MHz

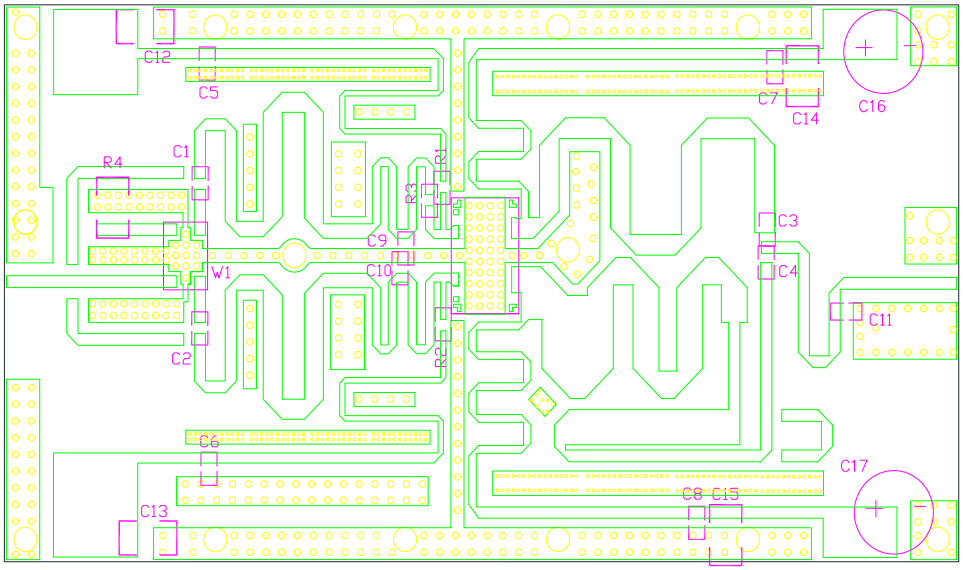
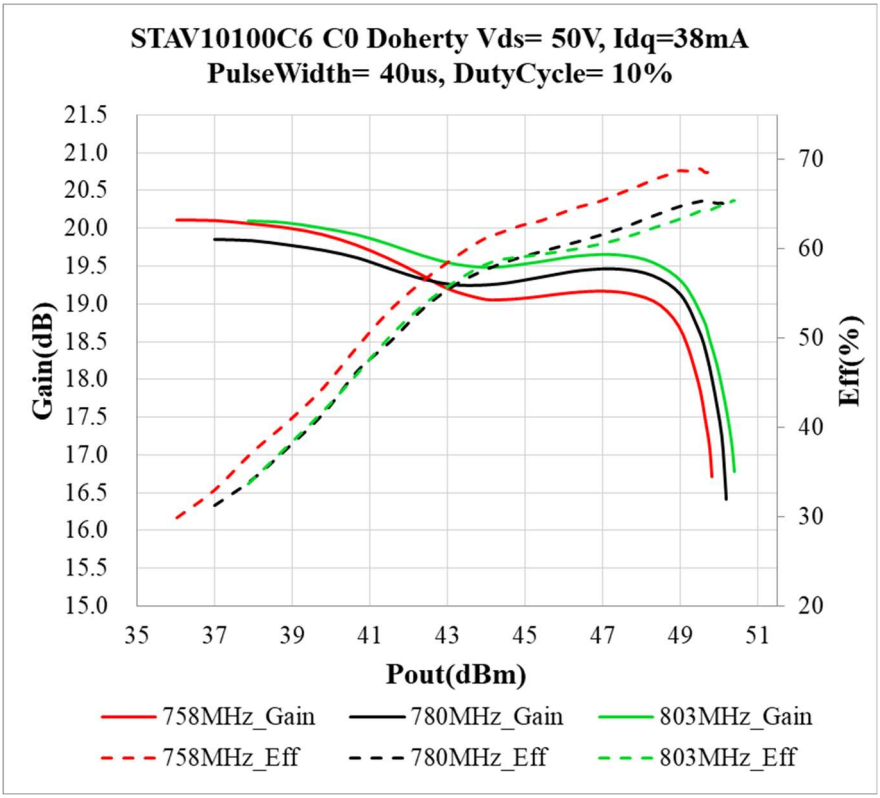


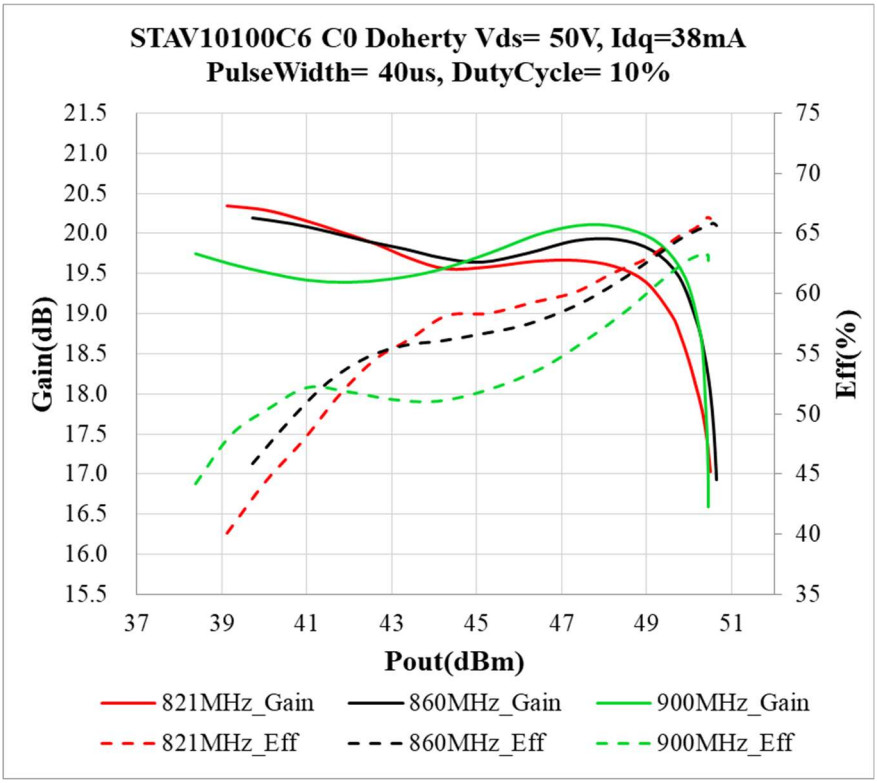
Table 5. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

Designator	Comment	Footprint	Quantity
C1, C2, C3, C4, C5, C6, C7, C8	68pF	0603	8
C9, C10	8.2 pF	0603	2
C11	3.3 pF	0603	1
C12, C13, C14, C15	10 uF/100V	1210	4
C16 C17	100 uF/63V		2
R1, R2	10 Ω	0603	2
R3	5.6 Ω	0603	1
R4	51 Ω	1206	1
W1	HC07F03 (700-1000 MHz)	5.08x3.18mm	1

Typical performance
758-960MHz wideband Doherty

Figure 8: Efficiency and power gain as function of Pout





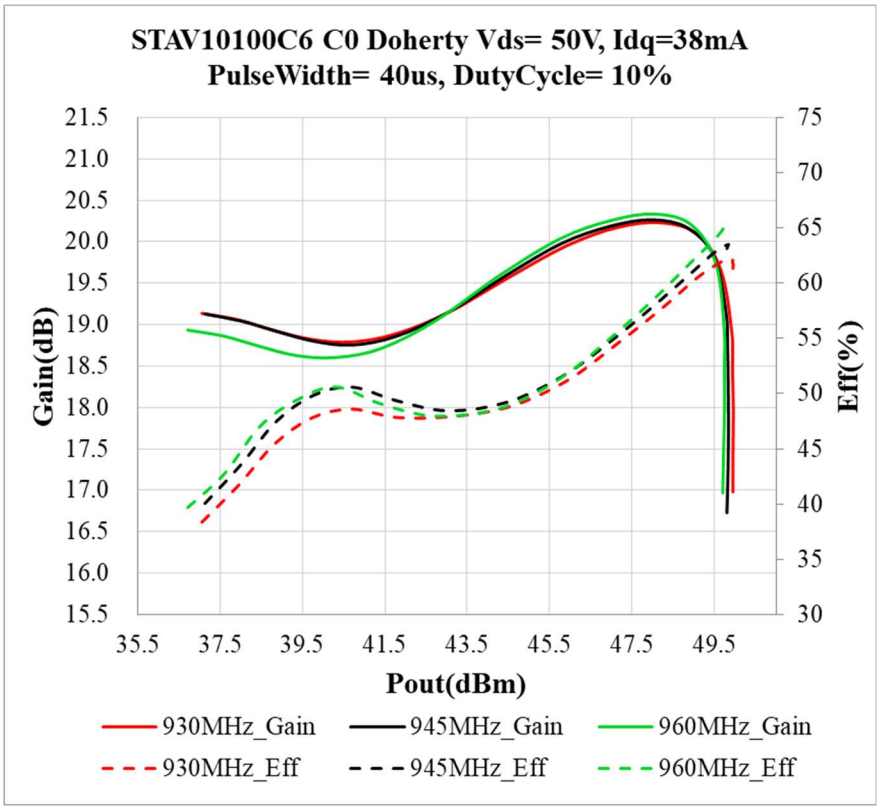


Figure 9: Network analyzer output, S11 and S21

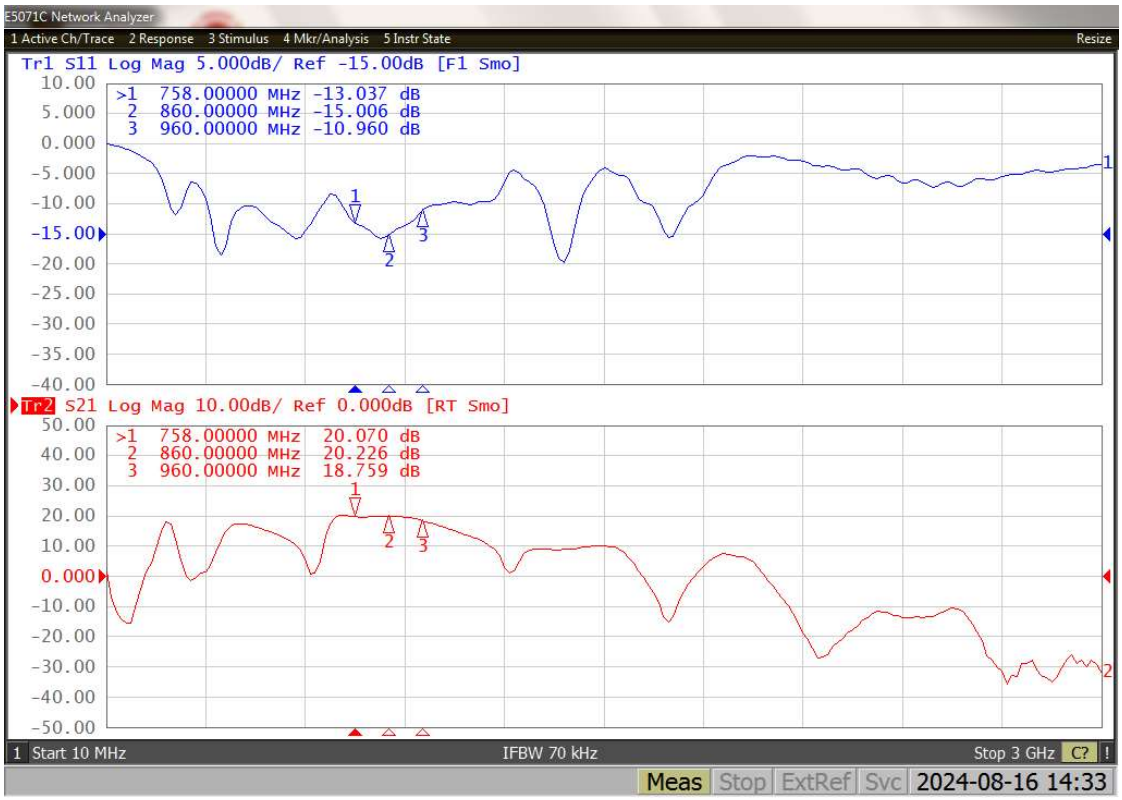


Figure 10: Picture of application board Doherty circuit for 758-960MHz

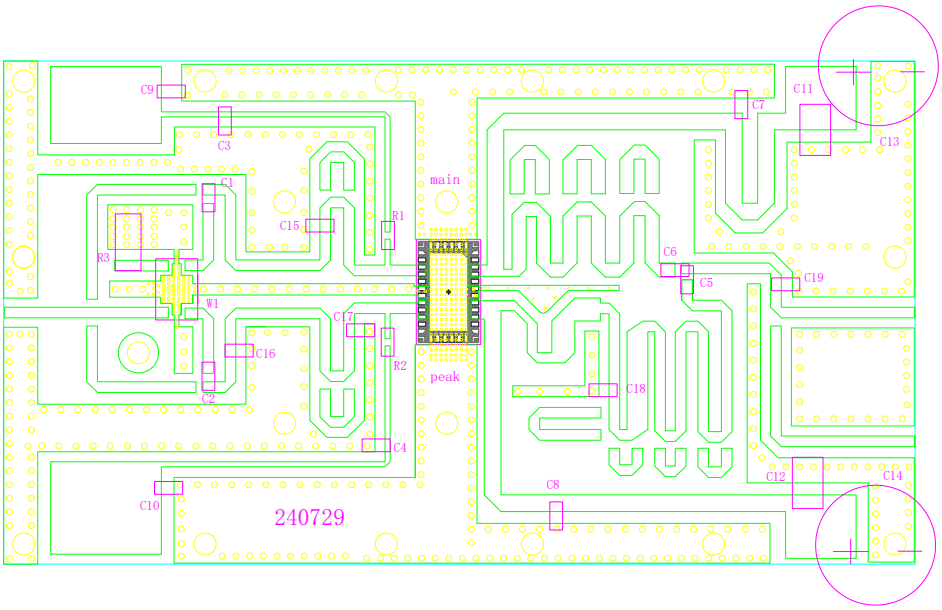
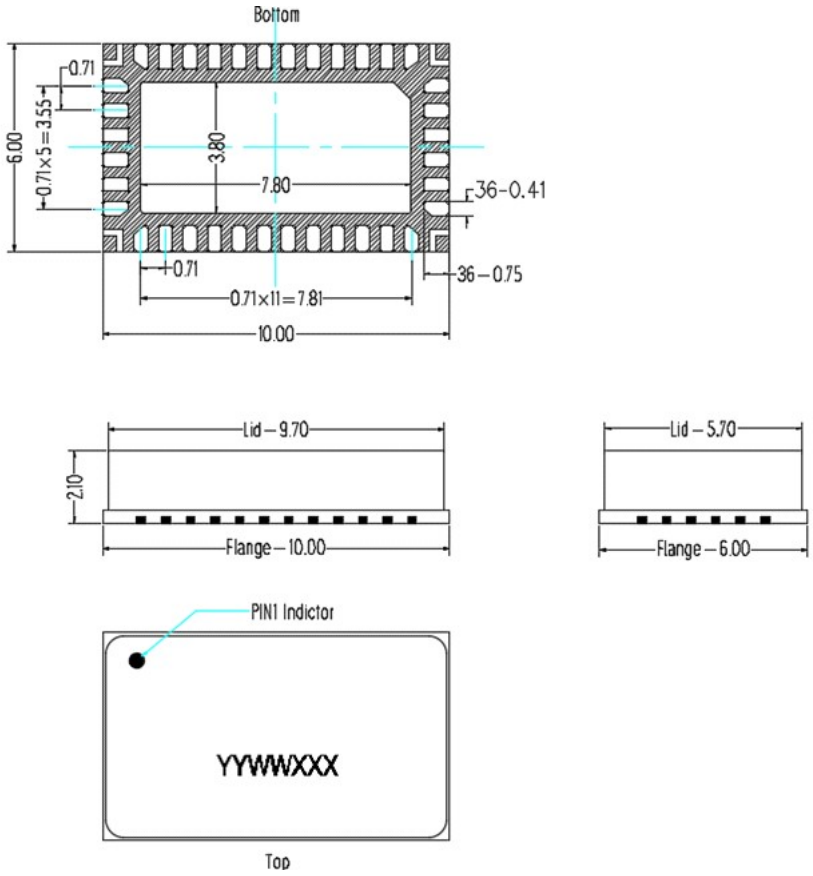


Table 6. Bill of materials of application board (PCB layout upon request, RO4350B 20mils)

Designator	Comment	Footprint	Quantity
C1, C2, C17	6.8pF	0603	2
C3, C4, C5, C6, C7, C8	68pF	0603	6
C9, C10	10 nF	0603	2
C11, C12	10 uF/100V	1210	2
C13, C14	470 uF/63V		2
C15, C18	2.0 pF	0603	2
C16	0.3 pF	0603	1
C19	3.0 pF	0603	1
R1, R2	10 Ω	0603	2
R3	51 Ω	1206	1
W1	DC07F02	5.08x3.18mm	1

Package Dimensions

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
2022/3/21	V1.0	Preliminary Datasheet Creation
2022/7/13	V1.1	Modify the BOM of application board
2022/12/9	V1.2	Update on Pin Definition
2023/3/22	V1.3	Add 758-803MHz narrow band Doherty application data
2024/8/16	V1.4	Add 758-960MHz wideband Doherty application data

Application data based on: LSM-22-02/23-13/24-27

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