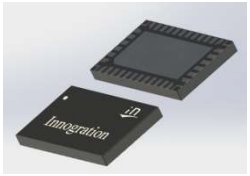
3.7-4.1GHz, 70W, 50V GaN matched PA Module

Description



The SMAV3741-70 is a 70-watt, integrated 2-stage Power Amplifier Module, designed for 5G massive MIMO applications, with frequencies up to 4.1 GHz. The module is 50 Ω input fully matched and output partially matched, and requires minimal external components. The module offers a much smaller footprint than traditional discrete component solutions，with much less sensitivity for production, housed in 10*6mm cost effective plastic open cavity package, and heat dissipated by copper flange.

Other Doherty reference design: 3.6-4GHz 70W @50V ,3.4-4GHz 60W @46V

- Typical Performance of Doherty Demo (On Innogration **3.7-4.1GH**z fixture with device soldered with grounding vias):

VDS= **50**V, IDQ-main=62mA Vgs-main=-2.97V. Vgs-peak=-4.9V, Idq-driver=12mA, Vgs-Driver=-2.76V

Freq (GHz)	Pulse CW Signal(1)				Pavg=40.5dBm WCDMA Signal(2)		
	P1dB (dBm)	Gp@ P1dB (dB)	P3dB (W)	η_D@P3dB (%)	Gp (dB)	η_D (%)	ACPR5M (dBc)
3.7	47.30	28.12	78.16	60.08	27.96	43.51	-28.78
3.8	46.82	28.57	75.16	61.83	28.47	44.90	-29.85
3.9	46.44	29.05	72.77	62.55	28.72	44.84	-31.78
4.0	43.61	29.22	68.39	62.44	28.35	43.54	-33.59
4.1	40.98	28.68	71.94	65.07	27.74	43.40	-29.96

- Typical Performance of Doherty Demo (On Innogration **3.6-4.0GH**z fixture with device soldered with grounding vias):

VDS= **50**V, IDQ-main=62mA Vgs-main=-2.97V. Vgs-peak=-4.9V, Idq-driver=12mA, Vgs-Driver=-2.76V

Freq (GHz)	Pulse CW Signal(1)				Pavg=40.5dBm WCDMA Signal(2)		
	P1dB (dBm)	Gp@ P1dB (dB)	P3dB (W)	η_D@P3dB (%)	Gp (dB)	η_D (%)	ACPR5M (dBc)
3.6	47.17	48.83	76.50	57.62	27.74	44.44	-30
3.8	46.81	48.51	71.01	60.96	27.76	44.77	-31
4.0	47.78	48.52	71.16	62.82	27.57	43.31	-33

- Typical Performance of Doherty Demo (On Innogration **3.4-4.0GH**z fixture with device soldered with grounding vias):

VDS= **46**V, IDQ-main=46mA Vgs-main=-2.99V. Vgs-peak=-4.7V, Idq-driver=15mA, Vgs-Driver=-2.87V

Freq (GHz)	Pulse CW Signal(1)			Pavg=39dBm WCDMA Signal(2)		
	P1-Gain (dB)	P3 (dBm)	P3 (W)	Gp (dB)	η_D (%)	ACPR5M (dBc)
3.4	29.18	48.50	70.80	29.31	41.09	-29.18
3.6	28.92	48.22	66.40	29.50	41.61	-31.82
3.8	30.73	47.75	59.60	30.84	44.45	-30.66
4.0	28.46	48.10	64.60	28.55	40.67	-31.50

Notes:

(1) Pulse Width=100 us, Duty cycle=20%
(2) WCDMA signal: 3GPP test model 1; 1 to 64 DPCH; Channel Bandwidth=3.84MHz,PAR =10.5 dB at 0.01 % probability on CCDF.

Features and Benefits

- Adjustable drain bias to fit different power demand
- Extremely good VBW performance to enable the broadest IBW/OBW
- Industry leading RF performance for 5G MIMO AAU, for instance
  - ✓ 64T:320 to 400W / 200MHz
  - ✓ 32T:160W to 200W / 200MHz
- Plastic open cavity without molding compound brings advantage compared to molded design
  - ✓ Minimize the risk of high density thermal distribution in fanless system for longer life time
  - ✓ Highly consistent RF performance for yield of volume production
- 50 Ω Input matched, output partially matched, effective PCB space smaller than 12*20mm
- Integrated Doherty Final and driver Stage
- 6x10 mm Surface Mount Package, full copper flange underneath for grounding and heat dissipation, much more effective than LGA PCB based design

Pin Configuration and Description

Pin No.	Symbol	Description
6	RF IN	RF Input
1	VDS-driver	Driver stage, Drain Bias
4	VGS-driver	Driver stage, Gate Bias
19,21	RF Out2	RF Output，Main Amplifier
22,24	RF Out1	RF Output, Peaking Amplifier
11	VGS-main	Main Amplifier, Gate Bias
16,17	VDS-main	Main Amplifier, Drain Bias
32	VGS-peak	Peaking Amplifier, Gate Bias
26,27	VDS-Peak	Peaking Amplifier, Drain Bias
3,8-10,14,15,28,29,33-35	NC	No connection
2,5,7,12,13,18,20,23,25,30,31,36	GND	Internal Grounding, recommend connecting to Epad ground
Package Base	GND	DC/RF Ground. Must be soldered to EVB ground plane over array of vias for thermal and RF performance. Solder voids under Pkg Base will result in excessive junction temperatures causing permanent damage.

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain--Source Voltage	V_{DSS}	200	Vdc
Gate--Source Voltage	V_{GS}	-8 to +0.6	Vdc
Operating Voltage	V_{DD}	+60	Vdc
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@Average Power, Junction to Case Tcase=+85℃，CW Test，，Pout=11W,	$R_{\theta JC}$	3.7	°C/W

Notes:
(1) The thermal resistance is acquired by our company's FEA model,which was calibrated by IR measurement,the value shall be applied to reliability.
(2) The reference Tcase temperature 85℃ is apply on the backside of package.
(3) If the device soldering onto the 20mil Rogers PCB with 50×Φ0.4mm via hole beneath the package backside and the reference temperature Tcase（85℃） apply on the groundside of the PCB, the total thermal resistance Rθ JC (TBD)℃/W.
(4) The power dissipation in the table is overall dissipation which include Carrier PA, Peaking PA and driver PA.

Table 3. ESD Protection Characteristics

Test Methodology	Class Voltage
Human Body Model(HBM) (JEDEC Standard JESD-A114)	TBD
Charged Device Model (CDM) (JEDEC Standard JESD22-C101F)	±1000V

Table 4. Electrical Characteristics

Parameter	Condition	Min	Typ	Max	Unit
Frequency Range		3.7		4.1	GHz
Driver Quiescent Current ($I_{DQ\text{-}driver}$)			20		mA
Carrier Quiescent Current ($I_{DQ\text{-}main}$)			62		mA
Peak PA Gate Quiescent Voltage (V_{PEAK})			-4.9		V
Power Gain @ Pout=40.5dBm	Freq=3.9GHz	28	28.7		dB
Efficiency @Pout=40.5dBm	Freq=3.9GHz	43	44.8		%
Ppeak by CCDF	Freq=3.9GHz		80		W

Load Mismatch of per Section (On Test Fixture, 50 ohm system): f = 3.9GHz

VSWR 10:1 at P3dB pulse CW Output Power	No Device Degradation

TYPICAL CHARACTERISTICS

3.7-4.1GHz Doherty @Vds=50V

Figure 1. Power Gain and Drain Efficiency as Function of Pulsed CW Output Power

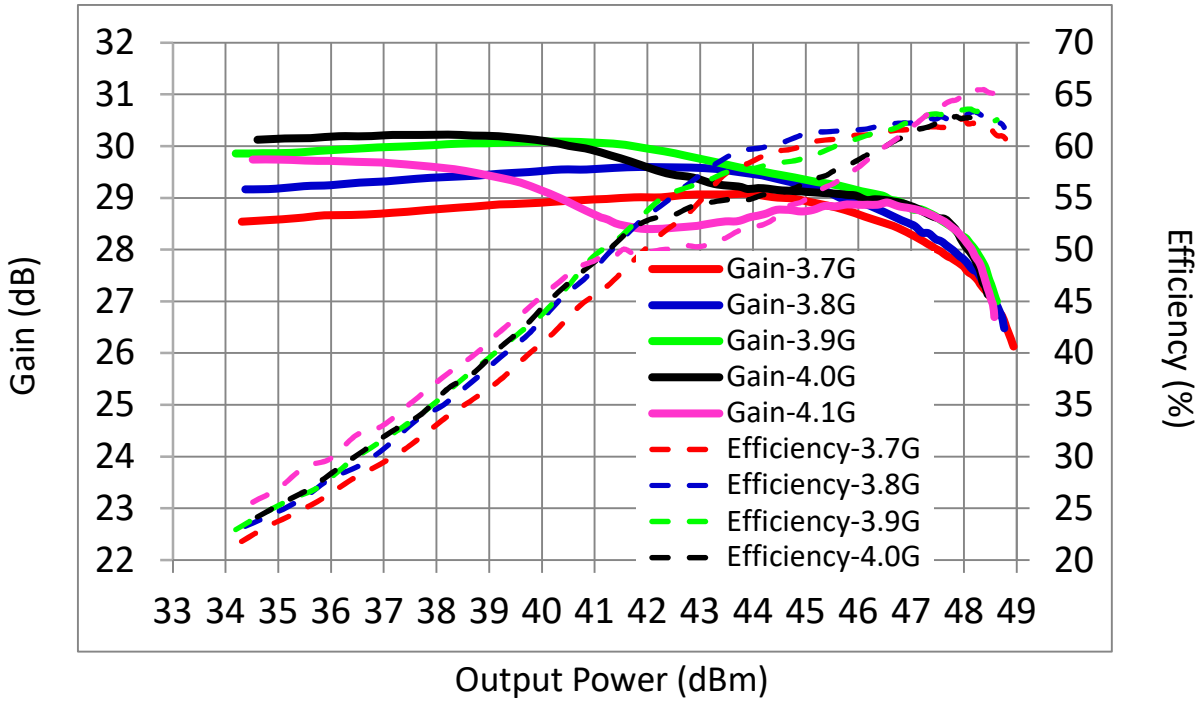
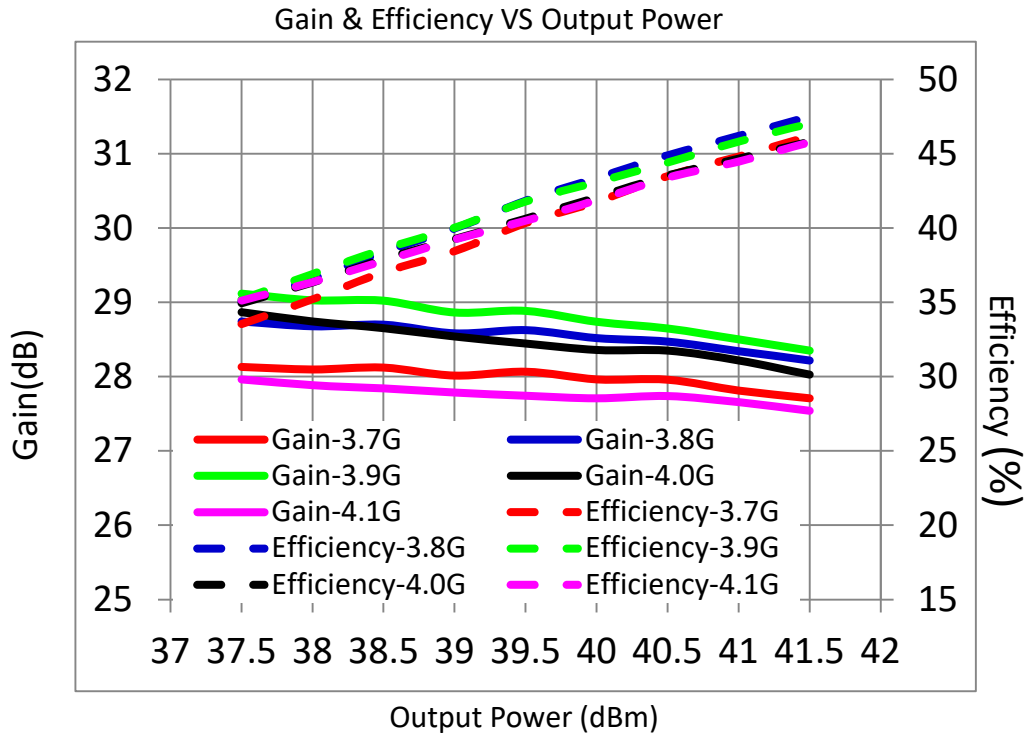


Figure 2. 1 Carrier WCDMA RF performance as function of output power



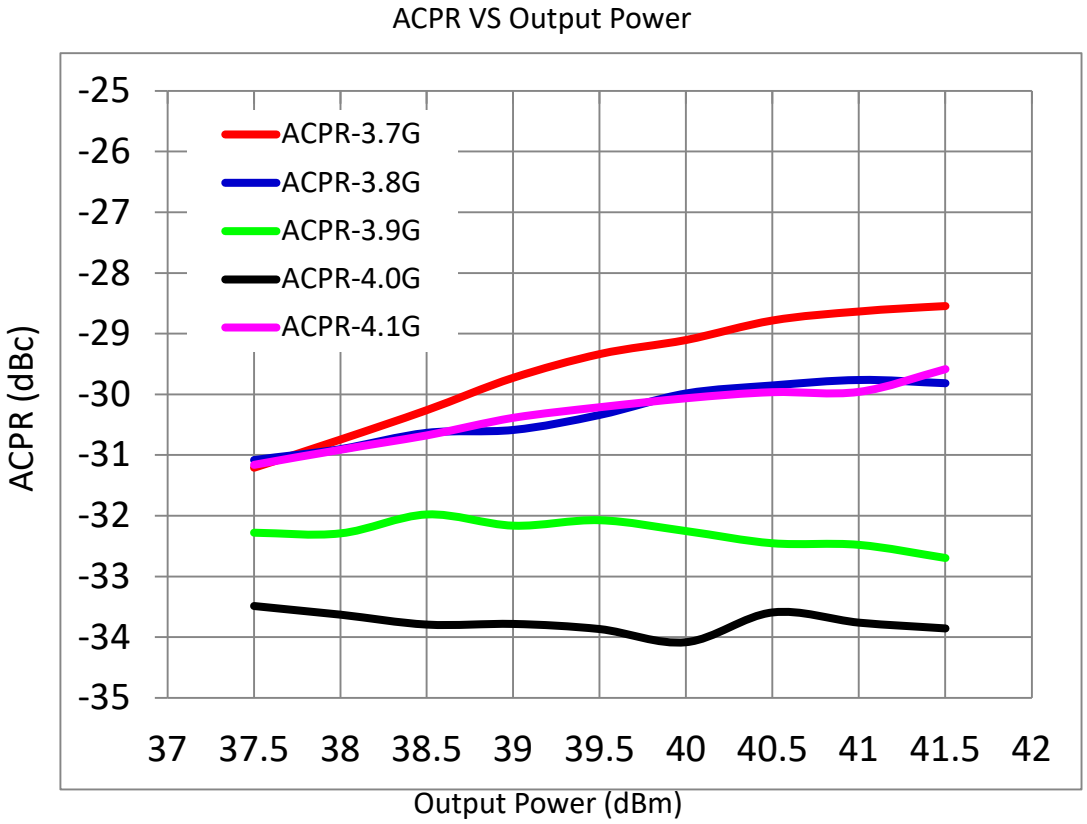
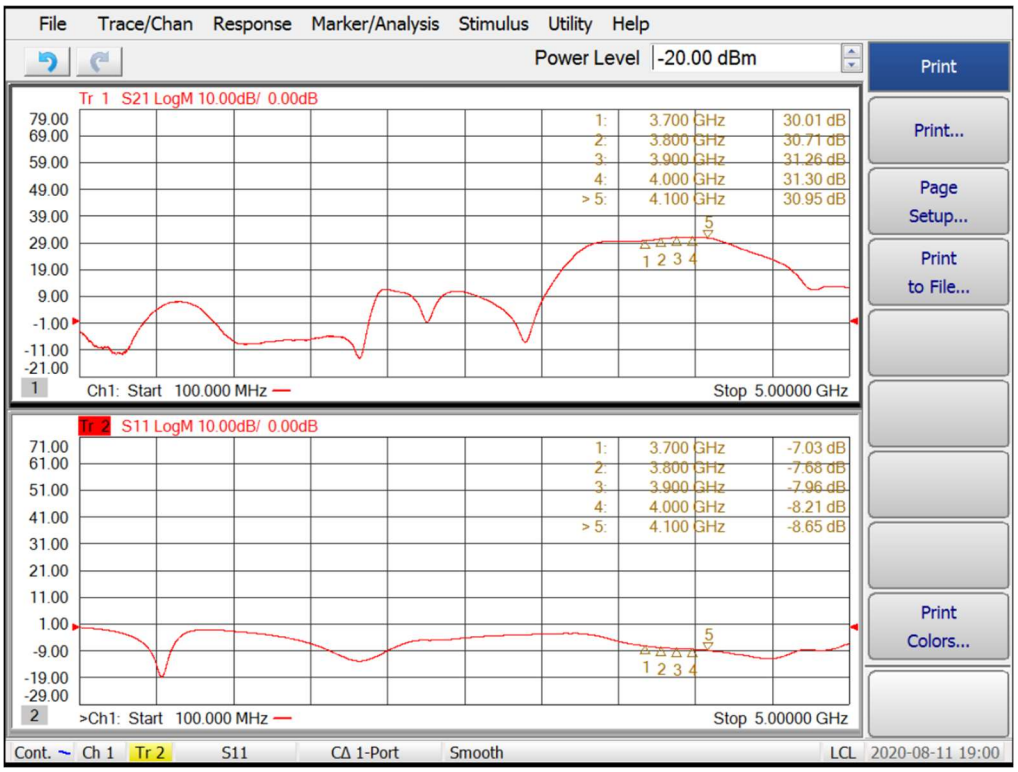


Figure 3. Network analyzer output S11/S21



TYPICAL CHARACTERISTICS

3.4-4.0GHz Doherty @Vds=46V

Figure 4. Power Gain and Drain Efficiency as Function of Pulsed CW Output Power

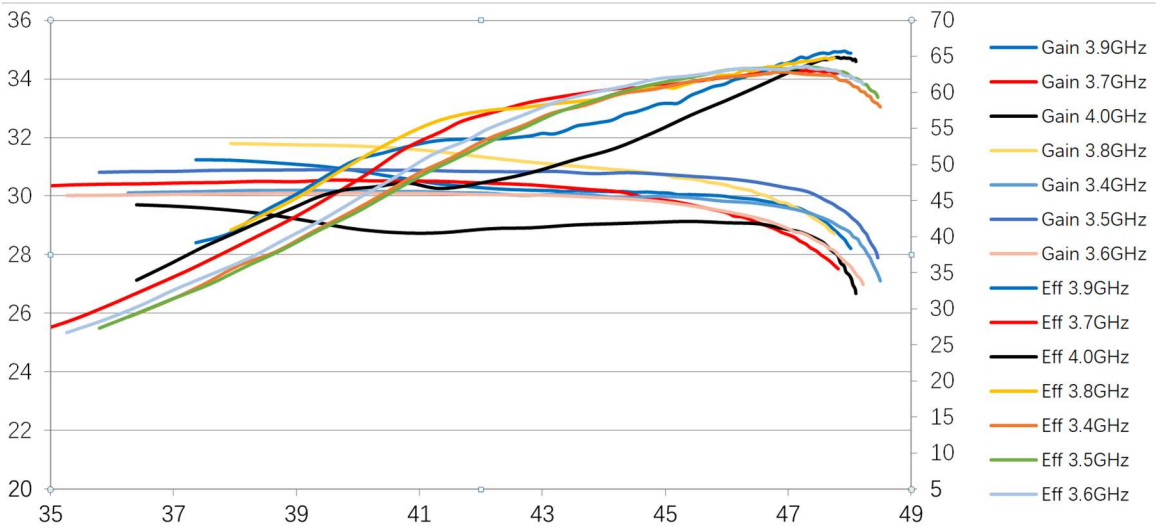


Figure 5. Network analyzer output S11/S21

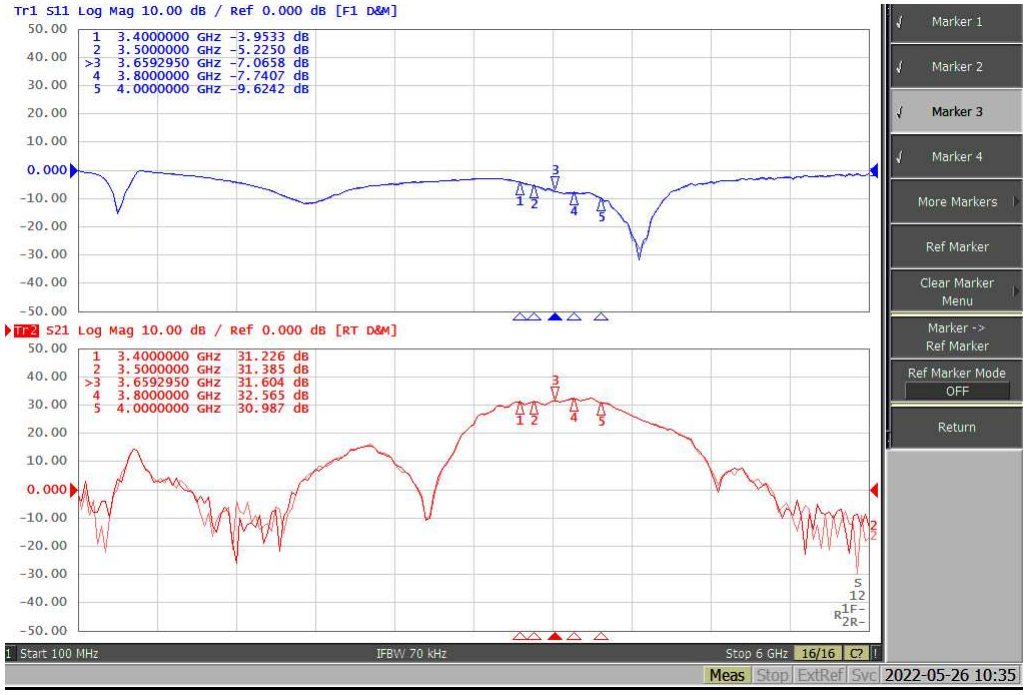
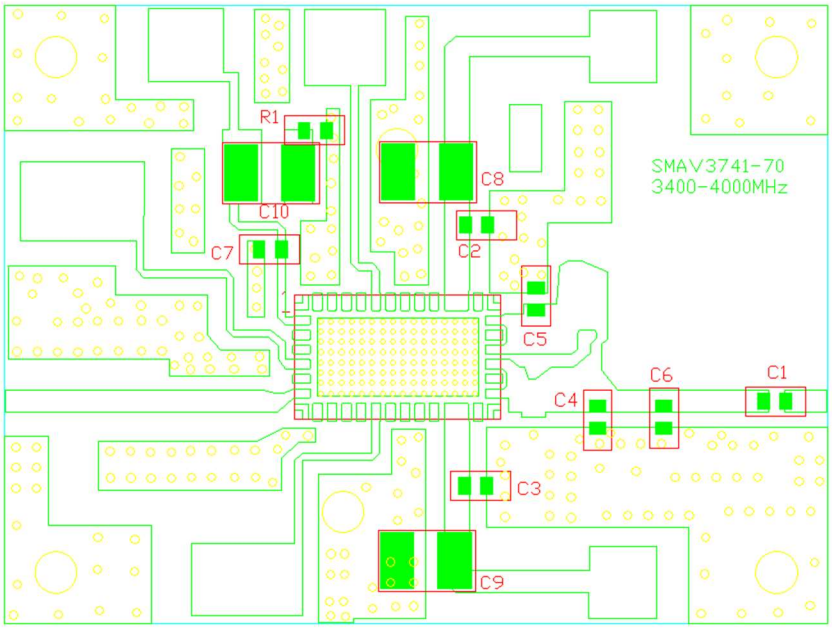


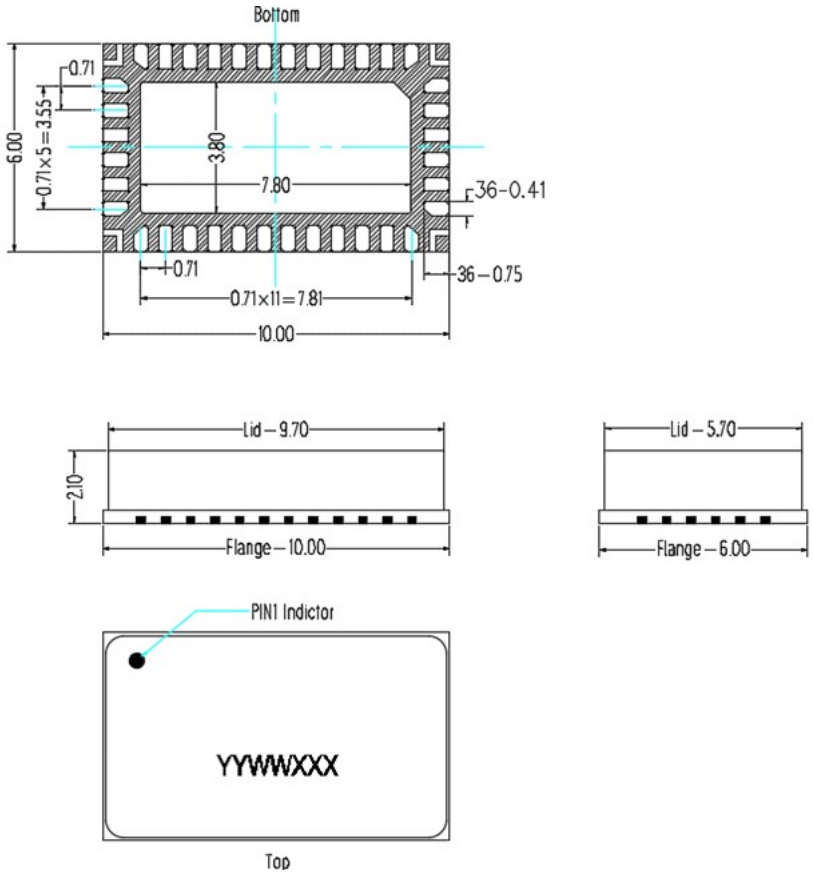
Figure 6. Application board layout info



BOM				
Part	**Quantity**	**Description**	**Part Number**	**Manufacture**
C1,C2,C3, C7	4	8.2pF High Q Capacitor	251SHS8R2BSE	TEMEX
C4	1	0.8pF High Q Capacitor	251SHS0R8BSE	TEMEX
C5	1	0.9pF High Q Capacitor	251SHS0R9BSE	TEMEX
C8,C9,C10	3	10uF MLCC	GRM32EC72A106ME 05	Murata
C6	1	0.6pF High Q Capacitor	251SHS0R6BSE	TEMEX
R1	1	2.7Ω Power Resistor	ESR03EZPF2R70	ROHM

Package Dimensions

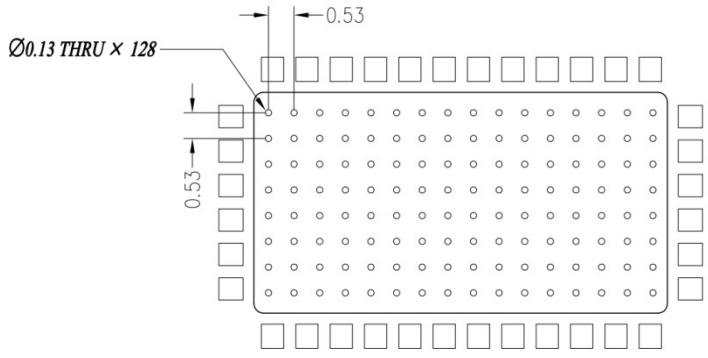
10*6 Plastic Package



Notes:

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

Mounting Footprint Pattern



Notes:

1. All dimensions are in mm;
2. Vias are required under the backside paddle of this device for proper RF/DC grounding and thermal dissipation. ALL vias are PTH to ground.

Revision history

Table 5. Document revision history

Date	Revision	Datasheet Status
2020/8/12	Rev 1.0	Preliminary Datasheet
2020/8/21	Rev 1.1	Add 3.6-4.0GHz application data
2022/5/26	Rev 1.2	Add 3.4-4.0GHz application data

Application data based on LWH-20-25/29,22-16

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