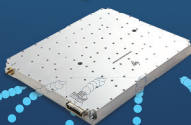
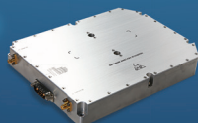


Sungsan E&C

World Leader in RF Amplifier solution



Company Introduction

INTRODUCTION

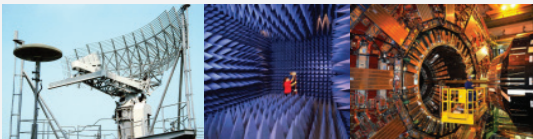
Sungsan E&C - Export-oriented Company

"Sungsan can design and develop amplifiers of the frequency range you want from several MHz to two-digit GHz."

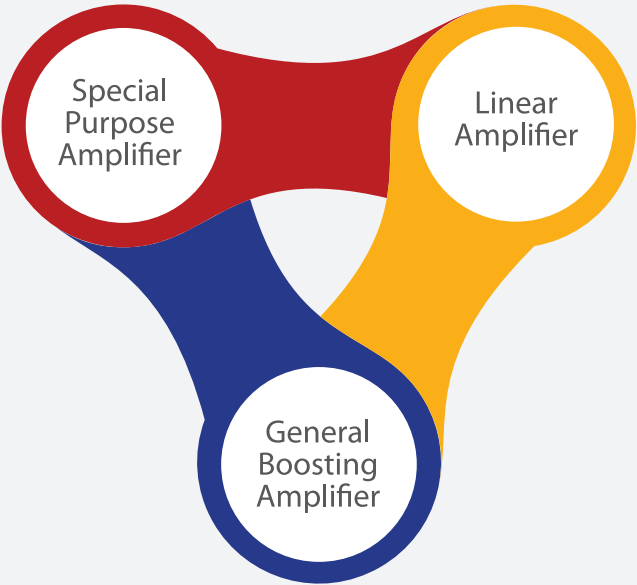
Since its establishment in 2001, Sungsan has been developing and exporting broadband amplifiers using GaN device and linear HPAs using several linearization technologies such as Analog predistortion and feedforward. Sungsan has been developing its amplifiers through their systematic and innovative technology development and know-how they accumulated over the years and has been trying to extend the application of its amplifiers to defense, industry, space, communication and medical equipment, paving the road to becoming the global leader. Since 2010, in an effort to shift their focus from amplifier modules to amplifier systems, Sungsan has been successfully proposing broadband high power amplifier solutions for EMC lab testing and for heavy-ion accelerator fields.

APPLICATION FIELDS

► Radar, EMC Testing, Accelerator



► Repeater, DAS, Base Station



► Jamming, UAV, Interception



STRENGTHS

Various solutions

Through the years-long experience in the RF field, Sungsan can propose not only signal-boosting amplifiers but also bespoke RF systems designed to meet each customer's specific signal source requirements.

Optimized bespoke solutions

Sungsan's experienced engineers can propose HPA or system solutions of the shape and high performance their customers want for their successful projects.

High quality

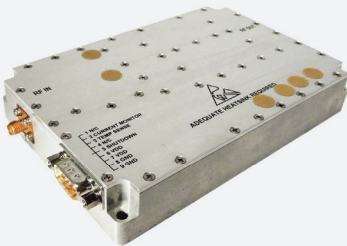
Sungsan has proved their unrivaled quality through exporting to overseas defense industries for many years. Sungsan can and will keep your quality level as high as you want.



MAIN PRODUCTS

General High Power Amplifier

- Jamming Amplifier
- Broadband High Power Amplifier



Linear Amplifier

- Analog Pre-Distortion Amplifier
- FeedForward Amplifier
- Adaptive Bias Control Amplifier



Special Purpose System

- Amplifier system for heavy-ion accelerator
- Amplifier system for EMC lab testing
- Amplifier system for Radar
- Amplifier system for RF Burning & Testing



General High Power Amplifier

GENERAL DESCRIPTION

1. Characteristics

The General high power amplifier amplifies small RF weak signal to the output power level customers want. Sungsan has an amplifier lineup from 1MHz to 11GHz and it includes not only normal boosting amplifier modules but also the special-purpose broadband HPA which covers several frequency ranges with only one PA module.

2. Main Features

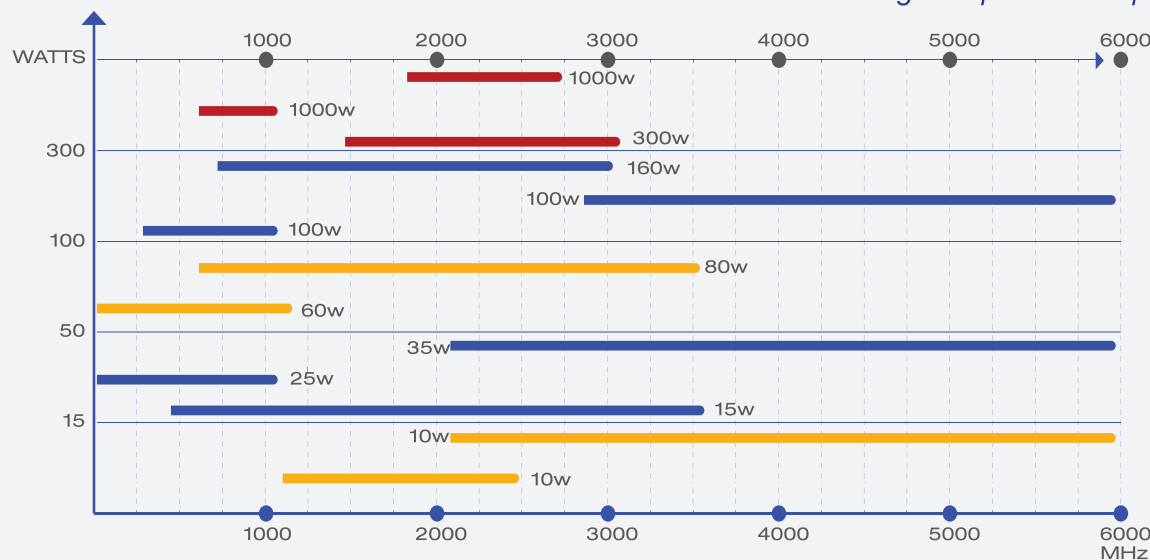
- Reverse voltage protection circuit
- Forward & Reverse Monitoring (option)
- Current Monitoring
- Over temp shutdown or Degradation
- Fast Shutdown
- Voltage Variable Attenuator (option)

3. Application

- FM, AM, CW boosting
- Jamming system
- RF passive Test system
- RF Energy system

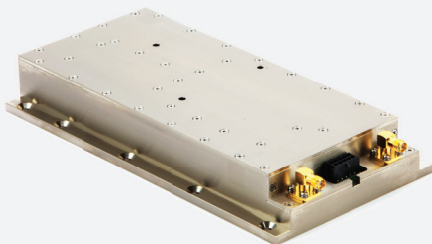


General High Amplifier List-up



NARROW HIGH POWER AMPLIFIER

The narrow HPA is suitable for signal boosting in telecommunication frequency ranges and normally, LDMOS device is used. It has high gain, wide dynamic range, low distortion and good linearity, as its main characteristics. It can be used as a normal signal boosting amplifier module which requires long-lasting reliability.



	Excellent	Good	Normal
Linearity		✓	
Efficiency		✓	
Price	✓		
Band cover			✓

General High Power Amplifier

▼ M25H27HP1H (2500~2700MHz, 100W)

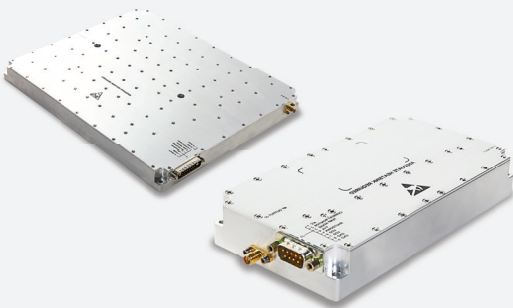
Parameter	Symbol	Specs.
Operating Frequency	BW	2500-2700MHz
Power Output CW	PSAT	min. 100 watts
Small Signal Gain	G1dB	typ. 50dB
Gain Flatness @ Rated POUT	△G	Max ±0.75 dB
Input Return Loss	S11	max -14 dB
Noise Figure @ max gain	NF	max 10 dB
Third Order Intercept Point 2-Tones @ 37 dBm/Tone, △= 100 KHz	IP3	typ. +55 dBm
Spurious Signals	Spur	max -60 dBc
Operating Voltage	VDC	28 V
Current Consumption @ 35 W	IDD	max 10 A
Dimension & Weight	208 x 110 x 30mm, 0.9kg	

Model	Frequency(MHz)		Pout(W)	Voltage(V)	Current(A)	Dimension(mm)
	Start	Stop				
M2050P1K	20	50	1k	50	50	220 x 350 x 40
M7080P6H	70	80	600	50	37	220 x 350 x 40
M140270P4H	140	270	400	50	25	220 x 350 x 40
M270419P4H	270	419	400	50	25	220 x 350 x 40
M8H1KP2H	800	1000	200	30	20	220 x 350 x 40
M8951170P6H	895	1170	600	32	60	220 x 350 x 40
M9H950P3H	900	950	300	30	19.4	220 x 350 x 40
M117014HP2H	1170	1400	200	32	18	220 x 350 x 40
M14751511P1H	1475	1511	100	28	11	152 x 76 x 25
M18H22HP60	1800	2200	60	28	5	162 x 86 x 25
M23H26HP4H	2300	2600	400	30	25	220 x 350 x 40
M26603KP250	2660	3000	250	32	26	220 x 350 x 40
M28H32HP1H	2800	3200	100	TBD	TBD	220 x 350 x 40
M57205830P90	5720	5830	90	28	15	220 x 270 x 40

General High Power Amplifier

BROADBAND HIGH POWER AMPLIFIER

The broadband HPA is Sungsan's representative item and it can amplify signals with frequency bands higher than octave band. It can be an ideal solution for broadband mobile jamming, band-specific high power and specific frequency ranges. Thanks to the use of excellent power density GaN device, it covers broadband frequency ranges and has high efficiency at the same time. In addition, it has higher breakdown voltage characteristics compared to LDMOS. Therefore, it has better output power stability under low VSWR conditions.



	Excellent	Good	Normal
Linearity			✓
Efficiency	✓		
Price		✓	
Band cover	✓		

PRODUCTS LIST UP

Model	Frequency(MHz)		Pout(W)	Gain(dB)	Operating Voltage(V)	Current Consumption(A)	Dimension(mm)
	Start	Stop					
MAX 1000MHz							
MJ205HP1H	20	500	100	50	28	12.5	163 x 96 x 28
MJ205HP2H	20	500	200	55	28	24	390 x 180 x 30
MJ201GP30	20	1000	30	44	28	3.8	163 x 87 x 28
MJ201GP1H	20	1000	100	22	28	20	195 x 175 x 30
MAX 3000MHz							
MJ5H25HP25	500	2500	25	46	28	3.3	152 x 76 x 25
MJ5H25HP50	500	2500	50	48	28	6	188 x 91 x 28
MJ5H27H25	500	2700	25	46	28	3.3	152 x 76 x 25
MJ5H27HP50	500	2700	50	48	28	6	188 x 91 x 28
MJ5H27HP1H	500	2700	100	54	30	13	208 x 91 x 27
MJ1G2GP120	1000	2000	120	50	28	14	188 x 104 x 27
MJ1G2GP230	1000	2000	230	13	28	22	208 x 127 x 25
MJ1G25HP50	1000	2500	50	48	28	6	163 x 69 x 25
MJ1G25HP1H	1000	2500	100	12	28	10	200 x 127 x 25
MJ1G3GP50	1000	3000	50	50	28	6.3	163 x 96 x 25
MJ1G3GP1H	1000	3000	100	10	28	12	173 x 113 x 29
MAX 6000MHz							
MJ2G4GP10	2000	4000	10	32	10	7.5	74 x 55 x 9
MJ2G6GP35	2000	6000	35	55	28	10	175 x 91 x 28
MJ25H6GP10	2500	6000	10	40	28	2	152 x 76 x 25
MJ3G6GP35	3000	6000	35	11	28	8	145 x 90 x 30
MAX 8000MHz							
MJ6G8GP30	6000	8000	30	48	28	8	150 x 100 x 25

MAIN PRODUCTS

▼ M5H27H90 (500 ~ 2700MHz, 90W)

Parameter	Specs.
Operating Frequency	500-2700MHz
Power Output CW	min. 90 Min. watts
Small Signal Gain	typ. 55dB
Gain Flatness @ Rated P_{OUT}	Max ± 1.5 dB
Input Return Loss	max -10 dB
Noise Figure @ max gain	max 10 dB
Third Order Intercept Point 2-Tones @ 33 dBm/Tone, $\Delta = 100$ KHz	typ. +46 dBm
Harmonics @ rated P_{1dB} Gain Compression Point	typ -20/-20 dBc
Spurious Signals	max -60 dBc
Operating Voltage	28 V
Current Consumption @ 35 W	max 13 A
Dimension & Weight	175 x 91 x 28mm, 0.9kg

▼ M25H6G35 (2.5~ 6GHz, 35W)

Parameter	Specs.
Operating Frequency	2500-6000MHz
Power Output CW	min. 35 Min. watts
Small Signal Gain	typ. 55dB
Gain Flatness @ Rated P_{OUT}	Max ± 1.5 dB
Gain Adjustment Range	min 25 dB
Input Return Loss	max -10 dB
Noise Figure @ max gain	max 10 dB
Third Order Intercept Point 2-Tones @ 33 dBm/Tone, $\Delta = 100$ KHz	typ. +46 dBm
Harmonics @ rated P_{1dB} Gain Compression Point	typ -20/-20 dBc
Spurious Signals	max -60 dBc
Operating Voltage	28 V
Current Consumption @ 35 W	max 10 A
Dimension & Weight	175 x 91 x 28mm, 0.9kg

Linear Amplifier

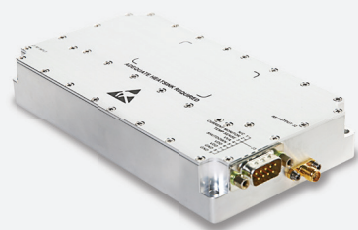
GENERAL DESCRIPTION

1. Characteristics

The linear amplifier lineup is ideal for use when various modulation signals need to be amplified. And it can also be a perfect solution for applications demanding high linearity from 400MHz to 3.8GHz. Various linearization technologies are applied to Sungsan's linear amplifiers and those are analog predistortion using predistortion IC, feedforward through the use of error amplifiers, IM cancellation with adaptive bias control. Analog predistortion technology is ideal when modulation signals of more than 1.5MHz bandwidth need to be amplified. Whereas, feedforward technology is suitable for multi-carrier signals such as GSM.

2. Main Features

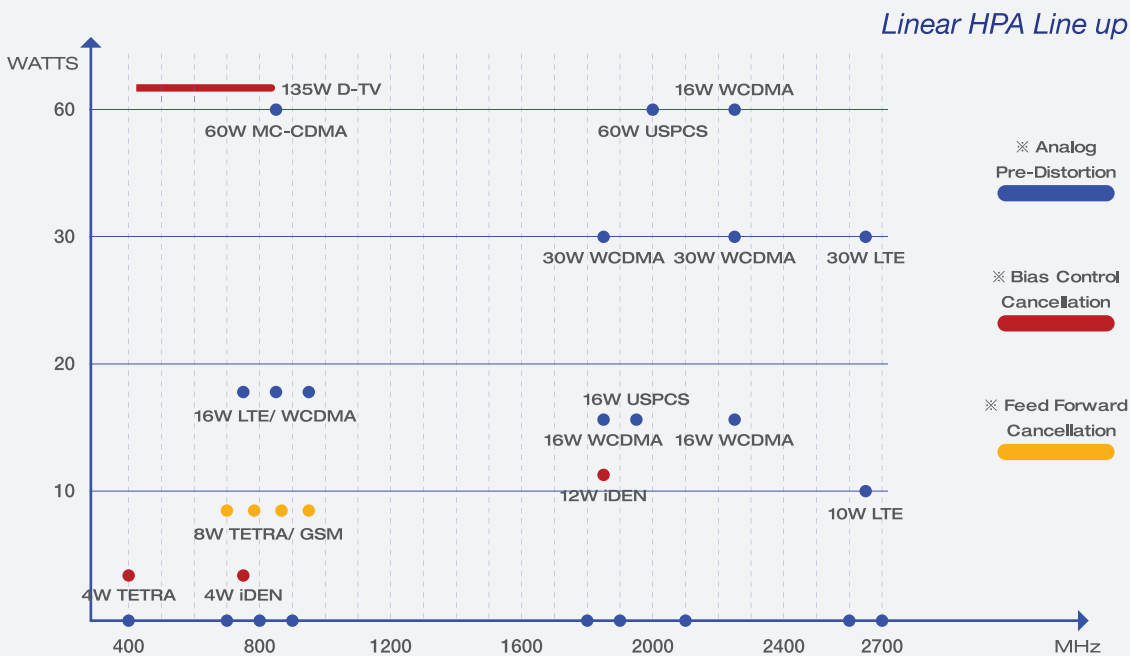
- In/out High Isolation
- Forward & Reverse Monitoring
- Current Monitoring
- Over temp. shutdown and Auto Recovery(option)
- Temperature Monitoring



3. Application

- LTE, WCDMA Signal Amplifier
- RF Repeater
- Distributed Antenna System
- Line Amplifier
- Amplifier for Digital Television

	Excellent	Good	Normal
Linearity	✓		
Efficiency	✓		
Price		✓	
Band cover			✓



PRODUCTS LIST

- ※ APD: Analog Pre-Distortion
- ※ FF: Feed Forward Cancellation
- ※ BC: Bias Control Cancellation

▼ Linear Amplifier Lineup(Less than 1GHz)

Model No.	Frequency (MHz)		Average Pout(W)	Current @ 28V	Method
	Start	Stop			
M758775P10	758	775	10@PAR 10dB	3.5	FF
M85187P08	851	870	8@PAR 10dB	3.5	FF
M861894P10	861	894	10@PAR 10dB	3.6	FF
M92596P08	925	960	8@PAR 10dB	3.5	FF
M791821P16	791	821	16@PAR 8.5dB	2.6	APD
M728757P16	728	757	16@PAR 8dB	3	APD
M869894P16	869	894	16@PAR 8dB	2.3	APD
M869894P60	869	894	60@PAR 8dB	8.5	APD
M728757P30	728	757	30@PAR 10dB	7	APD

▼ Linear Amplifier Lineup(1.8~2.2GHz)

Model No.	Frequency (MHz)		Average Pout(W)	Current @ 28V	Method
	Start	Stop			
M19302KP10	1930	2000	10@PAR 10dB	3.7	APD+BC
M21102170P60	2110	2170	60@PAR 8.5dB	8.5	APD
M19301995P16	1930	1995	16@PAR 8.5dB	3.3	APD
M19301995P30	1930	1995	30@PAR 8.5dB	5.5	APD
M21102170P30	2110	2170	30@PAR 8.5dB	5.5	APD
M18051880P16	1805	1880	16@PAR 8.5dB	2.25	APD
M19301995P16	1930	1995	16@PAR 8dB	2.3	APD
M21102170P60	2110	2170	60@PAR 8dB	8.5	APD
M19302KP10	1930	2000	10@PAR 8dB	4.2	APD+BC

▼ Linear Amplifier Lineup(2.3~3.8GHz)

Model No.	Frequency (MHz)		Average Pout(W)	Current @ 28V	Method
	Start	Stop			
M26182690P22	2618	2690	22@PAR 13dB	10	APD
M2496269P01	2496	2690	1.6@PAR 13dB	4	APD
M2330236P08	2330	2360	8@PAR 8.5dB	6.3	APD
M26202690P30	2620	2690	30@PAR 8.5dB	5	APD
M23H24HP15	2300	2400	15@PAR 8.5dB	3	APD

Special Purpose Amplifier for Accelerator

GENERAL DESCRIPTION

The heavy-ion accelerator is a device that provides energy by propelling charged particles such as electron, proton and ion. Working as a main partner in Korea's heavy-ion accelerator development project "RAON" since 2012, Sungsan has ample accelerator solutions which Sungsan has developed over the years. Those solutions include one with a maximum power of 80kW through the use of combiners for high power and heat removal method. Sungsan keeps playing their important role in Korea's various main plant projects.

2012 - Klystron-Preamplifier

- End user : Pohang University of Science and Technology Accelerator Research Institute
- 2846~2866MHz, 800W

2013 - Heavy-Ion-Accelerator

- End user : Institute for Basic Science (IBS, Korea national research institution)
- 81.25MHz, 5kW System 4Set

2014 - Heavy-Ion-Accelerator

- End user : Institute for Basic Science (IBS, Korea national research institution)
- 162.5MHz 7kW System 1Set

2015 - Heavy-Ion-Accelerator

- End user : Institute for Basic Science (IBS, Korea national research institution)
- 325MHz 20kW System, 1Set

2016 - Heavy-Ion-Accelerator

- End user : Institute for Basic Science (IBS, Korea national research institution)
- 325MHz 20kW 4 Set were provided in may
- 81.25 MHz 80kW 2 Set were provided in June



▼ SSB051A, SSB042A (20KW)



[Product Configuration]

Parameter	Specs.	Unit
Input Power	1	mW
Output Power	20 or more	kW
I/O Impedance	50	ohm
Frequency	81.25±5: SSB051A 325±5: SSB042A	MHz
Gain	73 or more	dB
Linearity@Gain	0.50	dB
Efficiency	50 or more	%
Harmonics	-45	dBc
Spurious	-70	dBc
Phase Shift	0.5	deg
Power Shift	0.5	%(peak to peak)
Output Port	Main/ Monitor	-
Control	Remote Control	-
Cooling	Water cooling	deg C
System Configuration	4EA of 6KW Final Shelves 2EA of Drive Shelves	

▼SSB050A (80KW)



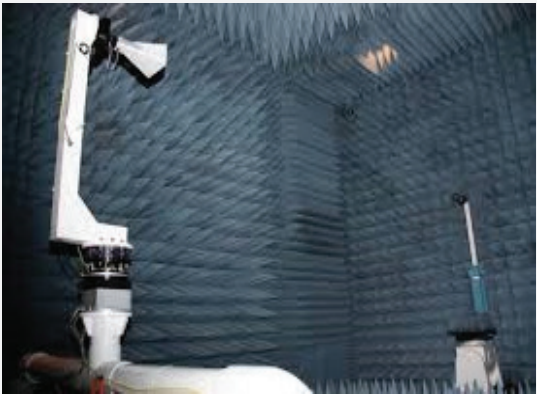
[System Configuration]

Parameter	Specs.	Unit
Input power	1	mW
Output power	80 or more	kW
I/O Impedance	50	ohm
Frequency	81.25+/-5	MHz
Gain	79	dB
Linearity@Gain	0.50	dB
Efficiency	50	%
Harmonics	-45	dBc
Spurious	-70	dBc
Phase Shift	0.5	deg
Power Shift	0.5	%(peak to peak)
Output Port	Main/ Monitor	-
Control	Remote Control	-
Cooling	Water cooling	deg C
System Configuration	4EA of 20KW 19" Rack	

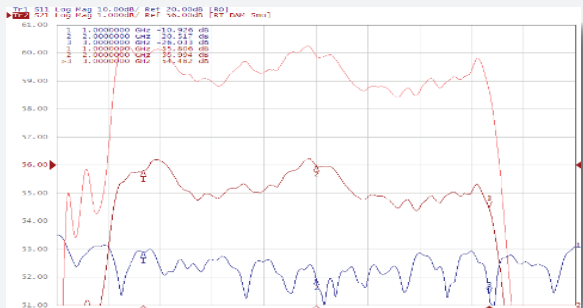
Special Purpose Amplifier for EMC

GENERAL DESCRIPTION

EMC (ElectroMagnetic Compatibility) testing is a test to measure the electro-magnetic interference(EMI) caused by an electrical device and the susceptibility of a product to electromagnetic interference from other sources. For most electronic and electrical products, EMC compliance is mandatory. In February, 2015, Sung-san got orders from Korean EMC testing laboratories for 12 units of amplifiers for Specific Absorption Rate(SAR) source and for another 14 units of amplifiers for Radiated Susceptibility(RS) source



▼ SS1T3G250A (1~3GHz, 250W)



Small Signal Gain and P_{SAT}

Top Curve: Small Signal Gain @ $PIN = -20dBm$

Middle Curve: Power Gain @ $PSAT$, $PIN = 0dBm$

Reference: 56dB, 1dB/div.



[20MHz~6GHz total rack]

Products List of EMC

Products List of EMC

ELECTRICAL SPECIFICATIONS @ 220VAC, 25°C, 50Ω System

▼ SS1T6G50A

Parameter	Symbol	Specs.	Unit
Operating Frequency	BW	1000 ~ 3000	MHz
		3000 ~ 6000	
Power Output CW	P _{SAT}	50 Min.	Watt
Power Gain @ CW	G _{1dB}	55 Typ.	dB
Input Power Range	P _{IN}	0 Typ.	dBm
Gain Adjustment Range	WA	20 Typ.	dB
Input Return Loss	S ₁₁	-10 Typ.	dB
Noise Figure @ maximum gain	NF	-10 Typ.	dB
Third Order Intermodulation 2-Tone @ 51dBm/Tone, 1MHz Spacing	IM3	-20Typ.	dBc
Harmonics @ POUT=10W (without Harmonic Suppression Filters)	2nd	-40 Max	dBc
	3rd	-40 Max.	
Spurious Signals	Spur	-60 Max	dBc
Operating Voltage-(1-Psase)	A _{AC}	100~230	Volt
Power Consumption @ 50W CW	P _D	500 Typ.	Watt



ELECTRICAL SPECIFICATIONS @ 220VAC, 25°C, 50Ω System

▼ SS20T500M500A

Parameter	Symbol	Specs.	Unit
Operating Frequency	BW	20~500	MHz
Power Output CW	PSAT	500 Min.	Watt
Power Gain @ CW	G1dB	60 Typ.	dB
Input Power Range	PIN	0 Typ.	dBm
Gain Adjustment Range	WA	20 Typ.	dB
Input Return Loss	S11	-10 Typ.	dB
Noise Figure @ maximum gain	NF	10 Typ.	dB
Third Order Intermodulation 2-Tone @ 51dBm/Tone, 1MHz Spacing	IM3	-20Typ.	dBc
Harmonics @ POUT=10W (without Harmonic Suppression Filters)	2nd	-20 Max	dBc
	3rd	-10 Max.	
Spurious Signals	Spur	-60 Max	dBc
Operating Voltage-(1-Psase)	AAC	210~230	Volt
Power Consumption @ 500W CW	PD	3000 Typ.	Watt



Products List of EMC

Products List of EMC

ELECTRICAL SPECIFICATIONS @ 220VAC, 25°C, 50Ω System

▼ SS80T1000M500A

Parameter	Symbol	Specs.	Unit
Operating Frequency	BW	1000.	MHz
Power Output CW	PSAT	500 Min.	Watt
Power Gain @ CW	G1dB	60 Typ.	dB
Input Power Range	PIN	0 Typ.	dBm
Gain Adjustment Range	WA	20 Typ.	dB
Input Return Loss	S11	-10 Typ.	dB
Noise Figure @ maximum gain	NF	10 Typ.	dB
Third Order Intermodulation 2-Tone @ 51dBm/Tone, 1MHz Spacing	IM3	-20Typ.	dBc
Harmonics @ POUT=10W (without Harmonic Suppression Filters)	2nd	-20 Max	dBc
	3rd	-10 Max.	
Spurious Signals	Spur	-60 Max	dBc
Operating Voltage-(1-Psase)	AAC	210~230	Volt
Power Consumption @ 500W CW	PD	3000 Typ.	Watt



Products List-Up

Model	Frequency(MHz)		Pout (W, Min)	Gain(dB)	Operating Voltage(VAC)	Power Consumption(W)
	Start	Stop				
SS20T500M500A	20	500	500	57	210- 230	3000
SS80T1000M250A	80	1000	250	54	210- 230	2000
SS80T1000M500A	80	1000	500	57	210- 230	3000
SS1T3G250A	1000	3000	250	54	210- 230	2000
SS2R5T6G35A	2500	6000	35	45	100- 230	500
SS3T6G50A	3000	6000	50	47	100- 230	500
	1000	3000				
SS1T6G50A	3000	6000	50	47	100- 240	500
SS20T500M1000A	20	500	1000	60	210- 230	5000
SS80T1000M1000A	80	1000	1000	60	210- 230	5000
SS1T3G500A	1000	3000	500	57	100- 230	3000
SS3T6G150A	3000	6000	150	52	100- 230	1000
SS300T6000M25A	300	2500	25/10	46/42	210- 230	250
	2500	6000				

Special Purpose Amplifier for Radar

GENERAL DESCRIPTION

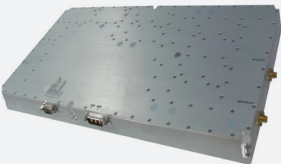
Pulse type amplifiers can be used for radar application and Sungsan currently has pulse type amplifiers for UHF frequency control system, Aeronautical and Maritime L-band, S-band and X-band frequency ranges



ELECTRICAL SPECIFICATIONS @ 220VAC, 25°C, 50Ω System

▼ M9G95HP60

Parameter	Symbol	Specifications	Unit
Operating Frequency	BW	9000-9500	MHz
Power Output CW	P _{SAT}	60 Min.	Watt
Input Power for Rated P _{out}	P _{IN}	0	dBm
Power Gain	G _{SS}	35 Typ.	dB
Gain Variation vs. Frequency	ΔG	±0.5 Typ.	dB
Input / Output Return Loss	S ₁₁ /S ₂₂	-14 Max	dB
Harmonics	H	-40 Typ.	dB
Supply Voltage	VDC	28/40	dB
Current Consumption @ rated P _{out}	28V	P _{OUT} = 60W Duty 20%	2.5 Max
	40V	P _{OUT} = 60W Duty 20%	2.0 Max
	28V	P _{OUT} = 60W CW	8.5 Max
	40V	P _{OUT} = 60W CW	3.5 Max
Pulse Droop		0.5 Max	dB
Duty Factor	D _{RATIO}	20 Max	Percent
Rising/Falling Time	TR/RF	20 Max	nSec



ELECTRICAL SPECIFICATIONS @ 220VAC, 25°C, 50Ω System

▼ M29H32HP2H

Parameter	Symbol	Specifications	Unit
Operating Frequency	BW	2900-3200	MHz
Power Output CW	P _{SAT}	200 Min.	Watt
Input Power for Rated P _{out}	P _{IN}	+4 Max	dBm
Power Gain	G _{SS}	50 Typ.	dB
Gain Variation vs. Frequency	ΔG	±1.0 Typ.	dB
Input / Output Return Loss	S ₁₁ /S ₂₂	-14 Max	dB
Harmonics	H	-40 Typ.	dB
Supply Voltage	VDC	32	Volt
Current Consumption @ rated P _{OUT}	I _{DD}	6.0 Max	Amp
Pulse Droop		0.6 Max	dB
Duty Factor	D _{RATIO}	25 Max	Percent
Rising/Falling Time	TR/RF	100 Max	nSec





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