

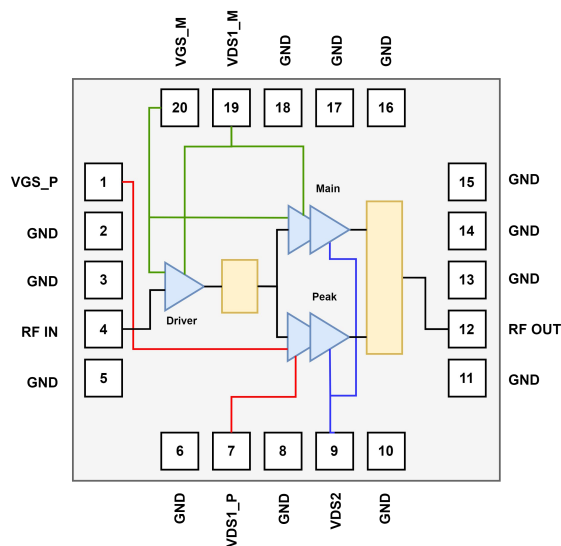
### Description

The H8G3540M12P is a LDMOS MMIC Integrated Asymmetrical Doherty based on 3-Stage with 12W saturated output power covering frequency range from 3.5 to 4.0 GHz.

The amplifier is 50  $\Omega$  Input/Output matched with a small compact footprint 7x7 mm which makes it ideal for integration.



### Block Diagram



H8G3540M12P Block Diagram

20 Pin LGA 7x7 mm Plastic Package



### Features

- Operating Frequency Range: 3.5 to 4.0 GHz
- Operating Drain Voltage: +28V
- Saturation Output Power: 12W
- 50  $\Omega$  Input/Output matched
- Integrated Input Divider
- Integrated Output Combiner
- Integrated Asymmetrical Doherty Final Stage
- High Efficiency: 30.6%@3.5GHz, WCDMA
- High Gain: 34.7dB@3.5 GHz, WCDMA
- Small footprint package: LGA 7x7 mm

### Applications

- 3GPP 5G NR FR1 n77/78 and 4G-LTE band B42/43
- Power Amplifier for Small Cells
- Driver Amplifier for Micro and Macro Base Stations
- Active Antenna Array for 5G mMIMO
- Repeaters/DAS
- Mobile Infrastructure

### Ordering Information

Part Number	Description
H8G3540M12P	Reel Package
H8G3540M12PEVB	3.5 to 4.0 GHz EVB



# H8G3540M12P

## 12W, 3.5 - 4.0 GHz LDMOS MMIC Amplifier

Product datasheet

### Typical Performance

#### RF Characteristics (Pulsed CW)

Freq (GHz)	P3dB (dBm)	Gain (dB)	Eff (%)	IRL (dB)
3.5	41.4	34.7	30.4	12.1
3.65	41.4	34.8	30.5	23.1
3.8	41.0	34.0	29.2	15.6
4.0	40.8	31.5	27.0	12.6

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ = 45 mA, Vgsp = Vgsm-0.5V, Pulse Width = 100 us, Duty Cycle = 10% test on WATECH Application Board

#### RF Characteristics (WCDMA)

Freq (GHz)	Gain (dB)	Eff (%)	IRL (dB)	ACPR* @5MHz (dBc)	ACPR* @10MHz (dBc)
3.5	34.7	30.6	12.5	-27.9	-41.5
3.65	34.4	30.8	21.8	-28.5	-43.0
3.8	33.6	30.1	15.5	-29.6	-44.6
4.0	31.0	27.2	12.3	-30.2	-42.7

Test conditions unless otherwise noted: 25 °C, VDD=+28Vdc, IDQ = 45 mA, Vgsp = Vgsm-0.5V, PAVG = 32 dBm

1C-WCDMA 5MHz Signal, 7.6 dB PAR @ 0.01% CCDF test on WATECH Application Board

\*Uncorrected DPD

### Absolute Maximum Ratings

Parameter	Range/Value	Unit
Drain voltage (V <sub>DSS</sub> )	-0.5 to +65	V
Gate voltage (V <sub>GS</sub> )	-5 to +10	V
Drain voltage (V <sub>DD</sub> )	0 to +28	V
Storage Temperature (T <sub>STG</sub> )	-55 to +150	°C
Case Temperature (T <sub>C</sub> )	-40 to +125	°C
Junction Temperature (T <sub>J</sub> )	-40 to +175	°C

### Electrical Specification

#### DC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Breakdown Voltage $V_{(BR)DSS}$	$V_{GS}=0V, I_{DS}=100\mu A$	65	-	-	V
Gate-Source Threshold Voltage $V_{GS(th)}$	$V_{GS}=V_{DS}, I_{DS}=5.2\mu A$	1.2	-	1.8	V
Drain Leakage Current $I_{DSS}$	$V_{GS}=0V, V_{DS}=28V$	-	-	0.5	$\mu A$
Gate Leakage Current $I_{GSS}$	$V_{GS}=5V, V_{DS}=0V$	-	-	0.05	$\mu A$

#### RF Characteristics (Pulsed CW)

Parameter	Freq (GHz)	Min	Typ.	Max	Unit
P3dB	3.45	40	41.1	-	dBm
	3.65	40	41.4	-	dBm
	4.0	39.7	40.7	-	dBm

Test conditions unless otherwise noted: 25 °C,  $V_{DD} = +28V_{DC}$ ,  $I_{DQ} = 45\text{ mA}$ ,  $V_{GSP} = V_{GSM} - 0.5V$ , Pulse Width = 100  $\mu s$ , Duty Cycle = 10% test on WATECH Production Board

#### RF Characteristics (WCDMA)

Parameter	Conditions	Min	Typ.	Max	Unit
Frequency		3.45			GHz
Gain	$P_{AVG} = 32\text{ dBm}$	31.5	34	-	dB
Eff	$P_{AVG} = 32\text{ dBm}$	26	28.5	-	%
IRL	$P_{AVG} = 32\text{ dBm}$	-	-	10	dB
ACPR@5MHz (Uncorrected)	$P_{AVG} = 32\text{ dBm}$	-	-28	-25	dBc

Parameter	Conditions	Min	Typ.	Max	Unit
Frequency		3.65			GHz
Gain	$P_{AVG} = 32\text{ dBm}$	31.5	34	-	dB
Eff	$P_{AVG} = 32\text{ dBm}$	28.5	31	-	%
IRL	$P_{AVG} = 32\text{ dBm}$	-	-	10	dB
ACPR@5MHz (Uncorrected)	$P_{AVG} = 32\text{ dBm}$	-	-28	-25	dBc



# H8G3540M12P

## 12W, 3.5 - 4.0 GHz LDMOS MMIC Amplifier

Product datasheet

Parameter	Conditions	Min	Typ.	Max	Unit
Frequency	4.0				GHz
Gain	$P_{AVG} = 32 \text{ dBm}$	28.5	31	-	dB
Eff	$P_{AVG} = 32 \text{ dBm}$	26	28.5	-	%
IRL	$P_{AVG} = 32 \text{ dBm}$	-	-	10	dB
ACPR@5MHz (Uncorrected)	$P_{AVG} = 32 \text{ dBm}$	-	-30	-27	dBc

Test conditions unless otherwise noted: 25 °C,  $V_{DD}=+28\text{Vdc}$ ,  $I_{DQ} = 45 \text{ mA}$ ,  $V_{gsp} = V_{gsm}-0.5\text{V}$ , 1C-WCDMA 5MHz Signal, 7.6 dB PAR @ 0.01% CCDF test on WATECH Production Board

### Load Mismatch Test

Condition	Test Result
VSWR=10:1, at all Phase Angles, $V_{DD}=28\text{Vdc}$ , $I_{DQ} = 25 \text{ mA}$ , $V_{gsp}=V_{gsm}-0.5\text{V}$ , 1C-WCDMA 5MHz Signal, 7.6 dB PAR @ 0.01% CCDF, Frequency tested 3.5, 3.65 and 3.8 GHz $P_{AVG} = 35 \text{ dBm}$ test on WATECH Application Board	No Device Degradation

### Thermal Information

Parameter	Condition	Value (Typ)	Unit
Thermal Resistance Junction to Case ( $R_{TH}$ )	$T_{CASE}= 90^{\circ}\text{C}$ , 1C-WCDMA 5MHz Signal, 7.6 dB PAR, $P_{AVG} = 32 \text{ dBm}$	10	$^{\circ}\text{C} / \text{W}$

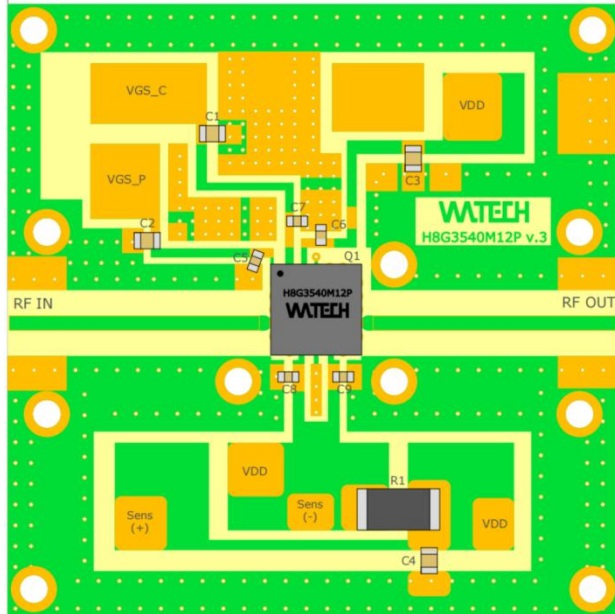


# H8G3540M12P

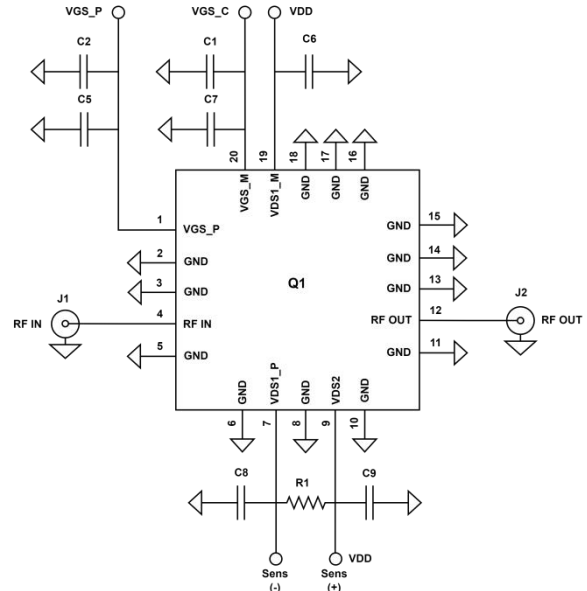
## 12W, 3.5 - 4.0 GHz LDMOS MMIC Amplifier

Product datasheet

### H8G3540M12P 3.5 – 4.0 GHz Reference Design (47 x47 mm)



EVb Layout

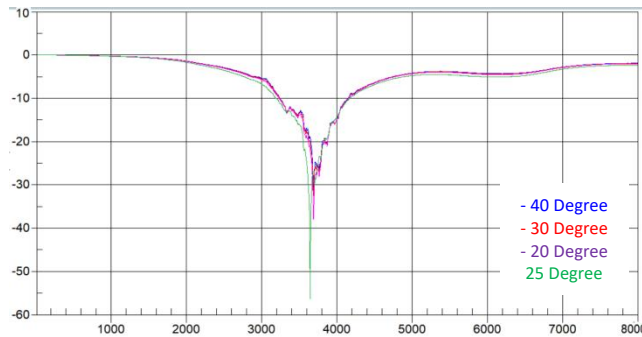


EVb Schematic

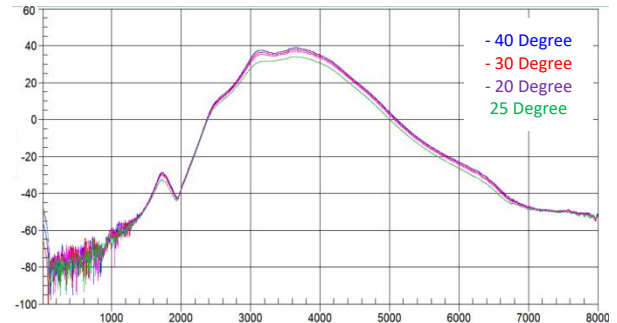
### Bill of Materials (BoM) - H8G3540M12P 3.5 – 4.0 GHz Reference Design

Reference	Value	Description	Manufacturer	P/N
Q1	-	12W, 3.5-4 GHz LDMOS MMIC PA	Watech	H8G3540M12P
C1 - C4	10uF ±10%, 0805	Multi-Layer Ceramic Capacitor	Murata	GRM21BB31C106KE15
C5 - C9	1uF ±10%, 0603	Multi-Layer Ceramic Capacitor	Murata	GCM188R71E105KA64D
R1	100mΩ/1W, 0.1%	High-Precision Resistor	Vishay	Y44870R10000B0R
PCB	<ul style="list-style-type: none"><li>Rogers 4350B, er = 3.66; Thickness= 20 mil (0.508 mm); Thickness copper plating = 35 µm (1oz)</li><li>Soldered on a 47x47x10 mm Copper Base-Plate</li></ul>			

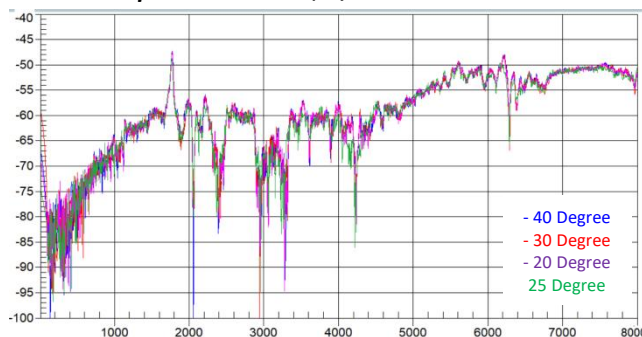
### Performance Plots



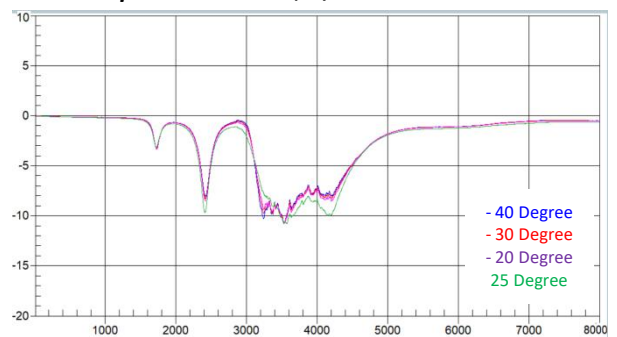
**S parameters S11 (dB) 10 MHz to 8 GHz**



**S parameters S21 (dB) 10 MHz to 8 GHz**

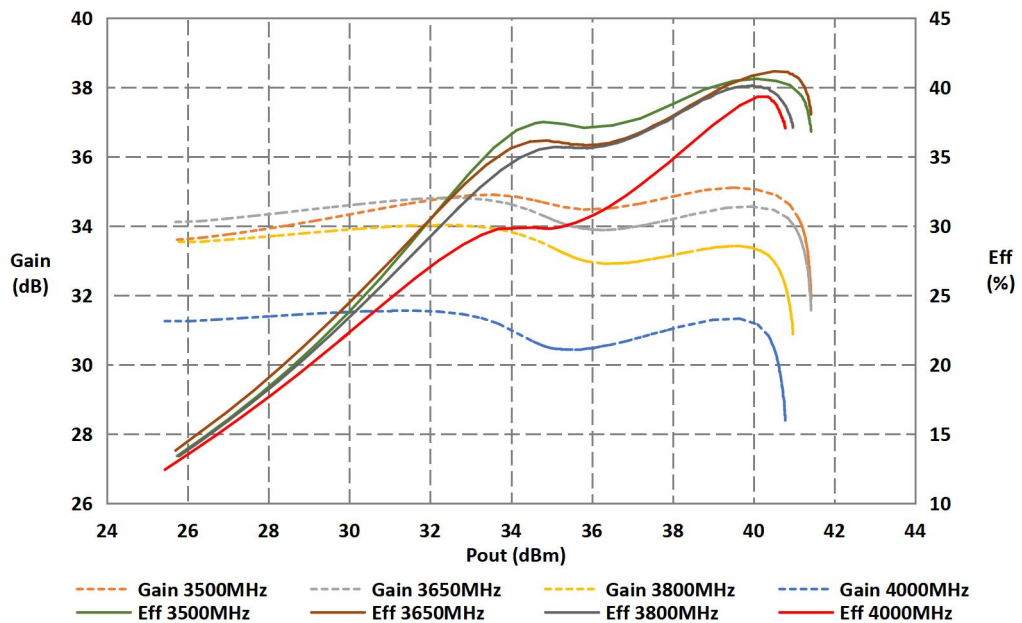


**S parameters S12 (dB) 10 MHz to 8 GHz**



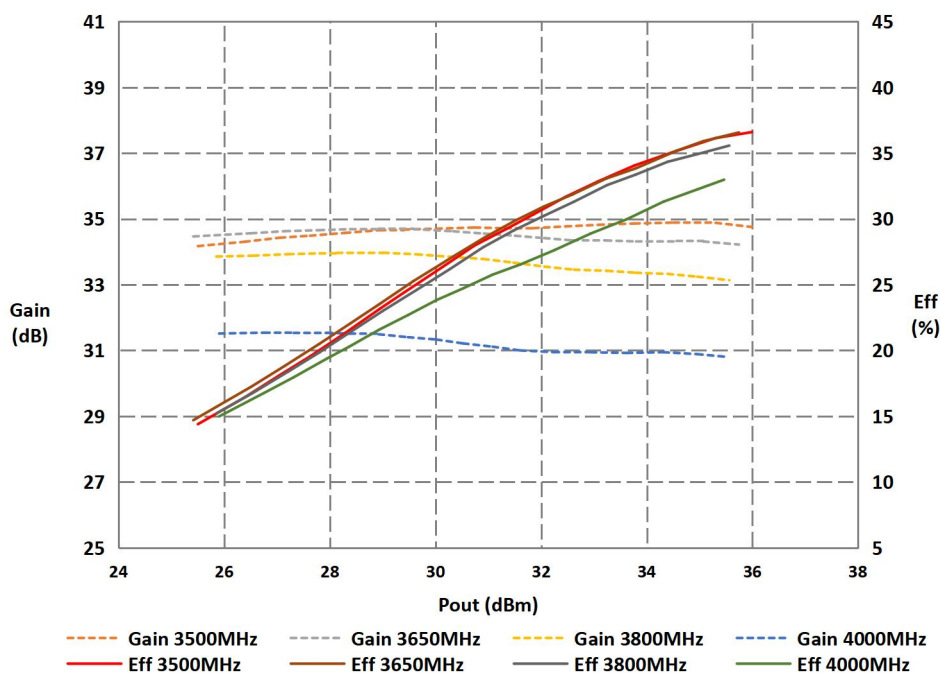
**S parameters S22 (dB) 10 MHz to 8 GHz**

Test conditions unless otherwise noted: 25 °C, VDD=+28Vdc, IDQ = 45 mA, Vgsp = Vgsm-0.5V, S-Parameters test on WATECH Application Board



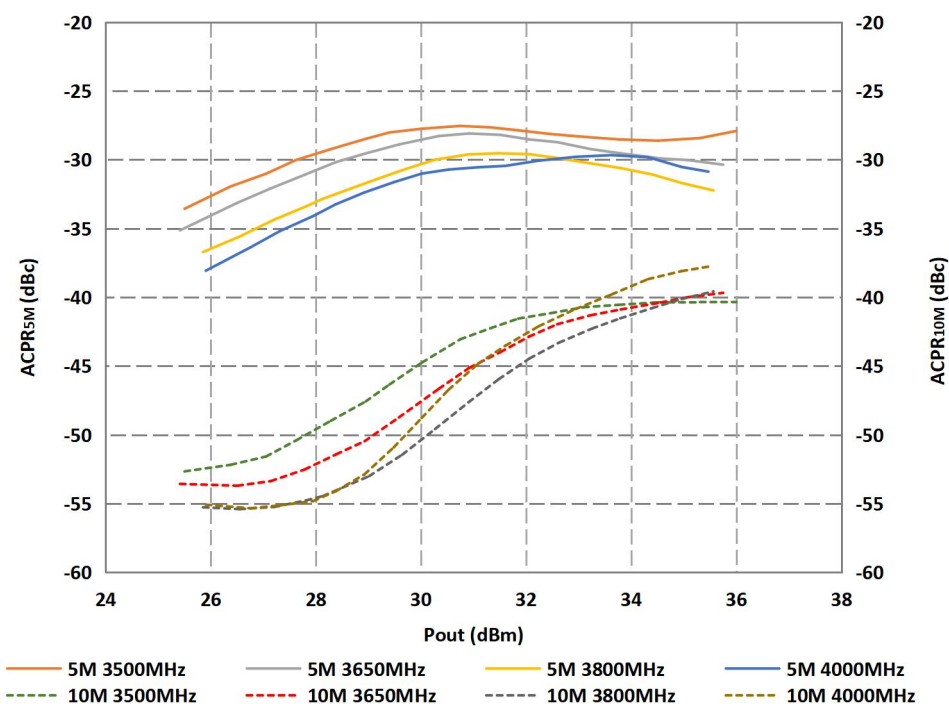
**Pulsed CW, Gain and Efficiency vs Pout**

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ = 45 mA, Vgsp = Vgsm-0.5V, Pulse Width = 100 us, Duty Cycle = 10% test on WATECH Application Board



### WCDMA, Gain and Efficiency vs Pout

Test conditions unless otherwise noted: 25 °C,  $V_{DD}=+28V_{dc}$ ,  $I_{DQ} = 45\text{ mA}$ ,  $V_{gsp} = V_{gsm}-0.5V$ , 1C-WCDMA 5MHz Signal, 7.6 dB PAR @ 0.01% CCDF test on WATECH Application Board

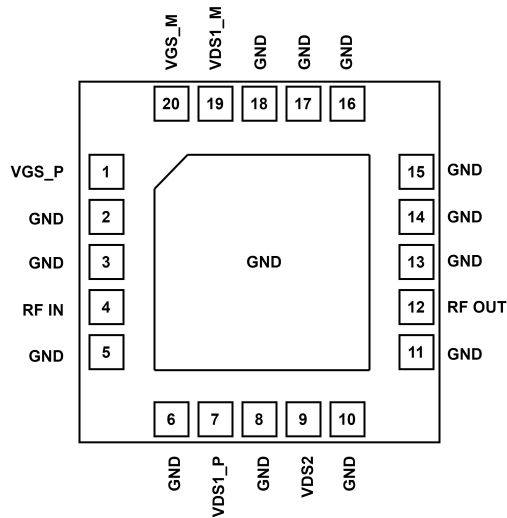


### WCDMA, ACPR 5MHz and 10MHz vs Pout

Test conditions unless otherwise noted: 25 °C,  $V_{DD}=+28V_{dc}$ ,  $I_{DQ} = 45\text{ mA}$ ,  $V_{gsp} = V_{gsm}-0.5V$ , 1C-WCDMA 5MHz Signal, 7.6 dB PAR @ 0.01% CCDF test on WATECH Application Board



### Pin Configuration and Description



17	GND	Ground
18	GND	Ground
19	VDS1_M	Drain-Source Voltage Main Driver
20	VGS_M	Gate-Source Voltage Main

Pinout Device Configuration

Pin Number	Label	Description
1	VGS_P	Gate-Source Voltage Peak
2	GND	Ground
3	GND	Ground
4	RFIN	RF Input
5	GND	Ground
6	GND	Ground
7	VDS1_P	Drain-Source Voltage Peak Driver
8	GND	Ground
9	VDS2	Drain-Source Voltage Final Stage
10	GND	Ground
11	GND	Ground
12	RFOUT	RF Output
13	GND	Ground
14	GND	Ground
15	GND	Ground
16	GND	Ground

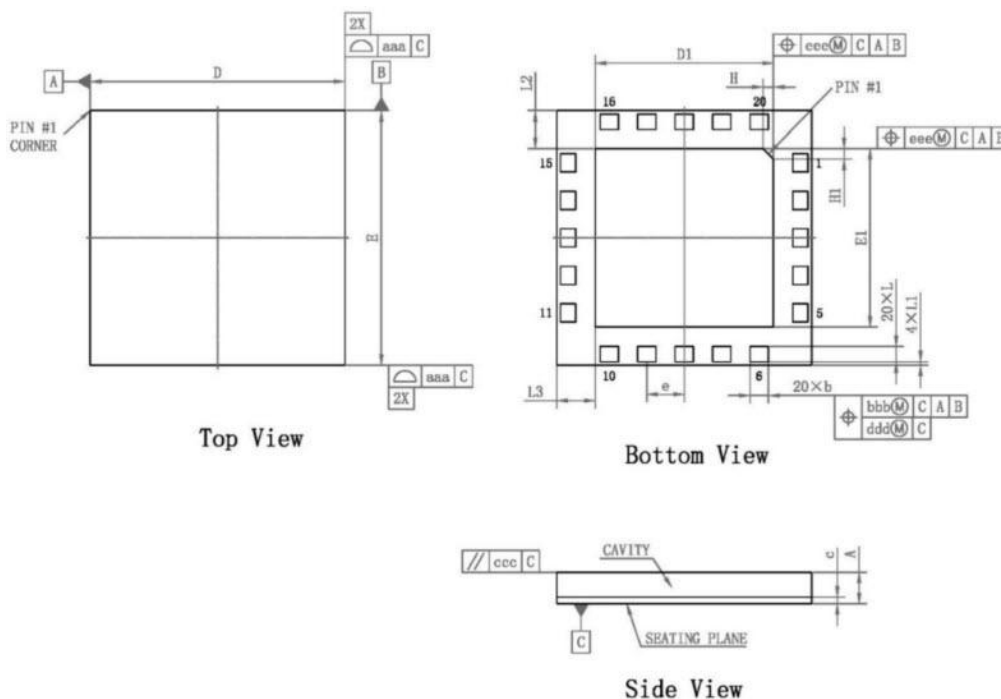


### Package Marking and Dimensions



- Line1 (fixed): Device name in W/O
- Line2 (unfixed): Marking Lot No in W/O (Sample: E596-20140001)
- Line3 (unfixed): Date Code + JY
- This Marking SPEC only stipulates the content of Marking. For marking requirements such as font and size, please refer to the latest version of “Watech Product Printing Specification”

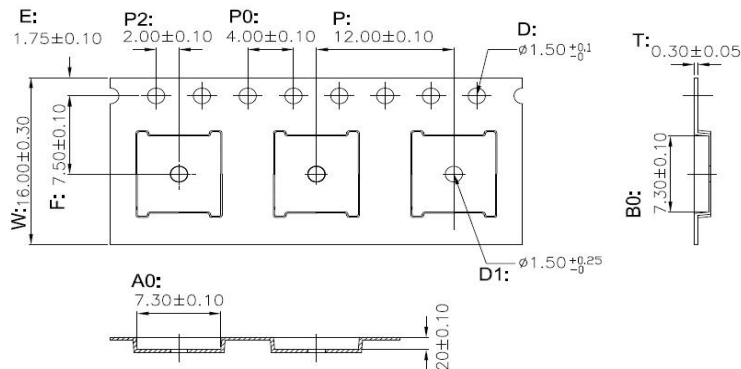
### Marking



symbol	Dimension in mm			Dimension in inch		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.760	0.960	0.960	0.030	0.034	0.038
c	0.150	0.180	0.210	0.006	0.007	0.008
D	6.900	7.000	7.100	0.272	0.276	0.280
E	6.900	7.000	7.100	0.272	0.276	0.280
D1	4.800	4.900	5.000	0.189	0.193	0.197
E1	4.800	4.900	5.000	0.189	0.193	0.197
H	—	0.286	—	—	0.011	—
H1	—	0.286	—	—	0.011	—
L	0.370	0.420	0.470	0.015	0.017	0.019
L1	0.025	0.100	0.175	0.001	0.004	0.007
L2	0.975	1.050	1.125	0.038	0.041	0.044
L3	0.975	1.050	1.125	0.038	0.041	0.044
e	—	1.030	—	—	0.041	—
b	0.450	0.500	0.550	0.018	0.020	0.022
aaa	—	0.150	—	—	0.006	—
bbb	—	0.150	—	—	0.006	—
ccc	—	0.100	—	—	0.004	—
ddd	—	0.080	—	—	0.003	—
eee	—	0.150	—	—	0.006	—

### Package Dimensions

### Tape and Reel Information




#### Notes:

1. Carrier tape color: BLACK.
2. Carrier material :PS (Polystyrene).
3. ESD surface resistivity <  $1 \times 10^{11}$   $\Omega$ /square per EJA, JEDEC TNR specification.
4. Heat deflection temperature for Tape & Reel material: 62°C
5. Vicat softening temperature (10N) for Tape & Reel material: 95°C
6. Dimension is millimeter.

#### Tape & Reel Packaging Descriptions

### Handling Precautions

Parameter	Grade
Moisture Sensitivity Level MSL	3

Parameter	Rating	Standard	
ESD – Human Body Model (HBM)	Class 1B	JESD22-A114	
ESD – Human Body Model (MM)	Class A	EIA/JESD22-A115	
ESD – Charged Device Model (CDM)	Class III	JESD22-C101	

### RoHS Compliance

This product is compliant with the 2011/65/EU RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment), as amended by Directive 2015/863/EU.

### Datasheet Status

Document status	Product status	Definition
Objective Datasheet	Design simulation	Product objective specification
Preliminary Datasheet	Customer sample	Engineering samples and first test results
Product Datasheet	Mass production	Final product specification

## Abbreviations

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Acronym	Definition
LDMOS	Laterally-Diffused Metal-Oxide Semiconductor
CW	Continuous Waveform
VSWR	Voltage Standing Wave Ratio

## Revision history

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Document ID	Datasheet Status	Release Date	Revision Version
Rev 1.1	Production	2021/07/15	First document version
Rev 1.2	Production	2021/07/19	Thermal resistance information added
Rev 1.3	Production	2021/07/30	Mass production data added, typical and low/high thresholds data
Rev 1.4	Production	2023/01/03	New format based on English version datasheet
Rev 1.5	Production	September 2024	Update Package and block diagram



# H8G3540M12P

## 12W, 3.5 - 4.0 GHz LDMOS MMIC Amplifier

Product datasheet

### Contact Information

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For the latest specifications, additional product information, worldwide sales and distribution locations and information about WATECH:

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- Email: [MKT@huatai-elec.com](mailto:MKT@huatai-elec.com)

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