

### Description

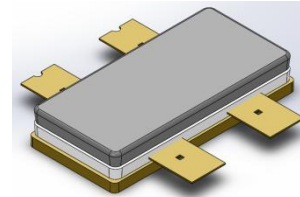
The HTN9G22P370S is a discrete LDMOS Power Amplifier designed for cellular base station applications with 370W saturated output power covering frequency range from 1805 - 2170 MHz.

### Features

- Operating Frequency Range: 1805 - 2170 MHz
- Operating Drain Voltage: +28V
- Saturation Output Power: 370W
- Power Average: 54W
- Asymmetrical Doherty Final Stage
- Excellent thermal stability due to low thermal resistance package
- Enhanced robustness design without device degradation

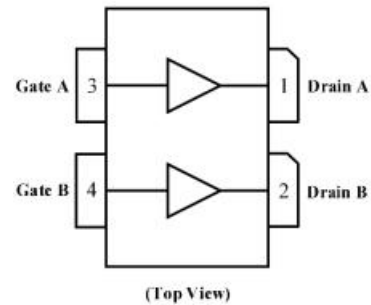
### Applications

- 3GPP 5G
- 4G-LTE
- Amplifier for Micro and Macro Base Stations
- Repeaters/DAS
- Mobile Infrastructure



**ACS2110S-4L** 

Earless Flanged  
Air Cavity Spliced Package; 4 Leads  
**HTN9G22P370S**



Note: Exposed backside of the package is the source terminal for the transistor

### Pin Connections

### Ordering Information

Part Number	Description
HTN9G22P370S	Reel Package
HTN9G22P370SEVB1	1805 - 1880 MHz EVB
HTN9G22P370SEVB2	2110 - 2170 MHz EVB



# HTN9G22P370S

## 370W, 1805 - 2170 MHz LDMOS Amplifier

Product datasheet

### Typical Performance

#### RF Characteristics (Pulsed CW)

Freq (MHz)	P5dB (dBm)	Gain (dB)	Eff (%) @P5dB	Eff (%) @47.3dBm	IRL (dB)
2110	55.7	16.1	55.3	50.5	11
2140	55.6	16.0	55.3	50.5	13
2170	55.6	15.7	55.4	49.2	15

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ\_Carrier= 380mA, Vgsp = Vgsc - 1.3V, PW = 100us, DC= 10% test on WATECH Application Board

#### RF Characteristics (WCDMA)

Freq (MHz)	Gain (dB)	Eff (%)	ACPR* @5MHz (dBc)	ACPR* @10MHz (dBc)	IRL (dB)
2110	15.4	47.2	-26.0	-41.3	11
2140	15.3	47.2	-27.4	-42.0	13
2170	15.1	46.5	-29.4	-43.1	15

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ\_Carrier= 380mA, Vgsp = Vgsc - 1.3V, PAVG = 47.3 dBm 1C-WCDMA 5MHz Signal, 9.9 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
Storage Temperature (T <sub>STG</sub> )	-55 to +150	°C
Junction Temperature (T <sub>J</sub> )	-40 to +225	°C

### Electrical Specification

#### DC Characteristics (Carrier)

Parameter	Conditions	Min	Typ	Max	Unit
Breakdown Voltage $V_{(BR)DSS}$	$V_{gs}=0V, I_{ds}=105\mu A$	65	68	-	V
Gate-Source Threshold Voltage $V_{GS(th)}$	$V_{gs}=10V, I_{ds}=105\mu A$	0.9	-	1.9	V
Drain Leakage Current $I_{DSS}$	$V_{gs}=0V, V_{ds}=65V$	-	-	105	nA
Gate Leakage Current $I_{GSS}$	$V_{gs}=10V, V_{ds}=0V$	-	-	105	nA

#### DC Characteristics (Peaking)

Parameter	Conditions	Min	Typ	Max	Unit
Breakdown Voltage $V_{(BR)DSS}$	$V_{gs}=0V, I_{ds}=203\mu A$	65	68	-	V
Gate-Source Threshold Voltage $V_{GS(th)}$	$V_{gs}=10V, I_{ds}=203\mu A$	0.9	-	1.9	V
Drain Leakage Current $I_{DSS}$	$V_{gs}=0V, V_{ds}=65V$	-	-	203	nA
Gate Leakage Current $I_{GSS}$	$V_{gs}=10V, V_{ds}=0V$	-	-	203	nA

#### RF Characteristics (Pulsed CW)

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range		1.805		2.17	GHz
P5dB	Pulse CW	55	55.5		dBm
Gain	$P_{out}=47.3dBm$	14.5	15.5		dB
Eff	$P_{out}=47.3dBm$	47	49		%
IRL	$P_{out}=47.3dBm$	8	10		dB

*Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ\_Carrier= 380mA, Vgs = Vgsc - 1.3V, PW = 100us, DC= 10% test on WATECH FT Board*

#### RF Characteristics (WCDMA)

Parameter	Conditions	Min	Typ	Max	Units
Frequency Range	$P_{out}=47.3dBm$	1.805		2.17	GHz
Gain	$P_{out}=47.3dBm$	13.5	15		dB



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Eff	Pout=47.3dBm	44	46	-	%
IRL	Pout=47.3dBm	10			dB
ACLR@5MHz	Pout=47.3dBm		-26	-24	dBc
ACLR@10MHz	Pout=47.3dBm		-41	-39	dBc

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ\_Carrier= 350mA, Vgsp = Vgsc - 1.3V,  
PAVG = 47.3 dBm 1C-WCDMA 5MHz Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH FT Board

### Load Mismatch Test

Condition	Test Result
VSWR=10:1, at all Phase Angles, VDD = +28Vdc, IDQ_Carrier= 350mA, Vgsp = Vgsc - 1.3V, 1C-WCDMA 5MHz Signal, 9.9 dB PAR, PAVG = 50 dBm, Frequency 2140 MHz test on WATECH Application Board	No Device Degradation

### Thermal Information

Parameter	Condition	Value (Typ)	Unit
Thermal Resistance Junction to Case (R <sub>TH</sub> )	T <sub>CASE</sub> = 80°C, VDD = +28Vdc, IDQ_Carrier= 350mA, 1C-WCDMA 5MHz Signal, 9.9 dB PAR, PAVG = 47.3dBm	0.35	°C /W

### Load Pull Performance Carrier

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ= 400mA, PW = 10us, DC = 10%

Max Output Power (Carrier)						
Freq (MHz)	Z <sub>source</sub> (Ω)	Z <sub>load</sub> [1] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
2110	5.9+j2.4	4+j0.3	20.3	52.2	166	59.3
2140	4.4+j2.3	3.3+j0.1	20.4	52.2	166	58.3
2170	3+j1.4	3.3+j0.3	20.3	52.2	166	57.8

[1] Load impedance for optimum P3dB pout



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## 370W, 1805 - 2170 MHz LDMOS Amplifier

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Max Drain Efficiency (Carrier)						
Freq (MHz)	Z <sub>source</sub> (Ω)	Z <sub>load</sub> [2] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
2110	5.9+j2.4	5.2-j3.2	23.6	50.7	115	67.6
2140	4.4+j2.3	5.8-j2.6	23.4	50.8	120	67.4
2170	3+j1.4	5.8-j1.8	23.1	50.9	125	67.3

[2] Load impedance for optimum P3dB efficiency

### Load Pull Performance Peaking

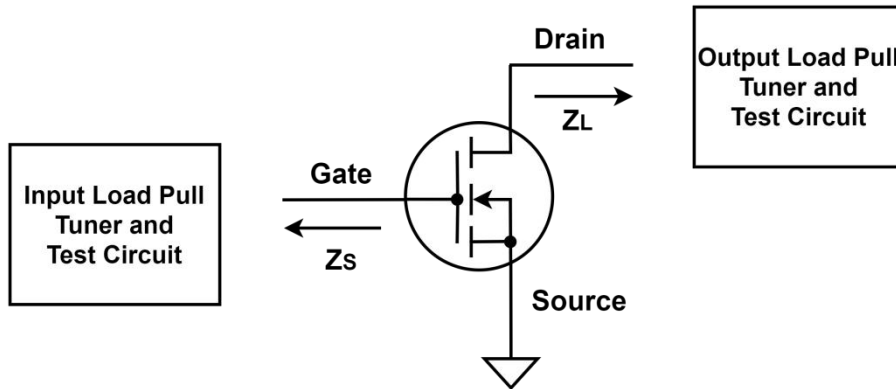
Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ= 800mA, PW = 10us, DC = 10%

Max Output Power (Peaking)						
Freq (MHz)	Z <sub>source</sub> (Ω)	Z <sub>load</sub> [1] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
2110	7.1+j3.8	5.1-j1.6	18.3	54.5	280	55.3
2140	4.9+j3.2	5.1-j1.1	18.6	54.5	280	54.9
2170	3.5+j2.5	4.5-j0.6	18.2	54.5	280	54.1

[1] Load impedance for optimum P3dB pout

Max Drain Efficiency (Peaking)						
Freq (MHz)	Z <sub>source</sub> (Ω)	Z <sub>load</sub> [2] (Ω)	Gain (dB)	P3dB (dBm)	P3dB (W)	Eff (%)
2110	7.1+j3.8	4.6-j5.1	21.2	53.4	225	62.7
2140	4.9+j3.2	4.8-j4.6	21.2	53.4	225	62.3
2170	3.5+j2.5	5.4-j4.2	21.1	53.4	225	62.1

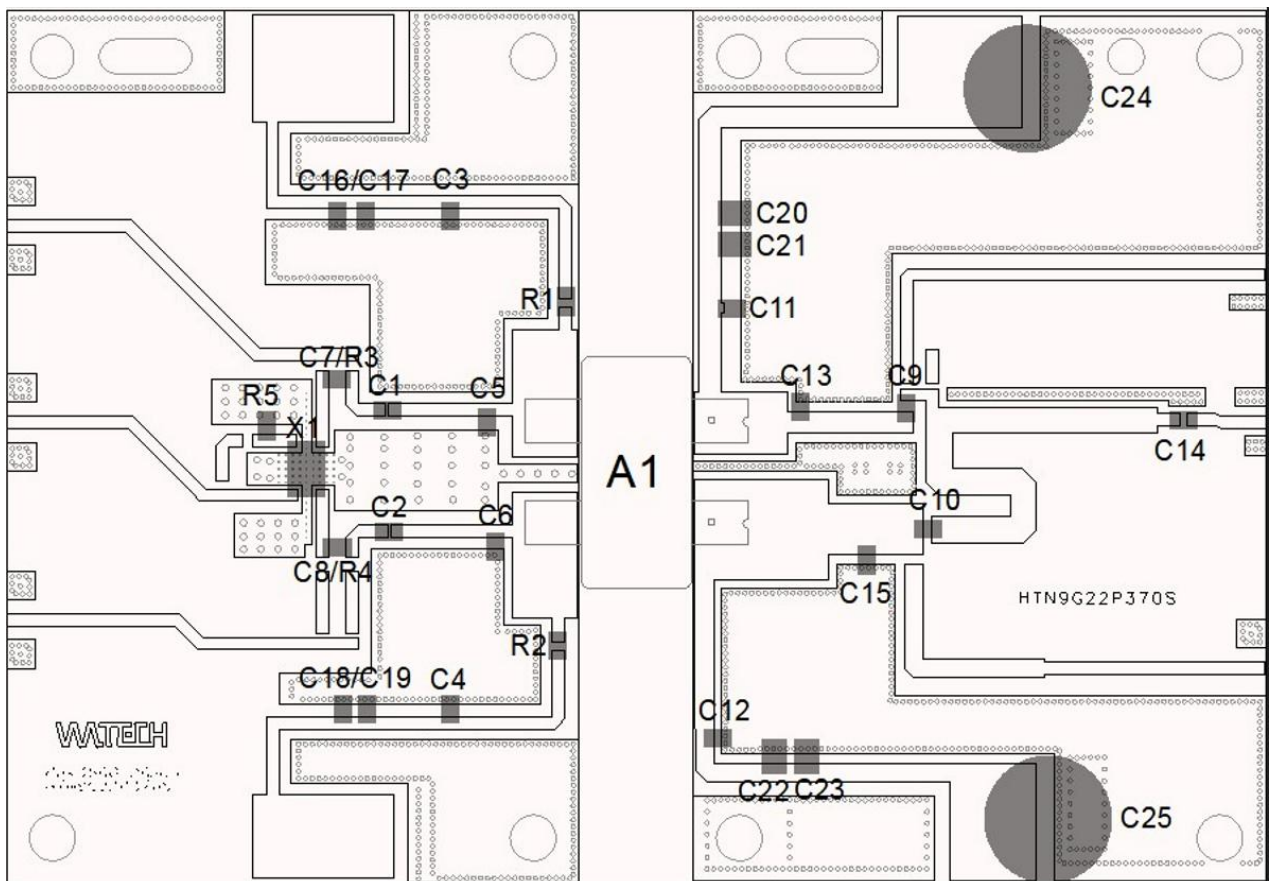
[2] Load impedance for optimum P3dB efficiency



$Z_{source}$  : Measured impedance presented to the input of the device at the package reference plane

$Z_{load}$  : Measured impedance presented to the output of the device at the package reference plane

### HTN9G22P370S 1805- 2170 MHz Reference Design



EVB Layout



# HTN9G22P370S

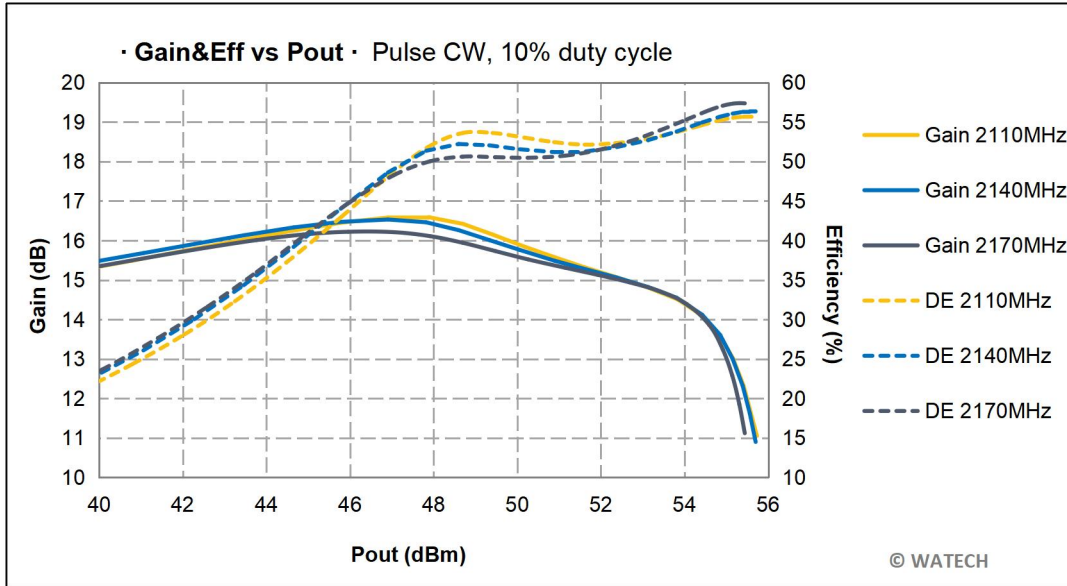
## 370W, 1805 - 2170 MHz LDMOS Amplifier

Product datasheet

### Bill of Materials (BoM) - HTN9G22P370S 2110 - 2170 MHz Reference Design

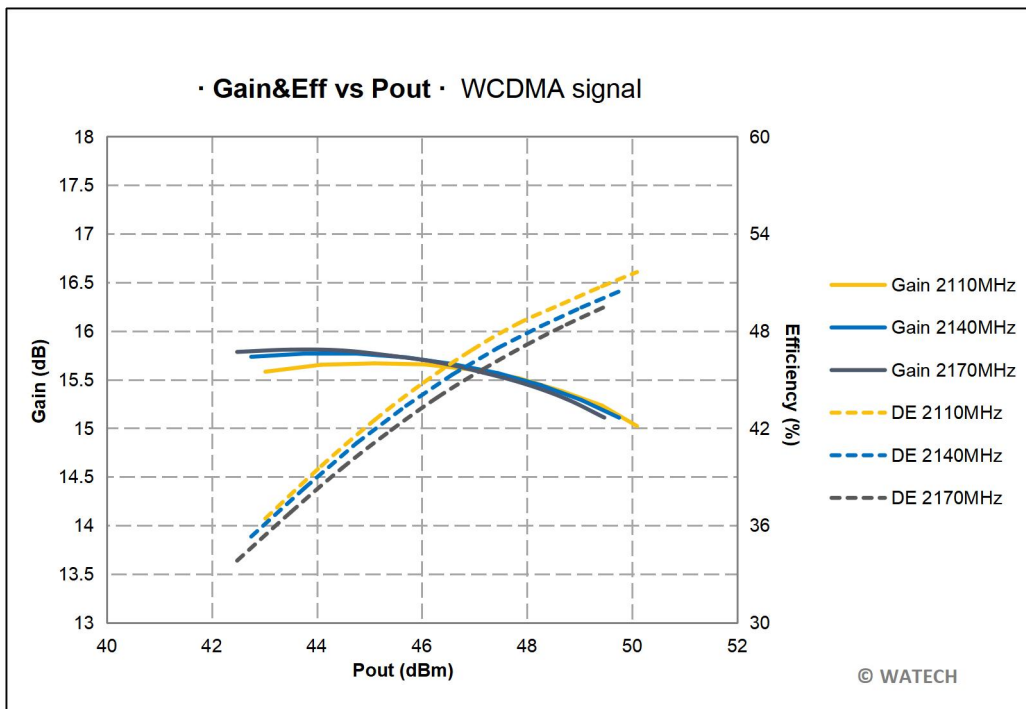
Reference	Value	Description	Manufacturer	P/N
A1	370W	LDMOS transistor	Watech	HTN9G22P370S
C1	8.2pF	0805 Chip Capacitor	Murata	GQM1875G2E8R20BB12D
C2,C3,C4	16pF	0805 Chip Capacitor	Murata	GQM1875G2E16R0BB12D
C5,C13	2.7pF	0805 Chip Capacitor	Murata	GQM1875G2E2R70BB12D
C6	3.3pF	0805 Chip Capacitor	Murata	GQM1875G2E3R60BB12D
C7,C8	5.0pF	0805 Chip Capacitor	Murata	GQM1875G2E5R00BB12D
C9	12pF	0805 Chip Capacitor	Murata	GQM1875G2E12R0BB12D
C10	20pF	0805 Chip Capacitor	Murata	GQM1875G2E20R0BB12D
C11,C12	24pF	0805 Chip Capacitor	Murata	GQM1875G2E24R0BB12D
C14	16pF	0805 Chip Capacitor	Murata	GQM1875G2E1R80BB12D
C15	0.9pF	0805 Chip Capacitor	Murata	GQM1875G2E0R80BB12D
C16,C17,C18,C19 C20,C21,C22,C23	10uF	1210 Chip Capacitor	Murata	GRM32EC72A106KE05L
C24,C25	470uF	Electrolytic Capacitor	Nichicon	
R1,R2	10ohm	0805, SMD		
R3,R4	100ohm	0805, SMD		
R5	50ohm	50ohm 25W Load	Anaren	C16A50Z4
X1	2dB	2dB, 90°	Anaren	X3C20F1-02S

### Performance Plots



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

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ= 380mA, Vgsp = Vgsc - 1.3V, PW = 100us, DC= 10% test on WATECH Application Board



**WCDMA, Gain and Efficiency vs Pout**

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ= 380mA, Vgsp = Vgsc - 1.3V, 1C-WCDMA 5MHz

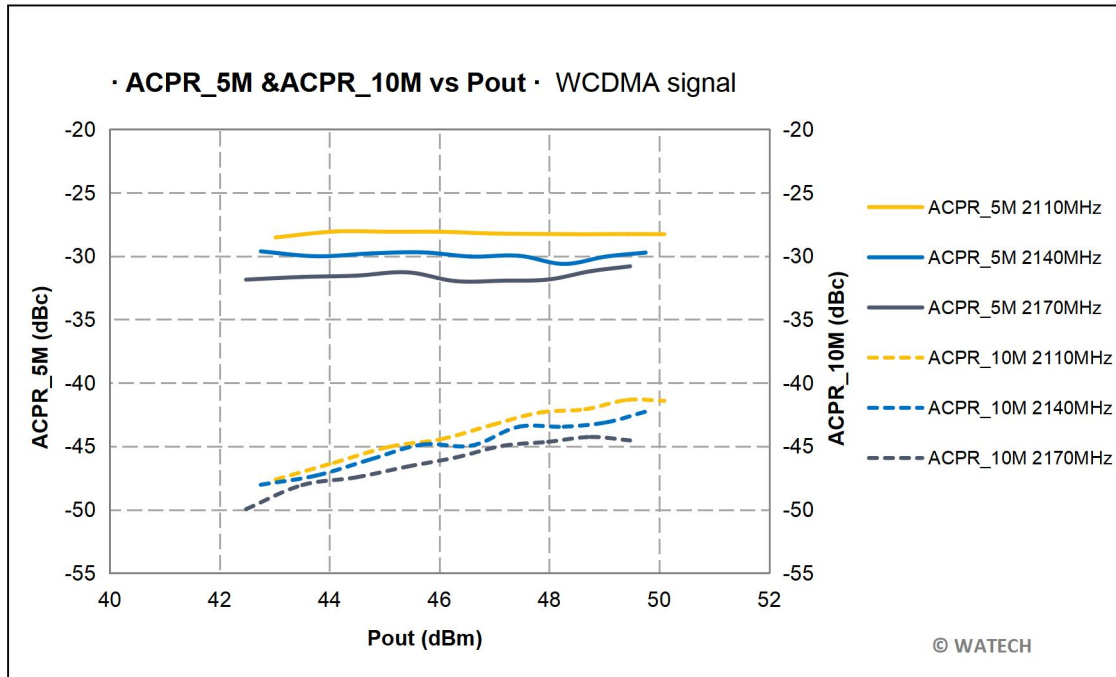




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Product datasheet

Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH Application Board

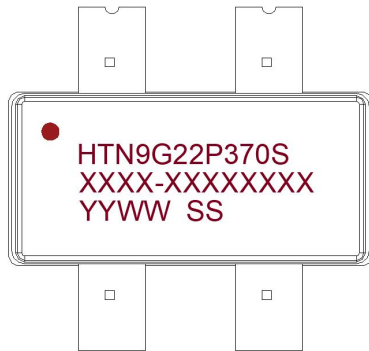


### WCDMA, ACPR\_5MHz, ACPR\_10MHz vs Pout

Test conditions unless otherwise noted: 25 °C, VDD = +28Vdc, IDQ= 380mA, Vgsp = Vgsc - 1.3V, 1C-WCDMA 5MHz

Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH Application Board

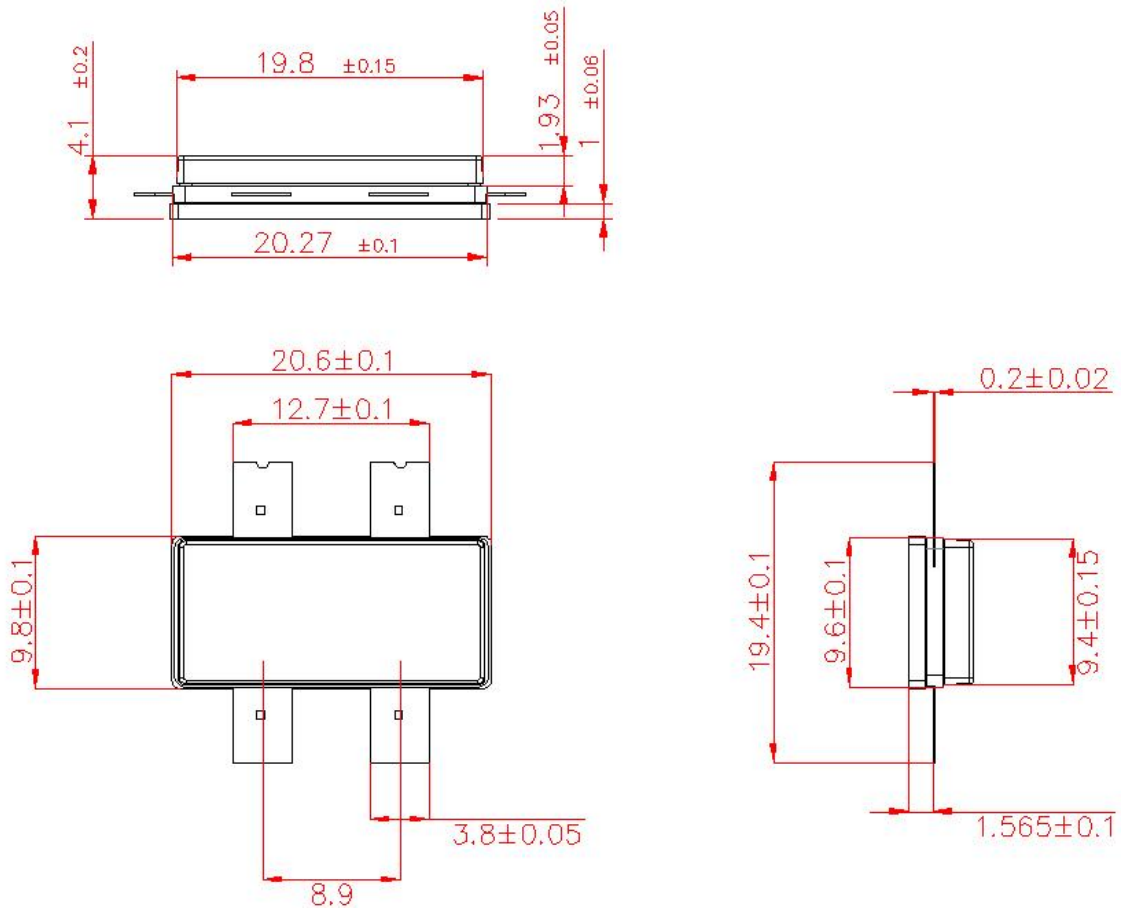
### Package Marking and Dimensions



- Line1 (fixed): Device name in W/O
- Line2 (unfixed): Marking Lot No in W/O (Sample: E596-EERA0001)
- Line3 (unfixed): Date Code + SS (last two of LOT No.)

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"

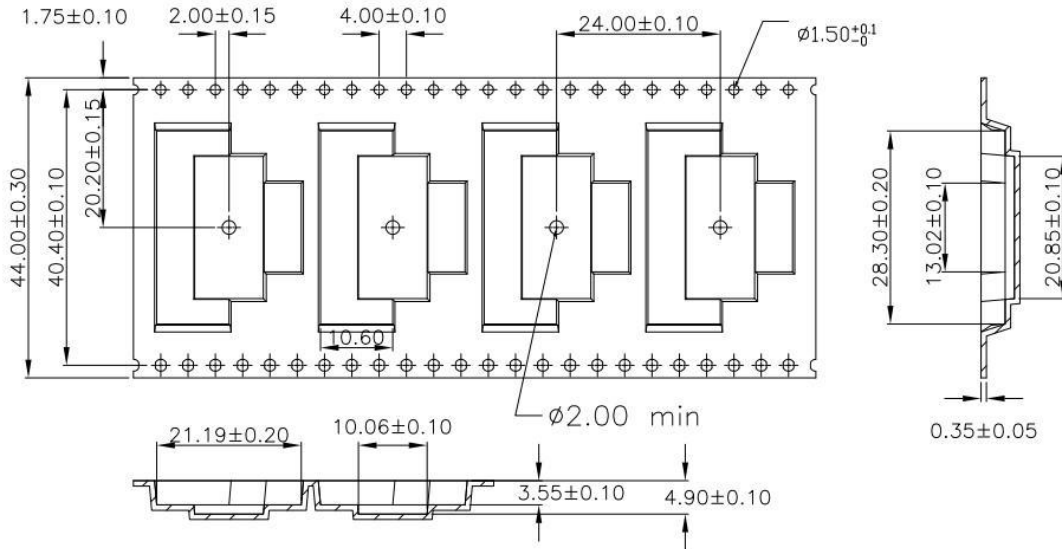
#### Marking



#### Package Dimensions

### Tape and Reel Information

Package Type	Reel Size(inch)	Qty/Reel(pcs)	Qty/Box(pcs)	Qty/Carton(pcs)
ACS2110S-4L	13	500	500	2500



**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 – 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

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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

## Revision history

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Document ID	Datasheet Status	Release Date	Revision Version
Rev 1.0	Preliminary	April. 2023	Preliminary
Rev 2.0	Product	Oct. 2023	Update
Rev 3.0	Product	Feb.2024	Update DC Characteristics and R <sub>TH</sub>



## 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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