

HS8298H Front-end Module

Product Features

High Output Power

- 34.0dBm at GSM850/EGSM900
- 31.0dBm at DCS1800/PCS1900

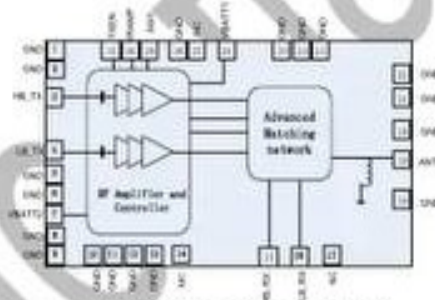
High Power Added Efficiency

- GSM850 41% PAE
- EGSM900 41% PAE
- DCS1800 35% PAE
- PCS1900 35% PAE

Integrated Control and Protection

Applications

- VBATT Operating range 3.0V to 4.5V
- Complete power control solution
- Advanced CMOS process
- LGA 5.25mm x 5.30mm x 0.82mm
- Quad-band cellular handsets
- Multimode Mobile Handset Applications
- GPRS Class 12 Compliant
- Portable Battery-Powered Equipment



Functional Block Diagram

Product Description

The HS8298H is a complete CMOS high-power, high-efficiency transmit module for low cost quad-band TX (GSM850/EGSM900/DCS1800/PCS1900)/dual-band RX GSM/GPRS mobile handsets. Power amplifier, Power controller circuit and switch circuit have been integrated in a single CMOS chip. Internal TX/RX 50Ω matching, DC blocking on TX/Ant and harmonic filtering circuits are integrated, and this eliminates the extra need of external components, simplifies layout and reduces board space as well. The advanced front-end module architecture has been designed specifically to use standard CMOS technology to implement high output power at high efficiency over all the operating conditions. No external compensation for temperature, frequency or battery is another advantage to meet RF performance over various conditions. The module is packaged in a small LGA format (5.25mm x 5.3mm x 0.82mm).

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.5 to 5.5	V _{DC}
Ramp Voltage (VRAMP)	-0.5 to 3.0	V
Input RF Power	10	dBm
Operating Case Temperature	-20 to 85	°C
Storage Temperature	-55 to 150	°C
Max Duty Cycle	50	%
ESD All Pins, Human Body Model ANSI/JEDEC/EDSA standard JS-001-2010	2,000	V
ESD Antenna port (IEC 61000-4-2)	8	kV

Electrical Specifications – Overall

Parameter	Min	Typ.	Max	Unit
Supply Voltage	3	3.5	4.5	V
Power Control Voltage (VRAMP)	0.2		1.7	V
TX Enable "ON" (TXEN pin)	1.5			V
TX Enable "OFF"			0.5	V
Logic control "High" (BS, VLOGIC pin)	1.5			V
Logic control "Low"			0.5	V
Input RF Power	0		6	dBm
Operating Temperature	-20	+25	+85	°C

Mode Control Logic Truth Table

Mode	TXEN	SW1	VRAMP
Power Down	0	0	--
LB TX On	1	0	Power control
HB TX On	1	1	Power control
LB RX ON(RXLB) ¹	0	0	--
HB RX ON(RXHB) ²	0	1	--

Note 1, 2 LB RX and HB RX ports don't support interchangeable function.

Electrical Specifications – Transmit GSM850 Band

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
Overall – GSM850 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 824 MHz to 849 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1= 'High', CTRL0 = 'Low'
Operating frequency	824		849	MHz	
Output Power					
Maximum Power		34.2			Temp= 25°C, VBAT=3.5V, VRAMP= VRAMP max
Power-Added Efficiency And Supply Current					
Maximum PAE		40		%	At P _{OUT} =33.0dBm typ.
Supply Current at Rated Power		1.3		A	Peak current at P _{OUT} =33.0dBm typ.
Spurious					
Output Noise Power		-83	-80	dBm	RBW=100kHz; 20MHz offset; P _{out} ≤33.5dBm
Forward Isolation 1		-55	-48	dBm	TXEN='Low', VRAMP ≤0.1V
Forward Isolation 2		-48	-40	dBm	TXEN='High', VRAMP ≤0.1V
2nd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 33.0dBm
3rd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 33.0dBm
All other harmonics up to 12.75 GHz			-30	dBm	P _{OUT} =5dBm to 33.0dBm
All Other Non-Harmonic Spurious			-36	dBm	P _{OUT} =5dBm to 33.0dBm

Electrical Specifications – Transmit GSM850 Band (cont.)

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
GSM850 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 824 MHz to 849 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'Low'
Output Load VSWR Stability	10:1				Spurious < -36dBm, with P _{OUT} set to ≤ 33.0dBm into 50Ω load, all phases, RBW=3MHz
Output Load VSWR Ruggedness	20:1				P _{OUT} set to ≤ 33.0dBm into 50Ω load No damage or permanent degradation. All phases
Output Load Impedance		50		Ω	Load impedance presented at Antenna pad
Input Port Characteristics					
Input Power Range	0		6	dBm	Max output guaranteed at Min input level
Input Impedance		50		Ω	
Input VSWR		2.0:1			P _{OUT} = 5dBm to 33.5dBm, P _{IN} ≤ 6dBm
Power Control					
Power Control Range	40	50		dB	VRAMP = VRAMP min to VRAMP max

Electrical Specifications – Transmit EGSM900 Band

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
EGSM900 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 880 MHz to 915 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'Low'
Operating frequency	880		915	MHz	
Output Power					
Maximum Power		34.1			Temp= 25°C, VBAT=3.5V, VRAMP= VRAMP max
Power-Added Efficiency And Supply Current					
Maximum PAE		40		%	At P _{OUT} =33.0dBm typ.
Supply Current at Rated Power		1.3		A	Peak current at P _{OUT} =33.0dBm typ.
Spurious					
Output Noise Power		-83	-80	dBm	RBW=100kHz; 20MHz offset; P _{out} ≤33.5dBm
Forward Isolation 1		-55	-48	dBm	TXEN='Low', VRAMP ≤0.1V
Forward Isolation 2		-48	-40	dBm	TXEN='High', VRAMP ≤0.1V
2nd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 33.0dBm
3rd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 33.0dBm
All other harmonics up to 12.75 GHz			-30	dBm	P _{OUT} =5dBm to 33.0dBm
All Other Non-Harmonic Spurious			-36	dBm	P _{OUT} =5dBm to 33.0dBm

Electrical Specifications – Transmit EGSM900 Band (cont.)

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
EGSM900 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 880 MHz to 915 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'Low'
Output Load VSWR Stability	10:1				Spurious < -36dBm, with P _{OUT} set to ≤ 33.0dBm into 50Ω load, all phases, RBW=3MHz
Output Load VSWR Ruggedness	20:1				P _{OUT} set to ≤ 33.0dBm into 50Ω load No damage or permanent degradation. All phases
Output Load Impedance		50		Ω	Load impedance presented at Antenna pad
Input Port Characteristics					
Input Power Range	0		6	dBm	Max output guaranteed at Min input level
Input Impedance		50		Ω	
Input VSWR		2.0:1			P _{OUT} = 5dBm to 33.5dBm, P _{IN} ≤ 6dBm
Power Control					
Power Control Range	40	50		dB	VRAMP = VRAMP min to VRAMP max

Electrical Specifications – Transmit DCS1800 Band

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
DCS1800 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 1710 MHz to 1785 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'High'
Operating frequency	1710		1785	MHz	
Output Power					
Maximum Power		31.5			Temp= 25°C, VBAT=3.5V, VRAMP= VRAMP max
Power-Added Efficiency And Supply Current					
Maximum PAE		30		%	At P _{OUT} =30.0dBm typ.
Supply Current at Rated Power		0.93		A	Peak current at P _{OUT} =30.0dBm typ.
Spurious					
Output Noise Power		-83	-80	dBm	RBW=100kHz; 20MHz offset; P _{out} ≤31dBm
Forward Isolation 1		-52		dBm	TXEN='Low', VRAMP ≤0.1V
Forward Isolation 2		-48	-40	dBm	TXEN='High', VRAMP ≤0.1V
2nd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 30dBm
3rd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 30dBm
All other harmonics up to 12.75 GHz			-30	dBm	P _{OUT} =5dBm to 30dBm
All Other Non-Harmonic Spurious			-36	dBm	P _{OUT} =5dBm to 30dBm

Electrical Specifications – Transmit DCS1800 Band (cont.)

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
DCS1800 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 1710 MHz to 1785 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'High'
Stability					
Output Load VSWR Stability	10:1				Spurious < -36dBm, with P _{OUT} set to ≤ 31dBm into 50Ω load, all phases, RBW=3MHz
Output Load VSWR Ruggedness	20:1				P _{OUT} set to ≤ 31dBm into 50Ω load No damage or permanent degradation. All phases
Output Load Impedance		50		Ω	Load impedance presented at Antenna pad
Input Port Characteristics					
Input Power Range	0		6	dBm	Max output guaranteed at Min input level
Input Impedance		50		Ω	
Input VSWR		2.0:1			P _{OUT} = 5dBm to 31dBm, P _{IN} ≤ 6dBm
Power Control					
Power Control Range	40	50		dB	VRAMP = VRAMP min to VRAMP max

Electrical Specifications – Transmit PCS1900 Band

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
PCS1900 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 1850 MHz to 1910 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'High'
Operating frequency	1850		1910	MHz	
Output Power					
Maximum Power		31.0			Temp= 25°C, VBAT=3.5V, VRAMP= VRAMP max
Power-Added Efficiency And Supply Current					
Maximum PAE		30		%	At P _{OUT} =30.0dBm typ.
Supply Current at Rated Power		0.93		A	Peak current at P _{OUT} =30.0dBm typ.
Spurious					
Output Noise Power		-83	-80	dBm	RBW=100kHz; 20MHz offset; P _{out} ≤31dBm
Forward Isolation 1		-52		dBm	TXEN='Low', VRAMP ≤0.1V
Forward Isolation 2		-48	-40	dBm	TXEN='High', VRAMP ≤0.1V
2nd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 30dBm
3rd harmonic		-40	-33	dBm	P _{OUT} =5dBm to 30dBm
All other harmonics up to 12.75 GHz			-30	dBm	P _{OUT} =5dBm to 30dBm
All Other Non-Harmonic Spurious			-36	dBm	P _{OUT} =5dBm to 30dBm

Electrical Specifications – Transmit PCS1900 Band (cont.)

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
PCS1900 Band					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBATT = 3.5V, PIN = 3dBm Frequency = 1850 MHz to 1910 MHz, 12.5% Duty Cycle, Pulse Width = 577μs, TXEN = 'High', CTRL1 = 'High', CTRL0 = 'High'
Stability					
Output Load VSWR Stability	10:1				Spurious < -36dBm, with P _{OUT} set to ≤ 31dBm into 50Ω load, all phases, RBW=3MHz
Output Load VSWR Ruggedness	20:1				P _{OUT} set to ≤ 31dBm into 50Ω load No damage or permanent degradation. All phases
Output Load Impedance		50		Ω	Load impedance presented at Antenna pad
Input Port Characteristics					
Input Power Range	0		6	dBm	Max output guaranteed at Min input level
Input Impedance		50		Ω	
Input VSWR		2.0:1			P _{OUT} = 5dBm to 31dBm, P _{IN} ≤ 6dBm
Power Control					
Power Control Range	40	50		dB	VRAMP = VRAMP min to VRAMP max

Electrical Specifications –RX GSM850/EGSM900 and DCS1800/PCS1900

Parameter	Specification			Unit	Condition
	Min	Typ	Max		
					Nominal Conditions (unless otherwise stated) Temperature = 25°C, VBA T = 3.5V
Insertion Loss ANT-RXLB		1.8		dB	Frequency=869MHz to 960MHz see Mode Control Logic Truth Table
Insertion Loss ANT-RXHB		1.8		dB	Frequency=1805MHz to 1990MHz see Mode Control Logic Truth Table
Input VSWR ANT-RXLB and ANT-RXHB Ports		1.5:1	2:1		Frequency=869MHz to 960MHz(RXLB) 1805MHz to 1990MHz(RXHB) see Mode Control Logic Truth Table
Leakage P _{OUT} at RXLB Port		2	5	dBm	P _{OUT} =33.0dBm, TXEN=High', CTRL0='Low' see Mode Control Logic Truth Table
Leakage P _{OUT} at RXHB Port		2	5	dBm	P _{OUT} =30.0dBm, TXEN=High', CTRL0=High' see Mode Control Logic Truth Table

Pin-Out Diagram

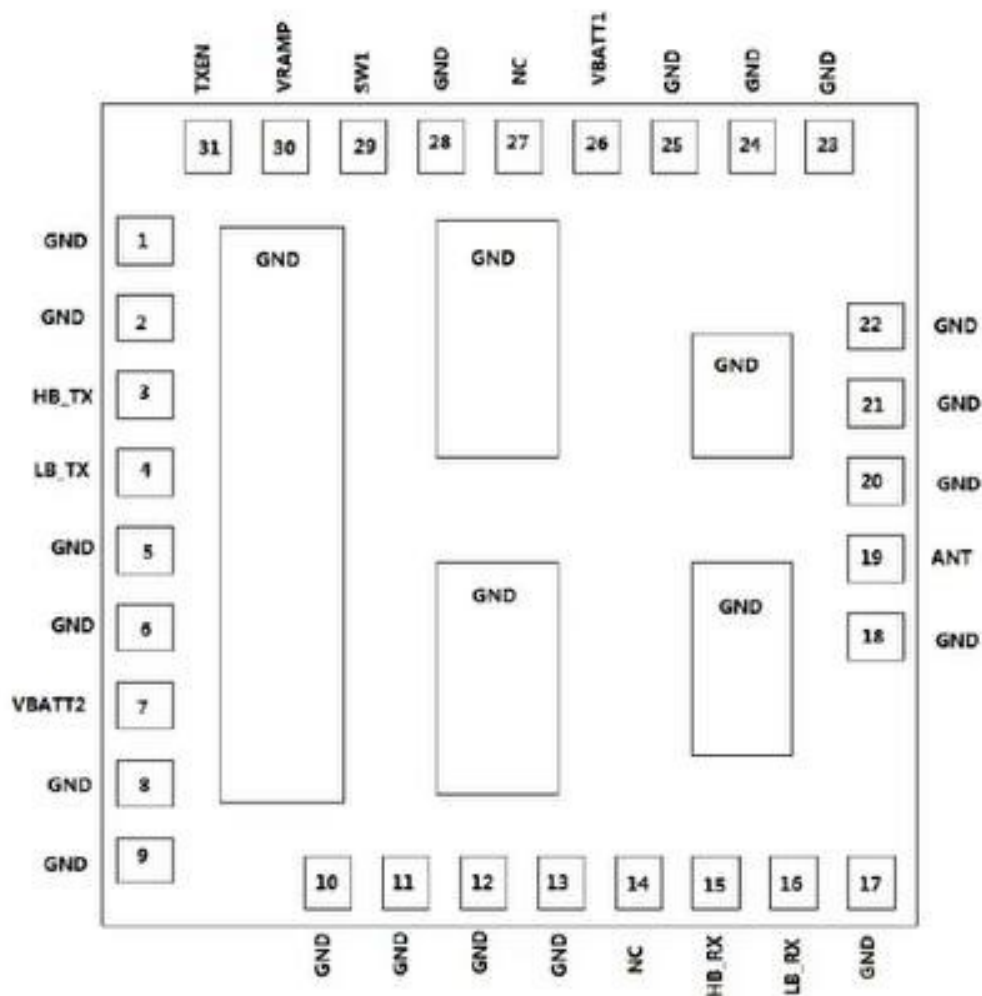


Figure 1 Top View of HS8298H

Pin-Out Information

Pin	Name	Description
1	GND	Ground.
2	GND	Ground.
3	HB_TX	HB RF input for DCS1800/PCS1900 bands. This is a 50Ω input.
4	LB_TX	LB RF input for GSM850/EGSM900 bands. This is a 50Ω input.
5	GND	Ground.
6	GND	Ground.

7	VBATT2	An external 10nF capacitor to GND should be connected to this pin . External connection to VBAT1 is not required.
8	GND	Ground.
9	GND	Ground.
10	GND	Ground.
11	GND	Ground.
12	GND	Ground.
13	GND	Ground.
14	NC	Ground.
15	HB_RX	HB RX port of antenna switch, for DCS1800 and PCS1900 RX. Matching network is integrated internally. A PI-type network is highly recommended for the best sensitivity optimization.(see Figure 2)
16	LB_RX	LB RX port of antenna switch, for GSM850 and EGSM900 RX. Matching network is integrated internally. A PI-type network is highly recommended for the best sensitivity optimization. (see Figure 2)
17	GND	Ground.
18	GND	Ground.
19	ANT	Antenna Port.
20/21/22/ 23/24/25	Ground.	Ground.
26	VBATT1	Power Supply for PA. The width of route trace for this pin should be larger than 2mm.
27	NC	Ground.
28	GND	Ground.
29	SW1	Band select logic pin. see Mode Control Logic Truth Table
30	VRAMP	VRAMP control pin.
31	TXEN	TX Enable logic pin. see Mode Control Logic Truth Table
	Ground Grid	Module underside

HS8298H Application Circuit

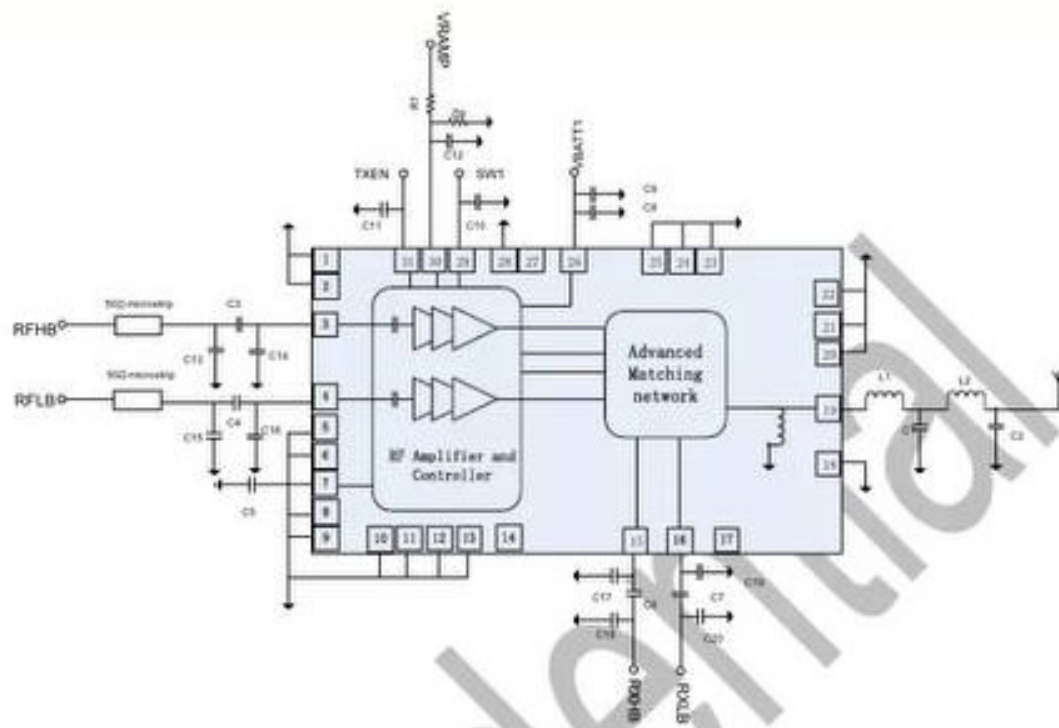


Figure 2 HS8298H Application Circuit

Table 1 Component values of application circuit

Component	Value	Component	Value
L1	3.9nH	C7	47pF
L2	0 Ohm	C10,C11	22pF
		C8	100pF
C1	0.5pF	C9	22uF
C2	NF	C12	220pF
C3	27pF		
C4	47pF	C13,C14,C15,C16,C17,C18,C19,C20	NF
C5	10nF	R1	10k
C6	27pF	R2	33k

Note:

1. C8 should be placed as close as possible to the chip.
2. The width for VBAT1 should be larger than 2mm.
3. C10, C11, are optional decoupling capacitors which may not be needed in the application.

4. L1,L2,C1, C2 are matching/filtering network(double L-type), should be placed as close as possible to the chip.

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Package Drawing

The HS8298H is encapsulated in a 5.25×5.30×0.82mm Land Grid Array (LGA) package on a laminate substrate. The HS8298H is RoHS compliant.

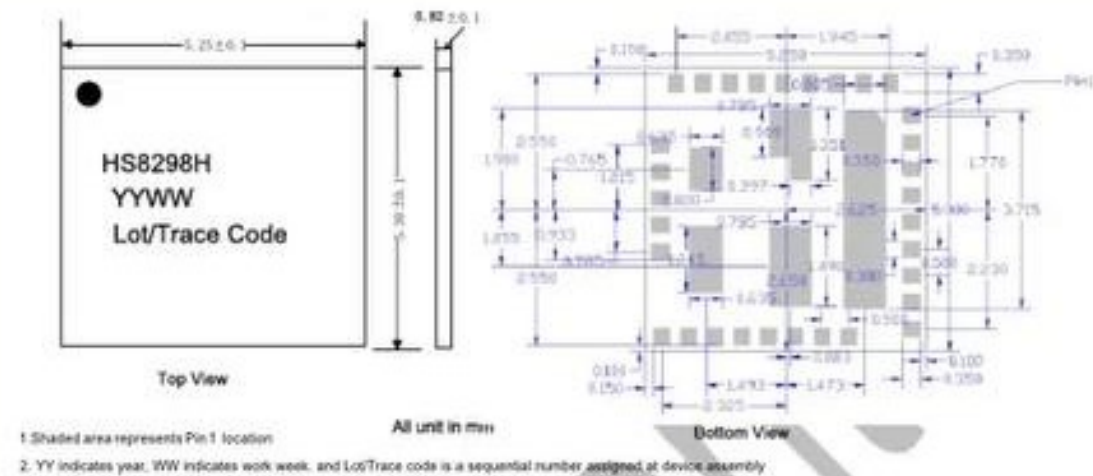


Figure 3 HS8298H Package Drawing

Suggested PCB Design



Figure 4 HS8298H PCB Metal Land Pattern (Top View)

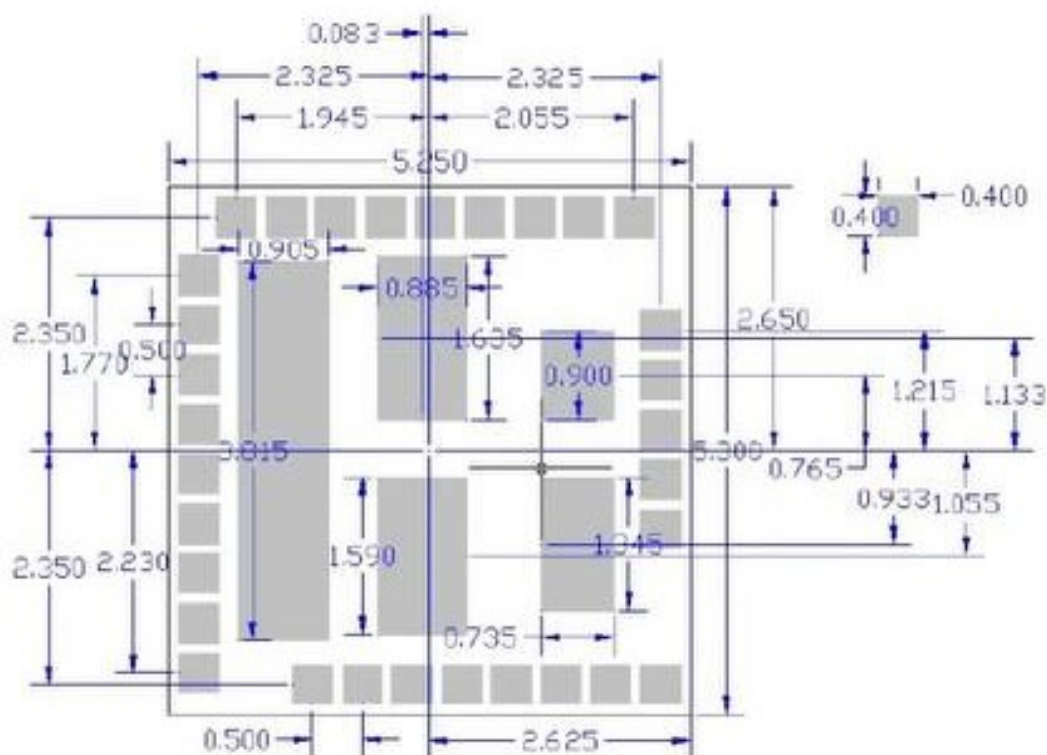


Figure 5 HS8298H PCB Solder Mask Pattern (Top View)

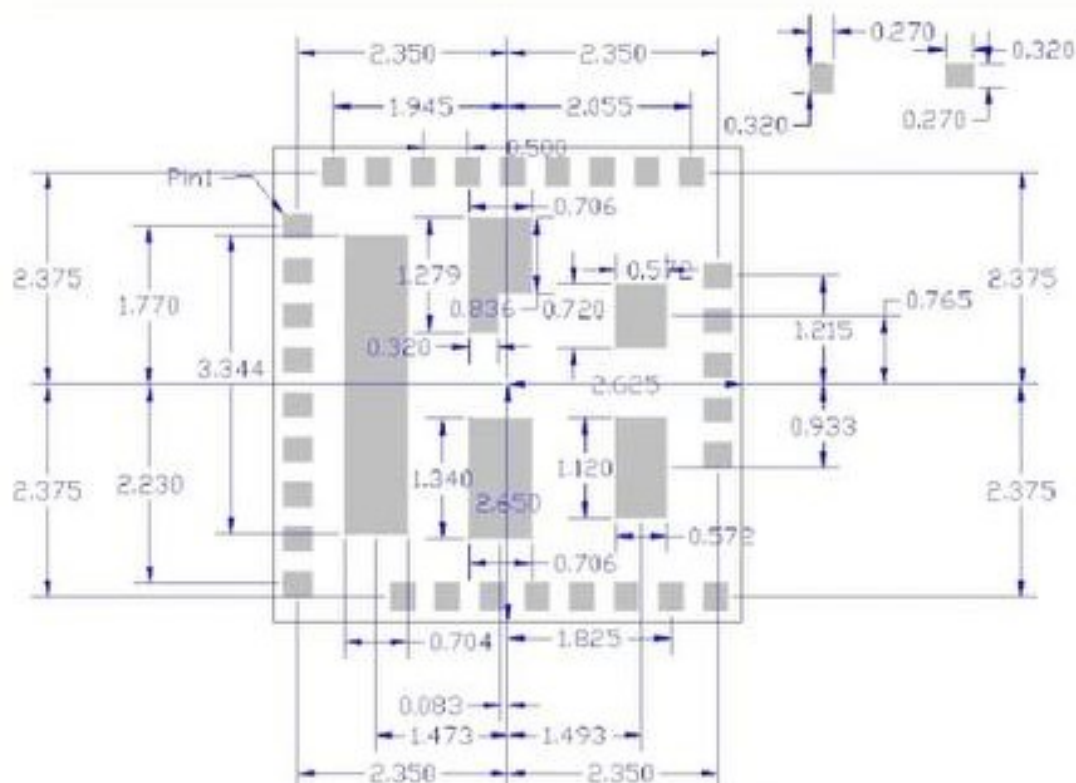


Figure 6 HS8298H PCB Stencil Pattern (Top View)

Notes:

1. All dimensions are in millimeters (mm)
2. Shaded area represents Pin1 location.
3. All dimensions are typical for reference only.

Ordering Information

Product Name	Order Number
Quad-Band GSM850/EGSM900/DCS1800/PCS1900 FEM	HS8298H

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