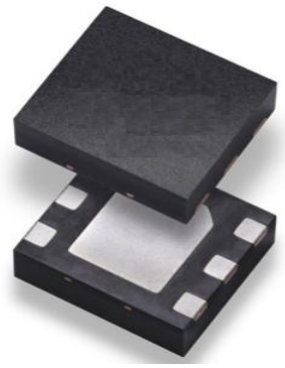
HTH2D49P060P
60 W, 4.5-5.0 GHz GaN Amplifier

Product Datasheet

Description

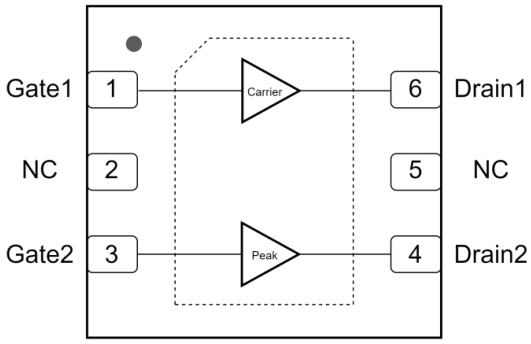
The HTH2D49P060P is a GaN Asymmetrical Doherty Power Amplifier designed for cellular base station applications with 60W saturation output power covering frequency range from 4.5 to 5.0 GHz.



RoHS compliant

DFN 7*6.5 Package

Block Diagram



Top View

Features

- Operating Frequency Range: 4.5 to 5.0 GHz
- Operating Drain Voltage: +48 V
- Saturation Output Power: 60 W
- Advanced Linearity Performance
- High Efficiency
- High terminal impedance for optimal broadband performance
- High reliability
- Small footprint package, DFN 7 x 6.5mm

Applications

- 3GPP 5G NR FR1 N79 and 4G/LTE band B79.
- Power Amplifier for Small cells.
- Driver Amplifier for macro base stations.
- Active antenna array for 5G mMIMO.
- Repeaters/DAS.

Order Information

Part Number	Description
HTH2D49P060P	Reel Package

Typical Performances

Freq (MHz)	P5dB (dBm)	Gain (dB)	Eff (%)	IRL (dB)
4500	48.7	15.0	43.2	15
4600	48.7	15.5	45.4	13
4700	48.7	15.3	46.4	13
4800	48.7	14.8	46.4	13
4900	48.5	14.1	45.6	12
5000	48.1	13.8	46.6	12

Test conditions unless otherwise noted: 25 °C, VDD = 48V, IDQ = 35mA, Vgsp = Vgsp[1] - 1.8V, Pout = 39.4dBm, Pulse Width = 100 us, Duty Cycle = 10% test on WATECH EVB.

[1] IDQ_Peak=40mA

Freq(MHz)	Gain(dB)	Eff(%)	ACPR 5MHz(dBc)	ACPR 10MHz(dBc)
4500	13.5	44.9	-26.8	-44.2
4600	14.2	46.5	-29.6	-46.4
4700	14.1	45.8	-33.9	-48.8
4800	13.9	44.8	-37.9	-49.2
4900	13.2	44.2	-38.1	-49.2
5000	12.9	45.0	-37.9	-49.3

Test conditions unless otherwise noted: 25 °C, VDD = 48V, IDQ = 35mA, Vgsp=Vgsp[1] - 1.8V, PAVG = 39.4 dBm 1C-WCDMA 5MHz Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH EVB.

Carrier LoadPull Performance

Max Output Power						
Freq (MHz)	Z_source (Ω)	Z_load [1] (Ω)	Gain (dB)	P5dB (dBm)	P5dB (W)	Eff (%)
4500	23.5 + j*59.7	9.4 - j*10.8	18.0	46.21	41.8	63.8
4700	29.1 + j*30.1	8.8 - j*11.2	17.8	46.24	42.1	65.2
5000	76.6 - j*10.9	9.1 - j*11.0	17.8	46.26	42.3	68.4
Max Drain Efficiency						
Freq (MHz)	Z_source (Ω)	Z_load [2] (Ω)	Gain (dB)	P5dB (dBm)	P5dB (W)	Eff (%)
4500	20.4 + j*58.6	5.8 - j*8.2	19.7	45.22	33.3	72.4
4700	28.7 + j*27.6	6.5 - j*7.9	19.3	45.30	33.9	72.7
5000	83.0 - j*15.6	6.4 - j*8.0	19.0	45.15	32.7	74.4

Test conditions unless otherwise noted: 25 °C, VDD = 48V, Idq = 35mA, Pulsed CW, 1000 us, Duty Cycle = 4%, Test on Watech Loadpull fixture.

Peak LoadPull Performance

Max Output Power						
Freq (MHz)	Z_source (Ω)	Z_load [1] (Ω)	Gain (dB)	P5dB (dBm)	P5dB (W)	Eff (%)
4500	18.0 + j*84.2	7.0 - j*15.8	16.7	47.69	58.7	63.5
4700	19.3 + j*55.2	5.7 - j*16.2	17.1	47.81	60.4	68.4
5000	26.9 + j*21.7	6.5 - j*16.8	16.5	47.77	59.8	66.5
Max Drain Efficiency						
Freq (MHz)	Z_source (Ω)	Z_load [2] (Ω)	Gain (dB)	P5dB (dBm)	P5dB (W)	Eff (%)
4500	17.6 + j*83.0	6.0 - j*12.7	17.5	46.91	49.1	68.3
4700	19.4 + j*53.2	5.5 - j*13.9	17.7	47.17	52.1	72.3
5000	27.9 + j*20.2	6.3 - j*14.4	16.7	47.15	51.9	67.5

Test conditions unless otherwise noted: 25 °C, VDD = 48V, Idq = 50mA, Pulsed CW, 1000 us, Duty Cycle = 4%, Test on Watech Loadpull fixture.

[1] Load impedance for optimum P5dB Pout

[2] Load impedance for optimum P5dB efficiency

Absolute Maximum Ratings

Parameter	Range/Value	Units
Drain voltage (VDSS)	0 to +150	V
Gate voltage (VGS)	-15 to =2	V
Storage Temperature (TSTG)	-55 to 150	℃
Case Temperature (TC)	-40 to 150	℃
Junction Temperature (TJ)	+275	℃

Electrical Specification

DC Characteristics Carrier

Parameter	Conditions	Min	Typ	Max	Units
Breakdown Voltage V(BR)DSS	VGS=-8V; IDS=3.5mA	150	-	-	V
Gate-Source threshold Voltage VGS(th)	VDS=6V; IDS=3.5mA	-3.8	-2.8	-2.2	V
Drain leakage Current IDSS	VDS=50V; VGS=-10V	-	-	0.7	mA
Gate leakage Current IGSS	VDS=0V; VGS=-8V	-	-	0.35	mA

DC Characteristics Peak

Parameter	Conditions	Min	Typ	Max	Units
Breakdown Voltage V(BR)DSS	VGS=-8V; IDS=5.0mA	150	-	-	V
Gate-Source threshold Voltage VGS(th)	VDS=6V; IDS=5.0mA	-3.8	-2.8	-2.2	V
Drain leakage Current IDSS	VDS=50V; VGS=-10V	-	-	1.0	mA
Gate leakage Current IGSS	VDS=0V; VGS=-8V	-	-	0.5	mA

RF Characteristics (Pulsed CW)

Parameter	Conditions	Min	Typ	Max	Units
P5dB	Freq=4.9GHz	47.5	48.5	-	dBm
Gain@39.4dBm	Freq=4.9GHz	11	13.5	-	dB
Eff@39.4dBm	Freq=4.9GHz	42	46	-	%
IRL	Freq=4.9GHz	10	12	-	dB
Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Units**
P5dB	Freq=5.0GHz	47.5	48.3	-	dBm
Gain@39.4dBm	Freq=5.0GHz	11	13.5	-	dB
Eff@39.4dBm	Freq=5.0GHz	40	44	-	%
IRL	Freq=5.0GHz	10	12	-	dB

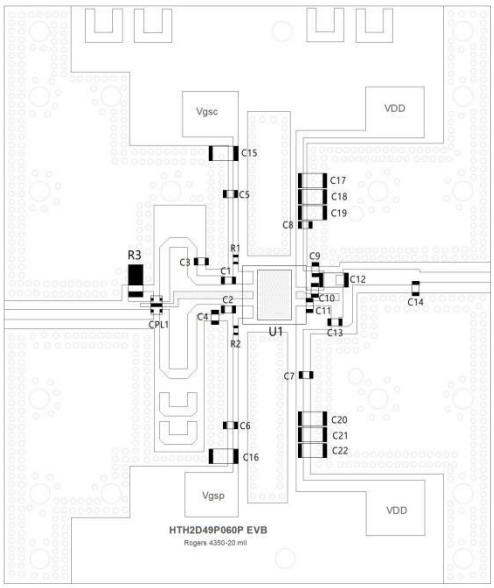
Test conditions, unless otherwise noted: 25 °C, VDD = 48V, IDQ = 35 mA, Vgsp = $Vgsp_{[1]}$-2.2V, Pulse Width = 1000 us, Duty Cycle = 5%, test on FT board with compensation.

[1] IDQ_Peak=40mA

Thermal Information

Symbol	Parameter	Conditions	Value (Typ)	Units
Rth(s-c)(IR)	Thermal resistance from active Die Surface to Case by Infrared measurement	T-Case = 125℃, Pdiss = 14W	4.0	K/W
Rth(ch-c)(FEA)	Thermal resistance from active Die Channel to Case by Finite Element Analysis	T-Case = 125℃, Pdiss = 14W	6.1	K/W

HTH2D49P060P 4.5-5.0 GHz Reference Design



EVB Layout

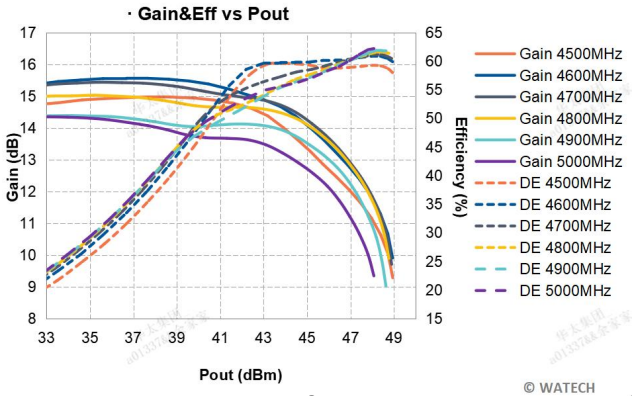
Rogers 4350B, thickness=20mil

PCB is soldered on a 54 mm by 64 mm copper base plate with 10 mm thickness

BOM-HTH2D49P060P 4.5 – 5.0 GHz Reference Design

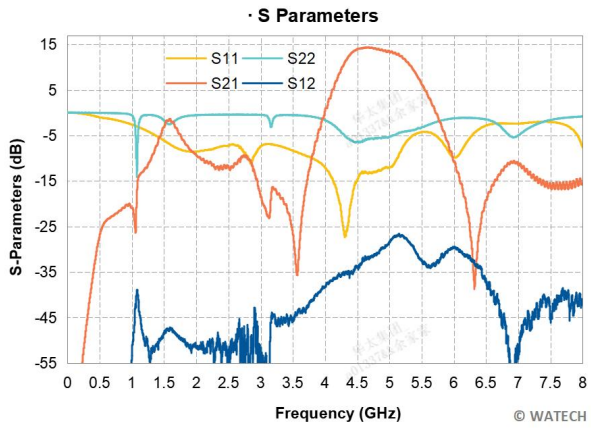
Component	Type	Value	Description	Manufacturer	P/N
U1	Transistor	/	GaN transistor	WATECH	HTH2D49P060P
C1,C2	Capacitor	1.0pF	0603 MLCC	Murata	GQM1875G2E1R0BB12
C3,C4	Capacitor	0.4pF	0603 MLCC	Murata	GQM1875G2ER40BB12
C5,C6,C7	Capacitor	1.8pF	0603 MLCC	Murata	GQM1875G2E1R8BB12
C8	Capacitor	1.2pF	0603 MLCC	Murata	GQM1875G2E1R2BB12
C9,C10,C11	Capacitor	0.5pF	0603 MLCC	Murata	GQM1875G2ER50BB12
C12	Capacitor	0.8pF	0805 MLCC	Murata	GQM2195G2ER80BB12
C13	Capacitor	1.0pF	0603 MLCC	Murata	GQM1875G2E1R0BB12
C14	Capacitor	0.1pF	0603 MLCC	Murata	GQM1875G2ER10BB12
C15-C22	Capacitor	1uF	0805 MLCC	Murata	GRM21BC72A105KE01L
R1,R2	Resistor	10 Ω	0402 Resistor	YAGEO	RC0402JR-100RL
R3	Resistor	50 Ω	16 Watts, 50Ω	Anaren	C16A50Z4
CPL1	Coupler	3dB	Hybrid Coupler	Anaren	X4C45J1-03S

Performance Plots



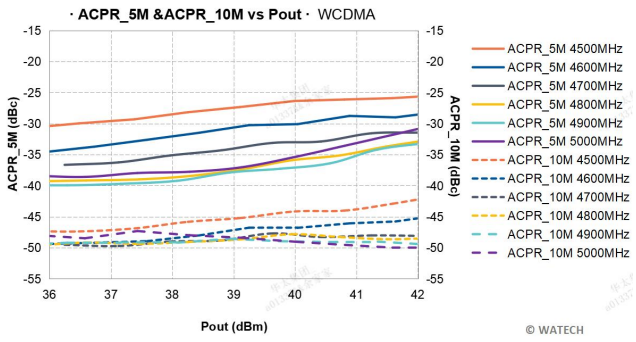
Pulsed-CW performance(Gain+Eff)

Test conditions, unless otherwise noted: 25 °C, VDD = 48 V, IDQ = 35 mA, Vgsp = Vgsp[1] - 1.8V, Pulse Width = 100 us, Duty Cycle = 10%, test on WATECH EVB.

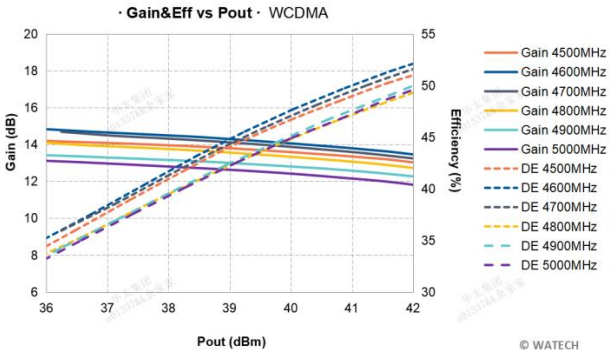


S-Parameter

Test conditions, unless otherwise noted: 25 °C, VDD = 48 V, IDQ = 35 mA, Vgsp = Vgsp[1] - 1.8V, test on WATECH EVB.



WCDMA performance(ACPR)

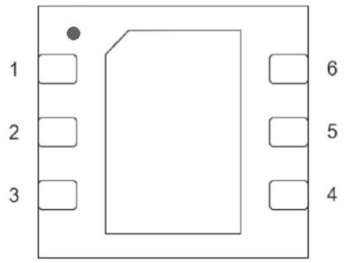


WCDMA performance(Gain+Eff)

Test conditions, unless otherwise noted: 25 °C, VDD = 48V, IDQ = 35 mA, Vgsp = Vgsp[1] - 1.8V, 1C-WCDMA 5MHz Signal, 9.9 dB PAR @ 0.01% CCDF test on WATECH EVB.

[1] IDQ_Peak=40mA

Pin Configuration and Description



Top view

Exposed backside of the package is the ground terminal of the device.

Pin Configuration

Pin Number	Label	Description
1	Gate1(carrier)	Gate-Source voltage of carrier
2	NC	Not Connected
3	Gate2(peak)	Gate-Source voltage of peak
4	Drain1(peak)	Drain-Source voltage of peak
5	NC	Not Connected
6	Drain2(carrier)	Drain-Source voltage of carrier

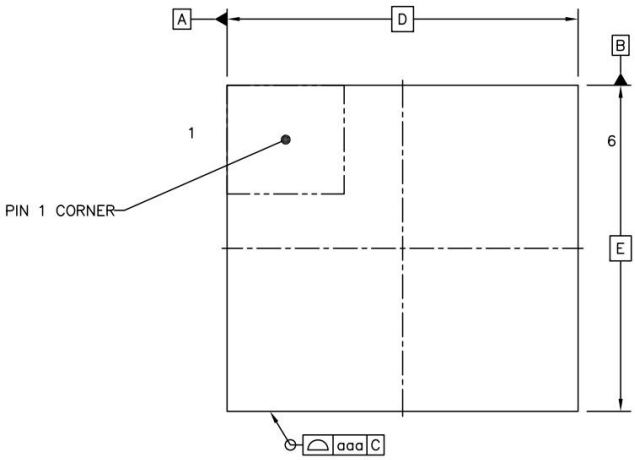
Package Marking and Dimensions

Line1: fixed : device name in W/O

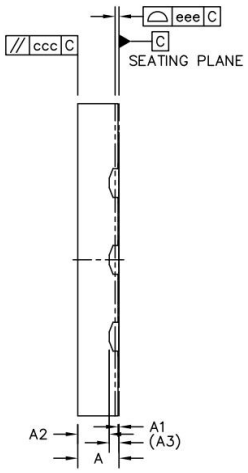
Line2 :unfixed: the last eight digits of Marking Lot No in W/O (Sample:EWRE0001)

Line3 :unfixed: "Date Code"+"-"+ "JY"

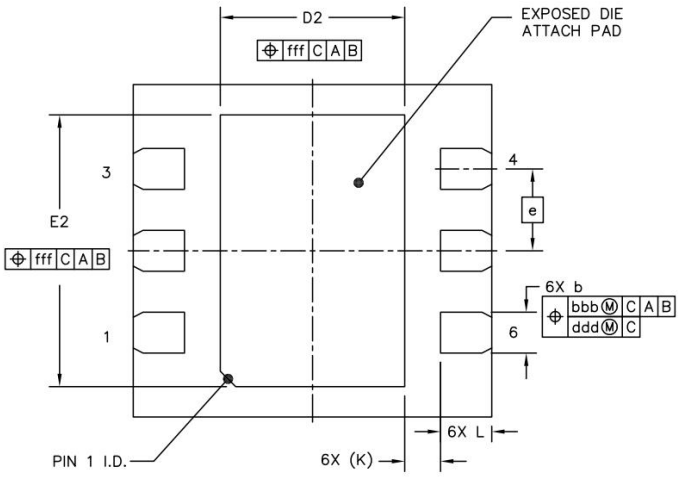
Marking



TOP VIEW



SIDE VIEW



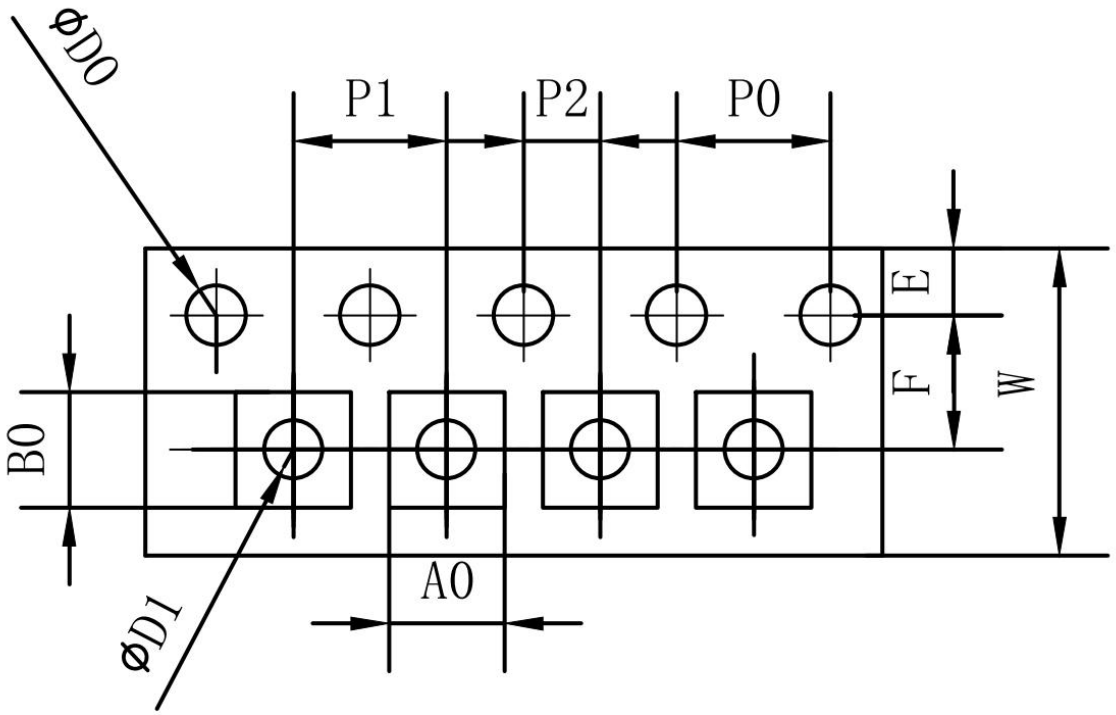
BOTTOM VIEW

		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.8	0.85	0.9
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.65	---
L/F THICKNESS		A3		0.203 REF	
LEAD WIDTH		b	0.75	0.8	0.85
BODY SIZE	X	D		7 BSC	
	Y	E		6.5 BSC	
LEAD PITCH		e		1.6 BSC	
EP SIZE	X	D2	3.5	3.6	3.7
	Y	E2	5.21	5.31	5.41
LEAD LENGTH		L	0.9	1	1.1
LEAD TIP TO EXPOSED PAD EDGE		K		0.7 REF	
PACKAGE EDGE TOLERANCE		aaa		0.1	
MOLD FLATNESS		ccc		0.1	
COPLANARITY		eee		0.08	
LEAD OFFSET		bbb		0.1	
		ddd		0.05	
EXPOSED PAD OFFSET		fff		0.1	

Package Dimensions

Packing Information

Package Type	Reel Size(inch)	Qty/Reel(pcs)	Qty/Box(pcs)	Qty/Carton(pcs)
DFN7*6.5-6L	13	3000	3000	15000



Item	W	E	F	D0	D1	P0	P2	P1	A0	B0
NOM	16．00	1.75	7.50	1.50	1.50	4.00	2.00	12.00	6.85	7.35
Tolerance	±0.30	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10	±0.10

Handling Precautions

Parameter	Rating	Standard	
ESD – Human Body Model (HBM)	1A	ANSI/ESDA/JEDEC Standard JS-001	
ESD – Charged Device Model (CDM)	C1	ANSI/ESDA/JEDEC Standard JS-002	
MSL – 260°C Convection Reflow	MSL3	IPC/JEDEC Standard J-STD-020	

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

Revision history

Document ID	Datasheet status	Release date	Version revision record
Rev1.0	Preliminary	Jul.2024	Preliminary
Rev2.0	Product	Dec.2024	Product

Abbreviations

Acronym	Definition
GaN	Gallium Nitride
CW	Continuous Waveform
VSWR	Voltage Standing Wave Ratio

Contact Information

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

- Web: www.watechelectronics.com
- Email: MKT@huatai-elec.com

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- Email: MKT@huatai-elec.com

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