DXG1PH60P-40N

RF Power GaN Transistor

1. Product profile

1.1 General description

DXG1PH60P-40N is a 40 W unmatched RF GaN HEMT Transistor with first generation RF GaN technology from Dynax, which is ideal for cellular base station applications at frequencies from DC to 6 GHz, and general purpose application.

Table 1. Typical performance [1]

Freq (MHz)	P_{sat} [2] (dBm)	P_{avg} [3] (dBm)	η_D [3] (%)	G_P [3] (dB)	ACPR [3] (dBc)
1805.0	46.4	38.5	48.0	20.6	-31.0
1842.5	46.4	38.5	49.0	21.0	-31.0
1880.0	46.4	38.5	49.0	20.9	-31.0

[1] Typical Doherty performance in Dynax Demo with the device soldered onto the heatsink, test condition: V_{DS} = 48 V, I_{DQA} = 40 mA, V_{GSB} = - 5.1 V.

[2] Test condition: Input signal Pulsed CW, Pulse width = 100 μs, Duty cycle = 10 %.

[3] Test condition: Single-Carrier W-CDMA, IQ magnitude clipping, Input signal PAR = 7.5 dB @ 0.01 % probability on CCDF. ACPR measured in 3.84 MHz channel bandwidth @ ±5 MHz offset.

1.2 Features and benefits

- High efficiency, high gain
- Excellent ruggedness
- Excellent reliability

1.3 Applications

- Small cell base station
- Broadband general purpose amplifier
- Public mobile radios
- Test instrumentation

1.4 Lead-free and RoHS compliant

Pb RoHS

2. Pinning information

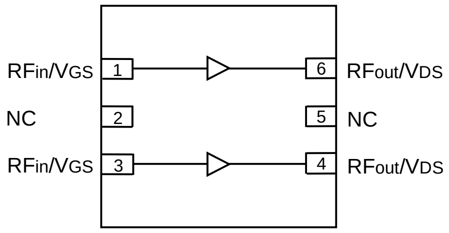


Fig 1. Pin configuration (Top view)

3. Ordering information

Table 2. Ordering information

Part number	Marking	Package type	Packaging information
DXG1PH60P-40N	DX4A	DFN 7×6.5mm	Tray: Suffix = 416 units
			Tape and Reel: Suffix = 1000 units; 16 mm Tape width; 13-inch Reel

4. Maximum ratings

Table 3. Maximum ratings

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DSS}	150	V
Gate-Source Voltage	V_{GS}	-10 ~ +2	V
Operating Voltage	V_{DS}	0 ~ +55	V
Maximum Forward Gate Current	I_{GMAX}	3.6	mA
Storage Temperature Range	T_{STG}	- 65 ~ +150	℃
Operating Junction Temperature	T_J	225	℃
Absolute Maximum Channel Temperature [1]	T_{MAX}	275	℃

[1] Functional operation above 225℃ has not been characterized and is not implied. Operation at T_{MAX} (275℃) reduces median time to failure by an order of magnitude; Operation beyond T_{MAX} could cause permanent damage.

5. Thermal characteristics

Table 4. Thermal characteristics

Parameter	Symbol	Value	Unit
Side A, Carrier			
Thermal Resistance at Average Power by Infrared Measurement, Active Die Surface-to-Case $T_{base\text{-}plate}$ = 85°C, P_D = 4.7 W	R_{thjc}(IR)	8.0	°C/W
Thermal Resistance at Average Power by Finite Element Analysis, Junction-to-Case $T_{base\text{-}plate}$ = 85°C, P_D = 4.7 W	R_{thjc}(FEA)	11.8	°C/W
Side B, Peaking			
Thermal Resistance at Average Power by Infrared Measurement, Active Die Surface-to-Case $T_{base\text{-}plate}$ = 85°C, P_D = 4.7 W	R_{thjc}(IR)	8.0	°C/W
Thermal Resistance at Average Power by Finite Element Analysis, Junction-to-Case $T_{base\text{-}plate}$ = 85°C, P_D = 4.7 W	R_{thjc}(FEA)	11.8	°C/W

6. ESD protection characteristics

Table 5. ESD protection characteristics

Test methodology	Class
Human Body Model (per JS-001-2012)	1A (> 250 V)
Charged Device Model (per JESD22-C101F)	C2 (> 500 V)

7. Moisture sensitivity level

Table 6. Moisture sensitivity level

Test methodology	Class
Moisture Sensitivity Level (per J-STD-020)	Level 3

8. Electrical characteristics (TA = 25℃ unless otherwise noted)

Table 7. DC characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Side A, Carrier					
Drain-Source Leakage Current (V_{GS} = -10 V, V_{DS} = 150 V)	I_{DSS}	-	-	1.8	mA
Drain-Source Breakdown Voltage (V_{GS} = -10 V, I_D = 1.8 mA)	$V_{(BR)DSS}$	150	-	-	V
Gate Threshold Voltage (V_{DS} = 48 V, I_D = 1.8 mA)	$V_{GS(th)}$	-4.0	-3.2	-1.0	V
Gate Quiescent Voltage (V_{DS} = 48 V, I_D = 40 mA)	$V_{GS(Q)}$	-	-3.0	-	V
Side B, Peaking					
Drain-Source Leakage Current (V_{GS} = -10 V, V_{DS} = 150 V)	I_{DSS}	-	-	1.8	mA
Drain-Source Breakdown Voltage (V_{GS} = -10 V, I_D = 1.8 mA)	$V_{(BR)DSS}$	150	-	-	V
Gate Threshold Voltage (V_{DS} = 48 V, I_D = 1.8 mA)	$V_{GS(th)}$	-4.0	-3.2	-1.0	V
Gate Quiescent Voltage (V_{DS} = 48 V, I_D = 40 mA)	$V_{GS(Q)}$	-	-3.0	-	V

Table 8. RF characteristics (Typical Doherty performance – 1880 MHz) [1]

Parameter	Symbol	Min.	Typ.	Max.	Unit
Peak Output Power [2]	P_{sat}	44.6	45.6	-	dBm
Drain Efficiency [3]	η_D	37.0	44.0	-	%
Power Gain [3]	G_P	16.6	18.2	19.8	dB

[1] Typical Doherty performance in Dynax DXG1PH60P-40N production test fixture, test condition: V_{DS} = 48 V, I_{DQA} = 40 mA, V_{GSB} = -2.1 V + V_{GSQ} @ 20 mA.

[2] Test condition: Pulsed CW, Pulse width = 100 µs, Duty cycle = 10 %.

[3] Test condition: P_{out} = 38.5 dBm Avg., Single-Carrier W-CDMA, IQ magnitude clipping, Input signal PAR = 7.5 dB @ 0.01 % probability on CCDF.

Table 9. Load mismatch

Parameter	Result
VSWR 10:1 at V_{DS} = 48 V, 40 W Pulsed CW output power, Pulse width = 100 µs, Duty cycle = 10%.	No device damage

9. Test information

9.1 Graphic Data

9.1.1 Pulsed CW

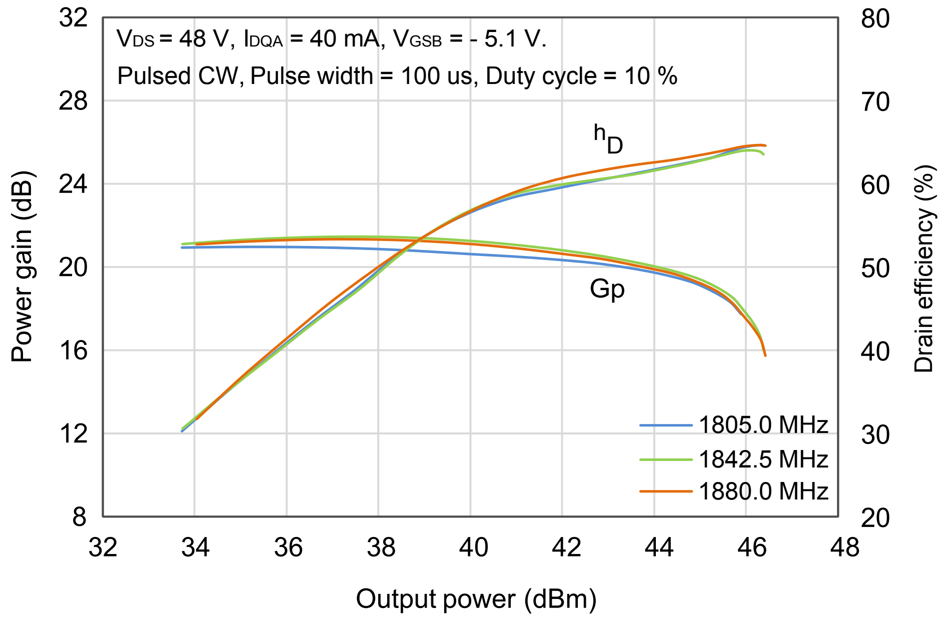


Fig 2. Power gain, Drain efficiency vs. Pulse output power

9.1.2 Single-Carrier W-CDMA

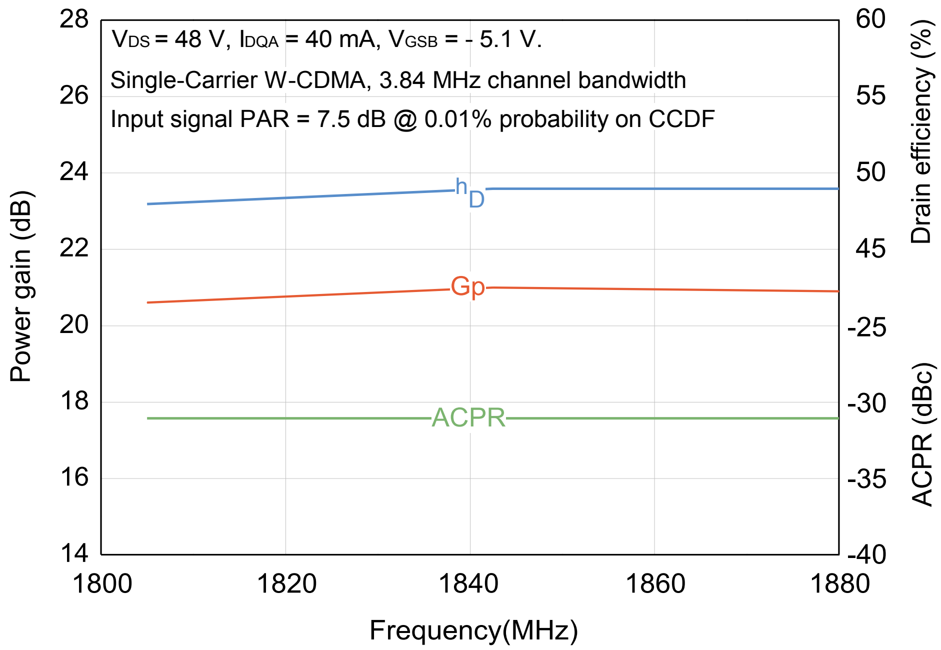


Fig 3. Power gain, Drain efficiency, ACPR vs. Frequency

Single-Carrier W-CDMA @ P_{out} = 7.1 Watts Avg.

10. Impedance information

Table 10. Typical impedance of carrier [1]

Maximum Output Power						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1800	4.3 + j12.1	29.8 + j15.1	24.0	43.8	24.0	66.2
2600	4.0 - j0.5	26.0 + j10.5	21.0	43.6	22.9	65.5
3500	6.1 - j15.1	22.6 + j3.6	19.3	43.4	21.9	62.0
Maximum Drain Efficiency						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1800	4.3 + j12.1	21.9 + j36.5	24.2	42.5	17.8	80.6
2600	4.0 - j0.5	11.6 + j26.1	21.5	41.7	14.8	79.5
3500	6.1 - j15.1	11.6 + j12.2	20.3	42.3	17.0	72.2

Table 11. Typical impedance of peaking [2]

Maximum Output Power						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1800	4.3 + j12.1	29.8 + j15.1	24.0	43.8	24.0	66.2
2600	4.0 - j0.5	26.0 + j10.5	21.0	43.6	22.9	65.5
3500	6.1 - j15.1	22.6 + j3.6	19.3	43.4	21.9	62.0
Maximum Drain Efficiency						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1800	4.3 + j12.1	21.9 + j36.5	24.2	42.5	17.8	80.6
2600	4.0 - j0.5	11.6 + j26.1	21.5	41.7	14.8	79.5
3500	6.1 - j15.1	11.6 + j12.2	20.3	42.3	17.0	72.2

[1] V_{DS} = 48 V, I_{DQA} = 40 mA, Pulsed CW, Pulse width = 100 μs, Duty cycle = 10 %.

[2] V_{DS} = 48 V, I_{DQB} = 40 mA, Pulsed CW, Pulse width = 100 μs, Duty cycle = 10 %.

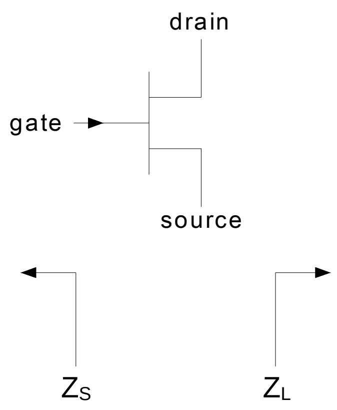


Fig 4. Definition of transistor impedance

11. Median lifetime

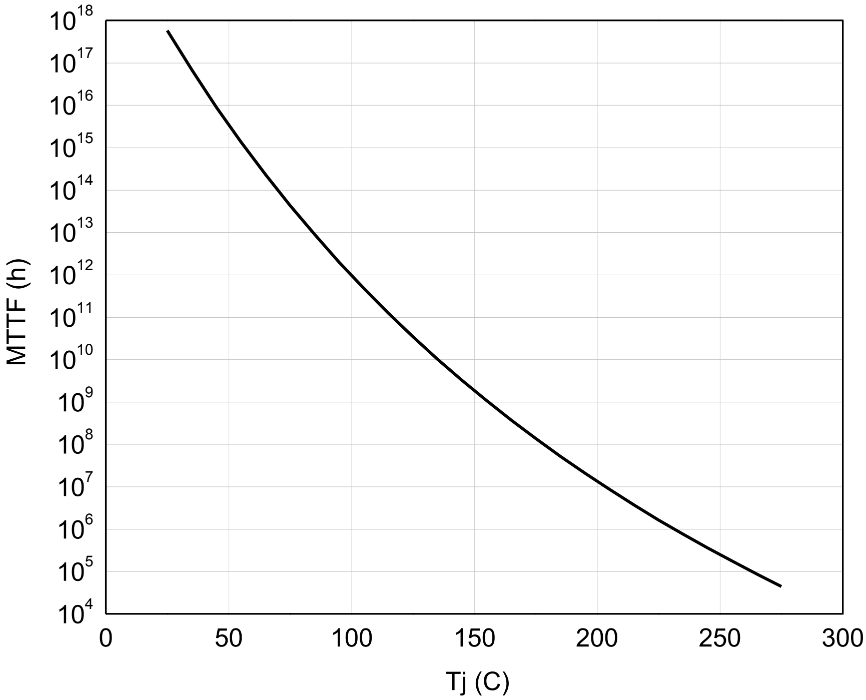
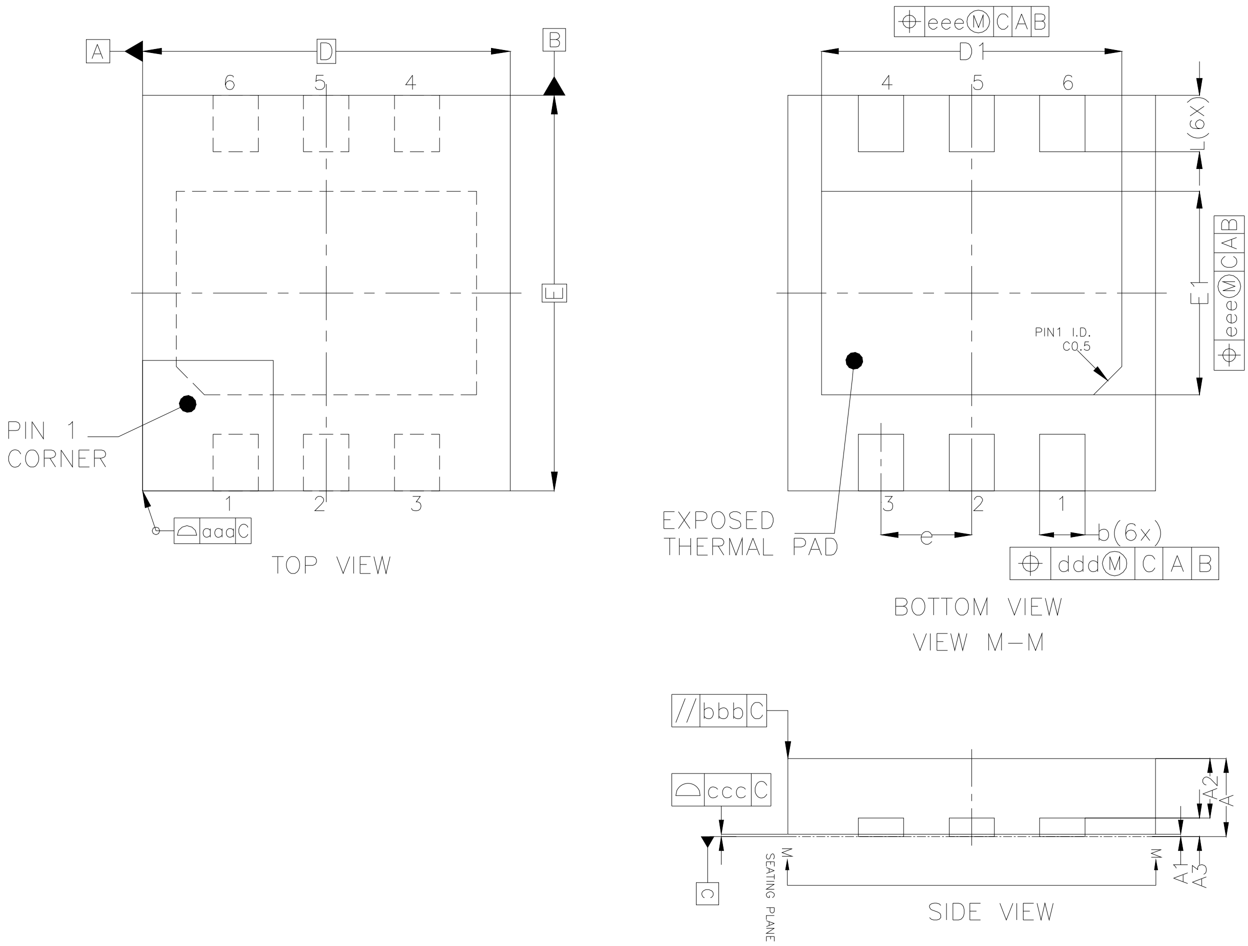


Fig 5. Median lifetime vs. channel temperature

12. Package outline



DESCRIPTION		SYMBOL	MILLIMETER MIN	MILLIMETER NOM	MILLIMETER MAX
TOTAL THICKNESS		A	0.80	0.85	0.90
STAND OFF		A1	0.00	---	0.05
MOLD THICKNESS		A2	0.60	0.65	0.70
L/F THICKNESS		A3	0.203 REF		
BODY SIZE	X	D	6.43	6.50	6.57
	Y	E	6.93	7.00	7.07
LEAD PITCH		e	1.60 BSC		
LEAD WIDTH		b	0.75	0.80	0.85
LEAD LENGTH		L	0.95	1.00	1.05
EP SIZE		D1	5.26	5.31	5.36
		E1	3.55	3.60	3.65
Tolerance of form and position					
PACKAGE EDGE TOLERANCE		aaa	0.1		
MOLD FLATNESS		bbb	0.1		
LEAD COPLANARITY		ccc	0.08		
LEAD POSITION OFFSET		ddd	0.1		
EXPOSED PAD OFFSET		eee	0.1		

Fig 6. Package outline —— DFN 7×6.5mm

13. Abbreviations

Table 12. Abbreviations

Acronym	Description
CW	Continuous Waveform
ESD	Electro-Static Discharge
GaN	Gallium Nitride
HEMT	High Electron Mobility Transistor
MTTF	Median Time To Failure
VSWR	Voltage Standing Wave Ratio

14. Legal information

14.1 Datasheet status

Document status	Product status	Definition
Objective [short] datasheet	Engineering sample	This document contains data from the objective specification for product development.
Preliminary [short] datasheet	Engineering sample	This document contains data from the preliminary specification.
Production [short] datasheet	Mass product	This document contains the product specification.

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