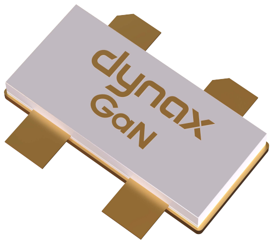
DXG1CH19A-370EF

RF Power GaN Transistor



1. Product profile

1.1 General description

DXG1CH19A-370EF is a 370 W RF GaN HEMT Transistor with first generation RF GaN technology from Dynax, which is ideal for cellular base station applications at frequencies from 1805 MHz to 1880 MHz.

Table 1. Typical performance

Freq (MHz)	P_{sat} [1] (dBm)	P_{avg} [2] (dBm)	η_D [2] (%)	G_P [2] (dB)	ACPR [2] (dBc)
1805~1880	55.7	47.5	56.0	15.5	-28.0

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

[2] Typical Doherty performance in Dynax Demo with the device soldered onto the heatsink, test condition: V_{DS} = 48 V, I_{DQA} = 400 mA, V_{GSB} = - 5.2 V, 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
- Internally matched for broadband performance
- Designed for Digital Pre-Distortion error correction systems
- Optimized for Doherty applications

1.3 Applications

- RF power amplifier for base stations and multi carrier applications in the 1805 MHz to 1880 MHz frequency range

1.4 Lead-free and RoHS compliant

2. Pinning information

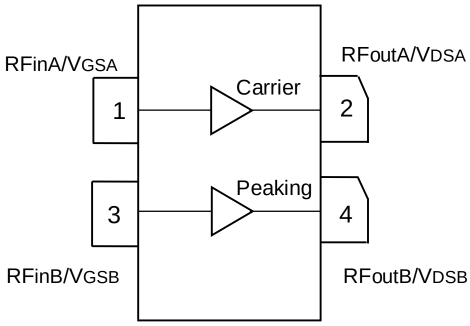


Fig 1. Pin configuration (Top view)

3. Ordering information

Table 2. Ordering information

Part number	Marking	Package type	Packaging information
DXG1CH19A-370EF	DXG1CH19A-370EF	780P2GB	Tray: Suffix = 20 units Tape and Reel: Suffix = 100 units; 44 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_{DD}	0 ~ +55	V
Maximum Forward Gate Current	I_{GMAX}	46.3	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℃, P_D = 38.0 W	R_{thjc}(IR)	1.8	℃/W
Thermal Resistance at Average Power by Finite Element Analysis, Junction-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 38.0 W	R_{thjc}(FEA)	2.3	℃/W
Side B, Peaking			
Thermal Resistance at Average Power by Infrared Measurement, Active Die Surface-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 9.5 W	R_{thjc}(IR)	0.9	℃/W
Thermal Resistance at Average Power by Finite Element Analysis, Junction-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 9.5 W	R_{thjc}(FEA)	1.1	℃/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 1

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}	-	-	14.7	mA
Drain-Source Breakdown Voltage (V_{GS} = -10 V, I_D = 14.7 mA)	$V_{(BR)DSS}$	150	-	-	V
Gate Threshold Voltage (V_{DS} = 48 V, I_D = 14.7 mA)	$V_{GS(th)}$	-4.0	-3.0	-1.0	V
Gate Quiescent Voltage (V_{DS} = 48 V, I_D = 360 mA)	$V_{GS(Q)}$	-	-2.8	-	V
Side B, Peaking					
Drain-Source Leakage Current (V_{GS} = -10 V, V_{DS} = 150 V)	I_{DSS}	-	-	31.6	mA
Drain-Source Breakdown Voltage (V_{GS} = -10 V, I_D = 31.6 mA)	$V_{(BR)DSS}$	150	-	-	V
Gate Threshold Voltage (V_{DS} = 48 V, I_D = 31.6 mA)	$V_{GS(th)}$	-4.0	-3.0	-1.0	V
Gate Quiescent Voltage (V_{DS} = 48 V, I_D = 790 mA)	$V_{GS(Q)}$	-	-2.8	-	V

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

Parameter	Symbol	Min.	Typ.	Max.	Unit
Peak Output Power [2]	P_{sat}	54.0	55.0	-	dBm
Drain Efficiency [3]	η_D	47.5	54.5	-	%
Power Gain [3]	G_P	14.7	16.3	17.9	dB

[1] Typical Doherty performance in Dynax DXG1CH19A-370EF production test fixture, test condition: V_{DS} = 48 V, I_{DQA} = 400 mA, V_{GSB} = -2.5 V + V_{GSQ} @200 mA.

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

[3] Test condition: P_{out} = 47.5 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, 370 W Pulsed CW output power, Pulse width = 100 μs, Duty cycle = 10%.	No device damage

9. Test information

9.1 Typical application circuit

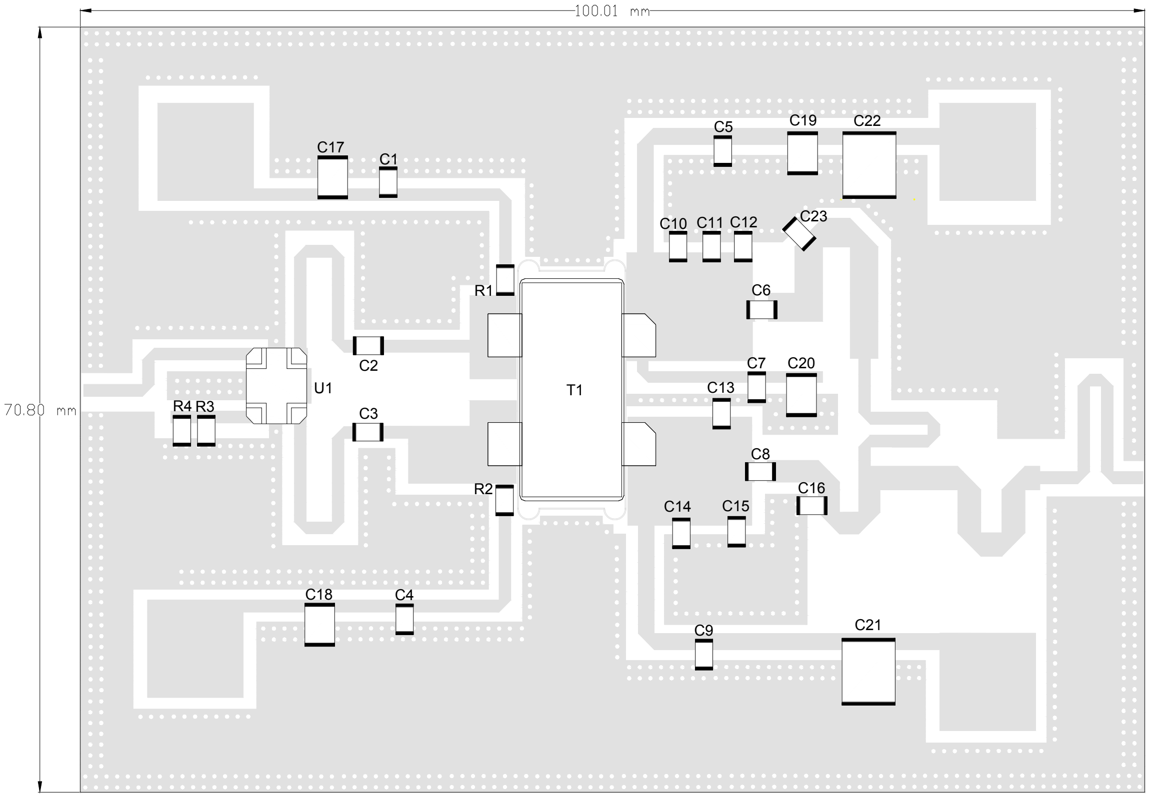


Fig 2. Component layout

Table 10. List of components

S/N	Type	Designator	Description	Value	Vendor
1	Cap	C1~C9	ATC600F100JT250XT	10 pF	ATC
2	Cap	C17~C22	GRM31CZ72A475KE	4.7 pF	Murata
3	Cap	C10,C11,C12	ATC600F1R5JT250XT	1.5 pF	ATC
4	Cap	C23	ATC600F0R5JT250XT	0.5 pF	ATC
5	Cap	C13	ATC100B0R8JT500XT	0.8 pF	ATC
6	Cap	C14,C15,C16	ATC600F1R2JT250XT	1.2 pF	ATC
7	Res	R1,R2	RC0805FR_0710RL	10 Ω	Yageo
8	Res	R3,R4	RC0805FR_07101RL	100 Ω	Yageo
9	HyBrid coupler	U1	CMX19Q03	3 dB	RN2
10	Transistor	T1	DXG1CH19A-370EF	/	Dynax
11	PCB	/	Rogers4350	20 mil	Rogers

9.2 Graphic Data

9.2.1 Pulsed CW

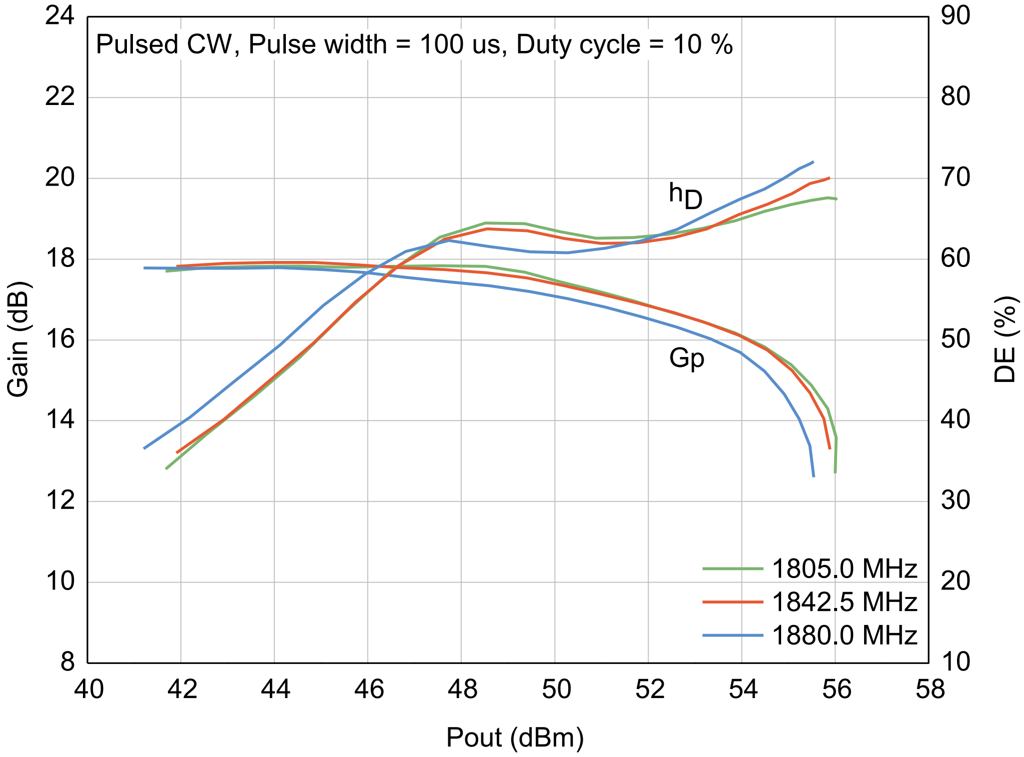


Fig 3. Power gain, Drain efficiency vs. Pulse output power

10. Impedance information

Table 11. 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 (%)
1805	8.2 - j15.4	6.0 - j2.4	20.6	52.0	158	71.4
1880	13.2 - j14.7	5.0 - j2.7	20.4	51.9	155	72.0
Maximum Drain Efficiency						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1805	8.2 - j15.4	3.4 + j3.6	22.7	49.1	81	83.9
1880	13.2 - j14.7	3.2 + j3.5	22.2	49.2	83	83.7

Table 12. 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 (%)
1805	8.5 - j14.2	2.4 - j2.2	21.0	54.5	281	69.7
1880	18.7 - j11.8	2.3 - j2.1	20.6	54.6	288	69.9
Maximum Drain Efficiency						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1805	8.5 - j14.2	2.1 + j0.4	22.2	52.4	173	79.4
1880	18.7 - j11.8	2.1 - j0.0	21.7	52.3	170	79.8

[1] V_{DS} = 48 V, I_{DQA} = 360 mA, Pulsed CW, Pulse width = 100 µs, Duty cycle = 10 %.

[2] V_{DS} = 48 V, I_{DQB} = 790 mA, Pulsed CW, Pulse width = 100 µs, Duty cycle = 10 %.

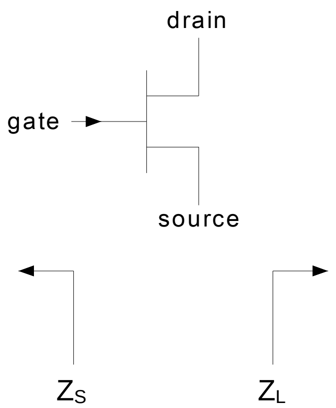


Fig 4. Definition of transistor impedance

11. Median lifetime

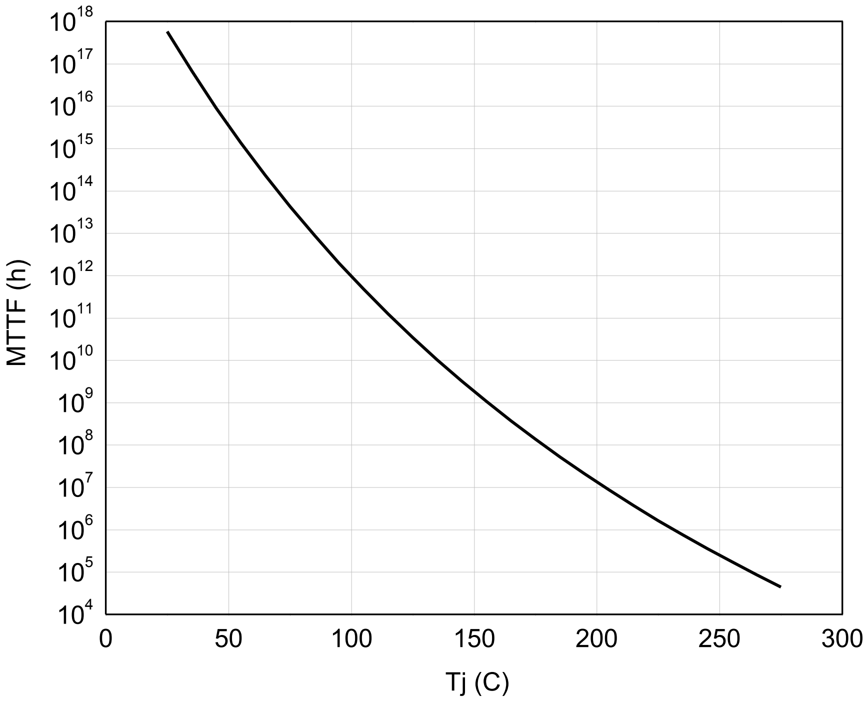
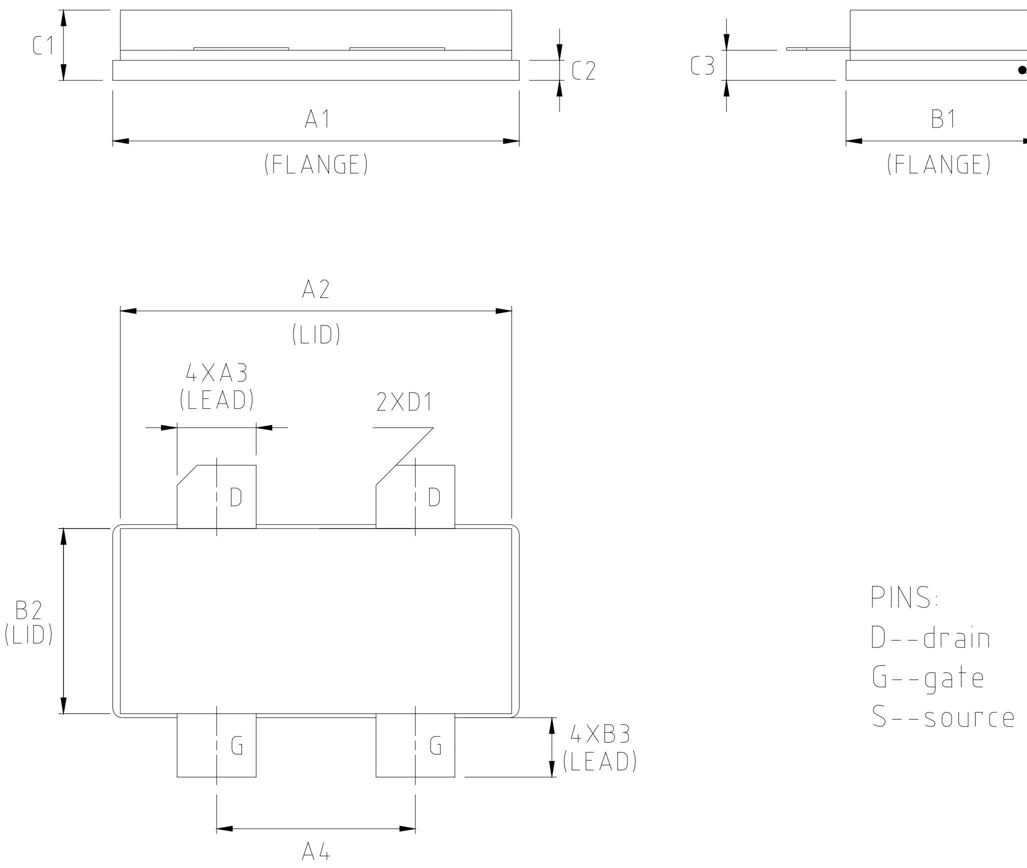


Fig 5. Median lifetime vs. channel temperature

12. Package outline



DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX
A1	0.805	0.815	20.45	20.70
A2	0.772	0.788	19.61	20.02
A3	0.153	0.162	3.87	4.13
A4	0.385	0.395	9.77	10.03
B1	0.380	0.390	9.65	9.91
B2	0.365	0.375	9.27	9.53
B3	0.108	0.128	2.75	3.25
C1	0.130	0.170	3.30	4.32
C2	0.035	0.045	0.89	1.14
C3	0.057	0.067	1.45	1.70
C4	0.003	0.006	0.08	0.15
D1	0.040 45° REF		1.02 45° REF	

Fig 6. Package outline —— 780P2GB

13. Abbreviations

Table 13. 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.
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