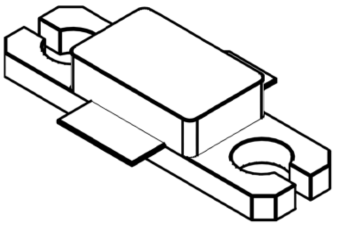
Dynax

DXG1CH59B-30DF

RF POWER GaN Transistor for ISM Application

5000 – 6000 MHz, 30 W,
RF POWER GaN Transistor

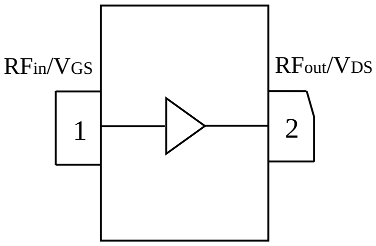
DXG1CH59B-30DF is a 30 W RF GaN HEMT Transistor with first generation RF GaN technology from Dynax, which is ideal for 5000 MHz to 6000 MHz ISM applications. It features input matching, wideband and a flange thermally-enhanced package.



Package Type: 360F1CA

Applications

- Wideband or Narrowband Amplifiers
- Test Instrumentations
- Civilian Radars
- Jammers



(Top View)
Figure 1. Pin Connection

Typical RF Performance [1]

- Frequency: 5000 – 6000 MHz
- Saturation Output Power: 35 W
- Saturation Drain Efficiency: 55%
- Drain Efficiency @ Pavg : 30%
- Power Gain @ Pavg : 16.0 dB

Note:

[1] Typical Performance in Dynax DXG1CH59B-30DF Class AB Demo with the device soldered onto the heatsink, test condition: V_{DD} = 48 V, I_{DQ} = 80 mA, Pavg = 9 W, Input signal Pulsed CW, Pulse Width = 100 μs, Duty Cycle = 10 %.

Table 1. 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}	4.0	mA
Storage Temperature Range	T_{STG}	-65 ~ +150	℃
Operating Junction Temperature	T_J	225	℃
Absolute Maximum Channel Temperature [2]	T_{MAX}	275	℃

[2] 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.

Table 2. Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance at Average Power by Infrared Measurement, Active Die Surface-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 25 W, Pulse Width = 100 µs, Duty Cycle = 10 %.	$R_{thjc(IR)}$	3.3	℃/W
Thermal Resistance at Average Power by Finite Element Analysis, Junction-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 25 W, Pulse Width = 100 µs, Duty Cycle = 10 %.	$R_{thjc(FEA)}$	4.3	℃/W

Table 3. ESD Protection Classifications

Test Methodology	Classification
Human Body Model (per JS-001-2012)	0B (> 150 V)
Charged Device Model (per JESD22-C101F)	C1 (> 250 V)

Table 4. MSL Classification

Test Methodology	Classification
Moisture Sensitivity Level (per J-STD-020)	Level 1

Table 5. Ruggedness Characteristics

VSWR 10:1 at V_{DD} = 48 V, 30 W Pulsed CW Output Power, Pulse Width = 100 µs, Duty Cycle = 10%	No Device Damage

Table 6. Ordering Information

Device	Package Type	Marking
DXG1CH59B-30DF	360F1CA	DXG1CH59B-30DF

Table 7. Bias Sequences

Bias-up Sequence	**Bias-down Sequence**
Set V_{GS} to -5 V	Turn off RF power
Turn on V_{DS} to 48 V	Reduce V_{DS} down to 0 V
Increase V_{GS} until I_{DS} current is attained	Turn off V_{GS}
Apply RF input power	

Table 8. Electrical Characteristics (T_A = 25 ℃ unless otherwise noted**)**

Characteristic	**Symbol**	**Min.**	**Typ.**	**Max.**	**Unit**
DC Characteristics (measured on wafer prior to packaging)					
Drain-Source Leakage Current (V_{GS} = -10 V, V_{DS} = 150 V)	I_{DSS}	-	-	4.0	mA
Drain-Source Breakdown Voltage (V_{GS} = -10 V, I_D = 4.0 mA)	$V_{(BR)DSS}$	150	-	-	V
Gate Threshold Voltage (V_{DS} = 48 V, I_D = 4.0 mA)	$V_{GS(th)}$	-4.0	-3.2	-1.0	V
Gate Quiescent Voltage (V_{DD} = 48 V, I_D = 80 mA)	$V_{GS(Q)}$	-	-3.0	-	V
RF Characteristics					
Typical Performance [3]					
Saturation Output Power	P_{sat}	25	35	-	W
Saturation Drain Efficiency	η_D	42	55	-	%
Drain Efficiency @ Pavg	η_D	22	30	-	%
Power Gain @ Pavg	G_P	13.5	16.0	-	dB
Gain Flatness	G_F	-	0.7	-	dB

[3] Typical Performance in Dynax DXG1CH59B-30DF Class AB Demo with the device soldered onto the heatsink, test condition: V_{DD} = 48 V, I_{DQ} = 80 mA, Pavg = 9 W, f = 5000 – 6000 MHz, Input signal Pulsed CW, Pulse Width = 100 µs, Duty Cycle = 10 %.

Table 9. Load Pull Performance

V_{DD} = 48 V, I_{DQ} = 80 mA, Pulsed CW, Pulse Width = 100 µs, Duty Cycle = 10 %.

Maximum Output Power						
Freq (MHz)	**Zsource (Ω)**	**Zload (Ω)**	**Gain (dB)**	**Psat (dBm)**	**Psat (W)**	**η_D (%)**
5000	32.4 - j5.1	20.9 - j6.9	19.0	46.8	47	61.9
5500	12.2 + j7.7	23.9 + j4.9	18.2	46.7	46	60.4
6000	6.0 - j5.2	21.8 + j12.6	17.4	46.2	42	58.0
Maximum Drain Efficiency						
Freq (MHz)	**Zsource (Ω)**	**Zload (Ω)**	**Gain (dB)**	**Psat (dBm)**	**Psat (W)**	**η_D (%)**
5000	32.4 - j5.1	11.5 - j14.2	20.3	45.4	34	65.4
5500	12.2 + j7.7	28.3 - j17.3	19.9	45.2	33	63.4
6000	6.0 - j5.2	36.5 + j9.6	18.4	45.7	37	61.2

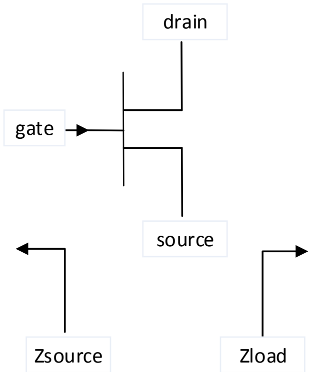


Figure 2. Definition of Transistor Impedance

Zsource: Measured impedance presented to the input of the device at the package plane
Zload: Measured impedance presented to the output of the device at the package plane

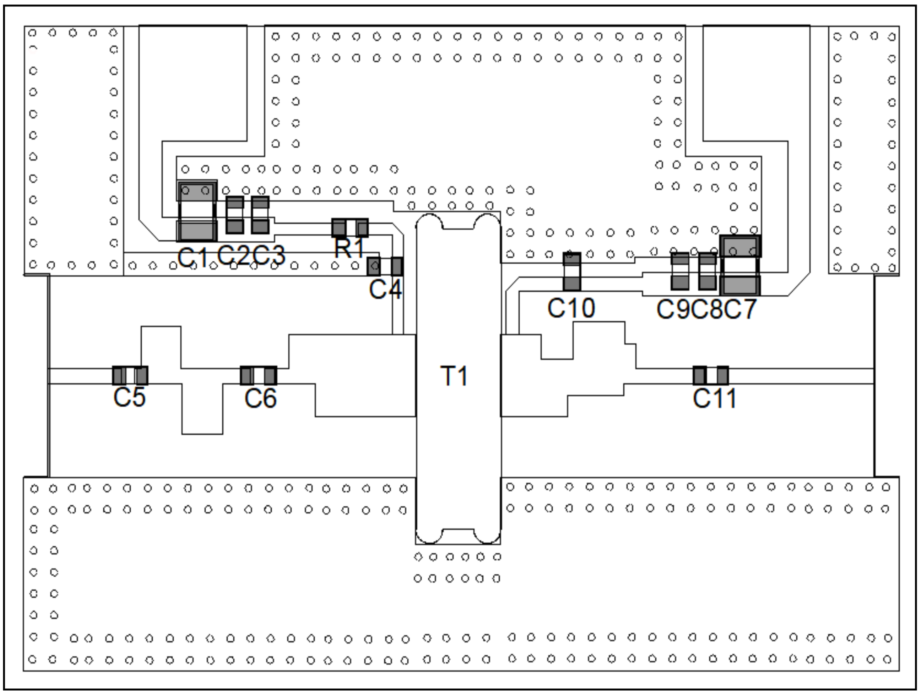


Figure 3. DXG1CH59B-30DF Test Circuit Component Layout

Table 10. DXG1CH59B-30DF Test Circuit Component Designations and Values

Component	Description	Part Number	Manufacturer
C1, C7	2.2 uF Capacitors	GRM31CR72D224KW	Murata
C2, C8	3.3 nF Capacitors	GRM21BR72A333KA01L	Murata
C4, C5, C10, C11	3.3 pF Capacitors	ATC600F3R3JT250XT	ATC
C6	0.6 pF Capacitor	ATC600F0R6JT250XT	ATC
R1	10 Ω Resistance	RC0805FR_0710RL	Yageo
T1	Transistor	DXG1CH59B-30DF	Dynax
PCB	20 mil	Ro4350B	Rogers

Typical Characteristics — 5000 – 6000 MHz

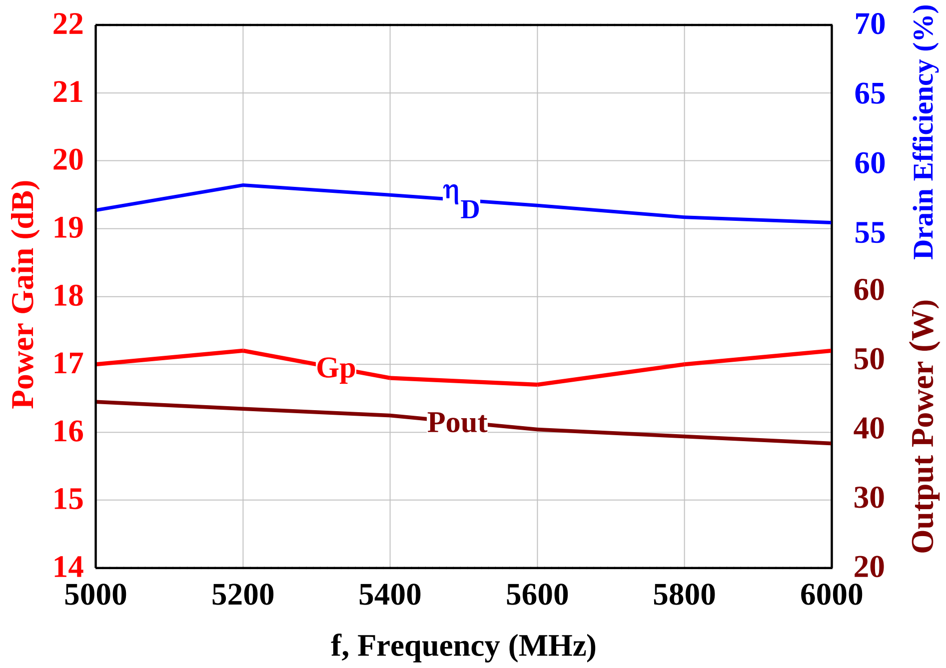


Figure 4. Power Gain, Drain Efficiency and CW Output Power vs. Frequency at a Constant Input Power

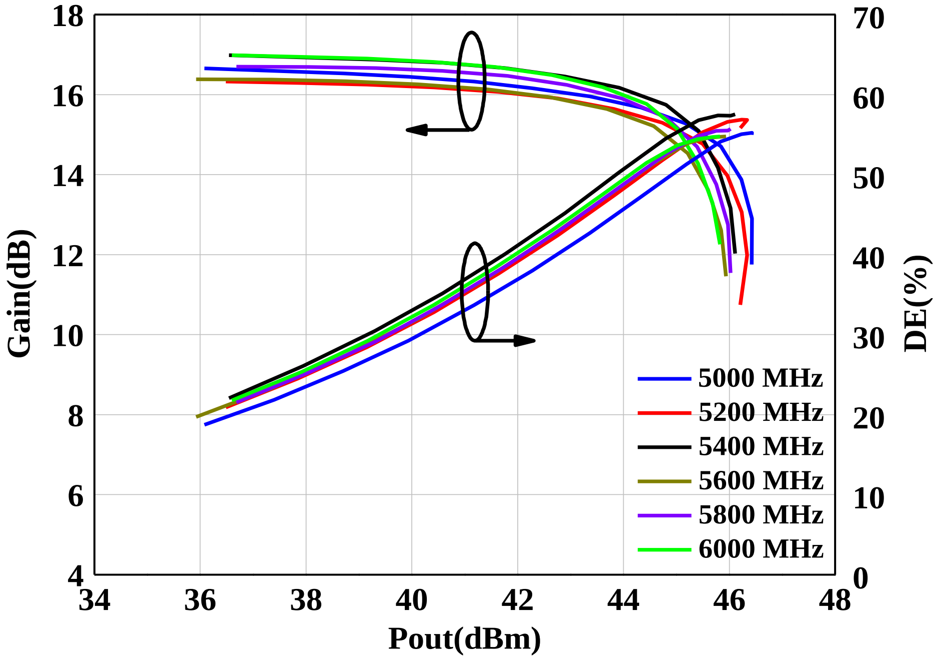


Figure 5. Power Gain, Drain Efficiency vs. CW Output Power and Frequency

Typical Characteristics — 5000 – 6000 MHz

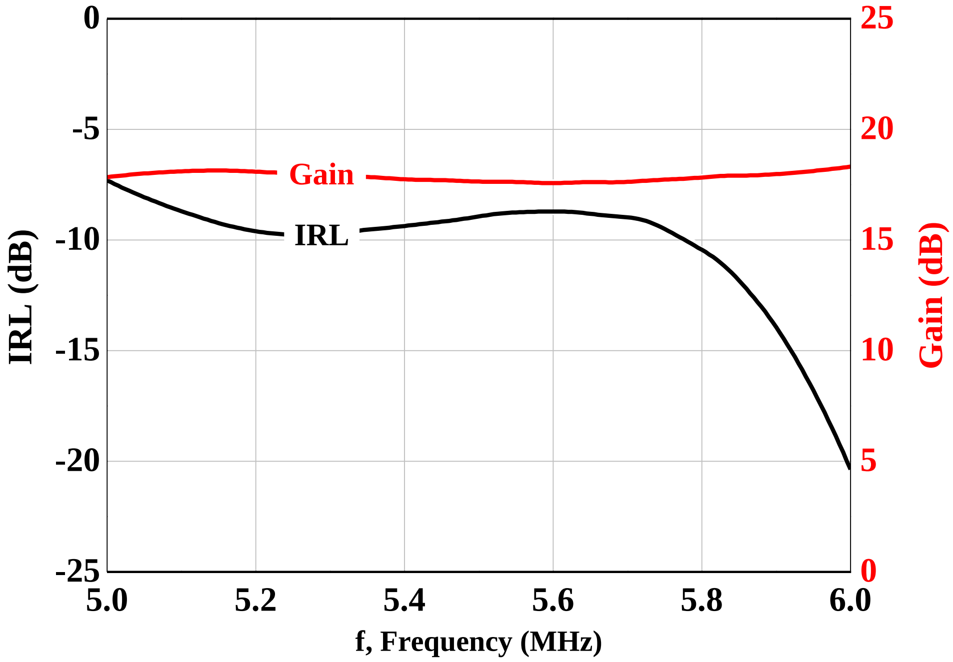


Figure 6. Small Signal Gain and Input Return Loss vs. Frequency

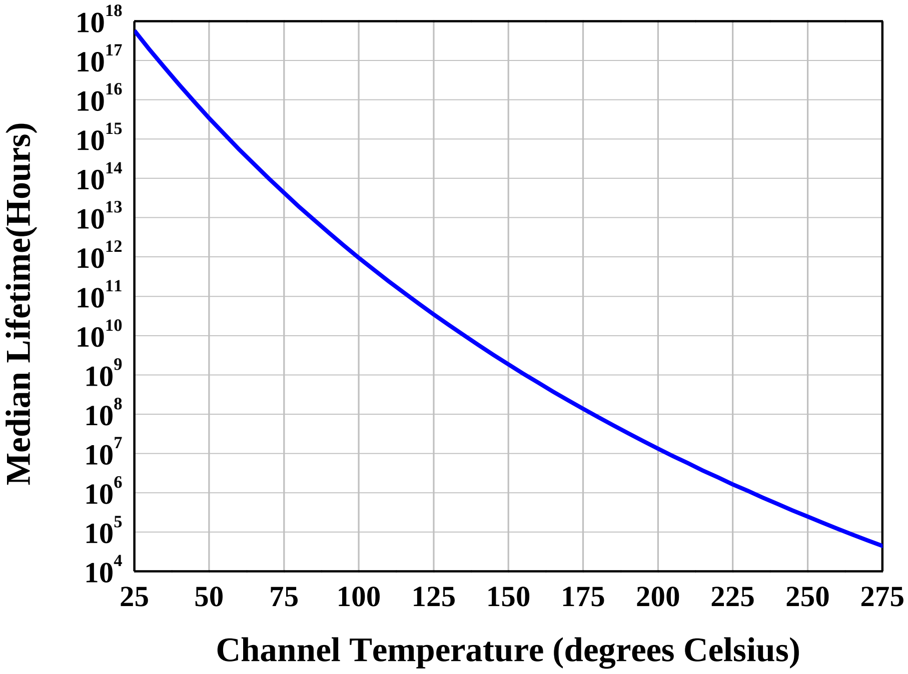
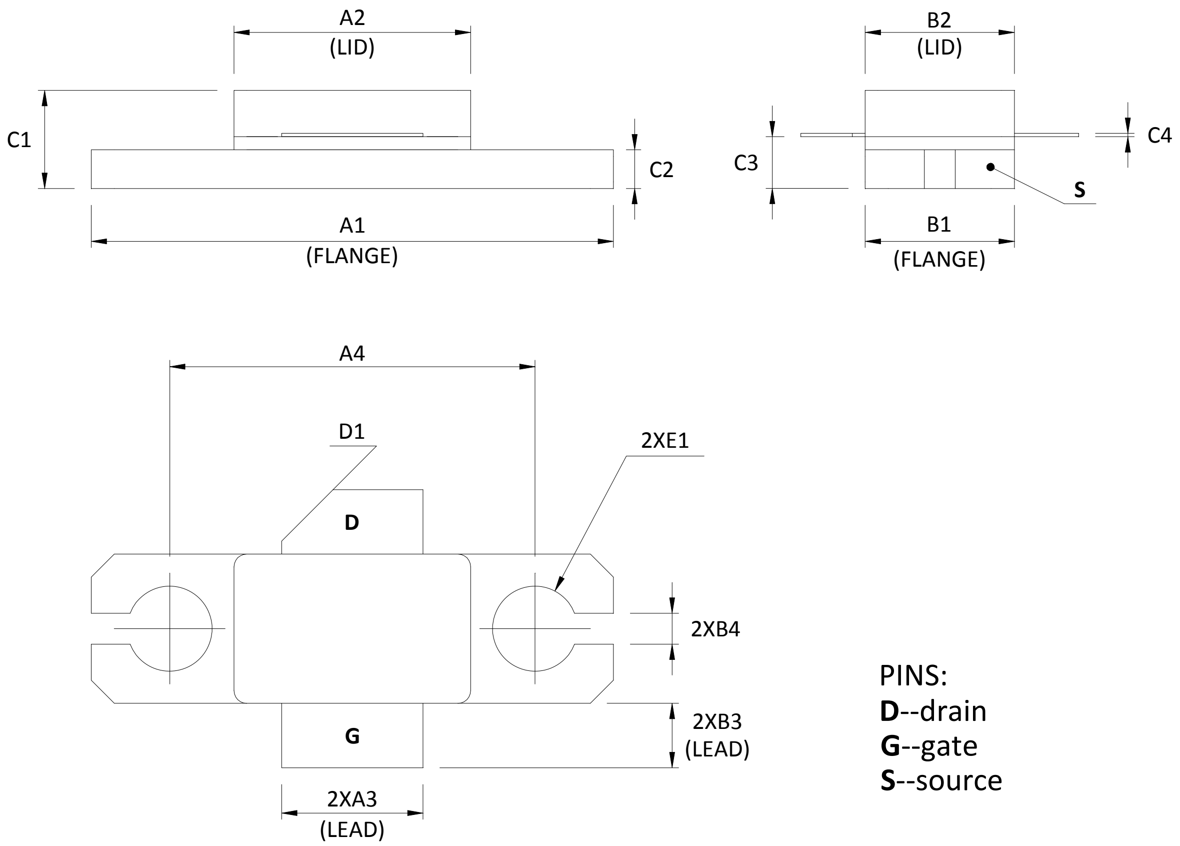


Figure 7. Median Lifetime vs. Channel Temperature

Package Dimensions

Package Type: 360F1CA



DIM	INCH		MILLIMETER	
	MIN	MAX	MIN	MAX
A1	0.794	0.804	20.17	20.43
A2	0.355	0.365	9.01	9.27
A3	0.211	0.222	5.37	5.63
A4	0.559 REF		14.20 REF	
B1	0.223	0.233	5.67	5.93
B2	0.223	0.233	5.67	5.93
B3	0.078	0.118	2.00	3.00
B4	0.047 REF		1.2 REF	
C1	0.138	0.178	3.50	4.50
C2	0.054	0.064	1.37	1.63
C3	0.077	0.087	1.95	2.21
C4	0.004	0.006	0.11	0.15
D1	0.079 45° REF		2.0 45° REF	
E1	ø0.130 REF		ø 3.30 REF	

Product Documentation and Software

Refer to the following resources to aid your design process.

Application Notes

- AN_02: Guideline of GaN HEMT transistor
- AN_04: Dynax 48V GaN Bias Circuit Reference Design

Software

- Large signal model

Development Tools

- Printed Circuit Board (PCB files provided if required)

Document Revision History

The following table summarizes revisions to this document.

Status	Revision	Date	Description
Preliminary datasheet	V01	10/15/2020	Initial version.
Production datasheet	V01	07/18/2021	Update performance data.

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

Disclaimer

Specifications are subject to change without notice. Dynax makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose. “Typical” parameters that may be provided in Dynax data sheets and/or specifications can and do vary in different applications, and actual performance may vary over time. All operating parameters should be validated by customer’s technical experts for each application. Dynax does not convey any license under its patent rights nor the rights of others. Dynax products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of a Dynax product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Dynax and its suppliers accept no liability for inclusion and/or use of Dynax products in such equipment or applications and therefore such inclusion and/or use are at the customer’s own risk.

Contact Information

For sales or technical support:

Home Page: www.dynax-semi.com

Tel: +86-512-36886888

Email: sales@dynax-semi.com

Zip Code: 215300

Company Address: No.18 Chenfeng Road, Kunshan, Jiangsu Province, China