DXG1PH19A-60N

RF Power GaN Transistor

1. Product profile

1.1 General description

DXG1PH19A-60N is a 60 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 [1]

Freq (MHz)	P_{sat} [2] (dBm)	P_{avg} [3] (dBm)	η_D [3] (%)	G_P [3] (dB)	ACPR [3] (dBc)
1805~1880	48.0	40.3	61.0	18.0	-30.0

[1] Typical Doherty performance in Dynax Demo with the device soldered onto the heatsink, test condition: V_{DS} = 48 V, I_{DQA} = 65 mA, V_{GSB} = - 4.7 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
- 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

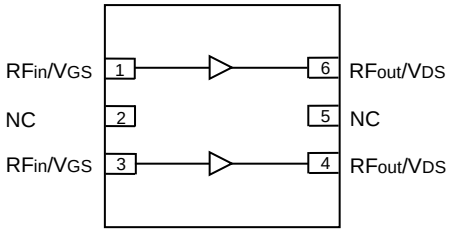


Fig 1. Pin configuration (Top view)

3. Ordering information

Table 2. Ordering information

Part number	Marking	Package type	Packaging information
DXG1PH19A-60N	DL6A	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}	7.1	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 = 5.6 W	R_{thjc}(IR)	5.5	℃/W
Thermal Resistance at Average Power by Finite Element Analysis, Junction-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 5.6 W	R_{thjc}(FEA)	8.5	℃/W
Side B, Peaking			
Thermal Resistance at Average Power by Infrared Measurement, Active Die Surface-to-Case $T_{base\text{-}plate}$ = 85℃, P_D = 1.4 W	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 = 1.4 W	R_{thjc}(FEA)	5.4	℃/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)	C1 (> 250 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}	-	-	3.1	mA
Drain-Source Breakdown Voltage (V_{GS} = -10 V, I_D = 3.1 mA)	$V_{(BR)DSS}$	150	-	-	V
Gate Threshold Voltage (V_{DS} = 48 V, I_D = 3.1 mA)	$V_{GS(th)}$	-4.0	-3.2	-1.0	V
Gate Quiescent Voltage (V_{DS} = 48 V, I_D = 65 mA)	$V_{GS(Q)}$	-	-3.0	-	V
Side B, Peaking					
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_{DS} = 48 V, I_D = 80 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}	46.7	47.7	-	dBm
Drain Efficiency [3]	η_D	47.7	54.7	-	%
Power Gain [3]	G_P	14.6	16.2	17.8	dB

[1] Typical Doherty performance in Dynax DXG1PH19A-60N production test fixture, test condition: V_{DS} = 48 V, I_{DQA} = 60 mA, V_{GSB} = -2.5 V + V_{GSQ} @ 20 mA.

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

[3] Test condition: P_{out} = 40.3 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, 60 W Pulsed CW output power, Pulse width = 100 µs, Duty cycle = 10%.	No device damage

9. Test information

9.1 Typical application circuit

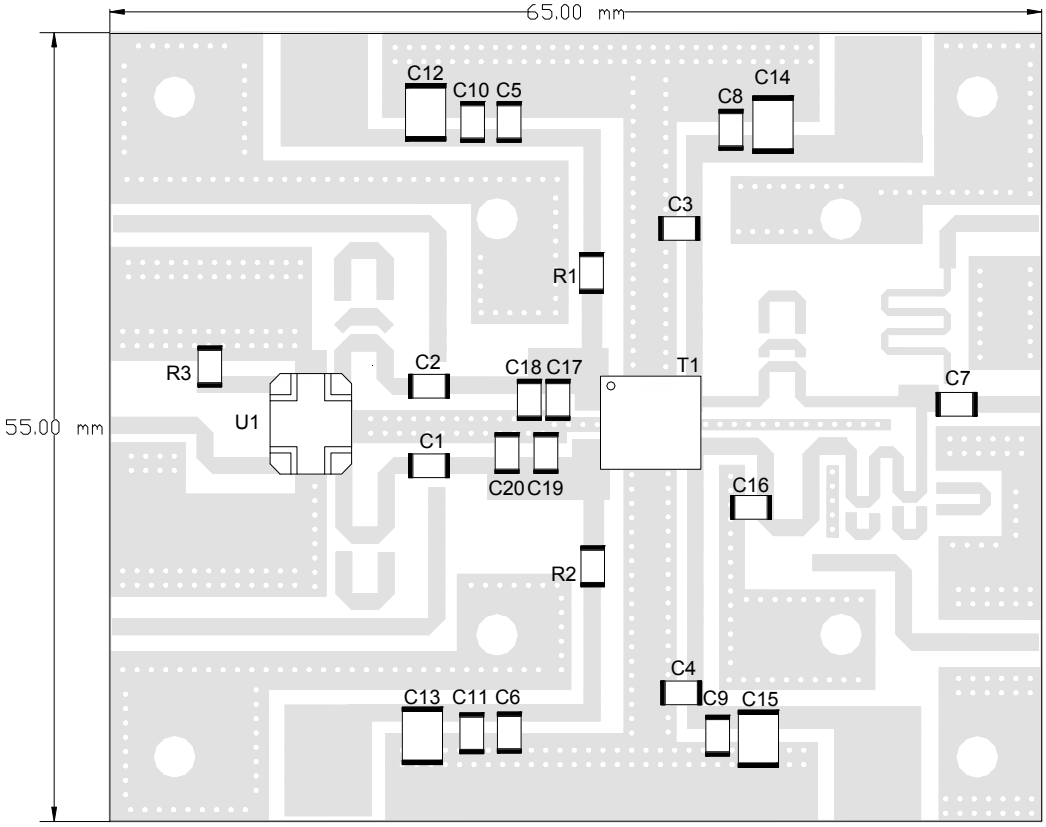


Fig 2. Component layout

Table 10. List of components

S/N	Type	Designator	Description	Value	Vendor
1	Cap	C1,C2,C3,C4,C5,C6,C7	ATC600L150BT200T	15 pF	ATC
2	Cap	C8,C9,C10,C11	GRM21BR72A333KA01L	33 nF	Murata
3	Cap	C12,C13,C14,C15	GRM31CZ72A106KE	10 uF	Murata
4	Cap	C16	ATC600F1R5JT250XT	1.5 pF	ATC
5	Cap	C17,C20	ATC600F1R0JT250XT	1.0 pF	ATC
6	Cap	C18	ATC600F0R5JT250XT	0.5 pF	ATC
7	Cap	C19	ATC600F1R3JT250XT	1.3 pF	ATC
8	Res	R1,R2	RC0805FR_0710RL	10 Ω	Yageo
9	Res	R3	RC0805FR_0749RL	49.9 Ω	Yageo
10	HyBrid coupler	U1	CMX19Q03	3 dB	RN2
11	Transistor	T1	DXG1PH19A-60N	/	Dynax

9.2 Graphic Data

9.2.1 Pulsed CW

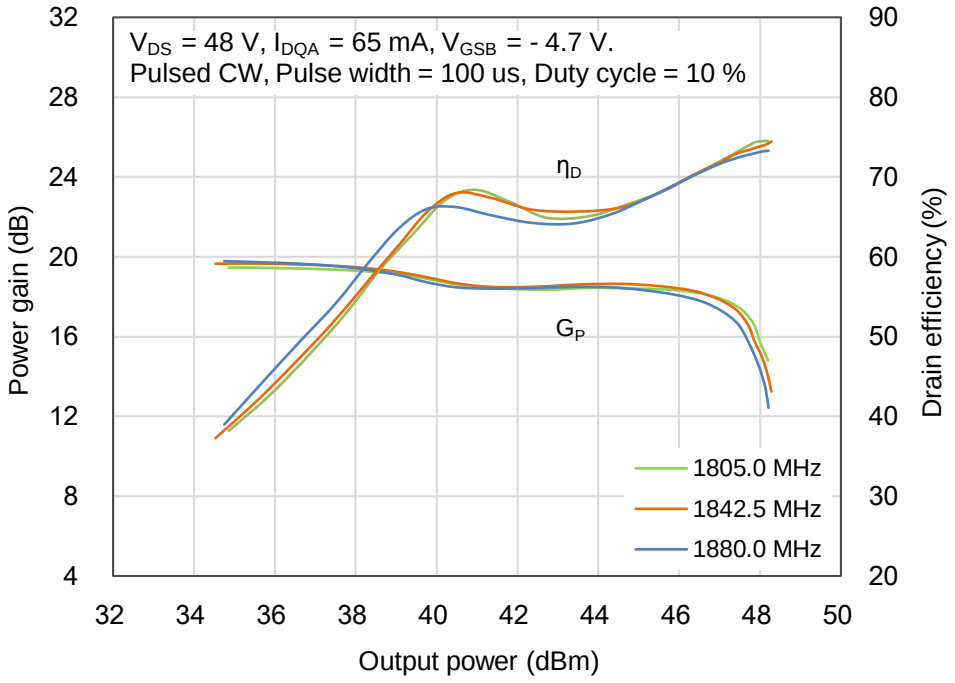


Fig 3. Power gain, Drain efficiency vs. Pulse output power

9.2.2 Single-Carrier W-CDMA

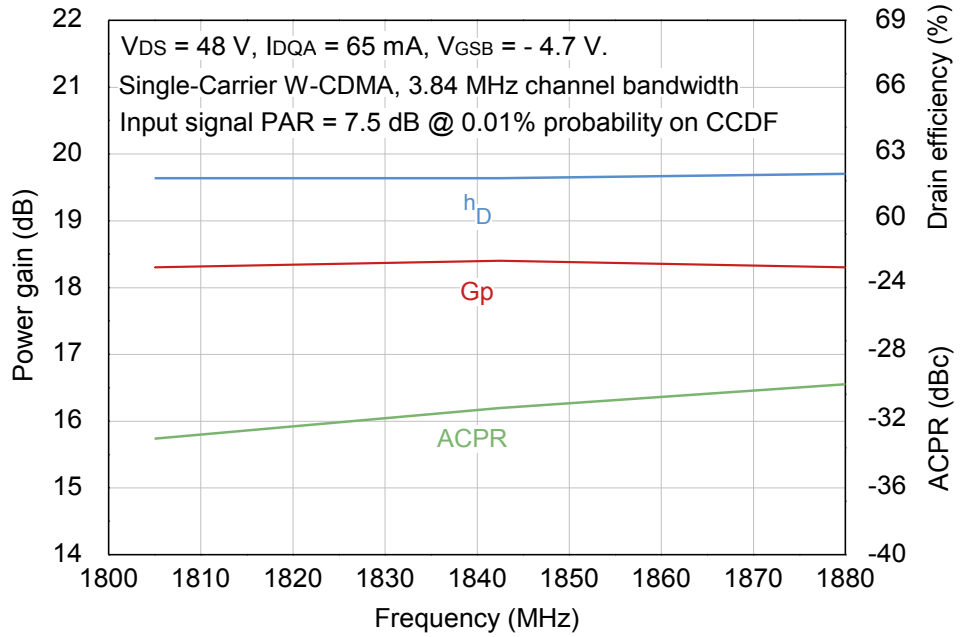


Fig 4. Power gain, Drain efficiency, ACPR vs. Frequency

Single-Carrier W-CDMA@ P_{out} = 10.7 Watts Avg.

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	6.4 - j12.8	18.9 + j8.5	23.3	45.2	33	75.0
1880	7.3 - j22.9	17.8 + j8.0	23.3	45.1	32	74.7
Maximum Drain Efficiency						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1805	6.4 - j12.8	15.1 + j25.6	25.1	43.0	20	84.0
1880	7.3 - j22.9	15.0 + j22.0	25.2	43.2	21	83.6

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	6.0 - j18.0	13.6 + j3.0	22.9	46.5	45	72.5
1880	7.6 - j24.1	12.9 + j3.0	22.9	46.4	44	73.7
Maximum Drain Efficiency						
Freq (MHz)	Z_S (Ω)	Z_L (Ω)	G_P (dB)	P_{sat} (dBm)	P_{sat} (W)	η_D (%)
1805	6.0 - j18.0	12.6 + j15.5	24.6	44.5	28	83.8
1880	7.6 - j24.1	12.0 + j14.7	24.3	44.4	28	83.0

[1] V_{DS} = 48 V, I_{DQA} = 65 mA, Pulsed CW, Pulse width = 100 µs, Duty cycle = 10 %.

[2] V_{DS} = 48 V, I_{DQB} = 80 mA, Pulsed CW, Pulse width = 100 µs, Duty cycle = 10 %.

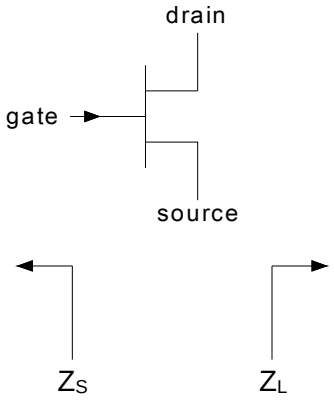


Fig 5. Definition of transistor impedance

11. Median lifetime

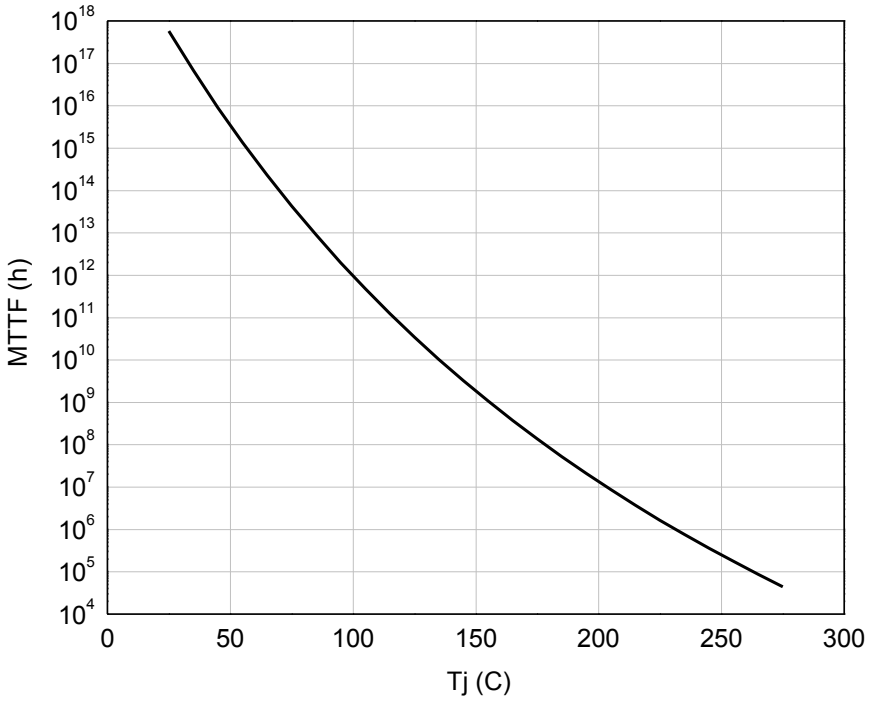
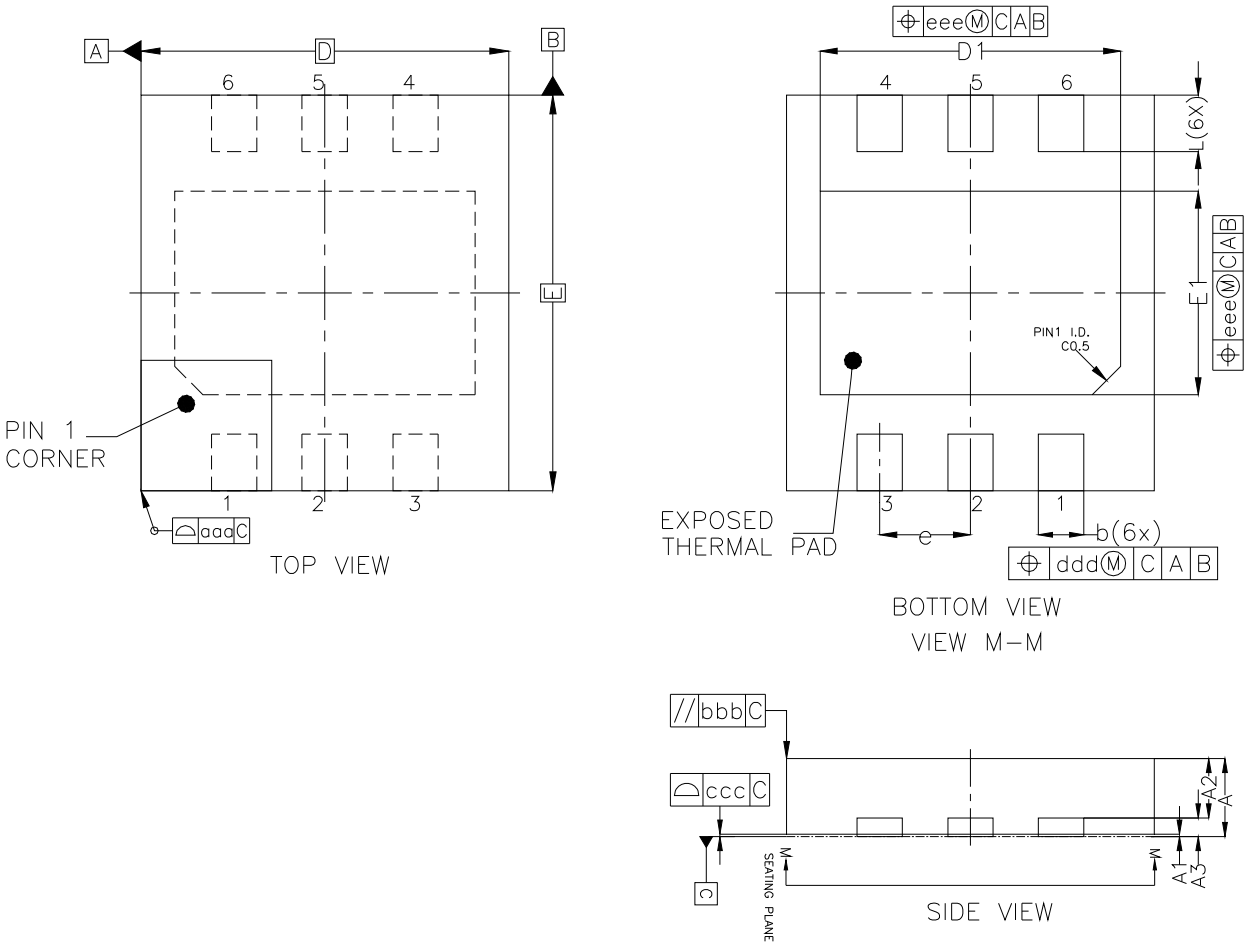


Fig 6. Median lifetime vs. channel temperature

12. Package outline



DESCRIPTION		SYMBOL	MILLIMETER		
			MIN	NOM	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 7. Package outline —— DFN 7×6.5mm

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.
Production [short] datasheet	Mass product	This document contains the product specification.

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