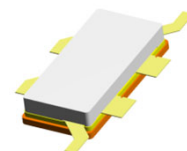


Product Features

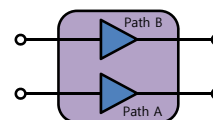
- 3700~4100MHz
- 400W Saturated Power @ 48V
- 46% Drain Efficiency @ 47.5dBm
- Internally Matched
- Asymmetrical Doherty GaN HEMT

Applications

- WiMAX, 5G NR, WCDMA, GSM
- Multi-Band, Multi-Mode
- Multi-Carrier
- High Efficiency, Doherty Amplifier



Package Type : RF24008DKR3

Typical Single-Carrier 5G NR Performance ($V_{DS} = +48V$, $T_C = 25^\circ C$, 50Ω)

Frequency [MHz]	Peak Power	Average Power ^{*1}			
	Power [W]	Power [W]	Gain [dB]	Drain Efficiency [%]	ACLR [dBc]
3750.0	431.5	56.2	13.9	43.2	-24.2
3900.0	406.4	56.2	14.2	46.1	-26.1
4050.0	393.6	56.2	13.6	43.0	-27.6

Note

*1 Measured in the ID41411DR Doherty test board amplifier circuit, under 5G NR 1FA 100MHz, PAR 8.0dB @0.01% probability on CCDF

Absolute Maximum Ratings

Rating	Symbol	Value	Unit	Condition
Drain to Source Voltage	V_{DSS}	150	V	$T_C = 25^\circ C$
Gate to Source Voltage	V_{GS}	-10, +2	V	$T_C = 25^\circ C$
Operating Voltage	V_{DD}	52	V_{DC}	
Storage Temperature	T_{STG}	-65, +150	$^\circ C$	
Case Operating Temperature	T_C	-40, +150	$^\circ C$	
Operating Junction Temperature ^{*1}	T_J	225	$^\circ C$	
Soldering Temperature ^{*2}	T_S	245	$^\circ C$	

Note

*1 Continuous use at maximum temperature will affect MTTF.

*2 Refer to the Application Note(AN-002) on soldering - "Solder Condition for RFHIC's GaN Device"

Thermal Characteristics

Rating	Symbol	Value	Unit	Condition
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.20 ^{*1}	$^\circ C/W$	$T_C = 85^\circ C$

Note

*1 Measured for the ID41411DR at dissipation power is 92W.

Electrical Characteristics (T_C=25°C unless otherwise noted)

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
DC Characteristics - Path A (Carrier) ^{*1}						
Maximum Forward Gate Current	Tc= 25℃	I _{GMAX}	-	-	21	mA
Maximum Drain Current ^{*2}	Tc= 25℃	I _{DMAX}	-	-	12.6	A
Power Dissipation	Tc= 85℃	P _{DMAX}	-	-	92	W
Gate Threshold Voltage	V _{DS} = 10V	V _{GS(TH)}	-3.75	-3.00	-2.25	V _{DC}
	I _D = 20.8mA					
Gate Quiescent Voltage	V _{DS} = 48V	V _{GS(Q)}	-	-2.45	-	V _{DC}
	I _D = 700mA					
Drain-Source Breakdown Voltage	V _{GS} = -8V	V _{BR}	150	-	-	V
	I _D = 20.8mA					
Saturated Drain Current ^{*3}	V _{DS} = 6V	I _{DS}	16.8	20.8	-	A
	V _{GS} = 2V					
Gate Leakage Current	V _{GS} = -8V	I _{GLKG150}	-6.5	-	-	mA
	V _{DS} = 150V					
Drain Leakage Current	V _{GS} = -8V	I _{DLKG150}	-	-	8.3	mA
	V _{DS} = 150V					
DC Characteristics - Path B (Peaking) ^{*1}						
Maximum Forward Gate Current	Tc= 25℃	I _{GMAX}	-	-	32	mA
Maximum Drain Current ^{*2}	Tc= 25℃	I _{DMAX}	-	-	12.0	A
Power Dissipation	Tc= 85℃	P _{DMAX}	-	-	118.5	W
Gate Threshold Voltage	V _{DS} = 10V	V _{GS(TH)}	-3.75	-3.00	-2.25	V _{DC}
	I _D = 28.8mA					
Gate Quiescent Voltage	V _{DS} = 48V	V _{GS(Q)}	-	-2.70	-	V _{DC}
	I _D = 1000mA					
Drain-Source Breakdown Voltage	V _{GS} = -8V	V _{BR}	150	-	-	V
	I _D = 28.8mA					
Saturated Drain Current ^{*3}	V _{DS} = 6V	I _{DS}	24.0	28.8	-	A
	V _{GS} = 2V					
Gate Leakage Current	V _{GS} = -8V	I _{GLKG150}	-8.9	-	-	mA
	V _{DS} = 150V					
Drain Leakage Current	V _{GS} = -8V	I _{DLKG150}	-	-	11.5	mA
	V _{DS} = 150V					

Note

*1 Measured on wafer prior to packaging.

*2 Current Limit for long term, reliable operation

*3 Scaled from PCM data.

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
RF Characteristics (F=3900MHz unless otherwise noted)						
Saturated Output Power ^{*1,4}	V _{DS} = 48V	P _{SAT}	350	400	470	W
	I _{DQ} = 700mA					
Modulated Gain ^{*2}	V _{DS} = 48V	G _{BR}	13.0	14.5	16.0	dB
	I _{DQ} = 700mA					
	P _{OUT} = 47.5dBm					
5G NR Linearity ^{*2}	V _{DS} = 48V	ACLR	-29.0	-25.0	-21.0	dBc
	I _{DQ} = 700mA					
	P _{OUT} = 47.5dBm					
Modulated Drain Efficiency ^{*2}	V _{DS} = 48V	η	37.0	45.0	53.0	%
	I _{DQ} = 700mA					
	P _{OUT} = 47.5dBm					
Output Mismatch Stress ^{*1,3}	V _{DS} = 48V	VSWR	-	-	10:1	ψ
	I _{DQ} = 700mA					
	P _{OUT} = P _{SAT} Pulsed					

Note

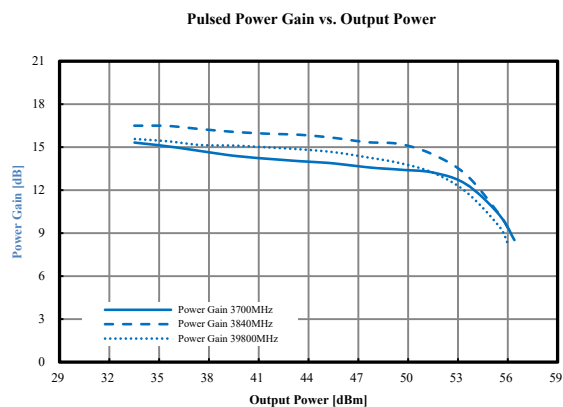
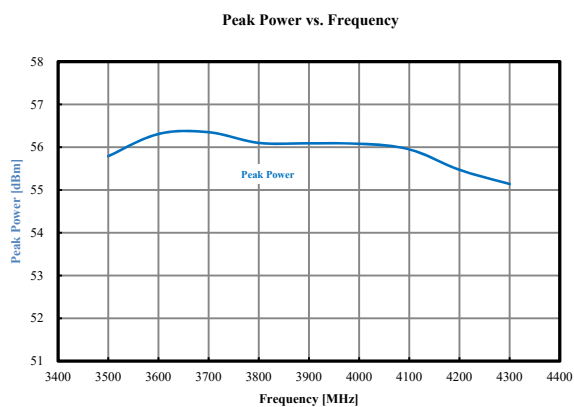
*1 Pulse width 10μsec, Duty Cycle 10%.

*2 Measured in the ID41411DR Doherty test board amplifier circuit, under 5GNR 1FA 100MHz, PAR 8.0dB @0.01% probability on CCDF.

*3 Measured in the ID41411DR Doherty test board amplifier circuit. No damage at all phase angles.

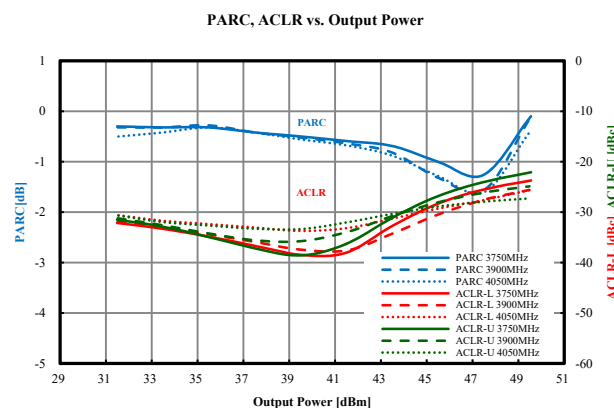
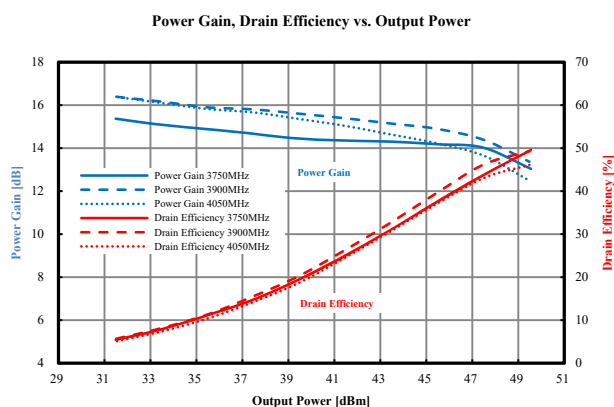
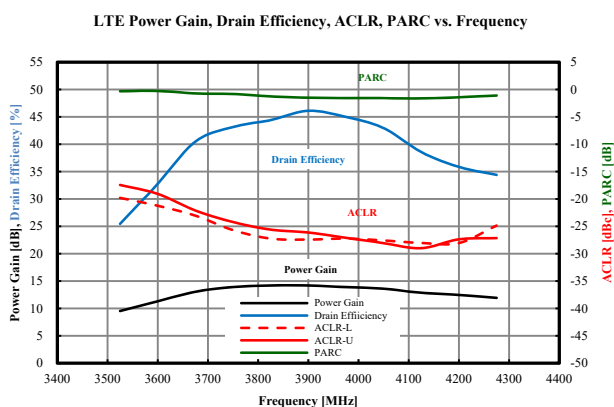
*4 Psat is defined as ΔPout/ΔPin<0.1, where ΔPin is increased input power, ΔPout is increased output power.

Typical Pulsed Signal Performance ($T_c=25^\circ\text{C}$, Measured in the ID41411DR test board amplifier circuit)



$$V_{DS} = 48\text{V}, \quad I_{DQ(C)} = 700\text{mA}, \quad V_{GS(P)} = -4.5\text{V}, \quad \text{Pulse Width} = 10\mu\text{sec}, \quad \text{Duty Cycle} = 10\%$$

Typical 5G NR Signal Performance ($T_c=25^\circ\text{C}$, Measured in the ID41411DR test board amplifier circuit)

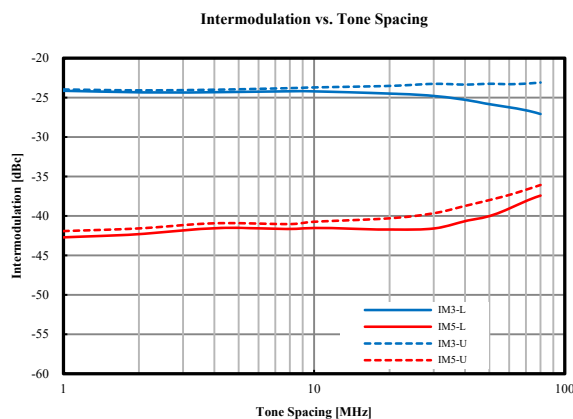


$$P_{AVG} = 47.5\text{dBm}, \quad V_{DS} = 48\text{V}, \quad I_{DQ(C)} = 700\text{mA}, \quad V_{GS(P)} = -4.5\text{V}$$

5G NR 1FA 100MHz BW, PAR 8.0dB @ 0.01% Probability on CCDF

Typical 2-tone Intermodulation Imbalance Performance

(Tc=25°C, Measured in the ID41411DR Doherty test board amplifier circuit)



2-tone Power = 47.5dBm,

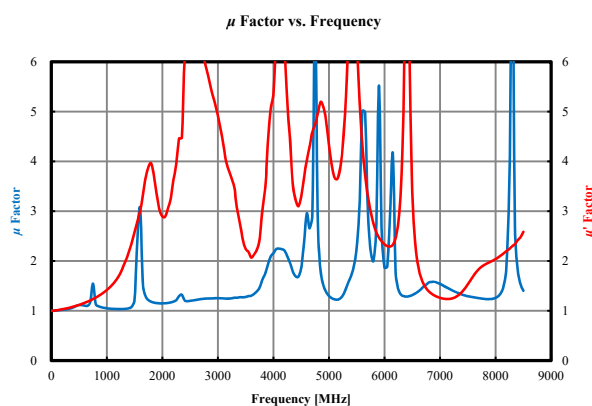
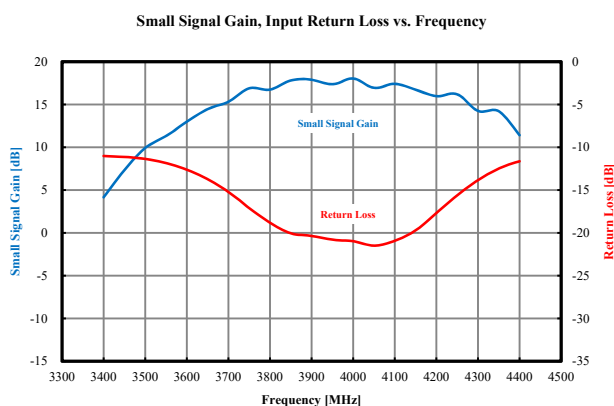
$V_{DS} = 48V$,

$I_{DQ(C)} = 700mA$,

$V_{GS(P)} = -4.5V$

Typical Small Signal Performance

(Tc=25°C, Measured in the ID41411DR Doherty test board amplifier circuit)

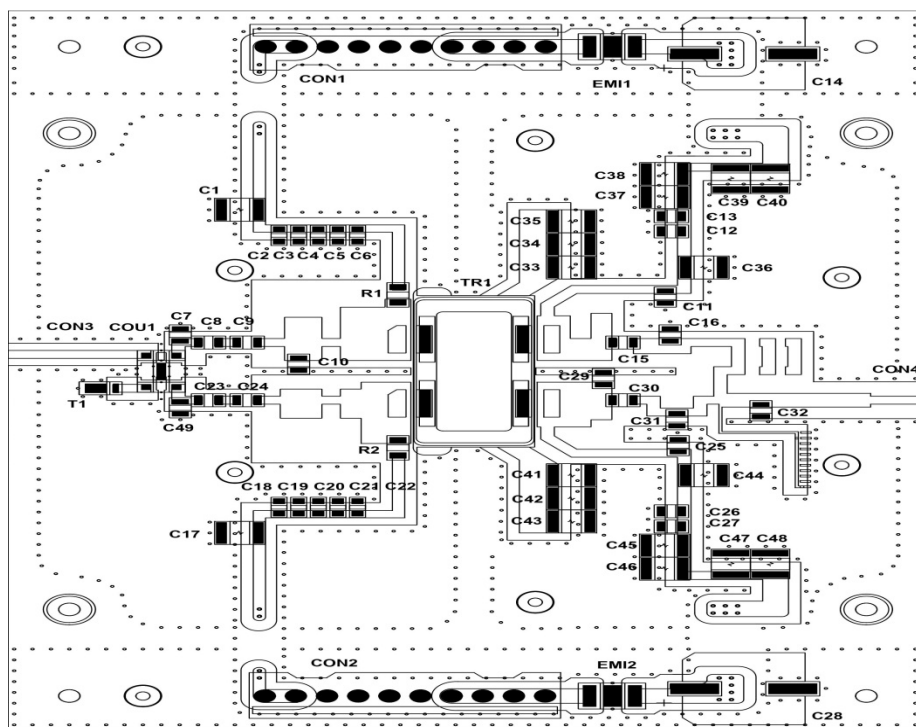


$P_{IN} = 0dBm$, $V_{DS} = 48V$,

$I_{DQ} = 700mA$,

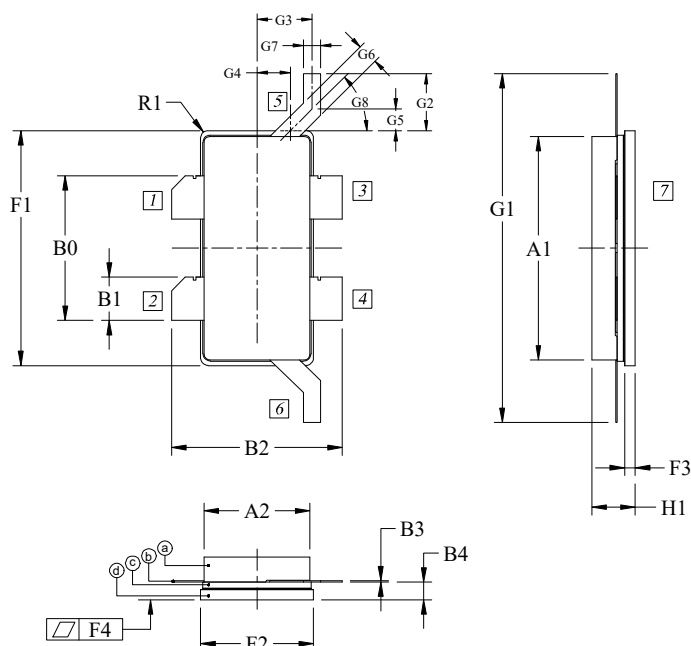
$V_{GS(P)} = -4.5V$

Test Board Component Layout



Part	Description	Part Number	Manufacturer
C1, C17	Polymer Capacitor	TCJB476M010R0070	AVX
C2, C18	1uF Chip Capacitor	GRM188R61C105KA01D	MURATA
C3, C19	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C4, C20	100pF Chip Capacitor	GRM1885C1H101JA01D	MURATA
C5, C21	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C6, C22	3pF Chip Capacitor	GRM1885C1H3R0CZ01D	MURATA
C7	0.3pF High Q Capacitor	201 CHA 0R3 BSLE	TEMEX
C8~9, C11, C23~25	2.7pF High Q Capacitor	201 CHA 2R7 CSLE	TEMEX
C12, C26	10pF High Q Capacitor	201 CHA 100 JSLE	TEMEX
C13, C27	100pF High Q Capacitor	201 CHA 101 JSLE	TEMEX
C14, C28	33uF Aluminum Capacitor	BDS100VC33MJ10TP	SAMYOUNG
C15, C30	2pF High Q Capacitor	201 CHA 2R0 CSLE	TEMEX
C29, C32, C49	0.2pF High Q Capacitor	201 CHA 0R2 BSLE	TEMEX
C33~48	10uF MLCC	GRM32EC72A106KE05	MURATA
R1, R2	10 ohm Chip Resistor	MCR10 EZHJ100	ROHM
T1	50 ohm Power Resistor	S1206N	RN2
EMI1, EMI2	EMI FILTER	CTH32R102S20A-TM	MARUWA
COU1	3dB Coupler	X3C35P1-03S	ANAREN
TR1	410W GaN Dual Transistor	ID41411DR	RFHIC
PCB	20mil, 2Layers	RO4350B2	ROGERS
CON1, CON2	DC Connector	LW0640-10	HANLIM
CON3, CON4	RF Connector	SMA-4Hole	Any
C10, C16, C31	Blank		

Package Dimensions (Type:RF24008DKR3)



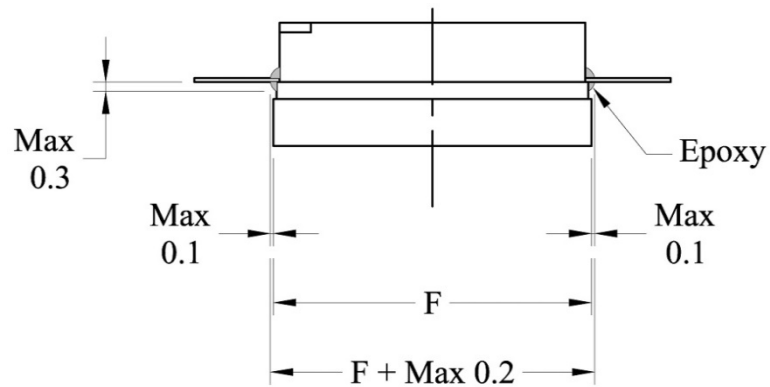
Pin Description	
Pin No	Function
	Path A Gate
	Path B Gate
[1]	Path A Drain
[2]	Path B Drain
[3]	-
[4]	-
[5]	Source

①- Lid

②- Lead Frame

③- Flange

Dim.	INCH			MILLIMETER		
	MIN	TYP	MAX	MIN	TYP	MAX
A1	0.766	0.772	0.778	19.45	19.6	19.75
A2	0.356	0.362	0.368	9.05	9.2	9.35
B0	0.494	0.5	0.506	12.55	12.7	12.85
B1	0.145	0.15	0.155	3.69	3.81	3.94
B2	0.565	0.584	0.604	14.34	14.84	15.34
B3	0.003	0.005	0.007	0.08	0.125	0.18
B4	0.057	0.062	0.067	1.45	1.57	1.7
F1	0.806	0.811	0.816	20.48	20.6	20.73
F2	0.381	0.386	0.391	9.68	9.8	9.93
F3	0.032	0.036	0.04	0.82	0.92	1.02
F4	-	0.002	-	-	0.05	-
G1	1.2	0.205	1.21	30.48	30.6	30.73
G2	0.192	0.197	0.202	4.88	5	5.13
G3	0.184	0.189	0.194	4.68	4.8	4.93
G4	0.109	0.114	0.119	2.78	2.9	3.03
G5	0.07	0.075	0.08	1.78	1.9	2.03
G6	0.066	0.071	0.076	1.68	1.8	1.93
G7	0.054	0.059	0.064	1.38	1.5	1.63
G8 (Angle)	-	45	-	-	45	-
H1	0.14	0.15	0.159	3.55	3.8	4.05
R1 (Radius)	0.02	0.026	0.031	0.5	0.65	0.8

Sealing Epoxy Tolerance (Type:RF24008DKR3)

Note

Unit : mm

F is maximum size of flange

Revision History

Part Number	Release Date	Version	Description	Data Sheet Status
ID41411DR	Mar, 2022	1.1	Extended operating bandwidth	
ID41411DR	Feb, 2021	1.0	Initial release of datasheet	

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