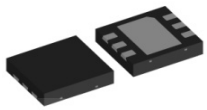
GaN Power Transistors ETQ2028P

Product Features

- Up to 6GHz
- 28W Saturated Power @ 48V, 2.6GHz
- 60% Drain Efficiency @ Psat, 2.6GHz
- 32% Drain Efficiency @ 38dBm, 2.6GHz

Applications

- WiMAX, LTE, WCDMA, GSM
- Multi-Band, Multi-Mode
- Multi-Carrier
- High Efficiency, Doherty Amplifier



Package Type : DFN66726L-Q2

Typical Single-Carrier LTE Performance (V_{DS}= +48V, T_C=25℃, 50Ω)

Frequency[MHz]	Peak Power		Average Power*1			
	Power[W]	Drain Efficiency[%]	Power[W]	Gain[dB]	Drain Efficiency[%]	ACLR[dBc]
2505	34.5	63.5	6.3	18.4	32.7	-35.1
2595	32.6	63.2	6.3	18.7	33.8	-33.0
2685	30.9	63.3	6.3	18.2	35.5	-31.5

Note

*1 Measured in the ETQ2028P test board amplifier circuit, under LTE 10MHz, PAR 7.5dB @0.01% probability on CCDF

Absolute Maximum Ratings

Rating	Symbol	Value	Unit	Condition
Drain to Source Voltage	V_{DSS}	150	V	Tc=25℃
Gate to Source Voltage	V_{GS}	-10, +2	V	Tc=25℃
Operating Voltage	V_{DD}	52	V_{DC}	-
Maximum Forward Gate Current	I_{GMAX}	4	mA	Tc=25℃
Maximum Drain Current*1	I_{DMAX}	1.5	A	Tc=25℃
Power Dissipation	P_{DISS}	20.3	W	Tc=85℃
Storage Temperature	T_{STG}	-65, +150	℃	-
Case Operating Temperature	T_C	-40, +150	℃	30 seconds
Operating Junction Temperature*2	T_J	225	℃	-
Soldering Temperature*3	T_S	245	℃	-

Note

*1 Current Limit for long term, reliable operation.

*2 Continuous use at maximum temperature will affect MTTF.

*3 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	$R_{\theta JC}$	6.90 *1	℃/W	Tc=85℃
		7.59 *2		

Note

*1 Measured for the ETQ2028P at dissipation power of 20.3W

*2 Measured for the ETQ2028P at dissipation power of 1.84W

Electrical Characteristics (T_C=25℃ unless otherwise noted)

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
DC Characteristics[*1]						
Gate Threshold Voltage	**V_{DS} = 10V** **I_D = 3.6mA**	$V_{GS(TH)}$	-3.8	-3.0	-2.3	V_{DC}
Gate Quiescent Voltage	**V_{DS} = 48V** **I_D = 100mA**	$V_{GS(Q)}$	-	-2.6	-	V_{DC}
Saturated Drain Current[*2]	**V_{DS} = 6V** **V_{GS} = 2V**	I_{DS}	2.9	3.5	-	A
Drain-Source Breakdown Voltage	**V_{GS} = -8V** **I_D = 3.6mA**	V_{BR}	150	-	-	V
Gate Leakage Current	**V_{GS} = -8V** **V_{DS} = 120V**	I_{GLKG}	-0.79	-	-	mA
Drain Leakage Current	**V_{GS} = -8V** **V_{DS} = 120V**	I_{DLKG}	-	-	1.44	mA
RF Characteristics (Fc=2595MHz unless otherwise noted)						
Saturated Output Power[*3,6]	**V_{DS} = 48V** **I_{DQ} = 100mA**	P_{SAT}	-	28	-	W
Pulsed Drain Efficiency[*3]	**V_{DS} = 48V** **I_{DQ} = 100mA** **P_{OUT} = P_{SAT} Pulsed**	η	55	60	-	%
Modulated Gain[*4]	**V_{DS} = 48V** **I_{DQ} = 100mA** **P_{OUT} = 38dBm**	G_{BR}	17.0	18.5	-	dB
LTE Linearity[*4]	**V_{DS} = 48V** **I_{DQ} = 100mA** **P_{OUT} = 38dBm**	ACLR	-	-30.0	-28.0	dBc
Modulated Drain Efficiency[*4]	**V_{DS} = 48V** **I_{DQ} = 100mA** **P_{OUT} = 38dBm**	η	28.0	32.0	-	%
Output Mismatch Stress[*3, 5]	**V_{DS} = 48V** **I_{DQ} = 100mA** **P_{OUT} = P_{SAT} Pulsed**	VSWR	-	-	10:1	ψ

Note

*1 Measured on wafer prior to packaging.

*2 Scaled from PCM data.

*3 Pulse width 100μsec, Duty Cycle 10%.

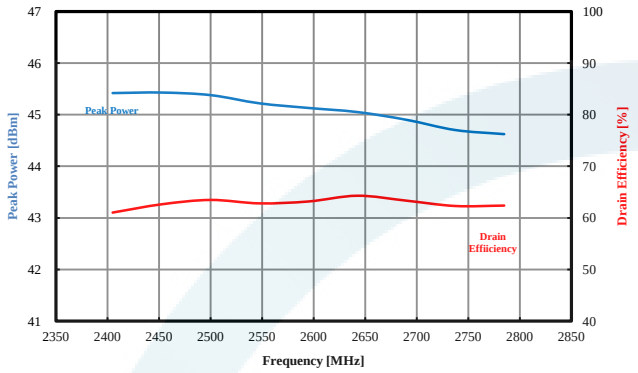
*4 Measured in the ETQ2028P-2600MHz test board amplifier circuit, under LTE 10MHz, PAR7.5dB @0.01% probability on CCDF.

*5 Measured in the ETQ2028P-2600MHz test board amplifier circuit. No damage at all phase angles.

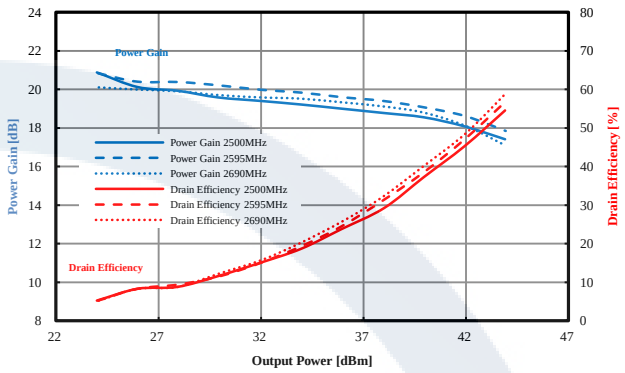
*6 Psat is defined as ΔPout/ΔPin<0.1, where ΔPin is increased input power, ΔPout is increased output power.

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ETQ2028P-2600MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



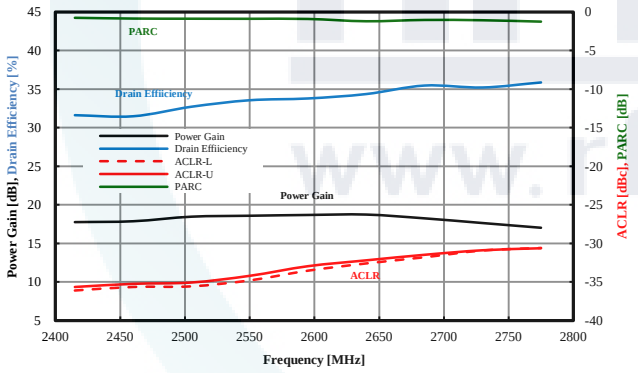
Pulsed Power Gain, Drain Efficiency vs. Output Power



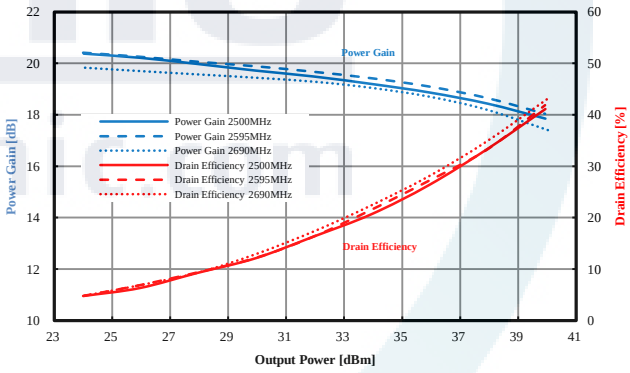
V_{DS} = 48V, I_{DQ} = 100mA, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ETQ2028P-2600MHz test board amplifier circuit)

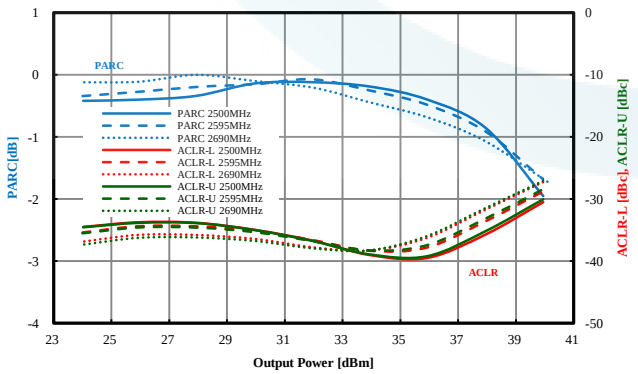
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

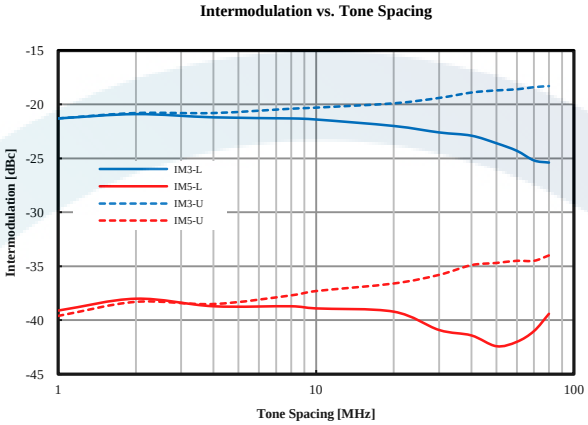


P_{AVG} = 38dBm, V_{DS} = 48V, I_{DQ} = 100mA

LTE 10MHz BW, PAPR=7.5dB @ 0.01% Probability on CCDF

Typical 2-tone Intermodulation Imbalance Performance

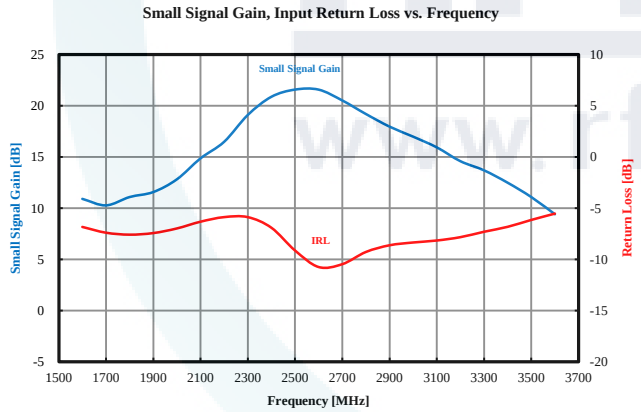
(Tc=25℃, Measured in the ETQ2028P-2600MHz test board amplifier circuit)

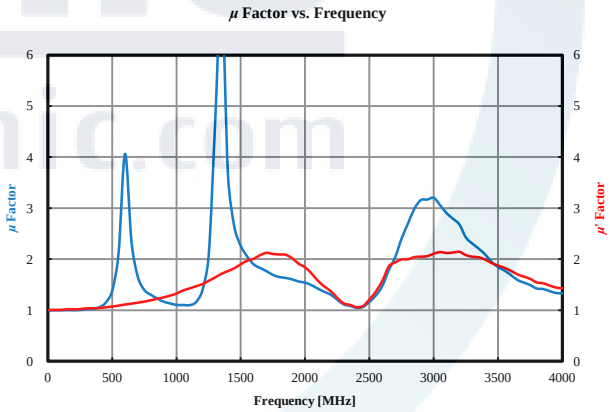


2-tone Power = 42.5dBm, V_{DS} = 48V, I_{DQ} = 100mA

Typical Small Signal Performance

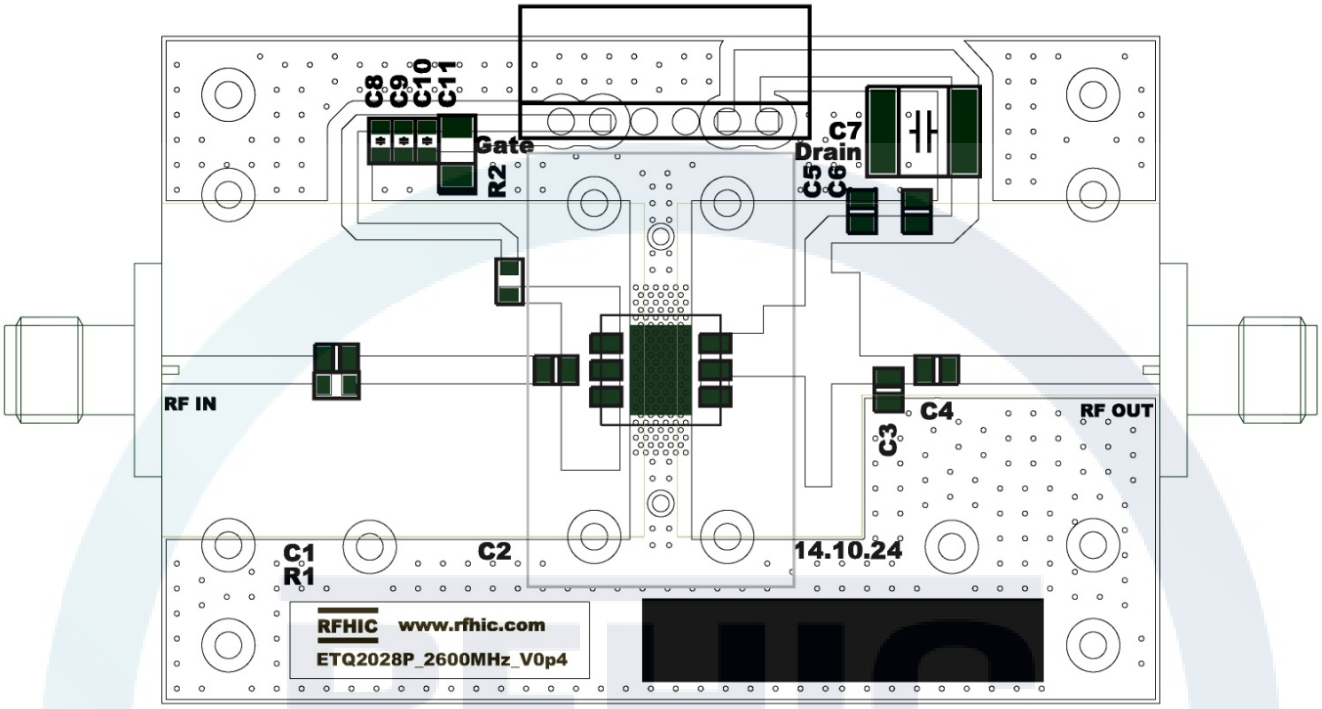
(Tc=25℃, Measured in the ETQ2028P-2600MHz test board amplifier circuit)





P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 100mA

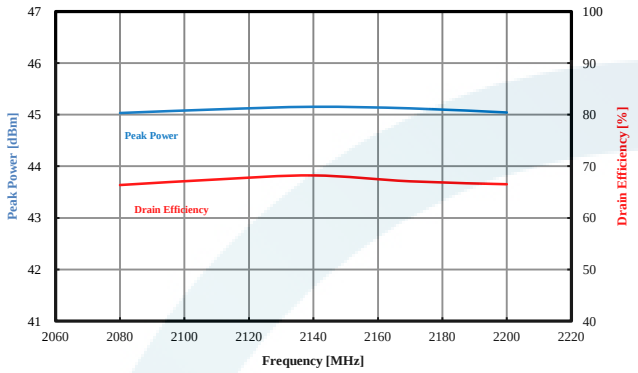
Test Board Component Layout(2600MHz)



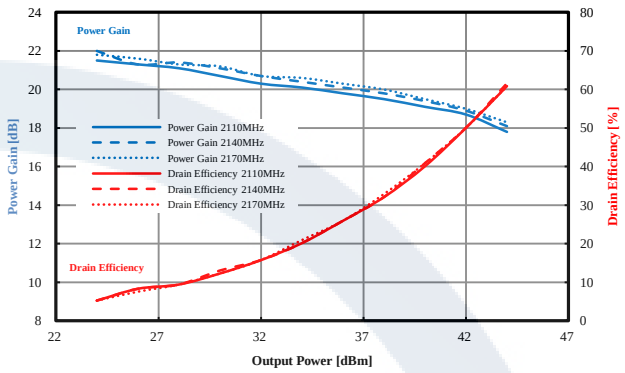
Part	Description	Part Number	Manufacturer
R1	10 ohm Chip Resistor	MCR10EZPJ100	ROHM
R2	100 ohm Chip Resistor	MCR10EZPJ101	ROHM
C1	3.9pF High Q Capacitor	201CHA3R9CSLE	TEMEX
C2	1.2pF High Q Capacitor	201CHA1R2CSLE	TEMEX
C3	0.6pF High Q Capacitor	201CHA0R6BSLE	TEMEX
C4	4.3pF High Q Capacitor	201CHA4R3CSLE	TEMEX
C5	-	-	-
C6	10pF High Q Capacitor	201CHA100JSLE	TEMEX
C7	10uF MLCC	RS80R2A106M	MARUWA
C8	100pF Chip Capacitor	GRM1885C1H101JA01D	MURATA
C9	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C10	10nF Chip Capacitor	GRM188R71H103KA01D	MURATA
C11	10uF Polymer Capacitor	TCJA106M016R0200	AVX
CON1	DC Connector	5268-06A	MOLEX
PCB	εr=3.48 ± 0.05, 0.030” (0.762mm)	RO4350B	ROGERS Corp.
TR1	28W GaN Transistor	ETQ2028P	RFHIC

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ETQ2028P-2100MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



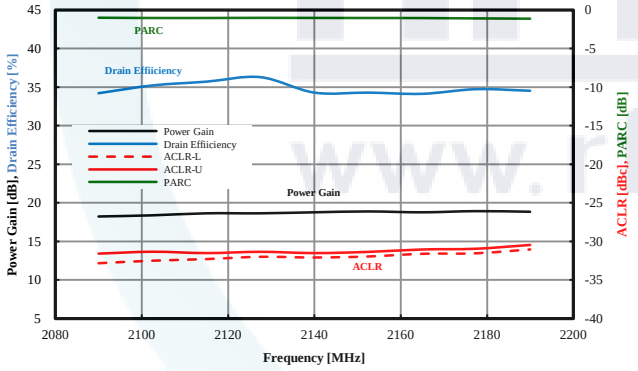
Pulsed Power Gain, Drain Efficiency vs. Output Power



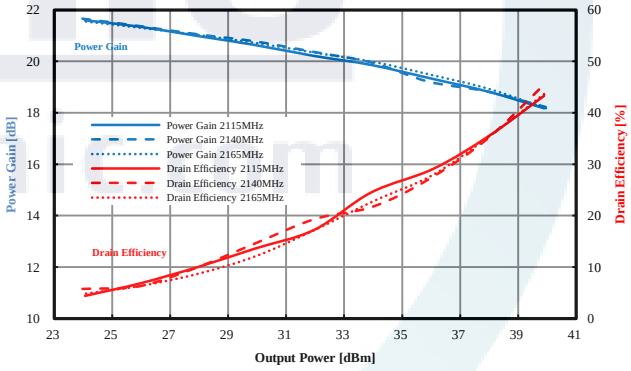
V_{DS} = 48V, I_{DQ} = 100mA, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ETQ2028P-2100MHz test board amplifier circuit)

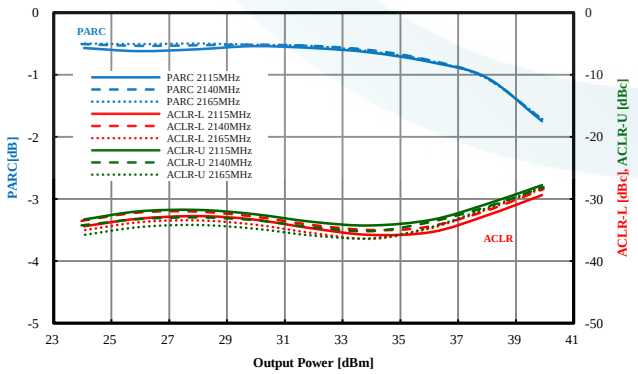
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

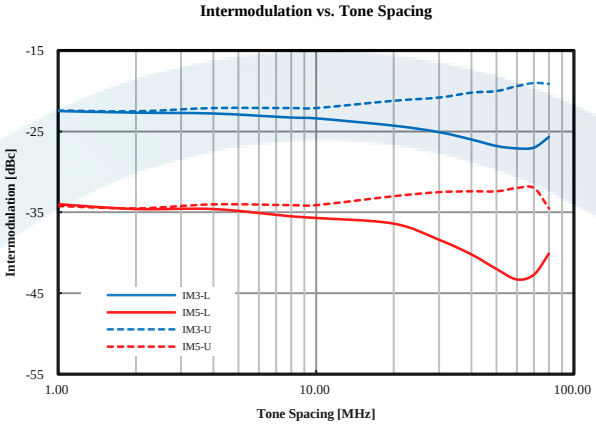


P_{AVG} = 38dBm, V_{DS} = 48V, I_{DQ} = 100mA

LTE 10MHz BW, PAPR=7.5dB @ 0.01% Probability on CCDF

Typical 2-tone Intermodulation Imbalance Performance

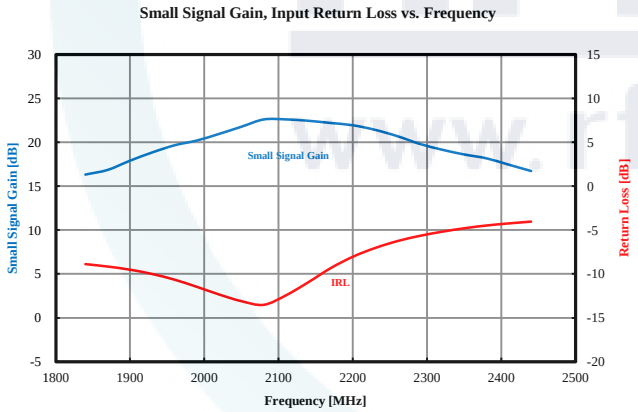
(Tc=25℃, Measured in the ETQ2028P-2100MHz test board amplifier circuit)

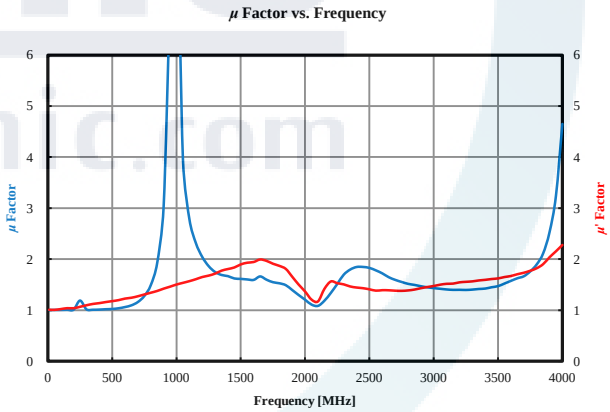


2-tone Power = 42.5dBm, V_{DS} = 48V, I_{DQ} = 100mA

Typical Small Signal Performance

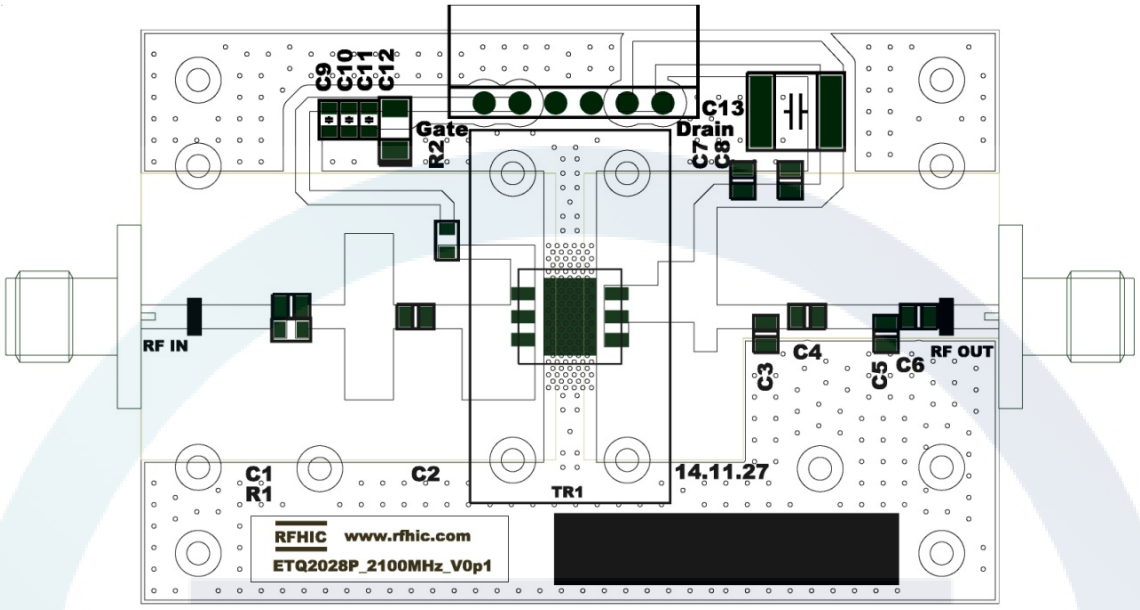
(Tc=25℃, Measured in the ETQ2028P-2100MHz test board amplifier circuit)





P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 100mA

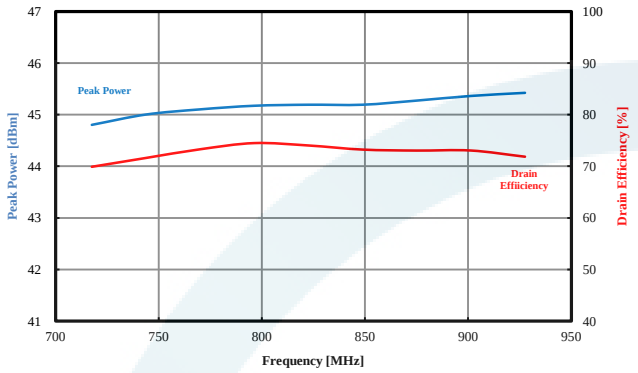
Test Board Component Layout(2100MHz)



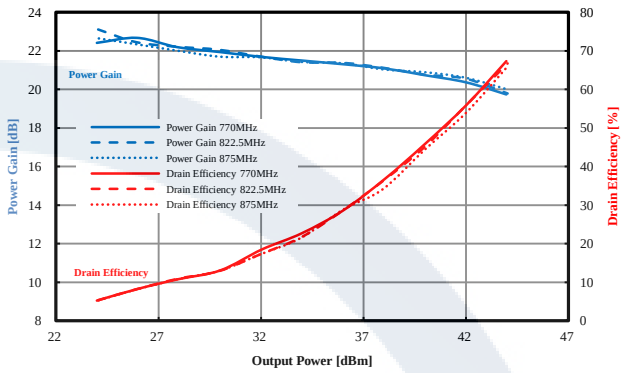
Part	Description	Part Number	Manufacturer
R1	10 ohm Chip Resistor	MCR10EZP100	ROHM
R2	100 ohm Chip Resistor	MCR10EZP101	ROHM
C1,C4	4.3pF High Q Capacitor	201CHA4R3CSLE	TEMEX
C2	2.2pF High Q Capacitor	201CHA2R2CSLE	TEMEX
C3	0.3pF High Q Capacitor	201CHA0R3BSLE	TEMEX
C5	0.8pF High Q Capacitor	201CHA0R8BSLE	TEMEX
C6	27pF High Q Capacitor	201CHA270JSLE	TEMEX
C7	-	-	-
C8	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C9	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C10	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C11	10nF Chip Capacitor	GRM188R71H103KA01D	MURATA
C12	10uF Polymer Capacitor	TCJA106M016R0200	AVX
C13	10uF MLCC	RS80R2A106M	MARUWA
CON1	DC Connector	5268-06A	MOLEX
PCB	εr=3.48 ± 0.05, 0.030” (0.762mm)	RO4350B	ROGERS Corp.
TR1	28W GaN Transistor	ETQ2028P	RFHIC

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ETQ2028P-800MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



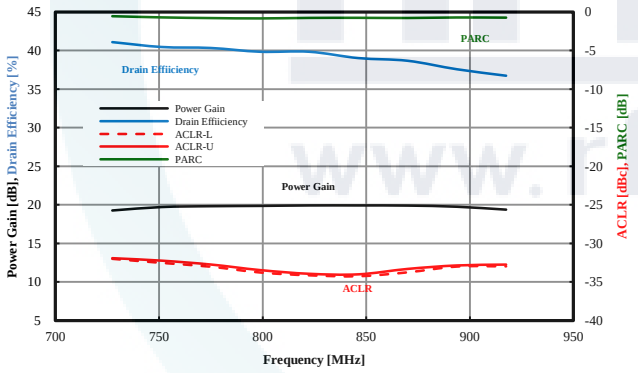
Pulsed Power Gain, Drain Efficiency vs. Output Power



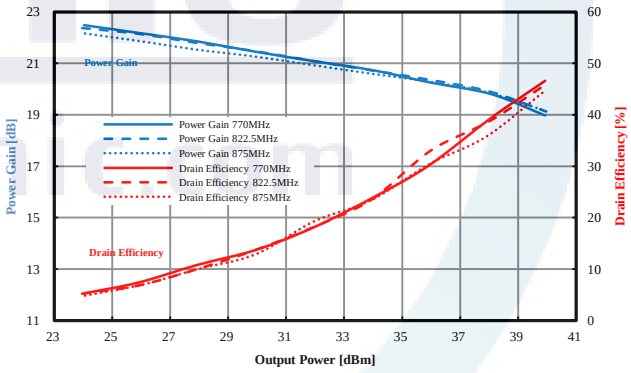
V_{DS} = 48V, I_{DQ} = 100mA, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ETQ2028P-800MHz test board amplifier circuit)

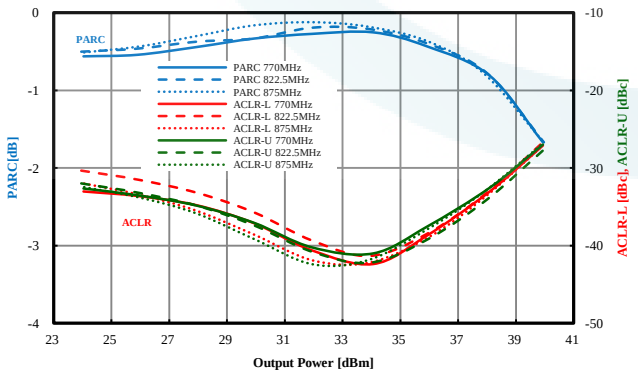
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

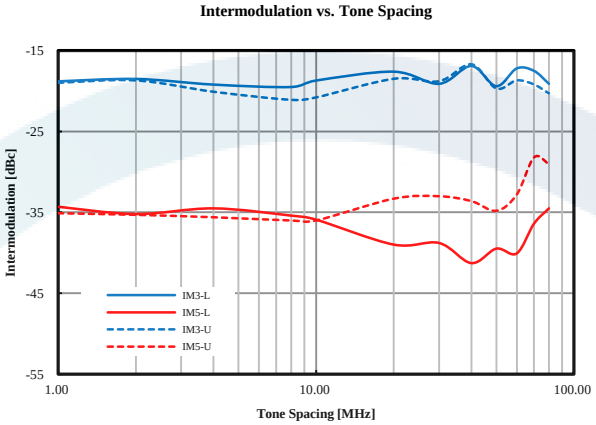


P_{AVG} = 38dBm, V_{DS} = 48V, I_{DQ} = 100mA

LTE 10MHz BW, PAPR=7.5dB @ 0.01% Probability on CCDF

Typical 2-tone Intermodulation Imbalance Performance

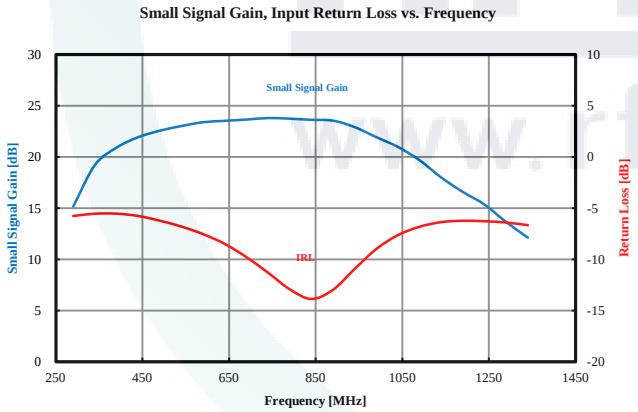
(Tc=25℃, Measured in the ETQ2028P-800MHz test board amplifier circuit)

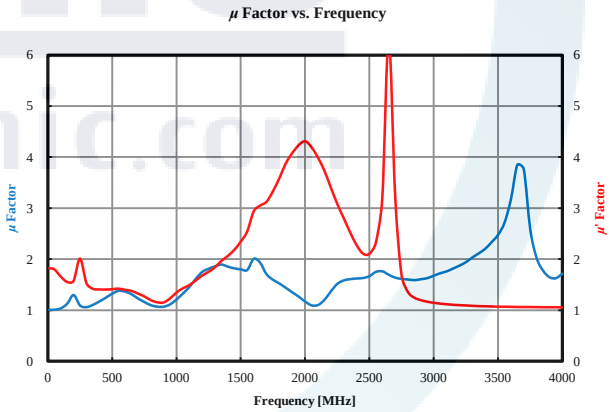


2-tone Power = 42.5dBm, V_{DS} = 48V, I_{DQ} = 100mA

Typical Small Signal Performance

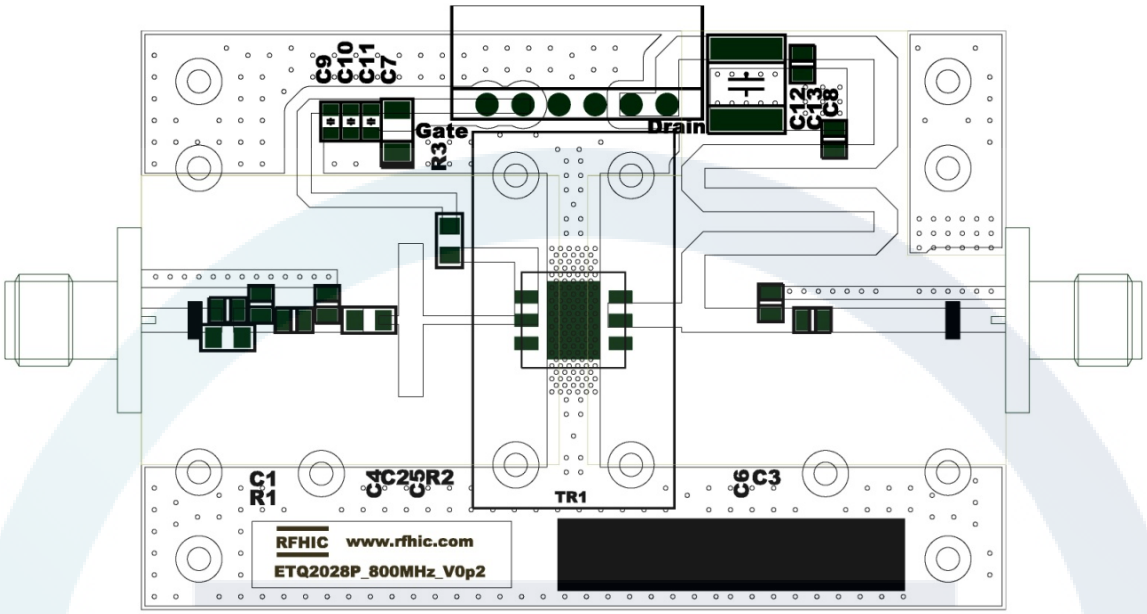
(Tc=25℃, Measured in the ETQ2028P-800MHz test board amplifier circuit)





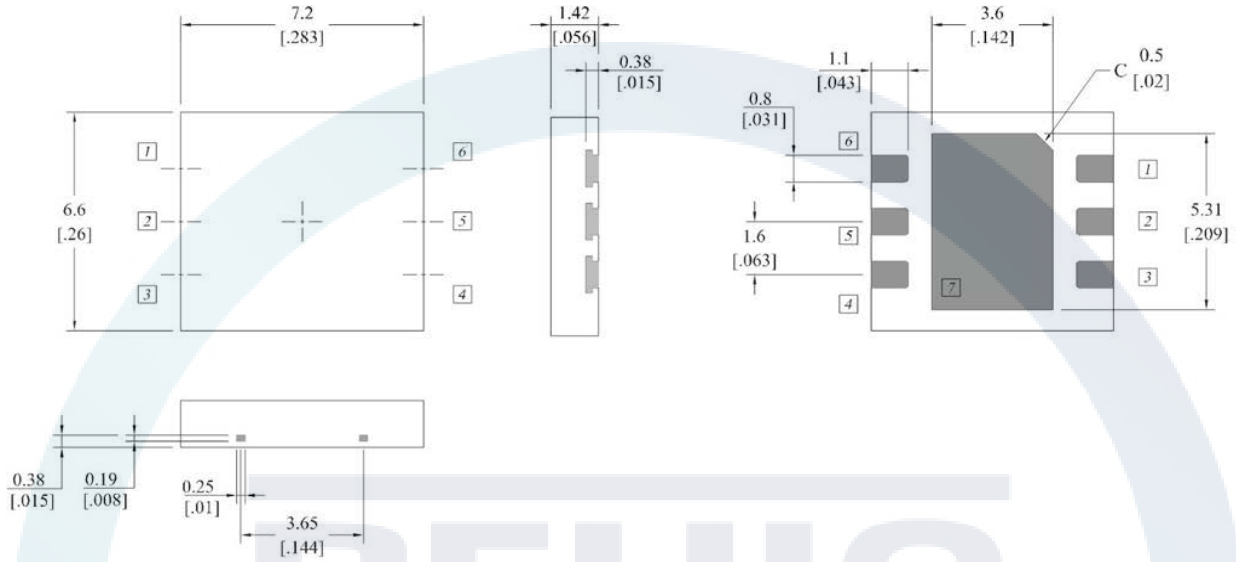
P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 100mA

Test Board Component Layout(800MHz)



Part	Description	Part Number	Manufacturer
R1	10 ohm Chip Resistor	MCR10EZP100	ROHM
R2	5.6 ohm Chip Resistor	MCR10EZP5R6	ROHM
R3	100 ohm Chip Resistor	MCR10EZP101	ROHM
C1	2.7 pF High Q Capacitor	201CHA2R7CSLE	TEMEX
C2, C3, C8	100 pF High Q Capacitor	201CHA101JSLE	TEMEX
C4	2.0 pF High Q Capacitor	201CHA2R0CSLE	TEMEX
C5	3.0 pF High Q Capacitor	201CHA3R0CSLE	TEMEX
C6	0.5 pF High Q Capacitor	201CHA0R5BSLE	TEMEX
C7	10uF Polymer Capacitor	TCJA106M016R0200	AVX
C9	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C10	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C11	10nF Chip Capacitor	GRM188R71H103KA01D	MURATA
C12	10uF MLCC	RS80R2A106M	MARUWA
C13	-	-	-
CON1	DC Connector	5268-06A	MOLEX
PCB	εr=3.48 ± 0.05, 0.030” (0.762mm)	RO4350B	ROGERS Corp.
TR1	28W GaN Transistor	ETQ2028P	RFHIC

Package Dimensions (Type:DFN66726L-Q2)



Pin Description	
Pin No	**Function**
1	N.C.
2	Gate
3	N.C.
4	N.C.
5	Drain
6	N.C.
7	Source

Revision History

Part Number	Release Date	Version	Description	Data Sheet Status
ETQ2028P	October, 2016	1.1	Modified BOM data	-
ETQ2028P	October, 2015	1.0	Initial Release of Data sheet	-