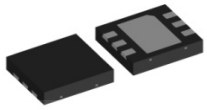
GaN Power Transistors ETQ2014P

Product Features

- Up to 6GHz
- 14W Saturated Power @ 48V, 2.6GHz
- 60% Drain Efficiency @ Psat, 2.6GHz
- 35% Drain Efficiency @ 35dBm, 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	18.5	66.6	3.2	18.4	35.1	-32.1
2595	17.0	63.3	3.2	18.5	35.2	-31.3
2685	15.8	63.6	3.2	18.3	37.3	-29.2

Note

*1 Measured in the ETQ2014P 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}	2.1	mA	Tc=25℃
Maximum Drain Current*1	I_{DMAX}	0.75	A	Tc=25℃
Power Dissipation	P_{DISS}	17.3	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	$R_{\theta JC}$	8.10 *1	℃/W	Tc=85℃
		8.91 *2		

Note

*1 Measured for the ETQ2014P at dissipation power of 17.3W.

*2 Measured for the ETQ2014P at dissipation power of 1.57W.

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 = 2.1mA	$V_{GS(TH)}$	-3.8	-3.0	-2.3	V_{DC}
Gate Quiescent Voltage	V_{DS} = 48V I_D = 50mA	$V_{GS(Q)}$	-	-2.6	-	V_{DC}
Saturated Drain Current[*2]	V_{DS} = 6V V_{GS} = 2V	I_{DS}	1.7	2.1	-	A
Drain-Source Breakdown Voltage	V_{GS} = -8V I_D = 2.1mA	V_{BR}	150	-	-	V
Gate Leakage Current	V_{GS} = -8V V_{DS} = 120V	I_{GLKG}	-0.46	-	-	mA
Drain Leakage Current	V_{GS} = -8V V_{DS} = 120V	I_{DLKG}	-	-	0.84	mA
RF Characteristics (Fc=2595MHz unless otherwise noted)						
Saturated Output Power[*3,6]	V_{DS} = 48V I_{DQ} = 50mA	P_{SAT}	-	14	-	W
Pulsed Drain Efficiency[*3]	V_{DS} = 48V I_{DQ} = 50mA P_{OUT} = P_{SAT} Pulsed	η	55	60	-	%
Modulated Gain[*4]	V_{DS} = 48V I_{DQ} = 50mA P_{OUT} = 35dBm	G_{BR}	17.0	18.5	-	dB
LTE Linearity[*4]	V_{DS} = 48V I_{DQ} = 50mA P_{OUT} = 35dBm	ACLR	-	-30.0	-28.0	dBc
Modulated Drain Efficiency[*4]	V_{DS} = 48V I_{DQ} = 50mA P_{OUT} = 35dBm	η	32.0	35.0	-	%
Output Mismatch Stress[*3, 5]	V_{DS} = 48V I_{DQ} = 50mA 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%.

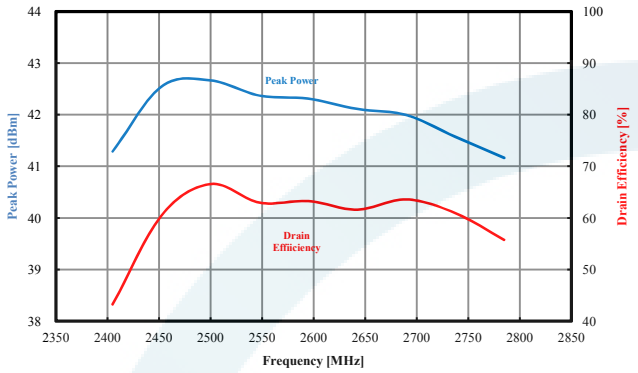
*4 Measured in the ETQ2014P-2600MHz test board amplifier circuit, under LTE 10MHz, PAR7.5dB @0.01% probability on CCDF.

*5 Measured in the ETQ2014P-2600MHz test board amplifier circuit. No damage at all phase angles.

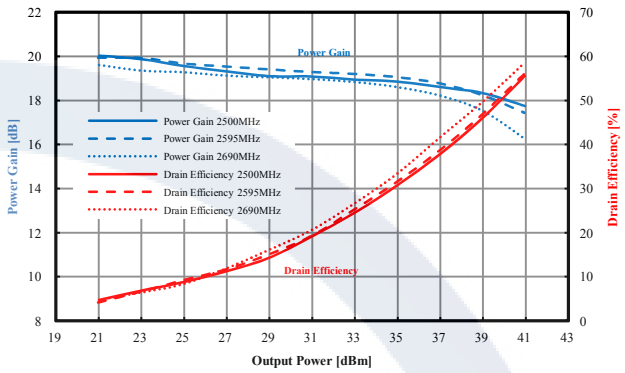
*6 Psat is defined as ΔPout/ΔPin<0.1, where ΔPin is increased input power, ΔPout is increased output power.

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ETQ2014P-2600MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



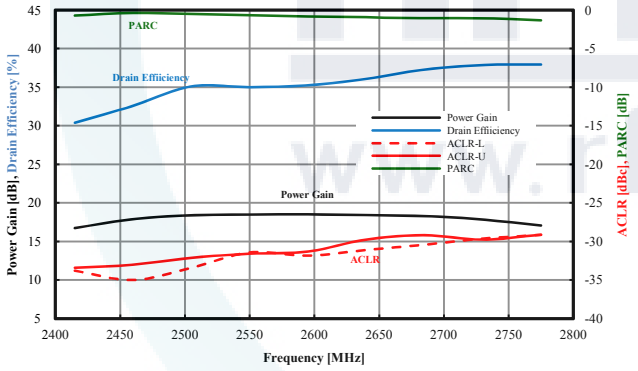
Pulsed Power Gain, Drain Efficiency vs. Output Power



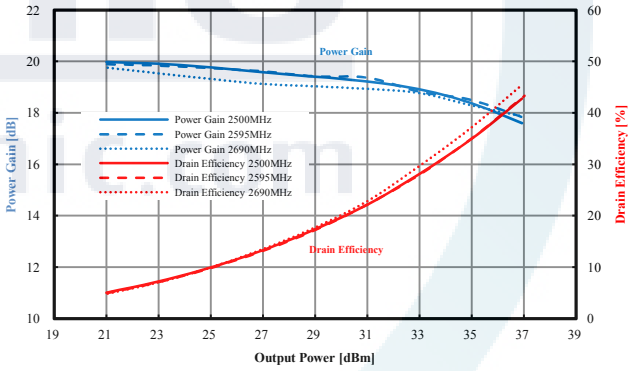
V_{DS} = 48V, I_{DQ} = 50mA, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ETQ2014P-2600MHz test board amplifier circuit)

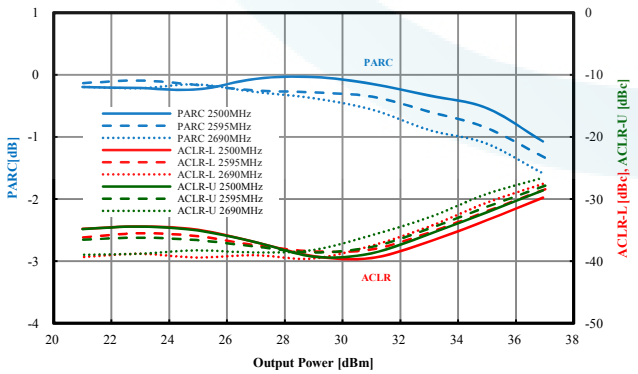
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

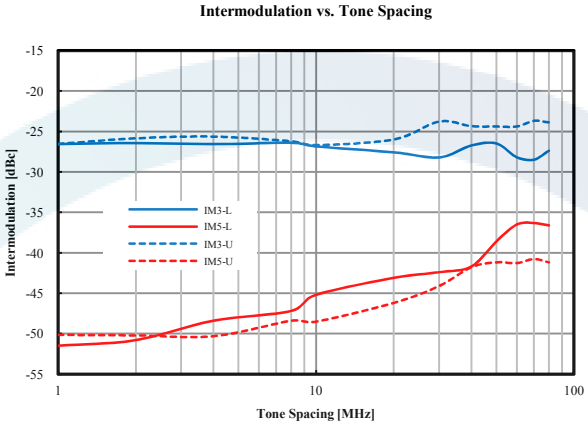


P_{AVG} = 35dBm, V_{DS} = 48V, I_{DQ} = 50mA

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

Typical 2-tone Intermodulation Imbalance Performance

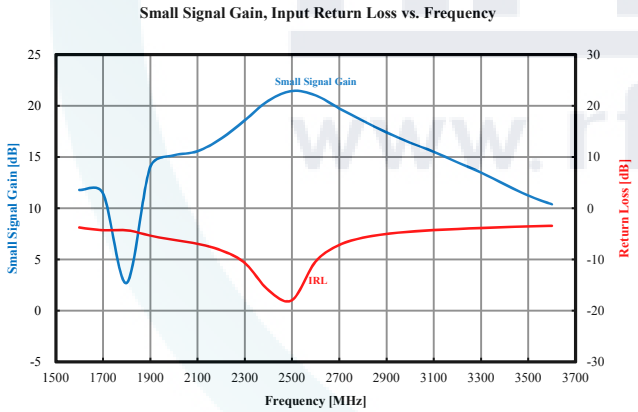
(Tc=25℃, Measured in the ETQ2014P-2600MHz test board amplifier circuit)

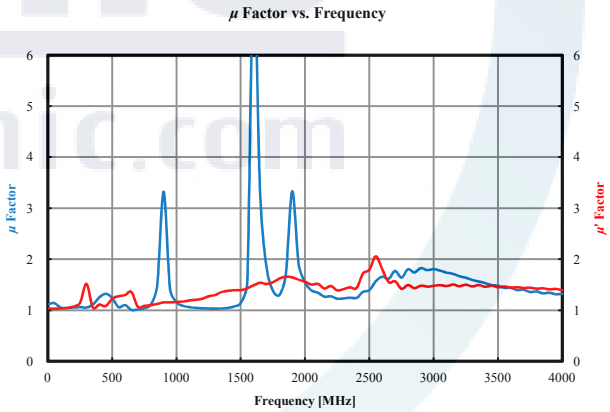


2-tone Power = 39.5dBm, V_{DS} = 48V, I_{DQ} = 50mA

Typical Small Signal Performance

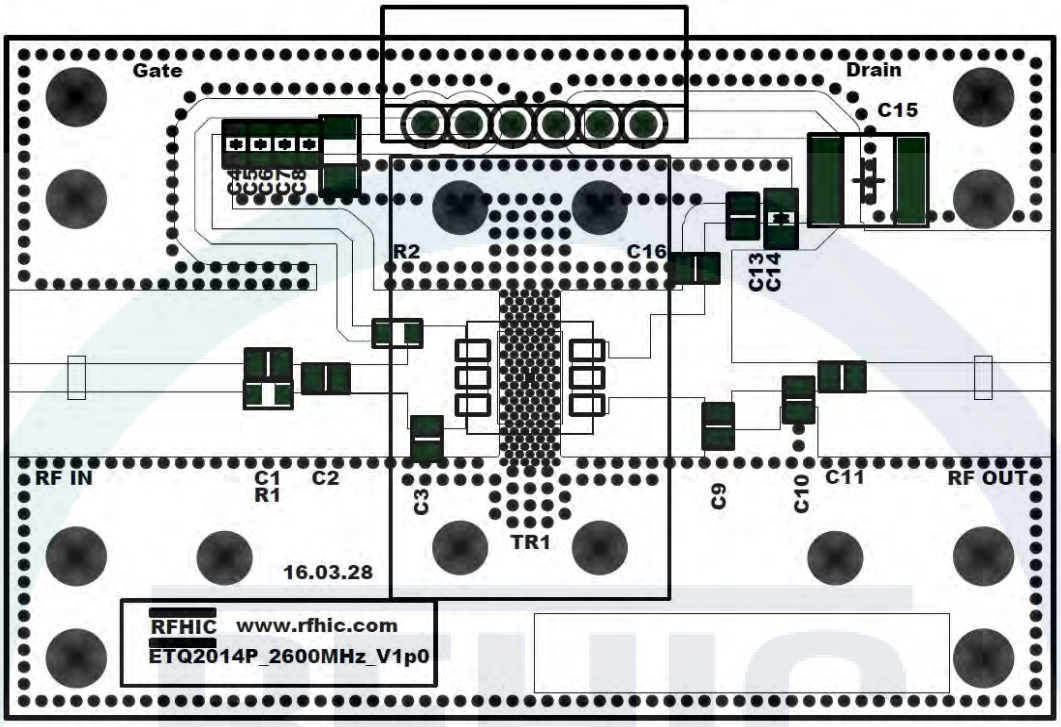
(Tc=25℃, Measured in the ETQ2014P-2600MHz test board amplifier circuit)





P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 50mA

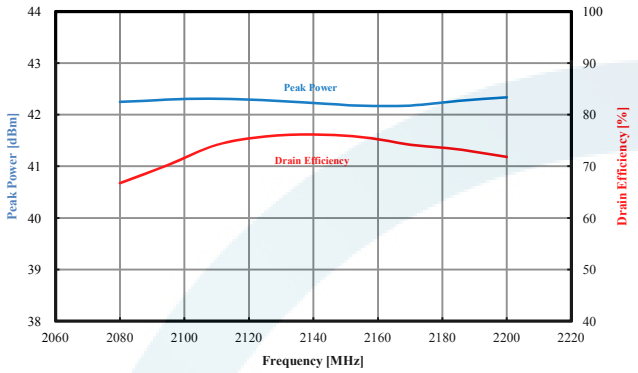
Test Board Component Layout(2600MHz)



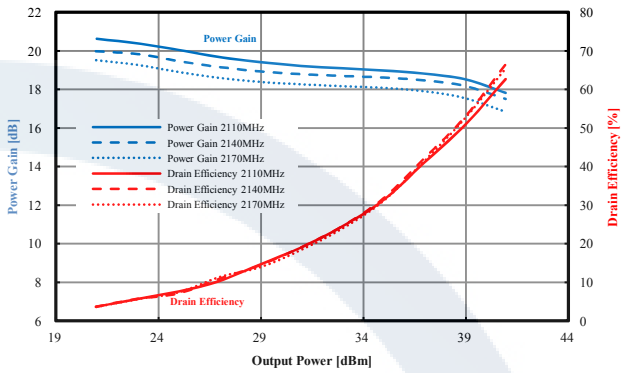
Part	Description	Part Number	Manufacturer
R1	20 ohm Chip Resistor	MCR10EZPJ200	ROHM
R2	200 ohm Chip Resistor	MCR10EZPJ201	ROHM
C1	2.2pF High Q Capacitor	201CHA2R2CSLE	TEMEX
C2	1.2pF High Q Capacitor	201CHA1R2BSLE	TEMEX
C3	-	-	-
C4	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C5	100pF Chip Capacitor	GRM1885C1H101JA01D	MURATA
C6	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C7	1uF Chip Capacitor	GRM188R71H105KA01D	MURATA
C8	Polymer Capacitor	TCJA106M016R0200	AVX
C9	0.5pF High Q Capacitor	201CHA0R5BSLE	TEMEX
C10	0.8pF High Q Capacitor	201CHA0R8BSLE	TEMEX
C11	1.8pF High Q Capacitor	201CHA1R8CSLE	TEMEX
C12	-	-	-
C13	10pF High Q Capacitor	201CHA100JSLE	TEMEX
C14	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C15	10uF MLCC	RS80R2A106M	MARUWA
C16	6.8pF High Q Capacitor	201CHA6R8CSLE	TEMEX
CON1	DC Connector	5268-06A	MOLEX
PCB	εr=3.66 ± 0.05, 0.030” (0.762mm)	RO4350B	ROGERS Corp.
TR1	14W GaN Transistor	ETQ2014P	RFHIC

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ETQ2014P-2100MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



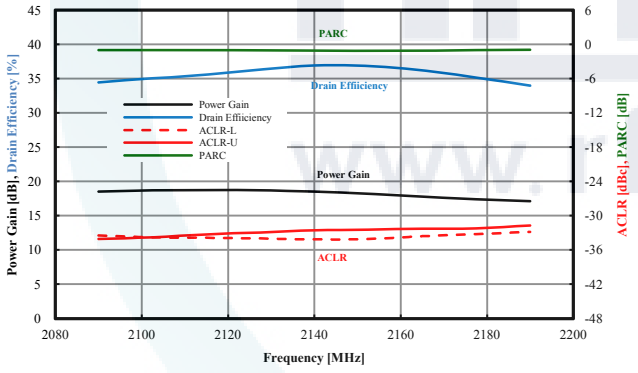
Pulsed Power Gain, Drain Efficiency vs. Output Power



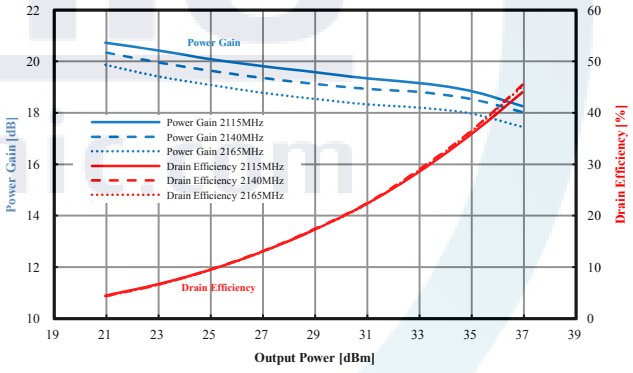
V_{DS} = 48V, I_{DQ} = 50mA, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ETQ2014P-2100MHz test board amplifier circuit)

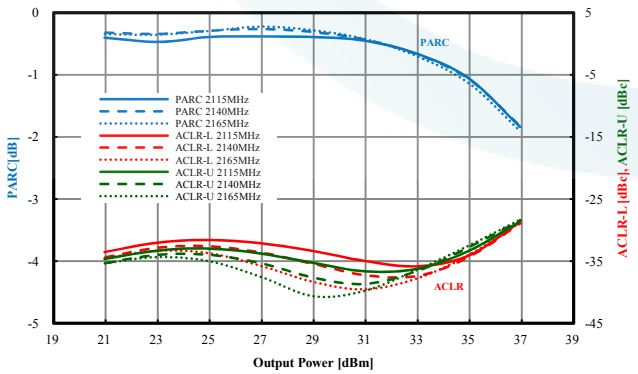
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

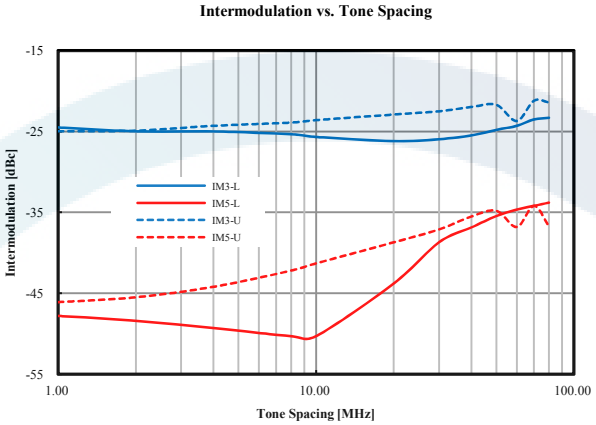


P_{AVG} = 35dBm, V_{DS} = 48V, I_{DQ} = 50mA

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

Typical 2-tone Intermodulation Imbalance Performance

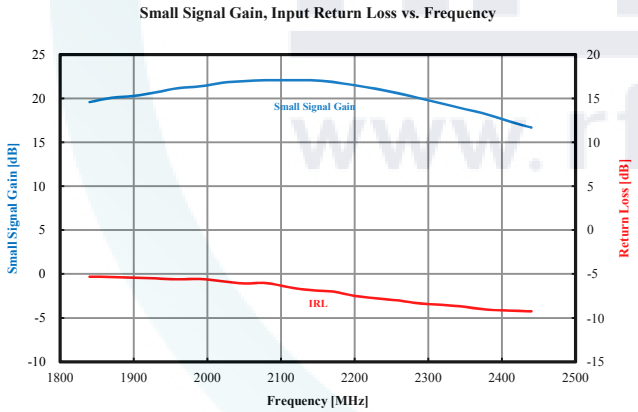
(Tc=25℃, Measured in the ETQ2014P-2100MHz test board amplifier circuit)

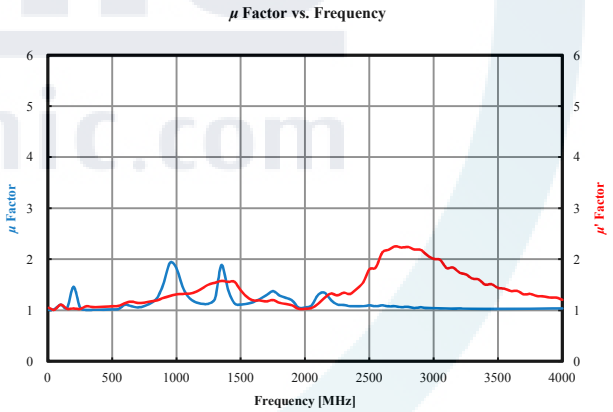


2-tone Power = 39.5dBm, V_{DS} = 48V, I_{DQ} = 50mA

Typical Small Signal Performance

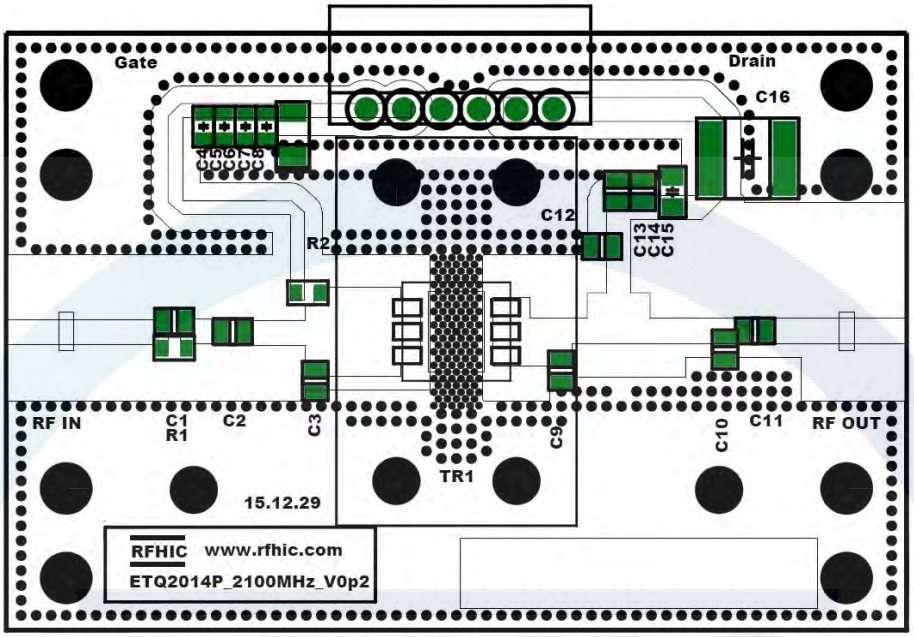
(Tc=25℃, Measured in the ETQ2014P-2100MHz test board amplifier circuit)





P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 50mA

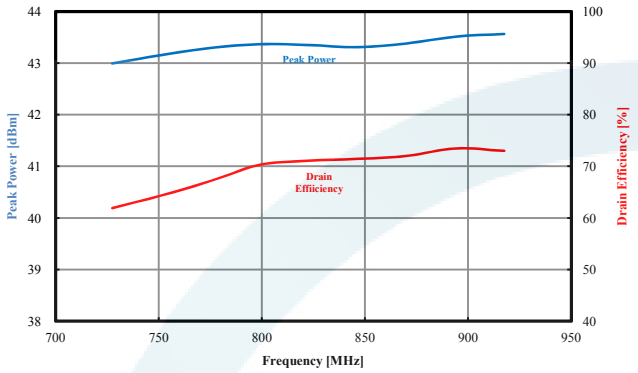
Test Board Component Layout(2100MHz)



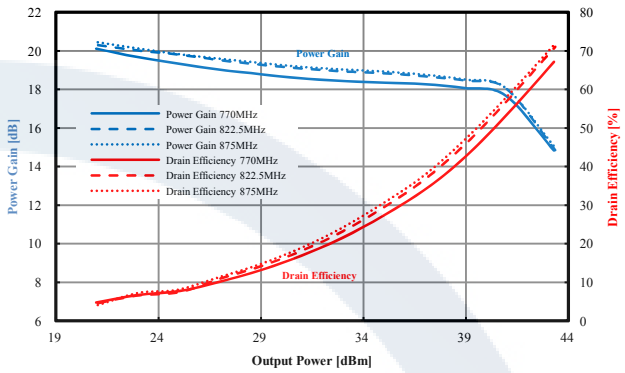
Part	Description	Part Number	Manufacturer
R1	30 ohm Chip Resistor	MCR10EZPJ300	ROHM
R2	200 ohm Chip Resistor	MCR10EZPJ201	ROHM
C1	1.5pF High Q Capacitor	201CHA1R5BSLE	TEMEX
C2	5.1pF High Q Capacitor	201CHA5R1CSLE	TEMEX
C3, C9	0.7pF High Q Capacitor	201CHA0R7BSLE	TEMEX
C4	10F Chip Capacitor	GRM1885C1H100JA01D	MURATA
C5	100F Chip Capacitor	GRM1885C1H101JA01D	MURATA
C6	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C7	1uF Chip Capacitor	GRM188R71H105KA01D	MURATA
C8	Polymer Capacitor	TCJA106M016R0200	AVX
C10	1.8pF High Q Capacitor	201CHA1R8CSLE	TEMEX
C11, C12	10pF High Q Capacitor	201CHA100JSLE	TEMEX
C13	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C14, C15	-	-	-
C16	10uF MLCC	RS80R2A106M	MARUWA
CON1	DC Connector	5268-06A	MOLEX
PCB	εr=3.66 ± 0.05, 0.030” (0.762mm)	RO4350B	ROGERS Corp.
TR1	14W GaN Transistor	ETQ2014P	RFHIC

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ETQ2014P-800MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



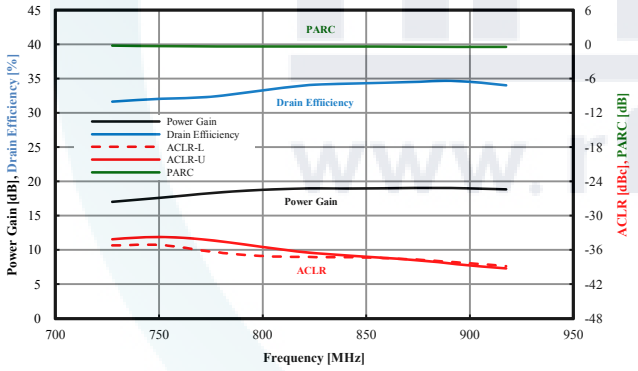
Pulsed Power Gain, Drain Efficiency vs. Output Power



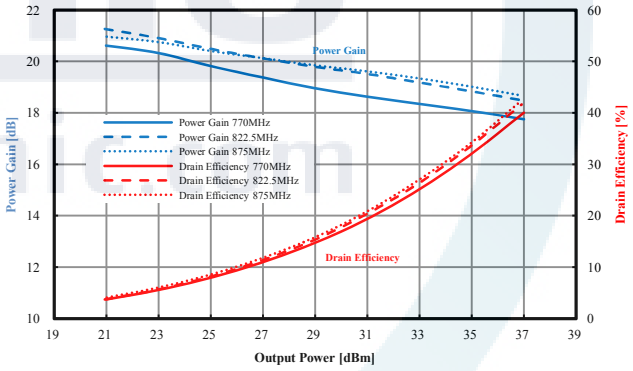
V_{DS} = 48V, I_{DQ} = 50mA, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ETQ2014P-800MHz test board amplifier circuit)

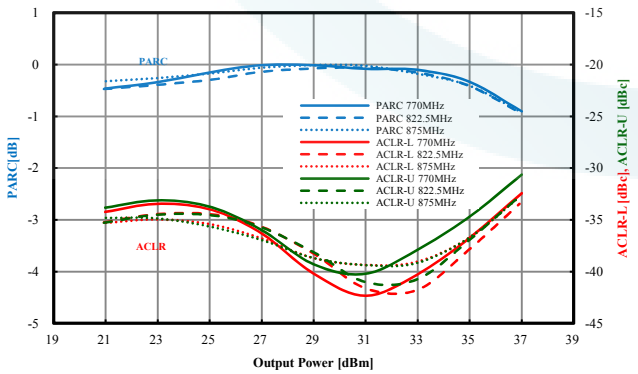
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

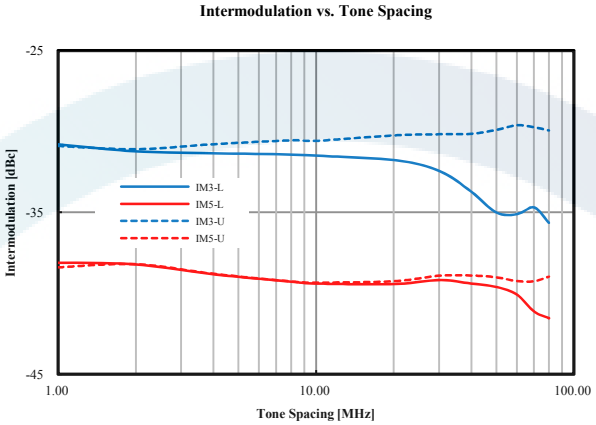


P_{AVG} = 35dBm, V_{DS} = 48V, I_{DQ} = 50mA

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

Typical 2-tone Intermodulation Imbalance Performance

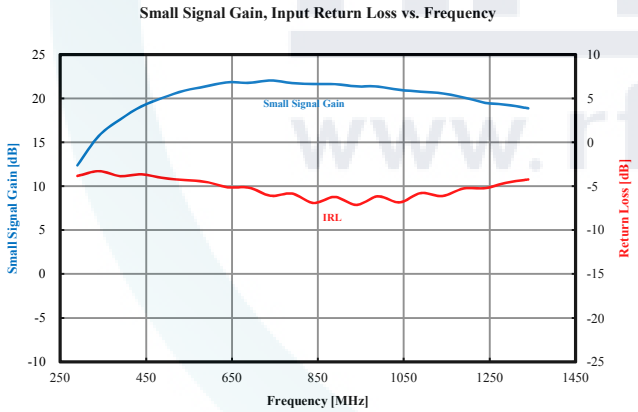
(Tc=25℃, Measured in the ETQ2014P-800MHz test board amplifier circuit)

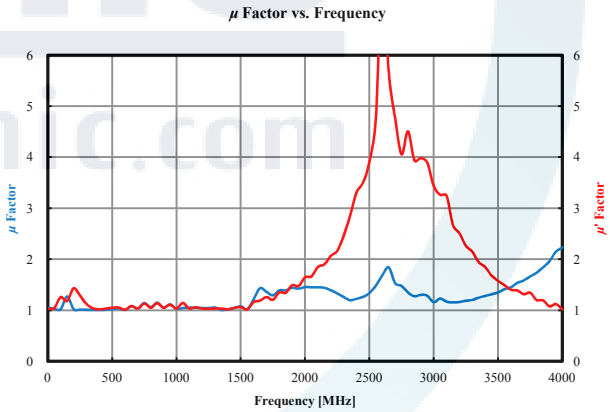


2-tone Power = 39.5dBm, V_{DS} = 48V, I_{DQ} = 50mA

Typical Small Signal Performance

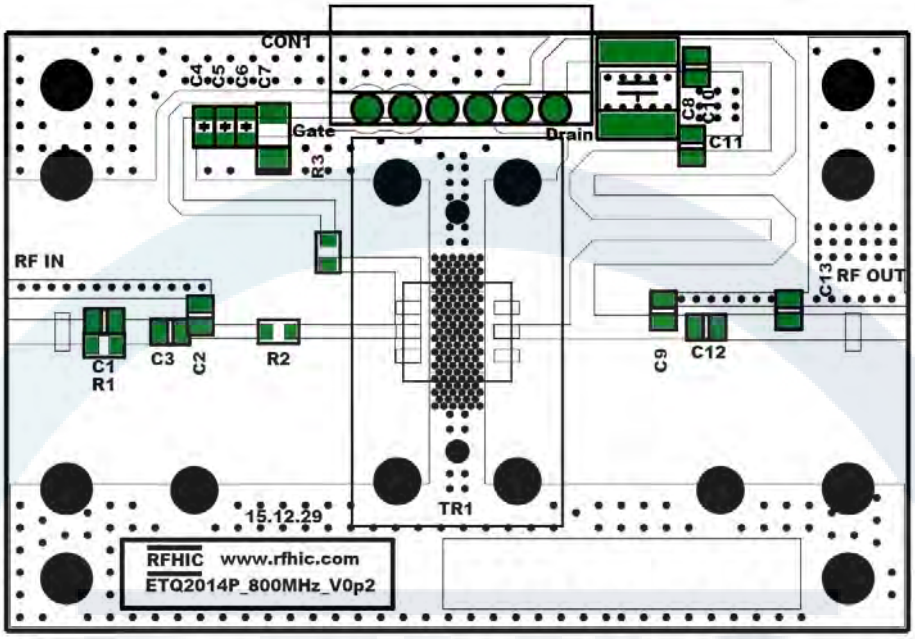
(Tc=25℃, Measured in the ETQ2014P-800MHz test board amplifier circuit)





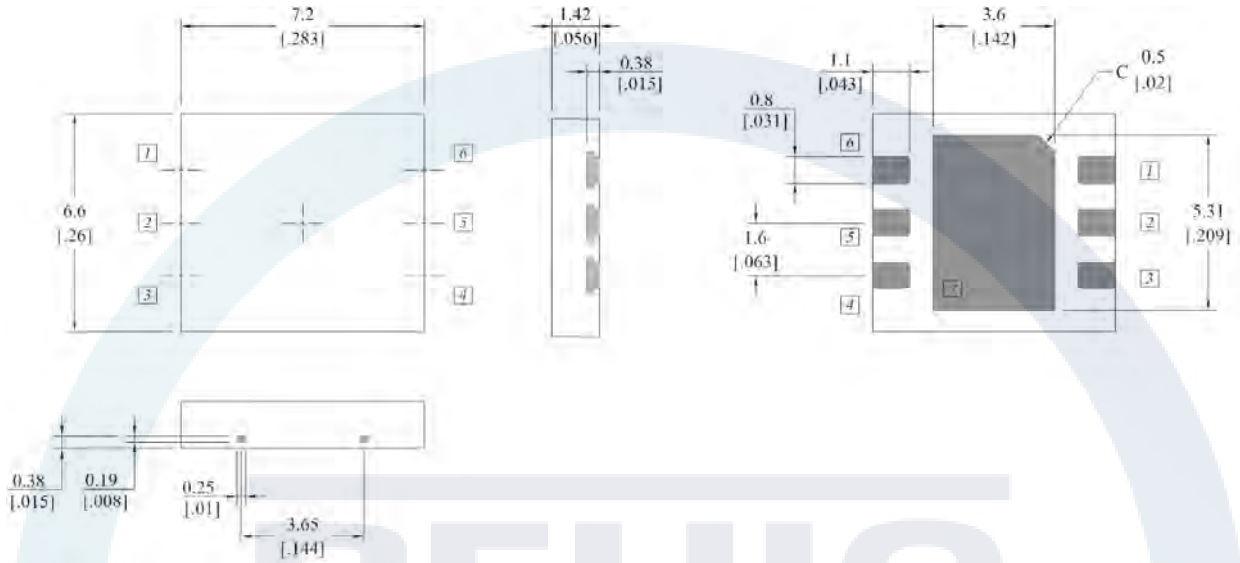
P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 50mA

Test Board Component Layout(800MHz)



Part	Description	Part Number	Manufacturer
R1	20 ohm Chip Resistor	MCR10EZPJ200	ROHM
R2	200 ohm Chip Resistor	MCR10EZPJ201	ROHM
R3	5.6 ohm Chip Resistor	MCR10EZPJ5R6	ROHM
C1	2.0pF High Q Capacitor	201CHA2R0CSLE	TEMEX
C2	1.3pF High Q Capacitor	201CHA1R3BSLE	TEMEX
C3, C10, C12	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C4	10F Chip Capacitor	GRM1885C1H100JA01D	MURATA
C5	100F Chip Capacitor	GRM1885C1H101JA01D	MURATA
C6	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C7	Polymer Capacitor	TCJA106M016R0200	AVX
C8	10uF MLCC	RS80R2A106M	MARUWA
C9, C13	-	-	-
C11	39pF High Q Capacitor	201CHA390JSLE	TEMEX
CON1	DC Connector	5268-06A	MOLEX
PCB	εr=3.66 ± 0.05, 0.030” (0.762mm)	RO4350B	ROGERS Corp.
TR1	14W GaN Transistor	ETQ2014P	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
ETQ2014P	January, 2018	1.0	Initial release of datasheet	-