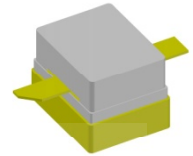


Product Features

- Up to 6GHz
- 60W Saturated Power @ 50V, 2.6GHz
- 70% Drain Efficiency @ Psat, 2.6GHz
- 35% Drain Efficiency @ 41.5dBm, 2.6GHz

Applications

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



Package Type : NS-CS01

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

Frequency [MHz]	Peak Power		Average Power ^{*1}			
	Power [W]	Drain Efficiency [%]	Power [W]	Gain [dB]	Drain Efficiency [%]	ACLR [dBc]
2505.0	80.9	75.6	14.1	16.3	35.1	-36.6
2595.0	67.3	71.5	14.1	17.0	37.5	-31.7
2685.0	65.8	69.9	14.1	16.2	38.4	-28.1

Note

*1 Measured in the DT12060P 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	$T_C=25^\circ C$
Gate to Source Voltage	V_{GS}	-10, +2	V	$T_C=25^\circ C$
Operating Voltage	V_{DD}	52	V_{DC}	-
Maximum Forward Gate Current	I_{GMAX}	15	mA	$T_C=25^\circ C$
Maximum Drain Current ^{*1}	I_{DMAX}	6	A	$T_C=25^\circ C$
Power Dissipation	P_{DISS}	33	W	$T_C=85^\circ C$
Storage Temperature	T_{STG}	-65, +150	$^\circ C$	-
Case Operating Temperature	T_C	-40, +150	$^\circ C$	-
Operating Junction Temperature ^{*2}	T_J	225	$^\circ C$	-
Soldering Temperature ^{*3}	T_S	245	$^\circ C$	-

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	$R_{\theta JC}$	4.22 ^{*1}	$^\circ C/W$	$T_C=85^\circ C$

Note

*1 Measured for the DT12060P at dissipation power of 33W.

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

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
DC Characteristics ^{*1}						
Gate Threshold Voltage	V _{DS} = 10V	V _{GS(TH)}	-3.8	-3.0	-2.3	V _{DC}
	I _D = 14.4mA					
Gate Quiescent Voltage	V _{DS} = 50V	V _{GS(Q)}	-	-2.6	-	V _{DC}
	I _D = 200mA					
Saturated Drain Current ^{*2}	V _{DS} = 6V	I _{DS}	11.6	14.0	-	A
	V _{GS} = 2V					
Drain-Source Breakdown Voltage	V _{GS} = -8V	V _{BR}	150	-	-	V
	I _D = 14.4mA					
Gate Leakage Current	V _{GS} = -8V	I _{GLKG}	-3.2	-	-	mA
	V _{DS} = 120V					
Drain Leakage Current	V _{GS} = -8V	I _{DLKG}	-	-	5.8	mA
	V _{DS} = 120V					
RF Characteristics (Fc=2595MHz unless otherwise noted)						
Saturated Output Power ^{*3,6}	V _{DS} = 50V	P _{SAT}	-	60.0	-	W
	I _{DQ} = 200mA					
Pulsed Drain Efficiency ^{*3}	V _{DS} = 50V	η	65	70	-	%
	I _{DQ} = 200mA					
	P _{OUT} = P _{SAT} Pulsed					
Modulated Gain ^{*4}	V _{DS} = 50V	G _{BR}	16.0	17.0	-	dB
	I _{DQ} = 200mA					
	P _{OUT} = 41.5dBm					
LTE Linearity ^{*4}	V _{DS} = 50V	ACLR	-	-30.0	-25.0	dBc
	I _{DQ} = 200mA					
	P _{OUT} = 41.5dBm					
Modulated Drain Efficiency ^{*4}	V _{DS} = 50V	η	30.0	35.0	-	%
	I _{DQ} = 200mA					
	P _{OUT} = 41.5dBm					
Output Mismatch Stress ^{*3,5}	V _{DS} = 50V	VSWR	-	-	10:1	ψ
	I _{DQ} = 200mA					
	P _{OUT} = P _{SAT} Pulsed					

Note

*1 Measured on wafer prior to packaging.

*2 Scaled from PCM data.

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

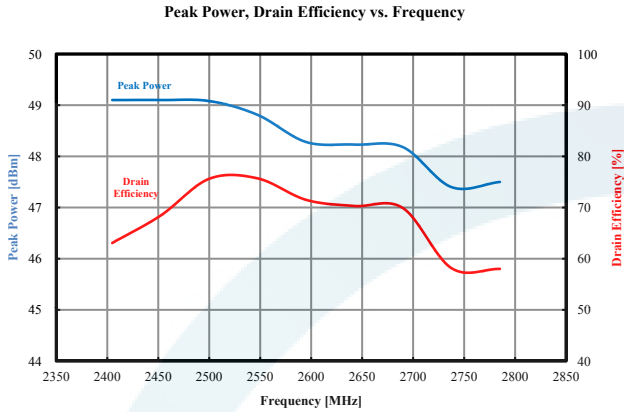
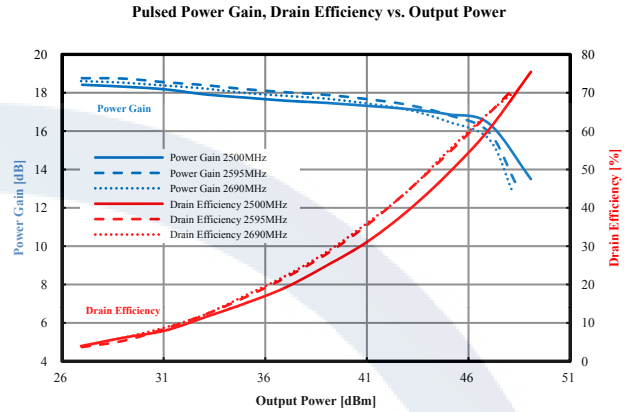
*4 Measured in the DT12060P test board amplifier circuit, under LTE 10MHz, PAR7.5dB @0.01% probability on CCDF.

*5 Measured in the DT12060P 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.

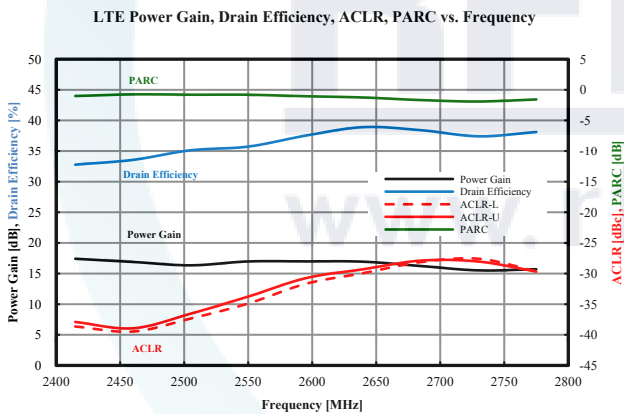
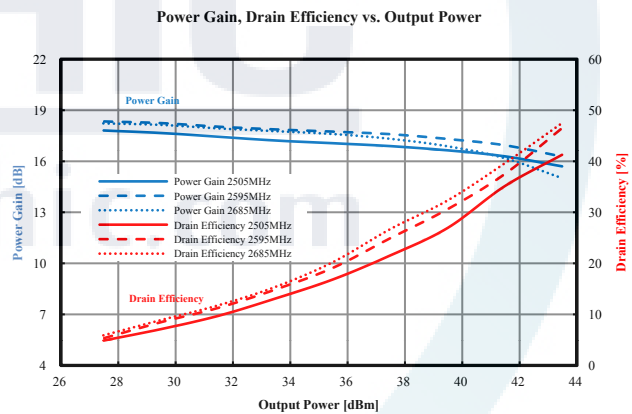
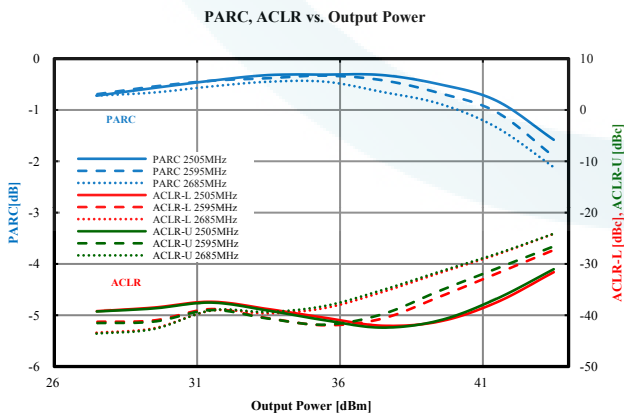
Typical Pulsed Signal Performance

(Tc=25 °C, Measured in the DT12060P-2600MHz test board amplifier circuit)


 $V_{DS} = 50V$, $I_{DQ} = 200mA$, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance

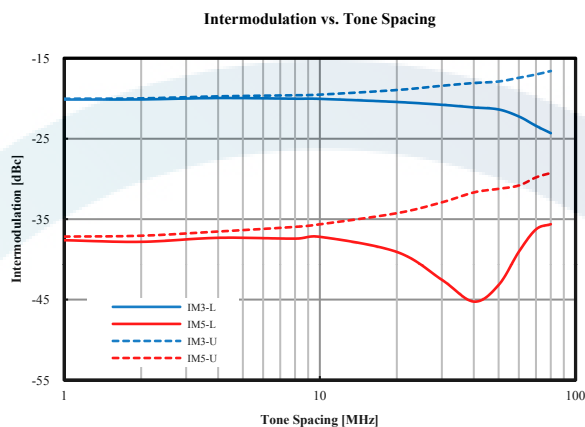
(Tc=25 °C, Measured in the DT12060P-2600MHz test board amplifier circuit)


 $P_{AVG} = 41.5dBm$, $V_{DS} = 50V$, $I_{DQ} = 200mA$

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

Typical 2-tone Intermodulation Imbalance Performance

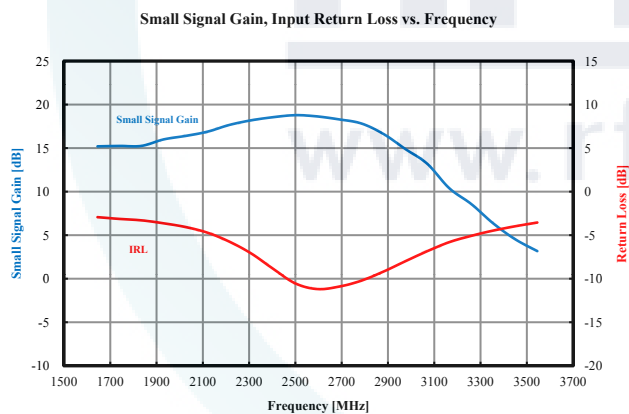
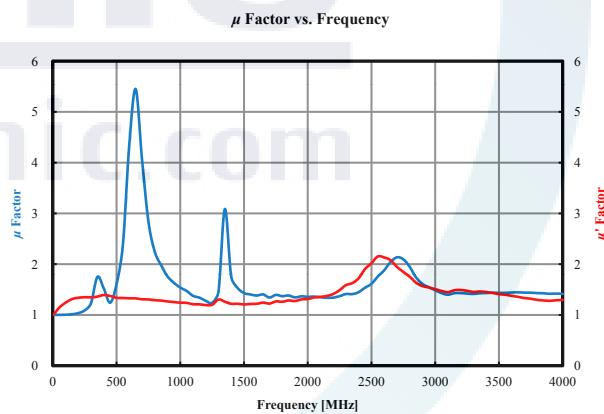
($T_c=25^\circ\text{C}$, Measured in the DT12060P-2600MHz test board amplifier circuit)



2-tone Power = 45.8dBm, $V_{DS} = 50\text{V}$, $I_{DQ} = 200\text{mA}$

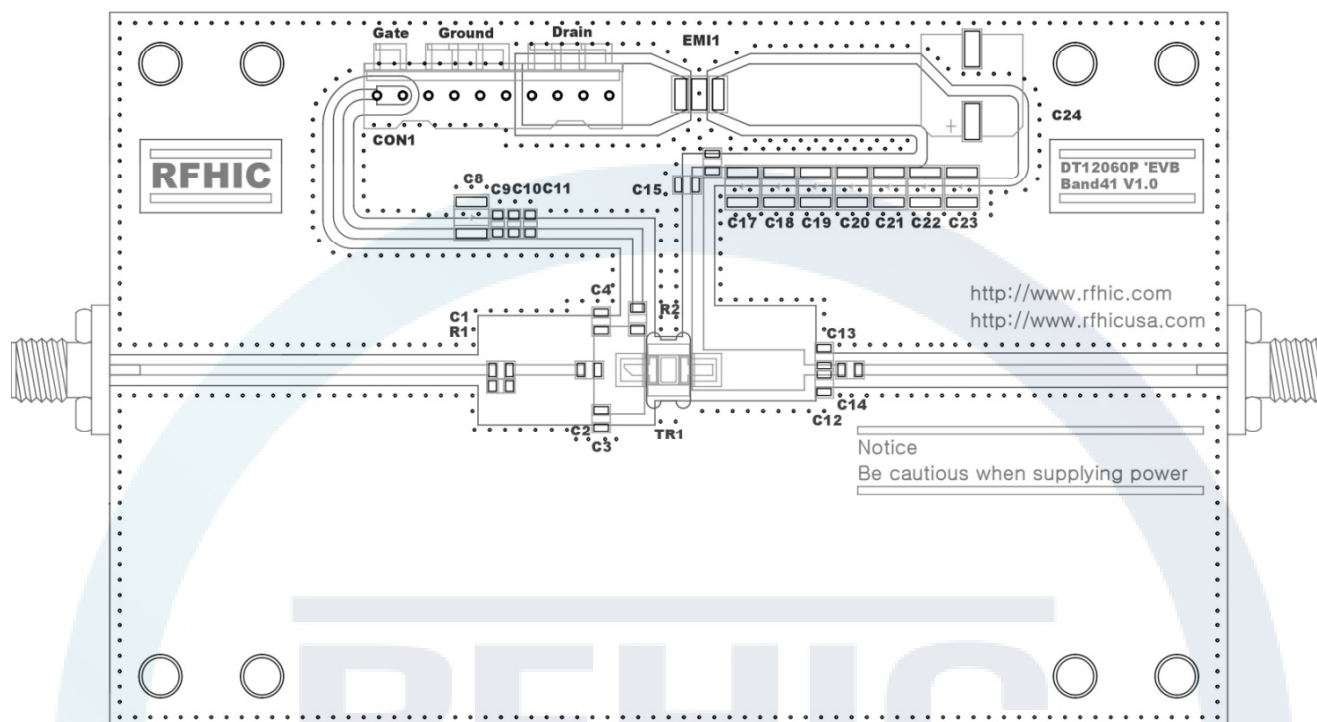
Typical Small Signal Performance

($T_c=25^\circ\text{C}$, Measured in the DT12060P-2600MHz test board amplifier circuit)



$P_{IN} = 0\text{dBm}$, $V_{DS} = 50\text{V}$, $I_{DQ} = 200\text{mA}$

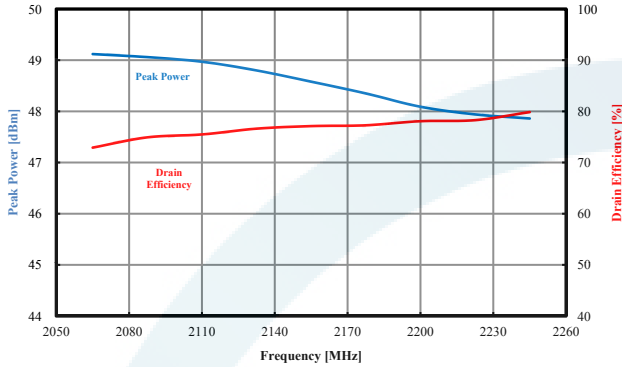
Test Board Component Layout(2600MHz)



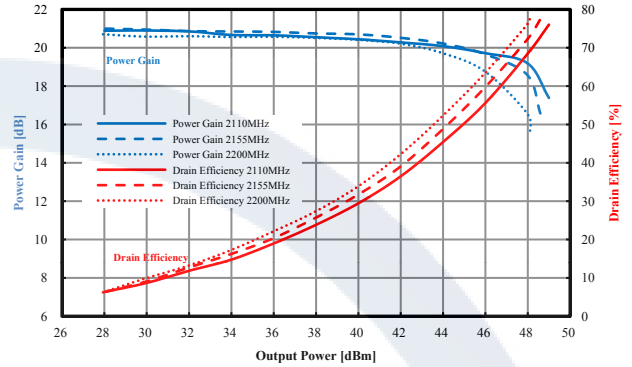
Part	Description	Part Number	Manufacturer
R1	100 ohm Chip Resistor	MCR03EZPJ101	ROHM
R2	51 ohm Chip Resistor	MCR10EZJH510	ROHM
C1	5.6pF High Q Capacitor	201CHA5R6CSLE	TEMEX
C2, C14, C15	10pF High Q Capacitor	201CHA100JSLE	TEMEX
C3, C13	0.5pF High Q Capacitor	201CHA0R5BSLE	TEMEX
C4	1.0pF High Q Capacitor	201CHA1R0BSLE	TEMEX
C8	Polymer Capacitor	TCJB476M010R0070	AVX
C9	100nF Chip Capacitor	GRM188R71H104KA01D	MURATA
C10	10nF Chip Capacitor	GRM188R71H103KA01D	MURATA
C11	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C12	0.8pF Chip Capacitor	201CHA0R8BSLE	TEMEX
C16	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C17, C18, C19	2.2uF MLCC	GRM32ER72A225KA35L	MURATA
C24	33uF Aluminum Capacitor	BDS100VC33MJ10TP	SAMYOUNG
EMI1	1000pF EMI Filter	CTH32R102S20A	MARUWA
CON1	DC Connector	LW0640-10	HANLIM
PCB	$\epsilon_r=3.48 \pm 0.05$, 0.020" (0.508mm)	RO4350B (70X110mm)	ROGERS Corp.
TR	60W GaN Transistor	DT12060P	RFHIC

Typical Pulsed Signal Performance (Tc=25 °C, Measured in the DT12060P-2100MHz test board amplifier circuit)

Peak Power, Drain Efficiency vs. Frequency



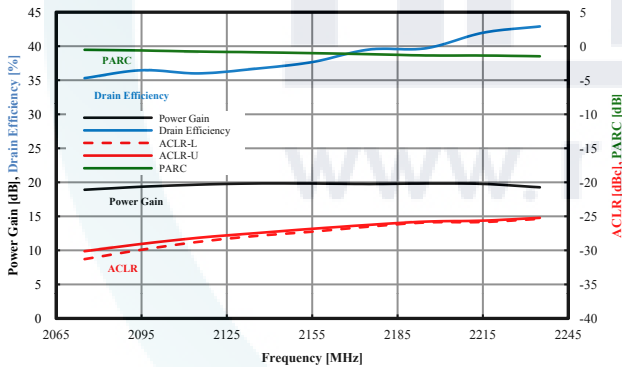
Pulsed Power Gain, Drain Efficiency vs. Output Power



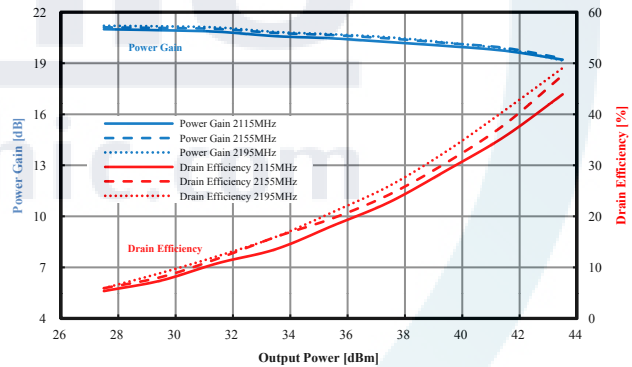
$V_{DS} = 50V$, $I_{DQ} = 200mA$, Pulse Width = 100μsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25 °C, Measured in the DT12060P-2100MHz test board amplifier circuit)

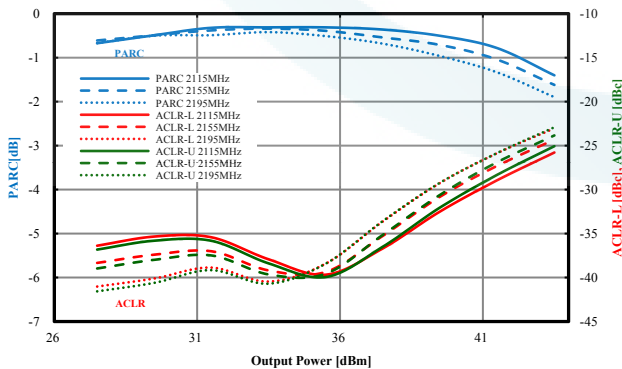
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

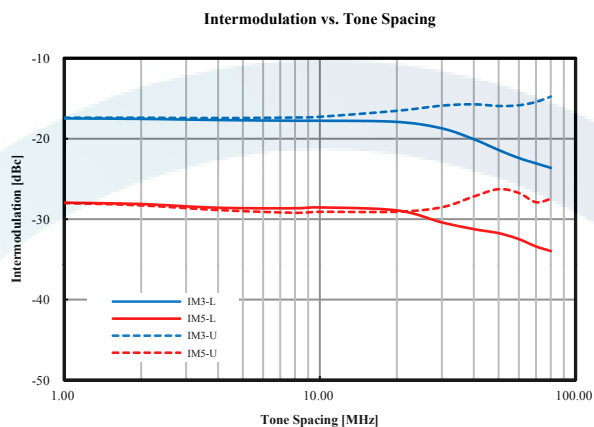


$P_{AVG} = 41.5dBm$, $V_{DS} = 50V$, $I_{DQ} = 200mA$

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

Typical 2-tone Intermodulation Imbalance Performance

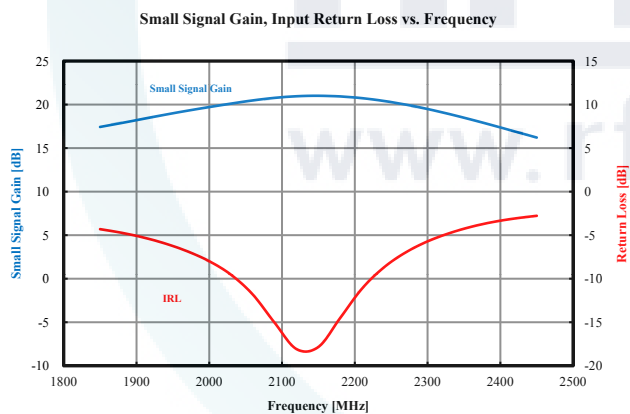
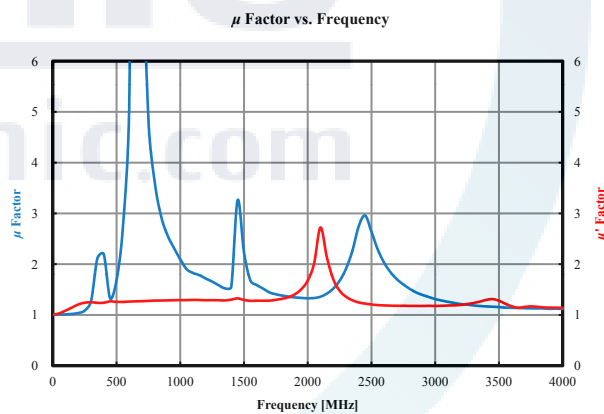
(Tc=25°C, Measured in the DT12060P-2100MHz test board amplifier circuit)



2-tone Power = 45.8dBm, $V_{DS} = 50V$, $I_{DQ} = 200mA$

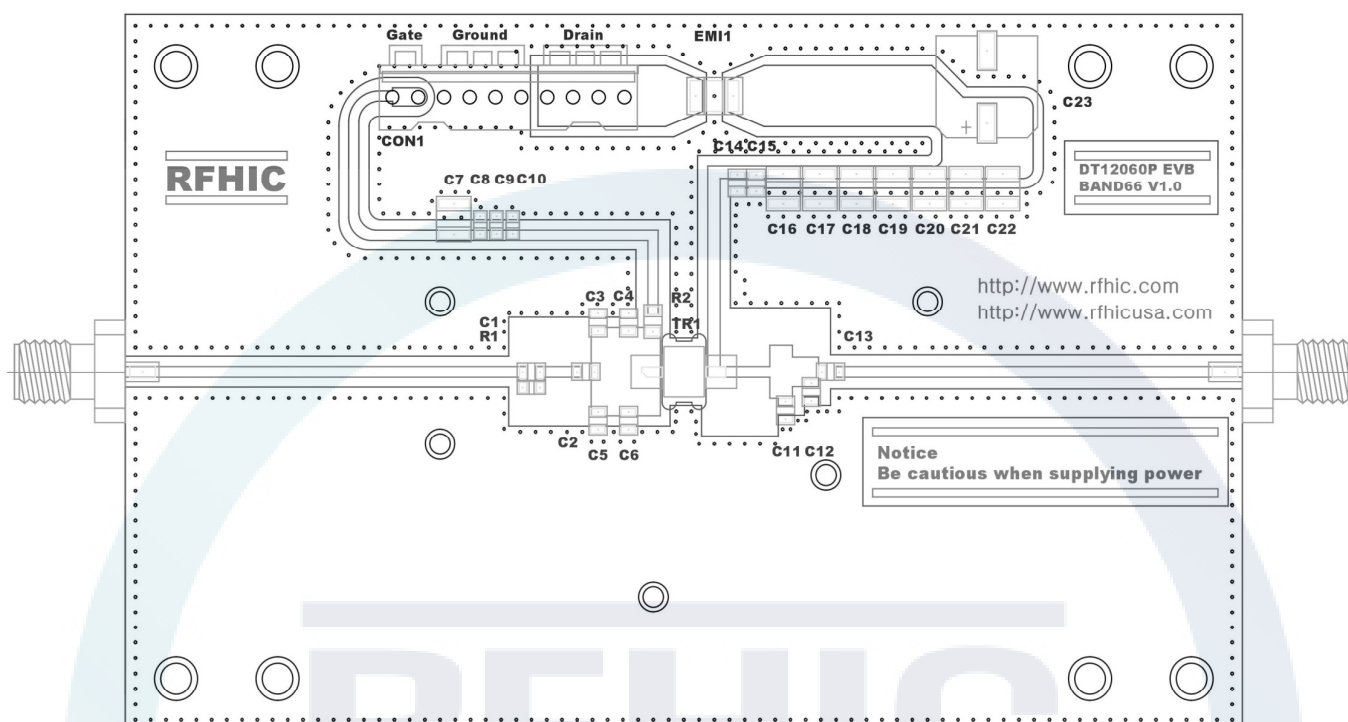
Typical Small Signal Performance

(Tc=25°C, Measured in the DT12060P-2100MHz test board amplifier circuit)



$P_{IN} = 0dBm$, $V_{DS} = 50V$, $I_{DQ} = 200mA$

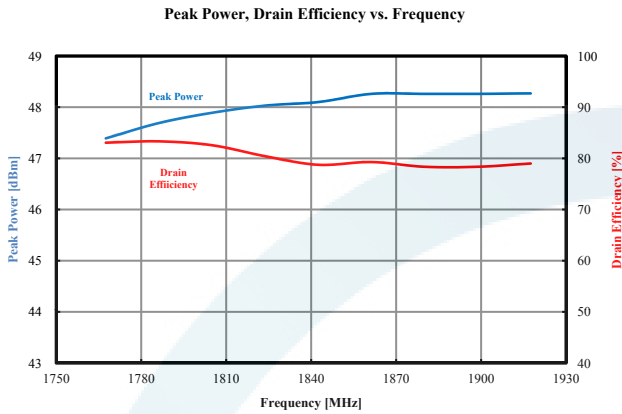
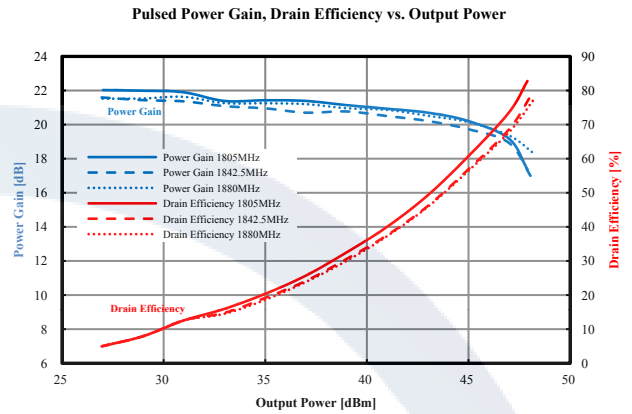
Test Board Component Layout(2100MHz)



Part	Description	Part Number	Manufacturer
R1	100 ohm Chip Resistor	MCR03EZPJ101	ROHM
R2	10 ohm Chip Resistor	MCR10EZJH100	ROHM
C1, C2	3.9pF High Q Capacitor	201CHA3R9CSLE	TEMEX
C13, C14	10pF High Q Capacitor	201CHA100JSLE	TEMEX
C3, C5	1.5pF Chip Capacitor	201CHA1R5BSLE	TEMEX
C7	Polymer Capacitor	TCJB476M010R0070	AVX
C8	100nF Chip Capacitor	GRM188R71H104KA01D	MURATA
C9	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C10	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C11	1pF High Q Capacitor	201CHA1R0BSLE	TEMEX
C12	0.3pF High Q Capacitor	201CHA0R3BSLE	TEMEX
C15	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C16 ~ C22	2.2uF MLCC	GRM32ER72A225KA35L	MURATA
C23	33uF Aluminum Capacitor	BDS100VC33MJ10TP	SAMYOUNG
EMI1	1000pF EMI Filter	CTH32R102S20A	MARUWA
CON1	DC Connector	LW0640-10	HANLIM
PCB	$\epsilon_r=3.48 \pm 0.05$, 0.020" (0.508mm)	RO4350B (70X110mm)	ROGERS Corp.
TR	60W GaN Transistor	DT12060P	RFHIC

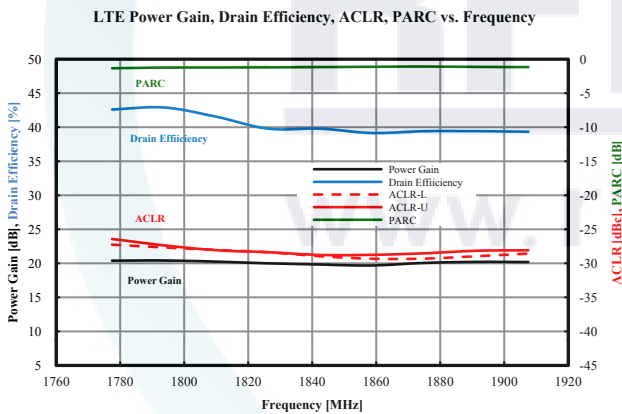
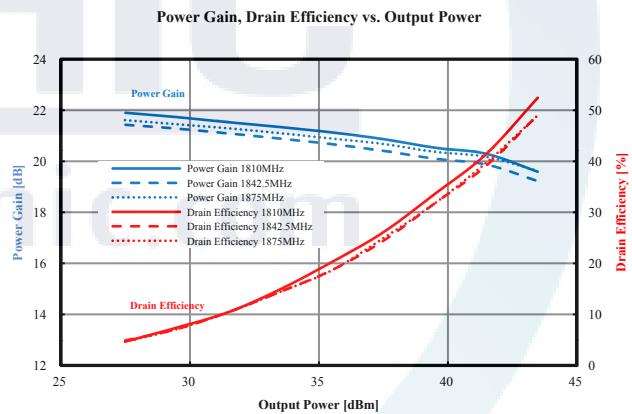
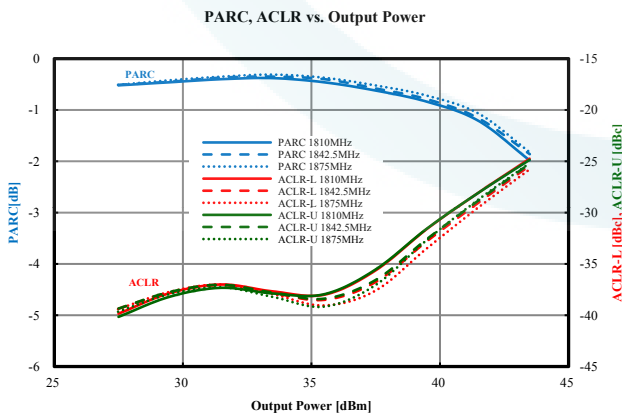
Typical Pulsed Signal Performance

(Tc=25 °C, Measured in the DT12060P-1800MHz test board amplifier circuit)


 $V_{DS} = 50V, \quad I_{DQ} = 200mA, \text{ Pulse Width} = 100\mu s, \text{ Duty Cycle} = 10\%$

Typical LTE Signal Performance

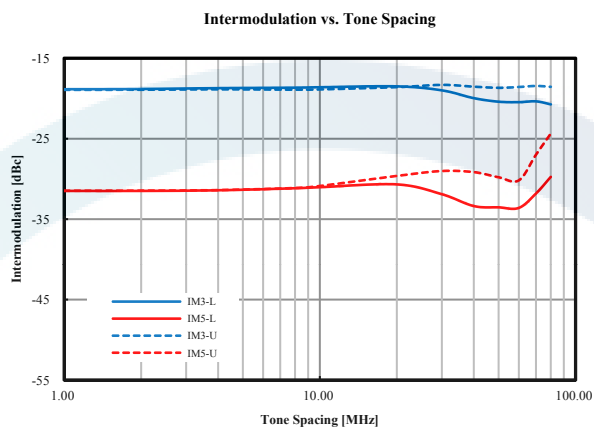
(Tc=25 °C, Measured in the DT12060P-1800MHz test board amplifier circuit)


 $P_{AVG} = 41.5dBm, \quad V_{DS} = 50V, \quad I_{DQ} = 200mA$

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

Typical 2-tone Intermodulation Imbalance Performance

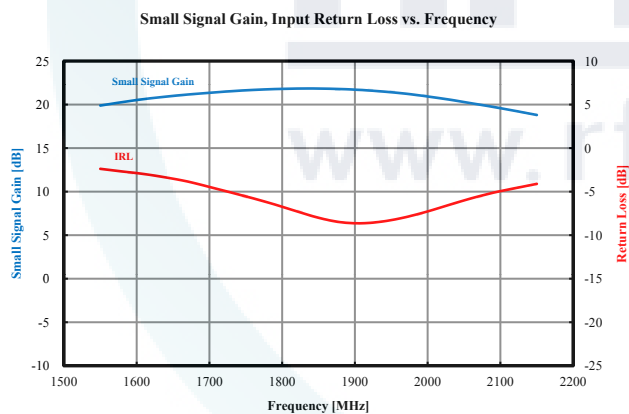
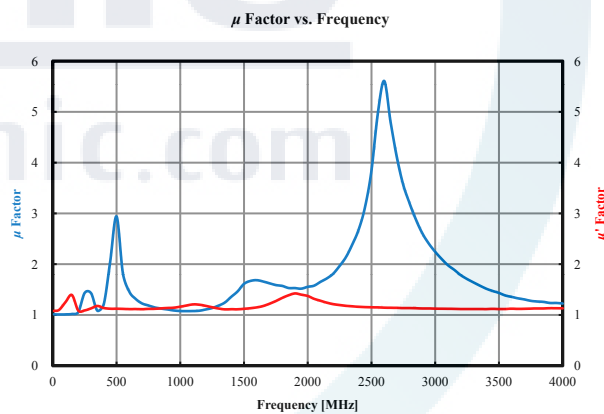
(Tc=25°C, Measured in the DT12060P-1800MHz test board amplifier circuit)



2-tone Power = 45.8dBm, $V_{DS} = 50V$, $I_{DQ} = 200mA$

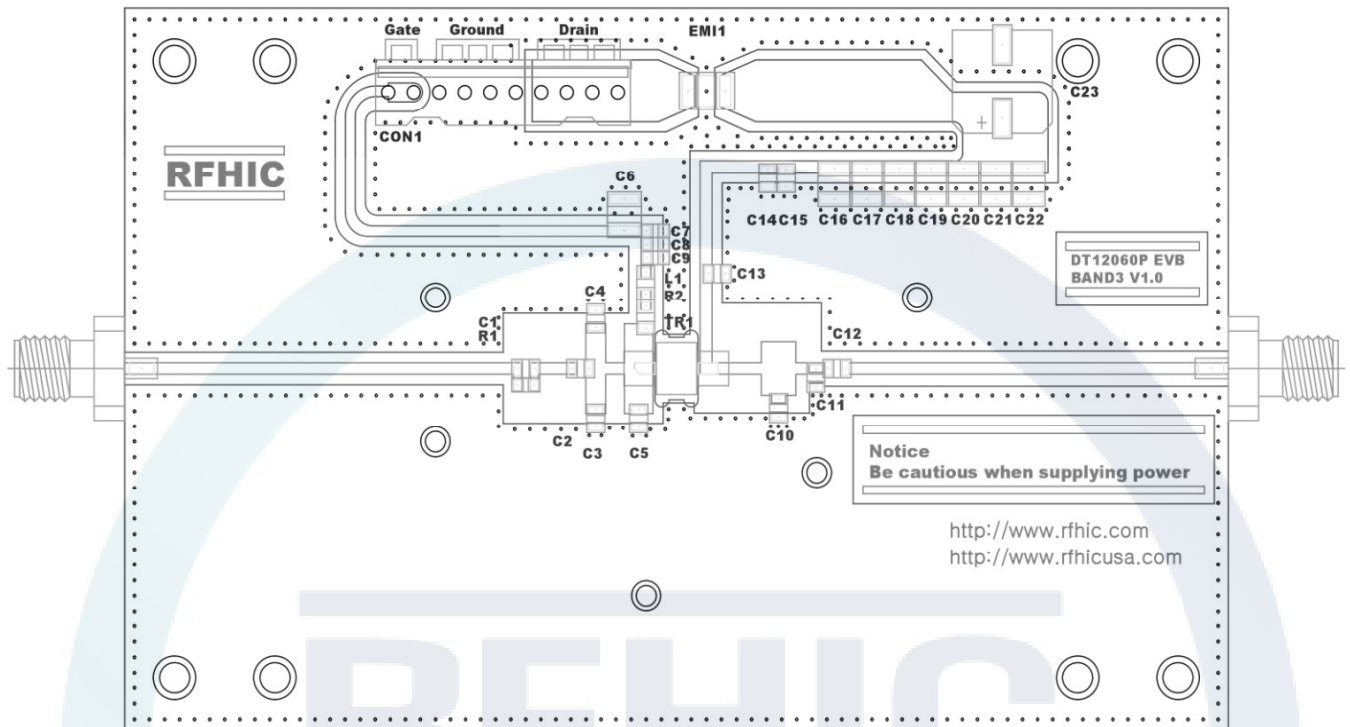
Typical Small Signal Performance

(Tc=25°C, Measured in the DT12060P-1800MHz test board amplifier circuit)



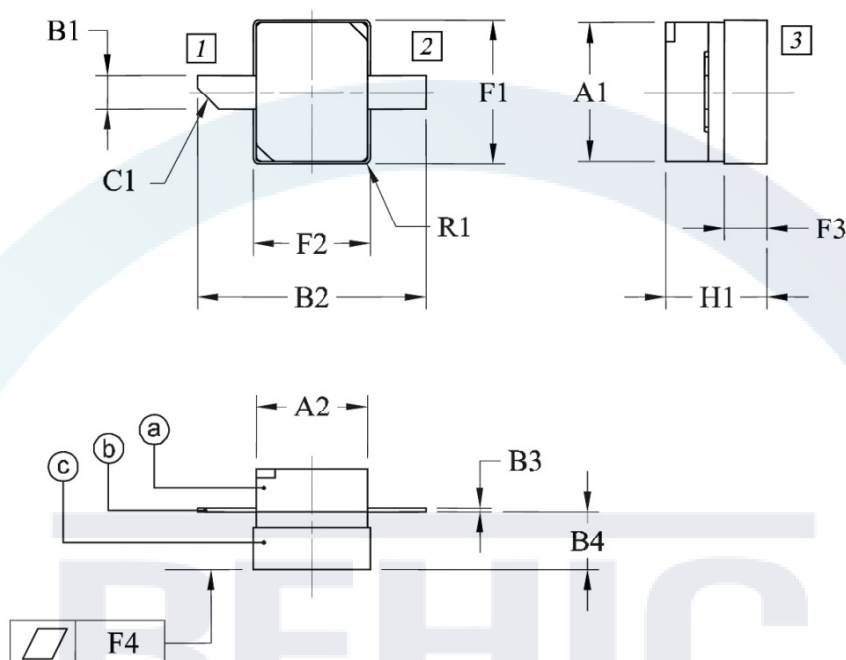
$P_{IN} = 0dBm$, $V_{DS} = 50V$, $I_{DQ} = 200mA$

Test Board Component Layout(1800MHz)



Part	Description	Part Number	Manufacturer
R1	100 ohm Chip Resistor	MCR03EZPJ101	ROHM
R2	51 ohm Chip Resistor	MCR10EZJH510	ROHM
C1, C2, C12 ~ C14	10pF High Q Capacitor	201CHA100JSLE	TEMEX
C3, C4	1.2pF High Q Capacitor	201CHA1R2BSLE	TEMEX
C6	Polymer Capacitor	TCJB476M010R0070	AVX
C7	100nF Chip Capacitor	GRM188R71H104KA01D	MURATA
C8	1nF Chip Capacitor	GRM188R71H102KA01D	MURATA
C9	10pF Chip Capacitor	GRM1885C1H100JA01D	MURATA
C10	0.5pF Chip Capacitor	201CHA0R5BSLE	TEMEX
C15	100pF High Q Capacitor	201CHA101JSLE	TEMEX
C16 ~ C22	2.2uF MLCC	GRM32ER72A225KA35L	MURATA
C23	33uF Aluminum Capacitor	BDS100VC33MJ10TP	SAMYOUNG
L1	27nH Wire Wound Inductor	0805CS-270XJLC	COILCRAFT
EMI1	1000pF EMI Filter	CTH32R102S20A	MARUWA
CON1	DC Connector	LW0640-10	HANLIM
PCB	$\epsilon_r=3.48 \pm 0.05$, 0.020" (0.508mm)	RO4350B (70X110mm)	ROGERS Corp.
TR	60W GaN Transistor	DT12060P	RFHIC

Package Dimensions (Type: NS-CS01)



Pin Description	
Pin No	Function
1	Gate
2	Drain
3	Source

- (a) - Lid
 (b) - Lead Frame
 (c) - Flange

Dim.	INCH			MILLIMETER		
	MIN	TYP	MAX	MIN	TYP	MAX
A1	.188	.193	.198	4.78	4.90	5.03
A2	.149	.154	.158	3.78	3.90	4.03
B1	.042	.047	.052	1.07	1.20	1.33
B2	.295	.315	.335	7.50	8.00	8.50
B3	.003	.005	.007	0.08	0.13	0.18
B4	.076	.081	.086	1.93	2.05	2.18
C1 (Chamfer)	.025	.030	.034	0.63	0.75	0.88
F1	.196	.201	.206	4.97	5.10	5.23
F2	.156	.161	.167	3.97	4.10	4.23
F3	.054	.059	.064	1.37	1.50	1.63
F4	-	.001	-	-	0.03	-
H1	.122	.144	.165	3.10	3.65	4.20
L1	-	-	-	-	-	-
L2	-	-	-	-	-	-
R1 (Radius)	.004	.008	.012	0.10	0.20	0.30

Revision History

Part Number	Release Date	Version	Description	Data Sheet Status
DT12060P	August, 2017	1.0	Initial release of datasheet	-



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