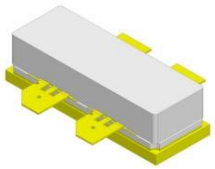
GaN Power Transistors ID20275WD

Product Features

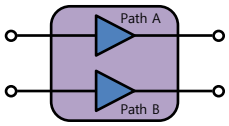
- 1880~2025MHz
- 282W Saturated Power @ 48V
- 53% Drain Efficiency @ 46.8dBm
- Internally Matched
- Asymmetrical Doherty GaN HEMT

Applications

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



Package Type : RF18010DKR3



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

Frequency [MHz]	Peak Power	Average Power*1			
	Power [W]	Power [W]	Gain [dB]	Drain Efficiency [%]	ACLR [dBc]
1885.0	342.8	48	15.2	54.6	-23.7
1952.5	302.7	48	15.3	52.6	-24.9
2020.0	285.8	48	14.8	50.3	-26.2

Note

*1 Measured in the ID20275WD Doherty 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}	
Storage Temperature	T_{STG}	-65, +150	℃	
Case Operating Temperature	T_C	-40, +150	℃	
Operating Junction Temperature*1	T_J	225	℃	
Soldering Temperature*2	T_S	245	℃	

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	$R_{\theta JC}$	2.14 *1	℃/W	Tc=85℃

Note

*1 Measured for the ID20275WD at dissipation power is 65W.

Electrical Characteristics (T_C=25℃ unless otherwise noted)

Characteristics	Conditions	Symbol	Min	Typ	Max	Unit
DC Characteristics - Path A (Carrier)[*1]						
Maximum Forward Gate Current	**Tc= 25℃**	I_{GMAX}	-	-	16	mA
Maximum Drain Current[*2]	**Tc= 25℃**	I_{DMAX}	-	-	6.0	A
Power Dissipation	**Tc= 85℃**	P_{DMAX}	-	-	65	W
Gate Threshold Voltage	**V_{DS} = 10V** **I_D = 14.4mA**	$V_{GS(TH)}$	-3.75	-3.00	-2.25	V_{DC}
Gate Quiescent Voltage	**V_{DS} = 48V** **I_D = 200mA**	$V_{GS(Q)}$	-	-2.85	-	V_{DC}
Drain-Source Breakdown Voltage	**V_{GS} = -8V** **I_D = 14.4mA**	V_{BR}	150	-	-	V
Saturated Drain Current[*3]	**V_{DS} = 6V** **V_{GS} = 2V**	I_{DS}	12.0	14.4	-	A
Gate Leakage Current	**V_{GS} = -8V** **V_{DS} = 150V**	$I_{GLKG150}$	-3.3	-	-	mA
Drain Leakage Current	**V_{GS} = -8V** **V_{DS} = 150V**	$I_{DLKG150}$	-	-	5.8	mA
DC Characteristics - Path B (Peaking)[*1]						
Maximum Forward Gate Current	**Tc= 25℃**	I_{GMAX}	-	-	24	mA
Maximum Drain Current[*2]	**Tc= 25℃**	I_{DMAX}	-	-	9.0	A
Power Dissipation	**Tc= 85℃**	P_{DMAX}	-	-	80.0	W
Gate Threshold Voltage	**V_{DS} = 10V** **I_D = 21.6mA**	$V_{GS(TH)}$	-3.75	-3.00	-2.25	V_{DC}
Gate Quiescent Voltage	**V_{DS} = 48V** **I_D = 750mA**	$V_{GS(Q)}$	-	-2.700	-	V_{DC}
Drain-Source Breakdown Voltage	**V_{GS} = -8V** **I_D = 21.6mA**	V_{BR}	150	-	-	V
Saturated Drain Current[*3]	**V_{DS} = 6V** **V_{GS} = 2V**	I_{DS}	18.0	21.6	-	A
Gate Leakage Current	**V_{GS} = -8V** **V_{DS} = 150V**	$I_{GLKG150}$	-4.5	-	-	mA
Drain Leakage Current	**V_{GS} = -8V** **V_{DS} = 150V**	$I_{DLKG150}$	-	-	5.8	mA

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=1952.5MHz unless otherwise noted)						
Saturated Output Power *1,4	**V_{DS} = 48V**	P_{SAT}	200	282	-	W
	I_{DQ} = 200mA					
Modulated Gain *2	**V_{DS} = 48V**	G_{BR}	11.5	12.5	-	dB
	I_{DQ} = 200mA					
	P_{OUT} = 46.8dBm					
LTE Linearity *2	**V_{DS} = 48V**	ACLR	-	-21.5	-18.5	dBc
	I_{DQ} = 200mA					
	P_{OUT} = 46.8dBm					
Modulated Drain Efficiency *2	**V_{DS} = 48V**	η	43	53	-	%
	I_{DQ} = 200mA					
	P_{OUT} = 46.8dBm					
Output Mismatch Stress *1, 3	**V_{DS} = 48V**	VSWR	-	-	10:1	ψ
	I_{DQ} = 200mA					
	P_{OUT} = P_{SAT} Pulsed					

Note

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

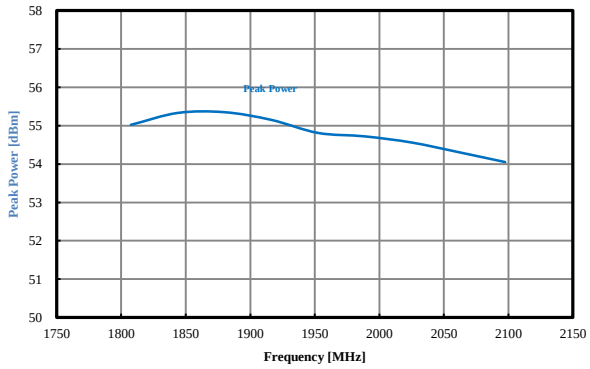
*2 Measured in the ID20275WD Doherty test board amplifier circuit, under LTE 10MHz, PAR7.5dB @0.01% probability on CCDF.

*3 Measured in the ID20275WD Doherty test board amplifier circuit. No damage at all phase angles.

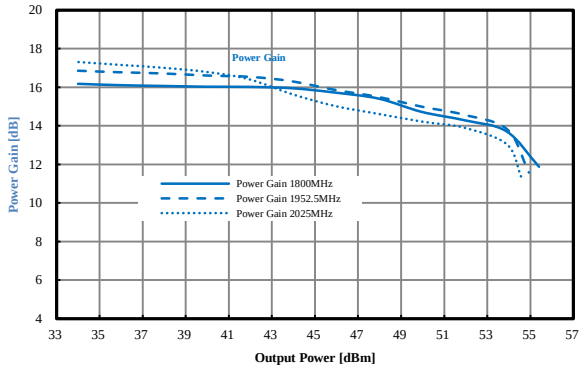
*4 Psat is defined as ΔPout/ΔPin<0.1, where ΔPin is increased input power, ΔPout is increased output power.

Typical Pulsed Signal Performance (Tc=25℃, Measured in the ID20275WD test board amplifier circuit)

Peak Power vs. Frequency



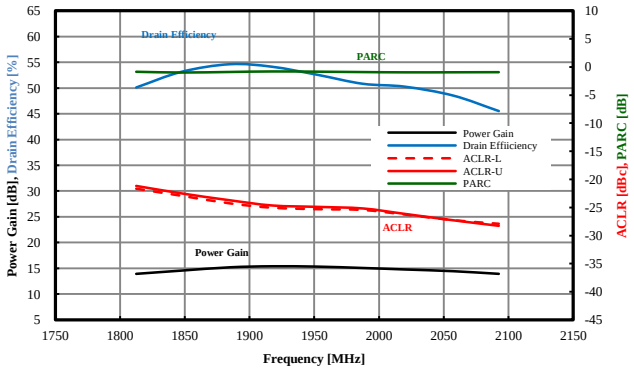
Pulsed Power Gain vs. Output Power



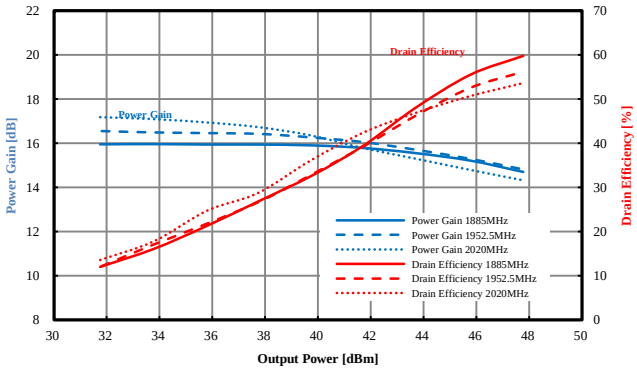
V_{DS} = 48V, $I_{DQ(C)}$ = 200mA, $V_{GS(P)}$= -5.7V, Pulse Width = 100µsec, Duty Cycle = 10%

Typical LTE Signal Performance (Tc=25℃, Measured in the ID20275WD test board amplifier circuit)

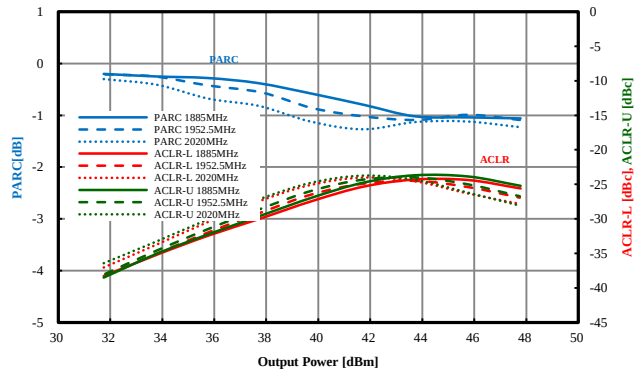
LTE Power Gain, Drain Efficiency, ACLR, PARC vs. Frequency



Power Gain, Drain Efficiency vs. Output Power



PARC, ACLR vs. Output Power

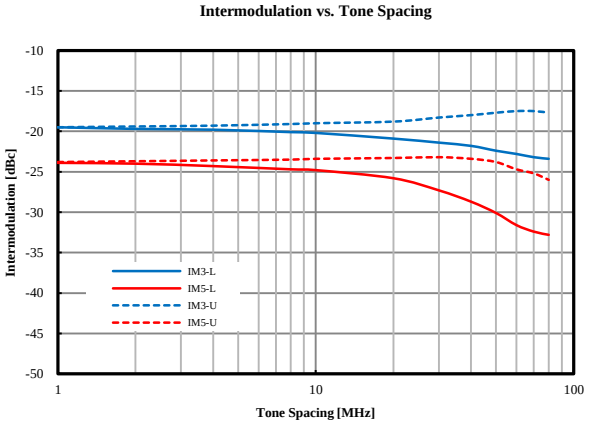


P_{AVG} = 46.8dBm, V_{DS} = 48V, $I_{DQ(C)}$ = 200mA, $V_{GS(P)}$ = -5.7V

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

Typical 2-tone Intermodulation Imbalance Performance

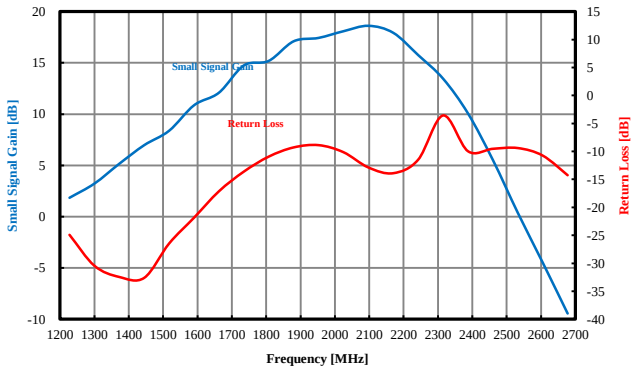
(Tc=25°C, Measured in the ID20275WD Doherty test board amplifier circuit)

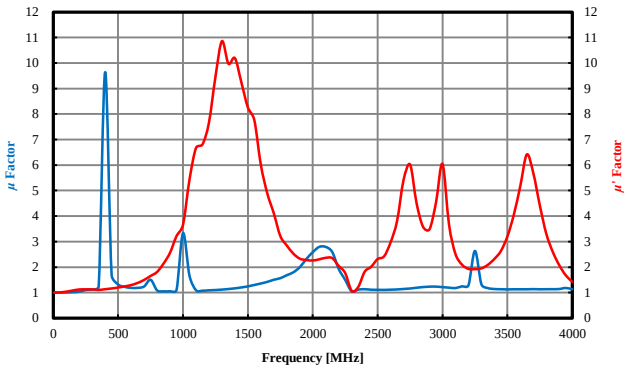


2-tone Power = 46.8dBm, V_{DS} = 48V, $I_{DQ(C)}$ = 200mA, $V_{GS(P)}$ = -5.7V

Typical Small Signal Performance

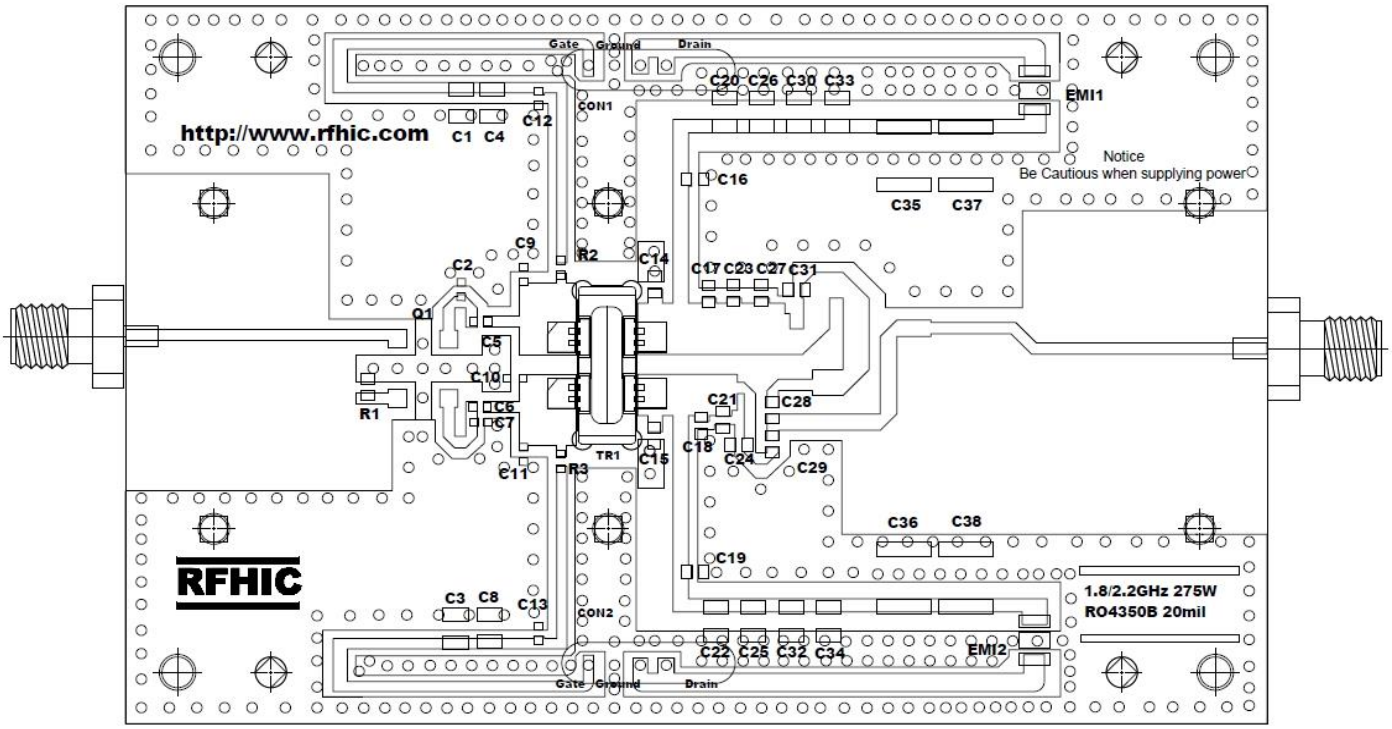
(Tc=25°C, Measured in the ID20275WD Doherty test board amplifier circuit)





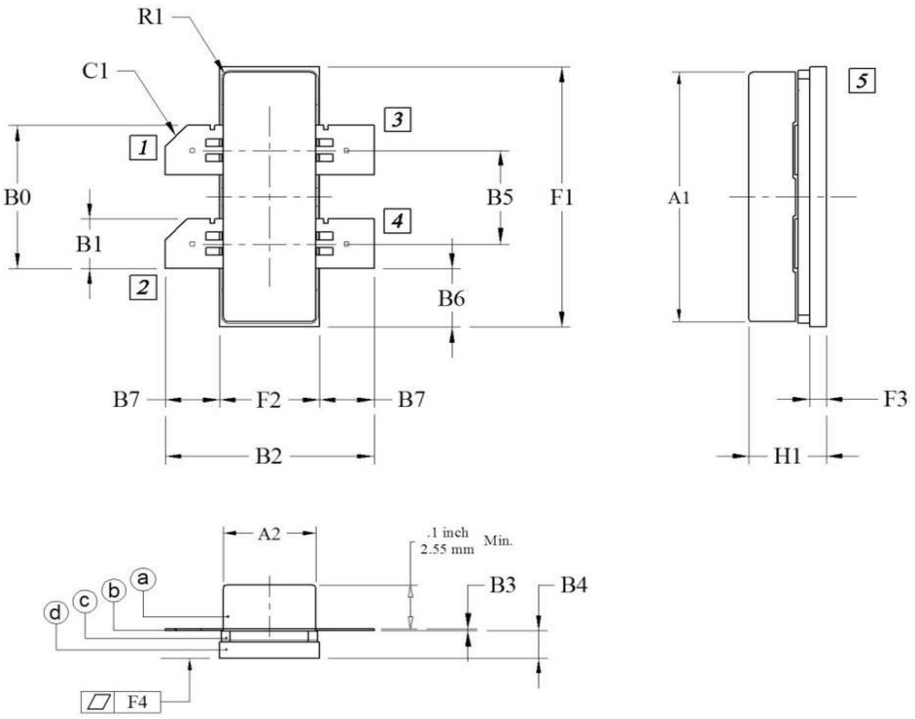
P_{IN} = 0dBm, V_{DS} = 48V, I_{DQ} = 200mA, $V_{GS(P)}$ = -5.7V

Test Board Component Layout



Part	Description	Part Number	Manufacturer
Q1	1.9GHz Hybrid Coupler	CMX19Q03	RN2
R1	50 ohm Term	S1020A	RN2
R2, R3	10 ohm Chip Resistor	MCR10EZHJ100	ROHM
C1, C3, C4, C8, C20, C22, C25, C26, C30, C32, C33, C34	2.2uF Chip Capacitor	GRM32ER72A225KA,3225,100V	MURATA
C2	1pF High Q Capacitor	UQCSVA1R0BATME. 1608. 250V	AVX
C5, C6	5.6pF High Q Capacitor	UQCSVA5R6CATME. 1608. 250V	AVX
C7	1.2pF High Q Capacitor	UQCSVA1R2CATME. 1608. 250V	AVX
C9, C11	2.2pF High Q Capacitor	UQCSVA2R2CATME. 1608. 250V	AVX
C10	0.3pF High Q Capacitor	UQCSVA0R3BATME. 1608. 250V	AVX
C12, C13	15pF High Q Capacitor	UQCSVA150JATME. 1608. 250V	AVX
C14, C21	1.5pF High Q Capacitor	UQCFVA1R5CATME. 2012. 250V	AVX
C15	1.8pF High Q Capacitor	UQCFVA1R8CATME. 2012. 250V	AVX
C16, C19, C28, C29	15pF High Q Capacitor	UQCFVA150JATME. 2012. 250V	AVX
C17	3.3pF High Q Capacitor	UQCFVA3R3CATME. 2012. 250V	AVX
C18, C23	2.7pF High Q Capacitor	UQCFVA2R7CATME. 2012. 250V	AVX
C24	0.8pF High Q Capacitor	UQCFVA0R8BATME. 2012. 250V	AVX
C27	0.5pF High Q Capacitor	UQCFVA0R5BATME. 2012. 250V	AVX
C31	1.2pF High Q Capacitor	UQCFVA1R2CATME. 2012. 250V	AVX
C35, C36, C37, C38	22uF MLCC	RS80R2A226M, 5750, 100V	MARUWA
EMI1, EMI2	EMI FILTER	CTH32R102S20A-TM	MARUWA
CON1, CON2	DC Connector, 4 Pin	5267-04A	MOLEX
PCB	εr=3.66 ± 0.05, 0.020” (0.508mm)	RO4350B	ROGERS Corp.
TR1	275W GaN Transistor	ID20275WD	RFHIC

Package Dimensions (Type:RF18010DKR3)

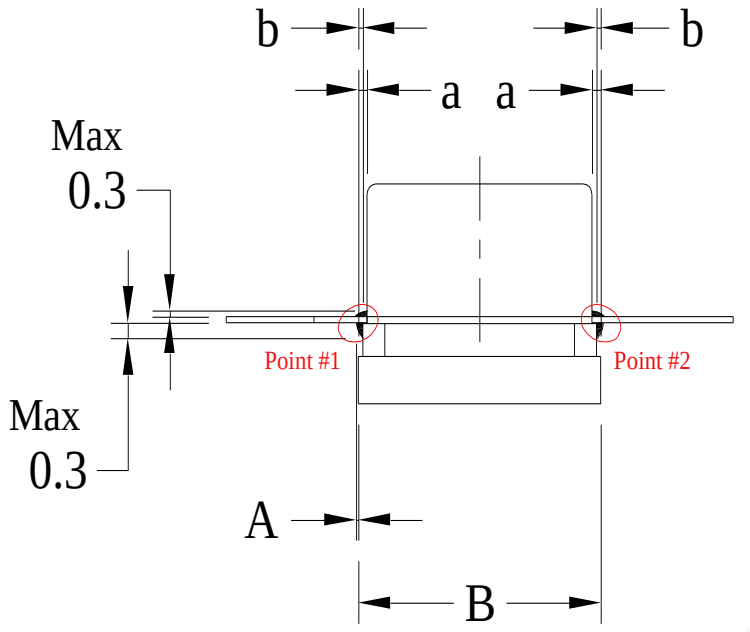


Pin Description	
Pin No	Function
1	Path A Gate
2	Path B Gate
3	Path A Drain
4	Path B Drain
5	Source

ⓐ- Lid
ⓑ- Lead Frame
ⓒ- Ceramic Ring
ⓓ- Flange

Dim.	INCH			MILLIMETER		
	MIN	TYP	MAX	MIN	TYP	MAX
A1	.573	.579	.585	14.55	14.70	14.85
A2	.195	.201	.207	4.95	5.10	5.25
B0	.325	.331	.337	8.25	8.40	8.55
B1	.109	.114	.119	2.775	2.900	3.025
B2	.432	.453	.473	10.98	11.50	12.03
B3	.003	.005	.007	0.075	0.125	0.175
B4	.057	.062	.067	1.455	1.580	1.705
B5	.211	.217	.222	5.35	5.50	5.65
B6	-	.136	-	-	3.45	-
B7	-	.118	-	-	3.00	-
C1 (Chamfer)	.034	.039	.044	0.875	1.000	1.125
F1	.597	.602	.607	15.175	15.300	15.425
F2	.212	.217	.221	5.375	5.500	5.625
F3	.032	.036	.040	0.82	0.92	1.02
F4	-	.002	-	-	0.05	-
H1	.157	.167	.177	4.00	4.25	4.50
R1 (Radius)	.008	.012	.016	0.20	0.30	0.40

Lid Epoxy Tolerance & Package Alignment



Inspection Items	Package Area	Inspection Method
Point#1 (Below the leadframe)	Gate Lead Frame	A: Gate epoxy overflow If 'A' exceeds than 200um or 'A+B' exceeds maximum width of the basemetal, then the product should be rejected..
Point#2 (Below the leadframe)	Drain Lead Frame	B : Package base width If the epoxy overflows the base (B) of package, then the product should be rejected.
a	Ceramic Lid to Basemetal	a ≥ 0 (a:Distance between ceramic lid edge and basemetal edge)
b	Ceramic Ring to Basemetal	b ≥ 0 (b:Distance between ceramic ring edge and basemetal edge)

Revision History

Part Number	Release Date	Version	Description	Data Sheet Status
ID20275WD	April, 2021	1.0	Initial release of datasheet	