

HiRel C- Band GaAs Power- MESFET

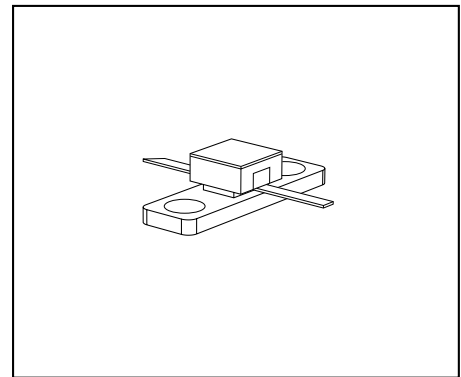
• **HiRel Discrete and Microwave Semiconductor**

- For professional power amplifiers
- For frequencies from 100 MHz to 6 GHz
- Hermetically sealed microwave package
- Low thermal resistance for high voltage application
- Power adds efficiency > 53%

• **ESA Space Qualified**

ESA/SCC Detail Spec. No.: 5614/006

Type Variante No.s 01 to 03



ESD (Electrostatic discharge) sensitive device, observe handling precaution!

Type	Marking	Pin Configuration				Package
CLY32-00	-	1=G	2=S	3=D	-	MWP-25
CLY32-05	-	1=G	2=S	3=D	-	MWP-25
CLY32-10	-	1=G	2=S	3=D	-	MWP-25

(q) Testing level: P: Professional testing
 H: High Rel quality
 S: Space quality
 ES: ESA qualified

CLY32-nn: specifies output power level (see electrical characteristics)

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-source voltage	V_{DS}	14	V
Drain-gate voltage	V_{DG}	16	
Gate-source voltage	V_{GS}	-6	
Drain current	I_D	1400	mA
Gate forward current	I_G	8	
Compression level ¹⁾ Operation Range 1 Operation Range 2 Operation Range 3	P_c	1.5 at $V_{DS} \leq 9V$ 2.5 at $V_{DS} \leq 8V$ 3.5 at $V_{DS} \leq 7V$ 3.5 at $V_{DS} \leq 7V$ tbd.	dB
Junction temperature	T_j	175	
Storage temperature	T_{stg}	-65...175	°C
Total power dissipation ²⁾	P_{tot}	6.75	W
Soldering temperature ³⁾	T_{sol}	230	°C

Thermal Resistance

Parameter	Symbol	Value	Unit
Junction - soldering point	R_{thJS}	≤20	K/W

¹⁾Operating Range 1: $250 \text{ mA} \leq I_D \leq 500 \text{ mA}$

Operating Range 2: $I_D > 500 \text{ mA}$

Operating Range 3: $I_D < 250 \text{ mA}$

²⁾At $T_S = 40^\circ\text{C}$. For $T_S > 40^\circ\text{C}$ derating is required.

³⁾During 15 sec. maximum. The same terminal shall not be resoldered until 3 minutes have elapsed

Electrical Characteristics (at $T_A = 25\text{ °C}$; unless otherwise specified)

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Drain- source saturation current $V_{DS} = 2\text{ V}, V_{GS} = 0\text{ V}$	I_{DSS}	600	1000	1400	mA
Gate threshold voltage $V_{DS} = 3\text{ V}, I_D = 40\text{ mA}$	$-V_{Gth}$	1.6	2.6	3.6	V
Drain current at pinch-off, low V_{DS} $V_{DS} = 3\text{ V}, V_{GS} = -3.8\text{ V}$	I_{Dp3}	-	-	100	μA
Gate current at pinch-off, low V_{DS} $V_{DS} = 3\text{ V}, V_{GS} = -3.8\text{ V}$	$-I_{Gp3}$	-	-	40	
Drain current at pinch-off, high V_{DS} $V_{DS} = 12\text{ V}, V_{GS} = -4\text{ V}$	I_{Dp12}	-	-	2000	
Gate current at pinch-off, high V_{DS} $V_{DS} = 12\text{ V}, V_{GS} = -4\text{ V}$	$-I_{Gp12}$	-	-	800	
Transconductance $V_{DS} = 3\text{ V}, I_D = 380\text{ mA}$	g_m	300	370	-	mS
Thermal resistance junction to soldering point $V_{DS} = 9\text{ V}, I_D = 380\text{ mA}, T_S = 25\text{ °C}$	R_{thJS}	-	16	-	K/W

Electrical Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Linear power gain ¹⁾ $V_{DS} = 9\text{ V}$, $I_D = 380\text{ mA}$, $f = 2.3\text{ GHz}$, $P_{IN} = 0\text{ dBm}$ CLY32-00 CLY32-05 CLY32-10	G_{Ip}	- 11 11.5 115	- 12 12.5 12.5	- - - -	dB
Output power at 1 dB gain compression ¹⁾ $V_{DS} = 9\text{ V}$, $I_{D(RF\ off)} = 380\text{ mA}$, $f = 2.3\text{ GHz}$ CLY32-00 CLY32-05 CLY32-10	P_{1dB}	- - -	- 31.8 32.3 33	- - - -	dBm
Output power ¹⁾ $V_{DS} = 9\text{ V}$, $I_{D(RF\ off)} = 380\text{ mA}$, $f = 2.3\text{ GHz}$, $P_{IN} = 21.5\text{ dBm}$ CLY32-00 CLY32-05 CLY32-10	P_{OUT}	- 31.5 32 32.5	- 31.8 32.3 33	- - - -	
Power added efficiency ¹⁾²⁾ $V_{DS} = 9\text{ V}$, $I_{D(RF\ off)} = 380\text{ mA}$, $f = 2.3\text{ GHz}$, $P_{IN} = 21.5\text{ dBm}$ CLY32-00 CLY32-05 CLY32-10	PAE	- 40 45 45	- 47 50 53	- - - -	%

¹RF Power characteristics given for power matching conditions

²Power added efficiency: $PAE = (P_{RFout} - P_{RFin})/P_{DC}$

Typical Common Source S-Parameters
 $V_{DS} = 3V, I_D = 380mA, Z_0 = 50 \Omega$

f	S ₁₁		S ₂₁		S ₁₂		S ₂₂		k-Fact.	S ₂₁ /S ₁₂	MAG
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
0.5	0.853	-118	6.201	111	0.0377	36	0.546	-176	0.45	22.2	-
0.6	0.839	-122	5.856	109	0.0385	34	0.552	-177	0.51	21.8	-
0.7	0.825	-128	5.477	106	0.0394	33	0.56	-178	0.57	21.4	-
0.8	0.816	-133	5.075	103	0.0403	30	0.568	-180	0.62	21	-
0.9	0.813	-140	4.658	99	0.0413	28	0.577	179	0.67	20.5	-
1	0.818	-147	4.239	94	0.0424	27	0.586	177	0.7	20	-
1.1	0.821	-153	3.876	89	0.0435	25	0.593	175	0.73	19.5	-
1.2	0.823	-158	3.561	85	0.0443	23	0.598	173	0.76	19.1	-
1.3	0.824	-162	3.29	82	0.0451	22	0.602	171	0.8	18.6	-
1.4	0.825	-166	3.055	78	0.0457	21	0.605	169	0.85	18.3	-
1.5	0.825	-170	2.852	75	0.0463	20	0.607	168	0.89	17.9	-
1.6	0.826	-173	2.672	72	0.0469	19	0.609	166	0.93	17.6	-
1.7	0.826	-177	2.512	69	0.0475	18	0.612	165	0.97	17.2	-
1.8	0.825	-179	2.372	66	0.0482	18	0.615	164	1.01	16.9	16.4
1.9	0.825	178	2.244	64	0.0487	17	0.618	163	1.04	16.6	15.4
2	0.825	176	2.13	61	0.0492	17	0.622	162	1.08	16.4	14.6
2.1	0.825	173	2.024	59	0.0496	16	0.625	161	1.12	16.1	14
2.2	0.825	171	1.927	57	0.0504	16	0.628	160	1.15	15.8	13.5
2.3	0.825	169	1.838	54	0.0508	16	0.631	159	1.19	15.6	12.9
2.4	0.825	167	1.756	52	0.0513	15	0.633	157	1.23	15.3	12.5
2.5	0.825	165	1.683	50	0.052	15	0.634	156	1.26	15.1	12
2.6	0.825	163	1.616	48	0.0525	15	0.635	155	1.29	14.9	11.6
2.7	0.825	161	1.555	45	0.0533	14	0.636	154	1.32	14.6	11.3
2.8	0.824	160	1.499	43	0.0542	14	0.637	153	1.35	14.4	10.9
2.9	0.824	158	1.449	41	0.0554	13	0.638	152	1.36	14.2	10.6
3	0.824	156	1.402	39	0.0561	13	0.64	151	1.39	14	10.3
3.1	0.824	155	1.358	37	0.0569	13	0.643	150	1.4	13.8	10
3.2	0.824	153	1.316	35	0.058	13	0.645	149	1.41	13.6	9.7
3.3	0.824	151	1.275	33	0.059	13	0.648	148	1.43	13.3	9.5
3.4	0.824	150	1.236	31	0.0596	12	0.65	147	1.45	13.2	9.2
3.5	0.824	148	1.2	29	0.0608	12	0.652	146	1.46	13	8.9

Typical Common Source S-Parameters
 $V_{DS} = 3V, I_D = 380mA, Z_0 = 50 \Omega$

<i>f</i>	<i>S</i> ₁₁		<i>S</i> ₂₁		<i>S</i> ₁₂		<i>S</i> ₂₂		k-Fact.	<i>S</i> ₂₁ / <i>S</i> ₁₂	MAG
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
3.6	0.824	147	1.167	27	0.062	12	0.654	145	1.46	12.7	8.7
3.7	0.825	145	1.137	25	0.0632	11	0.656	144	1.46	12.5	8.5
3.8	0.826	144	1.107	23	0.0642	10	0.658	143	1.47	12.4	8.3
3.9	0.826	142	1.081	21	0.0656	10	0.66	142	1.46	12.2	8.1
4	0.826	140	1.055	19	0.0664	9	0.662	141	1.47	12	8
4.1	0.827	139	1.029	17	0.0674	8	0.665	140	1.47	11.8	7.8
4.2	0.827	137	1.005	16	0.0684	8	0.669	139	1.47	11.7	7.6
4.3	0.827	136	0.981	14	0.0695	7	0.672	138	1.47	11.5	7.4
4.4	0.829	134	0.958	12	0.0703	7	0.673	136	1.48	11.3	7.3
4.5	0.829	133	0.933	10	0.071	6	0.675	135	1.49	11.2	7
4.6	0.829	131	0.91	8	0.0718	5	0.676	134	1.5	11	6.8
4.7	0.831	130	0.89	6	0.0722	5	0.677	133	1.52	10.9	6.7
4.8	0.831	129	0.873	5	0.0728	4	0.676	131	1.53	10.8	6.5
4.9	0.832	128	0.859	3	0.0734	4	0.676	130	1.54	10.7	6.4
5	0.833	127	0.849	2	0.074	4	0.674	130	1.55	10.6	6.2

Typical Common Source S-Parameters
 $V_{DS} = 5V, I_D = 380\text{ mA}, Z_0 = 50\ \Omega$

f	S ₁₁		S ₂₁		S ₁₂		S ₂₂		k-Fact.	S ₂₁ /S ₁₂	MAG
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
0.5	0.847	-116	7.584	111	0.033	36	0.403	-167	0.48	23.6	-
0.6	0.832	-120	7.161	108	0.0339	34	0.41	-168	0.54	23.2	-
0.7	0.818	-126	6.698	105	0.0348	33	0.419	-170	0.6	22.8	-
0.8	0.809	-132	6.206	102	0.0357	31	0.428	-172	0.66	22.4	-
0.9	0.806	-138	5.698	98	0.0366	29	0.438	-174	0.71	21.9	-
1	0.811	-145	5.189	93	0.0376	26	0.449	-176	0.74	21.4	-
1.1	0.813	-151	4.746	88	0.0385	25	0.458	-178	0.78	20.9	-
1.2	0.814	-156	4.363	84	0.0392	24	0.465	-180	0.81	20.5	-
1.3	0.816	-161	4.031	80	0.0397	23	0.47	178	0.86	20.1	-
1.4	0.817	-165	3.743	76	0.04	21	0.475	177	0.91	19.7	-
1.5	0.817	-169	3.492	73	0.0403	21	0.479	175	0.96	19.4	-
1.6	0.818	-172	3.27	70	0.0408	20	0.483	174	1	19	18.7
1.7	0.818	-175	3.072	67	0.0412	20	0.488	173	1.05	18.7	17.4
1.8	0.817	-178	2.898	64	0.0418	19	0.493	172	1.09	18.4	16.6
1.9	0.817	179	2.74	61	0.042	19	0.498	171	1.14	18.1	15.9
2	0.817	177	2.596	58	0.0424	19	0.504	170	1.18	17.9	15.3
2.1	0.817	175	2.464	56	0.0428	18	0.51	169	1.22	17.6	14.8
2.2	0.817	172	2.344	53	0.0433	18	0.516	168	1.26	17.3	14.3
2.3	0.817	170	2.233	51	0.044	17	0.521	167	1.29	17.1	13.8
2.4	0.817	168	2.132	48	0.0445	17	0.525	166	1.33	16.8	13.4
2.5	0.818	166	2.041	46	0.0451	17	0.529	165	1.36	16.6	13
2.6	0.818	164	1.957	43	0.0458	17	0.531	164	1.38	16.3	12.6
2.7	0.819	163	1.88	41	0.0464	17	0.535	163	1.41	16.1	12.3
2.8	0.819	161	1.809	39	0.0474	17	0.538	162	1.43	15.8	11.9
2.9	0.819	159	1.745	37	0.0481	17	0.541	161	1.46	15.6	11.6
3	0.819	157	1.684	35	0.0485	17	0.546	160	1.49	15.4	11.3
3.1	0.819	156	1.628	32	0.0492	17	0.55	160	1.5	15.2	11
3.2	0.819	154	1.574	30	0.05	17	0.555	159	1.52	15	10.7
3.3	0.819	153	1.522	28	0.0509	16	0.56	158	1.53	14.8	10.5
3.4	0.819	151	1.472	26	0.0515	16	0.565	157	1.55	14.6	10.2
3.5	0.82	149	1.427	24	0.0522	16	0.57	156	1.57	14.4	9.9

Typical Common Source S-Parameters
 $V_{DS} = 5V, I_D = 380 \text{ mA}, Z_0 = 50 \Omega$

<i>f</i>	<i>S</i> ₁₁		<i>S</i> ₂₁		<i>S</i> ₁₂		<i>S</i> ₂₂		k-Fact.	<i>S</i> ₂₁ / <i>S</i> ₁₂	MAG
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	MAG	dB	dB
3.6	0.82	148	1.384	22	0.053	15	0.574	155	1.57	14.2	9.7
3.7	0.822	146	1.345	20	0.0538	15	0.577	153	1.57	14	9.5
3.8	0.822	145	1.308	17	0.055	14	0.581	152	1.57	13.8	9.3
3.9	0.823	143	1.274	15	0.0563	14	0.586	151	1.55	13.5	9.2
4	0.824	141	1.24	13	0.0574	14	0.591	150	1.55	13.3	9
4.1	0.824	140	1.208	11	0.0584	14	0.596	149	1.55	13.2	8.8
4.2	0.825	138	1.177	9	0.0596	13	0.602	148	1.54	13	8.6
4.3	0.825	137	1.146	7	0.0608	13	0.607	147	1.54	12.8	8.4
4.4	0.827	135	1.116	5	0.0619	13	0.612	146	1.53	12.6	8.3
4.5	0.827	134	1.085	3	0.0628	12	0.616	144	1.54	12.4	8.1
4.6	0.827	132	1.057	1	0.0638	12	0.619	143	1.54	12.2	7.8
4.7	0.828	131	1.032	-1	0.0643	12	0.621	142	1.56	12.1	7.7
4.8	0.828	130	1.011	-3	0.065	11	0.622	141	1.56	11.9	7.5
4.9	0.829	129	0.994	-4	0.0655	10	0.623	140	1.57	11.8	7.4
5	0.83	128	0.981	-5	0.0658	10	0.622	139	1.58	11.7	7.3

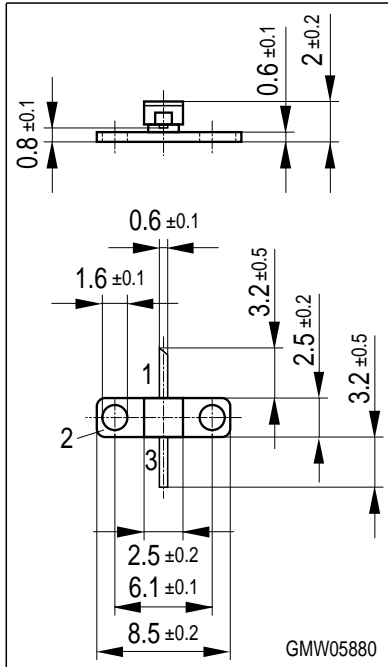
Typical Common Source S-Parameters
 $V_{DS} = 9V, I_D = 380 \text{ mA}, Z_0 = 50 \Omega$

f	S ₁₁		S ₂₁		S ₁₂		S ₂₂		k-Fact.	S ₂₁ /S ₁₂	MAG
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG			
0.5	0.845	-115	8.446	110	0.0278	36	0.257	-147	0.54	24.8	-
0.6	0.83	-120	7.968	107	0.0283	34	0.265	-149	0.61	24.5	-
0.7	0.817	-125	7.445	104	0.0289	32	0.273	-151	0.69	24.1	-
0.8	0.807	-131	6.891	101	0.0296	31	0.283	-153	0.76	23.7	-
0.9	0.804	-137	6.321	96	0.0302	29	0.294	-156	0.82	23.2	-
1	0.809	-144	5.755	91	0.0311	27	0.306	-158	0.84	22.7	-
1.1	0.812	-150	5.263	86	0.0316	26	0.317	-161	0.89	22.2	-
1.2	0.814	-156	4.838	81	0.0322	24	0.326	-163	0.93	21.8	-
1.3	0.815	-160	4.47	77	0.0327	23	0.334	-165	0.98	21.4	-
1.4	0.815	-164	4.15	73	0.0331	23	0.342	-167	1.04	21	19.8
1.5	0.816	-168	3.87	70	0.0335	22	0.35	-168	1.09	20.6	18.8
1.6	0.816	-171	3.621	66	0.0339	22	0.358	-169	1.14	20.3	18
1.7	0.817	-175	3.399	63	0.0341	21	0.366	-170	1.19	20	17.3
1.8	0.817	-177	3.2	60	0.0345	21	0.375	-171	1.24	19.7	16.7
1.9	0.817	180	3.02	57	0.0348	21	0.385	-172	1.29	19.4	16.1
2	0.817	178	2.857	54	0.0353	21	0.395	-173	1.33	19.1	15.6
2.1	0.817	175	2.707	51	0.0357	20	0.405	-174	1.37	18.8	15.2
2.2	0.818	173	2.57	48	0.0361	20	0.415	-175	1.41	18.5	14.7
2.3	0.818	171	2.444	46	0.0366	20	0.424	-176	1.45	18.2	14.3
2.4	0.819	169	2.33	43	0.037	21	0.433	-178	1.49	18	13.9
2.5	0.82	167	2.228	40	0.0376	21	0.441	-179	1.51	17.7	13.5
2.6	0.821	165	2.133	38	0.0381	21	0.448	180	1.55	17.5	13.1
2.7	0.821	163	2.045	35	0.0386	21	0.455	179	1.57	17.2	12.8
2.8	0.821	161	1.963	33	0.0393	22	0.463	178	1.6	17	12.5
2.9	0.821	160	1.889	30	0.0399	21	0.471	177	1.62	16.8	12.2
3	0.822	158	1.82	28	0.0405	22	0.479	176	1.64	16.5	11.9
3.1	0.822	156	1.755	26	0.0411	22	0.488	175	1.65	16.3	11.6
3.2	0.823	155	1.693	23	0.0419	22	0.498	174	1.65	16.1	11.3
3.3	0.823	153	1.632	21	0.0427	23	0.506	173	1.66	15.8	11.1
3.4	0.824	152	1.575	19	0.0434	23	0.514	172	1.67	15.6	10.8
3.5	0.825	150	1.522	16	0.0447	23	0.523	171	1.66	15.3	10.6

Typical Common Source S-Parameters
 $V_{DS} = 9V, I_D = 380 \text{ mA}, Z_0 = 50 \Omega$

<i>f</i> GHz	<i>S</i> ₁₁		<i>S</i> ₂₁		<i>S</i> ₁₂		<i>S</i> ₂₂		k-Fact.	<i>S</i> ₂₁ / <i>S</i> ₁₂	MAG
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	MAG	dB	dB
3.6	0.826	148	1.473	14	0.0458	23	0.53	169	1.65	15.1	10.4
3.7	0.827	147	1.43	12	0.0469	22	0.537	168	1.63	14.8	10.2
3.8	0.827	145	1.387	9	0.0482	23	0.545	167	1.62	14.6	10
3.9	0.828	144	1.346	7	0.0494	22	0.553	166	1.6	14.4	9.8
4	0.829	142	1.308	5	0.0505	22	0.561	164	1.58	14.1	9.7
4.1	0.83	141	1.27	3	0.0515	22	0.569	163	1.57	13.9	9.5
4.2	0.831	139	1.234	1	0.0525	22	0.578	162	1.55	13.7	9.3
4.3	0.831	137	1.198	-2	0.0539	21	0.586	160	1.53	13.5	9.2
4.4	0.833	136	1.163	-4	0.0547	21	0.593	159	1.53	13.3	9
4.5	0.834	134	1.128	-6	0.0557	20	0.599	157	1.52	13.1	8.8
4.6	0.835	133	1.94	-8	0.0567	20	0.605	156	1.52	12.9	8.6
4.7	0.836	132	1.065	-10	0.0575	19	0.61	154	1.52	12.7	8.4
4.8	0.837	130	1.042	-12	0.0582	19	0.613	153	1.52	12.5	8.3
4.9	0.838	130	1.022	-13	0.059	18	0.615	152	1.51	12.4	8.2
5	0.839	129	1.007	-15	0.0598	18	0.616	151	1.5	12.3	8.1

MWP-25 Package



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