Applications

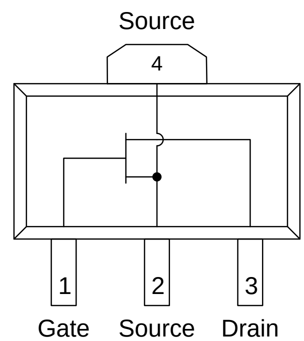
- Test and Measurement Equipment
- Defense Communications
- General Purpose Wireless

4 Pin SOT-223 Package

Product Features

- 400 – 2500 MHz Operating Range
- Wide Operating Voltage Range: +2.7 V to +6 V
- POUT=+26.5 dBm at V_D=+3 V, f=1.8 GHz
- High Efficiency: >55 %

Functional Block Diagram



General Description

The CLY5 is a high-breakdown voltage GaAs FET designed for power amplifier applications in the 400 MHz to 2.5 GHz frequency range. Excellent linearity and easy impedance matching make this device an ideal choice for portable PA applications in mobile phones and WLAN transceivers. The CLY5 provides +26.5 dBm output power, with an associated gain of 9.5 dB, at 1.8 GHz and V_{DS}=+3 V. Power added efficiencies to 55% are achievable.

The CLY5 is housed in an industry-standard lead-free / green / RoHS-compliant SOT-223 package.

Pin Configuration

Pin No.	Label
1	Gate
2, 4	Source
3	Drain

Ordering Information

Part No.	Description
CLY5	High Power GaAs FET

Standard T/R size = 1000 pieces on a 13” reel.

Absolute Maximum Ratings

Parameter	Rating
Storage Temperature (T_{STG})	−55 to 150°C
Drain-source voltage (V_{DS})	+9 V
Drain-gate voltage (V_{DG})	+12 V
Gate-source voltage (V_{GS})	−6 V
Drain current (I_D)	1.2 A
Pulse peak power (P_{PULSE})	9 W
Total power dissipation (P_{TOT}) ($T_S \leq 80$ °C), T_S: Temperature at soldering point	2 W

Operation of this device outside the parameter ranges given above may cause permanent damage.

Recommended Operating Conditions

Parameter	Min	Typ	Max	Units
T_{CASE}	−40		+85	°C
T_J (for >10^6 hours MTTF)			+150	°C

Electrical specifications are measured at specified test conditions. Specifications are not guaranteed over all recommended operating conditions.

Electrical Specifications

Test conditions unless otherwise noted: T_A=+25°C, Freq.=1.8 GHz

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-Source Saturation Current	I_{DSS}	V_{DS} = +3 V, V_{GS} = 0 V	600	800	1000	mA
Drain-Source Pinch-Off Current	I_D	V_{DS} = +3 V, V_{GS} = −3.8 V	-	10	100	µA
Gate Pinch-Off Current	I_G	V_{DS} = +3 V, V_{GS} = −3.8 V	-	5	20	µA
Pinch-Off Voltage	$V_{GS(p)}$	V_{DS} = +3 V, I_D = 100 µA	-3.8	-2.8	-1.8	V
Small Signal Gain (1)	G	V_{DS} = +3 V, I_D = 350 mA, P_{IN} = 0 dBm	10.5	11.0	-	dB
		V_{DS} = +5 V, I_D = 350 mA, Pin = 0 dBm	11.5	12.0	-	dB
Small Signal Gain (2)	G_p	V_{DS} = +3 V, I_D = 350 mA, Pin = 0 dBm	9.0	9.5	-	dB
Output Power	P_o	V_{DS} = +3 V, I_D = 350 mA, Pin = +19 dBm	+26.5	+27	-	dBm
		V_{DS} = +5 V, I_D = 350 mA, Pin = +21 dBm	+29.5	+30	-	dBm
1dB-Compression Point	P_{1dB}	V_{DS} = +3 V, I_D = 350 mA	-	+26.5	-	dBm
		V_{DS} = +5 V, I_D = 350 mA	-	+30	-	dBm
Power Added Efficiency	PAE	V_{DS} = +5 V, I_D = 350 mA, Pin = +21 dBm	40	55	-	%
Noise figure	NF	V_{DS} = +5 V, I_D = 350 mA		1.72		dB
Thermal Resistance	R_{th}	Channel-soldering point			35	°C/W

Notes:
1. Matching conditions for maximum small signal gain (not identical with power matching conditions!)
2. Power matching conditions: f = 1.8 GHz, Source Match (Γ_{ms}) Mag. 0.58; Ang. −143°; Load Match (Γ_{ml}) Mag. 0.76; Ang. −116°

Common Source S-Parameters (V_{DS} = +3 V)

Test conditions unless otherwise noted: V_{DS} = +3 V, I_D = 350 mA (typ.), Temp. = +25 °C, 50 Ohm system

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
100	0.9702	-30.6	14.9423	158.4	0.0103	85.9	0.2969	-175.8
150	0.9597	-44.7	14.2076	148.9	0.0134	71.7	0.3155	-177.3
200	0.9136	-59.6	13.3921	140.2	0.0189	67.4	0.3309	-175.1
250	0.8786	-71.8	12.5257	131.9	0.0218	66.8	0.3402	-176.1
300	0.8374	-83.2	11.6493	124.9	0.0261	66.1	0.3509	-177.6
400	0.7927	-104.6	10.0502	111.8	0.0318	60.6	0.3793	179.2
500	0.7507	-122.7	8.7221	100.7	0.0374	57.7	0.3970	176.2
600	0.7204	-138.3	7.6207	91.1	0.0424	53.6	0.4130	172.4
700	0.6962	-151.7	6.7149	82.8	0.0477	49.5	0.4283	168.0
800	0.6923	-163.7	5.9699	75.3	0.0519	46.7	0.4377	164.3
900	0.6833	-174.6	5.3660	67.9	0.0562	42.4	0.4501	160.8
1000	0.6829	175.9	4.8399	61.7	0.0614	41.2	0.4596	157.2
1200	0.6922	159.0	4.0337	49.3	0.0687	35.3	0.4811	150.5
1400	0.7041	144.0	3.4168	38.0	0.0761	29.8	0.5035	143.3
1500	0.7130	137.8	3.1757	32.7	0.0813	26.9	0.5133	140.4
1600	0.7197	131.2	2.9317	27.5	0.0849	25.6	0.5259	136.9
1800	0.7414	119.9	2.5649	17.7	0.0919	17.4	0.5478	130.4
2000	0.7622	109.5	2.2367	7.8	0.0967	11.0	0.5701	123.9
2200	0.7798	100.5	1.9842	-1.0	0.1015	6.3	0.5931	117.7
2400	0.8001	92.3	1.7624	-9.6	0.1055	1.1	0.6156	111.3
2500	0.8085	88.3	1.6590	-13.8	0.1083	-2.7	0.6265	108.2
3000	0.8413	71.7	1.2639	-32.5	0.1145	-15.4	0.6780	93.9
3500	0.8723	57.7	1.0034	-49.3	0.1179	-27.8	0.7216	81.3
4000	0.8837	45.5	0.8275	-64.9	0.1257	-39.5	0.7539	69.6
4500	0.8914	34.7	0.7034	-78.3	0.1247	-50.9	0.7710	57.9
5000	0.8985	24.3	0.6140	-91.4	0.1275	-60.8	0.7777	46.7
5500	0.9069	13.6	0.5521	-104.5	0.1361	-71.5	0.7907	34.8
6000	0.9159	2.7	0.5058	-118.6	0.1389	-83.4	0.8089	22.2

Noise Parameters (V_{DS} = +3 V)

Test conditions unless otherwise noted: V_{DS} = +3 V, I_D = 350 mA (typ.), Temp. = +25 °C, 50 Ohm system

Freq (MHz)	NF_{min} (dB)	MagOpt (mag)	AngOpt (deg)	R_n (Ω)	r_n
900	0.92	0.408	142	3.9	0.79
1800	1.72	0.664	-134	8.1	0.162

Common Source S-Parameters (V_{DS} = +5 V)

Test conditions unless otherwise noted: V_{DS} = +5 V, I_D = 350 mA (typ.), Temp. = +25 °C, 50 Ohm system

Freq (GHz)	S11 (dB)	S11 (ang)	S21 (dB)	S21 (ang)	S12 (dB)	S12 (ang)	S22 (dB)	S22 (ang)
100	0.9678	-31.3	16.8119	158.4	0.0095	85.0	0.1354	-161.6
150	0.9318	-43.8	15.8736	148.9	0.0123	72.8	0.1527	-159.1
200	0.9038	-58.1	15.0157	140.0	0.0165	71.3	0.1634	-156.8
250	0.8699	-70.1	14.0242	132.0	0.0187	66.3	0.1831	-158.0
300	0.8353	-81.9	13.0156	124.7	0.0238	64.5	0.1947	-160.5
400	0.7801	-102.9	11.2669	111.3	0.0286	59.2	0.2278	-165.2
500	0.7343	-120.2	9.8117	100.2	0.0332	56.1	0.2441	-169.2
600	0.7033	-135.4	8.5306	90.5	0.0384	53.9	0.2660	-173.6
700	0.6836	-148.9	7.5315	82.3	0.0422	50.2	0.2790	-178.3
800	0.6692	-161.2	6.7254	74.3	0.0473	51.1	0.2933	178.2
900	0.6638	-172.2	6.0311	66.8	0.0492	44.4	0.3080	174.1
1000	0.6609	178.3	5.4737	60.5	0.0529	42.5	0.3214	170.3
1200	0.6721	161.4	4.5677	47.7	0.0629	39.6	0.3501	162.7
1400	0.6855	146.6	3.8869	36.4	0.0681	34.3	0.3745	156.4
1500	0.6952	139.7	3.5927	30.5	0.0727	31.2	0.3897	153.1
1600	0.7006	133.5	3.3304	24.9	0.0729	28.7	0.4036	149.6
1800	0.7226	122.0	2.9092	14.6	0.0831	24.3	0.4333	143.0
2000	0.7467	111.9	2.5470	4.3	0.0890	16.4	0.4675	136.0
2200	0.7690	102.3	2.2428	-5.2	0.0963	11.8	0.4960	129.5
2400	0.7902	93.9	1.9933	-14.4	0.0979	5.7	0.5287	123.0
2500	0.8006	89.9	1.8674	-18.8	0.1008	2.6	0.5440	119.2
3000	0.8429	73.2	1.4113	-39.3	0.1107	-9.5	0.6182	104.2
3500	0.8759	59.0	1.1024	-57.2	0.1174	-22.2	0.6831	90.0
4000	0.8916	46.9	0.8874	-73.4	0.1231	-35.3	0.7301	77.4
4500	0.8991	35.4	0.7293	-88.1	0.1242	-47.1	0.7573	64.6
5000	0.9035	24.7	0.6214	-101.3	0.1292	-56.0	0.7784	53.0
5500	0.9164	14.0	0.5480	-114.3	0.1338	-67.4	0.7987	40.3
6000	0.9248	2.9	0.4926	-128.3	0.1380	-80.1	0.8228	27.1

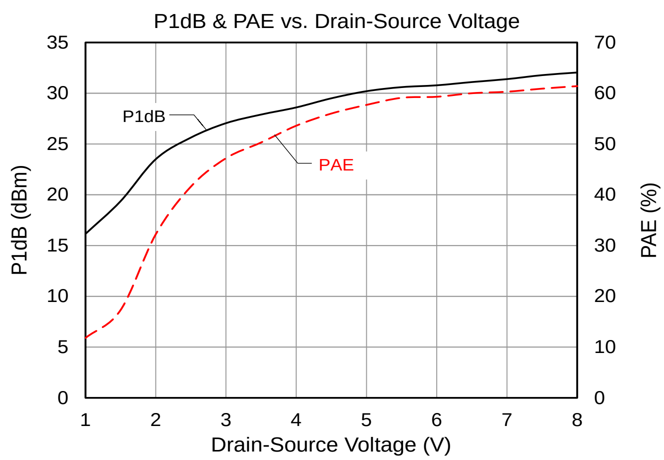
Noise Parameters (V_{DS} = +5 V)

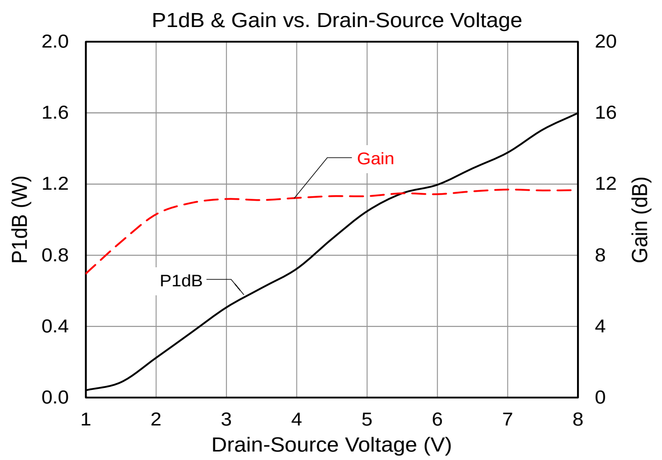
Test conditions unless otherwise noted: V_{DS} = +5 V, I_D = 350 mA (typ.), Temp. = +25 °C, 50 Ohm system

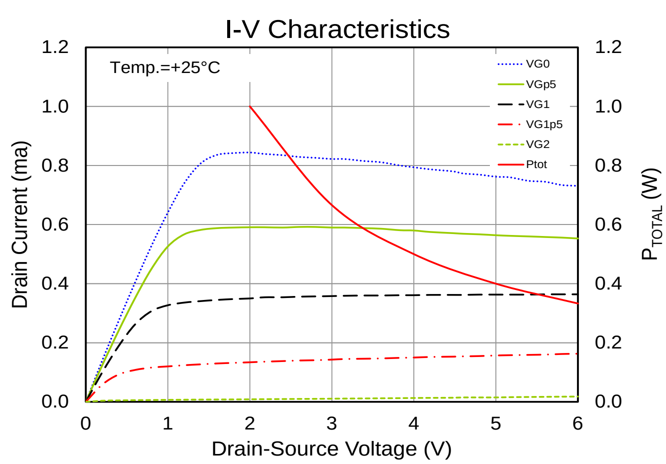
Freq (MHz)	NF_{min} (dB)	MagOpt (mag)	AngOpt (deg)	R_n (Ω)	r_n
900	1.05	0.369	139	4.9	0.097
1800	1.94	0.603	−132	10.9	0.218

Performance Plots

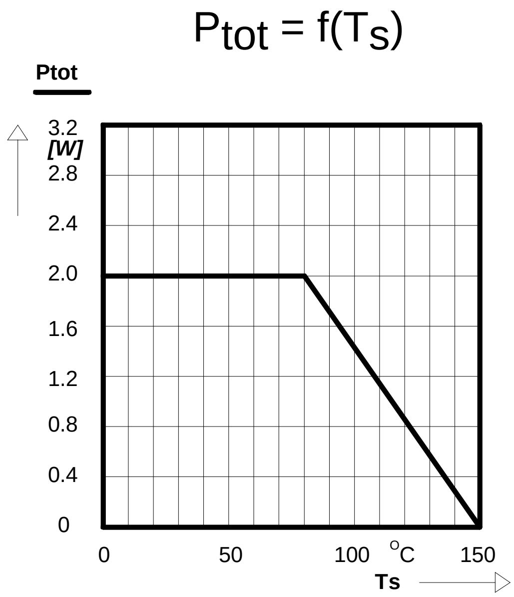
Test conditions unless otherwise noted: I_D=350 mA (typ.), Freq.=1800 MHz, Temp=+25°C



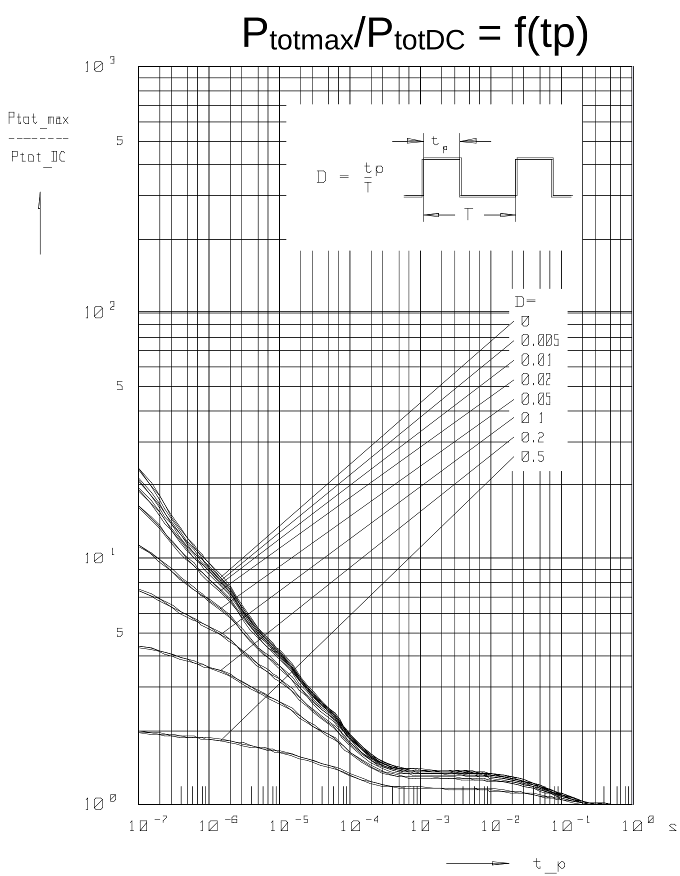




Total Power Dissipation

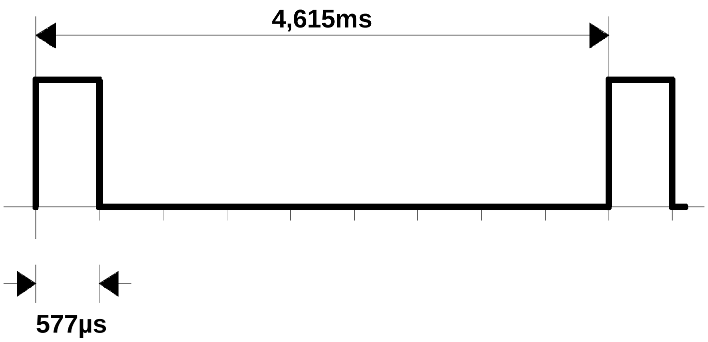


Permissible Pulse Load



Increased Power Handling Capability – Pulsed Applications

GSM/PCN TDMA-Frame:

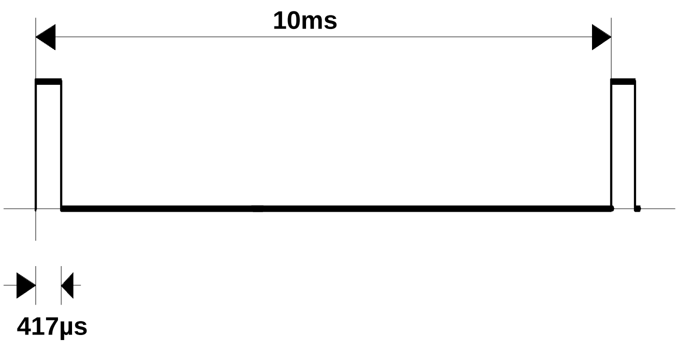


$$D = \frac{t_p}{T} = \frac{0.577\text{ms}}{4.615\text{ms}} = 0.125$$

Take value $\frac{P_{tot_{max}}}{P_{tot_{DC}}}$ from diagram permissible pulse load --> $\frac{P_{tot_{max}}}{P_{tot_{DC}}} \approx 1.4$

$$P_{tot} = 2\,\text{W} \times 1.4 = 2.8\,\text{W}$$

DECT TDMA-Frame:



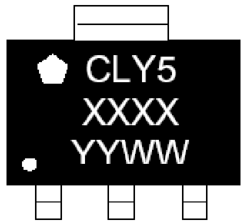
$$D = \frac{t_p}{T} = \frac{10\text{ms}}{4.615\text{ms}} = 0.0417$$

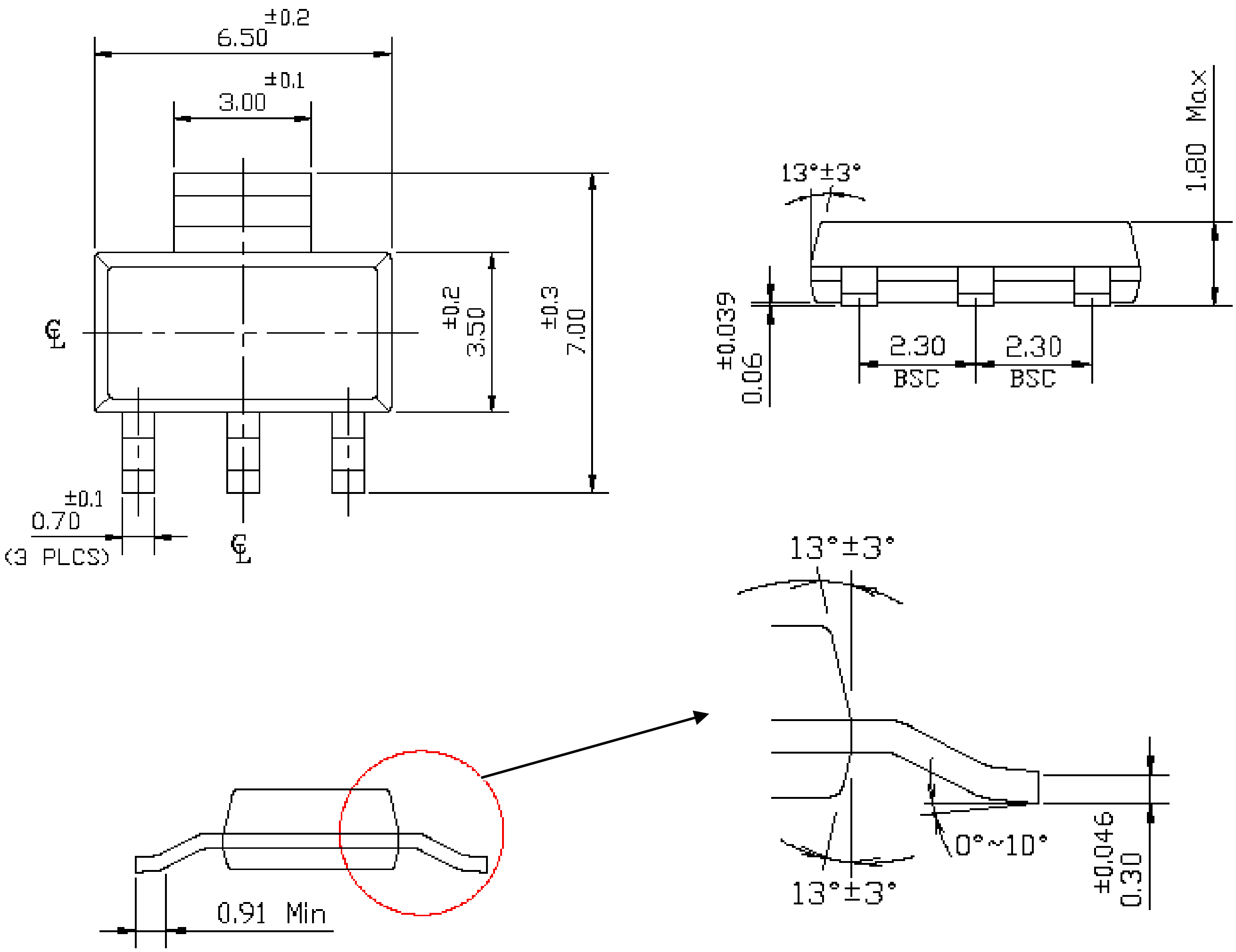
Take value $\frac{P_{tot_{max}}}{P_{tot_{DC}}}$ from diagram permissible pulse load --> $\frac{P_{tot_{max}}}{P_{tot_{DC}}} \approx 1.5$

$$P_{tot} = 2\,\text{W} \times 1.5 = 3\,\text{W}$$

Package Marking and Dimensions

<u>Marking</u>
Part Identifier: CLY5
Lot Code: XXXX
Date Code: YYWW





NOTES:
1. All dimensions are in millimeters. Angles are in degrees

Product Compliance Information

ESD Sensitivity Ratings

Caution! ESD-Sensitive Device

MSL Rating

MSL Rating:	Level 3
Test:	260°C convection reflow
Standard:	JEDEC Standard IPC/JEDEC J-STD-020

Solderability

Compatible with both lead-free (260 °C max. reflow temperature) and tin/lead (245 °C max. reflow temperature) soldering processes.

Package contact plating: NiPdAu

RoHs Compliance

This part is compliant with EU 2002/95/EC RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

This product also has the following attributes:

- Lead Free
- Halogen Free (Chlorine, Bromine)
- Antimony Free
- TBBP-A ($C_{15}H_{12}Br_{4}0_{2}$) Free
- PFOS Free
- SVHC Free

Contact Information

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