TriQuint SEMICONDUCTOR

**CLY5**
**Datasheet**

# High-Power Packaged GaAs FET

## 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. It is ideal for portable PA applications in mobile phones and portable WLAN transceivers due to its easy matching and excellent linearity. The CLY5 exhibits +26.5 dBm output power with +3V Vds at 1.8 GHz with an associated gain of 9.5 dB. Power added efficiencies to 55% are achievable.

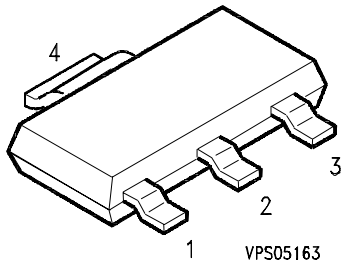
## Features:

- For frequencies up to 2.5 GHz
- Wide operating voltage range: 2.7 to 6 V
- $P_{OUT}$ 26.5 dBm typical at $V_D$=3V, f=1.8GHz
- High efficiency: better than 55 %
- Low Cost

## Applications:

- Power amplifier for mobile phones
- Power Amplifiers for WLAN transceivers
- Driver Amplifiers for WLAN or mobile phone basestations

## Package Outline, SOT223:




Pin Configuration:
1: Gate
2 & 4: Source

## Maximum Ratings:

| Parameter | Symbol | Values | Unit |
|---|---|---|---|
| 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 |
| Channel temperature | $T_{Ch}$ | 150 | °C |
| Storage temperature | $T_{stg}$ | -55...+150 | °C |
| Pulse peak power | $P_{Pulse}$ | 9 | W |
| Total power dissipation ($T_S \leq 80$ °C)<br>$T_S$: Temperature at soldering point | $P_{tot}$ | 2 | W |
| **Thermal Resistance** | | | |
| Channel-soldering point | $R_{thChS}$ | ≤35 | K/W |

## Electrical Characteristics:

($T_A$ = 25°C , unless otherwise specified)

| Parameter | Symbol | min | typ | max | Unit |
|---|---|---|---|---|---|
| Drain-source saturation current<br>$V_{DS}$ = 3 V $V_{GS}$ = 0 V | $I_{DSS}$ | 600 | 800 | 1000 | mA |
| Drain-source pinch-off current<br>$V_{DS}$ = 3 V $V_{GS}$ = -3.8 V | $I_D$ | - | 10 | 100 | µA |
| Gate pinch-off current<br>$V_{DS}$ = 3 V $V_{GS}$ = -3.8 V | $I_G$ | - | 5 | 20 | µA |
| Pinch-off Voltage<br>$V_{DS}$= 3 V $I_D$=100µA | $V_{GS(p)}$ | -3.8 | -2.8 | -1.8 | V |
| Small Signal Gain*)<br>$V_{DS}$ = 3 V $I_D$ = 350 mA f = 1.8 GHz<br>$P_{in}$ = 0 dBm | $G$ | 10.5 | 11.0 | - | dB |
| Small Signal Gain*)<br>$V_{DS}$ = 5 V $I_D$ = 350 mA f = 1.8 GHz<br>$P_{in}$ = 0 dBm | $G$ | 11.5 | 12.0 | - | dB |
| Small Signal Gain **)<br>$V_{DS}$ = 3 V $I_D$ = 350 mA f = 1.8 GHz<br>$P_{in}$ = 0 dBm | $G_p$ | 9.0 | 9.5 | - | dB |
| Output Power<br>$V_{DS}$ = 3 V $I_D$ = 350 mA f = 1.8 GHz<br>$P_{in}$ = 19 dBm | $P_o$ | 26.5 | 27 | - | dBm |
| Output Power<br>$V_{DS}$ = 5 V $I_D$ = 350 mA f = 1.8 GHz<br>$P_{in}$ = 21 dBm | $P_o$ | 29.5 | 30 | - | dBm |
| 1dB-Compression Point<br>$V_{DS}$ = 3 V $I_D$ = 350 mA f = 1.8 GHz | $P_{1dB}$ | - | 26.5 | - | dBm |
| 1dB-Compression Point<br>$V_{DS}$ = 5 V $I_D$ = 350 mA f = 1.8GHz | $P_{1dB}$ | - | 30 | - | dBm |
| Power Added Efficiency<br>$V_{DS}$ = 5 V $I_D$ = 350 mA f = 1.8 GHz<br>$P_{in}$ = 21 dBm | PAE | 40 | 55 | - | % |
| Noise figure<br>$V_{DS}$ = 5 V $I_D$ = 350 mA f = 1.8GHz | NF | | 1.72 | | dB |

*) Matching conditions for maximum small signal gain (not identical with power matching conditions!)

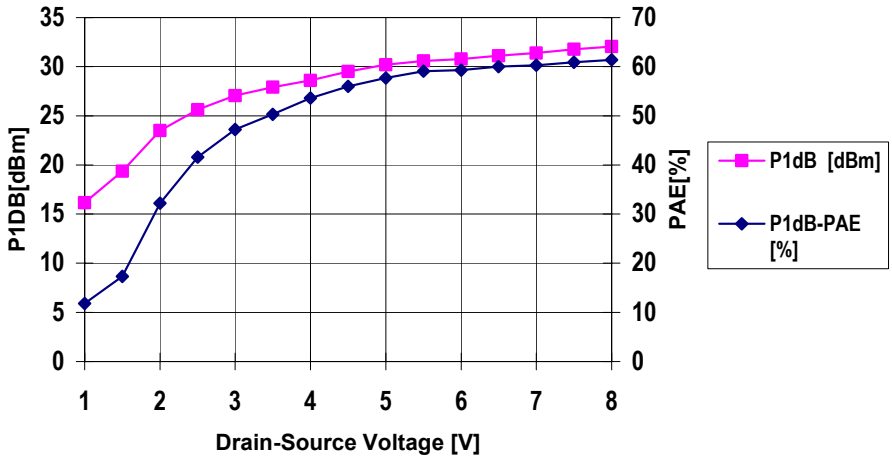
**) Power matching conditions: f=1.8GHz:

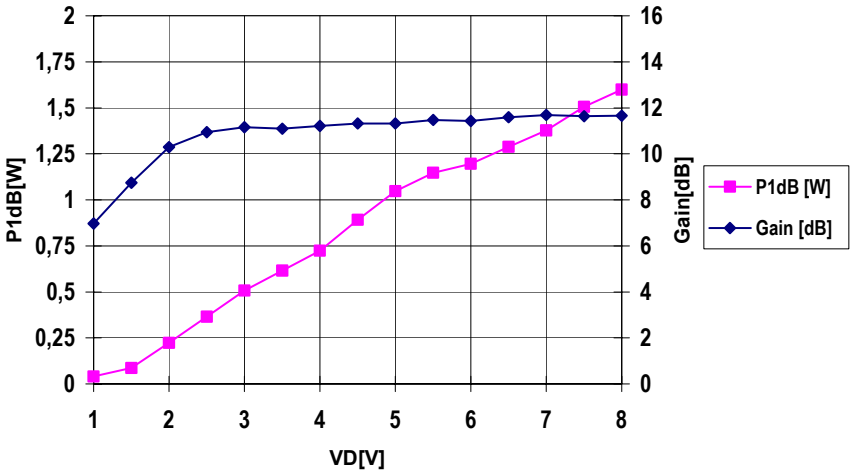
Source Match: $\Gamma_{ms}$ : MAG 0.58; ANG -143°; Load Match: $\Gamma_{ml}$ : MAG 0.76; ANG -116°

## Electrical Characteristics, Continued:

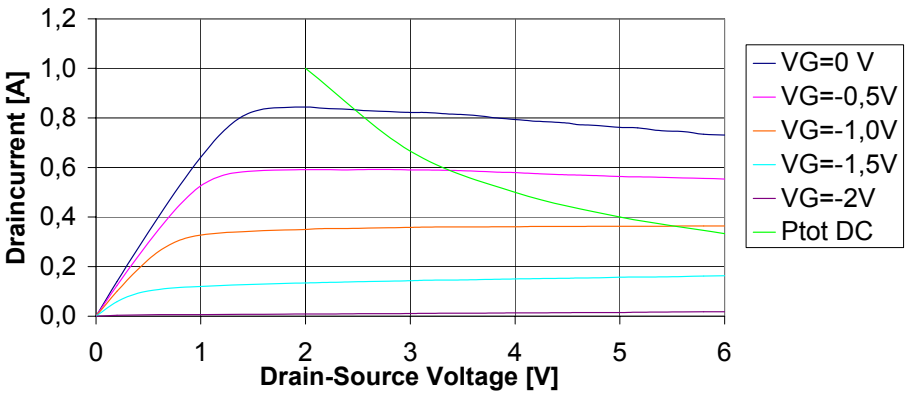
### *Compression Power vs. Drain-Source Voltage*

**f = 1.8GHz; IDS0=350mA**




### Output Characteristics:



## Electrical Characteristics, Continued:

### Typical Common Source S-Parameters and noise data

$V_{DS}$ = 3 V  $I_D$ = 350 mA  $Z_o$ = 50 Ω

| | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| f MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | 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 |

| f | $F_{min}$ | $\Gamma_{opt}$ | | $R_n$ | $r_n$ |
|---|---|---|---|---|---|
| GHz | dB | MAG | ANG | Ω | – |
| 0.9 | 0.92 | 0.408 | 142 | 3.9 | 0.79 |
| 1.8 | 1.72 | 0.664 | -134 | 8.1 | 0.162 |

Additional S-Parameter and noise data available on data disc!

## Electrical Characteristics, Continued:

## Typical Common Source S-Parameters and noise data

$V_{DS}$ = 5 V  $I_D$ = 350 mA  $Z_o$ = 50 Ω

| | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| f MHz | MAG | ANG | MAG | ANG | MAG | ANG | MAG | 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 |

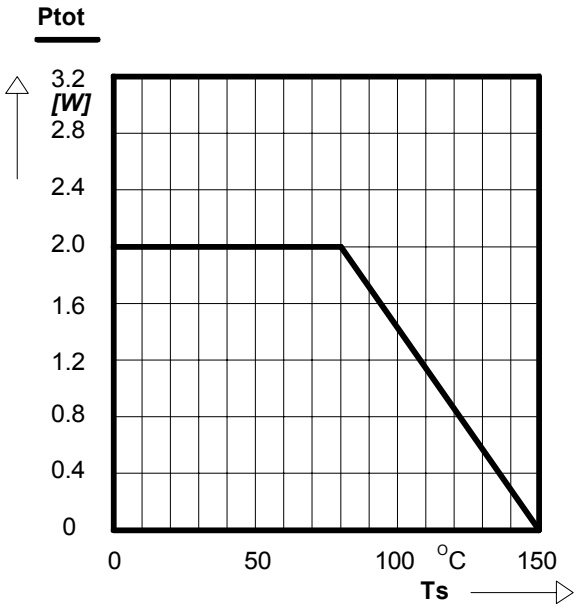
| f | $F_{min}$ | $\Gamma_{opt}$ | | $R_n$ | $r_n$ |
|---|---|---|---|---|---|
| GHz | dB | MAG | ANG | Ω | – |
| 0.9 | 1.05 | 0.369 | 139 | 4.9 | 0.097 |
| 1.8 | 1.94 | 0.603 | -132 | 10.9 | 0.218 |

Additional S-Parameter available on data disc!

## Electrical Characteristics, Continued:

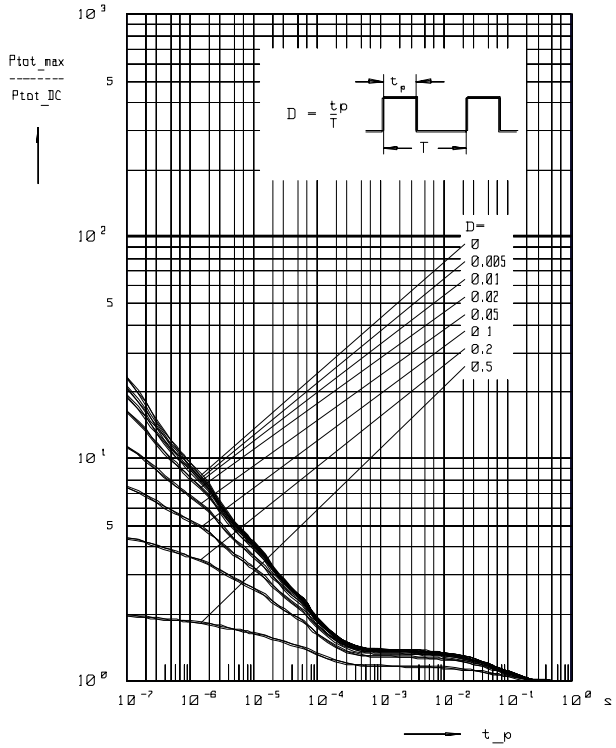
## Total Power Dissipation

$P_{tot} = f(T_S)$




## Permissible Pulse Load

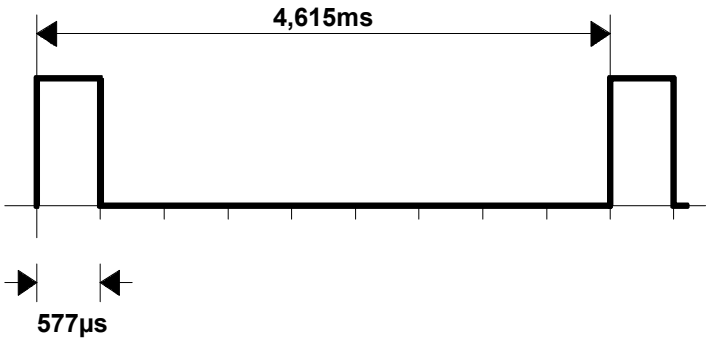
$P_{totmax}/P_{totDC} = f(t_p)$



## Electrical Characteristics, Continued:

## Increased Power Handling Capability Pulsed Applications

### GSM/PCN TDMA-Frame:

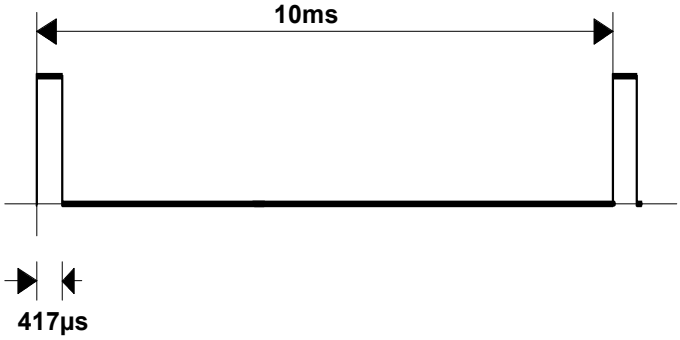



$$D = \frac{t_p}{T} = \frac{0,577ms}{4,615ms} = 0,125$$

Take value $\frac{P_{tot_{max}}}{P_{tot_{DC}}}$ from diagram permissible pulse load --> $\frac{P_{tot_{max}}}{P_{tot_{DC}}} \approx 1,4$

$$P_{tot} = 2W \times 1,4 = 2,8W$$

### DECT TDMA-Frame:

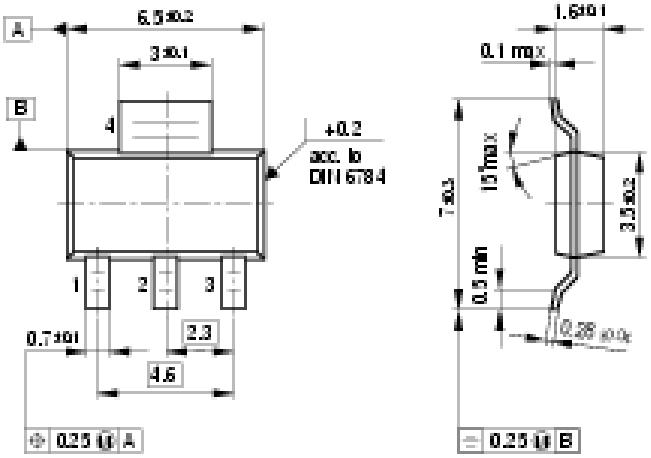



$$D = \frac{t_p}{T} = \frac{10ms}{4,615ms} = 0,0417$$

Take value $\frac{P_{tot_{max}}}{P_{tot_{DC}}}$ from diagram permissible pulse load --> $\frac{P_{tot_{max}}}{P_{tot_{DC}}} \approx 1,5$

$$P_{tot} = 2W \times 1,5 = 3W$$

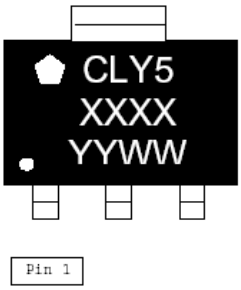
## Package Dimensions:




1. MSL Rating: 3/260C
2. Pb Free

## Package Marking:

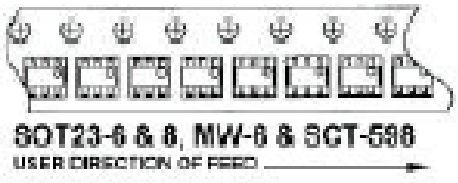
TOP MARK




LASER MARK.

Line 1 = (pentagon shape) + CLY5
Line 2 = XXXX= TriQuint Lot Number
Line 3 = YYWW = year, workweek.

## Package Orientation on Reel:



## Ordering Information:

| Type | Marking | Pin Configuration 1 | 2 | 3 | 4 | Package 1) |
|---|---|---|---|---|---|---|
| CLY 5 | CLY 5 | G | S | D | S | SOT 223 |

ESD: **E**lectro**s**tatic **d**ischarge sensitive device,
observe handling precautions!

### *Additional Information*

For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

**Web: www.triquint.com** **Tel: (503) 615-9000**
**Email: info_wireless@tqs.com** **Fax: (503) 615-8902**

For technical questions and additional information on specific applications:

**Email: info_wireless@tqs.com**



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