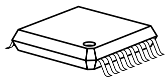
# GaAs MMIC

# CGY 93P

*Data Sheet*

- Power amplifier for GSM application
- 2 stage amplifier
- Overall power added efficiency 55%



MW-16

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

| **Type** | **Marking** | **Ordering Code** (taped) | **Package** |
|---|---|---|---|
| CGY 93P | CGY 93P | Q62702-G72 | MW-16 |

| **Maximum Ratings** | **Symbol** | **Value** | **Unit** |
|---|---|---|---|
| Positive supply voltage | $V_D$ | 7.0 | V |
| Negative supply voltage | $V_G$ | – 5.0 | V |
| Supply current stage 1 | $I_{D1}$ | 0.6 | A |
| Supply current stage 2 | $I_{D2}$ | 3.5 | A |
| Channel temperature | $T_{Ch}$ | 150 | °C |
| Storage temperature | $T_{stg}$ | – 55 … + 150 | °C |
| RF input power | $P_{in}$ | 20 | dBm |
| Total power dissipation (CW, $T_c \leq 83$ °C)<br>$T_c$: Temperature at soldering point | $P_{tot}$ | 7.5 | W |
| Pulse peak power dissipation duty cycle 12.5%, $t_{on} = 0.577$ ms | $P_{Puls}$ | 17 | W |

| **Thermal Resistance** | **Symbol** | **Value** | **Unit** |
|---|---|---|---|
| Junction-Case | $R_{thJCh}$ | 9.0 | K/W |

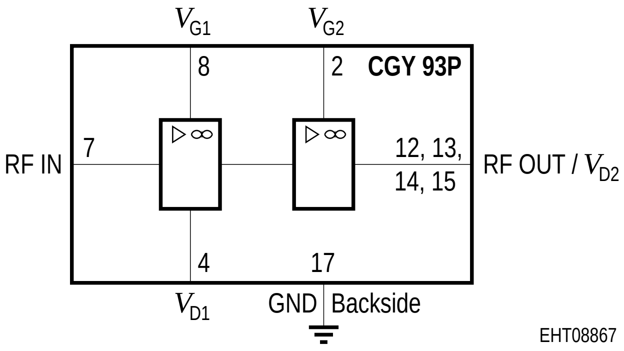



**Figure 1 Functional Block Diagram**

## Pin Out

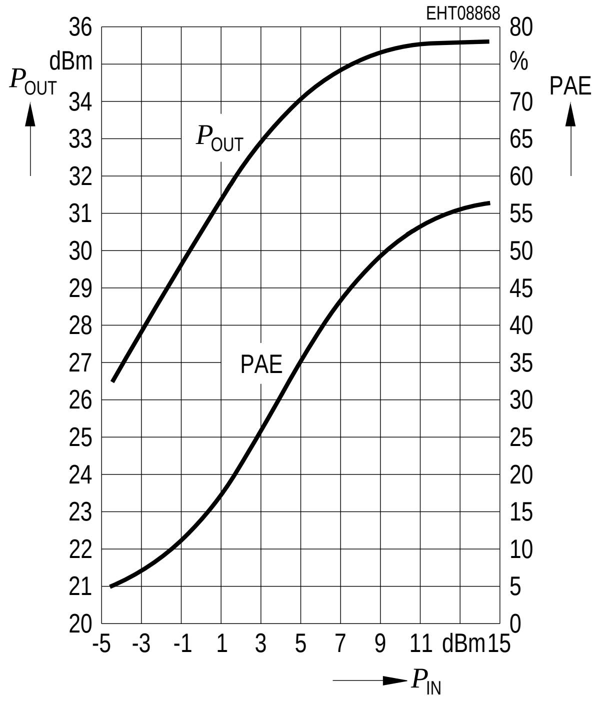
| Pin # | Name | Configuration |
|---|---|---|
| 1 | NC | – |
| 2 | VG2 | Gate voltage stage 2 |
| 3 | NC | – |
| 4 | VD1 | Drain Voltage stage 1 |
| 5 | NC | – |
| 6 | NC | – |
| 7 | RFin | RF input |
| 8 | VG1 | Gate Voltage stage 1 |
| 9 | NC | – |
| 10 | NC | – |
| 11 | NC | – |
| 12,13,14,15 | VD2/RFout | Drain voltage stage 2/RF output |
| 16 | NC | – |
| (17) | GND | Ground (backside of MW-16 housing) |

## Electrical Characteristics

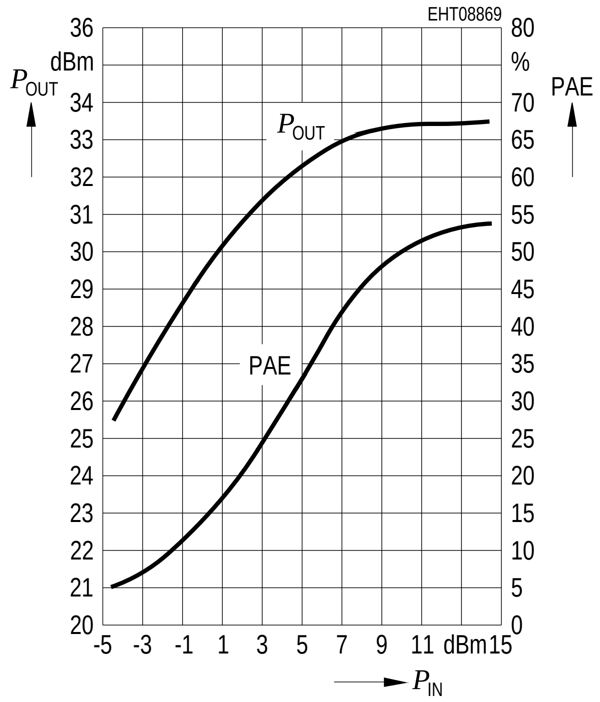
$T_A$ = 25 °C, pulsed with a duty cycle of 12.5%, $t_{on}$ = 577 µs.

| Parameters | Symbol | Limit Values | | | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| | | min. | typ. | max. | | |
| Frequency range | $f$ | 880 | – | 915 | MHz | – |
| Supply current with RF | $I_{DRF}$ | – | 1.8 | – | A | $P_{in}$ = 12 dBm, $V_D$ = 3.5 V |
| Small signal gain | $G$ | 29 | 30.0 | – | dB | $V_D$ = 3.5 V, $P_{in}$ = – 10 dBm |
| Power gain | $G_P$ | 23 | 23.3 | – | dB | $V_D$ = 3.5 V, $P_{in}$ = 12 dBm |
| Output Power | $P_{out}$ | 33.0 | 33.3 | – | dBm | $V_D$ = 2.8 V, $P_{in}$ = 12 dBm |
| Output Power | $P_{out}$ | 35.0 | 35.3 | – | dBm | $V_D$ = 3.5 V, $P_{in}$ = 12 dBm |
| Overall Power added Efficiency | $\eta$ | 47 | 53 | – | % | $V_D$ = 2.8 V, $P_{in}$ = 12 dBm |
| Overall Power added Efficiency | $\eta$ | 50 | 55 | – | % | $V_D$ = 3.5 V, $P_{in}$ = 12 dBm |
| Noise Power in RX (935 - 960 MHz) | $N_{RX}$ | – | – 82 | – | dBm | $P_{in}$ = 12 dBm, $P_{out}$ = 33.3 dBm, 100 kHz RBW |
| Harmonics | $H$ (2 $f_0$)<br>$H$ (3 $f_0$) | 40<br>40 | 43<br>43 | –<br>– | dBc<br>dBc | $V_D$ = 2.8 V, $P_{in}$ = 12 dBm, $P_{out}$ = 33.3 dBm |
| Stability all spurious outputs < – 60 dBc, VSWR load, all phase angles | – | – | 10 : 1 | – | – | – |
| Input VSWR (with external match) | – | – | 2 : 1 | 2.2 : 1 | – | – |

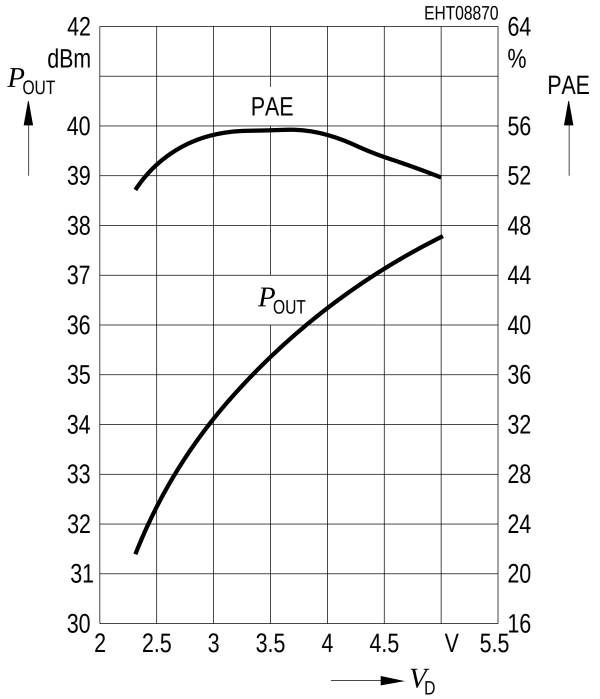
**CGY 93P, @ 2.8 V, $f$ = 900 MHz**
$V_G$ = – 2.0 V, pulsed with a duty cycle of 12.5%, $t_{on}$ = 0.577 ms




**CGY 93P, @ 2.8 V, $f$ = 900 MHz**
$V_G$ = – 2.0 V, pulsed with a duty cycle of 12.5%, $t_{on}$ = 0.577 ms




**CGY 93P – $P_{out}$ and PAE vs. $V_D$**
output matching optimized for $V_D$ = 3.5 V, $f$ = 900 MHz, duty cycle of 12.5%, $t_{on}$ = 0.577 ms, $P_{in}$ = 12 dBm



## GSM Application Board CGY 93P

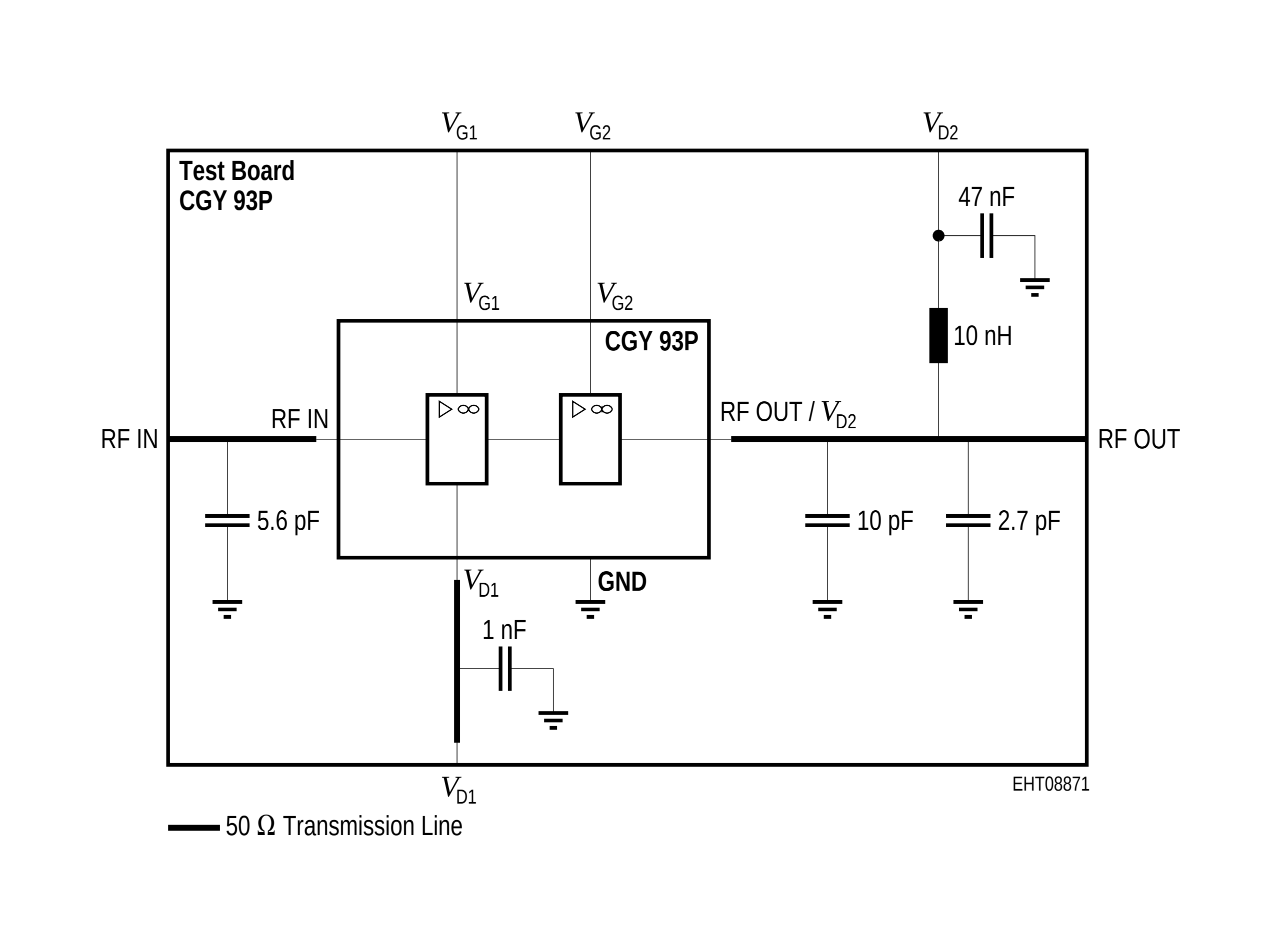



**Figure 2**

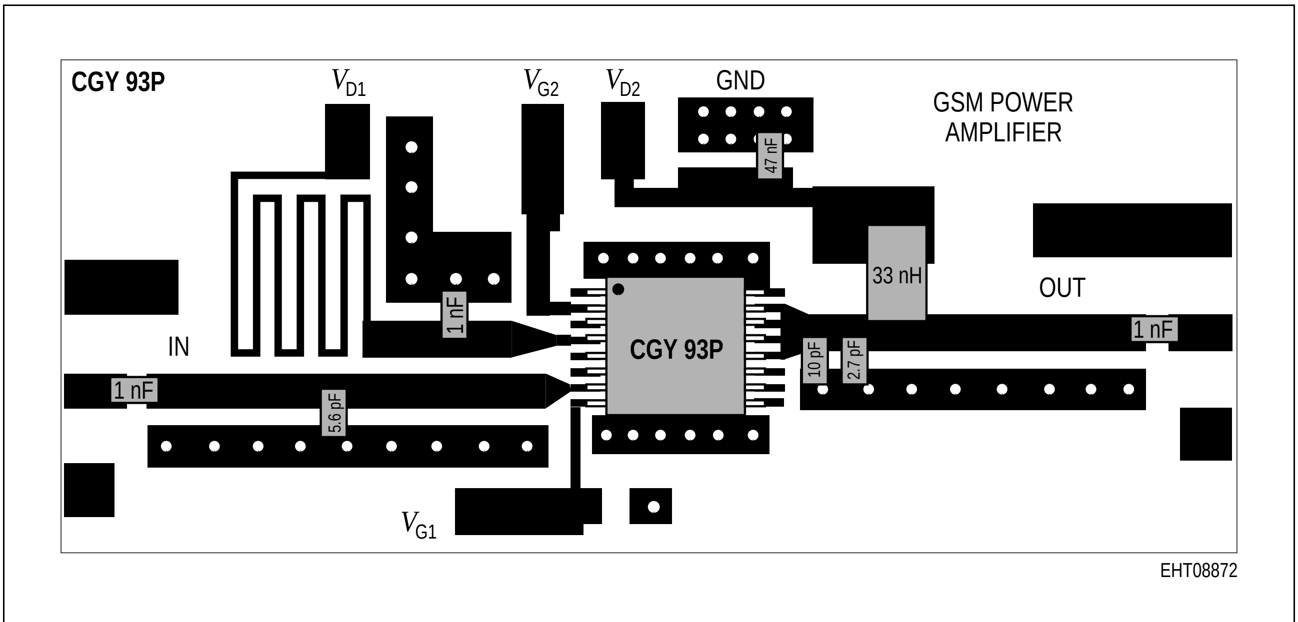



**Figure 3**

## Determination of Permissible Total Power Dissipation for Continuous and Pulse Operation

The purpose of the following procedure is to prevent the junction temperature $T_J$ from exceeding the maximum allowed data sheet value. $T_J$ is determined by the dissipated power and the thermal properties of the device and board. The dissipated power is the power which remains in the chip and heats the device and junction. It does not contain RF signals which are coupled out consistently.

This is a two step approach: For a pulsed condition both steps are needed. For CW and DC step one is sufficient.

### Step 1: Continuous Wave/DC Operation

For the determination of the permissible total power dissipation $P_{\text{tot-DC}}$ from the diagram below it is necessary to obtain the temperature of the case $T_C$ first. Because the MW-16 heat sink is not easily accessible to a temperature measurement the thermal resistance is defined as $R_{thJC}$ using the case temperature $T_{C.}$ There are two cases:

- When $R_{thCA}$ (case to ambient) is not known: Measure $T_C$ in operation of device and board at the upper side of the case where the temperature is highest. Small thermoelements (< 1 mm, thin wires, thermopaste) or thermopapers with low heat dissipation are well suited.

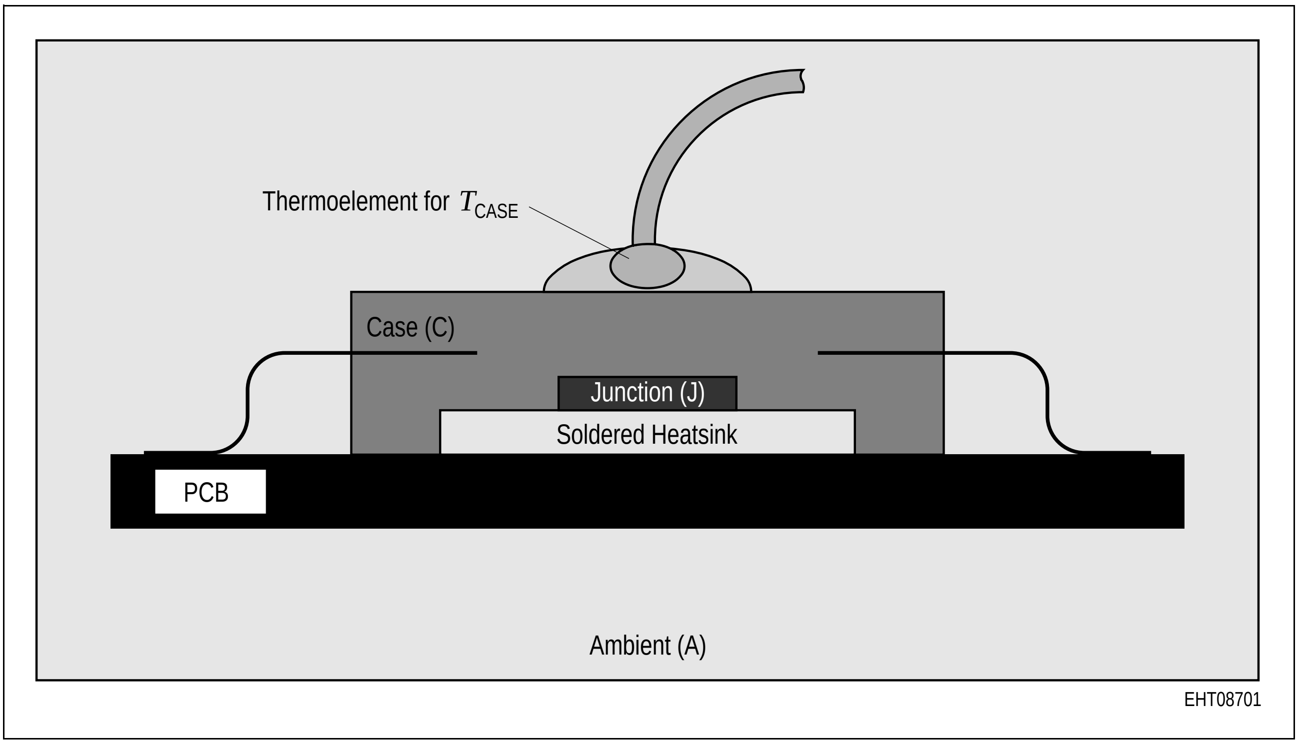
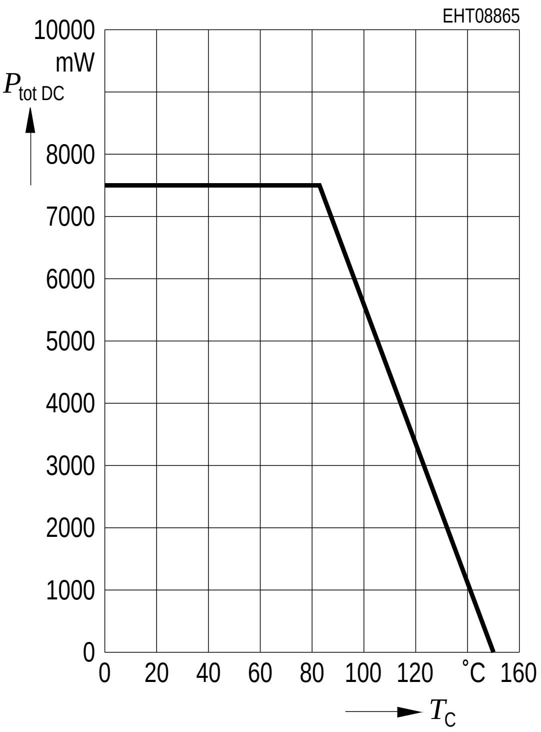



**Figure 4 Measurement of Case Temperature $T_C$**

- When $R_{thCA}$ is already known:

  Calculate the case temperature as $T_C = P_{diss} \times R_{thCA} + T_A$ Graph for $P_{tot\text{-}DC}$

**$P_{tot\text{-}DC}$ in mW**




**Step 2: Pulsed Operation**

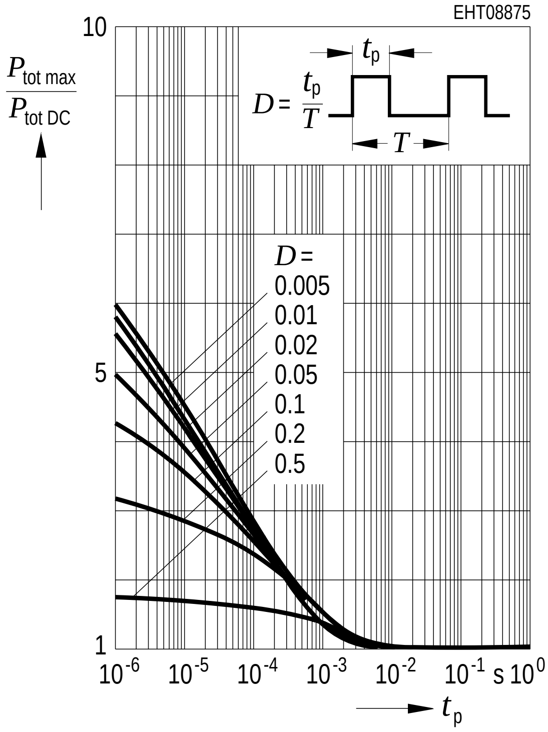
For the calculation of the permissible pulse load $P_{tot\text{-}max}$ the following formula is applicable:

$P_{tot\text{-}max} = P_{tot\text{-}DC} \times$ Pulse Factor $= P_{tot\text{-}DC} \times (P_{tot\text{-}max}/P_{tot\text{-}DC})$

Use the values for $P_{tot\text{-}DC}$ as derived from the above diagram and for the Pulse Factor $= P_{tot\text{-}max}/P_{tot\text{-}DC}$ from the following diagram to get a specific value.

## Pulse Factor

$P_{tot\text{-}max}/P_{tot\text{-}DC} = f(t\_p)$




$P_{tot\text{-}max}$ should not exceed the absolute maximum rating for the dissipated power

$P_{Pulse}$ = "Pulse peak power" = 17 W

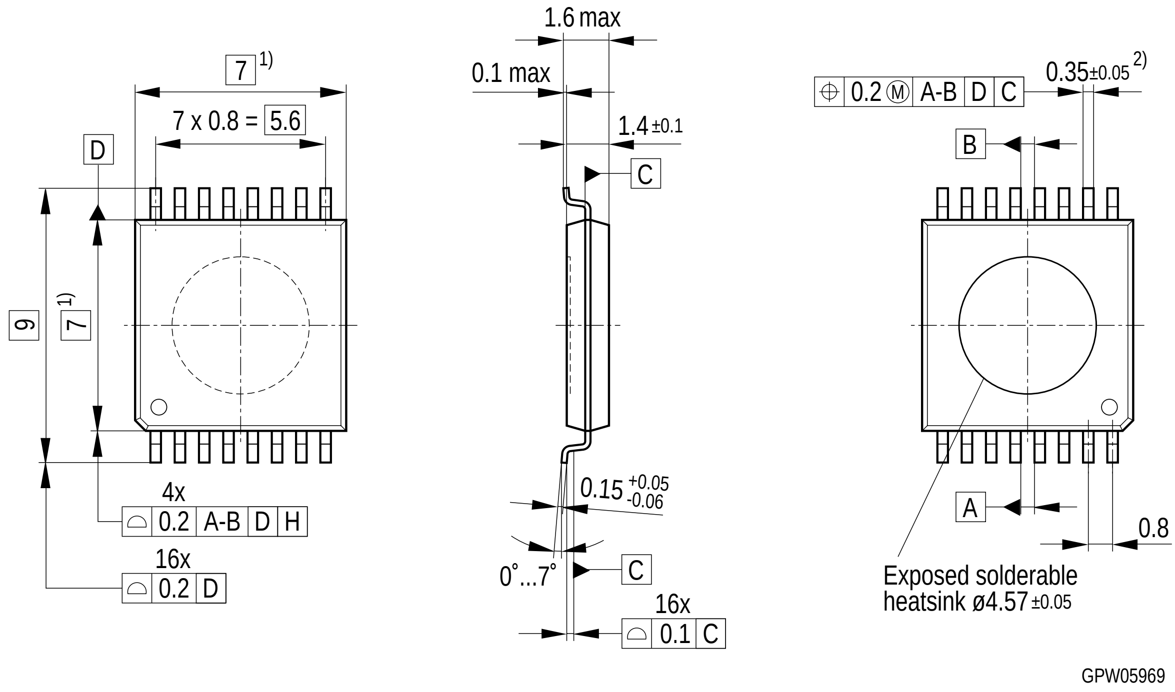
### Reliability Considerations

The above procedure yields the upper limit for the power dissipation for continuous wave (cw) and pulse applications which correspond to the maximum allowed junction temperature. For best reliability keep the junction temperature low. The following formula allows to track the individual contributions which determine the junction temperature.

| $T_J$ = | ($P_{tot\text{-}diss}$/Pulse Factor $\times$ | $R_{thJC}$) + | $T_C$ |
|---|---|---|---|
| Junction temperature (= channel temperature) | Power dissipated in the chip, divided by the applicable pulse factor (= 1 for DC and CW). It does not contain decoupled RF-power | $R_{th}$ of device from junction to case | Temperature of the case, measured or calculated, device and board operating |

## Package Outlines

**MW-16**
(Special Package)




**Sorts of Packing**
Package outlines for tubes, trays etc. are contained in our Data Book “Package Information”.

SMD = Surface Mounted Device

Dimensions in mm