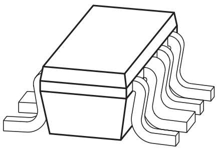
GaAs MMIC CGY 197

Data Sheet

- Multiband Power Amplifier (800 … 3500 MHz)
- DECT, PHS, PWT, Bluetooth, ISM900, ISM2400
- Single Voltage Supply
- P_{OUT} = 25.0 dBm at V_D = 2.1 V
- P_{OUT} = 25.5 dBm at V_D = 2.3 V
- P_{OUT} = 27.5 dBm at V_D = 3.0 V
- P_{OUT} = 30.0 dBm at V_D = 5.0 V
- Operating voltage range: 2.0 to 6 V
- Overall power added efficiency up to 50%
- Easy external matching



SCT-598

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

Type	**Marking**	**Ordering Code** (taped)	**Package**
CGY 197	D7s	Q62702-G0116	SCT-598

Maximum Ratings

Parameter	**Symbol**	**Value**	**Unit**
Positive supply voltage	V_D	6	V
Supply current	I_D	1.0	A
Maximum input power	P_{IN_max}	20	dBm
Channel temperature	T_{Ch}	150	°C
Storage temperature	T_{stg}	– 55 … + 150	°C
Total power dissipation ($T_S \leq 81$ °C) T_S: Temperature at soldering point	P_{tot}	1.0	W
Pulse peak power	P_{Pulse}	2.0	W

Thermal Resistance

Parameter	Symbol	Value	Unit
Channel-soldering point	R_{thChS}	70	K/W

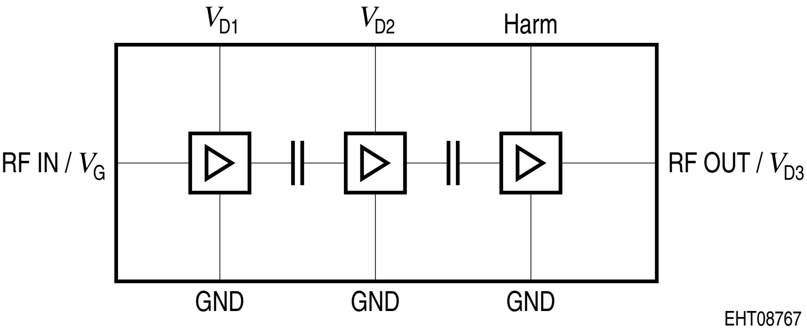


Figure 1 **Functional Block Diagram**

Pin Configuration

Pin No.	Symbol	Configuration
1	RF IN/V_G	RF input power + Gate voltage [0 V internal]
2	GND	RF and DC ground
3	V_{D2}	Pos. drain voltage of the 2nd stage
4	N.C.	Not connected
5	Harm	Harmonic Match
6	RF OUT/V_{D3}	RF output power/Pos. drain voltage of the 3rd stage
7	GND	RF and DC ground
8	V_{D1}	Pos. drain voltage of the 1st stage

DC Characteristics

Characteristics	Symbol	Limit Values			Unit	Test Conditions
		min.	typ.	max.		
Drain current stage 1 - 3	I_{DSS1}	–	40	–	mA	V_{D1} = 3 V
	I_{DSS2}	–	90	–	mA	V_{D2} = 3 V
	I_{DSS3}	–	390	–	mA	V_{D3} = 3 V
Transconductance stage 1 - 3	G_{FS1}	–	75	–	mS	V_D = 3 V, I_D = 40 mA
	G_{FS2}	–	160	–	mS	V_D = 3 V, I_D = 90 mA
	G_{FS3}	–	700	–	mS	V_D = 3 V, I_D = 390 mA

Determination of Permissible Total Power Dissipation for Continuous and Pulse Operation

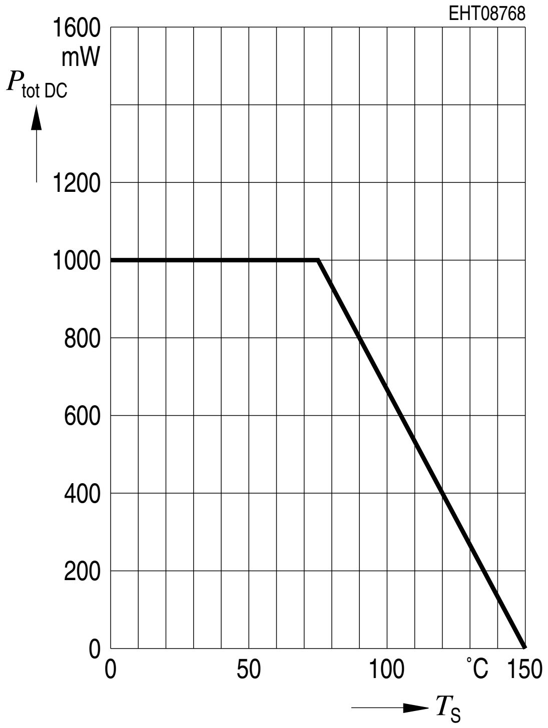
The dissipated power is the power which remains in the chip and heats the device. It does not contain RF signals which are coupled out consistently.

a) Continuous Wave/DC Operation

For the determination of the permissible total power dissipation $P_{tot\text{-}DC}$ from the diagram below it is necessary to obtain the temperature of the soldering point T_S first. There are two cases:

- When R_{thSA} (soldering point to ambient) is not known: Measure T_S with a temperature sensor at the leads were the heat is transferred from the device to the board (normally at the widest source or ground lead for GaAs). Use a small sensor of low heat transport, for example a thermoelement (< 1 mm) with thin wires or a temperature indicating paper while the device is operating.
- When R_{thSA} is already known: $T_S = P_{Diss} \times R_{thSA} + T_A$

Permissible Total Power Dissipation in DC Operation



b) Pulsed Operation

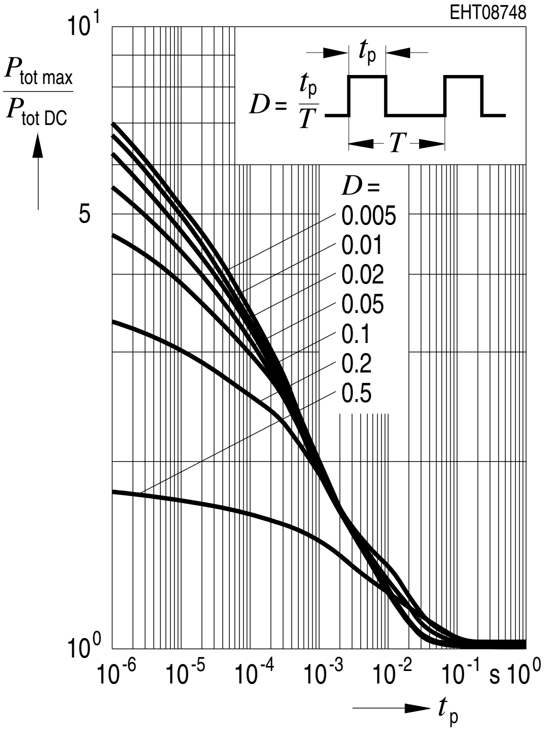
For the calculation of the permissible pulse load $P_{\text{tot-max}}$ the following formula is applicable:

$P_{\text{tot-max}} = P_{\text{tot-DC}} \times$ Pulse factor

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

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

Pulse Factor



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

P_{Pulse} = “Pulse peak power” = 2 W

c) Reliability Considerations

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

$T_{\text{Ch}} =$	$(P_{\text{Diss}} \times$	$R_{\text{thChS}}) +$	T_{S}
Channel temperature (= junction temperature)	Power dissipated in the chip. It does not contain decoupled RF- power	R_{th} of device from channel to soldering point	Temperature of soldering point, measured or calculated

Electrical Characteristics, 3.0 V ISM 2400 MHz Application

T_A = 25 °C, f = 2.40 GHz, Z_S = Z_L = 50 Ω, unless otherwise specified

Characteristics	Symbol	Limit Values			Unit	Test Conditions
		min.	typ.	max.		
Supply current	I_{DD}	–	450	–	mA	V_D = 3.0 V; P_{IN} = – 10 dBm
Supply current	I_{DD}	–	290	–	mA	V_D = 2.1 V; P_{IN} = 0 dBm
Output Power	P_O	–	24.3	–	dBm	V_D = 2.1 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	44	–	%	V_D = 2.1 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	46	–	%	V_D = 2.1 V; P_{IN} = 3 dBm
Supply current	I_{DD}	–	305	–	mA	V_D = 2.3 V; P_{IN} = 0 dBm
Output Power	P_O	–	24.8	–	dBm	V_D = 2.3 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	43	–	%	V_D = 2.3 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	45	–	%	V_D = 2.3 V; P_{IN} = 3 dBm
Supply current	I_{DD}	–	335	–	mA	V_D = 3.0 V; P_{IN} = 0 dBm
Output Power	P_O	–	26.2	–	dBm	V_D = 3.0 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	41	–	%	V_D = 3.0 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	43	–	%	V_D = 3.0 V; P_{IN} = 3 dBm
Off Isolation	-S21	–	35	–	dB	V_D = 0 V; P_{IN} = 0 dBm

Electrical Characteristics, 3.0 V ISM 2400 MHz Application (cont'd)
T_A = 25 °C, f = 2.40 GHz, $Z_S = Z_L$ = 50 Ω, unless otherwise specified

Characteristics	Symbol	Limit Values			Unit	Test Conditions
		min.	typ.	max.		
Load mismatch	–	No module damage for 10 s			–	P_{IN} = 0 dBm, $V_D \leq 3.0$ V, Z_S = 50 Ω Load VSWR = 20:1 for all phase
Load mismatch	–	No module damage for 10 s			–	P_{IN} = 3 dBm, $V_D \leq 3.0$ V, Z_S = 50 Ω Load VSWR = 20:1 for all phase
Stability	–	All spurious output more than 70 dB below desired signal level.			–	P_{IN} = 0 dBm, V_D = 3.0 V, Z_S = 50 Ω Load VSWR = 10:1 for all phase
Stability	–	All spurious output more than 70 dB below desired signal level.			–	P_{IN} = 3 dBm, V_D = 3.0 V, Z_S = 50 Ω Load VSWR = 10:1 for all phase

Electrical Characteristics (3.0 V ISM 2400 MHz Application)

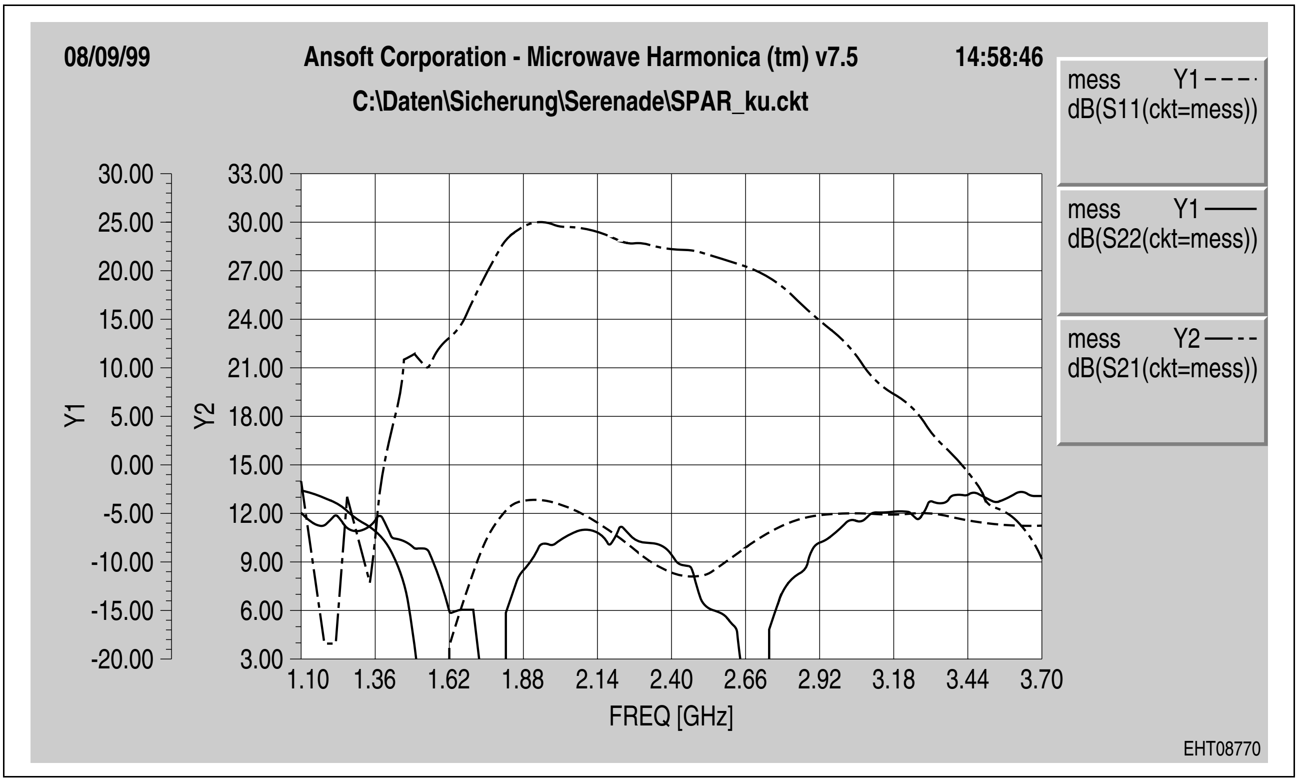


Figure 2 **S-Parameter**, V_D = 3.0 V, P_{IN} = – 10 dBm, Duty Cycle 10%

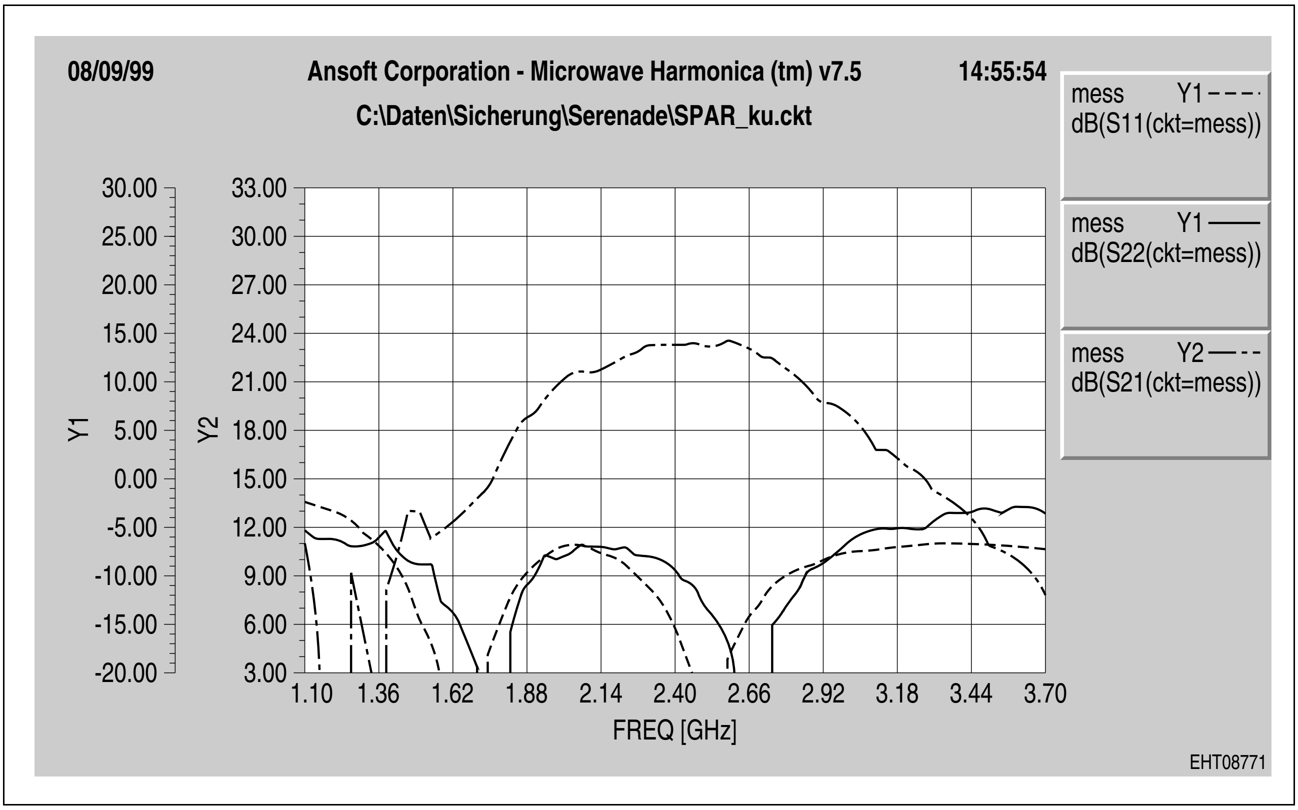


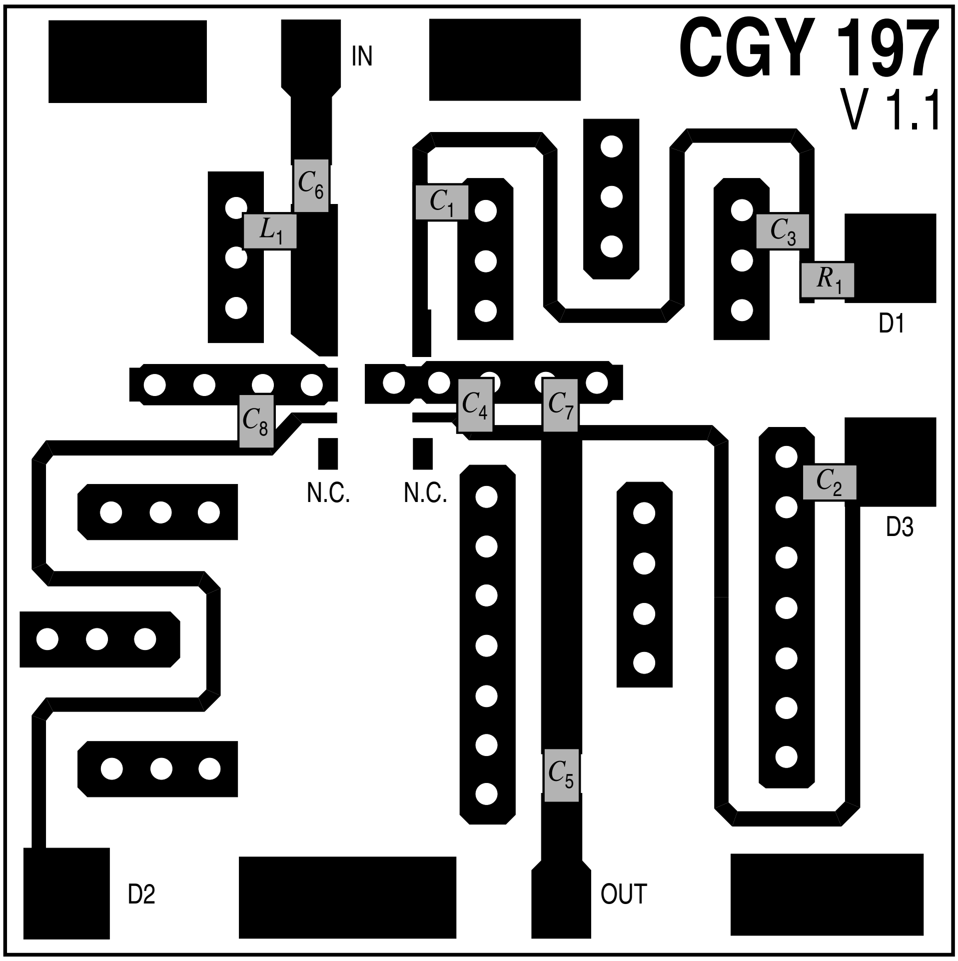
Figure 3 **S-Parameter**, V_D = 3.0 V, P_{IN} = + 3 dBm, Duty Cycle 10%

$P_{OUT} = f(P_{IN})$, V_D = 3 V

P_{IN} [dBm]	P_{OUT} [dBm]	I_D [A]	PAE [%]
– 10.00	18.93	0.296	8.7
– 9.00	19.84	0.296	10.8
– 8.00	20.74	0.293	13.4
– 7.00	21.59	0.291	16.4
– 6.00	22.43	0.291	19.9
– 5.00	23.44	0.293	25.0
– 4.00	24.17	0.301	28.8
– 3.00	24.92	0.314	32.8
– 2.00	25.56	0.329	36.3
– 1.00	25.94	0.335	38.9
0.00	26.19	0.334	41.3
1.00	26.24	0.327	42.8
2.00	26.15	0.315	43.4
3.00	26.06	0.311	43.0
4.00	25.93	0.307	42.1
5.00	25.82	0.303	41.6

$P_{OUT} = f(V_D)$, P_{IN} = 3 dBm

V_D [V]	P_{OUT} [dBm]	I_D [A]	PAE [%]
2.0	23.84	0.267	44.9
2.1	24.21	0.271	45.8
2.2	24.46	0.281	44.8
2.3	24.74	0.287	44.8
2.4	25.03	0.289	45.6
2.5	25.26	0.297	44.8
2.6	25.41	0.301	44.1
2.7	25.63	0.304	44.3
2.8	25.78	0.308	43.6
2.9	25.90	0.308	43.3
3.0	26.07	0.312	43.0
3.1	26.19	0.311	42.8
3.2	26.28	0.315	41.8
3.3	26.38	0.318	41.2
3.4	26.46	0.319	40.5
3.5	26.48	0.317	39.8
3.6	26.56	0.317	39.5
3.7	26.57	0.320	38.1
3.8	26.60	0.319	37.6
3.9	26.67	0.317	37.4
4.0	26.68	0.320	36.2



C_1 = 100 nF
C_2 = 100 nF

C_3 = 100 nF
C_4 = 1.5 pF

C_5 = 1 nF
C_6 = 120 pF

C_7 = 1 pF
C_8 = 10 pF 0402

L_1 = 4.7 nH
R_1 = 2.7 Ω

EHT08774

Figure 4 **Testboard Layout (3.0 V ISM 2400 MHz Application)**

Electrical Characteristics, 2.3 V DECT-Application: t.b.m.

T_A = 25 °C, f = 1.89 GHz, $Z_S = Z_L$ = 50 Ω, unless otherwise specified
pulsed mode: T = 417 µs, duty cycle 12.5%

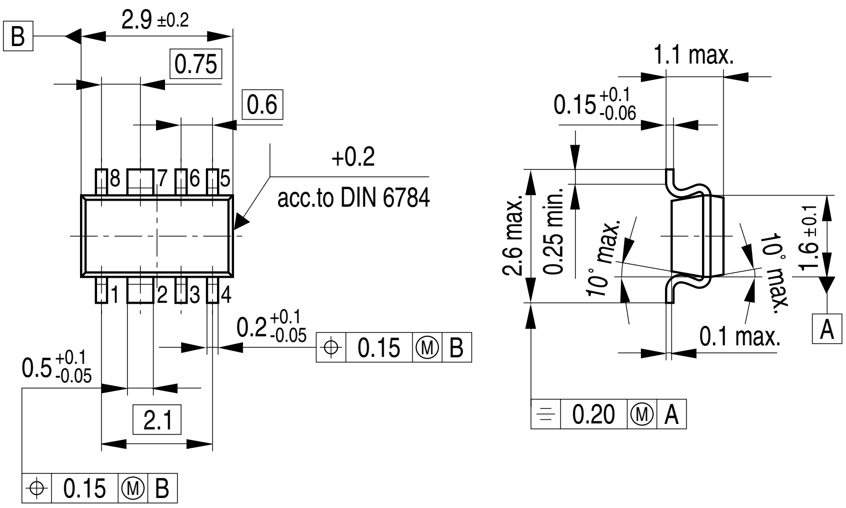
Characteristics	Symbol	Limit Values			Unit	Test Conditions
		min.	typ.	max.		
Supply current	I_{DD}	–	450	–	mA	V_D = 3.0 V; P_{IN} = – 10 dBm
Supply current	I_{DD}	–	330	–	mA	V_D = 2.1 V; P_{IN} = 0 dBm
Output Power	P_O	–	25.0	–	dBm	V_D = 2.1 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	45	–	%	V_D = 2.1 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	50	–	%	V_D = 2.1 V; P_{IN} = 3 dBm
Supply current	I_{DD}	–	340	–	mA	V_D = 2.3 V; P_{IN} = 0 dBm
Output Power	P_O	–	25.5	–	dBm	V_D = 2.3 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	45	–	%	V_D = 2.3 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	50	–	%	V_D = 2.3 V; P_{IN} = 3 dBm
Supply current	I_{DD}	–	370	–	mA	V_D = 3.0 V; P_{IN} = 0 dBm
Output Power	P_O	–	27.5	–	dBm	V_D = 3.0 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	45	–	%	V_D = 3.0 V; P_{IN} = 0 dBm
Overall Power added Efficiency	PAE	–	50	–	%	V_D = 3.0 V; P_{IN} = 3 dBm
Off Isolation	-S21	–	40	–	dB	V_D = 0 V; P_{IN} = 0 dBm

Electrical Characteristics, 2.3 V DECT-Application: t.b.m. (cont'd)
T_A = 25 °C, f = 1.89 GHz, $Z_S = Z_L$ = 50 Ω, unless otherwise specified
pulsed mode: T = 417 µs, duty cycle 12.5%

Characteristics	**Symbol**	**Limit Values**			**Unit**	**Test Conditions**
		min.	**typ.**	**max.**		
Load mismatch	–	No module damage for 10 s			–	P_{IN} = 0 dBm, $V_D \leq 3.0$ V, Z_S = 50 Ω Load VSWR = 20:1 for all phase
Load mismatch	–	No module damage for 10 s			–	P_{IN} = 3 dBm, $V_D \leq 3.0$ V, Z_S = 50 Ω Load VSWR = 20:1 for all phase
Stability	–	All spurious output more than 70 dB below desired signal level.			–	P_{IN} = 0 dBm, V_D = 3.0 V, Z_S = 50 Ω Load VSWR = 10:1 for all phase
Stability	–	All spurious output more than 70 dB below desired signal level.			–	P_{IN} = 3 dBm, V_D = 3.0 V, Z_S = 50 Ω Load VSWR = 10:1 for all phase

Package Outlines

SCT-598
(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