



TQM7M4022

(Preliminary data sheet)

3V Quad-Band GSM850/900/DCS/PCS Power Amplifier Module

Description:

Advanced quad-band, compact 3V power amplifier module designed for mobile handset applications. The small size and high performance is achieved with high-reliability InGaP HBT technology. The module is fully integrated, providing a simple 50 Ohms interface on all input and output ports. No external matching or bias components are required. Despite its very compact size, the module has exceptional efficiency in all bands. Band select and power control inputs on the module are CMOS compatible.

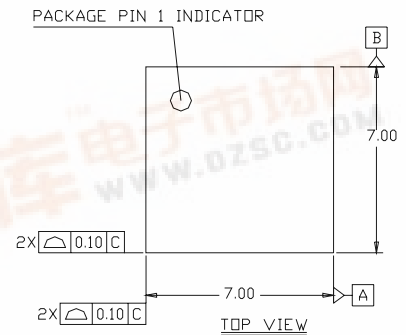
Features:

- Very compact size – 7x7x1.3mm³
- High efficiency – typical GSM850 53%, GSM900 58%, DCS 50%, PCS 50%.
- Positive supply voltage – 3.0 to 4.5 V.
- No reference voltage needed
- 50 Ω input and output impedances.
- GPRS class 12 compatible.
- CMOS band select and power control inputs.
- High-reliability InGaP technology.
- Ruggedness 10:1.

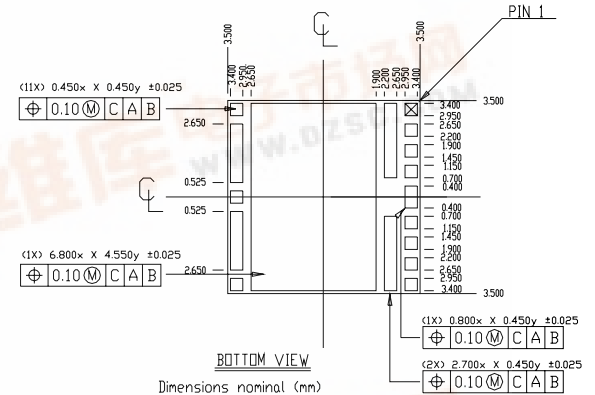
7mm x 7mm LGA Package Outline:

Dimensions in mm

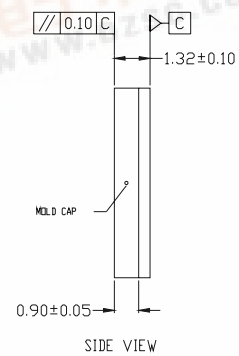
Top view



Bottom view



Side view



Caution! ESD sensitive device.

1. Absolute maximum ratings

Item	Parameter	Specifications					remarks
#		Symbol	Min	Typ	Max	Unit	
1	DC Supply Voltage	V_{BATT}	-0.5		6.0	V	No operation
2	DC Supply Current	I_{BATT}			2.4	A	
3	Power Control Voltage	V_{RAMP}	-0.5		3.0	V	
4	Transmit_Enable	TX_EN	-0.5		3.0	V	
5	Band Select	BS	-0.5		3.0	V	
6	Input RF Power	P_{IN}			13	dBm	
7	DC Voltage on RFin ports				4.0	V	
7	Operating Duty Cycle	δ			50	%	Frame Length = 4.6ms
8	Operating Temperature	T_A	-30		85	°C	
9	Storage Temperature	T_S	-55		155	°C	

Note: The amplifier will survive over the full range specified for any individual input, while other parameters are nominal and with no RF input.

2. Operating Parameters

Item	Parameter	Specifications					remarks
#		Symbol	Min	Typ	Max	Unit	
1	Supply Voltage	V_{BATT}	3.0	3.5	4.5	V	Normal operation
2	Supply current	$I_{BATT\ off}$			10	μA	TX_EN = low
3	Analog Power Control Voltage Current Input capacitance Rise time	V_{RAMP} I_{RAMP}	0.2	15	1.7 10 20 2	V A pF μs	$V_{RAMP_MAX} = 1.7V$ V_{RAMP} from 0.2V to V_{RAMP_MAX} , P_{OUT} from P_{OUT_MIN} to P_{OUT_MAX}
4	Transmit Enable TX_EN on TX_EN off Current	TX_EN	1.8 0		3.0 0.5 10	V V μA	Logic High: PA on Logic Low: PA off
5	Band Select High Low Current	BS	1.8 0		3.0 0.5 10	V V μA	Logic High: DCS/PCS Logic Low: GSM850/900

3. GSM850 Electrical Characteristics

Conditions unless otherwise stated: $T_A=25^\circ\text{C}$, $Z_S=Z_L=50\Omega$; $V_{\text{BATT}}=3.5\text{V}$; BS=low; TX_EN=high; $P_{\text{IN}}=5\text{dBm}$,
Duty Cycle = 25%, Pulse Width = 1154 μs , $V_{\text{RAMP}}=V_{\text{RAMP_MAX}}$

Item		Specifications					
#	Parameter	Symbol	Min	Typ	Max	Unit	remarks
1	Frequency range	$f_{\text{MIN}}\dots f_{\text{MA}}$	824		849	MHz	
2	Input power	P_{IN}	2	5	8	dBm	
3	Input impedance			50		Ω	TX_EN = low or high
	Input VSWR			1.5:1	2.5:1		$0.2\text{V} \leq V_{\text{RAMP}} \leq V_{\text{RAMP_MAX}}$
4	Load impedance			50		Ω	
5	Load mismatch stability All angles All spurious < -36 dBm, RBW=3MHz	VSWR	8:1				Set V_{RAMP} where $P_{\text{OUT}} \leq 34.2\text{dBm}$ into 50 Ohm load
6	Load mismatch ruggedness All angles No damage or permanent degradation	VSWR	10:1				Set V_{RAMP} where $P_{\text{OUT}} \leq 34.2\text{dBm}$ into 50 Ohm load
7	Forward isolation			-40	-30	dBm	TX_EN = low, $P_{\text{IN}} = 8\text{dBm}$
8	Crossover isolation						Measured @ high band port
	2nd harmonic			-25	-20	dBm	$P_{\text{OUT}} \leq P_{\text{OUT_MAX}}$ @ low band port
9	Harmonics						$P_{\text{OUT}} \leq 34.2\text{dBm}$
	2nd harmonic			-20	-10	dBm	
	3rd harmonic			-20	-15	dBm	
	4th ... 8th harmonic				-5	dBm	
10	Maximum output power $824\text{ MHz} \leq f \leq 849\text{ MHz}$	$P_{\text{OUT_MAX}}$	34.2	35		dBm	Nominal conditions
			32.5			dBm	$V_{\text{BATT}} = 3.0\text{V}$, $T_A = 85^\circ\text{C}$
11	Minimum output power	$P_{\text{OUT_MIN}}$			0	dBm	TX_EN=High, $V_{\text{RAMP}}=0.2\text{V}$, $P_{\text{IN}}=8\text{dBm}$
12	Power added efficiency	PAE	45	53		%	$P_{\text{OUT}} = P_{\text{OUT_MAX}}$
13	Power supply current	I_{BAT}	1.3	1.8	2.3	A	DC current at $P_{\text{OUT}} = P_{\text{OUT_MAX}}$
14	Output noise power, BW=100kHz						$P_{\text{OUT}} = P_{\text{OUT_MAX}}$
	869 MHz... 894 MHz			-85	-82	dBm	$f_0 = 849\text{ MHz}$
15	Slope $P_{\text{OUT}}/V_{\text{RAMP}}$				250	dB/V	$P_{\text{OUT}} > 0\text{dBm}$

4. GSM900 Electrical Characteristics

Conditions unless otherwise stated: $T_A=25^\circ\text{C}$, $Z_S=Z_L=50\Omega$; $V_{BATT}=3.5\text{V}$; BS=low; TX_EN=high; $P_{IN}=5\text{dBm}$,
Duty Cycle = 25%, Pulse Width = 1154 μs , $V_{RAMP}=V_{RAMP_MAX}$

Item		Specifications					
#	Parameter	Symbol	Min	Typ	Max	Unit	remarks
1	Frequency range	$f_{MIN}...f_{MA}$	880		915	MHz	
2	Input power	P_{IN}	2	5	8	dBm	
3	Input impedance			50		Ω	TX_EN = low or high
	Input VSWR			1.5:1	2.5:1		$0.2\text{V} \leq V_{RAMP} \leq V_{RAMP_MAX}$
4	Load impedance			50		Ω	
5	Load mismatch stability All angles All spurious < -36 dBm, RBW=3MHz	VSWR	8:1				Set V_{RAMP} where $P_{OUT} \leq 34.2\text{dBm}$ into 50 Ohm load
6	Load mismatch ruggedness All angles No damage or permanent degradation	VSWR	10:1				Set V_{RAMP} where $P_{OUT} \leq 34.2\text{dBm}$ into 50 Ohm load
7	Forward isolation			-40	-30	dBm	TX_EN = low, $P_{IN} = 8\text{dBm}$
8	Crossover isolation						Measured @ high band port
	2nd harmonic			-25	-20	dBm	$P_{OUT} \leq P_{OUT_MAX}$ @ low band port
9	Harmonics						$P_{OUT} \leq 34.2\text{dBm}$
	2nd harmonic			-20	-10	dBm	
	3rd harmonic			-20	-15	dBm	
	4th ... 8th harmonic				-5	dBm	
10	Maximum output power $880\text{ MHz} \leq f \leq 915\text{ MHz}$	P_{OUT_MAX}	34.2	35		dBm	Nominal conditions
			32.5			dBm	$V_{BATT} = 3.0\text{V}$, $T_A = 85^\circ\text{C}$
11	Minimum output power	P_{OUT_MIN}			0	dBm	TX_EN=High, $V_{RAMP}=0.2\text{V}$, $P_{IN}=8\text{dBm}$
12	Power added efficiency	PAE	50	58		%	$P_{OUT} = P_{OUT_MAX}$
13	Power supply current	I_{BAT}	1.2	1.7	2.3	A	DC current at $P_{OUT} = P_{OUT_MAX}$
14	Output noise power, BW=100kHz 925 MHz ... 935 MHz 935 MHz ... 960 MHz			-80	-72	dBm	$P_{OUT} = P_{OUT_MAX}$ $f_0 = 915\text{ MHz}$
				-85	-82	dBm	$f_0 = 915\text{ MHz}$
15	Slope P_{OUT}/V_{RAMP}				250	dB/V	$P_{OUT}>0\text{dBm}$

5. DCS Electrical Characteristics

Conditions unless otherwise stated: $T_A=25^\circ\text{C}$, $Z_S=Z_L=50\Omega$; $V_{\text{BATT}}=3.5\text{V}$; BS=high; TX_EN=high; $P_{\text{IN}}=5\text{dBm}$,
Duty Cycle = 25%, Pulse Width = 1154 μs , $V_{\text{RAMP}}=V_{\text{RAMP_MAX}}$

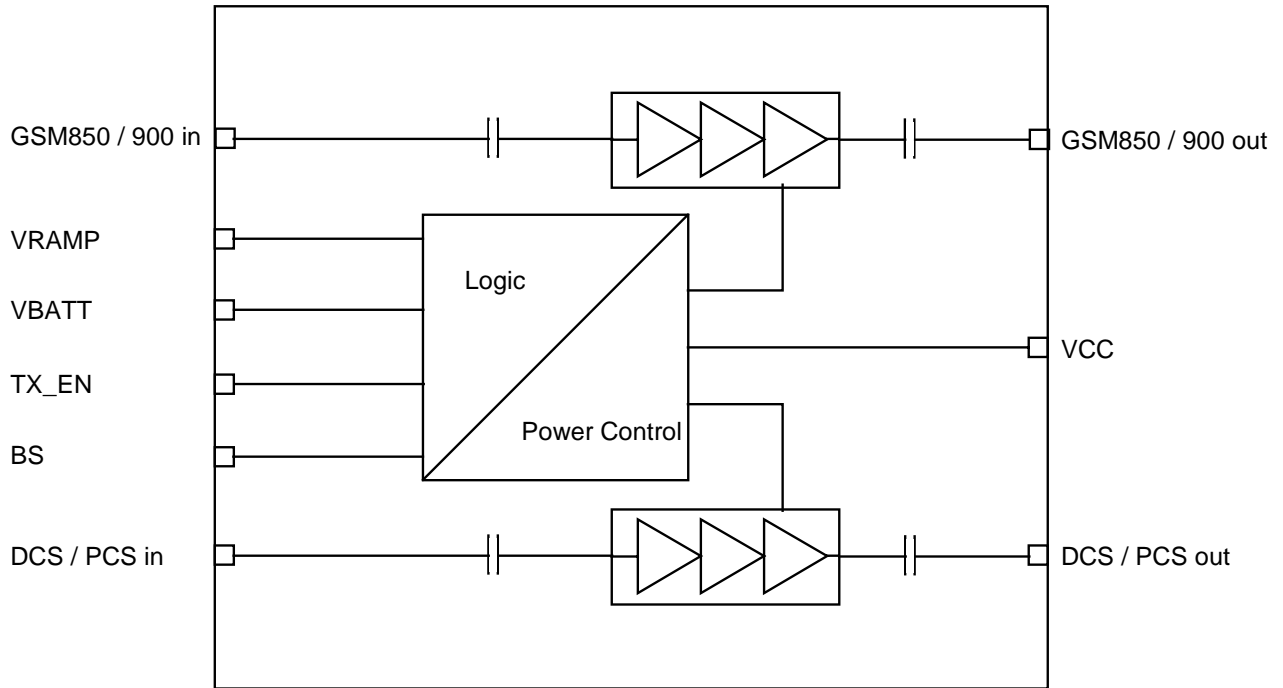
Item		Specifications					
#	Parameter	Symbol	Min	Typ	Max	Unit	remarks
1	Frequency range	$f_{\text{MIN}} \dots f_{\text{MA}}$	1710		1785	MHz	
2	Input power	P_{IN}	2	5	8	dBm	
3	Input impedance			50		Ω	TX_EN = low or high
	Input VSWR			1.5:1	2.5:1		$0.2\text{V} \leq V_{\text{RAMP}} \leq V_{\text{RAMP_MAX}}$
4	Load impedance			50		Ω	
5	Load mismatch stability All angles All spurious < -36 dBm, RBW=3MHz	VSWR	8:1				Set V_{RAMP} where $P_{\text{out}} \leq 32 \text{ dBm}$ into 50 Ohm load
6	Load mismatch ruggedness All angles No damage or permanent degradation	VSWR	10:1				Set V_{RAMP} where $P_{\text{out}} \leq 32 \text{ dBm}$ into 50 Ohm load
7	Forward isolation			-35	-30	dBm	TX_EN = low, $P_{\text{IN}} = 8\text{dBm}$
8	Harmonics						$P_{\text{OUT}} \leq 32\text{dBm}$
	2nd harmonic			-20	-10	dBm	
	3rd harmonic			-25	-15	dBm	
	4th ... 8th harmonic				-5	dBm	
9	Maximum output power	$P_{\text{OUT_MAX}}$	32	33		dBm	Nominal conditions
			30.5				dBm
10	Minimum output power	$P_{\text{OUT_MIN}}$			-5	dBm	TX_EN=High, $V_{\text{RAMP}}=0.2\text{V}$, $P_{\text{IN}} = 8\text{dBm}$
11	Power added efficiency	PAE	43	50		%	$P_{\text{OUT}} = P_{\text{OUT_MAX}}$
12	Power supply current	I_{BAT}	0.8	1.3	1.5	A	DC current at $P_{\text{OUT}} = P_{\text{OUT_MAX}}$
13	Output noise power, BW=100kHz 1805 MHz ... 1880 MHz			-83	-77	dBm	$P_{\text{OUT}} = P_{\text{OUT_MAX}}$ $f_0 = 1785\text{MHz}$
14	Slope $P_{\text{OUT}}/V_{\text{RAMP}}$				290	dB/V	$P_{\text{OUT}} > -5\text{dBm}$

6. PCS Electrical Characteristics

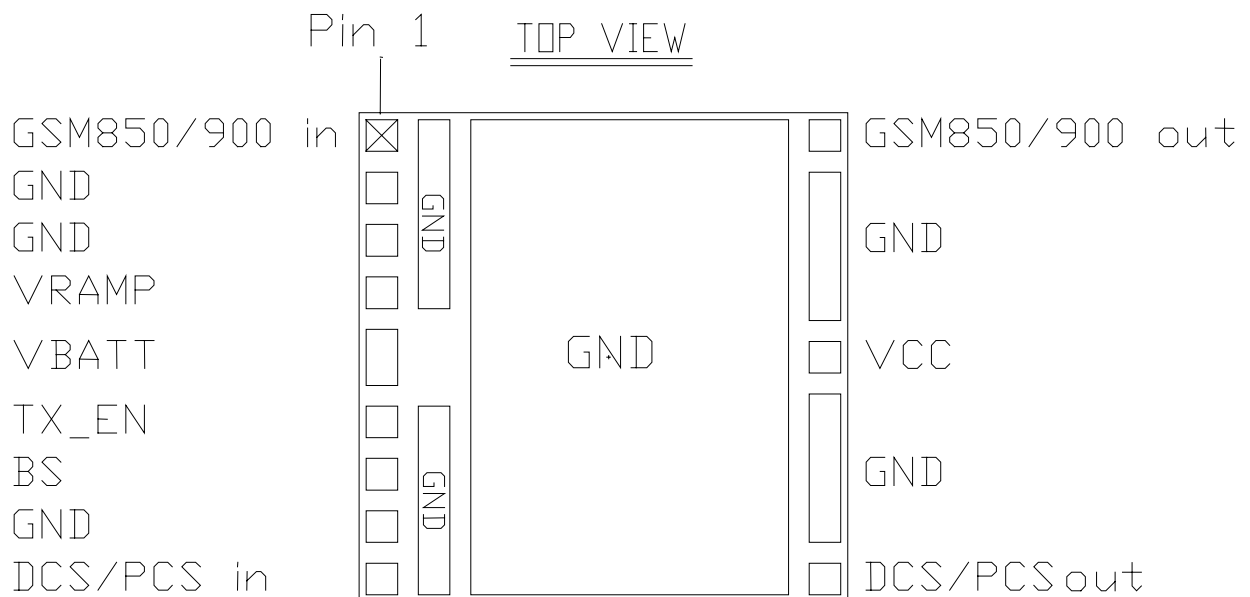
Conditions unless otherwise stated: $T_A=25^\circ\text{C}$, $Z_S=Z_L=50\Omega$; $V_{\text{BATT}}=3.5\text{V}$; BS=high; TX_EN=high; $P_{\text{IN}}=5\text{dBm}$,
Duty Cycle = 25%, Pulse Width = 1154 μs , $V_{\text{RAMP}}=V_{\text{RAMP_MAX}}$

Item		Specifications					
#	Parameter	Symbol	Min	Typ	Max	Unit	remarks
1	Frequency range	$f_{\text{MIN}}\dots f_{\text{MA}}$	1850		1910	MHz	
2	Input power	P_{in}	2	5	8	dBm	
3	Input impedance			50		Ω	TX_EN = low or high
	Input VSWR			1.5:1	2.5:1		$0.2\text{V} \leq V_{\text{RAMP}} \leq V_{\text{RAMP_MAX}}$
4	Load impedance			50		Ω	
5	Load mismatch stability All angles All spurious < -36 dBm, RBW=3MHz	VSWR	8:1				Set V_{RAMP} where $P_{\text{out}} \leq 32\text{ dBm}$ into 50 Ohm load
6	Load mismatch ruggedness All angles No damage or permanent degradation	VSWR	10:1				Set V_{RAMP} where $P_{\text{out}} \leq 32\text{ dBm}$ into 50 Ohm load
7	Forward isolation			-35	-30	dBm	TX_EN = low, $P_{\text{IN}} = 8\text{dBm}$
8	Harmonics						$P_{\text{OUT}} \leq 32\text{dBm}$
	2nd harmonic			-20	-10	dBm	
	3rd harmonic			-25	-15	dBm	
	4th ... 8th harmonic				-5	dBm	
9	Maximum output power	$P_{\text{OUT_MAX}}$	32	33		dBm	Nominal conditions
			30				dBm
10	Minimum output power	$P_{\text{OUT_MIN}}$			-5	dBm	TX_EN=High, $V_{\text{RAMP}}=0.2\text{V}$, $P_{\text{IN}} = 8\text{dBm}$
11	Power added efficiency	PAE	43	50		%	$P_{\text{OUT}} = P_{\text{OUT_MAX}}$
12	Power supply current	I_{BAT}	0.75	1.2	1.5	A	DC current at $P_{\text{OUT}} = P_{\text{OUT_MAX}}$
13	Output noise power, BW=100kHz 1930 MHz ... 1990 MHz			-83	-77	dBm	$P_{\text{OUT}} = P_{\text{OUT_MAX}}$ $f_0 = 1910\text{MHz}$
14	Slope $P_{\text{OUT}}/V_{\text{RAMP}}$				290	dB/V	$P_{\text{OUT}} > -5\text{dBm}$

7. Block Diagram

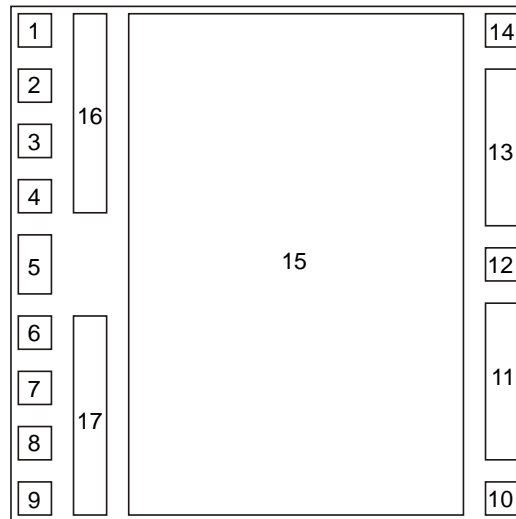


8. Pin Out



9. Pinning

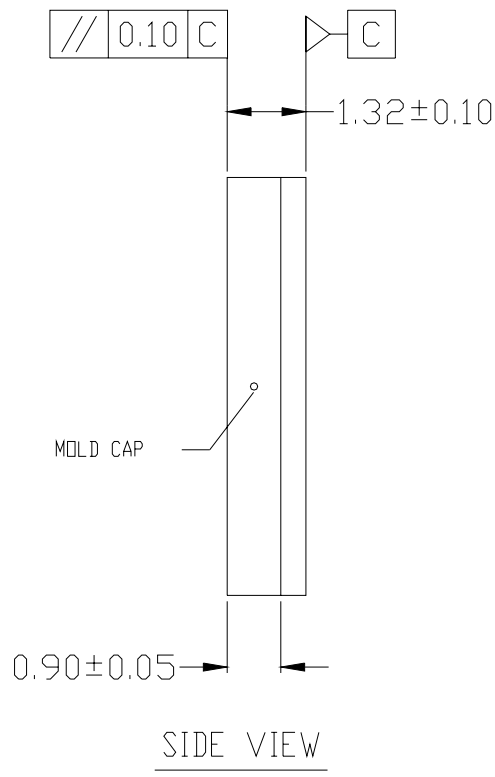
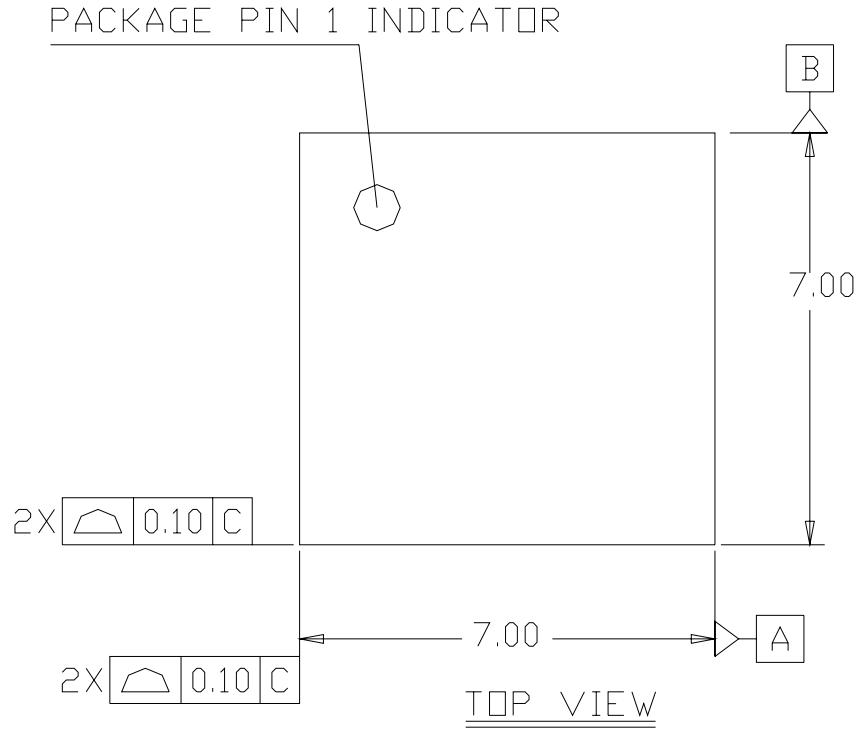
TQM7M4022 Footprint
Top View

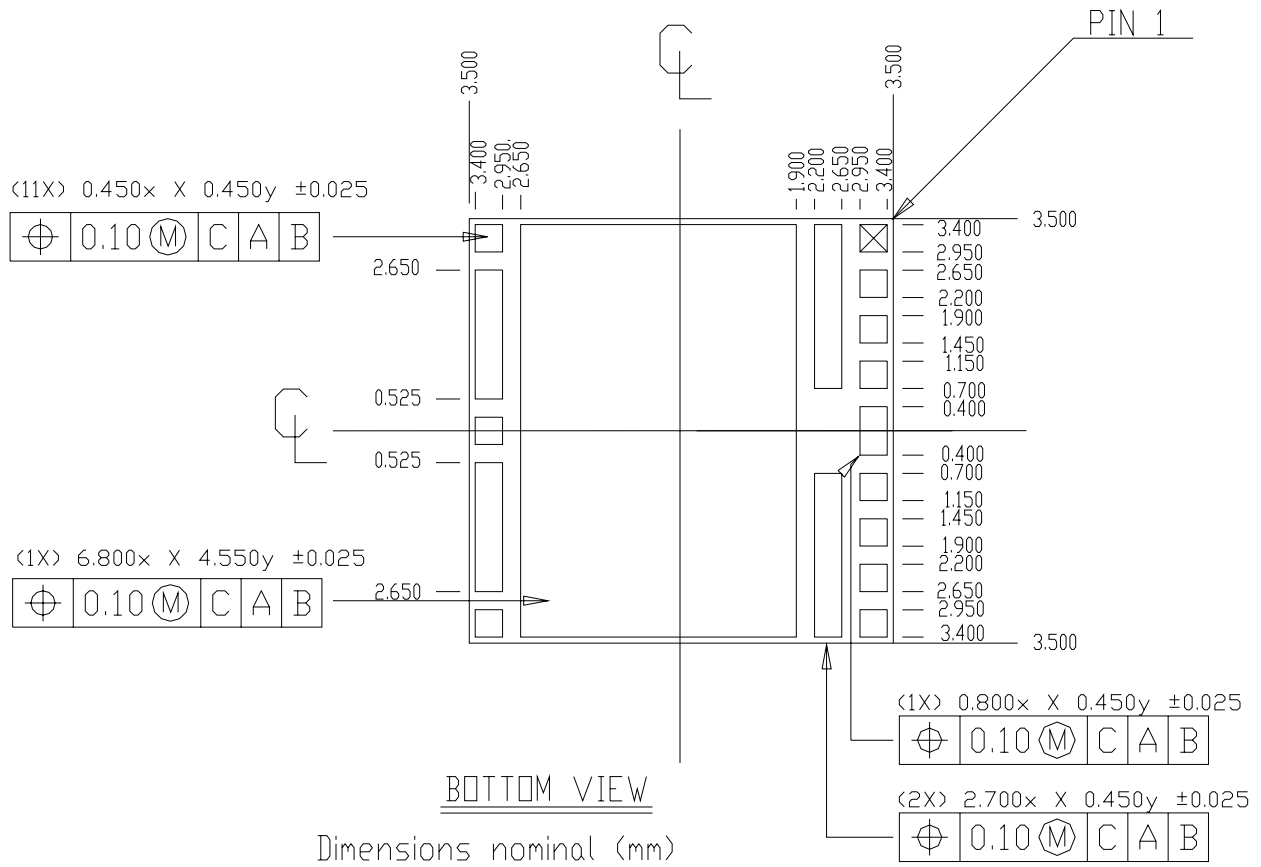


Pin #	Description	Function
1	GSM850 / 900 in	GSM850 / GSM900 RF input
2	GND	Ground
3	GND	Ground
4	VRAMP	DAC Control Signal for output power setting, nominal 0.2 .. 1.7 V
5	VBATT	Battery supply voltage, typ. 3.0 – 4.5 V, nom. 1.6A
6	TX_EN	Digital Transmit Enable Signal. When activated (TX_EN = high), all bands of the PA will be enabled for operation.
7	BS	Band Select Pin (Low -> GSM850/GSM900 mode active; High -> DCS/PCS mode active)
8	GND	Ground
9	DCS / PCS in	DCS/PCS RF input
10	DCS / PCS out	DCS / PCS RF output
11	GND	Ground
12	VCC	Internal Voltage
13	GND	Ground
14	GSM850 / 900 out	GSM850 / GSM900 RF output
15, 16, 17	GND	Ground

10. Package Outline

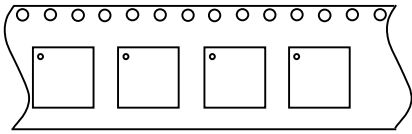
(all dimensions in mm):





11 Tape and Reel Information

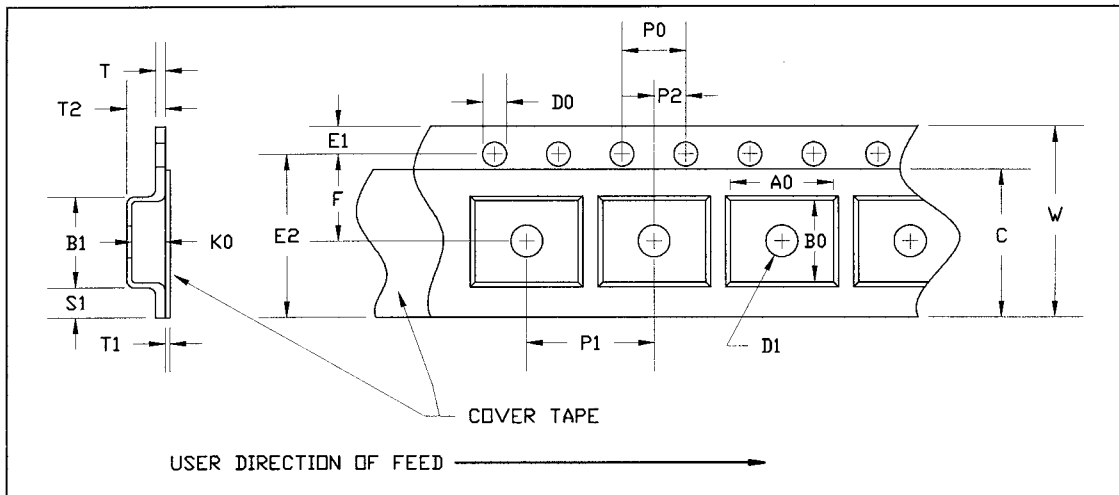
Module Orientation



MODULE 7X7

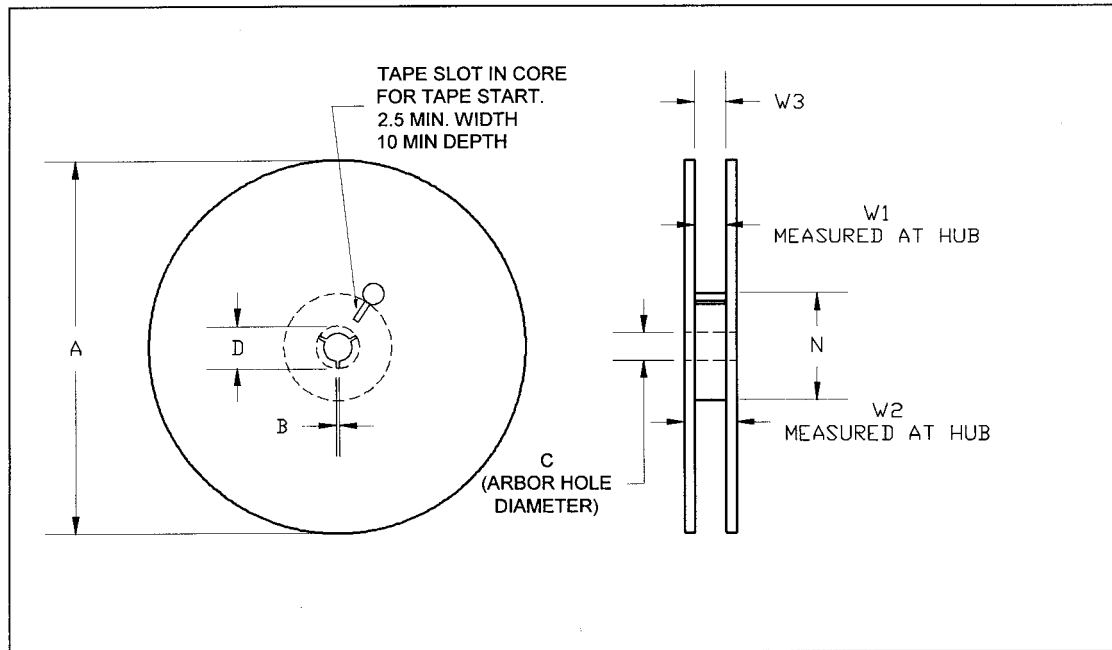
User Direction of Feed →

Carrier and Cover Tape Physical Dimensions



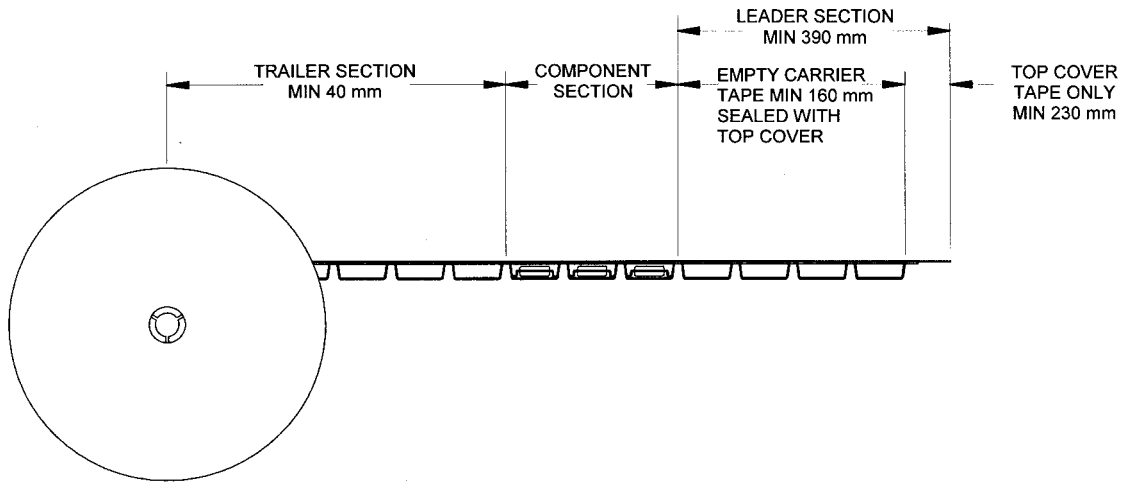
PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
CAVITY	BOTTOM HOLE DIAMETER	D1	0.059	1.50
PERFORATION	DIAMETER	D0	0.059	1.50
	PITCH	P0	0.157	4.00
	POSITION	E1	0.069	1.75
CARRIER TAPE	THICKNESS	T	0.012	0.30
COVER TAPE	THICKNESS	T1	0.002	0.056
CAVITY	LENGTH	A0	0.291	7.4
	WIDTH	B0	0.291	7.4
	DEPTH	K0	0.079	2.0
	PITCH	P1	0.472	12.00
DISTANCE BETWEEN CENTERLINE	CAVITY TO PERFORATION LENGTH DIRECTION	P2	0.079	2.00
	CAVITY TO PERFORATION WIDTH DIRECTION	F	0.295	7.50
COVER TAPE	WIDTH	C	0.524	13.30
CARRIER TAPE	WIDTH	W	0.630	16.00

Reel Physical dimensions



PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
FLANGE	DIAMETER	A	12.992	330.0
	THICKNESS	W2	0.874	22.2
	SPACE BETWEEN FLANGE	W1	0.661	16.8
HUB	OUTER DIAMETER	N	4.016	102.0
	ARBOR HOLE DIAMETER	C	0.512	13.0
	KEY SLIT WIDTH	B	0.079	2.0
	KEY SLIT DIAMETER	D	0.787	20.0

Completed Tape and Reel Assembly



Product label, Mfg Label and ESD label are placed on the flange opposite to the sprockets in the carrier tape

