TriQuint SEMICONDUCTOR

TQM 7M4014

3V Quad-Band GSM850/GSM900/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. It includes internal closed-loop power control. No external matching or bias components are required. Despite its very compact size, the module has exceptional efficiency in all bands.
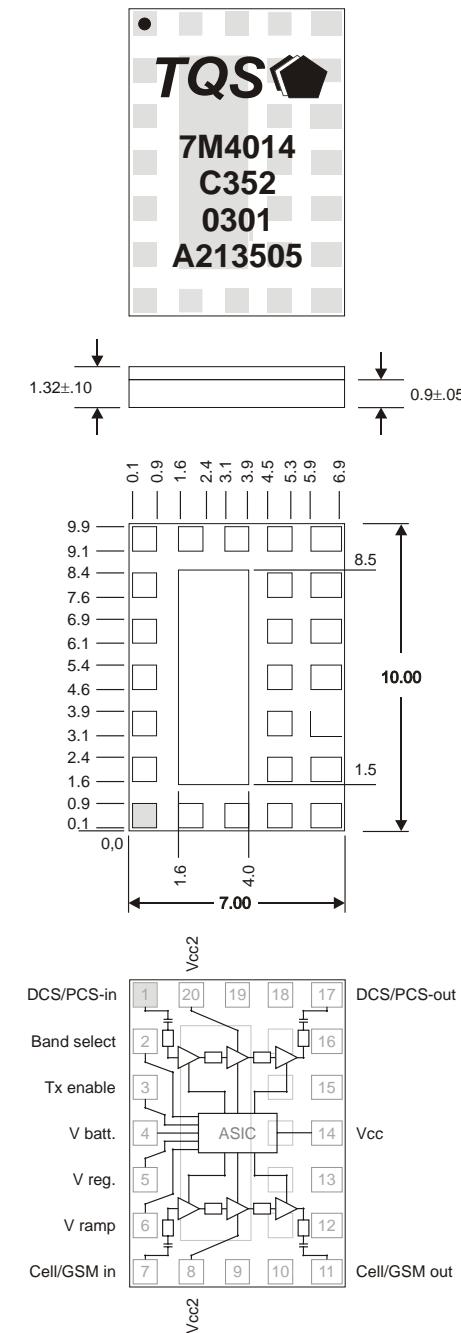
Features:

- **Very compact size – 10×7×1.4 mm³.**
- **High efficiency – typical GSM850 47%, GSM900 56%, DCS 51%, PCS 50%.**
- **Positive supply voltage – 2.9 to 4.5 V.**
- **50 Ω input and output impedances.**
- **GPRS class 12 compatible.**
- **CMOS band select and internal closed-loop power control.**
- **High-reliability InGaP technology.**
- **Ruggedness 10:1.**
- **Few external components.**

Description:

The module incorporates two highly-integrated InGaP power amplifier die with a CMOS controller. Each amplifier has three gain stages with on-die interstage matching implemented with a high Q passives technology for optimal performance. The CMOS controller implements a fully integrated closed-loop power control within the module. This eliminates the need for any external couplers, power detectors, current sensing etc., to assure the output power level. The latter is set directly from the V_{ramp} input from the DAC. The module has Tx enable and band select inputs. Excellent performance is achieved across the 824 – 849 MHz, 880 – 915 MHz, 1710 – 1785 MHz, and 1850 – 1910 MHz bands. Module construction is a low-profile overmolded land-grid array on laminate.

Package Outline:

Dimensions in mm

Absolute Maximum Ratings:

Parameter	Symbol	Min.	Max.	Units
Supply voltage	V_{bat}	-0.3	6.0	V_{dc}
DC supply current	I_{bat}		2.4	A
Power control voltage	V_{ramp}	-0.3	2.2	V
Duty cycle at max. power	δ		50	%
Output load	VSWR		10:1	
Operating case temperature	T_c	-25	85	ºC
Storage temperature	T_s	-55	150	ºC
Input power	P_{in}		11.5	dBm

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

Operating Parameters:

Parameter		Symbol	Min.	Typ.	Max.	Units
Supply voltage		V_{bat}	2.9	3.5	4.5	V_{dc}
Supply current	Tx_{en} High	I_{bat}		1.8		A
Band select voltage	GSM	V_{bs}-L	0		0.5	V
	DCS/PCS	V_{bs}-H	2		3.0	
Tx enable input	Low	Tx_{en}	0		0.5	V
	High		2		3.0	
Regulator voltage		V_{reg}	2.7	2.8	2.9	V
Regulator current	Tx_{en} Low	I_{reg}		10		μA
	Tx_{en} High			160	250	
Leakage current Tx_{en} Low, Vramp = 0.19V, BS=Low		I_l		1	10	μA
Leakage current Tx_{en} Low, Vramp = 0.19V, BS=High		I_l			40	μA

Moisture Sensitivity Levels:

Required Moisture Sensitivity Level is MSL 3, 240C minimum. Moisture sensitivity classification will be conducted in accordance with JEDEC J_STD_020B. Table 5.1 of JEDEC J_STD_020B identifies the floor life for given levels of MSL classification. Floor life is defined as the time from removal of a device from dry pack until it absorbs sufficient moisture to be at risk during re-flow soldering.

Typical Performance:

GSM850 Electrical Characteristics:

Test conditions (unless noted): V_{bat} = +3.5 V, V_{ramp} = 1.6 V, P_{in} = 2 dBm, Duty Cycle =25%, T_c = 25ºC

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Frequency Range	f	824		849	MHz	
Input Power for P_{out} max.	P_{in}	0.0	2.0	5.0	dBm	
Output Power	P_{out}	33.0	34.5		dBm	
		31.0	32.6			V_{bat} = 2.9 V, P_{in} = P_{in} min. $T_{min} \leq T_c \leq T_{max}$
Power Added Efficiency	η	40	47		%	P_{out} = P_{out} max.
Power Control Voltage	V_{ramp}	0.2		1.6	V	
Power Control Current	I_{ramp}			50	μA	
Power Control Range		33	36		dB	V_{ramp} min $\leq V_{ramp} \leq V_{ramp}$ max
Input VSWR			1.5:1	2.5:1		$0 \leq P_{out} \leq 34.5$ dBm
Forward Isolation	Iso		-45	-30	dBm	Tx_{en} = L, $P_{in} \leq P_{in}$ max
Harmonics	$2f_0$		-23	-5.0	dBm	
	$3f_0$		-20	-10.0		
	> $3f_0$			-10.0		
Rx noise power: 869 - 879 MHz			-84	-74.0	dBm	RBW = 100 kHz
879 - 894 MHz			-85	-82.0		P_{out} > 5 dBm
Stability				8:1		All phase angles $P_{out} \leq 34.2$ dBm
Ruggedness				10:1		All phase angles $P_{out} \leq 34.2$ dBm

GSM900 Electrical Characteristics:

Test conditions (unless noted): V_{bat} = +3.5 V, V_{ramp} = 1.6 V, P_{in} = 2 dBm, Duty Cycle =25%, T_c = 25ºC

| Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Frequency Range	f	880		915	MHz	
Input Power for P_{out} max.	P_{in}	0.0	2.0	5.0	dBm	
Output Power	P_{out}	34.5	35.0		dBm	
		32.0	33.5			V_{bat} = 2.9 V, P_{in} = P_{in} min. $T_{min} \leq T_c \leq T_{max}$
Power Added Efficiency	η	50	56		%	P_{out} = P_{out} max.
Power Control Voltage	V_{ramp}	0.2		1.6	V	
Power Control Current	I_{ramp}			50	µA	
Power Control Range		33	36		dB	V_{ramp} min $\leq V_{ramp} \leq V_{ramp}$ max
Input VSWR				2.5:1		$0 \leq P_{out} \leq 34.5$ dBm
Forward Isolation	Iso		-45	-30	dBm	Tx_{en} = L, $P_{in} \leq P_{in}$ max
Cross-band Isolation	Iso		-21	-19	dBm	P_{in} = P_{in} max., V_{bs} = Low $1710 \leq f \leq 1785$ MHz
Harmonics	$2f_0$		-25	-5.0	dBm	
	$3f_0$		-28	-15.0		
	$> 3f_0$			-10.0		
Rx noise power: 925 - 935 MHz			-83	-74.0	dBm	RBW = 100 kHz
935 - 960 MHz			-84	-82.0		P_{out} > 5 dBm
Stability				8:1		All phase angles $P_{out} \leq 34.2$ dBm
Ruggedness				10:1		All phase angles $P_{out} \leq 34.2$ dBm
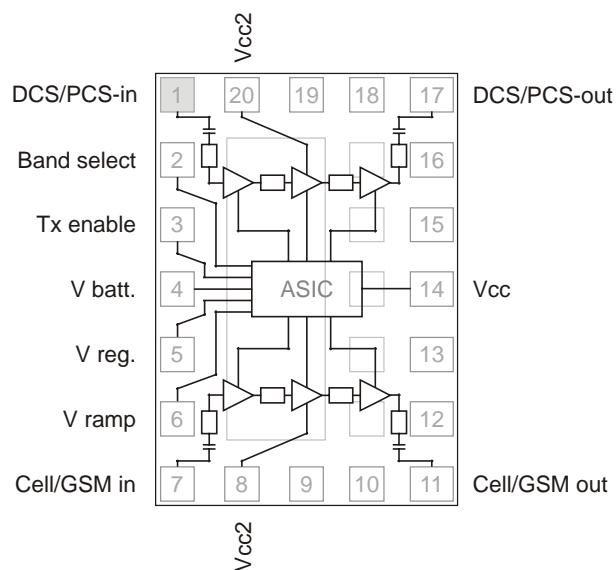
DCS1800/PCS1900 Electrical Characteristics:

Test conditions (unless noted): V_{bat} = +3.5 V, V_{ramp} = 1.6 V, P_{in} = 2 dBm, Duty Cycle = 25%, T_c = 25ºC

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Frequency Range	f	1710 1850		1785 1910	MHz	
Input Power for P_{out} max.	P_{in}	0.0	2.0	5.0	dBm	
Output Power	P_{out}				dBm	
1710 - 1785 MHz		32.0	33.3			
		29.5	31.2			V_{bat} = 2.9 V, P_{in} = P_{in} min. $T_{min} \leq T_c \leq T_{max}$
1850 - 1910 MHz		31.5	32.5			
		29.5	30.6			V_{bat} = 2.9 V, P_{in} = P_{in} min. $T_{min} \leq T_c \leq T_{max}$
Power Added Efficiency	η				%	P_{out} = P_{out} max.
1710 - 1785 MHz		45	51			T_c = 25° C
1850 - 1910 MHz			50			
Power Control Voltage	V_{ramp}	0.2		1.6	V	
Power Control Current	I_{ramp}			50	μA	
Power Control Range		33	36		dB	V_{ramp} min $\leq V_{ramp} \leq V_{ramp}$ max
Input VSWR			2.0:1	2.5:1		5 $\leq$ Pout $\leq P_{out}$ max
Forward Isolation	Iso		-38	-30	dBm	Tx_{en} = H, $P_{in} \leq P_{in}$ max
Harmonics	$2f_0$		-20	-5.0	dBm	
	$3f_0$		-20	-5.0		
	$> 3f_0$			-10.0		
Rx noise power			-83.0	-77.0	dBm	RBW = 100 kHz P_{in} = P_{in} min., P_{out} = P_{out} max.
Stability				8:1		All phase angles $P_{out} \leq$ 32 dBm
Ruggedness				10:1		All phase angles $P_{out} \leq$ 32 dBm

Pin Out:
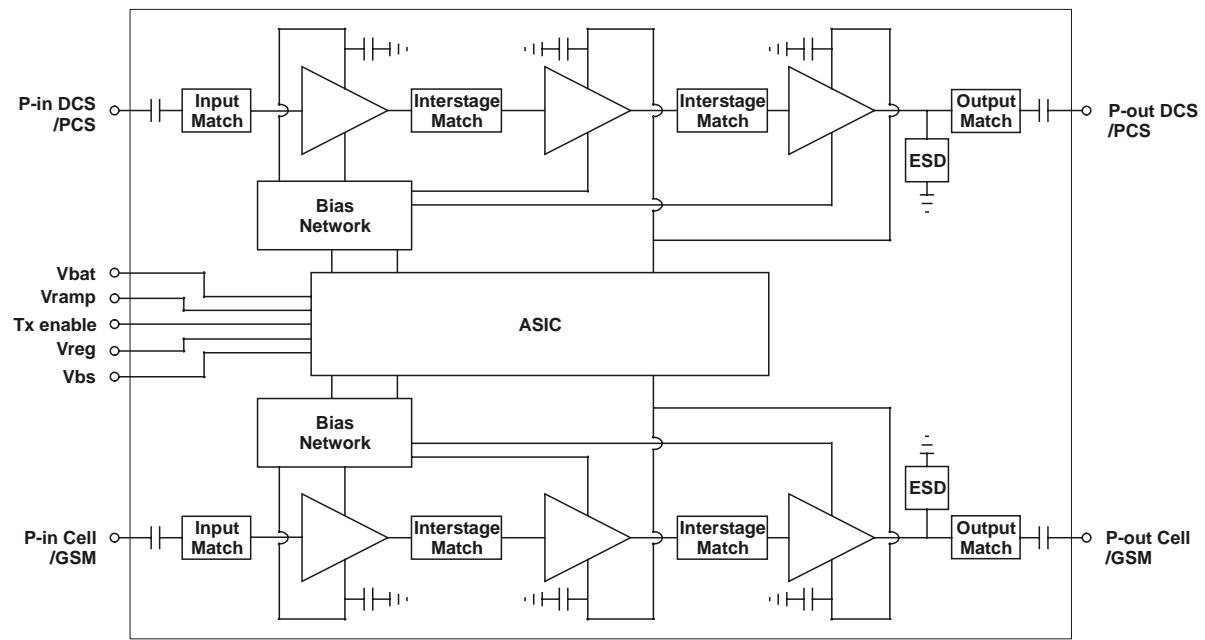
Top view
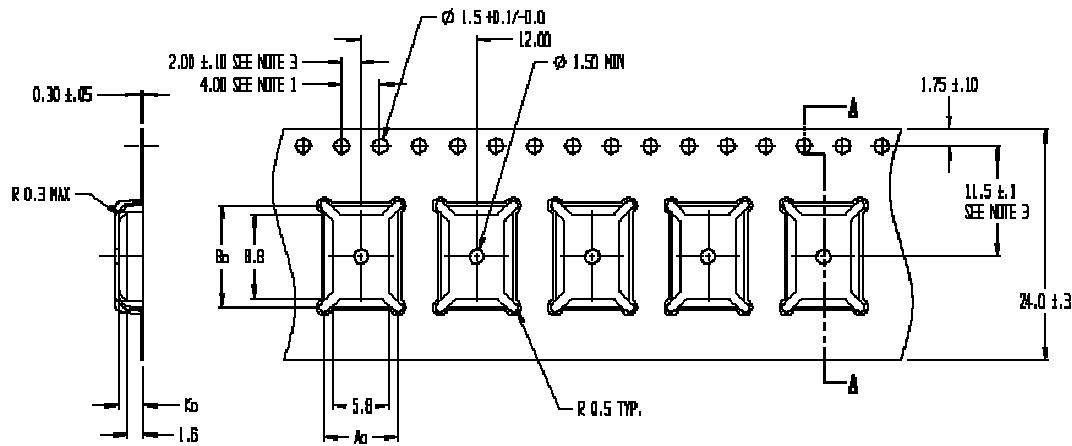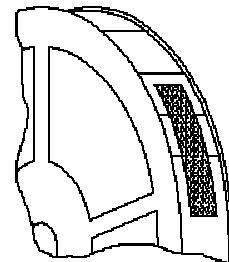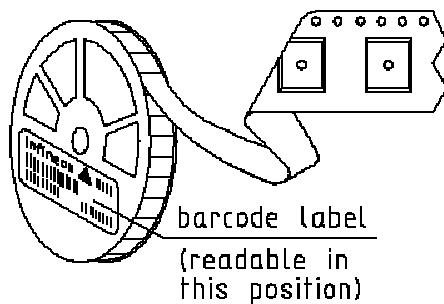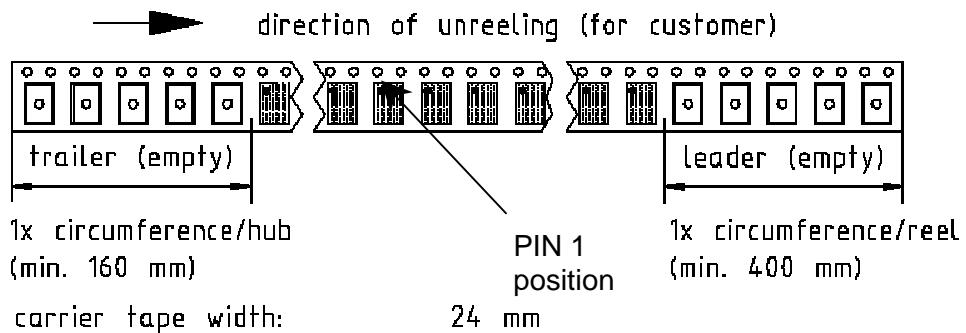
Pin	Symbol	Description
1	RFin - DCS/PCS	DCS/PCS power in
2	V_{bs}	Band select voltage
3	Tx_{en}	Transmit enable
4	V_{bat}	Supply voltage
5	V_{reg}	Regulated voltage input
6	V_{ramp}	DAC voltage input
7	RF_{in} - Cell/GSM	GSM850/900 power in
8	$V_{cc}2$	Vcc voltage input
11	RF_{out} - Cell/GSM	GSM850/900 power out
14	V_{cc}	V_{cc} voltage output
17	RF_{out} - DCS/PCS	DCS/PCS power out
20	$V_{cc}2$	Vcc voltage input

All other pins are ground

Schematic:

Tape and Reel Information:

direction of unreeling (for customer)

trailer (empty)

1x circumference/hub
(min. 160 mm)

carrier tape width:

PIN 1
position

24 mm

leader (empty)

1x circumference/reel
(min. 400 mm)

barcode label
(readable in
this position)

fixing of the tape end

Ø 1.5 +0.1/-0.0

12.00

Ø 1.50 MIN

2.00 ±.10 SEE NOTE 3

4.00 SEE NOTE 1

1.75 ±.10

0.30 ±.05

R 0.3 MAX

11.5 ±.1
SEE NOTE 3

Bo   8.8

24.0 ±.3

Ko

1.6

5.8

Ao

R 0.5 TYP.

A

A

SECTION A - A

Ao = 7.6
Bo = 10.6
Ko = 2.5

NOTES:
1. 10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE ±0.2
2. CAMBER IN COMPLIANCE WITH EIA 481
3. POCKET POSITION RELATIVE TO SPROCKET HOLE MEASURED
   AS TRUE POSITION OF POCKET, NOT POCKET HOLE

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