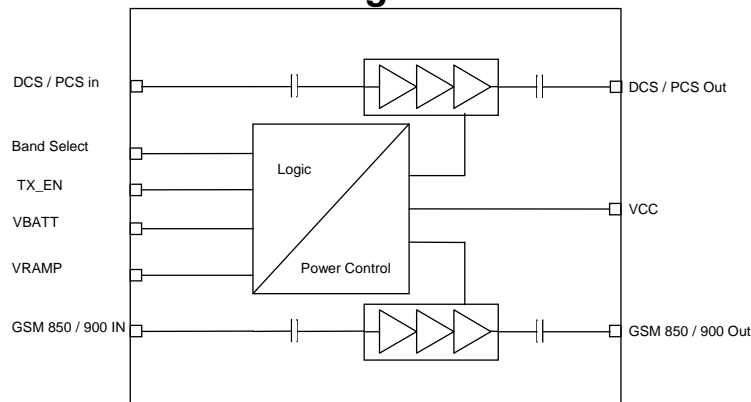


3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Functional Block Diagram



Product Description

The TQM7M4006 is an advanced, quad-band, ultra-compact, 3V power amplifier module designed for mobile handset applications. The module sets new standards in performance and size by employing the latest technologies in HBT power amplifier design, laminate design and CuFlip™ assembly technology. High-reliability is assured by InGaP HBT technology. This fully integrated module, in a minimal form factor, provides a simple 50 Ω interface on all input and output ports. It includes internal power control with wide dynamic range, and on-board reference voltage. No external matching or bias components are required. Despite its very compact size, the module has exceptional efficiency in all bands.

Incorporates two highly-integrated InGaP power amplifier die, a GaAs high Q passive matching die with a CMOS controller. All die are CuFlip™ mounted to minimize thermal excursions. Each amplifier has three gain stages with interstage matching implemented with a high Q passives technology for optimal performance. The CMOS controller implements a fully integrated power control circuit within the module, eliminating the need for external detection 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 and a highly-stable on-board reference voltage. 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.

Electrical Specifications

Parameter	850 Band			900 Band			DCS / PCS Band			Units
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
GSM Pout	34.2	35		34.2	35		32.5/32	33/32.5		dBm
Efficiency	44	52		50	57		44/44	51/51		%
Pin	1.5	5	8	1.5	5	8	1.5	5	8	dBm

Features

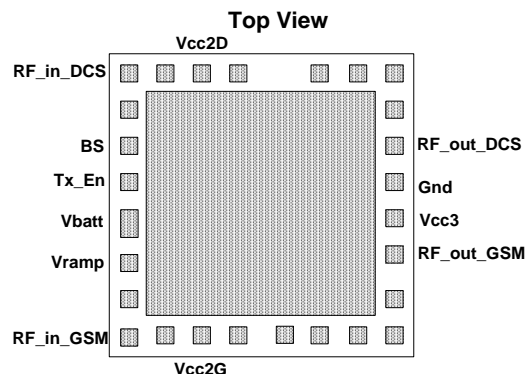
- Very compact size – 5×5×1.1 mm³.
- Positive supply voltage – 3.0 to 4.5 V.
- High efficiency – typical GSM850 52%, GSM900 57%, DCS 51%, PCS 51%.
- CMOS internal closed-loop power control.
- >55 dB dynamic control range.
- GPRS class 12 compatible.
- High-reliability InGaP technology.
- Ruggedness 10:1.
- 50 Ω input and output impedances.
- Few external components

Applications

- GSM handsets
- GSM wireless cards and data links

Package Style

Package Size: LGA 5 x 5 x 1.1 mm³



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3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Absolute Maximum Ratings

Symbol	Parameter	Absolute Maximum Value	Units
V _{BAT}	Supply Voltage	-0.5 to 5.5	VDC
I _{BAT}	DC Supply Current	2.5	A
V _{RAMP}	Power Control Voltage	-0.5 to V _{BAT}	V
δ	Duty Cycle at Max. Power	50	%
V _{SWR}	Output Load	10:1	
T _C	Case Temperature, Operating	-20 to +100	°C
T _{STG}	Storage Temperature	-55 to +150	°C
P _{IN}	Input Power	12	dBm
ESD ruggedness	HBM per EIA/JESD22-A114	2000	V
All ports	CDM per JESD22-C101	2000	V

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

Operating Parameters

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Supply Voltage- V _{BAT}		3.0	3.5	4.5	V
Supply Current- I _{BAT}			1.8		A
Band Select Voltage-	GSM V _{bs-} L	0		0.5	Vdc
	DCS/PCS V _{bs-} H	1.2		3.0	Vdc
TX Enable Input	Low V _{TX_EN-} L	0		0.5	Vdc
	High V _{TX_EN-} H	1.2		3.0	Vdc
Leakage Current - I _L	V _{TX_EN-} L, V _{RAMP} = 0.23V		1	10	μA
Load Impedances- Z ₀			50		Ω
Case Temperature- T _C		-20		+85	°C

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3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

GSM850/GSM900 Mode Characteristics

Standard Conditions: $V_{BATT}=3.5V$, $V_{ramp}=1.6V$, $P_{in}=5\text{ dBm}$, $TX_EN = H$, $BS = L$, $T_C = 25^\circ C$, Duty Cycle = 25%.

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency Range- f	GSM850	824		849	MHz
	GSM900	880		915	MHz
Input Power for Pout max.- P_{in}		1.5	5.0	8.0	dBm
Output Power- P_{out}	GSM850 Band	34.2	35.5		dBm
	GSM900 Band	34.2	35.2		dBm
Output Power Degradation	$V_{batt}=3.0V$, $P_{in}=5\text{dBm}$, $T_{min} < T_C < T_{max}$	32.5			dBm
Power Added Efficiency- η	GSM850 Band, $P_{out} = P_{out\ max}$	44	52		%
	GSM900 Band, $P_{out} = P_{out\ max}$	50	57		%
Power Control Voltage- V_{RAMP}	$V_{BAT_MIN} \leq V_{BAT} \leq V_{BAT_MAX}$	0.2		1.6	V
Power Control Range	$0.23V \leq V_{RAMP} \leq V_{RAMP_MAX}$		57		dB
Input VSWR	$5 \leq P_{out} \leq P_{out\ max}$				
	$V_{ramp} \leq 0.6V$			3.3:1	
	$V_{ramp} \geq 0.6V$			3.0:1	
Forward Isolation 1- Iso1	$V_{TX_EN} = L$, $P_{in} \leq P_{in_max}$		-32	-30	dBm
Forward Isolation 2- Iso2	$V_{TX_EN} = H$, $V_{RAMP} = 0.23V$		-23	-17	dBm
Harmonics:	$2f_0$		-20	-10	dBm
	$3f_0$		-20	-10	dBm
Rx Noise Power:	869 – 894 MHz RBW = 100 kHz; $5\text{dBm} < P_{OUT} < 34.2\ \text{dBm}$		-84	-81	dBm
	925 – 935 MHz RBW = 100 kHz; $5\text{dBm} < P_{out} < 34.2\ \text{dBm}$		-80	-74	dBm
	935 – 960 MHz RBW = 100 kHz; $5\text{dBm} < P_{out} < 34.2\ \text{dBm}$		-85	-82	dBm
Stability		8:1			
Ruggedness		10:1			
Cross Isolation – 2 nd Harmonic of GSM fundamental at DCS/PCS Port	$P_{in}=P_{in\ max}$, $V_{bs} = L$, $824 \leq \text{fundamental} \leq 915\ \text{MHz}$		-23	-17	dBm

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3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

DCS1800/PCS1900 Mode Characteristics

Standard Conditions: $V_{BATT}=3.5V$, $V_{ramp}=1.6V$, $P_{in}=5\text{ dBm}$, $TX_EN = H$, $BS = H$, $T_C = 25^\circ C$, Duty Cycle = 25%.

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Frequency Range- f		1710		1785	MHz
		1850		1910	MHz
Input Power for Pout max.- P_{in}		1.5	5.0	8.0	dBm
Output Power- P_{out}	1710 – 1785 MHz	32.5	33.0		dBm
	1850 – 1910 MHz	32.0	32.5		dBm
Output Power Degradation	$V_{batt}=3.0V$, $P_{in}=5\text{dBm}$, $T_{min} < T_C < T_{max}$				
		1710 – 1785 MHz	30.5		dBm
		1850 – 1910 MHz	30.5		dBm
Power Added Efficiency- η	$V_{RAMP} = 1.6\text{ VDC}$				
		1710 – 1785 MHz	44	51	%
		1850 – 1910 MHz	44	51	%
Power Control Voltage- V_{RAMP}	$V_{BAT_MIN} \leq V_{BAT} \leq V_{BAT_MAX}$	0.2		1.6	V
Power Control Range	$0.23\text{VDC} \leq V_{RAMP} \leq V_{RAMP_MAX}$		55		dB
Input VSWR	$0 \leq P_{out} \leq P_{out\ max}$			2.5:1	
Forward Isolation 1- Iso1	$V_{TX_EN}= L$, $P_{in}=5\text{dBm}$		-32	-30	dBm
Forward Isolation 2- Iso2	$V_{TX_EN}= H$, $V_{RAMP} = 0.23V$		-23	-17	dBm
Harmonics	$2f_0$		-20	-10	dBm
		$3f_0$		-20	-10
Rx Noise Power: 1805-1880MHz 1930-1990MHz	$RBW = 100\text{ kHz}$; $P_{IN} = P_{IN_min}$; $P_{OUT} \leq 32.5\text{ dBm}$		-83	-77.0	dBm
Stability			8:1		
Ruggedness			10:1		

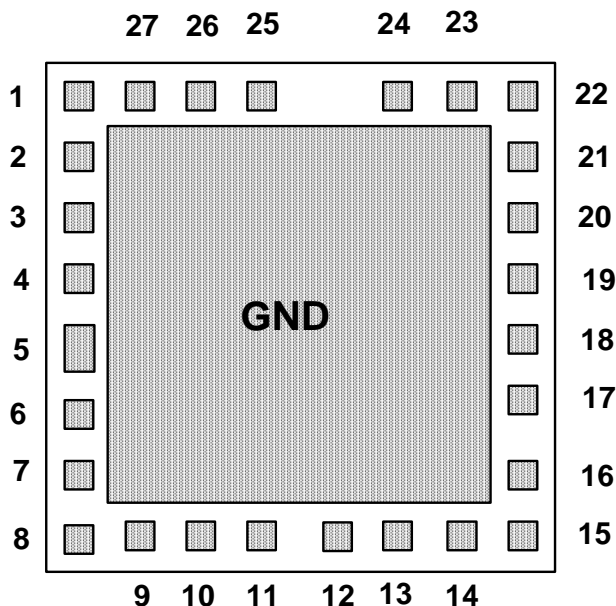
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3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Pin Out Diagram



Pin	Symbol	Description
1	RF _{in} - DCS/PCS	DCS/PCS power in
2	NC	No connect
3	V _{bs}	Band select input
4	Tx _{en}	Transmit enable
5	V _{bat}	Supply voltage
6	V _{ramp}	DAC voltage input
7	NC	No connect
8	RF _{in} - Cell/GSM	GSM850/900 power in
10	V _{cc2G}	V _{cc} voltage input
17	RF _{out} - Cell/GSM	GSM850/900 power out
18	V _{cc3}	V _{cc} voltage output
20	RF _{out} - DCS/PCS	DCS/PCS power out
26	V _{cc2D}	V _{cc} voltage input

All other pins are ground

3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

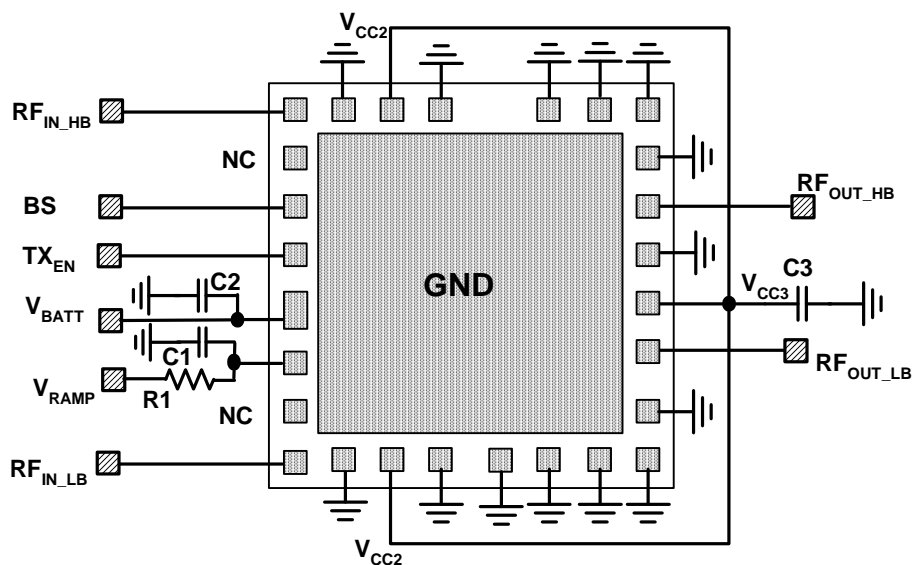
Logic Table

Operating Mode	Band Select	Tx Enable	Vramp
GMSK, High Band	High	High - Enabled	0.2 to 1.6 VDC
		Low - Disabled	
GMSK, Low Band	Low	High - Enabled	0.2 to 1.6 VDC
		Low - Disabled	
PA Off	X	Low	X

X- Don't Care

3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Test/Typical Application Circuit:



Bill of Material for TQM7M4006 Power Amplifier Module Test/Application Circuit¹

Component	Reference Designator	Part Number	Value	Size
Power Amplifier Module		TQM7M4006		28pin/5mm square
Capacitor (See note 2)	C1		TBD	TBD
Capacitor (See note 2)	C2		TBD	0402
Capacitor	C3		15p	0402
Resistor (See note 2)	R1		TBD	0402

Note 1: May vary due to printed circuit board layout and material

Note 2: Value of R1, C1 vary based on base-band. C2 depends on phone noise. Please see application note for further information.

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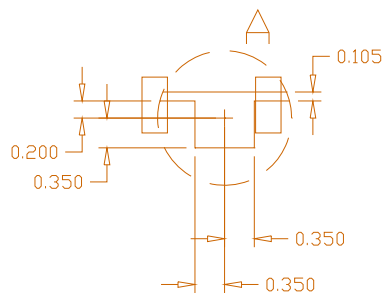
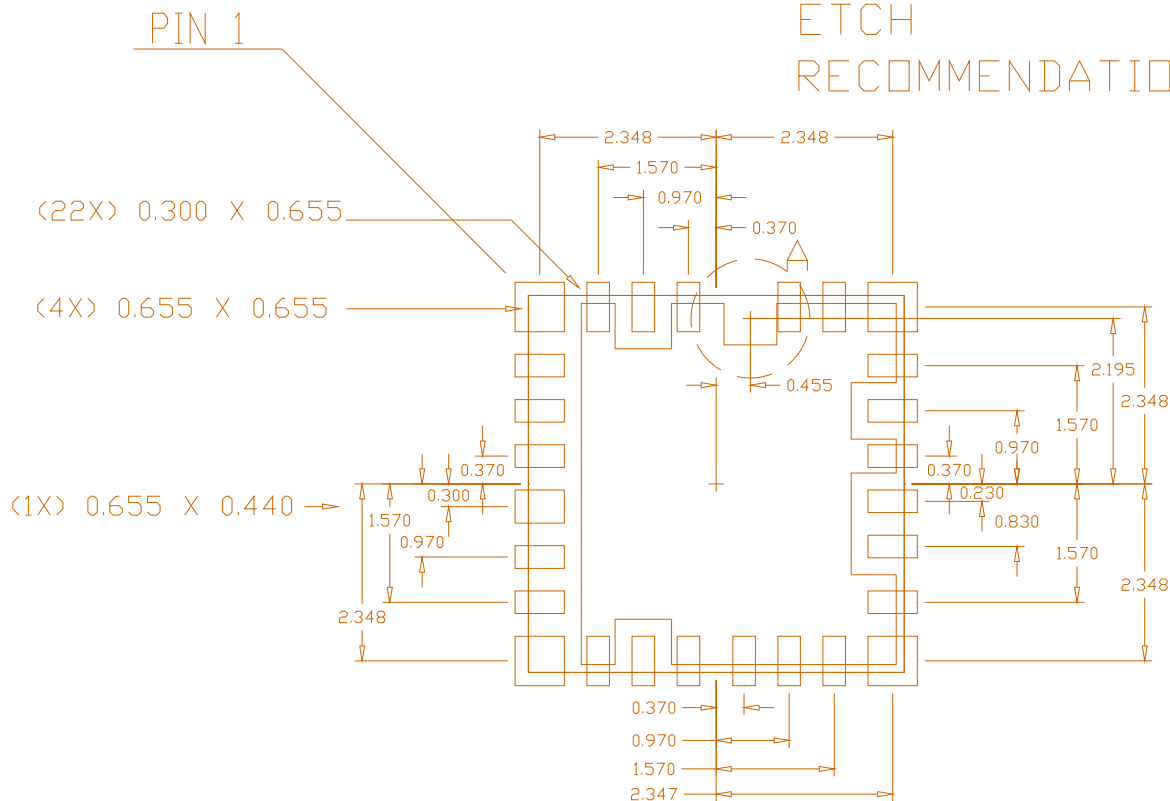
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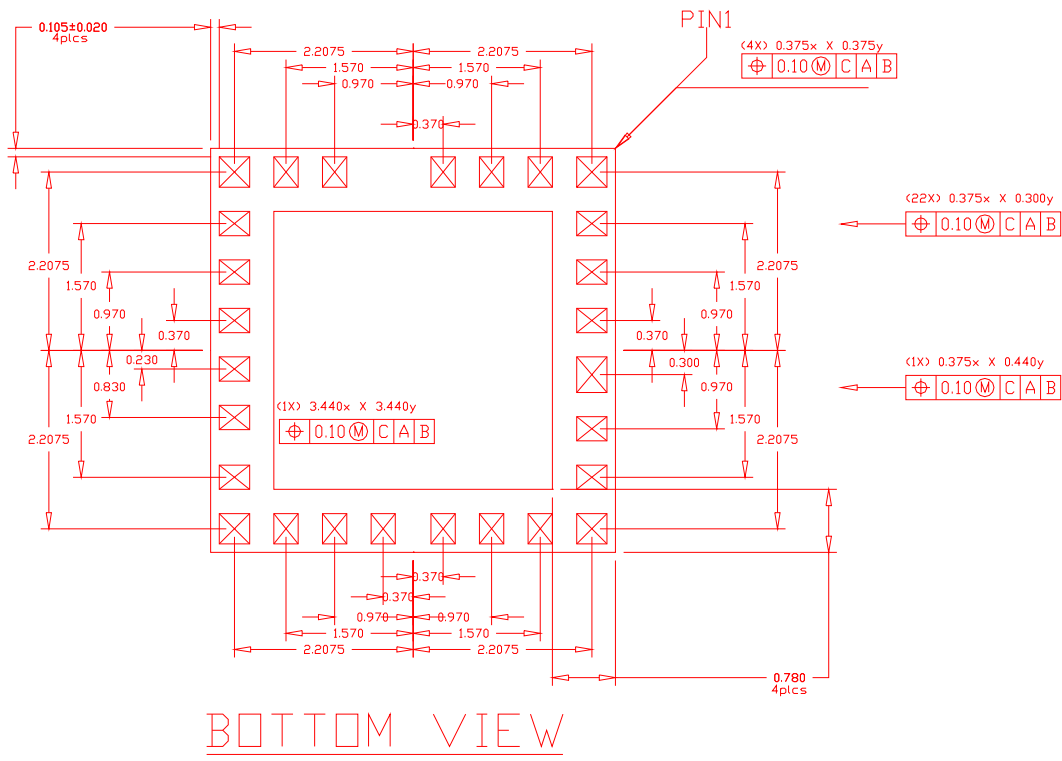
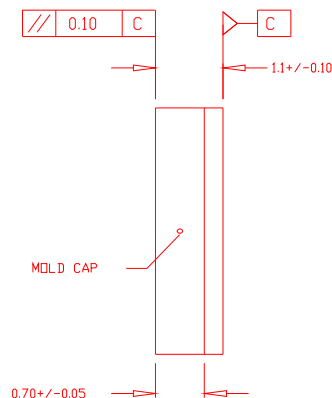
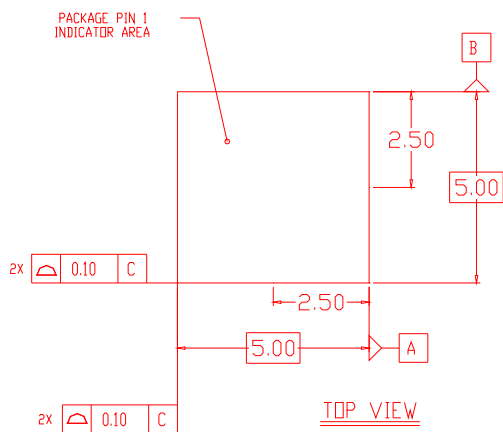
PC Board Layout Recommendations:

TOP VIEW
PCB FOOTPRINT
ETCH
RECOMMENDATIONS



3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Package Dimensional Drawings:



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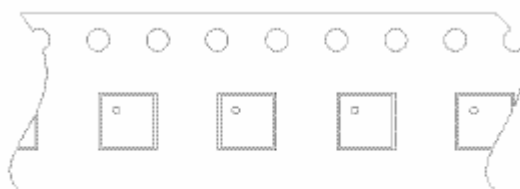
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3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Tape and Reel:*

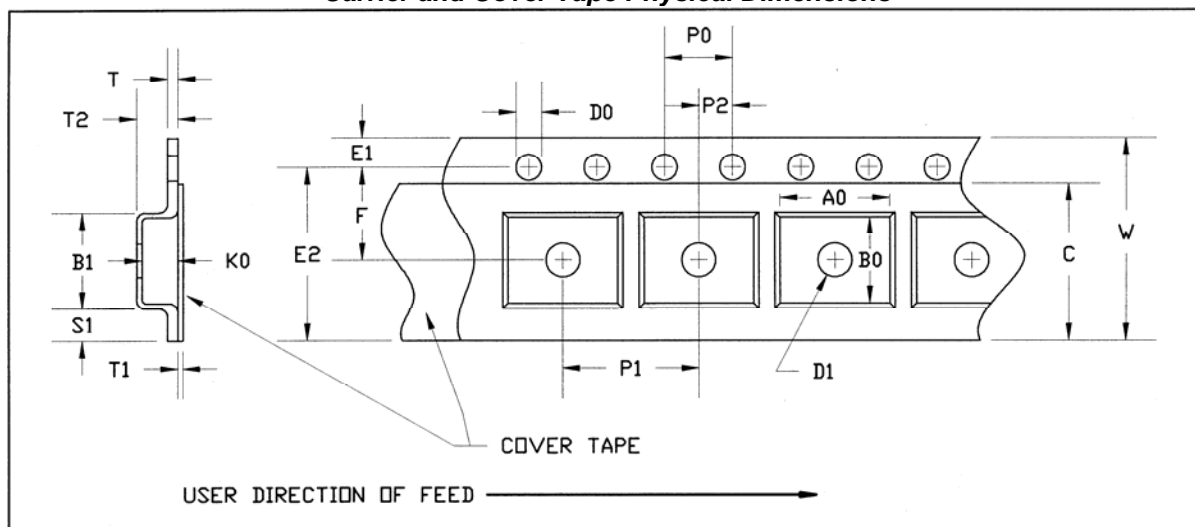
*Information provided as informational only. Please request TriQuint PKG.075 for controlling documentation.

Module Orientation



MODULE 3.5X3.5, 4x4 and 5x5
User Direction of Feed →

Carrier and Cover Tape Physical Dimensions



FIXED CARRIER AND COVER TAPE 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

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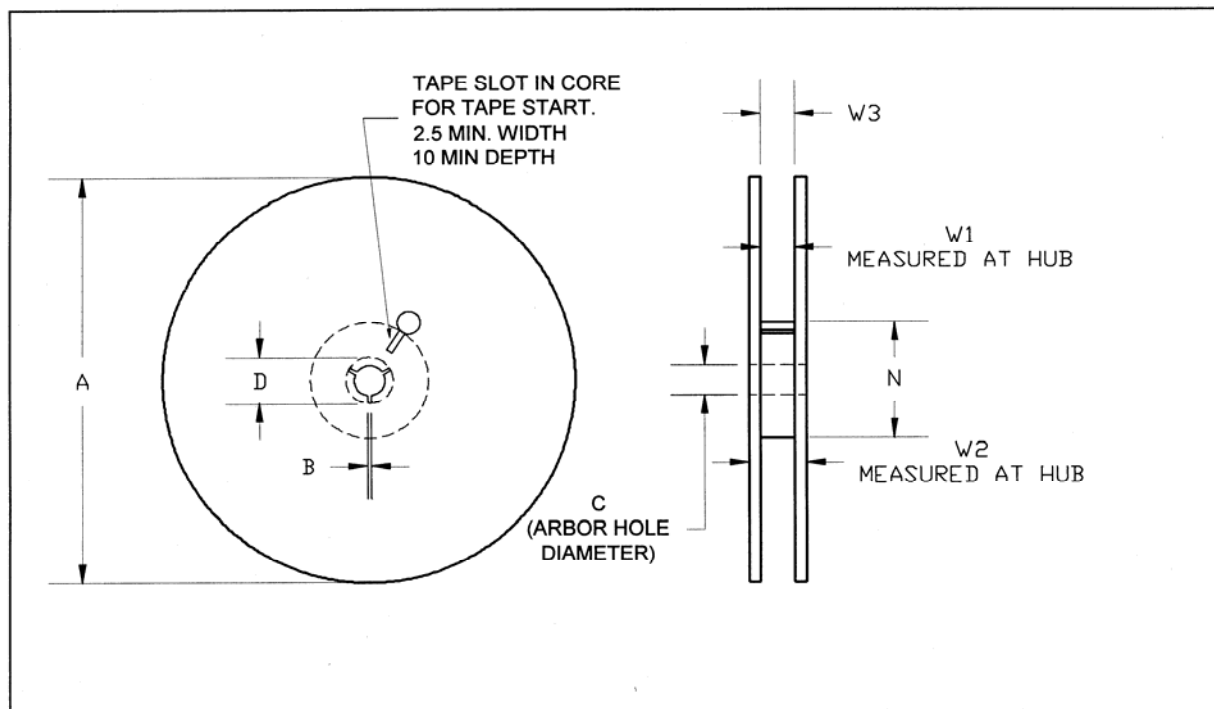
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3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

MODULE –5x5 CARRIER AND COVER TAPE DIMENSIONS

PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
CAVITY	LENGTH	A0	0.207	5.25
	WIDTH	B0	0.207	5.25
	DEPTH	K0	0.071	1.80
	PITCH	P1	0.315	8.00
DISTANCE BETWEEN CENTERLINE	CAVITY TO PERFORATION LENGTH DIRECTION	P2	0.079	2.00
	CAVITY TO PERFORATION WIDTH DIRECTION	F	0.217	5.50
COVER TAPE	WIDTH	C	0.362	9.20
CARRIER TAPE	WIDTH	W	0.472	12.00

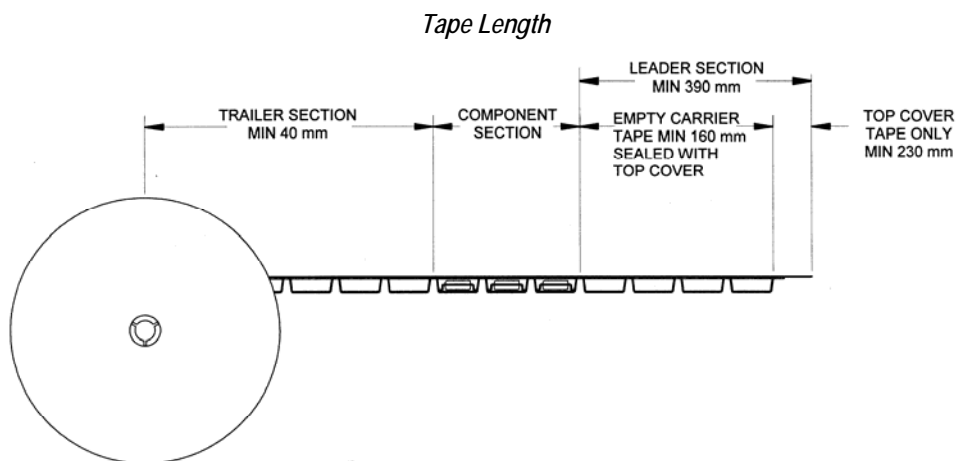
Reel Physical Dimensions



3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

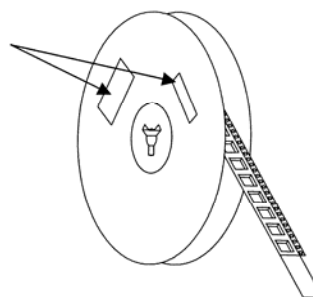
Reel Dimensions for 12mm Carrier Tape

Modules 5x5			13" REEL	
PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
FLANGE	DIAMETER	A	12.992	330
	THICKNESS	W2	0.717	18.2
	SPACE BETWEEN FLANGE	W1	0.504	12.8
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



Label Placement

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



Quantity Per Reel: 2500

3V Quad-Band GSM850/GSM900/DCS/PCS Power Amplifier Module

Marking Diagram:*

**Information provided as informational only. Please request TriQuint MRK.TQM7M4006 for controlling documentation.*



WHITE INK OR LASER MARK

- Line 1: TriQuint logo
- Line 2: Product Code = 7M4006
- Line 3: AaXXXX = Aa (2 letter vendor code)+Last 4 digits of TriQuint assembly lot number
- Line 4: YYWW = Year and Work Week

Additional Information¹

This part is compliant with RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

The part is rated Moisture Sensitivity Level 3 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.

¹ For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

Web: www.triquint.com Tel: (503) 615-9000
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