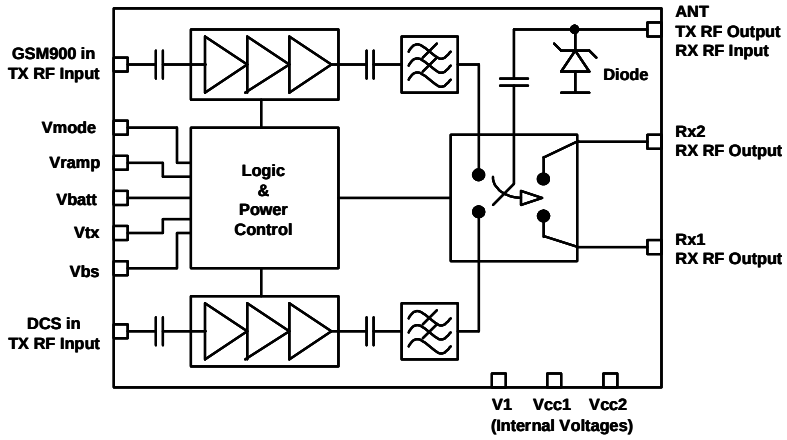
TQM6M4028E

Advance Data Sheet

3V Dual-Band GSM900/DCS Transmit Module

Functional Block Diagram



Product Description

The advanced dual-band **Transmit Module** designed for GSM900 / DCS mobile handset applications provides full RF transmit functionality in a size of only 36 mm². The GSM900 and DCS power amplifier blocks including power control are combined with the low insertion loss dual-band pHEMT switch, Tx harmonics filtering, integrated switch decoder, two receive ports, and full ESD protection. This architecture eliminates the need for any PA-to-switch design effort for phone designers. Both Rx ports are frequency independent and allow flexible routing to the transceiver. Fabricated in high-reliability InGaP HBT / pHEMT technology, the module supports GPRS class 12 operation and provides 50 Ohms input and output impedances at all RF input and output ports. The module control inputs are CMOS compatible and *has **no need for an external reference voltage***. With its excellent efficiency performance in both bands, the power amplifier and switch module contributes to the overall talk-time targets of next generation mobile handset designs.

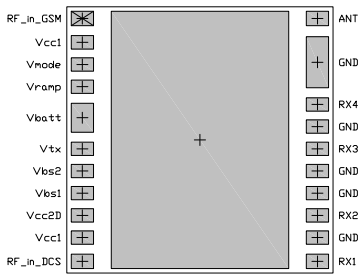
Features

- Ultra Compact Size – 6.0x6.0x1.1mm³.
- High System Efficiency – GSM900 45% , DCS 38%
- Integrated Power and SP4T Control
- Integrated SP4T pHEMT Switch
- Free choice of Rx ports for band selection
- Integrated Low Pass Tx Harmonics Filter
- Positive Supply Voltage 2.7 to 5.5 V.
- 50 Ω Input and Output Impedances.
- GPRS Class 12 Compatible.
- CMOS Compatible Module Control Inputs.
- High-Reliability InGaP HBT Technology
- Ruggedness 30:1
- 260°C RoHS compliant

Applications

- GSM GPRS Handsets and Modems
- Dual -band Class 12 Compatible

Package Style



3V Dual-Band GSM900/DCS Transmit Module

Absolute Maximum Ratings

Symbol	Parameter	Conditions	Absolute Maximum Value	Units
V_{Batt}	Positive Supply Voltage		-0.5 to 6.0	V
Vmode	Module enable		-0.5 to 3.0	V
VTX	Tx enable		-0.5 to 3.0	V
VBS	Band select		-0.5 to 3.0	V
Vramp	Power Control Voltage		-0.5 to 3.0	V
I_{Batt}	DC Supply Current		2.5 max	A
δ	PA Duty Cycle at Maximum Power		50 max [pulse time 2.3ms]	%
T_J	Junction Temperature		150 max	°C
$T_{STORAGE}$	Storage Temperature		-55 to +150	°C
T_C	Operating Case (ambient) Temperature		-20 to +100	°C
P_{in}	Maximum input power	RF input power applied	8	dBm
	ESD ruggedness at Antenna port	IEC 61000 – 4 – 2 (330 Ω, 150 pF)	8000[1)]	V
	ESD ruggedness at Rx ports	HBM (1500 Ω, 100 pF)	1000	V
	ESD ruggedness at all other ports	HBM (1500 Ω, 100 pF)	1000	V

Note: ***The transmit module will survive over the full range of specified maximum ratings for any individual parameter, while all other parameters are nominal and no RF input signal is applied (unless otherwise stated).***

1) Requires external inductor. Without external inductor, the ESD ruggedness at the antenna port is 4 kV according to IEC 61000-4-2. Please refer to the application note for further application details.

3V Dual-Band GSM900/DCS Transmit Module

Operating Parameters

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage	Vbatt		2.7	3.5	5.5	V
Transmit Enable	VTX					
VTXon		Logic High: PA ON	1.2		3.0	V
VTXoff		Logic Low: PA OFF	0		0.5	V
Current		Logic High: PA ON	-10		10	µA
Current		Logic Low: PA OFF	-5		5	µA
Switching time		Vramp from 0.2-2.0V			0.5	µs
Mode Selection	Vmode					
Vmode on		Logic High: Rx ON	1.2		3.0	V
Vmode off		Logic Low: Tx ON	0		0.5	V
On current		Logic High: Rx ON	-10		10	µA
Off current		Logic Low: Tx ON	-5		5	µA
Switching time					0.5	µs
Band Select	VBS					
High			1.2		3.0	V
Low			0		0.5	V
Band Select current High			-10		10	µA
Band Select current Low			-5		5	µA

3V Dual-Band GSM900/DCS Transmit Module

Operating Parameters (cont'd)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Analog power control						
Voltage	Vramp		0.2		1.6	V
Current	Iramp			10	50	µA
Input impedance			100			kΩ
Power Supply Current	Ibatt	VTX = High, VBS = Low		1.2	2.5	A
GSM [PoutMax]						
Power Supply Current	Ibatt	VTX = High, VBS = High		1.1	2.5	A
DCS [PoutMax]		Vmode = Low,				
Leakage Current (Sleep Mode)	Ibatt off	VTX = Low, VBS = High, Vmode = Low	0.1	2	10	µA
Rx Current	Ibatt_RX	Vmode = High, VTX = Low, VBS = low/high*	0.1	15	30	µA
		Vbatt = 3.5 V				
Input/Output impedance				50		Ω
RF power turn-on time				0.8		µs
RF power turn-off time				0.8		µs

**** Either low or High State***

Truth Table

	Control Voltage		
Operating Mode	**Vmode**	**VTX**	**VBS**
Tx-GSM 900	**Low**	**High**	**Low**
Tx-DCS	**Low**	**High**	**High**
Rx 1	**High**	**Low**	**Low**
Rx 2	**High**	**Low**	**High**
Sleep Mode	**Low**	**Low**	**Low**

All Rx ports can be used for any frequency band, there is no frequency selecting element at each port.

3V Dual-Band GSM900/DCS Transmit Module

GSM 900 Electrical Characteristics:

Nominal Conditions (unless otherwise specified): Vbatt=3.5V, Vramp=1.55V, Pin=4dBm, VTX= High, T_a = 25°C, duty cycle = 25% , VBS =Low, Vmode = Low

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Frequency	fmin..fmax		880		915	MHz
Input Power	Pin		2	4	6	dBm
Maximum Output Power	Pout_max	Nominal conditions	32.5	33.0		dBm
Output Power Degradation		Vbatt = 3.0V		31.6		
		Vbatt = 3.0V, T_a =-20°C to 85°C		31.2		dBm
Power Added Efficiency	PAE	Pout_max	38	42		%
Battery Current	Ibatt	$P_{out} \leq$ 33 dBm		1.4		A
Maximum Battery Current	Ibatt, max	VSWR < 10:1, V_{Batt} = 3.5V		2.2	2.4	A
Minimum Output Power	Pout_min	Vbatt = 3.5V, VTX = High, Vramp = 0.2V, Pin = Pinmax		-10	0	dBm
Forward Leakage Power at Antenna	Iso_Ant	VTX = Low, Pin = Pinmax		-62	-58	dBm
Tx-Rx Leakage Power	Iso_Rx	Pin = Pinmax, Rx1, Rx2		-5	5	dBm
Output Noise Power		BW=100kHz				
925 MHz..935 MHz		fo = 915 MHz		-81	-76	dBm
935 MHz..960 MHz		fo = 915 MHz		-85	-83	
Input VSWR		VTX = low or high, 0.2V $\leq V_{ramp} \leq$1.6V		1.5:1	3:1	
Stability	VSWR	2 dBm $\leq P_{in} \leq$ 6 dBm, $P_{out} \leq$ 33 dBm	12:1			
All spurious < - 36dBm		3.0V $\leq V_{Batt} \leq$ 5.5V, -20°C $\leq T_a \leq$ 85°C				
No oscillations, all angles						
Ruggedness	VSWR	2 dBm $\leq P_{in} \leq$ 6 dBm, $P_{out} \leq$ 33 dBm	30:1			
No permanent performance degradation, all angles		3.0V $\leq V_{Batt} \leq$ 5.5V, -20°C $\leq T_a \leq$ 85°C				
Harmonics						
H2, H3		$P_{out} \leq$ 33 dBm		-40	-34	dBm
H2, fo = 900 – 915 MHz		$P_{out} \leq$ 33 dBm, GMSK signal, RBW = 100 kHz (ETSI)		-44	-38	dBm
All other harmonics up to 13 GHz		$P_{out} \leq$ 33 dBm		-40	-35	dBm
Power Control Slope		Pout > 12dBm			150	
Pout/Vramp		5 dBm $\leq P_{out} \leq$ 12 dBm			250	dB/V
Power Accuracy						
P_{out} > 31 dBm		-20°C $\leq T_a \leq$ 85°C		± 1.0	+1.5/-2.0	
11dBm < $P_{out} \leq$31 dBm		3.0V $\leq V_{Batt} \leq$ 4.5V		± 1.5	± 3	dB
5dBm $\leq P_{out} \leq$11 dBm		P_{in} = 4 dBm		± 2.0	± 4	

3V Dual-Band GSM900/DCS Transmit Module

DCS Electrical Characteristics:

Nominal Conditions (unless otherwise specified): Vbatt=3.5V, Vramp=1.55V, Pin=4dBm, VTX= High, T_a = 25°C, duty cycle = 25% , VBS = High, Vmode = Low

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Frequency	fmin..fmax		1710		1785	MHz
Input Power	Pin		2	4	6	dBm
Maximum Output Power	Pout_max	Nominal conditions	30.5	31.0		dBm
Output Power Degradation		Vbatt = 3.0V		29.7		
		Vbatt = 3.0V, T_a =-20°C to 85°C		29.3		dBm
Power Added Efficiency	PAE	Pout_max	33	38		%
Battery Current	Ibatt	$P_{out} \leq$ 30.5 dBm		0.95		A
Maximum Battery Current	Ibatt, max	VSWR < 10:1 $V_{Batt=} \leq$ 3.5V			2.2	A
Minimum Output Power	Pout_min	Vbatt = 3.0V, VTX = High, Vramp = 0.2V, Pin = Pinmax		-12	-5	dBm
Forward Leakage Power at Antenna	Iso_Ant	VTX = Low, Pin = Pinmax		-55	-50	dBm
Tx-Rx Leakage Power	Iso_Rx	Pin = Pinmax, Rx1, Rx2		0	5	dBm
Output Noise Power		BW=100kHz				
1805 MHz..1880 MHz		fo = 1785 MHz		-80	-76	dBm
Input VSWR		VTX = low or high, 0.2V $\leq V_{ramp} \leq$1.6V		1.5:1	3:1	
Stability	VSWR	2 dBm $\leq P_{in} \leq$ 6 dBm, $P_{out} \leq$ 30.5 dBm	12:1			
All spurious < - 36dBm		3.0V $\leq V_{Batt} \leq$ 5.5V, -20°C $\leq T_a \leq$ 85°C				
No oscillations, all angles						
Ruggedness	VSWR	2 dBm $\leq P_{in} \leq$ 6 dBm, $P_{out} \leq$ 30.5 dBm	20:1			
No permanent performance degradation, all angles		3.0V $\leq V_{Batt} \leq$ 5.5V, -20°C $\leq T_a \leq$ 85°C				
Harmonics						
H2, H3		$P_{out} \leq$ 30 dBm		-40	-34	dBm
All other harmonics up to 13 GHz		$P_{out} \leq$ 30 dBm		-40	-35	dBm
Power Control Slope		Pout > 12dBm			150	
Pout/Vramp		5 dBm $\leq P_{out} \leq$ 12 dBm			200	
		0 dBm $\leq P_{out} <$ 5 dBm			250	dB/V
Power Accuracy						
P_{out} > 28 dBm				± 1.0	±1.5	dB
12dBm < $P_{out} \leq$ 28 dBm		-20°C $\leq T_a \leq$ 85°C, 3.0V $\leq V_{Batt} \leq$ 4.5V, P_{in} = 4 dBm		± 1.5	± 2	dB
2dBm $\leq P_{out} \leq$ 12 dBm				± 2.0	+3/-5	dB
0 dBm $\leq P_{out} \leq$ 2 dBm				± 2.0	+4/-5.5	dB

3V Dual-Band GSM900/DCS Transmit Module

Rx1 Receive Mode Electrical Characteristics:

Nominal Conditions: VBS =Low, Vbatt=3.5V, Vramp=0.2 .. 1.6V, VTX = Low, Vmode = High , T_a = 25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Frequency	fmin..fmax		925		1880	MHz
Insertion Loss GSM	Iloss	Nominal Conditions, 925MHz < f < 960 MHz			1.2	dB
		Vbatt=3.0V,Ta=85°C, 925MHz < f < 960 MHz			1.4	dB
Insertion Loss DCS	Iloss	Nominal Conditions, 1805MHz < f < 1880 MHz			1.4	dB
		Vbatt=3.0V,Ta=85°C, 1805MHz < f < 1880 MHz			1.6	dB
ANT-Rx2 Isolation	Iso_Rx	Vbatt=3.0V, Tc=-20°C to 85°C	25			dB
Inband Ripple 1	Iripp	925MHz-960MHz			0.2	dB
Inband Ripple 2	Iripp	1805MHz-1880MHz			0.5	dB
VSWR [Rx1 and Ant]					1.5:1	
Terminating Impedance				50		Ω

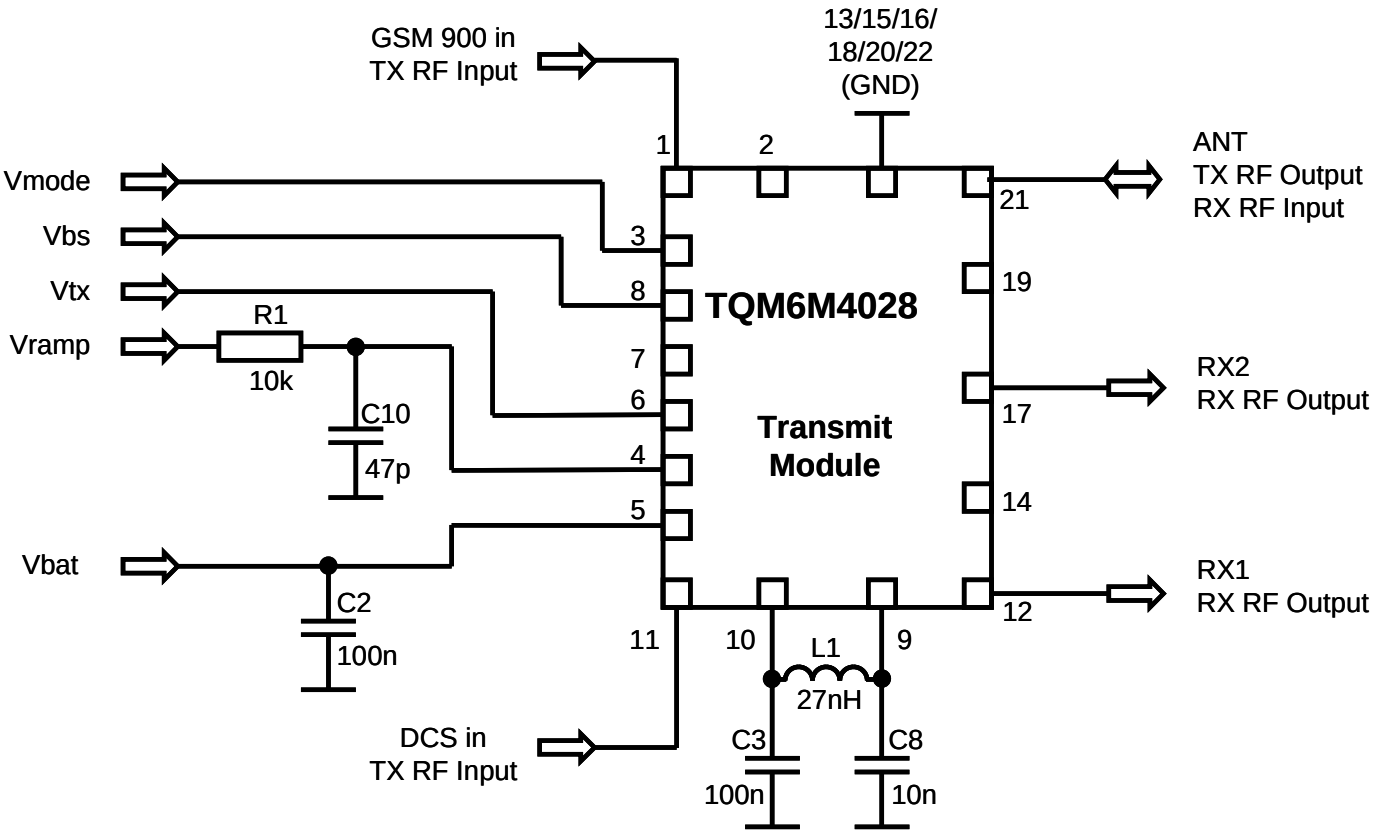
Rx2 Receive Mode Electrical Characteristics:

Nominal Conditions: VBS = High, Vbatt=3.5V, Vramp=0.2 .. 1.6V, VTX = Low, Vmode = High , T_a = 25°C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Frequency	fmin..fmax		925		1880	MHz
Insertion Loss GSM	Iloss	Nominal Conditions, 925MHz < f < 960 MHz			1.2	dB
		Vbatt=3.0V,Ta=85°C, 925MHz < f < 960 MHz			1.4	dB
Insertion Loss DCS	Iloss	Nominal Conditions, 1805MHz < f < 1880 MHz			1.4	dB
		Vbatt=3.0V,Ta=85°C, 1805MHz < f < 1880 MHz			1.6	dB
ANT-Rx1 Isolation	Iso_Rx	Vbatt=3.0V, Tc=-20°C to 85°C	25			dB
Inband Ripple 1	Iripp	925MHz-960MHz			0.2	dB
Inband Ripple 2	Iripp	1805MHz-1880MHz			0.5	dB
VSWR [Rx1 and Ant]					1.5:1	
Terminating Impedance				50		Ω

3V Dual-Band GSM900/DCS Transmit Module

Phone Board Circuit Recommendation



C2, C3	100 nF	RF bypass capacitors
C8	10 nF	RF bypass capacitors
L1	27 nH	Decoupling inductor
R1, C10		Depending on base band IC

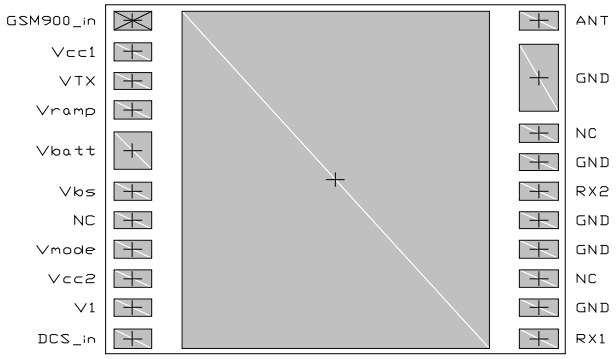
Please refer to the application note for further application details

3V Dual-Band GSM900/DCS Transmit Module

Pin Out

TOP VIEW

PIN DESIGNATIONS

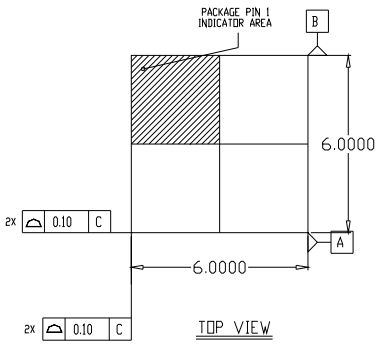


Pin	Symbol	Description
1	GSM900 in	GSM900 RF input
2	Vcc1	Internal Voltage
3	VTX	Digital Transmit Enable Signal. When activated (TX_EN = high), both bands of the PA will be enabled for operation.
4	Vramp	DAC Control Signal for output power setting, nominal 0.2 .. 1.6 V
5	Vbatt	Battery supply voltage, typ. 2.7 – 5.5 V, nom. 1.6A GSM
6	Vbs	Band Select Signal (cf. Truth table on p. 4)
7	NC	Not connected.
8	Vmode	Digital Mode Selection Signal: When activated (Vmode = high), the module is operated in Rx mode, when low, the PA & Switch module will be enabled for Tx operation.
9	Vcc2	Internal Voltage
10	V1	Internal Voltage; external connection to Vcc2 required
11	DCS in	DCS input
12	Rx1	Rx1 output
13	GND	Ground
14	NC	Not connected
15	GND	Ground
16	GND	Ground
17	Rx2	Rx2 output
18	GND	Ground
19	NC	Not connected
20	GND	Ground
21	ANT	Antenna port
22	GND	Ground

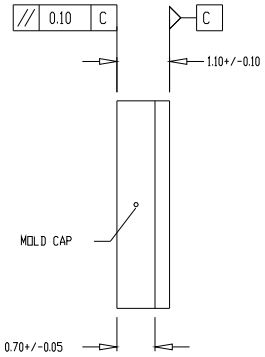
3V Dual-Band GSM900/DCS Transmit Module

Package Dimensions

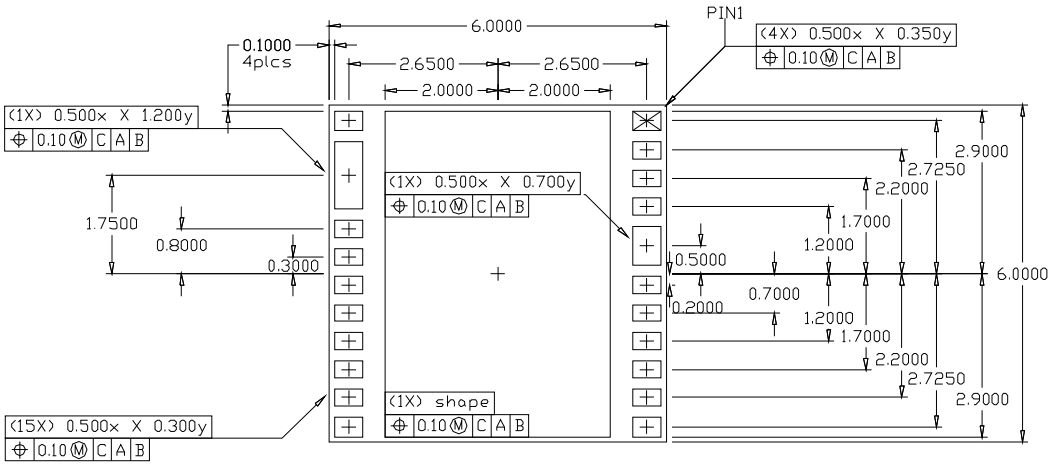
Top View



Side View

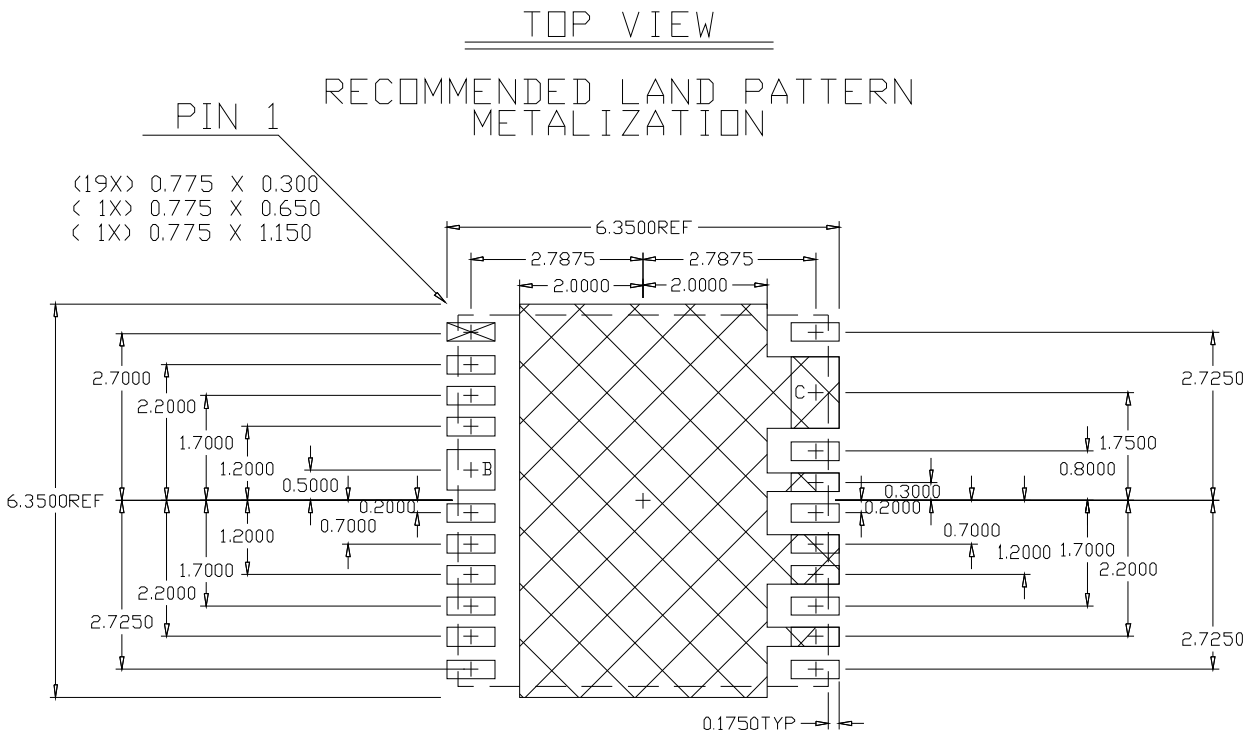


Bottom View



3V Dual-Band GSM900/DCS Transmit Module

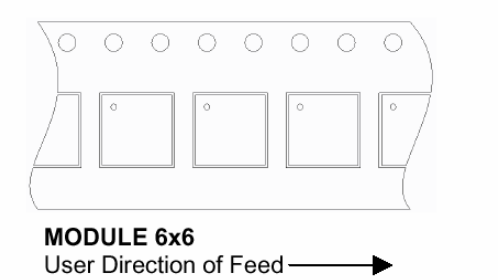
PCB Footprint Recommendation



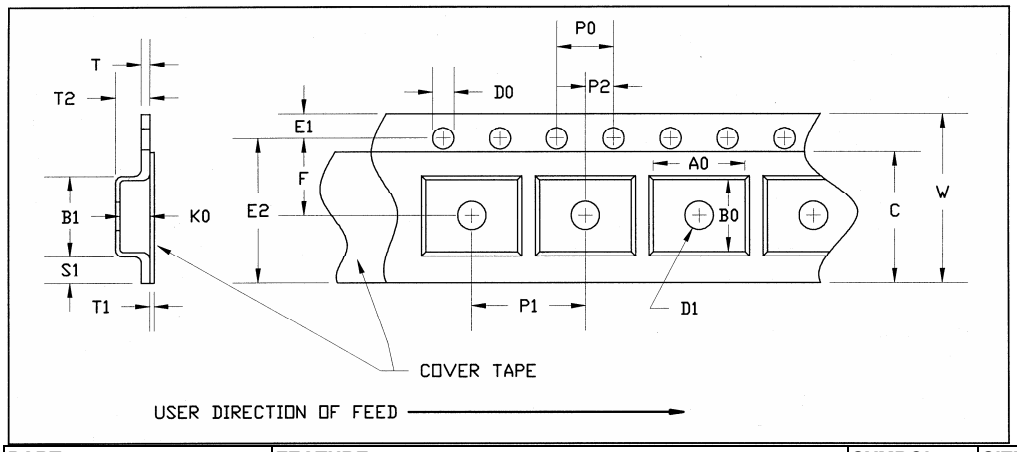
3V Dual-Band GSM900/DCS Transmit Module

Tape and Reel information

Module Orientation



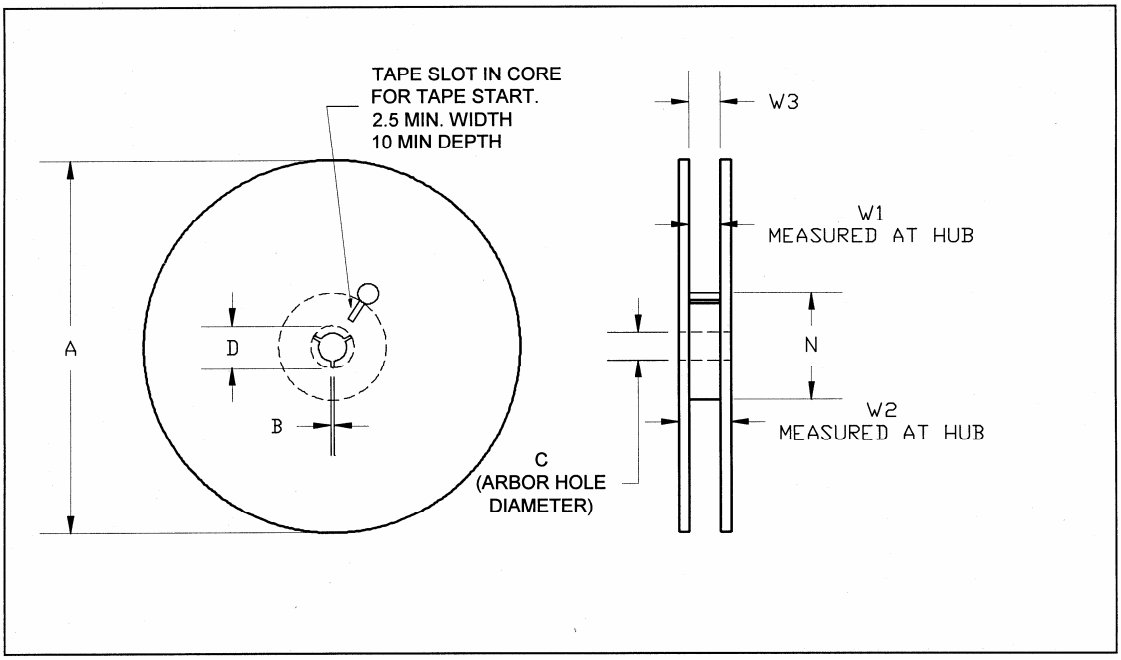
Carrier and Cover Tape Physical Dimensions



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	0.252	6.40
	WIDTH	B0	0.252	6.40
	DEPTH	K0	0.059	1.50
	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

3V Dual-Band GSM900/DCS Transmit Module

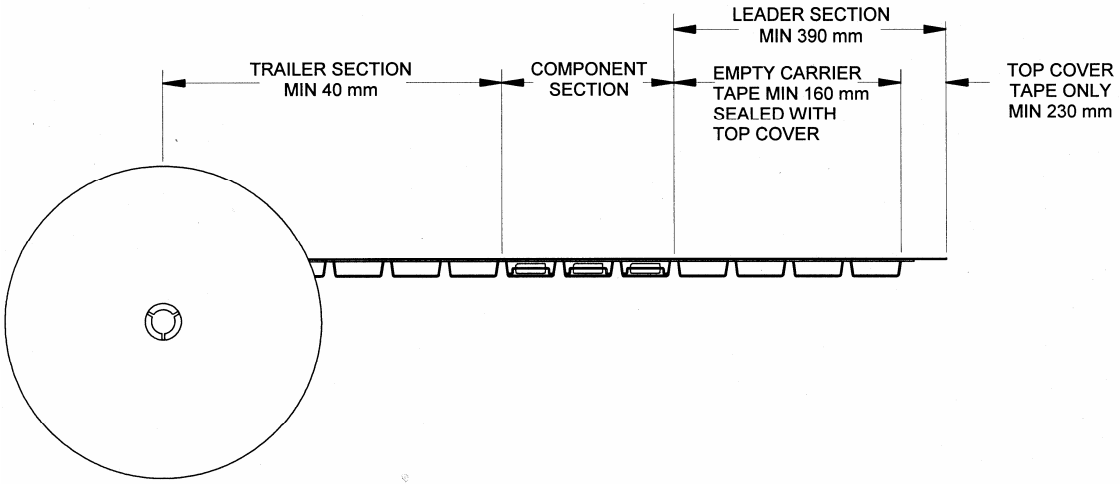
Reel Physical dimensio



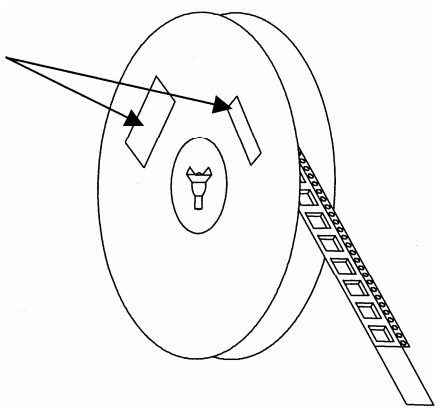
PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
FLANGE	DIAMETER	A	12.992	330
	THICKNESS	W2	0.717	18.2
	SPACE BETWEEN FLANGE	W1	0.504	12.8
HUB	OUTER DIAMETER	N	4.016	102.0
	ARBOR HOLE DIAMETER	C	0.512	13.0
	KEY SLIT WIDTH	B	0.079	2.0
	KEY SLIT DIAMETER	D	0.787	20.0

3V Dual-Band GSM900/DCS Transmit Module

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



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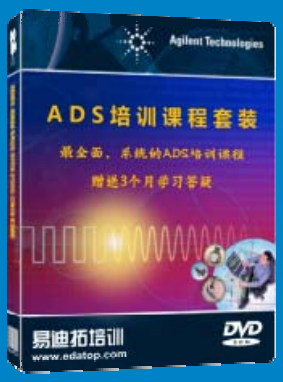
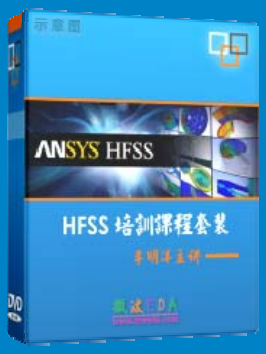
课程网址：http://www.edatop.com/peixun/rfe/110.html

ADS 学习培训课程套装



该套装是迄今国内最全面、最权威的 ADS 培训教程，共包含 10 门 ADS 学习培训课程。课程是由具有多年 ADS 使用经验的微波射频与通信系统设计领域资深专家讲解，并多结合设计实例，由浅入深、详细而又全面地讲解了 ADS 在微波射频电路设计、通信系统设计和电磁仿真设计方面的内容。能让您在最短的时间内学会使用 ADS，迅速提升个人技术能力，把 ADS 真正应用到实际研发工作中去，成为 ADS 设计专家...

课程网址： http://www.edatop.com/peixun/ads/13.html



HFSS 学习培训课程套装

该套课程套装包含了本站全部 HFSS 培训课程，是迄今国内最全面、最专业的 HFSS 培训教程套装，可以帮助您从零开始，全面深入学习 HFSS 的各项功能和在多个方面的工程应用。购买套装，更可超值赠送 3 个月免费学习答疑，随时解答您学习过程中遇到的棘手问题，让您的 HFSS 学习更加轻松顺畅…

课程网址：http://www.edatop.com/peixun/hfss/11.html

CST 学习培训课程套装

该培训套装由易迪拓培训联合微波 EDA 网共同推出，是最全面、系统、专业的 CST 微波工作室培训课程套装，所有课程都由经验丰富的专家授课，视频教学，可以帮助您从零开始，全面系统地学习 CST 微波工作的各项功能及其在微波射频、天线设计等领域的设计应用。且购买该套装，还可超值赠送 3 个月免费学习答疑…

课程网址：http://www.edatop.com/peixun/cst/24.html

HFSS 天线设计培训课程套装

套装包含 6 门视频课程和 1 本图书，课程从基础讲起，内容由浅入深，理论介绍和实际操作讲解相结合，全面系统的讲解了 HFSS 天线设计的全过程。是国内最全面、最专业的 HFSS 天线设计课程，可以帮助您快速学习掌握如何使用 HFSS 设计天线，让天线设计不再难…

课程网址：http://www.edatop.com/peixun/hfss/122.html

13.56MHz NFC/RFID 线圈天线设计培训课程套装

套装包含 4 门视频培训课程，培训将 13.56MHz 线圈天线设计原理和仿真设计实践相结合，全面系统地讲解了 13.56MHz 线圈天线的工作原理、设计方法、设计考量以及使用 HFSS 和 CST 仿真分析线圈天线的具体操作，同时还介绍了 13.56MHz 线圈天线匹配电路的设计和调试。通过该套课程的学习，可以帮助您快速学习掌握 13.56MHz 线圈天线及其匹配电路的原理、设计和调试…

详情浏览：http://www.edatop.com/peixun/antenna/116.html

我们的课程优势：

※ 成立于 2004 年，10 多年丰富的行业经验，

※ 一直致力并专注于微波射频和天线设计工程师的培养，更了解该行业对人才的要求

※ 经验丰富的一线资深工程师讲授，结合实际工程案例，直观、实用、易学

联系我们：

※ 易迪拓培训官网：http://www.edatop.com

※ 微波 EDA 网：http://www.mweda.com

※ 官方淘宝店：http://shop36920890.taobao.com