Features

- **High Power Added Efficiency**
- **1xRTT Compatible**
- **Industry Compatible, Digital Quiescent Current State Control**
- **Analog Continuous Bias Capability with Excellent Linearity**
- **CMOS-compatible State Logic Inputs**
- **Excellent ACP and ALT**
- **Excellent RX Band Noise Performance**
- **Low Leakage Current**

Benefits

- **Very Small 4 mm × 4 mm Package with 10 Pins**
- **Internal Matched Input and Output**
- **Few External Components**
- **Fully ESD Protected**

Applications

- **PCS Band CDMA IS-95/98 Based Mobile Phones**
- **Single-mode and Tri-mode CDMA Phones**

Description

The T0377 is a 4 mm × 4 mm 3-V CDMA PCS band power amplifier module designed for use in mobile phones. Its extremely small 4 mm × 4 mm package makes it ideal for today's very small data enable phones. The module supports the IS-95 and IS-98 standards and is also 1xRTT compliant. The T0377 provides excellent RF performance with low current consumption resulting in longer talk times in portable applications. The heart of the module is a three-stage power amplifier manufactured in Atmel's SiGe technology. The T0377 provides the capability to be operated digitally (one or two bias state) or continuous quiescent current mode. In two-state quiescent current mode operation, the T0377 is controlled by the baseband processor using a CMOS-compatible I_{CQ} control voltage. Overall current consumption of the device is minimized by selecting the lowest I_{CQ} state available for each power output level. The module is 50-Ω matched on the input and output, allowing the device to be used with minimal external circuitry.

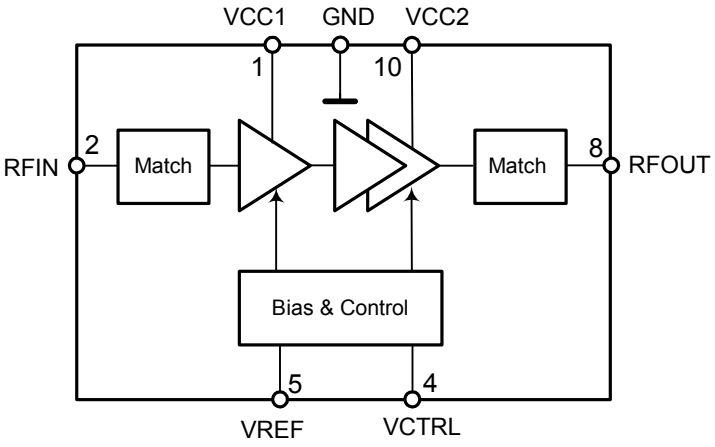
3-V CDMA Power Amplifier Module 4 mm × 4 mm for PCS Band

T0377

Preliminary (Summary)

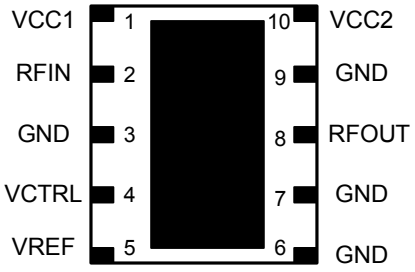
Rev. 4542AS–CDMA–09/02

Figure 1. Block Diagram



Pin Configuration

Figure 2. Pinning



Pin Description

Pin	Symbol	Function
1	VCC1	Collector supply for input stage
2	RFIN	RF input, the RF circuit is DC-grounded internally, 50-Ω RF impedance
3	GND	Ground recommended
4	VCTRL	CMOS-compatible logic level used to set bias level
5	VREF	Regulated supply for setting bias, reference voltage input, V_{Ref} to set to 0VDC to power off the T0377
6	GND	Ground recommended
7	GND	Ground recommended
8	RFOUT	RF output, the RF circuit is DC-blocked internally, 50-Ω RF impedance
9	GND	Ground recommended
10	VCC2	Collector supply for output stage
-	Paddle	Device ground and heat sink, requires good thermal path

Absolute Maximum Ratings

Parameters	Symbol	Value	Unit
Supply voltages, no RF applied	V_{CC1}, V_{CC2}	-0.5 to +6.0	VDC
Supply voltages, RF applied	V_{CC1}, V_{CC2}	-0.5 to +5.0	VDC
Bias reference voltages and bias control voltages (Pins 3, 4, and 8 respectively)	V_{REF}, V_{CTRL}	-0.5 to +5.0	VDC
Power dissipation	P_{DISS}	2.5	W
Case temperature, survival	T_C	-40 to +100	°C
Storage temperature	T_{stg}	-40 to +150	°C
DC-grounded RF input	RF_{IN}	0 to 0	VDC
DC-blocked RF output	RF_{OUT}	-20 to +20	VDC

Note: The part may not survive all maximum ratings applied simultaneously.

Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	TBD	K/W

Electrical Characteristics

Test conditions: $V_{CC1, CC2}$ = 3.4 VDC, V_{REF} = 2.9 VDC, V_{CTRL} = 0.5 VDC, RF = 1880 MHz, T_C = 25°C, P_{out} = 28 dBm, Minimum/maximum limits are at +25°C ambient temperature, unless otherwise specified

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	Frequency		2, 8	f_o	1850	1880	1910	MHz	A
	Output power		8	P_{out}		28		dBm	A
	Large signal gain	P_{out} = 28 dBm, V_{CTRL} = low	2, 8	G_{high}		29		dB	A
		P_{out} = 16 dBm, V_{CTRL} = high	2, 8	G_{low}		27		dB	A
	Gain variation versus temperature	-30°C to +85°C	2, 8			±2.5		dB	C
	Quiescent current (high-gain mode)	V_{CTRL} = low	1, 5, 10	$I_{CQ_}$hi		129		mA	A
	Quiescent current (low-gain mode)	V_{CTRL} = high	1, 5, 10	$I_{CQ_}$low		80		mA	A
	Current consumption	P_{out} = 28 dBm	1, 5, 10	I_{cc}		607		mA	A
	Output power (low)	ACPR = -50 dBc, IS-95/98 standard, V_{CTRL} = high	8	P_{out}		16		dBm	B
	Power added efficiency	P_{out} = 28 dBm V_{CTRL} = low		PAE		31		%	A
	Adjacent channel power	P_{out} = 28 dBm, IS-95/98 standard, V_{CTRL} = low	8	ACP		-51		dBc	A

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

Electrical Characteristics (Continued)

Test conditions: $V_{CC1, CC2}$ = 3.4 VDC, V_{REF} = 2.9 VDC, V_{CTRL} = 0.5 VDC, RF = 1880 MHz, T_C = 25°C, P_{out} = 28 dBm, Minimum/maximum limits are at +25°C ambient temperature, unless otherwise specified

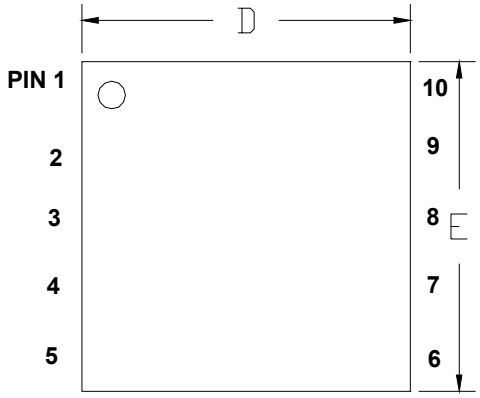
No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	Alternate channel power	P_{out} = 28 dBm, IS-95/98 standard, V_{CTRL} = low	8	ALT		-62		dBc	A
	Noise power in Rx band	P_{out} = 28 dBm, IS-95/98 standard, V_{CTRL} = low	8			-88		dBm/ 30 kHz	C
	RF input return loss	V_{CTRL} = low	2	S_{11}		11.5		dB	C
	Second harmonic	P_{out} = 28 dBm, IS-95/98 standard, V_{CTRL} = low	8	$2f_0$		-35		dBc	A
	Third harmonic	P_{out} = 28 dBm, IS-95/98 standard, V_{CTRL} = low	8	$3f_0$		-45		dBc	A
	Supply voltage		1, 10	V_{CC}	3.2	3.4	4.2	VDC	D
	Reference voltage	For one or two bias state operation	5	V_{REF}	2.8	2.9	3.0	VDC	D
	Reference current	V_{CTRL} = low	5	$I_{B\text{-}high}$		12		mA	A
		V_{CTRL} = high	5	$I_{B\text{-}low}$		4		mA	A
	Leakage current	V_{CTRL} = high; V_{REF} = 0 VDC	1, 10			10		µA	A
	Logic current	At V_{CTRL}	4	I_{CTRL}			100	µA	A
	Control voltage	High Low	4	V_{CTRL}	1.7 0	2.0 0.25	3.5 0.5	VDC VDC	D
	Ruggedness	No damage, P_{out} = 28 dBm, IS-95/98 standard, $V_{CC1, CC2}$ = high	8				10:1		C
	Stability	No oscillations, P_{out} = 28 dBm, IS-95/98 standard, $V_{CC1, CC2}$ = high	8				10:1		C

*) Type means: A = 100% tested, B = 100% correlation tested, C = Characterized on samples, D = Design parameter

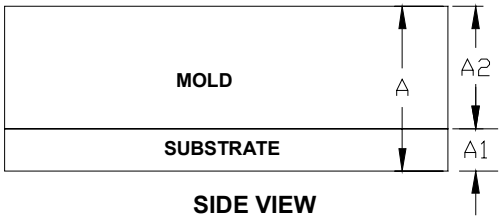
Ordering Information

Extended Type Number	Package	Remarks
T0377	4 mm × 4 mm module package	

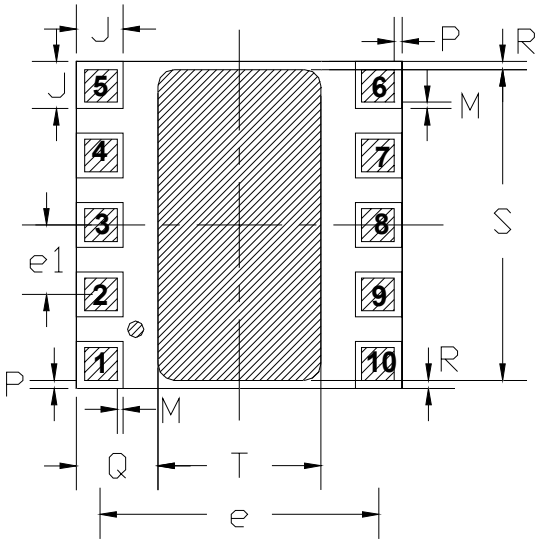
Package Information



TOP VIEW



SIDE VIEW



BOTTOM VIEW

Designation	Description	Dimensions
A	Overall height	1.06 ± 0.09 mm
A1	Substrate thickness	0.38 ± 0.05 mm
A2	Mold thickness	0.68 ± 0.05 mm
D	Package length	4.0 ± 0.1 mm
E	Package width	4.0 ± 0.1 mm
J	Terminal solder mask opening length (for all terminals)	0.575 ± 0.075 mm
M	Distance between metal pad and solder mask	0.075 ± 0.05 mm
P	Distance between metal pad and package edge	0.10 ± 0.025 mm
T	GND solder mask opening length	2.00 ± 0.5 mm
S	GND solder mask opening width	3.80 ± 0.5 mm
R	Distance between GND solder mask opening and package edge	0.10 ± 0.01 mm
Q	Distance between GND solder mask opening and package edge	1.00 ± 0.01 mm
e	Terminal pitch for terminals 1-10, 2-9, 3-8, 4-7 and 5-6	3.400 mm
e1	Terminal pitch for terminals 1-2-3-4-5 and 6-7-8-9-10	0.850 mm

For full data sheet, please contact MarketingNews@hno.atmel.com

Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 487-2600

Europe
Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
TEL (41) 26-426-5555
FAX (41) 26-426-5500

Asia
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimhatsui
East Kowloon
Hong Kong
TEL (852) 2721-9778
FAX (852) 2722-1369

Japan
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
TEL (81) 3-3523-3551
FAX (81) 3-3523-7581

Atmel Operations

Memory
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 436-4314

Microcontrollers
2325 Orchard Parkway
San Jose, CA 95131
TEL 1(408) 441-0311
FAX 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
TEL (33) 2-40-18-18-18
FAX (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards
Zone Industrielle
13106 Rousset Cedex, France
TEL (33) 4-42-53-60-00
FAX (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL 1(719) 576-3300
FAX 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
TEL (44) 1355-803-000
FAX (44) 1355-242-743

RF/Automotive
Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
TEL (49) 71-31-67-0
FAX (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL 1(719) 576-3300
FAX 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/
High Speed Converters/RF Datacom
Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
TEL (33) 4-76-58-30-00
FAX (33) 4-76-58-34-80

e-mail
literature@atmel.com

Web Site
http://www.atmel.com

4542AS–CDMA–09/02 xM