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## Features

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

## Benefits

- Extended Battery Operating Time
- Very Small 10 Pin 4 mm × 4 mm Package
- Few External Components
- Fully ESD Protected

## Applications

- Cell Band CDMA IS-95/98 Based Mobile Phones
- Single-mode, Dual-mode and Tri-mode CDMA Phones

## Description

The T0372 is a 4 mm × 4 mm 3-V CDMA/AMPS cell-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 T0372 provides excellent RF performance with low current consumption resulting in longer talk times in portable applications. The module has a small 4 mm × 4 mm footprint, which facilitates its use in the next generation of small, lightweight handsets and other wireless applications. The heart of the module is a two-stage power amplifier manufactured in Atmel's SiGe technology. The T0372 provides the capability to be operated digitally (one or two bias states), or in a continuous quiescent current mode. In two-state quiescent current mode operation, the T0372 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- $\Omega$  matched on the input and output, allowing the device to be used with minimal external circuitry.



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## 3-V CDMA/AMPS Power Amplifier Module 4 mm × 4 mm for Cell Band

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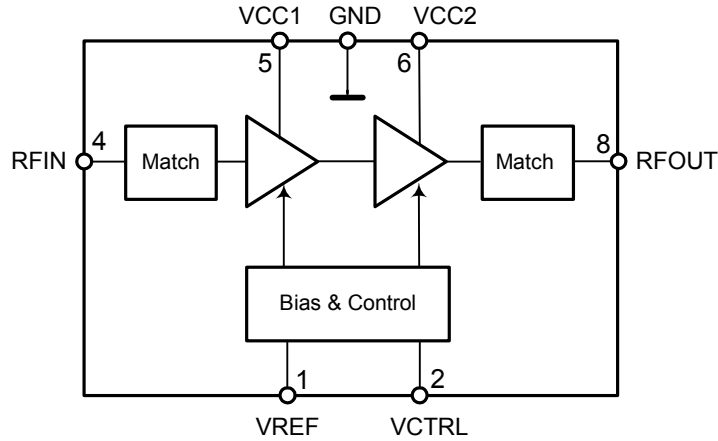
**T0372**

**Preliminary  
(Summary)**

Rev. 4541AS-CDMA-08/02

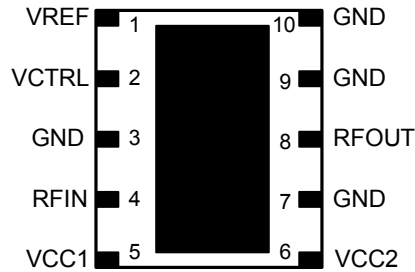


**Figure 1.** Block Diagram



## Pin Configuration

**Figure 2.** Pinning



## Pin Description

Pin	Symbol	Function
1	VREF	Regulated supply for setting bias, reference voltage input
2	VCTRL	CMOS-compatible logic level used to set bias
3	GND	Ground recommended
4	RFIN	RF input, the RF circuit is DC-grounded internally, 50-Ω RF impedance
5	VCC1	Collector supply for input stage
6	VCC2	Collector supply for output stage
7	GND	Ground recommended
8	RFOUT	RF output, the RF circuit is DC-blocked internally, 50-Ω RF impedance
9	GND	Ground recommended
10	GND	Ground recommended
-	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 and 4 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:  $V_{CC1}, V_{CC2} = 3.4$  VDC,  $V_{REF} = 2.85$  VDC,  $V_{CTRL} = 0.5$  VDC,  $RF = 836$  MHz,  $T_C = 25^\circ\text{C}$ ,  $P_{out} = 28$  dBm, Minimum/maximum limits are at  $+25^\circ\text{C}$  ambient temperature, unless otherwise specified

No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	Frequency		4, 8	$f_o$	824	836	849	MHz	A; D
	Output power		8	$P_{out}$		28		dBm	A
	Large signal gain	$P_{out} = 28$ dBm, $V_{CTRL} = \text{low}$	4, 8	$G_{high}$	26.0	29.0		dB	A
		$P_{out} = 16$ dBm, $V_{CTRL} = \text{high}$	4, 8	$G_{low}$	25.0	28.0		dB	A
	Gain variation versus temperature	$-30^\circ\text{C}$ to $+85^\circ\text{C}$	4, 8			$\pm 1.4$		dB	C
	Quiescent current (high-gain mode)	$V_{CTRL} = \text{low}$	1, 5, 6	$I_{CQ\_hi}$		110		mA	A
	Quiescent current (low-gain mode)	$V_{CTRL} = \text{high}$	1, 5, 6	$I_{CQ\_low}$		60		mA	A
	Current consumption	$P_{out} = 28$ dBm, $V_{CTRL} = \text{low}$	1, 5, 6	$I_{cc}$		503		mA	A
	Output power (low)	ACPR = -49 dBc, IS-95/98 standard, $V_{CTRL} = \text{high}$	8	$P_{out}$		16		dBm	B
	Power added efficiency	$P_{out} = 28$ dBm $V_{CTRL} = \text{low}$		PAE	33	36		%	A
	Adjacent channel power	$P_{out} = 28$ dBm, IS-95/98 standard, $V_{CTRL} = \text{low}$	8	ACP		-49	-44	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,  $V_{REF} = 2.85$  VDC,  $V_{CTRL} = 0.5$  VDC,  $R_F = 836$  MHz,  $T_c = 25^\circ\text{C}$ ,  $P_{out} = 28$  dBm, Minimum/maximum limits are at  $+25^\circ\text{C}$  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, $V_{CTRL} = \text{low}$	8	ALT		-57	-55	dBc	A
	Noise power in Rx band	$P_{out} = 28$ dBm, IS-95/98 standard, $V_{CTRL} = \text{low}$	8			-94		dBm/ 30 kHz	C
	RF input return loss	$P_{out} = 28$ dBm, $V_{CTRL} = \text{low}$	4	$S_{11}$		11.5		dB	A
	Second harmonic	$P_{out} = 28$ dBm, IS-95/98 standard, $V_{CTRL} = \text{low}$	8	2fo		-35		dBc	A
	Third harmonic	$P_{out} = 28$ dBm, IS-95/98 standard, $V_{CTRL} = \text{low}$	8	3fo		-45		dBc	A
	Supply voltage		5, 6	$V_{CC}$	3.1	3.4	4.2	VDC	D
	Reference voltage	For 1 or 2 bias state operation	1	$V_{REF}$	2.8	2.85	3.0	VDC	D
	Reference current	$V_{CTRL} = \text{low}$	1	$I_{B\_high}$		10		mA	A
		$V_{CTRL} = \text{high}$	1	$I_{B\_low}$		5		mA	A
	Leakage current	$V_{CTRL} = \text{high};$ $V_{REF} = 0$ VDC	5, 6			10		$\mu\text{A}$	A
	Logic current	At $V_{CTRL}$	2	$I_{CTRL}$		49	100	$\mu\text{A}$	A
	Control voltage	High Low	2	$V_{CTRL}$	1.7 0	2.0 0.25	4.5 0.5	VDC VDC	D
	Ruggedness	No damage, $P_{OUT} = 28$ dBm, IS-95/98 standard, $V_{CC1, CC2} = \text{high}$	8				10:1		C
	Stability	No oscillations, $P_{OUT} = 28$ dBm, IS-95/98 standard, $V_{CC1, CC2} = \text{high}$	8				10:1		C

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

## Electrical Characteristics (AMPS Mode)

Test conditions:  $V_{CC1, CC2} = 3.4$  VDC,  $V_{REF} = 2.85$  VDC,  $V_{CTRL} = 0.5$  VDC, RF = 836 MHz,  $T_c = 25^\circ\text{C}$ ,  $P_{out} = 31.5$  dBm, Minimum/maximum limits are at  $+25^\circ\text{C}$  ambient temperature, unless otherwise specified

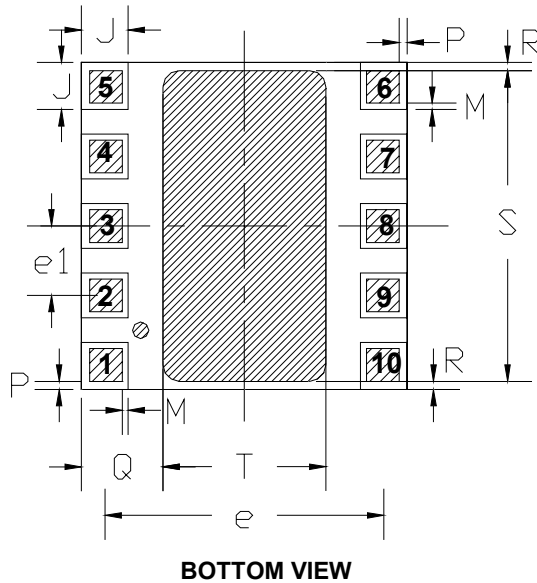
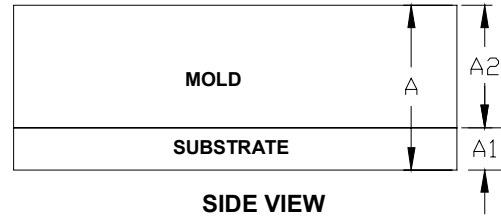
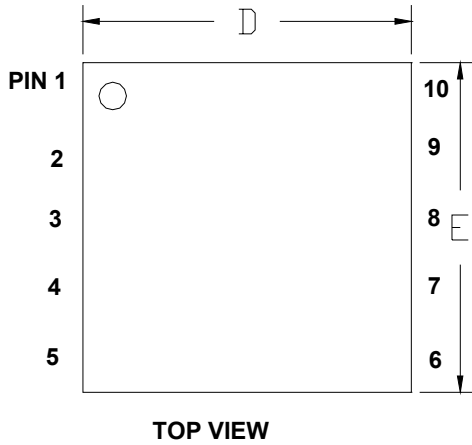
No.	Parameters	Test Conditions	Pin	Symbol	Min.	Typ.	Max.	Unit	Type*
	Frequency		4, 8	$f_o$	824	836	849	MHz	A, D
	Output power	Saturated, $P_{IN} = 3.5$ dBm	8	$P_{out}$		31.5		dBm	A
	Large signal gain	$P_{out} = 31.5$ dBm	4, 8	$I_{CQ\_hi}$	24.5	27.0		dB	A
	Power added efficiency	$P_{out} = 31.5$ dBm		PAE	47	51		%	A
	Noise power in Rx band	$P_{out} = 31.5$ dBm	8			-93		dBm/ 30 kHz	C
	RF input return loss	All operating $P_{out}$ and $V_{CC}$	4	$S_{11}$		11.5		dB	A
	Second harmonic	$P_{out} = 31.5$ dBm	8	2fo		-32.5		dBc	A
	Third harmonic	$P_{out} = 31.5$ dBm	8	3fo		-42.5		dBc	A
	Current consumption	$P_{out} = 31.5$ dBm	1, 5, 6	$I_{CC}$		783		mA	A

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

## Ordering Information

Extended Type Number	Package	Remarks
T0372	4 mm × 4 mm module package	-

## Package Information



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 and width (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 width	2.00 ± 0.05 mm
S	GND solder mask opening length	3.80 ± 0.05 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

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