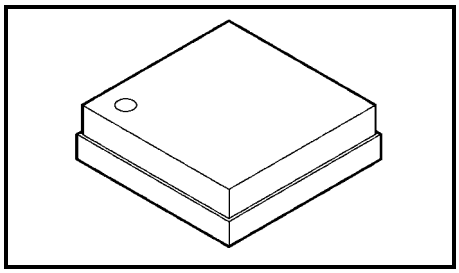
TOSHIBA RF Power Amplifier Module

S-AU87

Power Amplifier Module for Japan IS-95 and CDMA2000 1X

Features

- High output power: P_o = 27.5dBmW (min) @IS-95 mddulation
- Low operating current: I_{CC} = 395 mA (typ.) @P_o = 27.5dBmW, V_{CC} = 3.5 V, IS-95 modulation
  I_{CC} = 130 mA (typ.) @P_o = 17.0dBmW V_{CC} = 1.3 V IS-95 modulation
- Low idle current: I_{CC} (idle) = 55 mA (typ.) @V_{CC} = 3.5 V, V_{DC} = V_{con} = 2.8 V
- Low leakage current: I_{CC} (leak) = 10 μA (max) @V_{CC} = 3.5 V, V_{DC} = 2.8 V, V_{con} = 0 V
- Low-voltage operation: Operation at V_{CC} = 1.3 V is possible. @P_o = 17.0dBmW, IS-95 modulation
- Compact package: 4.0 mm × 4.0 mm × 1.2 mm (typ.)

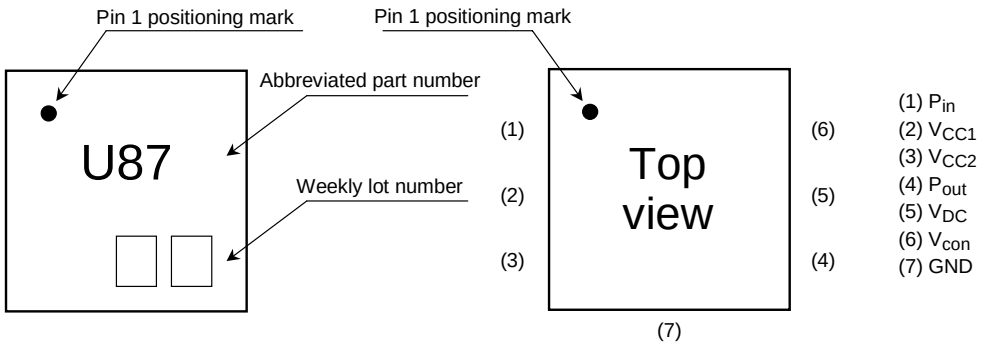


Weight: 0.055 g (typ.)

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Test Condition	Rating	Unit
Supply voltage 1	V_{CC1}	Po < 27.5dBm, V_{con} = V_{DC} = 2.80 V	6	V
Supply voltage 2	V_{CC2}	Po < 27.5dBm, V_{con} = V_{DC} = 2.80 V	6	V
Bias circuit voltage	V_{DC}	V_{CC1} = V_{CC2} = V_{con} = 0 V, P_i = None	6	V
Control voltage	V_{con}	V_{CC1} = V_{CC2} = V_{DC} = 0 V, P_i = None	4	V
Collector current	I_{CC}		1	A
Input power	P_i	Z_g = Z_l = 50 Ω, V_{CC1} = V_{CC2} = 3.5 V, V_{con} = V_{DC} = 2.80 V	7	dBmW
Power dissipation	P_D	Tc = 25°C	1	W
Operating temperature	T_{op}		−20 to +85	°C
Storage temperature range	T_{stg}		−30 to +125	°C

Marking and Pin Assignment



Electrical Characteristics 1
(1X modulation (Note 4), f = 887-925 MHz, Tc = 25°C, $Z_g = Z_l = 50\ \Omega$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector idle current (Note 1)	I_{CC} (idle)	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, P_i = no input	—	55	70	mA
Bias circuit current	I_{DC} (idle)		—	0.5	2.0	mA
Control current	I_{con} (idle)		—	2.5	4.0	mA
Leakage current (Note 1)	I_{CC} (leak)	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = 2.8$ V , $V_{con} = 0$ V, P_i = no input	—	1.0	10	μA
	I_{DC} (leak)		—	1.0	10	μA
Output power 1	P_{o1}	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, P_i = adjust	27.0	27.5	—	dBmW
Power gain 1	G_{p1}	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, P_o = 27.0dBmW	25.0	27.0	—	dB
Collector current 1 (Note 1)	I_{CC1}		—	355	395	mA
Bias circuit current 1	I_{DC1}		—	2.5	4.0	mA
Control current 1	I_{con1}		—	3.5	5.0	mA
Input VSWR 1	VSWRin1		—	2.0	3.5	—
Receiving band noise 1	NRB1		—	−139	−137	dBmW/Hz
2nd harmonics 1	2fo1		—	−35	−30	dBc
3rd harmonics 1	3fo1		—	−45	−40	dBc
Out-of-band noise 1	N-3MHz1	fo = 888 MHz	—	−45	−40	dBmW/30kHz
Adjacent-channel leakage power ratio 1	ACPR1	Δf = ±900 kHz (Note 2)	—	−49	−46	dBc
Adjacent-channel leakage power ratio 2	ACPR2	Δf = ±1.98 MHz (Note 2)	—	−60	−55	dBc
Adjacent-channel leakage power ratio 3	ACPR3	Δf = ±900 kHz (Note 2)	—	−50	−46	dBc
Adjacent-channel leakage power ratio 4	ACPR4	Δf = ±1.98 MHz (Note 2)	—	−61	−56	dBc
Power gain 2	G_{p2}	$V_{CC1} = V_{CC2} = 3.3$ V, $V_{DC} = V_{con} = 2.8$ V, P_o = 26.0dBmW	22.0	25.0	28.0	dB
Collector current 2 (Note 1)	I_{CC2}	$V_{CC1} = V_{CC2} = 1.3$ V, $V_{DC} = V_{con} = 2.8$ V, P_o = 15.0dBmW	—	105	130	mA
Bias circuit current 2	I_{DC2}		—	0.8	2.5	mA
Control current 2	I_{con2}		—	2.5	4.0	mA
Adjacent-channel leakage power ratio 5	ACPR5	Δf = ±900 kHz (Note 2)	—	−53	−48	dBc
Adjacent-channel leakage power ratio 6	ACPR6	Δf = ±1.98 MHz (Note 2)	—	−65	−60	dBc

Caution: The high-frequency power amplifier is sensitive to electrostatic discharge. When handling this product, ensure that the environment is protected against electrostatic discharge by using an earth strap, a conductive mat and an ionizer.

Electrical Characteristics 2 (IS-95 modulation, f = 887-925 MHz, Tc = 25°C, $Z_g = Z_l = 50\ \Omega$)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output power 2	P_{o2}	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, P_i = adjust	27.5	28.0	—	dBmW
Power gain 3	G_{p3}	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.5$dBmW	25.0	27.0	—	dB
Collector current 3 (Note 1)	I_{CC3}		—	395	435	mA
Bias circuit current 3	I_{DC3}		—	2.5	4.0	mA
Control current 3	Icon3		—	3.5	5.0	mA
Input VSWR 2	VSWRin2		—	2.0	3.5	—
Receiving band noise 2	NRB2		—	−138	−136	dBmW/Hz
2nd harmonics 2	2fo2		—	−35	−30	dBc
3rd harmonics 2	3fo2		—	−45	−40	dBc
Out-of-band noise 2	N-3MHz2	fo = 888 MHz	—	−44	−40	dBmW/30kHz
Adjacent-channel leakage power ratio 7	ACPR7	Δf = ±900 kHz (Note 2)	—	−50	−46	dBc
Adjacent-channel leakage power ratio 8	ACPR8	Δf = ±1.98 MHz (Note 2)	—	−59	−55	dBc
Adjacent-channel leakage power ratio 9	ACPR9	Δf = ±900 kHz (Note 2), $V_{CC1} = V_{CC2} = 3.3$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 26.5$dBmW	—	−53	−48	dBc
Adjacent-channel leakage power ratio 10	ACPR10	Δf = ±1.98 MHz (Note 2)	—	−60	−55	dBc
Power gain 4	G_{p4}	$V_{CC1} = V_{CC2} = 1.3$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 17.0$dBmW	22.0	25.0	28.0	dB
Collector current 4 (Note 1)	I_{CC4}		—	130	155	mA
Bias circuit current 4	I_{DC4}		—	0.8	2.5	mA
Control current 4	I_{con4}		—	2.5	4.0	mA
Adjacent-channel leakage power ratio 11	ACPR11	Δf = ±900 kHz (Note 2)	—	−49	−46	dBc
Adjacent-channel leakage power ratio 12	ACPR12	Δf = ±1.98 MHz (Note 2)	—	−65	−60	dBc

Note1: I_{CC} = Current of a V_{CC1} pin + current of a V_{CC2} pin.

Note2: ACPR

a) Pc (1.23 MHz) is average power measured for 1.23 MHz bandwidth with carrier frequency.

b) P (30 kHz) is average power measured for 30 kHz bandwidth with 900 kHz/1.98 MHz offset.

c) ACPR1 (or ACPR2) = P (30 kHz) − P_C (1.23 MHz) dB

Note3: These electrical characteristics are measured using Toshiba standard test board in Toshiba standard measurement system.

Note4: CDMA 20001X modulation condition is following.

CH	RC	Data Rate	Power	Data
Pch	N/A	N/A	−3.75	00000000
Fch	3	9600 bps	0	Random
Sch	3	9600 bps	0	Random

Electrical Characteristics 3
(1X modulation (Note 4), f = 887-925 MHz, Tc = –20 to 85°C, $Z_g = Z_l = 50\ \Omega$)

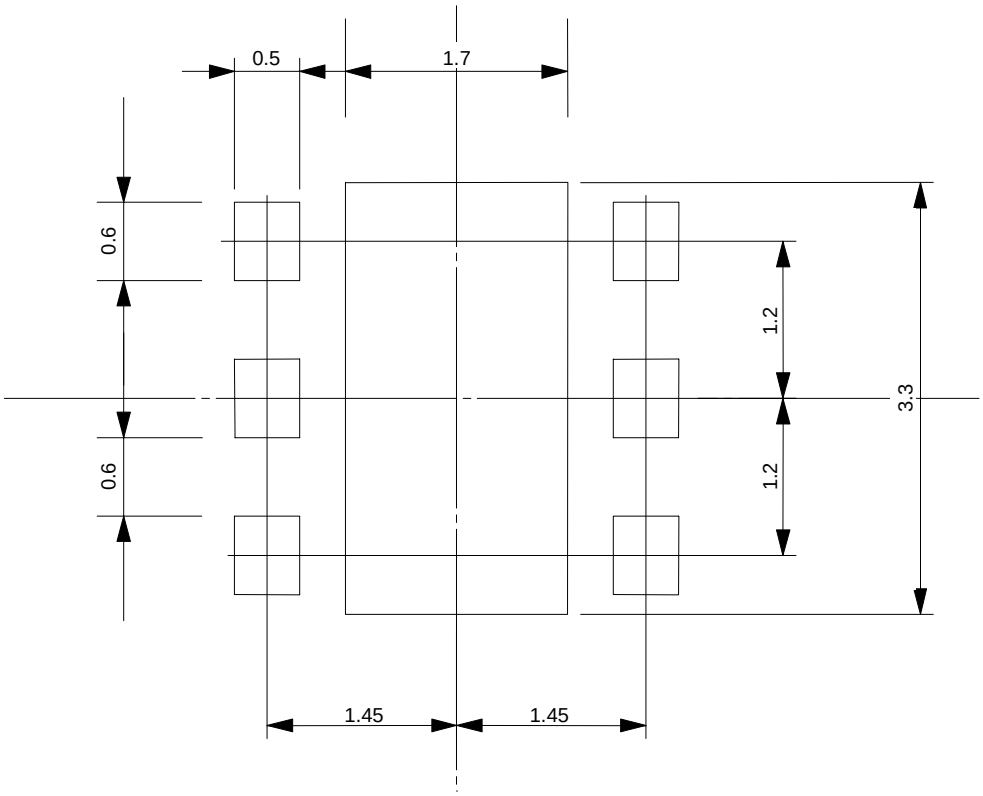
Characteristics	Symbol	Test Condition		Min	Typ.	Max	Unit
Power gain 5	G_{p5}	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.0$dBmW		23.0	—	—	dB
Adjacent-channel power ratio 13	ACPR13	$\Delta f = \pm 900$ kHz (Note 2)	$V_{CC1} = V_{CC2} = 3.3$ V,	—	–49	–44	dBc
Adjacent-channel power ratio 14	ACPR14	$\Delta f = \pm 1.98$ MHz (Note 2)	$V_{DC} = V_{con} = 2.8$ V, $P_o = 26.0$dBmW	—	–57	–54	dBc
Adjacent-channel power ratio 15	ACPR15	$\Delta f = \pm 900$ kHz (Note 2)	$V_{CC1} = V_{CC2} = 1.3$ V, $V_{DC} = V_{con} = 2.8$ V,	—	–49	–44	dBc
Adjacent-channel power ratio 16	ACPR16	$\Delta f = \pm 1.98$ MHz (Note 2)	$P_o = 15.0$dBmW	—	–57	–54	dBc
Receiving band noise 3	NRB3	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.0$dBmW		—	–138	–136	dBmW /Hz
Stability 1	SPR1	$V_{CC1} = V_{CC2} = 3.4$ V to 4.2 V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.0$dBmW, $Z_g = 50\ \Omega$, Load $V_{SWR} = 5{:}1$ all phase		—	—	–55	dBc
Load mismatch 1	—	$V_{CC1} = V_{CC2} = 3.4$ V to 4.2 V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.0$dBmW, $Z_g = 50\ \Omega$, V_{SWR} LOAD 5:1 all phase		No degradation			—

Electrical Characteristics 4
(IS-95 modulation, f = 887-925 MHz, Tc = –20~85°C, $Z_g = Z_l = 50\ \Omega$)

Characteristics	Symbol	Test Condition		Min	Typ.	Max	Unit
Power gain 6	G_{p6}	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.5$dBmW		23.0	—	—	dB
Adjacent-channel power ratio 17	ACPR17	$\Delta f = \pm 900$ kHz (Note 2)	$V_{CC1} = V_{CC2} = 3.3$ V,	—	–47	–44	dBc
Adjacent-channel power ratio 18	ACPR18	$\Delta f = \pm 1.98$ MHz (Note 2)	$V_{DC} = V_{con} = 2.8$ V, $P_o = 26.5$dBmW	—	–58	–54	dBc
Adjacent-channel power ratio 19	ACPR19	$\Delta f = \pm 900$ kHz (Note 2)	$V_{CC1} = V_{CC2} = 1.3$ V, $V_{DC} = V_{con} = 2.8$ V,	—	–47	–44	dBc
Adjacent-channel power ratio 20	ACPR20	$\Delta f = \pm 1.98$ MHz (Note 2)	$P_o = 17.0$dBmW	—	–58	–54	dBc
Receiving band noise 4	NRB4	$V_{CC1} = V_{CC2} = 3.5$ V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.5$dBmW		—	–137	–135	dBmW /Hz
Stability 2	SPR2	$V_{CC1} = V_{CC2} = 3.4$ V to 4.2 V, $V_{DC} = V_{con} = 2.8$ V, $P_o = 27.5$dBmW, $Z_g = 50\ \Omega$, Load $V_{SWR} = 5{:}1$ all phase		—	—	–55	dBc
Load mismatch 2	—	$V_{CC1} = V_{CC2} = 3.4$ V to 4.2V, $V_{DC} = V_{con} = 2.8$ V $P_o = 27.5$dBmW, $Z_g = 50\ \Omega$, V_{SWR} LOAD 5:1 all phase		No degradation			—

Recommend Foot Pattern

Unit: mm

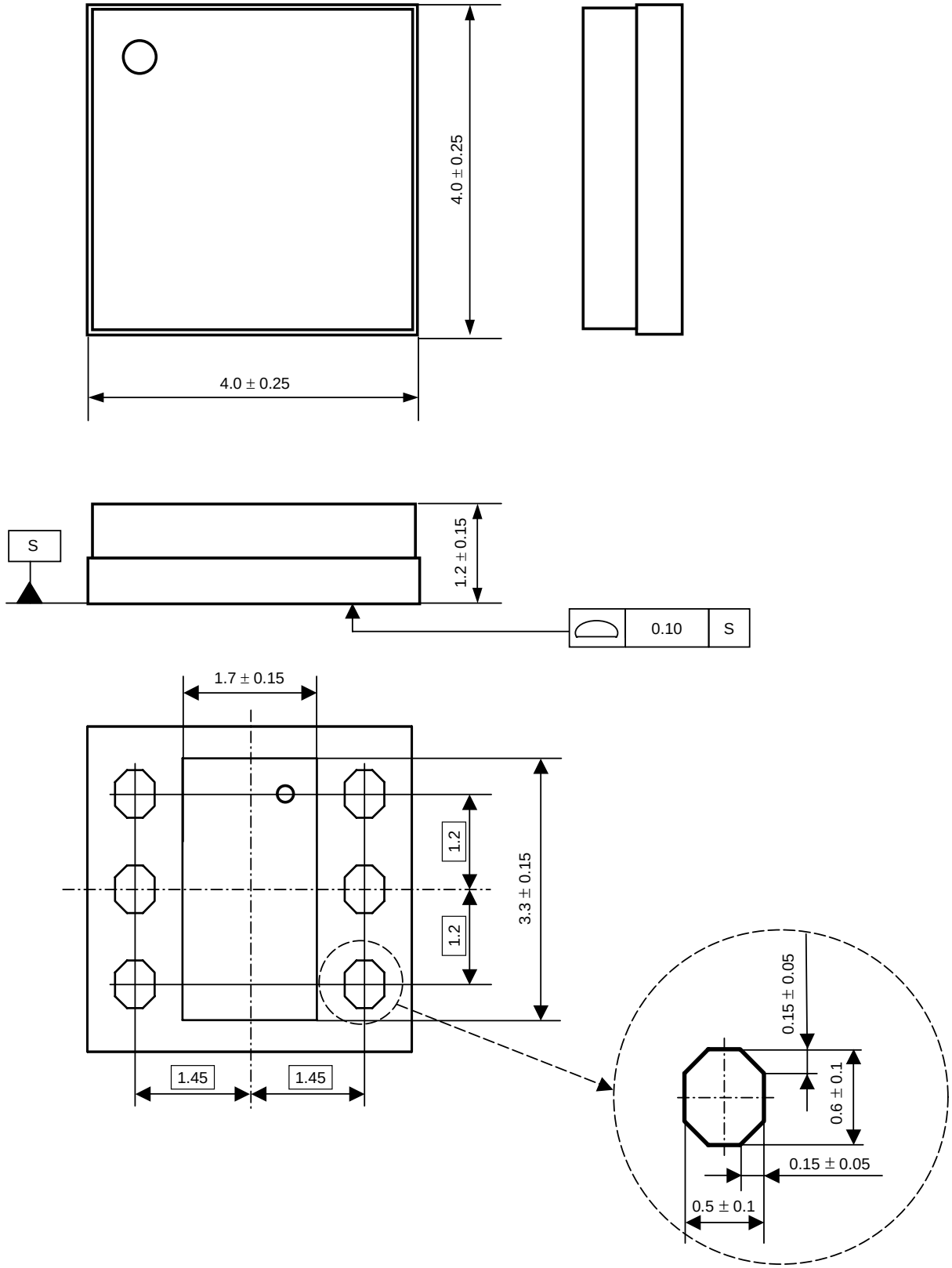


Pin Function

Pin No.	Symbol	Function
1	Pin	Power amplifier input. Internally DC blocked and matched to 50 Ω.
2	V_{CC1}	First stage collector supply
3	V_{CC2}	Second stage collector supply
4	P_{out}	Power amplifier output. Internally DC blocked and matched to 50 Ω.
5	V_{DC}	Power supply for bias circuit. Apply V_{con} or higher voltage.
6	V_{con}	Power control supply. The device is off when V_{con} = 0 V. To avoid damage to the device, do not apply a voltage to this pin when the pins V_{CC1}, V_{CC2} and V_{DC} are not supplied.
7	GND	Ground connection. The backside of the package should be soldered to a top side ground pad which is connected to the ground plane with multiple vias. The pad should have a short thermal path to the ground plane.

Package Dimensions

Unit: mm



Weight: 0.055 g (typ.)

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