

BAP70Q

Quad PIN diode attenuator

Rev. 2 — 6 March 2012

Product data sheet

1. Product profile

1.1 General description

Quad PIN diode in a SOT753 package.

1.2 Features and benefits

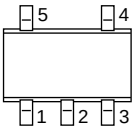
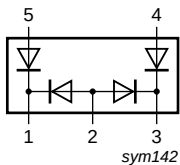
- 4 PIN diodes in a SOT753 package
- 300 kHz to 4 GHz
- High linearity
- Low insertion loss
- reduction in part count
- Low diode capacitance
- Low diode forward resistance

1.3 Applications

- Broadband system applications i.e. WCDMA, CATV, etc.
- General purpose Voltage Controlled Attenuators for high linearity applications

2. Pinning information

Table 1. Discrete pinning

Pin	Description	Simplified outline	Graphic symbol
1	RF in		 sym142
2	series bias		
3	RF out		
4	shunt 1 bias		
5	shunt 2 bias		

3. Ordering information

Table 2. Ordering information

Type number	Package		
	Name	Description	Version
BAP70Q	SC-74A	plastic surface-mounted package; 5 leads	SOT753



4. Marking

Table 3. Marking

Type number	Marking code
BAP70Q	A2

5. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Min	Max	Unit
V_R	reverse voltage	[1]	-	50	V
I_F	forward current	[1]	-	100	mA
P_{tot}	total power dissipation	$T_{sp} = 90\text{ °C}$ [1]	-	125	mW
T_{stg}	storage temperature		-65	+150	°C
T_j	junction temperature		-65	+150	°C

[1] single diode.

6. Thermal characteristics

Table 5. Thermal characteristics

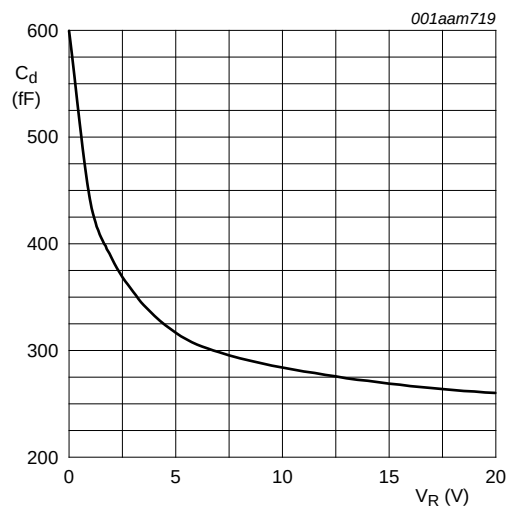
Symbol	Parameter	Conditions	Typ	Unit
$R_{th(j-sp)}$	thermal resistance from junction to solder point		350	K/W

7. Characteristics

Table 6. Characteristics

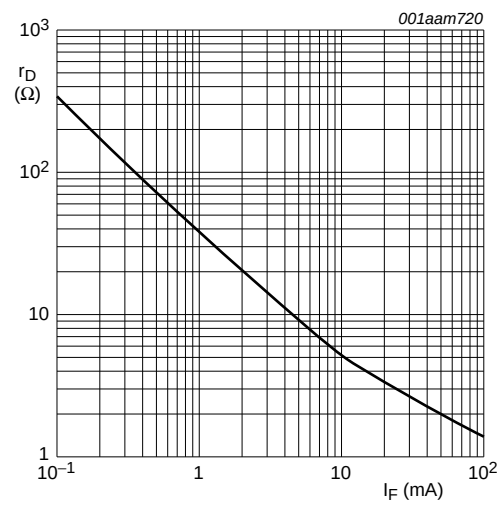
$T_j = 25\text{ °C}$ unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Per diode						
V_F	forward voltage	$I_F = 50\text{ mA}$	-	0.95	1.1	V
I_R	reverse current	$V_R = 50\text{ V}$	-	-	100	nA
C_d	diode capacitance	see Figure 1; $f = 1\text{ MHz}$;				
		$V_R = 0\text{ V}$	-	600	-	fF
		$V_R = 1\text{ V}$	-	430	-	fF
		$V_R = 20\text{ V}$	-	250	300	fF
r_D	diode forward resistance	see Figure 2; $f = 100\text{ MHz}$;				
		$I_F = 0.5\text{ mA}$	-	77	100	Ω
		$I_F = 1\text{ mA}$	-	40	50	Ω
		$I_F = 10\text{ mA}$	-	5.4	7	Ω
		$I_F = 100\text{ mA}$	-	1.4	1.9	Ω
τ_L	charge carrier life time	when switched from $I_F = 10\text{ mA}$ to $I_R = 6\text{ mA}$; $R_L = 100\text{ }\Omega$; measured at $I_R = 3\text{ mA}$	-	1.25	-	μs



$f = 1\text{ MHz}$; $T_J = 25\text{ }^{\circ}\text{C}$.

Fig 1. Diode capacitance as a function of reverse voltage; typical values.



$f = 100\text{ MHz}$; $T_J = 25\text{ }^{\circ}\text{C}$.

Fig 2. Diode forward resistance as a function of forward current; typical values.

8. Application information

8.1 Application circuit

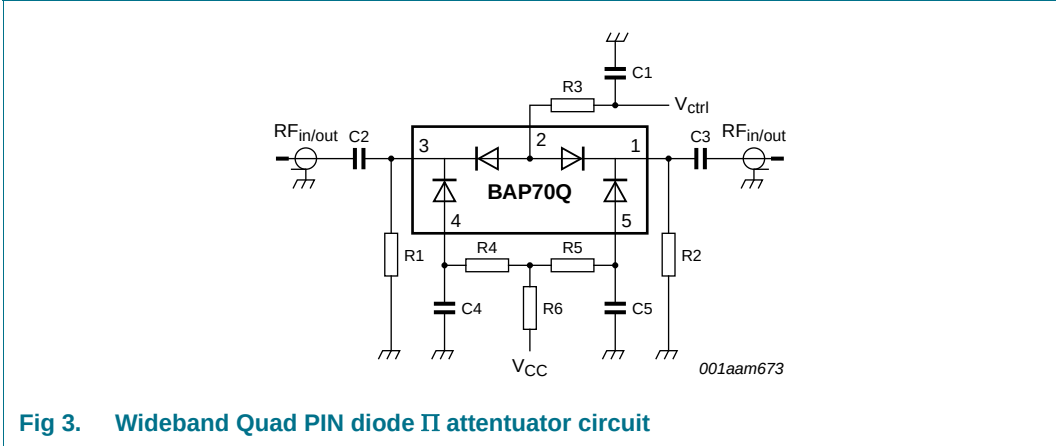


Fig 3. Wideband Quad PIN diode II attenuator circuit

Table 7. List of components used for the typical application

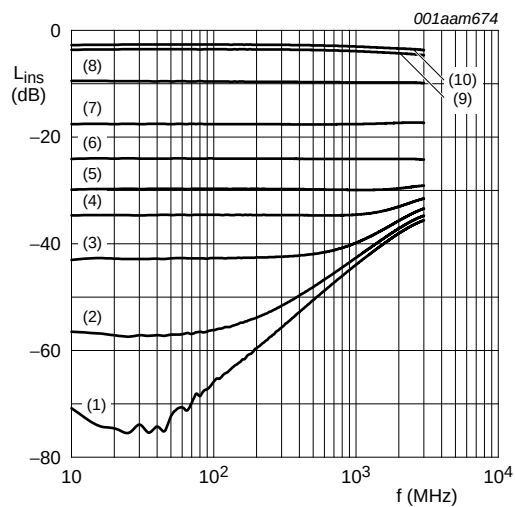
Component	Description	Conditions	Value
C1, C2, C3, C4, C5	chip capacitor	V _{CC} = 3.7 V	47 nF
		V _{CC} = 5 V	47 nF
R1, R2	chip resistor	V _{CC} = 3.7 V	560 Ω
		V _{CC} = 5 V	910 Ω
R3	chip resistor	V _{CC} = 3.7 V	330 Ω
		V _{CC} = 5 V	1000 Ω
R4, R5	chip resistor	V _{CC} = 3.7 V	1500 Ω
		V _{CC} = 5 V	2000 Ω
R6	chip resistor	V _{CC} = 3.7 V	680 Ω
		V _{CC} = 5 V	1000 Ω

8.2 Quad PIN pi attenuator characteristics

Table 8. Typical performance for BAP70Q quad PIN diode Π attenuator

$V_{CC} = 3.7\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified.

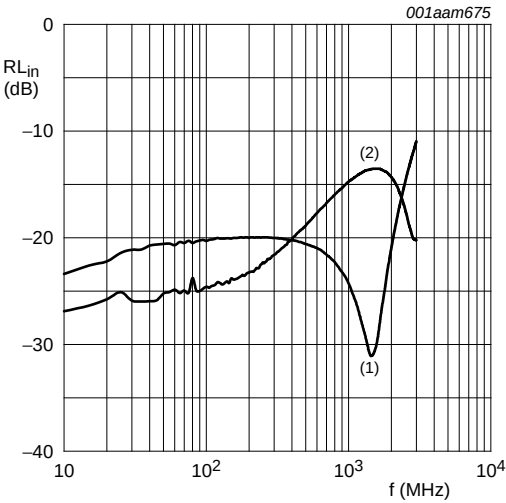
Symbol	Parameter	Test Conditions	Typ	Units
L_{ins}	insertion loss	$V_C = 10\text{ V}$; $f = 1\text{ GHz}$	3	dB
RL_{in}	input return loss	$V_C = 0\text{ V}$; $f = 1\text{ GHz}$	24	dB
α	attenuation	$V_C = 0\text{ V}$; $f = 1\text{ GHz}$	44	dB
$IP3_i$	input third-order intercept point	$f = 0.1\text{ GHz}$		
		$V_{ctrl} = 2\text{ V}$	38	dBm
		$V_{ctrl} = 10\text{ V}$	45	dBm
		$f = 0.9\text{ GHz}$		
		$V_{ctrl} = 2\text{ V}$	45	dBm
		$V_{ctrl} = 10\text{ V}$	45	dBm
		$f = 1.8\text{ GHz}$		
		$V_{ctrl} = 2\text{ V}$	45	dBm
		$V_{ctrl} = 10\text{ V}$	45	dBm
		$f = 2.1\text{ GHz}$		
		$V_{ctrl} = 2\text{ V}$	44	dBm
		$V_{ctrl} = 10\text{ V}$	44	dBm



$V_{CC} = 3.7 \text{ V}$; $T_{amb} = 25 \text{ }^{\circ}\text{C}$.

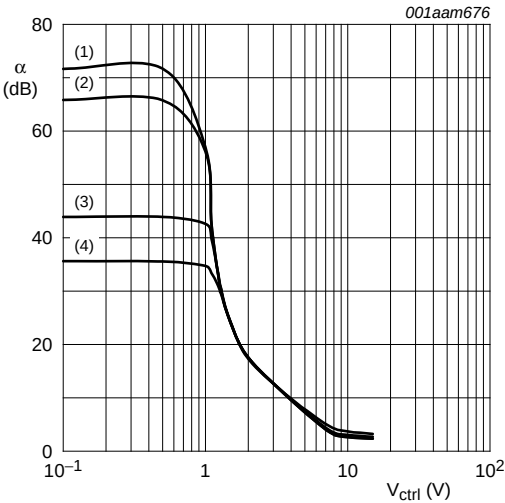
- (1) $V_{ctrl} = 0 \text{ V}$
- (2) $V_{ctrl} = 1 \text{ V}$
- (3) $V_{ctrl} = 1.1 \text{ V}$
- (4) $V_{ctrl} = 1.2 \text{ V}$
- (5) $V_{ctrl} = 1.3 \text{ V}$
- (6) $V_{ctrl} = 1.5 \text{ V}$
- (7) $V_{ctrl} = 2 \text{ V}$
- (8) $V_{ctrl} = 4 \text{ V}$
- (9) $V_{ctrl} = 7.5 \text{ V}$
- (10) $V_{ctrl} = 10 \text{ V}$

Fig 4. Insertion loss as function of frequency; typical values



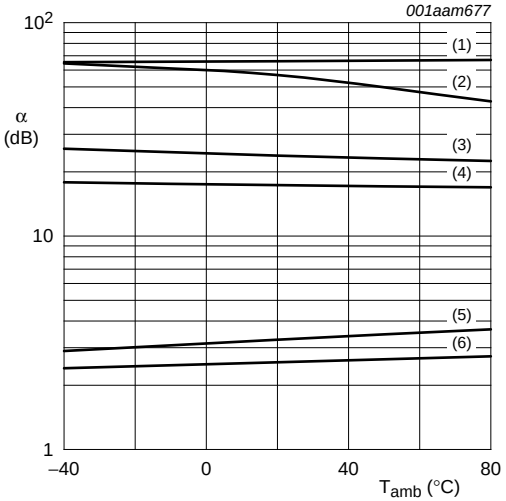
$V_{CC} = 3.7\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.
(1) $V_{ctrl} = 0\text{ V}$
(2) $V_{ctrl} = 15\text{ V}$

Fig 5. Return loss as function of frequency; typical values



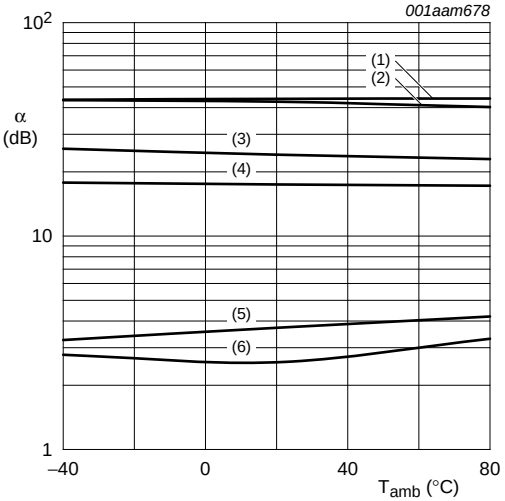
$V_{CC} = 3.7\text{ V}$; $T_{amb} = 25\text{ }^{\circ}\text{C}$.
(1) $f = 10\text{ MHz}$
(2) $f = 100\text{ MHz}$
(3) $f = 1000\text{ MHz}$
(4) $f = 3000\text{ MHz}$

Fig 6. Attenuation as function of control voltage; typical values



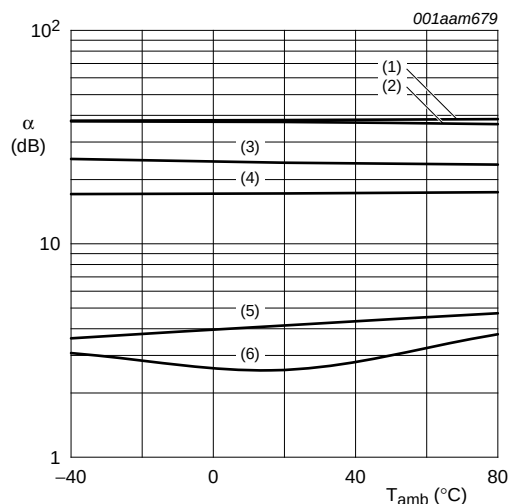
$V_{CC} = 3.7\text{ V}$; $f = 100\text{ MHz}$.
(1) $V_{ctrl} = 0\text{ V}$
(2) $V_{ctrl} = 1\text{ V}$
(3) $V_{ctrl} = 1.5\text{ V}$
(4) $V_{ctrl} = 2\text{ V}$
(5) $V_{ctrl} = 7.5\text{ V}$
(6) $V_{ctrl} = 10\text{ V}$

Fig 7. Attenuation as function of temperature; typical values



$V_{CC} = 3.7\text{ V}$; $f = 1000\text{ MHz}$.
(1) $V_{ctrl} = 0\text{ V}$
(2) $V_{ctrl} = 1\text{ V}$
(3) $V_{ctrl} = 1.5\text{ V}$
(4) $V_{ctrl} = 2\text{ V}$
(5) $V_{ctrl} = 7.5\text{ V}$
(6) $V_{ctrl} = 10\text{ V}$

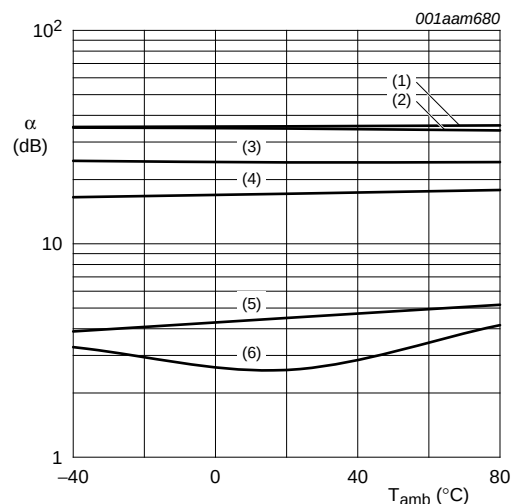
Fig 8. Attenuation as function of temperature; typical values



$V_{CC} = 3.7 \text{ V}$; $f = 2000 \text{ MHz}$.

- (1) $V_{ctrl} = 0 \text{ V}$
- (2) $V_{ctrl} = 1 \text{ V}$
- (3) $V_{ctrl} = 1.5 \text{ V}$
- (4) $V_{ctrl} = 2 \text{ V}$
- (5) $V_{ctrl} = 7.5 \text{ V}$
- (6) $V_{ctrl} = 10 \text{ V}$

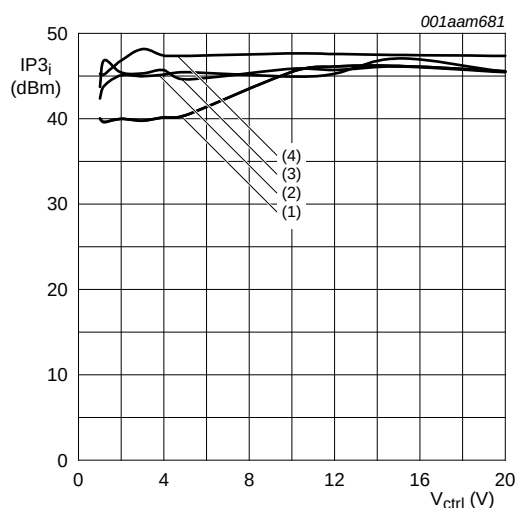
Fig 9. Attenuation as function of temperature; typical values



$V_{CC} = 3.7 \text{ V}$; $f = 3000 \text{ MHz}$.

- (1) $V_{ctrl} = 0 \text{ V}$
- (2) $V_{ctrl} = 1 \text{ V}$
- (3) $V_{ctrl} = 1.5 \text{ V}$
- (4) $V_{ctrl} = 2 \text{ V}$
- (5) $V_{ctrl} = 7.5 \text{ V}$
- (6) $V_{ctrl} = 10 \text{ V}$

Fig 10. Attenuation as function of temperature; typical values



$V_{CC} = 3.7 \text{ V}$; $T_{amb} = 25 \text{ °C}$.

- (1) $f = 100 \text{ MHz}$
- (2) $f = 900 \text{ MHz}$
- (3) $f = 1800 \text{ MHz}$
- (4) $f = 2100 \text{ MHz}$

Fig 11. Input third-order intercept point as control voltage; typical values

9. Package outline

Plastic surface-mounted package; 5 leadsSOT753

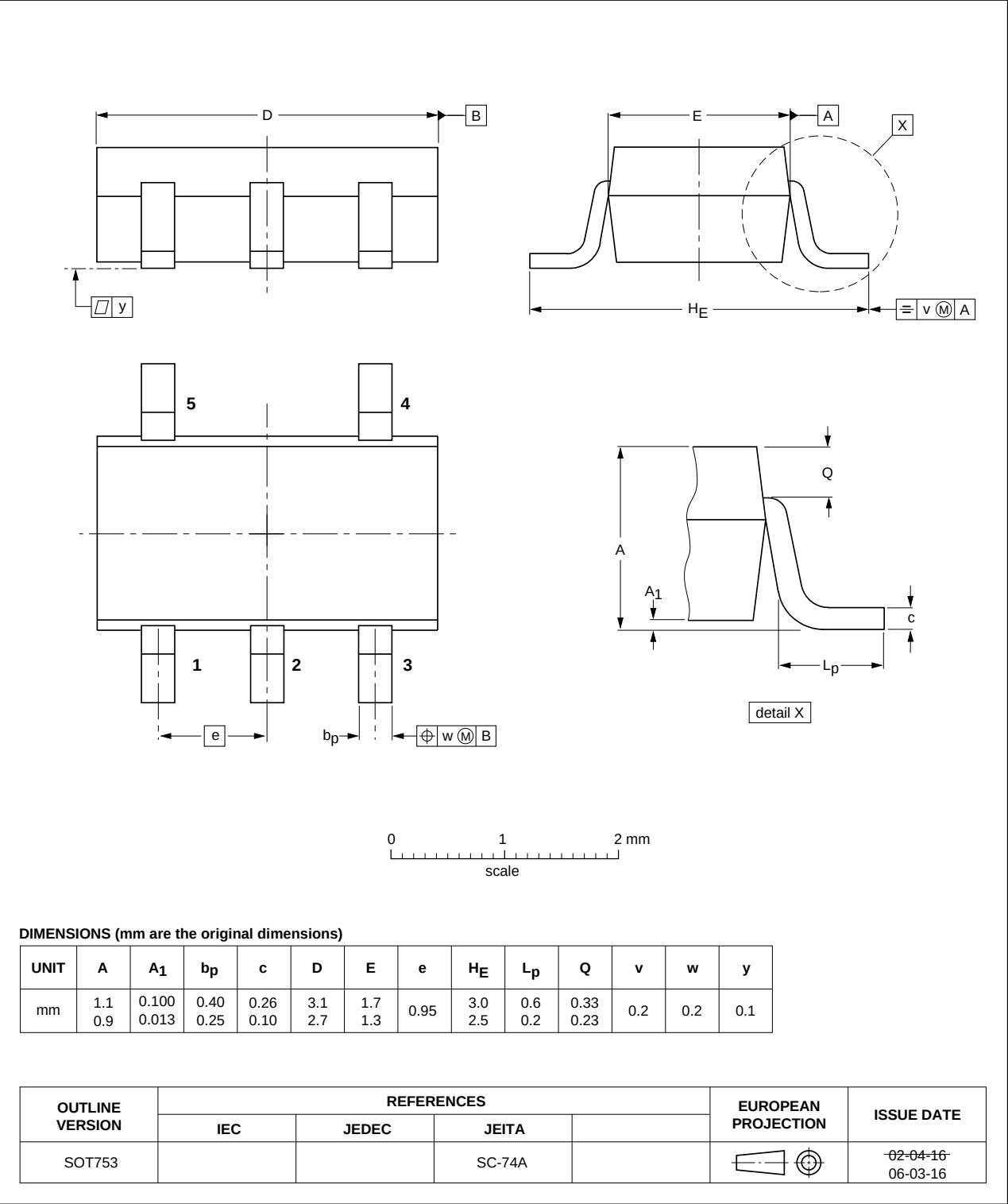


Fig 12. Package outline SOT753

10. Abbreviations

Table 9. Abbreviations

Acronym	Description
PIN	P-type, Intrinsic, N-type
RF	Radio Frequency

11. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BAP70Q v.2	20120306	Product data sheet	-	BAP70Q v.1
Modifications:	• Table 8: updated the title			
BAP70Q v.1	20101006	Product data sheet	-	-

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Document status ^{[1][2]}	Product status ^[3]	Definition
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Product [short] data sheet	Production	This document contains the product specification.

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Date of release: 6 March 2012

Document identifier: BAP70Q