



BAP70Q

Quad PIN diode attenuator

Rev. 3 — 3 August 2018

Product data sheet

1 Product profile

1.1 General description

Quad PIN diode in an 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
- AEC-Q101 qualified

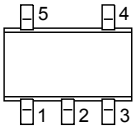
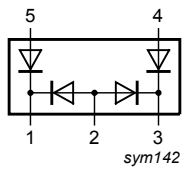
1.3 Applications

- 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		
2	series bias		
3	RF out		
4	shunt 1 bias		
5	shunt 2 bias		

3 Ordering information

Table 2. Ordering information

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

4 Marking code

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	$T_{sp} \leq 90\text{ °C}$	[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

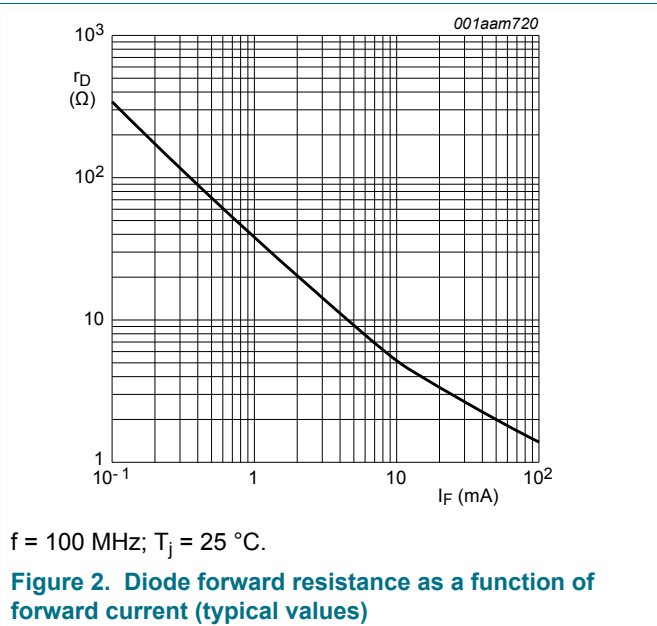
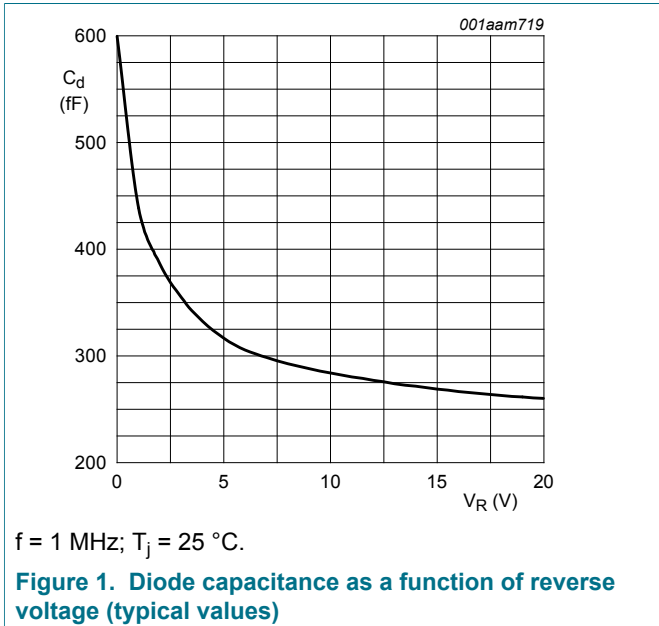
7 Characteristics

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	f = 1 MHz (see Figure 1)				
		$V_R = 0\text{ V}$	-	600	-	fF
		$V_R = 1\text{ V}$	-	430	-	fF
		$V_R = 20\text{ V}$	-	250	300	fF
r_D	diode forward resistance	f = 100 MHz (see Figure 2)				
		$I_F = 0.5\text{ mA}$	-	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 $I_R = 6\text{ mA}$; $R_L = 100\ \Omega$; measured at $I_R = 3\text{ mA}$	-	1.25	-	μs

8 Graphical data



9 Application information

9.1 Application circuit

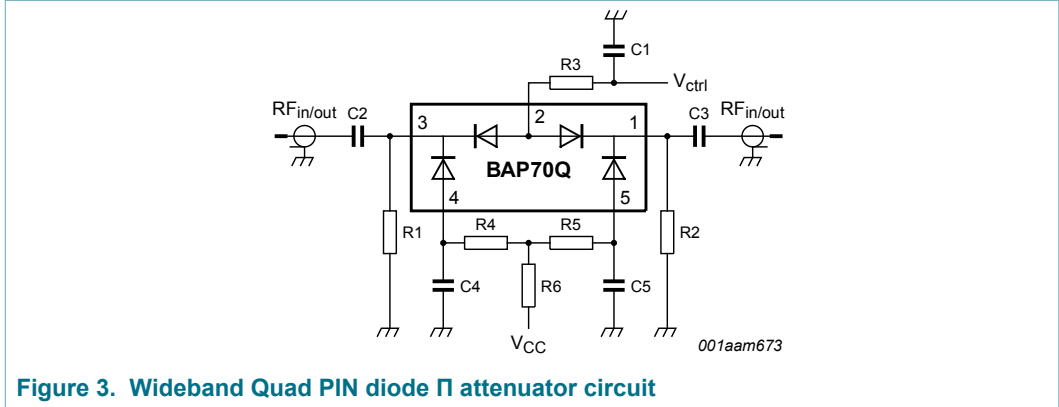


Figure 3. Wideband Quad PIN diode Π attenuator circuit

Table 7. List of components used for the typical application

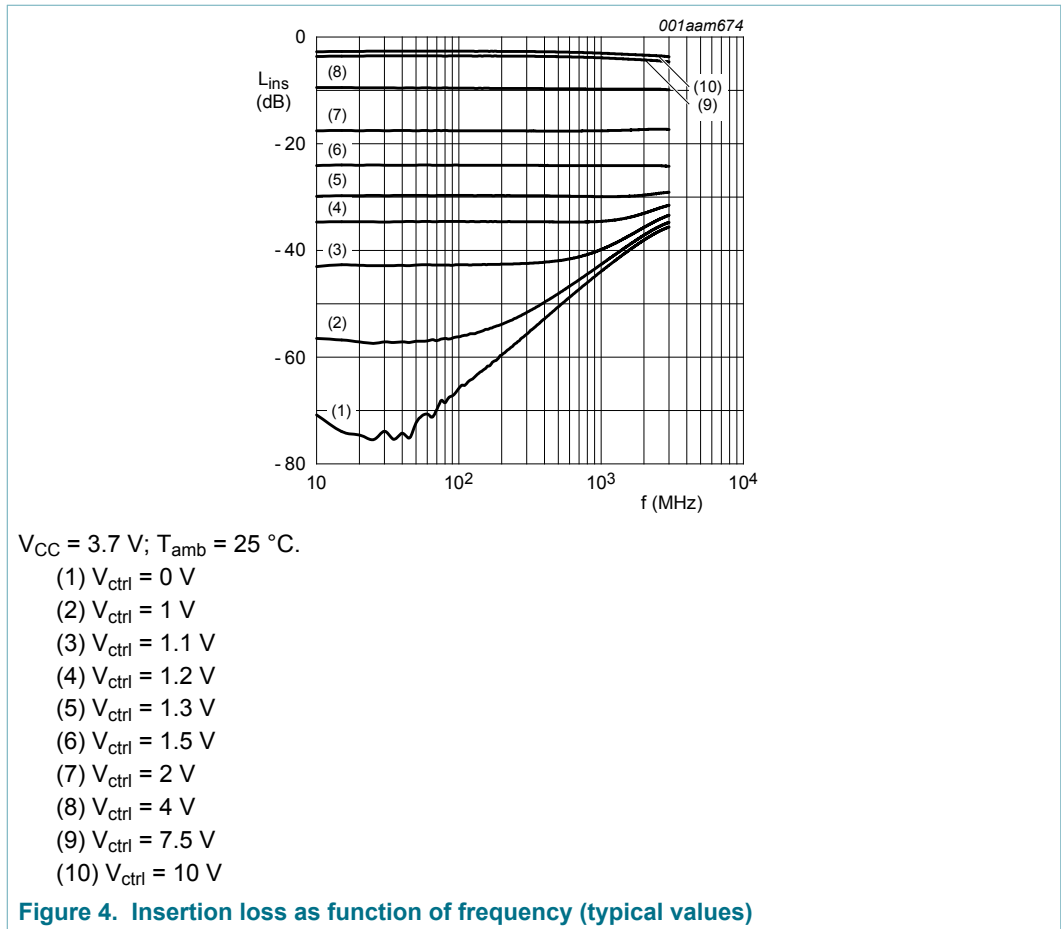
Component	Description	Conditions	Value
C1; C2; C3; C4; C5	chip capacitor	V _{CC} = 3.7 V	47 nF
		V _{CC} = 5 V	47 nF
R1; R2	chip resistor	V _{CC} = 3.7 V	560 Ω
		V _{CC} = 5 V	910 Ω
R3	chip resistor	V _{CC} = 3.7 V	330 Ω
		V _{CC} = 5 V	1000 Ω
R4; R5	chip resistor	V _{CC} = 3.7 V	1500 Ω
		V _{CC} = 5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

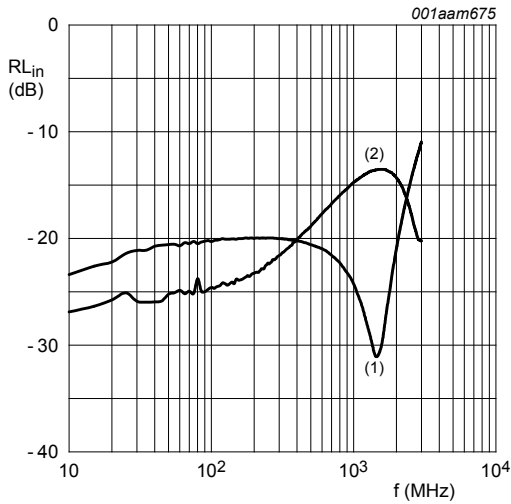
9.2 Quad PIN pi attenuator characteristics

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.

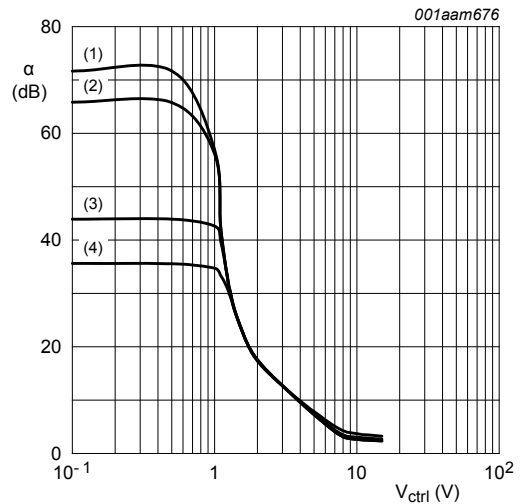
Symbol	Parameter	Test Conditions	Typ	Units
L_{ins}	insertion loss	$V_C = 10\text{ V}$; $f = 1\text{ GHz}$	3	dB
RL_{in}	input return loss	$V_C = 0\text{ V}$; $f = 1\text{ GHz}$	24	dB
α	attenuation	$V_C = 0\text{ V}$; $f = 1\text{ GHz}$	44	dB
$IP3_i$	input third-order intercept point	f = 0.1 GHz		
		$V_{ctrl}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





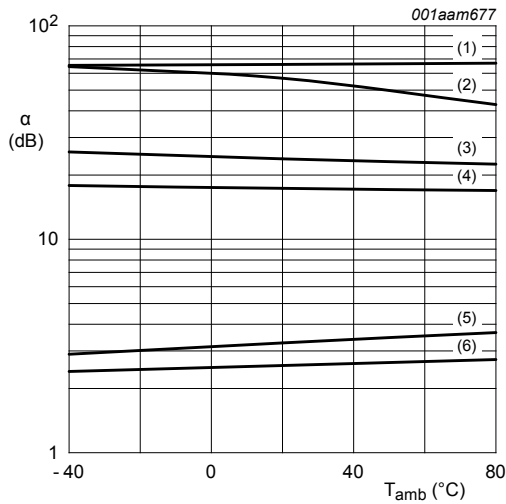
$V_{CC} = 3.7\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}.$
 (1) $V_{ctrl} = 0\text{ V}$
 (2) $V_{ctrl} = 15\text{ V}$

Figure 5. Return loss as function of frequency (typical values)



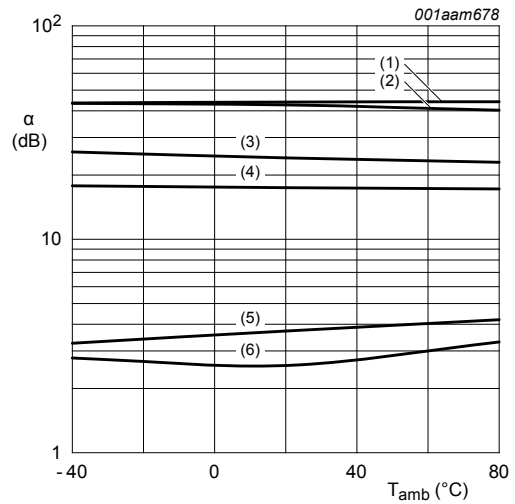
$V_{CC} = 3.7\text{ V}; T_{amb} = 25\text{ }^\circ\text{C}.$
 (1) $f = 10\text{ MHz}$
 (2) $f = 100\text{ MHz}$
 (3) $f = 1000\text{ MHz}$
 (4) $f = 3000\text{ MHz}$

Figure 6. Attenuation as function of control voltage (typical values)



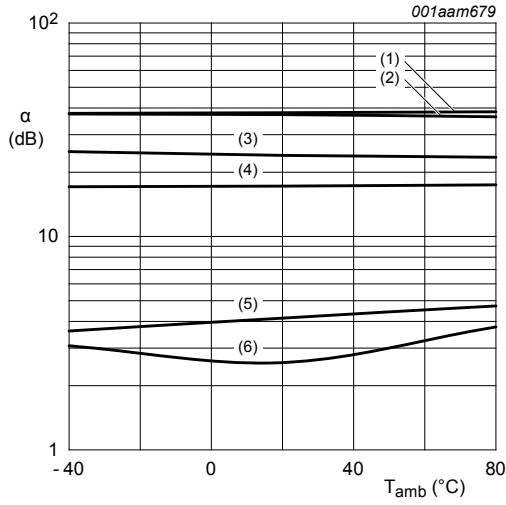
$V_{CC} = 3.7\text{ V}; f = 100\text{ MHz}.$
 (1) $V_{ctrl} = 0\text{ V}$
 (2) $V_{ctrl} = 1\text{ V}$
 (3) $V_{ctrl} = 1.5\text{ V}$
 (4) $V_{ctrl} = 2\text{ V}$
 (5) $V_{ctrl} = 7.5\text{ V}$
 (6) $V_{ctrl} = 10\text{ V}$

Figure 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) $V_{ctrl} = 10\text{ V}$

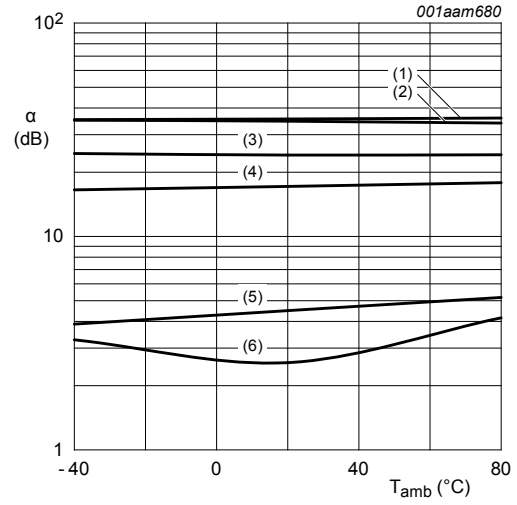
Figure 8. Attenuation as function of temperature (typical values)



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

- (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) $V_{ctrl} = 10 \text{ V}$

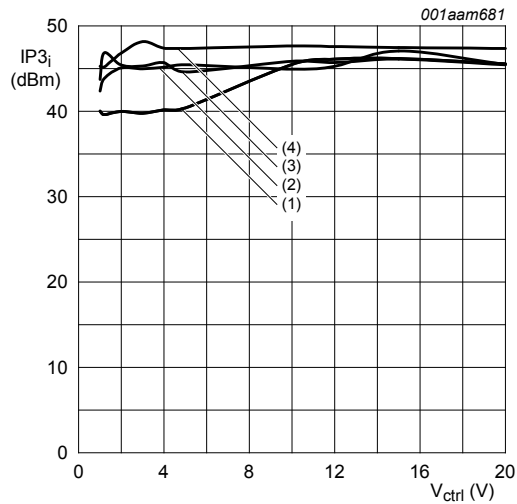
Figure 9. Attenuation as function of temperature (typical values)



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

- (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) $V_{ctrl} = 10 \text{ V}$

Figure 10. Attenuation as function of temperature (typical values)



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

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

Figure 11. Input third-order intercept point as control voltage (typical values)

10 Package outline

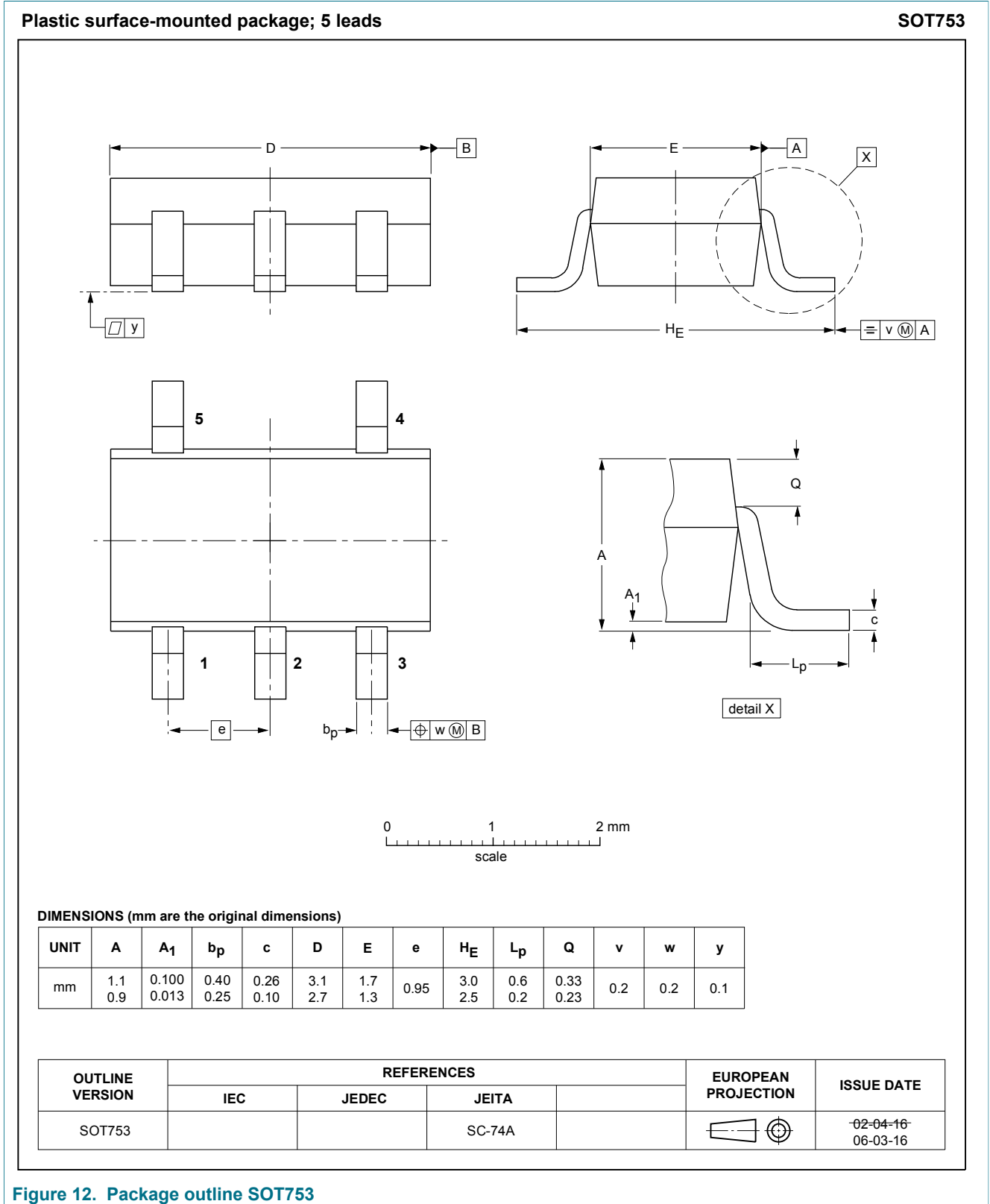


Figure 12. Package outline SOT753

11 Abbreviations

Table 9. Abbreviations

Acronym	Description
PIN	P-type, intrinsic, N-type
RF	radio frequency

12 Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
BAP70Q v.3	20181211	Product data sheet	-	BAP70Q v.2
Modifications:	<ul style="list-style-type: none">• Section 1.2 "Features and benefits" has been updated.• Changed to non automotive legal information• The "Legal information" pages have been updated.			
BAP70Q v.2	20120306	Product data sheet	-	BAP70Q v.1
BAP70Q v.1	20101006	Product data sheet	-	-

13 Legal information

13.1 Data sheet status

Document status ^{[1][2]}	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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