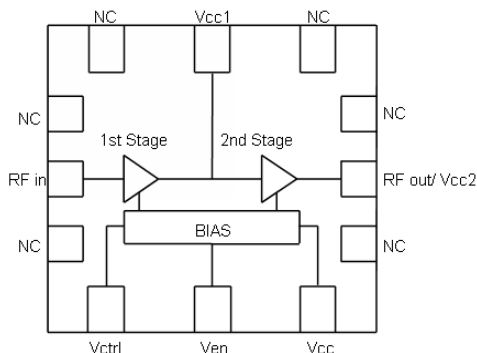


Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

Functional Block Diagram



Product Description

The TQP770001 Bluetooth PA is designed on TriQuint's advanced InGaP HBT GaAs technology offering state of the art reliability, temperature stability and ruggedness. The PA is a two-stage design requiring several SMD tuning elements for input and output matching, gain shaping, and bias injection. Features include an integrated bias controller with a power control (variable gain) function. The bias controller also acts to provide temperature compensation. The PA is housed in a 2.0 mm x 2.0 mm 12 pin STSLP package with a grounded back paddle. A recommended drawing is provided in section 4.3.2. This PA is designed to operate in Bluetooth v2.0 class 1 systems. It is also intended to be Enhanced Data Rate (EDR) compliant with Bluetooth v2.0 + EDR specification for both 2 Mbps and 3 Mbps modulation modes.

Electrical Specifications

Conditions: Vcc = 3.3 V, T = 25°C

Parameter	Min	Typ	Max	Units
Frequency	2.4		2.5	GHz
RF transmit power Vctrl=3.3V	19.5	21.0	-	dBm
Gain @ Pin= -10 dBm	25.0	27.0	-	dB
PAE @ 21.5dBm		50		%

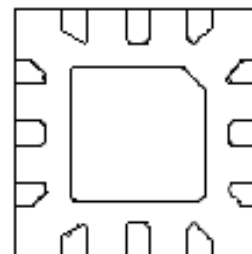
Features

- InGaP HBT Technology
- Bluetooth v2.0 class 1 systems
- High Efficiency: 50% @ 21.5dBm
- EDR (Enhanced Data Rate) Compliant
- Under EDR modulation, its low AM-AM and AM-PM distortion guarantee high modulation accuracy
- Will operate under Bluetooth FSK, 8DPSK, and Pi/4-DQPSK modulations
- Optimized for 50 ohm System
- Integrated bias controller with a power control (variable gain) function
- Small 12-pin QFN, 2x2mm module
- Lead-free 260°C RoHS Compliant
- Full ESD Protection

Applications

- Bluetooth v2.0 + EDR class 1 systems

Package Style



12-Pin 2.0x2.0x0.6mm STSLP Package
Bottom View

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

Absolute Maximum Ratings¹

Parameter	Symbol	Min.	Typ/Nom	Max.	Units
Power Supply Voltage	VCC	-	-	6	V
Power Supply Voltage	VCC, RF Applied	-	-	5	V
Bias and reference Voltage	PA_ON (PA_On = Ven = Venable)	-	-	5	V
Bias power control voltage	P_C (Vctrl = P_CTRL)	-	-	5	V
DC Supply current	ICC	-	-	250	mA
Storage Temperature	TSTORAGE	-40	-	85	°C
Operating Case Temperature	TC	-5	-	85	°C
Maximum input power	PI	-	-	5	dBm

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ/Nom	Max.	Units
Supply Voltage	V _{CC}	3.0	3.3	3.6	Volts
Reference Voltage	PA_ON (Ven)				Volts
PA On		3.0	3.3	3.60	
PA Off		0	-	0.4	
Bias power control voltage	P_CTRL (Vctrl)		0.0 – V _{CC}		Volts
Case Operating Temperature	T _{CASE}	-40	25	+85	°C

Note 1: No damage assuming only one parameter is set at a time with all other parameters set at or below nominal value.

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

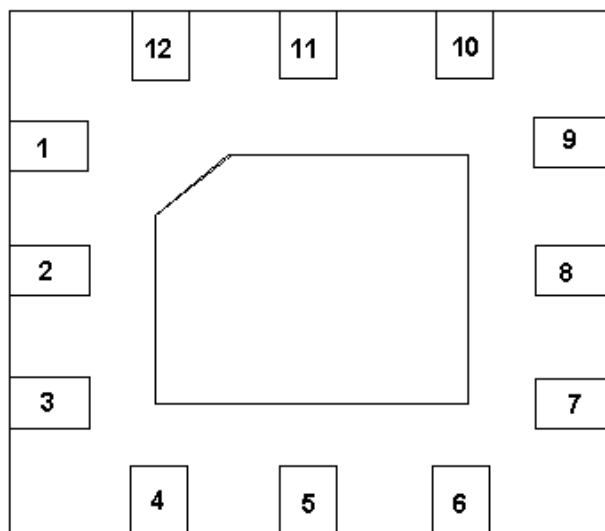
Electrical Characteristics

Conditions: $V_{CC} = V_{ctrl} = V_{en} = 3.3\text{ V}$, $T = 25^{\circ}\text{C}$

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
RF Frequency		2.4		2.5	GHz
Gain	$P_{in} = -25\text{ dBm}$	25	27		dB
Operating Temperature Range		-40	25	85	C
Minimum RF transmit power	$V_{ctrl} = 0.4\text{ V}$			-25	dBm
Maximum RF transmit power	$V_{ctrl} = 3.3\text{ V}$; Basic Data Rate	19.5	21.0		dBm
Gain variation over temperature	-40C to +85C		± 1		dB
Gain Flatness			± 0.3		
Harmonics (2 nd)				-35	dBc
Harmonics (3 rd)				-35	dBc
Spurious	$P_{out} = 20\text{ dBm}$		-60		dBc
Input return loss		8	9		dB
Output return loss		10	14		dB
1 dB gain compression	Depends on external matching		20		dBm
$V_{en} = V_{enable} = \text{PA ON Voltage}$		3.0	3.3	3.6	V
$V_{en} = V_{enable} = \text{PA ON Current}$				0.5	mA
$V_{ctrl} = \text{Power control voltage}$		0.0		3.6	V
$V_{ctrl} = \text{Power control current}$				0.5	mA
Off-state S21	$V_{CC} = 3.3\text{ V}$, $V_{en} = V_{ctrl} = 0.4\text{ V}$		-27	-15	dB
Supply voltage V_{CC}		3.0	3.3	3.6	V
Supply current			110	150	mA
Shutdown current	$0\text{ V} \leq V_{ctrl} = V_{en} \leq 0.4\text{ V}$		5		μA

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

Pin Out and Assignments

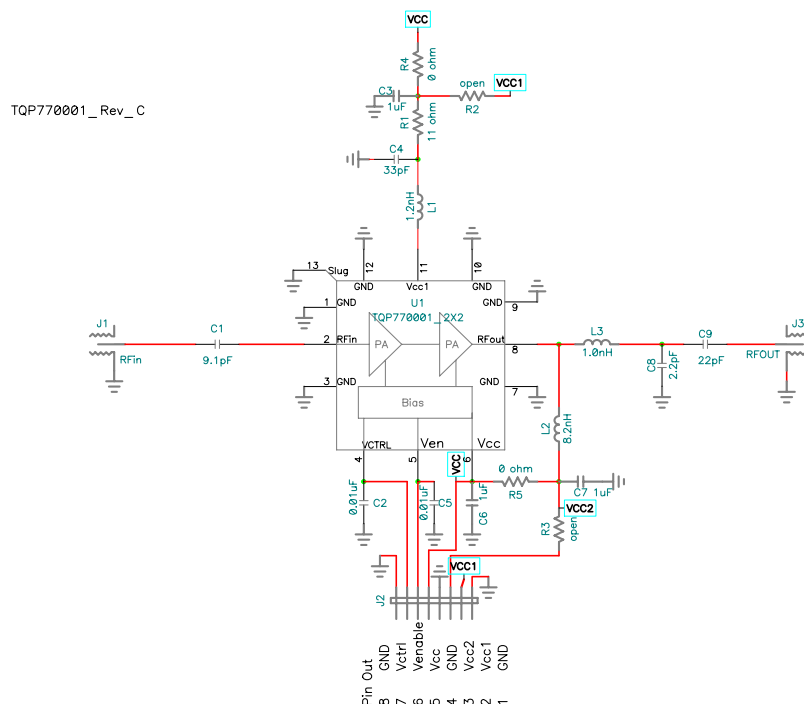


Top View (X-ray)

Pin #	Description	Function
1	NC or GND	No Connect
2	RF IN	RF input
3	NC or GND	No Connect
4	Vctrl	Amplifier Power/Gain/Current Control
5	Ven	Amplifier On/ Off
6	Vcc	Bias circuit Vcc
7	NC or GND	No Connect
8	RF OUT/Vcc2	RF output and second stage Vcc
9	NC or GND	No Connect
10	GND	Required ground
11	Vcc	First stage Vcc
12	NC or GND	No Connect
Back	Paddle ground connection	Required ground

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

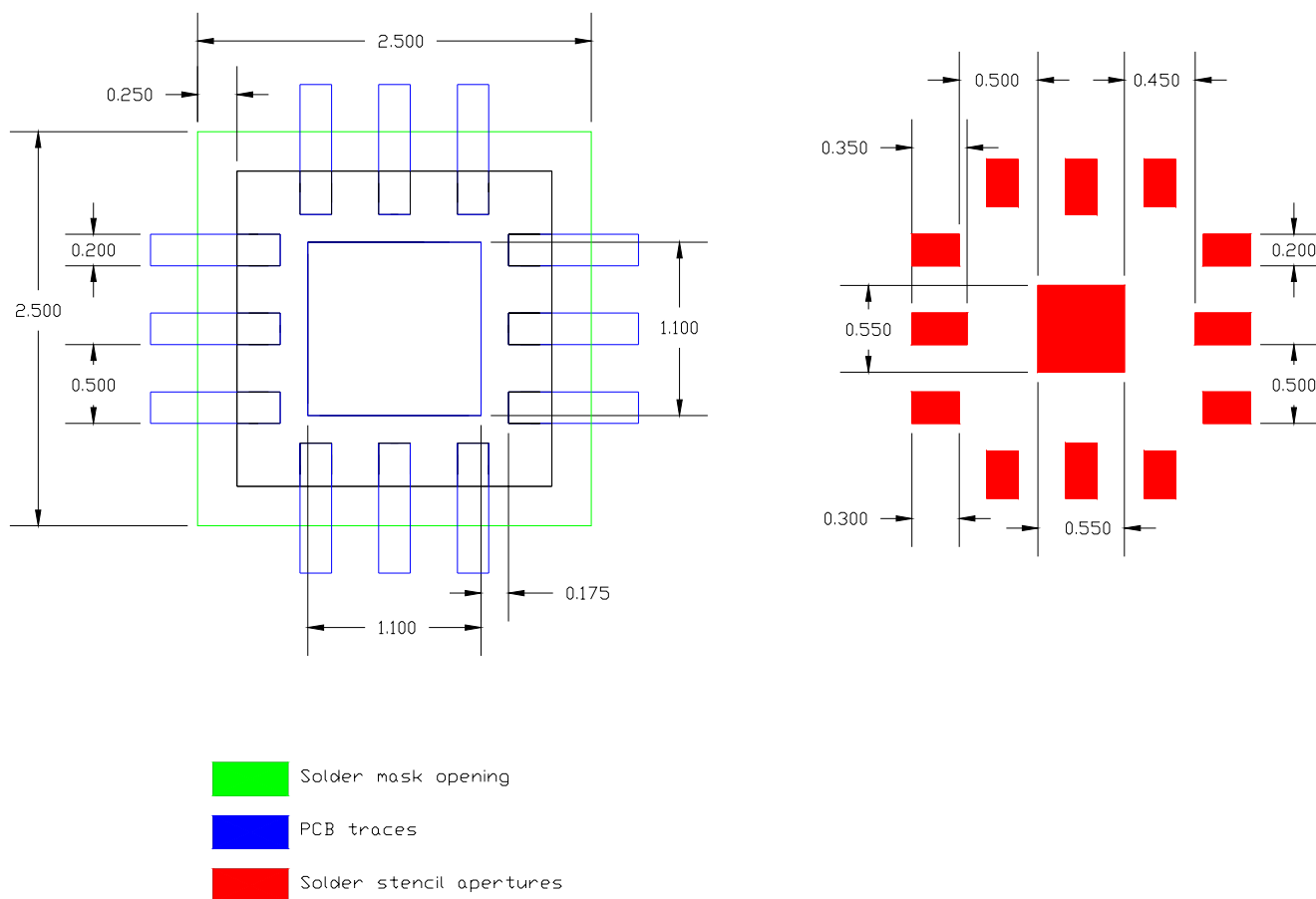
Application Circuit



Part	Description	Size	Comment
C1	9.1 pF ceramic cap	201	Provides DC block and input matching.
C2	0.01uF ceramic cap	201	Provides low frequency bypass at Vctrl.
C3	1.0uF ceramic cap	402	Provides low frequency bypass at Vcc1.
C4	33pF ceramic cap	201	Inter-stage matching, RF choke and RF bypass L1/C4 .
C5	0.01uF ceramic cap	201	Provides low frequency bypass at Venable.
C6	1.0uF ceramic cap	402	Provides low frequency bypass at Vcc.
C7	1.0uF ceramic cap	402	Provides low frequency bypass at Vcc2.
C8	2.2pF ceramic cap	201	Provides output matching circuit C8/L3.
C9	22pF ceramic cap	201	Provides Dc blocking.
L1	1.2nH chip inductor	201	Inter-stage matching, RF choke and RF bypass L1/C4 .
L2	8.2nH chip inductor	201	Provides RF choke at Vcc2.
L3	1.0 nH chip inductor	201	Provides output matching circuit C8/L3.
R1	11.0 Ohm chip resistor	201	Provides RF stability.
R2	0.0 Ohm chip resistor	402	DC jumper. Install to bias Vcc1 independently from Vcc and Vcc2.
R3	0.0 Ohm chip resistor	402	DC jumper. Install to bias Vcc2 independently from Vcc and Vcc2
R4	0.0 Ohm chip resistor	402	DC jumper. Install to connect Vcc1 bias to Vcc.
R5	0.0 Ohm chip resistor	402	DC jumper. Install to connect Vcc2 bias to Vcc.

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

PC Board Layout Recommendations

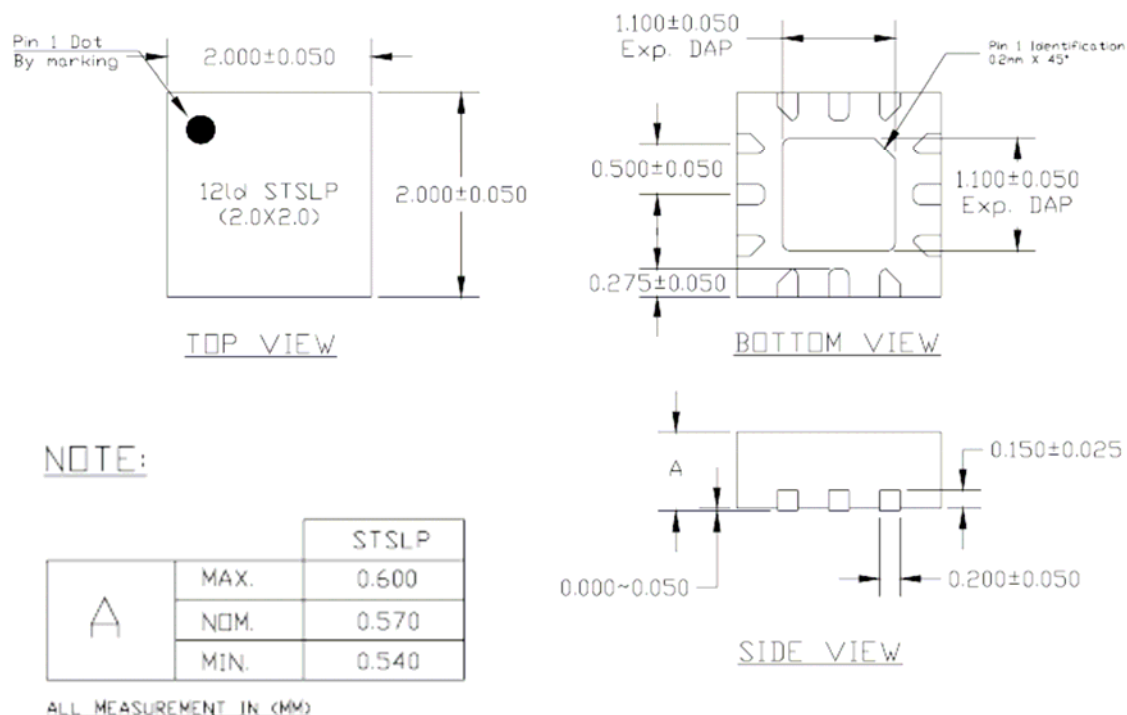


Notes:

- 1.) Only ground signal traces are allowed directly under the package
- 2.) Primary dimensions are in millimeters alternate dimensions are in inches.

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

Packaging Information



Packaging Marking Diagram



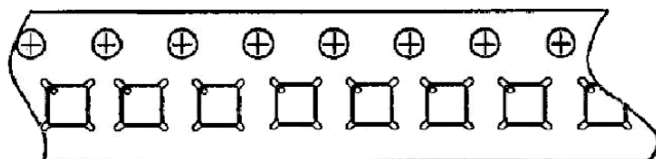
LASER MARK.

Line 1: 771 - Product code.

Line 2: XXX- Last 3 Char of TriQuint assembly lot number.

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

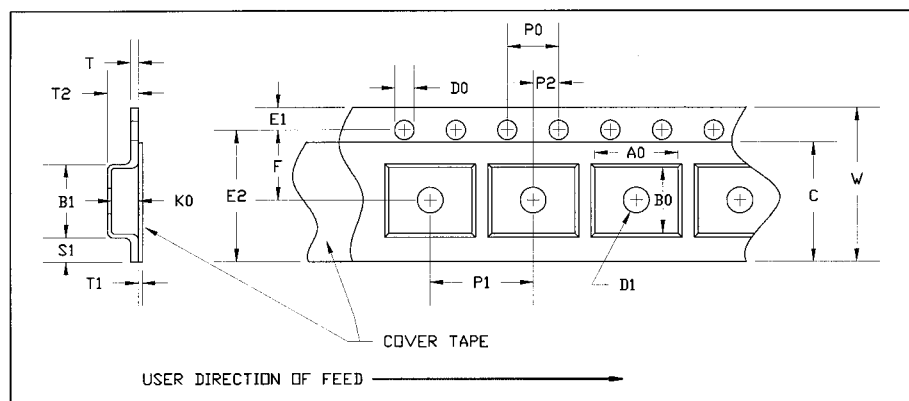
Tape and Reel Information:



HP VFQFP-N 2X2

USER DIRECTION OF FEED →

Carrier Cover and Physical Tape Dimensions:



HP VFQFP-N 2x2 CARRIER AND COVER TAPE DIMENSIONS (See note 1)

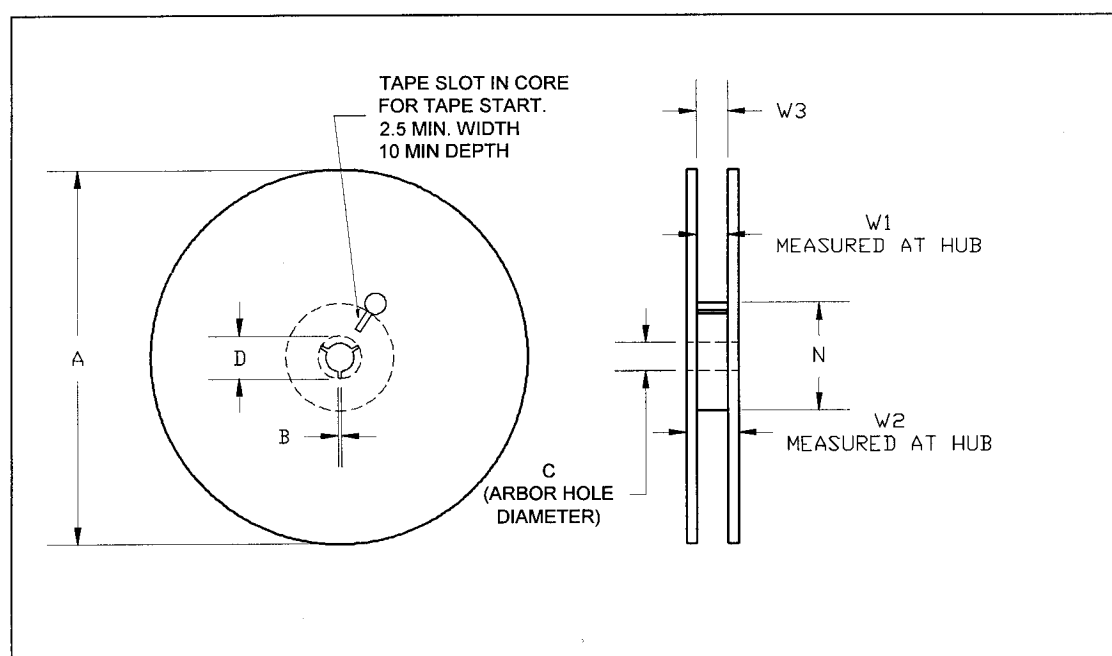
PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
CAVITY	LENGTH	A0	0.091	2.30
	WIDTH	B0	0.091	2.30
	DEPTH	K0	0.047	1.20
	PITCH	P1	0.157	4.00
DISTANCE BETWEEN CENTERLINE	CAVITY TO PERFORATION LENGTH DIRECTION	P2	0.079	2.00
	CAVITY TO PERFORATION WIDTH DIRECTION	F	0.138	3.50
COVER TAPE	WIDTH	C	0.213	5.40
CARRIER TAPE	WIDTH	W	0.315	8.00

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

NOTES –

1. HP VFQFP-N is the JEDEC nomenclature for the leadless package family defined in MO-220.
Equivalent vendor specific nomenclature for packages based on MO-220 include; MLF (AMKOR), MLP (Carsem), SLP (Unisem) , QLP (STATS) , LPCC (ASAT) and others.

Reel Physical Dimensions:

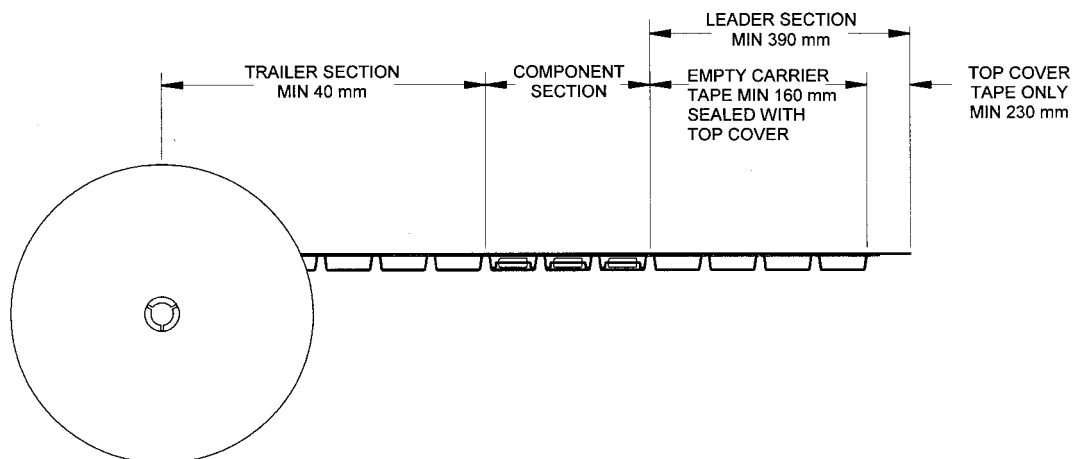


Reel Dimensions for 8mm Carrier Tape – 7" Reel

HP VFQFP-N 2X2			7" Reel	
PART	FEATURE	SYMBOL	SIZE (in)	SIZE (mm)
FLANGE	DIAMETER	A	6.969	177.0
	THICKNESS	W2	0.559	14.2
	SPACE BETWEEN FLANGE	W1	0.346	8.8
HUB	OUTER DIAMETER	N	4.016	102.0
	ARBOR HOLE DIAMETER	C	0.512	13.0
	KEY SLIT WIDTH	B	0.079	2.0
	KEY SLIT DIAMETER	D	0.787	20.0

Bluetooth Two Stage (HBT) Power Amplifier (EDR Compliant)

Tape Length and Label Placement:



Empty part cavities at the trailing and leading ends are sealed with cover tape.
See EIA 481-1-A

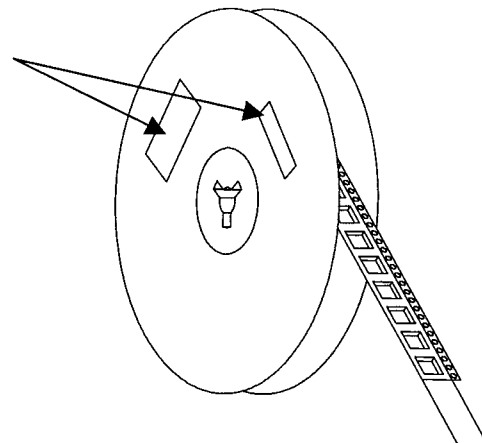
Product label, Mfg Label and ESD label
are placed on the flange opposite to
the sprockets in the carrier tape

Reel Quantity: 2,500 units

Additional Information¹

This part is compliant with RoHS directive (Restrictions on the Use of Certain Hazardous Substances in Electrical and Electronic Equipment).

The part is rated Moisture Sensitivity Level 1 at 260°C per JEDEC standard IPC/JEDEC J-STD-020.



¹ For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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Revision B, Sept. 18, 2006