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# Probing Solutions for TQFP/CQFP/PQFP Packages

## Product Overview

### Overview

Probing fine pitch QFP parts has become increasingly difficult over the past several years. HP has developed several revolutionary probing adapters for the 0.5mm and 0.65mm high density TQFP/CQFP/PQFP packages.

Several methods of probing signals on devices are available depending on system requirements. Soldering wires to devices or using other intermittent solutions is no longer necessary with the newest Hewlett-Packard probing solutions. These HP solutions can be used with logic analyzers, emulators, or oscilloscopes. A wide assortment of accessories allow connection from the probe adapter to a preprocessor or emulator pod.

### Elastomeric Probing Solutions

HP's Elastomeric probing solutions offer an inexpensive, rugged, and easy to use solution for QFP packages. The probes require a minimal "keep out" area around the device as shown in figure 5 and 6.

The Elastomeric probe makes contact between the probe and the pins of a device with an elastomer material. There are redundant connections for each pin ensuring a reliable and rugged connection. A retainer is glued to the top of the device for a solid connection to each pin. Five retainers, a locator tool, and adhesive are included with each elastomeric probe adapter.

For use with HP logic analyzers, emulators, and oscilloscopes

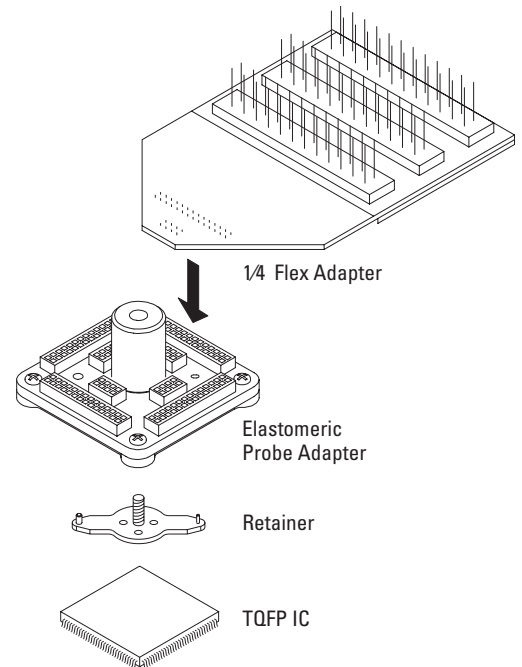
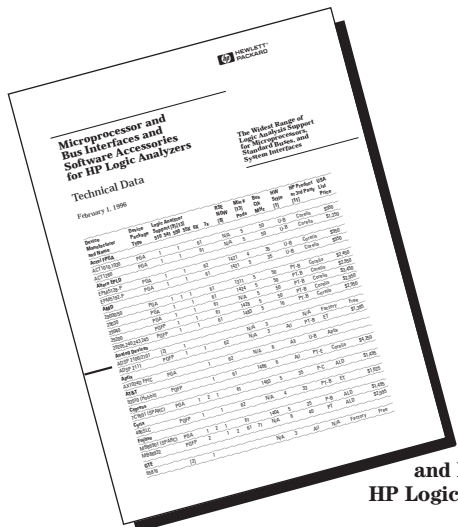


Figure 2. Elastomeric Probing Solution



Package	Pin Pitch	Elastomeric Probe Adapter
144-pin TQFP	0.5 mm	HP E5336A
144-pin PQFP/CQFP	0.65 mm	HP E5361A
160-pin PQFP/CQFP	0.65 mm	HP E5373A
176-pin TQFP	0.5 mm	HP E5348A
208-pin PQFP/CQFP	0.5 mm	HP E5374A
240-pin PQFP/CQFP	0.5 mm	HP E5363A

Table 1. Elastomeric Probe Adapters

Figure 1. For processor specific solutions, refer to the "Microprocessor and Bus Interface and Software Accessories for HP Logic Analyzers" (Pub # 5963-2435E)

## Installation

A locator tool, provided with the probe, is used for correct alignment of the retainer. A small amount of adhesive is used on the bottom of the retainer to make contact to the device. The locator tool is then removed and the elastomeric probe attached.

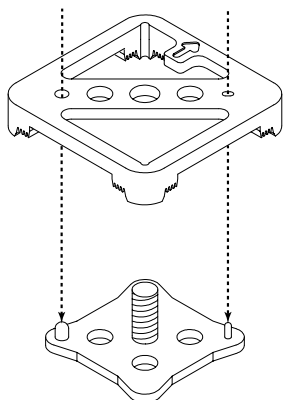


Figure 3. Locator Tool on Device

## Optional Accessories

1/4 flex adapters are available to bring the signals from the elastomeric probe adapter to general purpose headers for easy connection to logic analyzers, oscilloscopes, or other test equipment as shown in figure 2. Four 1/4 flex adapters are required to view all signals on a device. Each 1/4 flex adapter covers the pins on one side of the QFP device.

Additional retainers and locator tools are also available. A kit of five retainers and adhesive is available as option #201, while the locator tool is option #202. See table 3 below.

Package Supported	1/4 Flex Adapter	Elastomeric Probe
144-pin TQFP	HP E5340A	HP E5336A
144-pin PQFP/CQFP	HP E5340A	HP E5361A
160-pin PQFP/CQFP	HP E5349A	HP E5373A
176-pin TQFP	HP E5349A	HP E5348A
208-pin PQFP/CQFP	HP E5371A	HP E5374A
240-pin PQFP/CQFP	HP E5371A	HP E5363A

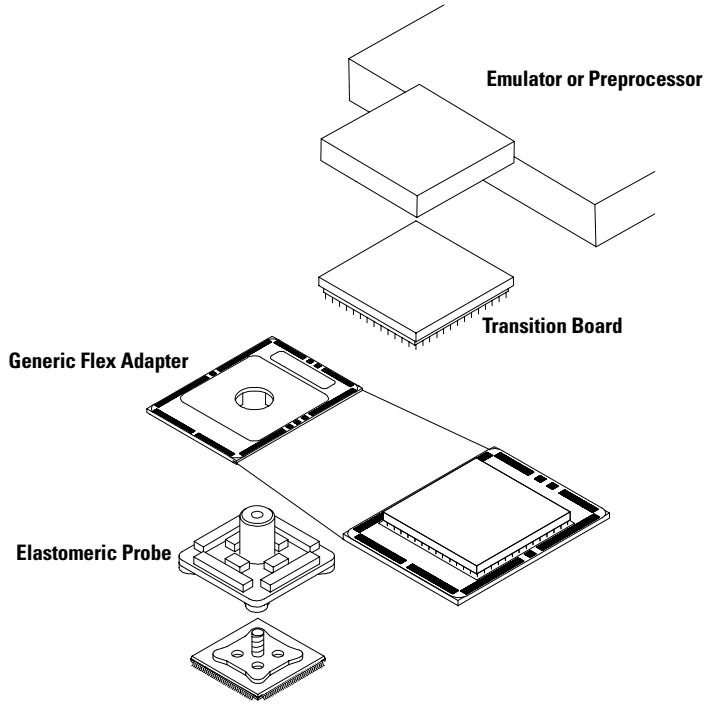
Table 2. Elastomeric 1/4 Flex Adapters

Package Supported	Elastomeric Probe	Retainer Kit Option #	Locator Tool Option #
144-pin TQFP	HP E5336A	201	202
144-pin PQFP/CQFP	HP E5361A	201	202
160-pin PQFP/CQFP	HP E5373A	201	202
176-pin TQFP	HP E5348A	201	202
208-pin PQFP/CQFP	HP E5374A	201	202
240-pin PQFP/CQFP	HP E5363A	201	202

Table 3. Elastomeric Accessories

**Microprocessor Package Support**

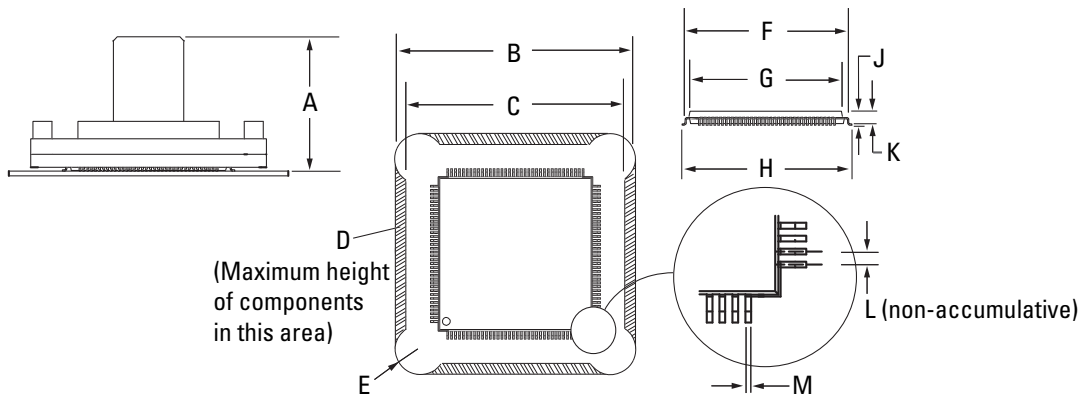
For existing preprocessors and emulators, HP offers transition boards and generic flex adapters for use with the elastomeric probes to support the latest high density packages available. The generic flex adapter brings the signals from the elastomeric probe adapter up through a flex circuit to a generic PGA array of pins for connection to the preprocessor or emulator probe.



**Figure 4. Microprocessor Support Configuraton**

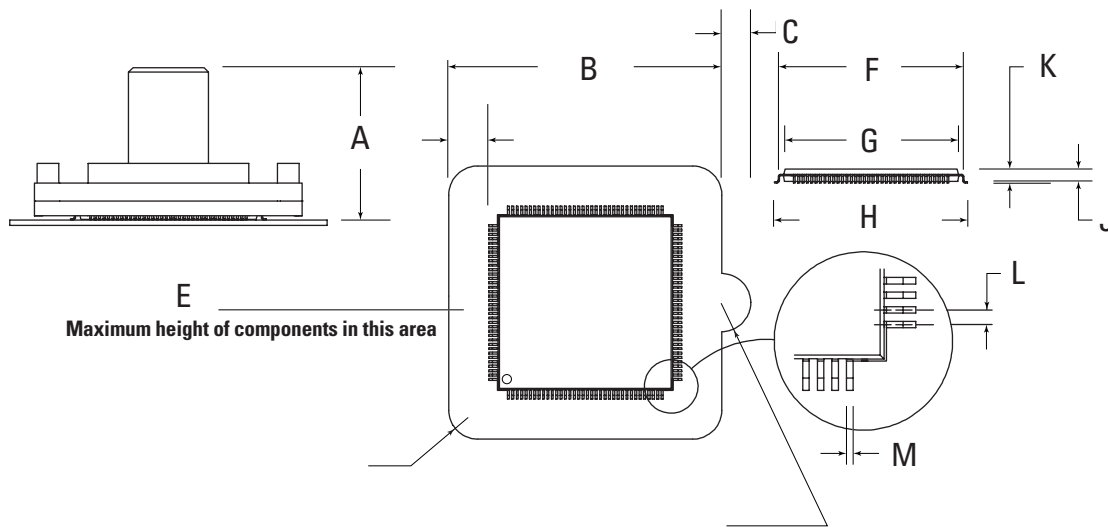
Microprocessor	Package	Products to Order	Emulator Supported	Preprocessor Supported
Motorola 68332	144 TQFP	HP E5336A Elastomeric Probe HP E5338A Generic Flex Adapter HP E5341A Transition Board		HP E2413C
Motorola 68332	144 TQFP	HP E5336A Elastomeric Probe HP E5338A Generic Flex Adapter HP E3416A Transition Board	HP 64782	
Motorola 68302	144 TQFP	HP E5336A Elastomeric Probe HP E5338A Generic Flex Adapter HP E3439A Transition Board	HP 64746	HP E2414B
Motorola 68302	144 TQFP	HP E5336A Elastomeric Probe HP E5338A Generic Flex Adapter No Transition Board Needed	HP 64798	
Motorola 68340	144 TQFP	HP E5336A Elastomeric Probe HP E5338A Generic Flex Adapter HP E5358A Transition Board	HP 64751	HP E2424B
Motorola 68360	240 PQFP/CQFP	HP E5363A Elastomeric Probe HP E5372A Generic Flex Adapter HP E8124A Transition Board	HP 64780	HP 2448A/B
Intel 386EX	144 TQFP	HP E5336A Elastomeric Probe HP E5338A Generic Flex Adapter HP E3442A Transition Board	HP 64789	HP E2454A
Intel 486SXSF	176 TQFP	HP E5353A Probing Kit Includes Generic Flex, Transition Board, and Elastomeric Probe		HP E2411C

**Table 4. Microprocessor Package Support Table**



Adapter	A	B	C	D	E	F	G	H	J	K	L	M
<b>144-Pin TQFP</b>												
(inches)	0.674	1.240	1.130	0.055	0.138	0.827 (min)	0.795 (max)	0.866±0.008	0.057 to 0.063	0.053 to 0.057	.0197 ±0.0012	0.009 ±0.002
(millimeters)	17.13	31.50	28.70	1.40	3.50	21.00 (min)	20.20 (max)	22.00 ±0.20	1.450 to 1.60	1.350 to 1.45	0.500 ±0.03	0.220±0.05
<b>176-Pin TQFP</b>												
(inches)	0.674	1.398	1.287	0.055	0.138	0.984(min)	0.953(max)	1.024 ±0.008	0.057 to 0.063	0.053 to 0.057	.0197 ±0.0012	0.009 ±0.002
(millimeters)	17.13	35.50	32.70	1.40	3.50	25.00(min)	24.20(max)	26.00 ±0.20	1.450 to 1.60	1.350 to 1.45	0.50 ±0.03	0.220 ±0.05

Figure 5. Elastomeric Probe and Package Dimensions for TQFP



Adapter	A	B	C	E	F	G	H	J	K	L	M
<b>144-Pin PQFP/CQFP</b>											
(inches)	0.73	1.58	0.16	0.01	1.14(min)	1.11 (max)	1.23(max)	0.094 to 0.098	0.057 to 0.063	.0256 ± 0.0012	0.009 ± 0.002
(millimeters)	18.5	40.21	4	0.3	28.85	28.10 (min)	31.20	2.4 to 2.5	2.75 max	0.65 ± .03	0.220 ± 0.05
<b>160-Pin PQFP/CQFP</b>											
(inches)	0.76	1.58	0.16	0.03	1.15(min)	1.11 (max)	1.27	0.126 to 0.146	0.136 to 0.161	.0256 ± 0.0012	0.009 ± 0.002
(millimeters)	19.2	40.21	4	0.8	29.32(min)	28.10 (max)	32.15	3.20 to 3.70	3.45 to 4.10	0.65 ± .03	0.220 ± 0.05
<b>208-Pin PQFP/CQFP</b>											
(inches)	0.76	1.58	0.16	0.03	1.14(min)	1.11(max)	1.197 to 1.213	0.126 to 0.142	0.136 to 0.161	0.0197 ± 0.0012	0.009 ±0.002
(millimeters)	19.2	40.21	4	0.8	28.85(min)	28.20(max)	30.4 to 30.8	3.20 to 3.60	3.45 to 3.60	0.500 ± 0.03	0.220 ±0.05
<b>240-Pin PQFP/CQFP</b>											
(inches)	0.76	1.94	0.16	0.03	1.29(min)	1.27(max)	1.55 to 1.57	0.126 to 0.142	0.136 to 0.161	0.0197 ± 0.0012	0.009 ± 0.002
(millimeters)	19.2	49.2	4	0.8	32.85(min)	32.20(max)	39.4 to 39.8	3.20 to 3.60	3.45 to 3.60	0.500 ± 0.03	0.220 ±0.05

Figure 6. Elastomeric Probe and Package Dimensions for PQFP/CQFP

<b>Electrical Characteristics</b>	<b>Elastomeric Probe Adapter</b>	<b>1/4 Flex Adapter</b>
Operating Voltage	<40V (DC + peak AC)	<40V (DC + peak AC)
Operating Current	0.5A (max)	0.5A (max)
Insulation Resistance	>100MΩ	>100MΩ
<b>Model Parameters</b>		
Pin-to-Ground Capacitance* (typical)		HP E5340A 3.0 pF First Row 4.0 pF Second Row 6.0 pF Third Row  HP E5349A 2.5 pF First Row 3.5 pF Second Row 5.0 pF Third Row  HP E5371A 2.5 pF First Row 3.5 pF Second Row 5.0 pF Third Row
Pin-to-Pin Capacitance* Self Inductance (typical)	0.5 pF	2 pF  HP E5340A 15 nH First Row 25 nH Second Row 35 nH Third Row  HP E5349A 20 nH First Row 30 nH Second Row 40 nH Third Row  HP E5371A 20 nH First Row 30 nH Second Row 40 nH Third Row
Operating Bandwidth	750 MHz (typical)	350MHz
<b>Environmental Characteristics</b>		
Operating Temperature	0°C to 50°C	0°C to 50°C
Max Operating Humidity 75% relative humidity	75% relative humidity	75% relative humidity

\* Add these values to the value of the probe adapter assembly capacitance for total capacitance.

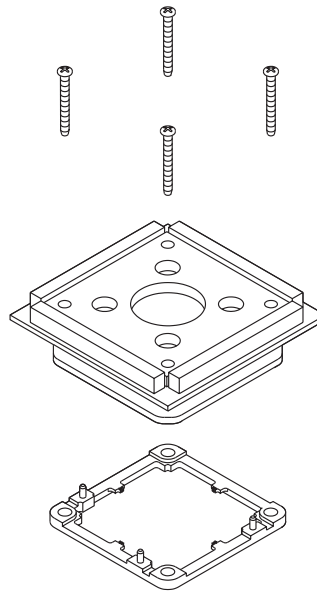
**Table 5. Probe and Flexible Adapter Electrical and Environmental Characteristics**

## Locator Base Probing Solutions

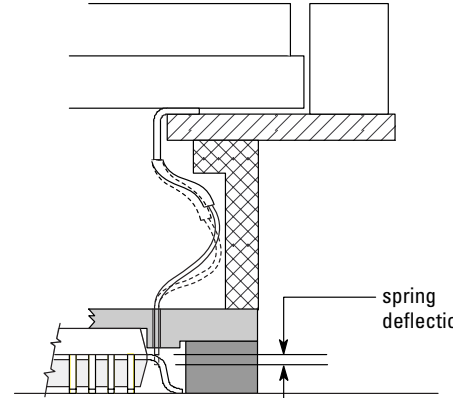
Locator base probe adapters provide an easy way to connect an HP logic analyzer, emulator or oscilloscope to many 0.5mm and 0.65mm pitch Ceramic Quad Flat Pack (CQFP) or Plastic Quad Flat Pack (PQFP) surface mount devices. Two different locator mounting techniques are supported. The locator base may be attached to the PC board with either adhesive or threaded inserts in mounting holes.

The probe adapter makes contact with the leads of the device as shown in figure 8. Each connection is spring loaded to ensure reliable contact with the package lead.

The probe adapter includes one probe, a pin guard protector for the adapter and adhesive.



**Figure 7. HP probe adapter for 0.5mm and 0.65 mm CQFP/PQFP packages**



**Figure 8. Spring loaded probe wire making contact with PQFP lead**

Package	Pin Pitch	Probe Adapter
160-pin PQFP/CQFP	0.65mm	HP E5319A
184-pin PQFP/CQFP	0.5mm	HP E5343A
208-pin PQFP/CQFP	0.5mm	HP E5318A
240-pin PQFP/CQFP	0.5mm	HP E5315A
304-pin PQFP/CQFP	0.5mm	HP E5331A

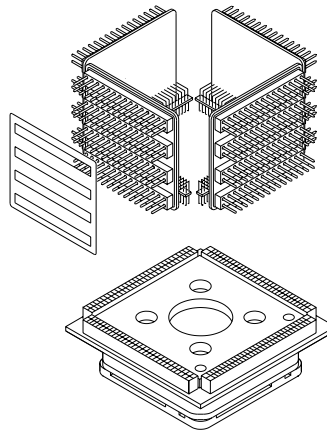
**Table 6. Locator Base Probe Adapter**

Package Supported	1/4 Flex Adapter	1/4 Rigid Adapter
160-pin PQFP/CQFP	HP E5316A	HP E5330A
184-pin PQFP/CQFP	HP E5316A	HP E5330A
208-pin PQFP/CQFP	HP E5316A	HP E5330A
240-pin PQFP/CQFP	HP E5316A	HP E5330A
304-pin PQFP/CQFP	HP E5333A	

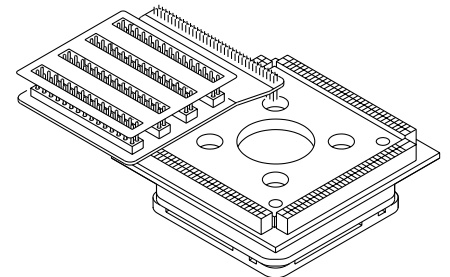
**Table 7. Locator Base 1/4 Flex Adapters and 1/4 Rigid Adapters**

## Optional Accessories

The 1/4 flex and 1/4 rigid adapters are designed to be installed on one side of the probe adapter. The 1/4 flex or 1/4 rigid adapters provide connectors designed to fit Hewlett-Packard logic analyzer or oscilloscope probes. Up to four flexible or rigid adapters may be used with the probe adapter. Table 7 can be used to determine the correct product numbers.



**Figure 9. 1/4 Rigid Adapter**



**Figure 10. 1/4 Flexible Adapter**

## Installation

There are two methods of installing the locator base. The first method uses a locator base with threaded inserts (provided with the probe adapter) and requires you to glue it to the PC board. The second method uses a locator base without inserts (optional) and requires you to incorporate threaded inserts into the design of the PC board. Table 8 shows the layout dimensions required to mount four #2-56 inserts on a PC board. The kit number shown in the table includes the appropriate locator base and four screws. Locator bases without inserts are provided with longer #2-56 screws, and board attachment hardware. The board attachment hardware consists of #2-56 nuts and threaded inserts.

## Locator Base

Adapter	a	b	c	d	e	f	g	Locator kit w/inserts	Locator kit No inserts
<b>160-Pin</b> (inches)	1.299	0.650	1.593	0.797	2.231	0.710	0.132	5042-1706	5042-1707
(millimeters)	33.0	16.5	40.47	20.24	56.67	18.03	3.36		
<b>184-Pin</b> (inches)	1.472	0.736	1.768	0.882	2.231	0.712	0.122	5042-1730	5042-1731
(millimeters)	37.4	18.7	44.9	22.4	56.67	18.08	3.1		
<b>208-Pin</b> (inches)	1.299	0.650	1.593	0.797	2.231	0.710	0.115	5042-1701	5042-1702
(millimeters)	33.0	16.5	40.47	20.24	56.67	18.05	2.92		
<b>240-Pin</b> (inches)	1.458	0.729	1.753	0.877	2.231	0.710	0.115	5041-9489	5041-9490
(millimeters)	37.04	18.52	44.53	22.27	56.67	18.05	2.92		
<b>304-Pin</b> (inches)	1.781	0.891	2.152	1.076	3.294	0.727	0.123	5042-1716	5042-1717
(millimeters)	45.23	22.62	54.67	27.37	83.67	18.46	3.12		

Table 8. Layout Dimension Requirements

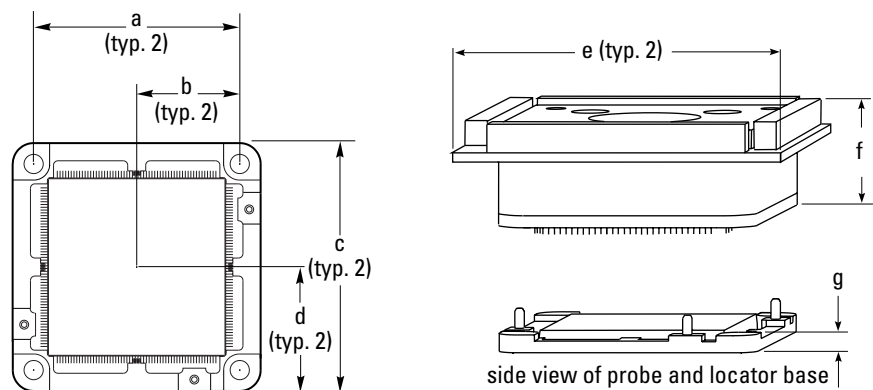


Figure 11. Physical Dimensions

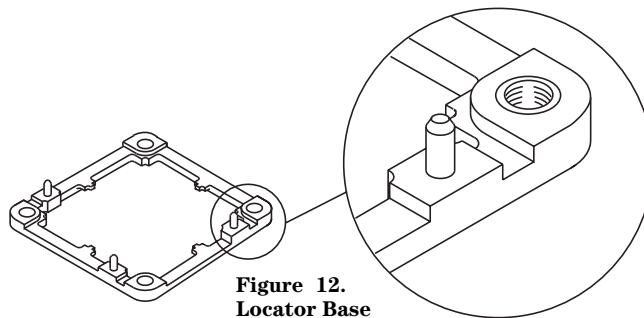


Figure 12.  
Locator Base  
with Inserts

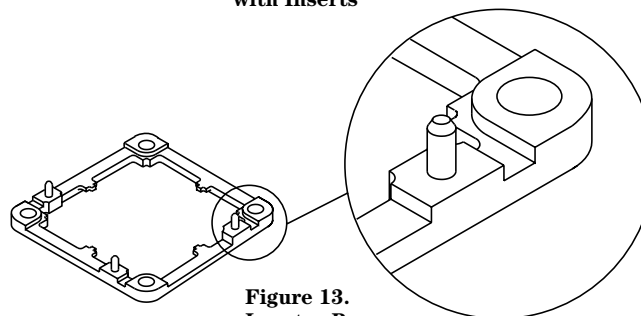
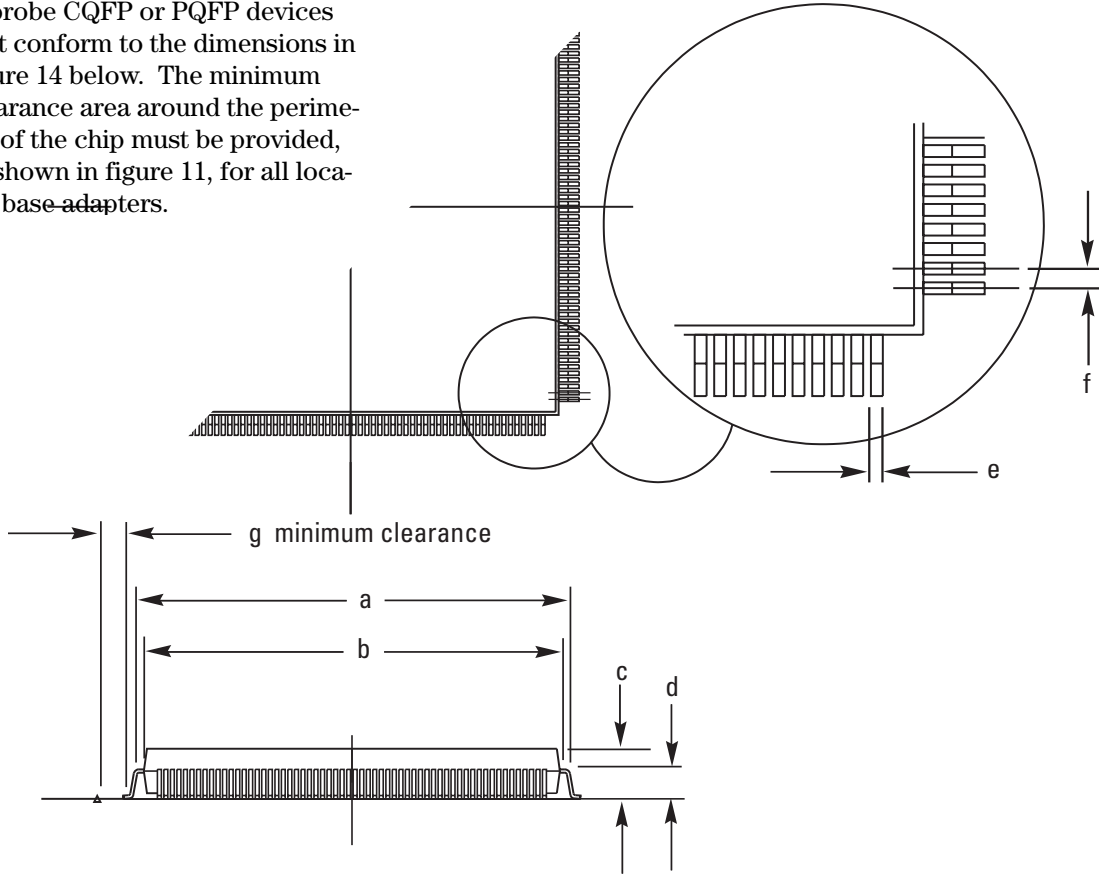


Figure 13.  
Locator Base  
without Inserts

## Target Requirements

The probe adapter will successfully probe CQFP or PQFP devices that conform to the dimensions in figure 14 below. The minimum clearance area around the perimeter of the chip must be provided, as shown in figure 11, for all locator base adapters.



Probe Adapter		a(Min)	a(Max)	b(Max)	c(Max)	d(Min)	e(Max)	f(Typ)	g(Min)
<b>HP E5319A</b>	<b>160-Pin Adapter</b>								
	(inches)	1.127	1.185	1.106	0.155	0.090	0.012	0.0256	0.236
	(millimeters)	28.63	30.1	28.1	3.9	2.29	0.31	0.65	6.00
<b>HP E5343A</b>	<b>184-Pin Adapter</b>								
	(inches)	1.320	1.360	1.260	0.155	0.075	0.0095	0.0256	0.236
	(millimeters)	33.5	34.5	32.0	3.9	1.9	0.241	0.65	6.00
<b>HP E5318A</b>	<b>208-Pin Adapter</b>								
	(inches)	1.171	1.200	1.100	0.150	0.070	0.0095	0.0197	0.236
	(millimeters)	29.74	30.48	27.94	3.81	1.78	0.241	0.5	6.00
<b>HP E5315A</b>	<b>240-Pin Adapter</b>								
	(inches)	1.330	1.360	1.260	0.169	0.065	0.0095	0.0197	0.236
	(millimeters)	33.8	34.5	32.0	4.3	1.7	0.241	0.5	6.00
<b>HP E5331A</b>	<b>304-Pin Adapter</b>								
	(inches)	1.625	1.669	1.564	0.160	0.079	0.0095	0.0197	0.275
	(millimeters)	41.3	42.4	39.7	4.1	2.0	0.241	0.5	7.00

Figure 14. Package Mechanical Dimension Requirements



## Microprocessor Package Support

For a list of supported microprocessors using the locator base solutions, see table 10. Each probing kit includes the probe and all necessary adapters for the preprocessor.

Microprocessor	Package	Products to Order	Preprocessor Supported
Motorola 68HC16Y1	160 PQFP/CQFP	HP E5335A Probing Kit	HP E2470A
Motorola 68040	184 PQFP/CQFP	HP E5345A Probing Kit	HP E2459A
IBM PowerPC 403GA	160 PQFP/CQFP	HP E5335A Probing Kit	HP E2468A
Intel 486DX4, SL Enhanced	208 PQFP/CQFP	HP E5344A Probing Kit	HP 2411C

Table 10. Microprocessor Package Support Table

	Probe Adapter	1/4 Flex Adapter	1/4 Rigid Adapter
<b>Electrical Characteristics</b>			
Operating Voltage	<40V (DC + peak AC)	<40V (DC + peak AC)	<40V (DC + peak AC)
Operating Current	0.5A (max)	0.5A (max)	0.5A (max)
Insulation Resistance	>100M $\Omega$	>100M $\Omega$	>100M $\Omega$
<b>Model Parameters</b>			
Pin-to-Ground Capacitance* (typical)		HP E5316A 2.5 pF First Row 3.5 pF Second Row 4.5 pF Third Row 5.5 pF Fourth Row	HP E5330A 2.0 pF First Row 2.0 pF Second Row 2.5 pF Third Row 3.0 pF Fourth Row
		HP E5333A 2.5 pF First Row 3.5 pF Second Row 4.5 pF Third Row 5.5 pF Fourth Row	
Pin-to-Pin Capacitance*	2 pF for all except HP E5331A	2 pF	1.2 pF
	HP E5331A 2.5 pF		
Self Inductance (typical)	30 nH for all except HP E5331A	HP E5316A 15 nH First Row 25 nH Second Row 35 nH Third Row 45 nH Fourth Row	HP E5330A 10 nH First Row 10 nH Second Row 20 nH Third Row 30 nH Fourth Row
	HP E5331A 45 nH		
		HP E5333A 15 nH First Row 25 nH Second Row 35 nH Third Row 45 nH Fourth Row	
Operating Bandwidth (typical)	600 MHz for all except HP E5331A 500 MHz	350 MHz	350 MHz
<b>Environmental Characteristics</b>			
Operating Temperature	0°C to 50°C	0°C to 50°C	0°C to 50°C
Max Operating Humidity	75% relative humidity	75% relative humidity	75% relative humidity
* Add these values to the value of the probe adapter assembly capacitance for total capacitance.			

Table 11. Locator Base Probe, 1/4 Flex, and 1/4 Rigid Adapter Electrical and Environmental Characteristics

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European Marketing Centre  
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