

## A Study on Cleaning Connector Fingers on Printed Circuit Boards

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### Introduction

This article summarizes a connector finger cleaning study that was conducted on Hewlett-Packard printed circuit boards (also referred to as printed wire assemblies) returned from customer use. The purpose of this work was to:

- Develop a procedure to clean circuit board connector fingers in repair centers and the customer's environment.
- Improve electrical performance
- Improve the connector's visual appearance.

The cleaning procedure and any materials used (solvents, cleaning solutions and/or cloths) must be readily available, safe, and easy to use by field service engineers, customers, and bench technicians.

The study consisted of three phases:

- 1) A preliminary screening of potential cleaning solvents
- 2) A more detailed second evaluation of the cleaners that performed best in the preliminary tests
- 3) A study of the effects of possible remaining cleaning residues.

### Phase 1: Preliminary Screening of Cleaning Solutions

Circuit boards were obtained from the Hewlett-Packard recycling center in Palo Alto. Samples were selected that contained a large exposed gold-plated

ground plane contaminated by a discolored film. The contamination on the ground plane was assumed to be similar to the contamination found on the board's connector fingers. All components were cut from these boards and the ground plane was cut into several samples approximately 2cm-by-2cm.

Prior to cleaning, areas of the ground plane were marked off on each sample and photographed for reference. A typical example of the film discoloration is shown in Figure 1. The marked areas were next soaked for one minute in each of the cleaning solvents listed in Table 1, rubbed using a solvent-soaked

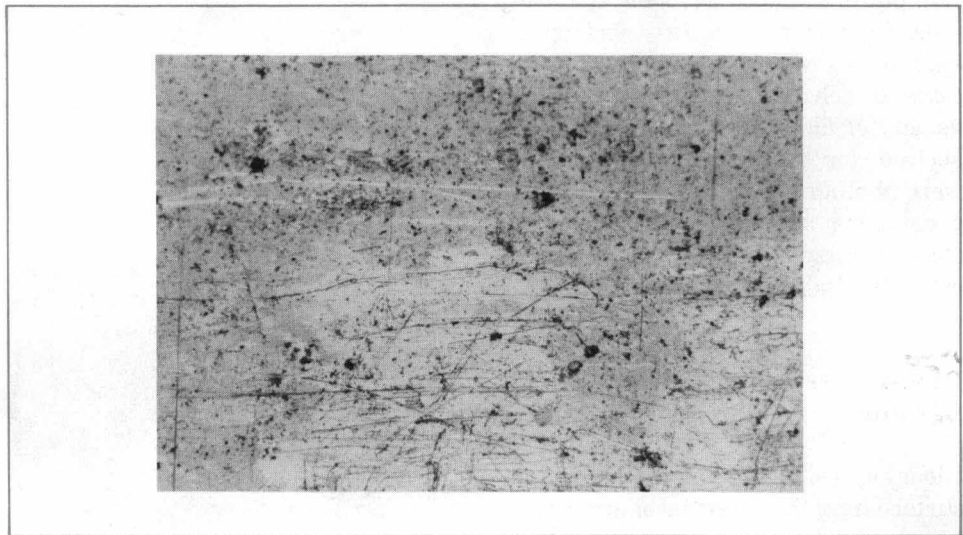


Figure 1. Film residue typical before cleaning.

Table 1. Solvents used in the preliminary cleaning evaluation.

Cleaning solutions	Concentrations
Xylene/isopropyl alcohol	20:80, 100% reactive solvent 99.5% assay IPA (by weight)
Methylethyl ketone (MEK)	100% reactive solvent
1, 1, 1-trichloroethane	90.0% assay by weight semiconductor grade
Acetonitrile	99.9% assay, HPLC grade
acetone	99.5% min assay
IPA/H <sub>2</sub> O (isopropyl alcohol/water)	80:20
NaH <sub>2</sub> CO <sub>3</sub> (sodium bicarbonate)	saturated solution
KOH (potassium hydroxide)	45.0-46.0% assay
NH <sub>4</sub> OH (ammonium hydroxide)	29.5% NH <sub>3</sub> by weight
MeOH (methyl alcohol)	anhydrous, absolute, acetone free

swab for 15 seconds, blown dry with nitrogen, then re-photographed. Initial observations indicated that rubbing was necessary to satisfactorily clean the surface. Visual observation was used to qualitatively evaluate the cleaning action. A cleaned example is shown in Figure 2.

### Phase 2: Evaluation of The Cleaning Solutions

Three solutions from Table 1 exhibited the best cleaning action. The three were potassium hydroxide (KOH), ammonium hydroxide (NH<sub>4</sub>OH), and an isopropyl alcohol/water combination (IPA/H<sub>2</sub>O). We decided to vary the IPA/H<sub>2</sub>O relative concentrations to broaden the base of choices (refer to Table 2). Eighteen circuit boards with contaminated connector fingers were obtained from the Hewlett-Packard Computer Support Division at Roseville, California. The dirty fingers on each board were divided into six sections so each cleaner could be used on a variety of films, leaving an uncleaned section for reference. The samples were photographed, rubbed for 15 seconds using a swab soaked with the cleaner, rinsed with DI water, evaporated dry and then re-photographed.

### Phase 3: Testing for Remaining Residues

Cleaning residues left on the connector surface have the potential of accelerating the effects of atmospheric corrosion on metal surfaces and degrading the electrical insulation of substrate materials. Corrosion of the metal surfaces was tested using an accelerated corrosion chamber. A temperature/humidity insulation resistance test was used to test degradation of the insulation resistance. For the corrosion test, nine samples, cleaned with the three best solutions, were cut from three separate boards. These samples, along with a reference, were placed in the atmospheric test chamber for 11 days. For the insulation test, five boards with interdigitated comb conductor patterns, as shown in Figure 3, were cleaned and placed in the

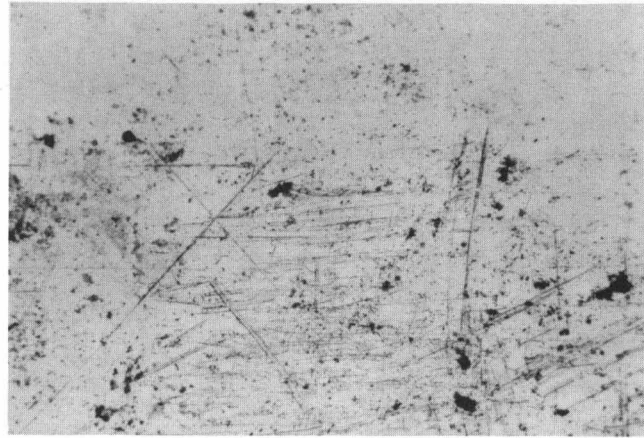


Figure 2. Typical section after cleaning.

Table 2. Evaluation of the cleaning solutions.

Cleaners	Concentration	Total # times tested	No. times cleaning was satisfactory
NH <sub>4</sub> OH	29.5% NH <sub>3</sub> by wt	18	16
IPA only	99.5% assay	8	0
IPA/H <sub>2</sub> O	50:50, 99.5% assay	10	1
IPA/H <sub>2</sub> O	80:20, 99.5% assay	18	7
KOH	45.0-46.0%	18	5

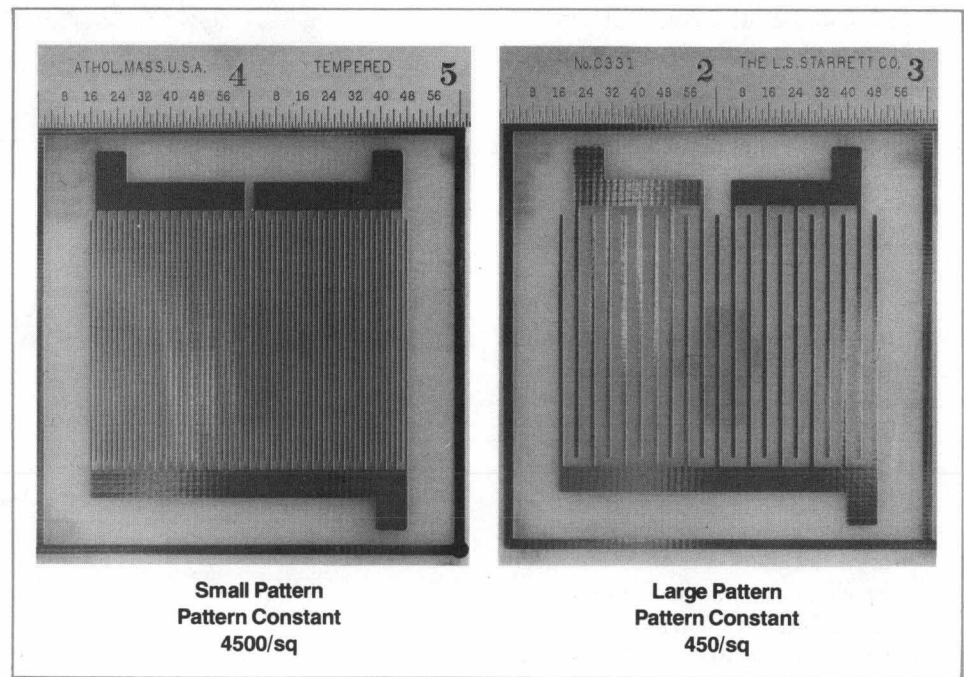


Figure 3. Interdigitated comb patterns used in the cleaning study.

temperature/humidity chamber for 42 days. These samples consisted of:

- A clean reference board
- A board wiped with 80:20 IPA/H<sub>2</sub>O then rinsed with DI water
- A board wiped with NH<sub>4</sub>OH then wiped clean (no rinse)
- A board wiped with 80:20 IPA/H<sub>2</sub>O then wiped clean (no rinse)
- A board wiped with NH<sub>4</sub>OH then wiped clean (no rinse)

## Conclusions

The three cleaning solutions that performed the best were:

- Ammonium hydroxide (NH<sub>4</sub>OH)
- 80:20 solution of isopropyl alcohol and water (IPA/H<sub>2</sub>O)
- Potassium hydroxide (KOH)

Table 2 shows the results of the second evaluation conducted in phase 2 of the test. The cleaning solutions were rated by summing the number of times the connector finger was cleaned satisfac-

torily. The results indicate that the NH<sub>4</sub>OH solution cleaned the contamination on nearly every connector finger tested. Cosmetic appearance was improved by cleaning, surface resistance did not decay following temperature, humidity, and bias testing, and the resistance of connector fingers to atmospheric corrosion was not effected.

At the end of 11 days in the atmospheric chamber, the cleaned connector fingers were visually less corroded than their uncleaned references. No

one solvent solution inhibited nor increased the corrosion rate over the others. After 42 days in the temperature/humidity chamber the board cleaned with NH<sub>4</sub>OH followed by a DI rinse had the highest resistivity.

In conclusion, we feel that an 80:20 solution of isopropyl alcohol/water will serve as a satisfactory cleaner where one would rather not use ammonia hydroxide. Concentrated solutions of ammonia require the use of gloves, eye goggles, and proper ventilation.

Service Tip

## Quick and Easy Amphenol Connector Replacement

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Frequent insertion and unpluging of Amphenol connectors can result in broken plastic edges and/ or broken or bent contact fingers as shown in Figure 1. When this connector is soldered directly to the edge of a printed circuit board, replacement (caused by overheating) often results in damaged printed circuit board contacts.

A procedure that will not damage the PC board contacts has been developed after many hours of experimenting

(and a few damaged boards). The tools you will need are:

- Dremel tool
- Grinding disc (P/N 409)
- Adjustable vise
- Soldering iron (60 watt)
- Face shield

1. The first thing to do is to mount the board in an adjustable vise so that the connector can be seen while cutting it with the the Dremel tool. See Figure 2.
2. Once clamped firmly in place the connector can be cut from the

board. Cut just below the fingers into the body of the connector as shown in Figure 3. Cut through the body on both sides and remove the connector leaving the connector fingers still attached to the printed circuit board contacts.

3. The final step removes the fingers from the contacts. Heat the contacts with a soldering iron and then wipe the finger downward away from the board. Refer to Figure 4. Do both sides and then clean the board in preparation for a new connector.

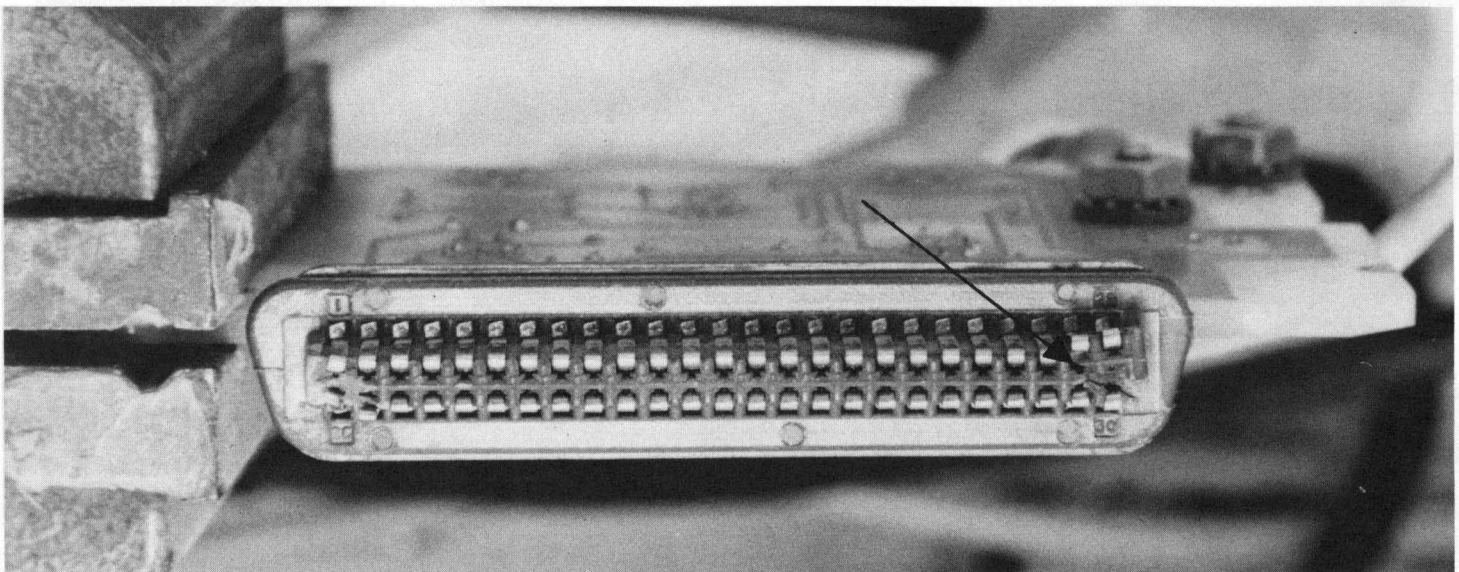


Figure 1. Broken Amphenol connector example.



Figure 2. Setup for cutting the connector.

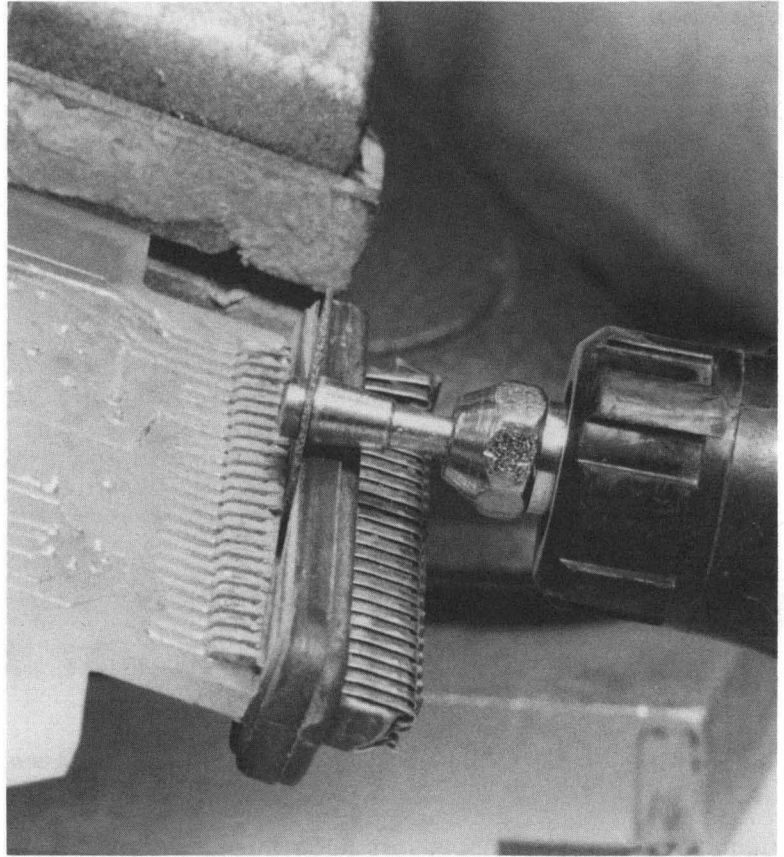


Figure 3. Dremel tool cutting position.

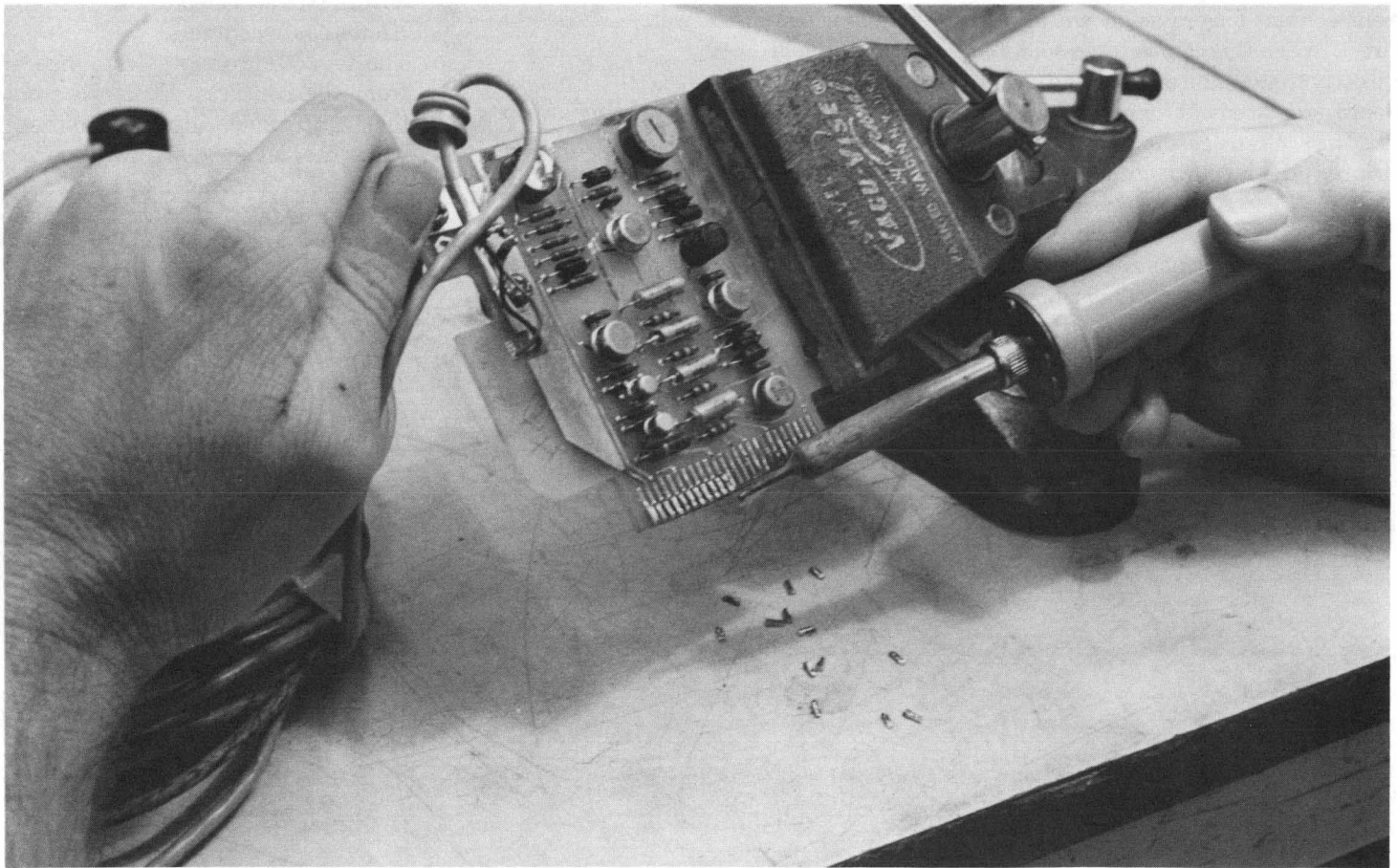


Figure 4. Removing the contacts.

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# Replacement Part Cross Reference

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When selecting replacement parts for your HP products, you may notice that many manuals list only an HP part number for the part, even though it appears that this part is manufactured by one of the large semiconductor manufacturers. Service personnel often ask why only HP part numbers are listed.

It is recommended that HP replacement parts be used to ensure that original performance of the product will be retained. While some parts used in HP instruments are identical to those that

can be purchased at a local electronics distributor, many times parts will be selected for certain characteristics, such as gain, bandwidth, capacitance, etc. There may also be slight mechanical differences, such as the shaping or length of leads. In some cases special quality checks are used to ensure that high reliability parts are used at the factory and at HP field offices.

Therefore, we suggest obtaining replacement parts from HP to maintain the quality that you have paid for in your instrument. There may be situa-

tions however where HP replacement parts are not in stock and substituting parts will allow you to return the product to service immediately. In these cases it may be worthwhile to see if a substitute part will work in the circuit. Perhaps an HP part could be ordered and installed at some later date.

To help you in these situations, here's a cross-reference of HP part numbers to JEDEC numbers for transistors and diodes.

## Manufacturers Code Number Cross Reference

Number	Manufacturer
00039	Nippon Electric Co.
00046	Unitrode Corp.
00746	ROHM Corporation
01250	GTE Sylvania Elek Components Group
01590	Plessey Semiconductors
01691	TRW Inc. Semiconductor Div.
01698	Texas Instr. Inc. Semicond. Compnt. Div.
01921	RCA Corp., Solid State Div.
01973	GE Co., Semiconductor Prod. Dept.
01979	Lansdale Transistor & Elek Inc.
01991	Transitron Electronic Corp.
02037	Motorola Semiconductor Products
02062	HP Div. 05 Microwave Semiconductor
02086	Westinghouse Elec. Corp. Semicon. Dept.
02158	Edal Industries Inc.
02237	Fairchild Semiconductor Div.
02526	Semicon. Inc.
02569	Crystalonics Div., Teledyne
02619	Solitron Devices Inc. (Diodes)
02634	Sprague Elect. Co., Semiconductor Div.
02664	Semtech. Crop.
02682	ITT Semiconductors Div. or ITT Corp.
02688	Microsemi Corporation
02713	General Instr. Corp., Semicon. Prod. GP
02803	Codi Semiconductor

Number	Manufacturer
02865	Alpha Industries Inc.
02883	Siliconix
02910	Signetics Corp.
02919	MSI Electronics Ind.
03038	International Rectifier Semicon Div.
03172	TRW Microwave
03191	Solitron Devices Inc. (FETS, Diodes)
03285	Analog Devices Inc.
03287	General Semiconductor Industries
03334	Amperex Elec. Corp., Semicon. & MC Div.
03406	National Semiconductor Corp.
03447	Hughes Aircraft Co. Newp. Beach Div.
03571	Lansdale XSTR Elek Co. Advance Line
03627	Solid State Devices Inc.
03714	Intersil Inc.
03776	Kertron Inc.
03793	Silicon General Inc.
03811	Intel Corp.
04161	KSW Electronics Inc.
04200	Sprague Electronic Co.
04583	Bradley Semiconductor Corp.
05088	Varo Semiconductor Inc.
05131	Electronic Devices Inc.
05176	TRW Capacitor Div.
05644	Philco-Ford Corp. Sierra Elek Opn

Number	Manufacturer
05695	Microwave Associates Inc.
05840	Delco Elek Div. of Genl. Motors Corp.
06002	R T C Division Cogeco
06023	Mullard Ltd.
06078	International Rectifier Ltd.
06121	Siemens AG
06338	SGS Ates
06344	Fujitsu Ltd.
06354	Toshiba Corporation
06418	Hughes International Ltd.
06563	Siemens Corp., Components Group
06592	SGS Ates (14)
06632	Semiconductor Technology Inc.
07050	Micro Power Systems
07221	Supertex Inc.
07766	La Radiotechnique Compelec
08852	Metelics Corp.
09283	Semi Processes Inc.
09914	Unitrode Corp.
10464	Thomson CSF Brazil
10674	Diode Transistor Co.
10760	Hybrid Die
10818	H-lbrape Electronica
10881	Thomson-CSF
10978	Frequency Sources
11152	Composants Semicond. De Protection

HP P/N	Mfr.	Desc.	Number	Manufacturer	Number	Manufacturer	Number	Manufacturer
0122-0002	01691	1N4813	0122-0070	02037	1N5456A	0122-0254	02037	1N5143A
0122-0004	01691	1N4809	0122-0071	02037	MV2107	0122-0255	02037	1N5144
0122-0005	01691	1N4810	0122-0072	02037	BB105B	0122-0256	02037	1N5144A
0122-0008	02569	VA114	0122-0074	05695	MA45644	0122-0257	02037	1N5145
0122-0014	01691	1N4810B	0122-0077	02037	MV2201	0122-0258	02037	1N5145A
0122-0017	01691	1N4810B	0122-0081	02037	MV1404	0122-0259	02037	1N5146
0122-0018	01691	1N4804	0122-0085	00039	1S2208 (B)	0122-0260	02037	1N5146A
0122-0018	01691	1N4801A	0122-0089	02037	MV109	0122-0261	02037	1N5147
0122-0019	01691	1N4803A	0122-0090	02037	BB-105B	0122-0262	02037	1N5147A
0122-0020	01691	1N4805A	0122-0158	10978	1N5146A (SEL)	0122-0263	02037	1N5148
0122-0021	01691	1N4807A	0122-0159	10978	1N5148A (SEL)	0122-0264	02037	1N5148A
0122-0022	01691	1N4808A	0122-0160	02865	6-6832-79	0122-0325	04161	KV1403
0122-0023	01691	1N4809A	0122-0161	03334	BB405B	0122-0331	02037	MV1403
0122-0024	01691	1N4810A	0122-0162	03334	BB809	0122-0332	02037	MV309
0122-0025	01691	1N4811A	0122-0163	02037	MVAM125	0837-0196	01973	V430MA3A
0122-0026	01691	1N4812A	0122-0164	10978	1N5148A (SEL)	0837-0241	03287	SA15A
0122-0027	01691	1N4813A	0122-0165	10978	KV31S1	0837-0243	01973	V47MA2B
0122-0028	01691	1N4814A	0122-0167	06121	BB409	0837-0255	03287	SA40CA
0122-0029	01691	1N4815A	0122-0245	02037	1N5139	0837-0256	03287	1.5KE100C
0122-0031	02569	VA126	0122-0246	02037	1N5139A	0837-0257	03287	1.5KE200C
0122-0034	01691	1N4814B	0122-0247	02037	1N5140	0837-0258	03287	P6KE47CA
0122-0044	02919	MV840C	0122-0248	02037	1N5140A	0837-0261	01973	V275LA20A
0122-0056	02037	MV2101	0122-0249	02037	1N5141	0837-0264	03287	1N6045A
0122-0060	02037	MV2308	0122-0250	02037	1N5141A	0837-0267	03287	1.5KE82
0122-0062	02037	1N5468A	0122-0251	02037	1N5142	0837-0268	01973	V300LA4
0122-0064	02037	MV1868D	0122-0252	02037	1N5142A	0837-0270	02713	1N6281A
0122-0066	02037	MV1401	0122-0253	02037	1N5143	0837-0271	03287	SA15CA
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0837-0277	03287	1.5KE300A						
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0837-0285	01973	V56MA2B						
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0837-0303	03287	P6KE39A						
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1820-0352	01921	CA3018						
1820-1804	02037	MPQ6842						
1821-0001	01921	CA3046						
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1821-0006	02237	SH6501PC						
1850-0003	03334	2N1516						
1850-0018	01921	2N384						

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1850-0032	01698	2N404	1853-0269	02037	2N3809	1853-0488	02237	MPS4356
1850-0041	01921	2N384	1853-0271	02037	2N4403	1853-0489	02037	MM4032
1850-0043	03334	2N1516	1853-0276	02037	MM3906	1853-0490	02037	TIP107
1850-0051	02634	2N1500	1853-0277	01921	JME5954	1853-0492	02037	JME2955
1850-0052	02713	2N596	1853-0280	02037	2N5195	1853-0493	03334	2N5415
1850-0055	04200	2N2360	1853-0281	02682	2N2907A	1853-0494	01973	D45H5
1850-0058	02037	2N174	1853-0290	02037	JTX2907A	1853-0496	02037	MPS-U57
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1850-0061	01698	2N2561	1853-0293	02037	2N5583	1853-0498	02037	TIP145
1850-0064	01921	2N1183	1853-0303	02037	2N5956	1853-0501	02037	MJ11015
1850-0065	01921	2N1370	1853-0305	02037	2N5875	1853-0523	02037	2C4403
1850-0074	01921	2N1396	1853-0308	02037	MM4645	1853-0524	02037	MJ11021
1850-0075	01979	2N779A	1853-0310	02237	2N4398	1853-0525	02037	MMBT2907A
1850-0076	01698	2N2556	1853-0311	02037	2N3792	1853-0526	02037	2N6437
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1850-0085	02037	2N964	1853-0318	02037	MPS6562	1853-0529	02037	MD1130
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1850-0103	01698	2N2190	1853-0327	01698	2N2944A	1853-0540	02037	2N5771
1850-0105	01979	2N2048	1853-0328	01921	2N6211	1853-0542	02037	2N6491
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1850-0111	01698	2N404A	1853-0334	02037	MJE1090	1853-0544	03334	BFQ51
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1850-0113	01698	2N1997	1853-0340	02037	2N5884	1853-0546	02037	2N3765
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1850-0119	02037	2N963	1853-0342	01921	40831	1853-0548	02037	2N6420
1850-0126	01921	2N2869	1853-0344	02037	2N5876	1853-0550	00746	2SB737
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1850-0137	01979	2N976	1853-0350	01698	TIP-34	1853-0554	02037	2C4405
1850-0146	02619	2N1501	1853-0351	02037	2N6053	1853-0555	02037	MPSC404A
1850-0150	05840	2N1358	1853-0353	02037	MPS-U55	1853-0556	02037	2C5087
1850-0151	01698	2N1309	1853-0355	01698	BF398	1853-0557	02037	BD416
1850-0154	01979	2N508A	1853-0356	01698	TIP42	1853-0558	02037	2N6554
1850-0160	01921	2N2147	1853-0360	02037	2N3799A	1853-0559	02037	MPSU55
1850-0163	02037	2N2635	1853-0362	02037	2N6053	1853-0563	02037	2N3906(SEL)
1850-0166	01698	2N2188	1853-0363	01973	X45H281	1853-0565	02037	2N4403
1850-0170	01698	2N1377	1853-0364	02037	MJE-701	1853-0566	02037	MMBT455
1850-0172	01698	2N2996	1853-0365	02037	MJE2901K	1853-0567	02037	MMBT3906
1850-0173	01698	2N1307	1853-0366	02237	BC321C-18	1853-0568	02037	MMBT5087
1850-0178	01698	2N1038	1853-0367	02037	MJE233	1853-0570	02037	2N5401(SEL)
1850-0179	02037	2N3323	1853-0368	02037	MJE170	1853-0572	02037	MPSA76
1850-0180	01698	2N1374	1853-0369	02037	MJE371K	1853-0573	10881	2N6709
1850-0181	01698	2N2552	1853-0370	01921	2N5782	1853-0574	02037	2N3468
1850-0182	01698	2N1378	1853-0371	01921	2N6107	1853-0575	03334	BFQ32(CHIP)
1850-0184	01698	2N1523	1853-0372	02037	MJE5195	1853-0576	02037	2N5416(SEL)
1850-0194	05840	2N1523	1853-0373	02237	2N5022	1853-0577	02037	2N3906RLRA2
1850-0404	01698	2N1305	1853-0377	01698	TIP 115	1853-0578	00039	NE90115
1850-0406	02783	2N1760	1853-0378	02037	2N5987	1853-0579	02037	2C2946
1850-0409	01698	2N2664	1853-0381	01698	2N6331	1853-0580	02037	MMBT4403
1850-0417	02713	2N597	1853-0383	02037	2N6296	1853-0581	02037	MMBT5401
1850-0418	02713	2N600	1853-0384	02037	2N3244	1854-0004	01698	2N743
1850-0439	02037	MA4404A	1853-0385	02037	MJE5194	1854-0005	02237	2N708
1850-0440	02037	MP603	1853-0387	02037	MJ2500	1854-0009	02037	2N709
1850-0441	06632	2N779A	1853-0391	02037	2N6051	1854-0010	02037	2N834
1851-0002	01698	2N388A	1853-0392	02037	2N3741	1854-0011	02037	2N835
1851-0003	01698	2N388A	1853-0394	02037	MJE 2370	1854-0013	02037	2N2218A
1851-0006	01973	2N169A	1853-0395	02037	MPS-A70	1854-0014	02037	2N2720
1851-0007	01973	2N169A	1853-0398	02037	MJE 210	1854-0017	02237	2N706A
1851-0009	01698	2N388A	1853-0399	03406	2N3467	1854-0021	02237	2N918
1851-0011	01698	2N1306	1853-0404	01698	AST4260	1854-0022	02237	S17843
1851-0021	01698	2N388A	1853-0405	02037	2N4209	1854-0026	01973	2N335
1851-0024	01698	2N388A	1853-0406	01921	2N6476	1854-0029	01973	2N2712
1851-0025	01698	2N1306	1853-0407	02037	2N5880	1854-0030	02237	2N2369
1851-0031	01698	2N1605	1853-0412	02037	MPSA65	1854-0031	01698	2N2865
1851-0034	01698	2N1605A	1853-0414	02037	2N6423	1854-0032	02037	2N2221
1851-0037	01698	2N1308	1853-0416	02037	MPS-A64	1854-0033	01973	2N3391
1851-0038	01973	2N1121	1853-0417	02037	MJE 253	1854-0036	02037	2N2958
1851-0041	03334	2N2430	1853-0418	02037	2N6317	1854-0039	01921	2N3053S
1853-0002	02619	2N1027	1853-0419	02037	2N4403	1854-0044	01973	2N2716
1853-0006	02037	2N3134	1853-0420	02037	MJ2955	1854-0048	01921	2N2857
1853-0007	02037	2N3251	1853-0422	01698	2N4033	1854-0050	02237	2N916
1853-0008	02037	2N3250	1853-0423	02037	MPS U-60	1854-0053	02037	2N2218
1853-0012	02037	2N2904A	1853-0424	01698	TIP-126	1854-0056	01921	2N3119
1853-0013	01698	2N2904	1853-0425	02037	2N5883	1854-0057	01973	2N3855A
1853-0014	02237	2N3304	1853-0426	02037	2N4904	1854-0060	02237	2N3565
1853-0019	01698	2N1131	1853-0428	02037	2N5684	1854-0062	01921	2N1701
1853-0023	01698	2N3703	1853-0429	02037	2N3762	1854-0063	01921	2N3055
1853-0028	02037	2N3634	1853-0430	02037	2N4959	1854-0064	01698	2N3710
1853-0031	02037	2N3789	1853-0431	02037	TIP42C	1854-0066	01973	2N2925
1853-0033	02634	2N3318	1853-0436	02037	MJE170	1854-0067	01921	2N2102
1853-0043	02037	MPS 6523	1853-0437	02037	2N6520	1854-0071	00746	CP4071
1853-0045	01921	2N4036	1853-0439	01921	2N6248	1854-0072	01921	2N3054
1853-0046	02037	2N3250	1853-0440	02037	MM4018	1854-0076	01698	2N1973
1853-0051	01921	2N4037	1853-0441	02037	MJE2955K	1854-0079	01921	2N3439
1853-0052	02037	2N3740	1853-0442	02037	2N3867	1854-0081	01698	2N3711
1853-0057	02634	3N91	1853-0447	02037	MJE253	1854-0084	02037	2N3232
1853-0058	02237	S32248	1853-0448	02037	MPSH81	1854-0086	05840	DTS413
1853-0059	02037	2N3791	1853-0449	02037	MPS-U95	1854-0090	03334	2N3053LV 2449
1853-0071	02037	2N3494	1853-0450	02037	MJE371K(SELECTED)	1854-0093	01973	2N3415
1853-0072	02237	2N4034	1853-0451	01698	2N3799	1854-0095	01921	40346
1853-0081	02237	2N4258	1853-0452	02037	2N6594	1854-0098	01973	2N3392
1853-0084	02037	2N4918	1853-0453	01698	TIP36	1854-0203	02237	2N3694
1853-0086	03406	2N5087	1853-0454	01698	TIP106	1854-0205	02037	2N3904
1853-0087	01921	40394	1853-0455	02037	MJE6040	1854-0209	02237	2N910
1853-0089	02237	2N4917	1853-0457	02037	2N5400	1854-0210	02037	2N2222
1853-0091	02237	2N4917	1853-0458	02037	MJE251	1854-0211	02037	2N2501
1853-0097	02237	BSX29	1853-0461	02037	2N6318	1854-0213	01698	2N2538
1853-0204	02037	2N4920	1853-0462	02037	2N3635	1854-0214	01921	2N1482
1853-0205	02037	2N2907	1853-0463	02037	TIP105	1854-0215	02037	2N3904
1853-0206	02237	2N4028	1853-0464	01698	TIS-149	1854-0216	01921	2N3441
1853-0212	02037	2N5194	1853-0467	02037	MPS-D54	1854-0217	01921	2N3442
1853-0213	02037	2N4236	1853-0468	01698	TIP-127	1854-0218	01973	2N3393
1853-0217	02037	MPS-404A	1853-0469	02037	2N6109	1854-0219	01973	2N3663
1853-0221	01921	2N5416	1853-0470	02037	JAN TXV 2N2907A	1854-0220	02037	2N3959
1853-0222	02037	2N4919	1853-0471	02037	MD-982	1854-0222	02037	MD2252
1853-0223	02037	2N4902	1853-0472	01973	D45H2	1854-0224	01921	40250
1853-0224	01921	2N5415	1853-0476	02037	MPS-U52	1854-022		

HP P/N	Mfr.	Desc.
1854-0235	01921	2N1484
1854-0238	03406	2N3933
1854-0242	01921	2N3262
1854-0246	02037	SFS 233
1854-0248	03191	2N4044
1854-0252	02037	2N3713
1854-0255	02237	2N3642
1854-0259	02037	2N3766
1854-0260	02037	2N3227
1854-0263	02037	2N3019
1854-0264	02037	2N3715
1854-0267	06338	2N3013
1854-0270	02037	SFS 3627
1854-0278	02237	2N3302
1854-0281	01698	2N2194
1854-0282	01921	2N3583
1854-0286	03776	2N5217
1854-0287	02237	2N915
1854-0289	01698	2N730
1854-0296	02037	MFS6543 SELECTED
1854-0301	01921	2N3261
1854-0304	02237	2N2483
1854-0307	03334	BCY 57/LV2345
1854-0308	01921	2N3553
1854-0311	01921	2N4240
1854-0313	01921	2N3771
1854-0315	01991	2N3633
1854-0323	01921	2N2857
1854-0324	02037	2N3739
1854-0325	01921	2N3478
1854-0345	02037	2N5179
1854-0347	02037	2N4923
1854-0349	02037	2N2913
1854-0350	01698	2N3724A
1854-0352	01921	2N2405
1854-0361	02037	2N4239
1854-0363	01921	2N5262
1854-0365	02037	2N4410
1854-0368	02037	2N5191
1854-0370	01921	2N5294
1854-0378	01921	2N5109
1854-0379	01921	2N4298
1854-0382	01921	2N4348
1854-0383	01921	40313
1854-0384	01921	2N5184
1854-0386	01921	2N5070
1854-0388	02237	SE5055
1854-0389	02037	2N4922
1854-0392	02037	2N5088
1854-0397	01698	2N4966
1854-0398	02037	2N5301
1854-0399	02037	2N4912
1854-0409	02037	2N5210
1854-0411	02037	2N2972
1854-0416	02237	2N3426
1854-0418	02237	2N3563
1854-0431	01921	2N5179
1854-0432	02237	2N3646
1854-0435	03334	A211
1854-0453	02037	2N5192
1854-0454	01921	2N5496
1854-0456	01698	TIP41A
1854-0467	02037	2N4401
1854-0472	02037	MFS-A14
1854-0474	02037	2N5551
1854-0476	01921	2N3879
1854-0477	02682	2N2222A
1854-0478	02237	2N4046
1854-0492	02037	MFS3643
1854-0518	02037	2N5877
1854-0519	01921	2N3772
1854-0527	02037	2N2895
1854-0534	01921	2N5838
1854-0540	02037	MM8006
1854-0547	01698	2N3725
1854-0548	02237	2N5963
1854-0555	02037	MMT3960
1854-0556	02037	2N4237
1854-0557	01698	2N2432A
1854-0560	02037	MFS A12
1854-0566	01921	2N3771
1854-0570	01921	2N5189
1854-0572	01921	2N5805
1854-0575	02037	MFS-A42
1854-0576	01921	2N6258
1854-0577	01921	2N6259
1854-0580	02037	MM8001
1854-0581	02037	MJE800
1854-0583	02037	MFS-A18
1854-0585	02037	MJE182
1854-0586	02037	2N5429
1854-0587	02037	MMT3960A
1854-0589	02037	MJ3772
1854-0590	01921	2N3054
1854-0591	03334	BFR90
1854-0593	01698	TIP-35A
1854-0594	01698	TIP-33
1854-0596	02037	2N5427
1854-0597	02037	2N5943
1854-0598	01921	2N6249
1854-0599	01921	2N6078
1854-0600	02037	2N4233A
1854-0611	02037	2N6055
1854-0612	01921	40608
1854-0613	01921	2N1701
1854-0615	01921	40854
1854-0617	01921	40852
1854-0618	02037	MJ3000
1854-0619	03285	AD814
1854-0621	01698	BF2540
1854-0622	02037	MJE340
1854-0623	02037	2N6306
1854-0624	02037	2N6308
1854-0625	01698	TIP-41
1854-0626	02037	MJE802

1854-0628	02037	MFS-H17
1854-0632	03334	BFR91
1854-0633	02037	MJE800
1854-0634	02037	MFS-U01
1854-0635	01973	D44H5
1854-0637	02037	2N2219A
1854-0639	01921	RCF-703C
1854-0640	02037	MJE2801K
1854-0642	02037	MFS-A17
1854-0643	01921	2N3585
1854-0644	01921	29C
1854-0646	03406	LM114AH
1854-0647	02037	MJE2102
1854-0648	02037	2N6300
1854-0653	02037	MJE521K
1854-0654	02037	MJE5192
1854-0656	02634	2N3414
1854-0659	02037	MJE180
1854-0662	02037	2N6296
1854-0663	01698	TIP140
1854-0664	05176	HP-3
1854-0665	06023	BUS11
1854-0667	01921	2N3053
1854-0669	02037	2N6057
1854-0670	01698	TIP110
1854-0671	02037	2N6282
1854-0679	02037	2N5885
1854-0682	02037	MJE5191
1854-0687	01698	2N3725A
1854-0691	02037	MFS A18
1854-0692	02037	MJE223
1854-0695	02037	2N5067
1854-0697	02037	2N5886
1854-0698	02037	2N6294
1854-0701	02037	MJE2100
1854-0705	10674	DTS-802
1854-0707	02037	MJ4035
1854-0708	01921	2N5578
1854-0709	01921	2N5575
1854-0714	02237	2N5962
1854-0715	01921	2N6354
1854-0721	03334	BFR95
1854-0722	03334	BFR96
1854-0723	03334	BFR98
1854-0727	01921	2N6474
1854-0730	02037	MFS6531
1854-0731	02237	2N5089
1854-0733	01921	2N3773
1854-0735	02037	MJE220
1854-0736	02037	MJE5657
1854-0737	01921	2N6477
1854-0738	01921	2N6261
1854-0739	02037	MJE200
1854-0741	02037	2N6338
1854-0743	02037	2N5878
1854-0746	02037	2N6339
1854-0747	05176	HP-4
1854-0748	02037	2N2896
1854-0749	02037	MJE2261
1854-0750	02237	2N720A
1854-0751	02237	2N5840
1854-0752	02037	MMCS2369
1854-0754	02037	MJE244
1854-0755	01921	2N6254
1854-0756	02037	2N6315
1854-0758	02037	2N5427
1854-0761	02037	2N2060
1854-0762	01921	2N5039
1854-0763	01698	TIP 141
1854-0764	02037	MFS U-10
1854-0765	01921	2N6292
1854-0766	02037	2N5428
1854-0767	01921	2N6306
1854-0768	02037	MJE1661
1854-0769	02062	35821E
1854-0770	02037	2N3904 CHIP
1854-0771	03406	2N4384 CHIP
1854-0774	01921	2N6056
1854-0775	03334	BUX-80
1854-0777	02237	FT50
1854-0780	03334	BUX-83
1854-0784	02037	2N3866A
1854-0785	02037	2N6305
1854-0786	02037	2N2540
1854-0787	02037	2N6545
1854-0792	02237	2N2920
1854-0793	01921	2N5671
1854-0794	02037	MJE243
1854-0795	02037	MFSH10
1854-0797	01698	BUI105
1854-0799	02037	MFS-U45
1854-0802	02037	TIP41C
1854-0803	01698	MM5262
1854-0804	03038	IR5062
1854-0805	02037	BD139
1854-0806	01698	TIP51
1854-0808	02037	MJE241
1854-0810	02634	CT-1058
1854-0817	02037	MFS-U05
1854-0819	02037	MJE2801T
1854-0825	02062	HXTR-5002
1854-0826	03406	LM-394BH
1854-0827	02037	MJE-13009
1854-0828	01698	TIP-122
1854-0829	02037	JAN TXV 2N2222A
1854-0830	03406	LM394
1854-0831	02037	2N6429A
1854-0834	01921	2N6033
1854-0836	02037	MFS-U02
1854-0837	01921	2N6289
1854-0838	02037	TIP47
1854-0839	02037	2N6497
1854-0840	02037	TIP100
1854-0842	02037	2N3014
1854-0845	02037	LM1012

1854-0847	02037	MJE12007
1854-0848	01691	2N6584
1854-0849	02037	MFR515
1854-0851	02037	2N4428
1854-0860	00039	2SC2334
1854-0861	02062	HXTR-6001
1854-0862	02062	HXTR-5002
1854-0863	02062	HXTR-2101
1854-0864	02062	HXTR-6105
1854-0865	03038	IR6062
1854-0866	02037	MFS834
1854-0867	02237	PN3568
1854-0868	06592	BFR 36
1854-0871	01921	2N6678
1854-0872	01973	D44H11
1854-0877	02037	MFS-U07
1854-0878	02062	HXTR-5104
1854-0879	02037	MJE6043
1854-0880	02037	TIP140
1854-0883	02037	MM3904
1854-0884	01921	2N6488
1854-0886	02037	MJE3302
1854-0887	02037	MJ11016
1854-0889	02037	2N6499
1854-0890	02037	MRF904
1854-0891	06023	BUX82
1854-0906	02037	MJ12010
1854-0929	02037	MMBT918
1854-0940	06344	2SC2429 (SEL)
1854-0941	02037	MJ12003
1854-0942	03334	BFG34
1854-0944	02062	HXTR-3101
1854-0946	00039	NE02135
1854-0948	02037	MJ10006
1854-0960	01698	TIP1753A
1854-0964	02037	MJ12004
1854-0965	02037	MJ8505
1854-0967	02037	TIP41C (SELECTED)
1854-0968	02037	SJ7076
1854-0969	02037	MJ12005
1854-0970	01698	TIP102
1854-0971	02062	2N6741
1854-0972	02037	BFR90
1854-0973	02037	MFS8098
1854-0977	02037	MFS-A14
1854-0978	01973	GES3416
1854-0979	02037	MFS2369
1854-0980	02037	MFR961
1854-0981	02037	MFS179
1854-0982	01698	TIP642
1854-0983	02037	MJ12005 (SELECTED)
1854-0984	02037	MJ16002 (SELECTED)
1854-0985	02037	TIP142
1854-0986	10881	BFR92
1854-0987	10881	BCX20
1854-0988	02037	2N3737
1854-0989	02037	MJ15003
1854-0990	02037	MRF630
1854-0991	00746	2SD786
1854-0992	03714	ITS1015 (SEL)
1854-0993	02037	MFSH10
1854-0994	02037	2N5179 (SEL)
1854-0996	02037	MJEL3003
1854-0997	02037	MFSW06
1854-0998	01973	D42C11N
1854-0999	01921	2N5320
1854-1000	03714	IT120/D
1854-1001	02037	MFSAC17
1854-1002	00039	NE64535
1854-1003	06354	2SC2876
1854-1004	02037	BD415
1854-1005	02037	BU508A
1854-1006	02037	BU406
1854-1007	02037	2N5943 (SEL)
1854-1008	00039	NE-41635
1854-1009	00039	NE21935
1854-1010	02037	MD918A
1854-1011	02037	2C3904
1854-1012	03334	BFG34 (CHIP)
1854-1014	02037</	

HP P/N	Mfr.	Desc.							
1855-0001	01973	2N1671A	1855-0502	03038	IRFD111	1900-0004	02865	1N76	
1855-0005	02763	2N3436	1855-0504	03038	IRF630	1900-0005	05695	1N82	
1855-0010	01973	2N2646	1855-0506	02037	MTF12N10	1900-0006	05695	1N416B	
1855-0020	02037	SFE793	1855-0507	03285	2N5912	1900-0009	01250	1N415B	
1855-0021	01973	2N1671B	1855-0508	03038	IRF150	1900-0010	01250	1N21BMR	
1855-0027	01973	2N2647	1855-0509	03038	IRF9520	1900-0011	05695	1N416BM	
1855-0038	02763	2N3922	1855-0510	03038	IRF830	1900-0012	01250	1N23B	
1855-0040	01698	2N3819	1855-0512	01921	RC49212A	1900-0015	05695	1N415C	
1855-0052	02237	2N4360	1855-0515	07050	MP833-1004	1900-0016	02865	1N4603	
1855-0055	02883	2N4339	1855-0517	03038	IRF9532	1900-0017	02865	1N21E	
1855-0056	02237	2N4342	1855-0518	03038	IRFD110	1900-0018	05695	1N23C	
1855-0065	01698	2N4891	1855-0519	02883	U311	1900-0019	05695	1N831	
1855-0077	01973	2N1671C	1855-0520	03038	IRFD113	1900-0020	01250	1N76A	
1855-0095	01921	40468	1855-0521	03038	IRFF210	1900-0025	02062	5082-0049	
1855-0096	02037	2N5485 (SEL)	1855-0522	03038	IRFD9120	1900-0030	02865	DME6569	
1855-0098	03714	IT1700	1855-0523	06121	BUZ 15	1900-0031	02865	DMJ4705	
1855-0099	02037	2N4853	1855-0524	03038	IRF640	1900-0032	02865	DS6474E	
1855-0204	02037	2N4852	1855-0525	02883	VN0300M	1900-0033	02865	5082-0008	
1855-0205	02883	VCR3P	1855-0526	02883	VPO300M	1900-0034	03172	AXK665	
1855-0206	02883	E111	1855-0527	02037	MTM2P45	1900-0035	02062	HSC8-5510	
1855-0207	03406	2N3955	1855-0529	03406	PF5101 (SELECTED)	1900-0036	03172	A5S092 SELECTED	
1855-0208	02883	2N4117	1855-0530	02883	U310	1900-0037	02037	MNBD101	
1855-0213	03406	2N5912	1855-0531	03038	IRF120	1900-0039	02037	MNBD352	
1855-0215	09283	SD211DE (SELECTED)	1855-0534	01921	40673	1900-0040	05695	MA-NE402L	
1855-0224	01698	2N3824	1855-0535	03714	IT1750	1900-0041	05695	MA-40035	
1855-0226	02037	2N5460	1855-0536	03038	IRF440	1900-0043	03172	AXZ2056	
1855-0232	02883	2N5565	1855-0537	03714	1VN5000TNE	1900-0045	05695	MA4P485	
1855-0235	02037	U310 (SELECTED)	1855-0539	06121	BUZ24	1901-0002	01921	1N1200A	
1855-0241	02910	SD215	1855-0540	03406	2N5115 (SEL)	1901-0004	03038	1N1084	
1855-0244	03406	2N4857	1855-0542	02037	MTF12N06	1901-0005	01991	1N603A	
1855-0250	01698	3N215	1855-0545	02883	VN10KE	1901-0006	02037	1N1566A	
1855-0256	02037	2N4416A CHIP	1855-0546	07221	VN0104N3	1901-0010	01973	1N540	
1855-0257	03406	2N5247	1855-0548	06121	BUZ71A	1901-0013	01991	1N253	
1855-0258	03406	2N5949	1855-0549	03038	IRF512	1901-0016	02037	1N1566	
1855-0263	02883	VMP-1	1855-0550	02883	VPO300L	1901-0017	01973	1N1118	
1855-0265	02883	VCR2N	1855-0551	03038	IRFD420	1901-0019	02086	1N1344	
1855-0268	02883	J309	1855-0552	02037	UC310	1901-0021	01973	1N538	
1855-0269	02910	SD214	1855-0553	06121	BUZ10	1901-0025	00046	1N645	
1855-0272	02037	MFE3004	1855-0554	03406	J304 (SEL)	1901-0032	02037	1N3209	
1855-0274	02883	E232	1855-0555	02883	VN0300L	1901-0033	00046	1N645	
1855-0275	02883	VN66AF	1855-0556	02883	VN2222L	1901-0038	02237	1N3064	
1855-0276	02037	2N4416A	1855-0557	09283	SD306 (SEL)	1901-0040	00046	1N4148	
1855-0277	02037	2N5268	1855-0559	09283	SD215	1901-0041	00046	1N4607	
1855-0278	03714	2N5116	1855-0560	02883	VN10LE	1901-0044	00046	1N4148	
1855-0279	03714	3N190	1855-0561	03038	IRF510	1901-0048	02037	1N3210	
1855-0280	02883	E107	1855-0562	03038	IRF250	1901-0050	00046	1N4150	
1855-0283	02763	2N5396	1855-0563	02037	MTF12N18	1901-0051	02037	1N1566A	
1855-0285	01698	2N5246	1855-0565	01921	RFP10N12	1901-0053	00046	1N5395	
1855-0286	02883	2N3966	1855-0567	03038	IRFD9123	1901-0057	02037	1N2525	
1855-0288	02883	2N5556	1855-0568	06121	BUZ71A	1901-0058	01991	1N628	
1855-0289	02883	J177	1855-0569	00039	NE71000	1901-0059	01991	1N629	
1855-0290	02037	2N5476	1855-0570	00039	2SK523	1901-0060	02037	1N1116	
1855-0291	02883	2N3631	1855-0571	00039	2SK533	1901-0061	01991	1N816	
1855-0292	03406	2N5432	1855-0572	03038	IRF523	1901-0062	02037	1N1563A	
1855-0293	02883	2N6658	1855-0573	02883	U440	1901-0071	02763	1N625	
1855-0296	03038	IRF300	1855-0574	02883	J175	1901-0081	00046	1N4148	
1855-0297	03406	2N2608	1855-0575	02883	2N6660	1901-0096	02237	FDH-400	
1855-0298	02883	J2472	1855-0576	00039	2SK105F, H	1901-0126	01921	1N1763	
1855-0301	02883	2N5198	1855-0580	02883	IRFF123	1901-0129	01698	1N647	
1855-0305	02883	2N4117A	1855-0581	03038	IRF521	1901-0131	01921	1N1764	
1855-0306	01921	3N128	1858-0004	01921	CA3049	1901-0132	01698	1N660	
1855-0307	01921	3N153	1858-0009	02037	MHQ2221	1901-0138	01991	1N1581	
1855-0309	02037	2N4352	1858-0010	02037	MPQ2906	1901-0144	03447	1N662	
1855-0314	01973	2N6027	1858-0020	02237	SH6401PC	1901-0147	02086	1N1202	
1855-0322	03334	2N5105	1858-0021	01921	CA3083	1901-0151	05131	1N2242	
1855-0323	03714	3N172	1858-0022	03793	SG3821N	1901-0161	02037	MDA1201	
1855-0327	01698	2N4416	1858-0023	01921	CA3081E	1901-0164	02037	1N4721	
1855-0332	01921	3N138	1858-0032	01921	CA3146E	1901-0179	02237	FD777	
1855-0341	02883	2N4338	1858-0034	02037	MPQ3725	1901-0304	01973	1N3570	
1855-0346	01973	2N6028	1858-0036	03285	AD821 (SPEC)	1901-0305	01973	1N2158	
1855-0357	01921	3N142	1858-0037	02634	ULN2082A	1901-0306	01973	1N2158R	
1855-0371	02037	2N4092	1858-0040	01921	CA3127E	1901-0307	01973	1N3289	
1855-0379	02037	2N5474	1858-0045	03406	LM3018AH	1901-0308	01973	1N3289R	
1855-0380	02037	2N4351	1858-0046	01921	CA3097E	1901-0309	01973	1N1347A	
1855-0386	02037	2N4392	1858-0047	02634	ULN-2003A	1901-0310	01973	1N250C	
1855-0387	02037	2N3993	1858-0048	01921	CA3082E	1901-0311	01973	1N3260R	
1855-0390	03714	2N3382	1858-0052	02037	SPQ1678	1901-0312	01973	1N3262	
1855-0393	01698	2N3330	1858-0055	02037	MPQ2369	1901-0313	01973	1N3262R	
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1855-0396	03714	3N190	1858-0058	02037	MPQ3906	1901-0315	06121	1N1183A	
1855-0398	02883	2N5519	1858-0061	02634	ULN-2004A	1901-0316	02086	1N1183AR	
1855-0400	02883	2N5905	1858-0062	02037	MPQ3762	1901-0317	02086	1N1184A	
1855-0402	02883	2N5115	1858-0063	01921	CA3102E	1901-0318	02086	1N1184AR	
1855-0406	03714	IT110	1858-0064	01921	CA3045H	1901-0319	02086	1N1186AR	
1855-0413	03406	2N5116	1858-0065	02634	ULN-2815A-2	1901-0320	02086	1N1187A	
1855-0414	02883	2N4393	1858-0066	03714	IH401A	1901-0321	02086	1N1187AR	
1855-0420	02883	2N4391	1858-0067	02634	ULN-2033A	1901-0327	01973	A14B	
1855-0421	02883	2N5114	1858-0069	02634	ULN-2803A	1901-0328	01973	A14D	
1855-0423	02883	VN10KM	1858-0071	02037	MPQ3798	1901-0329	01973	A14M	
1855-0424	03406	J108	1858-0072	02634	ULN-2813A	1901-0330	01973	A14N	
1855-0425	03406	J304	1858-0073	02634	ULN-2805A	1901-0343	02037	1N3491R	
1855-0427	02883	M100	1858-0074	02037	MPQ6100	1901-0346	02037	1N3209R	
1855-0430	03714	2N3685	1858-0075	02037	MPQ3546	1901-0356	00046	1N647	
1855-0431	03714	1VN5001ANF	1858-0076	02037	MPQ2907P	1901-0358	00046	MSD6101	
1855-0432	02883	3N163	1858-0077	02037	MPQ2222P	1901-0365	02037	MDA920A5	
1855-0434	03714	IT500	1858-0081	03811	C7254	1901-0370	01973	1N4530	
1855-0436	03406	U1897E	1858-0082	02634	ULN-2804A	1901-0376	00046	1N3595	
1855-0437	03406	J270	1858-0083	02634	TPQ6002	1901-0383	04583	1N2565	
1855-0440	09283	SD213	1858-0084	02634	ULN-2804A	1901-0398	04583	1N2148	
1855-0445	02883	J107	1858-0085	02634	UDN2580A	1901-0406	02037	1N3491	
1855-0446	02883	J112	1858-0086	02037	MPQ6700	1901-0409	02037	1N4719	
1855-0454	03038	IRF431	1858-0087	02037	MPQ3904	1901-0410	02037	1N4720	
1855-0478	02037	MTM15N50	1858-0088	02037	MPQ7091	1901-0411	02037	MR1033A	
1855-0484	03038	IRF9130	1858-0089	02037	MC1411	1901-0412	02037	1N4722	
1855-0488	03038	IRF610	1858-0090	02037	MPQ6002	1901-0413	02037	MR1035A	
1855-0489	03714	1VN5201TNF	1858-0091	02037	MPQ2484	1901-0414	02037	1N4723	
1855-0490	02037	MTM10N10 SELECTED	1858-0092	02037	MPQ3799	1901-0421	02037	1N3208	
1855-0492	03038	IRF530	1858-0093	02037	MPQ6700	1901-0422	02037	1N3211	
1855-0493	03038	IRF9530	1858-0094	02037	MPQ918	1901-0423	02037	1N3212	
1855-0494	03038	IRF130	1858-0095	00046	PIC900C	1901-0424	02037	1N3492	
1855-0495	02037	MTM10N15	1858-0096	01921	CA3183E	1901-0425	02037	1N3493	
1855-0497	02037	MTP2M90	1858-0097	02634	ULN-2023A	1901-0426	02037	1N3494	
1855-0498	03406	2N5397							



HPP/N	Mfr.	Desc.						
1901-0431	02037	1N3662	1901-0877	02037	MR340P	1902-0035	02037	1N3008B
1901-0432	02037	1N3663	1901-0878	02664	SMFR30K	1902-0039	06563	1N1597A
1901-0461	00046	1N4148	1901-0879	01973	A115M	1902-0041	02237	1N751A
1901-0463	01973	1N4156	1901-0881	02062	5082-0001	1902-0042	02037	1N1608
1901-0465	03447	1N4389	1901-0882	05088	V336X	1902-0082	02037	1N1596A
1901-0478	01973	1N3958	1901-0883	02062	HSCH-3486	1902-0086	02688	1N1513
1901-0490	02713	GI250-3	1901-0885	02037	MR1-1400	1902-0088	02037	1N3003B
1901-0491	02037	1N4724	1901-0888	00046	1N3912	1902-0089	02037	1N3004B
1901-0492	02037	1N5002	1901-0889	02037	MR508	1902-0094	02037	1N705A
1901-0493	02037	1N4725	1901-0890	02037	1N3893	1902-0095	02037	1N746
1901-0494	02037	1N5003	1901-0892	03038	20FQ040	1902-0121	02763	CD36191
1901-0495	02037	MR1120	1901-0893	01691	DSR5500X	1902-0156	02037	1N2986B
1901-0496	02037	MR1121	1901-0894	01973	1N4608	1902-0157	02037	1N2620
1901-0497	02037	MR1122	1901-0896	05131	RC60	1902-0178	02037	1N3004RA
1901-0498	02037	MR1123	1901-0904	00046	UES804	1902-0183	02037	1N2995B
1901-0499	02037	MR1124	1901-0905	01973	DE111	1902-0245	02037	1N4099
1901-0500	02037	MR1125	1901-0912	02037	MR3545	1902-0246	02037	1N4105
1901-0511	06563	1N3889R	1901-0917	03287	1.5KE15A	1902-0517	02037	SZ11213-48
1901-0519	00046	1N3070	1901-0920	02062	5082-2755	1902-0522	02037	1N5340B
1901-0526	02664	SCA11	1901-0921	03038	80SQ030	1902-0526	02037	1N5305
1901-0531	03172	A2S097	1901-0952	00046	1N5802	1902-0528	02037	1N5524D
1901-0532	01973	A14P	1901-0953	00046	UES601R	1902-0549	02037	1N5365A
1901-0537	00046	1N645	1901-0954	02037	1N5285	1902-0570	02688	DZ70302N
1901-0545	02062	5082-2805	1901-0960	05088	VSK71	1902-0584	02037	SZG30590
1901-0551	02037	MR1126	1901-0961	00046	UES803R	1902-0625	02037	1N829
1901-0552	02037	MR1128	1901-0970	02037	MUR115	1902-0627	02037	1N5312
1901-0553	02037	MR1130	1901-0974	05088	H2745-9	1902-0630	02037	1N5236B
1901-0557	01921	CA3019	1901-0975	02037	MPN3500	1902-0631	02037	1N5351B
1901-0578	02037	1N1184R	1901-0976	05088	VSK540	1902-0632	02037	1N5354B
1901-0585	02037	MR1120R	1901-0977	08852	MX1098	1902-0640	02037	1N5847A
1901-0591	05131	ED6240	1901-0978	02037	MR2400	1902-0643	02037	1N2979B
1901-0592	02037	MR1121R	1901-0979	00046	T1D778	1902-0645	02037	1N2997RB
1901-0620	00046	1N4607	1901-0981	02526	1N5653A	1902-0680	02037	1N827
1901-0630	02037	MR1123R	1901-0982	02526	1N5651A	1902-0686	02037	1N825
1901-0639	02062	5082-3080	1901-0983	02526	1N5641A	1902-0697	02237	JANTX1N750A
1901-0646	02664	S2F	1901-0984	00046	VX30	1902-0759	02037	1N2983B
1901-0661	02037	MRD5550A	1901-0985	02865	DDC 4565-96	1902-0761	02037	1N821
1901-0662	02037	MR751	1901-0986	02037	MR11060	1902-0772	02037	1N935
1901-0663	02619	NS3000	1901-0987	01921	RUR810	1902-0777	02037	1N825
1901-0669	02664	S4F	1901-0988	02664	3SF2	1902-0785	02037	1N936
1901-0671	02037	1N3900	1901-0990	06078	16MQ40(SEL)	1902-0786	02037	1N937
1901-0672	02037	1N3890	1901-0995	05088	TG-10	1902-0787	02037	1N938
1901-0673	01973	A15A	1901-0997	02713	RGP15M	1902-0788	02037	1N3154
1901-0674	02664	3SF1	1901-0998	02664	SFR0	1902-0789	02037	1N3155
1901-0678	02037	1N3899R	1901-0999	02682	SD103C	1902-0791	02037	1N944
1901-0684	02037	1N3890R	1901-1000	02037	MR504	1902-0793	02037	1N944
1901-0685	02037	MR822	1901-1015	01698	1N4531	1902-0795	02037	1N992B
1901-0690	01973	A114A	1901-1034	01973	MPD400	1902-0796	02037	1N989B
1901-0691	01973	A115A	1901-1035	02037	MR881R	1902-0905	01691	1VA56A
1901-0692	02037	MR852	1901-1037	02037	MR891R	1902-0906	01691	1VA43A
1901-0693	02037	1N4934	1901-1052	01973	1N4154	1902-0907	01691	1VA68A
1901-0696	01973	A114D	1901-1058	02037	1N1186	1902-0909	02037	1N2972A
1901-0699	02664	3L05	1901-1065	02713	1N4936	1902-0910	02037	1N298MRB
1901-0703	02682	ITT600	1901-1067	02237	FDH444	1902-0916	02037	MZ5556
1901-0704	02086	1N4002	1901-1078	02037	MRD5300	1902-0918	02037	5M17ZS2
1901-0710	01698	1N914	1901-1080	02037	1N5817 (RELEXED)	1902-0919	02037	5M18ZS2
1901-0717	02037	1N3891	1901-1081	02037	MR501	1902-0920	02037	1N5345B
1901-0719	02037	MR854	1901-1085	02062	5082-2835	1902-0923	02037	1N5337A
1901-0726	02037	1N5823	1901-1086	02037	MR820	1902-0924	02037	1N5927
1901-0731	02682	1N4004G	1901-1087	02037	MR856	1902-0925	02037	1NC470A
1901-0732	02237	1N4007	1901-1091	01973	A115F	1902-0927	02037	1N5349
1901-0734	02037	1N5818	1901-1092	01973	A114A	1902-0931	02037	1M120ZS5
1901-0738	02158	50L200	1901-1095	02037	MR1540	1902-0933	02037	1N5370B
1901-0739	02158	G6R110H	1901-1098	02763	1N4150	1902-0934	02037	1N5380B
1901-0742	01921	1N3563	1901-1100	01691	SD-41	1902-0939	02526	1N5908
1901-0743	01698	1N4004	1901-1101	02237	JANTXV 1N4148-1	1902-0941	03287	ICTE-12
1901-0750	02664	1N5553	1901-1102	02062	HSCH-5316	1902-0942	03406	LM103H-5.1
1901-0751	02664	1N5554	1901-1103	02664	1N5623	1902-0973	02037	JAN TXV 1N825
1901-0752	02664	1N3644	1901-1105	05088	VB10X	1902-0976	02526	1.5SE18C
1901-0754	01973	A15F	1901-1106	09914	UES-1106	1902-0977	02037	1N5352
1901-0756	02037	1N3881	1901-1107	03172	AZ11501	1902-0978	02037	1N5346
1901-0758	02037	1N5283	1901-1108	09914	UES1305	1902-0980	02037	5M30ZS2
1901-0759	02713	1N5406	1901-1109	09914	UES1306	1902-0981	02037	5M23ZS2
1901-0760	02037	MBI-101	1901-1110	09914	UES1105	1902-0982	02037	5M28ZS2
1901-0765	03627	1N5812	1901-1111	09914	UES1303	1902-0983	01691	1N4621
1901-0767	02037	MR754	1901-1112	03334	BYV27-150	1902-0986	02037	1N6270A
1901-0768	05088	H617	1901-1113	01921	RUR810	1902-0987	02037	1N2991
1901-0774	02037	1N3891R	1901-1114	10881	BAL 74	1902-0988	02037	5M27ZS2
1901-0775	02037	1N5000	1901-1115	01691	DSR3800X	1902-0989	02037	5M20ZS2
1901-0781	02037	MR754	1901-1116	01691	DSR3700X	1902-0990	02037	MZC5.6B2
1901-0782	02037	1N5821	1901-1117	00746	1SS135	1902-0991	02803	1N4577
1901-0786	02664	1N6074	1901-1118	06002	BYV27-100	1902-0993	03287	1.5KE7.5C
1901-0787	02037	MR756	1901-1119	02062	5082-3042	1902-0994	02037	.4MB. 2Z1
1901-0788	02037	MR752	1901-1120	02037	1N5758	1902-0995	02037	1N5373B
1901-0789	02037	MR850	1901-1121	02037	MR2406	1902-0996	02037	1N5336B
1901-0790	00046	1N5418	1901-1122	02037	MR862R	1902-0997	02037	JANTXV1N3020B
1901-0791	02037	1N3889	1901-1123	02713	1N5408	1902-0998	02037	1N3001B
1901-0824	02037	MR2004SR	1901-1124	02634	THD4150	1902-0999	02037	1N3993A
1901-0825	02037	MR2004S	1901-1126	10881	BYW80-100	1902-1000	02037	1N5366B
1901-0826	02062	5082-3900	1901-1127	00046	UES803	1902-1170	02037	1N4101
1901-0829	02037	MMDC6050	1901-1128	02037	1N5819	1902-1171	02037	1N4102
1901-0831	02037	1N4937	1901-1129	02037	MUR105	1902-1172	02037	1N4103
1901-0833	01691	1N6096	1901-1130	02037	MUR860A	1902-1195	06563	1N1362
1901-0835	01698	BY205-400	1901-1131	02062	5082-2810	1902-1199	06563	1N1604A
1901-0837	01698	BY 205-100	1901-1132	02865	ANS021 SELECTED	1902-1205	02037	1N2979RB
1901-0838	01921	1N5393	1901-1133	01973	1N5626	1902-1226	02037	1N3996A
1901-0839	02037	MR510	1901-1134	03334	BA483	1902-1228	02037	1N2988RB
1901-0841	02062	HSCH-1001	1901-1135	02713	GP30B	1902-1232	02037	1N3997RA
1901-0842	02883	PAD5	1901-1136	03038	10TQ045	1902-1234	02037	1N4000A
1901-0843	02037	1N5002R	1901-1137	02037	MR2406F	1902-1234	02037	1N5357B
1901-0844	02037	MPN3401	1901-1138	07766	BYV95C	1902-1259	02037	1N5255C
1901-0845	05088	VG-2X	1901-1140	02713	FEB8	1902-1260	02037	1N2809B
1901-0846	02037	1N5284	1901-1141	03334	BYV27-200	1902-1276	02037	1N5348B
1901-0847	02713	RGP-10M	1901-1142	02037	MMBD6050	1902-1278	02037	1N5342B
1901-0848	05088	V334X	1901-1143	02713	FE16F	1902-1288	02037	1N5358B
1901-0849	02713	1N4007	1901-1144	02037	BAV70	1902-1291	02037	1N5338B
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1901-0859	03038	40HQ030	1901-1152	02037	MR1645	1902-1294	02037	1N5388A
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2N3966	02037	1850-0078	2N5432	03406	1855-0292	2N910	02237	1854-0209
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2N4032	02237	1853-0072	2N5485 (SEL)	02037	1855-0096	2N963	02037	1850-0119
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MDA922-3	02037	1906-0028	MMT3960	02037	1854-0555	MR891R	02037	1901-1037
MDA922-4	02037	1906-0023	MMT3960A	02037	1854-0587	MRF571 (SEL)	02037	1854-1042
MDA922-6	02037	1906-0027	MP603	02037	1850-0440	MRF581	02037	1854-1022
MDA980-3	02037	1906-0032	MPF833-1004	07050	1855-0515	MRF581	02037	1854-1032
MDA980-6	02037	1906-0049	MPD200	01973	1901-0866	MRF587	02037	1854-1047
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MDA990-2	02037	1906-0058	MPN3401	02037	1901-0844	MRF904	02037	1854-0890
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MJ12003	02037	1854-0941	MPQ3798	02037	1858-0071	MUR105	02037	1901-1129
MJ12004	02037	1854-0964	MPQ3799	02037	1858-0092	MUR115	02037	1901-0970
MJ12005	02037	1854-0969	MPQ3904	02037	1858-0087	MUR860A	02037	1901-1130
MJ12005 (SELECTED)	02037	1854-0969	MPQ3906	02037	1858-0058	MV109	02037	0122-0089
MJ12010	02037	1854-0906	MPQ6002	02037	1858-0090	MV1401	02037	0122-0066
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MJ15003	02037	1854-0989	MPQ6700	02037	1858-0086	MV1404	02037	0122-0081
MJ16002 (SELECTED)	02037	1854-0984	MPQ6700	02037	1858-0093	MV1868D	02037	0122-0064
MJ16012	02037	1854-1015	MPQ6842	02037	1820-1804	MV2101	02037	0122-0056
MJ2500	02037	1853-0387	MPQ7091	02037	1858-0088	MV2101	02037	0122-0071
MJ2955	02037	1853-0420	MPQ918	02037	1858-0094	MV2201	02037	0122-0077
MJ3000	02037	1854-0618	MPS 6523	02037	1853-0043	MV2308	02037	0122-0060
MJ3772	02037	1854-0589	MPS A12	02037	1854-0560	MV309	02037	0122-0332
MJ4035	02037	1854-0707	MPS A18	02037	1854-0691	MV840C	02919	0122-0044
MJ4645	02037	1853-0348	MPS U-10	02037	1854-0764	MVAM125	02037	0122-0163
MJ8505	02037	1854-0965	MPS U-60	02037	1853-0423	MX1098	08852	1901-0977
MJE 210	02037	1853-0398	MPS-404A	02037	1853-0217	M25556	02037	1902-0916
MJE 2370	02037	1853-0394	MPS-A14	02037	1854-0472	MZC4-7A10	02037	1902-1480
MJE 253	02037	1853-0417	MPS-A14	02037	1854-0977	MZC5-6B2	02037	1902-0990
MJE-13009	02037	1853-0827	MPS-A17	02037	1854-0642	ND946	02634	1906-0092
MJE-701	02037	1853-0364	MPS-A18	02037	1854-0583	NE-41635	00039	1854-1008
MJE1091	02037	1853-0334	MPS-A18	02037	1854-0575	NE02135	00039	1854-0946
MJE1091	02037	1853-0334	MPS-A64	02037	1853-0416	NE21935	00039	1854-1009
MJE12007	02037	1853-0332	MPS-A66	02037	1853-0483	NE21935	00039	1854-1044
MJE13003	02037	1854-0847	MPS-AT0	02037	1853-0395	NE64533	00039	1854-1002
MJE1661	02037	1854-0926	MPS-D54	02037	1853-0467	NE71000	00039	1853-0569
MJE170	02037	1853-0768	MPS-H17	02037	1854-0628	NE90115	00039	1853-0578
MJE170	02037	1853-0368	MPS-U01	02037	1854-0634	NS3000	02619	1901-0663
MJE172	02037	1853-0341	MPS-U02	02037	1854-0836	P6KE10A	03287	0837-0300
MJE180	02037	1854-0659	MPS-U07	02037	1854-0817	P6KE15A	03287	0837-0301
MJE182	02037	1854-0585	MPS-U07	02037	1854-0877	P6KE20	03287	0837-0302
MJE200	02037	1854-0739	MPS-U45	02037	1854-0798	P6KE39A	03287	0837-0303
MJE2100	02037	1854-0701	MPS-U51	02037	1853-0326	P6KE47CA	03287	0837-0258
MJE2102	02037	1854-0647	MPS-U52	02037	1853-0476	PAD5	02883	1901-0842
MJE220	02037	1854-0735	MPS-U55	02037	1853-0353	PF5101 (SELECTED)	03406	1855-0529
MJE223	02037	1854-0692	MPS-U57	02037	1853-0496	PKGB2	02037	0837-0294
MJE233	02037	1853-0367	MPS-U95	02037	1853-0449	PKC900C	00046	1858-0095
MJE2361	02037	1854-0749	MPS-2369	02037	1854-0979	PK10	05131	1906-0203
MJE241	02037	1854-0808	MPS3640	02037	1853-0244	PN3568	02237	1854-0867
MJE243	02037	1854-0794	MPS3643	02037	1854-0492	R711XE	05088	1906-0242
MJE244	02037	1854-0754	MPS4356	02237	1853-0488	R712	05088	1906-0231
MJE251	02037	1853-0458	MPS4379	02037	1854-0981	R712A	05088	1906-0236
MJE253	02037	1853-0447	MPS6531	02037	1854-0730	R712E	05088	1906-0888
MJE2801K	02037	1854-0640	MPS6534	02037	1853-0536	R712X	05088	1906-0271
MJE2801T	02037	1854-0819	MPS6543	02037	1854-0296	R754	05088	1906-0067
MJE2901K	02037	1853-0365	MPS6562	02037	1853-0318	RC60	05131	1901-0896
MJE2901T	02037	1853-0547	MPS8098	02037	1854-0973	RCA9212A	01921	1855-0512
MJE2955K	02037	1853-0441	MPS834	02037	1854-0866	RCP-703C	01921	1854-0639
MJE3302	02037	1854-0886	MPSA65	02037	1853-0412	RFP10M12	01921	1855-0565
MJE340	02037	1854-0622	MPSA76	02037	1853-0572	RGP-10M	02713	1901-0847
MJE371K	02037	1853-0369	MPSA92	02037	1853-0336	RGP15M	02713	1901-0997
MJE371K (SELECTED)	02037	1853-0450	MPSAC17	02037	1854-1001	RUR810	01921	1901-0987
MJE5191	02037	1854-0682	MPSC404A	02037	1853-0555	RUR810	01921	1901-1113
MJE5192	02037	1854-0654	MPSH10	02037	1854-0795	S17843	02237	1854-0022
MJE5194	02037	1853-0385	MPSH10	02037	1854-0993	S2F	02664	1901-0646
MJE5195	02037	1853-0372	MPSH81	02037	1853-0448	S32248	02237	1853-0058
MJE521K	02037	1854-0653	MPSHC10	02037	1854-1058	S4F	02664	1901-0669
MJE5657	02037	1854-0736	MPSW06	02037	1854-0997	SA15A	03287	0837-0241
MJE6040	02037	1853-0455	MPSW55	02037	1853-0559	SA15CA	03287	0837-0271
MJE6043	02037	1854-0879	MPSW56	02037	1853-0552	SA00CA	03287	0837-0255
MJE700	02037	1853-0347	MPTC-10C	03287	0837-0279	SAT 5C	03287	0837-0281
MJE800	02037	1854-0581	MR1-1400	02037	1901-0885	SB1660	02713	1906-0300
MJE800	02037	1854-0633	MR1033A	02037	1901-0411	SCAJ1	02664	1901-0526
MJE802	02037	1854-0626	MR1035A	02037	1901-0413	SCHBA2F	02664	1906-0072
MM3904	02037	1854-0883	MR1120	02037	1901-0495	SCDA1	02664	1906-0040
MM3906	02037	1853-0276	MR1120R	02037	1901-0585	SCPA05F	02664	1906-0071
MM4018	02037	1853-0440	MR1121	02037	1901-0496	SCPAL	02664	1906-0039
MM4032	02037	1853-0489	MR1121R	02037	1901-0592	SD-241	01691	1906-0239
MM4645	02037	1853-0308	MR1122	02037	1901-0497	SD-41	01691	1901-1100
MM5262	02037	1854-0802	MR1123	02037	1901-0498	SD103C	02682	1901-0999
MM8001	02037	1854-0580	MR1123R	02037	1901-0630	SD211DE (SELECTED)	09283	1855-0215
MM8006	02037	1854-0540	MR1124	02037	1901-0499	SD213	09283	1855-0440
MMBC1321Q5	02037	1854-1020	MR1125	02037	1901-0500	SD214	02910	1855-0269
MMBD101	02037	1900-0037	MR1126	02037	1901-0551	SD215	02910	1855-0241
MMBD352	02037	1900-0039	MR1128	02037	1901-0552	SD215	09283	1855-0559
MMBD6050	02037	1901-1142	MR1130	02037	1901-0553	SD306 (SEL)	09283	1855-0557
MMBD7000	02037	1906-0298	MR2004S	02037	1901-0825	SE5055	02237	1854-0388
MMBR931	02037	1854-1027	MR2004SR	02037	1901-0824	SE5603CR	00046	1906-0259
MMBT2222A	02037	1854-1053	MR2400	02037	1901-0978	SFE793	02037	1855-0020
MMBT2907A	02037	1853-0525	MR2406	02037	1901-1121	SFR0	02664	1901-0998
MMBT3904	02037	1854-1037	MR2406F	02037	1901-1137	SG3821N	03793	1858-0022
MMBT3906	02037	1853-0567	MRS01	02037	1901-1081	SH6401PC	02237	1858-0020
MMBT4403	02037	1853-0580	MRS02	02037	1901-0870	SH6501PC	02237	1821-0006
MMBT5087	02037	1853-0568	MRS04	02037	1901-1000	SJ7076	02037	1854-0968
MMBT5401	02037	1853-0581	MRS08	02037	1901-0889	SL2364C	01590	1858-0101
MMBT5550	02037	1854-1052	MRS10	02037	1901-0839	SMFR30K	02664	1901-0878
MMBT6429	02037	1854-1014	MRS751	02037	1901-0662	SPQ1678	02037	1858-0052
MMBT918	02037	1854-0929	MRS752	02037	1901-0788	SFS 233	02037	1854-0246
MMBTAS5	02037	1853-0566	MRS754	02037	1901-0767	SFS 3627	02037	1854-0270
MMB2-5232	02037	1902-1436	MRS74	02037	1901-0781	SX43	02664	1902-1385
MMB2-5241	02037	1902-1437	MRS820	02037	1901-0787	SXT8-2N2219A	02037	1854-1021
MMCS2369	02037	1854-0752	MR820	02037	1901-1086	SZ11213-48	02037	1902-0517
MMD6100	02037	1906-0025	MR822	02037	1901-0685	SZ1521-250	02037	1902-0027
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MMD7000	02037	1906-0026	MR852					

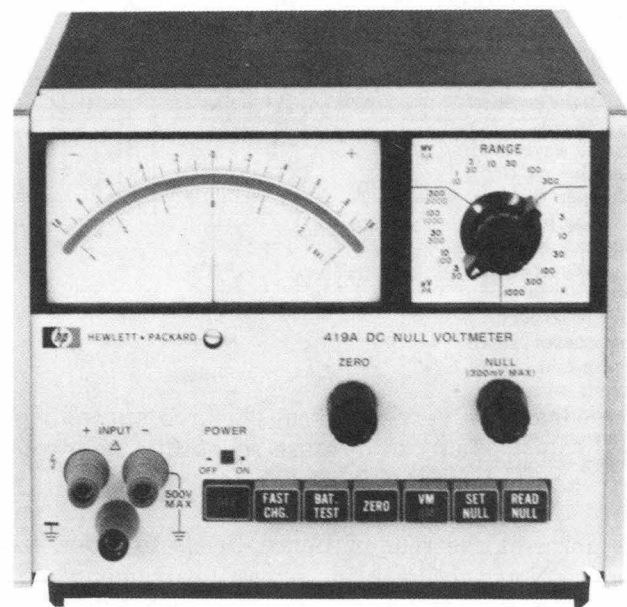
JDEC	Mfr	HP P/N						
TIP140	01698	1854-0663	TN-4030-J25Z	03406	1853-0551	V392A1	01973	0837-0278
TG-10	05088	1901-0995	TND908	02634	1906-0275	V430MA3A	01973	0837-0196
THD4150	02634	1901-1124	TPQ6002	02634	1858-0083	V47MA2B	01973	0837-0243
TID130	01698	1906-0202	U1897E	03406	1855-0436	V56MA2B	01973	0837-0285
TIP 115	01698	1853-0377	U310	02883	1855-0530	VA114	02569	0122-0008
TIP 141	01698	1854-0763	U310(SELECTED)	02037	1855-0235	VA126	02569	0122-0031
TIP-122	01698	1854-0828	U311	02883	1855-0519	VB10X	05088	1901-1105
TIP-126	01698	1853-0424	U440	02883	1855-0573	VCR2N	02883	1855-0265
TIP-127	01698	1853-0468	UC310	02037	1855-0552	VCR3P	02883	1855-0205
TIP-34	01698	1853-0350	UDN2580A	02634	1858-0085	VE48	05088	1906-0006
TIP-35A	01698	1854-0593	UES 2402	00046	1906-0262	VG-2X	05088	1901-0845
TIP-L1	01698	1854-0625	UES-1106	09914	1901-1106	VH148	05088	1906-0052
TIP100	02037	1854-0840	UES1105	09914	1901-1110	VHE2402A	05088	1906-0270
TIP102	01698	1854-0970	UES1303	09914	1901-1111	VJ148X	05088	1906-0079
TIP105	02037	1853-0463	UES1305	09914	1901-1108	VJ848TT	05088	1906-0085
TIP106	01698	1853-0454	UES1306	09914	1901-1109	VK248	05088	1906-0205
TIP107	02037	1853-0490	UES2605	00046	1906-0277	VKP 248	05088	1906-0264
TIP110	01698	1854-0670	UES601R	00046	1901-0953	VL447	05088	1906-0216
TIP112	02037	1854-1023	UES803	00046	1901-1127	VM28X	05088	1906-0289
TIP140	02037	1854-0880	UES803R	00046	1901-0961	VMP-1	02883	1855-0263
TIP142	02037	1854-0985	UES804	00046	1901-0904	VNO104N3	07221	1855-0546
TIP145	02037	1853-0498	ULN-2003A	02634	1858-0047	VNO300L	02883	1855-0555
TIP32C	03406	1853-0537	ULN-2003A(SEL)	02634	1858-0099	VNO300M	02883	1855-0525
TIP36	01698	1853-0453	ULN-2004A	02634	1858-0061	VN10KE	02883	1853-0545
TIP41A	01698	1854-0456	ULN-2023A	02634	1858-0097	VN10KM	02883	1855-0423
TIP41C	02037	1854-0799	ULN-2033A	02634	1858-0067	VN10LE	02883	1855-0560
TIP41C (SELECTED)	02037	1854-0967	ULN-2803A	02634	1858-0069	VN2222L	02883	1855-0556
TIP42	01698	1853-0356	ULN-2804A	02634	1858-0082	VN66AF	02883	1855-0275
TIP42A	01698	1853-0234	ULN-2804A	02634	1858-0084	VP0300L	02883	1855-0550
TIP42C	02037	1853-0431	ULN-2805A	02634	1858-0073	VPO300M	02883	1855-0526
TIP47	02037	1854-0838	ULN-2813A	02634	1858-0072	VSK148	05088	1906-0240
TIP51	01698	1854-0806	ULN-2815A-2	02634	1858-0065	VSK12	05088	1906-0263
TIP642	01698	1854-0982	ULM2082A	02634	1858-0037	VSK231	05088	1906-0278
TIP647	01698	1853-0543	USD 745C	00046	1906-0265	VSK3040T	05088	1906-0238
TIP75B	01698	1853-0543	V120MA1A	01973	0837-0273	VSK540	05088	1901-0976
TIP75B	01698	1854-0803	V120ZA6	01973	0837-0292	VSK71	05088	1901-0960
TIP753A	01698	1854-0960	V275LA20A	01973	0837-0261	VX30	00046	1901-0984
TIR101B	01698	1906-0213	V300LA4	01973	0837-0268	W02M	02713	1906-0256
TIR201B	01698	1906-0214	V334X	05088	1901-0848	X45H281	01973	1853-0363
TIS-149	01698	1853-0464	V336X	05088	1901-0882	ZSK533	00039	1855-0571

## Safety-Related Service Notes

Service Notes from HP relating to personal safety and possible equipment damage are of vital importance to our customers. To make you more aware of these important notes, they are printed on paper with a red border, and the service note number has a "-S" suffix. In order to make you immediately aware of any potential safety problems, we are highlighting safety-related service notes here with a brief description of each problem. Also, in order to draw your attention to safety-related service notes on the service note order form at the back of *Bench Briefs*, each appropriate number is highlighted by being printed in color.

### HP 419A DC Null Voltmeter

Some older 419A Voltmeters may have a potential shock hazard. If the instrument is floated above ground, control shafts (and control knob set screws) on the NULL and ZERO pots, and the RANGE switch are at the same potential as the - (minus) input terminal



### Checking For Isolation

1. With all power removed from the 419A and the line switch off, connect one lead of an ohmmeter to the - (minus) input terminal.
2. Set the ohmmeter on the 1ohm range.
3. Connect the other ohmmeter lead to the set screws on the NULL pot, ZERO pot, and RANGE switch one at a time and check for continuity.

4. The ohmmeter should read infinity. If it shows continuity instead, HP recommends that modification kit HP P/N 00419-69500 be installed.

Please order service note 419-7C-S for more details.

### 5342A Frequency Counter

5342A Counters with serial numbers 2317A07600 through 2317A07800 may

have a possible shock hazard. Some of the above units have a defective motherboard with reduced primary circuit spacings that are below the acceptable minimum as defined by the international safety standards.

For a shock hazard to exist, there must be a breakdown where the reduced spacings occur, **and** the instrument must either be disconnected from earth ground or a fault must occur in the earth grounding circuit.

In order for you to determine if the motherboard in your counter is defective, you must order safety service note 5342A-42-S. This safety service note has photographs to aid you in making the determination.



# supplement to BENCH BRIEFS SERVICE NOTE INDEX

## Need Any Service Notes?

They're free!

Here's the latest listing of Service Notes. They recommend modifications to Hewlett-Packard instruments to increase reliability, improve performance, or extend their usefulness.

Use the order form at the rear of Bench Briefs to order, free of charge, individual Service Notes documenting several instruments.

If you would like to purchase large quantities of Service Notes covering a wide range of instruments, or if you desire a complete history of all Service Notes documenting all changes to your instruments, Hewlett-Packard offers a microfiche library for a modest, one time charge. There is also a microfiche subscription service available that automatically updates the library on a quarterly schedule.

The part numbers for the microfiche library and subscription service are:

Library of	
Service Notes—	5951-6511
Subscription service—	5951-6517

Contact your local HP Sales Office for ordering information.

### HP 419A DC NULL VOLTMETER

419A-7C-S. Serials 0948A05467 and below. Elimination of potential shock hazard.

### HP 853A SPECTRUM ANALYZER DISPLAY

853A-11. Serials 2334A and below. Modification to prevent intermittent distortion of characters on the CRT.

### HP 1200A/B OSCILLOSCOPE

1200A/B-7. All serials. Recommended CRT replacement.

### HP 1205A/B OSCILLOSCOPE

1205A/B-4. All serials. Recommended CRT replacement.

### HP 1630A/D/G LOGIC ANALYZER

1630A/D/G-4. Serials 2311A-00808 and below (1630A); serials 2412A-03410 and below (1630D); serials 2415A-00171 and below (1630G). Overvoltage protection design change.  
1630G-5. Serials 2415A-00280 and below (1630G). Also 2415A-00286, 2415A-00287, 2415A-00289. PROM replacement to correct firmware.

### HP 1740A OSCILLOSCOPE

1740A-21. Serials 2026A and below, and serials 1751G and below. Modification to eliminate horizontal jitter, intensity flicker and power supply connector discoloring.

### HP 1741A OSCILLOSCOPE

1741A-14. Serials 2017A and below, and serials 2002G and below. Modification to eliminate horizontal jitter, intensity flicker and power supply connector discoloring.

### HP 1742A OSCILLOSCOPE

1742A-6. Serials 2021A and below. Modification to eliminate horizontal jitter, intensity flicker and power supply connector discoloring.

### HP 1743A OSCILLOSCOPE

1743A-7. Serials 2036A and below. Modification to eliminate horizontal jitter, intensity flicker and power supply connector discoloring.

### HP 1744A OSCILLOSCOPE

1744A-8. Serials 2109A and below. Modification to eliminate horizontal jitter, intensity flicker and power supply connector discoloring.



#### **HP 3060 BOARD TEST SYSTEM**

3060A-57. All serials. New test lead kit (HP P/N 03060-67902) for 3060A board test system.

#### **HP 3065 BOARD TEST SYSTEM**

3065-10. All serials. Edge connector cleaning procedure.  
3065-12. Software prior to rev. 2410. Modification to prevent fuse failure on the system 23 card.  
3065-13. Modification of the confirmation/diagnostic fixture part number 11345-80000.

#### **HP 3325A SYNTHESIZER/FUNCTION GENERATOR**

3325A-14. Serials 1748A-13470 and below. Transistor mounting modification to prevent intermittent resets and erroneous front panel displays.

#### **HP 3421A DATA ACQUISITION AND CONTROL UNIT**

3421A-8. Serials 2338A-03052 and below. Motherboard ROM replacement procedure.  
3421A-9. Serials 2338A-03053 and above. Front panel display operation change.

#### **HP 3453A DIGITAL STIMULUS/RESPONSE UNIT**

3453A-5A. All serials. Recommended IC socket replacement to reduce intermittent and reoccurring DSRU failures.

#### **HP 3455A DIGITAL VOLTMETER**

3455A-20C. All serials. Service kit (HP P/N 03455-69801) for 3455A digital voltmeter.

#### **HP 3496A SCANNER**

3496A-8. All serials. Replacing lighted pushbutton switches.

#### **HP 3764A DIGITAL TRANSMISSION ANALYZER**

3764A-3. Serials below 2418U-00237. Modification to prevent incorrect readings of the analogue AUX input voltage.  
3764A-4. Serials below 2418U-00244. Modification to prevent incorrect AIS and SYNC loss messages to the 3764A printer/cassette.

#### **HP 3770A AMPLITUDE/DELAY DISTORTION ANALYZER**

3770A-44. All serials. Preferred replacement of rotary pulse generator assembly A3.

#### **HP 3770B TELEPHONE LINE ANALYZER**

3770B-29. All serials. Preferred replacement of rotary pulse generator assembly A3.  
3770B-30. All serials. Preventive maintenance to minimize possibility of intermittent failures.

#### **HP 3771A/B DATA LINE ANALYZER**

3771A/B-18A. All serials. Retrofitting instructions for HP-IB option 005.  
3771A/B-32. All serials. Preferred replacement of IC's 1820-2037 and 1820-1486.

#### **HP 3776A/B PCM TERMINAL TEST SET**

3776A-10A. All serials. Easy modification to prevent multiple interrupts from the keyboard causing 'ERROR 104' to be displayed.  
3776A-13. All serials. Retrofitting instructions for data measurements option 001.  
3776A-15A. Serials below 2423U-00202. Software modification to correct a bug that prevents the running of the continuous pulse signaling dialing measurement, and also causes the analog RX-only gain measurement results to be affected by the idle state holding tone.  
3776A-16. All serials. Preferred replacement of analog switch IC HP P/N 1820-1971.  
3776A-17. All serials. Preferred replacement of RAM HP P/N 1818-1718.  
3776B-10A. All serials. Easy modification to prevent multiple interrupts from the keyboard causing 'ERROR 104' to be displayed.  
3776B-13A. All serials. Retrofitting instructions for data measurements option 001.  
3776B-15A. Serials below 2423U-00462. Software modification to correct a bug that prevents the running of the continuous pulse signaling dialing measurement, and also causes the analog RX-only gain measurement results to be affected by the idle state holding tone.  
3776B-16. All serials. Preferred replacement of analog switch IC HP P/N 1820-1971.  
3776B-17. All serials. Preferred replacement of RAM HP P/N 1818-1718.

#### **HP 3777A CHANNEL SELECTOR**

3777A-6. All serials. Preferred replacement for main transformer A9T1 and voltage regulator A9U1.

#### **HP 3779A/B PRIMARY MULTIPLEX ANALYZER**

3779A-23B. All serials. How to build service accessories for performance tests.  
3779A-32. All serials. List of 3779C/D assemblies that are replacements for obsolete 3779A/B assemblies.  
3779A-33. All serials. Recommended rear panel sub-assembly replacement.  
3779B-25B. All serials. How to build service accessories for performance tests.  
3779B-33. All serials. List of 3779C/D assemblies that are replacements for obsolete 3779A/B assemblies.  
3779B-34. All serials. Recommended rear panel sub-assembly replacement.

#### **HP 3779 C/D PRIMARY MULTIPLEX ANALYZER**

3779C-5B. All serials. How to build service accessories for performance tests.  
3779C-12B. Serials 2235U-00308 and below. Preferred replacements - A1, A9, A15, A16, A18, A31, A33, A37 and rear panel assemblies.  
3779C-16. Serials 2308U-00403 and below. Preferred replacement for assemblies A1, A8, A9, A31, A37.  
3779C-17. Serials 2235U-00308 and below. Recommended rear panel sub-assembly replacement.  
3779D-5B. All serials. How to build service accessories for performance tests.  
3779D-12B. Serials 2235U-00243 and below. Preferred replacements - A1, A9, A15, A16, A18, A31, A33, A37 and rear panel assemblies.  
3779D-13. Serials 2308U-00333 and below. Modification to allow CAS testing when in single channel mode.  
3779D-17. Serials 2308U-00333 and below. Preferred replacement for assemblies A1, A8, A9, A31, A37.  
3779D-18. All serials. Modification to single channel interface looping link.  
3779D-20. Serials 2235U-00243 and below. Recommended rear panel sub-assembly replacement.

**HP 3780A PATTERN GENERATOR/  
ERROR DETECTOR**

3780A-29. All instruments with option 100 above serial 1804U-00523; all instruments with option 101 above serial 1915U-00976; all instruments with option 103 or option 104. Modification to prevent sync loss in binary mode.

**HP 3785A/B JITTER GENERATOR &  
RECEIVER**

3785A-10. Serials 2244U and below. Reduction of displayed residual jitter in through data mode.  
3785B-9. Serials 2248U and below. Reduction of displayed residual jitter in through data mode.  
3785B-10. All serials. Recommended replacement processor RAMS to prevent failures.

**HP 4935A TRANSMISSION IMPAIRMENT  
MEASURING SET**

4935A-5A. Serials 2206A and above. New A4 transmitter board for improved performance.

**HP 4951A PROTOCOL ANALYZER**

4951A-2. Serials 2426A and below. Improved hole detection circuitry on tape option boards.

**HP 5061A CESIUM BEAM FREQUENCY  
STANDARD**

5061A-16. All serials. Correction to signal-to-noise check procedure for A12 cesium beam tube assembly.

**HP 5334A UNIVERSAL COUNTER**

5334A-1. Serials 2245A-00391 and below. HP-IB EPROM modification to insure interface clear.  
5334A-2. Serials 2245A-00326 and below with option 020. Measurement EPROM update for correct DVM readings.

**HP 5335A UNIVERSAL FREQUENCY  
COUNTER**

5335A-18. All serials. Installing firmware (ROM) revision 1.1.  
5342A-42-S. Serials 2317A-07600 through 2317A-07800. Possible shock hazard.

**HP 5384A/85A FREQUENCY COUNTER**

5384A/85A-1. All serials. Modification to prevent counter lockup.

**HP 6031A SYSTEM DC POWER SUPPLY**

6031A-1. Serials 2426A-00142 and below. Recommended A8U8 ROM replacement to improve performance.

**HP 6032A SYSTEM DC POWER SUPPLY**

6032A-1. Serials 2415A-00195 and below. Recommended A8U8 ROM replacement to improve performance.

**HP 6033A SYSTEM DC POWER SUPPLY**

6033A-1. Serials 2424A-00311 and below. Recommended A8U8 ROM replacement to improve performance.

**HP 6212A DC POWER SUPPLY**

6212A-1. All serials. Recommended top cover replacement.

**HP 6214A DC POWER SUPPLY**

6214A-1. All serials. Recommended top cover replacement.

**HP 6216A DC POWER SUPPLY**

6216A-1. All serials. Recommended top cover replacement.

**HP 6218A DC POWER SUPPLY**

6218A-1. All serials. Recommended top cover replacement.

**HP 8015A PULSE GENERATOR**

8015A-5. Serials 2027G-02890 and below. Protection against damage of the power lamp.

**HP 8160A PROGRAMMABLE PULSE  
GENERATOR**

8160A-9A. Serials 2409G-00606 and above, and 2417A-00832 and above. Recommended replacement of the microprocessor board.

**HP 8161A PROGRAMMABLE PULSE  
GENERATOR**

8161A-5A. Serials 2410G-00396 and above. Recommended replacement of the microprocessor board.

**HP 8340A SYNTHESIZED SWEEPER**

8340A-10. All serials. Retrofit from front panel to rear panel RF output (standard to option 004 and option 001 to option 005).  
8340A-11. Serials 2410A-00370 and below. Recommended replacement ALC detector cables.

**HP 8559A SPECTRUM ANALYZER**

8559A-27A. Serials 2320A-03301 to 2320A-03315, and 2320A-03376 to 2320A-03390. Modification to prevent breakage of elapsed time indicator.

**HP 8565A AND 8569A SPECTRUM  
ANALYZERS**

8565A-19. All serials. Recommended replacement RF-IF motherboard assembly.

**HP 8566A SPECTRUM ANALYZER**

8566A-20. All serials. Modification instructions to retrofit 8566A to 8566B.

**HP 8568A SPECTRUM ANALYZER**

8568A-44. All serials. Modification instructions to retrofit 8568A to 8568B.

**HP 8569A SPECTRUM ANALYZERS**

8569A-12. All serials. Recommended replacement RF-IF motherboard assembly.

**HP 8673A/B/C/D SYNTHESIZED SIGNAL  
GENERATOR**

8673A-1. All serials. Improved key code debouncing.  
8673B-1. Serials 2416A and below. Improved key code debouncing.  
8673C-1. Serials 2332A and below. Improved key code debouncing.  
8673D-1. Serials 2332A and below. Improved key code debouncing.

**HP 8970A NOISE FIGURE METER**

8970A-4. All serials. Troubleshooting frequency calibration failures, E18.  
8970A-5. All serials. Preferred replacement for driver integrated circuits A14U42, A1U4 and A1U5.  
8970A-6. Serials 2427A and below. Improved radiation performance.  
8970A-7. All serials. I.F. calibration with HP 346A noise source.

**HP 64203A-8085 EMULATOR POD**

64203A-8. Serials listed within this note. Emulator POD board compatibility information.

**HP 64212A-6800 EMULATOR POD**

64212A-1. Serials listed within this note. Emulator POD board compatibility information.

**HP 64213A-6802 EMULATOR POD**

64213A-2. Serials listed within this note. Emulator POD board compatibility information.

**HP 64214A-6809 EMULATOR CONTROL CARD**

64214A-1. Serials 2329A and below. Modification to prevent improper illegal opcode break if target asserts reset while emulator is in background.

**HP 64215A-6809 EMULATOR POD**

64215A-2. Serials listed within this note. Emulator POD board compatibility information.

**HP 64222A-8086 EMULATOR POD**

64222A-2. Serials listed within this note. Emulator POD board compatibility information.

**HP 64226A-8088 EMULATOR POD**

64226A-4. Serials listed within this note. Emulator POD board compatibility information.

**HP 64232A-Z8001 EMULATOR POD**

64232A-2. Serials listed within this note. Emulator POD board compatibility information.

**HP 64233A-Z8002 EMULATOR POD**

64233A-2. Serials listed within this note. Emulator POD board compatibility information.

**HP 64242A-68000 EMULATOR POD**

64242A-6. Serials listed within this note. Emulator POD board compatibility information.

**HP 64251A-Z80 EMULATOR CONTROL BOARD**

64251A-5A. Z80 emulation control board repair number prefix 2120A and below. Modification to prevent erroneous illegal opcode following halt instruction.

**HP 64252A-Z80 EMULATOR POD**

64252A-7. Serials listed within this note. Emulator POD board compatibility information.

**HP 64255A-6801/03 EMULATOR CONTROL CARD**

64255A-1A. All serials. Enhancement for Motorola 6801U4/6803U4.

**HP 64261A-8048 EMULATOR CONTROL CARD**

64261A-1. 64261-66501 Boards. Modification to remove glitch on lower half of port 2 when "MOVX" instruction occurs.

**HP 64262A-8048 EMULATOR POD**

64262A-4. Serials listed within this note. Emulator POD board compatibility information.

**HP 64621A LOGIC STATE CONTROL CARD**

64621A-2. State analysis performance verification changes.

**HP 64658A-80186/80188 INTERFACE MODULE**

64658A-1. Potential problems in executed instruction mode.

**HP 64941A FLOPPY DISC SYSTEM**

64941A-2. All serials. Change of vendor on floppy disc drive unit.

**HP 69750A SCAN CONTROL/PACER**

69750A-1A. Serials 2414A-00866 and below. HP6942A/44A multiprogrammer I/O card. Correction of random access, external channel selection problem.

# Service Note Order Form

If you want service notes, please check the appropriate boxes below and return this form separately to one of the following addresses.

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1820 Embarcadero Road  
Palo Alto, California 94303

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| <input type="checkbox"/> 853A-11     | <input type="checkbox"/> 3764A-3     | <input type="checkbox"/> 3779A-33  | <input type="checkbox"/> 5061A-16    | <input type="checkbox"/> 8566A-20 | <input type="checkbox"/> 64242A-6  |
| <input type="checkbox"/> 1200A/B-7   | <input type="checkbox"/> 3764A-4     | <input type="checkbox"/> 3779B-25B | <input type="checkbox"/> 5334A-1     | <input type="checkbox"/> 8568A-44 | <input type="checkbox"/> 64251A-5A |
| <input type="checkbox"/> 1205A/B-4   | <input type="checkbox"/> 3770A-44    | <input type="checkbox"/> 3779B-33  | <input type="checkbox"/> 5334A-2     | <input type="checkbox"/> 8569A-12 | <input type="checkbox"/> 64252A-7  |
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| <input type="checkbox"/> 1630G-5     | <input type="checkbox"/> 3770B-30    | <input type="checkbox"/> 3779C-5B  | <input type="checkbox"/> 5342A-42-S  | <input type="checkbox"/> 8673B-1  | <input type="checkbox"/> 64261A-1  |
| <input type="checkbox"/> 1740A-21    | <input type="checkbox"/> 3771A/B-18A | <input type="checkbox"/> 3779C-12B | <input type="checkbox"/> 5384A/85A-1 | <input type="checkbox"/> 8673C-1  | <input type="checkbox"/> 64262A-4  |
| <input type="checkbox"/> 1741A-14    | <input type="checkbox"/> 3771A/B-32  | <input type="checkbox"/> 3779C-16  | <input type="checkbox"/> 6031A-1     | <input type="checkbox"/> 8673D-1  | <input type="checkbox"/> 64621A-2  |
| <input type="checkbox"/> 1742A-6     | <input type="checkbox"/> 3776A-10A   | <input type="checkbox"/> 3779C-17  | <input type="checkbox"/> 6032A-1     | <input type="checkbox"/> 8970A-4  |                                    |
| <input type="checkbox"/> 1743A-7     | <input type="checkbox"/> 3776A-13A   | <input type="checkbox"/> 3779D-5B  | <input type="checkbox"/> 6033A-1     | <input type="checkbox"/> 8970A-5  |                                    |
| <input type="checkbox"/> 1744A-8     | <input type="checkbox"/> 3776A-15A   | <input type="checkbox"/> 3779D-12B | <input type="checkbox"/> 6212A-1     | <input type="checkbox"/> 8970A-6  | <input type="checkbox"/> 64658A-1  |
| <input type="checkbox"/> 3060A-57    | <input type="checkbox"/> 3776A-16    | <input type="checkbox"/> 3779D-13  | <input type="checkbox"/> 6214A-1     | <input type="checkbox"/> 8970A-7  | <input type="checkbox"/> 64941A-2  |
| <input type="checkbox"/> 3065-10     | <input type="checkbox"/> 3776A-17    | <input type="checkbox"/> 3779D-17  | <input type="checkbox"/> 6216A-1     | <input type="checkbox"/> 64203A-8 | <input type="checkbox"/> 69750A-1A |
| <input type="checkbox"/> 3065-12     | <input type="checkbox"/> 3776B-10A   | <input type="checkbox"/> 3779D-18  | <input type="checkbox"/> 6218A-1     | <input type="checkbox"/> 64212A-1 |                                    |
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