

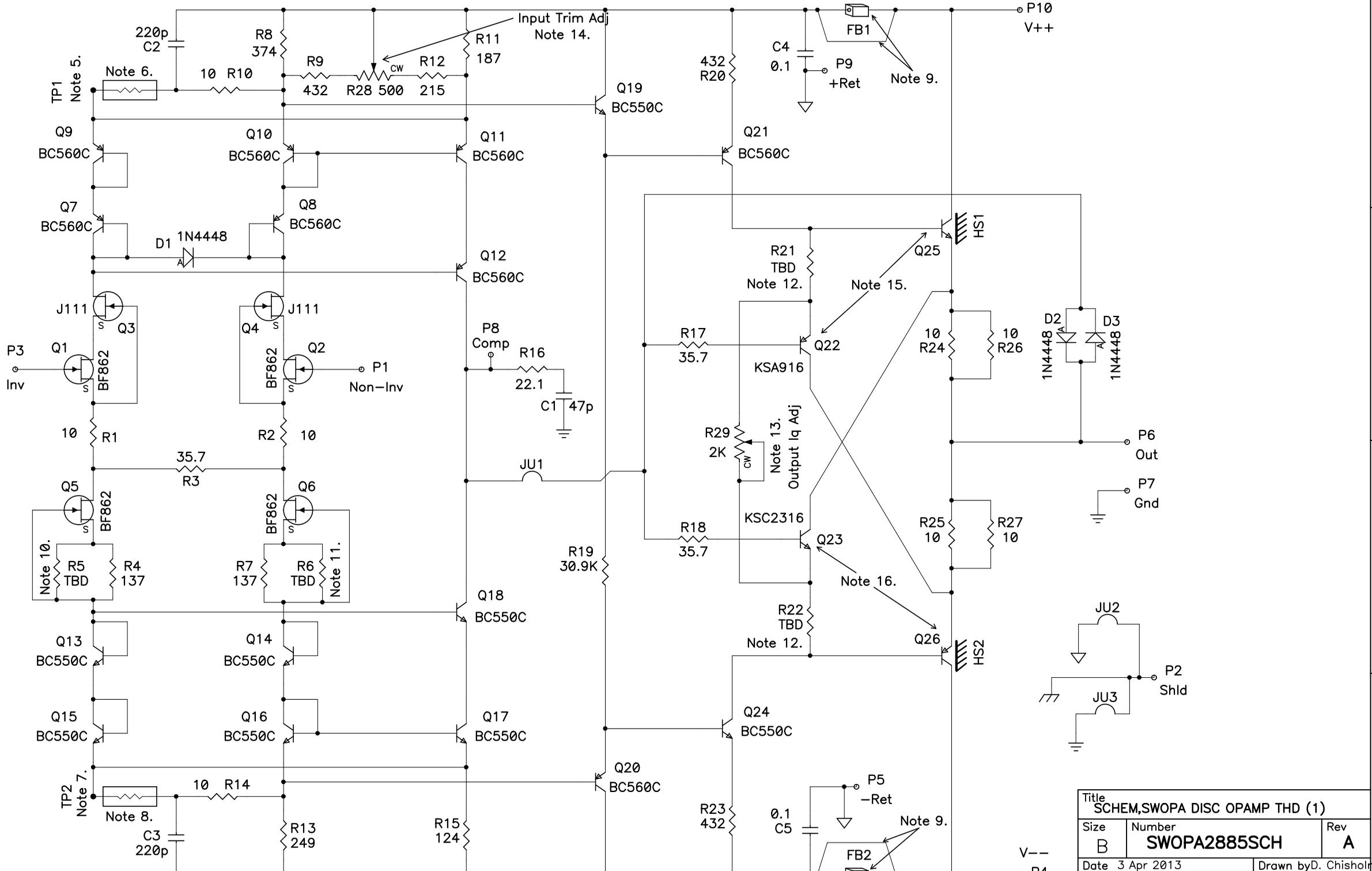
Notes (Unless Otherwise Indicated):

- 16 Provide thermal coupling between Q23 and Q26 by joining Q23 to Q26 with suitable adhesive or spring coupling device.
- 15 Provide thermal coupling between Q22 and Q25 by joining Q22 to Q25 with suitable adhesive or spring coupling device.
- 14 Input Balance Adjustment. Adjust to minimize input offset or overall THD as required by application.
- 13 Adjust for desired output stage bias current, or desired total module current. Typical adjustment values:
- | VARIANT: | Ic Q25/Q26 | Iq (Total) |
|----------|------------|------------|
| -0       | 6.2 mA     | 25.0 mA    |
| -1       | 27.8 mA    | 47.5 mA    |
- 12 Value sets range of output stage bias adjust. See Parts List.
- 11 Selected value.  
Selection criteria: 5 mA idle current through R13  
Nominal value 162 ohms. Expected range 20 ohms to 4320 ohms.
- 10 Selected value.  
Selection criteria: 10 mA idle current through R15  
Nominal value 162 ohms. Expected range 20 ohms to 4320 ohms.  
Select after selecting R7
- 9 Cut trace or remove jumper if indicated component is installed.
- 8 For alternative compensation method install R14 in this location rather than location shown.
- 7 Locate TP2 adjacent to R14 so that R14 may be installed either as shown, or in the alternate position between TP2 and C3.
- 6 For alternative compensation method install R10 in this location rather than location shown.
- 5 Locate TP1 adjacent to R10 so that R10 may be installed either as shown, or in the alternate position between TP1 and C2.
- 4 Last Reference Designator used:  
C5, D3, FB2, HS2, JU3, P10, Q26, R29  
Reference Designator not used: None
- 3 Fixed resistors thin film or metal film, 250 mW min, 1% or better tol, except as noted.  
Polarized capacitors aluminum electrolytic, rating as shown, tol +/-20% unless otherwise noted.  
Non-polarized capacitors see parts list for construction & rating
- 2 Component values shown for reference only. Refer to parts list associated with specific variant and revision level.
- 1 VARIANTS:  
SWOPA2885-0 T092 Output Devices  
SWOPA2885-1 T0126 Output Devices (High Bias)

Revision Notes

A. Preliminary development version of this dwg # and title. Not released. Circulated for comments. Circuit based on Post #2593 and #2643 in "Discrete Opamp Open Design" thread on "diyaudio.com". Available online at <  
<http://www.diyaudio.com/forums/analog-line-level/218373-discrete-opa-p-open-design-260.html#post3324000> > and <  
<http://www.diyaudio.com/forums/analog-line-level/218373-discrete-opa-p-open-design-265.html#post3344901> >.

|   |                         |          |
|---|-------------------------|----------|
| Title<br>SCHEM,SWOPA DISC OPAMP THD (1) |                         |          |
| Size<br>B                               | Number<br>SWOPA2885SCH  | Rev<br>A |
| Date<br>3 Apr 2013                      | Drawn by<br>D. Chisholm |          |
| Filename<br>SWOPA_Post2885_A.SCH        | Sheet<br>1 of 2         |          |



|   |                        |          |
|---|------------------------|----------|
| Title<br>SCHEM,SWOPA DISC OPAMP THD (1) |                        |          |
| Size<br>B                               | Number<br>SWOPA2885SCH | Rev<br>A |
| Date<br>3 Apr 2013                      | Drawn by D. Chisholm   |          |
| File Name<br>SWOPA_Post2885_A.SCH       | Sheet 2 of 2           |          |

Assy Dwg # SWOPA2885ASY  
 Dwg Title PCB ASSY,SW-OPA DISC OPAMP THD (1)  
 Rev A  
 Schem Dwg # SWOPA2885SCH  
 Schem Title SCHEM,SWOPA DISC OPAMP THD (1)  
 Rev A

Orig Date 16-Apr-13  
 Assy Short Name SWOPA Disc Opamp THD1  
 Rev Date 16-Apr-13  
 Orig Date 16-Apr-13  
 Rev Date 16-Apr-13  
 Engineer Dale Chisholm

| ITEM | REF DES | DESCRIPTION  | Unit of Meas | VARIANT USAGE:<br>-0 -1 | ORIGINAL COMPONENT MANUFACTURER   |                         |                     |           |          | ALTERNATIVE COMPONENT MANUFACTURER |       |  |                    |   |           |           |                        |                    |       |       |
|------|---------|--|--------------|-------------------------|-----------------------------------|-------------------------|---------------------|-----------|----------|------------------------------------|-------|--|--------------------|---|-----------|-----------|------------------------|--------------------|-------|-------|
|      |         |  |              |                         | Original Part Manufacturer (Pref) |                         | Mfr. Typical Source |           |          | LINE COST PER VARIANT:             |       | Original Part Manufacturer (Alternative) |                    | Alternative Manufacturer Typical Source |           |           | LINE COST PER VARIANT: |                    |       |       |
|      |         |  |              |                         | MFR                               | MFR P/N                 | Unit Cost           | Purch Qty | Vendor   | Vendor P/N                         | -0    | -1                                       | MFR                | MFR P/N                                 | Unit Cost | Purch Qty | Vendor                 | Vendor P/N         | -0    | -1    |
| 1    | <none>  | SW-OPA DISC OPAMP THD(1) PWB   | Ea           | X X                     | Pending                           | SWOPA2885PWB1           |                     |           | TBD      | TBD                                | .0000 | .0000                                    | Pending            | SWOPA2885PWB1                           |           |           | TBD                    | TBD                | .0000 | .0000 |
| 2    | C1      | Cap,Film PP 47pF   | Ea           | X X                     | WIMA                              | FKP2O100471D00KSSD      | .1900               | 10        | Mouser   | 505-FKP247/1000/10                 | .1900 | .1900                                    | WIMA               | FKP2O100471D00JSSD                      | .2886     | 25        | TAW Electronics        | FKP2O100471D00JSSD | .2886 | .2886 |
| 3    | C2      | Cap,Film PP 220pF 100V 5mm   | Ea           | X X                     | WIMA                              | FKP2O102201D00JSSD      | .2400               | 10        | Mouser   | 505-FKP2220/1000/5                 | .2400 | .2400                                    | WIMA               | FKP2O102201D00JSSD                      | .2821     | 25        | TAW Electronics        | FKP2O102201D00JSSD | .2821 | .2821 |
| 4    | C3      | Cap,Film PP 220pF 100V 5mm   | Ea           | X X                     | WIMA                              | FKP2O102201D00JSSD      | .2400               | 10        | Mouser   | 505-FKP2220/1000/5                 | .2400 | .2400                                    | WIMA               | FKP2O102201D00JSSD                      | .2821     | 25        | TAW Electronics        | FKP2O102201D00JSSD | .2821 | .2821 |
| 5    | C4      | Cap,Film 0.10uF 63V 5mm  | Ea           | X X                     | WIMA                              | MKS2-.1/63/5            | .2000               | 10        | Mouser   | 505-MKS2.1/63/5                    | .2000 | .2000                                    | Kemet              | R82DC3100AA50J                          | .1510     | 10        | Digi-Key               | 399-5863-ND        | .1510 | .1510 |
| 6    | C5      | Cap,Film 0.10uF 63V 5mm  | Ea           | X X                     | WIMA                              | MKS2-.1/63/5            | .2000               | 10        | Mouser   | 505-MKS2.1/63/5                    | .2000 | .2000                                    | Kemet              | R82DC3100AA50J                          | .1510     | 10        | Digi-Key               | 399-5863-ND        | .1510 | .1510 |
| 7    | D1      | Diode,Si Switch 100V 200mA 4nSec 1N4448                                  | Ea           | X X                     | NXP Semiconductors                | 1N4448,113              | .0920               | 1         | Digi-Key | 568-1361-1-ND                      | .0920 | .0920                                    | Vishay             | 1N4448TR                                | .0460     | 10        | Mouser                 | 78-1N4448          | .0460 | .0460 |
| 8    | D2      | Diode,Si Switch 100V 200mA 4nSec 1N4448                                  | Ea           | X X                     | NXP Semiconductors                | 1N4448,113              | .0920               | 1         | Digi-Key | 568-1361-1-ND                      | .0920 | .0920                                    | Vishay             | 1N4448TR                                | .0460     | 10        | Mouser                 | 78-1N4448          | .0460 | .0460 |
| 9    | D3      | Diode,Si Switch 100V 200mA 4nSec 1N4448                                  | Ea           | X X                     | NXP Semiconductors                | 1N4448,113              | .0920               | 1         | Digi-Key | 568-1361-1-ND                      | .0920 | .0920                                    | Vishay             | 1N4448TR                                | .0460     | 10        | Mouser                 | 78-1N4448          | .0460 | .0460 |
| 10   | FB1     | Bead,Ferrite Interference Supp 96 Ohms/25 MHz, 0.5A                      | Ea           | X X                     | Fair-Rite                         | 2743007112              | .1200               | 1         | Mouser   | 623-2743007112                     | .1200 | .1200                                    | Panasonic          | EXCELSA39                               | .1400     | 1         | Digi-Key               | P9818NK-ND         | .1400 | .1400 |
| 11   | FB2     | Bead,Ferrite Interference Supp 96 Ohms/25 MHz, 0.5A                      | Ea           | X X                     | Fair-Rite                         | 2743007112              | .1200               | 1         | Mouser   | 623-2743007112                     | .1200 | .1200                                    | Panasonic          | EXCELSA39                               | .1400     | 1         | Digi-Key               | P9818NK-ND         | .1400 | .1400 |
| 12   | HS1     | Heatsink,TO126 Clip On   | Ea           | X                       | Aavid Thermalloy                  | 577500B00000G           | .4000               | 1         | Digi-Key | HS216_ND                           | .4000 | .4000                                    | Assmann WSW        | V2110B                                  | .4300     | 1         | Digi-Key               | A10750-ND          | .4300 | .4300 |
| 13   | HS1     | Heatsink,TO126 Clip On   | Ea           | X                       | Aavid Thermalloy                  | 577500B00000G           | .4000               | 1         | Digi-Key | HS216_ND                           | .4000 | .4000                                    | Assmann WSW        | V2110B                                  | .4300     | 1         | Digi-Key               | A10750-ND          | .4300 | .4300 |
| 14   | P1      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 15   | P2      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 16   | P3      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 17   | P4      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 18   | P5      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 19   | P6      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 20   | P7      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 21   | P8      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 22   | P9      | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 23   | P10     | Pin,0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | X X                     | Mill-Max                          | 3125-2-00-00-00-00-08-0 | .2200               | 10        | Mouser   | 575-3125200000000                  | .2200 | .2200                                    | Cambion            | 460-2627-2                              |           |           |                        |                    | .0000 | .0000 |
| 24   | Q1      | XSTR,BF862 N-JFET Hi-Gm RF SOT23   | Ea           | X X                     | NXP Semiconductors                | BF862,215               | .2700               | 1         | Mouser   | 771-BF862-T/R                      | .2700 | .2700                                    | NXP Semiconductors | BF862,215                               | .3790     | 10        | Digi-Key               | 568-1968-1-ND      | .3790 | .3790 |
| 25   | Q2      | XSTR,BF862 N-JFET Hi-Gm RF SOT23   | Ea           | X X                     | NXP Semiconductors                | BF862,215               | .2700               | 1         | Mouser   | 771-BF862-T/R                      | .2700 | .2700                                    | NXP Semiconductors | BF862,215                               | .3790     | 10        | Digi-Key               | 568-1968-1-ND      | .3790 | .3790 |
| 26   | Q3      | XSTR,N-JFET J111 Hi-Vp Switch TO-92                                      | Ea           | X X                     | Fairchild                         | J111                    | .1600               | 1         | Mouser   | 512-J111                           | .1600 | .1600                                    | Fairchild          | J111                                    | .4900     | 1         | Digi-Key               | J111FS-ND          | .4900 | .4900 |
| 27   | Q4      | XSTR,N-JFET J111 Hi-Vp Switch TO-92                                      | Ea           | X X                     | Fairchild                         | J111                    | .1600               | 1         | Mouser   | 512-J111                           | .1600 | .1600                                    | Fairchild          | J111                                    | .4900     | 1         | Digi-Key               | J111FS-ND          | .4900 | .4900 |
| 28   | Q5      | XSTR,BF862 N-JFET Hi-Gm RF SOT23   | Ea           | X X                     | NXP Semiconductors                | BF862,215               | .2700               | 1         | Mouser   | 771-BF862-T/R                      | .2700 | .2700                                    | NXP Semiconductors | BF862,215                               | .3790     | 10        | Digi-Key               | 568-1968-1-ND      | .3790 | .3790 |
| 29   | Q6      | XSTR,BF862 N-JFET Hi-Gm RF SOT23   | Ea           | X X                     | NXP Semiconductors                | BF862,215               | .2700               | 1         | Mouser   | 771-BF862-T/R                      | .2700 | .2700                                    | NXP Semiconductors | BF862,215                               | .3790     | 10        | Digi-Key               | 568-1968-1-ND      | .3790 | .3790 |
| 30   | Q7      | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 31   | Q8      | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 32   | Q9      | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 33   | Q10     | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 34   | Q11     | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 35   | Q12     | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 36   | Q13     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 37   | Q14     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 38   | Q15     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 39   | Q16     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 40   | Q17     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 41   | Q18     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 42   | Q19     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC550CBU                | .0500               | 1         | Mouser   | 512-BC550CBU                       | .0500 | .0500                                    | ON Semiconductor   | BC550CG                                 | .1712     | 25        | Digi-Key               | BC550CGOS-ND       | .1712 | .1712 |
| 43   | Q20     | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |
| 44   | Q21     | XSTR,BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | X X                     | Fairchild                         | BC560CTA                | .1100               | 1         | Mouser   | 512-BC560CTA                       | .1100 | .1100                                    | ON Semiconductor   | BC560CG                                 | .1000     | 1         | Mouser                 | 863-BC560CG        | .1000 | .1000 |

| ITEM | REF | DES | DESCRIPTION   | Unit of Meas | VARIANT USAGE: |    | Original Part Manufacturer (Pref) |               | Mfr. Typical Source |           | LINE COST PER VARIANT: |            |        |                  | Original Part Manufacturer (Alternative) |         | Alternative Manufacturer Typical Source |                 |        |            | LINE COST PER VARIANT: |    |  |  |
|------|-----|-----|---|--------------|----------------|----|-----------------------------------|---------------|---------------------|-----------|------------------------|------------|--------|------------------|--|---------|---|-----------------|--------|------------|------------------------|----|--|--|
|      |     |     |   |              | -0             | -1 | MFR                               | MFR P/N       | Unit Cost           | Purch Qty | Vendor                 | Vendor P/N | -0     | -1               | MFR                                      | MFR P/N | Unit Cost                               | Purch Qty       | Vendor | Vendor P/N | -0                     | -1 |  |  |
| 45   | Q22 |     | XSTR,KSA916 PNP 120V 800 mA Driver TO-92L ECB Pinout  | Ea           | X              | X  | Fairchild                         | KSA916YTA     | 1                   | Mouser    | 512-KSA916YTA          | .1600      | .1600  | Fairchild        | KSA916YTA                                | 1       | Digi-Key                                | KSA916YTA-ND    | .5600  | .5600      |                        |    |  |  |
| 46   | Q23 |     | XSTR,KSC2316 NPN 120V 800 mA Driver TO-92L ECB Pinout | Ea           | X              | X  | Fairchild                         | KSC2316YTA    | 1                   | Arrow     | KSC2316YTA             | .0573      | .0573  | Fairchild        | KSC2316YTA                               | 1       | Arrow                                   | KSC2316YTA      | .0573  | .0573      |                        |    |  |  |
| 47   | Q24 |     | XSTR,BC550 NPN 45V 100 mA Hi-HFE Low Noise TO-92      | Ea           | X              | X  | Fairchild                         | BC550CUB      | 1                   | Mouser    | 512-BC550CUB           | .0500      | .0500  | ON Semiconductor | BC550CG                                  | 25      | Digi-Key                                | BC550CGOS-ND    | .1712  | .1712      |                        |    |  |  |
| 48   | Q25 |     | XSTR,KSC2316 NPN 120V 800 mA Driver TO-92L ECB Pinout | Ea           | X              |    | Fairchild                         | KSC2316YTA    | 1                   | Arrow     | KSC2316YTA             | .0573      | .0573  | Fairchild        | KSC2316YTA                               | 1       | Arrow                                   | KSC2316YTA      | .0573  | .0573      |                        |    |  |  |
| 49   | Q25 |     | XSTR,KSC2690A NPN 160V 1.2 A Med Pwr TO-126           | Ea           |                | X  | Fairchild                         | KSC2690AYS    | 1                   | Mouser    | 512-KSC2690AYS         | .3800      | .3800  | Fairchild        | KSC2690AYS                               | 1       | Digi-Key                                | KSC2690AYSFS-ND | .5400  | .5400      |                        |    |  |  |
| 50   | Q26 |     | XSTR,KSA916 PNP 120V 800 mA Driver TO-92L ECB Pinout  | Ea           | X              |    | Fairchild                         | KSA916YTA     | 1                   | Mouser    | 512-KSA916YTA          | .1600      | .1600  | Fairchild        | KSA916YTA                                | 1       | Digi-Key                                | KSA916YTA-ND    | .5600  | .5600      |                        |    |  |  |
| 51   | Q26 |     | XSTR,KSA1220A PNP 160V 1.2 A Med Pwr TO-126           | Ea           |                | X  | Fairchild                         | KSA1220AYS    | 1                   | Mouser    | 512-KSA1220AYS         | .3700      | .3700  | Fairchild        | KSA1220AYS                               | 1       | Digi-Key                                | KSA1220AYSFS-ND | .4300  | .4300      |                        |    |  |  |
| 52   | R1  |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 53   | R2  |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 54   | R3  |     | Res,Metal Film 1/4W 1% RN60 35.7 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D35R7FB14 | 1                   | Mouser    | 71-RN60D35R7F          | .1100      | .1100  | Vishay/Dale      | CMF5535R700FHEB                          | 10      | Digi-Key                                | CMF35.7HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 55   | R4  |     | Res,Metal Film 1/4W 1% RN60 137 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D1370FB14 | 1                   | Mouser    | 71-RN60D-F-137         | .1100      | .1100  | Vishay/Dale      | CMF55137R00FHEB                          | 10      | Digi-Key                                | CMF137HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 56   | R5  |     | Res,Metal Film 1/4W 1% RN60 Selected Value            | Ea           | X              | X  | Vishay/Dale                       | RN60D****FB14 | 1                   | Mouser    | TBD                    | .3300      | .3300  | Vishay/Dale      | CMF55****0FHEB                           | 10      | Digi-Key                                | TBD             | .5890  | .5890      |                        |    |  |  |
| 57   | R6  |     | Res,Metal Film 1/4W 1% RN60 Selected Value            | Ea           | X              | X  | Vishay/Dale                       | RN60D****FB14 | 1                   | Mouser    | TBD                    | .3300      | .3300  | Vishay/Dale      | CMF55****0FHEB                           | 10      | Digi-Key                                | TBD             | .5890  | .5890      |                        |    |  |  |
| 58   | R7  |     | Res,Metal Film 1/4W 1% RN60 137 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D1370FB14 | 1                   | Mouser    | 71-RN60D-F-137         | .1100      | .1100  | Vishay/Dale      | CMF55137R00FHEB                          | 10      | Digi-Key                                | CMF137HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 59   | R8  |     | Res,Metal Film 1/4W 1% RN60 374 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D3740FB14 | 1                   | Mouser    | 71-RN60D3740F          | .1100      | .1100  | Vishay/Dale      | CMF55374R00FHEB                          | 10      | Digi-Key                                | CMF374HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 60   | R9  |     | Res,Metal Film 1/4W 1% RN60 432 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D4320FB14 | 1                   | Mouser    | 71-RN60D-F-432         | .1100      | .1100  | Vishay/Dale      | CMF55432R00FHEB                          | 10      | Digi-Key                                | CMF432HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 61   | R10 |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 62   | R11 |     | Res,Metal Film 1/4W 1% RN60 187 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D1870FB14 | 1                   | Mouser    | 71-RN60D1870F          | .2000      | .2000  | Vishay/Dale      | CMF55187R00FHEB                          | 10      | Digi-Key                                | CMF187HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 63   | R12 |     | Res,Metal Film 1/4W 1% RN60 215 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D2150FB14 | 1                   | Mouser    | 71-RN60D-F-215         | .1100      | .1100  | Vishay/Dale      | CMF55215R00FHEB                          | 10      | Digi-Key                                | CMF215HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 64   | R13 |     | Res,Metal Film 1/4W 1% RN60 249 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D2490FB14 | 1                   | Mouser    | 71-RN60D-F-249         | .1100      | .1100  | Vishay/Dale      | RN60D2490FB14                            | 100     | Digi-Key                                | 1135-1590-MIL   | .2723  | .2723      |                        |    |  |  |
| 65   | R14 |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 66   | R15 |     | Res,Metal Film 1/4W 1% RN60 124 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D1240FB14 | 1                   | Mouser    | 71-RN60D-F-124         | .1100      | .1100  | Vishay/Dale      | CMF55124R00FHEB                          | 10      | Digi-Key                                | CMF124HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 67   | R16 |     | Res,Metal Film 1/4W 1% RN60 22.1 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D22R1FB14 | 1                   | Mouser    | 71-RN60D-F-22.1        | .1100      | .1100  | Vishay/Dale      | CMF5522R100FKEB                          | 10      | Digi-Key                                | CMF22.1HGCT-ND  | .4660  | .4660      |                        |    |  |  |
| 68   | R17 |     | Res,Metal Film 1/4W 1% RN60 35.7 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D35R7FB14 | 1                   | Mouser    | 71-RN60D35R7F          | .1100      | .1100  | Vishay/Dale      | CMF5535R700FHEB                          | 10      | Digi-Key                                | CMF35.7HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 69   | R18 |     | Res,Metal Film 1/4W 1% RN60 35.7 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D35R7FB14 | 1                   | Mouser    | 71-RN60D35R7F          | .1100      | .1100  | Vishay/Dale      | CMF5535R700FHEB                          | 10      | Digi-Key                                | CMF35.7HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 70   | R19 |     | Res,Metal Film 1/4W 1% RN60 30.9K ohm                 | Ea           | X              | X  | Vishay/Dale                       | RN60D3092FB14 | 1                   | Mouser    | 71-RN60D-F-30.9K       | .2000      | .2000  | Vishay/Dale      | CMF5530K900FHEB                          | 10      | Digi-Key                                | CMF30.9KHCT-ND  | .5890  | .5890      |                        |    |  |  |
| 71   | R20 |     | Res,Metal Film 1/4W 1% RN60 432 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D4320FB14 | 1                   | Mouser    | 71-RN60D-F-432         | .1100      | .1100  | Vishay/Dale      | CMF55432R00FHEB                          | 10      | Digi-Key                                | CMF432HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 72   | R21 |     | Res,Metal Film 1/4W 1% RN60 27.4 ohm                  | Ea           | X              |    | Vishay/Dale                       | RN60D27R4FB14 | 1                   | Mouser    | 71-RN60D-F-27.4        | .1100      | .1100  | Vishay/Dale      | CMF5527R400FHEB                          | 10      | Digi-Key                                | CMF27.4HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 73   | R21 |     | Res,Metal Film 1/4W 1% RN60 90.9 ohm                  | Ea           |                | X  | Vishay/Dale                       | RN60D90R9FB14 | 1                   | Mouser    | 71-RN60D-F-90.9        | .1100      | .1100  | Vishay/Dale      | CMF5590R900FHEB                          | 10      | Digi-Key                                | CMF90.9HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 74   | R22 |     | Res,Metal Film 1/4W 1% RN60 27.4 ohm                  | Ea           | X              |    | Vishay/Dale                       | RN60D27R4FB14 | 1                   | Mouser    | 71-RN60D-F-27.4        | .1100      | .1100  | Vishay/Dale      | CMF5527R400FHEB                          | 10      | Digi-Key                                | CMF27.4HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 75   | R22 |     | Res,Metal Film 1/4W 1% RN60 90.9 ohm                  | Ea           |                | X  | Vishay/Dale                       | RN60D90R9FB14 | 1                   | Mouser    | 71-RN60D-F-90.9        | .1100      | .1100  | Vishay/Dale      | CMF5590R900FHEB                          | 10      | Digi-Key                                | CMF90.9HFCT-ND  | .5890  | .5890      |                        |    |  |  |
| 76   | R23 |     | Res,Metal Film 1/4W 1% RN60 432 ohm                   | Ea           | X              | X  | Vishay/Dale                       | RN60D4320FB14 | 1                   | Mouser    | 71-RN60D-F-432         | .1100      | .1100  | Vishay/Dale      | CMF55432R00FHEB                          | 10      | Digi-Key                                | CMF432HFCT-ND   | .5890  | .5890      |                        |    |  |  |
| 77   | R24 |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 78   | R25 |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 79   | R26 |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 80   | R27 |     | Res,Metal Film 1/4W 1% RN60 10.0 ohm                  | Ea           | X              | X  | Vishay/Dale                       | RN60D10R0FRE6 | 1                   | Mouser    | 71-RN60D-F-10/R        | .1100      | .1100  | Vishay/Dale      | RN60D10R0FB14                            | 100     | Digi-Key                                | 1135-1563-MIL   | .2723  | .2723      |                        |    |  |  |
| 81   | R28 |     | Trimpot,Multiturn, Top Adj, 3/8" Thru Hole 500 ohms   | Ea           | X              | X  | Vishay/Sfernice                   | T93YB501KT20  | 1                   | Mouser    | 72-T93YB-500           | 1.4400     | 1.4400 | BI Technologies  | 67YR500LF                                | 1       | Digi-Key                                | 987-1618-ND     | 1.4000 | 1.4000     |                        |    |  |  |
| 82   | R29 |     | Trimpot,Multiturn, Top Adj, 3/8" Thru Hole 2000 ohms  | Ea           | X              | X  | Vishay/Sfernice                   | T93YB202KT20  | 1                   | Mouser    | 72-T93YB-2K            | 1.5800     | 1.5800 | BI Technologies  | 67YR2KLF                                 | 1       | Digi-Key                                | 987-1506-ND     | 1.4000 | 1.4000     |                        |    |  |  |
| 83   | TB1 |     | PWB Design Feature Only. No Physical Part.            | Ea           | X              | X  | N/A                               | N/A           | N/A                 | N/A       | N/A                    | .0000      | .0000  | N/A              | N/A                                      | N/A     | N/A                                     | N/A             | .0000  | .0000      |                        |    |  |  |
| 84   | TB2 |     | PWB Design Feature Only. No Physical Part.            | Ea           | X              | X  | N/A                               | N/A           | N/A                 | N/A       | N/A                    | .0000      | .0000  | N/A              | N/A                                      | N/A     | N/A                                     | N/A             | .0000  | .0000      |                        |    |  |  |
| 85   |     |     |   |              |                |    |                                   |               |                     |           |                        |            |        |                  |  |         |   |                 |        |            |                        |    |  |  |
| 86   |     |     |   |              |                |    |                                   |               |                     |           |                        |            |        |                  |  |         |   |                 |        |            |                        |    |  |  |
| 87   |     |     |   |              |                |    |                                   |               |                     |           |                        |            |        |                  |  |         |   |                 |        |            |                        |    |  |  |
| 88   |     |     |   |              |                |    |                                   |               |                     |           |                        |            |        |                  |  |         |   |                 |        |            |                        |    |  |  |
| 89   |     |     |   |              |                |    |                                   |               |                     |           |                        |            |        |                  |  |         |   |                 |        |            |                        |    |  |  |
| 90   |     |     |   |              |                |    |                                   |               |                     |           |                        |            |        |                  |  |         |   |                 |        |            |                        |    |  |  |

Component Parts Cost: \$13.511 \$14.843 \$0.000 \$0.000

Component Parts Cost: \$23.203 \$24.415 \$0.000 \$0.000

Assy Dwg # SWOPA2885ASY  
 Dwg Title PCB ASSY,SW-OPA DISC OPAMP THD (1)  
 Rev A  
 Schem Dwg # SWOPA2885SCH  
 Schem Title SCHEM,SWOPA DISC OPAMP THD (1)  
 Rev A

Orig Date 16-Apr-13  
 Assy Short Name SWOPA Disc Opamp THD1  
 Rev Date 16-Apr-13  
 Orig Date 16-Apr-13  
 Rev Date 16-Apr-13  
 Engineer Dale Chisholm

| ITEM | REF DES                                 | DESCRIPTION   | Unit of Meas | QTY PER VER: |    | PREFERRED MANUFACTURER |                         |           |           | ALTERNATE MANUFACTURER |                    |                         |                             |                    |                    |                       |            |                        |                        |        |        |
|------|---|---|--------------|--------------|----|------------------------|-------------------------|-----------|-----------|------------------------|--------------------|-------------------------|-----------------------------|--------------------|--------------------|-----------------------|------------|------------------------|------------------------|--------|--------|
|      |   |   |              | -0           | -1 | Original Part MFR      | Original Part MFR P/N   | Unit Cost | Purch Qty | Typical Source Vendor  | Vendor P/N         | Original Part MFR (Alt) | Original Part MFR P/N (Alt) | Unit Cost          | Purch Qty          | Typical Source Vendor | Vendor P/N | LINE COST PER VERSION: | LINE COST PER VERSION: |        |        |
|      |   |   |              |              |    |                        |                         |           |           |                        |                    |                         |                             |                    |                    |                       |            |                        |                        |        |        |
| 1    | <none>                                  | SW-OPA DISC OPAMP THD(1) PWB  | Ea           | 1            | 1  | Pending                | SWOPA2885PWB1           |           |           | TBD                    | TBD                | .0000                   | .0000                       | Pending            | SWOPA2885PWB1      |                       |            | TBD                    | TBD                    | .0000  | .0000  |
| 2    | C1                                      | Cap, Film PP 47pF   | Ea           | 1            | 1  | WIMA                   | FKP2O100471D00KSSD      | .1900     | 10        | Mouser                 | 505-FKP247/1000/10 | .1900                   | .1900                       | WIMA               | FKP2O100471D00JSSD | .2886                 | 25         | TAW Electronics        | FKP2O100471D00JSSD     | .2886  | .2886  |
| 3    | C2, C3                                  | Cap, Film PP 220pF 100V 5mm   | Ea           | 2            | 2  | WIMA                   | FKP2O102201D00JSSD      | .2400     | 10        | Mouser                 | 505-FKP2220/1000/5 | .4800                   | .4800                       | WIMA               | FKP2O102201D00JSSD | .2821                 | 25         | TAW Electronics        | FKP2O102201D00JSSD     | .5642  | .5642  |
| 4    | C4, C5                                  | Cap, Film 0.10uF 63V 5mm  | Ea           | 2            | 2  | WIMA                   | MKS2-.1/63/5            | .2000     | 10        | Mouser                 | 505-MKS2.1/63/5    | .4000                   | .4000                       | Kemet              | R82DC3100AA50J     | .1510                 | 10         | Digi-Key               | 399-5863-ND            | .3020  | .3020  |
| 5    | D1, D2, D3                              | Diode, Si Switch 100V 200mA 4nSec 1N4448                                  | Ea           | 3            | 3  | NXP Semiconductors     | 1N4448,113              | .0920     | 1         | Digi-Key               | 568-1361-1-ND      | .2760                   | .2760                       | Vishay             | 1N4448TR           | .0460                 | 10         | Mouser                 | 78-1N4448              | .1380  | .1380  |
| 6    | FB1, FB2                                | Bead, Ferrite Interference Supp 96 Ohms/25 MHz, 0.5A                      | Ea           | 2            | 2  | Fair-Rite              | 2743007112              | .1200     | 1         | Mouser                 | 623-2743007112     | .2400                   | .2400                       | Panasonic          | EXCELSA39          | .1400                 | 1          | Digi-Key               | P9818NK-ND             | .2800  | .2800  |
| 7    | HS1, HS2                                | Heatsink, TO126 Clip On   | Ea           | 0            | 2  | Aavid Thermalloy       | 577500B00000G           | .4000     | 1         | Digi-Key               | HS216_ND           | .0000                   | .8000                       | Assmann WSW        | V2110B             | .4300                 | 1          | Digi-Key               | A10750-ND              | .0000  | .8600  |
| 8    | P1, P2, P3, P4, P5, P6, P7, P8, P9, P10 | Pin, 0.040" Contact, Staked, 0.043" Mtg Hole, 0.170" Standoff, 0.062" PWB | Ea           | 10           | 10 | Mill-Max               | 3125-2-00-00-00-00-08-0 | .2200     | 10        | Mouser                 | 575-3125200000000  | 2.2000                  | 2.2000                      | Cambion            | 460-2627-2         |                       |            |                        |                        | .0000  | .0000  |
| 9    | Q1, Q2, Q5, Q6                          | XSTR, BF862 N-JFET Hi-Gm RF SOT23   | Ea           | 4            | 4  | NXP Semiconductors     | BF862,215               | .2700     | 1         | Mouser                 | 771-BF862-T/R      | 1.0800                  | 1.0800                      | NXP Semiconductors | BF862,215          | .3790                 | 10         | Digi-Key               | 568-1968-1-ND          | 1.5160 | 1.5160 |
| 10   | Q3, Q4                                  | XSTR, N-JFET J111 Hi-Vp Switch TO-92                                      | Ea           | 2            | 2  | Fairchild              | J111                    | .1600     | 1         | Mouser                 | 512-J111           | .3200                   | .3200                       | Fairchild          | J111               | .4900                 | 1          | Digi-Key               | J111FS-ND              | .9800  | .9800  |
| 11   | Q7, Q8, Q9, Q10, Q11, Q12, Q20, Q21     | XSTR, BC560 PNP 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | 8            | 8  | Fairchild              | BC560CTA                | .1100     | 1         | Mouser                 | 512-BC560CTA       | .8800                   | .8800                       | ON Semiconductor   | BC560CG            | .1000                 | 1          | Mouser                 | 863-BC560CG            | .8000  | .8000  |
| 12   | Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q24  | XSTR, BC550 NPN 45V 100 mA Hi-HFE Lo-Noise TO-92                          | Ea           | 8            | 8  | Fairchild              | BC550CBU                | .0500     | 1         | Mouser                 | 512-BC550CBU       | .4000                   | .4000                       | ON Semiconductor   | BC550CG            | .1712                 | 25         | Digi-Key               | BC550CGOS-ND           | 1.3696 | 1.3696 |
| 13   | Q22                                     | XSTR, KSA916 PNP 120V 800 mA Driver TO-92L ECB Pinout                     | Ea           | 1            | 1  | Fairchild              | KSA916YTA               | .1600     | 1         | Mouser                 | 512-KSA916YTA      | .1600                   | .1600                       | Fairchild          | KSA916YTA          | .5600                 | 1          | Digi-Key               | KSA916YTA-ND           | .5600  | .5600  |
| 14   | Q23                                     | XSTR, KSC2316 NPN 120V 800 mA Driver TO-92L ECB Pinout                    | Ea           | 1            | 1  | Fairchild              | KSC2316YTA              | .0573     | 1         | Arrow                  | KSC2316YTA         | .0573                   | .0573                       | Fairchild          | KSC2316YTA         | .0573                 | 1          | Arrow                  | KSC2316YTA             | .0573  | .0573  |
| 15   | Q25                                     | XSTR, KSC2316 NPN 120V 800 mA Driver TO-92L ECB Pinout                    | Ea           | 1            | 0  | Fairchild              | KSC2316YTA              | .0573     | 1         | Arrow                  | KSC2316YTA         | .0573                   | .0000                       | Fairchild          | KSC2316YTA         | .0573                 | 1          | Arrow                  | KSC2316YTA             | .0573  | .0000  |
| 16   | Q25                                     | XSTR, KSC2690A NPN 160V 1.2 A Med Pwr TO-126                              | Ea           | 0            | 1  | Fairchild              | KSC2690AYS              | .3800     | 1         | Mouser                 | 512-KSC2690AYS     | .0000                   | .3800                       | Fairchild          | KSC2690AYS         | .5400                 | 1          | Digi-Key               | KSC2690AYSFS-ND        | .0000  | .5400  |
| 17   | Q26                                     | XSTR, KSA916 PNP 120V 800 mA Driver TO-92L ECB Pinout                     | Ea           | 1            | 0  | Fairchild              | KSA916YTA               | .1600     | 1         | Mouser                 | 512-KSA916YTA      | .1600                   | .0000                       | Fairchild          | KSA916YTA          | .5600                 | 1          | Digi-Key               | KSA916YTA-ND           | .5600  | .0000  |
| 18   | Q26                                     | XSTR, KSA1220A PNP 160V 1.2 A Med Pwr TO-126                              | Ea           | 0            | 1  | Fairchild              | KSA1220AYS              | .3700     | 1         | Mouser                 | 512-KSA1220AYS     | .0000                   | .3700                       | Fairchild          | KSA1220AYS         | .4300                 | 1          | Digi-Key               | KSA1220AYSFS-ND        | .0000  | .4300  |
| 19   | R1, R2, R10, R14, R24, R25, R26, R27    | Res, Metal Film 1/4W 1% RN60 10.0 ohm                                     | Ea           | 8            | 8  | Vishay/Dale            | RN60D10R0FRE6           | .1100     | 1         | Mouser                 | 71-RN60D-F-10/R    | .8800                   | .8800                       | Vishay/Dale        | RN60D10R0FB14      | .2723                 | 100        | Digi-Key               | 1135-1563-MIL          | 2.1784 | 2.1784 |
| 20   | R3, R17, R18                            | Res, Metal Film 1/4W 1% RN60 35.7 ohm                                     | Ea           | 3            | 3  | Vishay/Dale            | RN60D35R7FB14           | .1100     | 1         | Mouser                 | 71-RN60D35R7F      | .3300                   | .3300                       | Vishay/Dale        | CMF5535R700FHEB    | .5890                 | 10         | Digi-Key               | CMF35.7HFCT-ND         | 1.7670 | 1.7670 |
| 21   | R4, R7                                  | Res, Metal Film 1/4W 1% RN60 137 ohm                                      | Ea           | 2            | 2  | Vishay/Dale            | RN60D1370FB14           | .1100     | 1         | Mouser                 | 71-RN60D-F-137     | .2200                   | .2200                       | Vishay/Dale        | CMF55137R00FHEB    | .5890                 | 10         | Digi-Key               | CMF137HFCT-ND          | 1.1780 | 1.1780 |
| 22   | R5                                      | Res, Metal Film 1/4W 1% RN60 Selected Value                               | Ea           | 1            | 1  | Vishay/Dale            | RN60D****FB14           | .3300     | 1         | Mouser                 | TBD                | .3300                   | .3300                       | Vishay/Dale        | CMF55****0FHEB     | .5890                 | 10         | Digi-Key               | TBD                    | .5890  | .5890  |
| 23   | R6                                      | Res, Metal Film 1/4W 1% RN60 Selected Value                               | Ea           | 1            | 1  | Vishay/Dale            | RN60D****FB14           | .3300     | 1         | Mouser                 | TBD                | .3300                   | .3300                       | Vishay/Dale        | CMF55****0FHEB     | .5890                 | 10         | Digi-Key               | TBD                    | .5890  | .5890  |
| 24   | R8                                      | Res, Metal Film 1/4W 1% RN60 374 ohm                                      | Ea           | 1            | 1  | Vishay/Dale            | RN60D3740FB14           | .1100     | 1         | Mouser                 | 71-RN60D3740F      | .1100                   | .1100                       | Vishay/Dale        | CMF55374R00FHEB    | .5890                 | 10         | Digi-Key               | CMF374HFCT-ND          | .5890  | .5890  |
| 25   | R9, R20, R23                            | Res, Metal Film 1/4W 1% RN60 432 ohm                                      | Ea           | 3            | 3  | Vishay/Dale            | RN60D4320FB14           | .1100     | 1         | Mouser                 | 71-RN60D-F-432     | .3300                   | .3300                       | Vishay/Dale        | CMF55432R00FHEB    | .5890                 | 10         | Digi-Key               | CMF432HFCT-ND          | 1.7670 | 1.7670 |

| ITEM                         | REF DES  | DESCRIPTION  | Unit of Meas | QTY PER VER: |    | Original Part Manufacturer (Pref) |               | Pref. Mfgr. Typical Source |           |        | LINE COST PER VERSION: |          | Original Part Manufacturer (Alt) |                 | Alternate Manufacturer Typical Source |                              |           |          | LINE COST PER VERSION: |        |        |  |  |  |  |  |  |          |          |         |         |
|------------------------------|----------|--|--------------|--------------|----|-----------------------------------|---------------|----------------------------|-----------|--------|------------------------|----------|----------------------------------|-----------------|---------------------------------------|------------------------------|-----------|----------|------------------------|--------|--------|--|--|--|--|--|--|----------|----------|---------|---------|
|                              |          |  |              | -0           | -1 | MFGFR                             | MFGFR P/N     | Unit Cost                  | Purch Qty | Vendor | Vendor P/N             | -0       | -1                               | MFGFR           | MFGFR P/N                             | Unit Cost                    | Purch Qty | Vendor   | Vendor P/N             | -0     | -1     |  |  |  |  |  |  |          |          |         |         |
| 26                           | R11      | Res.Metal Film 1/4W 1% RN60 187 ohm                  | Ea           | 1            | 1  | Vishay/Dale                       | RN60D1870FB14 | .2000                      | 1         | Mouser | 71-RN60D1870F          | .2000    | .2000                            | Vishay/Dale     | CMF55187R00FHEB                       | .5890                        | 10        | Digi-Key | CMF187HFCT-ND          | .5890  | .5890  |  |  |  |  |  |  |          |          |         |         |
| 27                           | R12      | Res.Metal Film 1/4W 1% RN60 215 ohm                  | Ea           | 1            | 1  | Vishay/Dale                       | RN60D2150FB14 | .1100                      | 1         | Mouser | 71-RN60D-F-215         | .1100    | .1100                            | Vishay/Dale     | CMF55215R00FHEB                       | .5890                        | 10        | Digi-Key | CMF215HFCT-ND          | .5890  | .5890  |  |  |  |  |  |  |          |          |         |         |
| 28                           | R13      | Res.Metal Film 1/4W 1% RN60 249 ohm                  | Ea           | 1            | 1  | Vishay/Dale                       | RN60D2490FB14 | .1100                      | 1         | Mouser | 71-RN60D-F-249         | .1100    | .1100                            | Vishay/Dale     | RN60D2490FB14                         | .2723                        | 100       | Digi-Key | 1135-1590-MIL          | .2723  | .2723  |  |  |  |  |  |  |          |          |         |         |
| 29                           | R15      | Res.Metal Film 1/4W 1% RN60 124 ohm                  | Ea           | 1            | 1  | Vishay/Dale                       | RN60D1240FB14 | .1100                      | 1         | Mouser | 71-RN60D-F-124         | .1100    | .1100                            | Vishay/Dale     | CMF55124R00FHEB                       | .5890                        | 10        | Digi-Key | CMF124HFCT-ND          | .5890  | .5890  |  |  |  |  |  |  |          |          |         |         |
| 30                           | R16      | Res.Metal Film 1/4W 1% RN60 22.1 ohm                 | Ea           | 1            | 1  | Vishay/Dale                       | RN60D22R1FB14 | .1100                      | 1         | Mouser | 71-RN60D-F-22.1        | .1100    | .1100                            | Vishay/Dale     | CMF5522R100FKEB                       | .4660                        | 10        | Digi-Key | CMF22.1HGCT-ND         | .4660  | .4660  |  |  |  |  |  |  |          |          |         |         |
| 31                           | R19      | Res.Metal Film 1/4W 1% RN60 30.9K ohm                | Ea           | 1            | 1  | Vishay/Dale                       | RN60D3092FB14 | .2000                      | 1         | Mouser | 71-RN60D-F-30.9K       | .2000    | .2000                            | Vishay/Dale     | CMF5530K900FHEB                       | .5890                        | 10        | Digi-Key | CMF30.9KHFCT-ND        | .5890  | .5890  |  |  |  |  |  |  |          |          |         |         |
| 32                           | R21, R22 | Res.Metal Film 1/4W 1% RN60 27.4 ohm                 | Ea           | 2            | 0  | Vishay/Dale                       | RN60D27R4FB14 | .1100                      | 1         | Mouser | 71-RN60D-F-27.4        | .2200    | .0000                            | Vishay/Dale     | CMF5527R400FHEB                       | .5890                        | 10        | Digi-Key | CMF27.4HFCT-ND         | 1.1780 | .0000  |  |  |  |  |  |  |          |          |         |         |
| 33                           | R21, R22 | Res.Metal Film 1/4W 1% RN60 90.9 ohm                 | Ea           | 0            | 2  | Vishay/Dale                       | RN60D90R9FB14 | .1100                      | 1         | Mouser | 71-RN60D-F-90.9        | .0000    | .2200                            | Vishay/Dale     | CMF5590R900FHEB                       | .5890                        | 10        | Digi-Key | CMF90.9HFCT-ND         | .0000  | 1.1780 |  |  |  |  |  |  |          |          |         |         |
| 34                           | R28      | Trimpot,Multiturn, Top Adj, 3/8" Thru Hole 500 ohms  | Ea           | 1            | 1  | Vishay/Sfernice                   | T93YB501KT20  | 1.4400                     | 1         | Mouser | 72-T93YB-500           | 1.4400   | 1.4400                           | BI Technologies | 67YR500LF                             | 1.4000                       | 1         | Digi-Key | 987-1618-ND            | 1.4000 | 1.4000 |  |  |  |  |  |  |          |          |         |         |
| 35                           | R29      | Trimpot,Multiturn, Top Adj, 3/8" Thru Hole 2000 ohms | Ea           | 1            | 1  | Vishay/Sfernice                   | T93YB202KT20  | 1.5800                     | 1         | Mouser | 72-T93YB-2K            | 1.5800   | 1.5800                           | BI Technologies | 67YR2KLF                              | 1.4000                       | 1         | Digi-Key | 987-1506-ND            | 1.4000 | 1.4000 |  |  |  |  |  |  |          |          |         |         |
| 36                           | TB1      | PWB Design Feature Only. No Physical Part.           | Ea           | 1            | 1  | N/A                               | N/A           | .0000                      | 1         | N/A    | N/A                    | .0000    | .0000                            | N/A             | N/A                                   | .0000                        | 1         | N/A      | N/A                    | .0000  | .0000  |  |  |  |  |  |  |          |          |         |         |
| 37                           | TB2      | PWB Design Feature Only. No Physical Part.           | Ea           | 1            | 1  | N/A                               | N/A           | .0000                      | 1         | N/A    | N/A                    | .0000    | .0000                            | N/A             | N/A                                   | .0000                        | 1         | N/A      | N/A                    | .0000  | .0000  |  |  |  |  |  |  |          |          |         |         |
| 38                           |          |  |              |              |    |                                   |               |                            |           |        |                        |          |                                  |                 |                                       |                              |           |          |                        |        |        |  |  |  |  |  |  |          |          |         |         |
| <b>Component Parts Cost:</b> |          |  |              |              |    |                                   |               |                            |           |        |                        | \$13.511 | \$14.843                         | \$0.000         | \$0.000                               | <b>Component Parts Cost:</b> |           |          |                        |        |        |  |  |  |  |  |  | \$23.203 | \$24.415 | \$0.000 | \$0.000 |