

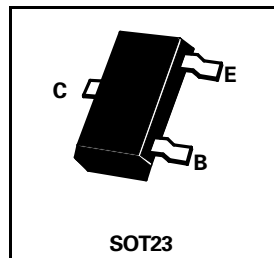
# SOT23 PNP SILICON PLANAR

## GENERAL PURPOSE TRANSISTORS

ISSUE 6 - APRIL 1997

|       |       |
|-------|-------|
| BC856 | BC857 |
| BC858 | BC859 |
| BC860 |       |

| PARTMARKING DETAILS |            | COMPLEMENTARY TYPES |       |
|---------------------|------------|---------------------|-------|
| BC856A-3A           | BC858C-3L  | BC856               | BC846 |
| BC856B-Z3B          | BC859A-Z4A | BC857               | BC847 |
| BC857A-Z3E          | BC859B-4B  | BC858               | BC848 |
| BC857B-3F           | BC859C-Z4C | BC859               | BC849 |
| BC857C-3G           | BC860A-Z4E | BC860               | BC850 |
| BC858A-3J           | BC860B-4F  |                     |       |
| BC858B-3K           | BC860C-4GZ |                     |       |



### ABSOLUTE MAXIMUM RATINGS.

| PARAMETER                                  | SYMBOL         | BC856       | BC857 | BC858 | BC859 | BC860 | UNIT        |
|--------------------------------------------|----------------|-------------|-------|-------|-------|-------|-------------|
| Collector-Base Voltage                     | $V_{CBO}$      | -80         | -50   | -30   | -30   | -50   | V           |
| Collector-Emitter Voltage                  | $V_{CES}$      | -80         | -50   | -30   | -30   | -50   | V           |
| Collector-Emitter Voltage                  | $V_{CEO}$      | -65         | -45   | -30   | -30   | -45   | V           |
| Emitter-Base Voltage                       | $V_{EBO}$      | -5          |       |       |       |       | V           |
| Continuous Collector Current               | $I_C$          | -100        |       |       |       |       | mA          |
| Peak Pulse Current                         | $I_{EM}$       | -200        |       |       |       |       | mA          |
| Base Current                               | $I_{BM}$       | -200        |       |       |       |       | mA          |
| Base Current                               | $I_{EM}$       | -200        |       |       |       |       | mA          |
| Power Dissipation at $T_{amb}=25^{\circ}C$ | $P_{tot}$      | 330         |       |       |       |       | mW          |
| Operating and Storage Temperature Range    | $T_j; T_{stg}$ | -55 to +150 |       |       |       |       | $^{\circ}C$ |

### ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}C$ unless otherwise stated).

| PARAMETER                            | SYMBOL        |      | BC856 | BC857 | BC858 | BC859 | BC860 | UNIT    | CONDITIONS.                               |
|--------------------------------------|---------------|------|-------|-------|-------|-------|-------|---------|-------------------------------------------|
| Collector Cut-Off Current            | $I_{CBO}$     | Max  | -15   |       |       |       |       | nA      | $V_{CB} = -30V$                           |
|                                      |               | Max  | -4    |       |       |       |       | $\mu A$ | $V_{CB} = -30V$<br>$T_{amb}=150^{\circ}C$ |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | Typ  | -75   | -75   | -75   | -75   | -75   | mV      | $I_C=-10mA$ ,<br>$I_B=-0.5mA$             |
|                                      |               | Max. | -300  | -300  | -300  | -250  | -250  | mV      | $I_C=-100mA$ ,<br>$I_B=-5mA$              |
|                                      |               | Typ  | -250  |       |       |       |       | mV      | $I_C=-100mA$ ,<br>$I_B=-5mA$              |
|                                      |               | Max. | -650  |       |       |       |       | mV      | $I_C=-10mA^*$                             |
| Base-Emitter Saturation Voltage      | $V_{BE(sat)}$ | Typ  | -700  |       |       |       |       | mV      | $I_C=-10mA$ ,<br>$I_B=-0.5mA$             |
|                                      |               | Typ  | -850  |       |       |       |       | mV      | $I_C=-100mA$ ,<br>$I_B=-5mA$              |
| Base-Emitter Voltage                 | $V_{BE}$      | Min  | -600  | -600  | -600  | -580  | -580  | mV      | $I_C=-2mA$                                |
|                                      |               | Typ  | -650  | -650  | -650  | -650  | -650  |         | $V_{CE}=-5V$                              |
|                                      |               | Max  | -750  | -750  | -750  | -750  | -750  |         |                                           |
|                                      |               | Max  | -820  |       |       |       |       | mV      | $I_C=-10mA$<br>$V_{CE}=-5V$               |

\* Collector-Emitter Saturation Voltage at  $I_C = 10mA$  for the characteristics going through the operating point  $I_C = 11mA$ ,  $V_{CE} = 1V$  at constant base current.

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| <b>BC856</b> | <b>BC857</b> |
| <b>BC858</b> | <b>BC859</b> |
| <b>BC860</b> |              |

## ELECTRICAL CHARACTERISTICS (Continued)

| PARAMETER                | SYMBOL                                                |            | BC856                                     | BC857             | BC858                    | BC859                | BC860                | UNIT                 | CONDITIONS.                                                                                          |           |                    |                                                                              |                                             |                    |                    |
|--------------------------|-------------------------------------------------------|------------|-------------------------------------------|-------------------|--------------------------|----------------------|----------------------|----------------------|------------------------------------------------------------------------------------------------------|-----------|--------------------|------------------------------------------------------------------------------|---------------------------------------------|--------------------|--------------------|
| Noise Figure             | N                                                     | Typ<br>Max | 2<br>10                                   | 2<br>10           | 2<br>10                  | 1<br>4               | 1<br>4               | dB<br>dB             | $V_{CB} = -5V$ ,<br>$I_C = 200\mu A$ , $R_G = 2k\Omega$ ,<br>$f = 1kHz$ , $\Delta f = 200Hz$         |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       | Typ<br>Max | —<br>—                                    | —<br>—            | —<br>—                   | 1.2<br>4             | 1<br>3               | dB<br>dB             | $V_{CB} = -5V$ ,<br>$I_C = 200\mu A$ , $R_G = 2k\Omega$ ,<br>$f = 30Hz$ to $15kHz$ at<br>-3dB points |           |                    |                                                                              |                                             |                    |                    |
| Equivalent Noise Voltage | $e_n$                                                 | Max        | —                                         | —                 | —                        | 110                  | 110                  | nV                   | $V_{CB} = -5V$ ,<br>$I_C = 200\mu A$ , $R_G = 2k\Omega$ ,<br>$f = 10Hz$ to $50Hz$ at<br>-3dB points  |           |                    |                                                                              |                                             |                    |                    |
| Dynamic Characteristics  | Group VI<br><br>Group A<br><br>Group B<br><br>Group C | $h_{ie}$   | Min<br>Typ<br>Max                         | 0.4<br>1.2<br>2.2 | 0.4<br>1.2<br>2.2        | 0.4<br>1.2<br>2.2    | —<br>—<br>—          | —<br>—<br>—          | k $\Omega$<br>k $\Omega$<br>k $\Omega$                                                               |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            | Min<br>Typ<br>Max                         | 1.6<br>2.7<br>4.5 |                          |                      |                      |                      | k $\Omega$<br>k $\Omega$<br>k $\Omega$                                                               |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            | Min<br>Typ<br>Max                         | 3.2<br>4.5<br>8.5 |                          |                      |                      |                      | k $\Omega$<br>k $\Omega$<br>k $\Omega$                                                               |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            | Min<br>Typ<br>Max                         | —<br>—<br>—       | —<br>—<br>—              | 6<br>8.7<br>15       | 6<br>8.7<br>15       | 6<br>8.7<br>15       | k $\Omega$<br>k $\Omega$<br>k $\Omega$                                                               |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            | Group VI<br>Group A<br>Group B<br>Group C | $h_{re}$          | Typ<br>Typ<br>Typ<br>Typ | 2.5<br>1.5<br>2<br>2 | 2.5<br>1.5<br>2<br>2 | 2.5<br>1.5<br>2<br>3 | —<br>1.5<br>2<br>3                                                                                   |           | —<br>1.5<br>2<br>3 | $\times 10^{-4}$<br>$\times 10^{-4}$<br>$\times 10^{-4}$<br>$\times 10^{-4}$ | $V_{CE} = -5V$<br>$I_C = 2mA$<br>$f = 1kHz$ |                    |                    |
|                          |                                                       |            |                                           |                   | Group A                  | Min<br>Typ<br>Max    | 75<br>110<br>150     | 75<br>110<br>150     | 75<br>110<br>150                                                                                     |           | —<br>—<br>—        | —<br>—<br>—                                                                  |                                             |                    |                    |
|                          |                                                       |            |                                           |                   |                          | Min<br>Typ<br>Max    | 125<br>220<br>260    |                      |                                                                                                      |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            |                                           |                   |                          | Min<br>Typ<br>Max    | 240<br>330<br>500    |                      |                                                                                                      |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            | Group B                                   | Min<br>Typ<br>Max |                          | —<br>—<br>—          |                      |                      |                                                                                                      |           |                    |                                                                              |                                             |                    |                    |
|                          |                                                       |            |                                           | Group C           | Min<br>Typ<br>Max        | —<br>—<br>—          | 450<br>600<br>900    | 450<br>600<br>900    | 450<br>600<br>900                                                                                    |           | 450<br>600<br>900  |                                                                              |                                             |                    |                    |
|                          |                                                       |            |                                           |                   | Group VI                 | $h_{oe}$             | Typ<br>Max           | 20<br>40             | 20<br>40                                                                                             |           | 20<br>40           | —<br>—                                                                       |                                             | —<br>—             | $\mu s$<br>$\mu s$ |
|                          |                                                       |            |                                           |                   |                          |                      | Group A              | Typ<br>Max           | 18<br>30                                                                                             |           |                    |                                                                              |                                             | $\mu s$<br>$\mu s$ |                    |
| Group B                  | Typ<br>Max                                            | 30<br>60   |                                           |                   |                          |                      |                      | $\mu s$<br>$\mu s$   |                                                                                                      |           |                    |                                                                              |                                             |                    |                    |
|                          | Group C                                               | Typ<br>Max | —<br>—                                    | —<br>—            |                          |                      |                      | 60<br>110            | 60<br>110                                                                                            | 60<br>110 | $\mu s$<br>$\mu s$ |                                                                              |                                             |                    |                    |

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## ELECTRICAL CHARACTERISTICS (Continued)

| PARAMETER                          |          | SYMBOL    |     | BC856 | BC857 | BC858                        | BC859 | BC860 | UNIT                               | CONDITIONS.                                 |                                 |  |
|------------------------------------|----------|-----------|-----|-------|-------|------------------------------|-------|-------|------------------------------------|---------------------------------------------|---------------------------------|--|
| Static<br>Forward<br>Current Ratio | Group VI | $h_{FE}$  | Min | 75    | 75    | 75                           | –     | –     |                                    | $I_C = -2mA,$<br>$V_{CE} = -5V$             |                                 |  |
|                                    |          |           | Typ | 110   | 110   | 110                          | –     | –     |                                    |                                             |                                 |  |
|                                    |          |           | Max | 150   | 150   | 150                          | –     | –     |                                    |                                             |                                 |  |
|                                    | Group A  | $h_{FE}$  | Typ | 90    | 90    | 90                           | –     | –     |                                    | $I_C = -0.01mA, V_{CE} = -5V$               |                                 |  |
|                                    |          |           | Min | 125   |       |                              |       |       |                                    |                                             | $I_C = -2mA,$<br>$V_{CE} = -5V$ |  |
|                                    |          |           | Typ | 180   |       |                              |       |       |                                    |                                             |                                 |  |
|                                    | Group B  | $h_{FE}$  | Max | 250   |       |                              |       |       |                                    | $I_C = -100mA, V_{CE} = -5V$                |                                 |  |
|                                    |          |           | Typ | 120   | 120   | 120                          | –     | –     | $I_C = -0.01mA, V_{CE} = -5V$      |                                             |                                 |  |
|                                    |          |           | Min | 150   |       |                              |       |       |                                    | $I_C = -2mA,$<br>$V_{CE} = -5V$             |                                 |  |
|                                    |          |           | Typ | 220   |       |                              |       |       |                                    |                                             |                                 |  |
| Max                                |          |           | 290 |       |       |                              |       |       |                                    |                                             |                                 |  |
| Typ                                | 200      | 200       | 200 | –     | –     | $I_C = -100mA, V_{CE} = -5V$ |       |       |                                    |                                             |                                 |  |
| Group C                            | $h_{FE}$ | Typ.      | –   | 270   | 270   | 270                          | 270   |       | $I_C = -0.01mA,$<br>$V_{CE} = -5V$ |                                             |                                 |  |
|                                    |          | Min       | –   | 420   | 420   | 420                          | 420   |       |                                    | $I_C = -2mA,$<br>$V_{CE} = -5V$             |                                 |  |
|                                    |          | Typ       | –   | 500   | 500   | 500                          | 500   |       |                                    |                                             |                                 |  |
|                                    |          | Max       | –   | 800   | 800   | 800                          | 800   |       |                                    | $I_C = -100mA, V_{CE} = -5V$                |                                 |  |
| Typ                                | –        | –         | 400 | –     | –     |                              |       |       |                                    |                                             |                                 |  |
| Transition Frequency               |          | $f_T$     | Typ | 150   | 150   | 150                          | 300   | 300   | MHz                                | $I_C = -10mA, V_{CE} = -5V$<br>$f = 100MHz$ |                                 |  |
| Collector-Base Capacitance         |          | $C_{obo}$ | Typ | 4.5   |       |                              |       |       |                                    | pF                                          | $V_{CB} = -10V,$<br>$f = 1MHz$  |  |

Spice parameter data is available upon request for these devices