

Under Voltage Sense/Reset Controllers

| Mfr.'s Type   |               | Standard Power Supply Supported (V) | Typical Threshold Voltage (V) | Typical Hysteresis Voltage (V) | Minimum Output Sink Current (mA) | Power Supply Input Voltage Range (V) | Maximum Quiescent Input Current | T <sub>A</sub> (°C) |
|---------------|---------------|-------------------------------------|-------------------------------|--------------------------------|----------------------------------|--------------------------------------|---------------------------------|---------------------|
| Case 29/T0-92 | Case 751/S0-8 |                                     |                               |                                |                                  |                                      |                                 |                     |
| MC34064P-5    | MC34064D-5    | 5.0 ±5%                             | 4.6                           | 0.02                           | 10                               | 1.0 to 10                            | 500 µA @ V <sub>IN</sub> =5.0 V | 0 to +70            |
| MC33064P-5    | MC33064D-5    | 5.0 ±5%                             | 4.6                           | 0.02                           | 10                               | 1.0 to 10                            | 500 µA @ V <sub>IN</sub> =5.0 V | -40 to +85          |
| MC34164P-5    | MC34164D-5    | 5.0 ±10%                            | 4.3                           | 0.09                           | 7                                | 1.0 to 12                            | 20 µA @ V <sub>IN</sub> =5.0 V  | 0 to +70            |
| MC33164P-5    | MC33164D-5    | 5.0 ±10%                            | 4.3                           | 0.09                           | 7                                | 1.0 to 12                            | 20 µA @ V <sub>IN</sub> =5.0 V  | -40 to +85          |

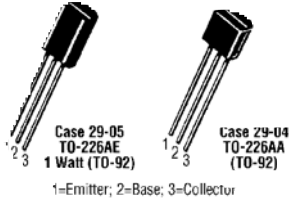
Precision Low Voltage References

| Mfr.'s Type   |               |             |             | V <sub>out</sub> (V) Typ. | I <sub>O</sub> (mA) Max. | V <sub>out</sub> /T (ppm/°C) Max. | Regline (mV) Max. | Regload (mV) Max. | Temperature Range (°C) |
|---------------|---------------|-------------|-------------|---------------------------|--------------------------|-----------------------------------|-------------------|-------------------|------------------------|
| Case 29/T0-92 | Case 751/S0-8 | 8 Lead PDIP | 8 Lead SOIC |                           |                          |                                   |                   |                   |                        |
| LM385BZ-1.2   | —             | —           | —           | 1.235 ±12 mV              | 20                       | 80 Typ.                           | Note 1            | 1*                | 0 to +70               |
| LM285Z-1.2    | —             | —           | —           | 1.235 ±25 mV              | 20                       | 80 Typ.                           | Note 1            | 1*                | -40 to +85             |
| LM385BZ-2.5   | —             | —           | —           | 2.500 ±38 mV              | 20                       | 80 Typ.                           | Note 1            | 2*                | 0 to +70               |
| LM285Z-2.5    | —             | —           | —           | 2.500 ±75 mV              | 20                       | 80 Typ.                           | Note 1            | 2*                | -40 to +85             |
| —             | MC1403D       | —           | —           | 2.500 ±25 mV              | 10                       | 40                                | Note 2            | 10**              | 0 to +70               |
| TL431CLP      | —             | —           | —           | 2.500 to 37               | 100                      | 50 Typ.                           | Note 3            | Note 3            | 0 to +70               |
| TL431ACL      | —             | —           | —           | 2.500 to 37               | 100                      | 50 Typ.                           | Note 3            | Note 3            | 0 to +70               |
| TL431ILP      | —             | TL431IP     | TL431ID     | 2.500 to 37               | 100                      | 50 Typ.                           | Note 3            | Note 3            | 0 to +70               |
| TL431AILP     | —             | —           | —           | 2.550 to 37               | 100                      | 50 Typ.                           | Note 3            | Note 3            | 0 to +70               |

Note 1: Micropower Reference Diode Dynamic Impedance (z) < 1.0 Ohm at I<sub>R</sub> = 100 µA. Note 2: 4.5 V < V<sub>IN</sub> < 15 V / 15 V < V<sub>IN</sub> < 40 V. Note 3: Shunt Reference Dynamic Impedance (z) < 0.5 Ohm. \*10 µA < I<sub>R</sub> < 1.0mA. \*\*20 µA < I<sub>R</sub> < 1.0 mA. \*\*\*0 mA < I<sub>L</sub> < 10 mA.

Bipolar Transistors

Plastic-Encapsulated Transistors



ON Semiconductor's Small Signal TO-226 plastic transistors encompass hundreds of devices with a wide variety of characteristics for general-purpose, amplifier and switching applications. The popular high-volume package combines proven reliability, performance, economy and convenience to provide the perfect solution for industrial and consumer

Plastic-Encapsulated General-Purpose Transistors (Case 29-04 — TO-226AA (TO-92))

These general-purpose transistors are designed for small-signal amplification from dc to low ratio frequencies. They are also useful as oscillators and general-purpose switches. Complementary devices shown where available.

| Mfr.'s Type |          | V <sub>BR(CEO)</sub> (V) Min. | f <sub>r</sub> @ I <sub>c</sub> |      | I <sub>c</sub> (mA) Max. | h <sub>FE</sub> @ I <sub>c</sub> |      |       | NF dB Max. | Style |
|-------------|----------|-------------------------------|---------------------------------|------|--------------------------|----------------------------------|------|-------|------------|-------|
| NPN         | PNP      |                               | (MHz) Min.                      | (mA) |                          | Min.                             | Max. | (mA)  |            |       |
| MPS8099     | —        | 80                            | 150                             | 10   | 500                      | 100                              | 300  | 1.0   | —          | 1     |
| MPSA06      | MPSA56   | 80                            | 100                             | 10   | 500                      | 100                              | —    | 100.0 | —          | 1     |
| —           | MPS2907A | 60                            | 200                             | 50   | 600                      | 100                              | 300  | 150.0 | —          | 1     |
| MPS2222A    | —        | 40                            | 300                             | 20   | 600                      | 100                              | 300  | 150.0 | —          | 1     |
| 2N4401      | 2N4403   | 40                            | 200                             | 20   | 600                      | 100                              | 300  | 150.0 | —          | 1     |
| MPS6602     | MPS6652  | 40                            | 100                             | 50   | 1000                     | 50                               | —    | 500.0 | —          | 1     |
| 2N3904      | 2N3906   | 40                            | 250                             | 10   | 200                      | 100                              | 300  | 10.0  | 5.0        | 1     |
| MPSA05      | MPSA55   | 60                            | 100                             | 10   | 500                      | 100                              | —    | 10.0  | —          | 1     |
| MPSA20      | —        | 40                            | 125                             | 50   | 100                      | 40                               | 400  | 5.0   | —          | 1     |

Plastic-Encapsulated General Purpose Transistors (Case 29-05 — TO-226AE (1-Watt TO-92))

| Mfr.'s Type | V <sub>BR(CEO)</sub> (V) Min. | f <sub>r</sub> @ I <sub>c</sub> |      | I <sub>c</sub> (A) Max. | h <sub>FE</sub> @ I <sub>c</sub> |      |      | V <sub>CE(sat)</sub> @ I <sub>c</sub> and I <sub>s</sub> |      |      | Style |
|-------------|-------------------------------|---------------------------------|------|-------------------------|----------------------------------|------|------|----------------------------------------------------------|------|------|-------|
|             |                               | (MHz) Min.                      | (mA) |                         | Min.                             | Max. | (mA) | (V) Max.                                                 | (mA) | (mA) |       |
| MPSW06      | 80                            | 50                              | 200  | 0.5                     | 80                               | —    | 50   | 0.4                                                      | 250  | 10   | 1     |

Plastic-Encapsulated Low-Noise and Good h<sub>FE</sub> Linearity (Case 29-04 — TO-226AA (TO-92))

These devices are designed to use on applications where good h<sub>FE</sub> linearity and low-noise characteristics are required: Instrumentation, hi-fi preamplifier.

| Mfr.'s Type |        | V <sub>BR(CEO)</sub> (V) | h <sub>FE</sub> @ I <sub>c</sub> |      |      | V <sub>i</sub> <sup>†</sup> (mV) Typ. | NF <sup>‡</sup> dB Max. | f <sub>r</sub> (MHz) Typ. | Style |
|-------------|--------|--------------------------|----------------------------------|------|------|---------------------------------------|-------------------------|---------------------------|-------|
| NPN         | PNP    |                          | Min.                             | Max. | (mA) |                                       |                         |                           |       |
| —           | 2N5087 | 50                       | 250                              | 800  | 0.1  | —                                     | 2.0                     | 40 <sup>‡</sup>           | 1     |
| MPSA18      | —      | 45                       | 500                              | —    | 1.0  | 6.5 <sup>†</sup>                      | —                       | 160                       | 1     |

<sup>†</sup>Typical. <sup>‡</sup>Min.

Plastic-Encapsulated Darlington Transistors (Case 29-05 — TO-226AE (1-Watt TO-92))

Darlington amplifiers are cascade transistors used in applications requiring very high-gain and input impedance. These devices have monolithic construction.

| Mfr.'s Type |     | V <sub>BR(CEO)</sub> (V) | f <sub>r</sub> @ I <sub>c</sub> |      | I <sub>c</sub> Max. | h <sub>FE</sub> @ I <sub>c</sub> |       |      | V <sub>CE(sat)</sub> @ I <sub>c</sub> and I <sub>s</sub> |      |      | Style |
|-------------|-----|--------------------------|---------------------------------|------|---------------------|----------------------------------|-------|------|----------------------------------------------------------|------|------|-------|
| NPN         | PNP |                          | (MHz) Min.                      | (mA) |                     | Min.                             | Max.  | (mA) | (V) Max.                                                 | (mA) | (mA) |       |
| MPSW45A     | —   | 50                       | 100                             | 200  | 1000                | 25 K                             | 150 K | 200  | 1.5                                                      | 1000 | 2.0  | 1     |

design problems. All devices are laser marked for ease of identification and shipped in antistatic containers, as part of ON Semiconductor's ongoing practice of maintaining the highest standards of quality and reliability.

Plastic-Encapsulated Darlington Transistors (Case 29-04 — TO-226AA (TO-92))

| Mfr.'s Type |        | V <sub>BR(CEO)</sub> (V) | f <sub>r</sub> @ I <sub>c</sub> |      | I <sub>c</sub> Max. | h <sub>FE</sub> @ I <sub>c</sub> |      |      | V <sub>CE(sat)</sub> @ I <sub>c</sub> and I <sub>s</sub> |      |      | Style |
|-------------|--------|--------------------------|---------------------------------|------|---------------------|----------------------------------|------|------|----------------------------------------------------------|------|------|-------|
| NPN         | PNP    |                          | (MHz) Min.                      | (mA) |                     | Min.                             | Max. | (mA) | (V) Max.                                                 | (mA) | (mA) |       |
| MPSA29      | —      | 100                      | 125                             | 10   | 500                 | 10 K                             | —    | 100  | 1.5                                                      | 100  | 0.1  | 1     |
| MPSA14      | MPSA64 | 30                       | 125                             | 10   | 500                 | 20 K                             | —    | 100  | 1.5                                                      | 100  | 0.1  | 1     |
| MPSA27      | —      | 60                       | 200                             | 10   | 500                 | 10 K                             | —    | 100  | 1.5                                                      | 100  | 0.1  | 1     |
| MPSA13      | MPSA77 | 60                       | 200                             | 10   | 500                 | 10 K                             | —    | 100  | 1.5                                                      | 100  | 0.1  | 1     |
| —           | —      | 30                       | 125                             | 10   | 500                 | 20 K                             | —    | 100  | 1.5                                                      | 100  | 0.1  | 1     |

Plastic-Encapsulated High-Current Transistors (Case 29-05 — TO-226AE (1-Watt TO-92))

The following table is a listing of devices that are capable of handling a higher current range for small-signal transistors.

| Mfr.'s Type |         | V <sub>BR(CEO)</sub> (V) Min. | f <sub>r</sub> @ I <sub>c</sub> |      | I <sub>c</sub> (mA) Max. | h <sub>FE</sub> @ I <sub>c</sub> |      |      | V <sub>CE(sat)</sub> @ I <sub>c</sub> and I <sub>s</sub> |      |      | Style |
|-------------|---------|-------------------------------|---------------------------------|------|--------------------------|----------------------------------|------|------|----------------------------------------------------------|------|------|-------|
| NPN         | PNP     |                               | (MHz) Min.                      | (mA) |                          | Min.                             | Max. | (mA) | (V) Max.                                                 | (mA) | (mA) |       |
| MPSW01A     | MPSW51A | 40                            | 50                              | 50   | 1000                     | 50                               | —    | 1000 | 0.5/0.7                                                  | 1000 | 100  | 1     |

Plastic-Encapsulated High-Current Transistors (Case 29-04 — TO-226AA (TO-92))

|        |        |    |    |    |      |    |   |      |     |      |     |   |
|--------|--------|----|----|----|------|----|---|------|-----|------|-----|---|
| MPS651 | MPS751 | 60 | 75 | 50 | 2000 | 75 | — | 1000 | 0.5 | 2000 | 200 | 1 |
|--------|--------|----|----|----|------|----|---|------|-----|------|-----|---|

Plastic-Encapsulated High-Voltage Amplifier Transistors (Case 29-05 — TO-226AE (1-watt TO-92) — PNP)

These high-voltage transistors are designed for driving neon bulbs and indicator tubes, for direct line operation, and for other applications requiring high-voltage capability at relatively low collector current. These devices are listed in order of decreasing breakdown voltage (V<sub>BR(CEO)</sub>).

| Mfr.'s Type | V <sub>BR(CEO)</sub> (V) Min. | I <sub>c</sub> (A) Max. | h <sub>FE</sub> @ I <sub>c</sub> |      | V <sub>CE(sat)</sub> @ I <sub>c</sub> and I <sub>s</sub> |      |      | f <sub>r</sub> @ I <sub>c</sub> |      | Style |
|-------------|-------------------------------|-------------------------|----------------------------------|------|----------------------------------------------------------|------|------|---------------------------------|------|-------|
|             |                               |                         | Min.                             | (mA) | (V) Max.                                                 | (mA) | (mA) | (MHz) Min.                      | (mA) |       |
| MPSW92      | 300                           | 0.5                     | 25                               | 30   | 0.50                                                     | 20   | 2.0  | 50                              | 10   | 1     |

Plastic-Encapsulated High-Voltage Amplifier Transistors (Case 29-04 — TO-226AA (TO-92) — NPN)

| Mfr.'s Type | V <sub>BR(CEO)</sub> (V) Min. | I <sub>c</sub> (A) Max. | h <sub>FE</sub> @ I <sub>c</sub> |      | V <sub>CE(sat)</sub> @ I <sub>c</sub> and I <sub>s</sub> |      |      | f <sub>r</sub> @ I <sub>c</sub> |      | Style |
|-------------|-------------------------------|-------------------------|----------------------------------|------|----------------------------------------------------------|------|------|---------------------------------|------|-------|
|             |                               |                         | Min.                             | (mA) | (V) Max.                                                 | (mA) | (mA) | (MHz) Min.                      | (mA) |       |
| MPSA44      | 400                           | 0.3                     | 40                               | 100  | 0.75                                                     | 50   | 5.0  | —                               | —    | 1     |
| 2N6517      | 350                           | 0.5                     | 30                               | 30   | 0.30                                                     | 10   | 1.0  | 40                              | 10   | 1     |
| MPSA42      | 300                           | 0.5                     | 40                               | 10   | 0.50                                                     | 20   | 2.0  | 50                              | 10   | 1     |
| 2N5551      | 160                           | 0.6                     | 80                               | 10   | 0.15                                                     | 10   | 1.0  | 100                             | 10   | 1     |