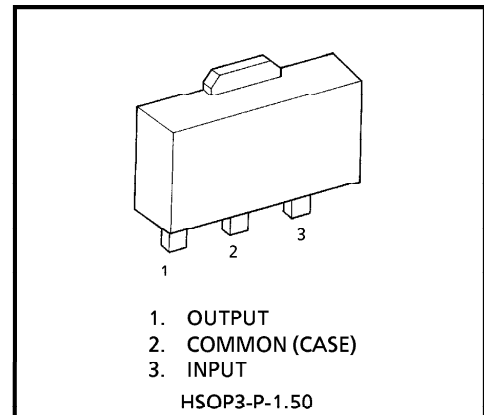


TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC  
**TA78L05F, TA78L06F, TA78L08F, TA78L09F, TA78L10F**  
**TA78L12F, TA78L15F, TA78L18F, TA78L20F, TA78L24F**

**5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 20V, 24V**  
**3-TERMINAL POSITIVE VOLTAGE REGULATORS**

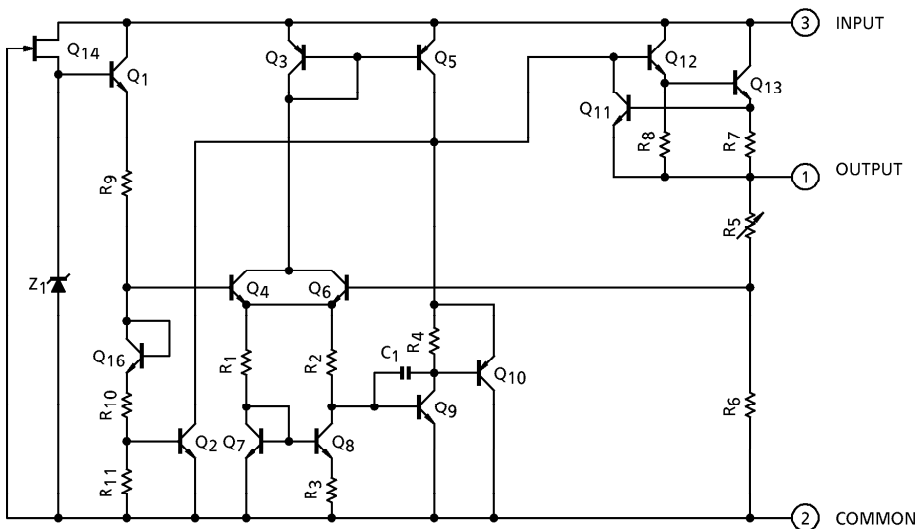
**FEATURES**

- Best suited to power supply for TTL / CMOS
- No external part needed
- Built-in thermal protective circuit
- Built-in short-circuit current limiting
- Max. output current 150mA. ( $T_j = 25^\circ\text{C}$ )
- Packaged in POWER MINI. (SOT-89)



Weight : 0.05g (Typ.)

**EQUIVALENT CIRCUIT**



| TYPE     | MARKING |
|----------|---------|
| TA78L05F | AE      |
| TA78L06F | BE      |
| TA78L08F | CE      |
| TA78L09F | DE      |
| TA78L10F | EE      |
| TA78L12F | FE      |
| TA78L15F | GE      |
| TA78L18F | HE      |
| TA78L20F | IE      |
| TA78L24F | JE      |

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**MAXIMUM RATINGS (Ta = 25°C)**

| CHARACTERISTIC                 |             | SYMBOL               | RATING   | UNIT |
|--------------------------------|-------------|----------------------|----------|------|
| Input Voltage                  | TA78L05F    | V <sub>IN</sub>      | 35       | V    |
|                                | TA78L06F    |                      |          |      |
|                                | TA78L08F    |                      |          |      |
|                                | TA78L09F    |                      |          |      |
|                                | TA78L10F    |                      |          |      |
|                                | TA78L12F    |                      |          |      |
|                                | TA78L15F    |                      |          |      |
|                                | TA78L18F    |                      | 40       |      |
|                                | TA78L20F    |                      |          |      |
|                                | TA78L24F    |                      |          |      |
| Power Dissipation              | (Ta = 25°C) | P <sub>D</sub>       | 500      | mW   |
| Operating Temperature          |             | T <sub>opr</sub>     | - 30~75  | °C   |
| Storage Temperature            |             | T <sub>stg</sub>     | - 55~150 | °C   |
| Operating Junction Temperature |             | T <sub>j</sub>       | - 30~150 | °C   |
| Thermal Resistance             |             | R <sub>th(j-a)</sub> | 250      | °C/W |

TA78L05F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 10V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                   | MIN.                            | TYP. | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|------------------------------------------------------------------|---------------------------------|------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                              | 4.75                            | 5.0  | 5.25 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                              | $7.0V \leq V_{IN} \leq 20V$     | —    | 55   | 150              | mV |
|                                                   |                             |               |                                                                  | $8.0V \leq V_{IN} \leq 20V$     | —    | 45   | 100              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                              | $1.0mA \leq I_{OUT} \leq 100mA$ | —    | 11   | 60               | mV |
|                                                   |                             |               |                                                                  | $1.0mA \leq I_{OUT} \leq 40mA$  | —    | 5.0  | 30               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                              | $7.0V \leq V_{IN} \leq 20V$     | 4.65 | —    | 5.35             | V  |
|                                                   |                             |               |                                                                  | $1.0mA \leq I_{OUT} \leq 40mA$  | 4.65 | —    | 5.35             |    |
|                                                   |                             |               |                                                                  | $1.0mA \leq I_{OUT} \leq 70mA$  | 4.65 | —    | 5.35             |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                              | —                               | 3.1  | 6.0  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                             | —                               | —    | 5.5  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $8.0V \leq V_{IN} \leq 20V$                                      | —                               | —    | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                   | —                               | —    | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$ , $10Hz \leq f \leq 100kHz$                  | —                               | 40   | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                                | —                               | 12   | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$8.0V \leq V_{IN} \leq 18V$ , $T_j = 25^{\circ}C$ | 41                              | 49   | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                          | —                               | 1.7  | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                  | —                               | -0.6 | —    | mV / $^{\circ}C$ |    |

TA78L06F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 11V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                   | MIN.                            | TYP. | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|------------------------------------------------------------------|---------------------------------|------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                              | 5.7                             | 6.0  | 6.3  | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                              | $8.1V \leq V_{IN} \leq 21V$     | —    | 50   | 150              | mV |
|                                                   |                             |               |                                                                  | $9.0V \leq V_{IN} \leq 21V$     | —    | 45   | 110              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                              | $1.0mA \leq I_{OUT} \leq 100mA$ | —    | 12   | 70               | mV |
|                                                   |                             |               |                                                                  | $1.0mA \leq I_{OUT} \leq 40mA$  | —    | 5.5  | 35               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                              | $8.1V \leq V_{IN} \leq 21V$     | 5.58 | —    | 6.42             | V  |
|                                                   |                             |               |                                                                  | $1.0mA \leq I_{OUT} \leq 40mA$  | 5.58 | —    | 6.42             |    |
|                                                   |                             |               |                                                                  | $1.0mA \leq I_{OUT} \leq 70mA$  | 5.58 | —    | 6.42             |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                              | —                               | 3.1  | 6.0  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                             | —                               | —    | 5.5  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $9.0V \leq V_{IN} \leq 20V$                                      | —                               | —    | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                   | —                               | —    | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                 | —                               | 40   | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                                | —                               | 14   | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$9.0V \leq V_{IN} \leq 19V$ , $T_j = 25^{\circ}C$ | 39                              | 47   | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                          | —                               | 1.7  | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                  | —                               | -0.7 | —    | mV / $^{\circ}C$ |    |

TA78L08F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 14V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP. | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 7.6                             | 8.0  | 8.4  | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $10.5V \leq V_{IN} \leq 23V$    | —    | 20   | 175              | mV |
|                                                   |                             |               |                                                                 | $11V \leq V_{IN} \leq 23V$      | —    | 12   | 125              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —    | 15   | 80               | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —    | 7.0  | 40               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $10.5V \leq V_{IN} \leq 23V$    | 7.44 | —    | 8.56             | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | 7.44 | —    | 8.56             |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 7.44 | —    | 8.56             |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.1  | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —    | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $11V \leq V_{IN} \leq 23V$                                      | —                               | —    | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —    | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 60   | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 20   | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$12V \leq V_{IN} \leq 23V$ , $T_j = 25^{\circ}C$ | 37                              | 45   | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7  | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -0.8 | —    | mV / $^{\circ}C$ |    |

TA78L09F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 15V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP.  | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|-------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 8.55                            | 9.0   | 9.45 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $11.4V \leq V_{IN} \leq 24V$    | —     | 80   | 200              | mV |
|                                                   |                             |               |                                                                 | $12V \leq V_{IN} \leq 24V$      | —     | 20   | 160              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —     | 17   | 90               | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —     | 8.0  | 45               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $11.4V \leq V_{IN} \leq 24V$    | 8.37  | —    | 9.63             | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | 8.37  | —    | 9.63             |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 8.37  | —    | 9.63             |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.2   | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —     | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $12V \leq V_{IN} \leq 24V$                                      | —                               | —     | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —     | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 65    | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 21    | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$12V \leq V_{IN} \leq 24V$ , $T_j = 25^{\circ}C$ | 36                              | 44    | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7   | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -0.85 | —    | mV / $^{\circ}C$ |    |

TA78L10F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 16V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP. | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 9.5                             | 10   | 10.5 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $12.5V \leq V_{IN} \leq 25V$    | —    | 80   | 230              | mV |
|                                                   |                             |               |                                                                 | $13V \leq V_{IN} \leq 25V$      | —    | 30   | 170              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —    | 18   | 90               | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —    | 8.5  | 45               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $12.5V \leq V_{IN} \leq 25V$    | 9.3  | —    | 10.7             | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | 9.3  | —    | 10.7             |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 9.3  | —    | 10.7             |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.2  | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —    | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $13V \leq V_{IN} \leq 25V$                                      | —                               | —    | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —    | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 70   | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 22   | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$13V \leq V_{IN} \leq 24V$ , $T_j = 25^{\circ}C$ | 36                              | 43   | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7  | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -0.9 | —    | mV / $^{\circ}C$ |    |

TA78L12F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 19V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP.  | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|-------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 11.4                            | 12    | 12.6 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $14.5V \leq V_{IN} \leq 27V$    | —     | 120  | 250              | mV |
|                                                   |                             |               |                                                                 | $16V \leq V_{IN} \leq 27V$      | —     | 100  | 200              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —     | 20   | 100              | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —     | 10   | 50               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $14.5V \leq V_{IN} \leq 27V$    | 11.16 | —    | 12.84            | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | 11.16 | —    | 12.84            |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 11.16 | —    | 12.84            |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.2   | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —     | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $16V \leq V_{IN} \leq 27V$                                      | —                               | —     | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —     | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 80    | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 24    | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$15V \leq V_{IN} \leq 25V$ , $T_j = 25^{\circ}C$ | 36                              | 41    | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7   | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -1.0  | —    | mV / $^{\circ}C$ |    |



TA78L15F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 23V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^\circ C \leq T_j \leq 125^\circ C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                     | MIN.                            | TYP.  | MAX.  | UNIT          |    |
|---------------------------------------------------|-----------------------------|---------------|--------------------------------------------------------------------|---------------------------------|-------|-------|---------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^\circ C$                                                 | 14.25                           | 15    | 15.75 | V             |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^\circ C$                                                 | $17.5V \leq V_{IN} \leq 30V$    | —     | 130   | 300           | mV |
|                                                   |                             |               |                                                                    | $20V \leq V_{IN} \leq 30V$      | —     | 110   | 250           |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^\circ C$                                                 | $1.0mA \leq I_{OUT} \leq 100mA$ | —     | 25    | 150           | mV |
|                                                   |                             |               |                                                                    | $1.0mA \leq I_{OUT} \leq 40mA$  | —     | 12    | 75            |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^\circ C$                                                 | $17.5V \leq V_{IN} \leq 30V$    | 13.95 | —     | 16.05         | V  |
|                                                   |                             |               |                                                                    | $1.0mA \leq I_{OUT} \leq 40mA$  | 13.95 | —     | 16.05         |    |
|                                                   |                             |               |                                                                    | $1.0mA \leq I_{OUT} \leq 70mA$  | 13.95 | —     | 16.05         |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^\circ C$                                                 | —                               | 3.3   | 6.5   | mA            |    |
|                                                   |                             |               | $T_j = 125^\circ C$                                                | —                               | —     | 6.0   |               |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $20V \leq V_{IN} \leq 30V$                                         | —                               | —     | 1.5   | mA            |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                     | —                               | —     | 0.1   |               |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^\circ C$<br>$10Hz \leq f \leq 100kHz$                    | —                               | 90    | —     | $\mu V_{rms}$ |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                                  | —                               | 30    | —     | mV / 1.0kh    |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$18.5V \leq V_{IN} \leq 28.5V$ , $T_j = 25^\circ C$ | 34                              | 40    | —     | dB            |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^\circ C$ , $I_{OUT} = 150mA$                             | —                               | 1.7   | —     | V             |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                    | —                               | -1.3  | —     | mV / °C       |    |

TA78L18F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 27V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP.  | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|-------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 17.1                            | 18    | 18.9 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $21.4V \leq V_{IN} \leq 33V$    | —     | 32   | 325              | mV |
|                                                   |                             |               |                                                                 | $22V \leq V_{IN} \leq 33V$      | —     | 27   | 275              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —     | 30   | 170              | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —     | 15   | 75               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $21.4V \leq V_{IN} \leq 33V$    | 16.74 | —    | 19.26            | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | 16.74 | —    | 19.26            |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 16.74 | —    | 19.26            |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.3   | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —     | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $22V \leq V_{IN} \leq 33V$                                      | —                               | —     | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —     | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 150   | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 45    | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$23V \leq V_{IN} \leq 33V$ , $T_j = 25^{\circ}C$ | 32                              | 38    | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7   | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -1.5  | —    | mV / $^{\circ}C$ |    |

TA78L20F

**ELECTRICAL CHARACTERISTICS**

(Unless otherwise specified,  $V_{IN} = 29V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP. | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 19.0                            | 20   | 21.0 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $23.5V \leq V_{IN} \leq 35V$    | —    | 33   | 330              | mV |
|                                                   |                             |               |                                                                 | $24V \leq V_{IN} \leq 35V$      | —    | 28   | 285              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —    | 33   | 180              | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —    | 17   | 90               |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $23.5V \leq V_{IN} \leq 35V$    | 18.6 | —    | 21.4             | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | 18.6 | —    | 21.4             |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 18.6 | —    | 21.4             |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.3  | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —    | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $24V \leq V_{IN} \leq 35V$                                      | —                               | —    | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —    | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 170  | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 49   | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$25V \leq V_{IN} \leq 35V$ , $T_j = 25^{\circ}C$ | 31                              | 37   | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7  | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -1.7 | —    | mV / $^{\circ}C$ |    |

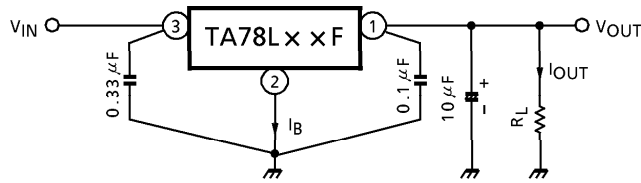
TA78L24F

**ELECTRICAL CHARACTERISTICS**

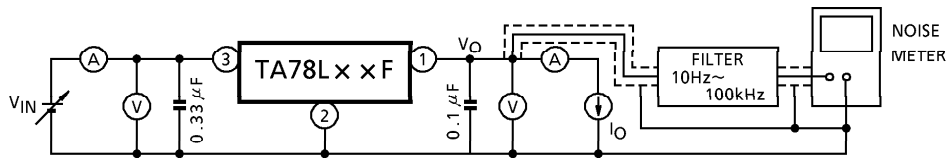
(Unless otherwise specified,  $V_{IN} = 33V$ ,  $I_{OUT} = 40mA$ ,  $C_{IN} = 0.33\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

| CHARACTERISTIC                                    | SYMBOL                      | TEST CIR-CUIT | TEST CONDITION                                                  | MIN.                            | TYP.  | MAX. | UNIT             |    |
|---------------------------------------------------|-----------------------------|---------------|-----------------------------------------------------------------|---------------------------------|-------|------|------------------|----|
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | 22.8                            | 24    | 25.2 | V                |    |
| Line Regulation                                   | Reg.line                    | 1             | $T_j = 25^{\circ}C$                                             | $27.5V \leq V_{IN} \leq 38V$    | —     | 35   | 350              | mV |
|                                                   |                             |               |                                                                 | $28V \leq V_{IN} \leq 38V$      | —     | 30   | 300              |    |
| Load Regulation                                   | Reg.load                    | 1             | $T_j = 25^{\circ}C$                                             | $1.0mA \leq I_{OUT} \leq 100mA$ | —     | 40   | 200              | mV |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —     | 20   | 100              |    |
| Output Voltage                                    | $V_{OUT}$                   | 1             | $T_j = 25^{\circ}C$                                             | $27.5V \leq V_{IN} \leq 38V$    | 22.32 | —    | 25.68            | V  |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 40mA$  | —     | —    | —                |    |
|                                                   |                             |               |                                                                 | $1.0mA \leq I_{OUT} \leq 70mA$  | 22.32 | —    | 25.68            |    |
| Quiescent Current                                 | $I_B$                       | 1             | $T_j = 25^{\circ}C$                                             | —                               | 3.5   | 6.5  | mA               |    |
|                                                   |                             |               | $T_j = 125^{\circ}C$                                            | —                               | —     | 6.0  |                  |    |
| Quiescent Current Change                          | $\Delta I_B$                | 1             | $28V \leq V_{IN} \leq 38V$                                      | —                               | —     | 1.5  | mA               |    |
|                                                   |                             |               | $1.0mA \leq I_{OUT} \leq 40mA$                                  | —                               | —     | 0.1  |                  |    |
| Output Noise Voltage                              | $V_{NO}$                    | 2             | $T_a = 25^{\circ}C$<br>$10Hz \leq f \leq 100kHz$                | —                               | 200   | —    | $\mu V_{rms}$    |    |
| Long Term Stability                               | $\Delta V_{OUT} / \Delta t$ | 1             | —                                                               | —                               | 56    | —    | mV / 1.0kh       |    |
| Ripple Rejection Ratio                            | R.R.                        | 3             | $f = 120Hz$<br>$29V \leq V_{IN} \leq 39V$ , $T_j = 25^{\circ}C$ | 31                              | 35    | —    | dB               |    |
| Dropout Voltage                                   | $ V_{IN} - V_{OUT} $        | 1             | $T_j = 25^{\circ}C$ , $I_{OUT} = 150mA$                         | —                               | 1.7   | —    | V                |    |
| Average Temperature Coefficient of Output Voltage | $T_{CVO}$                   | 1             | $I_{OUT} = 5mA$                                                 | —                               | -2.0  | —    | mV / $^{\circ}C$ |    |

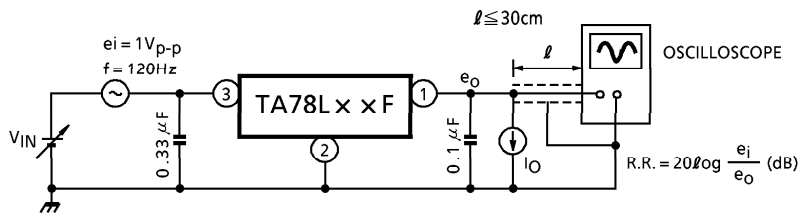
**TEST CIRCUIT 1 / STANDARD APPLICATION**

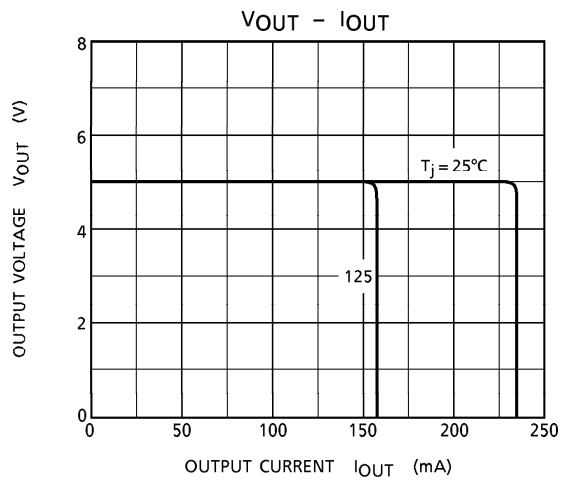
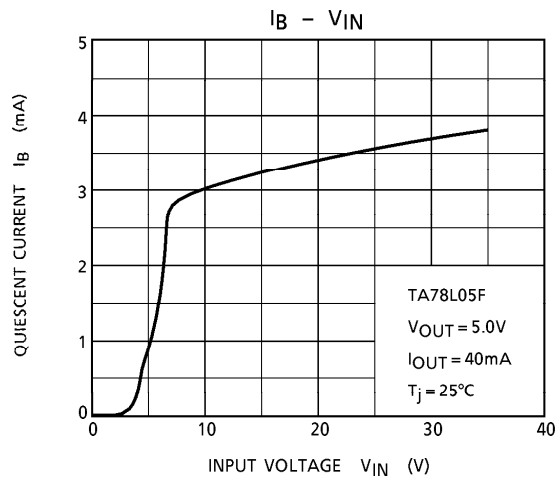
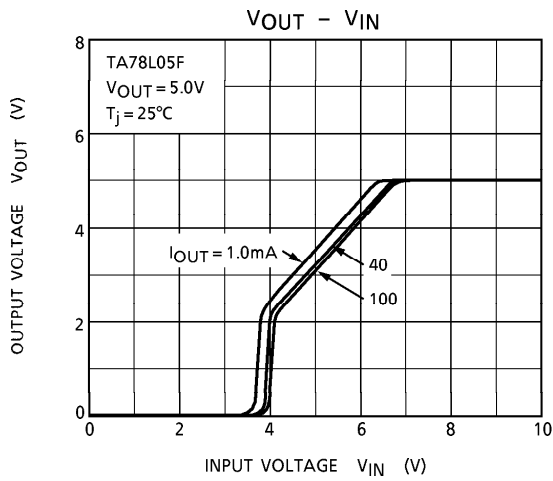
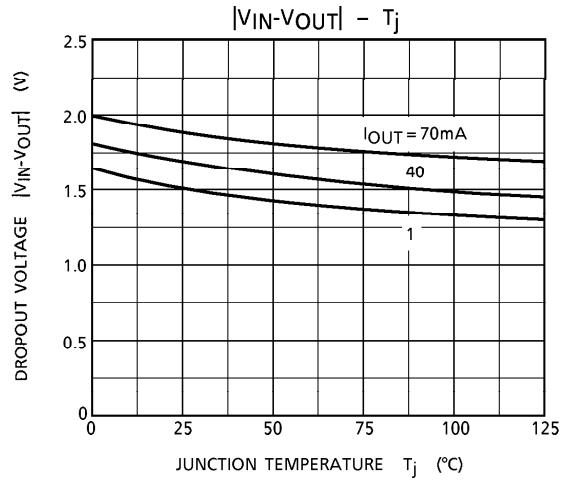
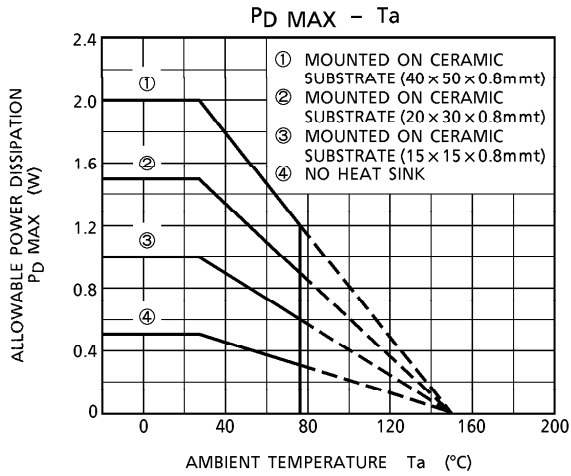


**TEST CIRCUIT 2  $V_{NO}$**



**TEST CIRCUIT 3 R.R.**



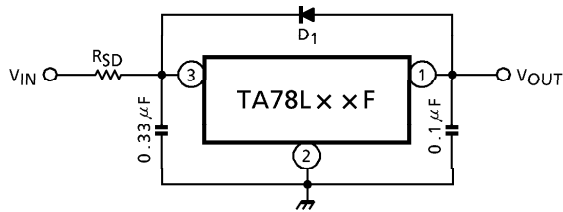


**Precautions for Use**

If high voltage in excess of output voltage (TYP. value) of IC is applied to its output terminal, IC may be destroyed. In this case, connect a Zener diode between the output terminal and GND to prevent application of excessive voltage. In particular, in such a current boosting circuit as shown in Application Circuit Example (2), if input voltage is suddenly applied by stages and furthermore, load is light, excessive voltage may be applied transiently to the output terminal of IC. In such a case as this, it may become necessary to increase capacity of output capacitor as appropriate, use a smaller R<sub>1</sub> (a resistor for bypassing IC bias current) or gradually rise input voltage in addition to use of a Zener diode as mentioned above.

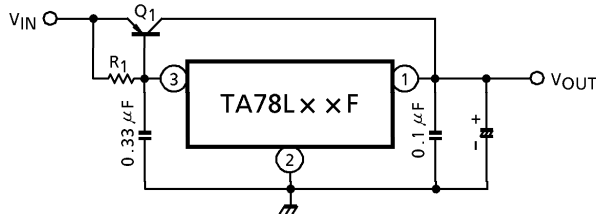
**APPLICATION CIRCUIT**

(1) STANDARD APPLICATION



D<sub>1</sub> : IC protective diode  
 When surge voltage is applied to IC output terminal or V<sub>IN</sub> < V<sub>OUT</sub> at the time of power ON/OFF, always connect the high speed switching diode D<sub>1</sub>.  
 R<sub>SD</sub> : Power limiting resistor  
 If V<sub>IN</sub> is too high, always connect R<sub>SD</sub> in order to reduce power consumption of IC.

(2) A. CURRENT BOOST VOLTAGE REGULATOR

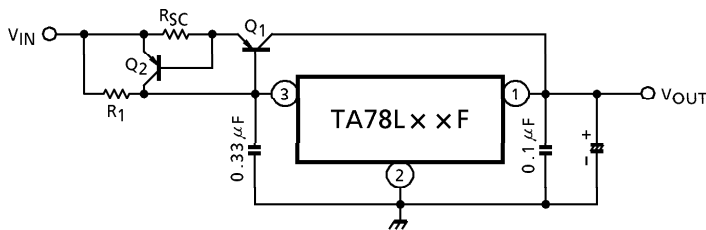


Use a required radiation plate for Q<sub>1</sub>.

$$R_1 \leq \frac{V_{BE1}}{I_B \text{ MAX}}$$

where, V<sub>BE1</sub> : V<sub>BE</sub> of external transistor Q<sub>1</sub>.  
 I<sub>B</sub> MAX : Max. bias current of IC.

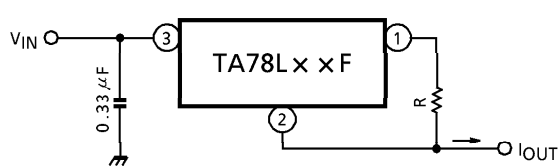
B. SHORT-CIRCUIT PROTECTION



$$R_{SC} = \frac{V_{BE2}}{I_{SC}}$$

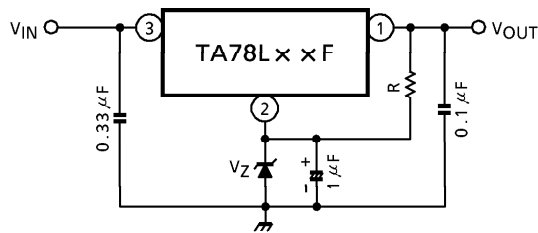
where, I<sub>SC</sub> : Short-Circuit current

(3) CURRENT REGULATOR

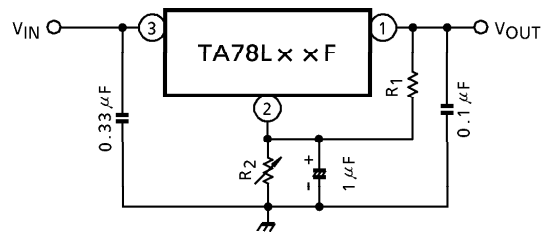


$$I_{OUT} = \frac{V_{OUT}}{R} + I_B$$

(4) VOLTAGE BOOST REGULATOR

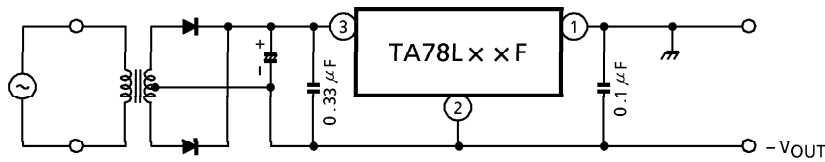


$V_{OUT} = V_Z + V_{OUT}(\text{of IC})$   
Apply current of several mA to R.

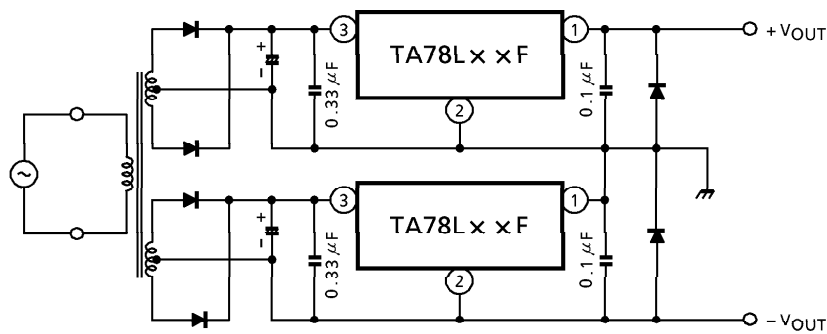


$$V_{OUT} = R_2 \left( I_B + \frac{V_{OUT}(\text{of IC})}{R_1} \right) + V_{OUT}(\text{of IC})$$

(5) NEGATIVE REGULATOR



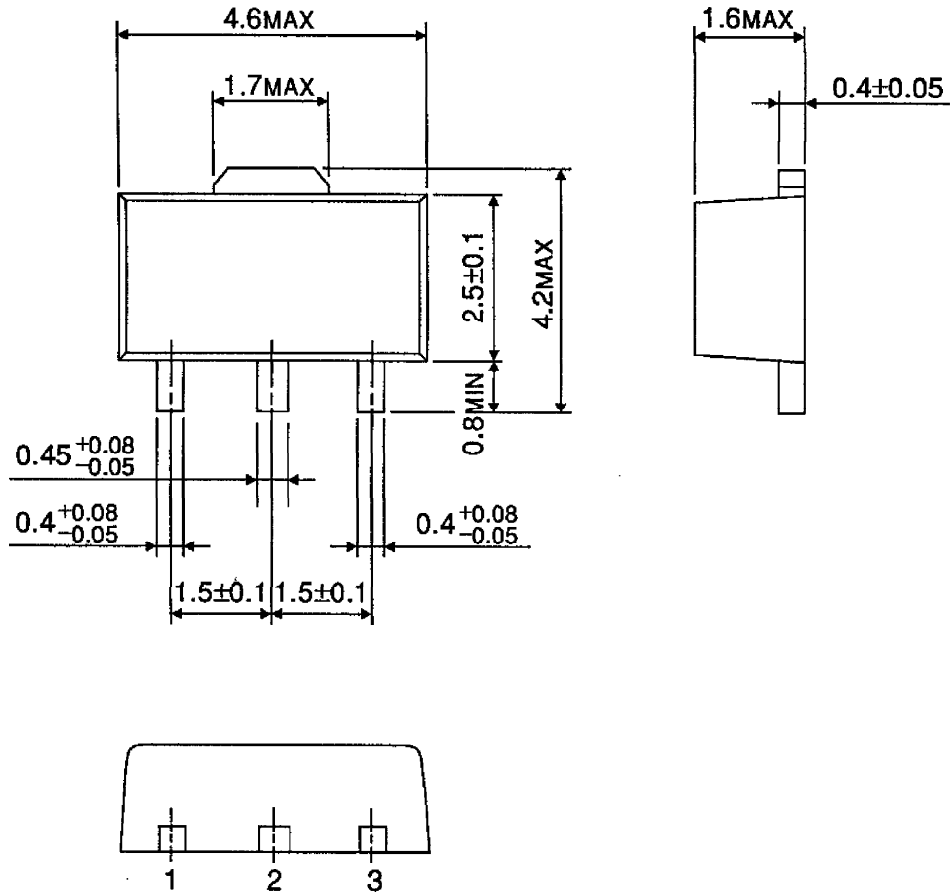
(6) POSITIVE AND NEGATIVE REGULATOR





OUTLINE DRAWING  
HSOP3-P-1.50

Unit : mm



Weight : 0.05g (Typ.)