

**LM2940****LINEAR INTEGRATED CIRCUIT****1A LOW-DROPOUT POSITIVE VOLTAGE REGULATOR****■ DESCRIPTION**

The UTC **LM2940** is a low dropout regulator designed to provide output current up to 1A with a typically 500mV dropout Voltage and a maximum of 1V. It is capable of reducing the ground current when the differential between the input voltage and the output voltage outrun 3V.

UTC **LM2940** offers low quiescent current (typically 30mA at 1A and an input-output differential of 5V). Higher quiescent currents only exist when the regulator is in the dropout mode ( $V_{IN}-V_{OUT} \leq 3V$ ).

**■ FEATURES**

- \* 500mV Typically Dropout at 1A
- \* Output Current in Excess of 1A
- \* Low Quiescent Current
- \* Reversed-Battery Protection
- \* Current Limit and Thermal Shutdown.
- \* Mirror Image Insertion Protection

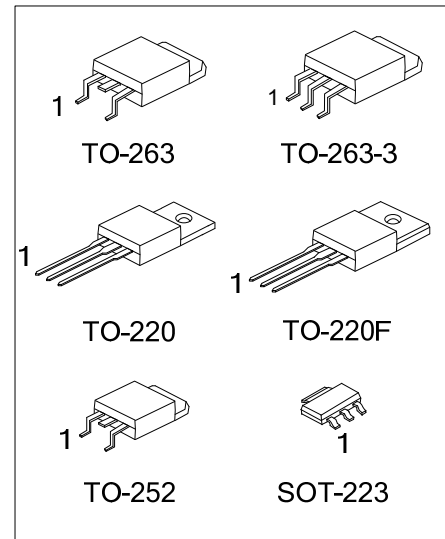
**■ ORDERING INFORMATION**

| Ordering Number  |                  | Package  | Pin Assignment |   |   | Packing   |
|------------------|------------------|----------|----------------|---|---|-----------|
| Lead Free        | Halogen Free     |          | 1              | 2 | 3 |           |
| -                | LM2940G-xx-AA3-R | SOT-223  | I              | G | O | Tape Reel |
| LM2940L-xx-TA3-T | LM2940G-xx-TA3-T | TO-220   | I              | G | O | Tube      |
| LM2940L-xx-TF3-T | LM2940G-xx-TF3-T | TO-220F  | I              | G | O | Tube      |
| LM2940L-xx-TN3-R | LM2940G-xx-TN3-R | TO-252   | I              | G | O | Tape Reel |
| LM2940L-xx-TQ2-R | LM2940G-xx-TQ2-R | TO-263   | I              | G | O | Tape Reel |
| LM2940L-xx-TQ2-T | LM2940G-xx-TQ2-T | TO-263   | I              | G | O | Tube      |
| LM2940L-xx-TQ3-R | LM2940G-xx-TQ3-R | TO-263-3 | I              | G | O | Tape Reel |
| LM2940L-xx-TQ3-T | LM2940G-xx-TQ3-T | TO-263-3 | I              | G | O | Tube      |

Notes: 1. xx: Output Voltage, refer to Marking Information.

2. Pin Assignment: I:  $V_{IN}$  G: GND O:  $V_{OUT}$

|                                                                                                                        |                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>LM2940G-xx-AA3-R</p> <p>(1) Packing Type<br/>(2) Package Type<br/>(3) Output Voltage Code<br/>(4) Green Package</p> | <p>(1) R: Tape Reel, T: Tube<br/>(2) AA3: SOT-223, TA3: TO-220, TF3: TO-220F<br/>TN3: TO-252, TQ2: TO-263, TQ3: TO-263-3<br/>(3) xx: refer to Marking Information<br/>(4) G: Halogen Free and Lead Free, L: Lead Free</p> |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



### MARKING INFORMATION

| PACKAGE                                | VOLTAGE CODE                                                                 | MARKING |
|----------------------------------------|------------------------------------------------------------------------------|---------|
| SOT-223                                | 50 : 5V<br>60 : 6V<br>80 : 8V<br>90 : 9V<br>10 : 10V<br>12 : 12V<br>15 : 15V |         |
| TO-220<br>TO-252<br>TO-263<br>TO-263-3 | 50 : 5V<br>60 : 6V<br>80 : 8V<br>90 : 9V<br>10 : 10V<br>12 : 12V<br>15 : 15V |         |

### ■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER                     |                 | SYMBOL    | RATINGS            | UNIT |
|-------------------------------|-----------------|-----------|--------------------|------|
| Input Voltage                 |                 | $V_{IN}$  | 26                 | V    |
| Power Dissipation             |                 | $P_D$     | Internally limited |      |
| Junction Temperature          |                 | $T_J$     | +150               | °C   |
| Ambient Operating Temperature | TO-220/TO-220F  | $T_{OPR}$ | -40 ~ +125         | °C   |
|                               | TO-263-3/TO-263 |           |                    |      |
|                               | SOT-223/ TO-252 |           | -40 ~ +85          |      |
| Storage Temperature           |                 | $T_{STG}$ | -65 ~ +150         | °C   |

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

### ■ THERMAL DATA

| PARAMETER           |                 | SYMBOL        | RATING | UNIT |
|---------------------|-----------------|---------------|--------|------|
| Junction to Ambient | SOT-223         | $\theta_{JA}$ | 174    | °C/W |
|                     | TO-220/TO-220F  |               | 60     |      |
|                     | TO-263/TO-263-3 |               | 80     |      |
|                     | TO-252          |               | 125    |      |
| Junction to Case    | TO-220/TO-263   | $\theta_{JC}$ | 4      | °C/W |
|                     | TO-263-3        |               |        |      |
|                     | TO-220F         |               | 6      |      |
|                     | TO-252          |               | 12     |      |
|                     | SOT-223         |               | 15     |      |

### ■ ELECTRICAL CHARACTERISTICS

( $T_A = T_J = 25^\circ\text{C}$ ,  $V_{IN} = V_{OUT} + 5\text{V}$ ,  $I_{OUT} = 1\text{A}$  and  $C_{OUT} = 22\mu\text{F}$ , unless otherwise specified.)

For LM2940-5.0V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                                                       | MIN  | TYP  | MAX  | UNIT                |
|------------------------------------------|------------------|---------------------------------------------------------------------------------------|------|------|------|---------------------|
| Output Voltage                           | $V_{OUT}$        | $6.25\text{V} \leq V_{IN} \leq 26\text{V}$ , $5\text{mA} \leq I_{OUT} \leq 1\text{A}$ | 4.85 | 5.00 | 5.15 | V                   |
| Line Regulation                          | $\Delta V_{OUT}$ | $V_{OUT} + 2\text{V} \leq V_{IN} \leq 26\text{V}$ , $I_{OUT} = 5\text{mA}$            |      | 20   | 50   | mV                  |
| Load Regulation                          | $\Delta V_{OUT}$ | $50\text{mA} \leq I_{OUT} \leq 1\text{A}$                                             |      | 35   | 50   | mV                  |
| Output Impedance                         | $R_{OUT}$        | 100 mA DC and 20mA <sub>RMS</sub> , $f_O = 120\text{Hz}$                              |      | 35   |      | mΩ                  |
| Quiescent Current                        | $I_Q$            | $V_{OUT} + 2\text{V} \leq V_{IN} \leq 26\text{V}$ , $I_{OUT} = 5\text{mA}$            |      | 10   | 15   | mA                  |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT} = 5\text{mA}$                                                   |      | 150  |      | $\mu\text{V}_{RMS}$ |
| Ripple Rejection                         | RR               | $f_O = 120\text{Hz}$ , 1V <sub>RMS</sub> , $I_{OUT} = 100\text{mA}$                   | 54   | 72   |      | dB                  |
| Long Term Stability                      |                  |                                                                                       |      | 20   |      | mV/1000Hr           |
| Dropout Voltage                          | $V_D$            | $I_{OUT} = 1\text{A}$                                                                 |      | 0.5  | 0.8  | V                   |
|                                          |                  | $I_{OUT} = 100\text{mA}$                                                              |      | 0.13 | 0.15 |                     |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                                                |      | 2.5  |      | A                   |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT} = 100\Omega$ , $T \leq 100\text{ms}$                                         | 60   | 75   |      | V                   |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT} = 100\Omega$                                                                 | -15  | -30  |      | V                   |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT} = 100\Omega$ , $T \leq 100\text{ms}$                                         | -50  | -75  |      | V                   |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

## For LM2940-6.0V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                       | MIN  | TYP  | MAX  | UNIT          |
|------------------------------------------|------------------|-------------------------------------------------------|------|------|------|---------------|
| Output Voltage                           | $V_{OUT}$        | $7.5V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$ | 5.82 | 6.00 | 6.18 | V             |
| Line Regulation                          | $\Delta V_{OUT}$ | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$        |      | 20   | 60   | mV            |
| Load Regulation                          | $\Delta V_{OUT}$ | $50mA \leq I_{OUT} \leq 1A$                           |      | 40   | 60   | mV            |
| Output Impedance                         | $R_{OUT}$        | 100 mA DC and $20mA_{RMS}, f_0=120Hz$                 |      | 40   |      | m $\Omega$    |
| Quiescent Current                        | $I_Q$            | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$        |      | 10   | 15   | mA            |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT}=5mA$                            |      | 180  |      | $\mu V_{RMS}$ |
| Ripple Rejection                         | RR               | $f_0=120Hz, 1V_{RMS}, I_{OUT}=100mA$                  | 60   | 72   |      | dB            |
| Long Term Stability                      |                  |                                                       |      | 20   |      | mV/1000Hr     |
| Dropout Voltage                          | $V_D$            | $I_{OUT}=1A$                                          |      | 0.5  | 0.8  | V             |
|                                          |                  | $I_{OUT}=100mA$                                       |      | 0.13 | 0.15 |               |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                |      | 2.5  |      | A             |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT}=100\Omega, T \leq 100ms$                     | 60   | 75   |      | V             |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT}=100\Omega$                                   | -15  | -30  |      | V             |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT}=100\Omega, T \leq 100ms$                     | -50  | -75  |      | V             |

## For LM2940-8.0V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                       | MIN  | TYP  | MAX  | UNIT          |
|------------------------------------------|------------------|-------------------------------------------------------|------|------|------|---------------|
| Output Voltage                           | $V_{OUT}$        | $9.4V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$ | 7.76 | 8.00 | 8.24 | V             |
| Line regulation                          | $\Delta V_{OUT}$ | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$        |      | 20   | 80   | mV            |
| Load Regulation                          | $\Delta V_{OUT}$ | $50mA \leq I_{OUT} \leq 1A$                           |      | 55   | 80   | mV            |
| Output Impedance                         | $R_{OUT}$        | 100 mA DC and $20mA_{RMS}, f_0=120Hz$                 |      | 55   |      | m $\Omega$    |
| Quiescent Current                        | $I_Q$            | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$        |      | 10   | 15   | mA            |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT}=5mA$                            |      | 240  |      | $\mu V_{RMS}$ |
| Ripple Rejection                         | RR               | $f_0=120Hz, 1V_{RMS}, I_{OUT}=100mA$                  | 54   | 66   |      | dB            |
| Long Term Stability                      |                  |                                                       |      | 32   |      | mV/1000Hr     |
| Dropout Voltage                          | $V_D$            | $I_{OUT}=1A$                                          |      | 0.5  | 0.8  | V             |
|                                          |                  | $I_{OUT}=100mA$                                       |      | 0.13 | 0.15 |               |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                |      | 2.5  |      | A             |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT}=100\Omega, T \leq 100ms$                     | 60   | 75   |      | V             |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT}=100\Omega$                                   | -15  | -30  |      | V             |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT}=100\Omega, T \leq 100ms$                     | -50  | -75  |      | V             |

## For LM2940-9.0V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                        | MIN  | TYP  | MAX  | UNIT          |
|------------------------------------------|------------------|--------------------------------------------------------|------|------|------|---------------|
| Output Voltage                           | $V_{OUT}$        | $10.5V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$ | 8.73 | 9.00 | 9.27 | V             |
| Line regulation                          | $\Delta V_{OUT}$ | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$         |      | 20   | 90   | mV            |
| Load Regulation                          | $\Delta V_{OUT}$ | $50mA \leq I_{OUT} \leq 1A$                            |      | 60   | 90   | mV            |
| Output Impedance                         | $R_{OUT}$        | 100 mA DC and $20mA_{RMS}, f_0=120Hz$                  |      | 60   |      | m $\Omega$    |
| Quiescent Current                        | $I_Q$            | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$         |      | 10   | 15   | mA            |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT}=5mA$                             |      | 270  |      | $\mu V_{RMS}$ |
| Ripple Rejection                         | RR               | $f_0=120Hz, 1V_{RMS}, I_{OUT}=100mA$                   | 52   | 64   |      | dB            |
| Long Term Stability                      |                  |                                                        |      | 34   |      | mV/1000Hr     |
| Dropout Voltage                          | $V_D$            | $I_{OUT}=1A$                                           |      | 0.5  | 0.8  | V             |
|                                          |                  | $I_{OUT}=100mA$                                        |      | 0.13 | 0.15 |               |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                 |      | 2.5  |      | A             |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT}=100\Omega, T \leq 100ms$                      | 60   | 75   |      | V             |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT}=100\Omega$                                    | -15  | -30  |      | V             |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT}=100\Omega, T \leq 100ms$                      | -50  | -75  |      | V             |

### ■ ELECTRICAL CHARACTERISTICS(Cont.)

For LM2940-10V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                        | MIN  | TYP   | MAX   | UNIT              |
|------------------------------------------|------------------|--------------------------------------------------------|------|-------|-------|-------------------|
| Output Voltage                           | $V_{OUT}$        | $11.5V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$ | 9.70 | 10.00 | 10.30 | V                 |
| Line regulation                          | $\Delta V_{OUT}$ | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$     |      | 20    | 100   | mV                |
| Load Regulation                          | $\Delta V_{OUT}$ | $50mA \leq I_{OUT} \leq 1A$                            |      | 65    | 100   | mV                |
| Output Impedance                         | $R_{OUT}$        | 100mA DC and 20mA <sub>RMS</sub> , $f_0=120Hz$         |      | 65    |       | mΩ                |
| Quiescent Current                        | $I_Q$            | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$     |      | 10    | 15    | mA                |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT} = 5mA$                           |      | 300   |       | μV <sub>RMS</sub> |
| Ripple Rejection                         | RR               | $f_0=120Hz, 1V_{RMS}, I_{OUT} = 100mA$                 | 51   | 63    |       | dB                |
| Long Term Stability                      |                  |                                                        |      | 36    |       | mV/1000Hr         |
| Dropout Voltage                          | $V_D$            | $I_{OUT} = 1A$                                         |      | 0.5   | 0.8   | V                 |
|                                          |                  | $I_{OUT} = 100mA$                                      |      | 0.13  | 0.15  |                   |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                 |      | 2.5   |       | A                 |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT}=100\Omega, T \leq 100ms$                      | 60   | 75    |       | V                 |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT}=100\Omega$                                    | -15  | -30   |       | V                 |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT}=100\Omega, T \leq 100ms$                      | -50  | -75   |       | V                 |

UTC LM2940-12V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                        | MIN   | TYP   | MAX   | UNIT              |
|------------------------------------------|------------------|--------------------------------------------------------|-------|-------|-------|-------------------|
| Output Voltage                           | $V_{OUT}$        | $13.6V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$ | 11.64 | 12.00 | 12.36 | V                 |
| Line regulation                          | $\Delta V_{OUT}$ | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$     |       | 20    | 120   | mV                |
| Load Regulation                          | $\Delta V_{OUT}$ | $50mA \leq I_{OUT} \leq 1A$                            |       | 55    | 120   | mV                |
| Output Impedance                         | $R_{OUT}$        | 100mA DC and 20mA <sub>RMS</sub> , $f_0=120Hz$         |       | 80    |       | mΩ                |
| Quiescent Current                        | $I_Q$            | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$     |       | 10    | 15    | mA                |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT} = 5mA$                           |       | 360   |       | μV <sub>RMS</sub> |
| Ripple Rejection                         | RR               | $f_0=120Hz, 1V_{RMS}, I_{OUT} = 100mA$                 | 54    | 66    |       | dB                |
| Long Term Stability                      |                  |                                                        |       | 48    |       | mV/1000Hr         |
| Dropout Voltage                          | $V_D$            | $I_{OUT} = 1A$                                         |       | 0.5   | 0.8   | V                 |
|                                          |                  | $I_{OUT} = 100mA$                                      |       | 0.11  | 0.15  |                   |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                 |       | 2.5   |       | A                 |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT}=100\Omega, T \leq 100ms$                      | 60    | 75    |       | V                 |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT}=100\Omega$                                    | -15   | -30   |       | V                 |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT}=100\Omega, T \leq 100ms$                      | -50   | -75   |       | V                 |

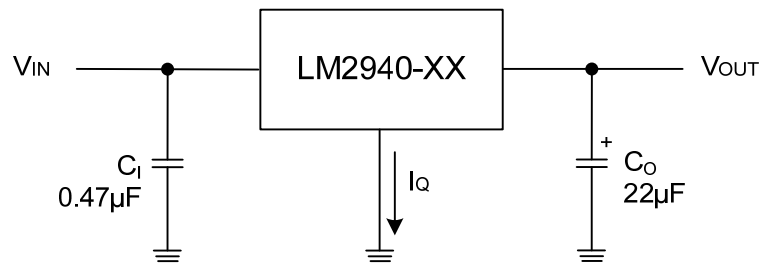
### ■ ELECTRICAL CHARACTERISTICS(Cont.)

#### UTC LM2940-15V

| PARAMETER                                | SYMBOL           | TEST CONDITIONS                                         | MIN   | TYP   | MAX   | UNIT              |
|------------------------------------------|------------------|---------------------------------------------------------|-------|-------|-------|-------------------|
| Output Voltage                           | $V_{OUT}$        | $16.75V \leq V_{IN} \leq 26V, 5mA \leq I_{OUT} \leq 1A$ | 14.55 | 15.00 | 15.45 | V                 |
| Line regulation                          | $\Delta V_{OUT}$ | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$      |       | 20    | 150   | mV                |
| Load Regulation                          | $\Delta V_{OUT}$ | $50mA \leq I_{OUT} \leq 1A$                             |       | 70    | 150   | mV                |
| Output Impedance                         | $R_{OUT}$        | 100mA DC and 20mA <sub>RMS</sub> , $f_0=120Hz$          |       | 100   |       | mΩ                |
| Quiescent Current                        | $I_Q$            | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$      |       | 10    | 15    | mA                |
| Output Noise Voltage                     | $e_N$            | 10Hz-100kHz, $I_{OUT} = 5mA$                            |       | 450   |       | μV <sub>RMS</sub> |
| Ripple Rejection                         | RR               | $f_0=120Hz, 1V_{RMS}, I_{OUT} = 100mA$                  | 52    | 64    |       | dB                |
| Long Term Stability                      |                  |                                                         |       | 60    |       | mV/1000Hr         |
| Dropout Voltage                          | $V_D$            | $I_{OUT} = 1A$                                          |       | 0.5   | 0.8   | V                 |
|                                          |                  | $I_{OUT} = 100mA$                                       |       | 0.11  | 0.15  |                   |
| Short Circuit Current                    | $I_{SC}$         | (Note)                                                  |       | 2.5   |       | A                 |
| Maximum Line Transient                   | $T_{IN}$         | $R_{OUT}=100\Omega, T \leq 100ms$                       | 60    | 75    |       | V                 |
| Reverse Polarity DC Input Voltage        | $V_{RIN}$        | $R_{OUT}=100\Omega$                                     | -15   | -30   |       | V                 |
| Reverse Polarity Transient Input Voltage | $V_{TRRI}$       | $R_{OUT}=100\Omega, T \leq 100ms$                       | -50   | -75   |       | V                 |

Note: Output current will decrease with temperature increase but will not drop below 1A at the maximum specified temperature.

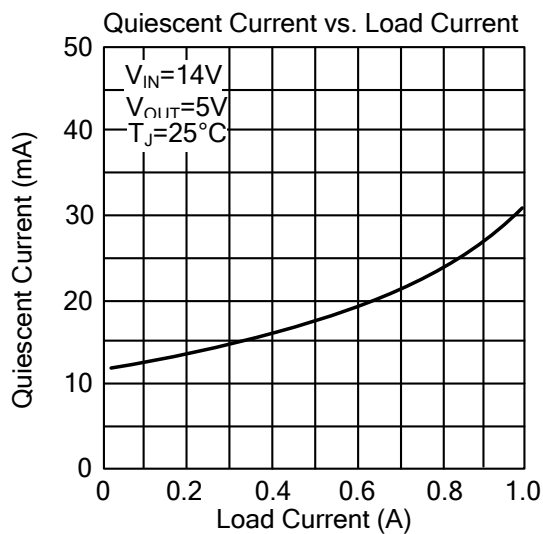
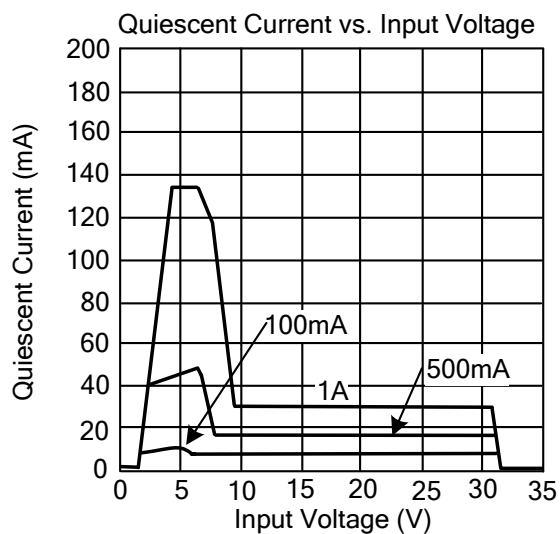
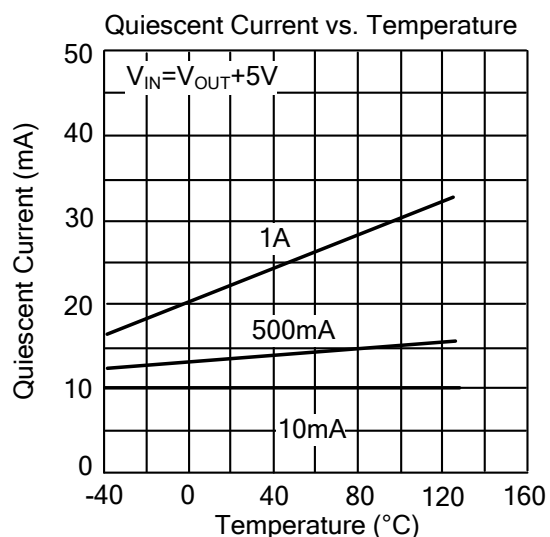
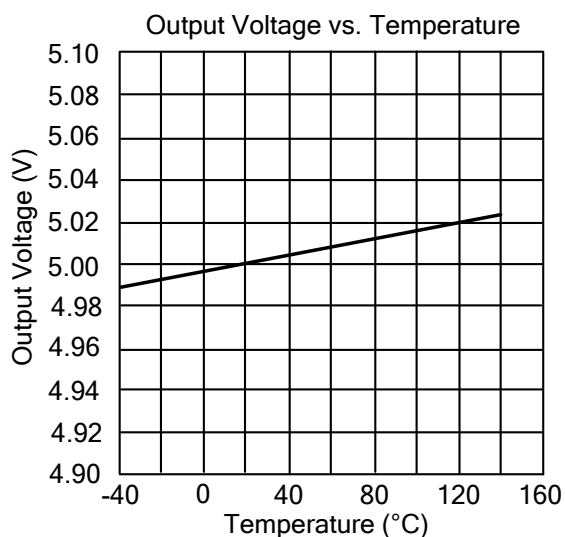
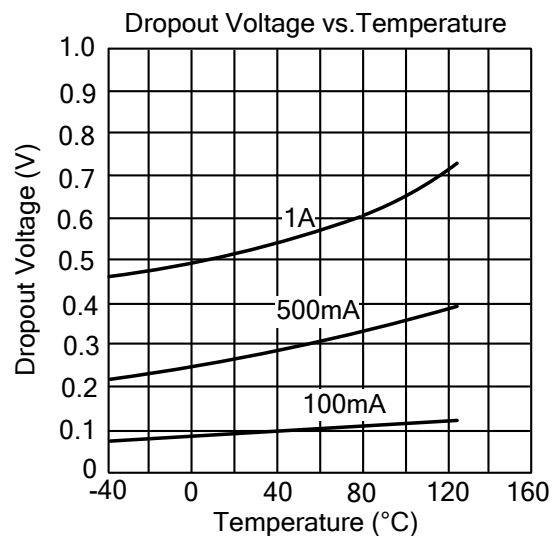
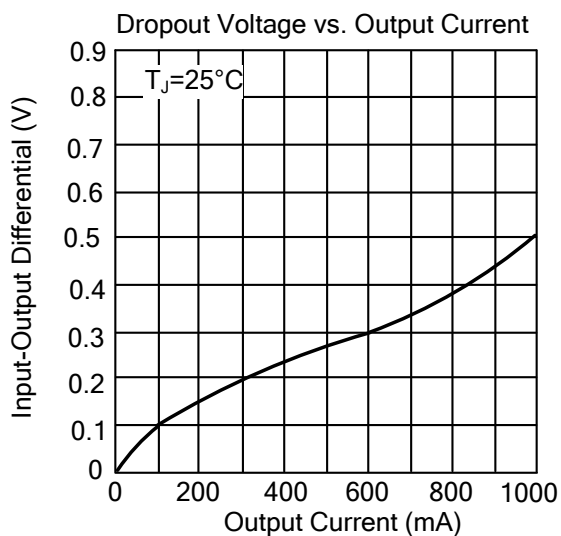
### ■ TYPICAL APPLICATION



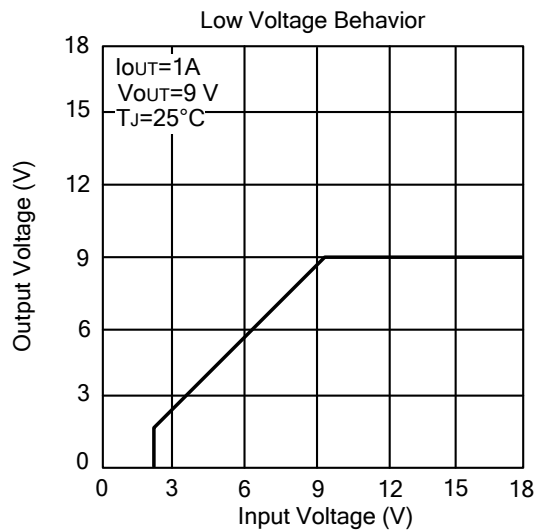
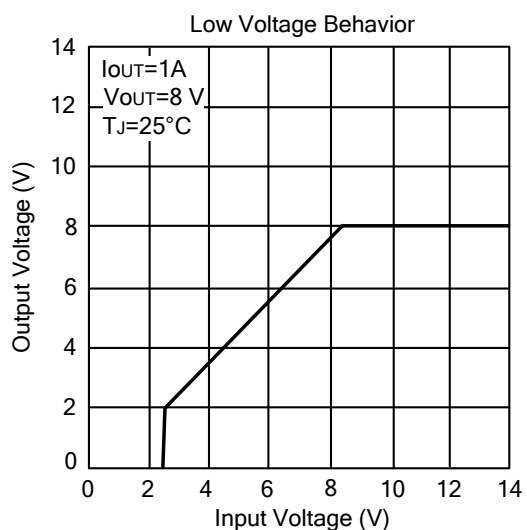
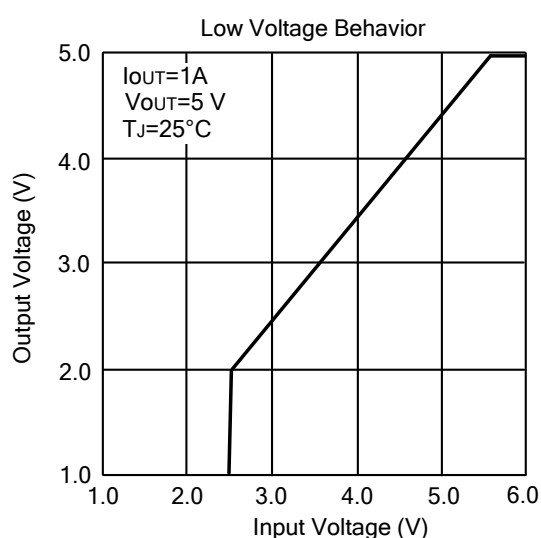
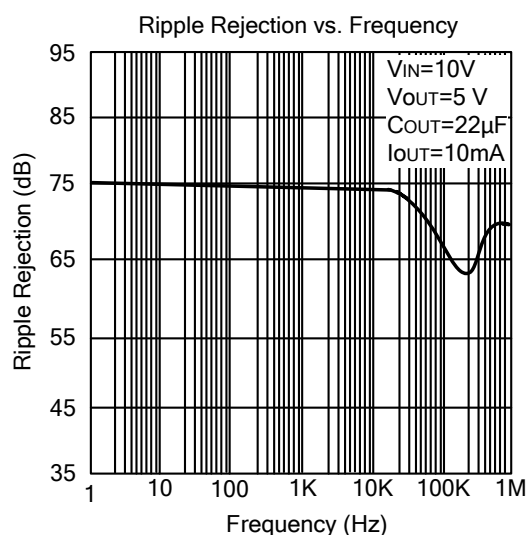
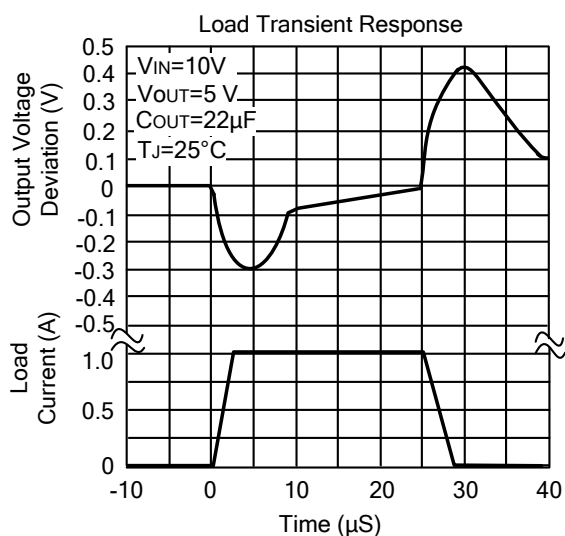
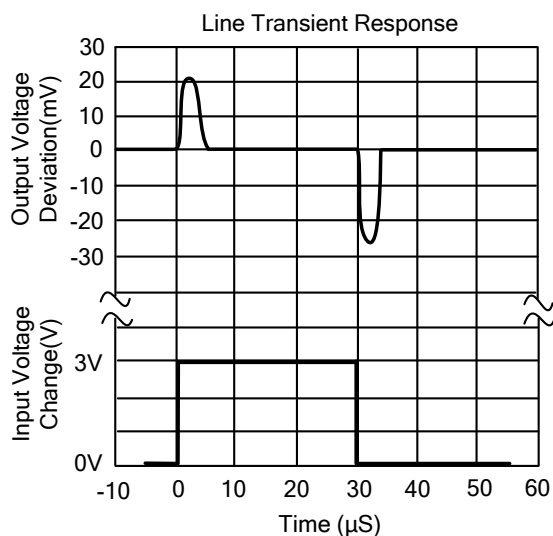
Note: 1.  $C_1$  is required if regulator is located far from power supply filter.

2.  $C_O$  must be higher than  $22\mu F$  for stability, and locate as close as possible to the regulator.

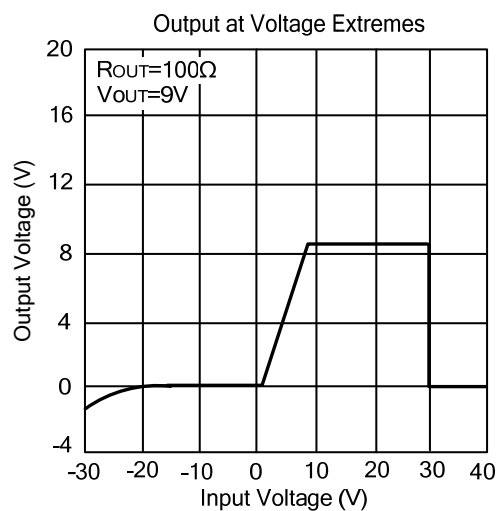
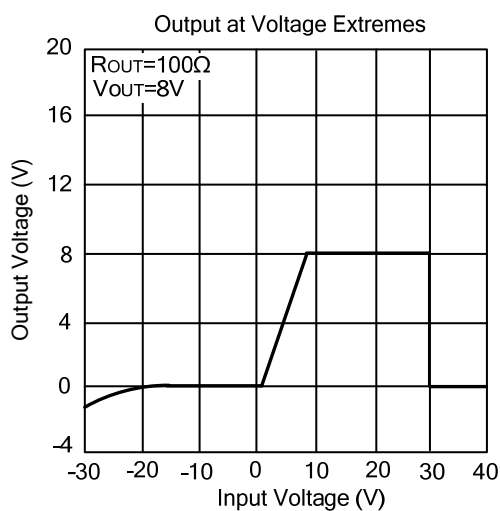
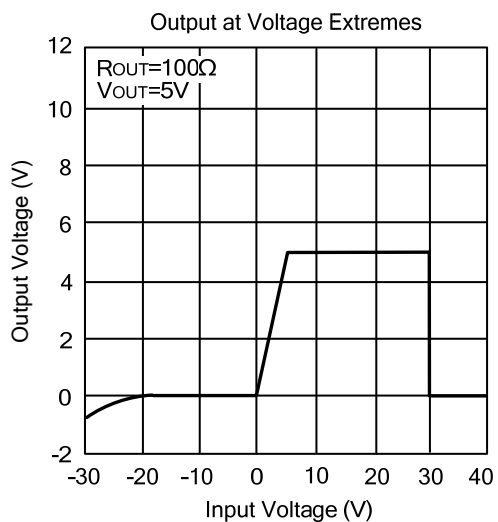
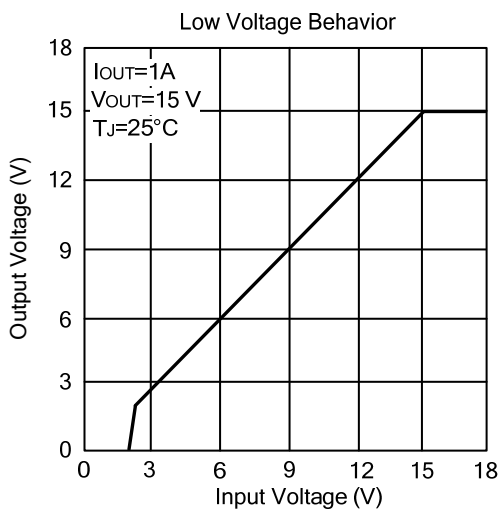
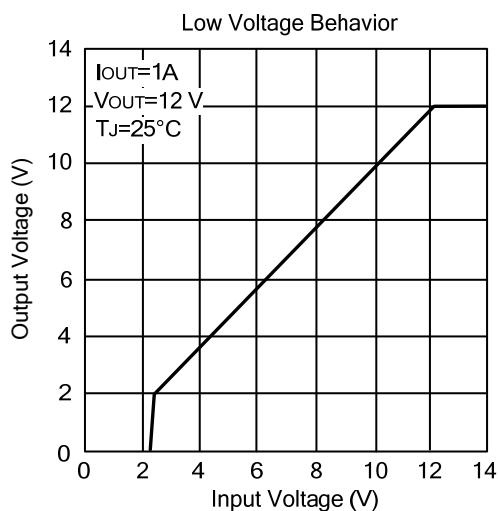
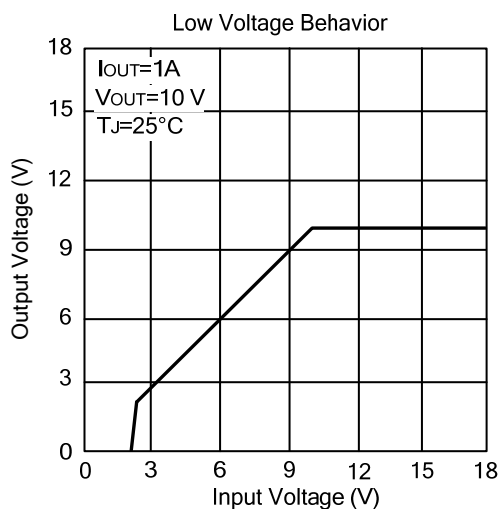
# ■ TYPICAL CHARACTERISTICS



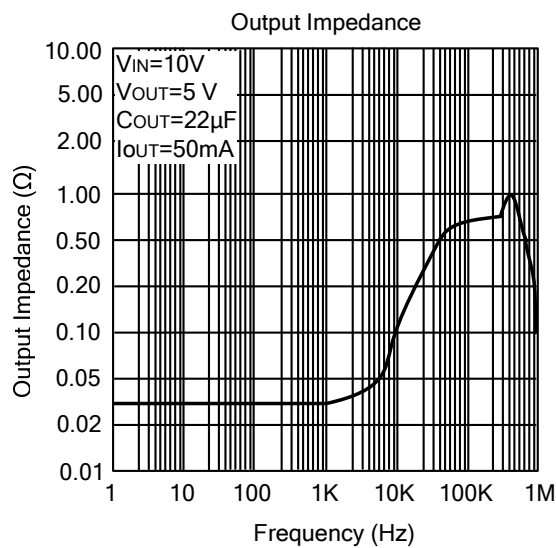
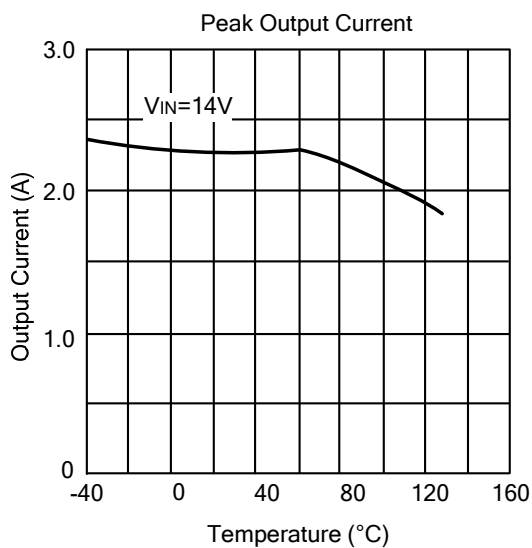
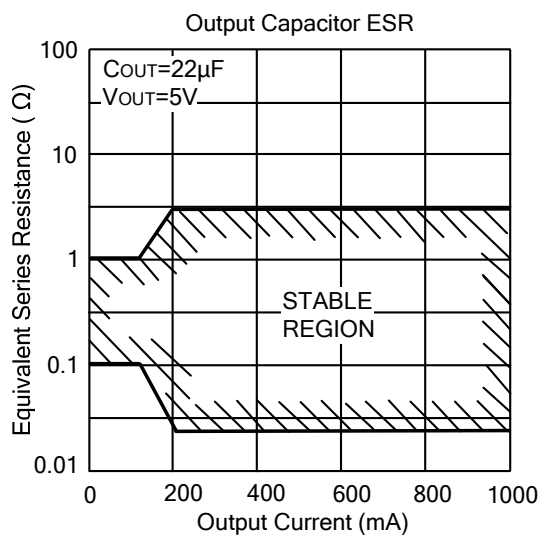
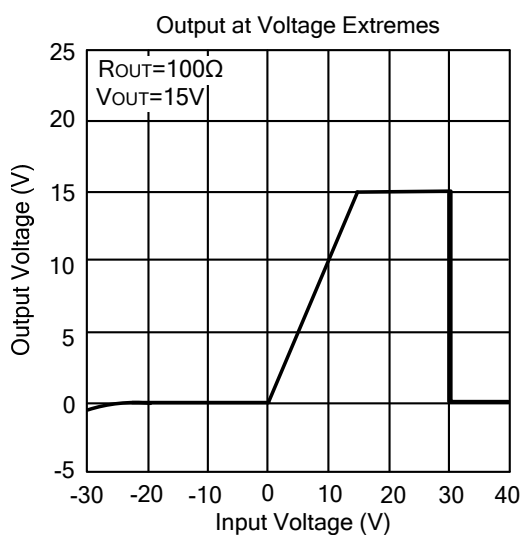
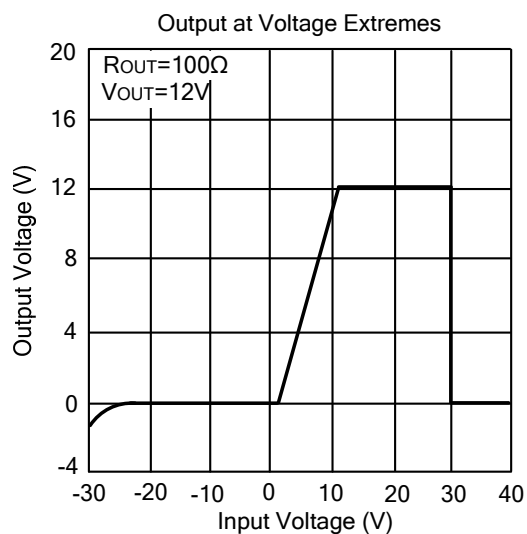
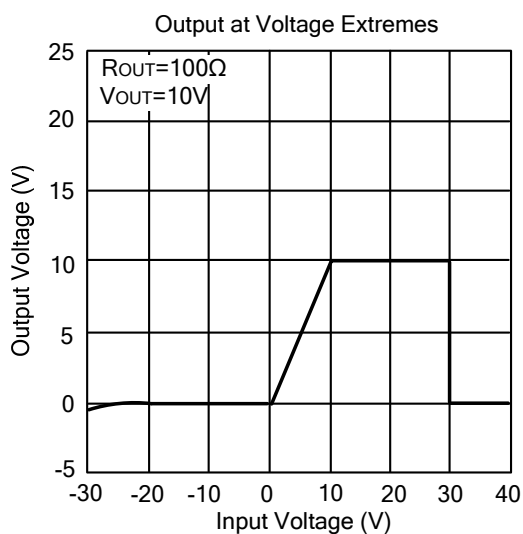
### ■ TYPICAL CHARACTERISTICS (Cont.)



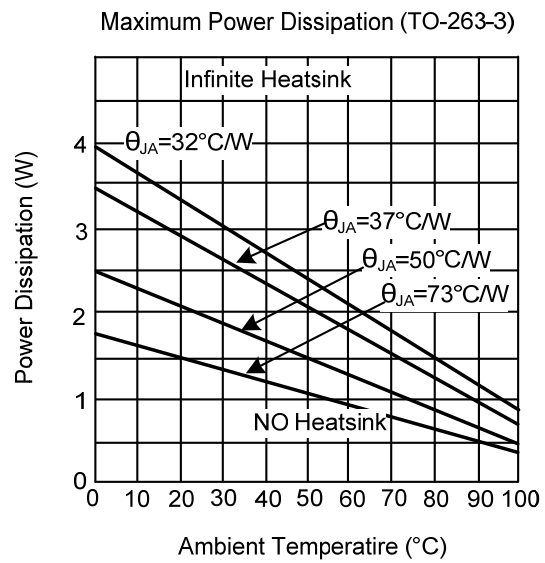
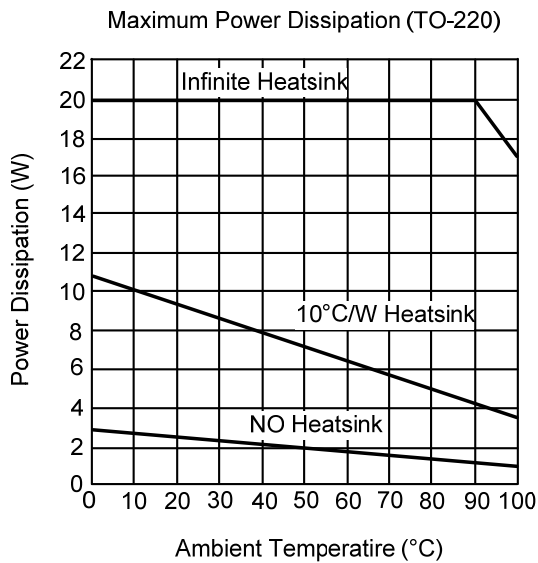
### ■ TYPICAL CHARACTERISTICS (Cont.)



## ■ TYPICAL CHARACTERISTICS (Cont.)



### ■ TYPICAL CHARACTERISTICS (Cont.)



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