



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

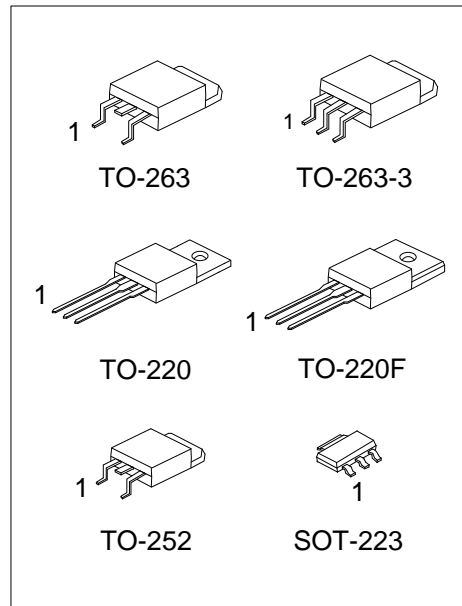
ORDERING INFORMATION

| Ordering Number | | Package | Pin Assignment | | | Packing |
|------------------|------------------|----------|----------------|---|---|-----------|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| LM2940Lxx-AA3-R | 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) R: Tape Reel, T: Tube (2) AA3: SOT-223, TA3: TO-220, TF3: TO-220F TN3: TO-252, TQ2: TO-263, TQ3: TO-263-3 (3) xx: refer to Marking Information (4) G: Halogen Free and Lead Free, L: Lead Free</p> |
|-------------------------|---|



MARKING INFORMATION

| PACKAGE | VOLTAGE CODE | MARKING |
|---|--|---------|
| SOT-223 | 50 : 5V 60 : 6V 80 : 8V 90 : 9V 10 : 10V 12 : 12V 15 : 15V | |
| TO-220 TO-220F TO-252 TO-263 TO-263-3 | 50 : 5V 60 : 6V 80 : 8V 90 : 9V 10 : 10V 12 : 12V 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 |
| Operating Temperature | T_{OPR} | -40 ~ +125 | °C |
| 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 | θ_{JA} | SOT-223 | 174 | °C/W |
| | | TO-220/TO-220F | 60 | |
| | | TO-263/TO-263-3 | 80 | |
| | | TO-252 | 125 | |
| Junction to Case | θ_{JC} | SOT-223 | 15 | °C/W |
| | | TO-220/TO-263 | 4 | |
| | | TO-263-3 | 6 | |
| | | TO-220F | 6 | |
| | | TO-252 | 12 | |

■ 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 | ΔV_{OUT} | $V_{OUT}+2\text{V} \leq V_{IN} \leq 26\text{V}$, $I_{OUT}=5\text{mA}$ | | 20 | 50 | mV |
| Load Regulation | ΔV_{OUT} | $50\text{mA} \leq I_{OUT} \leq 1\text{A}$ | | 35 | 50 | mV |
| Output Impedance | R_{OUT} | 100 mA DC and 20mA _{RMS} , $f_o=120\text{Hz}$ | | 35 | | m Ω |
| 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 | | μV_{RMS} |
| Ripple Rejection | RR | $f_o=120\text{Hz}$, 1V _{RMS} , $I_{OUT}=100\text{mA}$ | 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 | ΔV_{OUT} | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$ | | 20 | 60 | mV |
| Load Regulation | ΔV_{OUT} | $50mA \leq I_{OUT} \leq 1A$ | | 40 | 60 | mV |
| Output Impedance | R_{OUT} | 100 mA DC and 20mA _{RMS} , $f_o=120Hz$ | | 40 | | m Ω |
| 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 | | μV_{RMS} |
| Ripple Rejection | RR | $f_o=120Hz, 1V_{RMS}, I_{OUT}=100mA$ | 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 | ΔV_{OUT} | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$ | | 20 | 80 | mV |
| Load Regulation | ΔV_{OUT} | $50mA \leq I_{OUT} \leq 1A$ | | 55 | 80 | mV |
| Output Impedance | R_{OUT} | 100 mA DC and 20mA _{RMS} , $f_o=120Hz$ | | 55 | | m Ω |
| 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 | | μV_{RMS} |
| Ripple Rejection | RR | $f_o=120Hz, 1V_{RMS}, I_{OUT}=100mA$ | 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 | ΔV_{OUT} | $V_{OUT}+2V \leq V_{IN} \leq 26V, I_{OUT}=5mA$ | | 20 | 90 | mV |
| Load Regulation | ΔV_{OUT} | $50mA \leq I_{OUT} \leq 1A$ | | 60 | 90 | mV |
| Output Impedance | R_{OUT} | 100 mA DC and 20mA _{RMS} , $f_o=120Hz$ | | 60 | | m Ω |
| 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 | | μV_{RMS} |
| Ripple Rejection | RR | $f_o=120Hz, 1V_{RMS}, I_{OUT}=100mA$ | 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 | ΔV_{OUT} | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$ | | 20 | 100 | mV |
| Load Regulation | ΔV_{OUT} | $50mA \leq I_{OUT} \leq 1A$ | | 65 | 100 | mV |
| Output Impedance | R_{OUT} | 100mA DC and 20mA _{RMS} , $f_0=120Hz$ | | 65 | | m Ω |
| 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_{RMS} |
| 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 | ΔV_{OUT} | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$ | | 20 | 120 | mV |
| Load Regulation | ΔV_{OUT} | $50mA \leq I_{OUT} \leq 1A$ | | 55 | 120 | mV |
| Output Impedance | R_{OUT} | 100mA DC and 20mA _{RMS} , $f_0=120Hz$ | | 80 | | m Ω |
| 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_{RMS} |
| 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 |

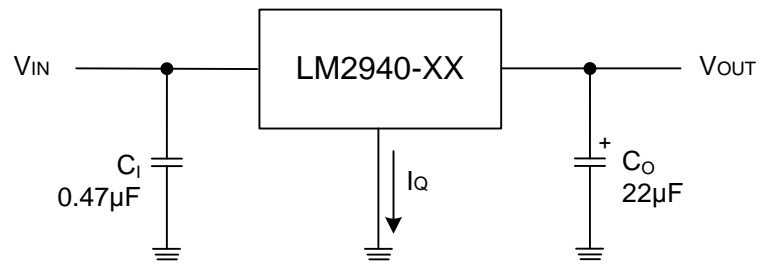
■ ELECTRICAL CHARACTERISTICS(Cont.)

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 | ΔV_{OUT} | $V_{OUT} + 2V \leq V_{IN} \leq 26V, I_{OUT} = 5mA$ | | 20 | 150 | mV |
| Load Regulation | ΔV_{OUT} | $50mA \leq I_{OUT} \leq 1A$ | | 70 | 150 | mV |
| Output Impedance | R_{OUT} | 100mA DC and 20mA _{RMS} , $f_o=120Hz$ | | 100 | | m Ω |
| 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_{RMS} |
| Ripple Rejection | RR | $f_o=120Hz, 1V_{RMS}, I_{OUT} = 100mA$ | 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 |

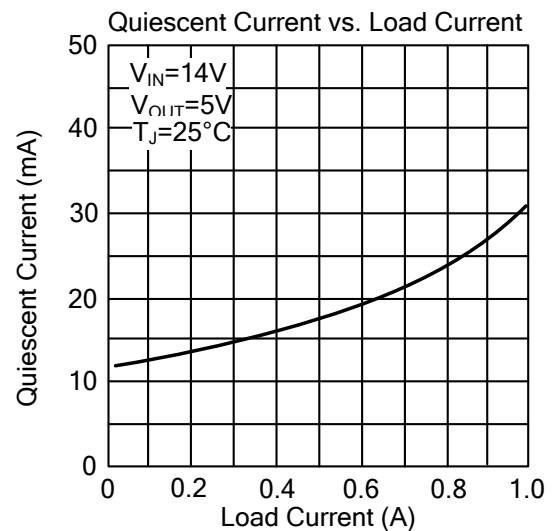
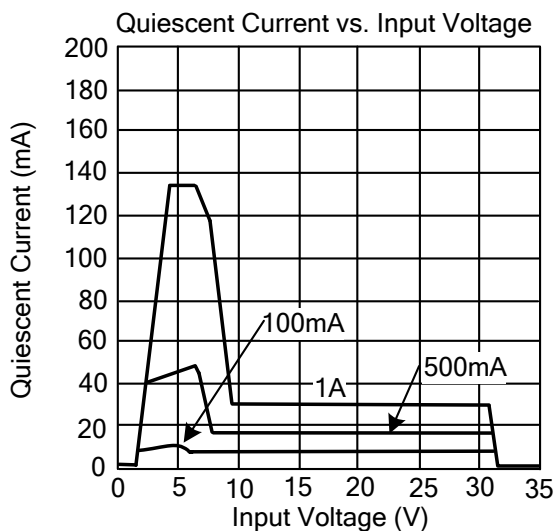
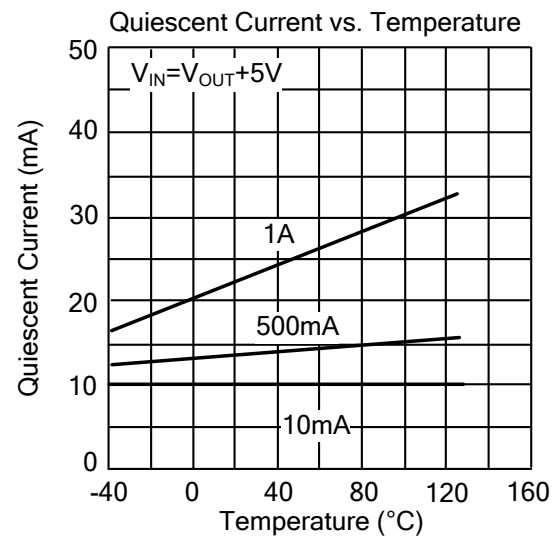
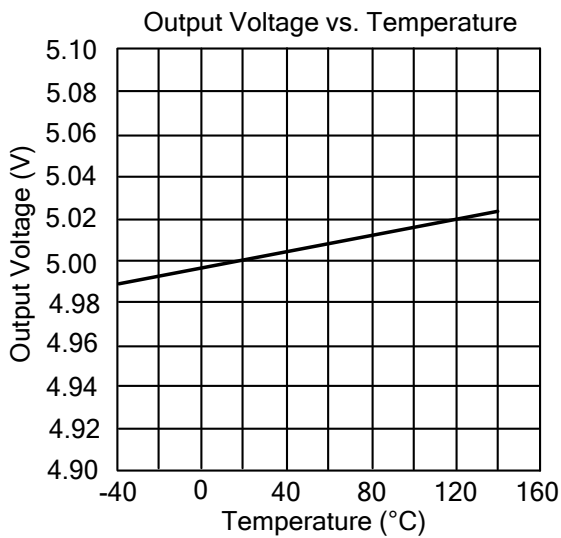
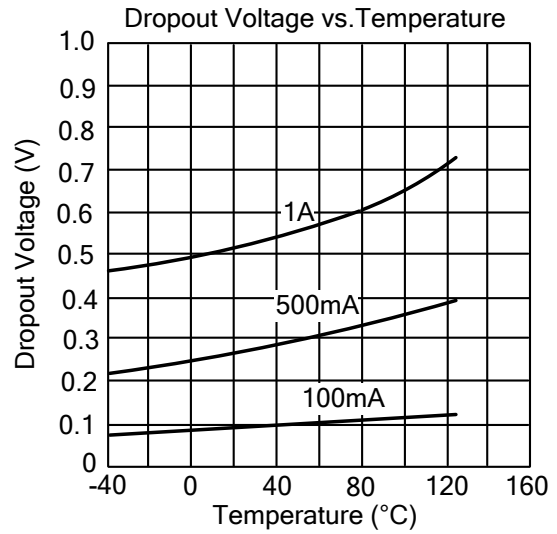
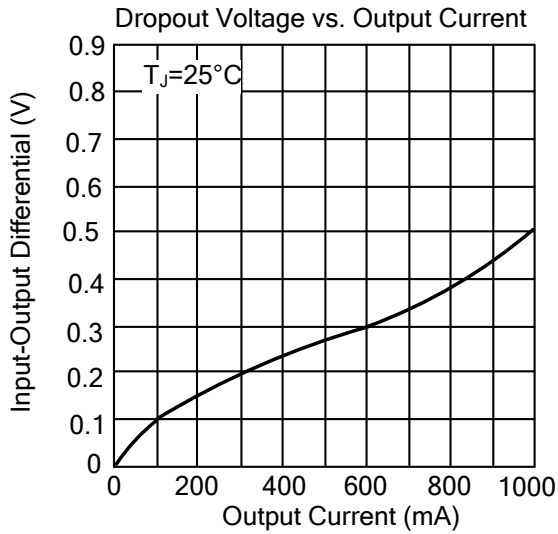
Note: Output current will decrease with temperature increase but will not drop below 1A at the maximum specified temperature.

■ TYPICAL APPLICATION

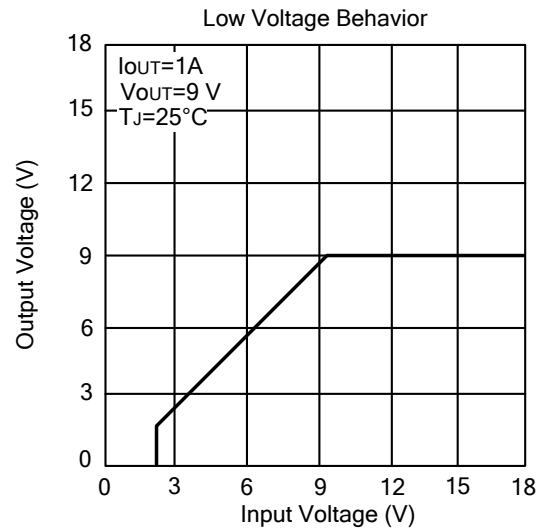
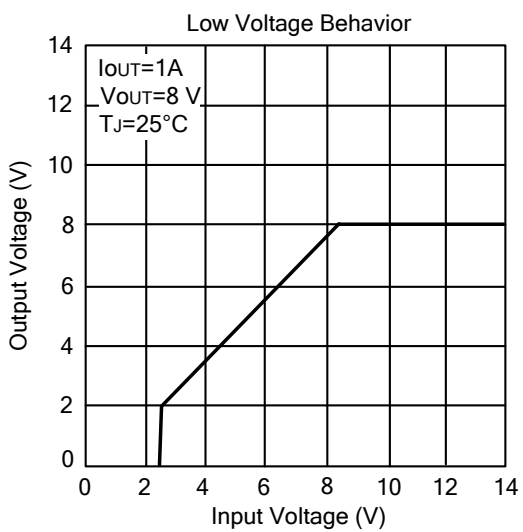
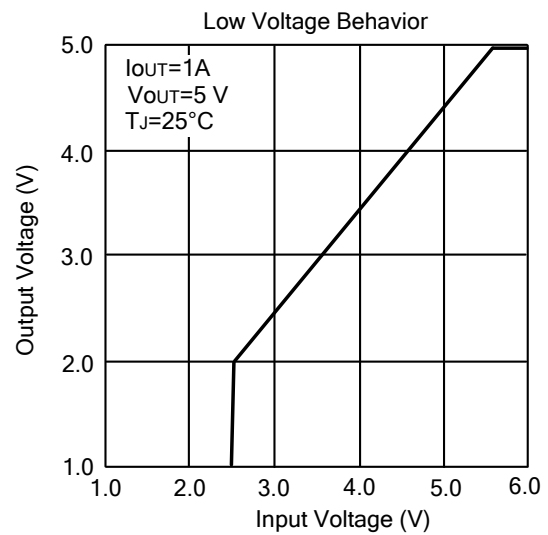
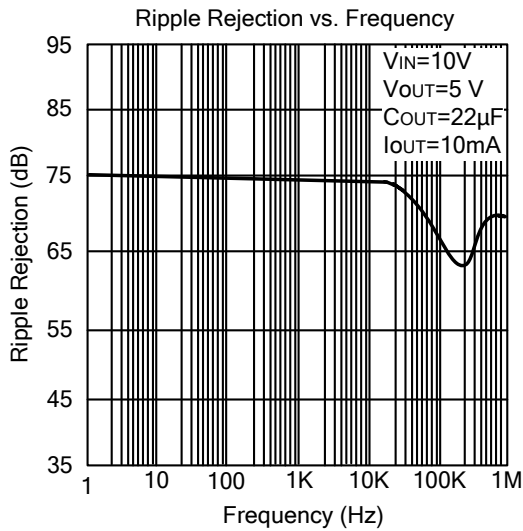
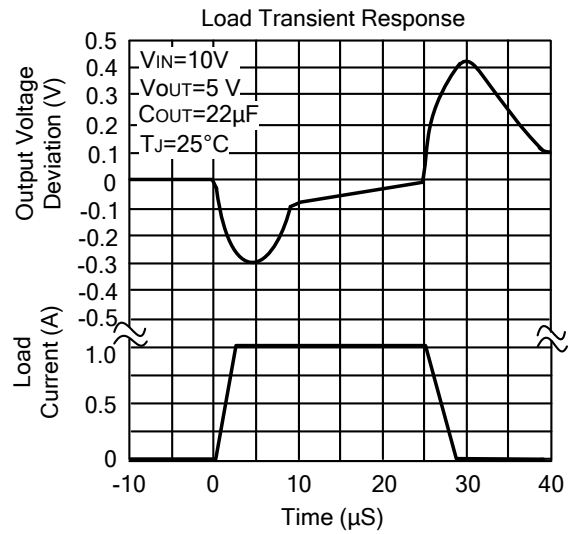
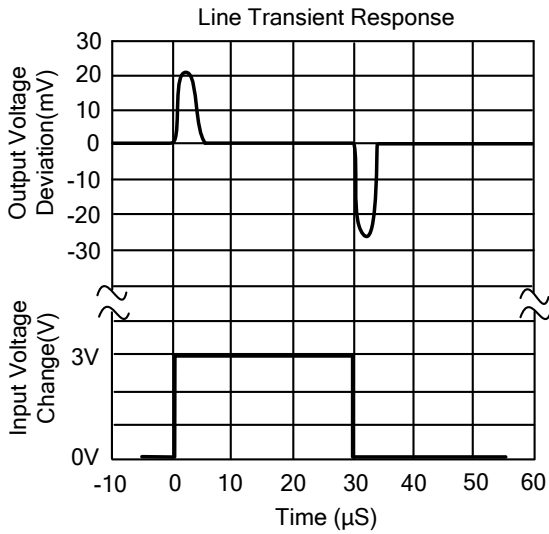


- Note: 1. C₁ is required if regulator is located far from power supply filter.
2. C₀ must be higher than 22µF for stability, and locate as close as possible to the regulator.

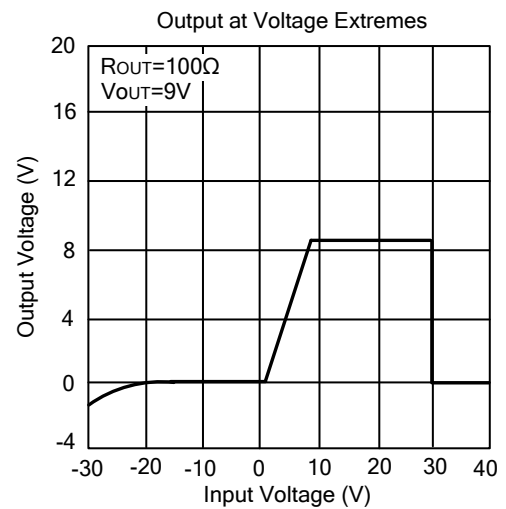
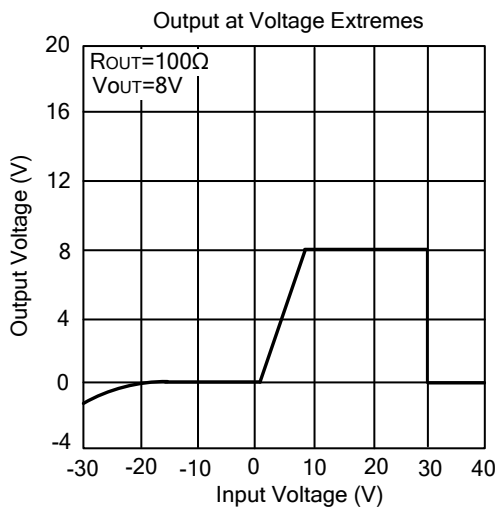
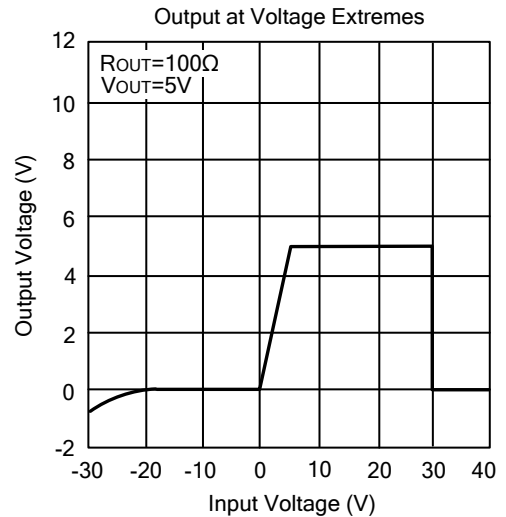
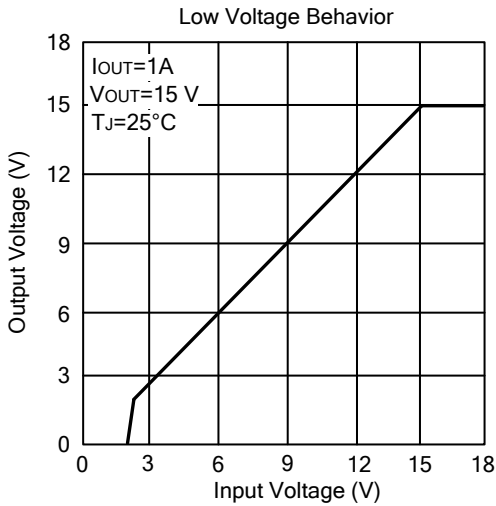
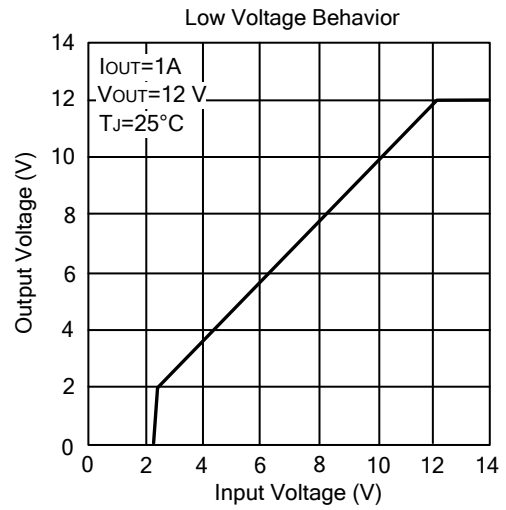
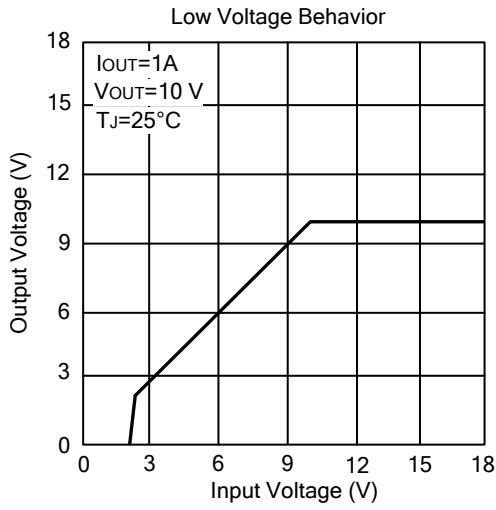
■ TYPICAL CHARACTERISTICS



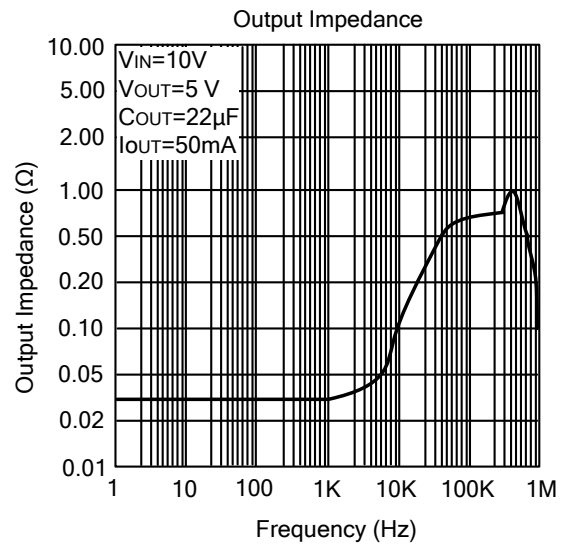
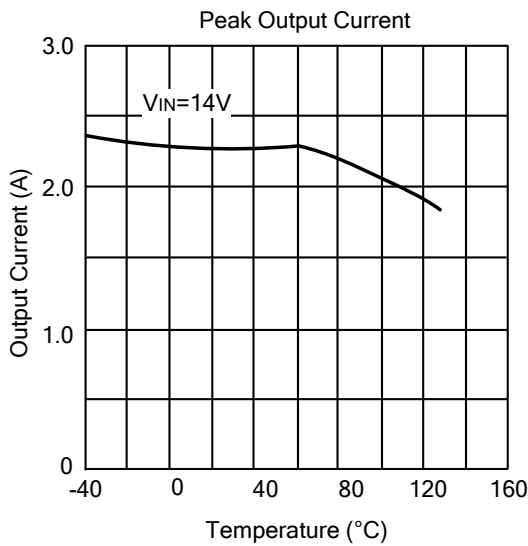
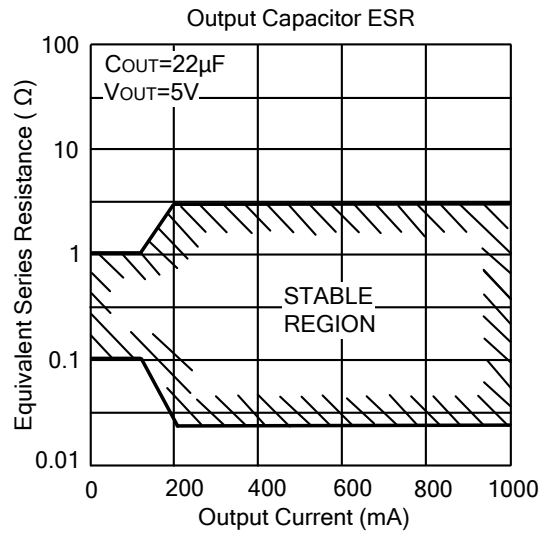
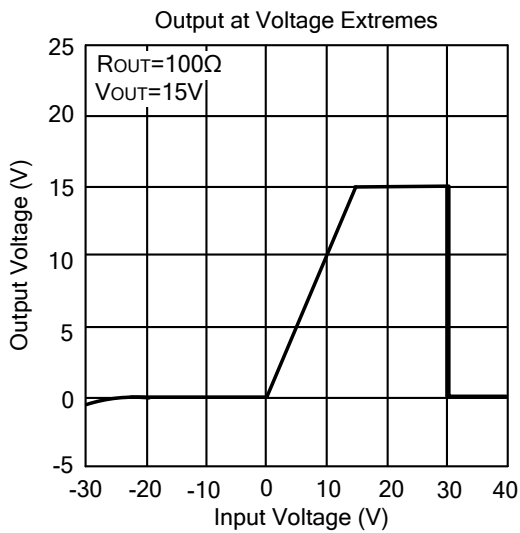
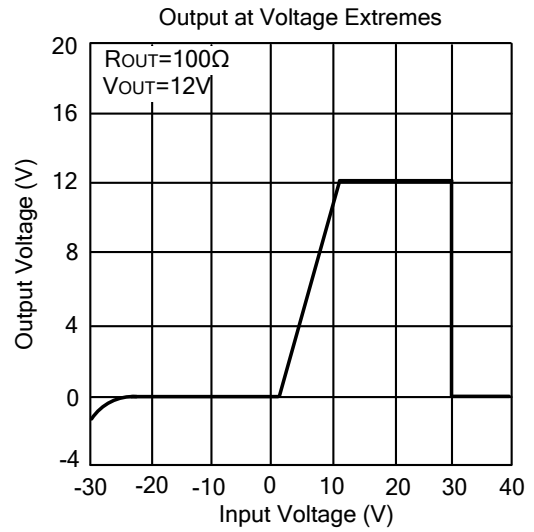
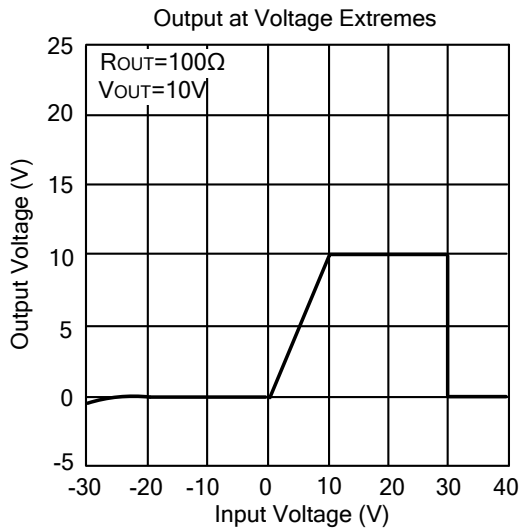
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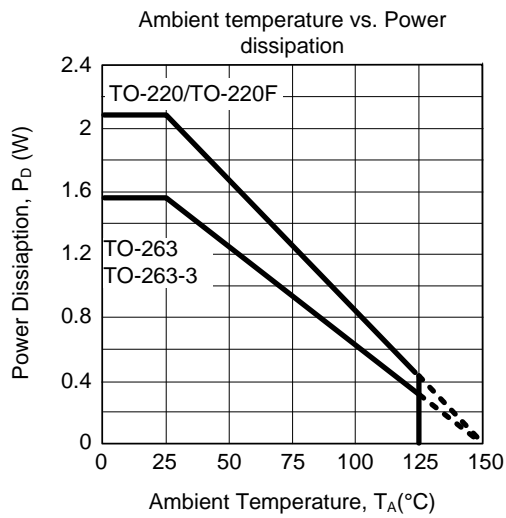
■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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