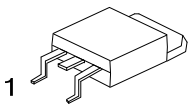
# 78DXXAA

**LINEAR INTEGRATED CIRCUIT**

## 3-TERMINALS 1.5A POSITIVE VOLTAGE REGULATOR




TO-252

### ■ DESCRIPTION

The UTC **78DXXAA** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 1.5 A.

### ■ FEATURES

* Peak output current up to 1.5A.
* Fixed output voltage of 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V and 18V available.
* Thermal overload shutdown protection.
* Short circuit current limiting.
* Output transistor SOA protection.

### ■ ORDERING INFORMATION

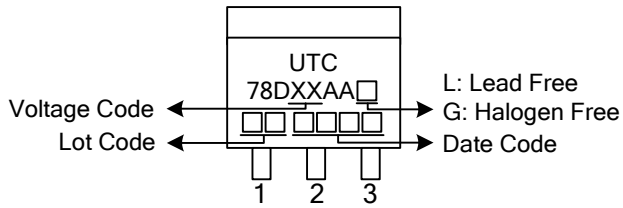
| Ordering Number | | Package | Pin Assignment | | | Packing |
|---|---|---|---|---|---|---|
| Lead Free | Halogen Free | | 1 | 2 | 3 | |
| 78DXXAAL-TN3-R | 78DXXAAG-TN3-R | TO-252 | I | G | O | Tape Reel |
| 78DXXAAL-TN3-T | 78DXXAAG-TN3-T | TO-252 | I | G | O | Tube |

Note: Pin Code: I: Input G: GND O: Output

78DXXAAG-TN3-R

| | |
|---|---|
| (1)Packing Type | (1) R: Tape Reel, T: Tube |
| (2)Package Type | (2) TN3: TO-252 |
| (3)Lead Free | (3) G: Halogen Free and Lead Free, L: Lead Free |
| (4)Output Voltage Code | (4) XX: refer to Marking Information |

### ■ MARKING INFORMATION

| PACKAGE | VOLTAGE CODE | MARKING |
|---|---|---|
| TO-252 | 05: 5V<br>06: 6V<br>07: 7V<br>08: 8V<br>09: 9V<br>10: 10V<br>12: 12V<br>15: 15V<br>18: 18V |  |

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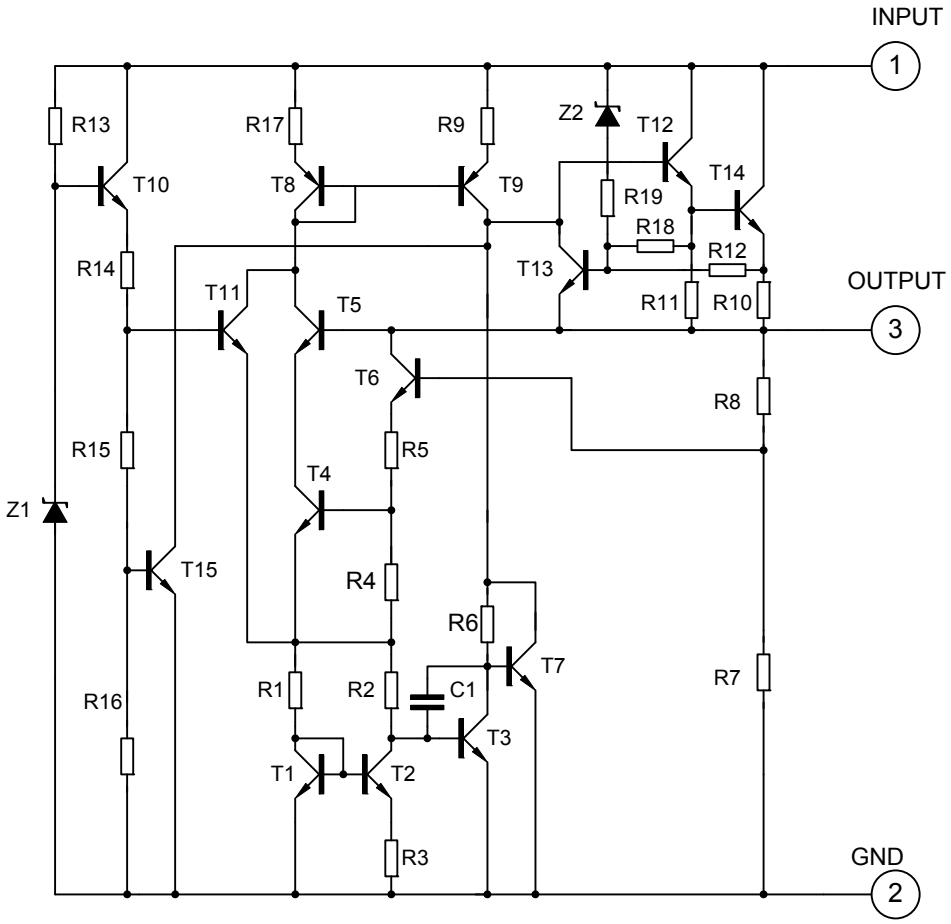
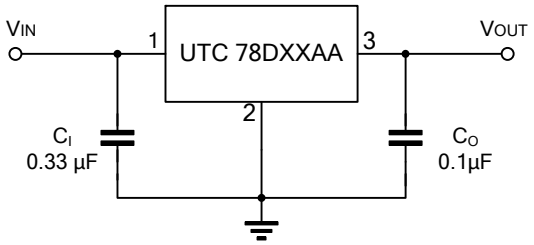
## ■ BLOCK DIAGRAM




## ■ APPLICATION CIRCUIT




Note: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

## ■ ABSOLUTE MAXIMUM RATINGS ($T_A$=25°C, unless otherwise specified)

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Input Voltage | $V_{IN}$ | 35 | V |
| Output Current | $I_{OUT}$ | 1.5 | A |
| Power Dissipation ($T_C$=25°C) | $P_D$ | 10 | W |
| Junction Temperature | $T_J$ | +150 | °C |
| Operating Temperature | $T_{OPR}$ | -40 ~ +125 | °C |
| Storage Temperature | $T_{STG}$ | -55 ~ +150 | °C |

Notes: 1. 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.

2. The maximum steady state usable output current are dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB. The data are showed as electrical characteristics table represents pulse test conditions with junction temperatures specified at the initiation of test.

## ■ THERMAL DATA

| PARAMETER | SYMBOL | RATINGS | UNIT |
|---|---|---|---|
| Junction to Ambient | $\theta_{JA}$ | 112 | °C/W |
| Junction to Case | $\theta_{JC}$ | 12.5 | °C/W |

## ■ ELECTRICAL CHARACTERISTICS

($T_J$=25°C, $C_I$ =0.33uF, $C_O$=0.1uF, $P_D \leq$15W, unless otherwise specified)

**For 78D05AA** ($V_{IN}$ =10V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 4.90 | 5.0 | 5.10 | V |
| | | $V_{IN}$ =7.5~20V, $I_{OUT}$ =5mA~1.0A | 4.85 | | 5.15 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 100 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 50 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =7~25V | | | 50 | mV |
| | | $V_{IN}$ =7.5~20V, $I_{OUT}$ =1.0A | | | 50 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT} \leq$1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =7.5~20V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 40 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =8~18V,f=120Hz | 59 | 80 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

**For 78D06AA** ($V_{IN}$ =11V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 5.88 | 6.0 | 6.12 | V |
| | | $V_{IN}$ =8.5~21V, $I_{OUT}$ =5mA~1.0A | 5.82 | | 6.18 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 120 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 60 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =8~25V | | | 60 | mV |
| | | $V_{IN}$ =8.5~21V, $I_{OUT}$ =1.0A | | | 60 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =8.5~21V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 45 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =9~19V,f=120Hz | 56 | 75 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

**For 78D07AA** ($V_{IN}$ =13V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 6.86 | 7.0 | 7.14 | V |
| | | $V_{IN}$ =9.5~22V, $I_{OUT}$ =5mA~1.0A | 6.79 | | 7.21 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 140 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 70 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =9~25V | | | 70 | mV |
| | | $V_{IN}$ =9.5~22V, $I_{OUT}$ =1.0A | | | 70 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =9.5~22V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 50 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =10.5V~20.5V, f=120Hz | 56 | 75 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.7 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

**For 78D08AA** ($V_{IN}$ =14V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 7.84 | 8.0 | 8.16 | V |
| | | $V_{IN}$ =10.5~23V, $I_{OUT}$ =5mA~1.0A | 7.76 | | 8.24 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 160 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 80 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =10.5~25V | | | 80 | mV |
| | | $V_{IN}$ =10.5~23V, $I_{OUT}$ =1.0A | | | 80 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =10.5~23V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 58 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =11.5~21.5V,f=120Hz | 53 | 72 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

**For 78D09AA** ($V_{IN}$ =15V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 8.82 | 9.0 | 9.18 | V |
| | | $V_{IN}$ =11.5~24V, $I_{OUT}$ =5mA~1.0A | 8.73 | | 9.27 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 180 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 90 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =11.5~25V | | | 90 | mV |
| | | $V_{IN}$ =11.5~24V, $I_{OUT}$ =1.0A | | | 90 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =11.5~24V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 58 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =12.5~22.5V,f=120Hz | 53 | 72 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

**For 78D10AA** ($V_{IN}$ =16V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 9.8 | 10 | 10.2 | V |
| | | $V_{IN}$ =12.5~25V, $I_{OUT}$ =5mA~1.0A | 9.7 | | 10.3 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 200 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 100 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =13~25V | | | 100 | mV |
| | | $V_{IN}$ =13~25V, $I_{OUT}$ =1.0A | | | 100 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =12.6V~25V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 58 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =13~23V,f=120Hz | 53 | 72 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

**For 78D12AA** ($V_{IN}$ =19V, $I_{OUT}$ =0.5A)

| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 11.76 | 12 | 12.24 | V |
| | | $V_{IN}$ =14.5~27V, $I_{OUT}$ =5mA~1.0A | 11.64 | | 12.36 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 240 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 120 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =14.5~30V | | | 120 | mV |
| | | $V_{IN}$ =14.6~27V, $I_{OUT}$ =1.0A | | | 120 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =14.5~30V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 75 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =15~25V,f=120Hz | 52 | 72 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

## ■ ELECTRICAL CHARACTERISTICS(Cont.)

**For 78D15AA** ($V_{IN}$ =23V, $I_{OUT}$ =0.5A)

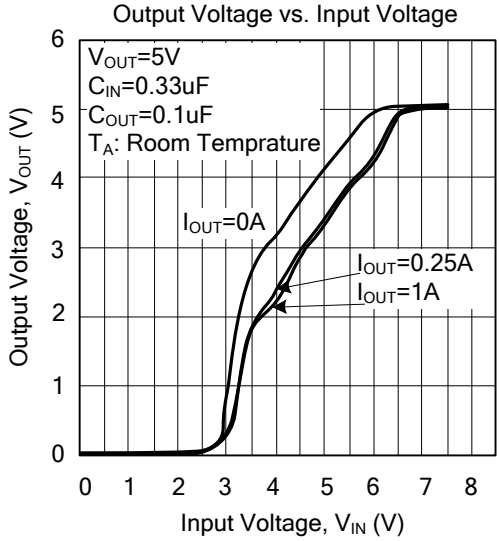
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$ =5mA~1.0A | 14.70 | 15 | 15.30 | V |
| | | $V_{IN}$ =17.5~30V, $I_{OUT}$ =5mA~1.0A | 14.55 | | 15.45 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$ =5mA~1.5A | | | 300 | mV |
| | | $I_{OUT}$ =0.25A~0.75A | | | 150 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =18.5~30V | | | 150 | mV |
| | | $V_{IN}$ =17.7~30V, $I_{OUT}$ =1.0A | | | 150 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =17.5~30V | | | 1.0 | mA |
| | | $I_{OUT}$ =5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 90 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =18.5~28.5V,f=120Hz | 51 | 70 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

**For 78D18AA** ($V_{IN}$ =27V, $I_{OUT}$ =0.5A)

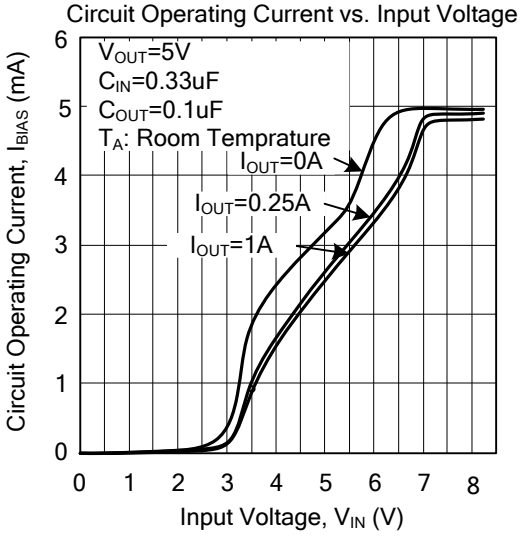
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $I_{OUT}$=5mA~1.0A | 17.64 | 18 | 18.36 | V |
| | | $V_{IN}$ =21~33V, $I_{OUT}$=5mA~1.0A | 17.46 | | 18.54 | V |
| Load Regulation | $\Delta V_{OUT}$ | $I_{OUT}$=5mA~1.5A | | | 360 | mV |
| | | $I_{OUT}$=0.25A~0.75A | | | 180 | mV |
| Line Regulation | $\Delta V_{OUT}$ | $V_{IN}$ =21~33V | | | 180 | mV |
| | | $V_{IN}$ =21~33V, $I_{OUT}$ =1.0A | | | 180 | mV |
| Quiescent Current | $I_Q$ | $I_{OUT}$≤1.0A | | | 8.0 | mA |
| Quiescent Current Change | $\Delta I_Q$ | $V_{IN}$ =21.5~33V | | | 1.0 | mA |
| | | $I_{OUT}$=5mA~1.0A | | | 0.5 | mA |
| Output Noise Voltage | eN | 10Hz≤f≤100kHz | | 110 | | μV |
| Ripple Rejection | RR | $V_{IN}$ =22~32V,f=120Hz | 50 | 69 | | dB |
| Peak Output Current | $I_{PEAK}$ | | | 1.8 | | A |
| Short-Circuit Current | $I_{SC}$ | $V_{IN}$ =35V | | 250 | | mA |
| Dropout Voltage | $V_D$ | $I_{OUT}$=1.5A | | 2.5 | | V |

## ■ TYPICAL CHARACTERISTICS

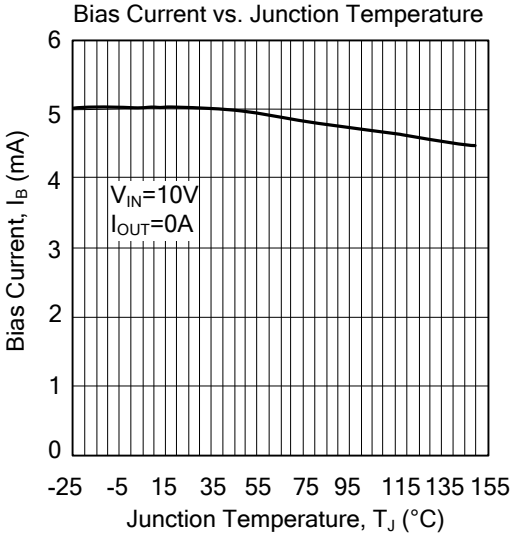
Output Voltage vs. Input Voltage



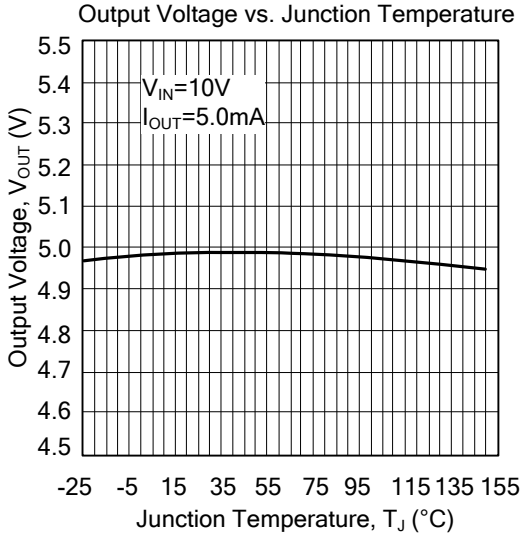

Circuit Operating Current vs. Input Voltage



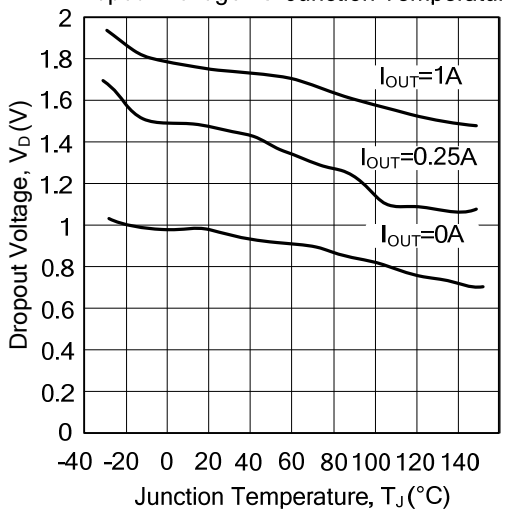

Bias Current vs. Junction Temperature



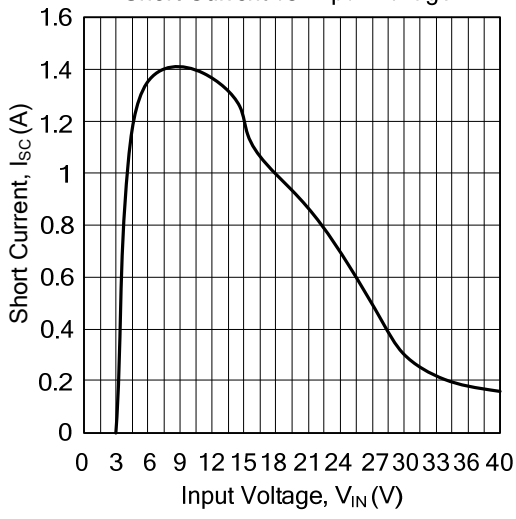

Output Voltage vs. Junction Temperature



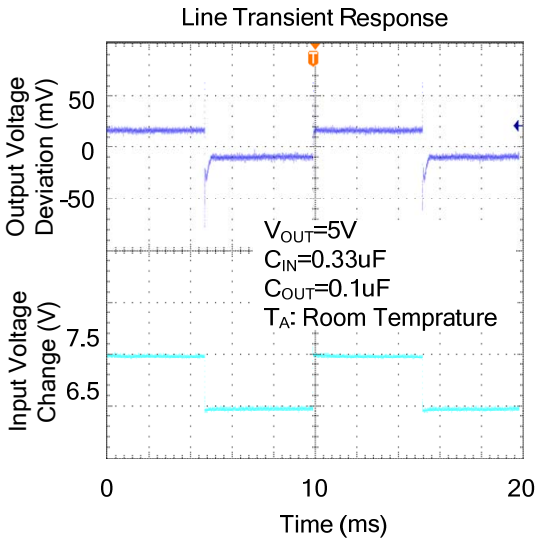

Dropout Voltage vs. Junction Temperature

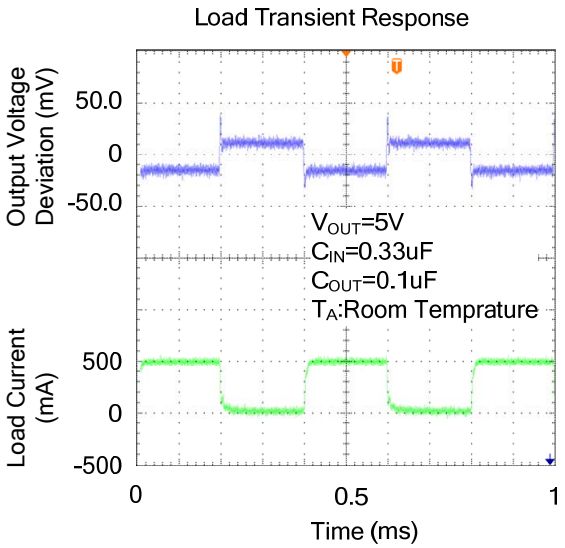



Short Current vs. Input Voltage



■ TYPICAL CHARACTERISTICS(Cont.)

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