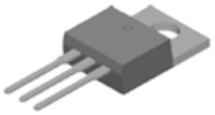
# 1A Ultra Low Dropout Voltage Regulator



TO-220

TO-263-3

SOT-223

DPAK (TO-252)

## General Description

- The LD2940 is a low dropout three-terminal regulator with a typical dropout of 280mV at 1A output current.
- The LD2940 provides current limit and thermal shutdown. On-chip thermal shutdown provides protection against any combination of high current and ambient temperature that would create excessive junction temperatures.
- The LD2940 has 1.2V, 1.8V, 2.5V, 3.3V and 5.0V versions.
- The LD2940 series is available in the industry standard TO-220, TO-263-3, DPAK(TO-252) and SOT-223 power packages. (Detailed information please refer to page 2 &3)

## Features

- Minimum Guaranteed Output Current: 1A
- Dropout Voltage at IOUT=1A: 280mV Typ. (Except 1.2V and 1.8V Versions)
- Output Accuracy: ± 1%
- Low Ground Current
- Internal Current Limit and Thermal Protection
- Reversed-battery and Reversed-lead Insertion Protection
- Fast Transient Response

RoHS Compliant

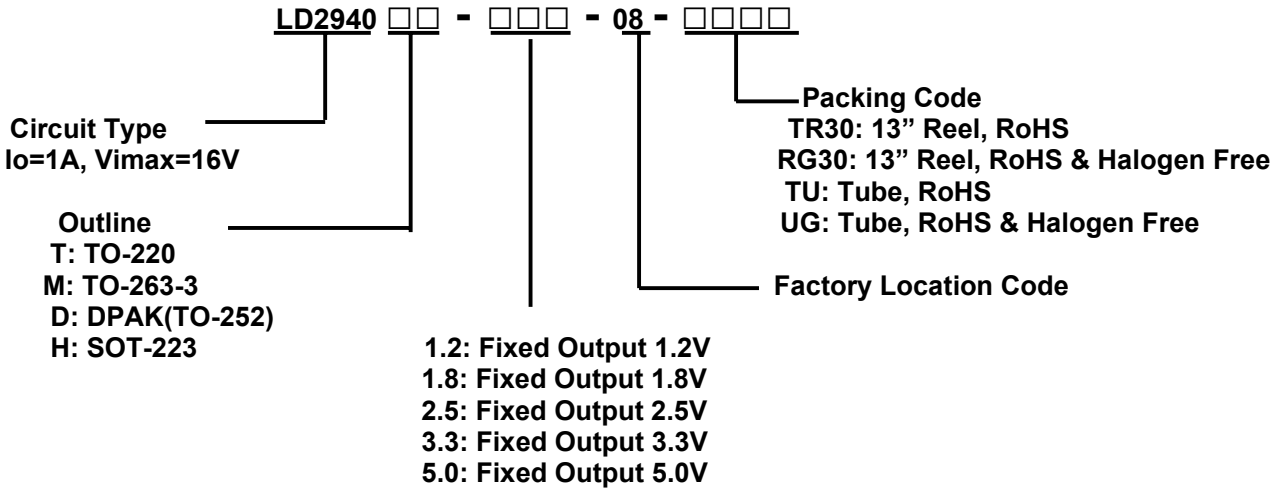
HALOGEN FREE

## Applications

- LCD TV
- Set Top Box
- LCD Monitor
- SMPS Post Regulator
- Laptop, Palmtop and Notebook
- Portable Instrumentation
- USB Power Supply

# LD2940 Series

## Ordering Information




## Marking Information

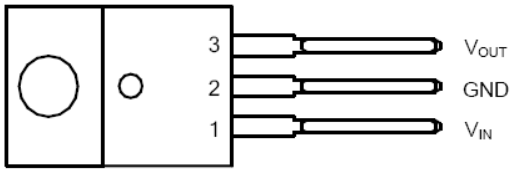
| Outline | Temperature Range | PN | | Marking Code | | Packing Type |
|---|---|---|---|---|---|---|
| | | ROHS | Halogen Free | ROHS | Halogen Free | |
| TO-220 | -40°C to 125°C | LD2940T-3.3-08-TU | LD2940T-3.3-08-UG | AZ2940T -3.3E1 | AZ2940T -3.3G1 | Tube |
| | | LD2940T-5.0-08-TU | LD2940T-5.0-08-UG | AZ2940T -5.0E1 | AZ2940T -5.0G1 | Tube |
| TO-263-3 | -40°C to 125°C | LD2940M-3.3-08-TU | LD2940M-3.3-08-UG | AZ2940S -3.3E1 | AZ2940S -3.3G1 | Tube |
| | | LD2940M-3.3-08-TR30 | LD2940M-3.3-08-RG30 | AZ2940S -3.3E1 | AZ2940S -3.3G1 | Tape & Reel |
| | | LD2940M-5.0-08-TU | LD2940M-5.0-08-UG | AZ2940S -5.0E1 | AZ2940S -5.0G1 | Tube |
| | | LD2940M-5.0-08-TR30 | LD2940M-5.0-08-RG30 | AZ2940S -5.0E1 | AZ2940S -5.0G1 | Tape & Reel |
| DPAK (TO-252) | -40°C to 125°C | | LD2940D-1.2-08-UG | | AZ2940D -1.2G1 | Tube |
| | | | LD2940D-1.2-08-RG30 | | AZ2940D -1.2G1 | Tape & Reel |
| | | LD2940D-1.8-08-TU | LD2940D-1.8-08-UG | AZ2940D -1.8E1 | AZ2940D -1.8G1 | Tube |
| | | LD2940D-1.8-08-TR30 | LD2940D-1.8-08-RG30 | AZ2940D -1.8E1 | AZ2940D -1.8G1 | Tape & Reel |
| | | LD2940D-2.5-08-TU | LD2940D-2.5-08-UG | AZ2940D -2.5E1 | AZ2940D -2.5G1 | Tube |
| | | LD2940D-2.5-08-TR30 | LD2940D-2.5-08-RG30 | AZ2940D -2.5E1 | AZ2940D -2.5G1 | Tape & Reel |

# LD2940 Series

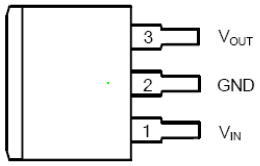
| Outline | Temperature Range | PN | | Marking Code | | Packing Type |
|---|---|---|---|---|---|---|
| | | ROHS | Halogen Free | ROHS | Halogen Free | |
| DPAK (TO-252) | -40°C to 125°C | LD2940D-3.3-08-TU | LD2940D-3.3-08-UG | AZ2940D -3.3E1 | AZ2940D -3.3G1 | Tube |
| | | LD2940D-3.3-08-TR30 | LD2940D-3.3-08-RG30 | AZ2940D -3.3E1 | AZ2940D -3.3G1 | Tape & Reel |
| | | LD2940D-5.0-08-TU | LD2940D-5.0-08-UG | AZ2940D -5.0E1 | AZ2940D -5.0G1 | Tube |
| | | LD2940D-5.0-08-TR30 | LD2940D-5.0-08-RG30 | AZ2940D -5.0E1 | AZ2940D -5.0G1 | Tape & Reel |
| SOT-223 | -40°C to 125°C | | LD2940H-1.2-08-RG30 | | GH12B | Tape & Reel |
| | | | LD2940H-1.8-08-RG30 | | GH12F | |
| | | | LD2940H-2.5-08-RG30 | | GH12G | |
| | | | LD2940H-3.3-08-RG30 | | GH12H | |
| | | | LD2940H-5.0-08-RG30 | | GH12J | |

## Pin Configuration (Top View)

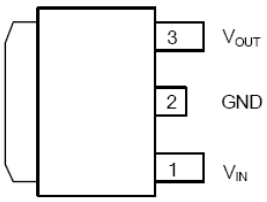
### TO-220

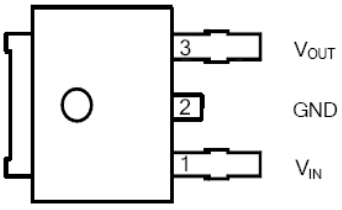



### TO-263-3

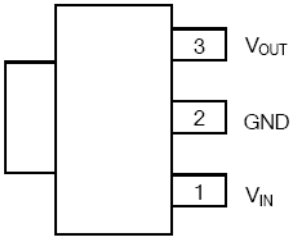



### DPAK(TO-252)



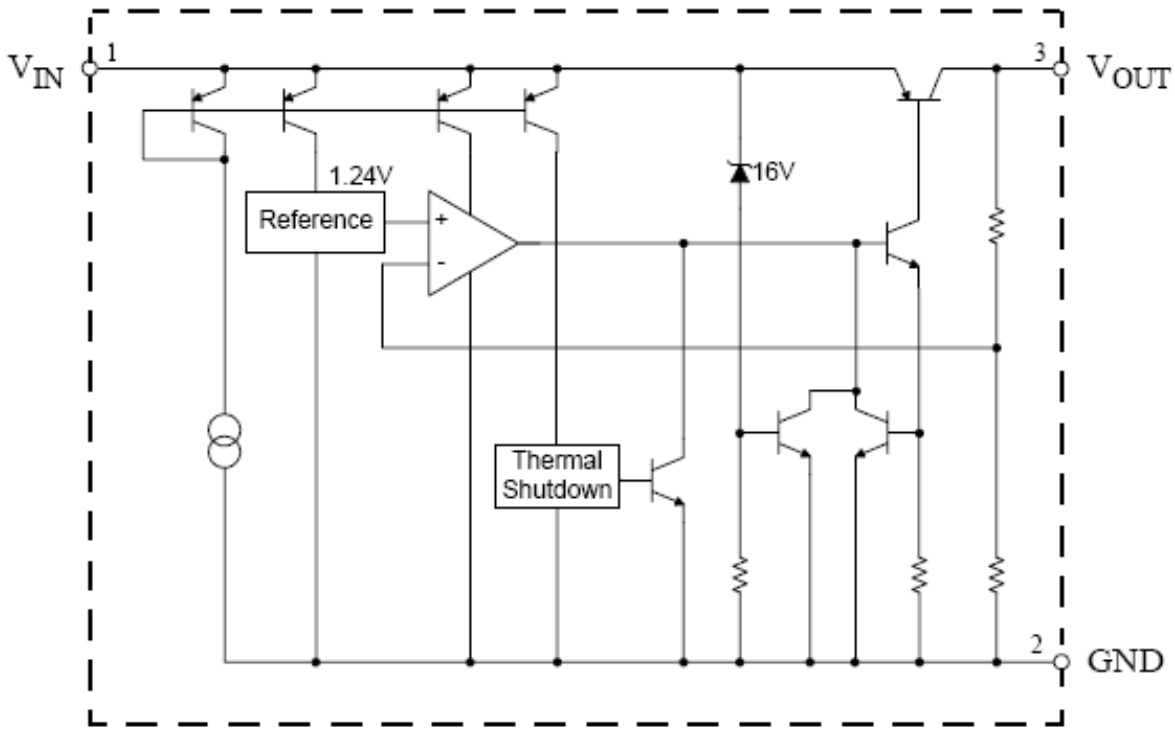

### SOT-233



## Pin Description

| Pin Number | Pin Name | Function |
|---|---|---|
| 1 | VIN | Unregulated Input |
| 2 | GND | Ground pin. This pin and TAB are internally connected |
| 3 | VOUT | Regulated output |

## Functional Block Diagram



## Absolute Maximum Ratings (Note 1)

| Symbol | Description | Ratings | | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | 16 | | V |
| $T_J$ | Operating Junction Temperature | 150 | | °C |
| $T_{STG}$ | Storage Temperature Range | -65 to 150 | | °C |
| $T_{LEAD}$ (10 sec) | Lead Soldering Temperature | 260 | | °C |
| $\theta_{JA}$ | Thermal Resistance | TO-220 | 60 | °C/W |
| | | TO-263-3 | 60 | |
| | | DPAK (TO-252) | 100 | |
| | | SOT-223 | 120 | |
| **ESD** | ESD (Machine model) | 300 | | V |
| **ESD** | ESD (Human Body model) | 5000 | | V |

**Note 1:** Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

## Recommended Operating Conditions

| Symbol | Description | Min. | Max. | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | 2.5 | 13.2 | V |
| $T_J$ | Operating Junction Temperature | -40 | 125 | °C |

## Electrical Characteristics

**For LD2940-1.2** ($V_{IN}$=2.5V, $I_{OUT}$=10mA, $C_{IN}$=10µF, $C_{OUT}$=10µF, $T_J$=25°C, **Bold** typeface applies over -40°C≤$T_J$≤125°C, unless otherwise specified.)

| Symbol | Description | Min. | Typ. | Max. | Unit | Conditions | |
|---|---|---|---|---|---|---|---|
| **$V_{OUT}$** | Output Voltage | 1.188 | 1.2 | 1.212 | V | $I_{OUT}$=10mA | |
| | | **1.176** | **1.2** | **1.224** | | 10mA≤$I_{OUT}$≤1A, 2.5V≤$V_{IN}$≤13.2V | |
| **$V_{RLINE}$** | Line Regulation | | 3.6 | 18 | mV | $I_{OUT}$=10mA, 2.5V≤$V_{IN}$≤13.2V | |
| **$V_{RLOAD}$** | Load Regulation | | 5.4 | 27 | mV | $V_{IN}$=2.5V, 10mA≤$I_{OUT}$≤1A | |
| **$\Delta V_{OUT}/\Delta T$** | Out Voltage Temperature Coefficient | | | **180** | µV/°C | $I_{OUT}$=10mA | |
| **$I_{GND}$** | Ground Current | | 12 | **25** | mA | $V_{IN}$=2.5V | $I_{OUT}$=750mA |
| | | | 18 | | | | $I_{OUT}$=1A |
| **$I_{SC}$** | Short Circuit Current | 1.5 | 2.2 | | A | $V_{OUT}$=0V (Note 2) | |
| **$I_{LOAD(MIN)}$** | Minimum Load Current | | 1 | 5 | mA | | |
| | Output Noise Voltage (rms) | | 400 | | µV | 10Hz to 100KHz, $I_{OUT}$=100mA, $C_{OUT}$=10µF | |
| **$\theta_{JC}$** | Thermal Resistance | | 7.8 | | °C/W | DPAK(TO-252) | |
| | | | 29.7 | | | SOT-223 | |

**Note 2:** $V_{IN}$=$V_{OUT(NOMINAL)}$+1V

**For LD2940-1.8** ($V_{IN}$=2.8V, $I_{OUT}$=10mA, $C_{IN}$=10µF, $C_{OUT}$=10µF, $T_J$=25°C, **Bold** typeface applies over -40°C≤$T_J$≤125°C, unless otherwise specified.)

| Symbol | Description | Min. | Typ. | Max. | Unit | Conditions | |
|---|---|---|---|---|---|---|---|
| **$V_{OUT}$** | Output Voltage | 1.782 | 1.8 | 1.818 | V | $I_{OUT}$=10mA | |
| | | **1.764** | **1.8** | **1.836** | | 10mA≤$I_{OUT}$≤1A, 2.8V≤$V_{IN}$≤13.2V | |
| **$V_{RLINE}$** | Line Regulation | | 3.6 | 18 | mV | $I_{OUT}$=10mA, 2.8V≤$V_{IN}$≤13.2V | |
| **$V_{RLOAD}$** | Load Regulation | | 5.4 | 27 | mV | $V_{IN}$=2.8V, 10mA≤$I_{OUT}$≤1A | |
| **$\Delta V_{OUT}/\Delta T$** | Out Voltage Temperature Coefficient | | **36** | **180** | µV/°C | $I_{OUT}$=10mA | |
| **$V_{DROP}$** | Dropout Voltage (Note 3) | | 290 | **500** | mV | $\Delta V_{OUT}$=1% | $I_{OUT}$=100mA |
| | | | 330 | **750** | | | $I_{OUT}$=1A |
| **$I_{GND}$** | Ground Current | | 12 | **25** | mA | $V_{IN}$=2.8V | $I_{OUT}$=750mA |
| | | | 18 | | | | $I_{OUT}$=1A |
| **$I_{SC}$** | Short Circuit Current | 1.5 | 2.2 | | A | $V_{OUT}$=0V (Note 2) | |
| **$I_{LOAD(MIN)}$** | Minimum Load Current | | 1 | 5 | mA | | |
| | Output Noise Voltage (rms) | | 400 | | µV | 10Hz to 100KHz, $I_{OUT}$=100mA, $C_{OUT}$=10µF | |
| **$\theta_{JC}$** | Thermal Resistance | | 7.8 | | °C/W | DPAK(TO-252) | |
| | | | 29.7 | | | SOT-223 | |

**Note 2:** $V_{IN}$=$V_{OUT(NOMINAL)}$+1V

**Note 3:** Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT}$+1V applied to $V_{IN}$. In application, $V_{IN}$ should be no less than 2.5V.

**For LD2940-2.5** ($V_{IN}$=3.5V, $I_{OUT}$=10mA, $C_{IN}$=10µF, $C_{OUT}$=10µF, $T_J$=25°C, **Bold** typeface applies over -40°C≤$T_J$≤125°C, unless otherwise specified.)

| Symbol | Description | Min. | Typ. | Max. | Unit | Conditions | |
|---|---|---|---|---|---|---|---|
| **$V_{OUT}$** | Output Voltage | 2.475 | 2.5 | 2.525 | V | $I_{OUT}$=10mA | |
| | | **2.45** | **2.5** | **2.55** | | 10mA≤$I_{OUT}$≤1A, 3.5V≤$V_{IN}$≤13.2V | |
| **$V_{RLINE}$** | Line Regulation | | 5.0 | 25 | mV | $I_{OUT}$=10mA, 3.5V≤$V_{IN}$≤13.2V | |
| **$V_{RLOAD}$** | Load Regulation | | 7.5 | 37.5 | mV | $V_{IN}$=3.5V, 10mA≤$I_{OUT}$≤1A | |
| **$\Delta V_{OUT}/\Delta T$** | Out Voltage Temperature Coefficient | | **50** | **250** | µV/°C | $I_{OUT}$=10mA | |
| **$V_{DROP}$** | Dropout Voltage (Note 4) | | 70 | **200** | mV | $\Delta V_{OUT}$=1% | $I_{OUT}$=100mA |
| | | | 280 | **550** | | | $I_{OUT}$=1A |
| **$I_{GND}$** | Ground Current | | 12 | **25** | mA | $V_{IN}$=3.5V | $I_{OUT}$=750mA |
| | | | 18 | | | | $I_{OUT}$=1A |
| **$I_{SC}$** | Short Circuit Current | 1.5 | 2.2 | | A | $V_{OUT}$=0V (Note 2) | |
| **$I_{LOAD(MIN)}$** | Minimum Load Current | | 1 | 5 | mA | | |
| | Output Noise Voltage (rms) | | 400 | | µV | 10Hz to 100KHz, $I_{OUT}$=100mA, $C_{OUT}$=10µF | |
| **$\theta_{JC}$** | Thermal Resistance | | 7.8 | | °C/W | DPAK(TO-252) | |
| | | | 29.7 | | | SOT-223 | |

**Note 2:** $V_{IN}$=$V_{OUT(NOMINAL)}$+1V

**Note 4:** Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT}$+1V applied to $V_{IN}$.

**For LD2940-3.3** ($V_{IN}$=4.3V, $I_{OUT}$=10mA, $C_{IN}$=10µF, $C_{OUT}$=10µF, $T_J$=25°C, **Bold** typeface applies over -40°C≤$T_J$≤125°C, unless otherwise specified.)

| Symbol | Description | Min. | Typ. | Max. | Unit | Conditions | |
|---|---|---|---|---|---|---|---|
| **$V_{OUT}$** | Output Voltage | 3.27 | 3.3 | 3.33 | V | $I_{OUT}$=10mA | |
| | | **3.23** | **3.3** | **3.37** | | 10mA≤$I_{OUT}$≤1A, 3.5V≤$V_{IN}$≤13.2V | |
| **$V_{RLINE}$** | Line Regulation | | 6.6 | 33 | mV | $I_{OUT}$=10mA, 3.5V≤$V_{IN}$≤13.2V | |
| **$V_{RLOAD}$** | Load Regulation | | 9.9 | 50 | mV | $V_{IN}$=3.5V, 10mA≤$I_{OUT}$≤1A | |
| **$\Delta V_{OUT}/\Delta T$** | Out Voltage Temperature Coefficient | | **66** | **330** | µV/°C | $I_{OUT}$=10mA | |
| **$V_{DROP}$** | Dropout Voltage (Note 4) | | 70 | **200** | mV | $\Delta V_{OUT}$=1% | $I_{OUT}$=100mA |
| | | | 280 | **550** | | | $I_{OUT}$=1A |
| **$I_{GND}$** | Ground Current | | 12 | **25** | mA | $V_{IN}$=3.5V | $I_{OUT}$=750mA |
| | | | 18 | | | | $I_{OUT}$=1A |
| **$I_{SC}$** | Short Circuit Current | 1.5 | 2.2 | | A | $V_{OUT}$=0V (Note 2) | |
| **$I_{LOAD(MIN)}$** | Minimum Load Current | | 1 | 5 | mA | | |
| | Output Noise Voltage (rms) | | 400 | | µV | 10Hz to 100KHz, $I_{OUT}$=100mA, $C_{OUT}$=10µF | |
| **$\theta_{JC}$** | Thermal Resistance | | 4.4 | | °C/W | TO-220 | |
| | | | 4.4 | | | TO-263-3 | |
| | | | 7.8 | | | DPAK(TO-252) | |
| | | | 29.7 | | | SOT-223 | |

**Note 2:** $V_{IN}$=$V_{OUT(NOMINAL)}$+1V

**Note 4:** Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT}$+1V applied to $V_{IN}$.

**For LD2940-5.0** ($V_{IN}$=6V, $I_{OUT}$=10mA, $C_{IN}$=10µF, $C_{OUT}$=10µF, $T_J$=25°C, **Bold** typeface applies over -40°C≤$T_J$≤125°C, unless otherwise specified.)

| Symbol | Description | Min. | Typ. | Max. | Unit | Conditions | |
|---|---|---|---|---|---|---|---|
| **$V_{OUT}$** | Output Voltage | 4.95 | 5.0 | 5.05 | V | $I_{OUT}$=10mA | |
| | | **4.90** | **5.0** | **5.10** | | 10mA≤$I_{OUT}$≤1A, 6V≤$V_{IN}$≤13.2V | |
| **$V_{RLINE}$** | Line Regulation | | 10 | 50 | mV | $I_{OUT}$=10mA, 6V≤$V_{IN}$≤13.2V | |
| **$V_{RLOAD}$** | Load Regulation | | 15 | 75 | mV | $V_{IN}$=6V, 10mA≤$I_{OUT}$≤1A | |
| **$\Delta V_{OUT}/\Delta T$** | Out Voltage Temperature Coefficient | | **100** | **500** | µV/°C | $I_{OUT}$=10mA | |
| **$V_{DROP}$** | Dropout Voltage (Note 4) | | 70 | **200** | mV | $\Delta V_{OUT}$=1% | $I_{OUT}$=100mA |
| | | | 280 | **550** | | | $I_{OUT}$=1A |
| **$I_{GND}$** | Ground Current | | 12 | **25** | mA | $V_{IN}$=6V | $I_{OUT}$=750mA |
| | | | 18 | | | | $I_{OUT}$=1A |
| **$I_{SC}$** | Short Circuit Current | 1.5 | 2.2 | | A | $V_{OUT}$=0V (Note 2) | |
| **$I_{LOAD(MIN)}$** | Minimum Load Current | | 1 | 5 | mA | | |
| | Output Noise Voltage (rms) | | 400 | | µV | 10Hz to 100KHz, $I_{OUT}$=100mA, $C_{OUT}$=10µF | |
| **$\theta_{JC}$** | Thermal Resistance | | 4.4 | | °C/W | TO-220 | |
| | | | 4.4 | | | TO-263-3 | |
| | | | 7.8 | | | DPAK(TO-252) | |
| | | | 29.7 | | | SOT-223 | |

**Note 2:** $V_{IN}$=$V_{OUT(NOMINAL)}$+1V

**Note 4:** Dropout voltage is defined as the input-to-output differential when the output voltage drops to 99% of its nominal value which is measured at $V_{OUT}$+1V applied to $V_{IN}$.

## Typical Characteristics Curves

**Fig.1- Line Regulation**

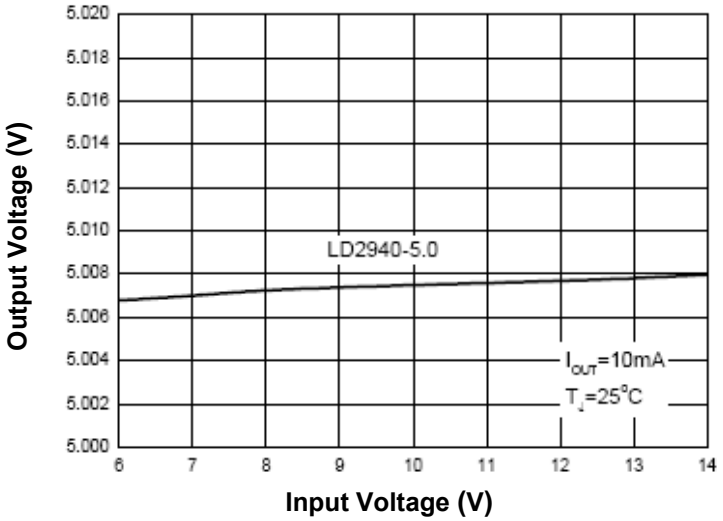



**Fig.2- Load Regulation**

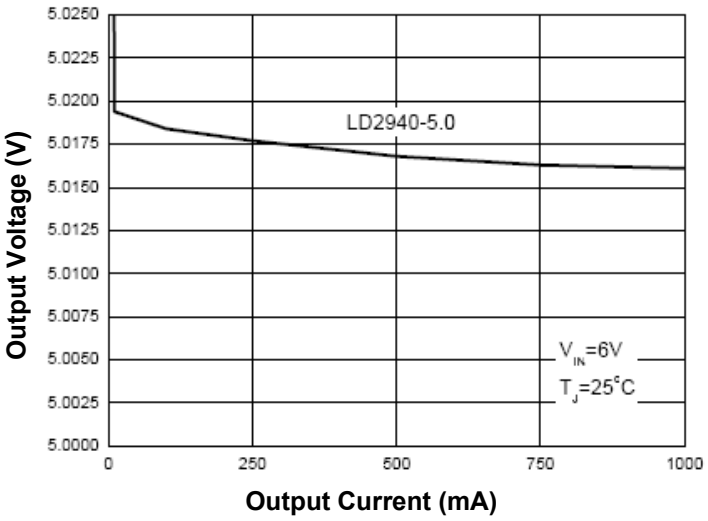



**Fig.3- Ground Current vs. Output Current**

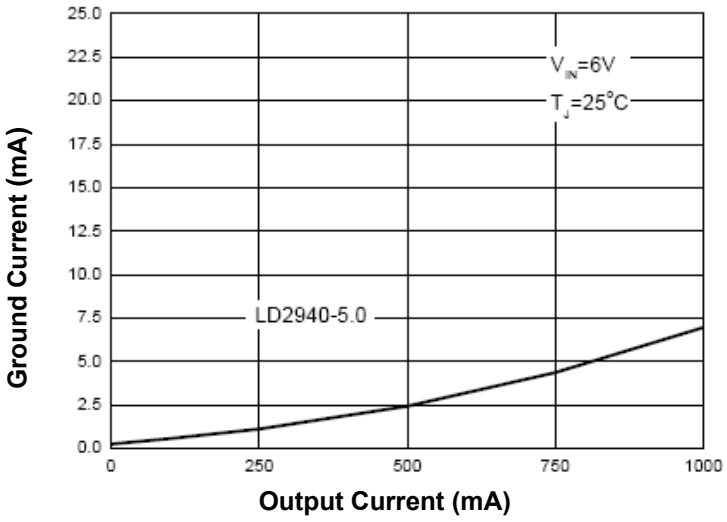



**Fig.4- Ground Current vs. Input Voltage**

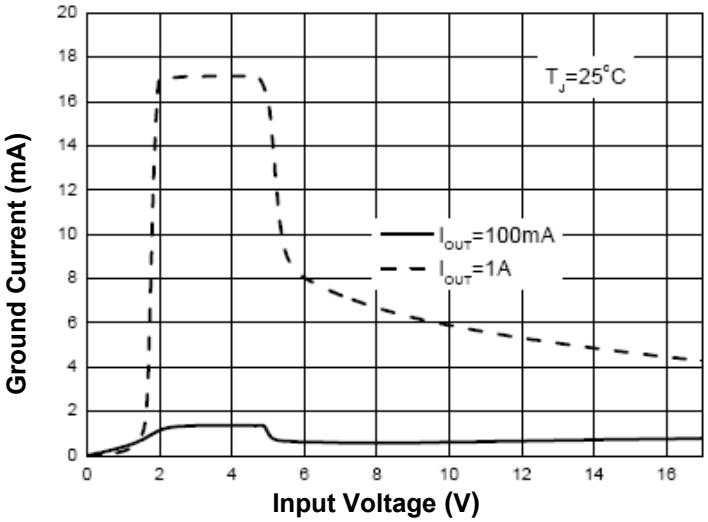


Fig.5- Dropout Voltage vs. Output Current

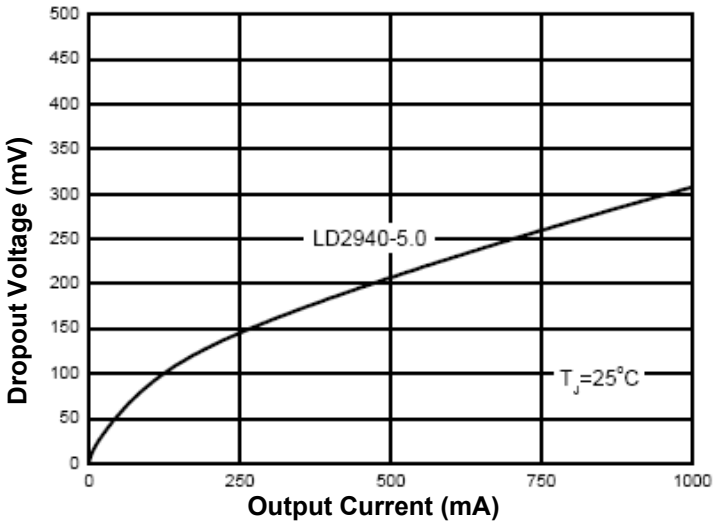



Fig.6- Ground Current vs. Junction Temperature

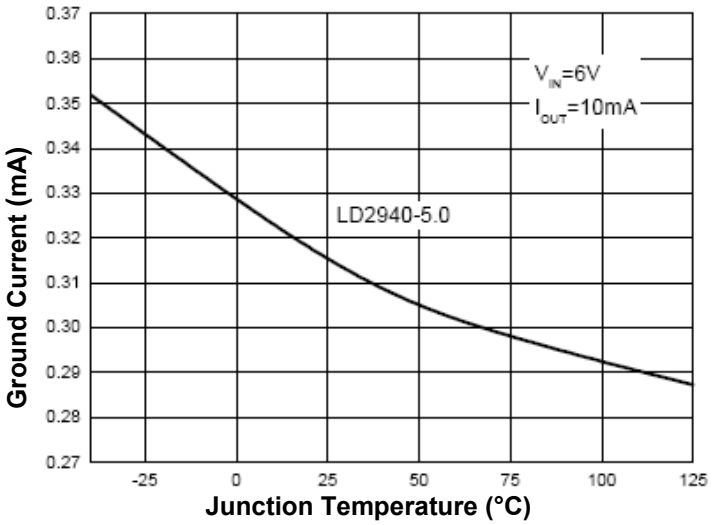



Fig.7- Ground Current vs. Junction Temperature

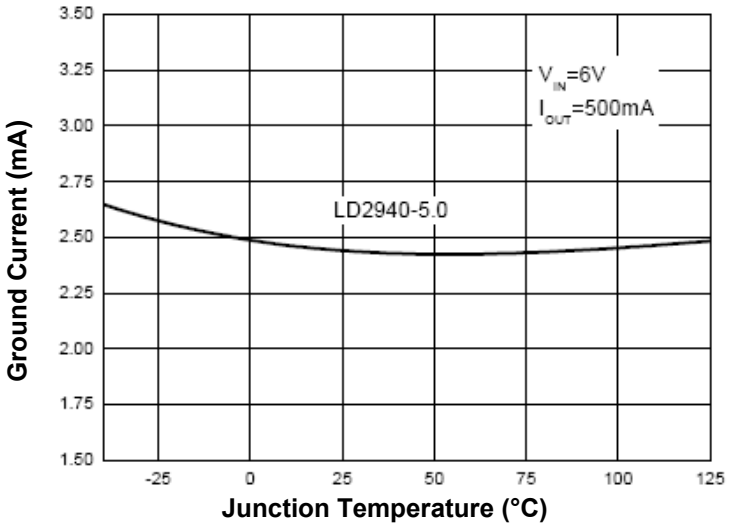



Fig.8- Ground Current vs. Junction Temperature

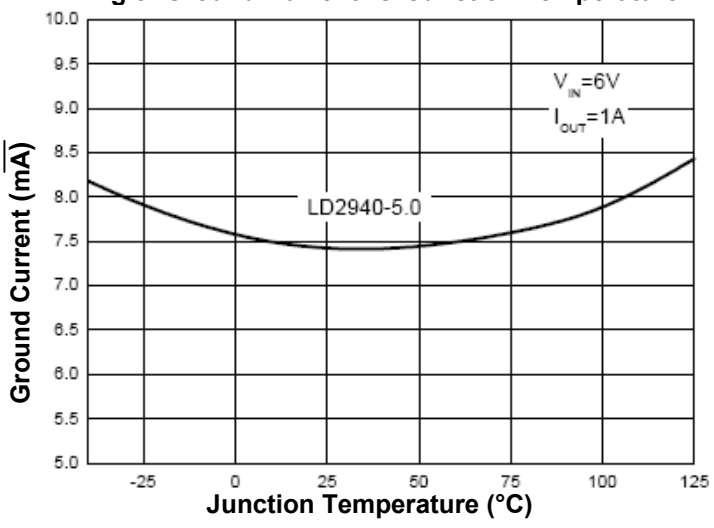


Fig.9- Dropout Voltage vs. Junction Temperature

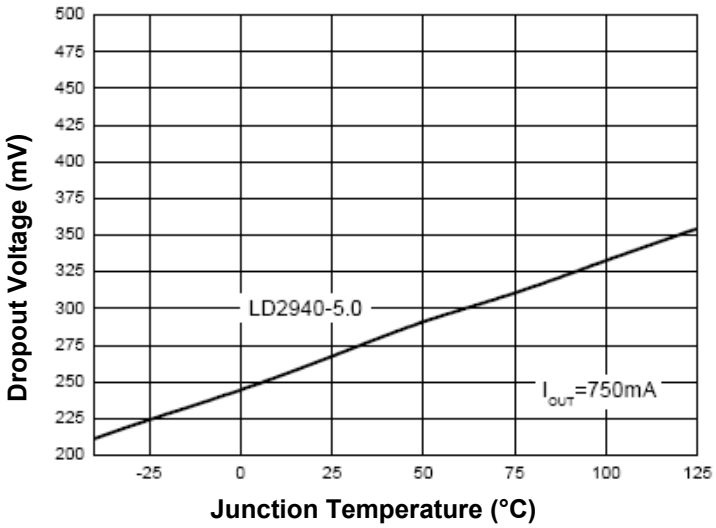



Fig.10- Dropout Voltage vs. Junction Temperature

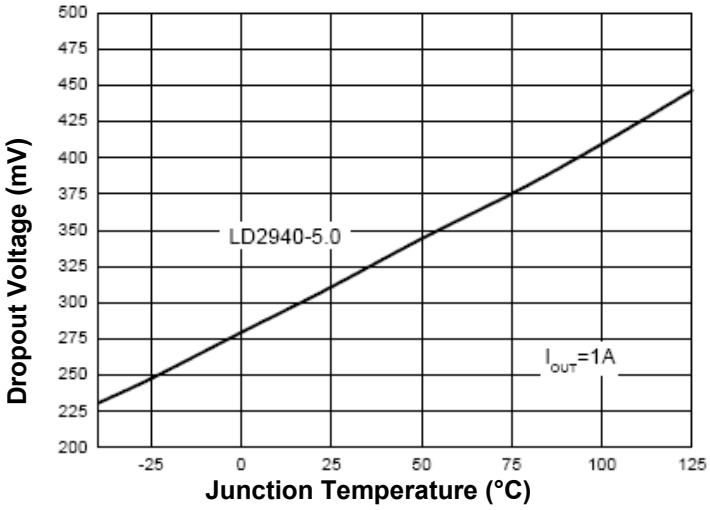



Fig.11- Output Voltage vs. Junction Temperature

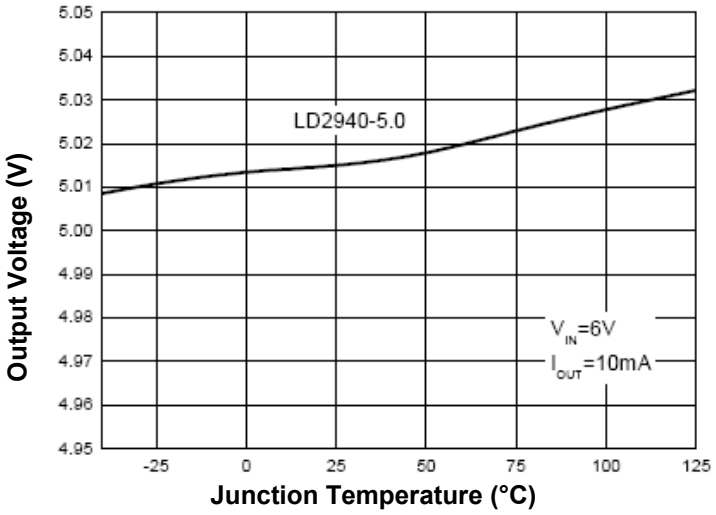



Fig.12- Output Capacitor ESR vs. Output Current (mA)

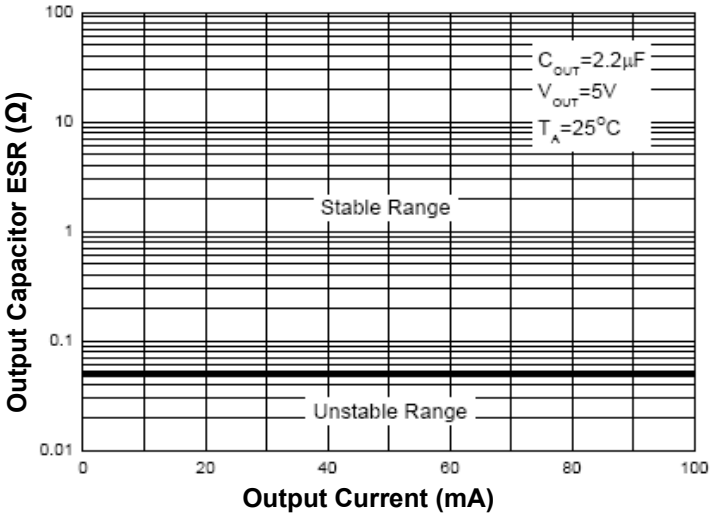


**Fig.13- Output Capacitor ESR vs. Output Current (mA)**

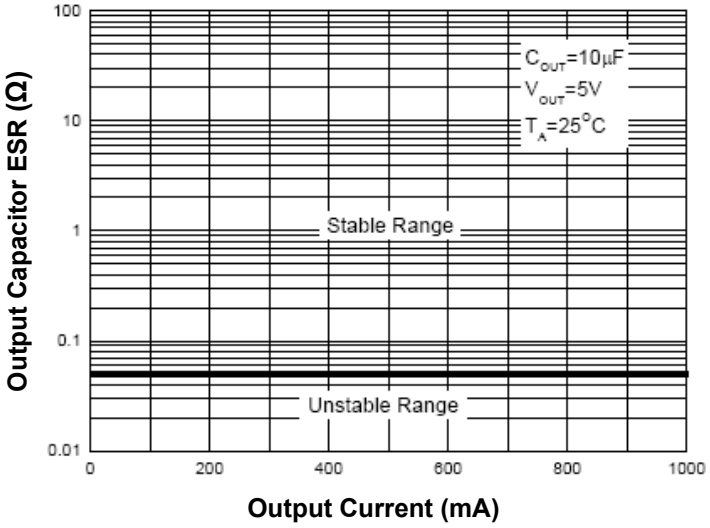



**Fig.14- Load Transient**

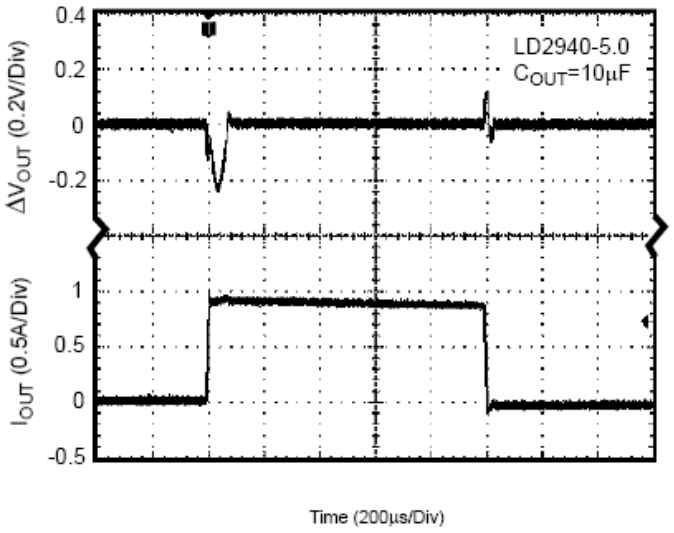



**Fig.15- Load Transient**

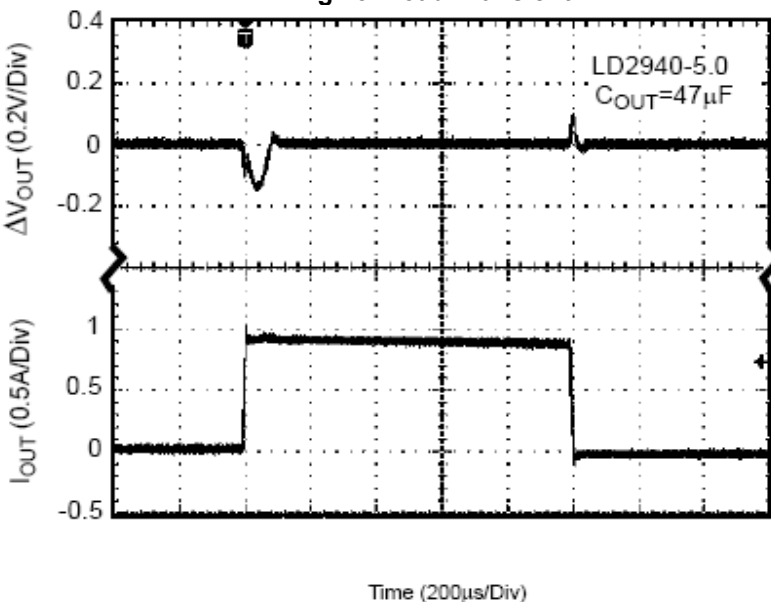



**Fig.16- Line Transient**

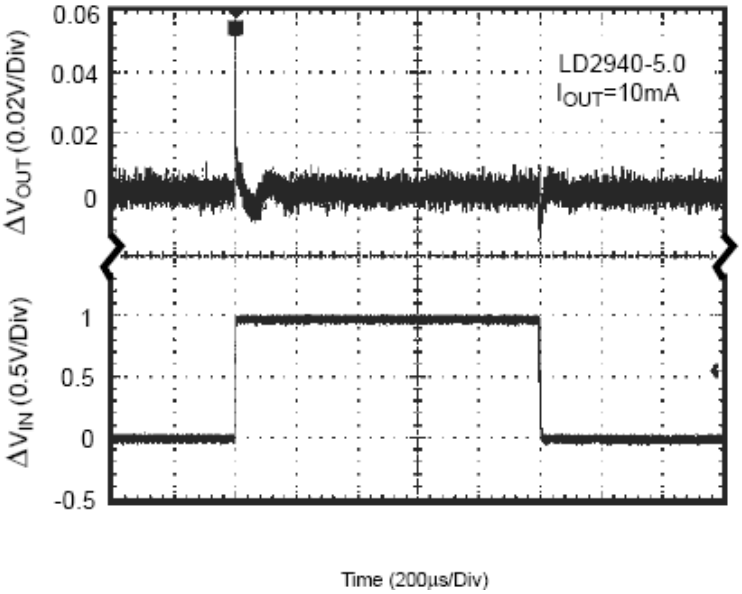


Fig.17- Power Dissipation vs. Case Temperature

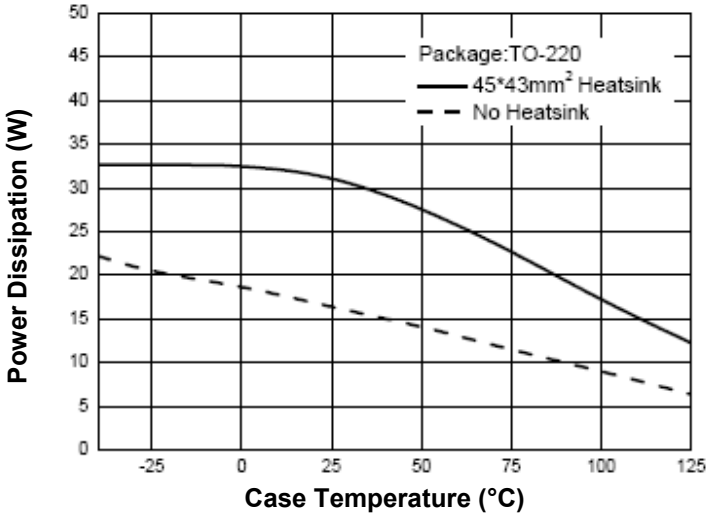



Fig.18- Power Dissipation vs. Case Temperature

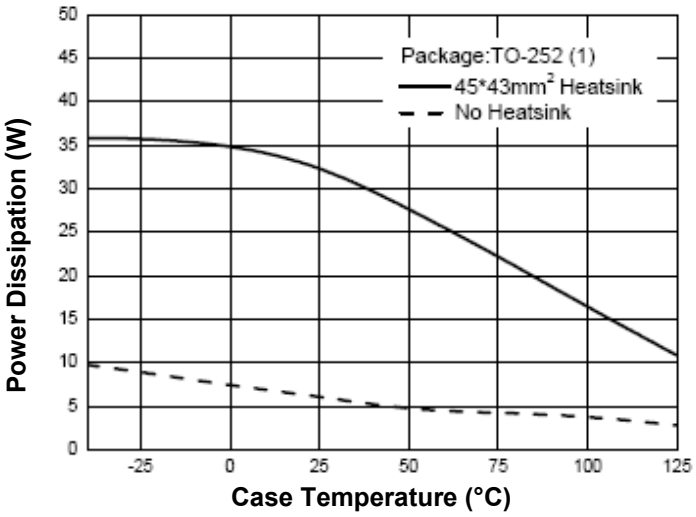
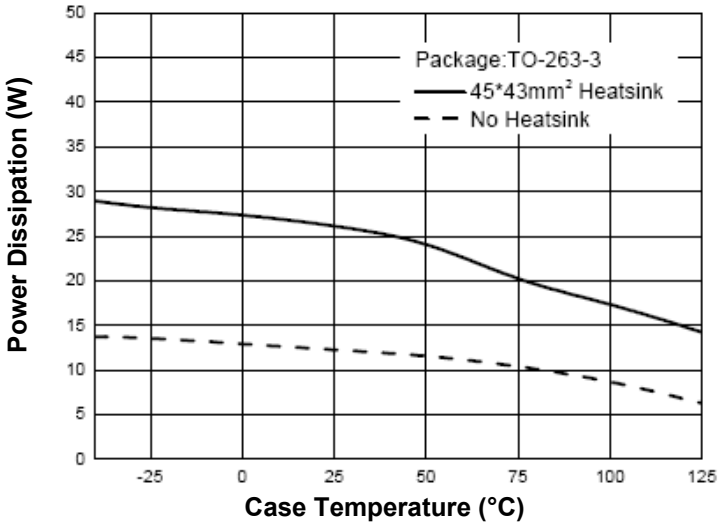
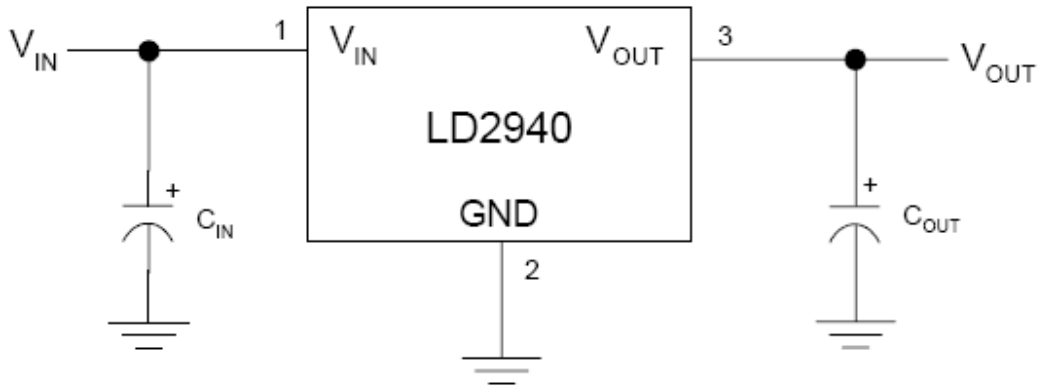



Fig.19- Power Dissipation vs. Case Temperature



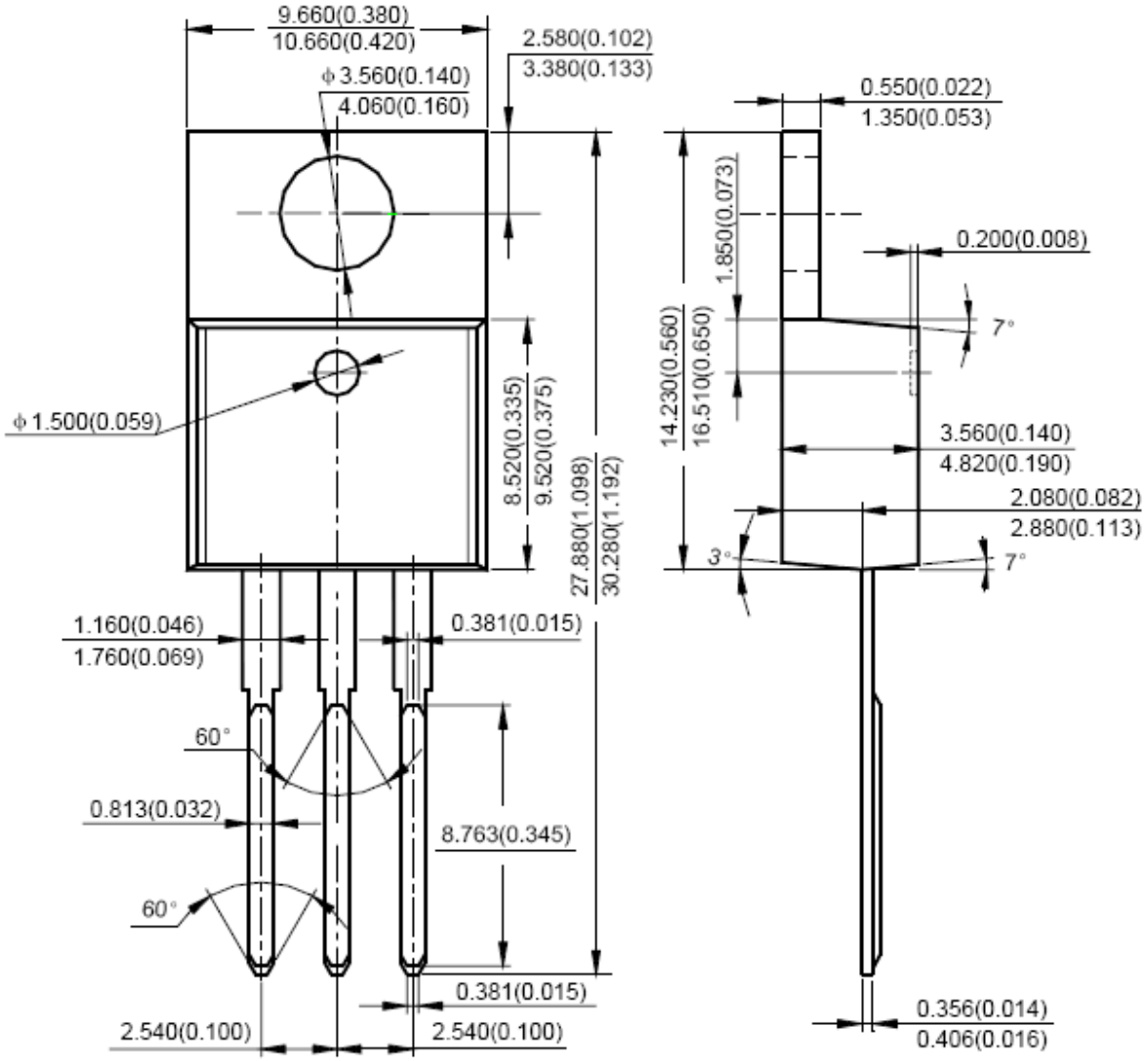
## Typical Applications



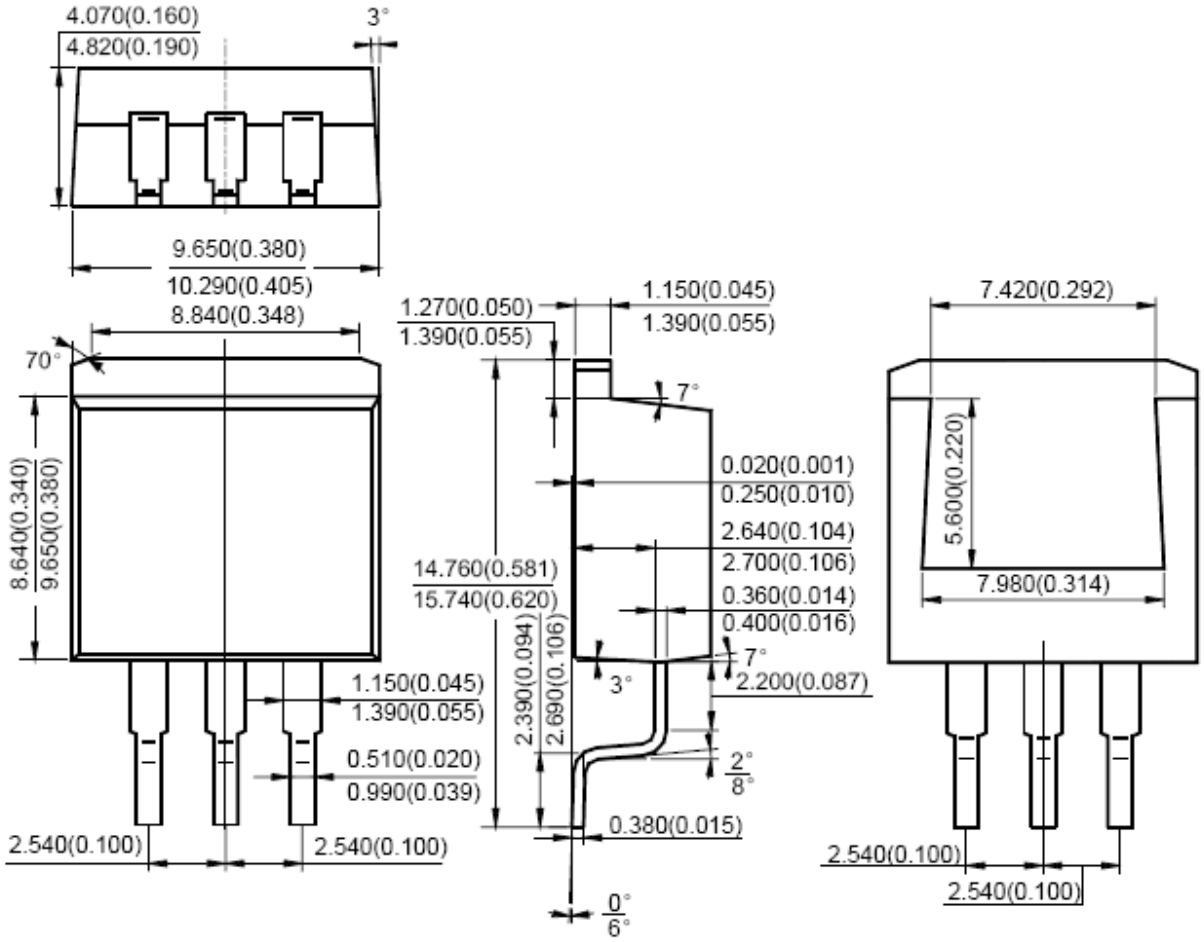

**Note 5:** CIN is required if regulator is located far from power supply filter and is recommended to be 0.47μF or greater. To maintain stability, COUT is recommended to be 2.2μF or greater. The ESR of this capacitor is critical, please see curve.

**Dimensions in mm (inch)**

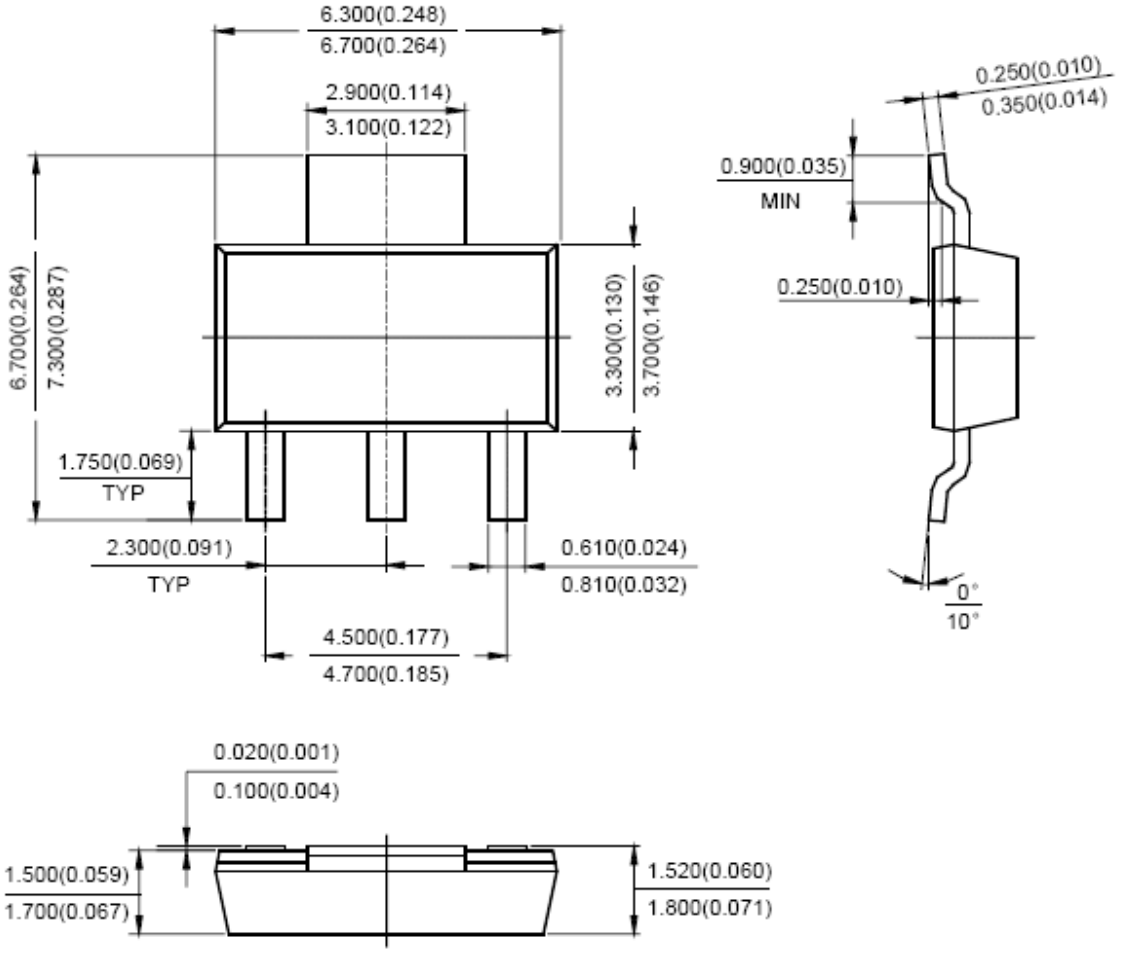
## TO-220



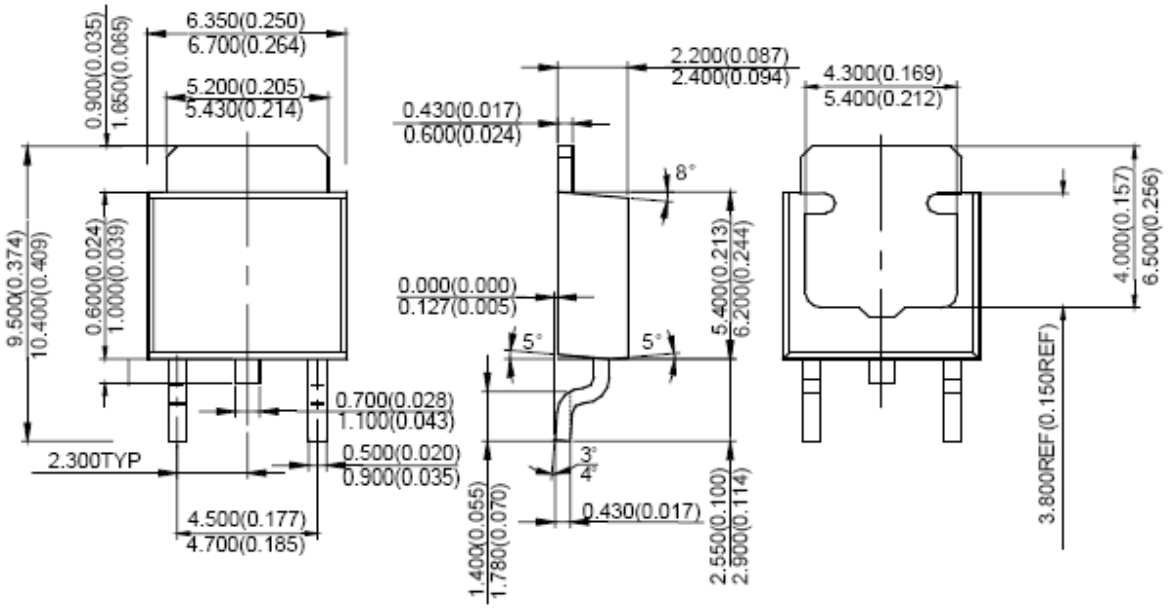
## TO-263-3

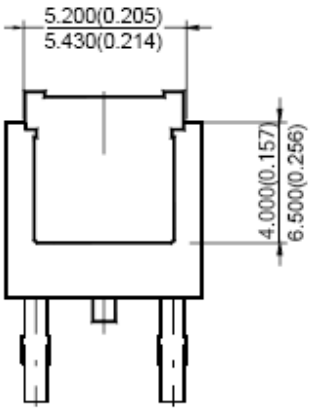

4.070(0.160)
4.820(0.190)
3°
9.650(0.380)
10.290(0.405)
8.840(0.348)
70°
8.640(0.340)
9.650(0.380)
1.150(0.045)
1.390(0.055)
0.510(0.020)
0.990(0.039)
2.540(0.100)
2.540(0.100)
1.270(0.050)
1.390(0.055)
1.150(0.045)
1.390(0.055)
7°
0.020(0.001)
0.250(0.010)
2.640(0.104)
2.700(0.106)
14.760(0.581)
15.740(0.620)
0.360(0.014)
0.400(0.016)
2.390(0.094)
2.690(0.106)
3°
7°
2.200(0.087)
2°
8°
0.380(0.015)
0°
6°
7.420(0.292)
5.600(0.220)
7.980(0.314)
2.540(0.100)
2.540(0.100)

## SOT-223


6.300(0.248)
6.700(0.264)
2.900(0.114)
3.100(0.122)
6.700(0.264)
7.300(0.287)
3.300(0.130)
3.700(0.146)
1.750(0.069)
TYP
2.300(0.091)
TYP
0.610(0.024)
0.810(0.032)
4.500(0.177)
4.700(0.185)
0.250(0.010)
0.350(0.014)
0.900(0.035)
MIN
0.250(0.010)
0°
10°
0.020(0.001)
0.100(0.004)
1.500(0.059)
1.700(0.067)
1.520(0.060)
1.800(0.071)

## DPAK(TO-252)




OPTIONAL
CONSTRUCTION

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