

#### DESCRIPTION

The LX8630 family are positive very low dropout regulators. They are designed to provide a power supply for very low headroom applications, such as 3.3V – 2.5V.

BiCMOS technology allows an effective series pass element resistance,  $R_{DS(ON)}$  of 150mΩ resulting in a typical dropout voltage of 450mV at 3A.

Low Quiescent Current and Logic-Controlled Shutdown help conserve battery life and increase system efficiency. Typical quiescent current is under 400μA irrespective of load current, while the

Shutdown current is only 10μA. The device will enter shutdown mode when the SHDN pin is pulled low.

**Thermal and Short-Circuit Current Limiting:** the LX8630 limits the current when the output is shorted, protecting the sensitive load circuits. The device will also turn off if the junction temperature exceeds 150°

**Available in Popular TO-220 and TO-263 Power Packages:** adjustable versions have five leads, and fixed output voltage devices are supplied in three lead packages.

**IMPORTANT:** For the most current data, consult MICROSEMI's website: <http://www.microsemi.com>

#### KEY FEATURES

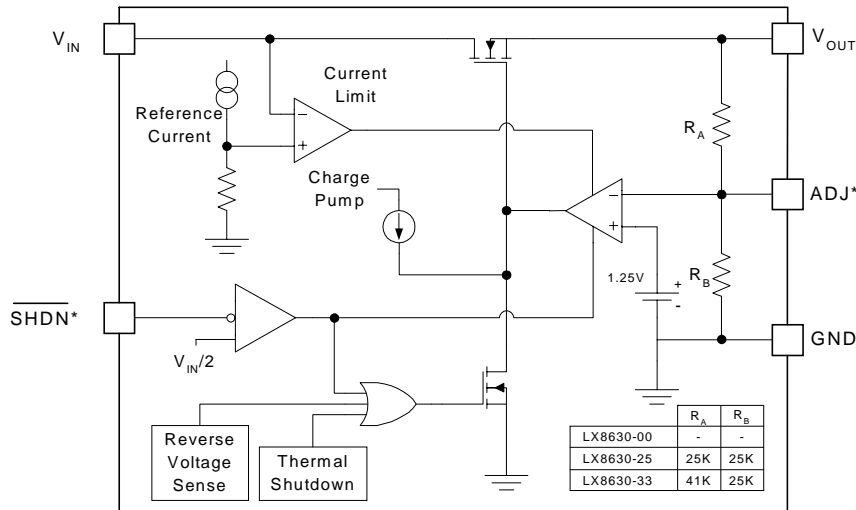
- Dropout Voltage Typically 450mV at 3A and 50mV at 10mA
- Low Quiescent Current, Typically Under 400μA, irrespective of Load
- Shutdown Current 10μA
- Adjustable Output Version in 5-Pin TO-220 & TO-263 Packages
- Low Reverse Leakage Current
- Short-Circuit and Thermal Shutdown Protection

#### APPLICATIONS/BENEFITS

- 3.3V & 2.5V Supplies for Memory, Microprocessors, Clock Circuits, Etc.
- Portable Equipment

#### PRODUCT HIGHLIGHT

LX8630-xx Simplified Block Diagram



\* Adjustable 5 lead version only

#### PACKAGE ORDER INFO

| $T_A$ (°C) | Output Voltage | Plastic TO-220 |             | Plastic TO-263 |              |
|------------|----------------|----------------|-------------|----------------|--------------|
|            |                | P 3-Pin        | P 5-Pin     | DD 3-Pin       | DD 5-Pin     |
| 0 to 125   | 3.3            | LX8630-33CP    | -           | LX8630-33CDD   | -            |
|            | 2.5            | LX8630-25CP    | -           | LX8630-25CDD   | -            |
|            | ADJ(00)        | -              | LX8630-00CP | -              | LX8630-00CDD |

Note: Available in Tape & Reel.

Append the letter "T" to the part number. (i.e. LX8630-33CDDT)

#### ABSOLUTE MAXIMUM RATINGS

|  |                          |
|--|--------------------------|
| Input Voltage ( $V_{IN}$ ) .....               | 6.5V                     |
| $\overline{SHDN}$ Pin .....                    | -0.3V to $V_{IN} + 0.3V$ |
| Operating Junction Temperature                 |                          |
| Plastic (P & DD Packages) .....                | 150°C                    |
| Storage Temperature Range .....                | -65°C to 150°C           |
| Lead Temperature (Soldering, 10 seconds) ..... | 300°C                    |

Note: Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.

#### THERMAL DATA

##### P PLASTIC TO-220 3-PIN

|   |         |
|---|---------|
| THERMAL RESISTANCE-JUNCTION TO TAB, $\theta_{JT}$     | 2.1°C/W |
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 60°C/W  |

##### P PLASTIC TO-220 5-PIN

|   |         |
|---|---------|
| THERMAL RESISTANCE-JUNCTION TO TAB, $\theta_{JT}$     | 2.1°C/W |
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 60°C/W  |

##### DD PLASTIC TO-263 3-PIN

|   |         |
|---|---------|
| THERMAL RESISTANCE-JUNCTION TO TAB, $\theta_{JT}$     | 2.1°C/W |
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 60°C/W  |

##### DD PLASTIC TO-263 5-PIN

|   |         |
|---|---------|
| THERMAL RESISTANCE-JUNCTION TO TAB, $\theta_{JT}$     | 2.1°C/W |
| THERMAL RESISTANCE-JUNCTION TO AMBIENT, $\theta_{JA}$ | 60°C/W  |

Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .

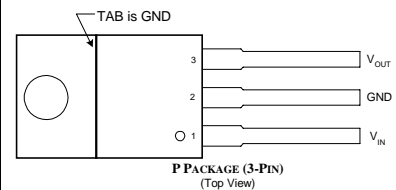
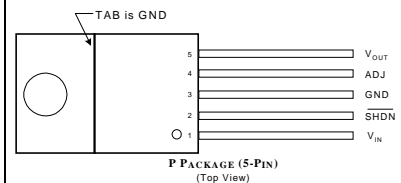
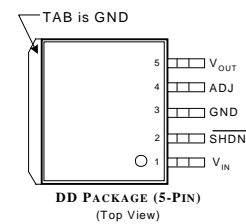
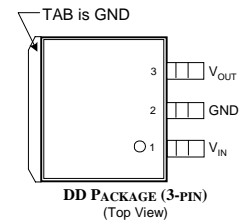
The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.

- $\theta_{JA}$  can be improved with package soldered to 0.5IN<sup>2</sup> copper area over backside ground plane or internal power plane.  $\theta_{JA}$  can vary from 20°C/W to > 40°C/W depending on mounting technique. See table below for thermal resistance guidelines:

| Copper Area (Topside)*          | Copper Area (Backside)*        | Board Area                     | Thermal Resistance ( $\theta_{JA}$ ) |
|---------------------------------|--------------------------------|--------------------------------|--------------------------------------|
| 2.5 sq" (1613mm <sup>2</sup> )  | 2.5 sq" (1613mm <sup>2</sup> ) | 2.5 sq" (1613mm <sup>2</sup> ) | 25°C/W                               |
| 1.0 sq" (645 mm <sup>2</sup> )  | 2.5 sq" (1613mm <sup>2</sup> ) | 2.5 sq" (1613mm <sup>2</sup> ) | 27°C/W                               |
| 0.17 sq" (110 mm <sup>2</sup> ) | 2.5 sq" (1613mm <sup>2</sup> ) | 2.5 sq" (1613mm <sup>2</sup> ) | 35°C/W                               |

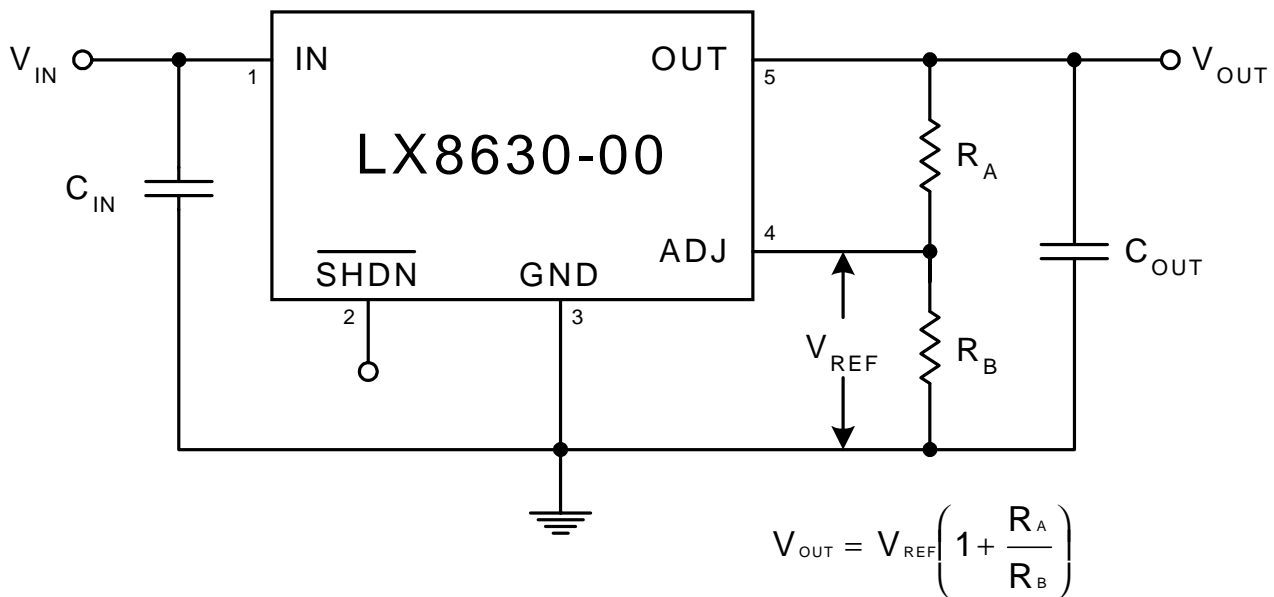
\*Tab of device attached to topside copper

#### PACKAGE PIN OUT



**FUNCTIONAL PIN DESCRIPTION**

| PIN NAME                 | DESCRIPTION  |
|--------------------------|--|
| V <sub>IN</sub>          | Positive supply input for the regulator. Bypass to GND with at least 2.2μF of low ESR, ESL capacitance if supply source is further than 1 inch from the device.  |
| V <sub>OUT</sub>         | Output for the regulator. It is recommended to bypass to GND with at least 10μF although this is not required for regulation, rather it is needed for transient response. Size your output capacitor to meet the transient loading requirement. If you have a very dynamic load, a larger capacitor will improve the response to these load steps. |
| GND                      | Reference ground. The input and output bypass capacitors should be connected to this pin. The tab on the TO-220 and TO-263 packages along with the ground pin are also used for heatsinking the device.  |
| ADJ                      | Feedback pin for the regulator. For the LX8630-00, the output voltage can be set by two external resistors with the following relationship: $V_{OUT} = 1.25V * (1 + R_A/R_B)$ where R <sub>A</sub> is the resistor connected between V <sub>OUT</sub> and ADJ, R <sub>B</sub> is the resistor connected between ADJ and GND pin.                   |
| $\overline{\text{SHDN}}$ | Shutdown pin. For the LX8630-00, this pin has a threshold of about V <sub>IN</sub> /2, it should be actively pulled high to enable the regulator. This can be accomplished with a resistive pull-up. When low, it turns off the regulator and puts the device in a low current shutdown state.   |

**TYPICAL APPLICATION**

**FIGURE 1 – Typical Application**

**RECOMMENDED OPERATING CONDITIONS**
**RECOMMENDED OPERATING CONDITIONS**

| PARAMETER                                | SYMBOL   | MIN. | TYP. | MAX. | UNITS   |
|--|----------|------|------|------|---------|
| INPUT VOLTAGE                            | $V_{IN}$ | 3.0  |      | 5.5  | V       |
| LOAD CURRENT (WITH ADEQUATE HEATSINKING) |          | 0.01 |      | 3    | A       |
| INPUT CAPACITOR ( $V_{IN}$ TO GND)       |          | 10   | 100  |      | $\mu$ F |
| OUTPUT CAPACITOR ( $V_{OUT}$ TO GND)     |          | 22   | 220* |      | $\mu$ F |

\* Size your output capacitor to meet the transient loading requirement. If you have a very dynamic load, a larger capacitor will improve the response to these load steps (see charts 2&3)

**ELECTRICAL CHARACTERISTICS**

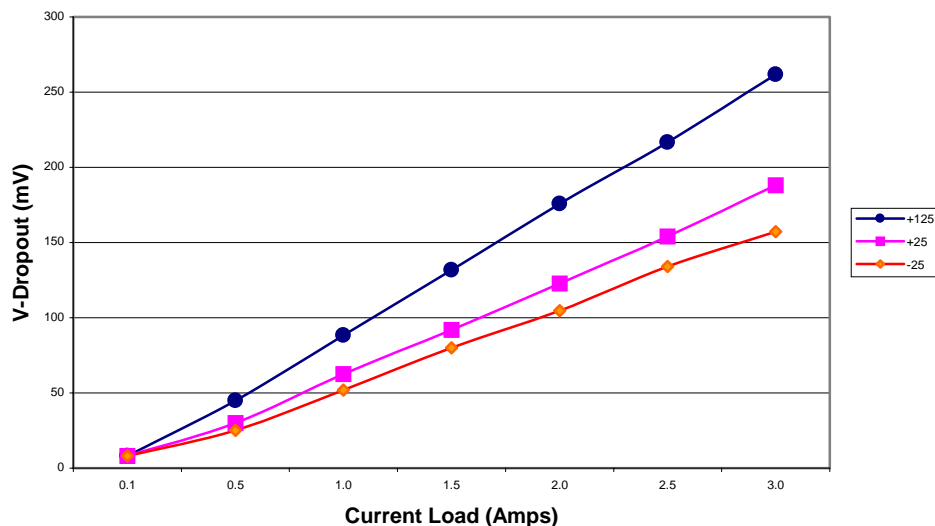
(Unless otherwise specified, the following specifications apply over the operating ambient temperatures for the LX8630-xxC with  $0^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$ ;  $V_{IN} = V_{OUT} + 1.5\text{V}$ ;  $I_{OUT} = 10\text{mA}$ ;  $C_{IN} = 10\mu\text{F}$ ;  $C_{OUT} = 22\mu\text{F}$ ;  $T_J = T_A$ . Test conditions: Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.)

| Parameter                                       | Symbol    | Test Conditions  | LX8630-xx |      |      | Units   |
|---|-----------|--|-----------|------|------|---------|
|   |           |  | Min       | Typ  | Max  |         |
| <b>LX8630-33 FIXED 3.3V, 3A</b>                 |           |  |           |      |      |         |
| Output Voltage                                  | $V_{OUT}$ | $T_J = 25^{\circ}\text{C}$   | 3.25      | 3.3  | 3.35 | V       |
|   |           | Over Temperature   | 3.22      |      | 3.38 |         |
| Line Regulation                                 | $V_{REG}$ | $V_{IN} = 3.9\text{V to } 5.5\text{V}$                                   |           | 2    | 8    | mV      |
| Load Regulation                                 | $I_{REG}$ | $I_{OUT} = 10\text{mA to } 3\text{A}$                                    |           | 18   | 40   | mV      |
| Dropout Voltage ( $V_{DO} = V_{IN} - V_{OUT}$ ) | $V_{DO}$  | $I_{OUT} = 3\text{A}, \Delta V_{OUT} = -1\%$                             |           | 0.4  | 0.6  | V       |
|   |           | $I_{OUT} = 1.5\text{A}, \Delta V_{OUT} = -1\%$                           |           | 0.3  | 0.4  |         |
|   |           | $I_{OUT} = 10\text{mA}, \Delta V_{OUT} = -1\%$                           |           | 0.05 | 0.15 |         |
| Short Circuit Current                           | $I_{SC}$  | $V_{OUT} = 0\text{V}$  |           | 5    | 6.5  | A       |
| Quiescent Current                               | $I_Q$     | $I_{OUT} = 10\text{mA to } 3\text{A}$                                    |           | 400  | 600  | $\mu$ A |
| Reverse Leakage Current                         | $I_{REV}$ | $0\text{V} < V_{IN} < V_{OUT}, V_{OUT} < 3.4\text{V}$ (at $V_{OUT}$ )    |           | 50   | 650  | $\mu$ A |
|   |           | $0\text{V} < V_{IN} < V_{OUT}, V_{OUT} < 3.4\text{V}$ (at $V_{IN}$ )     | -50       | 0    |      | mA      |
| <b>LX8630-25 FIXED 2.5V, 3A</b>                 |           |  |           |      |      |         |
| Output Voltage                                  | $V_{OUT}$ | $T_J = 25^{\circ}\text{C}$   | 2.46      | 2.5  | 2.54 | V       |
|   |           | Over Temperature   | 2.44      | 2.5  | 2.56 |         |
| Line Regulation                                 | $V_{REG}$ | $V_{IN} = 3.1\text{V to } 5.5\text{V}$                                   |           | 2    | 6    | mV      |
| Load Regulation                                 | $I_{REG}$ | $I_{OUT} = 10\text{mA to } 3\text{A}$                                    |           | 14   | 30   | mV      |
| Dropout Voltage ( $V_{DO} = V_{IN} - V_{OUT}$ ) | $V_{DO}$  | $I_{OUT} = 3\text{A}, \Delta V_{OUT} = -1\%, T_J = 85^{\circ}\text{C}$   |           | 0.4  | 0.6  | V       |
|   |           | $I_{OUT} = 1.5\text{A}, \Delta V_{OUT} = -1\%, T_J = 85^{\circ}\text{C}$ |           | 0.3  | 0.45 |         |
|   |           | $I_{OUT} = 10\text{mA}, \Delta V_{OUT} = -1\%$                           |           | 0.05 | 0.15 |         |
| Short Circuit Current                           | $I_{SC}$  | $V_{OUT} = 0\text{V}$  |           | 5    | 6.5  | A       |
| Quiescent Current                               | $I_Q$     | $I_{OUT} = 10\text{mA to } 3\text{A}$                                    |           | 400  | 600  | $\mu$ A |
| Reverse Leakage Current                         | $I_{REV}$ | $0\text{V} < V_{IN} < V_{OUT}, V_{OUT} < 2.6\text{V}$ (at $V_{OUT}$ )    |           | 50   | 650  | $\mu$ A |
|   |           | $0\text{V} < V_{IN} < V_{OUT}, V_{OUT} < 2.6\text{V}$ (at $V_{IN}$ )     | -50       | 0    |      | mA      |

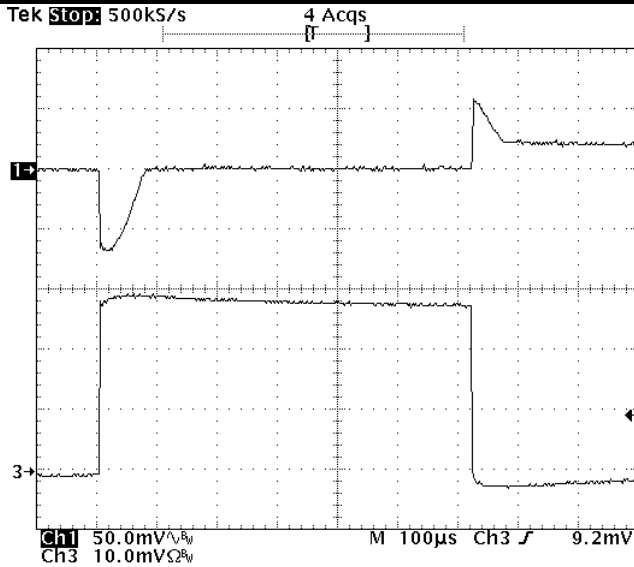
**ELECTRICAL CHARACTERISTICS (CONTINUED)**

| Parameter                              | Symbol     | Test Conditions   | LX8630-xx |              |      | Units         |
|--|------------|---|-----------|--------------|------|---------------|
|  |            |   | Min       | Typ          | Max  |               |
| <b>LX8630-00 ADJUSTABLE OUTPUT, 3A</b> |            |   |           |              |      |               |
| Reference Voltage                      | $V_{REF}$  | $T_J = 25^\circ\text{C}$  | 1.23      | 1.25         | 1.27 | V             |
|  |            | Over Temperature  | 1.22      | 1.25         | 1.28 |               |
| Line Regulation                        | $V_{REG}$  | $V_{IN} = (V_O + 0.6V)$ to 5.5V @ ADJ Pin (Note 1)              |           | 2            | 4    | mV            |
| Load Regulation                        | $I_{REG}$  | $I_{OUT} = 10\text{mA}$ to 3A @ ADJ Pin                         |           | 7            | 15   | mV            |
| Dropout Voltage                        | $V_{DO}$   | $I_{OUT} = 3A, \Delta V_{OUT} = -1\%, T_J = 85^\circ\text{C}$   |           | 0.4          | 0.6  | V             |
|  |            | $I_{OUT} = 1.5A, \Delta V_{OUT} = -1\%, T_J = 85^\circ\text{C}$ |           | 0.3          | 0.45 |               |
|  |            | $I_{OUT} = 10\text{mA}, \Delta V_{OUT} = -1\%$                  |           | 0.05         | 0.15 |               |
| Short Circuit Current                  | $I_{SC}$   | $V_{OUT} = 0V$  |           | 5            | 6.5  | A             |
| Quiescent Current                      | $I_Q$      | $I_{OUT} = 10\text{mA}$ to 3A                                   |           | 400          | 600  | $\mu\text{A}$ |
| Quiescent Current in Shutdown          |            | $V_{IN} = 4.8V; V_{SHDN} < 0.8V$                                |           | 1            | 40   |               |
| Reverse Leakage Current                | $I_{REV}$  | $0V < V_{IN} < V_{OUT}, V_{OUT} < 5.5V$ (at $V_{OUT}$ )         |           | 50           | 650  | $\mu\text{A}$ |
|  |            | $0V < V_{IN} < V_{OUT}, V_{OUT} < 5.5V$ (at $V_{IN}$ )          | -50       | 0            |      | mA            |
| Bias Current at ADJ Pin                | $I_{BIAS}$ |   |           | 100          |      | nA            |
| Shutdown Threshold                     | $V_{SHDN}$ | $V_{SHDN}$ falling  | 0.8       | $(V_{IN}/2)$ |      | V             |
|  |            | $V_{SHDN}$ rising   |           | $(V_{IN}/2)$ |      |               |
| SHDN Bias Current                      | $I_{SHDN}$ | $V_{SHDN} < 0.8V$   |           | -2           |      | $\mu\text{A}$ |
|  |            | $V_{SHDN} = 3V$   |           | -1           |      |               |

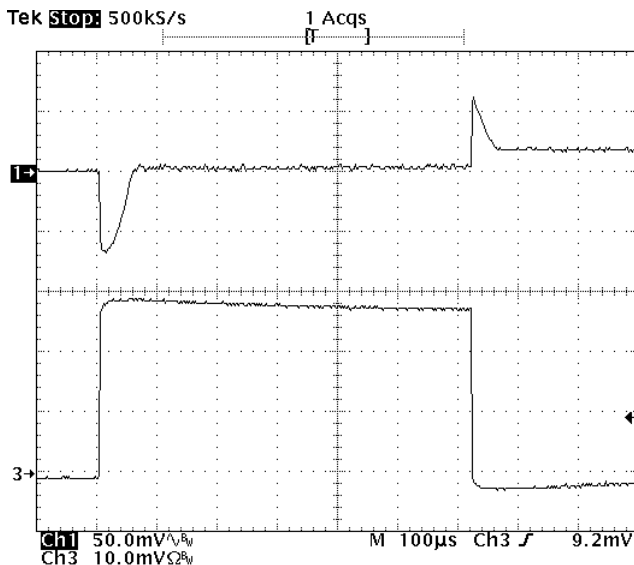
 Note 1:  $V_{IN}$  min.  $\geq 3V$ .

**DROPOUT VOLTAGE VS. OUTPUT CURRENT**

**CHART 1** – Dropout Voltage vs. Output Current (Typical – LX8630-33CCD)

**TRANSIENT RESPONSE**

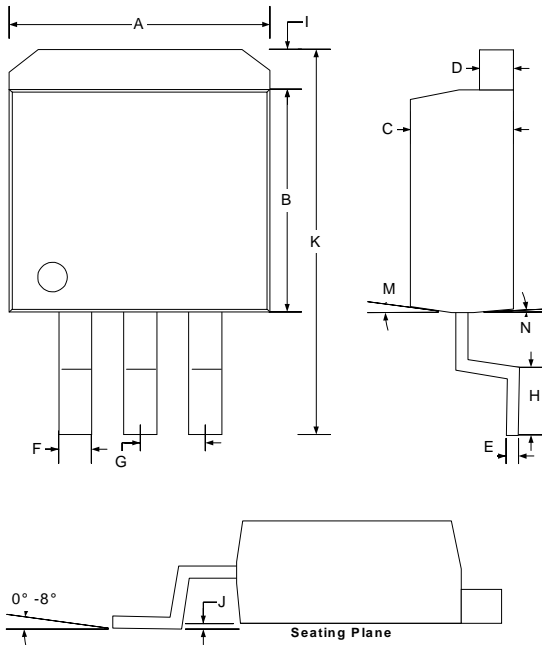


$V_{IN} = 3.3V$   
 CHAN 1 (TOP TRACE):  $V_{OUT}$  50mV/DIV at 2.5VDC  
 CHAN 3 (LOWER TRACE):  $I_{OUT}$  1A/DIV with  
 10mA preload current  
 Input Cap: 1 6MVGX 1500 $\mu$ F Sanyo Cap  
 Output Caps: 2 6MVGX 1500 $\mu$ F Sanyo Cap

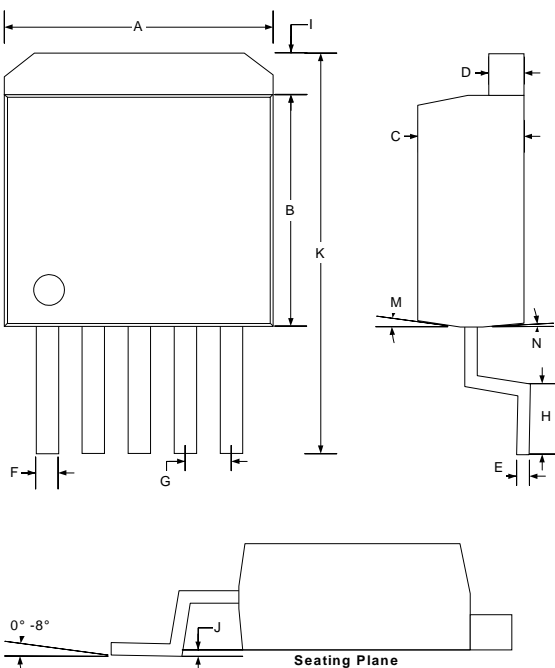


$V_{IN} = 5.0V$   
 CHAN 1 (TOP TRACE):  $V_{OUT}$  50mV/DIV at 2.5VDC  
 CHAN 3 (LOWER TRACE):  $I_{OUT}$  1A/DIV with  
 10mA preload current  
 Input Cap: 1 6MVGX 1500 $\mu$ F Sanyo Cap  
 Output Caps: 2 6MVGX 1500 $\mu$ F Sanyo Cap

**CHART 2 & 3** – LX8630-00CCD Transient Response  
 Note: Adjustable Resistors 10K Ohms Each

**MECHANICAL DIMENSIONS**
**DD 3-Pin Plastic TO-263**


| Dim | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 10.03       | 10.67 | 0.395  | 0.420 |
| B   | 8.51        | 9.17  | 0.335  | 0.361 |
| C   | 4.19        | 4.59  | 0.165  | 0.181 |
| D   | 1.14        | 1.40  | 0.045  | 0.055 |
| E   | 0.330       | 0.51  | 0.013  | 0.020 |
| F   | 1.19        | 1.34  | 0.047  | 0.053 |
| G   | 2.41        | 2.66  | 0.095  | 0.104 |
| H   | 2.29        | 2.79  | 0.090  | 0.110 |
| I   | —           | 1.65  | —      | 0.065 |
| J   | 0           | 0.25  | 0      | 0.010 |
| K   | 14.60       | 15.87 | 0.575  | 0.625 |
| M   | 7°          |       | 7°     |       |
| N   | 3°          |       | 3°     |       |

**DD 5-Pin Plastic TO-263**


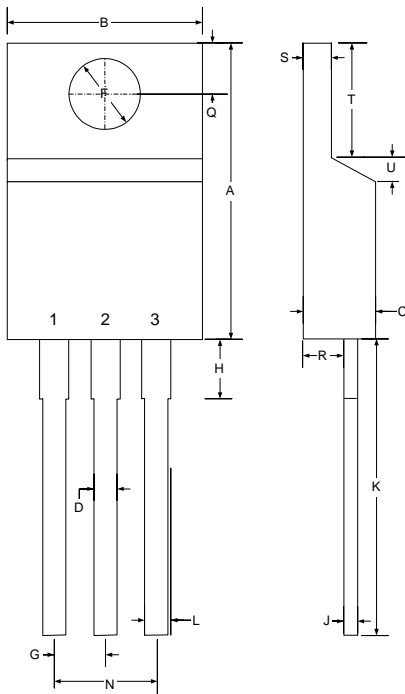
| Dim | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 10.03       | 10.67 | 0.395  | 0.420 |
| B   | 8.51        | 9.17  | 0.335  | 0.361 |
| C   | 4.19        | 4.59  | 0.165  | 0.181 |
| D   | 1.14        | 1.40  | 0.045  | 0.055 |
| E   | 0.330       | 0.51  | 0.013  | 0.020 |
| F   | 0.74        | 0.89  | 0.029  | 0.035 |
| G   | 1.57        | 1.83  | 0.062  | 0.072 |
| H   | 2.29        | 2.79  | 0.090  | 0.110 |
| I   | —           | 1.65  | —      | 0.065 |
| J   | 0           | 0.25  | 0      | 0.010 |
| K   | 14.60       | 15.87 | 0.575  | 0.625 |
| M   | 7°          |       | 7°     |       |
| N   | 3°          |       | 3°     |       |

**Note:**

- Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

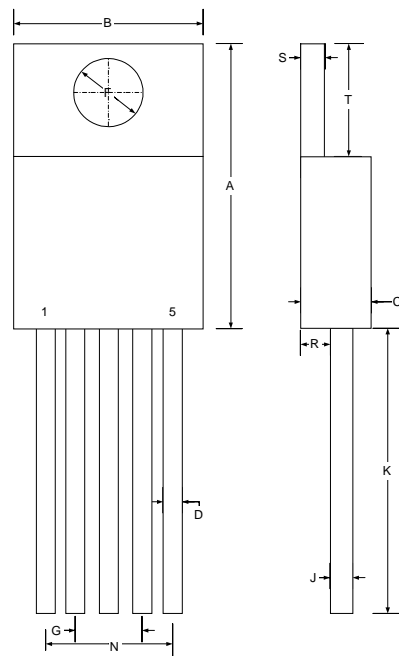
**MECHANICAL DIMENSIONS**

**P 3-Pin Plastic TO-220**



| Dim | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 14.22       | 15.88 | 0.560     | 0.625 |
| B   | 9.65        | 10.67 | 0.380     | 0.420 |
| C   | 3.56        | 4.83  | 0.140     | 0.190 |
| D   | 0.51        | 1.14  | 0.020     | 0.045 |
| F   | 3.53        | 4.09  | 0.139     | 0.161 |
| G   | 2.54 BSC    |       | 0.100 BSC |       |
| H   |             | 6.35  |           | 0.250 |
| J   | 0.30        | 1.14  | 0.012     | 0.045 |
| K   | 12.70       | 14.73 | 0.500     | 0.580 |
| L   | 1.14        | 1.27  | 0.045     | 0.050 |
| N   | 5.08 TYP    |       | 0.200 TYP |       |
| Q   | 2.54        | 3.05  | 0.100     | 0.120 |
| R   | 2.03        | 2.92  | 0.080     | 0.115 |
| S   | 1.14        | 1.40  | 0.045     | 0.055 |
| T   | 5.84        | 6.86  | 0.230     | 0.270 |
| U   | 0.508       | 1.14  | 0.020     | 0.045 |

**P 5-Pin Plastic TO-220**



| Dim | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 14.23       | 16.51 | 0.560     | 0.650 |
| B   | 9.66        | 10.66 | 0.380     | 0.420 |
| C   | 3.56        | 4.82  | 0.140     | 0.190 |
| D   | 0.46        | 0.89  | 0.018     | 0.035 |
| F   | 3.56        | 4.06  | 0.140     | 0.160 |
| G   | 3.40        |       | 0.134     |       |
| J   | 0.31        | 1.14  | 0.012     | 0.045 |
| K   | 12.70       | 14.73 | 0.500     | 0.580 |
| N   | 6.80 TYP    |       | 0.268 TYP |       |
| R   | 2.04        | 2.92  | 0.080     | 0.115 |
| S   | 1.14        | 1.39  | 0.045     | 0.055 |
| T   | 5.85        | 6.85  | 0.230     | 0.270 |

**Note:**

1. Dimensions do not include mold flash or protrusions; these shall not exceed 0.155mm(.006") on any side. Lead dimension shall not include solder coverage.

**NOTES**

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