# LTP8M420X
## Dual-Channel LDO with 36V Input



## General Description

The LTP8M420X integrates dual linear voltage regulators, featuring high input voltage and low quiescent current (IQ), making it an optimal 300mA LDO solution for portable battery-powered applications requiring ultra-low standby current consumption. With an exceptionally low quiescent current of 5.3μA, it significantly extends battery life and enables reliable power supply for external device circuits.

## Features

- The wide input voltage range of 36V
- 3.3V & 12V regulated output with load capacity（LTP8M4200EXS8/R8）
- 5V& 12V regulated output with load capacity （LTP8M4201EXS8/R8）
- Ultra-low quiescent current IQ：5.3uA
- Low Dropout：1000mV @300mA
- The built-in over-temperature protection feature operates at a low pressure differential, with temperature thresholds set at 155°C.

## Ordering Information

| Type Number | Package Name | Tape and Reel | Mark Code | NOTE |
|---|---|---|---|---|
| LTP8M4200EXS8/R8 | ESOP-8L | Tape and Reel, 4000 | 8M4200 | OUT1 3.3V; OUT2 12V |
| LTP8M4201EXS8/R8 | ESOP-8L | Tape and Reel, 4000 | 8M4201 | OUT1 5.0V ;OUT2 12V |

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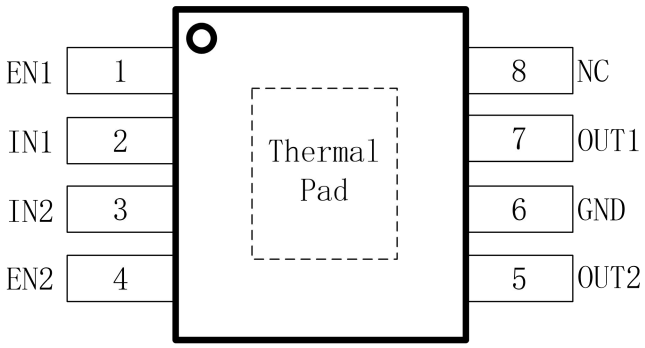
## Pin Description (Top View)

LTP8M4200
ESOP-8L




| Pin | Pin designation | Functional description |
|---|---|---|
| 1 | EN1 | Enable 1 (Active High) |
| 2 | IN1 | input1 pin |
| 3 | IN2 | input2 pin |
| 4 | EN2 | Enable 2 （Active High） |
| 5 | OUT2 | Output2 pin (12V) |
| 6 | GND | Ground |
| 7 | OUT1 | Output1 pin （3.3V） |
| 8 | NC | No connection |
| Thermal Pad | | Must either be left open or tied to ground.<br>— Solder to the printed-circuit-board (PCB) plane to enhance thermal performance. |

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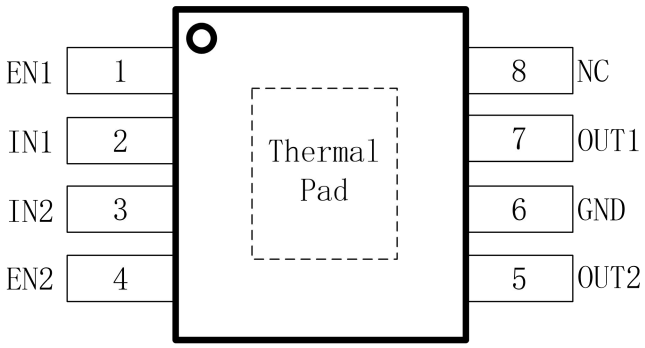
## Pin Description (Top View)

LTP8M4201
ESOP-8L




| Pin | Pin designation | Functional description |
|---|---|---|
| 1 | EN1 | Enable 1 (Active High) |
| 2 | IN1 | input1 pin |
| 3 | IN2 | input2 pin |
| 4 | EN2 | Enable 2 （Active High） |
| 5 | OUT2 | Output2 pin (12V) |
| 6 | GND | Ground |
| 7 | OUT1 | Output1 pin （5.0V） |
| 8 | NC | No connection |
| Thermal Pad | | Must either be left open or tied to ground.<br>— Solder to the printed-circuit-board (PCB) plane to enhance thermal performance. |

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## Absolute Maximum Ratings

$T_A$ = 25°C, all pins are referenced to GND unless otherwise specified.
LTP8M4200EXS8/R8 (OUT1 :3.3V ) LTP8M4201EXS8/R8(OUT1:5V)

| Symbol | Rating | Value | Unit |
|---|---|---|---|
| IN1,IN2 | Input Voltage | 0~43 | V |
| $V_{OUT1}$ | Output Voltage | 3.3 | V |
| $V_{OUT1}$ | Output Voltage | 5 | V |
| $V_{OUT2}$ | Output Voltage | 12 | V |
| $V_{EN}$ | Chip Enable Input | 0~43 | V |
| $T_{J(MAX)}$ | Maximum Junction Temperature | 150 | ℃ |
| $T_{STG}$ | Storage Temperature | -50~150 | ℃ |
| $J_A$ | Package Thermal Resistance | 63 | ℃/W |
| ESD | HBM Capability | ±1500 | V |
| | CDM Capability | ±2000 | V |

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## Recommended Operating Conditions

$T_A$ = 25°C, all pins are referenced to GND unless otherwise specified.

| Symbol | Item | Rating | Unit |
|---|---|---|---|
| IN1 | Input Voltage | 3 ~ 36 | V |
| IN2 | Input Voltage | 3 ~ 36 | V |
| $I_{OUT1}$ | Output Current | 0 ~ 300 | mA |
| $I_{OUT2}$ | Output Current | 0 ~ 300 | mA |
| $T_A$ | Operating Ambient Temperature | -40 ~ 125 | ℃ |
| $C_{IN1}$ | Effective Input Ceramic Capacitor Value | 1 ~ 10 | uF |
| $C_{IN2}$ | Effective Input Ceramic Capacitor Value | 1 ~ 10 | uF |
| $C_{OUT1}$ | Effective Output Ceramic Capacitor Value | 1 ~ 10 | uF |
| $C_{OUT2}$ | Effective Output Ceramic Capacitor Value | 1 ~ 10 | uF |
| ESR | Input and Output Capacitor Equivalent Series Resistance (ESR) | 5 ~ 100 | mΩ |

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## Electrical Characteristic

LDO1 $V_{OUT}$=3.3/5.0V
($V_{IN}$ =$V_{OUT}$+2V; $I_{OUT}$ = 10mA, $C_{IN}$ = $C_{OUT}$ = 1.0µF, unless otherwise noted. Typical values are at $T_A$ = +25°C.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Operating Input Voltage | | 3 | | 36 | V |
| $V_{OUT}$ | Output Voltage | $T_A$=+25℃ | -2% | | +2% | V |
| | | -40℃≤$T_A$≤85℃ | -3% | | +3% | |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA | | 2.5 | 4.5 | µA |
| $I_{Q\_OFF}$ | Standby Current | $V_{EN}$=0V,$T_A$=25℃ | | 0.1 | 1 | µA |
| $Line_{REG}$ | Line Regulation | VIN = VouT +1V to 36V<br>IouT=10mA<br>($\Delta V_{OUT}/\Delta V_{IN}/V_{OUT}$) | | 0.05 | 0.20 | %/V |
| $V_{DROP}$ | Dropout Voltage<br>$I_{OUT}$=300mA | $V_{OUT}$=12V | | 1000 | 1300 | mV |
| $Load_{REG}$ | Load Regulation | 1mA≤$I_{OUT}$≤300mA,<br>$V_{IN}$=$V_{OUT}$+3V | | | 40 | mV |
| $I_{LMT}$ | Current Limit | $V_{IN}$=$V_{OUT}$+2V | 300 | 450 | | mA |
| $V_{ENH}$ | EN Pin Threshold Voltage | EN Input Voltage“H” | 1.2 | | | V |
| $V_{ENL}$ | EN Pin Threshold Voltage | EN InputVoltage“L” | | | 0.4 | V |
| $I_{EN}$ | EN Pin Current | $V_{EN}$=0~36V | | 1 | | uA |
| PSRR | Power Supply<br>Rejection Ratio | f=1kHz, $V_{IN}$=$V_{OUT}$+J1V<br>$I_{OUT}$=20mA | | 60 | | dB |
| $e_N$ | Output Noise Voltage | $V_{IN}$=$V_{out}$+2V, $I_{OUT}$=1mA<br>f=10Hz to 100KHz<br>$V_{OUT}$=3V,$C_{OUT}$=1µF | | 100 | | µVrms |
| $T_{SD}$ | Thermal Shutdown<br>Temperature | Temperature Increasing<br>from$T_A$=+25℃ | | 155 | | ℃ |
| $T_{SDH}$ | Thermal Shutdown<br>Hysteresis | Temperature Falling from TSD | | 30 | | ℃ |

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## Electrical Characteristic (Cont.)

LDO2 $V_{OUT}$=12V
($V_{IN}$ =$V_{OUT}$+2V;$I_{OUT}$=10mA,$C_{IN}$=$C_{OUT}$=1.0uF,unless otherwise noted. Typical values are at $T_A$=+25℃.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{IN}$ | Operating Input Voltage | | 3.0 | | 36 | V |
| $V_{OUT}$ | Output Voltage | $T_A$=+25℃ | -2% | | +2% | V |
| | | -40℃≤$T_A$≤85℃ | -3% | | +3% | V |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA | | 2.8 | 6.5 | μA |
| $I_{Q\_OFF}$ | Standby Current | $V_{EN}$=0V,$T_A$=25℃ | | | 1 | μA |
| $Line_{REG}$ | Line Regulation | $VI_N$ = $V_{OUT}$ +1V to 36V<br>$I_{OUT}$=10mA<br>($\Delta V_{OUT}/\Delta V_{IN}/V_{OUT}$) | | 40 | 90 | mV |
| $V_{DROP}$ | DropOUT Voltage<br>$I_{OUT}$=300mA | $V_{OUT}$=3.3V | | 1000 | 1500 | mV |
| $Load_{REG}$ | Load Regulation | 1mA≤$I_{OUT}$≤300mA,<br>$V_{IN}$=$V_{OUT}$+3V | | 90 | 180 | mV |
| $I_{LMT}$ | Current Limit | $V_{IN}$=$V_{OUT}$+2V | | 450 | 800 | mA |
| $I_{SHORT}$ | Short Current Limit | $V_{OUT}$=0V | | 55 | 120 | mA |
| $V_{ENH}$ | EN Pin Threshold Voltage | EN Input Voltage“H” | 1.4 | | | V |
| $V_{ENL}$ | EN Pin Threshold Voltage | EN InputVoltage“L” | | | 0.4 | V |
| $I_{EN}$ | EN Pin Current | $V_{EN}$=0~36V | | 1 | | uA |
| PSRR | Power Supply<br>Rejection Ratio | f=1kHz, $V_{IN}$=$V_{OUT}$+1V<br>$I_{OUT}$=20mA | | 52 | | dB |
| $e_N$ | Output Noise Voltage | $V_{IN}$=$V_{OUT}$+2V, $I_{OUT}$=1mA<br>f=10Hz to 100KHz<br>$V_{OUT}$=3V, $C_{OUT}$=1μF | | 360 | | μVrms |
| $t_{ON}$ | Turn-On Time | From assertion of VEN to<br>$V_{OUT}$=90%$V_{OUT(NOM)}$ | | 1 | | ms |
| $V_{TRLN}$ | Line transient | $V_{IN}$= $V_{OUT}$+2V to $V_{OUT}$+10V in 10μs,<br>$I_{OUT}$=1mA, $T_A$= +25 ºC | | 50 | | mV |
| | | $V_{IN}$= $V_{OUT}$+10V to $V_{OUT}$+2V in 10μs,<br>$I_{OUT}$=1mA, $T_A$= +25 ºC | | 50 | | mV |
| $V_{TRLD}$ | Load transient | $I_{OUT}$=1mA to 300mA in 10μs<br>$V_{IN}$= $V_{OUT}$+2V, $T_A$= +25 ºC | | 210 | | mV |
| | | $I_{OUT}$=300mA to 1mA in 10μs<br>$V_{IN}$= $V_{OUT}$+2V, $T_A$= +25 ºC | | 160 | | mV |
| $T_{SD}$ | Thermal Shutdown<br>Temperature | Temperature Increasing<br>from $T_A$=+25℃ | | 155 | | ℃ |
| $T_{SDH}$ | Thermal Shutdown<br>Hysteresis | Temperature Fallingfrom TSD | | 25 | | ℃ |

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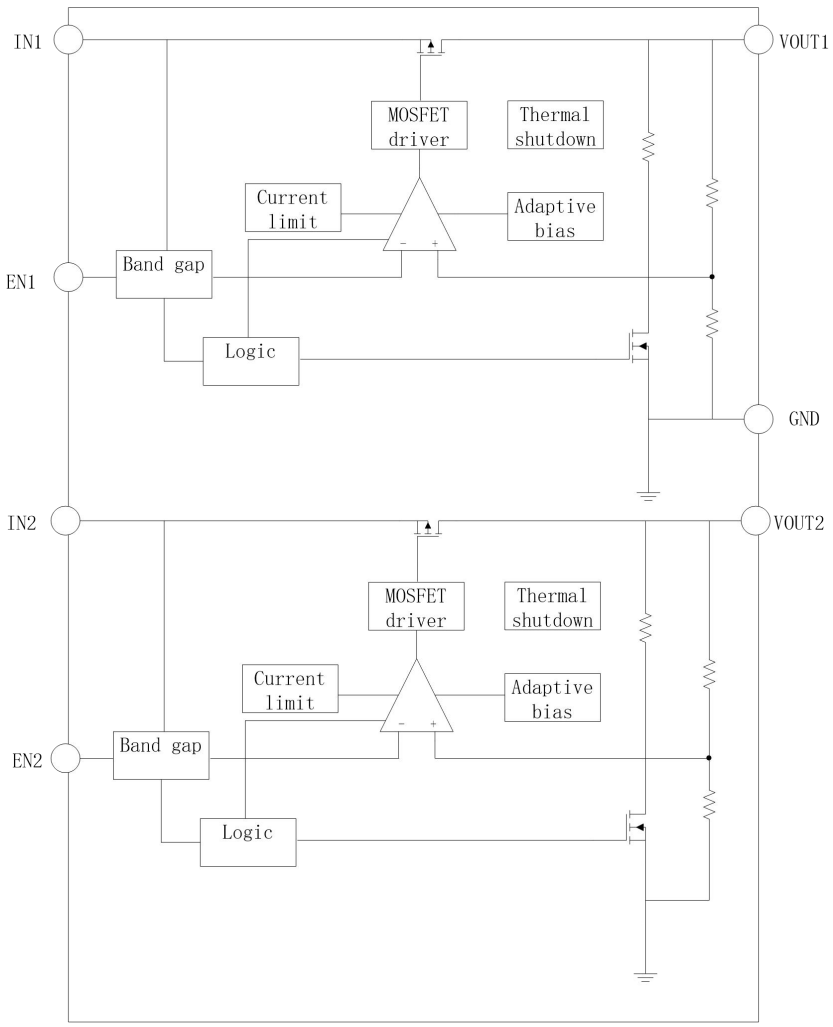
## Block Diagram




## Functional Description

### Input Capacitor

A 1μF~10μF ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

### Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended output capacitance is from 1μF to 10μF, Equivalent Series Resistance (ESR) is from 5mΩ to 100mΩ, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot. Place output capacitor as close as possible to OUT and GND pins.

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## Block Diagram (Cont.)

### Enable

The LTP8M420X delivers the output power when it is set to enable state. When it works in disable state, there is no output power and the operation quiescent current is almost zero. The enable pin (EN) is active high.

### Dropout Voltage

The LTP8M420X uses a PMOS pass transistor to achieve low dropout. When ($V_{IN}$ – $V_{OUT}$) is less than the dropout voltage (VDO), the PMOS pass device is in the linear region of operation and the input-to-output resistance is the $R_{DS(ON)}$ of the PMOS pass element. VDO scales approximately with output current because the PMOS device behaves like a resistor in dropout mode. As with any linear regulator, PSRR and transient response degrade as ($V_{IN}$ – $V_{OUT}$) approaches dropout operation.

### Thermal Shutdown

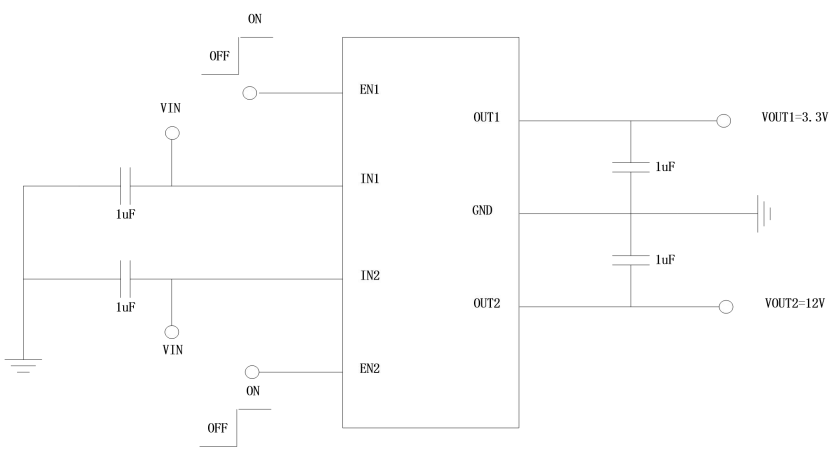
Thermal shutdown protection disables the output when the junction temperature rises to approximately 155°C.Disabling the device eliminates the power dissipated by the device, allowing the device to cool. When the junction temperature cools to approximately 125°C, the output circuitry is again enabled.

Depending on power dissipation, thermal resistance, and ambient temperature, the thermal protection circuit may cycle on and off. This cycling limits regulator dissipation, protecting the LDO from damage as a result of overheating. Activating the thermal shutdown feature usually indicates excessive power dissipation as a result of the product of the ($V_{IN}$ – $V_{OUT}$) voltage and the load current. For reliable operation, limit junction temperature to 125°C maximum.

### Current-Limit Protection

The LTP8M420X provides current limit function to prevent the device from damages during over-load or shorted-circuit condition. This current is detected by an internal sensing transistor.

## Application Circuits

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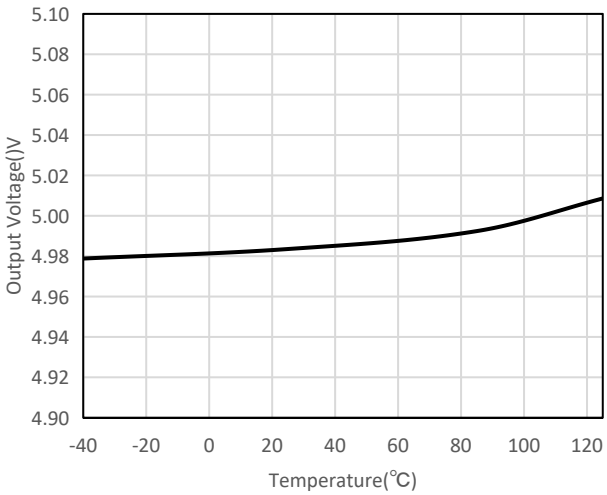
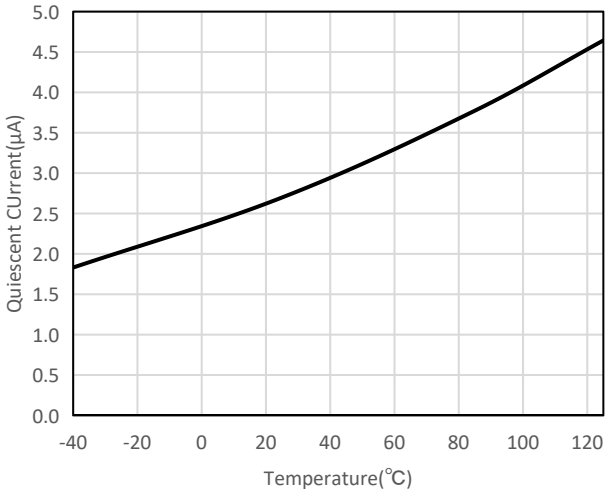
## Typical Characteristics

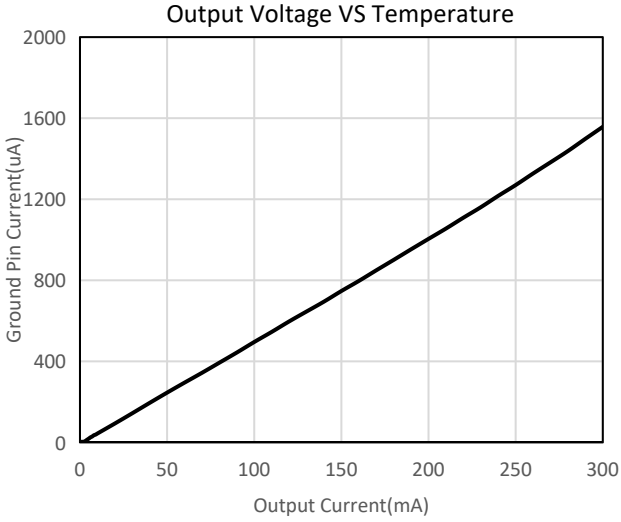
LDO1 （5.0V）



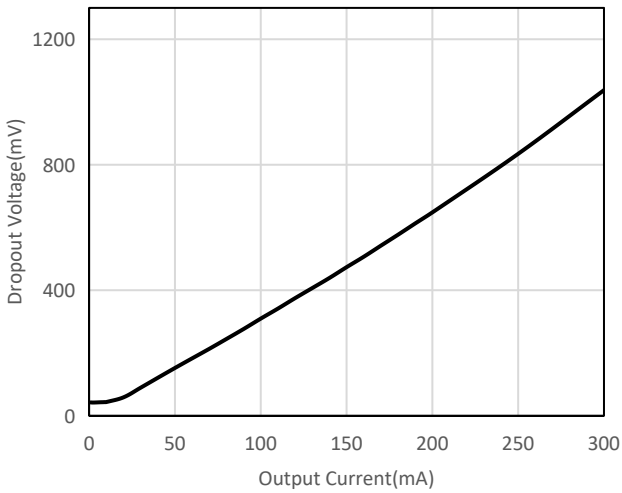

Output Voltage VS Temperature



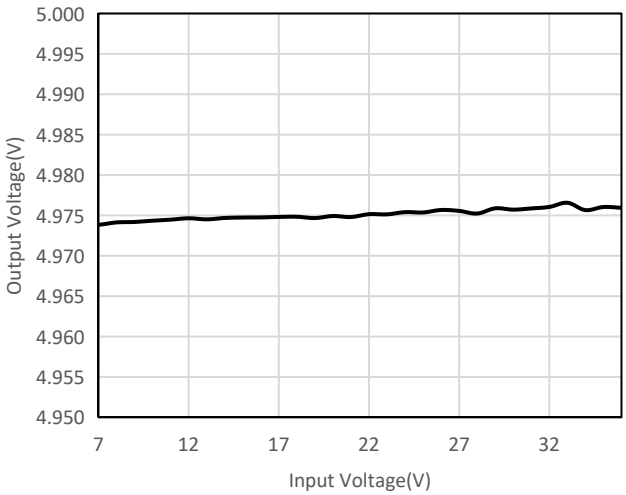

Quiescent Current VS Temperature



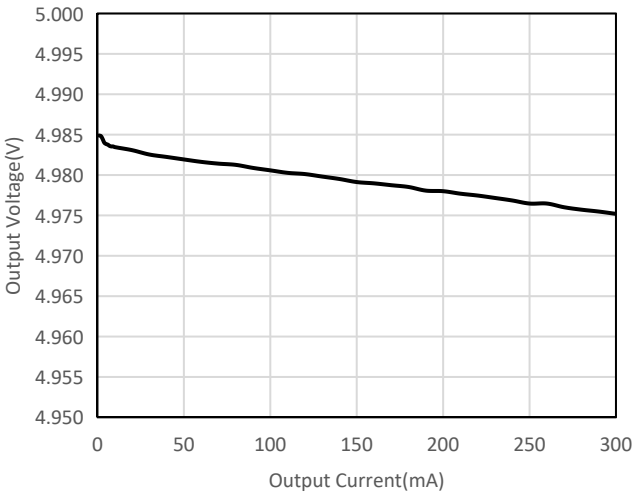

Ground Pin Current VS Output Current




Dropout Voltage VS Output Current




Output Voltage VS Input Voltage




Output Voltage VS Output Current

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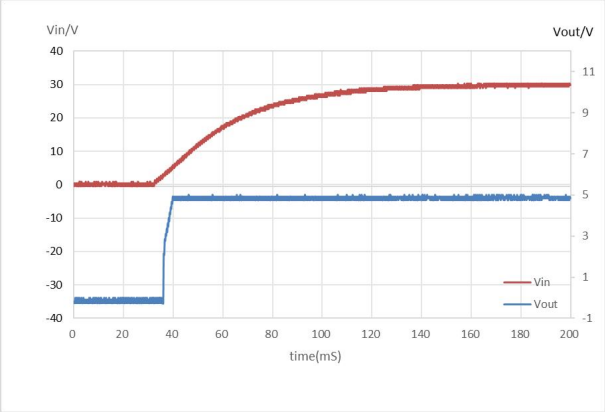
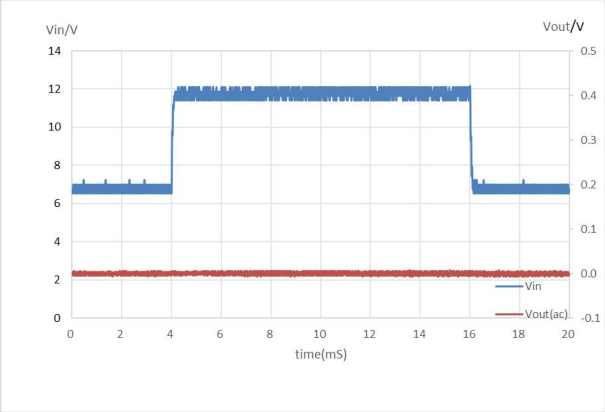
## Typical Characteristics (Cont.)

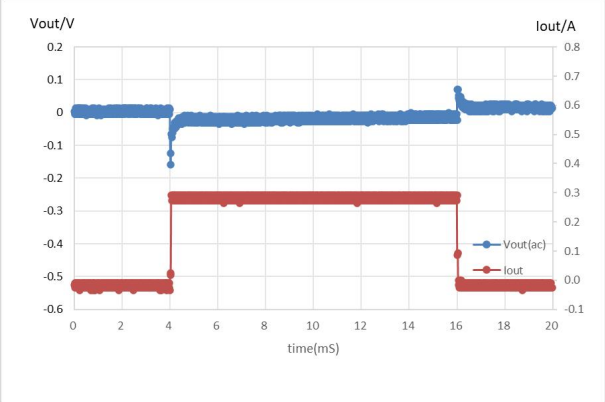
LDO1 （5.0V）




Start-up Response




Line-Transient Response




Load-Transient Response



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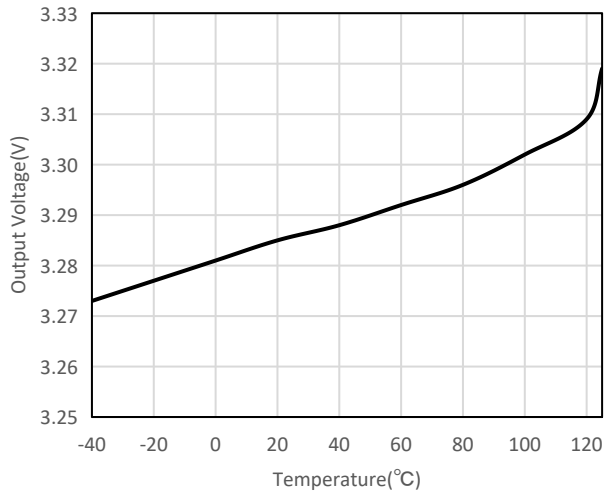
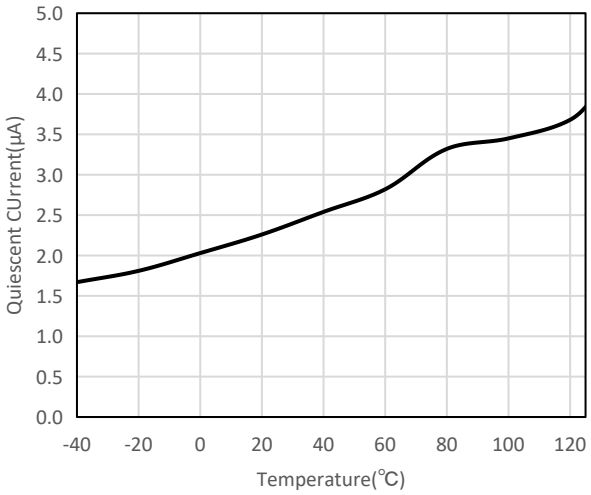
## Typical Characteristics (Cont.)

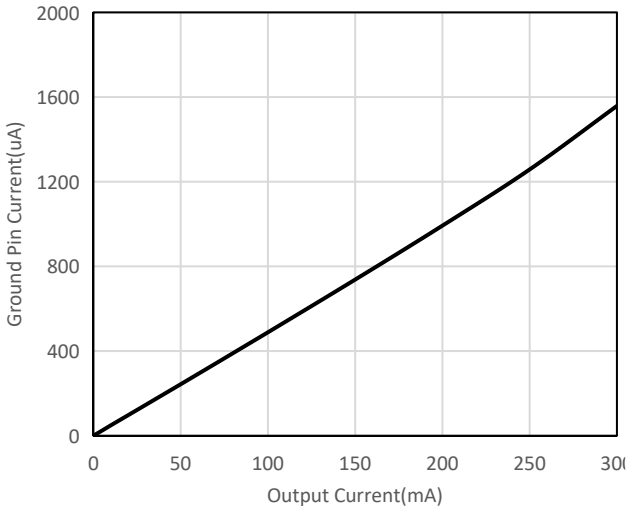
LDO1 （3.3V）



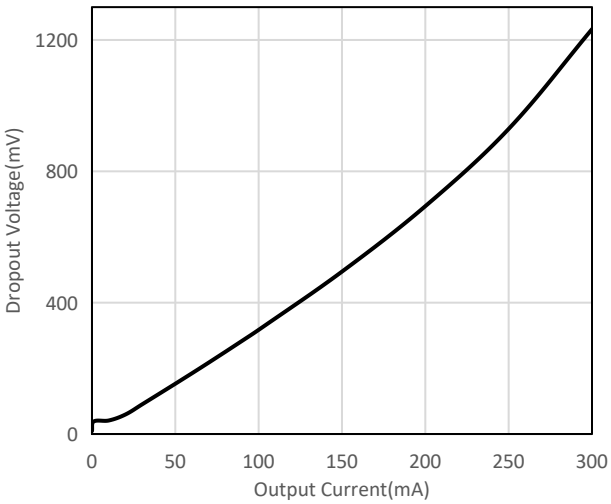

Output Voltage VS Temperature



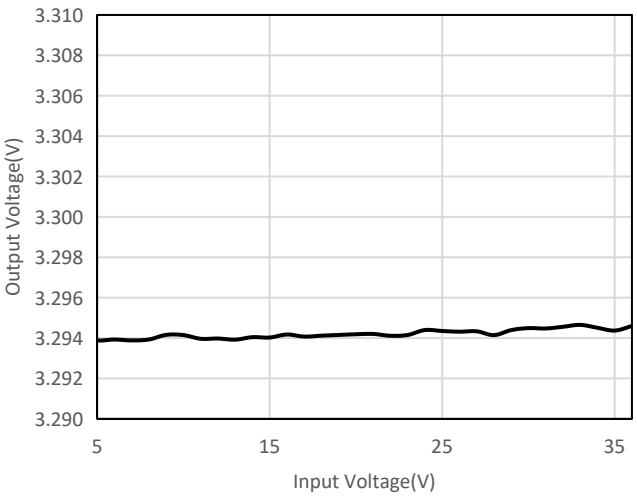

Quiescent Current VS Temperature



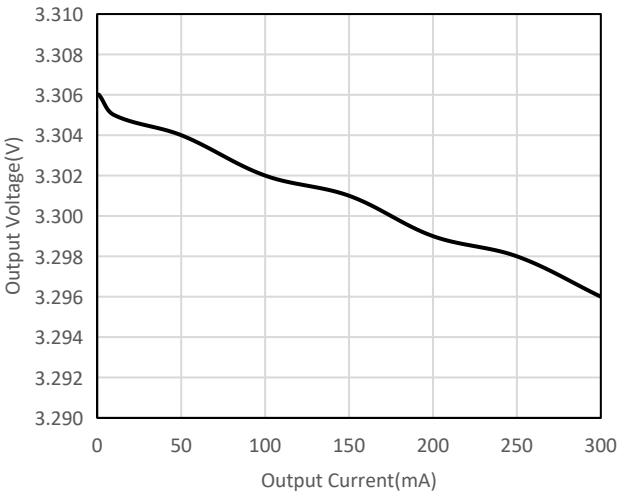

Ground Pin Current VS Output Current




Dropout Voltage VS Output Current




Output Voltage VS Input Voltage




Output Voltage VS Output Current

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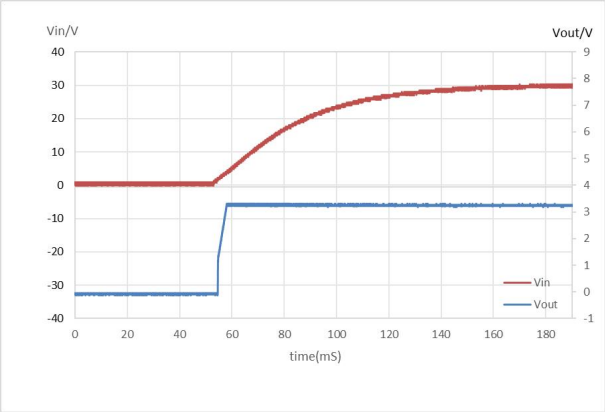
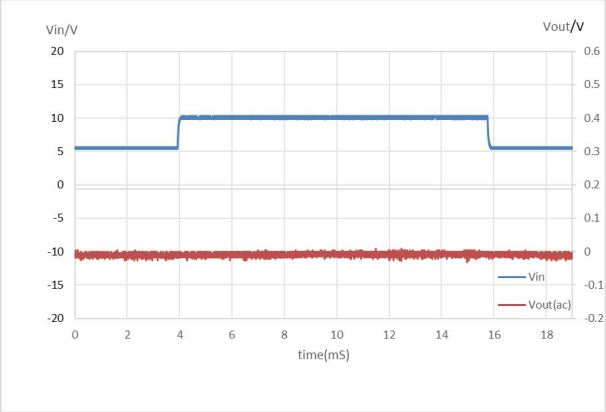
## Typical Characteristics (Cont.)

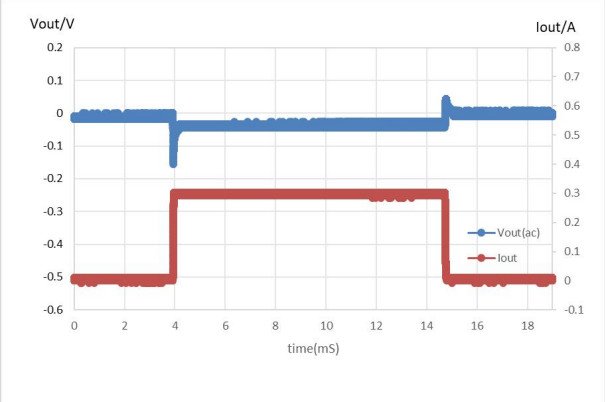
LDO1 （3.3V）




Start-up Response




Line-Transient Response




Load-Transient Response



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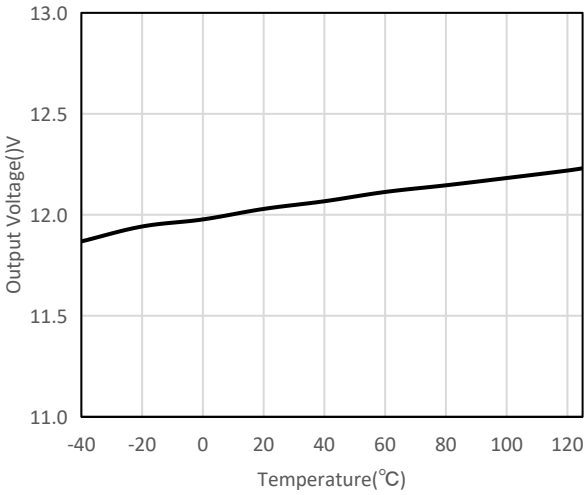
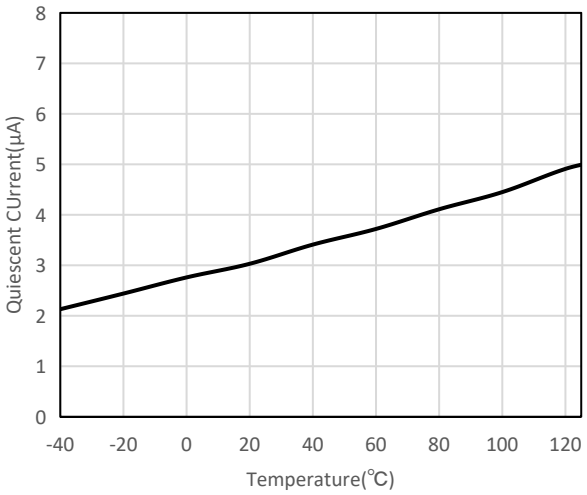
## Typical Characteristics (Cont.)

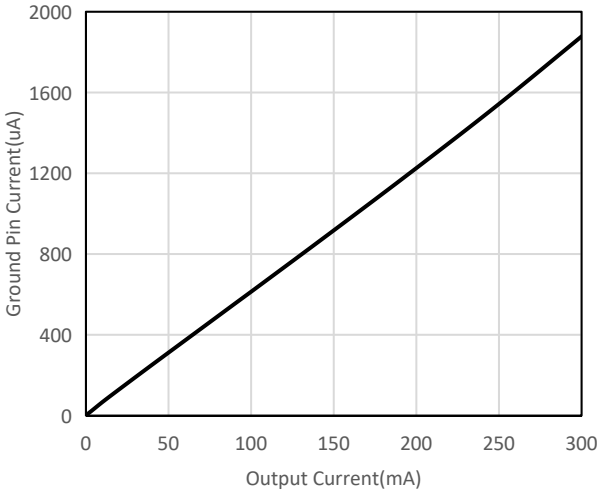
LDO2 （12V）



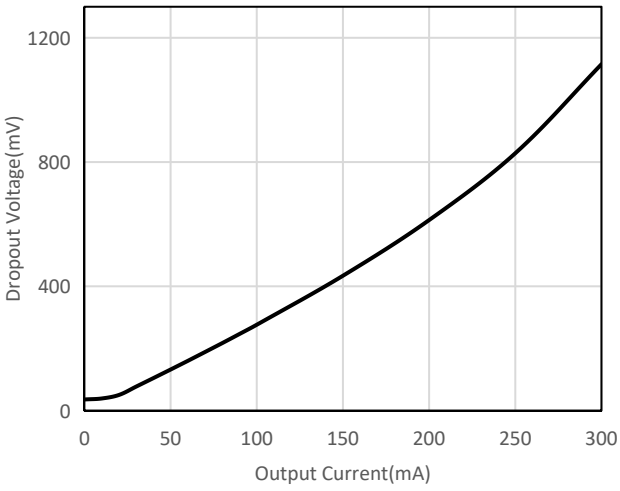

Output Voltage VS Temperature



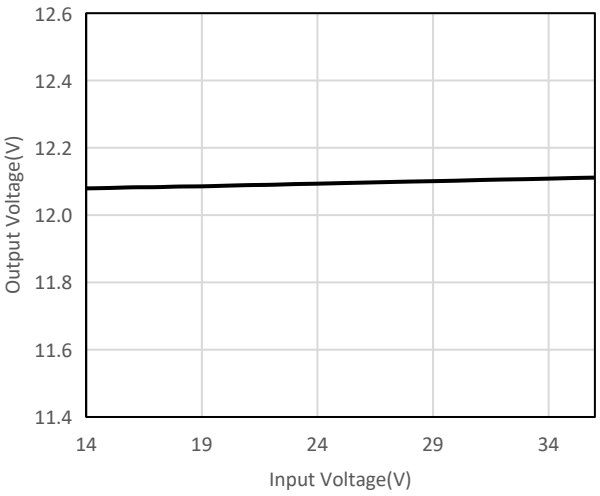

Quiescent Current VS Temperature



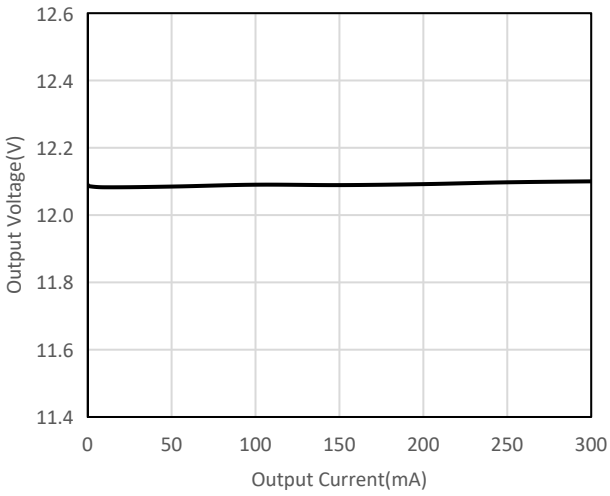

Ground Pin Current VS Output Current




Dropout Voltage VS Output Current




Output Voltage VS Input Voltage




Output Voltage VS Output Current

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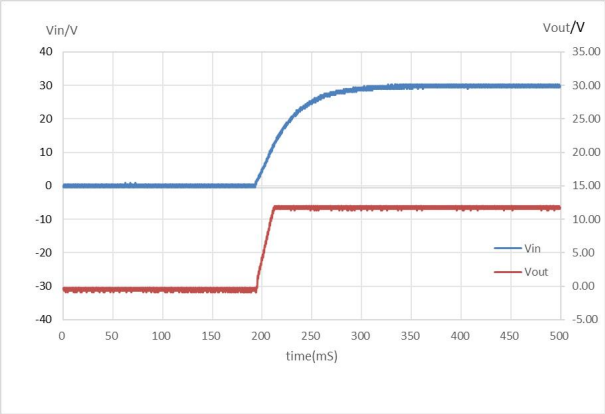
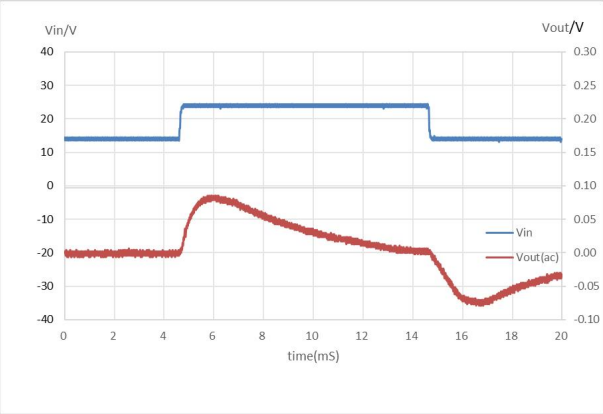
## Typical Characteristics (Cont.)

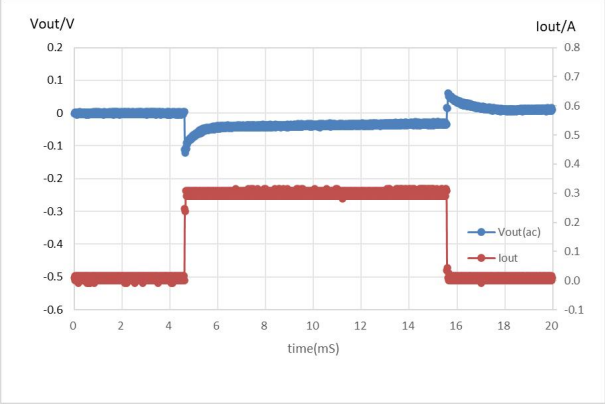
LDO2 （12V）




Start-up Response




Line-Transient Response




Load-Transient Response



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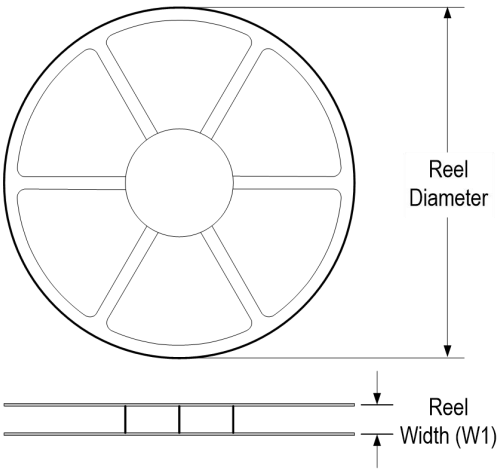
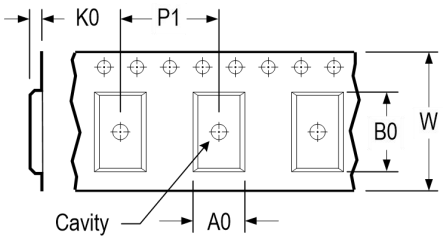
## Tape and Reel Information

### REEL DIMENSIONS

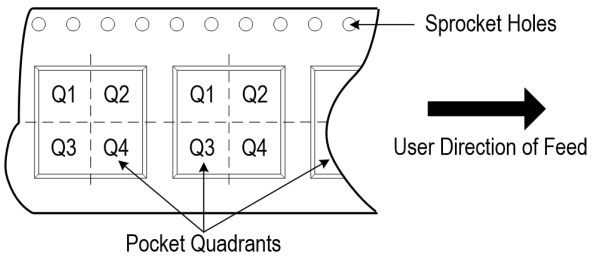



### TAPE DIMENSIONS




| | |
|---|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

### QUADRANT ASSIGNMENTS FOR PIN 1 ORIETATION IN TAPE




* All dimensions are nominal

| Device | Package Type | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin 1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LTP8M4200EXS8/R8 | ESOP | 8 | 4 000 | 330 | 12.5 | 6.6 | 5.3 | 2.0 | 8.0 | 12.0 | Q1 |
| LTP8M4201EXS8/R8 | ESOP | 8 | 4 000 | 330 | 12.5 | 6.6 | 5.3 | 2.0 | 8.0 | 12.0 | Q1 |

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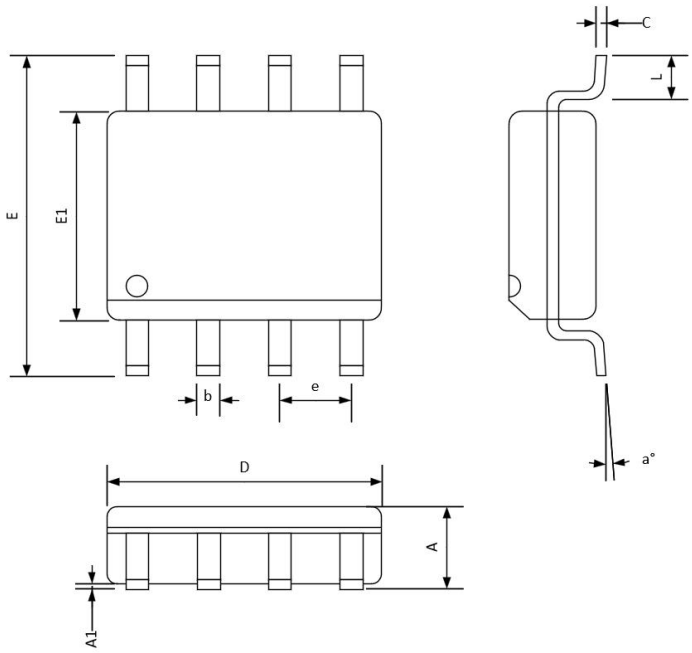
## Package Dimension

### ESOP-8L




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | -- | -- | 1.75 |
| A1 | 0.10 | -- | 0.23 |
| b | 0.33 | -- | 0.53 |
| c | 0.17 | -- | 0.25 |
| D | 4.70 | 4.90 | 5.10 |
| E | 5.80 | 6.00 | 6.20 |
| E1 | 3.70 | 3.90 | 4.10 |
| e | 1.27BSC | | |
| L | 0.50 | -- | 0.80 |
| a° | 0° | -- | 8° |



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For additional product information, or full datasheet, please contact with the Linearin's Sales Department or Representatives.

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