

### 5A LOW DROPOUT POSITIVE FIXED 3.3V OUTPUT REGULATOR

#### FEATURES

- **Guaranteed < 1.3V Dropout at Full Load Current**
- **Fast Transient Response**
- **1% Voltage Reference Initial Accuracy**
- Output Current Limiting
- Built-in Thermal Shutdown

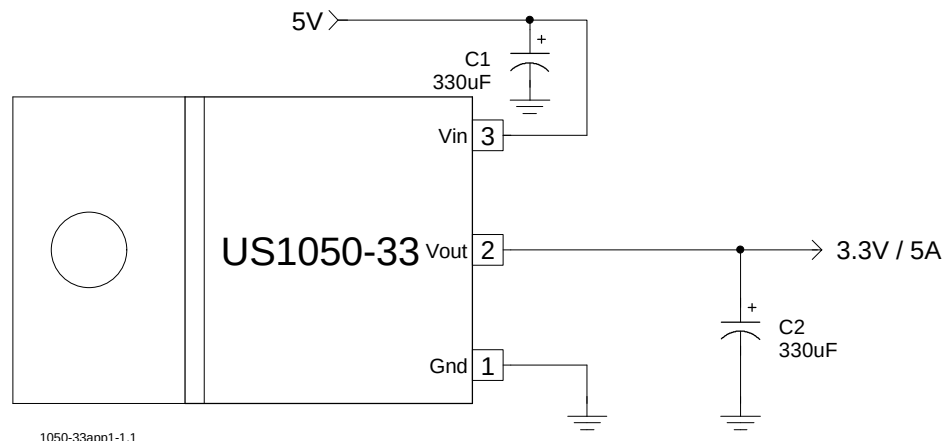
#### APPLICATIONS

- Standard 3.3V Chip-Set and Logic Applications

#### DESCRIPTION

The US1050-33 product is a low dropout three terminal fixed 3.3V output regulator with minimum of 5A output current capability. This product is specifically designed to provide well regulated supply for low voltage IC applications requiring 3.3V output. The US 1050-33 is **guaranteed to have <1.3V drop out at full load current** making it ideal to provide well regulated output with supply voltage as low as 4.6V input.

#### TYPICAL APPLICATION



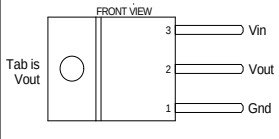
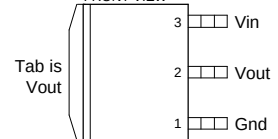
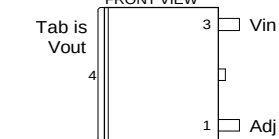
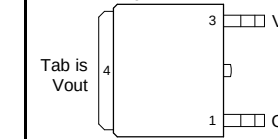
Typical application of US1050-33

| T <sub>j</sub> (°C) | 3 PIN PLASTIC<br>TO220 (T) | 3 PIN PLASTIC<br>TO263 (M) | 2 PIN PLASTIC<br>POWER FLEX (P) | 3 PIN PLASTIC<br>TO252 (D) |
|---------------------|----------------------------|----------------------------|---------------------------------|----------------------------|
| 0 TO 150            | US1050-33CT                | US1050-33CM                | US1050-33CP                     | US1050-33CD                |

## ABSOLUTE MAXIMUM RATINGS

|                                      |                    |
|--------------------------------------|--------------------|
| Input Voltage (Vin)                  | 7V                 |
| Power Dissipation                    | Internally Limited |
| Storage Temperature Range            | -65°C TO 150°C     |
| Operating Junction Temperature Range | 0°C TO 150°C       |

## PACKAGE INFORMATION

| 3 PIN PLASTIC TO220 ( T )                                                                                                                                                                 | 3 PIN PLASTIC TO263 ( M )                                                                                                                                          | 2 PIN PLASTIC POWER FLEX ( P )                                                                                                                                      | 3 PIN PLASTIC TO252 ( D )                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p> <math>\theta_{JT}=2.7^{\circ}\text{C/W}</math>   <math>\theta_{JA}=60^{\circ}\text{C/W}</math> </p> |  <p> <math>\theta_{JA}=35^{\circ}\text{C/W}</math> for 1" Square pad         </p> |  <p> <math>\theta_{JA}=70^{\circ}\text{C/W}</math> for 1" Square pad         </p> |  <p> <math>\theta_{JA}=70^{\circ}\text{C/W}</math> for 0.5" Sq pad         </p> |

## ELECTRICAL SPECIFICATIONS

Unless otherwise specified, these specifications apply over  $C_{in}=1\mu\text{F}$ ,  $C_{out}=10\mu\text{F}$ , and  $T_j=0$  to  $150^{\circ}\text{C}$ . Typical values refer to  $T_j=25^{\circ}\text{C}$ .

| PARAMETER                     | SYM          | TEST CONDITION                                                                                              | MIN            | TYP            | MAX            | UNITS         |
|-------------------------------|--------------|-------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|---------------|
| Output Voltage                | $V_o$        | $I_o=10\text{mA}$ , $T_j=25^{\circ}\text{C}$ , $V_{in}=5\text{V}$<br>$I_o=10\text{mA}$ , $V_{in}=5\text{V}$ | 3.267<br>3.234 | 3.300<br>3.300 | 3.330<br>3.366 | V             |
| Line Regulation               |              | $I_o=10\text{mA}$ , $4.7\text{V}<V_{in}<7\text{V}$                                                          |                |                | 0.2            | %             |
| Load Regulation (note 1)      |              | $V_{in}=5\text{V}$ , $V_{adj}=0$ , $10\text{mA}<I_o<5\text{A}$                                              |                |                | 0.4            | %             |
| Dropout Voltage (note 2)      | $\Delta V_o$ | Note 2, $I_o=5\text{A}$                                                                                     |                | 1.1            | 1.3            | V             |
| Current Limit                 |              | $V_{in}=5\text{V}$ , $dV_o=100\text{mV}$                                                                    | 5.1            |                |                | A             |
| Minimum Load Current (note 3) |              | $V_{in}=5\text{V}$                                                                                          |                | 5              | 10             | mA            |
| Thermal Regulation            |              | 30 mS PULSE, $V_{in}-V_o=3\text{V}$ , $I_o=5\text{A}$                                                       |                | 0.01           | 0.02           | %/W           |
| Ripple Rejection              |              | $f=120\text{HZ}$ , $C_o=25\mu\text{F}$ Tan<br>$I_o=2.5\text{A}$ , $V_{in}-V_o=3\text{V}$                    | 60             | 70             |                | dB            |
| Adjust Pin Current Change     |              | $I_o=10\text{mA}$ , $V_{in}-V_o=1.5\text{V}$ , $T_j=25$                                                     |                | 0.2            | 5              | $\mu\text{A}$ |
| Temperature Stability         |              | $V_{in}=5\text{V}$ , $V_{adj}=0\text{V}$ , $I_o=10\text{mA}$                                                |                | 0.5            |                | %             |
| Long Term Stability           |              | $T_j=125^{\circ}\text{C}$ , 1000 Hrs                                                                        |                | 0.3            | 1              | %             |
| RMS Output Noise              |              | $T_j=25^{\circ}\text{C}$ 10hz< $f$ <10khz                                                                   |                | 0.003          |                | % $V_o$       |

**Note 1 :** Low duty cycle pulse testing with Kelvin connections are required in order to maintain accurate data.

**Note 2 :** Drop-out voltage is defined as the minimum differential voltage between  $V_{in}$  and  $V_{out}$  required to maintain regulation at  $V_{out}$ . It is measured when the output voltage drops 1% below its nominal value.

**Note 3 :** Minimum load current is defined as the minimum current required at the output in order for the output voltage to maintain regulation. Typically the resistor dividers are selected such that it automatically maintains this current.

## PIN DESCRIPTIONS

| PIN # | PIN SYMBOL | PIN DESCRIPTION                                                                                                                                                                                                                                                                                                           |
|-------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Gnd        | This pin must be connected to GND plane using a low inductance short connection.                                                                                                                                                                                                                                          |
| 2     | Vout       | The output of the regulator. A minimum of 10uF capacitor must be connected from this pin to ground to insure stability.                                                                                                                                                                                                   |
| 3     | Vin        | The input pin of the regulator. Typically a large storage capacitor is connected from this pin to ground to insure that the input voltage does not sag below the minimum drop out voltage during the load transient response. This pin must always be 1.3V higher than Vout in order for the device to regulate properly. |

## BLOCK DIAGRAM

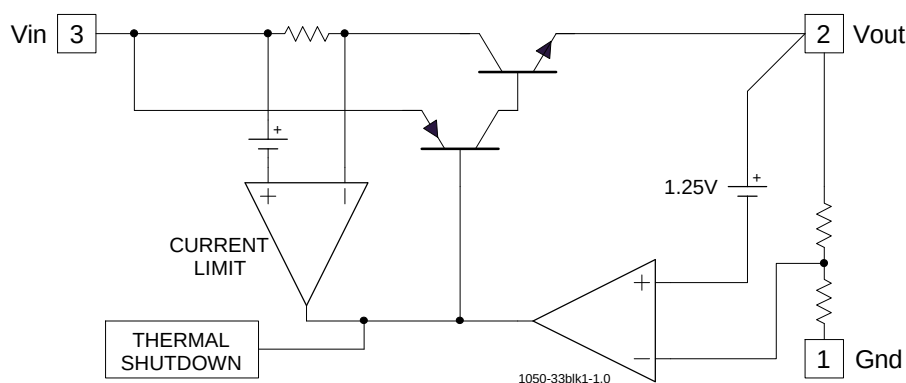


Figure 1 - Simplified block diagram of the US1050-33

## APPLICATION INFORMATION

### Stability

The US1050-33 requires the use of an output capacitor as part of the frequency compensation in order to make the regulator stable. Typical designs for microprocessor applications use standard electrolytic capacitors with a typical ESR in the range of 50 to 100 mΩ and an output capacitance of 500 to 1000uF. Fortunately as the capacitance increases, the ESR decreases resulting in a fixed RC time constant. The US1050-33 takes advantage of this phenomena in making the overall regulator loop stable. For most applications a minimum of 100uF aluminum electrolytic capacitor such as Sanyo MVGX series, Panasonic FA series as well as the Nichicon PL series insures both stability and good transient response.