

April 8, 1998

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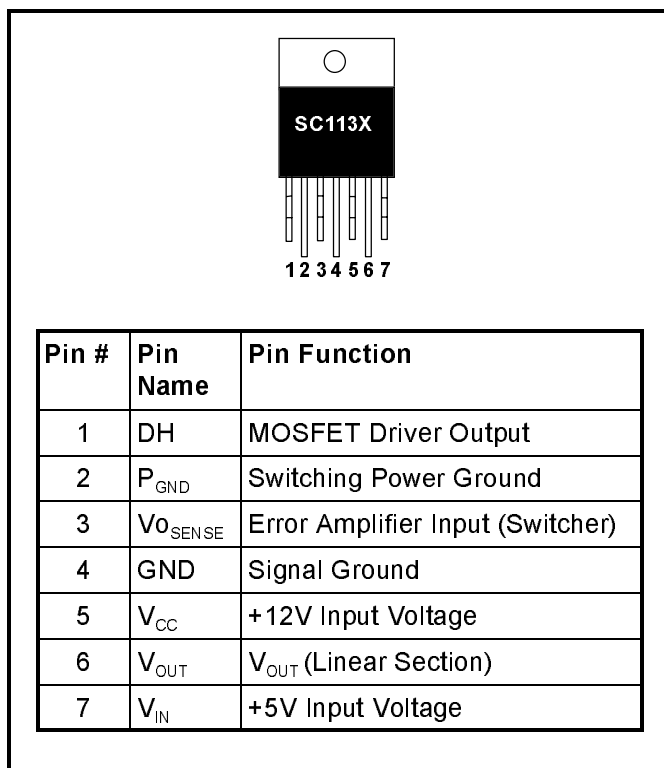
DESCRIPTION

The SC1131/2/3/4 incorporates a high current low dropout linear regulator section together with a switching buck mode controller. This unique combination is well suited for high current low voltage power supply applications such as the Intel Pentium™ P55, AMD K6 and the Cyrix M2 processors. The SC113X was designed to reduce the number of components required to design a dual power supply for multivoltage processor applications.

Switching Controller Section: The switching control section is a voltage mode controller designed for high current, low voltage power supply applications. Key features include a temperature compensated voltage reference, triangular oscillator and an internally compensated transconductance error amplifier. The switching controller operates at a fixed frequency of 200kHz, providing an optimum compromise between size, efficiency and cost in the intended application areas.

Linear Section: The linear portion is a high performance positive voltage regulator designed for use in applications requiring "very low dropout performance" at 1.5, 3, 5 and 7.5 amps. Additionally, the linear section provides excellent regulation over variations due to changes in line, load or temperature.

PIN CONFIGURATION



FEATURES

- 85% typical efficiency for switching section
- Grounded tab
- 1.5, 2.5 or 3.3V @ 1% for linear
- Thermal shutdown
- Internal short circuit protection
- 7 pin TO-220 package

APPLICATIONS

- Microprocessor supplies
- Modules supplies
- 1.3V to 3.5V power supplies
- Dual power supplies from 5V source

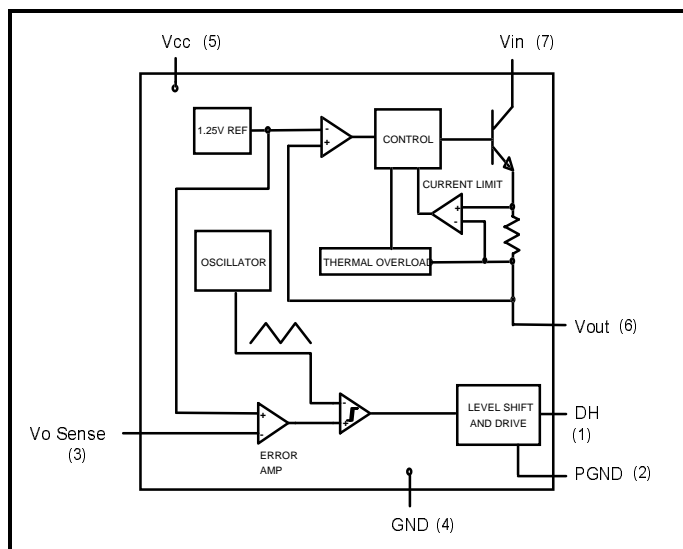
ORDERING INFORMATION

| PART NUMBER ⁽¹⁾ | PACKAGE | OUTPUT CURRENT |
|----------------------------|---------|----------------|
| SC1131CT-XY | TO-220 | 1.5A |
| SC1132CT-XY | TO-220 | 3.0A |
| SC1133CT-XY | TO-220 | 5.0A |
| SC1134CT-XY | TO-220 | 7.5A |

Note:

(1) Where XY denotes voltage options and lead configurations. Available voltages (X) are: 1.5V, 2.5V and 3.3V. Available lead configurations (Y) are dual bend (DB), single bend (SB) and straight leads (leave blank). Sample part number: SC1133CT-2.5DB.

BLOCK DIAGRAM



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ABSOLUTE MAXIMUM RATINGS

| | | |
|-----------------|---|-----------------|
| V_{IN} to GND | | -0.3V, 7V |
| V_{CC} to GND | | -0.3V, 15V |
| T_J | Junction Operating Temperature | 0°C to +125°C |
| T_S | Storage Temperature | -65°C to +125°C |
| T_L | Lead Soldering Temperature | 260°C, 10 sec. |
| θ_{JC} | Thermal Resistance, Junction to Case | 2°C/W |
| θ_{JA} | Thermal Resistance, Junction to Ambient | 50°C/W |

ELECTRICAL CHARACTERISTICS
SWITCHING CONTROL SECTION
 $V_{CC} = 12V$; $V_{IN} = 5.0V$; $GND = P_{GND} = 0V$; $V_{OUT} = 2.8V$. Per application circuit unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--------------|------------------------------|----------------------------------|----------|-------|-------|-------|-------|
| I_{CC} | Total Quiescent Current | Linear out = No Load | 25° C | | 15 | 25 | mA |
| V_{REF} | Reference Voltage | | 25° C | 1.238 | 1.250 | 1.263 | V |
| | | | 0-125° C | 1.225 | 1.250 | 1.275 | |
| Reg_{LOAD} | Load Regulation | | 25° C | | | 1 | % |
| Reg_{LINE} | Line Regulation | | 25° C | | 0.5 | | % |
| DH_{HI} | MOSFET Driver Source Voltage | $V_{CC} - DH$; $I_{DH} = 0.5A$ | 25° C | | 1.6 | | V |
| DH_{LOW} | MOSFET Driver Sink Voltage | $DH - P_{GND}$; $I_{DH} = 0.5A$ | 25° C | | 1.1 | | V |
| f_{OSC} | Oscillator Frequency | | 25° C | 180 | 200 | 220 | kHz |
| dc | Duty Cycle (maximum) | | 25° C | 90 | 95 | | % |

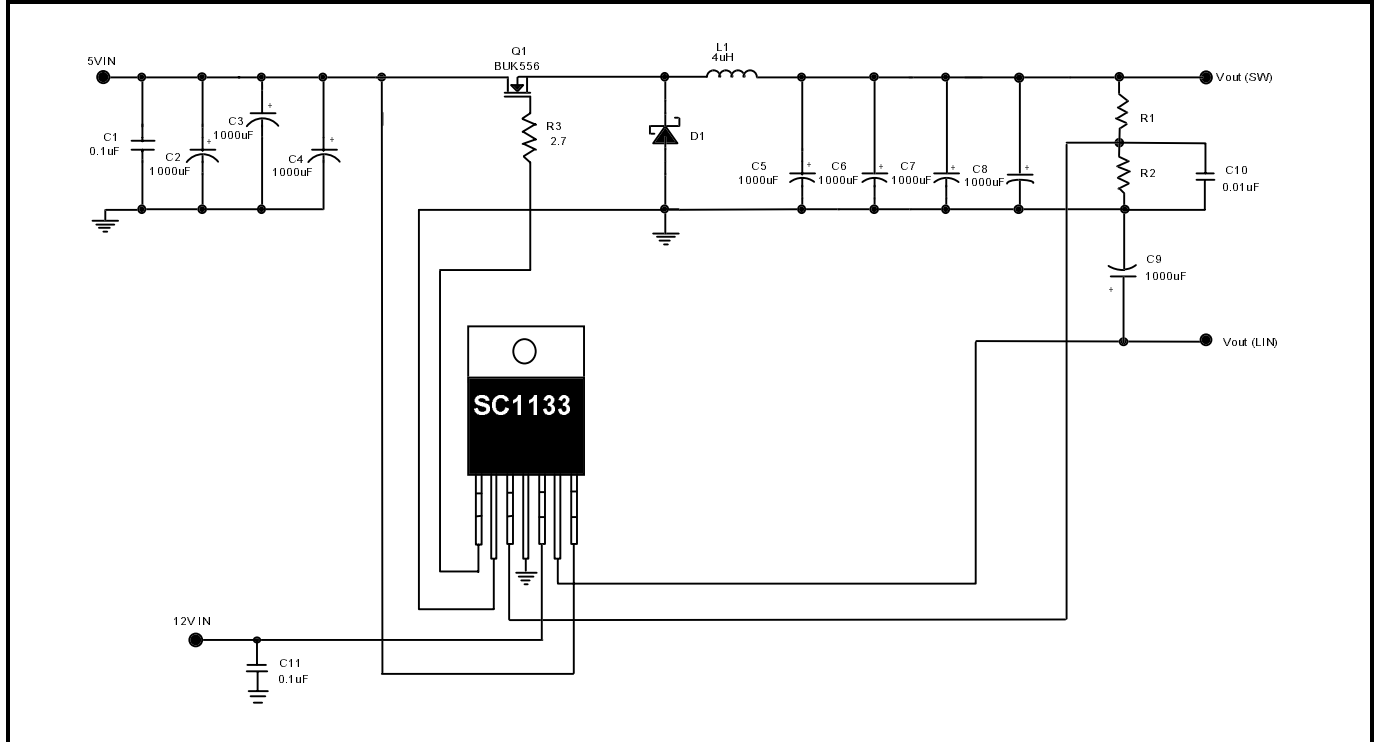
LINEAR SECTION
 $V_{CC} = 12V$; $V_{IN} = 5.0V$; $GND = P_{GND} = 0V$; $V_{OUT} = 3.3V$. Per application circuit unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--------------|-----------------------------------|---|--------------|-------------|-------|-------|-------|
| V_{OUT} | Output Voltage | $V_{IN} = 5.0V$, $I_{OUT} = I_R$ | 25° C | 3.267 | 3.300 | 3.333 | V |
| | | $V_{IN} = 4.75-5.55V$, $I_{OUT} = 10mA$ to I_R | 0-125° C | 3.234 | 3.300 | 3.366 | |
| Reg_{LOAD} | Load Regulation | $V_{IN} = 5.0V$ $I_{OUT} = 10mA$ to I_R | 25° C | | | 1 | % |
| | | | 0-125 C | | | 1.5 | |
| Reg_{LINE} | Line Regulation | $V_{IN} = 4.75-5.55V$, $I_{OUT} = I_R$ | 25° C | | 0.5 | | % |
| | | | 0-125 C | | 1 | | |
| I_{LIMIT} | Current Limit | | 25° C | $I_R + 0.1$ | | | A |
| R_A | Ripple Rejection ⁽¹⁾ | $V_{IN} = 5.0V$, $I_{OUT} = I_R/2$ | 25° C | 60 | 80 | | dB |
| T_{REG} | Thermal Regulation ⁽²⁾ | | 25° C | | 0.002 | 0.02 | %/°C |
| V_{DO} | Dropout Voltage ⁽³⁾ | $I_{OUT} = I_R$ | SC1131, 2, 3 | 25° C | 0.8 | 0.9 | V |
| | | | SC1134 | 25° C | 1.3 | 1.4 | |
| V_{IN} | Minimum V_{IN} | $I_{OUT} = I_R$ | SC1131, 2, 3 | 25° C | 0.8 | 0.9 | V |
| | | | SC1134 | 25° C | 1.3 | 1.4 | |

NOTES:

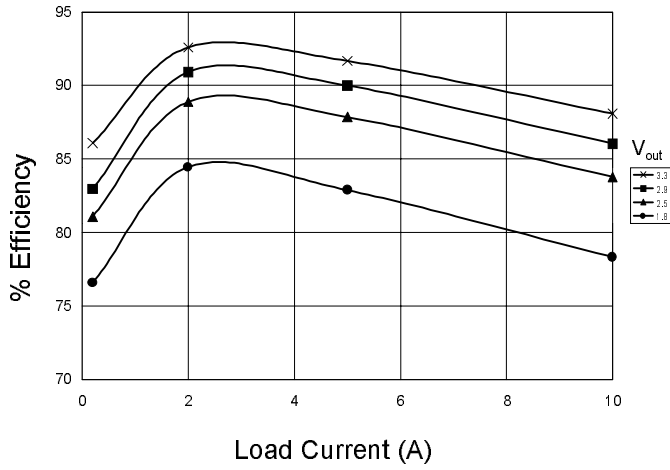
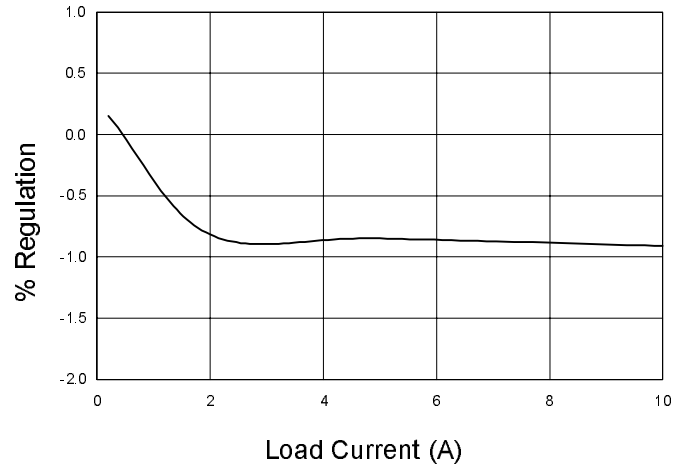
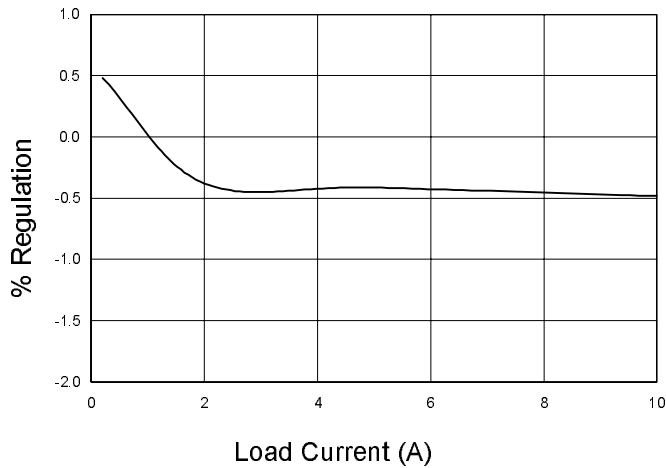
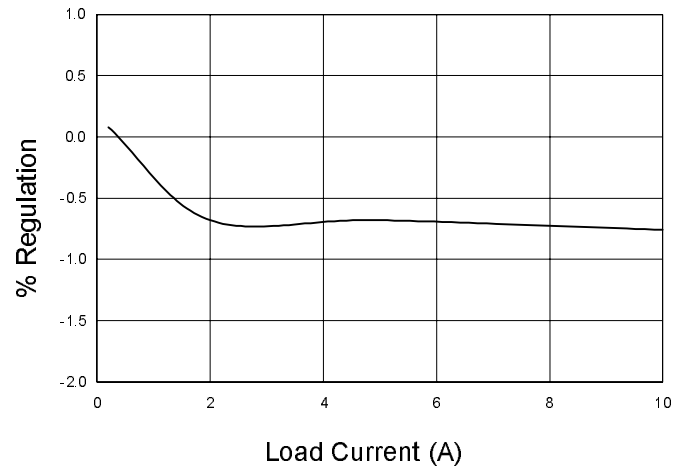
- $V_{CC} = V_{IN} = 5.0V$ Avg; $V_{RIPPLE} = 1V_{PK-PK}$, 120 Hz.
- 30ms pulse
- Minimum input/output voltage required to maintain 1% regulation
- I_R = Rated load current per ordering information

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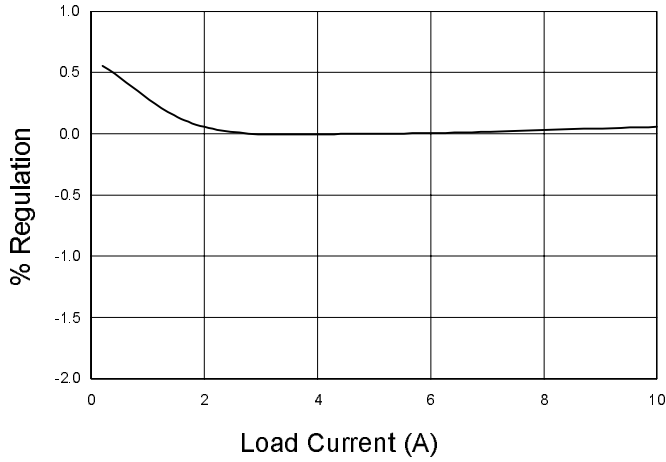
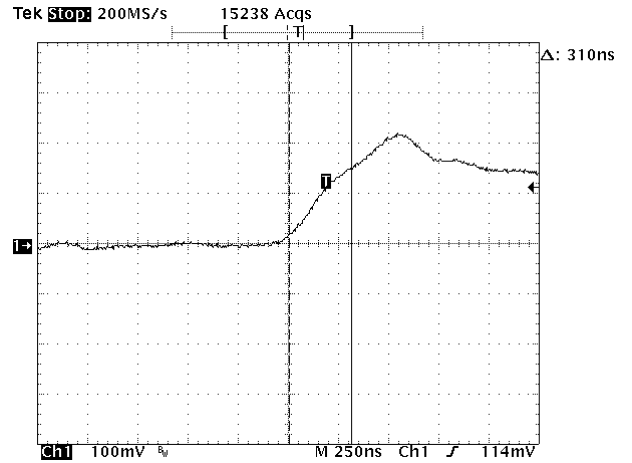
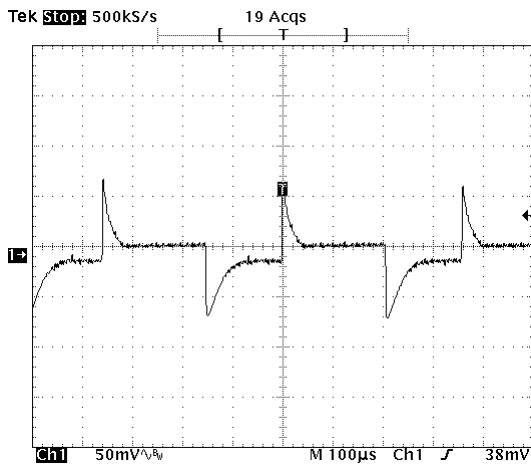
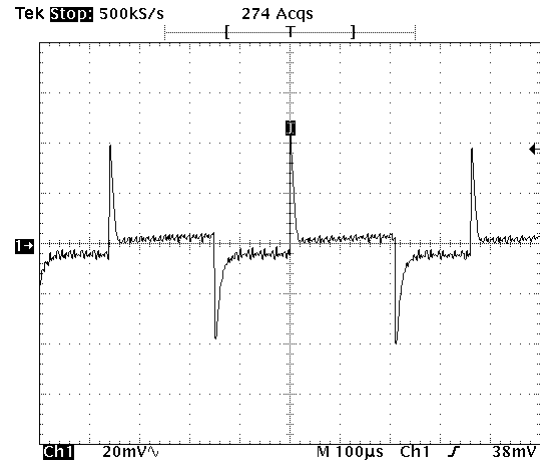
APPLICATION CIRCUIT

MATERIALS LIST

| Quantity | Reference | Part/Description | Vendor | Notes |
|----------|-----------|------------------|---------|---|
| 1 | C1,C11 | 0.1µF Ceramic | Various | |
| 1 | C10 | 0.01µF Ceramic | Various | |
| 8 | C2-C9 | 1000µF/6.3V | SANYO | MV-GX or equiv. Low ESR |
| 1 | D1 | 32CTQ030 | Various | 16A, 30V Schottky, TO-220 |
| 1 | L1 | 4µH | | 8 Turns 16AWG on MICROMETALS T50-52D core |
| 1 | Q1 | BUK556 | PHILIPS | Logic level FET, ≤ 22mΩ, 30V |
| 1 | U1 | SC1133T-XY | SEMTECH | 5A Linear Regulator with Switching Controller |
| 1 | R1 | SMT 1% | Various | Value depends on V_{OUT} |
| 1 | R2 | SMT 1% | Various | Value depends on V_{OUT} |
| 1 | R3 | 2.7Ω 1/8W | Various | |

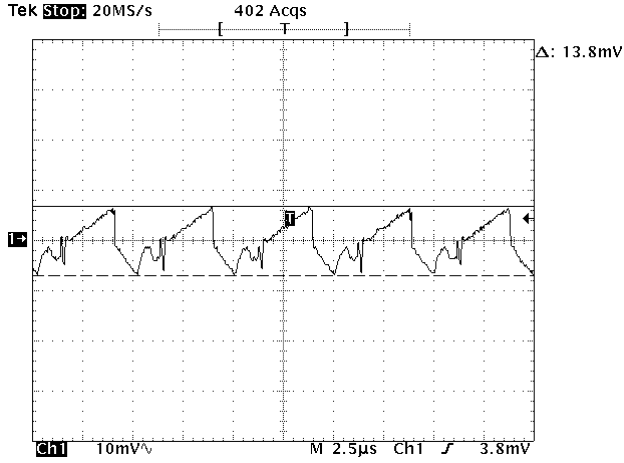
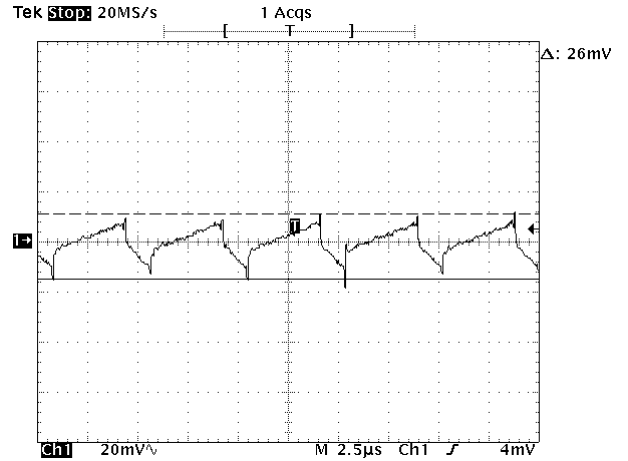
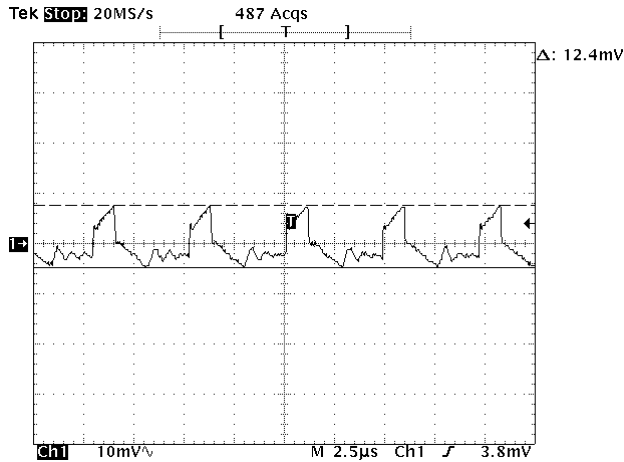
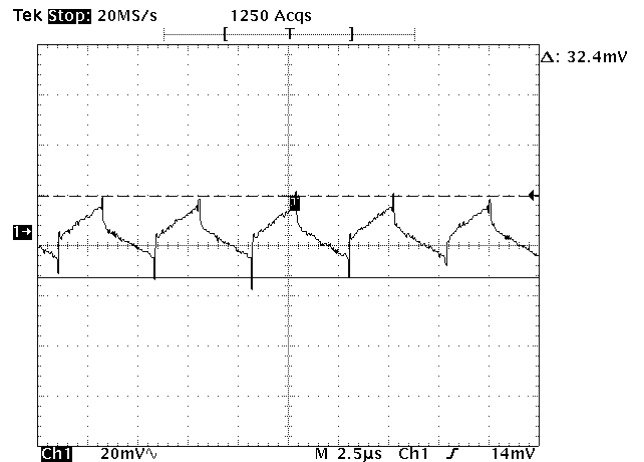
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SC113x Efficiency

% Load Regulation 3.3V, 0.3 to 10 Amps

% Load Regulation 2.9V, 0.3 to 10 Amps

% Load Regulation 2.3V, 0.2 to 10 Amps


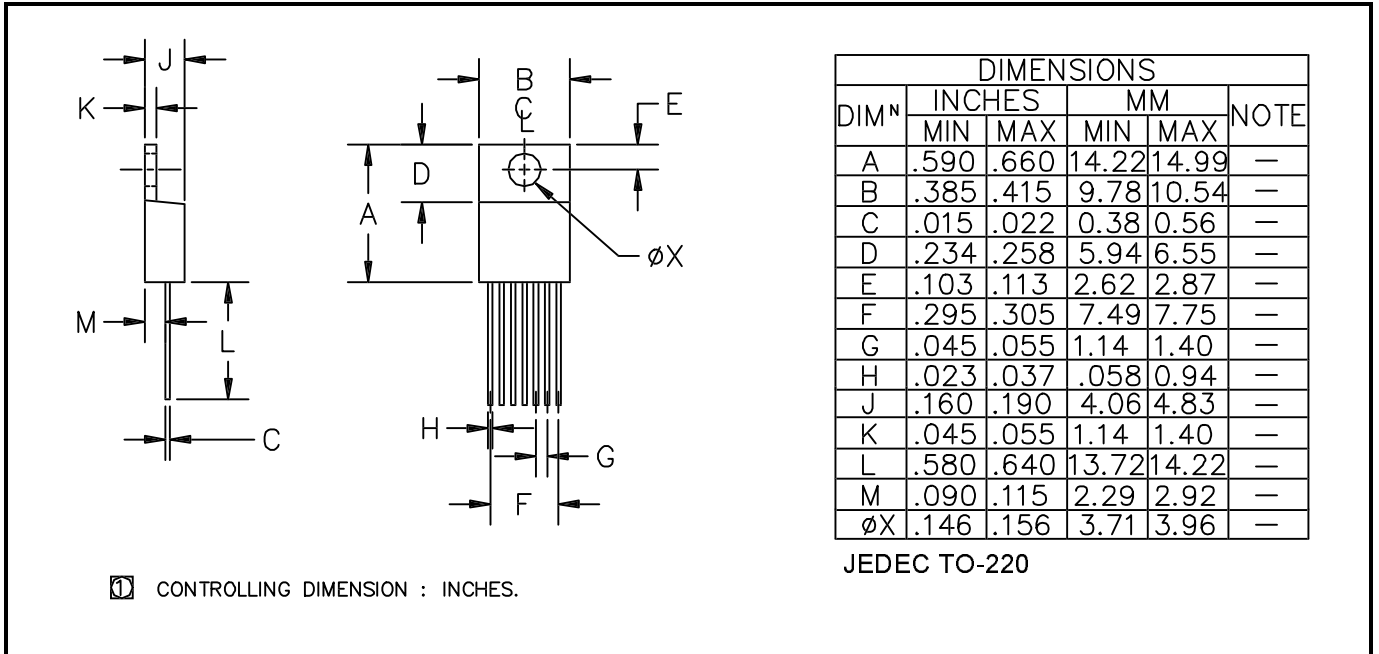
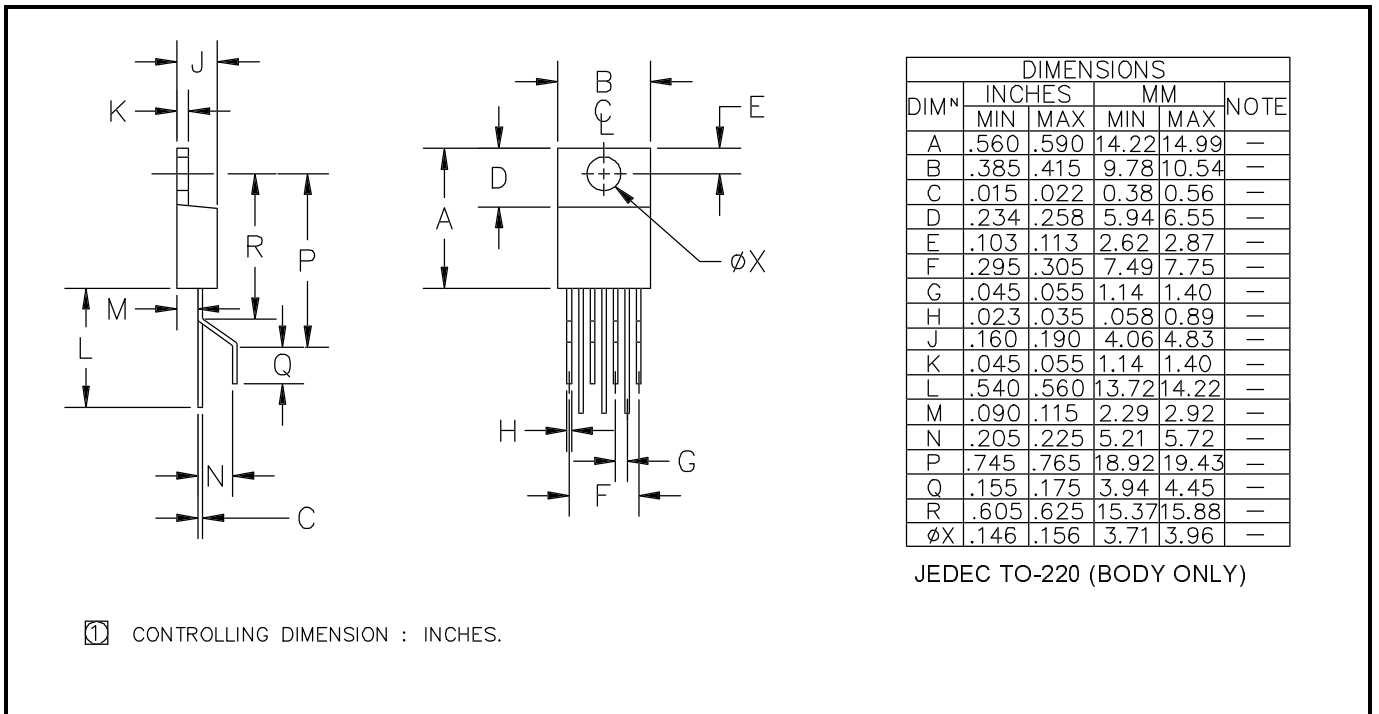
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% Load Regulation 1.8V, 0.2 to 10 Amps

Transient Load Current Rise 3.3V @ 10A

Transient Voltage Response 3.3V From 0.3 to 10A

Transient Voltage Response 1.8V From 0.2 to 10A


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Output Ripple 3.3V @ 0.3A

Output Ripple 1.8V @ 0.2A

Output Ripple 3.3V @ 10A

Output Ripple 1.8V @ 10A


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OUTLINE TO-220 (STRAIGHT LEAD)

OUTLINE: TO-220-SB (SINGLE BEND LEAD)


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OUTLINE: TO-220-DB (DUAL BEND LEAD)
