FEATURES:
- Hermetic Surface Mount Package
- Extremely Low Dropout Voltage: 350mV @ 1.5 Amps
- Available in 1.5V, 1.7V, 1.8V, 1.9V, 2.5V, 3.3V, 5.0V and 12.0V
- On Board Thermal Shut Down
- Reverse Battery and Load Dump Protection
- Low Ground Current: 32mA Typical at Full Load
- 1% Maximum Guaranteed Accuracy
- Output Current to 1.5 Amps
- Alternate Output Voltages Available

DESCRIPTION:
The MSK5215 series voltage regulators are available in +1.5V, +1.7V, +1.8V, +1.9V, +2.5V, +3.3V, +5.0V, and +12.0V output configurations. All boast ultra low dropout specifications due to the utilization of a super PNP output pass transistor with monolithic technology. Dropout voltages of 350mV at 1.5 amps are typical in this configuration, which drives efficiency up and power dissipation down. Accuracy is guaranteed with a 1% maximum output voltage tolerance. The MSK5215 series is packaged in a space efficient 3 pin power surface mount ceramic package.

TYPICAL APPLICATIONS
- High Efficiency, High Current Linear Regulators
- Constant Voltage/Current Regulators
- System Power Supplies
- Switching Power Supply Post Regulators
- Battery Powered Equipment
ABSOLUTE MAXIMUM RATINGS

- **V_{INP}**: Input Voltage (100mS 1% D.C.)......-20V to +60V
- **VIN**: Input Voltage...........................................26V
- **V_{EN}**: Enable Voltage...........................................-0.3V to 26V
- **I_{OUT}**: Output Current.....................................-3.5A

**T_{ST}**: Storage Temperature Range..............-65°C to +150°C

**T_{LD}**: Lead Temperature
(10 Seconds Soldering).................................300°C

**T_{J}**: Operating Temperature
MSK5251 Series........................................-40°C to +85°C
MSK5251H Series......................................-55°C to +125°C

ESD Rating..........................................................Class 1B

ELECTRICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Group A</th>
<th>Subgroup</th>
<th>MSK5215H SERIES</th>
<th>MSK 5215 SERIES</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Voltage Tolerance</td>
<td>I_{OUT} = 10mA;</td>
<td>1</td>
<td>2, 3</td>
<td>±0.5</td>
<td>±1.0</td>
<td>±1.0</td>
</tr>
<tr>
<td></td>
<td>VIN = VOUT +1V</td>
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<tr>
<td>Dropout Voltage</td>
<td>ΔVOUT = -1%;</td>
<td>1</td>
<td>2, 3</td>
<td>±0.1</td>
<td>±2.0</td>
<td>±2.0</td>
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<tr>
<td></td>
<td>I_{OUT} = 100 mA</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ΔVOUT = -1%;</td>
<td>1</td>
<td></td>
<td>±0.1</td>
<td>±2.0</td>
<td>±2.0</td>
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<tr>
<td></td>
<td>I_{OUT} = 1.5A</td>
<td></td>
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<tr>
<td>Load Regulation</td>
<td>10 mA ≤ I_{OUT} ≤ 1.25A</td>
<td>1</td>
<td>2, 3</td>
<td>±0.2</td>
<td>±1.0</td>
<td>±1.2</td>
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<tr>
<td>Line Regulation</td>
<td>(VOUT +1V) ≤ VIN ≤ 26V</td>
<td>1</td>
<td>2, 3</td>
<td>±0.05</td>
<td>±0.5</td>
<td>±0.6</td>
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<tr>
<td></td>
<td>I_{OUT} = 10 mA</td>
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</tr>
<tr>
<td>Output Current Limit</td>
<td>VOUT = 0V;</td>
<td>-</td>
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<tr>
<td></td>
<td>VIN = VOUT +1V</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Ground Current</td>
<td>VIN = VOUT +1V;</td>
<td>-</td>
<td></td>
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<tr>
<td></td>
<td>I_{OUT} = 0.75A</td>
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<tr>
<td></td>
<td>VIN = VOUT +1V;</td>
<td>-</td>
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<tr>
<td></td>
<td>I_{OUT} = 1.5A</td>
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<tr>
<td>Output Noise</td>
<td>CL = 10µF;</td>
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<td></td>
<td>10HZ ≤ f ≤ 100 KHZ</td>
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<tr>
<td>Thermal Resistance</td>
<td>Junction to Case @ 125°C</td>
<td>-</td>
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<tr>
<td>Thermal Shutdown</td>
<td>T_{J}</td>
<td>-</td>
<td>100°C</td>
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</tbody>
</table>

NOTES:

1. Output decoupled to ground using 33µF minimum capacitor unless otherwise specified.
2. Guaranteed by design but no tested. Typical parameters are representative of actual device performance but are for reference only.
3. All output parameters are tested using a low duty cycle pulse to maintain T_{J} = T_{C}.
4. Industrial grade devices shall be tested to subgroup 1 unless otherwise specified.
5. Military grade devices ('H' suffix) shall be 100% tested to subgroups 1,2,3.
6. Subgroup 1  T_{C} = +25°C
   Subgroup 2  T_{J} = +125°C
   Subgroup 3  T_{A} = -55°C
7. Please consult the factory if alternate output voltages are required.
8. Due to current limit, maximum output current may not be available at all values of V_{IN}-V_{OUT} and temperatures.
   See typical performance curves for clarification.
REGULATOR PROTECTION:

The MSK5215 series is fully protected against reversed input polarity, overcurrent faults, overtemperature conditions (Pd) and transient voltage spikes of up to 60V. If the regulator is used in dual supply systems where the load is returned to a negative supply, the output voltage must be diode clamped to ground.

OUTPUT CAPACITOR:

The output voltage ripple of the MSK5215 series voltage regulators can be minimized by placing a filter capacitor from the output to ground. The optimum value for this capacitor may vary from one application to the next, but a minimum of 33μF is recommended for optimum performance. Transient load response can also be improved by placing a capacitor directly across the load. The capacitor should not be an ultra-low ESR type. Tantalum capacitors are best for fast load transients but aluminum electrolytics will work fine in most applications.

LOAD CONNECTIONS:

In voltage regulator applications where very large load currents are present, the load connection is very important. The path connecting the output of the regulator to the load must be extremely low impedance to avoid affecting the load regulation specifications. Any impedance in this path will form a voltage divider with the load.

MINIMIZING POWER DISSIPATION:

Many applications cannot take full advantage of the extremely low dropout specifications of the regulator due to large input to output voltage differences. The simple circuit below illustrates a method to reduce the input voltage at the regulator to just over the dropout specification to keep the internal power dissipation minimized:

![Voltage Regulator Circuit Diagram]

For a given continuous maximum load of 1 amp, R1 can be selected to drop the voltage seen at the regulator to 4V. This allows for the output tolerance and dropout specifications. Input voltage variations (5V) also should be included in the calculations. The resistor should be sized according to the power levels required for the application.

POWER DISSIPATION EXAMPLE:

An MSK5215-3.3 is configured for VIN=+5V and VOUT=+3.3V. Iout is a continuous 1A DC level. The ambient temperature is +25°C. The maximum desired junction temperature is 125°C.

\[ R_\text{θjc} = 3.5°C/W \text{ and } R_\text{θcs} = 0.5°C/W \text{ typically.} \]

\[ \text{Power Dissipation} = (5V - 3.3V) \times (1A) = 1.7 \text{ Watts} \]

Solve for \( R_\text{θsa} \):

\[ R_\text{θsa} = \frac{125°C - 25°C}{1.7W} - 3.5°C/W - 0.5°C/W = 54.82°C/W \]

In this example, a heat sink with a thermal resistance of no more than 54°C/W must be used to maintain a junction temperature of no more than 125°C.

APPLICATION NOTES

REGULATOR PROTECTION:

The MSK5215 series is fully protected against reversed input polarity, overcurrent faults, overtemperature conditions (Pd) and transient voltage spikes of up to 60V. If the regulator is used in dual supply systems where the load is returned to a negative supply, the output voltage must be diode clamped to ground.

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For a given continuous maximum load of 1 amp, R1 can be selected to drop the voltage seen at the regulator to 4V. This allows for the output tolerance and dropout specifications. Input voltage variations (5V) also should be included in the calculations. The resistor should be sized according to the power levels required for the application.

POWER DISSIPATION EXAMPLE:

An MSK5215-3.3 is configured for VIN=+5V and VOUT=+3.3V. Iout is a continuous 1A DC level. The ambient temperature is +25°C. The maximum desired junction temperature is 125°C.

\[ R_\text{θjc} = 3.5°C/W \text{ and } R_\text{θcs} = 0.5°C/W \text{ typically.} \]

\[ \text{Power Dissipation} = (5V - 3.3V) \times (1A) = 1.7 \text{ Watts} \]

Solve for \( R_\text{θsa} \):

\[ R_\text{θsa} = \frac{125°C - 25°C}{1.7W} - 3.5°C/W - 0.5°C/W = 54.82°C/W \]

In this example, a heat sink with a thermal resistance of no more than 54°C/W must be used to maintain a junction temperature of no more than 125°C.
SCREENING
BLANK=INDUSTRIAL; H=MIL-PRF-38534 CLASS H
OUTPUT VOLTAGE
1.5=+1.5V; 1.7=+1.7V; 1.8=+1.8V; 1.9=+1.9V
2.5=+2.5V; 3.3=+3.3V; 5.0=+5.0V; 12=+12.0V
GENERAL PART NUMBER

The above example is a +3.3V, Military regulator.
<table>
<thead>
<tr>
<th>REV</th>
<th>STATUS</th>
<th>DATE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>Released</td>
<td>07/15</td>
<td>Add ESD rating to absolute maximum ratings and update format.</td>
</tr>
</tbody>
</table>