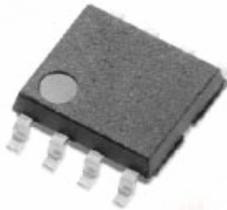
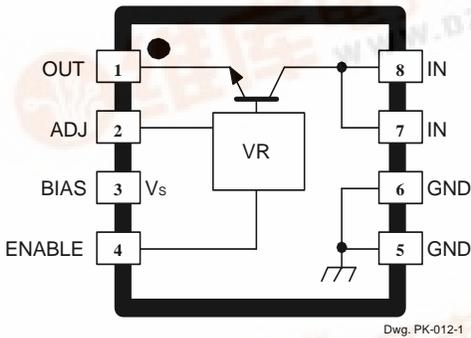


Linear
Regulators

SI-3010LLSL

Data Sheet
27468.44

1.5 A, Ultra-Low-Dropout, 1.1~3.3 V Regulator



ABSOLUTE MAXIMUM RATINGS

| | |
|---|-----------------|
| Input Voltage, V_I | 10 V |
| Output Current, I_O | 1.5 A* |
| Bias Voltage, V_S | 10 V |
| Enable Input Voltage, V_E | V_I |
| Junction Temperature, T_J | +125°C |
| Storage Temperature Range, T_S | -30°C to +125°C |

* Output current rating is limited by input voltage, duty cycle, and ambient temperature. Under any set of conditions, do not exceed a junction temperature of +125°C.

Designed to meet the high-current requirements in industrial and consumer applications; embedded core, memory, or logic supplies; TVs, VCRs, and office equipment, the SI-3010LLSL voltage regulator offers the reduced dropout voltage and low quiescent current essential for improved efficiency. This device delivers a regulated output at up to 1.5 A. Integrated thermal and overcurrent protection enhance overall system reliability.

An npn pass element provides a dropout voltage of less than 300 mV at 1 A of load current. Regulator accuracy and excellent temperature characteristics are provided by a bandgap reference. Low output voltages eliminate the need for expensive PWM buck converters. The low dropout voltage permits more efficient regulation before output regulation is lost. Quiescent current does not increase significantly as the dropout voltage is approached, an ideal feature in standby/resume power systems where data integrity is crucial. An LS-TTL/CMOS-compatible input gives the designer complete control over power up, standby, or power down.

This device is supplied in a fully molded 8-lead miniature surface-mount package (tape and reel) with enhanced power-dissipating qualities. It is rated for continuous operation between -30°C and +100°C.

FEATURES

- 1.5 A Output Current
- Adjustable 1.1 ~ 3.3 V Output Voltage
- 0.3 V Maximum Dropout Voltage at $I_O = 1$ A
- Fast Transient Response
- 1 μ A Maximum Standby Current
- Remote Voltage Sensing
- Foldback Current Limiting
- Superior Heat Dissipation
- Thermal Protection

APPLICATIONS

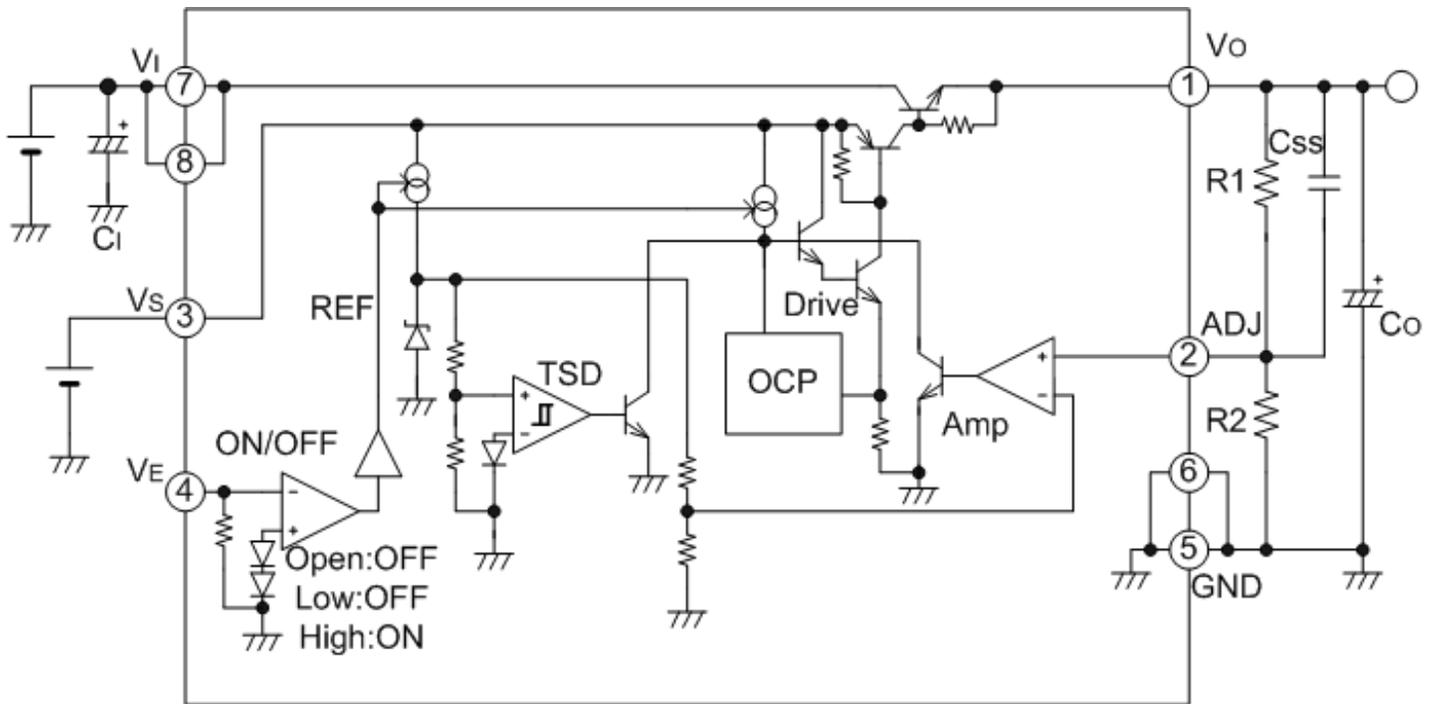
- TVs, VCRs, Electronic Games
- Embedded Core, Memory, or Logic Supplies
- Printers and Other Office Equipment
- Industrial Machinery
- Secondary-Side Stabilization of Multi-Output SMPS

Always order by complete part number, e.g., **SI-3010LLSL-TL**, where "-TL" indicates tape and reel..

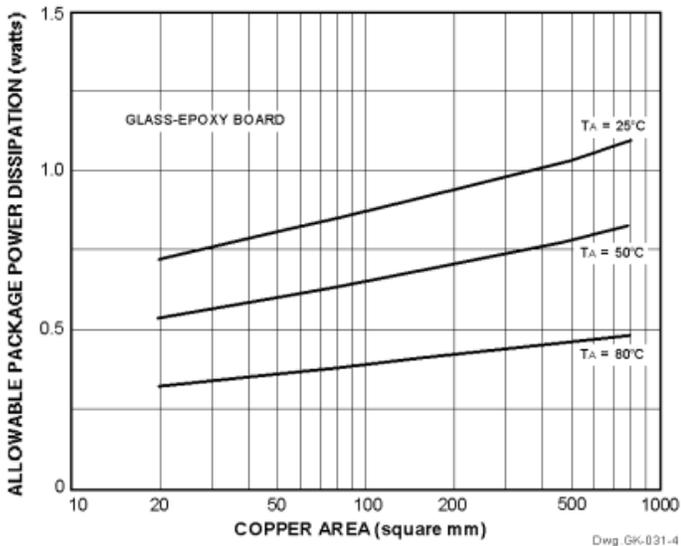
SI-3010LLSL
1.5 A, Ultra-Low-Dropout,
1.1~3.3 V Regulator

*Linear
Regulators*

FUNCTIONAL BLOCK DIAGRAM



Allowable Package Power Dissipation



Recommended Operating Conditions

| | Min | Max | Units |
|-------------------------------|-----|------|-------|
| DC Input Voltage | 1.4 | 3.6 | V |
| Adjustable Output Volt. Range | 1.1 | 3.3 | V |
| DC Output Current | 0 | 1.5 | A |
| DC Bias Voltage | 3.3 | 5.5 | V |
| Operating Junction Temp. | -20 | +100 | °C |

Leads 7 and 8 are soldered to the PCB copper area and provide heat sinking of the pass transistor.

This data sheet is based on Sanken data sheet SSJ-02412.

ELECTRICAL CHARACTERISTICS at $T_A = +25^\circ\text{C}$, $V_I = 1.8\text{ V}$, $V_O = 1.5\text{ V}$ adjusted, $V_S = 3.3\text{ V}$, $V_E = 2\text{ V}$ (unless otherwise noted).

| Characteristic | Symbol | Test Conditions | Limits | | | |
|------------------------------|----------------------------|---|--------|---------------------|-------|---------------|
| | | | Min. | Typ. | Max. | Units |
| Output Voltage | V_O | $V_I = V_{O(\text{nom})} + 1\text{ V}$, $I_O = 10\text{ mA}$ | — | $V_{O(\text{nom})}$ | — | V |
| | $V_{O(\text{off})}$ | $V_E = 0\text{ V}$ | — | — | 0.5 | V |
| Output Volt. Temp. Coeff. | a_{VO} | $0^\circ\text{C} \leq T_J \leq 100^\circ\text{C}$ | — | ± 0.2 | — | mV/°C |
| Internal Reference Voltage | V_{ref} | $I_O = 10\text{ mA}$ | 0.980 | 1.000 | 1.020 | V |
| Output Short-Circuit Current | I_{OM} | see note | 1.6 | — | — | A |
| Line Regulation | $\Delta V_{O(\Delta V_I)}$ | $V_I = 1.7 \sim 2.5\text{ V}$, $I_O = 10\text{ mA}$ | — | — | 10 | mV |
| Load Regulation | $\Delta V_{O(\Delta I_O)}$ | $V_I = 1.8\text{ V}$, $I_O = 0\text{ A} \sim 1.0\text{ A}$ | — | — | 30 | mV |
| Dropout Voltage | $V_{\text{imin}} - V_O$ | $I_O = 1.0\text{ A}$ | — | — | 0.3 | V |
| Ground Terminal Current | I_{GND} | $I_O = 0\text{ mA}$, $V_E = 2.0\text{ V}$ | — | 500 | 800 | μA |
| | | $V_E = 0\text{ V}$ | — | — | 1.0 | μA |
| Enable Input Voltage | V_{EH} | Output ON | 2.0 | — | — | V |
| | V_{EL} | Output OFF | — | — | 0.8 | V |
| Enable Input Current | I_{EH} | $V_E = 2.7\text{ V}$ | — | — | 50 | μA |
| | I_{EL} | $V_E = 0\text{ V}$ | — | — | 10 | μA |
| Ripple Rejection Ratio | PSRR | $100\text{ Hz} \leq f \leq 120\text{ Hz}$ | — | 60 | — | dB |
| Thermal Shutdown | T_J | | 135 | 152 | — | °C |

Typical values are given for circuit design information only.

Note: Output short-circuit current is at point where output voltage has decreased 5% below $V_{O(\text{nom})}$.

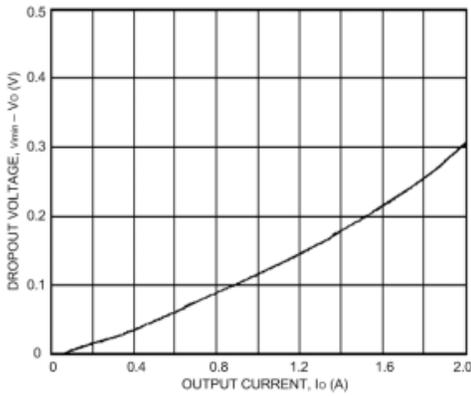
SI-3010LLSL
1.5 A, Ultra-Low-Dropout,
1.1~3.3 V Regulator

**Linear
Regulators**

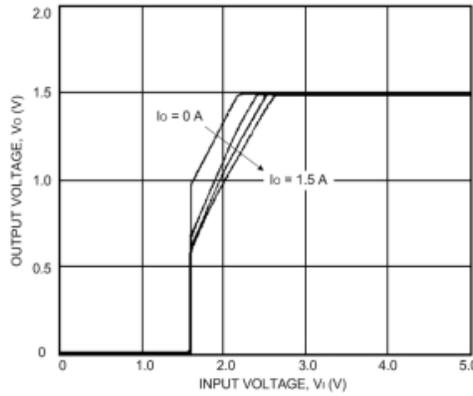
TYPICAL CHARACTERISTICS

($V_O = 1.5\text{ V}$ adjusted, $V_I = 1.8\text{ V}$, $V_S = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$)

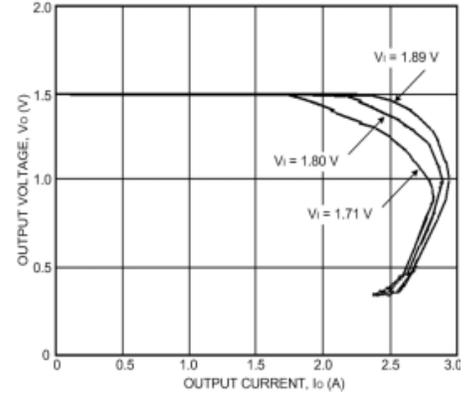
■ Dropout Voltage



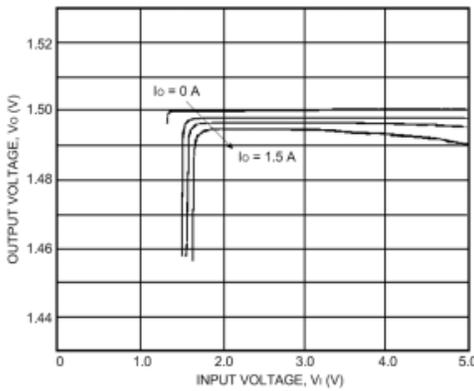
■ Low-Voltage Behavior



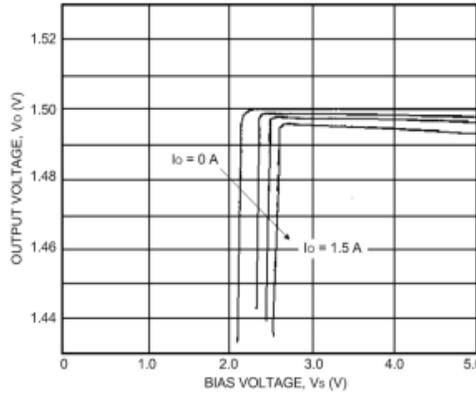
■ Overcurrent Protection



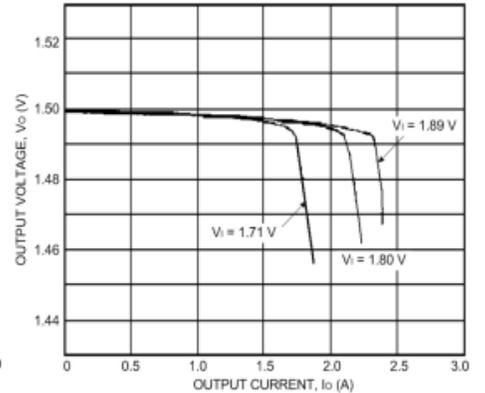
■ Input Line Regulation



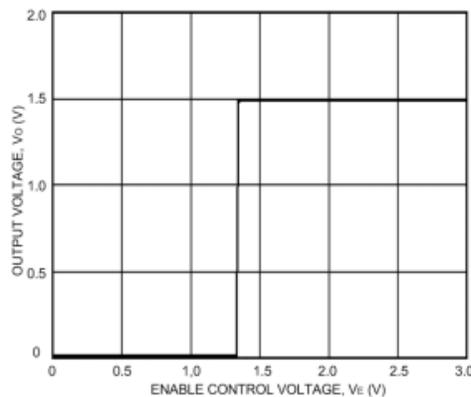
■ Bias Line Regulation



■ Load Regulation



■ ENABLE Control Voltage



APPLICATIONS INFORMATION

Input Capacitor (C_I , 0.1 μ F to 10 μ F). This is necessary either when the input line includes inductance or when the wiring is long.

Output Capacitor (C_O , $\geq 47 \mu$ F). This device is designed for use with a very low ESR output capacitor such as a ceramic capacitor. Output oscillation may occur with an ESR greater than 500 m Ω .

Output Voltage Adjustable Resistors (R1 and R2). The output voltage can be adjusted by R1 and R2. 10 k Ω or 11 k Ω for R2 is recommended.

$$R1 = (V_O - V_{ref}) / (V_{ref} / R2)$$

Soft-Start Capacitor (C_{SS}). This capacitor between V_O and ADJ will set up starting time.

ENABLE Input. The ENABLE (control) input features an internal pull-down resistor. Leaving this input open causes the output to turn off.

Determination of DC Input Voltage. The minimum input voltage $V_I(\text{min})$ should be higher than the sum of the fixed output voltage and the maximum rated dropout voltage.

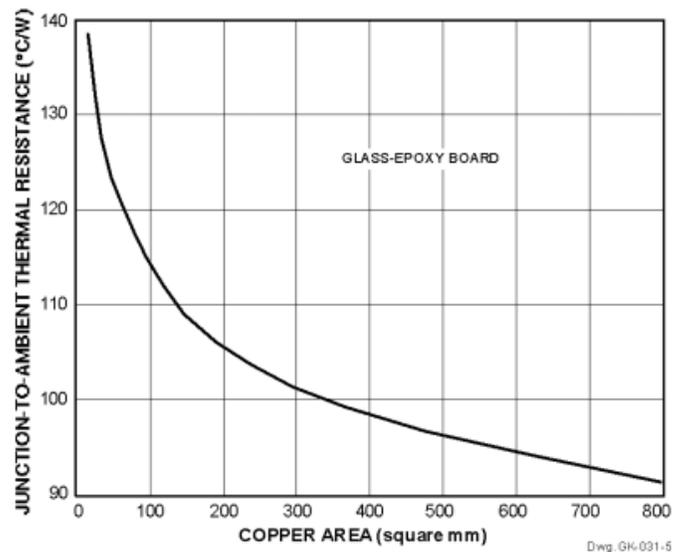
Overcurrent Protection. The SI-3000LLSL series has a built-in fold-back type overcurrent protection circuit, which limits the output current at a start-up mode. It thus cannot be used in applications that require current at the start-up mode such as:

- (1) constant-current load,
- (2) power supply with positive and negative outputs to common load (a center-tap type power supply), or
- (3) raising the output voltage by putting a diode or a resistor between the device ground and system ground.

Thermal Protection. Circuitry turns off the pass transistor when the junction temperature rises above 135 $^{\circ}$ C. It is intended only to protect the device from failures due to excessive junction temperatures and should not imply that output short circuits or continuous overloads are permitted.

Heat Radiation and Reliability. The reliability of the device is directly related to the junction temperature (T_J) in its operation. Accordingly, careful consideration should be given to heat dissipation.

The inner frame on which the pass transistor is mounted is connected to terminals 7 and 8. Therefore, it is very effective for heat radiation to enlarge the copper area that is connected to these terminals. The graph illustrates the effect of the copper area on the junction-to-ambient thermal resistance ($R_{\theta JA}$).



The junction temperature (T_J) can be determined from either of the following equations:

$$T_J = (P_D \times R_{\theta JA}) + T_A$$

or

$$T_J = (P_D \times R_{\theta JL}) + T_L$$

where $P_D = I_O \times (V_I - V_O)$,
 T_L is the temperature of lead 8, and
 $R_{\theta JL} = 36^{\circ}$ C/W.

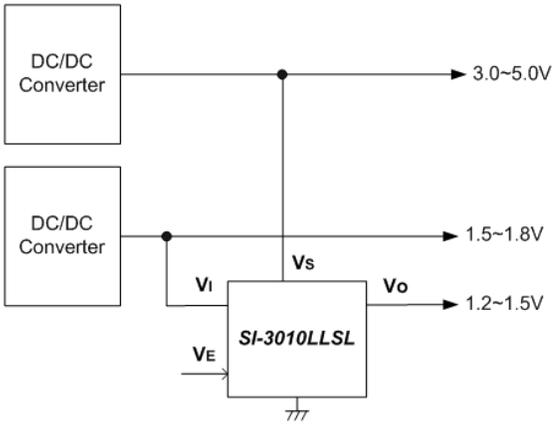
Parallel Operation. Parallel operation to increase load current is not permitted.

SI-3010LLSL
1.5 A, Ultra-Low-Dropout,
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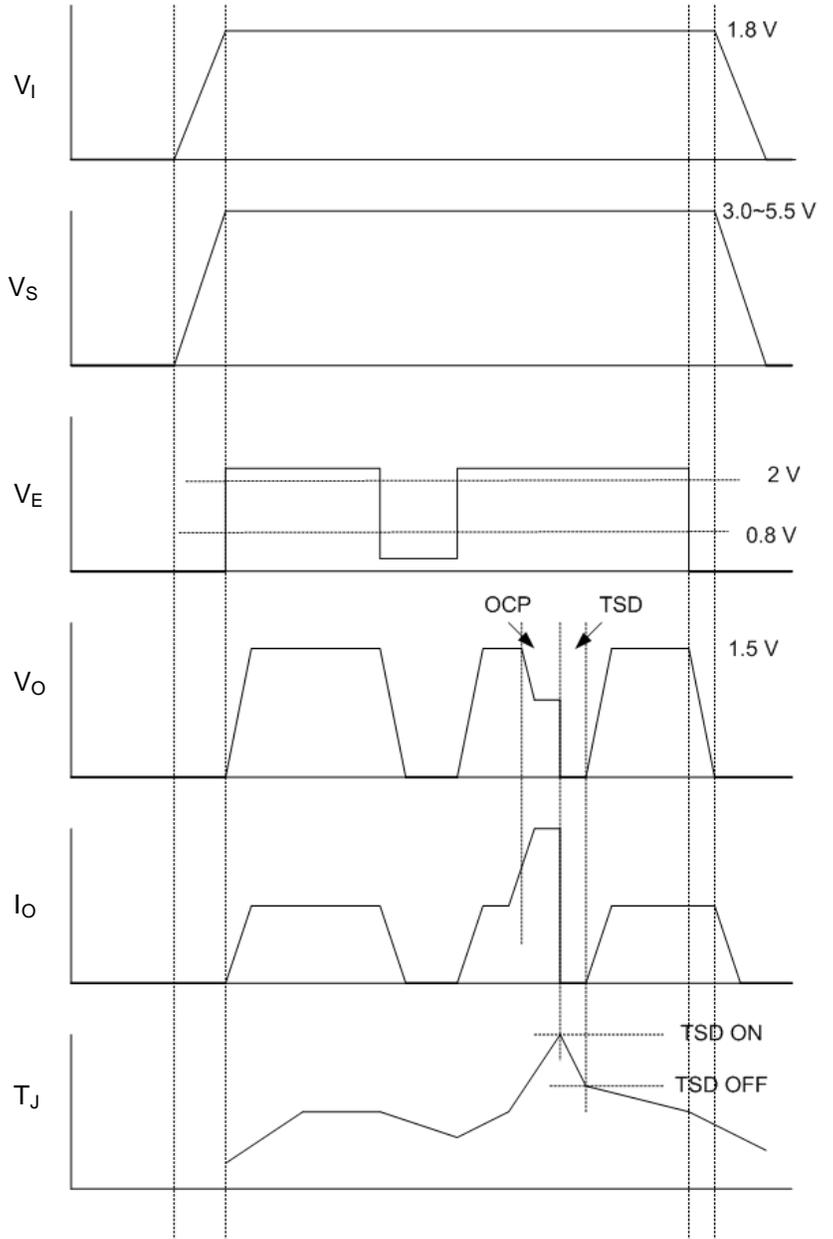
**Linear
Regulators**

APPLICATIONS INFORMATION (cont.)

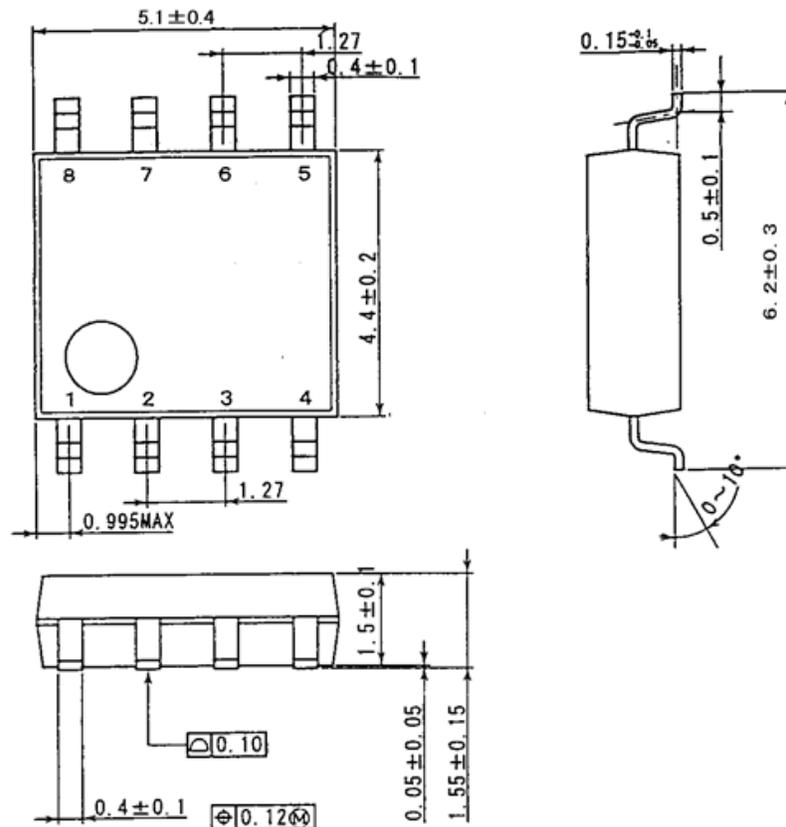
Typical Application.



Recommended Timing.



Dimensions in Millimeters



- NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
 2. Lead spacing tolerance is non-cumulative.
 3. Leads 7 and 8 are internally connected together and provide heat sinking of the pass transistor.
 4. Terminal finish: pure Sn (category e3)

SI-3010LLSL
1.5 A, Ultra-Low-Dropout,
1.1~3.3 V Regulator

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