

Universal-Input/15 W 67 kHz Flyback Switching Regulator



ABSOLUTE MAXIMUM RATINGS at $T_A = +25^\circ\text{C}$

| | |
|--|------------------------|
| Control Supply Voltage, V_{CC} | 36 V |
| Drain-Source Voltage, V_{DSS} | 650 V |
| Drain Switching Current, I_D | 2.5 A* |
| Peak Drain Switching Current, I_{DM} | 2.5 A |
| Single-Pulse Avalanche Energy, E_{AS} | 72 mJ |
| S/OCP Voltage Range, V_{OCP} | -0.3 V to +6 V |
| FB/CC/OLP Voltage Range, $V_{FB/OLP}$ | -0.3 V to +12 V |
| FM Voltage Range, V_{FM} | -0.3 V to +6 V |
| Package Power Dissipation, P_D control ($V_{CC} \times I_{CC(ON)}$) | 0.15 W |
| MOSFET ($V_{DSS} \times I_D$) | 1.35 W |
| total | 1.5 W |
| MOSFET Channel Temp., T_J | +150°C |
| Internal Frame Temp., T_F | +125°C |
| Storage Temperature Range, T_S | -40°C to +125°C |

* Drain switching current is limited by temperature (page 2) and safe operating area (page 4).

The STR-A6251M is a 67 kHz PWM topology (with $\pm 5\%$ frequency jittering for minimum EMI) regulator specifically designed to satisfy the requirements for increased integration and reliability in flyback converters. It incorporates a primary control and drive circuit with an avalanche-rated power MOSFET. This is a higher-frequency version of the STR-A6251.

Covering the power range from below 21 watts for a 230 VAC input, or to 15 watts for a universal (85 to 264 VAC) input, this device can be used in a wide range of applications, from DVD players and VCR player/recorders to ac adapters for cellular phones and digital cameras. An auto-burst standby function reduces power consumption at light load, while multiple protections, including the avalanche-energy guaranteed MOSFET, provide high reliability of system design.

Cycle-by-cycle current limiting, undervoltage lockout with hysteresis, overvoltage protection, and thermal shutdown protect the power supply during the normal overload and fault conditions. Overvoltage protection and thermal shutdown are latched after a short delay. The latch may be reset by cycling the input supply. Low start-up current and a low-power standby mode selected from the secondary circuit completes a comprehensive suite of features. It is provided in an 8-pin mini-DIP plastic package with pin 6 removed.

FEATURES AND BENEFITS

- 67 kHz PWM with $\pm 5\%$ Frequency Jittering
Cost Reduction of EMI Noise Filtering
- Rugged 650 V Avalanche-Rated MOSFET
Simplified Surge Absorption
No V_{DSS} Derating Required
- Low $r_{DS(on)}$ (3.95 Ω maximum)
- Auto-Burst Mode for Stand-By Operation or Light Loads
Less Transformer Audible Noise
- Built-In Leading Edge Blanking
- Soft Start and Low Start-Up Current
Start-Up Circuit Disabled in Operation
- Low Operating Current (4 mA max)
- Automatic Burst Stand-By (intermittent operation)
Input Power <0.1 W at No Load

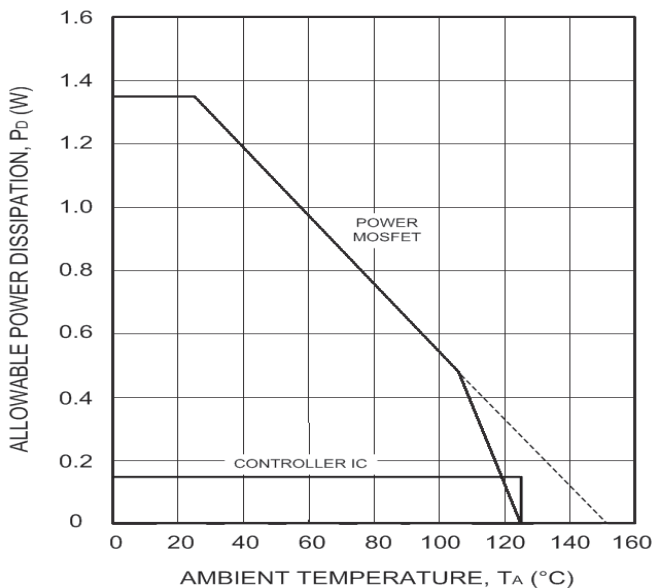
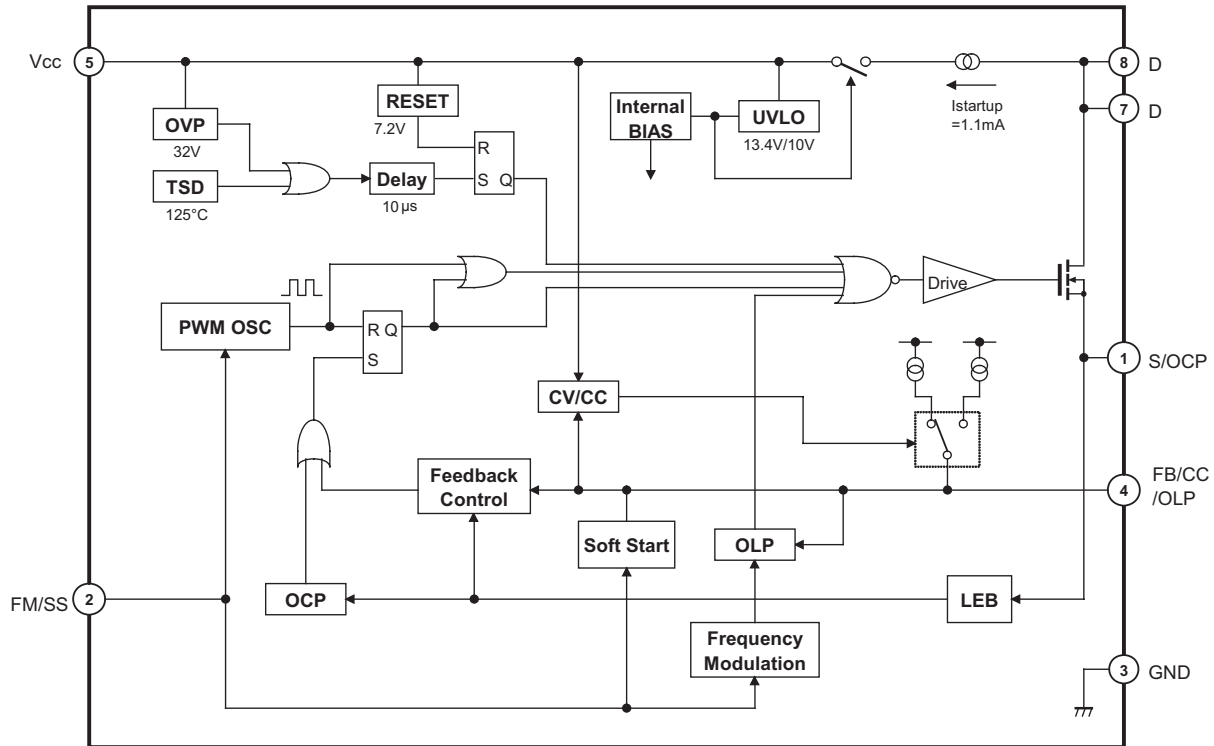
continued

Always order by complete part number, e.g., **STR-A6251M**.

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FUNCTIONAL BLOCK DIAGRAM



FEATURES AND BENEFITS (cont'd)

- Auto-Bias Function
Stable Burst Operation Without Generating Interference
- Internal Off-Timer Circuit
- Built-In Constant-Voltage/Constant Current
- Multiple Protections:
Pulse-by-Pulse Overcurrent Protection (OCP)
Overload Protection (OLP) with Auto Restart
Latching Overvoltage Protection (OVP)
Undervoltage Lockout (UVLO) with Hysteresis
Latching Thermal Shutdown (TSD)
- Molded Small-Size 8-Pin Package
For Low-Height SMPS

This data sheet is based on SanKen data sheet SSE-23420.

ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$, $V_{CC} = 18\text{ V}$ (unless otherwise specified).

| Characteristic | Pin No. | Symbol | Test Conditions | Ratings | | | |
|----------------------------------|---------|------------------|--|---------|-------|-------|--------------------|
| | | | | Min | Typ | Max | Units |
| Drain-to-Source Breakdown Volt. | 8 - 1 | $V_{(BR)DSS}$ | $I_D = 300\ \mu\text{A}$, $V_1 - V_3 = 0\text{ V}$ (short) | 650 | - | - | V |
| Drain Leakage Current | 8 | I_{DSS} | $V_{DS} = 650\text{ V}$, $V_1 - V_3 = 0\text{ V}$ (short) | - | - | 300 | μA |
| On-State Resistance | 8 - 1 | $r_{DS(on)}$ | $I_D = 0.4\text{ A}$ | - | - | 3.95 | Ω |
| MOSFET Switching Time | 8 - 3 | t_f | - | - | - | 250 | ns |
| Operation-Start Voltage | 5 - 3 | $V_{CC(ON)}$ | $V_{CC} = 0 \rightarrow 15.7\text{ V}$ | 12.9 | 14.3 | 15.7 | V |
| Operation-Stop Voltage | 5 - 3 | $V_{CC(OFF)}$ | $V_{CC} = 15.7 \rightarrow 9\text{ V}$ | 9.0 | 10 | 11 | V |
| Maximum Switching Frequency | 8 - 3 | $f_{osc(max)}$ | - | 60 | 67 | 74 | kHz |
| Frequency-Jitter Deviation | 8 - 3 | Δf_{osc} | - | 4.0 | 6.7 | 9.4 | kHz |
| Maximum ON Duty Cycle | 8 - 3 | D max | - | 70 | 76 | 82 | % |
| Circuit Current in Operation | 5 | $I_{CC(ON)}$ | - | - | - | 4.0 | mA |
| Circuit Current in Non-Operation | 5 | $I_{CC(OFF)}$ | $V_{CC} = 12\text{ V}$ | - | 14 | 25 | μA |
| FM Voltage | 2 - 3 | V_{FMH} | $f_{osc} = f_{osc(max)}$ | 4.0 | 4.5 | 5.0 | V |
| | | V_{FML} | $f_{osc} < f_{osc(max)}$ | 3.2 | 3.6 | 4.0 | V |
| FM Current | 2 | I_{FMH} | - | -7.7 | -11.0 | -15.4 | μA |
| | | I_{FML} | - | 7.7 | 11.0 | 15.4 | μA |
| OCP Threshold Voltage | 1 - 3 | V_{OCP} | - | 0.67 | 0.74 | 0.81 | V |
| Leading Edge Blanking Time | 8 - 3 | t_{bw} | - | 240 | 350 | 460 | ns |
| Burst Threshold Voltage | 4 - 3 | V_{burst} | - | 1.00 | 1.12 | 1.24 | V |
| OLP Threshold Voltage | 4 - 3 | V_{OLP} | - | 7.3 | 8.6 | 9.9 | V |
| Current at OLP Operation | 4 | I_{OLP} | - | -12 | -18 | -25 | μA |
| OLP Delay Time | 4 - 3 | t_{OLP} | - | 0.84 | 1.20 | 1.56 | s |
| Maximum FB Current | 4 | $I_{FB(MAX)}$ | - | 220 | 310 | 430 | μA |
| CC Set Voltage | 4 - 3 | $V_{SET(CC)}$ | - | 4.9 | 5.8 | 6.7 | V |
| CC Reset Voltage | 4 - 3 | $V_{RES(CC)}$ | $V_{CC} = 25\text{ V}$ | 3.5 | 3.9 | 4.3 | V |
| Start-Up Current | 5 | $I_{startup}$ | $V_{CC} = 13\text{ V}$ | 0.84 | 1.20 | 1.56 | mA |
| OVP Operation Voltage | 5 - 3 | $V_{CC(OVP)}$ | $V_{CC} = 18 \rightarrow 35.2\text{ V}$ | 28.8 | 32.0 | 35.2 | V |
| OVP/TSD Latch Sustaining Current | 5 | $I_{CC(H)}$ | $V_{CC} = 35.2 \rightarrow 8.6\text{ V}$ | - | - | 270 | μA |
| OVP/TSD Latch Release Voltage | 5 - 3 | V_{CC} | $V_{CC} = 35.2 \rightarrow 5.9\text{ V}$ | 5.9 | 7.2 | 8.6 | V |
| Thermal Shutdown | - | T_J | - | 125 | 140 | - | $^\circ\text{C}$ |
| Thermal Resistance | - | $R_{\theta JF}$ | - | - | - | 52 | $^\circ\text{C/W}$ |

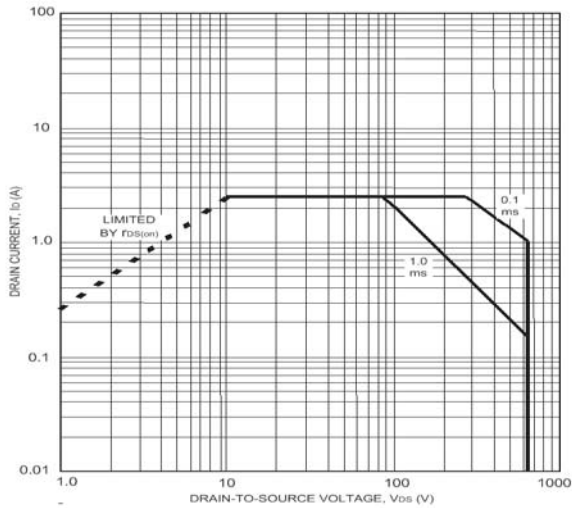
Typical values are given for circuit design information only.

Negative current is defined as coming out of (sourcing) the specified terminal.

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MOSFET TYPICAL CHARACTERISTICS

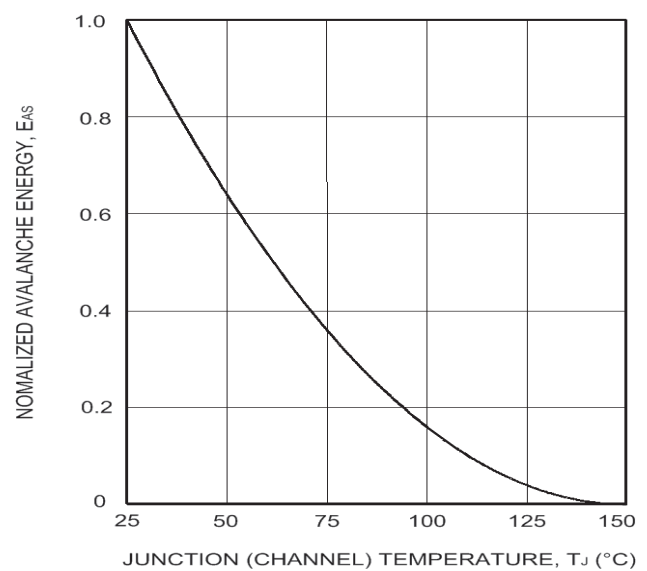
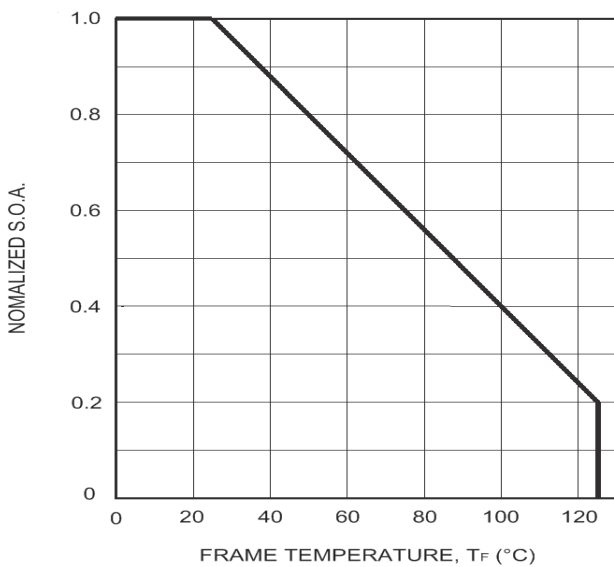


Recommended Operating Conditions

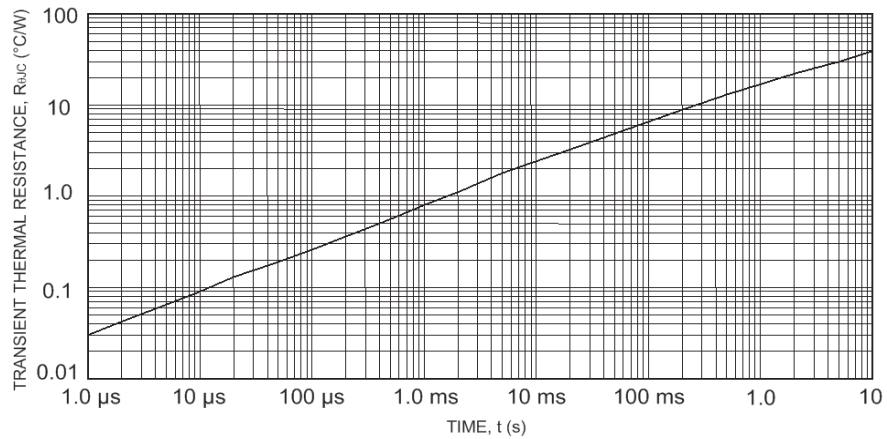
Operating Ambient Temperature -20°C to +100°C
 Operating Junction Temperature -20°C to +125°C
 Maximum Frame Temperature +115°C

For the availability of parts meeting -40°C requirements, contact Allegro's Sales Representative.

Avalanche energy is measured at $V_{DD} = 99 V$,
 $L = 20 mH$, $I_L = 2.5 A$.



MOSFET TYPICAL CHARACTERISTICS (cont'd)



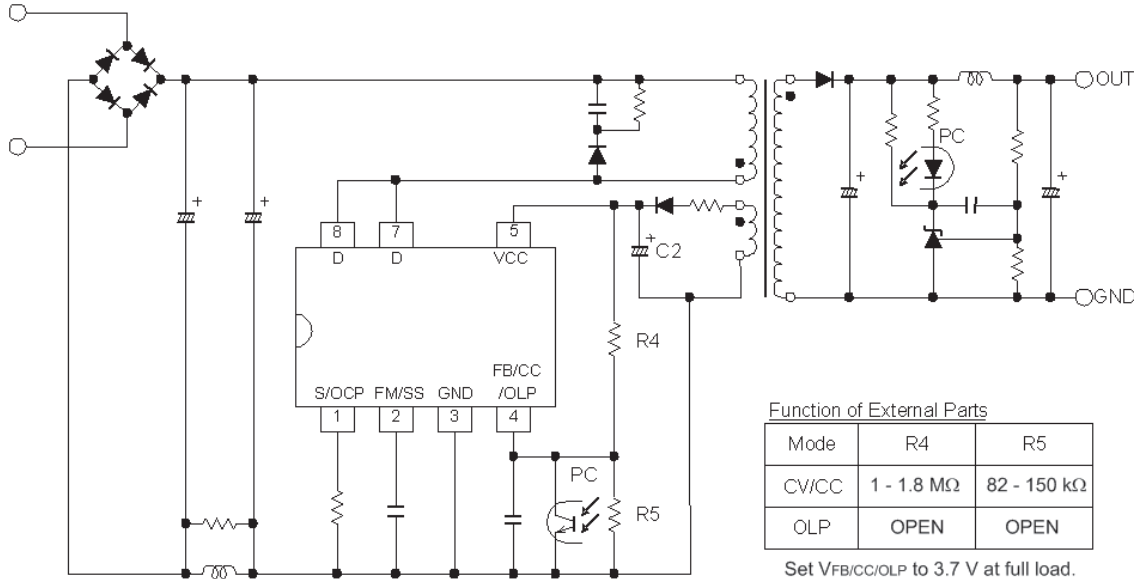
WARNING — These devices are designed to be operated at lethal voltages and energy levels. Circuit designs that embody these components must conform with applicable safety requirements. Precautions must be taken to prevent accidental contact with power-line potentials. Do not connect grounded test equipment.

The use of an isolation transformer is recommended during circuit development and breadboarding.

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APPLICATIONS INFORMATION



Typical Application

NOTE: The start-up performance of the IC can only be guaranteed for values of C2 greater than 22 μF. This value is required to keep the internal supply voltage within regulation during IC initialization.

Complete product description and applications information is provided in Application Note 28103.40, *Series STR-A6200 Flyback Switching Regulators*.

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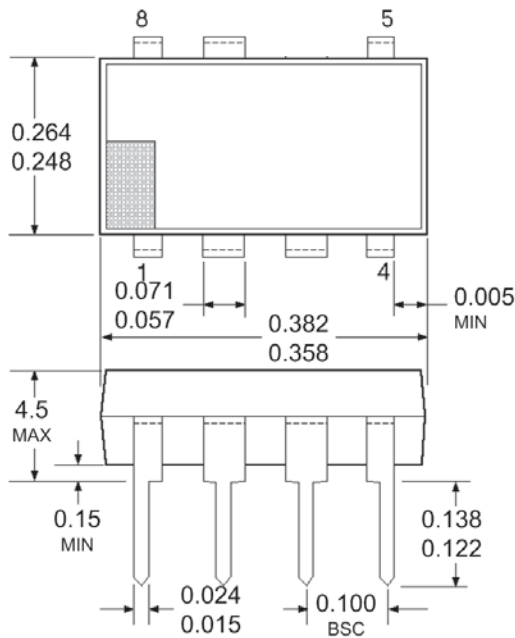
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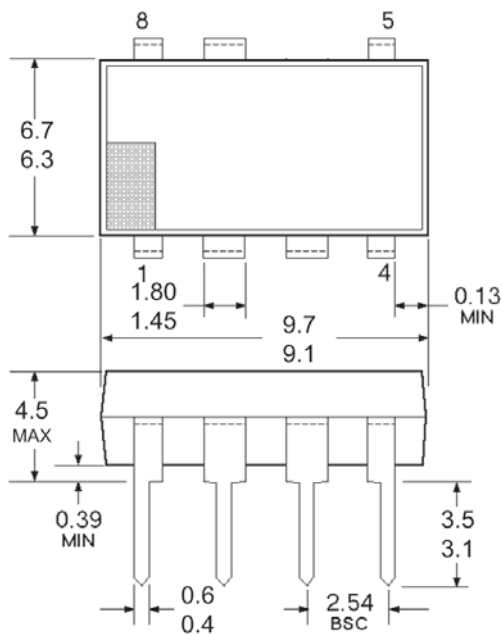
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PACKAGE DIMENSIONS



Dimensions in Inches
(for reference only)



Dimensions in Millimeters
(controlling dimensions)

Terminal Finish: Pure Sn, 2nd level interconnect category (e3).
Product Weight: Approx. 0.51 g.
Frame temperature, T_F , is measured at the root of pin 3.
For more efficient heat radiation, connect a broad PCB pattern at pins 7 and 8.