

Universal-Input/58 W Off-Line Quasi-Resonant Flyback Switching Regulator



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

| | |
|--|-------------------------|
| Control Supply Voltage, V_{CC} | 35 V |
| Drain-Source Voltage, V_{DSS} | 650 V |
| Drain Switching Current, I_D | 11.2 A* |
| Peak Drain Switching Current, I_{DM} | 11.2 A |
| Single-Pulse Avalanche Energy, E_{AS} | 145 mJ |
| OCP/BD Voltage Range, V_{OCP} | -1.5 V to +5 V |
| FB Input Current, I_{FB} | 10 mA |
| FB Voltage Range, V_{FP} | -0.5 V to +9 V |
| Package Power Dissipation, P_D control ($V_{CC} \times I_{CC(ON)}$) | 0.8 W |
| MOSFET ($V_{DSS} \times I_D$) | See Graph |
| MOSFET Channel Temp., T_J | +150°C |
| Internal Frame Temp., T_F | +115°C |
| Operating Temperature Range, T_A | -20°C to +115°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 5).

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

The STR-W6753 is a quasi-resonant regulator specifically designed to satisfy the requirements for increased integration and reliability in switch-mode power supplies. It incorporates a primary control and drive circuit with an avalanche-rated power MOSFET. The regulator exhibits only low-level high-frequency EMI noise because of soft switching of the MOSFET close to ground (bottom point). A bottom-skip function minimizes an increase of operational frequency during light loads to improve system efficiency over the entire load range.

Covering the power range from below 120 watts for a 230 VAC input, or 58 watts for a universal input (85 to 264 VAC), this device can be used in a range of applications, from DVD and VCR players to ac adapters for cellular phones and digital cameras. An auto-standby function, which is internally triggered by sensing on time, reduces power consumption at light load. An externally triggered standby mode reduces the input power further. Multiple protections, including the avalanche-energy-guaranteed MOSFET, provide high reliability of system design. Devices with an increased output power rating are the STR-W6754 and STR-W6756.

Cycle-by-cycle current limiting, undervoltage lockout with hysteresis, and overvoltage protection protect the power supply during the normal overload and fault conditions. Overvoltage protection is 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. The STR-W6753 is provided in a fully molded TO-220-style flange-mounted, high power, isolated plastic package.

FEATURES AND BENEFITS

- Rugged 650 V Avalanche-Rated MOSFET
Simplified Surge Absorption
No V_{DSS} Derating Required
- 1.7 Ω Maximum $r_{DS(on)}$
- Two Operational Modes by Automatic Switching:
Quasi-Resonant Mode for Normal Operation
Burst Mode for Standby Operation or Light Loads
- Automatic or Manually Triggered Burst Standby
Input Power <0.1 W at No Load
- Low Operating Current (6 mA typ)

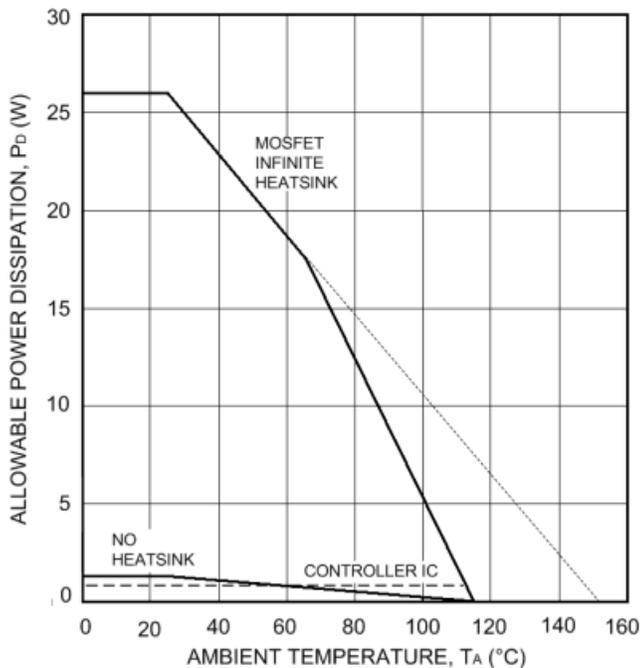
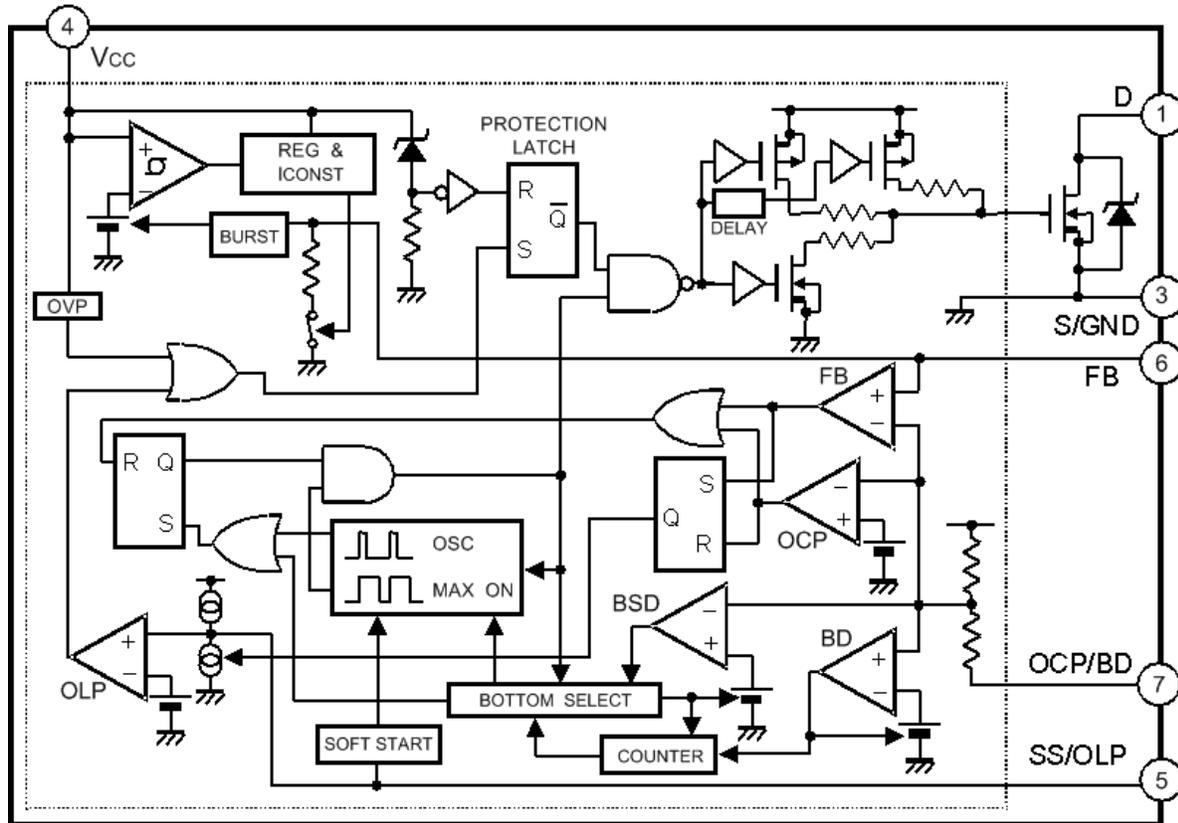
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Always order by complete part number, e.g., **STR-W6753**.

STR-W6753
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**Switching
Regulators**

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 Drive
- Multiple Protections:
Pulse-by-Pulse Overcurrent Protection
Overload Protection with Auto Recovery
Latching Overvoltage Protection
Undervoltage Lockout with Hysteresis
- RoHS Compliant

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ELECTRICAL CHARACTERISTICS at $T_A = +25^\circ\text{C}$, $V_{CC} = 20\text{ V}$, voltage measurements are referenced to S/GND terminal (unless otherwise specified).

| Characteristic | Symbol | Test Conditions | Limits | | | |
|------------------------------------|------------------|--|--------|------|------|---------------|
| | | | Min. | Typ. | Max. | Units |
| Start-Up Operation | | | | | | |
| Operation Start Voltage | $V_{CC(ON)}$ | Turn-on, $V_{CC} = 0 \rightarrow 19.9\text{ V}$ | 16.3 | 18.2 | 19.9 | V |
| Soft-Start Operation Stop Voltage | $V_{SS/OLP}$ | | 1.1 | 1.2 | 1.4 | V |
| Soft-Start Oper. Charging Current | $I_{SS/OLP}$ | | -390 | -550 | -710 | μA |
| Operation Stop Voltage | $V_{CC(OFF)}$ | Turn-off, $V_{CC} = 19.9 \rightarrow 8.8\text{ V}$ | 8.8 | 9.7 | 10.6 | V |
| Circuit Current in Non-Operation | $I_{CC(OFF)}$ | $V_{CC} = 15\text{ V}$ | – | – | 100 | μA |
| Normal Operation | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $I_D = 300\ \mu\text{A}$ | 650 | – | – | V |
| Drain Leakage Current | I_{DSS} | $V_{DS} = 650\text{ V}$ | – | – | 300 | μA |
| On-State Resistance | $r_{DS(on)}$ | $I_D = 1.4\text{ A}$, $T_J = +25^\circ\text{C}$ | – | – | 1.7 | Ω |
| Switching Time | t_f | | – | – | 400 | ns |
| Circuit Current | $I_{CC(ON)}$ | | – | – | 6.0 | mA |
| Oscillation Frequency | f_{osc} | | 19 | 22 | 25 | kHz |
| Bottom-Skip Oper. Threshold Volt. | $V_{OCPBD(BS1)}$ | | -605 | -665 | -720 | mV |
| | $V_{OCPBD(BS2)}$ | | -385 | -435 | -485 | mV |
| Quasi-Resonant Oper. Threshold | $V_{OCPBD(TH1)}$ | | 280 | 400 | 520 | mV |
| | $V_{OCPBD(TH2)}$ | | 670 | 800 | 930 | mV |
| Feedback-Pin Threshold Voltage | $V_{FB(OFF)}$ | | 1.32 | 1.45 | 1.58 | V |
| Feedback-Pin Current | $I_{FB(ON)}$ | | 600 | 1000 | 1400 | μA |
| Standby Operation | | | | | | |
| Standby Operation Start Voltage | $V_{CC(S)}$ | $V_{CC} = 0 \rightarrow 12.2\text{ V}$ | 10.3 | 11.1 | 12.1 | V |
| Standby Oper. Start Volt. Interval | V_{CC} | | 1.10 | 1.35 | 1.65 | V |
| Standby Non-Operation Current | $I_{CC(S)}$ | $V_{CC} = 10.2\text{ V}$ | – | 20 | 56 | μA |
| Feedback-Pin Current | $I_{FB(ON)}$ | $V_{CC} = 10.2\text{ V}$ | – | 4.0 | 14 | μA |
| Feedback-Pin Threshold Voltage | $V_{FB(S)}$ | $V_{CC} = 12.2\text{ V}$ | 0.55 | 1.10 | 1.50 | V |
| Minimum ON Time | $t_{on(min)}$ | | 0.5 | 0.8 | 1.2 | μs |

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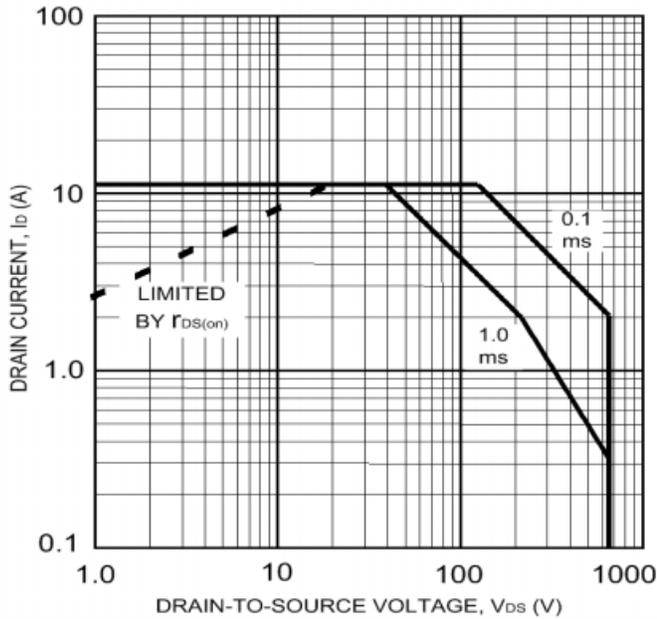
Switching
Regulators

ELECTRICAL CHARACTERISTICS at $T_A = +25^\circ\text{C}$, $V_{CC} = 20\text{ V}$, voltage measurements are referenced to S/GND terminal (unless otherwise specified).

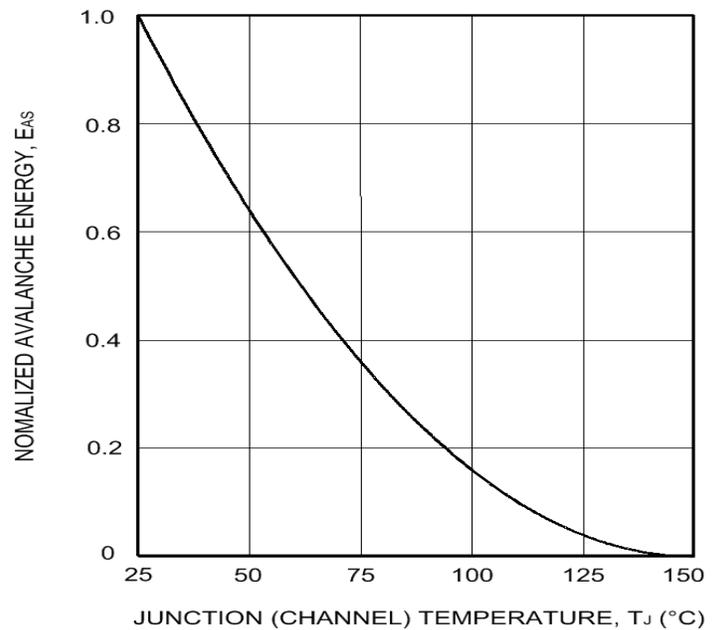
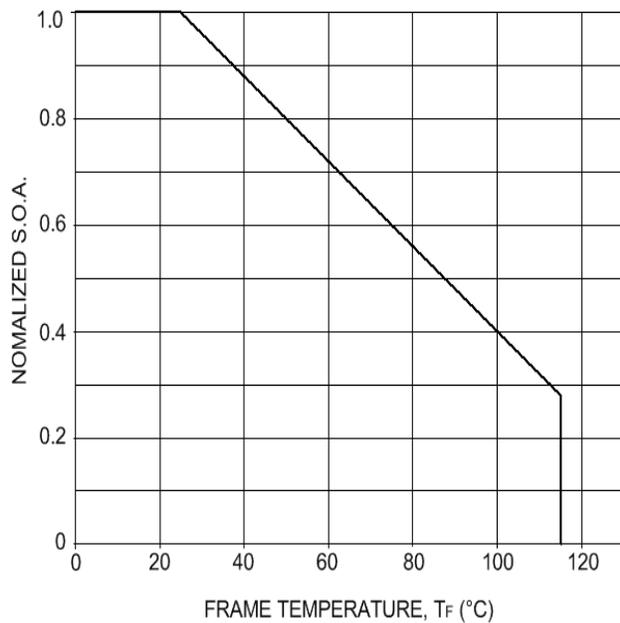
| Characteristic | Symbol | Test Conditions | Limits | | | |
|-------------------------------------|------------------|--|--------|--------|--------|--------------------|
| | | | Min. | Typ. | Max. | Units |
| Protection Operation | | | | | | |
| OVP Operation Voltage | $V_{CC(OVP)}$ | Turn-off, $V_{CC} = 0 \rightarrow 29.9\text{ V}$ | 25.5 | 27.7 | 29.9 | V |
| Maximum ON Time | $t_{on(max)}$ | | 27.5 | 32.5 | 39.0 | μs |
| OLP Operation Voltage | V_{SSOLP} | | 4.0 | 4.9 | 5.8 | V |
| OLP Operation Current | I_{SSOLP} | | -6.0 | -11 | -16 | μA |
| Overcurrent Detect. Threshold Volt. | $V_{OCPBD(LIM)}$ | | -0.895 | -0.940 | -0.995 | V |
| OCP/BD-Pin Current | I_{OCPBD} | | -40 | -100 | -250 | μA |
| Latch Holding Current | $I_{CC(H)}$ | $V_{CC} = 29.9 \rightarrow V_{CC(OFF)} - 0.3\text{ V}$ | - | 45 | 140 | mA |
| Latch Release Voltage | $V_{CC(L)}$ | $V_{CC} = 29.9 \rightarrow 6\text{ V}$ | 6.0 | 7.2 | 8.5 | V |
| Other | | | | | | |
| Thermal Resistance | $R_{\theta JF}$ | Output junction-to-frame | - | - | 2.0 | $^\circ\text{C/W}$ |

- NOTES: 1. Typical Data is for design information only.
2. Negative current is defined as coming out of (sourcing) the specified device terminal.

MOSFET TYPICAL CHARACTERISTICS



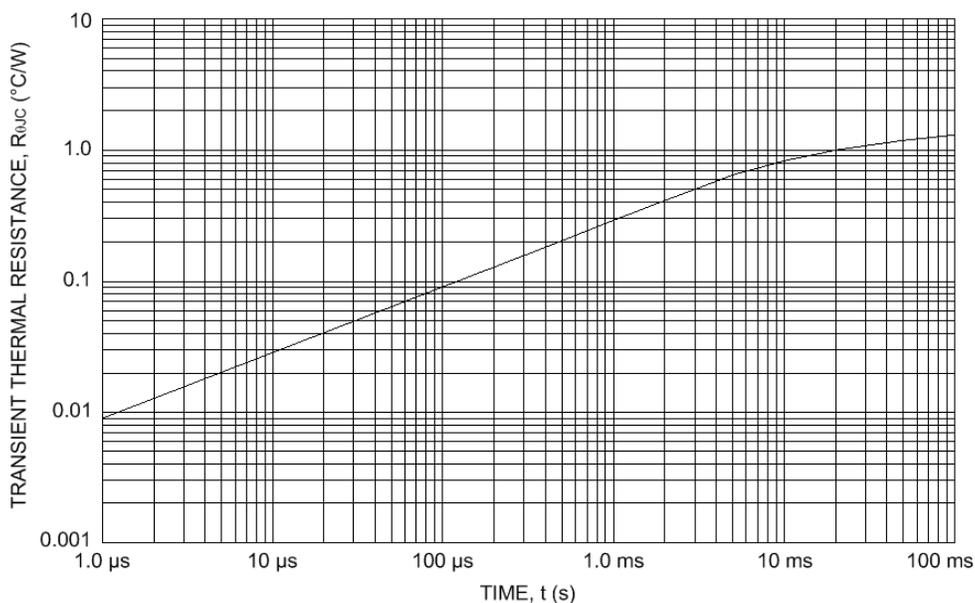
Avalanche energy is measured at $V_{DD} = 99$ V,
 $L = 20$ mH, $I_L = 3.6$ A.



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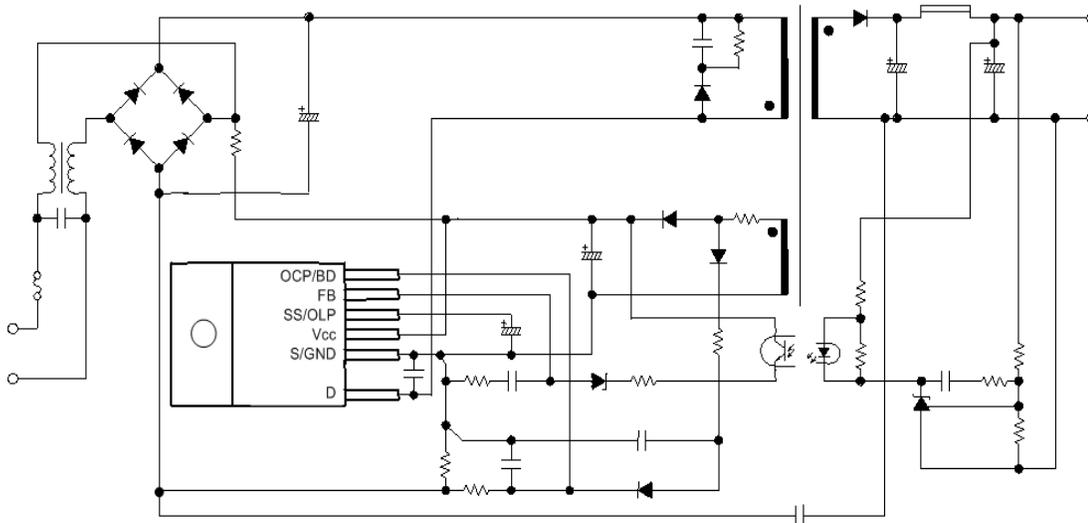
MOSFET TYPICAL CHARACTERISTICS (cont'd)



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.

APPLICATIONS INFORMATION



Typical Application

Complete product description and applications information is provided in Application Note 28103.30, *Series STR-W6750 Off-Line Quasi-Resonant Flyback Switching Regulators*.

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