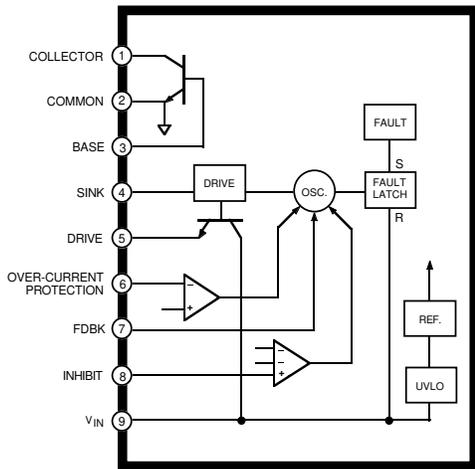


# STR-S6707 THRU STR-S6709

## OFF-LINE SWITCHING REGULATORS – WITH BIPOLAR SWITCHING TRANSISTOR



Dwg. PK-001

### ABSOLUTE MAXIMUM RATINGS

|                                                           |                 |
|-----------------------------------------------------------|-----------------|
| Supply Voltage, $V_{IN}$ .....                            | 15 V            |
| Output Voltage, $V_{CEX}$ .....                           | 850 V           |
| $V_{EBO}$ .....                                           | 7 V             |
| Continuous Output Current,<br>$I_C$ .....                 | See Table       |
| 1 ms Single-Pulse Output Current,<br>$I_{CM}$ .....       | See Table       |
| Sink Current, $I_S$ .....                                 | See Table       |
| Drive Current, $I_D$ .....                                | -700 mA         |
| Feedback Current, $I_{FDBK}$ .....                        | 20 mA           |
| Inhibit Voltage, $V_{INH}$ .....                          | 15 V            |
| Over-Current Protection Voltage Range,<br>$V_{OCP}$ ..... | $\pm 3.5$ V     |
| Insulation Voltage, $V_{WM(RMS)}$ .....                   | 2000 V          |
| Package Power Diss., $P_D$ .....                          | See Graph       |
| Output Junction Temperature, $T_J$ ..                     | +150°C          |
| Internal Frame Temperature, $T_F$ ...                     | +125°C          |
| Operating Temperature Range,<br>$T_A$ .....               | -20°C to +125°C |
| Storage Temperature Range,<br>$T_{stg}$ .....             | -40°C to +125°C |

The STR-S6707, STR-S6708, and STR-S6709 are specifically designed to meet the requirement for increased integration and reliability in off-line quasi-resonant flyback converters. These devices incorporate the primary control and proportional drive circuit with a third-generation high-voltage bipolar switching transistor.

Crucial system parameters such as maximum ON time and OFF time are fixed during manufacture. Local control circuit decoupling and layout are optimized within each device.

Cycle-by-cycle current limiting, under-voltage lock-out with hysteresis, over-voltage protection, and thermal shutdown protect these devices during all normal and overload conditions. Over-voltage protection and thermal shutdown are latched after a short delay. A versatile triple-level inhibit circuit includes the OFF time synchronization required to establish quasi-resonant operation. The inhibit function has also been expanded to initiate operation in stand-by mode in which the power supply delivers a small fraction of the steady-state output power. The dual requirements of dielectric isolation and low transient thermal impedance and steady-state thermal resistance are satisfied in an over-molded single-in-line power package.

Proven in substantial volumes, these devices and their fixed-frequency counterparts represent a significant advance in off-line SMPS reliability growth and integration.

### FEATURES

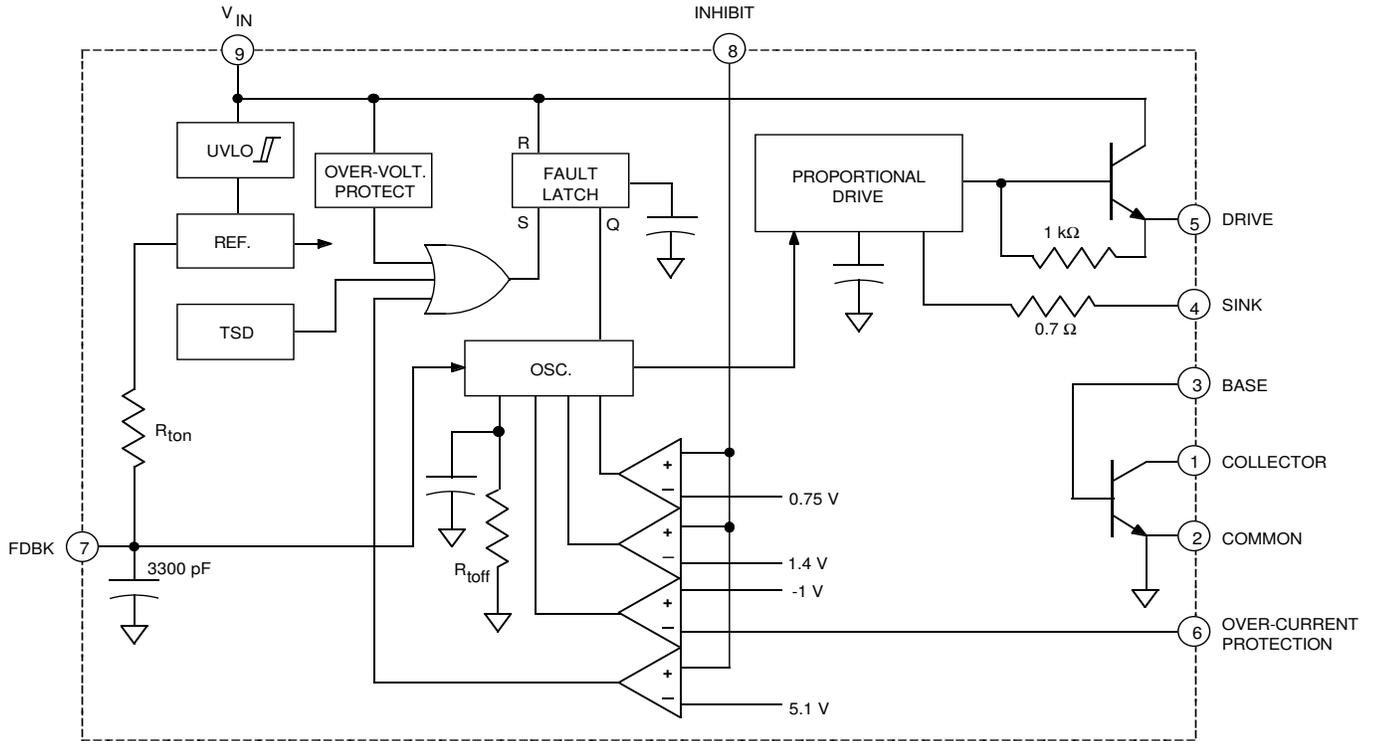
- Quasi-Resonant Operation for Low EMI and High Efficiency
- Output Power to 220 W
- Low-Power Output Standby Mode
- Pulse-by-Pulse Over-Current Protection
- Latched Over-Voltage and Thermal Protection
- Third-Generation Switching Transistor with Proportional Drive
- Maximum ON Time and Off Time Set During Manufacture
- Internal Under-Voltage Lockout with Hysteresis
- Over-Molded SIP with Integral Isolated Heat Spreader

Always order by complete part number:

| Part Number | Max. Cont. Current, $I_C$ | Peak Current, $I_{CM}$ | Max. Sink Current, $I_S$ |
|-------------|---------------------------|------------------------|--------------------------|
| STR-S6707   | 6 A                       | 12 A                   | 1.5 A                    |
| STR-S6708   | 7.5 A                     | 15 A                   | 1.5 A                    |
| STR-S6709   | 10 A                      | 20 A                   | 2 A                      |

# STR-S6707 THRU STR-S6709 OFF-LINE QUASI-RESONANT FLYBACK SWITCHING REGULATORS

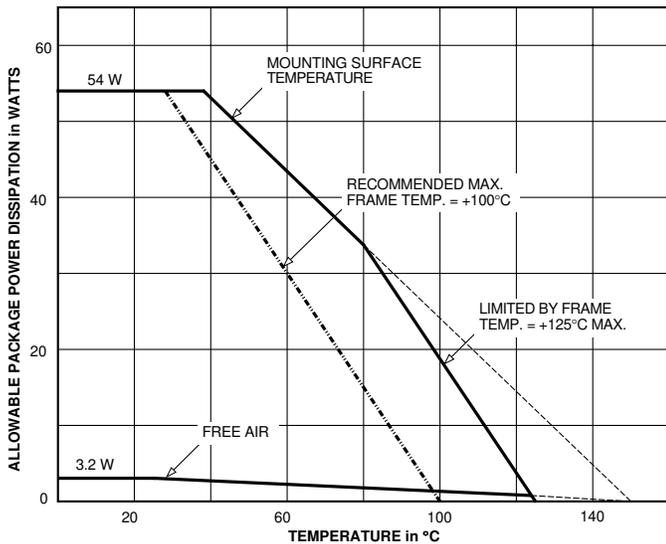
## STR-S6707 AND STR-S6708 FUNCTIONAL BLOCK DIAGRAM



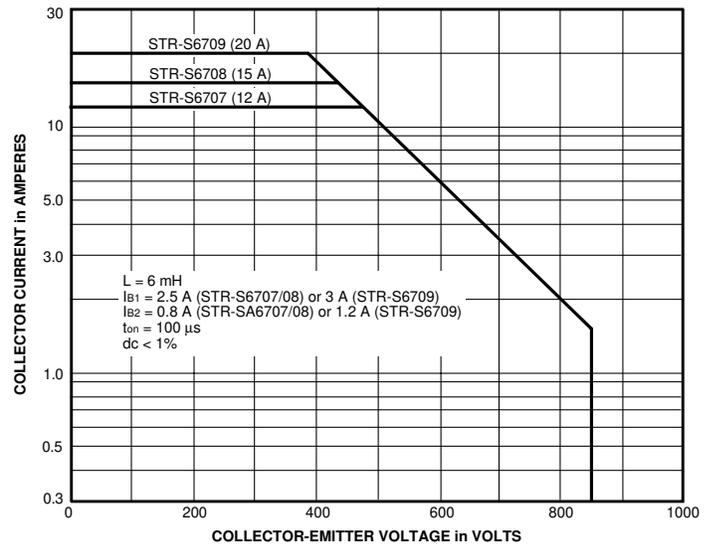
Dwg. FK-001

## ALLOWABLE PACKAGE POWER DISSIPATION

## MAXIMUM SAFE OPERATING AREA



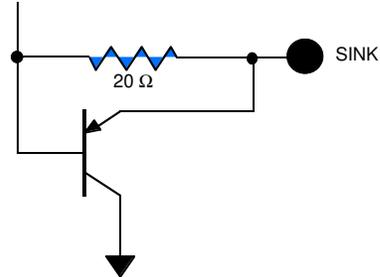
Dwg. GK-003-2



Dwg. GK-002

# STR-S6707 THRU STR-S6709 OFF-LINE QUASI-RESONANT FLYBACK SWITCHING REGULATORS

**STR-S6709  
FUNCTIONAL BLOCK DIAGRAM  
AS ABOVE  
EXCEPT FOR SINK OUTPUT**



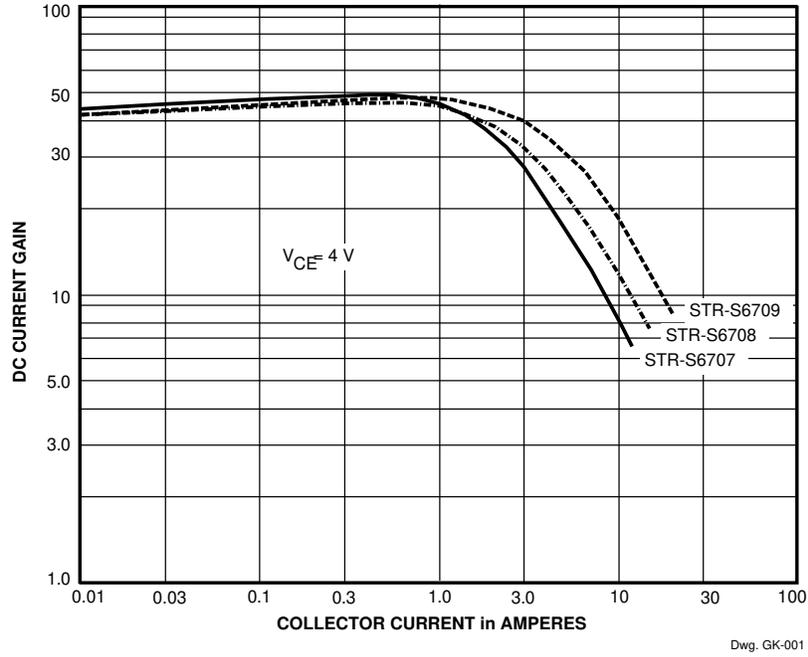
**ELECTRICAL CHARACTERISTICS at  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 8.5\text{ V}$ , voltage measurements are referenced to Common (pin 2) (unless otherwise noted).**

| Characteristic            | Symbol          | Test Conditions                                                   | Limits |      |      | Units              |
|---------------------------|-----------------|-------------------------------------------------------------------|--------|------|------|--------------------|
|                           |                 |                                                                   | Min.   | Typ. | Max. |                    |
| On-State Voltage          | $V_{INT}$       | Turn-on, increasing $V_{IN}$                                      | 7.6    | 8.0  | 8.4  | V                  |
| Under-Voltage Lockout     | $V_{INQ}$       | Turn-off, decreasing $V_{IN}$                                     | 4.6    | 4.9  | 5.2  | V                  |
| Over-Voltage Threshold    | $V_{OVP(th)}$   |                                                                   | 9.2    | ∅    | 10.7 | V                  |
| Output Leakage Current    | $I_{CEX}$       | $V_{CE} = 850\text{ V}$ , $V_{BE} = -1.5\text{ V}$                | ∅      | ∅    | 100  | $\mu\text{A}$      |
| Output Saturation Voltage | $V_{CE(sat)}$   | STR-S6707, $I_C = 2\text{ A}$ , $I_B = 400\text{ mA}$             | ∅      | ∅    | 400  | mV                 |
|                           |                 | STR-S6708, $I_C = 3\text{ A}$ , $I_B = 600\text{ mA}$             | ∅      | ∅    | 400  | mV                 |
|                           |                 | STR-S6709, $I_C = 4\text{ A}$ , $I_B = 800\text{ mA}$             | ∅      | ∅    | 400  | mV                 |
|                           | $V_{BE(sat)}$   | STR-S6707, $I_C = 2\text{ A}$ , $I_B = 400\text{ mA}$             | ∅      | ∅    | 1.5  | V                  |
|                           |                 | STR-S6708, $I_C = 3\text{ A}$ , $I_B = 600\text{ mA}$             | ∅      | ∅    | 1.5  | V                  |
|                           |                 | STR-S6709, $I_C = 4\text{ A}$ , $I_B = 800\text{ mA}$             | ∅      | ∅    | 1.5  | V                  |
| DC Current Gain           | $h_{FE}$        | $V_{CE} = 4\text{ V}$ , $I_C = 1\text{ A}$                        | 29     | ∅    | 61   | ∅                  |
| Maximum ON Time           | $t_{on}$        |                                                                   | 33     | ∅    | 41   | $\mu\text{s}$      |
| Minimum OFF Time          | $t_{off}$       |                                                                   | 45     | ∅    | 55   | $\mu\text{s}$      |
| Over-Current Threshold    | $V_{OCP(th)}$   |                                                                   | -0.9   | -1.0 | -1.1 | V                  |
| Feedback Threshold Volt.  | $V_{FDBK(th)}$  |                                                                   | ∅      | 650  | ∅    | mV                 |
| Inhibit Threshold Voltage | $V_{INH(th)}$   | Oscillation stops                                                 | 0.65   | 0.75 | 0.85 | V                  |
|                           |                 | Oscillation synchronized                                          | ∅      | 1.4  | 2.0  | V                  |
|                           |                 | Oscillation stops (fault latch set)                               | 3.2    | 5.1  | 5.6  | V                  |
| Latch Holding Current     | $I_{INH}$       | $V_{IN}$ reduced from 10.7 V to 4 V                               | ∅      | ∅    | 500  | $\mu\text{A}$      |
| Latch Reset Voltage       | $V_Q$           | $I_{IN} \leq 100\ \mu\text{A}$ , $V_{IN}$ reduced from 10.7 V     | 2.5    | 3.1  | ∅    | V                  |
| Supply Current            | $I_{IN(ON)}$    | Operating                                                         | 15     | ∅    | 29   | mA                 |
|                           | $I_{IN(OFF)}$   |                                                                   | ∅      | ∅    | 200  | $\mu\text{A}$      |
| Insulation RMS Voltage    | $V_{WM(RMS)}$   | All terminals simultaneous reference metal plate against backside | 2000   | ∅    | ∅    | V                  |
| Thermal Shutdown          | $T_J$           |                                                                   | 125    | 150  | ∅    | $^\circ\text{C}$   |
| Thermal Resistance        | $R_{\theta JM}$ | Output junction to mounting surface                               | ∅      | 2.0  | ∅    | $^\circ\text{C/W}$ |

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

**STR-S6707 THRU STR-S6709**  
**OFF-LINE**  
**QUASI-RESONANT FLYBACK**  
**SWITCHING REGULATORS**

**TYPICAL CHARACTERISTICS**

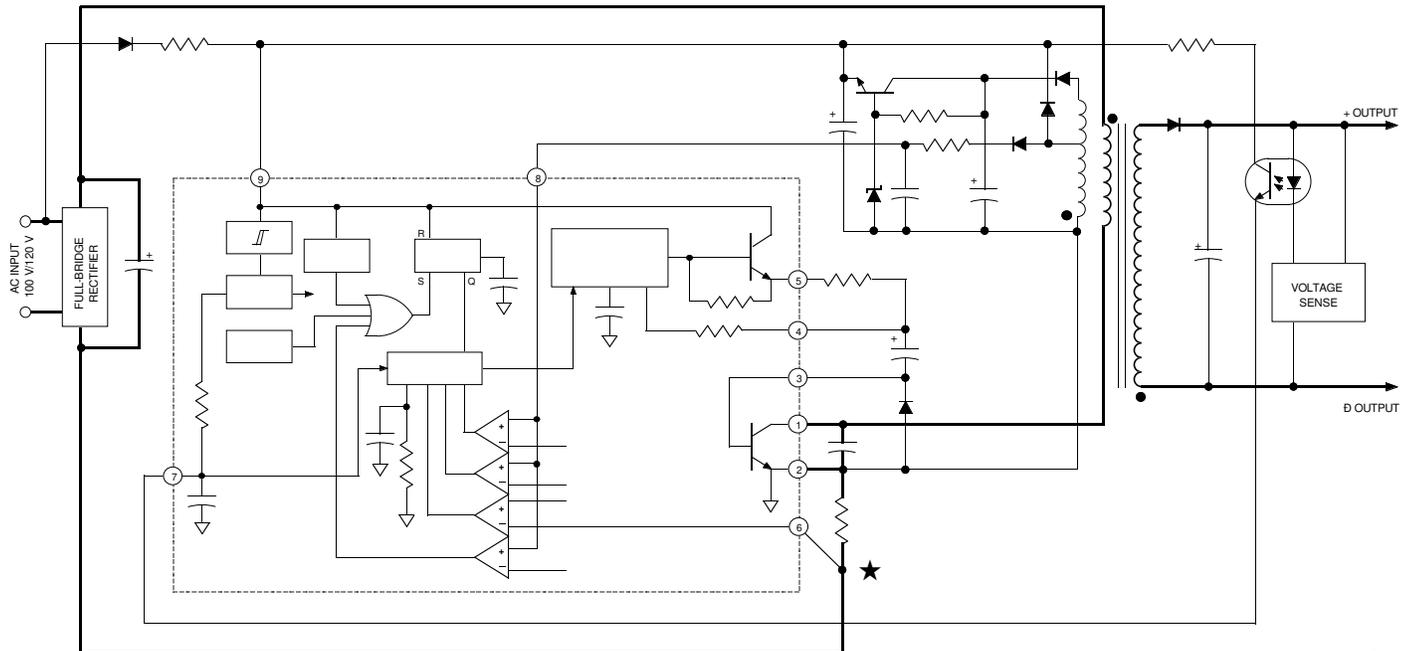


Dwg. GK-001

# STR-S6707 THRU STR-S6709 OFF-LINE QUASI-RESONANT FLYBACK SWITCHING REGULATORS

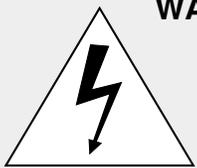
## TYPICAL QUASI-RESONANT FLYBACK CONVERTER

**WARNING:** lethal potentials are present. See text.



Dwg. EK-004A

## APPLICATIONS INFORMATION



**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.

Recommended mounting hardware torque:

4.34  $\bar{\Delta}$  5.79 lbf $\bar{\Delta}$ ft (6  $\bar{\Delta}$  8 kg $\bar{\Delta}$ cm or 0.588  $\bar{\Delta}$  0.784 Nm).

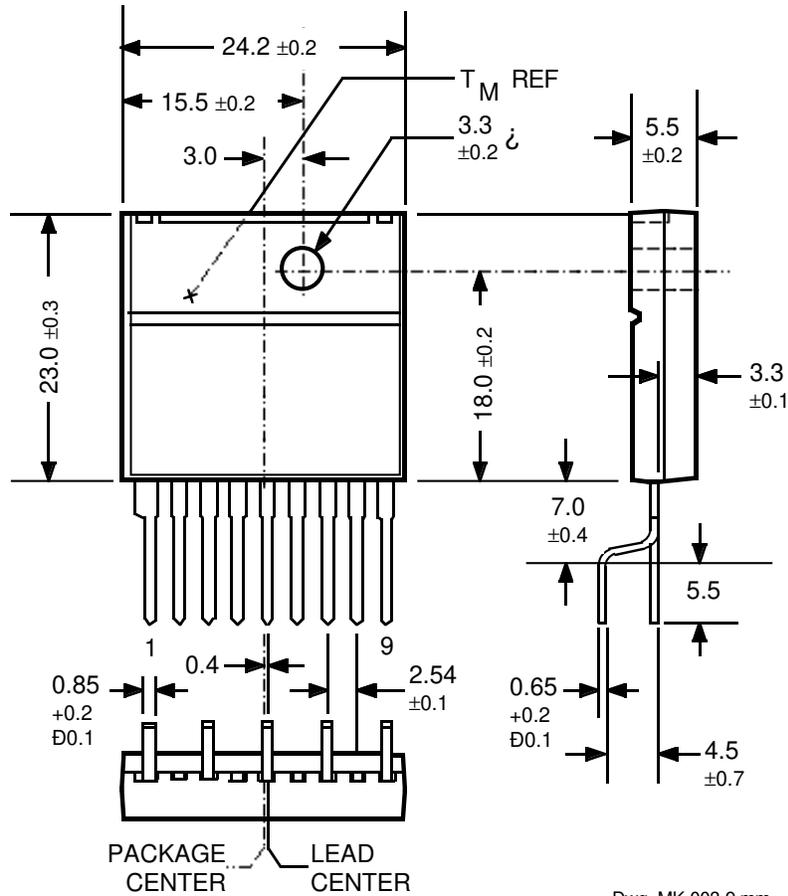
Recommended metal-oxide-filled, alkyl-degenerated oil base, silicone grease:

Dow Corning 340, or equivalent



# STR-S6707 THRU STR-S6709 OFF-LINE QUASI-RESONANT FLYBACK SWITCHING REGULATORS

## Dimensions in Millimeters (controlling dimensions)



Dwg. MK-003-9 mm

NOTE: Exact body and lead configuration at vendor's option within limits shown.

The products described here are manufactured in Japan by Sanken Electric Co., Ltd. for sale by Allegro MicroSystems, Inc.

Sanken Electric Co., Ltd. and Allegro MicroSystems, Inc. reserve the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of their products.

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**STR-S6707 THRU STR-S6709**  
**OFF-LINE**  
**QUASI-RESONANT FLYBACK**  
**SWITCHING REGULATORS**

**POWER CONVERSION/POWER MANAGEMENT**  
**SELECTION GUIDES**

**SWITCHING REGULATOR PMCMs**

| Part Number* | Application                                              | V <sub>I</sub>        | Max P <sub>O</sub> |       | Power Switch         |                    |
|--------------|----------------------------------------------------------|-----------------------|--------------------|-------|----------------------|--------------------|
| 3002M        | 5 V Switching Regulator and a 9 V Switching Regulator†   | 7.0-33 V              | –                  | –     | 500 mA<br>400 mA     | Bipolar<br>Bipolar |
| 3004M        | 5 V Switching Regulator and Dual 9 V Switching Regulator | 7.0-33 V              | –                  | –     | 500 mA<br>2 x 400 mA | Bipolar<br>Bipolar |
| S5703        | Quasi-Resonant Flyback Converter                         | 110/120 V             | 140 W              | 500 V | 6 A                  | Bipolar            |
| S5707        | Quasi-Resonant Flyback Converter                         | 85-265 V<br>220/240V  | 90 W<br>140 W      | 850 V | 6 A                  | Bipolar            |
| S5708        | Quasi-Resonant Flyback Converter                         | 85-265 V<br>220/240 V | 120 W<br>180 W     | 850 V | 7.5 A                | Bipolar            |
| S6703        | Quasi-Resonant Flyback Converter                         | 110/120V              | 140 W              | 500 V | 6 A                  | Bipolar            |
| S6704        | Quasi-Resonant Flyback Converter                         | 110/120 V             | 100 W              | 500 V | 5 A                  | Bipolar            |
| S6707        | Quasi-Resonant Flyback converter                         | 85-265 V<br>220/240 V | 90 W<br>140 W      | 850 V | 6 A                  | Bipolar            |
| S6708        | Quasi-Resonant Flyback Converter                         | 85-265 V<br>220/240 V | 120 W<br>180 W     | 850 V | 7.5 A                | Bipolar            |
| S6709        | Quasi-Resonant Flyback Converter                         | 85-265 V<br>220/240 V | 160 W<br>220 W     | 850 V | 10 A                 | Bipolar            |
| 8033S        | 3.3 V Switching Regulator                                | 5.5-28 V              | –                  | –     | 3 A                  | Bipolar            |
| 8050S        | 5.0 V Switching Regulator                                | 7.0-40 V              | –                  | –     | 3 A                  | Bipolar            |
| 8090S        | 9.0 V Switching Regulator                                | 12-40V                | –                  | –     | 3 A                  | Bipolar            |
| 8120S        | 12 V Switching Regulator                                 | 15-40 V               | –                  | –     | 3 A                  | Bipolar            |
| 8150S        | 15 V Switching Regulator                                 | 18-40 V               | –                  | –     | 3 A                  | Bipolar            |

\* Complete part number includes additional characters to indicate operating temperature range and/or package style.

† Also includes linear regulator output for 15.7 V at 1.0 A.

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