

# STR-S5707 AND STR-S5708

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

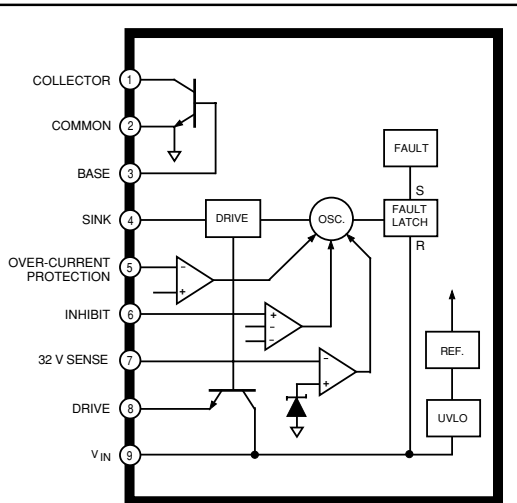


Fig. PK-004

### 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, $I_S$ .....                                 | 1.5 A           |
| Drive Current, $I_D$ .....                                | -700 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-S5707 and STR-S5708 are specifically designed to meet the requirement for increased integration and reliability in off-line quasi-resonant flyback converters with indirect feedback. Each device incorporates 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 primary-side error amplifier with reference is included to facilitate regulation from an auxiliary or bias winding of the power transformer. 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, this device and its fixed-frequency counterparts represents a significant advance in off-line SMPS reliability growth and integration.

### FEATURES

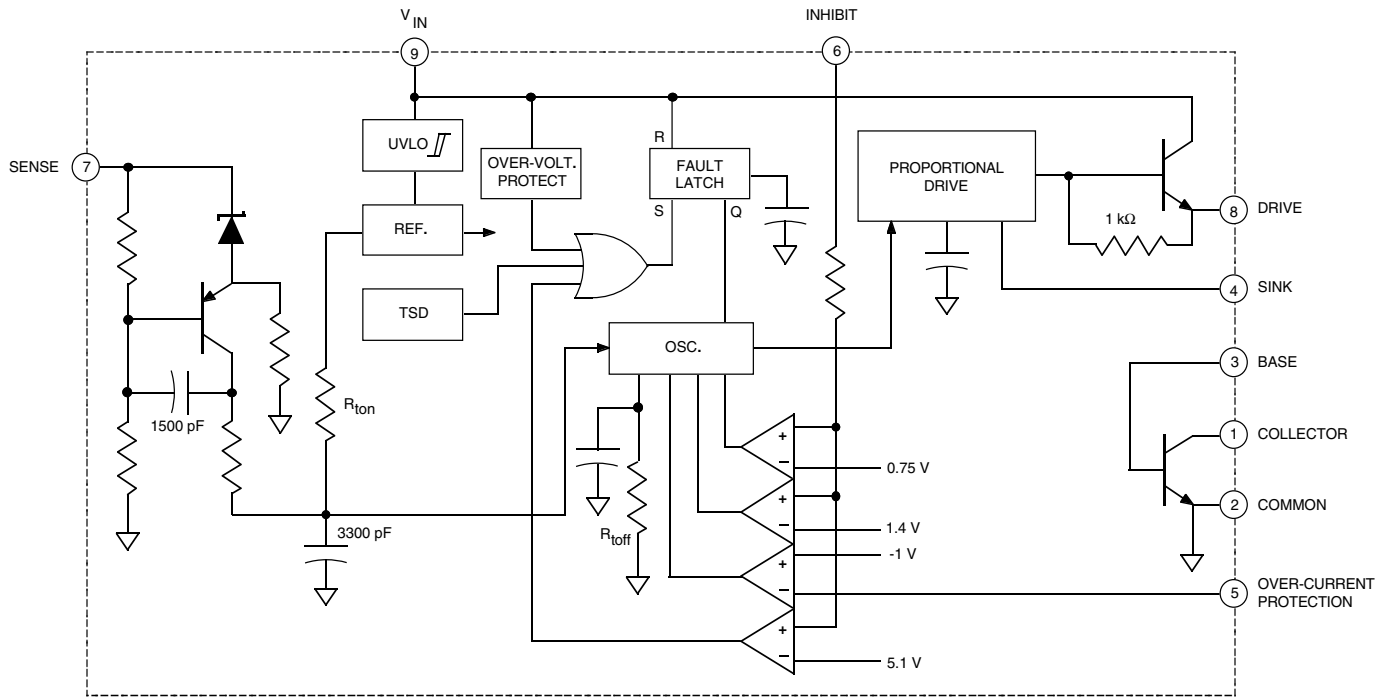
- Quasi-Resonant Operation for Low EMI and High Efficiency
- Low-Power Output Standby Mode
- Indirect Feedback from Auxiliary Winding  
Reduces External Component Count
- Pulse-by-Pulse Over-Current Protection
- Latched Over-Voltage and Thermal Protection
- Third-Generation Switching Transistor with 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 | Output Current    |                | Output Power, $P_O$ |                |
|-------------|-------------------|----------------|---------------------|----------------|
|             | Continuous, $I_C$ | Peak, $I_{CM}$ | Wide AC In          | 220/240 VAC In |
| STR-S5707   | 6 A               | 12 A           | 90 W                | 140 W          |
| STR-S5708   | 7.5 A             | 15 A           | 120 W               | 180 W          |

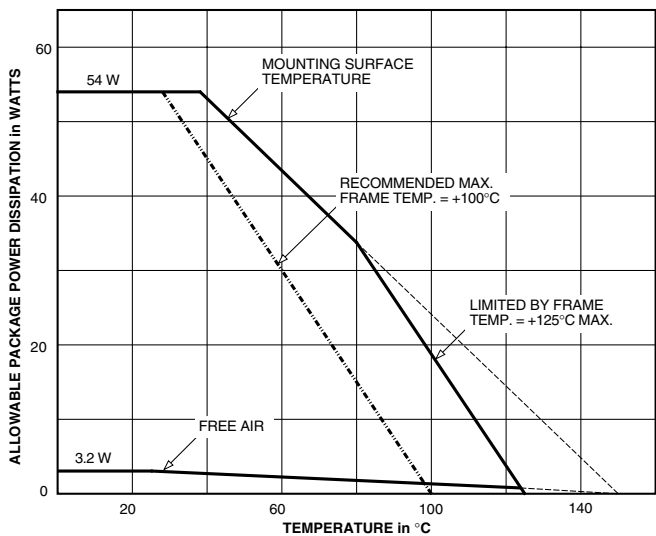
# STR-S5707 AND STR-S5708 OFF-LINE QUASI-RESONANT FLYBACK SWITCHING REGULATORS

## FUNCTIONAL BLOCK DIAGRAM



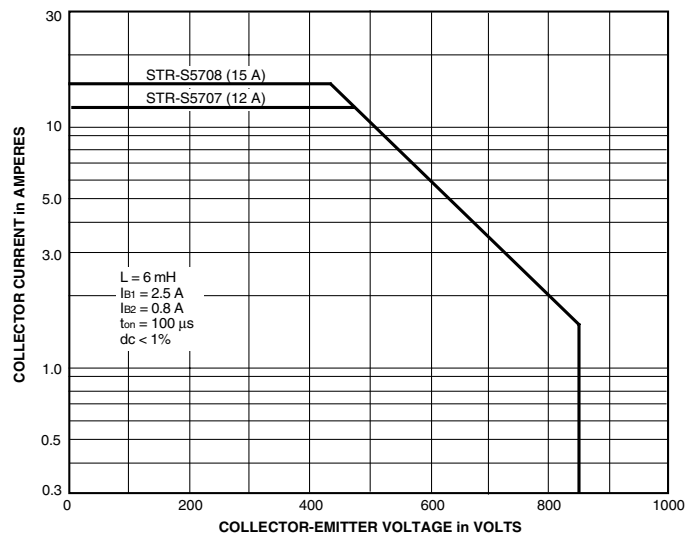
Dwg. FK-001-1

## ALLOWABLE PACKAGE POWER DISSIPATION



Dwg. GK-003-2

## MAXIMUM SAFE OPERATING AREA



Dwg. GK-002-1A



115 Northeast Cutoff, Box 15036  
Worcester, Massachusetts 01615-0036 (508) 853-5000  
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**OFF-LINE**  
**QUASI-RESONANT FLYBACK**  
**SWITCHING REGULATORS**

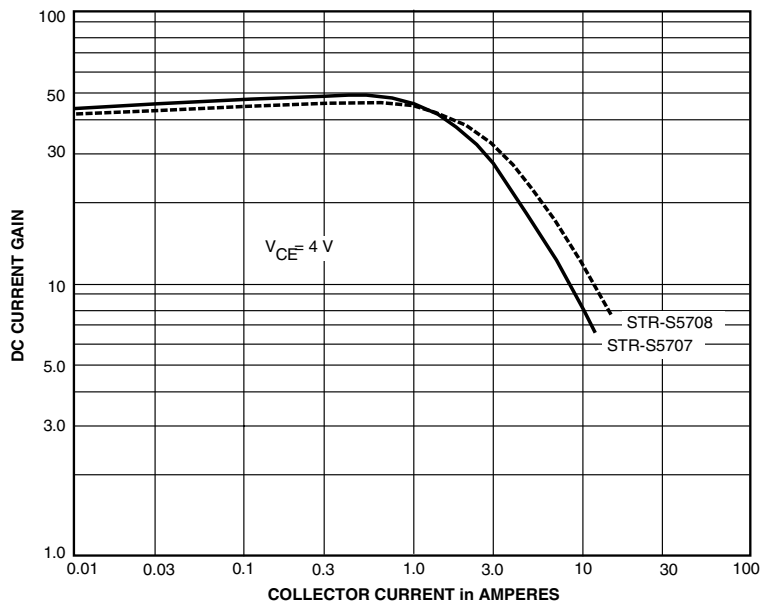
**ELECTRICAL CHARACTERISTICS at  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 8.5\text{ V}$ , voltage measurements are referred to Common (pin 2) (unless otherwise noted).**

| 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-S5707, $I_C = 2\text{ A}$ , $I_B = 400\text{ mA}$                           | –      | –    | 400   | mV                         |
|                           |                 | STR-S5708, $I_C = 3\text{ A}$ , $I_B = 600\text{ mA}$                           | –      | –    | 400   | mV                         |
|                           | $V_{BE(sat)}$   | STR-S5707, $I_C = 2\text{ A}$ , $I_B = 400\text{ mA}$                           | –      | –    | 1.5   | V                          |
|                           |                 | STR-S5708, $I_C = 3\text{ A}$ , $I_B = 600\text{ mA}$                           | –      | –    | 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    | $V_{OCP(th)}$   |   | -0.88  | -1.0 | -1.12 | V                          |
| Sense Voltage             | $V_{SENSE}$     | $I_{SENSE} = 3.2\text{ mA}$   | 31.7   | 32.0 | 32.3  | V                          |
| 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  | 5.8   | 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                          |
| Ref. Voltage Temp. Coeff. | $\alpha_{VZ}$   | $-20^\circ\text{C} \leq T_F \leq +100^\circ\text{C}$ , $I_{IN} = 3.2\text{ mA}$ | –      | 2.5  | –     | $\text{mV}/^\circ\text{C}$ |
| Supply Current            | $I_{IN(ON)}$    | Operating   | 15     | –    | 28    | 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  | –     | $^\circ\text{C}/\text{W}$  |

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

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**QUASI-RESONANT FLYBACK**  
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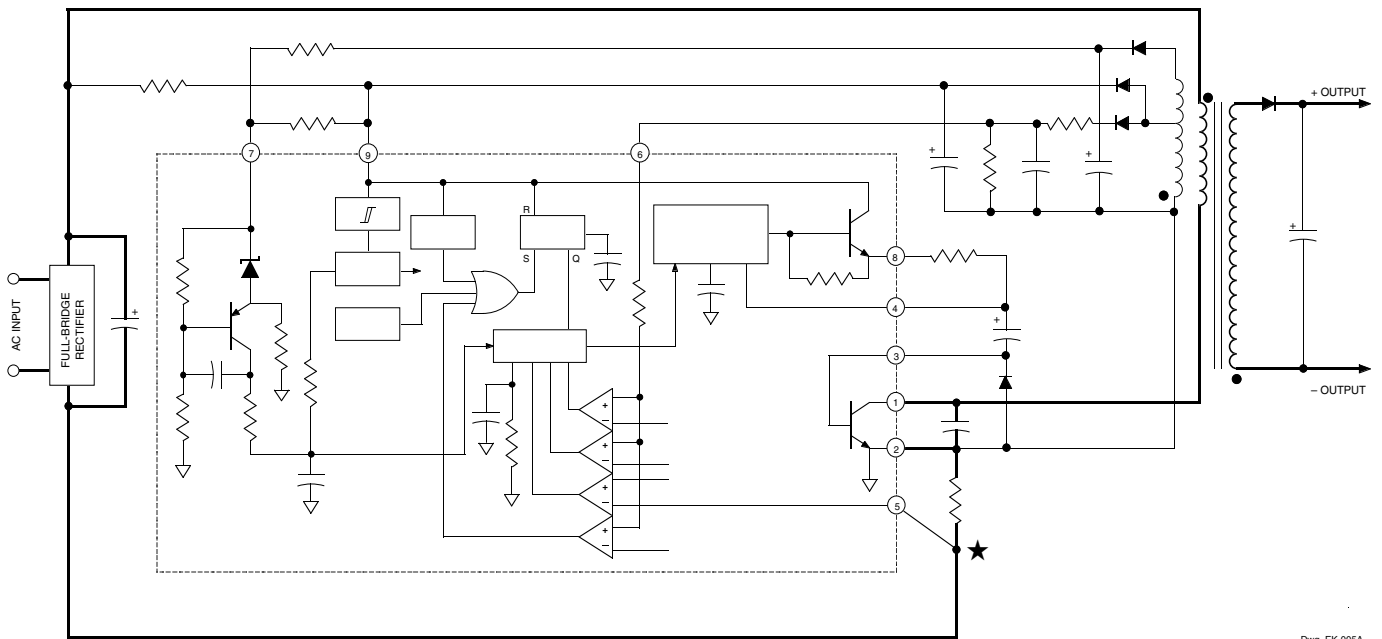
**TYPICAL CHARACTERISTICS**



# STR-S5707 AND STR-S5708 OFF-LINE QUASI-RESONANT FLYBACK SWITCHING REGULATORS

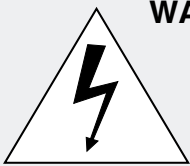
## TYPICAL QUASI-RESONANT FLYBACK CONVERTER

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



Dwg. EK-005A

## APPLICATIONS INFORMATION



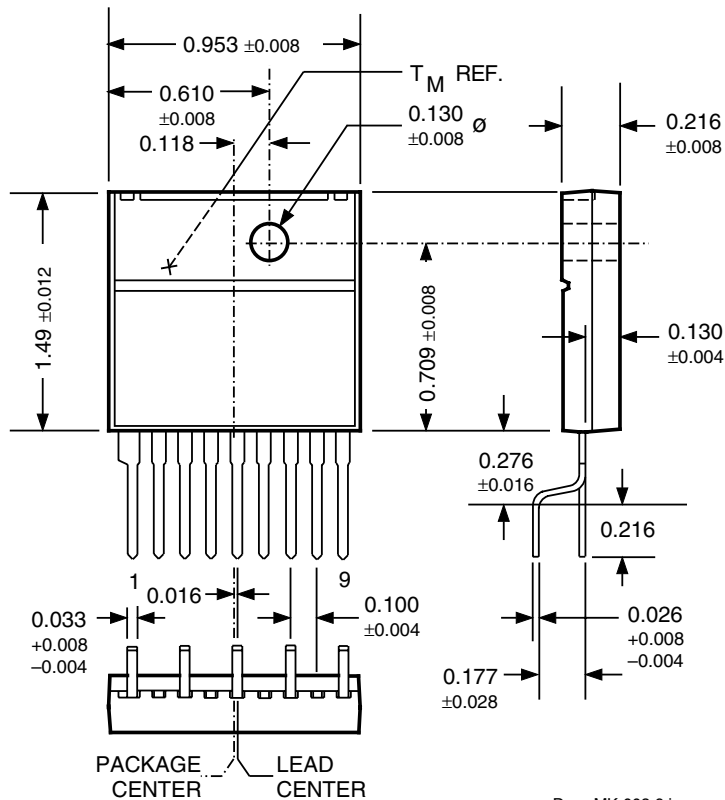
**WARNING** — These devices are designed to be operated at lethal voltages and energy levels. Circuit designs that embody these components must conform with applicable safety requirements. Precautions must be taken to prevent accidental contact with power-line potentials. Do not connect grounded test equipment. The use of an isolation transformer is recommended during circuit development and breadboarding.

Recommended mounting hardware torque:  
4.34 – 5.79 lbf•ft (6 – 8 kg•cm or 0.588 – 0.784 Nm).

Recommended metal-oxide-filled, alkyl-degenerated oil base, silicone grease:  
Dow Corning 340, or equivalent

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**Dimensions in Inches**  
**(for reference only)**



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



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**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       | bipolar |
|              |  |                       |                    |       | 400 mA       | bipolar |
| 3004M        | 5 V switching regulator and Dual 9 V switching regulator | 7.0-33 V              | –                  | –     | 500 mA       | bipolar |
|              |  |                       |                    |       | 2 x 400 mA   | 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.

‡ Without heat sink.

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115 Northeast Cutoff, Box 15036  
Worcester, Massachusetts 01615-0036 (508) 853-5000

