

## Universal-Input/20 W Flyback Switching Regulator



### ABSOLUTE MAXIMUM RATINGS

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

|                                                                                      |                         |
|--------------------------------------------------------------------------------------|-------------------------|
| Control Supply Voltage, $V_{CC}$ . . . .                                             | <b>35 V</b>             |
| Drain-Source Voltage, $V_{DSS}$ . . . . .                                            | <b>650 V</b>            |
| Drain Switching Current, $I_D$ . . . . .                                             | <b>3.4 A*</b>           |
| Peak Drain Switching Current,<br>$I_{DM}$ . . . . .                                  | <b>1.8 A</b>            |
| Single-Pulse Avalanche Energy,<br>$E_{AS}$ . . . . .                                 | <b>136 mJ</b>           |
| Start-Up-Pin Voltage Range,<br>$V_{startup}$ . . . . .                               | <b>-0.3 V to +600 V</b> |
| OCP Voltage Range,<br>$V_{OCP}$ . . . . .                                            | <b>-0.5 V to +6 V</b>   |
| FB/OLP Voltage Range,<br>$V_{FB/OLP}$ . . . . .                                      | <b>-0.5 V to +10 V</b>  |
| Package Power Dissipation, $P_D$<br>control ( $V_{CC} \times I_{CC(ON)}$ ) . . . . . | <b>0.46 W</b>           |
| MOSFET ( $V_{DSS} \times I_D$ ) . . . . .                                            | <b>1.81 W</b>           |
| total . . . . .                                                                      | <b>2.27 W</b>           |
| MOSFET Channel Temp., $T_J$ . . . . .                                                | <b>+150°C</b>           |
| Internal Frame Temp., $T_F$ . . . . .                                                | <b>+125°C</b>           |
| Operating Temperature Range,<br>$T_A$ . . . . .                                      | <b>-20°C to +125°C†</b> |
| Storage Temperature Range,<br>$T_S$ . . . . .                                        | <b>-40°C to +125°C</b>  |

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

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

The STR-A6153E is a PRC topology (fixed off-time) regulator specifically designed to satisfy the requirements for increased integration and reliability in flyback converters. It incorporates a primary control and drive circuit with avalanche-rated power MOSFET. The STR-A6153E features high switching current and avalanche-energy ratings and low on-resistance.

Covering the power range from below 24 watts for a 230 VAC input, or 20 watts for a universal (85 to 264 VAC) input, 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 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. The STR-A6153E is provided in an 8-pin mini-DIP plastic package.

### FEATURES AND BENEFITS

- Rugged 650 V Avalanche-Rated MOSFET  
Simplified Surge Absorption  
No  $V_{DSS}$  Derating Required
- $1.9 \Omega r_{DS(on)}$
- Two Operational Modes by Automatic Switching:  
PRC Mode for Normal Operation  
Burst Mode for Stand-By Operation or Light Loads
- Built-In Leading Edge Blanking
- Low Start-Up Current  
Start-Up Circuit Disabled in Operation
- Low Operating Current (1.5 mA typ)
- Automatic Burst Stand-By (intermittent operation)  
Input Power  $< 0.1 \text{ W}$  at No Load

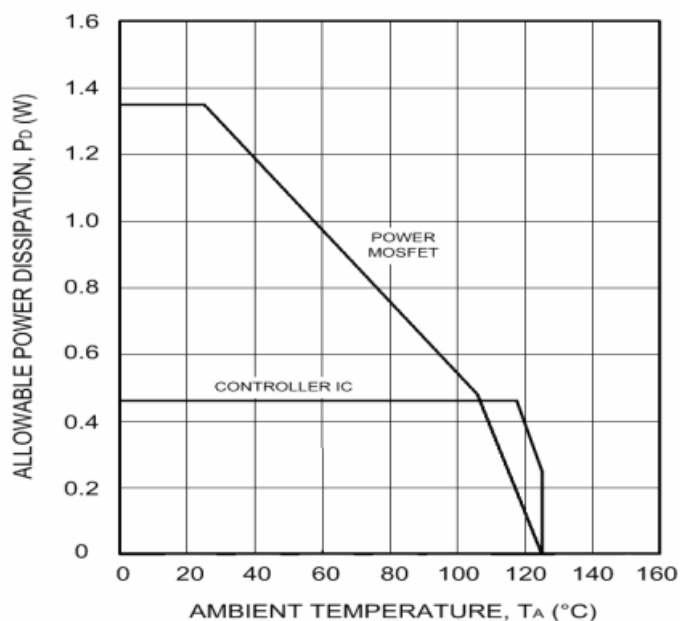
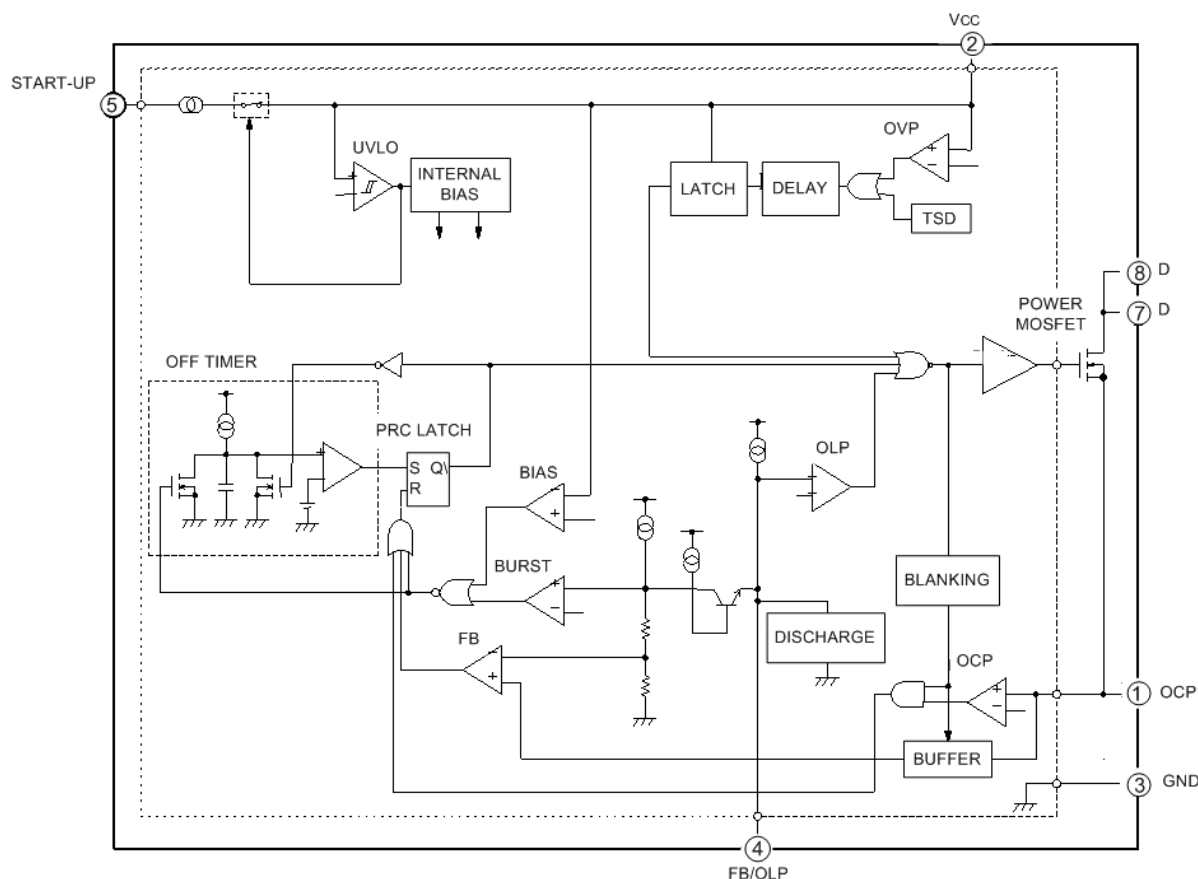
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Always order by complete part number, e.g., **STR-A6153E**.

**STR-A6153E**  
**Universal-Input/20 W**  
**Flyback Switching Regulator**

Switching  
Regulators

**FUNCTIONAL BLOCK DIAGRAM**

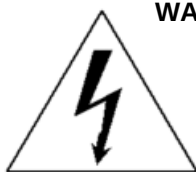


**FEATURES AND BENEFITS (cont'd)**

- 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
  - Latching Thermal Shutdown
- Molded Small-Size 8-Pin Package
  - For Low-Height SMPS
  - Polarized to Prevent Backwards Assembly

**ELECTRICAL CHARACTERISTICS** at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 20\text{ V}$  (unless otherwise specified).

| Characteristic                   | Pin No. | Symbol            | Test Conditions                                                      | Ratings |      |       |                    |
|----------------------------------|---------|-------------------|----------------------------------------------------------------------|---------|------|-------|--------------------|
|                                  |         |                   |                                                                      | Min     | Typ  | Max   | Units              |
| Drain-to-Source Breakdown Volt.  | 8 - 1   | $V_{(BR)DSS}$     | $I_D = 300\text{ }\mu\text{A}$ ,<br>$V_1 - V_3 = 0\text{ V}$ (short) | 650     | -    | -     | V                  |
| Drain Leakage Current            | 8 - 1   | $I_{DSS}$         | $V_{DS} = 650\text{ V}$ ,<br>$V_1 - V_3 = 0\text{ V}$ (short)        | -       | -    | 300   | $\mu\text{A}$      |
| On-State Resistance              | 8 - 1   | $r_{DS(on)}$      | $I_D = 0.4\text{ A}$                                                 | -       | -    | 1.9   | $\Omega$           |
| MOSFET Switching Time            | 8 - 3   | $t_f$             | -                                                                    | -       | -    | 250   | ns                 |
| Operation Start Voltage          | 2 - 3   | $V_{CC(ON)}$      | $V_{CC} = 0 \rightarrow 19.2\text{ V}$                               | 16      | 17.5 | 19.2  | V                  |
| Operation Stop Voltage           | 2 - 3   | $V_{CC(OFF)}$     | $V_{CC} = 19.2 \rightarrow 9\text{ V}$                               | 9.0     | 10   | 11    | V                  |
| Circuit Current in Operation     | 2 - 3   | $I_{CC(ON)}$      | -                                                                    | -       | -    | 4.0   | mA                 |
| Circuit Current in Non-Operation | 2 - 3   | $I_{CC(OFF)}$     | $V_{CC} = 14\text{ V}$                                               | -       | -    | 50    | $\mu\text{A}$      |
| Maximum OFF Time                 | 8 - 3   | $t_{OFF}$         | -                                                                    | 10.5    | 11.5 | 12.5  | $\mu\text{s}$      |
| OCP Threshold Voltage            | 1 - 3   | $V_{OCP}$         | -                                                                    | 0.96    | 1.13 | 1.28  | V                  |
| Leading Edge Blanking Time       | 8 - 3   | $t_b$             | -                                                                    | 200     | 320  | 480   | ns                 |
| Burst Threshold Voltage          | 4 - 3   | $V_{burst}$       | -                                                                    | 0.66    | 0.75 | 0.84  | V                  |
| OLP Threshold Voltage            | 4 - 3   | $V_{OLP}$         | -                                                                    | 6.5     | 7.2  | 7.9   | V                  |
| Current at OLP Operation         | 4 - 3   | $I_{OLP}$         | -                                                                    | -18.2   | -26  | -34.1 | $\mu\text{A}$      |
| Maximum FB Current               | 4 - 3   | $I_{FB(MAX)}$     | -                                                                    | 220     | 300  | 390   | $\mu\text{A}$      |
| Start-Up Current                 | 5 - 3   | $I_{startup}$     | $V_{CC} = 15\text{ V}$                                               | 340     | 790  | 1230  | $\mu\text{A}$      |
| Start-Up Circuit Leakage Current | 5 - 3   | $I_{start(leak)}$ | -                                                                    | -       | -    | 30    | $\mu\text{A}$      |
| OVP Operation Voltage            | 2 - 3   | $V_{CC(OVP)}$     | $V_{CC} = 0 \rightarrow 34.1\text{ V}$                               | 28.7    | 31.2 | 34.1  | V                  |
| OVP/TSD Latch Sustaining Current | 2 - 3   | $I_{CC(H)}$       | $V_{CC} = 34.1 \rightarrow 8.5\text{ V}$                             | -       | -    | 200   | $\mu\text{A}$      |
| OVP/TSD Latch Release Voltage    | 2 - 3   | $V_{CC}$          | $V_{CC} = 34.1 \rightarrow 6.6\text{ V}$                             | 6.6     | 7.3  | 8.0   | V                  |
| Thermal Shutdown                 | -       | $T_J$             | -                                                                    | 110     | -    | -     | $^\circ\text{C}$   |
| Thermal Resistance               | -       | $R_{\theta JF}$   | -                                                                    | -       | -    | 52    | $^\circ\text{C/W}$ |



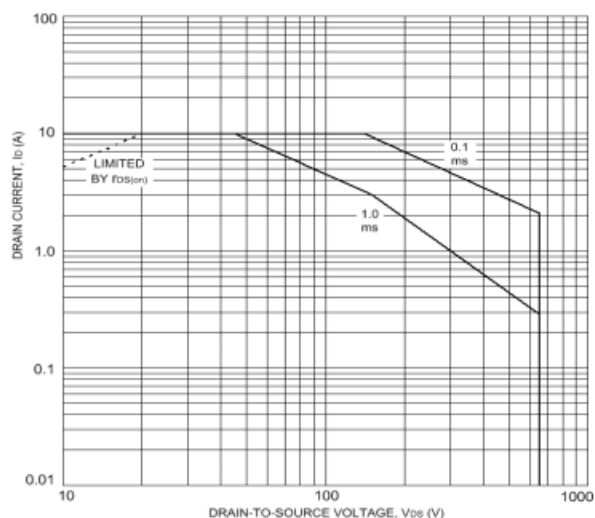
**WARNING** — These devices are designed to be operated at lethal voltages and energy levels. Circuit designs that embody these components must conform with applicable safety requirements. Precautions must be taken to prevent accidental contact with power-line potentials. Do not connect grounded test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

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

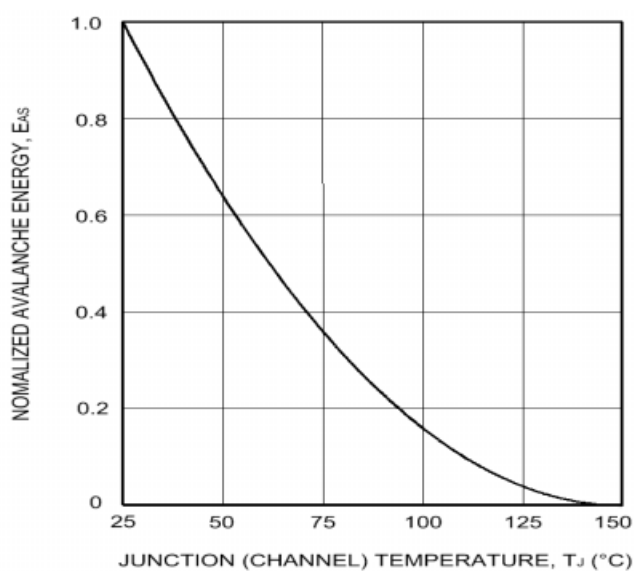
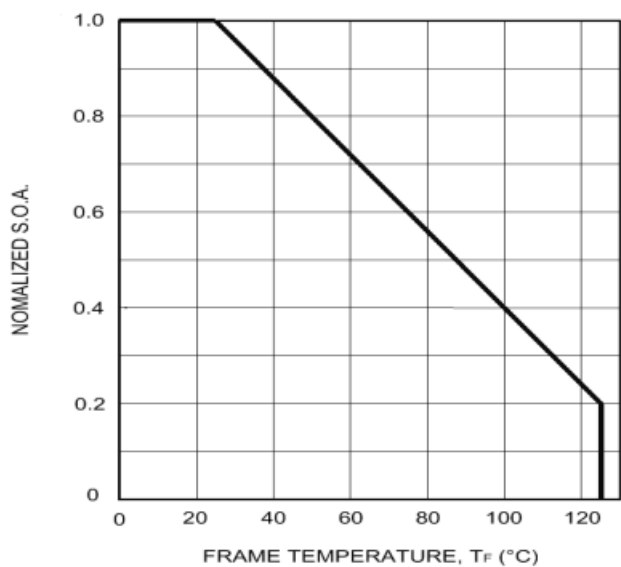
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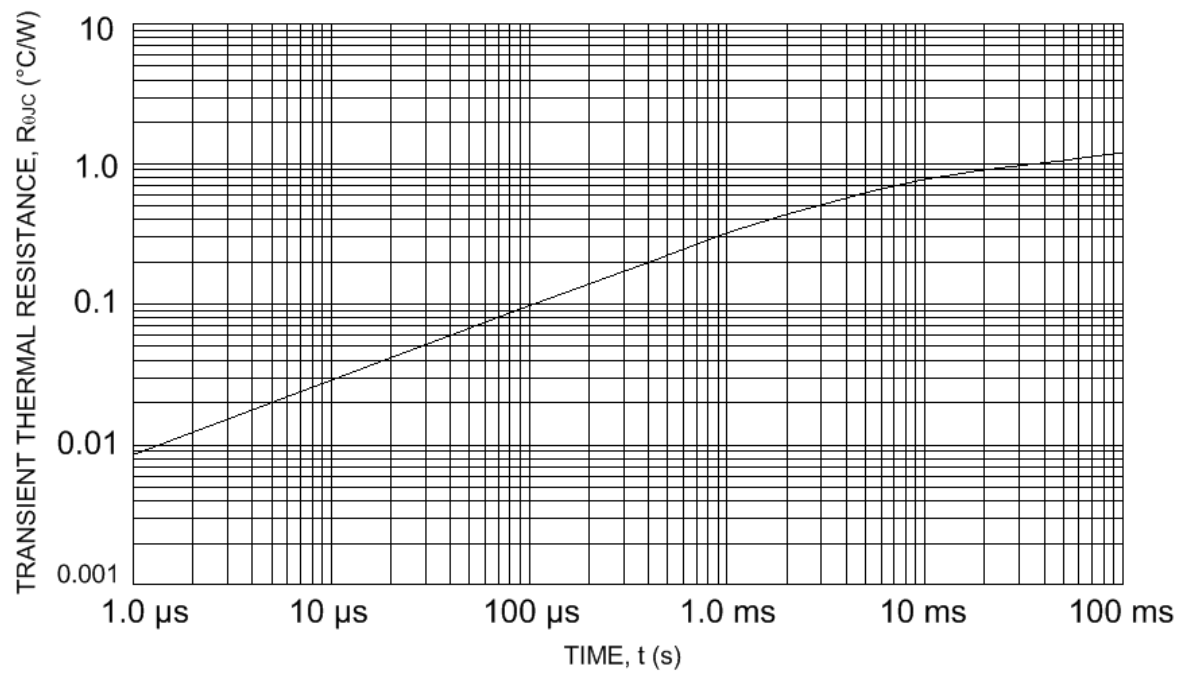
**MOSFET TYPICAL CHARACTERISTICS**



Avalanche energy is measured at  $V_{DD} = 99$  V,  $L = 20$  mH,  $I_L = 3.4$  A.



**MOSFET TYPICAL CHARACTERISTICS (cont'd)**



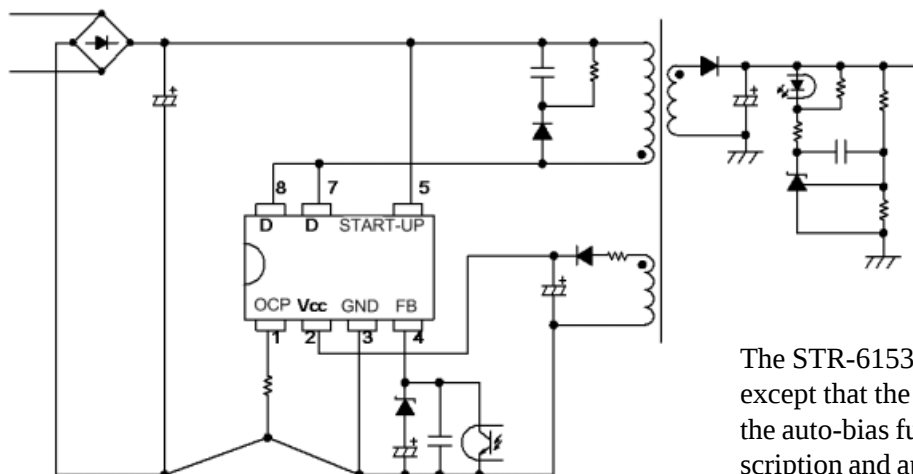
# STR-A6153E

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#### APPLICATIONS INFORMATION



Typical Application

The STR-6153E is similar to other devices in the series except that the maximum OFF time is typically 11.5  $\mu$ s and the auto-bias function is deleted. Complete product description and applications information is provided in Application Note 28103.20, *Series STR-A6100 Flyback Switching Regulators*.

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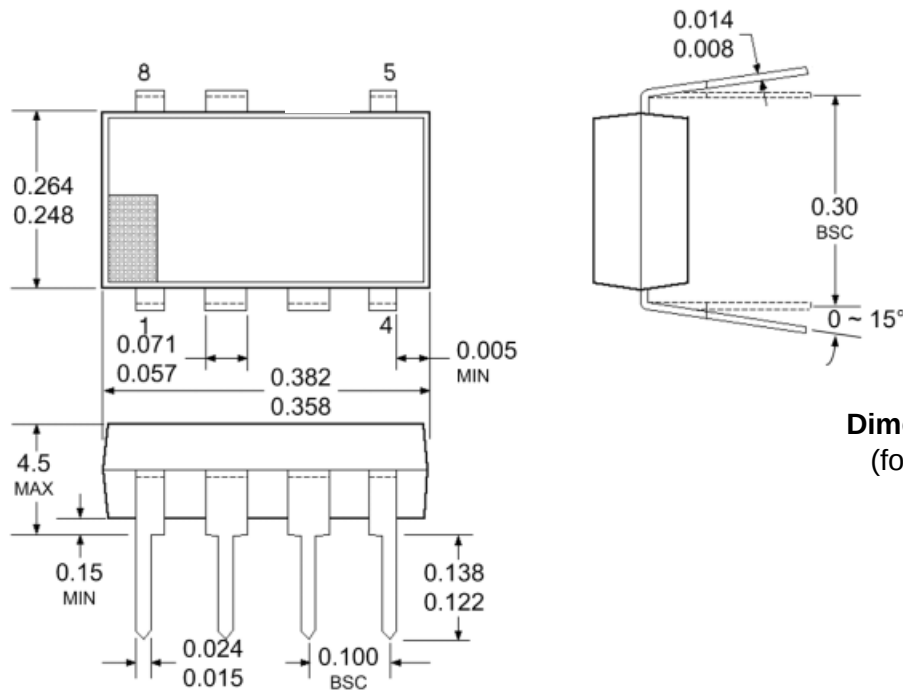
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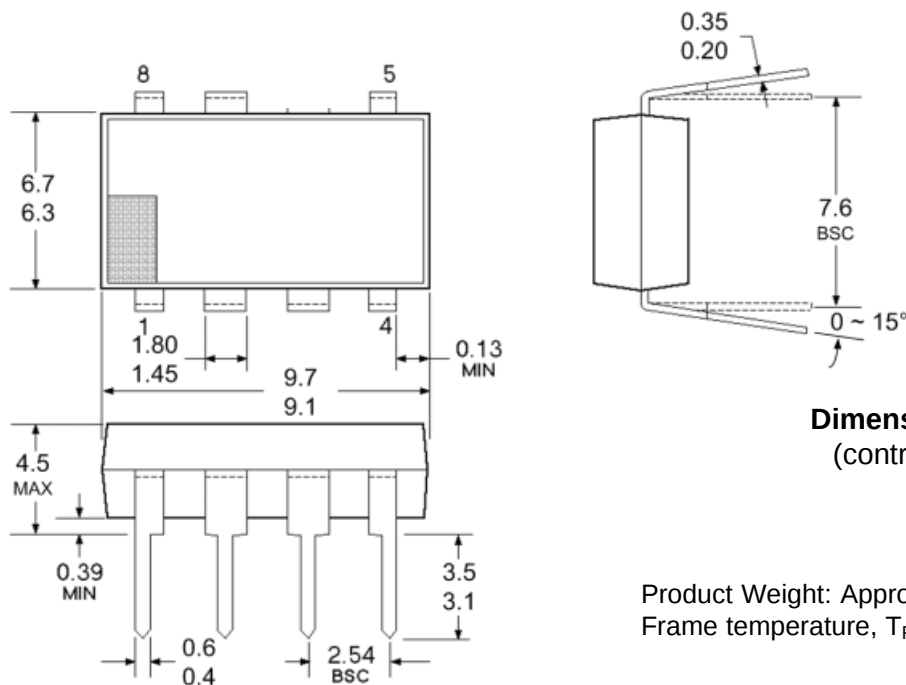
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**PACKAGE DIMENSIONS**



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



**Dimensions in Millimeters**  
(controlling dimensions)

Product Weight: Approx. 0.51 g.  
Frame temperature,  $T_F$ , is measured at the root of pin 3.