

# STR-A6251 AND STR-A6252

## Universal-Input/15 W 50 kHz Flyback Switching Regulators



### ABSOLUTE MAXIMUM RATINGS

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

Control Supply Voltage, $V_{CC}$ . . . . .	<b>36 V</b>
Drain-Source Voltage, $V_{DSS}$ . . . . .	<b>650 V</b>
Drain Switching Current, $I_D$	
STR-A6251 . . . . .	<b>2.5 A*</b>
STR-A6252 . . . . .	<b>3.0 A*</b>
Peak Drain Switching Current, $I_{DM}$	
STR-A6251 . . . . .	<b>2.5 A</b>
STR-A6252 . . . . .	<b>3.0 A</b>
Single-Pulse Avalanche Energy, $E_{AS}$	
STR-A6251 . . . . .	<b>72 mJ</b>
STR-A6252 . . . . .	<b>123 mJ</b>
S/OCP Voltage Range,	
$V_{OCP}$ . . . . .	<b>-0.3 V to +6 V</b>
FB/CC/OLP Voltage Range,	
$V_{FB/OLP}$ . . . . .	<b>-0.3 V to +12 V</b>
FM Voltage Range,	
$V_{FM}$ . . . . .	<b>-0.3 V to +6 V</b>
Package Power Dissipation, $P_D$	
control ( $V_{CC} \times I_{CC(ON)}$ ) . . . . .	<b>0.15 W</b>
MOSFET ( $V_{DSS} \times I_D$ ) . . . . .	<b>1.35 W</b>
total . . . . .	<b>1.5 W</b>
MOSFET Channel Temp., $T_J$ . . . . .	<b>+150°C</b>
Internal Frame Temp., $T_F$ . . . . .	<b>+125°C</b>
Storage Temperature Range,	
$T_S$ . . . . .	<b>-40°C to +125°C</b>

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

The STR-A6251 and STR-A6252 are 50 kHz PWM topology (with  $\pm 5\%$  frequency jittering for minimum EMI) regulators specifically designed to satisfy the requirements for increased integration and reliability in flyback converters. They incorporate a primary control and drive circuit with avalanche-rated power MOSFETs. The STR-A6252 features higher allowable switching current and lower on-resistance. The STR-A6251 is also available for 67 kHz operation.

Covering the power range from below 21 watts or 24 watts for a 230 VAC input, or to 15 or 20 watts for a universal (85 to 264 VAC) input, these devices 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. Both devices are provided in an 8-pin mini-DIP plastic package with pin 6 removed.

### FEATURES AND BENEFITS

- 50 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
- Choice of  $r_{DS(on)}$  (2.8  $\Omega$  or 3.95  $\Omega$  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)

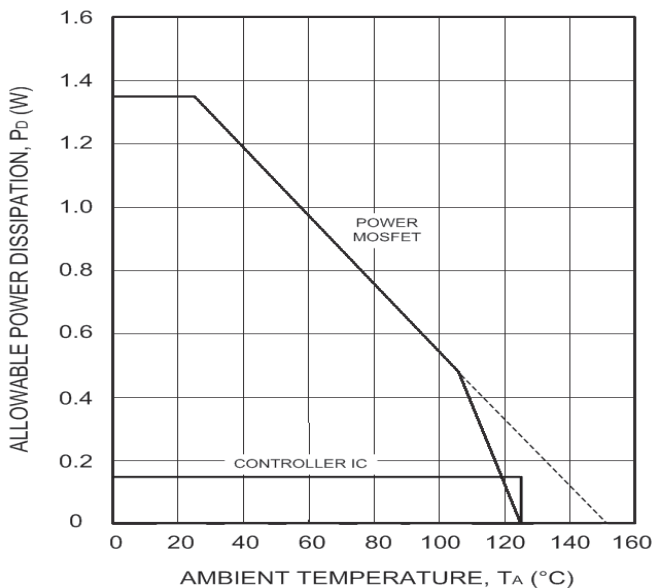
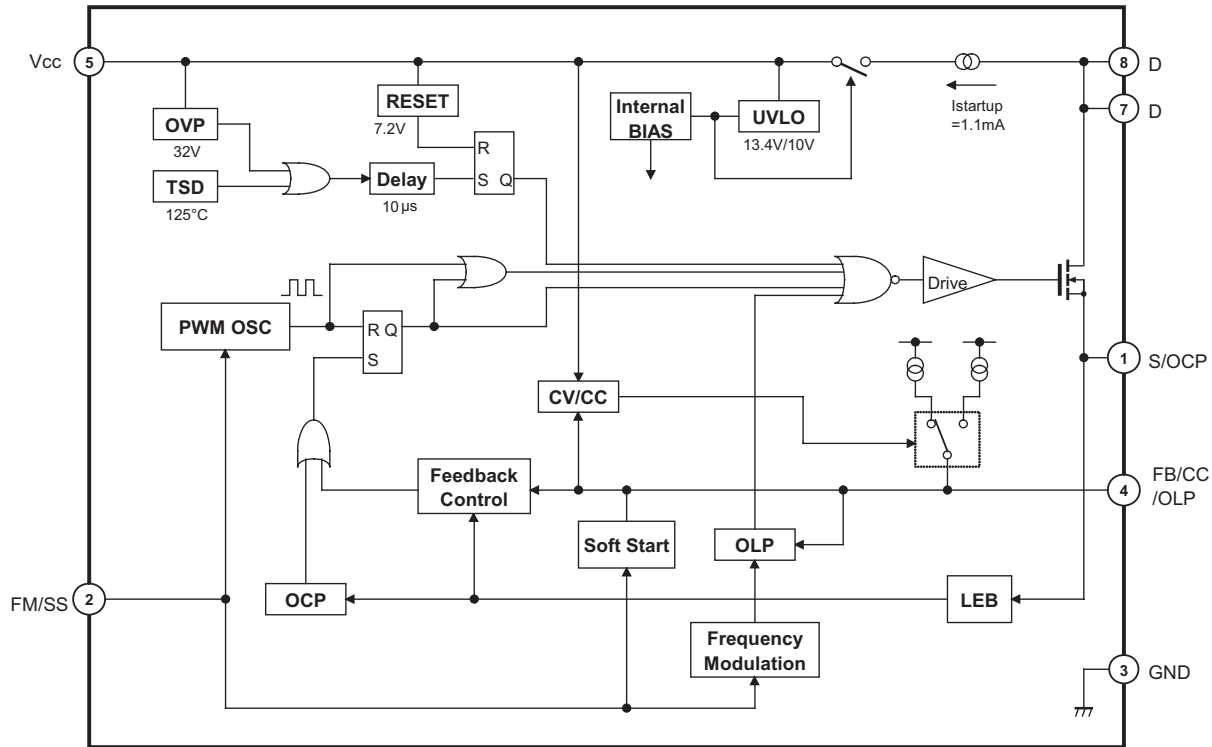
continued

Always order by complete part number, e.g., **STR-A6251**.

**STR-A6251 and STR-A6252**  
**Universal-Input/15 W 50 kHz**  
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**Switching  
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**FUNCTIONAL BLOCK DIAGRAM**



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

- Automatic Burst Stand-By (intermittent operation)  
Input Power < 0.1 W at No Load
- 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-23297 and SSE-23298.

**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	$\mu\text{A}$
On-State Resistance	8 - 1	$r_{DS(on)}$	STR-A6251, $I_D = 0.4\text{ A}$	-	-	3.95	$\Omega$
			STR-A6252, $I_D = 0.4\text{ A}$	-	-	2.8	$\Omega$
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	$f_{osc(max)}$	-	45	50	55	kHz
Frequency-Jitter Deviation	8 - 3	$\Delta f_{osc}$	-	3.0	5.0	7.0	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	$\mu\text{A}$
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	-14.3	$\mu\text{A}$
		$I_{FML}$		7.7	11.0	14.3	$\mu\text{A}$
OCP Threshold Voltage	1 - 3	$V_{OCP}$	-	0.67	0.74	0.81	V
Leading Edge Blanking Time	8 - 3	$t_{bw}$	-	220	320	420	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	-17	-22	$\mu\text{A}$
OLP Delay Time	4 - 3	$t_{OLP}$	-	0.84	1.20	1.56	s
Maximum FB Current	4	$I_{FB(MAX)}$	-	220	310	400	$\mu\text{A}$
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	$I_{startup}$	$V_{CC} = 13\text{ V}$	0.77	1.10	1.43	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	$\mu\text{A}$
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.

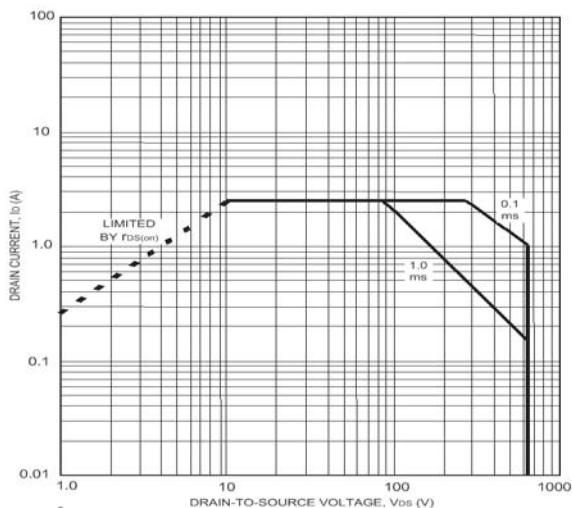
Negative current is defined as coming out of (sourcing) the specified terminal.

**STR-A6251 and STR-A6252**  
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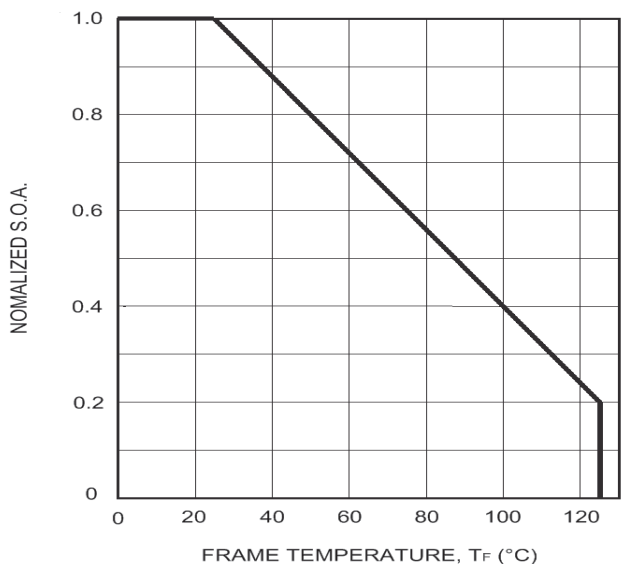
Switching  
Regulators

**MOSFET TYPICAL CHARACTERISTICS**

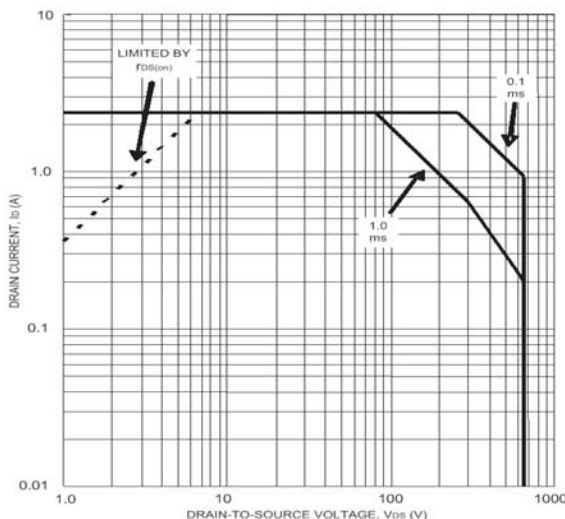
**STR-A6251**



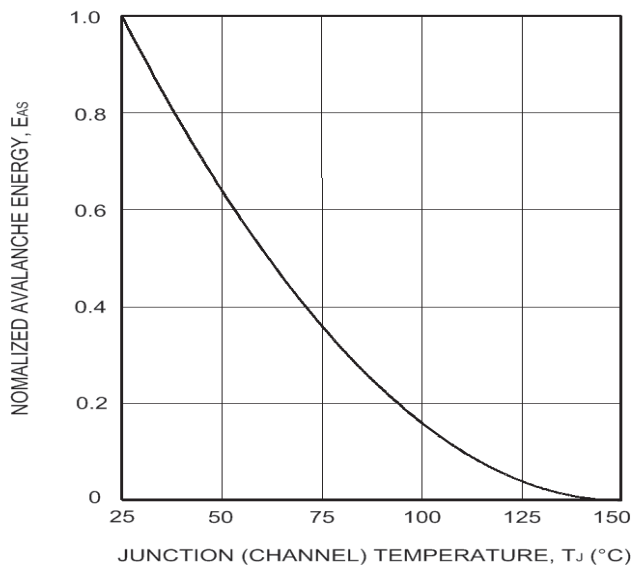
Avalanche energy is measured at  $V_{DD} = 99$  V,  
 $L = 20$  mH,  $I_L = 2.5$  A.



**STR-A6252**



Avalanche energy is measured at  $V_{DD} = 99$  V,  
 $L = 20$  mH,  $I_L = 3.0$  A.

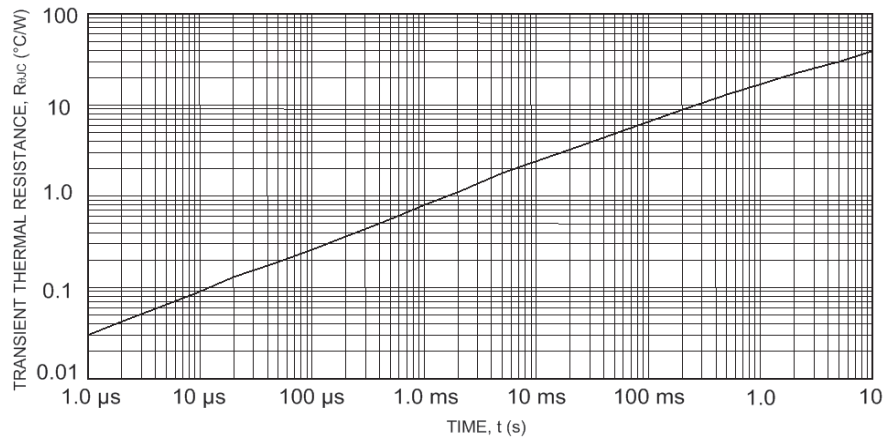


**Recommended Operating Conditions**

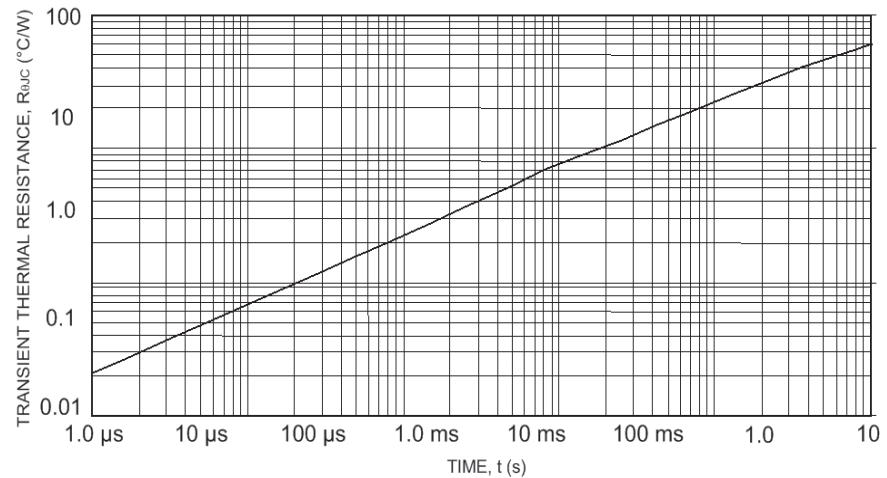
Operating Ambient Temperature ..... -20°C to +100°C  
 Operating Junction Temperature ..... -20°C to +125°C  
 Maximum Frame Temperature ..... +115°C  
 For the availability of parts meeting -40°C requirements, contact  
 Allegro's Sales Representative.

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

**STR-A6251**



**STR-A6252**



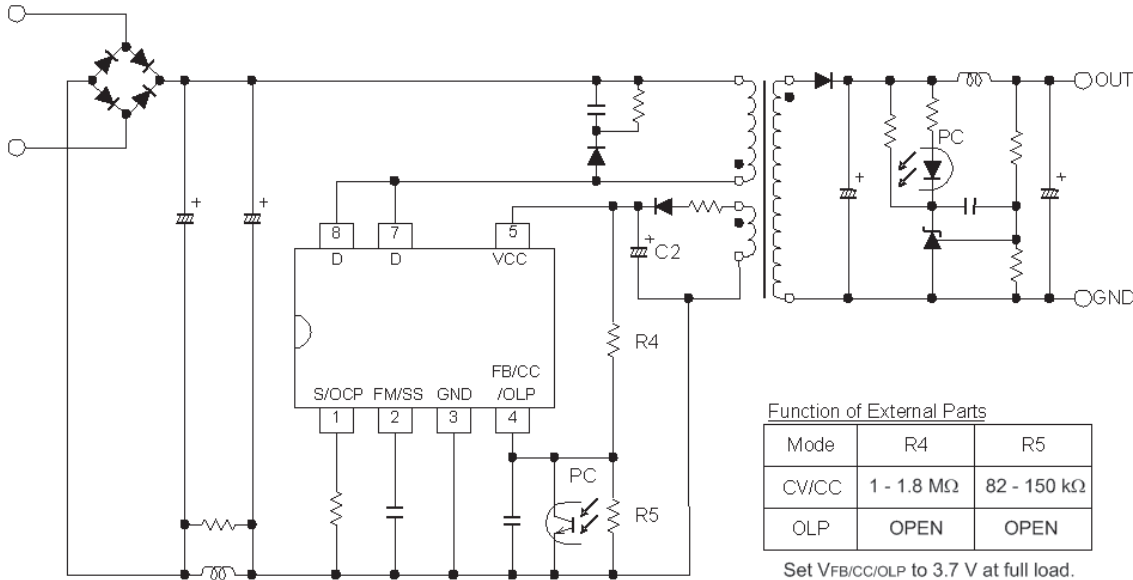
**WARNING** — These devices are designed to be operated at lethal voltages and energy levels. Circuit designs that embody these components must conform with applicable safety requirements. Precautions must be taken to prevent accidental contact with power-line potentials. Do not connect grounded test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

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

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Switching  
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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*.

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

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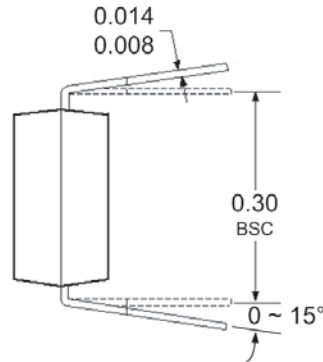
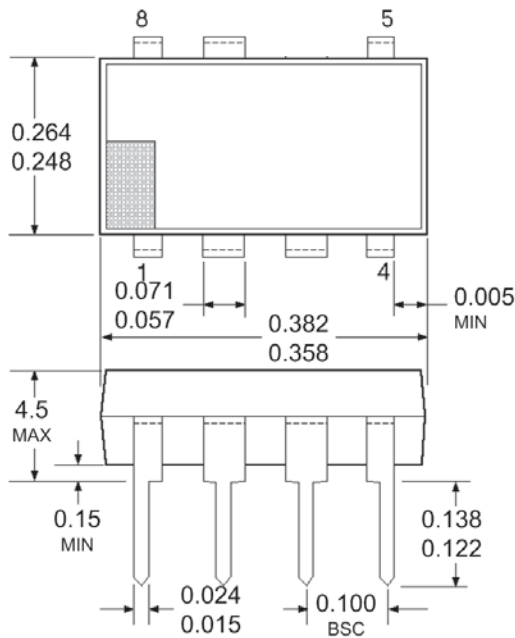
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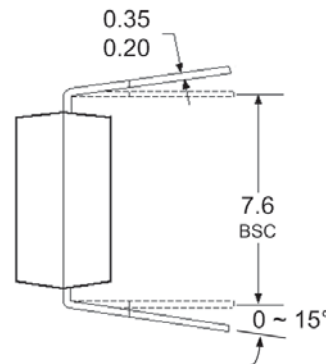
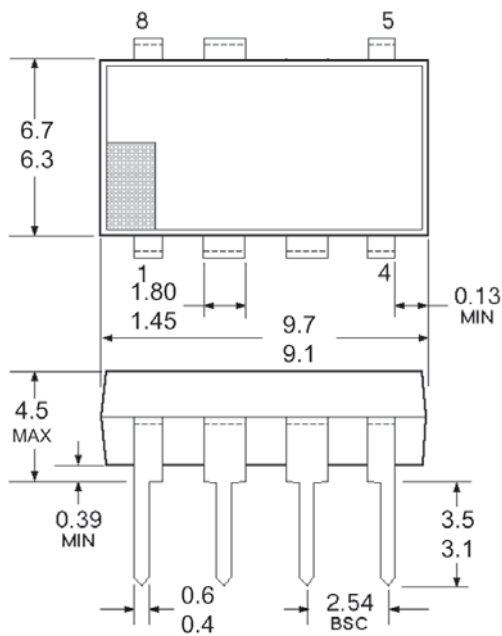
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**PACKAGE DIMENSIONS**



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



**Dimensions in Millimeters**  
(controlling dimensions)

Terminal Finish: Pure Sn, 2<sup>nd</sup> 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.