

Universal-Input/15 W 50 kHz Flyback Switching Regulators

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_{DS} Derating Required
- Choice of $r_{DS(on)}$ (2.8 Ω or 3.95 Ω maximum)
- Auto-Burst Mode for Stand-By Operation or Light Loads
Less Transformer Audible Noise
- Built-In Leading Edge Blanking
- Low Operating Current (4 mA max)

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Package: 8-pin DIP



Not to scale

Description

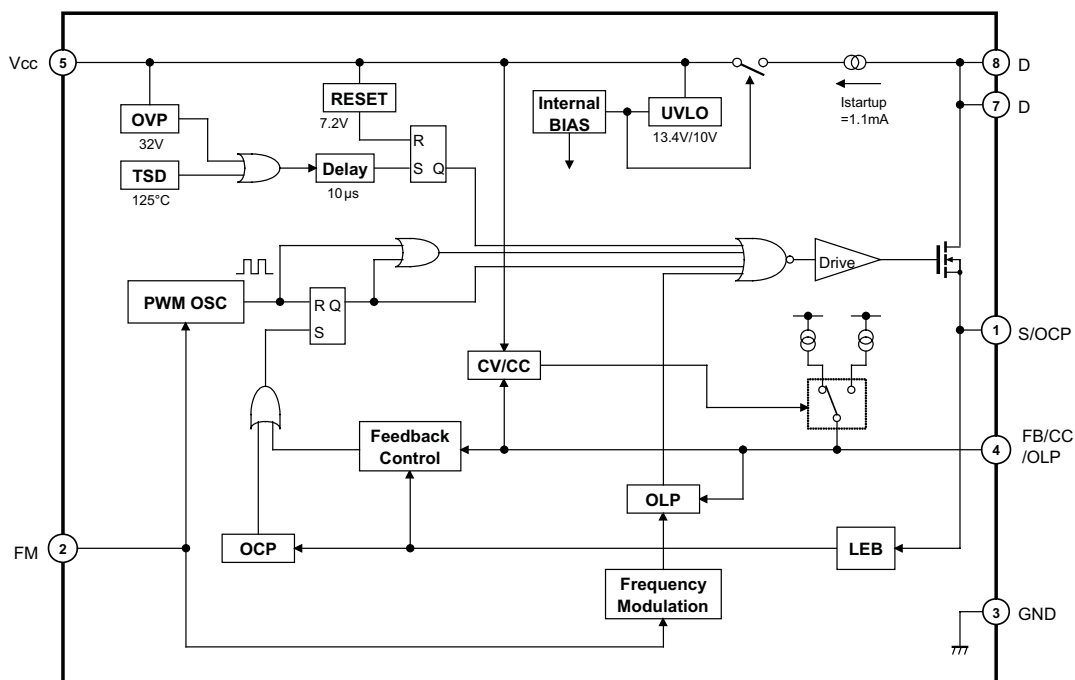
The STR-A6251D and STR-A6252D are 50 kHz PWM topology (with $\pm 5\%$ frequency jittering for minimum EMI) regulators specifically designed to satisfy the requirements for increased integration and reliability in flyback converters. They incorporate a primary control and drive circuit with avalanche-rated power MOSFETs. The STR-A6252 features higher allowable switching current and lower on-resistance. The STR-A6251D 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

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Functional Block Diagram



STR-A6251D and STR-A6252D

Universal-Input/15 W 50 kHz

Flyback Switching Regulators

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Features and Benefits (continued)

- 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

Description (continued)

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.

Selection Guide

Part Number	Package	$R_{DS(on)}$ (Ω)
STR-A6251D	7-pin DIP	3.95
STR-A6252D	7-pin DIP	2.8

*Contact Allegro for additional packing options

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

Characteristic	Symbol	Notes	Rating	Units
Control Supply Voltage	V_{CC}		36	V
Drain-Source Voltage	V_{DSS}		650	V
Drain Switching Current*	I_D	STR-A6251D	2.5	A
		STR-A6252D	3.0	A
Peak Drain Switching Current	I_{DM}	STR-A6251D	2.5	A
		STR-A6252D	3.0	A
Single-Pulse Avalanche Energy	E_{AS}	STR-A6251D	72	mJ
		STR-A6252D	123	mJ
S/OCP Voltage Range	V_{OCP}		-0.3 to 6	V
FB/CC/OLP Voltage Range	$V_{FB/OLP}$		-0.3 to 12	V
FM Voltage Range	V_{FM}		-0.3 to 6	V
Package Power Dissipation	P_D	Control ($V_{CC} \times I_{CC(ON)}$)	0.15	W
		MOSFET ($V_{DSS} \times I_D$)	1.35	W
		Total	1.5	W
MOSFET Channel Temperature	T_J		150	$^\circ\text{C}$
Internal Frame Temperature	T_F		125	$^\circ\text{C}$
Storage Temperature Range	T_S		-40 to 125	$^\circ\text{C}$

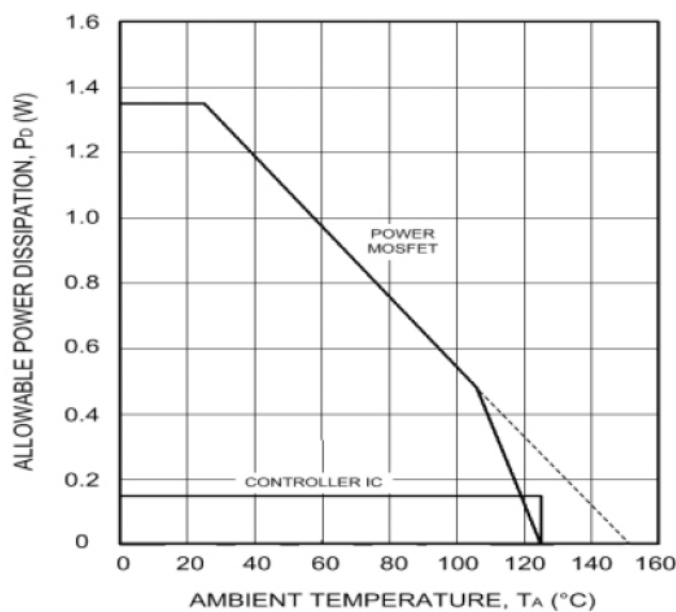
* Drain switching current is limited by temperature (page 2) and safe operating area (page 4).

All performance characteristics given are typical values for circuit or system baseline design only and are at the nominal operating voltage and an ambient temperature, T_A , of 25°C , unless otherwise stated.

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Maximum Allowable Power Dissipation



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.

ELECTRICAL CHARACTERISTICS at $T_A = 25^\circ\text{C}$, $V_{CC} = 18\text{ V}$ (unless otherwise specified).

Characteristic	Pin No.	Symbol	Test Conditions	Ratings			Units
				Min	Typ	Max	
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	μA
On-State Resistance	8 - 1	$r_{DS(on)}$	STR-A6251, $I_D = 0.4\text{ A}$	-	-	3.95	Ω
			STR-A6252, $I_D = 0.4\text{ A}$	-	-	2.8	Ω
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	Δf_{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	μA
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	μA
		I_{FML}	-	7.7	11.0	14.3	μA
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	μA
OLP Delay Time	4 - 3	t_{OLP}	-	0.84	1.20	1.56	s
Maximum FB Current	4	$I_{FB(MAX)}$	-	220	310	400	μA
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	μA
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.

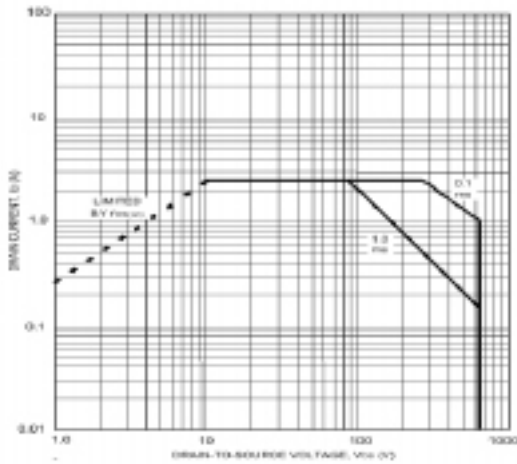
Negative current is defined as coming out of (sourcing) the specified terminal.

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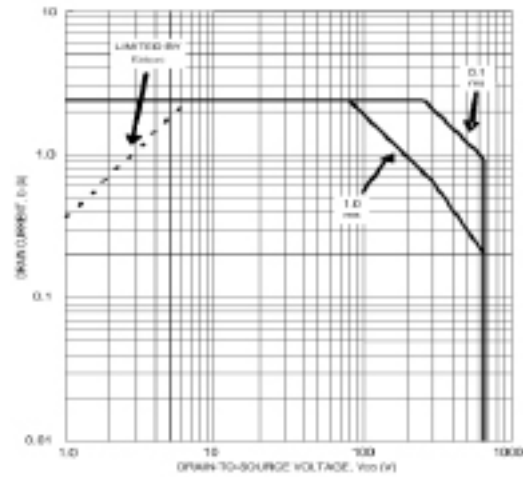
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MOSFET TYPICAL CHARACTERISTICS

STR-A6251D

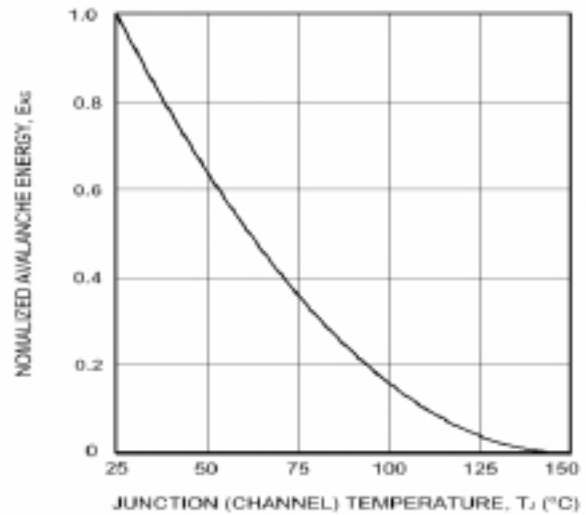
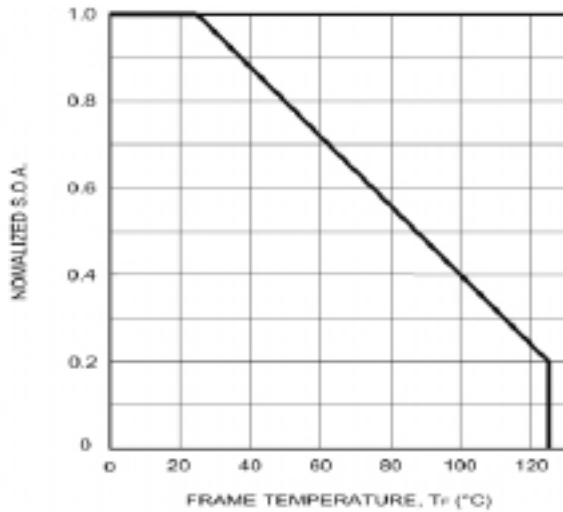


STR-A6252D



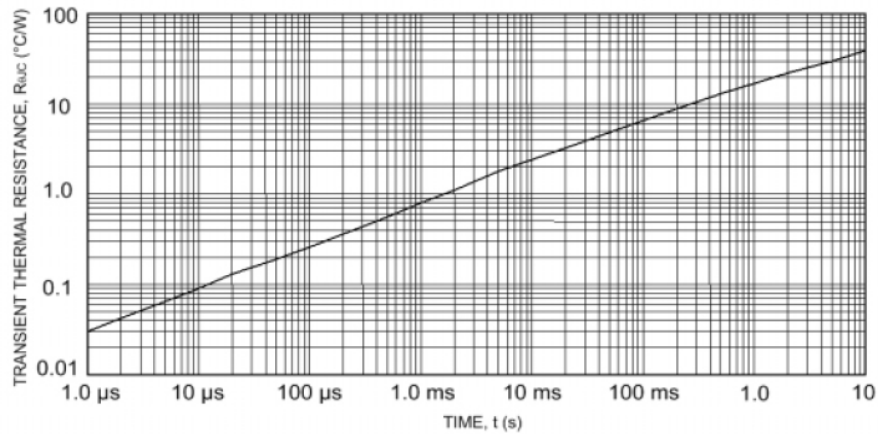
Avalanche energy is measured at $V_{DD} = 99$ V,
 $L = 20$ mH, $I_L = 2.5$ A.

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

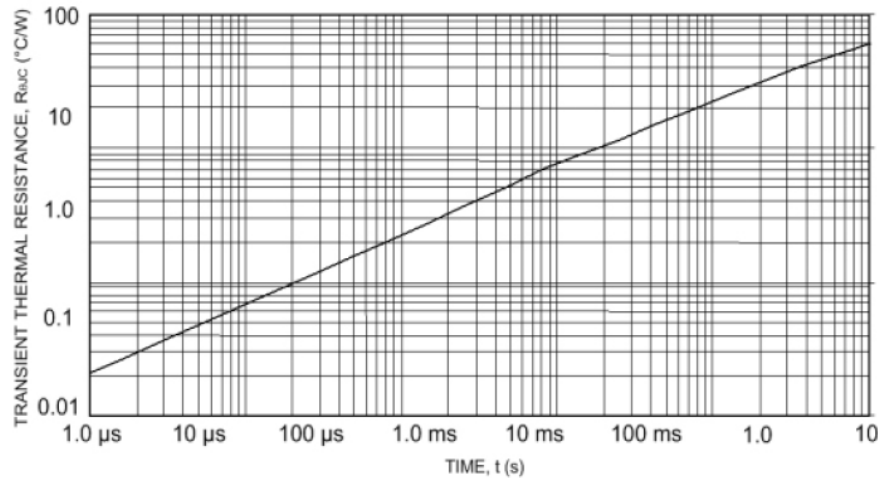


MOSFET TYPICAL CHARACTERISTICS (cont'd)

STR-A6251D



STR-A6252D



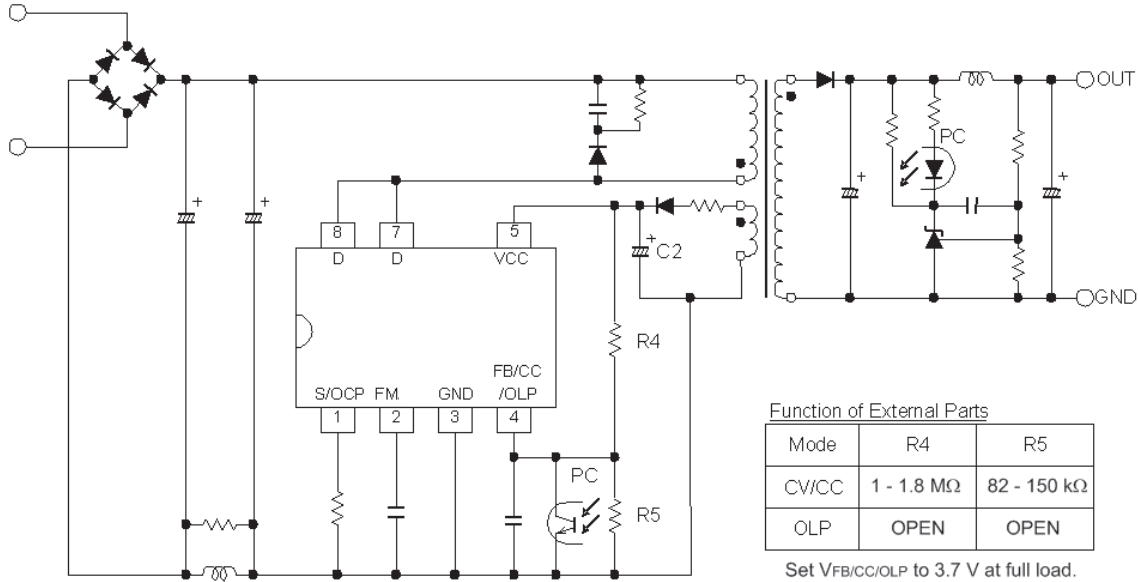
WARNING — These devices are designed to be operated at lethal voltages and energy levels. Circuit designs that embody these components must conform with applicable safety requirements. Precautions must be taken to prevent accidental contact with power-line potentials. Do not connect grounded test equipment.

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

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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*.

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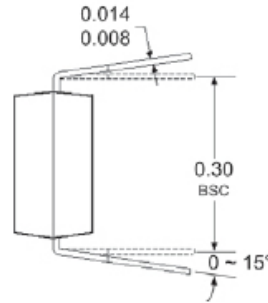
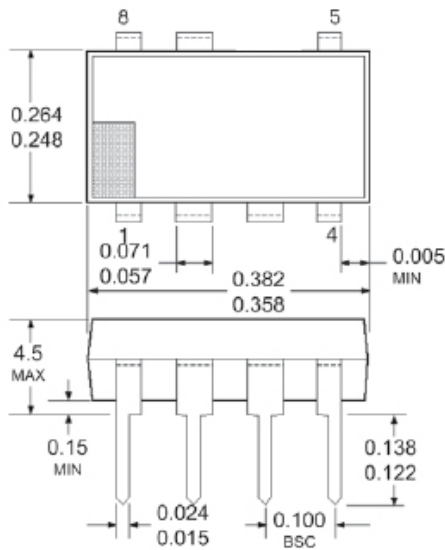
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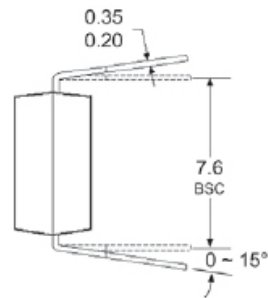
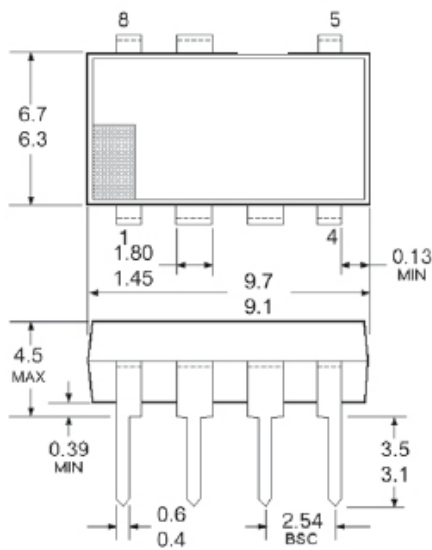
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PACKAGE DIMENSIONS



Dimensions in Inches
(for reference only)



Dimensions in Millimeters
(controlling dimensions)

Terminal Finish: Pure Sn, 2nd 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.

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