

# STR-A6251

September 2005

## ■General Description

STR-A6251 is a PWM-topology off-line secondary-feedback switching regulator IC that builds in a power MOSFET with avalanche immunity and a current-mode control chip. The auto-burst mode operation (intermittent burst operation) and a control chip with low power consumption improve the overall system efficiency. Since only a few external components are required, this IC simplifies the system design with high performance and low cost.

## ■Features

- DIP-8 package without pin 6 is ideal for low profile small power supply system

### ●PWM operational frequency jittering

The frequency jittering function suppresses EMI noise and consequently reduces the EMI noise filter cost. The center frequency of PWM operation is set to 50 KHz, and the frequency jittering provides variation of  $\Delta f = 5\text{KHz}$  (typ), which is adjustable by the external capacitor.

### ●Over Load Protection (OLP) with a built-in timer (Auto restart)

Built-in delay timer circuit to trip the overload protection requires no external OLP capacitor, which allows cost reduction and space-saving.

### ●Over current protection (OCP) with constant current drooping

Constant output current drooping can be realized by simply adding two external resistors.

### ●Soft start

Reduces stress of the built-in power MOSFET

### ●Auto burst standby operation

Reduces standby input power less than 100mW at no load and 264VAC

Normal operation = PWM mode

Standby operation = Intermittent burst mode

### ●Less transformer's audible noise during the burst mode operation

### ●Built-in MOSFET guaranteeing avalanche energy capability

Simplifies the design of surge absorber, and requires no derating of the breakdown voltage.

### ●Start-up circuit

Thanks to the proprietary 900V BCD process, the built-in startup circuit connected to the internal MOSFET drain reduces both the discrete component count and the power consumption.

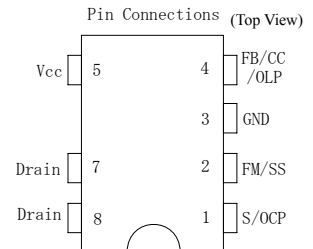
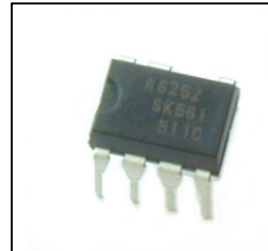
### ●Current Mode Feedback Control

### ●Leading Edge Blanking

### ●Various protections

Over current protection (OCP) ..... Pulse By Pulse  
 Over load protection (OLP) ..... Auto Restart  
 Over voltage protection (OVP) ..... Latch  
 Thermal shut down (TSD) .....Latch

## ■Package---DIP8



Pin No.	Symbols	Functions
1	Source/ O.C.P	MOSFET Source/ Over current protection
2	FM/SS	Capacitor connection terminal for frequency jitter modulation and soft start.
3	GND	Ground
4	FB /CC /OLP	Input of constant voltage control signal / constant current drooping control signal / overload protection signal
5	Vcc	Input of power supply for control circuit
7	D	MOSFET drain / Input of Startup current
8		

## ■Applications

- Standby power supply
- Battery charger
- Small power S.M.P.S

## ■Key Specifications

Part Number	Fosc [kHz]	MOS FET VDSS[V]	RDS(ON) MAX	Pout[W] 230V / Universal
STR-A6251	50	650	3.95[Ω]	21W / 15W

### Note 1.

The Pout [W] represents the thermal rating at PWM Operation, and the peak power of up to approx. 120 to 140% of the above value can be output. When the output voltage is low and ON-duty is narrow, the Pout [W] shall become lower than the above value.



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**Absolute maximum ratings (Ta=25°C)**

Parameter	Terminals	Symbol	Ratings	Units	Note
Drain Current	8 – 1	$I_{Dpeak}^{*1}$	2.5	A	Single Pulse
Maximum switching current	8 – 1	$I_{Dmax}$	2.5	A	$V_{1-3}=0.86V$ $T_a=-20\sim+125^{\circ}C$
Avalanche energy	8 – 1	$E_{AS}^{*2}$	72	mJ	Single Pulse
					$V_{DD}=99V, L=20mH$ $I_L=2.5A$
S/OCP pin voltage	1 – 3	$V_{O.C.P}$	-0.3 ~ 6	V	
Control supply voltage	5 – 3	$V_{CC}$	36	V	
FB/CC/OL pin voltage	4 – 3	$V_{F.B/O.L.P}$	-0.3 ~ 12	V	
FM pin voltage	2 – 3	$V_{FM}$	-0.3 ~ 6	V	
MOSFET power dissipation	8 – 1	$P_{D1}^{*3}$	1.35	W	*5
Control chip power dissipation	5 – 3	$P_{D2}^{*4}$	0.15	W	$P_{D2} = V_{CC} \times I_{CC}$
Internal frame temperature	–	$T_F$	-20 ~ +125	°C	
Operating temperature	–	$T_{op}$	-20 ~ +125	°C	
Storage temperature	–	$T_{stg}$	-40 ~ +125	°C	
Channel temperature	–	$T_{ch}$	+150	°C	

\*1 Refer to MOS FET A.S.O curve

\*2 Refer to MOS FET Tch-EAS curve

\*3 Refer to MOS FET Ta-PD1 curve

\*4 Refer to MIC TF-PD2 curve

\*5 When embedding this hybrid IC onto the printed circuit board (board size 15mm×15mm)

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**Electrical characteristics****Electrical characteristics for control part (Ta=25°C)**

Items	Terminals	Symbol	Ratings			Units
			Min	Typ	Max	
Operation start voltage	5 - 3	V <sub>cc(ON)</sub>	12.9	14.3	15.7	V
Operation stop voltage	5 - 3	V <sub>cc(OFF)</sub>	9	10	11	V
Operating current	5 - 3	I <sub>cc(ON)</sub>	—	—	4	mA
Quiescent current at non-operation	5 - 3	I <sub>cc(OFF)</sub>	—	—	25	μA
Average switching frequency	8 - 3	f <sub>osc(ave)</sub>	45	50	55	KHz
Delta of frequency jittering	8 - 3	Δf	3	5	7	kHz
Maximum ON-Duty	8 - 3	D <sub>max</sub>	70	76	82	%
FM pin high voltage	2 - 3	V <sub>HFM</sub>	4.0	4.5	5.0	V
FM pin low voltage	2 - 3	V <sub>LFM</sub>	3.2	3.6	4.0	V
FM pin source current	2 - 3	I <sub>src(FM)</sub>	7.7	11	14.3	μA
FM pin sink current	2 - 3	I <sub>sink(FM)</sub>	-14.3	-11	-7.7	μA
S/OCP threshold voltage	1 - 3	V <sub>OCP</sub>	0.67	0.74	0.81	V
Leading edge blanking time	8 - 3	T <sub>bw</sub>	220	320	420	Ns
Auto burst threshold voltage	4 - 3	V <sub>burst</sub>	1.0	1.12	1.24	V
OLP threshold voltage	4 - 3	V <sub>OLP</sub>	7.3	8.6	9.9	V
OLP source current	4 - 3	I <sub>OLP</sub>	12	17	22	μA
OLP delay time	4 - 3	T <sub>OLP</sub>	0.84	1.2	1.56	S
Maximum FB source current	4 - 3	I <sub>FB(MAX)</sub>	220	310	400	μA
CC Set voltage	4 - 3	V <sub>SET(CC)</sub>	4.9	5.8	6.7	V
CC Reset voltage	4 - 3	V <sub>RES(CC)</sub>	3.5	3.9	4.3	V
Start up current	5 - 3	I <sub>startup</sub>	0.77	1.1	1.43	mA
OVP activating voltage	5 - 3	V <sub>cc(OVP)</sub>	28.8	32	35.2	V
Latch holding current *6	5 - 3	I <sub>cc(H)</sub>	—	—	270	μA
Latch release voltage *6	5 - 3	V <sub>cc(La.OFF)</sub>	5.9	7.2	8.6	V
Thermal shutdown temperature	—	T <sub>j(TSD)</sub>	125	140	—	°C

\*6 Latch is activated by only thermal or over voltage faults.

**MOSFET electrical characteristics (Ta=25°C)**

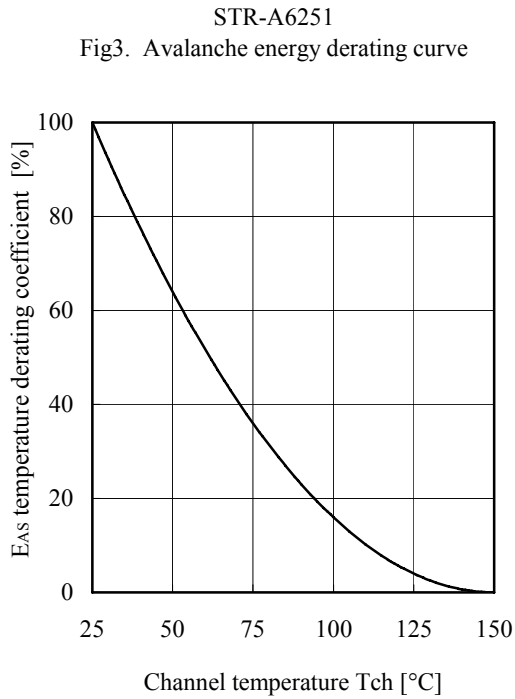
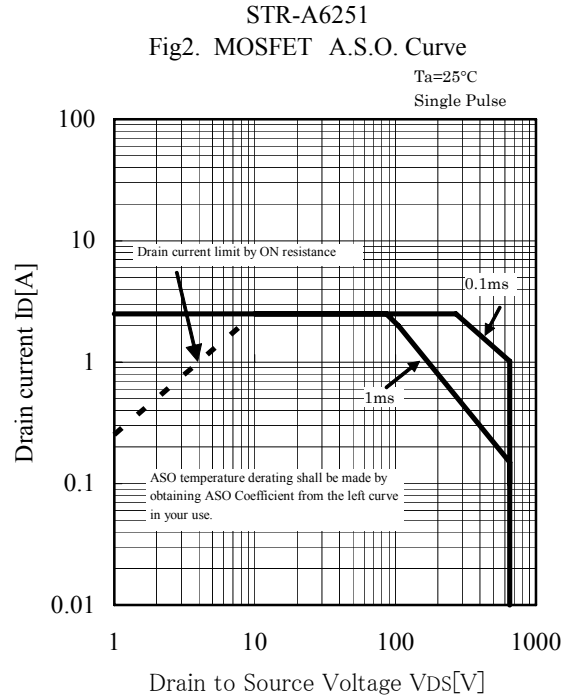
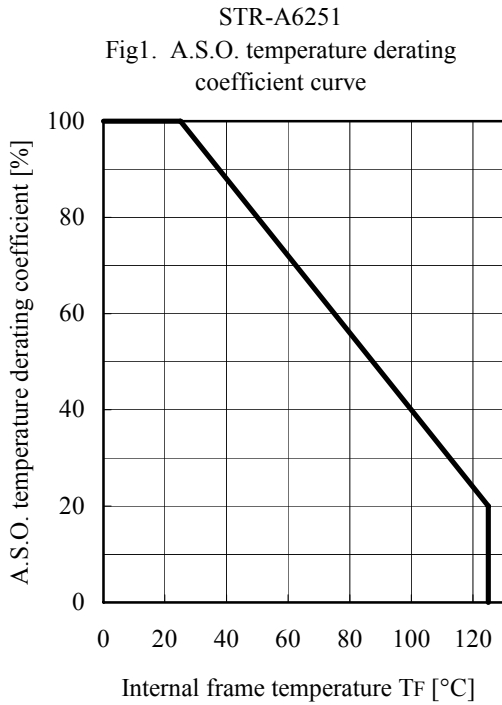
Items	Terminals	Symbol	Ratings			Units
			Min	Typ	Max	
Drain-to-Source breakdown voltage	8 - 1	V <sub>DSS</sub>	650	—	—	V
Drain leakage current	8 - 1	I <sub>DSS</sub>	—	—	300	μA
On-resistance	8 - 1	R <sub>DS(ON)</sub>	—	—	3.95	Ω
Switching time	8 - 1	t <sub>f</sub>	—	—	250	ns
Thermal resistance *7	-	θ <sub>ch-F</sub>	—	—	52	°C/W

\*7 Between channel and internal frame

Internal frame temperature (TF) is measured at the root of the Pin# 3.

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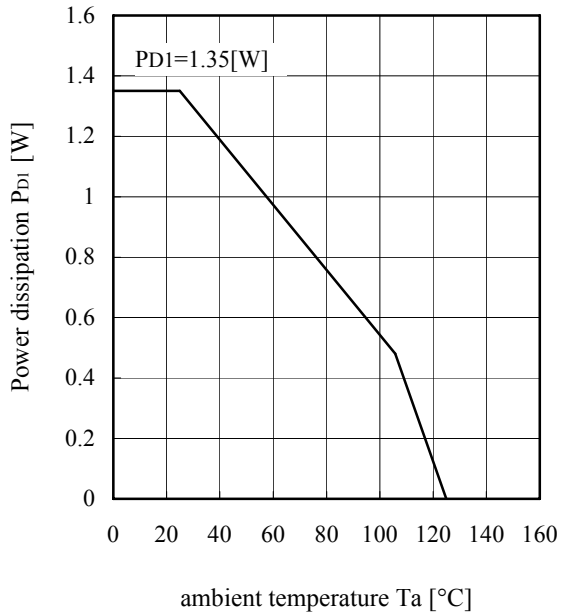
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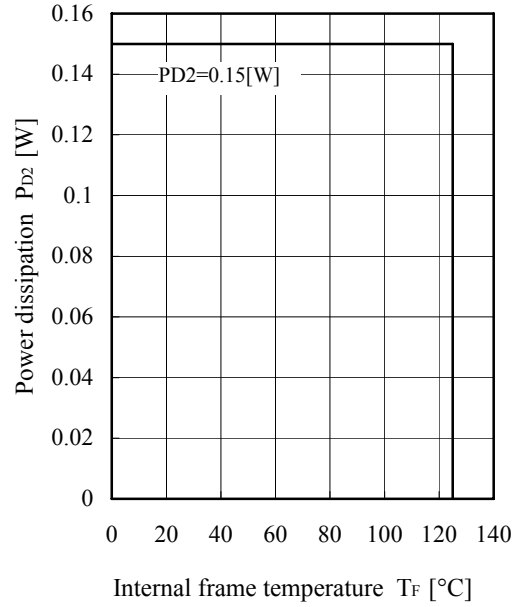
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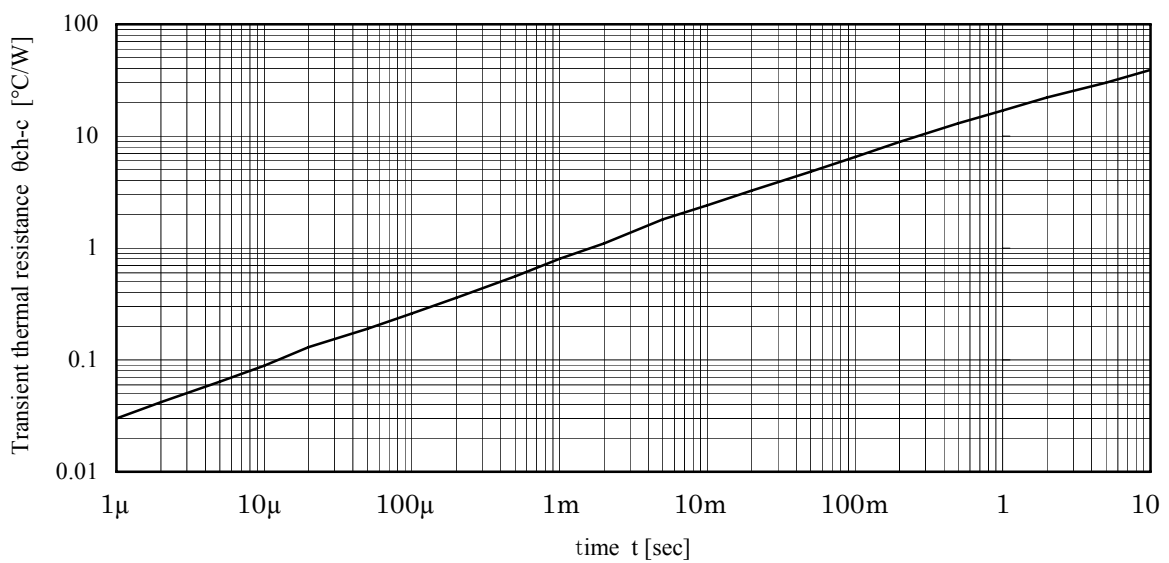
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Fig4. MOSFET Ta-P<sub>D1</sub> curve



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Fig5. MIC T<sub>F</sub>-P<sub>D2</sub> curve



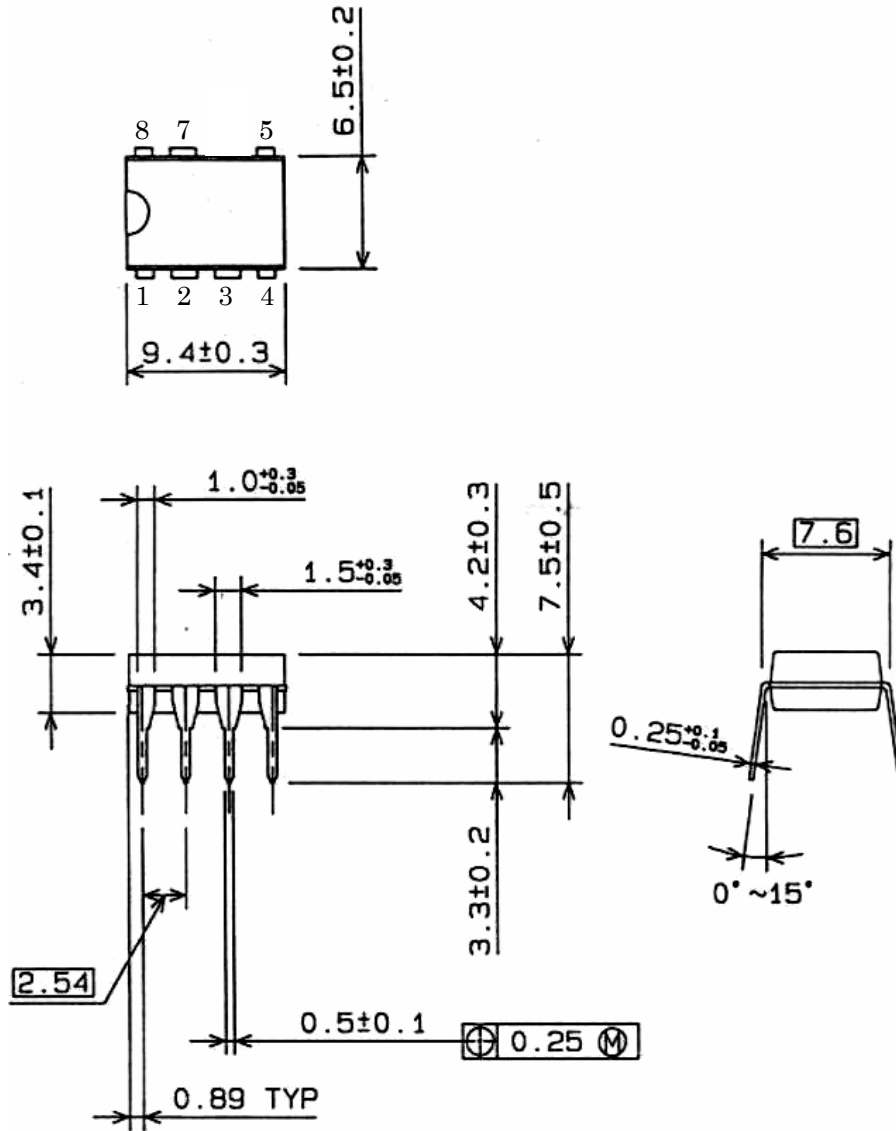
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Fig6. Transient thermal resistance curve



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## Outline



Unit : [mm]

Material of terminal : Cu

Treatment of terminal : solder plating (Pb Free)

Weight : Approx. 0.51[g]

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## Cautions and warnings

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Since reliability can be affected adversely by improper storage environment and handling methods during Characteristic tests, please observe the following cautions.

### Cautions for Storage

- Ensure that storage conditions comply with the standard temperature (5 to 35°C) and the standard relative humidity (around 40 to 75%) and avoid storage locations that experience extreme changes in temperature or humidity.
- Avoid locations where dust or harmful gases are present and avoid direct sunlight.
- Reinspect for rust in leads and solderability that have been stored for a long time.

### Cautions for characteristic Tests and Handling

- When characteristic tests are carried out during inspection testing and other standard tests periods, protect the devices from surge of power from the testing device, shorts between the devices and the heat-sink.

### Recommended operating temperature

- Inner frame temperature in operation TF=115 [°C] MAX.

### Soldering

- When soldering the products, please be sure to minimize the working time, within the following conditions.
  - 260±5°C 10sec.
  - 350±5°C 3sec. (Soldering iron)  
at a distance of 1.5mm from the main body of the Products

### Considerations to protect the Products from Electrostatic Discharge

- When handling the devices, operator must be grounded. Grounded wrist straps be worn and should have at least 1MΩ of resistance near operators to ground to prevent shock hazard.
- Workbenches where the devices are handled should be grounded and be provided with conductive table and floor mats.
- When using measuring equipment such as a curve tracer, the equipment should also be grounded.
- When soldering the devices, the head of a soldering iron or a solder bath must be grounded in order to prevent leak voltage generated by them from being applied to the devices.
- The devices should always be stored and transported in our shipping containers or conductive containers, or be wrapped up in aluminum foil.



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