**Low Profile and Creeping distance of 4mm Package**
**650V, 2.0Ω, $t_{OFF}$= 11.5μs PRC Off-Line Switching Regulator**

# STR-V153

Mar/28/2012

## General Descriptions

The STR-V100 series comprise an integrated power MOSFET and a controller IC with a current mode and PRC* control for switching power supply applications.

* PRC (Pulse Ratio Control)---the control method for OFF-time fixed and ON time controlled (Sanken's designation)

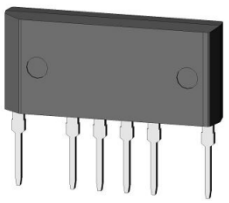
The SIP8L full mold package of low-profile and with creeping distance between high and low voltage of 4mm or longer (lead pin on Printed Circuit Board, PCB).

A startup circuit and a standby function are incorporated in the control circuit. Thereby, requirements for low power consumption and low standby power can be achieved.

The product easily achieves high cost-performance power supply system with few external components and enhanced protection functions.

## Package

SIP8L



## Features

- SIP8L package (2.54 pitch, straight lead pin)
  Creeping distance of 4mm or longer between high voltage pin and low voltage pin (lead pin on PCB)
  Low profile; height from PCB of 12mm or less
- Current-Mode type PRC Control
- Auto-Standby Function
  Input power $P_{IN}$ at no load < 40mW, for low power consumption
- Built-in Leading Edge Blanking Function
- Protection functions
  Overcurrent Protection (OCP)-----Pulse-by-pulse
  Overvoltage Protection (OVP) ----Latched shutdown
  Overload Protection (OLP) --------Auto restart
  Thermal Shutdown (TSD) ---------Latched shutdown

## Electrical Characteristics

- Power MOSFET
  $V_{DSS}$(MIN)= 650V
  $R_{DS(ON)}$(MAX)= 2.0Ω
- Fixed OFF-Time, $t_{OFF}$(TYP)= 11.5μs

## Applications

- Stand-by power supply
- White goods
- Office automation equipment
- Industrial equipment
- Communication equipment

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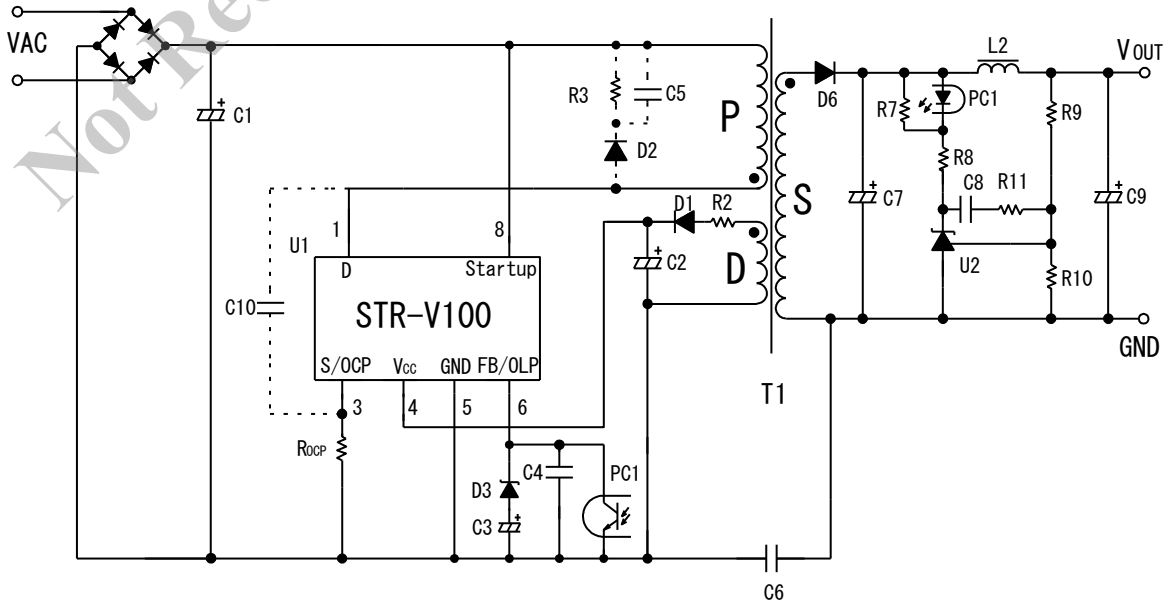
## Typical Application circuit



## Absolute Maximum Ratings (1) Valid at Ta=25°C unless otherwise specified

| Characteristic | Pins | Symbol | Rating | Unit | Notes |
|---|---|---|---|---|---|
| Drain Current (2) | 1−3 | $I_{DPEAK}$ | 5.0 | A | Single pulse |
| Maximum Switching Current | 1−3 | $I_{DMAX}$ | 5.0 | A | $V_{3-5}$=1.28V<br>Ta= −20 to +125°C |
| Avalanche Energy (3) | 1−3 | $E_{AS}$ | 130 | mJ | Single pulse<br>$V_{DD}$=99V, L=20mH<br>$I_L$=3.35A |
| S/OCP Pin Voltage | 3−5 | $V_{S/OCP}$ | −0.5 to 6 | V | |
| Supply Voltage for Control Circuit | 4−5 | $V_{CC}$ | 35 | V | |
| FB /OLP Pin Voltage | 6−5 | $V_{FB/OLP}$ | −0.5 to 10 | V | |
| Startup Pin Voltage | 8−5 | $V_{STARTUP}$ | −0.3 to 600 | V | |
| Power Dissipation in MOSFET (4) | 1−3 | $P_{D1}$ | 11.4 | W | With infinite heat sink |
| | | | 1.6 | W | Without heat sink |
| Power Dissipation in Control Circuit (5) | 4−5 | $P_{D2}$ | 0.15 | W | Specified by $V_{CC}$×$I_{CC}$ |
| Internal Frame Temperature in Operation | — | $T_F$ | −20 to +125 | °C | Recommended internal frame temperature<br>$T_F$= 115°C (Max) |
| Operating Ambient Temperature | — | $T_{OP}$ | −20 to +125 | °C | |
| Storage Temperature | — | $T_{stg}$ | −40 to +125 | °C | |
| Channel Temperature | — | $T_{ch}$ | +150 | °C | |

(1)Current characteristics are defined based on IC as sink (+), or source (−)
(2)Refer to MOSFET Safe Operating Area Curve
(3)Refer to MOSFET Avalanche Energy Derating Coefficient Curve
(4)Refer to MOSFET Temperature versus Power Dissipation Curve1
(5)Refer to MOSFET Temperature versus Power Dissipation Curve2

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## Electrical characteristics in Control Part [1] Valid at $V_{CC}$=20V, Ta = 25°C, unless otherwise specified

| Characteristic | Pins | Symbol | Rating | | | Unit | Notes |
|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | |
| Operation Start Voltage | 4 − 5 | $V_{CC\ (ON)}$ | 16.0 | 17.5 | 19.2 | V | |
| Operation Stop Voltage [2] | 4 − 5 | $V_{CC\ (OFF)}$ | 9 | 10 | 11 | V | |
| Circuit Current in Operation | 4 − 5 | $I_{CC(ON)}$ | — | — | 4 | mA | |
| Circuit Current in Non-operation | 4 − 5 | $I_{CC(OFF)}$ | — | — | 50 | μA | $V_{CC}$=14V |
| Maximum OFF Time | 1 − 5 | $t_{OFF(MAX)}$ | 10.5 | 11.5 | 12.5 | μs | |
| OCP Threshold Voltage | 3 − 5 | $V_{OCP}$ | 0.96 | 1.13 | 1.28 | V | |
| Leading Edge Blanking Time | 1 − 5 | $t_{BW}$ | 200 | 320 | 480 | ns | |
| Burst Threshold Voltage | 6 − 5 | $V_{BURST}$ | 0.66 | 0.75 | 0.84 | V | |
| OLP Threshold Voltage | 6 − 5 | $V_{OLP}$ | 6.5 | 7.2 | 7.9 | V | |
| OLP Source Current | 6 − 5 | $I_{OLP}$ | −34.1 | −26.0 | −18.2 | μA | |
| Maximum FB Source Current | 6 − 5 | $I_{FB(MAX)}$ | −390 | −300 | −220 | μA | |
| Startup Current | 8 − 5 | $I_{STARTUP}$ | 340 | 790 | 1230 | μA | |
| Startup Circuit Leakage Current | 8 − 5 | $I_{START(leak)}$ | — | — | 30 | μA | |
| $V_{CC}$ Pin Overvoltage Protection Threshold Voltage | 4 − 5 | $V_{CC(OVP)}$ | 28.7 | 31.2 | 34.1 | V | |
| Latch Circuit Holding Current [3] | 4 − 5 | $I_{CC(H)}$ | — | — | 200 | μA | |
| Latch Circuit Release Voltage [2] [3] | 4 − 5 | $V_{CC(La\ OFF)}$ | 6.6 | 7.3 | 8.0 | V | |
| Thermal Shutdown Operation Temperature | — | $T_{j(TSD)}$ | 135 | — | — | °C | |

[1] Current characteristics are defined based on IC as sink (+), or source (−)
[2] $V_{CC\ (OFF)} > V_{CC\ (La\ OFF)}$ always
[3] Latch circuit is activated by OVP and TSD protection functions

## Electrical Characteristics in MOSFET [1] Valid at Ta=25°C unless otherwise specified

| Characteristic | Pins | Symbol | Rating | | | Unit | Notes |
|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | | |
| Drain-source Voltage | 1 − 3 | $V_{DSS}$ | 650 | — | — | V | |
| Drain Leakage Current | 1 − 3 | $I_{DSS}$ | — | — | 300 | μA | |
| ON Resistance | 1 − 3 | $R_{DS(ON)}$ | — | — | 2.0 | Ω | |
| Switching Time | 1 − 3 | $t_f$ | — | — | 250 | ns | |
| Thermal Resistance [2] | — | $\theta_{ch-F}$ | — | — | 2.41 | °C/W | |

[1] Current characteristics are defined based on IC as sink (+), or source (−)
[2] The thermal resistance between the channel of the MOSFET and the internal frame

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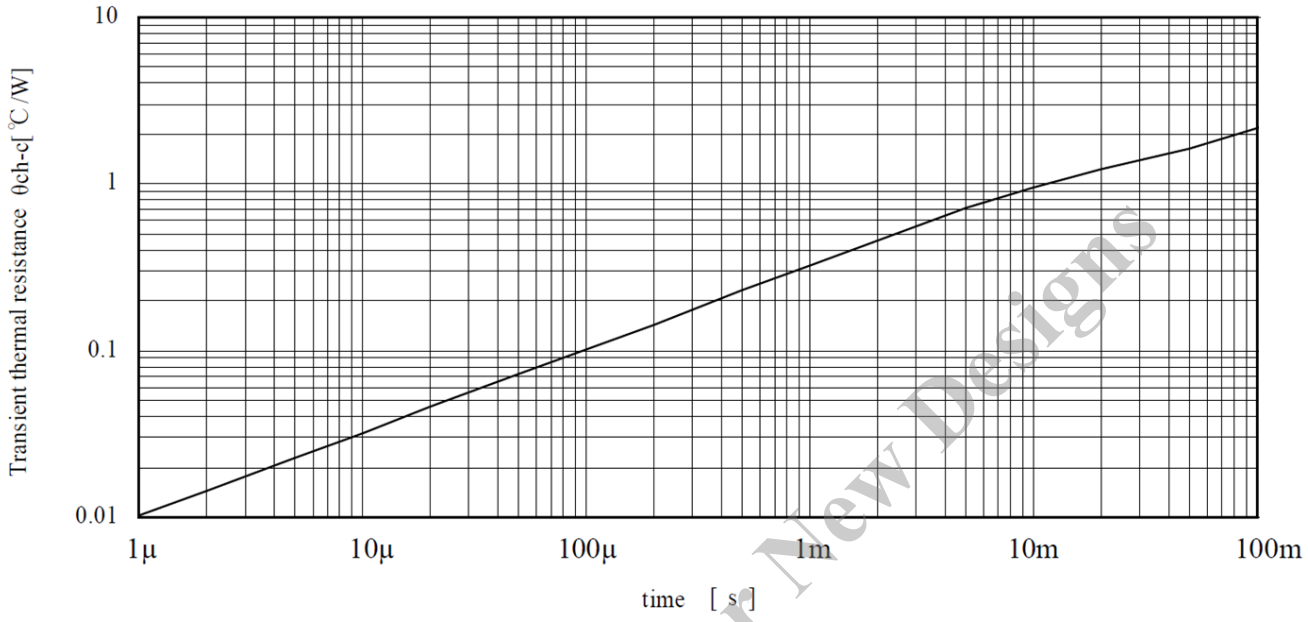
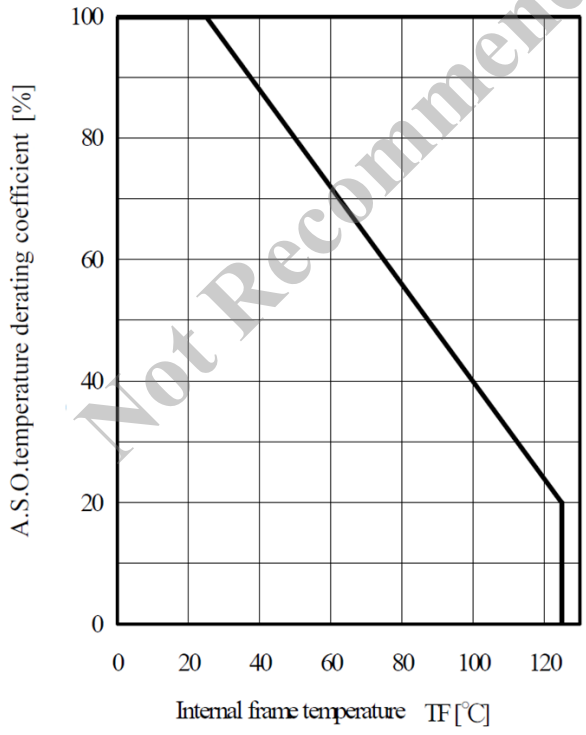
## MOSFET Performance Curves

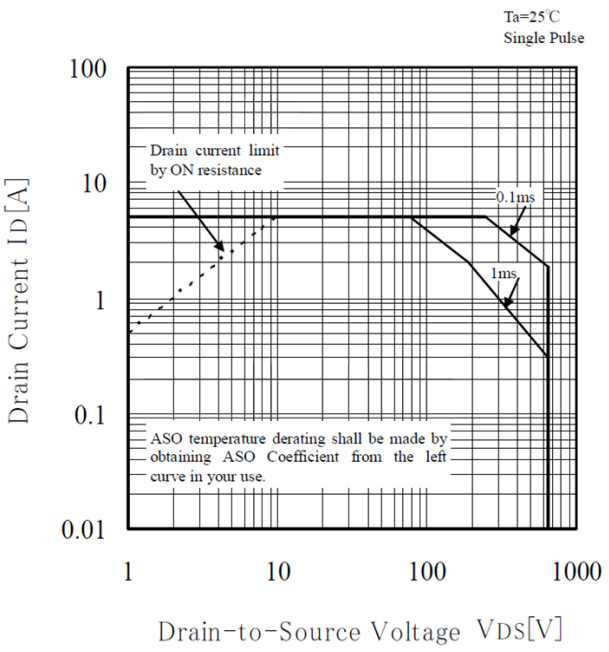
STR-V153
Transient thermal resistance curve




STR-V153
A.S.O. temperature derating coefficient curve




STR-V153
MOSFET A.S.O. Curve

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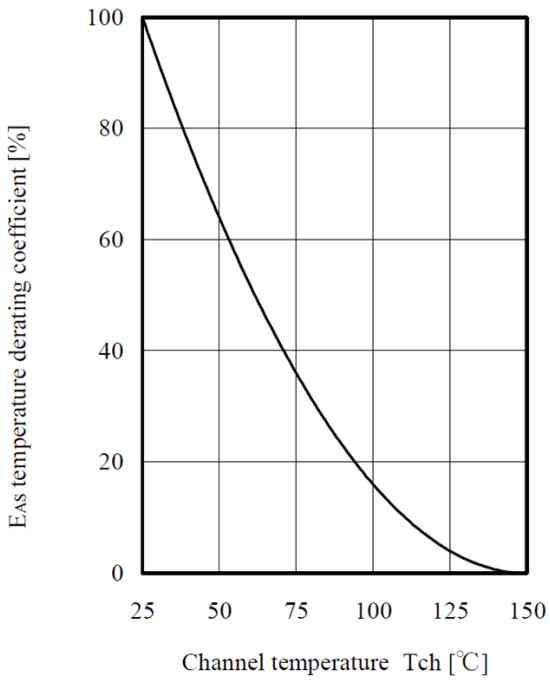
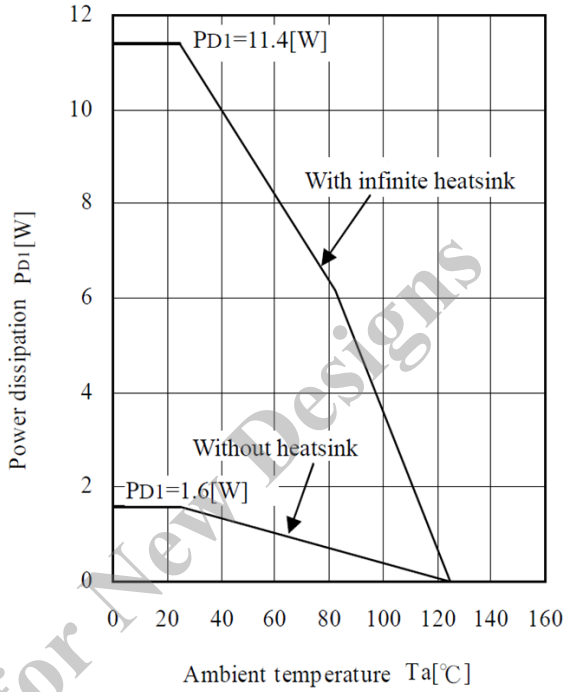
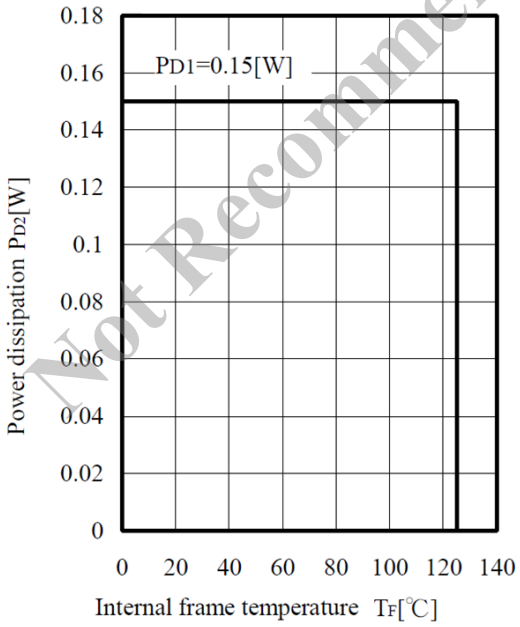
STR-V153
Avalanche energy derating curve




STR-V153
MOSFET Ta-PD1 Curve




STR-V153
MIC TF-PD2 Curve

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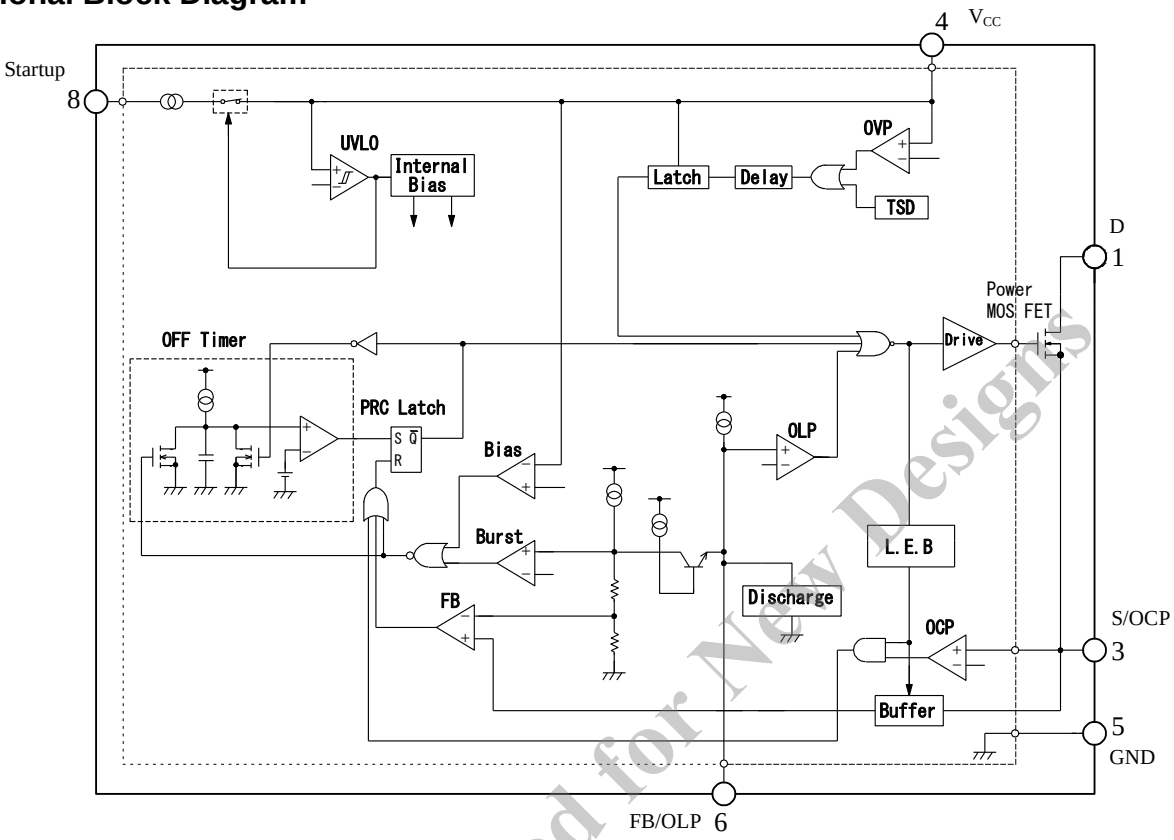
## Functional Block Diagram

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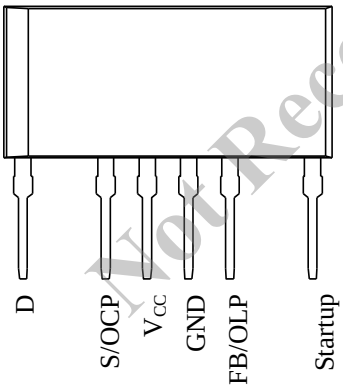
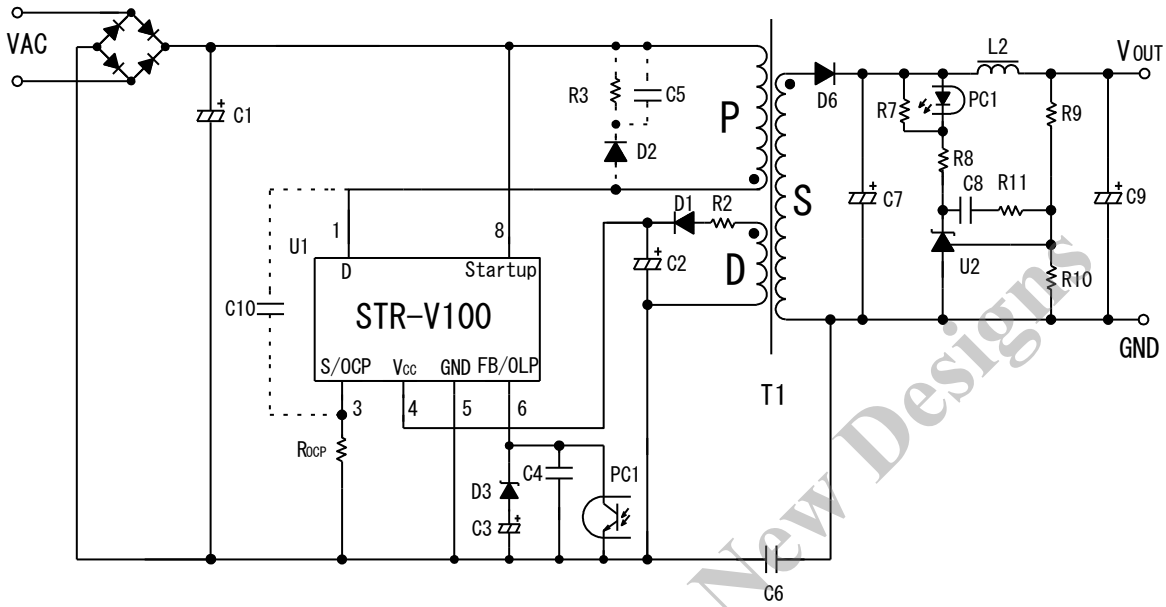
## Pin List Table




| Number | Name | Function |
|---|---|---|
| 1 | D | MOSFET drain |
| 2 | — | Pin removed |
| 3 | S/OCP | MOSFET source and overcurrent detection signal input |
| 4 | $V_{CC}$ | Control circuit power supply input and Overvoltage Protection (OVP) signal input |
| 5 | GND | Ground |
| 6 | FB/OLP | Constant voltage control signal input and overload protection signal input |
| 7 | — | Pin removed |
| 8 | Startup | Startup current input |

## Typical Application circuit

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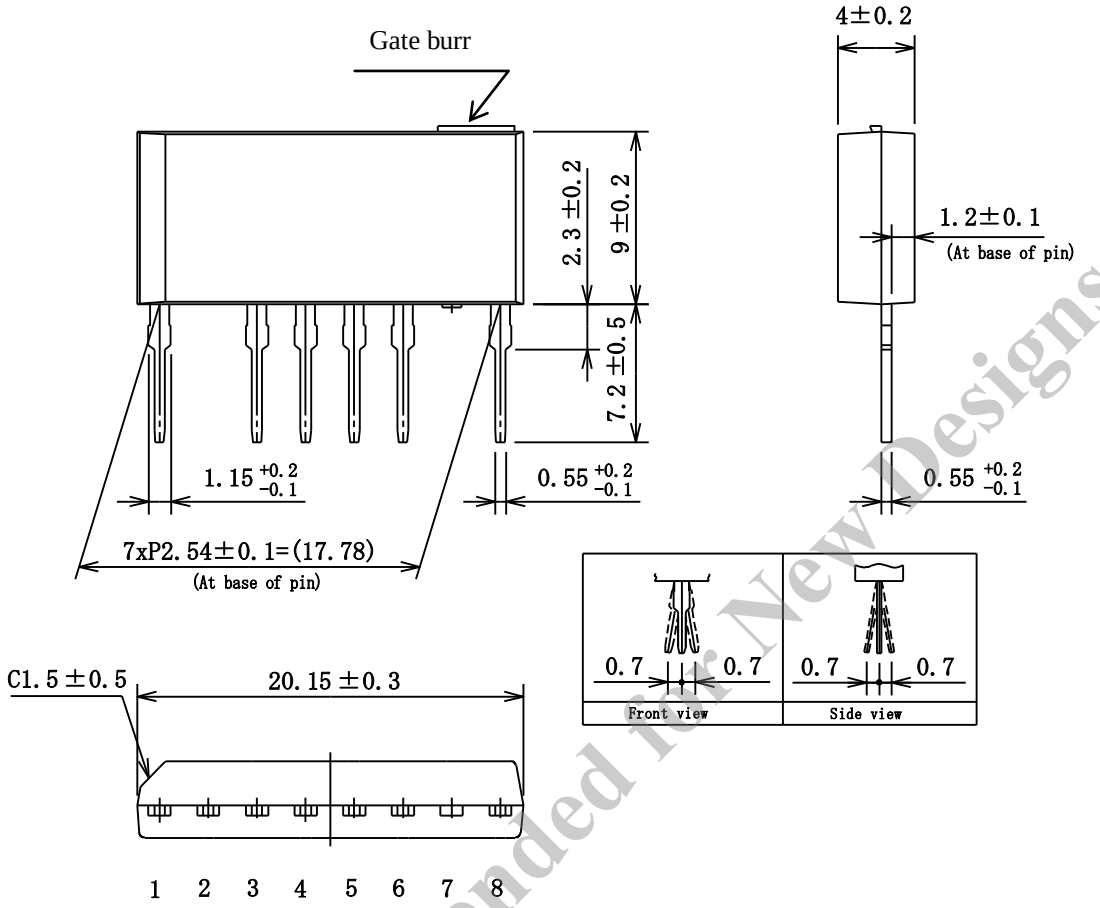
# STR-V153



## Package Information

SIP8L package (2.54 pitch, straight lead pin)




NOTES:

1) All liner dimensions are in millimeters
2) "Gate Burr" shows area where 0.3 mm (max) gate burr may be present
3) Pin treatment Pb-free. Device composition compliant with the RoHS directive

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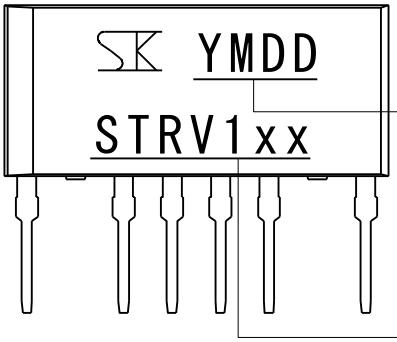
## Marking Diagram




Lot Number
- Y: Last digit of year (0 to 9)
- M: Month (1 to 9, N or D)
- DD: Date (01 to 31)

Device Part Number

## OPERATING PRECAUTIONS

Reliability can be affected adversely by improper storage environments and handling methods. 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%); 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 on leads and solderability of products that have been stored for a long time.

### Cautions for Testing and Handling

- When tests are carried out during inspection testing and other standard test periods, protect the products from power surges from the testing products, shorts between the product pins, and wrong connections. In addition, avoid tests exceeded ratings

### Remarks about Using Silicone Grease with a Heatsink

- When silicone grease is used in mounting this product on a heatsink, it shall be applied evenly and thinly. If more silicone grease than required is applied, it may produce excess stress.
- Volatile-type silicone greases may crack after long periods of time, resulting in reduced heat radiation effect. Silicone grease with low consistency (hard grease) may cause cracks in the mold resin when screwing the product to a heatsink.
  Our recommended silicone grease for heat radiation purposes, which will not cause any adverse effect on the product life, are indicated below:

| Type | Suppliers |
|---|---|
| G746 | Shin-Etsu Chemical Co., Ltd. |
| YG6260 | MOMENTIVE performance materials Inc. |
| SC102 | Dow Corning Toray Co., Ltd. |

### Soldering

- When soldering the products, please be sure to minimize the working time, within the following limits.
  - ・260±5°C 10±1 s(Flow, 2times)
  - ・380±10°C 3.5±0.5s (Soldering iron, 1time)

  Soldering should be at a distance of at least 1.5 mm from the body of the products.

### Electrostatic Discharge

- When handling the products, the operator must be grounded. Grounded wrist straps worn should have at least 1MΩ of resistance from the operator to ground to prevent shock hazard, and it should be placed near the operator.
- Workbenches where the products 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 be grounded.
- When soldering the products, the head of a soldering irons or the solder bath must be grounded in order to prevent leak voltages generated by them from being applied to the products.
- The products should always be stored and transported in Sanken shipping containers or conductive containers, or be wrapped in aluminum foil.

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  In addition, it should be noted that since power devices or IC's including power devices have large self-heating value, the degree of derating of junction temperature affects the reliability significantly.
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