

## STR7000+SI-8020 Series

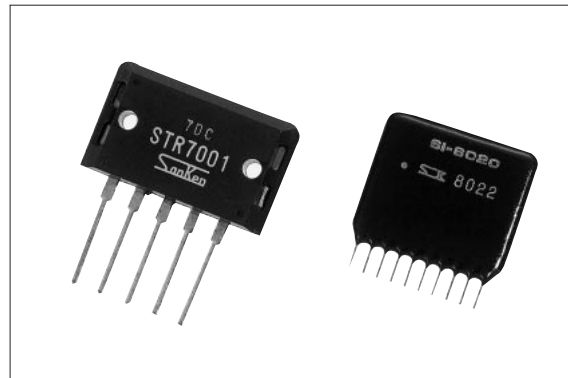
# Separate Excitation Switching Type

### ■Features

- High output current (6A:STR7000 series, 12A: STR7100 series)
- High efficiency (70 to 90%)
- Wide DC input voltage range
- Built-in drooping type overcurrent protection circuit
- Foldback type overcurrent protection can be set externally.
- Output voltage adjustment
- Built-in reference oscillator (35kHz)
- Output ON/OFF control

### ■Applications

- Electronic equipment



### ■Lineup

| $I_o$ (A) \ $V_o$ (V) | 5               | 12              | 15              | 24              |
|-----------------------|-----------------|-----------------|-----------------|-----------------|
| 6                     | STR7001+SI-8020 | STR7002+SI-8021 | STR7002+SI-8022 | STR7003+SI-8023 |
| 12                    | STR7101+SI-8020 | STR7102+SI-8021 | STR7102+SI-8022 | STR7103+SI-8023 |

### ■Absolute Maximum Ratings

Power Section: STR7000/STR7100 ( $T_a=25^\circ\text{C}$ )

| Parameter                             | Symbol        | Ratings                       |                               | Unit               |
|---------------------------------------|---------------|-------------------------------|-------------------------------|--------------------|
|                                       |               | STR7000 Series                | STR7100 Series                |                    |
| Power Transistor Breakdown Voltage    | $V_{4-1}$     | 60                            |                               | V                  |
| Drive Transistor Breakdown Voltage    | $V_{4-5}$     | 60                            |                               | V                  |
| Diode Breakdown Voltage               | $V_{1-2}$     | 60                            |                               | V                  |
| Collector Current                     | $I_c$         | 6(peak 7.5)                   | 12(peak 15)                   | A                  |
| Power Dissipation                     | $P_{D1}$      | 100( $T_c=25^\circ\text{C}$ ) | 125( $T_c=25^\circ\text{C}$ ) | W                  |
|                                       | $P_{D2}$      | 4.3(Without heatsink)         |                               | W                  |
| Power Transistor Thermal Resistance   | $R_{th(j-c)}$ | 1.25                          | 1.0                           | $^\circ\text{C/W}$ |
| Power Transistor Junction Temperature | $T_j$         | +150                          |                               | $^\circ\text{C}$   |
| Operating Temperature                 | $T_{OP}$      | -30 to +125( $T_c$ )          |                               | $^\circ\text{C}$   |
| Storage Temperature                   | $T_{Stg}$     | -30 to +125                   |                               | $^\circ\text{C}$   |

### ■Control Section: SI-8020 Series ( $T_a=25^\circ\text{C}$ )

| Parameter             | Symbol    | Ratings     | Unit             |
|-----------------------|-----------|-------------|------------------|
| DC Input Voltage      | $V_{IN}$  | 55          | V                |
| Power Dissipation     | $P_D$     | 1           | W                |
| Operating Temperature | $T_{OP}$  | -20 to +85  | $^\circ\text{C}$ |
| Storage Temperature   | $T_{Stg}$ | -20 to +100 | $^\circ\text{C}$ |

■Electrical Characteristics: 6A Type

(T<sub>a</sub>=25°C)

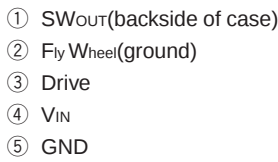
| Parameter                                           | Symbol              | Ratings                                          |      |      |                                                  |      |      |                                                  |      |      |                                                  |      |      | Unit |
|-----------------------------------------------------|---------------------|--------------------------------------------------|------|------|--------------------------------------------------|------|------|--------------------------------------------------|------|------|--------------------------------------------------|------|------|------|
|                                                     |                     | STR7001+SI-8020                                  |      |      | STR7002+SI-8021                                  |      |      | STR7002+SI-8022                                  |      |      | STR7003+SI-8023                                  |      |      |      |
|                                                     |                     | min.                                             | typ. | max. | min.                                             | typ. | max. | min.                                             | typ. | max. | min.                                             | typ. | max. |      |
| DC Input Voltage Range                              | V <sub>IN</sub>     | 11                                               |      | 40   | 18                                               |      | 50   | 21                                               |      | 50   | 30                                               |      | 50   | V    |
| Output Voltage                                      | V <sub>O</sub>      | 5.0                                              | 5.1  | 5.2  | 11.8                                             | 12.0 | 12.2 | 14.8                                             | 15.0 | 15.2 | 23.7                                             | 24.0 | 24.3 | V    |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =27V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =30V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =40V, I <sub>o</sub> =3.0A       |      |      |      |
| Efficiency                                          | η                   |                                                  | 72   |      |                                                  | 84   |      |                                                  | 86   |      |                                                  | 90   |      | %    |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =27V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =30V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =40V, I <sub>o</sub> =3.0A       |      |      |      |
| Switching Frequency                                 | f                   |                                                  | 35   |      |                                                  | 35   |      |                                                  | 35   |      |                                                  | 35   |      | kHz  |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =27V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =30V, I <sub>o</sub> =3.0A       |      |      | V <sub>IN</sub> =40V, I <sub>o</sub> =3.0A       |      |      |      |
| Line Regulation                                     | ΔV <sub>OLINE</sub> |                                                  |      | 80   |                                                  |      | 120  |                                                  |      | 150  |                                                  |      | 200  | mV   |
|                                                     | Conditions          | V <sub>IN</sub> =15 to 25V, I <sub>o</sub> =3.0A |      |      | V <sub>IN</sub> =22 to 32V, I <sub>o</sub> =3.0A |      |      | V <sub>IN</sub> =25 to 35V, I <sub>o</sub> =3.0A |      |      | V <sub>IN</sub> =35 to 45V, I <sub>o</sub> =3.0A |      |      |      |
| Load Regulation                                     | ΔV <sub>OLOAD</sub> |                                                  |      | 30   |                                                  |      | 40   |                                                  |      | 40   |                                                  |      | 50   | mV   |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>o</sub> =1 to 5A    |      |      | V <sub>IN</sub> =27V, I <sub>o</sub> =1 to 5A    |      |      | V <sub>IN</sub> =30V, I <sub>o</sub> =1 to 5A    |      |      | V <sub>IN</sub> =40V, I <sub>o</sub> =1 to 5A    |      |      |      |
| Ripple Rejection                                    | R <sub>REJ</sub>    |                                                  | 45   |      |                                                  | 45   |      |                                                  | 45   |      |                                                  | 45   |      | dB   |
|                                                     | Conditions          | f=100 to 120Hz                                   |      |      | f=100 to 120Hz                                   |      |      | f=100 to 120Hz                                   |      |      | f=100 to 120Hz                                   |      |      |      |
| Overcurrent Protection Starting Current             | I <sub>S1</sub>     | 6.0                                              |      | 7.5  | 6.0                                              |      | 7.5  | 6.0                                              |      | 7.5  | 6.0                                              |      | 7.5  | A    |
| Limited Current at Overcurrent Protection Operation | I <sub>S2</sub>     | 6.0                                              |      | 7.5  | 6.0                                              |      | 7.5  | 6.0                                              |      | 7.5  | 6.0                                              |      | 7.5  | A    |
|                                                     | Conditions          | R <sub>S</sub> =0.02Ω                            |      |      | R <sub>S</sub> =0.02Ω                            |      |      | R <sub>S</sub> =0.02Ω                            |      |      | R <sub>S</sub> =0.02Ω                            |      |      |      |

■Electrical Characteristics: 12A Type

(T<sub>a</sub>=25°C)

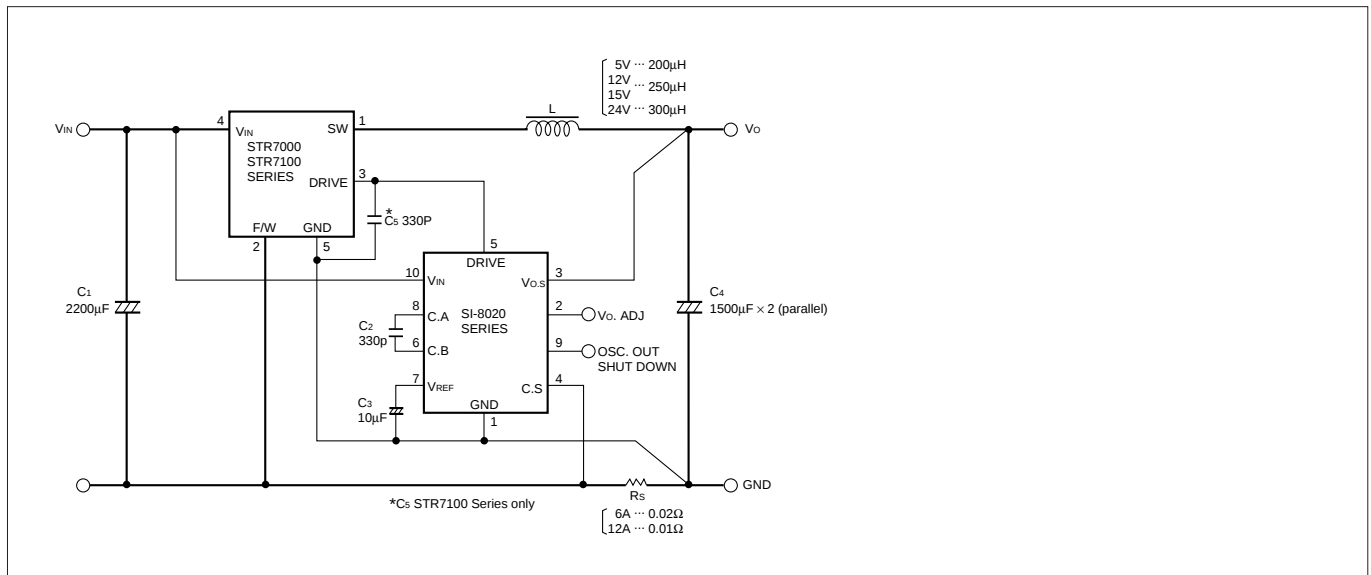
| Parameter                                           | Symbol              | Ratings                                          |      |      |                                                  |      |      |                                                  |      |      |                                                  |      |      | Unit |
|-----------------------------------------------------|---------------------|--------------------------------------------------|------|------|--------------------------------------------------|------|------|--------------------------------------------------|------|------|--------------------------------------------------|------|------|------|
|                                                     |                     | STR7101+SI-8020                                  |      |      | STR7102+SI-8021                                  |      |      | STR7102+SI-8022                                  |      |      | STR7103+SI-8023                                  |      |      |      |
|                                                     |                     | min.                                             | typ. | max. | min.                                             | typ. | max. | min.                                             | typ. | max. | min.                                             | typ. | max. |      |
| DC Input Voltage Range                              | V <sub>IN</sub>     | 11                                               |      | 40   | 18                                               |      | 50   | 21                                               |      | 50   | 30                                               |      | 50   | V    |
| Output Voltage                                      | V <sub>O</sub>      | 5.0                                              | 5.1  | 5.2  | 11.8                                             | 12.0 | 12.2 | 14.8                                             | 15.0 | 15.2 | 23.7                                             | 24.0 | 24.3 | V    |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =27V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =30V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =40V, I <sub>O</sub> =6.0A       |      |      |      |
| Efficiency                                          | η                   |                                                  | 70   |      |                                                  | 82   |      |                                                  | 84   |      |                                                  | 87   |      | %    |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =27V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =30V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =40V, I <sub>O</sub> =6.0A       |      |      |      |
| Switching Frequency                                 | f                   |                                                  | 35   |      |                                                  | 35   |      |                                                  | 35   |      |                                                  | 35   |      | kHz  |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =27V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =30V, I <sub>O</sub> =6.0A       |      |      | V <sub>IN</sub> =40V, I <sub>O</sub> =6.0A       |      |      |      |
| Line Regulation                                     | ΔV <sub>OLINE</sub> |                                                  |      | 80   |                                                  |      | 120  |                                                  |      | 150  |                                                  |      | 200  | mV   |
|                                                     | Conditions          | V <sub>IN</sub> =15 to 25V, I <sub>O</sub> =6.0A |      |      | V <sub>IN</sub> =22 to 32V, I <sub>O</sub> =6.0A |      |      | V <sub>IN</sub> =25 to 35V, I <sub>O</sub> =6.0A |      |      | V <sub>IN</sub> =35 to 45V, I <sub>O</sub> =6.0A |      |      |      |
| Load Regulation                                     | ΔV <sub>OLOAD</sub> |                                                  |      | 30   |                                                  |      | 40   |                                                  |      | 40   |                                                  |      | 50   | mV   |
|                                                     | Conditions          | V <sub>IN</sub> =20V, I <sub>O</sub> =3 to 9A    |      |      | V <sub>IN</sub> =27V, I <sub>O</sub> =3 to 9A    |      |      | V <sub>IN</sub> =30V, I <sub>O</sub> =3 to 9A    |      |      | V <sub>IN</sub> =40V, I <sub>O</sub> =3 to 9A    |      |      |      |
| Ripple Rejection                                    | R <sub>REJ</sub>    |                                                  | 45   |      |                                                  | 45   |      |                                                  | 45   |      |                                                  | 45   |      | dB   |
|                                                     | Conditions          | f=100 to 120Hz                                   |      |      | f=100 to 120Hz                                   |      |      | f=100 to 120Hz                                   |      |      | f=100 to 120Hz                                   |      |      |      |
| Overcurrent Protection Starting Current             | I <sub>S1</sub>     | 12                                               |      | 15   | 12                                               |      | 15   | 12                                               |      | 15   | 12                                               |      | 15   | A    |
| Limited Current at Overcurrent Protection Operation | I <sub>S2</sub>     | 12                                               |      | 15   | 12                                               |      | 15   | 12                                               |      | 15   | 12                                               |      | 15   | A    |
|                                                     | Conditions          | R <sub>S</sub> =0.01Ω                            |      |      | R <sub>S</sub> =0.01Ω                            |      |      | R <sub>S</sub> =0.01Ω                            |      |      | R <sub>S</sub> =0.01Ω                            |      |      |      |

(unit: mm)



The image contains two circuit diagrams. The left diagram is for the STR7000/7100 Series, showing a power MOSFET driver circuit. It includes a VIN pin (4), a DRIVE pin (3), a SW.OUT pin (1), a GND pin (5), and an F.WHEEL pin (2). The circuit features a MOSFET with a diode in parallel, a resistor network for the gate, and a freewheeling diode connected to the F.WHEEL pin. The right diagram is for the SI-8020 Series, a more complex integrated circuit. It includes pins for VIN (10), OSC.OUT SHUT DOWN (9), VREF (7), DRIVE (5), GND (1), V0 ADJ (2), V0 SENSE (3), COMPENSATION. B (6), COMPENSATION. A (8), CURR.SENSE (4), and I0 AMP (4). The internal blocks shown are a VOLTAGE REFERENCE and REGULATOR, a DEAD TIME CONTROLLED RAMP GENERATOR, a PWM COMP (comparator), and two op-amp blocks labeled I0 AMP and V0 AMP. The circuit is heavily populated with resistors and capacitors for timing and regulation.

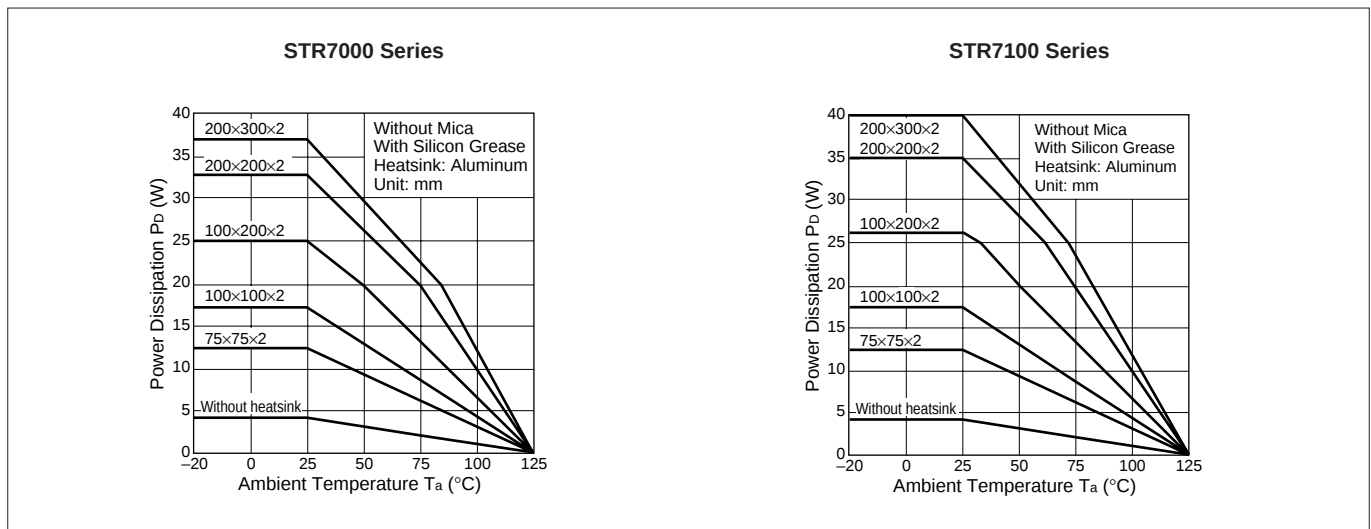
## Standard External Circuit



## Notes of Pattern Design

- 1) Thick lines in the Standard External Circuit are lines through which a large current flows. Make these pattern lines as thick as possible.
- 2) Place capacitor C1 on the input side as closely as possible to terminals no.2 and no.4 of the STR7000/7100 series. C1 may be used in combination with a smoothing capacitor for rectifying, but the above points must be taken into consideration. In cases where C1 is not provided or it is placed too far from the terminals stated above, abnormal oscillation due to poorer transient response or increased ringing may occur.
- 3) Connect voltage sensing terminal V<sub>O.S</sub> and GND as closely as possible to output capacitor C4 (a current of approximately 1mA flows into the V<sub>O.S</sub> terminal). If they are placed too far from C4, abnormal oscillation due to decreased regulation or increased switching ripple may occur.
- 4) Connect current sensing terminal C.S and GND as closely as possible to the detection resistor R<sub>s</sub> (a current of approximately 0.5mA flows from the CS terminal).  
If they are placed too far from R<sub>s</sub>, a decrease of the overcurrent setting point due to the voltage drop in the pattern, or malfunction of the protection circuit due to increased ringing may occur.

## T<sub>a</sub>-P<sub>D</sub> Characteristics

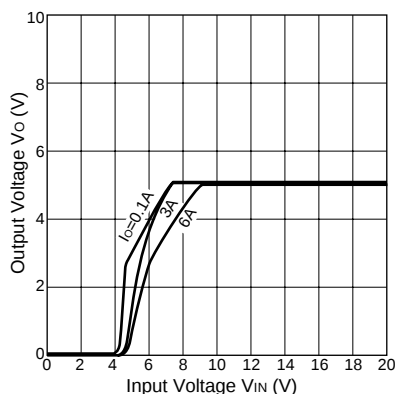


■Typical Characteristics

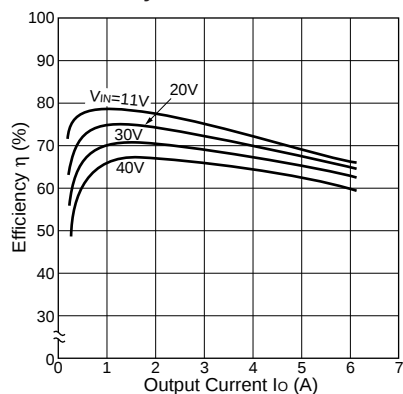
( $T_a=25^\circ\text{C}$ )

STR7001+SI-8020(5V)

Rise Characteristics

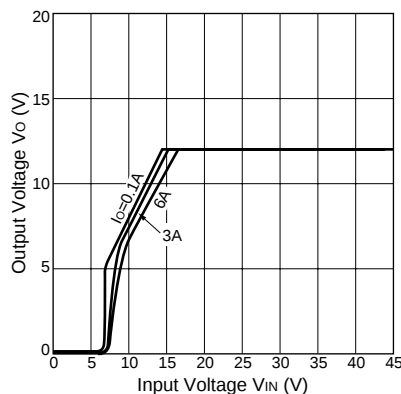


Efficiency Characteristics

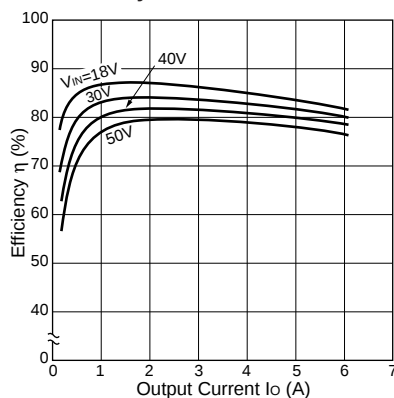


STR7002+SI-8021(12V)

Rise Characteristics

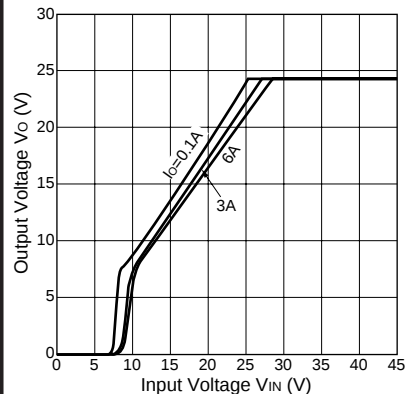


Efficiency Characteristics

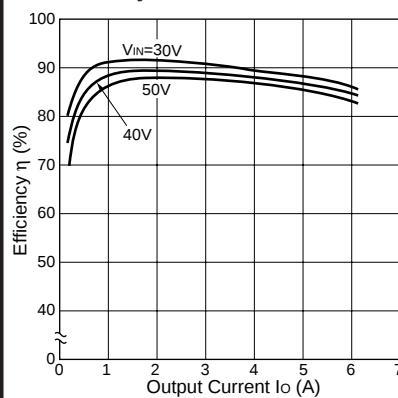


STR7003+SI-8023(24V)

Rise Characteristics

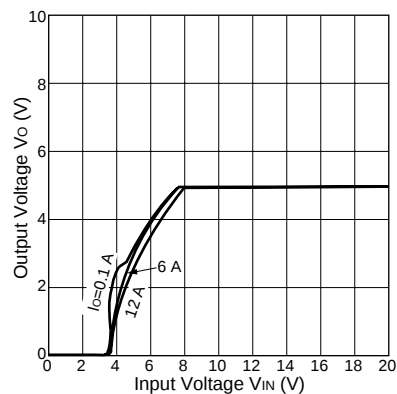


Efficiency Characteristics

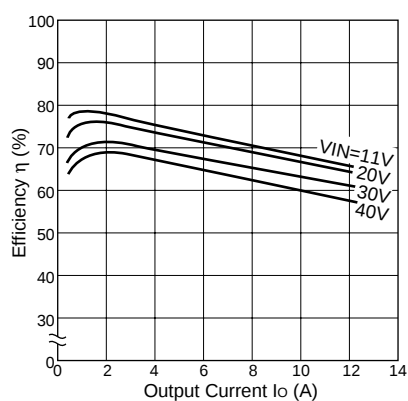


STR7101+SI-8020(5V)

Rise Characteristics

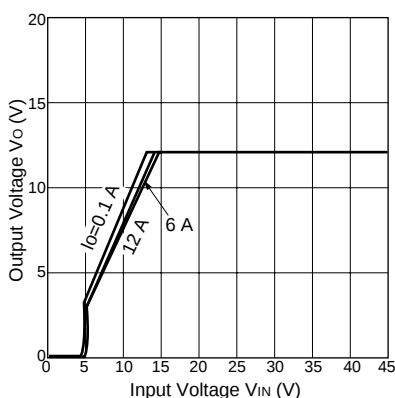


Efficiency Characteristics

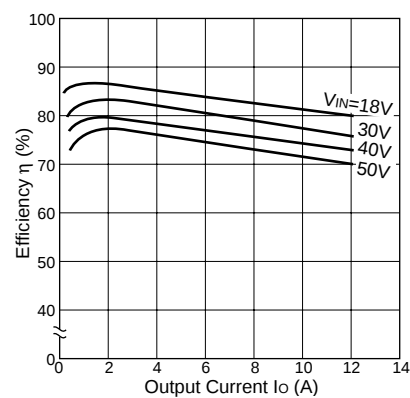


STR7102+SI-8021(12V)

Rise Characteristics

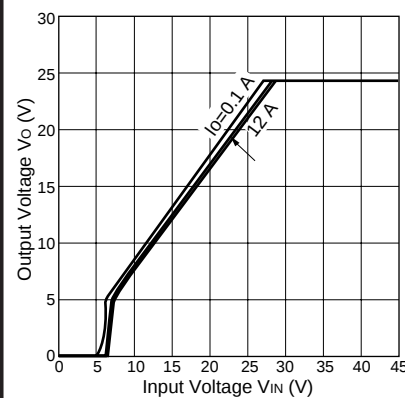


Efficiency Characteristics



STR7103+SI-8023(24V)

Rise Characteristics



Efficiency Characteristics

