SI-8400L/8500L Series

Separate Excitation Switching Type with Coil

■Features

- Integrated switching IC and coil construction
- Requires 2 external components only
- Low switching noise
- Heatsink not required
- Built-in overcurrent and thermal protection circuits
- Built-in soft start circuit (Output ON/OFF control)...SI-8500L Series

■Applications

- Telephone power supplies
- Onboard local power supplies

■Lineup

Part Number	SI-8401L	SI-8402L	SI-8403L	SI-8405L	SI-8501L	SI-8502L	SI-8503L	SI-8504L	SI-8505L
V_O(V)	5.0	12.0	3.3	15.0	5.0	12.0	3.3	9.0	15.0
I_O(A)	0.5	0.4	0.5	0.4	1.0				

■Absolute Maximum Ratings

Parameter	Symbol	Ratings		Unit
		SI-8400L	SI-8500L	
DC Input Voltage	V_{IN}	35		V
Power Dissipation	P_D	1.25	3	W
Junction Temperature	T_j	+100		°C
Storage Temperature	T_{stg}	–25 to +85		°C

■Recommended Operating Conditions

Parameter	Symbol	Ratings				Unit
		SI-8401L	SI-8402L	SI-8403L	SI-8405L	
DC Input Voltage Range	V_{IN}	7 to 33	15 to 33	5.3 to 33	18 to 33	V
Output Current Range	I_O	0 to 0.5	0 to 0.4	0 to 0.5	0 to 0.4	A
Operating Temperature Range	T_{op}	–20 to +85				°C

Parameter	Symbol	Ratings					Unit
		SI-8501L	SI-8502L	SI-8503L	SI-8504L	SI-8505L	
DC Input Voltage Range	V_{IN}	7 to 33	15 to 33	5.3 to 33	12 to 33	18 to 33	V
Output Current Range	I_O	0 to 1.0					A
Operating Temperature Range	T_{op}	–20 to +85					°C

■Electrical Characteristics

(Ta=25°C)

Parameter	Symbol	Ratings												Unit
		SI-8401L			SI-8402L			SI-8403L			SI-8405L			
		min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	
Output Voltage	V_O	4.80	5.00	5.20	11.40	12.00	12.60	3.17	3.30	3.43	14.25	15.00	15.75	V
	Conditions	V_{IN}=20V, I_O=0.3A			V_{IN}=24V, I_O=0.3A			V_{IN}=15V, I_O=0.3A			V_{IN}=27V, I_O=0.3A			
Efficiency	η		80			88			75			89		%
	Conditions	V_{IN}=20V, I_O=0.3A			V_{IN}=24V, I_O=0.3A			V_{IN}=15V, I_O=0.3A			V_{IN}=27V, I_O=0.3A			
Switching Frequency	f		60			60			60			60		kHz
	Conditions	V_{IN}=20V, I_O=0.3A			V_{IN}=24V, I_O=0.3A			V_{IN}=15V, I_O=0.3A			V_{IN}=27V, I_O=0.3A			
Line Regulation	ΔV_{OLINE}		80	100		100	130		60	80		100	130	mV
	Conditions	V_{IN}=10 to 30V, I_O=0.3A			V_{IN}=18 to 30V, I_O=0.3A			V_{IN}=8 to 30V, I_O=0.3A			V_{IN}=21 to 30V, I_O=0.3A			
Load Regulation	ΔV_{OLOAD}		30	40		70	95		20	30		90	120	mV
	Conditions	V_{IN}=20V, I_O=0.1 to 0.4A			V_{IN}=24V, I_O=0.1 to 0.4A			V_{IN}=15V, I_O=0.1 to 0.4A			V_{IN}=27V, I_O=0.1 to 0.4A			
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_a$		±0.5			±1.5			±0.5			±1.5		mV/°C
Switching Ripple	ΔV_r		20	40		35	70		15	30		40	80	mV_{p-p}
Voltage (C2=470μF)	Conditions	V_{IN}=20V, I_O=0.3A			V_{IN}=24V, I_O=0.3A			V_{IN}=15V, I_O=0.3A			V_{IN}=27V, I_O=0.3A			
Overcurrent Protection	I_{S1}	0.55			0.45			0.55			0.45			A
Starting Current	Conditions	V_{IN}=10V			V_{IN}=18V			V_{IN}=8V			V_{IN}=21V			

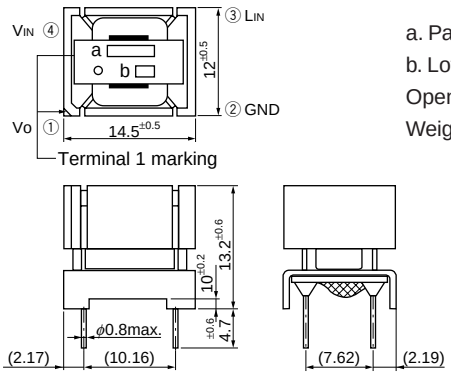
(Ta=25°C)

Parameter	Symbol	Ratings																Unit
		SI-8501L			SI-8502L			SI-8503L			SI-8504L			SI-8505L			
		min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	min.	typ.	max.	
Output Voltage	V_O	4.80	5.00	5.20	11.40	12.00	12.60	3.17	3.30	3.43	8.55	9.00	9.45	14.25	15.00	15.75	V
	Conditions	V_{IN}=20V, I_O=0.5A			V_{IN}=24V, I_O=0.5A			V_{IN}=15V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			V_{IN}=25V, I_O=0.5A			
Efficiency	η		83			89			79			87			90		%
	Conditions	V_{IN}=20V, I_O=0.5A			V_{IN}=24V, I_O=0.5A			V_{IN}=15V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			V_{IN}=25V, I_O=0.5A			
Switching Frequency	f		60			60			60			60			60		kHz
	Conditions	V_{IN}=20V, I_O=0.5A			V_{IN}=24V, I_O=0.5A			V_{IN}=15V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			V_{IN}=25V, I_O=0.5A			
Line Regulation	ΔV_{OLINE}		70	130		70	130		50	80		70	130		70	130	mV
	Conditions	V_{IN}=10 to 30V, I_O=0.5A			V_{IN}=18 to 30V, I_O=0.5A			V_{IN}=8 to 30V, I_O=0.5A			V_{IN}=15 to 30V, I_O=0.5A			V_{IN}=21 to 30V, I_O=0.5A			
Load Regulation	ΔV_{OLOAD}		30	55		30	55		20	45		30	55		30	55	mV
	Conditions	V_{IN}=20V, I_O=0.2 to 0.8A			V_{IN}=24V, I_O=0.2 to 0.8A			V_{IN}=15V, I_O=0.2 to 0.8A			V_{IN}=21V, I_O=0.2 to 0.8A			V_{IN}=25V, I_O=0.2 to 0.8A			
Temperature Coefficient of Output Voltage	$\Delta V_O/\Delta T_a$		±0.5			±1.5			±0.5			±1.0			±1.5		mV/°C
Switching Ripple	ΔV_r		45			30			15			25			30		mV_{p-p}
Voltage (C2=470μF)	Conditions	V_{IN}=20V, I_O=0.5A			V_{IN}=24V, I_O=0.5A			V_{IN}=15V, I_O=0.5A			V_{IN}=21V, I_O=0.5A			V_{IN}=25V, I_O=0.5A			
Overcurrent Protection	I_{S1}	1.1			1.1			1.1			1.1			1.1			A
Starting Current	Conditions	V_{IN}=18V			V_{IN}=24V			V_{IN}=12V			V_{IN}=21V			V_{IN}=25V			

■Outline Drawing

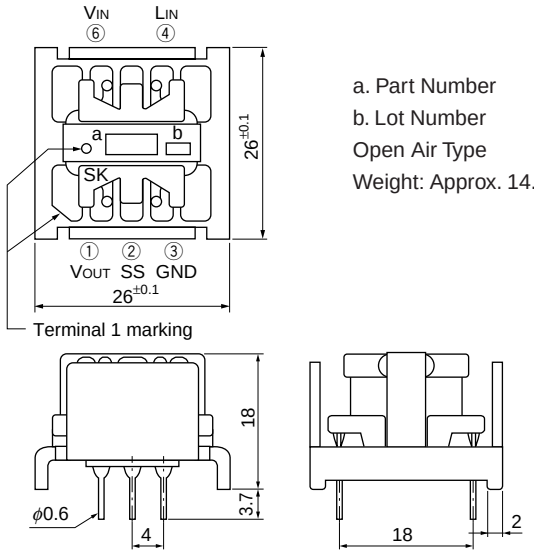
(unit:mm)

SI-8400L



a. Part Number
b. Lot Number
Open Air Type
Weight: Approx. 5.1g

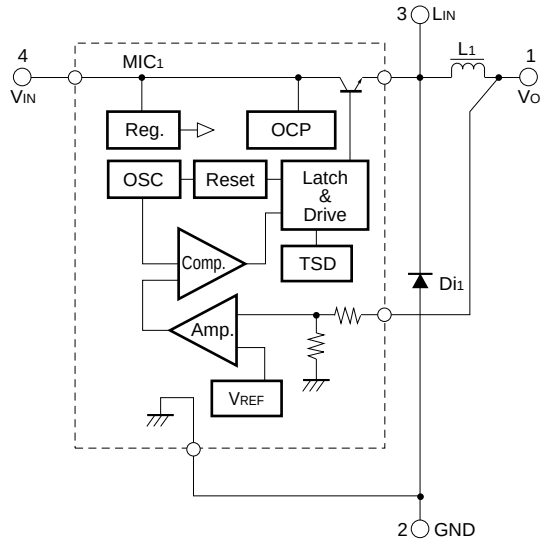
SI-8500L



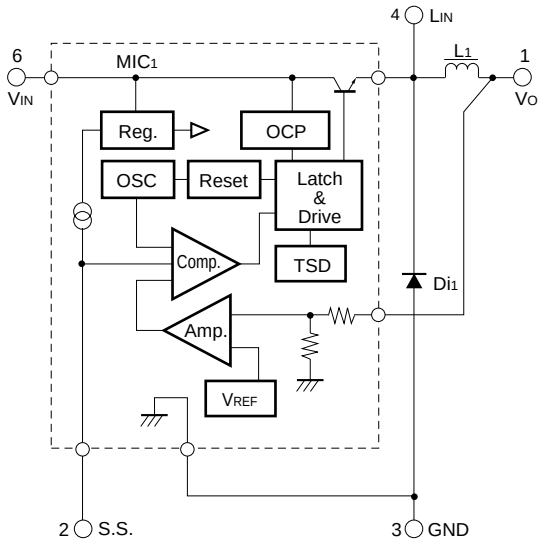
a. Part Number
b. Lot Number
Open Air Type
Weight: Approx. 14.5g

■Block Diagram

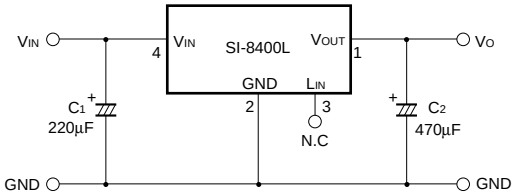
SI-8400L



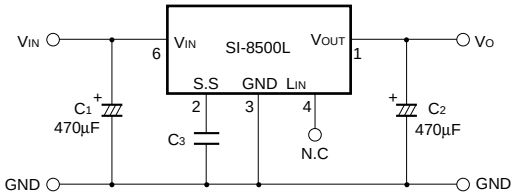
SI-8500L



■Standard External Circuit

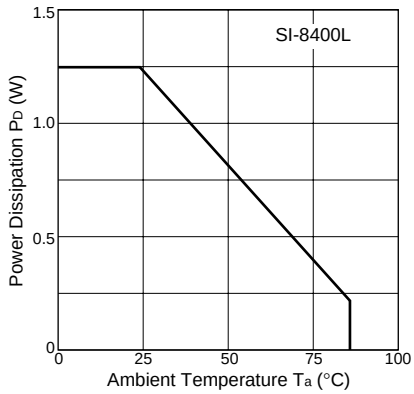


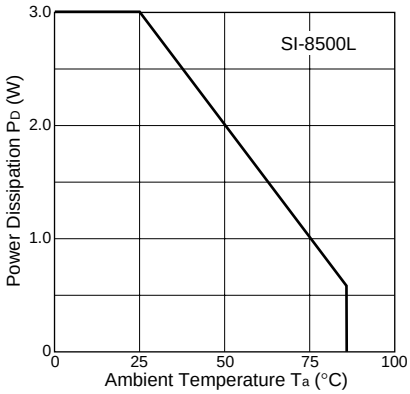
Pin compatible with SI-8200L



C3 is necessary only for using soft start function.
Pin compatible with SI-8300L

■T_a-P_D Characteristics





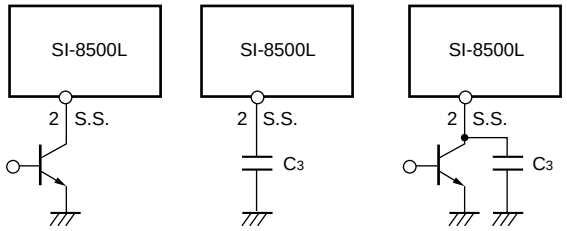
$$P_D = V_O \bullet I_O \left(\frac{100}{\eta\chi} - 1 \right)$$

V_O : Output voltage
I_O : Output current
$\eta\chi$: Efficiency (%)

The efficiency depends on the input voltage and the output current. Thus, obtain the value from the efficiency graph and substitute the percentage in the formula above.

■SI-8500L application circuit

Terminal no.2 is for soft start. Connecting a capacitor to the terminal enables the soft start function. See page 85 for the formulas to calculate delay time and rise time. Output can be turned on and off by using the soft start terminal. To stop output, set the soft start terminal voltage to V_{SSL} (0.2V typ.) or less. To switch the potential of the soft start terminal, drive the open collector of the transistor. Since the discharge current from C_3 flows to the ON/OFF control transistor, limit the current for protection. The SS terminal is pulled up to the power supply in the IC and no external voltage can be applied.



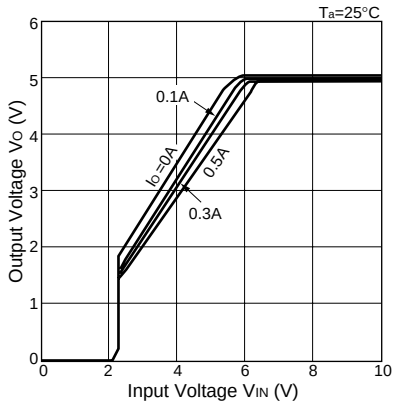
V_O. ON/OFF　　Soft start　　Soft start +V_O ON/OFF

■Caution

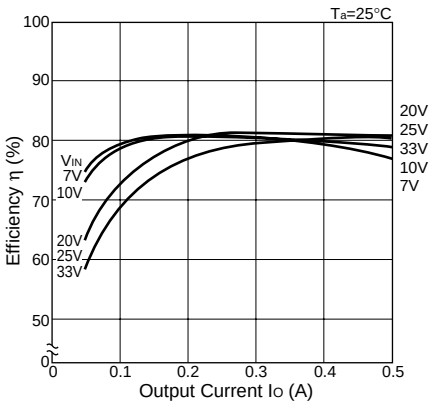
1. Allocation of Components
   For the best operating environment, the ground should be a single ground line at the GND terminal (terminal 2 on the SI-8400L, terminal 3 on the SI-8500L), and the wiring from C_1 and C_2 to ground should be as short as possible.
2. Capacitors C_1 and C_2
   1) They must satisfy the breakdown voltage and allowable ripple current.
      Exceeding the ratings of these capacitors or using them without derating shortens their service lives and may also cause abnormal oscillation of the IC.
   2) C_2 must be a low-impedance type capacitor to ensure minimum ripple voltage and stable switching operation.
   3) C_3 (SI-8500L only) is a capacitor for soft start. When not using soft start, leave terminal 2 open. It is pulled up inside the IC.
3. Terminals LIN and NC in the connection diagram must be left unconnected to other circuits.
4. The IC's metalic heatsink is electrically floating. Do not connect it to GND or any other circuit.
5. Since the SI-8400L and 8500L series have an open-package construction, they can only be operated in specific environments. Verify the operating environment and use the conditions indicated in the reliability data.

■Typical Characteristics (SI-8400L Series)

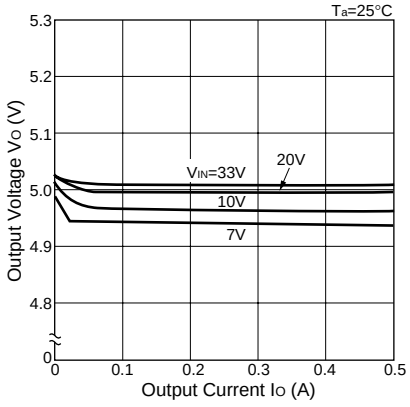
Rise Characteristics(SI-8401L)



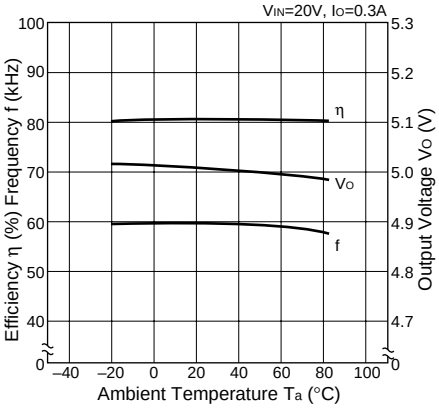
Efficiency Characteristics(SI-8401L)



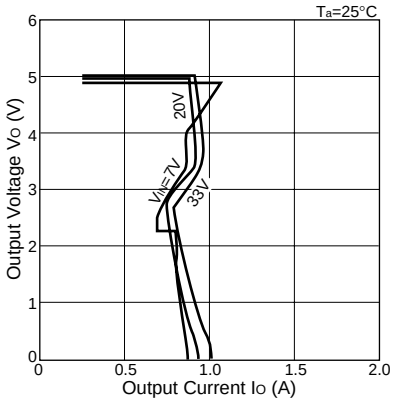
Load Regulation(SI-8401L)



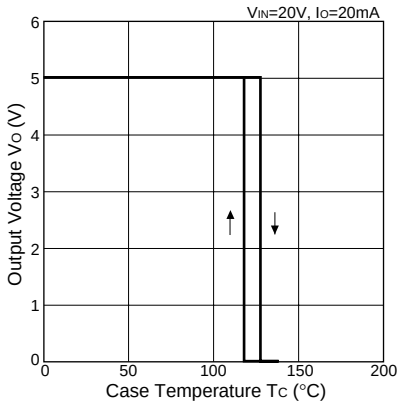
Temperature Characteristics(SI-8401L)



Overcurrent Protection Characteristics(SI-8401L)



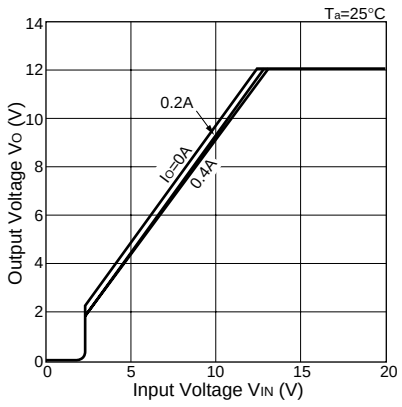
Thermal Protection Characteristics(SI-8401L)



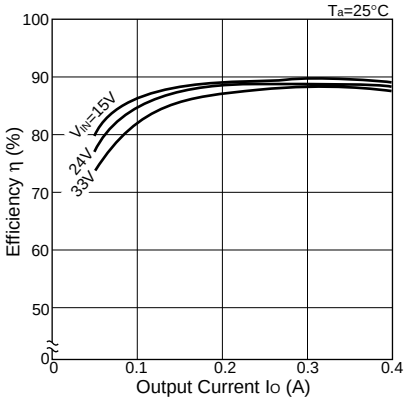
Note on Thermal Protection:

The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation is not guaranteed for short-circuiting over extended periods of time.

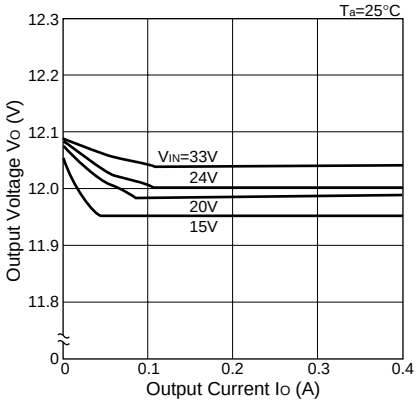
Rise Characteristics(SI-8402L)



Efficiency Characteristics(SI-8402L)

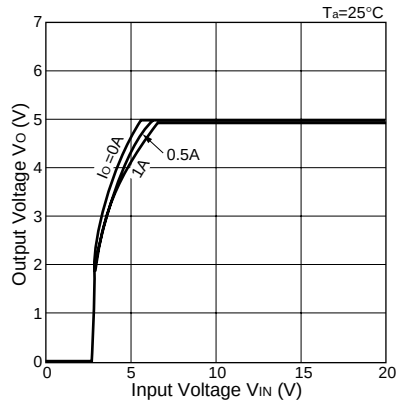


Load Regulation(SI-8402L)

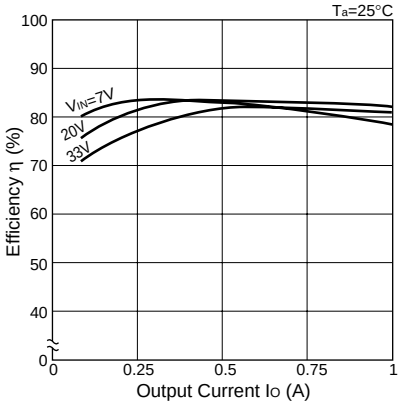


■Typical Characteristics (SI-8500L Series)

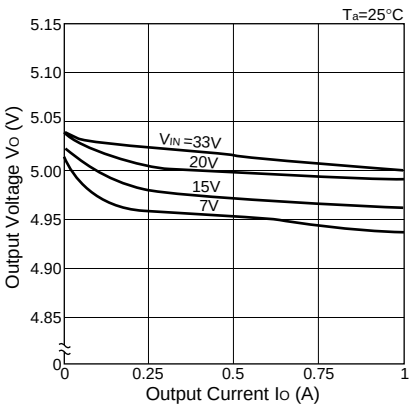
Rise Characteristics(SI-8501L)



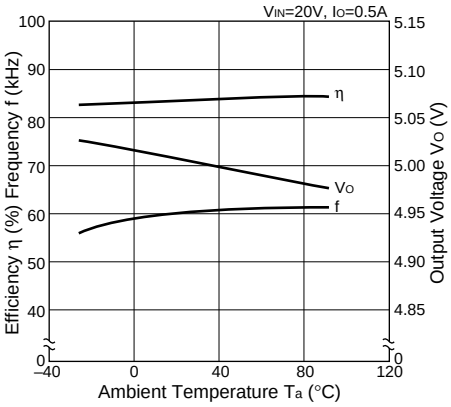
Efficiency Characteristics(SI-8501L)



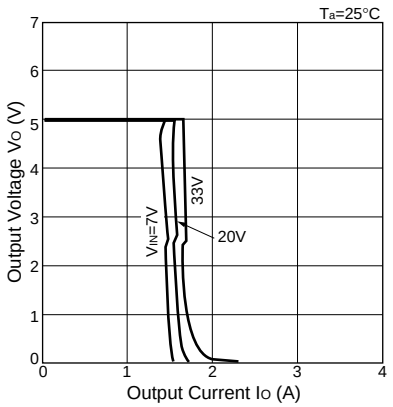
Load Regulation(SI-8501L)



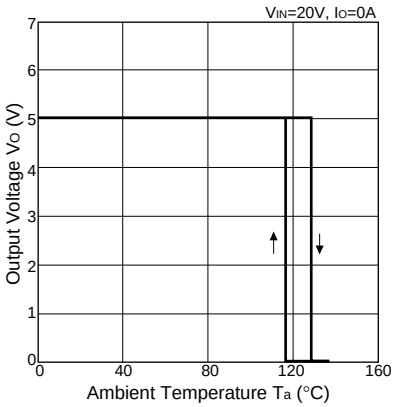
Temperature Characteristics(SI-8401L)



Overcurrent Protection Characteristics(SI-8401L)



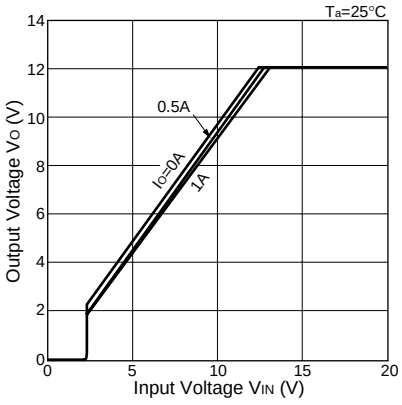
Thermal Protection Characteristics(SI-8401L)



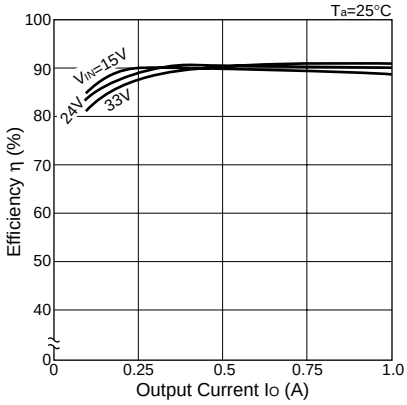
Note on Thermal Protection:

The thermal protection circuit is intended for protection against heat during instantaneous short-circuiting. Its operation is not guaranteed for short-circuiting over extended periods of time.

Rise Characteristics(SI-8502L)



Efficiency Characteristics(SI-8502L)



Load Regulation(SI-8502L)