Ordering number : ENA1790A

SANYO Semiconductors
DATA SHEET

An ON Semiconductor Company

STK760-213A-E — Thick-Film Hybrid IC Single-phase rectification Active Converter Hybrid IC

Overview

This IC is average current control type Active Converter Hybrid IC for power factor improvement of single-phase AC power supply, that containing power devices of step-up active converter, control IC over-current and over-voltage protection circuits.

Applications

- Single-phase rectification active filter for power rectification for air conditioners and general-purpose inverters.

Features

- Power switching device for active converter is adopting IGBT.
- Soft start functions and the over current, the over voltage, and the low-voltage are including as protection circuit
- Capable of controlling ON/OFF by logic level input signal.
- Output voltage changeability functions by control signal.

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Specifications

Absolute Maximum Ratings at Ta = 25°C

Parameter		Symbol	Conditions	Ratings	unit
IGBT (TR1+TR2)	Collector-emitter voltage	VCE		600	V
	Repetitive peak collector current	ICP	*1	300	A
	Collector current	IC		105	A
	Power dissipation	PC1		156	W
FRD1 (D1)	Diode reverse voltage	VRM		600	V
	Repetitive peak forward current	IF1P	*1	110	A
	Diode forward current	IF1		36	A
	Power dissipation	PD1		75	W
FRD2 (D2)	Repetitive peak forward current	IF2P	*1	15	A
	Diode forward current	IF2		7	A
	Power dissipation	PD2		13	W
Supply voltage (V_{CC}-GND)		V_{CC}		20	V
Signal pin input voltage	Pin 4	VIS		-10 to 0.3	V
	Pin 5	VCOMP		-0.3 to 6.5	
	Pin 8	VFB			
	Pin 9	VOVP			
	Pin 2	VONF		-0.3 to V_{CC}	
	Pin 6	Vctl			
Maximum input AC voltage		VAC	Single-phase Full-rectified	264	V
Maximum output voltage		V_O	Under the Application condition (VAC=200V)	450	V
Maximum output power		Wo		6	kW
Input AC current (normal condition)		I_{IN}		30	Arms
Junction temperature		Tj		150	°C
Operating case temperature		Tc	HIC case temperature *2	-20 to +100	°C
Storage temperature		Tstg		-40 to +125	°C
Tightening torque			A screw part *3	1.17	N•m
Withstand voltage		VINS	50Hz sine wave AC 1minute *4	2000	VRMS

[Note]

*1: Duty ratio D = 0.1, tp = 1ms

*2: Measure point is between 5mm to center of back.

*3: Torque should be set within 0.79 to 1.17N·m. Flatness of the heat-sink should be lower than 0.2mm.

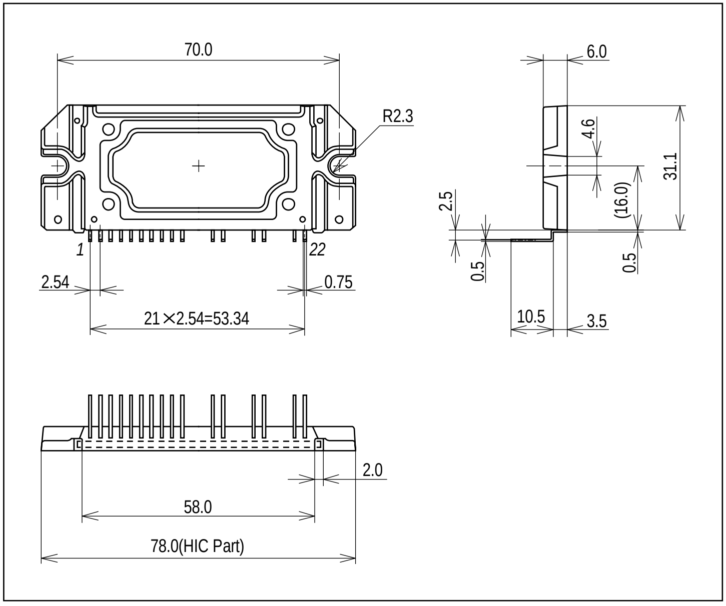
*4: The test condition: AC2500V, 1 second.

Electrical Characteristics at Tc = 25°C, V_{CC} = 15.0V: Unless otherwise noted

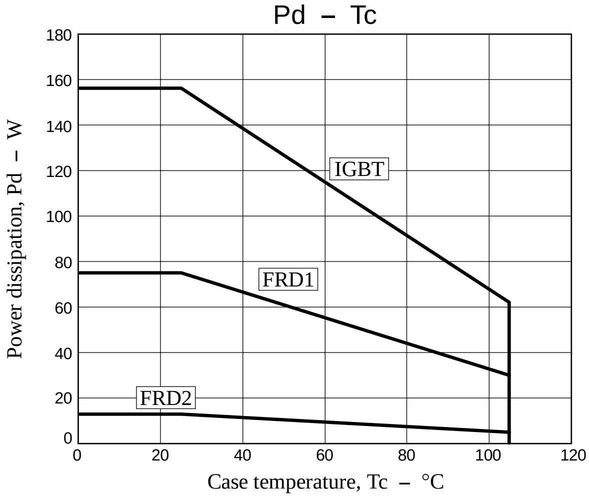
Parameter	Symbol	Conditions	Test circuit	Ratings min	Ratings typ	Ratings max	unit
Power output part							
Collector-emitter leak current (IGBT)	I_{CES}	V_{CE} = 600V	Fig.1			200	μA
Collector-emitter saturation voltage (IGBT)	V_{CE}(sat)	I_C = 40A	Fig.2		1.2	1.8	V
Diode reverse current (FRD1)	I_R	V_R = 600V	Fig.1			200	μA
Diode forward voltage (FRD1)	V_F1	I_F = 40A	Fig.3		2.2	2.8	V
Diode forward voltage (FRD2)	V_F2	I_F = 5A	Fig.3		2.5	3.5	V
Junction to case thermal resistance	θj-c1	IGBT (TR1+TR2)			0.80		°C/W
	θj-c2	FRD1 (D1)			1.65		°C/W
	θj-c3	FRD2 (D2)			9.0		°C/W
Control IC part							
Control IC input current	I_{CC}(ON)	V_{CC} = 15V, VONF = 5V	Fig.4		14	20	mA
	I_{CC}(OFF)	V_{CC} = 15V, VONF = 0V			2.5	5	
Oscillation frequency	f_{OSC}	V_{CC} = 15V, VONF = 5V		19.5	22.0	24.5	kHz
Open loop protection threshold voltage	VOLP			0.8	0.95	1.1	V
Error-amp reference voltage	Vref		Fig.5	4.88	5.0	5.12	V
Peak current protection threshold voltage	VIS(PK)			-0.58	-0.5	-0.42	V
Over voltage protection threshold voltage	VOVP(ON)		Fig.6	5.095	5.3	5.51	V
ON/OFF threshold voltage	VTHON	V_{CC} = 15V	Fig.7	3.0			V
	VTHOFF					0.5	V
Start-up V_{CC} voltage	V_{CC}(ON)	VONF = 5V	Fig.8	12.4	13.25	14.1	V
Shut-down V_{CC} voltage	V_{CC}(OFF)			9.4	10.0	10.7	V
Substrate temperature monitor resistance	RTH	Resistance between VTH-GND	Fig.3	90	100	110	kΩ
Application circuit : VAC = 200V, V_O = 380V (Vctl = 1.507V)							
Output voltage	V_O	Wo = 2kW	Fig.9	366	380	394	V
Power Factor	cosϕ	Wo = 400W		0.98	0.99		
		Wo = 2kW		0.99	0.995	1.0	

Package Dimensions

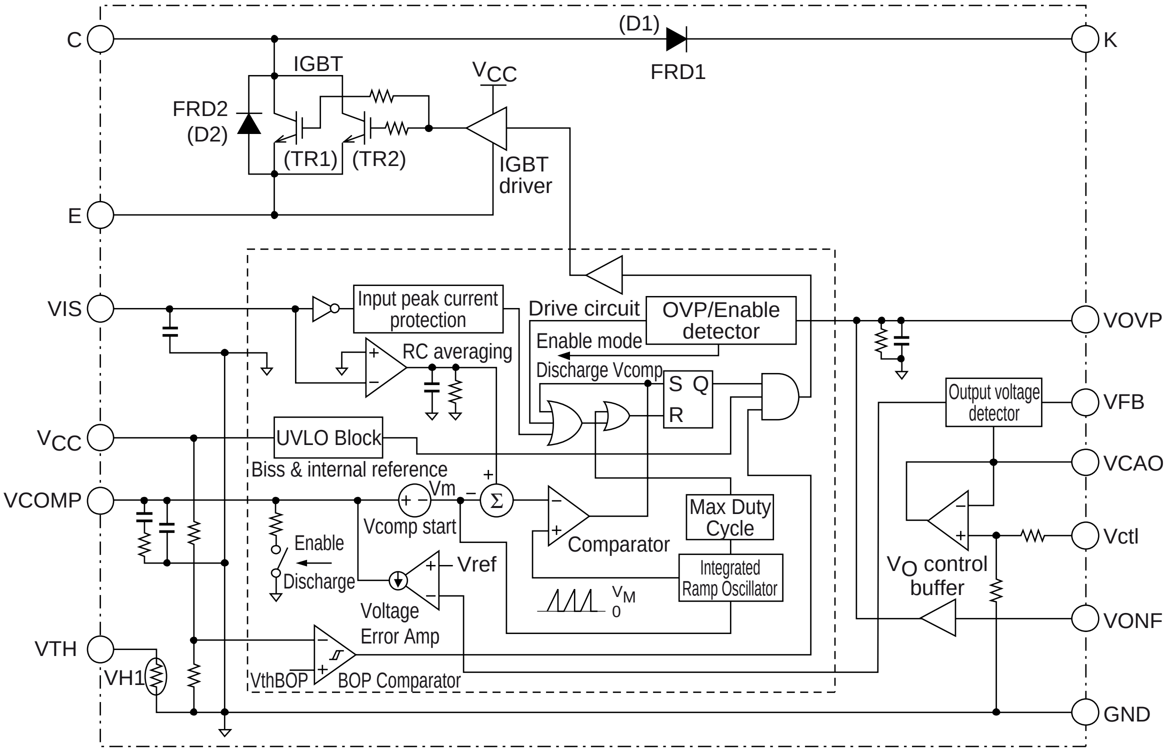
unit:mm (typ)



IGBT (TR1+TR2), FRD1 (D1) & FRD2 (D2) vs. Temperature Derating (Ta = 25°C)



Block Diagram



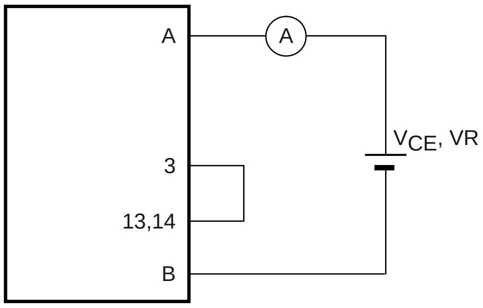
Explanation of Terminal

Terminal No.	Symbol	Explanation
1	V_{CC}	Control IC power supply input
2	VONF	ON/OFF control terminal
3	GND	Signal GND
4	VIS	Current detection terminal
5	VCOMP	Phase compensation terminal (Voltage error amplifier out)
6	Vctl	Output voltage control signal input
7	VCAO	Output voltage control amplifier output
8	VFB	Output voltage feed back terminal
9	VOVP	Over voltage protection terminal
10	VTH	Terminal of thermistor TH1
11, 12	-	An empty terminal
13, 14	E	IGBT (TR1+TR2) Emitter
15, 16	-	An empty terminal
17, 18	C	IGBT (TR1+TR2) Collector
19, 20	-	An empty terminal
21, 22	K	FRD1 (D1) Cathode

Test Circuit -1

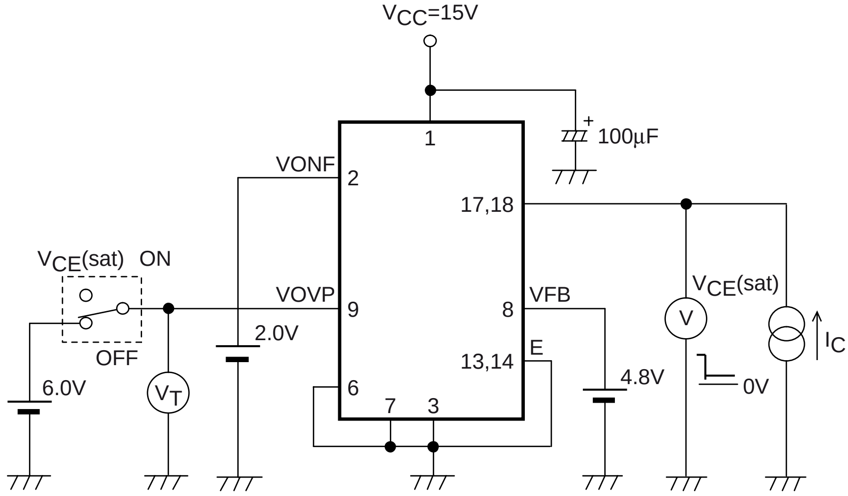
(1) I_{CES}, I_R

	IGBT	FRD1
A	17, 18	21, 22
B	13, 14	17, 18



⟨Fig.1⟩

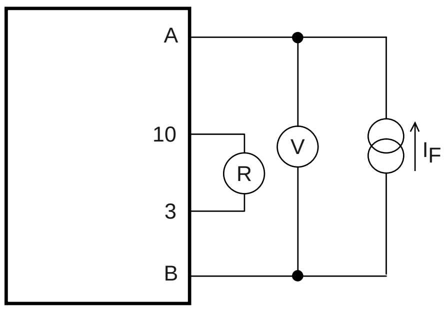
(2) V_{CE}(sat) (Test by Pulse)



⟨Fig.2⟩

(3) V_F1, V_F2 (Test by Pulse), RTH

	FRD1	FRD2
A	17, 18	13, 14
B	21, 22	17, 18

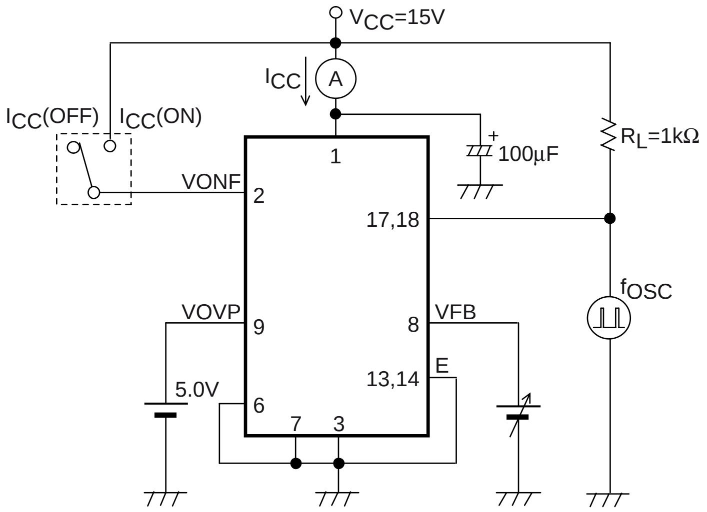


⟨Fig.3⟩

Test Circuit -2

(4) I_{CC}(ON)/I_{CC}(OFF), VOLP, f_{OSC}

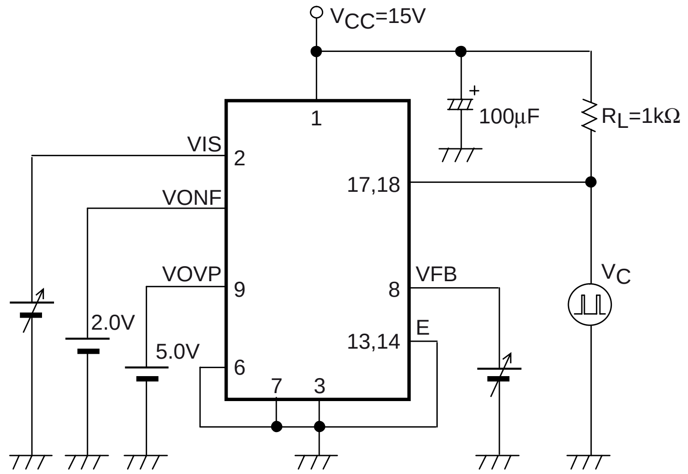
I_{CC}, f_{OSC}	VOLP
VFB = 1.1V	VONF = 5.0V



〈Fig.4〉

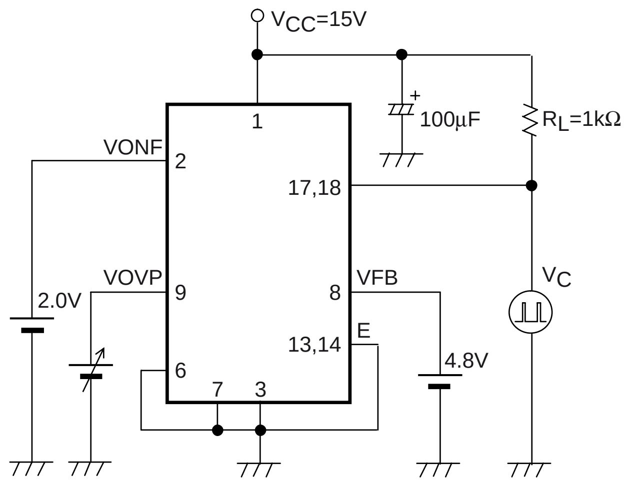
(5) Vref, VIS(PK)

Vref	VIS(PK)
VIS = -0.6V	VFB = 4.8V



〈Fig.5〉

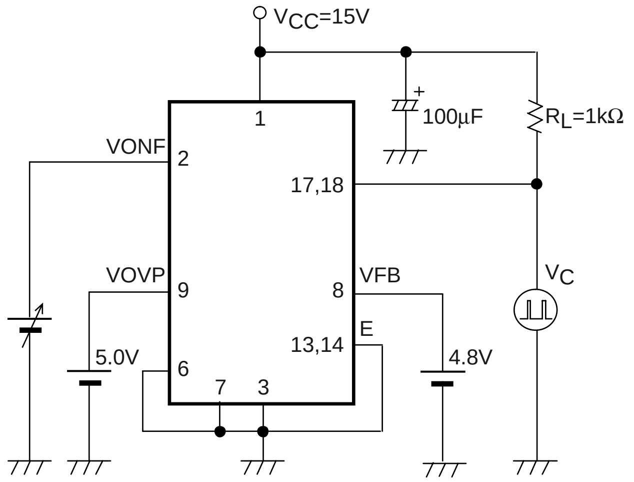
(6) VOVP(ON)



〈Fig.6〉

Test Circuit -3

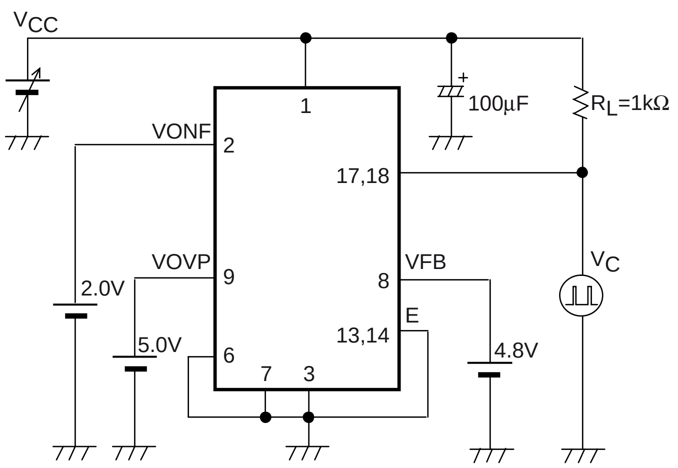
(7) VTHON, VTHOFF



⟨Fig.7⟩

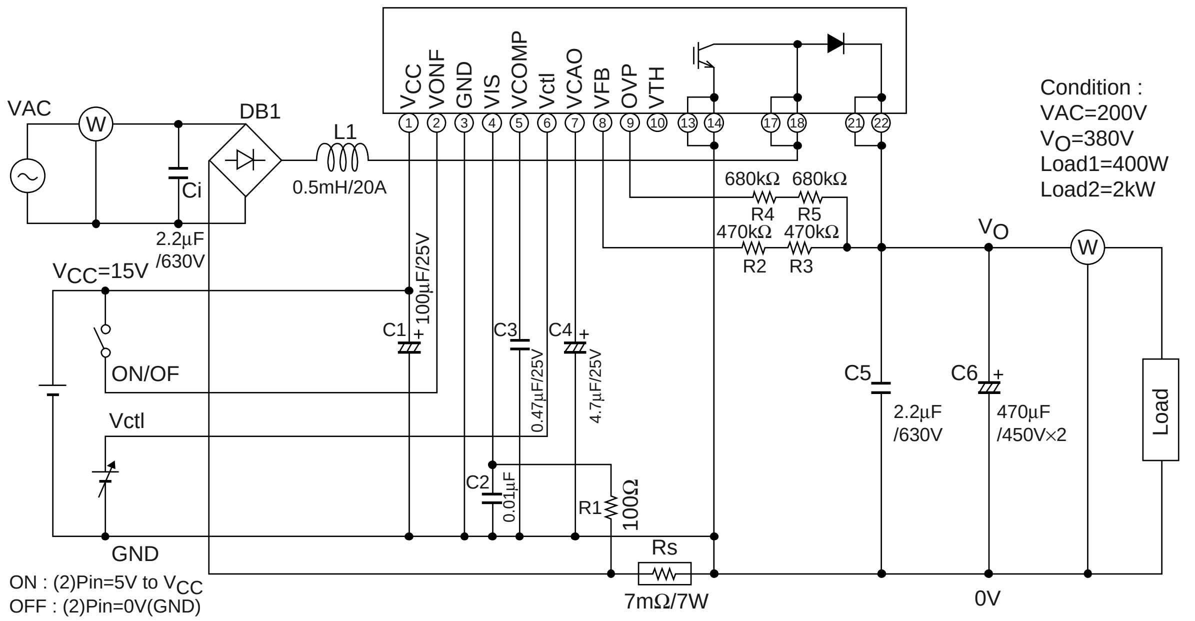
(8) V_{CC}(ON), V_{CC}(OFF)

V_{CC}(ON)	V_{CC}(OFF)
Vc-ON	Vc-OFF



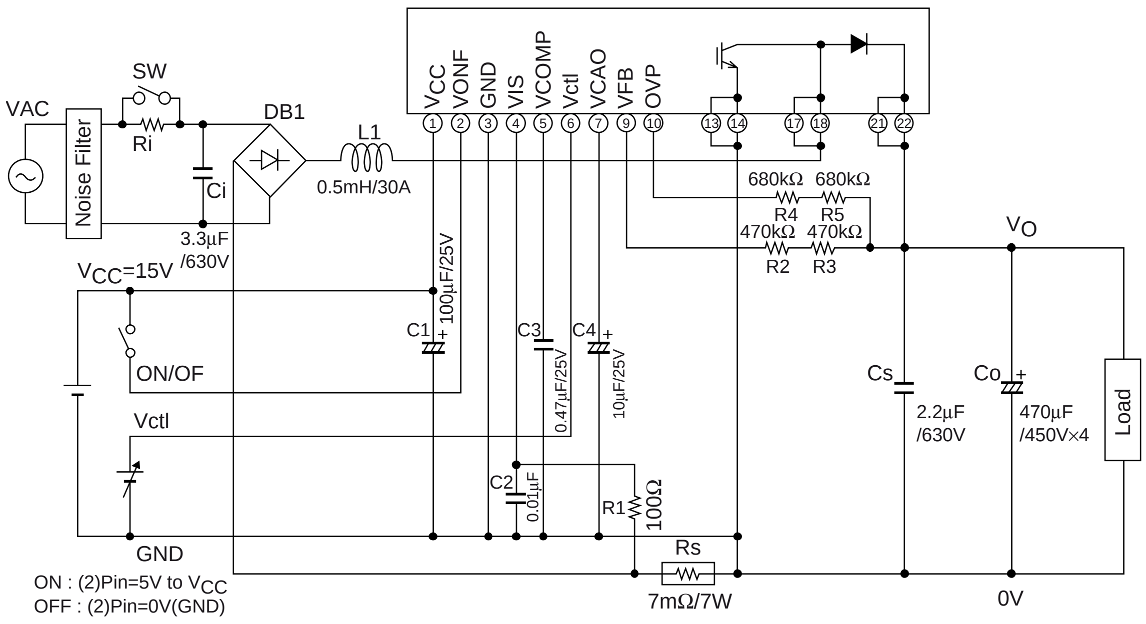
⟨Fig.8⟩

(9) Power Factor (COSϕ)



⟨Fig.9⟩

Application Circuit

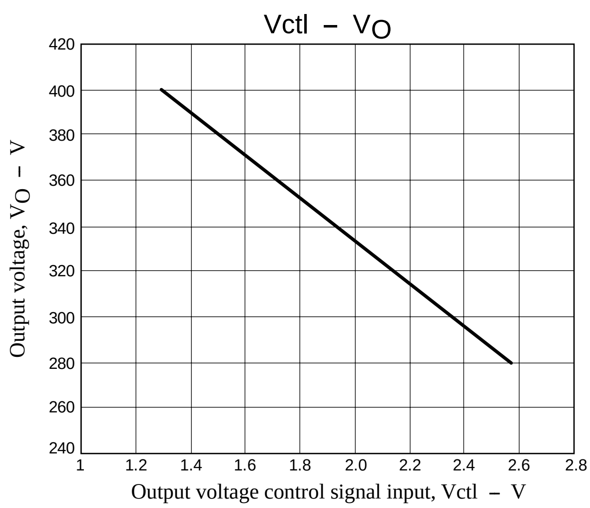


Recommended Condition

Parameter	Symbol	Conditions	Ratings	unit
AC Voltage	VAC	50/60Hz	170 to 264	Vrms
Output voltage	V_O		VAC×√2+(10 to 15)≤450	V
Over-voltage detection voltage	VOV		V_{OUT}+(10 to 20)	V
Control IC supply voltage	V_{CC}	V_{CC}-GND	14.5 to 17.0	V
Inductor	L1		0.5	mH
Input film capacitor	Ci		3.3≤Ci	µF
Output film capacitor	Cs		2.2≤Cs	µF
Output electrolytic capacitor	Co		1880≤Co	µF

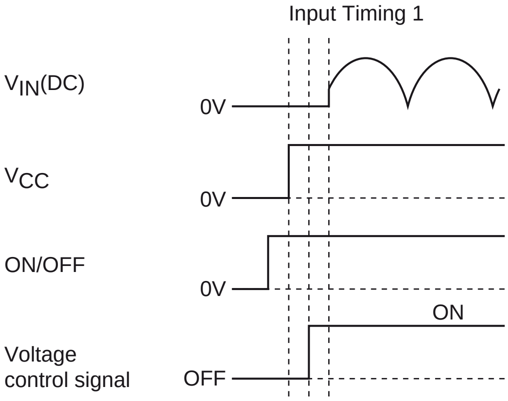
Output Voltage Control

Output voltage control signal Vctl sets referring to the Vctl-V_O characteristic of the figure below.

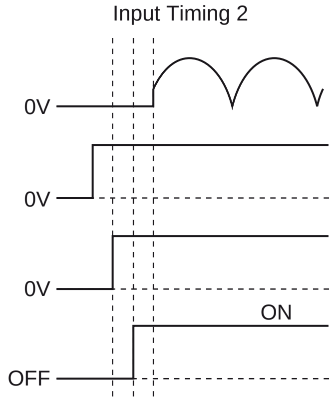


Timing Chart

Even if power supply and signal at any timing are input, this IC is not destroyed.
However, soft start circuit doesn't operate when V_{IN}(DC) is input at the timing of Figure 11 and 12.
Therefore, overcurrent protection circuit will operate, and audio frequency noise from coil may generate.
Please turn on ON/OFF or V_{CC} after V_{IN}(DC) to avoid this.

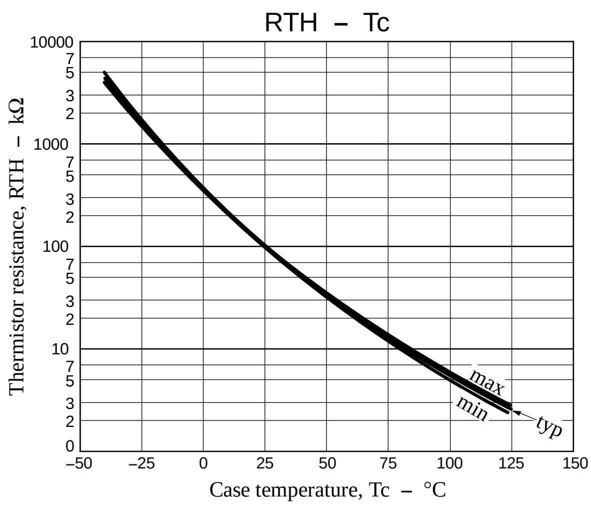


⟨Fig.11⟩



⟨Fig.12⟩

The built-in thermistor resistance temperature characteristic



This catalog provides information as of October, 2012. Specifications and information herein are subject to change without notice.