Ordering number : EISB*0001A

Preliminary

SANYO Semiconductors
DATA SHEET

Ultrathin Miniature Package

SR10000 Series — 1-channel Step-up DC/DC Converter ICs

Overview

The SR10000 Series is a SANYO's original SIP (System In Package) that includes a DC/DC converter control IC, a power MOSFET and a Schottky barrier diode. All these components are mounted into one thin-and-small package by utilizing SANYO's high-density mounting technology, "Integrated System in Board (ISB)".
The advantage using this DC/DC converter package is that it greatly decreases its mounting area and space, compared with when the same circuit is set up with the discrete devices. In addition to that, it is very easy to assemble step-up switching power supply with by just adding voltage-setting resistance, inductor and capacitors.

Functions and Features

- Since the SR10000 Series packages a voltage step-up DC/DC converter IC as well as power MOSFET and Schottky barrier diode devices in the same package with the minimum trace length between components, it can provides high efficiency and superior characteristics including low output ripple. In particular the mounting area required by these components is reduced when compared to implementations using discrete devices.
- The output voltage is set using an external resistor.
- Standby function: Standby mode current=1μA (maximum)
- Automatic PWM/PFM switching control (SR10020, SR10040, SR10050)
- External PWM/PFM switching control (SR10030, SR10060, SR10070)
- Oscillator frequency: 100kHz (SR10060), 180kHz (SR10030), 300kHz (SR10020, SR10070), 500kHz (SR10040, SR10050) (accuracy±15%)

- The values given in this data sheet for models SR10060 is tentative and subject to change before putting into mass production.

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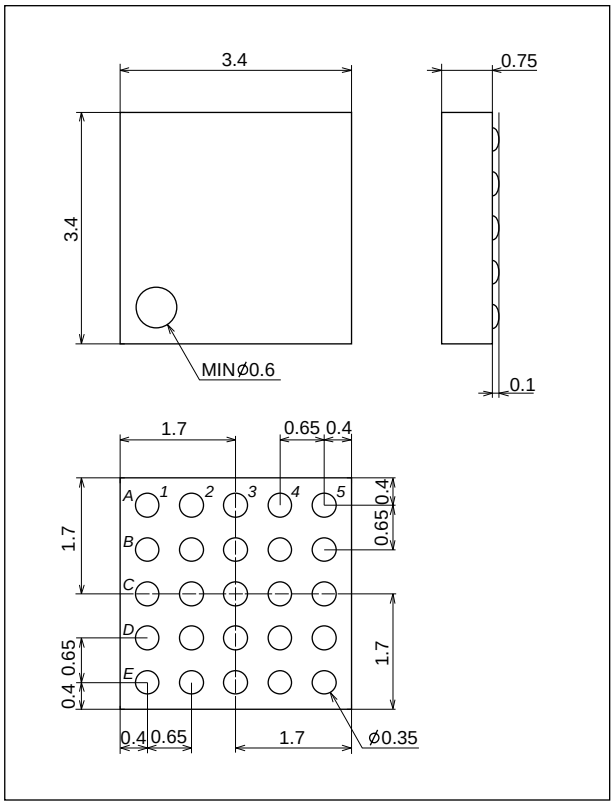
Comparison of Functions

Type No.	DC/DC Controller IC			TR Maximum Rating		Di Maximum Rating		Output Setting *1
	Control System	Input Voltage Range	Oscillator Frequency	V_{DSS}	I_D	V_{RRM}	I_O	
SR10020	Automatic PWM/PFM switching control	0.9V to 10V	300kHz	30V	2.5A	30V	1A	1.5V to 20V
SR10030	External PWM/PFM switching control	0.9V to 10V	180kHz	30V	2.5A	30V	1A	1.5V to 20V
SR10040	Automatic PWM/PFM switching control	0.9V to 10V	500kHz	30V	2.5A	30V	1A	1.5V to 20V
SR10050	Automatic PWM/PFM switching control	0.9V to 10V	500kHz	30V	2.5A	15V	2A	1.5V to 10V
SR10060	External PWM/PFM switching control	0.9V to 10V	100kHz	20V	3A	30V	1A	1.5V to 13V
SR10070	External PWM/PFM switching control	0.9V to 10V	300kHz	20V	3A	15V	2A	1.5V to 10V

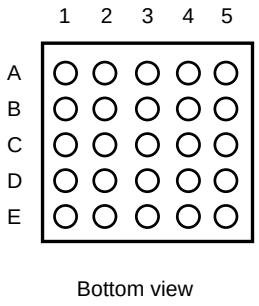
*1: The output setting maximum values are voltages that are 1/1.5 times the V_{DSS} and V_{RRM} as a general rule of thumb, and they are provided to serve as a reference only. As such, it must be verified during actual operation that they do not exceed the rated voltages.

Package Dimensions

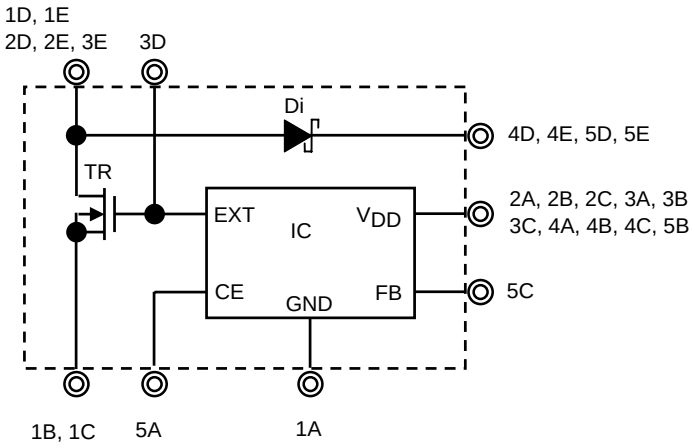
unit : mm



Pin Layout and Internal Equivalent Circuit Block Diagram



Bottom view



Specifications

Absolute Maximum Ratings at Ta = 25°C

Device	Parameter	Symbol	Conditions	Ratings	Unit
IC	V_{DD} pin voltage	V_{DD}		-0.3 to +12	V
	FB pin voltage	VFB		-0.3 to +12	V
	CE pin voltage	V_{CE}		-0.3 to +12	V
	EXT pin voltage	VEXT		-0.3 to V_{DD}+0.3	V
	EXT pin current	IEXT		±100	mA
TR	Drain-to-source voltage 1	$V_{DSS}1$	SR10020, SR10030, SR10040, SR10050	30	V
	Gate-to-source voltage 1	$V_{GSS}1$		±12	V
	Drain current 1	I_D1		2.5	A
	Drain-to-source voltage 2	$V_{DSS}2$	SR10060, SR10070	20	V
	Gate-to-source voltage 2	$V_{GSS}2$		±10	V
	Drain current 2	I_D2		3	A
	Allowable power dissipation	P_D-T	60mm×60mm×1.6mm^3 FR4 board	700	mW
Di	Reverse voltage 1	$V_{RRM}1$	SR10020, SR10030, SR10040, SR10060	30	V
	Output current 1	I_O1		1	A
	Reverse voltage 2	$V_{RRM}2$	SR10050, SR10070	15	V
	Output current 2	I_O2		2	A
	Allowable power dissipation	P_D-D	60mm×60mm×1.6mm^3 FR4 board	750	mW
Operating temperature		Topr		-30 to +85	°C
Storage temperature		Tstg		-40 to +125	°C

Electrical Characteristics

Overall Operating Characteristics at Ta = 25°C, in the specified test circuit

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output voltage	V_{OUT}	V_{IN}=2V, I_O=10mA	3.217	3.300	3.383	V
Output voltage setting range	VOSET	V_{IN}=VOSET×0.6, V_{DD}=3.3V, I_{OUT}=10mA	1.5		*2	V
FB control voltage	VFB			0.9		V
Supply voltage	V_{DD}	*3	1.8		10	V
Operation start voltage	VST	I_O=1mA			0.9	V
Current dissipation	I_{DD}	V_{IN}=2V, I_O=0mA SR10060		29	41	µA
		V_{IN}=2V, I_O=0mA SR10030		45	64	µA
		V_{IN}=2V, I_O=0mA SR10020, SR10070		62	88	µA
		V_{IN}=2V, I_O=0mA SR10040, SR10050		97	137	µA
Standby current	ISTB	V_{IN}=2V, V_{CE}=0V			1	µA
Oscillator frequency	F_{OSC}	V_{IN}=2V, I_O=10mA SR10060	85	100	115	kHz
		V_{IN}=2V, I_O=10mA SR10030	153	180	207	kHz
		V_{IN}=2V, I_O=10mA SR10020, SR10070	255	300	345	kHz
		V_{IN}=2V, I_O=10mA SR10040, SR10050	425	500	575	kHz
Efficiency	EFFI			85		%
CE high voltage	VCEH		0.65			V
CE low voltage	VCEL				0.20	V
PWM high voltage	VPWMH	SR10030, SR10060, SR10070 *4	V_{DD}-0.2			V
PWM low voltage	VPWML	SR10030, SR10060, SR10070 *4			V_{DD}-1.0	V
CE high current	ICEH	CE=V_{DD}=3.3V			0.1	µA
CE low current	ICEL	CE=0V			0.1	µA

*2: The output setting maximum voltages are within 1/1.5 times the V_{DSS} of the built-in MOSFET and within 1/1.5 times the V_{RRM} of the Di as a general rule of thumb. As such, it must be verified during actual operation that they do not exceed the rated voltages.

*3: V_{DD} should be 1.8V or higher when V_{IN} or other power source is supplying V_{DD} since the output voltage and oscillating frequency become steady when V_{DD} is set 1.8V or higher, although the built-in IC starts step-up voltage operation from V_{DD}=0.8V.

*4: For models SR10030, SR10060, and SR10070, the CE pin also serves to implement a PWM/PFM external switching function. When the voltage is V_{DD}-0.2V or more, PWM control is exercised, and when it is VCEH or more but V_{DD}-1.0V or less, PWM/PFM automatic switching at a duty ratio of 25% is controlled.

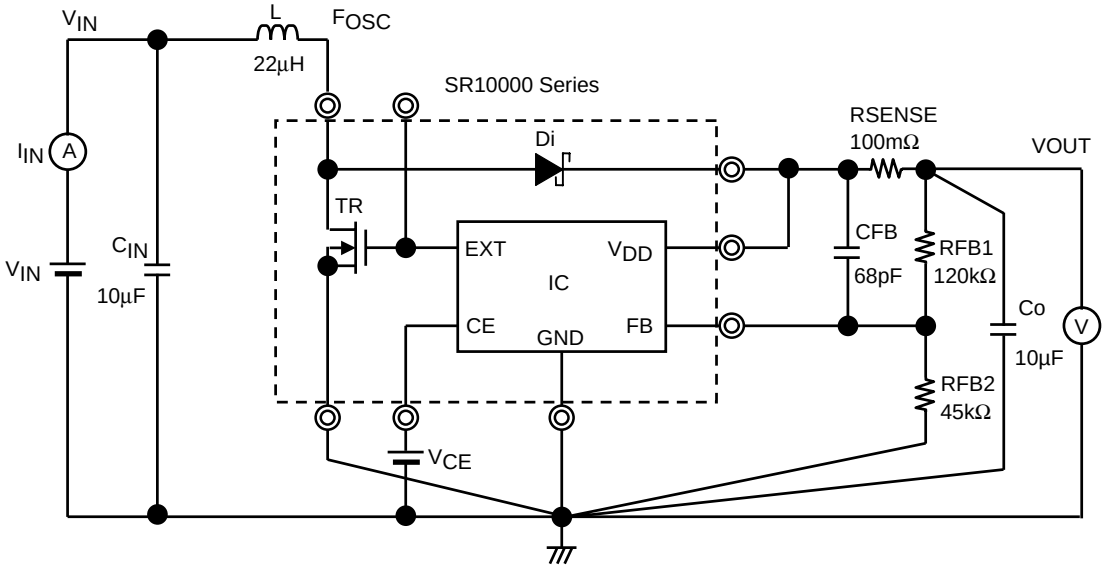
Di Characteristics at Ta = 25°C, in the specified test circuit

Parameter	Symbol	Conditions		min	typ	max	unit
Forward voltage 1	VF1	SR10020, SR10030 SR10040, SR10060	IF=1A		0.43	0.47	V
Reverse current 1	IR1		VR=30V		40	200	µA
Forward voltage 2	VF2	SR10050, SR10070	IF=1A		0.30	0.35	V
Reverse current 2	IR2		VR=6V			600	µA

Pin Functions

Pin No.	Pin Name	Description
1A	GND	Ground pin for IC.
1B, 1C	TR Source	Source pin for TR
1D, 1E, 2D, 2E, 3E	TR Drain, Di Anode	Drain of TR and Anode of Diode
2A, 2B, 2C, 3A, 3B, 3C 4A, 4B, 4C,5B	IC V_{DD}	Supply voltage for IC
3D	IC EXT, TR Gate	Gate for TR
4D, 4E, 5D, 5E	Di Cathode	Cathode of Diode and V_{OUT}
5A	IC CE	Operation starts when chip enable pin is set to “high”. This pin also serves as a PWM/PFM selector for models SR10030, SR10060, and SR10070.
5C	IC FB	External resistance connecting pin for output voltage setting, internal control voltage: 0.9V typical

Equivalent Circuit and Test Peripheral Circuitry



Selection rules of external components

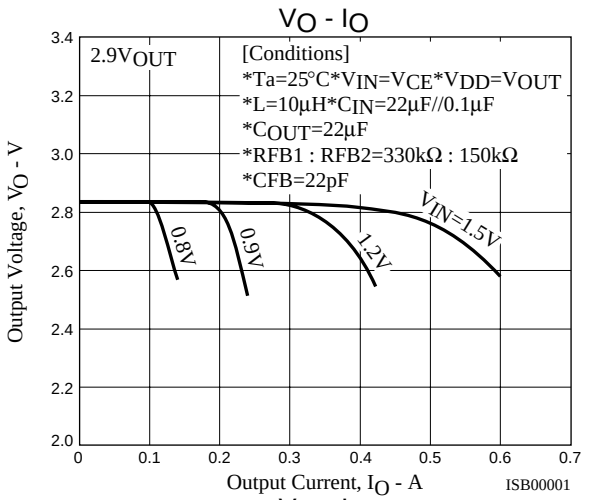
1) RFB: Set the ratio of RFB1 and RFB2 to be RFB1+RFB2≤2MΩ and VFB=0.9V.
2) CFB: Set fzfb=1/(2×π×CFB×RFB1) to be within 5kHz to 30kHz.
3) L, Co, RSENSE:

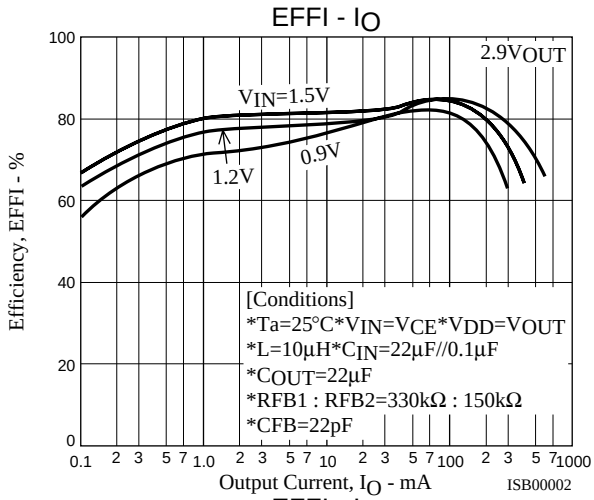
When ceramic capacitor is used for Co:	L=10µH, Co=10µF (SR10020, SR10040, SR10050, SR10070)
	L=22µH, Co=10µF (SR10030, SR10060)
	RSENSE=50mΩ (SR10060), 100mΩ (other than SR10060)
When tantalum capacitor is used for Co:	L=10µH, Co=47µF (SR10040, SR10050)
	L=22µH, Co=47µF (SR10020, SR10070)
	L=47µH, Co=47µF (SR10030, SR10060)
	RSENSE=None (shorted)
When electrolytic capacitor is used for Co:	L=22µH, Co=100µF//2.2µF ceramic (SR10020, SR10070)
	L=47µH, Co=100µF//2.2µF ceramic (SR10030, SR10060)
	RSENSE=None (shorted)

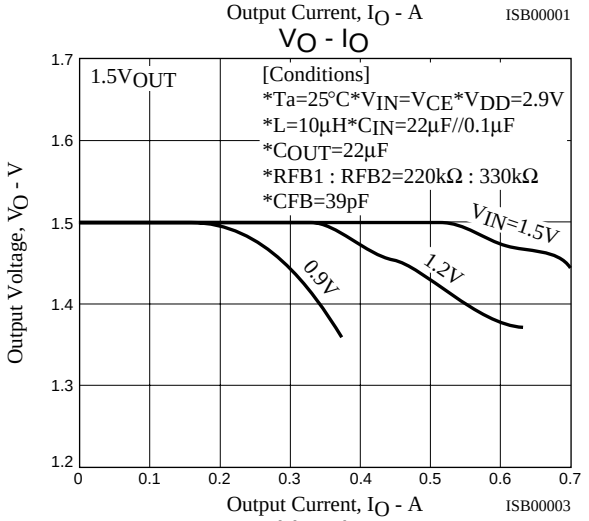
These constants of the components above should be changed if necessary for larger step-up ratio V_{OUT}/V_{IN} and larger output current I_{OUT} using the expression shown below as a reference.

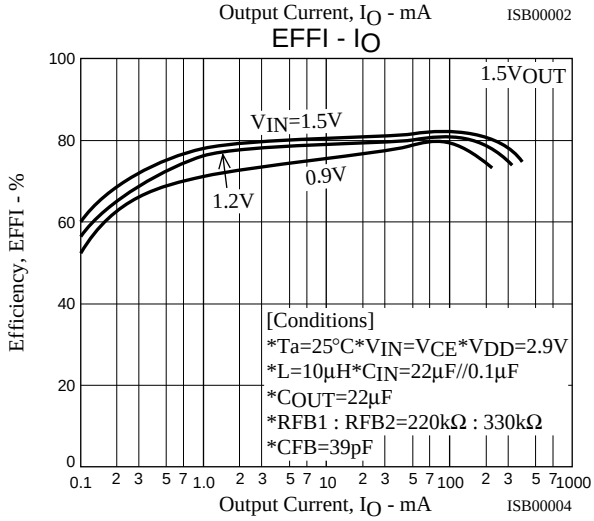
Co=(Standard Co*) × (I_{OUT} (mA) / 300mA × V_{OUT}/V_{IN})

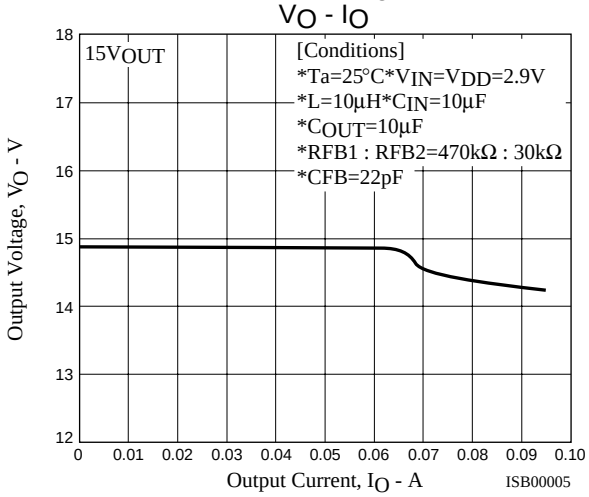
* Standard Co: values shown above

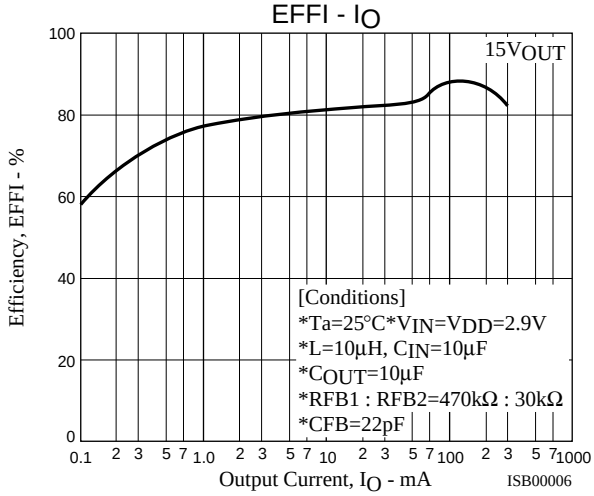

VO - IO
2.9VOUT
[Conditions]
*Ta=25°C*VIN=VCE*VDD=VOUT
*L=10µH*CIN=22µF//0.1µF
*COUT=22µF
*RFB1 : RFB2=330kΩ : 150kΩ
*CFB=22pF
0.8V
0.9V
1.2V
VIN=1.5V
Output Voltage, VO - V
Output Current, IO - A
ISB00001

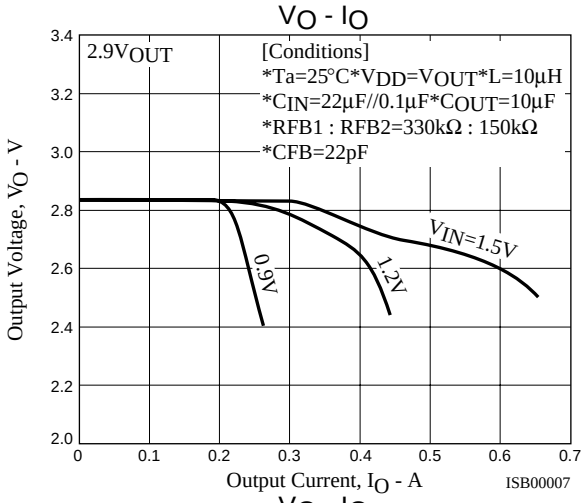

EFFI - IO
2.9VOUT
VIN=1.5V
0.9V
1.2V
[Conditions]
*Ta=25°C*VIN=VCE*VDD=VOUT
*L=10µH*CIN=22µF//0.1µF
*COUT=22µF
*RFB1 : RFB2=330kΩ : 150kΩ
*CFB=22pF
Efficiency, EFFI - %
Output Current, IO - mA
ISB00002

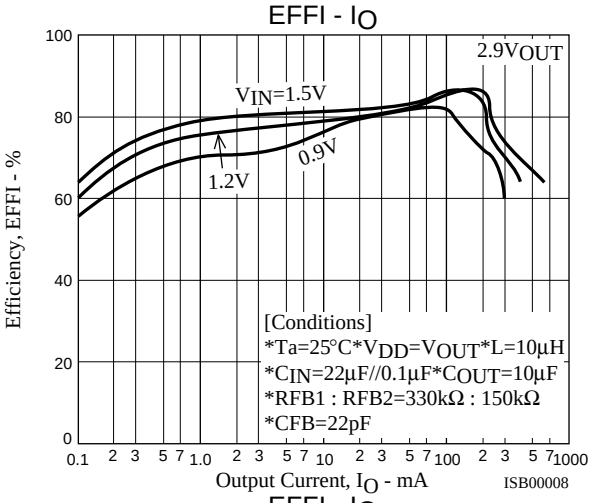

VO - IO
1.5VOUT
[Conditions]
*Ta=25°C*VIN=VCE*VDD=2.9V
*L=10µH*CIN=22µF//0.1µF
*COUT=22µF
*RFB1 : RFB2=220kΩ : 330kΩ
*CFB=39pF
VIN=1.5V
1.2V
0.9V
Output Voltage, VO - V
Output Current, IO - A
ISB00003

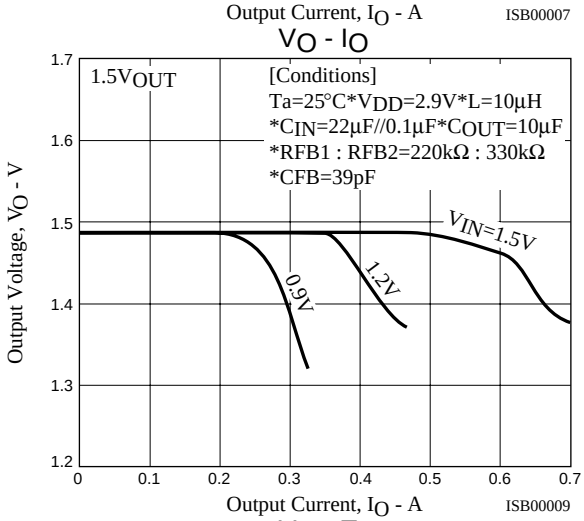

EFFI - IO
1.5VOUT
VIN=1.5V
0.9V
1.2V
[Conditions]
*Ta=25°C*VIN=VCE*VDD=2.9V
*L=10µH*CIN=22µF//0.1µF
*COUT=22µF
*RFB1 : RFB2=220kΩ : 330kΩ
*CFB=39pF
Efficiency, EFFI - %
Output Current, IO - mA
ISB00004

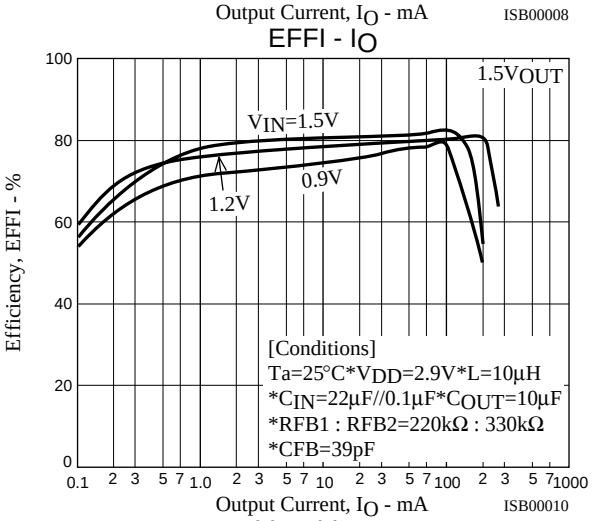

VO - IO
15VOUT
[Conditions]
*Ta=25°C*VIN=VDD=2.9V
*L=10µH*CIN=10µF
*COUT=10µF
*RFB1 : RFB2=470kΩ : 30kΩ
*CFB=22pF
Output Voltage, VO - V
Output Current, IO - A
ISB00005

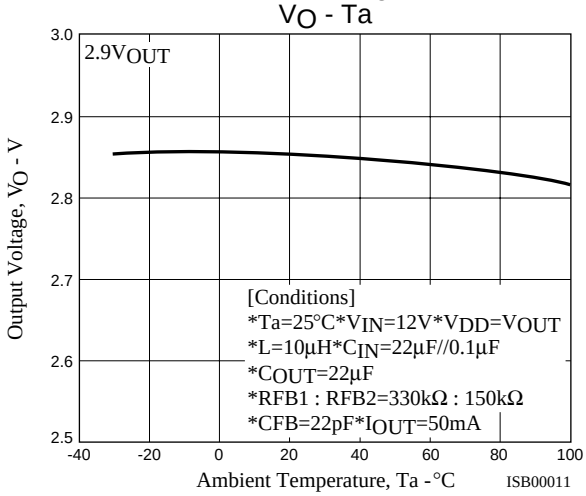

EFFI - IO
15VOUT
[Conditions]
*Ta=25°C*VIN=VDD=2.9V
*L=10µH, CIN=10µF
*COUT=10µF
*RFB1 : RFB2=470kΩ : 30kΩ
*CFB=22pF
Efficiency, EFFI - %
Output Current, IO - mA
ISB00006

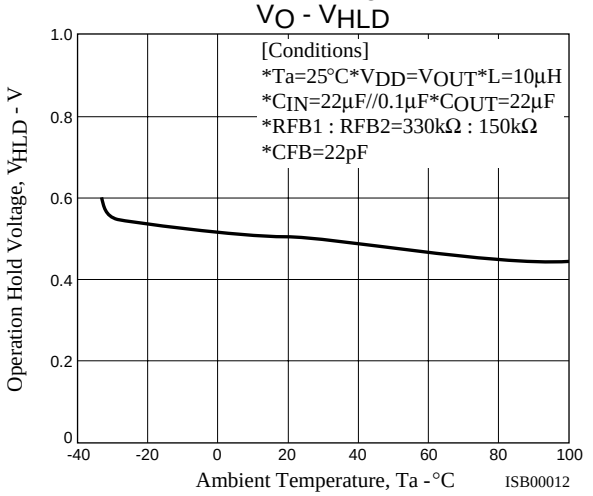

VO - IO
2.9VOUT
[Conditions]
*Ta=25°C*VDD=VOUT*L=10µH
*CIN=22µF//0.1µF*COUT=10µF
*RFB1 : RFB2=330kΩ : 150kΩ
*CFB=22pF
VIN=1.5V
1.2V
0.9V
Output Voltage, VO - V
Output Current, IO - A
ISB00007


EFFI - IO
2.9VOUT
VIN=1.5V
0.9V
1.2V
[Conditions]
*Ta=25°C*VDD=VOUT*L=10µH
*CIN=22µF//0.1µF*COUT=10µF
*RFB1 : RFB2=330kΩ : 150kΩ
*CFB=22pF
Efficiency, EFFI - %
Output Current, IO - mA
ISB00008


VO - IO
1.5VOUT
[Conditions]
Ta=25°C*VDD=2.9V*L=10µH
*CIN=22µF//0.1µF*COUT=10µF
*RFB1 : RFB2=220kΩ : 330kΩ
*CFB=39pF
VIN=1.5V
1.2V
0.9V
Output Voltage, VO - V
Output Current, IO - A
ISB00009


EFFI - IO
1.5VOUT
VIN=1.5V
0.9V
1.2V
[Conditions]
Ta=25°C*VDD=2.9V*L=10µH
*CIN=22µF//0.1µF*COUT=10µF
*RFB1 : RFB2=220kΩ : 330kΩ
*CFB=39pF
Efficiency, EFFI - %
Output Current, IO - mA
ISB00010


VO - Ta
2.9VOUT
[Conditions]
*Ta=25°C*VIN=12V*VDD=VOUT
*L=10µH*CIN=22µF//0.1µF
*COUT=22µF
*RFB1 : RFB2=330kΩ : 150kΩ
*CFB=22pF*IOUT=50mA
Output Voltage, VO - V
Ambient Temperature, Ta -°C
ISB00011


VO - VHLD
[Conditions]
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*CIN=22µF//0.1µF*COUT=22µF
*RFB1 : RFB2=330kΩ : 150kΩ
*CFB=22pF
Operation Hold Voltage, VHLD - V
Ambient Temperature, Ta -°C
ISB00012

<Manufactured by>

ISB Business Unit, Electronic Device Company,
Component & Device Group, SANYO Electric Co., Ltd.

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