Description

The YB1900C is a high side slew rate controlled smart load switch. The slew rate control in YB1900C can effectively avoid the large in-rush current which is commonly observed in normal power switches. Moreover, the level shift in YB1900C allows customers to control 1.8 to 5.5V system with 1.5V logic and without sacrificing leakage current.

The YB1900C has typical low $R_{DS(on)}$ around 100mΩ, which allows large power handling capabilities. Very low quiescent current and fast load discharge also makes it ideal for power sensitive applications nowadays.

The YB1900C is available in SOT23-5 or SOT23-6 package with the temperature range valid from -40 to 85℃.

Features

- 1.8V to 5.5V Input Voltage Range
- Slew Rate Limited at 100μs
- Very Low $R_{DS(on)}$, Typically 100mΩ
- Less than 1μA Shutdown Current
- Output Voltage As Low As 0.6V
- Very Low Quiescent Current, Typically 2μA
- Fast Shutdown Load Discharge
- TTL / CMOS Input Logic Level
- 4KV ESD Rating
- EMI Free Circuit
- SOT23-5 or SOT23-6 Package
- Green Package (RoHS) Available

Applications

- Cellular and Smart Phones
- Hot Swap Supplies
- Microprocessors and DSP Core Supplies
- PDAs
- MP3 Players
- Digital Still and Video Cameras
- Portable Instruments

Typical Application Circuit

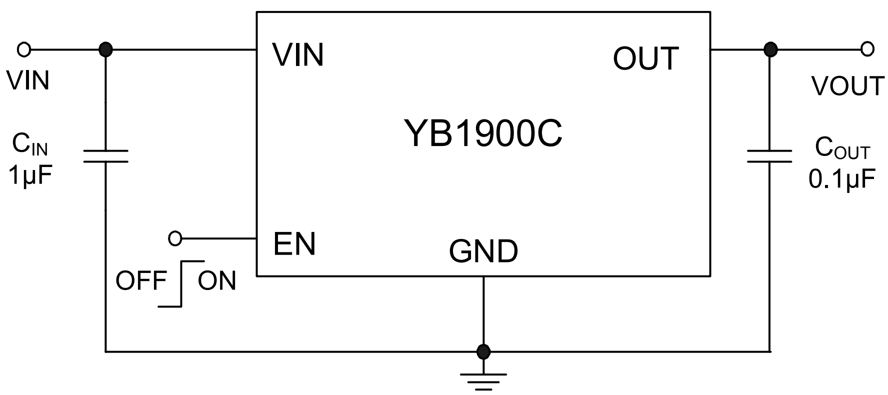


Figure 1: Typical Application Circuit

Pin Configuration

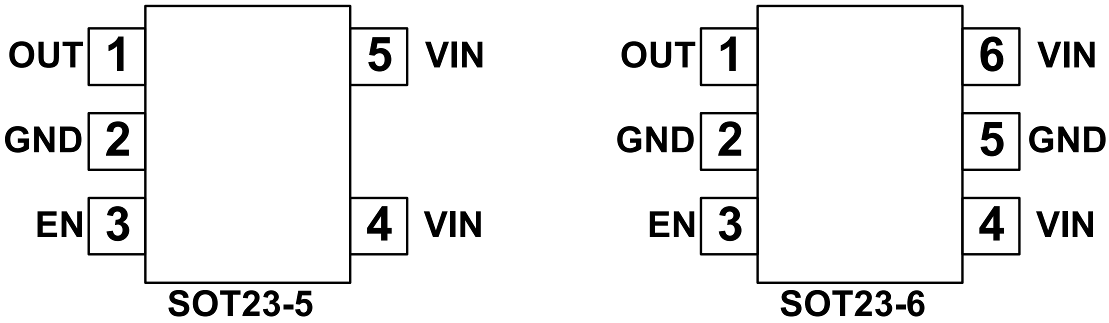


Figure 2: Pin Configuration

Pin Assignment &Description

Table 1
FOR SOT23-5

Pin	Name	Description
1	OUT	Switch output drain of P-channel power MOSFET.
2	GND	Ground pin. Connect directly to local ground plane.
3	EN	Enable control input.
4, 5	VIN	Switch input source of P-channel power MOSFET.

Table 2
FOR SOT23-6

Pin	Name	Description
1	OUT	Switch output drain of P-channel power MOSFET.
2, 5	GND	Ground pin. Connect directly to local ground plane.
3	EN	Enable control input.
4, 6	VIN	Switch input source of P-channel power MOSFET.

Ordering Information

Table 3

Order Number	Package Type	Supplied As	Package Marking
YB1900ST25	SOT23-5	3000 Units Tape & Reel	Y9C
YB1900ST26	SOT23-6	3000 Units Tape & Reel	Y9C

Absolute Maximum Ratings (Note 1)

V_{IN} to GND .... -0.3V to 6V
V_{EN} to GND .... -0.3V to 6V
OUT to GND .... -0.3V to 6V
Maximum Current 1.5A
Junction Temperature .... 150℃
Storage Temperature .... -65℃ to 150℃
Lead Temperature .... 300℃
ESD HBM 4KV
ESD MM 200V

Recommended Operating Conditions
(Note 2)

Supply Voltage VIN................. 1.8V to 5.5V
Operating Temperature......... -40℃ to 85℃
Output Current........................... 0V to 1.2A

Thermal Resistance

θ_{JA}.. 220℃/W
(Note 3)

Note:
1. Exceeding these ratings may damage the device.
2. The device is not guaranteed to function outside of its operating conditions.
3. θ_{JA} is measured in the natural convection at T_A = 25℃ on a low effective thermal conductivity board.

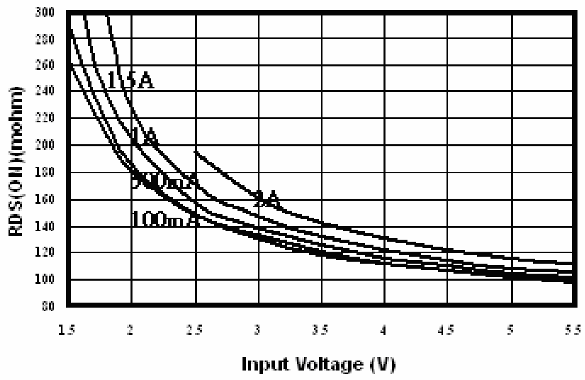
Electrical Characteristics

Table 4 (V_{IN}=5V, V_{EN}=1.5V, T_A=25°C, unless otherwise noted.)

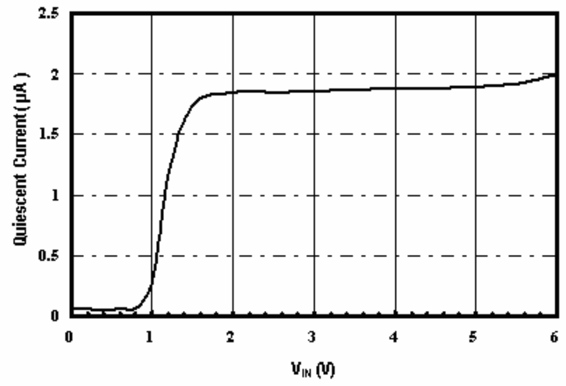
Description	Symbol	Test Conditions	MIN	TYP	MAX	Units
Input Voltage	V_{IN}		1.8	5	5.5	V
Quiescent Current	I_Q	V_{EN} = 1.5V		2	5	μA
Shutdown Current	I_{SD}	V_{EN} = 0V, OUT = open		0.1	1	μA
Off Switch Current	I_{SO}	V_{EN} = 0V, V_{OUT} = 0V		0.1	1	μA
On Resistance	$R_{DS(ON)}$	V_{IN} = 5V @ 100mA		100	130	mΩ
		V_{IN} = 4.2V @ 100mA		110	140	
		V_{IN} = 3V @ 100mA		130	160	
		V_{IN} = 1.8V @ 100mA		200	250	
EN Input Logic Low	V_{IL}	R_{OUT} = 10Ω		0.6		V
EN Input Logic High	V_{IH}	R_{OUT} = 10Ω		0.8		V
EN Input Leakage	I_{EN}	V_{EN} = 5.5V		0.1	1	μA
Output Turn-On Delay	$T_{D(ON)}$	R_{OUT} = 10Ω		40	80	μs
Output Turn-On Rise Time	T_{ON}	R_{OUT} = 10Ω		100		μs
Output Turn-Off Delay	$T_{D(OFF)}$	R_{OUT} = 10Ω		4	10	μs
Output Pull-Down Resistance	R_{PD}	V_{EN} = 0V		150	250	Ω

Typical Performance Characteristics

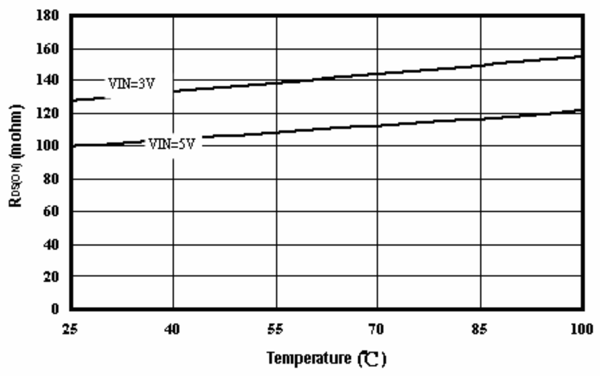
$R_{DS(ON)}$ vs. V_{IN}



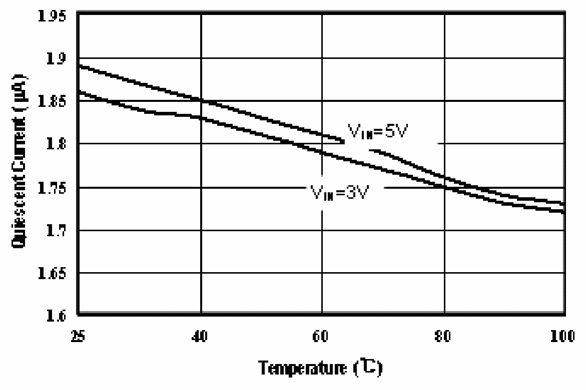
Quiescent Current vs. Input Voltage



$R_{DS(ON)}$ vs. Temperature

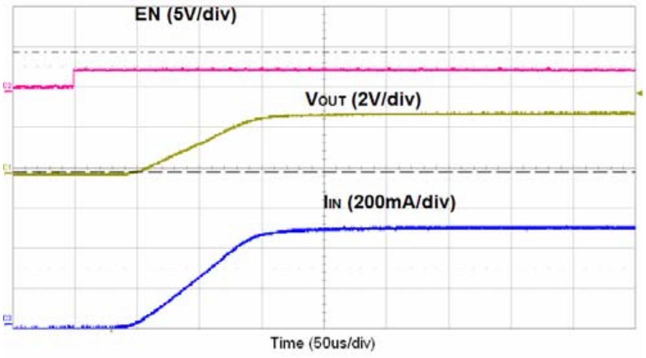


Quiescent Current Temperature

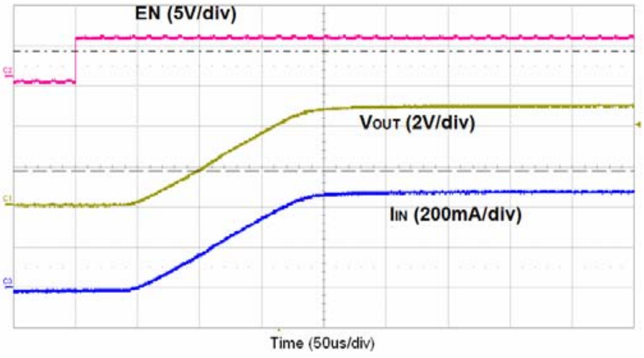


Typical Performance Characteristics

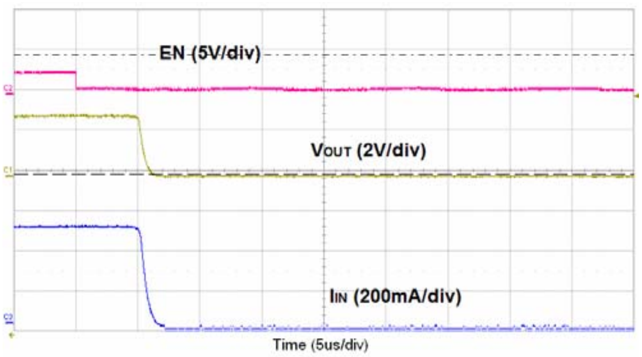
Turn-On Transient Response
(V_{IN}=3V, R_L=6Ω)



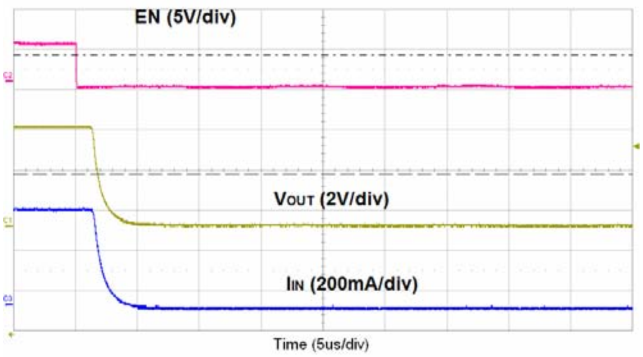
Turn-On Transient Response
(V_{IN}=5V, R_L=10Ω)



Turn-Off Transient Response
(V_{IN}=3V, R_L=6Ω)



Turn-Off Transient Response
(V_{IN}=5V, R_L=10Ω)



Function Block

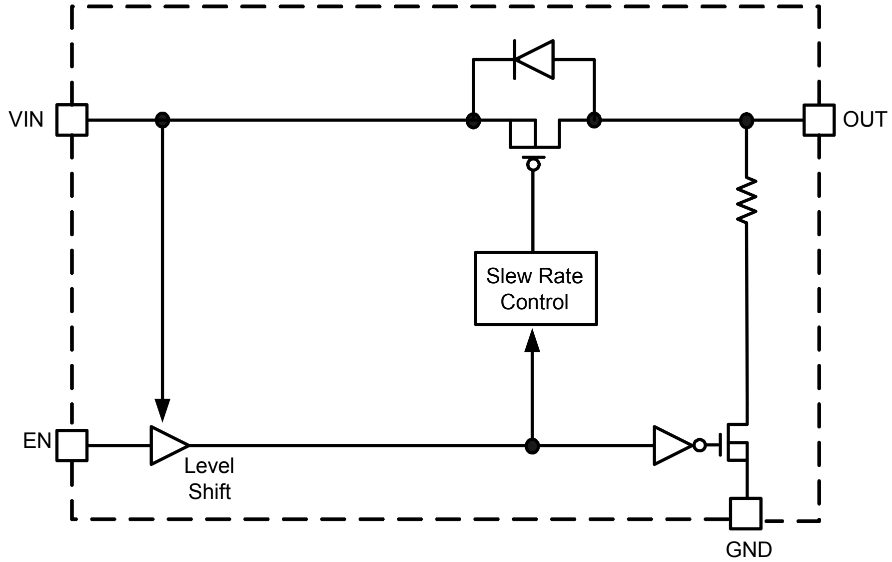


Figure 3: Function Block

Application Information

The YB1900C features very low quiescent current and very low $R_{DS(ON)}$ and making them ideal for battery-powered applications. The ENABLE control pin is TTL compatible and driven by 1.5V beyond making the YB1900C an ideal level-shifting load switch.

Input Capacitor Selection

A 1μF or larger input capacitor is recommended to prevent load transients from affecting upstream circuits. C_{IN} should be located as close to the device V_{IN} pin as practically. No specific required type of capacitor is recommended for normal operation. However, for higher current operation, ceramic capacitors are recommended for C_{IN}.

Output Capacitor Selection

For proper slew operation, a 0.1μF or greater is recommended. The output capacitor has also no specific capacitor type requirement. If desired, C_{OUT} may be increased without limit to accommodate any load transient.

Reverse Output-to-Input Voltage Conditions and Protection

Under normal conditions, there is a parasitic diode between the output & input of the load switch. In case of V_{OUT} exceeding V_{IN}, this would forward bias the internal parasitic diode and allow excessive current flow into the V_{OUT} pin and possibly damage the load switch.

In applications, where there is a possibility of V_{OUT} exceeding V_{IN} for brief periods of time during operation, the use of larger value C_{IN} capacitor is highly recommended. A larger value of C_{IN} with respect to C_{OUT} will affect a slower C_{IN} decay rate during shutdown, thus preventing V_{OUT} from exceeding V_{IN}.

In case of extended period of time for V_{OUT} exceeding V_{IN}, it is recommended to place a Schottky diode from V_{IN} to V_{OUT}.

Thermal Considerations

The YB1900C is designed to deliver a continuous load current. The maximum limit is package power dissipation. At any given ambient temperature, the maximum package power dissipation can be determined by the following equation:

$$P_{D(MAX)} = [T_{J(MAX)} - T_A] / \theta_{JA}$$

Constraints for the YB1900C are maximum junction temperature $T_{J(MAX)}$ = 125℃, and package thermal resistance, θ_{JA} = 220℃/W. The maximum continuous output current for YB1900C depends on package power dissipation and the $R_{DS(ON)}$ of MOSFET at $T_{J(MAX)}$. Typical conditions are calculated under normal ambient condition where T_A = 25℃. At 85℃, $P_{D(MAX)}$ = 181mW, and at T_A = 25℃, $P_{D(MAX)}$ = 454mW.

The maximum current is calculated by the following equation:

$$I_{OUT} < (P_{D(MAX)} / R_{DS(MAX)})^{1/2}$$

For example, if V_{IN} = 5V, $R_{DS(MAX)}$ = 130mΩ and T_A = 25℃, $I_{OUT(MAX)}$ = 1.8A. If temperature is raised to 125℃, the $R_{DS(MAX)}$ will be increased to 180mΩ due to positive temperature coefficient, and $I_{OUT(MAX)}$ should be reduced to 1.5A.

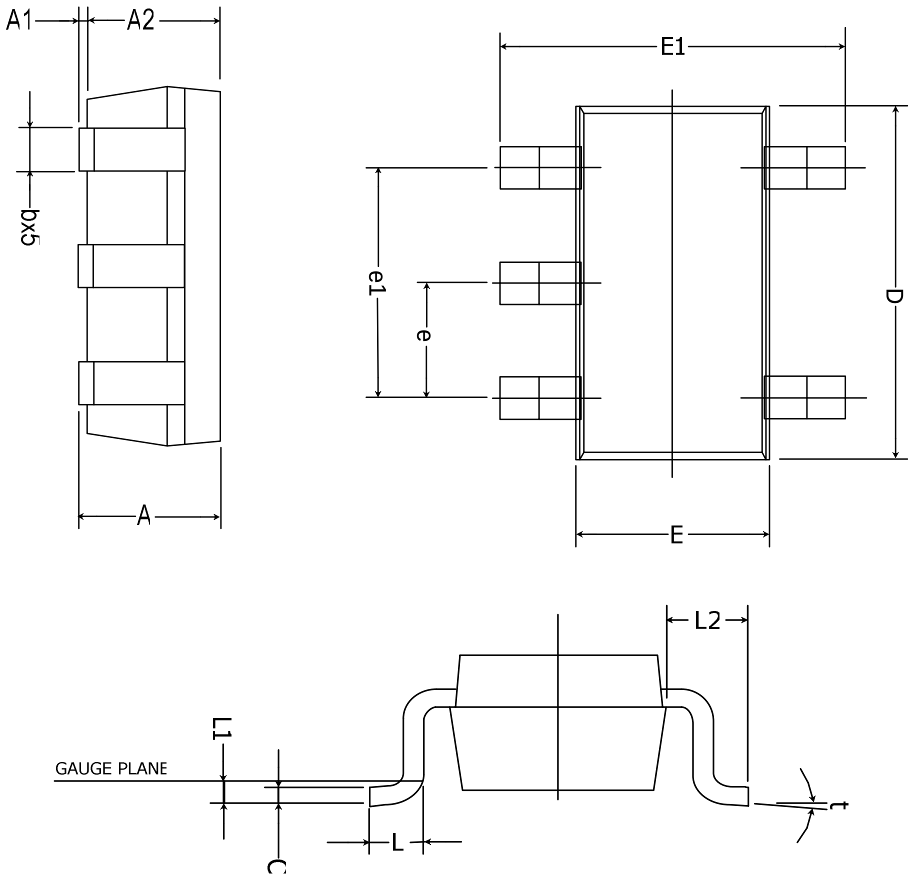
If the output load current were very close to $I_{OUT(MAX)}$ and the ambient temperature were to increase, the internal die temperature would increase, and the device would be damaged.

PCB Layout Consideration

To maximize YB1900C performance, some board layout rules should be followed:

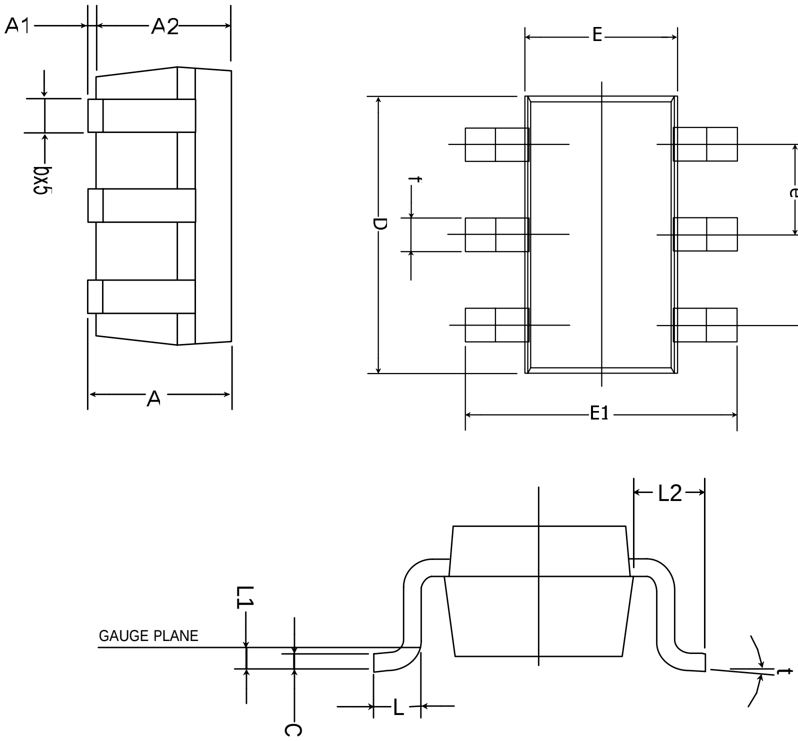
V_{IN} and V_{OUT} should be routed using wider than normal traces, and GND should be connected to a ground plane. For best performance, C_{IN} and C_{OUT} should be placed close to the package pins.

Package Information (SOT23-5)



Symbol	milimeters		Inches	
	MIN.	MAX.	MIN.	MAX.
A	0.95	1.45	.037	.057
A1	0.05	0.15	.002	.006
A2	0.90	1.30	.035	.051
b	0.30	0.50	.0118	.019
C	0.08	0.20	.0031	.0078
D	2.84	3.00	.1118	.118
E	1.50	1.70	.059	.0669
E1	2.60	3.00	.102	.118
e	0.95 BSC.		.0374 BSC.	
e1	1.90 BSC.		.0748 BSC.	
L	0.35	0.55	.0137	.0216
L1	0.10 BSC.		.0039 BSC.	
L2	0.60 REF.		.0236 REF.	
t	0°	8°	0°	8°

Package Information (SOT23-6)



Symbol	milimeters		Inches	
	MIN.	MAX.	MIN.	MAX.
A	0.95	1.45	.037	.057
A1	0.05	0.15	.002	.006
A2	0.90	1.30	.035	.051
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C	0.08	0.20	.0031	.0078
D	2.84	3.00	.1118	.118
E	1.50	1.70	.059	.0669
E1	2.60	3.00	.102	.118
e	0.95 BSC.		.0374 BSC.	
e1	1.90 BSC.		.0748 BSC.	
f	0.50 BSC.		.0197 BSC.	
L	0.35	0.55	.0137	.0216
L1	0.10 BSC.		.0039 BSC.	
L2	0.60 BSC.		.0236 BSC.	
t	0°	8°	0°	8°

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