TS1900

Ultra Low Quiescent Current Smart Load Switch

SOT-25

Pin Definition:
1. Output
2. Ground
3. Enable
4. Input
5. Input

General Description

TS1900 is a high side slew rate controlled smart load switch. The slew rate control in TS1900 can effectively avoid the large in-rush current which is commonly observed in normal power switches. Moreover, the level shift in TS1900 allows customers to control 1.8 to 6.5V system with 1.5V logic and without sacrificing leakage current.
TS1900 has typical low $R_{DS(on)}$ at 100mΩ, it allows large power handling capabilities. And very low quiescent current and fast load discharge make it ideal for power sensitive applications nowadays.

Features

- 1.8 to 6.5V Input Voltage Range
- Slew Rate Limited at 100uS
- Very Low $R_{DS(ON)}$, Typically 100mΩ
- Less than 1uA Shutdown Current
- Very Low Quiescent Current, Typically 2uA
- Fast Shutdown Load Discharge
- Thermal Fault Protection
- TTL / CMOS Input Logic Level
- 2KV ESD Rating
- EMI Free Circuit

Ordering Information

Part No.	Package	Packing
TS1900CX5 RF	SOT-25	3Kpcs / 7" Reel

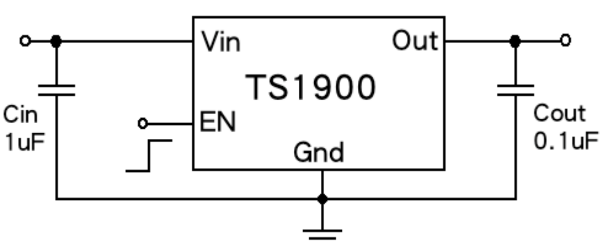
Pin Description

Pin	Name	Function
1	Out	Drain of P-CH Power MOSFET
2	Gnd	Gnd Pin. Connect directly to local ground plane.
3	EN	Enable Control Input
4,5	Vin	Source of P-CH Power MOSFET

Applications

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

Application Circuit



Absolute Maximum Rating

Parameter	Symbol	Limit	Unit
Input Supply Voltage	V_{IN} to Gnd	-0.3 to 6.5	V
Enable to Ground Voltage	V_{EN} to Gnd	-0.3 to 6.5	V
Output to Ground Voltage	V_{OUT} to Gnd	-0.3 to 6.5	V
Power Dissipation	P_D	Internally Limited	
Maximum Continues Current	$I_{CONTINUE}$	2.2	A
Junction Temperature Range	T_J	+150	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C
ESD HBM / MM		2 / 200	KV / V

Recommended Operating Conditions (Note 2)

Parameter	Symbol	Limit	Unit
Supply Voltage	V_{IN}	-0.3 to 6.5	V
Operating Temperature Range	T_{OPR}	-40 to +85	°C
Junction to Ambient Thermal Resistance (PCB mounted)	$R\Theta_{JA}$	220	°C/W

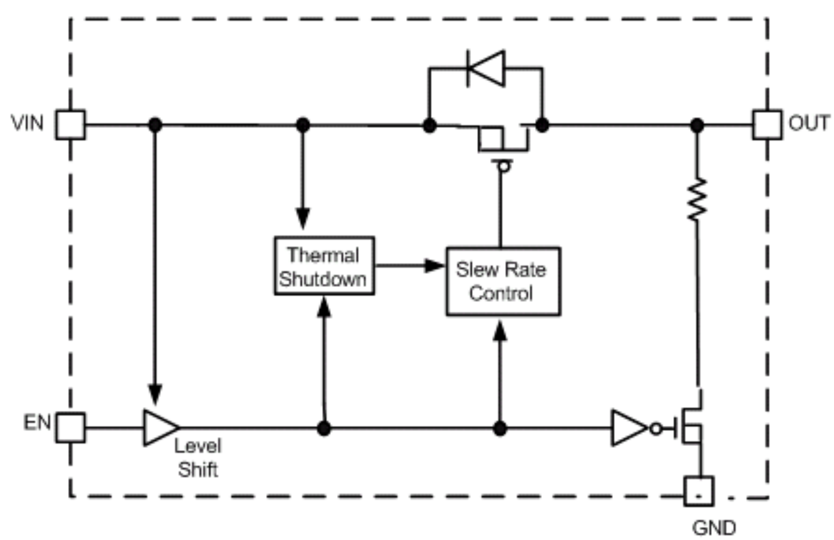
Note: 1. Exceeding these ratings may damage the device.

2. The device is not guaranteed to function outside of its operating conditions.

Electrical Specifications (V_{IN}=5V, V_{EN}=1.5V, T_A=25°C, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	TYP	MAX	Units
Input Voltage	V_{IN}		1.8	5	6.5	V
Quiescent Current	I_Q	V_{EN}=1.5V	--	2	4	μA
Shutdown Current	I_{SD}	V_{EN}=0V, Out = Open	--	0.05	1	μA
Off Switch Current	I_{SO}	V_{EN}=0V, V_{OUT} = 0	--	0.05	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	--	--	0.4	V
EN Input Logic High	V_{IH}	R_{OUT} = 10Ω	1	--	--	V
EN Input Leakage	I_{SINK}	V_{EN}=5.5V	--	0.01	1	μA
Output Turn-On Delay	$T_{D(ON)}$	R_{OUT} = 10Ω	--	40	80	uS
Output Turn-On Rise Time	T_{ON}	R_{OUT} = 10Ω	--	100	150	uS
Output Turn-Off Delay	$T_{D(OFF)}$	R_{OUT} = 10Ω	--	4	10	uS
Output Pull-Down Resistance	R_{PD}	V_{EN}=0V	--	150	250	Ω
Thermal Shutdown Temperature	T_{SD}		140	160	180	°C
Thermal Recovery Temperature	T_R		120	140	160	°C

Block Diagram



Application Information

The TS1900 featured very low quiescent current and very low RDS(ON) and making them ideal for battery-powered applications. The ENABLE control pin is TTL compatible and driven by 1.5V beyond making the TS1900 an ideal level-shifting load switch.

Input Capacitor Selection

A 1UF 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. There is no specific requirement type of capacitor is recommended. However, for higher current operation, ceramic capacitors are recommended for C_{IN}.

$L=[V_{OUT}$ X $(V_{IN}-V_{OUT})]$ / $[V_{IN}$ X $(\Delta I_L$ X$(F_{OSC}]$

Where ΔI_L is the inductor ripple current. Larger inductance is recommended for better efficiency in light load condition.

Output Capacitor Selection

For proper slew operation, a 0.1uF or greater is recommended. The output capacitor has also no specific capacitor type requirement. If desired, C_{OUT} maybe 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 TS1900 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 TS1900 are maximum $T_{J(MAX)}$ = 125°C, and package thermal resistance, θ_{JA} = 120°C /W. The maximum continuous output current for TS1900 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°C At 85°C, $P_{D(MAX)}$ = 333mW. At T_A = 25□, $P_{D(MAX)}$ = 833mW.

The maximum current is calculated by the following equation:

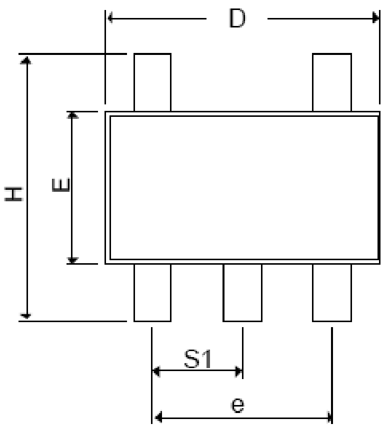
$I_{OUT} < (P_{D(MAX)} / R_{DS(MAX)})<(1/2)$

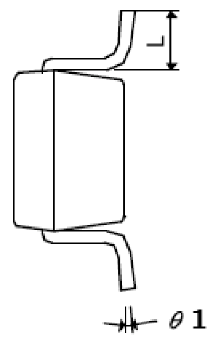
For example, if V_{IN} = 5V, $R_{DS(MAX)}$ = 160mΩ and T_A = 25℃, $I_{OUT(MAX)}$ = 2.2A.
Thermal Shutdown is employed to protect the device damage when over temperature 160°C.

PCB Layout Consideration

To maximize TS1900 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.

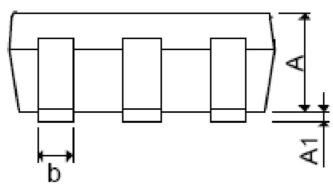
SOT-25 Mechanical Drawing





SOT-25 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX.
A+A1	0.09	1.25	0.0354	0.0492
B	0.30	0.50	0.0118	0.0197
C	0.09	0.25	0.0035	0.0098
D	2.70	3.10	0.1063	0.1220
E	1.40	1.80	0.0551	0.0709
E	1.90 BSC		0.0748 BSC	
H	2.40	3.00	0.09449	0.1181
L	0.35 BSC		0.0138 BSC	
Θ1	0º	10º	0º	10º
S1	0.95 BSC		0.0374 BSC	

Front View



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