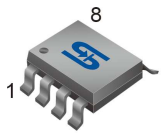
TAIWAN SEMICONDUCTOR

RoHS COMPLIANCE

TS2025

0.5A Dual Channel USB High-Side Power Switch

SOP-8



Pin Definition:

1. CTLA	8. OUTA
2. FLGA	7. IN
3. FLGB	6. GND
4. CTLB	5. OUTB

General Description

The TS2025 is integrated 90mΩ high-side power switch for self-powered and bus-powered Universal Serial Bus (USB) applications. This switch operates with input ranging from 2.7V to 6.5V, making it ideal for both 3V and 5V system. The protection includes current limiting with foldback, short circuit and thermal shutdown. Fault current is limited to typically 1A in accordance with the USB power requirements. The TS2025 is ideal for any system where current limiting and power control are desired. Guaranteed minimum output rise time limits inrush current during hot plug-in as well as minimizing EMI and prevents the voltage at upstream port from dropping excessively.

Features

- 90mΩ High-Side MOSFET Switch
- 0.5A Dual Continuous Load Current
- 80uA Quiescent Supply Current
- 1uA Maximum Shutdown Supply Current
- 2.7V to 6.5V Input Voltage Range
- 20Ω Open-Drain Over-Current Flag Output
- 2.3V Under-Voltage Lockout
- Current-Limit / Short Circuit Protection
- Thermal Shutdown Protection
- Soft Start prevents large Inrush Current.
- Reverse Current Blocking
- 9ms Error Flag Delay Time
- Enable Active-Low
- 8KV Contact ESD Capable
- 15KV Air ESD Capable

Ordering Information

Part No.	Package	Packing
TS2025CS RLG	SOP-8	2.5Kpcs / 13” Reel

Note: “G” denote for Halogen Free Product

Applications

- USB Power Management
- High-Side Power Protection Switch
- Hot Plug-In Power Supplies
- Battery-Charger Circuits
- Portable Application
- Digital Television

Absolute Maximum Rating

Parameter	Symbol	Limit	Unit
VIN Pin Voltage	V_{IN}	7	V
Fault Flag Voltage	V_{FLG}	7	V
CTL Input Voltage	V_{CTL}	-0.3 ~ 7	V
Operating Temperature Range	T_{OP}	-40 to +85	°C
Junction Temperature	T_J	+125	°C
Power Dissipation	P_D	350	mW
Storage Temperature Range	T_{STG}	-65 to +150	°C
Thermal Resistance from Junction to case	θ_{JC}	40	°C/W
Thermal Resistance from Junction to ambient	θ_{JA}	160	°C/W

Note: Absolute maximum rating are those values beyond which the life of a device may be impaired. The package is placed on a 2 layers PCB with 2oz copper and 2 in^2, connected by 8 vias.

Electrical Characteristics

(V_{IN}=5V, C_{IN}=C_{OUT}=1uF, T_A=25℃, unless otherwise noted)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
Input Voltage	V_{IN}		2.7	--	6.5	V
Supply Current	I_S	Switch On, Out=Open	--	80	160	uA
		Switch Off, Out=Open	--	0.2	2	uA
Shutdown Supply Current	I_{SD}	V_{IN}=3.6V, V_{EN}=0V	--	0.1	1	μA
Control Input Current	I_{IN-CTL}	V_{CTL}=Logic ”0”	--	0.01	0.1	uA
		V_{CTL}=Logic ”1”	--	0.01	0.1	uA
Current Limit Threshold	I_{LIMIT}		0.6	1.0	1.25	A
Output MOSFET Resistance	$RDS_{(ON)}$		--	90	--	mΩ
Output Turn-On Rise Time	T_{ON}	R_{LOAD}=10Ω each output	--	1000	2500	uS
Output Turn-Off Fall Time	T_{OFF}	R_{LOAD}=10Ω each output	--	0.7	20	uS
EN Input Threshold	V_{EN}	low-to-high transition	--	--	1.8	V
		High-to-low transition	0.6	--	--	
Output Leakage Current	$I_{LEAKAGE}$	EN=0, V_{OUT}=0V	--	0.5	1	uA
Short Circuit Current Fold-back	$I_{FOLDBACK}$	V_{OUT}=0V	--	0.45	--	A
Over Temperature Shutdown Threshold	OTP	T_J Increasing	--	150	--	°C
		T_J Decreasing	--	120	--	°C
Under Voltage Lockout Threshold	UVLO	V_{IN} Increasing	--	2.3	2.65	V
		V_{IN} Decreasing	--	2.1	--	
Over Current Flag Response Delay	FLG_{DELAY}		4	9	--	mS
FLG Output Resistance	R_{FLG}	I_{SINK}=1mA	--	20	--	Ω
FLG Off-State Current	$I_{FLG-OFF}$	V_{FLG}=5V	--	0.01	1	uA

Note: Specifications are production tested at T_A=25. Specifications over the -40℃ to 85℃ operatin g temperature range are assured by design. Characterization and correlation with statistical quality controls (SQC).

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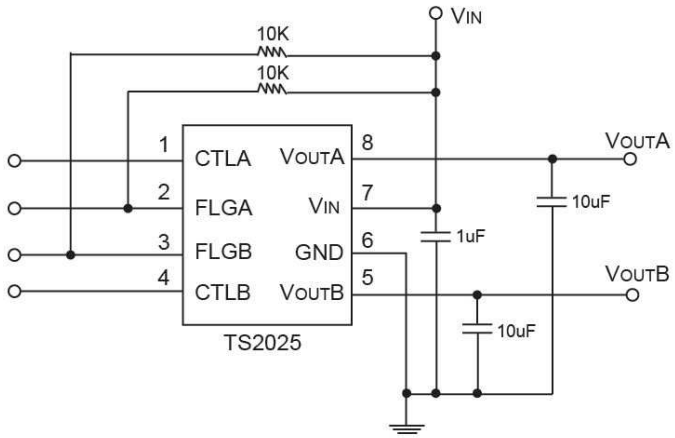
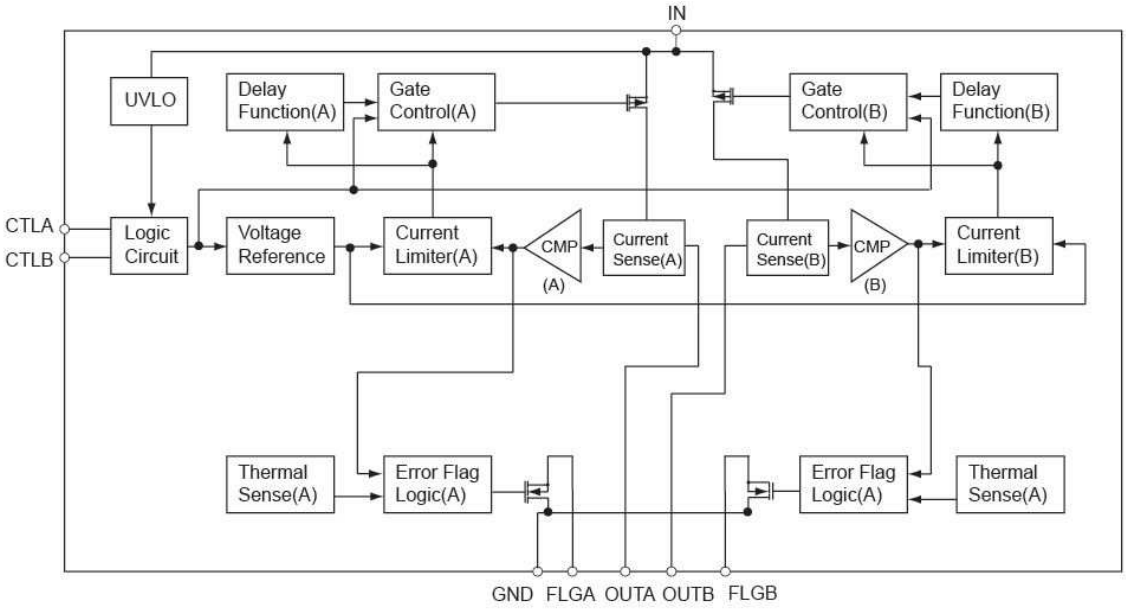
Typical Application Circuit



Block Diagram



Pin Function Description

Pin NO.	Pin Name	Pin Description
1	CTLA	Control the turn-on/turn-off of channel A MOSFET with TTL as a control input.
2	FLGA	An active-low and open drained fault flag output for channel A. FLGA is an indicator for current limit when CTLA is active. In normal mode operation (CTLA or/and CTLB is active), its also can indicate thermal shutdown or under-voltage
3	FLGB	An active-low and open drained fault flag output for channel B. FLGB is an indicator for current limit when CTLB is active. In normal mode operation (CTLB or/and CTLA is active), its also can indicate thermal shutdown or under-voltage
4	CTLB	Control the turn-on/turn-off of channel B MOSFET with TTL as a control input.
5	OUTB	Channel B MOSFET Switch Output
6	GND	Power Ground
7	IN	Power Supply Input
8	OUTA	Channel A MOSFET Switch Output

Application Information

Flag Output

An error Flag is an open-drained output of an N-channel MOSFET. Flag output is pulled low to signal the following fault conditions: input under-voltage, output current limit, and thermal shutdown. The current limit flag response delay time is 9ms.

Current Limit

The current limit threshold is preset internally. It protects the output MOSFET switches from damage resulting from undesirable short circuit conditions or excess inrush current, which is often encountered during hot plug-in. The error flag signals when any current limit conditions occur.

Thermal Shutdown

When temperature of TS2025 exceeds 150ºC for any reasons, the thermal shutdown function turns MOSFET switch off and signals the error flag. A hysteresis of 30ºC prevents the MOSFETs from turning back on until the chip temperature drops below 120ºC.

Enable Control

Enable must be driven logic low for a clearly defined input. Floating the input may cause unpredictable operation

Under-Voltage Lockout

UVLO (under-voltage lockout) prevents the output MOSFET from turning on until input voltage exceeds 2.3V typically. After the switch turns on, if the input voltage drops below 2.1V typically, UVLO shuts off the output MOSFET.

Supply Filtering

A 1uF bypass capacitor from USB IN to GND, located near the device, is strongly recommended to control supply transients. Without a bypass capacitor, an output short may cause sufficient ringing on the input (from supply lead inductance) to damage internal control circuitry

Transient Requirements

USB supports dynamic attachment (hot plug-in) of peripherals. A current surge is caused by the input capacitance of downstream device. Ferrite beads are recommended in series with all power and ground connector pins. Ferrite beads reduce EMI and limit the inrush current during hot attachment by filtering high-frequency signals.

Short Circuit Transient

Bulk capacitance provides the short-term transient current needed during a hot-attachment event. A 10uF/10V ceramic capacitor mounted close to downstream connect each port should provide transient drop protection

Printed Layout Circuit

The power circuitry of USB printed circuit boards requires a customized layout to maximize thermal dissipation and to minimize voltage drop and EMI

Electrical Characteristics Curve

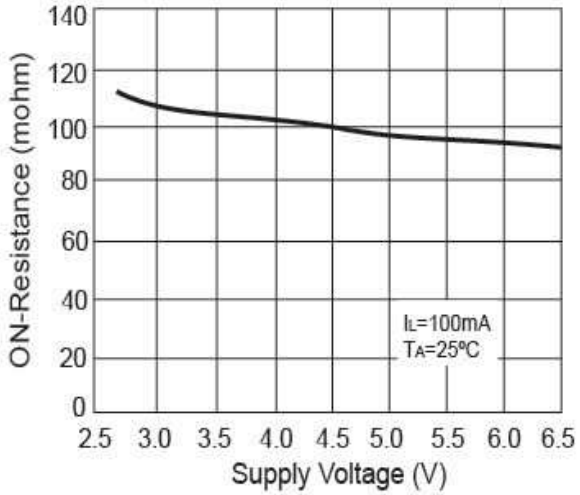


Figure 1. ON Resistance vs. Supply Voltage

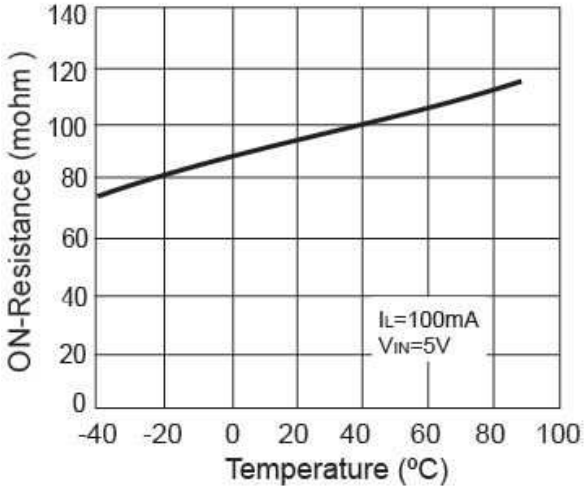


Figure 2. ON Resistance vs. Temperature

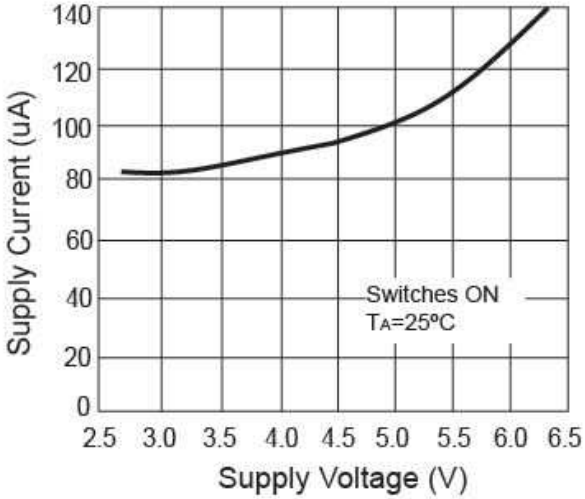


Figure 3. ON-State Current vs. Supply Voltage

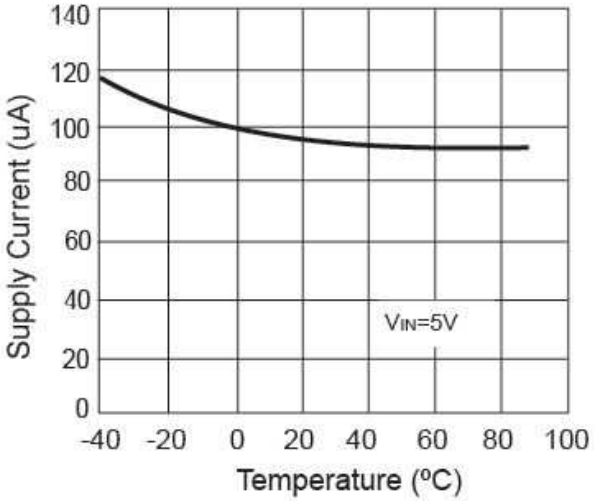


Figure 4. ON-State Current vs. Temperature

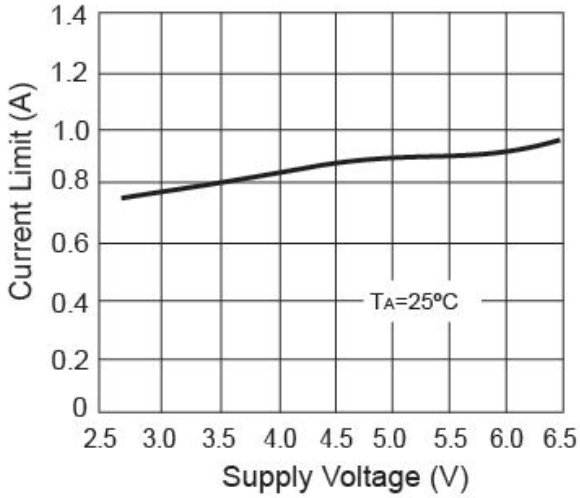


Figure 5. Current Limit vs. Supply Voltage

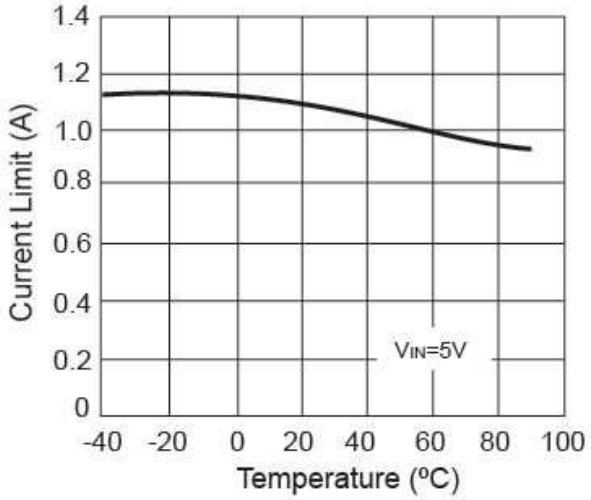


Figure 6. Current Limit vs. Temperature

Electrical Characteristics Curve

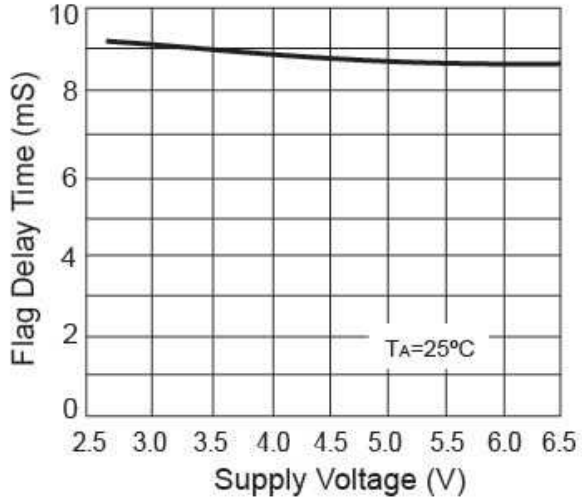


Figure 7. Flag Delay Time vs. Supply Voltage

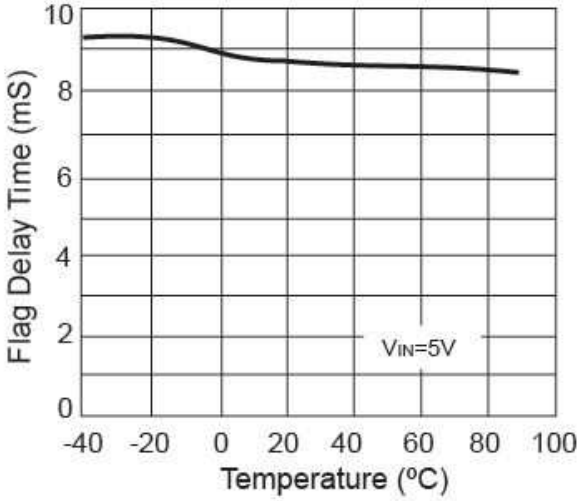


Figure 8. Flag Delay Time vs. Temperature

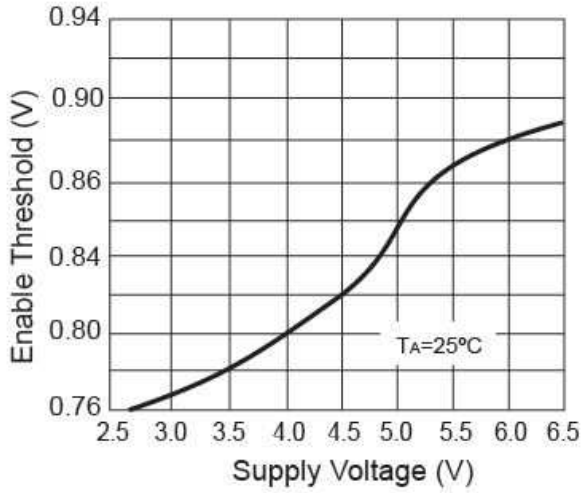


Figure 9. Enable Threshold vs. Supply Voltage

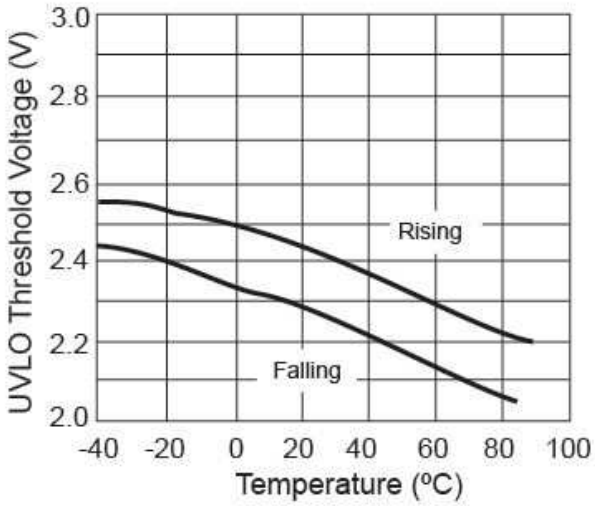


Figure 10. UVLO Threshold vs. Temperature

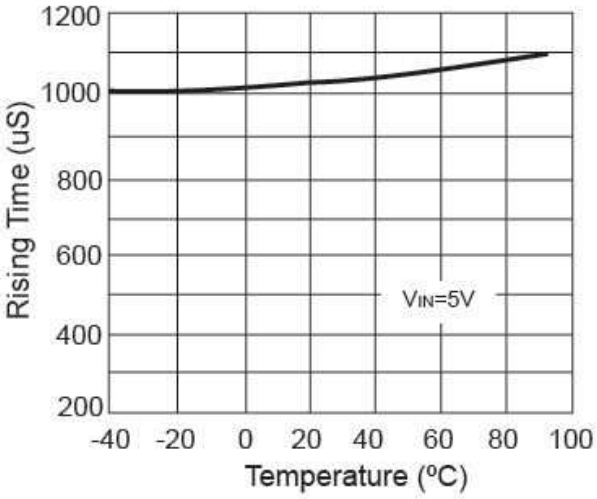


Figure 11. Rising Time vs. Supply Voltage

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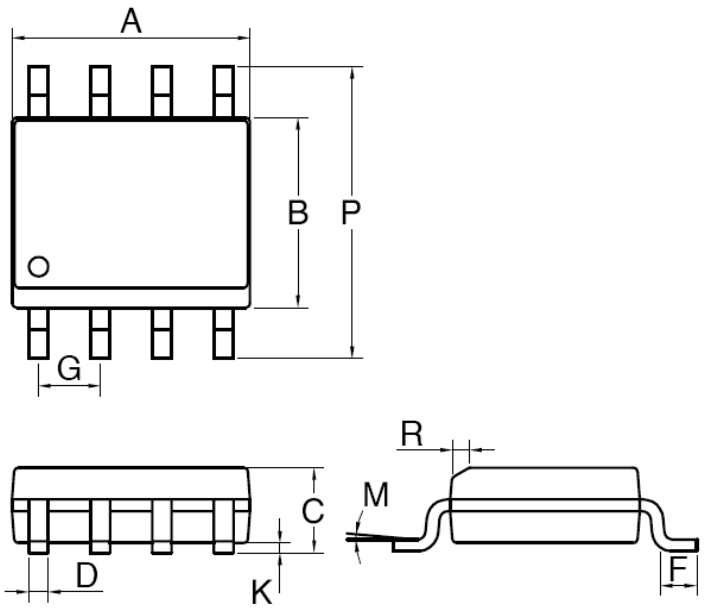
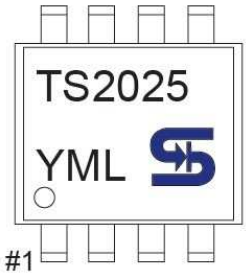
SOP-8 Mechanical Drawing



SOP-8 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX.
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27BSC		0.05BSC	
K	0.10	0.25	0.004	0.009
M	0º	7º	0º	7º
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

Marking Diagram



Y = Year Code

M = Month Code for Halogen Free Product
(**O**=Jan, **P**=Feb, **Q**=Mar, **R**=Apl, **S**=May, **T**=Jun, **U**=Jul, **V**=Aug, **W**=Sep, **X**=Oct, **Y**=Nov, **Z**=Dec)

L = Lot Code

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