



23m Ω , 5.5V 4A Single Channel Load Switch

General Description

The VS8401 is a small, low RON, single-channel load switch with controlled turnon. The device contains two N-channel MOSFETs that can operate over an input voltage range of 0.8 V to 5.5 V and can support a maximum continuous current of 4 A per channel. The switch is controlled by an on and off input (ON), which can interface directly with low-voltage control signals. In VS8401, a 220- Ω on-chip load resistor is added for quick-output discharge when switch is turned off.

The VS8401 is available in a small, space-saving DFN2X2 package (DPU) with integrated thermal pad allowing for high power dissipation. The device is characterized for operation over the free-air temperature range of 0°C to +105°C.

Ordering Information

Part Number	Package	Note
VS8401	DFN2X2	

Features

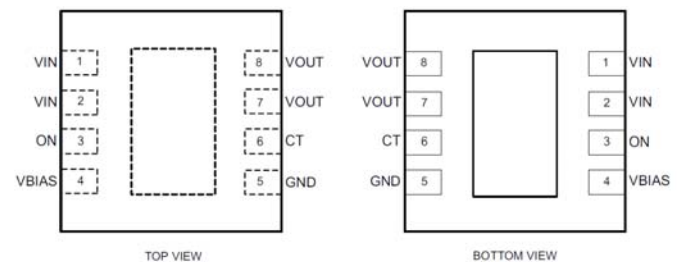
- Input Voltage Range: 0.8 V to 5.5 V
- Integrated Single-Channel Load Switch
- On-Resistance 23m Ω per Channel
- 4-A Maximum Continuous Switch Current
- Low Quiescent Current (46uA)
- Configurable Rise Time (CT pin)
- Quick Output Discharge (QOD) (Optional)
- DFN2X2 Package With Thermal Pad

- Thermal Protection

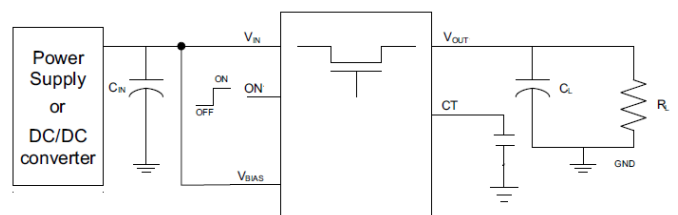
Applications

- Ultrabook
- Notebooks and Netbooks
- Tablet PCs
- Consumer Electronics
- Set-top Boxes and Residential Gateways
- Telecom Systems
- Solid-State Drives (SSD)

Pin Configuration



Typical Application Circuit

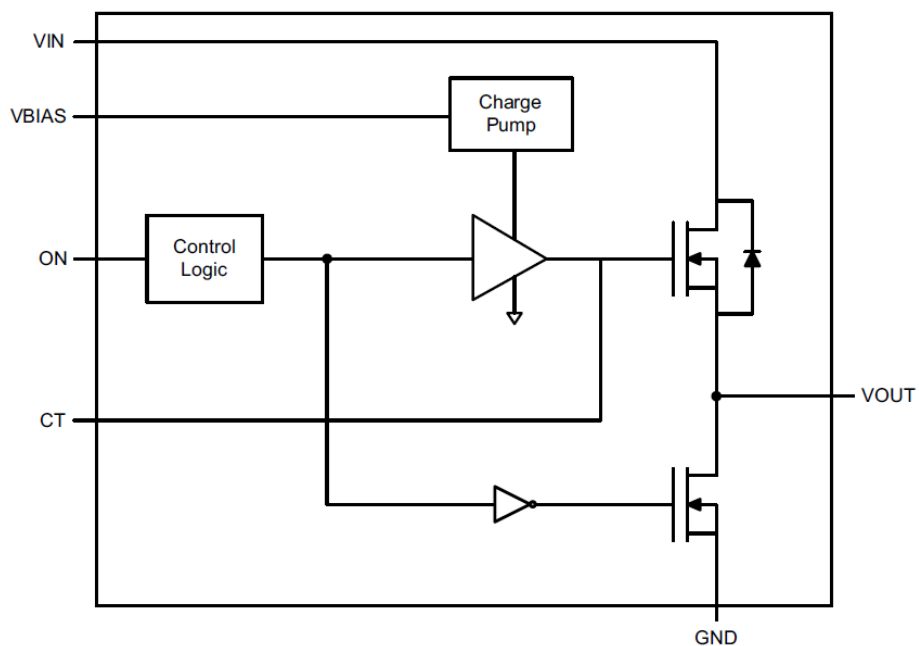




Pin Assignment

Pin Name	Pin No.	Pin Function
VIN	1,2	Switch input
ON	3	Active high switch control input. Do not leave floating
VBIAS	4	Bias voltage. Power supply to the device.
GND	5	Ground
CT	6	Switch slew rate control. Can be left floating.
VOUT	7,8	Switch output
Thermal PAD		Thermal pad (exposed center pad) to alleviate thermal stress. Tie to GND.

Function Block Diagram





Absolute Maximum Ratings (Note1)

- V_{IN} ----- -0.3V to +6.0V
- V_{OUT} ----- -0.3V to +6.0V
- V_{ON} ----- -0.3V to 6.0V
- V_{BIAS} ----- -0.3V to 6.0V
- I_{MAX} ----- 4A
- Junction Temperature----- 125°C
- Lead Temperature (Soldering, 10 sec.)----- 300°C
- Storage Temperature ----- -65°C to 150°C

Recommended Operating Conditions

- V_{IN} ----- 0.8V to V_{BIAS}
- V_{BIAS} ----- 2.5V to 5.5V
- V_{ON} ----- 0V to 5.5V
- Junction Temperature ----- 0°C to 105°C

Electrical Characteristics

$V_{BIAS}=5V$, $T_A=25^{\circ}C$, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
POWER SUPPLIES AND CURRENTS						
VBIAS quiescent current	I_{BIAS}	$I_{OUT} = 0\text{ mA}$, $V_{IN} = V_{ON} = V_{BIAS} = 5\text{ V}$	--	46	70	uA
VBIAS shutdown current	I_{BIAS_OFF}	$V_{ON} = 0\text{ V}$	--	--	2	uA
VIN off-state supply current (per channel)	I_{VIN_OFF}	$V_{ON} = 0\text{ V}$	--	--	3	uA
ON pin input leakage current	I_{ON}	$V_{ON} = 5.5\text{ V}$	--	--	1	uA
RESISTANCE CHARACTERISTICS						
ON-state resistance	R_{ON}	$V_{IN} = 5V$, $I_{OUT}=200mA$		23	33	mΩ
		$V_{IN} = 3.3V$, $I_{OUT}=200mA$		23	33	
		$V_{IN} = 1.8V$, $I_{OUT}=200mA$		23	33	
		$V_{IN} = 1.5V$, $I_{OUT}=200mA$	--	23	33	
		$V_{IN} = 1.2V$, $I_{OUT}=200mA$	--	23	33	
		$V_{IN} = 0.8V$, $I_{OUT}=200mA$	--	23	33	
VOUT Pull Down Resistor	R_{PD}		--	200	300	Ω



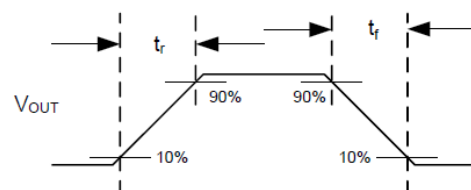
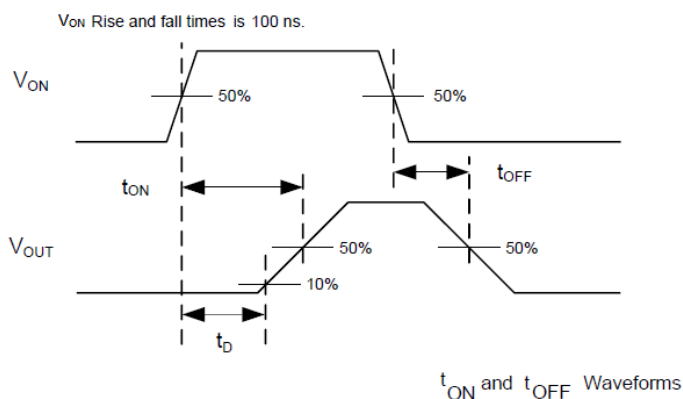
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$V_{BIAS}=2.5V$, $T_A=25^{\circ}C$, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
POWER SUPPLIES AND CURRENTS						
VBIAS quiescent current	I_{BIAS}	$I_{OUT} = 0\text{ mA}$, $V_{IN} = V_{ON} = V_{BIAS} = 2.5\text{ V}$	--	40	65	μA
VBIAS shutdown current	I_{BIAS_OFF}	$V_{ON} = 0\text{ V}$	--	--	2	μA
VIN off-state supply current	I_{VIN_OFF}	$V_{ON} = 0\text{ V}$	--	--	2	μA
ON pin input leakage current	I_{ON}	$V_{ON} = 5.5\text{ V}$	--	--	1	μA
RESISTANCE CHARACTERISTICS						
ON-state resistance (per channel)	R_{ON}	$V_{IN} = 2.5V$, $I_{OUT}=200mA$		24	38	$m\Omega$
		$V_{IN} = 1.8V$, $I_{OUT}=200mA$		24	38	
		$V_{IN} = 1.5V$, $I_{OUT}=200mA$		24	38	
		$V_{IN} = 1.2V$, $I_{OUT}=200mA$	--	24	38	
		$V_{IN} = 1.0V$, $I_{OUT}=200mA$	--	24	38	
		$V_{IN} = 0.8V$, $I_{OUT}=200mA$	--	24	38	
VOUT Pull Down Resistor	R_{PD}		--	200	330	Ω

$V_{BIAS}=5V$ or $2.5V$, $T_A=25^{\circ}C$, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
ON INPUT SUPPLY						
High-level input voltage	V_{ON_H}		1.1	--	--	V
Low-level input voltage	V_{ON_L}		--	--	0.5	V
Thermal Shutdown Protection						
Thermal Shutdown	T_{THER_OFF}		--	150	--	$^{\circ}C$
Thermal Hysteresis	T_{THER_HY}		--	35	--	$^{\circ}C$





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Timing Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
V_{IN} = V_{ON} = V_{BIAS} = 5V, T_A = 25°C						
Turnon Time	T _{ON}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		1320		uS
Turnoff Time	T _{OFF}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		2		
Vout Rise Time	T _R	R _L =10Ω, C _L =0.1uF, C _T =1000pF		1768		
Vout fall Time	T _F	R _L =10Ω, C _L =0.1uF, C _T =1000pF		3		
ON Delay Time	T _D	R _L =10Ω, C _L =0.1uF, C _T =1000pF		272		
V_{IN} = 0.8V, V_{ON} = V_{BIAS} = 5V, T_A = 25°C						
Turnon Time	T _{ON}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		340		uS
Turnoff Time	T _{OFF}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		20		
Vout Rise Time	T _R	R _L =10Ω, C _L =0.1uF, C _T =1000pF		225		
Vout fall Time	T _F	R _L =10Ω, C _L =0.1uF, C _T =1000pF		3		
ON Delay Time	T _D	R _L =10Ω, C _L =0.1uF, C _T =1000pF		220		
V_{IN} = V_{ON} = V_{BIAS} = 3.3V, T_A = 25°C						
Turnon Time	T _{ON}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		2900		uS
Turnoff Time	T _{OFF}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		2		
Vout Rise Time	T _R	R _L =10Ω, C _L =0.1uF, C _T =1000pF		2800		
Vout fall Time	T _F	R _L =10Ω, C _L =0.1uF, C _T =1000pF		3		
ON Delay Time	T _D	R _L =10Ω, C _L =0.1uF, C _T =1000pF		1260		
V_{IN} = 0.8V, V_{ON} = V_{BIAS} = 3.3V, T_A = 25°C						
Turnon Time	T _{ON}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		1890		uS
Turnoff Time	T _{OFF}	R _L =10Ω, C _L =0.1uF, C _T =1000pF		10		
Vout Rise Time	T _R	R _L =10Ω, C _L =0.1uF, C _T =1000pF		1100		
Vout fall Time	T _F	R _L =10Ω, C _L =0.1uF, C _T =1000pF		3		
ON Delay Time	T _D	R _L =10Ω, C _L =0.1uF, C _T =1000pF		1140		



Rise Time Value

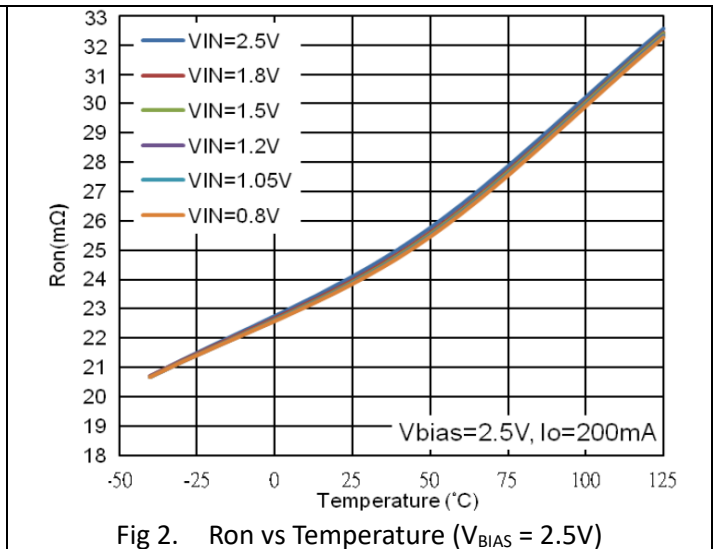
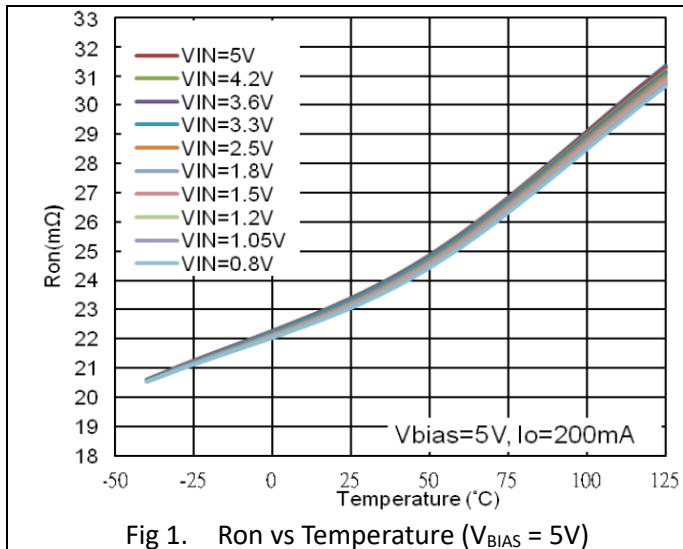
CT (pF)	RISE TIME (uS) 10% to 90%, C _L =0.1uF, C _{IN} =1uF, R _L =10Ω							
	5V	3.3V	2.5V	1.8V	1.5V	1.2V	1.05V	0.8V
0	90.46	69.41		49.06	45.01	41.05	38.62	34.1
220	462.7	277.6		118.7	88.06	57.82	41.36	40
470	925.3	579.2		272.1	204.3	141.8	113.4	54.9
1000	1759	1122		557.7	437.4	313	260.3	150.1
2200	3965	2467		1285	1052	768.2	670.1	440.6
4700	8199	5240		2814	2266	1742	1450	1012
10000	20210	12090		6443	5391	4245	3639	2511

$$\text{Rise Time (uS)} = (\text{CT} + \text{TBD}) * (\text{Vout}) * \text{TBD} + \text{TBD}$$

Ex1: CT=470pF, Vout=2.5V, Rise Time=

Typical Characteristics

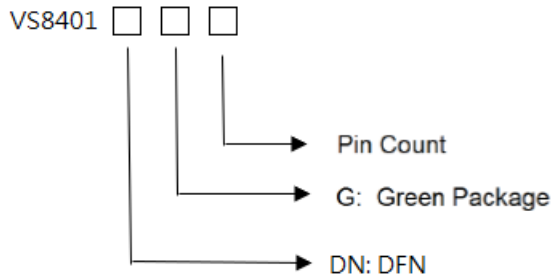
C_{IN}=10uF, C_L=0.1uF, T_J=25°C, unless otherwise specified





VS8401

Ordering Information



Part No.	Q`ty/Reel
VS8401DNG8	4000

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