20mΩ, 5.5V 6A Dual Channel Load Switch

General Description

The VS8601 is a small, low RON, dual-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 6 A per channel. Each switch is independently controlled by an on and off input (ON1 and ON2), which can interface directly with low-voltage control signals. In VS8601, a 220-Ω on-chip load resistor is added for quick-output discharge when switch is turned off.

The VS8601 is available in a small, space-saving DFN3X2 package (DPU) with integrated thermal pad allowing for high power dissipation. The device is characterized for operation over the free-air temperature range of -40°C to +105°C.

Ordering Information

Part Number	Package	Note
VS8601	DFN3X2	

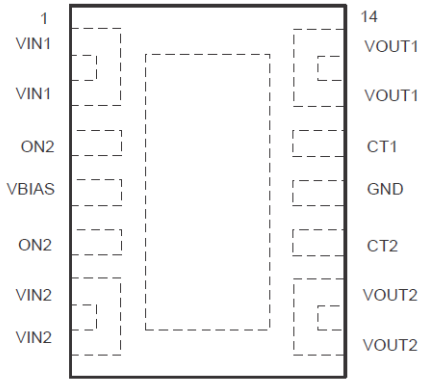
Features

- Input Voltage Range: 0.8 V to 5.5 V
- Integrated Dual-Channel Load Switch
- On-Resistance 20mΩ per Channel
- 6-A Maximum Continuous Switch Current per Channel
- Low Quiescent Current (80uA Both Channels)
- Configurable Rise Time (CT pin)
- Quick Output Discharge (QOD) (Optional)
- DFN3X2 Package With Thermal Pad
- Thermal Protection

Applications

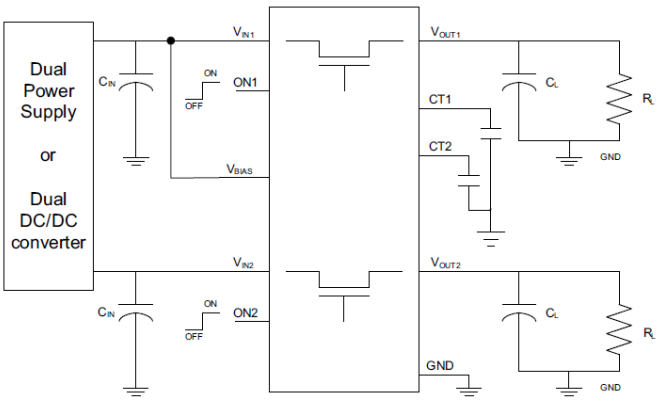
- Ultrabook
- Notebooks and Netbooks
- Tablet PCs
- Consumer Electronics
- Set-top Boxes and Residental Gateways
- Telecom Systems
- Solid-State Drives (SSD)

Pin Configuration



Top View

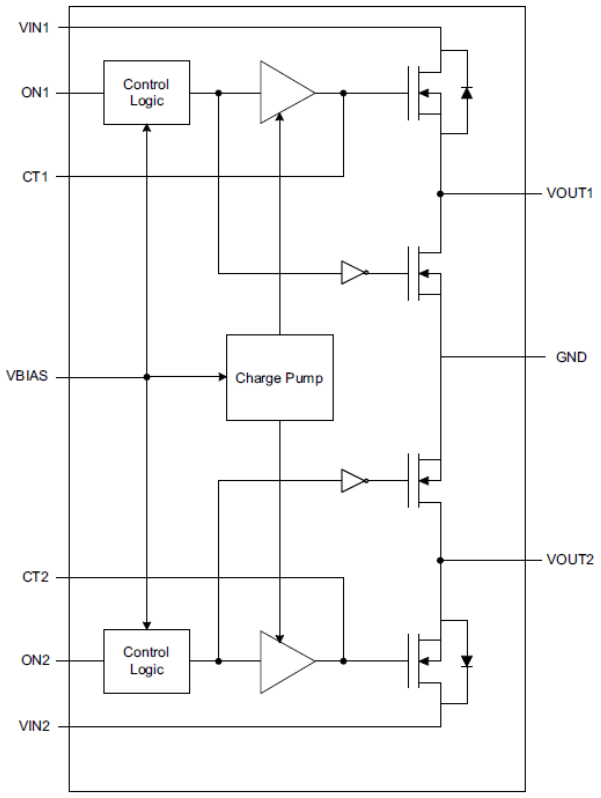
Typical Application Circuit



Pin Assignment

Pin Name	Pin No.	Pin Function
VIN1	1,2	Switch 1 input
ON1	3	Active high switch 1 control input. Do not leave floating
VBIAS	4	Bias voltage. Power supply to the device.
ON2	5	Active high switch 2 control input. Do not leave floating
VIN2	6,7	Switch 2 input
VOUT2	8,9	Switch 2 output
CT2	10	Switch 2 slew rate control. Can be left floating.
GND	11	Ground
CT1	12	Switch 1 slew rate control. Can be left floating.
VOUT1	13,14	Switch 1 output
Thermal PAD		Thermal pad (exposed center pad) to alleviate thermal stress. Tie to GND.

Function Block Diagram



Absolute Maximum Ratings (Note1)

- $V_{IN1,2}$ ---------- -0.3V to +6.0V
- $V_{OUT1,2}$ ---------- -0.3V to +6.0V
- $V_{ON1,2}$ ---------- -0.3V to 6.0V
- V_{BIAS} ---------- -0.3V to 6.0V
- IMAX ---------- 6A
- Junction Temperature---------- 125°C
- Lead Temperature (Soldering, 10 sec.)---------- 300°C
- Storage Temperature ---------- –65°C to 150°C

Note 1: Stress beyond those listed at "absolute maximum rating" table may cause permanent damage to the device. These are stress rating ONLY. For functional operation are strongly recommend follow up "recommended operation conditions" table.

Recommended Operating Conditions

- $V_{IN1,2}$ ---------- 0.8V to VBIAS
- V_{BIAS} ---------- 2.5V to 5.5V
- $V_{ON1,2}$ ---------- 0V to 5.5V
- Junction Temperature ---------- -40°C to 105°C

Thermal Information

Symbol	Parameter	Limit	Unit
θ_{JA}	Thermal resistance (Junction to Air)	52.3	°C/W
$\theta_{JC(top)}$	Thermal resistance (Junction to Case(top))	45.9	°C/W
θ_{JB}	Thermal resistance (Junction to Board)	11.5	°C/W
ψ_{JT}	Junction-to-top characterization parameter	0.8	°C/W
ψ_{JB}	Junction-to-board characterization parameter	11.4	°C/W

Electrical Characteristics

V_{BIAS}=5V, T_A=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
POWER SUPPLIES AND CURRENTS						
VBIAS quiescent current (Both channels)	I_{BIAS_BOTH}	I_{OUT1} = I_{OUT2} = 0 mA $V_{IN1,2}$ = $V_{ON1,2}$ = V_{BIAS} = 5 V	--	80	120	uA
VBIAS quiescent current (Single channel)	I_{BIAS_SINGLE}	I_{OUT1} = I_{OUT2} = 0 mA, V_{ON2} = 0 V $V_{IN1,2}$ = V_{ON1} = V_{BIAS} = 5 V	--	60	120	uA
VBIAS shutdown current	I_{BIAS_OFF}	$V_{ON1,2}$ = 0 V	--	--	2	uA
VIN1,2 off-state supply current (per channel)	I_{VIN_OFF}	$V_{ON1,2}$ = 0 V	--	--	3	uA
ON pin input leakage current	I_{ON}	V_{ON} = 5.5 V	--	--	1	uA
RESISTANCE CHARACTERISTICS						
ON-state resistance (per channel)	R_{ON}	V_{IN} = 5V, I_{OUT}=200mA		20	25	mΩ
		V_{IN} = 3.3V, I_{OUT}=200mA		20	25	
		V_{IN} = 1.8V, I_{OUT}=200mA		20	25	
		V_{IN} = 1.5V, I_{OUT}=200mA	--	20	25	
		V_{IN} = 1.2V, I_{OUT}=200mA	--	20	25	

		V_{IN} = 0.8V, I_{OUT}=200mA	--	20	25	
VOUT Pull Down Resistor	R_{PD}		--	200	300	Ω

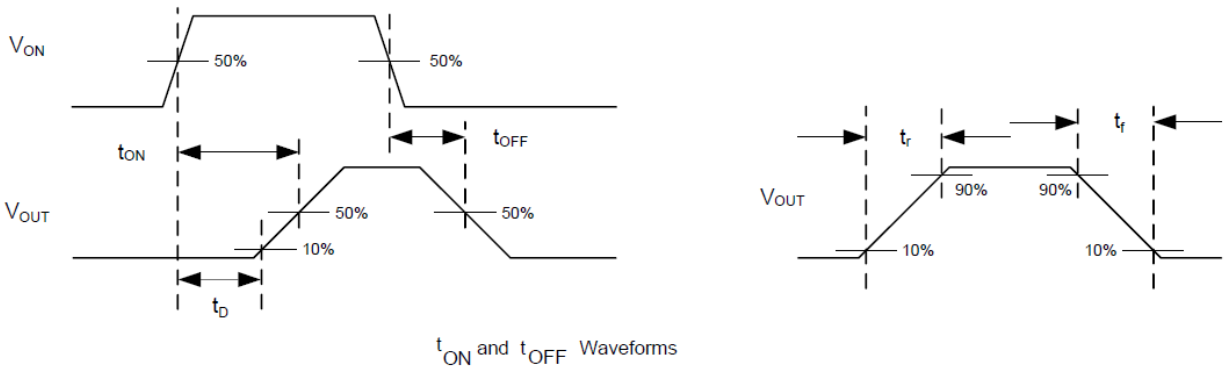
V_{BIAS}=2.5V, T_A=25℃, unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
POWER SUPPLIES AND CURRENTS						
VBIAS quiescent current (Both channels)	I_{BIAS_BOTH}	I_{OUT1} = I_{OUT2} = 0 mA $V_{IN1,2}$ = $V_{ON1,2}$ = V_{BIAS} = 2.5 V	--	30	40	uA
VBIAS quiescent current (Single channel)	I_{BIAS_SINGLE}	I_{OUT1} = I_{OUT2} = 0 mA, V_{ON2} = 0 V $V_{IN1,2}$ = V_{ON1} = V_{BIAS} = 2.5 V	--	25	40	uA
VBIAS shutdown current	I_{BIAS_OFF}	$V_{ON1,2}$ = 0 V	--	--	2	uA
VIN1,2 off-state supply current (per channel)	I_{VIN_OFF}	$V_{ON1,2}$ = 0 V	--	--	2	uA
ON pin input leakage current	I_{ON}	V_{ON} = 5.5 V	--	--	1	uA
RESISTANCE CHARACTERISTICS						
ON-state resistance (per channel)	R_{ON}	V_{IN} = 2.5V, I_{OUT}=200mA		22	29	mΩ
		V_{IN} = 1.8V, I_{OUT}=200mA		22	29	
		V_{IN} = 1.5V, I_{OUT}=200mA		22	29	
		V_{IN} = 1.2V, I_{OUT}=200mA	--	22	29	
		V_{IN} = 1.0V, I_{OUT}=200mA	--	22	29	
		V_{IN} = 0.8V, I_{OUT}=200mA	--	22	29	
VOUT Pull Down Resistor	R_{PD}		--	200	330	Ω

V_{BIAS}=5V or 2.5V, T_A=25℃, 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	--	℃
Thermal Hysteresis	T_{THER_HY}		--	35	--	℃

V_{ON} Rise and fall times is 100 ns.



t_{ON} and t_{OFF} Waveforms

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		1250		uS
Turnoff Time	T_{OFF}	R_L=10Ω, C_L=0.1uF, C_T=1000pF		7		
Vout Rise Time	T_R	R_L=10Ω, C_L=0.1uF, C_T=1000pF		1680		
Vout fall Time	T_F	R_L=10Ω, C_L=0.1uF, C_T=1000pF		7		
ON Delay Time	T_D	R_L=10Ω, C_L=0.1uF, C_T=1000pF		210		
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		370		uS
Turnoff Time	T_{OFF}	R_L=10Ω, C_L=0.1uF, C_T=1000pF		11		
Vout Rise Time	T_R	R_L=10Ω, C_L=0.1uF, C_T=1000pF		310		
Vout fall Time	T_F	R_L=10Ω, C_L=0.1uF, C_T=1000pF		6		
ON Delay Time	T_D	R_L=10Ω, C_L=0.1uF, C_T=1000pF		210		
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		1950		uS
Turnoff Time	T_{OFF}	R_L=10Ω, C_L=0.1uF, C_T=1000pF		9		
Vout Rise Time	T_R	R_L=10Ω, C_L=0.1uF, C_T=1000pF		2320		
Vout fall Time	T_F	R_L=10Ω, C_L=0.1uF, C_T=1000pF		8		
ON Delay Time	T_D	R_L=10Ω, C_L=0.1uF, C_T=1000pF		520		
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		910		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		710		
Vout fall Time	T_F	R_L=10Ω, C_L=0.1uF, C_T=1000pF		5		
ON Delay Time	T_D	R_L=10Ω, C_L=0.1uF, C_T=1000pF		520		

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	126	97	79	66	59	50	44	37
220	498	341	268	182	167	131	121	100
470	971	641	482	345	291	236	201	162
1000	1869	1195	854	638	520	441	395	313
2200	4172	2643	1914	1405	1130	952	818	652
4700	8615	5534	4262	3032	2580	2107	1689	1366
10000	18003	11897	8911	6294	5278	4823	4640	3060

Rise Time (uS) = (CT+58) * (Vout) *0.36 + 21

Ex1: CT=470pF, Vout=2.5V, Rise Time=(470+58)*2.5*0.36+21=496nS

Typical Characteristics

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

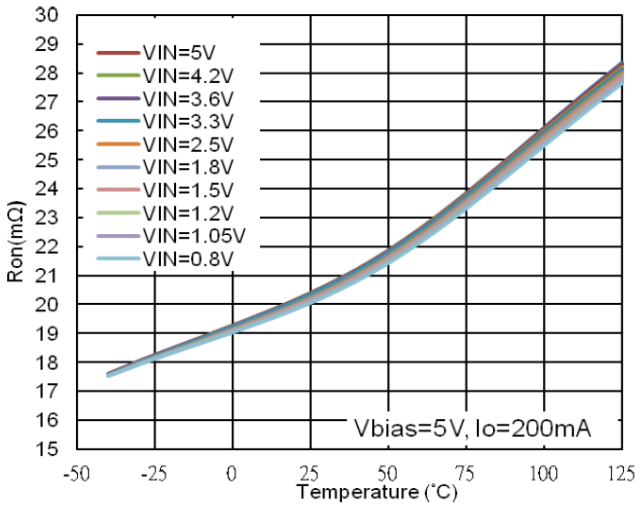


Fig 1. Ron vs Temperature (V_{BIAS} = 5V)

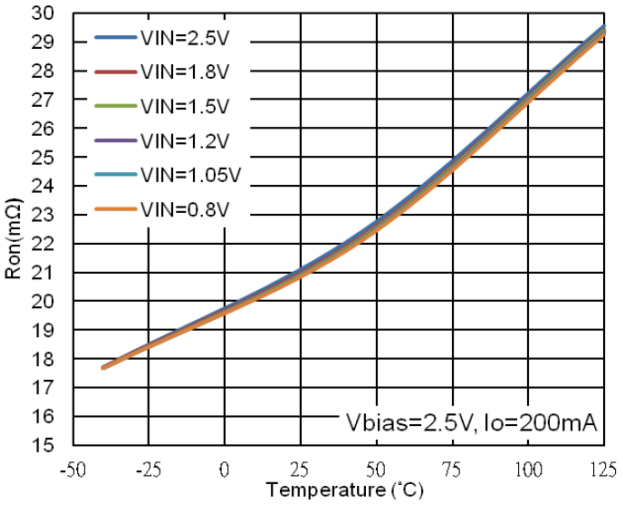
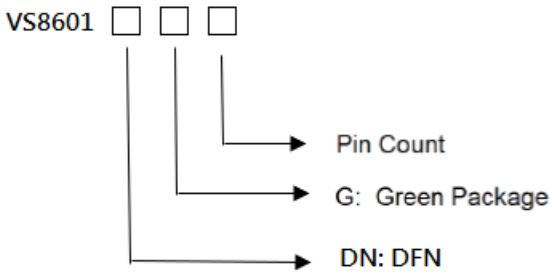


Fig 2. Ron vs Temperature (V_{BIAS} = 2.5V)

Ordering Information



Part No.	Q`ty/Reel
VS8601DNG14	3000

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