TPU4013DJ

23mΩ, 5.5V 4A Single Channel Load Switch

Features

- Input Voltage Range: 0.8 V to 5.5 V
- Integrated Single-Channel Load Switch
- On-Resistance 23mΩ per Channel
- 4-A Maximum Continuous Switch Current
- Low Quiescent Current (46uA)
- Configurable Rise Time (CT pin)
- Quick Output Discharge (QOD) (Optional)
- Thermal Protection
- DFN2X2 Package With Thermal Pad
- RoHS and Halogen free compliance
- ESD Protection: 2kV HBM, 2kV CDM

Applications

- Notebook and Desktop Computers
- High-Side Power Protection Switchs
- Consumer Electronics
- Telecom Systems
- Digital TV
- USB Device Power Switch
- Solid-State Drives (SSD)

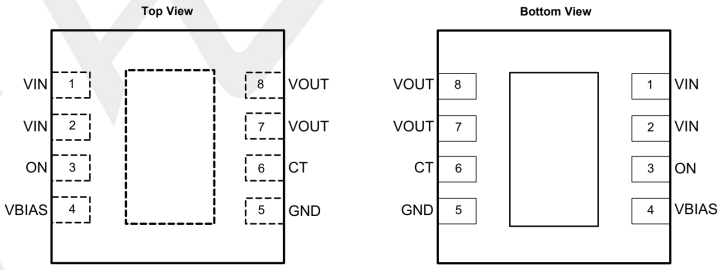
General Description

The is a small, low RON, single-channel load switch with controlled turn-on. The device contains single 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. a 220-Ω on-chip load resistor is added for quick-output discharge when switch is turned off.

The is available in a small, space-saving DFN2X2 package (DPU) with integrated thermal pad allowing for high power dissipation.

Pin Configurations

DFN2X2-8L



Pin Assignment

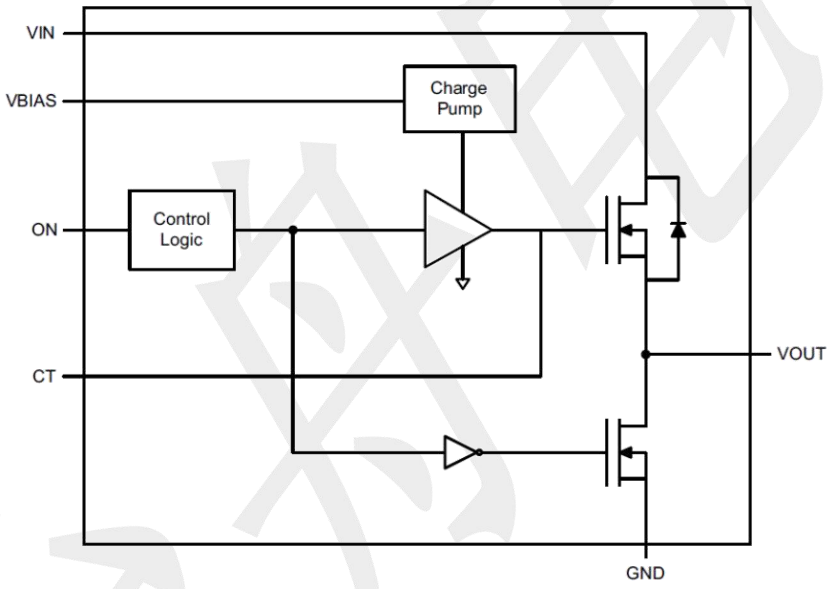
Pin Number	Pin Name	Pin Function
1,2	VIN	Switch input
3	ON	Active high switch control input. Do not leave floating
4	VBIAS	Bias voltage. Power supply to the device
5	GND	Ground.
6	CT	Switch slew rate control. Can be left floating
7,8	VOUT	Switch output
Thermal PAD		Thermal pad (exposed center pad) to alleviate thermal stress. Tie to GND

Absolute Maximum Ratings

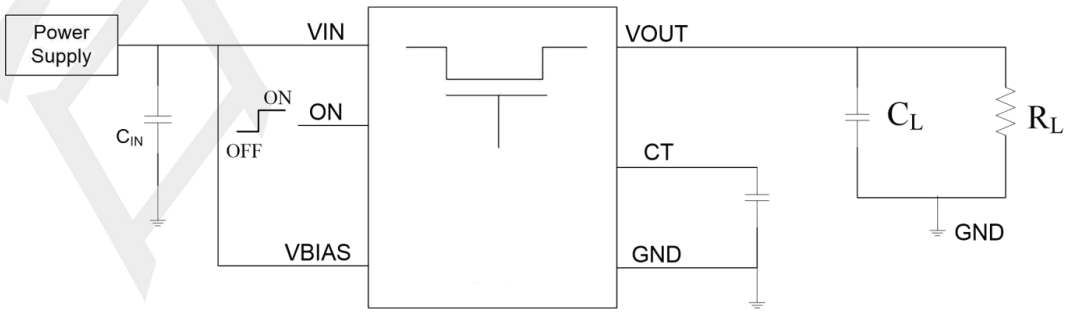
over operating free-air temperature range (unless otherwise noted)

Parameter		MIN	MAX	UNIT
VIN,V_{BIAS},VOUT,EN	Voltage range	-0.3	6.0	V
IMAX	Maximum current	4		A
PD	Power Dissipation	1.11		W
ESD HBM	Human Body ESD Protection	2000		V
ESD CDM	Charged Device Model	2000		V
Temperature	Junction Temperature , TJ	-40	125	℃
	Storage, Tstg	-65	150	℃
LT	Lead Temperature (Soldering, 10 sec.)	300		℃

BLOCK DIAGRAM



Typical Application Circuit



Recommend Operating Ratings

Parameter	Value	Unit
Operating voltage V_{IN}	0.8～V_{BIAS}	V
Operating voltage V_{BIAS}	2.5~5.5	V
Operating voltage V_{ON}	0~5.5	V
Operating ambient temperature	-40～85	ºC
Operating Junction temperature	-40～125	ºC
Decoupling input capacitor	≧1	uF

Electrical Characteristics

(Ta=25ºC, V_{IN}=5V, unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
POWER SUPPLIES AND CURRENTS						
VBIAS quiescent current	I_{BIAS}	I_{OUT} = 0 mA, V_{IN} = V_{ON} = V_{BIAS} = 5 V	--	46	70	uA
VBIAS shutdown current	I_{BIAS_OFF}	V_{ON} = 0 V	--	--	2	uA
VIN off-state supply current (per channel)	I_{VIN_OFF}	V_{ON} = 0 V	--	--	3	uA
ON pin input leakage current	I_{ON}	V_{ON} = 5.5 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

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

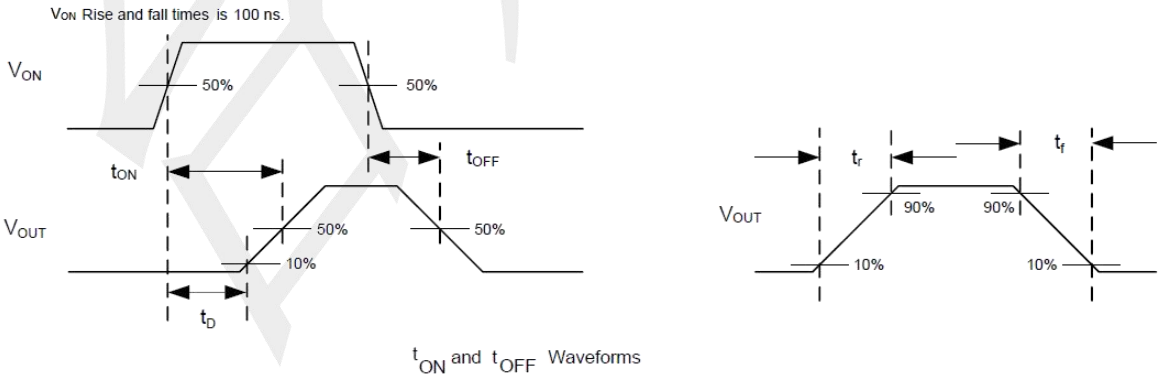
Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
POWER SUPPLIES AND CURRENTS						
VBIAS quiescent current	I_{BIAS}	I_{OUT} = 0 mA, V_{IN} = V_{ON} = V_{BIAS} = 2.5 V	--	40	65	uA
VBIAS shutdown current	I_{BIAS_OFF}	V_{ON} = 0 V	--	--	2	uA
VIN off-state supply current	I_{VIN_OFF}	V_{ON} = 0 V	--	--	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		24	38	mΩ
		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℃, 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	--	℃

Timing Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
V_{IN} = V_{ON} = V_{BIAS} = 5V, T_A = 25℃						
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℃						
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℃						
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℃						
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	--	



t_{ON} and t_{OFF} Waveforms

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	107	82.4	71.5	60.5	54.1	48	45.6	39.2
220	481	324	251	192	162	138	123	102
470	920	605	469	347	291	237	217	174
1000	1810	1190	901	669	557	453	409	329
2200	4040	2610	1990	1450	1210	976	875	685
4700	9410	6000	4430	3240	2650	2150	1910	1500
10000	16700	10700	8050	5950	4960	3920	3550	2830

Rise Time (uS) = (CT+ 55) * (Vout) *0.34 + 23

Ex1: CT=470pF, Vout=1.8V, Rise Time=344.3us

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

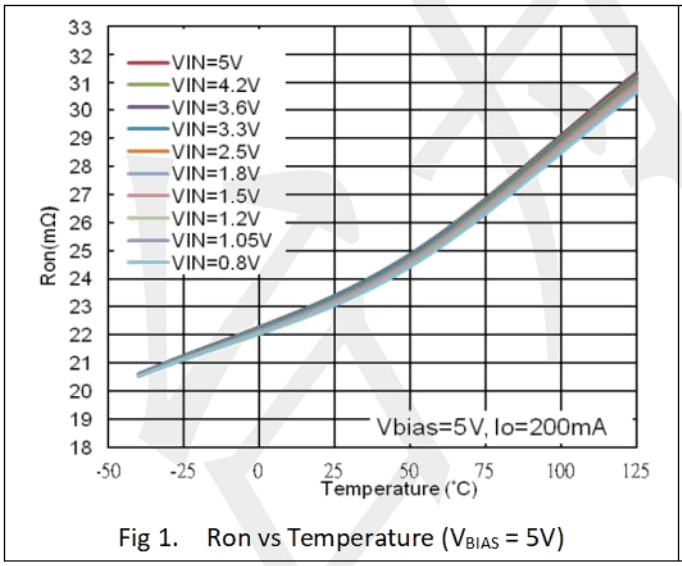


Fig 1. Ron vs Temperature (V_{BIAS} = 5V)

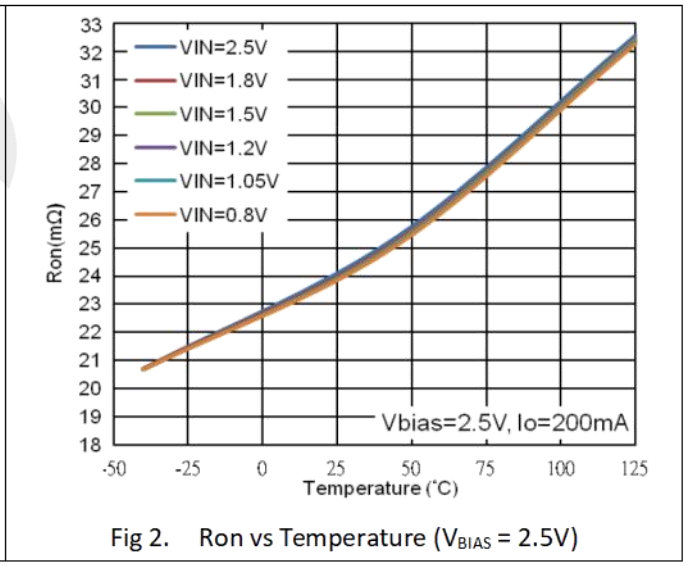
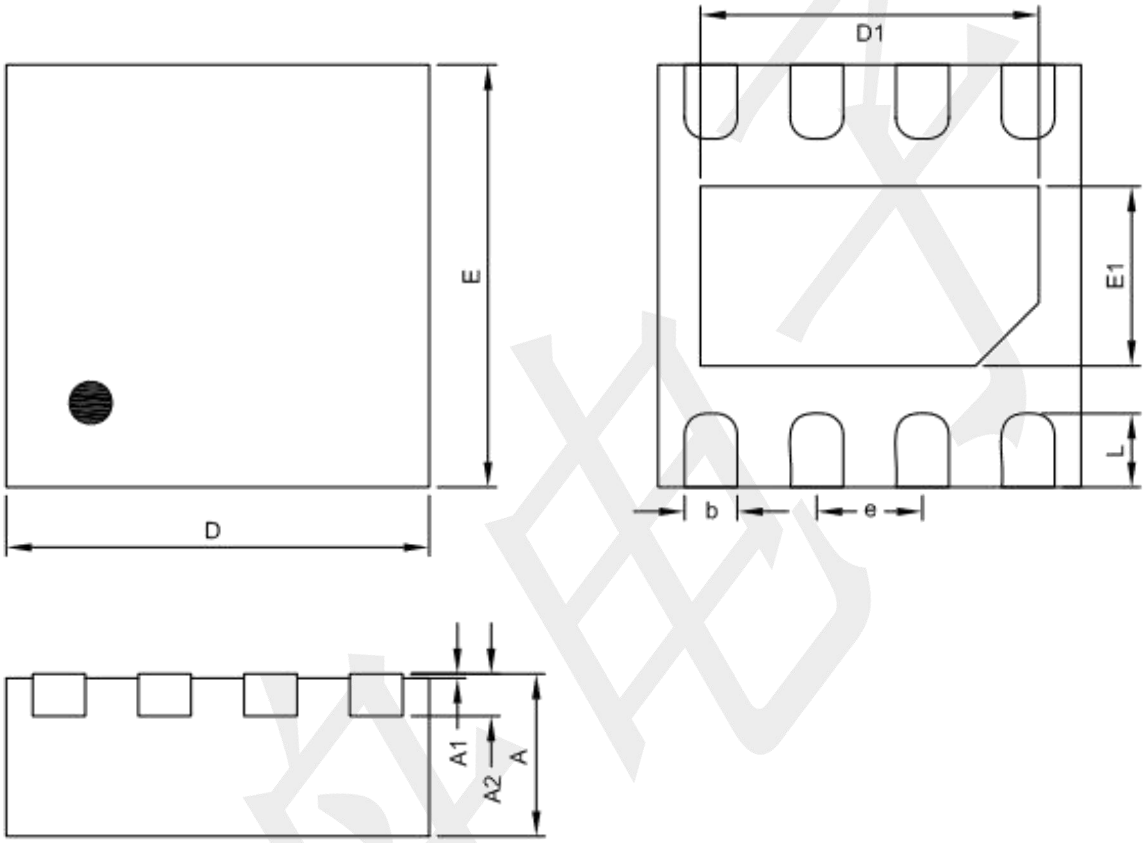


Fig 2. Ron vs Temperature (V_{BIAS} = 2.5V)

Package informantion

DFN2X2-8L



Symbol	Dimension in mm		
	Min.	Nom.	Max.
A	0.70	0.75	0.80
A1	0.00	- - -	0.05
A2	0.19	0.20	0.21
D	1.95	2.00	2.05
E	1.95	2.00	2.05
D1	1.45	1.55	1.65
E1	0.75	0.85	0.95
b	0.18	0.23	0.28
e	0.50 BSC		
L	0.30	0.35	0.40