

TPG2127 300V Current Sensing Single Channel MOSFET/IGBT Driver

1 Features and Benefits

- Floating channel designed for bootstrap operation
- Fully operational to +300 V
- 3.3V, 5V and 15V input logic compatible
- dV/dt noise Immunity ± 50 V/nsec
- Allowable negative Vs capability: -5V
- Output in phase with input
- Gate drive supply range from 12V to 20V
- Undervoltage lockout for both channels
--UVLO 9V/10.3V
- Propagation delay
--Ton/Toff =150ns/150ns
- Wide operating temperature range -40°C ~125°C
- Fault lead indicates shutdown has occurred
- RoSH compatible
- SOIC8(S)

2 Application

- Motor control and drive
- Robot technology
- Fast charging of electric vehicles

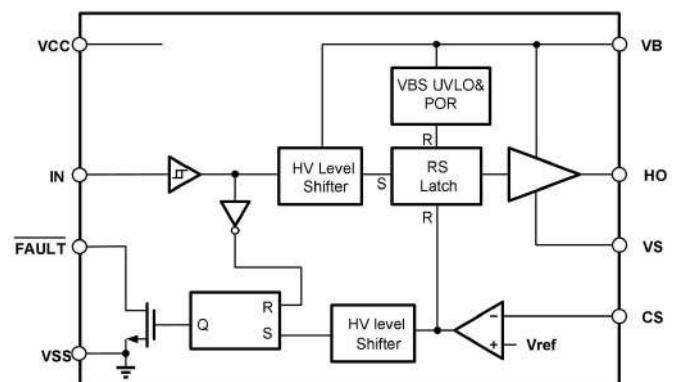
3 Description

The TPG2127 is a high voltage, high speed power MOSFET and IGBT driver. Proprietary HVIC and latch immune CMOS technologies enable ruggedized monolithic construction. The logic input is compatible with standard CMOS or LSTTL outputs, down to 3.3V. The protection circuitry detects over-current in the driven power transistor and terminates the gate drive voltage. An open drain FAULT signal is provided to indicate that an over-current shutdown has occurred. The output driver features a high pulse current buffer stage designed for minimum cross-conduction. The floating channel can be used to drive an N-channel power MOSFET or IGBT in the high side or low side configuration which operates up to 300 volts.

Device information

Part Number	Package	Body size
TPG2127	SOIC8	4.9mm*3.9mm

Functional Block Diagram



4 Selection Guide

Part Number	Input logic	Overcurrent threshold	Undervoltage threshold	Ron,FLT	Ton/Toff (ns)	IO+/IO- (mA)
TPG2127	IN, $\overline{\text{FAULT}}$	0.25V	9V/10.3V	125ohm	150/150	300/600

5 Ordering Guide

Part Number	Package	Package	SPQ
TPG2127	SOIC8	Tape & Reel	4K

6 Revision history

Version	Content	Time
V1.0	Create	2022.01.06
V1.1	Update maximum working voltage	2022.09.29
V1.2	Add instructions for setting overcurrent protection resistors, correct mistakes	2023.10.31

7 Function Pin Description

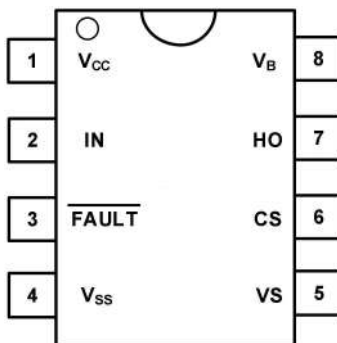


Figure7-1 8-Pin SOIC8 Top view

Table7-1 Lead Definitions

Number	Symbol	Description
1	V _{CC}	Power supply
2	IN	Logic input for high side gate driver output (HO), in phase
3	$\overline{\text{FAULT}}$	Indicates over-current shutdown has occurred, negative logic
4	V _{SS}	Logic ground
5	V _S	High side floating supply return
6	CS	Current sense input to current sense comparator
7	HO	High side gate drive output
8	V _B	High side floating supply

8 Product specifications

8.1 Absolute Maximum Ratings

Exceeding the limit maximum rating may cause permanent damage to the device. All voltage parameters are rated with reference to VSS and an ambient temperature of 25°C.

Symbol	Definition	MIN.	MAX.	Units
V _B	High side floating supply	-0.3	322	V
V _S	High side floating supply return	V _B - 22	V _B + 0.3	
V _{HO}	High side gate drive output	V _S - 0.3	V _B + 0.3	
V _{CC}	Low side and main power supply	-0.3	22	
V _{IN}	Logic input of IN	-0.3	V _{CC} + 0.3	
V _{FLT}	FAULT output voltage	-0.3	V _{CC} + 0.3	
V _{CS}	Current sense voltage	V _S - 0.3	V _B + 0.3	
dV _S /dt	Allowable Offset Supply Voltage Transient	—	50	V/ns

8.2 ESD rating

Symbol	Definition	MIN.	MAX.	Units
ESD	HBM Model	2	—	kV
	Machine Model	500	—	V

8.3 Rated power

Symbol	Definition	MIN.	MAX.	Units
P _D	Package Power Dissipation @ TA ≤25°C	—	0.625	W

8.4 Thermal information

Symbol	Definition	MIN.	MAX.	Units
R _{thJA}	Thermal Resistance, Junction to Ambient	--	200	°C/W
T _J	Junction Temperature	—	150	°C
T _S	Storage Temperature	-55	150	
T _L	Lead Temperature (Soldering, 10 seconds)	—	300	

8.5 Recommended Operating Conditions

For proper operation, the device should be used under the following recommended conditions. The bias ratings of VS and VSS are measured at a supply voltage of 15V, and unless otherwise specified, the ratings of all voltage parameters are referenced to VSS and the ambient temperature is 25°C.

Symbol	Definition	MIN.	MAX.	Units
VB	High side floating supply	VS + 12	VS + 20	V
VS	High side floating supply return	-5	300	
VHO	High side gate drive output	VS	VB	
VCC	Low side and main power supply	10	20	
VIN	Logic input of IN	0	VCC	
VFLT	FAULT output voltage	0	VCC	
VCS	Current sense signal voltage	VS	VS+5	
TA	Ambient temperature	-40	125	°C

Note1: Transient negative VS can be used for VSS-50V with a pulse width of 50ns, guaranteed by design.

8.6 Electrical Characteristics

Valid for temperature range at TA= 25°C, VCC=VB= 15V, CL=1nF, unless otherwise specified

8.6.1 Dynamical electrical characteristics

Symbol	Definition	MIN.	TYP.	MAX.	Units	Test Condition
tON	Turn-on propagation delay	—	150	250	ns	VS=0V
tOFF	Turn-off propagation delay	—	150	250	ns	VS=300V
tR	Turn-on rise time	—	80	130	ns	
tF	Turn-off fall time	—	40	70	ns	
tBL	Start-up blanking time	550	750	950	ns	
tCS	CS shutdown propagation delay	—	65	360	ns	
tfit	CS to FAULT pull-up propagation delay	—	270	510	ns	

8.6.2 Static electrical characteristics

Valid for temperature range at $T_A = 25^\circ\text{C}$, $V_{CC} = V_B = 15\text{V}$, $C_L = 1\text{nF}$, unless otherwise specified.

Symbol	Definition	MIN.	TYP.	MAX.	Units	Test Condition
V_{IH}	Logic "1" (IN) input voltage	2.5	—	—	V	VCC=10Vto 20V
V_{IL}	Logic "0" (IN) input voltage	—	—	0.8	V	
V_{CSTH+}	CS input positive going threshold	180	250	320	mV	
V_{BSUV+}	VBS supply UVLO threshold	8.8	10.3	11.8	V	
V_{BSUV-}		7.5	9.0	10.6	V	
I_{LK}	High-side floating supply leakage current	—	—	50	μA	$V_B = V_S = 300\text{V}$
I_{QBS}	Quiescent VB supply current	—	300	800	μA	$V_{IN} = 0\text{V}$ or 5V
I_{QCC}	Quiescent VCC supply current	—	60	120	μA	$V_{IN} = 0\text{V}$ or 5V
I_{CS+}	"High"CS bias current	—	—	5	μA	CS=3V
I_{CS-}	"High"CS bias current	—	—	5	μA	CS=0V
V_{OH}	High level output voltage, VBIAS - VO	—	—	0.2	V	$I_o = 2\text{mA}$
V_{OL}	Low level output voltage, VO	—	—	0.1	V	
I_{IN+}	Logic "1" Input bias current	—	7	15	μA	$V_{IN} = 5\text{V}$
I_{IN-}	Logic "0" Input bias current	—	0	5	μA	$V_{IN} = 0\text{V}$
I_{o+}	Output high short circuit pulsed current	200	300	—	mA	$V_o = 0\text{V}$ $PW \leq 10\mu\text{s}$
I_{o-}	Output low short circuit pulsed current	420	600	—	mA	$V_o = 15\text{V}$ $PW \leq 10\mu\text{s}$
$R_{on,FLT}$	FAULT-low on resistance	—	125	—	Ω	

9 Function Description

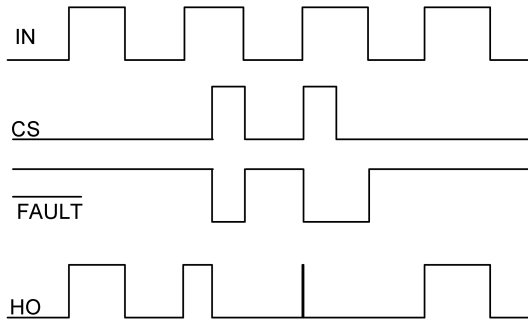


Figure 9-1 TPG2127 Input and output timing waveform

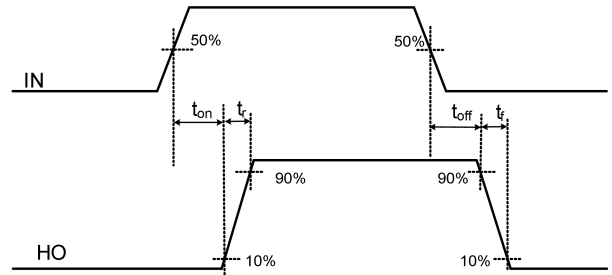


Figure 9-2 Switching Time Waveform Definition

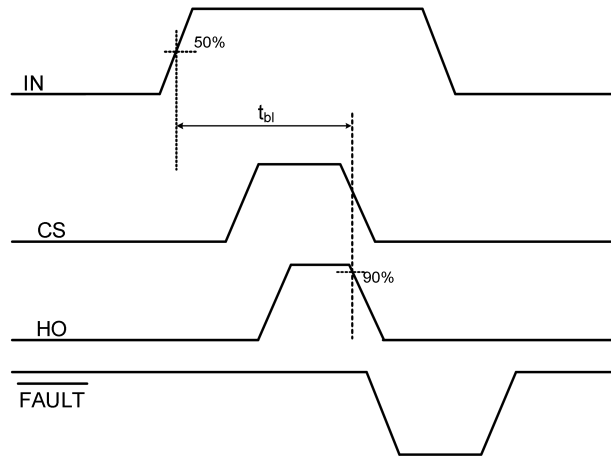


Figure 9-3 Start-up Blanking Time Waveform Definitions

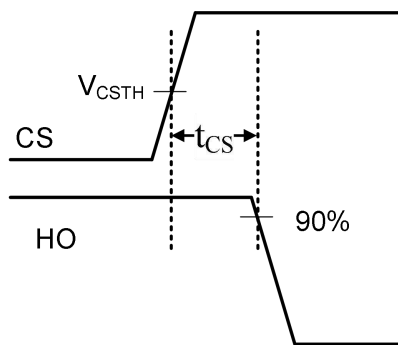


Figure 9-4 CS Shutdown Waveform Definitions

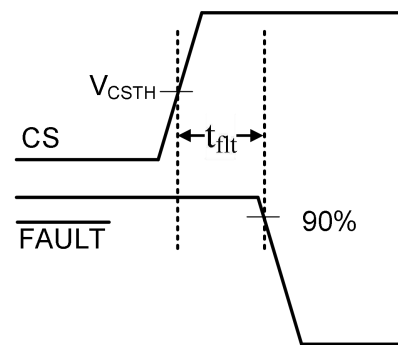


Figure 9-5 CS to FAULT Waveform Definitions

10 Description

10.1 Function Block Diagram

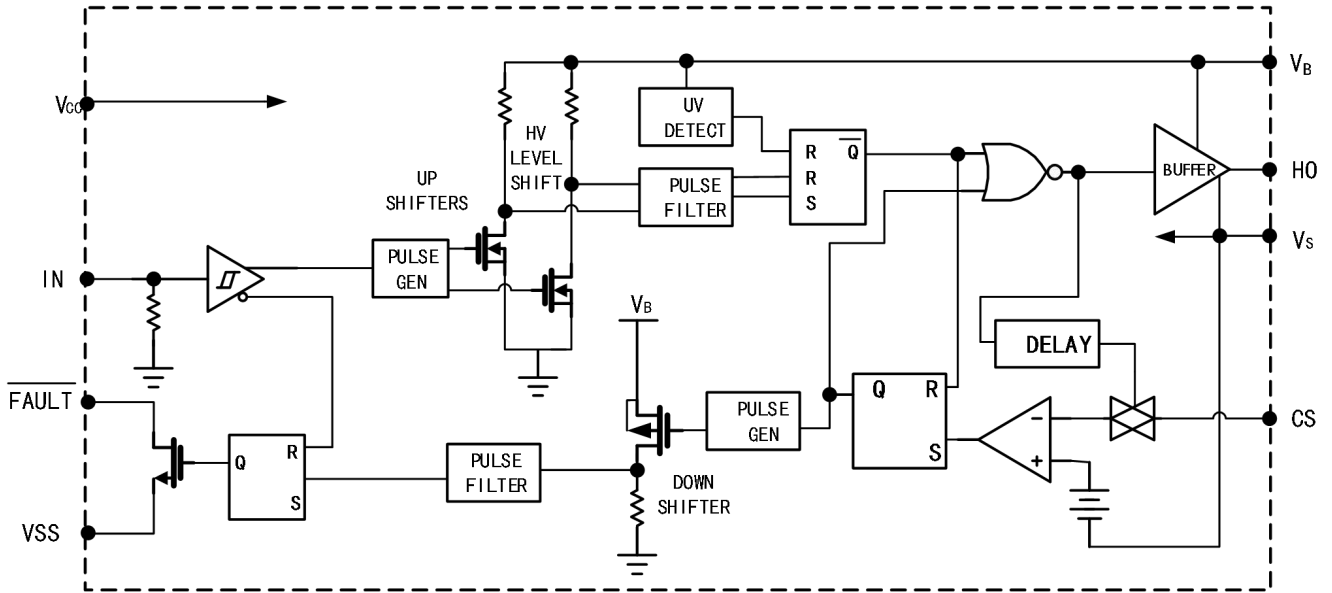


Figure10-1 Function Block Diagram of TPG2127

10.2 Application message

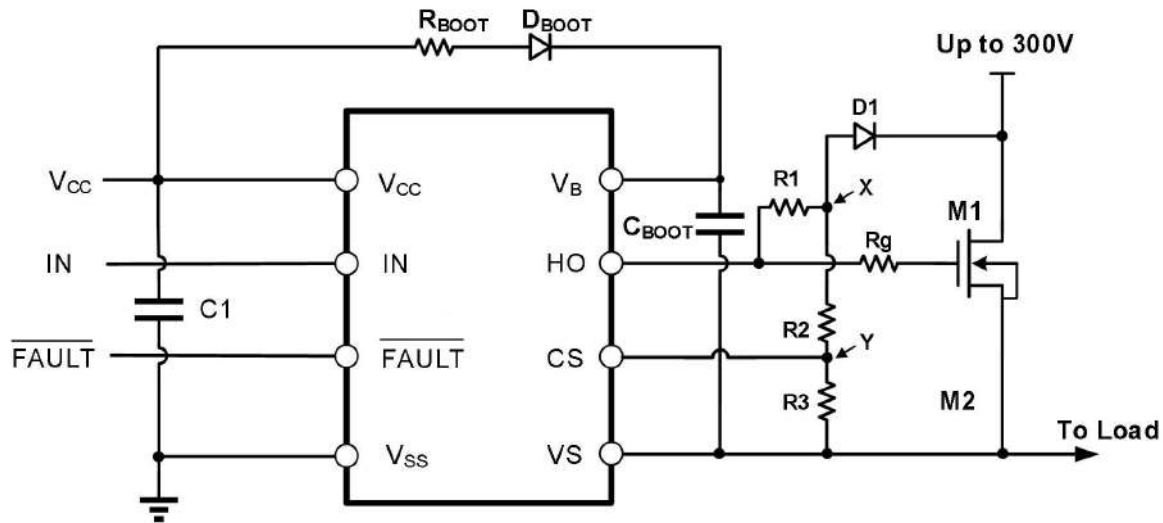


Figure10-2 Typical application circuit of TPG2127

To Calculate the resistor values use the following guidelines.

R_g is the gate resistor, and the value is chosen to optimize switching speed and switching losses.

R_1 is typically chosen to be 10k (12V V_{bs})/22k (15V V_{bs})/33k (18V V_{bs}); this high value helps to minimize the increased miller capacitance effect from diode D1, and makes sure there is not significant current being drawn from the HO output. Note diode D1 must have the same characteristics as the bootstrap diode.

When the HO output goes high MOSFET (or it could be an IGBT) Q1 turns on. Now point X in fig 10-2) will be pulled down to a voltage which equals the voltage across the FET (V_{DS}) plus the voltage across diode D1.

Therefore in an overload condition we want to shut down the driver output when the voltage across the FET (or IGBT) Q1 equals a set limit that indicates on overload condition has occurred (for example 8V).

Therefore with a 8V V_{ds} on Q1. V_{D1} is typically 1.2V for a small 1A ultra fast recovery diode.

$$V_X = V_{D1} + V_{DS}$$

$$V_X = 1.2 + 8$$

$$V_X = 9.2V$$

For a TPG2127 the CS pin threshold is 250mV, therefore we need to divide V_X , so that when $V_X = 11.2V$, then

$V_Y = 250mV$.

$$V_Y = V_X \cdot R_3 / (R_2 + R_3) \quad \text{let } R_2 = 33k$$

$$R_3 = 922 \Omega$$

11. Package Information

SOIC-8 Package Dimensions

Size Symbol	MIN(mm)	TYP(mm)	MAX(mm)	Size Symbol	MIN(mm)	TYP(mm)	MAX(mm)
A	-	-	1.75	D	4.70	4.90	5.10
A1	0.10	-	0.225	E	5.80	6.00	6.20
A2	1.30	1.40	1.50	E1	3.70	3.90	4.10
A3	0.60	0.65	0.70	e	1.27BSC		
b	0.39	-	0.48	h	0.25	-	0.50
b1	0.38	0.41	0.43	L	0.50		
c	0.21	-	0.26	L1	1.05BSC	-	-
c1	0.19	0.20	0.21	θ	0	-	8°

SOIC -8 Package Outlines

