

TPD7000AF

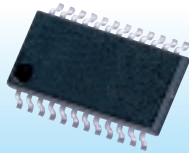
● 4-channel Low-Side N-ch Power-MOSFET Driver for ABS Applications

The IC incorporates a circuit which monitors the voltage between the power MOSFET drain and source. It supports an intelligent function for power MOSFET protection and diagnosis.

Features

- Low-side N-channel power MOSFET driver (input capacitance: 15 nF max)
- Incorporates a power MOSFET overcurrent protection function.
- Incorporates induction load energy clamping function.
- INHIBIT option using enable input, open collector output.
- SSOP 24-pin package for packing in embossed-tape

SSOP-24PIN



Maximum Rating (T_a = 25°C)

Characteristic	Symbol	Rating	Unit	
Supply Voltage	DC	V _{DH} (1)	25	V
	Pulse	V _{DH} (2)	30 (1 s)	
Supply Voltage	V _{DL}	10	V	
Output Voltage	V _{OPOUT}	10	V	
Input Voltage	V _{IN}	-0.5 to 7	V	
Output Current	I _{OPOUT}	20	mA	
Power Dissipation	T _a = 25°C	P _D	0.5	W
Operating Temperature	T _{opr}	-40 to 110	°C	
Junction Temperature	T _j	150	°C	
Storage Temperature	T _{stg}	-55 to 150	°C	

Electrical Characteristics (T_j = -40 to 110°C, V_{DH} = 13 V, V_{DL} = 5 ± 0.5 V)

Characteristic	Symbol	Terminal	Test Condition	Min	Typ.	Max	Unit	
Operating Voltage	V _{DH}	V _{DH}	—	8	13	18	V	
	V _{DL}	V _{DL}		4.5	5	5.5		
Current Dissipation	I _{DH}	I _{DH}	V _{IN} = 0 V, V _{DH} = 13 V, Output Off	—	2	5	mA	
	I _{DL}	I _{DL}	V _{IN} = 0 V, V _{DL} = 5 V, Output Off	—	8	12		
Input Voltage	V _{IL}	IN / ENB	When Output Off	—	—	1.5	V	
	V _{IH}	/ OPIN	When Output On	3.5	—	—		
Input Current	I _{IL}	IN / ENB	V _{IN} = 0 V	—	—	1	μA	
	I _{IH}	/ OPIN	V _{IN} = 5 V	—	100	200		
High-Level Output Voltage 1	V _{OH} 1	V _G S	V _{IN} = 5 V, I _O = 0 A, V _{DH} < 14 V	—	—	V _{DH}	V	
High-Level Output Voltage 2	V _{OH} 2	V _G S	V _{IN} = 5 V, I _O = 0 A, V _{DH} ≥ 14 V	12	—	15	V	
Low-Level Output Voltage	V _{OL}	V _G S	V _{IN} = 0 V, I _O = 0 A	—	—	0.5	V	
V _{DS} Detection Voltage	V _D S	V _D S	—	—	1.0	—	V	
Diagnostic Resistance	R _{DIAG}	DIAG	—	—	10	—	kΩ	
Diagnostic Output Voltage	"L" Level	V _{DIAG}	DIAG	V _{DL} = 5 V	—	—	0.4	V
Diagnostic Output Current	"H" Level	I _{DIAG}	DIAG	V _{DIAG} = 5 V	—	—	10	μA
Optional Output Voltage	V _{OPL}	OPOUT	I _{OP} = 10 mA	—	—	0.4	V	
Optional Off Current	I _{OPH}	OPOUT	V _{OPOUT} = 5 V	—	—	10	μA	
Zener Voltage between Drain and Gates	V _{CLAMP}	V _D S	I _D S = 5 mA, V _{CLAMP} = V _D S - V _G S	30	35	40	V	
Switching Time	When On	t _{PLH}	V _G S	C _L = 3000 pF (capacitance between V _G S and GND pins)	—	—	100	μs
	When Off	t _{PLH}			—	—	100	

Operation

(1) When normal

● At external power MOS on

When 3.5 V or more is applied to the IN and ENB pins, the VGS pin goes high and 1 mA (Typ.) constant current drives the power MOS gate. A VGS mask circuit is built in to prevent erroneous detection of overcurrent in the transient area before the power MOS comes sufficiency on from off state. This circuit is set so that overcurrent is not erroneously detected before the VGS rises to 6.5 V (Typ.).

DIAG output a voltage that is the inverse of the VDS state. The power MOS and its load state can be checked by monitoring the input voltage and the DIAG output.

● External power MOS off

When the input voltage of IN or ENB falls to 1.5 V or below, the VGS pin goes low, the external power MOS gate is discharged, and the MOSFET turns off.

The ENB pin has priority over the IN pin. When ENB is low, the VGS pin does not go on even if a high level input voltage is applied to IN.

(2) At Overcurrent

If the VDS pin voltage (the voltage between the power MOS drain and source) is around 1.0 V or above (VDS typical detection voltage) while high level input voltage is applied to the IN and ENB pins, overcurrent to the external power MOS is detected and the VGS output is a instantly shut down and latched. Setting the input voltage back to low level releases the latch.

When the voltage reaches the VDS detection voltage or above, DIAG outputs low level.

(3) At load open

As a pull-down resistor is connected to the VDS pin, when the load is open the VDS pin is always low and high level is output to DIAG.

(4) OPTION function

The OPTION function is controlled by two input pins: OPIN and ENB. ENB has priority over OPIN. When high level voltage is input to OPIN or ENB, the OPOUT pin goes low. This function can be used as a pre-diver for lamps and mechanical relays.

(5) At VDL low voltage

TPD7000AF incorporates a low-voltage lock circuit for locking the VGS and DIAG outputs when VDL falls. This circuit is designed to operate around VDL = 2.8 V (Typ.) or lower. When the circuit is in operation, ENB is locked at low level to cut off the VGS output.

Truth table

State	IN	ENB	VDS	DIAG
Normal	L	H	H	L
	H		L	H
	L	L	H	L
	H		H	L
Overcurrent	L	H	H	L
	H		H	L
	L	L	H	L
	H		H	L
Load Short Circuit	L	H	H	L
	H		H	L
	L	L	H	L
	H		H	L
Power MOS Short Circuit	L	H	L	H
	H		L	H
	L	L	L	H
	H		L	H
Load Open	L	H	L	H
	H		L	H
	L	L	L	H
	H		L	H

OPIN	ENB	OUTPUT
L	H	HZ
H	H	L
L	L	HZ
H	L	HZ

*OPOUT is an NPN open collector.

*HZ: High impedance

*ENB is active high.

*DIAG monitors VDS regardless of IN or ENB.