

# TPD1030F

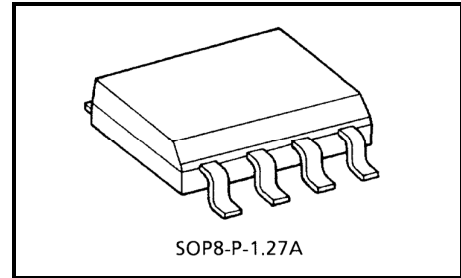
## 2-IN-1 Low-Side Switch for Motor, Solenoid and Lamp Drive

The TPD1030F is a 2-IN-1 low-side switch.

The IC has a vertical MOSFET output which can be directly driven from a CMOS or TTL logic circuit (e.g., an MPU). The IC is equipped with intelligent self-protection functions.

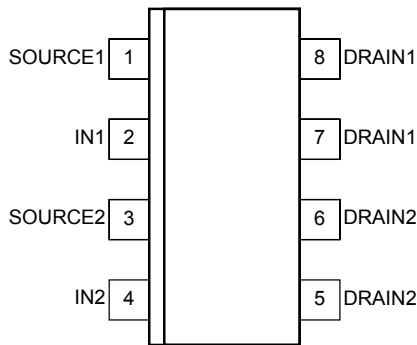
### Features

- Two built-in power IC chips with a new structure combining a control block and a vertical power MOSFET (L<sup>2</sup>-π-MOS) on each chip.
- Can directly drive a power load from a CMOS or TTL logic.
- Built-in protection circuits against overvoltage (active clamp), overtemperature (thermal shutdown), and overcurrent (current limiter).
- Low Drain-Source ON-resistance: R<sub>DS (ON)</sub> = 0.6 Ω (max) (@V<sub>IN</sub> = 5 V, I<sub>D</sub> = 0.5 A, T<sub>ch</sub> = 25°C)
- Low Leakage Current: I<sub>DSS</sub> = 10 μA (max) (@V<sub>IN</sub> = 0 V, V<sub>DS</sub> = 30 V, T<sub>ch</sub> = 25°C)
- Low Input Current: I<sub>IN</sub> = 300 μA (max) (@V<sub>IN</sub> = 5 V, T<sub>ch</sub> = 25°C)
- 8-pin SOP package with embossed-tape packing.

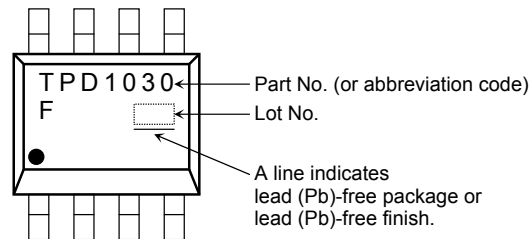


Weight: 0.08 g (typ.)

### Pin Assignment (top view)

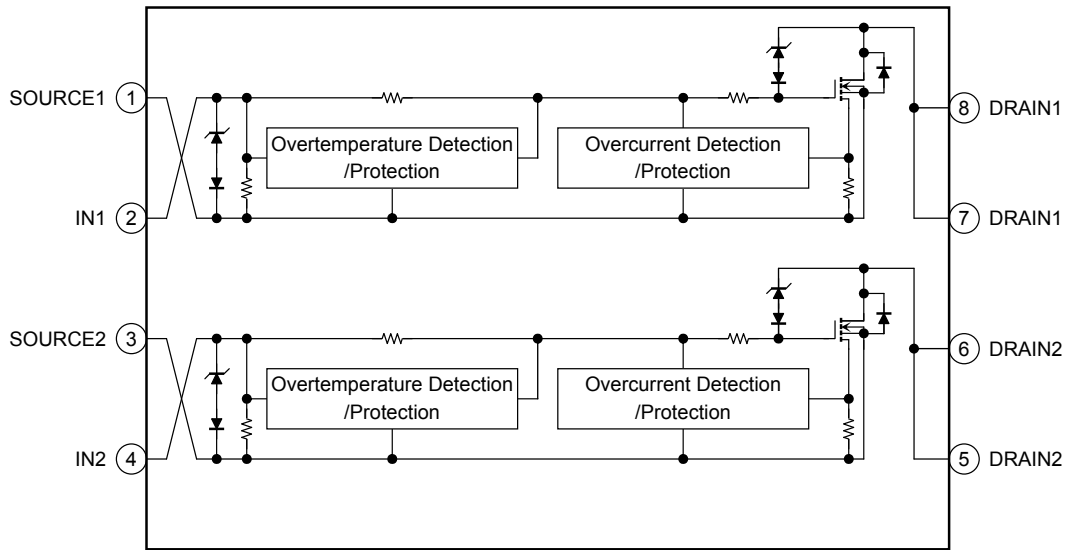


### Marking



Note1: Due to its MOS structure, this product is sensitive to static electricity.

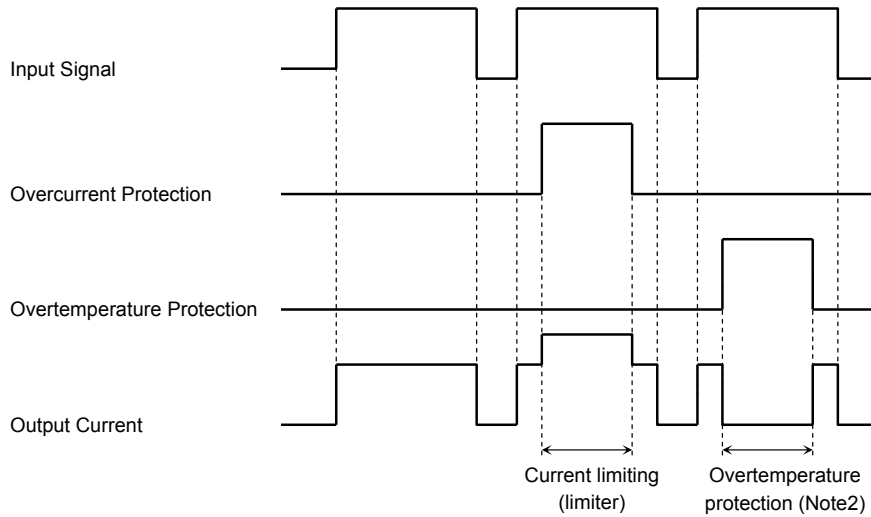
**Block Diagram**



**Pin Description**

Pin No.	Symbol	Pin Description
1	SOURCE1	Source pin 1
2	IN1	Input pin 1 This pin is connected to a pull-down resistor internally, so that even when input wiring is open-circuited, output can never be turned on inadvertently.
3	SOURCE2	Source pin 2
4	IN2	Input pin 2 This pin is connected to a pull-down resistor internally, so that even when input wiring is open-circuited, output can never be turned on inadvertently.
5, 6	DRAIN2	Drain pin 2 Drain current is limited (by current limiter) if it exceeds 1 A (min) in order to protect the IC.
7, 8	DRAIN1	Drain pin 1 Drain current is limited (by current limiter) if it exceeds 1 A (min) in order to protect the IC.

**Timing Chart**



Note2: The overheating detector circuits feature hysteresis. After overheating is detected, normal operation is restored only when the channel temperature falls by the hysteresis amount (5°C typ.) in relation to the overheating detection temperature.

**Truth Table**

IN	V <sub>OUT</sub>	Mode
L	H	Normal
H	L	
L	H	Overcurrent
H	H	
L	H	Overtemperature
H	H	

**Absolute Maximum Ratings (Ta = 25°C)**

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V <sub>DS (DC)</sub>	40	V
Drain current	I <sub>D</sub>	Internally Limited	A
Input voltage	V <sub>IN</sub>	-0.3 to 7	V
Power dissipation (t = 10 s)	P <sub>D</sub>	2.0 (Note 3)	W
Single pulse active clamp capability (Note 4)	E <sub>AS</sub>	10	mJ
Active clamp current	I <sub>AR</sub>	1	A
Repetitive active clamp capability (Note 5)	E <sub>AR</sub>	0.2	mJ
Operating temperature	T <sub>opr</sub>	-40 to 110	°C
Channel temperature	T <sub>ch</sub>	150	°C
Storage temperature	T <sub>stg</sub>	-55 to 150	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

## Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10 s) (Note3)	R <sub>th (ch-a)</sub>	62.5	°C/W

Note 3: Drive operation: Mounted on glass epoxy board [25.4mm × 25.4mm × 0.8mm]  
(with the two devices operating)

Note 4: Active clamp capability (single pulse) test condition  
V<sub>DD</sub> = 25 V, Starting T<sub>ch</sub> = 25°C, L = 10 mH, I<sub>AR</sub> = 1 A, R<sub>G</sub> = 25 Ω

Note 5: Repetitive rating, pulse width limited by maximum channel temperature.

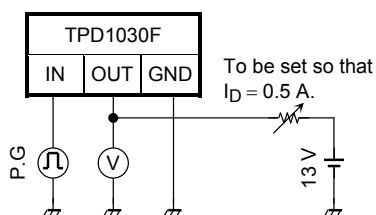
## Electrical Characteristics

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit	
Drain-source clamp voltage	V <sub>(CL) DSS</sub>	—	T <sub>ch</sub> =-40~110°C V <sub>IN</sub> = 0 V, I <sub>D</sub> =1mA	40	—	60	V	
Input threshold voltage	V <sub>th</sub>	—	T <sub>ch</sub> =25°C T <sub>ch</sub> =-40~110°C V <sub>DS</sub> = 13 V, I <sub>D</sub> =10mA	1.0 0.9	—	2.8 3.0	V	
Protective circuit operation input voltage range	V <sub>IN (opr)</sub>	—	T <sub>ch</sub> =25°C T <sub>ch</sub> =-40~110°C	3 3.5	—	7 7	V	
Drain cut-off current	I <sub>DSS</sub>	—	T <sub>ch</sub> =25°C T <sub>ch</sub> =-40~110°C V <sub>IN</sub> = 0 V, V <sub>DS</sub> =30V	— —	—	10 100	μA	
Input current	I <sub>IN (1)</sub>	—	T <sub>ch</sub> =25°C V <sub>IN</sub> = 5 V, at normal operation	—	—	300	μA	
	I <sub>IN (2)</sub>	—	T <sub>ch</sub> =-40~110°C V <sub>IN</sub> = 5 V, when overcurrent protective circuit is actuated	—	—	350		
Drain-source on resistance	R <sub>DS (ON)</sub>	—	T <sub>ch</sub> =25°C T <sub>ch</sub> =-40~110°C I <sub>D</sub> = 0.5 A	— —	0.44	0.6 0.9	Ω	
Overtemperature protection	T <sub>S</sub>	—	— V <sub>IN</sub> = 5 V	150	160	—	°C	
Overcurrent protection	I <sub>S</sub>	—	T <sub>ch</sub> =25°C T <sub>ch</sub> =-40~110°C V <sub>IN</sub> = 5 V	1 0.7	1.8	—	A	
Switching time	t <sub>ON</sub>	1	T <sub>ch</sub> =25°C	V <sub>DD</sub> = 13 V, V <sub>IN</sub> = 0V/5 V, I <sub>D</sub> = 0.5 A	—	—	30	μs
			T <sub>ch</sub> =-40~110°C		—	—	60	
	T <sub>ch</sub> =25°C		—		—	60		
	T <sub>ch</sub> =-40~110°C		—		—	90		
t <sub>OFF</sub>	—	—	—	—	—	—	—	
Source-drain diode forward voltage	V <sub>DSF</sub>	—	T <sub>ch</sub> =25°C I <sub>F</sub> = 1 A, V <sub>IN</sub> = 0 V	—	—	1.7	V	

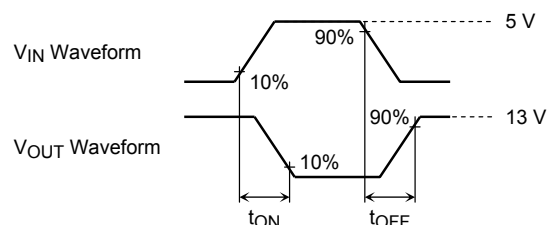
## Test Circuit 1

Switching time measuring circuit

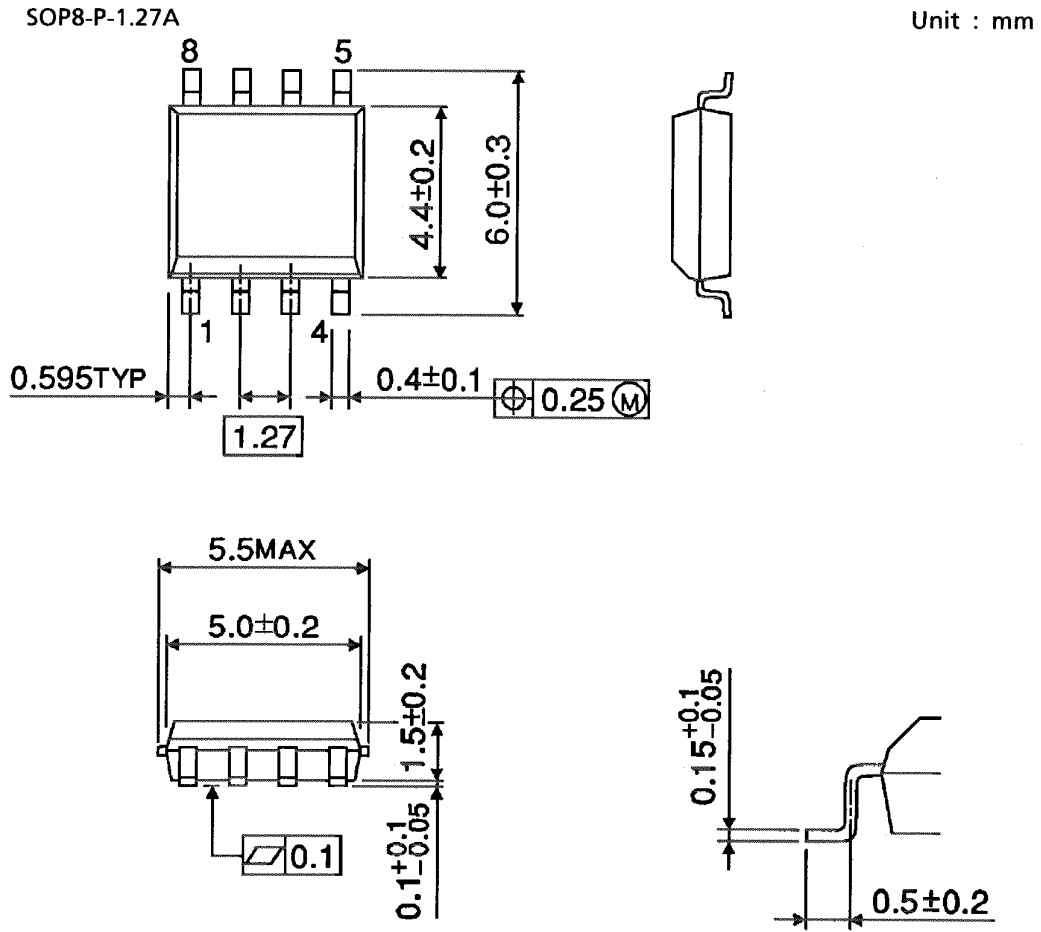
### Test Circuit



### Measured Waveforms



## Package Dimensions



Weight: 0.08 g (typ.)

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