

**Preliminary**

Toshiba Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

**TPD1030F**

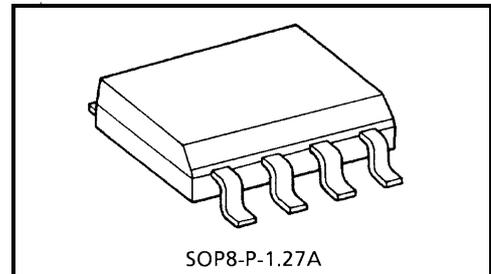
2-IN-1 Low-Side Switch for Motor, Solenoid and Lamp Drive

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 offers intelligent self-protection function.

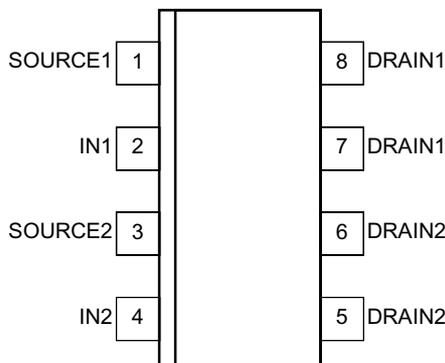
**Features**

- Built-in two 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)**



Note1: That because of its MOS structure, this product is sensitive to static electricity.

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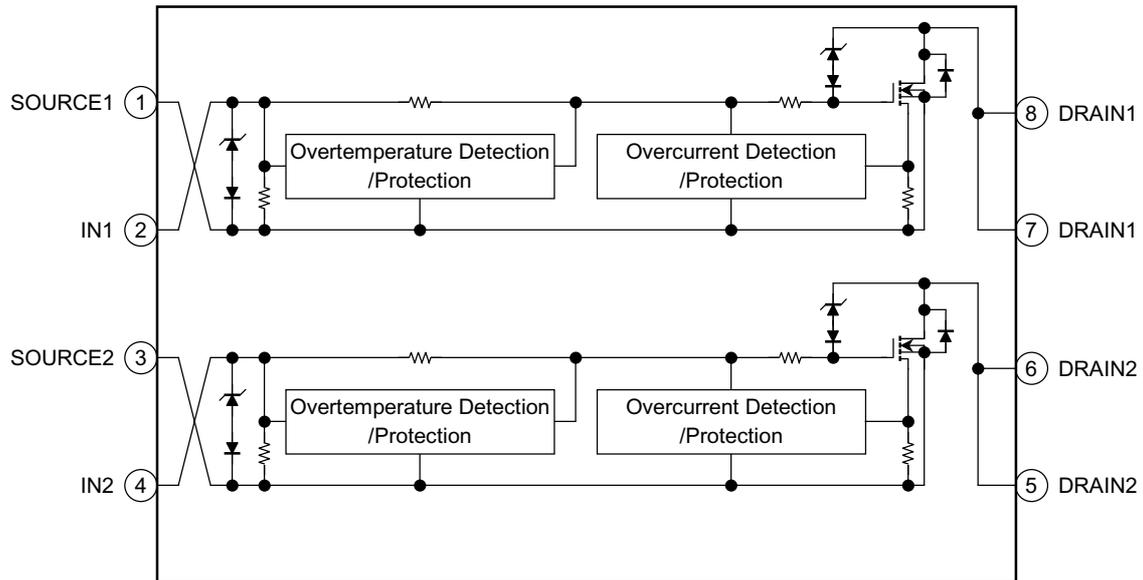
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**Block Diagram**

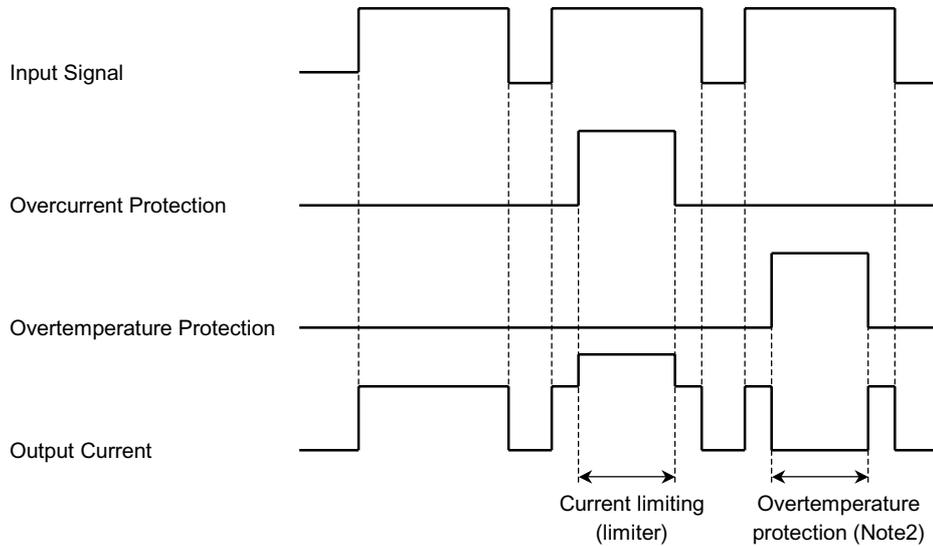


**Pin Description**

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.

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**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	

**Maximum Ratings (Ta = 25°C)**

Characteristics	Symbol	Rating	Unit
Drain-source voltage	V <sub>DS</sub> (DC)	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 (Note3)	W
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

Note3: Drive operation: Mount on glass epoxy board [1 inch<sup>2</sup> × 0.8 t] (in the two devices driving)

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### 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

Note3: Drive operation: Mount on glass epoxy board [1 inch<sup>2</sup> × 0.8 t] (in the two devices driving)

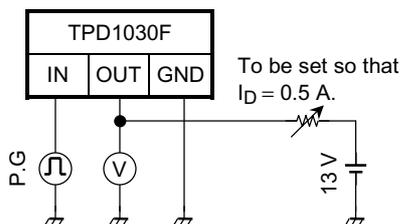
### Electrical Characteristics (T<sub>ch</sub> = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Drain-source clamp voltage	V <sub>(CL) DSS</sub>	—	V <sub>IN</sub> = 0 V, I <sub>D</sub> = 1 mA	40	—	60	V
Input threshold voltage	V <sub>th</sub>	—	V <sub>DS</sub> = 13 V, I <sub>D</sub> = 10 mA	1.0	—	2.8	V
Protective circuit operation input voltage range	V <sub>IN (opr)</sub>	—	—	3	—	7	V
Drain cut-off current	I <sub>DSS</sub>	—	V <sub>IN</sub> = 0 V, V <sub>DS</sub> = 30 V	—	—	10	μA
Input current	I <sub>IN (1)</sub>	—	V <sub>IN</sub> = 5 V, at normal operation	—	—	300	μA
	I <sub>IN (2)</sub>	—	V <sub>IN</sub> = 5 V, when protective circuit is actuated	—	—	390	
Drain-source on resistance	R <sub>DS (ON)</sub>	—	V <sub>IN</sub> = 5 V, I <sub>D</sub> = 0.5 A	—	0.44	0.6	Ω
Overtemperature protection	T <sub>S</sub>	—	V <sub>IN</sub> = 5 V	150	160	—	°C
Overcurrent protection	I <sub>S</sub>	—	V <sub>IN</sub> = 5 V	1.0	—	—	A
Switching time	t <sub>ON</sub>	1	V <sub>DD</sub> = 13 V, V <sub>IN</sub> = 5 V, I <sub>D</sub> = 0.5 A	—	—	30	μs
	t <sub>OFF</sub>	1		—	—	30	
Source-drain diode forward voltage	V <sub>DSF</sub>	—	I <sub>F</sub> = 1 A, V <sub>IN</sub> = 0 V	—	—	1.7	V

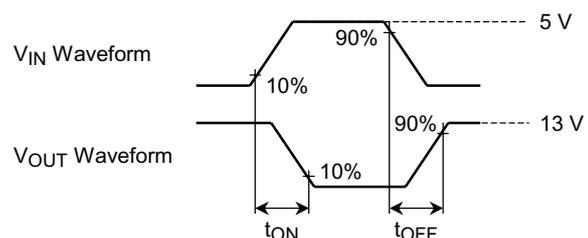
### Test Circuit 1

Switching time measuring circuit

#### Test Circuit

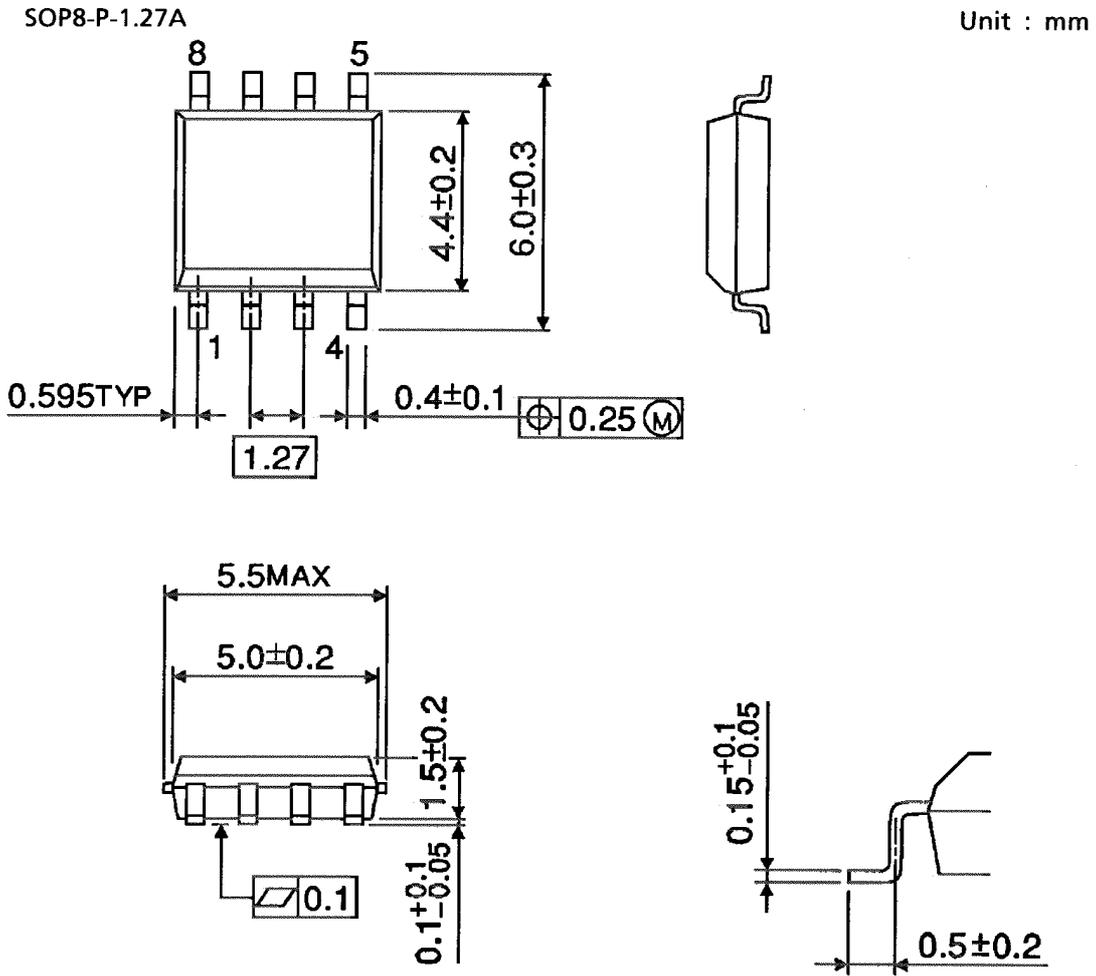


#### Measured Waveforms



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**Package Dimensions**



Weight: 0.08 g (typ.)