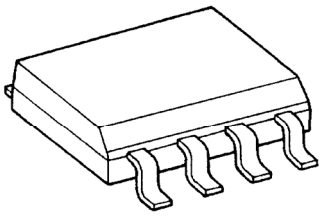
Toshiba Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

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.



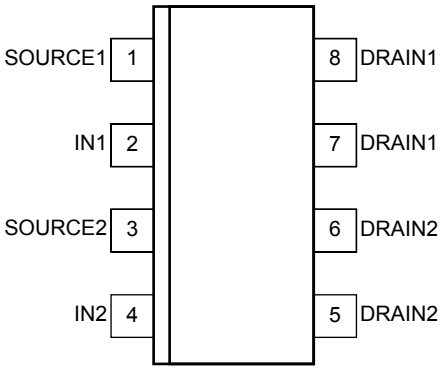
SOP8-P-1.27A

Weight: 0.08 g (typ.)

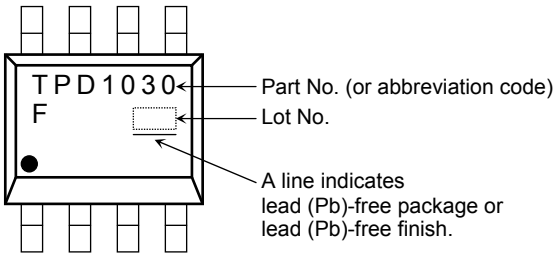
Features

- Two built-in power IC chips with a new structure combining a control block and a vertical power MOSFET (L^2-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: $R_{DS\ (ON)}$ = 0.6 Ω (max) (@V_{IN} = 5 V, I_D = 0.5 A, T_{ch} = 25°C)
- Low Leakage Current: I_{DSS} = 10 μA (max) (@V_{IN} = 0 V, V_{DS} = 30 V, T_{ch} = 25°C)
- Low Input Current: I_{IN} = 300 μA (max) (@V_{IN} = 5 V, T_{ch} = 25°C)
- 8-pin SOP package with embossed-tape packing.

Pin Assignment (top view)

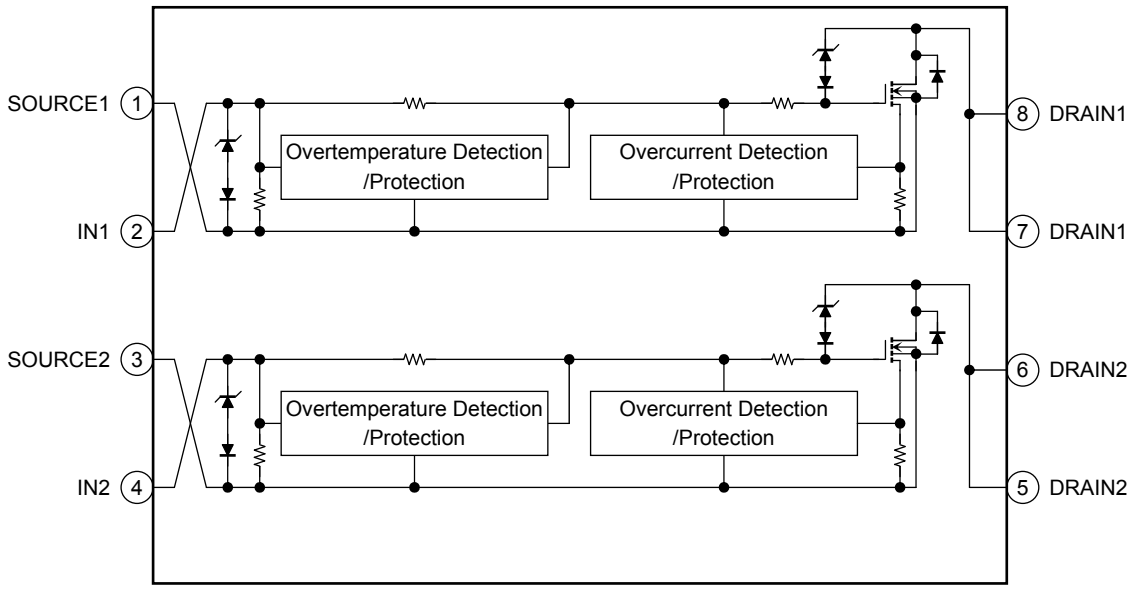


Marking



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

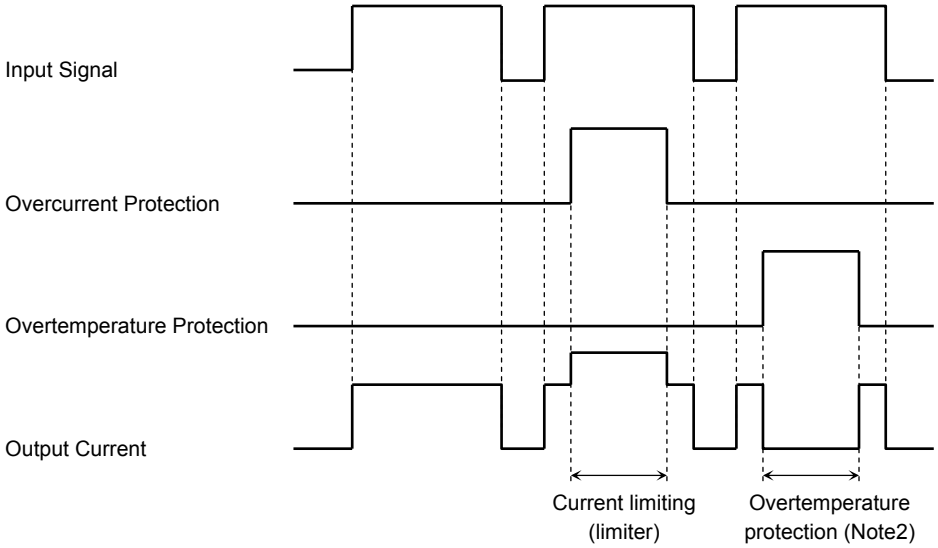
Block Diagram



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_{OUT}	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	$V_{DS\ (DC)}$	40	V
Drain current	I_D	Internally Limited	A
Input voltage	V_{IN}	−0.3 to 7	V
Power dissipation (t = 10 s)	P_D	2.0 (Note 3)	W
Single pulse active clamp capability (Note 4)	E_{AS}	10	mJ
Active clamp current	I_{AR}	1	A
Repetitive active clamp capability (Note 5)	E_{AR}	0.2	mJ
Operating temperature	T_{opr}	−40 to 110	°C
Channel temperature	T_{ch}	150	°C
Storage temperature	T_{stg}	−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)	$R_{th\ (ch\text{-}a)}$	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_{DD} = 25 V, Starting T_{ch} = 25°C, L = 10 mH, I_{AR} = 1 A, R_G = 25 Ω

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

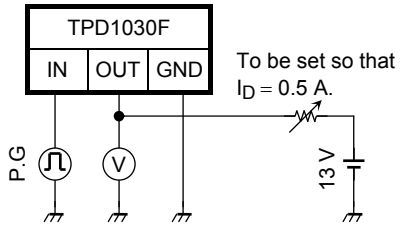
Electrical Characteristics

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

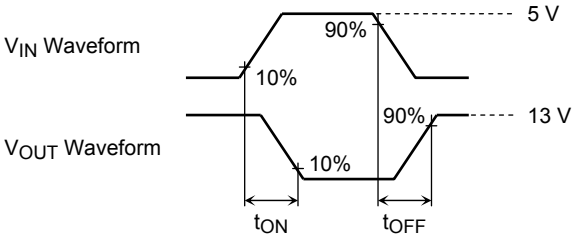
Test Circuit 1

Switching time measuring circuit

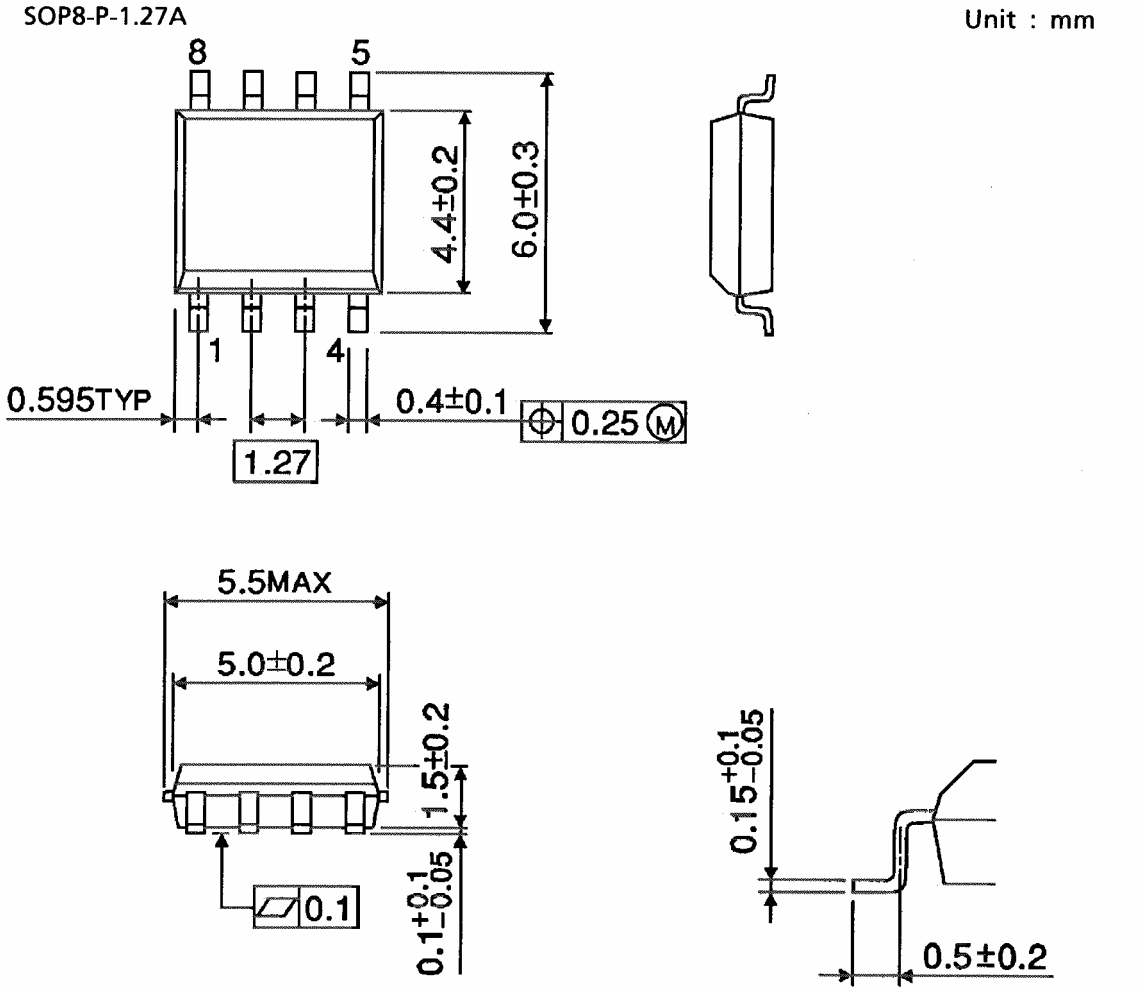
Test Circuit



Measured Waveforms



Package Dimensions



Weight: 0.08 g (typ.)

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