

TOSHIBA INTELLIGENT POWER DEVICE SILICON MONOLITHIC POWER MOS IC

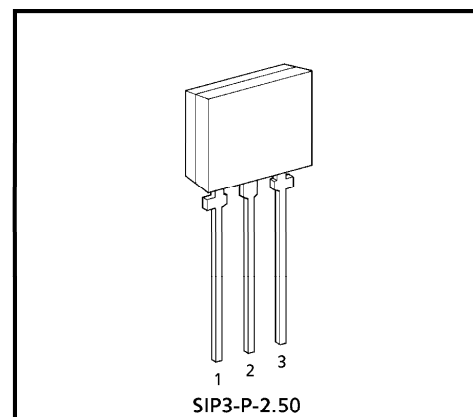
# TPD1028AS

## LOW-SIDE SWITCH FOR MOTOR, SOLENOID AND LAMP DRIVE

TPD1028AS is a monolithic power IC for 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 functions.

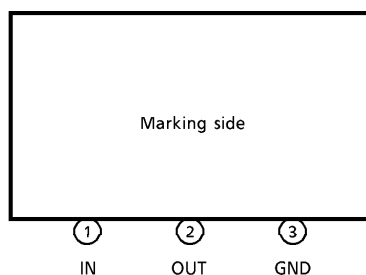
### FEATURES

- A monolithic power IC with a new structure combining a control block and a vertical power MOSFET ( $\pi$ -MOS) on a single chip.
- Can directly drive a power load from a CMOS logic etc.
- Built-in protection circuits against overvoltage, overheat, and overcurrent.
- Low ON-resistance.  $R_{DS(ON)} = 0.25 \Omega$  (Max.) (@ $V_{IN} = 5V$ ,  $T_j = 25^\circ C$ )
- Package TPS can be packed in tape.



Weight : 0.54 g (Typ.)

### PIN ASSIGNMENT

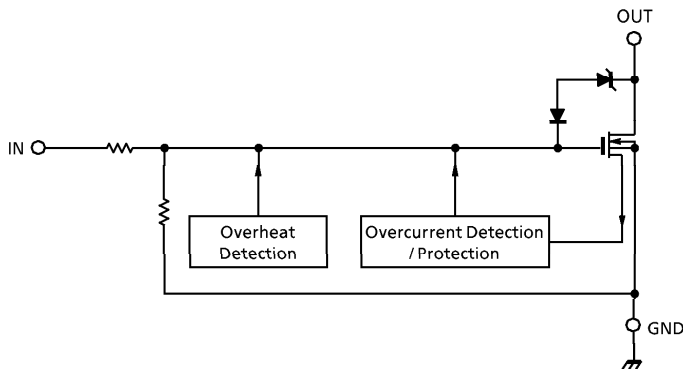


(Note) That because of its MOS structure, this product is sensitive to static electricity.

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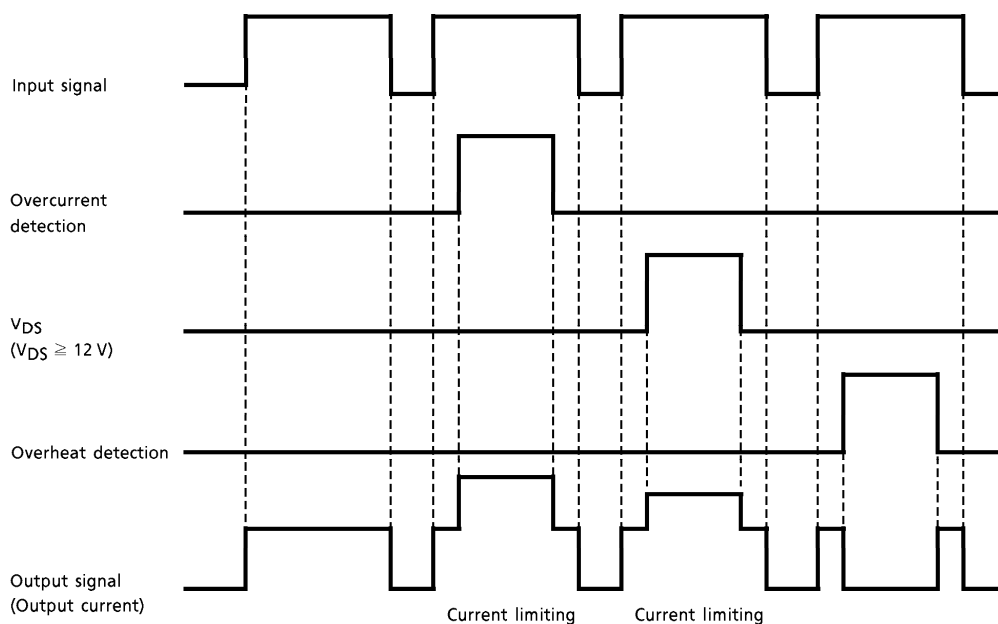
**BLOCK DIAGRAM**



**PIN DESCRIPTION**

PIN No.	SYMBOL	PIN DESCRIPTION
1	IN	Input pin. 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.
2	OUT	Output pin. If an inrush current flows (e.g., from a lamp), the current is clamped at 10 A (typ.) by an overcurrent protective circuit. Also, a 150 $\mu$ s (typ.) mask circuit is included internally, so that if $V_{DS} \geq 12$ V (typ.) after this mask time, the current is clamped at 3 A (Typ.).
3	GND	Ground pin.

**TIMING CHART**



## TRUTH TABLE

IN	VOUT	MODE
L	H	Normal
H	L	
L	H	Overcurrent (during inrush)
H	L	
L	H	Overcurrent (shorted load)
H	L	
L	H	Overheat
H	H	

## MAXIMUM RATING (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Drain-source Voltage	V <sub>DS</sub> (DC)	40	V
Output Current	I <sub>D</sub>	1.5	A
Input Voltage	V <sub>IN</sub>	-0.5~6	V
Power Dissipation	P <sub>D</sub>	1.2	W
Energy Tolerance	ES / B	200	mJ
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Junction Temperature	T <sub>j</sub>	150	°C

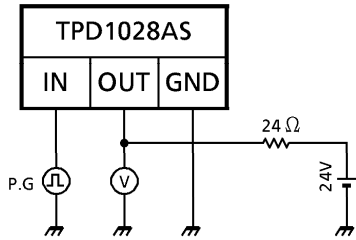
## ELECTRICAL CHARACTERISTICS (Tj = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Drain-source Breakdown Voltage	V <sub>(BR) DSS</sub>	—	V <sub>IN</sub> = 0 V, I <sub>D</sub> = 10 mA	40	—	—	V
Operating Supply Voltage	V <sub>DD</sub>	—	—	—	—	38	V
High Level Input Voltage	V <sub>IH</sub>	—	V <sub>DS</sub> = 24 V, I <sub>D</sub> = 1 A	4.5	5	5.5	V
Low Level Input Voltage	V <sub>IL</sub>	—	V <sub>DS</sub> = 24 V, I <sub>D</sub> = 10 μA	—	—	0.8	V
Current at Output Off	I <sub>DSS</sub> (1)	—	V <sub>IN</sub> = 0 V, V <sub>DS</sub> = 40 V	—	—	100	μA
	I <sub>DSS</sub> (2)	—	V <sub>IN</sub> = 0 V, V <sub>DS</sub> = 24 V	—	—	10	
Input Current	I <sub>IN</sub>	—	V <sub>IN</sub> = 5 V, at normal operation	—	—	300	μA
ON-Resistance	R <sub>DS</sub> (ON)	—	V <sub>IN</sub> = 5 V, I <sub>D</sub> = 1 A	—	—	0.25	Ω
Overheat Protection	T <sub>S</sub>	—	V <sub>IN</sub> = 5 V	—	160	—	°C
Overcurrent Protection	I <sub>S</sub> (1)	—	V <sub>DS</sub> = 24 V, V <sub>IN</sub> = 5 V, during inrush	—	10	—	A
	I <sub>S</sub> (2)	—	V <sub>DS</sub> = 24 V, V <sub>IN</sub> = 5 V, when shorted load	—	3	—	
Shorted Load Detection Voltage	V <sub>DS</sub>	—	When shorted load	—	12	—	V
Switching Time	t <sub>ON</sub>	1	V <sub>DS</sub> = 24 V, V <sub>IN</sub> = 5 V, R <sub>L</sub> = 24 Ω	—	70	—	μs
	t <sub>OFF</sub>			—	120	—	
Diode Forward Voltage Between Drain and Source	V <sub>DSF</sub>	—	I <sub>F</sub> = 1.5 A	—	0.9	1.8	V

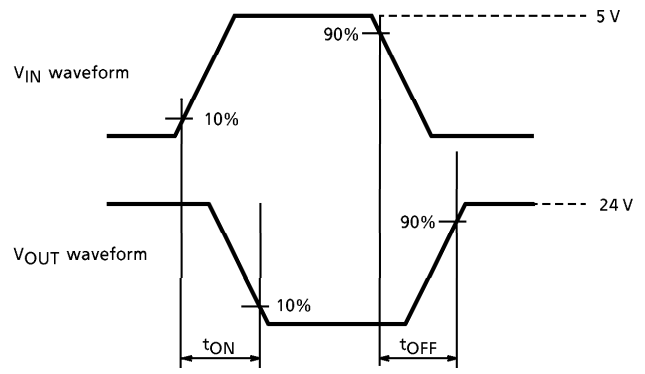
**TEST CIRCUIT 1**

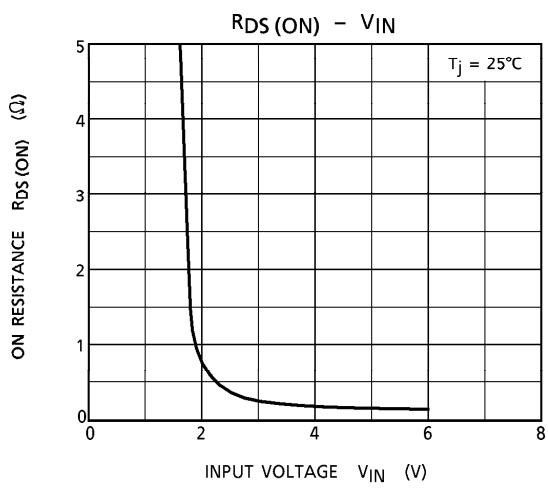
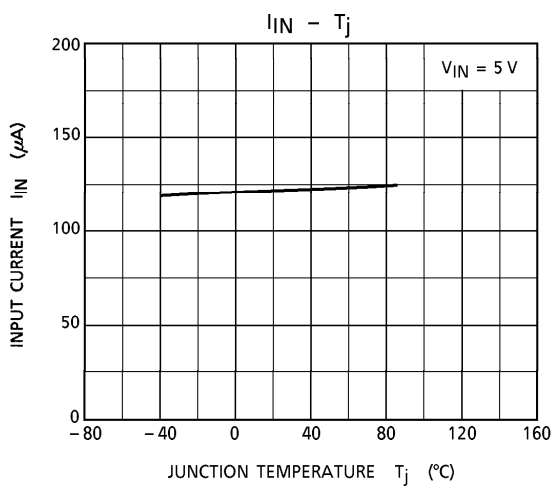
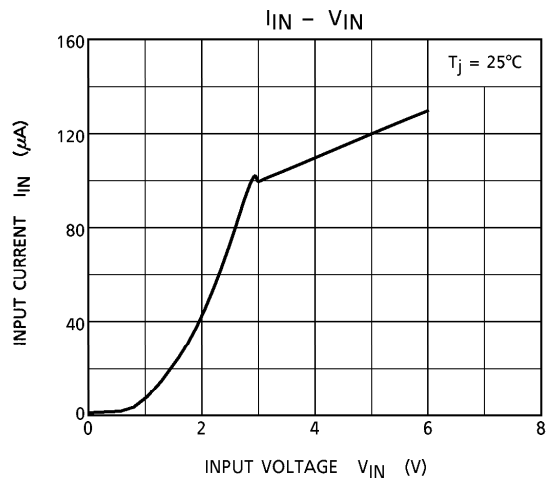
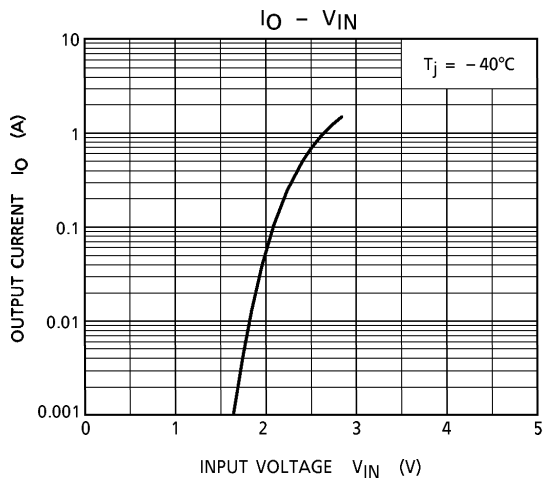
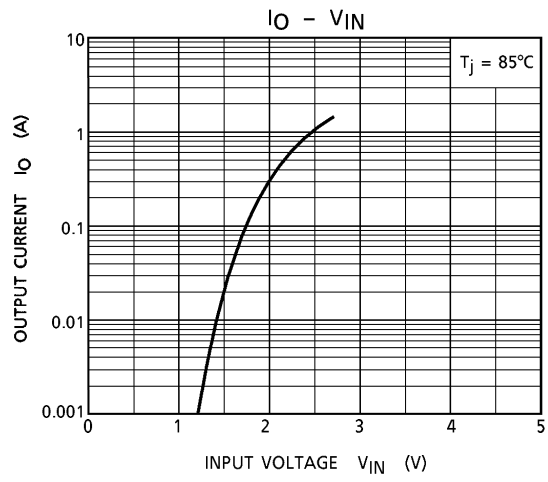
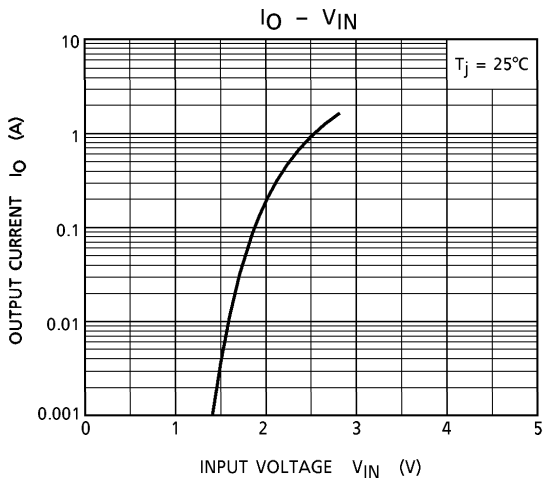
Switching time measuring circuit

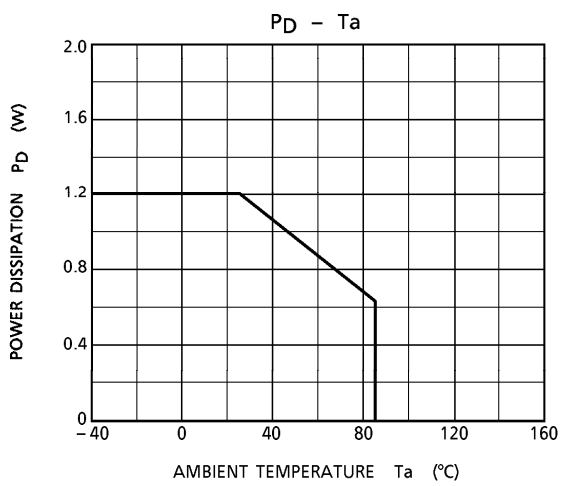
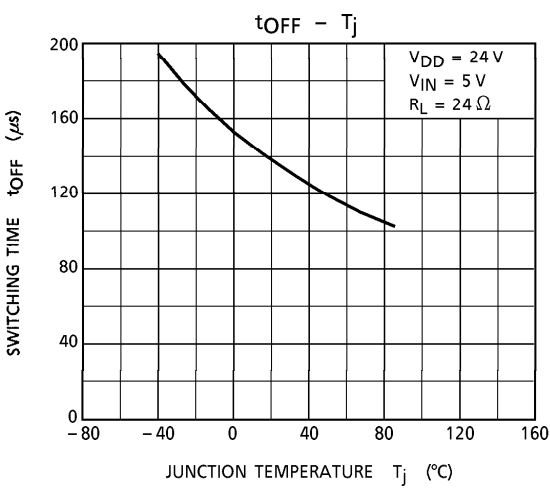
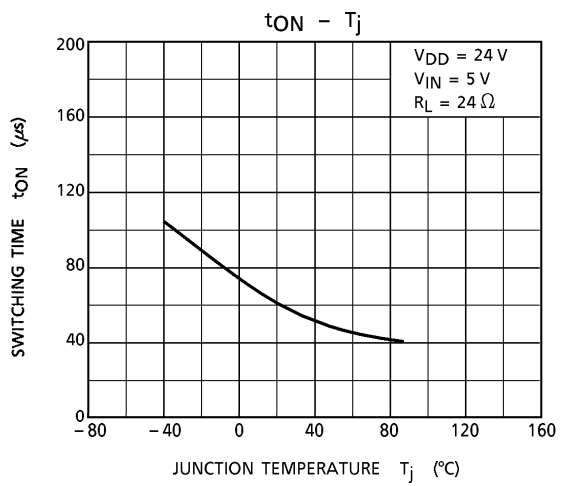
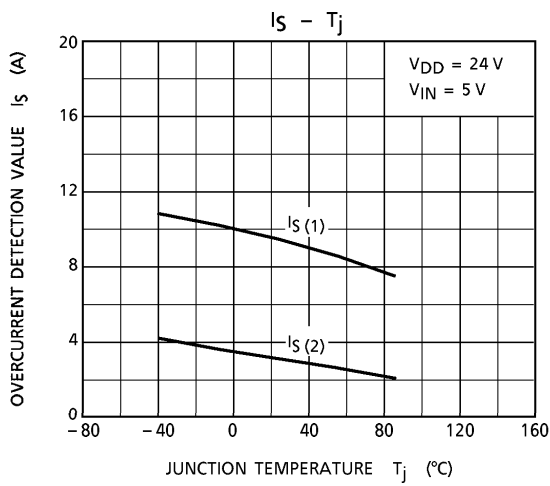
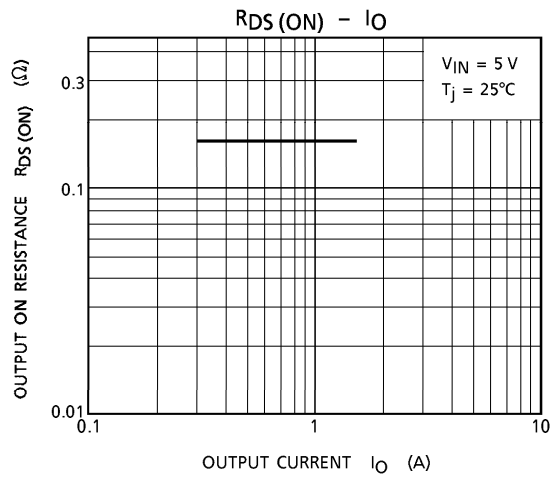
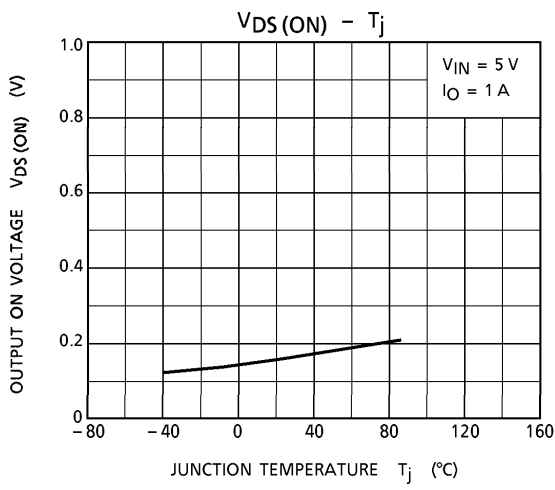
Test circuit



Measured waveforms

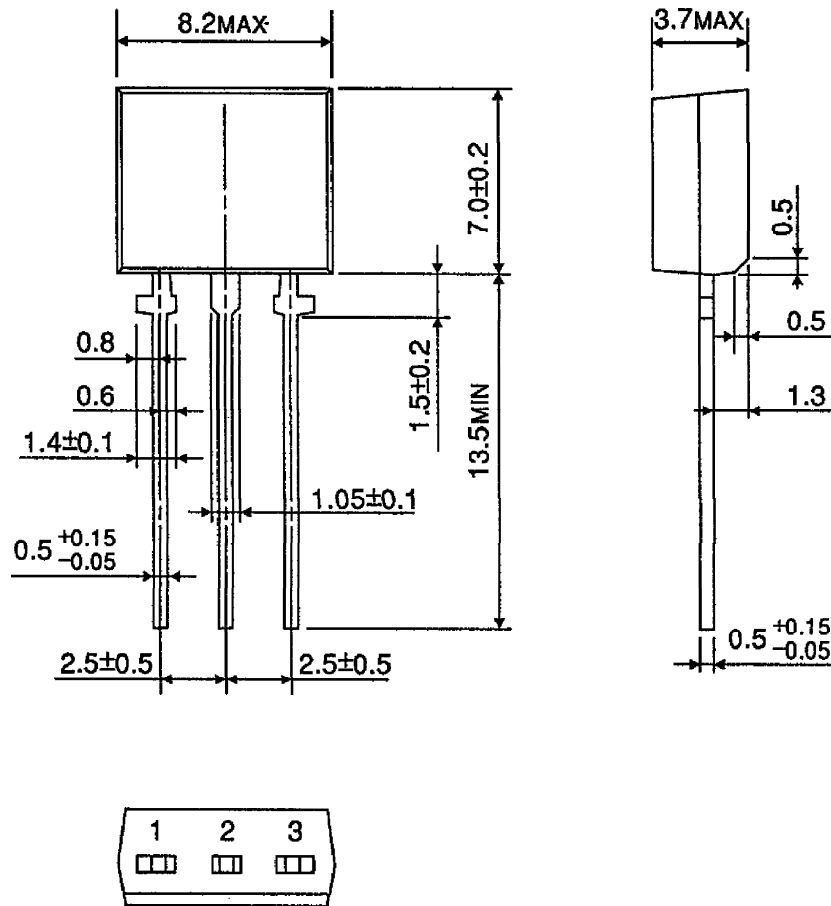






OUTLINE DRAWING  
SIP3-P-2.50

Unit : mm



Weight : 0.54 g (Typ.)