

TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS IC

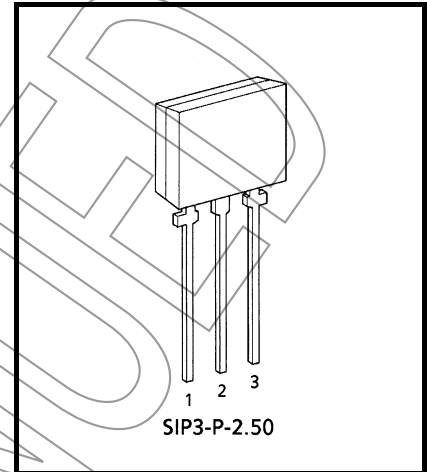
# TPD1028AS

## 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.

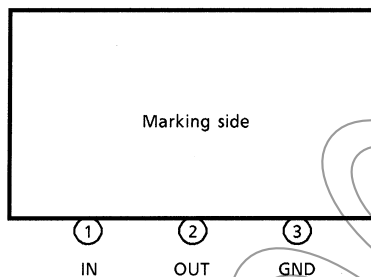
### Features

- 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, load short circuit, and thermal shutdown.
- 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.



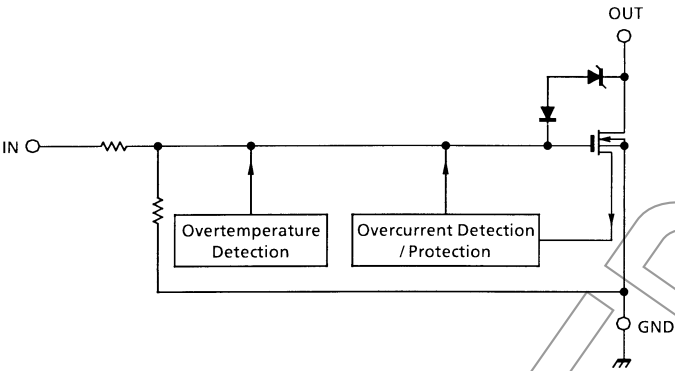
Weight: 0.54g (typ.)

### Pin Assignment



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

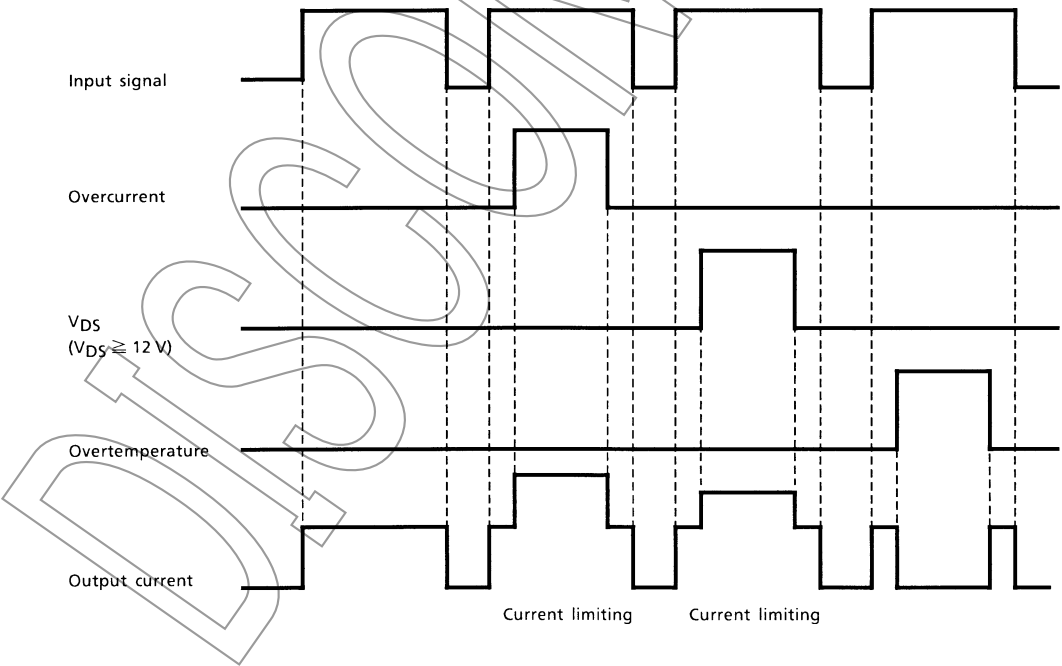
Block Diagram



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 10A (typ.) by an overcurrent protective circuit. Also, a 150 $\mu$ s (typ.) mask circuit is included internally, so that if $V_{DS} \geq 12V$ (typ.) after this mask time, the current is clamped at 3A (typ.).
3	GND	Ground pin.

Timing Chart



## Truth Table

IN	VOUT	State
L	H	Normal
H	L	
L	H	Overcurrent (during inrush)
H	L	
L	H	Overcurrent (shorted load)
H	L	
L	H	Overtemperature
H	H	

## Maximum Rating (Ta = 25°C)

Characteristics	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

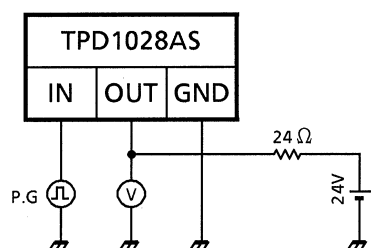
Electrical Characteristics (T<sub>j</sub> = 25°C)

Characteristics	Symbol	Test Circuit	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> = 10mA	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> = 1A	4.5	5	5.5	V
Low Level Input Voltage	V <sub>IL</sub>	—	V <sub>DS</sub> = 24 V, I <sub>D</sub> = 10μA	—	—	0.8	V
Current at Output Off	I <sub>DSS</sub> (1)	—	V <sub>IN</sub> = 0V, V <sub>DS</sub> = 40V	—	—	100	μA
	I <sub>DSS</sub> (2)	—	V <sub>IN</sub> = 0V, V <sub>DS</sub> = 24V	—	—	10	
Input Current	I <sub>IN</sub>	—	V <sub>IN</sub> = 5V, at normal operation	—	—	300	μA
On Resistance	R <sub>DS</sub> (ON)	—	V <sub>IN</sub> = 5V, I <sub>D</sub> = 1A	—	—	0.25	Ω
Thermal Shutdown Temperature	T <sub>S</sub>	—	V <sub>IN</sub> = 5V	—	160	—	°C
Overcurrent Protection	I <sub>S</sub> (1)	—	V <sub>DS</sub> = 24V, V <sub>IN</sub> = 5V, during inrush	—	10	—	A
	I <sub>S</sub> (2)	—	V <sub>DS</sub> = 24V, V <sub>IN</sub> = 5V, 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> = 24V, V <sub>IN</sub> = 5V, R <sub>L</sub> = 24Ω	—	70	—	μs
	t <sub>OFF</sub>			—	120	—	
Diode Forward Voltage Between Drain and Source	V <sub>DSF</sub>	—	I <sub>F</sub> = 1.5A	—	0.9	1.8	V

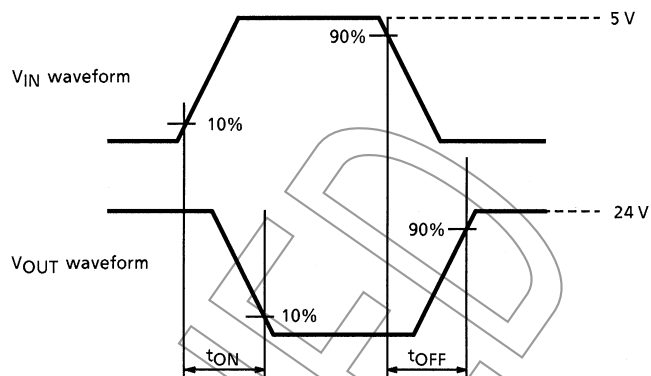
## Test Circuit 1

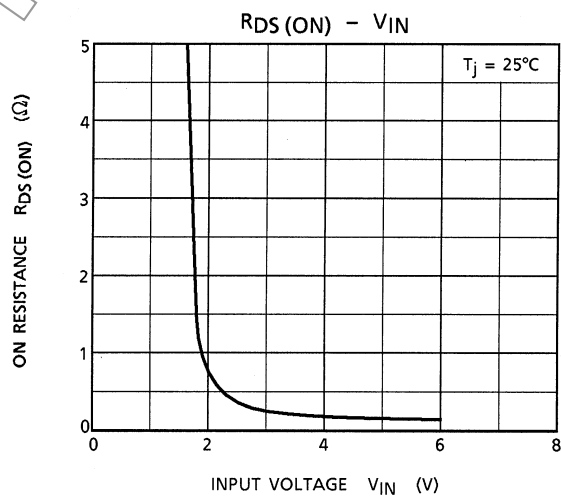
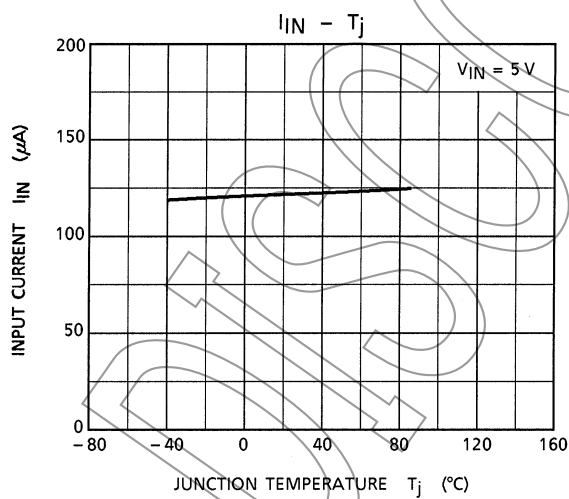
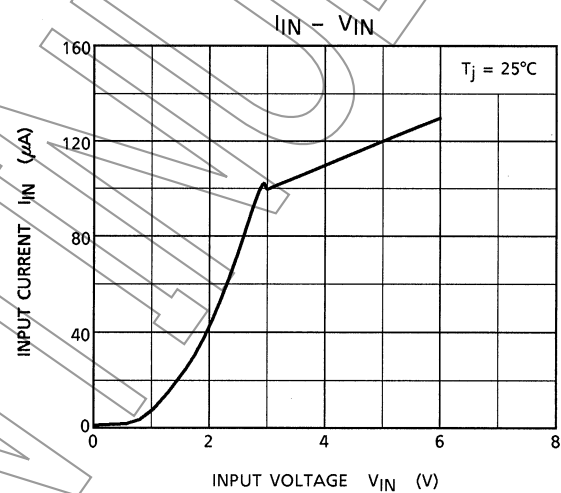
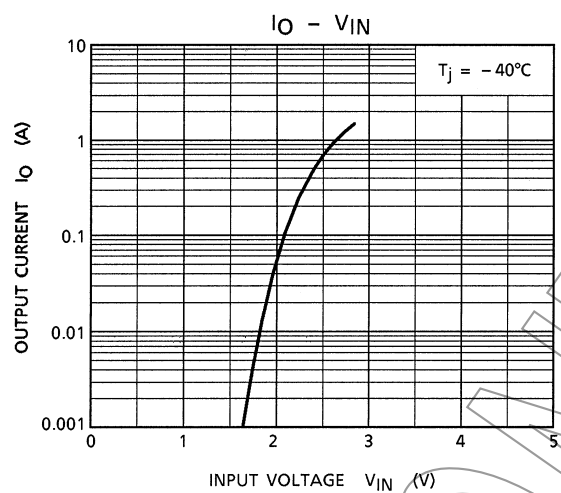
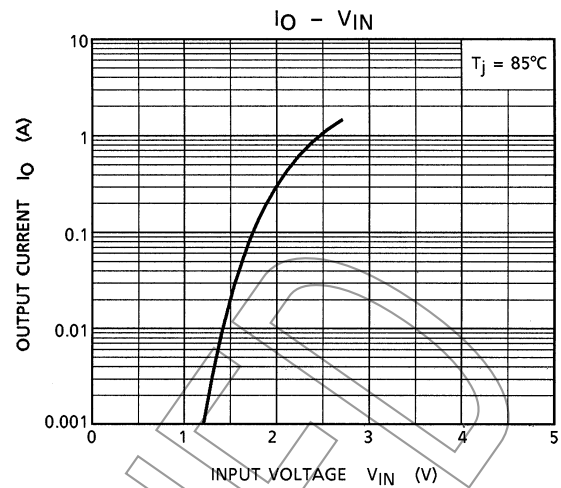
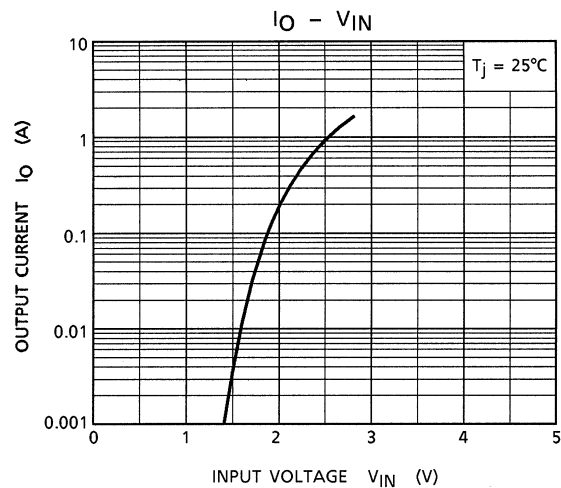
### Switching time measuring circuit

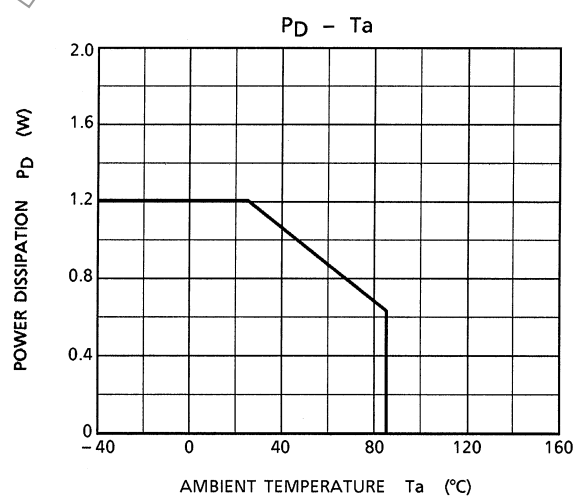
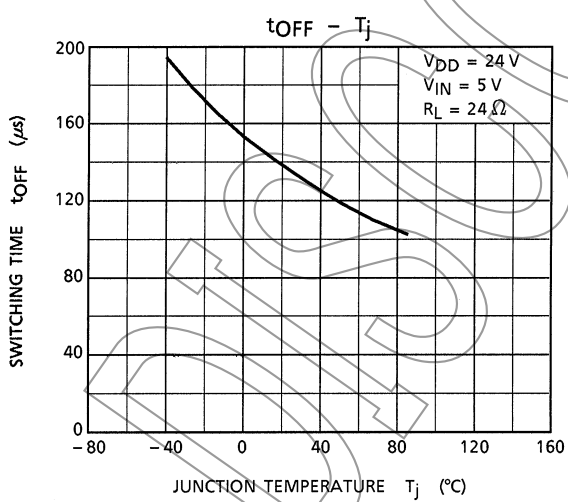
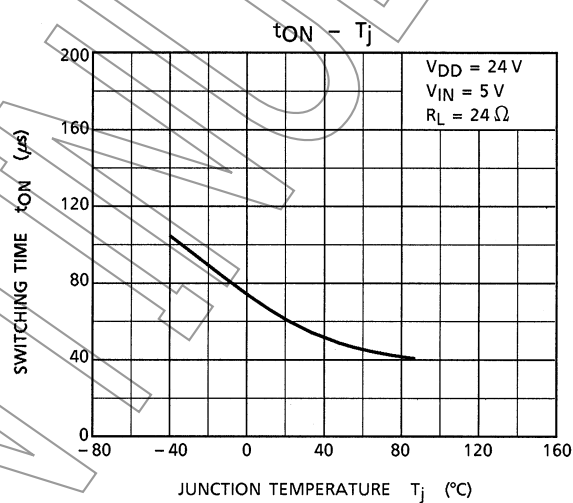
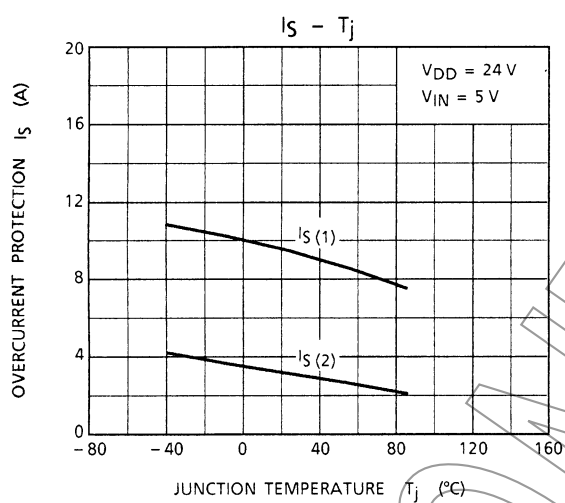
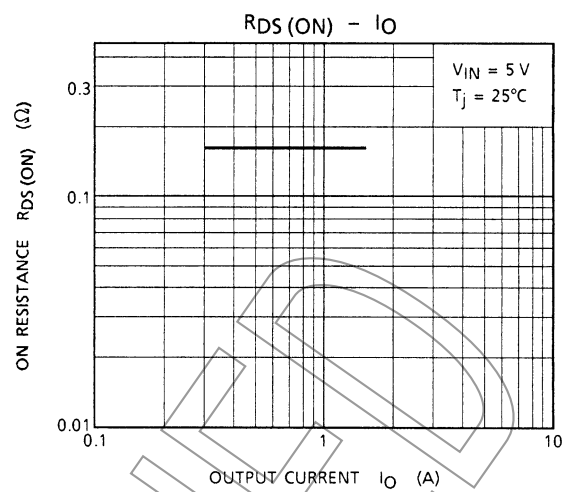
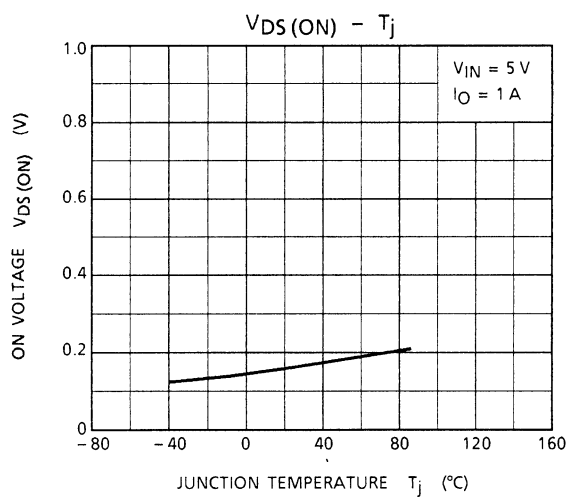
Test circuit



Measured waveforms

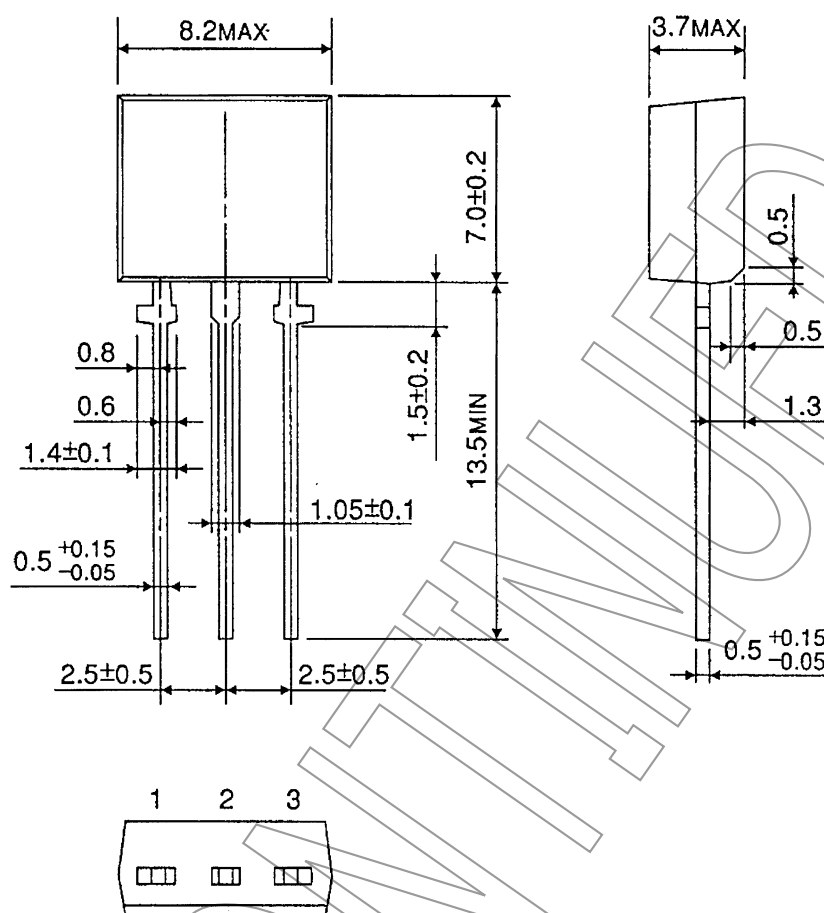






## SIP3-P-2.50

Unit : mm



Weight: 0.54g (typ.)

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