

TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS IC

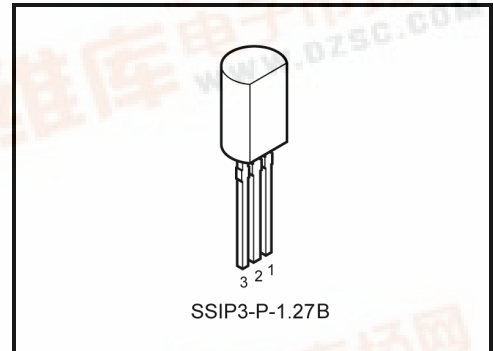
# TPD1028BS

## Low-Side Switch for Motors, Solenoids, and Lamp Drivers

TPD1028BS 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.

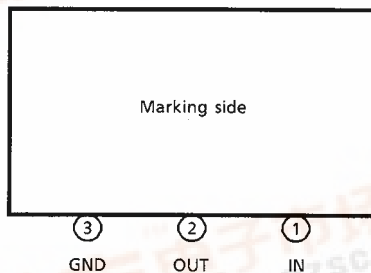
### Features

- A monolithic power IC with a new structure combining a control block and a vertical power MOSFET (n-MOS) on a single chip.
- Can directly drive a power load from a CMOS or TTL logic.
- Built-in Protection circuits against overvoltage, load short circuiting, and thermal shutdown.
- Low on-resistance.  $R_{DS(ON)} = 0.25 \text{ (max) (@} V_{IN} = 5 \text{ V, } T_j = 25^\circ\text{C)}$
- Package TO-92(MOD) can be packed in tape.



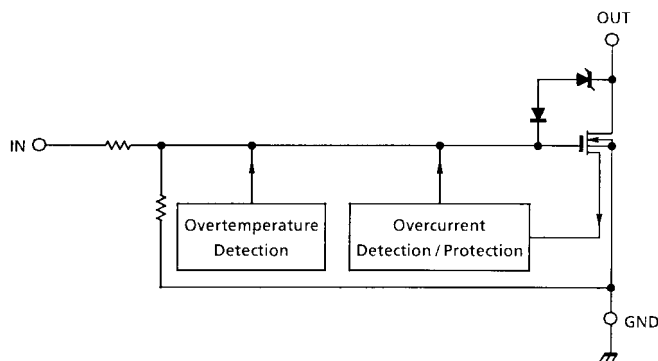
Weight: 0.36 g (typ.)

### Pin Assignment



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

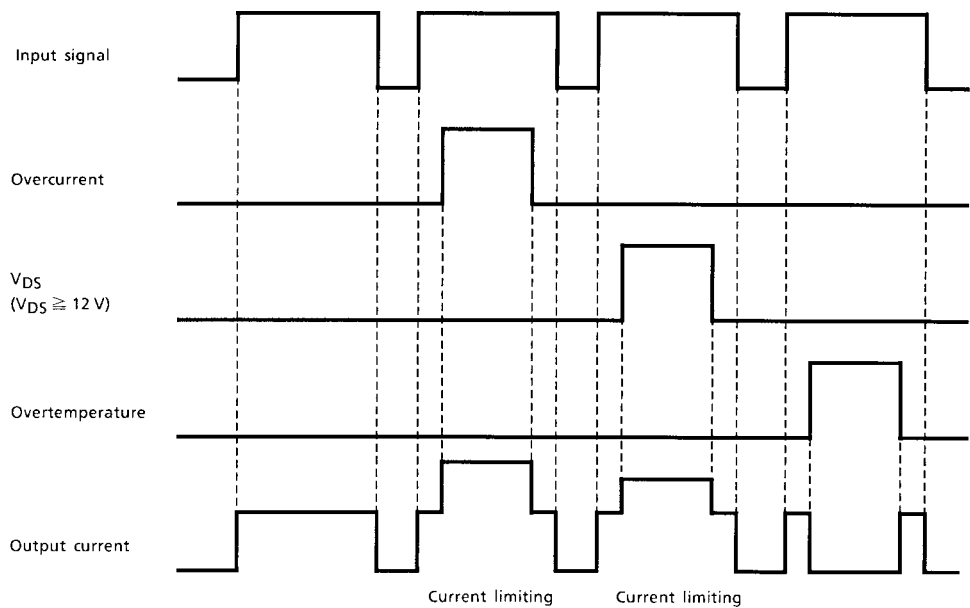
Block Diagram



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 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	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)

Characteristic	Symbol	Rating	Unit
Drain-source voltage	$V_{DS}$ (DC)	40	V
Output current	$I_D$	1.5	A
Input voltage	$V_{IN}$	- 0.5 ~ 6	V
Power dissipation	$P_D$	0.9	W
Energy tolerance	$E_S / B$	200	mJ
Operating temperature	$T_{opr}$	- 40 ~ 85	°C
Junction temperature	$T_j$	150	°C

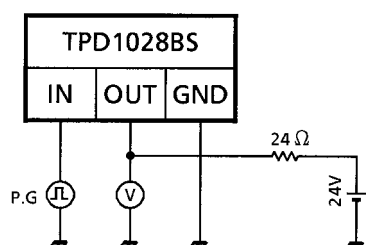
## Electrical Characteristics (T<sub>j</sub> = 25°C)

Characteristic	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> = 10 mA	40	—	—	V
Operating supply voltage	V <sub>DD</sub>	—	—	—	—	38	V
High level input voltage	V <sub>IH(1)</sub>	—	V <sub>DS</sub> = 24 V, I <sub>D</sub> = 1 A	4.5	5	5.5	V
	V <sub>IH(2)</sub>	—	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.75 A	3.9	5	5.7	
	V <sub>IH(3)</sub>	—	V <sub>DS</sub> = 38 V, I <sub>D</sub> = 0.75 A	3.9	5	5.7	
Low level input voltage	V <sub>IL(1)</sub>	—	V <sub>DS</sub> = 24 V, I <sub>D</sub> = 10 μA	—	—	0.8	V
	V <sub>IL(2)</sub>	—	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 10 μA	—	—	0.8	
	V <sub>IL(3)</sub>	—	V <sub>DS</sub> = 38 V, I <sub>D</sub> = 10 μA	—	—	0.8	
Current at output off	I <sub>DSS(1)</sub>	—	V <sub>IN</sub> = 0 V, V <sub>DS</sub> = 40 V	—	—	100	μA
	I <sub>DSS(2)</sub>		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(ON)</sub>	—	V <sub>IN</sub> = 5 V, I <sub>D</sub> = 1 A	—	—	0.25	Ω
Thermal shutdown temperature	T <sub>S</sub>	—	V <sub>IN</sub> = 5 V	—	160	—	°C
Overcurrent protection	I <sub>S(1)</sub>	—	V <sub>DS</sub> = 24 V, V <sub>IN</sub> = 5 V, during inrush	—	10	—	A
	I <sub>S(2)</sub>	—	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

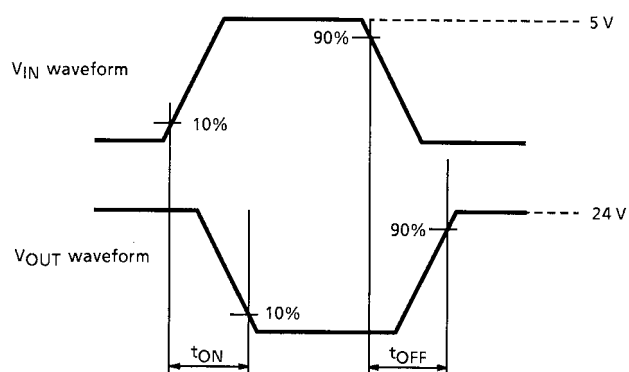
## Test Circuit 1

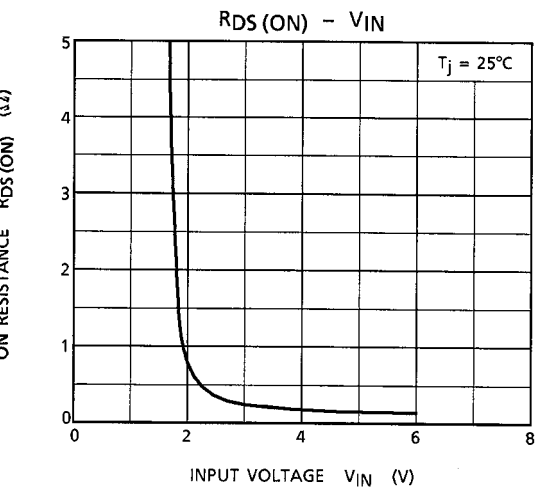
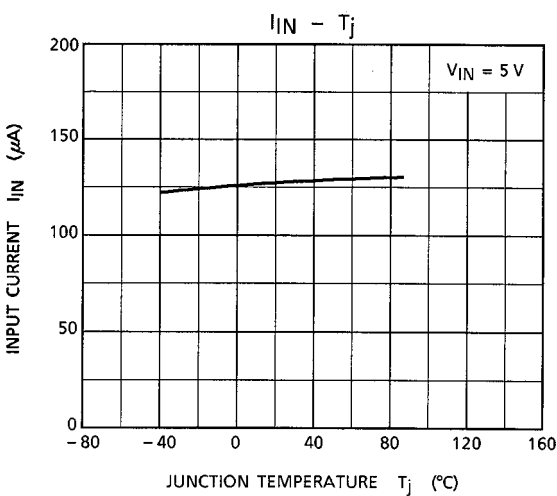
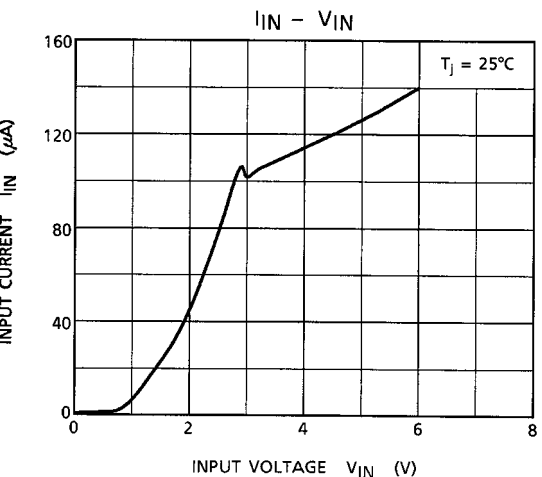
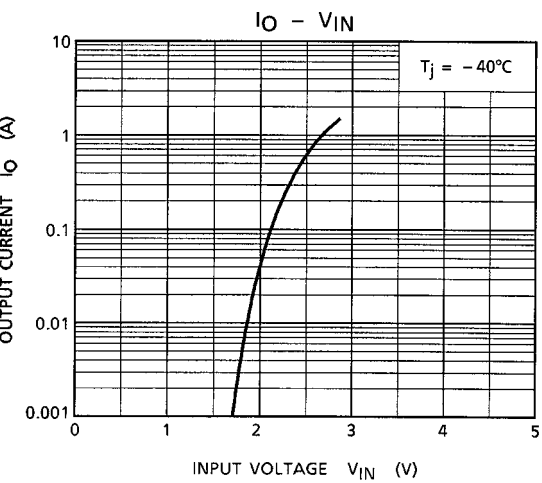
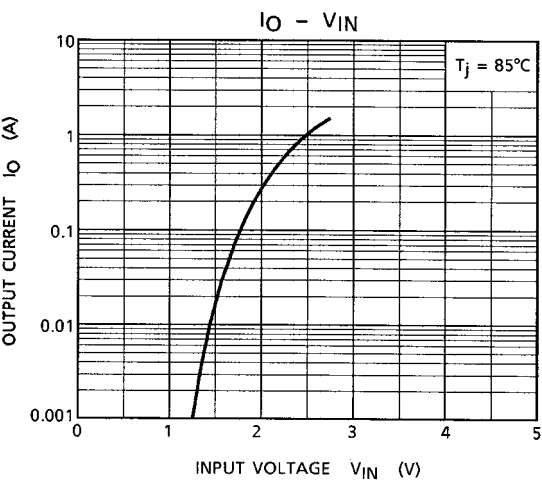
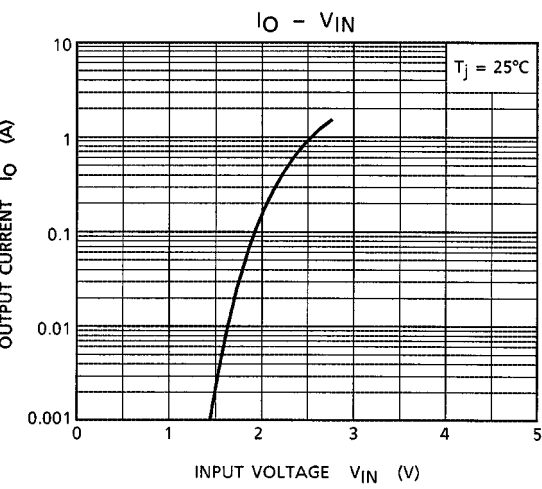
### Switching time measuring circuit

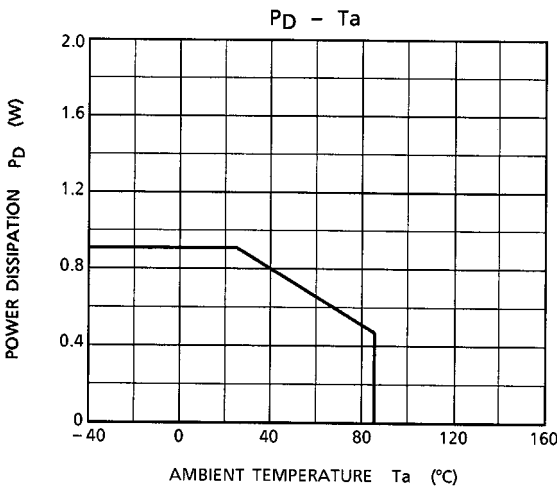
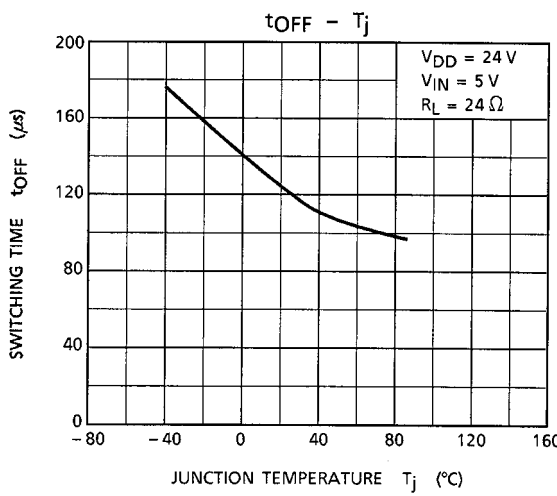
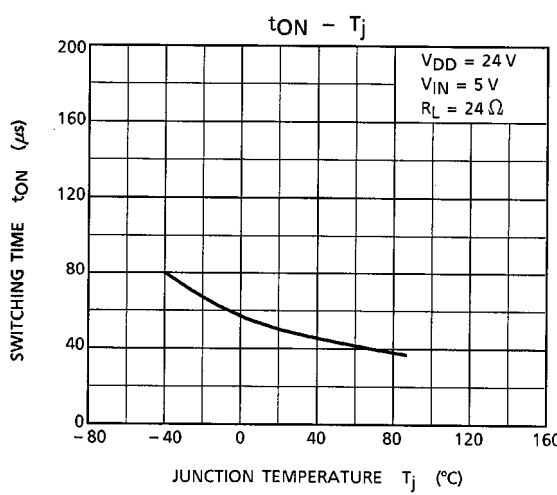
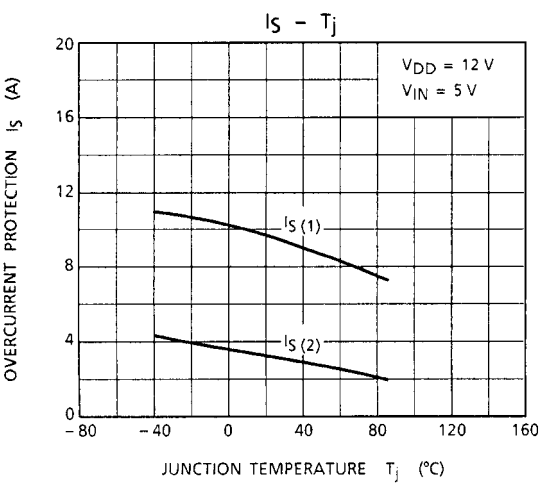
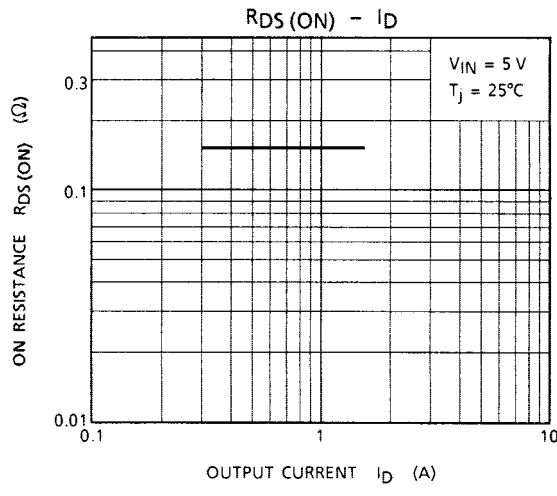
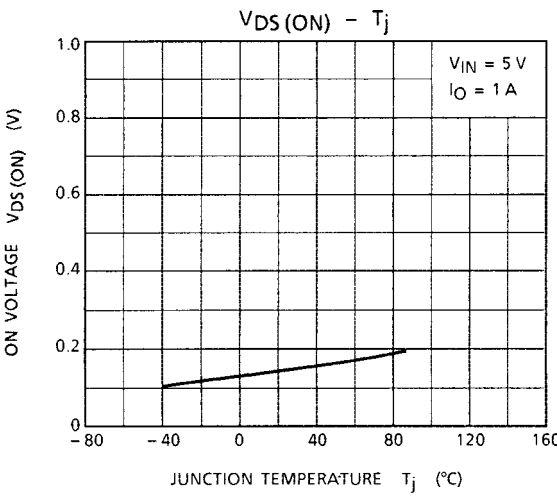
#### Test circuit



#### Measured waveforms



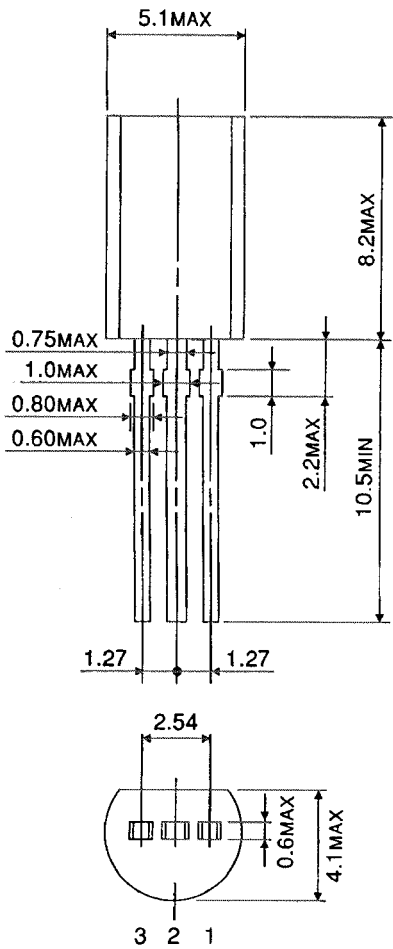




Package Dimensions

SSIP3-P-1.27B

Unit : mm



Weight: 0.36 g (typ.)

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