

TOSHIBA INTELLIGENT POWER DEVICE SILICON MONOLITHIC POWER MOS IC

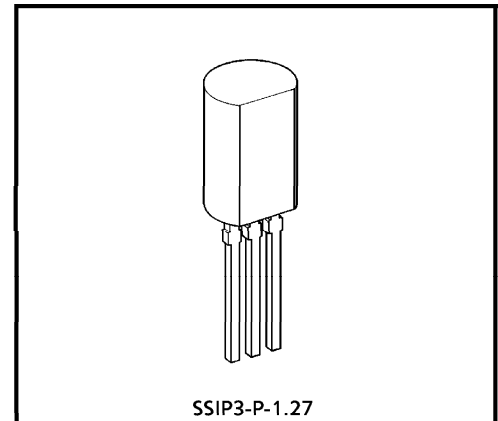
# TPD1028BS

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

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.

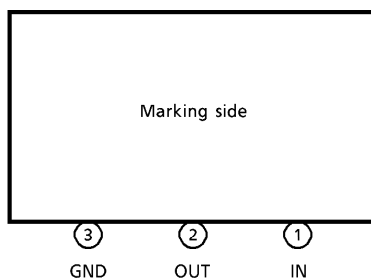
### FEATURES

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



Weight : 0.36 g (Typ.)

### PIN ASSIGNMENT

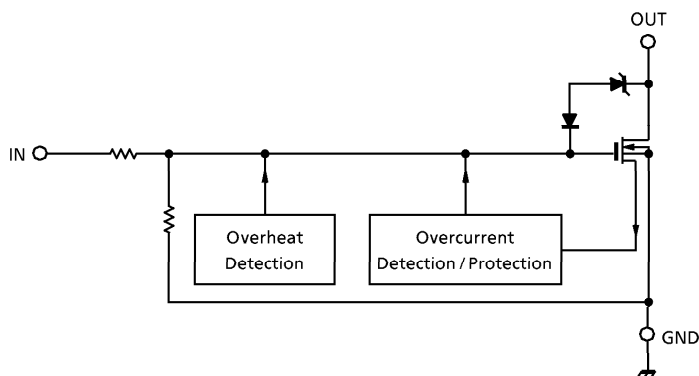


(Note) That because of its MOS structure, this product is sensitive to static electricity.

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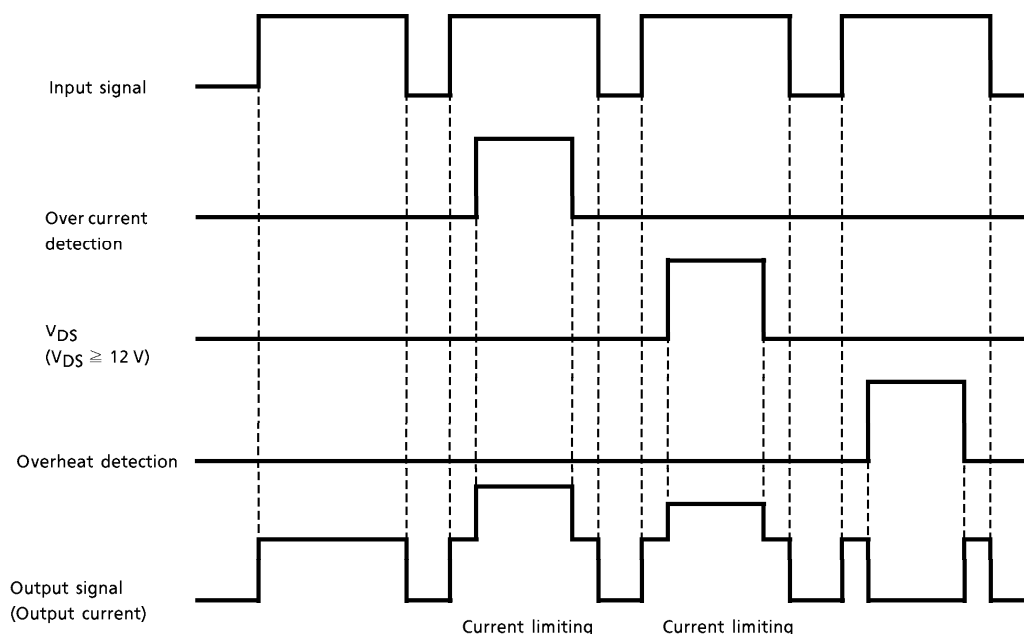
BLOCK DIAGRAM



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	

## ABSOLUTE 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>	0.9	W
Energy Tolerance	ES / B	200	mJ
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Junction Temperature	T <sub>j</sub>	150	°C

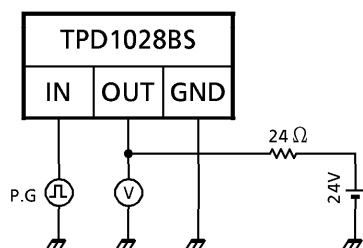
**ELECTRICAL CHARACTERISTICS** ( $T_j = 25^\circ\text{C}$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT
Drain-source Breakdown Voltage	$V_{(BR)DSS}$	—	$V_{IN} = 0\text{ V}, I_D = 10\text{ mA}$	40	—	—	V
Operating Supply Voltage	$V_{DD}$	—	—	—	—	38	V
High Level Input Voltage	$V_{IH(1)}$	—	$V_{DS} = 24\text{ V}, I_D = 1\text{ A}$	4.5	5	5.5	V
	$V_{IH(2)}$	—	$V_{DS} = 10\text{ V}, I_D = 0.75\text{ A}$	3.9	5	5.7	
	$V_{IH(3)}$	—	$V_{DS} = 38\text{ V}, I_D = 0.75\text{ A}$	3.9	5	5.7	
Low Level Input Voltage	$V_{IL(1)}$	—	$V_{DS} = 24\text{ V}, I_D = 10\ \mu\text{A}$	—	—	0.8	V
	$V_{IL(2)}$	—	$V_{DS} = 10\text{ V}, I_D = 10\ \mu\text{A}$	—	—	0.8	
	$V_{IL(3)}$	—	$V_{DS} = 38\text{ V}, I_D = 10\ \mu\text{A}$	—	—	0.8	
Current at Output Off	$I_{DSS(1)}$	—	$V_{IN} = 0\text{ V}, V_{DS} = 40\text{ V}$	—	—	100	$\mu\text{A}$
	$I_{DSS(2)}$	—	$V_{IN} = 0\text{ V}, V_{DS} = 24\text{ V}$	—	—	10	
Input Current	$I_{IN}$	—	$V_{IN} = 5\text{ V}$ , at normal operation	—	—	300	$\mu\text{A}$
ON-Resistance	$R_{DS(ON)}$	—	$V_{IN} = 5\text{ V}, I_D = 1\text{ A}$	—	—	0.25	$\Omega$
Overheat Protection	$T_S$	—	$V_{IN} = 5\text{ V}$	—	160	—	$^\circ\text{C}$
Overcurrent Protection	$I_S(1)$	—	$V_{DS} = 24\text{ V}, V_{IN} = 5\text{ V}$ , during inrush	—	10	—	A
	$I_S(2)$	—	$V_{DS} = 24\text{ V}, V_{IN} = 5\text{ V}$ , when shorted load	—	3	—	
Shorted Load Detection Voltage	$V_{DS}$	—	when shorted load	—	12	—	V
Switching Time	$t_{ON}$	1	$V_{DS} = 24\text{ V}, V_{IN} = 5\text{ V}$ , $R_L = 24\ \Omega$	—	70	—	$\mu\text{s}$
	$t_{OFF}$			—	120	—	
Diode Forward Voltage Between Drain and Source	$V_{DSF}$	—	$I_F = 1.5\text{ A}$	—	0.9	1.8	V

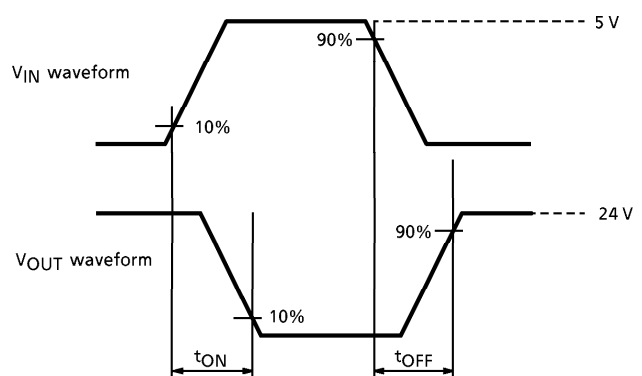
**TEST CIRCUIT 1**

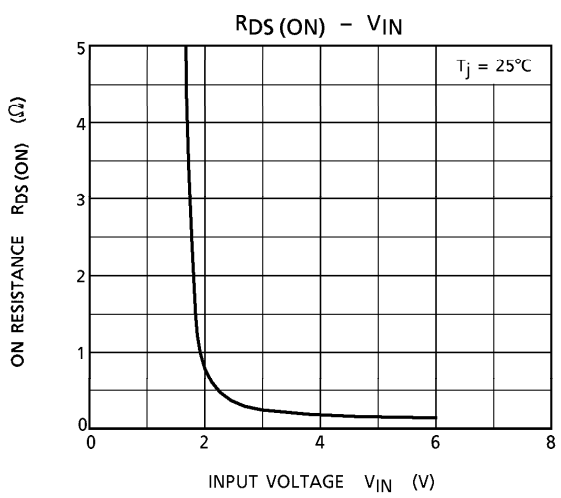
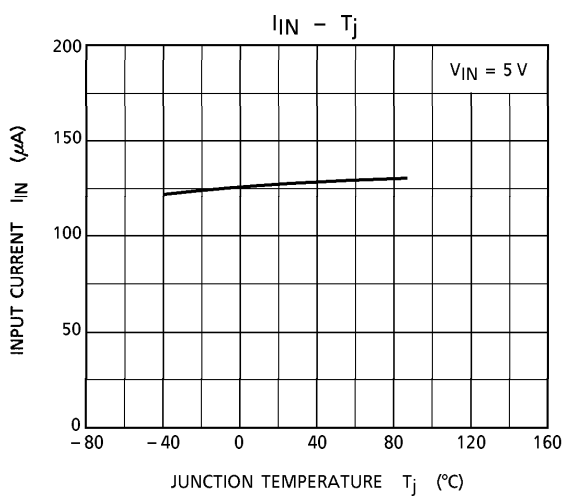
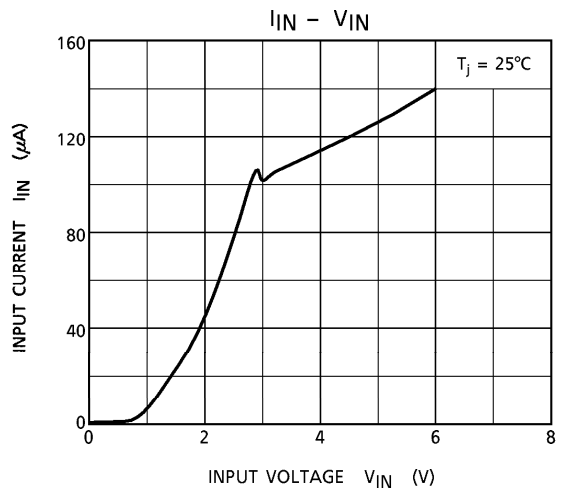
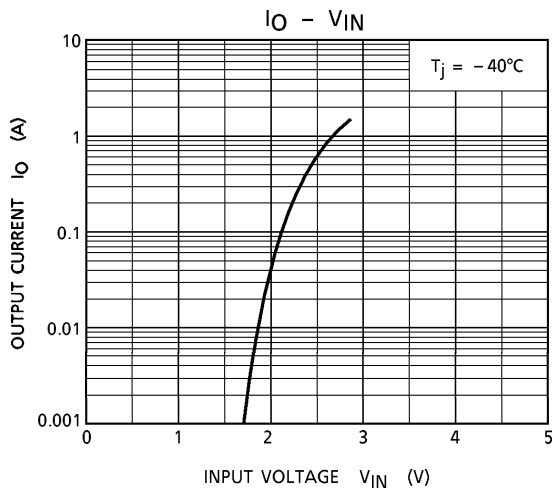
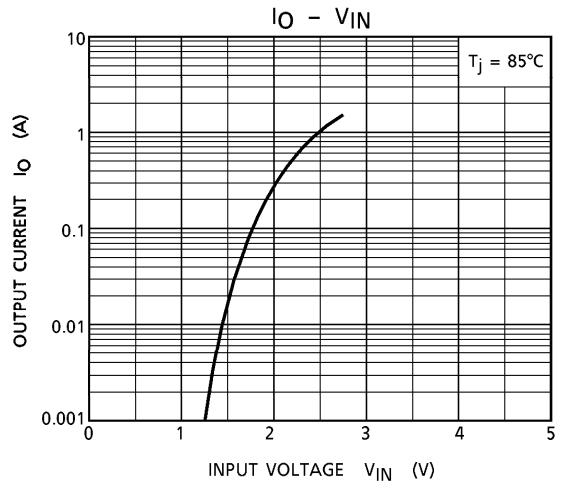
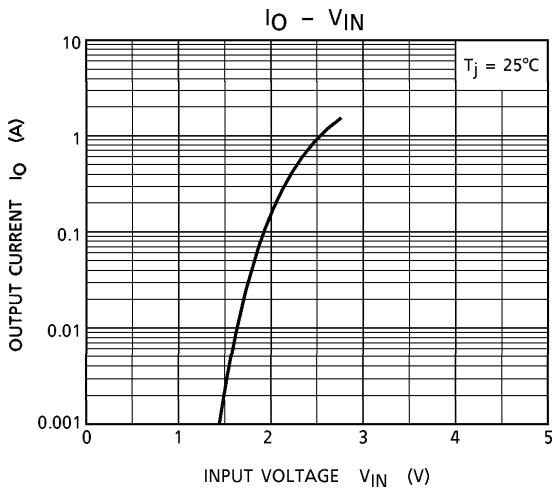
Switching time measuring circuit

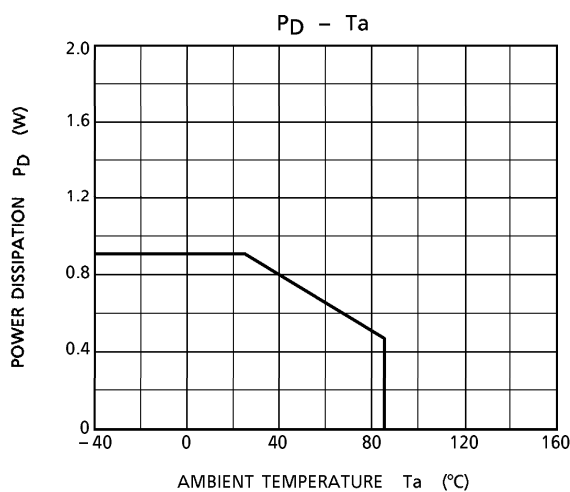
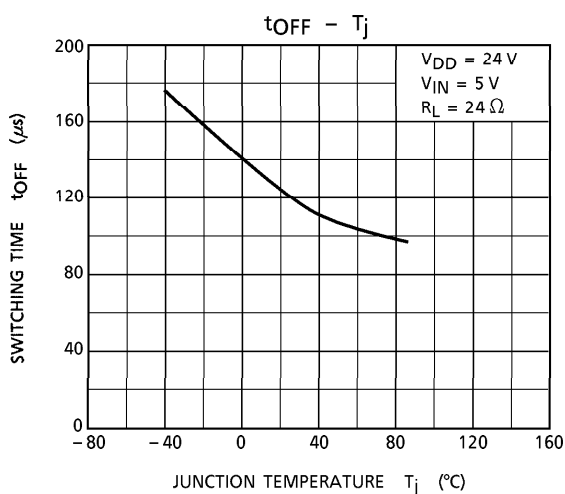
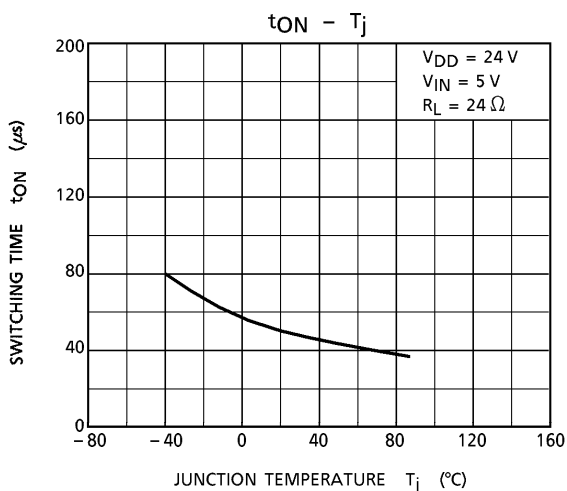
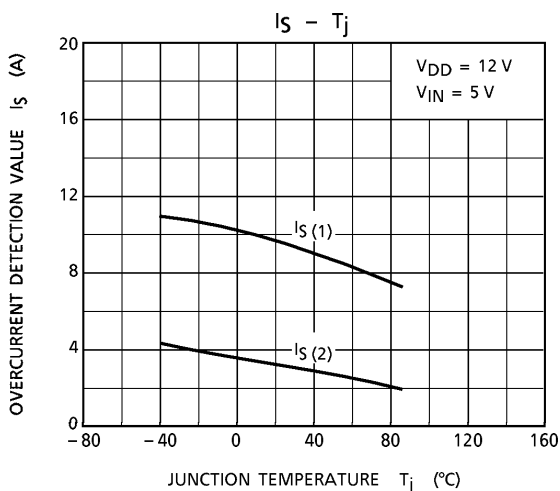
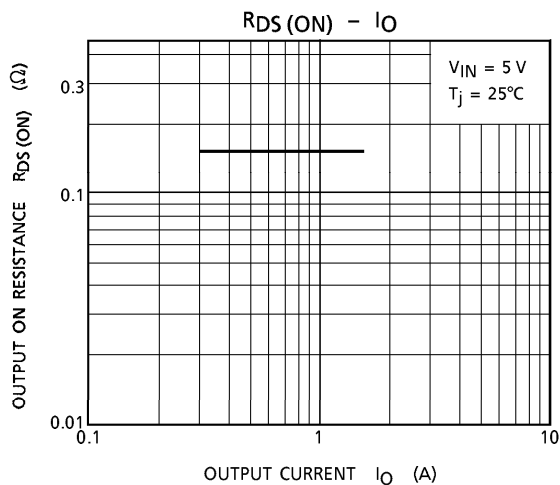
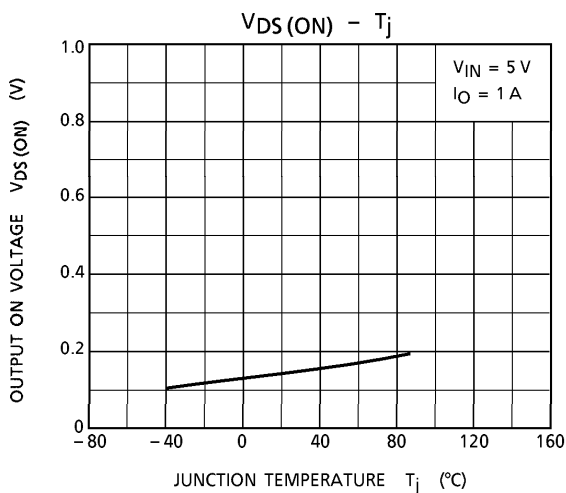
Test circuit



Measured waveforms

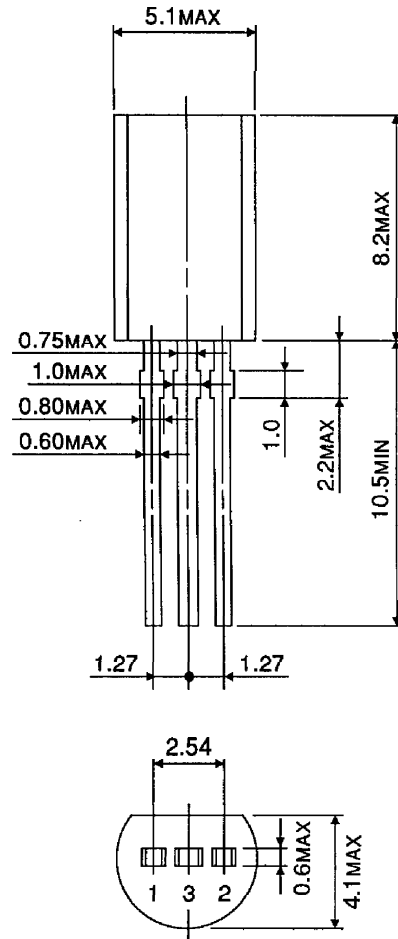






**PACKAGE DIMENSIONS**  
SSIP3-P-1.27

Unit : mm



Weight : 0.36 g (Typ.)