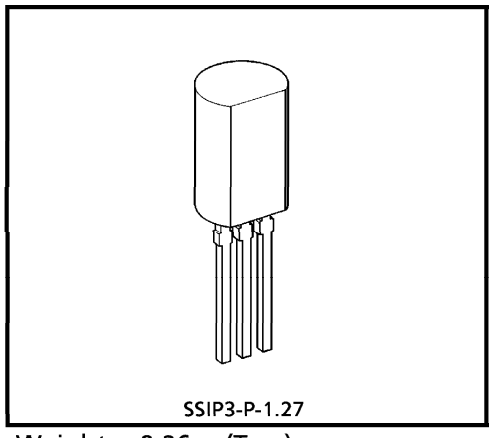
TOSHIBA INTELLIGENT POWER DEVICE SILICON MONOLITHIC POWER MOS IC

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.



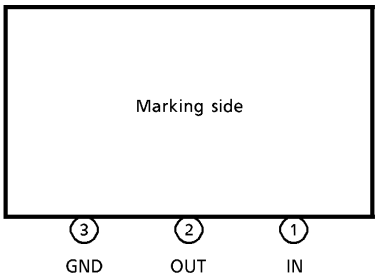
SSIP3-P-1.27

Weight : 0.36 g (Typ.)

FEATURES

- A monolithic power IC with a new structure combining a control block and a vertical power MOSFET (π-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°C)
- Package TO-92 (MOD) can be packed in tape.

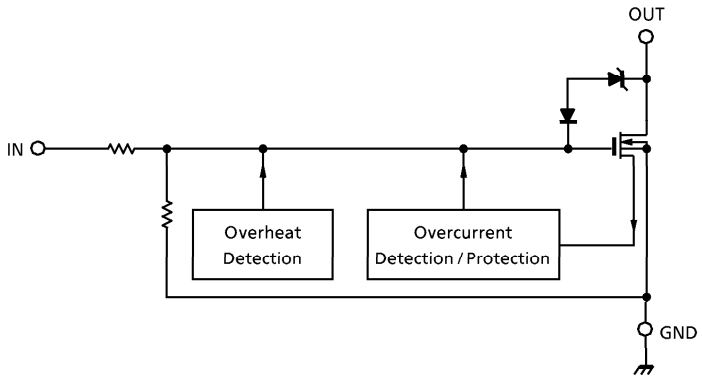
PIN ASSIGNMENT



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

980910EBA1

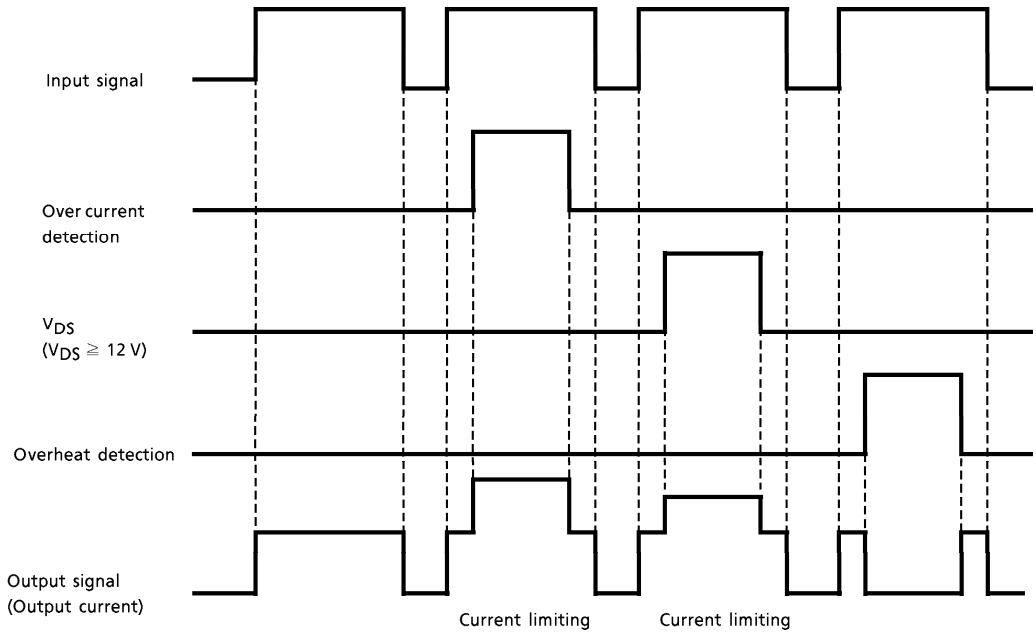
BLOCK DIAGRAM



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, outputcan 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 μs (typ.) mask circuit is included internally, so that if $V_{DS} \geqq 12$ 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	$V_{DS\ (DC)}$	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	ES / B	200	mJ
Operating Temperature	T_{opr}	−40~85	°C
Junction Temperature	T_j	150	°C

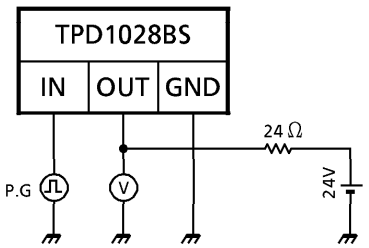
ELECTRICAL CHARACTERISTICS (T_j = 25°C)

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

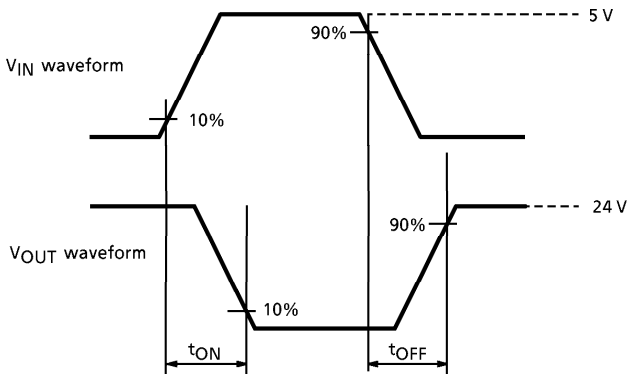
TEST CIRCUIT 1

Switching time measuring circuit

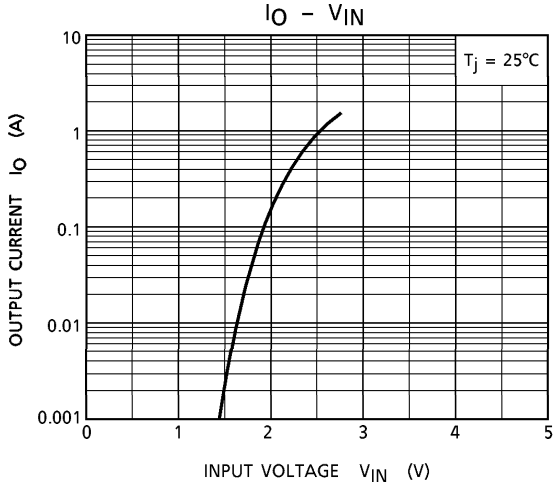
Test circuit



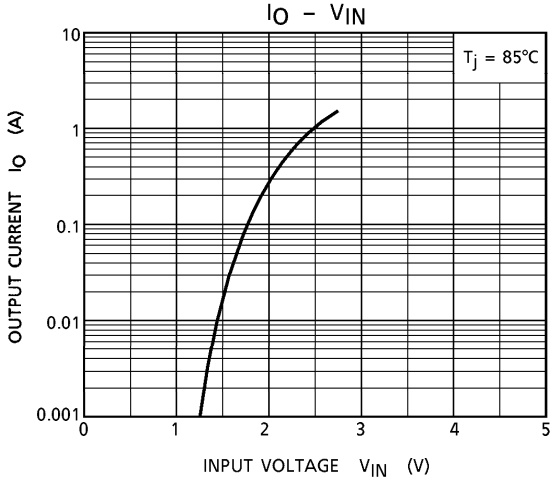
Measured waveforms



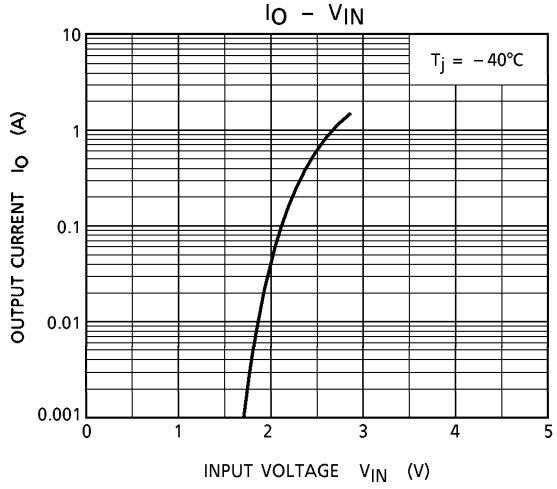
I_O – V_{IN}



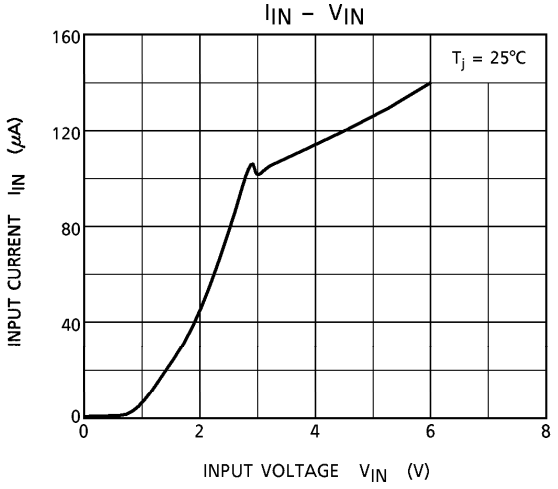
I_O – V_{IN}



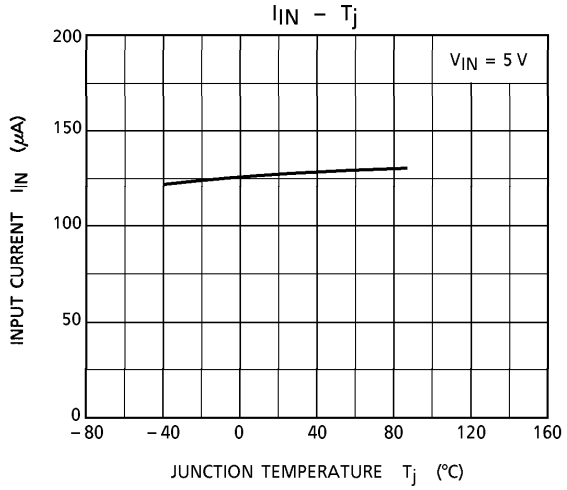
I_O – V_{IN}



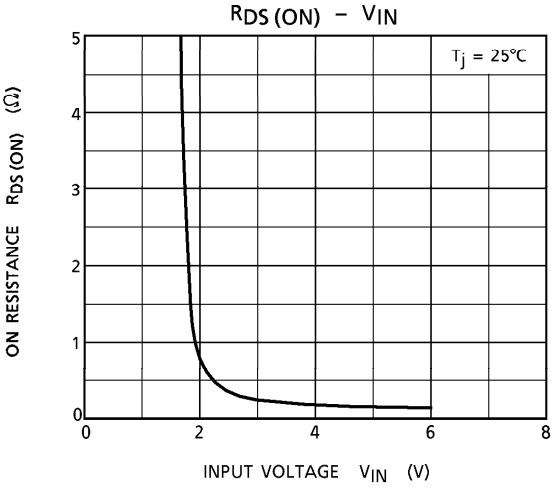
I_{IN} – V_{IN}



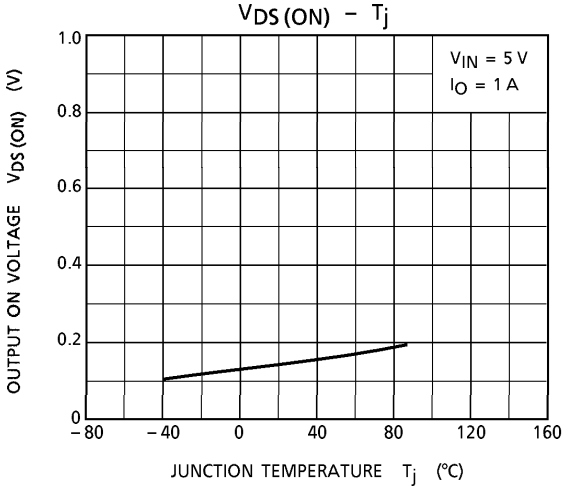
I_{IN} – T_j



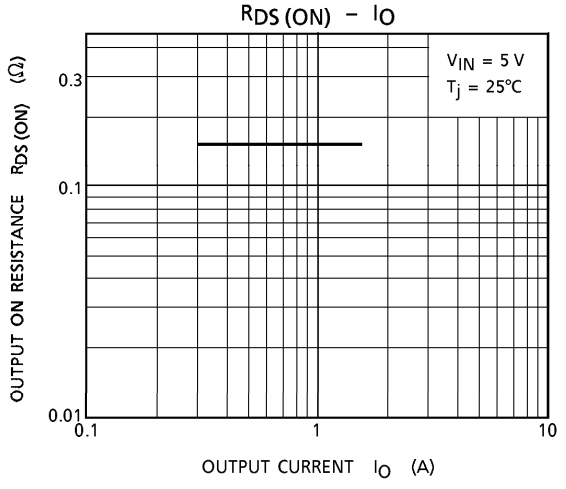
$R_{DS\ (ON)}$ – V_{IN}



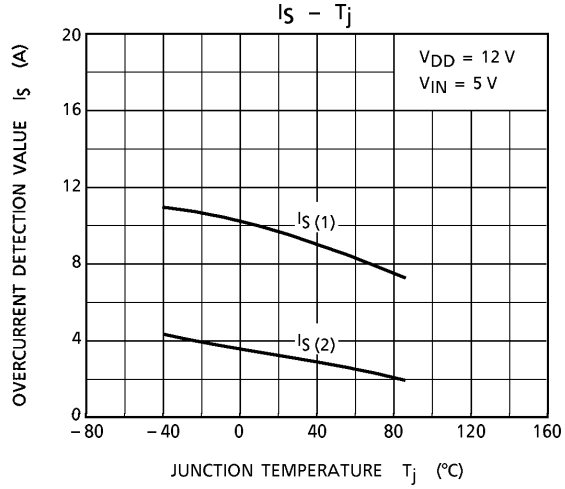
$V_{DS\,(ON)}$ – T_j



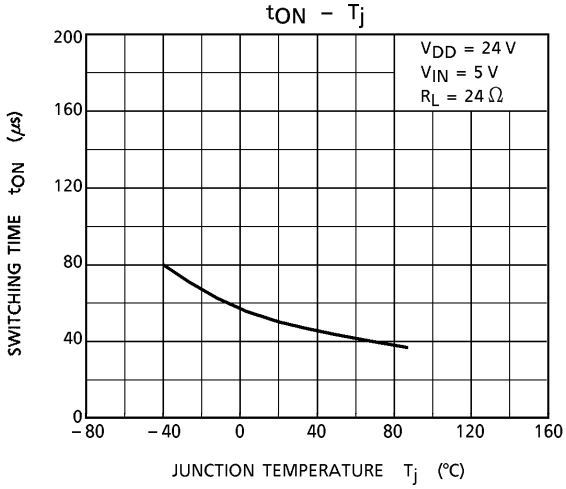
$R_{DS\,(ON)}$ – I_O



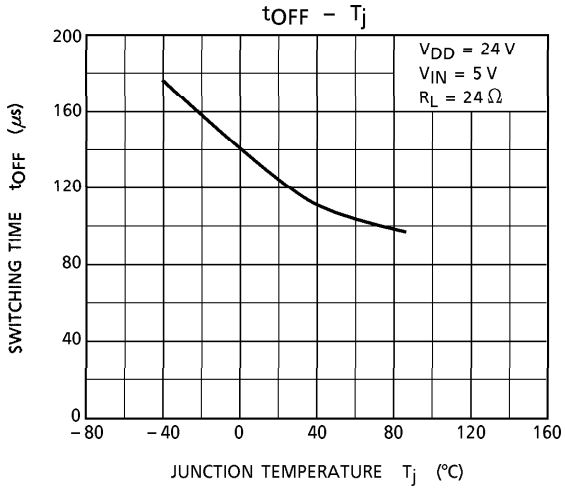
I_S – T_j



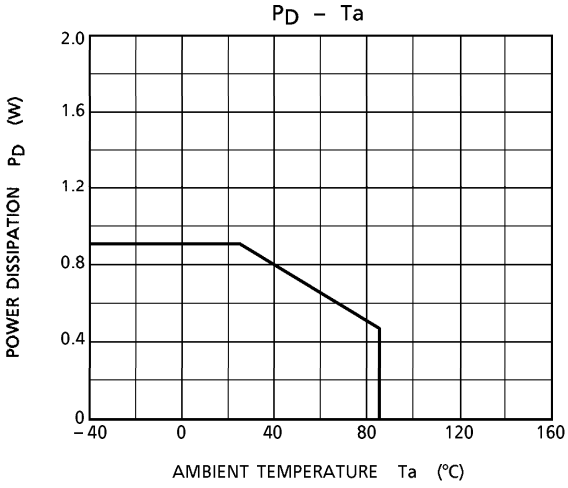
t_{ON} – T_j



t_{OFF} – T_j

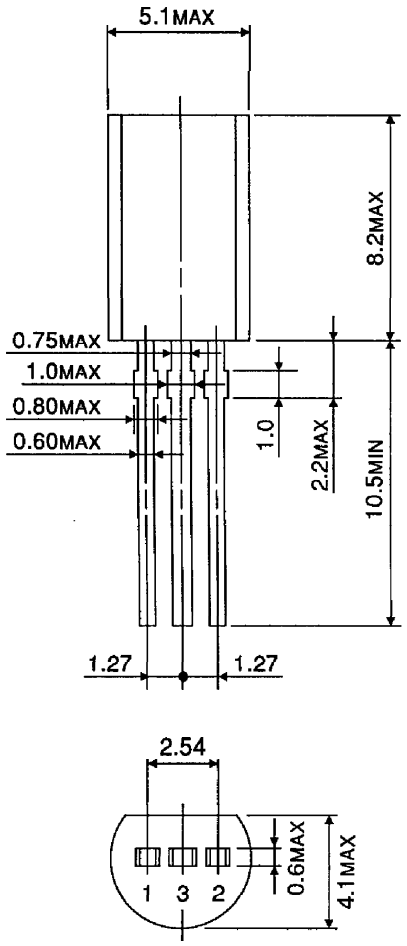


P_D – Ta



PACKAGE DIMENSIONS

SSIP3-P-1.27 Unit : mm



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