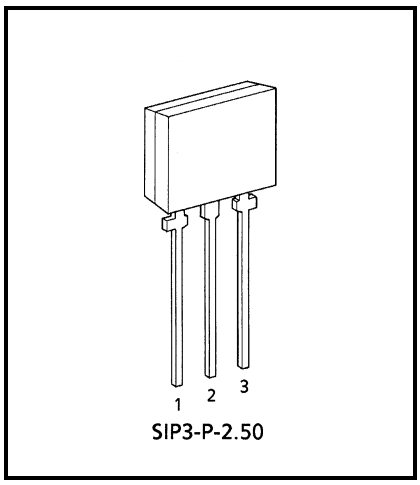
TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS IC

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.

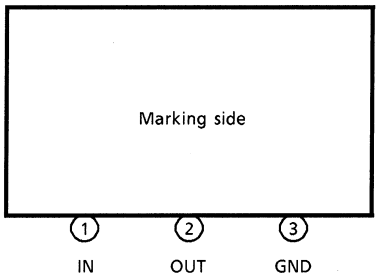


Weight: 0.54g (typ.)

Features

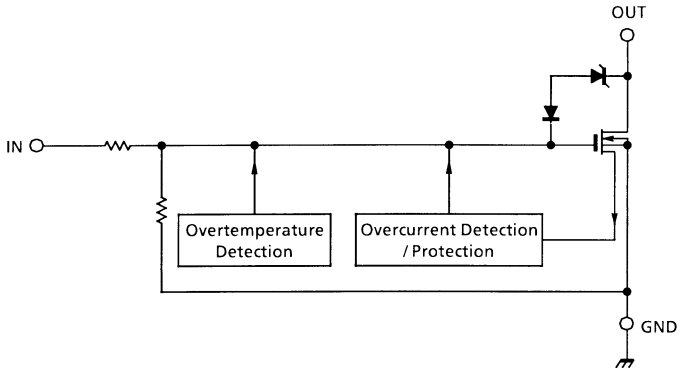
- A monolithic power IC with a new structure combining a control block and a vertical power MOSFET (π−MOS) on a single chip.
- Can directly drive a power load from a CMOS logic etc.
- Built−in protection circuits against overvoltage, load short circuit, and thermal shutdown.
- Low on resistance. $R_{DS\ (ON)}$ = 0.25Ω (max) (@V_{IN} = 5V, T_j = 25°C)
- Package TPS can be packed in tape.

Pin Assignment



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

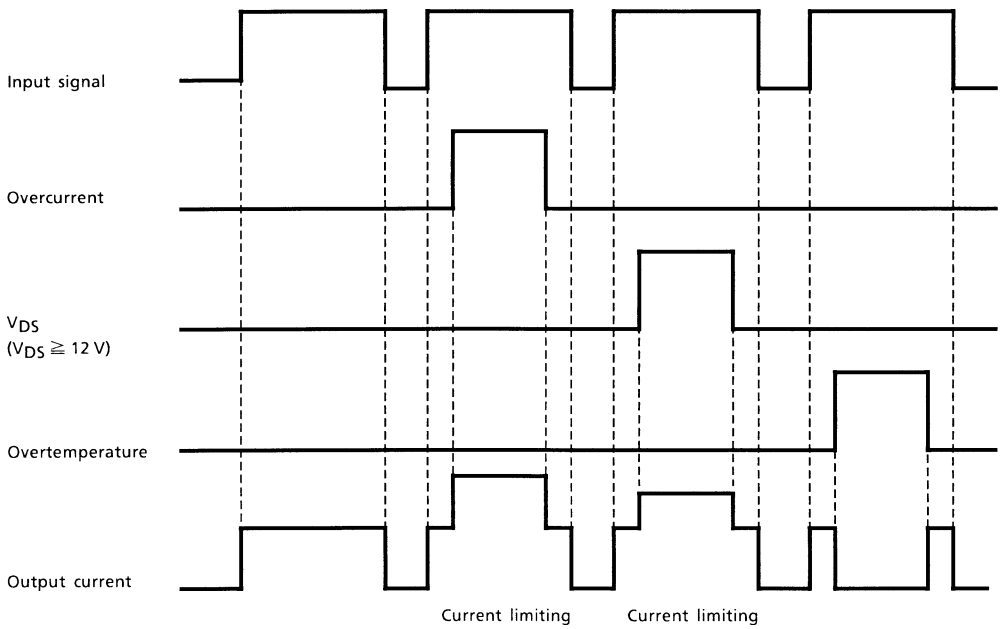
Block Diagram



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 150μs (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	$V_{DS\ (DC)}$	40	V
Output Current	I_D	1.5	A
Input Voltage	V_{IN}	−0.5~6	V
Power Dissipation	P_D	1.2	W
Energy Tolerance	ES/B	200	mJ
Operating Temperature	T_{opr}	−40~85	°C
Junction Temperature	T_j	150	°C

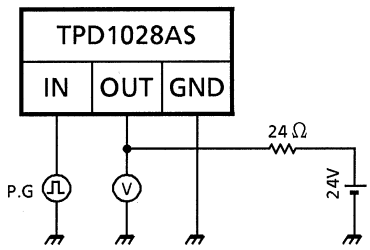
Electrical Characteristics (T_j = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Drain−source Breakdown Voltage	$V_{(BR)\ DSS}$	—	V_{IN} = 0 V, I_D = 10mA	40	—	—	V
Operating Supply Voltage	V_{DD}	—	—	—	—	38	V
High Level Input Voltage	V_{IH}	—	V_{DS} = 24 V, I_D = 1A	4.5	5	5.5	V
Low Level Input Voltage	V_{IL}	—	V_{DS} = 24 V, I_D = 10μA	—	—	0.8	V
Current at Output Off	$I_{DSS\ (1)}$	—	V_{IN} = 0V, V_{DS} = 40V	—	—	100	μA
	$I_{DSS\ (2)}$		V_{IN} = 0V, V_{DS} = 24V	—	—	10	
Input Current	I_{IN}	—	V_{IN} = 5V, at normal operation	—	—	300	μA
On Resistance	$R_{DS\ (ON)}$	—	V_{IN} = 5V, I_D = 1A	—	—	0.25	Ω
Thermal Shutdown Temperature	T_S	—	V_{IN} = 5V	—	160	—	°C
Overcurrent Protection	$I_{S\ (1)}$	—	V_{DS} = 24V, V_{IN} = 5V, during inrush	—	10	—	A
	$I_{S\ (2)}$	—	V_{DS} = 24V, V_{IN} = 5V, when shorted load	—	3	—	
Shorted Load Detection Voltage	V_{DS}	—	When shorted load		12	—	V
Switching Time	t_{ON}	1	V_{DS} = 24V, V_{IN} = 5V, R_L = 24Ω	—	70	—	μs
	t_{OFF}			—	120	—	
Diode Forward Voltage Between Drain and Source	V_{DSF}	—	I_F = 1.5A	—	0.9	1.8	V

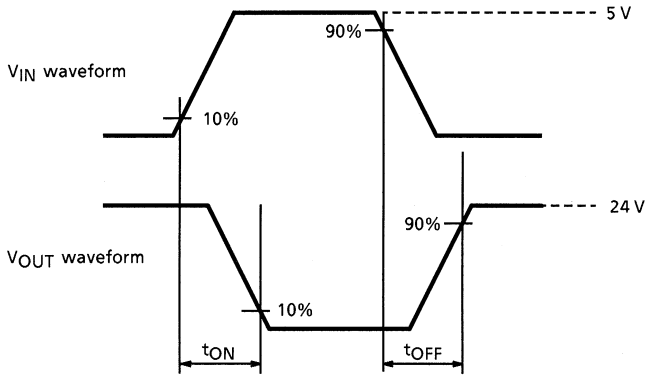
Test Circuit 1

Switching time measuring circuit

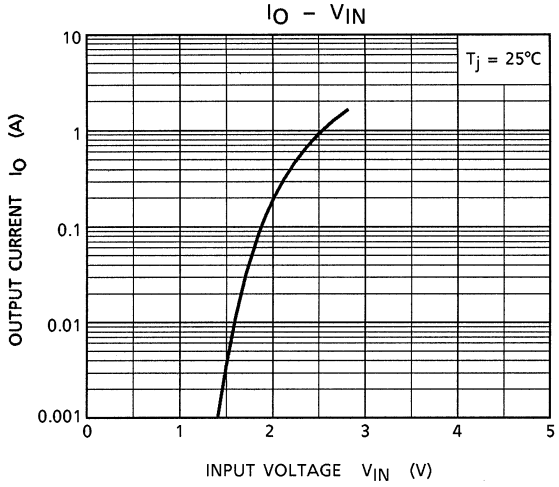
Test circuit



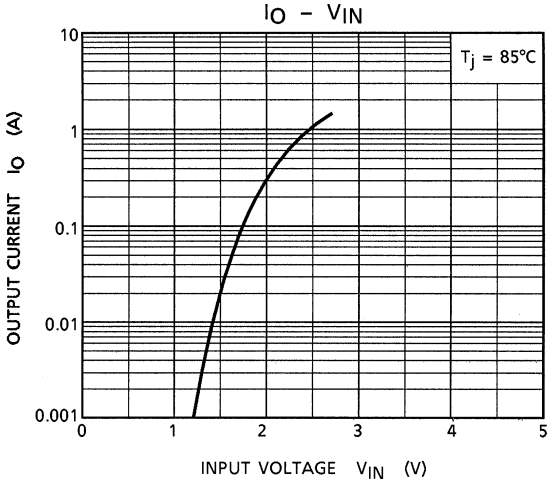
Measured waveforms



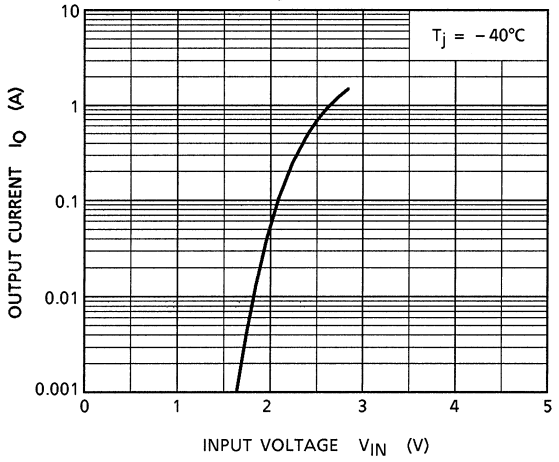
I_O – V_{IN}



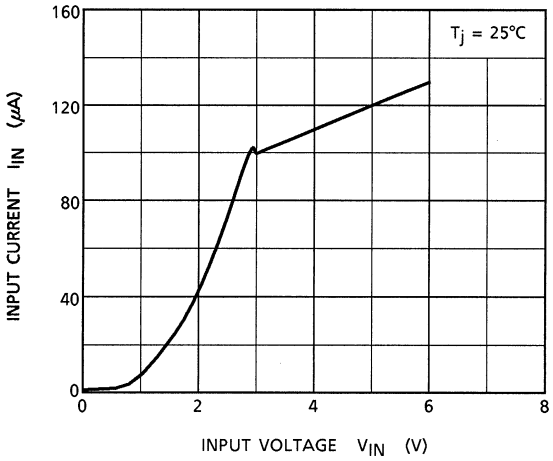
I_O – V_{IN}



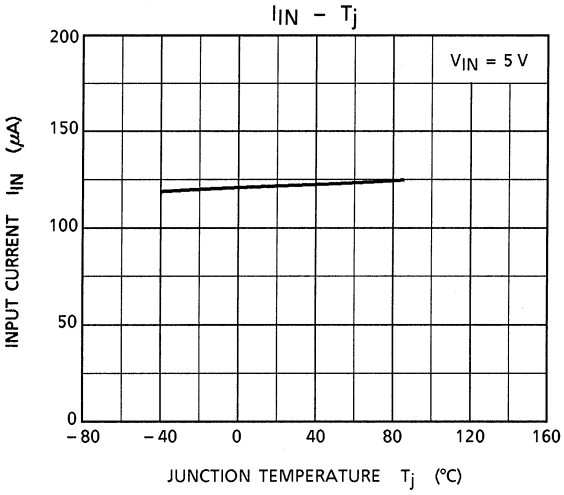
I_O – V_{IN}



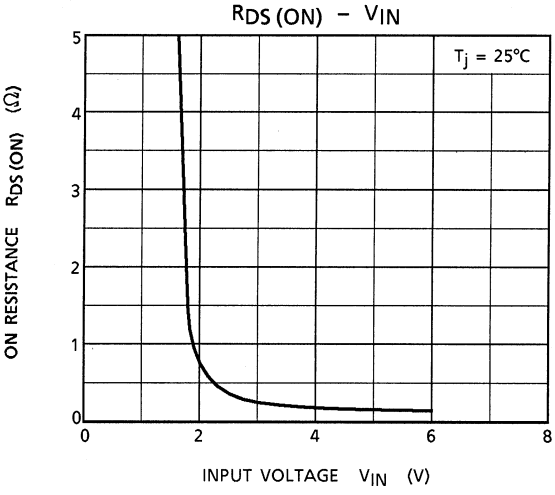
I_{IN} – V_{IN}



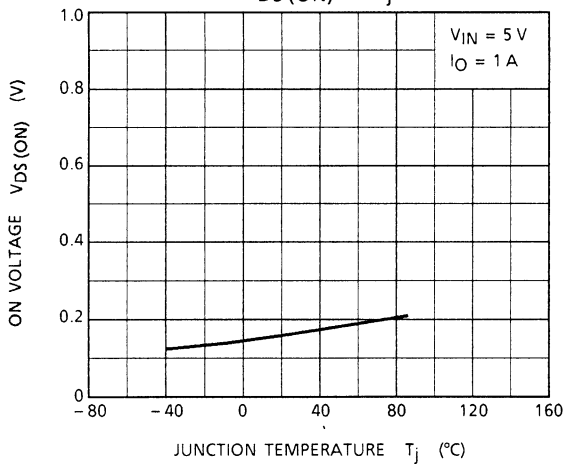
I_{IN} – T_j



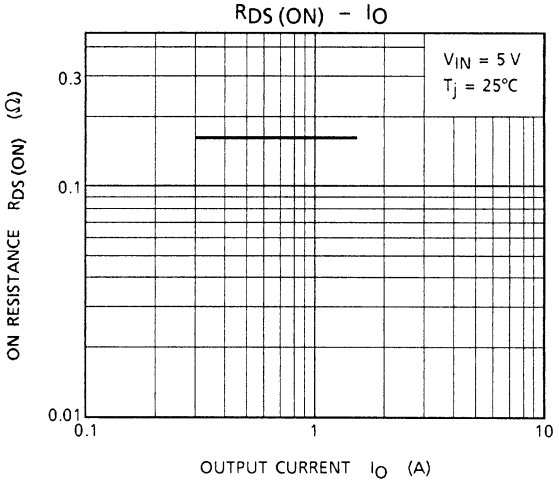
$R_{DS\,(ON)}$ – V_{IN}



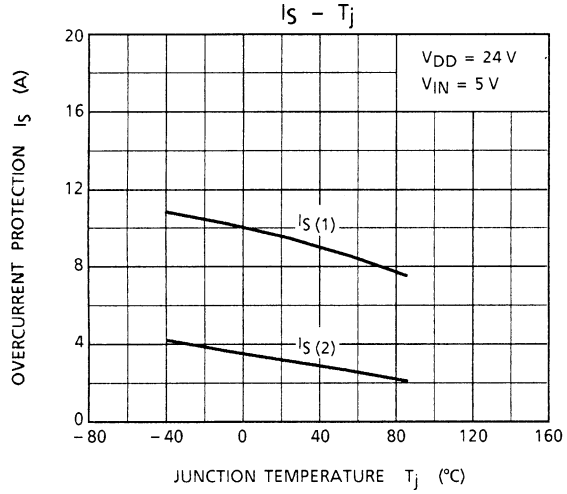
$V_{DS\,(ON)}$ – T_j



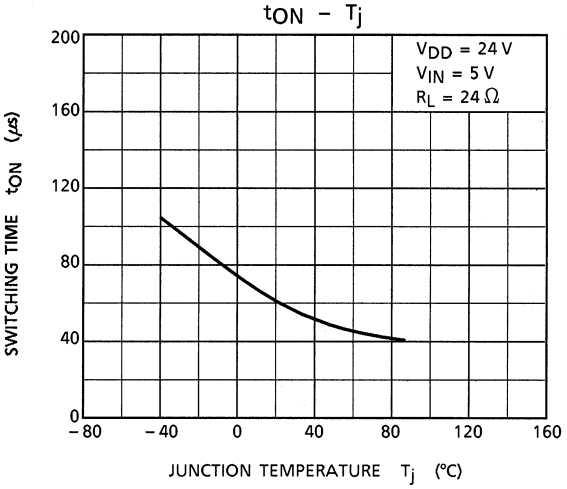
$R_{DS\,(ON)}$ – I_O



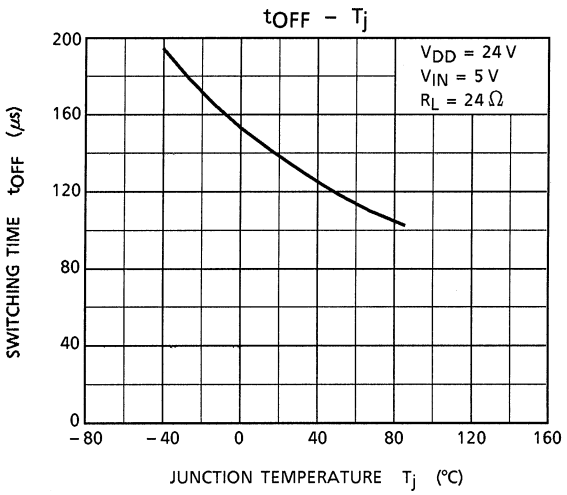
I_S – T_j



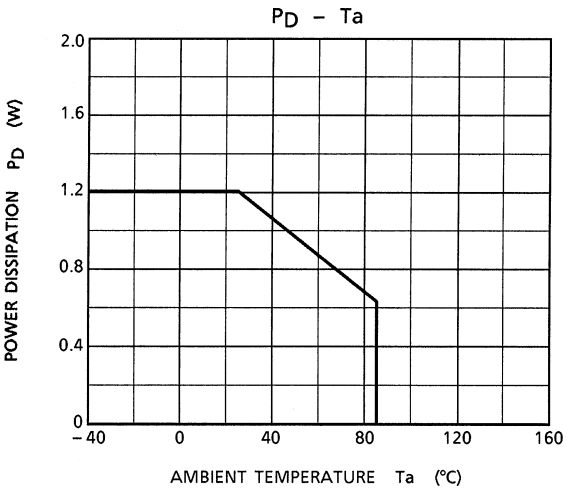
t_{ON} – T_j



t_{OFF} – T_j

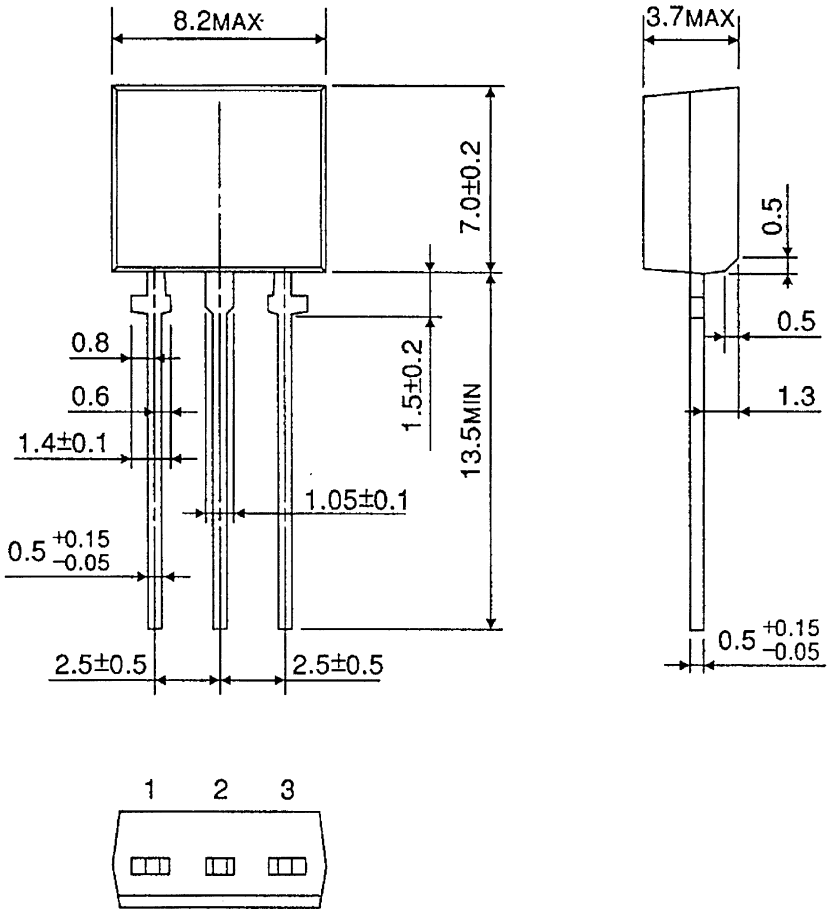


P_D – Ta



Package Dimensions

SIP3-P-2.50 Unit : mm



Weight: 0.54g (typ.)

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