

Preliminary

Toshiba Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

TPD1035F

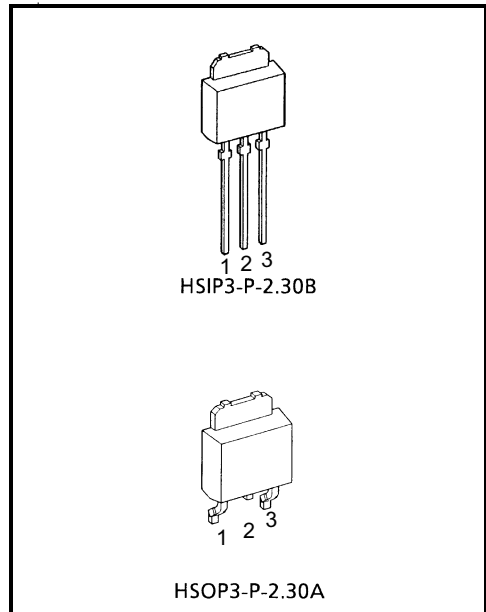
Low-Side Power Switch for Motor, Solenoid and Lamp Drivers

TPD1035F is a 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 (L^2 - π -MOS) on a single chip.
- Can directly drive a power load from a CMOS or TTL logic.
- Built-in protection circuits against overvoltage (active clamp), overtemperature (thermal shutdown), and overcurrent (current limiter).
- Low Drain-Source ON-resistance: $R_{DS(ON)} = 0.4 \Omega$ (max)
(@ $V_{IN} = 5 \text{ V}$, $I_D = 1 \text{ A}$, $T_{ch} = 25^\circ\text{C}$)
- Low Leakage Current: $I_{DSS} = 10 \mu\text{A}$ (max)
(@ $V_{IN} = 0 \text{ V}$, $V_{DS} = 30 \text{ V}$, $T_{ch} = 25^\circ\text{C}$)
- Low Input Current: $I_{IN} = 300 \mu\text{A}$ (max)
(@ $V_{IN} = 5 \text{ V}$, $T_{ch} = 25^\circ\text{C}$)
- 3-pin package for surface mounting can be packed in tape.

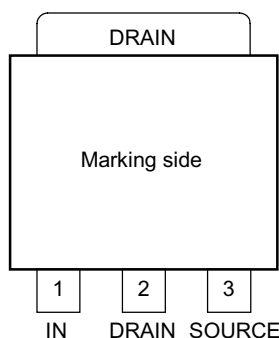


Weight

HSIP3-P-2.30B: 0.36 g (typ.)

HSOP3-P-2.30A: 0.28 g (typ.)

Pin Assignment (top view)



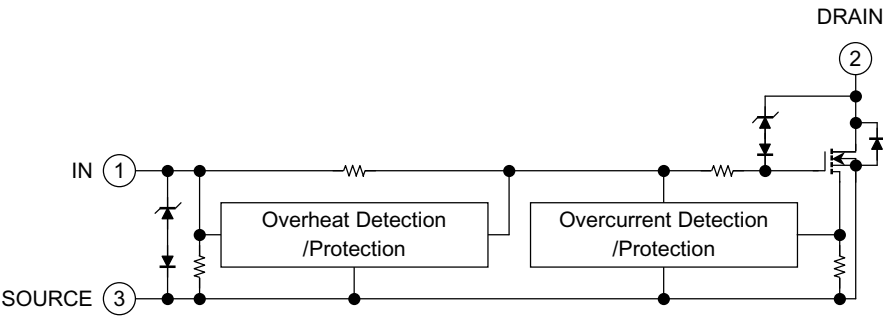
Note1: That because of its MOS structure, this product is sensitive to static electricity.

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Block Diagram

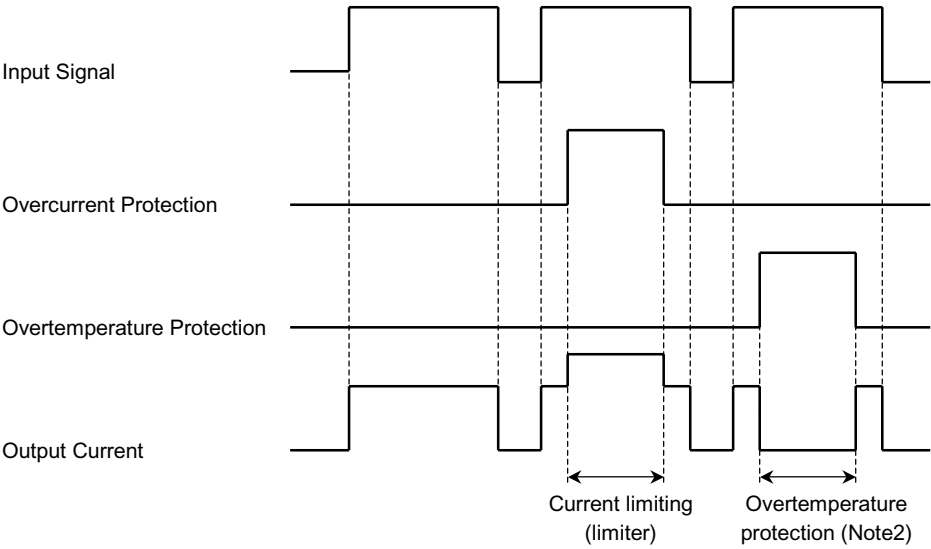


Pin Description

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	DRAIN	Drain pin Drain current is limited (by current limiter) if it exceeds 3 A (min) in order to protect the IC.
3	SOURCE	Source pin

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Timing Chart



Note2: The overheating detector circuits feature hysteresis. After overheating is detected, normal operation is restored only when the channel temperature falls by the hysteresis amount (5°C typ.) in relation to the overheating detection temperature.

Truth Table

IN	V _{OUT}	Mode
L	H	Normal
H	L	
L	H	Overcurrent
H	H	
L	H	Overtemperature
H	H	

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage		V _{DS} (DC)	20	V
Drain current		I _D	Internally Limited	A
Input voltage		V _{IN}	−0.3 to 7	V
Power dissipation	T _c = 25°C	P _D	10	W
	T _a = 25°C		1	
Operating temperature		T _{opr}	−40 to 110	°C
Channel temperature		T _{ch}	150	°C
Storage temperature		T _{stg}	−55 to 150	°C

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Thermal Characteristics

Characteristics	Symbol	Max	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	12.5	°C/W
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	125	°C/W

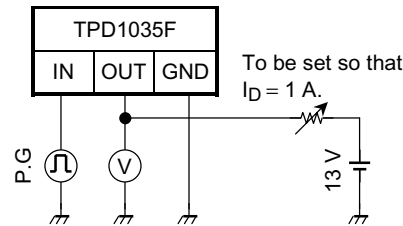
Electrical Characteristics ($T_{ch} = 25^{\circ}\text{C}$)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Drain-source clamp voltage	$V_{(CL)DSS}$	—	$V_{IN} = 0\text{ V}$, $I_D = 1\text{ mA}$	40	—	60	V
Input threshold voltage	V_{th}	—	$V_{DS} = 13\text{ V}$, $I_D = 10\text{ mA}$	1.0	—	2.8	V
Protective circuit operation input voltage range	$V_{IN(opr)}$	—	—	3	—	7	V
Drain cut-off current	I_{DSS}	—	$V_{IN} = 0\text{ V}$, $V_{DS} = 30\text{ V}$	—	—	10	μA
Input current	$I_{IN(1)}$	—	$V_{IN} = 5\text{ V}$, at normal operation	—	—	300	μA
	$I_{IN(2)}$	—	$V_{IN} = 5\text{ V}$, when protective circuit is actuated	—	—	390	
Drain-source on resistance	$R_{DS(ON)}$	—	$V_{IN} = 5\text{ V}$, $I_D = 1\text{ A}$	—	0.25	0.4	Ω
Overtemperature protection	T_S	—	$V_{IN} = 5\text{ V}$	150	160	—	°C
Overcurrent protection	I_S	—	$V_{IN} = 5\text{ V}$	3	—	—	A
Switching time	t_{ON}	1	$V_{DD} = 13\text{ V}$, $V_{IN} = 5\text{ V}$, $I_D = 1\text{ A}$	—	—	30	μs
	t_{OFF}	1		—	—	60	
Source-drain diode forward voltage	V_{DSF}	—	$I_F = 3\text{ A}$, $V_{IN} = 0\text{ V}$	—	—	1.7	V

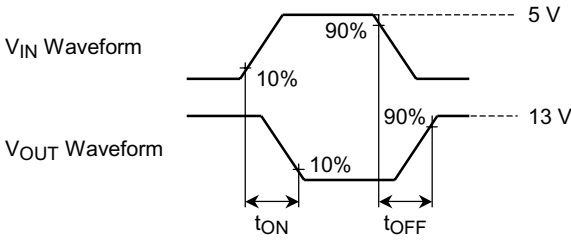
Test Circuit 1

Switching time measuring circuit

Test Circuit



Measured Waveforms

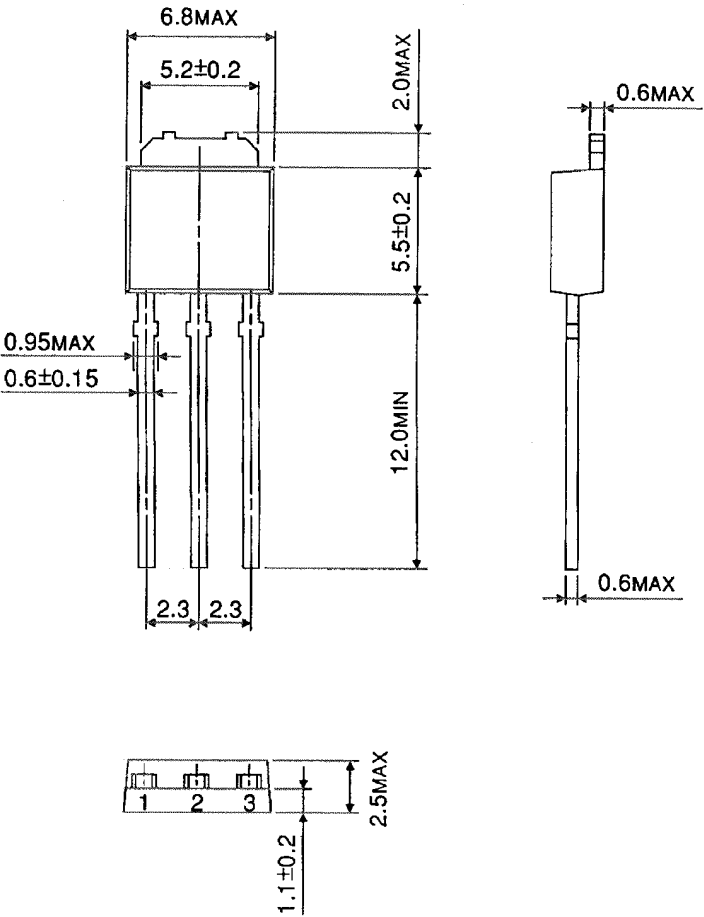


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Package Dimensions

HSIP3-P-2.30B

Unit : mm

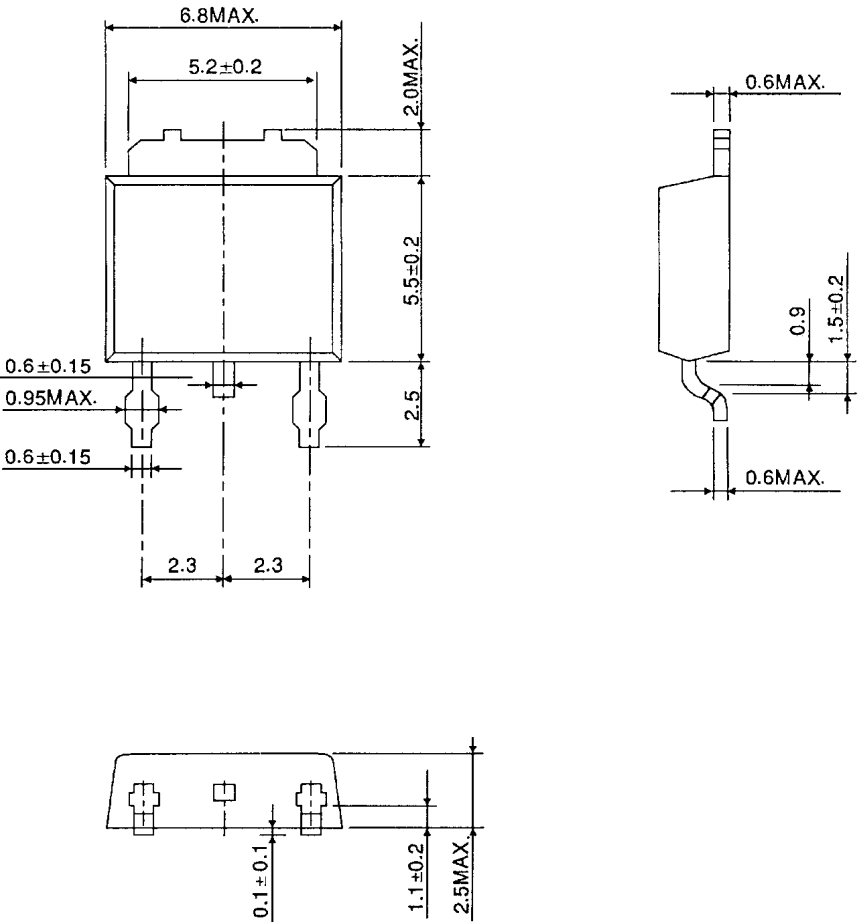


Weight: 0.36 g (typ.)

Package Dimensions

HSOP3-P-2.30A

Unit : mm



Weight: 0.28 g (typ.)