

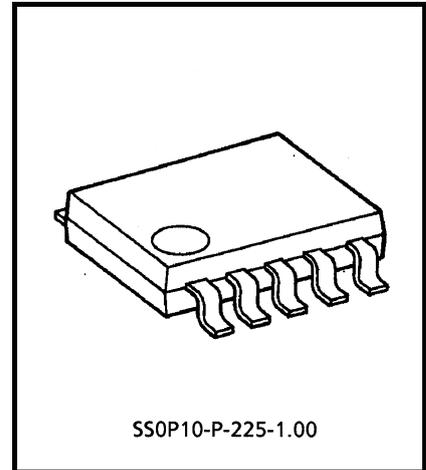
# TPD1018F

## High-side Power Switch for Motors, Solenoids, and Lamp Drivers

The TPD1018F is a monolithic power IC for high-side switches. The IC has a vertical MOS FET output that can be directly driven from a CMOS or TTL logic circuit (e.g., an MPU). The device is equipped with intelligent self-protection and diagnostic functions.

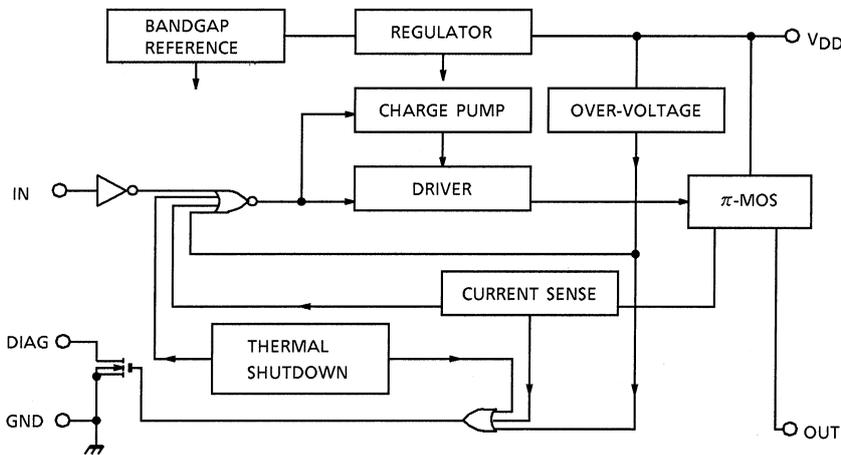
### Features

- A monolithic power IC with a new structure combining a control block (Bi-CMOS) and a vertical power MOS FET ( $\pi$ -MOS) on a single chip
- One side of load can be grounded to a high-side switch
- Can directly drive a power load from a microprocessor.
- Built-in protection against overvoltage, thermal shutdown, and load short-circuiting
- Incorporates a diagnosis function that allows diagnosis output to be read externally in the event of load short-circuiting, overvoltage, or overheating.
- Low on-resistance :  $R_{DS(ON)} = 0.8\Omega$  (max)
- Low operating current :  $I_{DD} = 120\mu A$  (typ.) (@ $V_{DD} = 13.2V, V_{IN} = 0V$ )
- 10-pin SSOP package for surface mounting

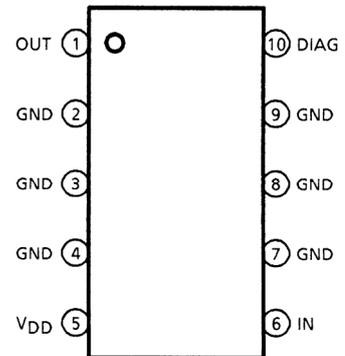


Weight: 0.08g (typ.)

### Block Diagram

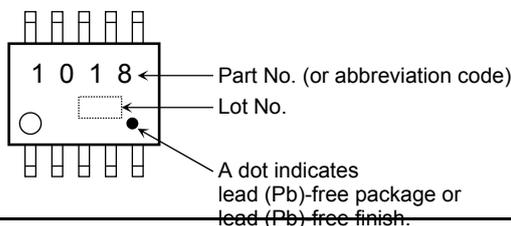


### Pin Assignment (top view)



Note: Due to its MOS structure, this product is sensitive to static electricity.

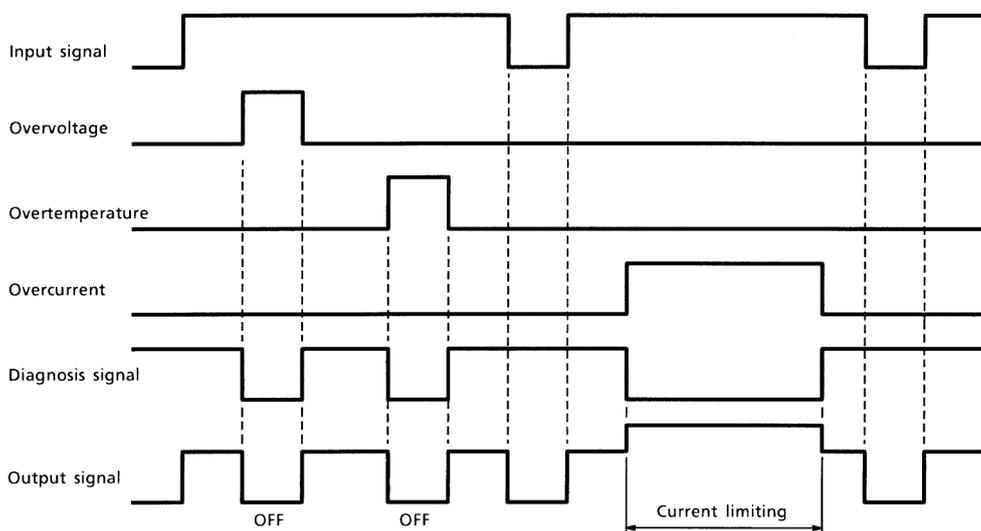
### Marking



## Pin Description

Pin No.	Symbol	Function
1	OUT	Output pin. When the load is short-circuited and current in excess of the detection current (0.5A min) flows to the output pin, the current limiter operates to protect the IC.
2, 3, 4	GND	Ground pins.
5	V <sub>DD</sub>	Power pin. Incorporates an overvoltage protection function which turns off the output when the voltage applied exceeds 25V (min). Protects IC and load. Incorporates 2V (typ.) hysteresis.
6	IN	Input is CMOS-compatible, with pull-down resistor connected. Even if the input is open, output will not accidentally turn on.
7, 8, 9	GND	Ground pins.
10	DIAG	Self-diagnosis detection pin. Goes low when overcurrent, overheating, or overvoltage is detected. n-channel open drain.

## Timing Chart



## Truth Table

Input Signal	Output Signal	Diagnosis Output	State
H	H	H	Normal
L	L	H	
H	L	L	Overcurrent
L	L	H	
H	L	L	Overtemperature
L	L	H	
H	L	L	Overvoltage
L	L	H	

## Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Drain-source Voltage	V <sub>DS</sub>	60	V
Supply Voltage	DC	V <sub>DD</sub> (1)	25
	Pulse	V <sub>DD</sub> (2)	60 (R <sub>s</sub> = 1Ω, τ = 250ms)
Input Voltage	DC	V <sub>IN</sub> (1)	-0.5~25
	Pulse	V <sub>IN</sub> (2)	V <sub>DD</sub> (1) + 1.5 (t = 100ms)
Output Current	I <sub>O</sub>	0.5	A
Input Current	I <sub>IN</sub>	±10	mA
Power Dissipation	P <sub>D</sub>	300	mW
Operating Temperature	T <sub>opr</sub>	-40~125	°C
Junction Temperature	T <sub>j</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55~150	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

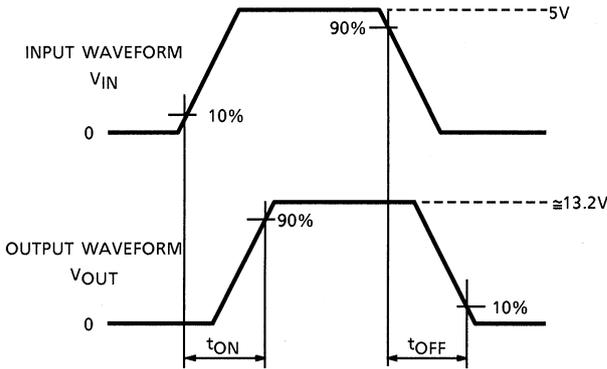
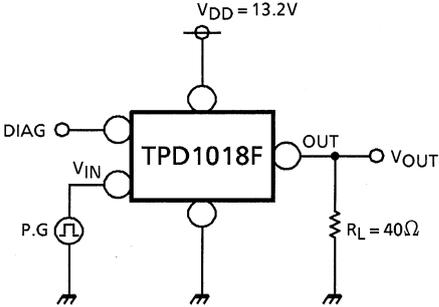
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/Derating Concept and Methods) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

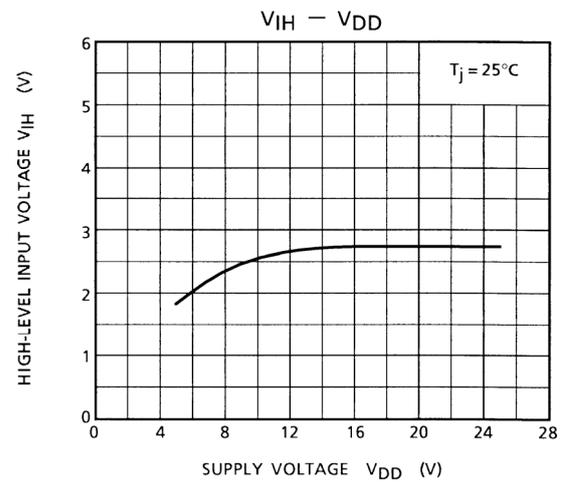
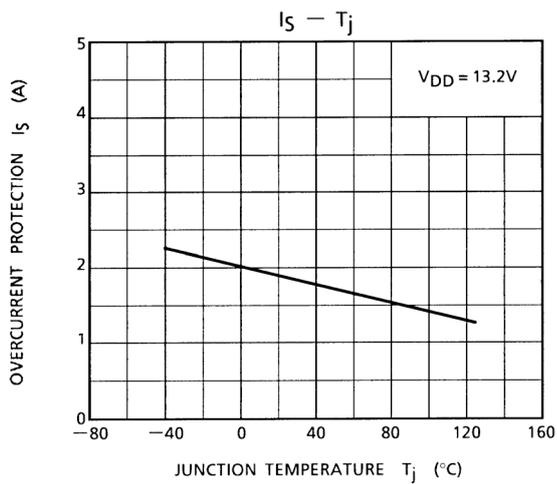
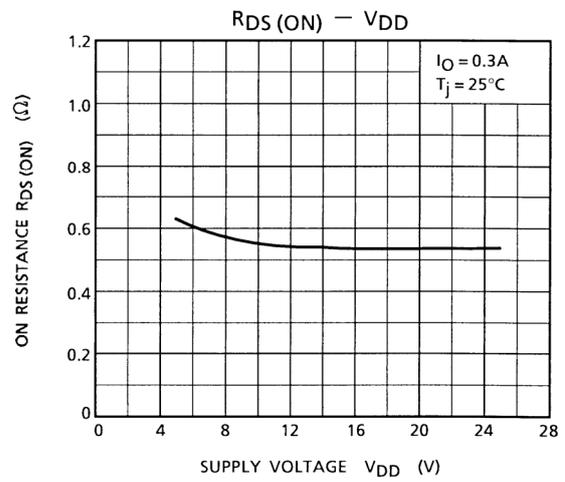
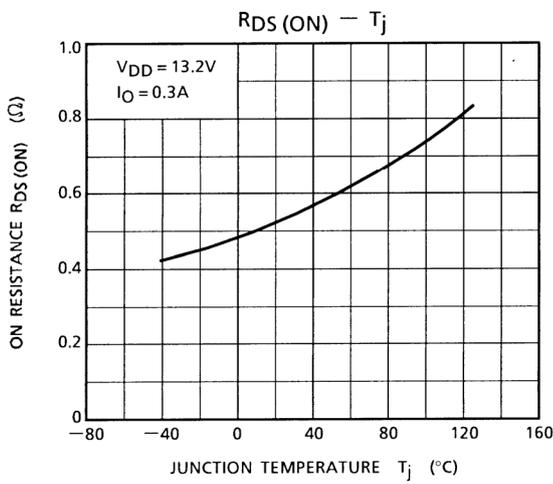
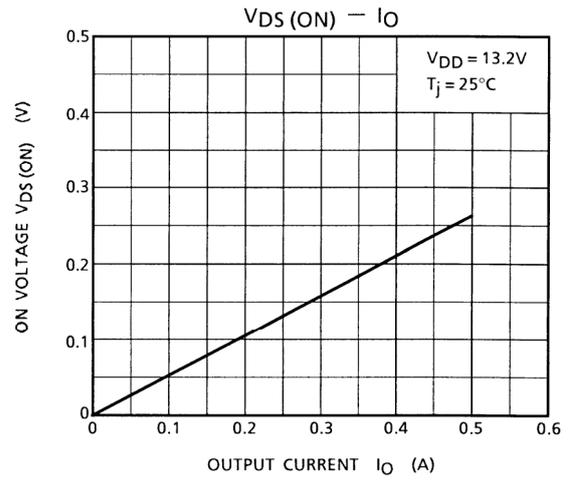
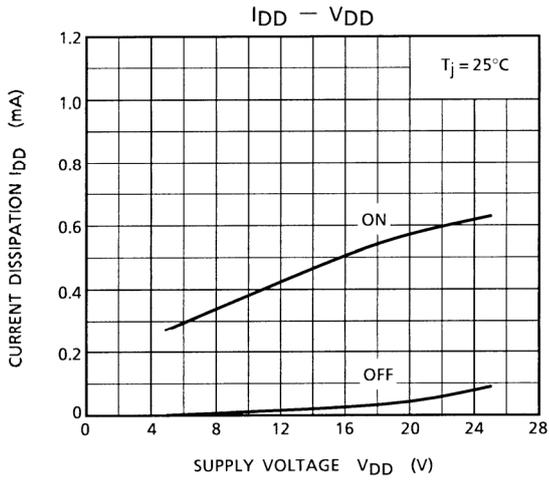
## Electrical Characteristics (Tj = -40~125°C)

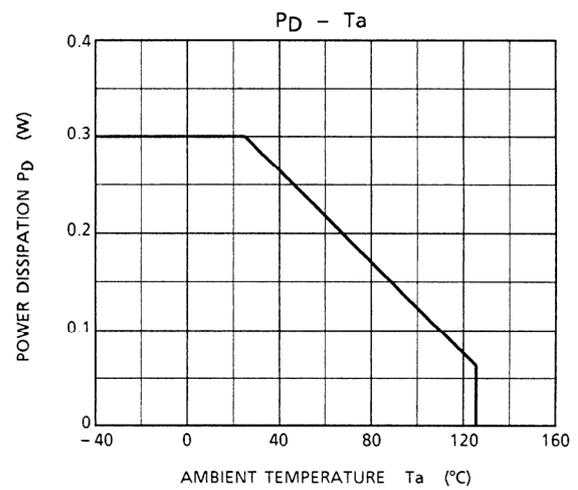
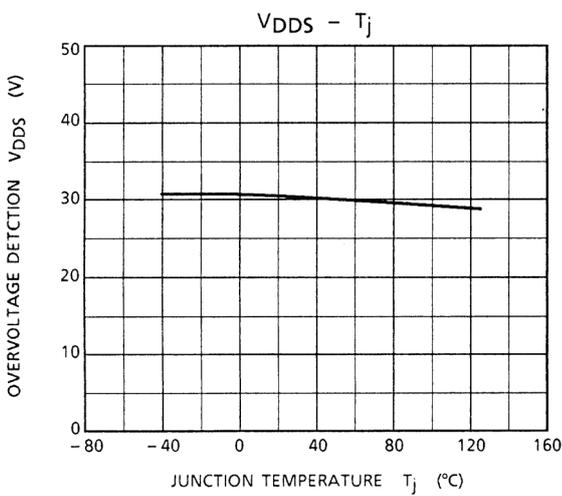
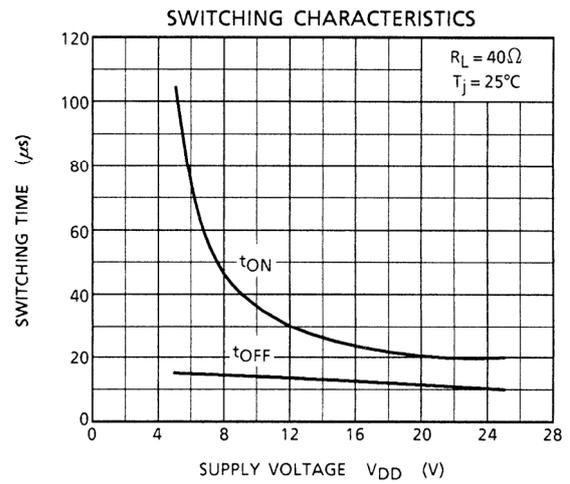
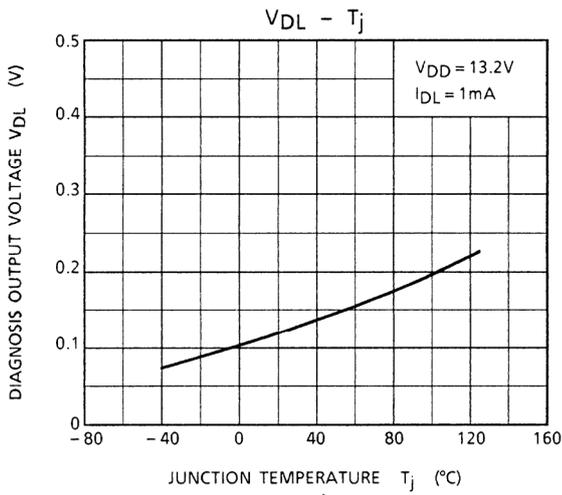
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Operating Supply Voltage	V <sub>DD</sub> (opr)	—	—	5	12	25	V
Supply Current	I <sub>DD</sub> (1)	—	V <sub>DD</sub> = 13.2V, V <sub>IN</sub> = 0V, T <sub>j</sub> = 85°C	—	120	300	μA
	I <sub>DD</sub> (2)	—	V <sub>DD</sub> = 13.2V, V <sub>IN</sub> = 5V	—	1	1.5	mA
Input Voltage	V <sub>IH</sub>	—	V <sub>DD</sub> = 13.2V, I <sub>O</sub> = 300mA	3.5	—	—	V
	V <sub>IL</sub>	—	V <sub>DD</sub> = 13.2V, I <sub>O</sub> = 100μA	—	—	1.5	V
Input Current	I <sub>IN</sub> (1)	—	V <sub>DD</sub> = 13.2V, V <sub>IN</sub> = 5V	—	10	100	μA
	I <sub>IN</sub> (2)	—	V <sub>DD</sub> = 13.2V, V <sub>IN</sub> = 0V	-0.2	—	0.2	μA
On-voltage	V <sub>DS</sub> (ON)	—	V <sub>DD</sub> = 13.2V, I <sub>O</sub> = 300mA, T <sub>j</sub> = 25°C	—	0.21	0.24	V
On-resistance	R <sub>DS</sub> (ON)(1)	—	V <sub>DD</sub> = 13.2V, I <sub>O</sub> = 300mA, T <sub>j</sub> = 25°C	—	0.7	0.8	Ω
	R <sub>DS</sub> (ON)(2)	—	V <sub>DD</sub> = 13.2V, I <sub>O</sub> = 300mA, T <sub>j</sub> = -40~85°C	—	—	1.2	Ω
Diagnosis Output Voltage	"L" Level V <sub>DL</sub>	—	V <sub>DD</sub> = 13.2V, I <sub>DL</sub> = 1mA	—	—	0.4	V
Diagnosis Output Current	"H" Level I <sub>DH</sub>	—	V <sub>DD</sub> = 25V, I <sub>DH</sub> = 25V	—	—	10	μA
Output Leakage Current	I <sub>OL</sub>	—	V <sub>DD</sub> = 25V, V <sub>IN</sub> = 0V	—	—	100	μA
Overcurrent Protection	I <sub>S</sub>	—	V <sub>DD</sub> = 13.2V, T <sub>j</sub> = 25°C	0.5	—	3	A
Thermal Shutdown	Temperature T <sub>S</sub>	—	—	150	160	200	°C
	Hysteresis ΔT <sub>S</sub>	—	—	—	20	50	°C
Overvoltage Protection	Voltage V <sub>DDS</sub>	—	—	25	—	—	V
	Hysteresis ΔV <sub>DDS</sub>	—	—	—	2	7	V
Switching Time	t <sub>ON</sub>	1	V <sub>DD</sub> = 13.2V, R <sub>L</sub> = 40Ω, T <sub>j</sub> = 25°C	—	50	—	μs
	t <sub>OFF</sub>	1	V <sub>DD</sub> = 13.2V, R <sub>L</sub> = 40Ω, T <sub>j</sub> = 25°C	—	10	—	μs

Test Circuit 1

Switching Time







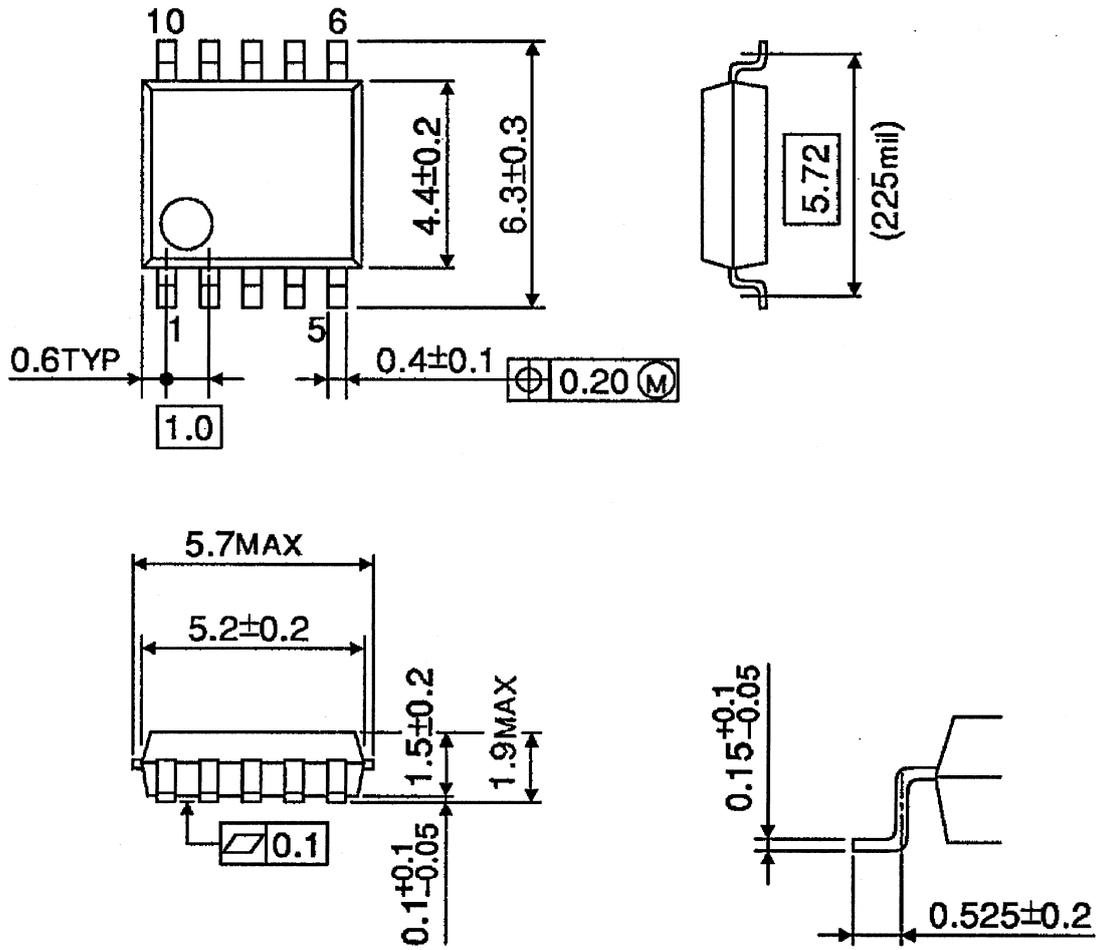
**Precaution:**

1. Since there is no built-in protection against reverse connection of batteries, etc., provide such protection using external circuits.
2. Since this IC does not include a negative bias protection circuit for the output pin, connect a freewheeling diode (FWD) between OUT and GND when negative bias is applied to the output pin.

**Package Dimensions**

SSOP10-P-225-1.00

Unit : mm



Weight: 0.08g (typ.)

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