

TPD1011S

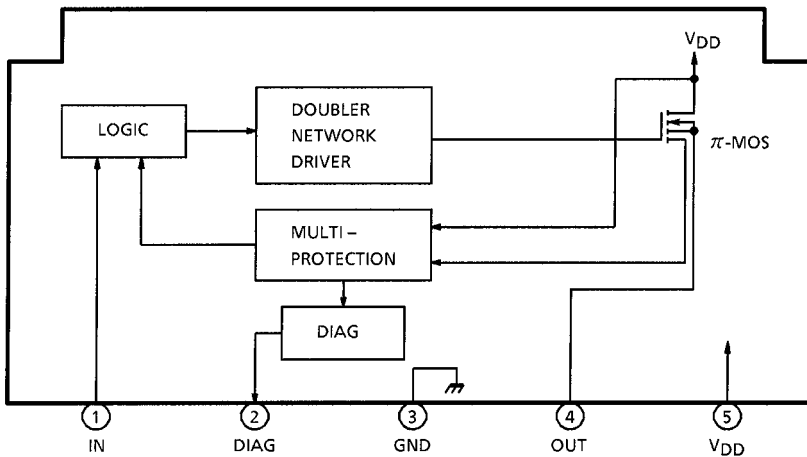
High-side Power Switch for Motors, Solenoids, and Lamp Drivers

TPD1011S is a monolithic power IC for high-side switches. The IC has a vertical MOS FET output which can be directly driven from a CMOS or TTL logic circuit (eg, an MPU). The device offers intelligent self-protection and diagnostic functions.

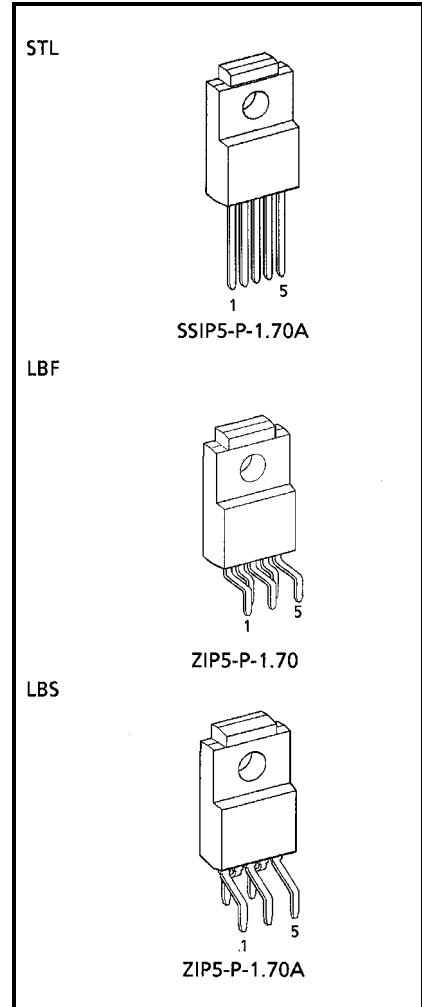
Features

- A monolithic power IC with a new structure combining a control block (Bi-CMOS) and a vertical power MOS FET (π -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 thermal shutdown and load short circuiting. Also incorporates a diagnosis function that allows diagnosis output to be read externally at load short circuiting, opening, or overtemperature.
- Up to -10V of counterelectromotive force from an L load can be applied.
- Low on resistance : $R_{ON} = 60m\Omega$ (max)
- Low operating current : $I_{DD} = 1mA$ (typ.) (@ $V_{DD} = 12V, V_{IN} = 0V$)
- 5-pin TO-220 insulated package.
- Three standard lead configurations.

Pin Assignment

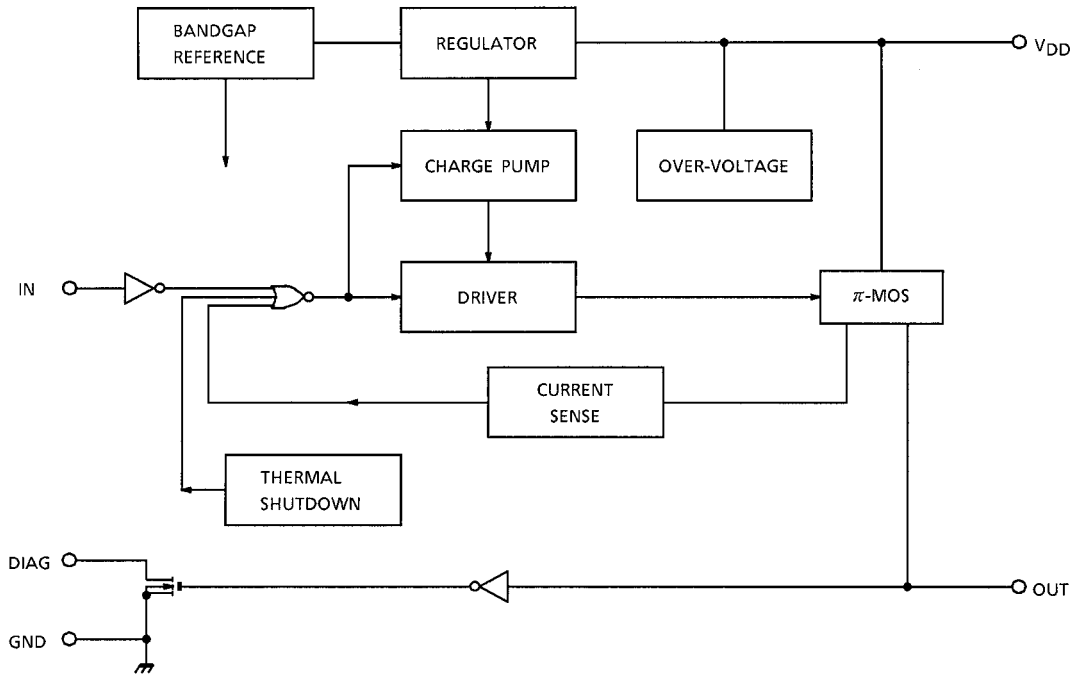


Note : That because of its MOS structure, this product is sensitive to static electricity.



Weight
 SSIP5-P-1.70A : 2.2g (typ.)
 ZIP5-P-1.70 : 2.2g (typ.)
 ZIP5-P-1.70A : 2.2g (typ.)

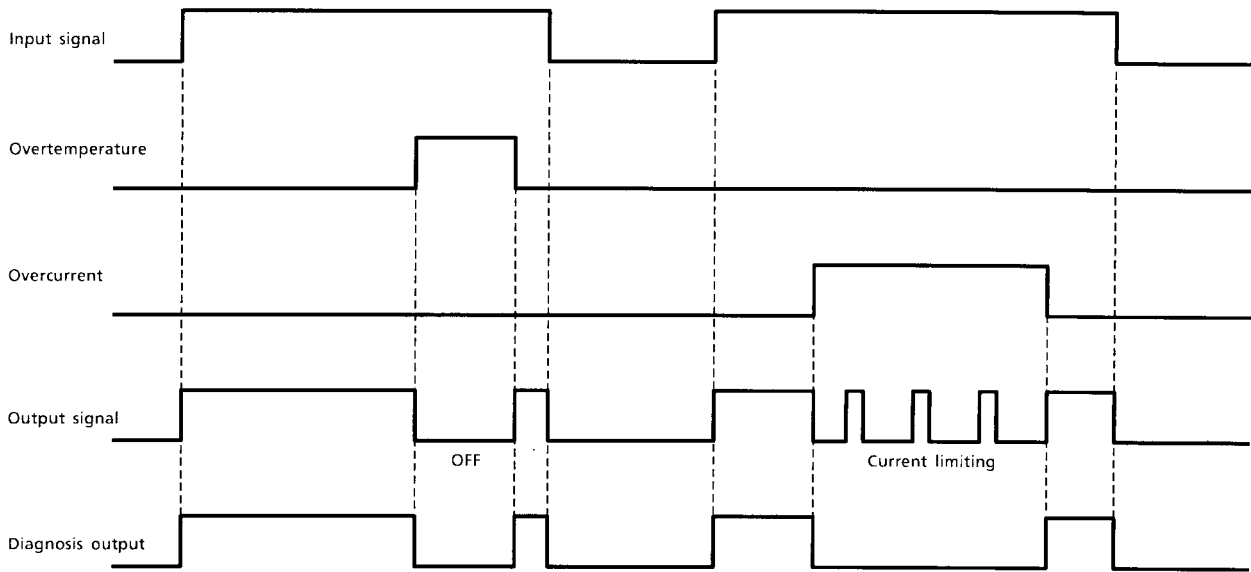
Block Diagram



Pin Description

Pin No.	Symbol	Function
1	IN	Input pin. Input is CMOS-compatible, with pull-down resistor connected. Even if the input is open, output will not accidentally turn on.
2	DIAG	Self-diagnosis detection pin. Goes low when overtemperature is detected or when output is short circuited with input on (high). n-channel open drain.
3	GND	Ground pin.
4	OUT	Output pin. When the load is short circuited and current in excess of the detection current flows to the output pin, the output automatically turns on or off.
5	V _{DD}	Power pin.

Timing Chart



Truth Table

Input Signal	Output Signal	Diagnosis Output	State
H	H	H	Normal
L	L	L	
H	L	L	Overcurrent
L	L	L	
H	H	H	Load open
L	H	H	
H	L	L	Overtemperature
L	L	L	

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Drain-source Voltage	V _{DS}	60	V
Supply Voltage	DC	V _{DD} (1)	25
	Pulse	V _{DD} (2)	60 (R _s = 1Ω, τ = 250ms)
Input Voltage	DC	V _{IN} (1)	-0.5~12
	Pulse	V _{IN} (2)	V _{DD} (1) + 1.5 (t = 100ms)
Diagnosis Output Voltage	V _{DIAG}	-0.5~25	V
Output Current	I _O	Internally Limited	A
Input Current	I _{IN}	±10	mA
Diagnosis Output Current	I _{DIAG}	5	mA
Power Dissipation	T _c = 25°C	P _D (1)	30
	T _a = 25°C	P _D (2)	2
Operating Temperature	T _{opr}	-40~85	°C
Junction Temperature	T _j	150	°C
Storage Temperature	T _{stg}	-55~150	°C
Lead Temperature/time	T _{SOL}	275 (5s), 260 (10s)	°C

Electrical Characteristics (T_j = -40~85°C, V_{DD} = 8~18V)

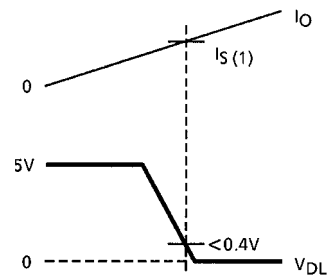
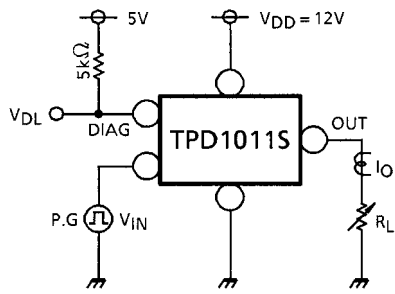
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit	
Operating Supply Voltage	V _{DD} (opr)	—	—	5	12	18	V	
Supply Current	I _{DD}	—	V _{DD} = 12V, V _{IN} = 0V	—	1	5	mA	
Input Voltage	V _{IH}	—	V _{DD} = 12V, I _O = 8A	3.5	—	—	V	
	V _{IL}	—	V _{DD} = 12V, I _O = 1.2mA	—	—	1.5	V	
Input Current	I _{IN} (1)	—	V _{DD} = 12V, I _{IN} = 5V	—	50	200	μA	
	I _{IN} (2)	—	V _{DD} = 12V, I _{IN} = 0V	-0.2	—	0.2	μA	
On Voltage	V _{DS} (ON)	—	V _{DD} = 12V, I _O = 8A, T _j = 25°C	—	—	0.48	V	
On Resistance	R _{DS} (ON)	—	V _{DD} = 12V, I _O = 8A, T _j = 25°C	—	—	0.06	Ω	
Output Leakage Current	I _{OL}	—	V _{DD} = 18V, V _{IN} = 0V	—	—	1.2	mA	
Diagnosis Output Voltage	“L” Level	V _{DL}	—	V _{DD} = 12V, I _{DL} = 1mA	—	—	0.4	V
Diagnosis Output Current	“H” Level	I _{DH}	—	V _{DD} = 18V, V _{DH} = 18V	—	—	10	μA
Overcurrent Protection	I _S (1) (Note 1)	1	V _{DD} = 12V, T _j = 25°C	15	40	—	A	
	I _S (2) (Note 2)	2		30	50	—	A	
Thermal Shutdown	Temperature	T _S	—	150	160	200	°C	
	Hysteresis	ΔT _S	—	—	10	—	°C	
Open Detection Resistance	R _{Ops}	—	V _{DD} = 8V	1	50	100	kΩ	
Switching Time	t _{ON}	3	V _{DD} = 12V, R _L = 5Ω T _j = 25°C	10	200	—	μs	
	t _{OFF}	3		10	30	—	μs	

Note 1: I_S (1) Overcurrent detection value when load is short circuited and V_{IN} = “L” → “H”

Note 2: I_S (2) Overcurrent detection value when load current is increased while V_{IN} = “H”

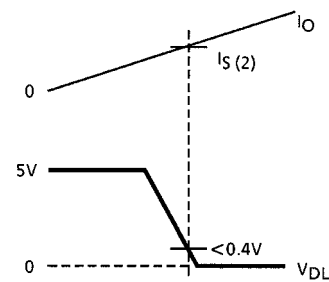
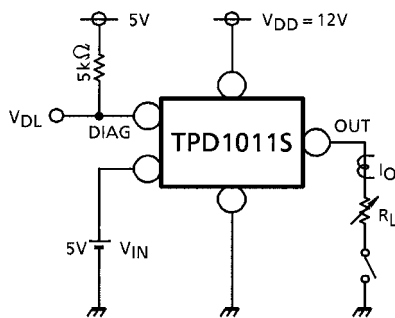
Test Circuit 1

Overcurrent detection



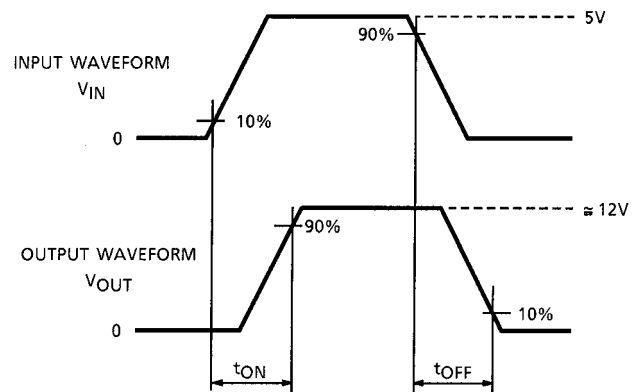
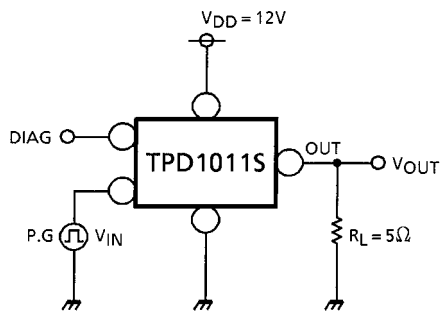
Test Circuit 2

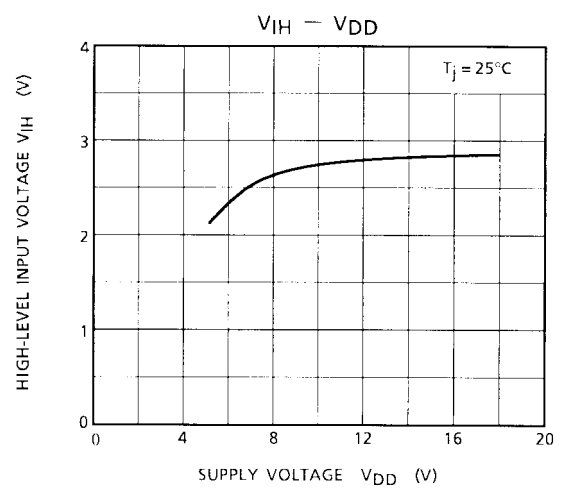
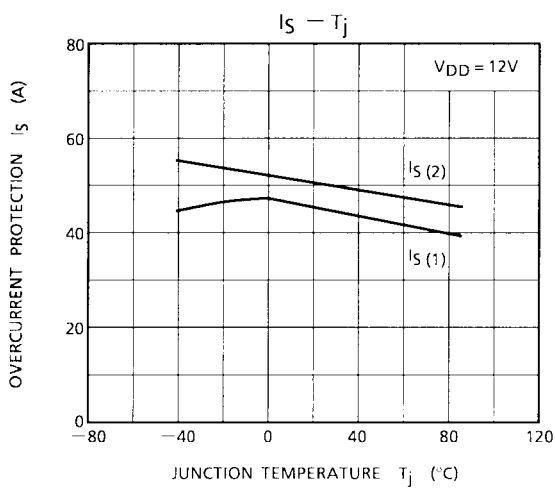
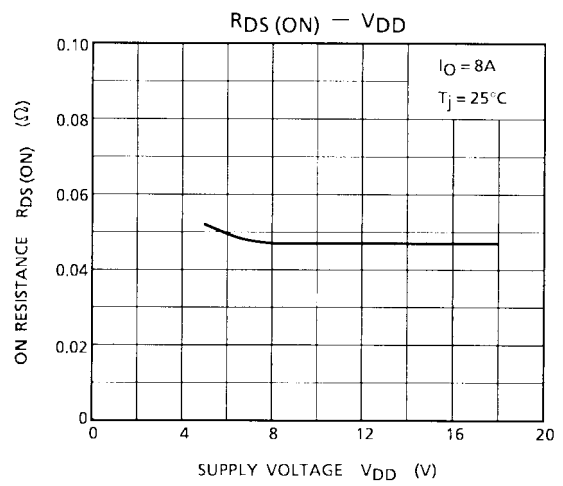
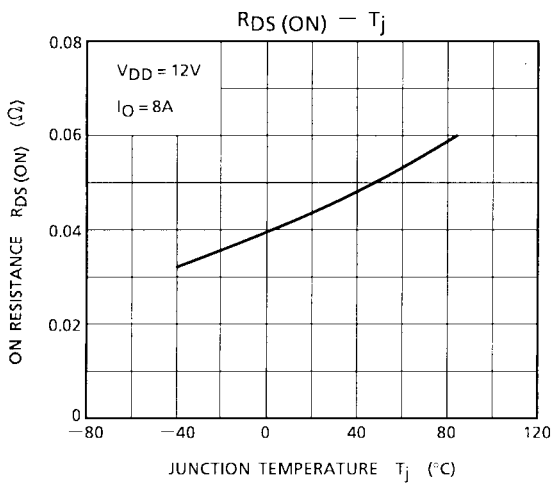
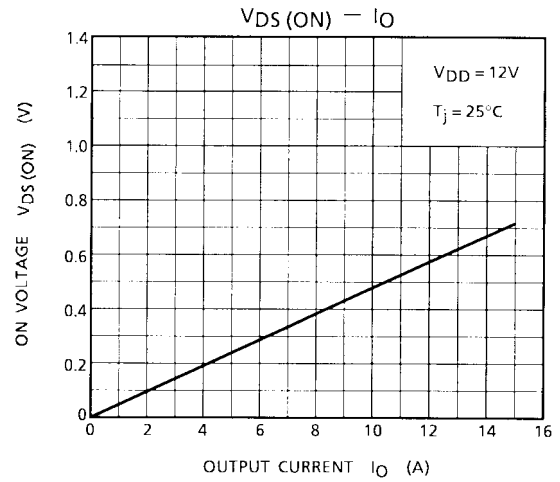
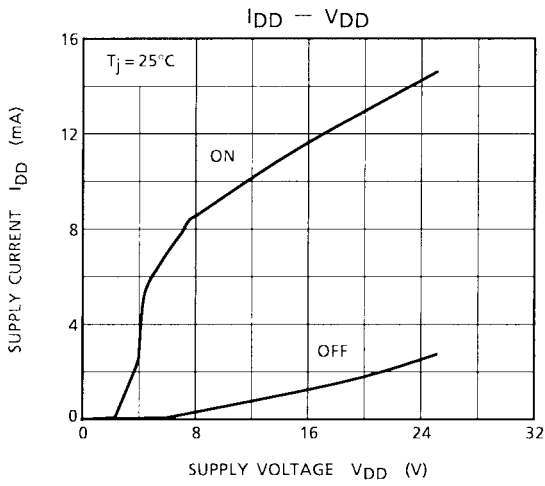
Over-current detection

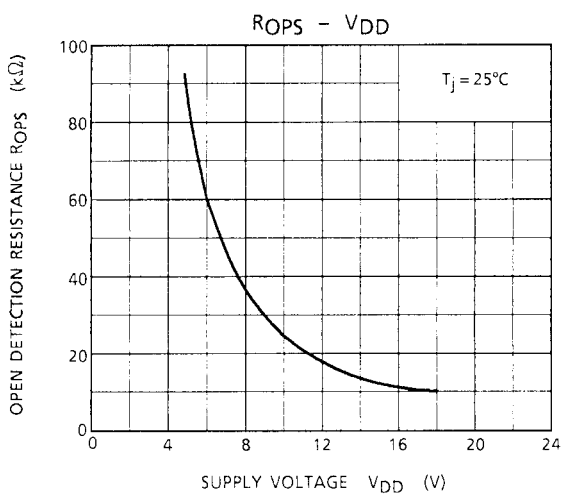
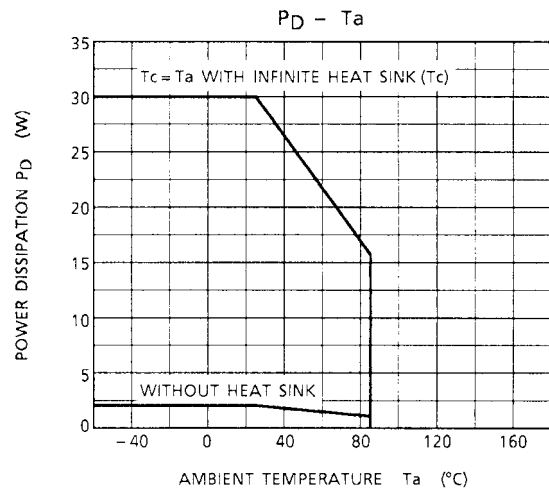
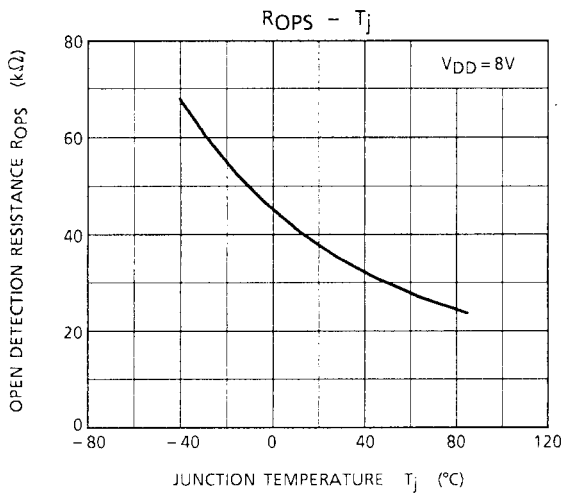
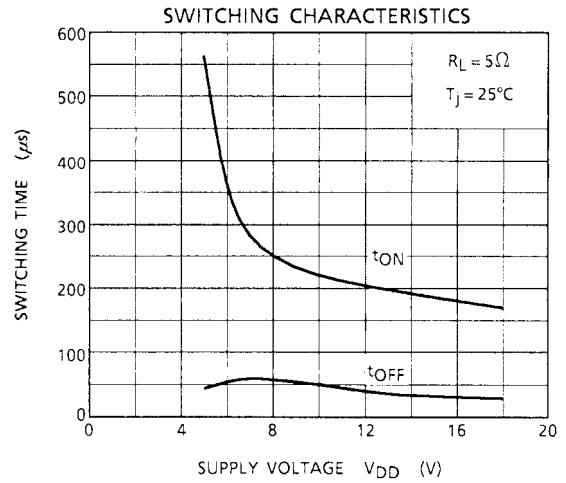
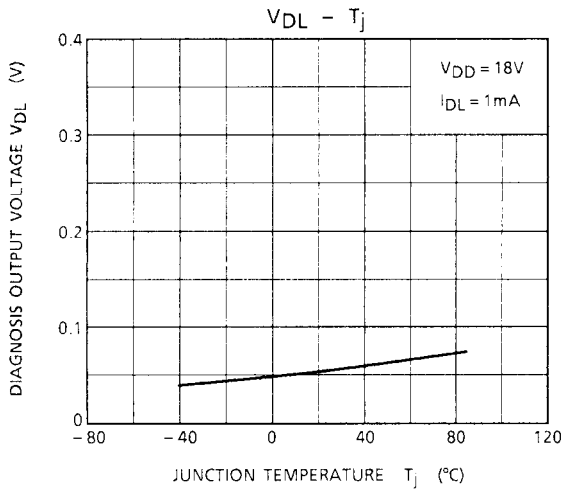


Test Circuit 3

Switching time







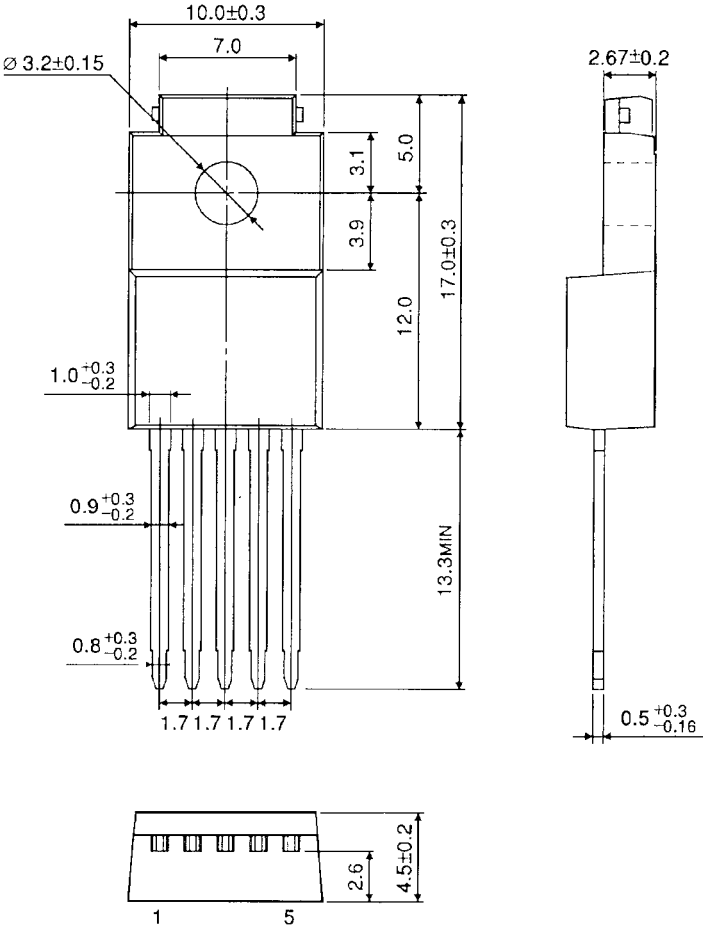
Precaution:

1. Since protection for, for example, reverse connection of the battery is not incorporated, provide protection using external circuits.

Package Dimensions

SSIP5-P-1.70A (STL)

Unit : mm

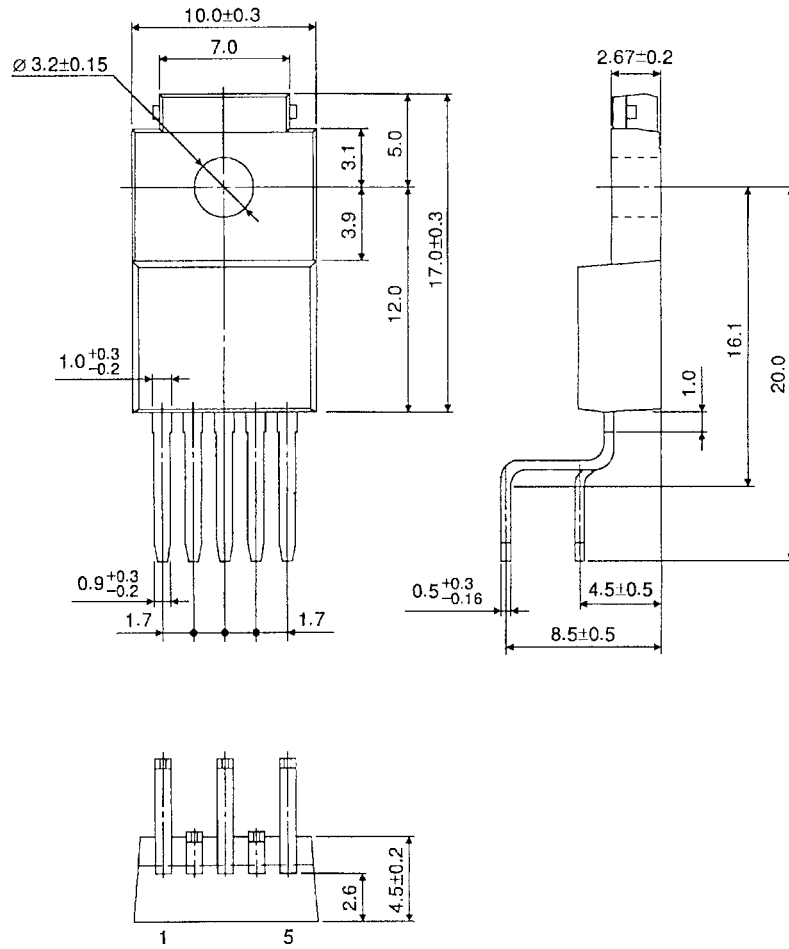


Weight: 2.2g (typ.)

Package Dimensions

ZIP5-P-1.70 (LBF)

Unit : mm

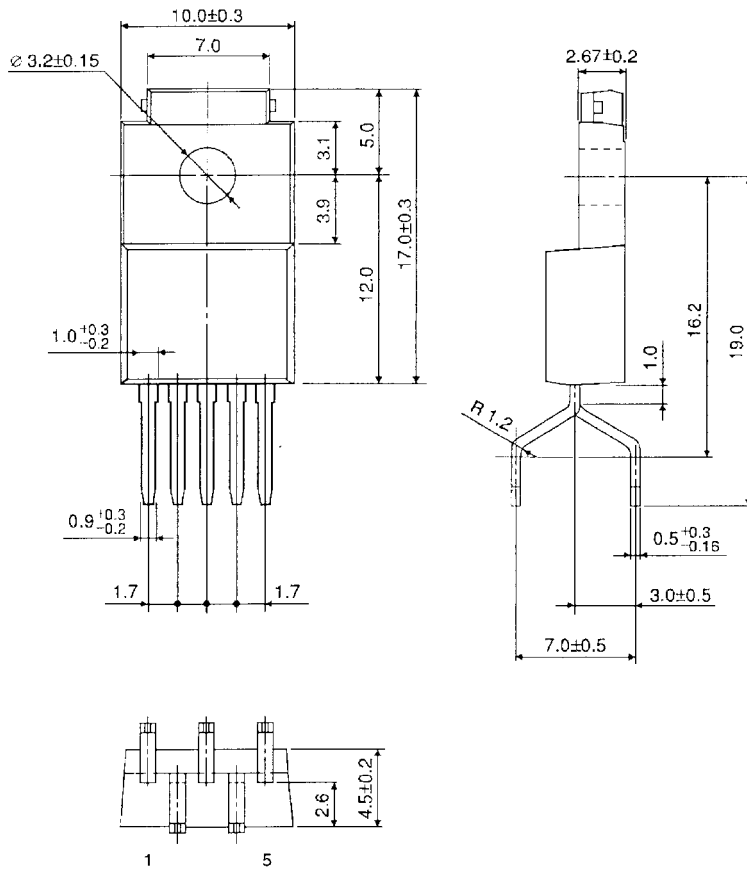


Weight: 2.2g (typ.)

Package Dimensions

ZIP5-P-1.70A (LBS)

Unit : mm



Weight: 2.2g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.