

TOSHIBA INTELLIGENT POWER DEVICE SILICON MONOLITHIC POWER MOS INTEGRATED CIRCUIT

TPD1011S

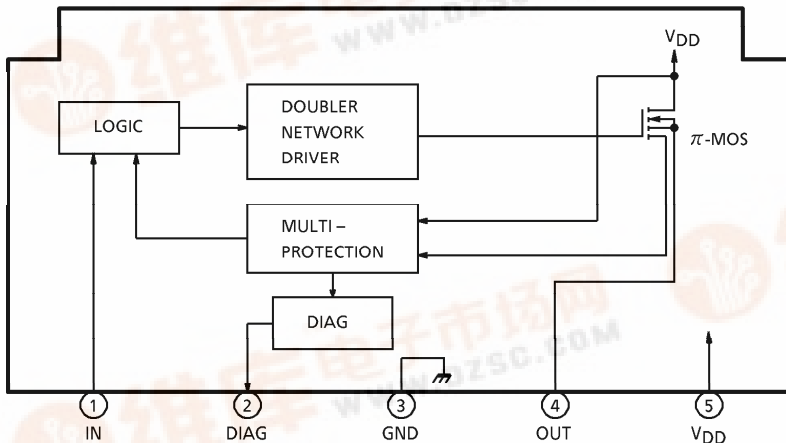
HIGH-SIDE POWER SWITCH for MOTORS, SOLENOIDS, and LAMP DRIVERS

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.

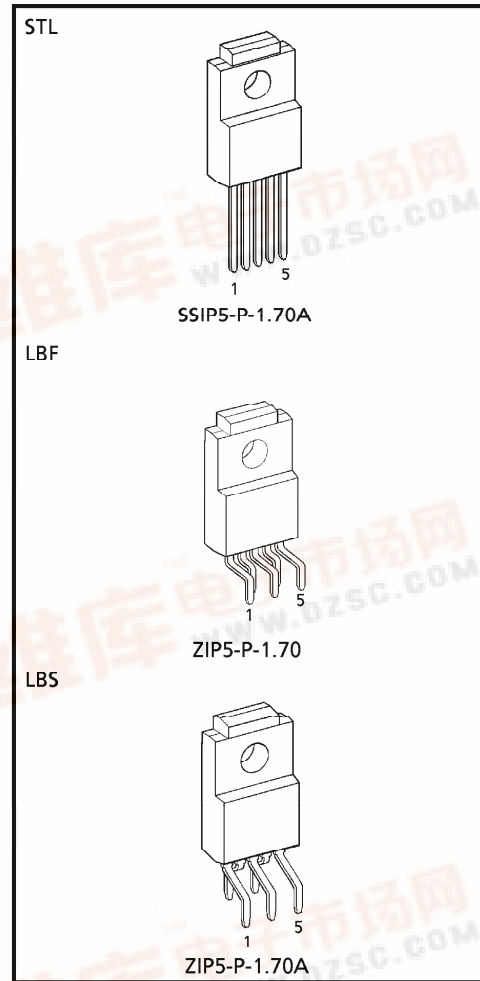
FEATURES

- 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 overheating and load short circuiting. Also incorporates a diagnosis function that allows diagnosis output to be read externally at load short circuiting, opening, or overheating.
- 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.), at $V_{DD} = 12V$, $V_{IN} = 0$
- 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.



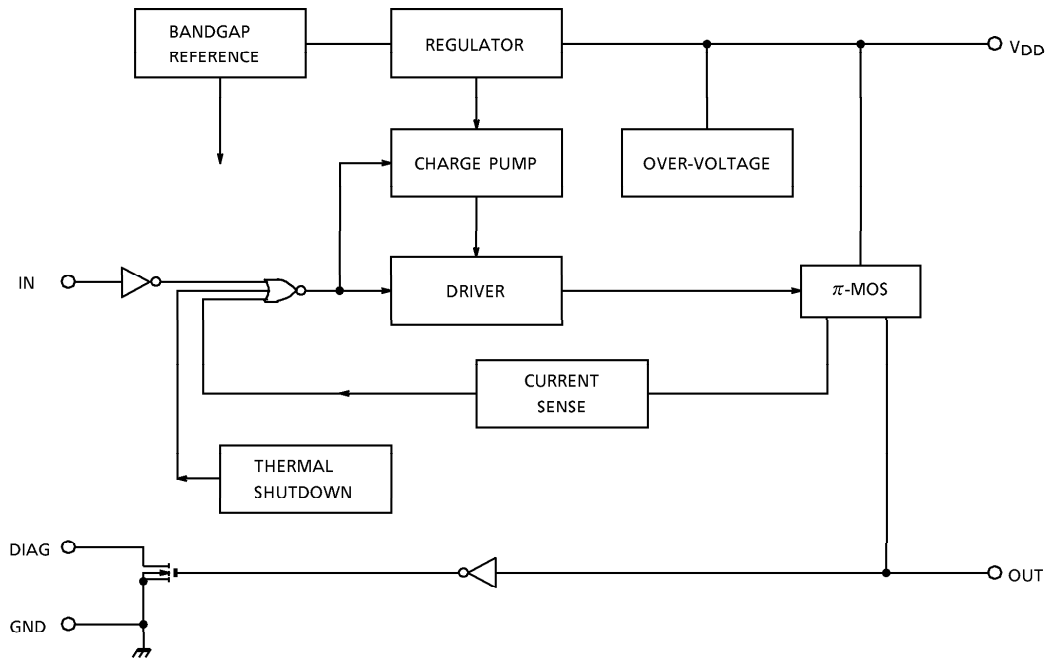
Weight
 SSIP5-P-1.70A : 2.2g (Typ.)
 ZIP5-P-1.70 : 2.2g (Typ.)
 ZIP5-P-1.70A : 2.2g (Typ.)

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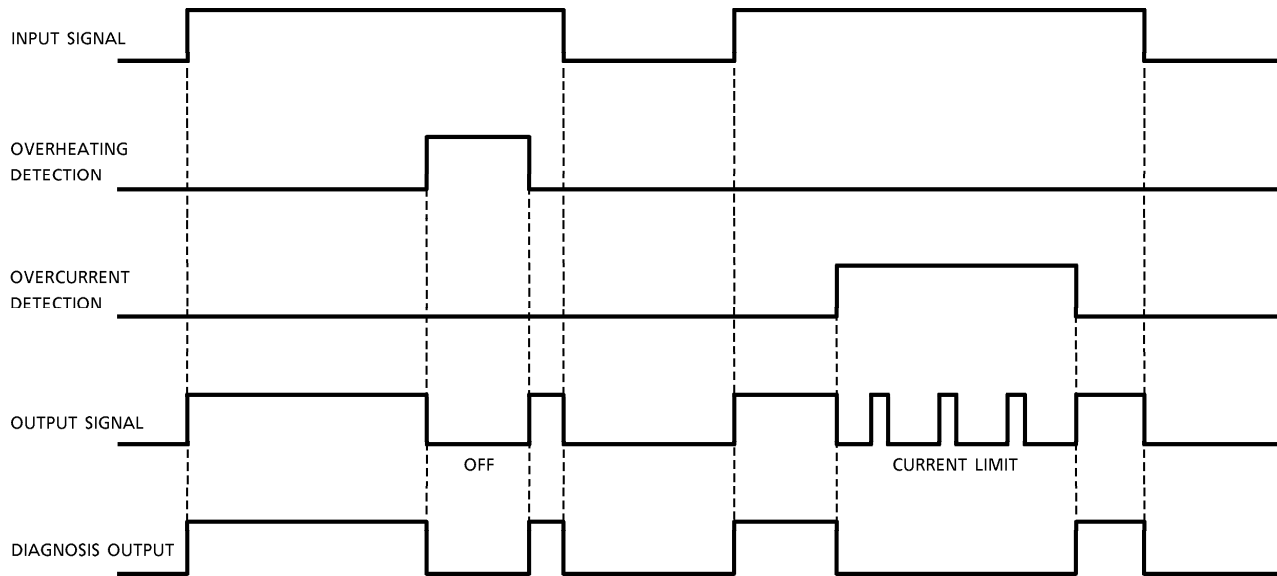
BLOCK DIAGRAM



PIN DESCRIPTION

PIN No.	SYMBOL	FUNCTION
1	IN	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 overheating 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	Load short circuited
L	L	L	
H	H	H	Load open
L	H	H	
H	L	L	Overheating
L	L	L	

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Drain-source Voltage	V _{DS}	60	V
Supply Voltage	DC	V _{DD} (1)	25
	Pulse	V _{DD} (2)	60 (Rs = 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	Tc = 25°C	P _D (1)	30
	Ta = 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 (Tc = -40~85°C, V_{DD} = 8~18V)

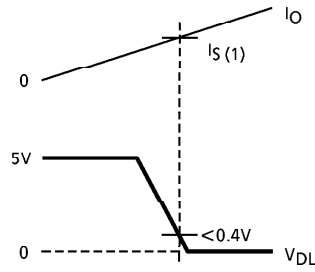
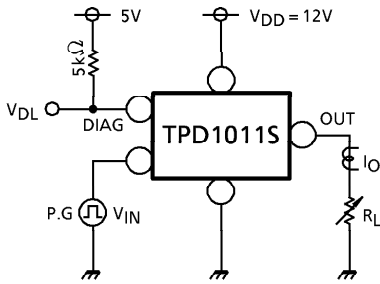
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN	TYP.	MAX	UNIT	
Operating Supply Voltage	V _{DD} (OPR)	—	—	5	12	18	V	
Current Dissipation	I _{DD}	—	V _{DD} = 12V, V _{IN} = 0	—	1	5	mA	
Input Voltage	V _{IH}	—	V _{DD} = 12V, I _O = 8A	3.5	—	—	V	
	V _{IL}	—	V _{DD} = 12V, I _O = 1.2mA	—	—	1.5	V	
Input Current	I _{IN} (1)	—	V _{DD} = 12V, I _{IN} = 5V	—	50	200	μA	
	I _{IN} (2)	—	V _{DD} = 12V, I _{IN} = 0	-0.2	—	0.2	μA	
On Voltage	V _{DS} (ON)	—	V _{DD} = 12V, I _O = 8A, Tc = 25°C	—	—	0.48	V	
On Resistance	R _{DS} (ON)	—	V _{DD} = 12V, I _O = 8A, Tc = 25°C	—	—	0.06	Ω	
Output Leakage Current	I _{OL}	—	V _{DD} = 18V, V _{IN} = 0	—	—	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 Detection	I _S (1) *1	1	V _{DD} = 12V, Tc = 25°C	15	40	—	A	
	I _S (2) *2	2		30	50	—	A	
Overheating Detection	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	10	200	—	μs	
	t _{OFF}	3	Tc = 25°C	10	30	—	μs	

*1 I_S (1) Overcurrent detection value when load is short circuited and V_{IN} = "L" → "H"

*2 I_S (2) Overcurrent detection value when load current is increased while V_{IN} = "H"

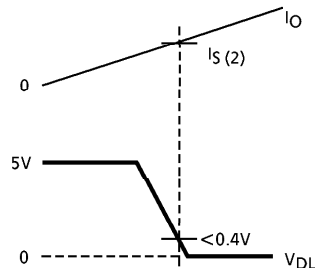
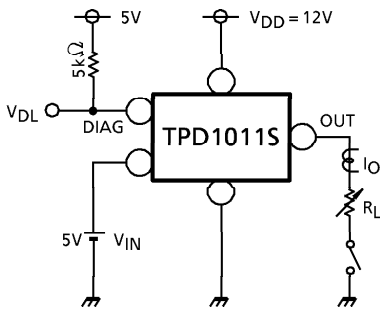
TEST CIRCUIT 1

Overcurrent detection



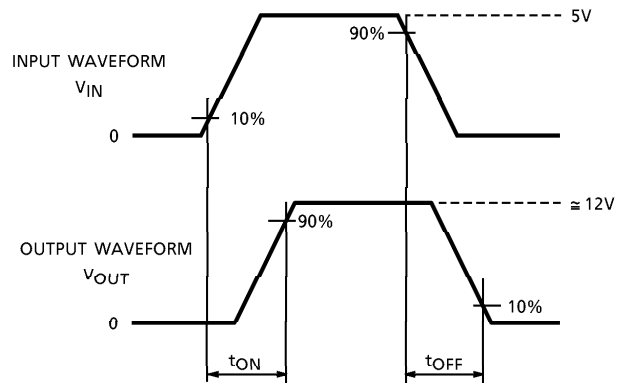
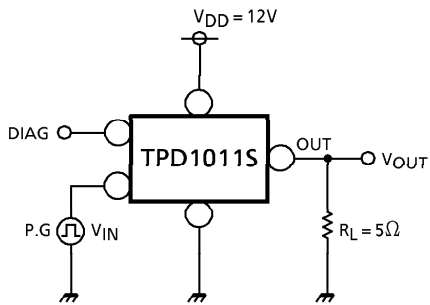
TEST CIRCUIT 2

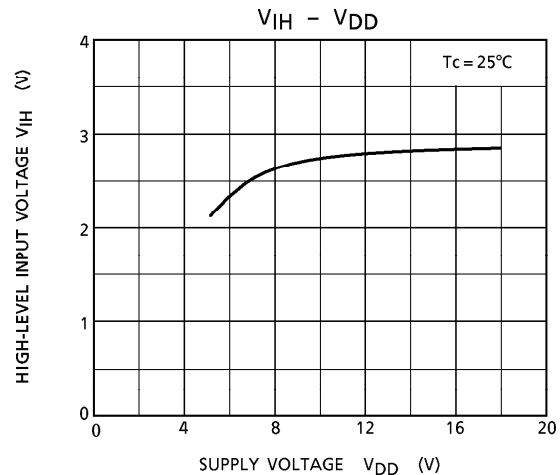
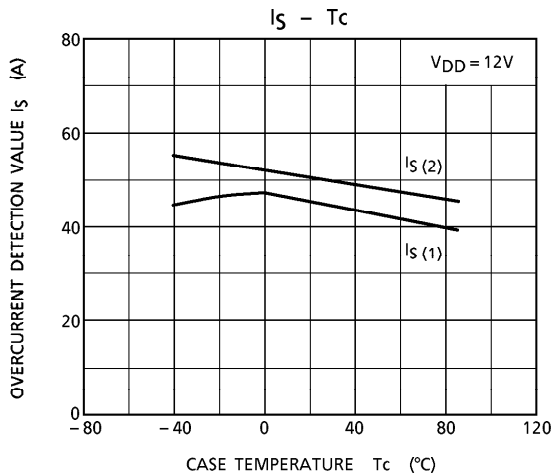
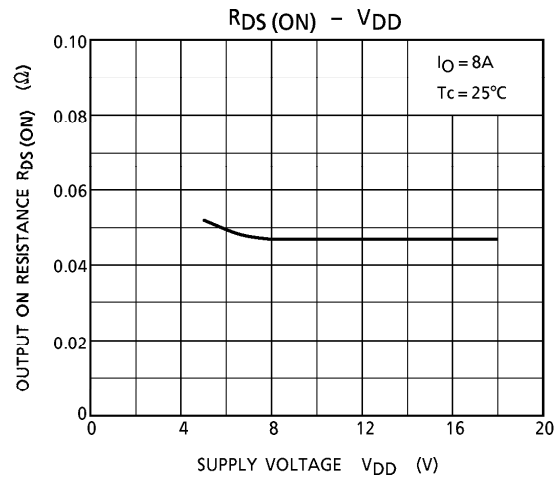
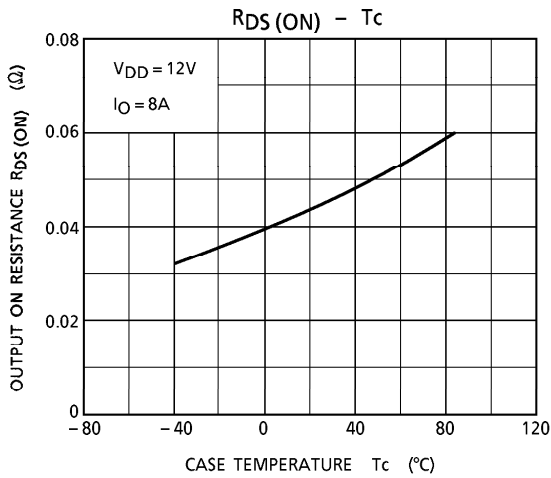
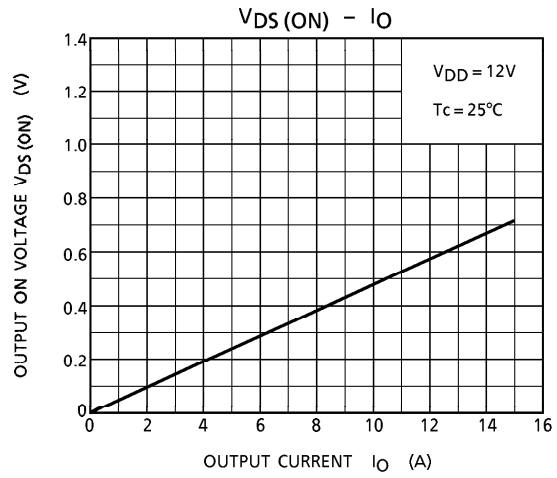
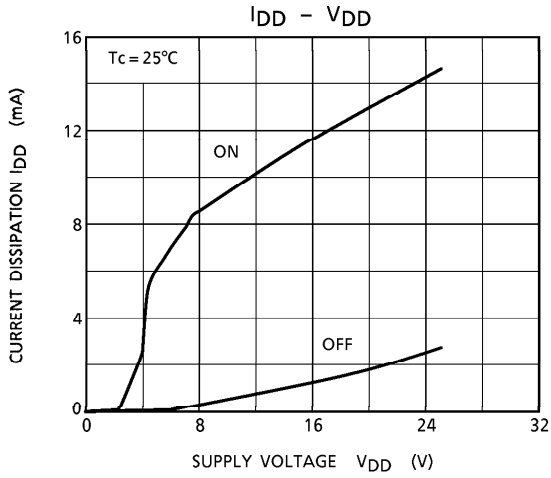
Over-current detection

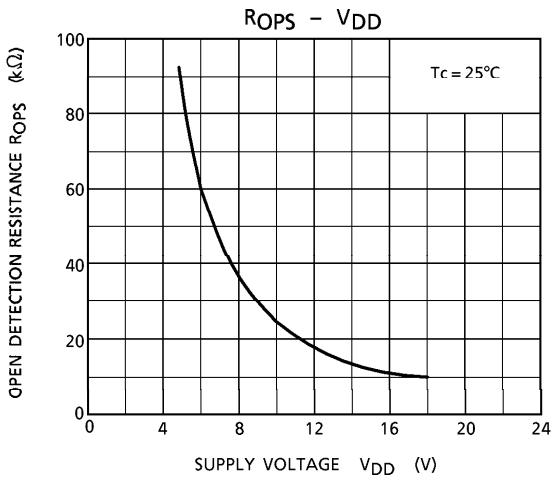
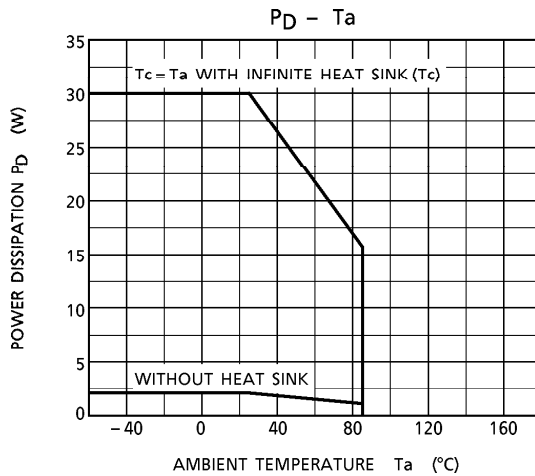
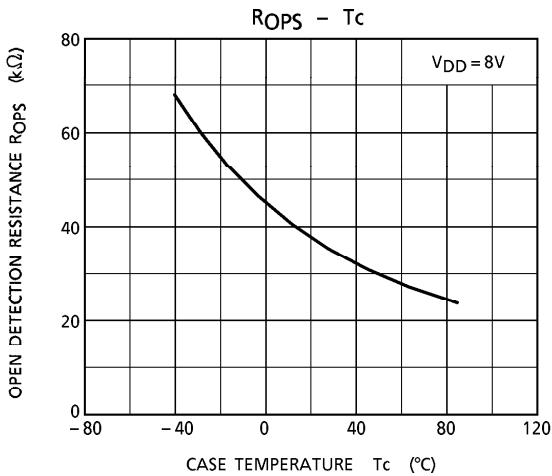
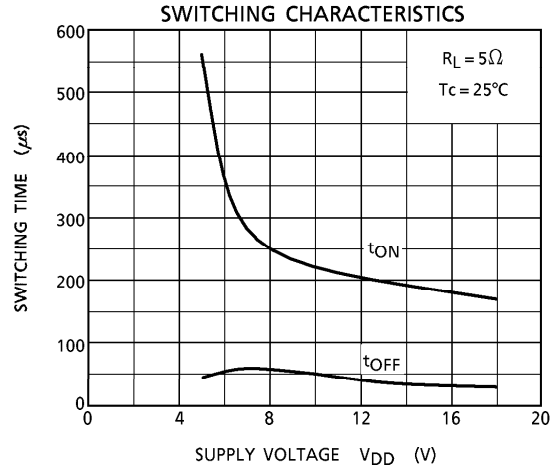
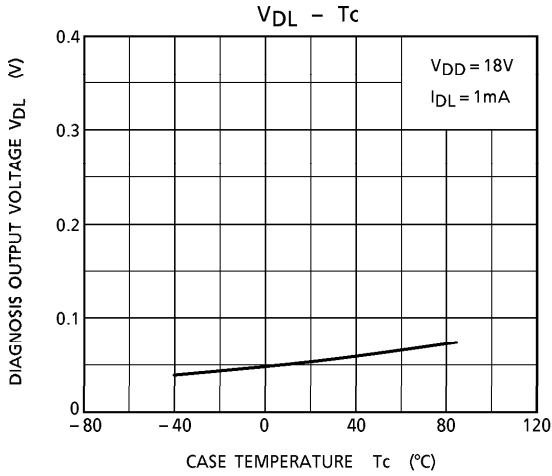


TEST CIRCUIT 3

Switching time





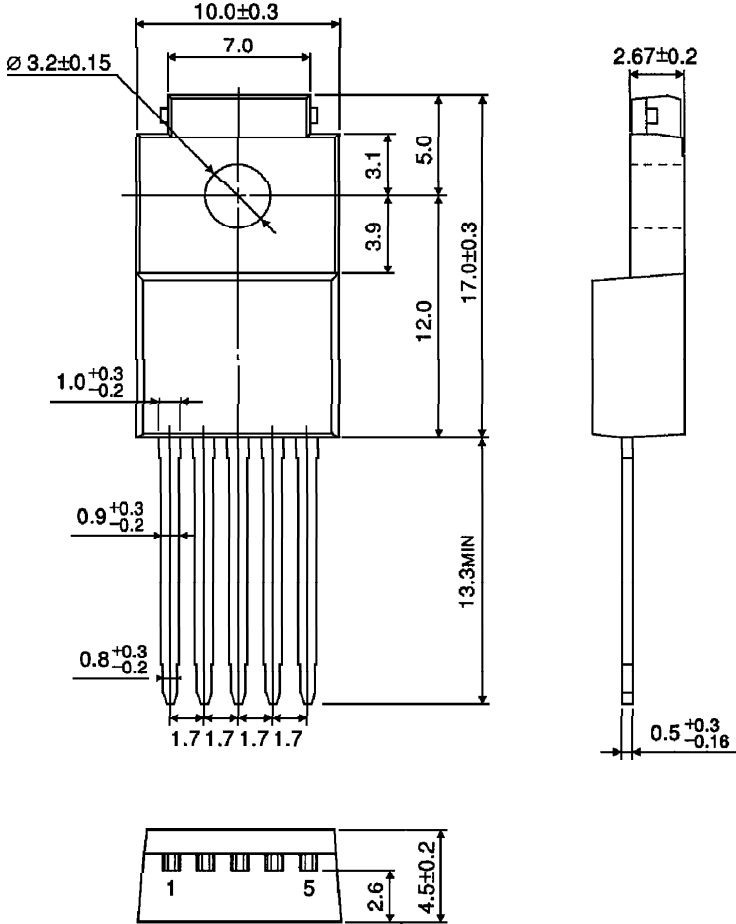


PRECAUTION:

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

OUTLINE DRAWING
SSIP5-P-1.70A (STL)

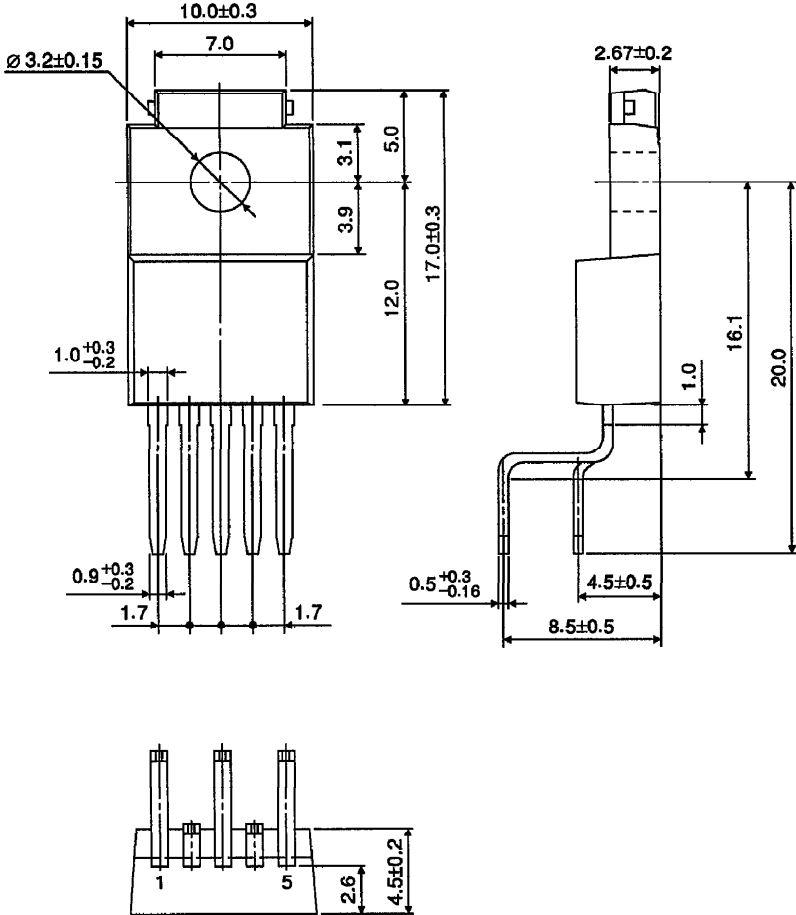
Unit : mm



Weight : 2.2g (Typ.)

OUTLINE DRAWING
ZIP5-P-1.70 (LBF)

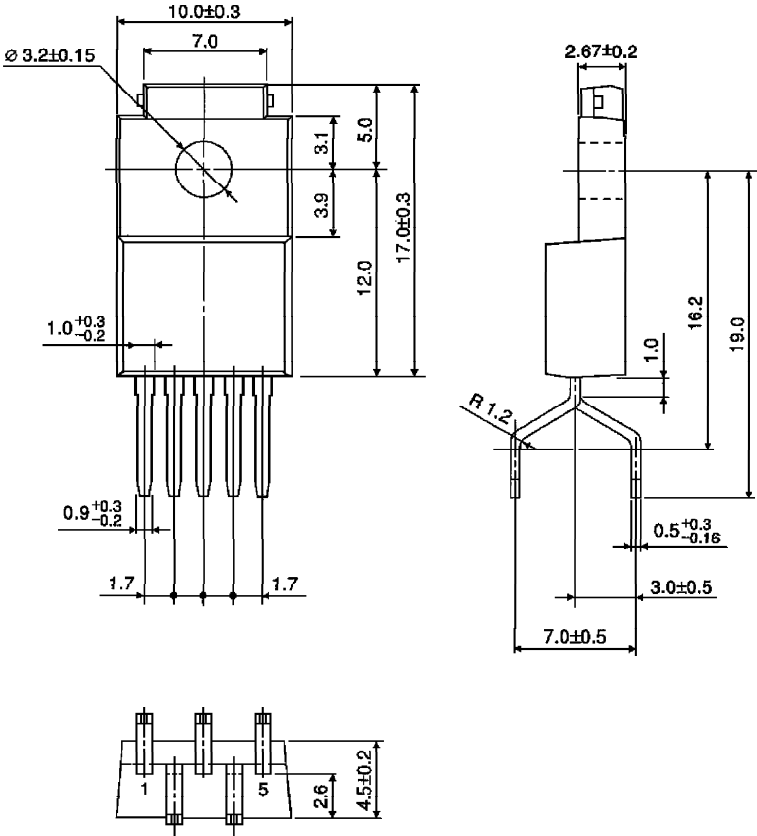
Unit : mm



Weight : 2.2g (Typ.)

OUTLINE DRAWING
ZIP5-P-1.70A (LBS)

Unit : mm



Weight : 2.2g (Typ.)