

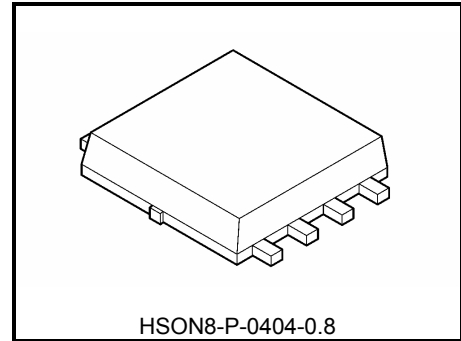
# TPD1048F

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

The TPD1048F is a monolithic power IC intended for low-side load switching applications. The output has a vertical MOSFET, and the input can be directly driven from CMOS or TTL logic (e.g., an MPU). The TPD1048F provides intelligent protection functions.

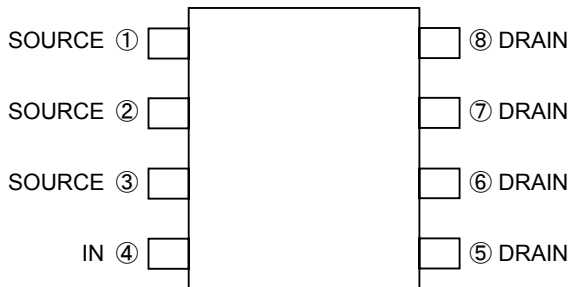
### Features

- A structure that incorporates control circuitry and a vertical power MOSFET on a single chip.
- Can be directly driven from a microprocessor, a CMOS logic IC, etc.
- Overvoltage (active clamp), overtemperature (thermal shutdown) and overcurrent (current limiter) protections are built in.
- Low ON-resistance :  $R_{DS(ON)} = 0.5 \Omega$  (max) (@ $V_{IN} = 5 \text{ V}$ ,  $I_D = 0.7 \text{ A}$ ,  $T_{ch} = 25^\circ\text{C}$ )
- 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) (@ $V_{IN} = 5 \text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$ )
- Housed in the 8-pin TSSOP Advance package and supplied in embossed carrier tape.

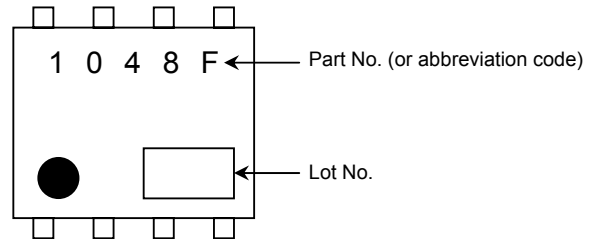


Weight: 0.029 g (typ.)

### Pin Assignment (top view)

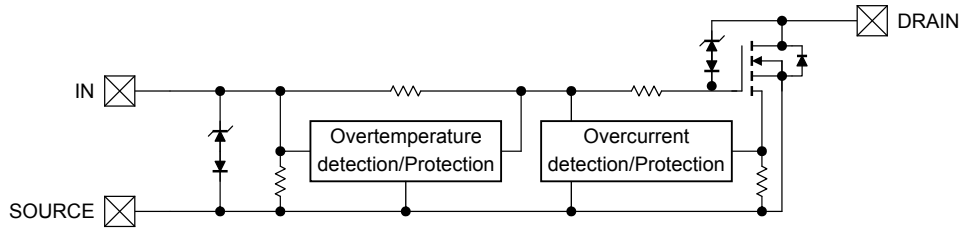


### Marking



Note: This product has a MOS structure and is sensitive to electrostatic discharge.

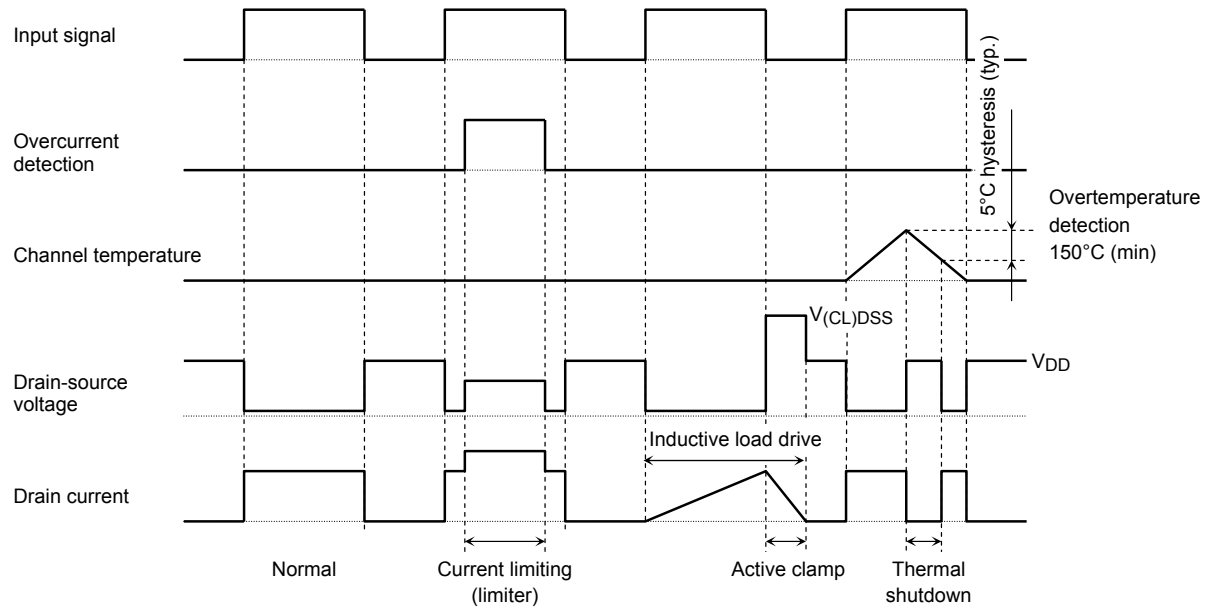
**Block Diagram**



**Pin Description**

Pin No.	Symbol	Pin Description
1, 2, 3	SOURCE	Source (ground) pins.
4	IN	Input pin. This pin is connected to a pull-down resistor internally, so that even if the input is open-circuited, the output never turns on inadvertently.
5, 6, 7, 8	DRAIN	Drain pins. Drain current is limited (by current limiter) if it exceeds 1.5 A (min) in order to protect the IC.

**Timing Chart**



**Truth Table**

$V_{IN}$	$V_{DS}$	Output State	Operating State
L	H	Off	Normal
H	L	On	
L	H	Off	Load short-circuited
H	H	Current limiting(limiter)	
L	H	Off	Overtemperature
H	H	Off	

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Drain-source voltage	$V_{DS}$	40	V
Drain current	$I_D$	Internally limited	A
Input voltage	$V_{IN}$	-0.3 to 6	V
Power dissipation ( $T_c = 25^\circ\text{C}$ )	$P_{D(1)}$	30	W
Power dissipation( $T_a = 25^\circ\text{C}$ ) (Note 2-a)	$P_{D(2)}$	1.19	W
Power dissipation( $T_a = 25^\circ\text{C}$ ) (Note 2-b)	$P_{D(3)}$	0.50	W
Single pulse active clamp capability (Note 3)	$E_{AS}$	208	mJ
Active clamp current	$I_{AR}$	1.5	A
Repetitive active clamp capability (Note 2-a) (Note 4)	$E_{AR}$	3	mJ
Operating temperature	$T_{opr}$	-40 to 85	$^\circ\text{C}$
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to 150	$^\circ\text{C}$

Note 1: 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).

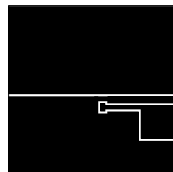
## Thermal Characteristics

Characteristics	Symbol	Rating	Unit
Thermal resistance, channel to case	$R_{th(ch-c)}$	4.17	$^\circ\text{C/W}$
Thermal resistance, channel to ambient	$R_{th(ch-a)}$	104.4 (Note 2-a)	
		247.2 (Note 2-b)	

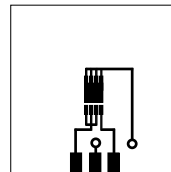
Note 2:

2-a: glass epoxy board (a)

2-b: glass epoxy board (b)



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)



FR-4  
25.4 × 25.4 × 0.8  
(unit: mm)

Note 3: Single pulse active clamp capability test condition

$V_{DD} = 25\text{ V}$ ,  $T_{ch} = 25^\circ\text{C}$  (initial),  $L = 92.6\text{ mH}$ ,  $I_{AR} = 1.5\text{ A}$ ,  $R_G = 25\ \Omega$

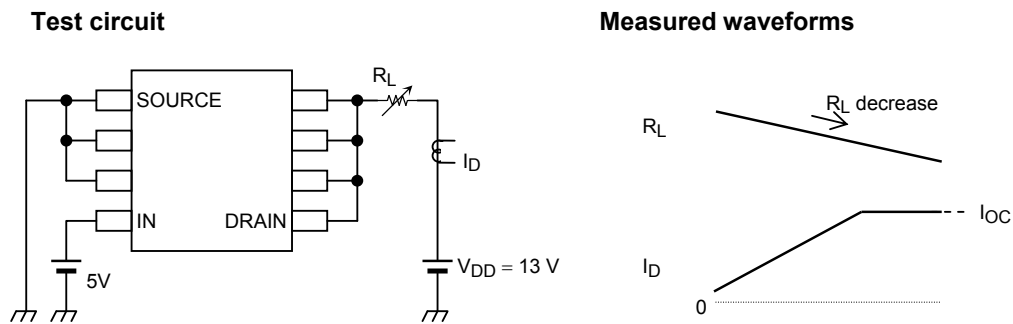
Note 4: Repetitive rating: Pulse width limited by maximum channel temperature

## Electrical Characteristics (T<sub>ch</sub> = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Drain-source clamp voltage	V <sub>(CL)DSS</sub>	-	V <sub>IN</sub> = 0 V, I <sub>D</sub> = 1 mA	40	-	60	V
Maximum Drain-source voltage (Load short-circuited)	V <sub>DS(s)</sub>	-	V <sub>IN</sub> = 5 V, R <sub>L</sub> = 0 Ω	31	-	-	V
Input threshold voltage	V <sub>th</sub>	-	V <sub>DS</sub> = 13 V, I <sub>D</sub> = 10mA	1.0	1.6	2.8	V
Protective circuit operation input Voltage range	V <sub>IN(opr)</sub>	-	-	4	5	6	V
Drain cut-off current	I <sub>DSS</sub>	-	V <sub>IN</sub> = 0 V, V <sub>DS</sub> = 30 V	-	-	10	μA
Input current	I <sub>IN</sub> (1)	-	V <sub>IN</sub> = 5 V, at normal operation	-	90	300	μA
	I <sub>IN</sub> (2)	-	V <sub>IN</sub> = 5 V, when overcurrent protective circuit is actuated	-	170	350	
Drain-source ON-resistance	R <sub>DS(ON)</sub>	-	V <sub>IN</sub> = 5 V, I <sub>D</sub> = 0.7 A	-	0.3	0.5	Ω
Overtemperature detection	T <sub>OT</sub>	-	V <sub>IN</sub> = 5 V	150	160	-	°C
Overcurrent detection	I <sub>OC</sub>	1	V <sub>IN</sub> = 5 V	1.5	2.5	-	A
Switching times	t <sub>on</sub>	2	V <sub>DD</sub> = 13 V, V <sub>IN</sub> = 0 V/5 V, I <sub>D</sub> = 0.7 A	-	12	30	μs
	t <sub>off</sub>			-	25	60	
Drain-source diode forward Voltage	V <sub>DSF</sub>	-	V <sub>IN</sub> = 0 V, I <sub>F</sub> = 1.5 A	-	-	1.7	V

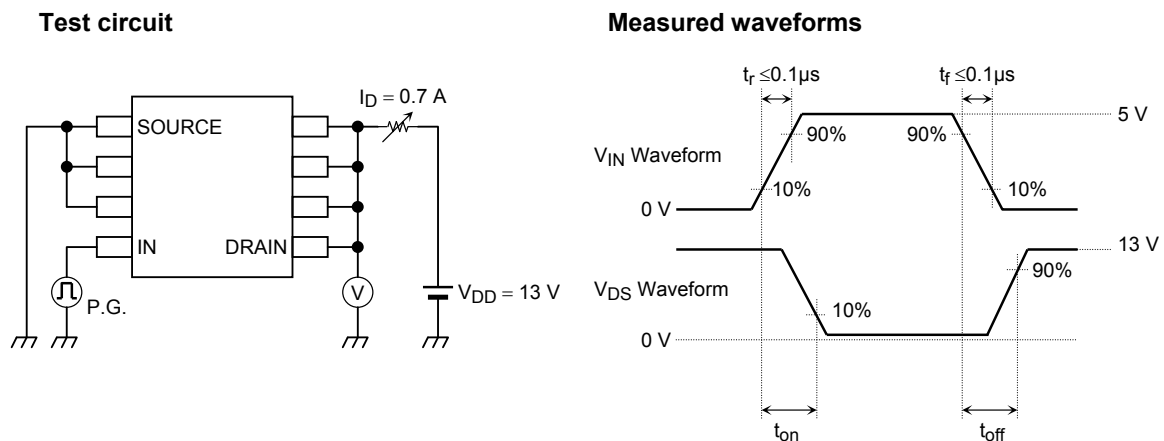
### Test Circuit 1

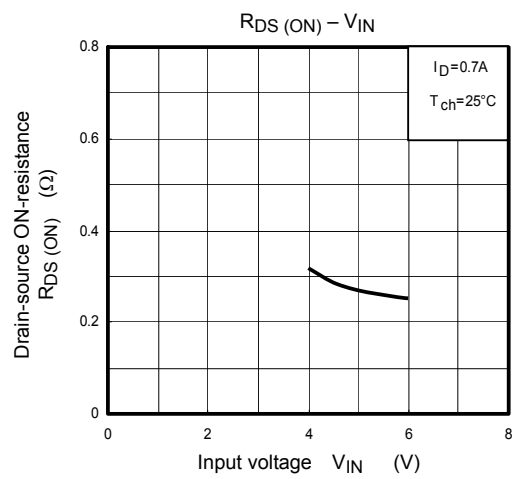
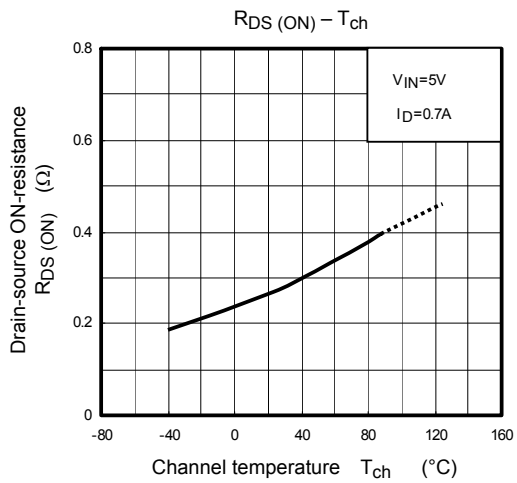
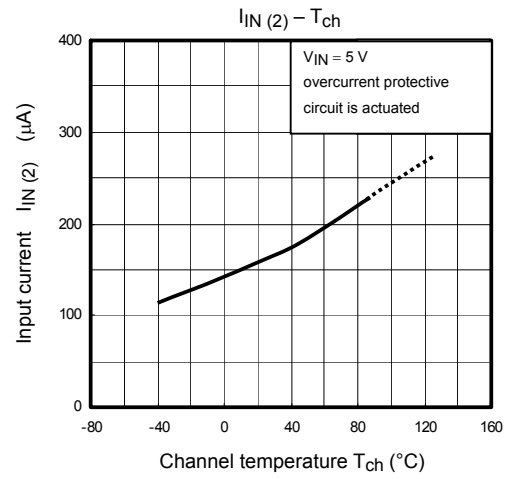
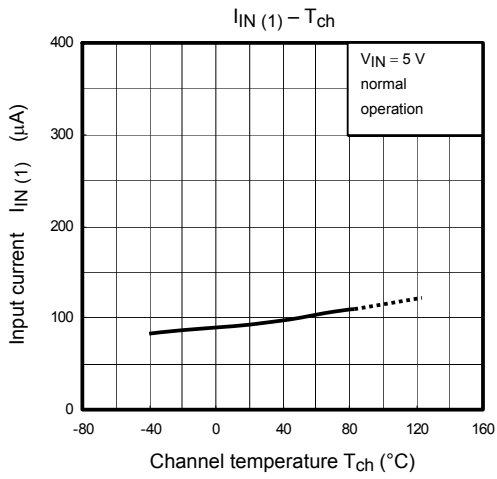
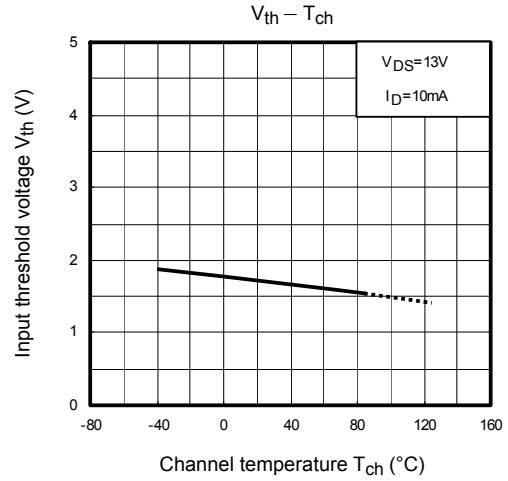
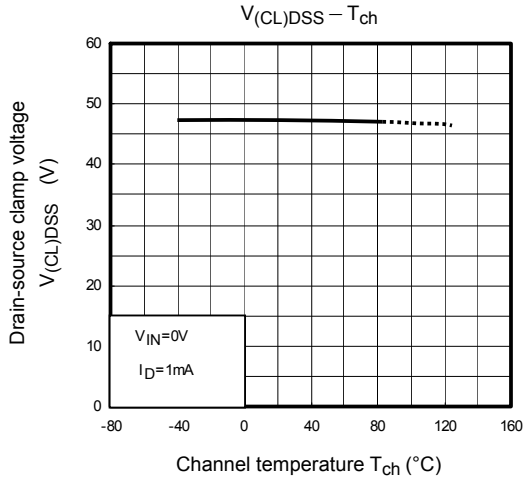
#### Overcurrent detection measuring circuit

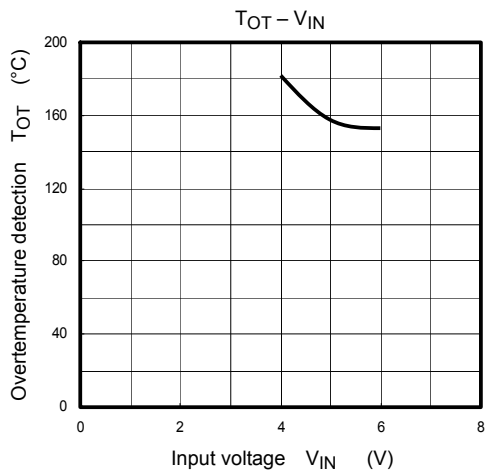
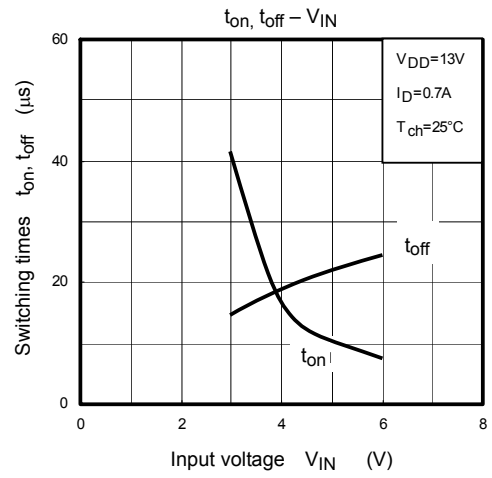
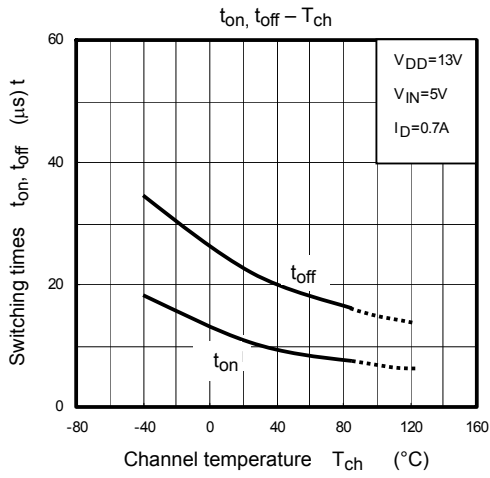
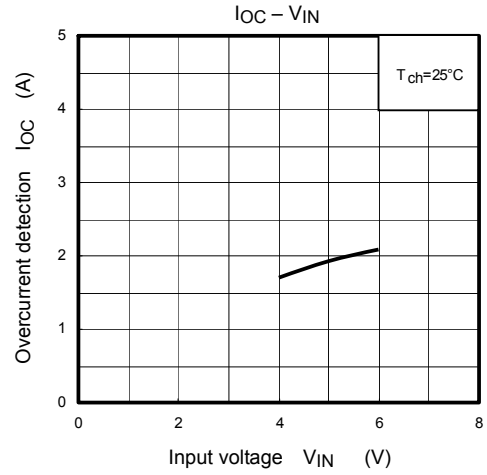
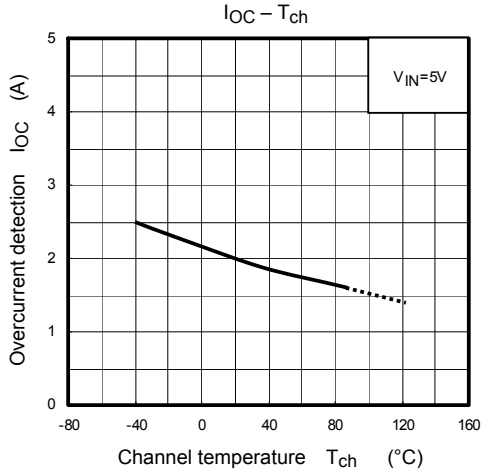


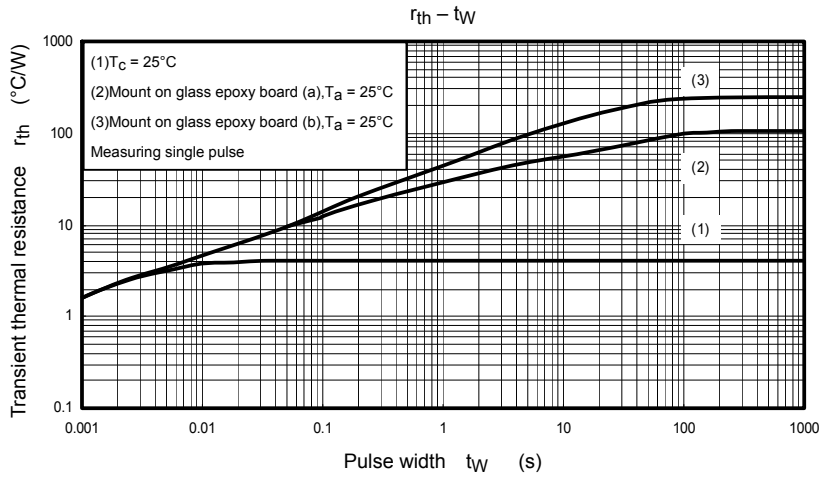
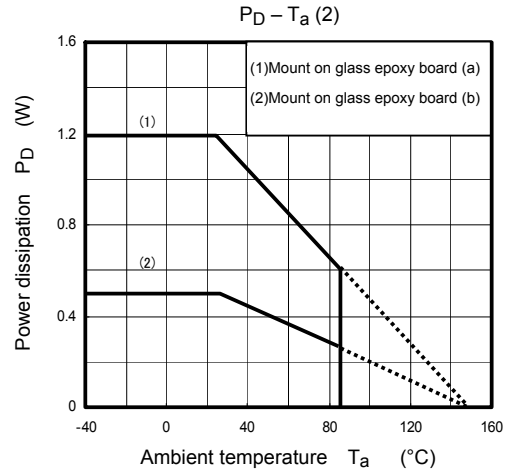
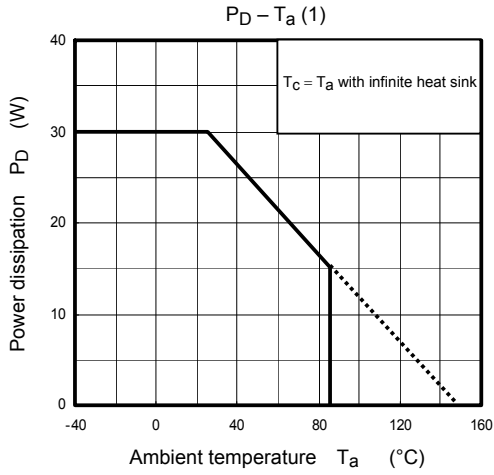
### Test Circuit 2

#### Switching times measuring circuit







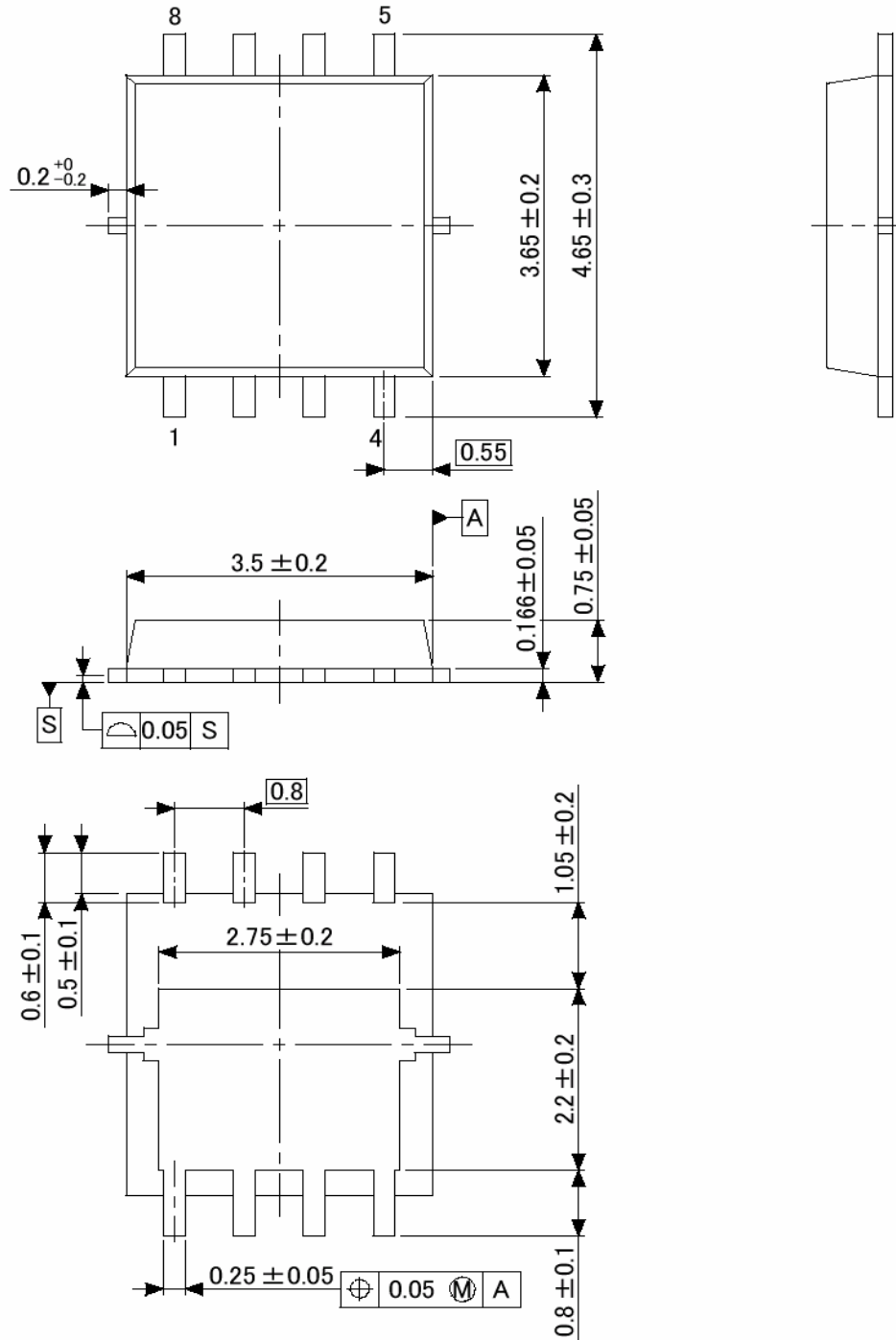




## Package Dimensions

HSON8-P-0404-0.80

Unit: mm



Weight: 0.029 g (typ.)

**RESTRICTIONS ON PRODUCT USE**

20070701-EN GENERAL

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