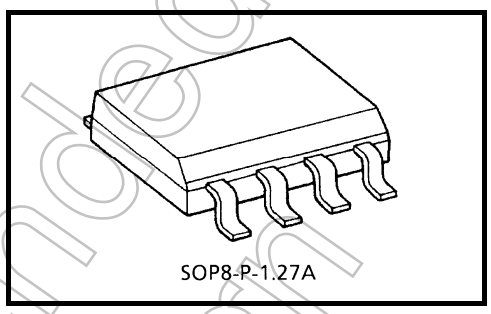
Toshiba Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

TPD1036F

2-IN-1 Low-Side Power Switch for Motor, Solenoid and Lamp Drivers

The TPD1036F is a 2-IN-1 low-side switch.
The output has a vertical MOSFET, and the input can be directly driven from CMOS or TTL logic (e.g., an MPU). The IC provides intelligent protection functions.

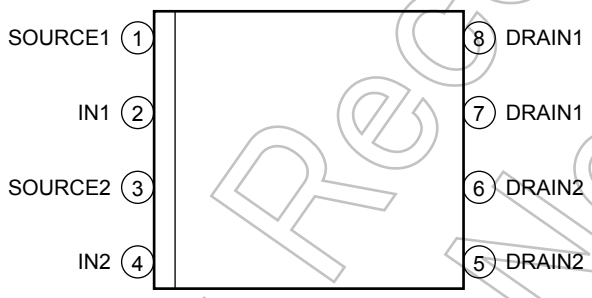


Weight: 0.08 g (typ.)

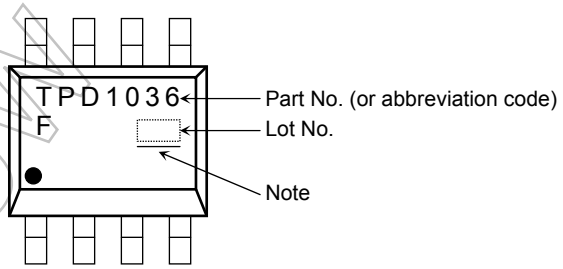
Features

- Two built-in power IC chips with a structure that incorporates a control block and a vertical power MOSFET on each 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 Ω (max) (@V_{IN} = 5 V, I_D = 0.7 A, T_{ch} = 25°C)
- Low drain cut-off current: I_{DSS} = 10 μA (max) (@V_{IN} = 0 V, V_{DS} = 30 V, T_{ch} = 25°C)
- Low input current: I_{IN} = 300 μA (max) (@V_{IN} = 5 V, T_{ch} = -40 to 110°C)
- Housed in the 8-pin SOP package and supplied in embossed carrier tape.

Pin Assignment (top view)



Marking



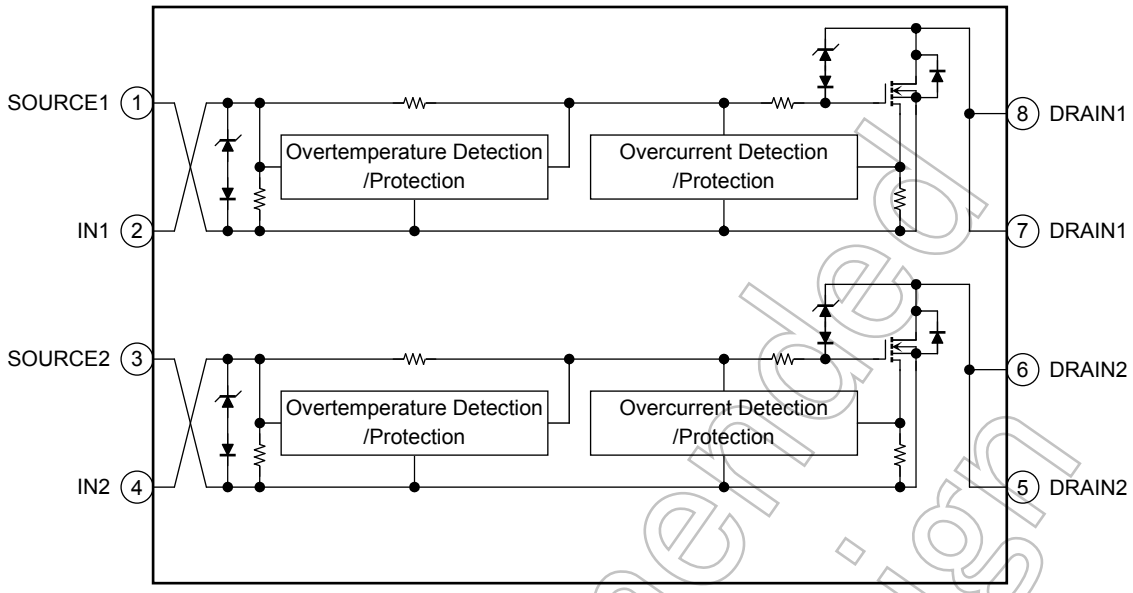
Note: A line under a Lot No. identifies the indication of product Labels
Not underlined: [[Pb]]/INCLUDES > MCV
Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The RoHS is Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

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

Start of commercial production
1999-10

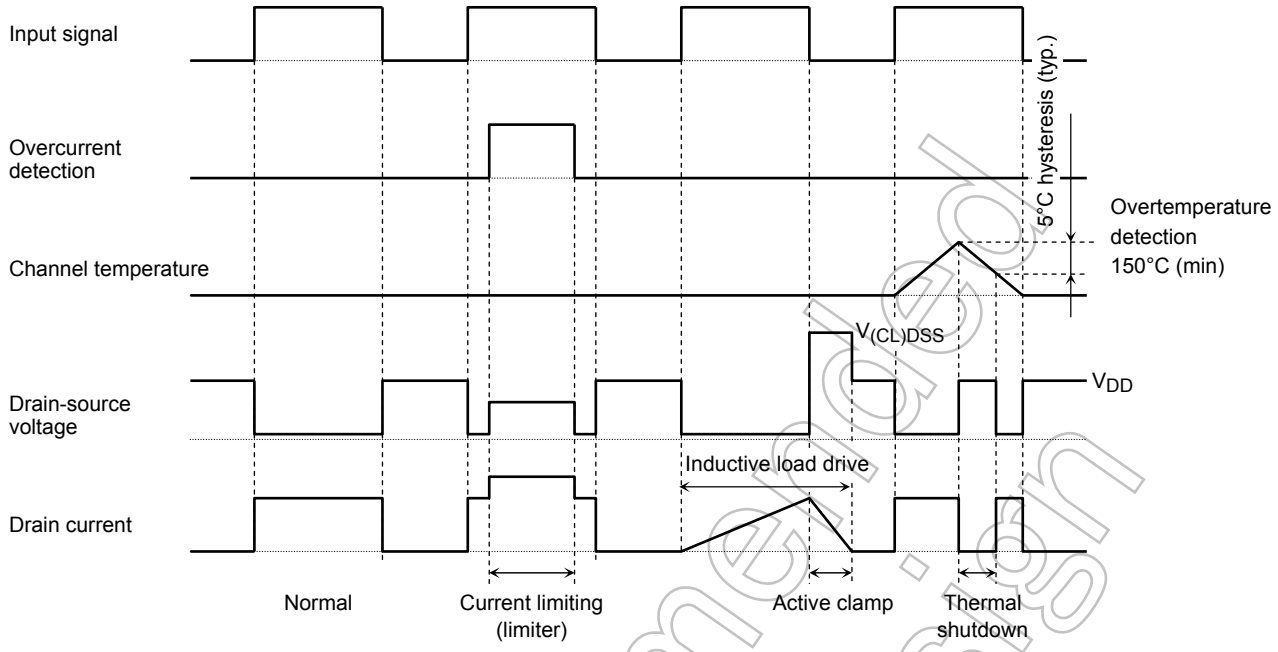
Block Diagram



Pin Description

Pin No.	Symbol	Pin Description
1	SOURCE1	Source pin 1.
2	IN1	Input pin 1. This pin is connected to a pull-down resistor internally, so that even if the input is open-circuited, output never turns on inadvertently.
3	SOURCE2	Source pin 2.
4	IN2	Input pin 2. This pin is connected to a pull-down resistor internally, so that even if the input is open-circuited, output never turns on inadvertently.
5, 6	DRAIN2	Drain pin 2. Drain current is limited (by current limiter) if it exceeds 1 A (min) in order to protect the IC.
7, 8	DRAIN1	Drain pin 1. Drain current is limited (by current limiter) if it exceeds 1 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 (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain-source voltage	DC	V_{DS}	30	V
Drain current		I_D	Internally limited	A
Input voltage		V_{IN}	−0.3 to 6	V
Power dissipation (t = 10 s) (Note 2)		P_D	2.0	W
Single pulse active clamp capability (Note 3)		E_{AS}	23	mJ
Active clamp current		I_{AR}	1.5	A
Repetitive active clamp capability (Note 4)		E_{AR}	0.2	mJ
Operating temperature		T_{opr}	−40 to 110	°C
Channel temperature		T_{ch}	150	°C
Storage temperature		T_{stg}	−55 to 150	°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	Max	Unit
Thermal resistance, channel to ambient (Note 2)	$R_{th\ (ch\text{-}a)}$	62.5	°C/W

Note 2: Mount on glass epoxy boad [25.4 × 25.4 × 0.8mm] (with the two devices driving)(t =10 s)

Note 3: Single pulse active clamp capability test condition
V_{DD} = 25 V, T_{ch} = 25°C (initial), L = 10 mH, I_{AR} = 1.5 A, R_G = 25Ω

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

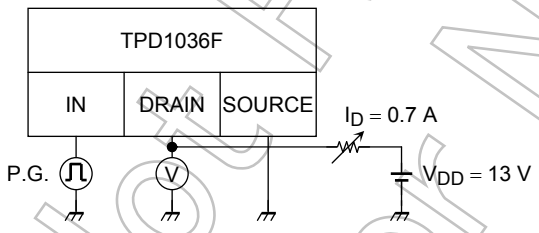
Electrical Characteristics

Characteristics	Symbol	Test Circuit	Test Condition		Min	Typ.	Max	Unit
Drain-source clamp voltage	$V_{(CL)\ DSS}$	—	T_{ch} = -40 to 110℃	V_{IN} = 0 V, I_D=1mA	40	—	60	V
Input threshold voltage	V_{th}	—	T_{ch} = 25℃	V_{DS} = 13 V, I_D = 10mA	1.0	—	2.8	V
			T_{ch} = -40 to 110℃		0.9	—	3.0	
Protective circuit operation input voltage range	$V_{IN\ (opr)}$	—	T_{ch} = 25℃	—	3	—	6	V
			T_{ch} = -40 to 110℃	—	3.5	—	6	
Drain cut-off current	I_{DSS}	—	T_{ch} = 25℃	V_{IN} = 0 V, V_{DS} = 30V	—	—	10	μA
			T_{ch} = -40 to 110℃		—	—	100	
Input current	$I_{IN\ (1)}$	—	T_{ch} = -40 to 110℃	V_{IN} = 5 V, at normal operation	—	—	300	μA
	$I_{IN\ (2)}$	—	T_{ch} = -40 to 110℃	V_{IN} = 5 V, when overcurrent protective circuit is actuated	—	—	350	
Drain-source ON-resistance	$R_{DS\ (ON)}$	—	T_{ch} = 25℃	V_{IN} = 5 V, I_D = 0.7 A	—	0.3	0.5	Ω
			T_{ch} = -40 to 110℃		—	—	0.75	
Overtemperature detection	T_S	—	—	V_{IN} = 5 V	150	160	—	°C
Overcurrent detection	I_S	2	T_{ch} = 25℃	V_{IN} = 5 V	1.5	2.5	—	A
			T_{ch} = -40 to 110℃		1	—	—	
Switching times	t_{ON}	1	T_{ch} = 25℃	V_{DD} = 13 V, V_{IN} = 0 V/5 V, I_D = 0.7 A	—	—	30	μs
			T_{ch} = -40 to 110℃		—	—	60	
	t_{OFF}		T_{ch} = 25℃		—	—	60	
			T_{ch} = -40 to 110℃		—	—	90	
Drain-source diode forward voltage	V_{DSF}	—	T_{ch} = 25℃	V_{IN} = 0 V, I_F = 1.5 A	—	—	1.7	V

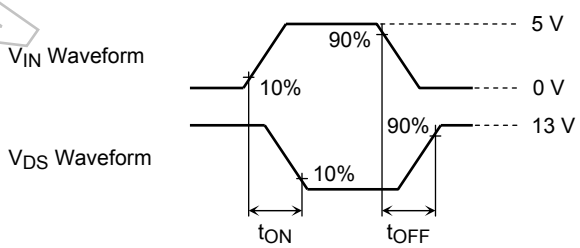
Test Circuit 1

Switching times measuring circuit

Test Circuit



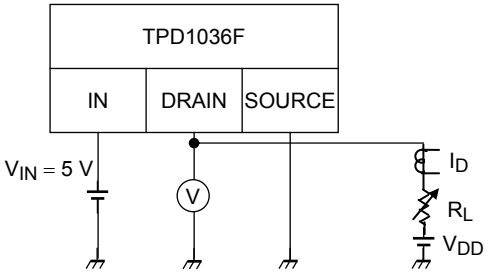
Measured Waveforms

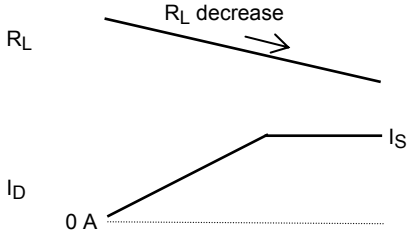


Test Circuit 2

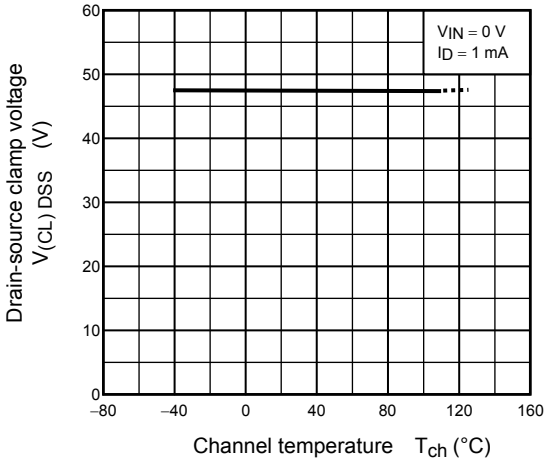
Overcurrent detection measuring circuit

Test Circuit

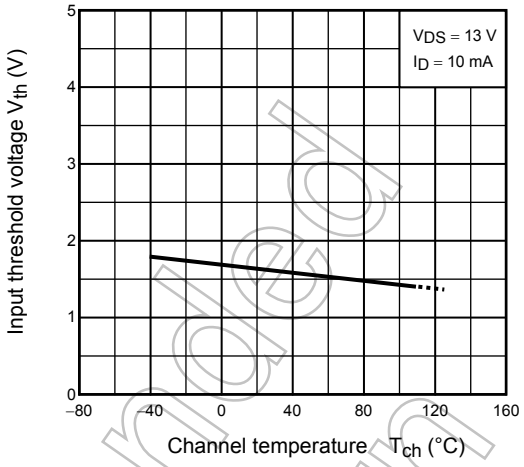




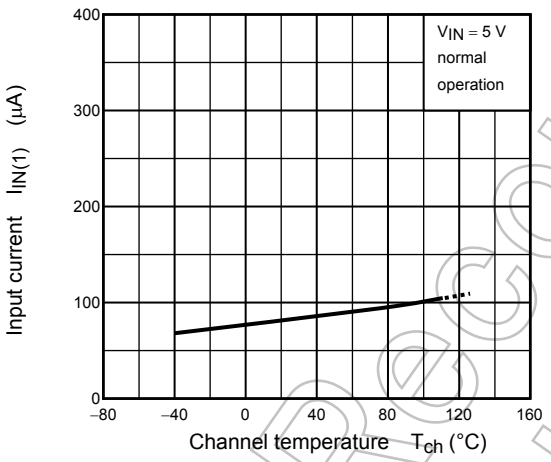
$V_{(CL)\ DSS} - T_{ch}$



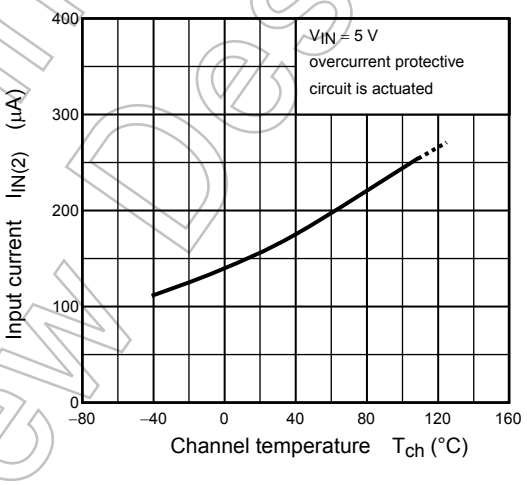
$V_{th} - T_{ch}$



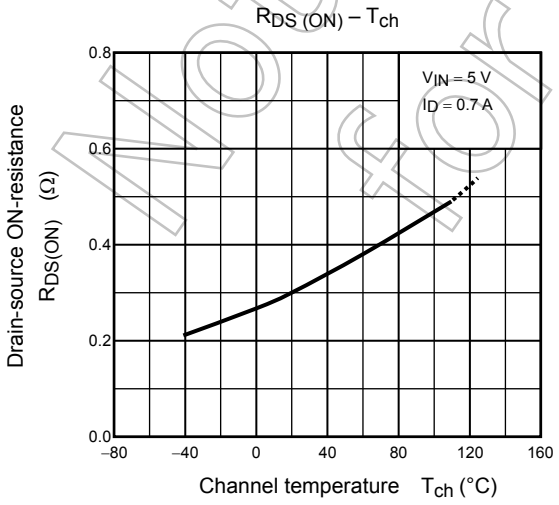
$I_{IN\ (1)} - T_{ch}$



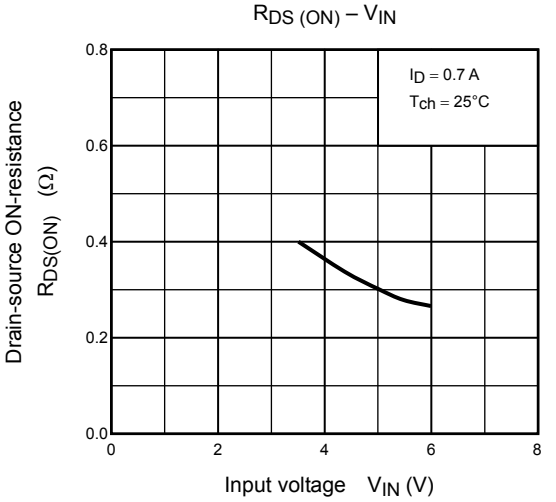
$I_{IN\ (2)} - T_{ch}$



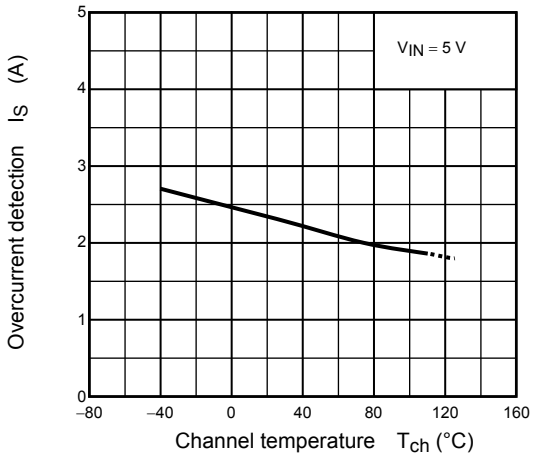
$R_{DS\ (ON)} - T_{ch}$



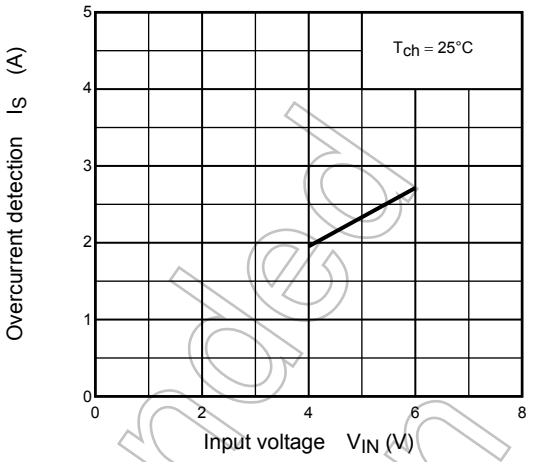
$R_{DS\ (ON)} - V_{IN}$



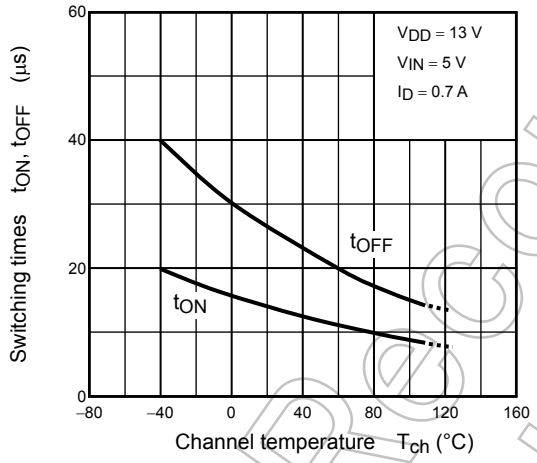
$I_S - T_{ch}$



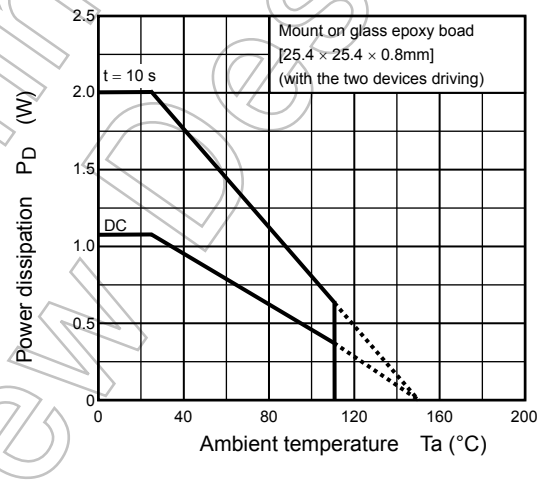
$I_S - V_{IN}$



t_{ON}, $t_{OFF} - T_{ch}$

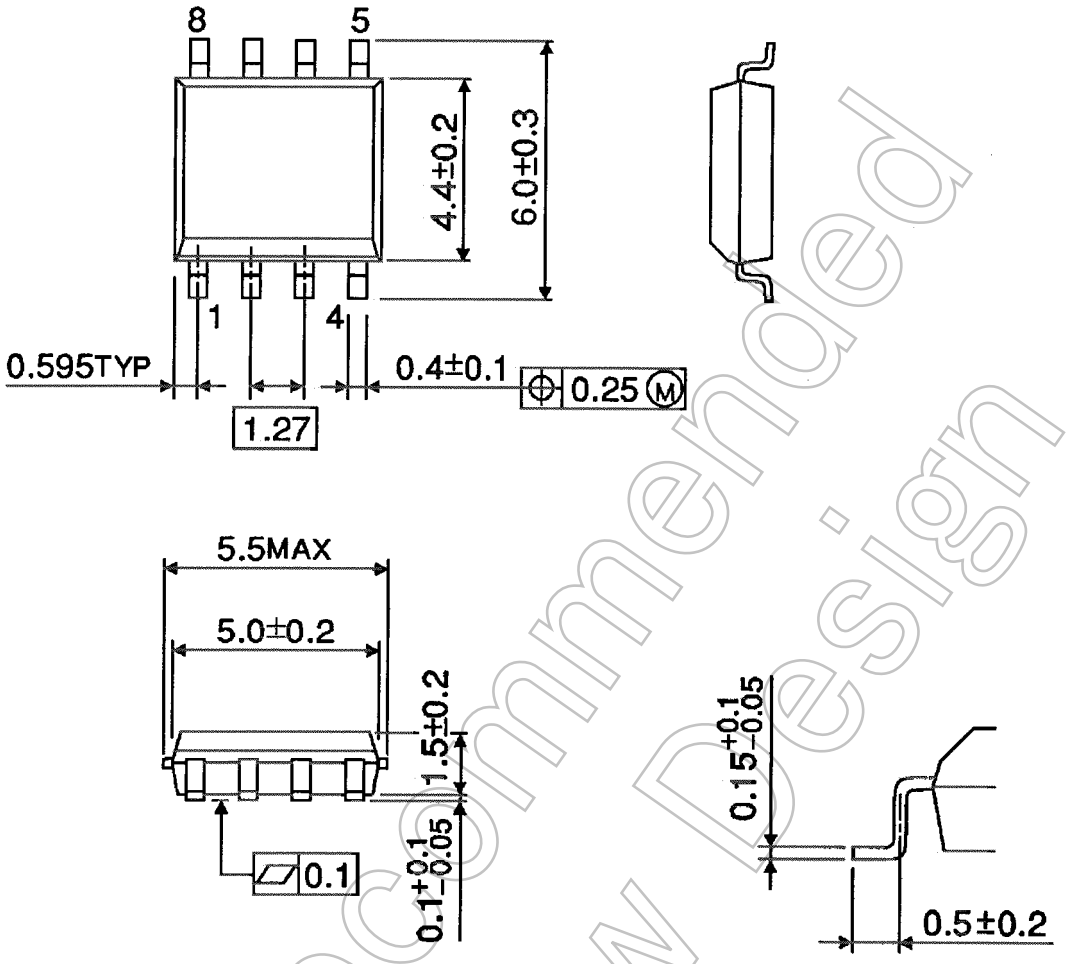


$P_D - Ta$



Package Dimensions

SOP8-P-1.27A Unit : mm



Weight: 0.08 g (typ.)

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