

TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

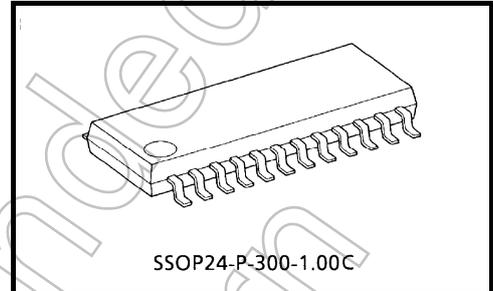
# TPD2007F

Low-Side Power Switch Array (8 Channels) for Motors, Solenoids, and Lamp Drivers

The TPD2007F is an 8-channel low-side switch array. The IC has a vertical MOSFET output which can be directly driven from a CMOS or TTL logic circuit (e.g., an MPU). It offers overcurrent and overtemperature protection functions.

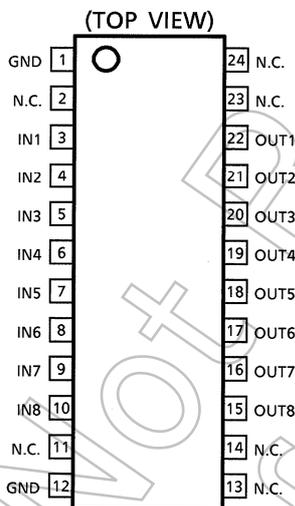
## Features

- 8-channel low-side switch array incorporating an N-channel power MOSFET (1.4Ω max)
- Can directly drive a power load from a microprocessor.
- Built-in protection against overtemperature and overcurrent
- 8-channel access enables space-saving design.
- High operating voltage: 40 V
- Low on-resistance: 1.4 Ω max @VIN = 5 V, ID = 0.5 A (per channel)
- Supports parallel operation.
- Built-in active clamp circuit
- Supplied in an SSOP-24 package (300 mil) in embossed taping.

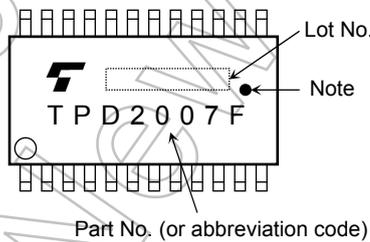


Weight: 0.29 g (typ.)

## Pin Assignment



## Marking



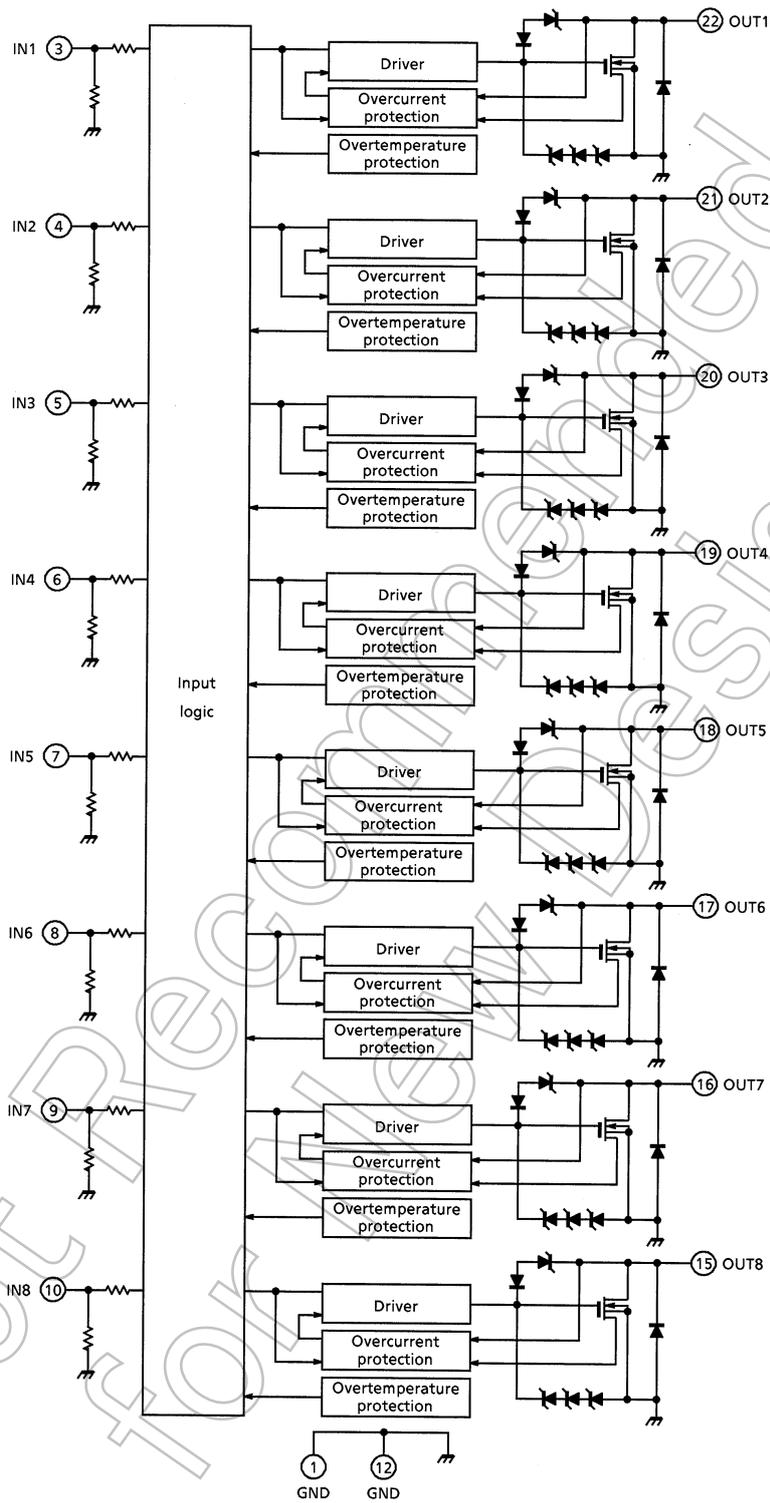
Note : A dot marking for identifying the indication of product Labels.  
 Not underlined: [[Pb]]/INCLUDES > MCV  
 Underlined: [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

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. When handling this product, ensure that the environment is protected against electrostatic discharge.

Start of commercial production  
1999-05

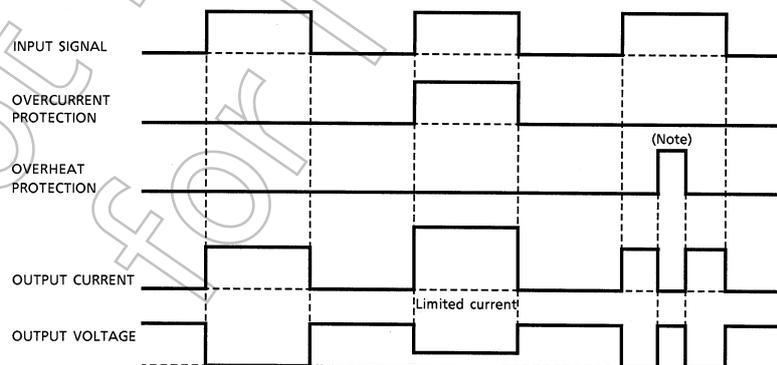
Block Diagram



## Pin Description

Pin No.	Symbol	Description
1	GND	GND pin; in common with the pin no.12 internally.
2	N.C.	—
3	IN1	Control input pin for channel 1 and built-in pull-down resistor (300 kΩ typ.)
4	IN2	Control input pin for channel 2 and built-in pull-down resistor (300 kΩ typ.)
5	IN3	Control input pin for channel 3 and built-in pull-down resistor (300 kΩ typ.)
6	IN4	Control input pin for channel 4 and built-in pull-down resistor (300 kΩ typ.)
7	IN5	Control input pin for channel 5 and built-in pull-down resistor (300 kΩ typ.)
8	IN6	Control input pin for channel 6 and built-in pull-down resistor (300 kΩ typ.)
9	IN7	Control input pin for channel 7 and built-in pull-down resistor (300 kΩ typ.)
10	IN8	Control input pin for channel 8 and built-in pull-down resistor (300 kΩ typ.)
11	N.C.	—
12	GND	GND pin; in common with the pin no.1 internally.
13	N.C.	—
14	N.C.	—
15	OUT8	Output pin for channel 8
16	OUT7	Output pin for channel 7
17	OUT6	Output pin for channel 6
18	OUT5	Output pin for channel 5
19	OUT4	Output pin for channel 4
20	OUT3	Output pin for channel 3
21	OUT2	Output pin for channel 2
22	OUT1	Output pin for channel 1
23	N.C.	—
24	N.C.	—

## Timing Chart



Note: The overheating detector circuits feature hysteresis. After overheating is detected, normal operation is restored only when the junction temperature falls by the hysteresis amount (10°C typ.) in relation to the overheating detection temperature.

## Truth Table

Input Signal	Output Signal	State
L	H	Normal
H	L	
L	H	Overcurrent protection
H	Internally limited	
L	H	Overtemperature protection
H	H	

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

Characteristic	Symbol	Rating	Unit
Drain-source voltage	V <sub>DSS</sub>	40	V
Input voltage	V <sub>IN</sub>	-0.5 ~ 7	V
Output current	I <sub>D</sub>	Internally Limited	A
Power dissipation (operating all channels, ta = 25°C)	P <sub>T</sub>	0.8	W
		1.2 (Note)	
Single pulse avalanche energy	E <sub>AS</sub>	10	mJ
Operating temperature	T <sub>opr</sub>	-40 ~ 85	°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).

## Thermal Characteristics

Characteristic	Symbol	Rating	Unit
Thermal resistance junction to ambient (operating all channels, ta = 25°C)	ΣR <sub>th(j-a)</sub>	156.3	°C / W
		104.2 (Note)	

Note: 60 mm × 60 mm × 1.6 mm when mounted on a glass epoxy PCB (DC)

## Electrical Characteristics (Unless otherwise specified, $T_j = 25^\circ\text{C}$ )

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Drain-source clamp voltage	$V_{(BR)DSS}$	—	$I_D = 10\text{ mA}$ , $V_{IN} = 0\text{ V}$	40	—	—	V
Input voltage	$V_{th}$	—	$V_{DS} = 24\text{ V}$ , $I_{DS} = 1\text{ mA}$	0.8	—	2.0	V
Input current	$I_{IL}$	—	$V_{IN} = 0\text{ V}$	-10	—	10	$\mu\text{A}$
	$I_{IH}$	—	$V_{IN} = 5\text{ V}$	—	140	300	
On resistance	$R_{DS(ON)}$	—	$V_{IN} = 5\text{ V}$ , $I_O = 0.5\text{ A}$	—	1.0	1.4	$\Omega$
Off current	$I_{DSS}$	—	$V_{DS} = 40\text{ V}$	—	—	100	$\mu\text{A}$
Overcurrent protection	$I_S(1)$	—	$V_{DS} = 12\text{ V}$ , $V_{IN} = 5\text{ V}$ , $R_L = 3\Omega$	1	2	3	A
	$I_S(2)$	—	$V_{DS} = 30\text{ V}$ , $V_{IN} = 5\text{ V}$ , $R_L = 3\Omega$	0.7	—	2	
Overtemperature Protection	Temperature	TSD	—	—	160	—	$^\circ\text{C}$
	Hysteresis	$\Delta\text{TSD}$	—	—	10	—	
Switching time	$t_{ON}$	1	$V_{DD} = 12\text{ V}$ , $R_L = 24\Omega$ , $V_{IN} = 0\text{ V} / 5\text{ V}$	—	10	50	$\mu\text{s}$
	$t_{OFF}$	1		—	10	50	
Operating input voltage protection circuit	$V_{IN(P)}$	—	—	3.9	—	6.0	V
Drain-source diode forward voltage	$V_{DSF}$	—	$I_F = 1\text{ A}$ , $V_{IN} = 0\text{ V}$	—	—	1.6	V

## Description of Protector Circuit

### (1) Overtemperature Protection

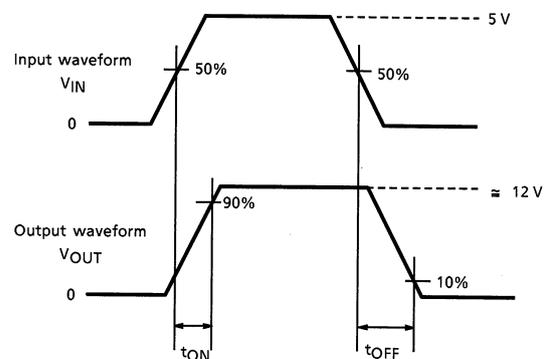
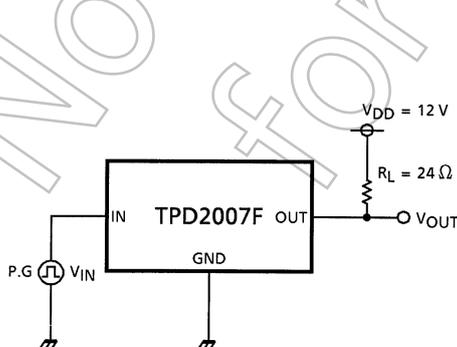
- The overheating detector circuits feature hysteresis. After overheating is detected, normal operation is restored only when the junction temperature falls by the hysteresis amount ( $10^\circ\text{C}$  typ.) in relation to the overheating detection temperature.

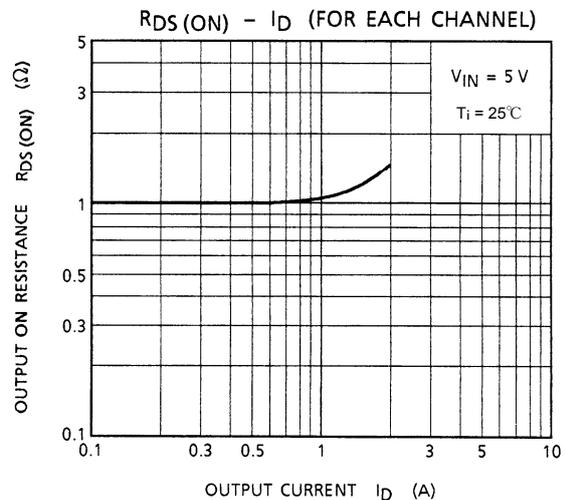
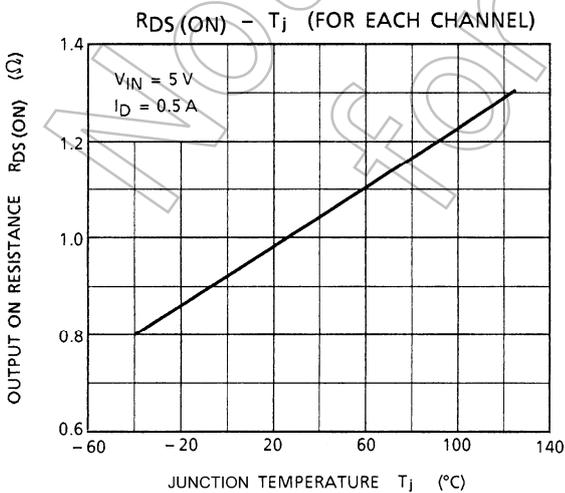
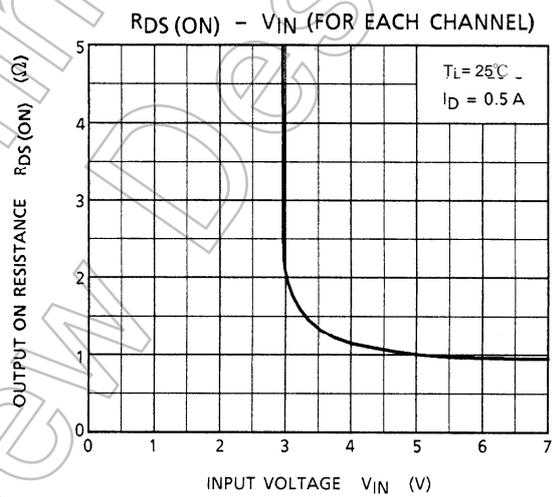
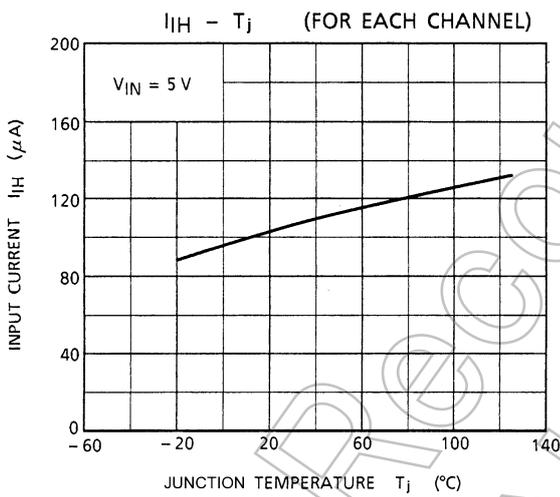
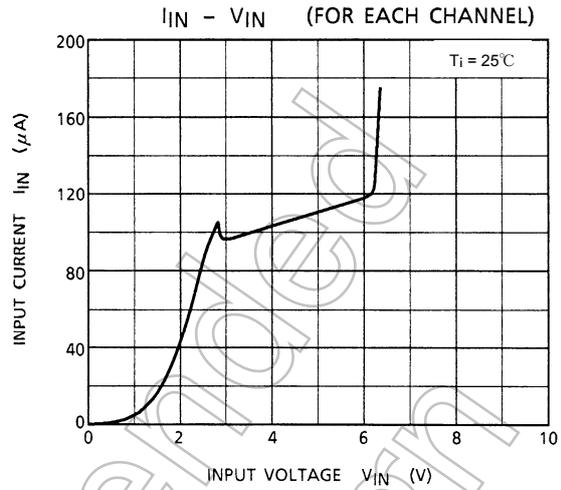
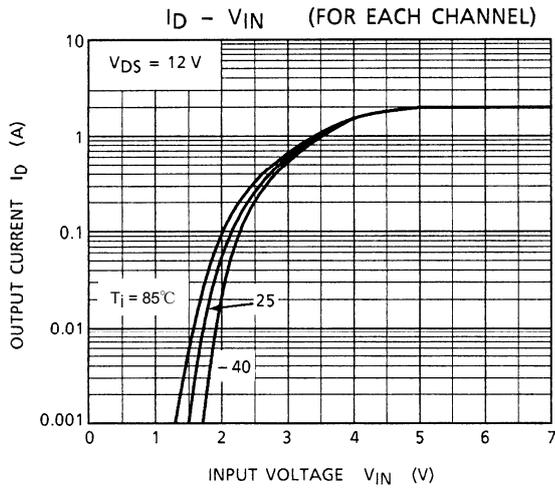
### (2) Overcurrent Protection

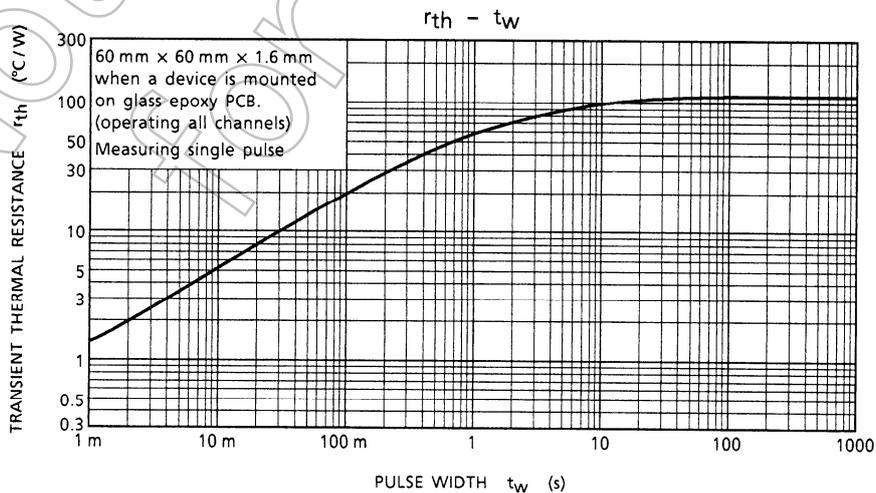
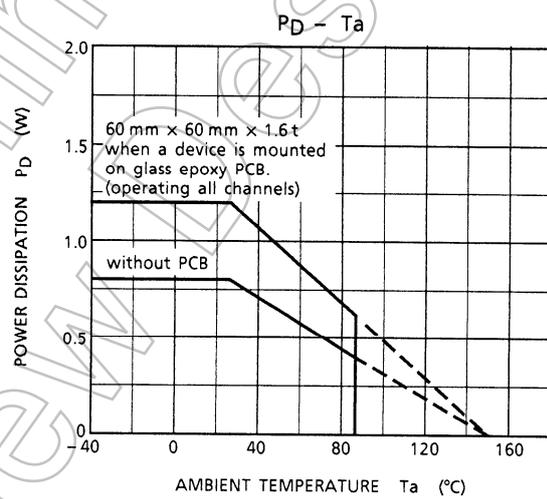
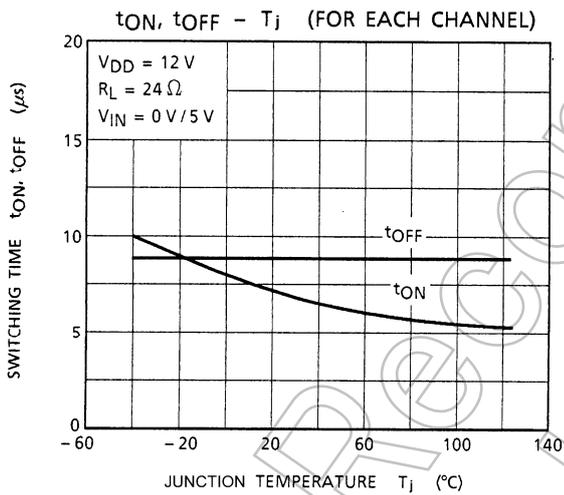
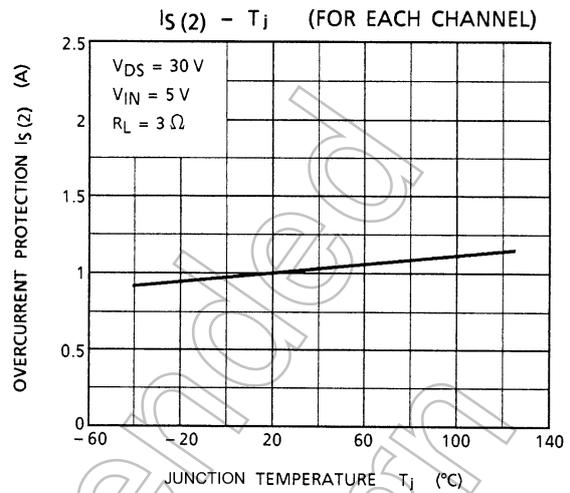
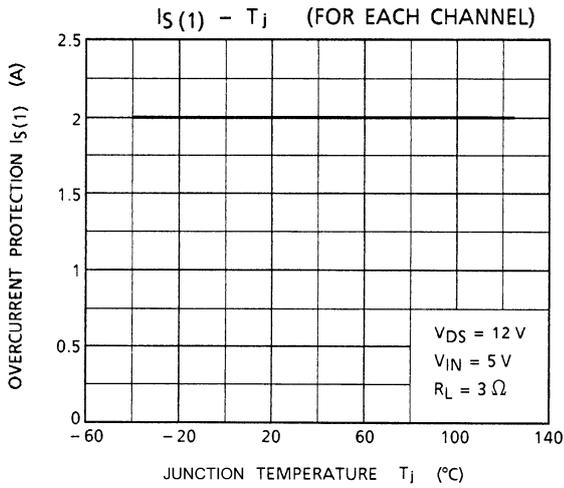
- When overcurrent is detected, the overcurrent limiter function limits the output current. Normal operation is restored when the load current drops below the overcurrent detection value.

## Test Circuit

### Switching Time







**Moisture-Proof Packing**

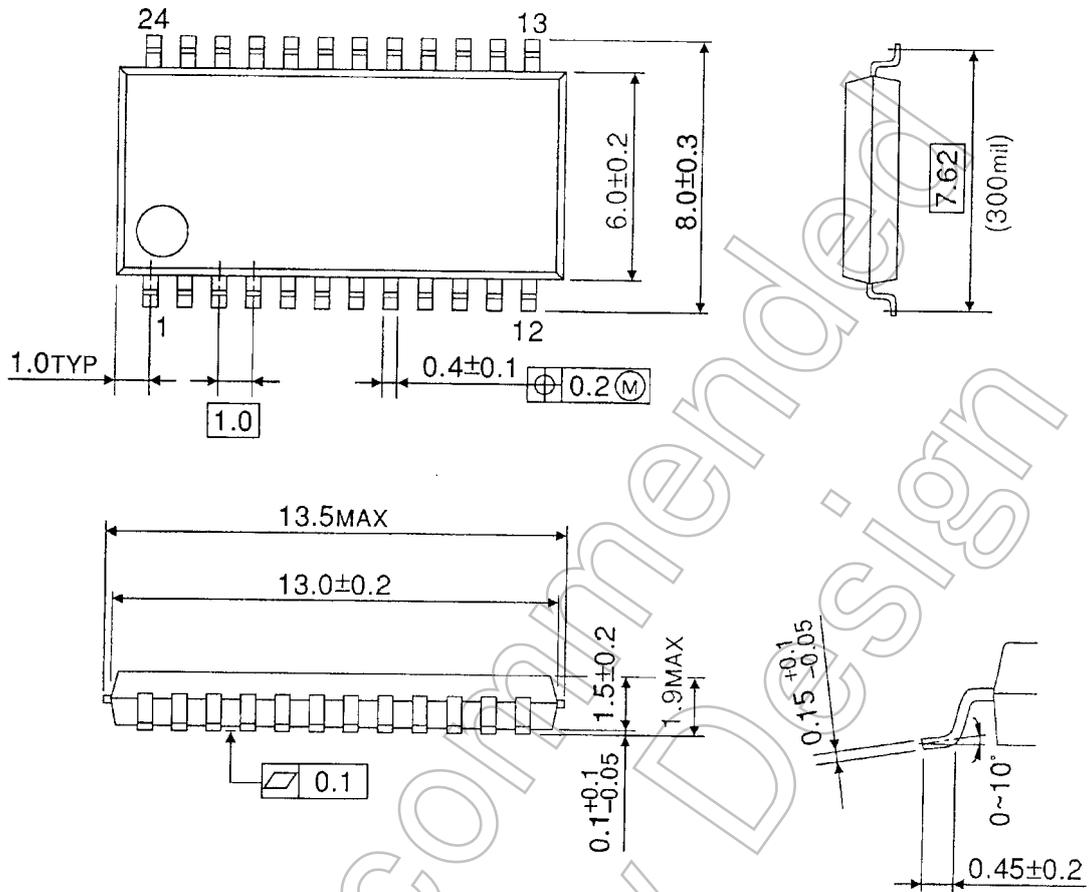
After the pack is opened, the devices should be used within 48 hours and in a 30°C, 60% RH environment. Embossed-tape packing cannot be baked. Devices so packed must be within their allowable time limits after unpacking, as specified on the packing.  
Standard tape packing quantity: 2000 devices / reel (EL1)

Not Recommended  
for New Design

## Package Dimensions

SSOP24-P-300-1.00C

Unit : mm



Weight: 0.29 g (typ.)

Not Recommended for New Design

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