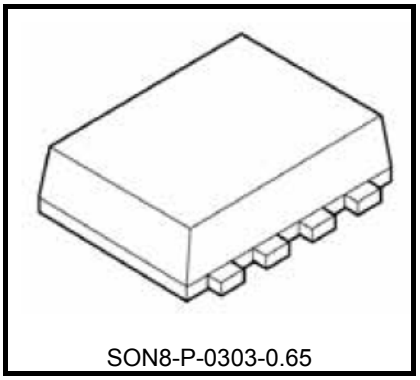
TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

TPD7211F

Power MOSFET Gate Driver for half-bridge

TPD7211F is a Power MOSFET gate driver for half-bridge circuit. BiCD process is applied on this product.



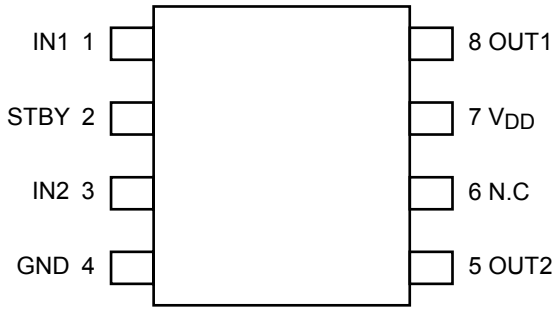
SON8-P-0303-0.65

Weight: 0.017g (typ.)

Features

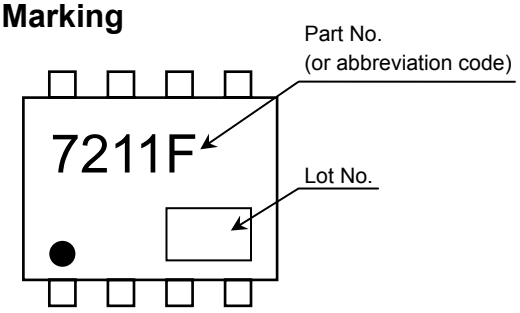
- Power MOSFET gate driver for half-bridge
- High-side can operate P channel MOSFET, Low-side can operate N channel MOSFET
- Housed in the PS-8 package and supplied in embossed carrier tape.

Pin Assignment (top view)



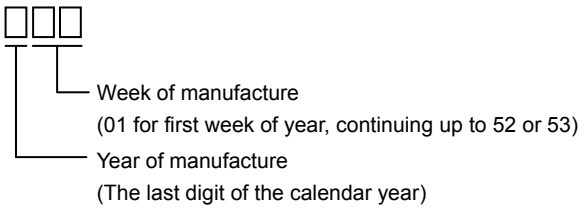
（TOP　VIEW）

Marking



・● on the lower left of the marking indicates Pin 1

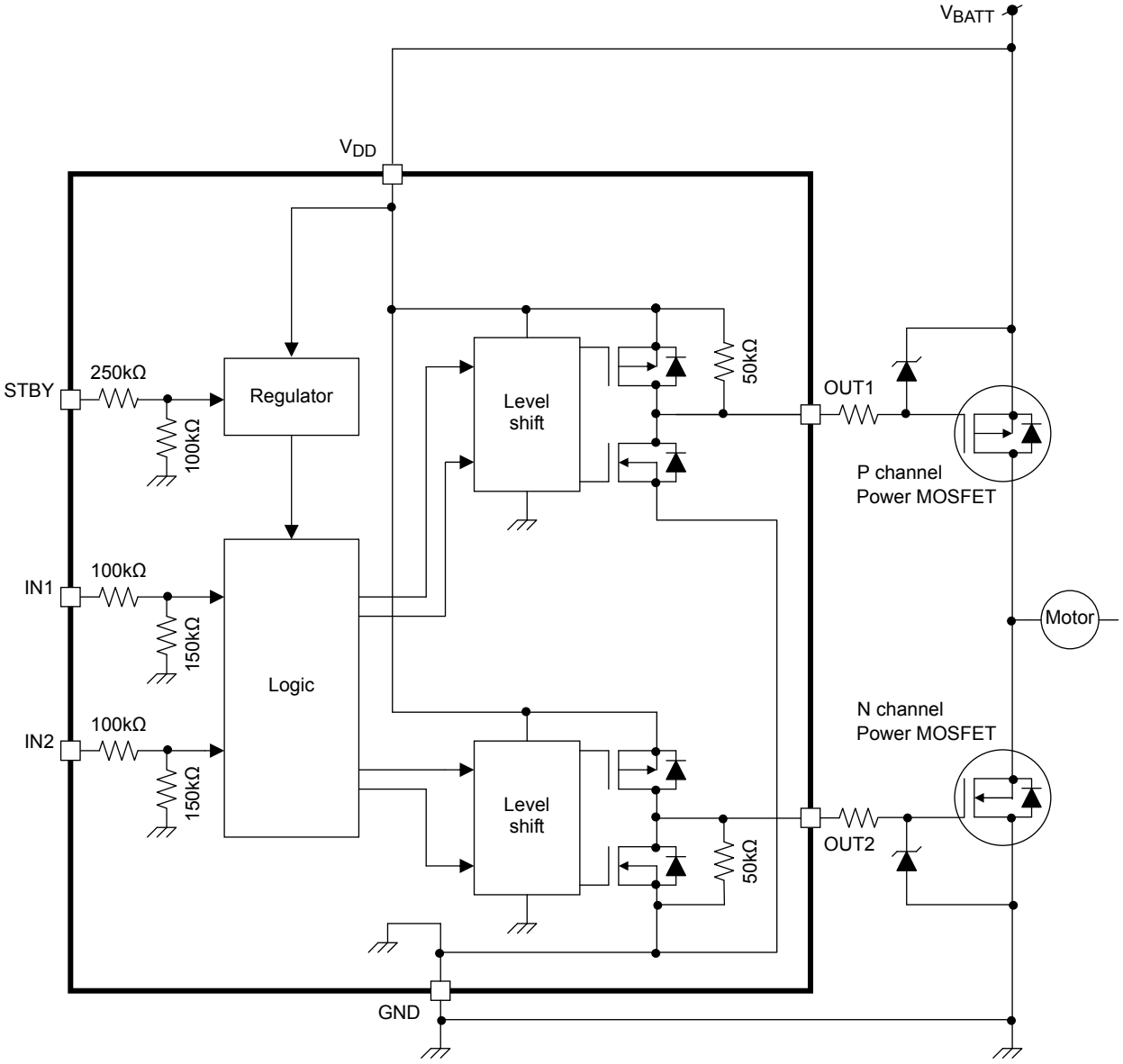
*Weekly code: (Three digits)



Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.
The RoHS is the Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain

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

Block Diagram / Application Circuit



Pin Description

Pin No.	Symbol	Pin Description
1	IN1	Input pin for high-side output (OUT1) control. The IN1 pin has an internal pull-down resistor. Thus, even if the input is open-circuit, the OUT1 never turns on (“L”) inadvertently.
2	STBY	Standby pin:By driving this pin “L”, supply current is 10μA or less and all outputs can be turned off regardless of input signals. By driving this pin “H”, all outputs are switching normally. The STBY pin has an internal pull-down resistor. When input is open circuit, this IC becomes the same operation as “L”.
3	IN2	Input pin for low-side output (OUT2) control. The IN2 pin has an internal pull-down resistor. Thus, even if the input is open-circuit, the OUT2 never turns on (“H”) inadvertently.
4	GND	Ground pin.
5	OUT2	Drives the low-side N channel power MOSFET.
6	N.C	No-Connect pin.
7	V_{DD}	Power supply pin.
8	OUT1	Drives the high-side P channel power MOSFET.

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Pin	Rating	Unit	Remarks
Power supply voltage	V_{DD}	V_{DD}	−0.3 to 35	V	When V_{DD} range is 30V or more, Pulse width ≤ 0.3s
Input voltage	V_{IN}	IN1、IN2	−0.3 to 6	V	-
	V_{STBY}	STBY	−0.3 to 35	V	When V_{DD} range is 30V or more, Pulse width ≤ 0.3s
Output voltage	V_{OUT}	OUT1, OUT2	−0.3 to V_{DD}+0.3	V	Absolute Maximum Ratings is 35V or less. When V_{DD} range is 30V or more, Pulse width ≤ 0.3s
Output current	I_{OUT}	OUT1, OUT2	±500	mA	-
Power dissipation(Note 2)	$P_{D(1)}$	-	0.7	W	Refer to Note 2a
	$P_{D(2)}$	-	0.35	W	Refer to Note 2b
Operating temperature	T_{opr}	-	−40 to 125	°C	-
Junction temperature	T_j	-	150	°C	-
Storage temperature	T_{stg}	-	−40 to 150	°C	-

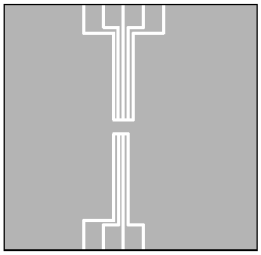
Note1: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) 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 Resistance

Characteristic	Symbol	Rating	Unit
Junction to ambient thermal resistance	$R_{th\ (j-a)}$	178.6 (Note 2a)	°C / W
		357.2 (Note 2b)	

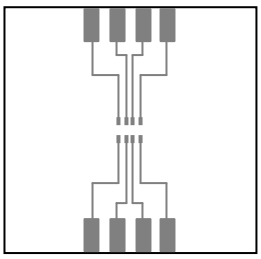
Note 2:

(a)Mounted on glass epoxy board



Glass epoxy board
Material : FR-4
25.4mm×25.4mm×0.8mm

(b) Mounted on glass epoxy board



Glass epoxy board
Material : FR-4
25.4mm×25.4mm×0.8mm

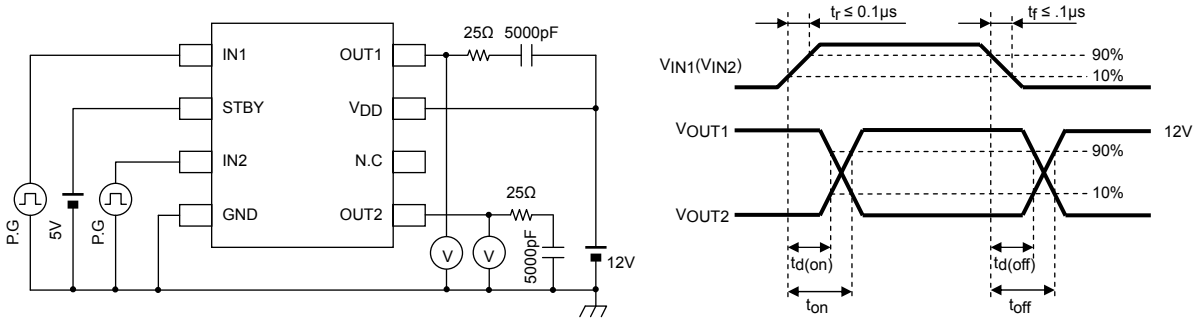
Electrical Characteristics
(Unless otherwise specified, T_j = − 40 to 125 °C, V_{DD} = 5 to 18 V, V_{STBY} = 5 V)

Characteristics	Symbol	Pin	Condition	Min	Typ.	Max	Unit
Operating supply voltage	$V_{DD(opr)}$	V_{DD}	-	5	12	18	V
Supply current	I_{DD1}	V_{DD}	V_{STBY}=0V, V_{DD}=12V, Output pin is open.	-	-	10	μA
	I_{DD2}	V_{DD}	V_{STBY}=5V, V_{DD}=12V, $V_{IN1,2}$=0V, Output pin is open.	-	-	3	mA
High level input voltage	V_{IH1}	IN1,IN2	-	3.5	-	-	V
	V_{IH2}	STBY		3.5	-	-	V
Low level input voltage	V_{IL1}	IN1,IN2		-	-	1.5	V
	V_{IL2}	STBY		-	-	0.8	V
High level input current	I_{IH1}	IN1,IN2	$V_{IN1,2}$=5V, per one input.	-	20	50	μA
	I_{IH2}	STBY	V_{STBY}=5V	-	15	50	μA
Low level input current	I_{IL1}	IN1,IN2	$V_{IN1,2}$=0V, per one input.	-0.2	-	+0.2	μA
	I_{IL2}	STBY	V_{STBY}=0V	-0.2	-	+0.2	μA
High-side(OUT1) high-level output voltage	V_{O1H}	OUT1	V_{IN1}=0V, I_o=-10mA	V_{DD} -0.2	-	-	V
High-side(OUT1) low-level output voltage	V_{O1L}	OUT1	V_{IN1}=5V, I_o=+10mA	-	-	0.2	V
Low-side(OUT2) high-level output voltage	V_{O2H}	OUT2	V_{IN2}=5V, I_o=-10mA	V_{DD} -0.2	-	-	V
Low-side(OUT2) low-level output voltage	V_{O2L}	OUT2	V_{IN2}=0V, I_o=+10mA	-	-	0.2	V
Output ON Resistance	$R_{DS(ON)[SOURCE]}$	OUT1, OUT2	T_j=25℃, I_o=-250mA	-	4	8	Ω
	$R_{DS(ON)[SINK]}$	OUT1, OUT2	T_j=25℃, I_o=+250mA	-	3	6	
Switching times	$t_{d(on)1}$	OUT1	V_{DD}=12V, R_o=25Ω, C_o=5000pF	-	0.25	1	μs
	t_{ON1}			-	0.5	2	
	$t_{d(off)1}$			-	0.25	1	
	t_{OFF1}			-	0.5	2	
	$t_{d(on)2}$	OUT2		-	0.25	1	
	t_{ON2}			-	0.5	2	
	$t_{d(off)2}$			-	0.25	1	
	t_{OFF2}			-	0.5	2	
Dead times	t_{dead1}	OUT1, OUT2	$t_{d(off)1}$-$t_{d(on)2}$, $t_{d(off)2}$-$t_{d(on)1}$	-	-	1	μs
	t_{dead2}	OUT1, OUT2	$t_{d(off)1}$-$t_{d(on)1}$, $t_{d(off)2}$-$t_{d(on)2}$	-	-	1	

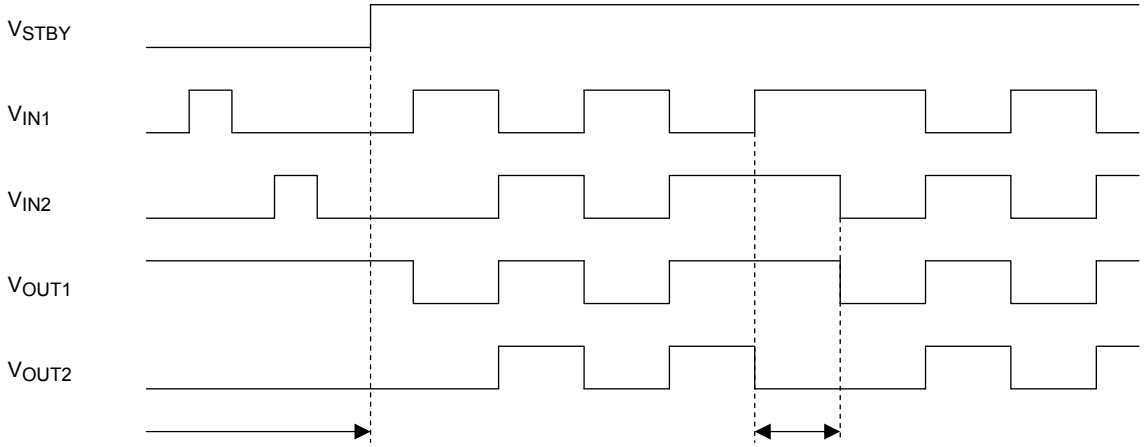
*Please set the deadtime of the input signal after considering the switching time of external power MOSFET.

*The condition of the typical value is T_j=25°C, V_{DD}=12V.

Switching times test circuit



Timing chart



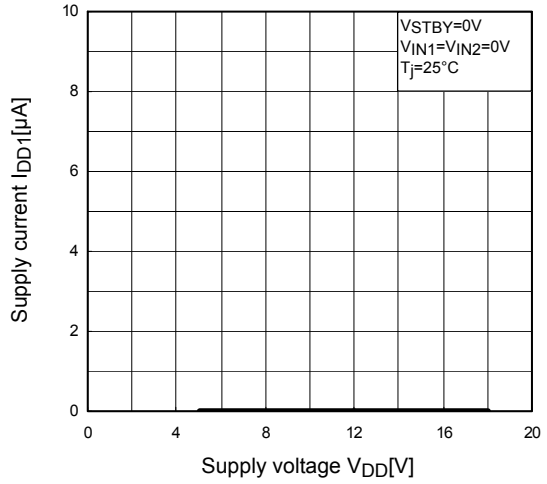
By driving STBY low, all output DMOS are turned off regardless of input signals.

Input that is High-side/Low-side arm shorting mode(V_{IN1}=V_{IN2}=H) is a prohibition mode.
When it is prohibition mode, it is V_{OUT1}=H and V_{OUT2}=L.
(External MOSFETs are all off)

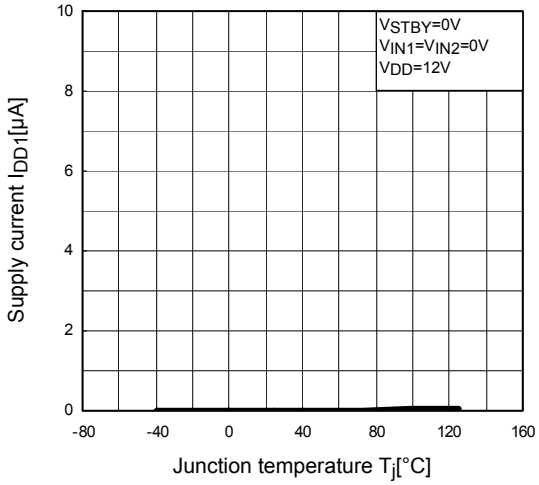
Truth Table

STBY signal	IN1 signal	IN2 signal	V_{OUT1}	V_{OUT2}	Remarks
L	L	L	H	L	Standby mode (Output is all off)
L	H	L	H	L	
L	L	H	H	L	
L	H	H	H	L	
H	L	L	H	L	OUT1 and OUT2 are off mode. (External MOSFETs are all off mode)
H	H	L	L	L	OUT1 is on mode. (External high side MOSFET is on mode)
H	L	H	H	H	OUT2 is on mode. (External low side MOSFET is on mode)
H	H	H	H	L	High-side/Low-side arm shorting mode.

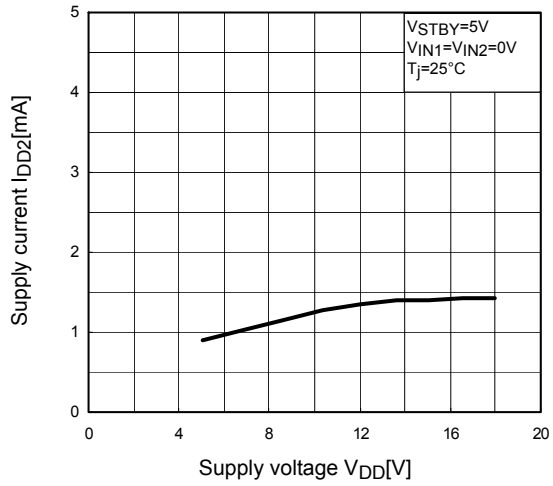
I_{DD1} - V_{DD}



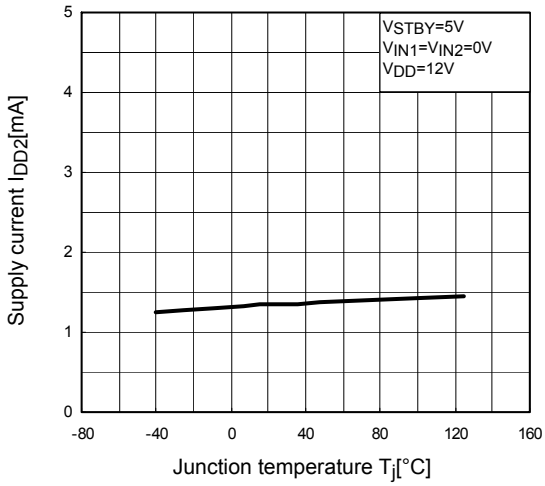
I_{DD1} - T_j



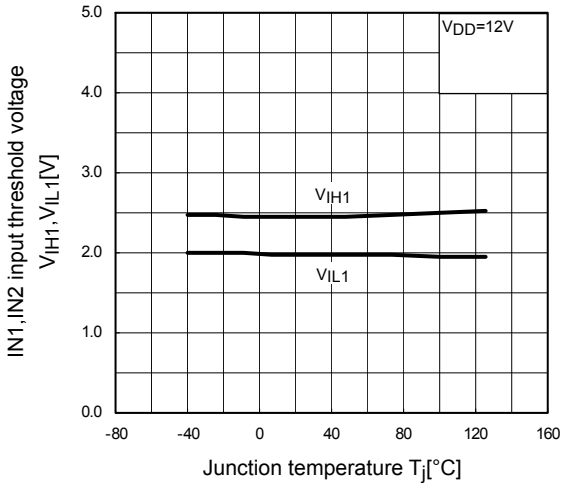
I_{DD2} - V_{DD}



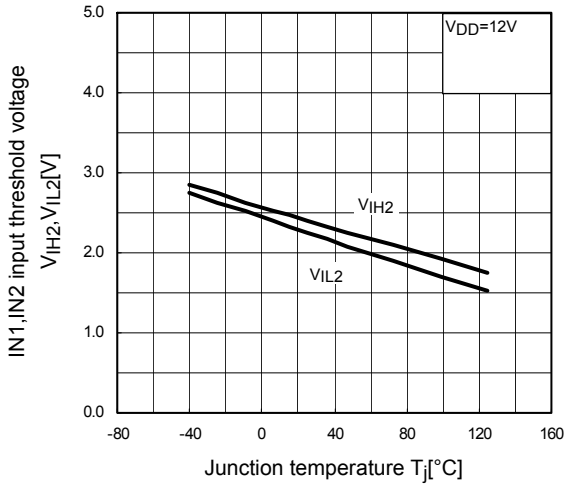
I_{DD2} - T_j



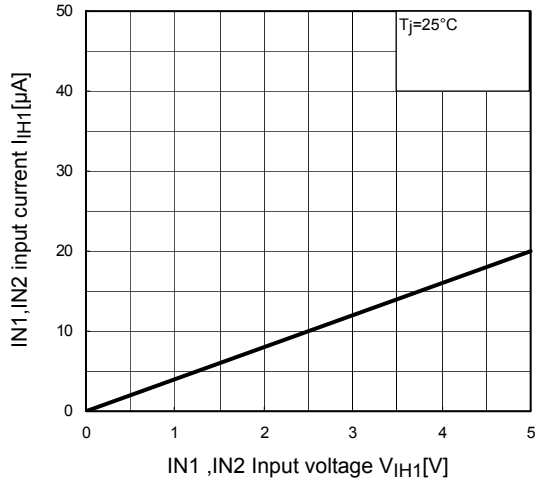
V_{IH1},V_{IL1} - T_j



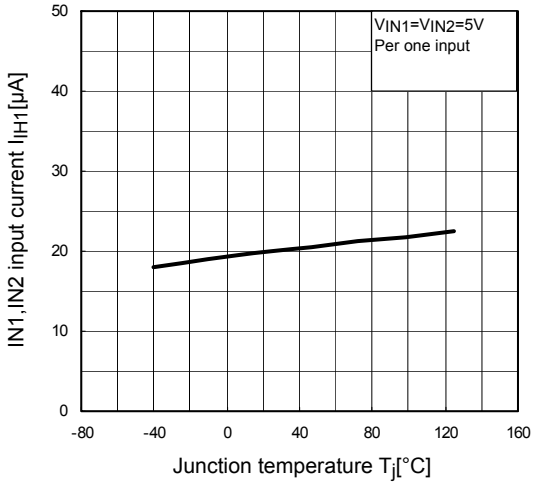
V_{IH2},V_{IL2} - T_j



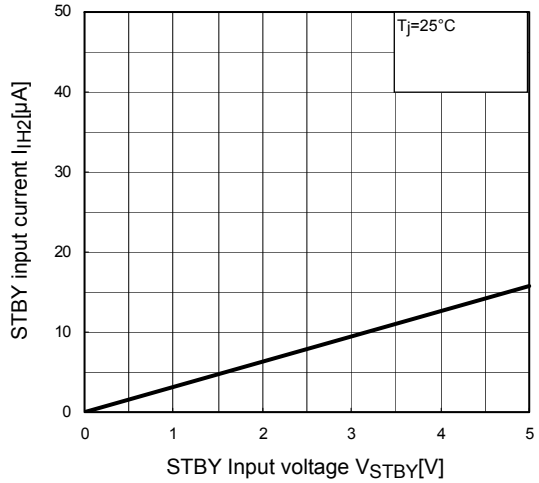
$I_{IH1} – V_{IH1}$



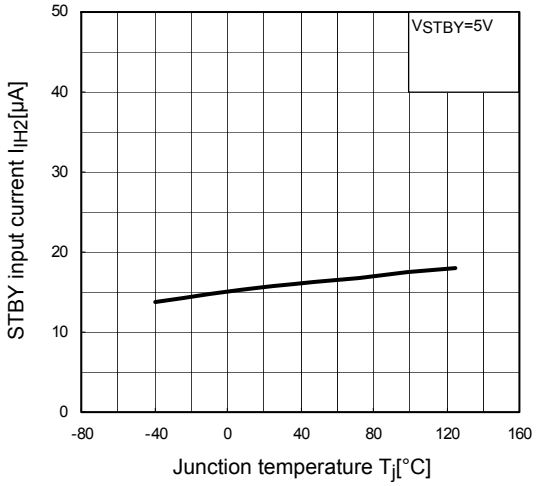
I_{IH1} - T_j



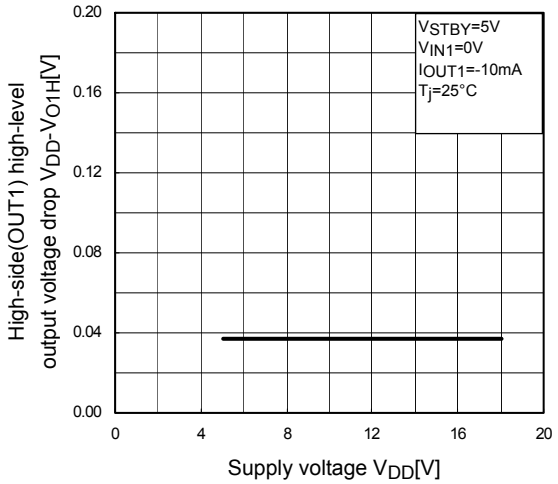
$I_{IH2} – V_{STBY}$



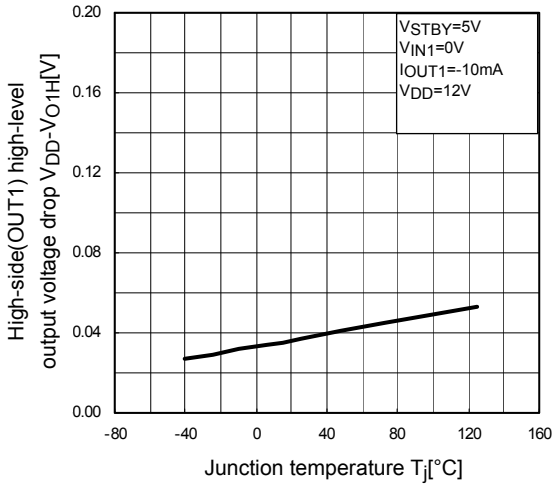
I_{IH2} - T_j



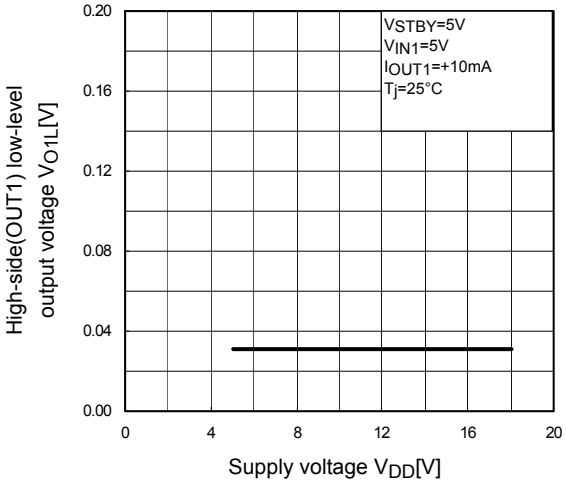
$V_{DROP(OUT1)}$ - V_{DD}



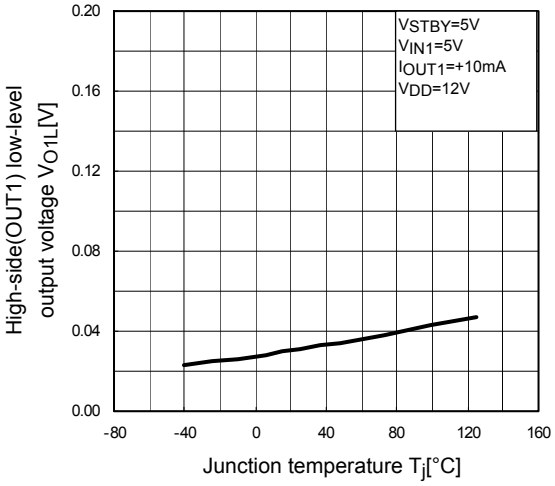
$V_{DROP(OUT1)}$ - T_j



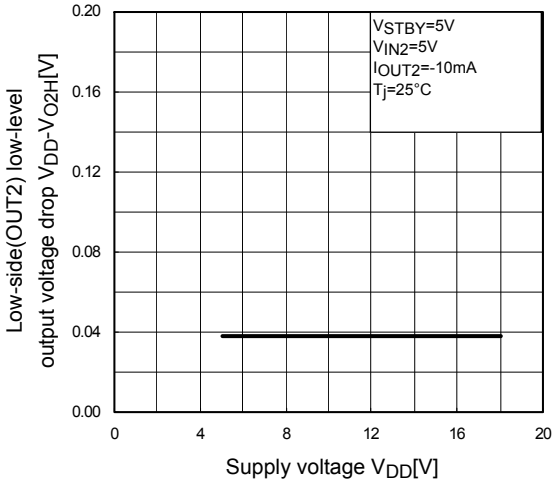
V_{O1L} - V_{DD}



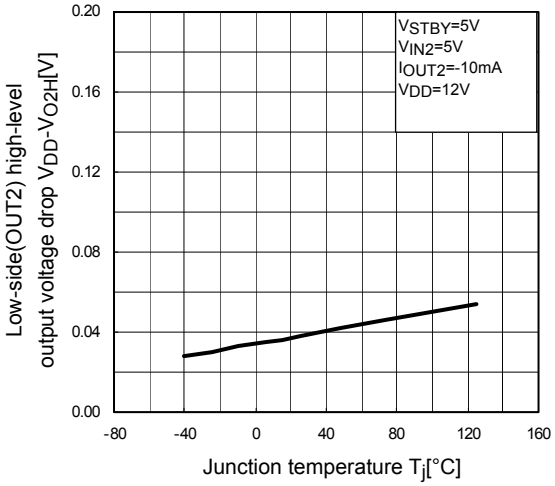
V_{O1L} - T_j



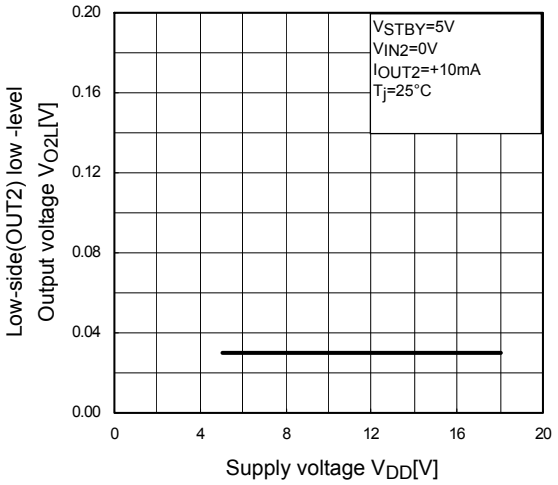
$V_{DROP(OUT2)}$ - V_{DD}



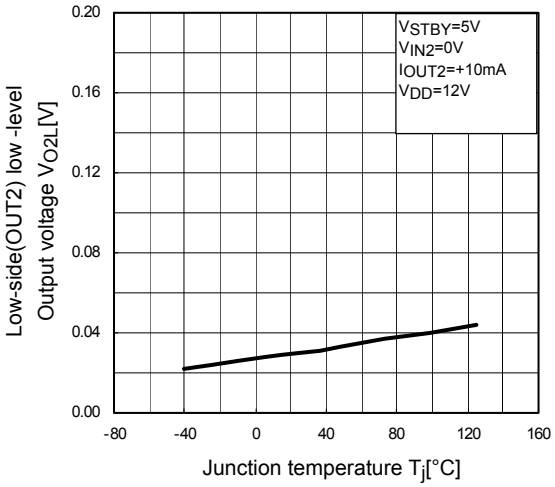
$V_{DROP(OUT2)}$ - T_j



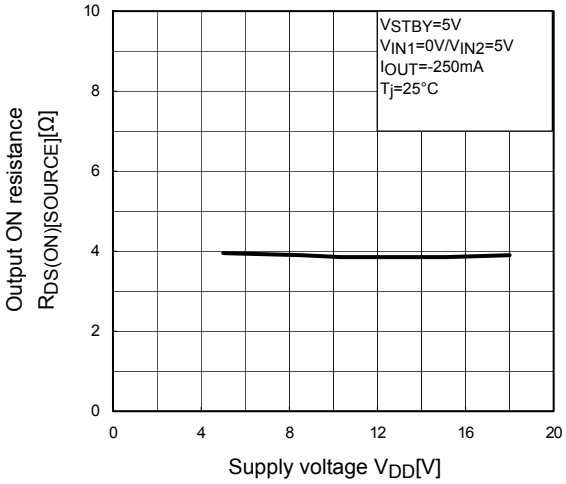
V_{O2L} - V_{DD}



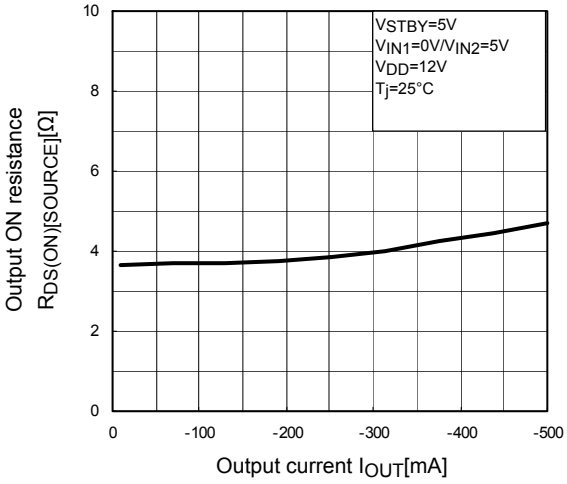
V_{O2L} - T_j



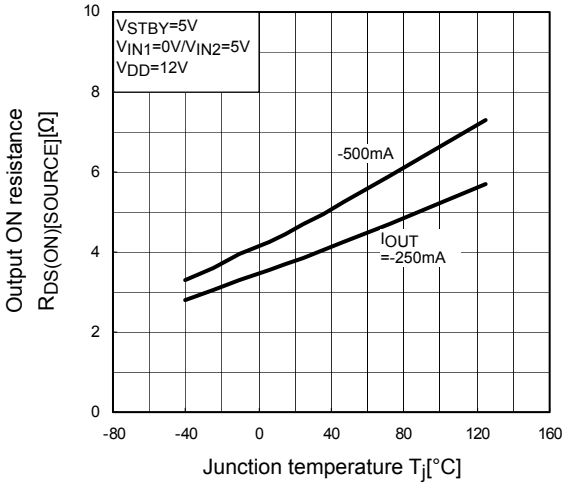
$R_{DS(ON)[SOURCE]}$ - V_{DD}



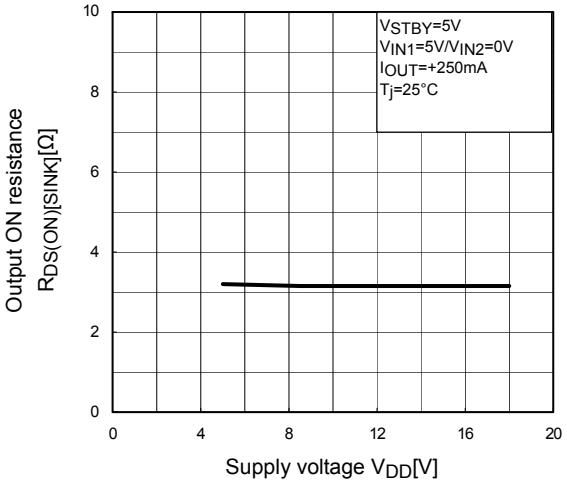
$R_{DS(ON)[SOURCE]}$ – I_{OUT}



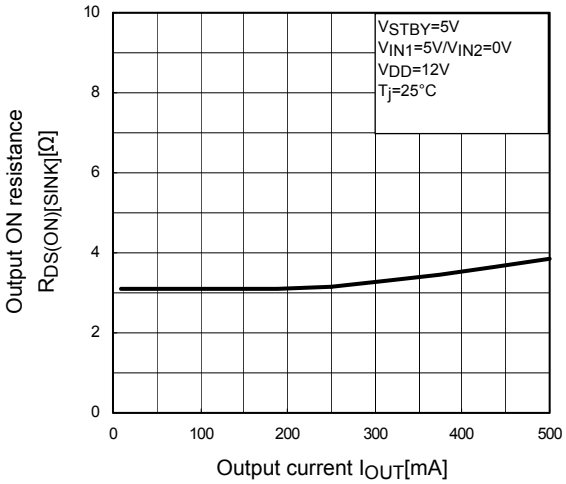
$R_{DS(ON)[SOURCE]}$ - T_j



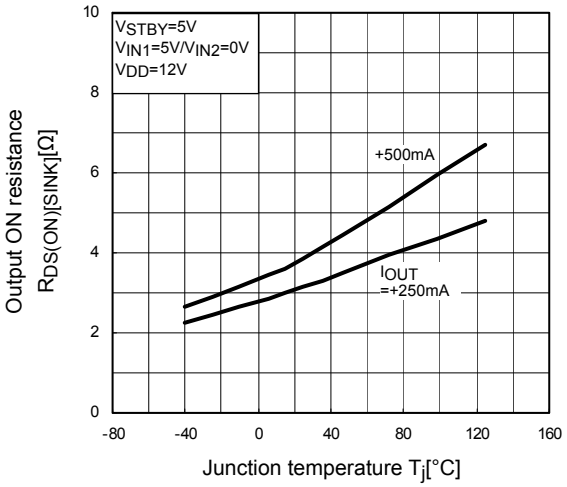
$R_{DS(ON)[SINK]}$ - V_{DD}



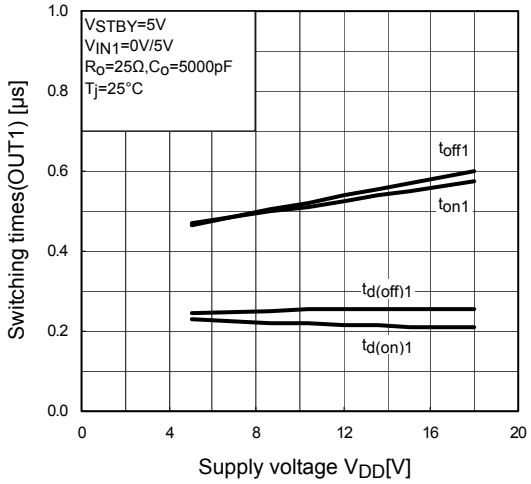
$R_{DS(ON)[SINK]}$ - I_{OUT}



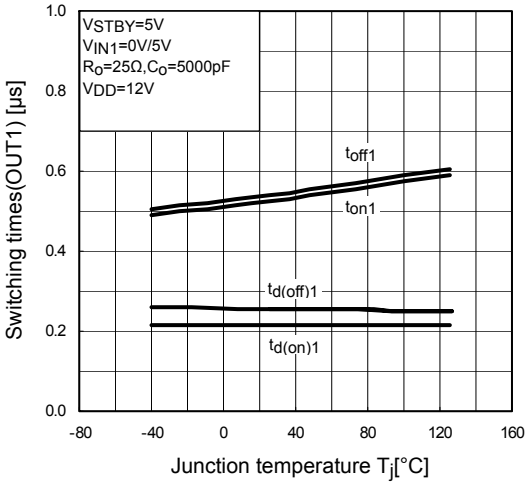
$R_{DS(ON)[SINK]}$ - T_j



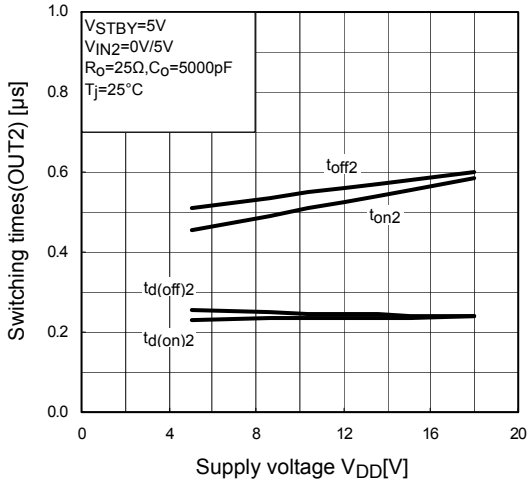
Switching times (OUT1) - V_{DD}



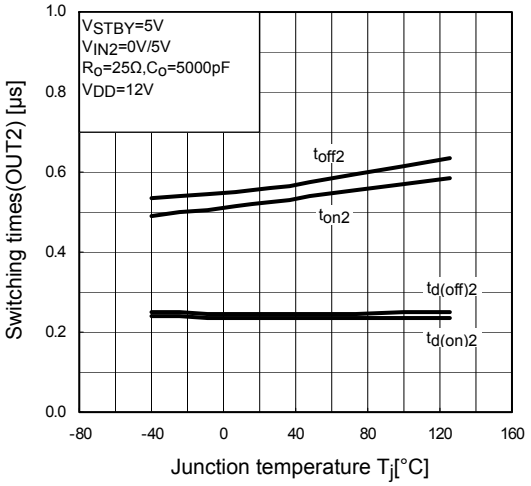
Switching times (OUT1) – T_j



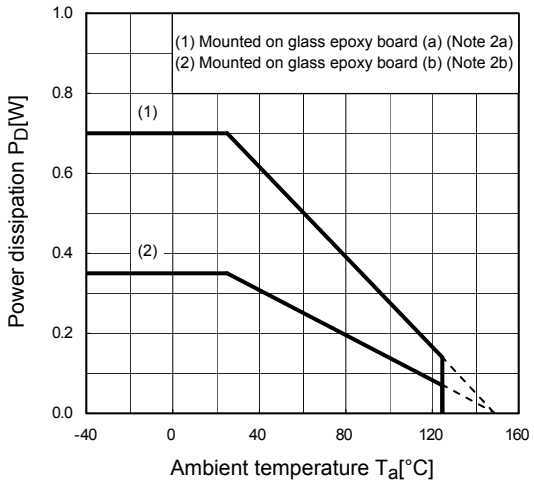
Switching times (OUT2) - V_{DD}



Switching times (OUT2) – T_j



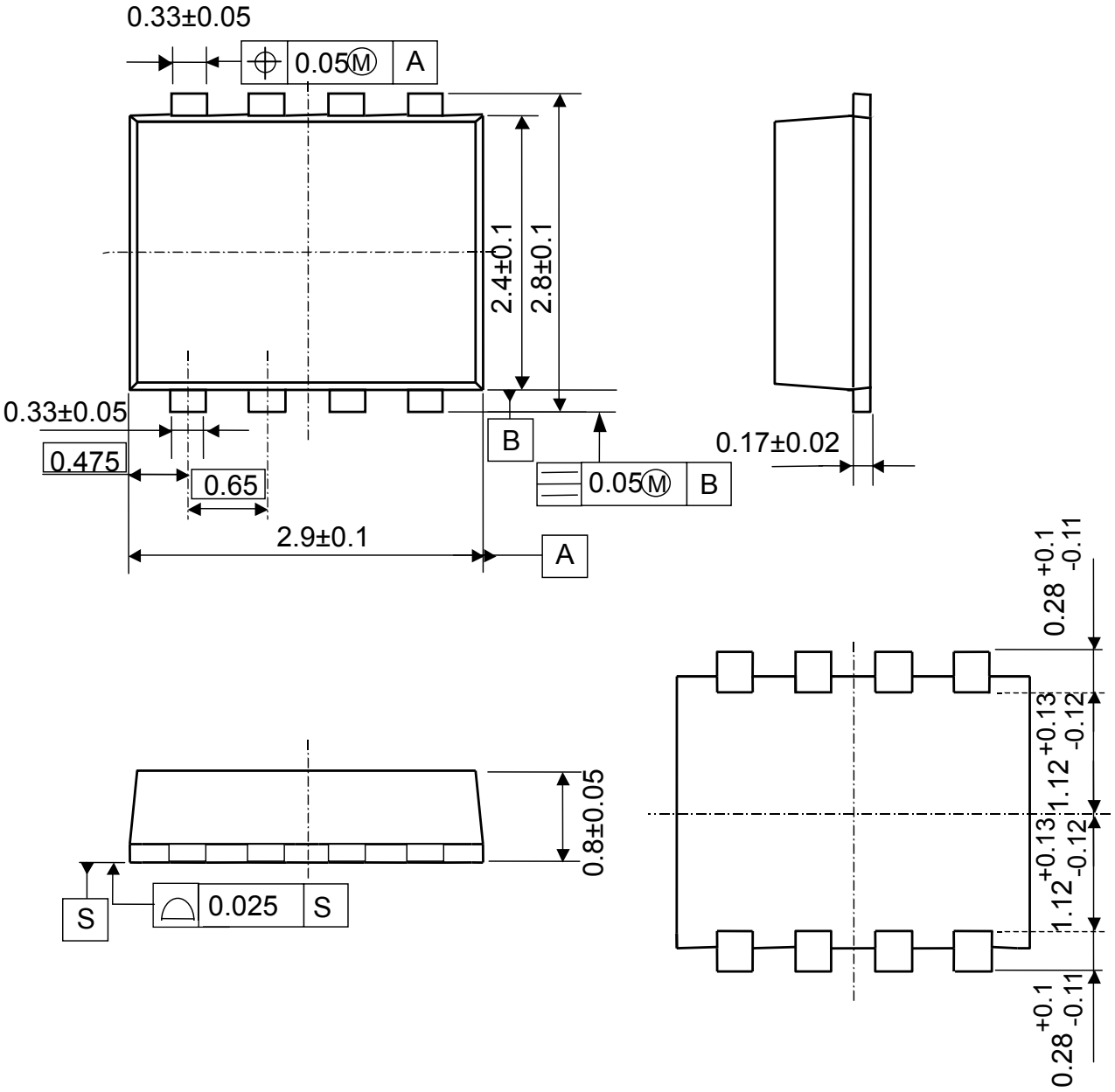
P_D - T_a



Package Dimensions

SON8-P-0303-0.65

Unit : mm



Weight : 0.017g(typ.)

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