

TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

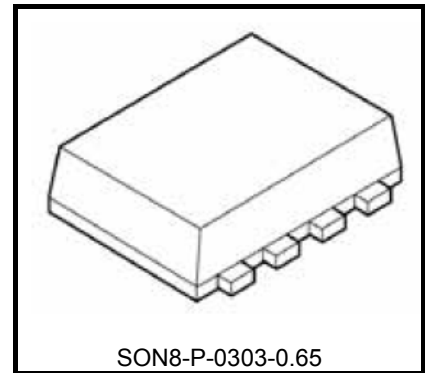
TPD7102F

1 channel High-Side N channel Power MOSFET Gate Driver

TPD7102F is a 1channel high-side N channel power MOSFET gate driver. This IC contains a charge pump circuit, allowing easy configuration of a high-side switch for large-current applications.

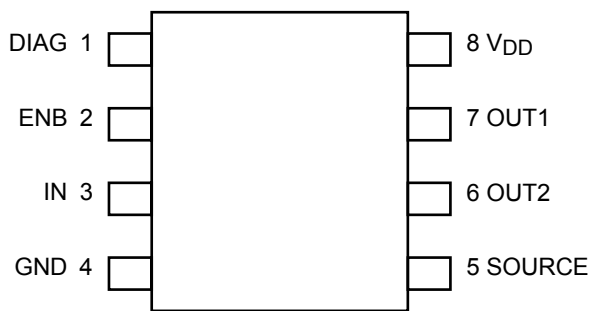
Features

- Charge pump circuit is built in
- The diagnosis function of the voltage between OUT1 and SOURCE is built in
- Housed in the PS-8 package and supplied in embossed carrier tape.



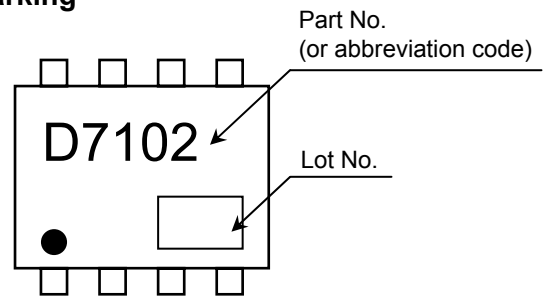
Weight: 0.017g (typ.)

Pin Assignment (top view)



(TOP VIEW)

Marking



•Note: ● on the lower left of the marking indicates Pin 1

*Weekly code: (Three digits)



Week of manufacture

(01 for first week of year, continuing up to 52 or 53)

Year of manufacture

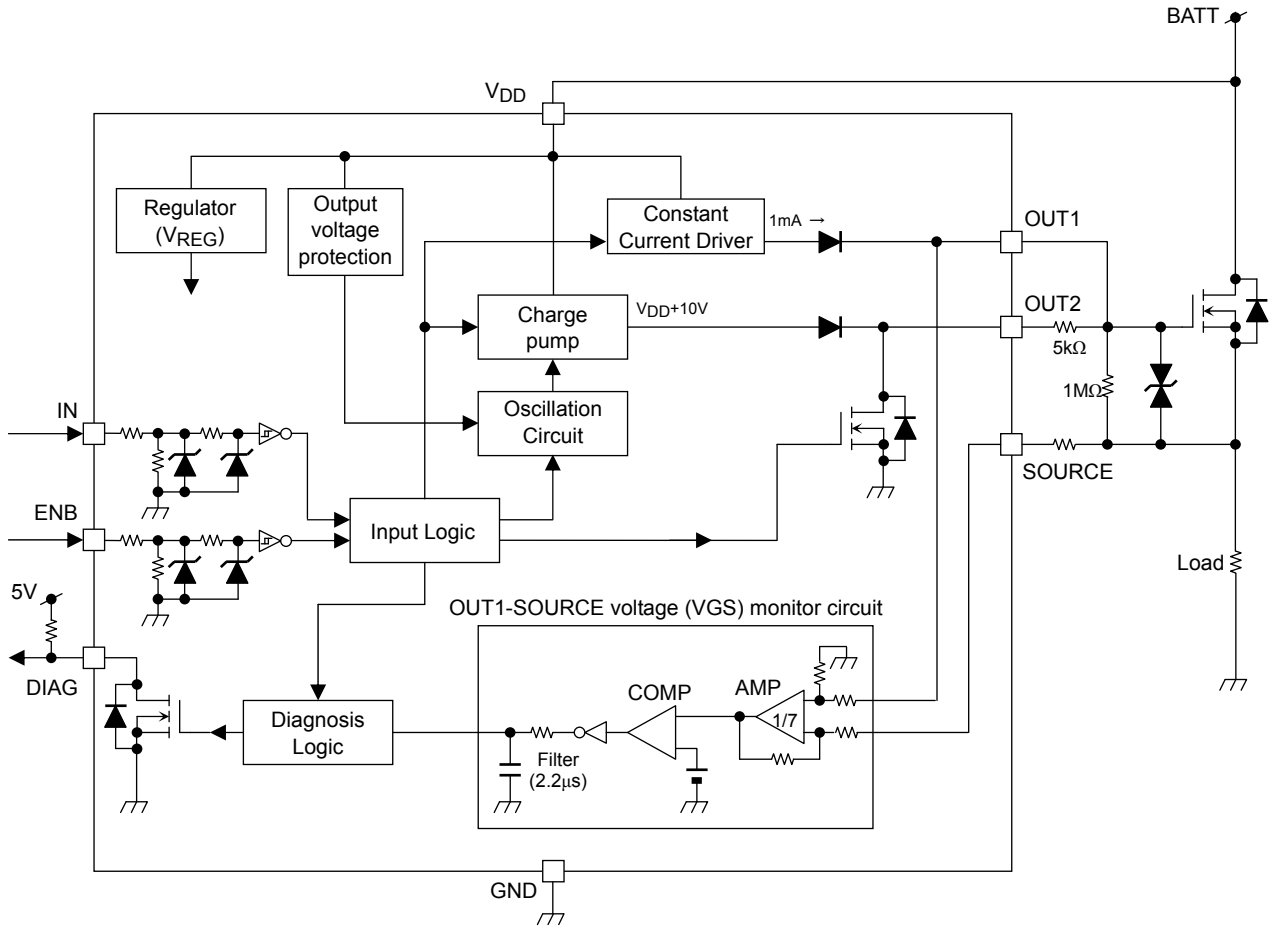
(The last digit of the calendar year)

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

Note: That because of its MOS structure, this product is sensitive to static electricity.

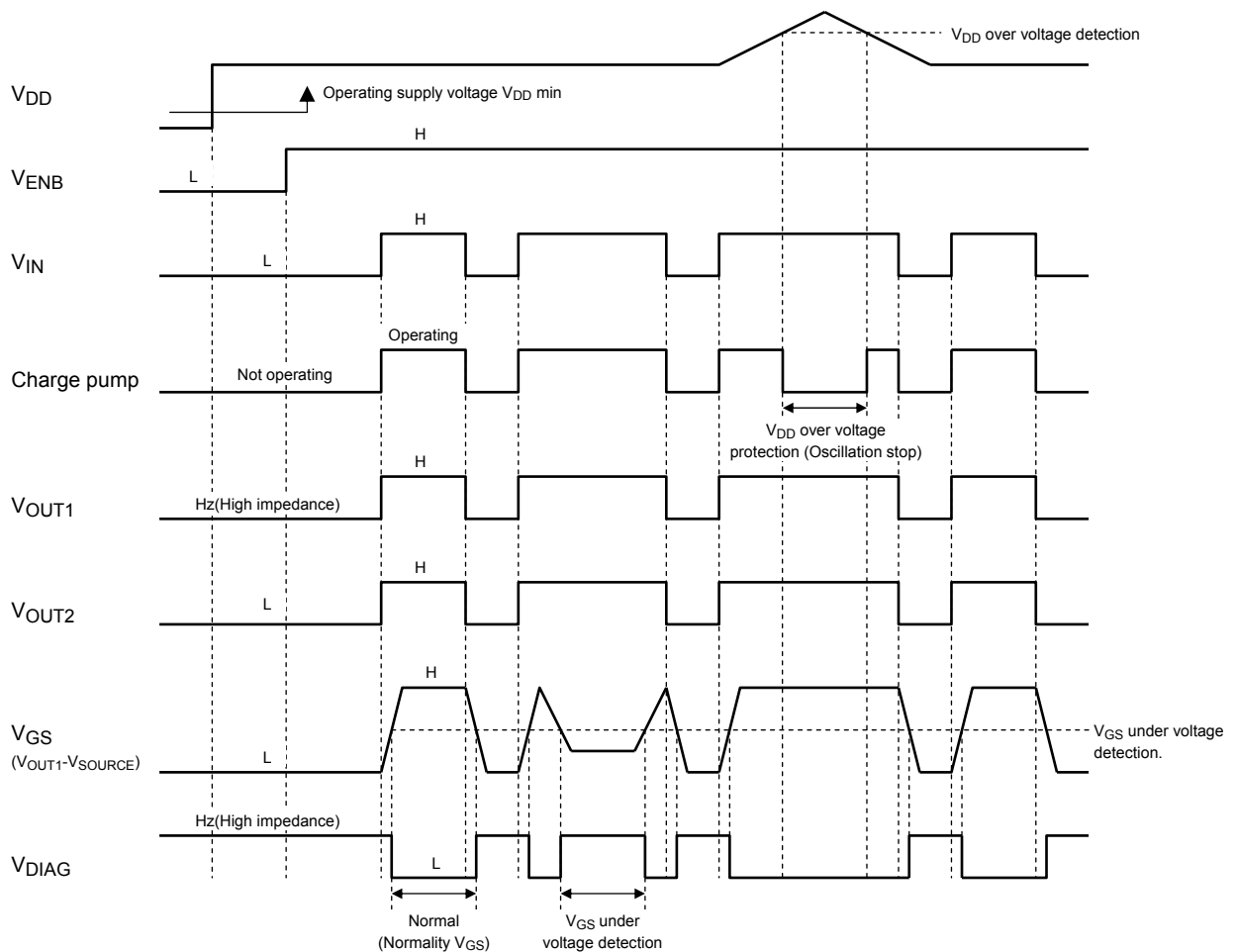
Block Diagram / Application circuit



Pin Description

Pin No.	Symbol	Function
1	DIAG	Diagnosis detection pin. N channel open drain.
2	ENB	Enable pin. The ENB pin has a pull-down resistor. When V_{ENB} is L, OUT1 is Hz and OUT2 is L.
3	IN	Input pin. The IN pin has a pull-down resistor. When V_{IN} and V_{ENB} are H, OUT1 and OUT2 are H.
4	GND	Ground pin.
5	SOURCE	Source voltage of the external power MOSFET monitor pin.
6	OUT2	Output pin 2.
7	OUT1	Output pin 1.
8	V_{DD}	Power supply pin.

Timing Chart



Note: IN and ENB apply H, after V_{DD} applied operating supply voltage.

Truth Table

IN signal	ENB signal	Charge pump circuit	V _{OUT1}	V _{OUT2}	V _{GS}	DIAG	Mode
L	L	Oscillation stop	Hz	L	V _{GS} =H	Hz	Normal (V _{DD} =7 to 18V)
H	L		Hz	L		Hz	
L	H		Hz	L		Hz	
H	H	Oscillation	H	H	L		
L	L	Oscillation stop	Hz	L	V _{GS} =L	Hz	
H	L		Hz	L		Hz	
L	H		Hz	L		Hz	
H	H	Oscillation	H	H	Hz		
L	L	Oscillation stop	Hz	L	V _{GS} =H	Hz	V _{DD} over volatage (V _{DD} >18V)
H	L		Hz	L		Hz	
L	H		Hz	L		Hz	
H	H		H	H		L	
L	L		Hz	L	V _{GS} =L	Hz	
H	L		Hz	L		Hz	
L	H		Hz	L		Hz	
H	H		H	H		Hz	

Note: V_{GS}=H(V_{GS}>V_{GSUV}) / V_{GS}=L(V_{GS}≤V_{GSUV}) *V_{GS}=V_{OUT1}-V_{SOURCE}

Note: Hz: High impedance

* DIAG is L only when V_{IN} and V_{ENB} and V_{GS} are H.

Absolute Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit	Remarks
Power supply voltage	DC	V _{DD(1)}	-0.3 to 25	V
	Pulse	V _{DD(2)}	35	V
Input voltage	V _{IN}	-0.3 to 6	V	
Diagnosis output voltage	V _{DIAG}	-0.3 to 25	V	
Diagnosis output current	I _{DIAG}	2	mA	
Output sink current(DC)	I _{OUT2(+)}	5	mA	Sink current
SOURCE pin negative voltage	-V _{SOURCE}	-7	V	t≤0.1μs, SOURCE pin 10kΩ connect
Power dissipation (Note 1-a)	P _{D(1)}	0.7	W	
Power dissipation (Note 1-b)	P _{D(2)}	0.35	W	
Operating temperature	T _{opr}	-40 to 125	°C	
Junction temperature	T _j	150	°C	
Storage temperature	T _{stg}	-55 to 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.

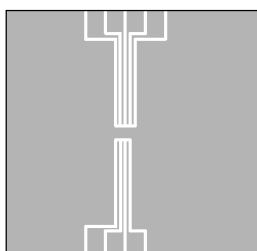
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Thermal Resistance

Characteristic	Symbol	Rating	Unit
Thermal resistance, junction to ambient	R _{th(j-a)}	178.6(Note 1-a)	°C / W
		357.2(Note 1-b)	

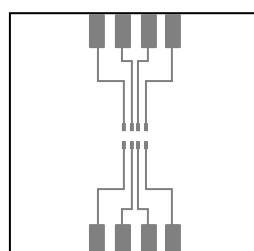
Note 1:

(a)Glass epoxy board



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

(b)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 , $V_{DD} = 7$ to 18V)

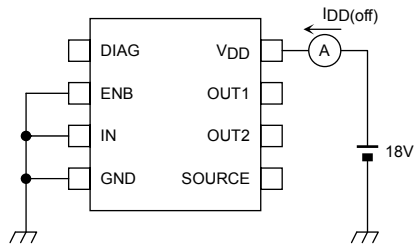
Characteristics	Symbol	Pin	Test Condition	Min	Typ.	Max	Unit
Operating supply voltage (Charge pump circuit, Input logic, Diagnosis logic operate)	$V_{DD(OPR)}$	V_{DD}	-	7	12	18	V
Supply current	$I_{DD(off)}$	V_{DD}	$V_{DD} = 18\text{V}, V_{IN} = V_{ENB} = 0\text{V}$	-	0.35	2	mA
	$I_{DD(on)}$	V_{DD}	$V_{DD} = 18\text{V}, V_{IN} = V_{ENB} = 5\text{V}$	-	3	8	mA
Input voltage	V_{INH}	IN, ENB	-	3.5	-	-	V
	V_{INL}		-	-	-	1.5	
Input current	I_{INH}, I_{ENBH}	IN, ENB	$V_{IN} = V_{ENB} = 5\text{V}$ *Each pin current	-	50	200	μA
	I_{INIL}, I_{ENBL}		$V_{IN} = V_{ENB} = 0\text{V}$ *Each pin current	-1	-	1	
Output voltage	V_{OUT1H}	OUT1	$V_{DD} = 9$ to $18\text{V}, V_{IN} = V_{ENB} = 5\text{V},$ $V_{SOURCE} = V_{DD},$ OUT1-SOURCE $1\text{M}\Omega$	$V_{DD} - 2.7$	$V_{DD} - 1$	V_{DD}	V
	V_{OUT2H}	OUT2	$V_{DD} = 9$ to $18\text{V}, V_{IN} = V_{ENB} = 5\text{V},$ $V_{SOURCE} = V_{DD},$ OUT2-SOURCE $1\text{M}\Omega$	$V_{DD} + 6.0$	$V_{DD} + 10$	$V_{DD} + 12.5$	V
OUT2 sink DMOS ON-Resistance	$R_{ONOUT2L}$	OUT2	$V_{DD} = 7$ to $18\text{V}, V_{IN} = V_{ENB} = 0\text{V},$ $I_{OUT2} = 1\text{mA}$	-	70	180	Ω
OUT1 high level output current	I_{OH1}	OUT1	$V_{DD} = 9$ to $18\text{V}, V_{IN} = V_{ENB} = 5\text{V}$	-	-1.0	-0.15	mA
OUT1 output leakage current	I_{OL1}	OUT1	$V_{DD} = 9$ to $18\text{V}, V_{IN} = V_{ENB} = 0\text{V}$	-1	-	-	μA
OUT1 sink current	I_{OUT1+}	OUT1	$V_{OUT1} = 12\text{V}, V_{IN} = V_{ENB} = 0\text{V}$	-	5	20	μA
OUT2 output current	I_{OH2}	OUT2	$V_{DD} = 9$ to $18\text{V}, V_{IN} = V_{ENB} = 5\text{V},$ $V_{OUT2} = V_{DD} + 6\text{V}$	-	-100	-30	μA
Diagnosis output leakage current	I_{DIAGH}	DIAG	$V_{DD} = 7$ to $18\text{V}, V_{IN} = V_{ENB} = 0\text{V}$ $V_{DIAG} = 5\text{V}$	-	-	10	μA
Diagnosis output voltage	V_{DIAGL}	DIAG	$V_{DD} = 7$ to $18\text{V}, V_{IN} = V_{ENB} = 5\text{V}$ $I_{DIAG} = 1\text{mA}$	-	-	0.4	V
V_{GS} under voltage detection (OUT1-SOURCE voltage)	V_{GSUV}	OUT1, SOURCE	$V_{DD} = 9$ to $18\text{V}, V_{IN} = V_{ENB} = 5\text{V}$	3.3	4.1	4.8	V
V_{DD} over voltage detection	V_{DDOV}	V_{DD}	-	18	22	25	V
Switching time	t_{on}	IN→OUT1	Refer to Test circuit 7	-	16	100	μs
	t_{off}			-	2	10	

Note: Typical condition is $V_{DD} = 12\text{V}, T_j = 25^\circ\text{C}$.

Note: Sink current to this IC is expressed by "+", source current from this IC is expressed by "-".

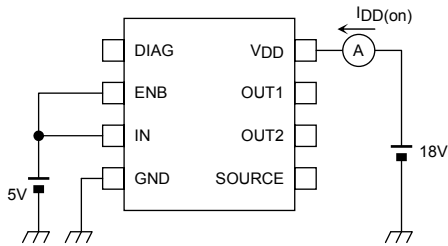
Test circuit 1

Supply current $I_{DD(off)}$



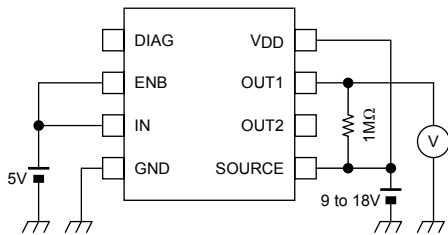
Test circuit 2

Supply current $I_{DD(on)}$



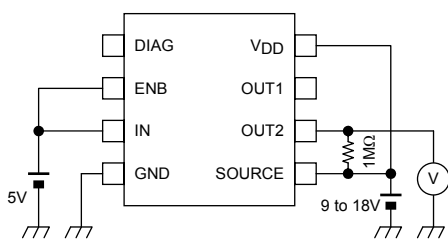
Test circuit 3

Output voltage V_{OUT1H}



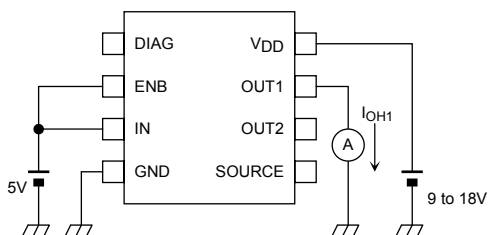
Test circuit 4

Output voltage V_{OUT2H}



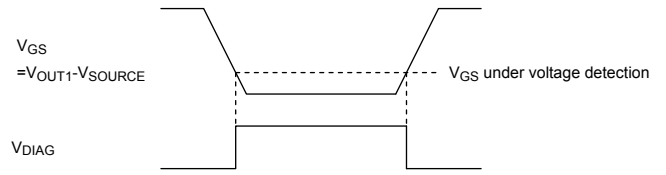
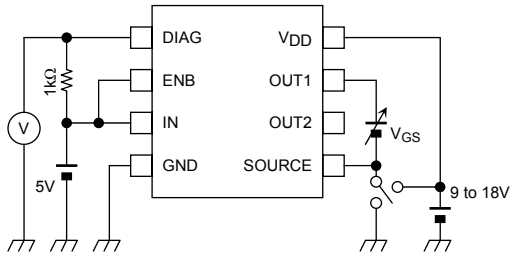
Test circuit 5

OUT1 high level output current I_{OH1}



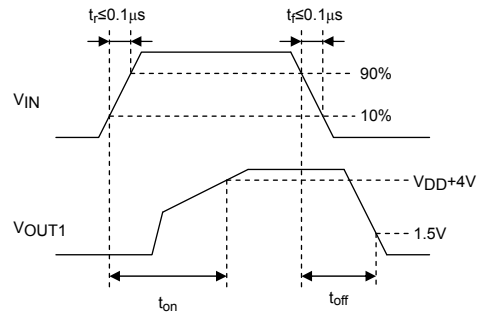
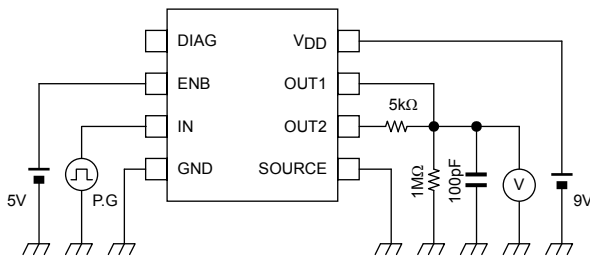
Test circuit 6

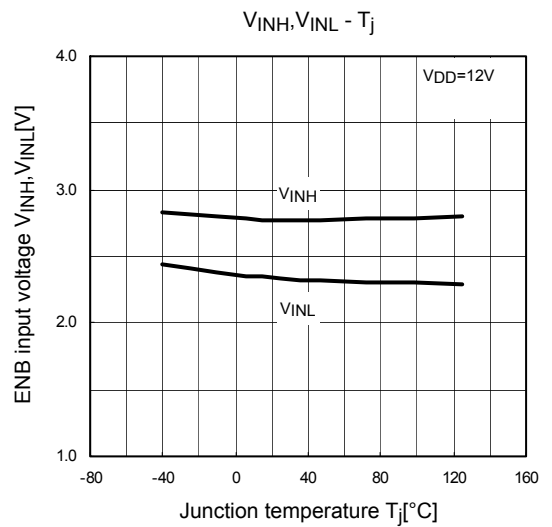
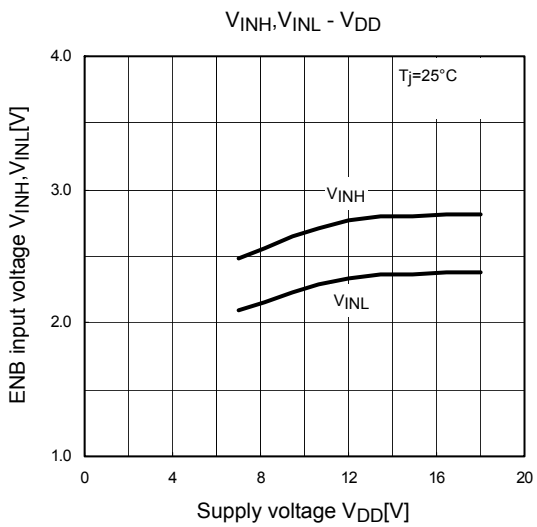
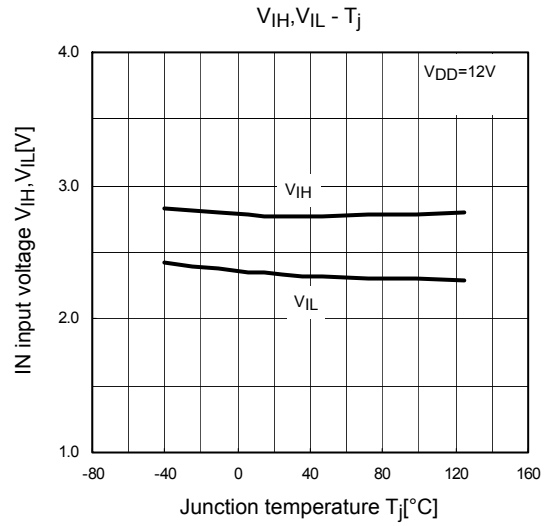
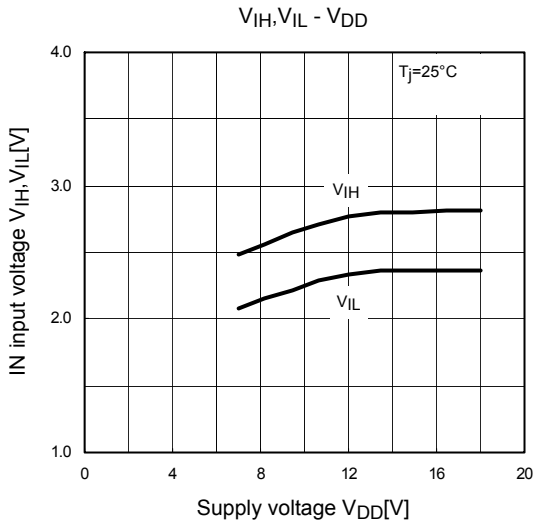
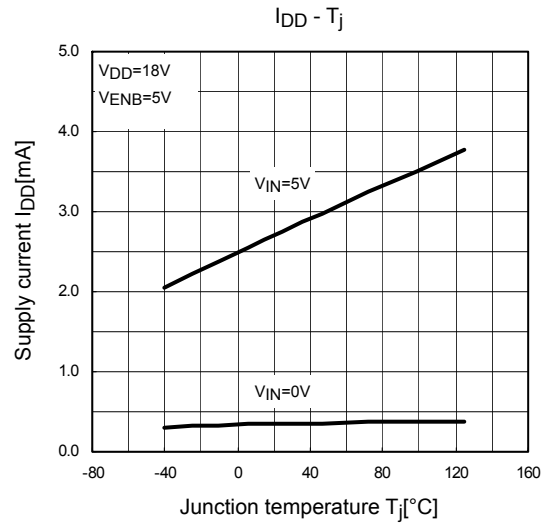
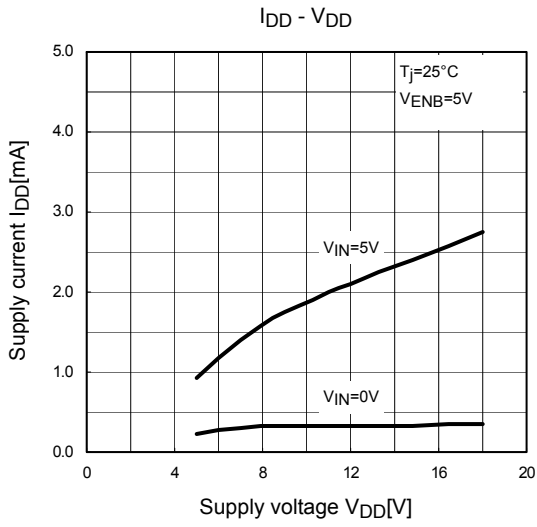
V_{GS} under voltage detection

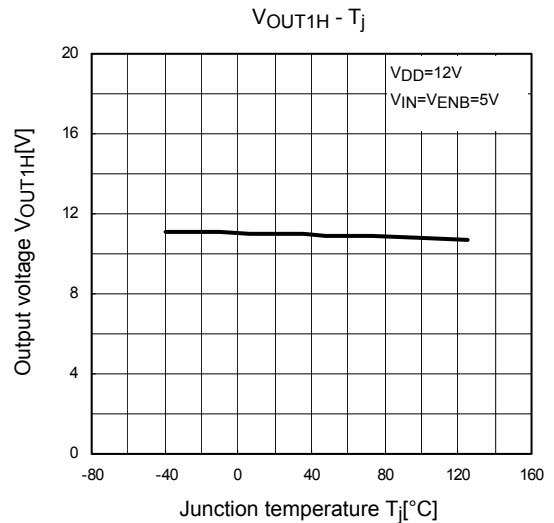
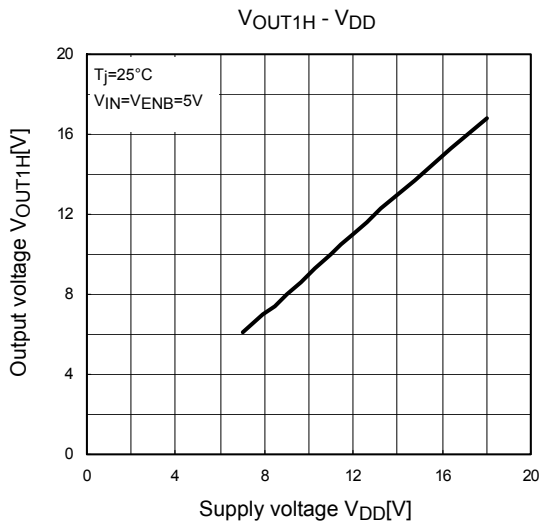
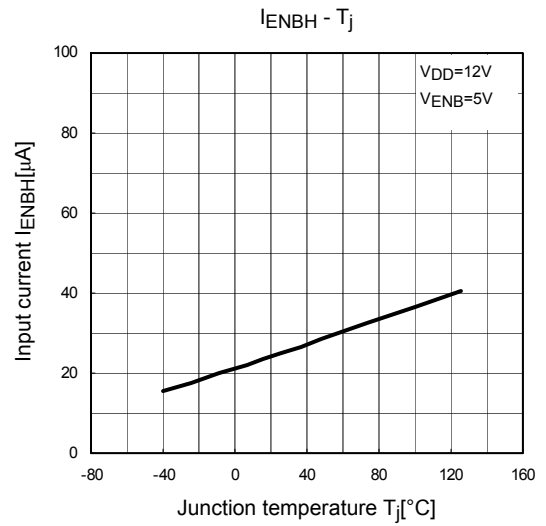
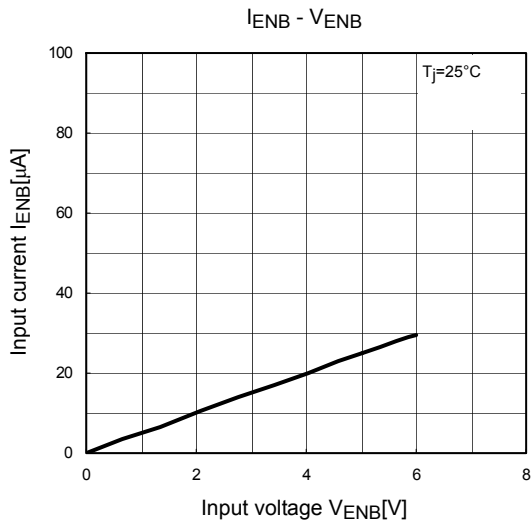
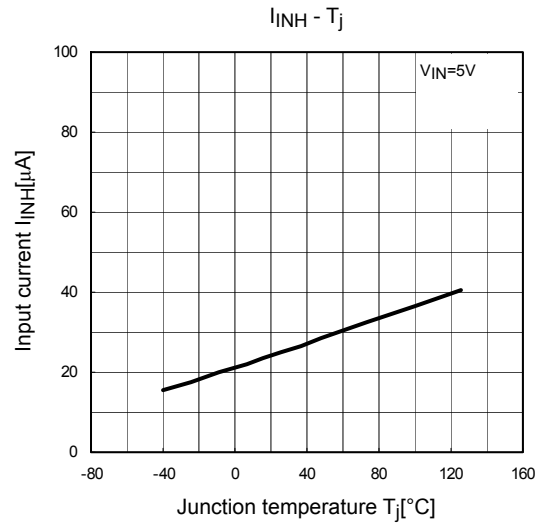
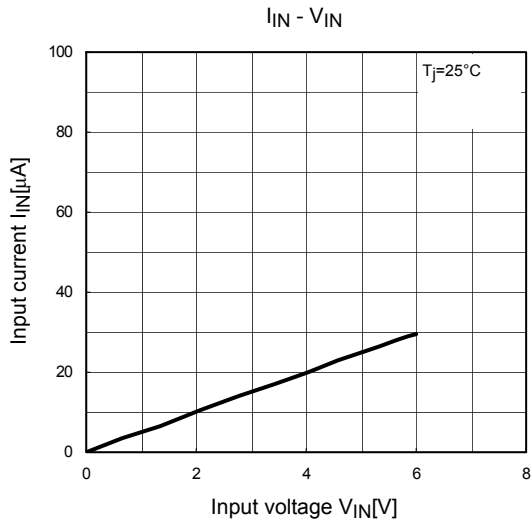


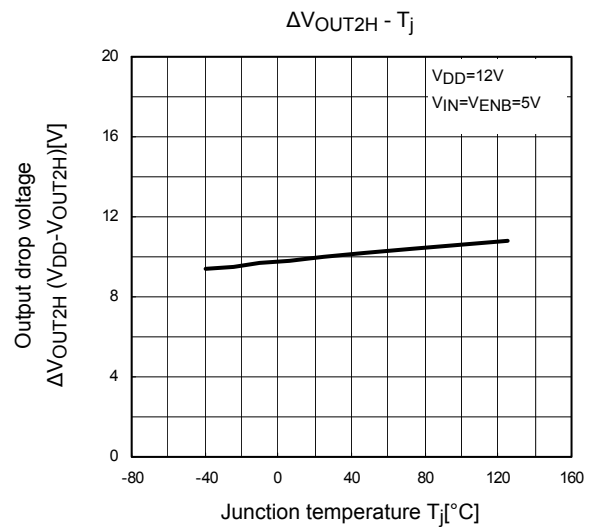
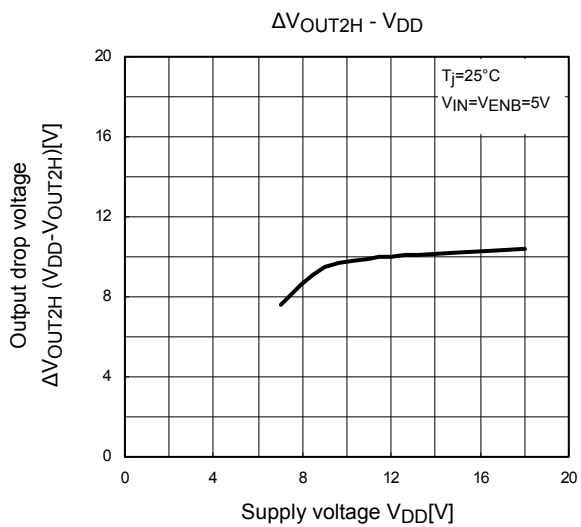
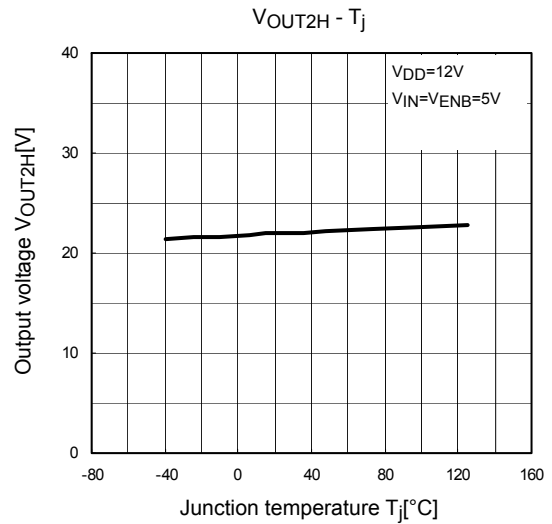
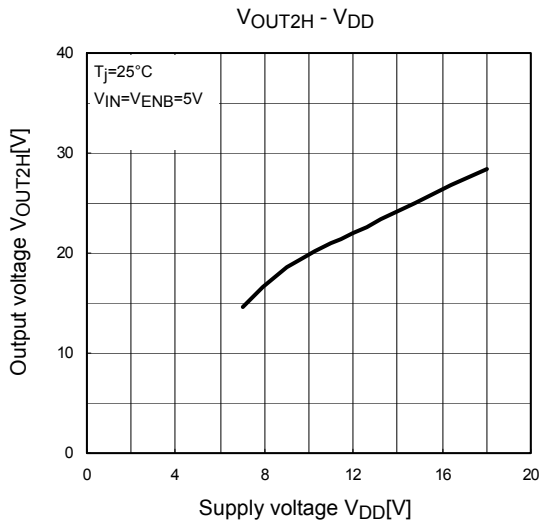
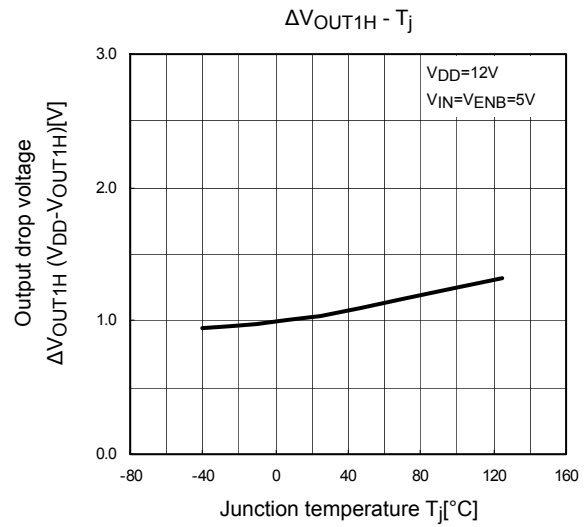
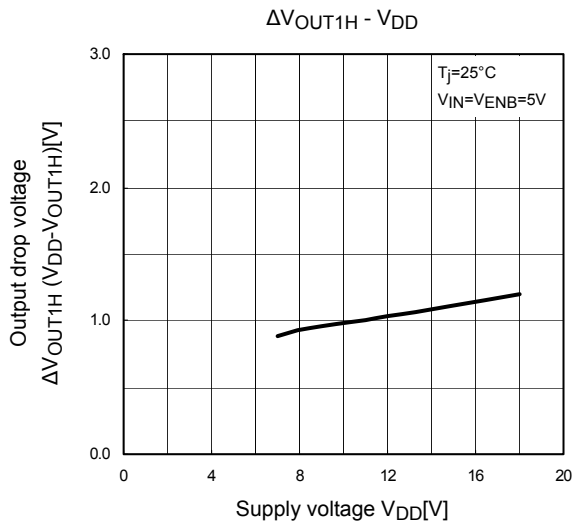
Test circuit 7

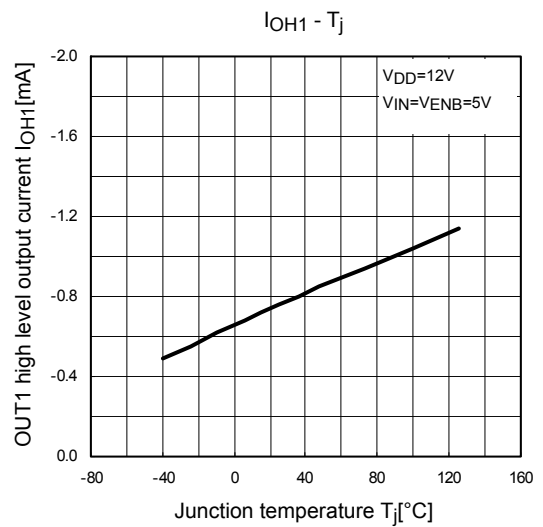
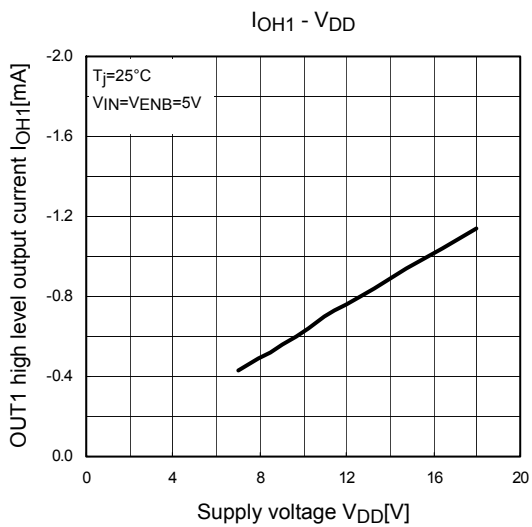
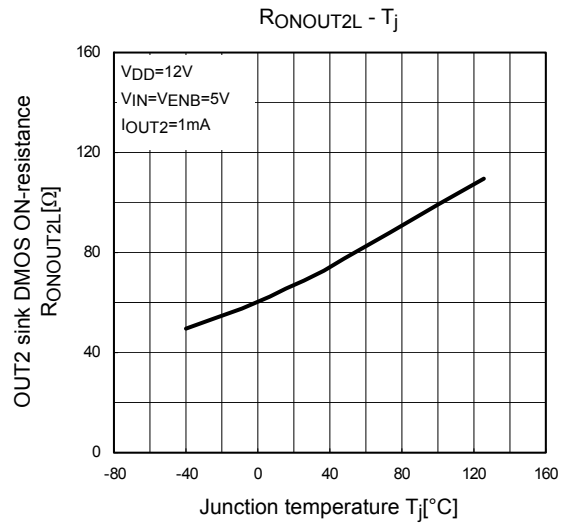
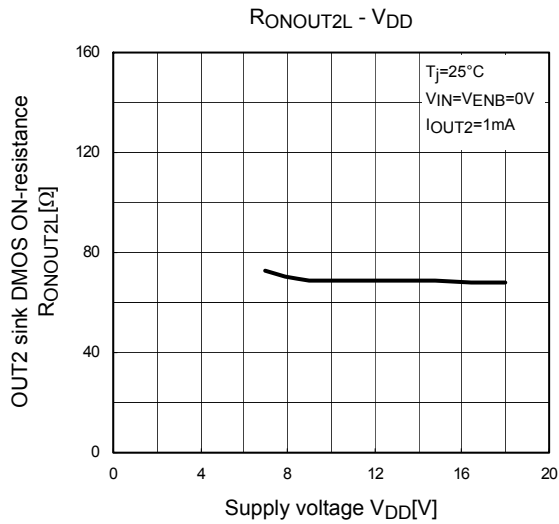
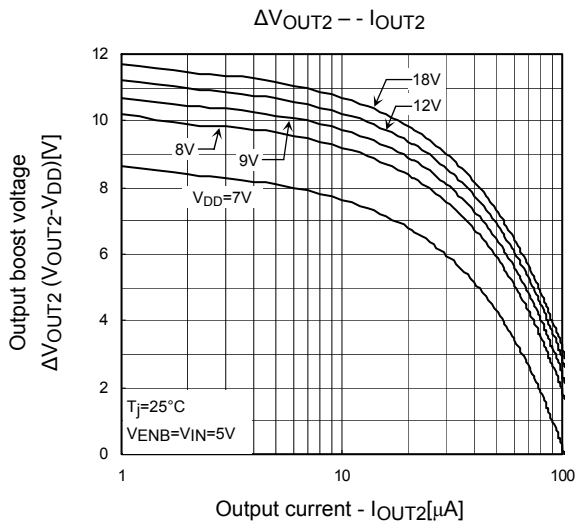
Switching time t_{on} , t_{off}

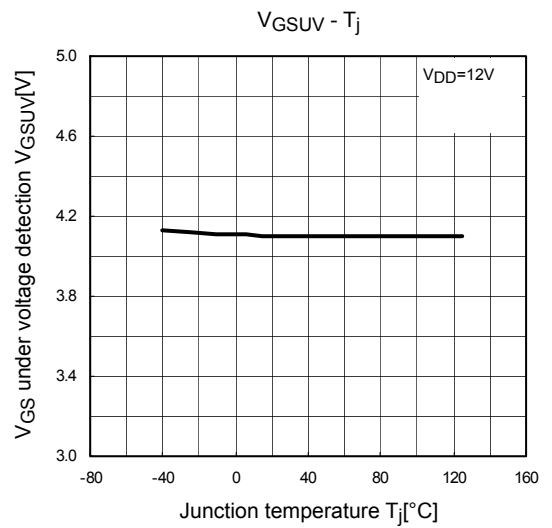
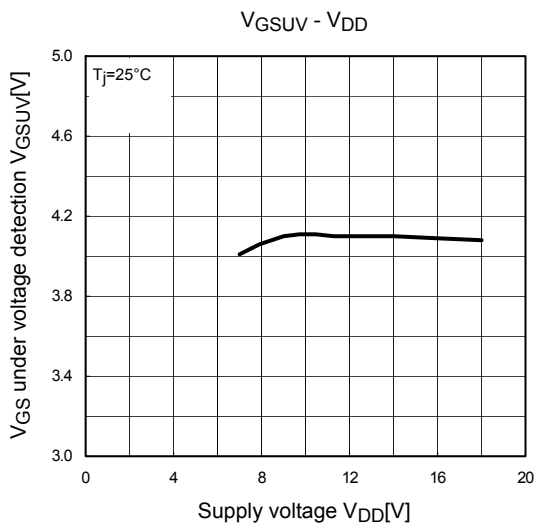
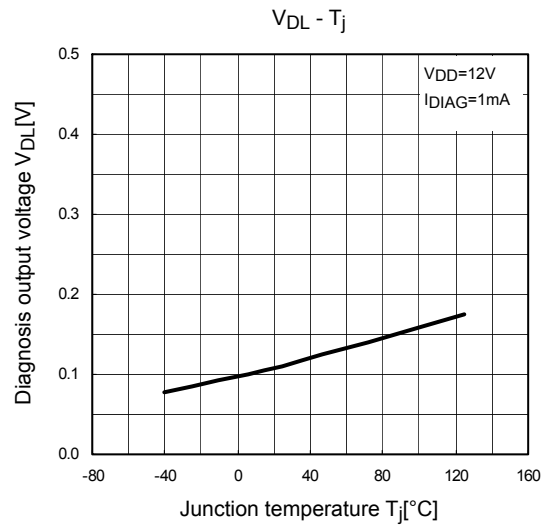
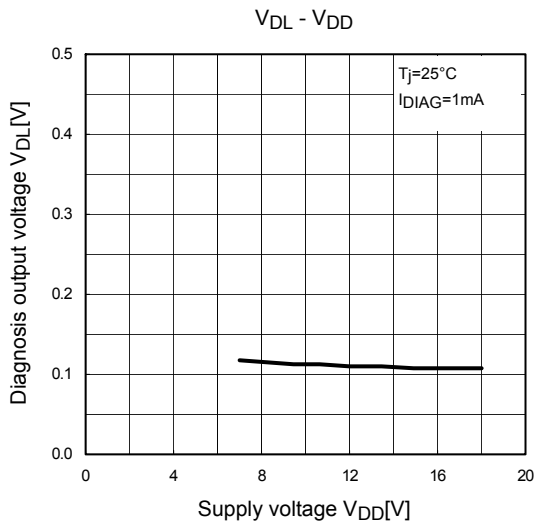
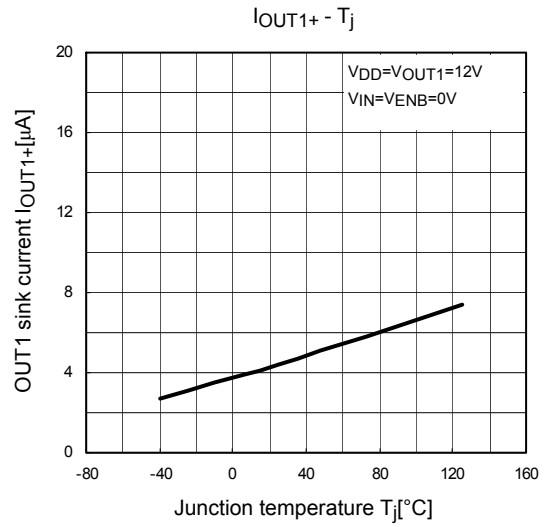


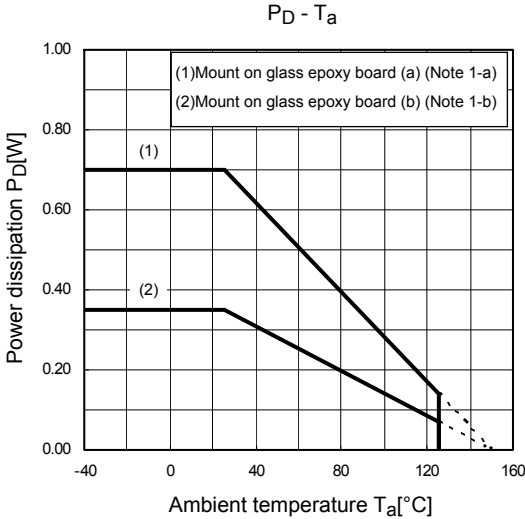
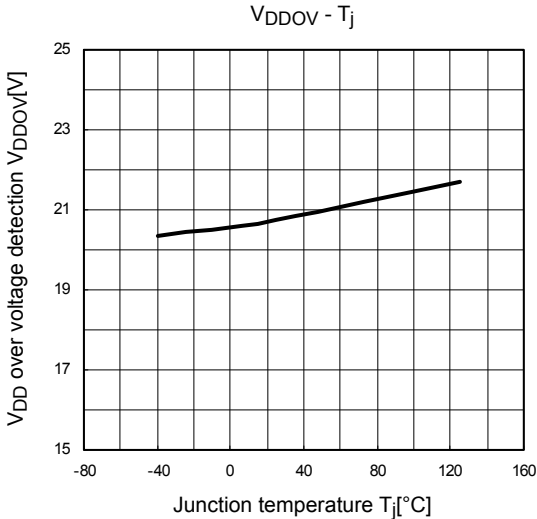








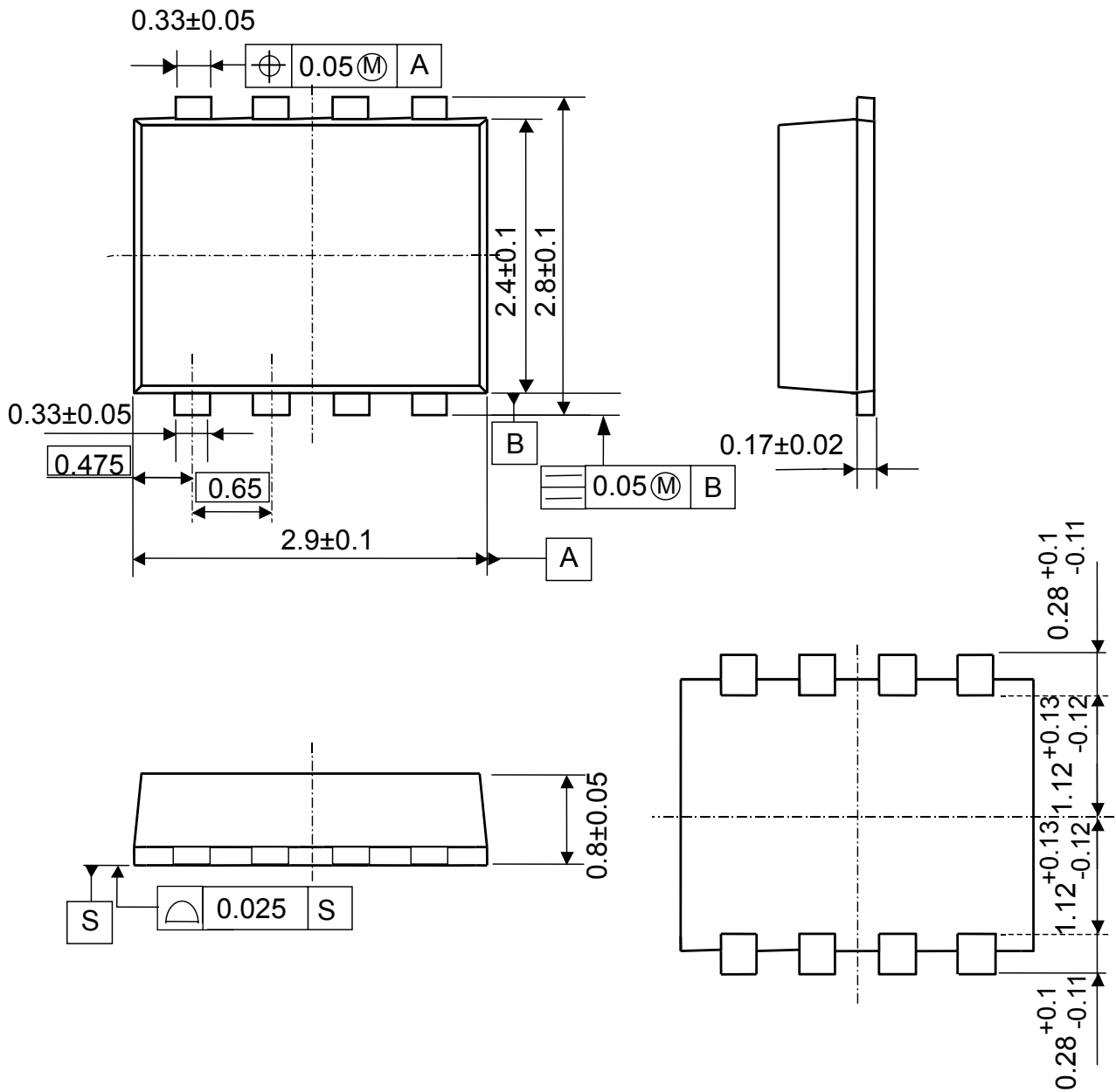




Package Dimensions

SON8-P-0303-0.65

Unit ; mm



Weight : 0.017g(Typ.)

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