

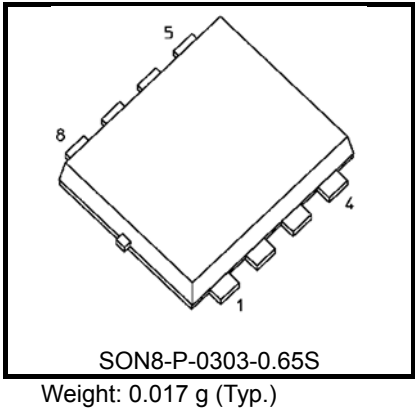
TPD7104AF

1 channel High-Side N channel Power MOSFET Gate Driver

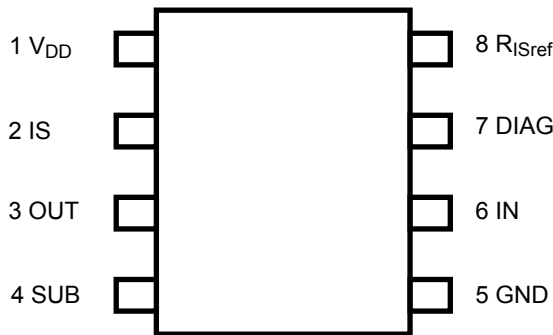
TPD7104AF is a 1channel high-side N channel power MOSFET gate driver. This IC contains a charge pump circuit, allowing easy configuration of a high-side switch for large-current applications.

Features

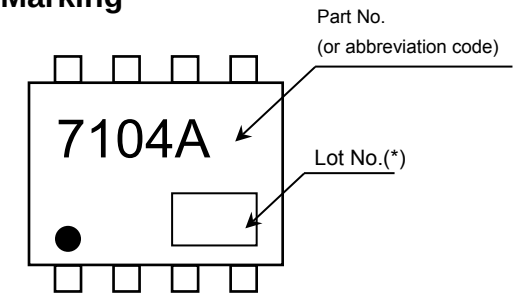
- Charge pump circuit is built in
- Built-in short circuit and reverse battery protection
- Housed in the PS-8 package and supplied in embossed carrier tape



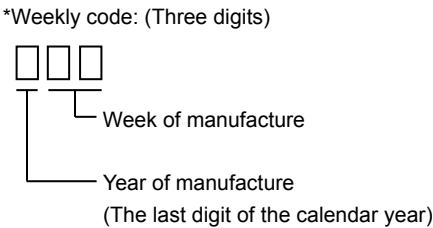
Pin Assignment (top view)



Marking



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

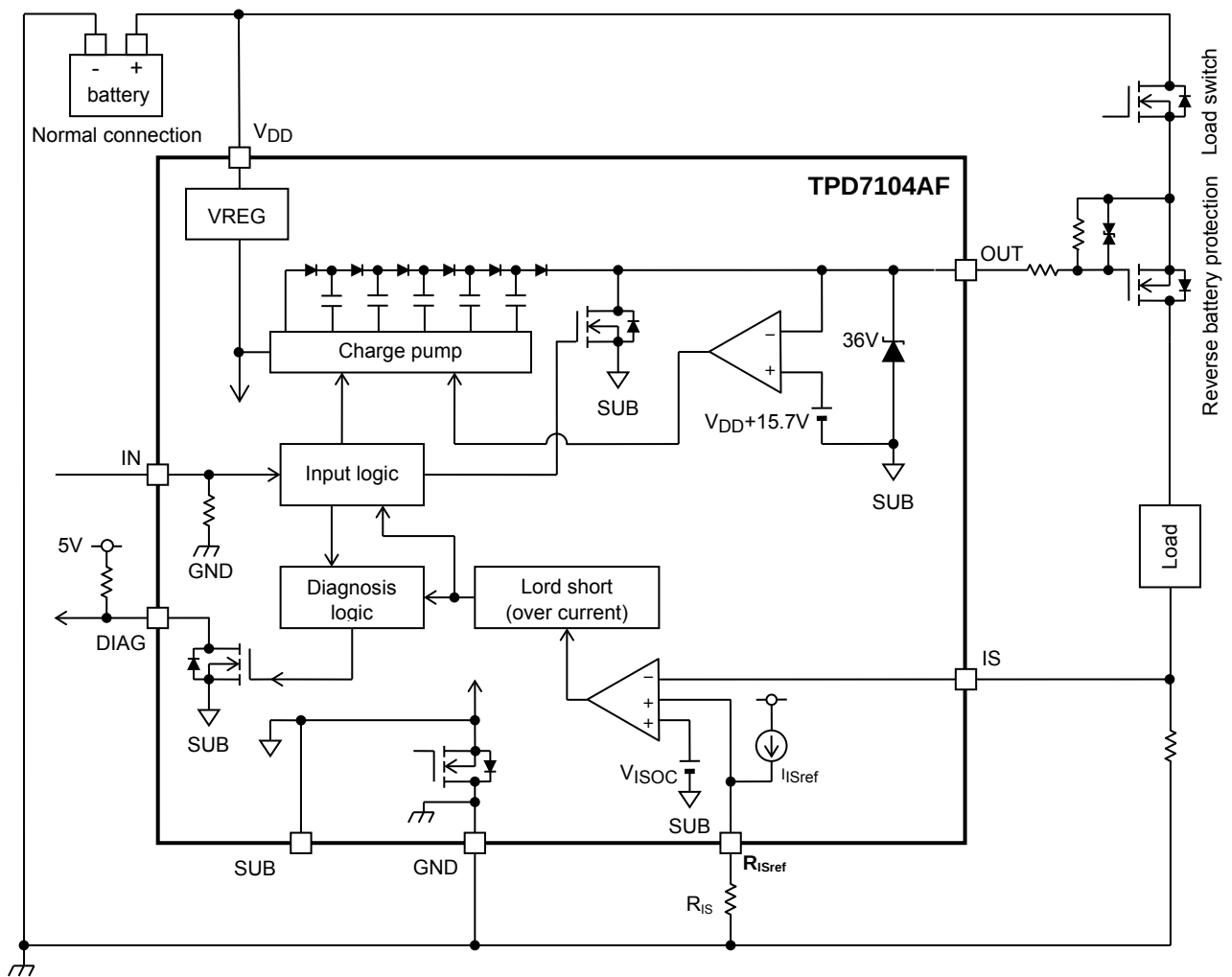


Note: That because of its MOS structure, this product is sensitive to static electricity

Start of commercial production
2015-08

[illegible]

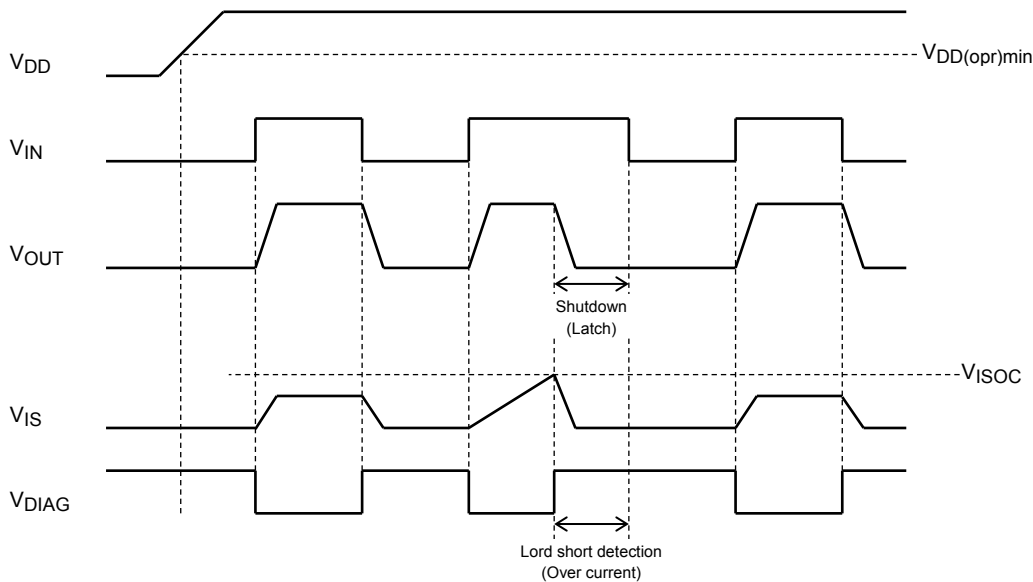
Application circuit 2 (Reverse battery protection circuit “ FET off”)



Pin Description

Pin No.	Symbol	Function
1	V _{DD}	Power supply pin.
2	IS	Detection pin for short circuit. If short circuit detection is not used, IS pin connect to GND.
3	OUT	Output pin for an external MOSFET drive. State is off if detect short circuit.
4	SUB	Please use open if use protection for reverse connection of power supply. If protection for reverse connection of power supply is not used, SUB pin connect to GND.
5	GND	Ground pin.
6	IN	Input pin. IN has a pull-down resistor.
7	DIAG	Diagnosis detection pin. It is open drain composition. Output is inverted if detect short circuit.
8	R _{ISref}	Adjust pin for sense level for short circuit detection. If R _{ISref} is not used, R _{ISref} pin is open.

Timing Chart



Note: Output shut down when it detects short circuit and becomes latch state and protects outside MOSFET.
DIAG becomes H-state, and makes input L-state when reset the latch circuit.

Truth Table

V_{IN}	V_{OUT}	Charge pump	V_{IS} (Note 1)	V_{DIAG}	Mode
L	L	Charge pump stop (oscillation is stopped)	L	H (Note 2)	Normal
H	H	Charge pump operation.	L	L	
L	L	Charge pump stop (oscillation is stopped)	H	H (Note 2)	Load short
H	L	Charge pump stop (oscillation is stopped)	H	H (Note 2)	
-	Hz (Note 3)	-	-	Hz (Note 3)	Reverse battery (SUB pin open)

Note 1: V_{IS} : Load short detection voltage.

Note 2: The Diag Output is a Nch open drain and it is OFF state at the time of $V_{DIAG} = "H"$.

Note 3: Hz : High impedance.

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit	Remarks
Power supply voltage	DC	V _{DD(1)}	-0.3 to 24	V	-
	Pulse	V _{DD(2)}	40	V	t=300ms single pulse
Power supply reverse connection		-V _{DD(3)}	18	V	SUB open
Input voltage		V _{IN}	-0.3 to 6	V	-
Output source current		I _{OUT(-)}	Internal capacity	mA	Source current
Output sink current		I _{OUT(+)}	5	mA	Sink current
IS pin voltage		V _{IS}	-0.3 to 6	V	-
Diagnosis output voltage		V _{DIAG}	-0.3 to 6	V	-
Diagnosis pin current		I _{DIAG}	5	mA	-
Power dissipation (Note1-a)		P _{D(1)}	0.7	W	-
Power dissipation (Note1-b)		P _{D(2)}	0.35	W	-
Operateing temperature		T _{opr}	-40 to 125	°C	-
Junction temperature		T _j	150	°C	-
Strage temerature		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.

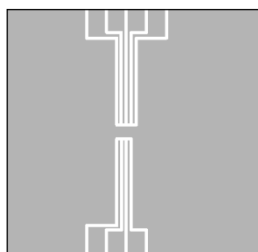
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Thermal Resistance

Characteristics	Symbol	Rating	unit
Thermal resistance, junction to ambient	$R_{th(j-a)}$	178.6(Note 1-a)	°C / W
		357.2(Note 1-b)	

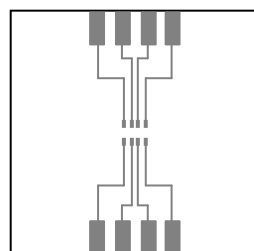
Note 1:

(Note 1-a) Glass epoxy board



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

(Note 1-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 , $V_{DD} = 5$ to 18V)

Characteristics	Symbol	Pin	Test Condition	Min	Typ.	Max	Unit
Operating supply voltage	$V_{DD(opr)}$	V_{DD}	-	5	12	18	V
Supply current	$I_{DD(off)}$	V_{DD}	$V_{DD} = 12\text{V}$, $V_{IN} = V_{IL}$, $T_j = 25^\circ\text{C}$	-	0.7	3	mA
	$I_{DD(on)}$	V_{DD}	$V_{IN} = V_{IH}$, output is open circuit	-	-	5	mA
Input voltage	V_{IH}	IN	-	2.5	-	-	V
	V_{IL}		-	-	-	1.5	
Input current	I_{IH}	IN	$V_{IN} = 5\text{V}$	-	19	50	μA
	I_{IL}		$V_{IN} = 0\text{V}$	-1	-	1	
Output voltage	V_{OUTH1}	OUT	$V_{DD} = 5\text{V}$, $V_{IN} = V_{IH}$, $I_{OUT} = -100\mu\text{A}$	$V_{DD} + 8$	$V_{DD} + 13$	$V_{DD} + 18$	V
	V_{OUTH2}	OUT	$V_{DD} = 8$ to 18V , $V_{IN} = V_{IH}$, $I_{OUT} = -100\mu\text{A}$	$V_{DD} + 10$	$V_{DD} + 15.7$	$V_{DD} + 18$	V
Output clamp voltage	V_{clamp}	OUT	$V_{IN} = V_{IH}$	31	36	40	V
Output resistance	R_{SINK}	OUT	$V_{IN} = V_{IL}$, $I_{OUT} = 1\text{mA}$	-	510	800	Ω
Diagnosis output leakage current	I_{DIAGH}	DIAG	$V_{IN} = V_{IL}$, $V_{DIAG} = 5\text{V}$	-	-	10	μA
Diagnosis output voltage	V_{DIAGL}	DIAG	$V_{IN} = V_{IH}$, $I_{DIAG} = 500\mu\text{A}$	-	0.22	0.4	V
Short circuit detection voltage	V_{ISOC}	R_{ISref}	$V_{DD} = 12\text{V}$, R_{ISref} pin is open circuit	0.8	1.02	1.2	V
R_{ISref} pin output current	$I_{ISref(1)}$	R_{ISref}	$V_{RISref} = 0.2\text{V}$	-60	-38	-20	μA
	$I_{ISref(2)}$	R_{ISref}	$V_{RISref} = 0.4\text{V}$	-60	-38	-20	μA
	$I_{ISref(3)}$	R_{ISref}	$V_{RISref} = 0.6\text{V}$	-60	-38	-20	μA
Switching time	t_{on}	OUT	Refer to Test circuit 1, $T_j = 25^\circ\text{C}$	-	450	800	μs
	t_{off}			-	480	800	
Output current for reverse connection	$I_{REV(1)}$	OUT	Refer to Test circuit 2 $V_{DD} = -5$ to -18V , $T_j = 25^\circ\text{C}$	-1	-	-	μA
	$I_{REV(2)}$	OUT	Refer to Test circuit 2 $V_{DD} = -5$ to -18V , $T_j = -40$ to 125°C	-10	-	-	μA

Note2 : Typical condition is $V_{DD} = 12\text{V}$, $T_j = 25^\circ\text{C}$.

Note3 : The current detection voltage is controllable, when connecting resistance to R_{ISref} pin.

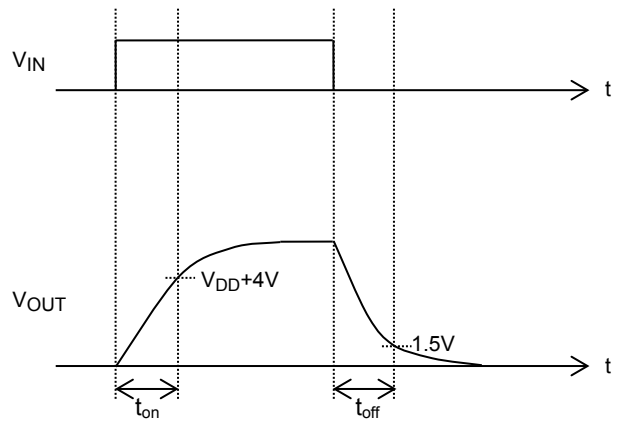
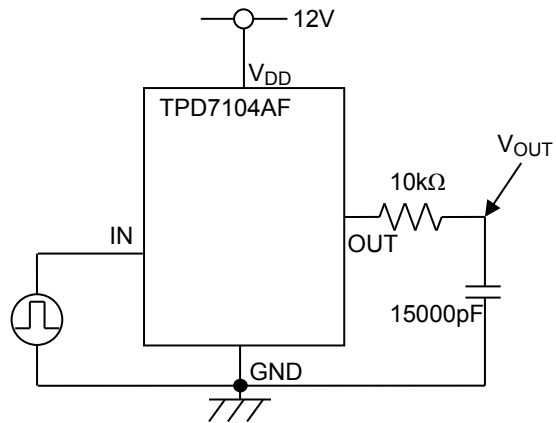
But, when $V_{RISref}(R_{IS} \times I_{ISref})$ is over V_{ISOC} , the current detection voltage is V_{ISOC} .

Note4 : About the charge pump voltage

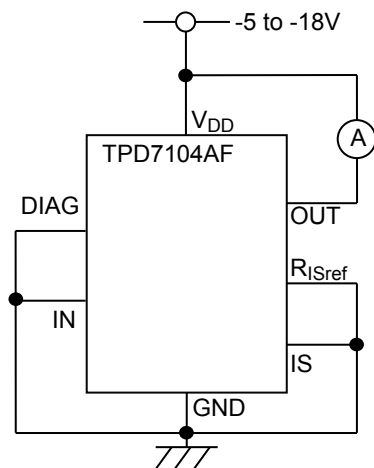
So as not to apply over-voltage to the gate-source voltage(V_{GS}) of external power MOSFET, and so as to become the best driving voltage, the clamping circuit is built into.

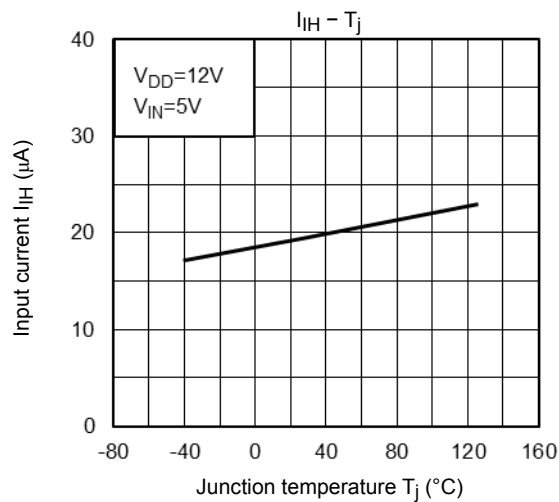
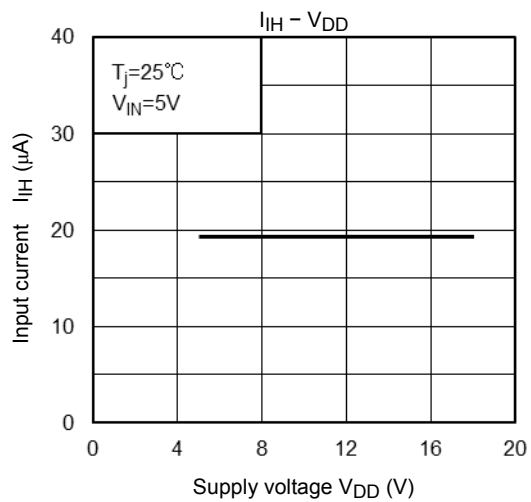
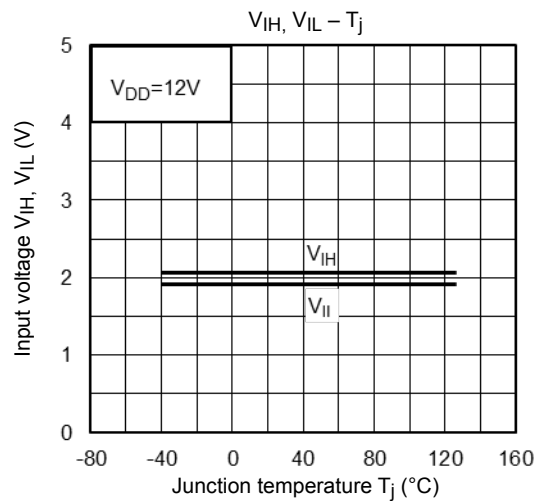
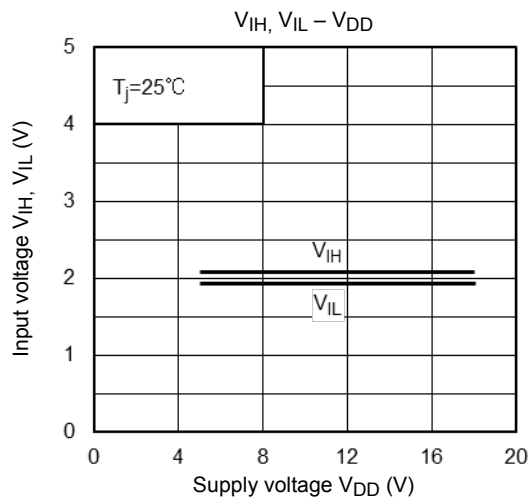
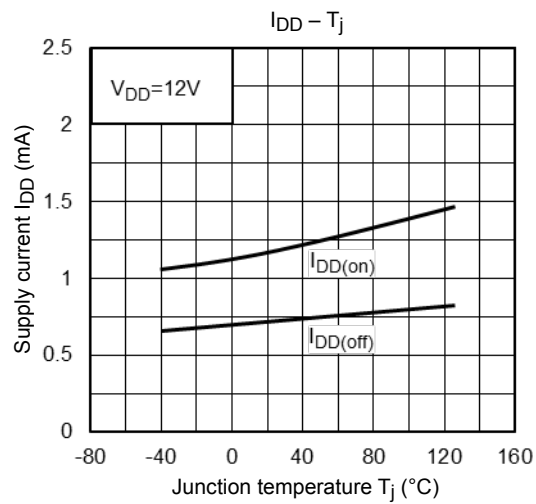
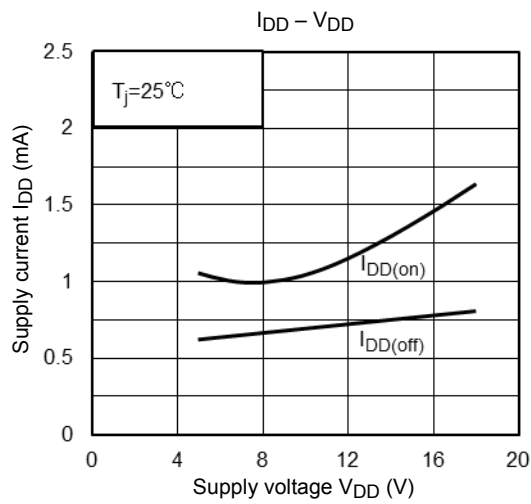
And it doesn't output over 36V(Typ.), because of protection of itself.

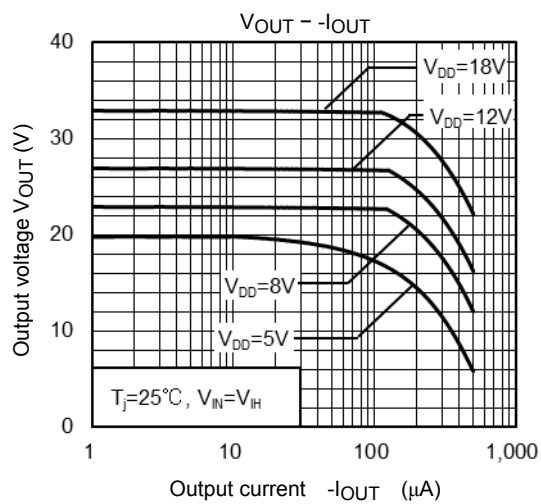
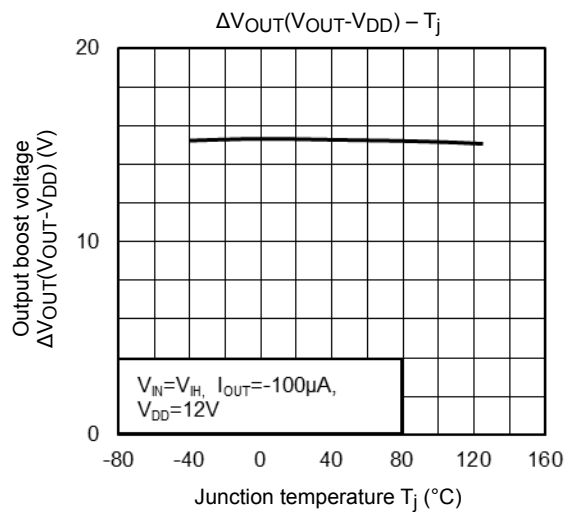
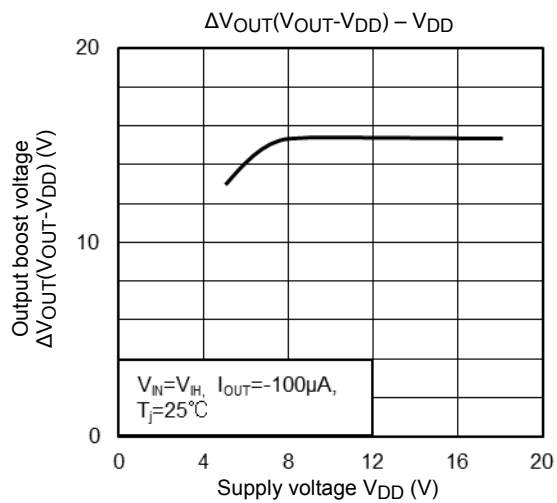
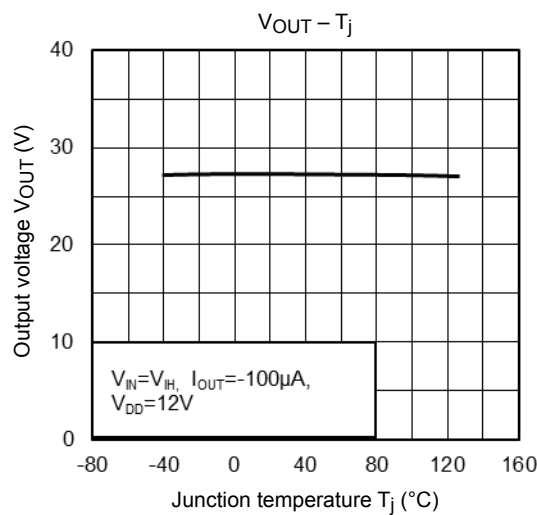
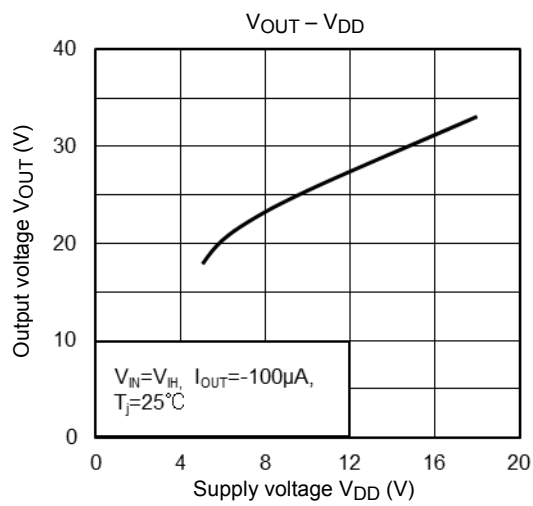
Test circuit 1 for switching time

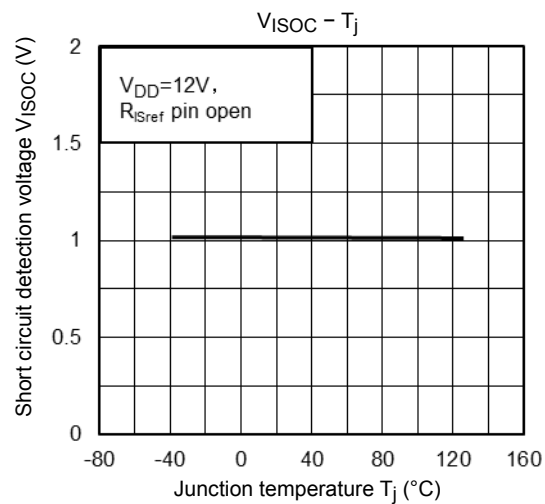
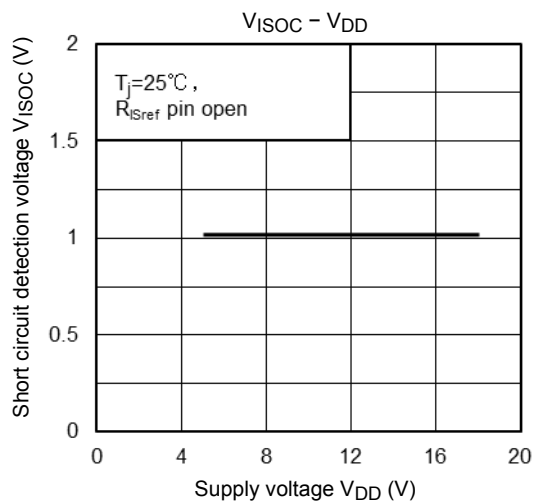
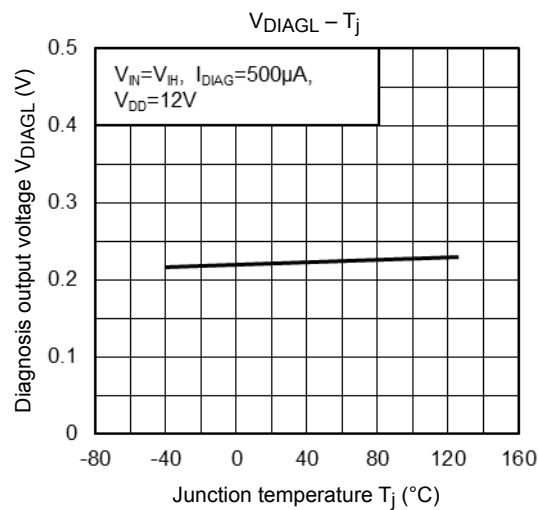
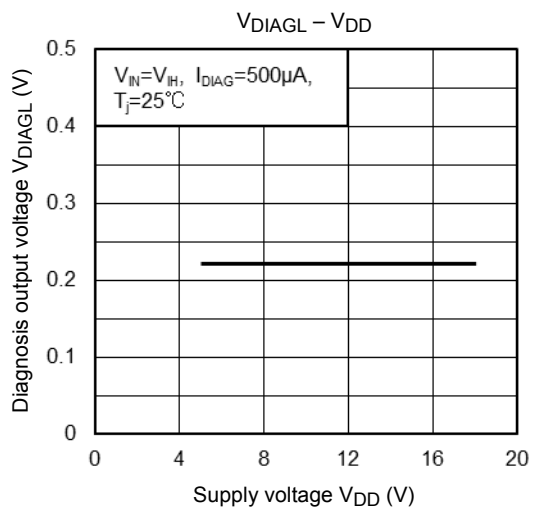
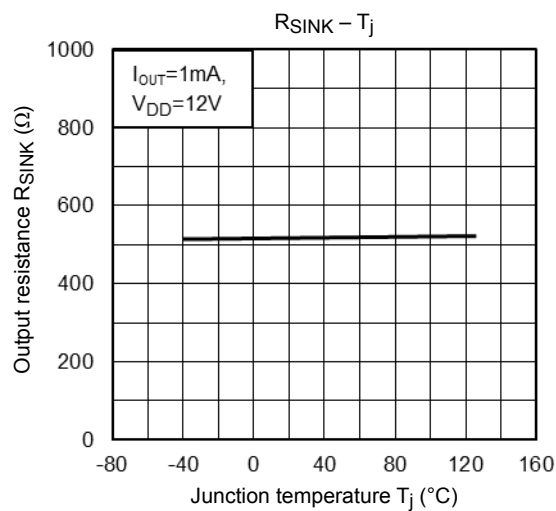
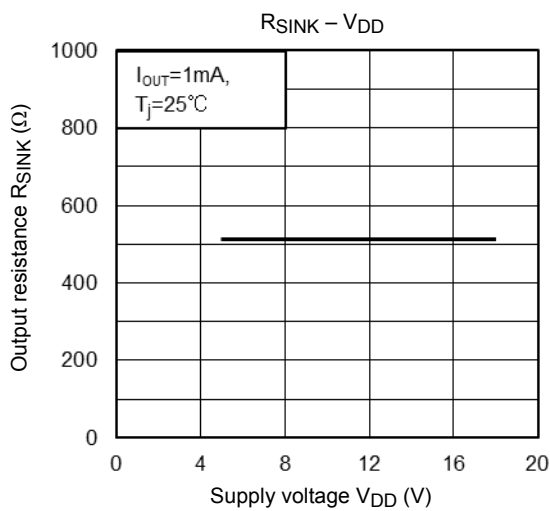


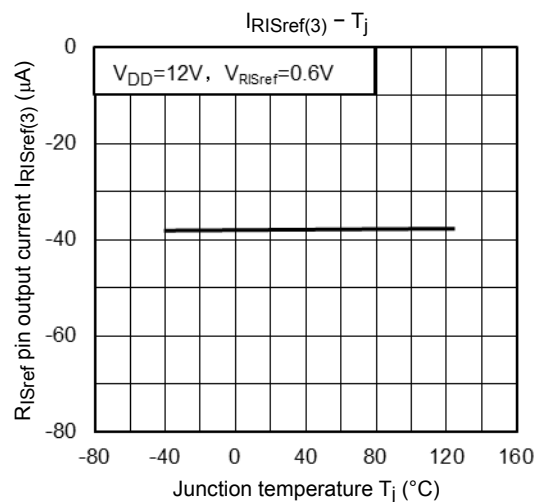
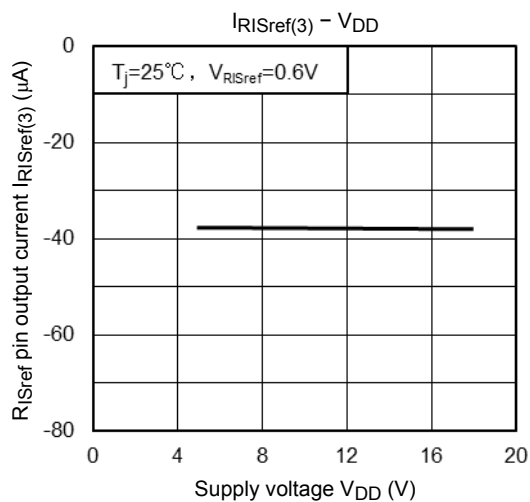
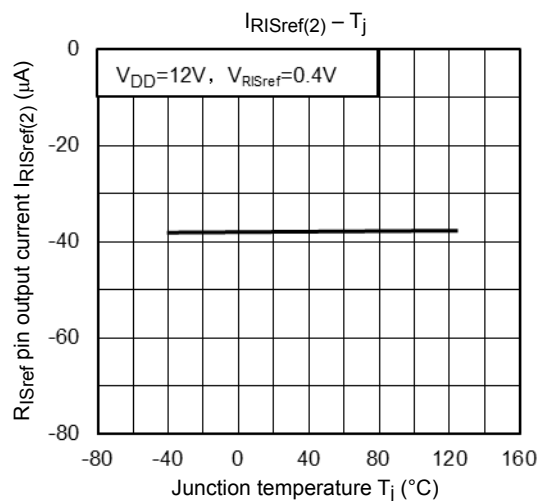
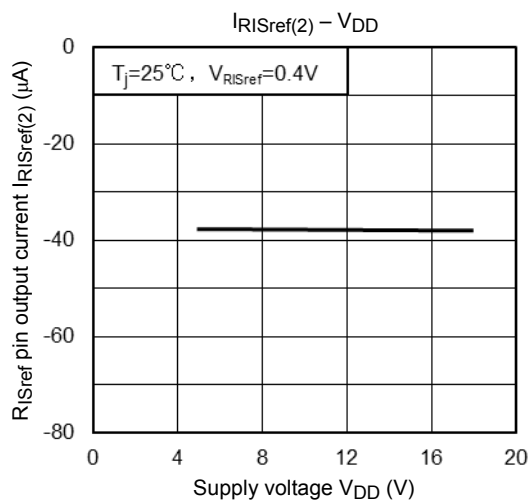
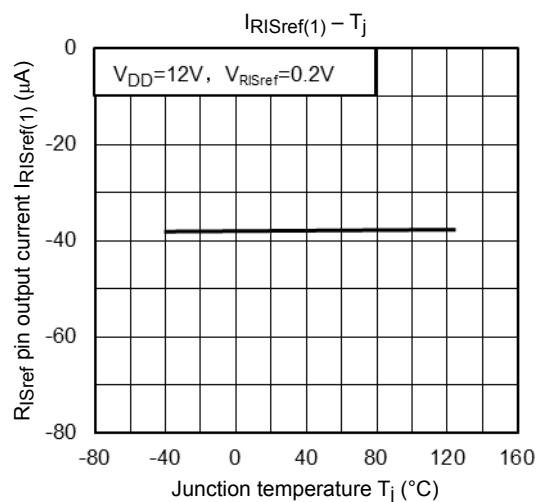
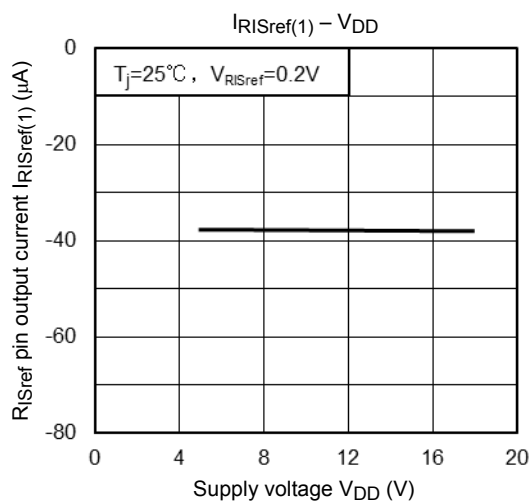
Test circuit 2 for Output current for reverse connection

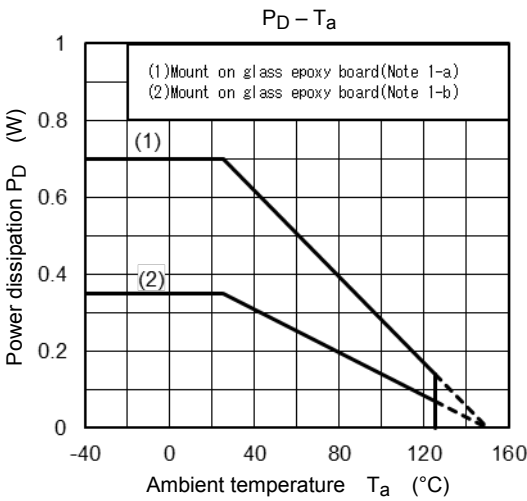
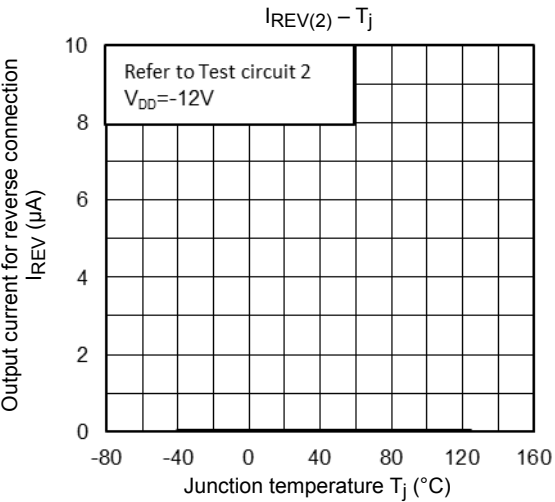
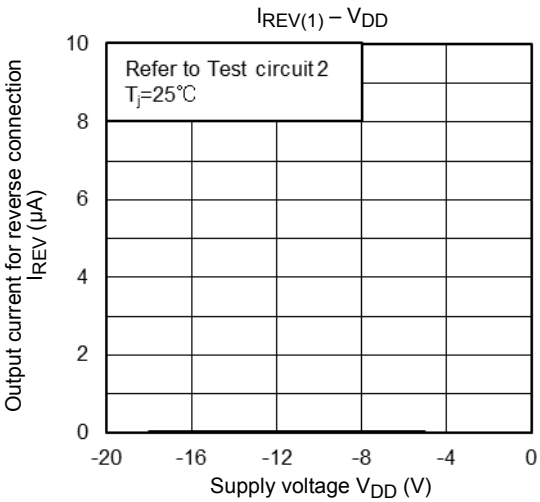
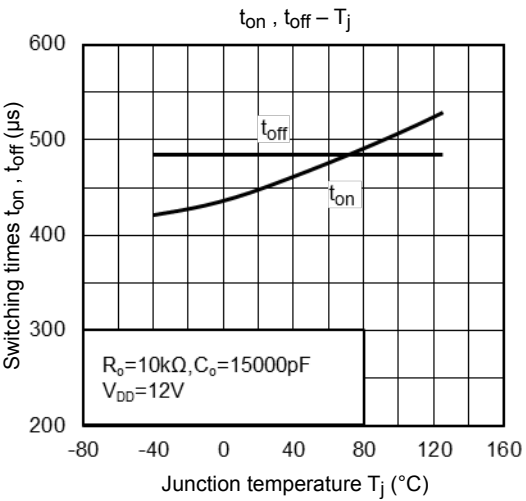
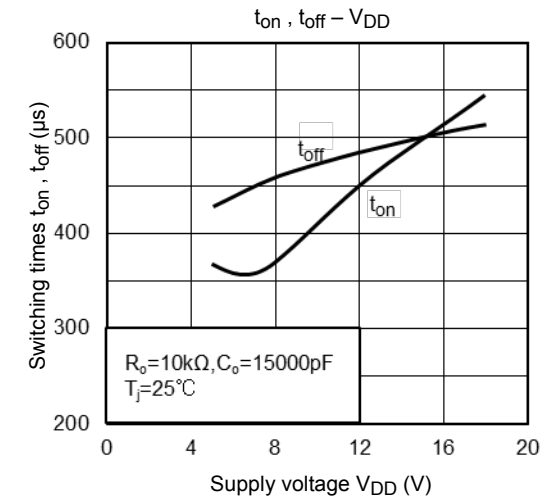








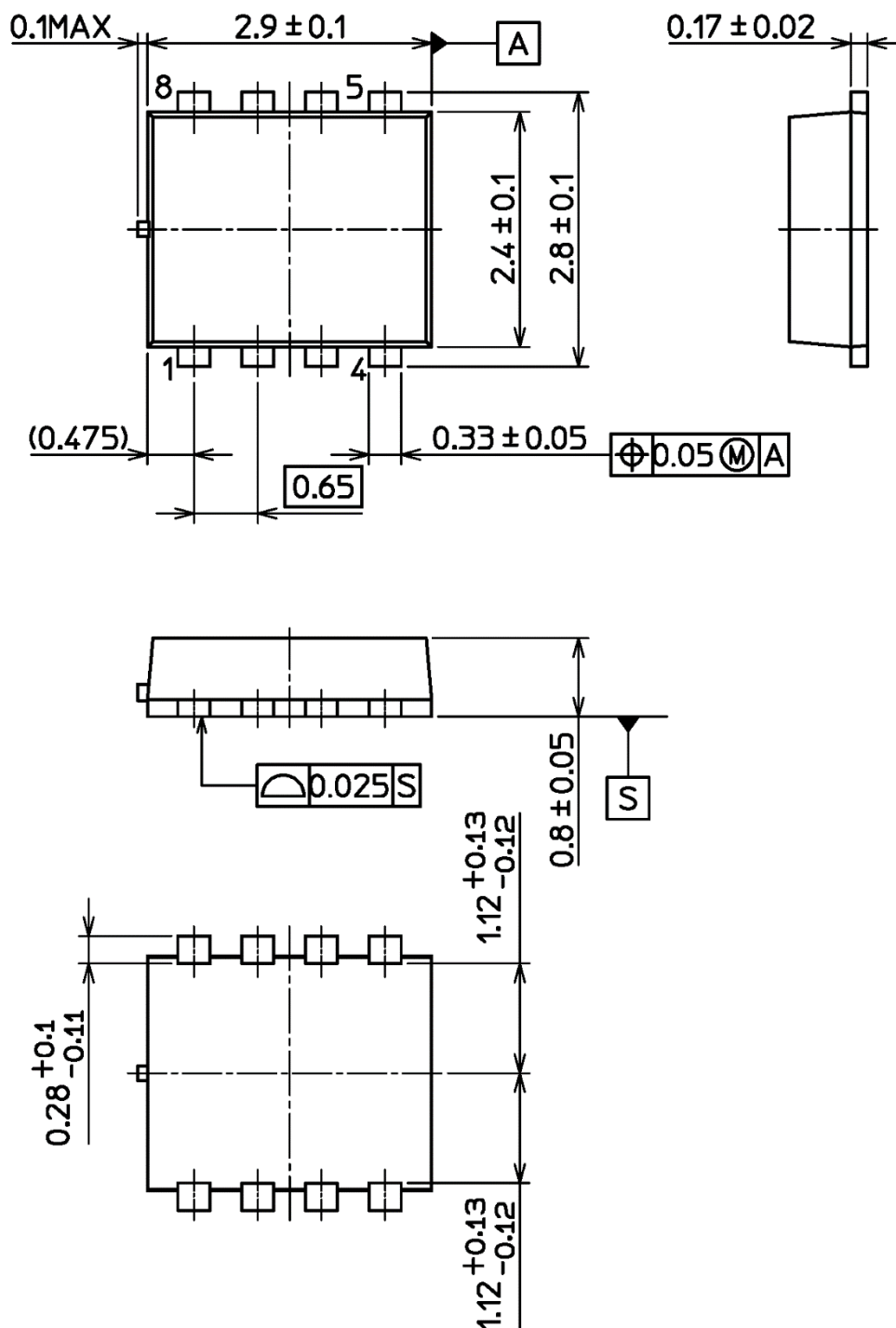




Package Dimensions

SON8-P-0303-0.65S

Unit: mm



Weight: 0.017g(typ.)

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