

TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

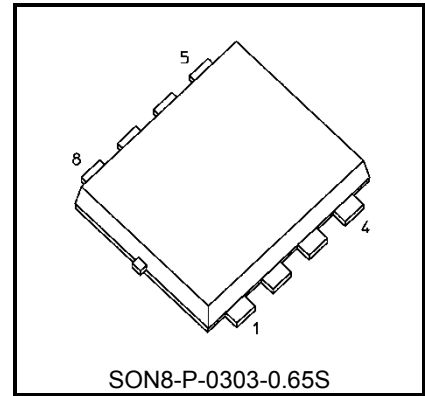
TPD7104F

1 channel High-Side N channel Power MOSFET Gate Driver

TPD7104F is a 1 channel 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.

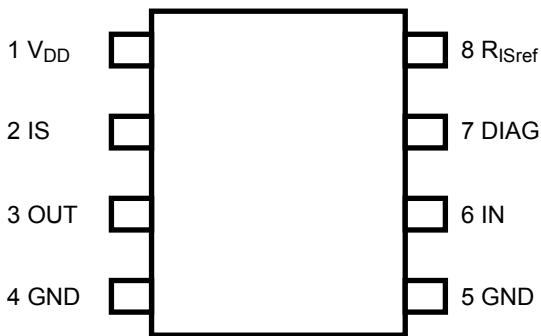
Features

- Charge pump circuit is built in
- Over current protection circuit is built in
- Housed in the PS-8 package and supplied in embossed carrier tape



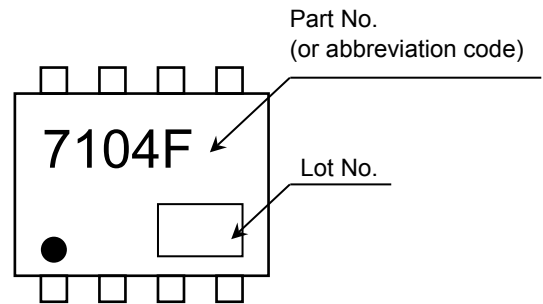
SON8-P-0303-0.65S
Weight: 0.017 g (typ.)

Pin Assignment (top view)



Note: 4pin and 5pin should short-circuit externally.

Marking



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

*Weekly code: (Three digits)

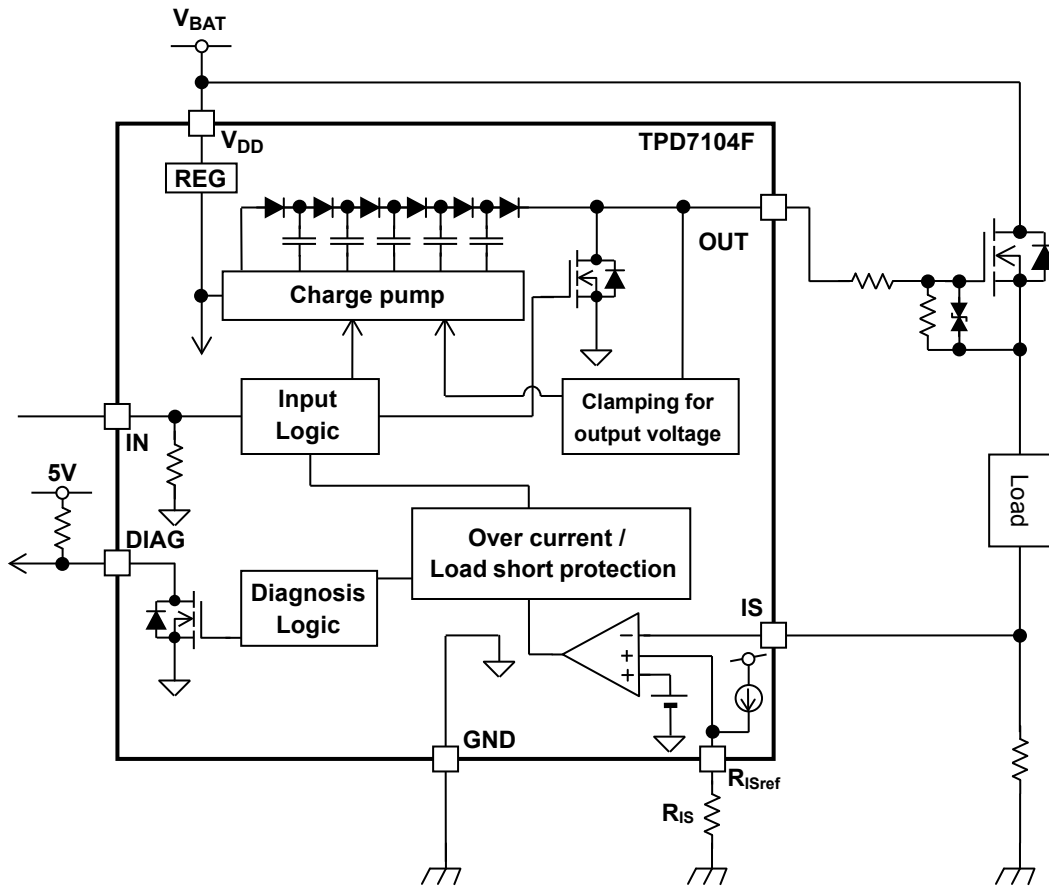


Week of manufacture
(01 for first week of year, continuing up to 52 or 53)
Year of manufacture
(The last digit of the calendar year)

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

Start of commercial production
2014-9

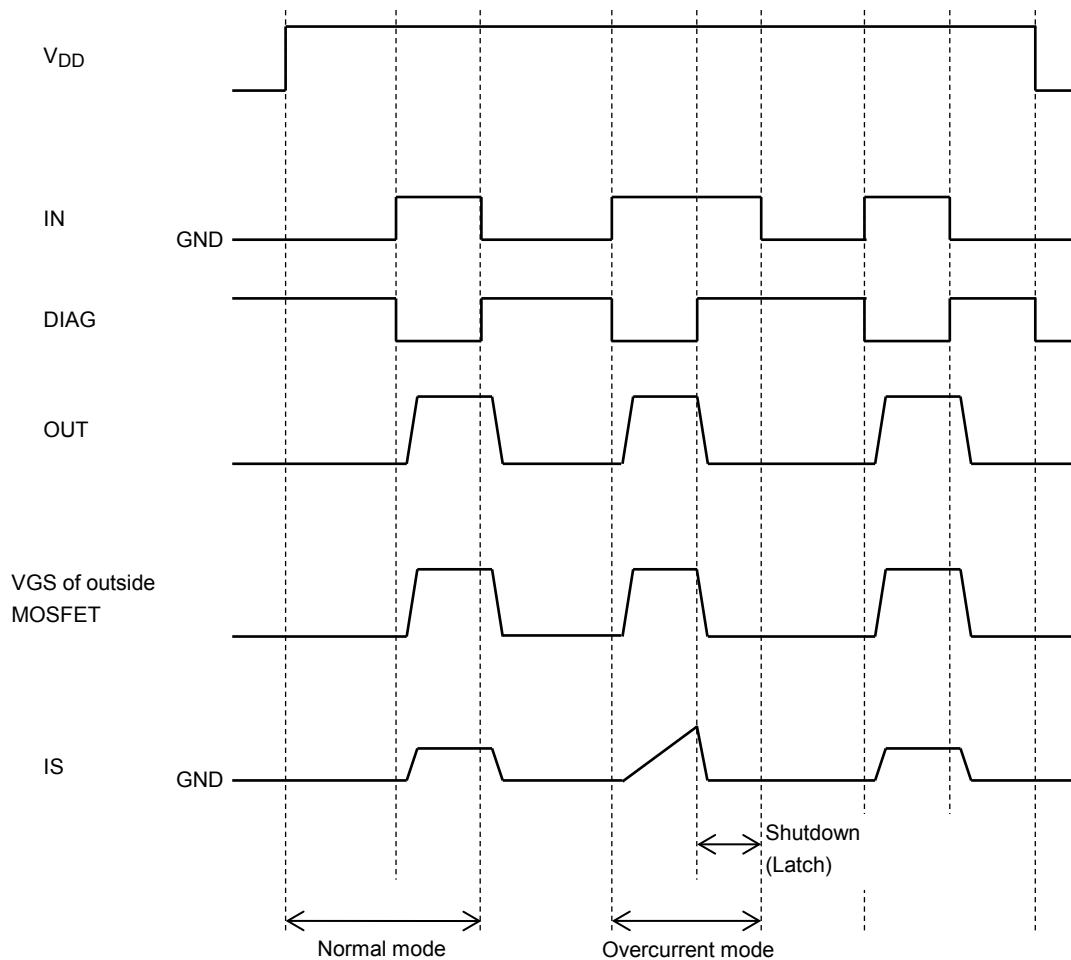
Block Diagram / Application circuit



Pin Description

Pin No.	Symbol	Function.
1	V _{DD}	Power supply pin.
2	IS	Detection pin for over current. If overcurrent detection is not used, IS pin connect to GND.
3	OUT	Output pin. State is off if detect overcurrent.
4	GND	Ground pin.
5	GND	Ground pin.
6	IN	Input pin. IN has a pull-down resistor. Out is H state if V _{IN} is H state.
7	DIAG	Diagnosis detection pin. Output is inverted if detect overcurrent.
8	R _{ISref}	Adjust pin for sense level for over current. If R _{ISref} is not used, R _{ISref} pin is open.

Timing Chart



Truth Table

V_{IN}	Charge pump circuit	V_{IS}	V_{OUT}	V_{DIAG}	Mode
L	Oscillation stop	L	L	H	Normal
H	Oscillation	L	H	L	
L	Oscillation stop	H	L	H	Over current protection
H	Oscillation stop	H	L	H	

Note: $V_{IS} = L (V_{IS} < V_{ISOC}) / V_{IS} = H (V_{IS} > V_{ISOC}) @ V_{ISOC} < V_{RISref}$
 $V_{IS} = L (V_{IS} < V_{RISref}) / V_{IS} = H (V_{IS} > V_{RISref}) @ V_{ISOC} > V_{RISref}$

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
Input voltage	V _{IN}	-0.3 to 6	V	-	
Output voltage	V _{OUT}	-0.3 to internally limited	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.

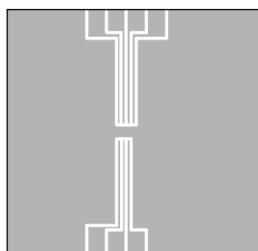
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

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)	

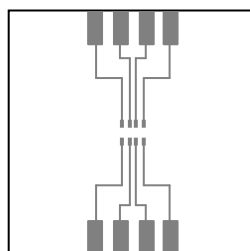
Note 1:

(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	-	3.5	-	-	V
	V_{IL}		-	-	-	1.5	
Input current	I_{IH}	IN	$V_{IN} = 5\text{V}$	-	20	50	μA
	I_{IL}		$V_{IN} = 0\text{V}$	-1	-	1	
Output voltage	V_{OUT}	OUT	$V_{DD} = 5\text{V}$, $V_{IN} = V_{IH}$, $I_{OUT} = -100\mu\text{A}$, $C_o = 15000\text{pF}$	$V_{DD} + 8$	$V_{DD} + 13$	$V_{DD} + 18$	V
	V_{OUT}	OUT	$V_{DD} = 8$ to 18V , $V_{IN} = V_{IH}$, $I_{OUT} = -100\mu\text{A}$, $C_o = 15000\text{pF}$	$V_{DD} + 10$	$V_{DD} + 15.7$	$V_{DD} + 18$	V
Output resistance	R_{SINK}	OUT	$I_{OUT} = 1\text{mA}$	-	500	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	$V_{IN} = V_{IH}$, $I_{DIAG} = 500\mu\text{A}$	-	-	0.4	V
Over current detection voltage	V_{ISOC}	IS	$V_{DD} = 12\text{V}$, R_{ISref} pin is open circuit	0.9	1.02	1.2	V
R_{ISref} pin output current	$I_{ISref(1)}$	R_{ISref}	$V_{RISref} = 0.2\text{V}$	-60	-40	-20	μA
	$I_{ISref(2)}$	R_{ISref}	$V_{RISref} = 0.4\text{V}$	-60	-40	-20	μA
	$I_{ISref(3)}$	R_{ISref}	$V_{RISref} = 0.6\text{V}$	-60	-40	-20	μA
Switching time	t_{on}	OUT	Refer to Test circuit, $T_j = 25^\circ\text{C}$	-	370	800	μs
	t_{off}			-	420	800	

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.

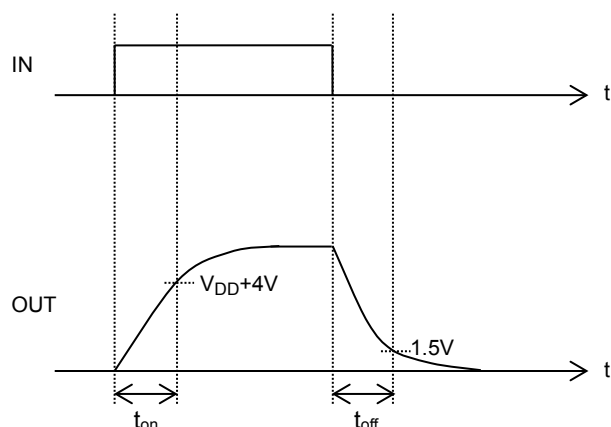
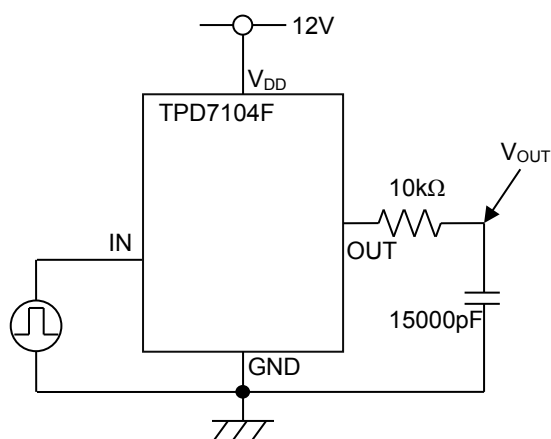
But, when $V_{RISref}(R_{IS} \times I_{ISref})$ is over V_{ISOC} , the current detection voltage is V_{ISOC} .

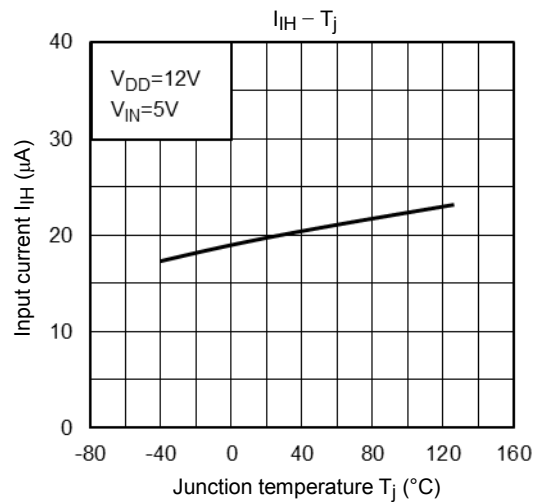
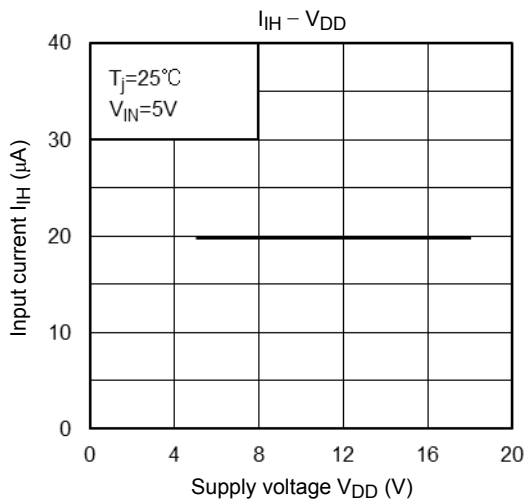
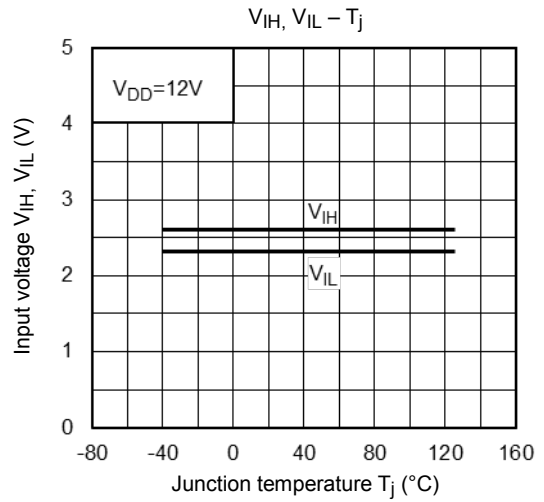
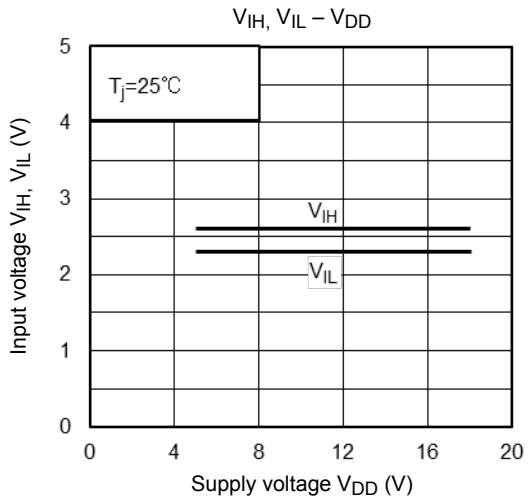
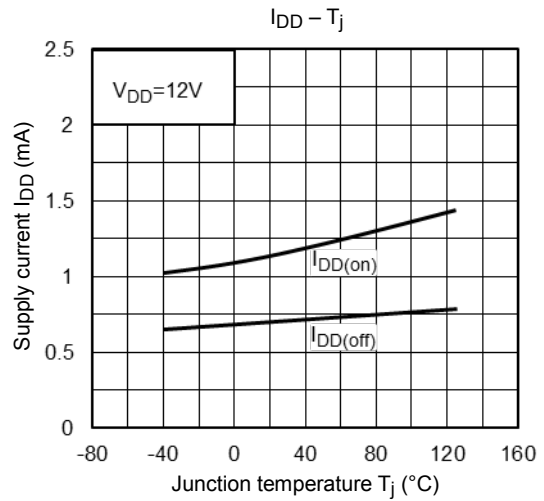
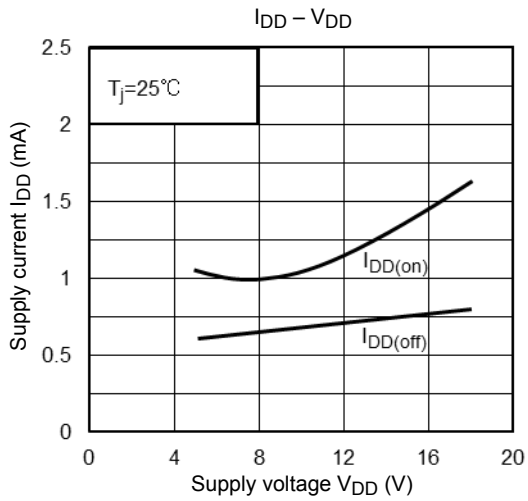
Note4 : About the charge pump voltage

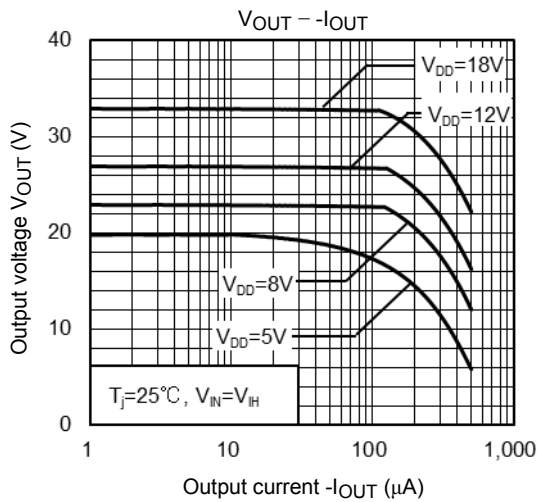
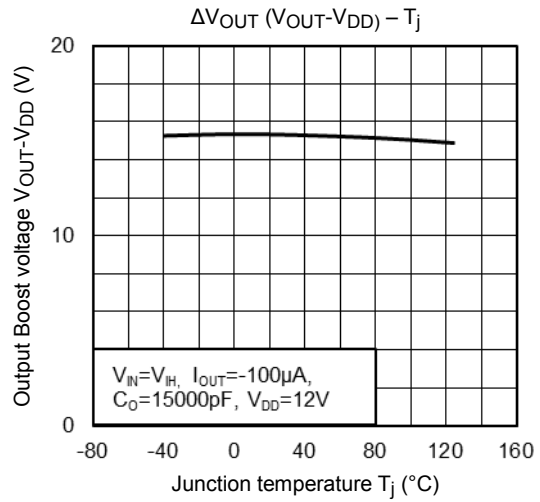
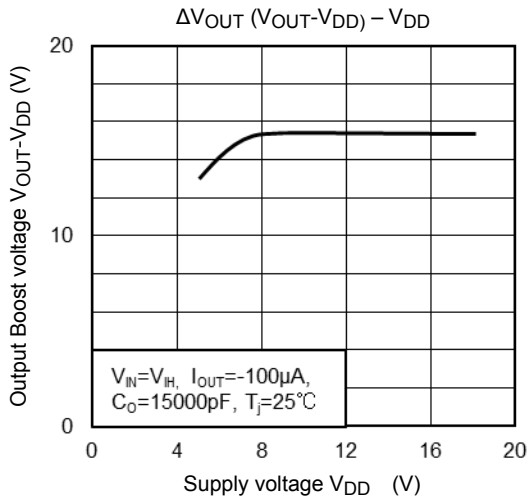
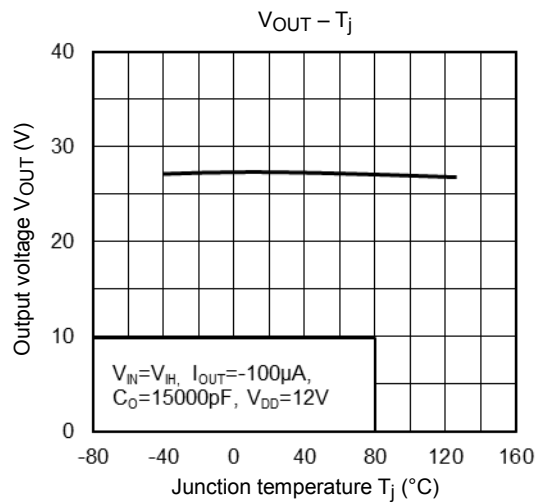
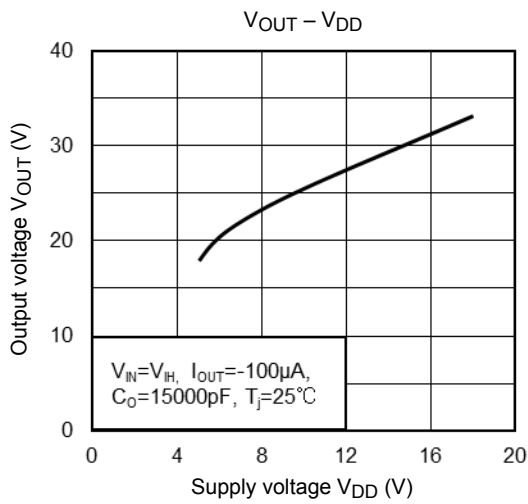
So as not to apply over-voltage to the gate-source voltage (V_{GS}) of external power MOSFET, and so as to become the best driving voltage, the clamping circuit is built into.

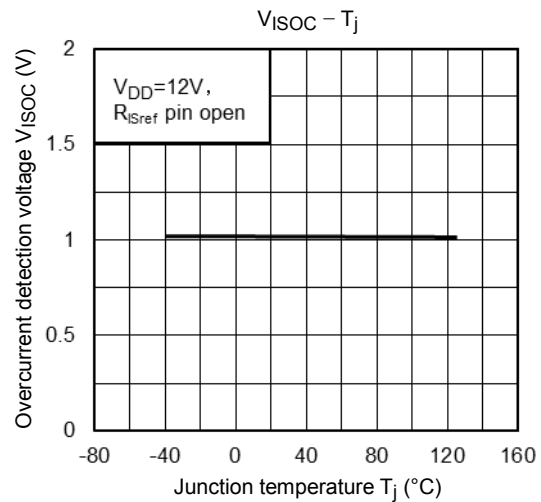
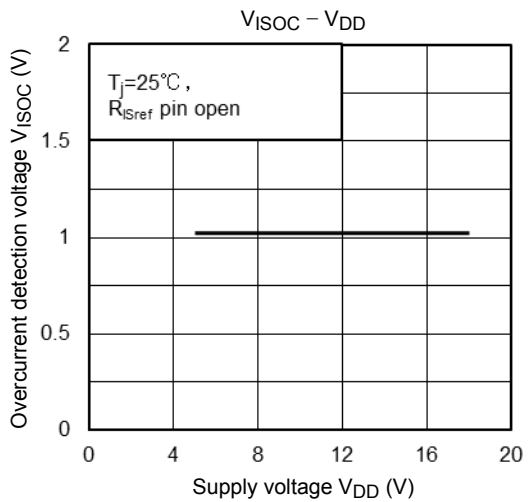
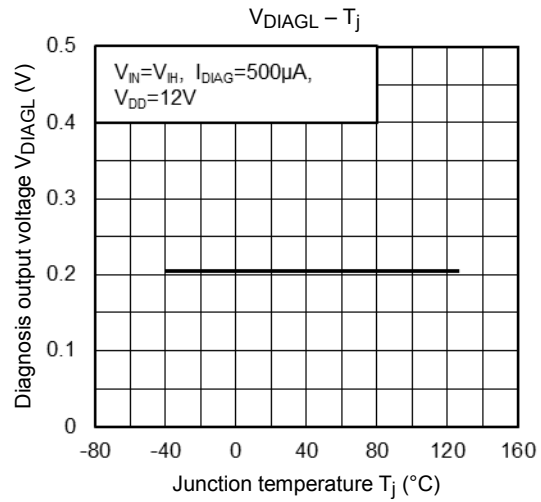
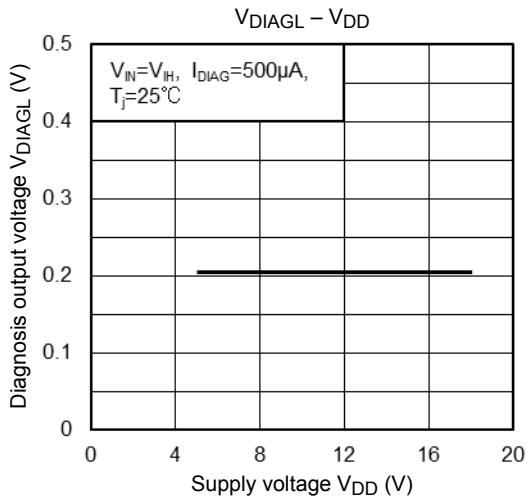
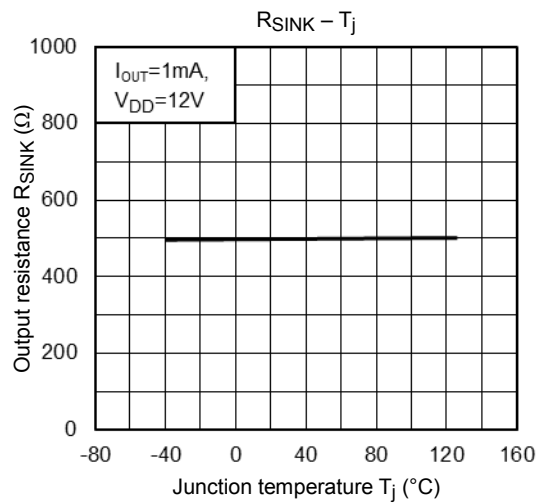
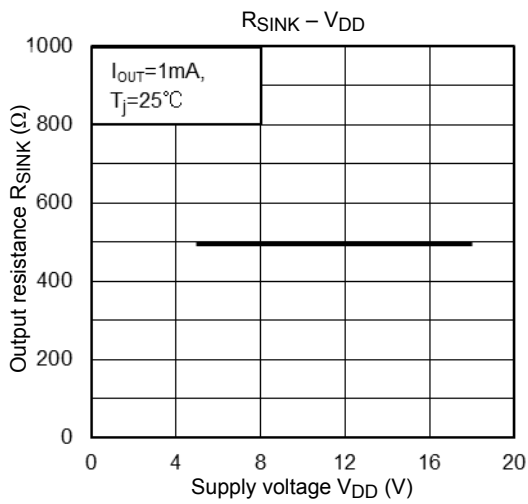
And it doesn't output over 36V(Typ.) , because of protection of itself.

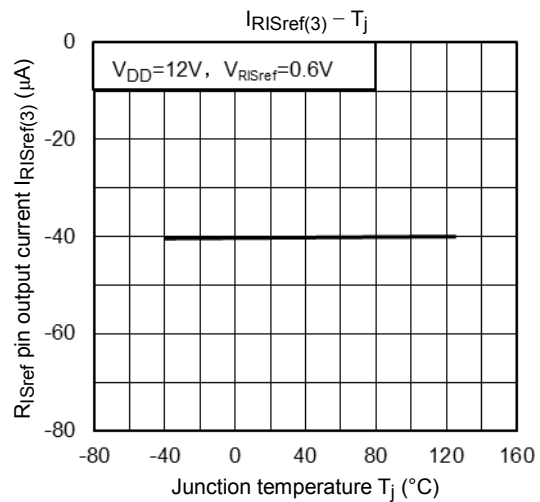
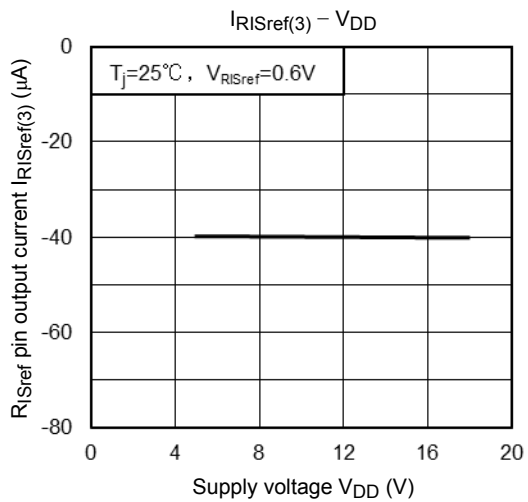
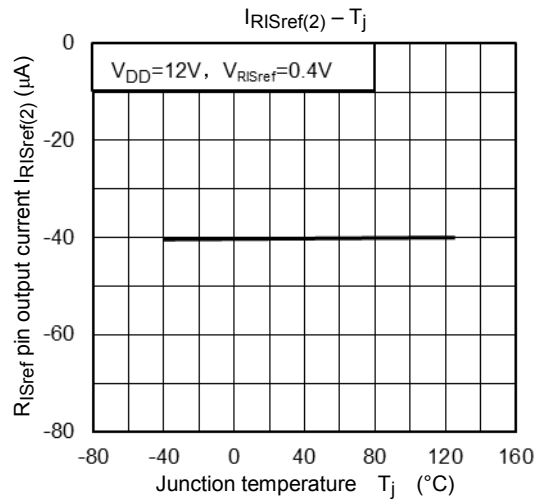
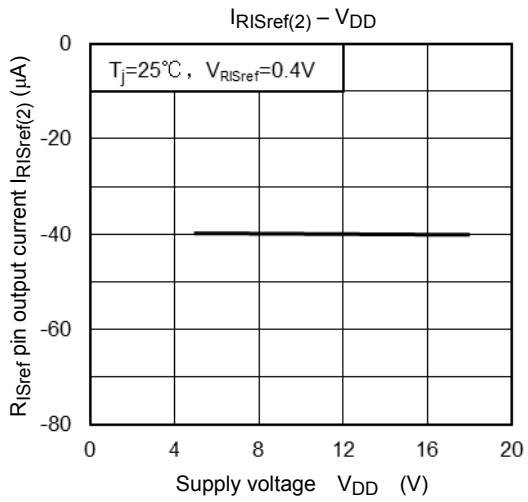
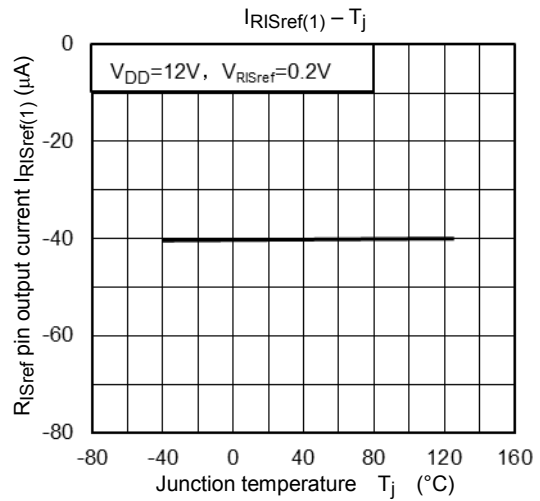
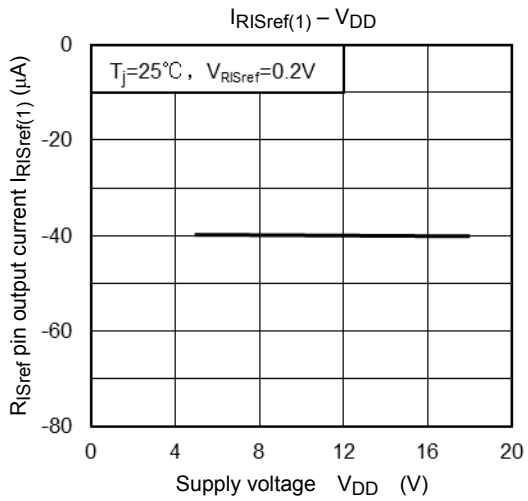
Test circuit for switching time

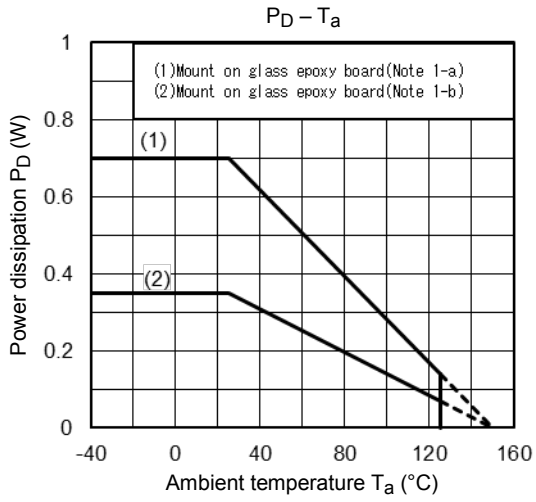
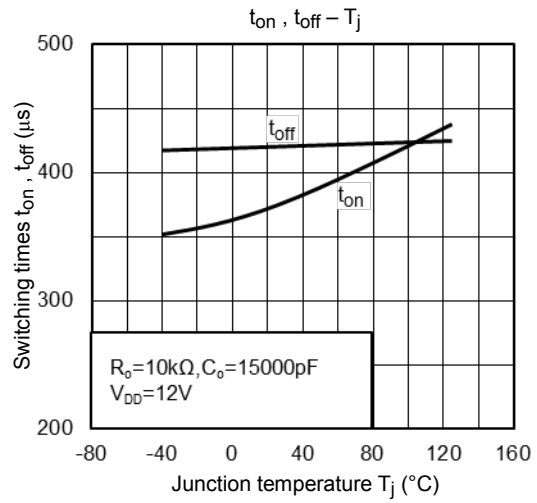
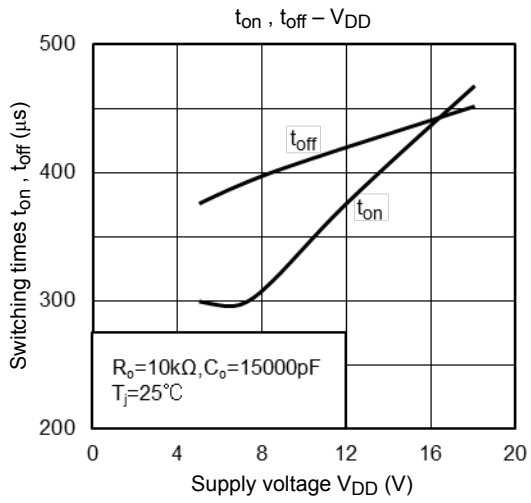












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