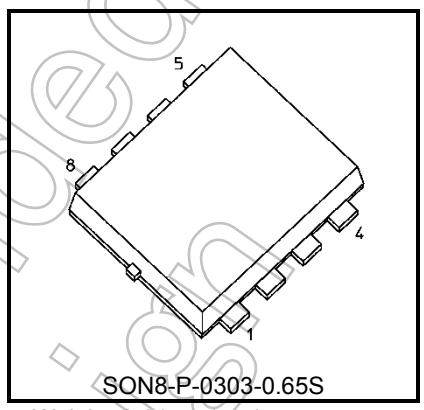
TOSHIBA Intelligent Power Device Silicon Monolithic Power MOS Integrated Circuit

TPD7104F

1 channel High-Side N channel Power MOSFET Gate Driver

TPD7104F 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.



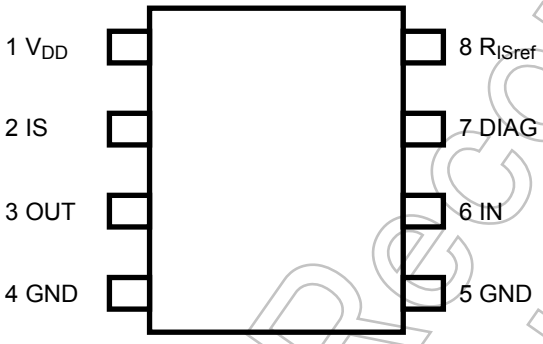
SON8-P-0303-0.65S

Weight: 0.017 g (typ.)

Features

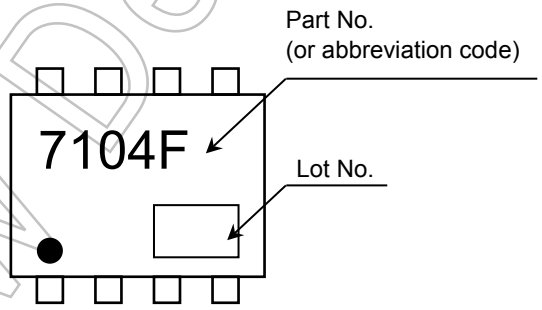
- Charge pump circuit is built in
- Over current protection circuit is built in
- Housed in the PS-8 package and supplied in embossed carrier tape

Pin Assignment (top view)



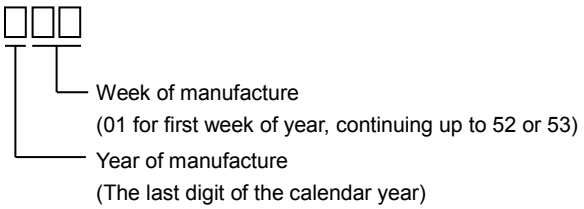
Note: 4pin and 5pin should short-circuit externally.

Marking



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

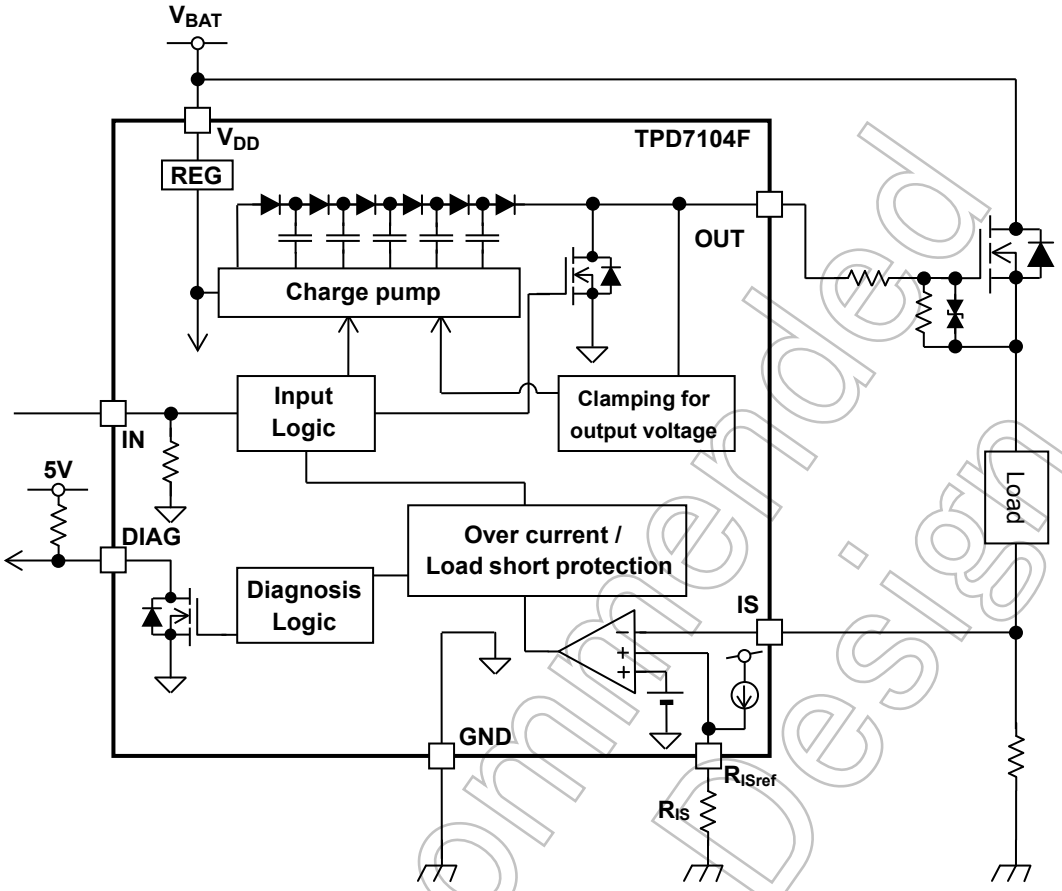
*Weekly code: (Three digits)



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

Start of commercial production
2014-9

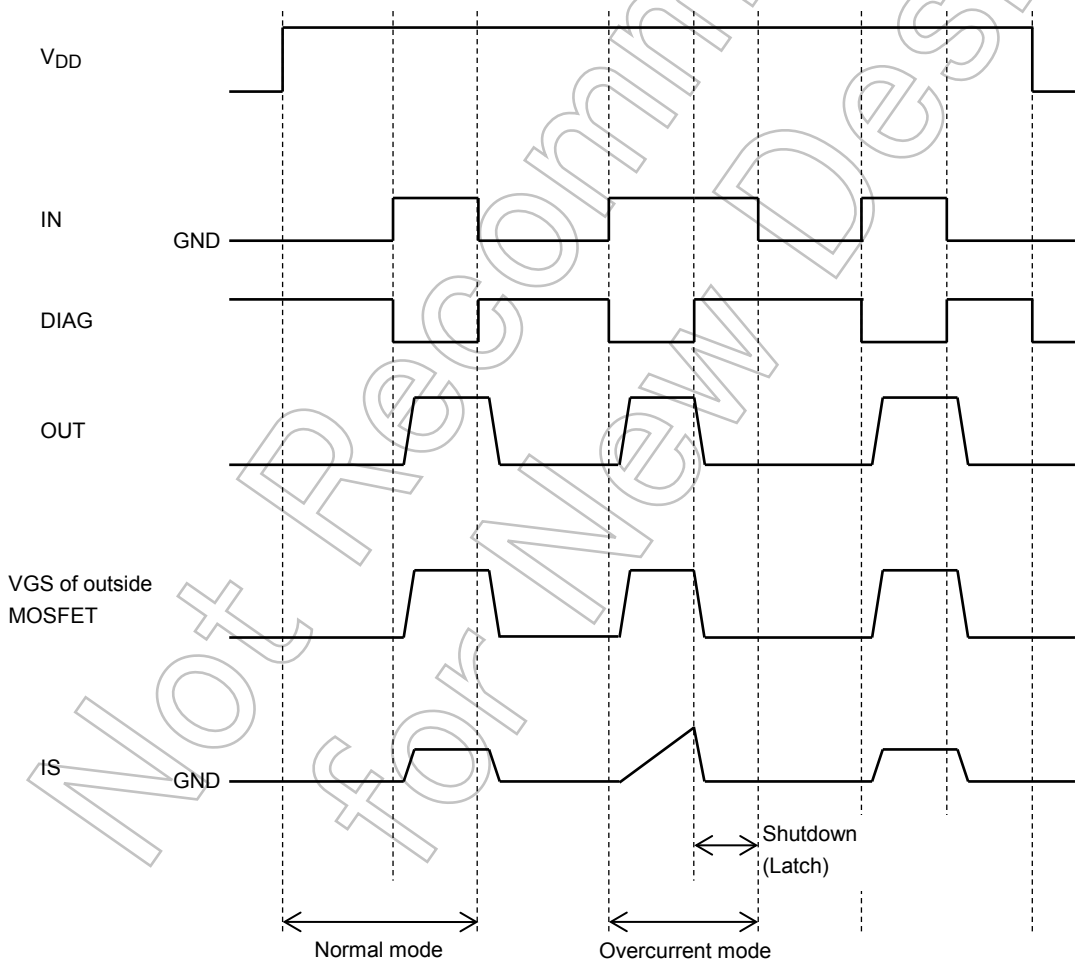
Block Diagram / Application circuit



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	-

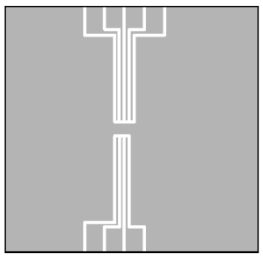
Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.)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

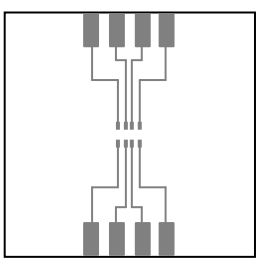
Note 1:

(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)

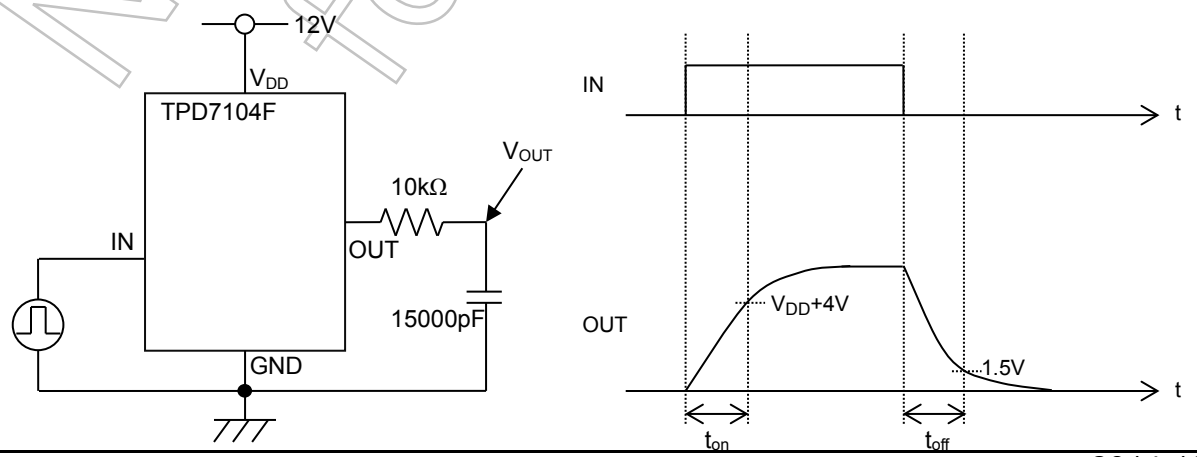
Characteristics	Symbol	Pin	Test Condition	Min	Typ.	Max	Unit
Operating supply voltage	$V_{DD(OPR)}$	V_{DD}	-	5	12	18	V
Supply current	$I_{DD(off)}$	V_{DD}	V_{DD} = 12V, V_{IN} = V_{IL}, T_j=25°C	-	0.7	3	mA
	$I_{DD(on)}$	V_{DD}	V_{IN} = V_{IH}, output is open circuit	-	-	5	mA
Input voltage	V_{IH}	IN	-	3.5	-	-	V
	V_{IL}		-	-	-	1.5	
Input current	I_{IH}	IN	V_{IN} = 5V	-	20	50	μA
	I_{IL}		V_{IN} = 0V	-1	-	1	
Output voltage	V_{OUT}	OUT	V_{DD} = 5V, V_{IN} = V_{IH}, I_{OUT} = -100μA, C_o = 15000pF	V_{DD} +8	V_{DD} +13	V_{DD} +18	V
	V_{OUT}	OUT	V_{DD} = 8 to 18V, V_{IN} = V_{IH}, I_{OUT} = -100μA, C_o = 15000pF	V_{DD} +10	V_{DD} +15.7	V_{DD} +18	V
Output resistance	R_{SINK}	OUT	I_{OUT} = 1mA	-	500	800	Ω
Diagnosis output leakage current	I_{DIAGH}	DIAG	V_{IN} = V_{IL}, V_{DIAG} = 5V	-	-	10	μA
Diagnosis output voltage	V_{DIAGL}	DIAG	V_{IN} = V_{IH}, I_{DIAG} = 500μA	-	-	0.4	V
Over current detection voltage	V_{ISOC}	IS	V_{DD} = 12V, 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} = 0.2V	-60	-40	-20	μA
	$I_{ISref(2)}$	R_{ISref}	V_{RISref} = 0.4V	-60	-40	-20	μA
	$I_{ISref(3)}$	R_{ISref}	V_{RISref} = 0.6V	-60	-40	-20	μA
Switching time	t_{on}	OUT	Refer to Test circuit, T_j = 25°C	-	370	800	μs
	t_{off}			-	420	800	

Note2 : Typical condition is V_{DD}=12V, T_j=25°C.

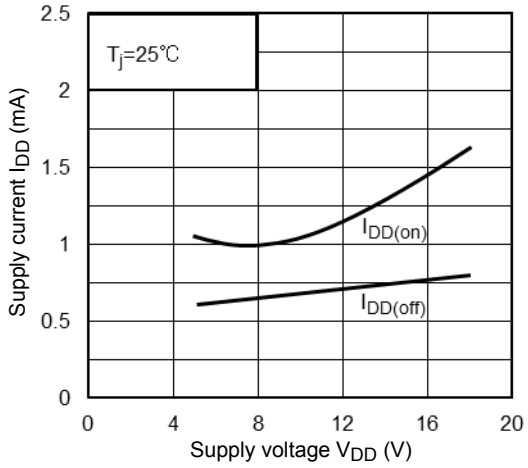
Note3 : The current detection voltage is controllable, when connecting resistance to R_{ISref} pin.
But, when V_{RISref}(R_{IS}×I_{ISref}) is over V_{ISOC}, the current detection voltage is V_{ISOC}.

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.

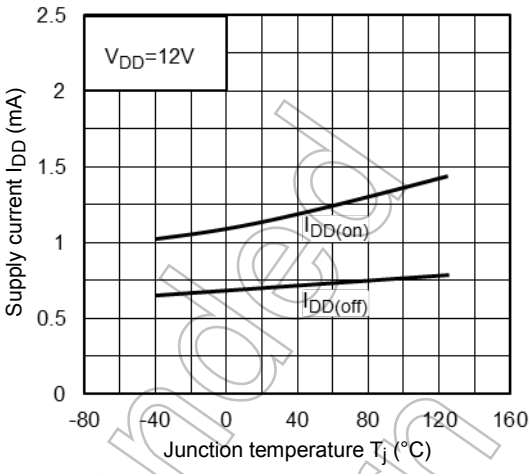
Test circuit for switching time



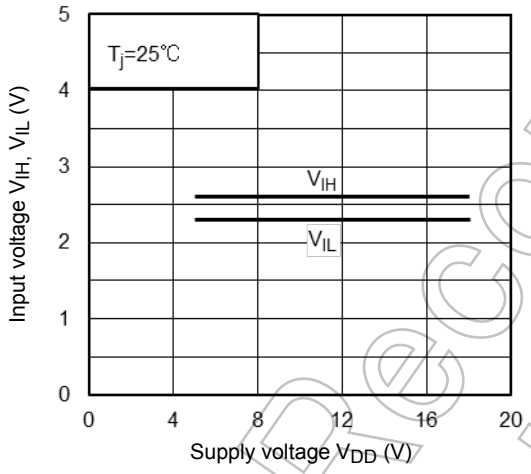
$I_{DD} - V_{DD}$



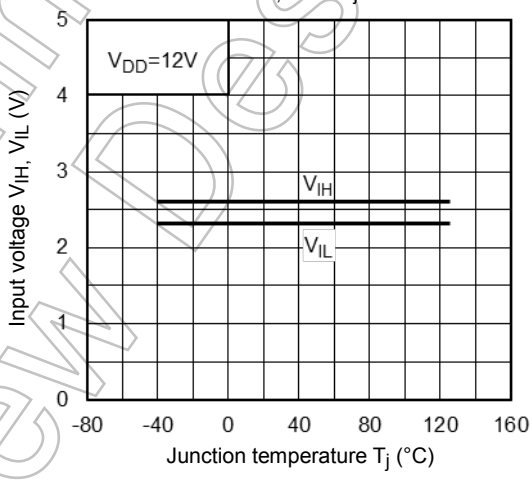
$I_{DD} - T_j$



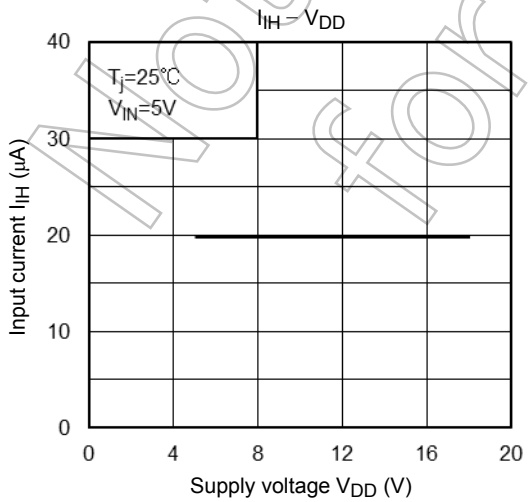
$V_{IH}, V_{IL} - V_{DD}$



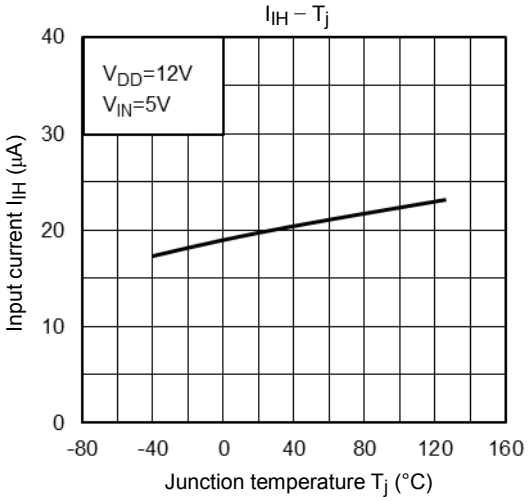
$V_{IH}, V_{IL} - T_j$



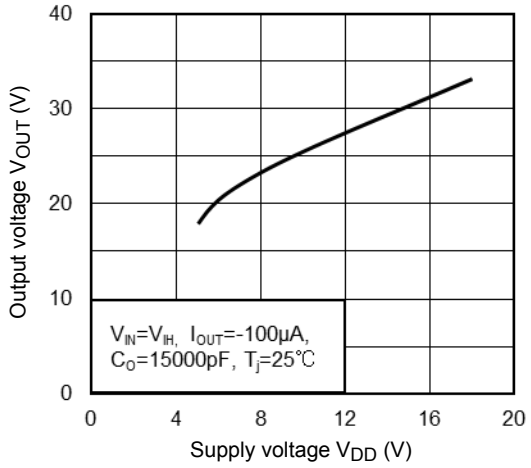
$I_{IH} - V_{DD}$



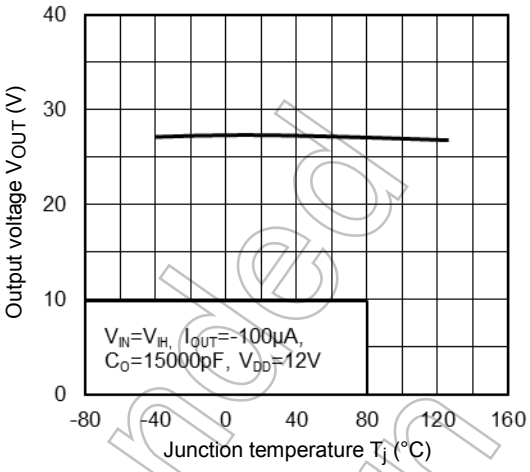
$I_{IH} - T_j$



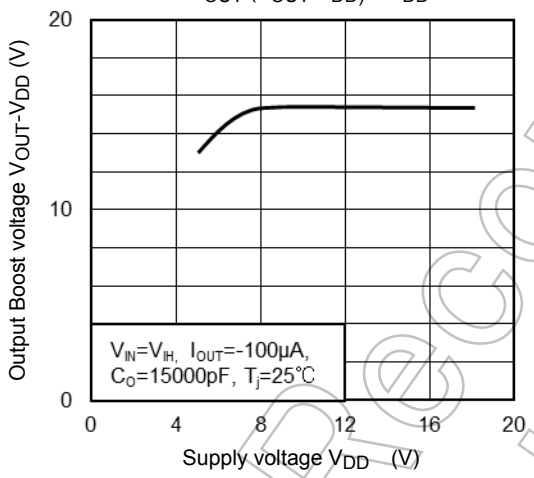
V_{OUT} – V_{DD}



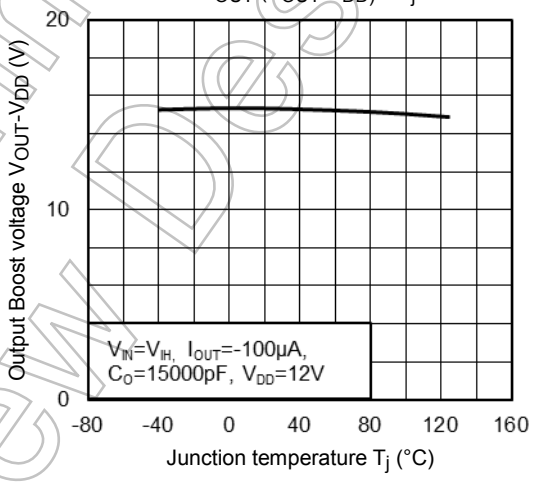
V_{OUT} – T_j



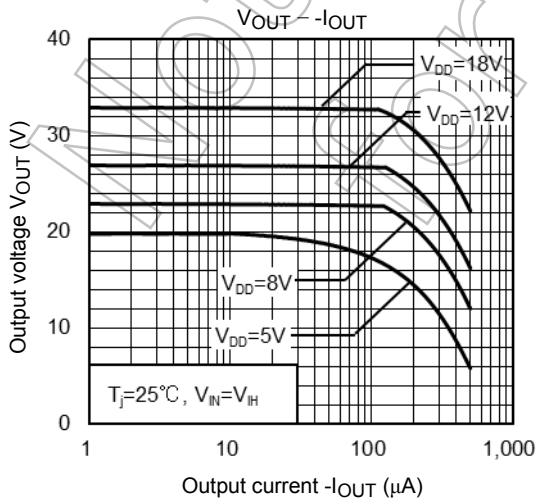
ΔV_{OUT} (V_{OUT}-V_{DD}) – V_{DD}



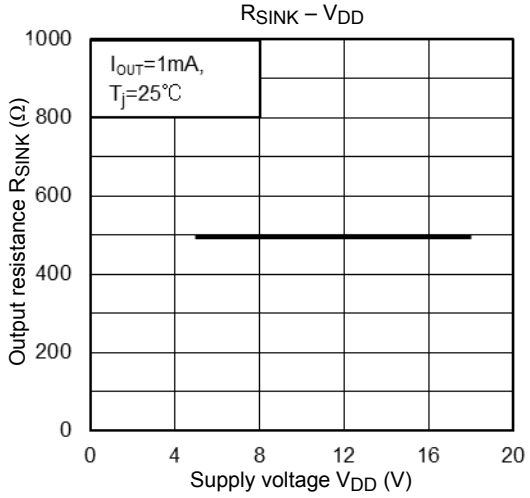
ΔV_{OUT} (V_{OUT}-V_{DD}) – T_j



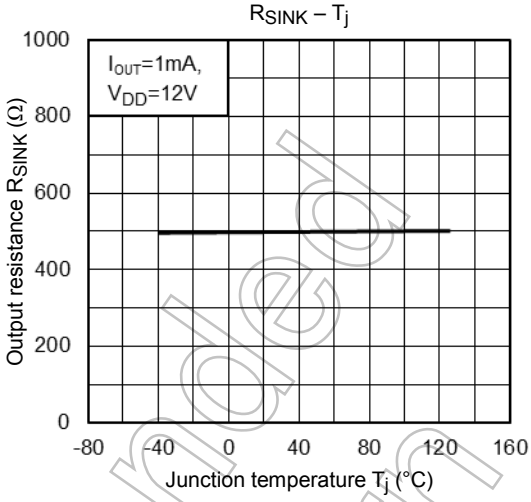
V_{OUT} – -I_{OUT}



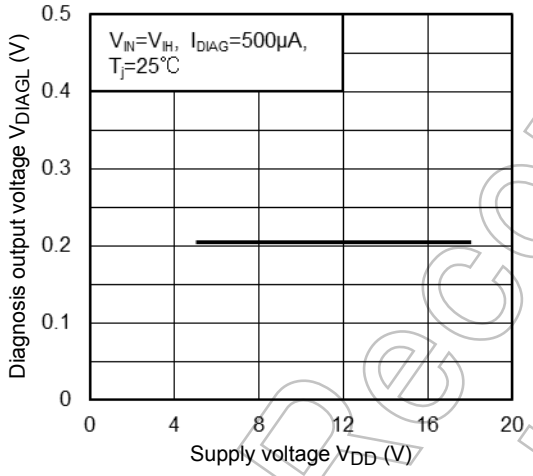
R_{SINK} – V_{DD}



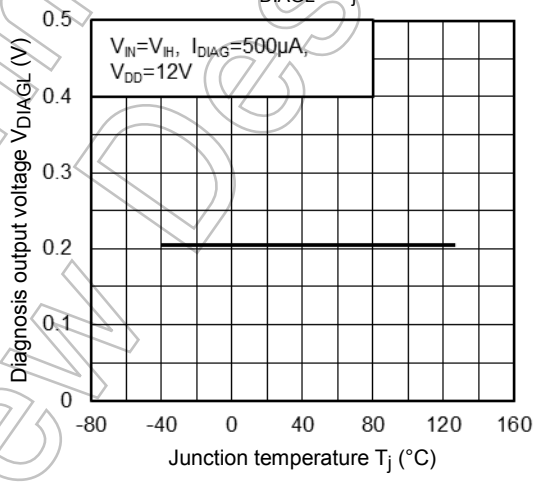
R_{SINK} – T_j



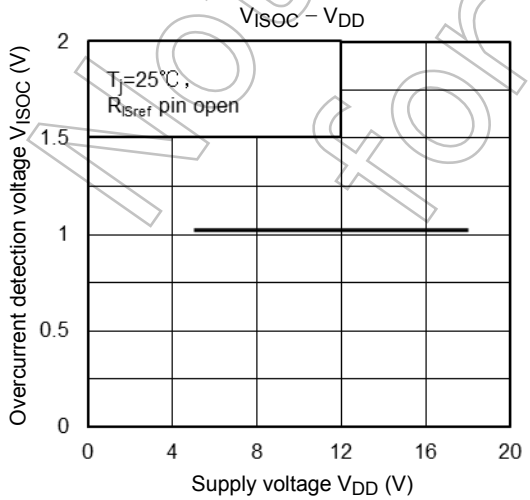
V_{DIAGL} – V_{DD}



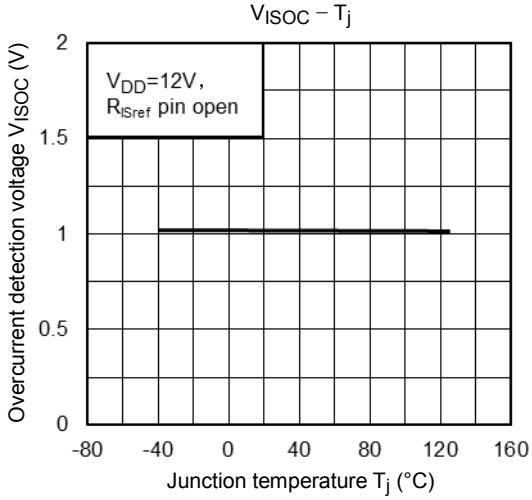
V_{DIAGL} – T_j



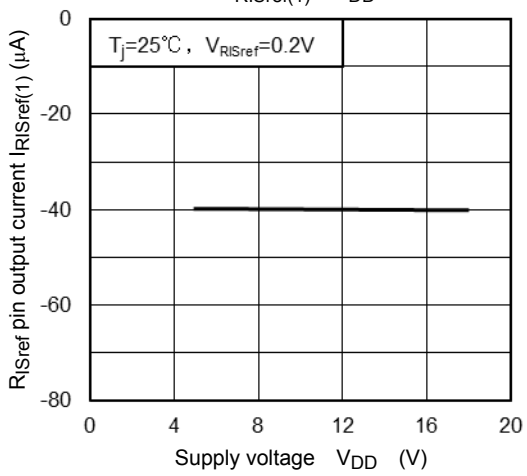
V_{ISOC} – V_{DD}



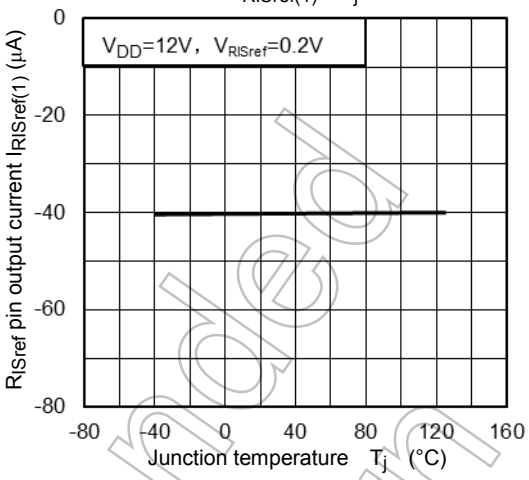
V_{ISOC} – T_j



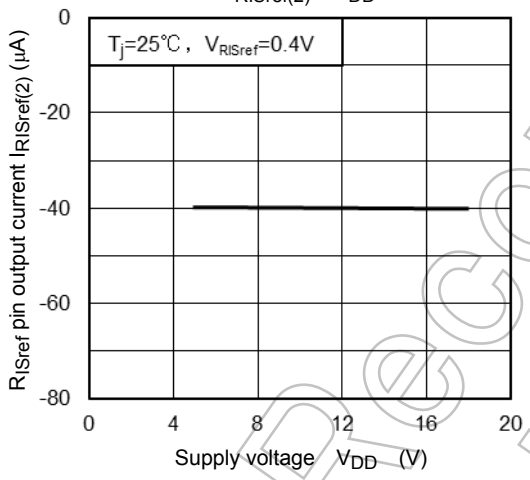
$I_{RISref(1)} - V_{DD}$



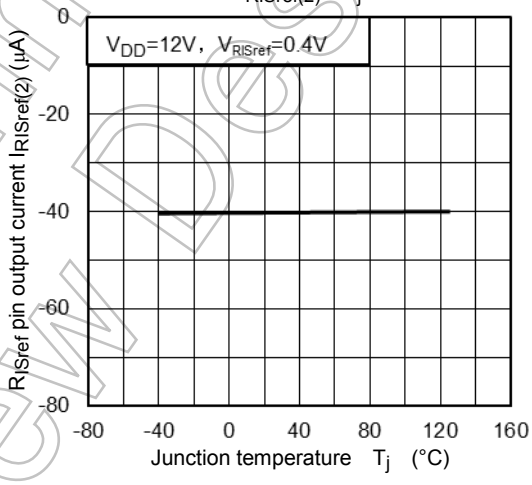
$I_{RISref(1)} - T_j$



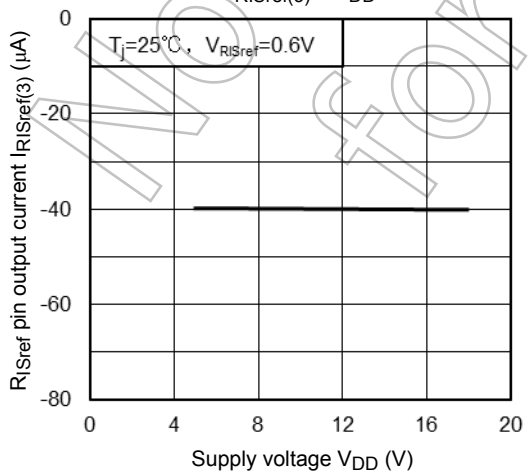
$I_{RISref(2)} - V_{DD}$



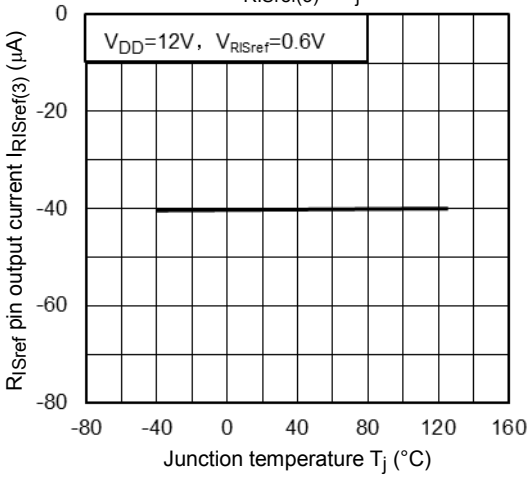
$I_{RISref(2)} - T_j$



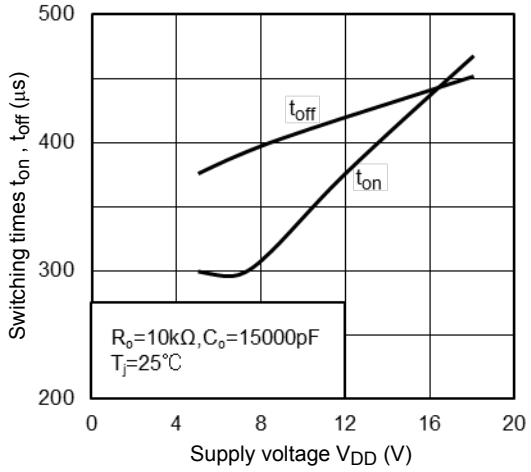
$I_{RISref(3)} - V_{DD}$



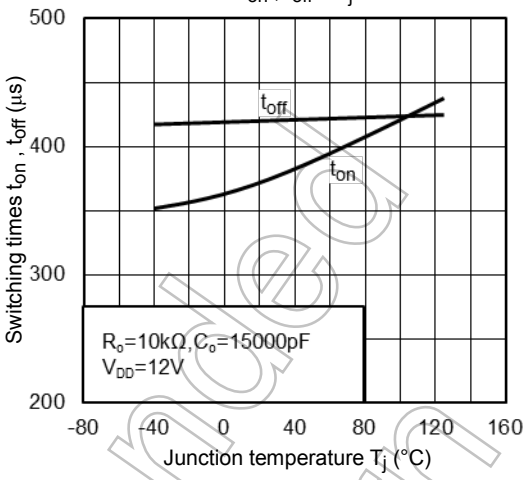
$I_{RISref(3)} - T_j$



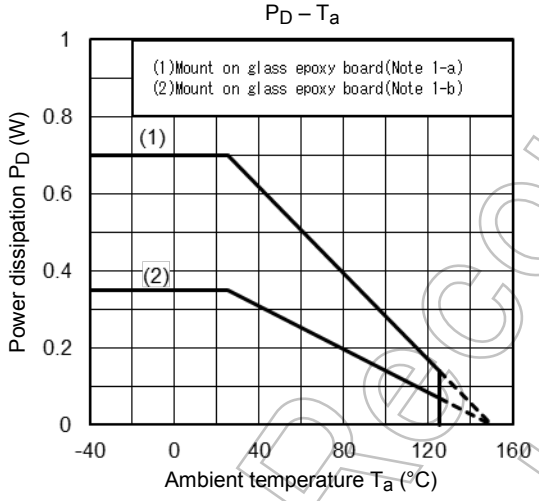
t_{on} , t_{off} – V_{DD}



t_{on} , t_{off} – T_j



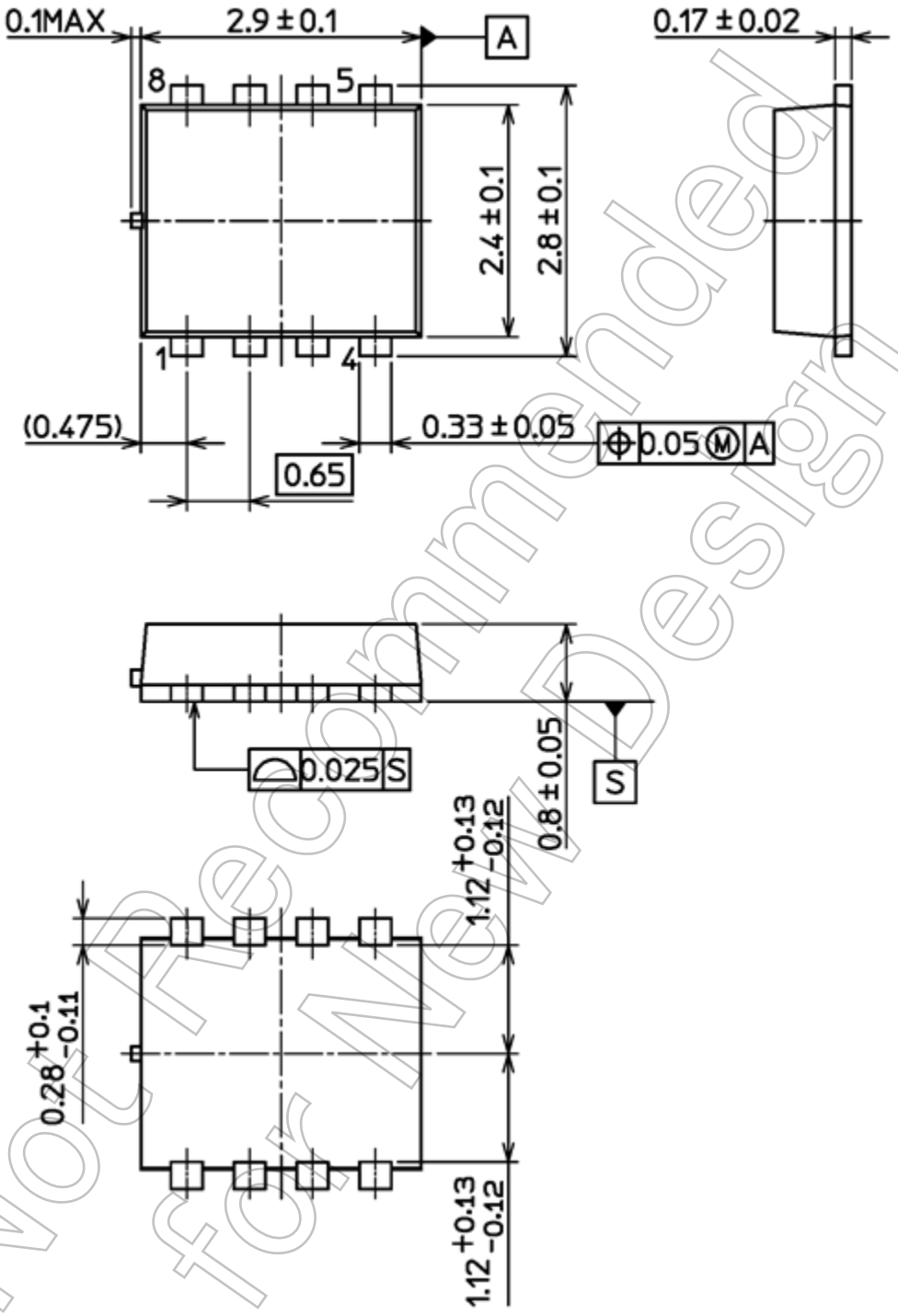
P_D – T_a



Package Dimensions

SON8-P-0303-0.65S

Unit: mm



Weight: 0.017g (typ.)

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