

# Temperature Switch IC With Enable

## Monolithic IC MM3588

### Outline

This IC is a temperature switch IC that senses the IC ambient temperature and switches the IC output from the Low to the High level when there is a detected temperature.

With the hysteresis circuit, IC output level keeps High until the ambient temperature falls to hysteresis temperature after detection.

The detection temperature can be selected in the range of  $60^{\circ}\text{C} \leq \text{TDET} \leq 90^{\circ}\text{C}$  at  $1.0^{\circ}\text{C}$  steps using rank expansion, with detection temperature accuracy of  $\pm 2.0^{\circ}\text{C}$ .

### Features

1. Low current consumption (Typ.  $1.5\mu\text{A}$ )
2. With enable function pin
3. Low operating power supply voltage (Operating voltage 1.6~5.0V)

### Package

SSON-6J

### Applications

1. Mobile phone
2. Video games
3. Laptops
4. System temperature monitoring, etc.

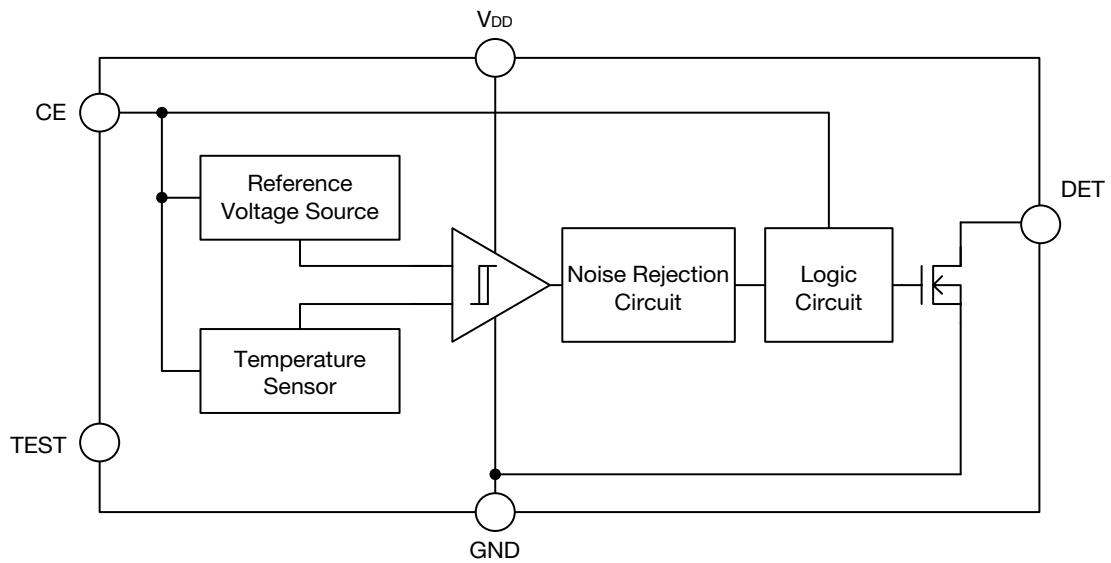
Model Name

M M 3 5 8 8 X X X R R E  
 1 2 3 4

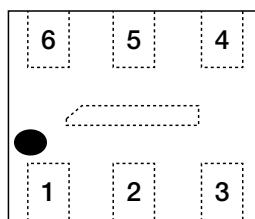
1		2	
Hysteresis Temperature (T <sub>HYS</sub> )		Detecting Temperature (T <sub>DET</sub> )	
A	T <sub>HYS</sub> =5.0°C	60	T <sub>DET</sub> =60°C
B	T <sub>HYS</sub> =10°C	70	T <sub>DET</sub> is 1.0°C steps
C	T <sub>HYS</sub> =15°C	90	T <sub>DET</sub> =90°C

3		4	
Package		Packing Specifications	
R	SSON-6J	R	R HOUSING (Standard)
		L	L HOUSING

Block Diagram



Pin Assignment



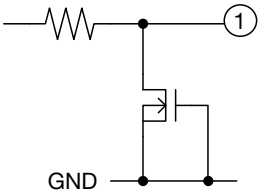
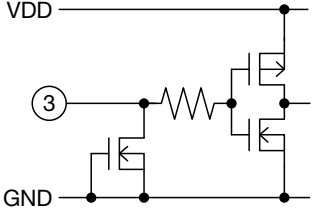
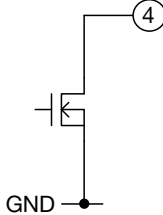
1	TEST
2	GND
3	CE
4	DET
5	N.C.
6	V <sub>DD</sub>

SSON-6J (TOP VIEW)

Exposed Die Pad \*1

\*1 : The tab on the center of the bottom face is connected to the IC substrate inside the package. To use the device, it should be shorted to GND or OPEN.

## Pin Description

Pin No.	Pin Name	Function	Internal Equivalent Circuit									
1	TEST*2	Testing pin										
2	GND	Ground pin										
3	CE*3	ON/OFF-CONTROL PIN <table border="1" data-bbox="507 678 991 795"> <thead> <tr> <th>CE</th> <th colspan="2">DET</th> </tr> </thead> <tbody> <tr> <td>L</td> <td>OFF</td> <td>High Impedance</td> </tr> <tr> <td>H</td> <td>ON</td> <td>Standard Mode</td> </tr> </tbody> </table>	CE	DET		L	OFF	High Impedance	H	ON	Standard Mode	
CE	DET											
L	OFF	High Impedance										
H	ON	Standard Mode										
4	DET	Temp. Detect Output Pin										
5	N.C.	NO CONNECTION										
6	VDD	Power supply pin										

\*2 : Testing pin is connected with the internal circuit for testing.

When resistance and capacity are connected with Testing pin, this product produce improper operating signals. Please set Testing pin to the open state.

\*3 : If any inputs are left open, since the input potential is undefined, the output logic level will be undefined, creating an unstable operating state. Connect CE pin with VDD pin, when it is not used.

## Absolute Maximum Ratings

Item	Symbol	Ratings	Units
Supply voltage	VDD <sub>max</sub>	-0.3~6.0	V
DET output voltage	VDET <sub>max</sub>	-0.3~6.0	V
CE input voltage	VCE <sub>max</sub>	-0.3~6.0	V
Junction temperature	T <sub>jMAX</sub>	150	°C
Storage temperature	T <sub>stg</sub>	-55~150	°C
Power dissipation	Pd	250	mW

## Recommended Operating Conditions

Item	Symbol	Ratings	Units
Operating ambient temperature	T <sub>opr</sub>	-30~125	°C
Operating voltage	V <sub>DD</sub>	1.6~5.0	V

**Electrical Characteristics** (Except where noted otherwise Ta=25°C)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Units	*4
Operating supply voltage	V <sub>DD</sub>	T <sub>DET</sub> =60~90°C	1.6	1.8	5.0	V	
Detecting temperature accuracy*5	T <sub>DETAC</sub>	V <sub>DD</sub> =1.8V	-2.0		2.0	°C	A
Hysteresis temperature*6	T <sub>HYS</sub>	THYS=5.0°C	2.5	5.0	7.5	°C	A
		THYS=10°C	7	10	13		
		THYS=15°C	10.5	15.0	19.5		
Supply current	I <sub>DD</sub>	CE=V <sub>DD</sub> , Ta=+25°C		1.5	2.0	μA	B
		CE=GND, Ta=+25°C			0.1	μA	C
DET sink current	I <sub>DETL</sub>	V <sub>DET</sub> =0.4V	4	12		mA	D
DET leak current	I <sub>LEAK</sub>	V <sub>DET</sub> =5.0V			0.1	μA	E
CE input current	I <sub>CE</sub>	V <sub>CE</sub> =H Level			0.1	μA	F
CE high threshold voltage	V <sub>CEH</sub>	V <sub>CE</sub> =H Level	1.4		V <sub>DD</sub> +0.3	V	G
CE low threshold voltage	V <sub>CEL</sub>	V <sub>CE</sub> =L Level	0		0.2	V	G
CE response time	t <sub>CER</sub>				200	μs	H
Noise rejection time	t <sub>noise</sub>	Ta=60~90°C		250	500	μs	A
V <sub>DD</sub> start-up response time	t <sub>VSR</sub>	RPULL-UP=1MΩ		100	500	μs	I

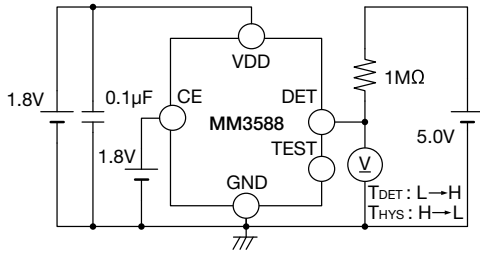
\*4 : The test circuit symbols.

\*5 : Detection temperature can be selected in 1.0°C steps (60~90°C).

\*6 : Hysteresis temperature can be selected in 5.0°C steps (5.0°C, 10°C, 15°C).

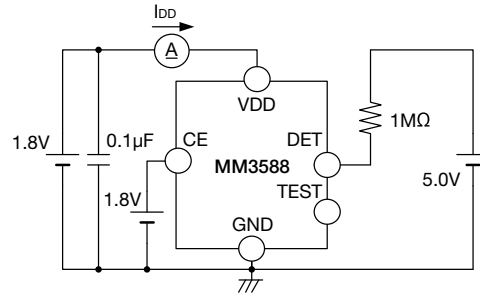
Measuring Circuit

A. Detecting Temperature

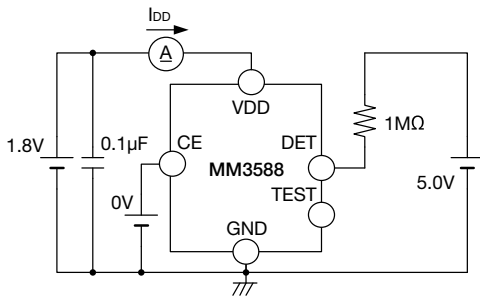


L : State of DET output Low level  
 H : State of DET output High level  
 $T_a = 40 \leftrightarrow 100^\circ\text{C}$

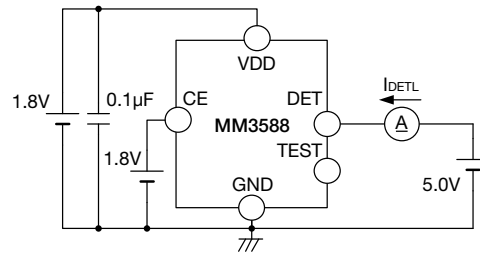
B. Supply Current



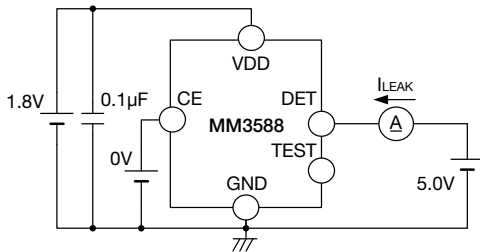
C. Supply Current (VCE=GND)



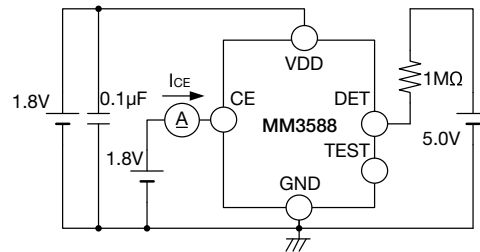
D. DET Sink Current



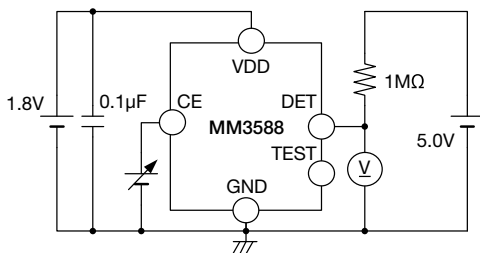
E. DET Leak Current



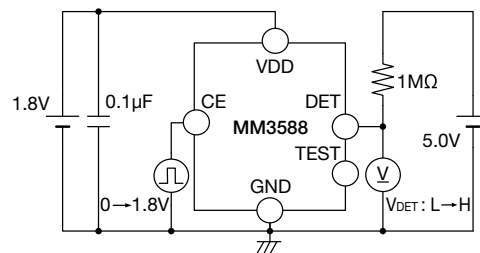
F. CE Pin Current



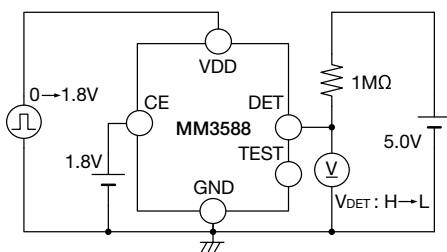
G. CE Threshold Voltage



H. CE Response Time

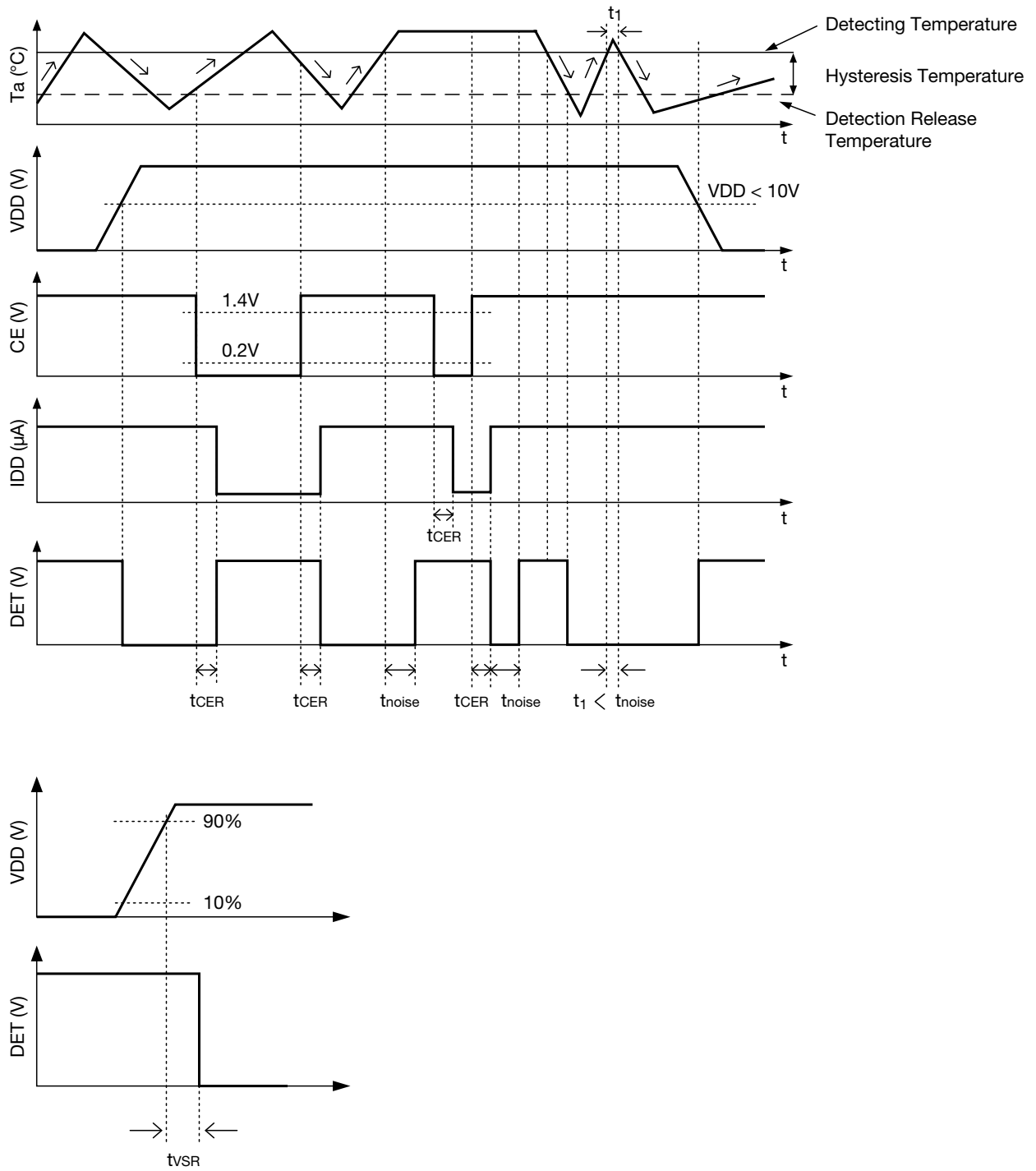


I. VDD Start-up Response Time



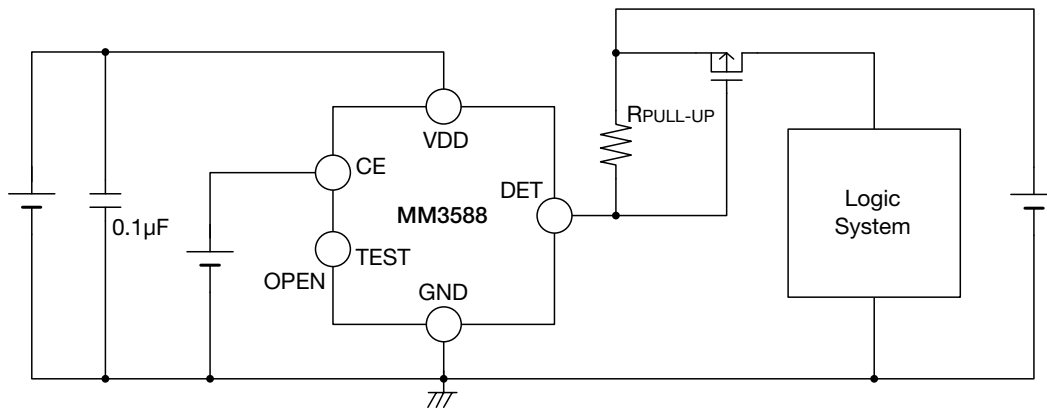
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Timing Chart



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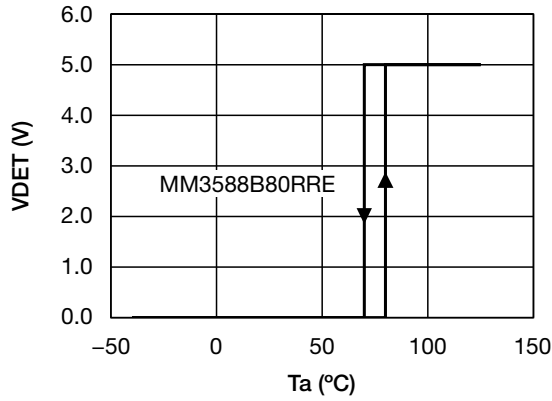
Application Circuit



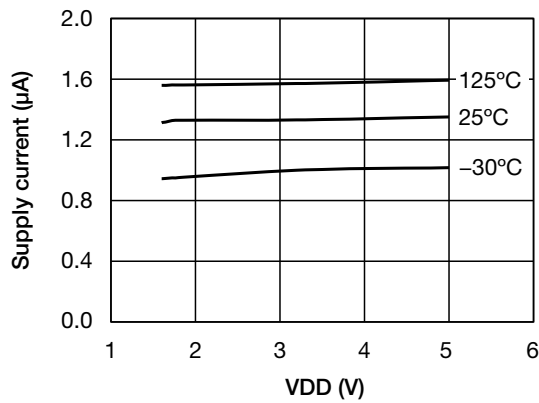
- We shall not be liable for any trouble or damage caused by using this circuit.
- In the event a problem which may affect industrial property or any other rights of us or a third party is encountered during the use of information described in these circuit, Mitsumi Electric Co., Ltd. shall not be liable for any such problem, nor grant a license therefore.

**Characteristics** (Except where noted otherwise  $T_a=25^\circ\text{C}$ ,  $V_{DD}=1.8\text{V}$ )

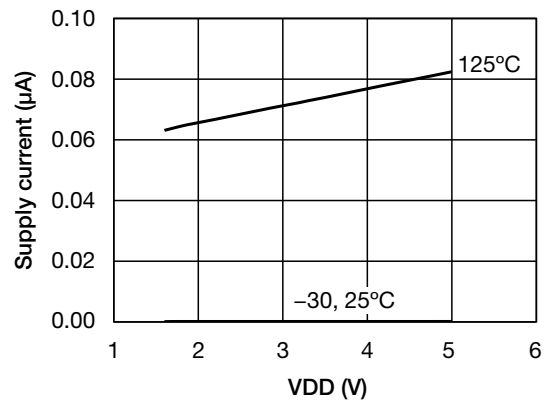
**Ambient temperature - DET output voltage**



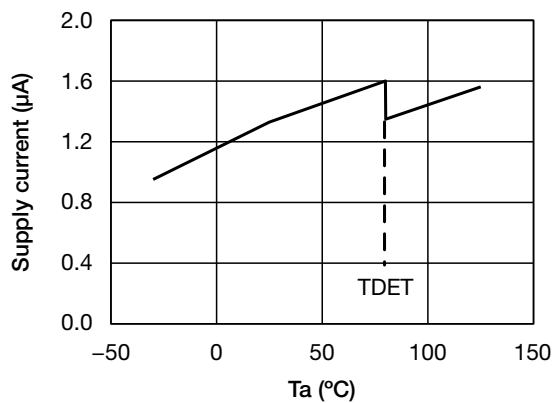
**Supply voltage - Supply current (CE=VDD)**



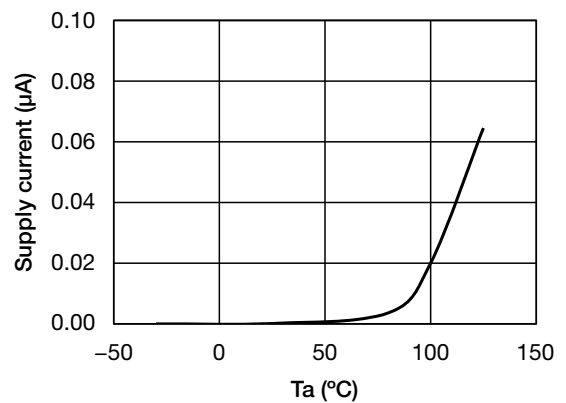
**Supply voltage - Supply current (CE=GND)**



**Ambient temperature - Supply current (CE=VDD)**

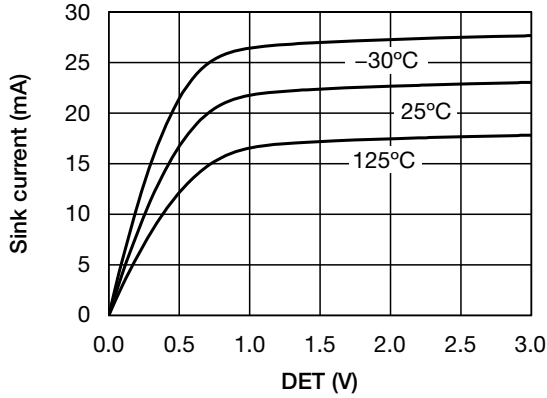


**Ambient temperature - Supply current (CE=GND)**

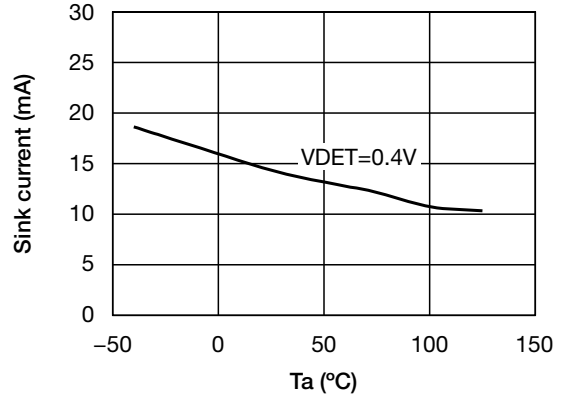


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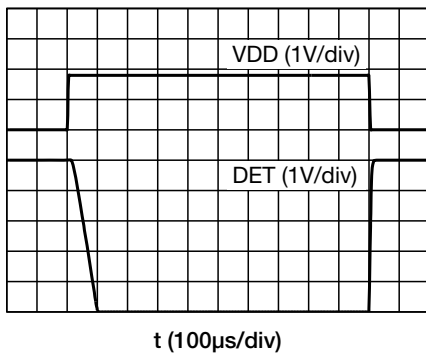
■ Supply voltage - DET sink current



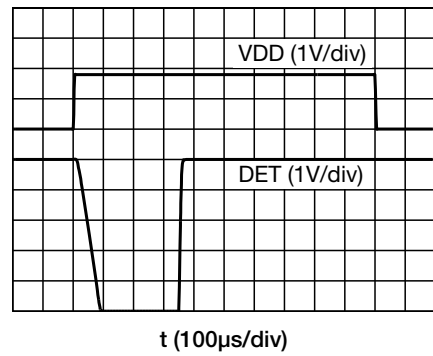
■ Ambient temperature - DET sink current



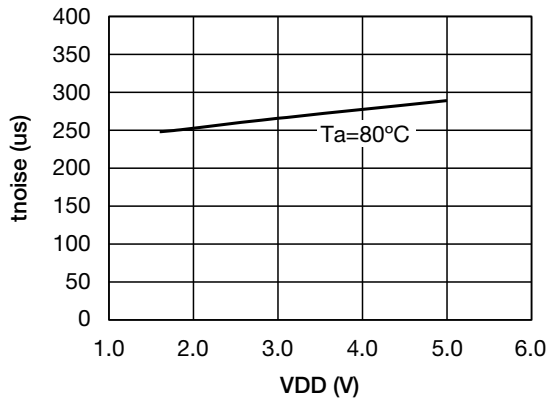
■ Start-up response (Ta < TDET)



■ Start-up response (Ta ≥ TDET)



■ Supply voltage - Noise rejection time



■ Ambient temperature - Noise rejection time

