Isolation Voltage 2500Vrms
1ch Gate Driver Providing Galvanic Isolation

BM6105AFW-LBZ

General Description

This is the product guarantees long time support in Industrial market. As these applications, it is the best product when used.

The BM6105AFW-LBZ is a gate driver with isolation voltage 2500Vrms, I/O delay time of 120ns, and minimum input pulse width of 60ns. The miller clamp function, fault signal output functions, ready signal output function, under voltage lockout (UVLO) function, and desaturation protection (DESAT) function are built-in.

Features

- Long Time Support Product for Industrial Applications.
- Providing Galvanic Isolation 1ch
- Miller Clamp Function
- Fault Signal Output Function
- Ready Signal Output Function
- Under Voltage Lockout Function
- Desaturation Protection Function
- Supporting Negative VEE2

Applications

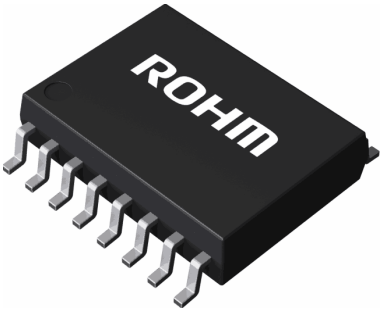
- Driving IGBT Gate for Industrial Equipment
- Driving MOSFET Gate for Industrial Equipment

Key Specifications

- Isolation Voltage: 2500Vrms
- Maximum Gate Drive Voltage: 20V
- I/O Delay Time: 120ns (Max)
- Minimum Input Pulse Width: 60ns (Max)

Package W(Typ) x D(Typ) x H(Max)

SOP16WM 10.34mm x 10.31mm x 2.64mm



SOP16WM

Typical Application Circuit

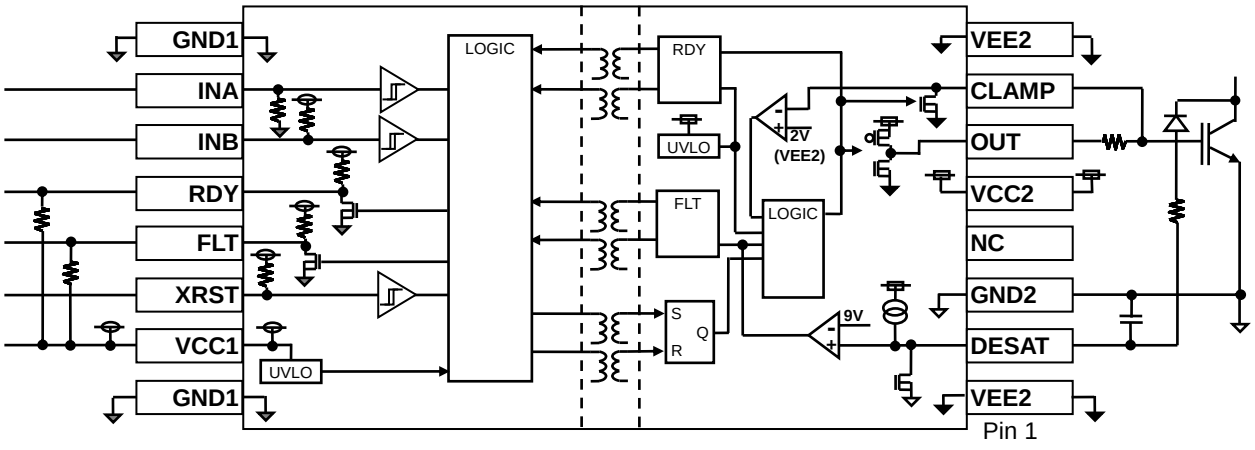


Figure 1. Typical Application Circuit

Contents

Recommended Range of External Constants

Pin Name	Symbol	Recommended Value			Unit
		Min	Typ	Max	
VCC1	C_{VCC1}	0.1	1.0	-	μF
VCC2	C_{VCC2}	0.33	-	-	μF

Pin Configurations

(TOP VIEW)

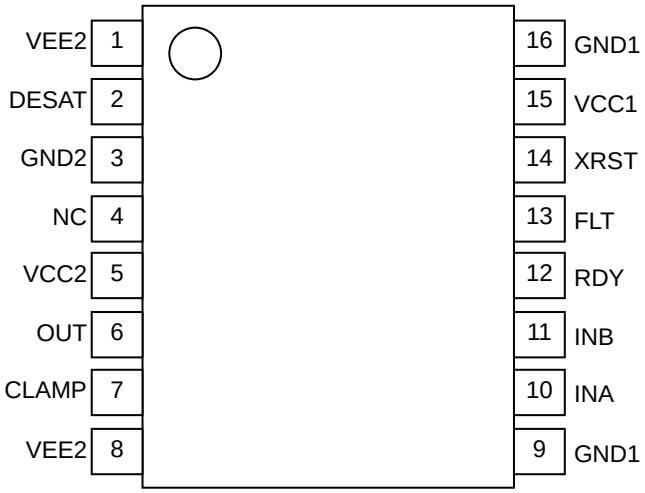


Figure 2. Pin Configuration

Pin Descriptions

Pin No.	Pin Name	Function
1	VEE2	Output-side negative power supply pin
2	DESAT	Desaturation detection pin
3	GND2	Output-side ground pin
4	NC	Non-connection
5	VCC2	Output-side positive power supply pin
6	OUT	Output pin
7	CLAMP	Miller clamp pin
8	VEE2	Output-side negative power supply pin
9	GND1	Input-side ground pin
10	INA	Control input pin A
11	INB	Control input pin B
12	RDY	Ready output pin
13	FLT	Fault output pin
14	XRST	Reset input pin
15	VCC1	Input-side power supply pin
16	GND1	Input-side ground pin

Pin Descriptions - continued

1. VCC1 (Input-side power supply pin)
   The VCC1 pin is a power supply pin on the input side. To reduce voltage fluctuations due to the current to drive internal transformers, connect a bypass capacitor between the VCC1 and the GND1 pins.

2. GND1 (Input-side ground pin)
   The GND1 pin is a ground pin on the input side.

3. VCC2 (Output-side positive power supply pin)
   The VCC2 pin is a positive power supply pin on the output side. To reduce voltage fluctuations due to the OUT pin output current and due to the current to drive internal transformers, connect a bypass capacitor between the VCC2 and the GND2 pins.

4. VEE2 (Output-side negative power supply pin)
   The VEE2 pin is a negative power supply pin on the output side. To reduce voltage fluctuations due to the OUT pin output current and due to the current to drive internal transformers, connect a bypass capacitor between the VEE2 and the GND2 pins. To use no negative power supply, connect the VEE2 pin to the GND2 pin.

5. GND2 (Output-side ground pin)
   The GND2 pin is a ground pin on the output side. Connect the GND2 pin to the emitter/source of a power device.

6. INA, INB and XRST (Control input pin and Reset input pin)
   The INA, INB and XRST pins are used to determine output logic.

XRST	INB	INA	OUT
L	X	X	L
H	H	X	L
H	L	L	L
H	L	H	H

7. FLT (Fault output pin)
   The FLT pin is an open drain pin used to output a fault signal when desaturation function is activated, and will be cleared at the rising edge of XRST.

Status	FLT
While in normal operation	H
When desaturation function is activated	L

8. RDY (Ready output pin)
   The RDY pin shows the status of three internal protection features which are VCC1 UVLO, VCC2 UVLO, and output state feedback (OSFB). ‘output state feedback’ is a function to compare output logic with input logic, and outputs L when it does not match.

Status	RDY
While in normal operation	H
VCC1 UVLO or VCC2 UVLO or Output state feedback (disaccord)	L

9. OUT (Output pin)
   The OUT pin is a pin used to drive the gate of a power device.

10. CLAMP (Miller clamp pin)
    The CLAMP pin is a pin for preventing increase in gate voltage due to the miller current of the power device connected to OUT pin. Connect the CLAMP pin to the VEE2 pin when miller clamp function is not used.

11. DESAT (Desaturation detection pin)
    This is a detection pin for DESAT protection. When the DESAT pin voltage is V_{DESAT} or more, DESAT function will be activated. This may cause the IC to malfunction in an open state. To avoid such trouble, short circuit the DESAT pin to the GND2 pin when the desaturation protection is not used. In order to prevent the wrong detection due to noise, the noise filter time $t_{DESATFIL}$ is set.

Description of Functions and Examples of Constant Setting

1. Miller Clamp Function
   If OUT=L and the CLAMP pin voltage < V_{CLPON}, the internal MOSFET of the CLAMP pin turns on.

OUT	CLAMP	Internal MOSFET of the CLAMP pin
L	Less than V_{CLPON}	ON
L	V_{CLPON} or more	OFF
H	X	OFF

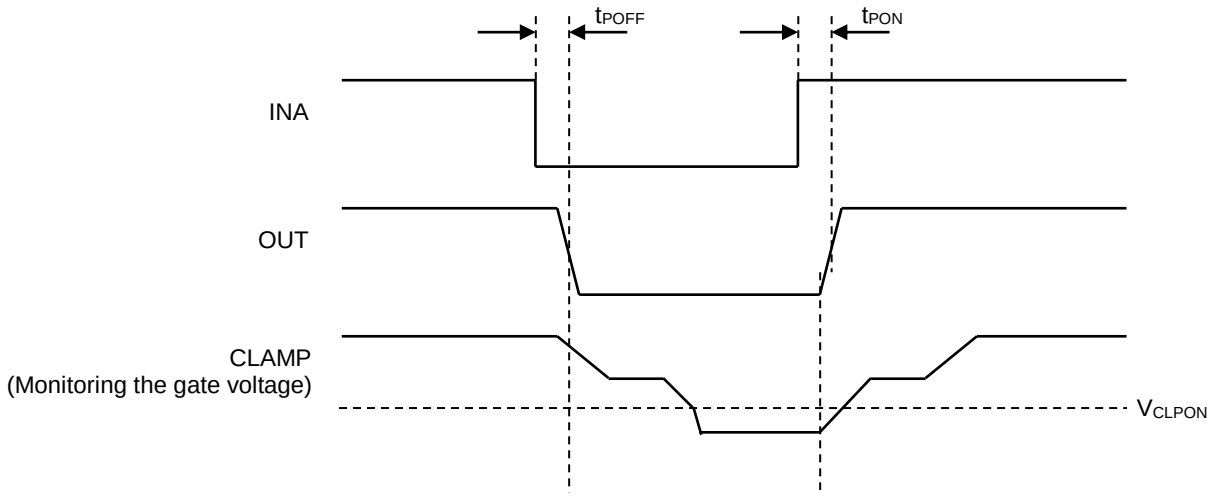


Figure 3. Timing Chart of Miller Clamp Function

2. Fault Status Output
   This function is used to output a fault signal from the FLT pin when the desaturation protection function is activated and hold the Fault signal until rising edge of XRST is put in.

3. Under Voltage Lockout (UVLO) Function
   The BM6105AFW-LBZ incorporates the Under Voltage Lockout (UVLO) function both on the input and the output sides. When the power supply voltage drops to V_{UVLO1L} or V_{UVLO2L}, the OUT pin and the RDY pin both will output the “L” signal. When the power supply voltage rises to V_{UVLO1H} or V_{UVLO2H}, these pins will be reset. To prevent malfunctions due to noises, mask time $t_{UVLO1MSK}$ and $t_{UVLO2MSK}$ are set on both input and output sides.

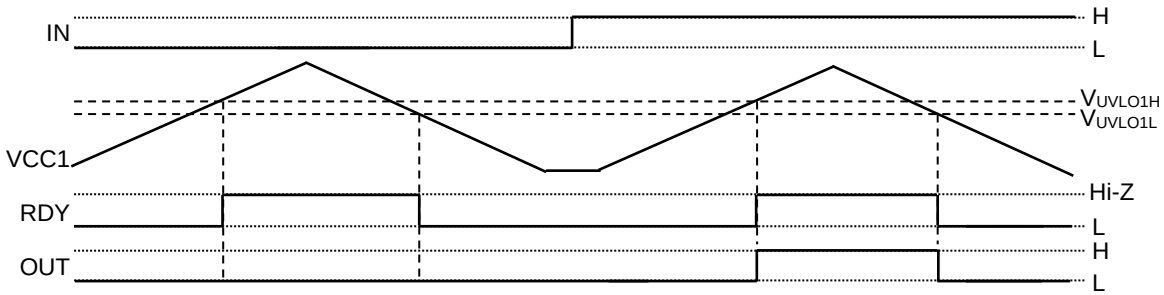


Figure 4. Input-side UVLO Function Operation Timing Chart

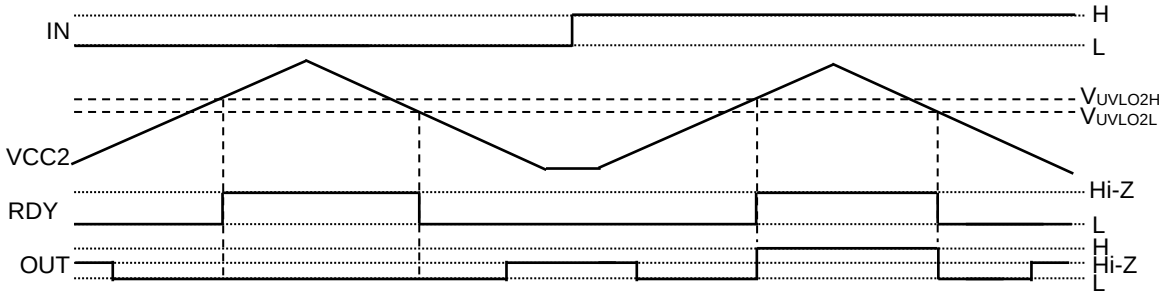


Figure 5. Output-side UVLO Operation Timing Chart

Description of Functions and Examples of Constant Setting - continued

4. Desaturation Protection Function (DESAT)

When the DESAT pin voltage is V_{DESAT} or more, the DESAT function will be activated. When the DESAT function is activated, the OUT pin voltage will be set to the “L” level, and then the FLT pin voltage to the “L” level. When the rising edge is put in the XRST pin, the DESAT function will be released.

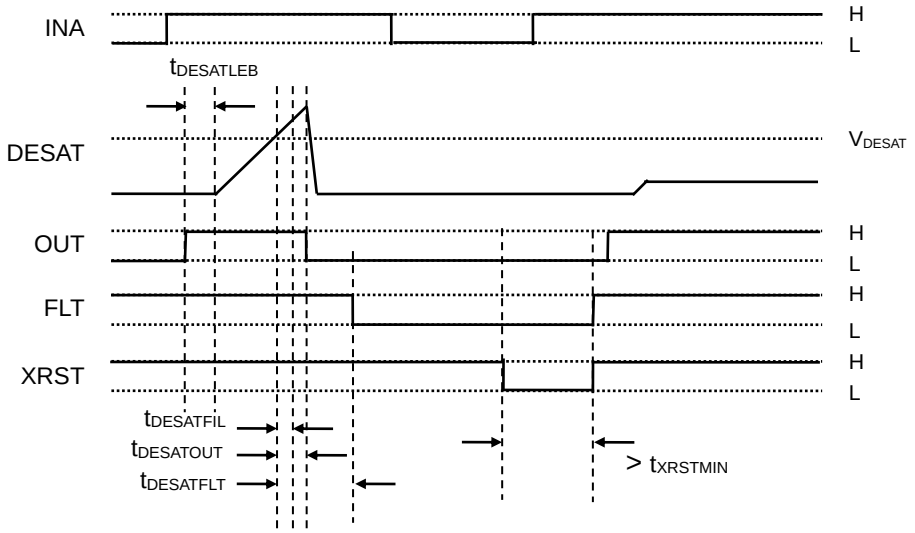


Figure 6. DESAT Operation Timing Chart

5. I/O Condition Table

No.	Status	Input							Output			
		VCC1	VCC2	DESAT	XRST	INB	INA	CLAMP	OUT	CLAMP	FLT	RDY
1	VCC1 UVLO	UVLO	X	X	X	X	X	H	L	Hi-Z	H	L
2		UVLO	X	X	X	X	X	L	L	L	H	L
3	VCC2 UVLO	○	UVLO	L	X	X	X	H	L	Hi-Z	H	L
4		○	UVLO	L	X	X	X	L	L	L	H	L
5		○	UVLO	H	X	X	X	H	L	Hi-Z	L	L
6		○	UVLO	H	X	X	X	L	L	L	L	L
7	DESAT	○	○	H	X	X	X	H	L	Hi-Z	L	H
8		○	○	H	X	X	X	L	L	L	L	H
9	XRST	○	○	L	L	X	X	H	L	Hi-Z	H	H
10		○	○	L	L	X	X	L	L	L	H	H
11	Normal operation	○	○	L	H	H	X	H	L	Hi-Z	H	H
12		○	○	L	H	H	X	L	L	L	H	H
13		○	○	L	H	L	L	H	L	Hi-Z	H	H
14		○	○	L	H	L	L	L	L	L	H	H
15		○	○	L	H	L	H	X	H	Hi-Z	H	H

○: VCC1 or VCC2 > UVLO, X:Don't care

Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
Input-side Supply Voltage	V_{CC1}	-0.3 to +7.0*(Note 1)*	V
Output-side Positive Supply Voltage	V_{CC2}	-0.3 to +24.0*(Note 2)*	V
Output-side Negative Supply Voltage	V_{EE2}	-15.0 to +0.3*(Note 3)*	V
Maximum Difference Voltage between Output-side Positive and Negative Supply Voltages	V_{MAX2}	30.0	V
INA, INB, XRST Pin Input Voltage	V_{IN}	-0.3 to +VCC1+0.3 or 7.0*(Note 1)*	V
RDY, FLT Pin Input Voltage	V_{FLT}	-0.3 to +VCC1+0.3 or 7.0*(Note 1)*	V
DESAT Pin Input Voltage	$V_{DESATIN}$	-0.3 to VCC2+0.3*(Note 2)*	V
OUT Pin Output Current (10µs)	$I_{OUTPEAK}$	5.0	A
OUT, CLAMP Pin Voltage	V_{OUT}	VEE2-0.3 to VCC2+0.3	V
RDY, FLT Output Current	I_{FLT}	10	mA
Storage Temperature Range	Tstg	-55 to +150	°C
Maximum Junction Temperature	Tjmax	+150	°C

Caution 1: *Operating the IC over the absolute maximum ratings may damage the IC. The damage can either be a short circuit between pins or an open circuit between pins and the internal circuitry. Therefore, it is important to consider circuit protection measures, such as adding a fuse, in case the IC is operated over the absolute maximum ratings.*

Caution 2: *Should by any chance the maximum junction temperature rating be exceeded the rise in temperature of the chip may result in deterioration of the properties of the chip. In case of exceeding this absolute maximum rating, design a PCB with thermal resistance taken into consideration by increasing board size and copper area so as not to exceed the maximum junction temperature rating.*

(Note 1) Relative to GND1.
(Note 2) Relative to GND2.
(Note 3) Must not exceed Tjmax=150°C.

Thermal Resistance*(Note 4)*

Parameter	Symbol	Thermal Resistance (Typ)		Unit
		1s*(Note 6)*	2s2p*(Note 7)*	
SOP16WM				
Junction to Ambient	θ_{JA}	104.1	66.2	°C/W
Junction to Top Characterization Parameter*(Note 5)*	Ψ_{JT}	34	32	°C/W

(Note 4) Based on JESD51-2A (Still-Air).
(Note 5) The thermal characterization parameter to report the difference between junction temperature and the temperature at the top center of the outside surface of the component package.
(Note 6) Using a PCB board based on JESD51-3.
(Note 7) Using a PCB board based on JESD51-7.

Layer Number of Measurement Board	Material	Board Size
Single	FR-4	114.3mm x 76.2mm x 1.57mmt

Top	
Copper Pattern	Thickness
Footprints and Traces	70µm

Layer Number of Measurement Board	Material	Board Size
4 Layers	FR-4	114.3mm x 76.2mm x 1.6mmt

Top		2 Internal Layers		Bottom	
Copper Pattern	Thickness	Copper Pattern	Thickness	Copper Pattern	Thickness
Footprints and Traces	70µm	74.2mm x 74.2mm	35µm	74.2mm x 74.2mm	70µm

Recommended Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Input-side Supply Voltage	V_{CC1} *(Note 8)*	4.5	5.0	5.5	V
Output-side Positive Supply Voltage	V_{CC2} *(Note 9)*	13.3	15.0	20.0	V
Output-side Negative Supply Voltage	V_{EE2} *(Note 9)*	-12	-	0	V
Maximum Difference Voltage between Output-side Positive and Negative Supply Voltages	V_{MAX2}	-	-	28.0	V
Operating Temperature	Topr	-40	+25	+105	°C

(Note 8) Relative to GND1.
(Note 9) Relative to GND2.

Insulation Related Characteristics

Parameter	Symbol	Characteristic	Unit
Insulation Resistance (V_{IO}=500V)	R_S	$>10^9$	Ω
Insulation Withstand Voltage (1min)	V_{ISO}	2500	Vrms
Insulation Test Voltage (1s)	V_{ISO}	3000	Vrms

Electrical Characteristics

(Unless otherwise specified Ta=-40°C to +105°C, V_{CC1}=4.5V to 5.5V, V_{CC2}=13.3V to 20V, V_{EE2}=-12V to 0V)

Parameter	Symbol	Min	Typ	Max	Unit	Conditions
General						
Input-side Circuit Current 1	I_{CC11}	0.16	0.32	0.48	mA	
Input-side Circuit Current 2	I_{CC12}	0.21	0.42	0.63	mA	INA=10kHz, Duty=50%
Input-side Circuit Current 3	I_{CC13}	0.26	0.52	0.78	mA	INA=20kHz, Duty=50%
Output-side Circuit Current 1	I_{CC21}	0.9	1.8	2.7	mA	OUT=L
Output-side Circuit Current 2	I_{CC22}	0.8	1.7	2.5	mA	OUT=H
Logic						
Logic High Level Input Voltage	V_{INH}	2.0	-	V_{CC1}	V	INA, INB, XRST
Logic Low Level Input Voltage	V_{INL}	0	-	0.8	V	INA, INB, XRST
Logic Pull-down Resistance	R_{IND}	25	50	100	kΩ	INA
Logic Pull-up Resistance	R_{INU}	25	50	100	kΩ	INB, XRST, RDY, FLT
Logic Minimum Pulse Width	t_{INMSK}	-	-	60	ns	INA, INB
XRST Input Mask Time	$t_{XRSTMIN}$	-	-	800	ns	
Output						
OUT ON Resistance (Source)	R_{ONH}	0.3	0.8	1.5	Ω	I_{OUT}=-40mA
OUT ON Resistance (Sink)	R_{ONL}	0.2	0.5	0.9	Ω	I_{OUT}=40mA
OUT Maximum Current	I_{OUTMAX}	3.0	4.5	-	A	Guaranteed by design
CLAMP ON Resistance	R_{ONCLP}	0.2	0.5	0.9	Ω	I_{CLAMP}=40mA
Low level CLAMP Current	I_{CLAMPL}	3.0	4.5	-	A	Guaranteed by design
Turn ON Time	t_{PON}	50	80	120	ns	
Turn OFF Time	t_{POFF}	50	80	120	ns	
Propagation Distortion	t_{PDIST}	-20	0	+20	ns	t_{POFF} - t_{PON}
Rise Time	t_{RISE}	-	50	100	ns	10Ω, 10nF between OUT to VEE2
Fall Time	t_{FALL}	-	50	100	ns	Guaranteed by design
CLAMP ON Threshold Voltage	V_{CLPON}	1.8	2	2.2	V	Relative to VEE2
Common Mode Transient Immunity	CM	100	-	-	kV/μs	Guaranteed by design
Protection functions						
VCC1 UVLO OFF Voltage	V_{UVLO1H}	3.35	3.50	3.65	V	
VCC1 UVLO ON Voltage	V_{UVLO1L}	3.25	3.40	3.55	V	
VCC1 UVLO Mask Time	$t_{UVLO1MSK}$	0.8	2.5	5.0	μs	
VCC2 UVLO OFF Voltage	V_{UVLO2H}	11.3	12.3	13.3	V	
VCC2 UVLO ON Voltage	V_{UVLO2L}	10.3	11.3	12.3	V	
VCC2 UVLO Mask Time	$t_{UVLO2MSK}$	3.8	7.7	14	μs	
DESAT Charging Current	I_{DESATC}	450	500	550	μA	
DESAT Threshold Voltage	V_{DESAT}	8.5	9.0	9.5	V	
DESAT Filter Time	$t_{DESATFIL}$	0.16	0.25	0.34	μs	
DESAT Delay Time (OUT)	$t_{DESATOUT}$	0.31	0.38	0.45	μs	
DESAT Delay Time (FLT)	$t_{DESATFLT}$	0.34	0.42	0.50	μs	
DESAT Low Voltage	V_{DESATL}	-	0.1	0.22	V	I_{DESAT}=1mA
Leading Edge Blanking	$t_{DESATLEB}$	0.28	0.4	0.52	μs	Guaranteed by design
OSFB Output Filtering Time	$t_{OSFBFIL}$		2		μs	
RDY Output Low Voltage	V_{RDYL}	-	0.08	0.15	V	I_{RDY}=5mA
FLT Output Low Voltage	V_{FLTL}	-	0.08	0.15	V	I_{FLT}=5mA

Typical Performance Curves

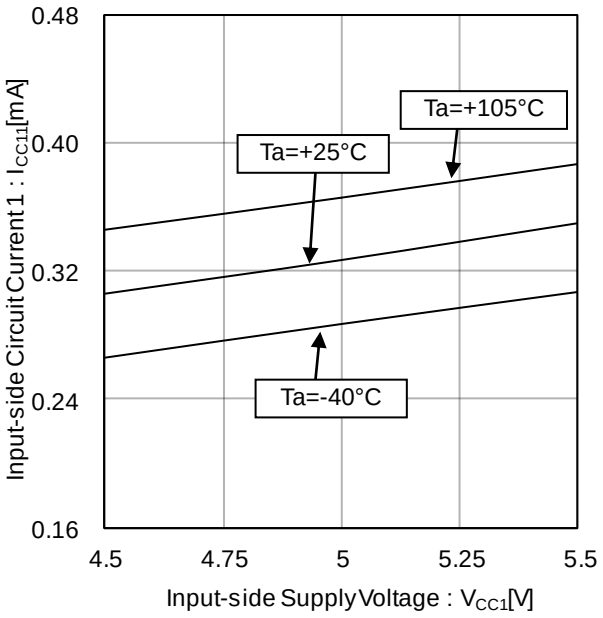


Figure 7. Input-side Circuit Current 1 vs Input-side Supply Voltage

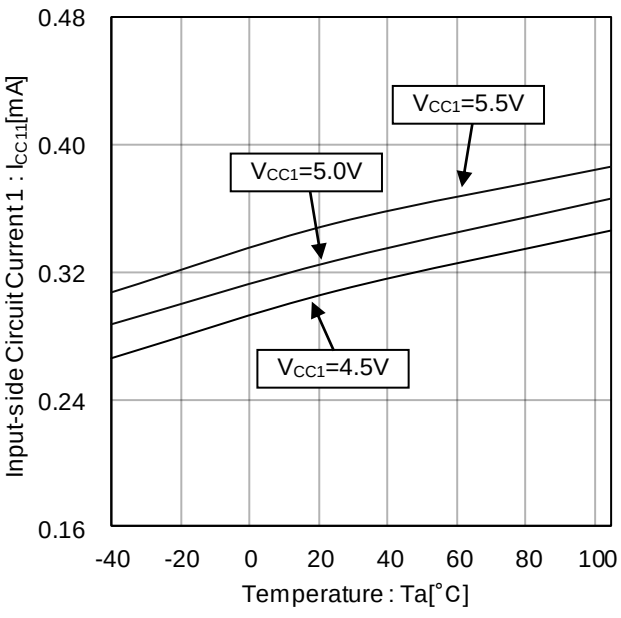


Figure 8. Input-side Circuit Current 1 vs Temperature

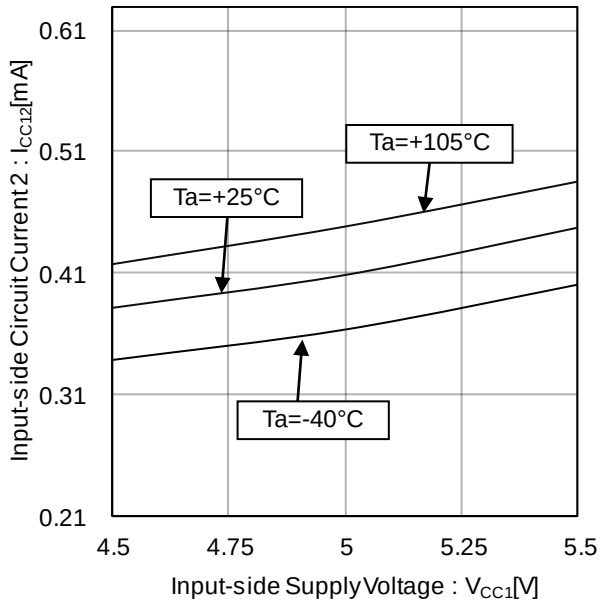


Figure 9. Input-side Circuit Current 2 vs Input-side Supply Voltage (INA=10kHz, Duty=50%)

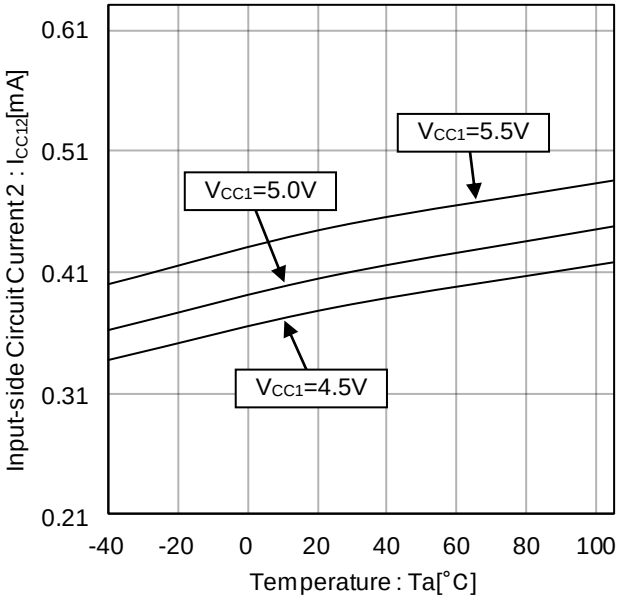


Figure 10. Input-side Circuit Current 2 vs Temperature (INA=10kHz, Duty=50%)

Typical Performance Curves - continued

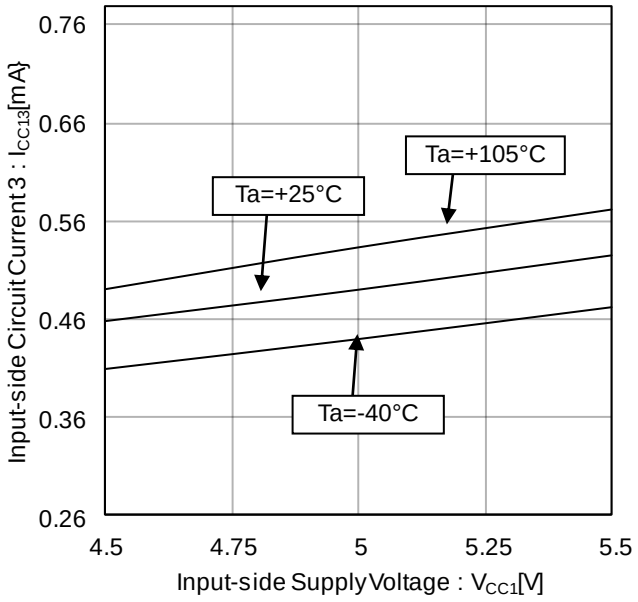


Figure 11. Input-side Circuit Current 3 vs Input-side Supply Voltage (INA=20kHz, Duty=50%)

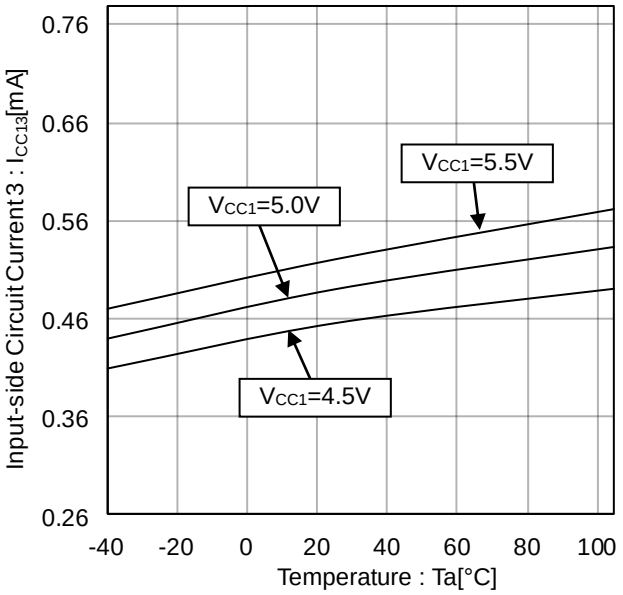


Figure 12. Input-side Circuit Current 3 vs Temperature (INA=20kHz, Duty=50%)

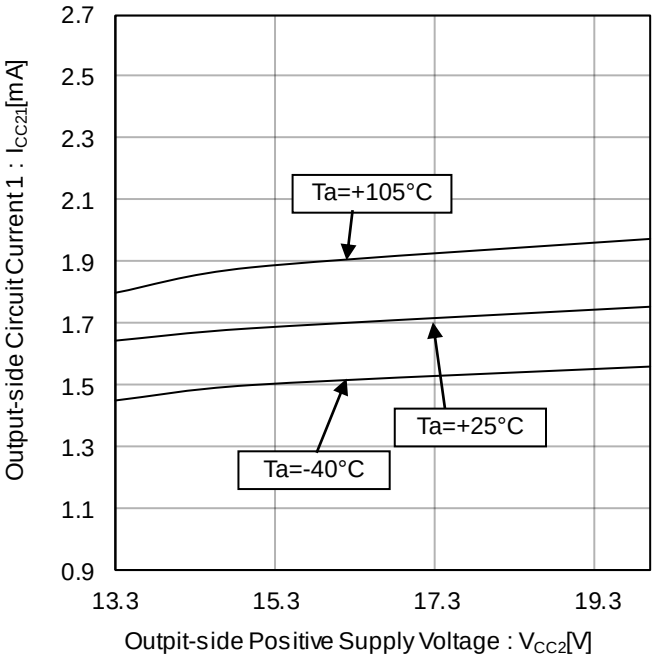


Figure 13. Output-side Circuit Current 1 vs Output-side Positive Supply Voltage (V_{EE2}=0V, OUT=L)

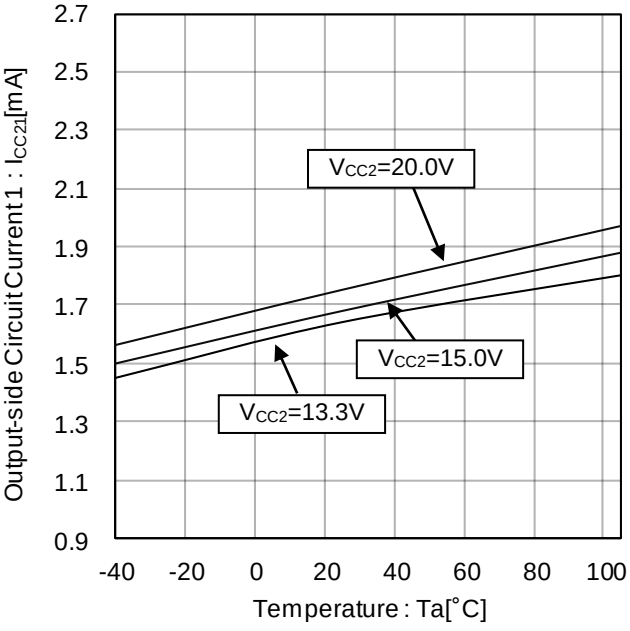


Figure 14. Output-side Circuit Current 1 vs Temperature (V_{EE2}=0V, OUT=L)

Typical Performance Curves - continued

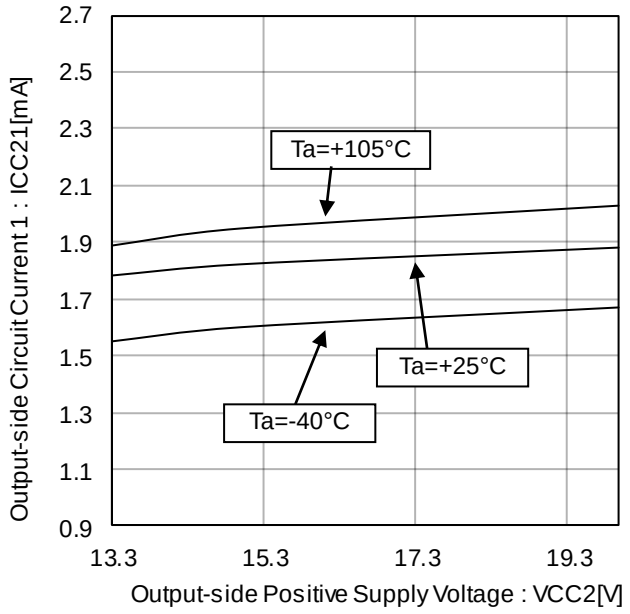


Figure 15. Output-side Circuit Current 1 vs Output-side Positive Supply Voltage (V_{EE2}=-8V, OUT=L)

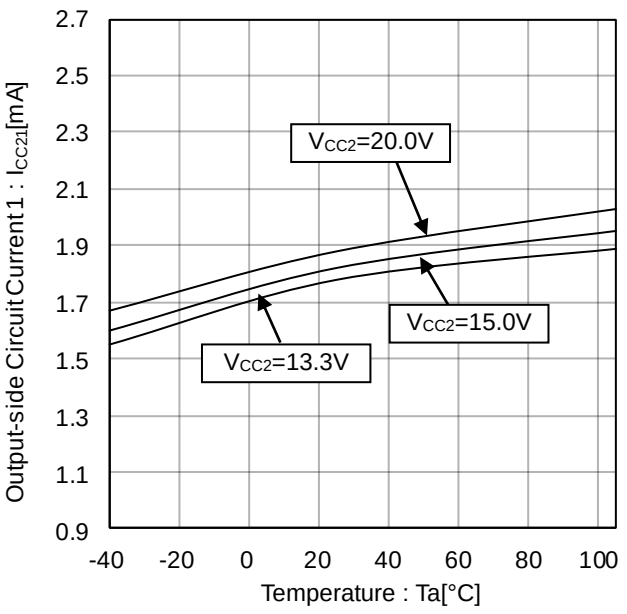


Figure 16. Output-side Circuit Current 1 vs Temperature (V_{EE2}=-8V, OUT=L)

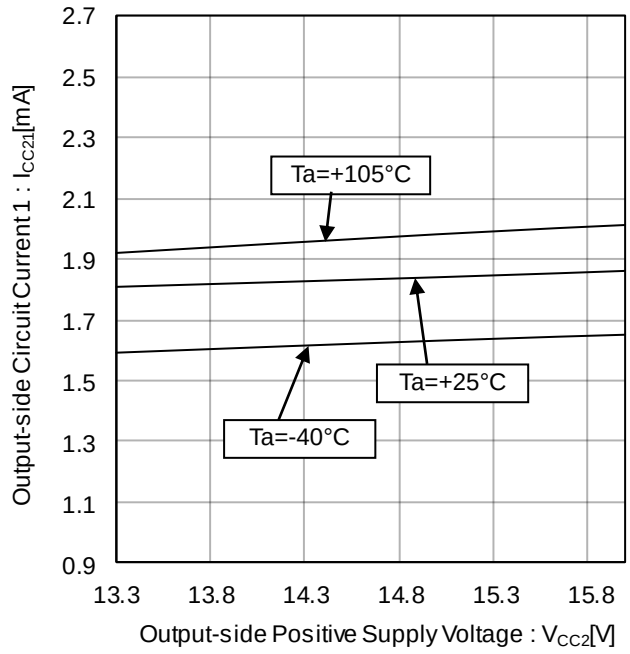


Figure 17. Output-side Circuit Current 1 vs Output-side Positive Supply Voltage (VEE2=-12V, OUT=L)

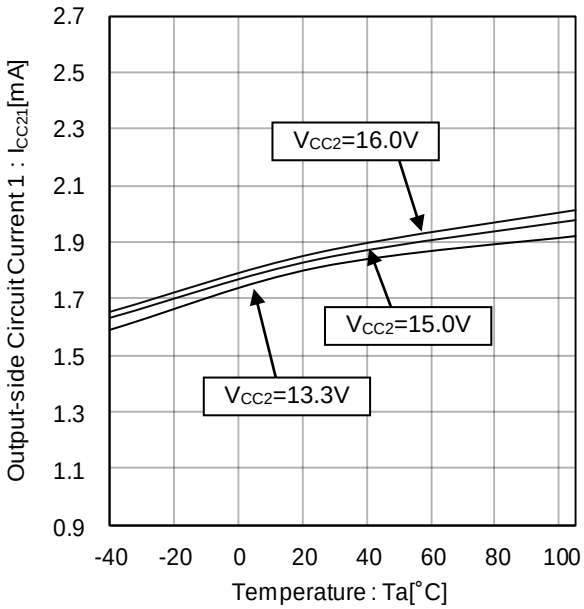


Figure 18. Output-side Circuit Current 1 vs Temperature (VEE2=-12V, OUT=L)

Typical Performance Curves - continued

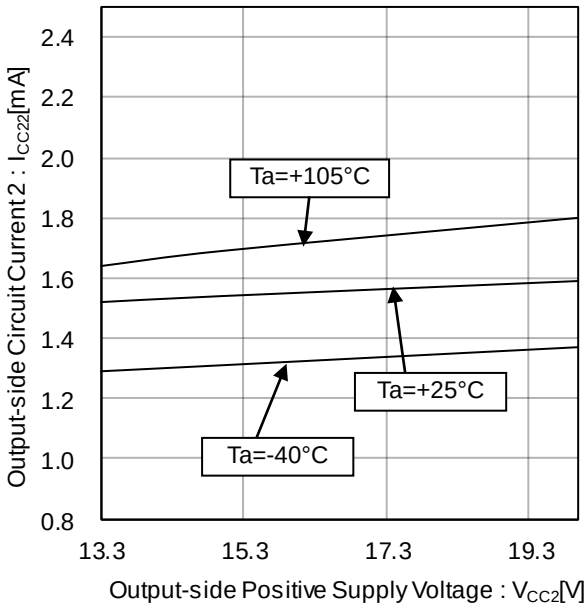


Figure 19. Output-side Circuit Current 2 vs Output-side Positive Supply Voltage (V_{EE2}=0V, OUT=H)

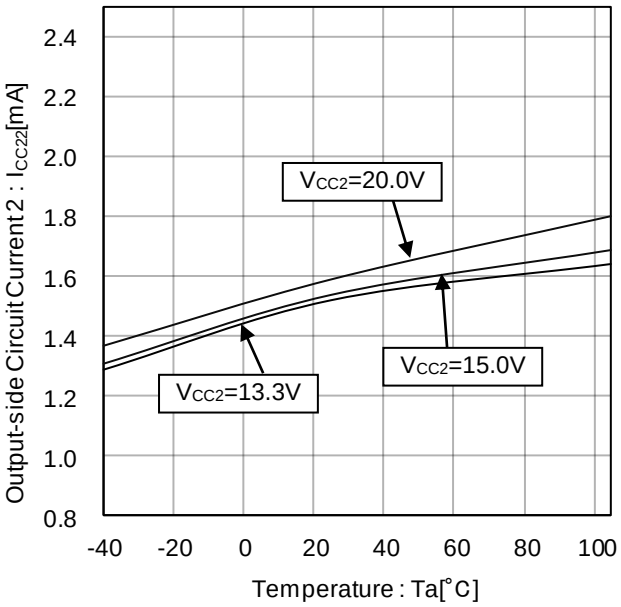


Figure 20. Output-side Circuit Current 2 vs Temperature (V_{EE2}=0V, OUT=H)

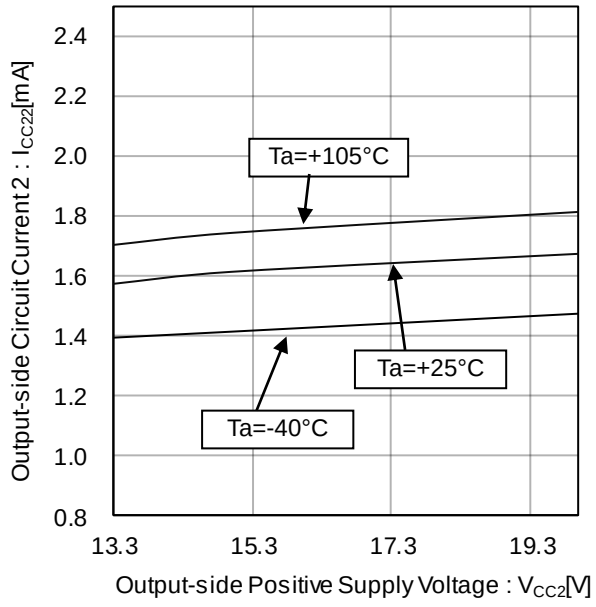


Figure 21. Output-side Circuit Current 2 vs Output-side Positive Supply Voltage (V_{EE2}=-8V, OUT=H)

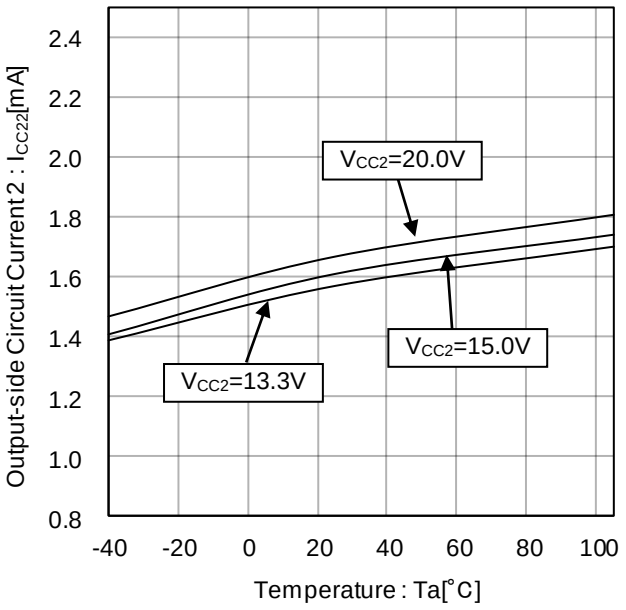


Figure 22. Output-side Circuit Current 2 vs Temperature (V_{EE2}=-8V, OUT=H)

Typical Performance Curves - continued

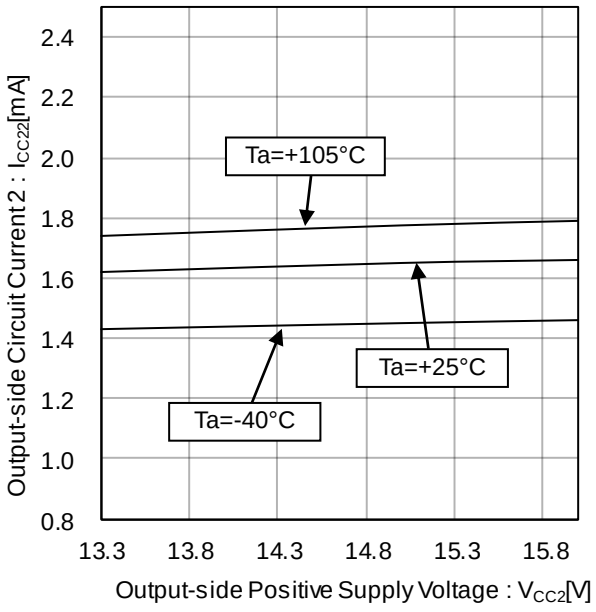


Figure 23. Output-side Circuit Current 2 vs Output-side Positive Supply Voltage (V_{EE2}=-12V, OUT=H)

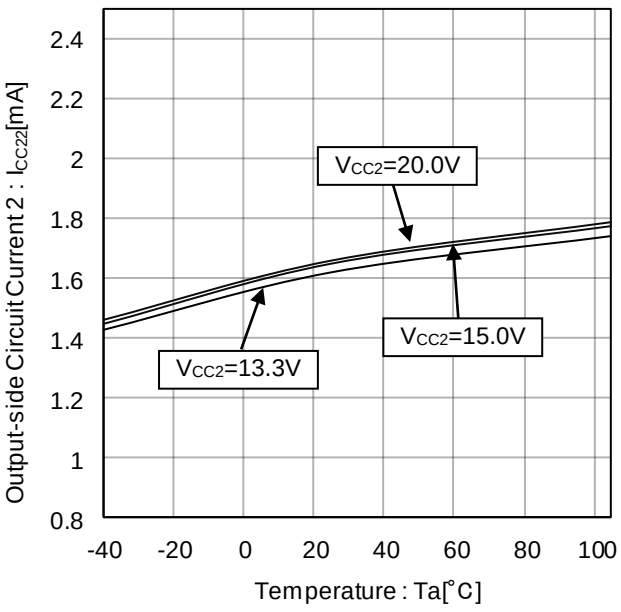


Figure 24. Output-side Circuit Current 2 vs Temperature (V_{EE2}=-12V, OUT=H)

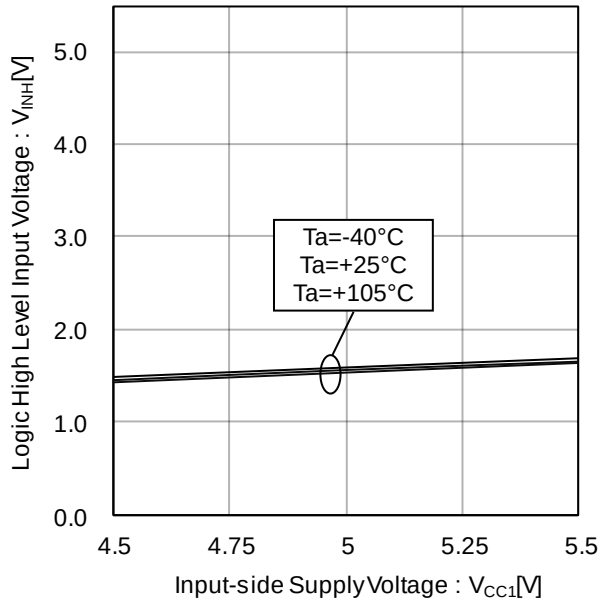


Figure 25. Logic High Level Input Voltage vs Input-side Supply Voltage

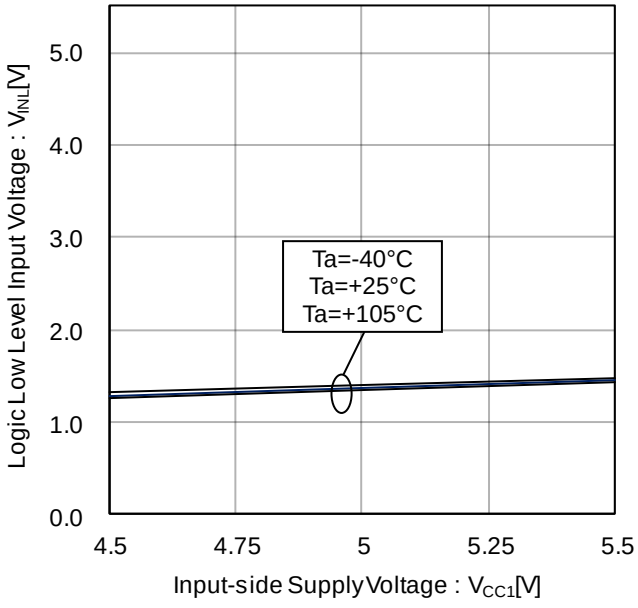


Figure 26. Logic Low Level Input Voltage vs Input-side Supply Voltage

Typical Performance Curves - continued

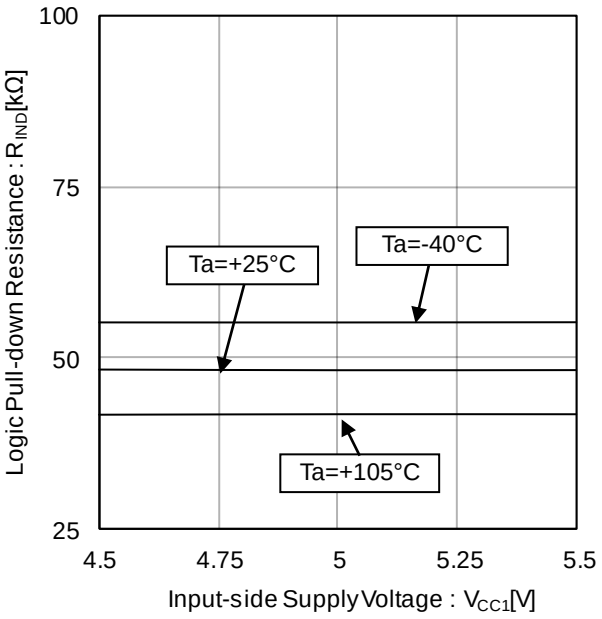


Figure 27. Logic Pull-down Resistance vs Input-side Supply Voltage

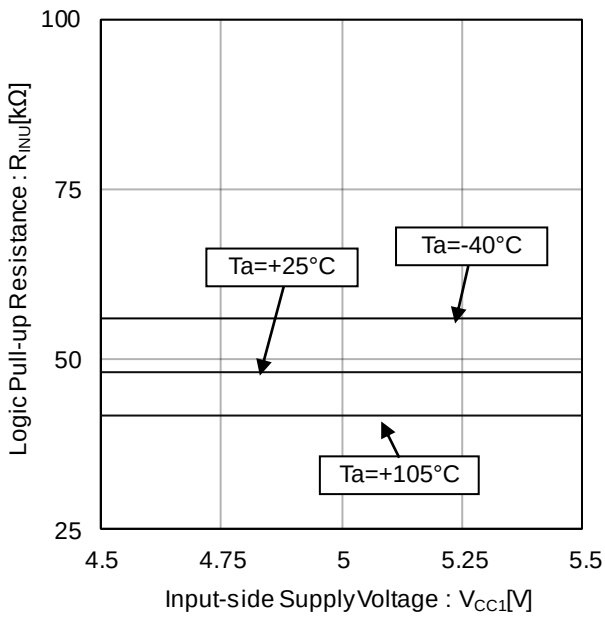


Figure 28. Logic Pull-up Resistance vs Input-side Supply Voltage

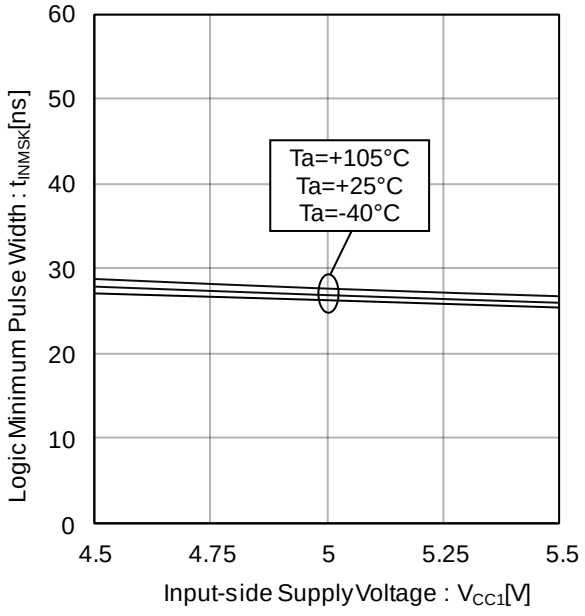


Figure 29. Logic Minimum Pulse Width vs Input-side Supply Voltage

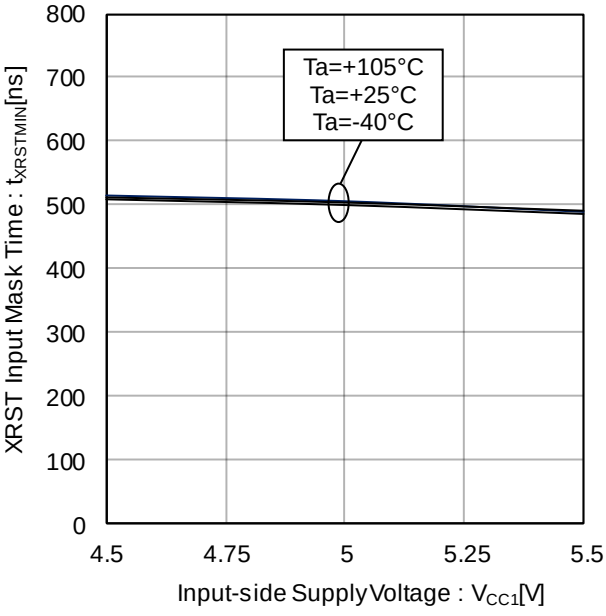


Figure 30. XRST Input Mask Time vs Input-side Supply Voltage

Typical Performance Curves - continued

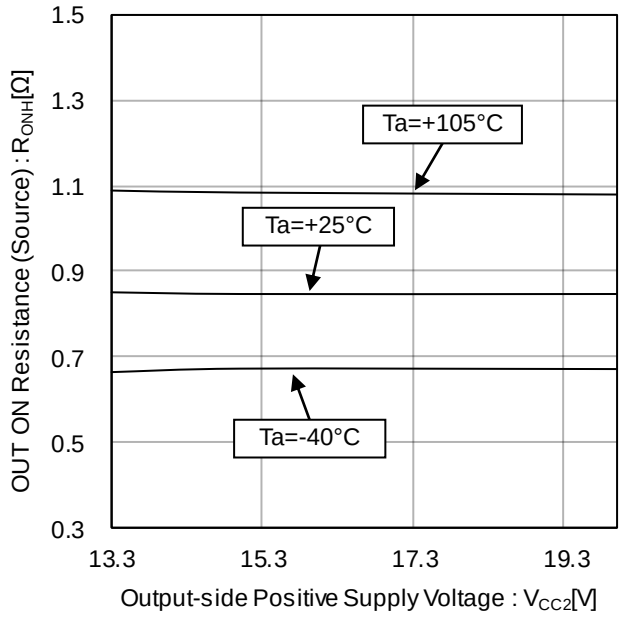


Figure 31. OUT ON Resistance (Source) vs Output-side Positive Supply Voltage (I_{OUT}=-40mA)

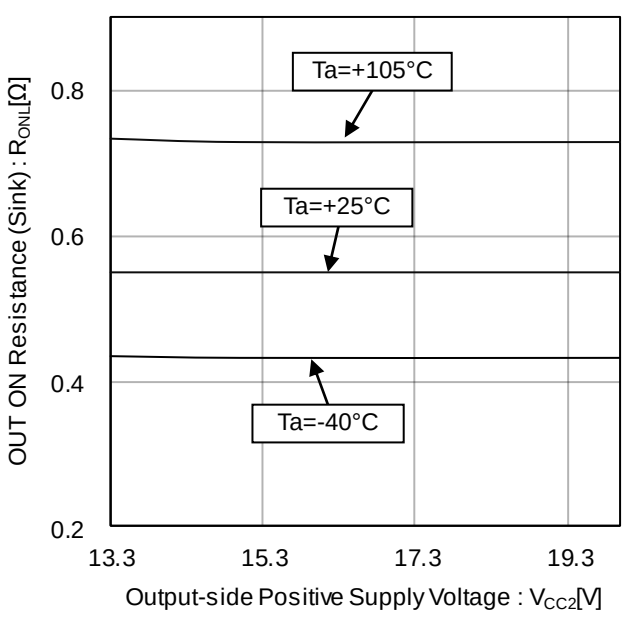


Figure 32. OUT ON Resistance (Sink) vs Output-side Positive Supply Voltage (I_{OUT}=40mA)

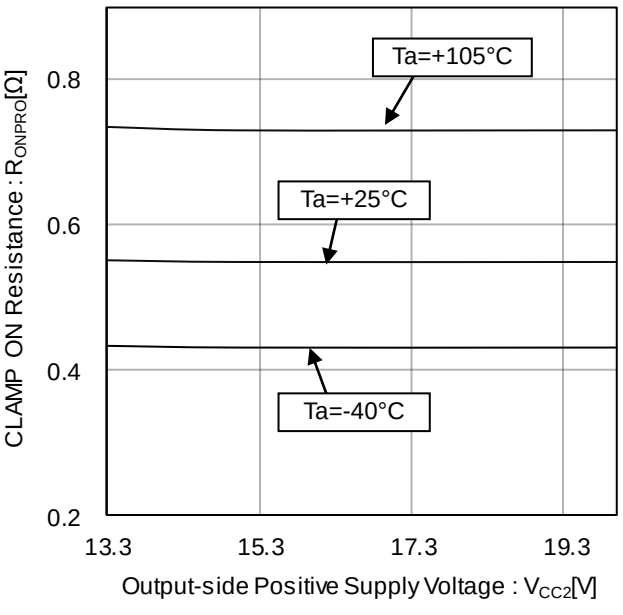


Figure 33. CLAMP ON Resistance vs Output-side Positive Supply Voltage (I_{CLAMP}=40mA)

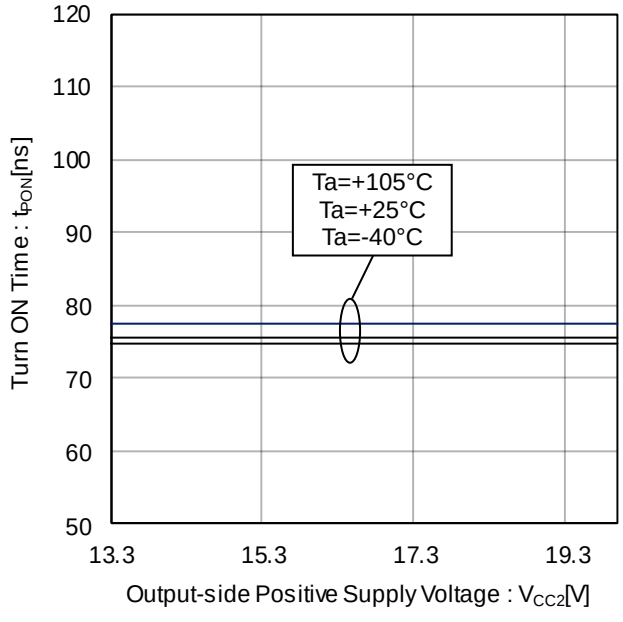


Figure 34. Turn ON Time vs Output-side Positive Supply Voltage

Typical Performance Curves - continued

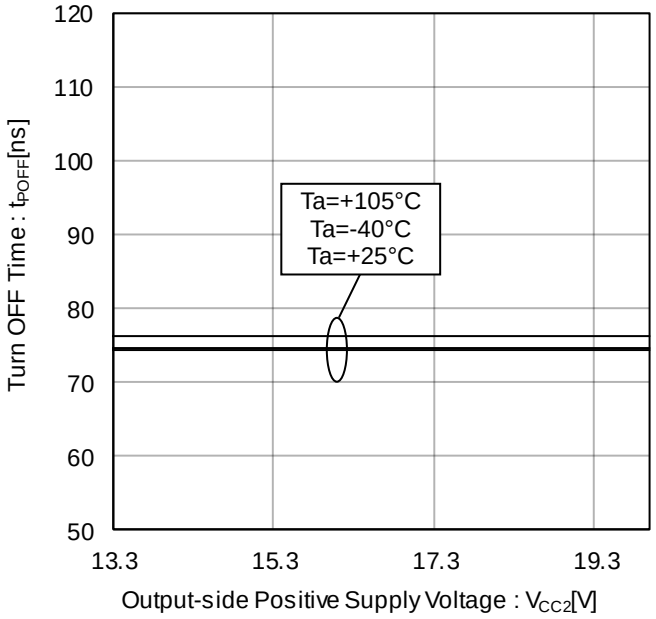


Figure 35. Turn OFF Time vs
Output-side Positive Supply Voltage

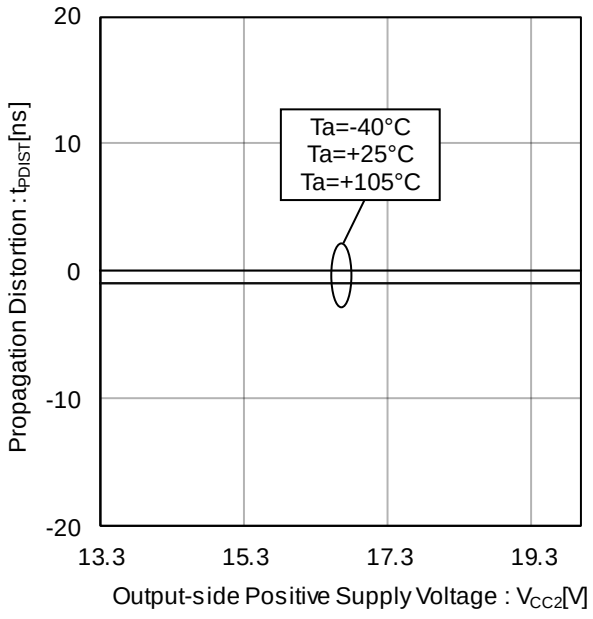


Figure 36. Propagation Distortion vs
Output-side Positive Supply Voltage

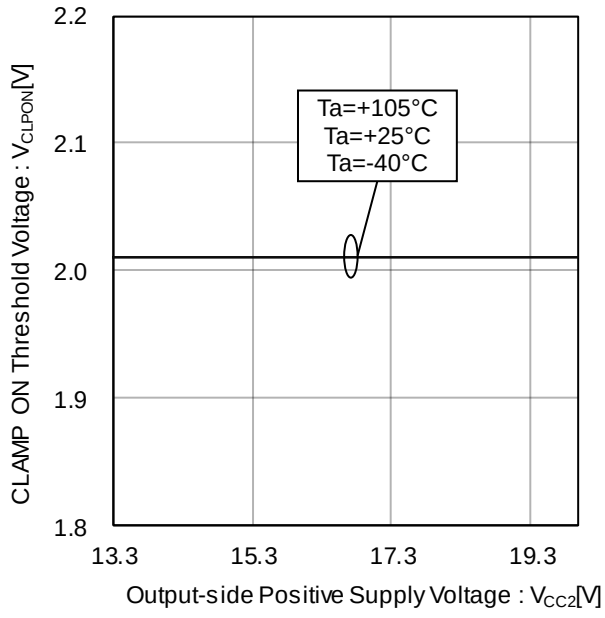


Figure 37. CLAMP ON Threshold Voltage vs
Output-side Positive Supply Voltage

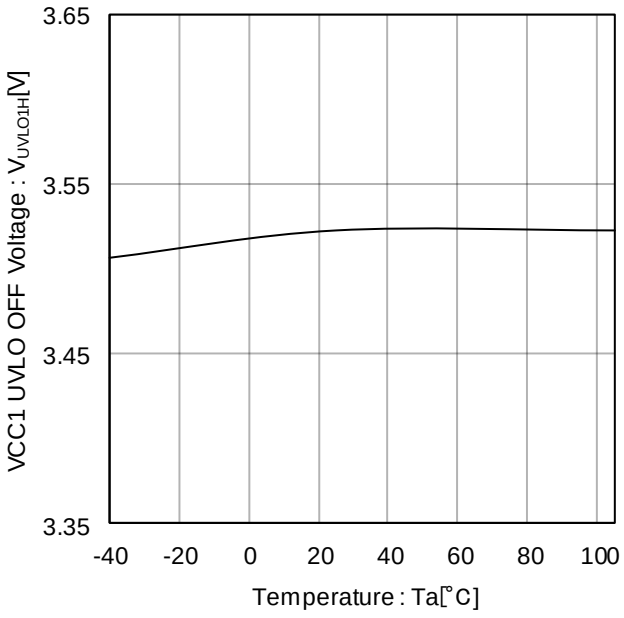


Figure 38. VCC1 UVLO OFF Voltage vs Temperature

Typical Performance Curves - continued

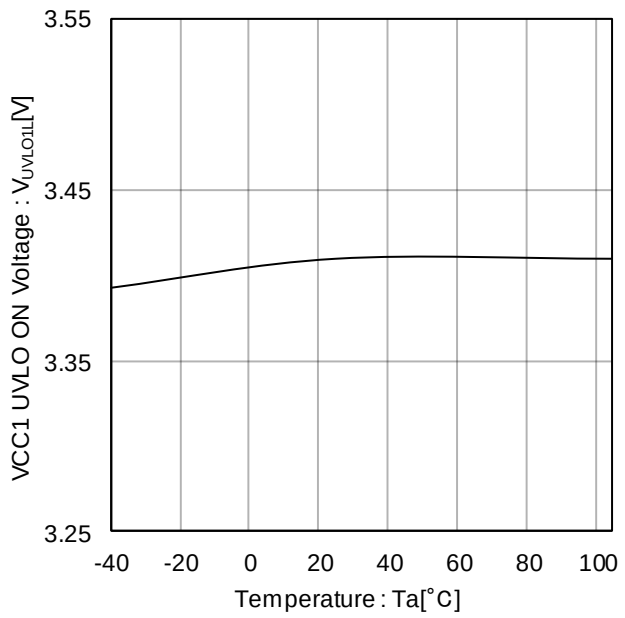


Figure 39. VCC1 UVLO ON Voltage vs Temperature

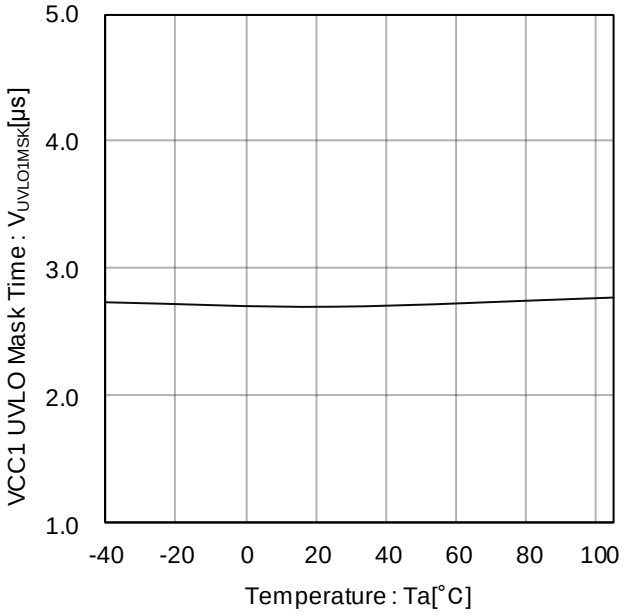


Figure 40. VCC1 UVLO Mask Time vs Temperature

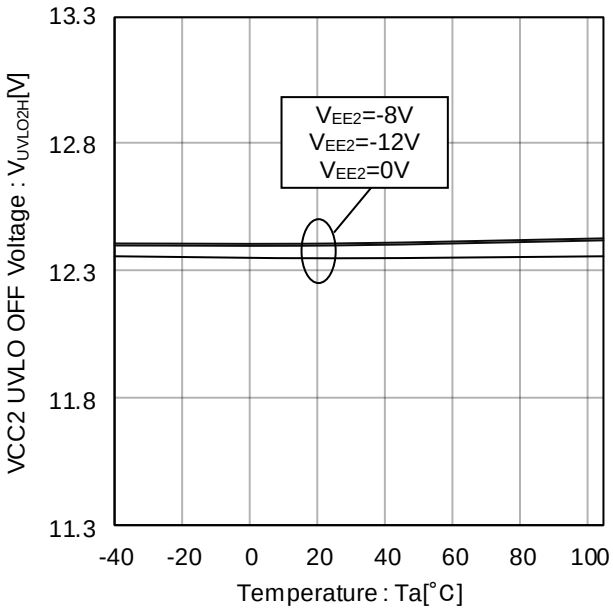


Figure 41. VCC2 UVLO OFF Voltage vs Temperature

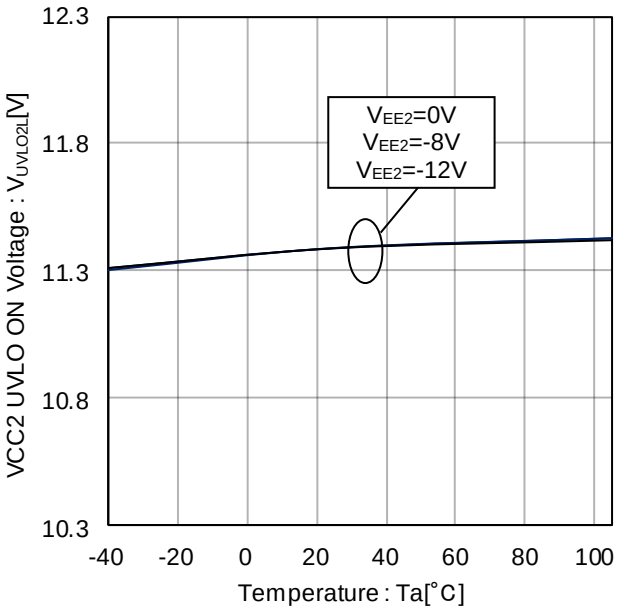


Figure 42. VCC2 UVLO ON Voltage vs Temperature

Typical Performance Curves - continued

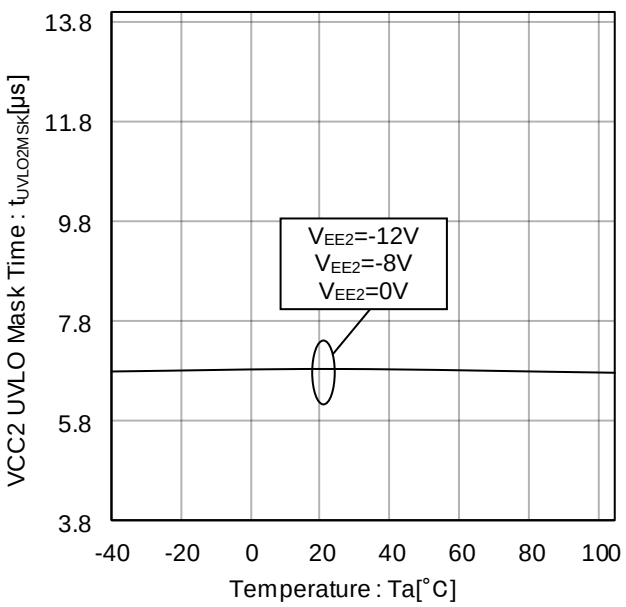


Figure 43. VCC2 UVLO Mask Time vs Temperature

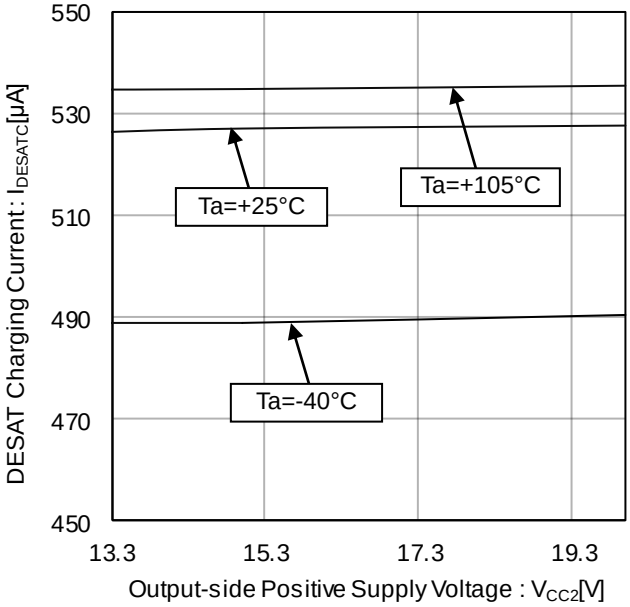


Figure 44. DESAT Charging Current vs Output-side Positive Supply Voltage

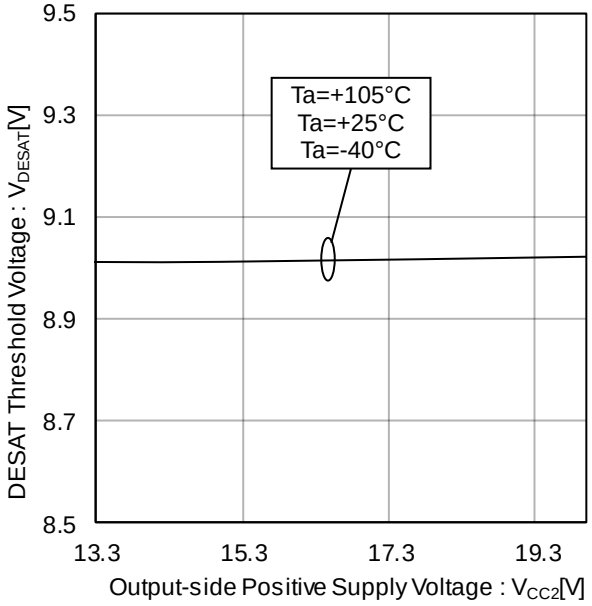


Figure 45. DESAT Threshold Voltage vs Output-side Positive Supply Voltage

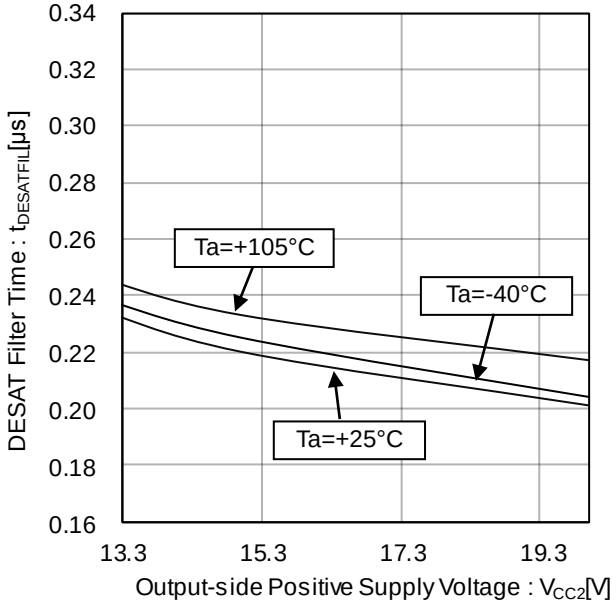


Figure 46. DESAT Filter Time vs Output-side Positive Supply Voltage

Typical Performance Curves - continued

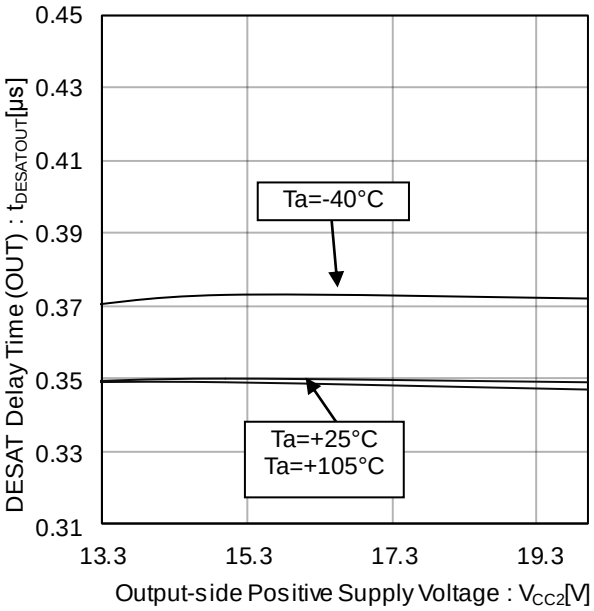


Figure 47. DESAT Delay Time (OUT) vs Output-side Positive Supply Voltage

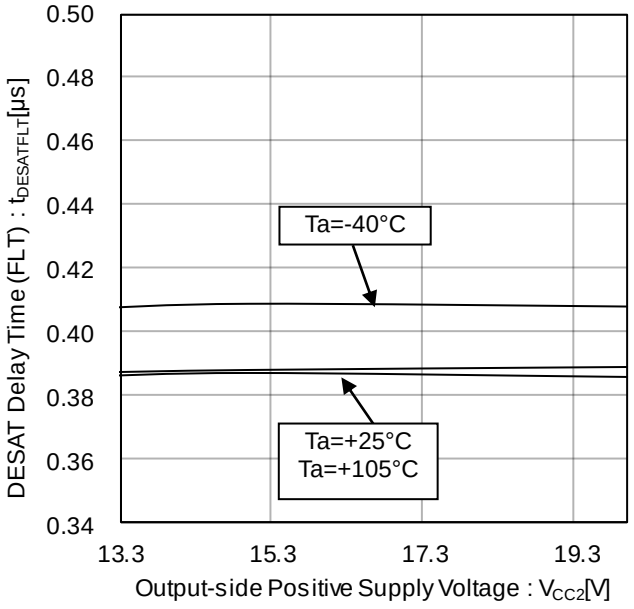


Figure 48. DESAT Delay Time (FLT) vs Output-side Positive Supply Voltage

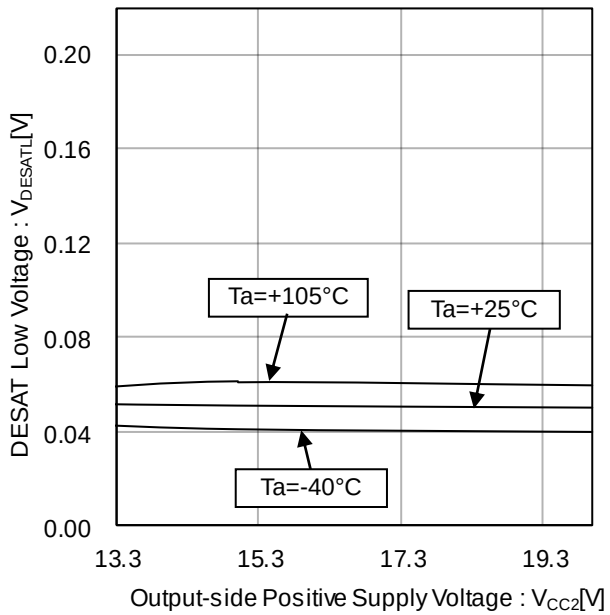


Figure 49. DESAT Low Voltage vs Output-side Positive Supply Voltage

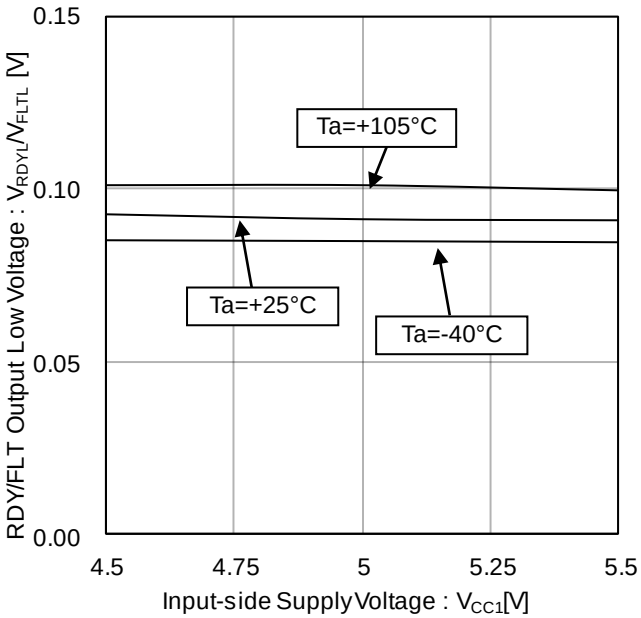
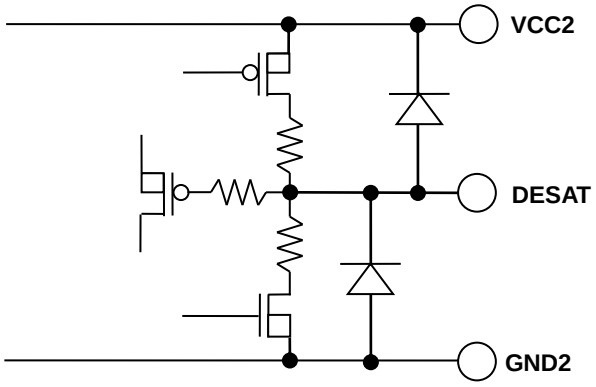
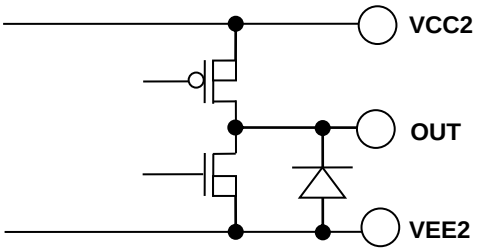
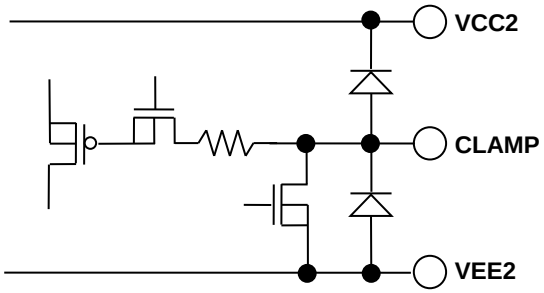
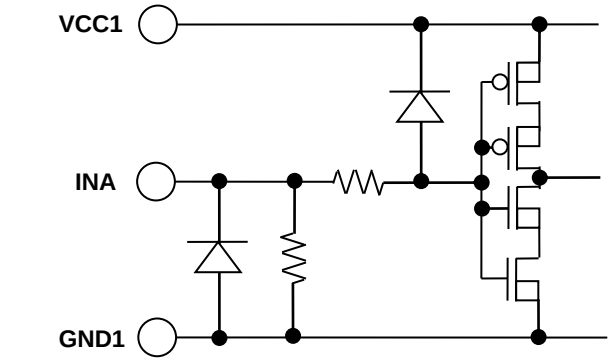
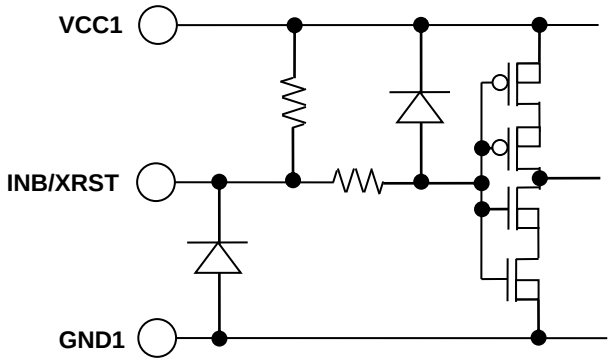
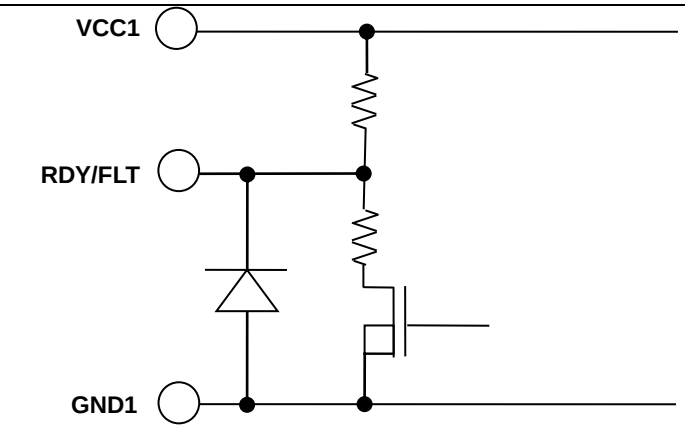


Figure 50. RDY/FLT Output Low Voltage vs Input-side Supply Voltage

I/O Equivalence Circuits

Pin No.	Name / Function	I/O equivalence circuits
2	DESAT Desaturation detection pin	
6	OUT Output pin	
7	CLAMP Miller clamp pin	

I/O Equivalence Circuits - continued

Pin No.	Name / Function	I/O equivalence circuits
10	INA Control input pin A	
11	INB Control input pin B	
14	XRST Reset input pin	
12	RDY Ready output pin	
13	FLT Fault output pin	

Operational Notes

1. **Reverse Connection of Power Supply**
   Connecting the power supply in reverse polarity can damage the IC. Take precautions against reverse polarity when connecting the power supply, such as mounting an external diode between the power supply and the IC's power supply pins.

2. **Power Supply Lines**
   Design the PCB layout pattern to provide low impedance supply lines. Separate the ground and supply lines of the digital and analog blocks to prevent noise in the ground and supply lines of the digital block from affecting the analog block. Furthermore, connect a capacitor to ground at all power supply pins. Consider the effect of temperature and aging on the capacitance value when using electrolytic capacitors.

3. **Ground Voltage**
   Ensure that no pins are at a voltage below that of the ground pin at any time, even during transient condition.

4. **Ground Wiring Pattern**
   When using both small-signal and large-current ground traces, the two ground traces should be routed separately but connected to a single ground at the reference point of the application board to avoid fluctuations in the small-signal ground caused by large currents. Also ensure that the ground traces of external components do not cause variations on the ground voltage. The ground lines must be as short and thick as possible to reduce line impedance.

5. **Recommended Operating Conditions**
   The function and operation of the IC are guaranteed within the range specified by the recommended operating conditions. The characteristic values are guaranteed only under the conditions of each item specified by the electrical characteristics.

6. **Inrush Current**
   When power is first supplied to the IC, it is possible that the internal logic may be unstable and inrush current may flow instantaneously due to the internal powering sequence and delays, especially if the IC has more than one power supply. Therefore, give special consideration to power coupling capacitance, power wiring, width of ground wiring, and routing of connections.

7. **Operation Under Strong Electromagnetic Field**
   Operating the IC in the presence of a strong electromagnetic field may cause the IC to malfunction.

8. **Testing on Application Boards**
   When testing the IC on an application board, connecting a capacitor directly to a low-impedance output pin may subject the IC to stress. Always discharge capacitors completely after each process or step. The IC's power supply should always be turned off completely before connecting or removing it from the test setup during the inspection process. To prevent damage from static discharge, ground the IC during assembly and use similar precautions during transport and storage.

9. **Inter-pin Short and Mounting Errors**
   Ensure that the direction and position are correct when mounting the IC on the PCB. Incorrect mounting may result in damaging the IC. Avoid nearby pins being shorted to each other especially to ground, power supply and output pin. Inter-pin shorts could be due to many reasons such as metal particles, water droplets (in very humid environment) and unintentional solder bridge deposited in between pins during assembly to name a few.

10. **Unused Input Pins**
    Input pins of an IC are often connected to the gate of a MOS transistor. The gate has extremely high impedance and extremely low capacitance. If left unconnected, the electric field from the outside can easily charge it. The small charge acquired in this way is enough to produce a significant effect on the conduction through the transistor and cause unexpected operation of the IC. So unless otherwise specified, unused input pins should be connected to the power supply or ground line.

Operational Notes – continued

11. Regarding the Input Pin of the IC

This IC contains P+ isolation and P substrate layers between adjacent elements in order to keep them isolated. P-N junctions are formed at the intersection of the P layers with the N layers of other elements, creating a parasitic diode or transistor. For example (refer to figure below):

When GND > Pin A and GND > Pin B, the P-N junction operates as a parasitic diode.
When GND > Pin B, the P-N junction operates as a parasitic transistor.

Parasitic diodes inevitably occur in the structure of the IC. The operation of parasitic diodes can result in mutual interference among circuits, operational faults, or physical damage. Therefore, conditions that cause these diodes to operate, such as applying a voltage lower than the GND voltage to an input pin (and thus to the P substrate) should be avoided.

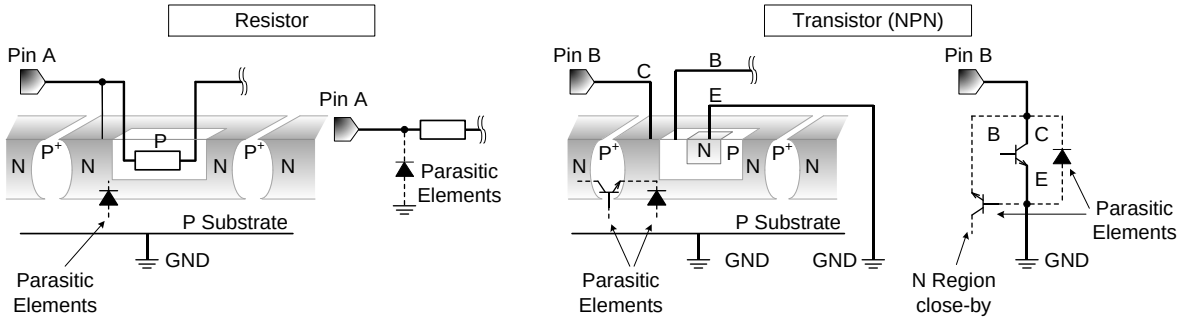


Figure 51. Example of IC structure

12. Ceramic Capacitor

When using a ceramic capacitor, determine a capacitance value considering the change of capacitance with temperature and the decrease in nominal capacitance due to DC bias and others.

13. Area of Safe Operation (ASO)

Operate the IC such that the output voltage, output current, and the maximum junction temperature rating are all within the Area of Safe Operation (ASO).

Ordering Information

B M 6 1 0 5 A F W - L B Z E 2

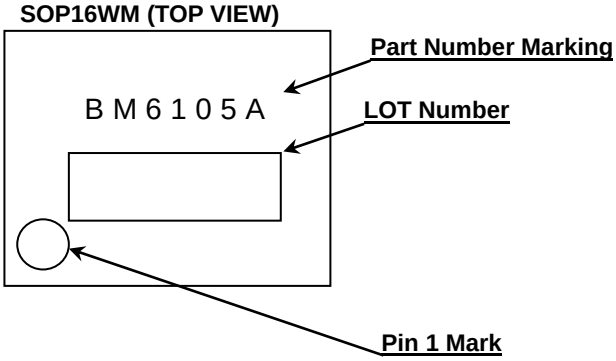
Part Number

Package
FW: SOP16WM

Product class
LB: Industrial applications
Z: Manufacturing code
Packaging and forming specification
E2: Embossed tape and reel

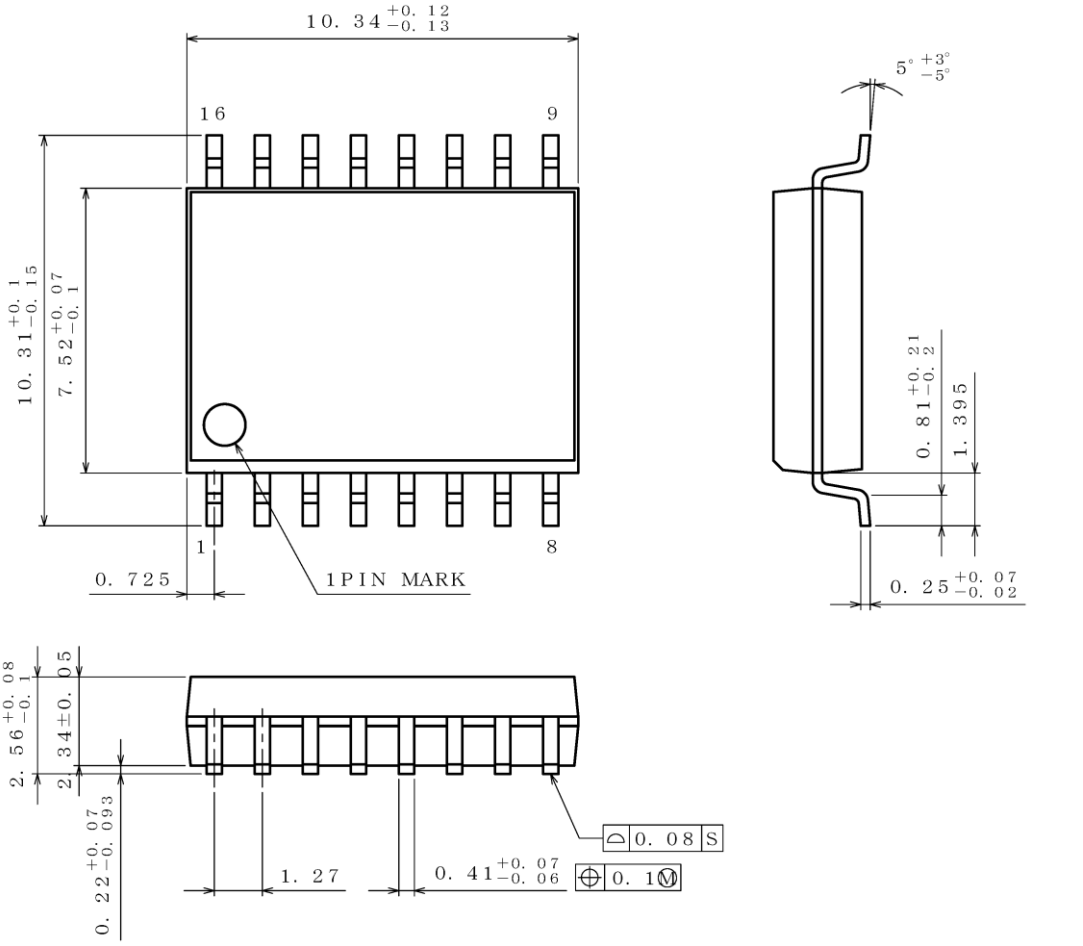
Marking Diagram

SOP16WM (TOP VIEW)



Physical Dimension and Packing Information

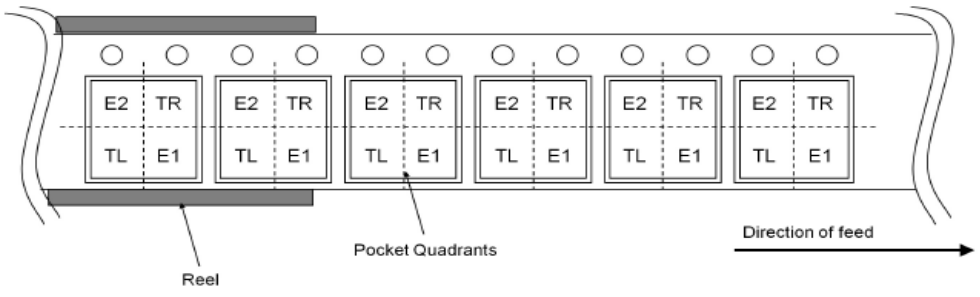
Package Name	SOP16WM



(UNIT : mm)
PKG : SOP16WM
Drawing No. EX001−0046

< Tape and Reel Information >

Tape	Embossed carrier tape
Quantity	1500pcs
Direction of feed	E2 The direction is the pin 1 of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand



Revision History

Date	Revision	Changes
07.Jun.2018	001	New Release

Notice

Precaution on using ROHM Products

1. If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment (Note 1), aircraft/spacecraft, nuclear power controllers, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
   [a] Installation of protection circuits or other protective devices to improve system safety
   [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are not designed under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
   [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
   [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse. is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

Precaution Regarding Intellectual Property Rights

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General Precaution

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