## ■Absolute Maximum Ratings

| Item | Symbol | Min | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|
| Input voltage for DC/DC converter | $V_{IN}$ | −0.3 | 28 | Vdc | Between Vin(+) to Vin(−) |
| Minimum operating input voltage for DC/DC converter | $V_{INMIN}$ | 13 | – | Vdc | |
| Input−side signal voltage | $V_{SG}$ | −0.3 | 5.2 | V | INA, INB, XRST, RDY, FLT |
| Input−side signal maximum current | $I_{SG}$ | – | 5 | mA | RDY, FLT |
| DESAT pin input voltage | $V_{DESAT}$ | −0.3 | $V_{OUTH}$+0.3 | V | |
| CLAMP pin input voltage | $V_{CLAMP}$ | $V_{OUTL}$−0.3 | $V_{OUTH}$+0.3 | V | |
| OUT pin output current(peak) | $I_{OUTPEAK}$ | – | 18 | A | Guaranteed by design |
| Output power for DC/DC converter | $P_{OUT}$ | – | 3 | W | By one circuit |
| Switching frequency | $F_{SW}$ | – | 200 | kHz | |
| Operating temperature range | $T_{OP}$ | −30 | 85 | ℃ | See the derating curve |
| Operating humidity | $RH_{OP}$ | 20 | 95 | %RH | No condensation |
| Storage temperature range | $T_{STG}$ | −30 | 100 | ℃ | |
| Storage humidity | $RH_{STG}$ | 5 | 95 | %RH | No condensation |

## ■Recommended Operating Conditons

| Item | Symbol | Min | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|
| Input voltage range for DC/DC converter | $V_{IN}$ | 13.5 | 26.4 | Vdc | Rated Input Voltage:24V |
| Driver circuit number | N | – | 2 | – | |
| Logic high level input voltage | $V_{SGH}$ | 2 | 5 | V | INA, INB ,XRST |
| Logic low level input voltage | $V_{SGL}$ | 0 | 0.8 | V | INA, INB ,XRST |
| Source current of control signal | $I_{SG}$ | 20 | – | mA | INA, INB, XRST, $V_{SG}$=5V |
| Maximum gate drive capability(200kHz) | $Q_{MAX}$ | – | 700 | nC | $T_{OP}$=55℃ Reference value |
| Maximum gate drive capability(50kHz) | $Q_{MAX}$ | – | 2800 | nC | $T_{OP}$=55℃ Reference value |
| Minimum input pulse width | $t_{INMSK}$ | – | 60 | ns | |

## ■Electrical Specification （Ta=25℃）

DC/DC converter block

| Item | Symbol | Min | Typ | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|---|
| Start-up voltage | $V_{START}$ | – | 11.5 | 12.5 | V | |
| Efficiency | Effi | 69 | 74 | – | % | Rated Input Voltage, $I_{OUTAVE}$(CH1,2):100mA |
| Standby power | $P_{STBY}$ | – | 0.7 | 1 | W | Rated Input Voltage, No load |
| Output voltage(Hgih) | $V_{1+}, V_{2+}$ | 17.5 | 18.5 | 19.5 | V | $I_{OUTAVE}$(CH1) = $I_{OUTAVE}$(CH2) = 10-150mA |
| | | 17.5 | 18.5 | 20.5 | V | $I_{OUTAVE}$(CH1) = $I_{OUTAVE}$(CH2) = 0-10mA |
| Output voltage(Low) | $V_{1-}, V_{2-}$ | –3 | –2 | –1 | V | $I_{OUTAVE}$(CH1) = $I_{OUTAVE}$(CH2) = 0-150mA |
| Output voltage(5VDC) | $V_{5VDC}$ | 4.8 | 5.0 | 5.2 | V | |
| Output Voltage(High)(Load imbalance) | $V_{1+}, V_{2+}$ | – | – | 25 | V | $I_{OUTAVE}$(CH1):100mA,$I_{OUTAVE}$(CH2):0mA |
| Output Voltage(Low)(Load imbalance) | $V_{1-}, V_{2-}$ | –5 | – | – | V | or $I_{OUTAVE}$(CH1):0mA,$I_{OUTAVE}$(CH2):100mA |

Gate drive block

| Item | Symbol | Min | Typ | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|---|
| Logic | | | | | | |
| Logic high level input voltage | $V_{SGH}$ | 2 | – | $V_{5VDC}$ | V | INA, INB ,XRST |
| Logic low level input voltage | $V_{SGL}$ | 0 | – | 0.8 | V | INA, INB ,XRST |
| Logic pull-down resistance | $R_{SGD}$ | – | 270 | – | Ω | INA, INB ,XRST |
| Logic pull-up resistance | $R_{SGU}$ | – | 5100 | – | Ω | RDY, FLT |
| Logic input mask time | $t_{INMSK}$ | – | – | 60 | ns | INA, INB |
| Minimum XRST pulse width | $t_{XRSTMIN}$ | 800 | – | – | ns | |

■Electrical Specification – Continued （Ta=25℃）

Gate drive block – continued

| Item | | Symbol | Min | Typ | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|---|---|
| Output | | | | | | | |
| Output pin voltage(Hgih) | | $V_{OUTH}$ | – | $V_{DCDCOH}-0.5$ | – | V | No load |
| Output pin voltage(Low) | | $V_{OUTL}$ | – | $V_{DCDCOL}+0.5$ | – | V | No load, Miller clamp pin no used |
| | | | – | $V_{DCDCOL}+0.1$ | – | V | No load, Miller clamp pin used |
| OUT ON resistance(Source) | | $R_{ONH}$ | – | – | 50 | mΩ | Guaranteed by design |
| OUT ON resistance(Sink) | | $R_{ONL}$ | – | – | 50 | mΩ | Guaranteed by design |
| CLAMP ON resistance | | $R_{ONPRO}$ | 0.2 | 0.5 | 0.9 | Ω | $I_{CLAMP}=40mA$ |
| Low level CLAMP current | | $I_{CLAMPL}$ | 3 | 4.5 | – | A | Guaranteed by design |
| CLAMP ON threshold voltage | | $V_{CLPON}$ | $V_{OUTL}+1.8$ | $V_{OUTL}+2$ | $V_{OUTL}+2.2$ | V | Guaranteed by design |
| Delay time | Turn ON time | $t_{PON}$ | 55 | 80 | 105 | ns | |
| | Turn OFF time | $t_{POFF}$ | 55 | 80 | 105 | ns | |

■Protection

DC/DC converter block

| Item | Symbol | Min | Typ | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|---|
| Overload protection | – | 6 | – | – | W | Auto recovery |
| Overheat protection | – | 120 | – | 150 | ℃ | Internal temperature |

Gate drive block

| Item | Symbol | Min | Typ | Max | Unit | Conditions・Note |
|---|---|---|---|---|---|---|
| 5VDC UVLO OFF voltage | $V_{UVLO5VH}$ | 3.35 | 3.50 | 3.65 | V | Guaranteed by design |
| 5VDC UVLO ON voltage | $V_{UVLO5VL}$ | 3.25 | 3.40 | 3.55 | V | Guaranteed by design |
| 5VDC UVLO UVLO mask time | $T_{UVLO5VMSK}$ | 1.0 | 2.5 | 5.0 | us | Guaranteed by design |
| OUT(H) UVLO OFF voltage | $V_{UVLOOHH}$ | 11.3 | 12.3 | 13.3 | V | Guaranteed by design |
| OUT(H) UVLO ON voltage | $V_{UVLOOHL}$ | 10.3 | 11.3 | 12.3 | V | Guaranteed by design |
| OUT(H) UVLO mask time | $T_{UVLOOHMSK}$ | 1.0 | 2.0 | 3.0 | us | Guaranteed by design |
| DESAT source current | $I_{DESAT}$ | 450 | 500 | 550 | uA | |
| DESAT threshold voltage | $V_{DESAT}$ | 8.5 | 9 | 9.5 | V | |
| DESAT filter time | $t_{DESATFIL}$ | 0.16 | 0.25 | 0.34 | us | Guaranteed by design |
| DESAT delay time(OUT) | $t_{DESATOUT}$ | 0.31 | 0.38 | 0.45 | us | Guaranteed by design |
| DESAT delay time(FLT) | $t_{DESATFLT}$ | 0.34 | 0.42 | 0.5 | us | Guaranteed by design |
| DESAT low voltage | $V_{DESATL}$ | – | 0.1 | 0.22 | V | $I_{DESAT}=1mA$ |
| DESAT leading edge blanking | $t_{DESTLEB}$ | 0.28 | 0.4 | 0.52 | us | Guaranteed by design |
| 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 | $I_{FLT}=5mA$ |

■Insulation

| Item | Specification | Conditions・Note |
|---|---|---|
| Between Input−Output | | |
| Dielectric withstand voltage | AC2500V | 1min, Cutoff 2mA |
| Test dielectric withstand voltage | AC2500V | 1sec, Cutoff 2mA |
| Insulation resistance | 100MΩ or more | DC500V |
| Minimum clearance distances | 6mm | |
| Minimum creepage distances | 6mm | |
| Between Ch1−Ch2 | | |
| Dielectric withstand voltage | AC2500V | 1min, Cutoff 2mA |
| Test dielectric withstand voltage | AC2500V | 1sec, Cutoff 2mA |
| Insulation resistance | 100MΩ or more | DC500V |
| Minimum clearance distances | 6mm | |
| Minimum creepage distances | 6mm | |

■Ambient Temperature Derating Curve

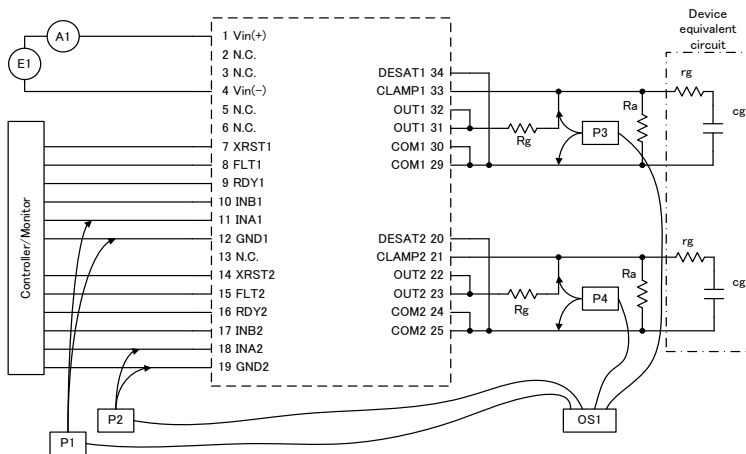Reduce the input power according to the following temperature derating table.
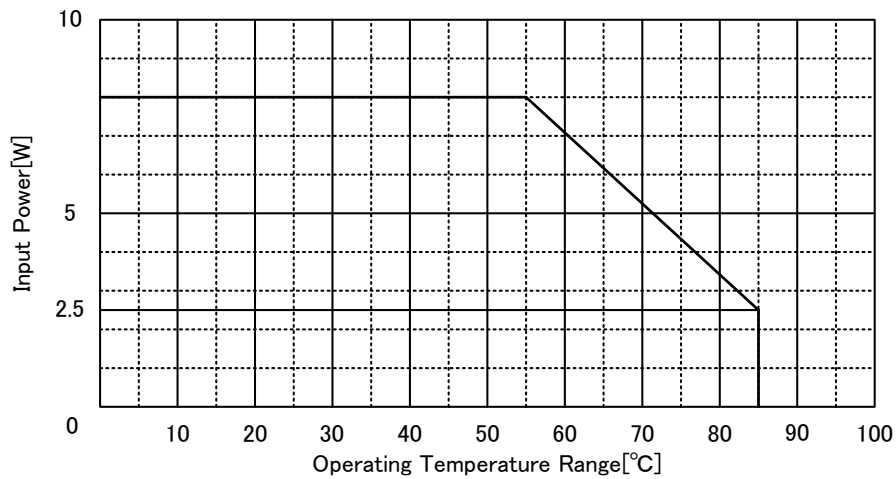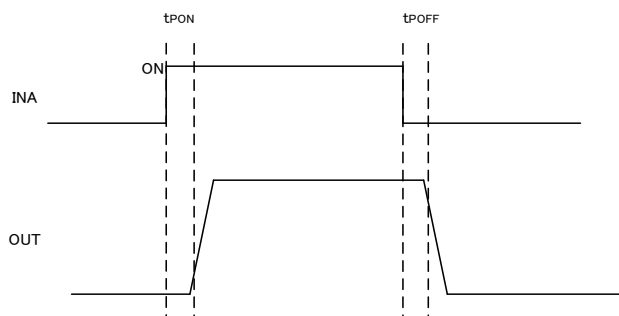
■Measure Circuit

【DC/DC converter】
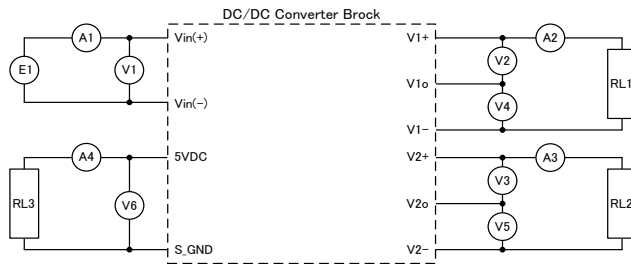


E1 : DC power supply
A1–4 : Ammeter Class 0.5
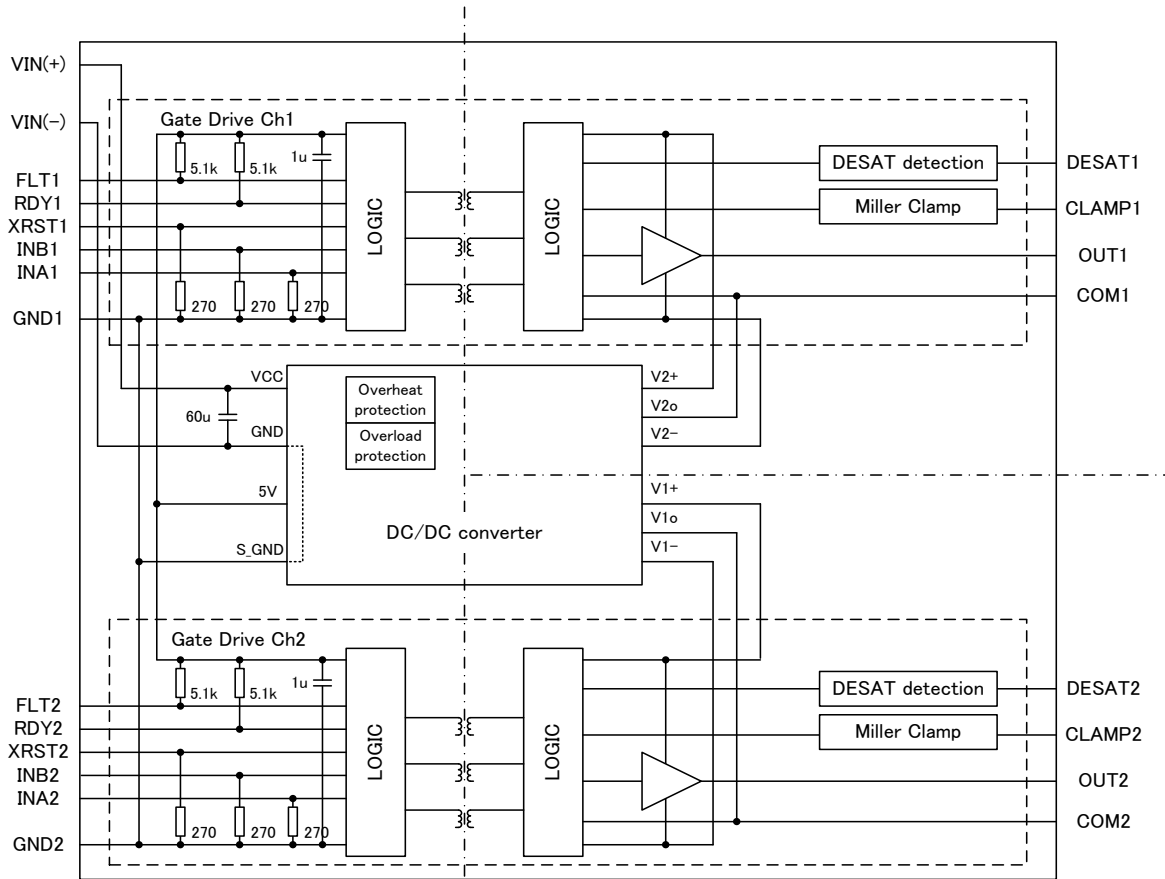RL1–3 : Electronic load
V1–6 : Voltmeter Class 0.5

【Gate drive】



E1 : DC power supply
A1 : Ammeter Class 0.5
OS1 : Oscilloscope
P1–4 : Probe
Rg : 4Ω
Ra : 47kΩ
rg : 1Ω
cg : 100nF

【Rising waveform/Falling waveform 】

■Block Diagram

■Pin Connection

See the next section for details of pin functions

Input side

| Pin No. | Name | CH | Explanation of pins |
|---------|------|----|----|
| 1 | Vin(+) | Common | Power supply pin for DC/DC converter(+) |
| 2 | N.C. | – | Unused pin ＊Don't connect with other circuits. |
| 3 | N.C. | – | Unused pin ＊Don't connect with other circuits. |
| 4 | Vin(–) | Common | Power supply pin for DC/DC converter(–) |
| 5 | N.C. | – | Unused pin ＊Don't connect with other circuits. |
| 6 | N.C. | – | Unused pin ＊Don't connect with other circuits. |
| 7 | XRST1 | 1 | Reset input pin |
| 8 | FLT1 | 1 | Fault output pin |
| 9 | RDY1 | 1 | Ready output pin |
| 10 | INB1 | 1 | Opposite driver's control input pin |
| 11 | INA1 | 1 | Control input pin |
| 12 | GND1 | 1 | Ground pin for control circuit |
| 13 | N.C. | – | Unused pin ＊Don't connect with other circuits. |
| 14 | XRST2 | 2 | Reset input pin |
| 15 | FLT2 | 2 | Fault output pin |
| 16 | RDY2 | 2 | Ready output pin |
| 17 | INB2 | 2 | Opposite driver's control input pin |
| 18 | INA2 | 2 | Control input pin |
| 19 | GND2 | 2 | Ground pin for control circuit |

Output side

| Pin No. | Name | CH | Explanation of pins |
|---------|------|----|----|
| 20 | DESAT2 | 2 | Desaturation protection pin |
| 21 | CLAMP2 | 2 | Miller clamp pin |
| 22 | OUT2 | 2 | Gate drive pin |
| 23 | OUT2 | 2 | Gate drive pin |
| 24 | COM2 | 2 | Common pin |
| 25 | COM2 | 2 | Common pin |
| 26 | NONE | – | None |
| 27 | NONE | – | None |
| 28 | NONE | – | None |
| 29 | COM1 | 1 | Common pin |
| 30 | COM1 | 1 | Common pin |
| 31 | OUT1 | 1 | Gate drive pin |
| 32 | OUT1 | 1 | Gate drive pin |
| 33 | CLAMP1 | 1 | Miller clamp pin |
| 34 | DESAT1 | 1 | Desaturation protection pin |

■Terminal Function

・Vin(+), Vin(−) (Power supply pin for DC/DC converter)

・GND(Ground pin for drive circuit)

・INA, INB, XRST(Control input pin, XRST input pin)

　　The INA, INB and XRST pin is a pin used to determine output logic.

　　And XRST is in charge of setting back the FLT pin.

| XRST | INB | INA | OUT |
|------|-----|-----|-----|
| L | X | X | L |
| H | H | X | L |
| H | L | L | L |
| H | L | H | H |

・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 FLT.

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

・RDY(Ready output pin)

　　The RDY pin shows the status of three internal protection features which are 5VDC UVLO, OUT(H) UVLO, and output state

　　feedback (OSFB). The term 'output state feedback' shows whether output internal logic is high or low corresponds to input logic or not.

| Status | RDY |
|--------|-----|
| While in normal operation | H |
| 5VDC UVLO or OUT(H) UVLO or Output internal logic feedback | L |

・OUT(Output pin)

　　The OUT pin is a pin used to drive the gate of a power device.

・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.

・DESAT(Desaturation protection pin)

　　The DESAT pin is a pin used to detect desaturation of IGBT/MOSFET. When the DESAT pin voltage exceeds $V_{DESAT}$, the 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 COM pin

　　if the desaturation protection is not used. In order to prevent the wrong detection due to noise, the noise mask time $t_{DESATFIL}$ is set.

・COM(Common pin)

　　COM pin is a pin to be connected to the emitter / source of the power device.

■Description Of Protection

1. Gate voltage rise prevention function

If OUT=L and the CLAMP pin voltage < VCLPON, the internal MOSFET of the CLAMP pin turns on.

| OUT | CLAMP | Internal MOSFET of the CLAMP pin |
|-----|-------|----------------------------------|
| L | Less than $C_{CLPON}$ | ON |
| L | Not less than $C_{CLPON}$ | OFF |
| H | X | OFF |



Timing chart of Miller clamp function
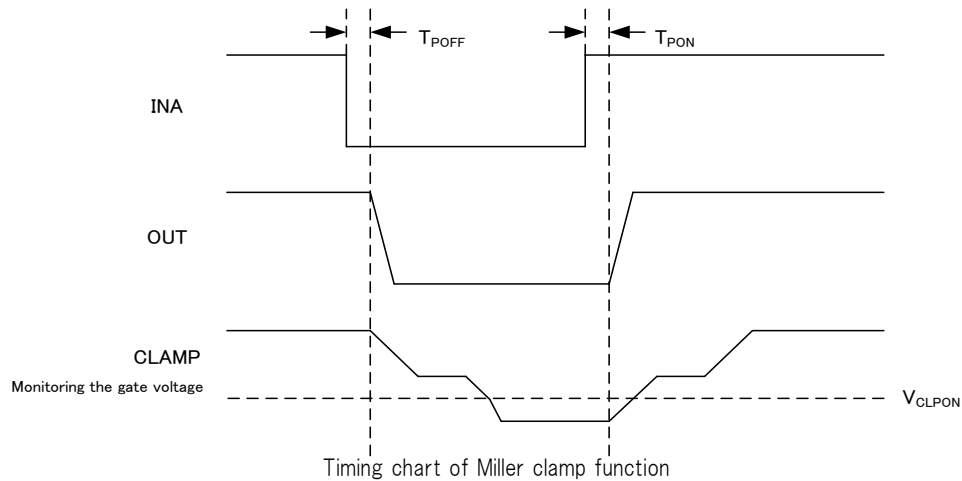
2. Undervoltage Lockout (UVLO) function

The control circuit incorporates the undervoltage lockout (UVLO) function both on the 5VDC and the OUT(H) sides.

When the 5VDC or the OUT(H) voltage drops to the UVLO ON voltage, the OUT pin and the RDY pin both will output the "L" signal.

When the 5VDC or the OUT(H) voltage rises to the UVLO OFF voltage, 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.

3. Desaturation protection function(DESAT), Fault signal output function

When the DESAT pin voltage exceeds VDESAT, 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.
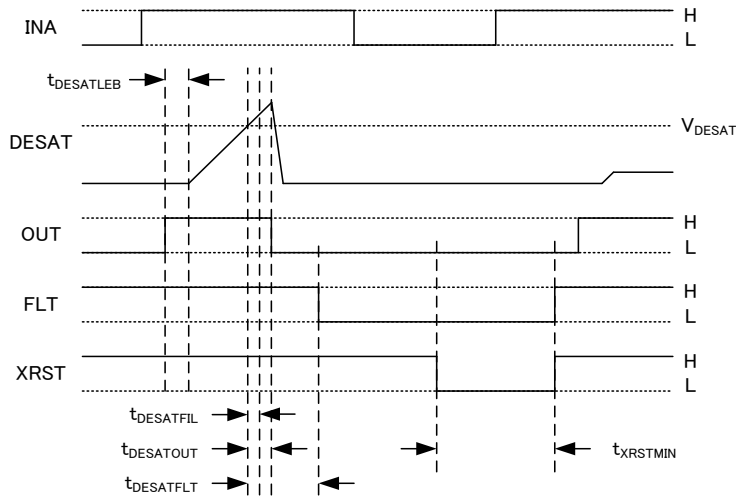


DESAT Operation Timing Chart

■I/O Condition Table

| No. | Status | Input | | | | | | | Output | | | |
|-----|--------|-------|------|-------|------|-----|-----|-------|-----|-------|-----|-----|
| | | $V_{5VDC}$ | $V_{OUTH}$ | DESAT | XRST | INB | INA | CLAMP | OUT | CLAMP | FLT | RDY |
| 1 | $V_{5VDC}$ 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 | $V_{OUTH}$ 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(*) |

○ : 5VDC or OUT(H) UVLO > UVLO, X : Don't care

(*) If the internal logic of high voltage side doesn't become the expected value, the RDY pin will become "L". And this

stage is cleared automatically if the internal logic of high voltage side becomes the expected value.

■**Application**

【Circuit example】
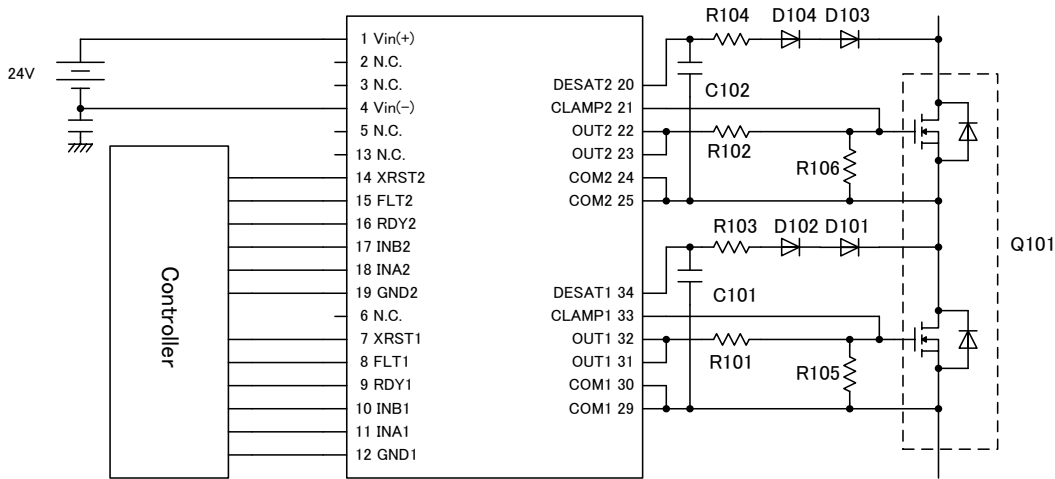


【Configuration example】

| Symbol | Description | Part No. | Manufacturer |
|---|---|---|---|
| Q101 | SiC MOSFET | BSM180D12P3C007 | ROHM |
| D101-104 | Diode | CMF05 | TOSHIBA |
| C101,102 | Capacitor | 100pF 25V | |
| R101,102 | Resistor | 4Ω 6W | |
| R103,104 | Resistor | 1kΩ | |
| R105,106 | Resistor | 47kΩ | |

■Reliability

| Item | Test condition and acceptance criterion |
|---|---|
| Exposure in high temperature | 100℃, 240H, ※ |
| Exposure in low temperature | −30℃, 240H, ※ |
| Exposure in high temperature and high humidity | 60℃, 90〜95%RH, 240H, ※ |
| Thermal shock | −30℃/30min to 100℃/30min,  500cycles, ※ |
| Low temperature operation | Input voltage:DC24V,  Output current:Rated Load<br>−30℃, 240H, ※ |
| High temperature operation | Input voltage:DC24V,  Output current:Rated Load<br>85℃, 240H, ※ |
| high temperature and high humidity operation | Input voltage:DC24V,  Output current:Rated Load<br>60℃, 90〜95%RH, 240H, ※ |
| Vibration | Vibration amplitude:1.5mm(peak to peak), Vibration Frequency:10 to 55Hz, Sweeping:1min.<br>In each X，Y and Z direction:once, 120min. ※ |
| Impact | Acceleration:490m/s$^2$ (50G), Operating time:11ms<br>In each ±X，Y and Z direction:3 times, ※ |
| Drop test for packaged freights | Dorp to concrete.　　Height:40cm<br>Dorp surface:1 corner, 3 spines, 6 surfaces, 1 time each. |
| Solderblity | Sample shall be dipped into the solution of Methanol and Rosin<br>(having 75% Methanol and having 25% Rosin by weight measuring)<br>and shall be dippend into the solder bath having the solder Sn−3Ag−0.5Cu<br>of 250±5℃ to the position to 3mm from the end of terminal for 3.0±0.5 seconds,<br>and pulled up. After above treatment, the sample shall be coveredby solder uniformly<br>at more than 75% of circumference and shall not show any unusual appearance. |
| Resistance to soldering heat | Sample shall be dipped into the solution of Methanol and Rosin<br>(having 75% Methanol and having 25% Rosin by weight measuring)<br>and shall be dippend into the solder bath having the solder Sn−3Ag−0.5Cu<br>of 260±5℃ to the position to 3mm from the end of terminal for 10.0±0.5<br>seconds, and pulled up. After that sample shall be replace in normal ambient<br>for 1〜2 hours and shall not show any unusual appearance. |

※After each test, exposure at room temperature and humidity condition for 24 hours.

　There shall be no abnormality on the electrical specification and appearance.
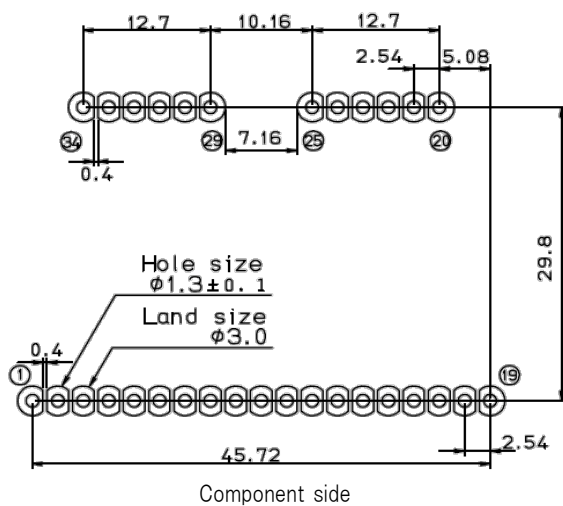
■Outline Dimensional Drawing



22.5 ±1
3 ±0.3
54.5
□0.64 Tin plated brass

(2.5)
(2.5)
36.5

4.4 ±0.8
(18-P2.54)
①
⑲
(29.8)
3.5 ±0.8
㉞　㉙　㉕　⑳
9.5 ±0.8
(5-P2.54)
(5-P2.54)
(10.16)
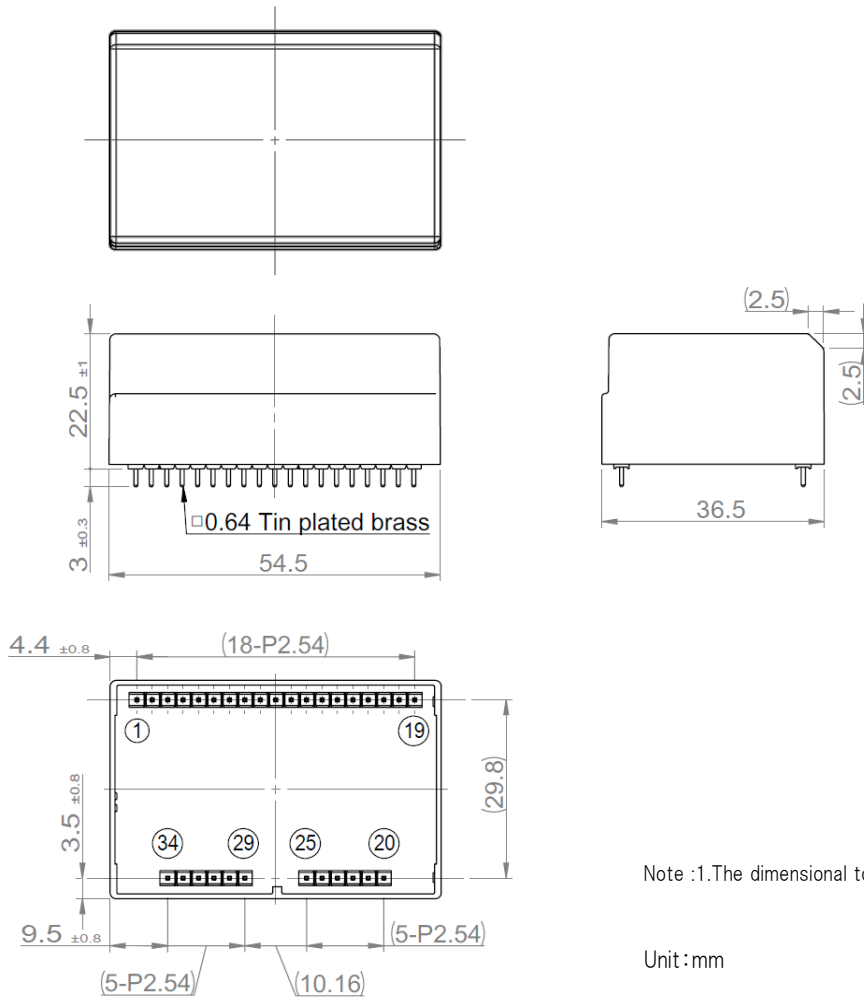
Note :1.The dimensional tolerance without directions is ± 0.5mm.

Unit：mm

■Product Weight

75g(TYP)

■Recommended Hole Diameter And Land Size



12.7　10.16　12.7
2.54　5.08
㉞　㉙　7.16　㉕　⑳
0.4

Hole size
Φ1.3±0.1
Land size
Φ3.0
0.4
①
⑲
45.72
2.54
29.8

Component side

※The round pulling out figure is a pin numbering.

Unit：mm

■Recommended Soldering Condition

　・Flow soldering condition　　　　　：　255±3℃ Less than 5sec

　　　　　　　　　　　　　　　　　　　　Temperature of preheating 110℃～130℃

　　　　　　　　　　　　　　　　　　　　End temperature of preheating 110℃±10℃

　・Soldering condition of hand work　：　350℃(MAX) Less than 4sec


■Storage Conditions

| Item | Min | Max | Unit | Conditions・Note |
|---|---|---|---|---|
| Storage temperature | -25 | 60 | ℃ | A packing state |

※If you want to use past the long period there is a concern that the solder non-wetting by terminal oxidation to occur.

　Therefore, please use from taking enough tests.


■Usage Cautions

● Always mount fuse on the plus side of input for ensuring safety because the fuse is not built-in the product.

　Please select the fuse considering conditions such as steady current, inrush current, and ambient temperature.

　When using a fuse having large rated current or high capacity input electrolytic condenser, by combining

　another converter and input line and input electrolytic condenser, fuse may not blow off in the case of abnormality.

　Do not combine high voltage line and fuse.


● This product is designed to be best when it drives two devices to have the same gate capacitance simultaneously.

　Because it leads to the "output unstable" and "output accuracy deterioration".

　If you want to use to drive only one of the devices, because of the output voltage accuracy deterioration prevention,

　please configure the dummy gate circuit (resistor and capacitor) to consume the equivalent of the power and the drive side.


● This product is to transmit the signal of the insulating part by the magnetic coupling.

　Therefore, if you use this product in a strong magnetic field in, there is a possibility of malfunction.

　In that case, connect the capacitor between the GND terminal of this product and a metal enclosure.


● Make sure the rise/fall time of the input signal is 500ns or less.

■Important Notice

● The content of this information is subject to change without prior notice for the purpose of improvements, etc.
Ensure that you are in possession of the most up-to-date information when using this product.

● The operation examples and circuit examples shown in this document are for reference purposes only, and TAMURA Corporation disclaims all responsibility for any violations of industrial property rights, intellectual property rights and any other rights owned by TAMURA Corporation or third parties that these may entail.

● The circuit examples and part constants listed in this document are provided as reference for the verification of characteristics. You are to perform design, verification, and judgment at your own responsibility, taking into account the various conditions.

● TAMURA Corporation constantly strives to improve quality and reliability, but malfunction or failures are bound to occur with some probability in power products. To ensure that failures do not cause accidents resulting in injury or death, fire accidents, social damage, and so on, you are to thoroughly verify the safety of their designs in devices and/or systems, at your own responsibility.

● This product is intended for use in consumer electronics (electric home appliances, business equipment, Information equipment, communication terminal equipment, measuring devices, and so on.) If considering use of this product in equipment or devices that require high reliability (medical devices, transportation equipment, traffic signal control equipment, fire and crime prevention equipment, aeronautics and space devices, nuclear power control, fuel control, in-vehicle equipment, safety devices, and so on), please consult a TAMURA sales representative in advance. Do not use this product for such applications without written permission from TAMURA Corporation.

● This product is intended for use in environments where consumer electronics are commonly used.
It is not designed for use in special environments such as listed below, and if such use is considered,
you are to perform thorough safety and reliability checks at your own responsibility.
  ・ Use in liquids such as water, oil, chemical solutions, or organic solvents, and use in locations
     where the product will be exposed to such liquids.
  ・ Use that involves exposure to direct sunlight, outdoor exposure, or dusty conditions.
  ・ Use in locations where corrosive gases such as salt air, C12, H2S, NH3, SO2, or NO2, are present.
  ・ Use in environments with strong static electricity or electromagnetic radiation.
  ・ Use that involves placing inflammable material next to the product.
  ・ Use of this product either sealed with a resin filling or coated with resin.
  ・ Use of water or a water soluble detergent for flux cleaning.
  ・ Use in locations where condensation is liable to occur.

● This product is not designed to resist radiation.

● This product is not designed to be connected in series or parallel.
Do not operate this product in a series, parallel, or N+1 redundant configuration.

● Do not use or otherwise make available the TAMURA products or the technology described in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of mass destruction weapons (e.g. nuclear, chemical, or biological weapons or missile technology products).
When exporting and re-exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations including, without limitation, Japan -Foreign Exchange and Foreign Trade Control Law and  U.S.- Export Administration Regulations.
The TAMURA products and related technology should not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.

● Please contact your TAMURA sales office for details as to environmental matters such as the RoHS compatibility of product.
Please use TAMURA products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive.
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