

# High-side Power Switch ICs [With Diagnostic Function] SI-5155S

## Features

- Built-in diagnostic function to detect short and open circuiting of loads and output status signals
- Low saturation PNP transistor use
- Allows direct driving using LS-TTL and C-MOS logic levels
- Built-in overcurrent and thermal protection circuits
- Built-in protection against reverse connection of power supply
- $T_j = 150^\circ\text{C}$  guaranteed
- TO220 equivalent full-mold package not require insulation mica

## Absolute Maximum Ratings

( $T_a = 25^\circ\text{C}$ )

| Parameter                 | Symbol     | Ratings       | Unit             | Conditions                                          |
|---------------------------|------------|---------------|------------------|-----------------------------------------------------|
| Power supply voltage      | $V_B$      | -13 to +40    | V                |                                                     |
| Input terminal voltage    | $V_{IN}$   | -0.3 to $V_B$ | V                |                                                     |
| DIAG terminal voltage     | $V_{DIAG}$ | 6             | V                |                                                     |
| Collector-emitter voltage | $V_{CE}$   | 40            | V                |                                                     |
| Output current            | $I_O$      | 2.5           | A                |                                                     |
| Power dissipation         | $P_{D1}$   | 22            | W                | With infinite heatsink ( $T_c = 25^\circ\text{C}$ ) |
|                           | $P_{D2}$   | 1.8           | W                | Stand-alone without heatsink                        |
| Junction temperature      | $T_j$      | -40 to +150   | $^\circ\text{C}$ |                                                     |
| Operating temperature     | $T_{OP}$   | -40 to +100   | $^\circ\text{C}$ |                                                     |
| Storage temperature       | $T_{stg}$  | -40 to +150   | $^\circ\text{C}$ |                                                     |

## Electrical Characteristics

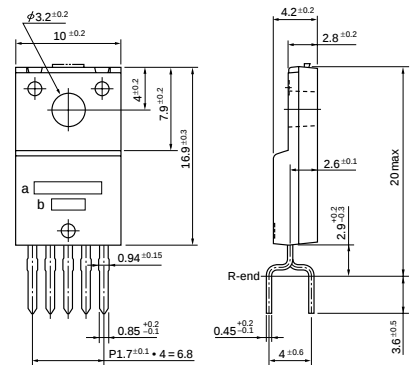
( $T_a = 25^\circ\text{C}$  unless otherwise specified)

| Parameter                               |            | Symbol        | Ratings |     |       | Unit | Conditions                                      |
|-----------------------------------------|------------|---------------|---------|-----|-------|------|-------------------------------------------------|
|                                         |            |               | min     | typ | max   |      |                                                 |
| Operating power supply voltage          |            | $V_{Bopr}$    | 6.0     |     | 30    | V    |                                                 |
| Quiescent circuit current               |            | $I_q$         |         | 5   | 12    | mA   | $V_{Bopr}=14V$ , $V_{IN}=0V$                    |
| Saturation voltage of output transistor |            | $V_{CE(sat)}$ |         |     | 0.3   | V    | $I_O\leq 1.0A$ , $V_{Bopr}=6$ to 16V            |
|                                         |            |               |         |     | 0.72  | V    | $I_O\leq 2.5A$ , $V_{Bopr}=6$ to 16V            |
| Output leak current                     |            | $I_{O, leak}$ |         |     | 2     | mA   | $V_{CE0}=16V$ , $V_{IN}=0V$                     |
| Input voltage                           | Output ON  | $V_{IH}$      | 2.0     |     | $V_B$ | V    | $V_{Bopr}=6$ to 16V                             |
|                                         | Output OFF | $V_{IL}$      | -0.3    |     | 0.8   | V    | $V_{Bopr}=6$ to 16V                             |
| Input current                           | Output ON  | $I_{IH}$      |         |     | 1     | mA   | $V_{IN}=5V$                                     |
|                                         | Output OFF | $I_{IL}$      | -0.1    |     |       | mA   | $V_{IN}=0V$                                     |
| Overcurrent protection starting current |            | $I_S$         | 2.6     |     |       | A    | $V_{Bopr}=14V$ , $V_O=V_{Bopr}-1.5V$            |
| Thermal protection starting temperature |            | $T_{TSD}$     | 150     |     |       | °C   | $V_{Bopr}\geq 6V$                               |
| Open load detection resistor            |            | $R_{open}$    |         |     | 30    | kΩ   | $V_{Bopr}=6$ to 16V                             |
| Output transfer time                    | $T_{ON}$   |               |         | 8   | 30    | μs   | $V_{Bopr}=14V$ , $I_O=1A$                       |
|                                         | $T_{OFF}$  |               |         | 15  | 30    | μs   | $V_{Bopr}=14V$ , $I_O=1A$                       |
| DIAG output voltage                     | $V_{DH}$   | 4.5           |         |     | 6     | V    | $V_{CC}=6V$ , $V_{Bopr}=6$ to 16V               |
|                                         | $V_{DL}$   |               |         |     | 0.3   | V    | $V_{CC}=6V$ , $V_{Bopr}=6$ to 16V, $I_{DO}=2mA$ |
| DIAG output transfer time               | $T_{PLH}$  |               |         |     | 30    | μs   | $V_{Bopr}=14V$ , $I_O=1A$                       |
|                                         | $T_{PHL}$  |               |         |     | 30    | μs   | $V_{Bopr}=14V$ , $I_O=1A$                       |
| Minimum load inductance                 |            | L             | 1       |     |       | mH   |                                                 |

Note:

\* The rule of protection against reverse connection of power supply is  $V_B = -13\text{V}$ , one minute (all terminals except,  $V_B$  and GND, are open).

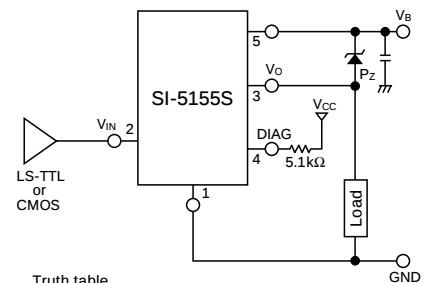
## External Dimensions (unit: mm)



1. GND
  2.  $V_{IN}$
  3.  $V_O$
  4. DIAG
  5.  $V_B$
- a: Part No.  
b: Lot No.

(Forming No. 1123)

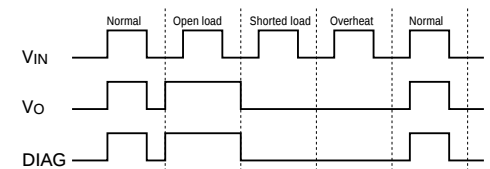
## Standard Circuit Diagram



Truth table

| $V_{IN}$ | $V_O$ |
|----------|-------|
| H        | H     |
| L        | L     |

## Diagnostic Function

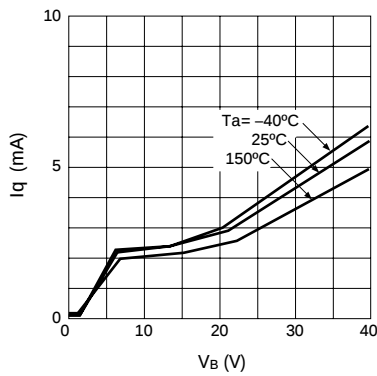


| Mode         | $V_{IN}$ | $V_O$ | DIAG |
|--------------|----------|-------|------|
| Normal       | L        | L     | L    |
| Open load    | L        | H     | H    |
| Shorted load | L        | L     | L    |
| Overheat     | L        | L     | L    |

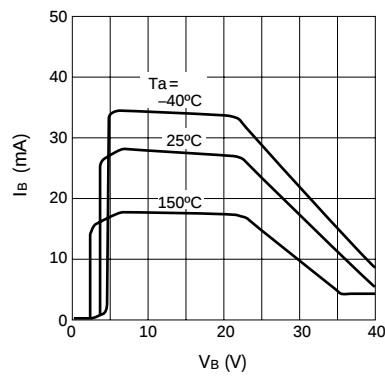
- DIAG output will be undetermined when a voltage exceeding 25V is applied to  $V_B$  terminal.

## Electrical Characteristics

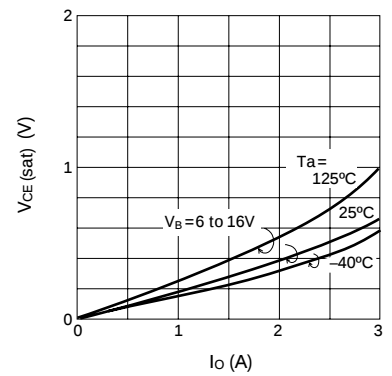
■ Quiescent Circuit Current



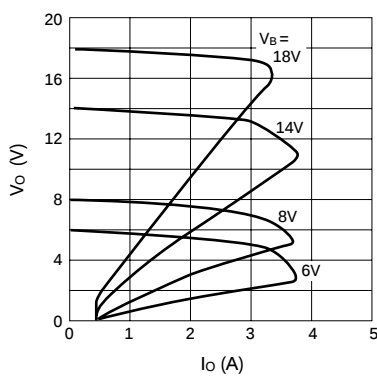
■ Circuit Current



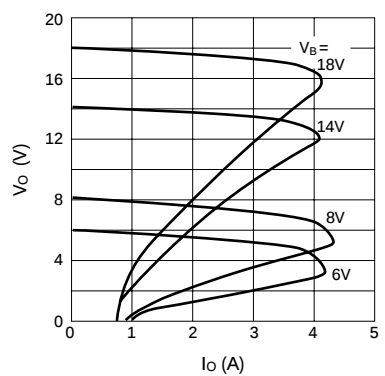
■ Saturation Voltage of Output Transistor



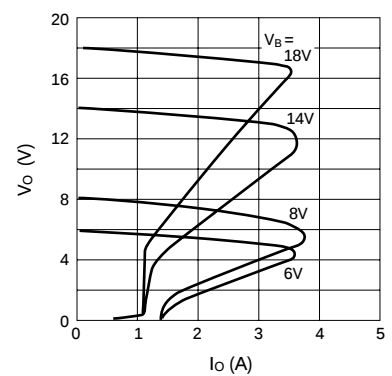
■ Overcurrent Protection Characteristics ( $T_a = -40^\circ\text{C}$ )



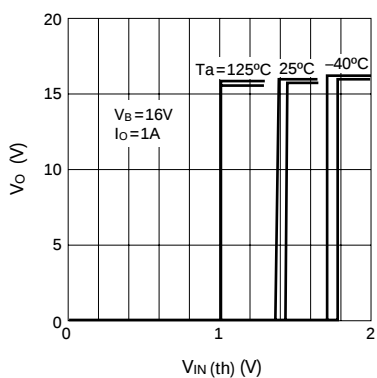
■ Overcurrent Protection Characteristics ( $T_a = 25^\circ\text{C}$ )



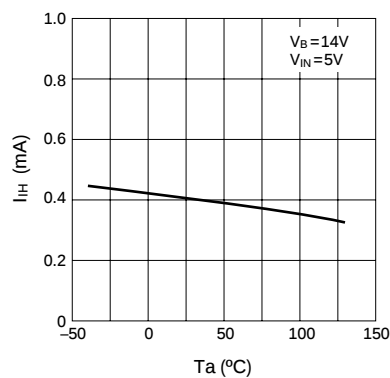
■ Overcurrent Protection Characteristics ( $T_a = 125^\circ\text{C}$ )



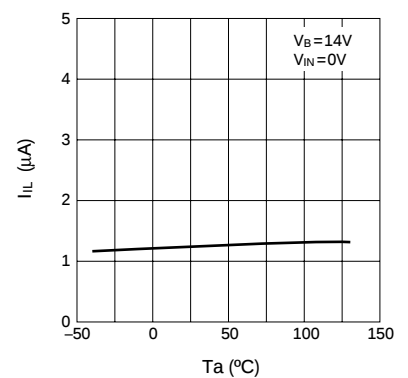
■ Threshold input voltage



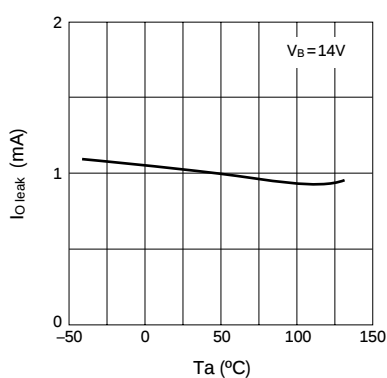
■ Input Current (Output ON)



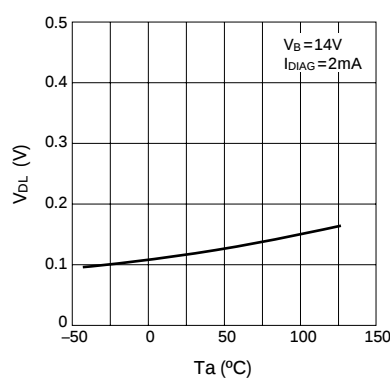
■ Input Current (Output OFF)



■ Output Terminal Leak Current



■ Saturation Voltage of DIAG Output



■ Thermal Protection Characteristics

