# MOSFET – Power, Dual, N-Channel, For 1-2 Cells Lithium-ion Battery Protection

## 24 V, 11.6 mΩ, 10 A,

# ECH8697R

| $V_{DSS}$ | $R_{DS(on)}$ Max | $I_D$ Max |
|---|---|---|
| 24 V | 11.6 mΩ @ 4.5 V | 10 A |
| | 12.6 mΩ @ 4.0 V | |
| | 15 mΩ @ 3.1 V | |
| | 17.5 mΩ @ 2.5 V | |

### Description

This Power MOSFET features a low on−state resistance. This device is suitable for applications such as power switches of portable machines. Best suited for 1−2 cells Lithium−ion Battery applications.

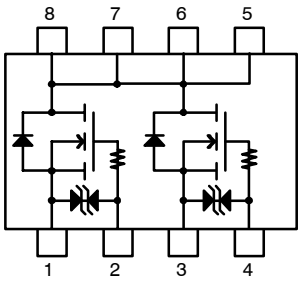
### Features

- Low On−Resistance
- 2.5 V Drive
- Common−Drain Type
- ESD Diode−Protected Gate
- Built−in Gate Protection Resistor
- These Devices are Pb−Free and are RoHS Compliant

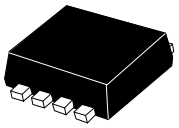
### Typical Applications

- 1−2 cells Lithium−ion Battery Charging and Discharging Switch

### ELECTRICAL CONNECTION
N−Channel

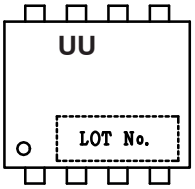



1 : Source1
2 : Gate1
3 : Source2
4 : Gate2
5 : Drain
6 : Drain
7 : Drain
8 : Drain



SOT−28FL/ECH8
CASE 318BF

### MARKING DIAGRAM




### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DSS}$ | Drain to Source Voltage | 24 | V |
| $V_{GSS}$ | Gate to Source Voltage | ±12.5 | V |
| $I_D$ | Drain Current (DC) | 10 | A |
| $I_{DP}$ | Drain Current (Pulse)<br>PW ≤ 10 μs, duty cycle ≤ 1% | 60 | A |
| $P_D$ | Power Dissipation<br>Surface mounted on ceramic substrate<br>(1000 mm$^2$ x 0.8 mm) 1 unit | 1.5 | W |
| $P_T$ | Total Dissipation<br>Surface mounted on ceramic substrate<br>(1000 mm$^2$ x 0.8 mm) | 1.6 | W |
| Tj | Junction Temperature | 150 | °C |
| Tstg | Storage Temperature | −55 to +150 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{\theta JA}$ | Junction to Ambient Surface mounted on ceramic substrate (1000 mm$^2$ x 0.8 mm) 1 unit | 83.3 | °C/W |

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**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C)

| Symbol | Parameter | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_{(BR)DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = 1 mA, $V_{GS}$ = 0 V | 24 | – | – | V |
| $I_{DSS}$ | Zero−Gate Voltage Drain Current | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V | – | – | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±8 V, $V_{DS}$ = 0 V | – | – | ±1 | μA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = 10 V, $I_D$ = 1 mA | 0.5 | – | 1.3 | V |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 10 V, $I_D$ = 5 A | – | 5.0 | – | S |
| $R_{DS(on)}$ | Static Drain to Source On−State Resistance | $I_D$ = 5 A, $V_{GS}$ = 4.5 V | 7.4 | 9.3 | 11.6 | mΩ |
| | | $I_D$ = 5 A, $V_{GS}$ = 4.0 V | 7.7 | 9.7 | 12.6 | mΩ |
| | | $I_D$ = 5 A, $V_{GS}$ = 3.1 V | 8.5 | 10.7 | 15 | mΩ |
| | | $I_D$ = 2.5 A, $V_{GS}$ = 2.5 V | 10 | 12.5 | 17.5 | mΩ |
| $t_{d(on)}$ | Turn−ON Delay Time | See Figure 1 (Note 1) | – | 160 | – | ns |
| $t_r$ | Rise Time | | – | 230 | – | ns |
| $t_{d(off)}$ | Turn−OFF Delay Time | | – | 19.7 | – | μs |
| $t_f$ | Fall Time | | – | 23.6 | – | μs |
| $t_{d(on)}$ | Turn−ON Delay Time | See Figure 2 (Note 1) | – | 160 | – | ns |
| $t_r$ | Rise Time | | – | 230 | – | ns |
| $t_{d(off)}$ | Turn−OFF Delay Time | | – | 980 | – | μs |
| $t_f$ | Fall Time | | – | 350 | – | μs |
| Qg | Total Gate Charge | | – | 6 | – | nC |
| Qgs | Gate to Source Charge | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V, $I_D$ = 10 A | – | 1.1 | – | nC |
| Qgd | Gate to Drain “Miller” Charge | | – | 0.9 | – | nC |
| $V_{SD}$ | Forward Diode Voltage | $I_S$ = 10 A, $V_{GS}$ = 0 V | – | 0.8 | 1.2 | V |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. The fall switching time is dependent on the input pulse width.

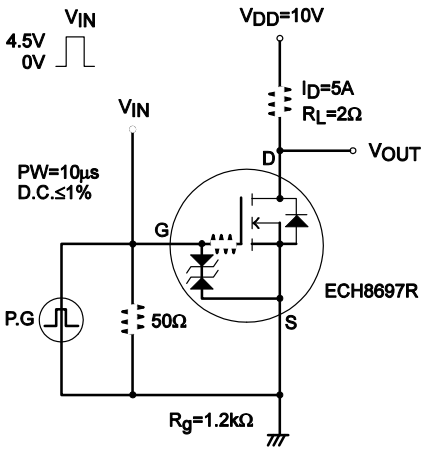


**Figure 1. Switching Time Test Circuit 1**

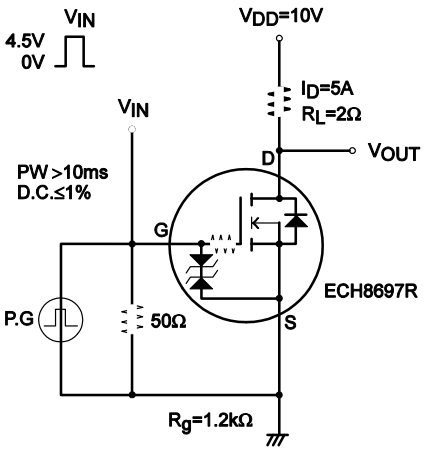


**Figure 2. Switching Time Test Circuit 2**

## TYPICAL CHARACTERISTICS

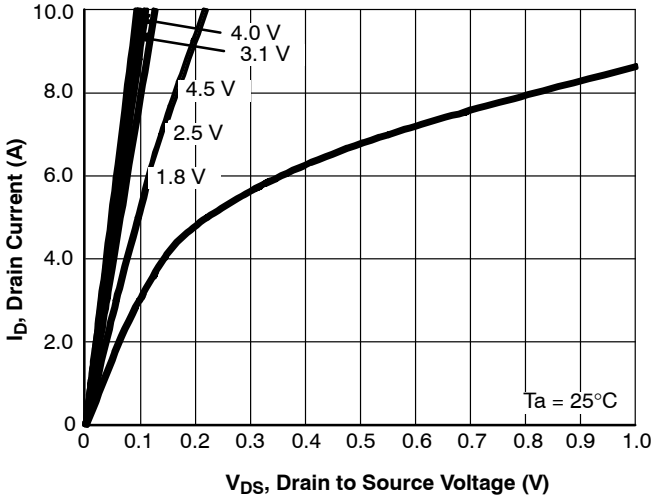


Figure 3. $I_D - V_{DS}$

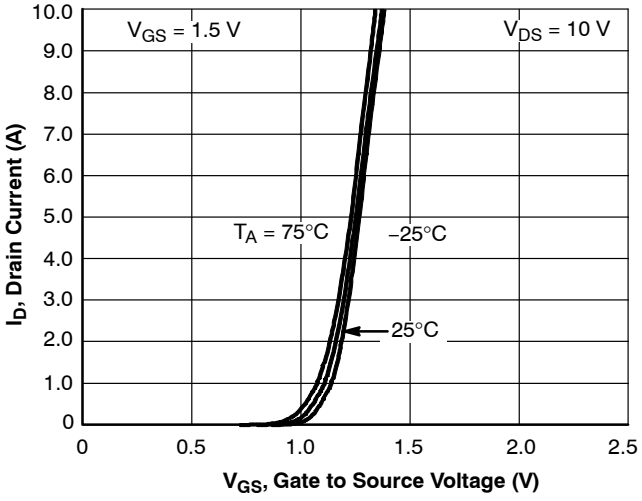


Figure 4. $I_D - V_{GS}$

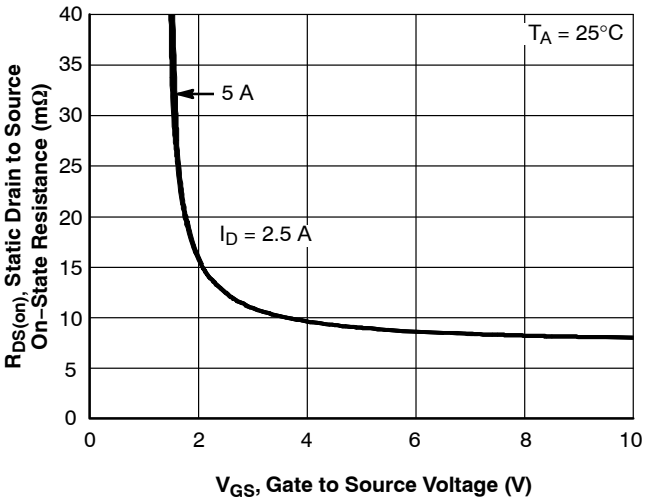


Figure 5. $R_{DS(on)} - V_{GS}$

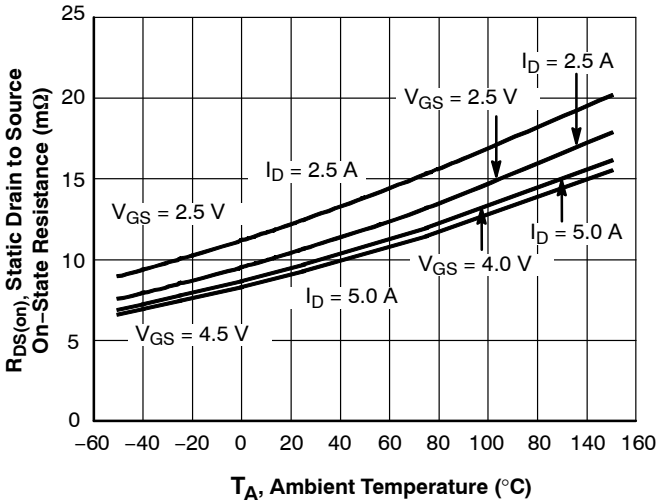


Figure 6. $R_{DS(on)} - T_A$

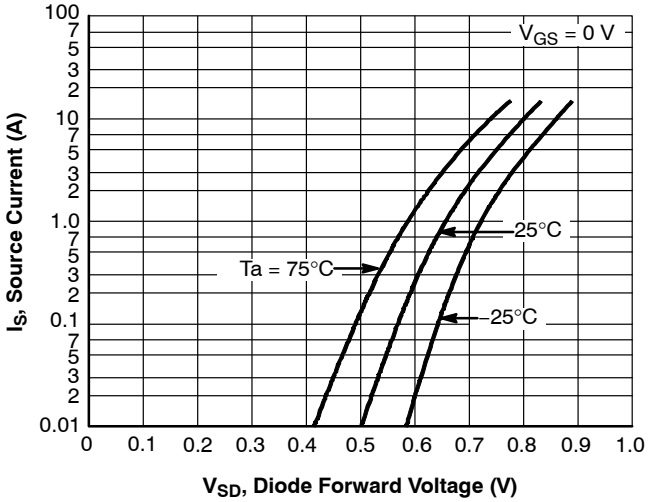


Figure 7. $I_S - V_{SD}$

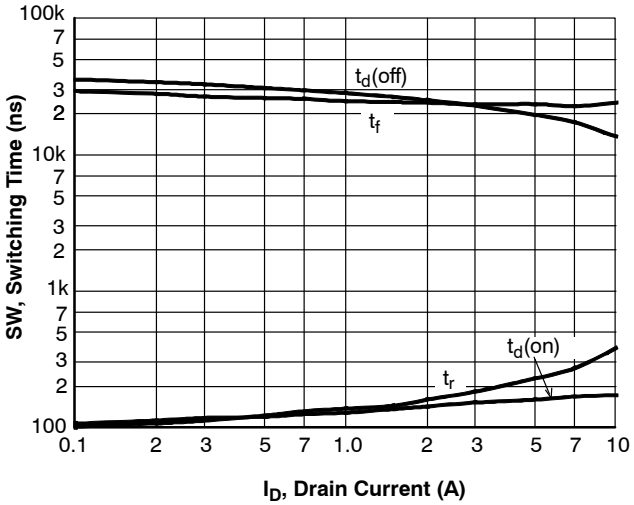


Figure 8. $I_D$ − S/W Time

## TYPICAL CHARACTERISTICS (CONTINUED)

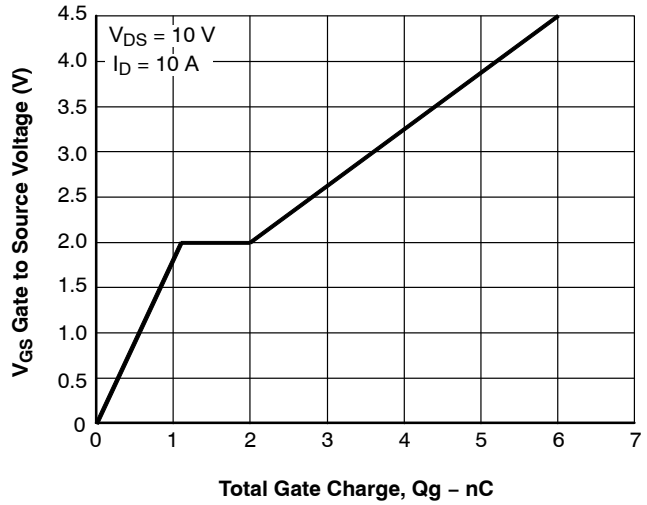


**Figure 9. $V_{GS}$ – $Q_g$**

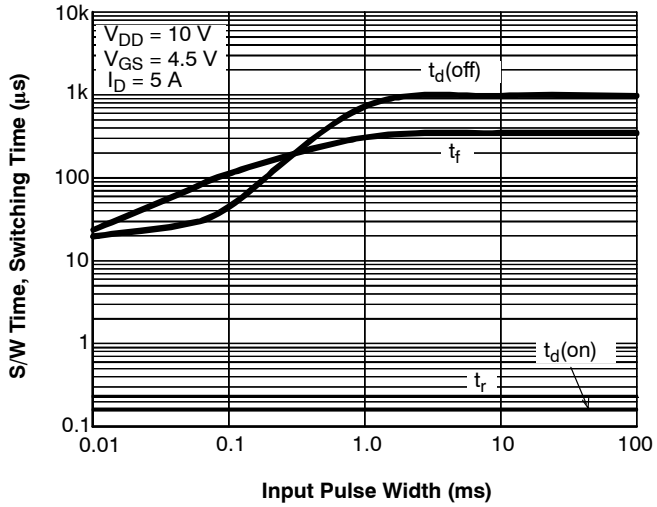


**Figure 10. S/W Time – Input Pulse Width**

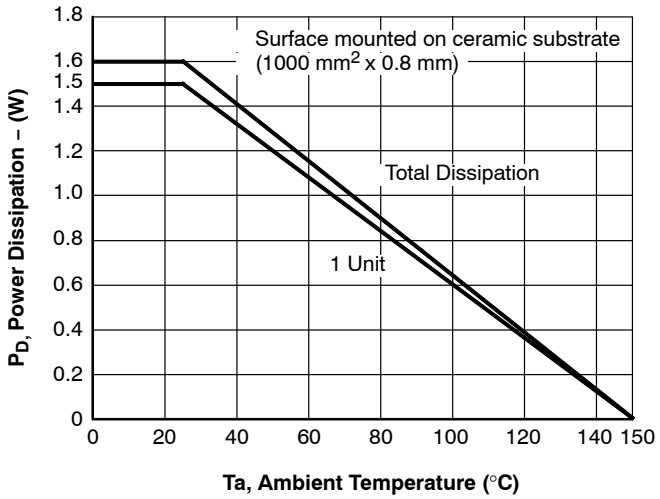


**Figure 11. $P_D$ – Ta**

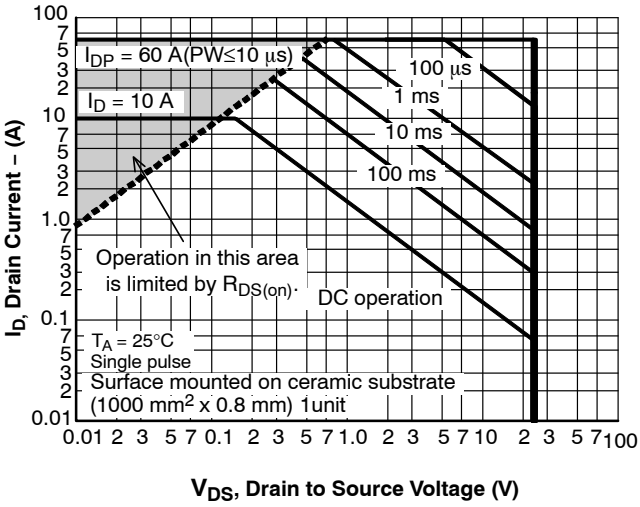


**Figure 12. S O A**

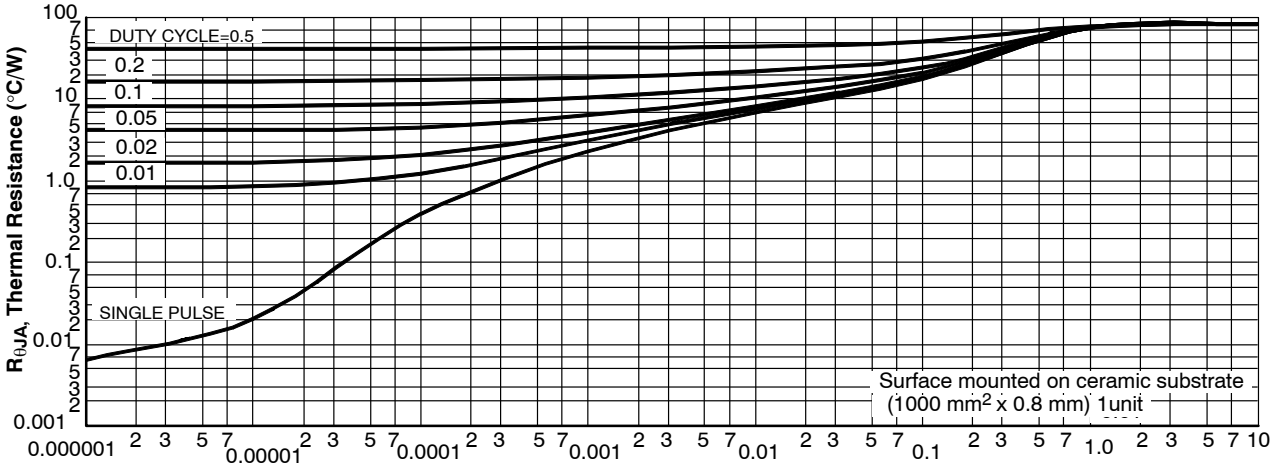


**Figure 13. $R_{\theta JA}$ – Pulse Time**

## ORDERING INFORMATION

| Product Number | Package | Shipping† |
|---|---|---|
| ECH8697R−TL−W | SOT−28FL, / ECH8<br>(Pb−Free / Halogen Free) | 3000 / Tape and Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

Note on usage : Since the ECH8697R is a MOSFET product, please avoid using this device in the vicinity of highly charged objects. Please contact sales for use except the designated application.

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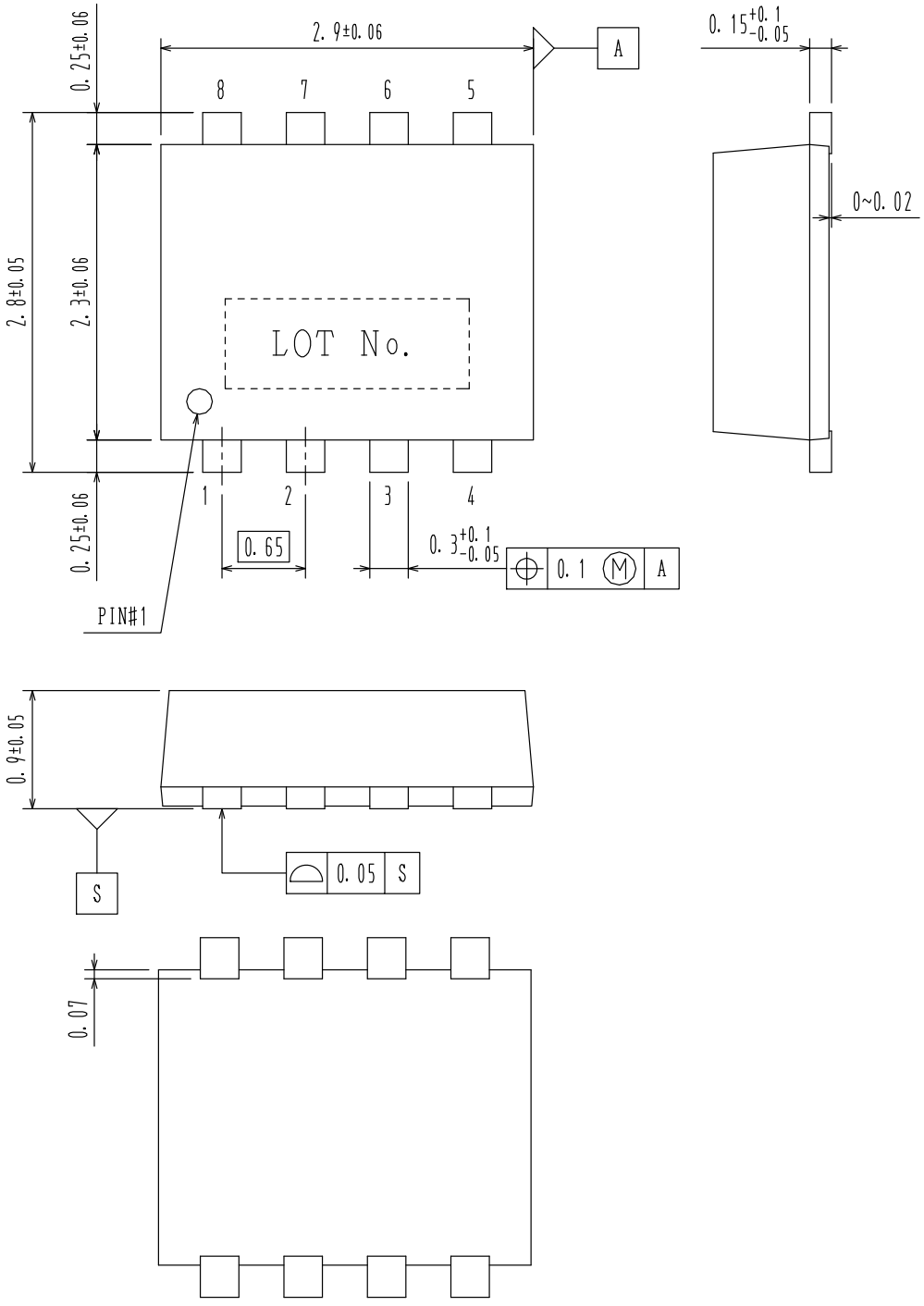


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