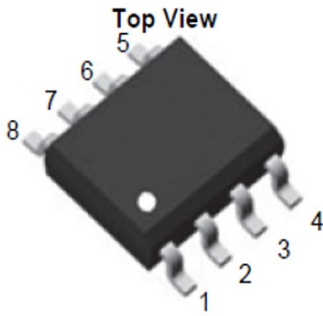
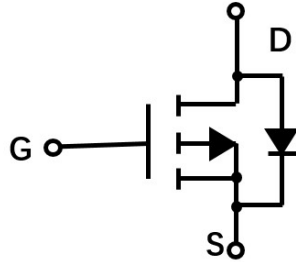
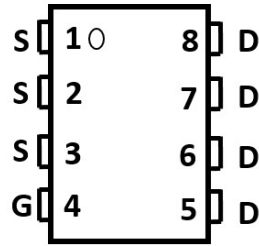


## P-Channel Enhancement Mode Field Effect Transistor



**SOP-8**



### Product Summary

- $V_{DS}$  -30V
- $I_D$  -18A
- $R_{DS(ON)}$  (at  $V_{GS}=-20V$ ) <5.5mohm
- $R_{DS(ON)}$  (at  $V_{GS}=-10V$ ) <6.0mohm
- $R_{DS(ON)}$  (at  $V_{GS}=-4.5V$ ) <10mohm

### General Description

- Trench Power LV MOSFET technology
- High density cell design for Low  $R_{DS(ON)}$
- High Speed switching

### Applications

- Battery protection
- Power management
- Load switch

### ■ Absolute Maximum Ratings ( $T_A=25^\circ C$ unless otherwise noted)

| Parameter  | Symbol          | Maximum                         | Unit         |
|--|-----------------|---------------------------------|--------------|
| Drain-source Voltage   | $V_{DS}$        | -30                             | V            |
| Gate-source Voltage  | $V_{GS}$        | $\pm 25$                        | V            |
| Drain Current  | $I_D$           | $T_A=25^\circ C$ @ Steady State | -18          |
|  |                 | $T_A=70^\circ C$ @ Steady State | -14.4        |
| Pulsed Drain Current <sup>A</sup>                                  | $I_{DM}$        | -72                             | A            |
| Single Pulse Avalanche Energy <sup>B</sup>                         | $E_{AS}$        | 136                             | mJ           |
| Total Power Dissipation @ $T_A=25^\circ C$ <sup>C</sup>            | $P_D$           | 3.4                             | W            |
| Thermal Resistance Junction-to-Ambient @ Steady State <sup>D</sup> | $R_{\theta JA}$ | 36.7                            | $^\circ C/W$ |
| Junction and Storage Temperature Range                             | $T_J, T_{STG}$  | -55~+150                        | $^\circ C$   |

### ■ Ordering Information (Example)

| PREFERRED P/N | PACKING CODE | Marking | MINIMUM PACKAGE(pcs) | INNER BOX QUANTITY(pcs) | OUTER CARTON QUANTITY(pcs) | DELIVERY MODE |
|---------------|--------------|---------|----------------------|-------------------------|----------------------------|---------------|
| YJS4409A      | F2           | Q4409   | 4000                 | 8000                    | 64000                      | 13" reel      |



# YJS4409A

## ■ Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

| Parameter                         | Symbol              | Conditions   | Min  | Typ  | Max  | Units |
|-----------------------------------|---------------------|--|------|------|------|-------|
| <b>Static Parameter</b>           |                     |  |      |      |      |       |
| Drain-Source Breakdown Voltage    | BV <sub>DSS</sub>   | V <sub>GS</sub> = 0V, I <sub>D</sub> =-250μA   | -30  |      |      | V     |
| Zero Gate Voltage Drain Current   | I <sub>DSS</sub>    | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, T <sub>C</sub> =25°C                             |      |      | -1   | μA    |
| Gate-Body Leakage Current         | I <sub>GSS</sub>    | V <sub>GS</sub> = ±25V, V <sub>DS</sub> =0V  |      |      | ±100 | nA    |
| Gate Threshold Voltage            | V <sub>GS(th)</sub> | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =-250μA                                   | -1.0 | -1.5 | -2.5 | V     |
| Static Drain-Source On-Resistance | R <sub>DS(ON)</sub> | V <sub>GS</sub> = -20V, I <sub>D</sub> =-18A   |      | 4.5  | 5.5  | mΩ    |
|                                   |                     | V <sub>GS</sub> = -10V, I <sub>D</sub> =-15A   |      | 5.1  | 6.0  |       |
|                                   |                     | V <sub>GS</sub> = -6V, I <sub>D</sub> =-10A  |      | 7.0  | 8.5  |       |
|                                   |                     | V <sub>GS</sub> = -4.5V, I <sub>D</sub> =-10A  |      | 7.5  | 10   |       |
| Diode Forward Voltage             | V <sub>SD</sub>     | I <sub>S</sub> =-18A, V <sub>GS</sub> =0V  |      | -0.8 | -1.2 | V     |
| <b>Dynamic Parameters</b>         |                     |  |      |      |      |       |
| Input Capacitance                 | C <sub>iss</sub>    | V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1MHZ   |      | 4850 |      | pF    |
| Output Capacitance                | C <sub>oss</sub>    |  |      | 674  |      |       |
| Reverse Transfer Capacitance      | C <sub>rss</sub>    |  |      | 624  |      |       |
| <b>Switching Parameters</b>       |                     |  |      |      |      |       |
| Total Gate Charge                 | Q <sub>g</sub>      | V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-12A                           |      | 77.2 |      | nC    |
| Gate Source Charge                | Q <sub>gs</sub>     |  |      | 13.5 |      |       |
| Gate Drain Charge                 | Q <sub>gd</sub>     |  |      | 17.3 |      |       |
| Reverse Recovery Charge           | Q <sub>rr</sub>     | I <sub>F</sub> = -12A, di/dt=100A/us   |      | 14.0 |      |       |
| Reverse Recovery Time             | t <sub>rr</sub>     |  |      | 30   |      |       |
| Turn-on Delay Time                | t <sub>D(on)</sub>  | V <sub>GS</sub> =-10V, V <sub>DD</sub> =-15V, I <sub>D</sub> =-1A,<br>R <sub>GEN</sub> =2.5Ω |      | 16   |      | ns    |
| Turn-on Rise Time                 | t <sub>r</sub>      |  |      | 21   |      |       |
| Turn-off Delay Time               | t <sub>D(off)</sub> |  |      | 105  |      |       |
| Turn-off Fall Time                | t <sub>f</sub>      |  |      | 64   |      |       |

A. Pulse Test: Pulse Width ≤ 300us, Duty cycle ≤ 2%.

B. R<sub>θJA</sub> is the sum of the junction-to-lead and lead-to-ambient thermal resistance, where the lead thermal reference is defined as the solder mounting surface of the drain pins. R<sub>θJL</sub> is guaranteed by design, while R<sub>θJA</sub> is determined by the board design. The maximum rating presented here is based on mounting on a 1 in 2 pad of 2oz copper.

■ Typical Performance Characteristics

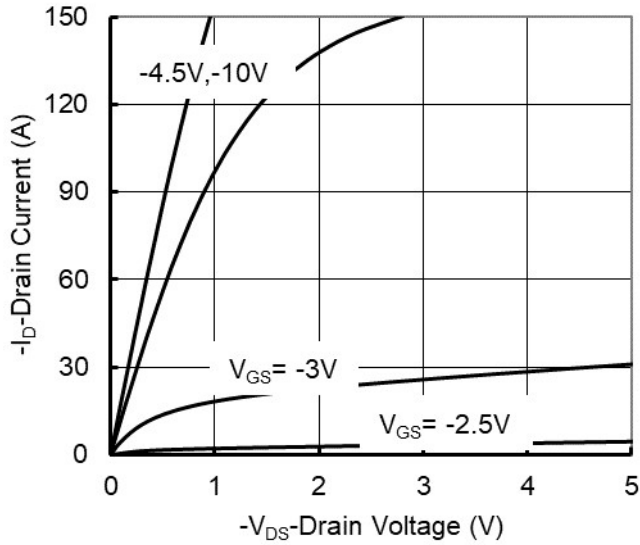


Figure 1. Output Characteristics

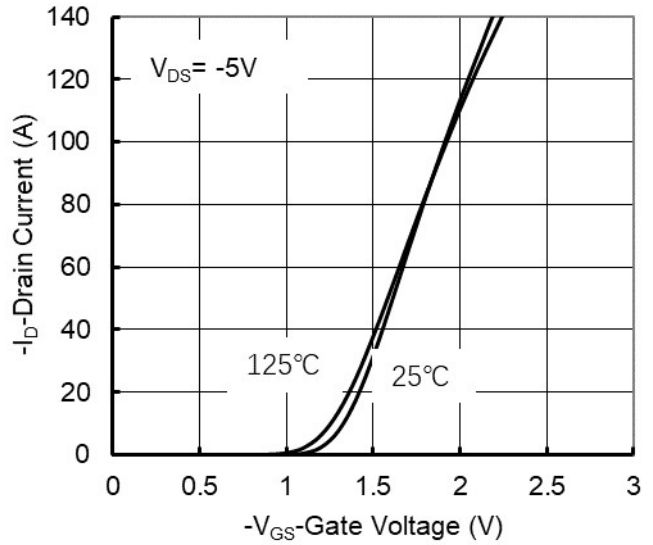


Figure 2. Transfer Characteristics

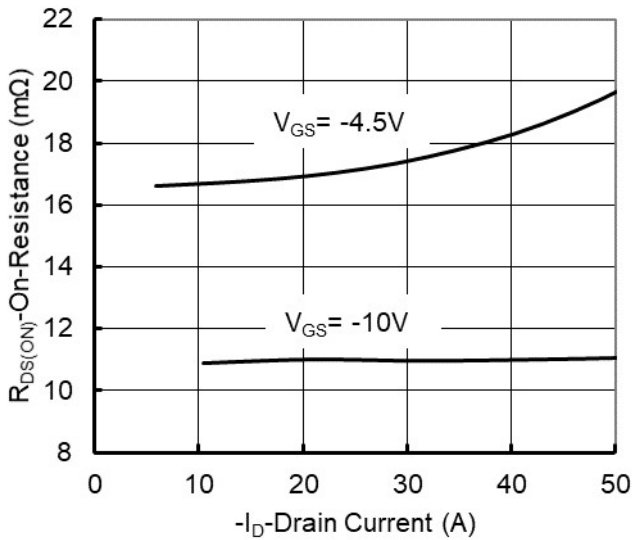


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

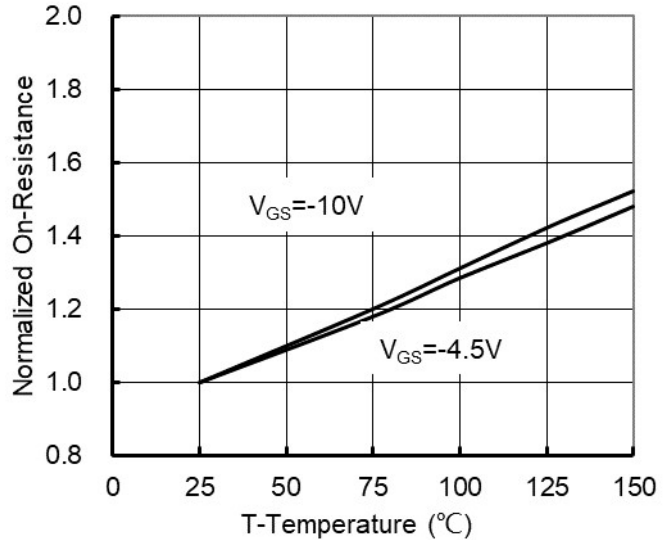


Figure 4. On-Resistance vs. Junction Temperature

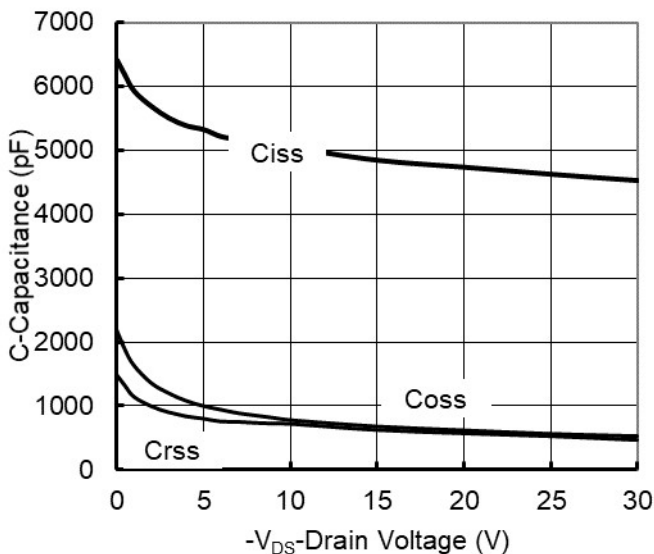


Figure 5. Capacitance Characteristics

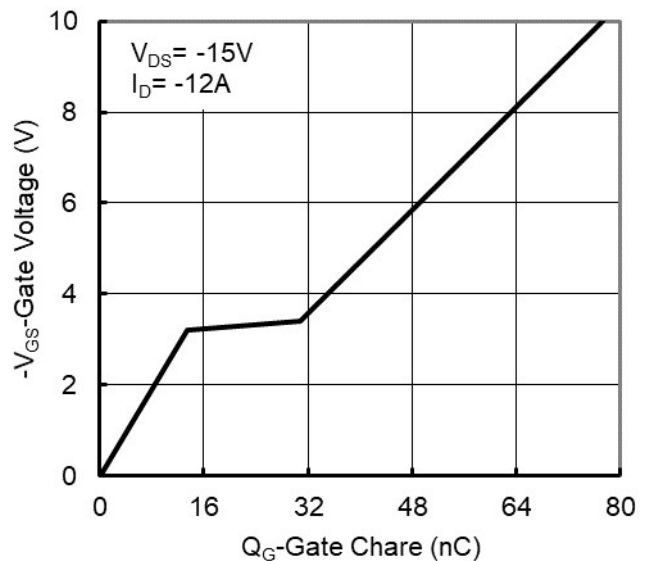


Figure 6. Gate Charge

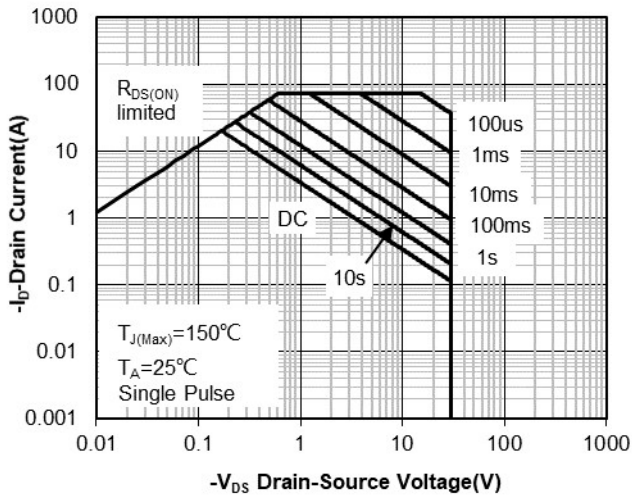


Figure 7. Safe Operation Area

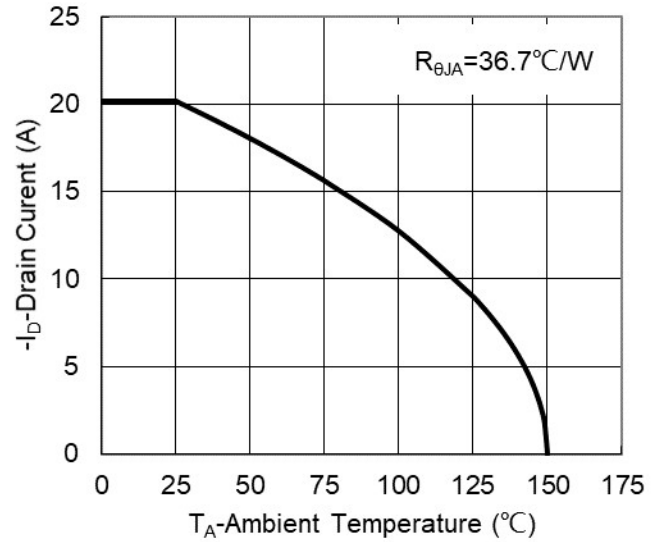


Figure 8. Maximum Continuous Drain Current vs Ambient Temperature

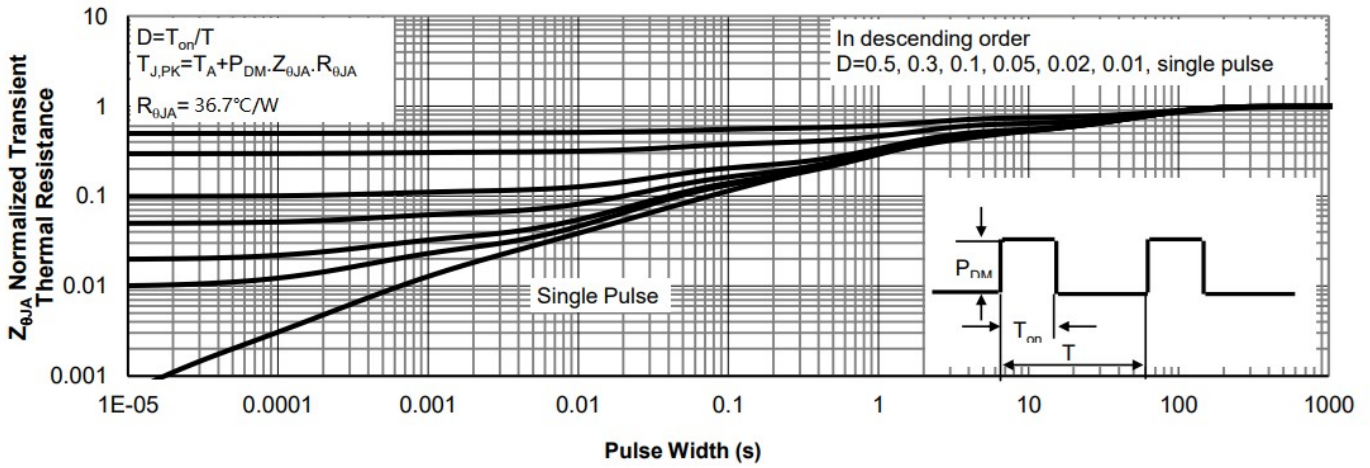
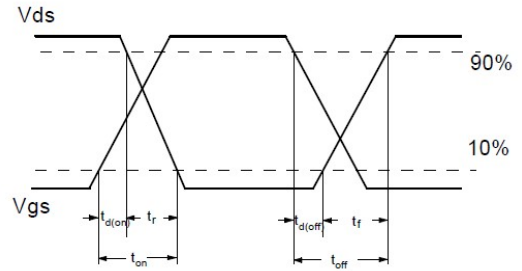
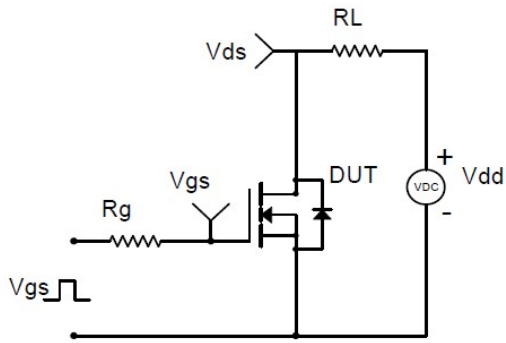
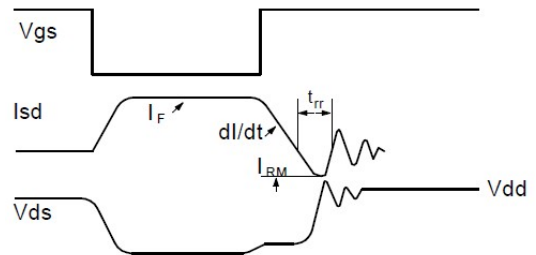
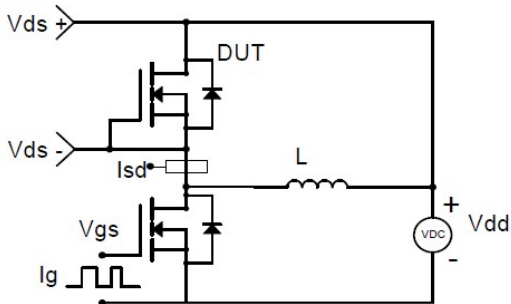


Figure 9. Normalized Maximum Transient Thermal Impedance



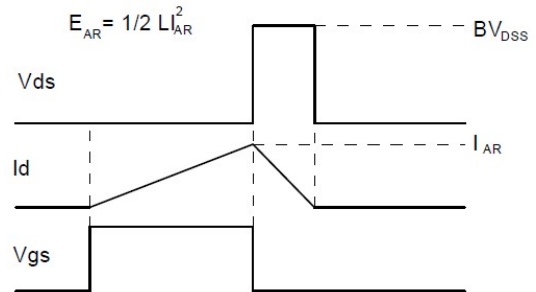
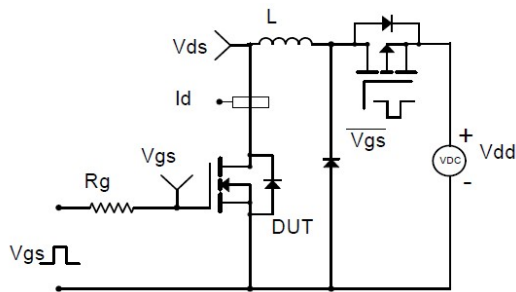
**Resistive Switching Test Circuit & Waveforms**



**Diode Recovery Test Circuit & Waveforms**



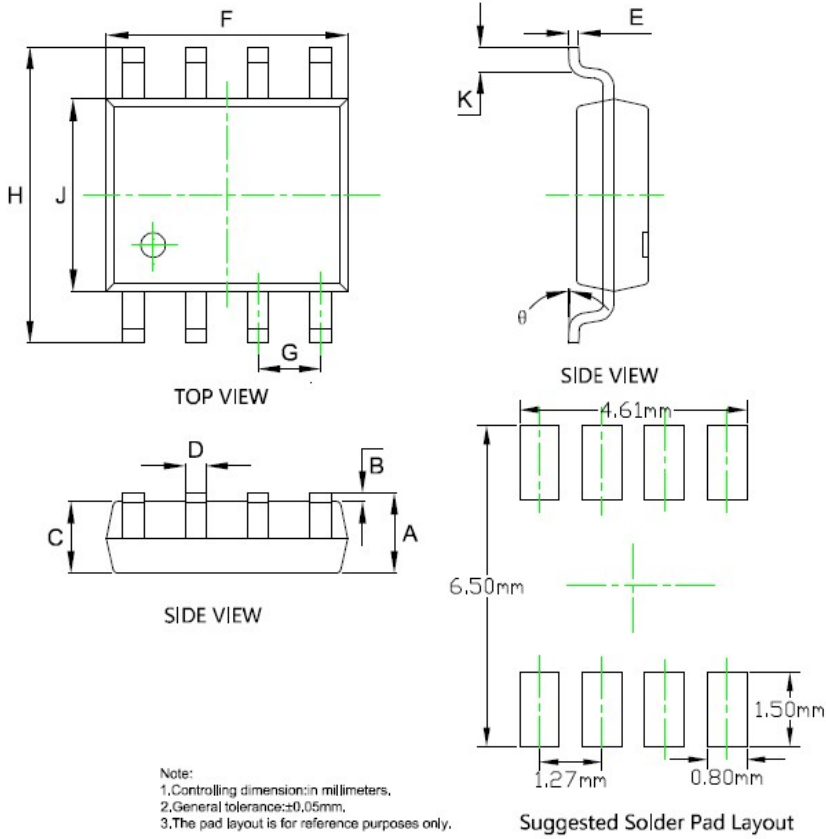
**Gate Charge Test Circuit & Waveform**



**Unclamped Inductive Switching (UIS) Test Circuit & Waveforms**



■ SOP-8 Package information



| SYMBOL   | DIMENSIONS |       |            |       |
|----------|------------|-------|------------|-------|
|          | INCHES     |       | Millimeter |       |
|          | MIN.       | MAX.  | MIN.       | MAX.  |
| A        | 0.053      | 0.069 | 1.350      | 1.750 |
| B        | 0.004      | 0.010 | 0.100      | 0.250 |
| C        | 0.053      | 0.061 | 1.350      | 1.550 |
| D        | 0.013      | 0.020 | 0.330      | 0.510 |
| E        | 0.007      | 0.010 | 0.170      | 0.250 |
| F        | 0.189      | 0.197 | 4.800      | 5.000 |
| G        | 0.050BSC   |       | 1.270BSC   |       |
| H        | 0.228      | 0.244 | 5.800      | 6.200 |
| J        | 0.150      | 0.157 | 3.800      | 4.000 |
| K        | 0.016      | 0.050 | 0.400      | 1.270 |
| $\theta$ | 0°         | 8°    | 0°         | 8°    |



## Disclaimer

The information presented in this document is for reference only. Yangzhou Yangjie Electronic Technology Co., Ltd. reserves the right to make changes without notice for the specification of the products displayed herein to improve reliability, function or design or otherwise.

The product listed herein is designed to be used with ordinary electronic equipment or devices, and not designed to be used with equipment or devices which require high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), Yangjie or anyone on its behalf, assumes no responsibility or liability for any damages resulting from such improper use of sale.

This publication supersedes & replaces all information previously supplied. For additional information, please visit our website [http:// www.21yangjie.com](http://www.21yangjie.com) , or consult your nearest Yangjie's sales office for further assistance.