

# Silicon Carbide (SiC) JFET – EliteSiC, Power N-Channel, TO247-4, 750 V, 4.8 mohm

## UJ4N075005K4S

### Description

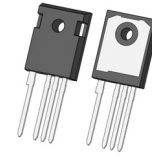
onsemi's UJ4N075005K4S is a 750 V, 4.8 mΩ High-Performance Gen 4 Normally-On SiC JFET Transistor. This device exhibits Ultra-low On resistance ( $R_{DS(ON)}$ ) in a TO247-4L Package, making it an ideal fit to address the Challenging Thermal Constraints of Solid-state Circuit Breakers and Relay Applications. Additionally, the JFET is a Robust Device Technology Capable of the High-Energy Switching Required in Circuit Protection Applications.

### Features

- Single Digit On-Resistance
- Operating Temperature: 175 °C (Max)
- High Pulse Current Capability
- Excellent Device Robustness
- Silver-Sintered Die Attach for Excellent Thermal Resistance
- Low Intrinsic Capacitance
- Short Circuit Rated
- This Device is Pb-Free, Halogen Free and is RoHS Compliant

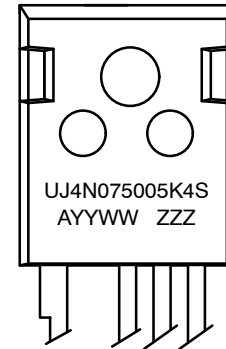
### Typical Applications

- Solid State / Semiconductor Circuit Breaker
- Solid State / Semiconductor Relay
- Battery Disconnects
- Surge Protection
- Inrush Current Control
- Induction Heating



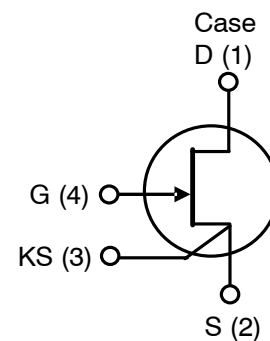
TO247-4  
CASE 340AN

### MARKING DIAGRAM



|               |                        |
|---------------|------------------------|
| UJ4N075005K4S | = Specific Device Code |
| A             | = Assembly Location    |
| YY            | = Year                 |
| WW            | = Work Week            |
| ZZZ           | = Lot ID               |

### PIN CONNECTIONS



### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# UJ4N075005K4S

## MAXIMUM RATINGS

| Parameter                                                            | Symbol             | Test Conditions                                                               | Value      | Unit               |
|----------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------|------------|--------------------|
| Drain-Source Voltage                                                 | $V_{DS}$           |                                                                               | 750        | V                  |
| Gate-Source Voltage                                                  | $V_{GS}$           | DC                                                                            | -30 to +3  | V                  |
|                                                                      |                    | AC (Note 1)                                                                   | -30 to +30 |                    |
| Continuous Drain Current (Note 2)                                    | $I_D$              | $T_C < 127\text{ }^{\circ}\text{C}$                                           | 120        | A                  |
| Pulsed Drain Current (Note 3)                                        | $I_{DM}$           | $T_C = 25\text{ }^{\circ}\text{C}$                                            | 588        | A                  |
| Short Circuit Withstand Time                                         | $t_{SC}$           | $V_{DS} = 400\text{ V}$ , $T_{J(\text{START})} = 175\text{ }^{\circ}\text{C}$ | 5          | $\mu\text{S}$      |
| Power Dissipation                                                    | $P_{TOT}$          | $T_C = 25\text{ }^{\circ}\text{C}$                                            | 714        | W                  |
| Maximum Junction Temperature                                         | $T_{J,\text{max}}$ |                                                                               | 175        | $^{\circ}\text{C}$ |
| Operating and Storage Temperature                                    | $T_J$ , $T_{STG}$  |                                                                               | -55 to 175 | $^{\circ}\text{C}$ |
| Max. Lead Temperature for Soldering,<br>1/8" from Case for 5 seconds | $T_L$              |                                                                               | 250        | $^{\circ}\text{C}$ |

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.

1. +30 V AC Rating Applies for Turn-on Pulses <200 ns applied with external  $R_G > 1\Omega$ .
2. Limited by Bondwires
3. Pulse width  $t_p$  limited by  $T_{J,\text{max}}$

## THERMAL CHARACTERISTICS

| Parameter                            | Symbol          | Test Conditions | Value |      |      |                             |
|--------------------------------------|-----------------|-----------------|-------|------|------|-----------------------------|
|                                      |                 |                 | Min   | Typ  | Max  | Unit                        |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ |                 | -     | 0.16 | 0.21 | $^{\circ}\text{C}/\text{W}$ |

**ELECTRICAL CHARACTERISTICS** ( $T_J = +25\text{ }^{\circ}\text{C}$  Unless otherwise specified)

| Parameter                           | Symbol       | Test Conditions                                                                            | Min  | Typ  | Max  | Unit             |
|-------------------------------------|--------------|--------------------------------------------------------------------------------------------|------|------|------|------------------|
| <b>TYPICAL PERFORMANCE – STATIC</b> |              |                                                                                            |      |      |      |                  |
| Drain-Source Breakdown Voltage      | $BV_{DS}$    | $V_{GS} = -20\text{ V}$ , $I_D = 2\text{ mA}$                                              | 750  | –    | –    | V                |
| Total Drain Leakage Current         | $I_{DSS}$    | $V_{DS} = 750\text{ V}$ , $V_{GS} = -20\text{ V}$ ,<br>$T_J = 25\text{ }^{\circ}\text{C}$  | –    | 13   | 120  | $\mu\text{A}$    |
|                                     |              | $V_{DS} = 750\text{ V}$ , $V_{GS} = -20\text{ V}$ ,<br>$T_J = 175\text{ }^{\circ}\text{C}$ | –    | 65   | –    |                  |
| Total Gate Leakage Current          | $I_{GSS}$    | $V_{GS} = -20\text{ V}$ , $T_J = 25\text{ }^{\circ}\text{C}$                               | –    | 0.1  | 100  | $\mu\text{A}$    |
|                                     |              | $V_{GS} = -20\text{ V}$ , $T_J = 175\text{ }^{\circ}\text{C}$                              | –    | 0.3  | –    | $\mu\text{A}$    |
| Drain-Source On-Resistance          | $R_{DS(on)}$ | $V_{GS} = 2\text{ V}$ , $I_D = 80\text{ A}$ , $T_J = 25\text{ }^{\circ}\text{C}$           | –    | 4.8  | –    | $\text{m}\Omega$ |
|                                     |              | $V_{GS} = 0\text{ V}$ , $I_D = 80\text{ A}$ , $T_J = 25\text{ }^{\circ}\text{C}$           | –    | 5.4  | 6.6  |                  |
|                                     |              | $V_{GS} = 2\text{ V}$ , $I_D = 80\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$          | –    | 10.4 | –    |                  |
|                                     |              | $V_{GS} = 0\text{ V}$ , $I_D = 80\text{ A}$ , $T_J = 175\text{ }^{\circ}\text{C}$          | –    | 11.9 | –    |                  |
| Gate Threshold Voltage              | $V_{G(th)}$  | $V_{DS} = 5\text{ V}$ , $I_D = 180\text{ mA}$                                              | –8.3 | –6.0 | –3.7 | V                |
| Gate Resistance                     | $R_G$        | $f = 1\text{ MHz}$ , Open Drain                                                            | –    | 0.8  | –    | $\Omega$         |

**TYPICAL PERFORMANCE – DYNAMIC**

|                                              |               |                                                                                           |   |      |   |               |
|----------------------------------------------|---------------|-------------------------------------------------------------------------------------------|---|------|---|---------------|
| Input Capacitance                            | $C_{iss}$     | $V_{DS} = 400\text{ V}$ , $V_{GS} = -20\text{ V}$ ,<br>$f = 100\text{ kHz}$               | – | 3028 | – | $\text{pF}$   |
| Output Capacitance                           | $C_{oss}$     |                                                                                           | – | 364  | – |               |
| Reverse Transfer Capacitance                 | $C_{rss}$     |                                                                                           | – | 360  | – |               |
| Effective Output Capacitance, Energy Related | $C_{oss(er)}$ | $V_{DS} = 0\text{ V to } 400\text{ V}$ , $V_{GS} = -20\text{ V}$                          | – | 448  | – | $\text{pF}$   |
| $C_{OSS}$ Stored Energy                      | $E_{OSS}$     | $V_{DS} = 400\text{ V}$ , $V_{GS} = -20\text{ V}$                                         | – | 36   | – | $\mu\text{J}$ |
| Total Gate Charge                            | $Q_G$         | $V_{DS} = 400\text{ V}$ , $I_D = 80\text{ A}$ ,<br>$V_{GS} = -18\text{ V to } 0\text{ V}$ | – | 400  | – | $\text{nC}$   |
| Gate-Drain Charge                            | $Q_{GD}$      |                                                                                           | – | 270  | – |               |
| Gate-Source Charge                           | $Q_{GS}$      |                                                                                           | – | 60   | – |               |

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.

TYPICAL PERFORMANCE DIAGRAM

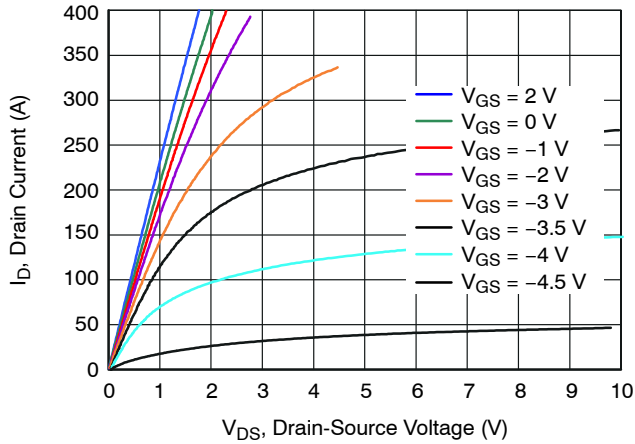


Figure 1. Typical Output Characteristics at  $T_J = -55\text{ }^{\circ}\text{C}$ ,  $t_p < 250\text{ }\mu\text{s}$

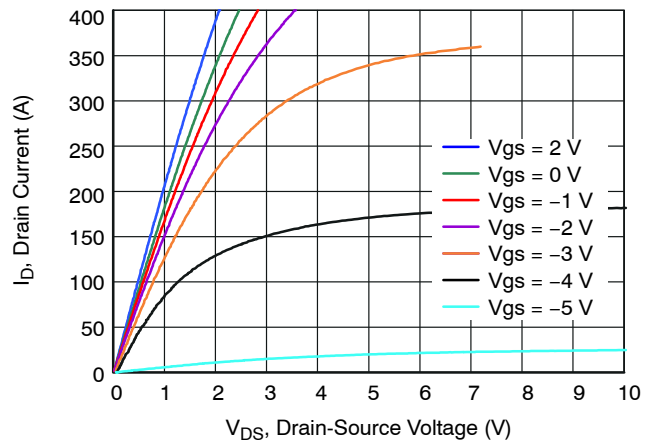


Figure 2. Typical Output Characteristics at  $T_J = 25\text{ }^{\circ}\text{C}$ ,  $t_p < 250\text{ }\mu\text{s}$

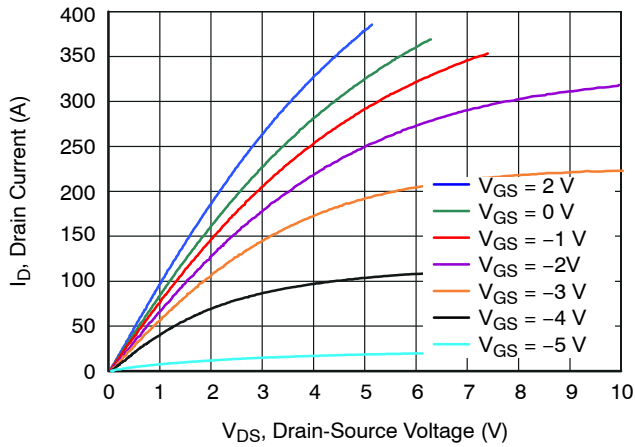


Figure 3. Typical Output Characteristics at  $T_J = 175\text{ }^{\circ}\text{C}$ ,  $t_p < 250\text{ }\mu\text{s}$

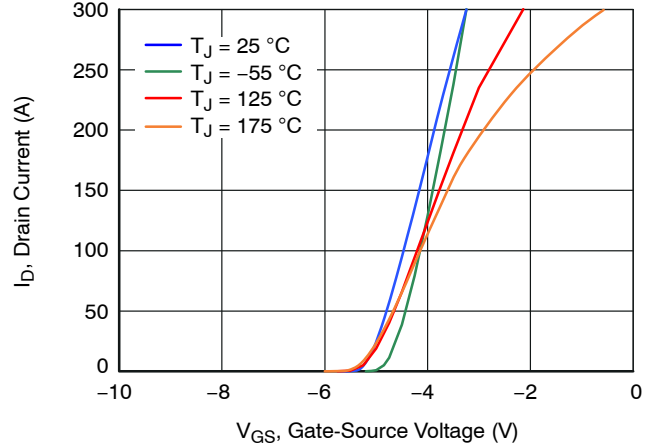


Figure 4. Typical Transfer Characteristics at  $V_{DS} = 5\text{ V}$

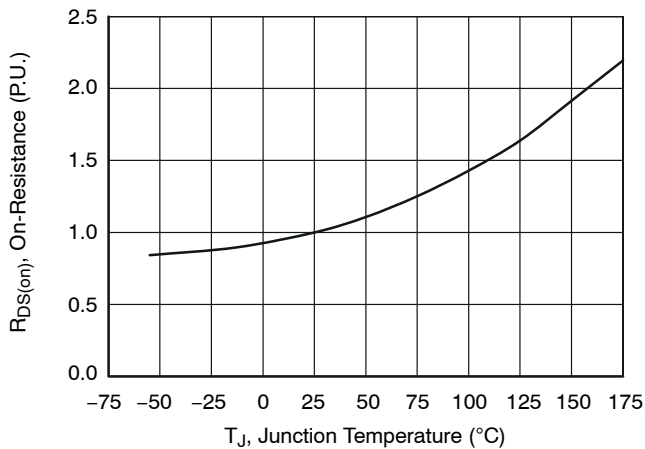


Figure 5. Normalized On-Resistance Vs. Temperature at  $V_{GS} = 0\text{ V}$  and  $I_D = 80\text{ A}$

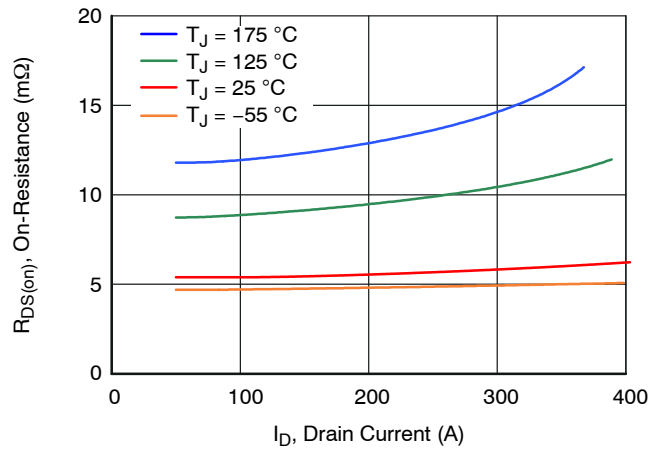
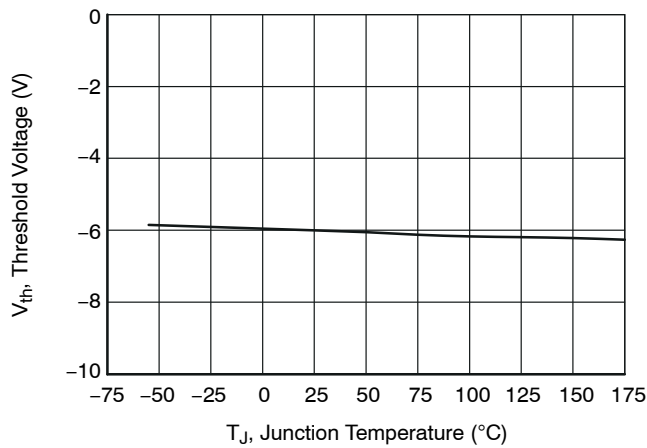
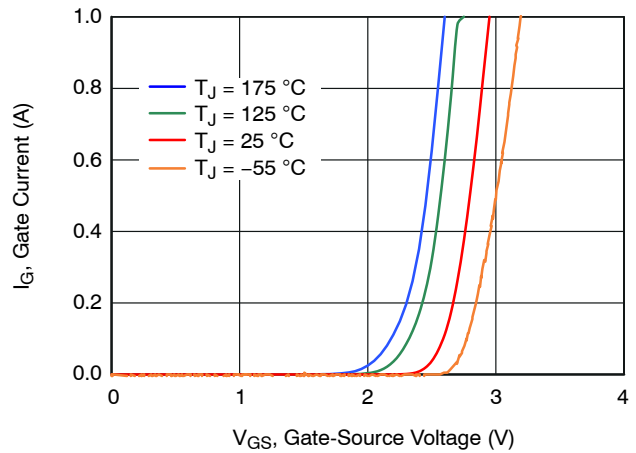


Figure 6. Typical Drain-Source On-Resistance  $V_{GS} = 0\text{ V}$

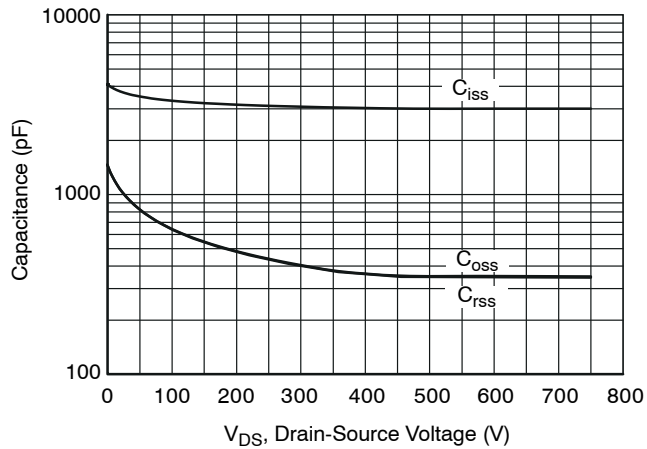
## TYPICAL PERFORMANCE DIAGRAMS (CONTINUED)



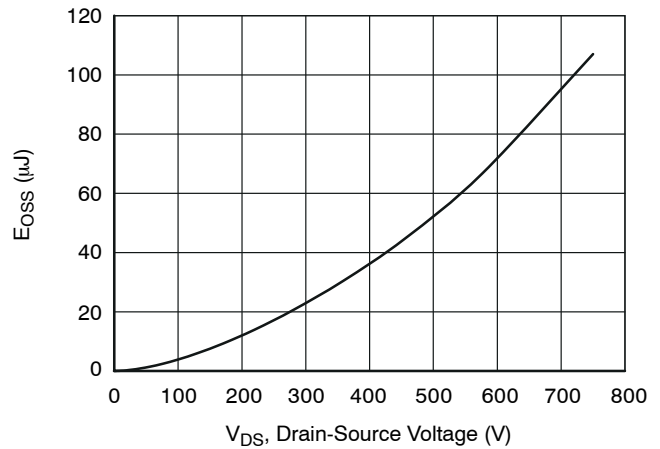
**Figure 7. Threshold Voltage vs. Junction Temperature**  
at  $V_{DS} = 5\text{ V}$  and  $I_D = 180\text{ mA}$



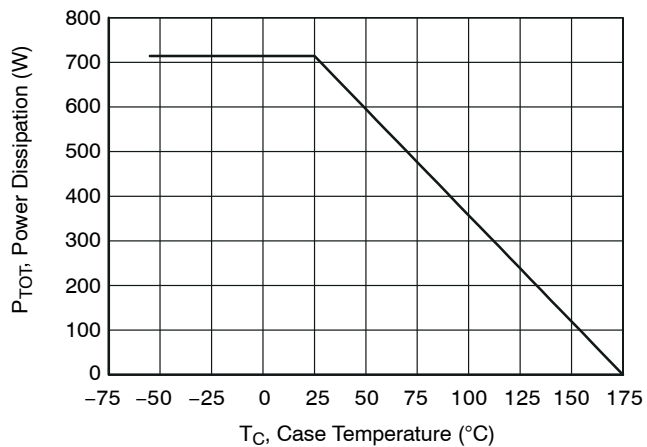
**Figure 8. Typical Gate Forward Current at  $V_{DS} = 0\text{ V}$**



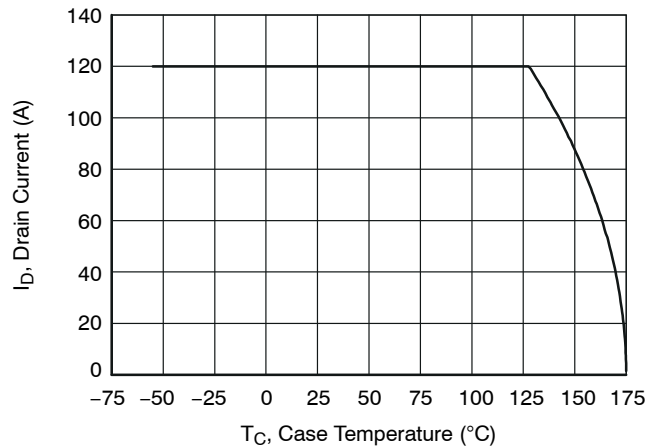
**Figure 9. Typical Capacitances at  $f = 100\text{ KHz}$  and  $V_{GS} = -20\text{ V}$**



**Figure 10. Typical Stored Energy in  $C_{OSS}$  at  $V_{GS} = -20\text{ V}$**



**Figure 11. Total Power Dissipation**



**Figure 12. DC Drain Current Derating**

TYPICAL PERFORMANCE DIAGRAMS (CONTINUED)

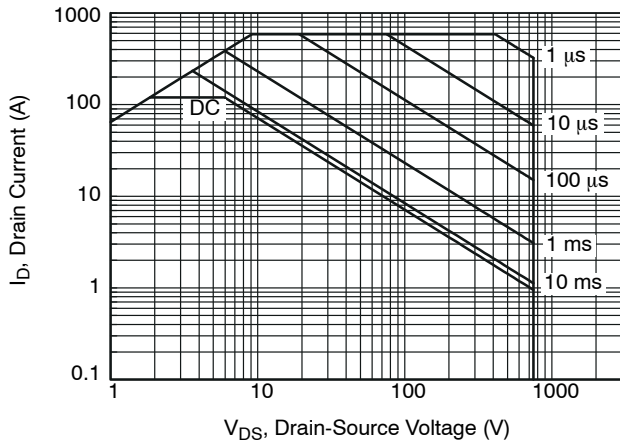


Figure 13. Safe Operation Area at  $T_C = 25\text{ }^{\circ}\text{C}$ , Parameter  $t_p$

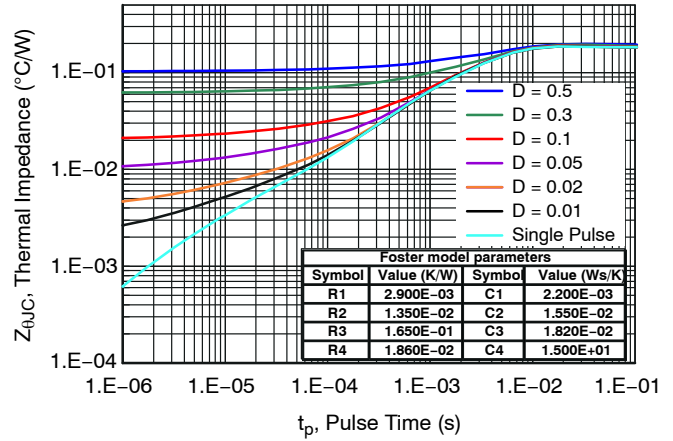


Figure 14. Maximum Transient Thermal Impedance

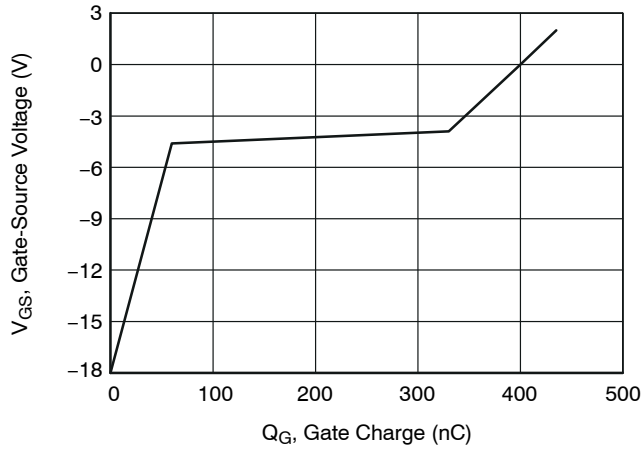
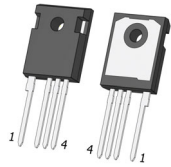


Figure 15. Typical Gate Charge at  $V_{DS} = 400\text{ V}$  and  $I_D = 80\text{ A}$

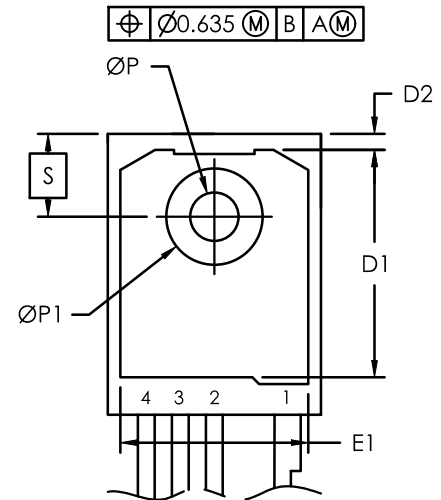
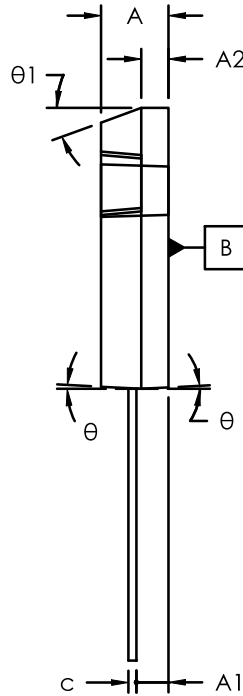
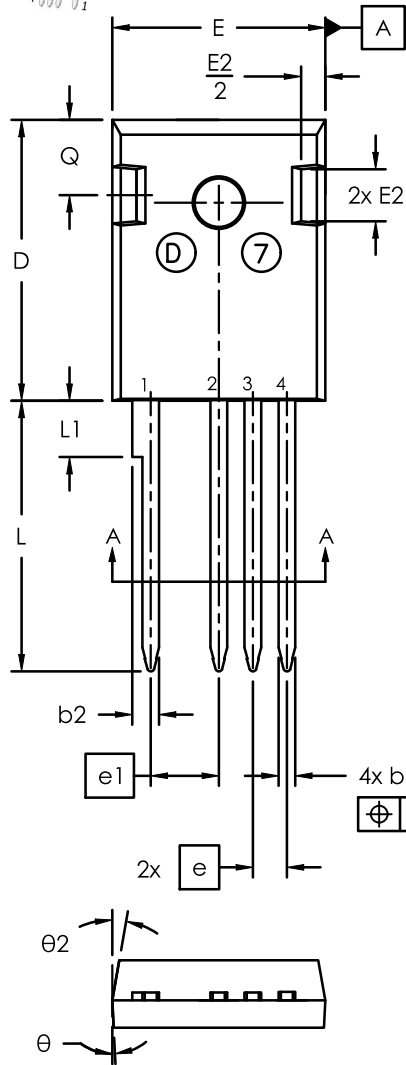
ORDERING INFORMATION

| Part Number   | Marking       | Package                            | Shipping         |
|---------------|---------------|------------------------------------|------------------|
| UJ4N075005K4S | UJ4N075005K4S | TO247-4<br>(Pb-Free, Halogen Free) | 600 Units / Tube |



**TO247-4 15.90x20.96x5.03, 5.44P**  
CASE 340AN  
ISSUE D

DATE 14 APR 2025



| SYM | millimeters |       |       |
|-----|-------------|-------|-------|
|     | MIN         | NOM   | MAX   |
| A   | 4.70        | 5.03  | 5.31  |
| A1  | 2.21        | 2.40  | 2.59  |
| A2  | 1.50        | 2.03  | 2.49  |
| b   | 0.99        | 1.20  | 1.40  |
| b2  | 1.65        | 2.03  | 2.39  |
| c   | 0.38        | 0.60  | 0.89  |
| D   | 20.80       | 20.96 | 21.46 |
| D1  | 13.08       | —     | —     |
| D2  | 0.51        | 1.19  | 1.35  |
| E   | 15.49       | 15.90 | 16.26 |
| e   | 2.54 BSC    |       |       |
| e1  | 5.08 BSC    |       |       |
| E1  | 13.46       | —     | —     |
| E2  | 3.43        | 3.89  | 5.20  |
| L   | 19.81       | 20.17 | 20.32 |
| L1  | —           | —     | 4.50  |
| ØP  | 3.40        | 3.60  | 3.80  |
| ØP1 | 7.06        | 7.19  | 7.39  |
| Q   | 5.38        | 5.62  | 6.20  |
| S   | 6.17 BSC    |       |       |
| θ   | 3°          |       |       |
| θ1  | 20°         |       |       |
| θ2  | 10°         |       |       |

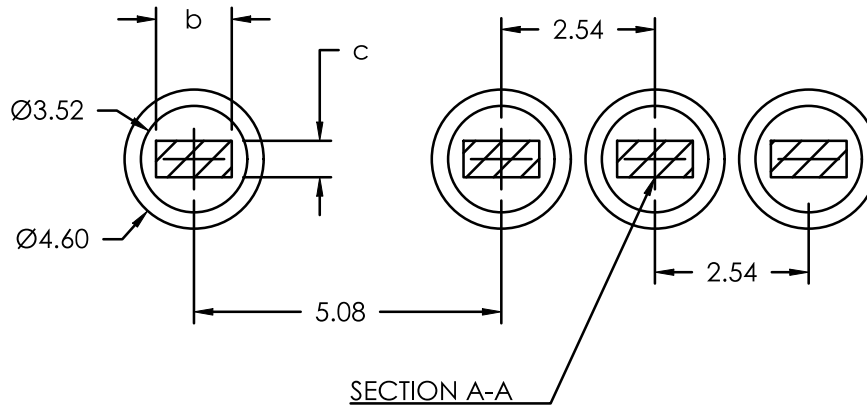
**NOTE:**

1. Dimensioning and tolerancing as per ASME Y14.5 - 2018
2. Controlling dimension : millimeters
3. Package Outline in compliance with JEDEC standard var. AD.
4. Dimensions D & E does not include mold flash.
5. ØP to have max draft angle of 1.7° to the top with max. hole diameter of 3.91mm.
5. Through Hole diameter value = End Hole diameter
6. PCB Through Hole pattern as per IPC-2221/IPC-2222

|                         |                                        |                                                                                                                                                                                     |
|-------------------------|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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RECOMMENDED PCB THROUGH HOLE



NOTE: LAND PATTERN AND THROUGH HOLE DIMENSIONS SERVE ONLY AS AN INITIAL GUIDE.  
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|                  |                                 |                                                                                                                                                                                     |
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