

# Silicon Carbide (SiC) JFET – EliteSiC, Power N-Channel, TO247-3, 1200 V, 70 mohm

## UJ3N120070K3S

### Description

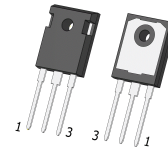
onsemi offers the high-performance G3 SiC normally-on JFET transistors. This series exhibits ultra-low on resistance ( $R_{DS(ON)}$ ) and gate charge ( $Q_G$ ) allowing for low conduction and switching loss. The device normally-on characteristics with low  $R_{DS(ON)}$  at  $V_{GS} = 0\text{ V}$  is also ideal for current protection circuits without the need for active control, as well as for cascode operation.

### Features

- Typical On-resistance  $R_{DS(on)}$ , Typ of 70 m $\Omega$
- Voltage Controlled
- Maximum Operating Temperature of 175 °C
- Extremely Fast Switching not Dependent on Temperature
- Low Gate Charge
- Low Intrinsic Capacitance
- This Device is Pb-Free, Halogen Free and is ROHS Compliant

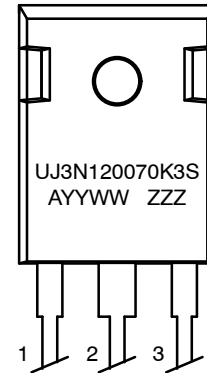
### Typical Applications

- Over Current Protection Circuits
- DC-AC Inverters
- Switch Mode Power Supplies
- Power Factor Correction Modules
- Motor Drives
- Induction Heating



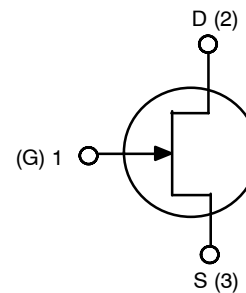
TO247-3  
CASE 340AK

### MARKING DIAGRAM



UJ3N120070K3S = 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 7 of this data sheet.

# UJ3N120070K3S

## MAXIMUM RATINGS

| Parameter                                                            | Symbol         | Test Conditions                     | Value      | Unit               |
|----------------------------------------------------------------------|----------------|-------------------------------------|------------|--------------------|
| Drain-source Voltage                                                 | $V_{DS}$       |                                     | 1200       | V                  |
| Gate-source Voltage                                                  | $V_{GS}$       | DC                                  | -20 to +3  | V                  |
|                                                                      |                | AC (Note 1)                         | -20 to +20 |                    |
| Continuous Drain Current (Note 2)                                    | $I_D$          | $T_C = 25\text{ }^{\circ}\text{C}$  | 33.5       | A                  |
|                                                                      |                | $T_C = 100\text{ }^{\circ}\text{C}$ | 24.5       |                    |
| Pulsed Drain Current (Note 3)                                        | $I_{DM}$       | $T_C = 25\text{ }^{\circ}\text{C}$  | 85         | A                  |
| Power Dissipation                                                    | $P_{tot}$      | $T_C = 25\text{ }^{\circ}\text{C}$  | 254        | W                  |
| Maximum Junction Temperature                                         | $T_{J, max}$   |                                     | 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. +20 V AC rating applies for turn-on pulses <200 ns applied with external  $R_G > 1\text{ }\Omega$ .
2. Limited by  $T_{J, max}$ .
3. Pulse width  $t_p$  limited by  $T_{J, max}$ .

## THERMAL CHARACTERISTICS

| Parameter                            | Symbol          | Test Conditions | Value |      |      | Unit                 |
|--------------------------------------|-----------------|-----------------|-------|------|------|----------------------|
|                                      |                 |                 | Min   | Typ  | Max  |                      |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ |                 | -     | 0.45 | 0.59 | $^{\circ}\text{C/W}$ |

# UJ3N120070K3S

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = +25 °C unless otherwise specified)

| Parameter                           | Symbol              | Test Conditions                                                            | Min  | Typ   | Max | Unit |
|-------------------------------------|---------------------|----------------------------------------------------------------------------|------|-------|-----|------|
| <b>TYPICAL PERFORMANCE – STATIC</b> |                     |                                                                            |      |       |     |      |
| Drain-source Breakdown Voltage      | BV <sub>DS</sub>    | V <sub>GS</sub> = -20 V, I <sub>D</sub> = 1 mA                             | 1200 | –     | –   | V    |
| Total Drain Leakage Current         | I <sub>D</sub>      | V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = -20 V, T <sub>J</sub> = 25 °C  | –    | 5     | 30  | μA   |
|                                     |                     | V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = -20 V, T <sub>J</sub> = 175 °C | –    | 18    | –   |      |
| Total Gate Leakage Current          | I <sub>G</sub>      | V <sub>GS</sub> = -20 V, T <sub>J</sub> = 25 °C                            | –    | 5     | 50  | μA   |
|                                     |                     | V <sub>GS</sub> = -20 V, T <sub>J</sub> = 175 °C                           | –    | 20    | –   |      |
| Drain-source On-resistance          | R <sub>DS(on)</sub> | V <sub>GS</sub> = 2 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 25 °C       | –    | 63    | –   | mΩ   |
|                                     |                     | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 25 °C       | –    | 70    | 90  |      |
|                                     |                     | V <sub>GS</sub> = 2 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 175 °C      | –    | 139   | –   |      |
|                                     |                     | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 10 A, T <sub>J</sub> = 175 °C      | –    | 154   | –   |      |
| Gate Threshold Voltage              | V <sub>G(th)</sub>  | V <sub>DS</sub> = 5 V, I <sub>D</sub> = 35 mA                              | -14  | -11.5 | -6  | V    |
| Gate Resistance                     | R <sub>G</sub>      | f = 1 MHz, open drain                                                      | –    | 3.3   | –   | Ω    |

## TYPICAL PERFORMANCE – DYNAMIC

|                                              |                      |                                                                                                                                                                |   |     |   |    |
|----------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|---|----|
| Input Capacitance                            | C <sub>iss</sub>     | V <sub>DS</sub> = 100 V, V <sub>GS</sub> = -20 V, f = 100 kHz                                                                                                  | – | 985 | – | pF |
| Output Capacitance                           | C <sub>oss</sub>     |                                                                                                                                                                | – | 100 | – |    |
| Reverse Transfer Capacitance                 | C <sub>rss</sub>     |                                                                                                                                                                | – | 95  | – |    |
| Effective Output Capacitance, Energy Related | C <sub>oss(er)</sub> | V <sub>DS</sub> = 0 V to 800 V, V <sub>GS</sub> = -20 V                                                                                                        | – | 52  | – | pF |
| Total Gate Charge                            | Q <sub>G</sub>       | V <sub>DS</sub> = 800 V, I <sub>D</sub> = 25 A, V <sub>GS</sub> = -18 V to 0 V                                                                                 | – | 116 | – | nC |
| Gate-drain Charge                            | Q <sub>GD</sub>      |                                                                                                                                                                | – | 63  | – |    |
| Gate-source Charge                           | Q <sub>GS</sub>      |                                                                                                                                                                | – | 11  | – |    |
| Turn-on Delay Time                           | t <sub>d(on)</sub>   | V <sub>DS</sub> = 800 V, I <sub>D</sub> = 25 A, Gate Driver = -18 V to 0 V, R <sub>G, EXT</sub> = 1 Ω, Inductive Load, FWD: UJ2D1215T, T <sub>J</sub> = 25 °C  | – | 17  | – | ns |
| Rise Time                                    | t <sub>r</sub>       |                                                                                                                                                                | – | 25  | – |    |
| Turn-off Delay Time                          | t <sub>d(off)</sub>  |                                                                                                                                                                | – | 29  | – |    |
| Fall Time                                    | t <sub>f</sub>       |                                                                                                                                                                | – | 39  | – |    |
| Turn-on Energy                               | E <sub>ON</sub>      |                                                                                                                                                                | – | 434 | – | μJ |
| Turn-off Energy                              | E <sub>OFF</sub>     |                                                                                                                                                                | – | 393 | – |    |
| Total Switching Energy                       | E <sub>TOTAL</sub>   |                                                                                                                                                                | – | 827 | – |    |
| Turn-on Delay Time                           | t <sub>d(on)</sub>   | V <sub>DS</sub> = 800 V, I <sub>D</sub> = 25 A, Gate Driver = -18 V to 0 V, R <sub>G, EXT</sub> = 1 Ω, Inductive Load, FWD: UJ2D1215T, T <sub>J</sub> = 150 °C | – | 17  | – | ns |
| Rise Time                                    | t <sub>r</sub>       |                                                                                                                                                                | – | 23  | – |    |
| Turn-off Delay Time                          | t <sub>d(off)</sub>  |                                                                                                                                                                | – | 25  | – |    |
| Fall Time                                    | t <sub>f</sub>       |                                                                                                                                                                | – | 24  | – |    |
| Turn-on Energy                               | E <sub>ON</sub>      |                                                                                                                                                                | – | 418 | – | μJ |
| Turn-off Energy                              | E <sub>OFF</sub>     |                                                                                                                                                                | – | 278 | – |    |
| Total Switching Energy                       | E <sub>TOTAL</sub>   |                                                                                                                                                                | – | 696 | – |    |

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 DIAGRAMS

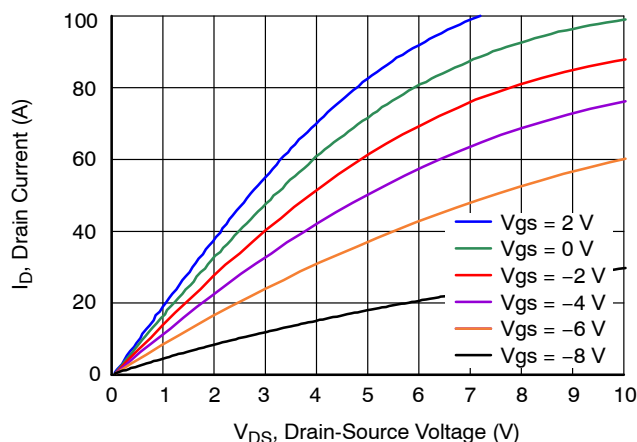


Figure 1. Typical Output Characteristics at  $T_J = -55^\circ\text{C}$

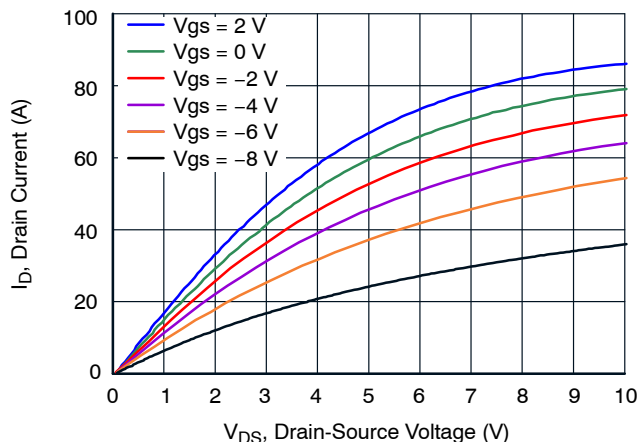


Figure 2. Typical Output Characteristics at  $T_J = 25^\circ\text{C}$

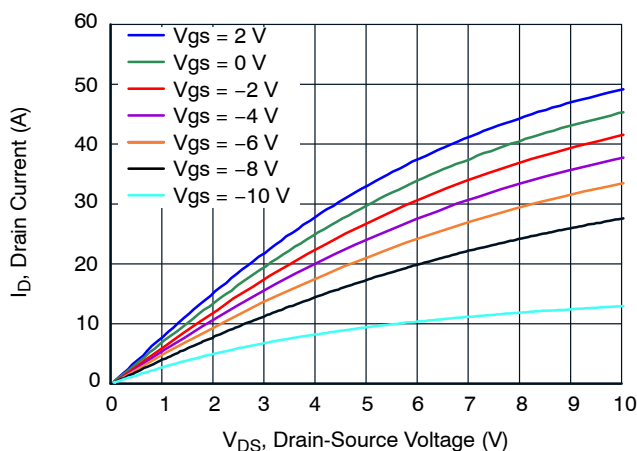


Figure 3. Typical Output Characteristics at  $T_J = 175^\circ\text{C}$

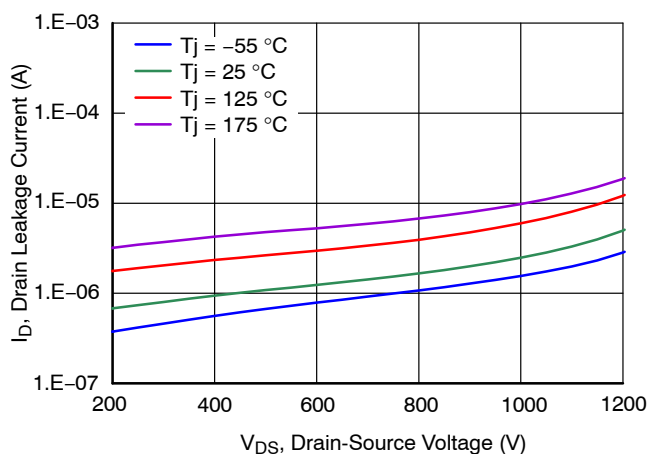


Figure 4. Typical Drain-Source Leakage at  $V_{GS} = -20\text{ V}$

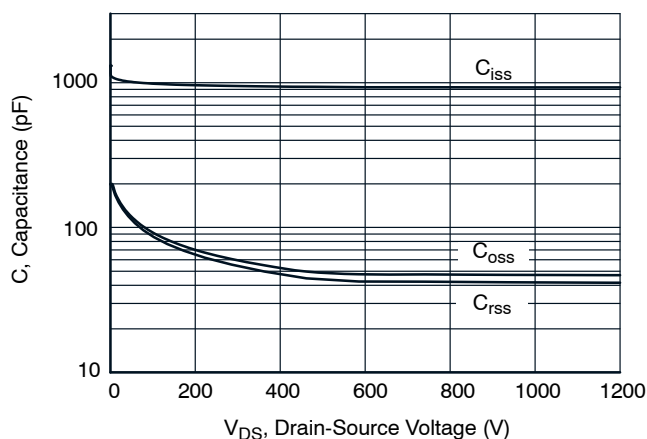


Figure 5. Typical Capacitances at 100 kHz and  $V_{GS} = -20\text{ V}$

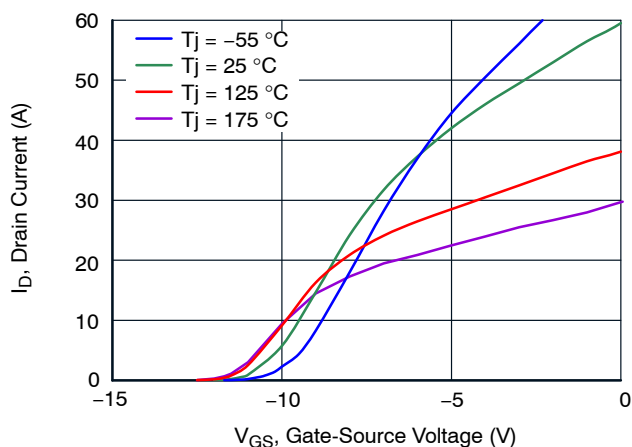


Figure 6. Typical Transfer Characteristics at  $V_{DS} = 5\text{ V}$

TYPICAL PERFORMANCE DIAGRAMS (continued)

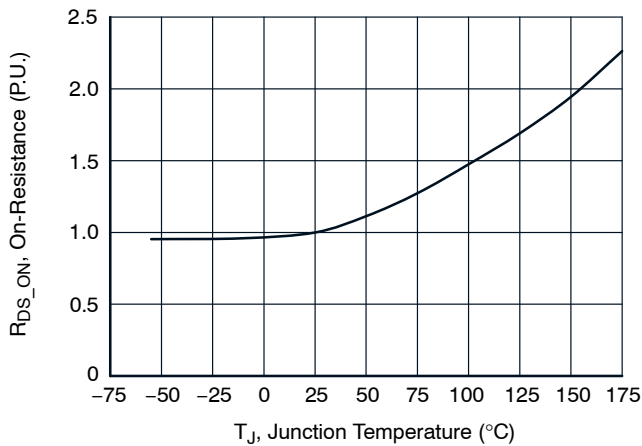


Figure 7. Normalized On-Resistance vs. Temperature at  $V_{GS} = 0\text{ V}$  and  $I_D = 10\text{ A}$

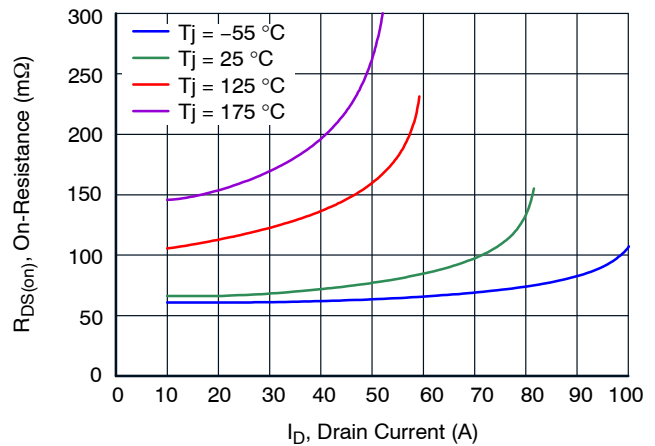


Figure 8. Typical Drain-Source On-Resistance at  $V_{GS} = 0\text{ V}$

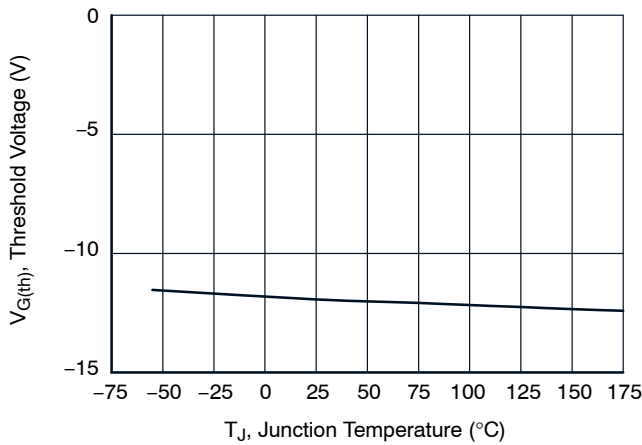


Figure 9. Threshold Voltage vs.  $T_J$  at  $V_{DS} = 5\text{ V}$  and  $I_D = 35\text{ mA}$

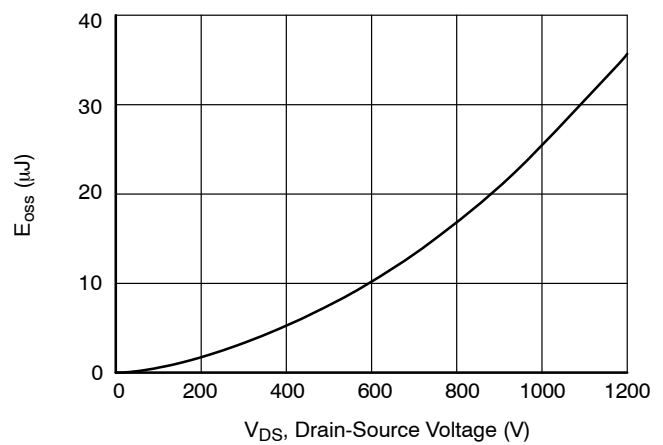


Figure 10. Typical Stored Energy in  $C_{oss}$  at  $V_{GS} = -20\text{ V}$

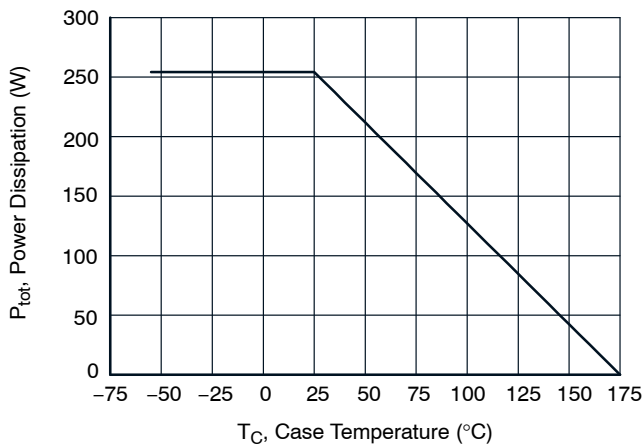


Figure 11. Total Power Dissipation

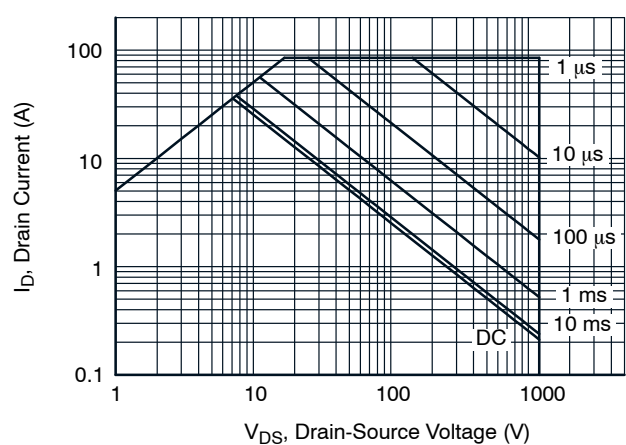


Figure 12. Safe Operation Area  $T_C = 25\text{ °C}$ , Parameter  $t_p$

TYPICAL PERFORMANCE DIAGRAMS (continued)

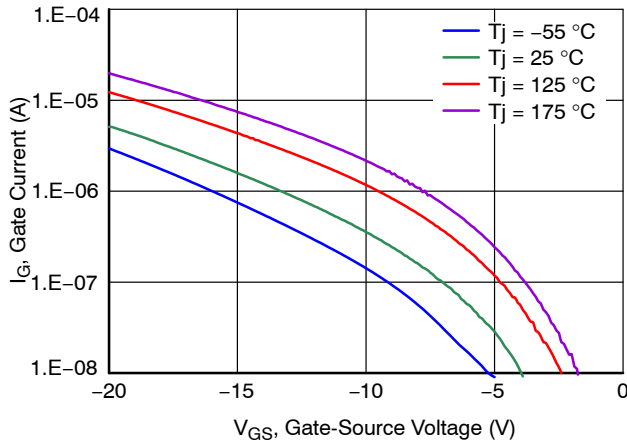


Figure 13. Typical Gate Leakage Current at  $V_{DS} = 0$  V

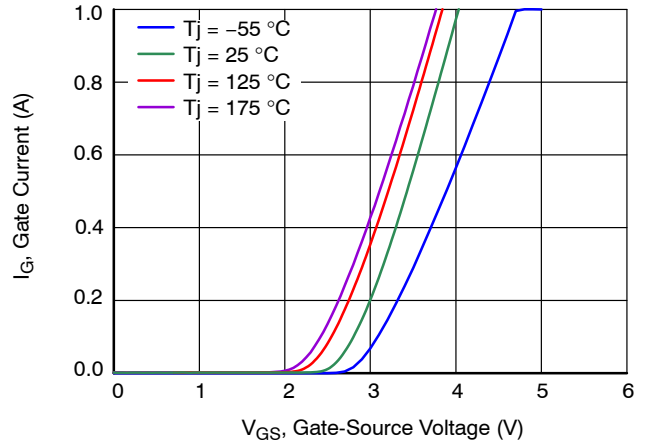


Figure 14. Typical Gate Forward Current at  $V_{DS} = 0$  V

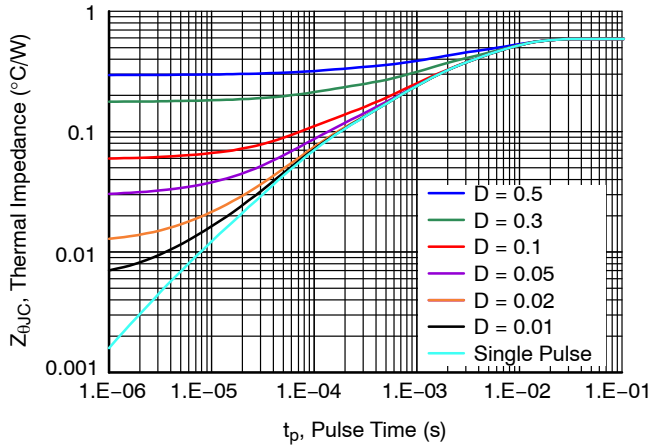


Figure 15. Maximum Transient Thermal Impedance

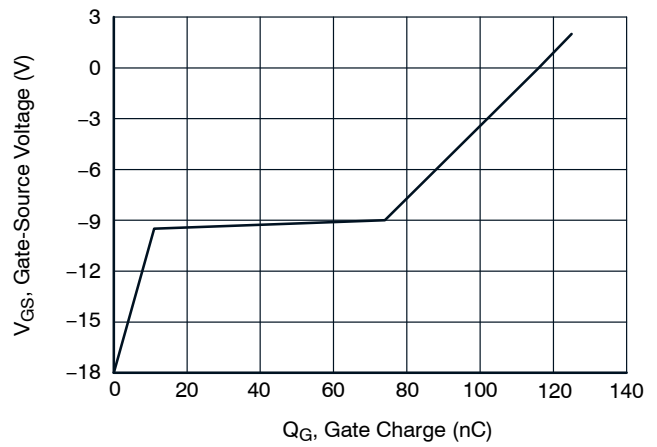


Figure 16. Typical Gate Charge at  $V_{DS} = 800$  V and  $I_D = 25$  A

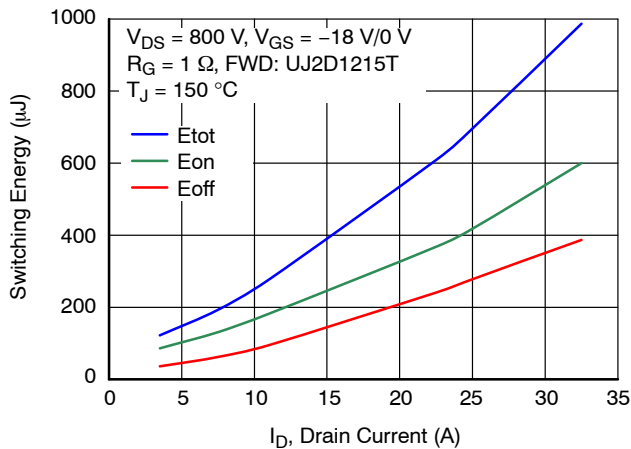


Figure 17. Clamped Inductive Switching Energy vs. Drain Current at  $T_J = 150$  °C

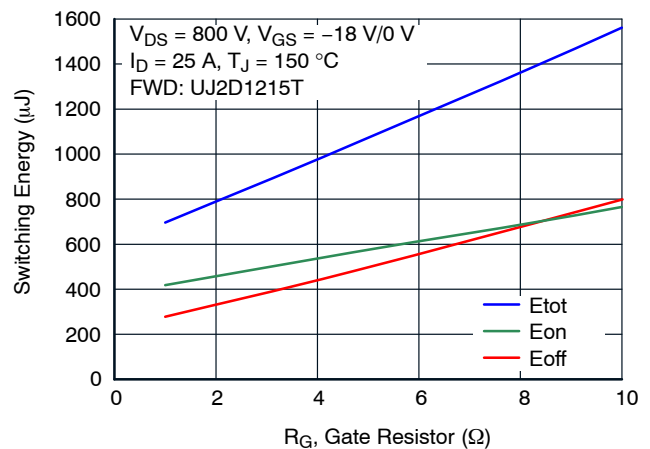
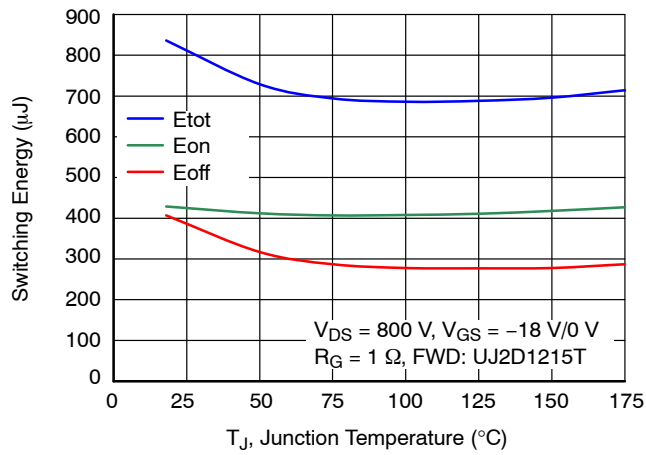


Figure 18. Clamped Inductive Switching Energy vs. Gate Resistor  $R_G$

# UJ3N120070K3S

## TYPICAL PERFORMANCE DIAGRAMS (continued)



**Figure 19. Clamped Inductive Switching  
Energy vs. Junction Temperature at  $I_D = 25\text{ A}$**

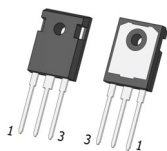
### ORDERING INFORMATION

| Part Number   | Marking       | Package                            | Shipping         |
|---------------|---------------|------------------------------------|------------------|
| UJ3N120070K3S | UJ3N120070K3S | TO247-3<br>(Pb-Free, Halogen Free) | 600 Units / Tube |

## UJ3N120070K3S

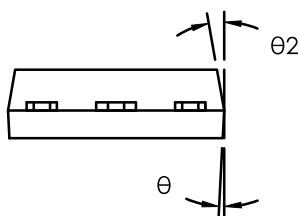
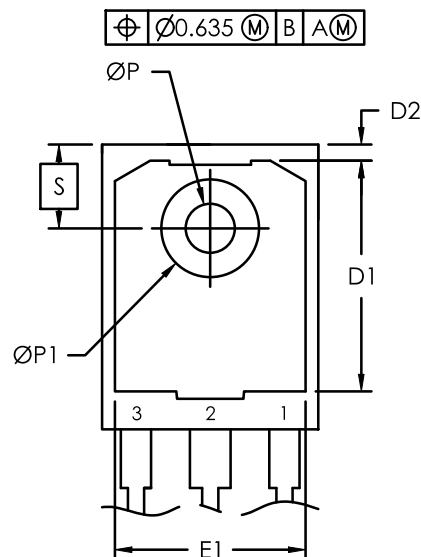
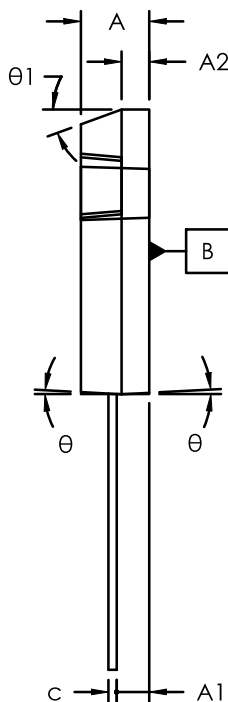
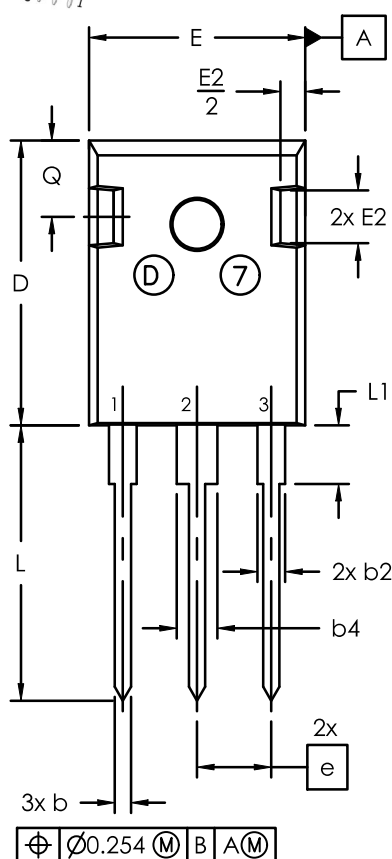
### REVISION HISTORY

| Revision | Description of Changes                                                                                                                            | Date      |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| C        | Acquired the original Qorvo JFET Division Data Sheet and updated the main document title to comply with <b>onsemi</b> standards for SiC products. | 3/21/2025 |
| 3        | Converted the Data Sheet to <b>onsemi</b> format.                                                                                                 | 6/3/2025  |



**TO247-3 15.90x20.96x5.03, 5.44P**  
CASE 340AK  
ISSUE B

DATE 14 APR 2025



**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.

| 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  |
| b4  | 2.59        | 3.00  | 3.43  |
| c   | 0.38        | 0.60  | 0.89  |
| D   | 20.70       | 20.96 | 21.46 |
| D1  | 13.08       | —     | —     |
| D2  | 0.51        | 1.19  | 1.35  |
| E   | 15.49       | 15.90 | 16.26 |
| e   | 5.44 BSC    |       |       |
| E1  | 13.00       | 13.30 | 13.60 |
| E2  | 3.43        | 3.89  | 5.20  |
| L   | 19.62       | 20.27 | 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   | 6.15 BSC    |       |       |
| θ   | 3°          |       |       |
| θ1  | 20°         |       |       |
| θ2  | 10°         |       |       |

**DOCUMENT NUMBER:** 98AON88794E

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**DESCRIPTION:** TO247-3 15.90x20.96x5.03, 5.44P

**PAGE 1 OF 1**

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