DATASHEET

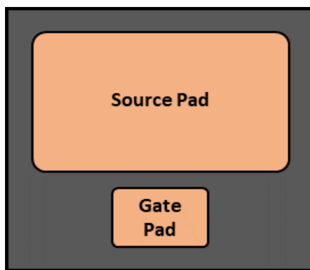
# UF3N120140Z

## 1200V-140mΩ SiC Normally-on JFET

Preliminary, March 2019

## Description

United Silicon Carbide, Inc 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 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 140mΩ
- Voltage controlled
- Maximum operating temperature of 175°C
- Extremely fast switching not dependent on temperature
- Low gate charge
- Low intrinsic capacitance
- RoHS compliant

## Typical applications

- Over Current Protection Circuits
- DC-AC Inverters
- Switch mode power supplies
- Power factor correction modules
- Motor drives
- Induction heating

| Part Number | Package |
|---|---|
| UF3N120140Z | Die on tape |
| UF3N120140 | Undiced wafer |

## Maximum Ratings

| Parameter | Symbol | Test Conditions | Value | Units |
|---|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | | 1200 | V |
| Gate-source voltage | $V_{GS}$ | DC | -20 to +3 | V |
| | | AC [1] | -20 to +20 | V |
| Continuous drain current [2,3] | $I_D$ | $T_C$ = 25°C | 20.8 | A |
| | | $T_C$ = 100°C | 14.7 | A |
| Pulsed drain current [3,4] | $I_{DM}$ | $T_C$ = 25°C | TBD | A |
| Maximum junction temperature [5] | $T_{J,max}$ | | 175 | °C |
| Operating and storage temperature | $T_J$, $T_{STG}$ | | -55 to 175 | °C |

1. +20V AC rating applies for turn-on pulses <200ns applied with external $R_G$ > 1Ω.
2. Limited by $T_{J,max}$
3. Assumes a maximum junction-to-case thermal resistance of 0.9°C/W
4. Pulse width $t_p$ limited by $T_{J,max}$
5. Package limited

## Electrical Characteristics ($T_J$ = +25°C unless otherwise specified)

## Typical Performance - Static

| Parameter | Symbol | Test Conditions | Value | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Drain-source breakdown voltage | $BV_{DS}$ | $V_{GS}$=-20V, $I_D$=1mA | 1200 | | | V |
| Total drain leakage current | $I_{DSS}$ | $V_{DS}$=1200V, $V_{GS}$=-20V, $T_J$=25°C | | 1.3 | 17 | μA |
| | | $V_{DS}$=1200V, $V_{GS}$=-20V, $T_J$=175°C | | TBD | | |
| Total gate leakage current | $I_{GSS}$ | $V_{GS}$=-20V, $T_J$=25°C | | 0.04 | 0.5 | μA |
| | | $V_{GS}$=-20V, $T_J$=175°C | | TBD | | μA |
| Drain-source on-resistance | $R_{DS(on)}$ | $V_{GS}$=2V, $I_D$=5A, $T_J$=25°C | | 116 | | mΩ |
| | | $V_{GS}$=0V, $I_D$=5A, $T_J$=25°C | | 140 | 175 | |
| | | $V_{GS}$=2V, $I_D$=5A, $T_J$=175°C | | TBD | | |
| | | $V_{GS}$=0V, $I_D$=5A, $T_J$=175°C | | TBD | | |
| Gate threshold voltage | $V_{G(th)}$ | $V_{DS}$=5V, $I_D$=2.4mA | -11 | -8.4 | -7 | V |
| Gate resistance | $R_G$ | f=1MHz, open drain | | TBD | | Ω |

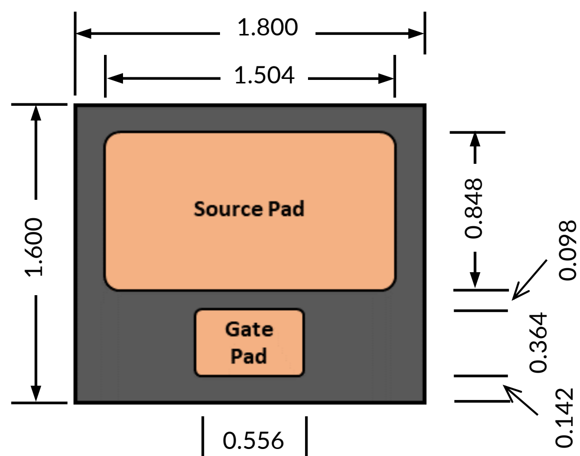
## Typical Performance - Dynamic

| Parameter | Symbol | Test Conditions | Value | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Input capacitance | $C_{iss}$ | $V_{DS}$=100V, $V_{GS}$=-20V f=100kHz | | TBD | | pF |
| Output capacitance | $C_{oss}$ | | | TBD | | |
| Reverse transfer capacitance | $C_{rss}$ | | | TBD | | |
| Effective output capacitance, energy related | $C_{oss(er)}$ | $V_{DS}$=0V to 800V, $V_{GS}$=-20V | | TBD | | pF |
| $C_{OSS}$ stored energy | $E_{oss}$ | $V_{DS}$=800V, $V_{GS}$=-20V | | TBD | | µJ |
| Total gate charge | $Q_G$ | $V_{DS}$=800V, $I_D$=14A, $V_{GS}$ = -18V to 0V | | TBD | | nC |
| Gate-drain charge | $Q_{GD}$ | | | TBD | | |
| Gate-source charge | $Q_{GS}$ | | | TBD | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=800V, $I_D$=54A, Gate Driver =-18V to 0V, $R_G$=1Ω, Inductive Load, FWD: UJ3D1204TS $T_J$=25°C | | TBD | | ns |
| Rise time | $t_r$ | | | TBD | | |
| Turn-off delay time | $t_{d(off)}$ | | | TBD | | |
| Fall time | $t_f$ | | | TBD | | |
| Turn-on energy | $E_{ON}$ | | | TBD | | µJ |
| Turn-off energy | $E_{OFF}$ | | | TBD | | |
| Total switching energy | $E_{TOTAL}$ | | | TBD | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=800V, $I_D$=14A, Gate Driver =-18V to 0V, $R_G$=1Ω, Inductive Load, FWD: UJ3D1204TS $T_J$=150°C | | TBD | | ns |
| Rise time | $t_r$ | | | TBD | | |
| Turn-off delay time | $t_{d(off)}$ | | | TBD | | |
| Fall time | $t_f$ | | | TBD | | |
| Turn-on energy | $E_{ON}$ | | | TBD | | µJ |
| Turn-off energy | $E_{OFF}$ | | | TBD | | |
| Total switching energy | $E_{TOTAL}$ | | | TBD | | |

## Mechanical Characteristics

| Parameter | Typical Value | Units |
|---|---|---|
| Die dimensions with scribe line (L x W) | 1.800 x 1.600 | mm |
| Scribe line width | 80 | μm |
| Source pad metal dimensions (L x W) | 1.504 x 0.848 | mm |
| Gate pad metal dimensions (L x W) | 0.556 x 0.364 | mm |
| Source metallization (AlCu) | 5 | μm |
| Gate metallization (AlCu) | 5 | μm |
| Backside drain metallization (Ti/Ni/Ag) | 0.1/0.2/1 | μm |
| Frontside passivation | Polyimide | |
| Die thickness | 150 | μm |
| Wafer size | 150 | mm |
| Gross die per wafer | 4,954 | |

## Chip Dimensions




Unit: mm

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