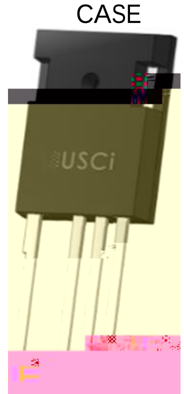
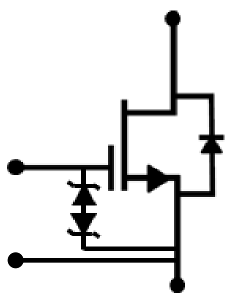
## Is N w Part of

rn m r b ut ns mi™, p s visit ur w bsit t
www. ns mi.c m



| Part Number | Package | Marking |
|---|---|---|
| UF3C120080K4S | TO-247-4L | UF3C120080K4S |

## Maximum Ratings

| Parameter | Symbol | Test Conditions | Value | Units |
|---|---|---|---|---|
| Drain-source voltage | $V_{DS}$ | | 1200 | V |
| Gate-source voltage | $V_{GS}$ | DC | -25 to +25 | V |
| Continuous drain current [1] | $I_D$ | $T_C$ = 25°C | 33 | A |
| | | $T_C$ = 100°C | 24 | A |
| Pulsed drain current [2] | $I_{DM}$ | $T_C$ = 25°C | 77 | A |
| Single pulsed avalanche energy [3] | $E_{AS}$ | L=15mH, $I_{AS}$ =2.8A | 58.5 | mJ |
| Power dissipation | $P_{tot}$ | $T_C$ = 25°C | 254.2 | W |
| Maximum junction temperature | $T_{J,max}$ | | 175 | °C |
| Operating and storage temperature | $T_J$, $T_{STG}$ | | -55 to 175 | °C |
| Max. lead temperature for soldering, 1/8" from case for 5 seconds | $T_L$ | | 250 | °C |

1. Limited by $T_{J,max}$
2. Pulse width $t_p$ limited by $T_{J,max}$
3. Starting $T_J$ = 25°C

## Thermal Characteristics

| Parameter | Symbol | Test Conditions | Value | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Thermal resistance, junction-to-case | $R_q$ | | | 0.45 | 0.59 | °C/W |

# Electrical Characteristics

## Typical Performance - Static

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| $BV_{DS}$ | 1200 | | | V |
| | | 10 | 75 | |
| | | 50 | | |
| $I_{GSS}$ | | 6 | 20 | mA |
| | | 80 | 100 | |
| | | 172 | | |
| $V_{G(th)}$ | 4 | 5 | 6 | V |
| $R_G$ | | 4.5 | | W |

## Typical Performance - Reverse Diode

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| $I_S$ | | | 33 | A |
| $I_{S,puin}$ | | | | |

## Typical Performance - Dynamic

| Parameter | Symbol | Test Conditions | Value | | | Units |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Input capacitance | $C_{iss}$ | $V_{DS}$=100V, $V_{GS}$=0V f=100kHz | | 1500 | | pF |
| Output capacitance | $C_{oss}$ | | | 100 | | |
| Reverse transfer capacitance | $C_{rss}$ | | | 2.1 | | |
| Effective output capacitance, energy related | $C_{oss(er)}$ | $V_{DS}$=0V to 800V, $V_{GS}$=0V | | 59 | | pF |
| Effective output capacitance, time related | $C_{oss(tr)}$ | $V_{DS}$=0V to 800V, $V_{GS}$=0V | | 136 | | pF |
| $C_{OSS}$ stored energy | $E_{oss}$ | $V_{DS}$=800V, $V_{GS}$=0V | | 19 | | mJ |
| Total gate charge | $Q_G$ | $V_{DS}$=800V, $I_D$=20A, $V_{GS}$ = -5V to 12V | | 43 | | nC |
| Gate-drain charge | $Q_{GD}$ | | | 11 | | |
| Gate-source charge | $Q_{GS}$ | | | 19 | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=800V, $I_D$=20A, Gate Driver =-5V to +12V, Turn-on $R_{G,EXT}$=8.5W, Turn-off $R_{G,EXT}$=20W Inductive Load, FWD: same device with $V_{GS}$ = -5V, $R_G$ = 10W, $T_J$=25°C | | 33 | | ns |
| Rise time | $t_r$ | | | 13 | | |
| Turn-off delay time | $t_{d(off)}$ | | | 43 | | |
| Fall time | $t_f$ | | | 10 | | |
| Turn-on energy | $E_{ON}$ | | | 355 | | mJ |
| Turn-off energy | $E_{OFF}$ | | | 88 | | |
| Total switching energy | $E_{TOTAL}$ | | | 443 | | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DS}$=800V, $I_D$=20A, Gate Driver =-5V to +12V, Turn-on $R_{G,EXT}$=8.5W, Turn-off $R_{G,EXT}$=20W Inductive Load, FWD: same device with $V_{GS}$ = -5V, $R_G$ = 10W, $T_J$=150°C | | 29 | | ns |
| Rise time | $t_r$ | | | 11 | | |
| Turn-off delay time | $t_{d(off)}$ | | | 45 | | |
| Fall time | $t_f$ | | | 10 | | |
| Turn-on energy | $E_{ON}$ | | | 306 | | mJ |
| Turn-off energy | $E_{OFF}$ | | | 82 | | |
| Total switching energy | $E_{TOTAL}$ | | | 388 | | |

## Typical Performance Diagrams

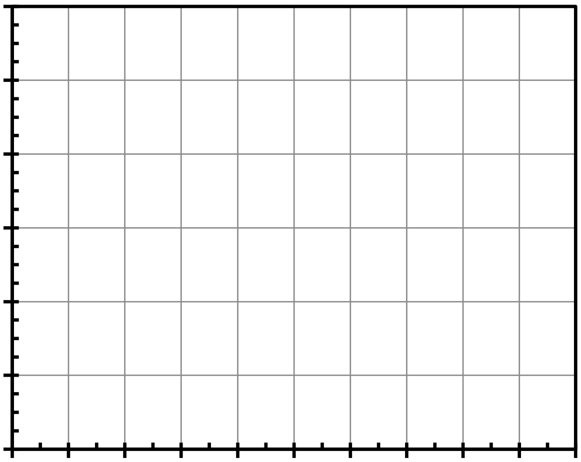


Figure 1. Typical output characteristics at $T_J$ = -55°C, tp < 250ms

Figure 2. Typical output characteristics at $T_J$ = 25°C, tp < 250ms

Figure 3. Typical output characteristics at $T_J$ = 175°C, tp < 250ms

Figure 4. Normalized on-resistance vs. temperature at $V_{GS}$ = 12V and $I_D$ = 20A

Figure 5. Typical drain-source on-resistances at $V_{GS}$ = 12V

Figure 6. Typical transfer characteristics at $V_{DS}$

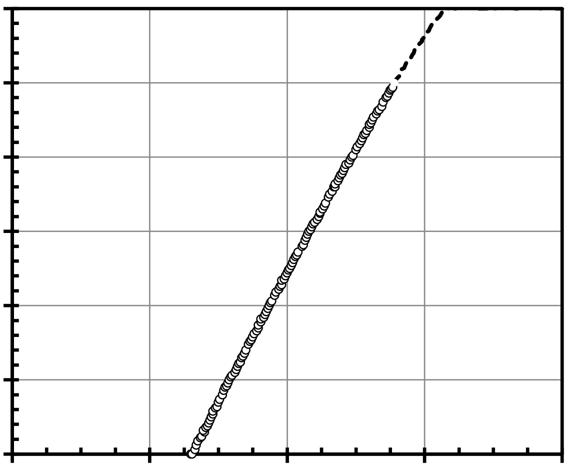


Figure 9. 3rd quadrant characteristics at $T_J$ = -55°C

Figure 10. 3rd quadrant characteristics at $T_J$ = 25°C

Figure 11. 3rd quadrant characteristics at $T_J$ = 175°C

Figure 12. Typical stored energy in $C_{OSS}$ at $V_{GS}$ = 0V

Figure 22. Reverse recovery charge Qrr vs. junction temperature

## Applications Information

SiC cascodes are enhancement-mode power switches formed by a high-voltage SiC depletion-mode JFET and a low-voltage silicon MOSFET connected in series. The silicon MOSFET serves as the control unit while the SiC JFET provides high voltage blocking in the off state. This combination of devices in a single package provides compatibility with standard gate drivers and offers superior performance in terms of low on-resistance ($R_{DS(on)}$), output capacitance ($C_{oss}$), gate charge ($Q_G$), and reverse recovery charge (Qrr) leading to low conduction and switching losses. The SiC cascodes also provide excellent reverse conduction capability eliminating the need for an external anti-parallel diode.

Like other high performance power switches, proper PCB layout design to minimize circuit parasitics is strongly recommended due to the high dv/dt and di/dt rates. An external gate resistor is recommended when the cascode is working in the diode mode in order to achieve the optimum reverse recovery performance. For more information on cascode operation, see www.unitedsic.com.

## Disclaimer

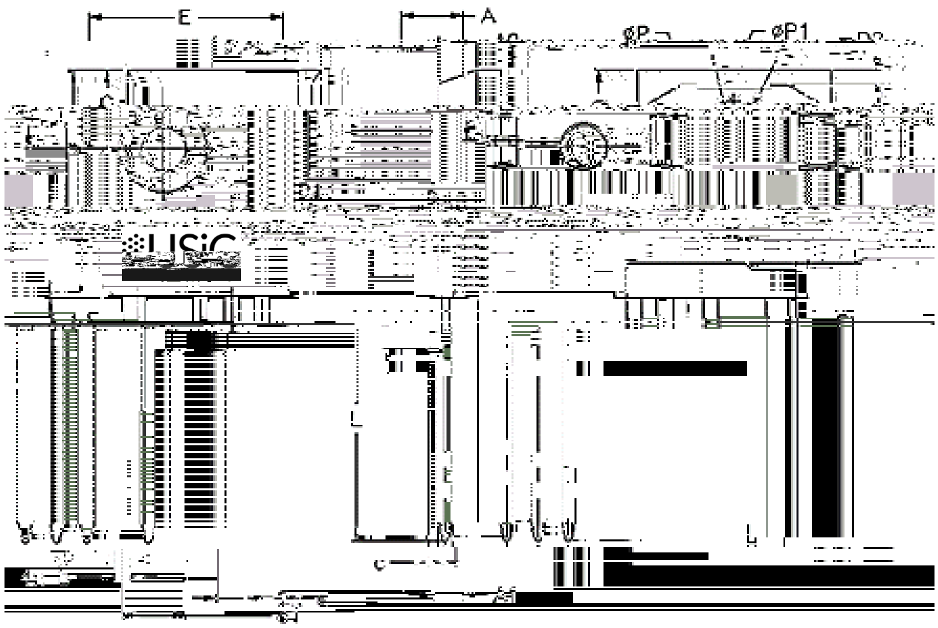
United Sili(e)-

Information on all products and contained herein is intended for description only. No license, express or implied, to any intellectual property rights is granted within this document.

United Silicon Carbide, Inc. assumes no liability whatsoever relating to the choice, selection or use of the United Silicon Carbide, Inc. products and services described herein.

# TO-247-4L PACKAGE OUTLINE, PART MARKING AND TUBE SPECIFICATIONS

## PACKAGE OUTLINE




| DIM | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| ΦP | | | | |
| ΦP1 | | | | |
| | | | | |
| | | | | |

## PART MARKING

## PACKING TYPE