# N- Channel SiC Power MOSFET

CI60N120SM4

### Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

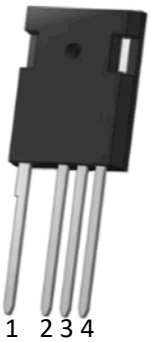
### Benefits

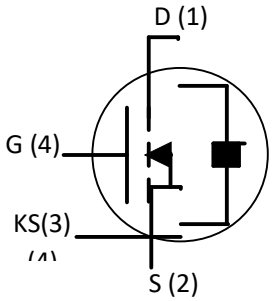
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

### Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications

### Package




## Maximum Ratings ($T_C$ = 25 ˚C unless otherwise specified)

| Symbol | Parameter | Value | Unit | Test Conditions | Note |
|---|---|---|---|---|---|
| $V_{DSmax}$ | Drain - Source Voltage | 1200 | V | $V_{GS}$ = 0 V, $I_D$ = 100 µA | |
| $V_{GSmax}$ | Gate - Source Voltage | -10/+25 | V | Absolute maximum values | |
| $V_{GSop}$ | Gate - Source Voltage | -5/+20 | V | Recommended operational values | |
| $I_D$ | Continuous Drain Current | 60 | A | $V_{GS}$ = 20 V, $T_C$ = 25˚C | Fig. 19 |
| | | 40 | | $V_{GS}$ = 20 V, $T_C$ = 100˚C | |
| $I_{D(pulse)}$ | Pulsed Drain Current | 160 | A | Pulse width $t_P$ limited by $T_{jmax}$ | Fig. 22 |
| $P_D$ | Power Dissipation | 330 | W | $T_C$=25˚C, $T_J$ = 150 ˚C | Fig. 20 |
| $T_J$ , $T_{stg}$ | Operating Junction and Storage Temperature | -55 to +175 | ˚C | | |
| $T_L$ | Solder Temperature | 260 | ˚C | 1.6mm (0.063”) from case for 10s | |
| $M_d$ | Mounting Torque | 1<br>8.8 | Nm<br>lbf-in | M3 or 6-32 screw | |

## Electrical Characteristics

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | Drain-Source Breakdown Voltage | 1200 | | | V | $V_{GS}$=0V,$I_D$=100μA | |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 2.50 | 4.0 | V | $V_{GS}$= $V_{DS}$, $I_{DS}$=10mA,$T_C$=25°C | Fig. 6 |
| | | | 1.80 | | | $V_{GS}$= $V_{DS}$, $I_{DS}$=10mA,$T_C$=150°C | |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | | 1 | 100 | μA | $V_{DS}$= 1200V, $V_{GS}$=0V | |
| $I_{GSS}$ | Gate-Source Leakage Current | | | 200 | nA | $V_{GS}$= 20 V, $V_{DS}$= 0V | |
| $R_{DS(on)}$ | Drain-Source on-state Resistance | | 45 | 55 | mΩ | $V_{GS}$= 20 V, $I_D$=40A, $T_C$=25°C | Fig. 4 |
| | | | 58 | | mΩ | $V_{GS}$= 20 V, $I_D$=40A, $T_C$=150°C | |
| $g_{fs}$ | Transconductance | | 14.1 | | S | $V_{GS}$ = 20 V, $I_D$ = 40A, $T_J$ = 25 °C | Fig. 5 |
| | | | 12.5 | | S | $V_{GS}$ = 20 V, $I_D$ = 40A, $T_J$ = 150 °C | |
| Ciss | Input Capacitance | | 3550 | | pF | $V_{GS}$=0V, $V_{DS}$=1000 V, f=1MHz, $V_{AC}$=25 mV | Fig. 9 |
| Coss | Output Capacitance | | 162 | | | | |
| Crss | Reverse Transfer Capacitance | | 29 | | | | |
| $E_{ON}$ | Turn-On Switching Energy | | 1.5 | | mJ | $V_{DS}$=800V, $V_{GS}$=-5/20V, $I_D$= 40A, $R_{G(ext)}$ = 5Ω, L= 80 μH | |
| $E_{OFF}$ | Turn-Off Switching Energy | | 0.7 | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | | 60 | | ns | $V_{DD}$=800V, $V_{GS}$=-5/20 V $I_D$ = 40A, $R_{G(ext)}$ = 5 Ω , $R_L$=20Ω , Timing relative to $V_{DS}$ | |
| $t_r$ | Rise Time | | 140 | | | | |
| $t_{d(off)}$ | Turn-Off Delay Time | | 50 | | | | |
| $t_f$ | Fall Time | | 42 | | | | |
| $R_{G(int)}$ | Internal Gate Resistance | | 1.0 | | Ω | f=1 MHz, $V_{AC}$=25mV | |
| $Q_{gs}$ | Gate to Source Charge | | 40 | | nC | $V_{DD}$=800V, $V_{GS}$=-5/20 V $I_D$ = 40A | Fig. 10 |
| $Q_{gd}$ | Gate to Drain Charge | | 55 | | | | |
| $Q_g$ | Total Gate Charge | | 160 | | | | |

### Reverse Diode Characteristics

| Symbol | Parameter | Typ. | Max. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | 3.6 | | V | $V_{GS}$ = -5V, $I_{SD}$ = 20 A, $T_J$ = 25 °C | Fig. 7 |
| | | 3.3 | | V | $V_{GS}$ =- 5V, $I_{SD}$ = 20 A, $T_J$ = 150 °C | Fig. 8 |
| $I_S$ | Continuous Diode Forward Current | | 20 | A | $T_C$ = 25°C | |

### Thermal Characteristics

| Symbol | Parameter | Typ. | Unit | Test Conditions | Note |
|---|---|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance from Junction to Case | 0.40 | ℃/W | | Fig. 12 |
| $R_{\theta JA}$ | Thermal Resistance From Junction to Ambient | 38 | | | |

## Typical Performance

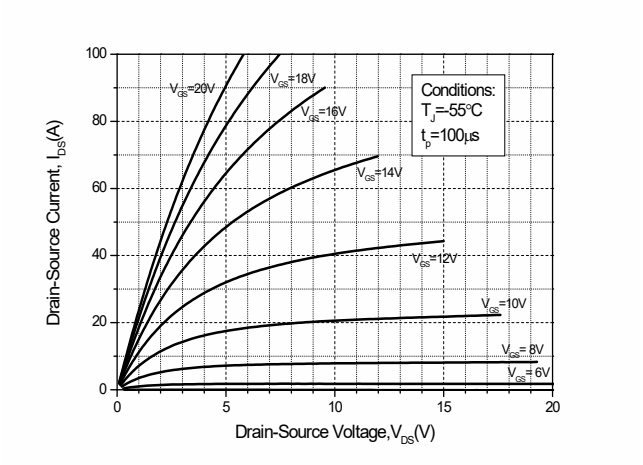



Figure 1. Output Characteristics $T_J$ = -55 ℃

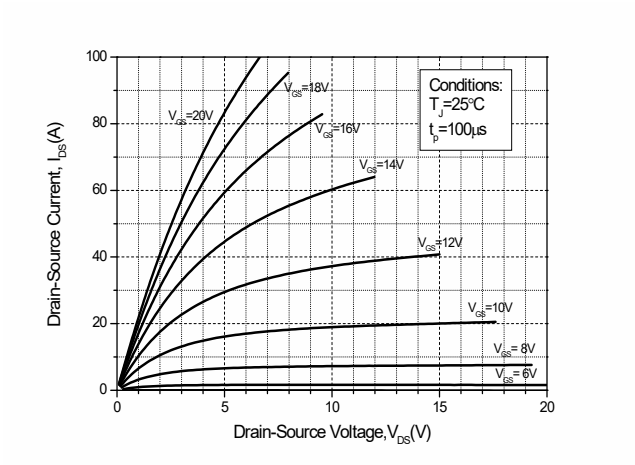



Figure 2. Output Characteristics $T_J$ = 25 ℃

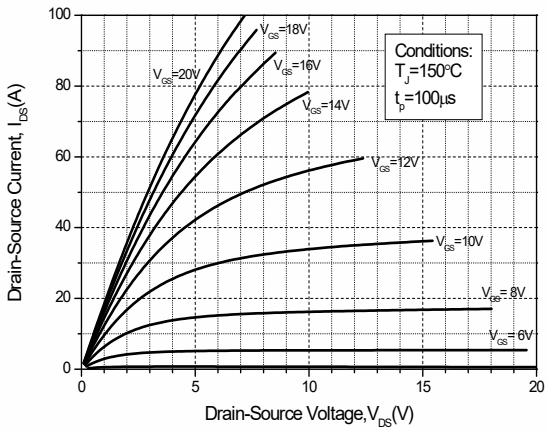



Figure 3. Output Characteristics $T_J$ =150 ℃

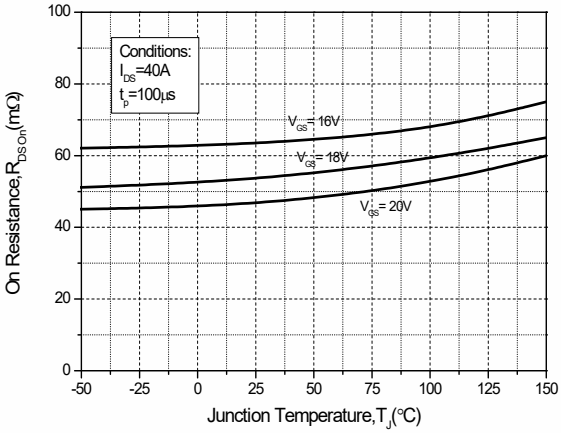



Figure 4. On-Resistance For Various Gate Voltage

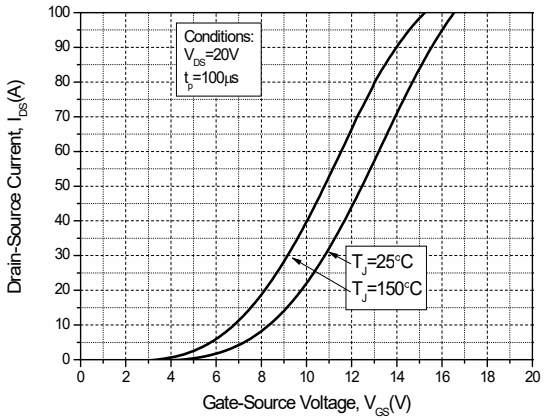



Figure 5. Transfer Characteristic for Various Junction Temperatures

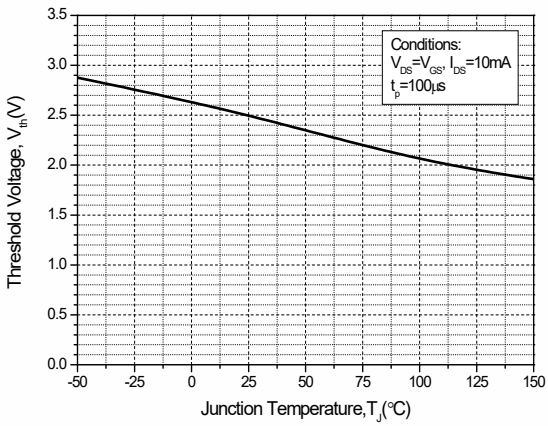



Figure 6. Threshold Voltage vs. Temperature

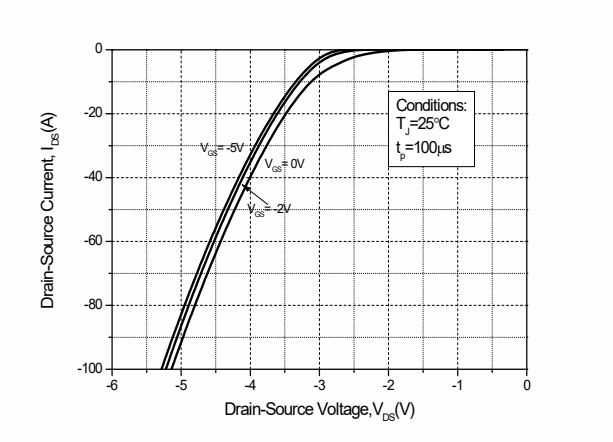



Figure 7. Body Diode Characteristics

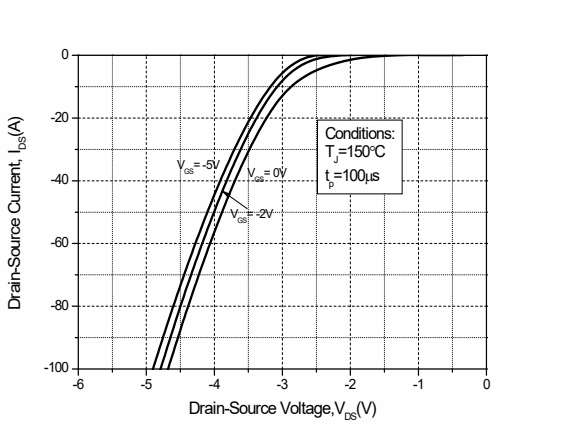



Figure 8. Body Diode Characteristics

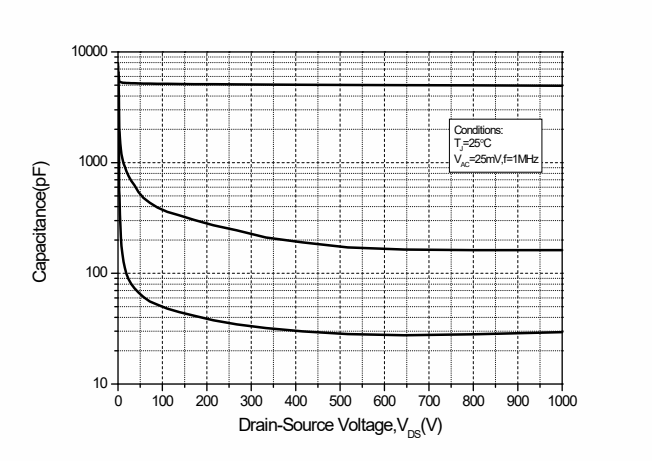



Figure 9. Capacitances vs. Drain-Source Voltage

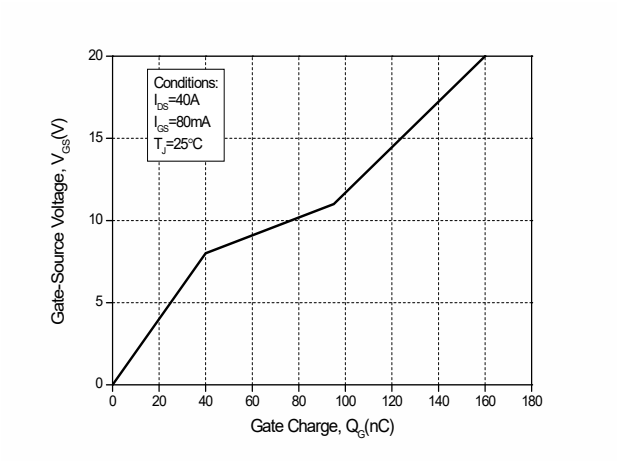



Figure 10. Gate Charge Characteristics

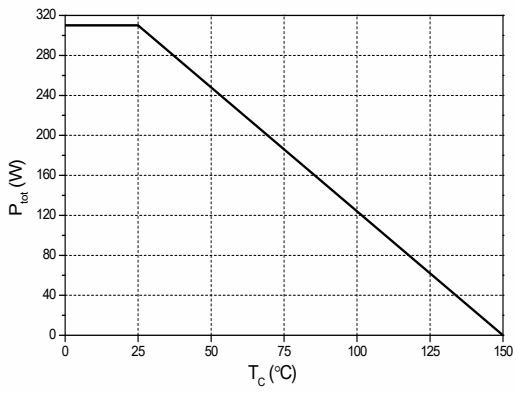



Figure 11. Power Dissipation Derating

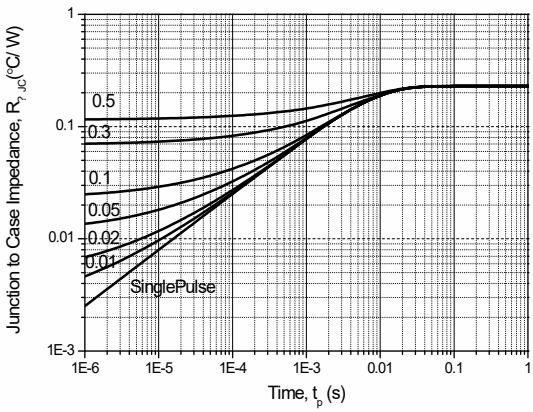
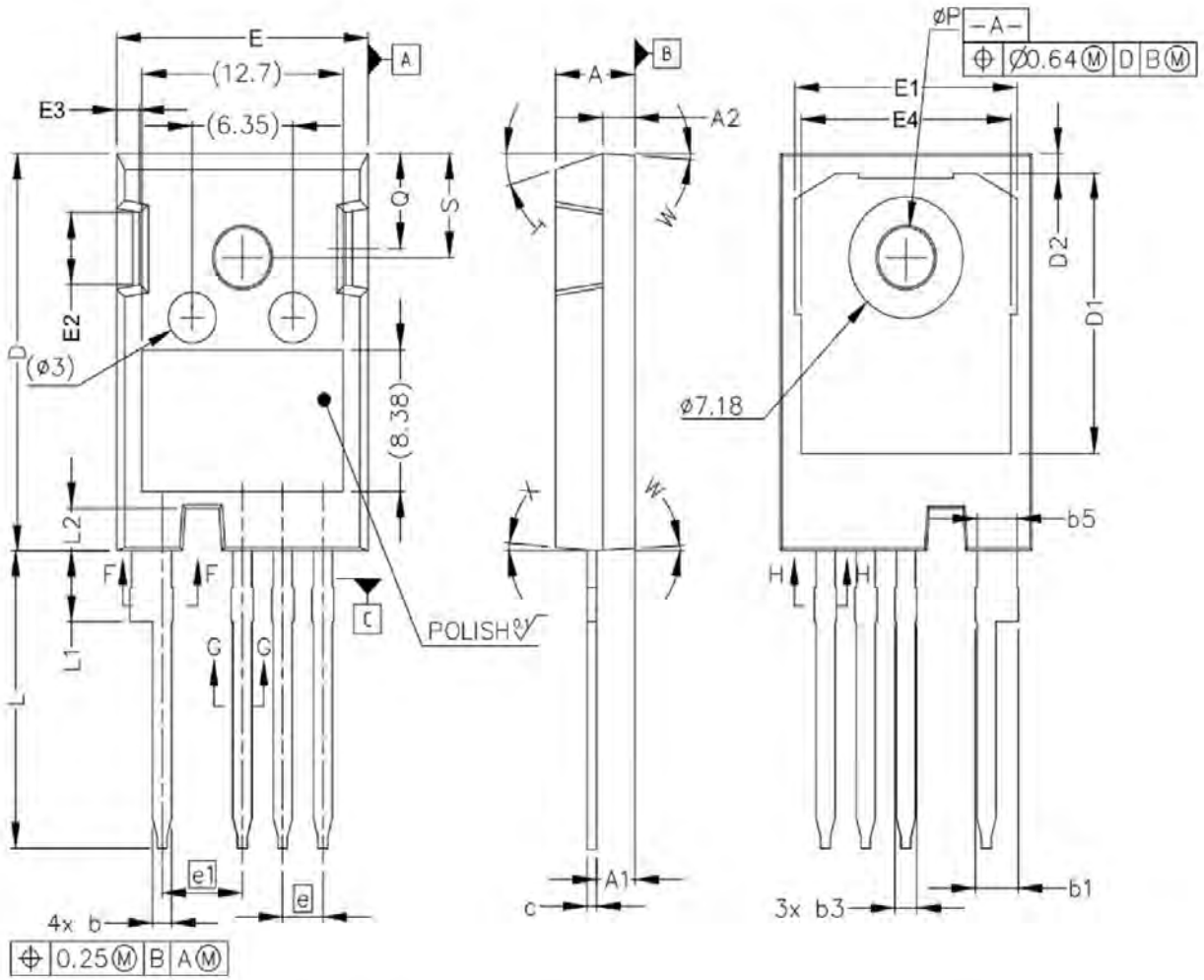



Figure 12. Transient Thermal Impendance

**Package Dimensions: TO-247-4L**




| SYMBOL | Mechanical Dimensions/mm | | | SYMBOL | Mechanical Dimensions/mm | | | SYMBOL | Mechanical Dimensions/mm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | | | | | | MIN | NOM | MAX |
| A | 4.83 | 5.00 | 5.21 | D | 23.30 | 23.45 | 23.60 | L1 | 3.97 | 4.13 | 4.37 |
| A1 | 2.29 | 2.41 | 2.54 | D1 | 16.25 | 16.55 | 17.65 | ø P | 3.51 | 3.6 | 3.65 |
| A2 | 1.91 | 2.00 | 2.16 | E | 15.75 | 15.90 | 16.13 | W | - | 3.5 | - |
| b | 1.07 | 1.20 | 1.33 | E1 | 13.10 | 13.65 | 14.15 | X | - | 4 | - |
| b1 | 2.39 | 2.60 | 2.94 | E2 | 3.68 | 5.0 | 5.1 | Q | 5.49 | 5.8 | 6.0 |
| b2 | 2.39 | - | 2.84 | e | 2.54 | | | S | 6.04 | 6.15 | 6.30 |
| c | 0.55 | 0.60 | 0.68 | L | 17.31 | 17.45 | 17.82 | T | - | 17.5 | - |

NOTE:
1The plastic package is not marked as smooth surfaceRa=0.1;Subglossy surfaceRa=0.8
2.Undeclared tolerance±0.15,Unmarked filletRmax=0.25

| NAME | TO-247-4L OUTLINE | UNIT | mm | DESIGNED | Shawn | THIRD ANGLE SYSTEM |
|---|---|---|---|---|---|---|
| DWGNO | | PAGE | 1 OF 1 | CHECKED | | |
| VERSION | Ver1.0 | ISSUE DATE | | APPROVED | | |

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