

1200V, 40mΩ SiC Power MOSFET

General Description

The AKM120N040T4A 1200V, 40mΩ SiC power MOSFET is an N-channel enhancement mode device. This device shows high current density and great switching behavior. Due to excellent thermal conductivity, this device significantly improved in thermal capability and temperature independent switching behavior.

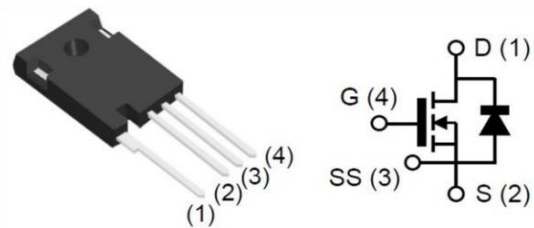
| V _{DS} | R _{DS(ON)} | I _{D(@25°C)} |
|-----------------|---------------------|-----------------------|
| 1200V | 40mΩ | 78A |

Features

- Low On-Resistance and High Current Density
- Low Capacitance for High Frequency Operation
- Positive Temperature Coefficient Device
- AEC-Q101 Qualified
- RoHS Compliant and Halogen Free

Applications

- Switching Mode Power Supply
- Power Inverters
- DC/DC Converters, UPS, and PFC
- Auxiliary Power Supplies
- Solar/Wind Renewable Energy

TO-247-4L


Ordering Information

| Part Number | Package | Marking | Remark |
|---------------|-----------|-------------|--------------|
| AKM120N040T4A | TO-247-4L | M120N040T4A | Halogen Free |

Absolute Maximum Ratings

T_C=25°C unless otherwise specified

| Symbol | Parameter | AKM120N040T4A | Unit |
|-----------------------------------|--|---|------|
| V _{DS, max} | Drain-to-Source Voltage ^[1] | 1200 | V |
| I _D | Continuous Drain Current | V _{GS} =20V, T _C =25°C | 78 |
| | | V _{GS} =20V, T _C =100°C | 57 |
| P _D | Power Dissipation | T _C =25°C, T _j =175°C | 405 |
| V _{GS, op} | Recommend Gate Source Voltage | -5 to 20 | V |
| V _{GS, max} | Maximum Gate Source Voltage | -10 to 25 | |
| T _L | Soldering Temperature | 260 | °C |
| T _j , T _{stg} | Soldering Temperature | -55 to 175 | |

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

Thermal Characteristics

| Symbol | Parameter | AKM120N040T4A | Unit |
|------------------|--------------------------------------|---------------|------|
| R _{θJC} | Thermal Resistance, Junction-to-Case | 0.25 | °C/W |

Electrical Characteristics
 $T_C = 25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---------------|-------------------------------------|------|------|------|------------|---|
| $V_{(BR)DSS}$ | Drain-to-Source Breakdown Voltage | 1200 | -- | -- | V | $V_{GS}=0V, I_D=100\mu A$ |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 2.5 | 4.0 | V | $V_{DS}=10V, I_{DS}=40mA$ |
| | | -- | 1.5 | -- | | $V_{DS}=10V, I_{DS}=40mA, T_j=175^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | -- | 5 | 100 | μA | $V_{DS}=1200V, V_{GS}=0V$ |
| I_{GSS} | Gate-to-Source Leakage Current | -- | 10 | 200 | nA | $V_{GS}=20V, V_{DS}=0V$ |
| | | - | -10 | -200 | | $V_{GS}=-10V, V_{DS}=0V$ |
| $R_{DS(ON)}$ | Drain-to-Source On-State Resistance | -- | 40 | 50 | m Ω | $V_{GS}=20V, I_{DS}=40A$ |
| | | -- | 59 | -- | | $V_{GS}=20V, I_{DS}=40A, T_j=175^\circ\text{C}$ |
| gfs | Transconductance | -- | 10.4 | -- | S | $V_{DS}=20V, I_{DS}=40A$ |
| | | -- | 7.7 | -- | | $V_{DS}=20V, I_{DS}=40A, T_j=175^\circ\text{C}$ |
| C_{iss} | Input Capacitance | -- | 2101 | -- | pF | $V_{GS}=0V, V_{DS}=1000V, f=100KHz, V_{AC}=25mV$ |
| C_{oss} | Output Capacitance | -- | 161 | -- | | |
| C_{rss} | Reverse Transfer Capacitance | -- | 14 | -- | | |
| $t_{d(on)}$ | Turn On Delay Time | -- | 22 | -- | ns | $V_{GS}=-5/+20V, V_{DS}=800V, I_D=40A, R_L=20\Omega, R_{G(ext)}=2.5\Omega$ Timing relative to V_{DS} |
| t_r | Rise Time | -- | 49 | -- | | |
| $t_{d(off)}$ | Turn Off Delay Time | -- | 71 | -- | | |
| t_f | Fall Time | -- | 23 | -- | | |
| E_{oss} | C_{oss} Stored Energy | -- | 90 | -- | μJ | $V_{GS}=0V, V_{DS}=1000V, f=100KHz, V_{AC}=25mV$ |
| E_{on} | Turn-on Switching Energy | -- | 1.1 | -- | mJ | $V_{DS}=800V, V_{GS}=-5/20V, I_D=40A, R_{G(ext)}=2.5\Omega, L=100\mu H$ |
| E_{off} | Turn-off Switching Energy | -- | 0.9 | -- | | |
| $R_{G(int.)}$ | Internal Gate Resistance | -- | 1.7 | -- | Ω | $f=1MHz, V_{AC}=25mV$ |

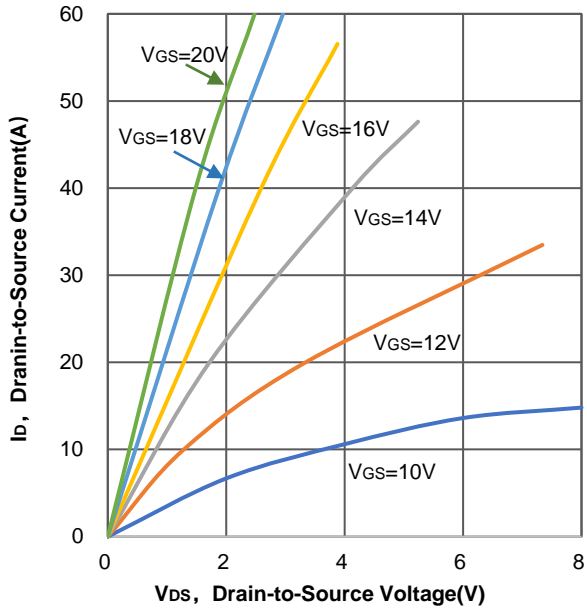
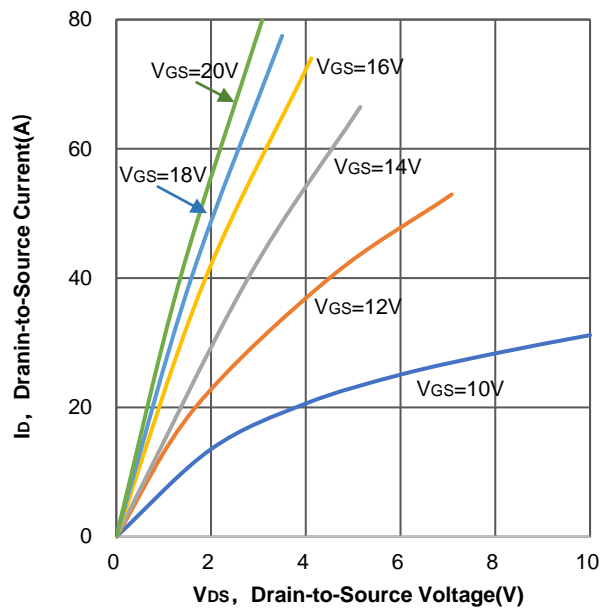
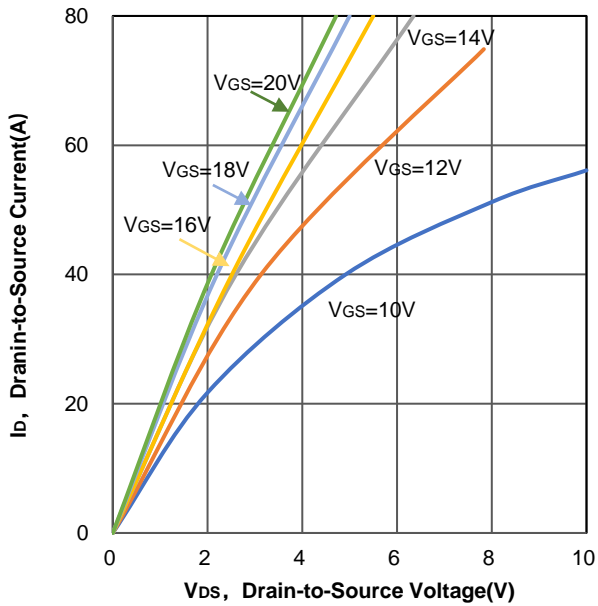
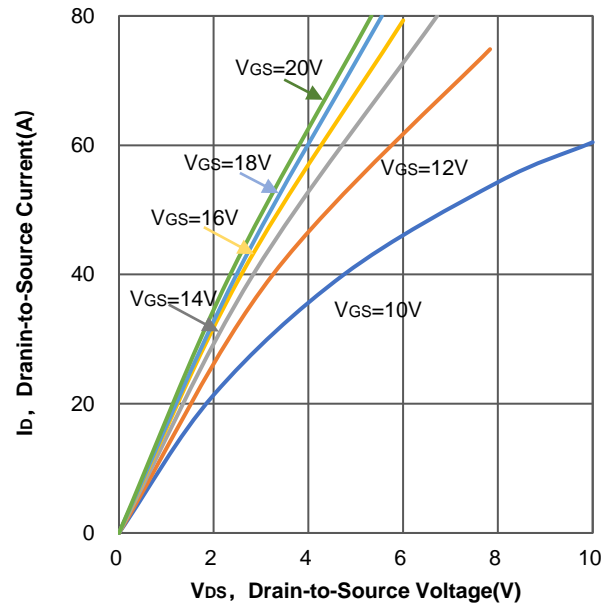
Built-in SiC Diode Characteristics
 $T_C = 25^\circ\text{C}$ unless otherwise specified

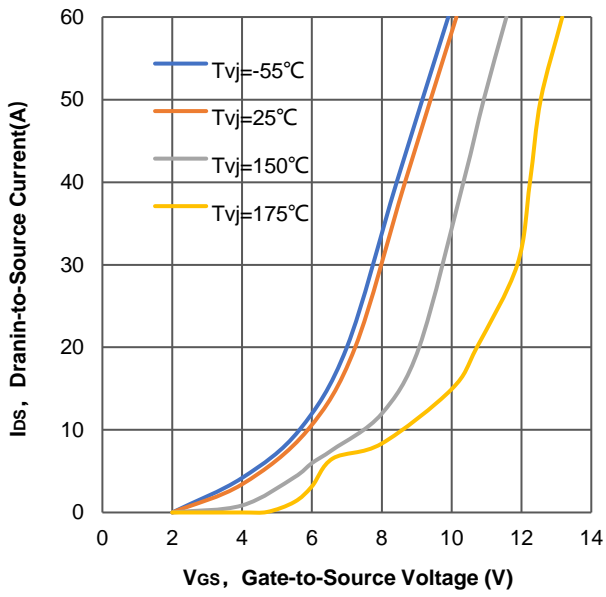
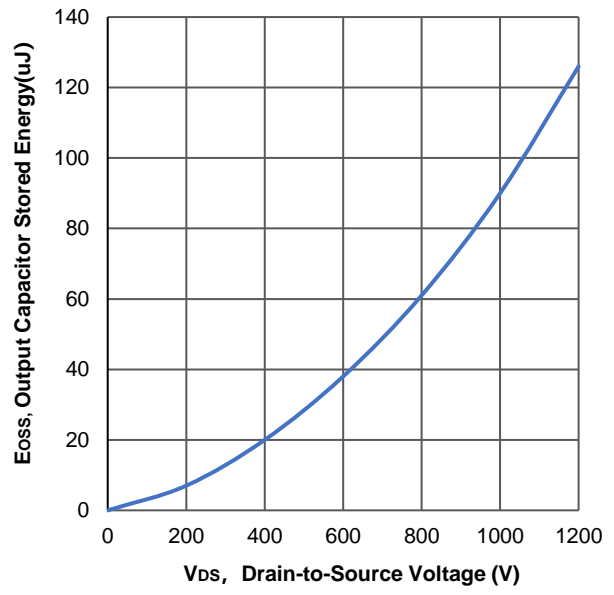
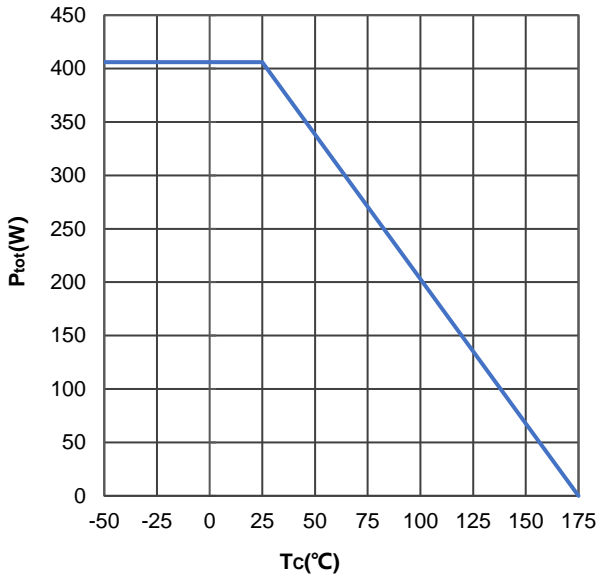
| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|-----------|----------------------------------|------|------|------|------|--|
| V_{SD} | Inverse Diode Forward Voltage | -- | 4.1 | -- | V | $V_{GS}=-5V, I_{SD}=2A$ |
| | | -- | 3.5 | -- | | $V_{GS}=-5V, I_{SD}=2A, T_j=175^\circ\text{C}$ |
| I_S | Continuous Diode Forward Current | -- | -- | 83 | A | $V_{GS}=-5V, T_C=25^\circ\text{C}$ |
| t_{rr} | Reverse Recovery Time | -- | 56 | -- | ns | $V_{GS}=-5V, I_{SD}=40A, V_{DS}=800V, di/dt=1165A/\mu s$ |
| Q_{rr} | Reverse Recovery Charge | -- | 508 | -- | nC | |
| I_{rrm} | Peak Reverse Recovery Current | -- | 18 | -- | A | |

Gate Charge Characteristics
 $T_C = 25^\circ\text{C}$ unless otherwise specified

| Symbol | Parameter | Min | Typ. | Max. | Units | Test Conditions |
|----------|-----------------------|-----|------|------|-------|--|
| Q_{GS} | Gate-to-Source Charge | -- | 33 | -- | nC | $V_{DS}=800V, V_{GS}=-5/+20V, I_D=40A$ |
| Q_{GD} | Gate-to-Drain Charge | -- | 51 | -- | | |
| Q_G | Total Gate Charge | -- | 131 | -- | | |

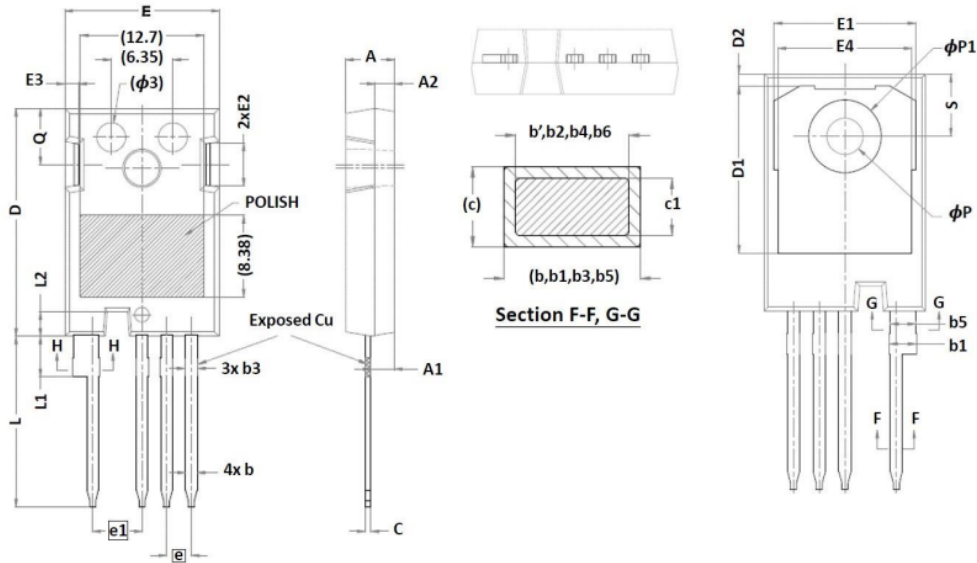
Typical Characteristics

Figure 1. Output Characteristics $I_{DS}=f(V_{DS})$, $T_J=-55^{\circ}\text{C}$

Figure 2. Output Characteristics $I_{DS}=f(V_{DS})$, $T_J=25^{\circ}\text{C}$

Figure 3. Output Characteristics $I_{DS}=f(V_{DS})$, $T_J=150^{\circ}\text{C}$

Figure 4. Output Characteristics $I_{DS}=f(V_{DS})$, $T_J=175^{\circ}\text{C}$


**Figure 5. Output Capacitor $I_{DS}=f(V_{GS})$,
 $V_{DS}=20V$**

**Figure 6. Output Capacitor Stored Energy
 $E_{OSS}=f(V_{DS}), T_J=25^{\circ}C$**

**Figure 7. Maximum Power Dissipation Derating
 $P_{tot}=f(T_C), T_J \leq 175^{\circ}C$**


Package Dimensions

TO-247-4L



| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | Min. | Avg. | Max. |
| A | 4.83 | 5.02 | 5.21 |
| A1 | 2.29 | 2.41 | 2.54 |
| A2 | 1.91 | 2.00 | 2.16 |
| b' | 1.07 | 1.20 | 1.28 |
| b | 1.07 | 1.20 | 1.33 |
| b1 | 2.39 | 2.67 | 2.94 |
| b2 | 2.39 | 2.67 | 2.84 |
| b3 | 1.07 | 1.30 | 1.60 |
| b4 | 1.07 | 1.30 | 1.50 |
| b5 | 2.39 | 2.53 | 2.69 |
| b6 | 2.39 | 2.53 | 2.64 |
| c | 0.55 | 0.60 | 0.68 |
| c1 | 0.55 | 0.60 | 0.65 |
| D | 23.30 | 23.45 | 23.60 |
| D1 | 16.25 | 16.55 | 17.65 |

| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-------|-------|
| | Min. | Avg. | Max. |
| D2 | 0.95 | 1.19 | 1.25 |
| E | 15.75 | 15.94 | 16.13 |
| E1 | 13.10 | 14.02 | 14.15 |
| E2 | 3.68 | 4.40 | 5.10 |
| E3 | 1.00 | 1.45 | 1.90 |
| E4 | 12.38 | 13.26 | 13.43 |
| e | 2.54 BSC | | |
| e1 | 5.08 BSC | | |
| L | 17.31 | 17.57 | 17.82 |
| L1 | 3.97 | 4.19 | 4.37 |
| L2 | 2.35 | 2.50 | 2.65 |
| ϕP | 3.51 | 3.61 | 3.65 |
| ϕP1 | 7.19 REF. | | |
| Q | 5.49 | 5.79 | 6.00 |
| S | 6.04 | 6.17 | 6.30 |

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