

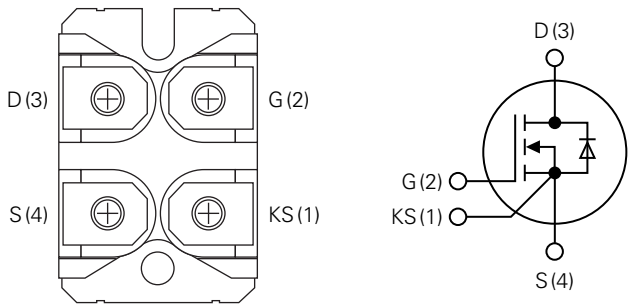
# IXFN55N120SK

1200 V, 32 mΩ, 54 A SiC Power MOSFET

 E72873



### Pinout Diagram (SOT-227B miniBLOC)



**D:** Drain; **G:** Gate; **S:** Source; **KS:** Kelvin Source; **Backside:** Isolated

### Features & Benefits:

- Latest Generation SiC MOSFET with Low  $R_{DS(on)}$
- Ideal for High Frequency Switching Applications
- Compatible with 15 V Gate Drive Voltage
- Real Kelvin Source Connection

### Applications:

- Solar Inverters
- DC/DC Converters
- Motor Drives
- Switch Mode Power Supplies
- UPS
- Battery Chargers
- Induction Heating

### Package:

- Isolation Voltage: 2500 V AC
- RoHS Compliant
- Epoxy Meets UL 94V-0
- Baseplate with Aluminum Nitride Isolation

### Product Summary

| Characteristic  | Value | Unit |
|-----------------|-------|------|
| $I_{D25}$       | 54    | A    |
| $V_{DSS}$       | 1200  | V    |
| $R_{DS(on)typ}$ | 32    | mΩ   |

## MOSFET

| Symbol              | Characteristic                       | Conditions                                                                                                                                                              |                          | Value |      |      | Unit |  |
|---------------------|--------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|------|------|------|--|
|                     |                                      |                                                                                                                                                                         |                          | Min.  | Typ. | Max. |      |  |
| BV <sub>DSS</sub>   | Drain-Source Breakdown Voltage       | V <sub>GS</sub> = 0 V, I <sub>D</sub> =19 μA, T <sub>VJ</sub> = 25 °C                                                                                                   |                          | 1200  | –    | –    | V    |  |
| V <sub>GS</sub>     | Gate-Source Voltage                  | Continuous                                                                                                                                                              | T <sub>VJ</sub> = 25 °C  | –4    | –    | 15   | V    |  |
|                     |                                      | Transient                                                                                                                                                               |                          | –8    | –    | 19   | V    |  |
| I <sub>D25</sub>    | Continuous Drain Current             | V <sub>GS</sub> = 15 V                                                                                                                                                  | T <sub>C</sub> = 25 °C   | –     | –    | 54   | A    |  |
| I <sub>D80</sub>    |                                      |                                                                                                                                                                         | T <sub>C</sub> = 80 °C   | –     | –    | 43   |      |  |
| I <sub>D100</sub>   |                                      |                                                                                                                                                                         | T <sub>C</sub> = 100 °C  | –     | –    | 38   |      |  |
| R <sub>DS(on)</sub> | Static Drain-Source on Resistance    | I <sub>D</sub> = 40 A, V <sub>GS</sub> = 15 V                                                                                                                           | T <sub>VJ</sub> = 25 °C  | –     | 32   | 42   | mΩ   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 53   | –    |      |  |
| V <sub>GS(th)</sub> | Gate Threshold Voltage               | I <sub>D</sub> = 12 mA, V <sub>GS</sub> = V <sub>DS</sub>                                                                                                               | T <sub>VJ</sub> = 25 °C  | 1.8   | 2.5  | 3.6  | V    |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 2.1  | –    |      |  |
| I <sub>DSS</sub>    | Drain-Source Leakage Current         | V <sub>DS</sub> = 1200 V, V <sub>GS</sub> = 0 V                                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 1    | 20   | μA   |  |
| I <sub>GSS</sub>    | Gate-Source Leakage Current          | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 15 V                                                                                                                           | T <sub>VJ</sub> = 25 °C  | –     | –    | 250  | nA   |  |
| R <sub>G(int)</sub> | Internal Gate Resistance             | f = 1 MHz, V <sub>AC</sub> = 25 mV, ESR of C <sub>iss</sub>                                                                                                             |                          | –     | 1.7  | –    | Ω    |  |
| T <sub>VJ,op</sub>  | Virtual Junction Temperature         | –                                                                                                                                                                       |                          | –40   | –    | 150  | °C   |  |
| T <sub>VJ,max</sub> | Maximum Virtual Junction Temperature | –                                                                                                                                                                       |                          | –     | –    | 175  | °C   |  |
| C <sub>iss</sub>    | Input Capacitance                    | V <sub>DS</sub> = 1000 V, V <sub>GS</sub> = 0 V,<br>f = 100 kHz                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 3360 | –    | pF   |  |
| C <sub>oss</sub>    | Output Capacitance                   |                                                                                                                                                                         |                          | –     | 130  | –    | pF   |  |
| C <sub>rss</sub>    | Reverse Transfer Capacitance         |                                                                                                                                                                         |                          | –     | 8    | –    | pF   |  |
| Q <sub>g</sub>      | Total Gate Charge                    | V <sub>DS</sub> = 800 V, I <sub>D</sub> = 40 A,<br>V <sub>GS</sub> = –4 / 15 V                                                                                          | T <sub>VJ</sub> = 25 °C  | –     | 107  | –    | nC   |  |
| Q <sub>gs</sub>     | Gate-Source Charge                   |                                                                                                                                                                         |                          | –     | 37   | –    | nC   |  |
| Q <sub>gd</sub>     | Gate-Drain Charge                    |                                                                                                                                                                         |                          | –     | 33   | –    | nC   |  |
| t <sub>d(on)</sub>  | Turn-on Delay Time                   | Inductive Switching<br><br>V <sub>DS</sub> = 800 V, V <sub>GS</sub> = –4 / 15 V,<br>I <sub>D</sub> = 40 A, R <sub>G,ext</sub> = 5 Ω,<br>Free Wheeling Diode: Body Diode | T <sub>VJ</sub> = 25 °C  | –     | 24   | –    | ns   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 22   | –    |      |  |
| t <sub>r</sub>      | Current Rise Time                    |                                                                                                                                                                         | T <sub>VJ</sub> = 25°C   | –     | 23   | –    | ns   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150°C  | –     | 27   | –    |      |  |
| t <sub>d(off)</sub> | Turn-off Delay Time                  |                                                                                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 41   | –    | ns   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 46   | –    |      |  |
| t <sub>f</sub>      | Current Fall Time                    |                                                                                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 11   | –    | ns   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 16   | –    |      |  |
| E <sub>on</sub>     | Turn-on Energy per Pulse             |                                                                                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 562  | –    | μJ   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 813  | –    |      |  |
| E <sub>off</sub>    | Turn-off Energy per Pulse            |                                                                                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 162  | –    | μJ   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 166  | –    |      |  |
| E <sub>rec</sub>    | Reverse Recovery Losses at Turn-off  |                                                                                                                                                                         | T <sub>VJ</sub> = 25 °C  | –     | 110  | –    | μJ   |  |
|                     |                                      |                                                                                                                                                                         | T <sub>VJ</sub> = 150 °C | –     | 372  | –    |      |  |

## Thermal Characteristics

| Symbol      | Characteristic                           | Conditions                                          | Value |      |      | Unit |
|-------------|------------------------------------------|-----------------------------------------------------|-------|------|------|------|
|             |                                          |                                                     | Min.  | Typ. | Max. |      |
| $R_{th,JC}$ | Thermal Resistance, Junction-to-Case     | $T_{VJ} = 125\text{ }^\circ\text{C}$                | –     | –    | 0.71 | K/W  |
| $R_{th,JH}$ | Thermal Resistance, Junction-to-Heatsink | With heatsink compound $\lambda = 0.67\text{ W/mK}$ | –     | 0.79 | –    | K/W  |

## Source-Drain Diode

| Symbol              | Characteristic                            | Conditions                                                                                                                                        |                          | Value |      |      | Unit |  |
|---------------------|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------|------|------|------|--|
|                     |                                           |                                                                                                                                                   |                          | Min.  | Typ. | Max. |      |  |
| V <sub>SD</sub>     | Forward Voltage Drop                      | I <sub>F</sub> = 20 A; V <sub>GS</sub> = −4 V                                                                                                     | T <sub>VJ</sub> = 25 °C  | –     | 4.6  | –    | V    |  |
|                     |                                           |                                                                                                                                                   | T <sub>VJ</sub> = 150 °C | –     | 4.2  | –    | V    |  |
| t <sub>rr</sub>     | Reverse Recovery Time                     | V <sub>GS</sub> = −4 V; I <sub>F</sub> = 40 A; V <sub>R</sub> = 800 V<br>MOSFET Gate Drive:<br>V <sub>GS</sub> = −4 / +15 V; R <sub>G</sub> = 5 Ω | T <sub>VJ</sub> = 25 °C  | –     | 15   | –    | ns   |  |
|                     |                                           |                                                                                                                                                   | T <sub>VJ</sub> = 150 °C | –     | 20   | –    |      |  |
| Q <sub>rm</sub>     | Reverse Recovery Charge (Intrinsic Diode) |                                                                                                                                                   | T <sub>VJ</sub> = 25 °C  | –     | 337  | –    | μC   |  |
|                     |                                           |                                                                                                                                                   | T <sub>VJ</sub> = 150 °C | –     | 721  | –    |      |  |
| I <sub>rm</sub>     | Max. Reverse Recovery Current             |                                                                                                                                                   | T <sub>VJ</sub> = 25 °C  | –     | 39   | –    | A    |  |
|                     |                                           |                                                                                                                                                   | T <sub>VJ</sub> = 150 °C | –     | 65   | –    |      |  |
| dI <sub>F</sub> /dt | Current Slew Rate                         |                                                                                                                                                   | T <sub>VJ</sub> = 25 °C  | –     | 5257 | –    | A/μs |  |
|                     |                                           |                                                                                                                                                   | T <sub>VJ</sub> = 150 °C | –     | 5758 | –    |      |  |

**Note:** When using SiC Body Diode the maximum recommended  $V_{GS} = -4\text{V}$

## Package SOT-227B (miniBLOC)

| Symbol                                       | Characteristic                 | Conditions                                   |                    | Value |      |      | Unit |
|----------------------------------------------|--------------------------------|----------------------------------------------|--------------------|-------|------|------|------|
|                                              |                                |                                              |                    | Min.  | Typ. | Max. |      |
| I <sub>RMS</sub>                             | RMS Current                    | Per Terminal                                 |                    | –     | –    | 100  | A    |
| T <sub>stg</sub>                             | Storage Temperature            | –                                            |                    | –40   | –    | 150  | °C   |
| T <sub>op</sub>                              | Operation Temperature          | –                                            |                    | –40   | –    | 150  | °C   |
| M <sub>D</sub>                               | Mounting Torque <sup>1</sup>   | Screws to Heatsink                           |                    | –     | –    | 1.5  | Nm   |
|                                              |                                | Terminal Connection Screws                   |                    | –     | –    | 1.3  | Nm   |
| V <sub>ISOL</sub>                            | Isolation Voltage              | I <sub>ISOL</sub> ≤ 1 mA; 50/60 Hz, 1 sec.   |                    | 3000  | –    | –    | V    |
|                                              |                                | I <sub>ISOL</sub> ≤ 1 mA; 50/60 Hz, 1 minute |                    | 2500  | –    | –    | V    |
| d <sub>Spp/App</sub><br>d <sub>Spb/Apb</sub> | Clearance Distance Through Air | Terminal to Terminal                         | Between Pin 1 to 2 | 7.1   | –    | –    | mm   |
|                                              |                                |                                              | Between Pin 3 to 4 |       |      |      |      |
|                                              |                                |                                              | Between Pin 2 to 3 | 3.2   | –    | –    | mm   |
|                                              |                                |                                              | Between Pin 4 to 1 |       |      |      |      |
|                                              | Creepage Distance on Surface   | Terminal to Terminal<br>(With Nut)           | Between Pin 1 to 2 | 9.6   | –    | –    | mm   |
|                                              |                                |                                              | Between Pin 3 to 4 |       |      |      |      |
|                                              |                                |                                              | Between Pin 2 to 3 | 10.5  | –    | –    | mm   |
|                                              |                                |                                              | Between Pin 4 to 1 |       |      |      |      |
|                                              | Clearance Distance Through Air | Terminal to Backside Plane                   | For All Terminals  | 8.6   | –    | –    | mm   |
|                                              | Creepage Distance on Surface   | Terminal to Backside Tab                     |                    | 10.5  | –    | –    |      |
| W                                            | Weight                         | –                                            |                    | –     | 30   | –    | g    |

**1)** For further information see application note "[Handling and Mounting Littelfuse miniBLOC - SOT227B](#)"

## Characteristic Curves

Fig. 1. Typical Transfer Characteristics

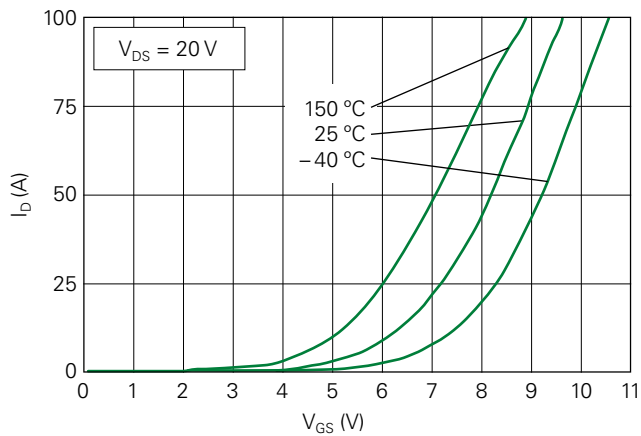


Fig. 2. Typical Forward Transconductance

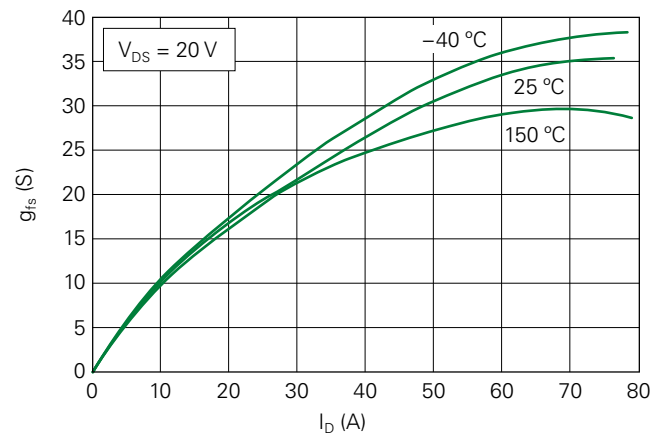


Fig. 3. Normalized Breakdown Voltage and Threshold Voltage vs. Junction Temperature

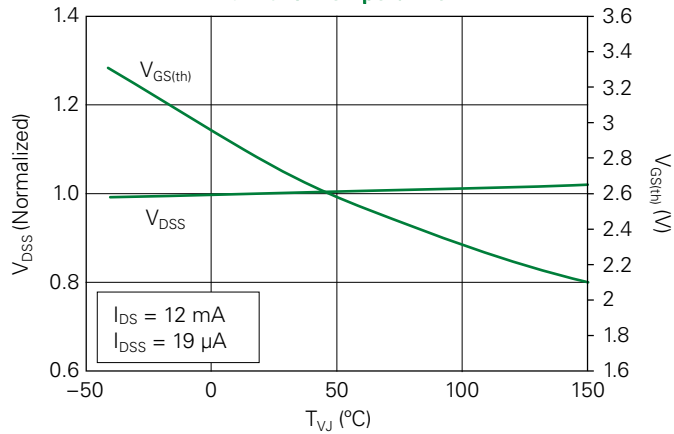
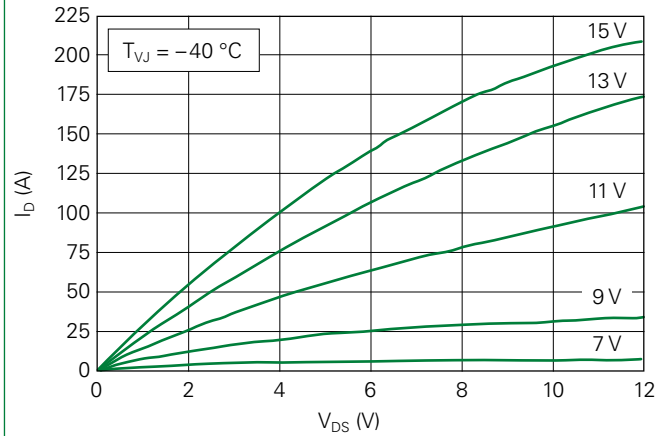
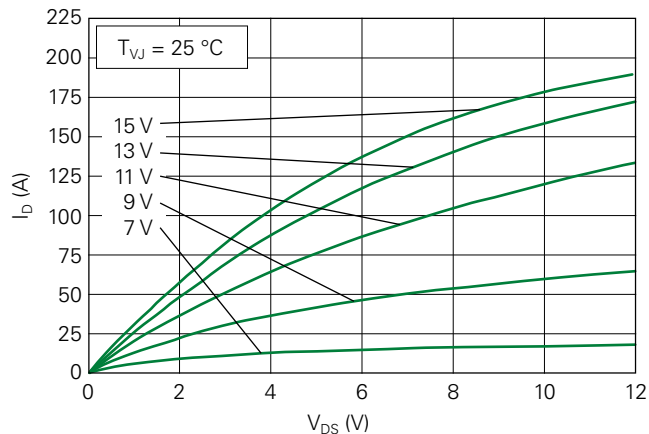
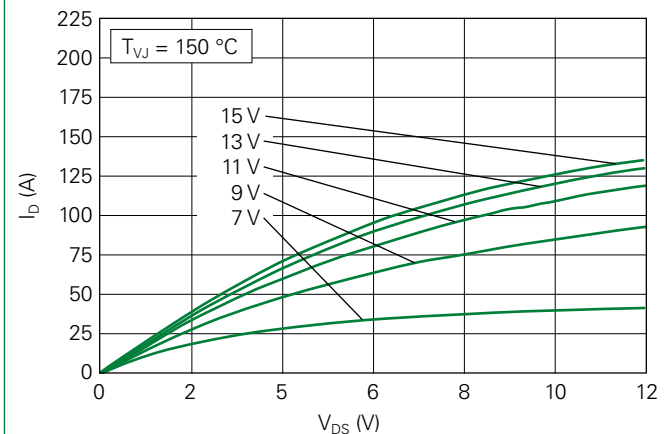
Fig. 4. Typical Output Characteristics ( $T_{VJ} = -40$  °C)Fig. 5. Typical Output Characteristics ( $T_{VJ} = 25$  °C)Fig. 6. Typical Output Characteristics ( $T_{VJ} = 150$  °C)

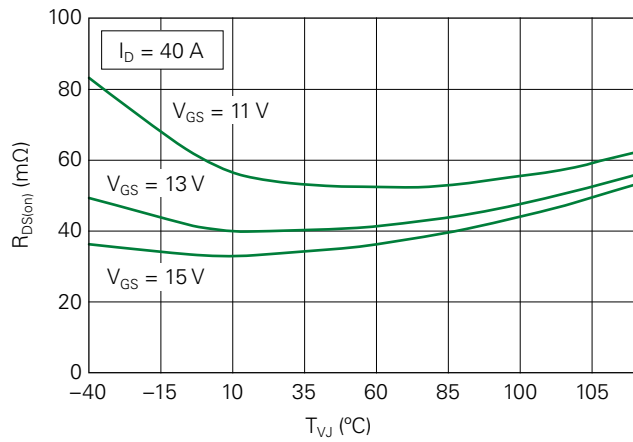
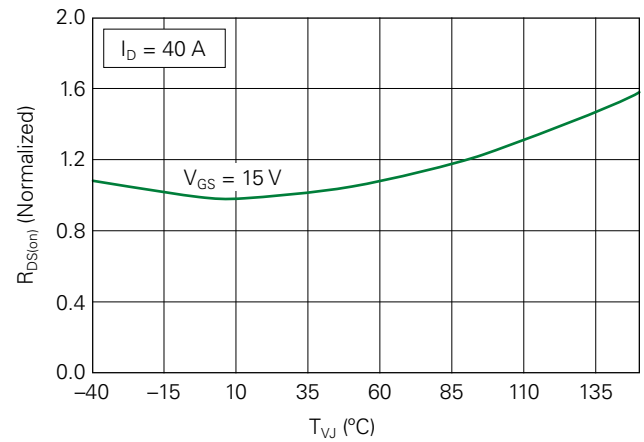
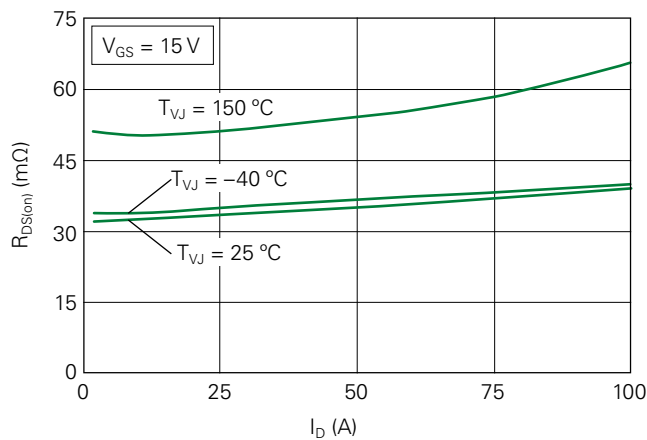
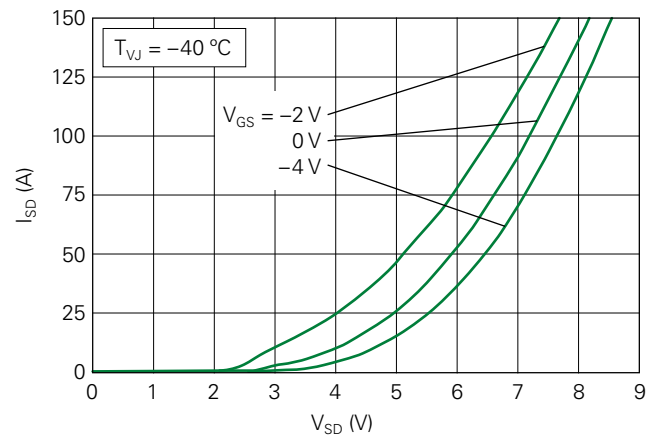
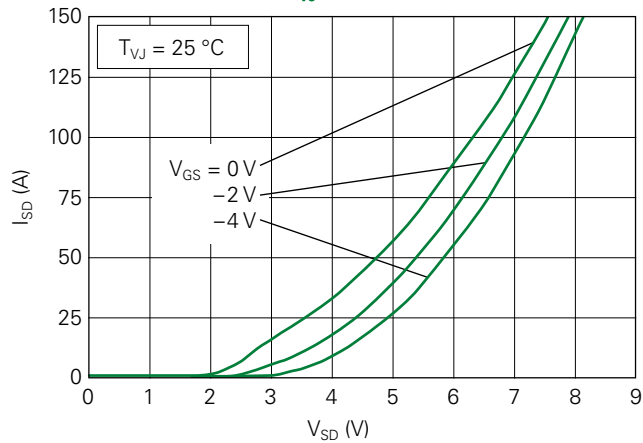
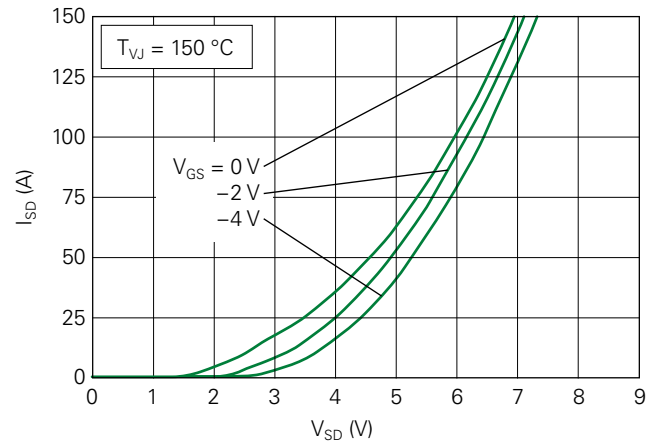
Fig. 7.  $R_{DS(on)}$  vs. Junction TemperatureFig. 8.  $R_{DS(on)}$  Normalised vs. Junction TemperatureFig. 9.  $R_{DS(on)}$  vs. Drain CurrentFig. 10. Typical Reverse Conduction Characteristics ( $T_{VJ} = -40^{\circ}$ C)Fig. 11. Typical Reverse Conduction Characteristics ( $T_{VJ} = 25^{\circ}$ C)Fig. 12. Typical Reverse Conduction Characteristics ( $T_{VJ} = 150^{\circ}$ C)

Fig. 13. Typical Junction Capacitances

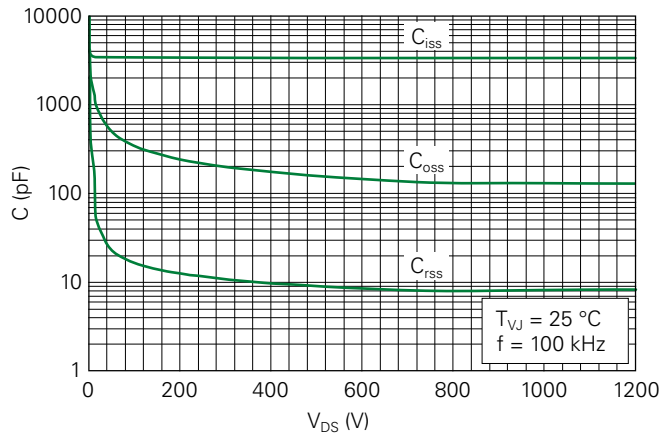


Fig. 14. Power Dissipation vs. Case Temperature

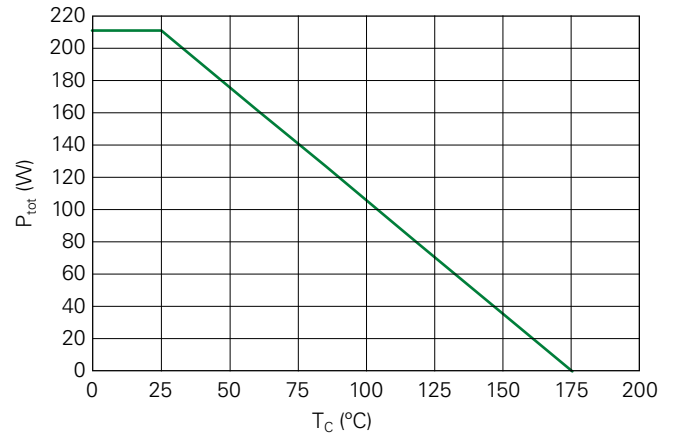


Fig. 15. Drain Current vs. Case Temperature

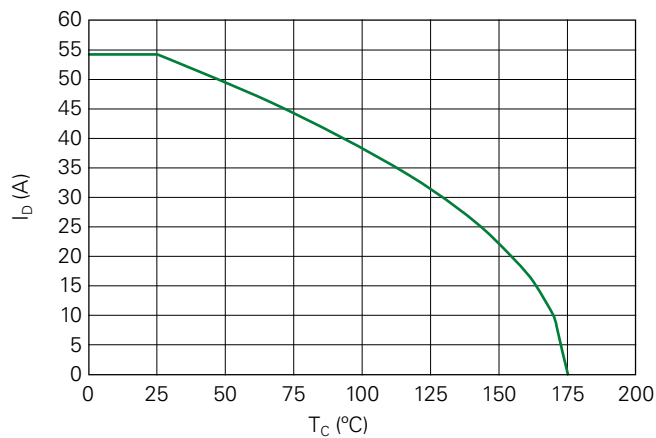


Fig. 16. Typical Switching Energy vs. Drain Current

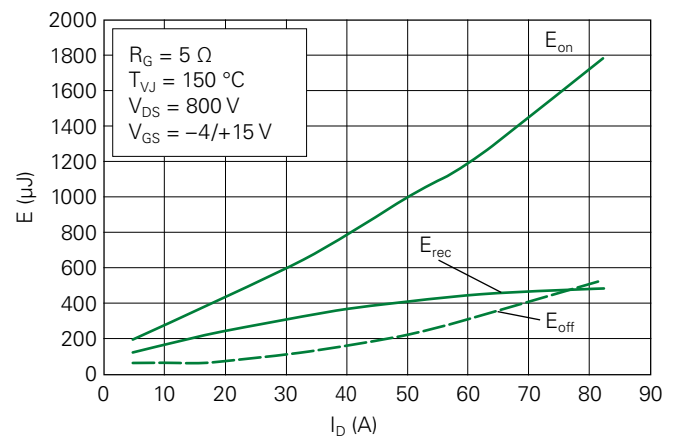


Fig. 17. Typical Switching Energy vs. Junction Temperature

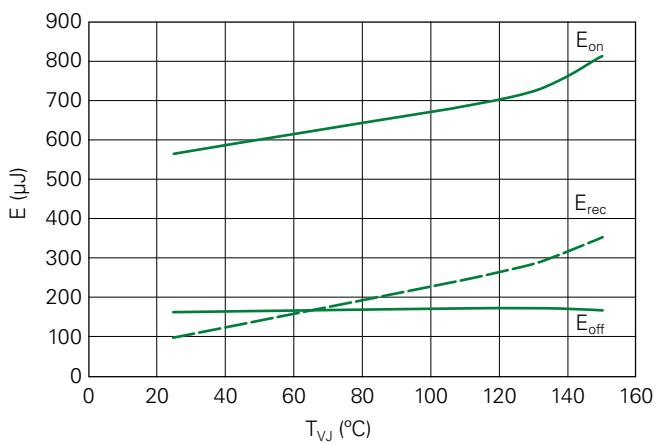


Fig. 18. Typical Switching Energy vs. External Gate Resistor

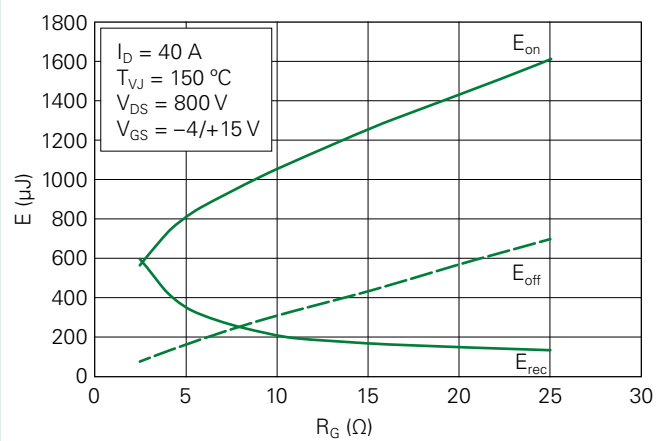


Fig. 19. Typical Switching Time vs. External Gate Resistor

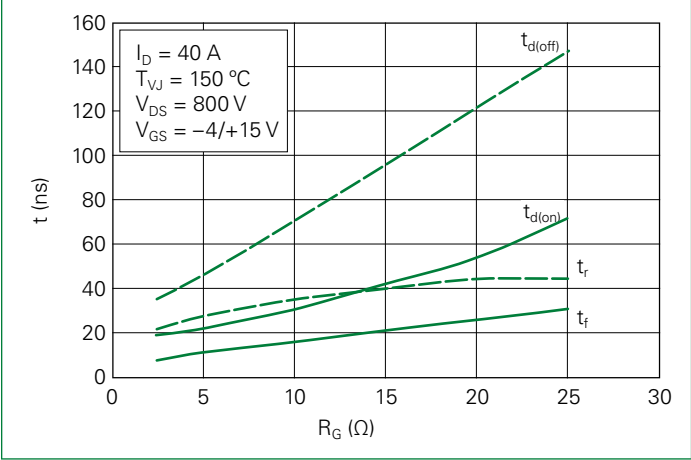


Fig. 20. Typical Turn on Gate Charge Trendline

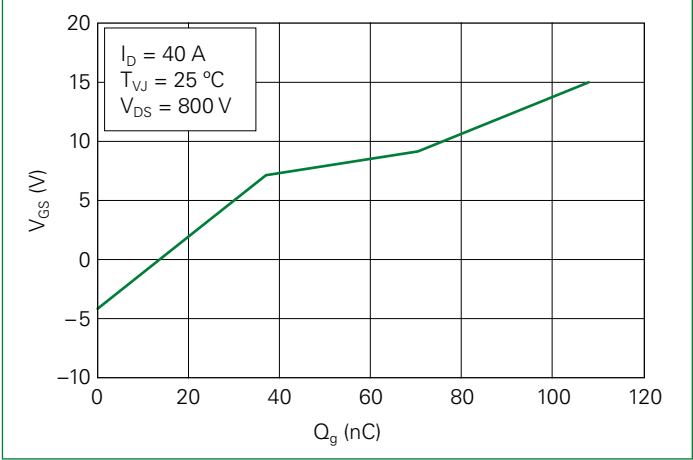
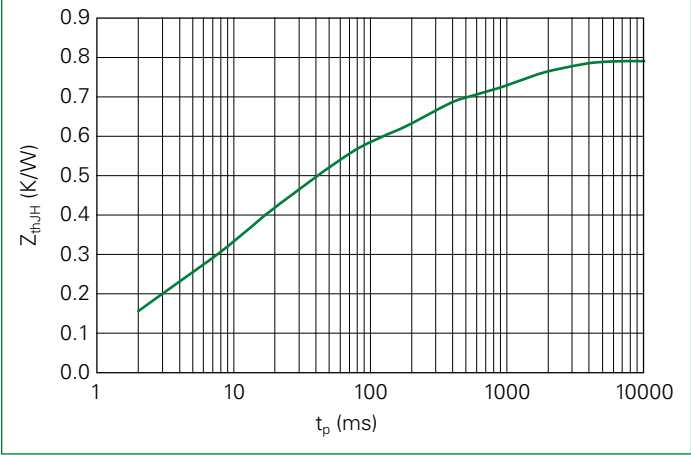
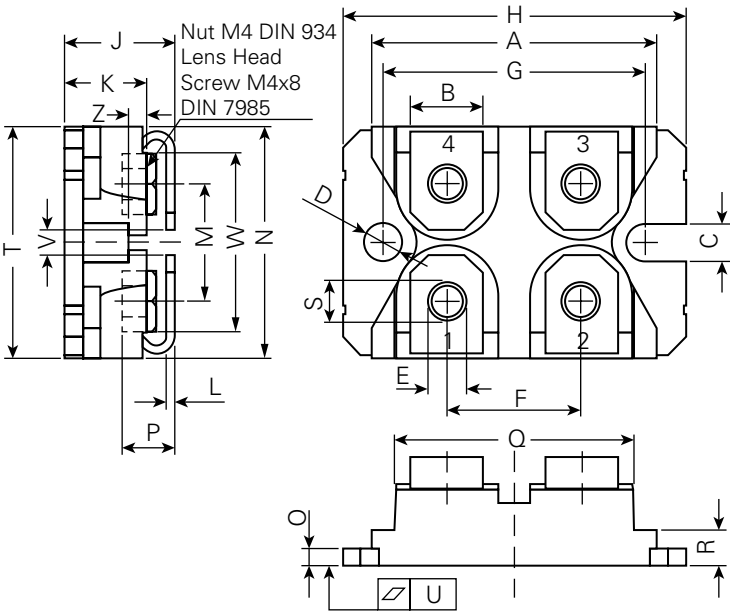


Fig. 21. Typical Transient Thermal Impedance

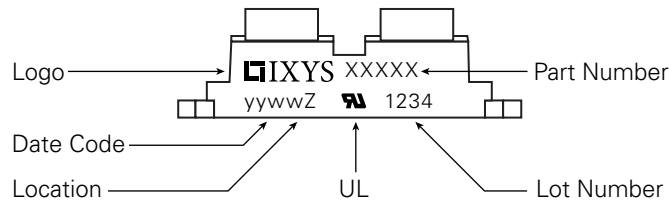


Part Outline Drawing (SOT-227B miniBLOC)



| Symbol | Inches  |       | Millimeters |       |
|--------|---------|-------|-------------|-------|
|        | Min.    | Max.  | Min.        | Max   |
| A      | 1.240   | 1.255 | 31.50       | 31.88 |
| B      | 0.307   | 0.323 | 7.80        | 8.20  |
| C      | 0.161   | 0.169 | 4.09        | 4.29  |
| D      | 0.161   | 0.169 | 4.09        | 4.29  |
| E      | 0.161   | 0.169 | 4.09        | 4.29  |
| F      | 0.587   | 0.595 | 14.91       | 15.11 |
| G      | 1.186   | 1.193 | 30.12       | 30.30 |
| H      | 1.488   | 1.505 | 37.80       | 38.23 |
| J      | 0.460   | 0.481 | 11.68       | 12.22 |
| K      | 0.351   | 0.378 | 8.92        | 9.60  |
| L      | 0.029   | 0.033 | 0.74        | 0.84  |
| M      | 0.492   | 0.516 | 12.50       | 13.10 |
| N      | 0.990   | 1.001 | 25.15       | 25.42 |
| O      | 0.077   | 0.084 | 1.95        | 2.13  |
| P      | 0.195   | 0.244 | 4.95        | 6.20  |
| Q      | 1.045   | 1.059 | 26.54       | 26.90 |
| R      | 0.155   | 0.167 | 3.94        | 4.42  |
| S      | 0.179   | 0.191 | 4.55        | 4.85  |
| T      | 0.968   | 0.994 | 24.59       | 25.25 |
| U      | - 0.002 | 0.004 | -0.05       | 0.10  |
| V      | 0.126   | 0.217 | 3.20        | 5.50  |
| W      | 0.780   | 0.830 | 19.81       | 21.08 |
| Z      | .098    | 0.106 | 2.50        | 2.70  |

Part Number and Marking



Ordering Information

| Ordering | Part Number  | Marking on Product | Delivering Mode | Base Quantity | Ordering Code |
|----------|--------------|--------------------|-----------------|---------------|---------------|
| Standard | IXFN55N120SK | IXFN55N120SK       | Tube            | 10            | IXFN55N120SK  |

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