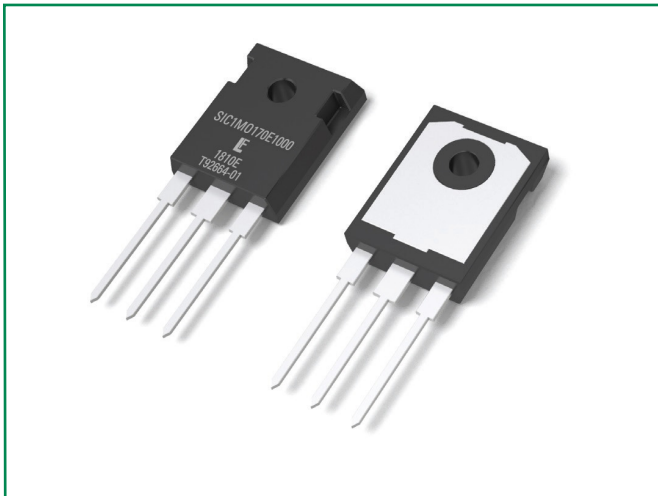


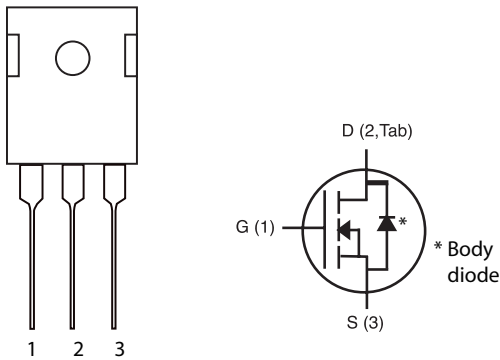
**LSIC1MO170E1000 1700 V N-channel, Enhancement-mode SiC MOSFET** **HF** **RoHS** **Pb**



**Product Summary**

| Characteristics                                  | Value | Unit |
|--------------------------------------------------|-------|------|
| $V_{DS}$                                         | 1700  | V    |
| Typical $R_{DS(ON)}$                             | 750   | mΩ   |
| $I_D$ ( $T_c \leq 100\text{ }^{\circ}\text{C}$ ) | 3.5   | A    |

**Circuit Diagram TO-247-3L**



**Features**

- Optimized for high-frequency, high-efficiency applications
- Extremely low gate charge and output capacitance
- Low gate resistance for high-frequency switching
- Normally-off operation at all temperatures
- Ultra-low on-resistance

**Environmental**

- Littelfuse "RoHS" logo = **RoHS**  
RoHS conform
- Littelfuse "HF" logo = **HF**  
Halogen Free
- Littelfuse "Pb-free" logo = **Pb**  
Pb-free lead plating

**Applications**

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

### Maximum Ratings

| Characteristics                   | Symbol         | Conditions                                  | Value      | Unit  |
|-----------------------------------|----------------|---------------------------------------------|------------|-------|
| Continuous Drain Current          | $I_D$          | $V_{GS} = 20\text{ V}, T_C = 25\text{ °C}$  | 5.0        | A     |
|                                   |                | $V_{GS} = 20\text{ V}, T_C = 100\text{ °C}$ | 3.5        |       |
| Pulsed Drain Current <sup>1</sup> | $I_{D(pulse)}$ | $T_C = 25\text{ °C}$                        | 15         | A     |
| Power Dissipation                 | $P_D$          | $T_C = 25\text{ °C}, T_J = 150\text{ °C}$   | 54         | W     |
| Operating Junction Temperature    | $T_J$          |                                             | -55 to 150 | °C    |
| Gate-source Voltage               | $V_{GS,MAX}$   | Absolute maximum values                     | -6 to 22   | V     |
|                                   | $V_{GS,OPTR}$  | Transient, <1% duty cycle                   | -10 to 25  |       |
|                                   | $V_{GS,OP}$    | Recommended DC operating values             | -5 to 20   |       |
| Storage Temperature               | $T_{STG}$      | -                                           | -55 to 150 | °C    |
| Lead Temperature for Soldering    | $T_{solder}$   | -                                           | 260        | °C    |
| Mounting Torque                   | $M_D$          | M3 or 6-32 screw                            | 0.6        | Nm    |
|                                   |                |                                             | 5.3        | in-lb |

Footnote 1: Pulse width limited by  $T_{J,max}$

### Thermal Characteristics

| Characteristics                                 | Symbol          | max | Unit |
|-------------------------------------------------|-----------------|-----|------|
| Maximum Thermal Resistance, junction-to-case    | $R_{\theta JC}$ | 2.3 | °C/W |
| Maximum Thermal Resistance, junction-to-ambient | $R_{\theta JA}$ | 40  | °C/W |

### Electrical Characteristics ( $T_J = 25\text{ °C}$ unless otherwise specified)

| Characteristics                  | Symbol        | Conditions                                                         | Min  | Typ  | Max  | Unit          |
|----------------------------------|---------------|--------------------------------------------------------------------|------|------|------|---------------|
| <b>Static Characteristics</b>    |               |                                                                    |      |      |      |               |
| Drain-source Breakdown Voltage   | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$                | 1700 | -    | -    | V             |
| Zero Gate Voltage Drain Current  | $I_{DSS}$     | $V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}$                      | -    | 0.05 | 10   | $\mu\text{A}$ |
|                                  |               | $V_{DS} = 1700\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ °C}$ | -    | 0.10 | -    |               |
| Gate Leakage Current             | $I_{GSS,F}$   | $V_{GS} = 22\text{ V}, V_{DS} = 0\text{ V}$                        | -    | -    | 100  | nA            |
|                                  | $I_{GSS,R}$   | $V_{GS} = -6\text{ V}, V_{DS} = 0\text{ V}$                        | -    | -    | 100  |               |
| Drain-source On-state Resistance | $R_{DS(ON)}$  | $I_D = 2\text{ A}, V_{GS} = 20\text{ V}$                           | -    | 750  | 1000 | mΩ            |
|                                  |               | $I_D = 2\text{ A}, V_{GS} = 15\text{ V}$                           | -    | 1000 | -    |               |
|                                  |               | $I_D = 2\text{ A}, V_{GS} = 20\text{ V}, T_J = 150\text{ °C}$      | -    | 1450 | -    |               |
| Gate Threshold Voltage           | $V_{GS(th)}$  | $V_{DS} = V_{GS}, I_D = 1\text{ mA}$                               | 1.8  | 2.5  | 4.0  | V             |
|                                  |               | $V_{DS} = V_{GS}, I_D = 1\text{ mA}, T_J = 150\text{ °C}$          | -    | 1.6  | -    |               |
| Gate Resistance                  | $R_G$         | Resonance method, Drain-Source shorted                             | -    | 5.8  | -    | Ω             |

### Electrical Characteristics ( $T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

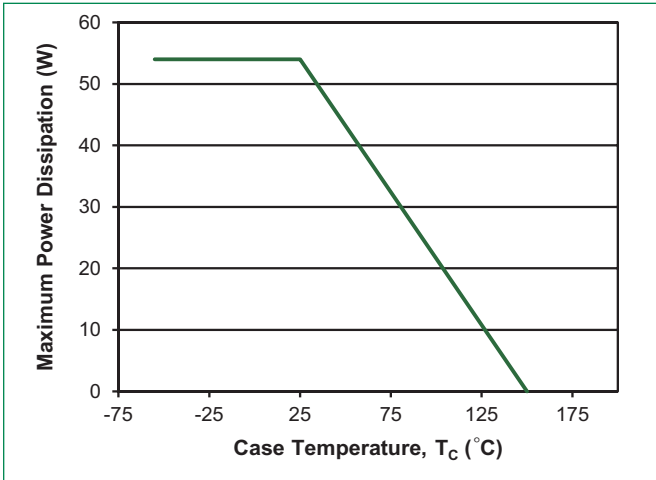
| Characteristics                  | Symbol              | Conditions                                                                                                                                                                 | Value |     |     | Unit |
|----------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-----|-----|------|
|                                  |                     |                                                                                                                                                                            | Min   | Typ | Max |      |
| Dynamic Characteristics          |                     |                                                                                                                                                                            |       |     |     |      |
| Turn-on Switching Energy         | E <sub>ON</sub>     | V <sub>DD</sub> = 1200 V, I <sub>D</sub> = 2 A,<br>V <sub>GS</sub> = -5/+20 V, R <sub>G,ext</sub> = 20 Ω,<br>L = 1.4mH                                                     | -     | 59  | -   | μJ   |
| Turn-off Switching Energy        | E <sub>OFF</sub>    |                                                                                                                                                                            | -     | 25  | -   |      |
| Total Per-cycle Switching Energy | E <sub>TS</sub>     |                                                                                                                                                                            | -     | 84  | -   |      |
| Input Capacitance                | C <sub>ISS</sub>    | V <sub>DD</sub> = 1000 V, V <sub>GS</sub> = 0 V,<br>f = 1 MHz, V <sub>AC</sub> = 25 mV                                                                                     | -     | 200 | -   | pF   |
| Output Capacitance               | C <sub>OSS</sub>    |                                                                                                                                                                            | -     | 11  | -   |      |
| Reverse Transfer Capacitance     | C <sub>RSS</sub>    |                                                                                                                                                                            | -     | 2   | -   |      |
| C <sub>OSS</sub> Stored Energy   | E <sub>OSS</sub>    |                                                                                                                                                                            | -     | 5.3 | -   | μJ   |
| Total Gate Charge                | Q <sub>g</sub>      | V <sub>DD</sub> = 1200 V, I <sub>D</sub> = 2 A,<br>V <sub>GS</sub> = -5/+20 V                                                                                              | -     | 15  | -   | nC   |
| Gate-source Charge               | Q <sub>gs</sub>     |                                                                                                                                                                            | -     | 3   | -   |      |
| Gate-drain Charge                | Q <sub>gd</sub>     |                                                                                                                                                                            | -     | 7   | -   |      |
| Turn-on Delay Time               | t <sub>d(on)</sub>  | V <sub>DD</sub> = 1200 V, V <sub>GS</sub> = -5/+20 V,<br>I <sub>D</sub> = 2 A, R <sub>G,ext</sub> = 20 Ω,<br>R <sub>L</sub> = 600 Ω,<br>Timing relative to V <sub>DS</sub> | -     | 9   | -   | ns   |
| Rise Time                        | t <sub>r</sub>      |                                                                                                                                                                            | -     | 15  | -   |      |
| Turn-off Delay Time              | t <sub>d(off)</sub> |                                                                                                                                                                            | -     | 17  | -   |      |
| Fall Time                        | t <sub>f</sub>      |                                                                                                                                                                            | -     | 50  | -   |      |

### Reverse Diode Characteristics

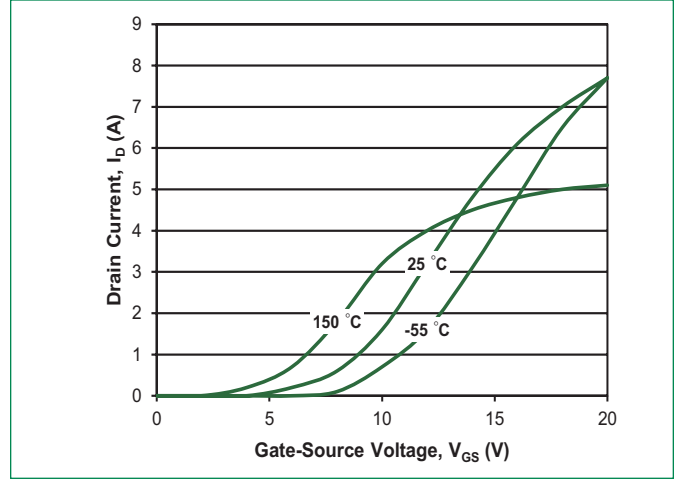
| Characteristics                         | Symbol   | Conditions                                                                 | Value |     |     | Unit       |
|-----------------------------------------|----------|----------------------------------------------------------------------------|-------|-----|-----|------------|
|                                         |          |                                                                            | Min   | Typ | Max |            |
| Diode Forward Voltage                   | $V_{SD}$ | $I_S = 1\text{ A}, V_{GS} = 0\text{ V}$                                    | -     | 3.7 | -   | $\text{V}$ |
|                                         |          | $I_S = 1\text{ A}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^{\circ}\text{C}$ | -     | 3.4 | -   |            |
| Continuous Diode Forward Current        | $I_S$    | $V_{GS} = 0\text{ V}, T_C = 25\text{ }^{\circ}\text{C}$                    | -     | -   | 8   | $\text{A}$ |
| Peak Diode Forward Current <sup>1</sup> | $I_{SP}$ |                                                                            | -     | -   | 15  |            |

Footnote 1: Pulse width limited by  $T_{J,max}$

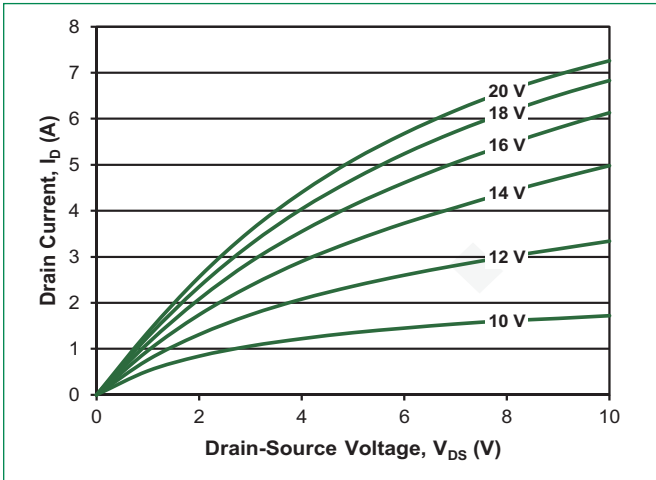
**Figure 1: Maximum Power Dissipation ( $T_J = 150^\circ\text{C}$ )**



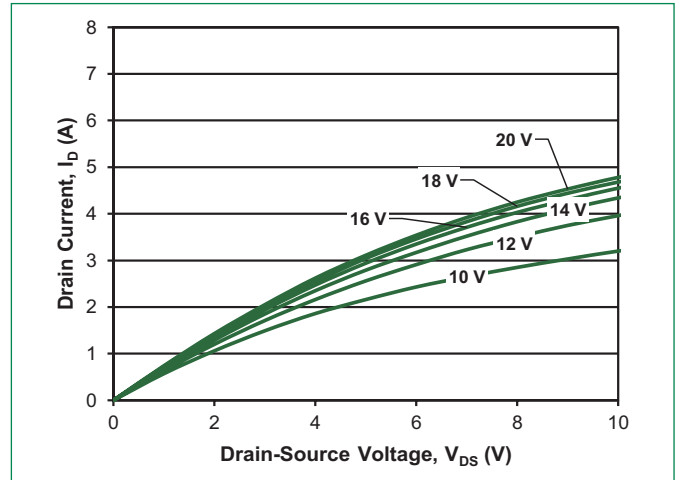
**Figure 2: Transfer Characteristics ( $V_{DS} = 10\text{ V}$ )**



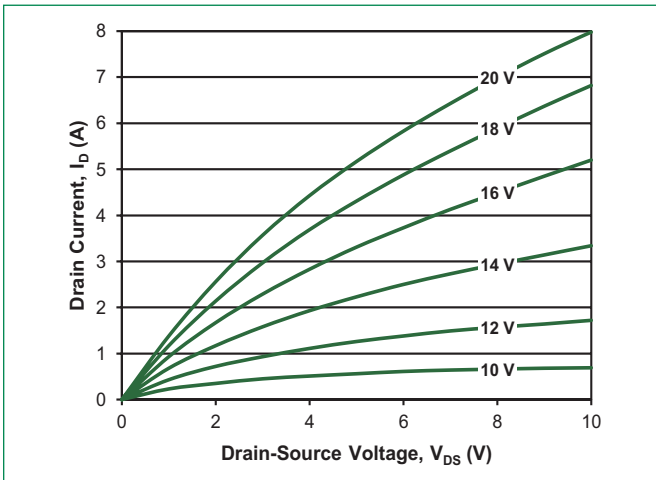
**Figure 3: Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



**Figure 4: Output Characteristics ( $T_J = 150^\circ\text{C}$ )**



**Figure 5: Output Characteristics ( $T_J = -55^\circ\text{C}$ )**



**Figure 6: Reverse Conduction Characteristics ( $T_J = 25^\circ\text{C}$ )**

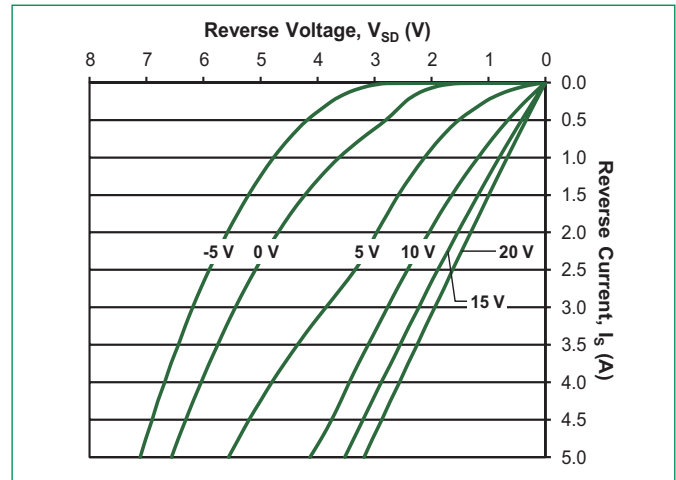


Figure 7: Reverse Conduction Characteristics ( $T_J = 150\text{ }^{\circ}\text{C}$ )

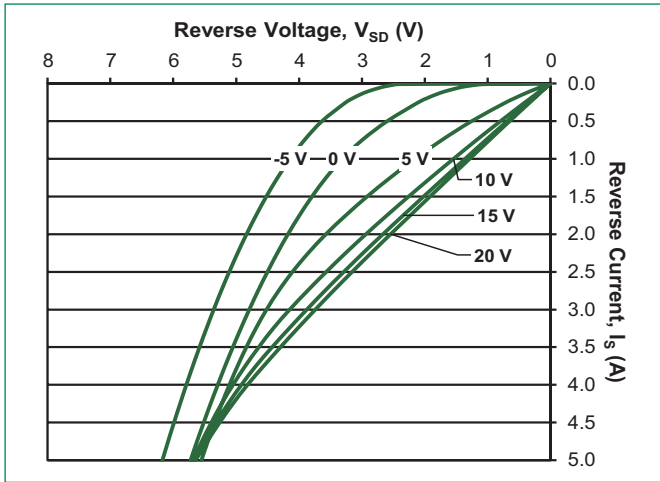


Figure 8: Reverse Conduction Characteristics ( $T_J = -55\text{ }^{\circ}\text{C}$ )

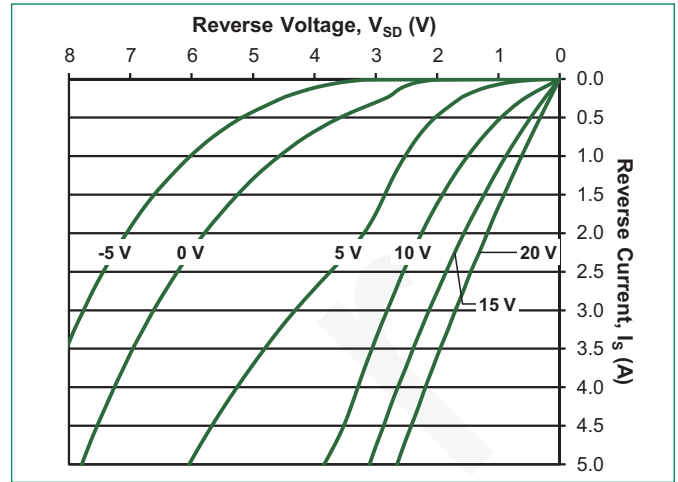


Figure 9: Transient Thermal Impedance

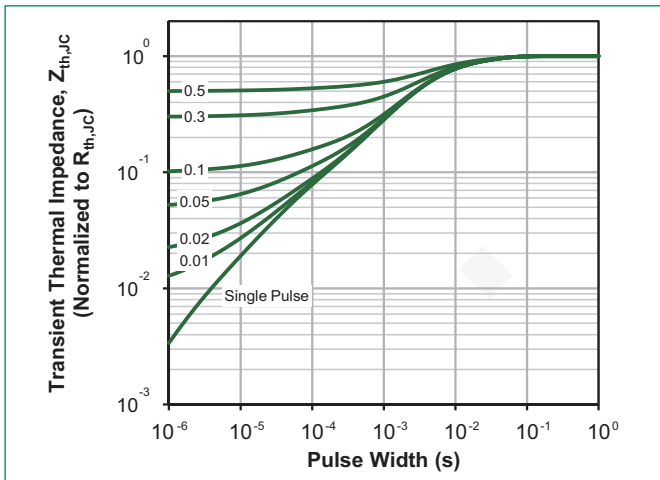


Figure 10: Safe Operating Area ( $T_c = 25\text{ }^{\circ}\text{C}$ )

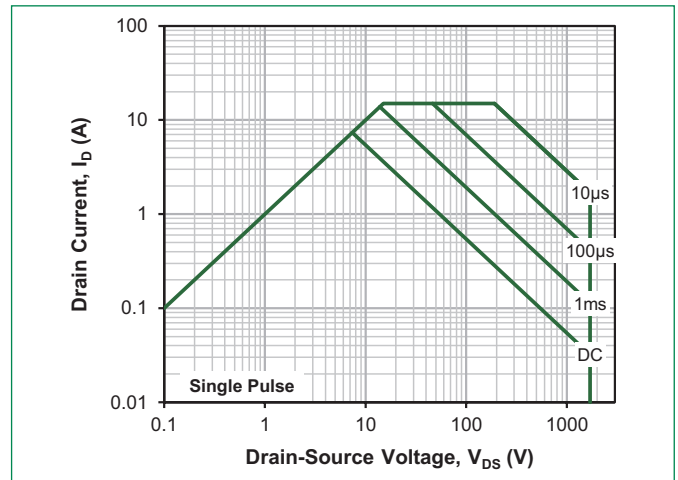


Figure 11: On-resistance vs. Drain Current

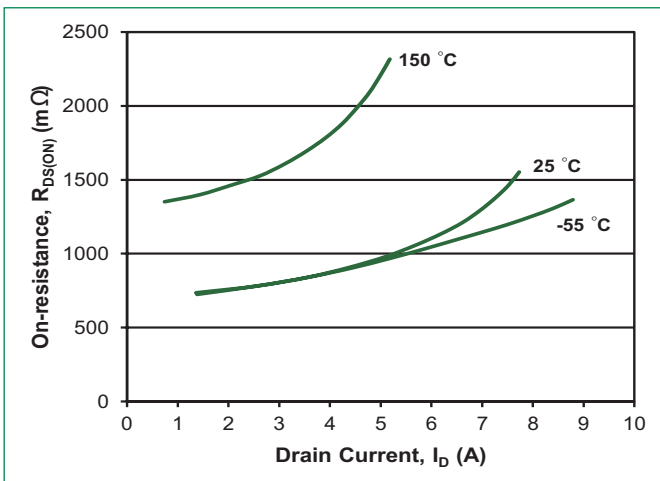
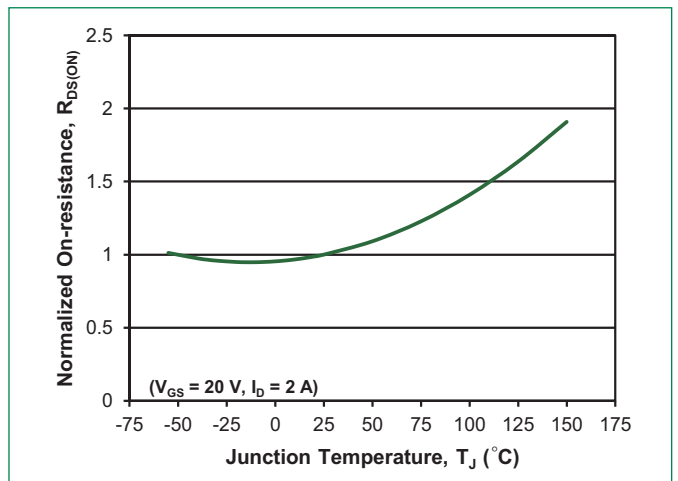
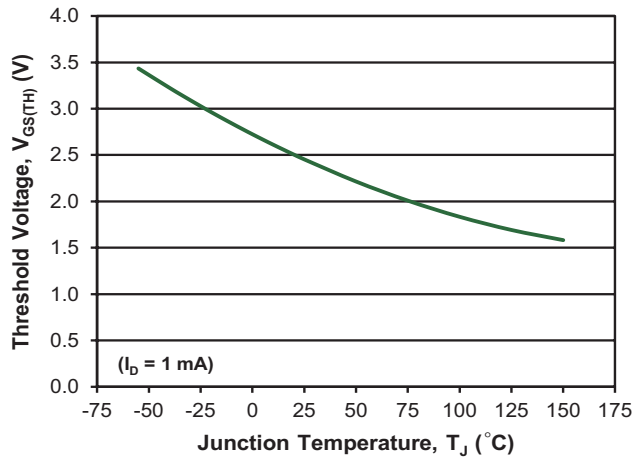


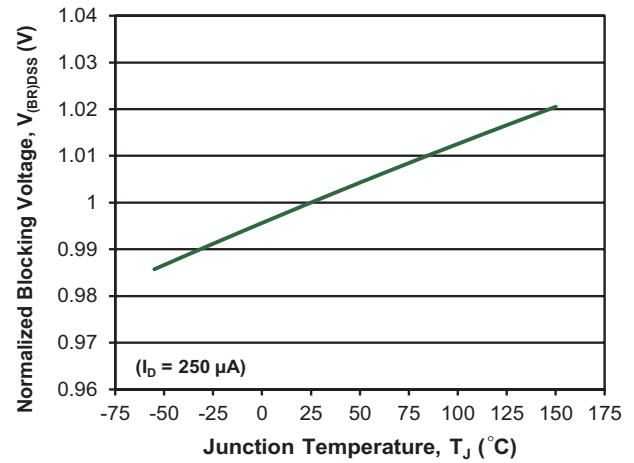
Figure 12: Normalized On-resistance



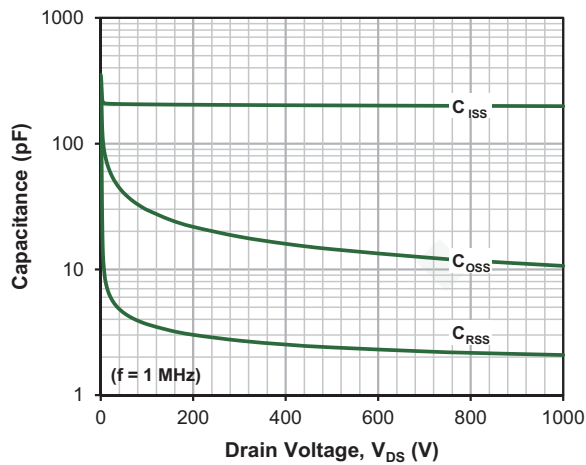
**Figure 13: Threshold Voltage**



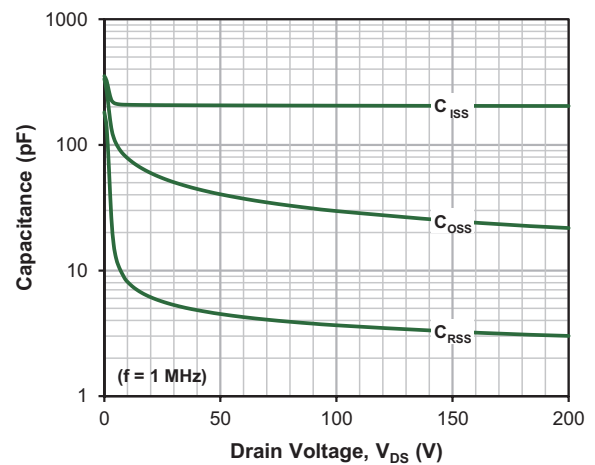
**Figure 14: Drain-Source Blocking Voltage**



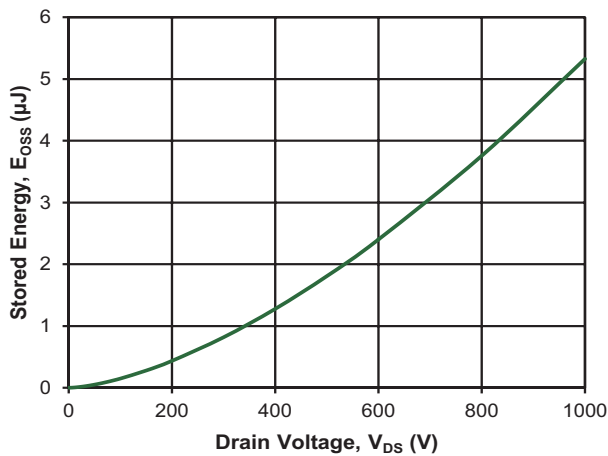
**Figure 15: Junction Capacitances**



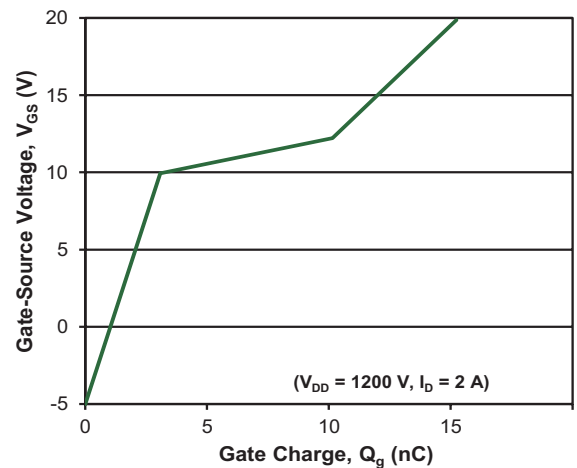
**Figure 16: Junction Capacitances**



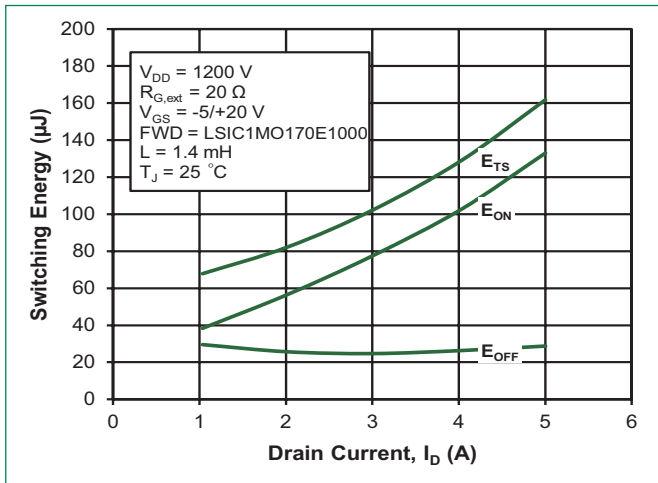
**Figure 17:  $C_{OSS}$  Stored Energy  $E_{OSS}$**



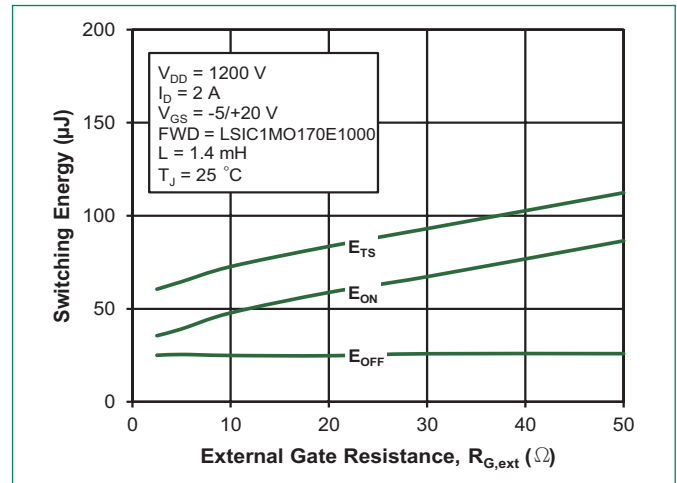
**Figure 18: Gate Charge**



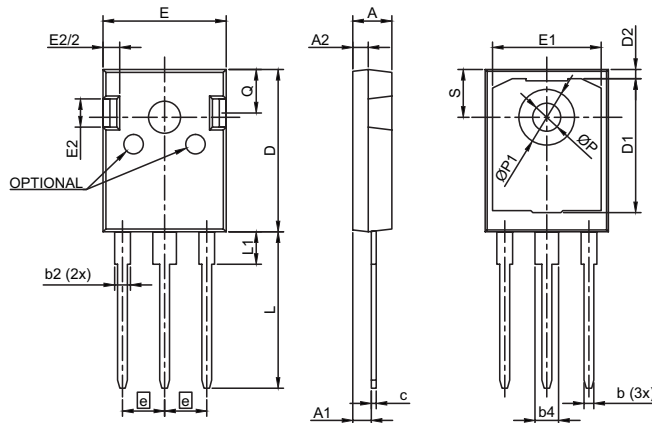
**Figure 19: Switching Energy vs. Drain Current**



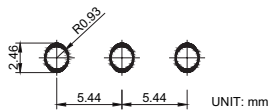
**Figure 20: Switching Energy vs. Gate Resistance**



### Package Dimensions TO-247-3L



#### Recommended Hole Pattern Layout

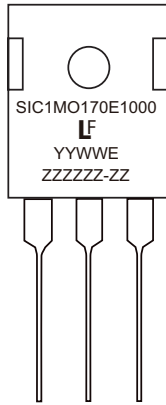


#### Notes:

1. Dimensions are in millimeters
2. Dimension D, E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These measured at the outermost extreme of plastic body.
3.  $\phi P$  to have a maximum draft angle of  $1.5^\circ$  to the top of the part with a maximum hole diameter of 0.154"

| Symbol    | Millimeters |       |       |
|-----------|-------------|-------|-------|
|           | Min         | Nom   | Max   |
| A         | 4.80        | 5.03  | 5.20  |
| A1        | 2.25        | 2.38  | 2.54  |
| A2        | 1.85        | 1.98  | 2.11  |
| b         | 0.99        | -     | 1.40  |
| b2        | 1.65        | -     | 2.39  |
| b4        | 2.59        | -     | 3.43  |
| c         | 0.38        | 0.64  | 0.89  |
| D         | 20.80       | 20.96 | 21.34 |
| D1        | 13.50       | -     | -     |
| D2        | 0.51        | 1.19  | 1.35  |
| e         | 5.44 BSC    |       |       |
| E         | 15.75       | 15.90 | 16.13 |
| E1        | 13.06       | 14.02 | 14.15 |
| E2        | 4.19        | 4.32  | 4.83  |
| L         | 19.81       | 20.19 | 20.57 |
| L1        | 3.81        | 4.19  | 4.45  |
| $\phi P$  | 3.55        | 3.61  | 3.66  |
| $\phi P1$ | 7.06        | 7.19  | 7.32  |
| Q         | 5.49        | 5.61  | 6.20  |
| S         | 6.05        | 6.17  | 6.30  |

### Part Numbering and Marking System

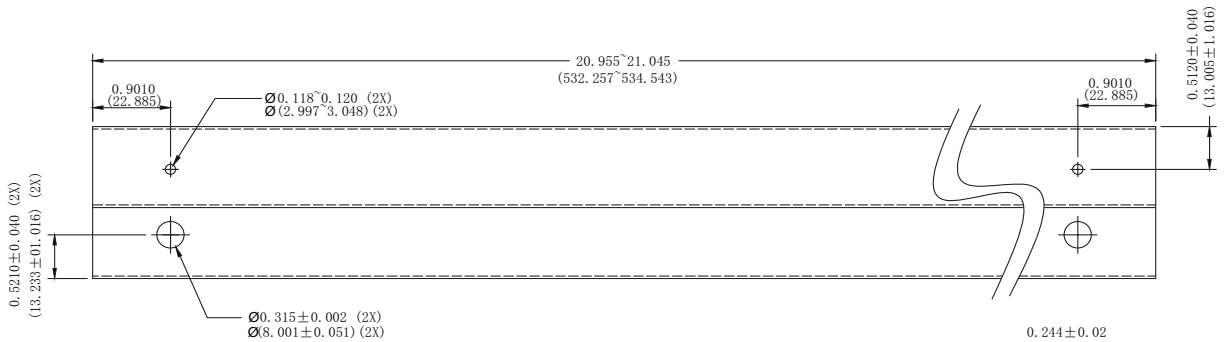


SiC = SiC  
 1 = Gen1  
 MO = MOSFET  
 170 = Voltage Rating (1700 V)  
 E = TO-247-3L  
 1000 =  $R_{DS(ON)}$  (1000 mOhm)  
 YY = Year  
 WW = Week  
 E = Special Code  
 ZZZZZZ-ZZ = Lot Number

### Packing Options

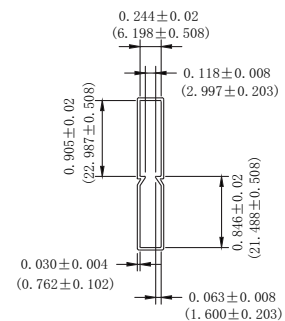
| Part Number     | Marking        | Packing Mode | M.O.Q |
|-----------------|----------------|--------------|-------|
| LSIC1MO170E1000 | SIC1MO170E1000 | Tube (30pcs) | 450   |

### Packing Specification TO-247-3L



#### NOTE:

1. All pin plug holes are considered critical dimension
2. Tolerance is to be  $\pm 0.010$  unless otherwise specified
3. Dimension are in inches (and millimeters).



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