

LSIC1MO120E0080

1200 V, 80 mOhm N-Channel SiC MOSFET

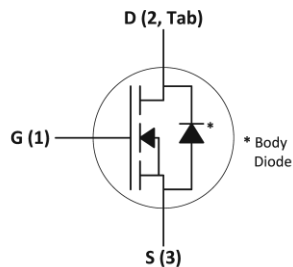
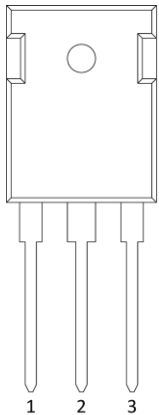


Agency Approvals and Environmental

Environmental Approvals



Circuit Diagram



Product Summary

| Characteristic | Value | Unit |
|----------------------------------|-------|------|
| V_{DS} | 1200 | V |
| Typical $R_{DS(ON)}$ | 80 | mOhm |
| I_D ($T_C \leq 100^\circ C$) | 25 | A |

Features

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

Applications

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

| | |
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1. Maximum Ratings

| Characteristic | Symbol | Conditions | Value | Unit |
|-----------------------------------|-----------------------------|--|-------------|-------|
| Drain-Source Voltage | V_{DS} | $V_{GS} = 0\text{ V}$ | 1200 | V |
| Continuous Drain Current | I_D | $V_{GS} = 20\text{ V}, T_C = 25\text{ °C}$ | 39 | A |
| | | $V_{GS} = 20\text{ V}, T_C = 100\text{ °C}$ | 25 | |
| Pulsed Drain Current ¹ | $I_{D(pulse)}$ | $T_C = 25\text{ °C}$ | 80 | A |
| Power Dissipation | P_D | $T_C = 25\text{ °C}, T_J = 175\text{ °C}$ | 214 | W |
| Gate-Source Voltage | $V_{GS,MAX}$ | Absolute maximum values – Steady state | -6 to +22 | V |
| | $V_{GS,OP,TR}$ ² | Transient, $t_{transient} < 300\text{ nsec}$ | -10 to +25 | |
| | $V_{GS,OP}$ ³ | Recommended DC operating values | -5 to +20 | |
| Operating Junction Temperature | T_J | - | -55 to +175 | °C |
| Storage Temperature | T_{STG} | - | -55 to +150 | °C |
| Mounting Torque | M_D | M3 or 6-32 screw | 0.6 | Nm |
| | | | 5.3 | in-lb |

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

Footnote 2: See Figure 21 for further information

Footnote 3: MOSFET can operate with $V_{GS(OFF)} = 0\text{ V}$ – dependent upon PCB layout. $V_{GS(OFF)} = -5\text{ V}$ provides added noise margin and faster turn-off speed

2. Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|-----------------|-------|------|
| Maximum Thermal Resistance, junction-to-case | $R_{th,JC,MAX}$ | 0.7 | °C/W |
| Maximum Thermal Resistance, junction-to-ambient | $R_{th,JA,MAX}$ | 40 | °C/W |

3. Electrical Characteristics

3.1. Static Characteristics ($T_J = 25\text{ °C}$ unless otherwise specified)

| Characteristic | Symbol | Conditions | Value | | | Unit |
|----------------------------------|---------------|--|-------|-----|-----|---------------|
| | | | Min | Typ | Max | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$ | 1200 | - | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$ | - | 1 | 100 | μA |
| | | $V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ °C}$ | - | 2 | - | |
| 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 | $R_{DS(ON)}$ | $I_D = 20\text{ A}, V_{GS} = 20\text{ V}$ | - | 80 | 100 | m Ω |
| | | $I_D = 20\text{ A}, V_{GS} = 20\text{ V}, T_J = 175\text{ °C}$ | - | 120 | - | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS} = V_{GS}, I_D = 10\text{ mA}$ | 1.8 | 2.8 | 4.0 | V |
| | | $V_{DS} = V_{GS}, I_D = 10\text{ mA}, T_J = 175\text{ °C}$ | - | 1.8 | - | |
| Internal Gate Resistance | $R_{G,int}$ | Resonance method, Drain-Source shorted ¹ | - | 0.6 | - | Ω |

Footnote 1: For a description of the resonance method for measuring R_G , refer to the JEDEC Standard JESD24-11 test method

3.2. Dynamic Characteristics (T_J = 25 °C unless otherwise specified)

| Characteristic | Symbol | Conditions | Value | | | Unit |
|----------------------------------|---------------------|--|-------|------|-----|------|
| | | | Min | Typ | Max | |
| Turn-On Switching Energy | E _{ON} | V _{DD} = 800 V, I _D = 20 A, V _{GS} = -5 / +20 V, R _{G,ext} = 2 Ω, L = 714 μH, FWD = LSIC2SD120A10 | - | 220 | - | μJ |
| Turn-Off Switching Energy | E _{OFF} | | - | 32 | - | |
| Total Per-Cycle Switching Energy | E _{TS} | | - | 252 | - | |
| Input Capacitance | C _{ISS} | V _{DD} = 800 V, V _{GS} = 0 V, f = 1 MHz, V _{AC} = 25 mV | - | 1700 | - | pF |
| Output Capacitance | C _{OSS} | | - | 82 | - | |
| Reverse Transfer Capacitance | C _{RSS} | | - | 9 | - | |
| COSS Stored Energy | E _{OSS} | | - | 26 | - | |
| Total Gate Charge | Q _g | V _{DD} = 800 V, I _D = 20 A, V _{GS} = -5 / +20 V | - | 92 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 28 | - | |
| Gate-Drain Charge | Q _{gd} | | - | 35 | - | |
| Turn-On Delay Time | t _{d(on)} | V _{DD} = 800 V, I _D = 20 A, V _{GS} = -5 / +20 V, R _{G,ext} = 2 Ω, R _L = 40 Ω, Timing relative to V _{DS} | - | 10 | - | ns |
| Rise Time | t _r | | - | 10 | - | |
| Turn-Off Delay Time | t _{d(off)} | | - | 16 | - | |
| Fall Time | t _f | | - | 8 | - | |

4. Reverse Diode Characteristics

| Characteristic | Symbol | Conditions | Value | | | Unit |
|---|------------------|---|-------|-----|-----|------|
| | | | Min | Typ | Max | |
| Diode Forward Voltage | V _{SD} | I _S = 10 A, V _{GS} = 0 V | - | 3.6 | - | V |
| | | I _S = 10 A, V _{GS} = 0 V, T _J = 175 °C | - | 3.2 | - | |
| Continuous Diode Forward Current | I _S | V _{GS} = 0 V, T _C = 25 °C | - | - | 35 | A |
| Peak Diode Forward Current ¹ | I _{SP} | | - | - | 85 | |
| Reverse Recovery Time | t _{rr} | V _{GS} = -5 V, I _S = 20 A, V _R = 800 V, di/dt = 5.5 A/ns | - | 21 | - | ns |
| Reverse Recovery Charge | Q _{rr} | | - | 210 | - | nC |
| Peak Reverse Recovery Current | I _{rrm} | | - | 19 | - | A |

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

5. Performance Curves

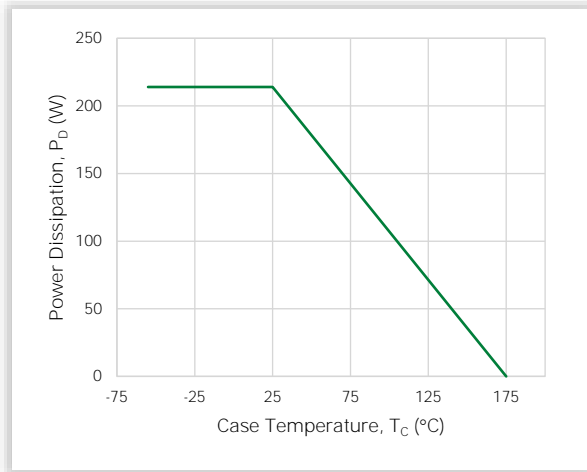
 Figure 1. Maximum Power Dissipation ($T_J = 175\text{ }^\circ\text{C}$)


Figure 2. Typical Transfer Characteristics

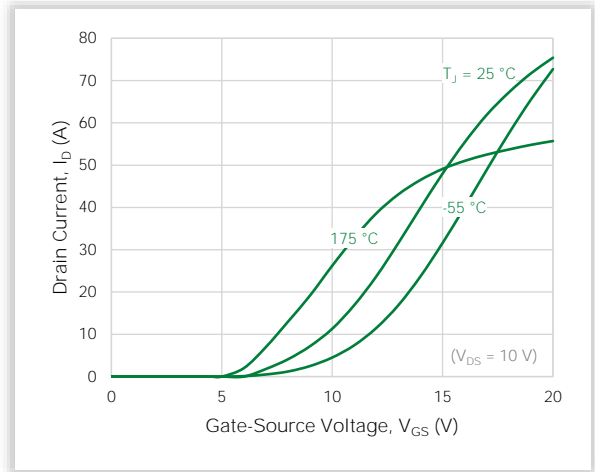
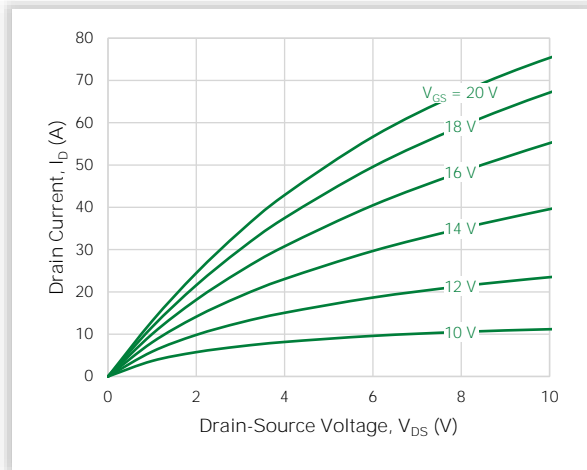
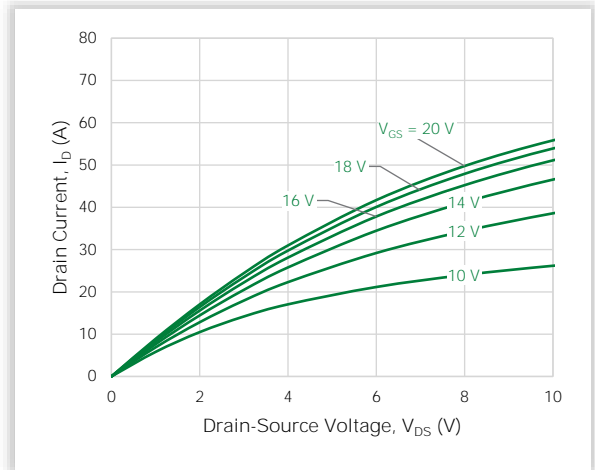
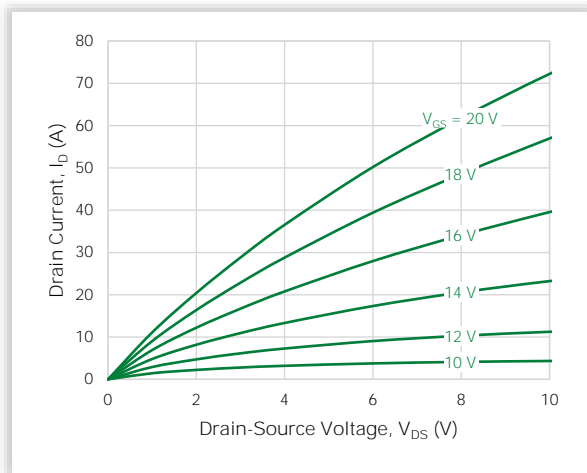
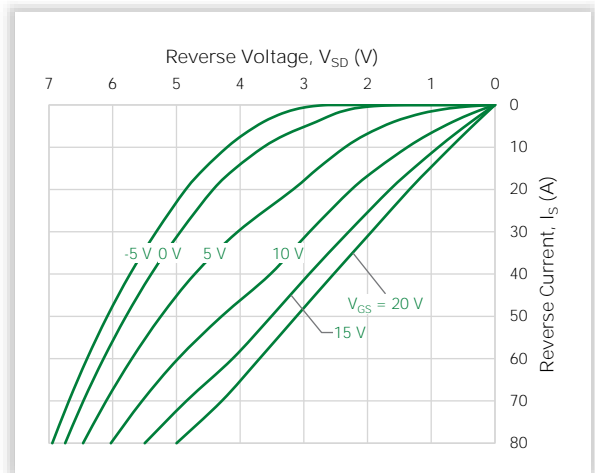

 Figure 3. Typical Output Characteristics ($T_J = 25\text{ }^\circ\text{C}$)

 Figure 4. Typical Output Characteristics ($T_J = 175\text{ }^\circ\text{C}$)

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

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


Figure 7. Typical Reverse Conduction Characteristics ($T_J = 175\text{ }^\circ\text{C}$)

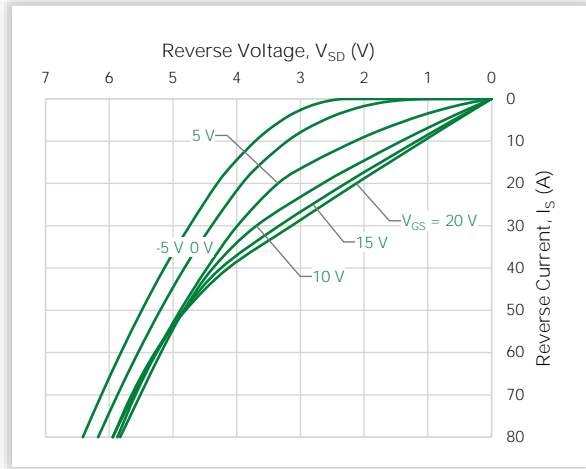


Figure 8. Typical Reverse Conduction Characteristics ($T_J = -55\text{ }^\circ\text{C}$)

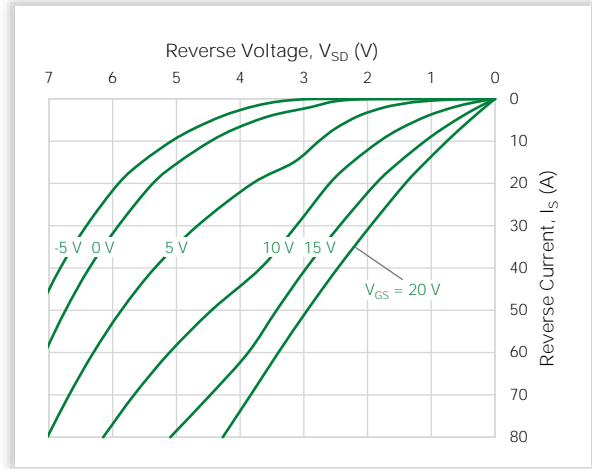


Figure 9. Normalized Transient Thermal Impedance

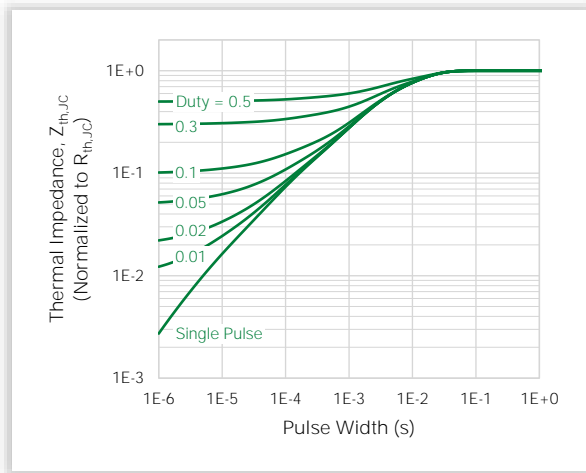


Figure 10. Maximum Safe Operating Area ($T_C = 25\text{ }^\circ\text{C}$)

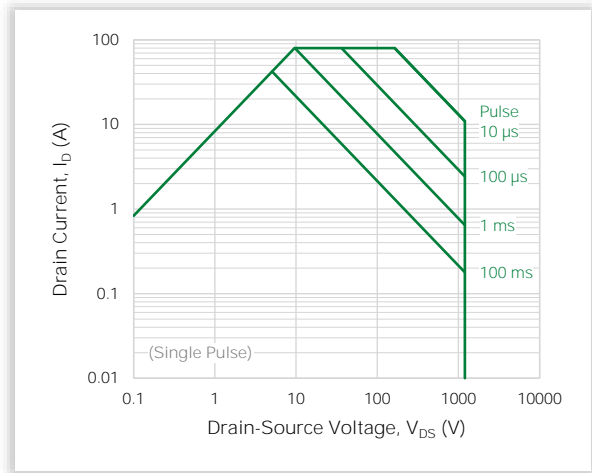


Figure 11. On-resistance vs. Drain Current

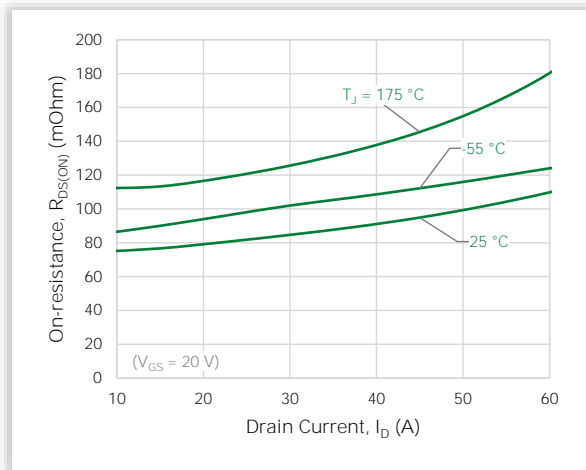


Figure 12. Normalized On-resistance vs. Junction Temperature

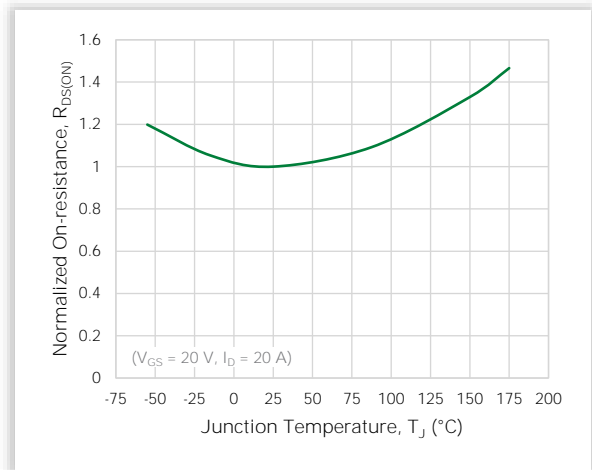


Figure 13. Typical On-resistance vs. Junction Temperature

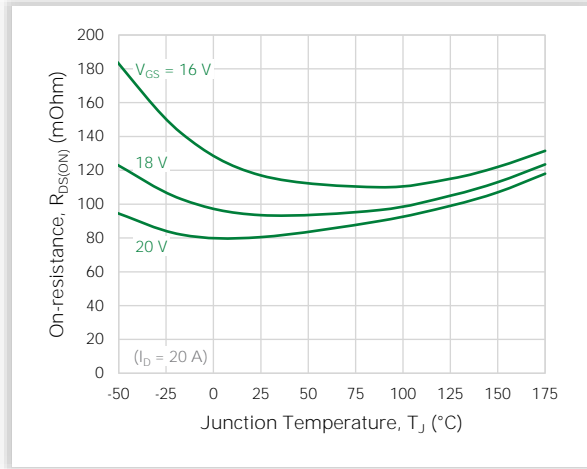


Figure 14. Typical Threshold Voltage

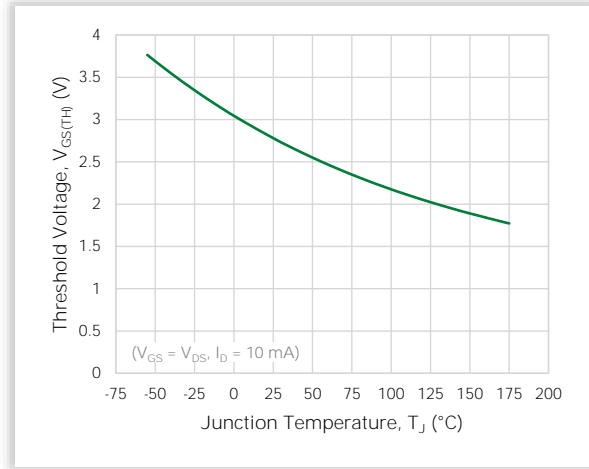


Figure 15. Typical Junction Capacitances up to 1000 V

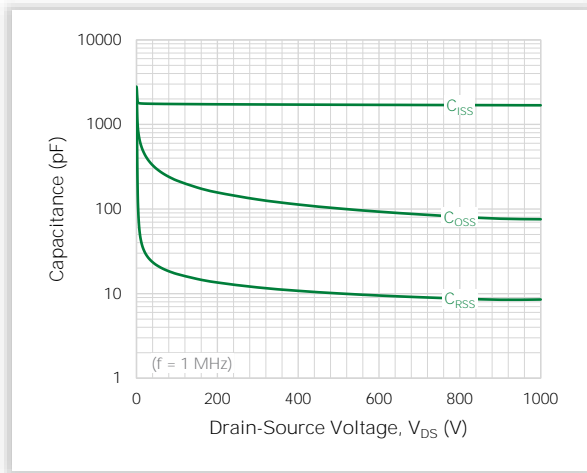


Figure 16. Typical Junction Capacitances up to 200 V

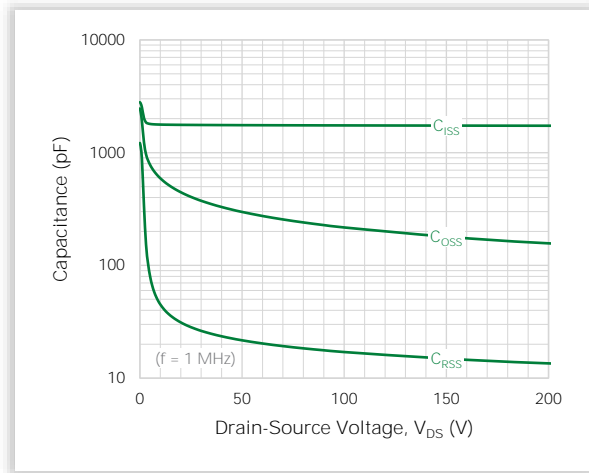


Figure 17. Typical C_{OSS} Stored Energy E_{OSS}

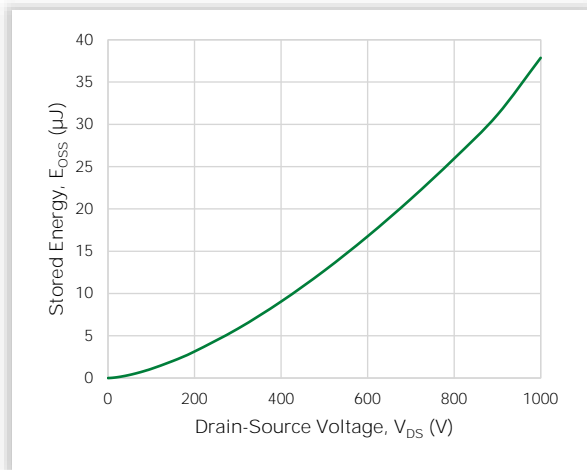


Figure 18. Typical Gate Charge

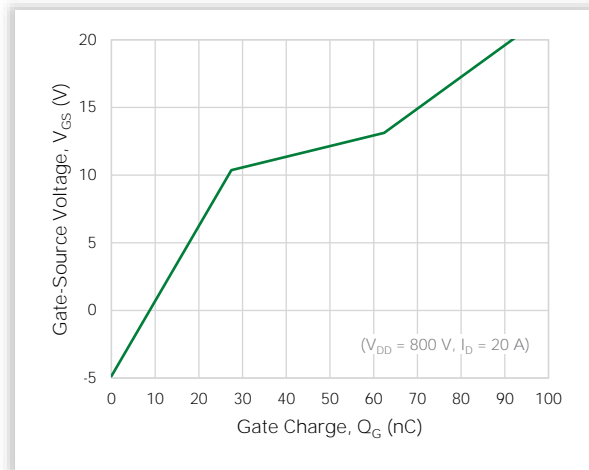


Figure 19. Typical Switching Energy vs. Drain Current

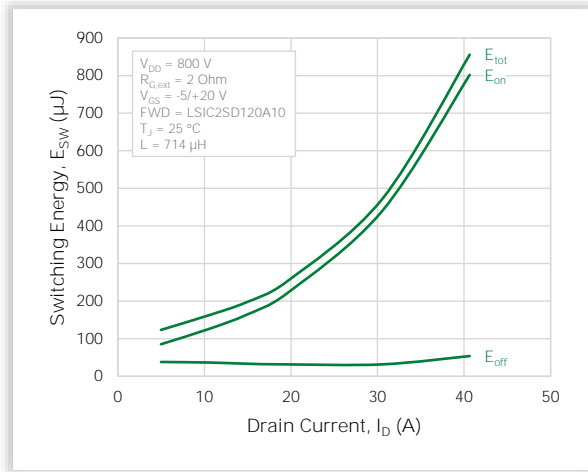
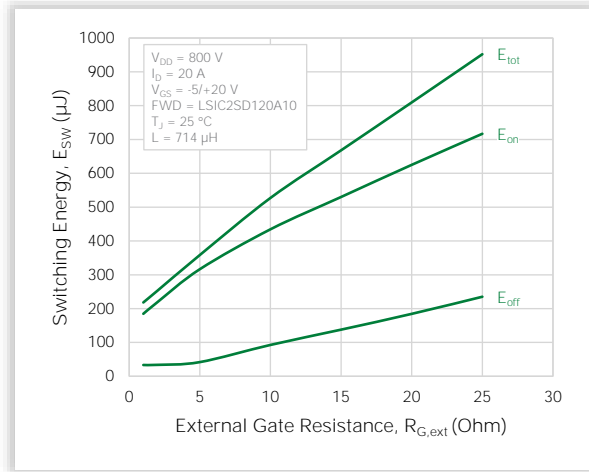
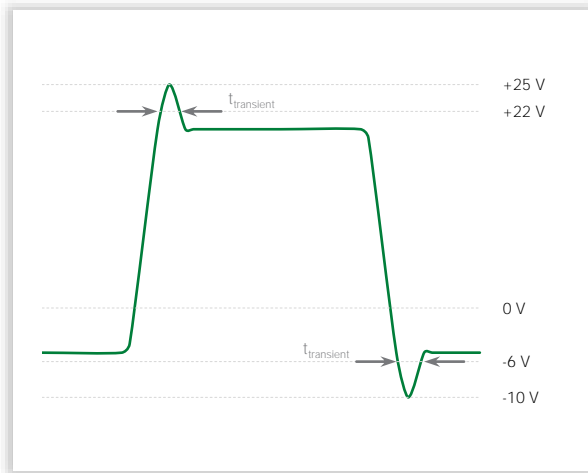
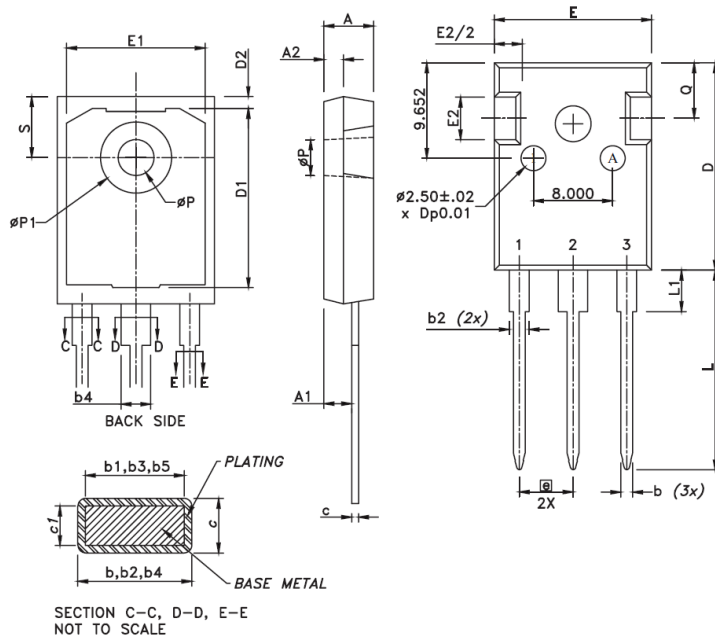


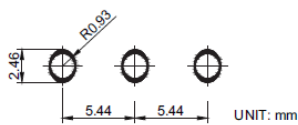
Figure 20. Typical Switching Energy vs. External Gate Resistance


 Figure 21. V_{GS} Waveform Definitions


6. Package Dimensions



Recommended Hole Pattern Layout:

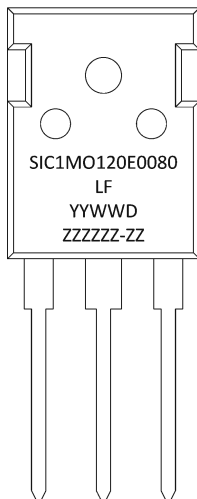


Notes:

1. Dimensions are in millimeters
2. Dimension D, E do not include mold flash. Mold flash shall not exceed 0.127 mm per side measured at outer most extreme of plastic body.
3. ϕP to have a maximum draft angle of 1.7° to the top of the part with a maximum hole diameter of 3.912 mm.

| Symbol | Millimeters | | |
|-----------|-------------|-----|--------|
| | Min | Nom | Max |
| A | 4.699 | - | 5.309 |
| A1 | 2.210 | - | 2.591 |
| A2 | 1.499 | - | 2.489 |
| b | 0.990 | - | 1.400 |
| b2 | 1.650 | - | 2.390 |
| b4 | 2.590 | - | 3.430 |
| c | 0.380 | - | 0.890 |
| D | 20.800 | - | 21.463 |
| D1 | 13.081 | - | - |
| D2 | 0.508 | - | 1.350 |
| e | 5.440 BSC | | |
| E | 15.494 | - | 16.256 |
| E1 | 13.060 | - | 14.150 |
| E2 | 3.429 | - | 5.486 |
| L | 19.810 | - | 20.570 |
| L1 | 3.810 | - | 4.496 |
| ϕP | 3.550 | - | 3.660 |
| $\phi P1$ | 7.060 | - | 7.390 |
| Q | 5.385 | - | 6.200 |
| S | 6.050 | - | 6.300 |

7. Part Numbering and Marking



| | |
|-----------|---------------------------|
| SiC | = SiC |
| 1 | = Gen 1 |
| MO | = MOSFET |
| 120 | = Voltage Rating (1200 V) |
| E | = TO-247-3L |
| 0080 | = $R_{DS(ON)}$ (80 mOhm) |
| YY | = Year |
| WW | = Week |
| D | = Special Code |
| ZZZZZZ-ZZ | = Lot Number |

8. Packing Options

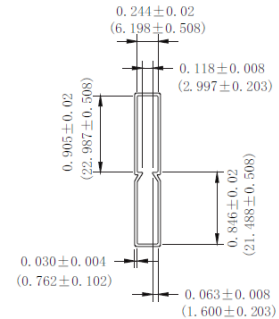
| Part Number | Marking | Packing Mode | M.O.Q. |
|-----------------|----------------|---------------|--------|
| LSIC1MO120E0080 | SIC1MO120E0080 | Tube (30 pcs) | 450 |

9. Packing Specifications



NOTE:

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



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