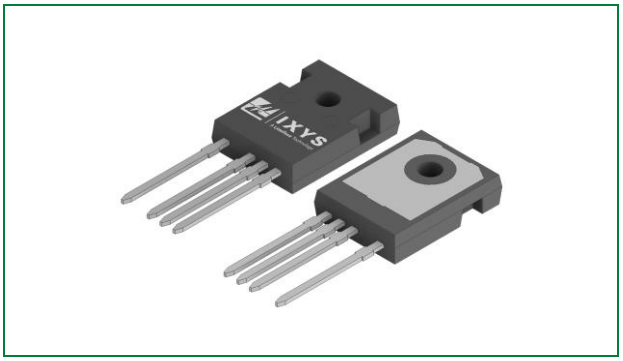
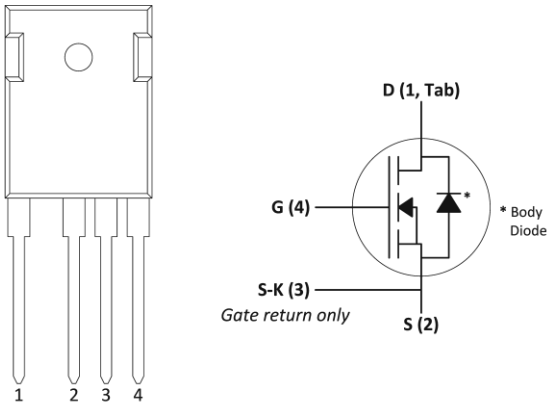
# LSIC1MO120G0080
# 1200 V, 80 mOhm N-Channel SiC MOSFET



## Agency Approvals and Environmental

| Environmental Approvals |
|---|
| RoHS HF |

## Pinout Diagram




## Product Summary

| Characteristic | Value | Unit |
|---|---|---|
| $V_{DS}$ | 1200 | V |
| Typical $R_{DS(ON)}$ | 80 | mOhm |
| $I_D$ ($T_C \leq 100$ °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
- Optimized package with separate driver source pin

## Applications

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

## 1. Maximum Ratings

| Characteristic | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | $V_{GS}$ = 0 V | 1200 | V |
| Continuous Drain Current | $I_D$ | $V_{GS}$ = 20 V, $T_C$ = 25 °C | 39 | A |
| | | $V_{GS}$ = 20 V, $T_C$ = 100 °C | 25 | |
| Pulsed Drain Current [1] | $I_{D(pulse)}$ | $T_C$ = 25 °C | 80 | A |
| Power Dissipation | $P_D$ | $T_C$ = 25 °C, $T_J$ = 175 °C | 214 | W |
| Gate-Source Voltage | $V_{GS,MAX}$ | Absolute maximum values – Steady state | -6 to +22 | V |
| | $V_{GS,OP,TR}$ [2] | Transient, $t_{transient}$ < 1 % duty cycle | -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 |
| Lead Temperature for Soldering | $T_{sold}$ | - | 260 | °C |
| Mounting Torque | $M_D$ | M3 or 6-32 screw | 1.0 | Nm |
| | | | 8.8 | 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 V – dependent upon PCB layout. $V_{GS(OFF)}$ = -5 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 °C unless otherwise specified)

| Characteristic | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 100 µA | 1200 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 1200, $V_{GS}$ = 0 V | - | 1 | 100 | µA |
| | | $V_{DS}$ = 1200 V, $V_{GS}$ = 0 V, $T_J$ = 175 °C | - | 2 | - | |
| Gate Leakage Current | $I_{GSS,F}$ | $V_{GS}$ = 22 V, $V_{DS}$ = 0 V | - | - | 100 | nA |
| | $I_{GSS,R}$ | $V_{GS}$ = -6 V, $V_{DS}$ = 0 V | - | - | 100 | |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $I_D$ = 20 A, $V_{GS}$ = 20 V | - | 80 | 100 | mΩ |
| | | $I_D$ = 20 A, $V_{GS}$ = 20 V, $T_J$ = 175 °C | - | 120 | - | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 10 mA | 1.8 | 2.8 | 4.0 | V |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = 10 mA, $T_J$ = 175 °C | - | 1.8 | - | |
| Gate Resistance | $R_G$ | 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 = LSIC2SD120A20 | - | 105 | - | µJ |
| Turn-Off Switching Energy | $E_{OFF}$ | | - | 59 | - | |
| Total Per-Cycle Switching Energy | $E_{TS}$ | | - | 164 | - | |
| 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 | - | µJ |
| 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 $V_{DS}$ | - | 12 | - | ns |
| Rise Time | $t_r$ | | - | 7 | - | |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 17 | - | |
| Fall Time | $t_f$ | | - | 20 | - | |

## 4. Reverse Diode Characteristics ($T_J$ = 25 °C unless otherwise specified)

| Characteristic | Symbol | Conditions | Value | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| Diode Forward Voltage | $V_{SD}$ | $I_S$ = 10 A, $V_{GS}$ = -5 V | - | 4.2 | - | V |
| | | $I_S$ = 10 A, $V_{GS}$ = -5 V, $T_J$ = 175 °C | - | 3.7 | - | |
| Continuous Diode Forward Current | $I_S$ | $V_{GS}$ = -5 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 = 10.7 A/ns | - | 10 | - | ns |
| Reverse Recovery Charge | $Q_{rr}$ | | - | 350 | - | nC |
| Peak Reverse Recovery Current | $I_{rrm}$ | | - | 55 | - | A |

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

## 5. Performance Curves

Figure 1. Maximum Power Dissipation ($T_J$ = 175 °C)

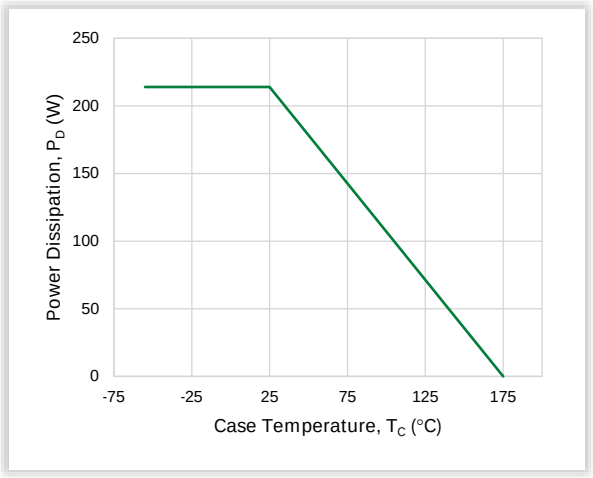



Figure 2. Typical Transfer Characteristics

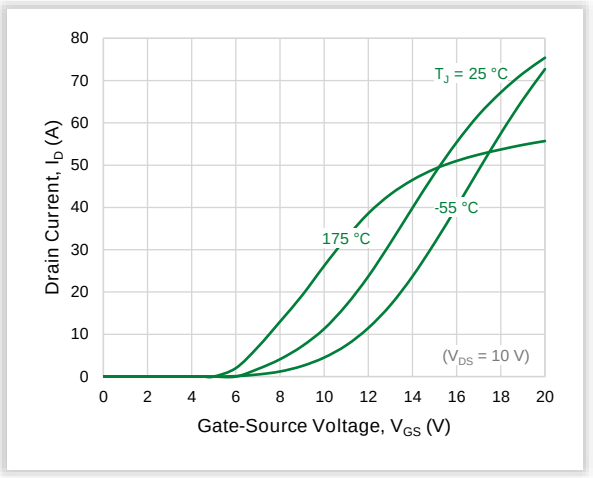



Figure 3. Typical Output Characteristics ($T_J$ = 25 °C)

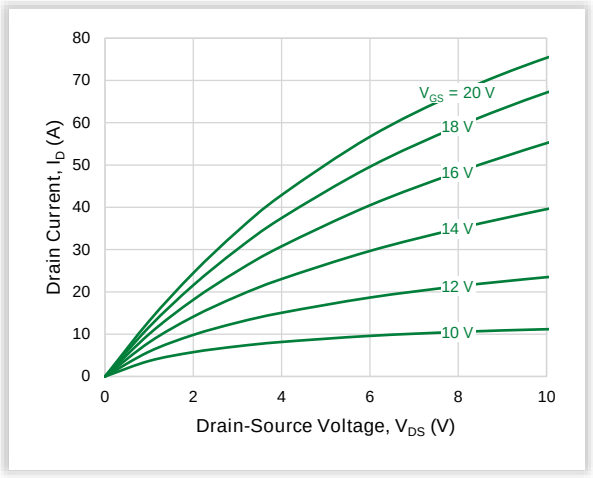



Figure 4. Typical Output Characteristics ($T_J$ = 175 °C)

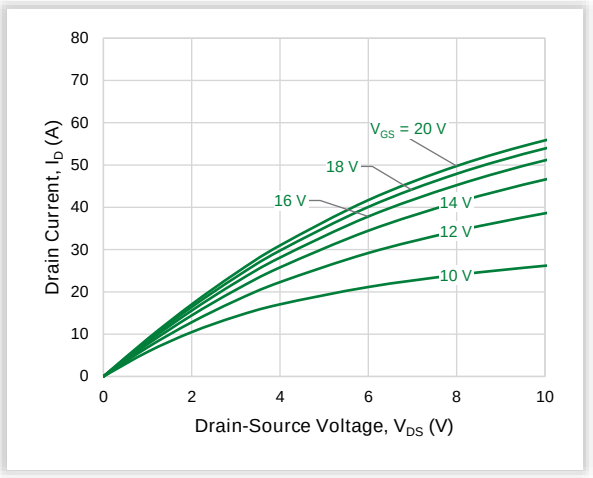



Figure 5. Typical Output Characteristics ($T_J$ = -55 °C)

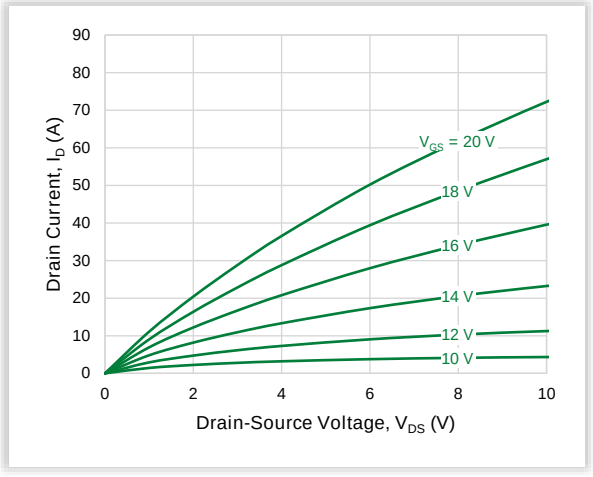



Figure 6. Typical Reverse Conduction Characteristics ($T_J$ = 25 °C)

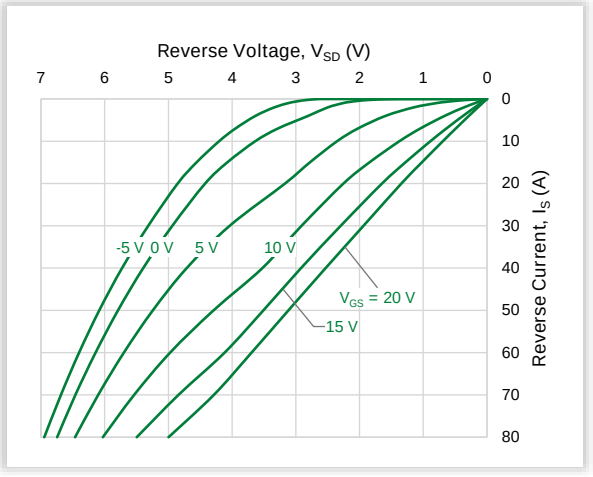


Figure 7. Typical Reverse Conduction Characteristics ($T_J$ = 175 °C)

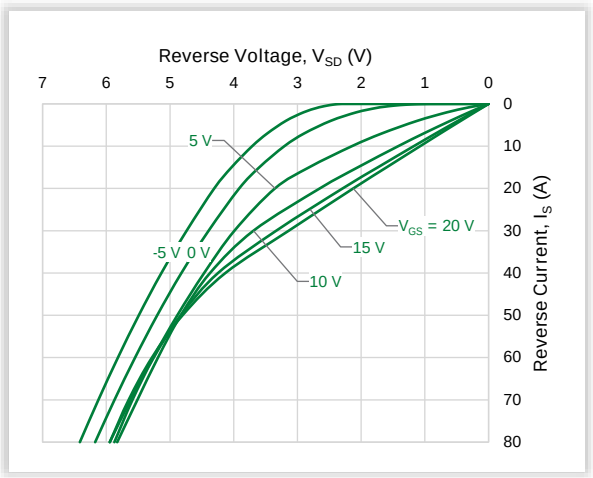



Figure 8. Typical Reverse Conduction Characteristics ($T_J$ = -55 °C)

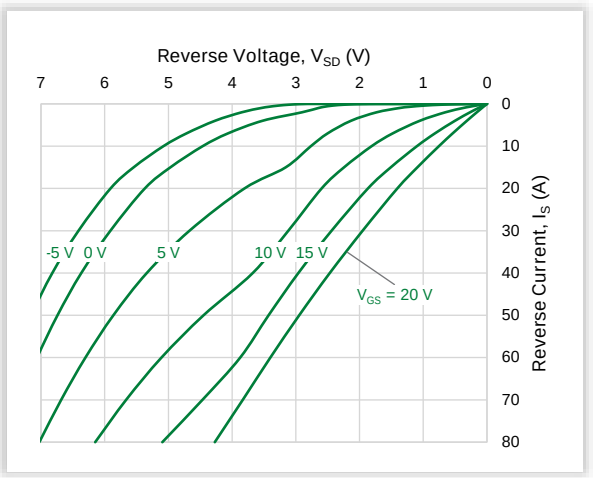



Figure 9. Transient Thermal Impedance

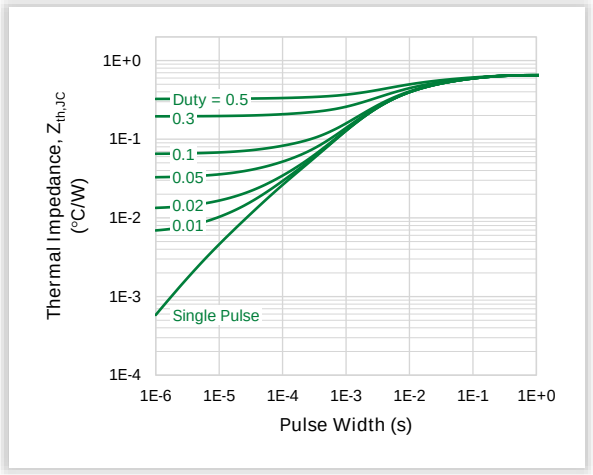



Figure 10. Maximum Safe Operating Area ($T_C$ = 25 °C)

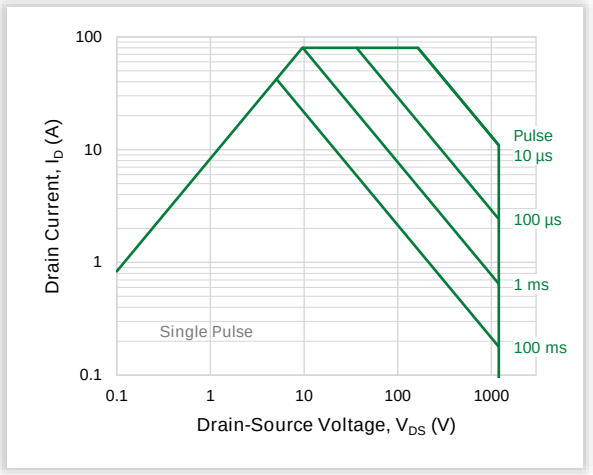



Figure 11. On-resistance vs. Drain Current

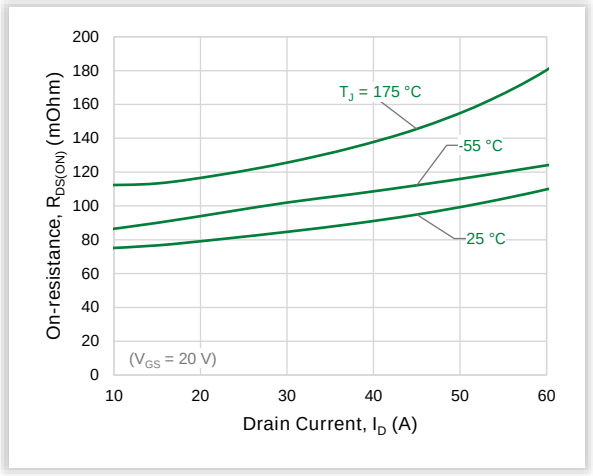



Figure 12. Normalized On-resistance vs. Junction Temperature

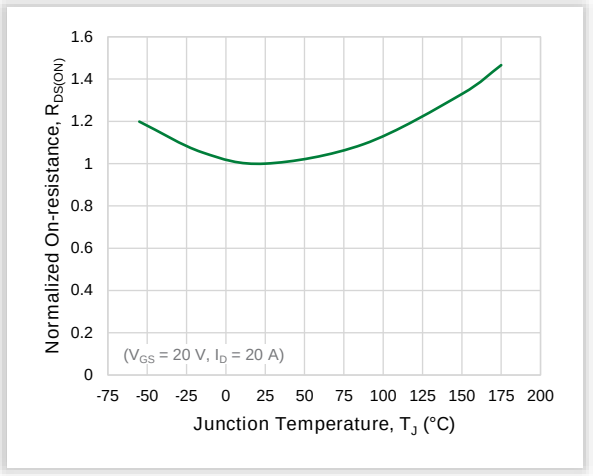


Figure 13. Typical On-resistance vs. Junction Temperature

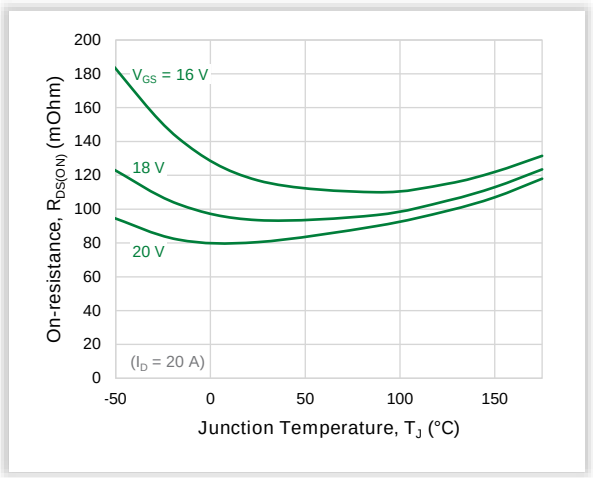



Figure 14. Typical Threshold Voltage

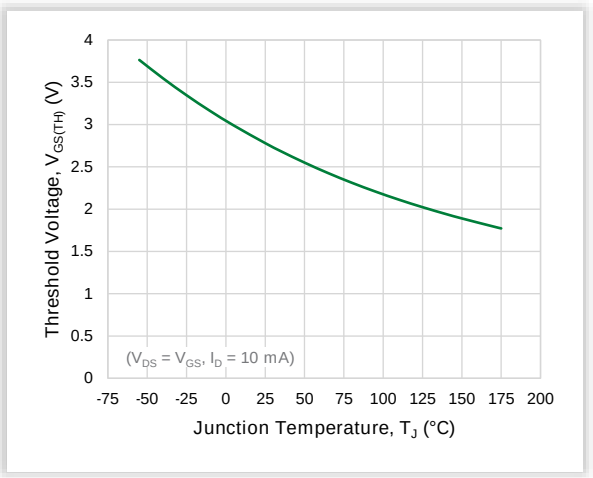



Figure 15. Typical Junction Capacitances up to 1000 V

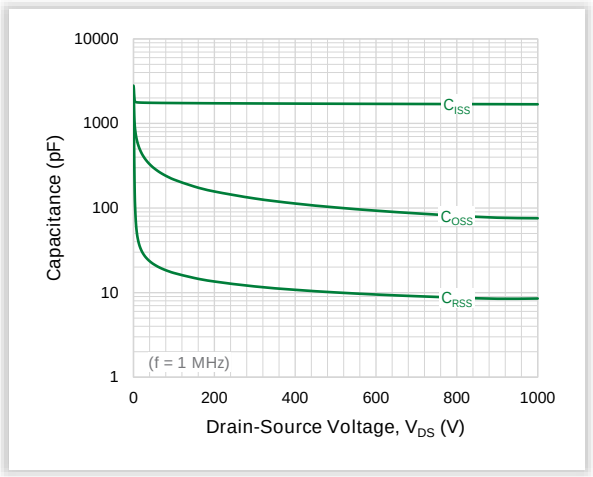



Figure 16. Typical Junction Capacitances up to 200 V

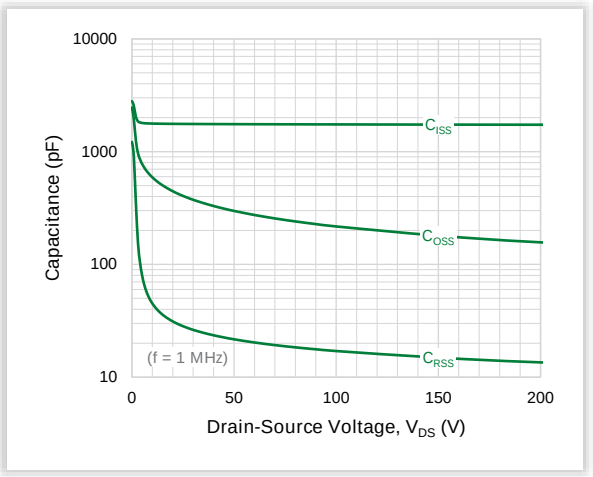



Figure 17. Typical $C_{OSS}$ Stored Energy $E_{OSS}$

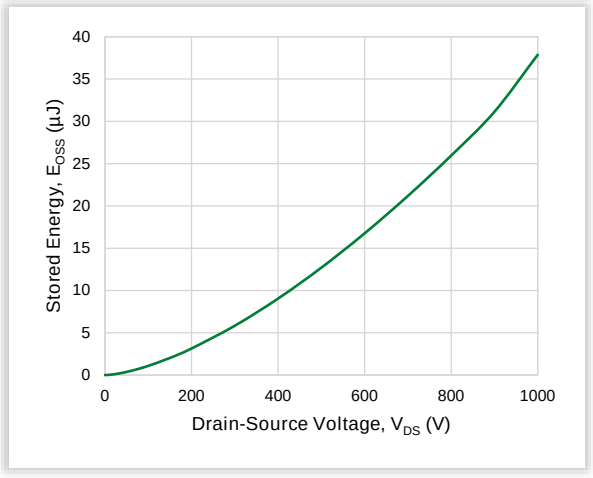



Figure 18. Typical Gate Charge

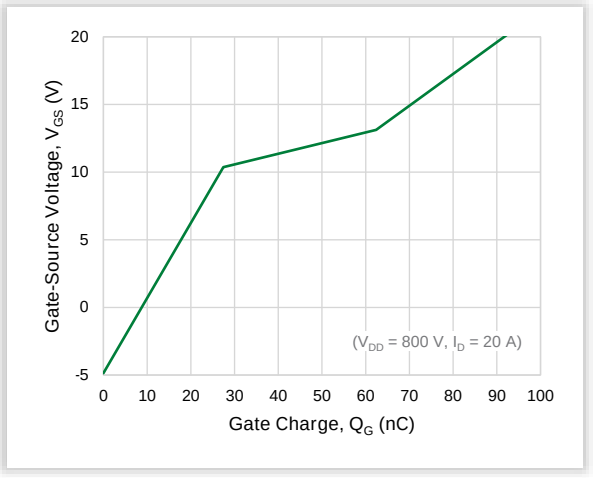


Figure 19. Typical Switching Energy vs. Drain Current

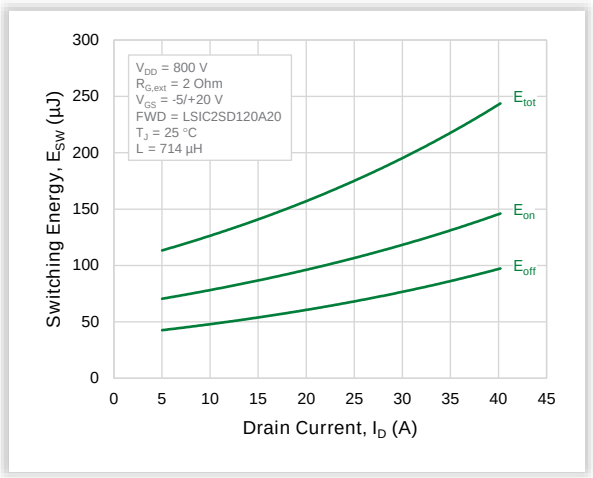



Figure 20. Typical Switching Energy vs. External Gate Resistance

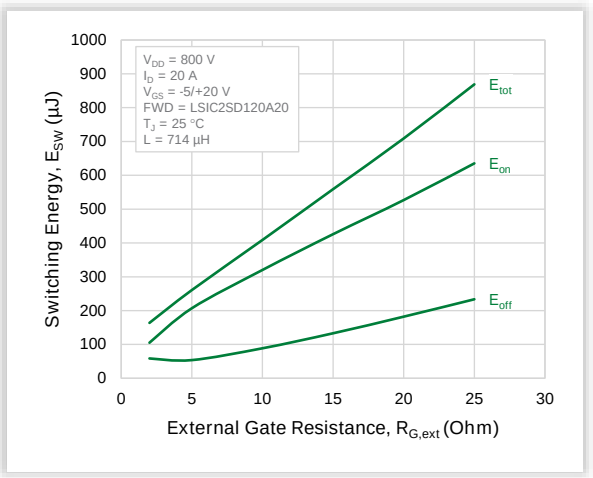
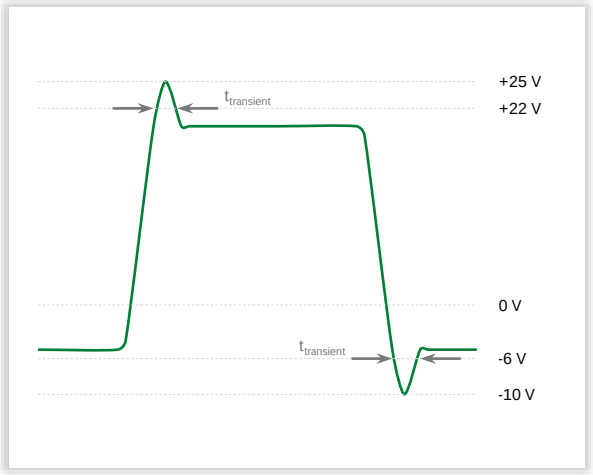
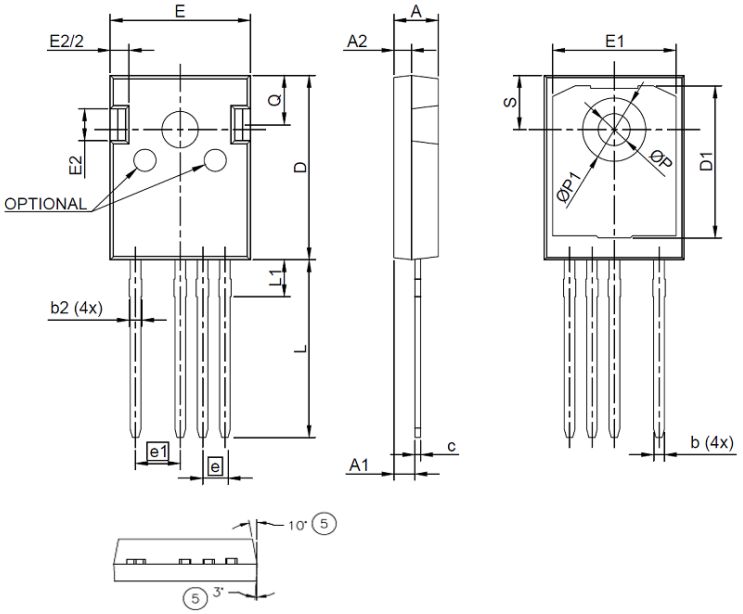



Figure 21. $V_{GS}$ Waveform Definition

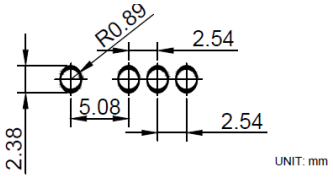


## 6. Package Dimensions




| Symbol | Millimeters | |
|---|---|---|
| | Min | Max |
| A | 4.70 | 5.31 |
| A1 | 2.21 | 2.59 |
| A2 | 1.50 | 2.49 |
| b | 0.99 | 1.40 |
| b2 | 1.65 | 2.39 |
| c | 0.38 | 0.89 |
| D | 20.80 | 21.46 |
| D1 | 13.08 | - |
| D2 | 0.51 | 1.35 |
| E | 15.49 | 16.26 |
| e | 2.54 BSC | |
| e1 | 4.83 | 5.33 |
| E1 | 13.46 | - |
| E2 | 3.56 | 4.06 |
| L | 19.81 | 20.32 |
| L1 | - | 4.50 |
| øP | 3.56 | 3.66 |
| øP1 | 7.06 | 7.39 |
| Q | 5.38 | 6.20 |
| S | 6.17 BSC | |

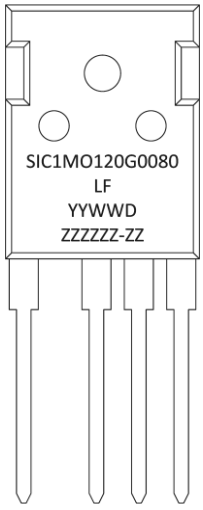
Recommended Hole Pattern Layout:




Notes:

1. Dimensioning and tolerancing as per ASME Y14.5 – 2009.
2. Package outline in compliance with JEDEC Standard Var. Ad.
3. Dimension D, E do not include mold flash.
4. Mold draft angles excluded on the table.
5. øP to have a maximum draft angle of 1.7° to the top with a maximum hole diameter of 3.912 mm.

## 7. Part Numbering and Marking

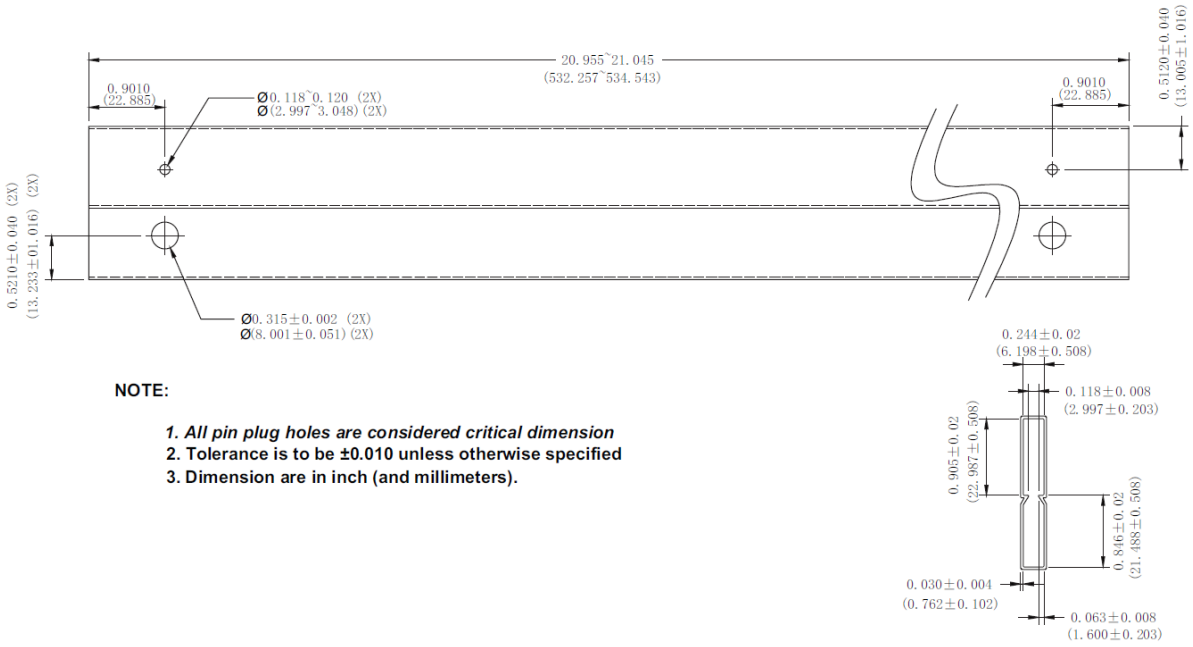



| | |
|---|---|
| SiC | = SiC |
| 1 | = Gen 1 |
| MO | = MOSFET |
| 120 | = Voltage Rating (1200 V) |
| G | = TO-247-4L |
| 0080 | = $R_{DS(ON)}$ (80 mOhm) |
| YY | = Year |
| WW | = Week |
| D | = Special Code |
| ZZZZZZ-ZZ | = Lot Number |

## 8. Packing Options

| Part Number | Marking | Packing Mode | M.O.Q. |
|---|---|---|---|
| LSIC1MO120G0080 | SIC1MO120G0080 | 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).**