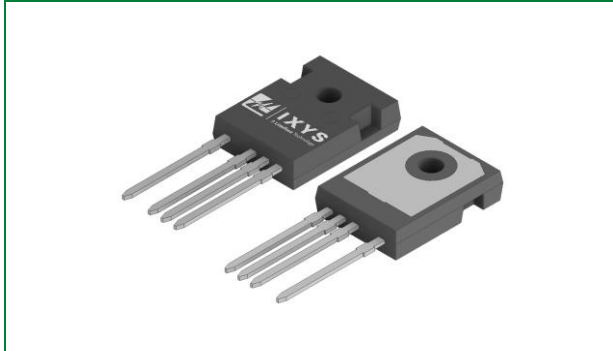


## LSIC1MO120G0160 1200 V, 160 mOhm N-Channel SiC MOSFET

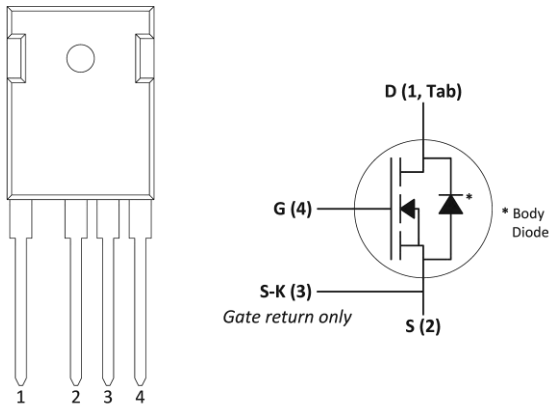


### Agency Approvals and Environmental

Environmental Approvals



### Circuit Diagram



### Product Summary

Characteristic	Value	Unit
$V_{DS}$	1200	V
Typical $R_{DS(ON)}$	160	mOhm
$I_D$ ( $T_C \leq 100\text{ }^\circ\text{C}$ )	14	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
- RoHS compliant, lead-free, and halogen-free

### 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	$I_D$	$V_{GS} = 20\text{ V}, T_C = 25\text{ }^\circ\text{C}$	22	A
		$V_{GS} = 20\text{ V}, T_C = 100\text{ }^\circ\text{C}$	14	
Pulsed Drain Current <sup>1</sup>	$I_{D(pulse)}$	$T_C = 25\text{ }^\circ\text{C}$	45	A
Power Dissipation	$P_D$	$T_C = 25\text{ }^\circ\text{C}, T_J = 175\text{ }^\circ\text{C}$	125	W
Gate-Source Voltage	$V_{GS,MAX}$	Absolute maximum values – Steady state	-6 to +22	V
	$V_{GS,OP,TR}$ <sup>2</sup>	Transient, $t_{transient} < 300\text{ nsec}$	-10 to +25	
	$V_{GS,OP}$ <sup>3</sup>	Recommended DC operating values	-5 to +20	
Operating Junction Temperature	$T_J$	-	-55 to +175	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-	-55 to +150	$^\circ\text{C}$
Lead Temperature for Soldering	$T_{sold}$	-	260	$^\circ\text{C}$
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  $V_{GS(OFF)} = 0\text{ V}$ .  $V_{GS(OFF)} = -5\text{ V}$  provides added noise margin and faster turn-off speed

## 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Maximum Thermal Resistance, junction-to-case	$R_{th,JC,MAX}$	1.2	$^\circ\text{C/W}$
Maximum Thermal Resistance, junction-to-ambient	$R_{th,JA,MAX}$	40	$^\circ\text{C/W}$

## 3. Electrical Characteristics

### 3.1. Static Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ 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	$\mu\text{A}$
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	<1	-	
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	$R_{DS(ON)}$	$I_D = 10\text{ A}, V_{GS} = 20\text{ V}$	-	160	200	m $\Omega$
		$I_D = 10\text{ A}, V_{GS} = 20\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	230	-	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 5\text{ mA}$	1.8	2.8	4.0	V
		$V_{DS} = V_{GS}, I_D = 5\text{ mA}, T_J = 175\text{ }^\circ\text{C}$	-	1.8	-	
Gate Resistance	$R_G$	Resonance method, Drain-Source shorted <sup>1</sup>	-	0.85	-	$\Omega$

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

Characteristic	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Turn-On Switching Energy	$E_{ON}$	$V_{DD} = 800\text{ V}$ , $I_D = 10\text{ A}$ , $V_{GS} = -5 / +20\text{ V}$ , $R_{G,ext} = 5\ \Omega$ , $L = 1.4\text{ mH}$ , FWD = LSIC2SD120A05	-	74	-	$\mu\text{J}$
Turn-Off Switching Energy	$E_{OFF}$		-	32	-	
Total Per-Cycle Switching Energy	$E_{TS}$		-	106	-	
Input Capacitance	$C_{ISS}$	$V_{DD} = 800\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$ , $V_{AC} = 25\text{ mV}$	-	890	-	$\text{pF}$
Output Capacitance	$C_{OSS}$		-	45	-	
Reverse Transfer Capacitance	$C_{RSS}$		-	5	-	
COSS Stored Energy	$E_{OSS}$		-	14	-	
Total Gate Charge	$Q_g$	$V_{DD} = 800\text{ V}$ , $I_D = 10\text{ A}$ , $V_{GS} = -5 / +20\text{ V}$	-	50	-	$\text{nC}$
Gate-Source Charge	$Q_{gs}$		-	15	-	
Gate-Drain Charge	$Q_{gd}$		-	17	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 800\text{ V}$ , $I_D = 10\text{ A}$ , $V_{GS} = -5 / +20\text{ V}$ , $R_{G,ext} = 5\ \Omega$ , $R_L = 80\ \Omega$ , Timing relative to $V_{DS}$	-	11	-	$\text{ns}$
Rise Time	$t_r$		-	7	-	
Turn-Off Delay Time	$t_{d(off)}$		-	17	-	
Fall Time	$t_f$		-	9	-	

### 4. Reverse Diode Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)

Characteristic	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Diode Forward Voltage	$V_{SD}$	$I_S = 5\text{ A}$ , $V_{GS} = -5\text{ V}$	-	4.2	-	$\text{V}$
		$I_S = 5\text{ A}$ , $V_{GS} = -5\text{ V}$ , $T_J = 175\text{ }^\circ\text{C}$	-	3.7	-	
Continuous Diode Forward Current	$I_S$	$V_{GS} = -5\text{ V}$ , $T_C = 25\text{ }^\circ\text{C}$	-	-	24	$\text{A}$
Peak Diode Forward Current <sup>1</sup>	$I_{SP}$		-	-	45	
Reverse Recovery Time	$t_{rr}$	$V_{GS} = -5\text{ V}$ , $I_S = 10\text{ A}$ , $V_R = 800\text{ V}$ , $di/dt = 6.2\text{ A/ns}$	-	9	-	$\text{ns}$
Reverse Recovery Charge	$Q_{rr}$		-	140	-	$\text{nC}$
Peak Reverse Recovery Current	$I_{rm}$		-	25	-	$\text{A}$

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

5. Performance Curves

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

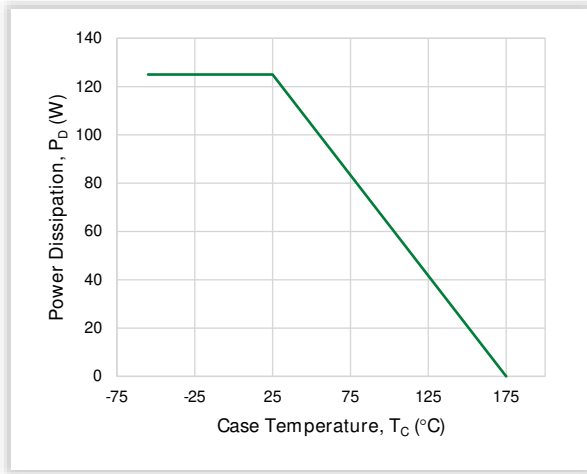


Figure 2. Typical Transfer Characteristics

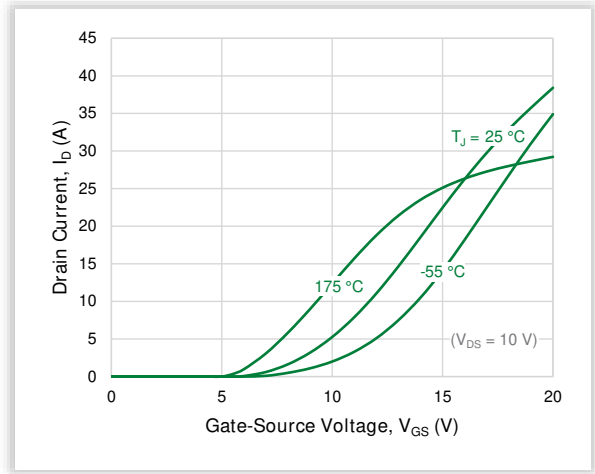


Figure 3. Typical Output Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ )

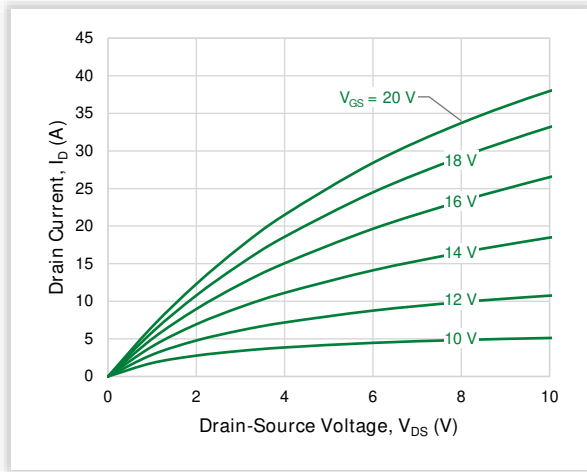


Figure 4. Typical Output Characteristics ( $T_J = 175\text{ }^\circ\text{C}$ )

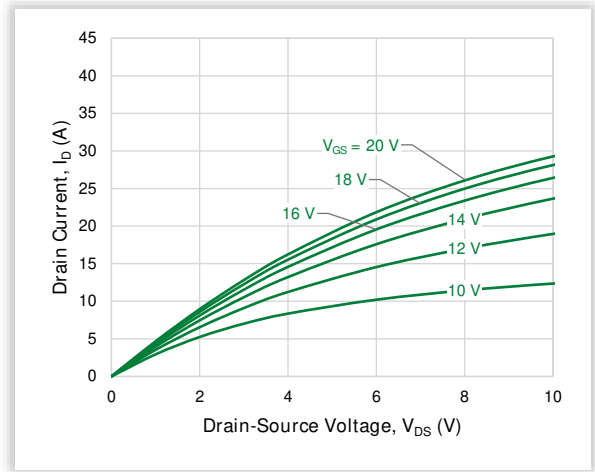


Figure 5. Typical Output Characteristics ( $T_J = -55\text{ }^\circ\text{C}$ )

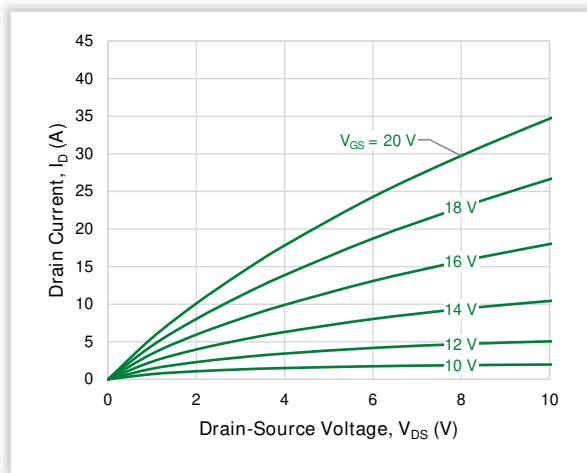


Figure 6. Typical Reverse Conduction Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ )

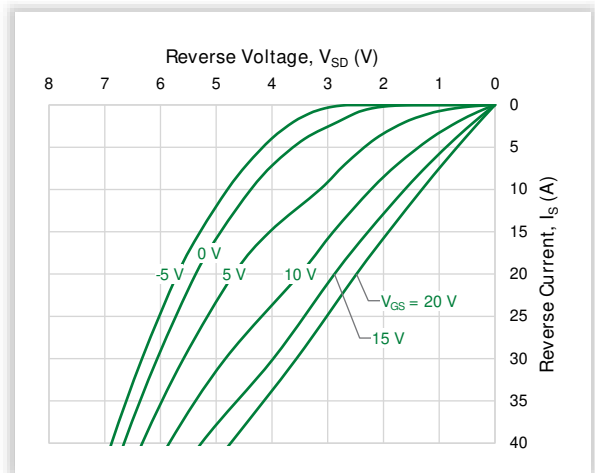


Figure 7. Typical Reverse Conduction Characteristics ( $T_J = 175\text{ }^\circ\text{C}$ )

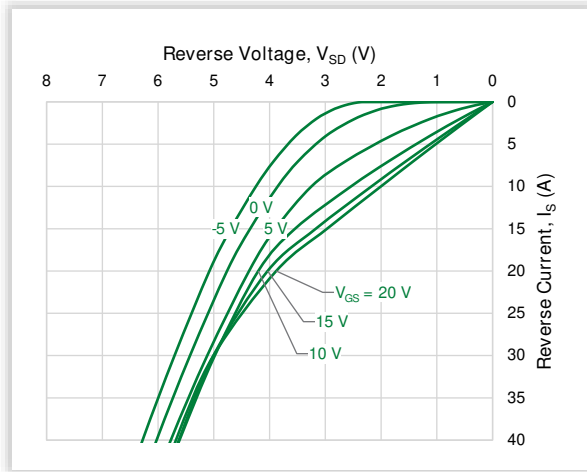


Figure 8. Typical Reverse Conduction Characteristics ( $T_J = -55\text{ }^\circ\text{C}$ )

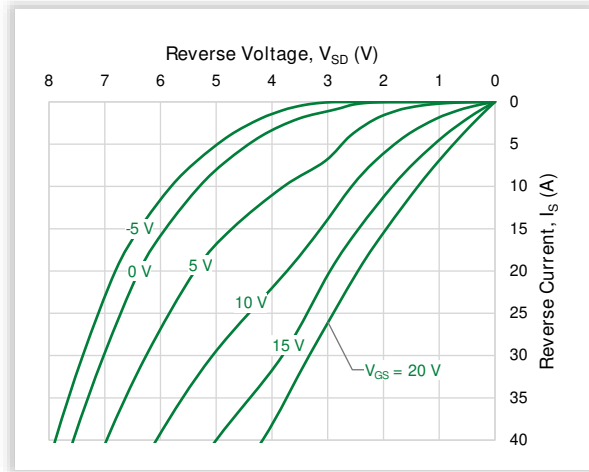


Figure 9. Transient Thermal Impedance

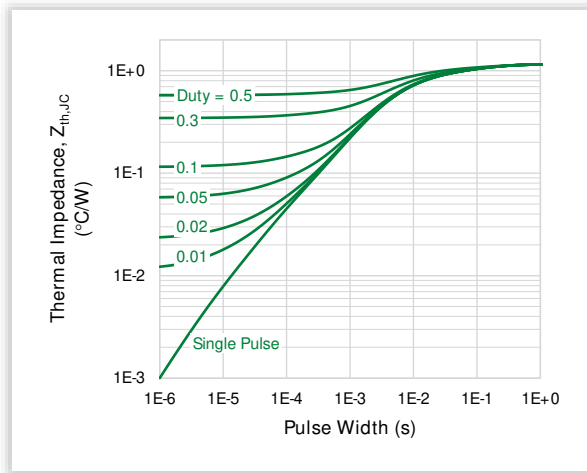


Figure 10. Maximum Safe Operating Area ( $T_C = 25\text{ }^\circ\text{C}$ )

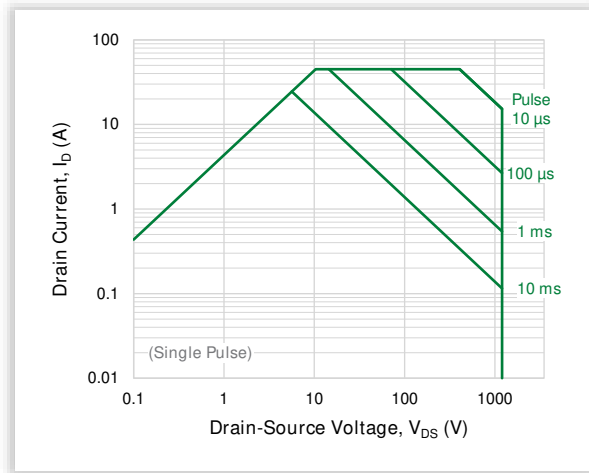


Figure 11. On-resistance vs. Drain Current

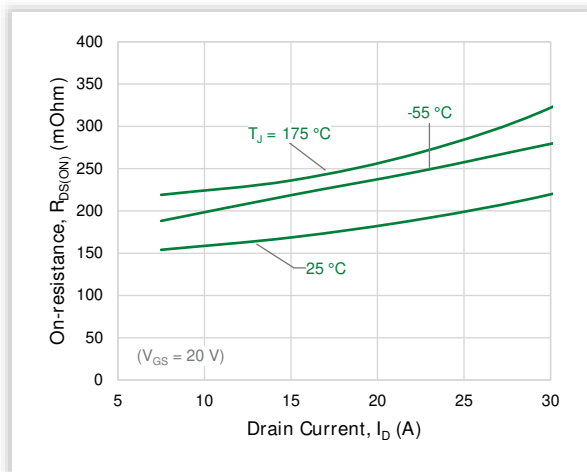


Figure 12. Normalized On-resistance vs. Junction Temperature

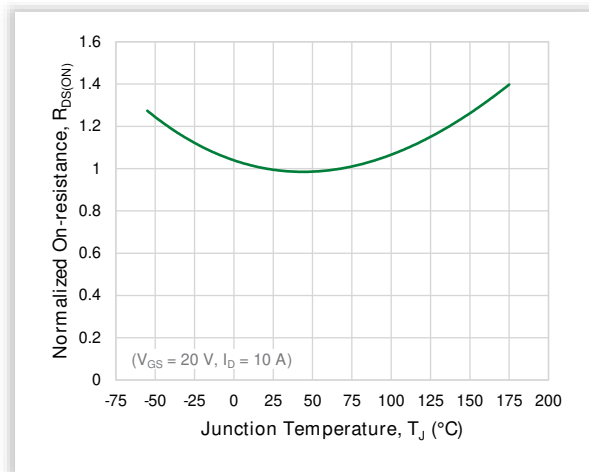


Figure 13. Typical On-resistance vs. Junction Temperature

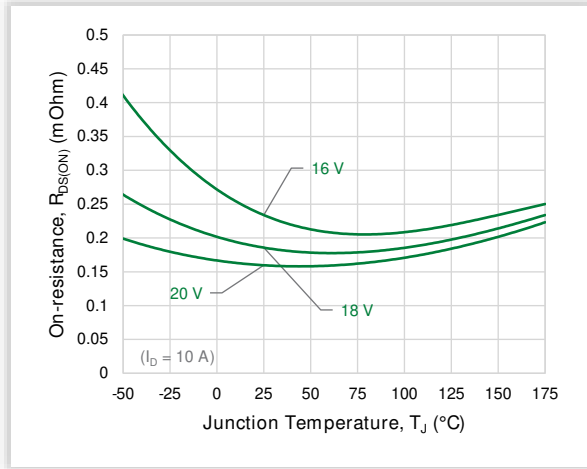


Figure 14. Typical Threshold Voltage

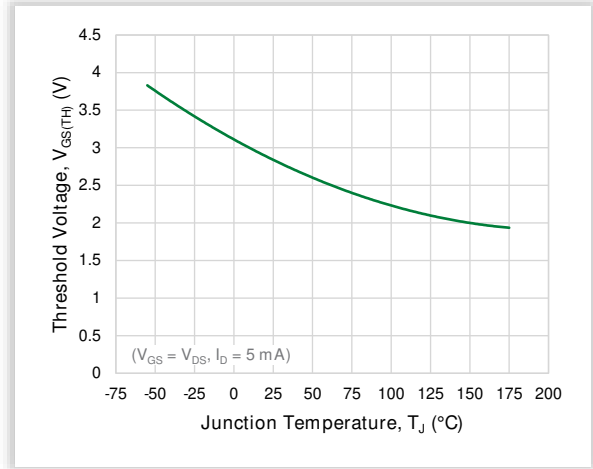


Figure 15. Typical Junction Capacitances up to 1000 V

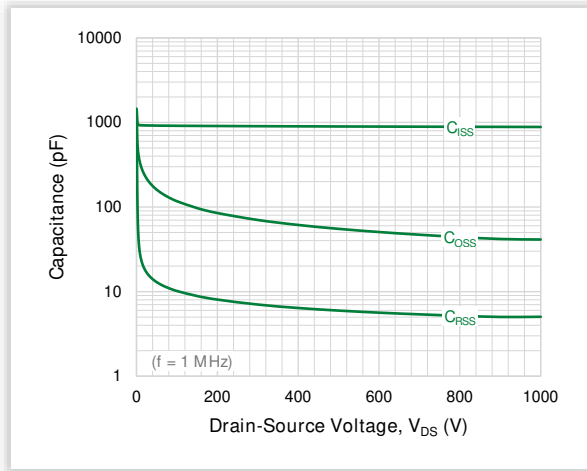


Figure 16. Typical Junction Capacitances up to 200 V

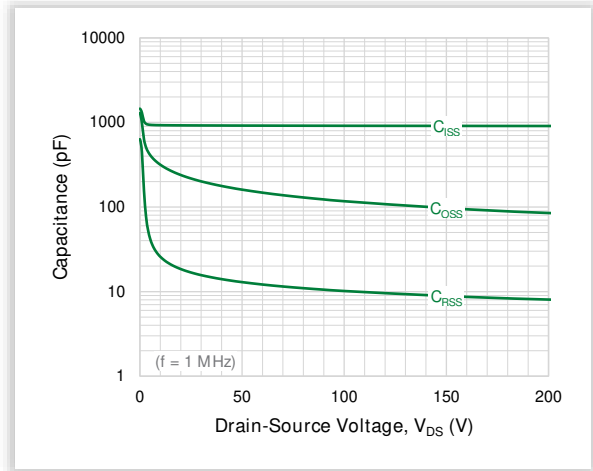


Figure 17. Typical  $C_{OSS}$  Stored Energy  $E_{OSS}$

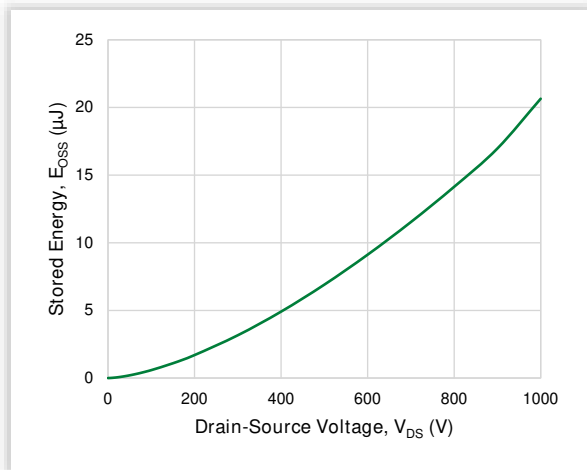


Figure 18. Typical Gate Charge

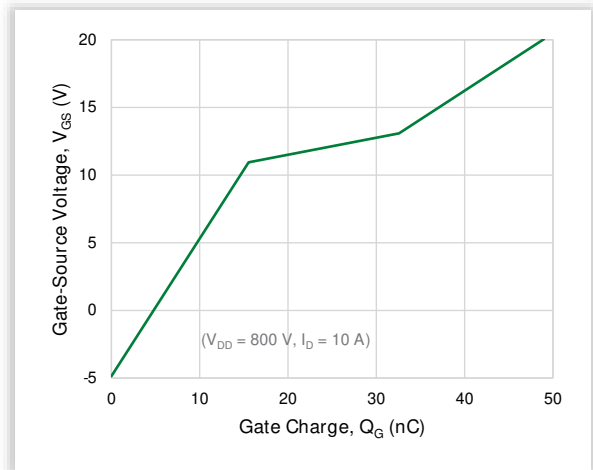


Figure 19. Typical Switching Energy vs. Drain Current

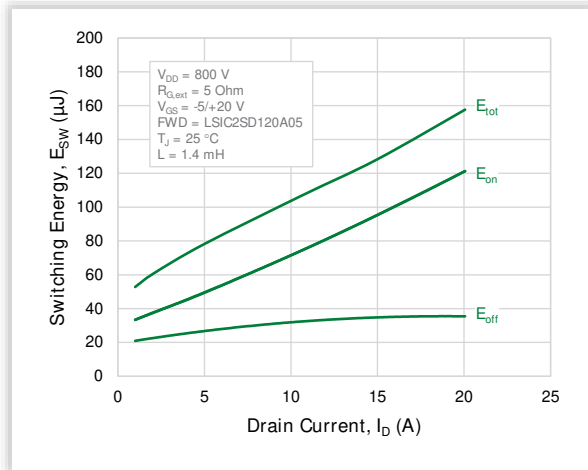


Figure 20. Typical Switching Energy vs. External Gate Resistance

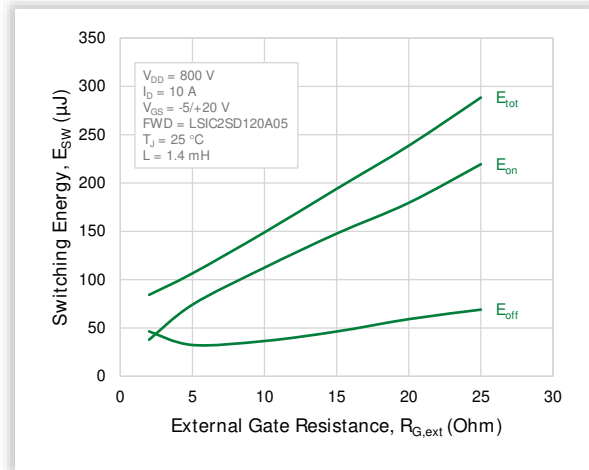
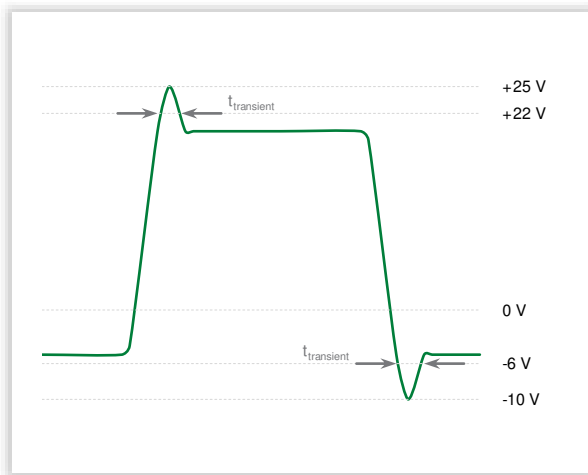
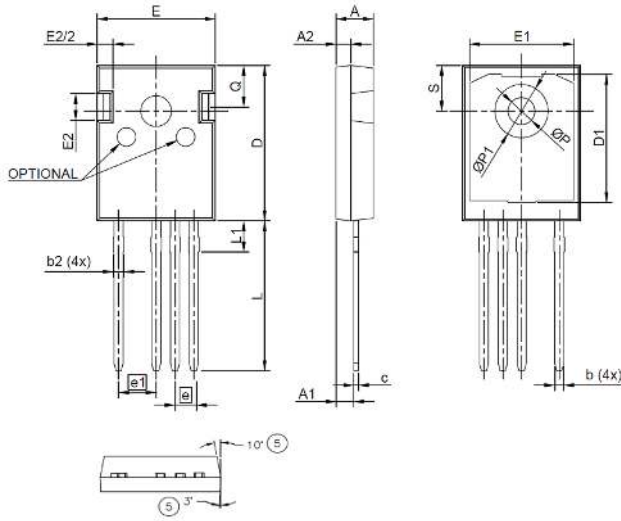


Figure 21.  $V_{GS}$  Waveform Definitions

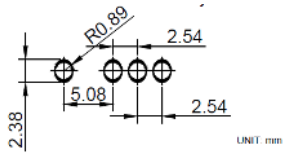




6. Package Dimensions



Recommended Hole Pattern Layout:

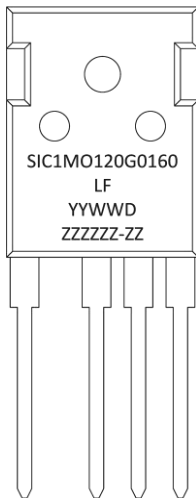


Notes:

1. 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.  $\phi P$  to have a maximum draft angle of 1.7° to the top with a maximum hole diameter of 3.912 mm.

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
$\phi P$	3.56	3.66
$\phi P1$	7.06	7.39
Q	5.38	6.20
S	6.17 BSC	

7. Part Numbering and Marking

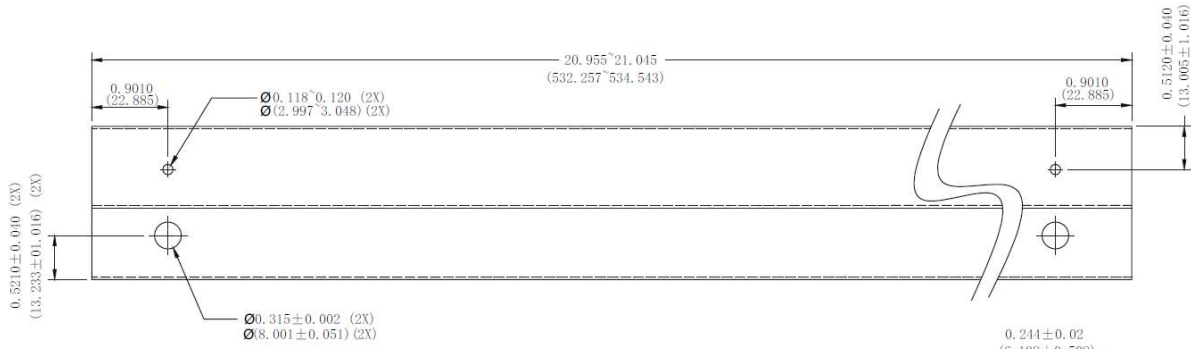


- SiC = SiC
- 1 = Gen 1
- MO = MOSFET
- 120 = Voltage Rating (1200 V)
- G = TO-247-4L
- 0160 =  $R_{DS(ON)}$  (160 mOhm)
- YY = Year
- WW = Week
- D = Special Code
- ZZZZZZ-ZZ = Lot Number

8. Packing Options

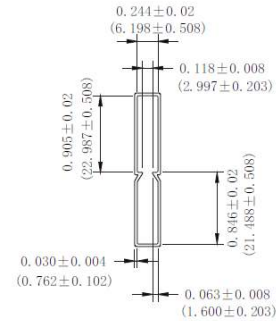
Part Number	Marking	Packing Mode	M.O.Q.
LSIC1MO120G0160	SIC1MO120G0160	Tube (30 pcs)	450

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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