

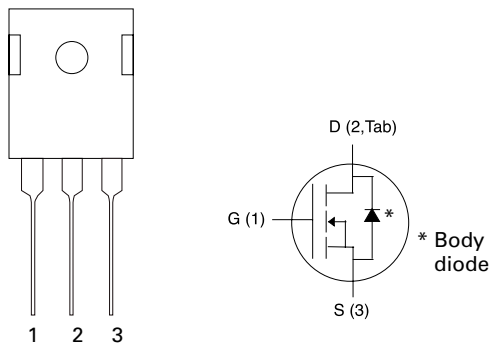
LSIC1MO120E0160 1200 V N-channel, Enhancement-mode SiC MOSFET



**Product Summary**

Characteristics	Value	Unit
$V_{DS}$	1200	V
Typical $R_{DS(ION)}$	160	m $\Omega$
$I_D$ ( $T_C \leq 100^\circ C$ )	14	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
- Halogen-free, RoHS compliant and lead-free

**Environmental**

- Littelfuse "RoHS" logo = RoHS conform
- Littelfuse "HF" logo = Halogen Free
- Littelfuse "Pb-free" logo = 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	$I_D$	$V_{GS} = 20\text{ V}, T_C = 25\text{ }^\circ\text{C}$	22	A
		$V_{GS} = 20\text{ V}, T_C = 100\text{ }^\circ\text{C}$	14	
Pulsed Drain Current <sup>1</sup>	$I_{D(pulse)}$	$T_C = 25\text{ }^\circ\text{C}$	44	A
Power Dissipation	$P_D$	$T_C = 25\text{ }^\circ\text{C}, T_J = 150\text{ }^\circ\text{C}$	125	W
Operating Junction Temperature	$T_J$		-55 to 150	$^\circ\text{C}$
Gate-source Voltage	$V_{GS,MAX}$	Absolute maximum values	-6 to 22	V
	$V_{GS,OP,TR}$	Transient, <1% duty cycle	-10 to 25	
	$V_{GS,OP}$	Recommended DC operating values	-5 to 20	
Storage Temperature	$T_{STG}$	-	-55 to 150	$^\circ\text{C}$
Lead Temperature for Soldering	$T_{solid}$	-	260	$^\circ\text{C}$
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	Value	Unit
Maximum Thermal Resistance, junction-to-case	$R_{th,JC,max}$	1.0	$^\circ\text{C/W}$
Maximum Thermal Resistance, junction-to-ambient	$R_{th,JA,max}$	40	$^\circ\text{C/W}$

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

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Static Characteristics						
Drain-source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	1200	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	-	1	100	$\mu\text{A}$
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	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	$R_{DS(ON)}$	$I_D = 10\text{ A}, V_{GS} = 20\text{ V}$	-	160	200	m $\Omega$
		$I_D = 10\text{ A}, V_{GS} = 20\text{ V}, T_J = 150\text{ }^\circ\text{C}$	-	210	-	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 5\text{ mA}$	1.8	2.8	4.0	V
		$V_{DS} = V_{GS}, I_D = 5\text{ mA}, T_J = 150\text{ }^\circ\text{C}$	-	1.9	-	
Gate Resistance	$R_G$	Resonance method, Drain-Source shorted	-	0.95	-	$\Omega$

### Electrical Characteristics (T<sub>J</sub> = 25 °C unless otherwise specified)

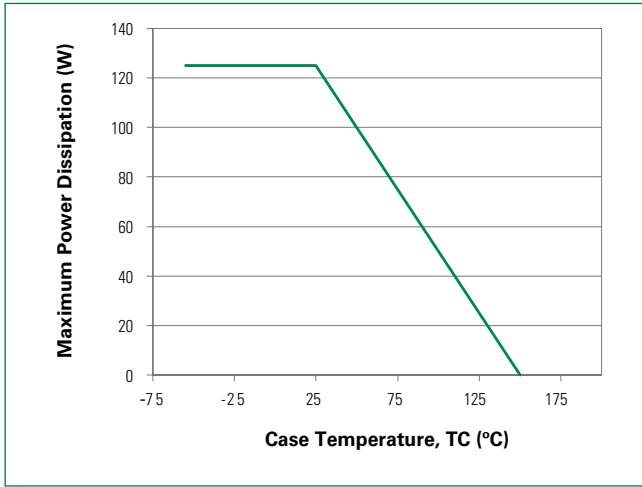
Characteristics	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Dynamic Characteristics						
Turn-on Switching Energy	E <sub>ON</sub>	V <sub>DD</sub> = 800 V, I <sub>D</sub> = 10 A, V <sub>GS</sub> = -5/+20 V, R <sub>G,ext</sub> = 5 Ω, L = 1.4mH, FWD=LSIC2SD120A05	-	77	-	μJ
Turn-off Switching Energy	E <sub>OFF</sub>		-	59	-	
Total Per-cycle Switching Energy	E <sub>TS</sub>		-	136	-	
Input Capacitance	C <sub>ISS</sub>	V <sub>DD</sub> = 800 V, V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>AC</sub> = 25 mV	-	870	-	pF
Output Capacitance	C <sub>OSS</sub>		-	45	-	
Reverse Transfer Capacitance	C <sub>RSS</sub>		-	7	-	
C <sub>OSS</sub> Stored Energy	E <sub>OSS</sub>		-	14	-	
Total Gate Charge	Q <sub>g</sub>	V <sub>DD</sub> = 800 V, I <sub>D</sub> = 10 A, V <sub>GS</sub> = -5/+20 V	-	57	-	nC
Gate-source Charge	Q <sub>gs</sub>		-	14	-	
Gate-drain Charge	Q <sub>gd</sub>		-	20	-	
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 800 V, V <sub>GS</sub> = -5/+20 V, I <sub>D</sub> = 10 A, R <sub>G,ext</sub> = 5 Ω, R <sub>L</sub> = 80 Ω, Timing relative to V <sub>DS</sub>	-	12	-	ns
Rise Time	t <sub>r</sub>		-	8	-	
Turn-off Delay Time	t <sub>d(off)</sub>		-	19	-	
Fall Time	t <sub>f</sub>		-	14	-	

### Reverse Diode Characteristics

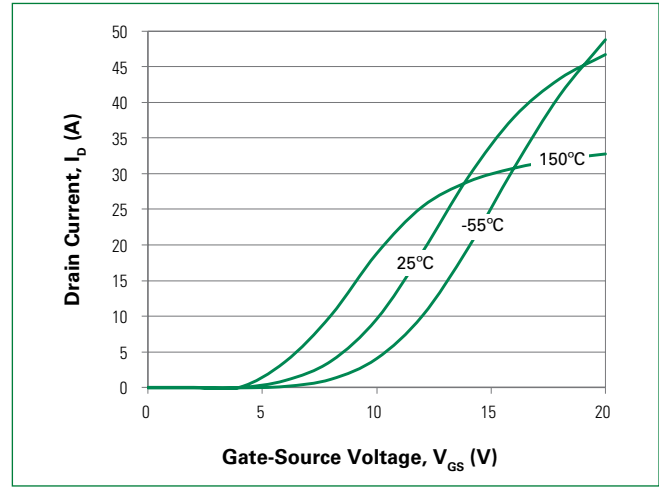
Characteristics	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> = 5 A, V <sub>GS</sub> = 0 V	-	3.8	-	V
		I <sub>S</sub> = 5 A, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 150 °C	-	3.4	-	
Continuous Diode Forward Current	I <sub>S</sub>	V <sub>GS</sub> = 0 V, T <sub>C</sub> = 25 °C	-	-	24	A
Peak Diode Forward Current <sup>1</sup>	I <sub>SP</sub>		-	-	44	

Footnote 1: Pulse width limited by T<sub>J,max</sub>

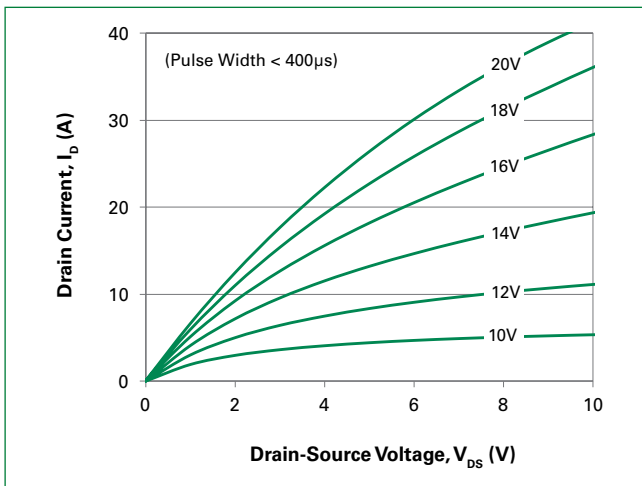
**Figure 1: Maximum Power Dissipation ( $T_j = 150\text{ }^\circ\text{C}$ )**



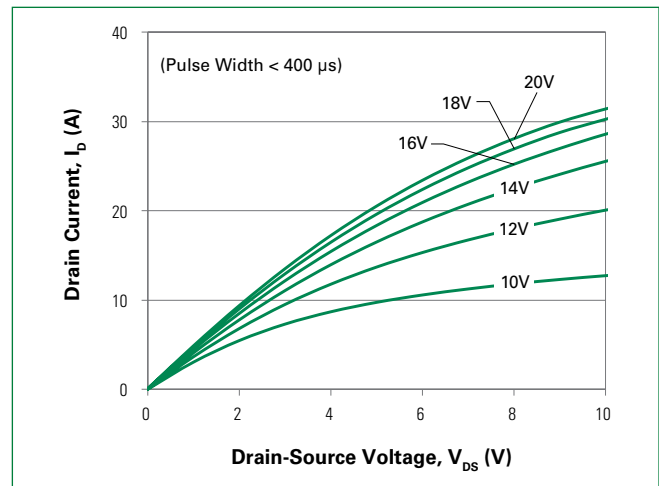
**Figure 2: Transfer Characteristics ( $V_{DS} = 10\text{ V}$ )**



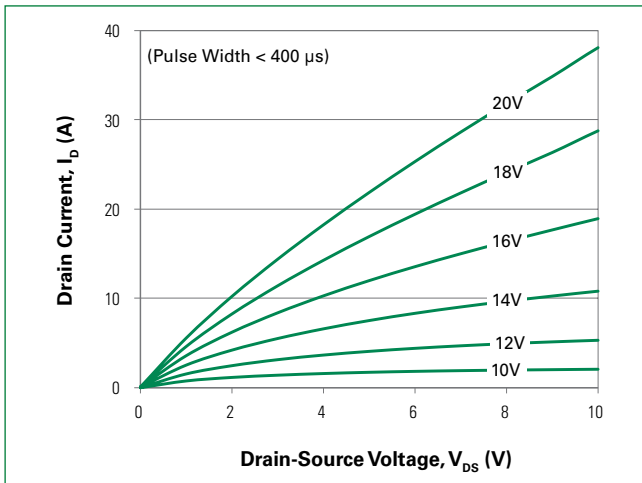
**Figure 3: Output Characteristics ( $T_j = 25\text{ }^\circ\text{C}$ )**



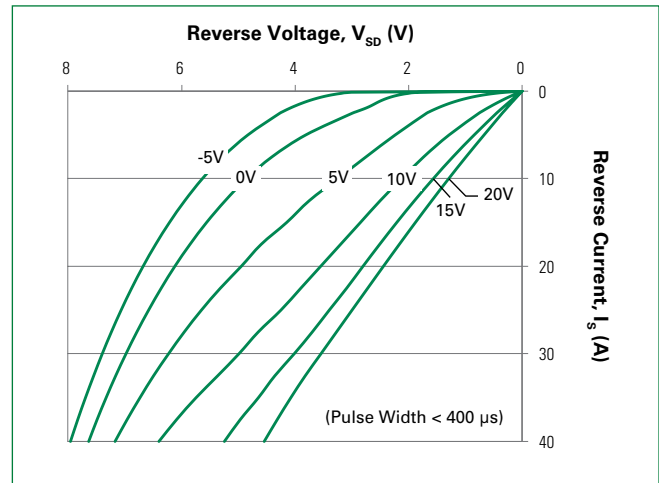
**Figure 4: Output Characteristics ( $T_j = 150\text{ }^\circ\text{C}$ )**



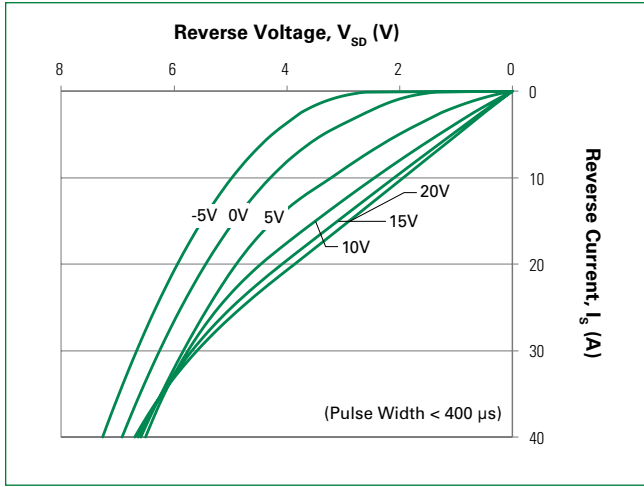
**Figure 5: Output Characteristics ( $T_j = -55\text{ }^\circ\text{C}$ )**



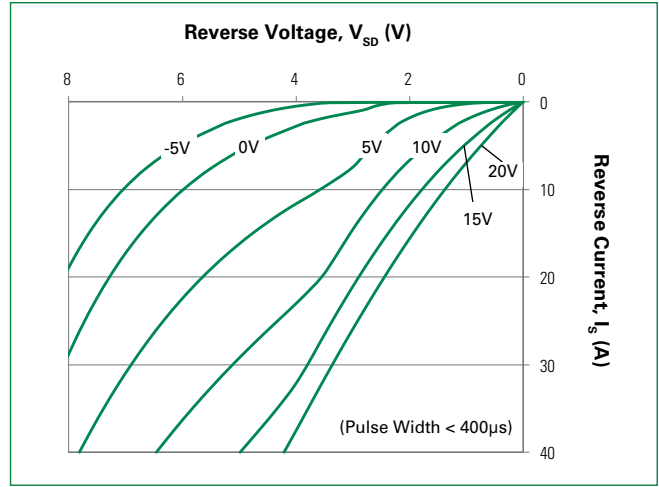
**Figure 6: Reverse Conduction Characteristics ( $T_j = 25\text{ }^\circ\text{C}$ )**



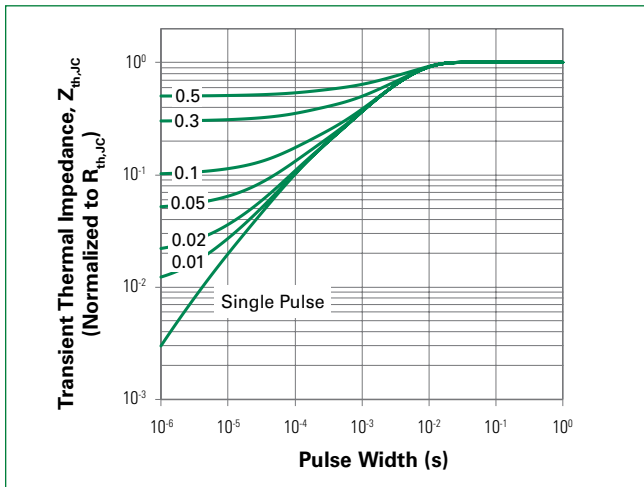
**Figure 7: Reverse Conduction Characteristics ( $T_j = 150^\circ\text{C}$ )**



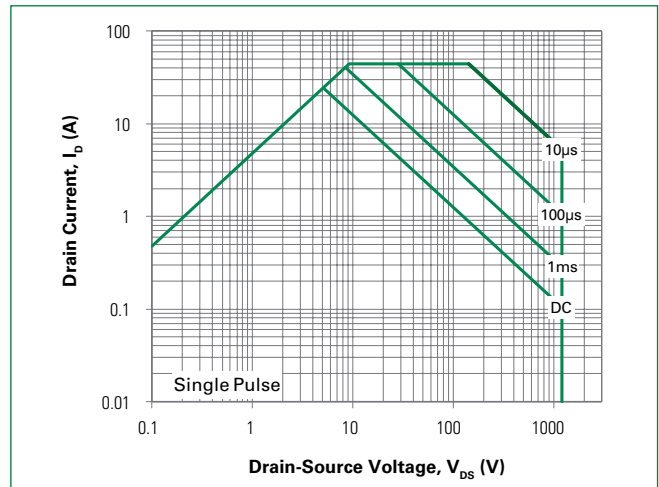
**Figure 8: Reverse Conduction Characteristics ( $T_j = -55^\circ\text{C}$ )**



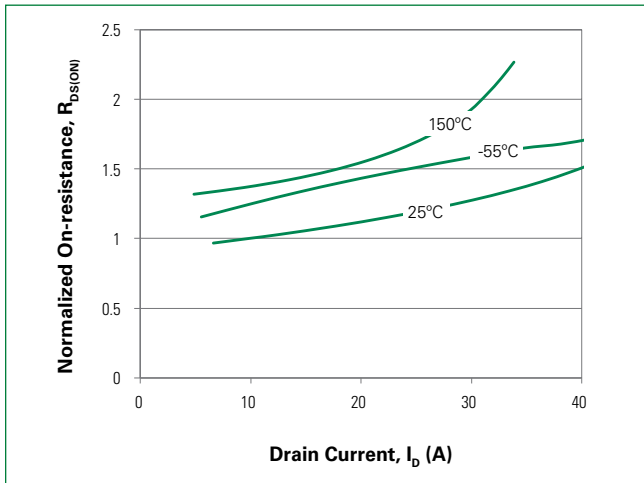
**Figure 9: Transient Thermal Impedance**



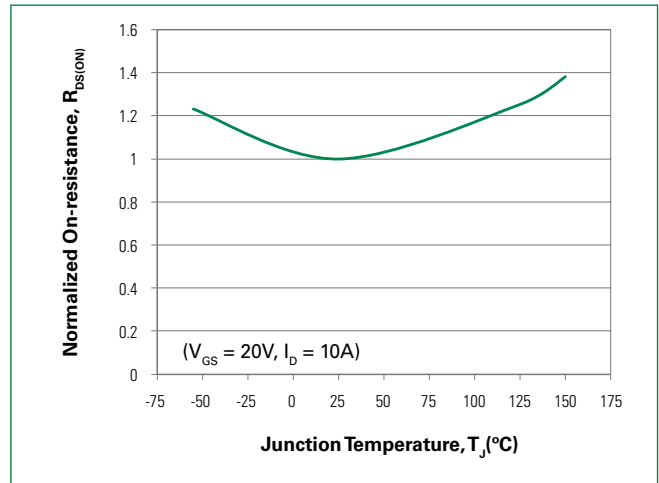
**Figure 10: Safe Operating Area ( $T_c = 25^\circ\text{C}$ )**



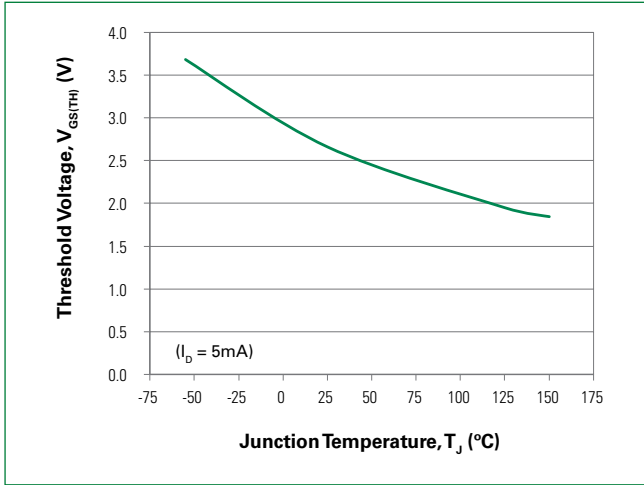
**Figure 11: On-resistance vs. Drain Current**



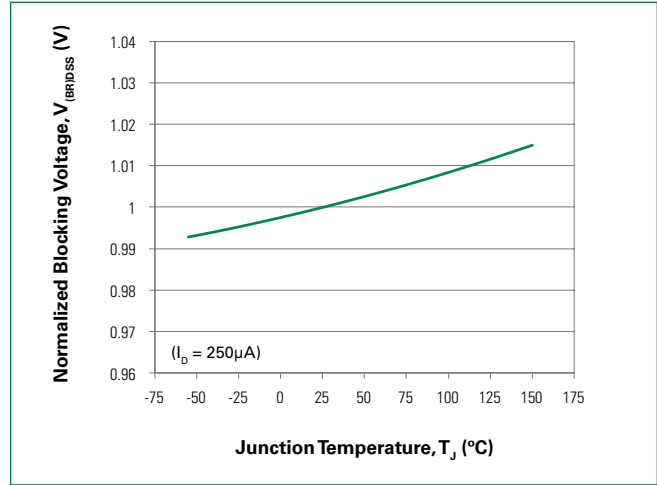
**Figure 12: Normalized On-resistance**



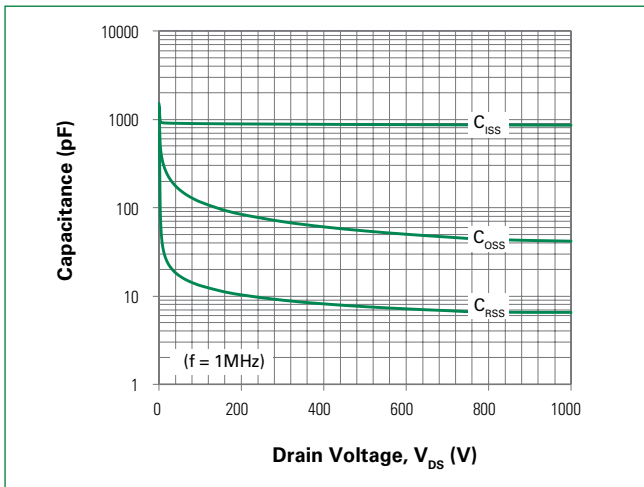
**Figure 13: Threshold Voltage**



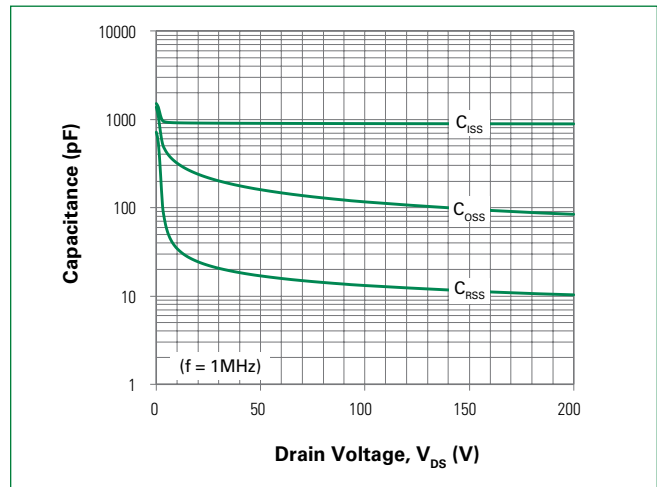
**Figure 14: Drain-Source Blocking Voltage**



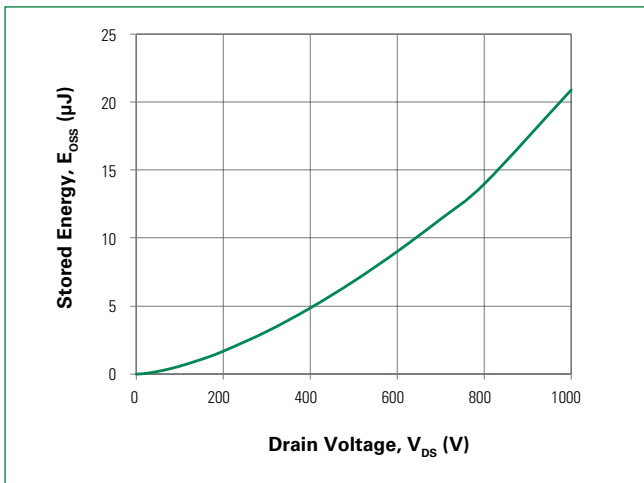
**Figure 15: Junction Capacitances**



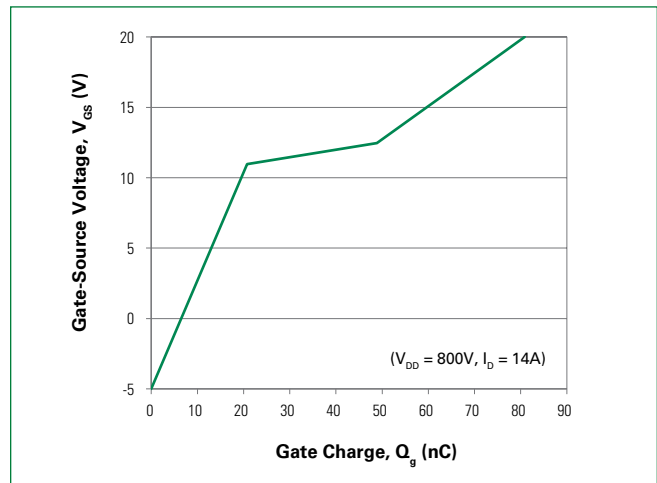
**Figure 16: Junction Capacitances**



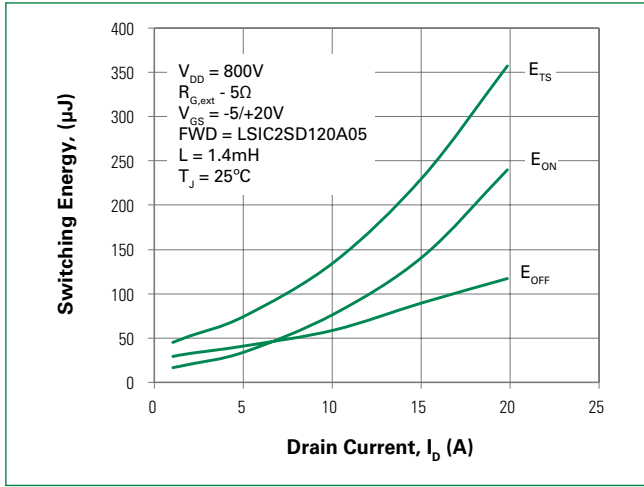
**Figure 17:  $C_{OSS}$  Stored Energy  $E_{OSS}$**



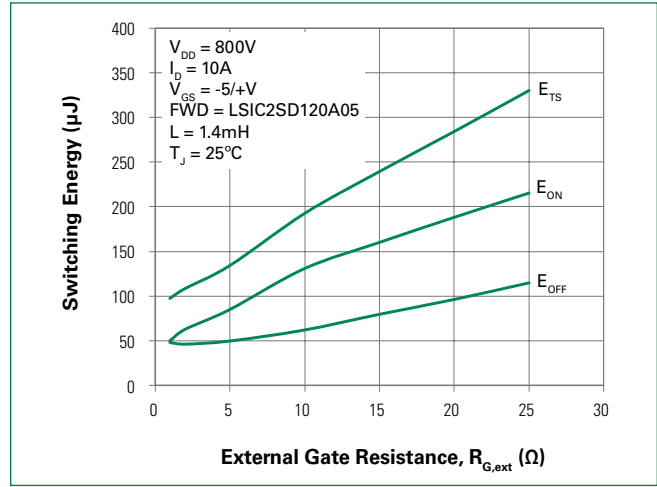
**Figure 18: Gate Charge**



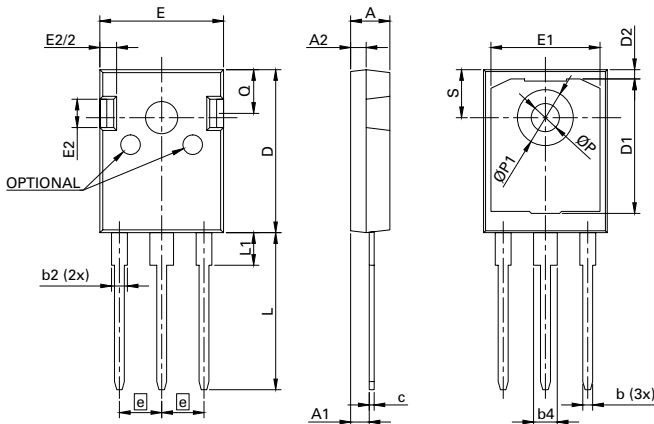
**Figure 19: Switching Energy vs. Drain Current**



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

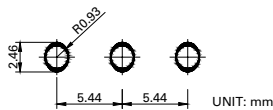


**Package Dimensions TO-247-3L**



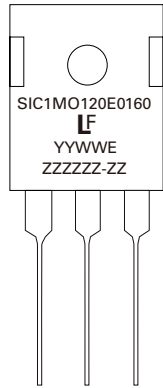
- Notes:
1. Dimensions are in millimeters
  2. Dimension D, E do not include mold flash. Mold flash shall not exceed 0.127 mm per side measured at outer most extreme of plastic body.
  3.  $\phi P$  to have a maximum draft angle of 38.1 mm to the top of the part with a maximum hole diameter of 3.912 mm.

**Recommended Hole Pattern Layout**



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

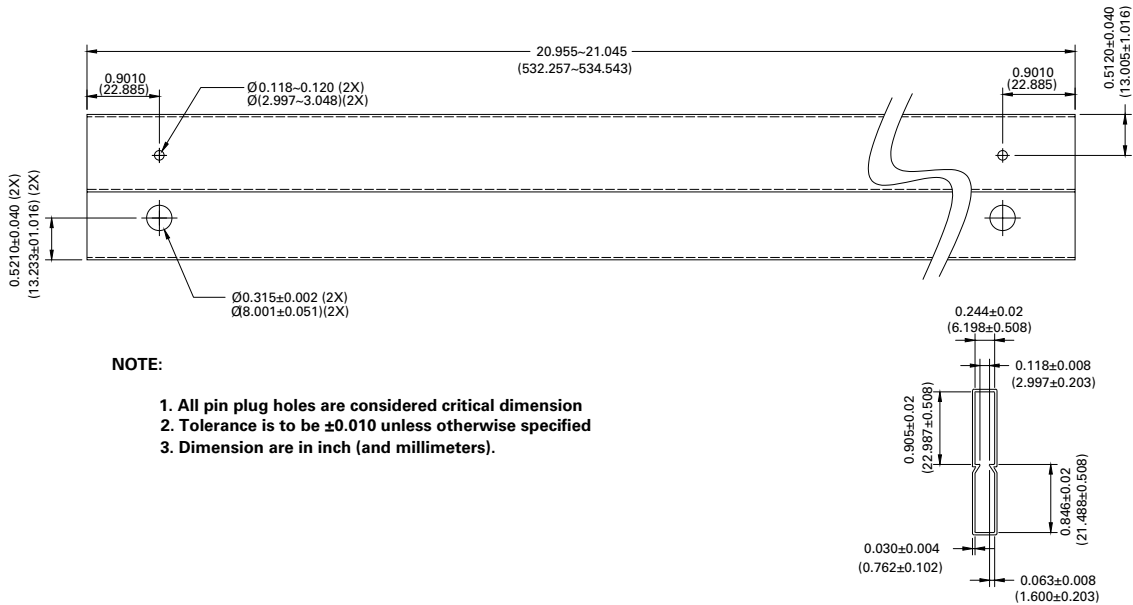


**SIC** = SiC  
**1** = Gen1  
**MO** = MOSFET  
**120** = Voltage Rating (1200 V)  
**E** = TO-247-3L  
**0160** =  $R_{DS(ON)}$  (160 mOhm)  
**YY** = Year  
**WW** = Week  
**E** = Special Code  
**ZZZZZZ-ZZ** = Lot Number

### Packing Options

Part Number	Marking	Packing Mode	M.O.Q
LSIC1MO120E0160	SIC1MO120E0160	Tube (30pcs)	450

### Packing Specification TO-247-3L



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