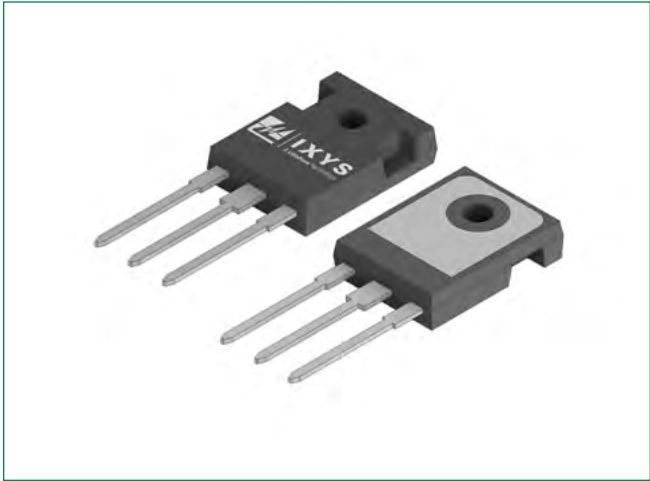


LSIC1M0120E0160

1200V N-Channel, Enhancement-mode SiC MOSFET

HF **RoHS** **Pb**



Product Summary

Characteristics	Value	Unit
V_{DS}	1200	V
Typical $R_{DS(ON)}$	160	m Ω
I_D ($T_C \leq 100^\circ\text{C}$)	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 operation at all temperatures
- Halogen-free, lead-free, and RoHS-compliant

Additional Information



Resources



Accessories

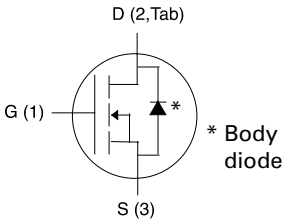
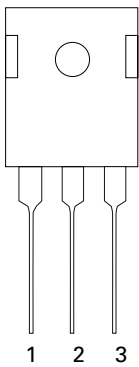


Samples

Applications

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

Circuit Diagram



LSIC1M0120E0160**1200V N-Channel, Enhancement-mode SiC MOSFET****Maximum Ratings**

Characteristic	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}	$V_{GS} = 0V$	1200	V
Continuous Drain Current	I_D	$V_{GS} = 20V, T_C = 25^\circ C$	20	A
		$V_{GS} = 20V, T_C = 100^\circ C$	14	
Pulsed Drain Current ¹	$I_{D(pulse)}$	$T_C = 25^\circ C$	45	A
Power Dissipation	P_D	$T_C = 25^\circ C, T_J = 175^\circ C$	125	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	$^\circ C$
Storage Temperature	T_{STG}	-	-55 to +150	$^\circ C$
Lead Temperature for Soldering	T_{solder}	-	260	$^\circ C$
Mounting Torque	M_D	M3 or 6-32 screw	1.0	Nm
			8.8	in-lb
ESD Sensitivity Rating	HBM ESD	Maximum Withstand Voltage	750	V
	CDM ESD	Maximum Withstand Voltage	1000	

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

2. See Figure 21 for further information

3. MOSFET can operate with $V_{GS(OFF)} = 0V$, $V_{GS(ON)} = -5V$ provides added noise margin and faster turn-off speed**Thermal Characteristics**

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

Electrical Characteristics - Static Characteristics ($T_J = 25^\circ C$ unless otherwise specified)

Characteristic	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 100 \mu A$	1200	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 1200V, V_{GS} = 0V$	-	<1	100	μA
		$V_{DS} = 1200V, V_{GS} = 0V, T_J = 175^\circ C$	-	<1	-	
Gate Leakage Current	$I_{GSS, F}$	$V_{GS} = 22V, V_{DS} = 0V$	-	-	100	nA
	$I_{GSS, R}$	$V_{GS} = -6V, V_{DS} = 0V$	-	-	100	
Drain-Source On-State Resistance	$R_{DS(ON)}$	$I_D = 10A, V_{GS} = 20V$	-	160	200	m Ω
		$I_D = 10A, V_{GS} = 20V, T_J = 175^\circ C$	-	230	-	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 5mA$	1.8	2.8	4.0	V
		$V_{DS} = V_{GS}, I_D = 5mA, T_J = 175^\circ C$	-	1.8	-	
Gate Resistance	R_G	Resonance method, Drain-Source shorted ¹	-	0.85	-	Ω

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

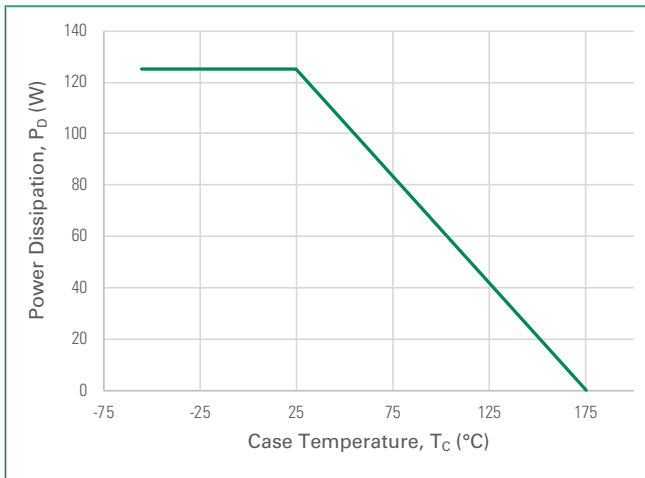
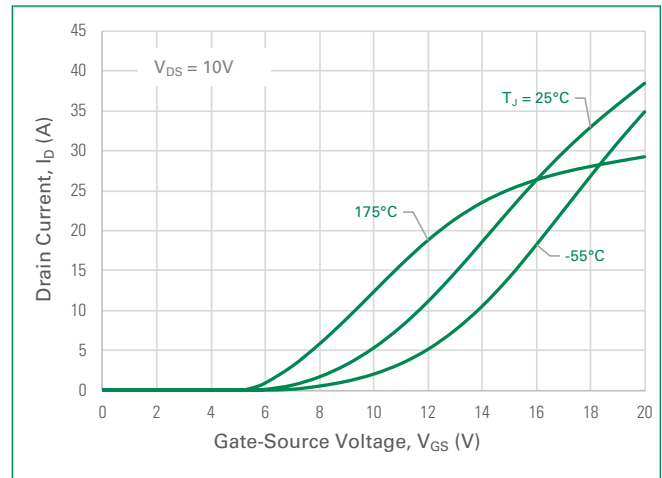
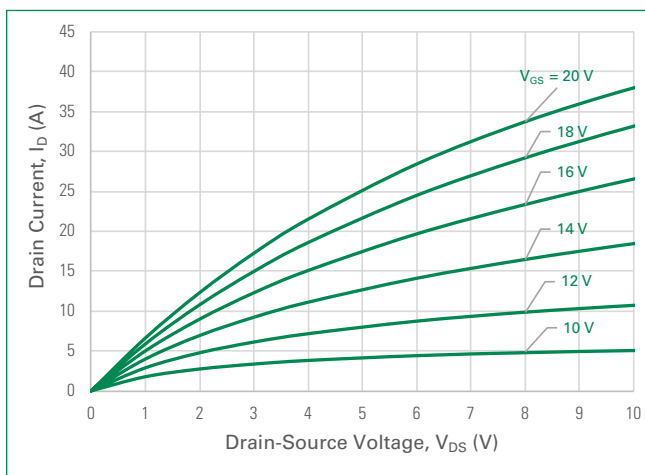
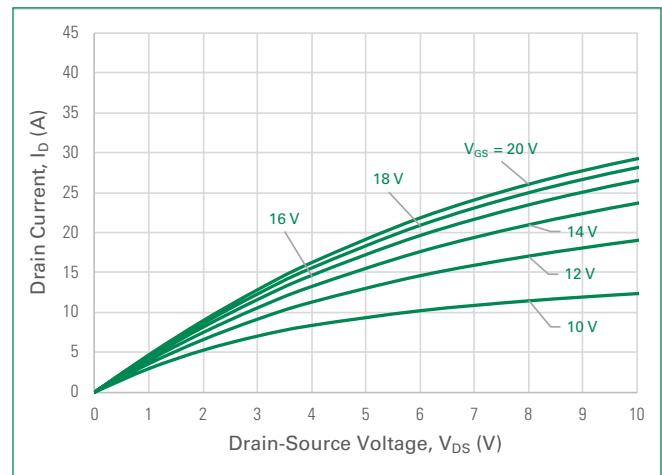
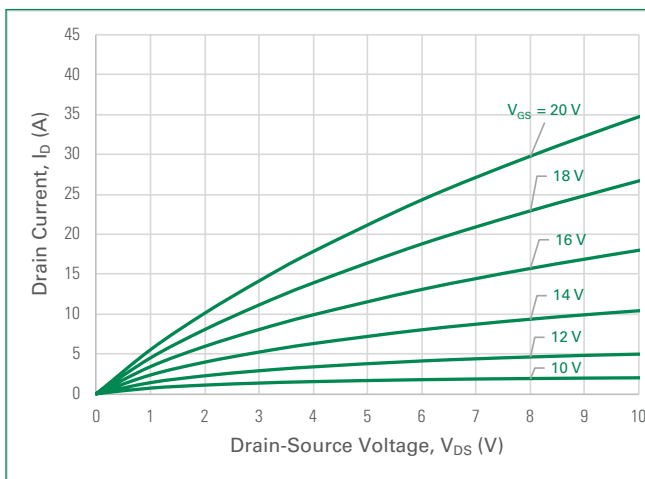
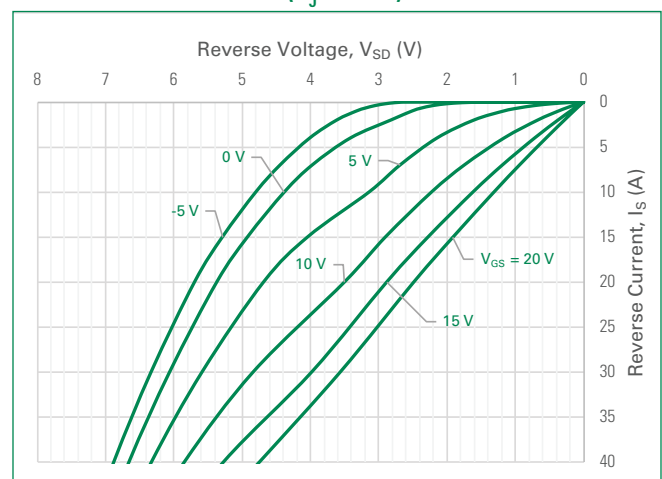
LSIC1M0120E0160**1200V N-Channel, Enhancement-mode SiC MOSFET****Electrical Characteristics - Dynamic Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise specified)**

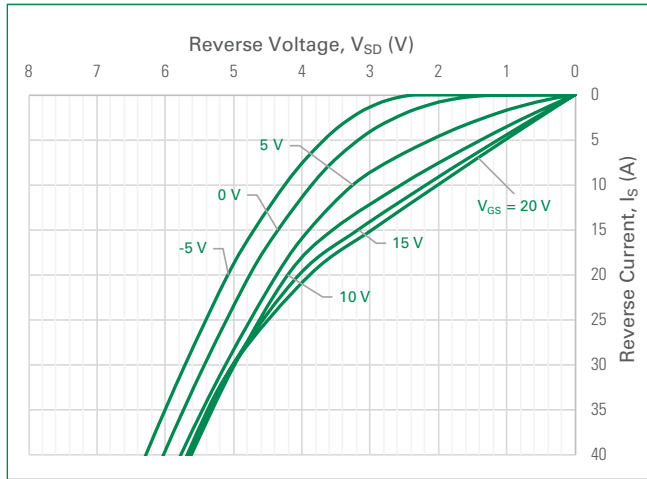
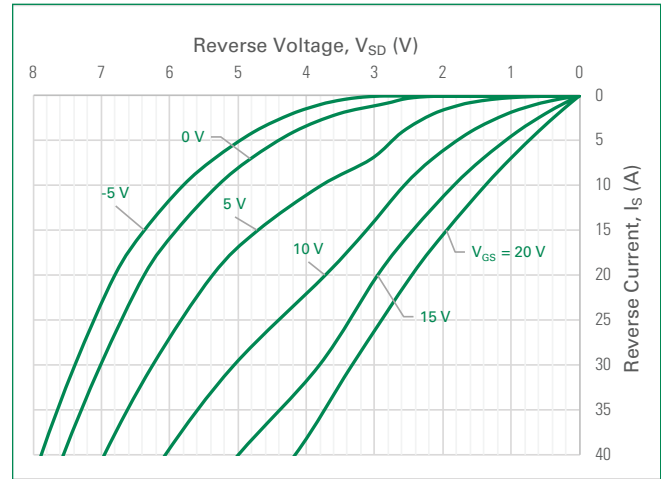
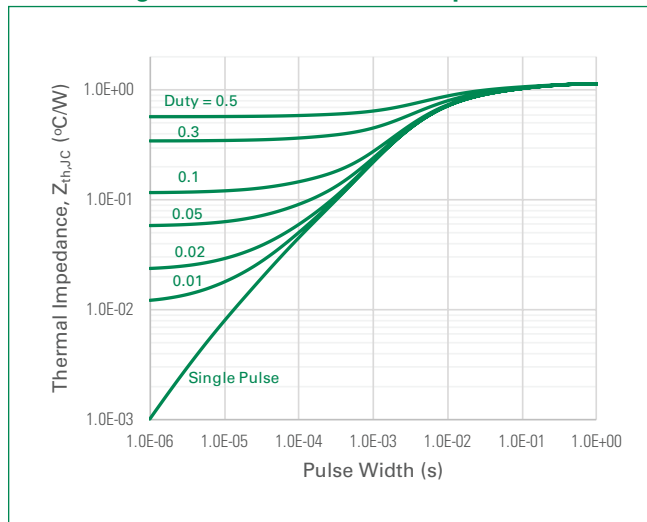
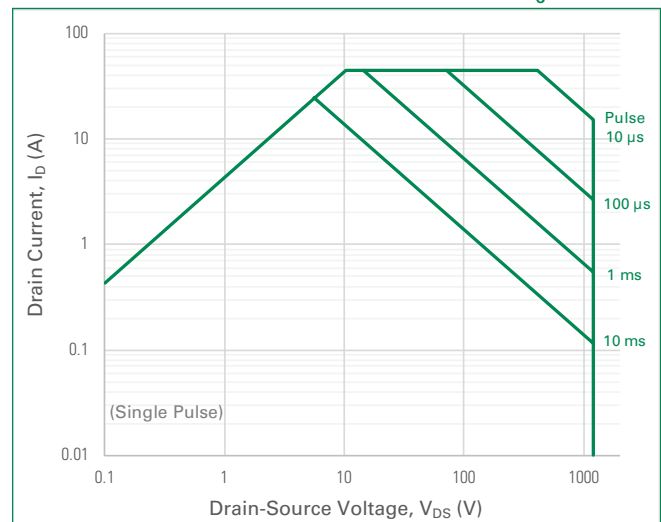
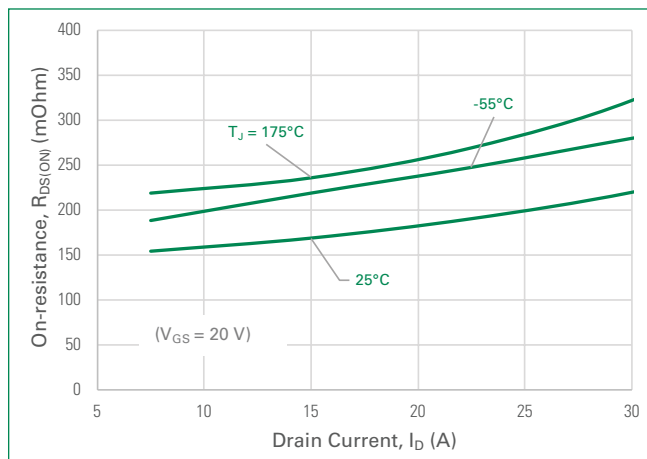
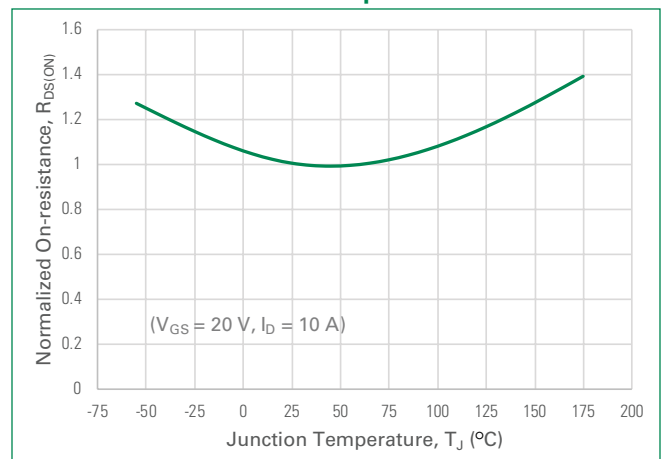
Characteristic	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Turn-On Switching Energy	E_{ON}	$V_{DD} = 800\text{ V}, I_D = 10\text{ A},$ $V_{GS} = -5 / +20\text{ V},$ $R_{G,ext} = 5\ \Omega, L = 1.4\text{ mH},$ FWD = LSIC2SD120A05	–	140	–	μJ
Turn-Off Switching Energy	E_{OFF}		–	22	–	
Total Per-Cycle Switching Energy	E_{TS}		–	162	–	
Input Capacitance	C_{ISS}	$V_{DD} = 800\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	–	890	–	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	–	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}	–	12	–	ns
Rise Time	t_r		–	9	–	
Turn-Off Delay Time	$t_{d(off)}$		–	17	–	
Fall Time	t_f		–	9	–	

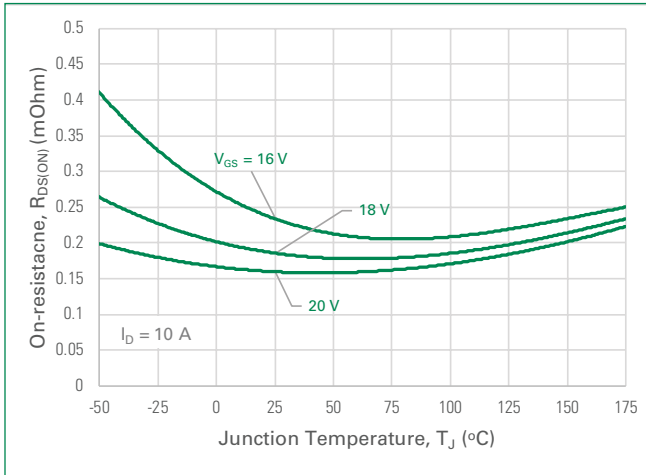
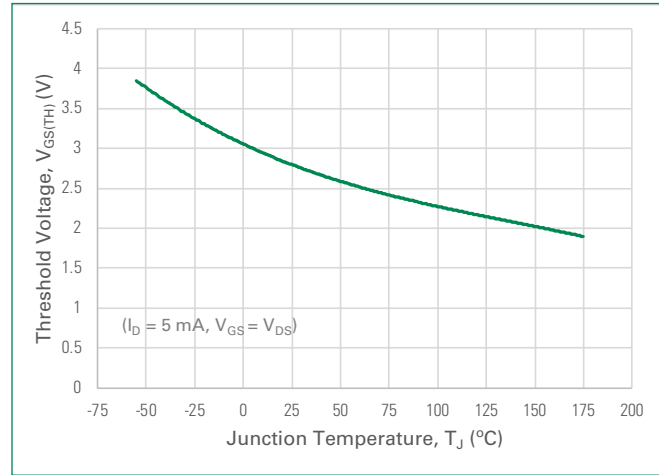
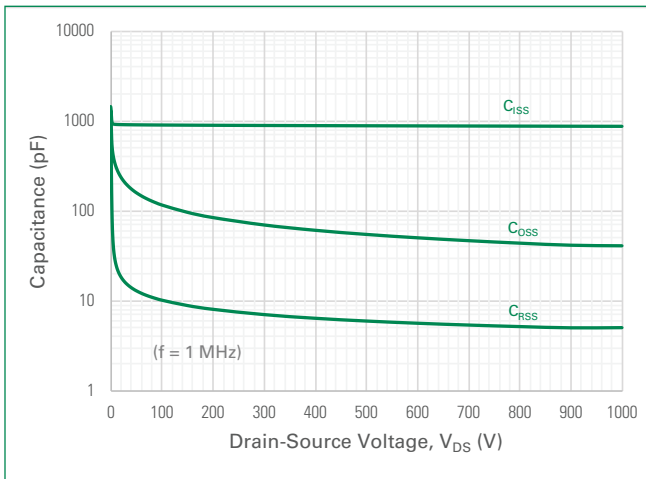
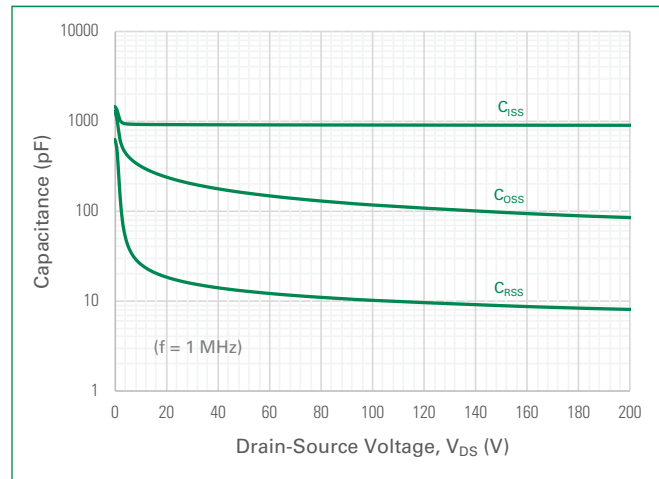
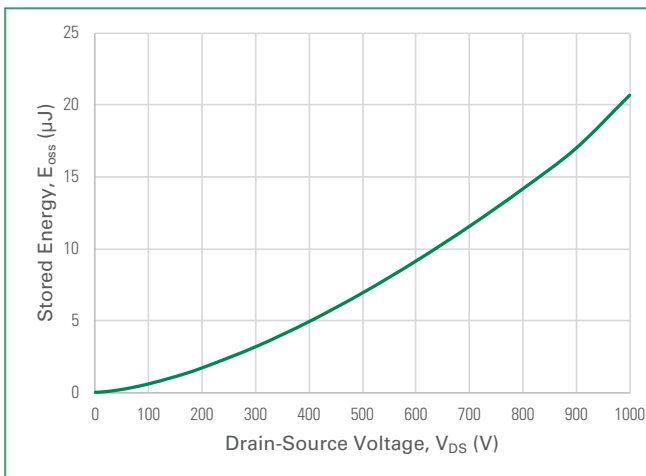
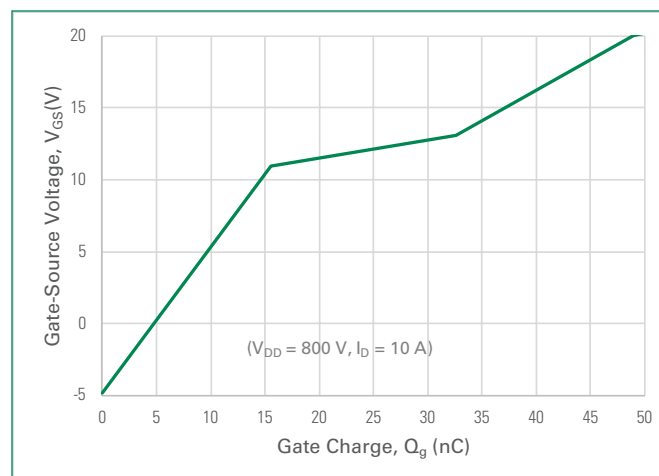
Reverse Diode Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise specified)

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	–	V
		$I_S = 5\text{ A}, V_{GS} = -5\text{ V}, T_J = 175^\circ\text{C}$	–	3.7	–	
Continuous Diode Forward Current	I_S	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$	–	–	21	A
Peak Diode Forward Current ¹	I_{SP}		–	–	45	
Reverse Recovery Time	t_{rr}	$V_{GS} = -5\text{ V}, I_S = 10\text{ A},$ $V_R = 800\text{ V},$ $di/dt = 3.4\text{ A/ns}$	–	17	–	ns
Reverse Recovery Charge	Q_{rr}		–	87	–	nC
Peak Reverse Recovery Current	I_{rrm}		–	7	–	A

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

LSIC1M0120E0160**1200V N-Channel, Enhancement-mode SiC MOSFET****Figure 1. Maximum Power Dissipation ($T_J = 175^\circ\text{C}$)****Figure 2. Typical Transfer Characteristics****Figure 3. Typical Output Characteristics ($T_J = 25^\circ\text{C}$)****Figure 4. Typical Output Characteristics ($T_J = 175^\circ\text{C}$)****Figure 5. Typical Output Characteristics ($T_J = -55^\circ\text{C}$)****Figure 6. Typical Reverse Conduction Characteristics ($T_J = 25^\circ\text{C}$)**

LSIC1M0120E0160**1200V N-Channel, Enhancement-mode SiC MOSFET****Figure 7. Typical Reverse Conduction Characteristics ($T_J = 175^\circ\text{C}$)****Figure 8. Typical Reverse Conduction Characteristics ($T_J = -55^\circ\text{C}$)****Figure 9. Transient Thermal Impedance****Figure 10. Maximum Safe Operating Area ($T_C = 25^\circ\text{C}$)****Figure 11. On-resistance vs. Drain Current****Figure 12. Normalized On-resistance vs Junction Temperature**

LSIC1M0120E0160**1200V N-Channel, Enhancement-mode SiC MOSFET****Figure 13. Typical On-resistance vs Junction Temperature (Per V_{GS})****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**

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1200V N-Channel, Enhancement-mode SiC MOSFET

Figure 19. Typical Switching Energy vs Drain Current

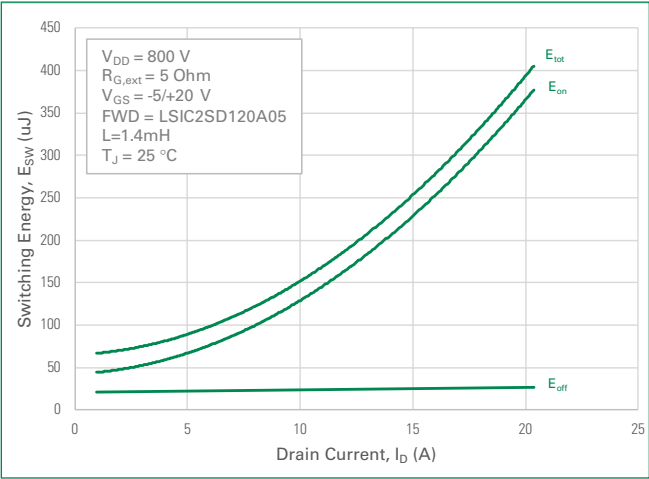


Figure 20. Typical Switching Energy vs External Gate Resistance

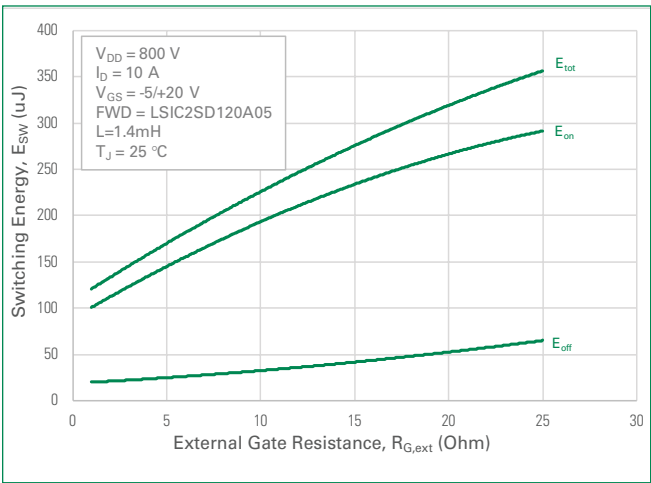
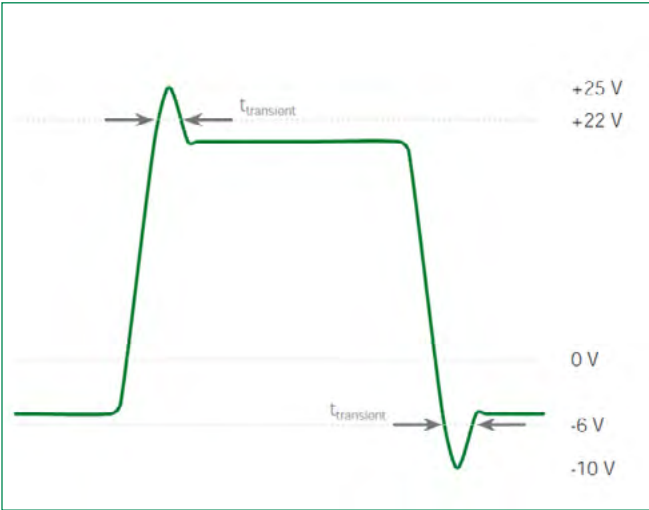


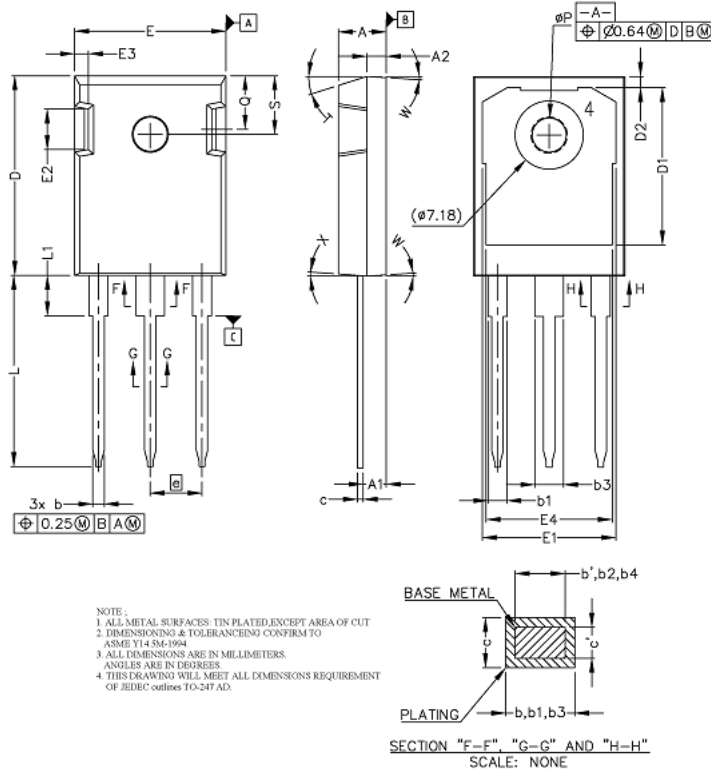
Figure 21. V_{GS} Waveform Definition



LSIC1MO120E0160

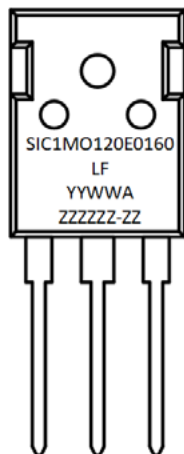
1200V N-Channel, Enhancement-mode SiC MOSFET

Package Dimensions



Symbol	Millimeters	
	Min	Max
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	1.91	2.41
b2	1.91	2.16
b3	2.87	3.38
b4	2.87	3.13
c'	0.55	0.65
c	0.55	0.68
D	20.80	21.10
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	5.44 BSC	
N	3	
L	19.81	20.32
L1	4.10	4.40
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5° REF.	
X	4° REF.	

Part Numbering and Marking



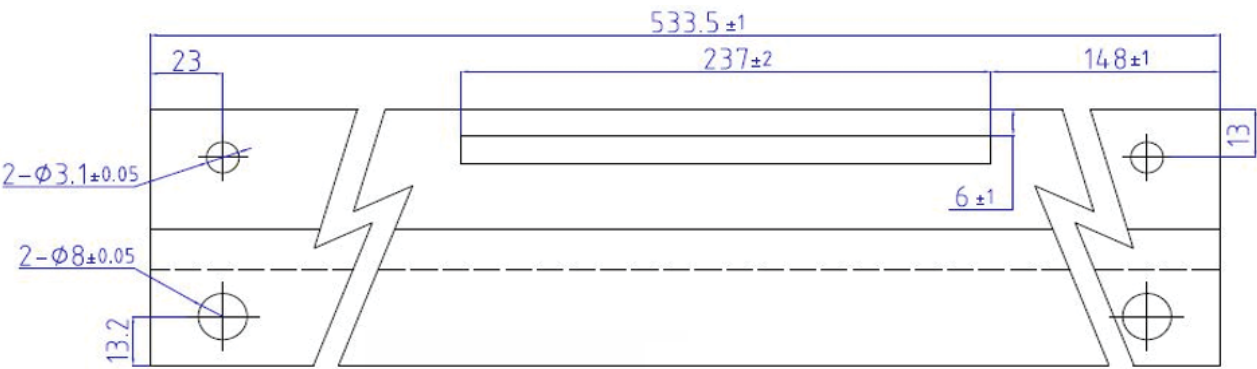
SiC	= SiC
1	= Gen 1
MO	= MOSFET
120	= Voltage Rating (1200 V)
E	= TO-247-3L
0160	= $R_{DS(ON)}$ (160 mOhm)
YY	= Year
WW	= Week
A	= Special Code
ZZZZZZ-ZZ	= Lot Number

Packing Options

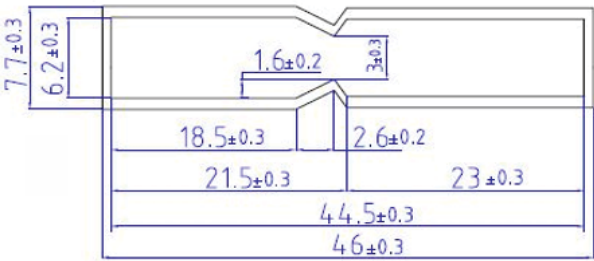
Part Number	Marking	Packing Mode	M.O.Q.
LSIC1MO120E0160	SIC1MO120E0160	Tube (30 Pcs)	450

LSIC1M0120E0160
1200V N-Channel, Enhancement-mode SiC MOSFET

Packing Specifications (Tube Dimensions)



Note: Dimensions in millimeters



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