

**LSIC1M0120E0160**

1200V N-Channel, Enhancement-mode SiC MOSFET

**Product Summary**

Characteristics	Value	Unit
$V_{DS}$	1200	V
Typical $R_{DS(ON)}$	160	m $\Omega$
$I_D$ ( $T_C \leq 100^\circ\text{C}$ )	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



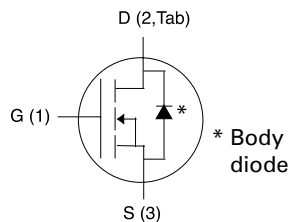
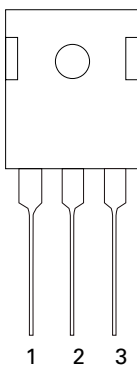
Accessories



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 <sup>1</sup>	$I_{D(pulse)}$	$T_C = 25^\circ C$	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, $t_{transient} < 300$ 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	$T_{sold}$	-	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  $V_{GS(OP)} = 0V, V_{GS(OP)} = -5V$  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	$\mu A$
		$V_{DS} = 1200V, V_{GS} = 0V, T_J = 175^\circ C$	-	<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 $\Omega$
		$I_D = 10A, V_{GS} = 20V, T_J = 175^\circ C$	-	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 <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.

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### 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	–	$\mu\text{J}$
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	–	$\text{pF}$
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 $V_{DS}$	–	12	–	$\text{ns}$
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)

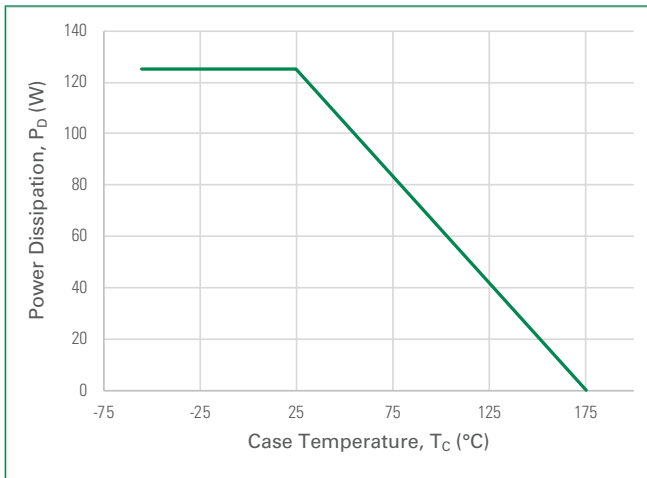
Characteristic	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Diode Forward Voltage	$V_{SD}$	$I_S = 5\text{ A}, V_{GS} = -5\text{ V}$	–	4.2	–	$\text{V}$
		$I_S = 5\text{ A}, V_{GS} = -5\text{ V}, T_J = 175^\circ\text{C}$	–	3.7	–	
Continuous Diode Forward Current	$I_S$	$V_{GS} = -5\text{ V}, T_C = 25^\circ\text{C}$	–	–	21	$\text{A}$
Peak Diode Forward Current <sup>1</sup>	$I_{SP}$		–	–	45	
Reverse Recovery Time	$t_{rr}$	$V_{GS} = -5\text{ V}, I_S = 10\text{ A},$	–	17	–	$\text{ns}$
Reverse Recovery Charge	$Q_{rr}$	$V_R = 800\text{ V},$	–	87	–	$\text{nC}$
Peak Reverse Recovery Current	$I_{rrm}$	$dI/dt = 3.4\text{ A/ns}$	–	7	–	$\text{A}$

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

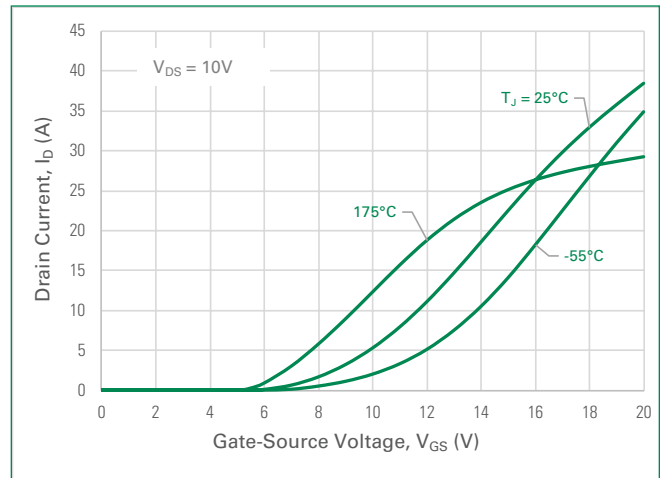
# LSIC1M0120E0160

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

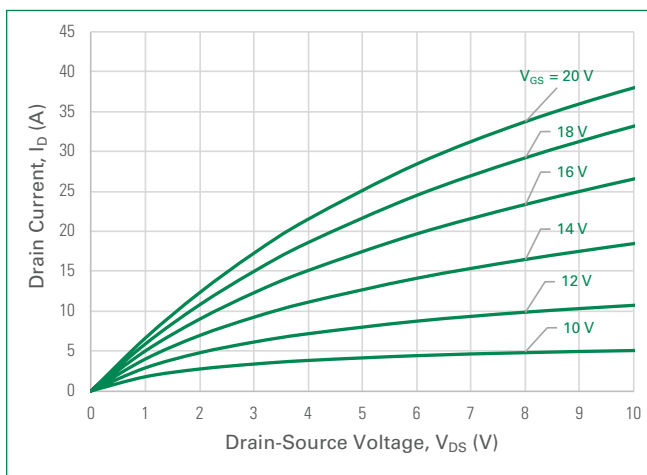
**Figure 1. Maximum Power Dissipation ( $T_J = 175^\circ\text{C}$ )**



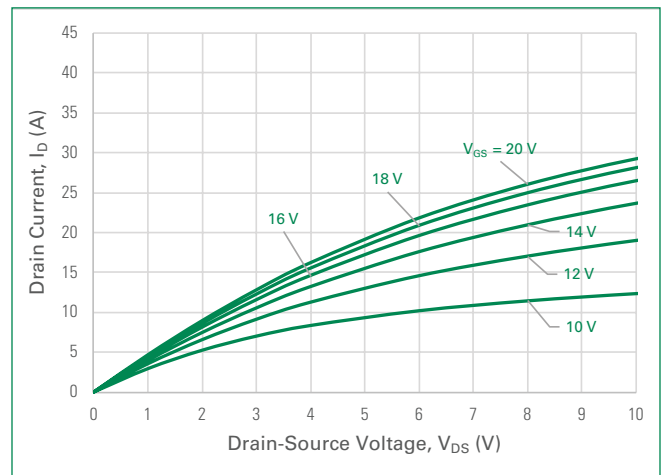
**Figure 2. Typical Transfer Characteristics**



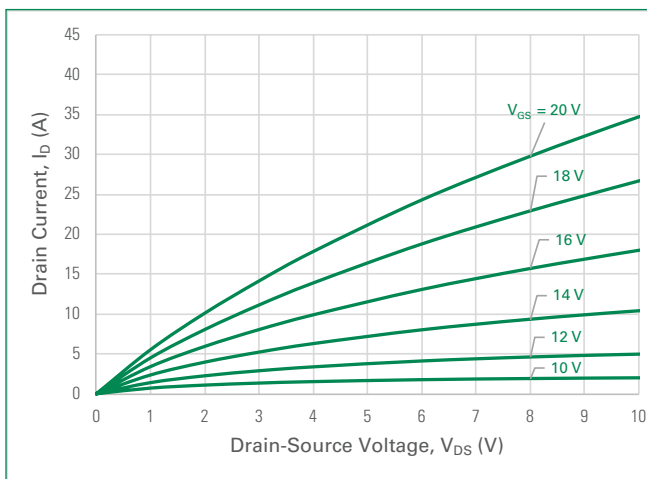
**Figure 3. Typical Output Characteristics ( $T_J = 25^\circ\text{C}$ )**



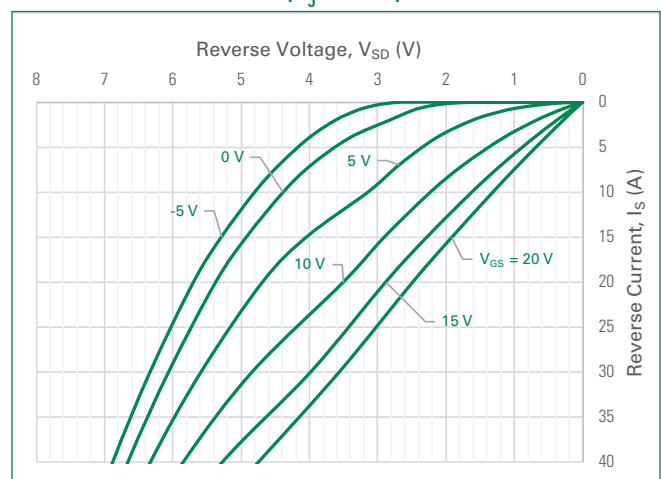
**Figure 4. Typical Output Characteristics ( $T_J = 175^\circ\text{C}$ )**



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



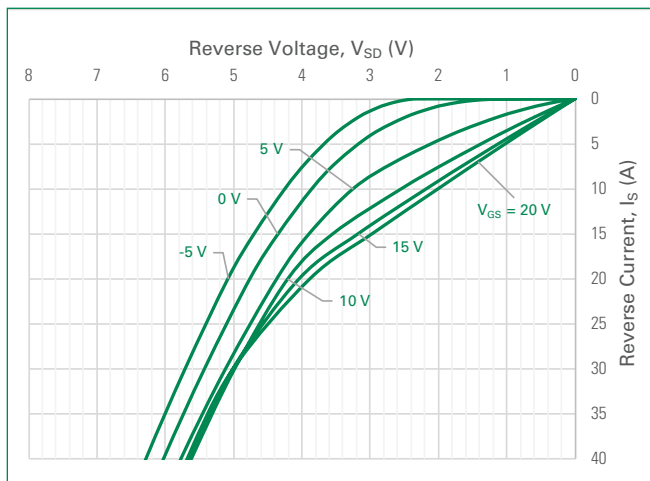
**Figure 6. Typical Reverse Conduction Characteristics ( $T_J = 25^\circ\text{C}$ )**



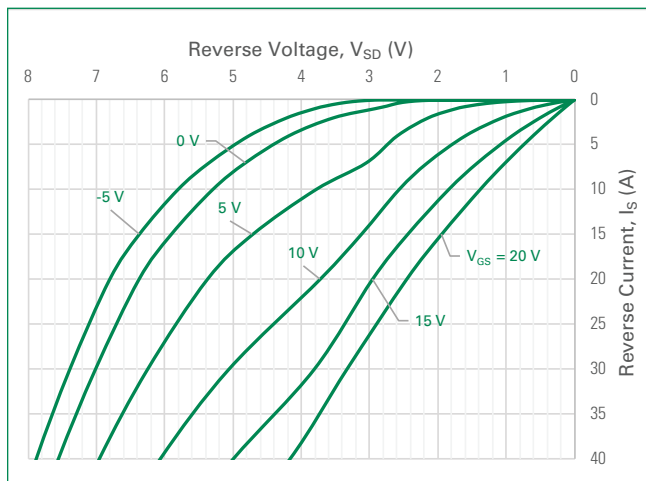
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## 1200V N-Channel, Enhancement-mode SiC MOSFET

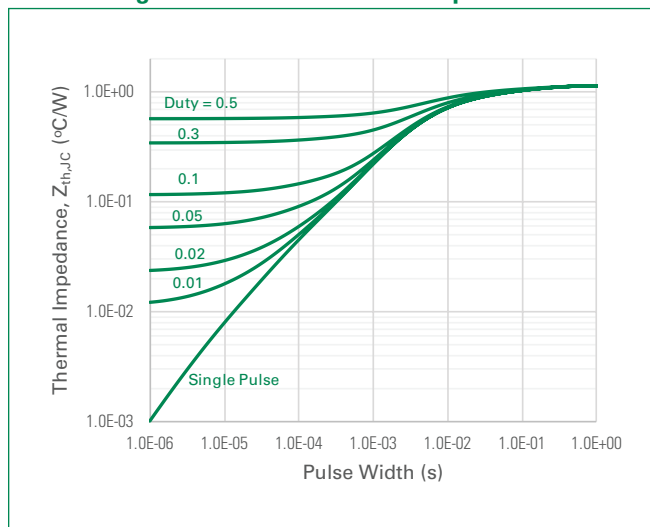
**Figure 7. Typical Reverse Conduction Characteristics ( $T_J = 175^\circ\text{C}$ )**



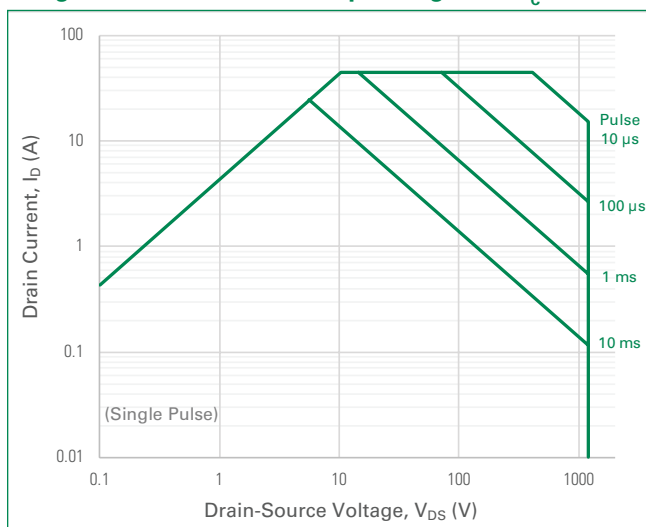
**Figure 8. Typical Reverse Conduction Characteristics ( $T_J = -55^\circ\text{C}$ )**



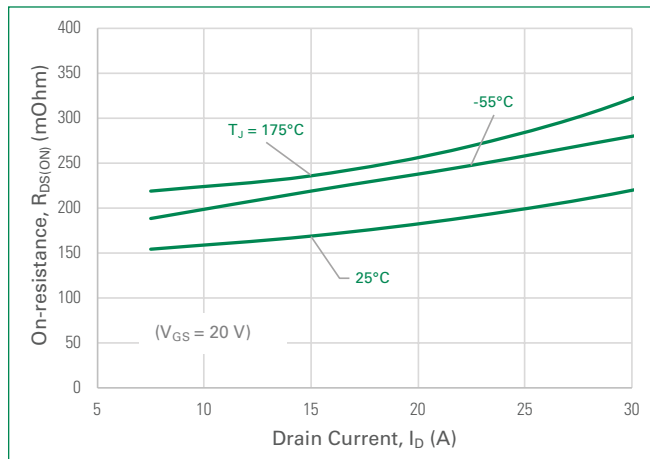
**Figure 9. Transient Thermal Impedance**



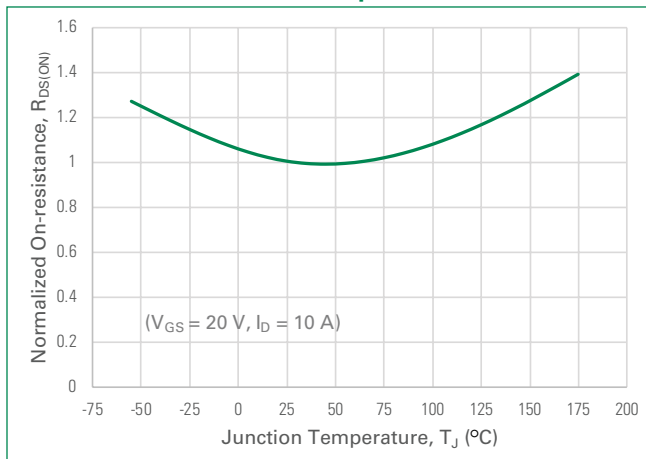
**Figure 10. Maximum Safe Operating Area ( $T_c = 25^\circ\text{C}$ )**



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



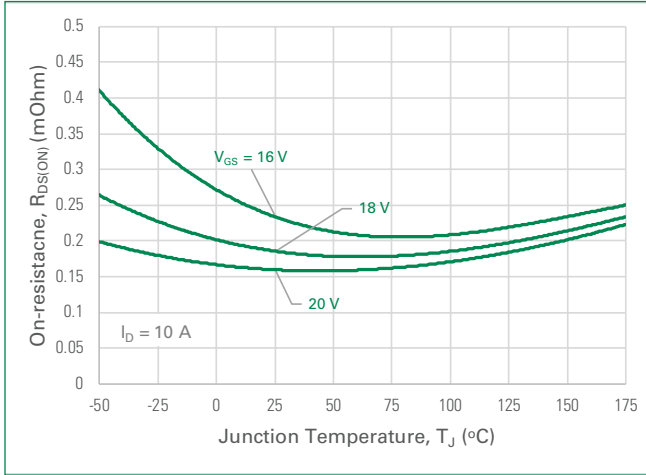
**Figure 12. Normalized On-resistance vs Junction Temperature**



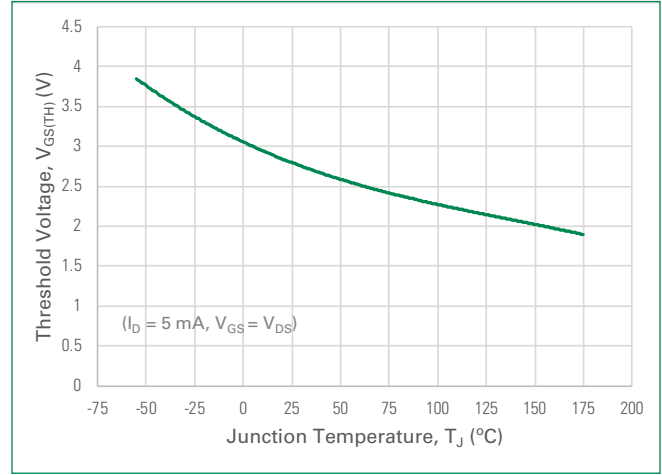
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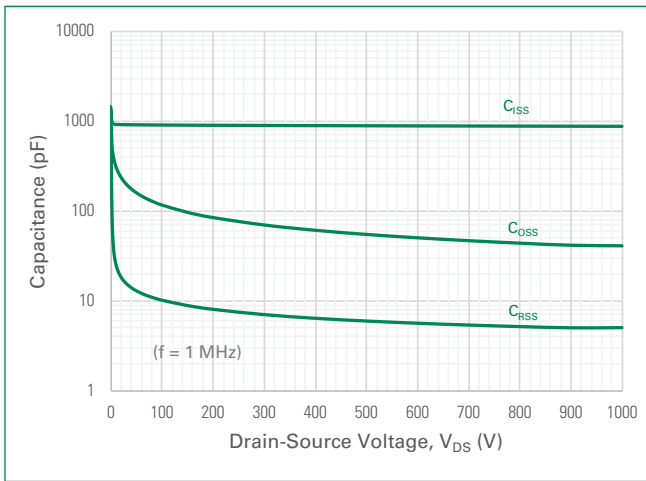
**Figure 13. Typical On-resistance vs Junction Temperature (Per  $V_{GS}$ )**



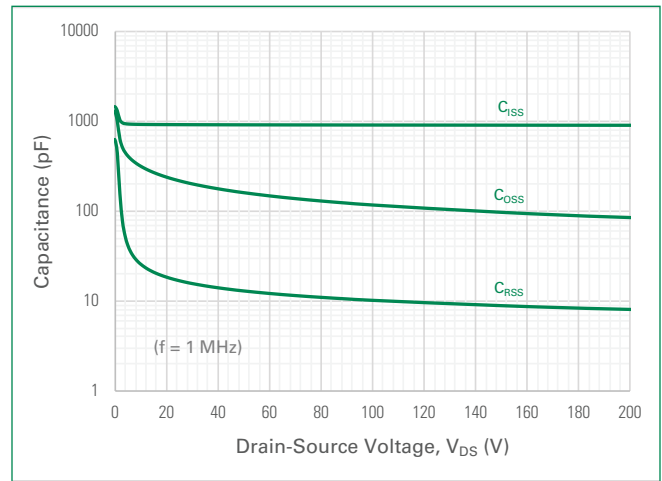
**Figure 14. Typical Threshold Voltage**



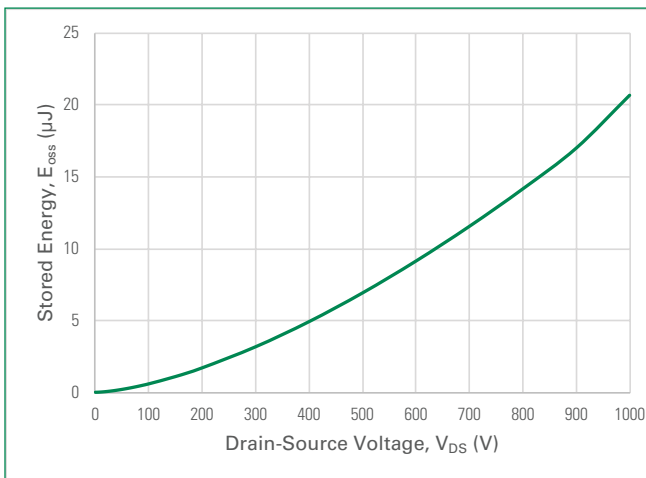
**Figure 15. Typical Junction Capacitances up to 1000 V**



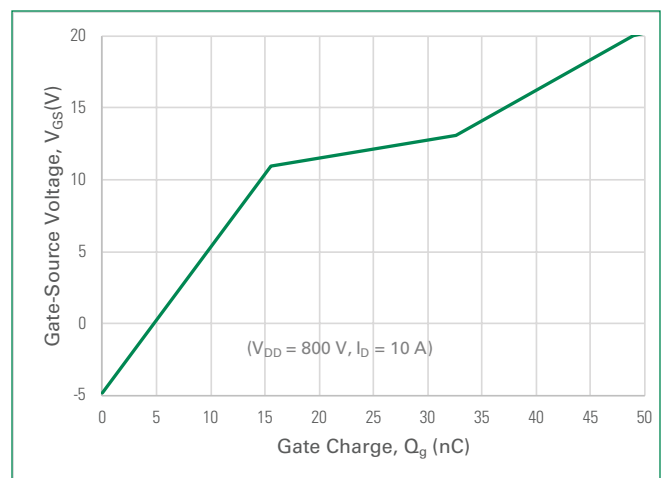
**Figure 16. Typical Junction Capacitances up to 200 V**



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



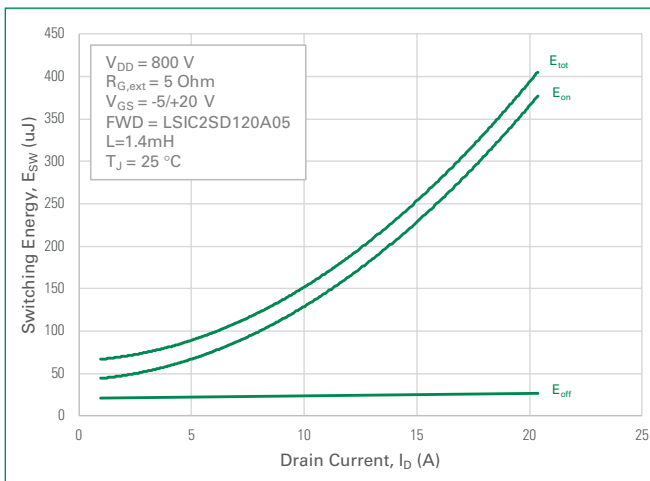
**Figure 18. Typical Gate Charge**



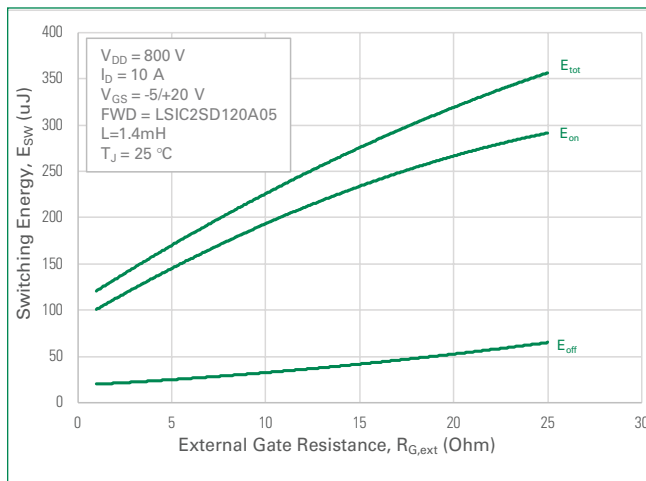
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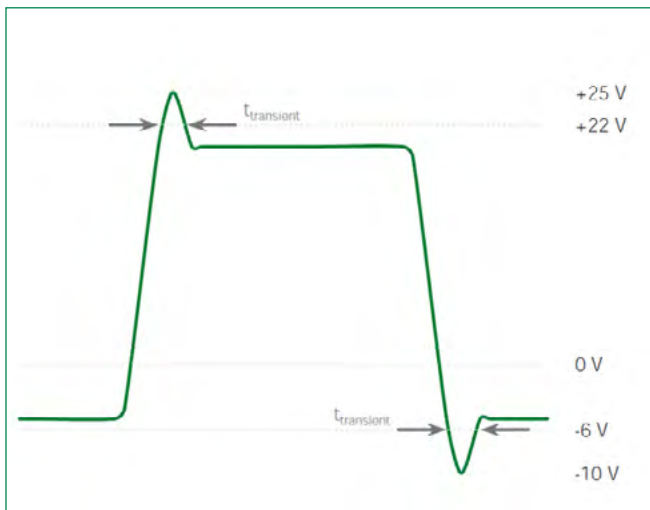
**Figure 19. Typical Switching Energy vs Drain Current**



**Figure 20. Typical Switching Energy vs External Gate Resistance**



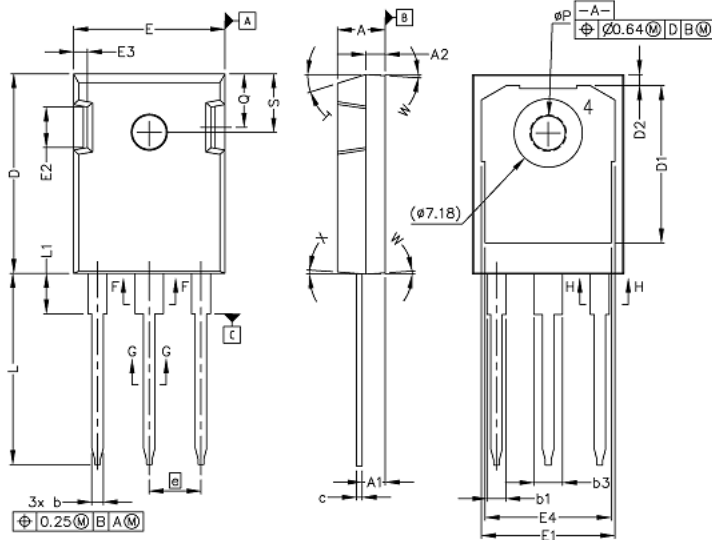
**Figure 21.  $V_{GS}$  Waveform Definition**



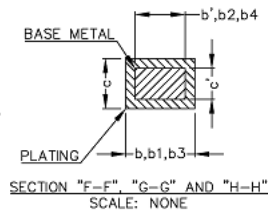
# LSIC1MO120E0160

1200V N-Channel, Enhancement-mode SiC MOSFET

## Package Dimensions

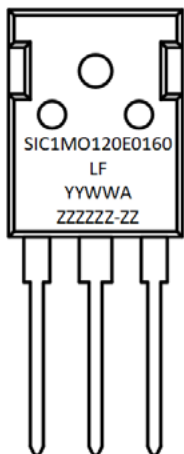


NOTE:  
 1. ALL METAL SURFACES: TIN PLATED, EXCEPT AREA OF CUT  
 2. DIMENSIONING & TOLERANCING CONFIRM TO ASME Y14.5M-1994  
 3. ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.  
 4. THIS DRAWING WILL MEET ALL DIMENSIONS REQUIREMENT OF JEDEC outlines TO-247 AD.



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
- ZZZZZ-ZZ = Lot Number

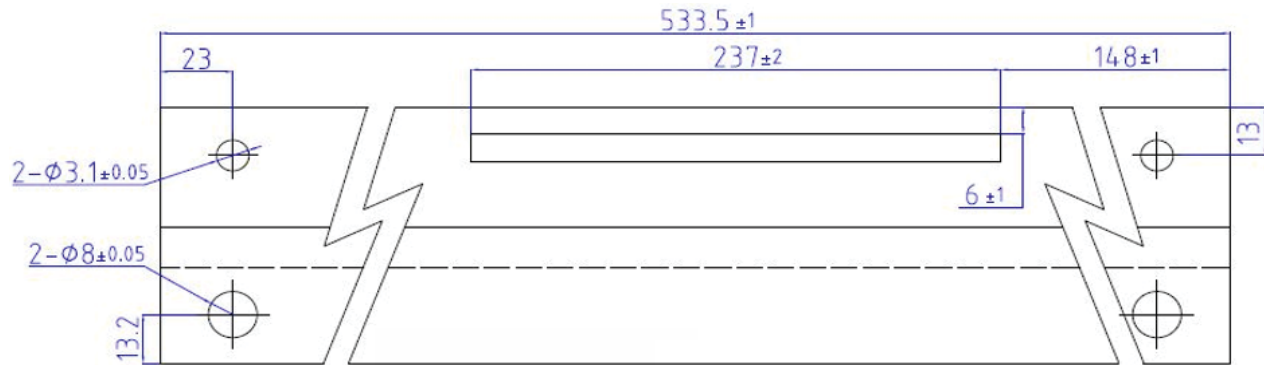
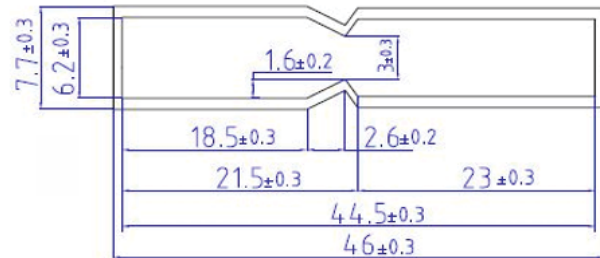
## Packing Options

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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