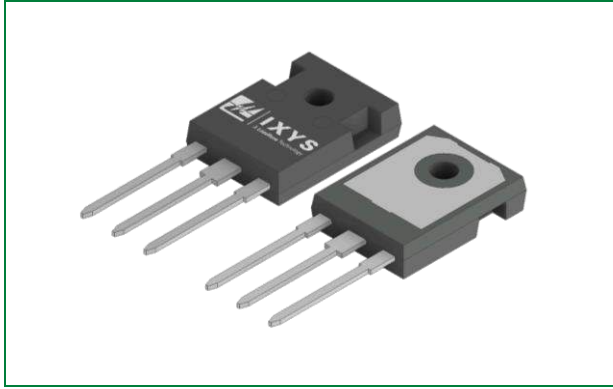


## LSIC1MO170E0750 1700 V, 750 mOhm N-Channel SiC MOSFET

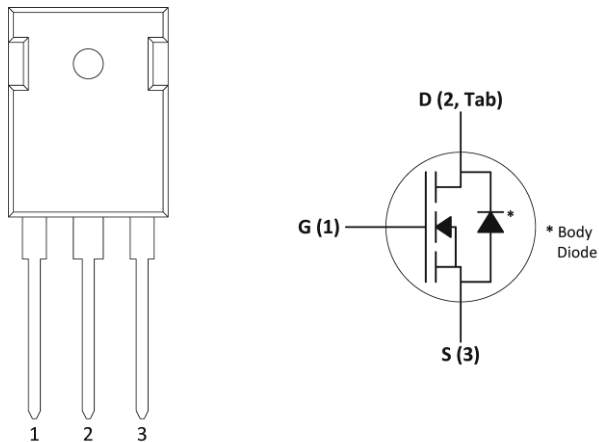


### Agency Approvals and Environmental

Environmental Approvals



### Circuit Diagram



### Product Summary

Characteristic	Value	Unit
$V_{DS}$	1700	V
Typical $R_{DS(ON)}$	750	mOhm
$I_D$ ( $T_C \leq 100\text{ }^\circ\text{C}$ )	4.4	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

### 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	$V_{DS}$	$V_{GS} = 0 \text{ V}$	1700	V
Continuous Drain Current	$I_D$	$V_{GS} = 20 \text{ V}, T_C = 25 \text{ }^\circ\text{C}$	6.2	A
		$V_{GS} = 20 \text{ V}, T_C = 100 \text{ }^\circ\text{C}$	4.4	
Pulsed Drain Current <sup>1</sup>	$I_{D(pulse)}$	$T_C = 25 \text{ }^\circ\text{C}$	11	A
Power Dissipation	$P_D$	$T_C = 25 \text{ }^\circ\text{C}, T_J = 175 \text{ }^\circ\text{C}$	60	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	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  $V_{GS(OFF)} = 0 \text{ V}$  – dependent upon PCB layout.  $V_{GS(OFF)} = -5 \text{ V}$  provides added noise margin and faster turn-off speed

## 2. Thermal Characteristics

Characteristic	Symbol	Value	Unit
Typical Thermal Resistance, junction-to-case	$R_{th,JC,MAX}$	2.5	$^\circ\text{C/W}$
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	$V_{BR(DSS)}$	$V_{GS} = 0 \text{ V}, I_D = 100 \text{ } \mu\text{A}$	1700	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 1700 \text{ V}, V_{GS} = 0 \text{ V}$	-	0.05	10	$\mu\text{A}$
		$V_{DS} = 1700 \text{ V}, V_{GS} = 0 \text{ V}, T_J = 175 \text{ }^\circ\text{C}$	-	0.1	-	
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	$R_{DS(ON)}$	$I_D = 2 \text{ A}, V_{GS} = 20 \text{ V}$	-	750	1000	m $\Omega$
		$I_D = 2 \text{ A}, V_{GS} = 20 \text{ V}, T_J = 175 \text{ }^\circ\text{C}$	-	1550	-	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 1 \text{ mA}$	1.8	2.8	4.0	V
		$V_{DS} = V_{GS}, I_D = 1 \text{ mA}, T_J = 175 \text{ }^\circ\text{C}$	-	1.9	-	
Gate Resistance	$R_G$	Resonance method, Drain-Source shorted <sup>1</sup>	-	29	-	$\Omega$

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	$E_{ON}$	$V_{DD} = 1200\text{ V}, I_D = 2\text{ A},$ $V_{GS} = -5 / +20\text{ V},$ $R_{G,ext} = 2\ \Omega, L = 1.4\text{ mH},$ FWD = LSIC1MO170E0750	-	52	-	$\mu\text{J}$
Turn-Off Switching Energy	$E_{OFF}$		-	61	-	
Total Per-Cycle Switching Energy	$E_{TS}$		-	113	-	
Input Capacitance	$C_{ISS}$	$V_{DD} = 1000\text{ V}, V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	-	200	-	$\text{pF}$
Output Capacitance	$C_{OSS}$		-	11.5	-	
Reverse Transfer Capacitance	$C_{RSS}$		-	1.7	-	
COSS Stored Energy	$E_{OSS}$		-	5.7	-	
Total Gate Charge	$Q_g$	$V_{DD} = 1200\text{ V}, I_D = 2\text{ A},$ $V_{GS} = -5 / +20\text{ V}$	-	13	-	$\text{nC}$
Gate-Source Charge	$Q_{gs}$		-	3.5	-	
Gate-Drain Charge	$Q_{gd}$		-	6	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 1200\text{ V}, V_{GS} = -5 / +20\text{ V},$ $I_D = 2\text{ A}, R_{G,ext} = 2\ \Omega,$ $R_L = 600\ \Omega,$ Timing relative to $V_{DS}$	-	8	-	$\text{ns}$
Rise Time	$t_r$		-	12	-	
Turn-Off Delay Time	$t_{d(off)}$		-	23	-	
Fall Time	$t_f$		-	74	-	

### 4. Reverse Diode Characteristics

Characteristic	Symbol	Conditions	Value			Unit
			Min	Typ	Max	
Diode Forward Voltage	$V_{SD}$	$I_S = 1\text{ A}, V_{GS} = 0\text{ V}$	-	3.7	-	$\text{V}$
		$I_S = 1\text{ A}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	3.2	-	
Continuous Diode Forward Current	$I_S$	$V_{GS} = 0\text{ V}, T_C = 25\text{ }^\circ\text{C}$	-	-	9	$\text{A}$
Peak Diode Forward Current <sup>1</sup>	$I_{SP}$		-	-	15	

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

5. Figure Data

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

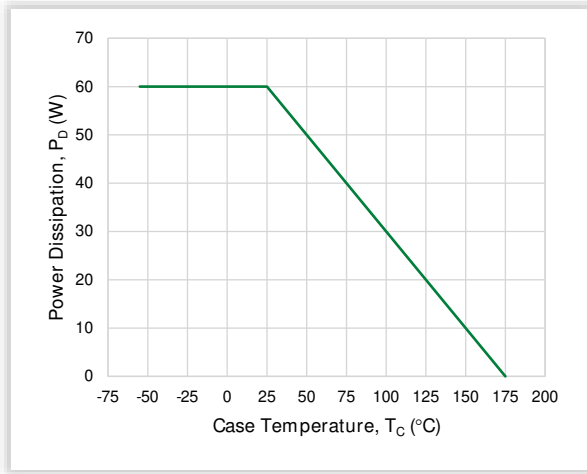


Figure 2. Typical Transfer Characteristics

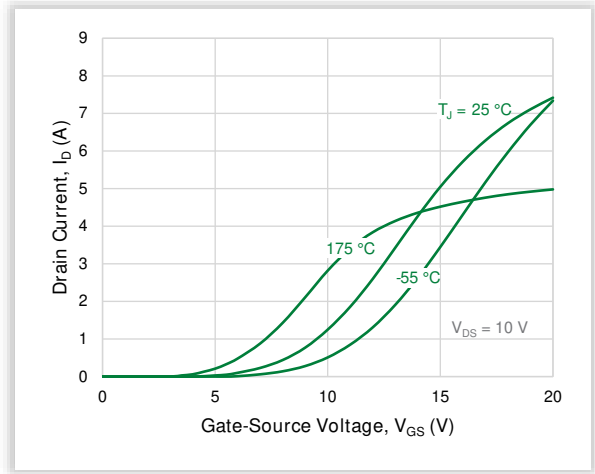


Figure 3. Typical Output Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ )

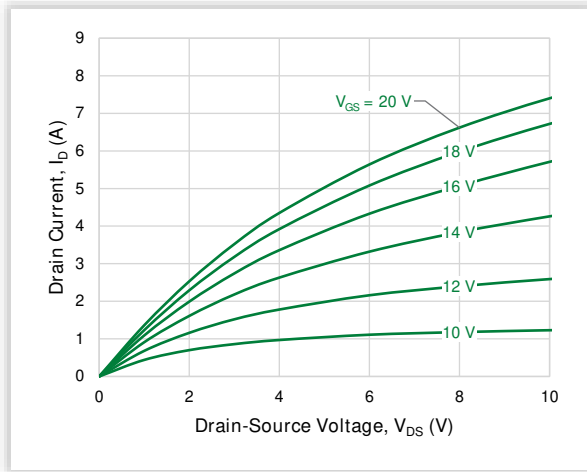


Figure 4. Typical Output Characteristics ( $T_J = 175\text{ }^\circ\text{C}$ )

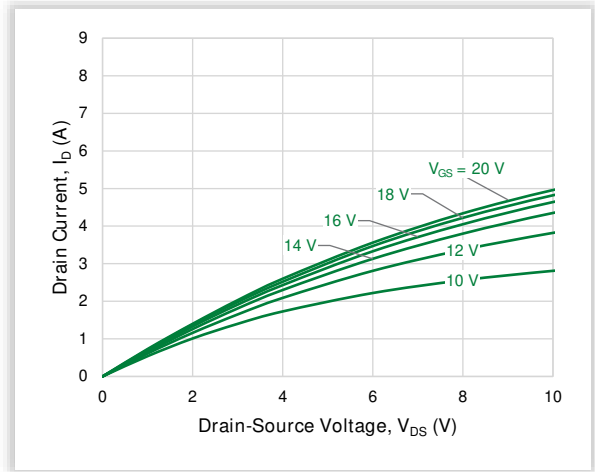


Figure 5. Typical Output Characteristics ( $T_J = -55\text{ }^\circ\text{C}$ )

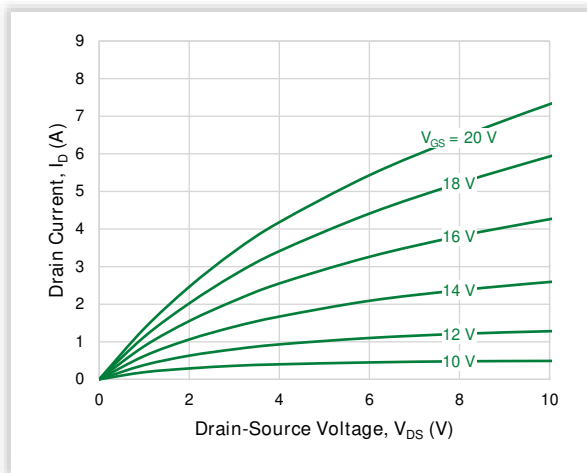


Figure 6. Typical Reverse Conduction Characteristics ( $T_J = 25\text{ }^\circ\text{C}$ )

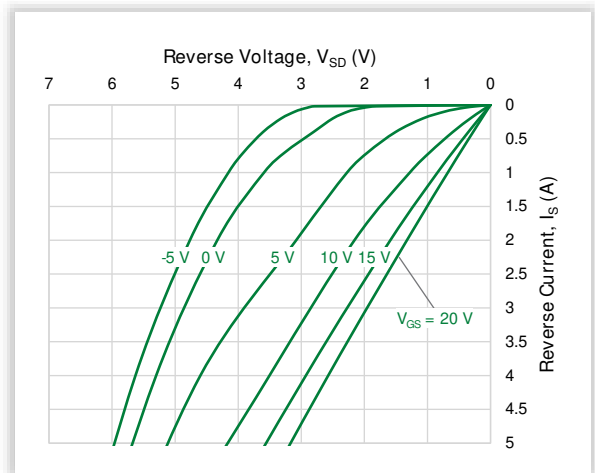


Figure 7. Typical Reverse Conduction Characteristics ( $T_J = 175\text{ }^\circ\text{C}$ )

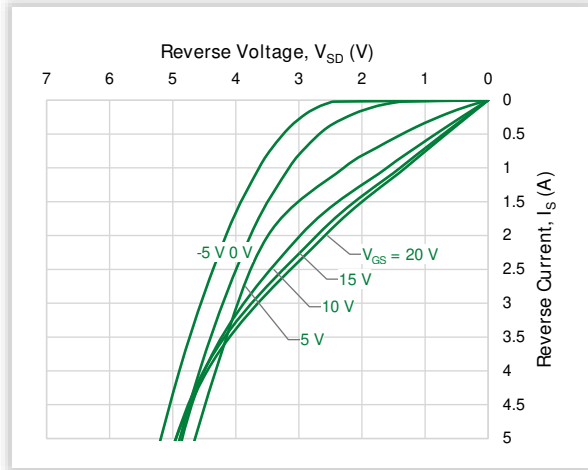


Figure 8. Typical Reverse Conduction Characteristics ( $T_J = -55\text{ }^\circ\text{C}$ )

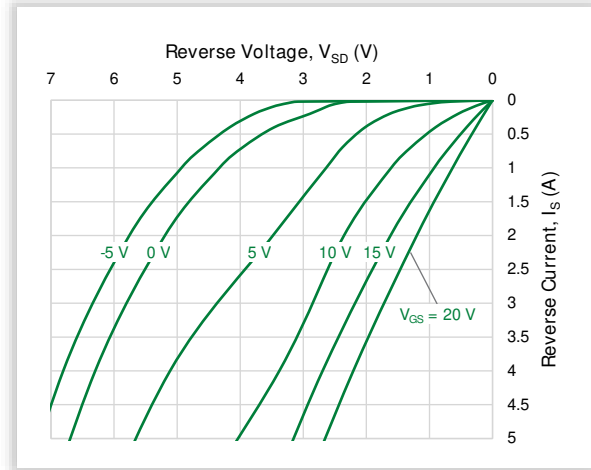


Figure 9. Transient Thermal Impedance

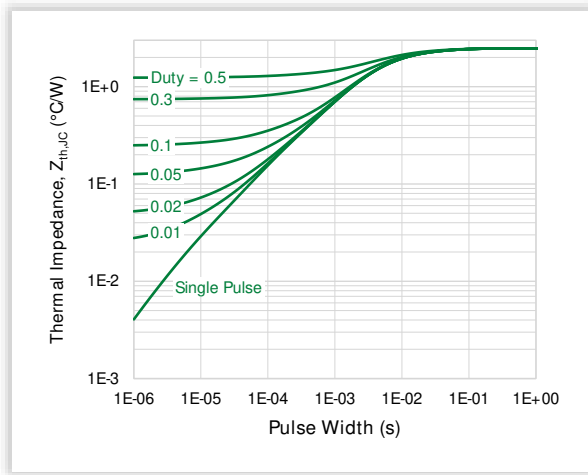


Figure 10. Maximum Safe Operating Area ( $T_C = 25\text{ }^\circ\text{C}$ )

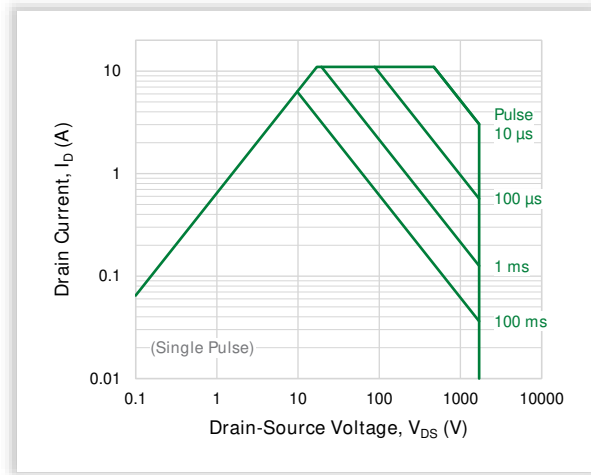


Figure 11. Typical On-resistance vs. Drain Current

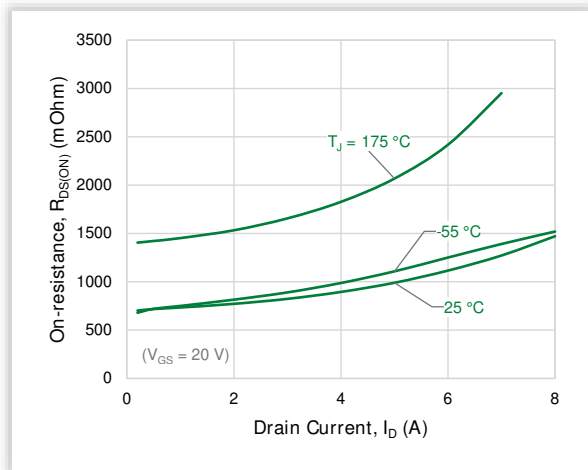


Figure 12. Normalized On-resistance vs. Junction Temperature

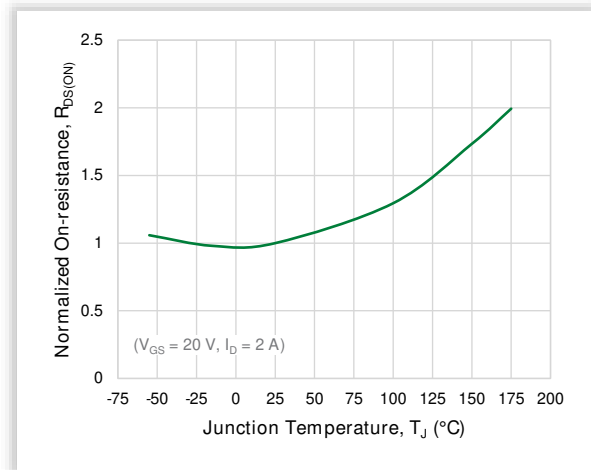


Figure 13. Typical On-resistance vs. Junction Temperature

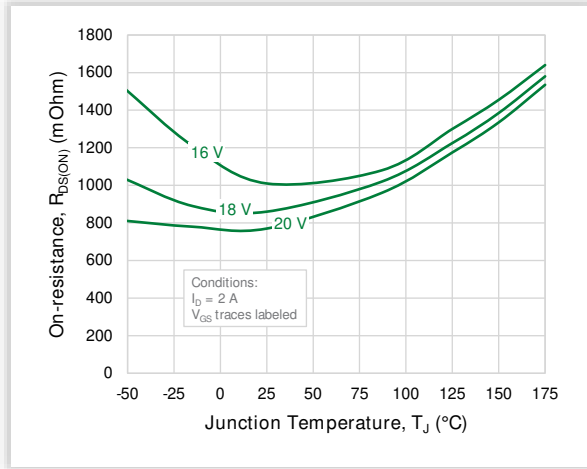


Figure 14. Typical Threshold Voltage

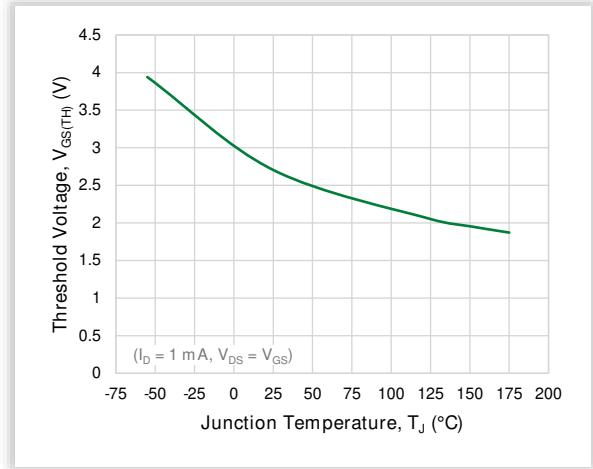


Figure 15. Typical Junction Capacitances up to 1000 V

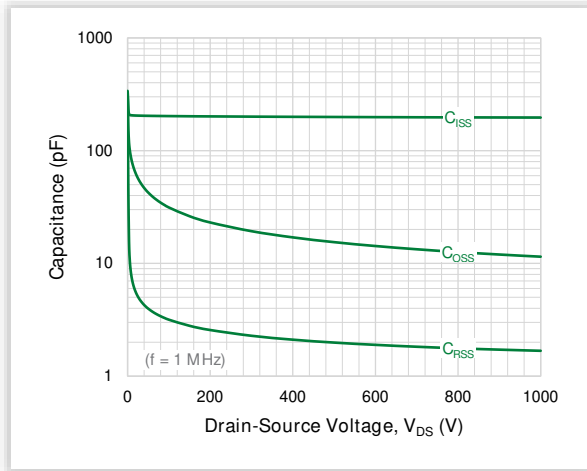


Figure 16. Typical Junction Capacitances up to 200 V

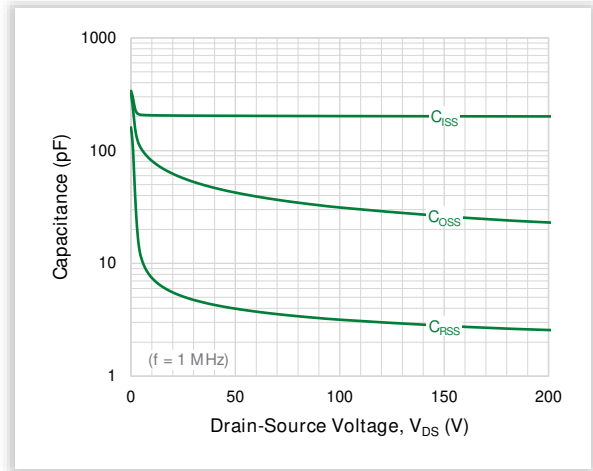


Figure 17. Typical  $C_{OSS}$  Stored Energy  $E_{OSS}$

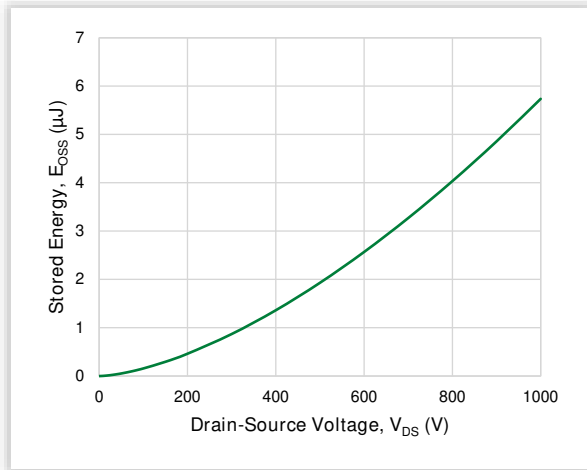


Figure 18. Typical Gate Charge

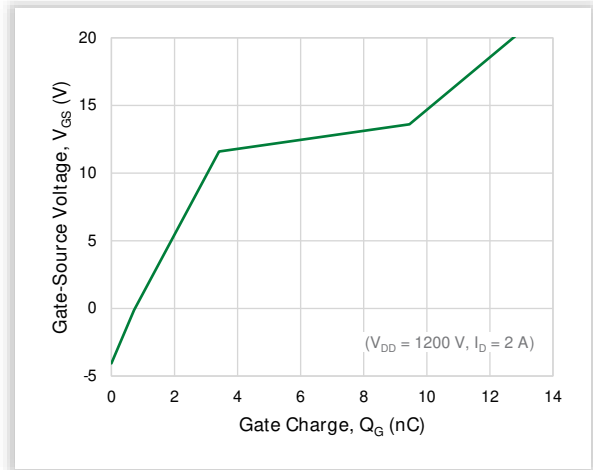


Figure 19. Typical Switching Energy vs. Drain Current

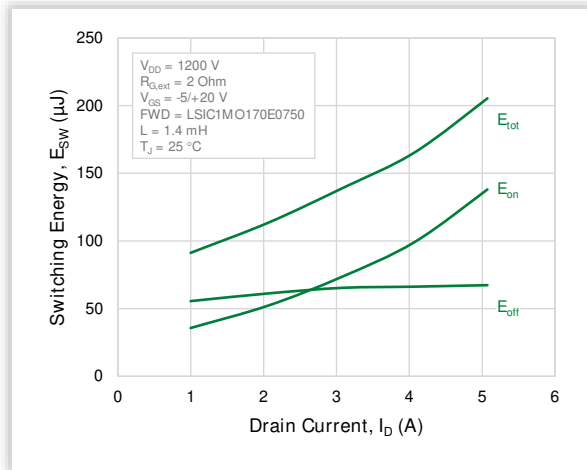


Figure 20. Typical Switching Energy vs. External Gate Resistance

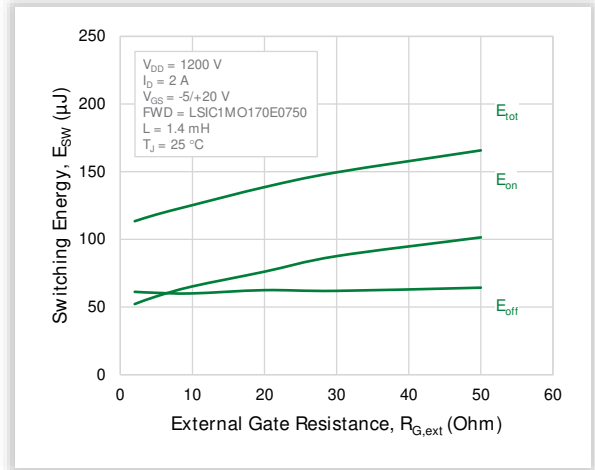
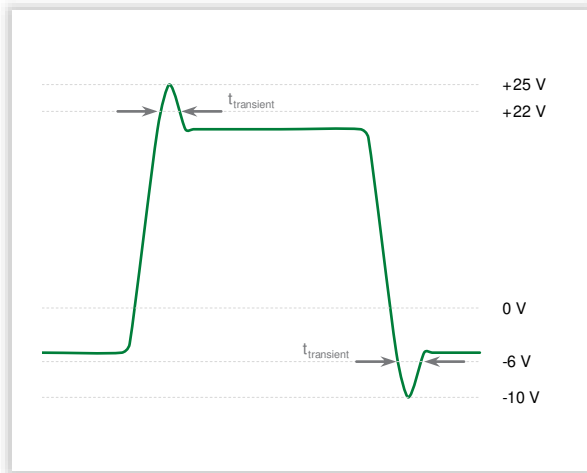
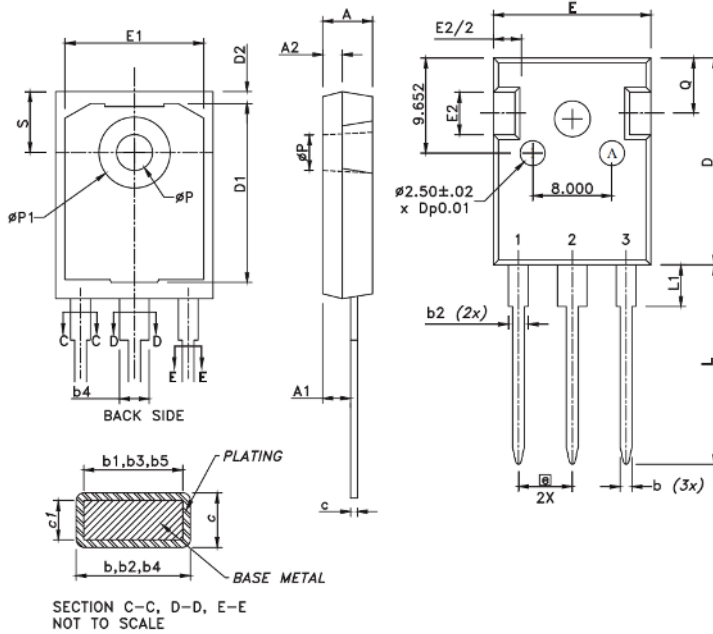


Figure 21.  $V_{GS}$  Waveform Definitions



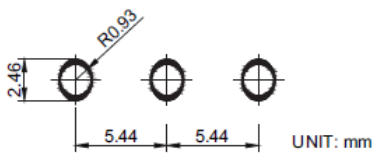


6. Package Dimensions



Symbol	Millimeters		
	Min	Nom	Max
A	4.699	-	5.309
A1	2.210	-	2.591
A2	1.499	-	2.489
b	0.990	-	1.400
b2	1.650	-	2.390
b4	2.590	-	3.430
c	0.380	-	0.890
D	20.800	-	21.463
D1	13.081	-	-
D2	0.508	-	1.350
e	5.440 BSC		
E	15.494	-	16.256
E1	13.060	-	14.150
E2	3.429	-	5.486
L	19.810	-	20.570
L1	3.810	-	4.496
øP	3.550	-	3.660
øP1	7.060	-	7.390
Q	5.385	-	6.200
S	6.050	-	6.300

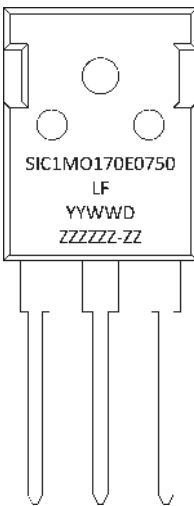
Recommended Hole Pattern Layout:



Notes:

1. Dimensions are in millimeters
2. Dimensions D & E do not include mold flash. Mold flash shall not exceed 0.127 mm per side. These dimensions are measured at the outermost extreme of the plastic body.
3. øP to have a maximum draft angle of 1.7° to the top of the part with a maximum hole diameter of 3.912 mm.

7. Part Numbering and Marking



- SIC = SiC
- 1 = Gen 1
- MO = MOSFET
- 170 = Voltage Rating (1700 V)
- E = TO-247-3L
- 0750 = R<sub>DS(ON)</sub> (750 mOhm)
- YY = Year
- WW = Week
- D = Special Code
- ZZZZZZ-ZZ = Lot Number

8. Packing Options

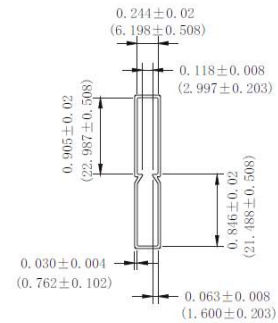
Part Number	Marking	Packing Mode	M.O.Q.
LSIC1MO170E0750	SIC1MO170E0750	Tube (30 Pcs)	450

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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