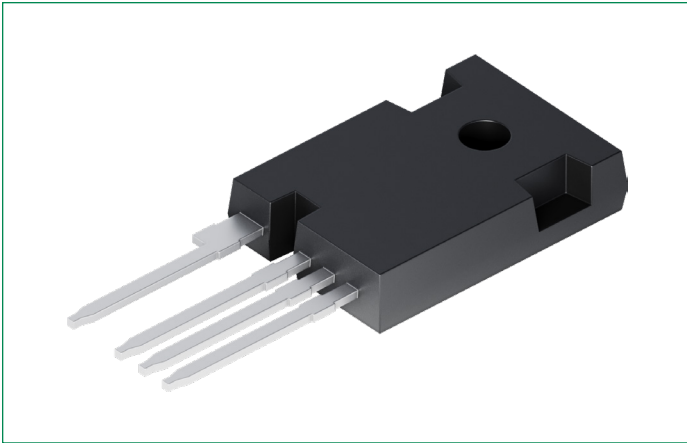


IXSH50N120L3KHV

1200 V, 55 mΩ, 48.3 A SiC MOSFET

HF 

Features

- 3rd Generation SiC MOSFET Technology with -3.5/+15...18 V gate drive
- High blocking voltage with low on-state resistance
- High-speed switching with low capacitance
- 175 °C operating junction temperature capability
- Ultra-fast and robust intrinsic body diode
- Kelvin source contact

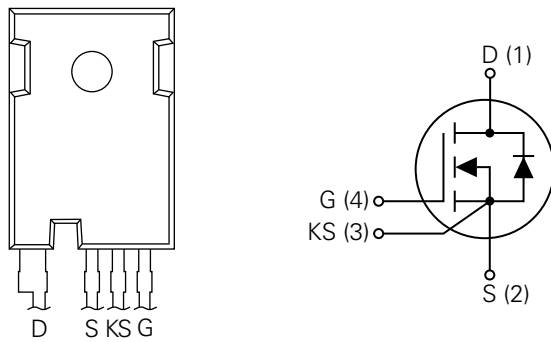
Applications

- Motor drives
- EV charging infrastructure
- DC/DC converter
- Switch mode power supplies
- Solar inverters

Product Summary

Characteristic	Value	Unit
V_{DSS}	1200	V
$R_{DS(on)}$	55	mΩ
$I_D @ 25\text{ °C}$	48.3	A

Pinout Diagram (TO-247-4L)



D: Drain; **G:** Gate; **KS:** Kelvin Source; **S:** Source

Maximum Ratings ($T_c = 25\text{ °C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value	Unit
V_{DSS}	Drain-source voltage	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	1200	V
V_{GSM}	Maximum gate-source voltage	Static (DC)	-5 to +20	V
	Transient gate-source voltage	Pulse width < 200 ns, D < 1%	-10 to +23	
I_D	Drain current (continuous) Fig. 23	$V_{GS} = 18\text{ V}, T_c = 25\text{ °C}$	48.3	A
		$V_{GS} = 18\text{ V}, T_c = 100\text{ °C}$	34.5	A
I_{DM}	Peak drain current Fig. 26	Pulse width limited by SOA	120.8	A
I_{SM}	Diode pulsed forward current Fig. 25, 26	Pulse width limited by SOA and dynamic $R_{th(j-c)}$	111	A
P_{tot}	Total power dissipation Fig. 24	$T_c = 25\text{ °C}$	250	W
T_{vj}	Virtual junction temperature range	-	-55 to +175	°C
T_{stg}	Storage temperature range	-	-55 to +175	°C
T_{sold}	Soldering temperature	Wave soldering only allowed at leads, 1.6 mm from case for 10 s	260	°C

Recommended Values

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
V_{GSon}	Recommended turn-on voltage	15	-	18	V
V_{GSoff}	Recommended turn-off voltage	-3.5	-	-2	

Thermal Characteristics

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance from junction to case Fig. 25	-	0.6	-	K/W

Electrical Characteristics – Static ($T_c = 25\text{ °C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
I_{DSS}	Drain-source leakage current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	-	5	100	μA
I_{GSS}	Gate leakage current	$V_{DS} = 0\text{ V}, V_{GS} = -5 \sim 20\text{ V}$	-	-	± 100	nA
$V_{GS(th)}$	Gate threshold voltage Fig. 8, 9	$V_{GS} = V_{DS}, I_D = 4\text{ mA}$	2.0	2.8	4.0	V
		$V_{GS} = V_{DS}, I_D = 4\text{ mA}, T_{vj} = 175\text{ °C}$	-	2.0	-	
$R_{DS(on)}$	Drain-source on-state resistance Fig. 4, 5, 6, 7	$V_{GS} = 18\text{ V}, I_D = 14\text{ A @ } T_{vj} = 25\text{ °C}$	-	55	71	m Ω
		$V_{GS} = 18\text{ V}, I_D = 14\text{ A @ } T_{vj} = 175\text{ °C}$	-	93	-	
		$V_{GS} = 15\text{ V}, I_D = 14\text{ A @ } T_{vj} = 25\text{ °C}$	-	66	-	
		$V_{GS} = 15\text{ V}, I_D = 14\text{ A @ } T_{vj} = 175\text{ °C}$	-	98	-	

Electrical Characteristics – Dynamic ($T_{vj} = 25\text{ °C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit	
			Min.	Typ.	Max.		
C_{iss}	Input capacitance Fig. 16	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V},$ $f = 100\text{ kHz}, V_{AC} = 25\text{ mV}$	–	1340	–	pF	
C_{oss}	Output capacitance Fig. 16		–	61.7	–		
C_{rss}	Reverse transfer capacitance Fig. 16		–	1.75	–		
E_{oss}	C_{oss} stored energy Fig. 17		–	25.9	–		μJ
Q_G	Total gate charge Fig. 18	$V_{DS} = 800\text{ V}, I_D = 20\text{ A},$ $V_{GS} = -3\text{ to }+18\text{ V}$	–	55.6	–	nC	
Q_{GS}	Gate-source charge Fig. 18		–	14.4	–		
Q_{GD}	Gate-drain charge Fig. 18		–	15.2	–		
$R_{g(int)}$	Gate input resistance	$f = 1\text{ MHz}$	–	4.18	–	Ω	
E_{on}	Turn-on switching energy Fig. 19, 20	$V_{DS} = 800\text{ V}, I_D = 20\text{ A},$ $V_{GS} = -3.5\text{ to }+18\text{ V},$ $R_{G(ext)} = 3.3\ \Omega, L = 200\ \mu\text{H}$	$T_{vj} = 25\text{ °C}$	–	178.3	–	μJ
			$T_{vj} = 175\text{ °C}$	–	270.6	–	
E_{off}	Turn-off switching energy Fig. 19, 20, 22		$T_{vj} = 25\text{ °C}$	–	34	–	ns
			$T_{vj} = 175\text{ °C}$	–	37.2	–	
$t_{d(on)}$	Turn-on delay time Fig. 19, 20		$T_{vj} = 25\text{ °C}$	–	5.2	–	ns
t_r	Rise time Fig. 19, 20		$T_{vj} = 25\text{ °C}$	–	11.8	–	
$t_{d(off)}$	Turn-off delay time Fig. 19, 20		$T_{vj} = 25\text{ °C}$	–	12.5	–	
t_f	Fall time Fig. 19, 20		$T_{vj} = 25\text{ °C}$	–	7.5	–	

Reverse Diode Characteristics ($T_{vj} = 25\text{ °C}$ unless otherwise specified)

Symbol	Characteristic	Conditions	Value			Unit
			Min.	Typ.	Max.	
V_{SD}	Diode forward voltage Fig. 10, 11, 12	$I_{SD} = 7\text{ A}, V_{GS} = 0\text{ V}$	–	3.1	–	V
		$I_{SD} = 7\text{ A}, V_{GS} = 0\text{ V}, T_{vj} = 175\text{ °C}$	–	2.8	–	V
I_s	Diode forward current (continuous)	$V_{GS} = -2\text{ V}, T_c = 25\text{ °C}$	–	–	44.4	A
		$V_{GS} = -2\text{ V}, T_c = 100\text{ °C}$	–	–	26.1	
t_{rr}	Reverse recovery time	$V_{GS} = -3.5\text{ V}/+18\text{ V}, I_{SD} = 20\text{ A}, V_R = 800\text{ V},$ $R_{G(ext)} = 12\ \Omega, L = 200\ \mu\text{H}, di/dt = 3000\text{ A}/\mu\text{s}$	–	19.6	–	ns
Q_{rr}	Reverse recovery charge		–	120	–	nC
I_{rrm}	Peak reverse recovery current		–	16.4	–	A

Characteristic Curves

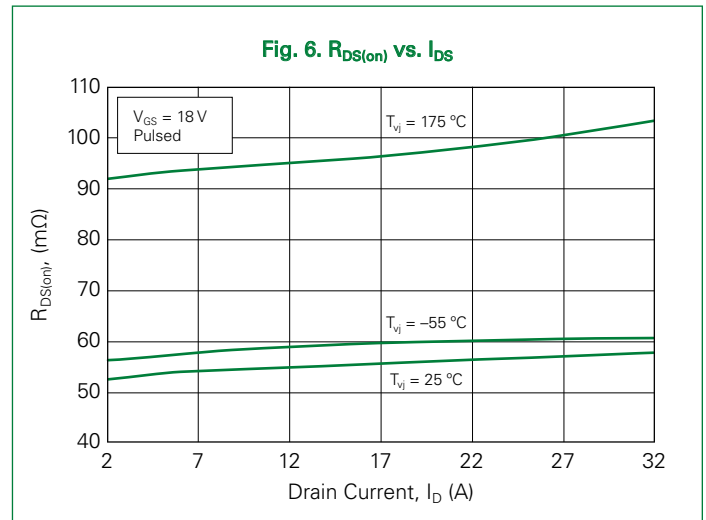
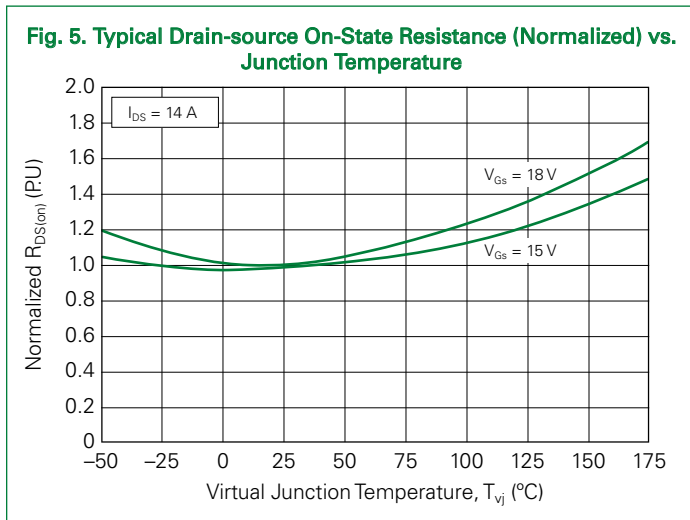
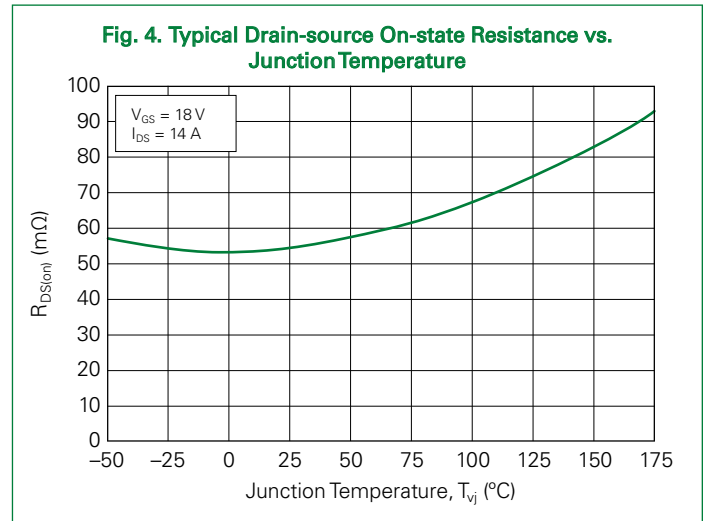
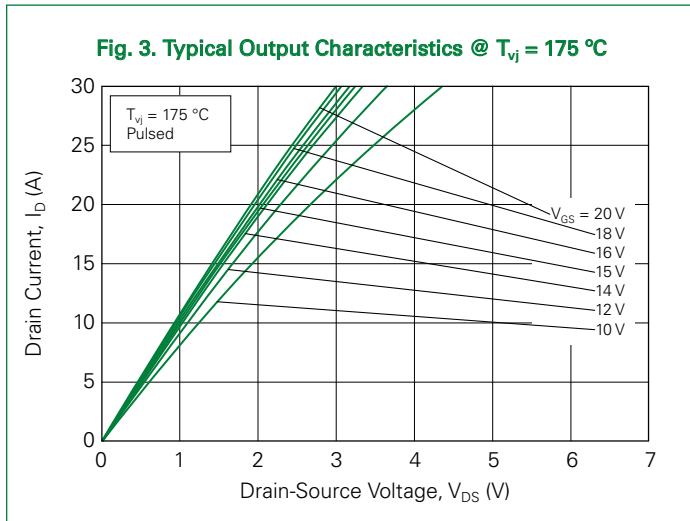
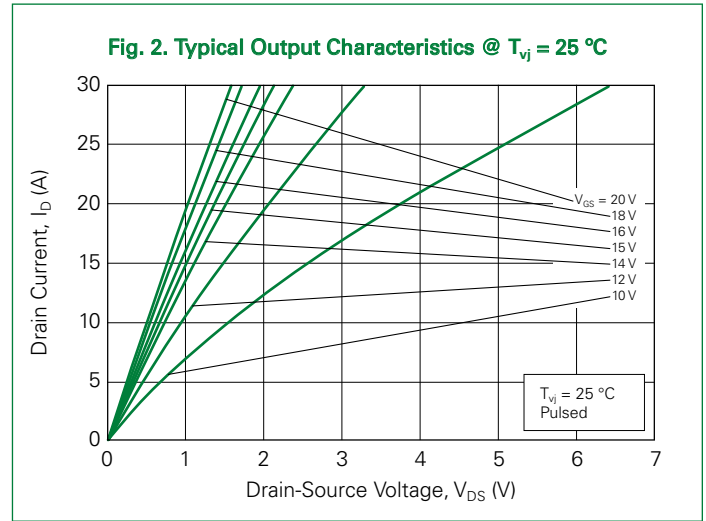
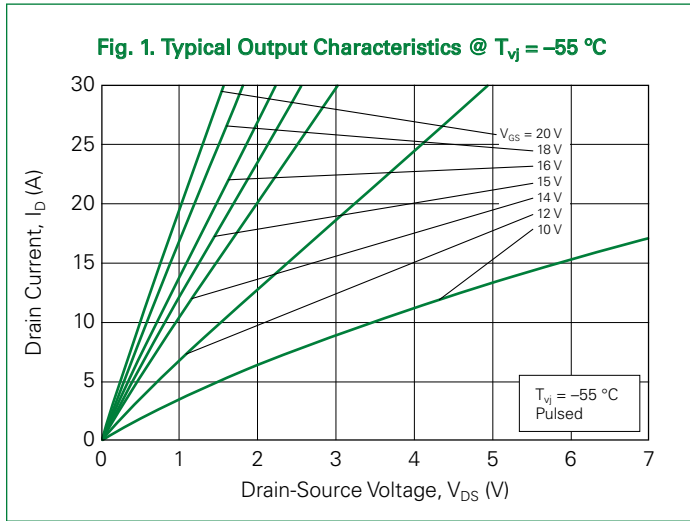


Fig. 7. $R_{DS(on)}$ vs. Temperature

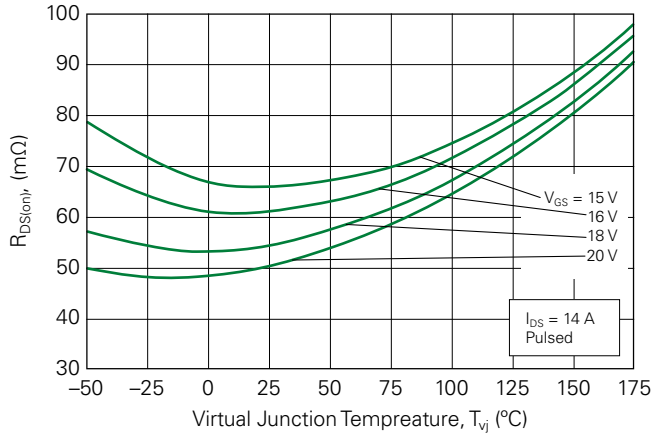


Fig. 8. Transfer Curves

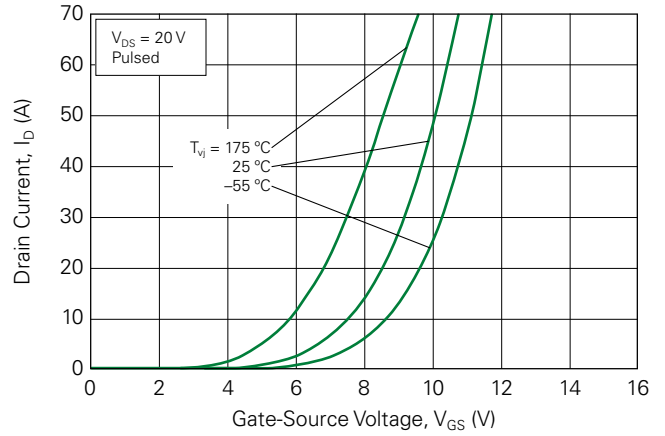


Fig. 9. Threshold Voltage vs. Temperature

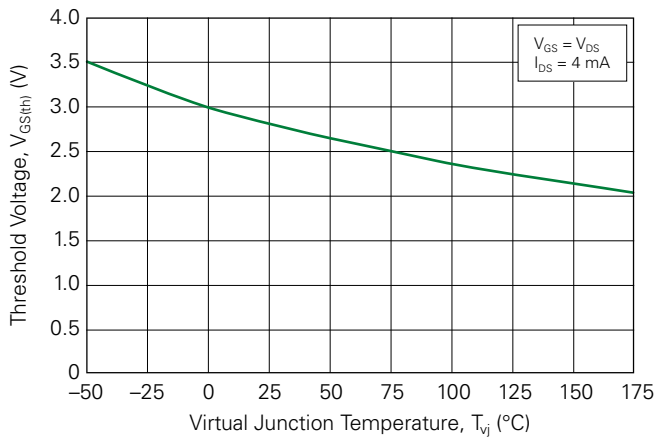


Fig. 10. Body Diode Curves @ $T_{vj} = -55$ °C

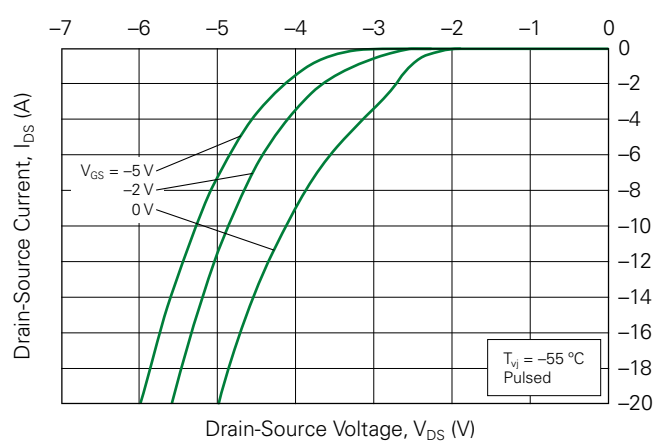


Fig. 11. Body Diode Curves @ $T_{vj} = 25$ °C

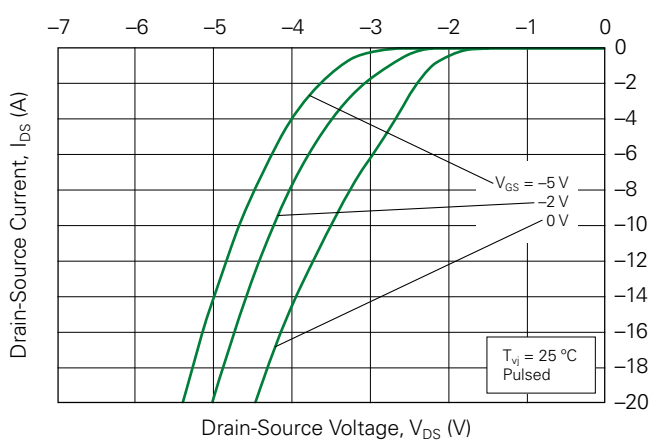


Fig. 12. Body Diode Curves @ $T_{vj} = 175$ °C

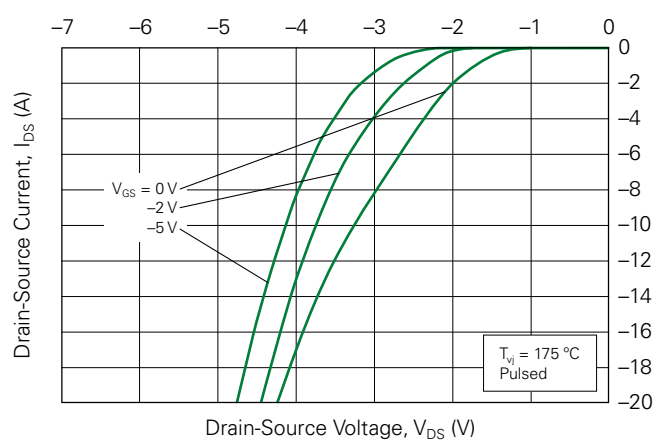


Fig. 13. 3rd Quadrant Curves @ $T_{vj} = -55\text{ }^\circ\text{C}$

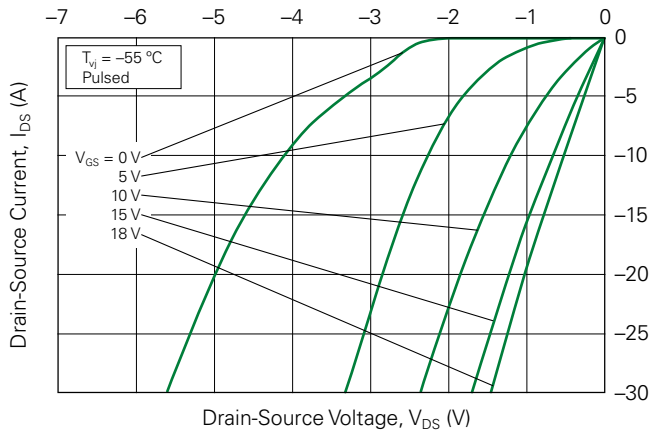


Fig. 14. 3rd Quadrant Curves @ $T_{vj} = 25\text{ }^\circ\text{C}$

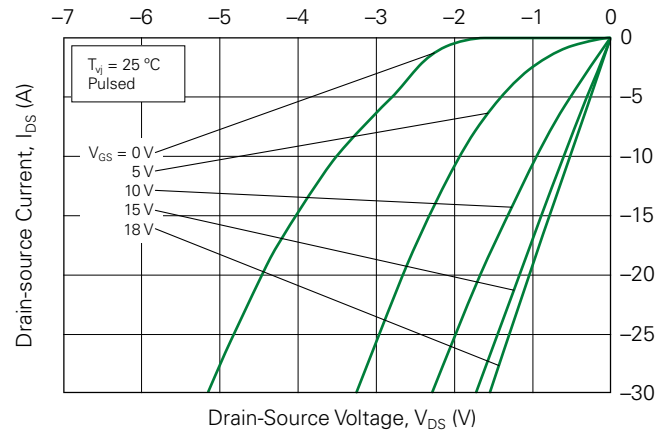


Fig. 15. 3rd Quadrant Curves @ $T_{vj} = 175\text{ }^\circ\text{C}$

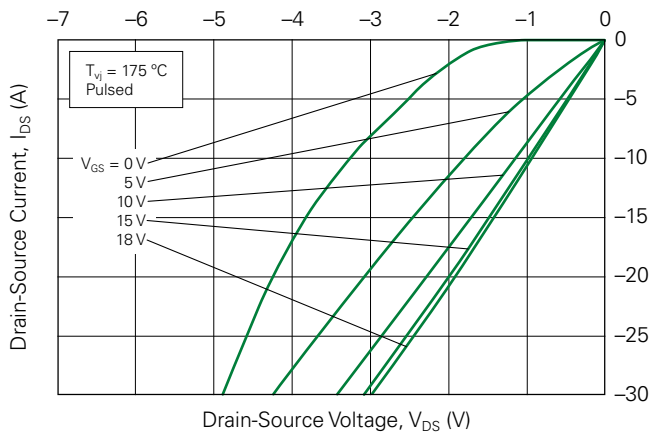


Fig. 16. Capacitance vs. V_{DS}

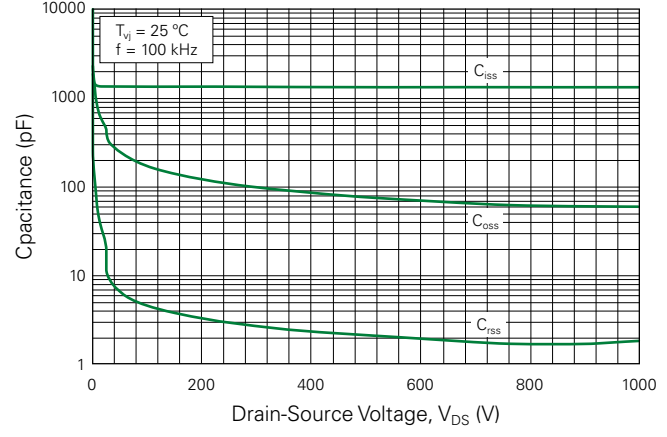


Fig. 17. Output Capacitor Stored Energy

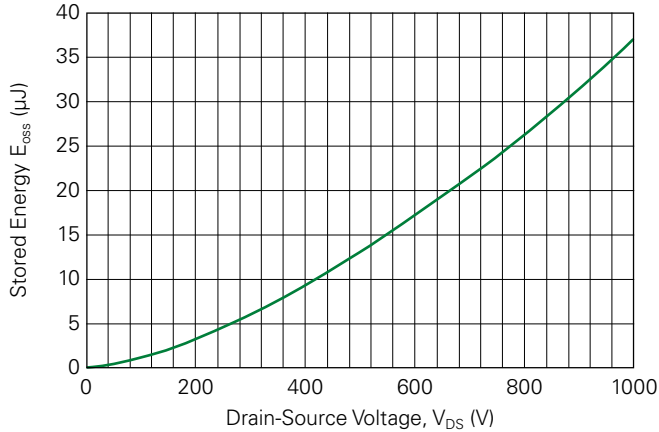
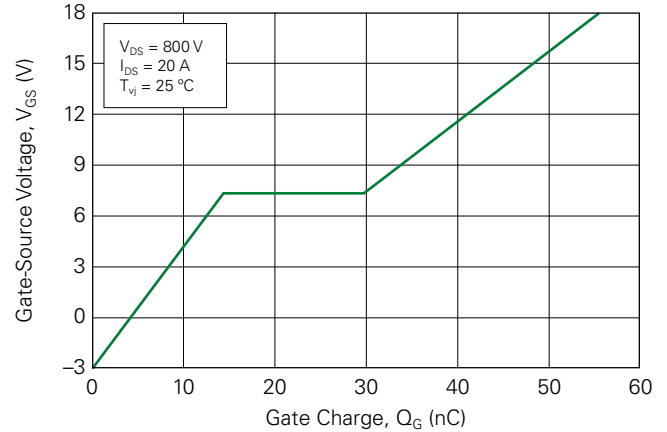
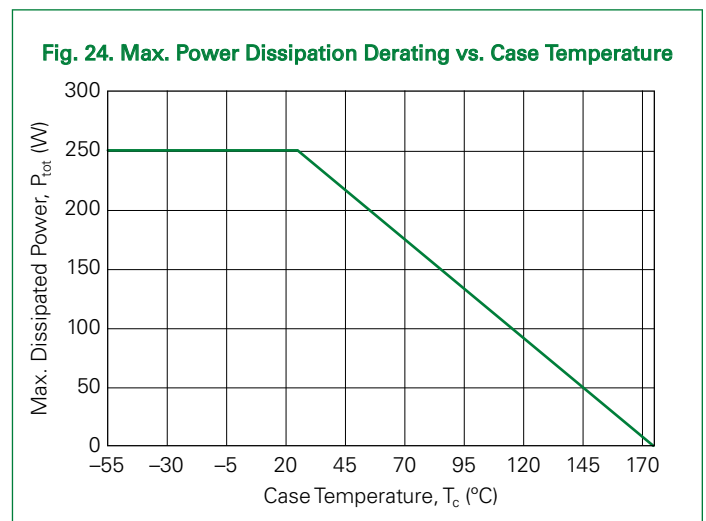
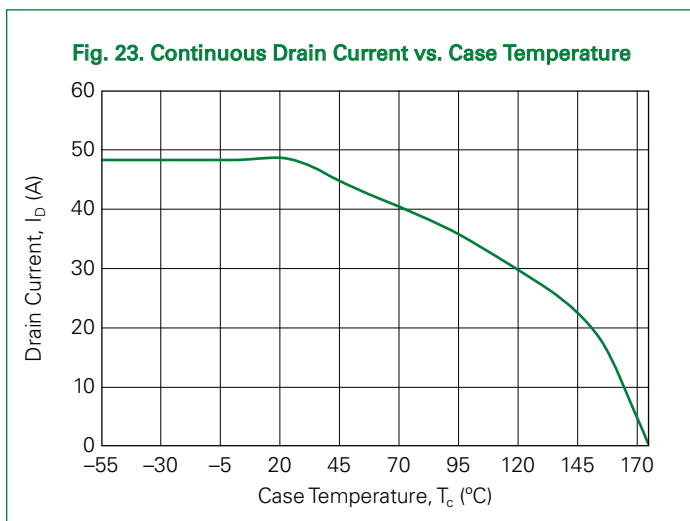
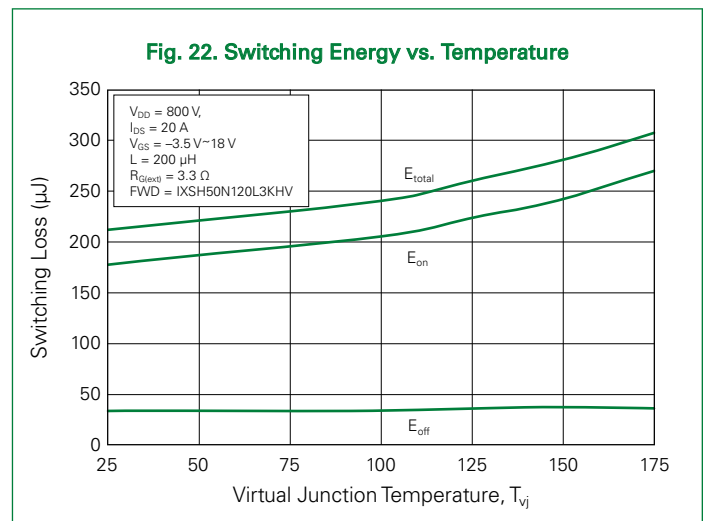
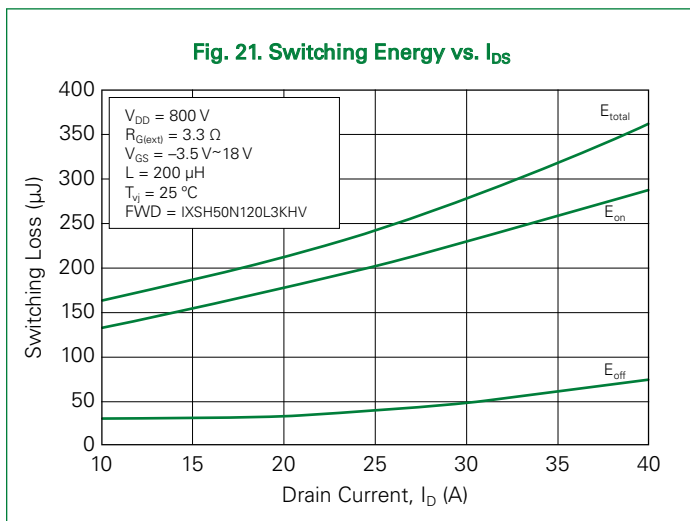
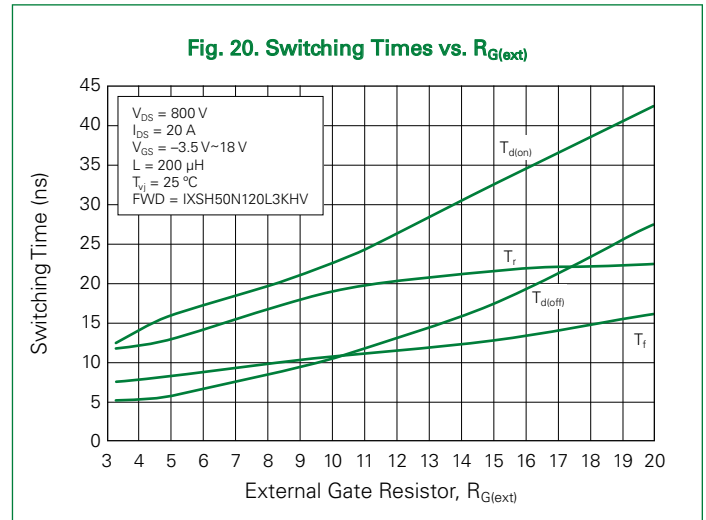
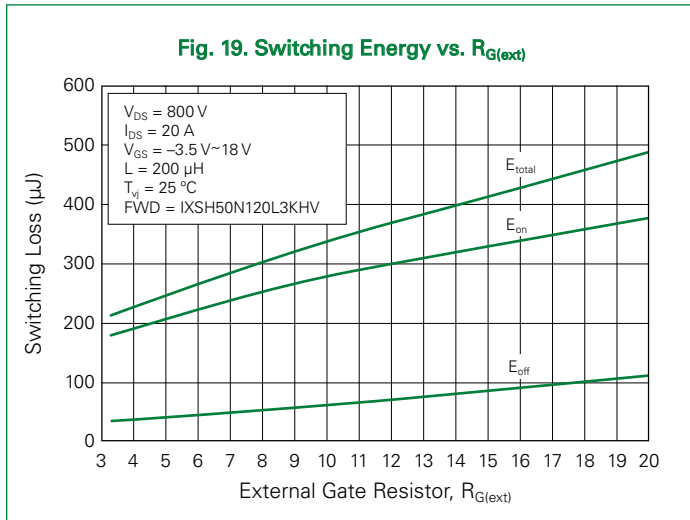
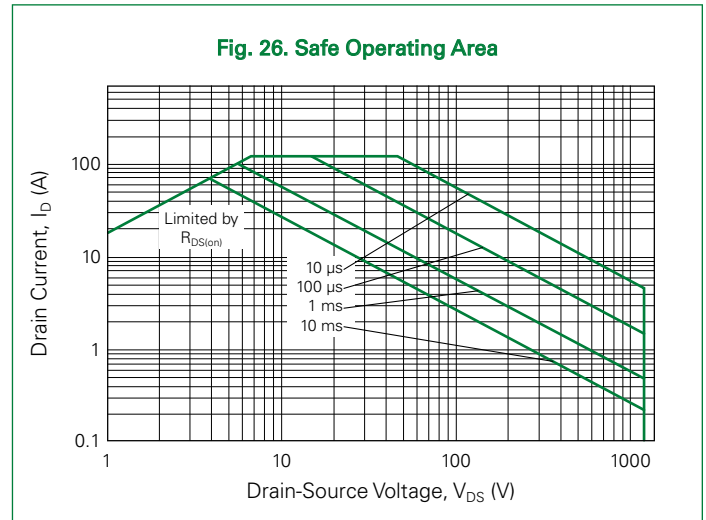
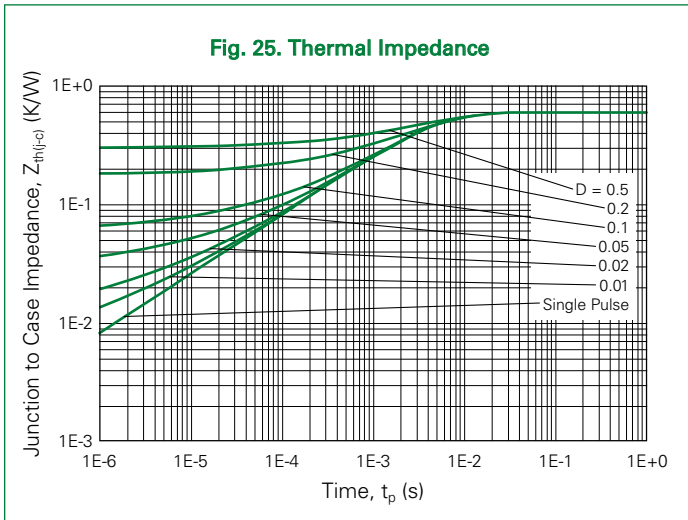


Fig. 18. Gate Charge Characteristics

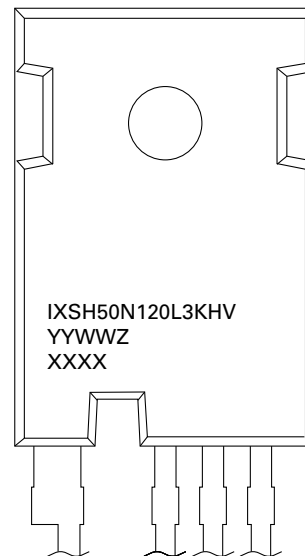




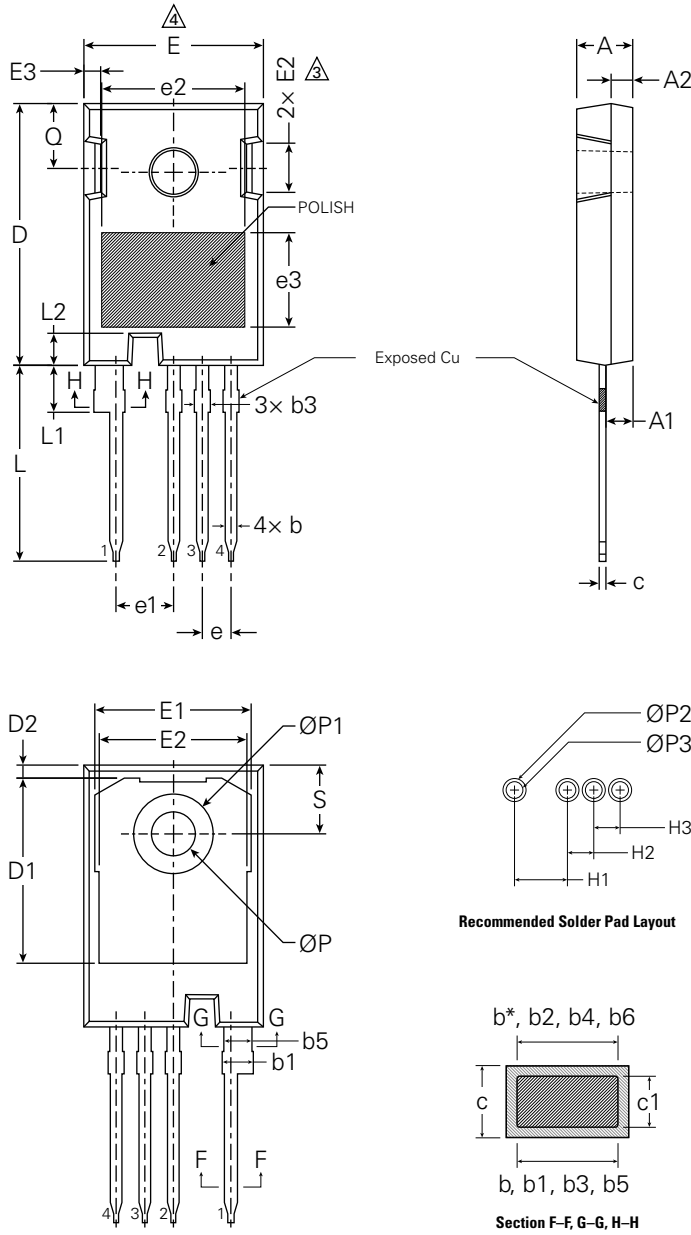


Part Number and Marking

- IXSH50N120L3KHV = Device Part Number
- YY = Year
- WW = Work Week
- Z = Assembly Location
- XXXX = Lot Traceability



Part Outline Drawing (TO-247-4L)



Note:

1. Package reference: JEDEC TO247, Variation AD
- △ Slot required, notch may be rounded
- △ Dimension D&E do not include mold flash
4. Subject to change without notice

Symbol	Inches			Millimeters		
	Min.	Typical	Max.	Min.	Typical	Max
A	0.190	-	0.205	4.83	-	5.21
A1	0.090	-	0.100	2.29	-	2.54
A2	0.075	-	0.085	1.91	-	2.16
b	0.042	-	0.052	1.07	-	1.33
b*	0.042	-	0.050	1.07	-	1.28
b1	0.094	-	0.116	2.39	-	2.94
b2	0.094	-	0.112	2.39	-	2.84
b3	0.042	-	0.063	1.07	-	1.60
b4	0.042	-	0.059	1.07	-	1.50
b5	0.094	-	0.106	2.39	-	2.69
b6	0.094	-	0.104	2.39	-	2.64
c	0.022	-	0.027	0.55	-	0.68
c1	0.022	-	0.026	0.55	-	0.65
D	0.917	-	0.929	23.30	-	23.60
D1	0.640	-	0.695	16.25	-	17.65
D2	0.037	-	0.049	0.95	-	1.25
E	0.620	-	0.635	15.75	-	16.13
E1	0.516	-	0.557	13.10	-	14.15
E2	0.145	-	0.201	3.68	-	5.10
E3	0.039	-	0.075	1.00	-	1.90
E4	0.487	-	0.529	12.38	-	13.43
e	0.100 BSC			2.54 BSC		
e1	0.200 BSC			5.08 BSC		
e2	-	0.500	-	-	12.70	-
e3	-	0.330	-	-	8.38	-
H1	-	0.200	-	-	5.08	-
H2	-	0.100	-	-	2.54	-
H3	-	0.100	-	-	2.54	-
L	0.681	-	0.702	17.31	-	17.82
L1	0.156	-	0.172	3.97	-	4.37
L2	0.093	-	0.104	2.35	-	2.65
ØP	0.138	-	0.144	3.51	-	3.65
ØP1	0.283 REF.			7.18 REF.		
ØP2	-	0.088	-	-	2.24	-
ØP3	-	0.067	-	-	1.70	-
Q	0.216	-	0.236	5.49	-	6.00
S	0.238	-	0.248	6.04	-	6.30

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