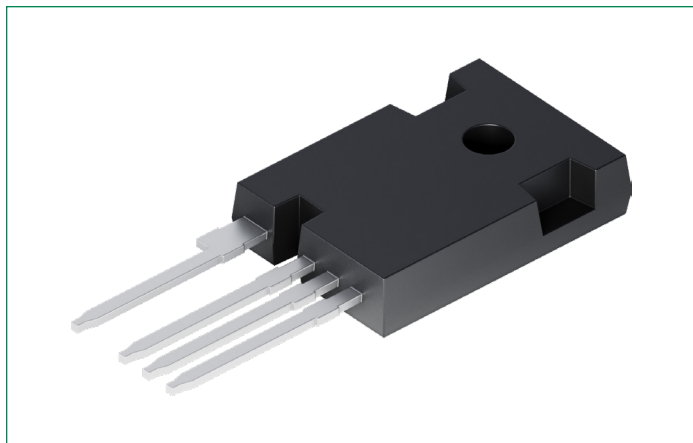


IXSH40N120L2KHV

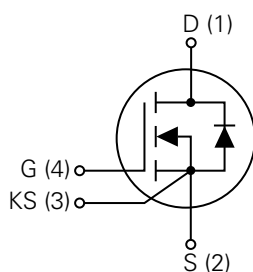
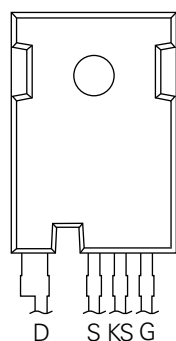
1200 V, 80 mΩ, 41 A SiC MOSFET

RoHS

HF



Pinout Diagram (TO-247-4L)



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

Features

- SiC MOSFET Technology with $-3/+15$ V gate drive
- High blocking voltage with low on-state resistance
- High-speed switching with low capacitance
- Maximum virtual junction temperature of 175 °C
- Ultra-fast intrinsic body diode
- Kelvin source contact
- MSL1 rated

Applications

- Solar Inverters
- Switch mode power supplies
- UPS
- Motor drives
- DC/DC converters
- EV charging infrastructure
- Induction heating

Product Summary

Characteristic	Value	Unit
V_{DSS}	1200	V
$R_{DS(on)}$	80	mΩ
I_{D25}	41	A

Maximum Ratings ($T_c = 25\text{ }^{\circ}\text{C}$ 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	–	–5 to +20	V
	Transient gate-source voltage	$t_{transient} = 200\text{ ns}, D < 1\%$	–10 to +23	
I_D	Drain current (continuous) Fig. 23	$V_{GS} = 18\text{ V}, T_c = 25\text{ }^{\circ}\text{C}$	41	A
		$V_{GS} = 18\text{ V}, T_c = 100\text{ }^{\circ}\text{C}$	29	A
I_{DM}	Peak drain current Fig. 25, 26	Pulse width limited by SOA and dynamic $R_{\theta(J-C)}$	102	A
I_{SM}	Diode pulsed forward current Fig. 25, 26	Pulse width limited by SOA and dynamic $R_{\theta(J-C)}$	102	A
P_{tot}	Total power dissipation Fig. 24	$T_c = 25\text{ }^{\circ}\text{C}$	250	W
T_{stg}	Storage temperature range	–	–55 to 175	$^{\circ}\text{C}$
T_{vj}	Virtual junction temperature range	–	–55 to 175	$^{\circ}\text{C}$
T_{sold}	Soldering temperature	Wave soldering only allowed at leads, 1.6 mm from case for 10 s	260	$^{\circ}\text{C}$
M_d	Mounting Torque	M3 screw	0.7	Nm

Recommended Values

Symbol	Characteristic	Value			Unit
		Min.	Typ.	Max.	
V_{GSon}	Recommended turn-on voltage	15	–	18	V
V_{GSoff}	Recommended turn-off voltage	–5	–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 ($T_c = 25\text{ }^{\circ}\text{C}$ 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	$V_{GS} = V_{DS}, I_D = 5\text{ mA}$	1.8	2.9	4.5	V
		$V_{GS} = V_{DS}, I_D = 5\text{ mA}, T_{vj} = 175\text{ }^{\circ}\text{C}$	–	2.0	–	
$R_{DS(on)}$	Drain-source on-state resistance Fig. 4, 5, 6, 7	$V_{GS} = 18\text{ V}, I_D = 10\text{ A @ } T_{vj} = 25\text{ }^{\circ}\text{C}$	–	80	104	m Ω
		$V_{GS} = 18\text{ V}, I_D = 10\text{ A @ } T_{vj} = 175\text{ }^{\circ}\text{C}$	–	136	–	
		$V_{GS} = 15\text{ V}, I_D = 10\text{ A @ } T_{vj} = 25\text{ }^{\circ}\text{C}$	–	100	–	
		$V_{GS} = 15\text{ V}, I_D = 10\text{ A @ } T_{vj} = 175\text{ }^{\circ}\text{C}$	–	145	–	

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 V, V _{GS} = 0 V, f = 1 MHz, V _{AC} = 25 mV		–	1214	–	pF
C _{oss}	Output capacitance Fig. 16			–	58.1	–	
C _{rss}	Reverse transfer capacitance Fig. 16			–	4.2	–	
E _{oss}	C _{oss} stored energy Fig. 17			–	58	–	μJ
Q _g	Total gate charge Fig. 18	V _{DS} = 800 V, I _D = 20 A, V _{GS} = –3 to 18 V		–	53	–	nC
Q _{gs}	Gate-source charge Fig. 18			–	14	–	
Q _{gd}	Gate-drain charge Fig. 18			–	24	–	
R _{g(int)}	Gate input resistance	f = 1 MHz		–	4.2	–	Ω
E _{on}	Turn-on switching energy Fig. 19, 20, 22	V _{DS} = 800 V, I _D = 20 A, V _{GS} = –3.5 to +18 V, R _{G(ext)} = 3.3 Ω, L = 200 μH	T _{vj} = 25 °C	–	181.5	–	μJ
			T _{vj} = 175 °C	–	275.7	–	
E _{off}	Turn-off switching energy Fig. 19, 20, 22		T _{vj} = 25 °C	–	45.1	–	
			T _{vj} = 175 °C	–	44.3	–	
t _{d(on)}	Turn-on delay time Fig. 19, 20		T _{vj} = 25 °C	–	3.9	–	ns
t _r	Rise time Fig. 19, 20		T _{vj} = 25 °C	–	11.7	–	
t _{d(off)}	Turn-off delay time Fig. 19, 20		T _{vj} = 25 °C	–	14.5	–	
t _f	Fall time Fig. 19, 20		T _{vj} = 25 °C	–	8.4	–	

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	$I_{SD} = 10\text{ A}, V_{GS} = 0\text{ V}$	–	4.0	–	V
		$I_{SD} = 10\text{ A}, V_{GS} = 0\text{ V}, T_{vj} = 175\text{ °C}$	–	3.8	–	V
I_s	Diode forward current (continuous)	$V_{GS} = -2\text{ V}, T_c = 25\text{ °C}$	–	–	41	A
		$V_{GS} = -2\text{ V}, T_c = 100\text{ °C}$	–	–	24	
t_{rr}	Reverse recovery time	$V_{GS} = -3.5\text{ V}/+18\text{ V}, I_{SD} = 20\text{ A}, V_R = 800\text{ V},$ $R_{G(ext)} = 13\text{ Ω}, L = 200\text{ μH}, di/dt = 3000\text{ A}/\mu\text{s}$	–	28.6	–	ns
Q_{rr}	Reverse recovery charge		–	163.4	–	nC
I_{rrm}	Peak reverse recovery current		–	14.7	–	A

Characteristic Curves

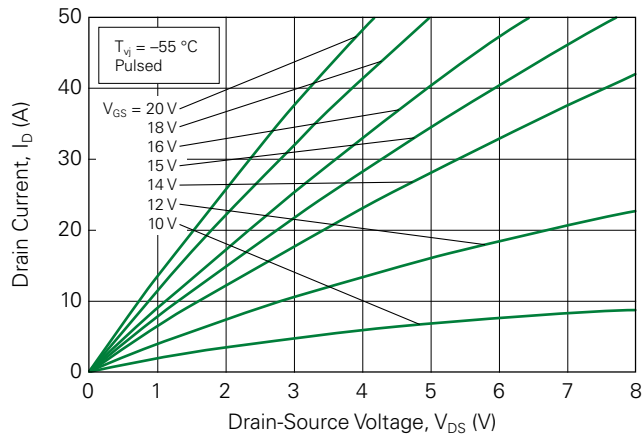
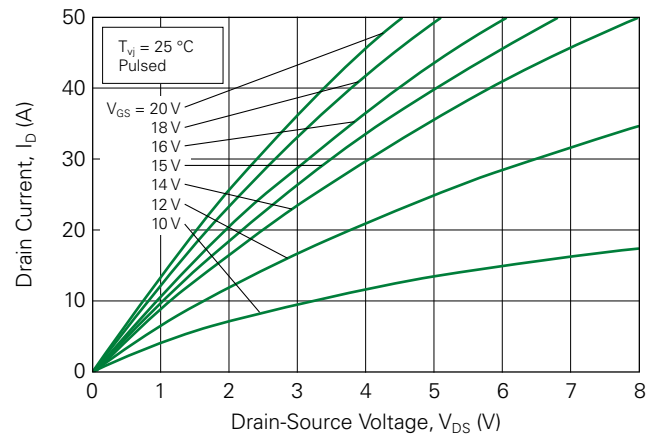
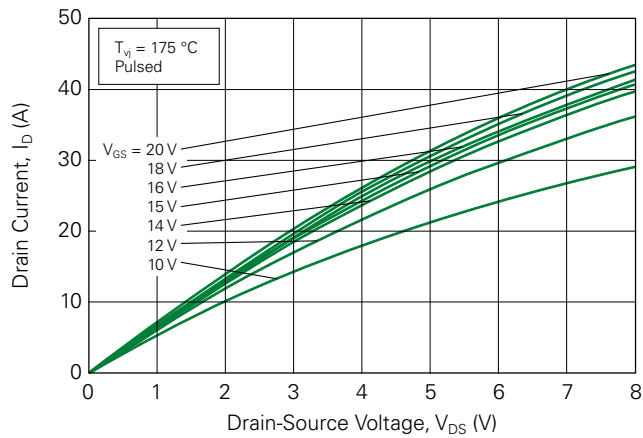
Fig. 1. Typical Output Characteristics @ $T_{vj} = -55^\circ\text{C}$ Fig. 2. Typical Output Characteristics @ $T_{vj} = 25^\circ\text{C}$ Fig. 3. Typical Output Characteristics @ $T_{vj} = 175^\circ\text{C}$ 

Fig. 4. Typical Drain-source On-state Resistance vs. Junction Temperature

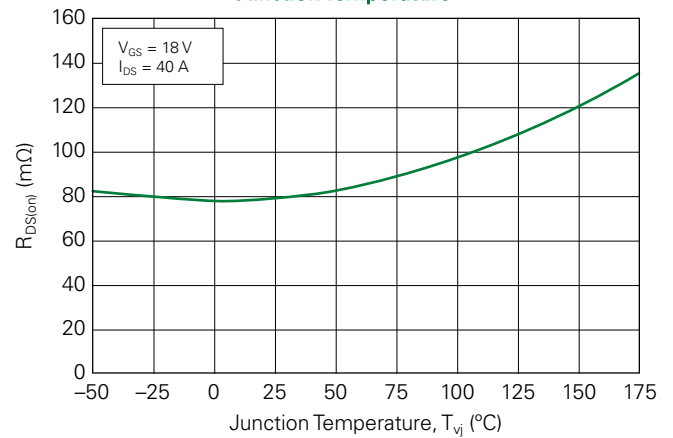


Fig. 5. Typical Drain-source On-State Resistance (Normalized) vs. Junction Temperature

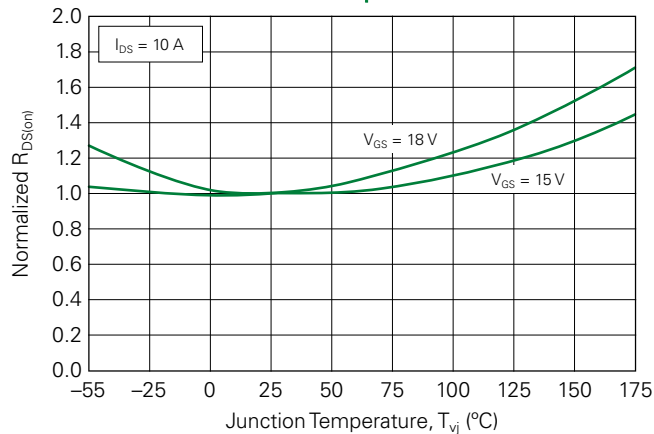
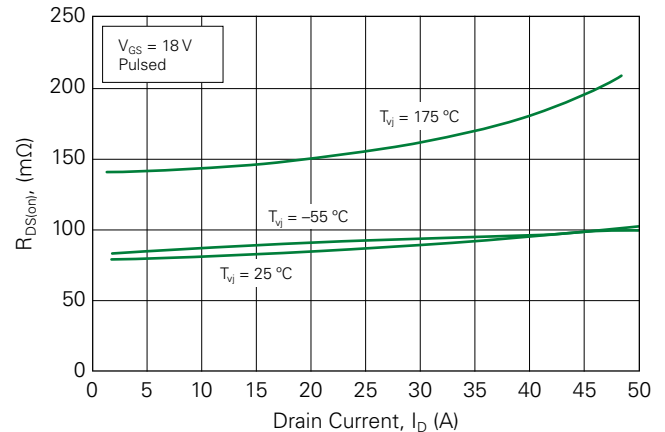
Fig. 6. $R_{DS(on)}$ vs. I_{DS} 

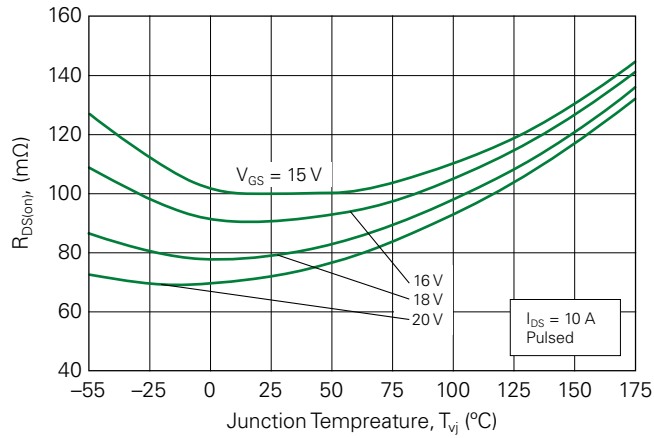
Fig. 7. $R_{DS(on)}$ vs. Temperature

Fig. 8. Transfer Curves

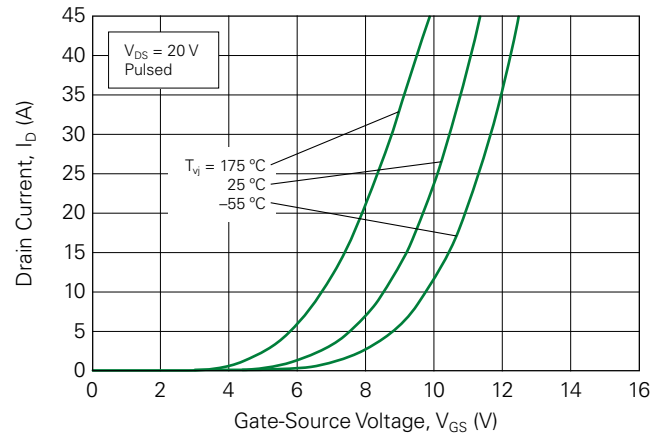


Fig. 9. Threshold Voltage vs. Temperature

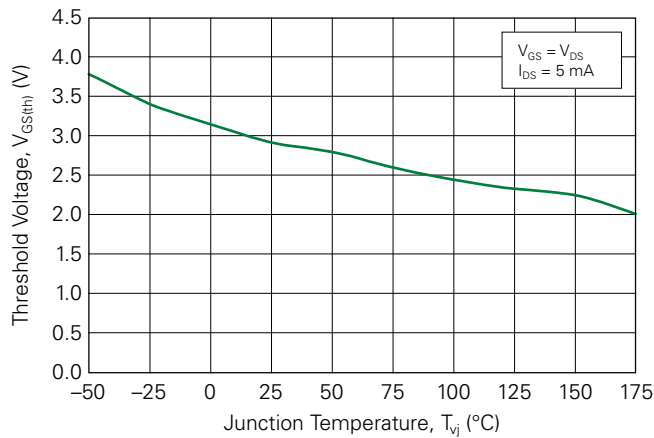
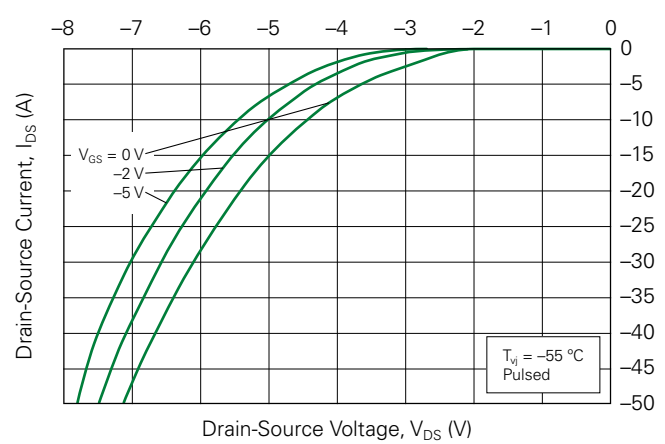
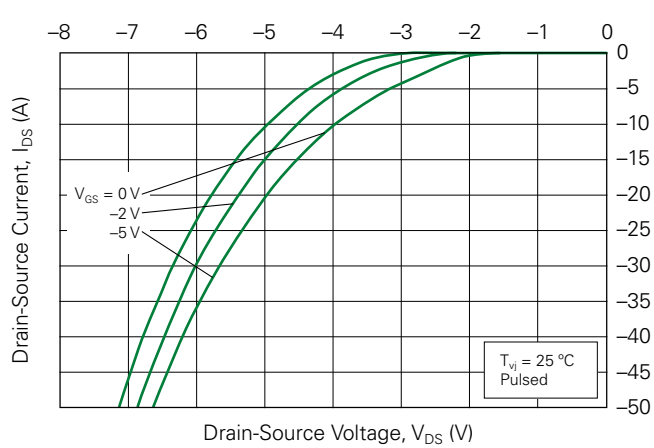
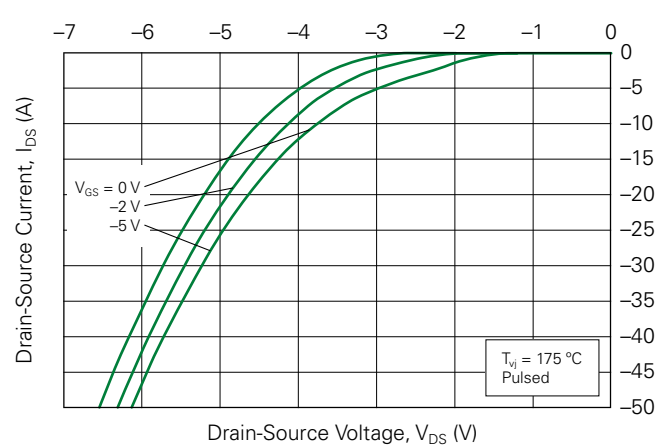
Fig. 10. Body Diode Curves @ $T_{vj} = -55^\circ C$ Fig. 11. Body Diode Curves @ $T_{vj} = 25^\circ C$ Fig. 12. Body Diode Curves @ $T_{vj} = 175^\circ C$ 

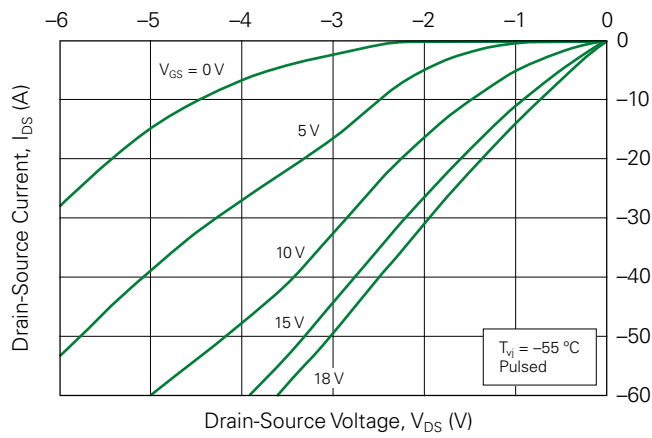
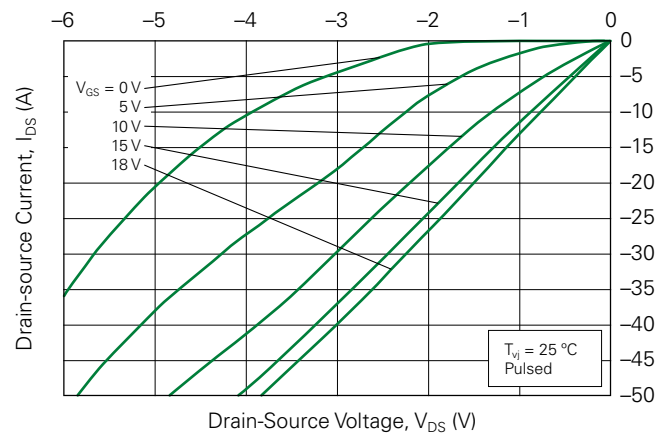
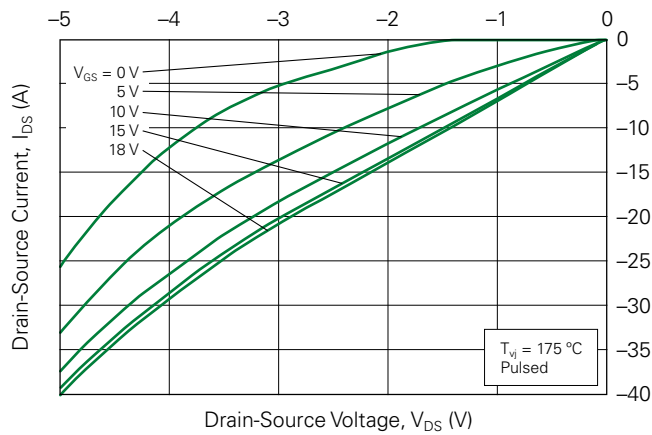
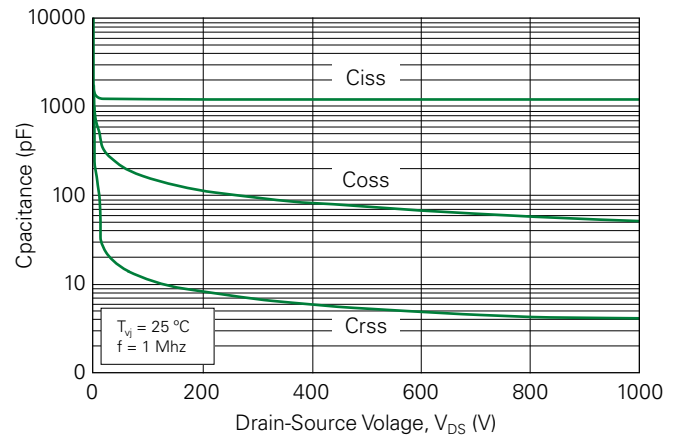
Fig. 13. 3rd Quadrant Curves @ $T_{vj} = -55^\circ\text{C}$ Fig. 14. 3rd Quadrant Curves @ $T_{vj} = 25^\circ\text{C}$ Fig. 15. 3rd Quadrant Curves @ $T_{vj} = 175^\circ\text{C}$ Fig. 16. Capacitance vs. V_{DS} 

Fig. 17. Output Capacitor Stored Energy

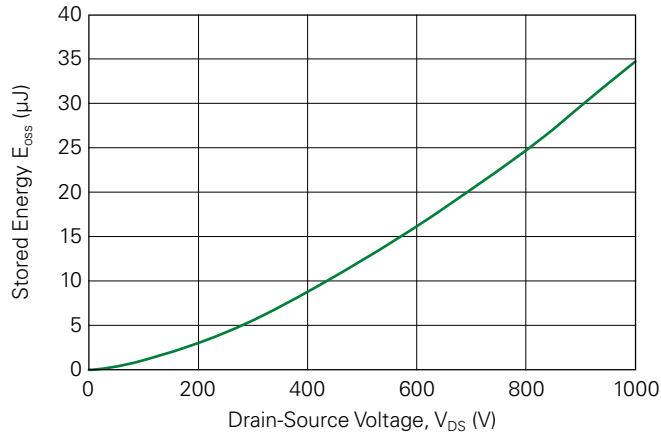


Fig. 18. Gate Charge Characteristics

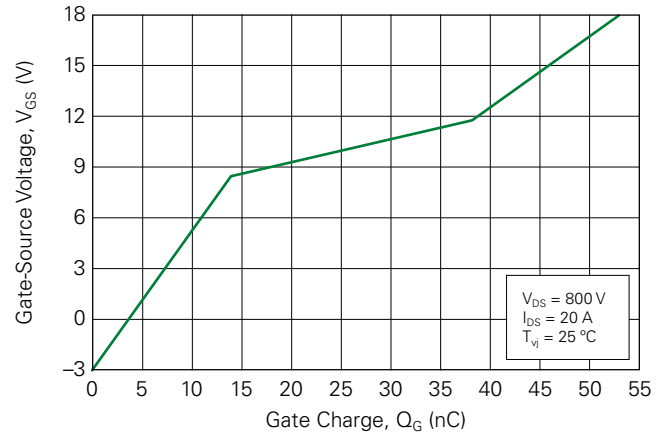


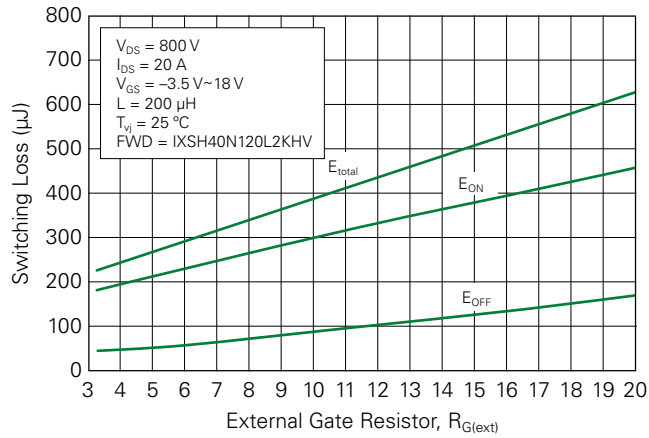
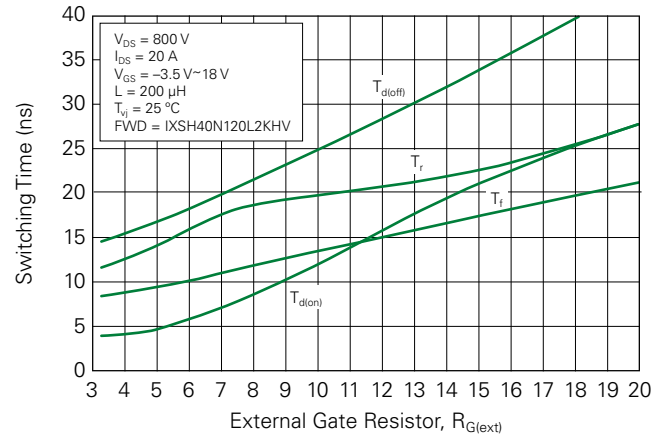
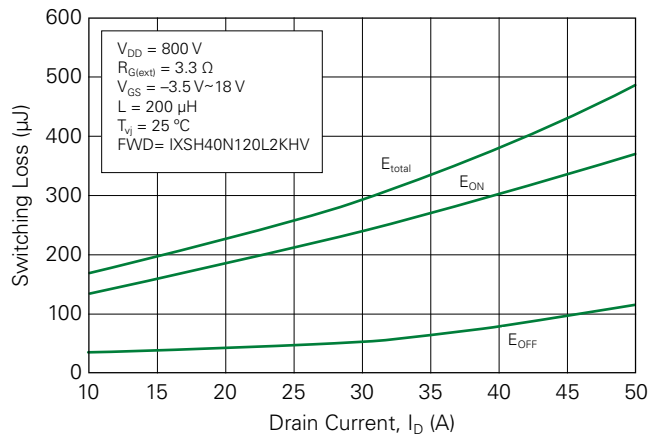
Fig. 19. Switching Energy vs. $R_{G(ext)}$ Fig. 20. Switching Times vs. $R_{G(ext)}$ Fig. 21. Switching Energy vs. I_{DS} 

Fig. 22. Switching Energy vs. Temperature

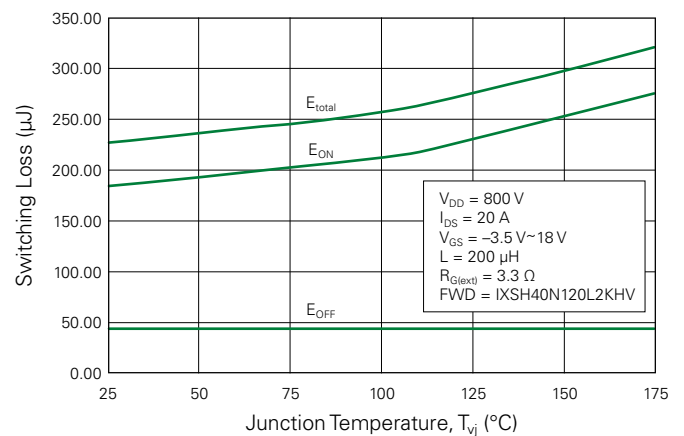


Fig. 23. Continuous Drain Current vs. Case Temperature

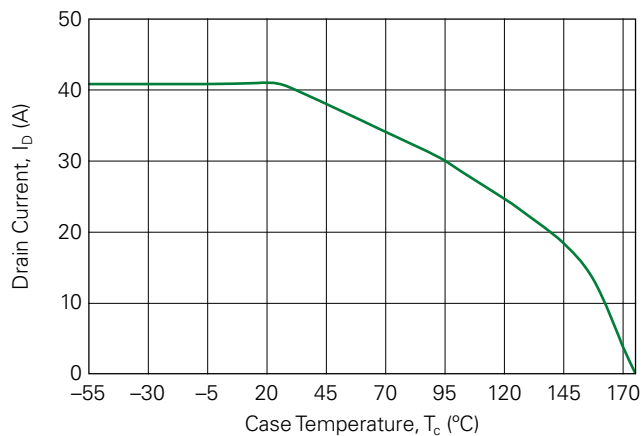


Fig. 24. Max. Power Dissipation Derating vs. Case Temperature

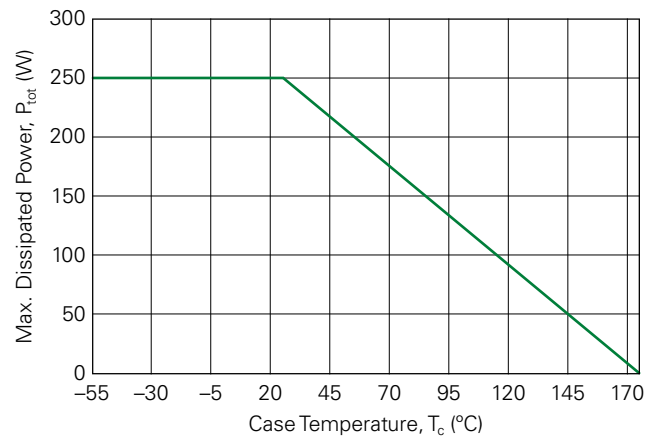


Fig. 25. Thermal Impedance

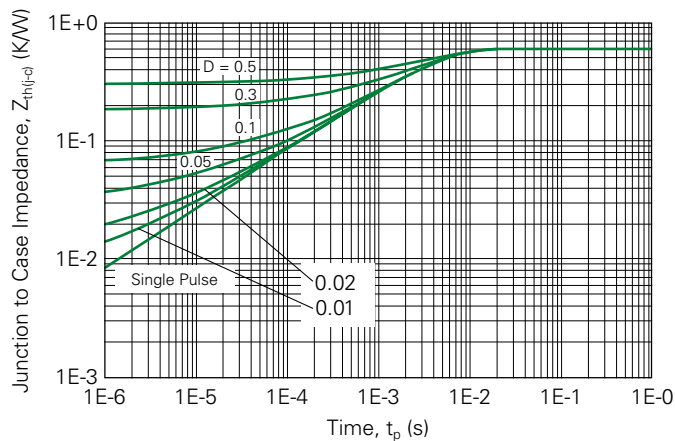
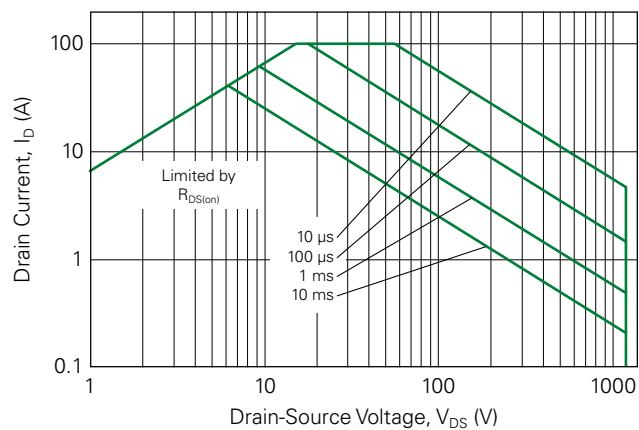


Fig. 26. Safe Operating Area



Part Number and Marking

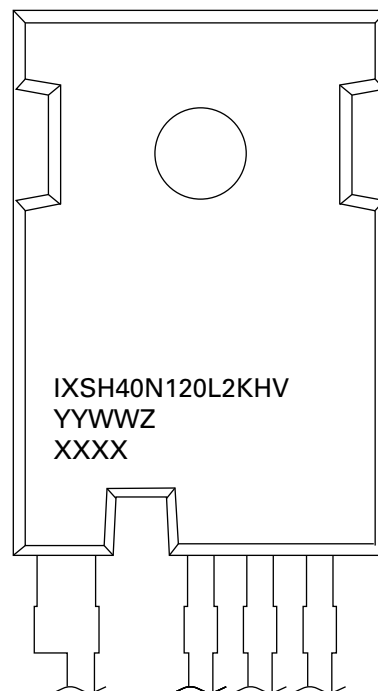
IXSH40N120L2KHV = Device Part Number

YY = Year

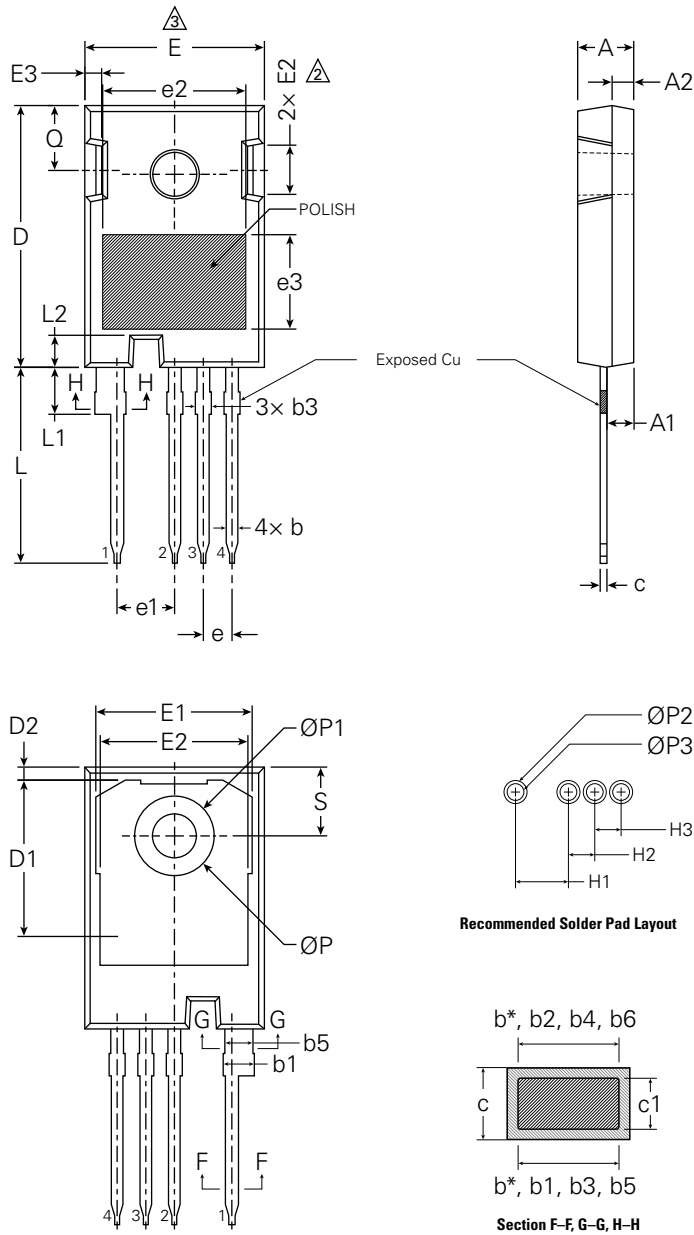
WW = Work Week

Z = Assembly Location

XXXX = Lot Traceability



Part Outline Drawing (TO-247-4L)

**Note:**

- Package reference: JEDEC TO247, Variation AD
- Slot required, notch may be rounded
- Dimension D&E do not include mold flash
- 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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Part of:

