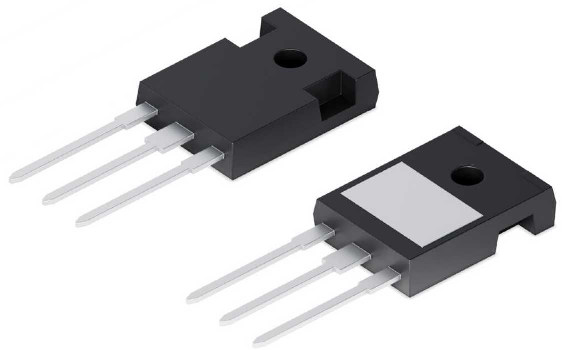
IXSJ80N120R1

1200 V, 18 mΩ, 85 A SiC Power MOSFET

RoHS HF E153432



Features

- Up to 1200 V blocking voltage with low $R_{DS(on)}$ of 18 mΩ
- Low gate charge of 154 nC and low input capacitance of 4522 pF
- Flexible gate voltage range (15–18 V) and 0 V recommended turn-off gate voltage

Benefits

- Low conduction losses and reduced heat dissipation
- Low gate drive power requirements
- Supports high-speed switching with reduced gate drive losses

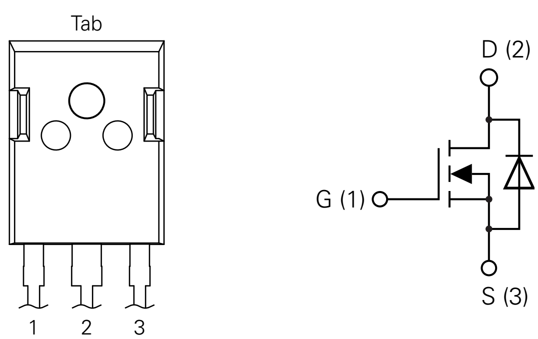
ISO247-3L Package

- High performance ceramic based isolated package improves overall thermal resistance $R_{th(j-h)}$ and power handling capability
- Isolation voltage 2500 V AC (RMS), 1 minute
- Reduced EMI attributed to the small chip-to-heatsink stray capacitance
- Industry standard package outline

Applications

- EV charging infrastructure
- Solar inverters
- Switch mode power supplies
- Uninterruptible power supply
- Motor drives
- DC/DC converters
- Battery chargers
- Induction heating
- High-frequency applications

Pinout Diagram (ISO247-3L)



1: Gate; **2:** Drain; **3:** Source; **Tab:** Isolated

Product Summary

Characteristic	Value	Unit
I_{D25}	85	A
V_{DSS}	1200	V
$R_{DS(on)\ typ}$	18	mΩ

Maximum Ratings (T_{vj} = 25 °C unless otherwise specified)

Symbol	Characteristics	Conditions		Value			Unit
				Min.	Typ.	Max.	
V_{DSS}	Drain-source voltage	V_{GS} = 0 V, I_D = 9.9 mA, T_{vj} = 25 °C		–	1200	–	V
V_{GSM}	Maximum gate-source voltage	Gate-source voltage (DC)		–4	–	+21	V
	Transient gate-source voltage	Transient, $t_{transient}$ < 300 ns		–4	–	+23	V
I_D	Drain current	V_{GS} = 18 V	T_c = 25 °C	–	85	–	A
			T_c = 80 °C	–	63	–	
			T_c = 100 °C	–	54	–	
I_{DM}	Peak drain current	T_c = 25 °C, pulse width limited by $T_{vj(max)}$		–	157	–	A
I_S	Diode forward current	V_{GS} = 0 V , T_c = 25 °C		–	37	–	A
I_{SM}	Body-diode surge forward current	Pulse width limited by $T_{vj(max)}$		–	85	–	A
P_{tot}	Total power dissipation	T_c = 25 °C		–	266	–	W
T_{vj}	Virtual junction temperature range	–		–40	–	+150	°C
$T_{vj(max)}$	Maximum virtual junction temperature	–		–	150	–	°C
T_{stg}	Storage temperature range	–		–40	–	+150	°C
F_C	Mounting force with clip	–		0.8	–	1.2	Nm
T_{sold}	Soldering temperature	3 mm (1/8 in.) from case 10 s		–	260	–	°C
$d_{Spp/App}$ $d_{Spb/Apb}$	Creepage distance on surface / Clearance distance through air	Terminal to terminal	Between pin 1 to 2	3.88	–	–	mm
			Between pin 2 to 3	1.34	–	–	
			Between pin 3 to 4		–	–	
	Clearance distance through air	Terminal to backside plane	For all Terminals	2.4	–	–	
	Creepage distance on surface	Terminal to backside tab		5.26	–	–	
G	Package weight	–		–	8	–	g

Recommended Values

Symbol	Characteristics	Conditions	Value	Unit
$V_{GS(on)}$	Recommended turn-on gate-source voltage	–	18	V
$V_{GS(off)}$	Recommended turn-off gate-source voltage	–	0	V

Thermal Characteristics

Symbol	Characteristics	Conditions	Value			Unit
			Min.	Typ.	Max.	
$R_{th(j-c)}$	Thermal resistance junction to case	–	–	–	0.47	K/W

Electrical Characteristics – Static (T_{vj} = 25 °C unless otherwise specified)

Symbol	Characteristics	Conditions		Value			Unit
				Min.	Typ.	Max.	
$V_{(BR)DSS}$	Breakdown voltage, drain-source	V_{GS} = 0 V, I_D = 9.9 mA, T_{vj} = 25 °C		1200	–	–	V
$V_{GS(th)}$	Gate-source threshold voltage	V_{GS} = V_{DS}, I_D = 22.2 mA	T_{vj} = 25 °C	2.8	–	4.8	V
			T_{vj} = 150 °C	–	2.8	–	V
I_{DSS}	Drain-source leakage current	V_{DS} = 1200 V, V_{GS} = 0 V	T_{vj} = 25 °C	–	1	80	µA
			T_{vj} ≤ 150 °C	–	35	–	
$I_{GSS,F}$	Gate leakage current	V_{GS} = 21 V, V_{DS} = 0 V		–	–	100	nA
$I_{GSS,R}$		V_{GS} = –4 V, V_{DS} = 0 V		–	–	–100	
$R_{DS(on)}$	Drain-source on-state resistance	I_D = 40 A, V_{GS} = 18 V	T_{vj} = 25 °C	–	18	23.4	mΩ
			T_{vj} = 150 °C	–	36	–	mΩ
$R_{g(int)}$	Internal gate resistance	f = 1 MHz, R_G, Resonance method, drain-source shorted[1]		–	1	–	Ω
g_{fs}	Transconductance	V_{DS} = 10 V, I_D = 42 A		–	27	–	S

Note 1: For a description of the resonance method for measuring R_g, refer to the JEDEC Standard JESD24-11 test method

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

Symbol	Characteristics	Conditions		Value Min.	Value Typ.	Value Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 800 V, V_{GS} = 0 V, f = 1 MHz		–	4522	–	pF
C_{oss}	Output capacitance			–	131	–	
C_{rss}	Reverse transfer capacitance			–	9	–	
Q_G	Total gate charge	V_{DD} = 800 V, I_D = 42 A , V_{GS} = 0/+18V, $R_{g(ext)}$ = 3.3 Ω, L = 250 µH FWD: Body Diode		–	154	–	nC
Q_{GS}	Gate-source charge			–	36	–	
Q_{GD}	Gate-drain charge			–	35	–	
E_{oss}	Output capacitance charge energy	V_{DS} = 800 V, V_{GS} = 0 V, f = 1 MHz		–	42	–	µJ
$t_{d(on)}$	Turn-on delay time	Inductive Switching Free Wheeling Diode: Body Diode V_{DD} = 800 V, V_{GS} = 0/+18V, I_D = 42 A, $R_{g(ext)}$ = 3.3 Ω	T_{vj} = 25 °C	–	20	–	ns
			T_{vj} = 150 °C	–	18	–	
t_r	Rise time		T_{vj} = 25 °C	–	44	–	
			T_{vj} = 150 °C	–	40	–	
t_{on}	Turn-on time		T_{vj} = 25 °C	–	63	–	
			T_{vj} = 150 °C	–	59	–	
E_{on}	Turn-on energy		T_{vj} = 25 °C	–	1070	–	µJ
			T_{vj} = 150 °C	–	1029	–	
$t_{d(off)}$	Turn-off delay time		T_{vj} = 25 °C	–	52	–	ns
			T_{vj} = 150 °C	–	60	–	
t_f	Fall time		T_{vj} = 25 °C	–	13	–	
			T_{vj} = 150 °C	–	14	–	
t_{off}	Turn-off time		T_{vj} = 25 °C	–	64	–	
			T_{vj} = 150 °C	–	74	–	
E_{off}	Turn-off energy		T_{vj} = 25 °C	–	366	–	µJ
			T_{vj} = 150 °C	–	437	–	
E_{tot}	Total switching energy		T_{vj} = 25 °C	–	1436	–	µJ
			T_{vj} = 150 °C	–	1466	–	

Electrical Characteristics – Body Diode (T_{vj} = 25 °C unless otherwise specified)

Symbol	Characteristics	Conditions		Value Min.	Value Typ.	Value Max.	Unit
V_{SD}	Forward voltage drop	I_{SD} = 42 A, V_{GS} = 0 V	T_{vj} = 25 °C	–	3.4	–	V
			T_{vj} = 150 °C	–	3.7	–	
t_{rr}	Reverse recovery time	V_{GS} = 0 V, I_F = 42 A, V_R = 800 V MOSFET Gate Drive: $R_{g(ext)}$ = 3.3 Ω	T_{vj} = 25 °C	–	31	–	ns
			T_{vj} = 150 °C	–	24	–	
Q_{rr}	Reverse recovery charge		T_{vj} = 25 °C	–	281	–	nC
			T_{vj} = 150 °C	–	302	–	
I_{rrm}	Peak reverse recovery current		T_{vj} = 25 °C	–	15	–	A
			T_{vj} = 150 °C	–	15	–	
di_F/dt	Current slew rate		T_{vj} = 25 °C	–	1922	–	A/µs
			T_{vj} = 150 °C	–	1912	–	
$E_{rec(off)}$	Turn-off energy of intrinsic diode per pulse	Inductive load, V_{DD} =800 V, V_{GS} = 0/+18 V, I_S = 42 A, $R_{g(ext)}$ = 3.3 Ω, L = 250 µH	T_{vj} = 25 °C	–	87	–	µJ
			T_{vj} = 150 °C	–	98	–	

Characteristic Curves

Fig. 1. Typical Transfer Characteristics

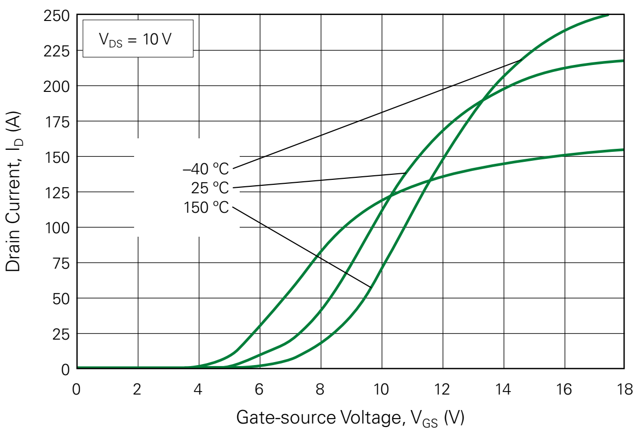


Fig. 2. Typical Transconductance

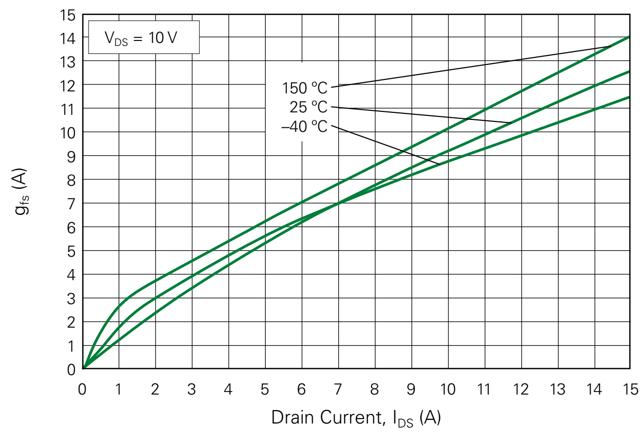


Fig. 3. Typical Output Characteristics @ T_{vj} = 25 °C

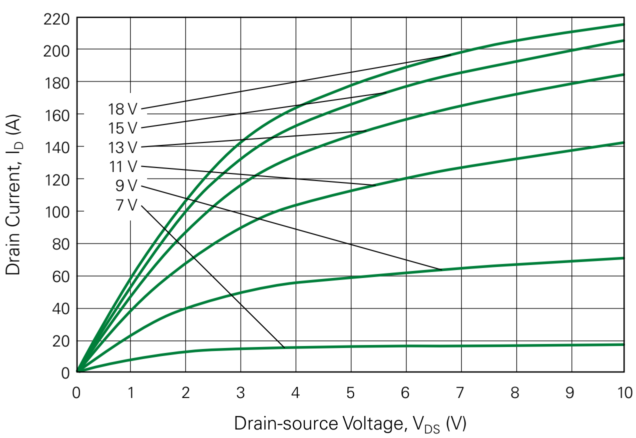


Fig. 4. Typical Output Characteristics @ T_{vj} = 150 °C

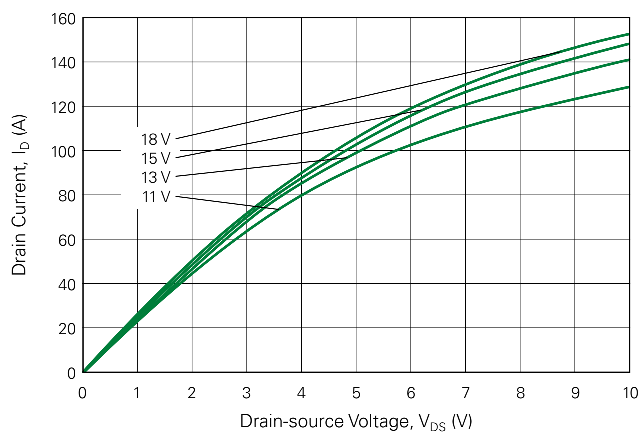


Fig. 5. Typical Output Characteristics @ T_{vj} = – 40°C

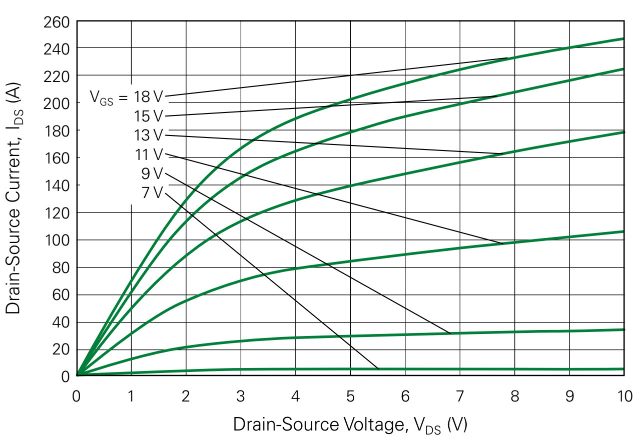


Fig. 6. $R_{DS(on)}$ Normalized to I_D = 40 A vs. Drain Current

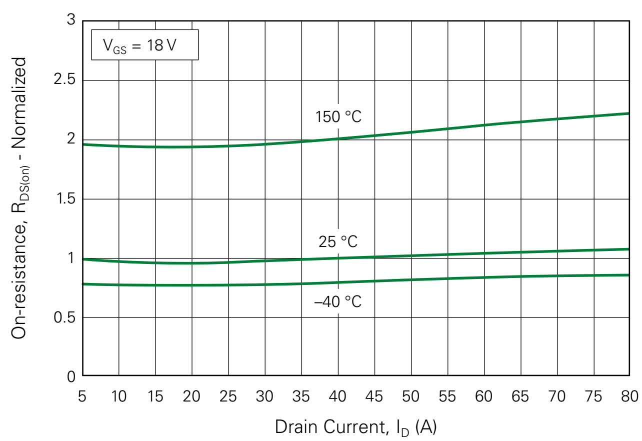


Fig. 7. $R_{DS(on)}$ Normalized to I_D = 40 A vs. Junction Temperature

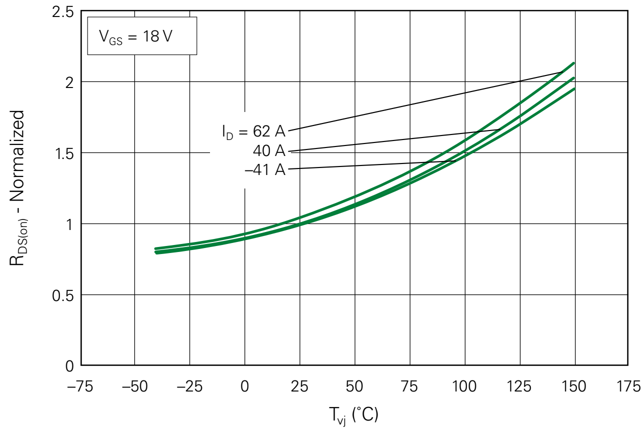


Fig. 8. Typical Drain-source On-state Resistance vs. Gate-source Voltage

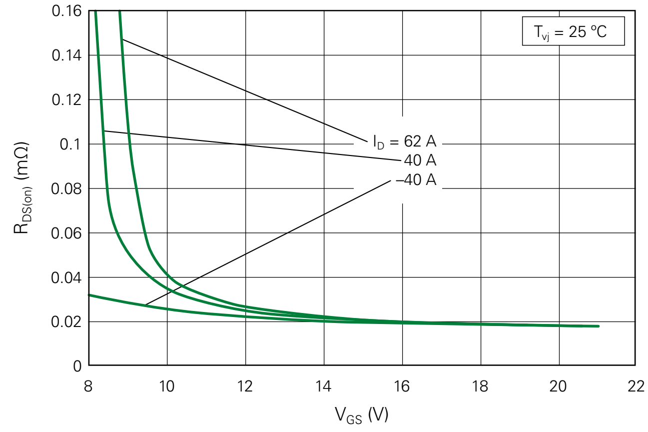


Fig. 9. Typical $V_{(BR)DSS}$/$V_{GS(th)}$ (Normalized) vs. Virtual Junction Temperature

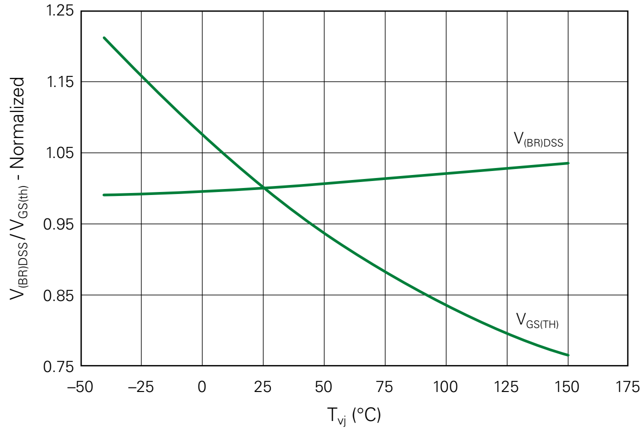


Fig. 10. Typical Reverse Conduction Characteristics @ T_{vj} = –40 °C

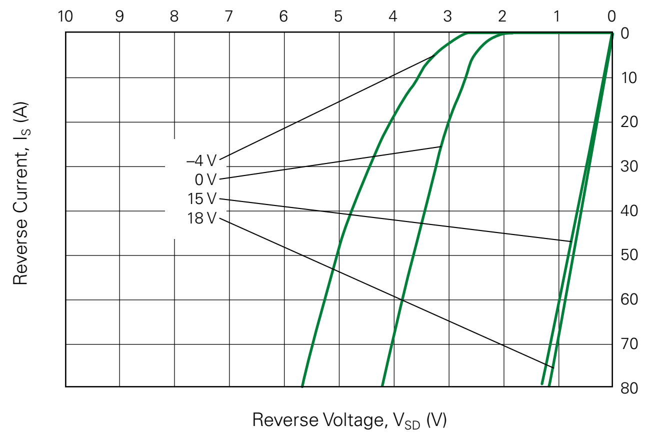


Fig. 11. Typical Reverse Conduction Characteristics @ T_{vj} = 25 °C

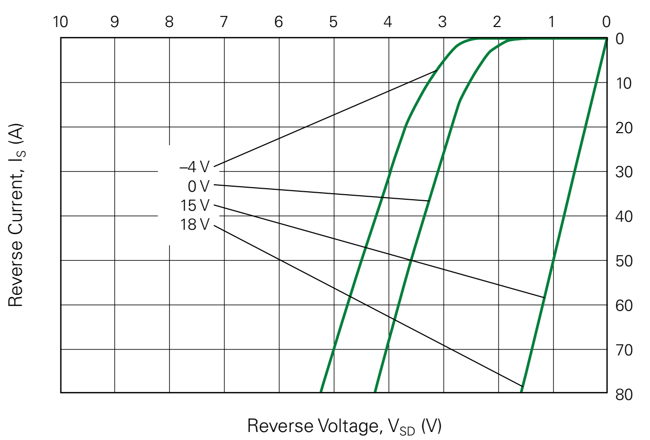


Fig. 12. Typical Reverse Conduction Characteristics @ T_{vj} = 150 °C

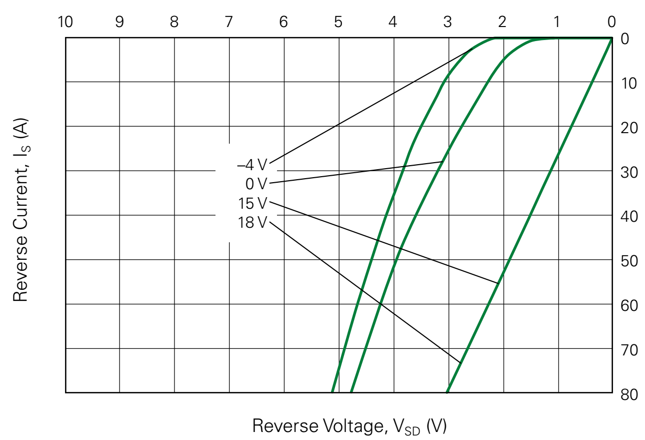


Fig. 13. Typical On-resistance vs. Junction Temperature

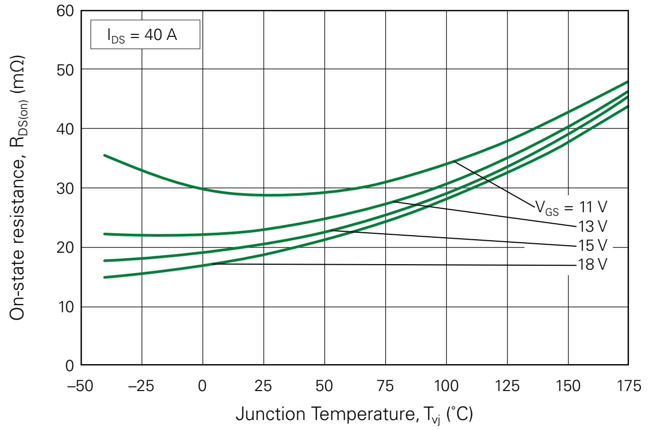


Fig. 14. Typical Threshold Voltage

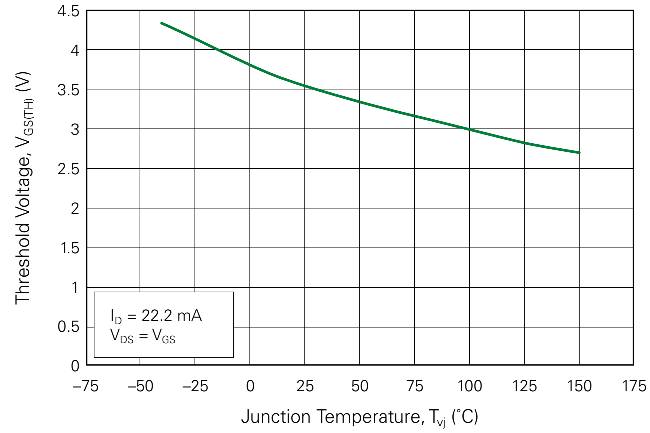


Fig. 15. Body Diode Forward Voltage vs. Gate-source Voltage

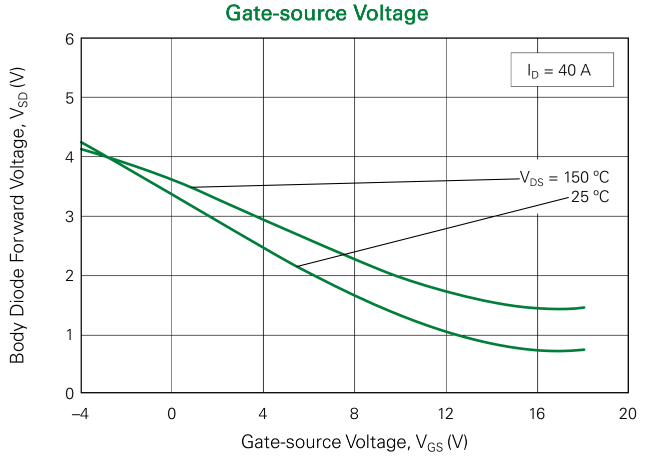


Fig. 16. Gate Charge Characteristics

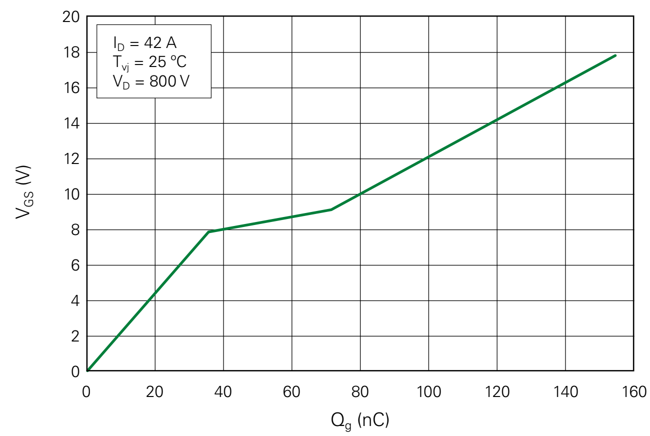


Fig. 17. Capacitance vs. V_{DS}

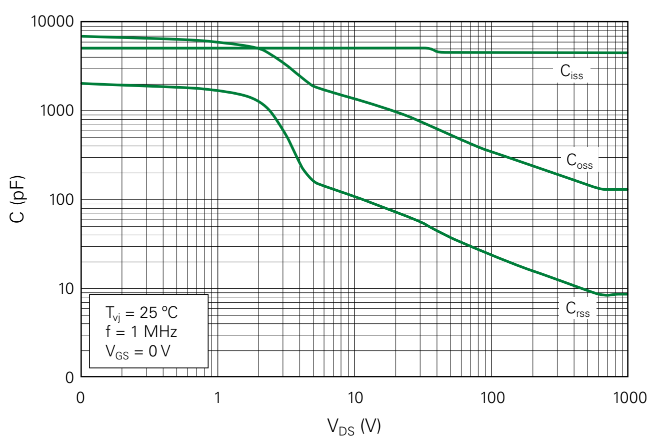


Fig. 18. Output Capacitance C_{oss} Stored Energy

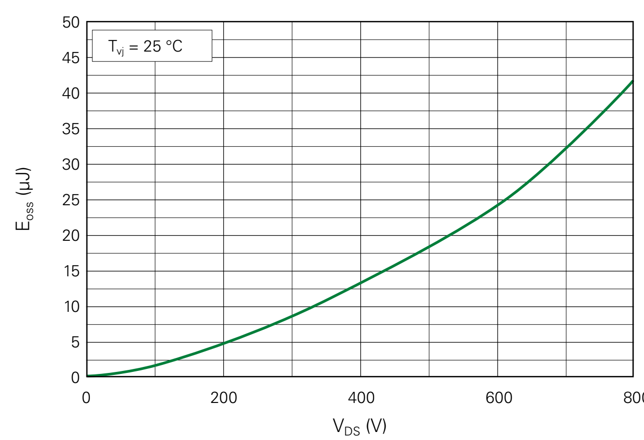


Fig. 19. Typical Switching Time vs. External Gate Resistor

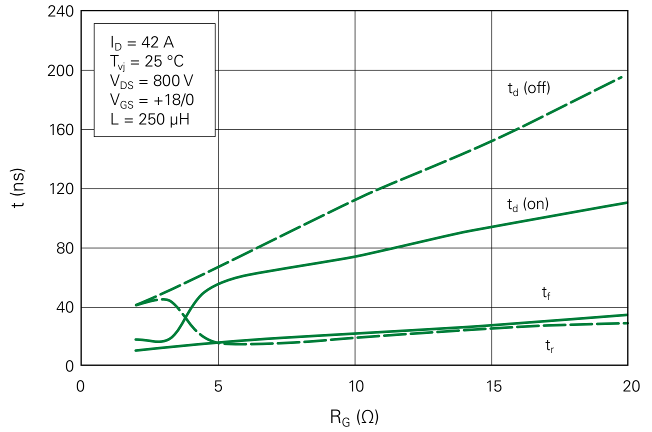


Fig. 20. Typical Switching Energy vs. Drain Current

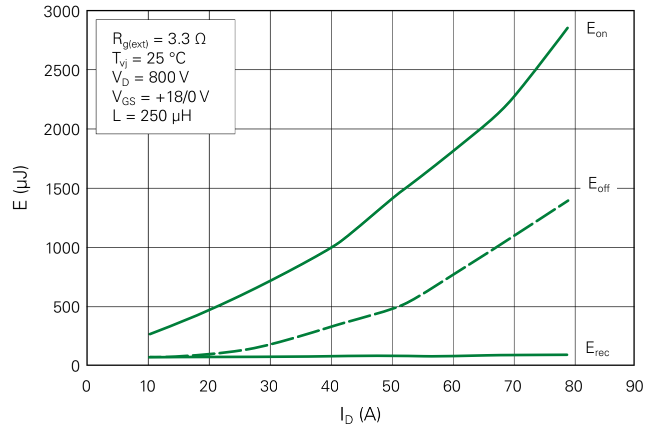


Fig. 21. Typical Switching Energy vs. External Gate Resistor

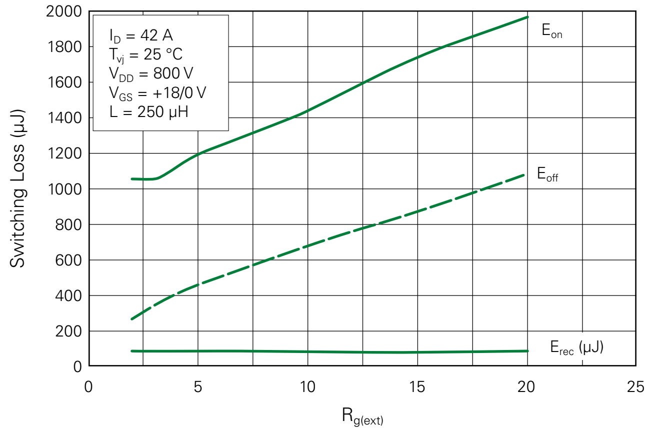


Fig. 22. Typical Switching Energy vs. Junction Temperature

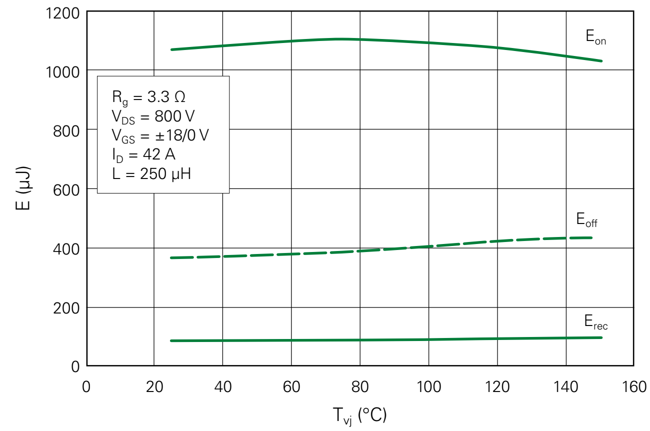


Fig. 23. Typical Reverse Recovery Charge vs. Diode Recovery Current Slope

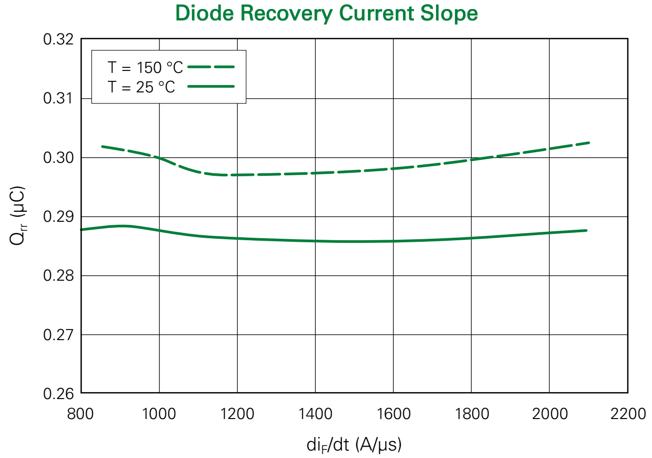


Fig. 24. Typical Reverse Recovery Current vs. Diode Recovery Current Slope

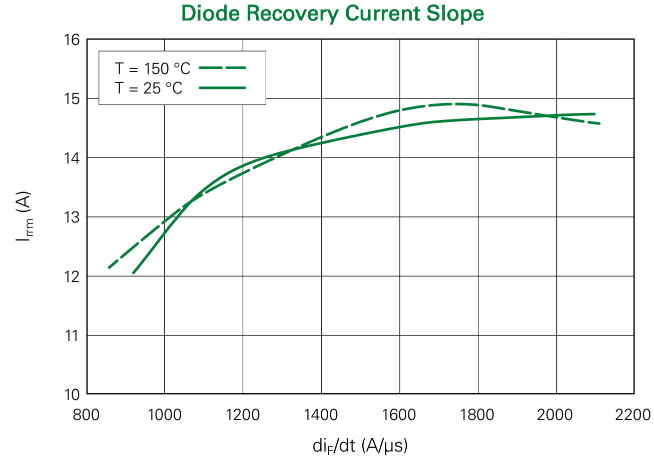


Fig. 25. Thermal Impedance (Normalized)

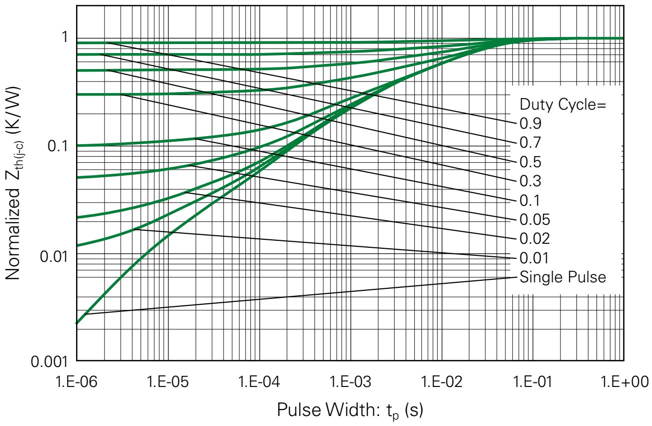
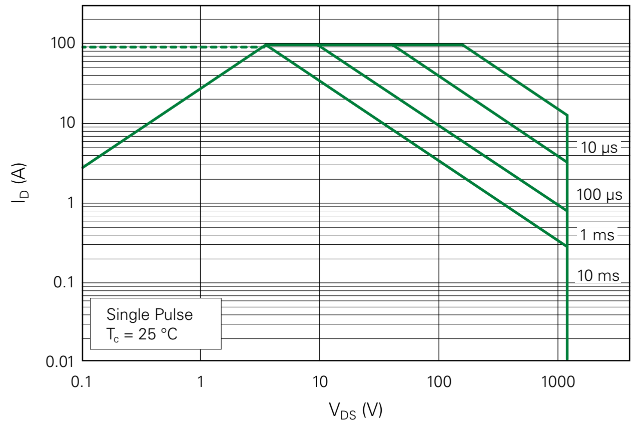
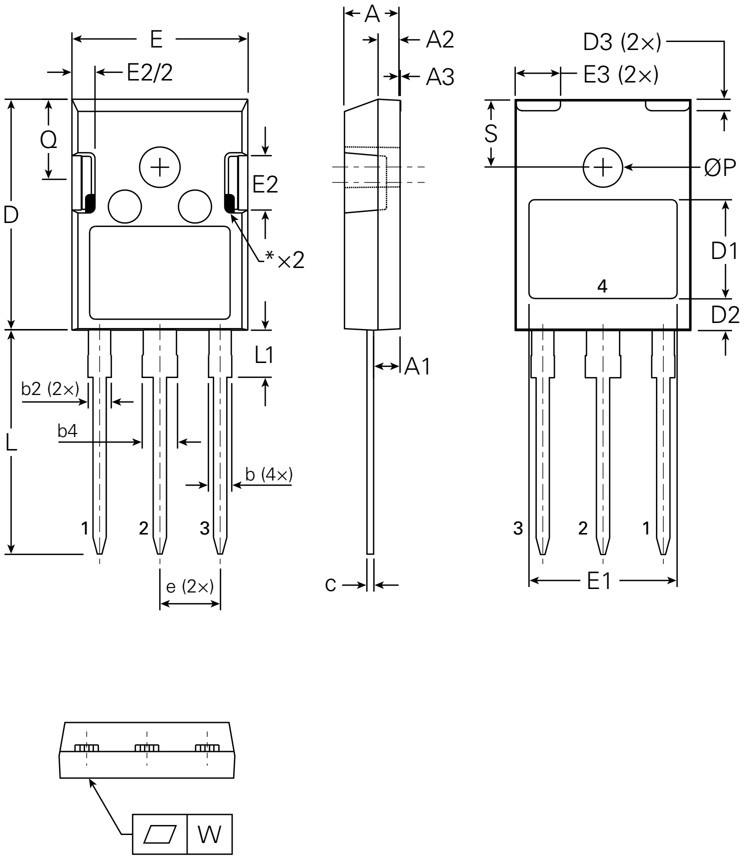


Fig. 26. Maximum Safe Operating Area (T_c = 25 °C)



Part Outline Drawing (ISO247-3L)



Symbol	Inches			Millimeters		
	Min.	**Typical**	**Max.**	**Min.**	**Typical**	**Max**
A	0.185	–	0.205	4.70	–	5.21
A1	0.087	–	0.102	2.21	–	2.59
A2	0.059	–	0.098	1.50	–	2.49
A3		0.002 TYP			0.05 TYP	
b	0.039	–	0.055	0.99	–	1.40
b2	0.065	–	0.094	1.65	–	2.39
b4	0.102	–	0.135	2.59	–	3.43
c	0.015	–	0.035	0.38	–	0.89
D	0.819	–	0.844	20.80	–	21.45
D1		0.360 TYP			9.15 TYP	
D2		0.110 TYP			2.80 TYP	
D3		0.039 TYP			1.00 TYP	
E	0.610	–	0.639	15.49	–	16.24
E1		0.528 TYP			13.40 TYP	
E2	0.170	–	0.216	4.32	–	5.48
E3		0.157 TYP			4.00 TYP	
e		0.215 BSC			5.46 BSC	
L	0.780	–	0.799	19.81	–	20.30
L1	–	–	0.177	–	–	4.49
Q	0.290	–	0.306	7.36	–	7.76
ØP	0.140	–	0.144	3.56	–	3.65
S		0.242 BSC			6.15 BSC	
W		0.004 TYP			0.10 TYP	

Note:

1. Bottom Heatsink #4 is Pre-Ni Plated and electrically isolated from Pin #1, #2, and #3.
2. Dimensions are exclusive of burrs, mold flash and tie bar extrusions.
3. Drawing conforms to ASME 14.5–2009.

* Exposed metal, electrically isolated.