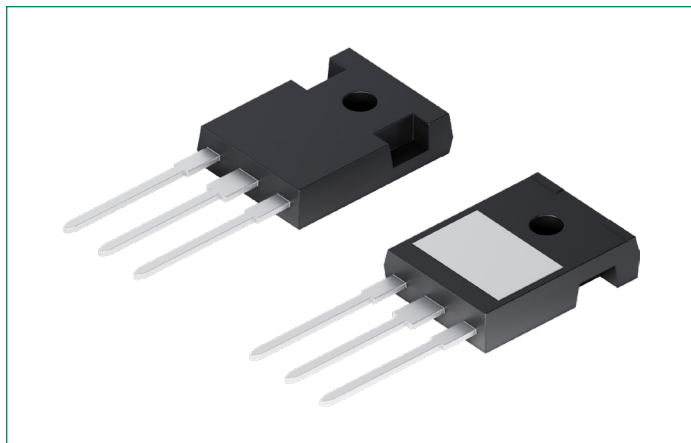
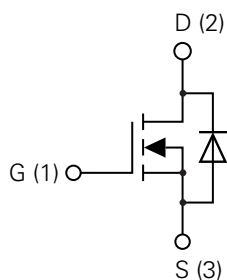
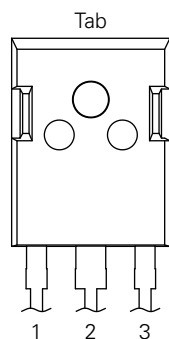


IXSJ43N120R1

1200 V, 36 mΩ, 45 A SiC Power MOSFET



Pinout Diagram (ISO247-3L)



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

Features

- Up to 1200 V blocking voltage with low $R_{DS(on)}$ of 36 mΩ
- Low gate charge of 79 nC and low input capacitance of 2453 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

Product Summary

Characteristic	Value	Unit
I_{D25}	45	A
V_{DSS}	1200	V
$R_{DS(on)}$ typ	36	mΩ

Maximum Ratings

Symbol	Characteristics	Conditions	Value			Unit	
			Min.	Typ.	Max.		
V _{DSS}	Drain-source voltage	V _{GS} = 0 V, I _D = 9.2 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		
I _D	Drain current	V _{GS} = 18 V	T _c = 25 °C	–	45	–	A
			T _c = 80 °C	–	36	–	A
			T _c = 100 °C	–	32	–	A
I _{DM}	Peak drain current	T _c = 25 °C, pulse width limited by T _{vj(max)}	–	74	–	A	
I _S	Diode forward current	V _{GS} = 0 V , T _c = 25 °C	–	39	–	A	
I _{SM}	Body-diode surge Forward Current	Pulse width limited by T _{vj(max)}	–	74	–	A	
P _{tot}	Total power dissipation	T _c = 25 °C	–	142	–	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	–	–	–	0.88	K/W

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

Symbol	Characteristics	Conditions		Ratings			Unit
				Min.	Typ.	Max.	
$V_{(BR)DSS}$	Breakdown voltage, drain-source	$V_{GS} = 0\text{ V}$, $I_D = 11.1\text{ mA}$, $T_{vj} = 25\text{ }^{\circ}\text{C}$		1200	–	–	V
$V_{GS(th)}^2$	Gate-source threshold voltage	$V_{GS} = 0\text{ V}$, $I_D = 11.1\text{ mA}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	2.8	–	4.8	V
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	–	3.2	–	
I_{DSS}	Drain-source leakage current	$V_{DS} = 1200\text{ V}$, $V_{GS} = 0\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	–	1	80	μA
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	–	25	–	
$I_{GSS,F}$	Gate leakage current	$V_{GS} = 21\text{ V}$, $V_{DS} = 0\text{ V}$		–	–	100	nA
$I_{GSS,R}$		$V_{GS} = -4\text{ V}$, $V_{DS} = 0\text{ V}$		–	–	–100	
$R_{DS(on)}$	Drain-source on-state resistance	$I_D = 1\text{ A}$, $V_{GS} = 18\text{ V}$	$T_{vj} = 25\text{ }^{\circ}\text{C}$	–	36	47	m Ω
			$T_{vj} = 150\text{ }^{\circ}\text{C}$	–	70	–	
$R_{g(int)}$	Internal gate resistance	Resonance method, drain-source shorted ¹		–	1	–	Ω
g_{fs}	Transconductance	$V_{DS} = 10\text{ V}$, $I_D = 21\text{ A}$		–	16	–	S

Note 1: Pulse width limited by $T_{vj,max}$

Note 2: Tested after applying $V_{GS} = 21\text{ V}$ for 100 ms

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

Symbol	Characteristics	Conditions	Ratings			Unit	
			Min.	Typ.	Max.		
C _{iss}	Input capacitance	V _{DS} = 800 V, V _{GS} = 0 V, f = 1 MHz	–	2453	–	pF	
C _{oss}	Output capacitance		–	70	–		
C _{rss}	Reverse transfer capacitance		–	5	–		
Q _G	Total gate charge	V _{DD} = 800 V, I _D = 21 A, V _{GS} = 0/+18 V, R _{g(ext)} = 3.3 Ω, L = 250 μH FWD: Body Diode	–	79	–	nC	
Q _{GS}	Gate-source charge		–	20	–		
Q _{GD}	Gate-drain charge		–	17	–		
E _{oss}	Output capacitance charge energy	V _{DS} = 800 V, V _{GS} = 0 V, f = 1MHz		22		μJ	
t _{d(on)}	Turn-on delay time	Inductive Switching Free wheeling diode: body diode V _{DD} = 800 V, V _{GS} = 0/+18 V, I _D = 21 A, R _{g(ext)} = 3.3 Ω, L = 250 μH	T _{vj} = 25 °C	–	15	–	ns
			T _{vj} = 150 °C	–	14	–	
t _r	Rise time		T _{vj} = 25 °C	–	30	–	
			T _{vj} = 150 °C	–	27	–	
t _{on}	Turn-on time		T _{vj} = 25 °C		44		
			T _{vj} = 150 °C		41		
E _{on}	Turn-on energy per pulse		T _{vj} = 25 °C		404		μJ
			T _{vj} = 150 °C		378		
t _{d(off)}	Turn-off delay time		T _{vj} = 25 °C	–	32	–	ns
			T _{vj} = 150 °C	–	37	–	
t _f	Fall time		T _{vj} = 25 °C	–	10	–	
			T _{vj} = 150 °C	–	11	–	
t _{off}	Turn-off time		T _{vj} = 25 °C	–	43	–	
			T _{vj} = 150 °C	–	48	–	
E _{off}	Turn-off energy per pulse		T _{vj} = 25 °C	–	78	–	μJ
			T _{vj} = 150 °C	–	93	–	
E _{tot}	Total switching energy		T _{vj} = 25 °C	–	482	–	
			T _{vj} = 150 °C	–	472	–	

Electrical Characteristics- Body Diode ($T_{vj} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Symbol	Characteristics	Conditions		Ratings			Unit		
				Min.	Typ.	Max.			
V _{SD}	Forward voltage drop	I _{SD} = 21 A, V _{GS} = 0 V		–	3.4	–	V		
		I _{SD} = 21 A, V _{GS} = 0 V, T _{vj} = 150 °C		–	3.6	–			
t _{rr}	Reverse recovery time	V _{GS} = 0 V, V _R = 800 V, I _F = 21 A MOSFET gate drive: R _{g(ext)} = 3.3 Ω		T _{vj} = 25 °C	–	26	–	ns	
				T _{vj} = 150 °C	–	26	–		
Q _{rr}	Reverse recovery charge			T _{vj} = 25 °C	–	158	–	nC	
				T _{vj} = 150 °C	–	171	–		
I _{rrm}	Maximum reverse recovery current			T _{vj} = 25 °C	–	10	–	A	
				T _{vj} = 150 °C	–	10	–		
di _F /dt	Current slew rate			T _{vj} = 25 °C	–	1617	–	A/μs	
				T _{vj} = 150 °C	–	1615	–		
E _{rec (off)}	Turn-off energy of intrinsic diode per pulse	Inductive load, V _{DD} = 800 V, V _{GS} = 0/+18 V, I _S = 21 A, R _{g(ext)} = 3.3 Ω, L = 250 μH		T _{vj} = 25 °C	–	51	–	μJ	
				T _{vj} = 150 °C	–	55	–		

Characteristic Curves

Fig. 1. Typical Transfer Characteristics

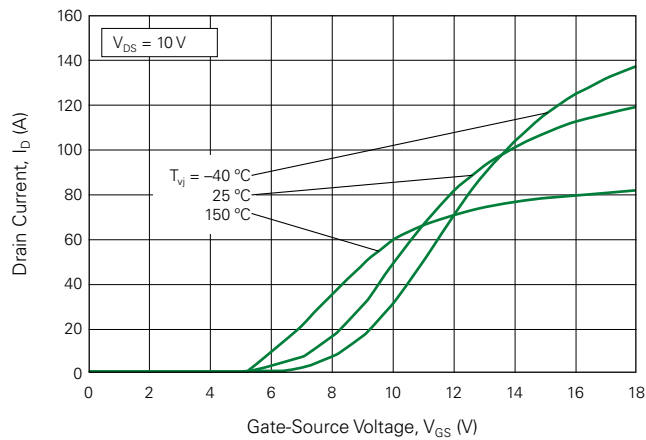


Fig. 2. Typical Transconductance

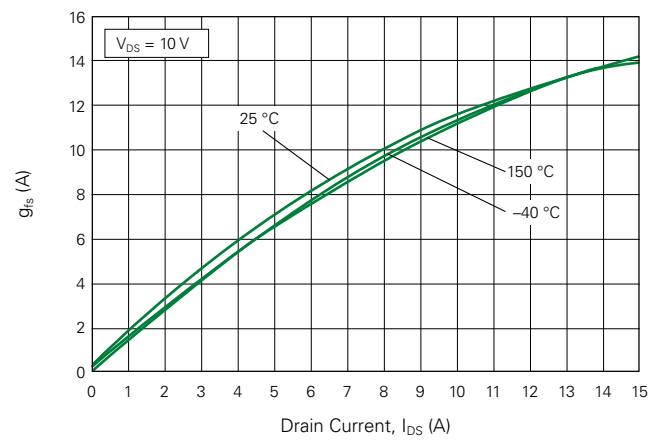
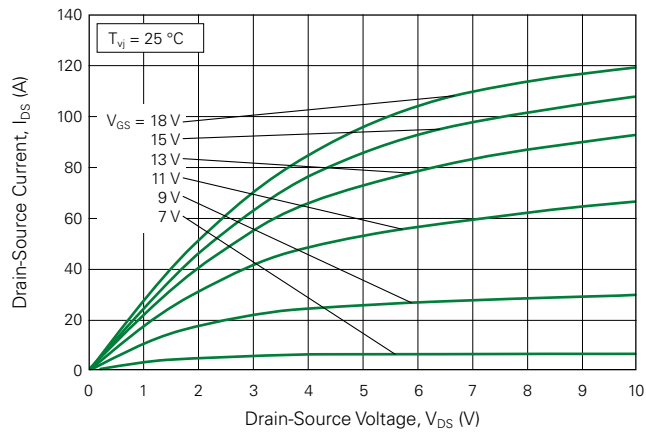
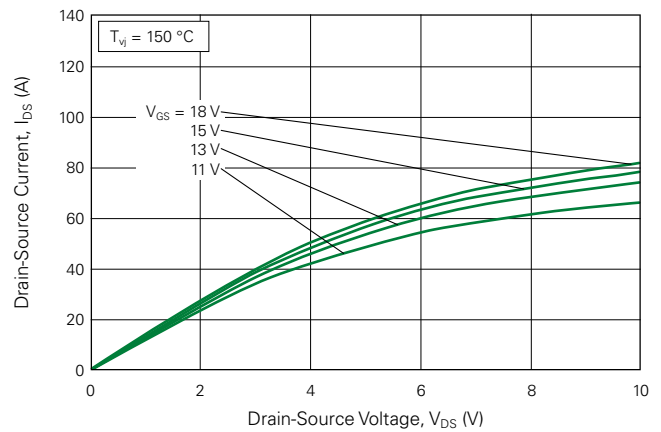
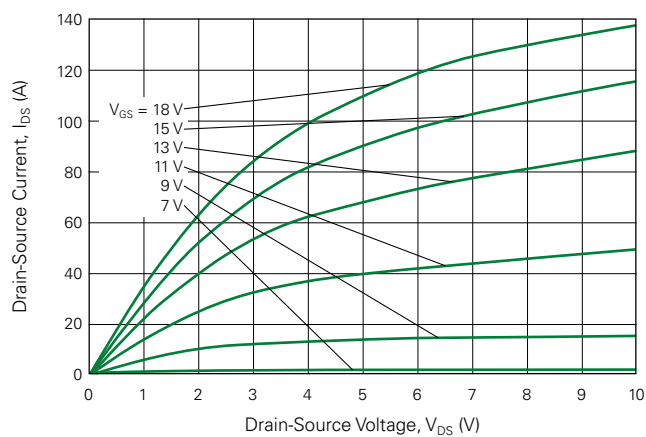
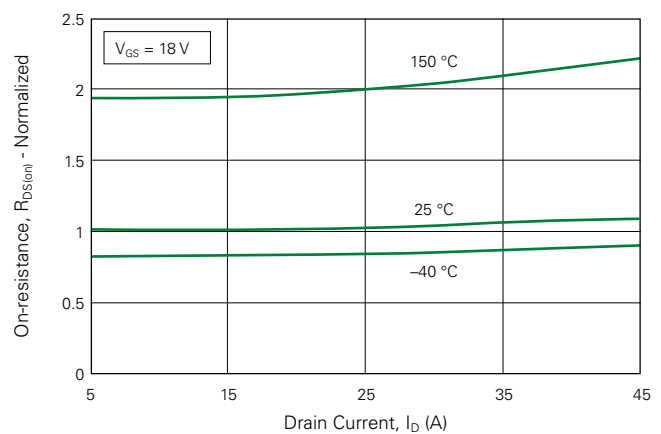
Fig. 3. Typical Output Characteristics @ $T_{vj} = 25\text{ }^{\circ}\text{C}$ Fig. 4. Typical Output Characteristics @ $T_{vj} = 150\text{ }^{\circ}\text{C}$ Fig. 5. Typical Output Characteristics @ $T_{vj} = -40\text{ }^{\circ}\text{C}$ Fig. 6. $R_{DS(on)}$ Normalized to $I_D = 20\text{ A}$ vs. Drain Current

Fig. 7. $R_{DS(on)}$ Normalized to $I_D = 21$ A vs. Junction Temperature

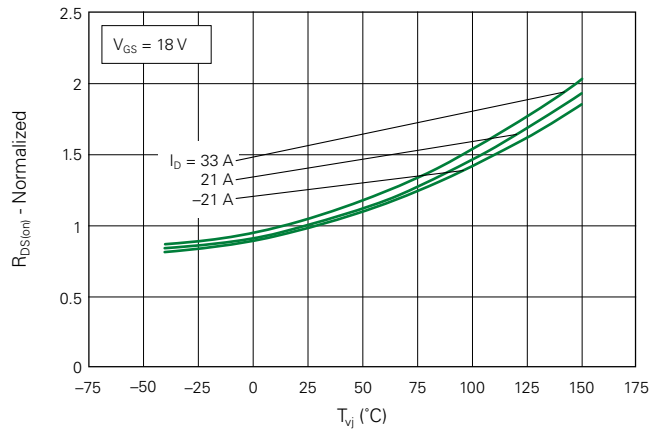


Fig. 8. Typical Drain-source On-state Resistance vs. Gate-source Voltage

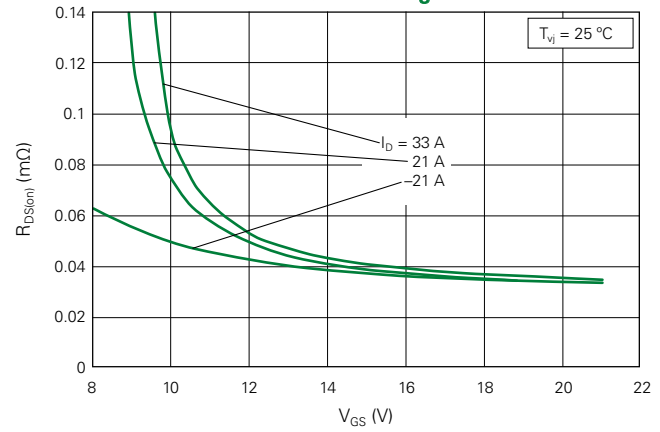


Fig. 9. Typical $V_{(BR)DSS}/V_{GS(th)}$ (Normalized) vs. Virtual Junction Temperature

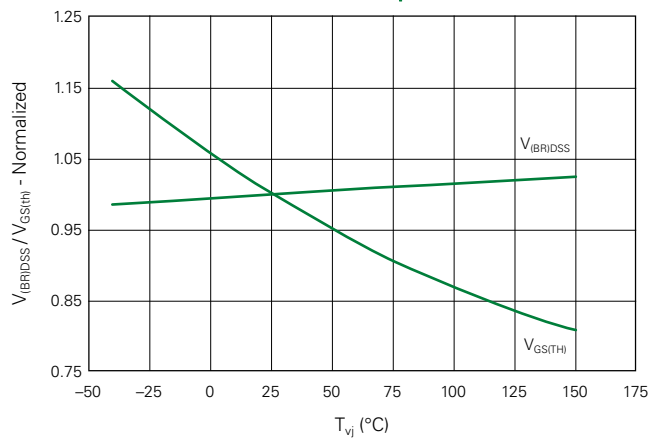


Fig. 10. Typical Reverse Conduction Characteristics @ $T_{vj} = -40$ °C

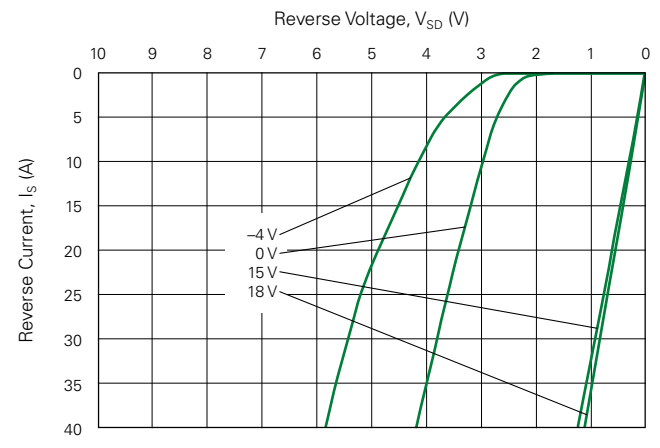


Fig. 11. Typical Reverse Conduction Characteristics @ $T_{vj} = 25$ °C

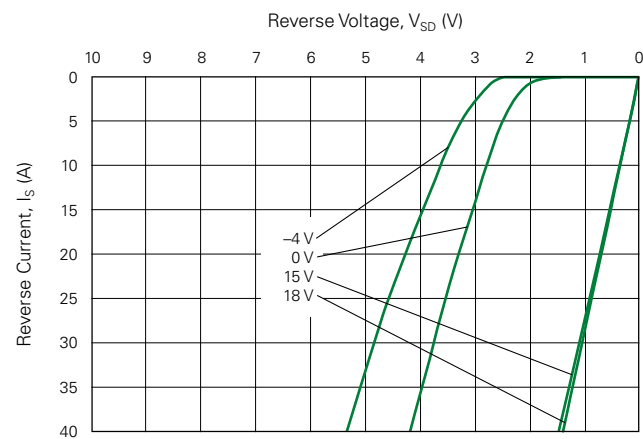


Fig. 12. Typical Reverse Conduction Characteristics @ $T_{vj} = 150$ °C

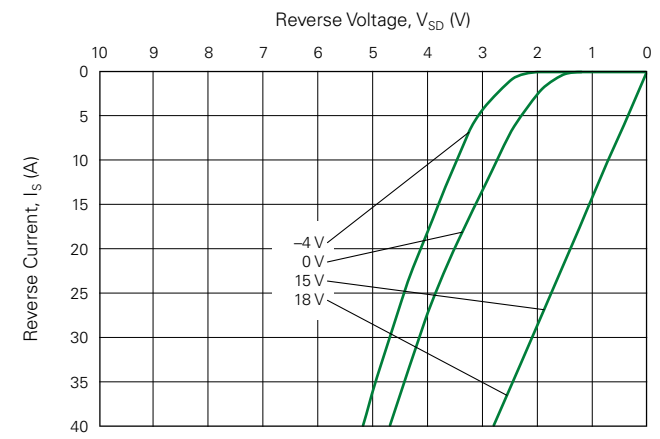


Fig. 13. Typical On-resistance vs. Junction Temperature

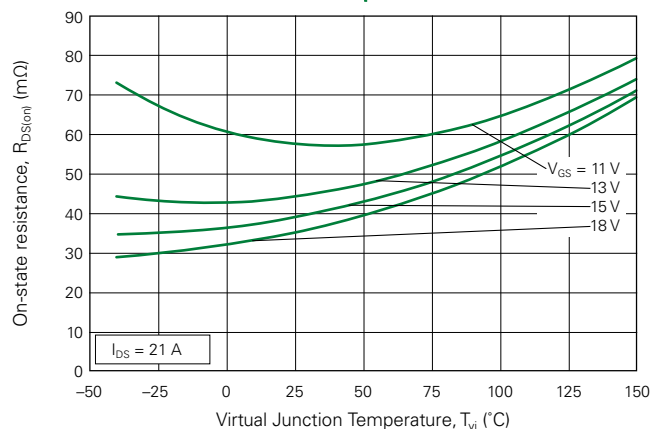


Fig. 14. Typical Threshold Voltage

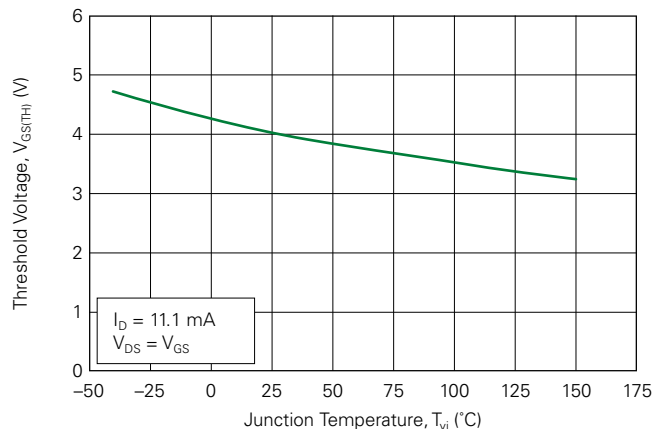


Fig. 15. Body Diode Forward Voltage vs. Gate-source Voltage

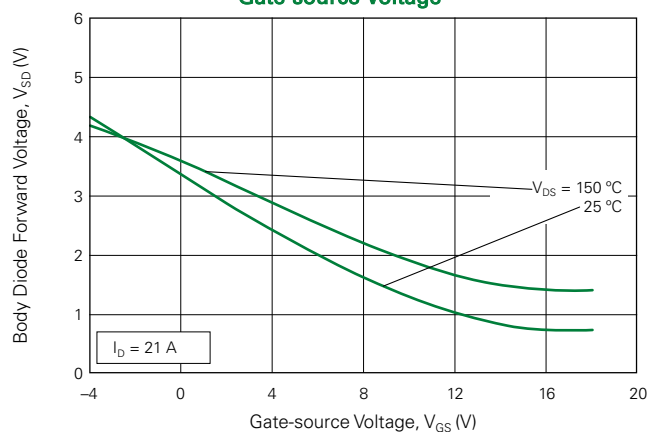


Fig. 16. Gate Charge Characteristics

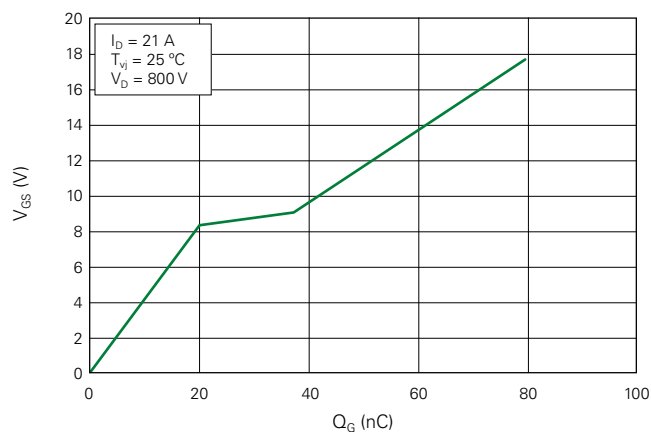
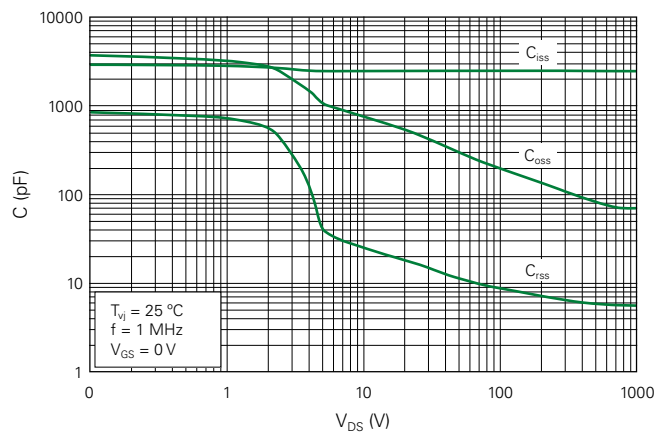
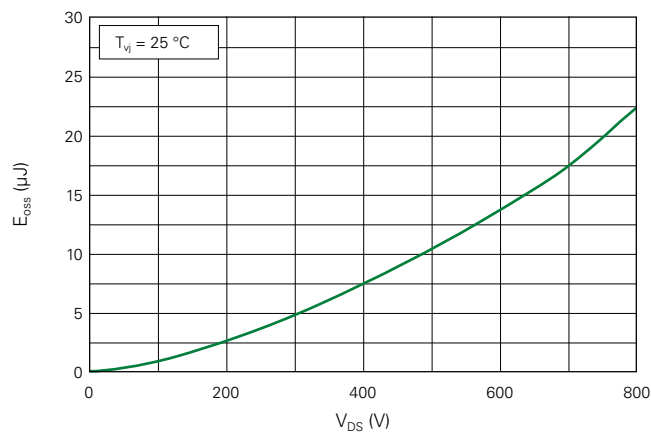
Fig. 17. Capacitance vs. V_{DS} Fig. 18. Output Capacitance C_{oss} Stored Energy

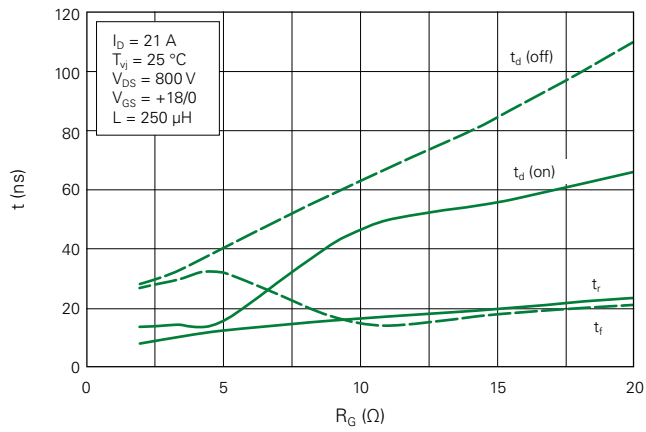
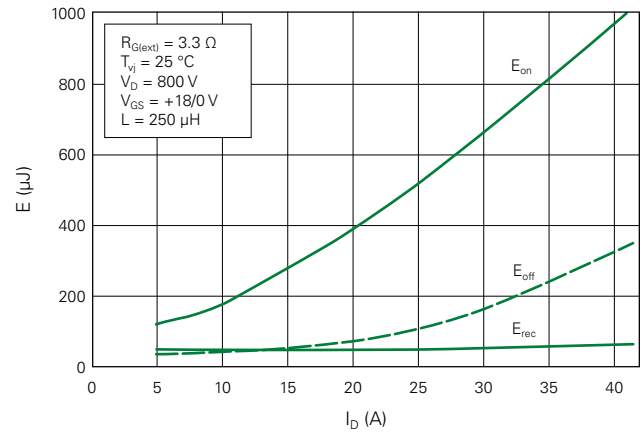
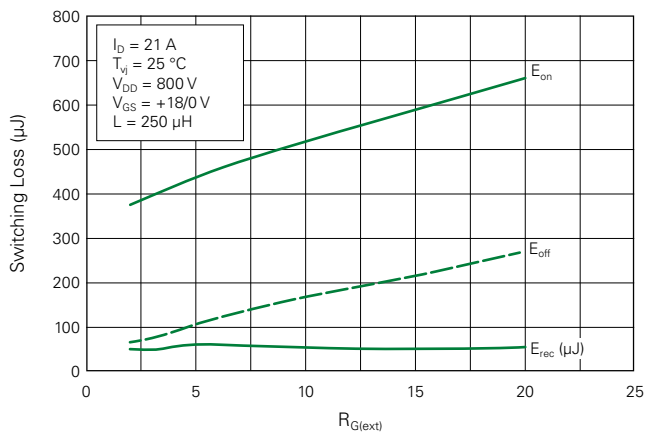
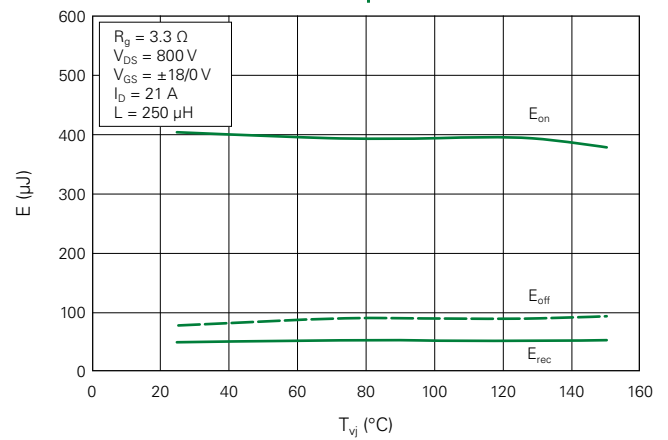
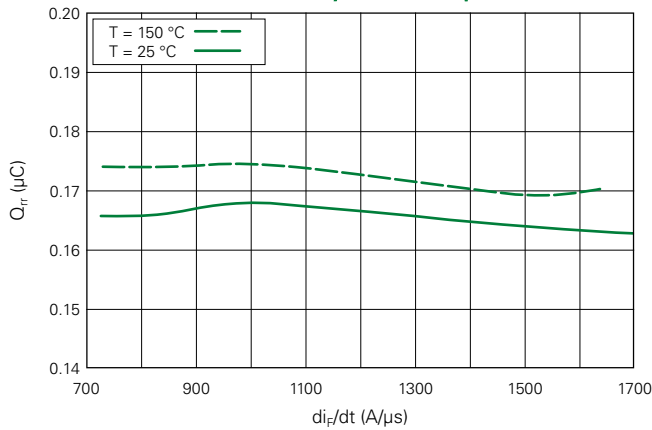
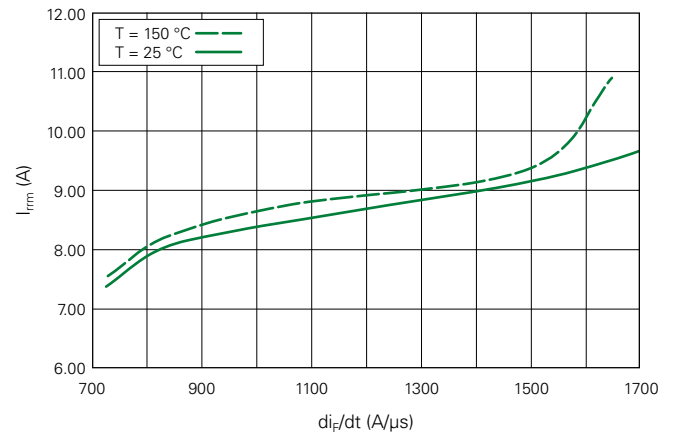
Fig. 19. Typical Switching Time vs. External Gate Resistor**Fig. 20. Typical Switching Energy vs. Drain Current****Fig. 21. Typical Switching Energy vs. External Gate Resistor****Fig. 22. Typical Switching Energy vs. Junction Temperature****Fig. 23. Typical Reverse Recovery Charge vs. Diode Recovery Current Slope****Fig. 24. Typical Reverse Recovery Current vs. Diode Recovery Current Slope**

Fig. 25. Thermal Impedance (Normalized)

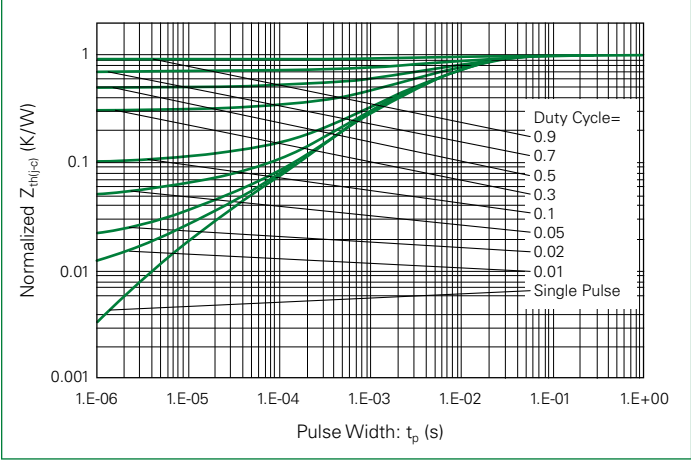
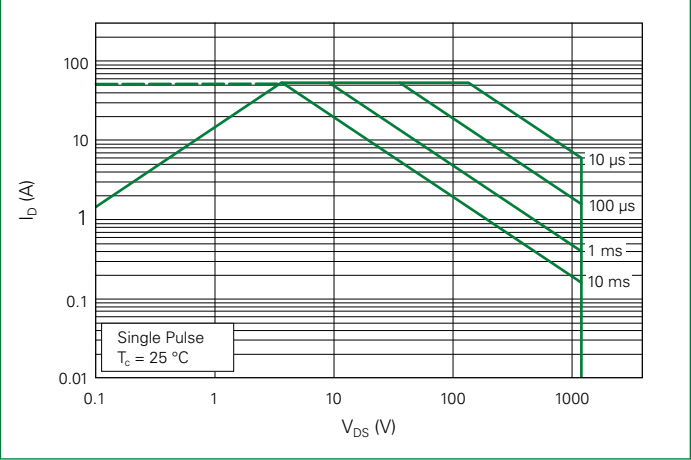
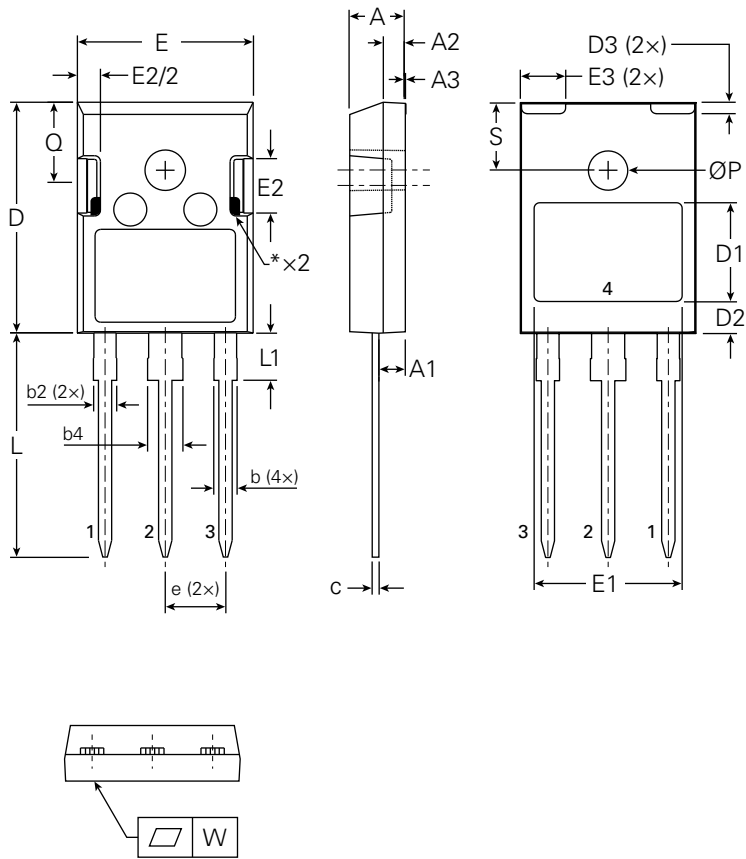


Fig. 26. Maximum Safe Operating Area ($T_c = 25\text{ }^{\circ}\text{C}$)



Part Outline Drawing (ISO247-3L)



- 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.

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		

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