NWK202CJ1-4

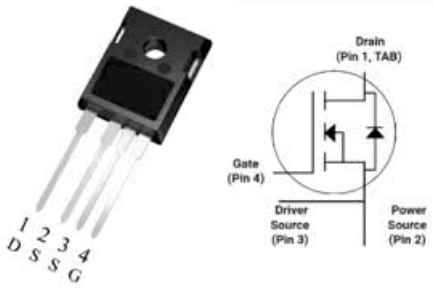
1200V Silicon Carbide Mosfet

Parameter	Value	Unit
V_{RRM}	1200	V
$R_{DS(on)}$	20	mΩ
I_D (T_C = 100℃)	96	A

Features

- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- RoHS Compliant

TO247-4



Applications

- Electric Vehicle Charging Stations
- Switch Mode Power Supplies
- Motor Drives
- High Voltage DC/DC Converters
- Solar Inverters

Description

The NWK202CJ1-4 is a 1200 V, SiC mosfet based on NovaWave's advanced SiC technology resulting in high performance and long-term reliability. It supports high-temperature operation while showing minimal losses , zero reverse recovery, and low leakage current.

Part Description

Part Number	Package	Marking
NWK202CJ1-4	TO247-4	NWK202CJ1-4

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Absolute Maximum Ratings

T_J = 25 °C except as noted. Exceeding the maximum ratings may damage the device.

Parameter	Symbol	Value	Unit	Test conditions
Drain-Source Voltage	$V_{DSS.max}$	1200	V	Static
Continuous Drain Current,limited by $T_{vj(max)}$	I_D	136 96 141 100	A	T_C = 25 °C V_{GS} =15V T_C = 100 °C V_{GS} =15V T_C = 25 °C V_{GS} =18V T_C = 100 °C V_{GS} =18V
Pulse Drain Current, Pulse width t_p limited by $T_{vj(max)}$	$I_{D(pulse)}$	351	A	T_C = 25 °C V_{GS} =18V
Short-circuit withstand time	t_{SC}	3	μs	V_{DS}≤ 800V,$V_{DS,peak}$ < 1200V $V_{GS,on}$ =18V, $T_{vj(start)}$ = 25 °C
Power Dissipation	P_D	555 278	W	T_C = 25 °C T_C = 100 °C
Maximum Gate Source Voltage,transient voltage	V_{GSmax}	-10 to +25	V	
Maximum Gate Source Voltage,static voltage	V_{GSmax}	-7 to +23	V	
Recommended turn-on Gate Source Voltage	V_{GSon}	+15 to +18	V	
Recommended turn-off Gate Source Voltage	V_{GSoff}	-5 to -3	V	
Storage Temperature Range	T_{stg}	-55 to +175	°C	
Soldering Temperature	T_L	260	°C	
Virtual junction temperature	T_{vj}	-55 to +175	°C	

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance from Junction to Case	$R_{TH,\ J\text{-}C}$	--	0.27	--	°C/W

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Electrical Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1350			V	I_D=100μA, V_{GS}=0V
Zero Gate Voltage Drain Current	I_{DSS}		0.1	10	μA	V_{DS}=1200V, V_{GS}=0V,T_{vj}=25°C
Gate-Source Leakage Current	I_{GSS}		1	50	nA	V_{GS}=23V
Gate Threshold Voltage	$V_{GS(th)}$	1.9	2.6 1.8	3.7	V	V_{DS}=V_{GS},I_D=18mA ,T_{vj}=25°C V_{DS}=V_{GS},I_D=18mA ,T_{vj}=175°C
Drain-Source On-State Resistance	$R_{DS(on)}$		20		mΩ	V_{GS} = 15 V, I_D = 41 A, T_{vj} = 25°C
			27			V_{GS} = 15 V, I_D = 41 A, T_{vj} = 150°C
			30			V_{GS} = 15 V, I_D = 41 A, T_{vj} = 175°C
			16			V_{GS} = 18 V, I_D = 41 A, T_{vj} = 25°C
			26			V_{GS} = 18 V, I_D = 41 A, T_{vj} = 150°C
			28			V_{GS} = 18 V, I_D = 41 A, T_{vj} = 175°C
Transconductance	g_{fs}		42 40		S	V_{DS}=20V, I_{DS}=41A, T_{vj}=25°C V_{DS}=20V, I_{DS}=41A, T_{vj}=175°C
Input Capacitance	C_{iss}		4509		pF	V_{DS}=1200V, f=100KHz, V_{GS}=0V V_{AC}=25mV
Output Capacitance	C_{oss}		185		pF	
Reverse Transfer Capacitance	C_{rss}		11		pF	
C_{oss} Stored Energy	E_{oss}		142		μJ	
Output Charge	Q_{oss}		359		nC	
Internal Gate Resistance	$R_{G(int)}$		2.1		Ω	f=1MHz V_{AC}=25mV
Total Gate Charge	Q_g		180		nC	V_{DS}=800V, I_D=41A, V_{GS}=-4V/18V
Gate to Source Charge	Q_{gs}		47		nC	
Gate to Drain Charge	Q_{gd}		40		nC	

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Parameters	Symbol	Min	Typ	Max	Unit	Condition
Turn-On Delay Time	$t_{d(on)}$		32		ns	V_{DS}=800V, I_D=41A, V_{GS}=-4V/18V, $R_{G(on)}$=2.5Ω, $R_{G(off)}$=2.5Ω, L=500μH, T_{vj}=25°C FWD = Body Diode
Rise Time	t_r		23		ns	
Turn-Off Delay Time	$t_{d(off)}$		37		ns	
Fall Time	t_f		11		ns	
Turn-On Energy	E_{on}		578		μJ	
Turn-Off Energy	E_{off}		192		μJ	
Total Switching Energy	E_{Total}		770		μJ	
Turn-On Delay Time	$t_{d(on)}$		29		ns	V_{DS}=800V, I_D=41A, V_{GS}=-4V/18V, $R_{G(on)}$=2.5Ω, $R_{G(off)}$=2.5Ω, L=500μH, T_{vj}=25°C FWD = Body Diode
Rise Time	t_r		22		ns	
Turn-Off Delay Time	$t_{d(off)}$		42		ns	
Fall Time	t_f		12		ns	
Turn-On Energy	E_{on}		890		μJ	
Turn-Off Energy	E_{off}		208		μJ	
Total Switching Energy	E_{Total}		1098		μJ	
Effective output capacitance,energy related	$C_{o(er)}$		197		pF	V_{GS} = 0 V, V_{DS} = 0...1200 V
Effective output capacitance, time related	$C_{o(tr)}$		299		pF	V_{GS} = 0 V, V_{DS} = 0...1200 V I_D = constant

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Reverse Diode Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Diode Forward Voltage	V_{SD}		3.0		V	V_{GS}=0V,I_S=41A,T_j=25°C
Continuous Diode Forward Current	I_S			141	A	V_{GS}=-4V,T_c=25°C,
Diode pulse Current	$I_{S(pulse)}$		18		ns	Pulse width t_p, limited by $T_{vj(max)}$

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Electrical Performance Graphs

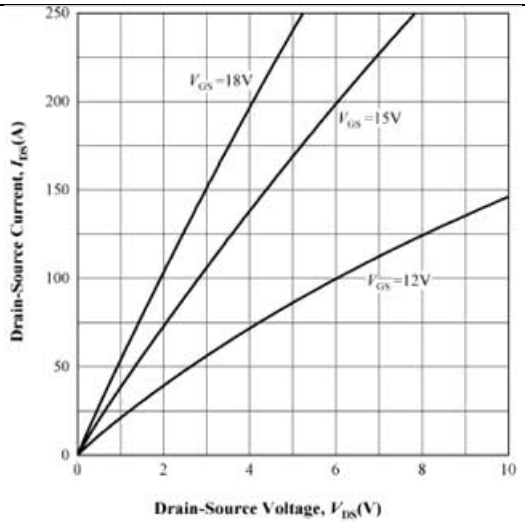


Figure 1: Output Characteristics
T_{vj}=-55°C

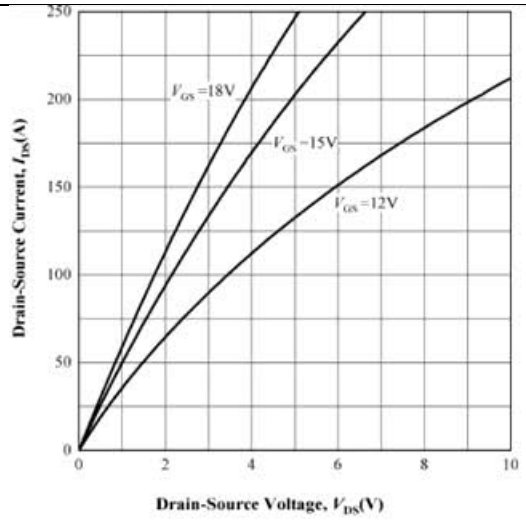


Figure 2: Output Characteristics
T_{vj}=25°C

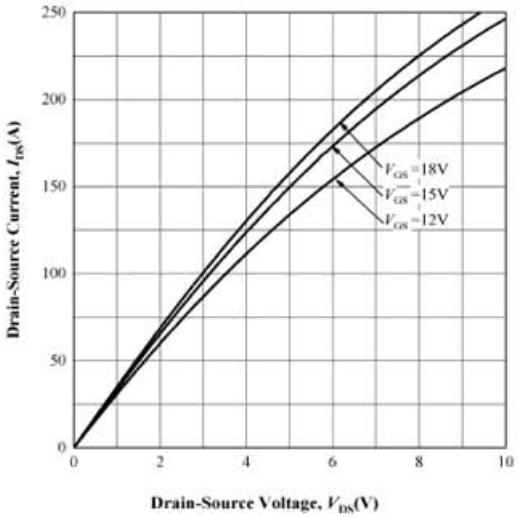


Figure 3: Output Characteristics
T_{vj}=175°C

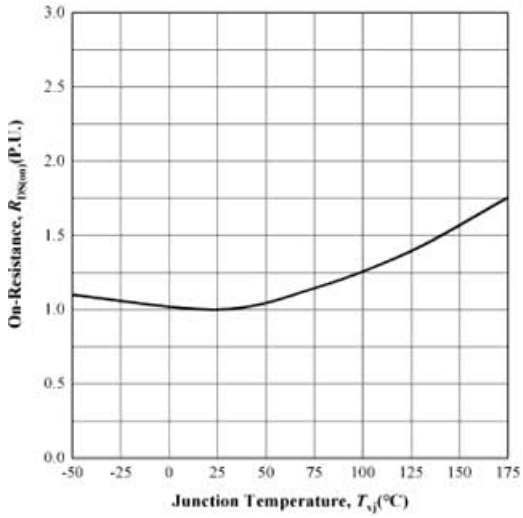


Figure 4: Normalized On-Resistance vs. Temperature I_D=41A V_{GS}=18V

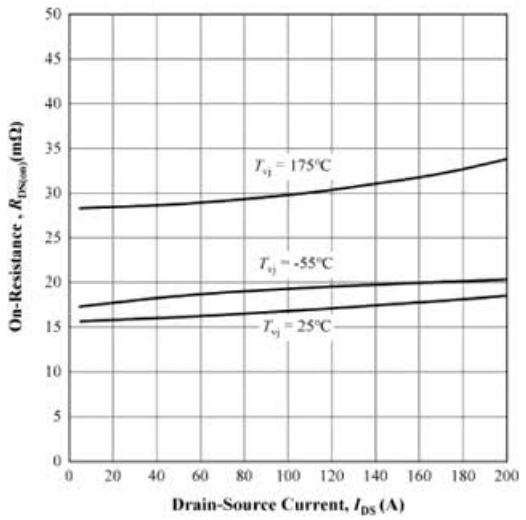


Figure 5: On-Resistance vs. Drain Current for Various Temperature V_{GS}=18V

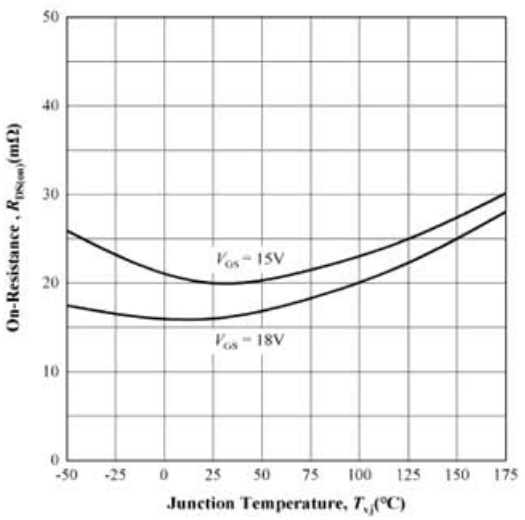


Figure 6: On-Resistance vs. Junction Temperature For Various Gate Voltage I_D=41A

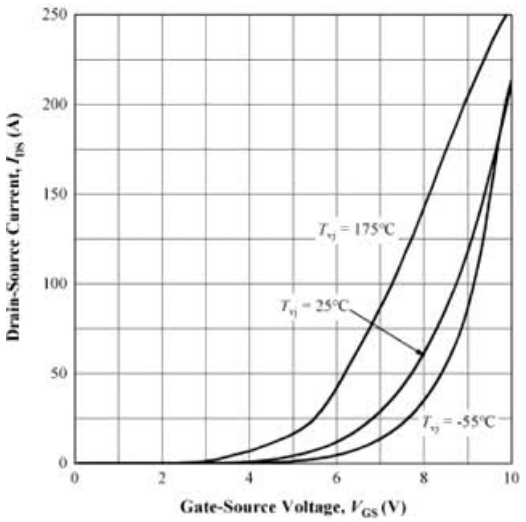


Figure 7: Transfer Characteristic for Various Temperatures V_{DS}=20V

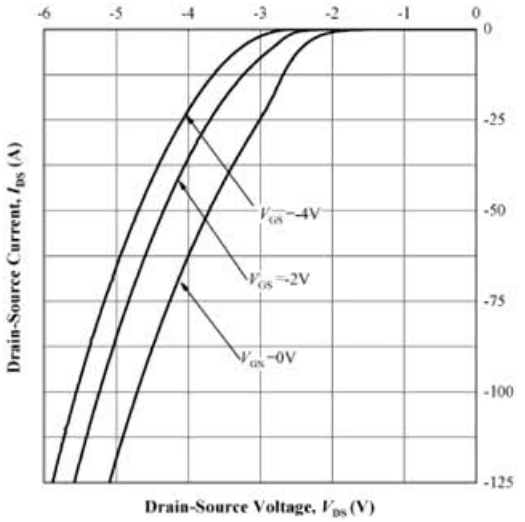


Figure 8: Body Diode Characteristic T_{vj}=-55°C

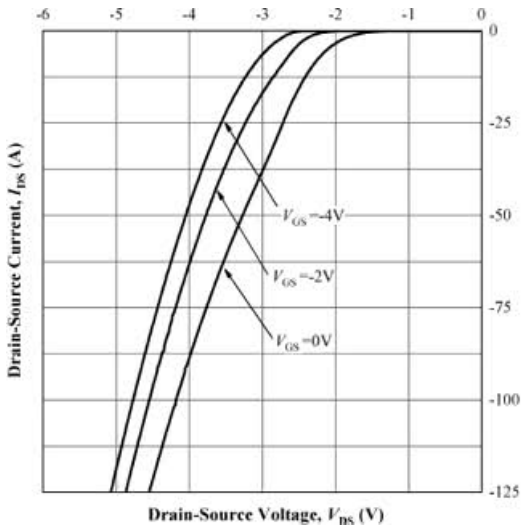


Figure 9: Body Diode Characteristic
T_{vj}=25°C

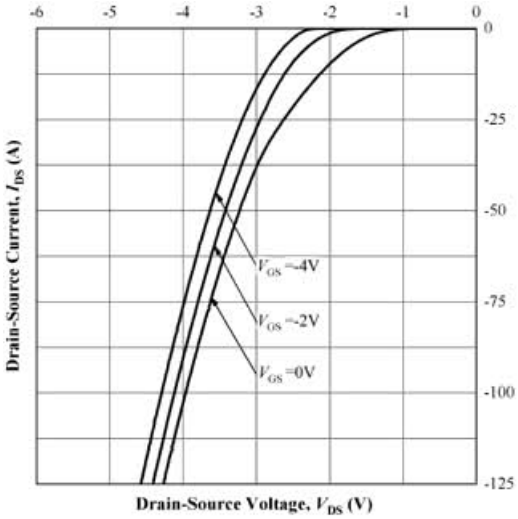


Figure 10: Body Diode Characteristic
T_{vj}=175°C

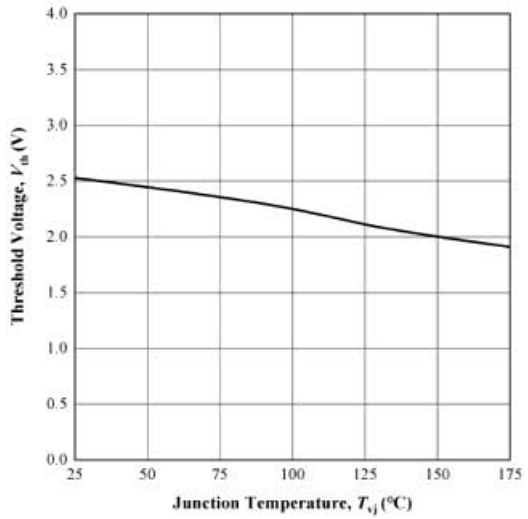


Figure 11. Threshold Voltage vs. Temperature V_{GS} = V_{DS}, I_D = 18 mA

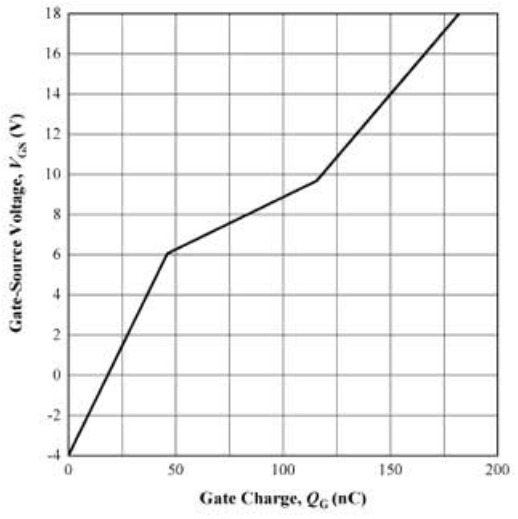


Figure 12. Gate Charge Characteristics
V_{DS} = 800 V, T_{vj} = 25 ℃

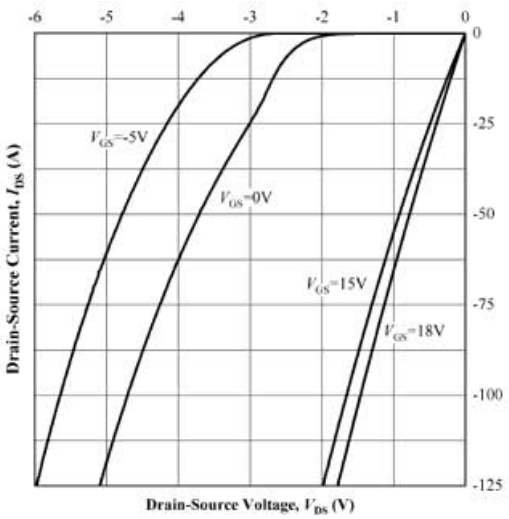


Figure 13. 3rd Quadrant Characteristic
T_{vj}=-55°C

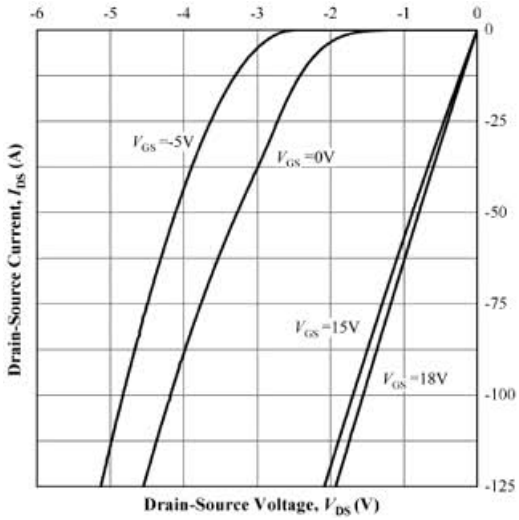


Figure 14. 3rd Quadrant Characteristic
T_{vj}=25°C

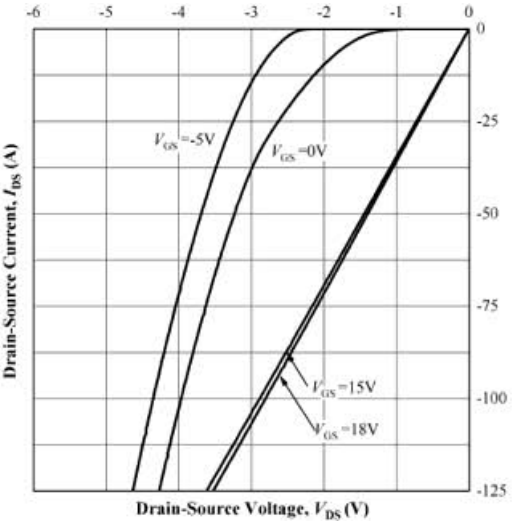


Figure 15. 3rd Quadrant Characteristic
T_{vj}=175°C

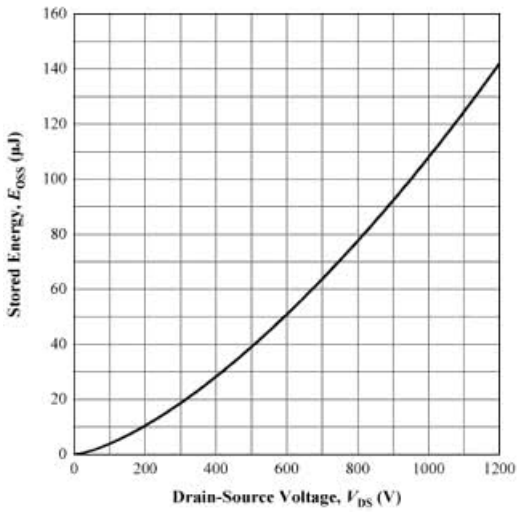


Figure 16. Output Capacitor Stored Energy

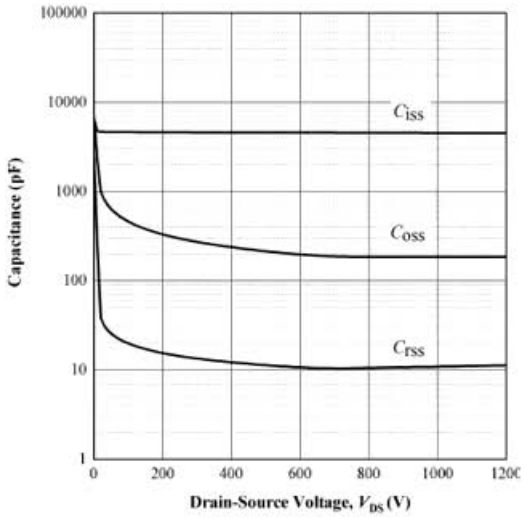


Figure 17: Capacitances vs. Drain-Source Voltage (0 – 1200 V)

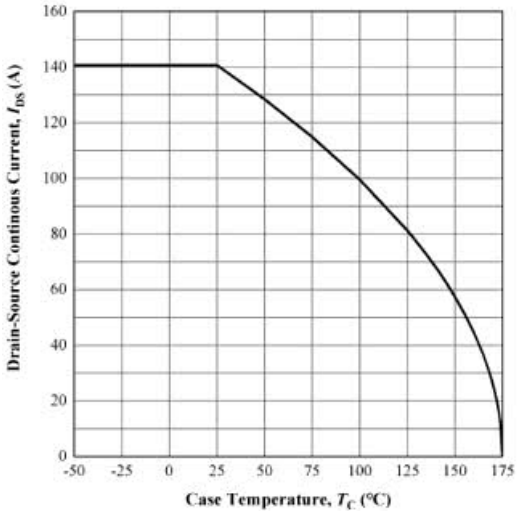


Figure 18: Continuous Drain Current Derating vs. Case Temperature

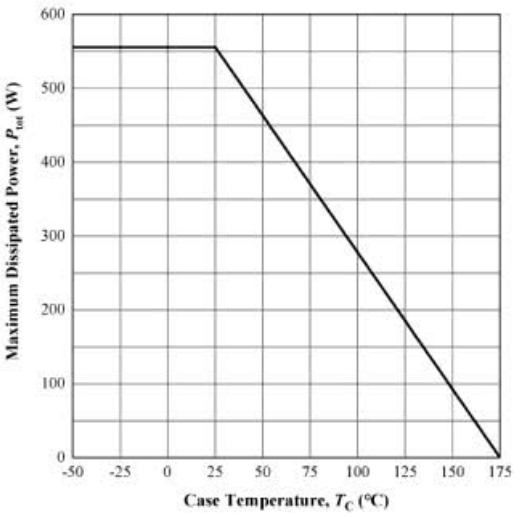


Figure 19: Maximum Power Dissipation Derating vs. Case Temperature

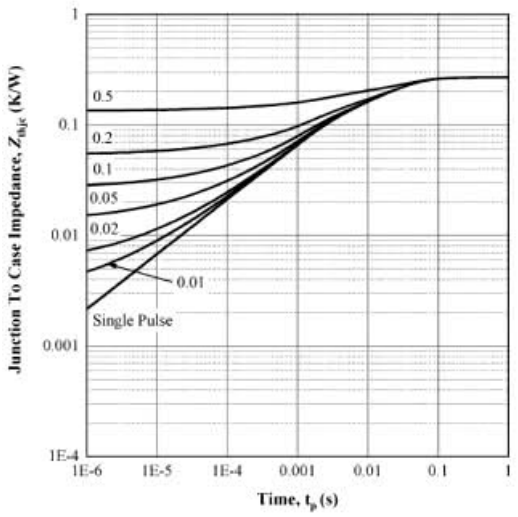


Figure 20: Transient Thermal Impedance

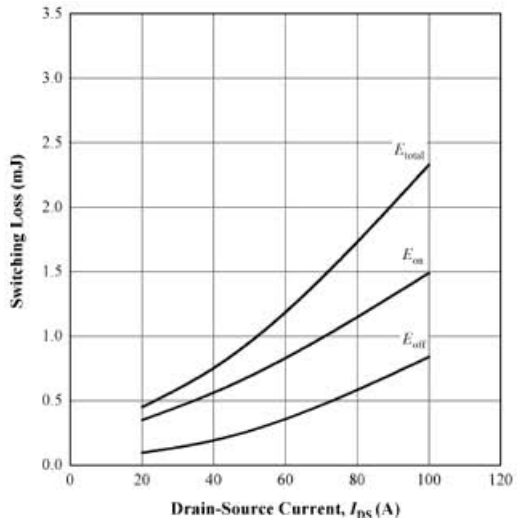


Figure 21: Clamped Inductive Switching Energy vs. Drain Current T_{vj}=25°C

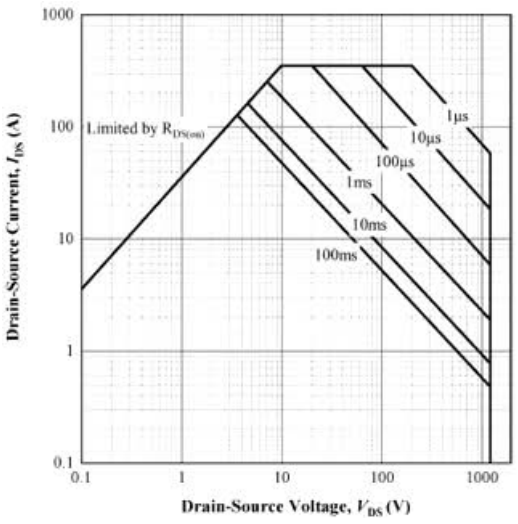


Figure 22: Safe Operating Area

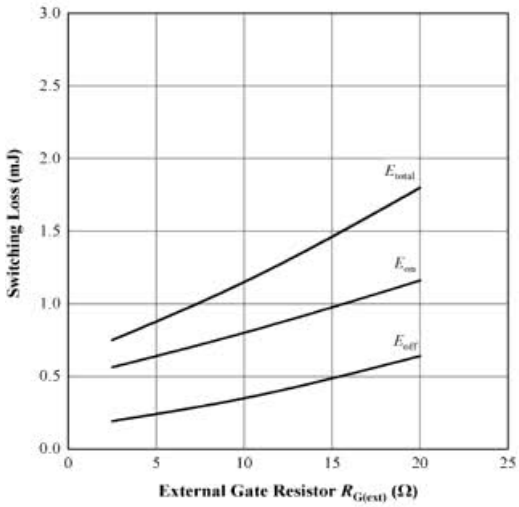


Figure23: Clamped Inductive Switching Energy vs. RG(ext) T_{vj}=25°C

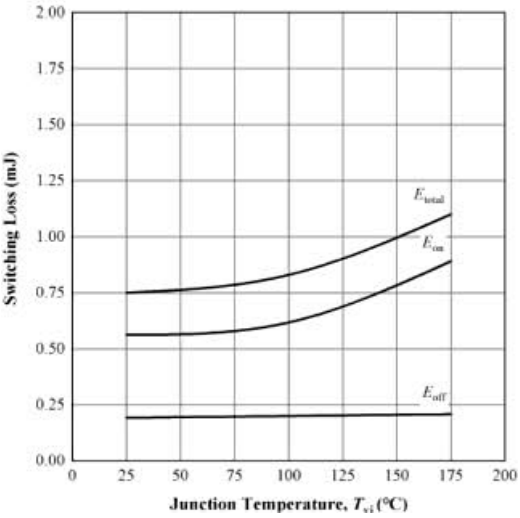


Figure 24: Clamped Inductive Switching Energy vs. Temperature

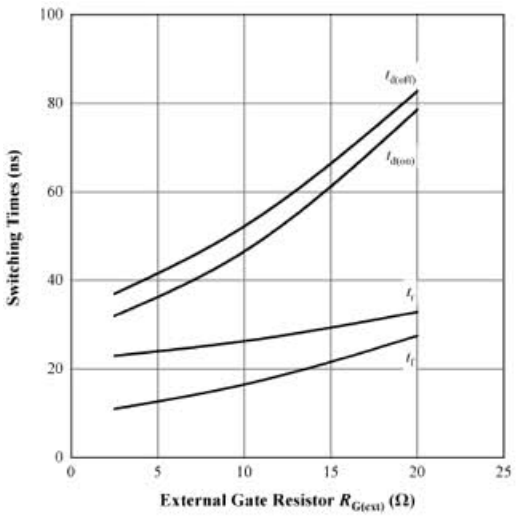


Figure25: Switching Times vs. RG(ext)
T_{vj}=25°C

Testing conditions

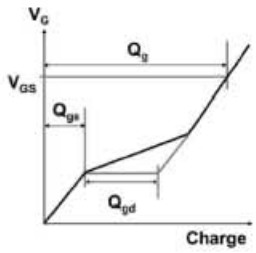


Figure A: Definition of Q_{gd}

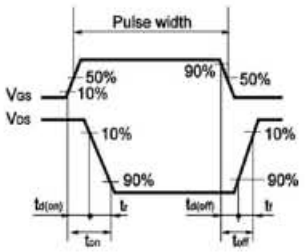


Figure B: Definition of switching times

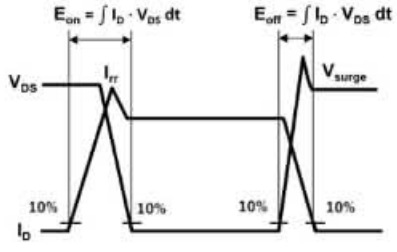


Figure C: Definition of switching losses

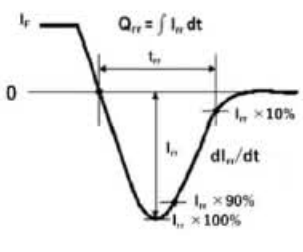
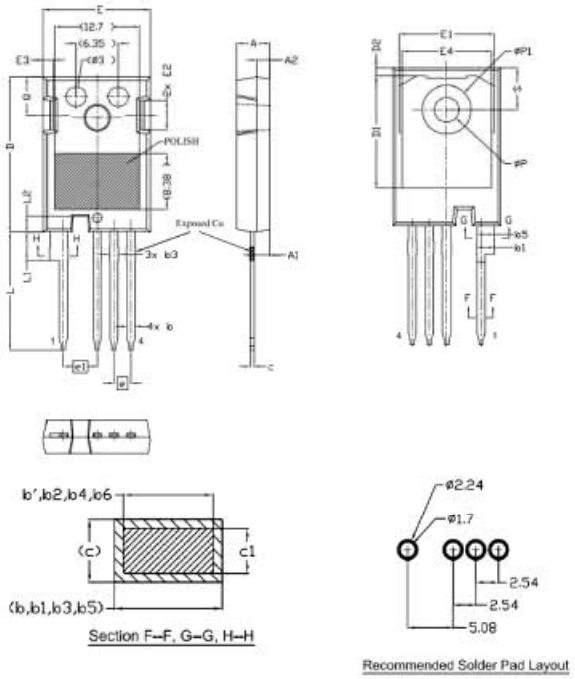


Figure D: Definition of reverse recovery

Package Dimensions

Package: TO-247-4



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ØP	3.51	3.61	3.65
ØP1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

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