

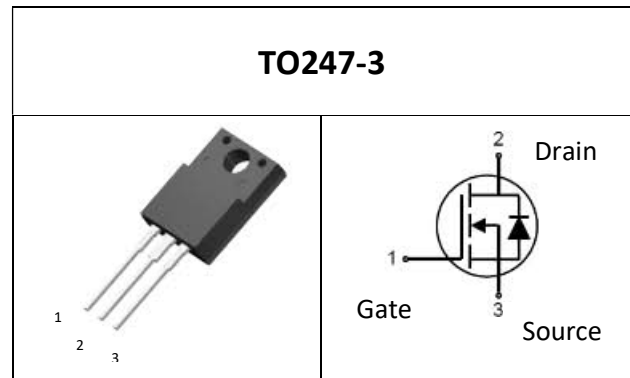
NWK204CJ1

1200V Silicon Carbide Mosfet

Parameter	Value	Unit
V_{RRM}	1200	V
$R_{DS(on)}$	41	m Ω
I_D ($T_C = 100^\circ\text{C}$)	61	A

Features

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



Applications

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

Part Description

Part Number	Package	Marking
NWK204CJ1	TO247-3	NWK204CJ1

Description

The NWK204CJ1 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.

Absolute Maximum Ratings

Gate-source transient voltage, $t_p < 1 \mu\text{s}$, $t \leq 10$ hours over lifetime, -10/+25 V.

Parameter	Symbol	Value	Unit	Test conditions
Drain-Source Voltage	$V_{DSS,max}$	1200	V	$V_{GS} = 0 \text{ V}$, $I_D = 100 \mu\text{A}$
Continuous Drain Current, limited by $T_{vj(max)}$	I_D	87 61	A	$T_C = 25 \text{ }^\circ\text{C}$ $V_{GS}=18\text{V}$ $T_C = 100 \text{ }^\circ\text{C}$ $V_{GS}=18\text{V}$
Pulse Drain Current, Pulse width t_p limited by $T_{vj(max)}$	$I_{D(pulse)}$	202	A	$T_C = 25 \text{ }^\circ\text{C}$ $V_{GS}=18\text{V}$
Power Dissipation	P_D	468 234	W	$T_C = 25 \text{ }^\circ\text{C}$ $T_C = 100 \text{ }^\circ\text{C}$
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	$^\circ\text{C}$	
Soldering Temperature	T_L	260	$^\circ\text{C}$	
Virtual junction temperature	T_{vj}	-55 to +175	$^\circ\text{C}$	

Thermal Characteristics

Parameter	Symbol	Min	Typ	Max	Unit
Thermal Resistance from Junction to Case	$R_{TH, J-C}$	--	0.32	--	$^\circ\text{C/W}$

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

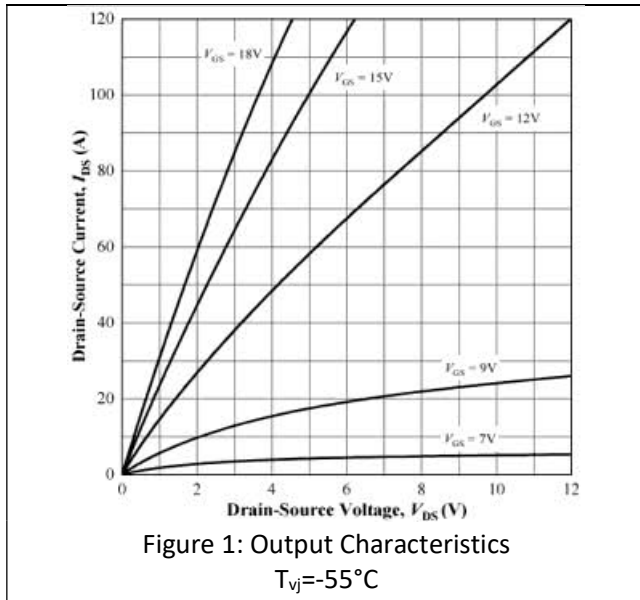
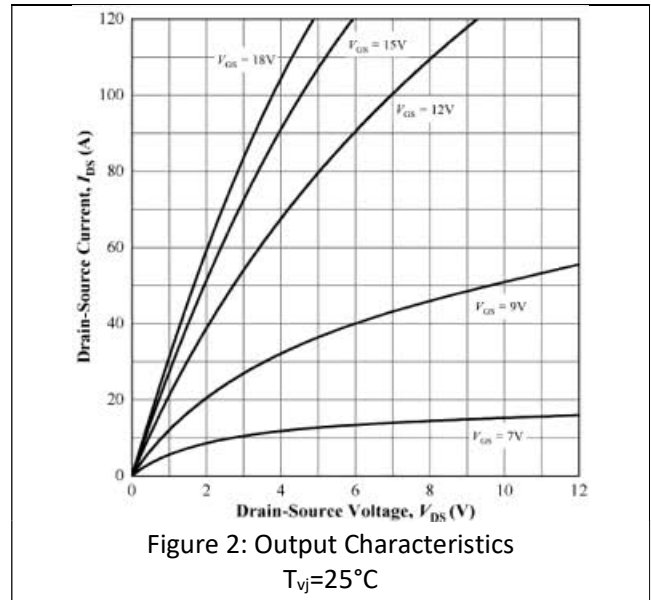
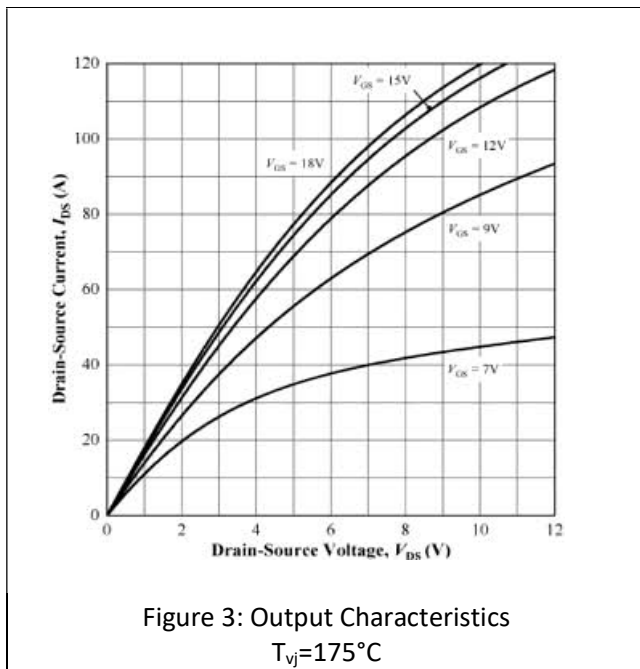
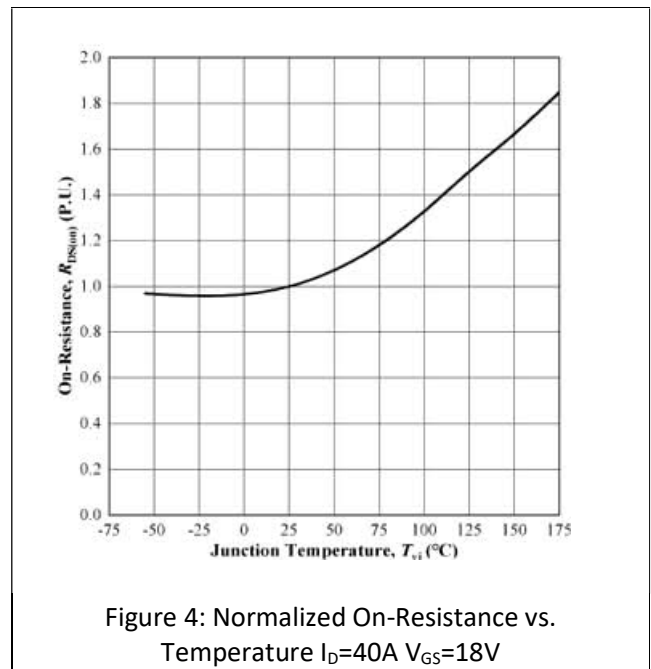
Parameters	Symbol	Min	Typ	Max	Unit	Condition
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	1200			V	$I_D=100\mu\text{A}$, $V_{GS}=0\text{V}$
Zero Gate Voltage Drain Current	I_{DSS}		0.1	10	μA	$V_{DS}=1200\text{V}$, $V_{GS}=0\text{V}$, $T_{vj}=25^{\circ}\text{C}$
Gate-Source Leakage Current	I_{GSS}		10	50	nA	$V_{GS}=18\text{V}$
Gate Threshold Voltage	$V_{GS(th)}$	1.8	2.6 1.8	3.8	V	$V_{DS}=V_{GS}$, $I_D=18\text{mA}$, $T_{vj}=25^{\circ}\text{C}$ $V_{DS}=V_{GS}$, $I_D=18\text{mA}$, $T_{vj}=175^{\circ}\text{C}$
Drain-Source On-State Resistance	$R_{DS(on)}$		41		m Ω	$V_{GS} = 15\text{ V}$, $I_D = 40\text{ A}$, $T_{vj} = 25^{\circ}\text{C}$
			56			$V_{GS} = 15\text{ V}$, $I_D = 40\text{ A}$, $T_{vj} = 150^{\circ}\text{C}$
			64			$V_{GS} = 15\text{ V}$, $I_D = 40\text{ A}$, $T_{vj} = 175^{\circ}\text{C}$
			33			$V_{GS} = 18\text{ V}$, $I_D = 40\text{ A}$, $T_{vj} = 25^{\circ}\text{C}$
			55			$V_{GS} = 18\text{ V}$, $I_D = 40\text{ A}$, $T_{vj} = 150^{\circ}\text{C}$
			61			$V_{GS} = 18\text{ V}$, $I_D = 40\text{ A}$, $T_{vj} = 175^{\circ}\text{C}$
Transconductance	g_{fs}		25 27		S	$V_{DS}=20\text{V}$, $I_{DS}=40\text{A}$, $T_{vj}=25^{\circ}\text{C}$ $V_{DS}=20\text{V}$, $I_{DS}=40\text{A}$, $T_{vj}=175^{\circ}\text{C}$
Input Capacitance	C_{iss}		1855		pF	$V_{DS}=1000\text{V}$, $f=100\text{KHz}$, $V_{GS}=0\text{V}$ $V_{AC}=25\text{mV}$
Output Capacitance	C_{oss}		91		pF	
Reverse Transfer Capacitance	C_{rss}		6.6		pF	
C_{oss} Stored Energy	E_{oss}		50		μJ	
Output Charge	Q_{oss}		153		nC	
Internal Gate Resistance	$R_{G(int)}$		0.76		Ω	$f=1\text{MHz}$ $V_{AC}=25\text{mV}$
Total Gate Charge	Q_g		88		nC	$V_{DS}=800\text{V}$, $I_D=40\text{A}$, $V_{GS}=-4\text{V}/18\text{V}$
Gate to Source Charge	Q_{gs}		22		nC	
Gate to Drain Charge	Q_{gd}		35		nC	
Effective output capacitance,energy related	$C_{o(er)}$		158		pF	$V_{GS} = 0\text{ V}$, $V_{DS} = 0\ldots 800\text{ V}$
Effective output capacitance, time related	$C_{o(tr)}$		192		pF	$V_{GS} = 0\text{ V}$, $V_{DS} = 0\ldots 800\text{ V}$ $I_D = \text{constant}$



Reverse Diode Characteristics

Parameters	Symbol	Min	Typ	Max	Unit	Condition
Diode Forward Voltage	V_{SD}		3.2		V	$V_{GS}=0V, I_S=20A$
Continuous Diode Forward Current	I_S		87		A	$V_{GS}=-4V$
Diode pulse Current	$I_{S(pulse)}$			202	A	Pulse width t_p , limited by $T_{vj(max)}$

Electrical Performance Graphs



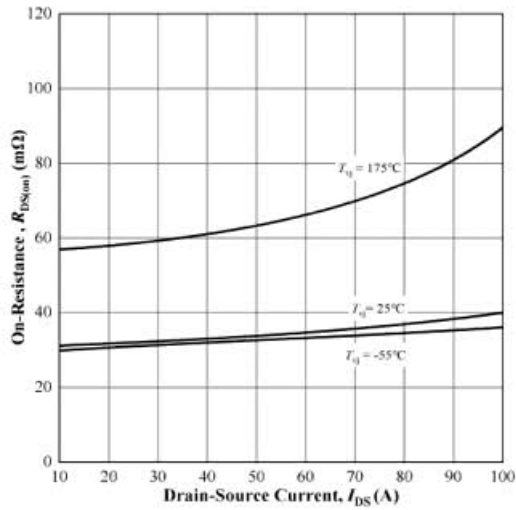


Figure 5: On-Resistance vs. Drain Current for Various Temperature $V_{GS}=18\text{V}$

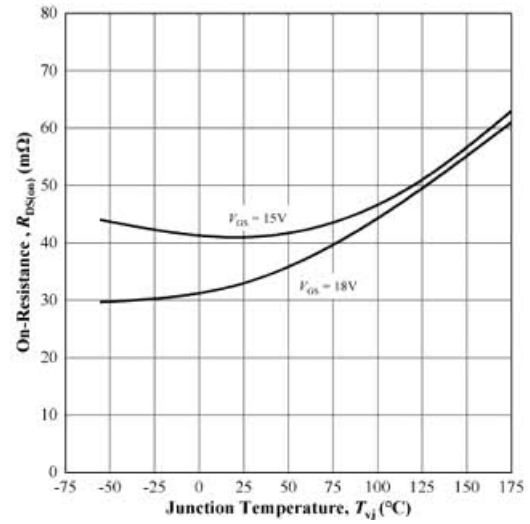


Figure 6: On-Resistance vs. Junction Temperature For Various Gate Voltage $I_D=40\text{A}$

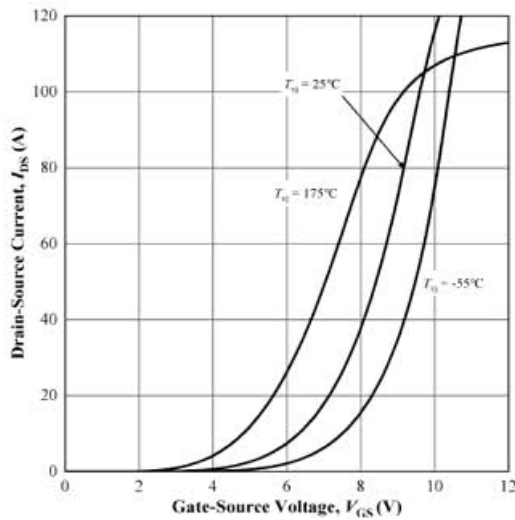


Figure 7: Transfer Characteristic for Various Temperatures $V_{DS}=20\text{V}$

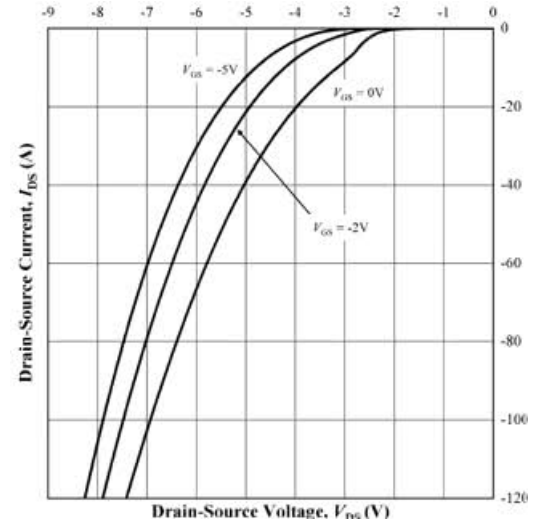


Figure 8: Body Diode Characteristic $T_{vj}=-55^\circ\text{C}$

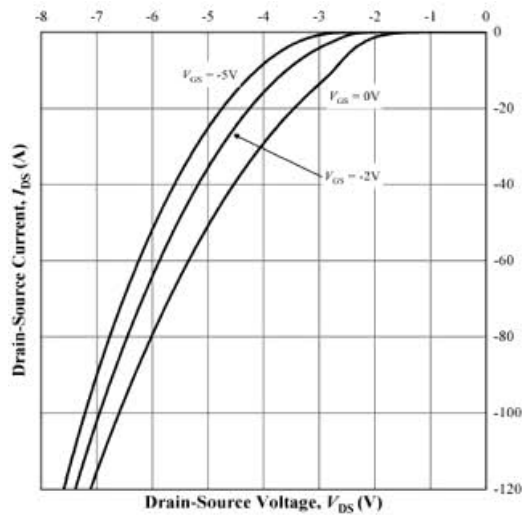


Figure 9: Body Diode Characteristic
 $T_{vj}=25^{\circ}\text{C}$

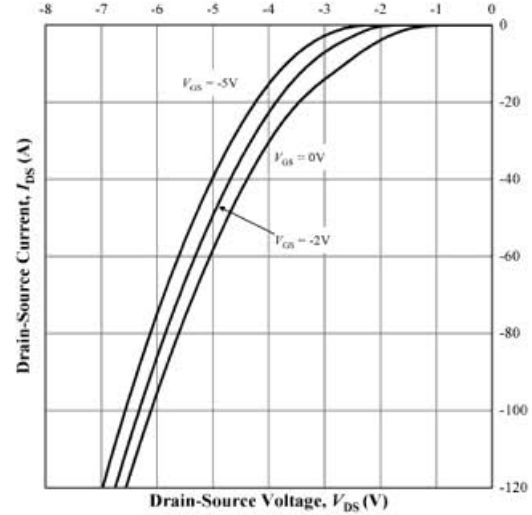


Figure 10: Body Diode Characteristic
 $T_{vj}=175^{\circ}\text{C}$

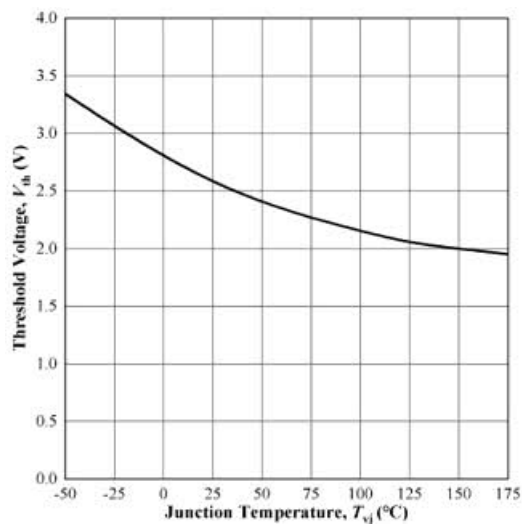


Figure 11. Threshold Voltage vs.
Temperature $V_{GS} = V_{DS}$, $I_D = 10\text{ mA}$

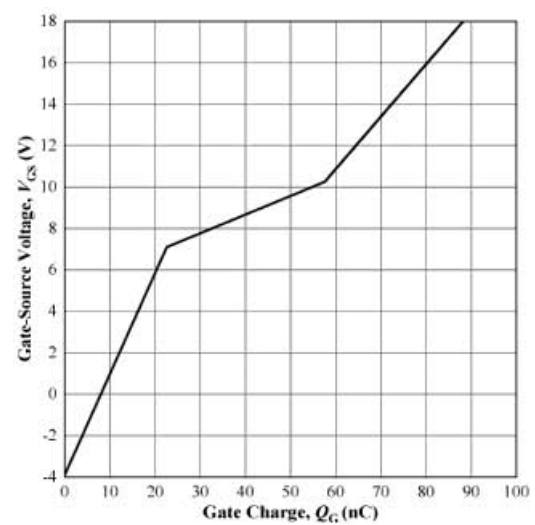


Figure 12. Gate Charge Characteristics
 $V_{DS} = 800\text{ V}$, $T_{vj} = 25^{\circ}\text{C}$

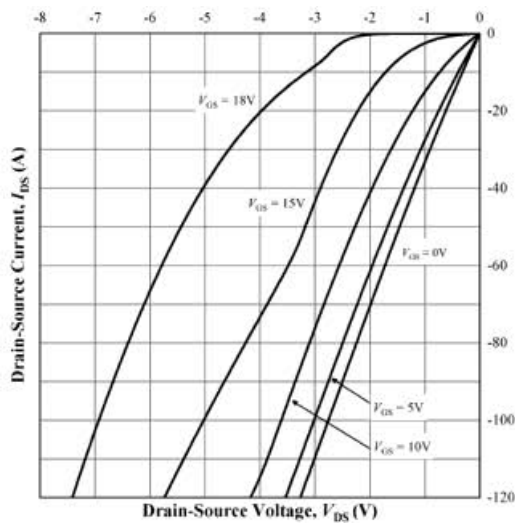


Figure 13. 3rd Quadrant Characteristic
 $T_{vj} = -55^{\circ}\text{C}$

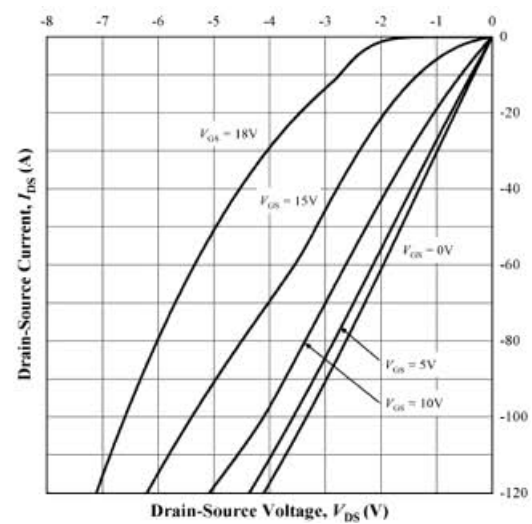


Figure 14. 3rd Quadrant Characteristic
 $T_{vj} = 25^{\circ}\text{C}$

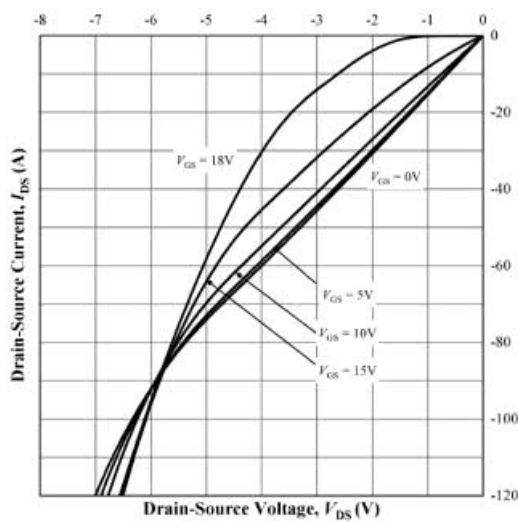


Figure 15. 3rd Quadrant Characteristic
 $T_{vj} = 175^{\circ}\text{C}$

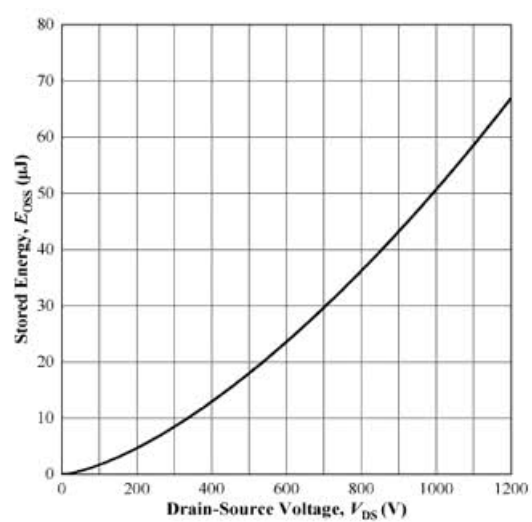


Figure 16. Output Capacitor Stored Energy

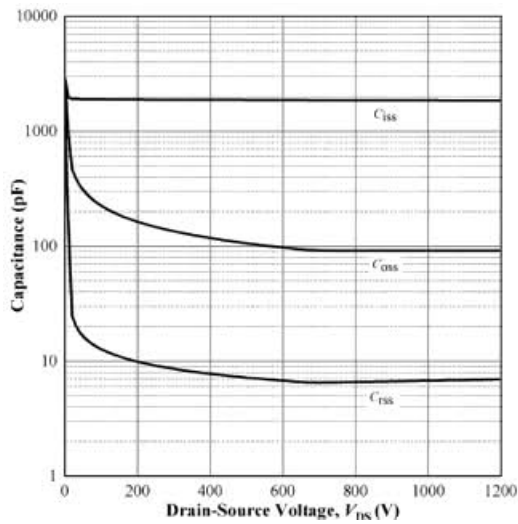


Figure 17: Capacitances vs. Drain-Source Voltage (0 – 1200 V)

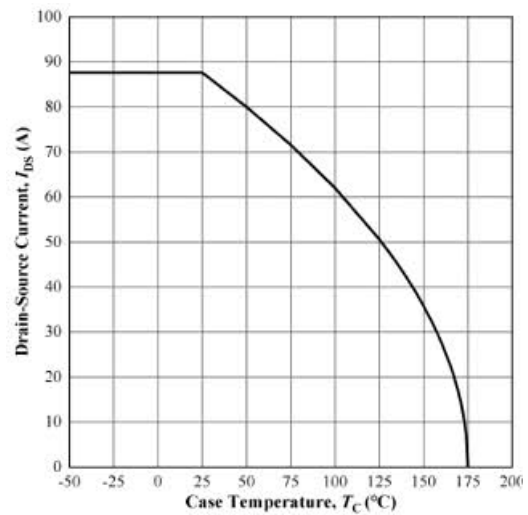


Figure 18: Continuous Drain Current Derating vs. Case Temperature

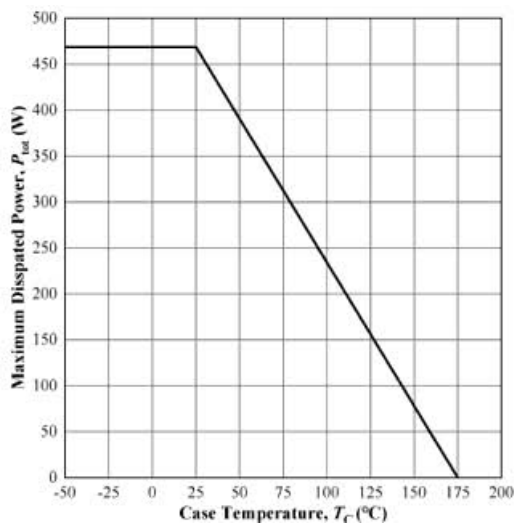


Figure 19: Maximum Power Dissipation Derating vs. Case Temperature

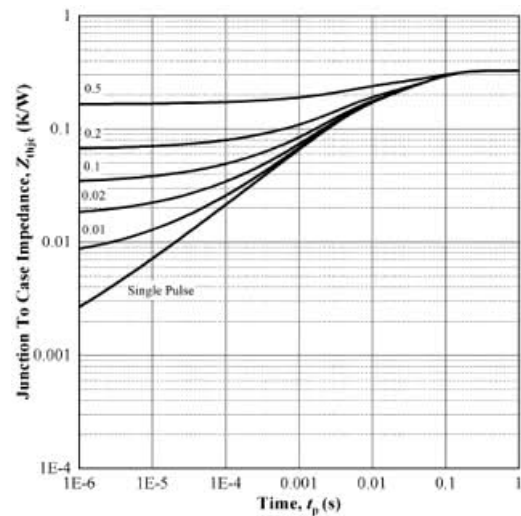
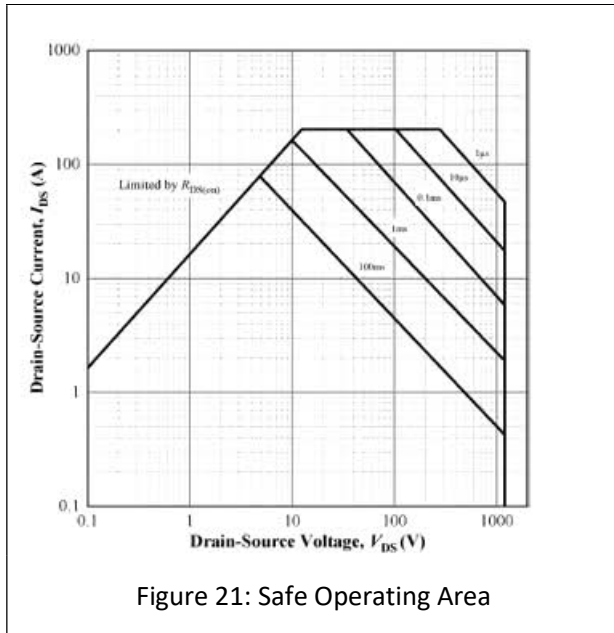
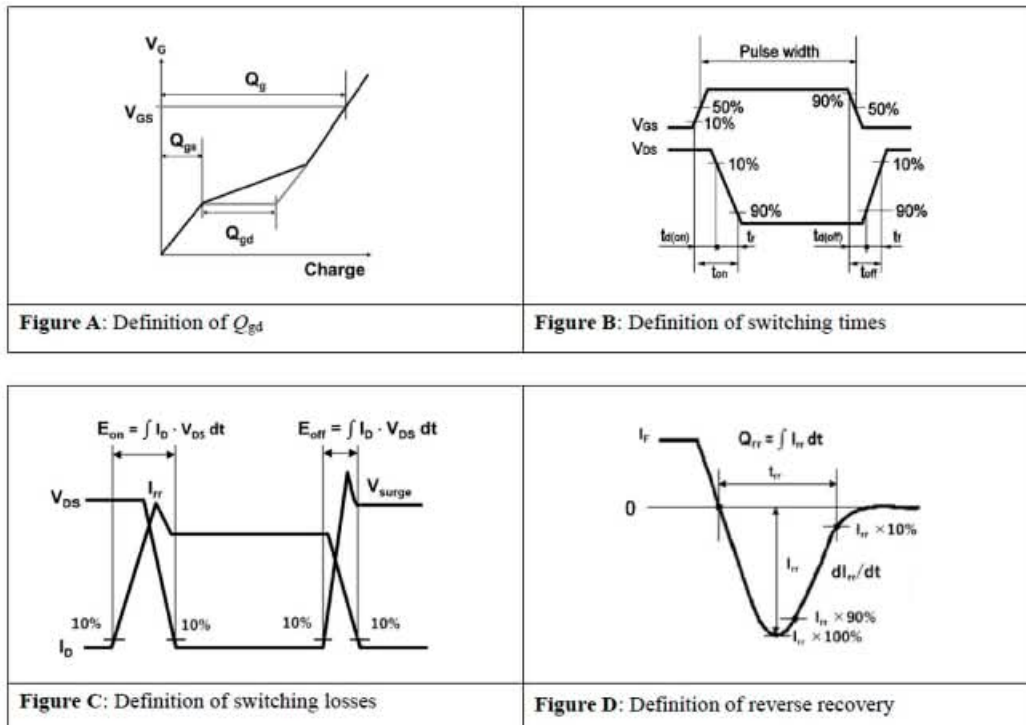


Figure 20: Transient Thermal Impedance

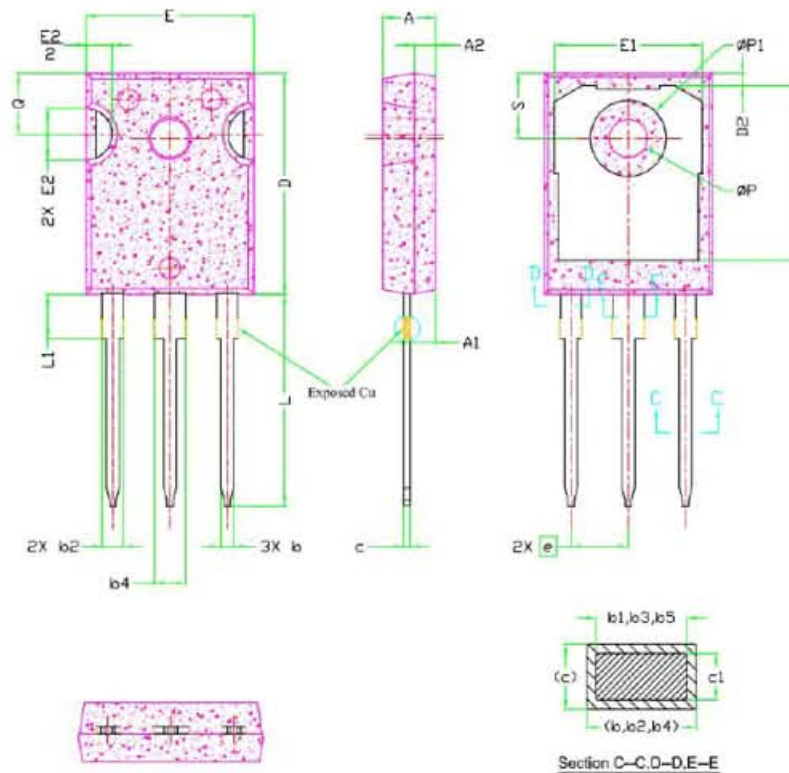


Testing conditions



Package Dimensions

Package: TO-247-3



SYMBOL	DIMENSIONS			NOTES
	MIN.	NOM.	MAX.	
A	4.43	5.02	5.21	
A1	2.29	2.41	2.55	
A2	1.50	2.00	2.49	
b	1.12	1.20	1.33	
b1	1.12	1.20	1.28	
b2	1.91	2.00	2.39	6
b3	1.91	2.00	2.34	
b4	2.67	3.00	3.22	6, 8
b5	2.67	3.00	3.16	
c	0.65	0.60	0.69	6
c1	0.65	0.60	0.65	
D	20.80	20.95	21.10	4
D1	18.25	18.35	17.65	5
D2	0.51	1.19	1.35	
E	15.75	15.94	16.13	4
E1	13.46	14.02	14.16	5
E2	4.32	4.91	5.49	3
e	5.44BSC			
L	19.81	20.07	20.32	
L1	4.10	4.19	4.40	6
ØP	3.66	3.61	3.65	7
ØP1	7.19REF.			
Q	5.39	5.70	6.20	
S	8.04	6.17	8.30	

Note:

1. Package Reference: JEDEC TO247, Variation AD.
2. All Dimensions Are In mm.
3. Slot Required, Notch May Be Rounded
4. Dimension D & E Do Not Include Mold Flash. Mold Flash Shall Not Exceed 0.127mm Pre Side. These Dimensions Are Measured At The Outermost Extreme Of The Plastic Body.
5. Thermal Pad Contour Optional Within Dimension D1 & E1.
6. Lead Finish Uncontrolled In L1.
7. ØP To Have A Maximum Draft Angle Of 1.5° To The Top Of The Part With A Maximum Hole Diameter Of 3.91mm.
8. Dimension "b2" And "b4" Does Not Include Dambar Protrusion. Allowable Dambar Protrusion Shall Be 0.10mm Total In Excess Of "b2" And "b4" Dimension At Maximum Material Condition.



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