

# 42A,1200V N-Channel Silicon Carbide Power MOSFET

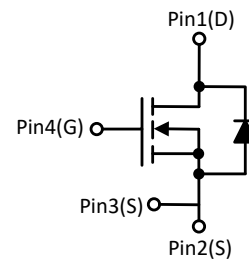
## Features

- High blocking voltage
- Low on-resistance with high junction temperature
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- RoHS compliant



## Applications

- Switch Mode Power Supplies
- DC/DC converters
- Solar Inverters
- Battery Chargers
- Motor Drives



### Absolute Maximum Ratings (@T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V <sub>DS</sub>	1200	V
Gate Source Voltage	V <sub>GS</sub>	-5/+20	V
Drain Current Continuous	I <sub>D</sub>	42	A
T <sub>C</sub> =25°C			
Drain Current Pulse	I <sub>DM</sub>	84	A
Power Dissipation(T <sub>C</sub> =25°C)	P <sub>D</sub>	208	W
Operating Temperature/ Storage Temperature	T <sub>J</sub> /T <sub>STG</sub>	-55 ~ +175	°C

### Thermal Characteristics

Parameter	Symbol	Typ	Unit
Thermal Resistance ,Junction-to-Ambient	R <sub>θJA</sub>	--	°C/W
Thermal Resistance Junction-to-Case	R <sub>θJC</sub>	0.68	°C/W

### Electrical Characteristics (@T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =100μA	1200	--	--	V
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =20V	--	10	250	nA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V	--	11	100	μA
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =5mA	2	--	4	V
Drain-Source On-state Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =20V, I <sub>D</sub> =20A	--	78	100	mΩ
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> =-5/+20V, V <sub>DS</sub> =800V, I <sub>D</sub> =20A	--	52	--	nC
Gate- Source Charge	Q <sub>gs</sub>		--	17	--	nC
Gate- Drain Charge	Q <sub>gd</sub>		--	15	--	nC
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>GS</sub> =-5/+20V, V <sub>DS</sub> =800V, I <sub>D</sub> =20A, R <sub>G</sub> =2.5Ω,	--	35	--	ns
Turn-on Rise Time	t <sub>r</sub>		--	16	--	ns
Turn-off Delay Time	t <sub>d(off)</sub>		--	43	--	ns
Turn-off Fall Time	t <sub>f</sub>		--	12	--	ns
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =1000V, f=1.0MHz, V <sub>AC</sub> =25mV	--	1128	--	pF
Output Capacitance	C <sub>oss</sub>		--	86	--	pF
Reverse Transfer Capacitance	C <sub>rss</sub>		--	5	--	pF

### Reverse Diode Characteristics (@T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Continuous Diode Forward Current	I <sub>SD</sub>		--	--	42	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =20A, V <sub>GS</sub> =0V	4	--	--	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>S</sub> = 20A, V <sub>GS</sub> =-5V, V <sub>DS</sub> =800V, di/dt =2100 A/μs,	--	26	--	ns
Reverse Recovery Charge	Q <sub>rr</sub>		--	163	--	nC

## Ratings and Characteristics Curves

( $T_A = 25^\circ\text{C}$  unless otherwise noted)

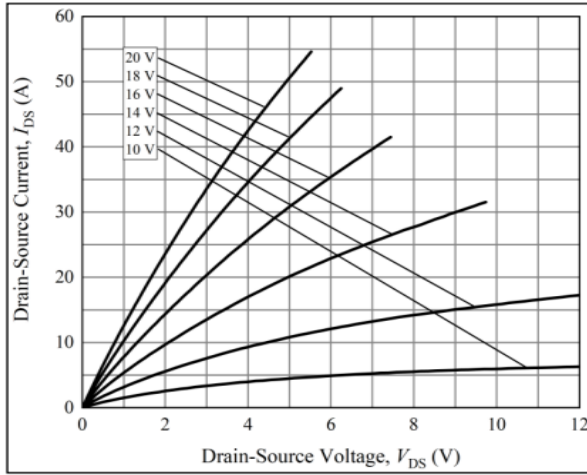


Figure 1. Typical Output Characteristics at  $T_J = -55^\circ\text{C}$

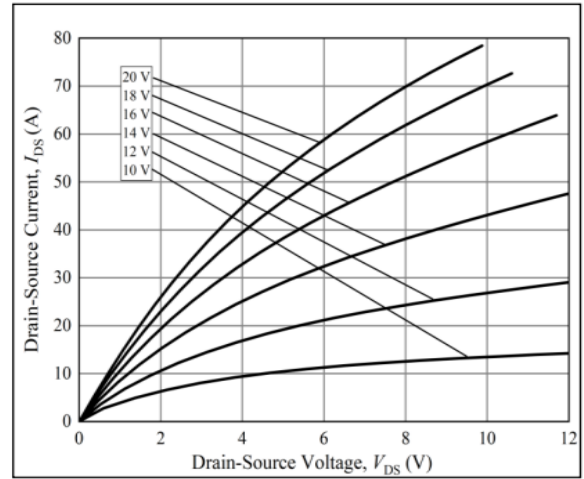


Figure 2. Typical Output Characteristics at  $T_J = 25^\circ\text{C}$

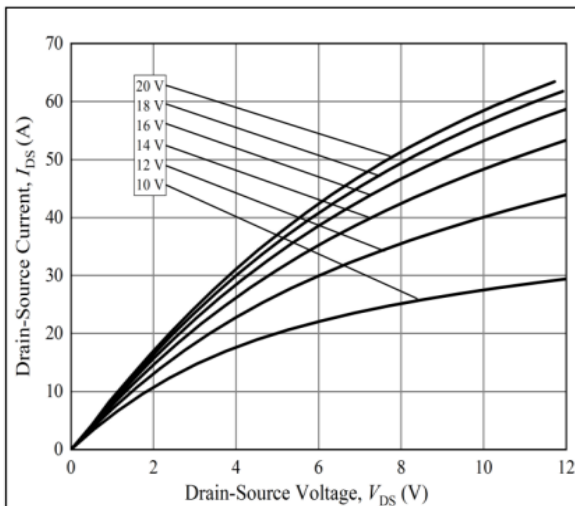


Figure 3. Typical Output Characteristics at  $T_J = 175^\circ\text{C}$

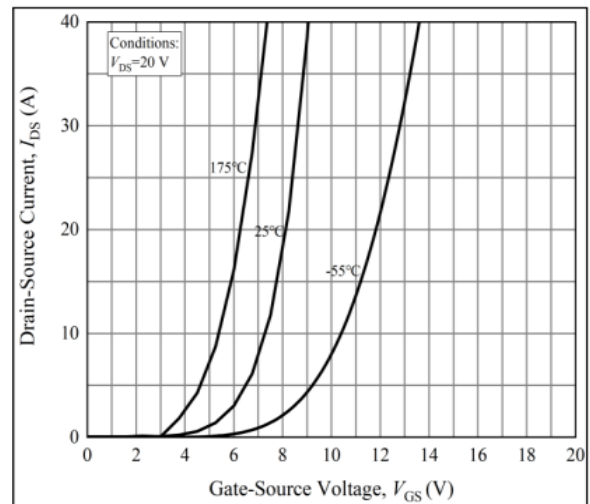


Figure 4. Typical Transfer Characteristics for Various Temperature

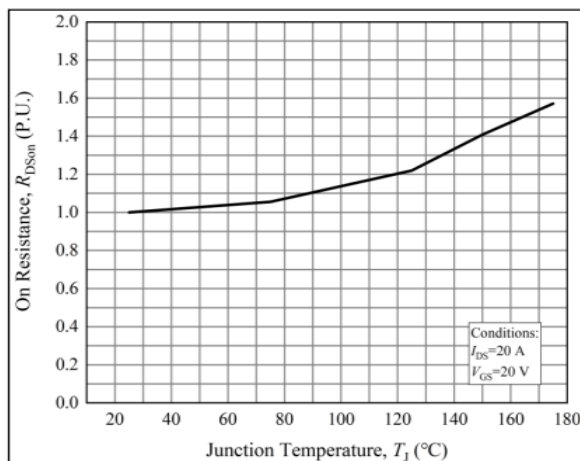


Figure 5. Normalized On-Resistance vs. Temperature

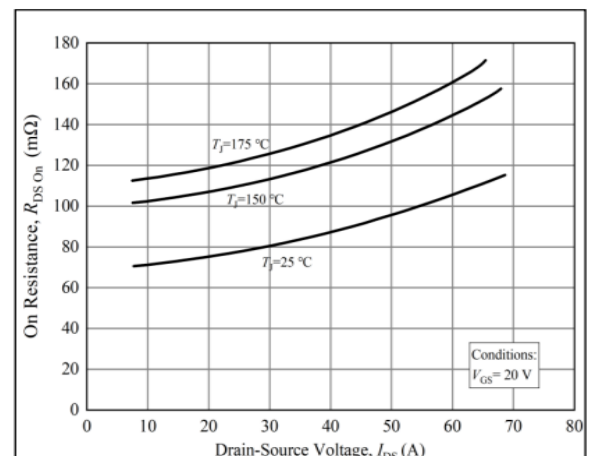


Figure 6. On-Resistance vs. Drain Current for Various Temperatures

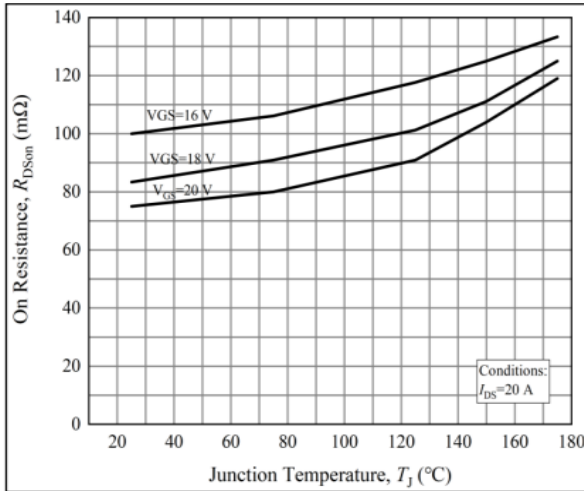


Figure 7. On-Resistance vs. Temperature for Gate

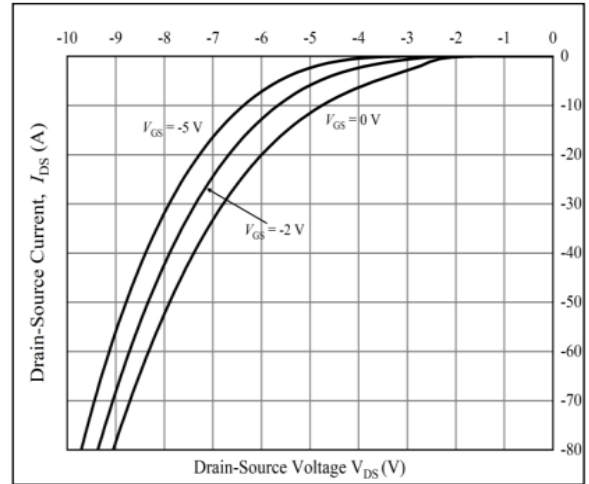


Figure 8. Typical Body Diode Characteristics at  $T_J = -55\text{ }^\circ\text{C}$

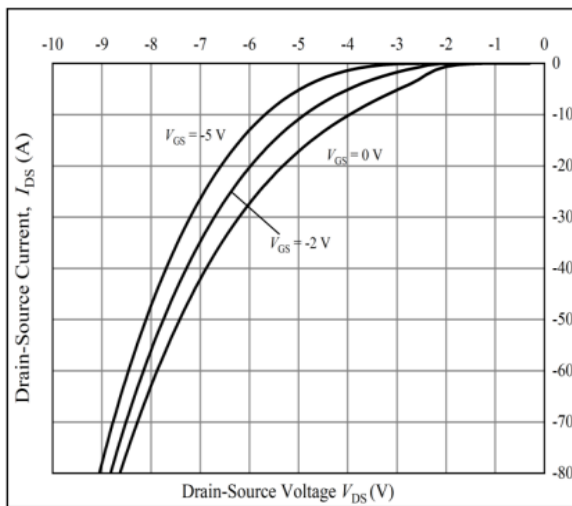


Figure 9. Typical Body Diode Characteristics at  $T_J = 25\text{ }^\circ\text{C}$

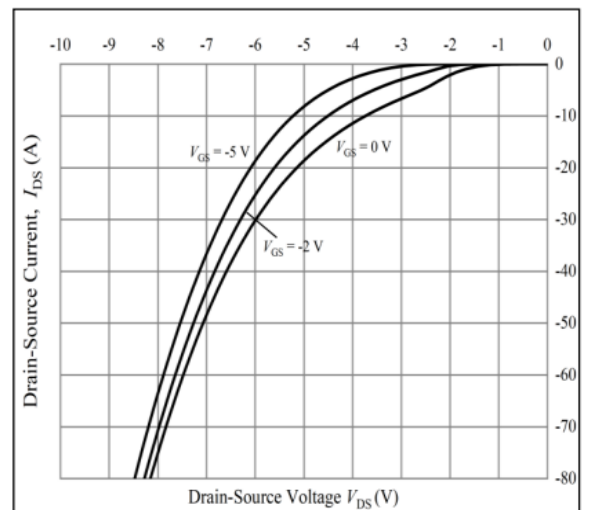


Figure 10. Typical Body Diode Characteristics at  $T_J = 175\text{ }^\circ\text{C}$

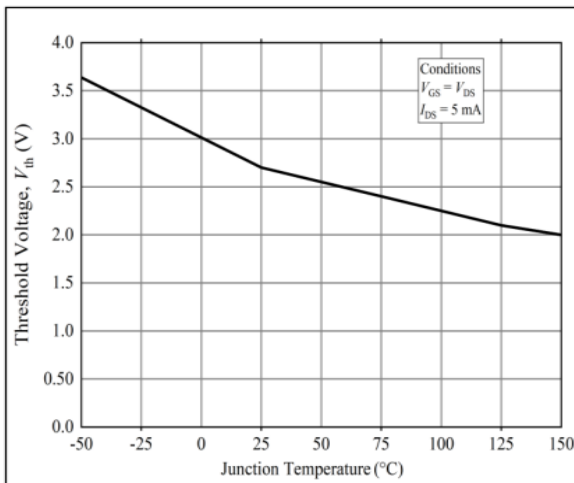


Figure 11. Typical Threshold Voltage vs. Temperature

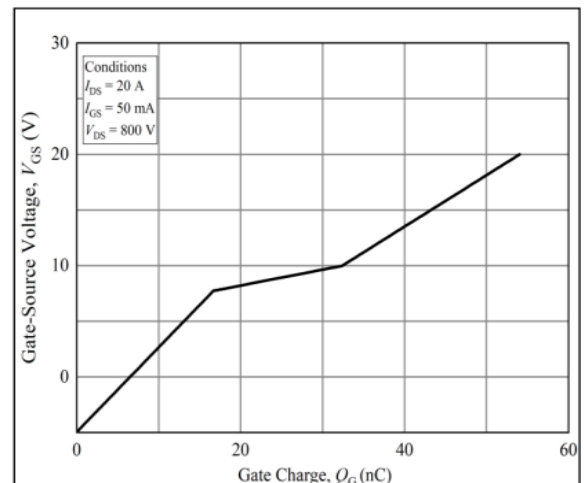
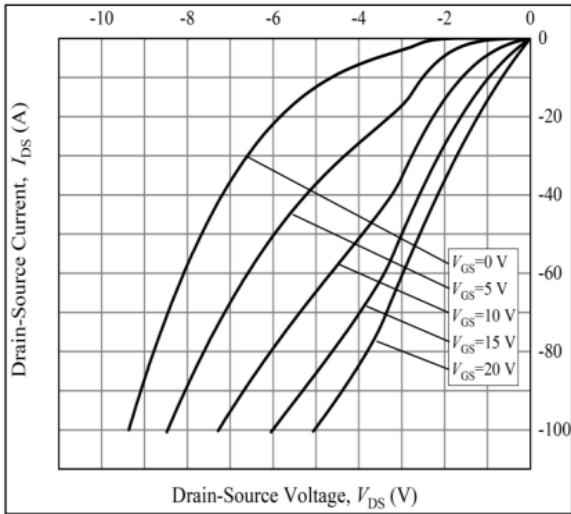
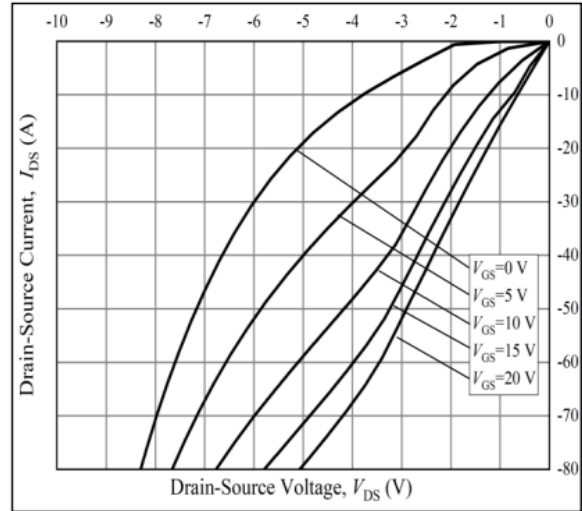


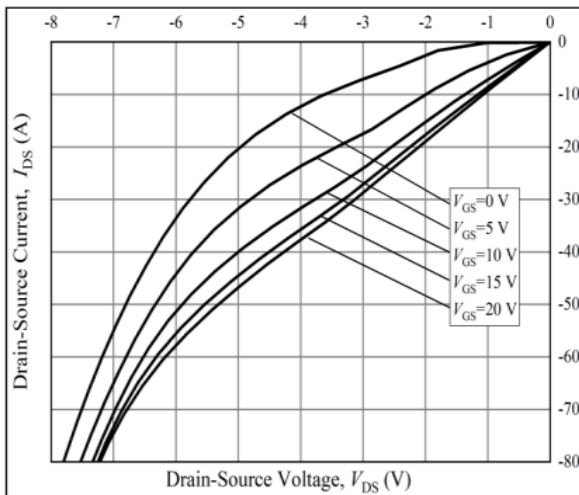
Figure 12. Typical Gate Charge Characteristics at  $T_J = 25\text{ }^\circ\text{C}$



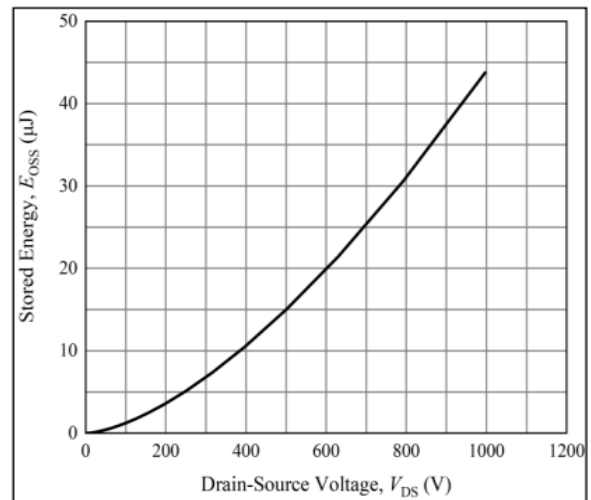
**Figure 13. Typical 3rd Quadrant Characteristics at  $T_J = -55\text{ }^\circ\text{C}$**



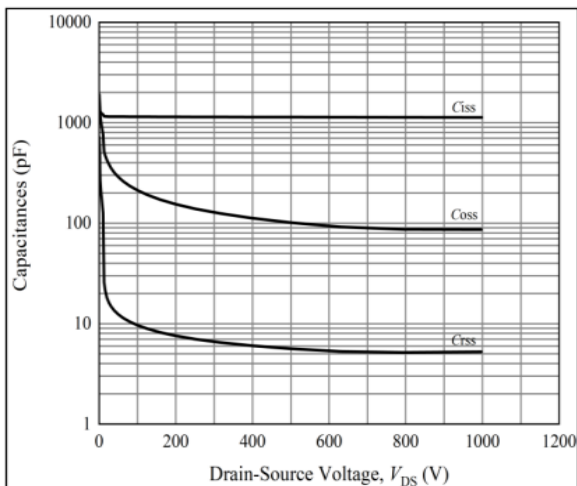
**Figure 14. Typical 3rd Quadrant Characteristics at  $T_J = 25\text{ }^\circ\text{C}$**



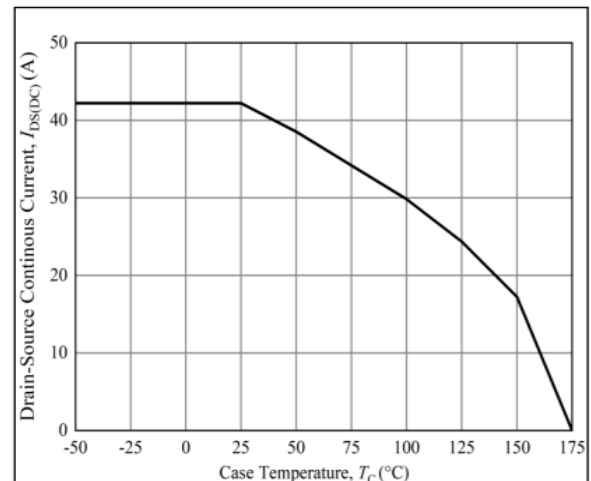
**Figure 15. Typical 3rd Quadrant Characteristics at  $T_J = 175\text{ }^\circ\text{C}$**



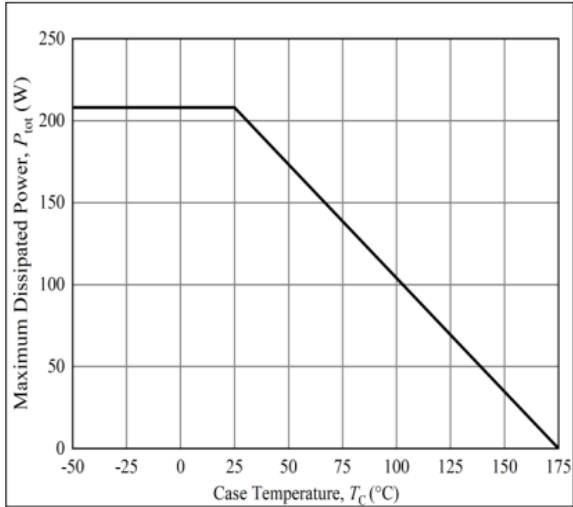
**Figure 16. Typical Output Capacitor Stored Energy**



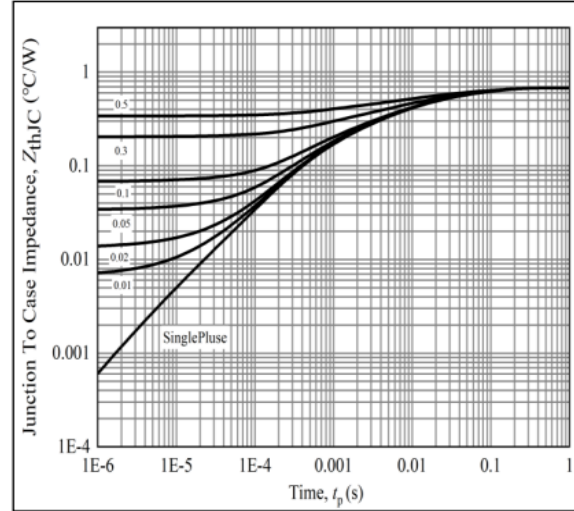
**Figure 17. Typical Capacitances vs. Drain-Source Voltage**



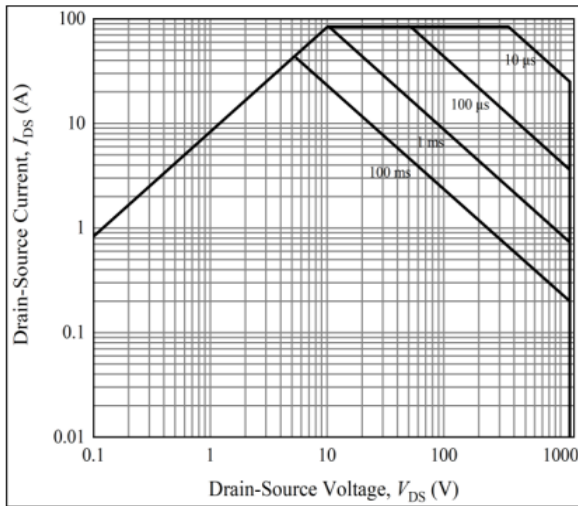
**Figure 18. Continuous  $I_{DS}$  Current Derating Curve**



**Figure 19. Power Dissipation Derating Curve**



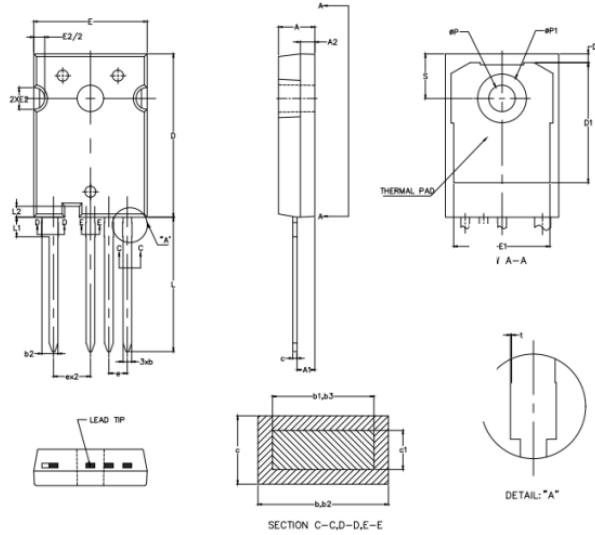
**Figure 20. Typical Transient Thermal Impedance (Junction – Case) with Duty Cycle**



**Figure 21. Safe Operate Area**

**Package Outline Dimensions** (Unit: millimeters)

**TO-247-4L**



TO-247-4L					
	Min.	Max.		Min.	Max.
A	4.9	5.1	D1	16.25	16.85
A1	2.31	2.51	D2	1.05	1.35
A2	1.9	2.1	E	15.75	15.9
b	1.16	1.26	E1	13.26	-
b1	1.15	2.22	E2	2.9	3.1
b2	2.16	2.26	e	2.54BSC	
b3	2.15	2.22	L	18.3	18.6
c	0.59	0.66	L1	-	2.8
c1	0.58	0.62	L2		1.5
D	22.4	22.6	ΦP	3.5	3.7
S	6.05	6.25	ΦP1		7.4
t	0	0.15			

**Revision History**

Document Version	Date of release	Description of changes
Rev.A	2023.02.08	Preliminary Datasheet

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