



1200V 13mΩ N-Channel SiC Power MOSFET

Description

SiC Power MOSFET is new generation of high voltage MOSFET family that is utilizing a revolutionary semiconductor material – Silicon Carbide.

This new device has been tailored to minimize conduction loss, provide superior switching performance and robust avalanche capability, with benefits of efficiency improvement, higher frequency, increased power density and reduced cooling effort.

SiC Power MOSFET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency. Such as solar inverter, EV charger, UPS, industrial power supply.

Features

- 175°C Max. junction temperature
- 1200V @Tc = 25 °C
- Typ. $R_{DS(on)}$ = 12.5mΩ
- Fast intrinsic diode with very low reverse recovery
- Switching behavior independent of temperature



TO-247-4L

Absolute Maximum Ratings

Symbol	Parameter	Values	Unit
BV_{DSS}	Drain-Source Voltage	1200	V
I_D	Drain Current -Continuous (Tc = 25°C)	158	A
	-Continuous (Tc = 100°C)	112	
I_{DM}	Drain Current-Pulsed	394	A
V_{GSS}	Gate-Source Voltage(DC)	-10 / +23	V
	Recommended Operation Value	-5 / +18	V
P_D	Power Dissipation (Tc = 25°C)	652	W
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	°C

Thermal Characteristics

Symbol	Parameter	Values	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.23	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	°C/W

**Electrical Characteristics Tc = 25°C** unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA	1200	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 1200V, V _{GS} = 0V	-	1	100	μA
I _{GSS}	Gate-Source Leakage Current	V _{GS} = +23V, V _{DS} = 0V	-	10	250	nA
I _{GSS-}	Gate-Source Leakage Current	V _{GS} = -10V, V _{DS} = 0V	-	10	250	nA
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 30mA	2.0	2.9	4.0	V
		V _{DS} = V _{GS} , I _D = 30mA , T _j = 175°C	-	2.1	-	
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 18V, I _D = 75A	-	12.5	18	mΩ
		V _{GS} = 18V, I _D = 75A, T _j = 175°C	-	23	-	
g _{fs}	Transconductance	V _{DS} = 20V, I _D = 75A	-	65	-	S
		V _{DS} = 20V, I _D = 75A, T _j = 175°C	-	60	-	
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =1000V, f =100kHz,	-	5600	-	pF
C _{oss}	Output Capacitance	V _{AC} =25mV	-	211	-	
C _{rss}	Reverse Transfer Capacitance	f=1MHz, V _{AC} =25mV	-	21	-	
R _{G(int)}	Internal Gate Resistance	f=1MHz, V _{AC} =25mV		1.9		Ω
E _{ON}	Turn-On Switching Energy	V _{DS} =800V, V _{GS} = -4V/18V I _D =75A, R _{G(ext)} =3Ω, L=100μH		1.4		mJ
E _{OFF}	Turn-Off Switching Energy			0.56		
Q _{gs}	Gate-Source Charge	V _{DS} = 800V, V _{GS} = -4 / +18 V, I _D = 75 A		55		nC
Q _{gd}	Gate-Drain Charge			42		
Q _g	Total Gate Charge			230		

Reverse Diode Characteristics Tc = 25°C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{SD}	Diode Forward Voltage	V _{GS} = -4V, I _{SD} = 37.5A	-	3.9	-	V
		V _{GS} = -4V, I _{SD} = 37.5A, T _j = 175°C	-	3.6	-	
I _S	Continuous Diode Forward Current	T _c = 25°C	-	-	158	A
t _{rr}	Reverse Recover Time	V _R =800V, I _{SD} =75A	-	30	-	ns
Q _{rr}	Reverse Recovery Charge		-	296	-	nC
I _{rrm}	Peak Reverse Recovery Current		-	17	-	A



Typical Performance Characteristics

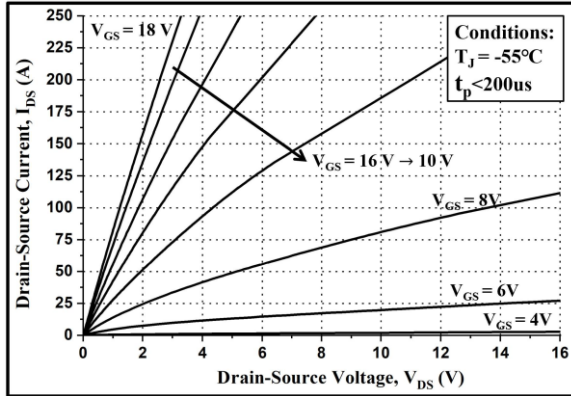


Figure 1. Output Characteristics $T_J = -55^\circ\text{C}$

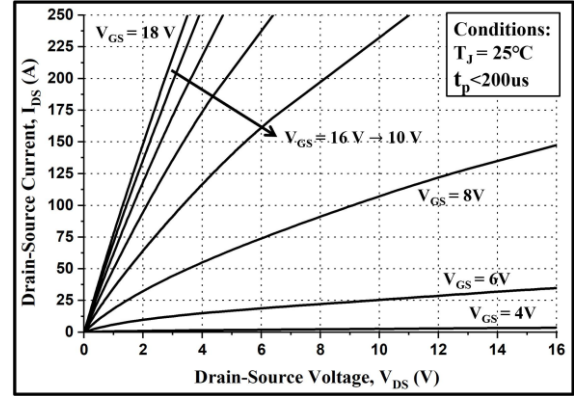


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

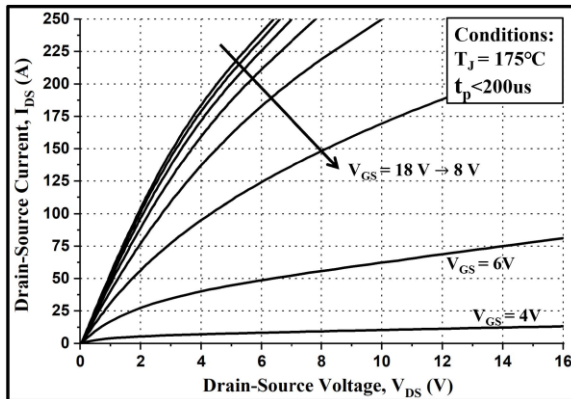


Figure 3. Output Characteristics $T_J = 175^\circ\text{C}$

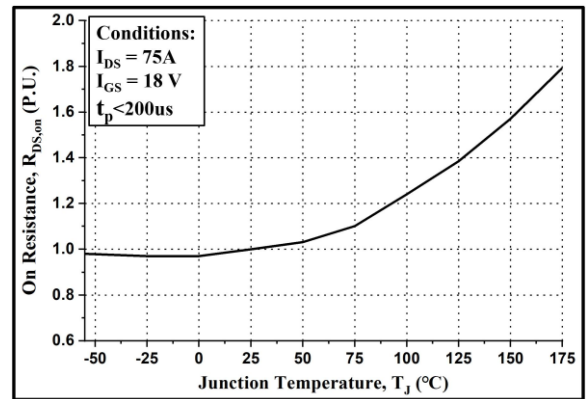


Figure 4. Normalized On-Resistance vs. Temperature

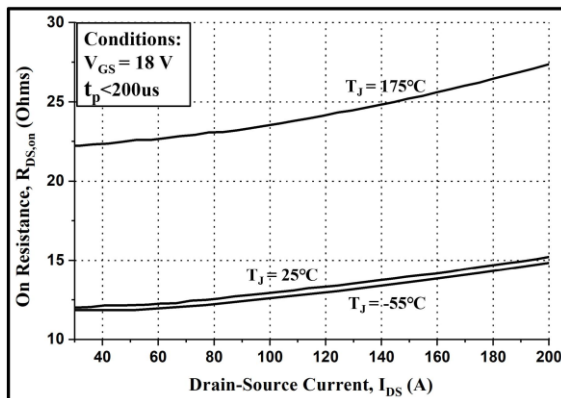


Figure 5. On-Resistance vs. Drain Current For Various Temperatures

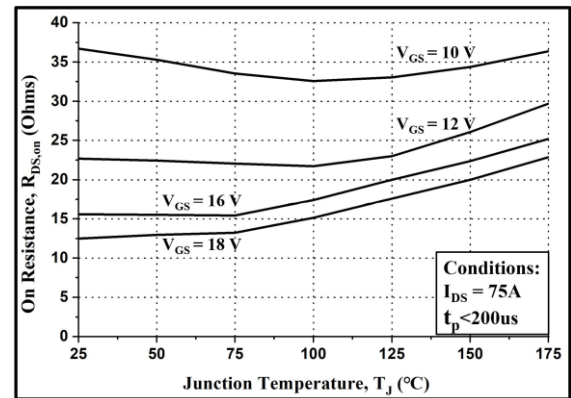


Figure 6. On-Resistance vs. Temperature For Various Gate Voltage



Typical Performance Characteristics

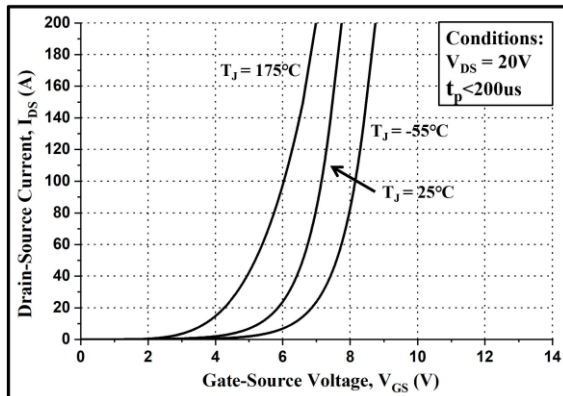


Figure 7. Transfer Characteristic for Various Junction Temperatures

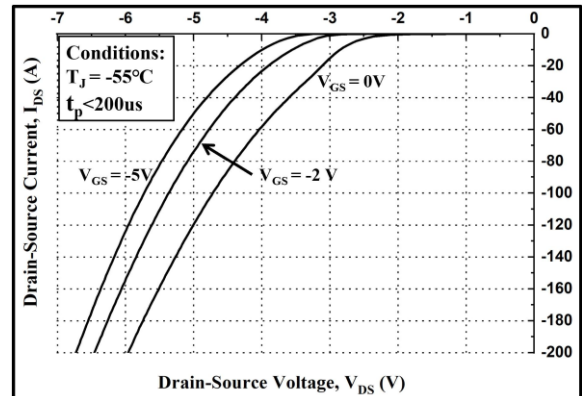


Figure 8. Body Diode Characteristic at -55°C

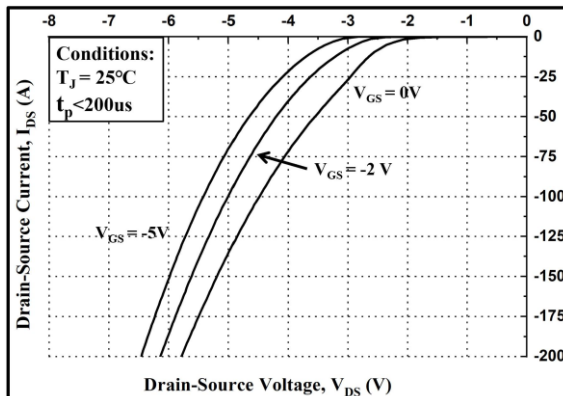


Figure 9. Body Diode Characteristic at 25°C

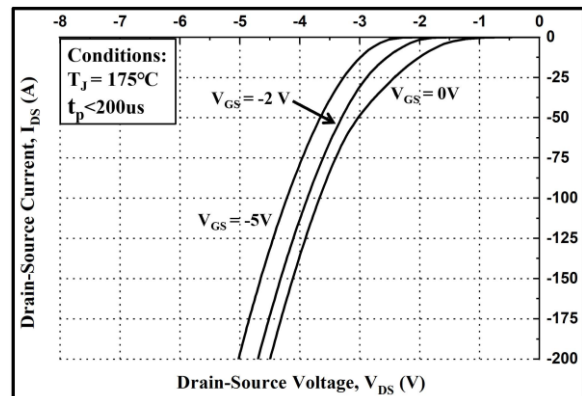


Figure 10. Body Diode Characteristic at 175°C

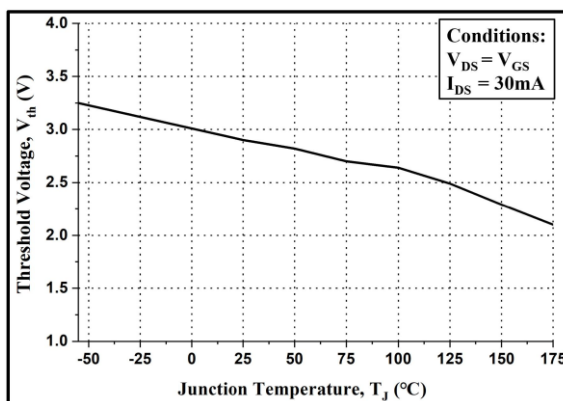


Figure 11. Threshold Voltage vs. Temperature

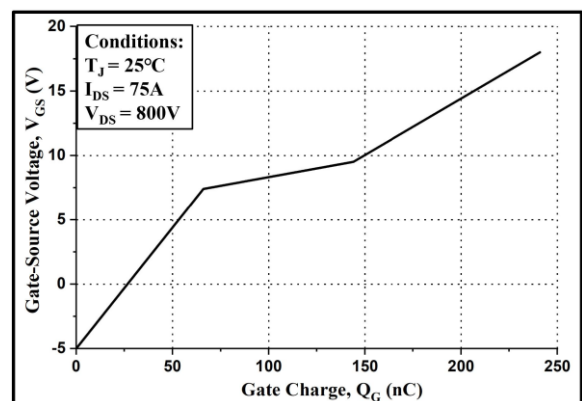


Figure 12. Gate Charge Characteristics



Typical Performance Characteristics

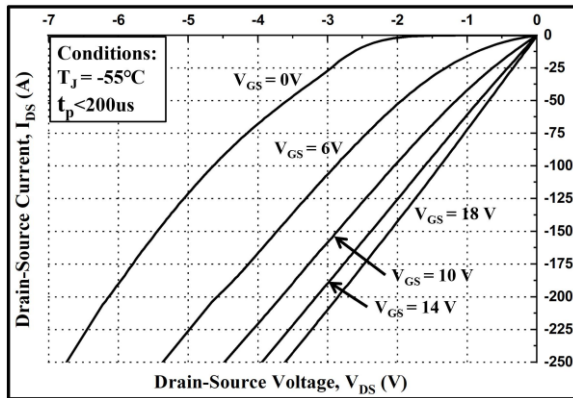


Figure 13. 3rd Quadrant Characteristic at -55°C

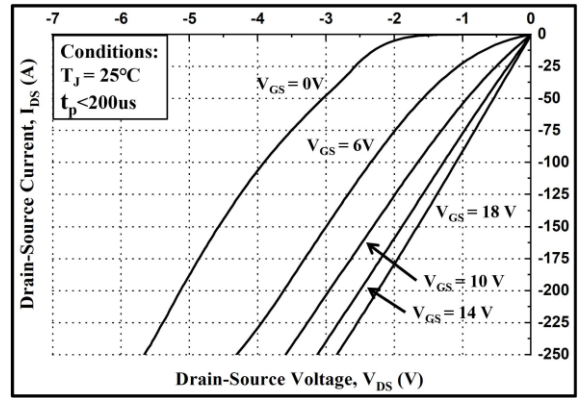


Figure 14. 3rd Quadrant Characteristic at 25°C

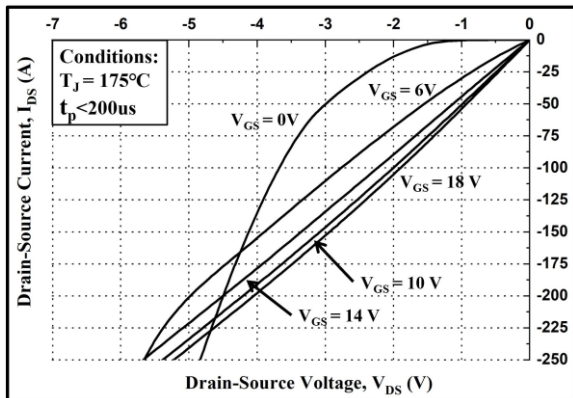


Figure 15. 3rd Quadrant Characteristic at 175°C

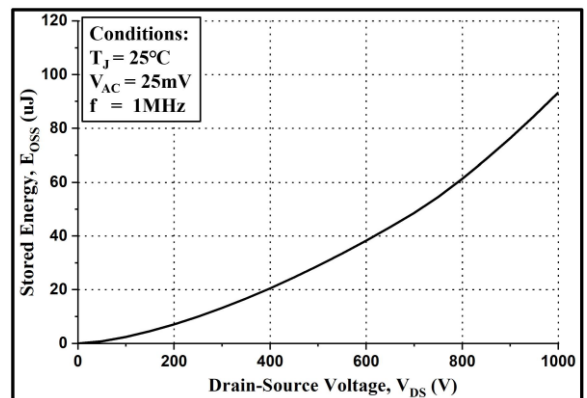


Figure 16. Output Capacitor Stored Energy

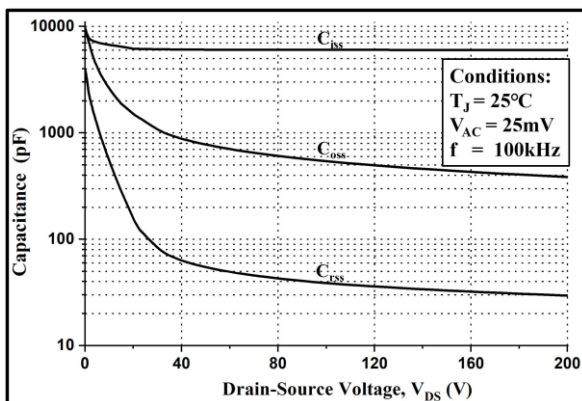


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

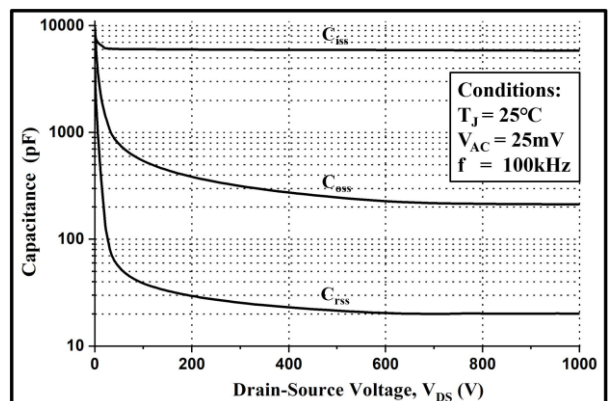


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1000V)



Typical Performance Characteristics

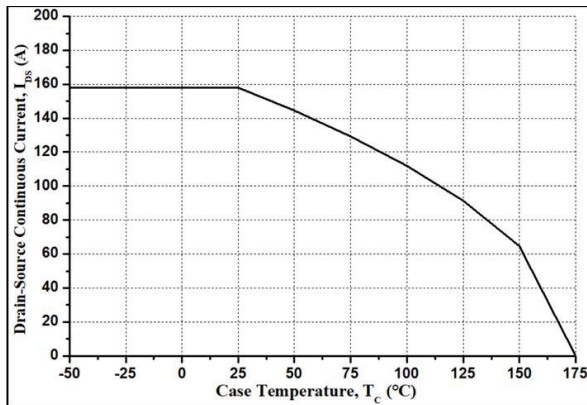


Figure 19. Continuous Drain Current vs. Case Temperature

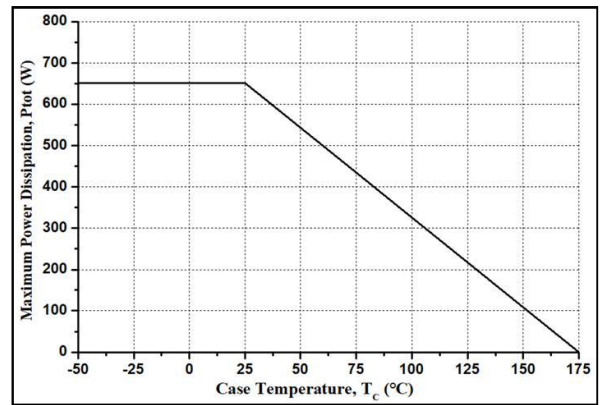


Figure 20. Maximum Power Dissipation vs. Case Temperature

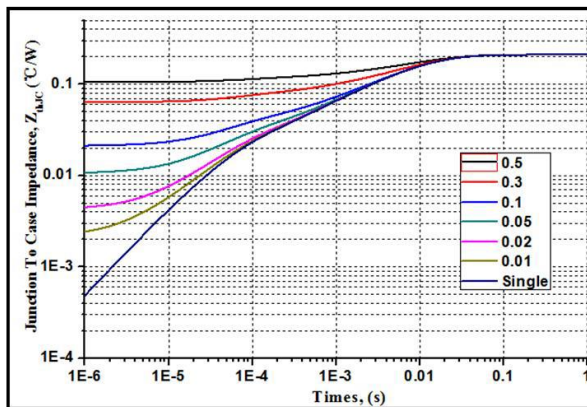


Figure 21. Transient Thermal Impedance (Junction - Case)

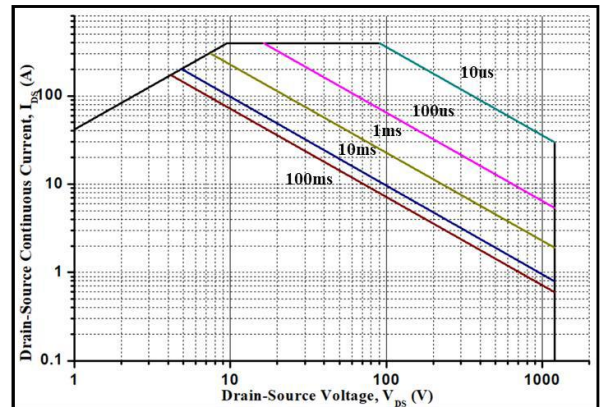
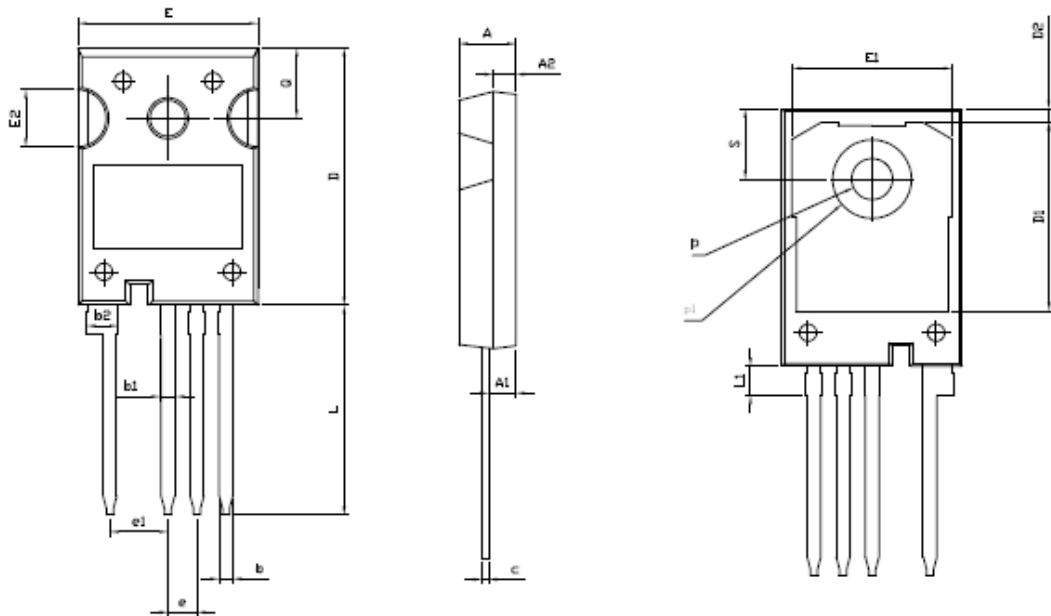


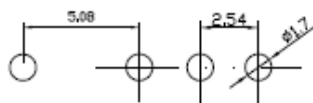
Figure 22. Safe Operating Area



TO-247-4L PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



UNIT: mm

	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.25	2.40	2.45
A2	1.85	2.00	2.15
b	1.05	1.20	1.35
b1	1.00	1.30	1.60
b2	2.35	2.65	2.95
c	0.50	0.60	0.70
D	22.34	22.54	22.74
D1	16.00	16.50	17.00
D2	0.97	1.17	1.37
e	2.34	2.54	2.74
e1	4.88	5.08	5.28
E	15.60	15.80	16.00
E1	13.50	14.00	14.50
E2	4.80	5.00	5.20
L	18.08	18.38	18.68
L1	2.38	2.58	2.78
p	3.50	3.60	3.70
p1	6.60	6.80	7.00
Q	6.00	6.15	6.30
S	6.00	6.15	6.30