N-Channel Silicon Carbide (SiC) MOSFET

Description

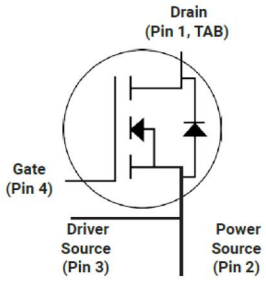
Silicon Carbide (SiC) MOSFET use a completely new technology that provide superior switching performance and higher reliability compared to Silicon. In addition, the low ON resistance and compact chip size ensure low capacitance and gate charge. Consequently, system benefits include highest efficiency, faster operating frequency, increased power density, reduced EMI, and reduced system size.

Features

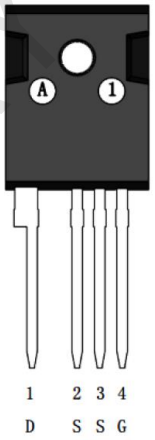
- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low RDS(on)
- Optimized package with separate driver source pin
- Easy to parallel and simple to drive
- ROHS Compliant, Halogen free

Application

- EV motor drive
- High Voltage DC/DC Converters
- Switch Mode Power Supplies
- Solar inverters
- EV charging



Schematic diagram



TO-247-4

Ordering Information

Device	Package	Marking	Packaging
GS120R045Q4	TO-247-4	GS120R045	30pcs/Tube

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	1200	V
Continuous Drain Current ,T_C=25℃	I_D	60	A
Continuous Drain Current ,T_C=100℃	I_D	48	A
Pulsed Drain Current	I_{DM}	100	A
Gate-Source Voltage	V_{GS}	-10 / +20	V
Power Dissipation	P_D	395	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55 To +175	ºC

Thermal Resistance

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Ambient	R_{thJA}	40	ºC/W
Thermal Resistance, Junction-to-Case	R_{thJC}	0.38	ºC/W

Electrical Characteristics(TJ = 25℃ unless otherwise specified)

Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Typical Performance-Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V , I_D = 250μA	1200	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 1200V , V_{GS} = 0V	--	--	100	μA
Gate-body Leakage Current	I_{GSS}	V_{GS} = -10 to 20V	--	--	250	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS} , I_D = 10mA	2	3	4	V
Recommended turn-on Voltage	V_{GSon}	Static	--	18	--	V
Recommended turn-off Voltage	V_{GSoff}		--	-5	--	V
Static Drain-source On Resistance	$R_{DS(on)}$	V_{GS} = 18V , I_D = 20A	--	45	52	mΩ
		V_{GS} = 18V , I_D = 20A , T_J= 175℃	--	72	--	
Typical Performance-Dynamic						
Input Capacitance	C_{iss}	V_{DS} = 1000V, f = 100kHz, V_{AC}=25mV	--	2565	--	pF
Output Capacitance	C_{oss}		--	109	--	
Reverse Transfer Capacitance	C_{rss}		--	4	--	
Transconductance	g_{fs}	V_{DS} = 20V , I_D = 20A	--	24	--	S
C_{OSS} Stored Energy	E_{OSS}	V_{DS} = 1000V, f = 100kHz	--	63	--	μJ
Turn-On Energy（Body Diode）	E_{ON}	V_{DS} = 800V , V_{GS} = -5/20V, I_D = 20A , L = 100uH T_J = 175℃	--	611	--	
Turn-Off Energy（Body Diode）	E_{OFF}		--	103	--	
Total Gate Charge	Q_g	V_{DS} = 800V, V_{GS} = -5V/20V, I_D = 20A	--	125	--	nC
Gate-Source Charge	Q_{gs}		--	32	--	
Gate-Drain Charge	Q_{gd}		--	33	--	
Internal Gate Resistance	$R_{G（int）}$	f = 1MHz,V_{AC} = 25mV	--	4.2	--	Ω
Turn-on Delay Time	$t_{d(on)}$	V_{DS} = 800V , V_{GS} = -5V/20V, I_D = 20A , L = 100μH Rext = 2.5Ω	--	15	--	ns
Turn-on Rise Time	t_r		--	19	--	
Turn-off Delay Time	$t_{d(off)}$		--	25	--	
Turn-off Fall Time	t_f		--	10	--	

Typical Performance-Reverse Diode(TJ = 25℃ unless otherwise specified)						
Parameter	**Symbol**	**Test Conditions**	**Value**			**Unit**
			Min.	**Typ.**	**Max.**	
Continuous Diode Forward Current	I_S	T_C = 25ºC	--	55	--	A
Forward Voltage	V_{FSD}	V_{GS} = 0V , I_F = 20A , T_J = 25℃	--	4.2	6	V
		V_{GS} = 0V , I_F = 20A , T_J = 175℃	--	3.5	6	
Reverse Recovery Charge	Q_{rr}	V_{GS} = -5V , I_F = 20A, V_R = 800V , T_J = 175℃ di/dt = 900A/μs	--	712	--	nC
Reverse Recovery Time	T_{rr}		--	50	--	ns
Peak Reverse Recovery Current	I_{rrm}		--	19	--	A

The values are based on the junction-to case thermal impedance which is measured with the device mounted to a large heat sink assuming maximum junction temperature of Tj(max)=175℃

Electrical Characteristics

Fig1. Output characteristics (T_J = 25 °C)

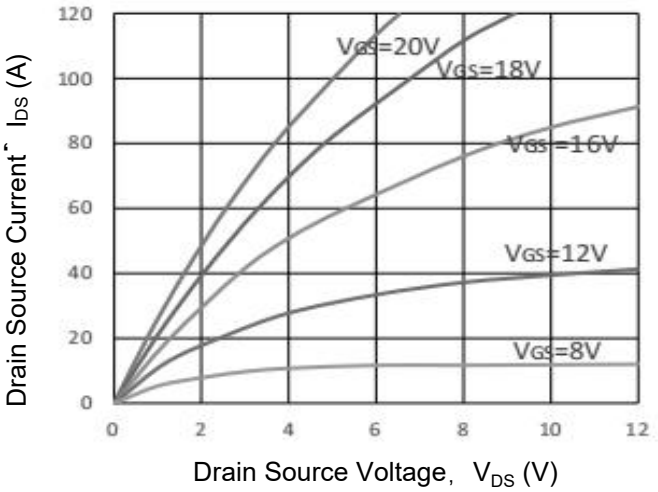


Fig2. Output characteristics (T_J = 175 °C)

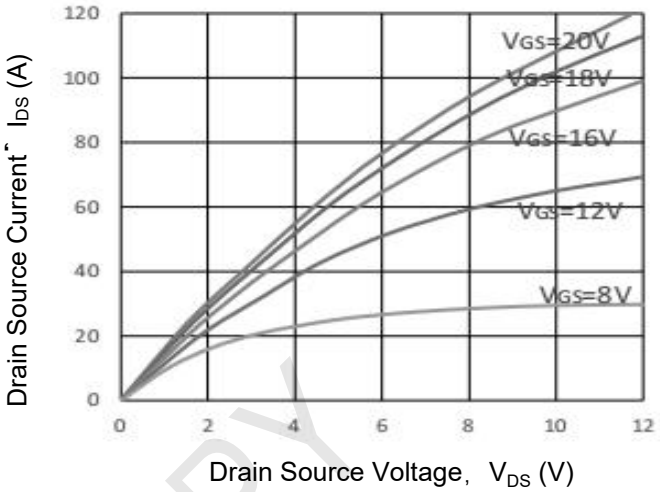


Fig3.Normalized On-Resistance vs. Temperature

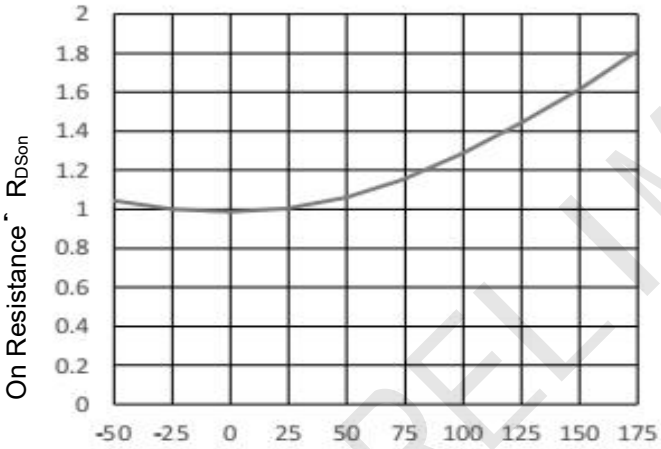


Fig4. On-Resistance vs. Temperature

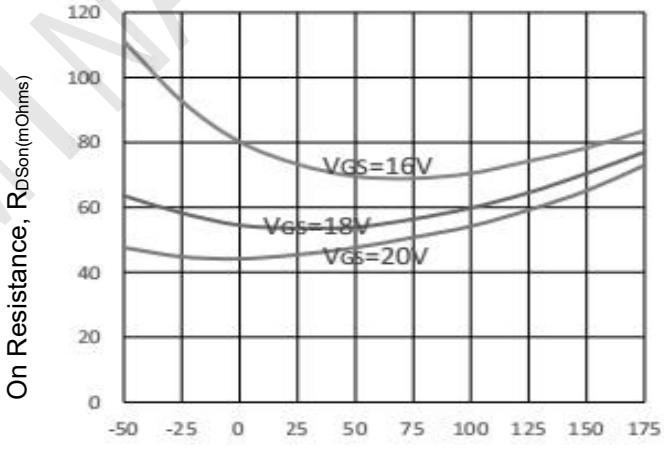


Fig5. Transfer Characteristic

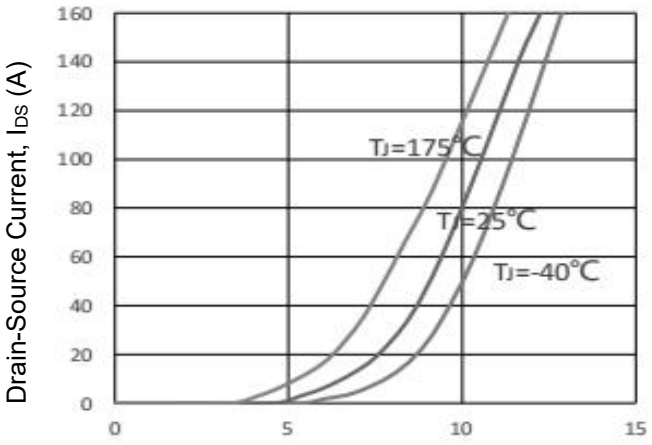


Fig6. Body Diode Characteristic at 25 ºC

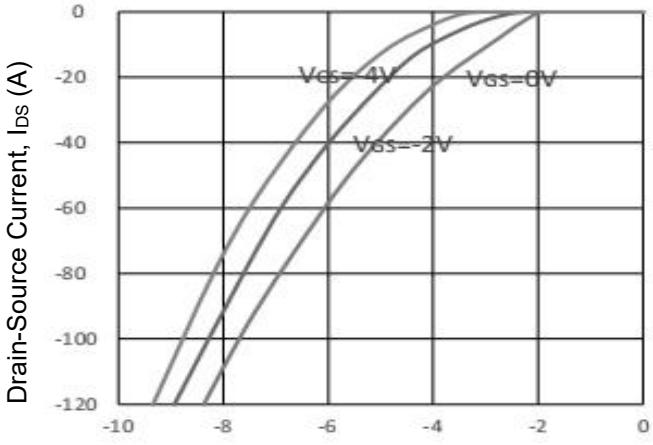


Fig7.Threshold Voltage vs. Temperature

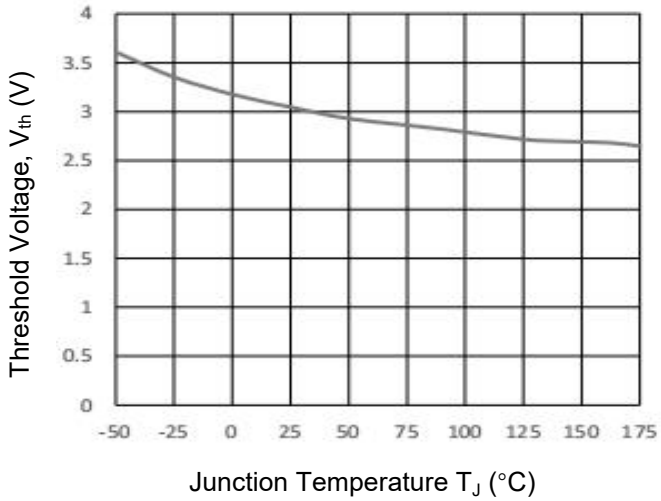


Fig8. Gate Charge Characteristics

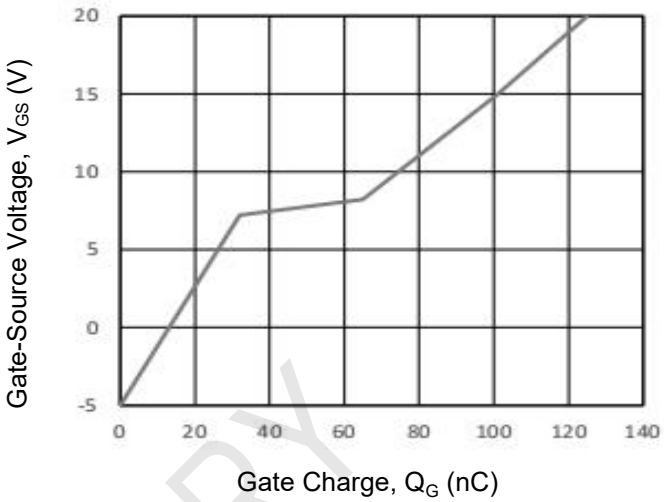


Fig9. 3rd Quadrant Characteristic at 25 ºC

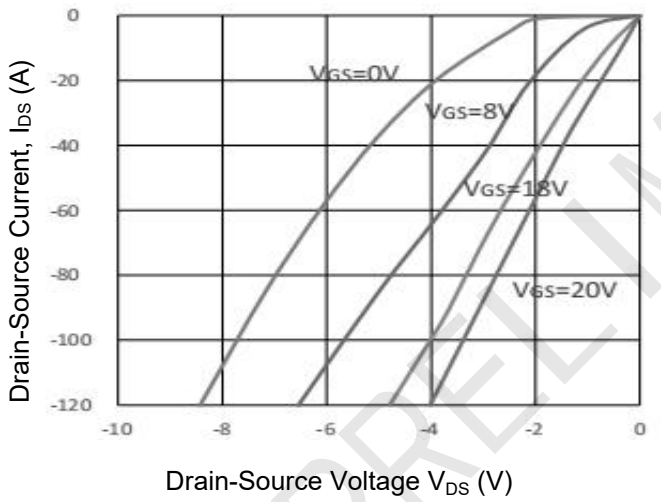


Fig10. Output Capacitor Stored Energy

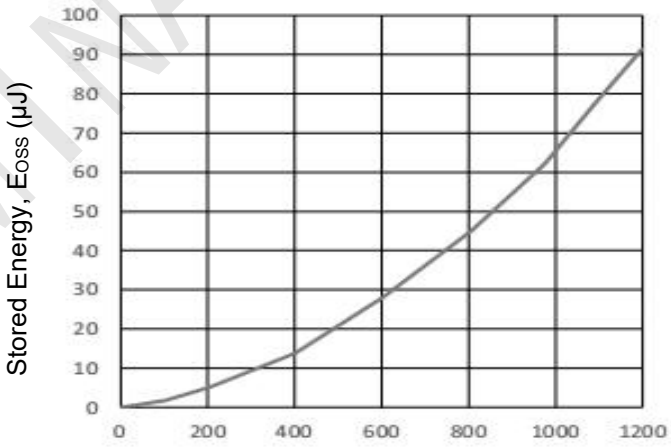


Fig11. Capacitances vs. Drain-Source

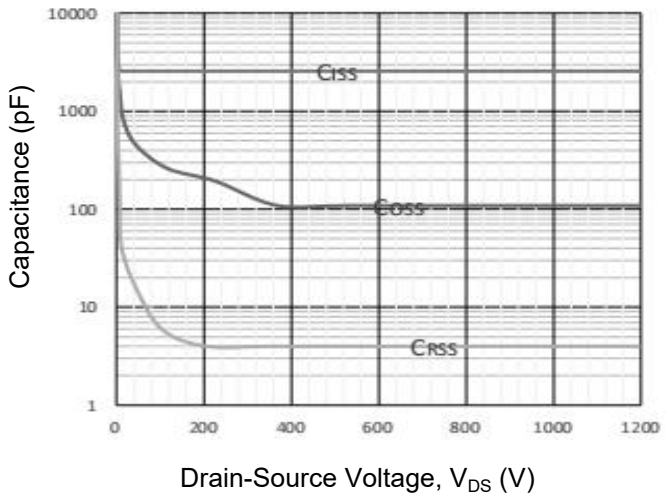


Fig12. Max Power Dissipation Derating Vs T_C

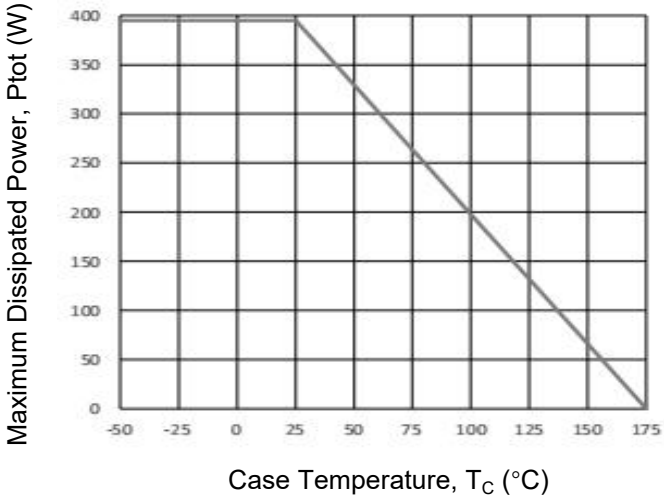


Fig13. Switching Energy vs. Drain Current

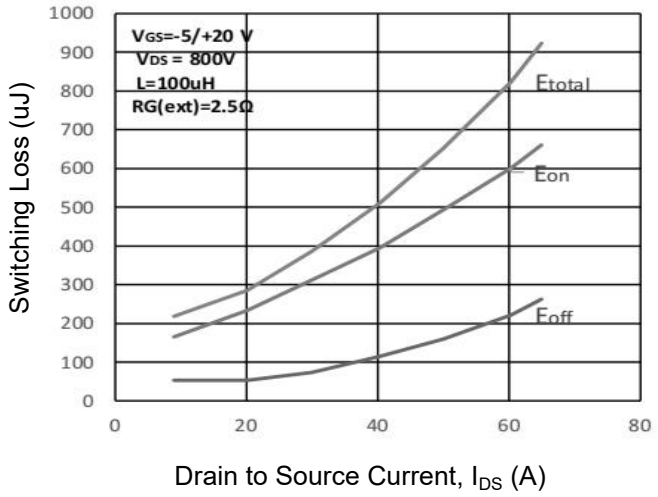


Fig14. Switching Energy vs. RG(ext)

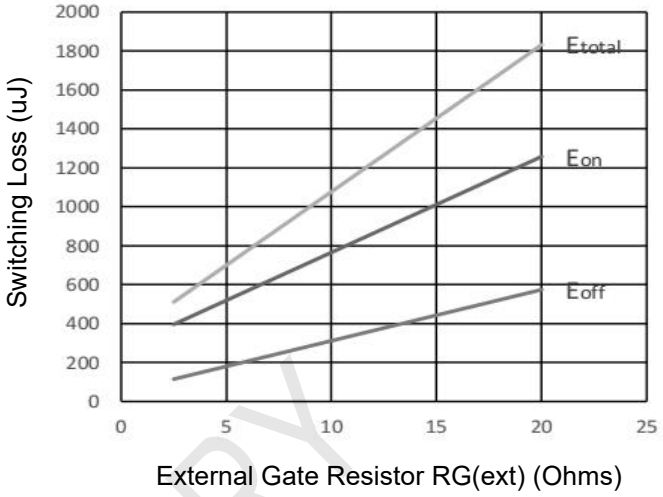


Fig15. Switching Energy vs. Temperature

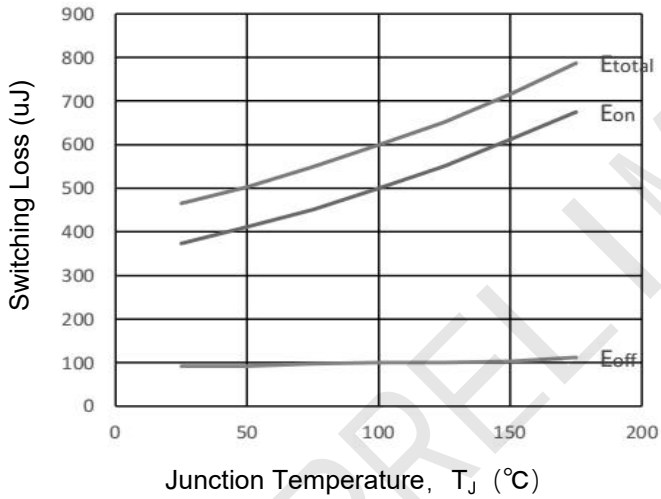


Fig16. Switching Times vs. RG(ext)

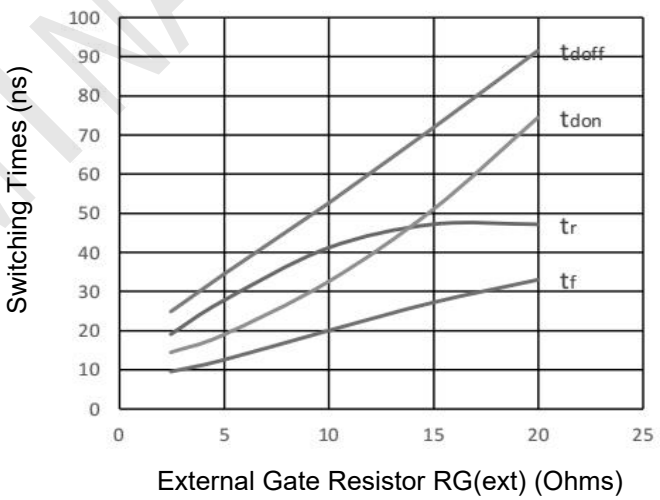


Fig17.Transient Thermal Impedance

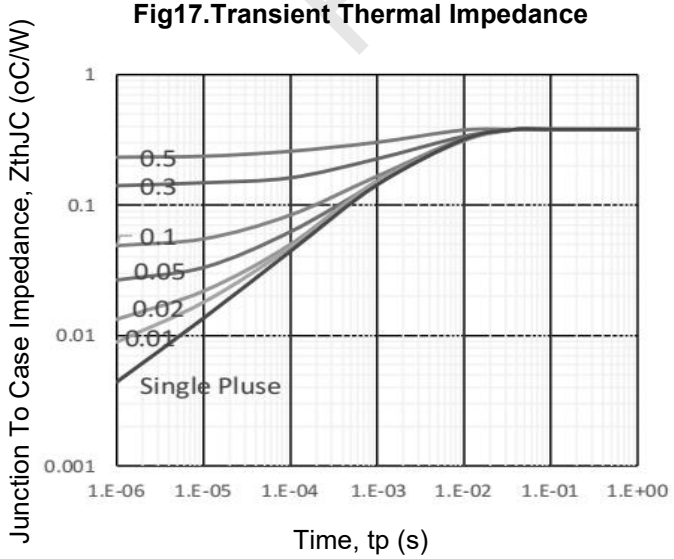
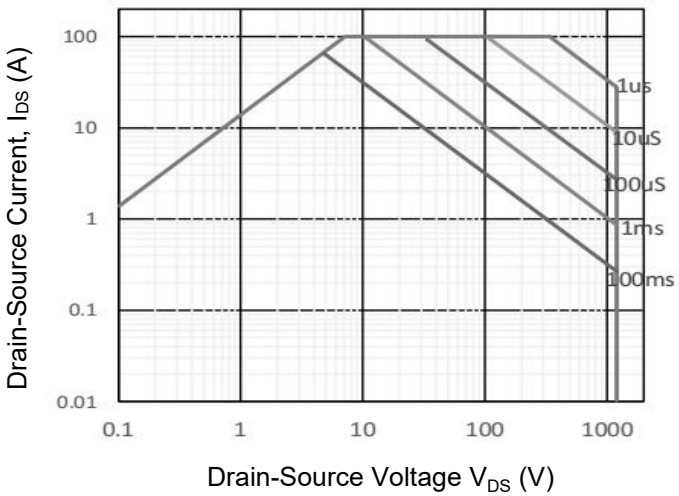
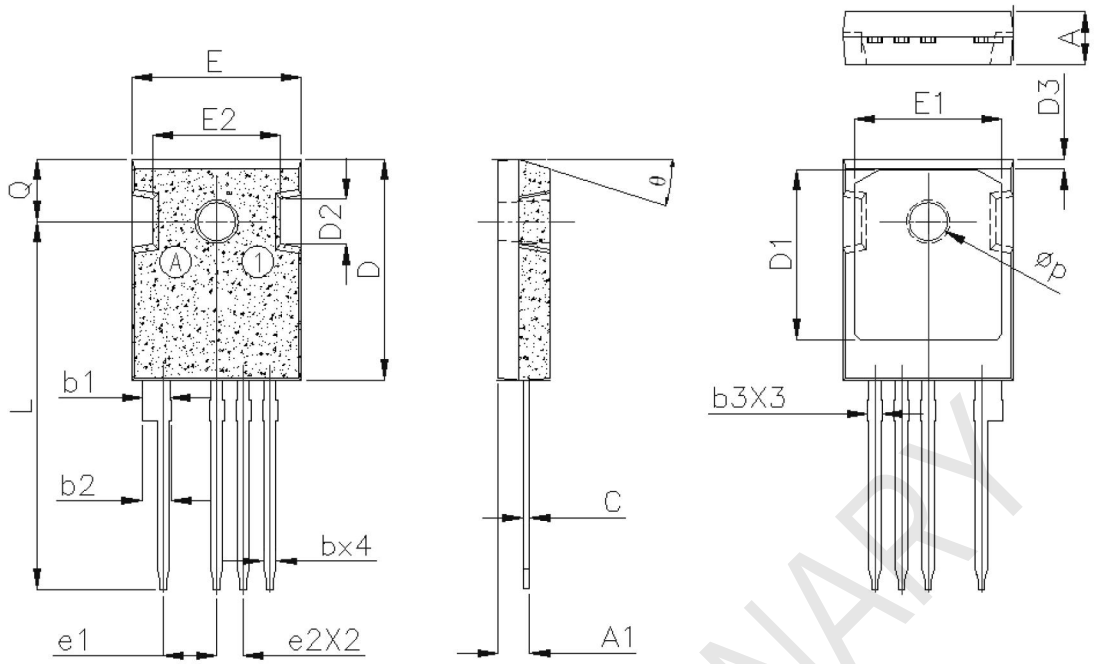


Fig18. Safe Operating Area



TO-247-4 Package Information



Dimensions (UNIT: mm)

SYMBDLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	TYPE	MAX	MIN	TYPE	MAX
A	4.80	5.00	5.20	0.189	0.197	0.205
A1	2.85	3.00	3.15	0.112	0.118	0.124
b	1.15	1.20	1.25	0.045	0.047	0.049
b1	2.40	2.50	2.60	0.094	0.098	0.102
b2	2.61	2.76	2.91	0.103	0.109	0.115
b3	1.30	1.42	1.57	0.051	0.056	0.062
C	0.55	0.60	0.65	0.022	0.024	0.026
D	20.80	21.00	21.20	0.819	0.827	0.835
D1	15.94	16.24	16.54	0.628	0.639	0.651
D2		4.3TYPE			0.169TYPE	
e1	4.93	5.08	5.23	0.194	0.200	0.206
e2	2.39	2.54	2.69	0.094	0.100	0.106
E	15.95	16.15	16.35	0.628	0.636	0.644
E1	13.82	14.02	14.26	0.544	0.552	0.561
E2	12.00	12.20	12.40	0.472	0.480	0.488
L	34.65	35.05	35.45	1.364	1.380	1.396
Q	5.85	5.95	6.05	0.230	0.234	0.238
øP	3.45	3.60	3.75	0.136	0.142	0.148
θ		17.5°			0.689°	