

1200V N-Channel Silicon Carbide Power MOSFET

■ Product Summary

- V_{DS} 1200V
- I_D 57A
- $R_{DS(ON)}$ (at $V_{GS} = 18V$) $< 46m\Omega$ (Typ: $35m\Omega$)
- $R_{DS(ON)}$ (at $V_{GS} = 15V$) $< 52m\Omega$ (Typ: $40m\Omega$)

■ Naming Convention

M	G	X	4	0	N	1	2	0	N
Megain									
		W: TO-247-3 X: TO-247-4 I: TO-263-7							
		ROSON Typ. @ $V_{GS}=15V$							
		N: N P: P							
						120: 1200V			
									L: $V_{th}(1\sim2.5V)$ N: $V_{th}(2\sim4V)$

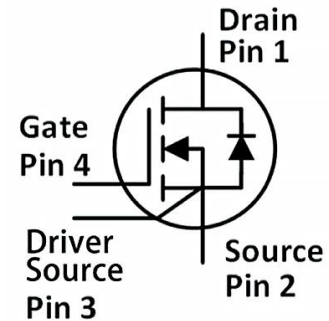
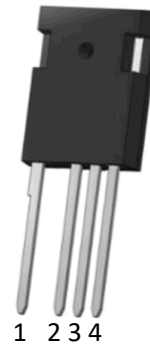
■ Features

- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- High-speed switching with low capacitances
- Fast and robust intrinsic body diode
- Easy to parallel

■ Applications

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

■ Package & Pin Configuration



■ Ordering Information

Order code	Package	Form	Quantity (PCS)	Marking
MGX40N120N	TO-247-4	Tube	30 / Tube	MGX40N120N

■ Absolute Maximum Ratings

$T_C=25^\circ C$ Unless Otherwise Noted.

Symbol	Parameter	Test Conditions	Value	Units
V_{DS}	Drain-Source Voltage	$V_{GS} = 0V, I_D = 100\mu A$	1200	V
$I_D^{(1)}$	Drain Current – Continuous	$V_{GS} = 18V, T_C = 25^\circ C$	57	A
$I_{DM}^{(2)}$	Drain Current – Pulsed		190	A
$P_D^{(1)}$	Total Power Dissipation	$T_C = 25^\circ C$	255	W
V_{GS}	Recommend Gate Source Voltage		-5/+18	V
	Maximum Gate Source Voltage		-10/+25	V
T_{STG}	Storage Temperature Range		-55 to 175	$^\circ C$
T_J	Operating Junction Temperature Range		-55 to 175	$^\circ C$
T_L	Soldering Temperature		260	$^\circ C$

(1) I_D and P_D are limited by package.

(2) Pulse width is limited by safe operating area.

■ Thermal Characteristics

Symbol	Parameter	Max	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance Junction to Case	-	0.41	-	$^{\circ}\text{C}/\text{W}$

■ Electrical Characteristics

$T_J = 25^{\circ}\text{C}$ Unless Otherwise Noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Static						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 100μA	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} = 18V	-	1	100	nA
V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 10mA	1.6	-	3.6	V
R _{DS(ON)}	Drain-Source On-state Resistance	V _{GS} = 18V, I _D = 40A	-	35	46	mΩ
		V _{GS} = 15V, I _D = 40A	-	40	52	mΩ
Dynamic						
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = 800V, f = 1MHz, V _{AC} = 25mV	-	1456	-	pF
C _{oss}	Output Capacitance		-	96	-	
C _{rss}	Reverse Transfer Capacitance		-	9	-	
E _{oss}	Coss Stored Energy				36	
Q _g	Total Gate Charge	V _{DS} = 800V, V _{GS} = -5/+18V, I _D = 40A	-	115	-	nC
Q _{gs}	Gate-Source Charge		-	15	-	
Q _{gd}	Gate-Drain Charge		-	57	-	
R _{G(int)}	Internal Gate Resistance	f = 1MHz, V _{AC} = 25mV	-	1.8	-	Ω
t _{d(ON)}	Turn-on Delay Time	V _{DS} = 800V, V _{GS} = -5/+18V, R _G = 2.5Ω, I _D = 40A	-	13	-	nS
t _r	Turn-on Rise Time		-	19	-	
t _{d(OFF)}	Turn-off Delay Time		-	39	-	
t _f	Turn-off Fall Time		-	7	-	
E _{ON}	Turn-on Switching Energy	V _{DS} = 800V, V _{GS} = -5/+18V, R _G = 2.5Ω, I _D = 40A	-	222	-	μJ
E _{OFF}	Turn-off Switching Energy		-	126	-	μJ
Body Diode Characteristics						
I _S	Continuous Source Current		-	-	57	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0V, I _S = 20A	-	3.8	-	V
t _{rr}	Reverse Recovery Time	I _S = 20A, V _{DS} = 800V V _{GS} = -5V di/dt = 2000A/μs	-	22	-	nS
Q _{rr}	Reverse Recovery Charge		-	335	-	nC
I _{rrm}	Peak Reverse Recovery Current		-	25	-	A

■ Typical Characteristics

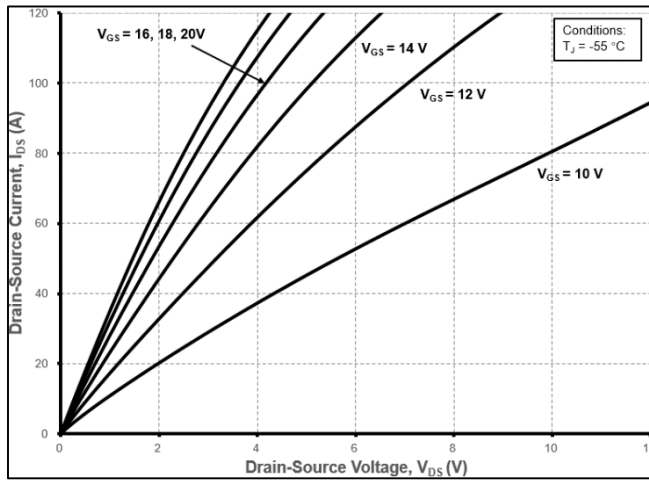


Fig 1. Typical Output Characteristics at $T_J = -55\text{ }^{\circ}\text{C}$

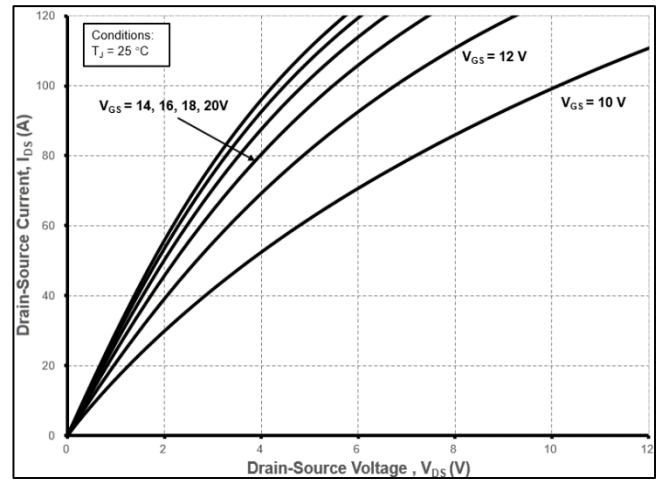


Fig 2. Typical Output Characteristics at $T_J = 25\text{ }^{\circ}\text{C}$

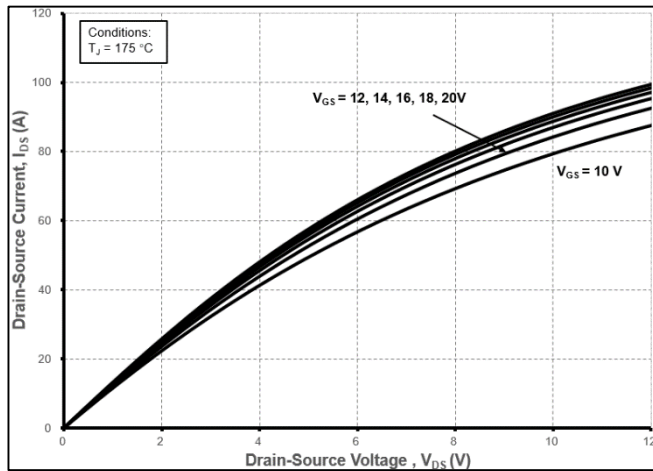


Fig 3. Typical Output Characteristics at $T_J = 175\text{ }^{\circ}\text{C}$

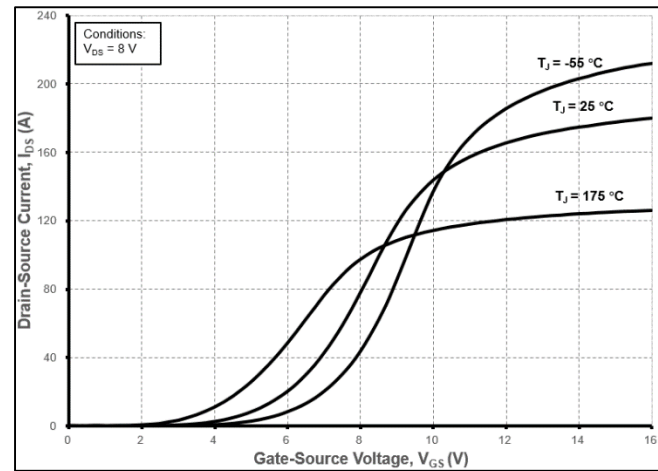


Fig 4. Typical Transfer Characteristics for Various Temperatures

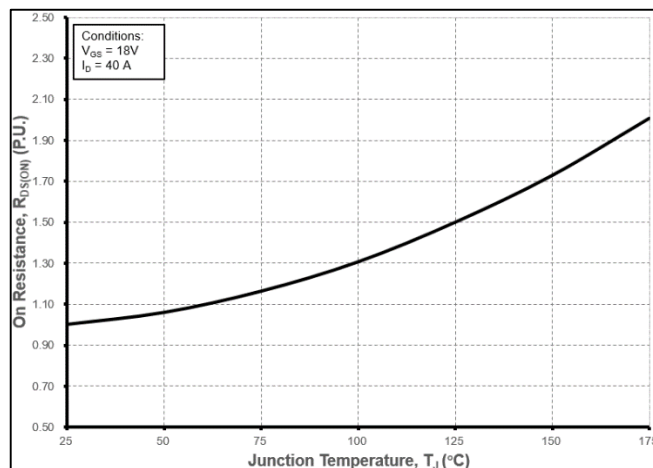


Fig 5. Normalized On-Resistance vs. Temperature

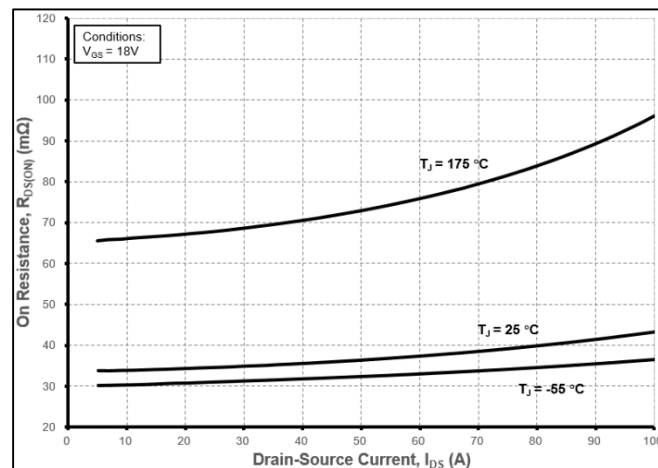


Fig 6. On-Resistance vs. Drain Current for Various Temperatures

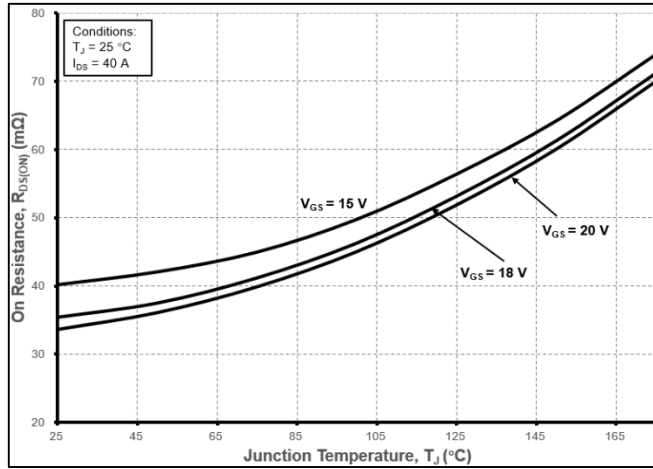


Fig 7. On-Resistance vs. Temperature for Various Gate Voltage

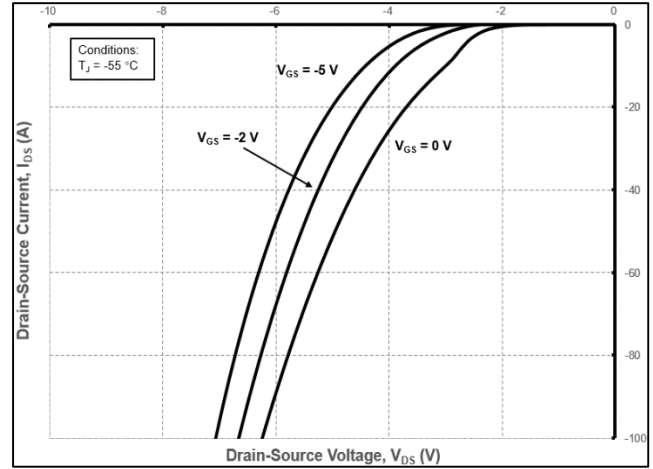


Fig 8. Typical Body Diode Characteristics at $T_J = -55^\circ\text{C}$

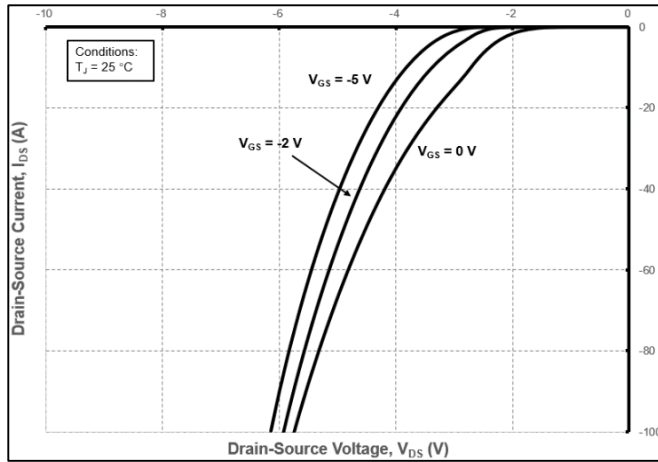


Fig 9. Typical Body Diode Characteristics at $T_J = 25^\circ\text{C}$

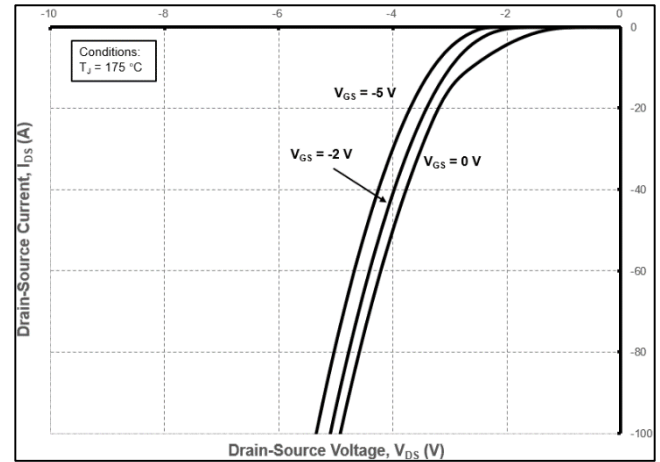


Fig 10. Typical Body Diode Characteristics at $T_J = 175^\circ\text{C}$

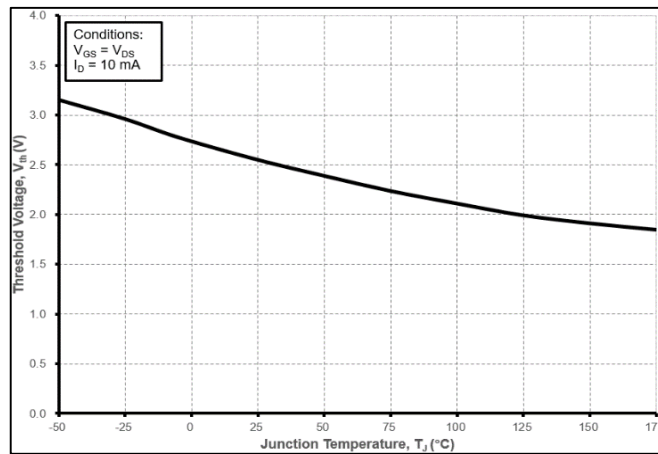


Fig 11. Typical Threshold Voltage vs. Temperature

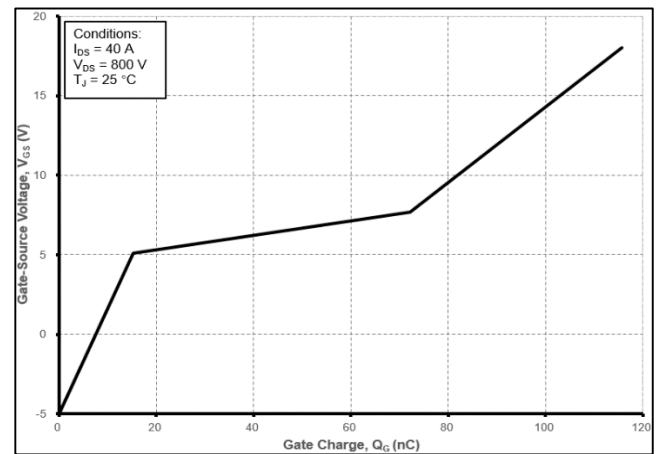


Fig 12. Gate Charge Characteristics

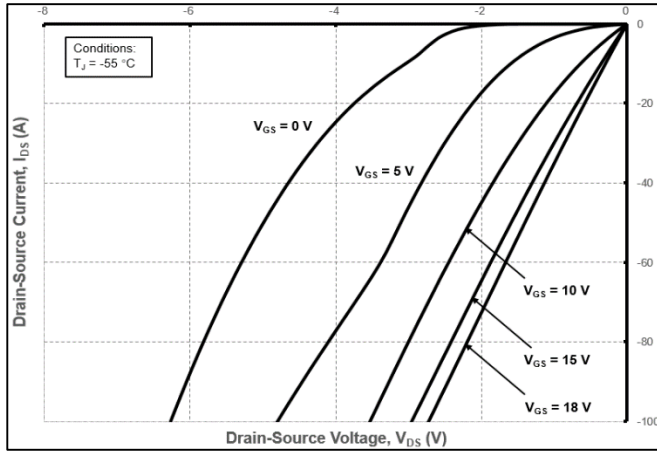


Fig 13. Typical 3rd Quadrant Characteristics at $T_J = -55\text{ }^{\circ}\text{C}$

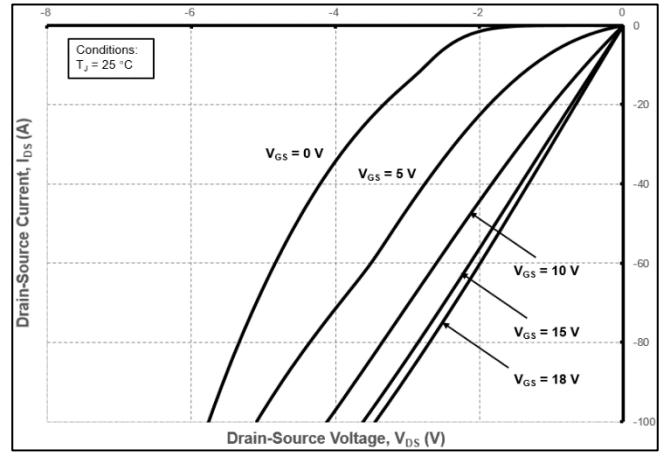


Fig 14. Typical 3rd Quadrant Characteristics at $T_J = 25\text{ }^{\circ}\text{C}$

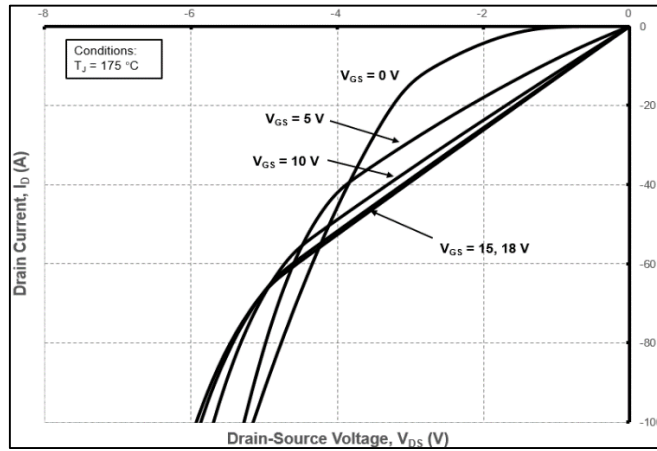


Fig 15. Typical 3rd Quadrant Characteristics at $T_J = 175\text{ }^{\circ}\text{C}$

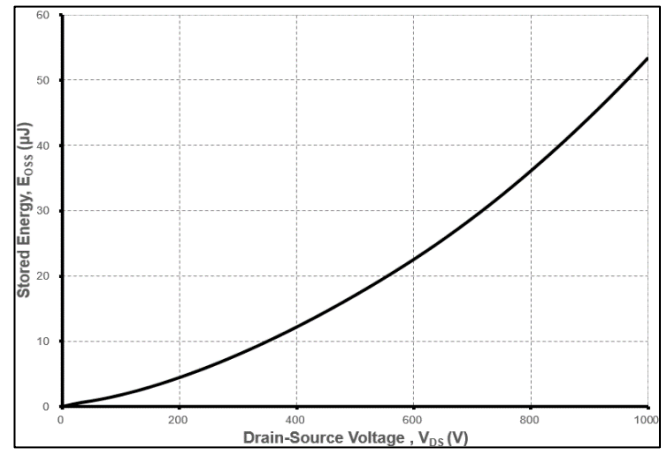


Fig 16. Output Capacitor Stored Energy

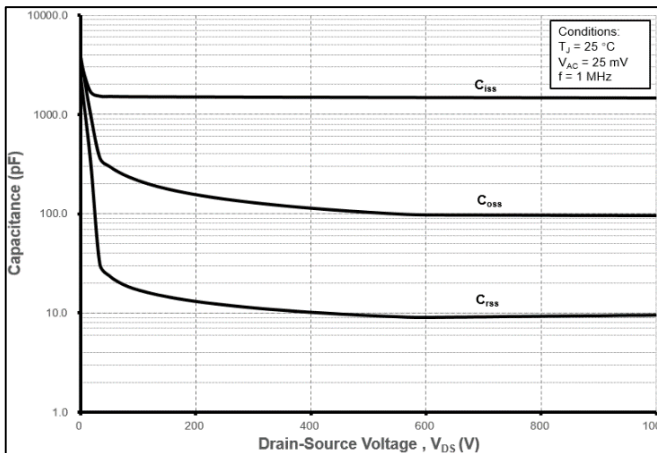


Fig 17. Capacitances vs. Drain-Source Voltage

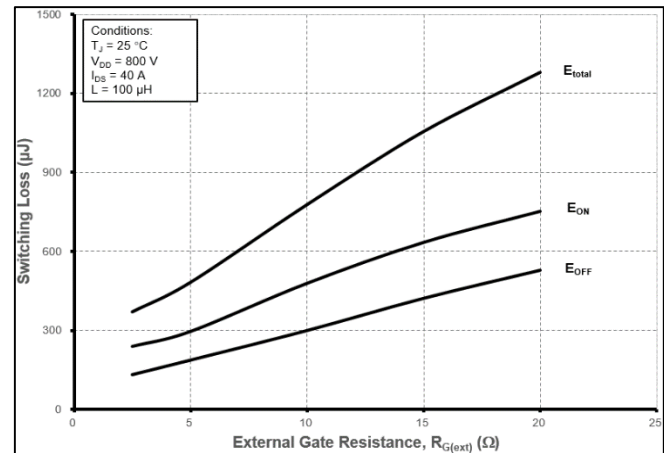


Fig 18. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

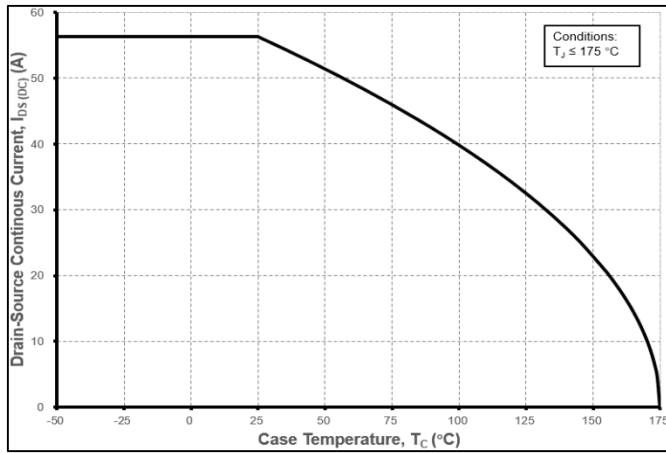


Fig 19. Continuous Drain Current Derating vs. Case Temperature

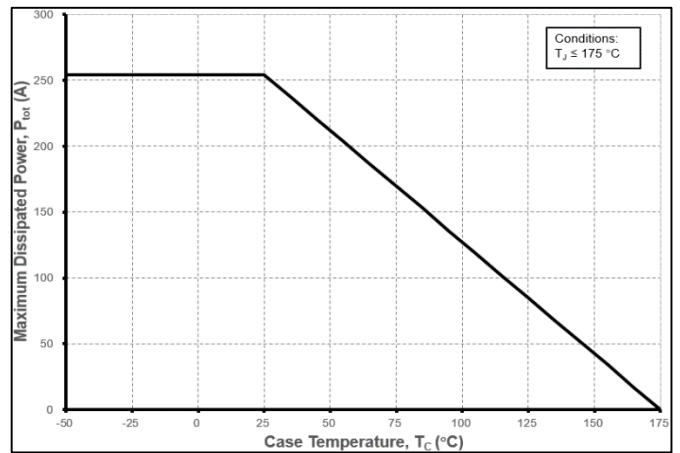


Fig 20. Maximum Power Dissipation Derating vs. Case Temperature

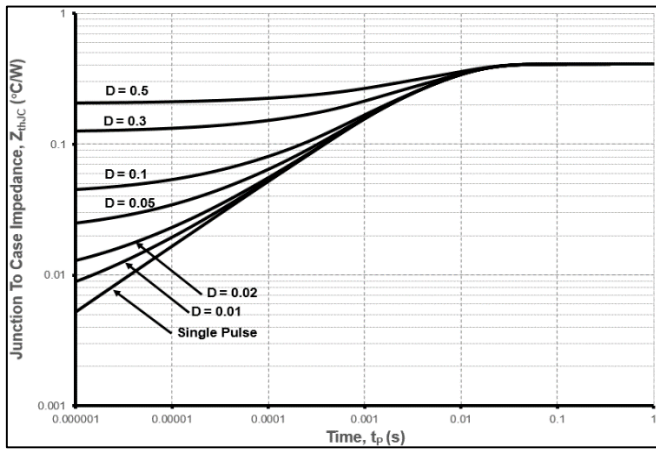


Fig 21. Transient Thermal Impedance (Junction – Case)

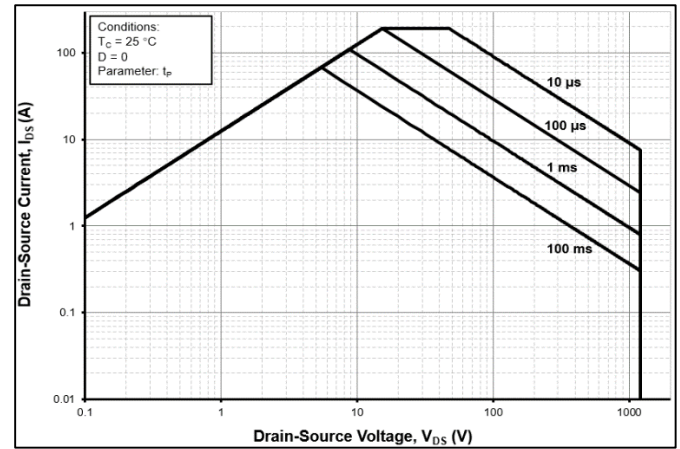
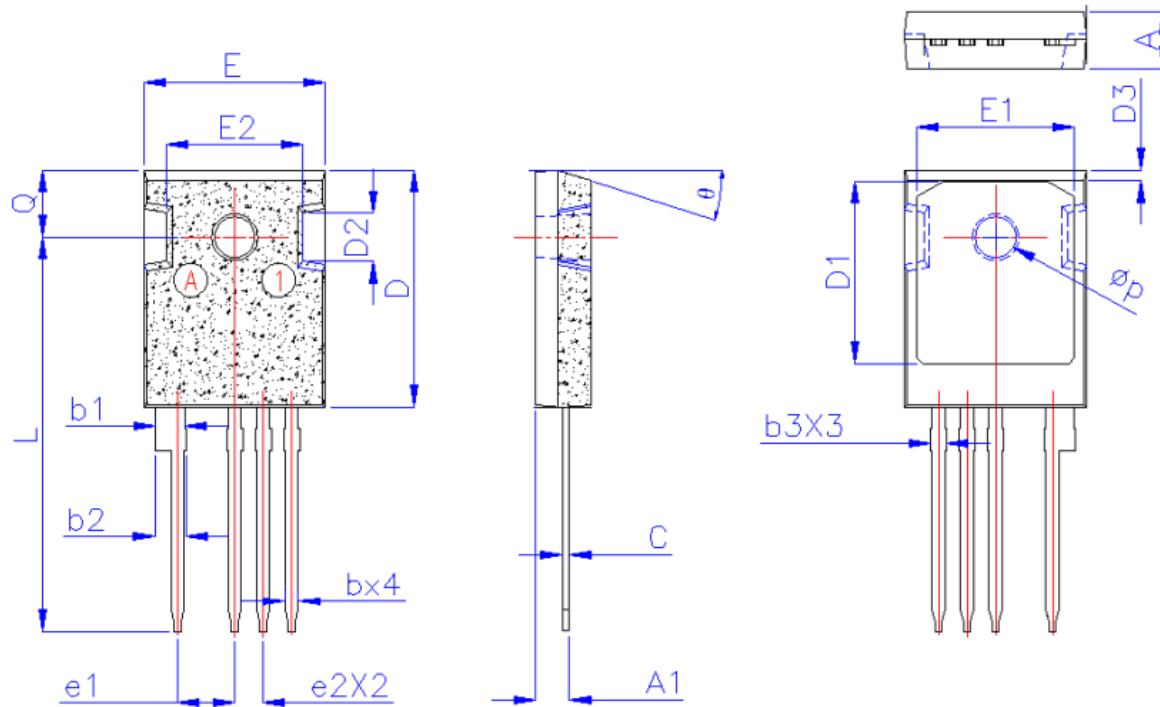


Fig 22. Safe Operating Area

■ Package size

Unit: mm。

TO-247-4:



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	4.3 TYPE			0.169 TYPE		
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°		