

1200V N-Channel Silicon Carbide Power MOSFET

■ Product Summary

- V_{DS} 1200V
- I_D 152A
- $R_{DS(ON)}$ (at $V_{GS} = 20V$) 12m Ω (Max: 15.6m Ω)
- $R_{DS(ON)}$ (at $V_{GS} = 18V$) 12.8m Ω (Max: 17m Ω)
- $R_{DS(ON)}$ (at $V_{GS} = 15V$) 14.5m Ω (Max: 19m Ω)

■ Naming Convention

M	G	X	1	5	N	1	2	0	N
Megain		W: TO-247-3 X: TO-247-4 I: TO-263-7	RO(SION) Typ. @V _{GS} =15V		N: N P: P	120: 1200V		L:V _{th} (1~2.5V) N:V _{th} (2~4V)	

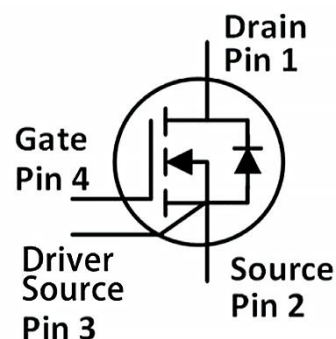
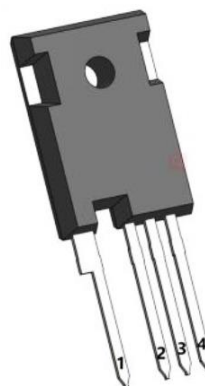
■ Features

- High speed switching
- Very low switching losses
- High blocking voltage with low on-resistance
- Temperature independent turn-off switching losses
- Halogen free, RoHS compliant

■ Applications

- PV string inverters
- Solar power optimizer
- Switch mode power supplies
- Online UPS/Industrial UPS
- High Voltage DC/DC Converters

■ Package & Pin Configuration



■ Ordering Information

Order code	Package	Form	Quantity (PCS)	Marking
MGX15N120N	TO-247-4	Tube	30 / Tube	MGX15N120N

■ Absolute Maximum Ratings

T_C=25°C Unless Otherwise Noted.

Symbol	Parameter	Test Conditions	Value	Units
V_{DS}	Drain-Source Voltage	$V_{GS} = 0\text{ V}$, $I_D = 100\mu\text{A}$	1200	V
$I_D^{(1)}$	Drain Current – Continuous	$V_{GS} = 18\text{ V}$, $T_C = 25\text{ }^\circ\text{C}$	152	A
$I_{DM}^{(2)}$	Drain Current – Pulsed		520	A
$P_D^{(1)}$	Total Power Dissipation	$T_C = 25\text{ }^\circ\text{C}$	684	W
V_{GS}	Recommend Gate Source Voltage		-5/+18	V
	Maximum Gate Source Voltage		-10/+25	
T_{STG}	Storage Temperature Range		-55 to 175	$^\circ\text{C}$
T_J	Operating Junction Temperature Range		-55 to 175	$^\circ\text{C}$
T_L	Soldering Temperature		260	$^\circ\text{C}$

(1) I_D and P_D are limited by package.

- (1) I_B and I_E 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	-	0.22	-	$^{\circ}\text{C}/\text{W}$

■ 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 = 30mA	1.8	2.8	3.8	V
R _{DS(ON)}	Drain-Source On-state Resistance	V _{GS} = 18V, I _D = 60A	-	12.8	17	mΩ
		V _{GS} = 15V, I _D = 60A	-	14.5	19	
Dynamic						
C _{iss}	Input Capacitance	V _{GS} = 0V, V _{DS} = 800V, f = 1MHz, V _{AC} = 25mV	-	3936	-	pF
C _{oss}	Output Capacitance		-	336	-	
C _{rss}	Reverse Transfer Capacitance		-	14	-	
E _{oss}	C _{oss} Stored Energy				82	
Q _g	Total Gate Charge	V _{DS} = 800V, V _{GS} = -5/+18V, I _D = 60A	-	280	-	nC
Q _{gs}	Gate-Source Charge		-	45	-	
Q _{gd}	Gate-Drain Charge		-	125	-	
R _{G(int)}	Internal Gate Resistance	f = 1MHz, V _{AC} = 25mV	-	2.5	-	Ω
t _{d(ON)}	Turn-on Delay Time	V _{DS} = 800V, V _{GS} = -5/+18V, R _G = 2.5Ω, I _D = 60A	-	28	-	nS
t _r	Turn-on Rise Time		-	35	-	
t _{d(OFF)}	Turn-off Delay Time		-	72	-	
t _f	Turn-off Fall Time		-	16	-	
E _{ON}	Turn-on Switching Energy	V _{DS} = 800V, V _{GS} = -5/+18V, R _G = 2.5Ω, I _D = 60A	-	666	-	μJ
E _{OFF}	Turn-off Switching Energy		-	487	-	μJ
Body Diode Characteristics						
I _S	Continuous Source Current		-	-	152	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0V, I _S = 60A	-	3.8	-	V
t _{rr}	Reverse Recovery Time	I _S = 60A, V _{DS} = 800V V _{GS} = -5V di/dt = 1000A/μs	-	56	-	nS
Q _{rr}	Reverse Recovery Charge		-	898	-	nC
I _{rrm}	Peak Reverse Recovery Current		-	28	-	A

■ Typical Characteristics

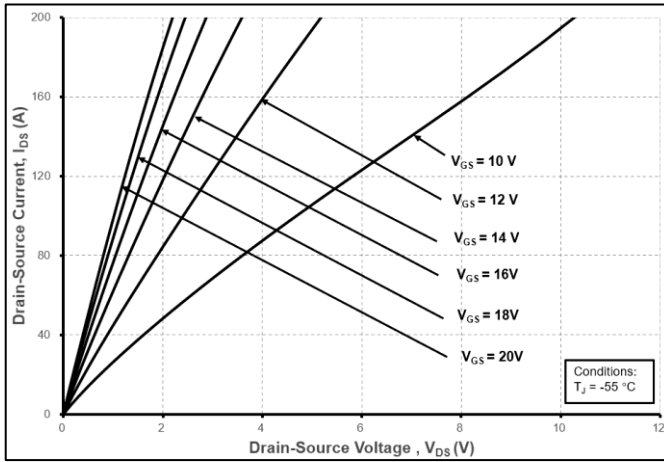


Fig 1. Typical Output Characteristics at $T_J = -55^\circ\text{C}$

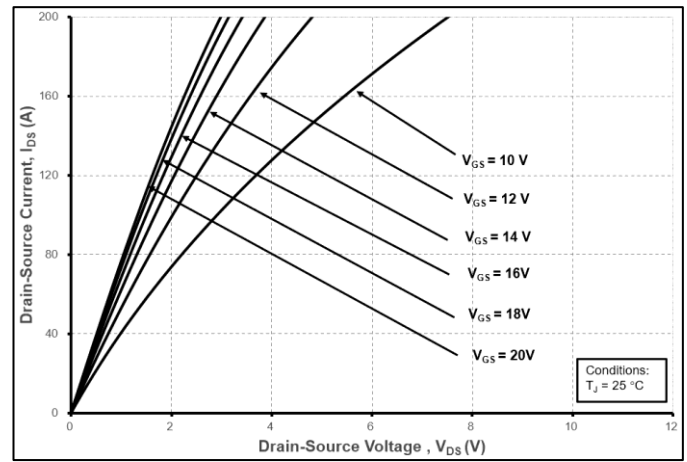


Fig 2. Typical Output Characteristics at $T_J = 25^\circ\text{C}$

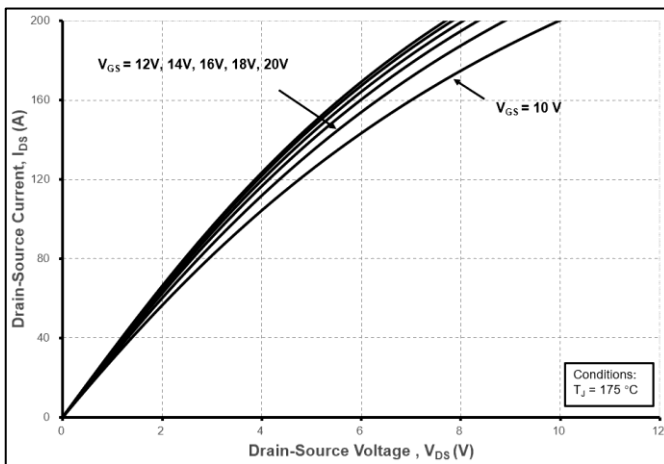


Fig 3. Typical Output Characteristics at $T_J = 175^\circ\text{C}$

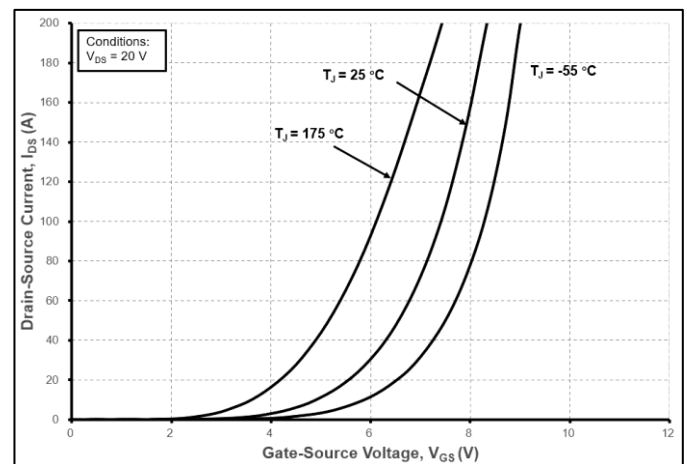


Fig 4. Typical Transfer Characteristics for Various Temperatures

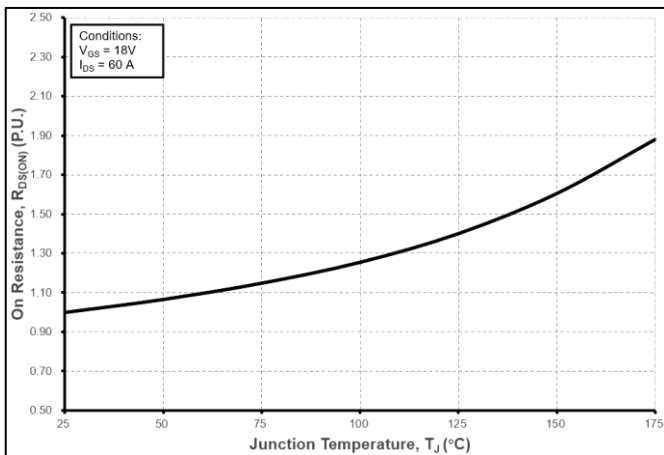


Fig 5. Normalized On-Resistance vs. Temperature

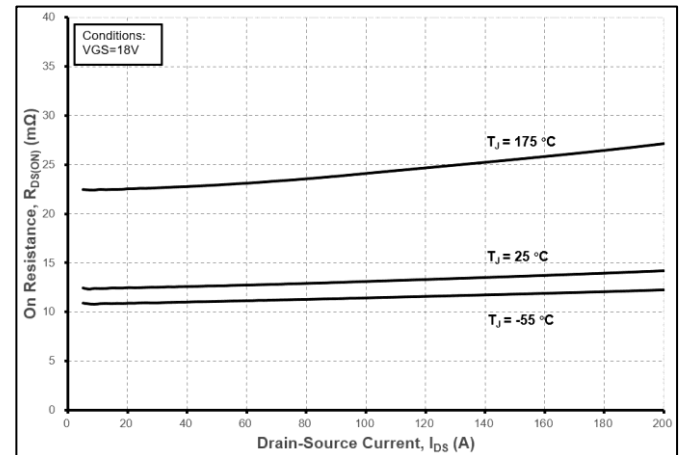


Fig 6. On-Resistance vs. Drain Current for Various Temperatures

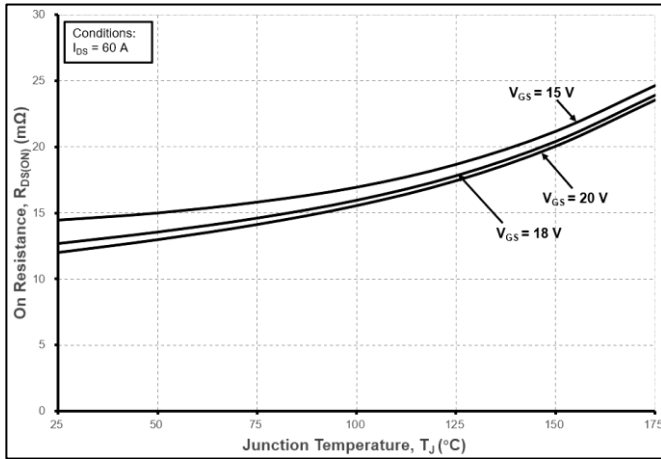


Fig 7. On-Resistance vs. Temperature for Various Gate Voltage

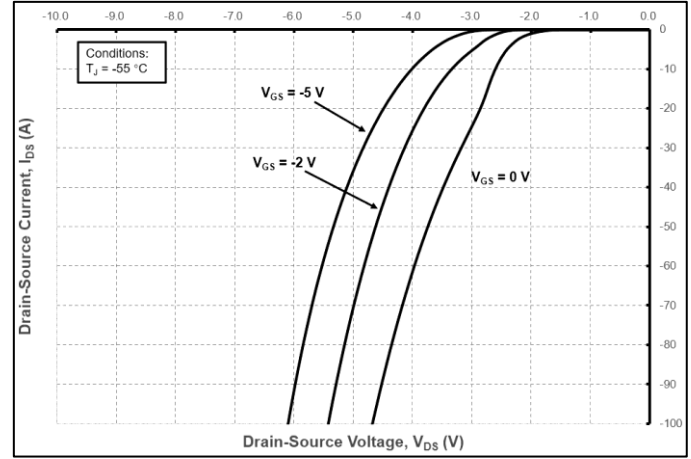


Fig 8. Typical Body Diode Characteristics at $T_J = -55^{\circ}\text{C}$

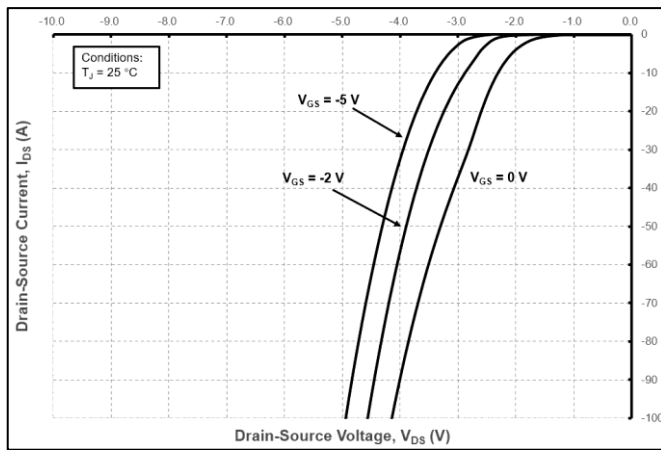


Fig 9. Typical Body Diode Characteristics at $T_J = 25^{\circ}\text{C}$

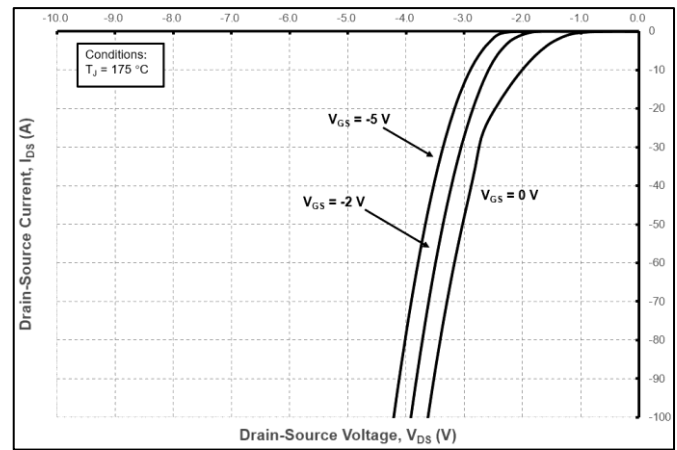


Fig 10. Typical Body Diode Characteristics at $T_J = 175^{\circ}\text{C}$

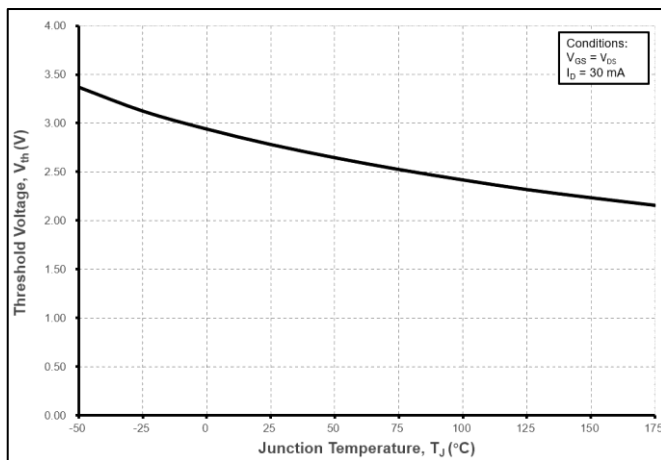


Fig 11. Typical Threshold Voltage vs. Temperature

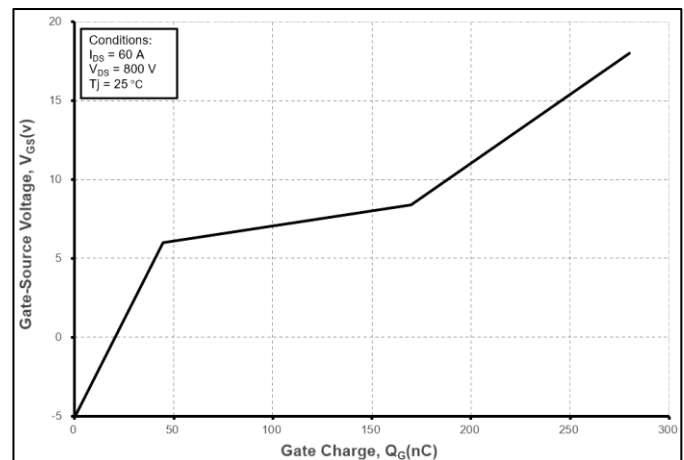


Fig 12. Gate Charge Characteristics

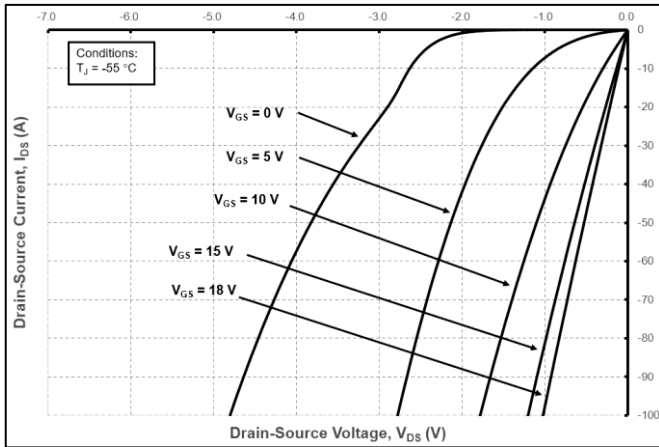


Fig 13. Typical 3rd Quadrant Characteristics at $T_J = -55^\circ\text{C}$

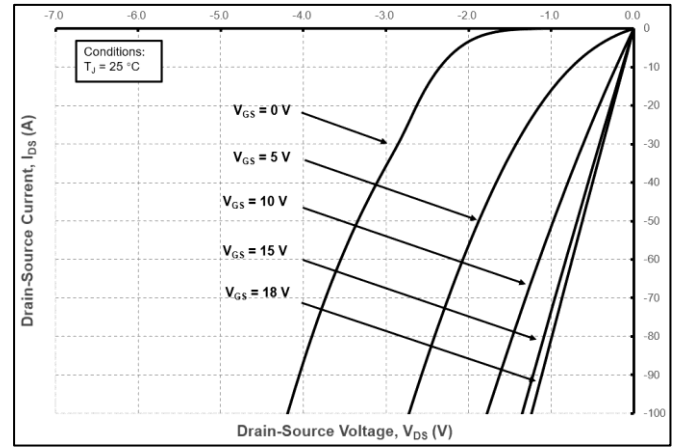


Fig 14. Typical 3rd Quadrant Characteristics at $T_J = 25^\circ\text{C}$

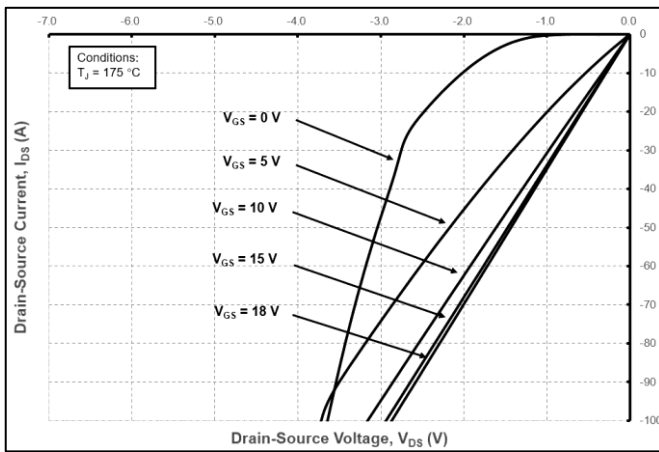


Fig 15. Typical 3rd Quadrant Characteristics at $T_J = 175^\circ\text{C}$

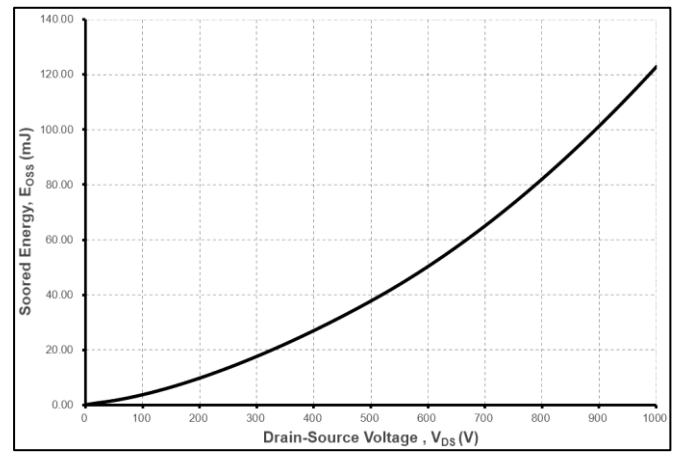


Fig 16. Output Capacitor Stored Energy

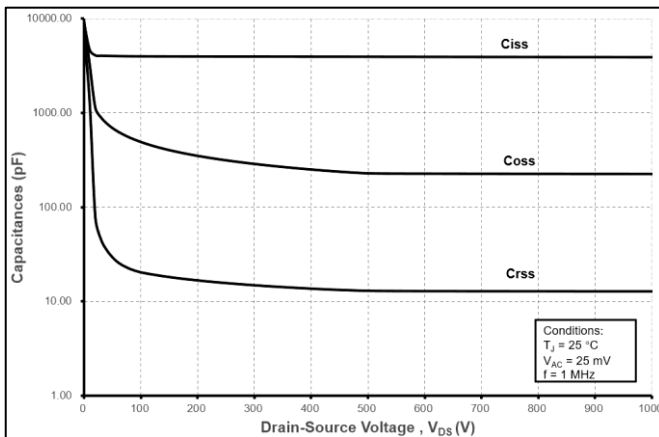


Fig 17. Capacitances vs. Drain-Source Voltage

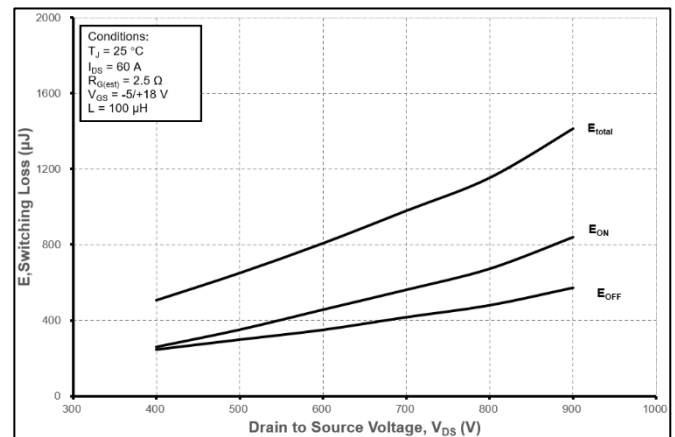


Fig 18. Clamped Inductive Switching Energy vs. V_{DS}

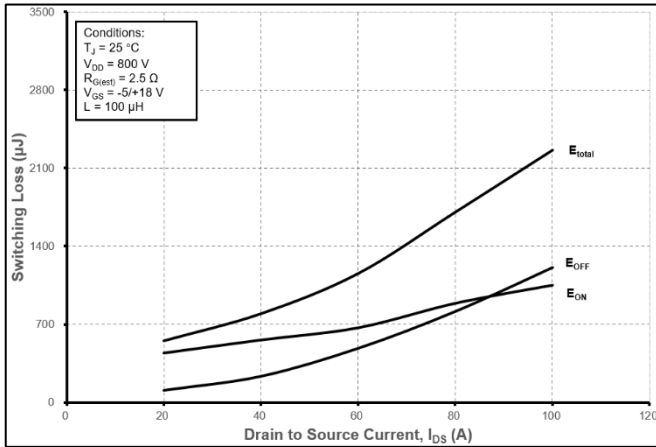


Fig 19. Clamped Inductive Switching Energy vs. I_{DS}

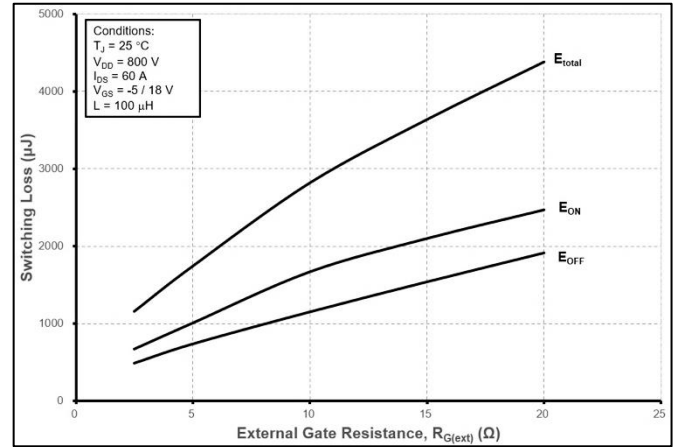


Fig 20. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

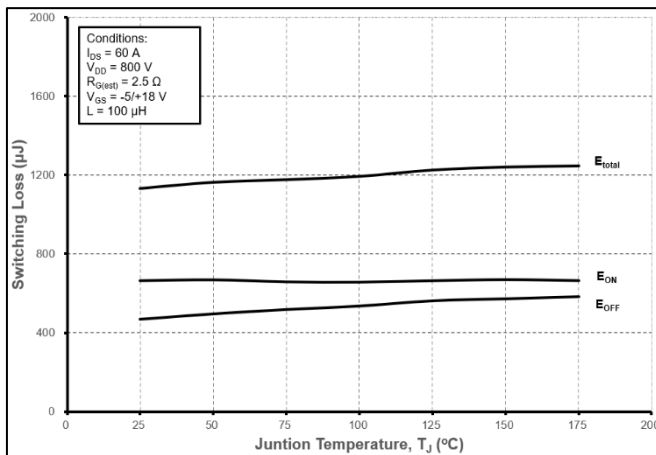


Fig 21. Clamped Inductive Switching Energy vs. T_J

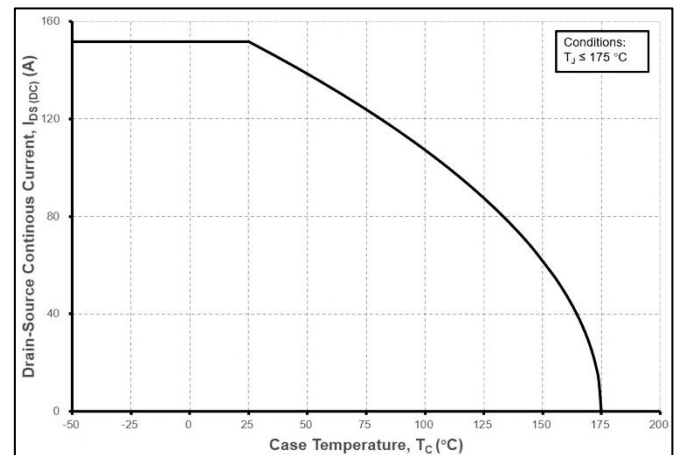


Fig 22. Continuous Drain Current Derating vs. Case Temperature

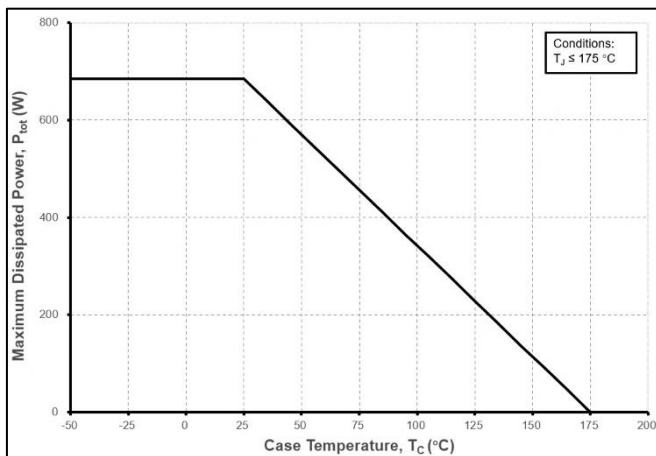


Fig 23. Maximum Power Dissipation Derating vs. Case Temperature

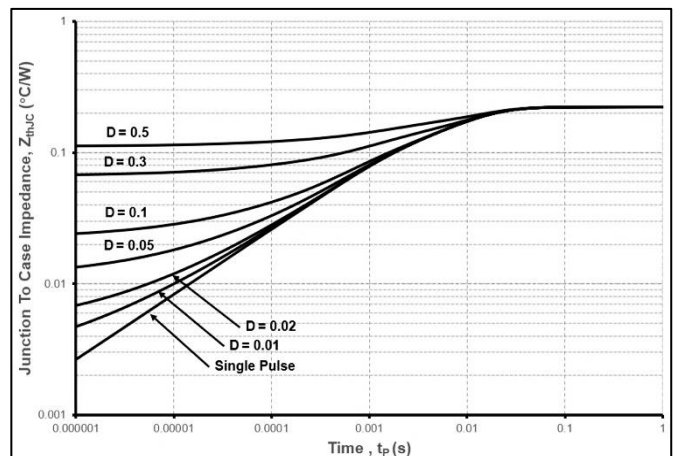


Fig 24. Transient Thermal Impedance (Junction – Case)

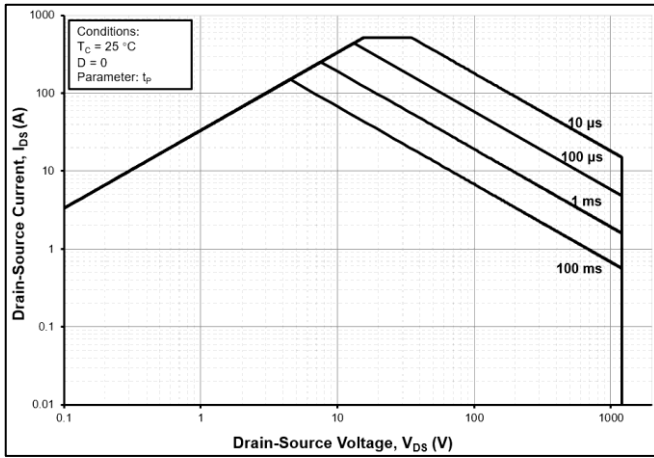
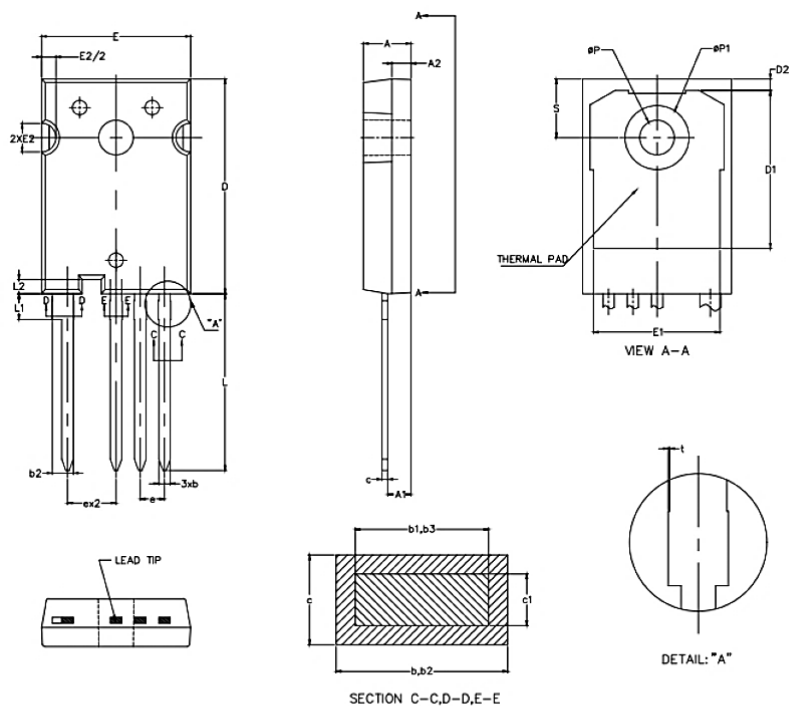


Fig 25. Safe Operating Area

■ Package size

Unit: mm.

TO-247-4:



SYMBOLS	DIMENSIONS			
	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.15	1.22	0.045	0.048
b2	2.16	2.26	0.085	0.089
b3	2.15	2.22	0.085	0.087
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	22.40	22.60	0.882	0.890
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.75	15.90	0.620	0.626
E1	13.26	—	0.552	—
E2	2.90	3.10	0.114	0.122
e	2.54BSC		0.1BSC	
L	18.30	18.60	0.720	0.732
L1	—	2.80	—	0.110
L2	—	1.50	—	0.059
ØP	3.50	3.70	0.138	0.146
ØP1	—	7.40	—	0.291
S	6.05	6.25	0.238	0.246
t	0.00	0.15	0.000	0.006