

MOSFET - SiC Power, Single N-Channel

1200 V, 32 mΩ, 68 A



KXMW120R40T3

Features

- Typ. $R_{DS(on)} = 32 \text{ m}\Omega$
- Ultra Low Gate Charge ($Q_{G(tot)} = 97 \text{ nC}$)
- Capacitance ($C_{oss} = 154 \text{ pF}$)
- 100% UIL Tested

Typical Applications

- UPS
- DC/DC Converter
- Boost Inverter

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	1200	V
Gate-to-Source Voltage			V_{GS}	-7/23	V
Recommended turn on Gate-to-Source Voltage		$T_C < 175^{\circ}C$	$V_{GS, on}$	15-18	V
Recommended turn off Gate-to-Source Voltage			$V_{GS, off}$	0	V
Continuous Drain Current $R_{\theta JC}$	Steady State	$T_C = 25^{\circ}C$	I_D	68	A
		$T_C = 100^{\circ}C$		54	A
Power Dissipation $R_{\theta JC}$	Steady State	$T_C = 25^{\circ}C$	P_D	519	W
		$T_C = 150^{\circ}C$		86	
Pulsed Drain Current (Note 2)	$T_A = 25^{\circ}C$ V_{ES}		I_{DM}	229	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	$^{\circ}C$
Source Current (Body Diode)			I_S	68	A

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

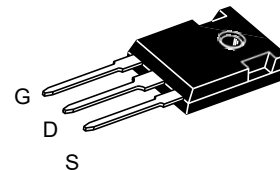
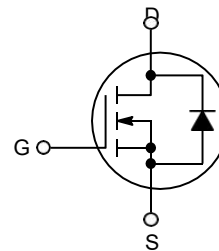
THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Max	Unit
Junction-to-Case (Note 1)	$R_{\theta JC}$	0.29	0.63	$^\circ\text{C/W}$
Junction-to-Ambient (Note 1)	$R_{\theta JA}$	32.36	-	$^\circ\text{C/W}$

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Repetitive rating, limited by max junction temperature.

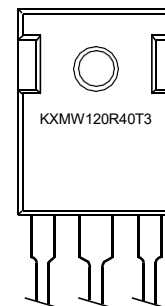
$V_{(BR)DS}$	$R_{DS(on)}$ MAX	I_D MAX
1200 V	32mΩ	68 A

N-CHANNEL MOSFET



TO-247-3L
CASE 340CX

MARKING DIAGRAM



Publication Order Number:
KXMW120R40T3

Static Electrical Characteristics

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$		1200	1360	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_J = 25\text{ }^\circ\text{C}$		1.24	100	μA
		$V_{GS} = 0\text{ V}, V_{DS} = 1200\text{ V}, T_J = 175\text{ }^\circ\text{C}$		9.6	100	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$	-0.3	-5	-100	nA
		$V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$	0.8	7	100	
Transconductance	g_{fs}	$V_{DS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 25\text{ }^\circ\text{C}$		11.34		S
		$V_{DS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 175\text{ }^\circ\text{C}$		11.32		
Drain-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 25\text{ }^\circ\text{C}$		32		m Ω
		$V_{GS} = 20\text{ V}, I_D = 20\text{ A}, T_J = 175\text{ }^\circ\text{C}$		51		
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS} = V_{DS}, I_D = 10\text{ mA}, T_J = 25\text{ }^\circ\text{C}$		2.4		V
		$V_{GS} = V_{DS}, I_D = 10\text{ mA}, T_J = 175\text{ }^\circ\text{C}$		1.5		

Dynamic Electrical Characteristics

Parameter	Symbol	Test Conditions	Typ	Unit
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, V_{DS} = 1000\text{ V},$ $f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	2062	pF
Output Capacitance	C_{OSS}		154	
Reverse Transfer Capacitance	C_{RSS}		3	
Coss Stored Energy	E_{OSS}		171	μJ
Turn-On Switching Loss	E_{ON}	$V_{GS} = -4/20\text{ V}, V_{DS} = 800\text{ V},$ $I_D = 20\text{ A}, R_G = 2\text{ }\Omega, \text{ Inductive Load}$ $T_J = 25\text{ }^\circ\text{C}$ $T_J = 175\text{ }^\circ\text{C}$	446	μJ
			416	
Turn-Off Switching Loss	E_{OFF}	$V_{GS} = -4/20\text{ V}, V_{DS} = 800\text{ V},$ $I_D = 20\text{ A}, R_G = 2\text{ }\Omega, \text{ Inductive Load}$ $T_J = 25\text{ }^\circ\text{C}$ $T_J = 175\text{ }^\circ\text{C}$	658	
			397	
Total Gate Charge	$Q_{G(tot)}$	$V_{GS} = -4/20\text{ V}, V_{DS} = 800\text{ V}, I_D = 20\text{ A}$	97	nC
Gate-Source Charge	Q_{GS}		24	
Gate-Drain Charge	Q_{GD}		37	
Internal Gate Resistance	R_G	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	1.8	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{GS} = -4/20\text{ V}, V_{DS} = 800\text{ V},$ $I_D = 20\text{ A}, R_G = 2\text{ }\Omega, T_J = 175\text{ }^\circ\text{C}$ Inductive Load	10	ns
Rise Time	t_r		8	
Turn-Off Delay Time	$t_{d(off)}$		24	
Fall Time	t_f		26	

Reverse Diode Characteristic

Parameter	Symbol	Test Conditions	Typ	Unit
Continuous Drain-to-Source Diode Forward Current	I_{SD}	$V_{GS} = 0\text{ V}, T_J = 25\text{ }^{\circ}\text{C}$	68	A
Forward Diode Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_{SD} = 20\text{ A}, T_J = -55\text{ }^{\circ}\text{C}$	3.6	V
		$V_{GS} = 0\text{ V}, I_{SD} = 20\text{ A}, T_J = 25\text{ }^{\circ}\text{C}$	3.3	
		$V_{GS} = 0\text{ V}, I_{SD} = 20\text{ A}, T_J = 175\text{ }^{\circ}\text{C}$	3.2	
Pulsed Drain-to-Source Diode Forward Current (Note 2)	I_{SDM}	$T_J = 25\text{ }^{\circ}\text{C}$	767	A
Reverse Recovery Time	t_{RR}	$V_{GS} = -4\text{ V}, I_{SD} = 20\text{ A}, V_{DS} = 800\text{ V},$ $di_S/dt = 1000\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$ Q_{fr} includes also Q_C	13.7	ns
Reverse Recovery Charge	Q_{RR}		89	nC
Peak Reverse Recovery Current	I_{RRM}		16	A
Reverse Recovery Energy	E_{RR}		88	

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

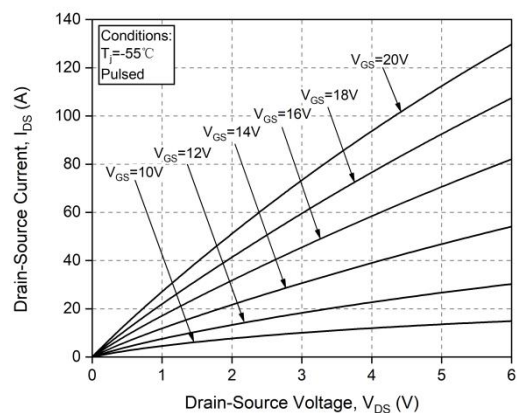


Figure 1. Output characteristics, $T_J = -55^\circ\text{C}$

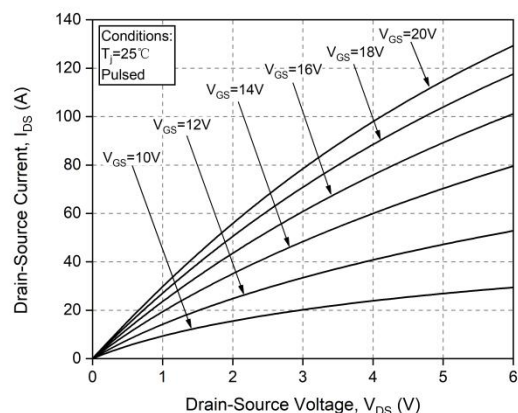


Figure 2. Output characteristics, $T_J = 25^\circ\text{C}$

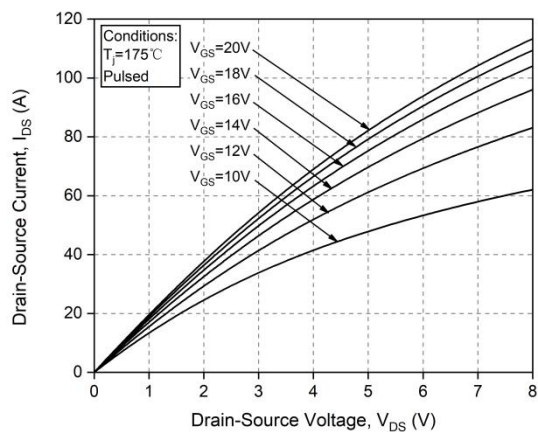


Figure 3. Output characteristics, $T_J = 175^\circ\text{C}$

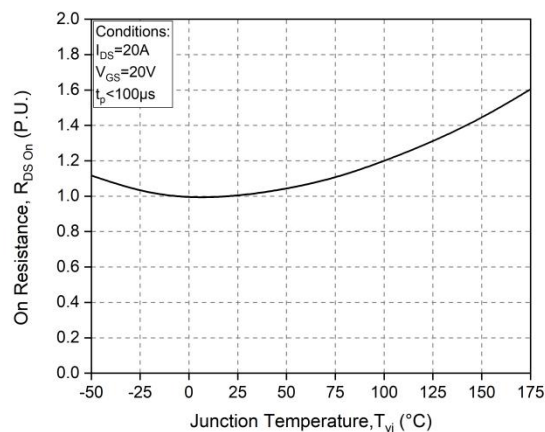


Figure 4. Normalized on-resistance vs. temperature

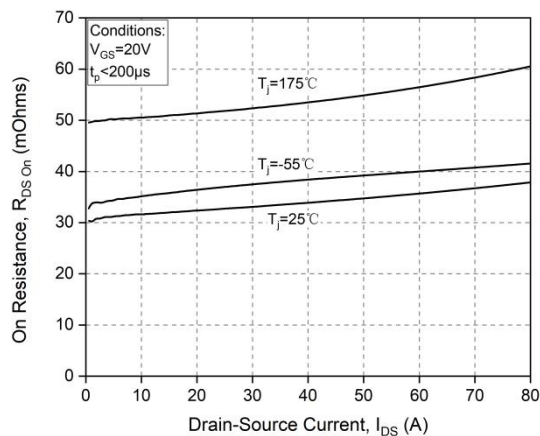


Figure 5. On-resistance vs. drain current

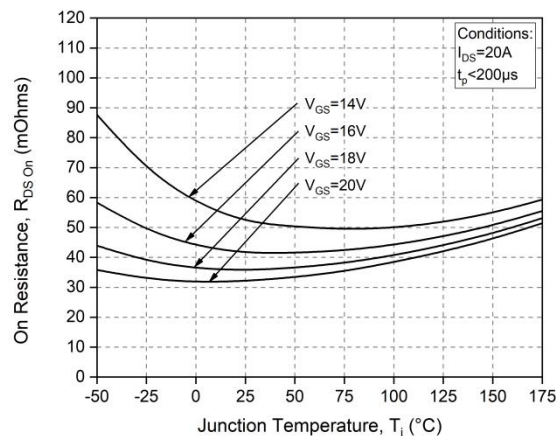


Figure 6. On-resistance vs. temperature for various gate voltage

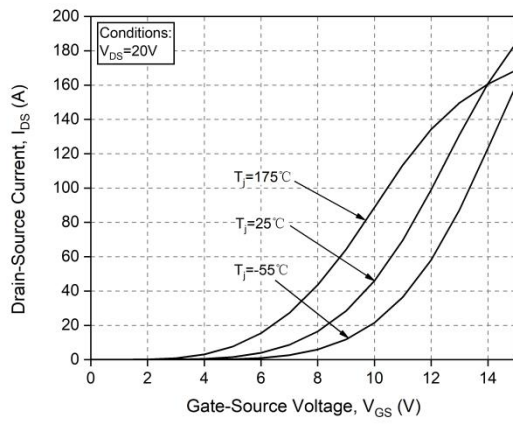


Figure 7. Transfer characteristic for various junction temperatures

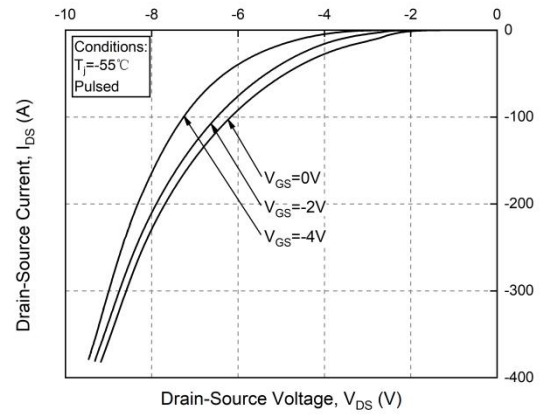


Figure 8. Body diode characteristic at $T_J = -55^\circ\text{C}$

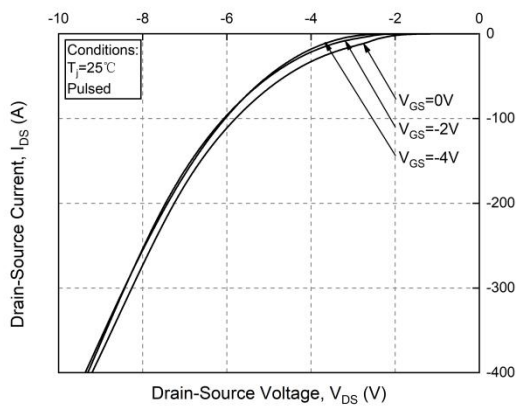


Figure 9. Body diode characteristic at $T_J = 25^\circ\text{C}$

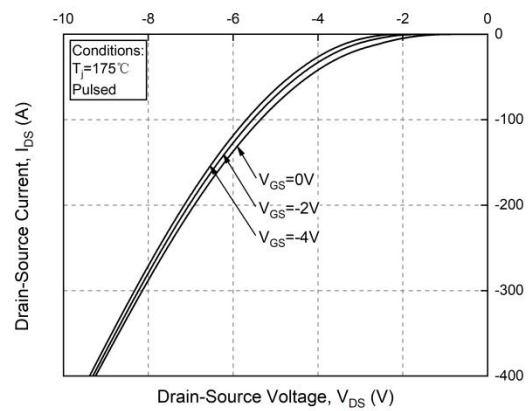


Figure 10. Body diode characteristic at $T_J = 175^\circ\text{C}$

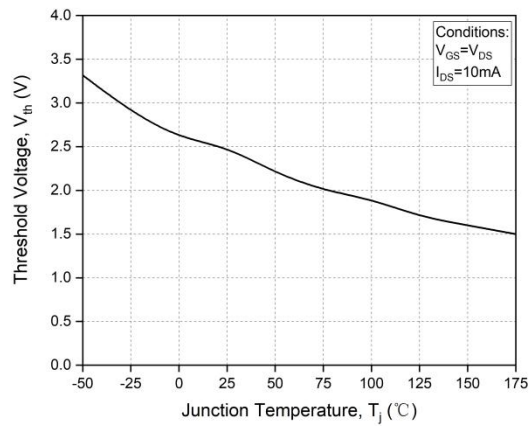


Figure 11. Threshold voltage vs. temperature

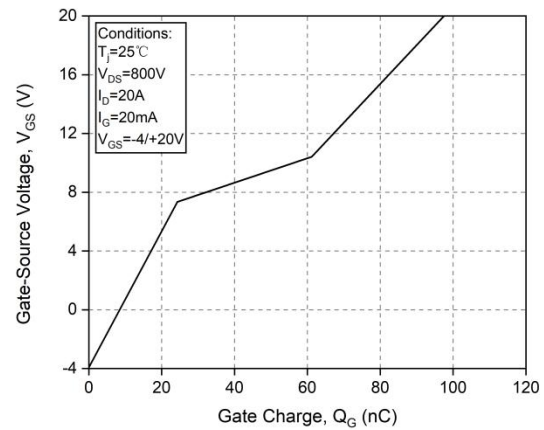


Figure 12. Gate charge characteristic

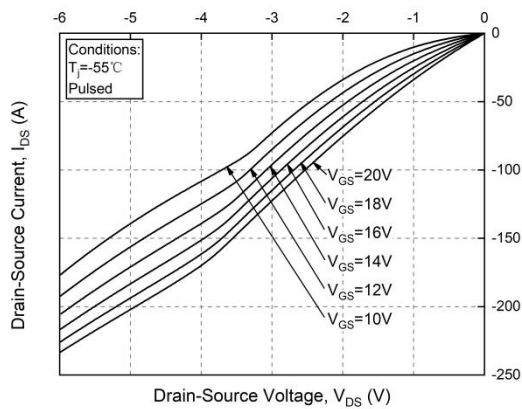


Figure 13. 3rd quadrant characteristic at $T_J = -55^\circ\text{C}$

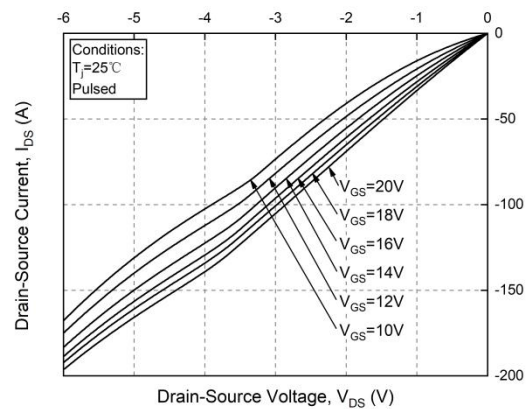


Figure 14. 3rd quadrant characteristic at $T_J = 25^\circ\text{C}$

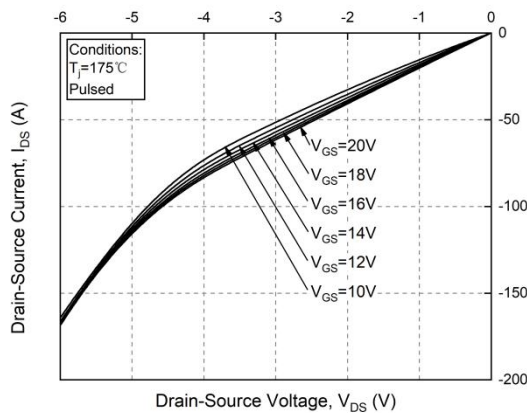


Figure 15. 3rd quadrant characteristic at $T_J = 175^\circ\text{C}$

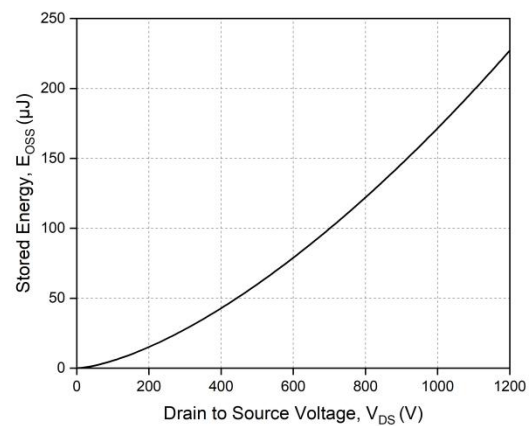


Figure 16. Output capacitor stored energy

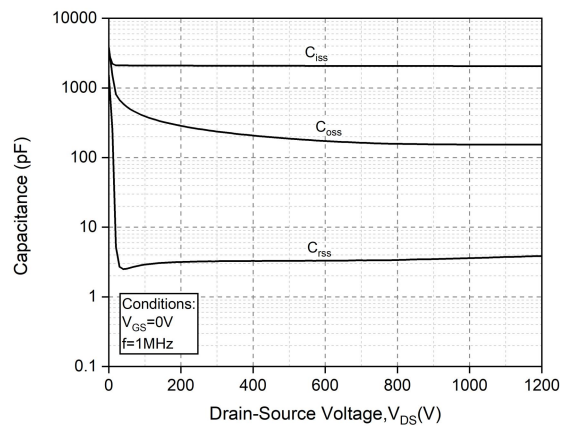


Figure 17. Capacitances vs. drain-source voltage

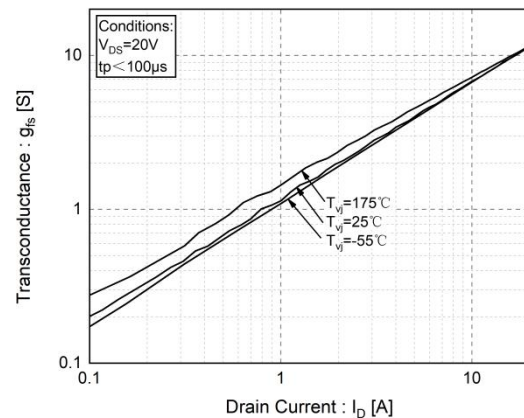


Figure 18. Transconductance vs drain current

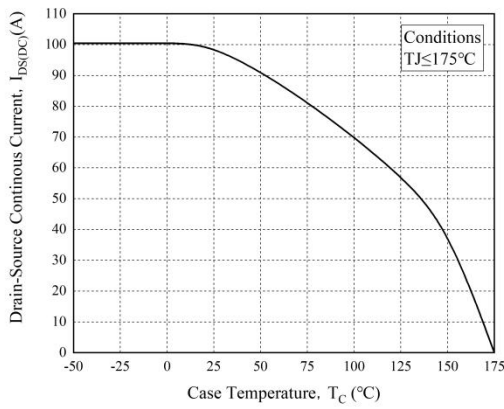


Figure 19. Continuous drain current derating vs. case temperature

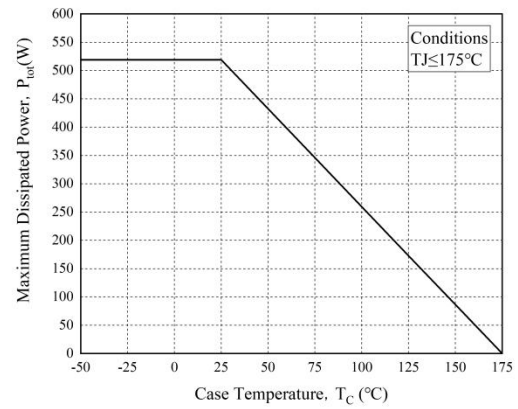


Figure 20. Maximum power dissipation derating vs. case temperature

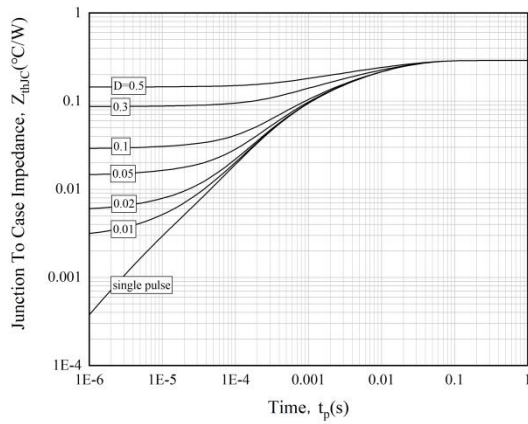


Figure 21. Transient thermal impedance (junction - case)

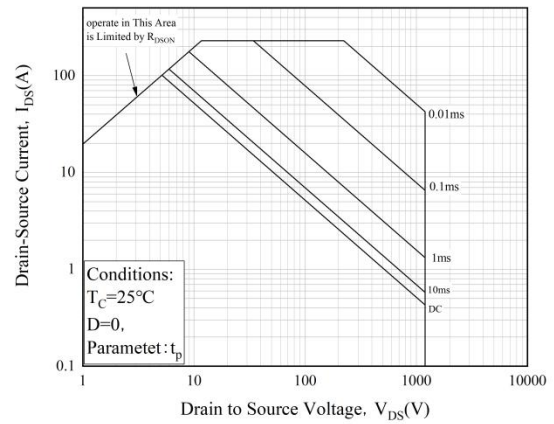


Figure 22. Safe operating area

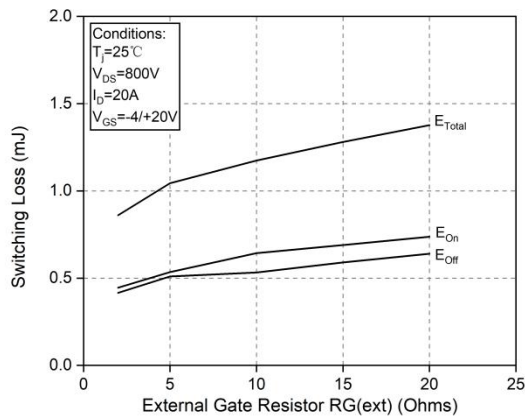


Figure 23. Clamped inductive switching energy vs. $R_{G(ext)}$

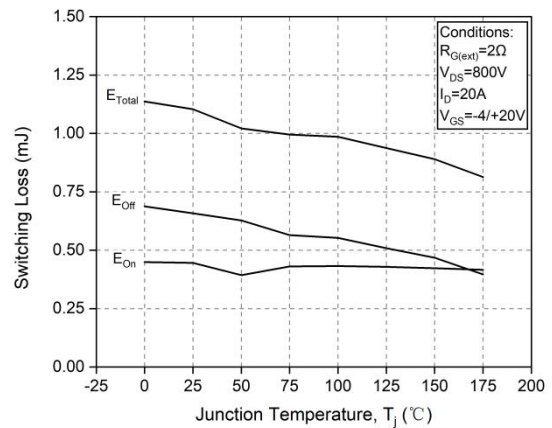


Figure 24. Clamped inductive switching energy vs. temperature

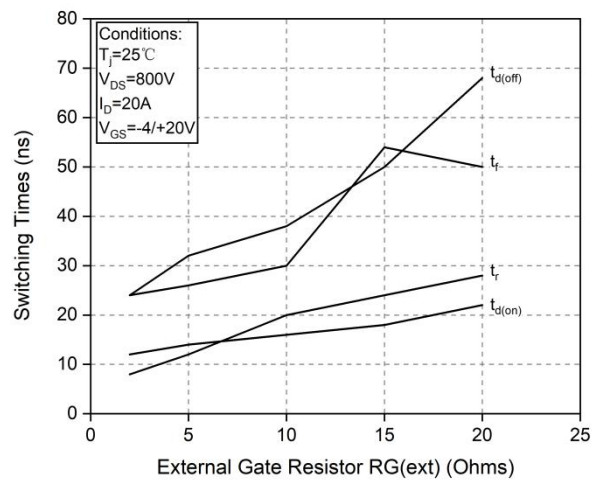
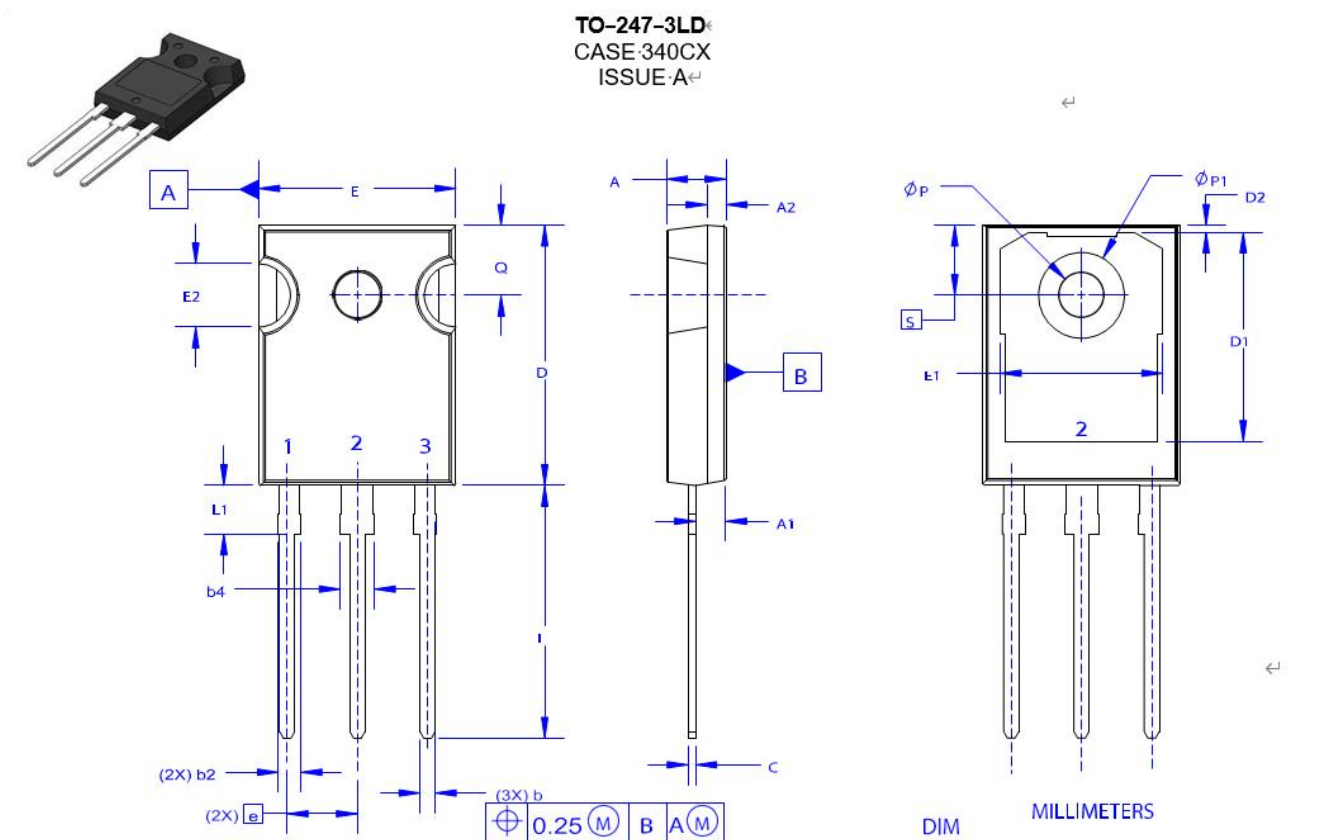


Figure 25. Switching times vs. $R_{G(\text{ext})}$

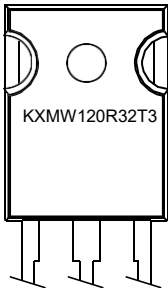
PACKAGE MARKING AND ORDERING INFORMATION

Part Number	Top Marking	Package	Packing Method	Reel Size	Tape Width	Quantity
KXMW120R40T3	KXMW120R40T3	TO-247 Long Lead	Tube	N/A	N/A	30 Units



NOTES: UNLESS OTHERWISE SPECIFIED.

- A. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- B. ALL DIMENSIONS ARE IN MILLIMETERS.
- C. DRAWING CONFORMS TO ASME Y14.5 - 2009.
- D. DIMENSION A1 TO BE MEASURED IN THE REGION DEFINED BY L1.
- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
D	20.32	20.57	20.82
E	15.37	15.62	15.87
E2	4.96	5.08	5.20
e	~	5.56	~
L	19.75	20.00	20.25
L1	3.69	3.81	3.93
ϕP	3.51	3.58	3.65
Q	5.34	5.46	5.58
S	5.34	5.46	5.58
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D1	13.08	~	~
D2	0.51	0.93	1.35
E1	12.81	~	~
$\phi P1$	6.60	6.80	7.00