

## AS1M040120T-VB Datasheet

### N-Channel 1200V (D-S) SiC Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	1200	
$R_{DS(on)}$ at 25 °C ( $\Omega$ )	$V_{GS} = 10$ V	0.040
$Q_g$ (nC)	101	

#### FEATURES

- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)



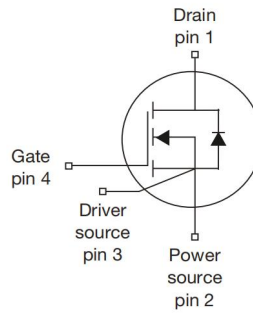
#### APPLICATIONS

- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- DC/DC converter

TO-247-4L



- Pin1 D - Drain
- Pin2 S - Source(Power)
- Pin3 S - Source(Driver)
- Pin4 G - Gate




N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)			
PARAMETER	SYMBOL	LIMIT	UNIT
Drain-Source Voltage	$V_{DS}$	1200	V
Gate-Source Voltage	$V_{GS}$	-10 / +22	
Continuous Drain Current ( $T_J = 150\text{ }^\circ\text{C}$ )	$V_{GS}$ at 18 V	$T_C = 25\text{ }^\circ\text{C}$	60
		$T_C = 100\text{ }^\circ\text{C}$	42
Pulsed Drain Current <sup>a</sup>	$I_{DM}$	160	A
Linear Derating Factor		2.1	W/ $^\circ\text{C}$
Single Pulse Avalanche Energy <sup>b</sup>	$E_{AS}$	1200	mJ
Maximum Power Dissipation	$P_D$	320	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55 to +175	$^\circ\text{C}$
Drain-Source Voltage Slope	$dV/dt$	$T_J = 125\text{ }^\circ\text{C}$	50
Reverse Diode $dV/dt$ <sup>d</sup>		15	
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s	260	$^\circ\text{C}$

#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DD} = 100$  V, starting  $T_J = 25\text{ }^\circ\text{C}$ ,  $L = 30$ mH,  $R_g = 25\text{ }\Omega$ ,  $I_{AS} = 9$ A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu\text{s}$ , starting  $T_J = 25\text{ }^\circ\text{C}$ .

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	40	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.47	

SPECIFICATIONS ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}, I_D = 1\text{ mA}$	-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 10\text{ mA}$	2.5	-	4.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = +22\text{ V}$	-	-	100	nA
		$V_{GS} = -10\text{ V}$	-	-	100	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$	-	10	-	$\mu\text{A}$
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}, I_D = 30\text{ A}$	-	0.040	-	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 0\text{ V}, I_D = 30\text{ A}$	-	16	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 800\text{ V}, f = 1\text{ MHz}$	-	2200	-	pF
Output Capacitance	$C_{oss}$		-	123	-	
Reverse Transfer Capacitance	$C_{rss}$		-	10	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$	-	156	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$		-	268	-	
Total Gate Charge	$Q_g$	$V_{GS} = -5/18\text{ V}, I_D = 20\text{ A}, V_{DS} = 800\text{ V}$	-	101	-	nC
Gate-Source Charge	$Q_{gs}$		-	29	-	
Gate-Drain Charge	$Q_{gd}$		-	33	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 800\text{ V}, I_D = 20\text{ A}, V_{GS} = -5/18\text{ V}, R_g = 2\text{ }\Omega$	-	18	25	ns
Rise Time	$t_r$		-	24	55	
Turn-Off Delay Time	$t_{d(off)}$		-	80	-	
Fall Time	$t_f$		-	12	-	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}, \text{ open drain}$	-	3.2	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	60	A
Pulsed Diode Forward Current	$I_{SM}$		-	-	160	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ }^\circ\text{C}, I_S = 30\text{ A}, V_{GS} = 0$	-	-	4.1	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ }^\circ\text{C}, I_F = I_S = 30\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}, V_R = 800\text{ V}$	-	47	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	220	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$		-	60	-	A

**Notes**

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .  
 b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .

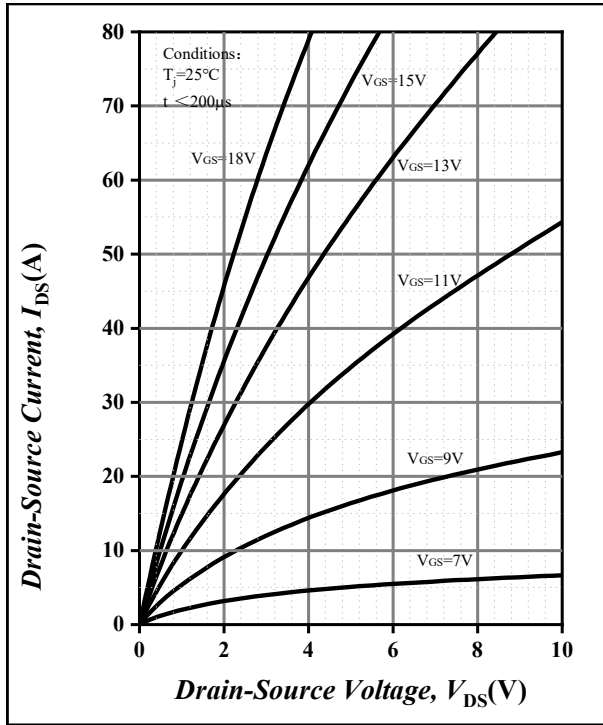


Fig.1 Output characteristics  $T_j=25^\circ\text{C}$

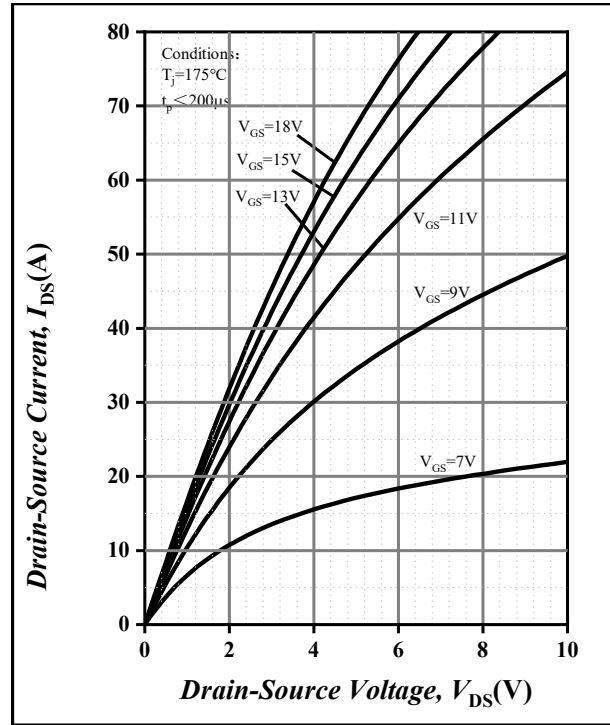


Fig.2 Output characteristics  $T_j=175^\circ\text{C}$

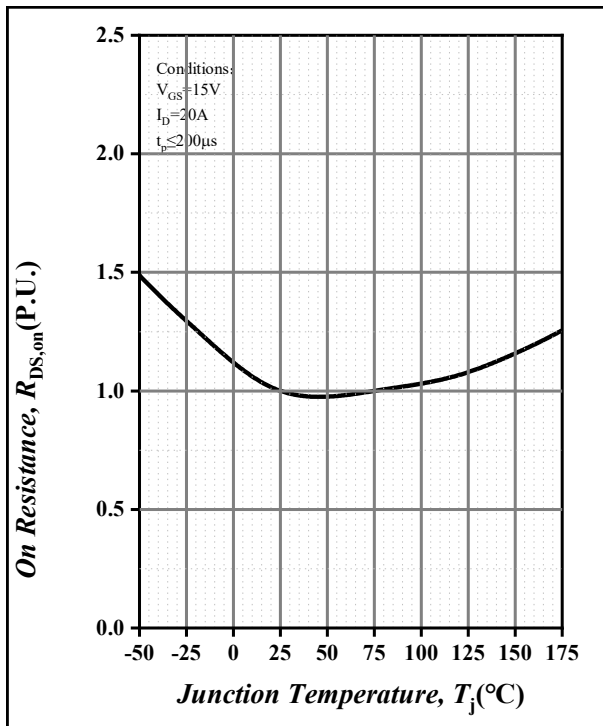


Fig.3 Normalized On-Resistance vs. Temperature

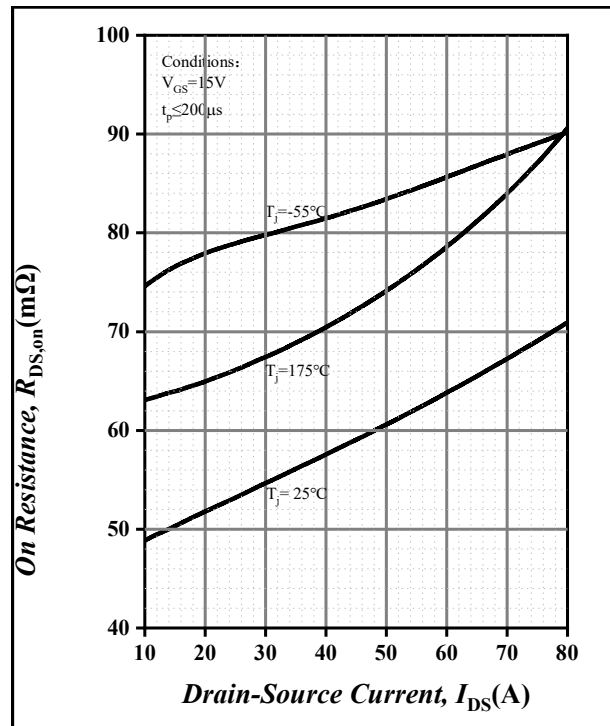


Fig.4 On-Resistance vs. Drain Current For Various Temperatures

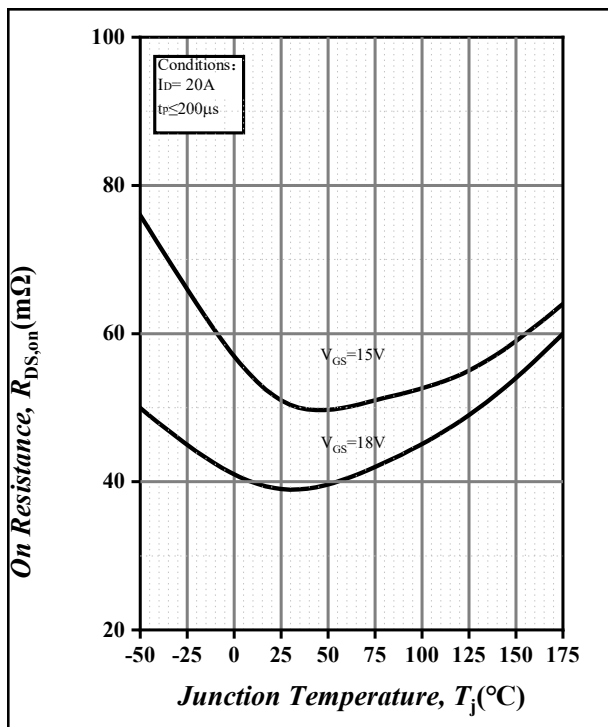


Fig.5 On-Resistance vs. Temperature For Various Gate Voltage

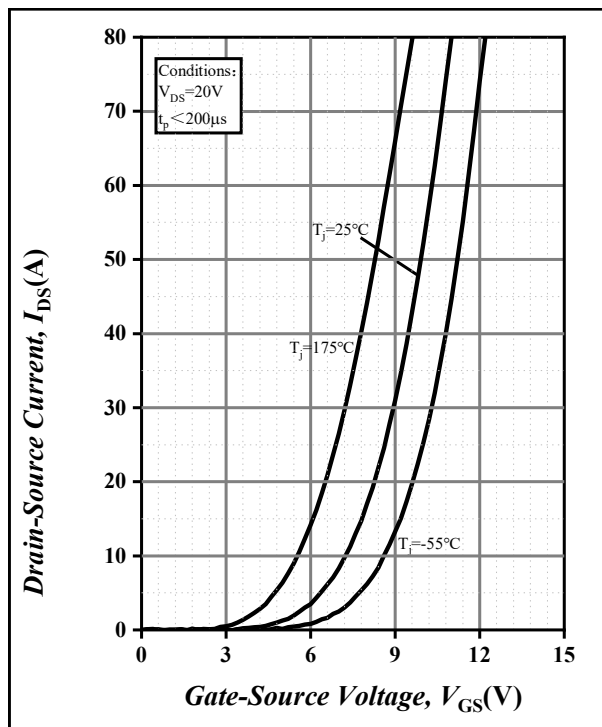


Fig.6 Transfer Characteristic For Various Junction Temperatures

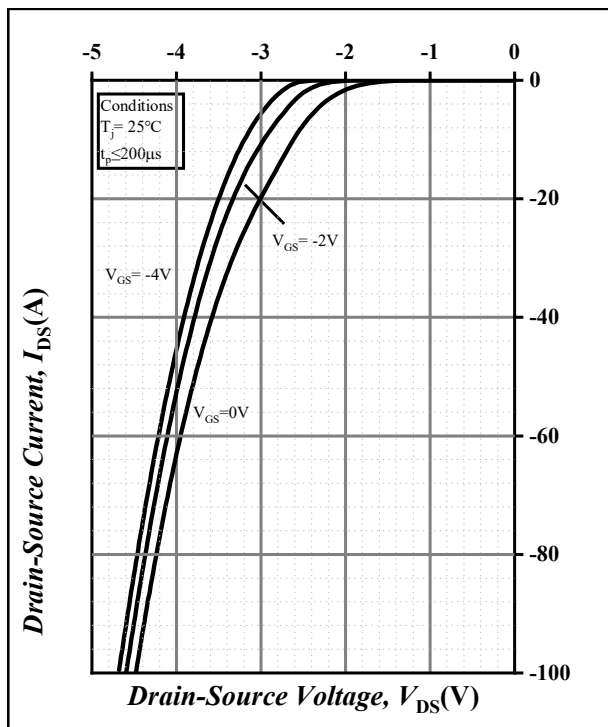


Fig.7 Body Diode Characteristic at 25 $^{\circ}$ C

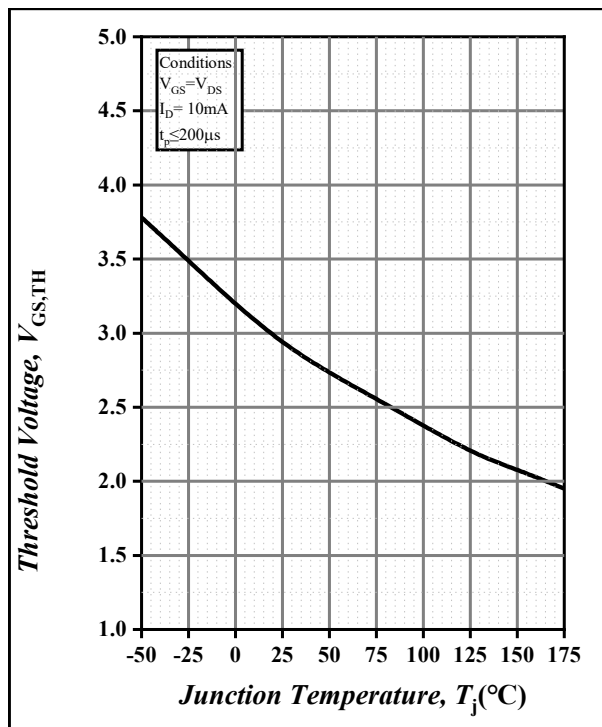


Fig.8 Threshold Voltage vs. Temperature

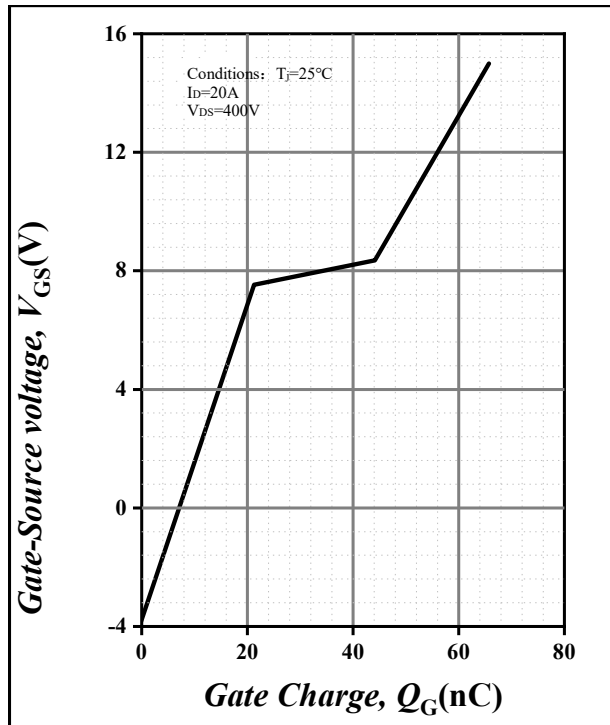


Fig.9 Gate Charge Characteristics

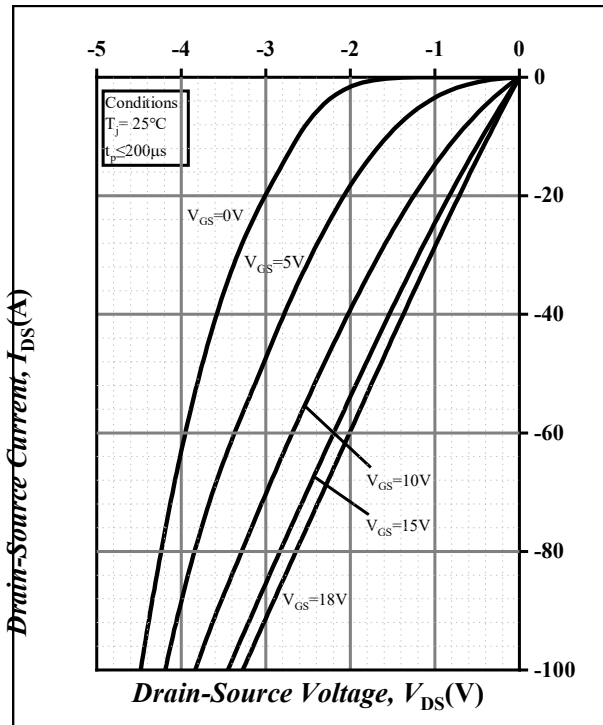


Fig.10 3<sup>rd</sup> Quadrant Characteristic at 25°C

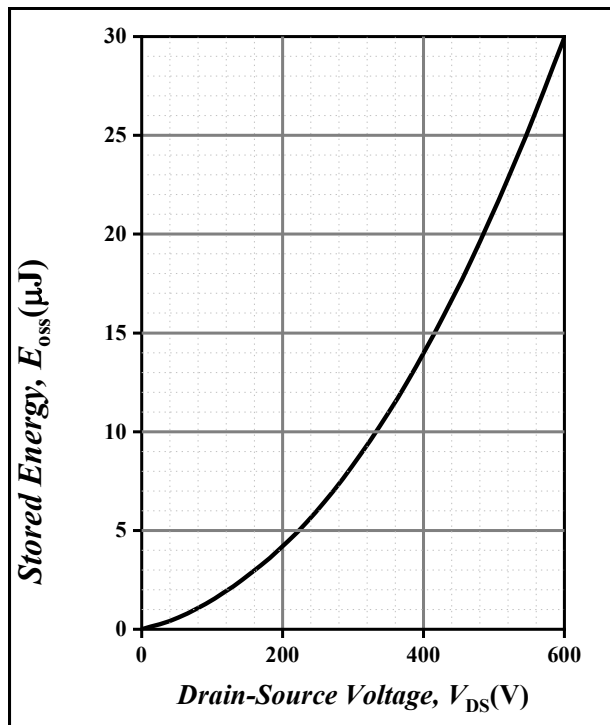


Figure 11. Output Capacitor Stored Energy

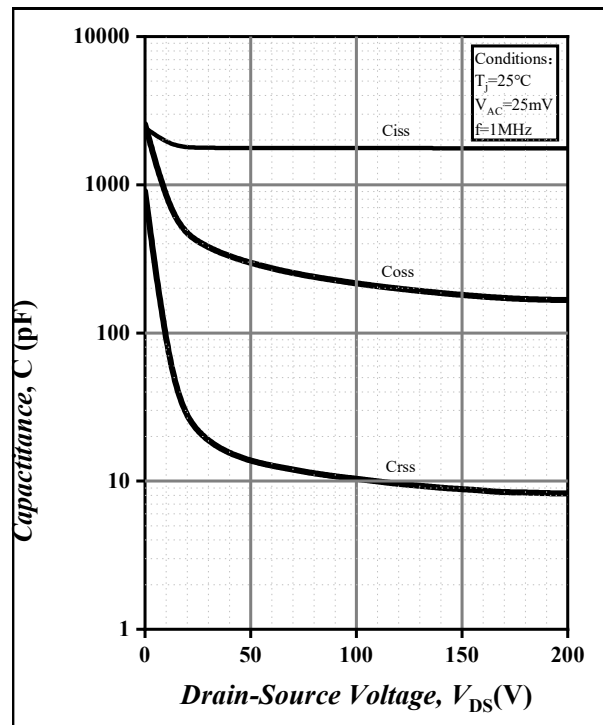


Fig.12 Capacitances vs. Drain-Source Voltage(0-200V)

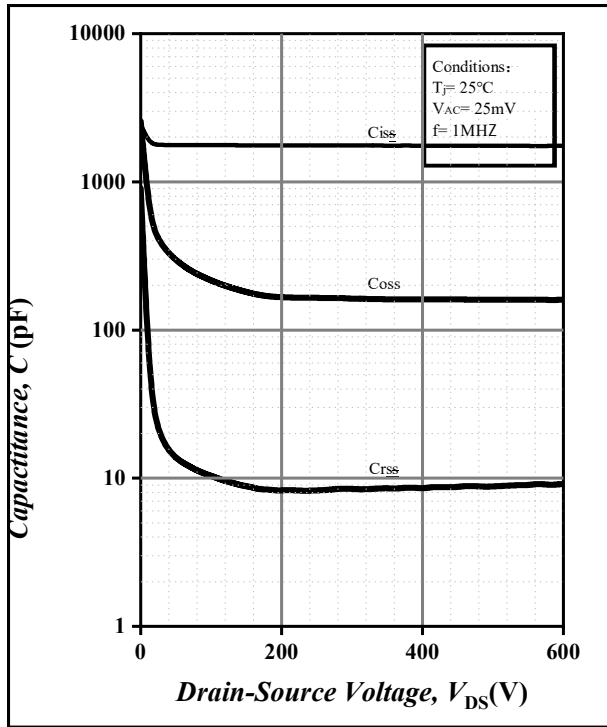


Fig.13 Capacitances vs. Drain-Source Voltage(0-600V)

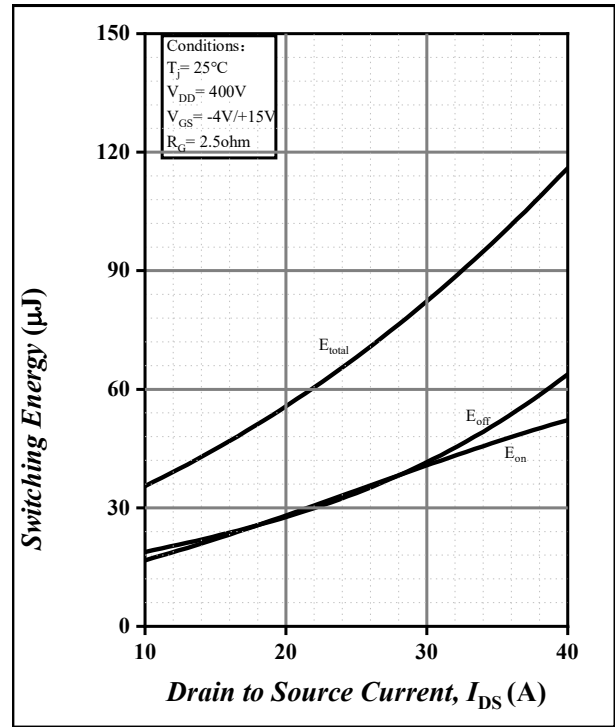


Figure 14. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD}=400V$ )

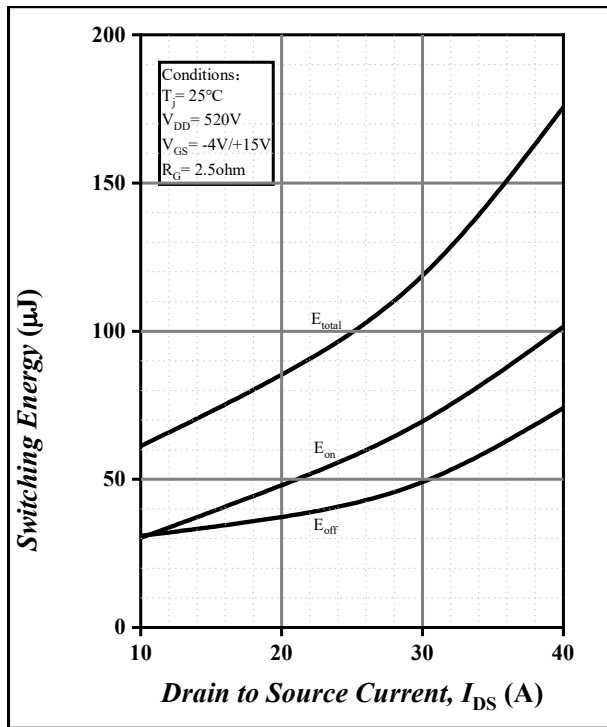


Figure 15. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD}=520V$ )

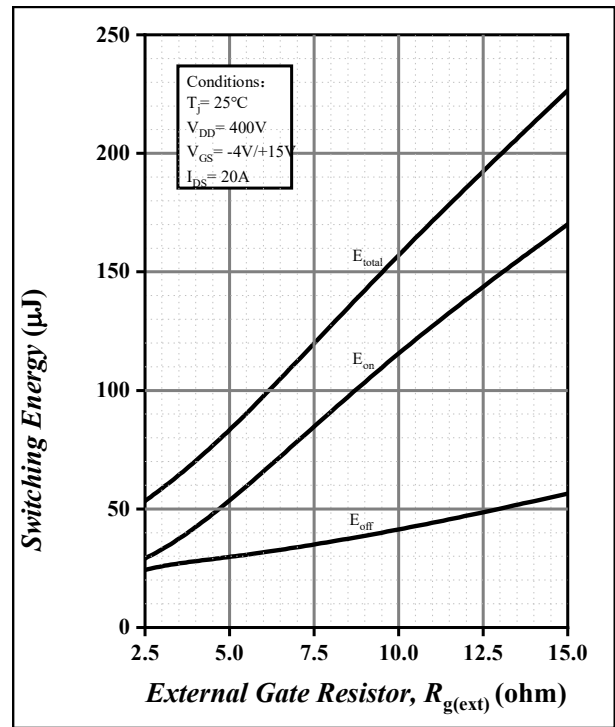


Figure 16. Clamped Inductive Switching Energy vs.  $R_{g(ext)}$

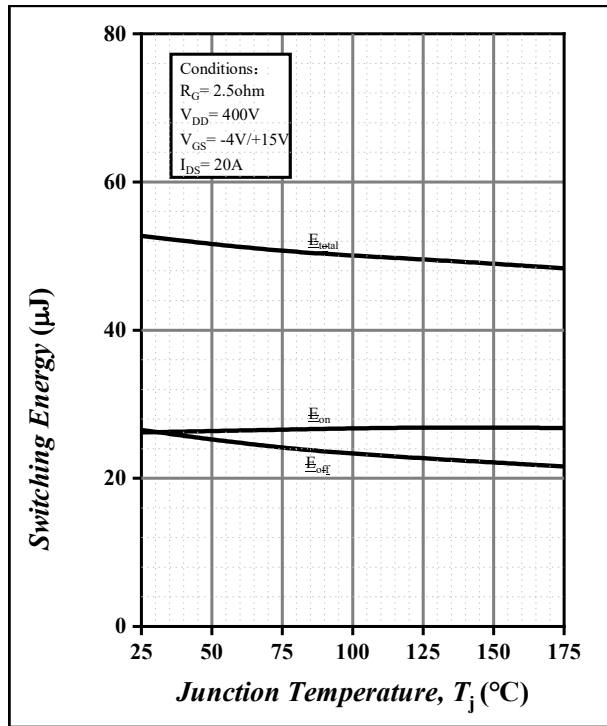
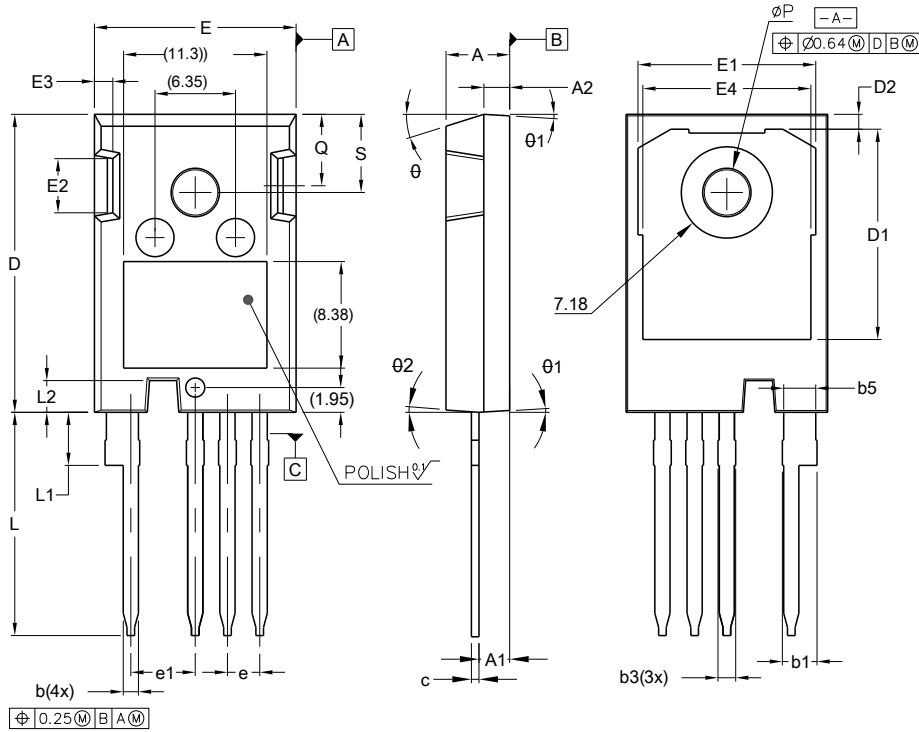


Figure 17. Clamped Inductive Switching Energy vs. Temperature



Figure 18. Switching Times vs.  $R_{g(ext)}$

### TO247-4L Package Outline Dimensions



TO247-4 Standard		
Dim	Min	Max
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.07	1.33
b1	2.39	2.94
b3	1.07	1.60
b5	2.39	2.69
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.30
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
$\phi P$	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
$\theta$	17.5° - 20° REF	
$\theta_1$	3.5° - 5° REF	
$\theta_2$	4° - 5° REF	
All Dimensions in mm		

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