NSF040120L4A0Q-VB Datasheet

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

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

FEATURES

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

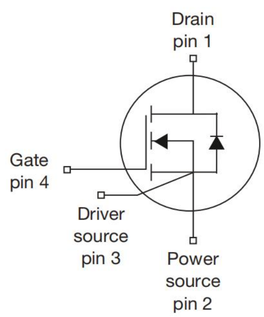
RoHS

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



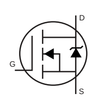
N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °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 °C)	V_{GS} at 18 V	T_C = 25 °C	I_D	60	A
		T_C = 100 °C		42	
Pulsed Drain Current [a]			I_{DM}	160	
Linear Derating Factor				2.1	W/°C
Single Pulse Avalanche Energy [b]			E_{AS}	1200	mJ
Maximum Power Dissipation			P_D	320	W
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	°C
Drain-Source Voltage Slope	T_J = 125 °C		dV/dt	50	V/ns
Reverse Diode dV/dt [d]				15	
Soldering Recommendations (Peak Temperature) [c]	for 10 s			260	°C

Notes

a. Repetitive rating; pulse width limited by maximum junction temperature.
b. V_{DD} = 100 V, starting T_J = 25 °C, L = 30mH, R_g = 25 Ω, I_{AS} = 9A.
c. 1.6 mm from case.
d. $I_{SD} \leq I_D$, dI/dt = 100 A/μs, starting T_J = 25 °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 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 1 mA	1200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to 25 °C, I_D = 1 mA	-	0.70	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 10 mA	2.5	-	4.5	V
Gate-Source Leakage	I_{GSS}	V_{GS} = +22 V	-	-	100	nA
		V_{GS} = -10 V	-	-	100	μA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V	-	10	-	μA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 125 °C	-	-	100	
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 30A	-	0.040	-	Ω
Forward Transconductance	g_{fs}	V_{DS} = 0 V, I_D = 30 A	-	16	-	S
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 800 V, f = 1 MHz	-	2200	-	pF
Output Capacitance	C_{oss}		-	123	-	
Reverse Transfer Capacitance	C_{rss}		-	10	-	
Effective Output Capacitance, Energy Related [a]	$C_{o(er)}$	V_{DS} = 0 V to 800 V, V_{GS} = 0 V	-	156	-	
Effective Output Capacitance, Time Related [b]	$C_{o(tr)}$		-	268	-	
Total Gate Charge	Q_g	V_{GS} = -5/18 V, I_D = 20 A, V_{DS} = 800 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 V, I_D = 20A, V_{GS} = -5/18 V , R_g = 2 Ω	-	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 MHz, open drain	-	3.2	-	Ω
Drain-Source Body Diode Characteristics						
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 °C, I_S = 30 A, V_{GS} = 0	-	-	4.1	V
Reverse Recovery Time	t_{rr}	T_J = 25 °C, I_F = I_S = 30 A, dI/dt = 1000 A/μs, V_R = 800 V	-	47	-	ns
Reverse Recovery Charge	Q_{rr}		-	220	-	μC
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}.

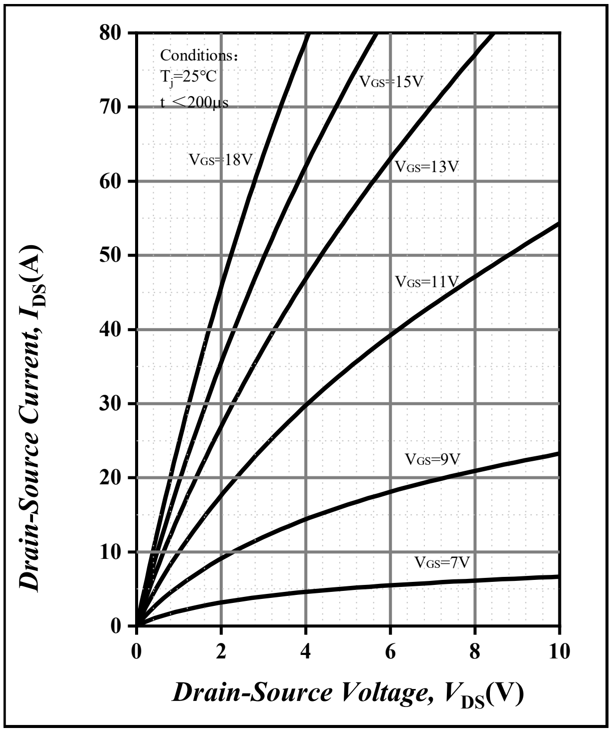


Fig.1 Output characteristics Tj=25℃

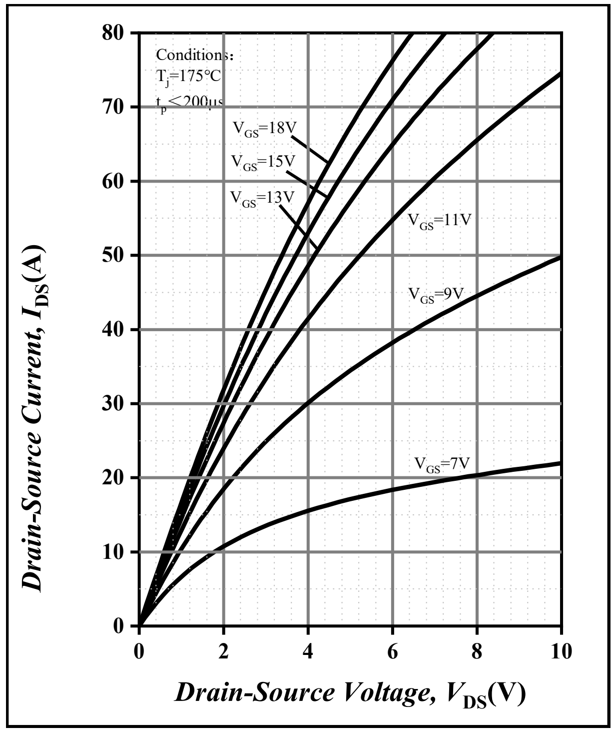


Fig.2 Output characteristics Tj=175℃

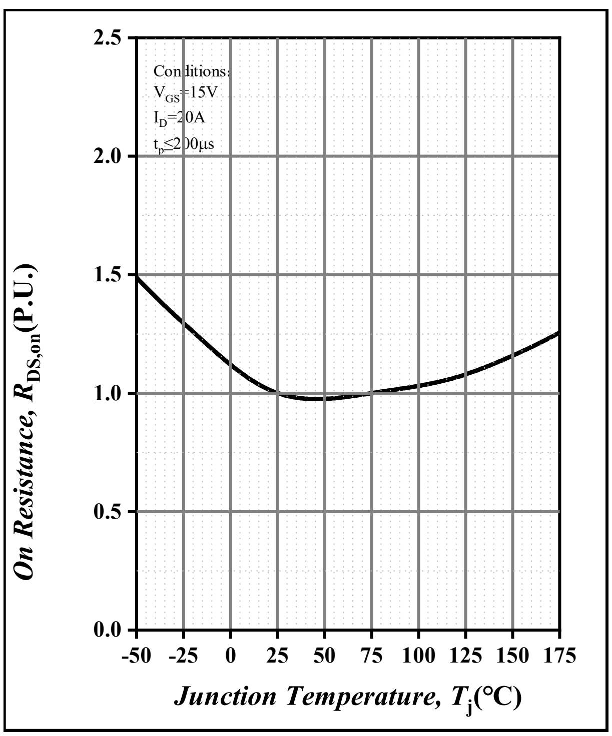


Fig.3 Normalized On-Resistance vs. Temperature

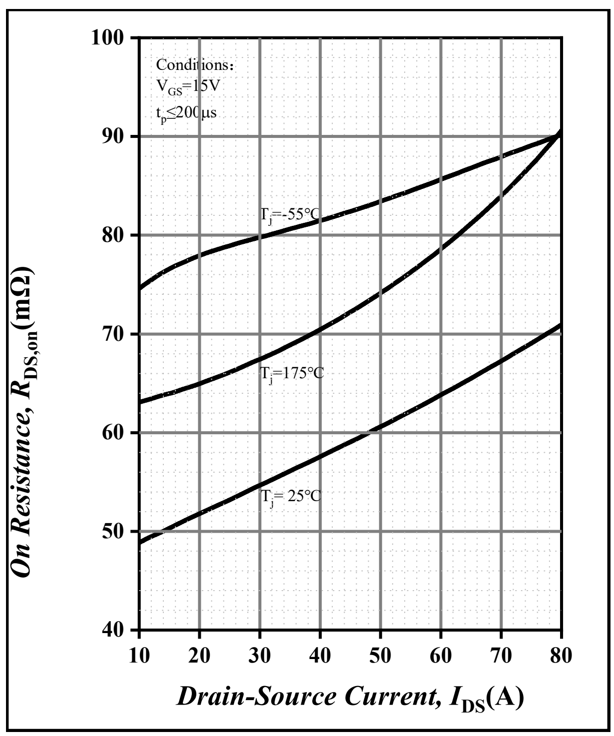


Fig.4 On-Resistance vs. Drain Current For Various Temperatures

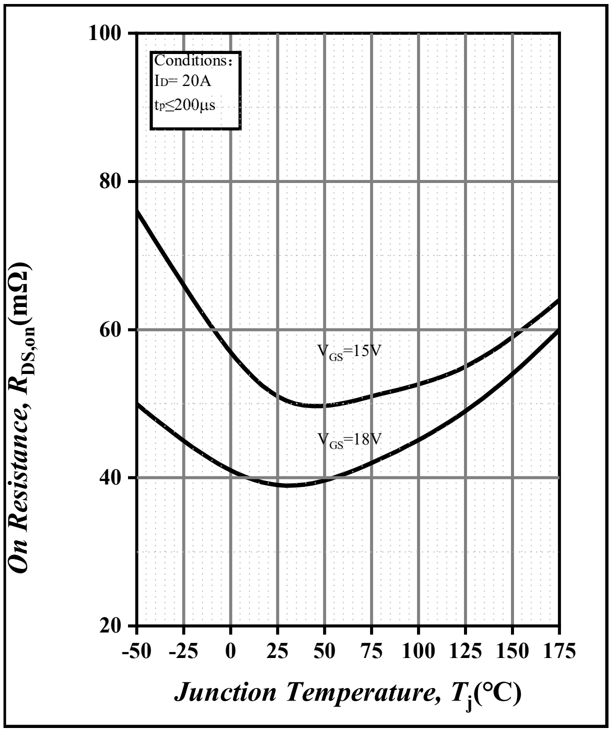


Fig.5 On-Resistance vs. Temperature For Various Gate Voltage

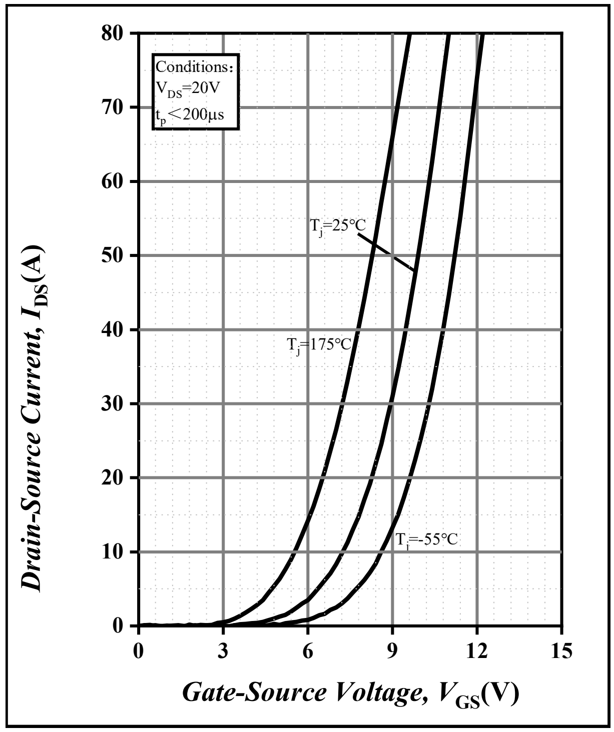


Fig.6 Transfer Characteristic For Various Junction Temperatures

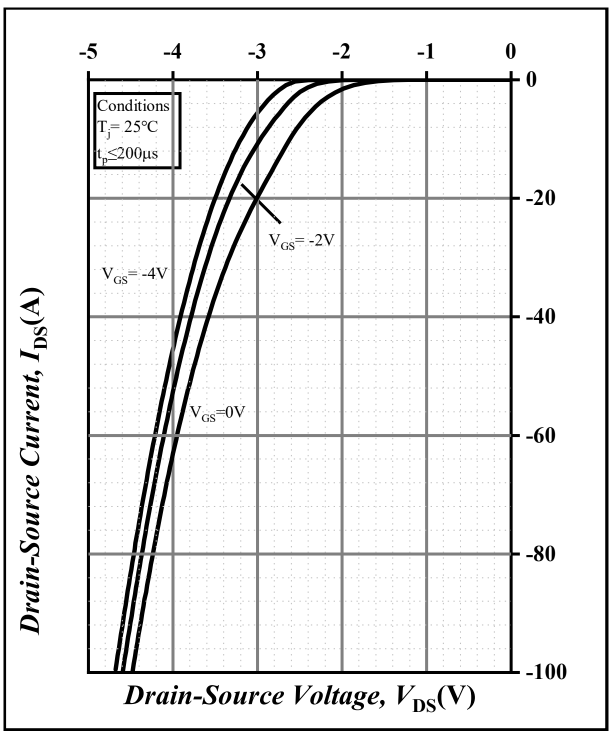


Fig.7 Body Diode Characteristic at 25℃

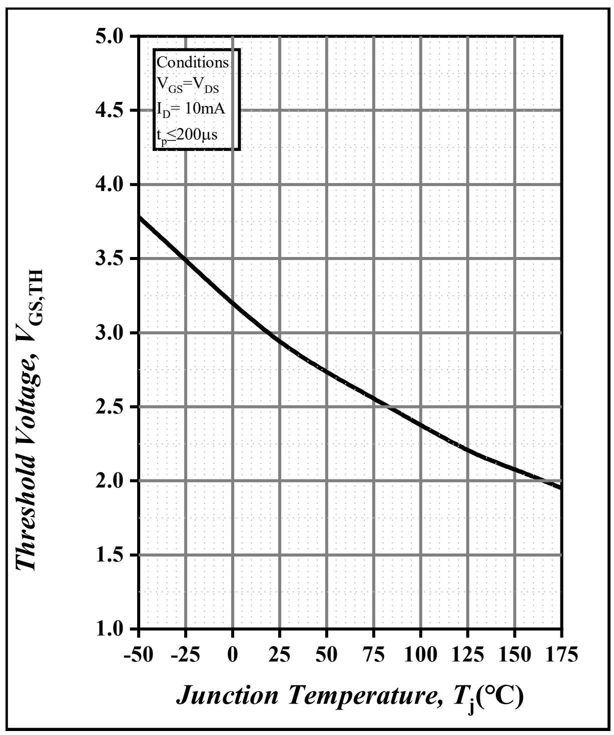


Fig.8 Threshold Voltage vs. Temperature

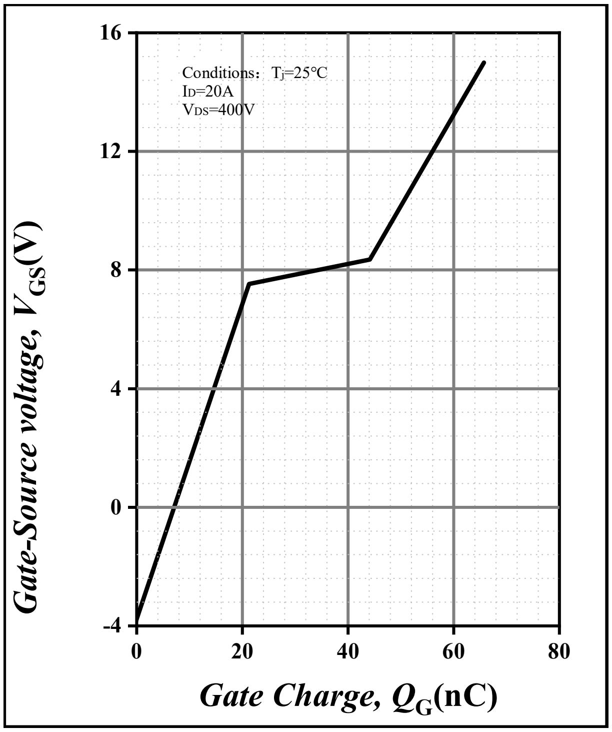


Fig.9 Gate Charge Characteristics

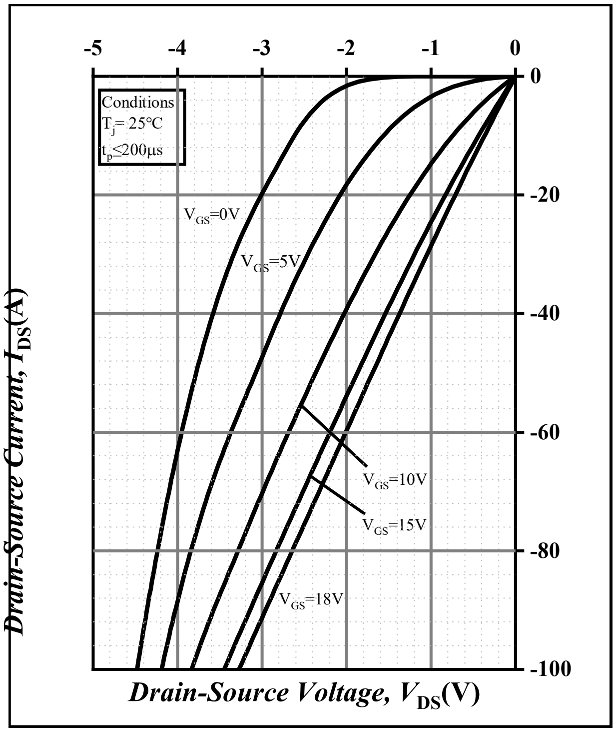


Fig.10 3rd Quadrant Characteristic at 25℃

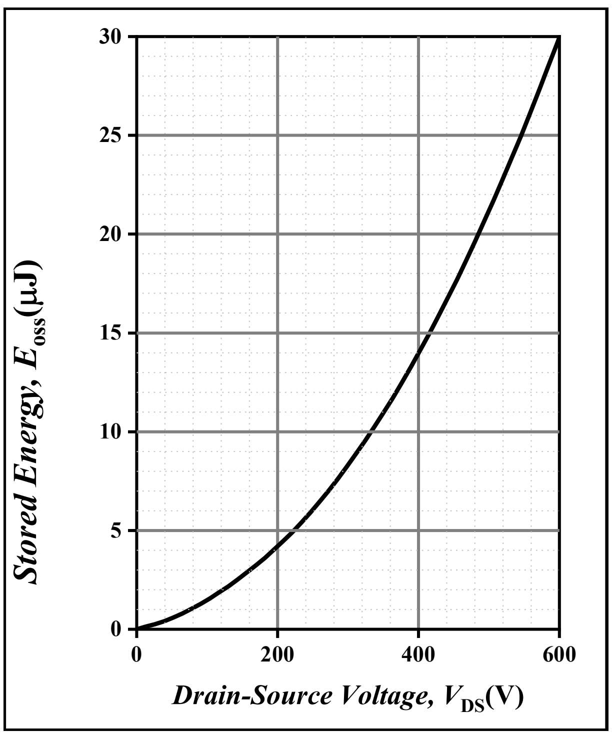


Figure 11. Output Capacitor Stored Energy

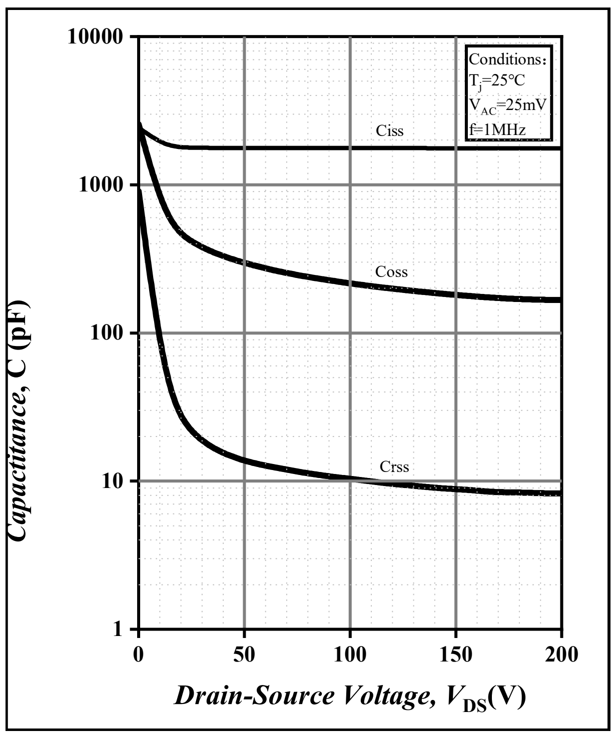


Fig.12 Capactitances vs. Drain-Source Voltage(0-200V)

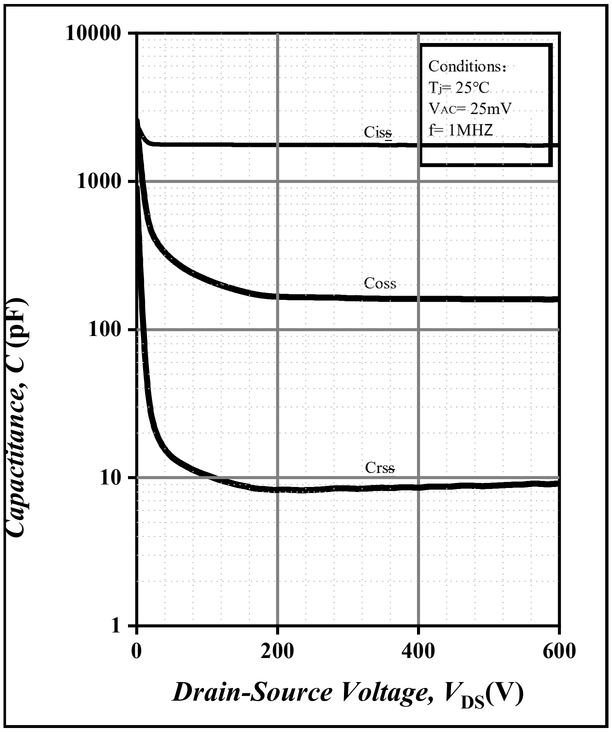


Fig.13 Capactitances vs. Drain-Source Voltage(0-600V)

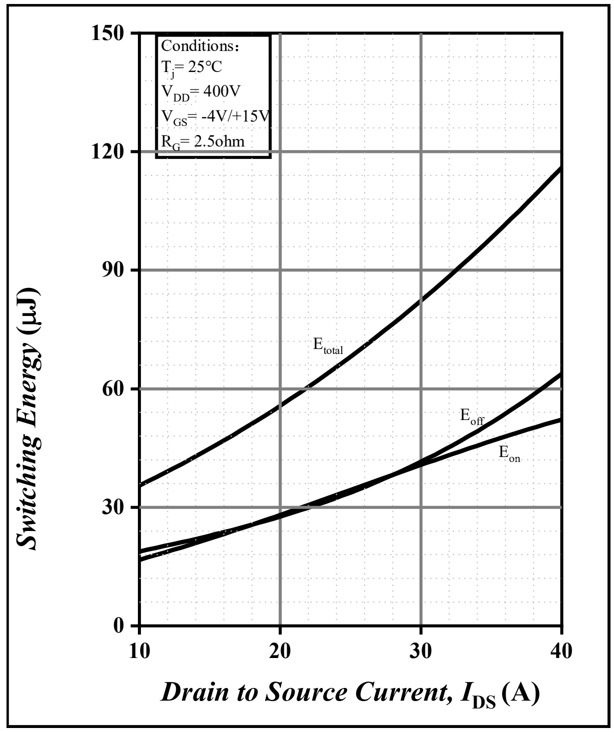


Figure 14. Clamped Inductive Switching Energy vs. Drain Current(V_{DD}=400V)

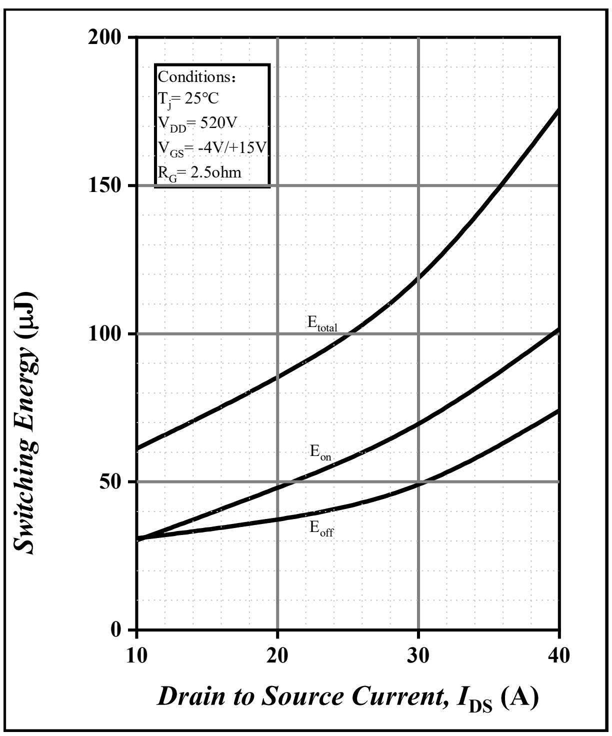


Figure 15. Clamped Inductive Switching Energy vs. Drain Current(V_{DD}=520V)

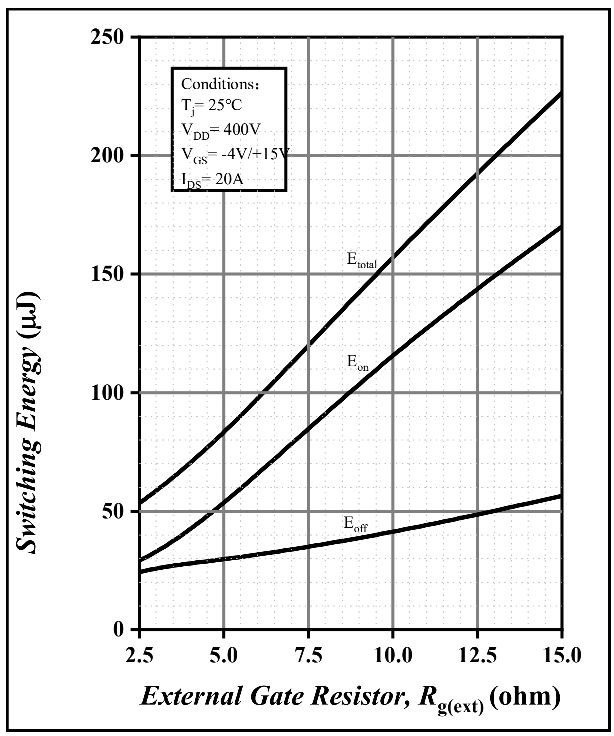


Figure 16. Clamped Inductive Switching Energy vs. $R_{g(ext)}$

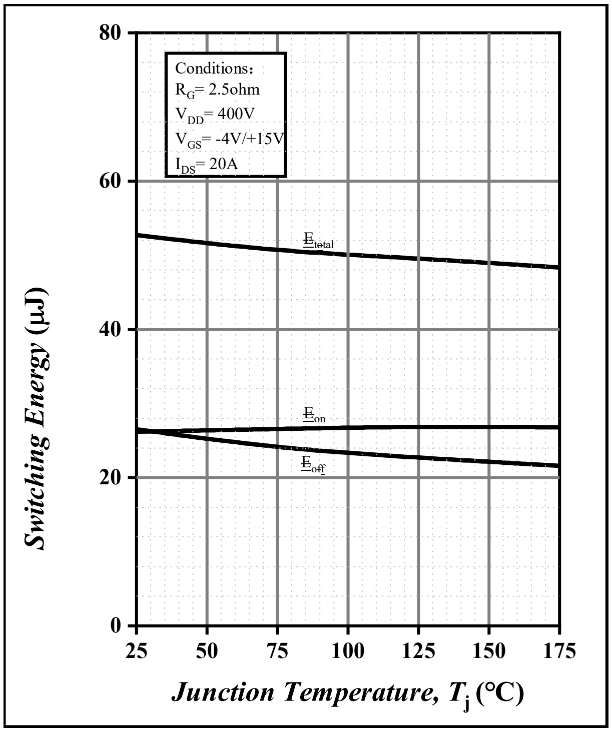


Figure 17. Clamped Inductive Switching Energy vs. Temperature

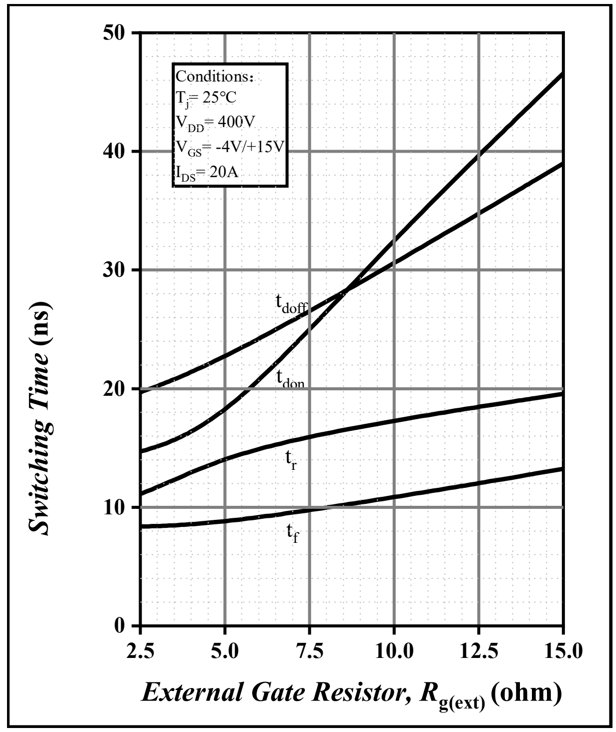
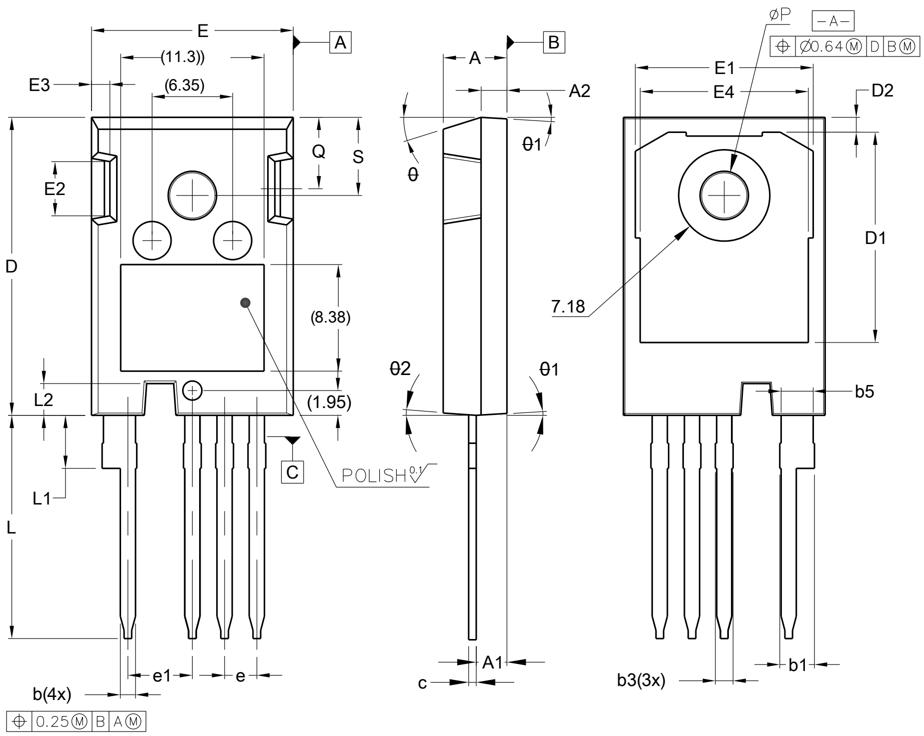


Figure 18. Switching Times vs. $R_{g(ext)}$

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
ØP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
θ	17.5°- 20° REF	
θ1	3.5°- 5° REF	
θ2	4°- 5° REF	
All Dimensions in mm		

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