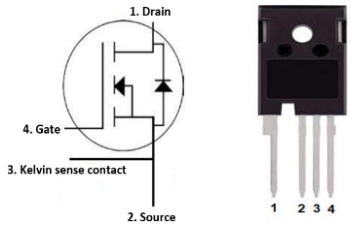
BLC40N120

Silicon Carbide Power MOSFET

1. Description

BLC40N120 is an N-channel enhancement type planar MOSFET, with the revolutionary semiconductor material - silicon carbide, which has the advantages of low on-resistance, low capacitance and gate charge, and superior switching performance. The device can provide higher efficiency, faster operation frequency and compact system size for power-electronic system application compared to Silicon.



TO-247-4L

FEATURES

- Revolutionary semiconductor material - Silicon Carbide
- High blocking voltage with low on-resistance
- Fast intrinsic diode with low reverse recovery
- Low switching losses
- 100% Avalanche Tested
- RoHS product

KEY CHARACTERISTICS

Parameter	Value	Unit
V_{DS}	1200	V
I_D	70	A
$R_{DS(ON).Typ}$	40	mΩ

APPLICATIONS

- Switching mode power supply
- Solar Inverters
- DC-DC Converter

ORDERING INFORMATION

Ordering Codes	Package	Product Code	Packing
BLC40N120-Z	TO-247-4L	C40N120	Tube

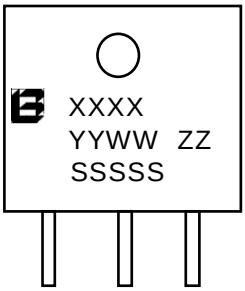
BLC40N120-Z

(2) Package type

(1) Chip name

(1) BLC40N120:1200V 40mΩ

(2) Z：TO-247-4L



XXXX：Product Code

YYWW：Year&Week

ZZ：Assembly Code

SSSSS：Lot Code

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2. ABSOLUTE RATINGS

at T_C = 25°C, unless otherwise specified

Symbol	Parameter	Rating	Units
V_{DSS}	Drain-to-Source Voltage	1200	V
I_D	Continuous Drain Current	70	A
	Continuous Drain Current T_C = 100 °C	50	A
I_{DM}	Pulsed Drain Current(Note1)	160	A
V_{GS}	Gate-to-Source Voltage	-10/+25	V
V_{GSop}	Recommended turn-on gate-to-source voltage, $V_{GS,on}$	+15/+20	V
	Recommended turn-off gate-to-source voltage, $V_{GS,off}$	-4	V
P_D	Power Dissipation at T_C = 25 °C	306	W
T_J，T_{stg}	Operating Junction and Storage Temperature Range	–40 to 175	℃
T_L	Maximum Temperature for Soldering	260	℃

3. Thermal characteristics

Symbol	Parameter	RATINGS	Units
$R_{\theta JC}$	Junction-to-Case	0.49	℃/W
$R_{\theta JA}$	Junction-to-Ambient	40	℃/W

4. Electrical Characteristics

at T_C = 25°C, unless otherwise specified

OFF Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
V_{DSS}	Drain to Source Breakdown Voltage	V_{GS}=0V, I_D=100μA	1200	--	--	V
I_{DSS}	Drain to Source Leakage Current	V_{DS} =1200V, V_{GS}= 0V, T_J = 25℃	--	1	100	μA
$I_{GSS(F)}$	Gate to Source Forward Leakage	V_{GS} =+25V	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	V_{GS} =-10V	--	--	-100	nA

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ON Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	V_{GS}=15V,I_{DS}=35A, T_J=25℃	--	39	53	mΩ
		V_{GS}=18V,I_{DS}=35A, T_J=25℃	--	29	39	mΩ
		V_{GS}=20V,I_{DS}=35A, T_J=25℃	--	26	35	mΩ
		V_{GS} = 15 V, I_{DS} = 35A, T_J = 175ºC	--	56	--	mΩ
		V_{GS} = 18 V, I_{DS} = 35A, T_J = 175ºC	--	50	--	mΩ
		V_{GS} = 20 V, I_{DS} = 35A, T_J = 175ºC	--	48	--	mΩ
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_{DS} = 10.5 mA, T_J=25℃	1.8	2.6	3.6	V
		V_{DS} = V_{GS}, I_{DS} = 10.5 mA, T_J = 175ºC	--	2.0	--	V

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$R_{G(int)}$	Internal Gate Resistance	f = 1.0MHz	--	3.3	--	Ω
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 1000V f = 1.0MHz	--	3686.6	--	pF
C_{oss}	Output Capacitance		--	107.4	--	
C_{rss}	Reverse Transfer Capacitance		--	4.8	--	

Switching Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-on Delay Time	I_D =35A V_{DD} = 800V V_{GS} = -4/+15V R_G =2.5Ω Inductive Load T_J=25 ºC	--	14.4	--	ns
tr	Rise Time		--	32.6	--	
$t_{d(off)}$	Turn-Off Delay Time		--	30.4	--	
t_f	Fall Time		--	10.5	--	
E_{on}	Turn-on energy		--	637.6	--	μJ
E_{off}	Turn-off energy		--	183	--	
$t_{d(on)}$	Turn-on Delay Time	I_D =35A V_{DD} = 800V V_{GS} = -4/+18V R_G =2.5Ω Inductive Load T_J=25 ºC	--	12.5	--	ns
tr	Rise Time		--	21.1	--	
$t_{d(off)}$	Turn-Off Delay Time		--	33.6	--	
t_f	Fall Time		--	10.2	--	

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E_{on}	Turn-on energy		--	518.6	--	μJ
E_{off}	Turn-off energy		--	181	--	
$t_{d(on)}$	Turn-on Delay Time	I_D =35A V_{DD} = 800V V_{GS} = -4/+20V R_G =2.5Ω Inductive Load T_J=25 ºC	--	11.5	--	ns
tr	Rise Time		--	18.9	--	
$t_{d(off)}$	Turn-Off Delay Time		--	35.8	--	
t_f	Fall Time		--	9.9	--	
E_{on}	Turn-on energy		--	475.6	--	μJ
E_{off}	Turn-off energy		--	179.1	--	
$t_{d(on)}$	Turn-on Delay Time	I_D =35A V_{DD} = 800V V_{GS} = -4/+15V R_G =2.5Ω Inductive Load T_J=175 ºC	--	11.5	--	ns
tr	Rise Time		--	19.8	--	
$t_{d(off)}$	Turn-Off Delay Time		--	41.6	--	
t_f	Fall Time		--	11.5	--	
E_{on}	Turn-on energy		--	502.7	--	μJ
E_{off}	Turn-off energy		--	217.9	--	
Q_g	Total Gate Charge	I_D =35A V_{DS} =800V V_{GS} = -4/+15V T_J=25 ºC	--	94	--	nC
Q_{gs}	Gate to Source Charge		--	38.5	--	
Q_{gd}	Gate to Drain		--	19.8	--	

Source-Drain Diode Characteristics

Symbol	Parameter	Test Conditions	Values			Units
			Min.	Typ.	Max.	
I_S	Continuous Source Current (Body Diode)	T_C=25 °C	--	--	70	A
I_{SM}	Maximum Pulsed Current (Body Diode)		--	--	160	A
V_{SD}	Diode Forward Voltage	I_S=35A, V_{GS}=-4V(Note2) T_J=25 ºC	--	5.3	--	V
		I_S=35A, V_{GS}=-4V, T_J = 175ºC	--	4.7	--	V
T_{rr}	Reverse Recovery Time	V_{DD} = 800V I_S=35A, T_J = 25°C dI_F/dt=2250A/us	--	18.5	--	ns
Q_{rr}	Reverse Recovery Charge		--	279	--	nC
I_{rrm}	Reverse Recovery Current		--	27.1	--	A

Note1: Pulse width limited by maximum junction temperature
Note2: Pulse width tp≤300μs, δ≤2%

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5. Characteristics Curves

Figure 1 Output Characteristics, T_J = -40 °C

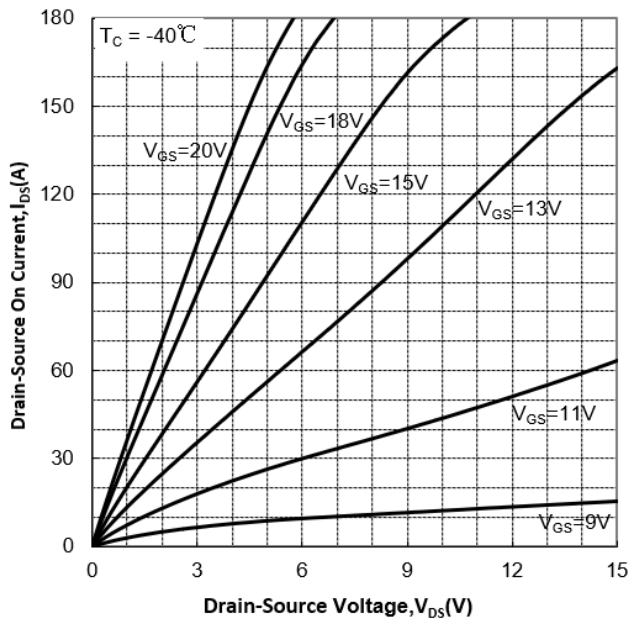


Figure 2 Output Characteristics, T_J =25 °C

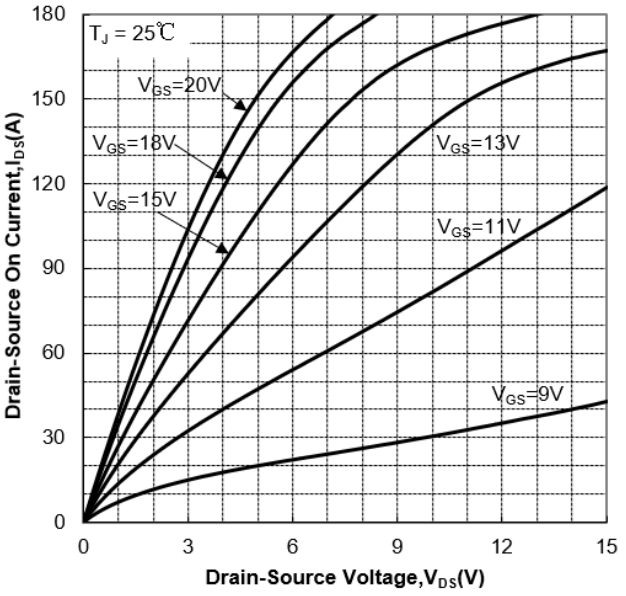


Figure 3 Output Characteristics, T_J = 175 °C

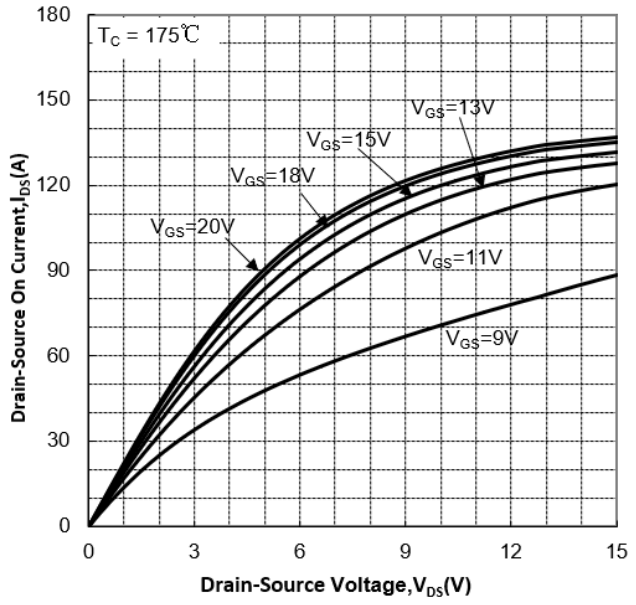
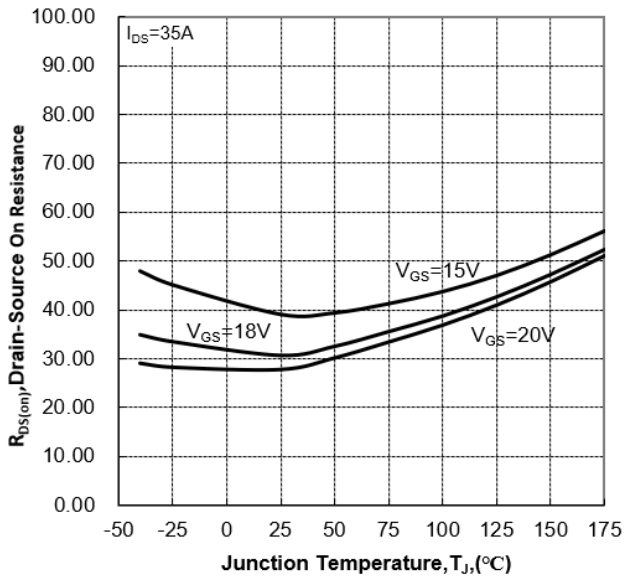


Figure 4 On-Resistance vs. Temperature For Various Gate Voltage



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Figure 5 Transfer Characteristic for Various Junction Temperatures

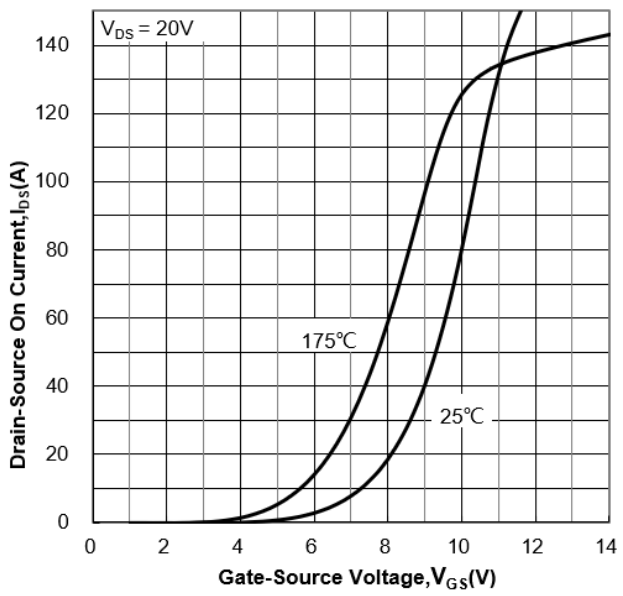


Figure 6 Normalized gate-source threshold voltage vs. Temperature

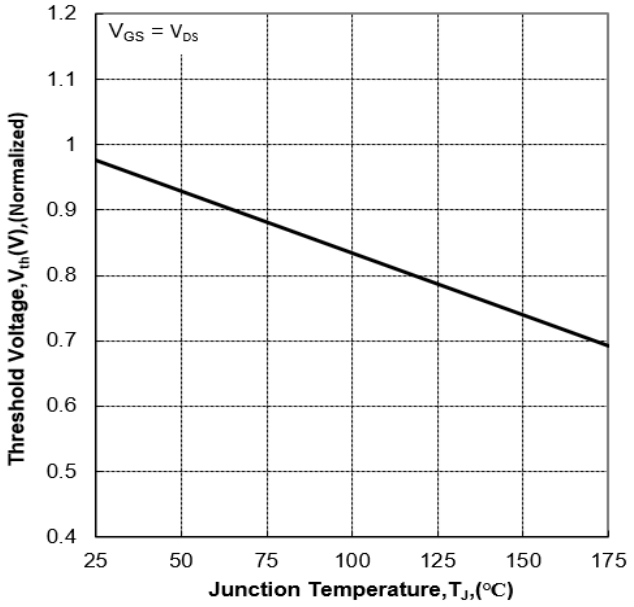


Figure 7 Body Diode Characteristic at -40 ºC

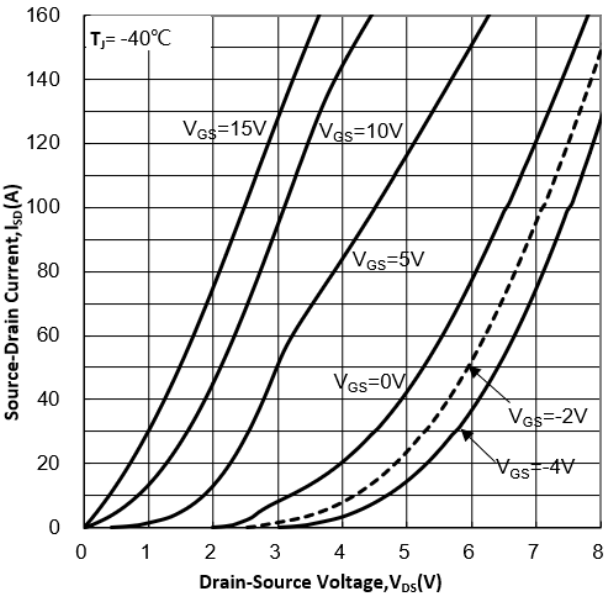
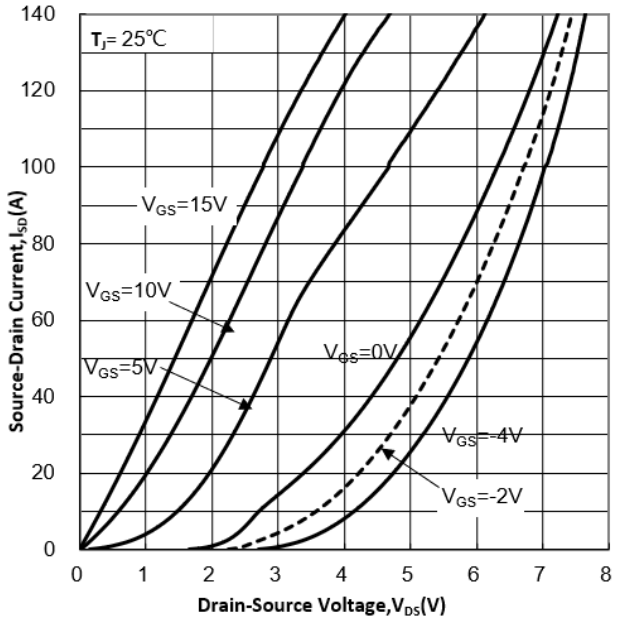


Figure 8 Body Diode Characteristic at 25 ºC



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Figure 9 Body Diode Characteristic at 175 ºC

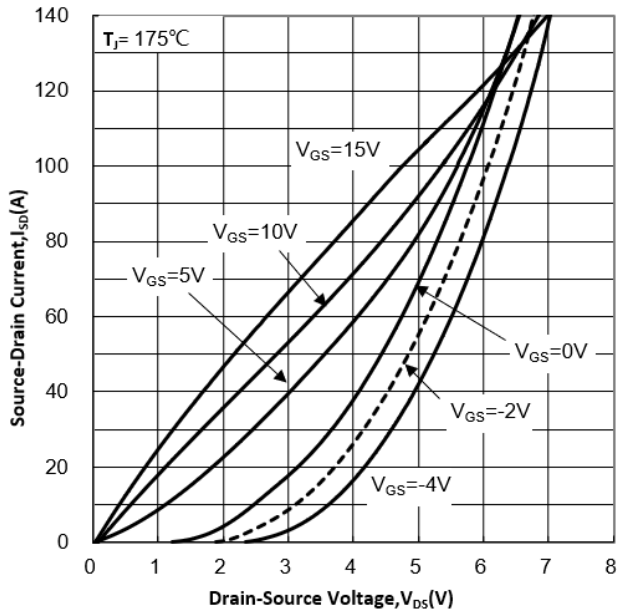


Figure 10 Gate Charge Characteristics

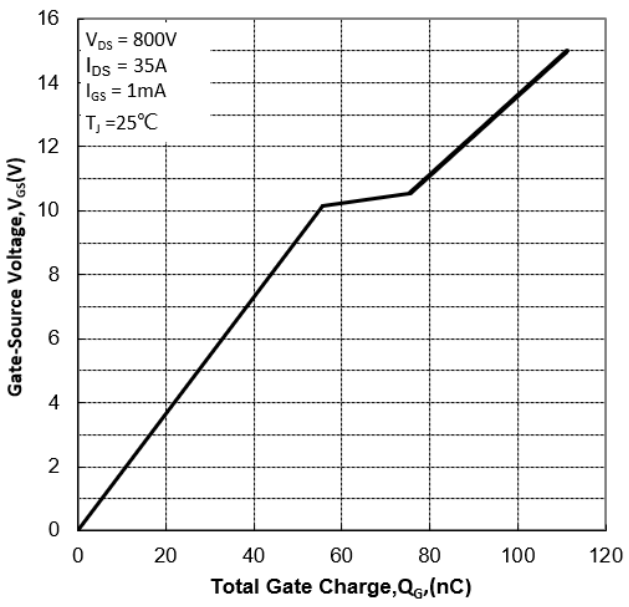


Figure 11 Capacitances vs. Drain-Source Voltage (0-200V)

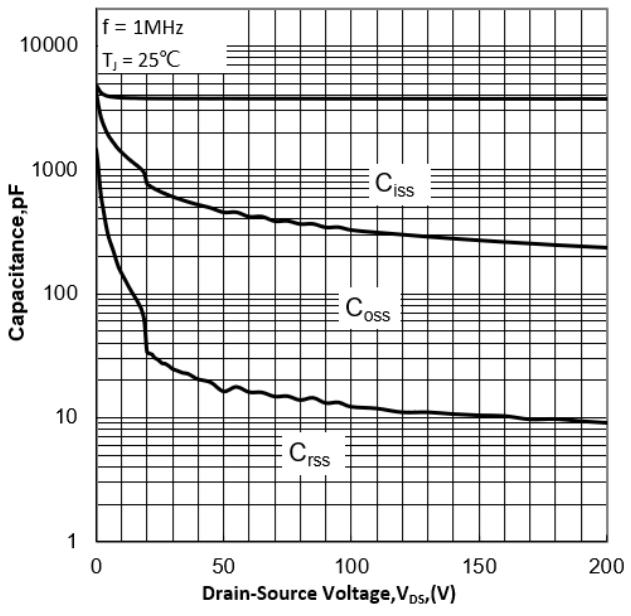
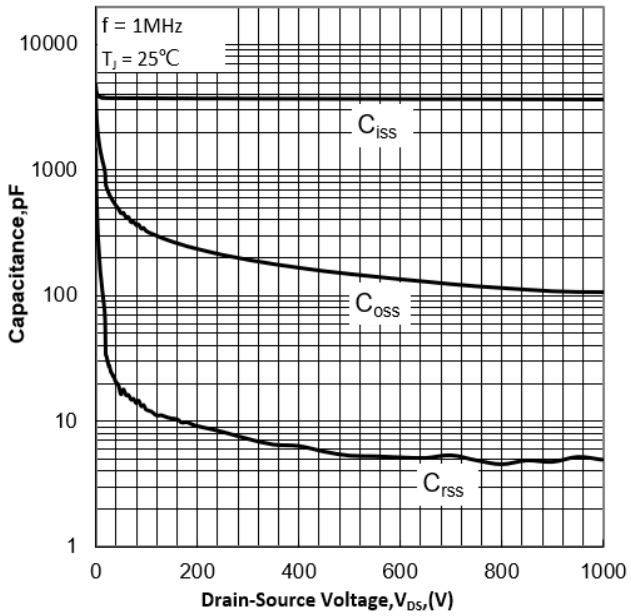


Figure 12 Capacitances vs. Drain-Source Voltage (0-1000V)



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Figure 13 Continuous Drain Current Derating vs. Case Temperature

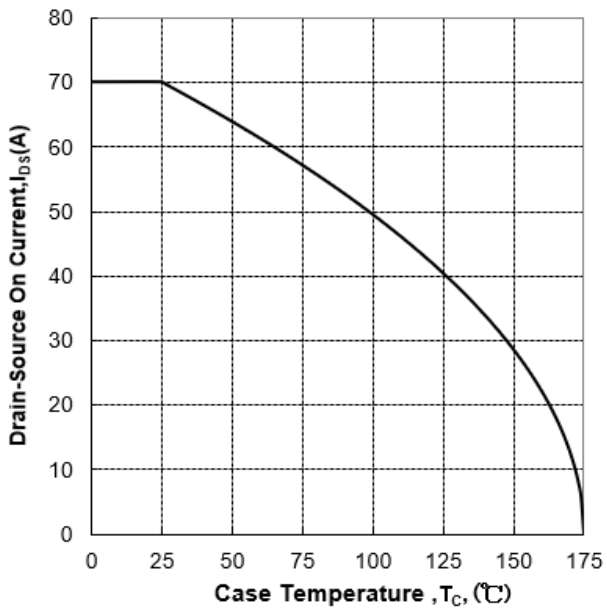


Figure 14 Maximum Power Dissipation Derating vs. Case Temperature

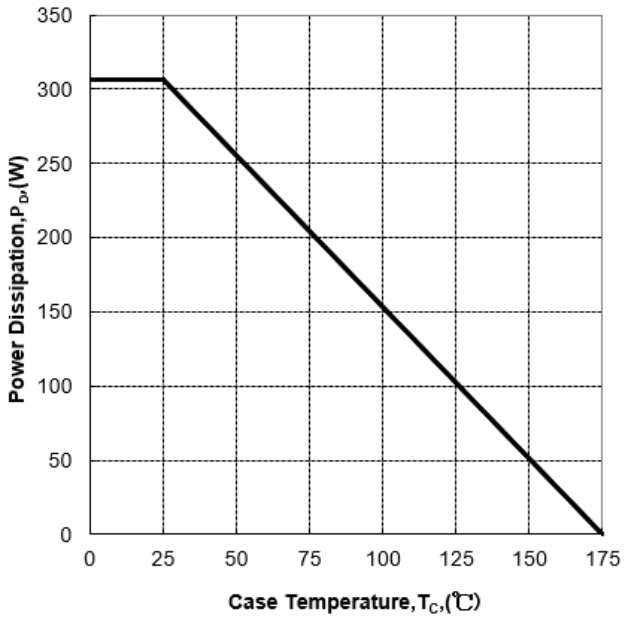


Figure 15 Transient Thermal Impedance (Junction - Case)

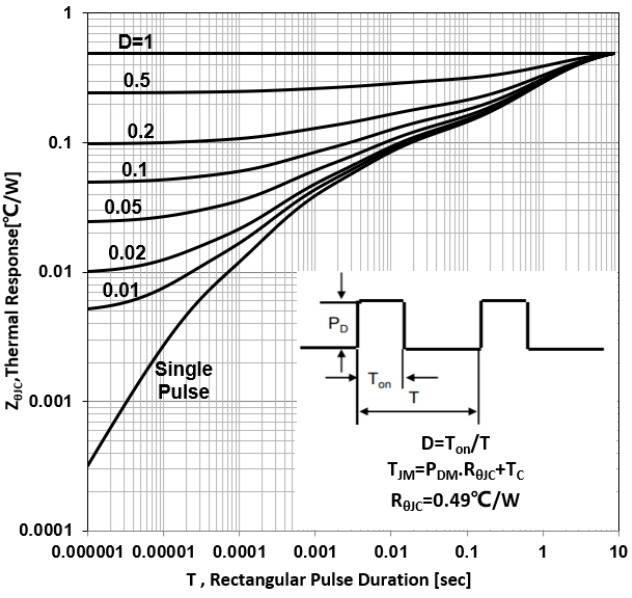
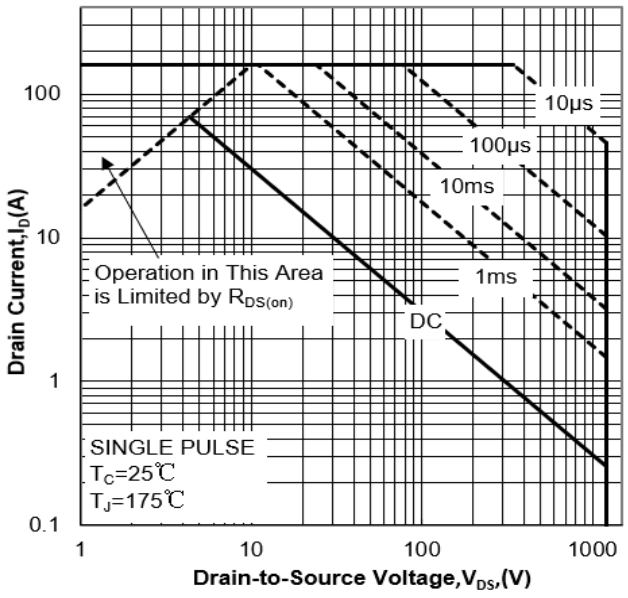


Figure 16 Safe Operating Area



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Figure 17 Clamped Inductive Switching Energy vs. Drain Current (VGS=-4V/+15V)

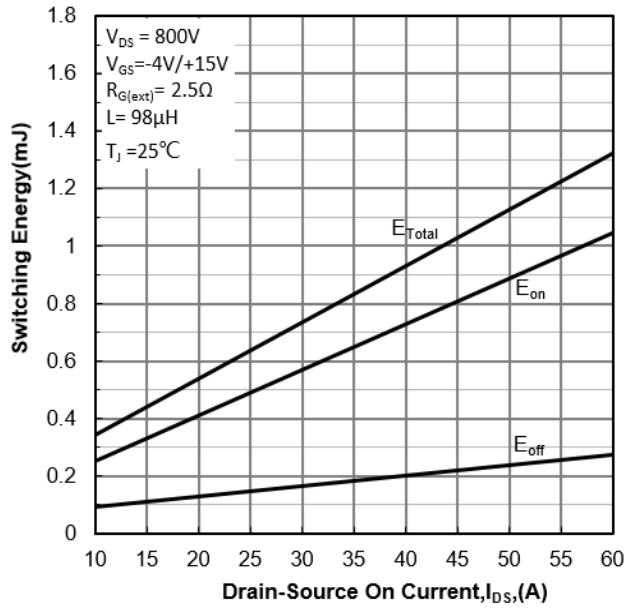


Figure 18 Clamped Inductive Switching Energy vs. Drain Current (VGS=-4V/+18V)

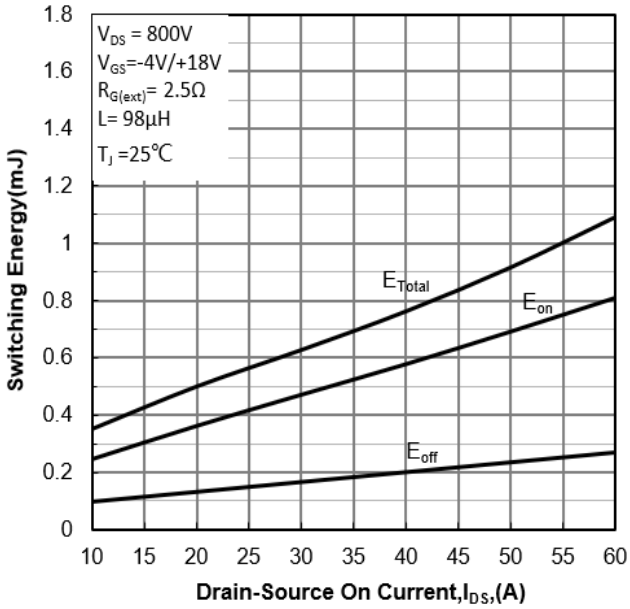


Figure 19 Clamped Inductive Switching Energy vs. Drain Current (VGS=-4V/+20V)

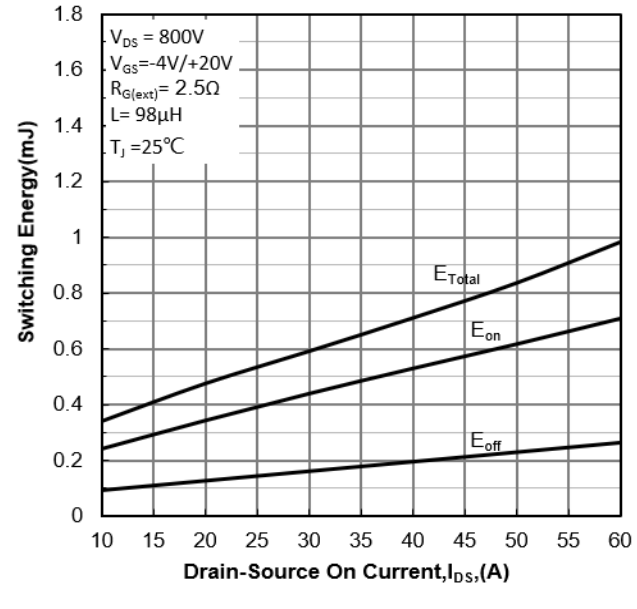
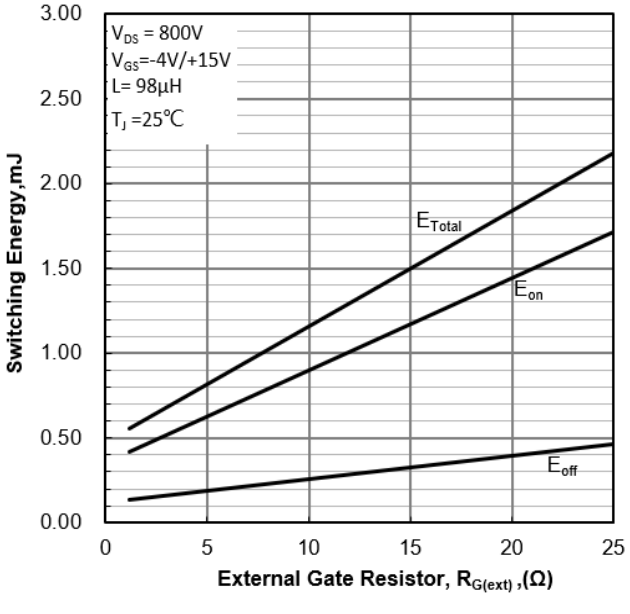


Figure 20 Clamped Inductive Switching Energy vs. RG(ext)



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Figure 21 Clamped Inductive Switching Energy vs. Temperature (VGS=-4V/+15V)

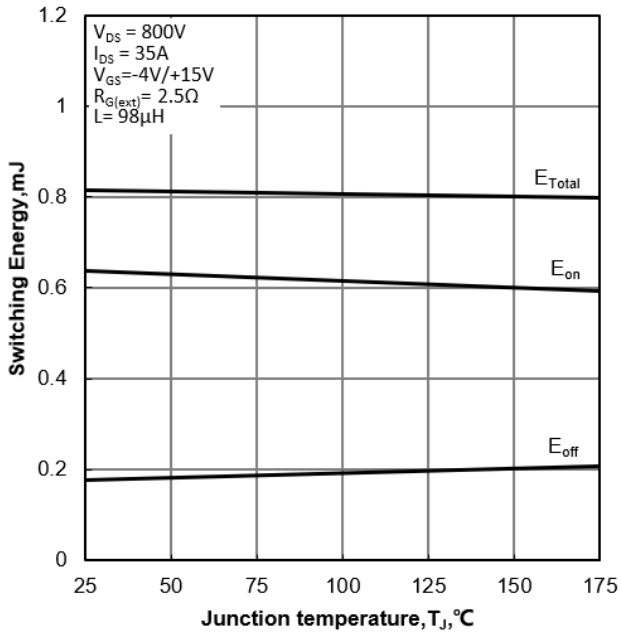


Figure 22 Clamped Inductive Switching Energy vs. Temperature (VGS=-4V/+18V)

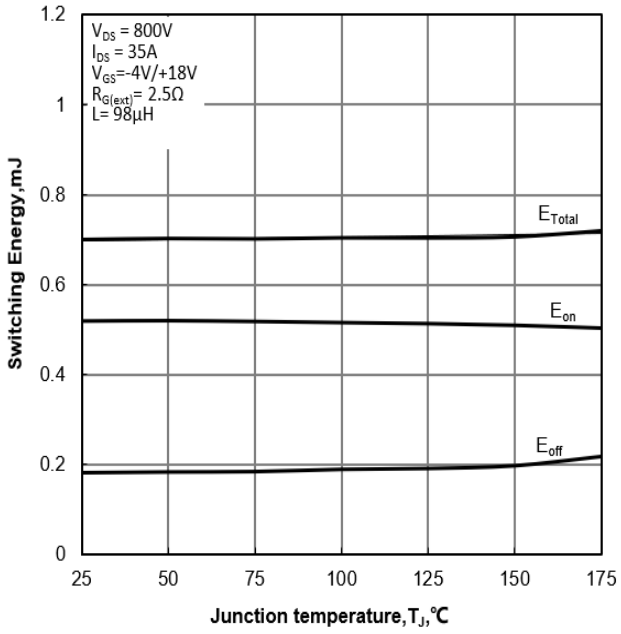


Figure 23 Clamped Inductive Switching Energy vs. Temperature (V_{GS}=-4V/+20V)

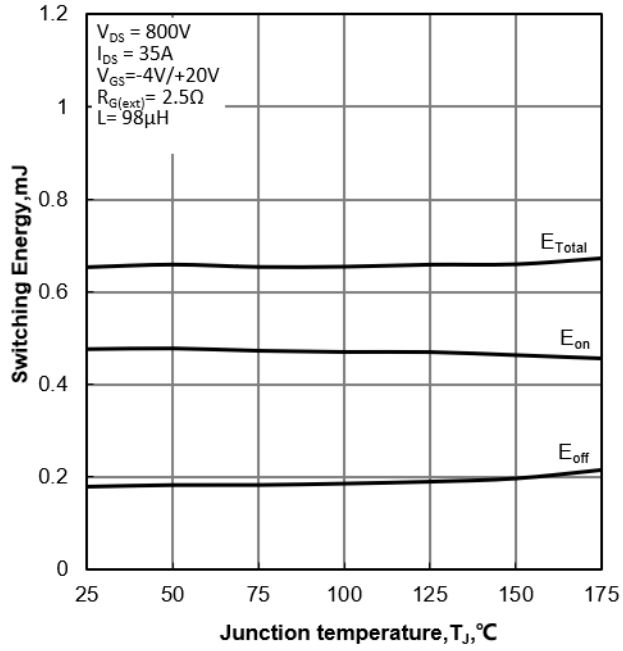
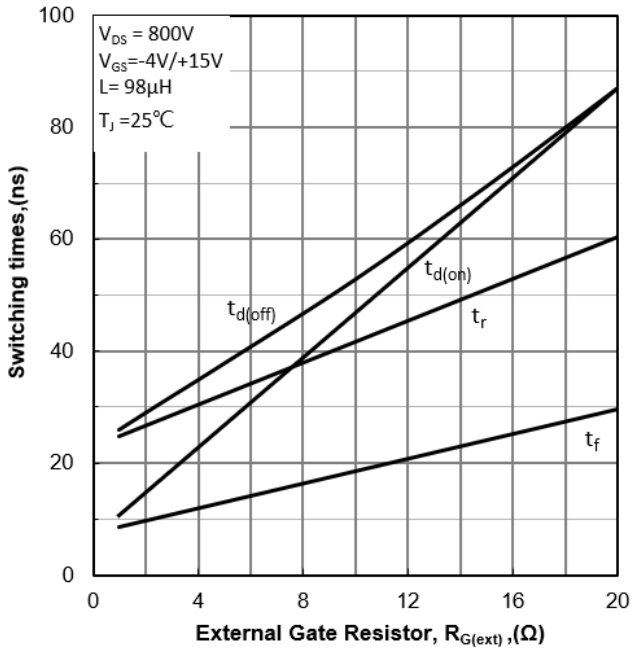


Figure 24 Switching Times vs. RG(ext)



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6. Test Circuit and Waveform

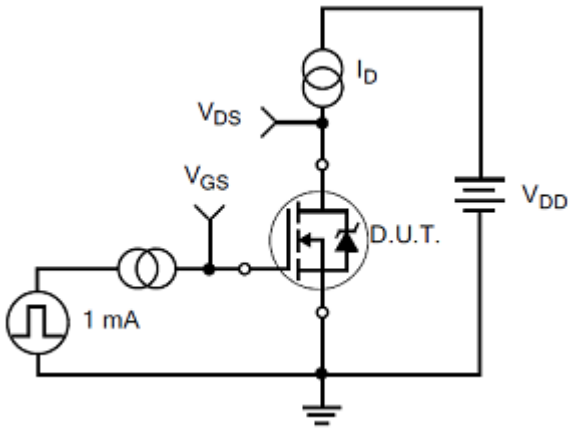
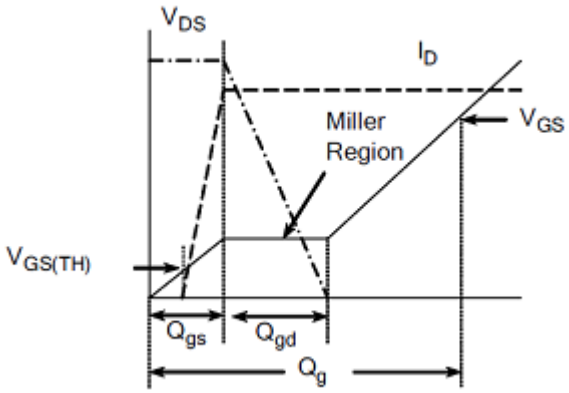
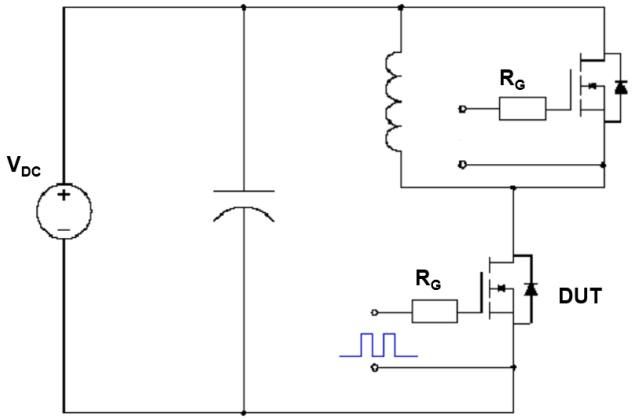
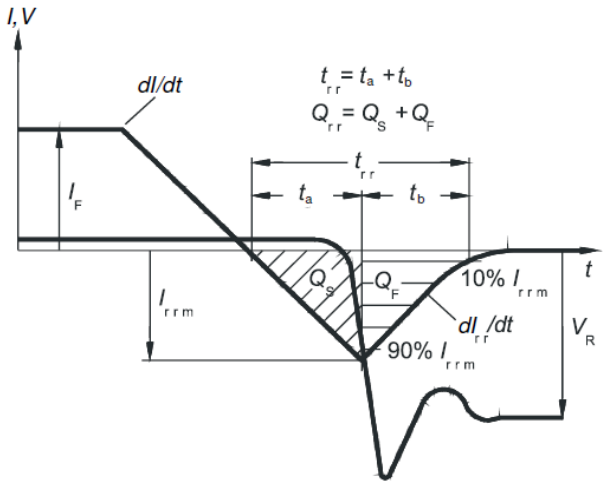
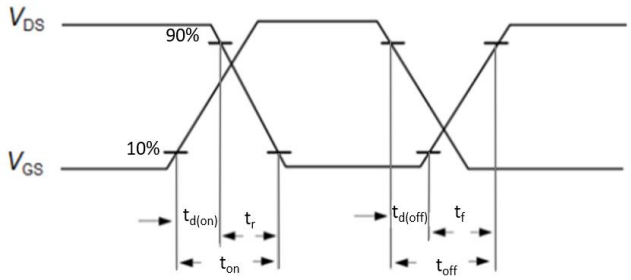
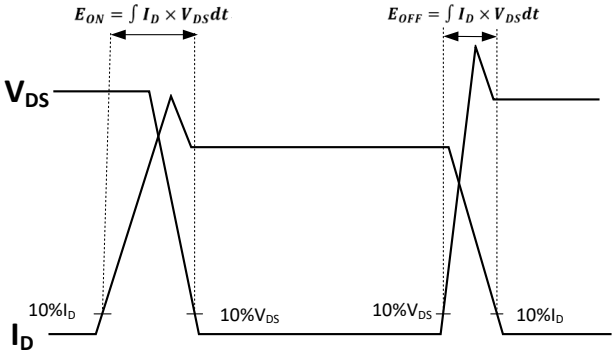
Figure 15 Gate Charge Test Circuit	Figure 16 Gate Charge Waveforms
	

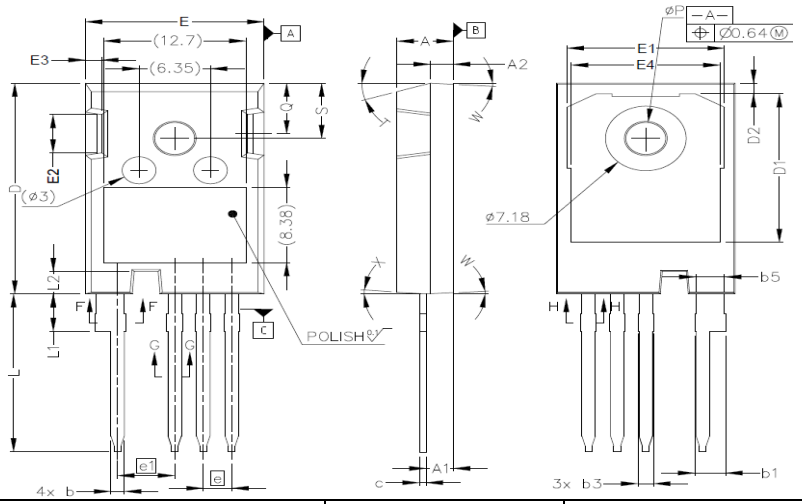
Figure 17 Inductive Switching Test Circuit	Figure 18 Diode Reverse Recovery Waveform
	

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Figure 19 Definition of switching times	Figure 20 Definition of switching losses
	

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7. Package Description



Items	Values(mm)		Items	Values(mm)	
	MIN	MAX		MIN	MAX
A	4.83	5.21	E4	12.38	13.43
A1	2.29	2.54	e	2.54 BSC	
A2	1.91	2.16	e1	5.08 BSC	
b’	1.07	1.28	N	4	
b	1.07	1.33	L	17.31	17.82
b1	2.39	2.94	L1	3.97	4.37
b2	2.39	2.84	L2	2.35	2.65
b3	1.07	1.60	Φ_P	3.51	3.65
b4	1.07	1.50	Q	5.49	6.00
b5	2.39	2.69	S	6.04	6.30
b6	2.39	2.64	T	17.5° REF	
c’	0.55	0.65	W	3.5° REF	
c	0.55	0.68	X	4° REF	
D	23.30	23.60			
D1	16.25	17.65			
D2	0.95	1.25			
E	19. 80	20.31			
E1	4.17	4.47			
E2	3.68	5.10			
E3	1.00	1.90			

TO-247-4L Package

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NOTE:

1. Exceeding the maximum ratings of the device in performance may cause damage to the device, even the permanent failure, which may affect the dependability of the machine. Please do not exceed the absolute maximum ratings of the device when circuit designing.
2. When installing the heat sink, please pay attention to the torsional moment and the smoothness of the heat sink.
3. MOSFETs is the device which is sensitive to the static electricity, it is necessary to protect the device from being damaged by the static electricity when using it.
4. Shanghai Belling reserves the right to make changes in this specification sheet and is subject to change without prior notice.

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