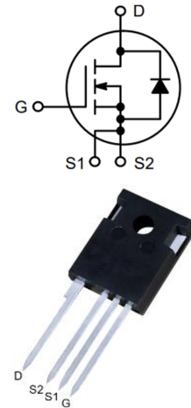
30mΩ, 1200V, Silicon Carbide N-Channel Power MOSFET

Description

The LXP SEMI LX2C030N120BY silicon carbide Power MOSFET device has been developed using LXP's advanced and innovative 2nd generation SiC MOSFET technology. The device features a very low $R_{DS(on)}$ over the entire temperature range combined with low capacitances and good switching performance, which improve application performance in frequency, energy efficiency, system size and weight reduction.

Key Features

- Typ. $R_{DS(on)}$ = 30mΩ @ V_{GS} = 18V
- High speed switching performances
- Low Switching Losses
- 100% Avalanche Tested
- EMI Improved Design
- Very fast and robust intrinsic body diode



TO-247-4

Applications

- DC/DC converter for EV/HEV
- On board charger (OBC)
- Solar Inverters
- Energy Storage Systems
- SMPS (Switch Mode Power Supplies)

Key performance

Parameter	Value	Unit
$V_{DS(T_j=25°C)}$	1200	V
$R_{DS(on), typ(T_j=25°C, I_D=30A, V_{GS}=18V)}$	30	mΩ
$I_{D(Tj=25°C)}$	72	A
$T_{j, max}$	175	ºC

Package Feature

Order code	Marking	Package	Packing
LX2C030N120BY	**LX2C030N120B**	**TO-247-4PIN**	**Tube**

1.Maximum Ratings (T_j=25°C unless otherwise specified)

Parameter		Symbol	Rating	Unit
Drain-Source Voltage		V_{DSS}	1200	V
Gate-Source Voltage		V_{GSS}	-10/+22	V
Gate-Source Voltage Recommended Operation Values		V_{GSS}	-5/+18	V
Gate-Source Transient Voltage (t_p < 1µs, t ≤ 10 hours)		V_{GSS}	-11/+25	V
Continuous Drain Current	T_C = 25ºC	I_D	72	A
	T_C = 100ºC		51	
Pulsed Drain Current (Note 2)		I_{DM}	236	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	220	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	21	A
Continuous Diode Forward Current		I_S	72	A
Power Dissipation		P_{tot}	455	W
Operating Temperature/ Storage Temperature		T_J	-55~175	ºC

Note:

1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. L = 1mH, I_{AS} = 21A, V_{DD} = 120V, V_{GS} = 18V, R_g = 25Ω, Starting T_J = 25°C

2.Thermal characteristics

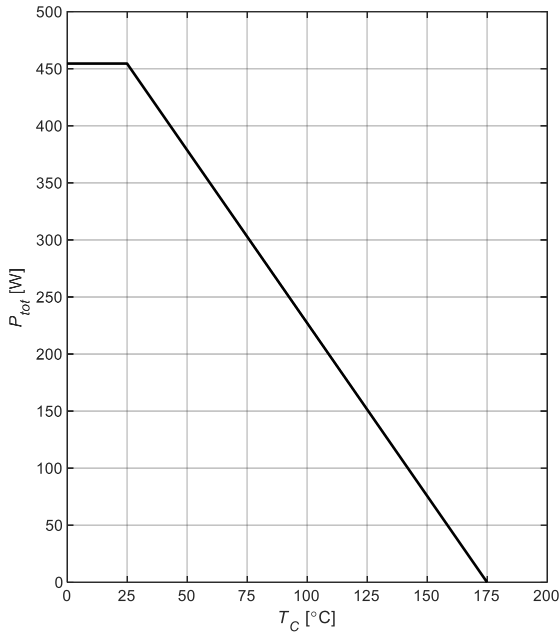
Parameter	Symbol	Value	Unit
Thermal resistance, junction-to-case	R_{thJC}	0.33	°C/W
Thermal resistance, junction-to-ambient	R_{thJA}	45	°C/W

3.Electrical Characteristics (T_j=25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Statistic Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0 V, I_D = 100 μA	1200	1600		V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 1200 V, V_{GS} = 0 V		1	10	μA
Gate-Source Leakage Current	I_{GSSF}	V_{GS} = 22 V, V_{DS} = 0 V			100	nA
	I_{GSSR}	V_{GS} = -10 V, V_{DS} = 0 V			-100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 10 mA	2.1	2.8	3.5	V
Static Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS} = 18 V, I_D = 30 A		30	40	mΩ
		V_{GS} = 18 V, I_D = 30 A, T_j =150 ºC		45		
		V_{GS} = 18 V, I_D = 30 A, T_j =175 ºC		50		
		V_{GS} = 15 V, I_D = 30 A		43	55	
		V_{GS} = 15 V, I_D = 30 A, T_j =150 ºC		55		
		V_{GS} = 15 V, I_D = 30 A, T_j =175 ºC		60		
Gate Resistance	R_G	f = 1 MHz，open drain		2		Ω
Dynamic Characteristics						
Input Capacitance	C_{ISS}	V_{GS} = 0 V V_{DS} = 800 V f = 1 MHz		3100		pF
Output Capacitance	C_{OSS}			170		
Reverse Transfer Capacitance	C_{RSS}			15		
Gate to Source Charge	Q_{gs}	V_{DS} = 800 V V_{GS} = -5 to 18 V I_D = 30 A		50		nC
Gate to Drain Charge	Q_{gd}			38		
Gate Charge Total	Q_g			150		
Switching Characteristic						
Turn-on delay time	$T_{d(on)}$	V_{DD} = 800 V, I_D = 30 A, R_G = 4.7 Ω, V_{GS} = -5/+18 V		15		ns
Rise time	T_r			22		
Turn-off delay time	$T_{d(off)}$			50		
Fall time	T_f			20		
Turn-on switching energy	E_{on}			340		μJ
Turn-off switching energy	E_{off}			150		
Reverse Diode Characteristics						
Diode Forward Voltage	V_{SD}	V_{GS} = -5 V, I_{SD} = 30 A		4.1		V
		V_{GS} = -5 V, I_{SD} = 30 A, Tj=175 ºC		3.6		
Reverse Recovery Time	t_{rr}	V_R = 800 V, I_F = 30 A, di/dt = 1000 A/μs		25		ns
Reverse Recovery Charge	Q_{rr}			120		nC
Peak Reverse Recovery Current	I_{rrm}			13		A

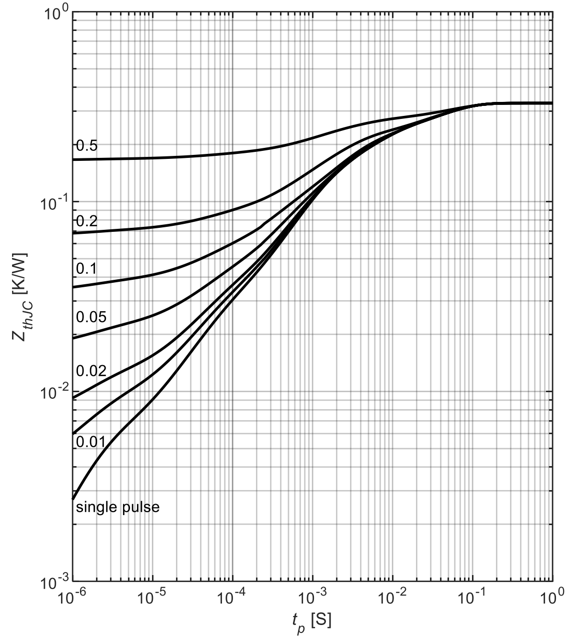
4.Electrical characteristic curves

Figure 1: Power dissipation



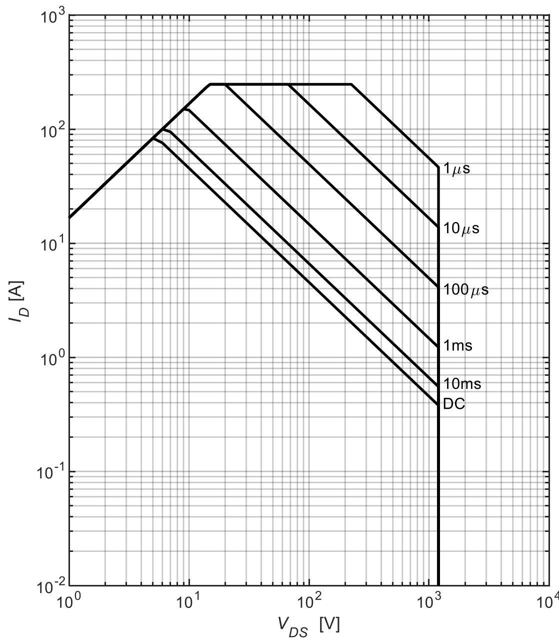
$P_{tot}=f(T_c)$

Figure 2: Transient thermal impedance



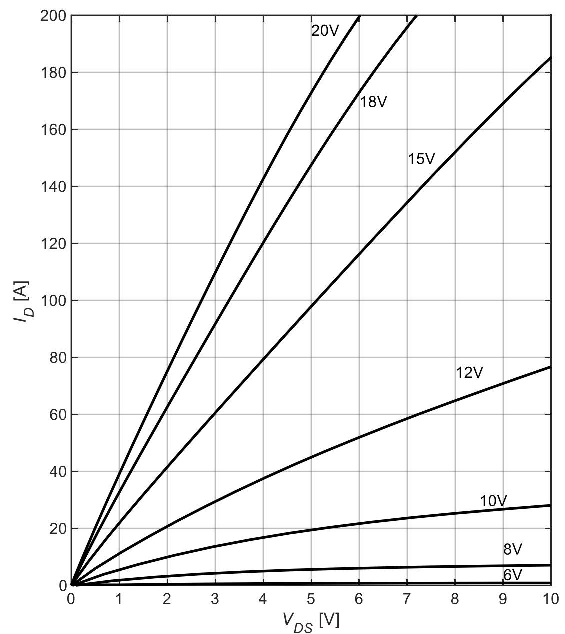
$Z_{(thJC)}=f(t_p)$; parameter: $D=t_p/T$

Figure 3: Safe operating area



$I_D=f(V_{DS})$; $T_c=25℃$; $V_{GS}>7.5V$; parameter t_p

Figure 4: Typ. output characteristics



$I_D=f(V_{DS})$; $T_j=-55℃$; parameter: V_{GS}

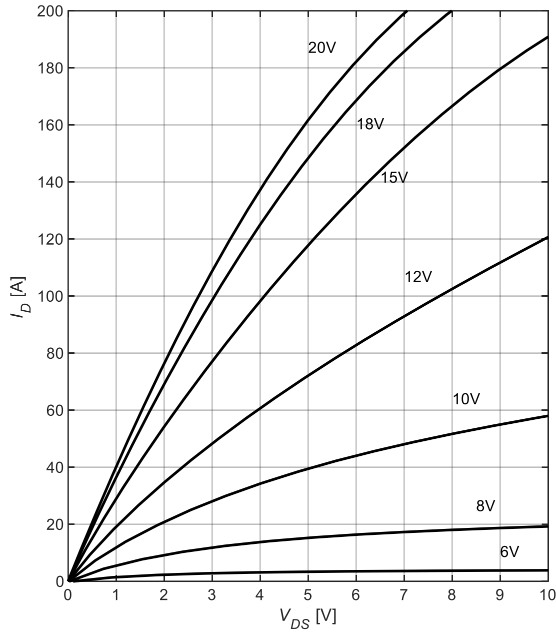
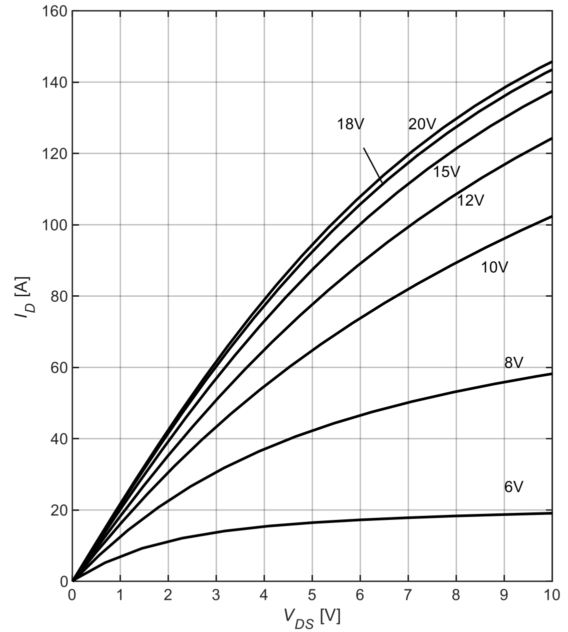
Figure 5: Typ. output characteristics	Figure 6: Typ. output characteristics
	
$I_D=f(V_{DS})$; $T_j=25℃$; parameter: V_{GS}	$I_D=f(V_{DS})$; $T_j=175℃$; parameter: V_{GS}

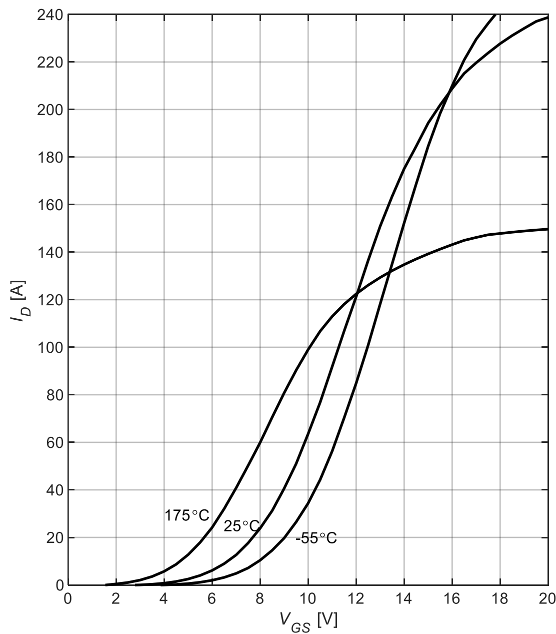
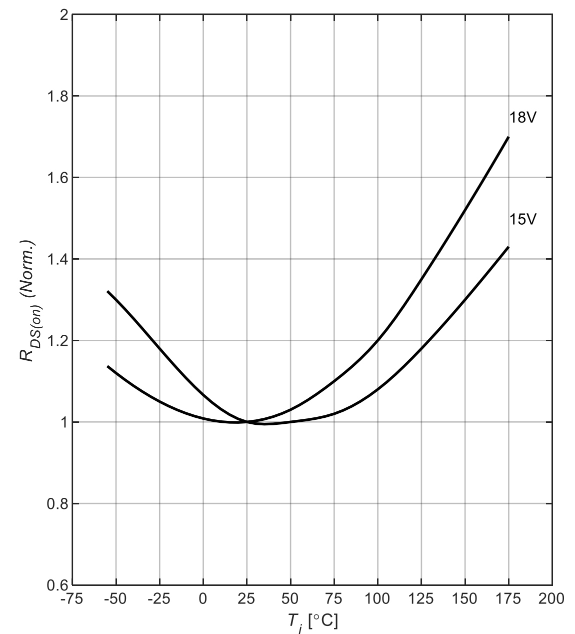
Figure 7: Typ. transfer characteristics	Figure 8: Norm. Drain-Source On-State Resistance
	
$I_D=f(V_{GS})$; $V_{DS}=10V$; parameter: T_j	$R_{DS(on)}=f(T_j)$; $I_D=30A$; parameter: V_{GS}

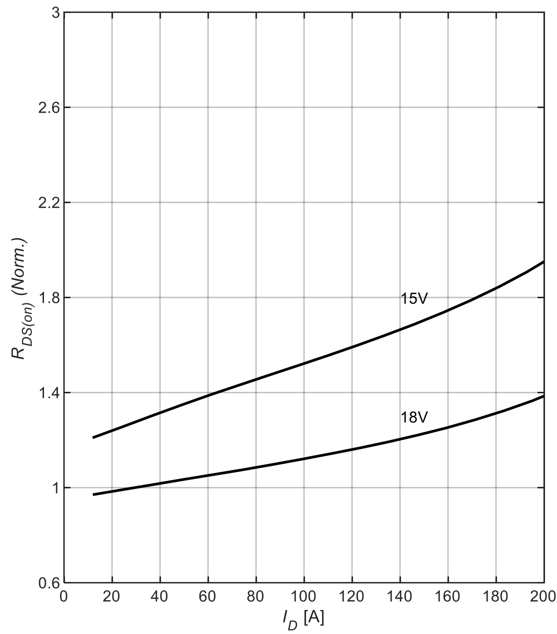
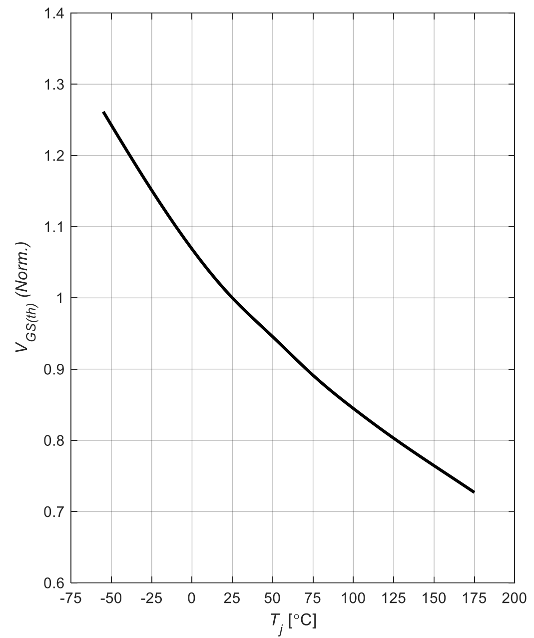
Figure 9: Norm. Drain-Source On-State Resistance	Figure 10: Norm. gate threshold voltage
	
$R_{DS(on)}$=f(I_D); T_j=25℃; parameter: V_{GS}	$V_{GS(th)}$=f(T_j); V_{DS}=V_{GS}, I_D =10mA

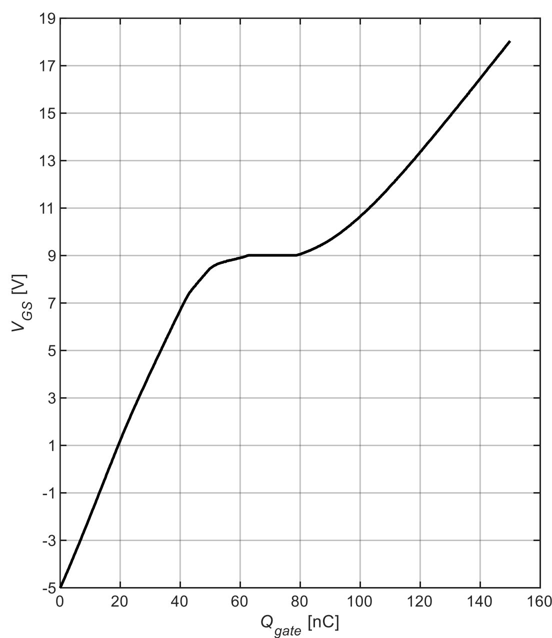
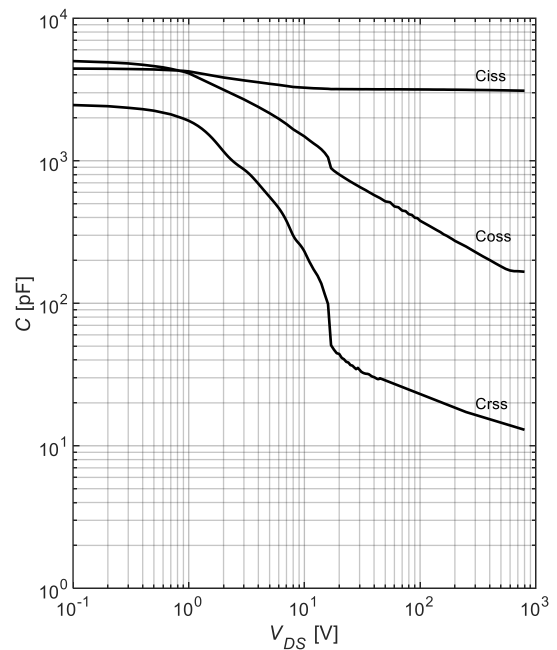
Figure 11: Typ. gate charge	Figure 12: Typ. capacitances
	
V_{GS}=f(Q_{gate}), V_{DS}=800V, I_D=30A pulsed	C=f(V_{DS}); V_{GS}=0; f=1MHz

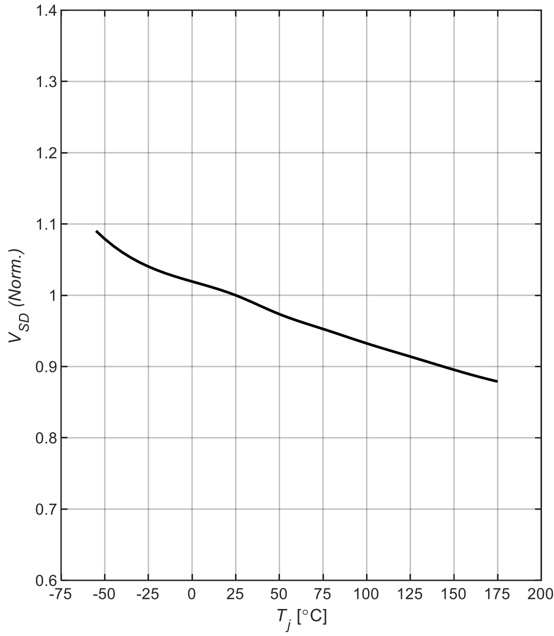
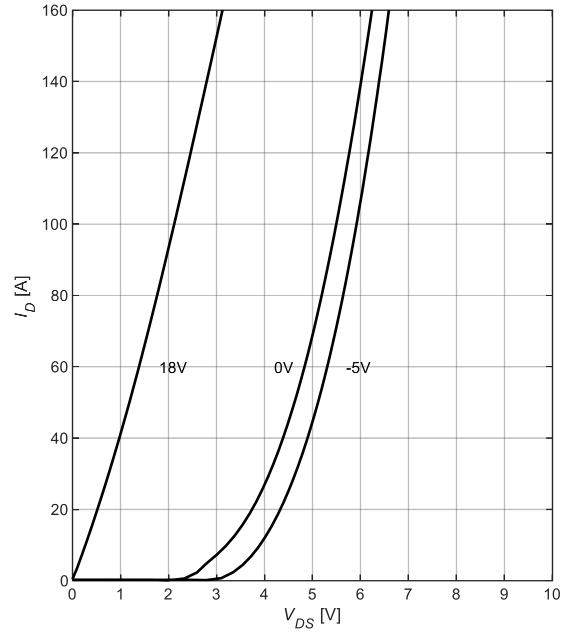
Figure 13: Norm. reverse diode forward voltage	Figure 14: Typ. reverse conduction characteristics
	
V_{SD}=f(T_j); I_{SD}=30A; V_{GS}=-5V	I_{SD}=f(V_{SD}); T_j=-55℃; parameter: V_{GS}

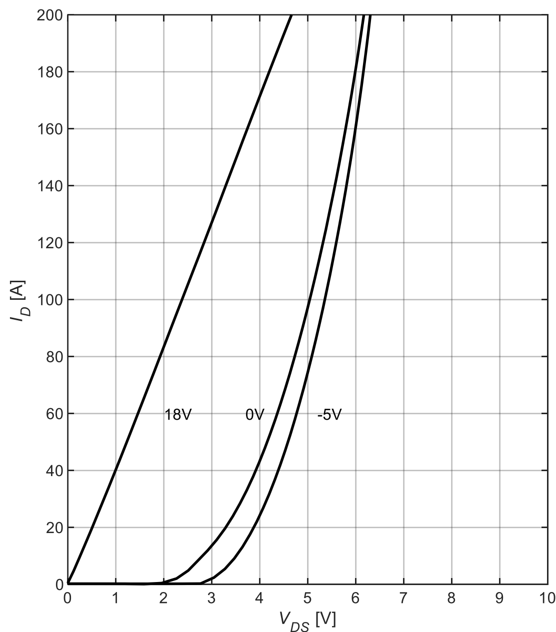
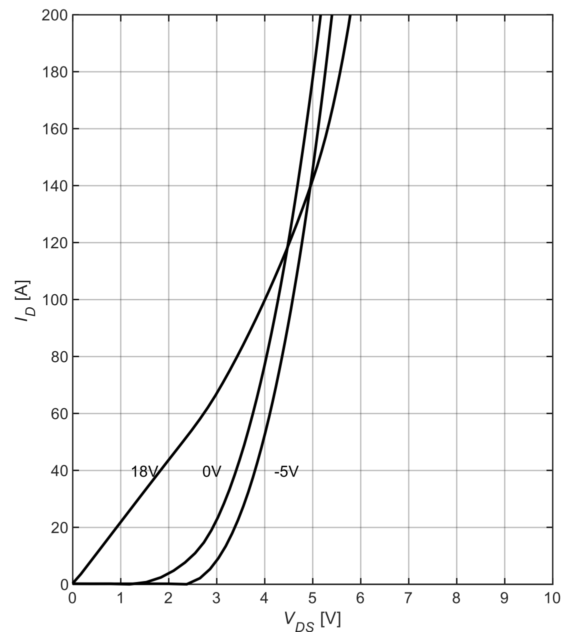
Figure 15: Typ. reverse conduction characteristics	Figure 16: Typ. reverse conduction characteristics
	
I_{SD}=f(V_{SD}); T_j=25℃; parameter: V_{GS}	I_{SD}=f(V_{SD}); T_j=175℃; parameter: V_{GS}

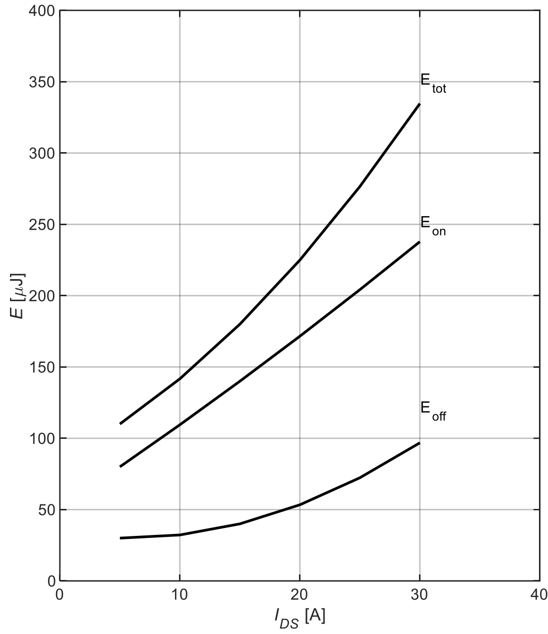
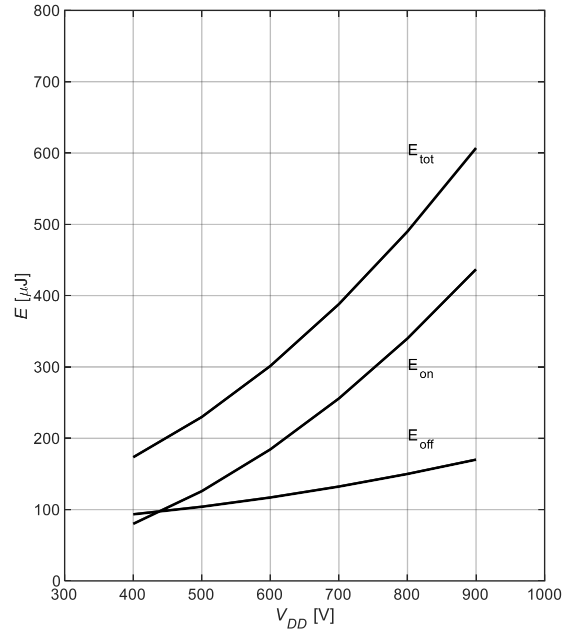
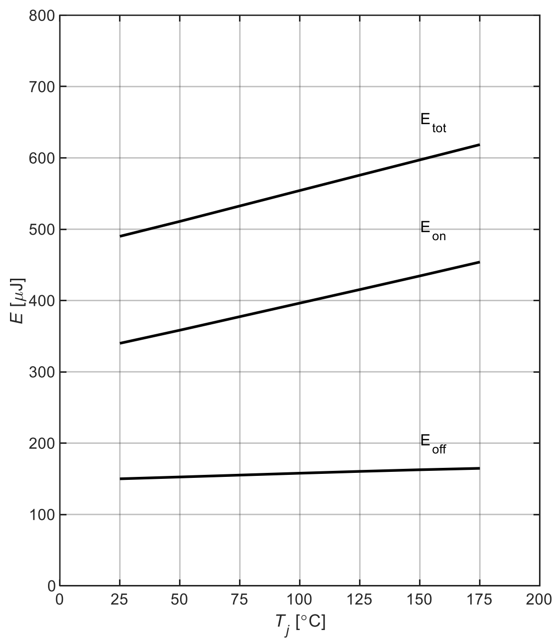
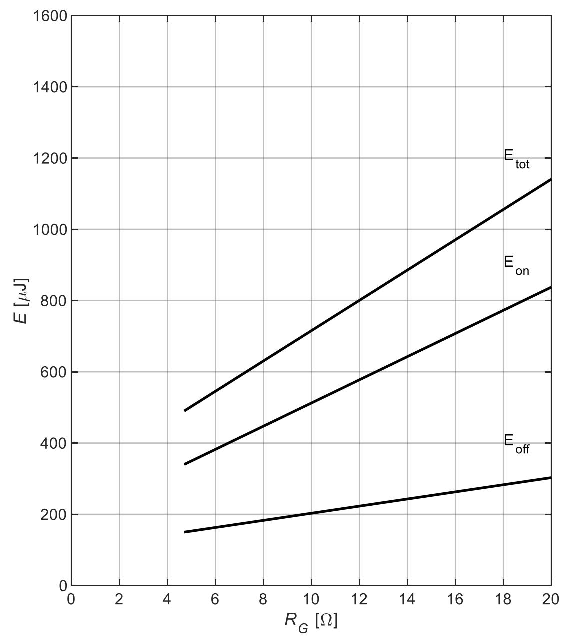
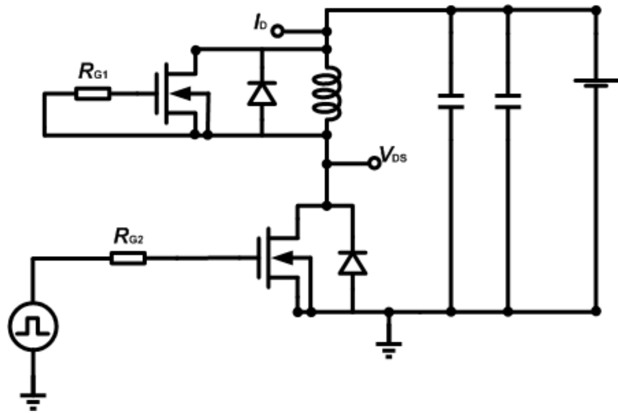
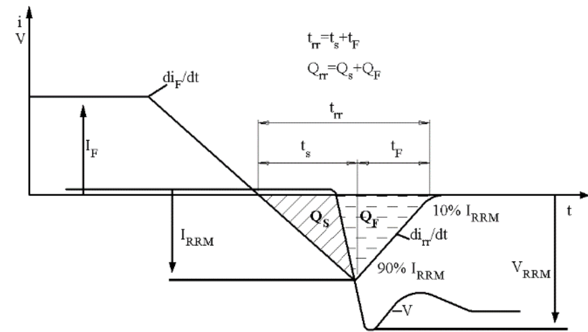
Figure 17: Typ. switching energy losses	Figure 18: Typ. switching energy losses
	
E=f(I_{DS}); V_{DD}=800V; V_{GS}=-5/+18V; R_G =4.7Ω; T_j= 25°C	E=f(V_{DD}); V_{GS}=-5/+18V; R_G =4.7Ω; I_D=30A

Figure 19: Typ. switching energy losses	Figure 20: Typ. switching energy losses
	
E=f(T_j); V_{DD}=800V; V_{GS}=-5/+18V; R_G =4.7Ω; I_D=30A	E=f(R_G); V_{DD}=800V; V_{GS}=-5/+18V; I_D=30A

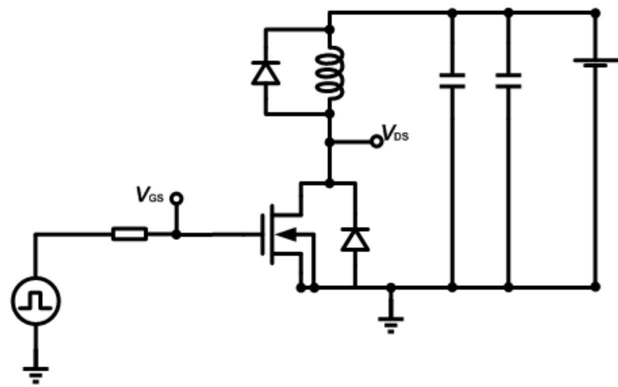
5.Test Circuits

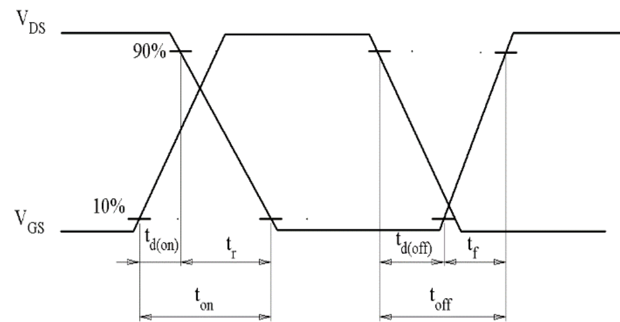
1) Test circuit and waveform for diode characteristics



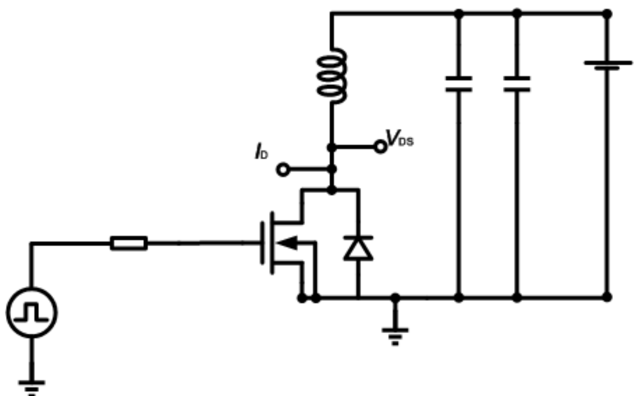


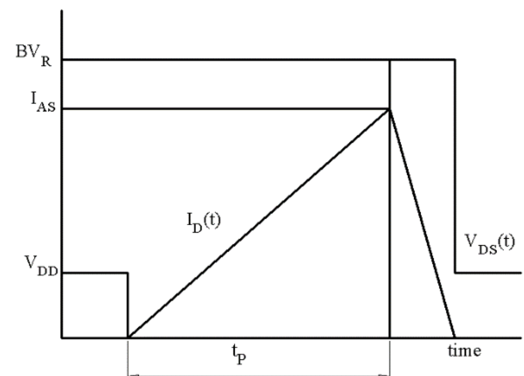
2) Switch time test circuit



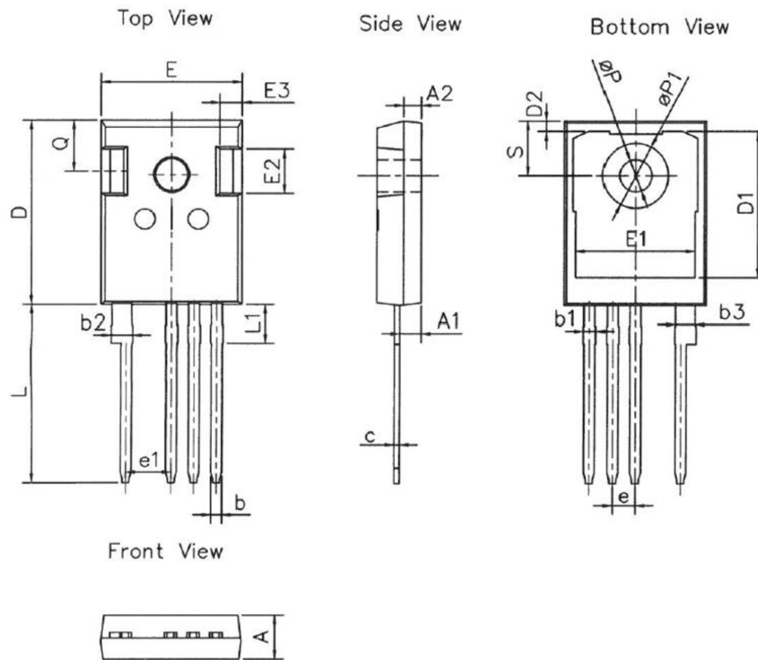


3) Unclaimed inductive switching test circuit & waveforms





6.Package outline dimensions



Dimension unit:[mm]			
SYMBOL	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b1	1.11	1.37	1.57
b2	2.24	2.40	2.60
b3	2.11	2.21	2.36
c	0.51	0.60	0.75
D	20.70	20.90	21.30
D1	15.92	16.22	16.52
D2	1.00	1.20	1.35
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	2.54 BSC		
e1	5.08 BSC		
L	19.62	19.92	20.22
L1	–	–	4.30
øP	3.40	3.60	3.80
øP1	–	–	7.30
Q	5.40	5.80	6.20
S	6.20 BSC		

7.Revision History

Revision	Description	Date
1.0	Initial version	2023/12/15

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