

60mΩ, 1200V, Silicon Carbide N-Channel Power MOSFET

Description

The LXP SEMI LX2C060N120BY 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. $R_{DS(on)} = 60m\Omega @ V_{GS} = 18V$
- 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
$V_{DS}(T_J=25^\circ C)$	1200	V
$R_{DS(on)}$, typ($T_J=25^\circ C$, $I_D=15A$, $V_{GS}=18V$)	60	mΩ
$I_D(T_J=25^\circ C)$	35	A
$T_{j, max}$	175	°C

Package Feature

Order code	Marking	Package	Packing
LX2C060N120BY	LX2C060N120B	TO-247-4PIN	Tube



1. Maximum Ratings ($T_J=25^{\circ}\text{C}$ 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 ($t_p < 1\mu\text{s}$, $t \leq 10$ hours)		V_{GSS}	-11/+25	V
Continuous Drain Current	$T_C = 25^{\circ}\text{C}$	I_D	35	A
	$T_C = 100^{\circ}\text{C}$		25	
Pulsed Drain Current (Note 2)		I_{DM}	115	A
Avalanche Energy, Single Pulse (Note 3)		E_{AS}	200	mJ
Avalanche Current, Repetitive (Note 2)		I_{AR}	20	A
Continuous Diode Forward Current		I_S	35	A
Power Dissipation		P_{tot}	217	W
Operating Temperature/ Storage Temperature		T_J	-55~175	$^{\circ}\text{C}$

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. $L = 1\text{mH}$, $I_{AS} = 20\text{A}$, $V_{DD} = 120\text{V}$, $V_{GS} = 18\text{V}$, $R_g = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$

2. Thermal characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-to-case	R_{thJC}	0.69	$^{\circ}\text{C/W}$
Thermal resistance, junction-to-ambient	R_{thJA}	48	$^{\circ}\text{C/W}$



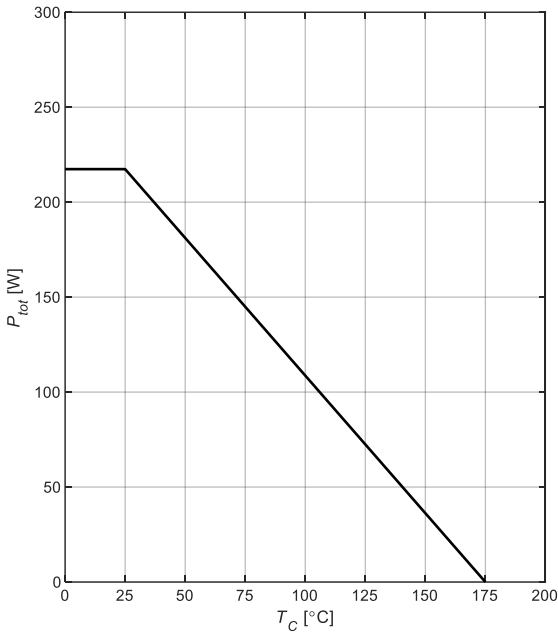
3.Electrical Characteristics ($T_j=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Statistic Characteristics							
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	1200	1600		V	
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$		1	10	μA	
Gate-Source Leakage Current	I_{GSSF}	$V_{GS} = 22\text{ V}, V_{DS} = 0\text{ V}$			100	nA	
	I_{GSSR}	$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	nA	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 5\text{ mA}$	2.1	2.8	3.5	V	
Static Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS} = 18\text{ V}, I_D = 15\text{ A}$		60	80	m Ω	
		$V_{GS} = 18\text{ V}, I_D = 15\text{ A}, T_j = 150^{\circ}\text{C}$		90			
		$V_{GS} = 18\text{ V}, I_D = 15\text{ A}, T_j = 175^{\circ}\text{C}$		100			
		$V_{GS} = 15\text{ V}, I_D = 15\text{ A}$		85	110		
		$V_{GS} = 15\text{ V}, I_D = 15\text{ A}, T_j = 150^{\circ}\text{C}$		110			
		$V_{GS} = 15\text{ V}, I_D = 15\text{ A}, T_j = 175^{\circ}\text{C}$		120			
Gate Resistance	R_G	$f = 1\text{ MHz}, \text{ open drain}$		2		Ω	
Dynamic Characteristics							
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}$		1500		pF	
Output Capacitance	C_{OSS}	$V_{DS} = 800\text{ V}$		80			
Reverse Transfer Capacitance	C_{RSS}	$f = 1\text{ MHz}$		7			
Gate to Source Charge	Q_{gs}	$V_{DS} = 800\text{ V}$		24		nC	
Gate to Drain Charge	Q_{gd}	$V_{GS} = -5\text{ to }18\text{ V}$		19			
Gate Charge Total	Q_g	$I_D = 15\text{ A}$		73			
Switching Characteristic							
Turn-on delay time	$T_{d(on)}$	$V_{DD} = 800\text{ V}, I_D = 15\text{ A},$ $R_G = 4.7\ \Omega, V_{GS} = -5/+18\text{ V}$		9		ns	
Rise time	T_r			19			
Turn-off delay time	$T_{d(off)}$			32			
Fall time	T_f			18			
Turn-on switching energy	E_{on}				140		μJ
Turn-off switching energy	E_{off}				40		
Reverse Diode Characteristics							
Diode Forward Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 15\text{ A}$		4.1		V	
		$V_{GS} = -5\text{ V}, I_{SD} = 15\text{ A}, T_j = 175^{\circ}\text{C}$		3.6			
Reverse Recovery Time	t_{rr}	$V_R = 800\text{ V}, I_F = 15\text{ A},$ $di/dt = 1000\text{ A}/\mu\text{s}$		17		ns	
Reverse Recovery Charge	Q_{rr}			65		nC	
Peak Reverse Recovery Current	I_{rrm}			10		A	



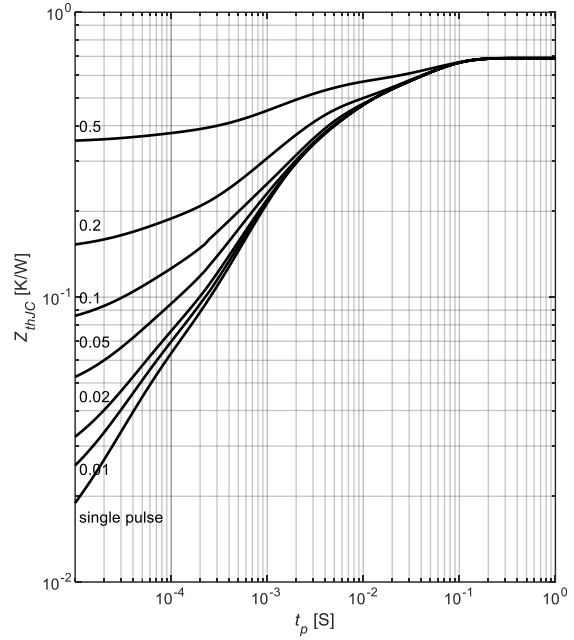
4. Electrical characteristic curves

Figure 1: Power dissipation



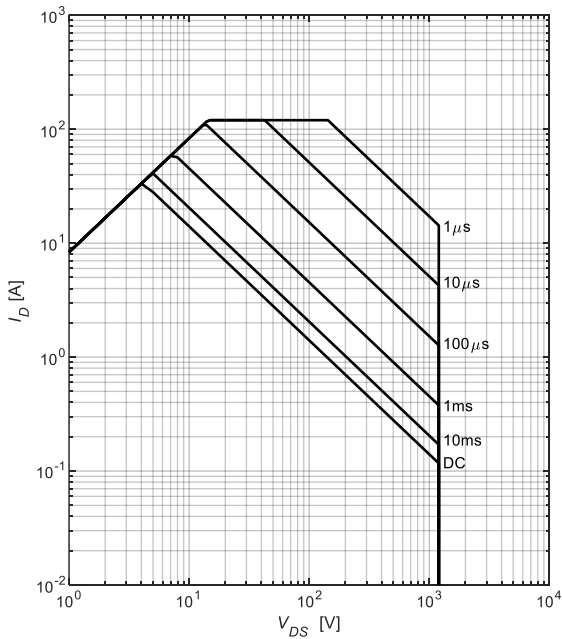
$P_{tot}=f(T_c)$

Figure 2: Transient thermal impedance



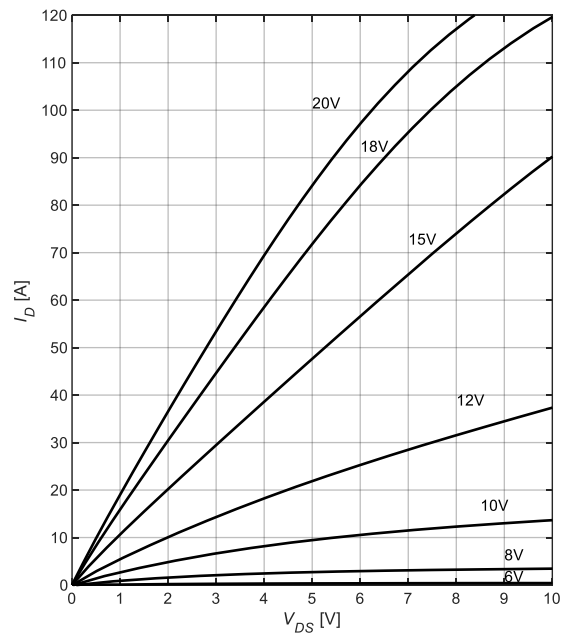
$Z_{(thjC)}=f(t_p)$; parameter: $D=t_p/T$

Figure 3: Safe operating area



$I_D=f(V_{DS})$; $T_c=25^\circ C$; $V_{GS}>7.5V$; parameter t_p

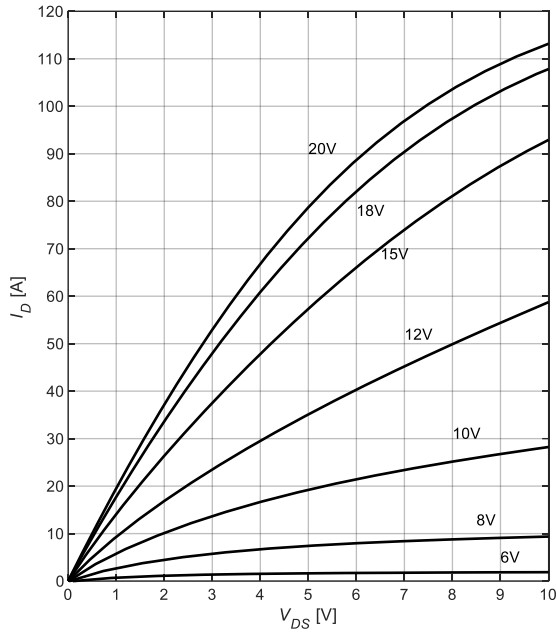
Figure 4: Typ. output characteristics



$I_D=f(V_{DS})$; $T_j=-55^\circ C$; parameter: V_{GS}

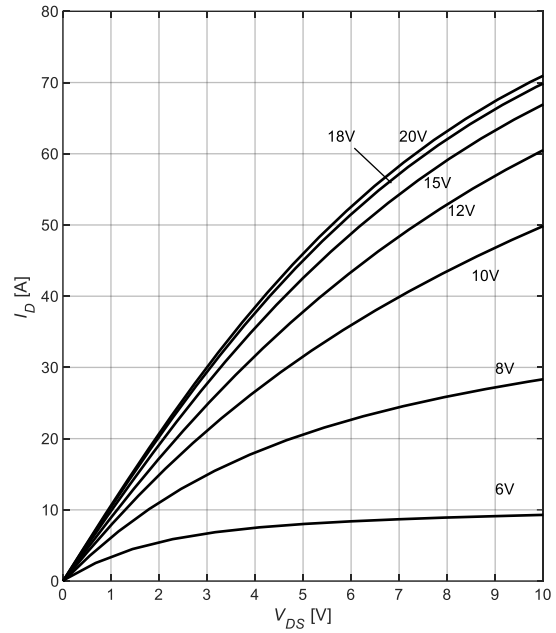


Figure 5: Typ. output characteristics



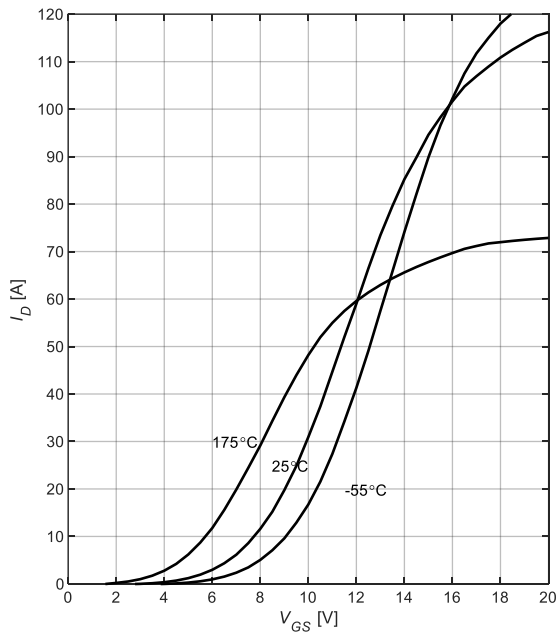
$I_D=f(V_{DS}); T_j=25^{\circ}\text{C}; \text{parameter: } V_{GS}$

Figure 6: Typ. output characteristics



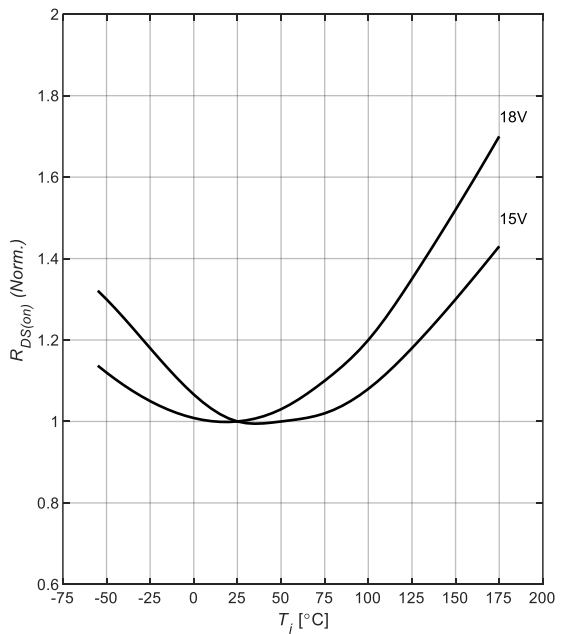
$I_D=f(V_{DS}); T_j=175^{\circ}\text{C}; \text{parameter: } V_{GS}$

Figure 7: Typ. transfer characteristics



$I_D=f(V_{GS}); V_{DS}=10\text{V}; \text{parameter: } T_j$

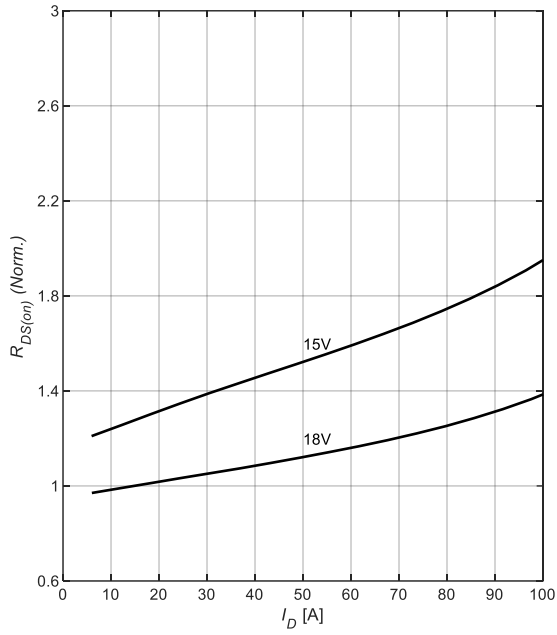
Figure 8: Norm. Drain-Source On-State Resistance



$R_{DS(on)}=f(T_j); I_D=15\text{A}; \text{parameter: } V_{GS}$

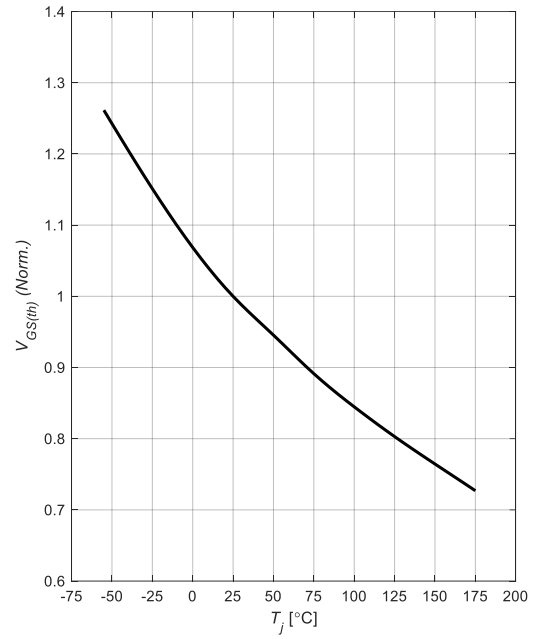


Figure 9: Norm. Drain-Source On-State Resistance



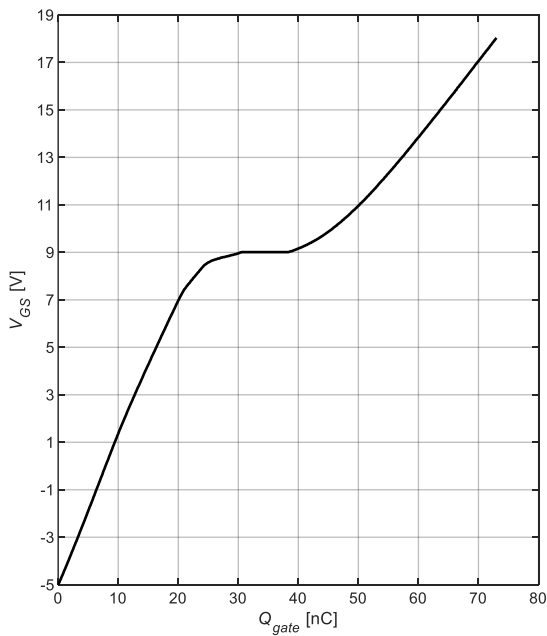
$R_{DS(on)}=f(I_D)$; $T_j=25^\circ\text{C}$; parameter: V_{GS}

Figure 10: Norm. gate threshold voltage



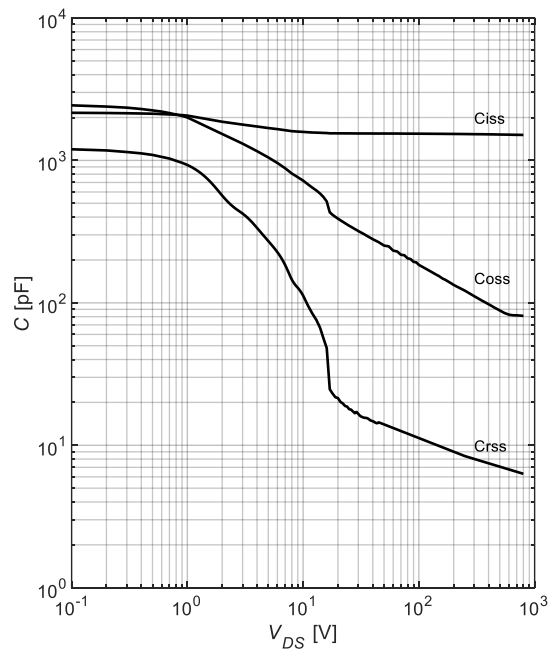
$V_{GS(th)}=f(T_j)$; $V_{DS}=V_{GS}$, $I_D=5\text{mA}$

Figure 11: Typ. gate charge



$V_{GS}=f(Q_{gate})$, $V_{DS}=800\text{V}$, $I_D=15\text{A}$ pulsed

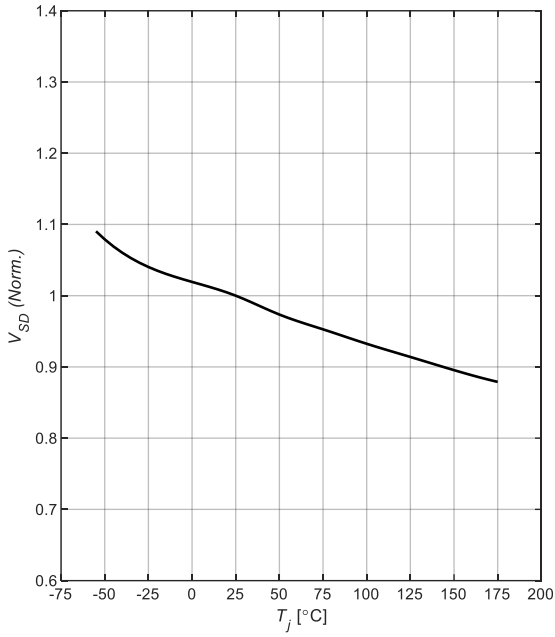
Figure 12: Typ. capacitances



$C=f(V_{DS})$; $V_{GS}=0$; $f=1\text{MHz}$

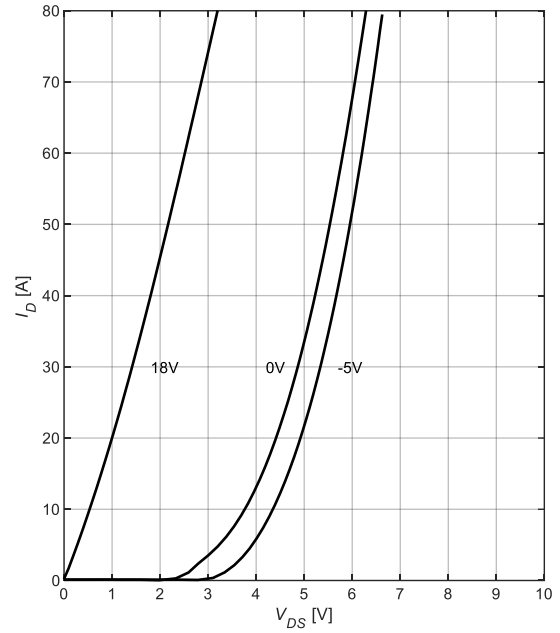


Figure 13: Norm. reverse diode forward voltage



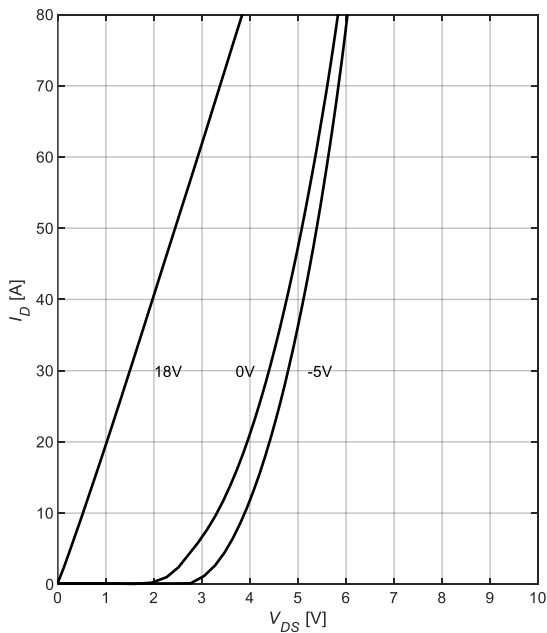
$V_{SD}=f(T_j)$; $I_{SD}=15A$; $V_{GS}=-5V$

Figure 14: Typ. reverse conduction characteristics



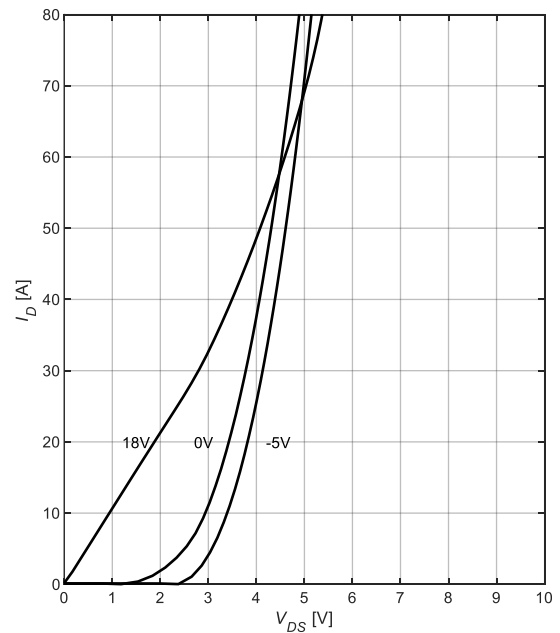
$I_{SD}=f(V_{SD})$; $T_j=-55^\circ\text{C}$; parameter: V_{GS}

Figure 15: Typ. reverse conduction characteristics



$I_{SD}=f(V_{SD})$; $T_j=25^\circ\text{C}$; parameter: V_{GS}

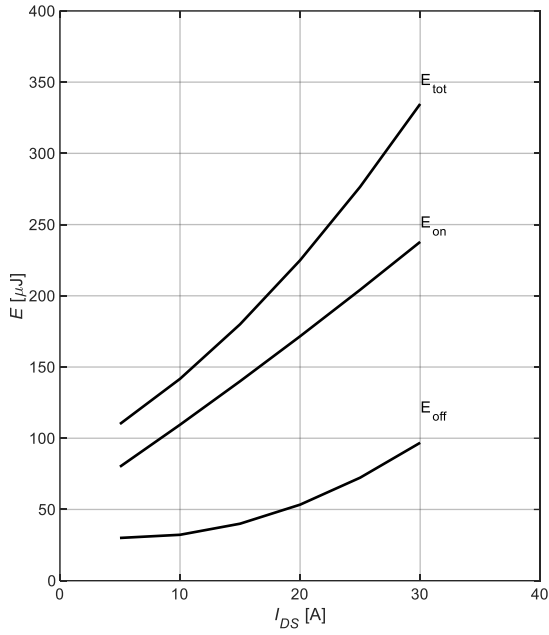
Figure 16: Typ. reverse conduction characteristics



$I_{SD}=f(V_{SD})$; $T_j=175^\circ\text{C}$; parameter: V_{GS}

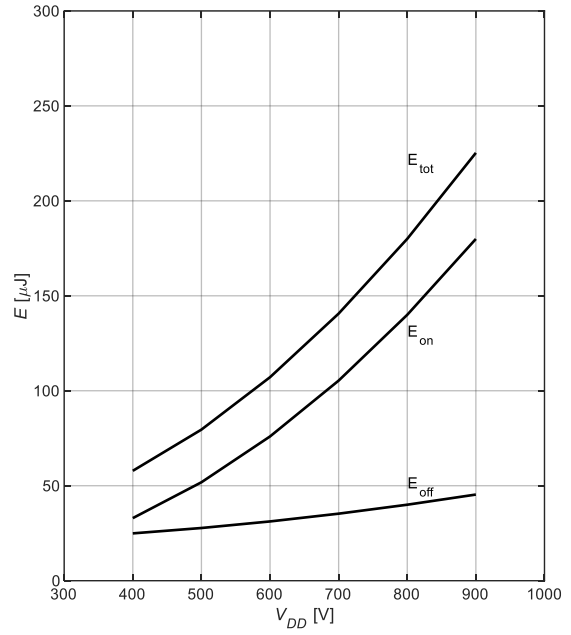


Figure 17: Typ. switching energy losses



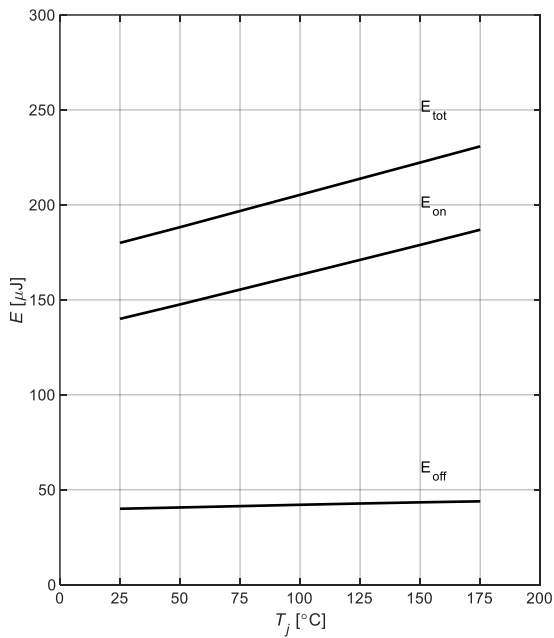
$E=f(I_{DS}); V_{DD}=800V; V_{GS}=-5/+18V; R_G=4.7\Omega; T_j=25^\circ C$

Figure 18: Typ. switching energy losses



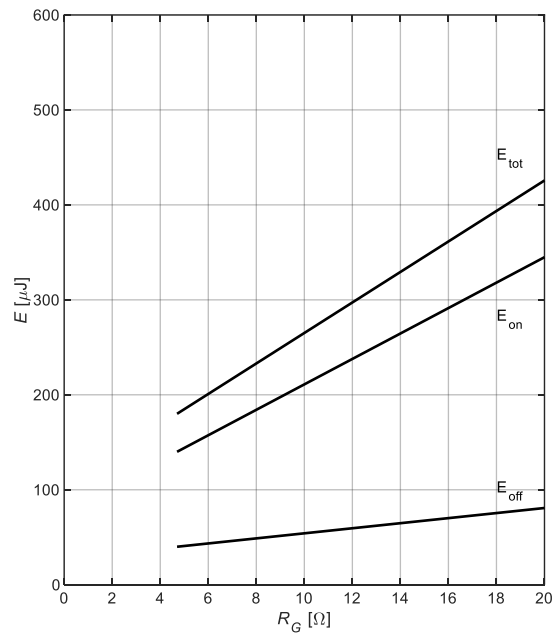
$E=f(V_{DD}); V_{GS}=-5/+18V; R_G=4.7\Omega; I_D=15A$

Figure 19: Typ. switching energy losses



$E=f(T_j); V_{DD}=800V; V_{GS}=-5/+18V; R_G=4.7\Omega; I_D=15A$

Figure 20: Typ. switching energy losses

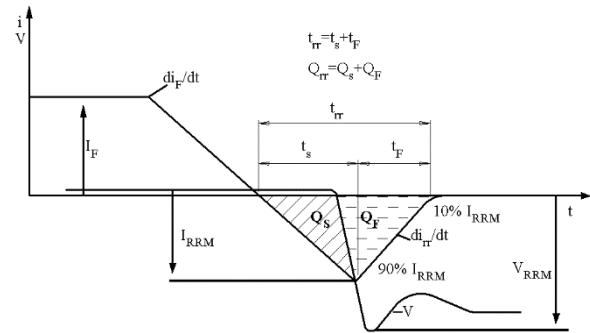
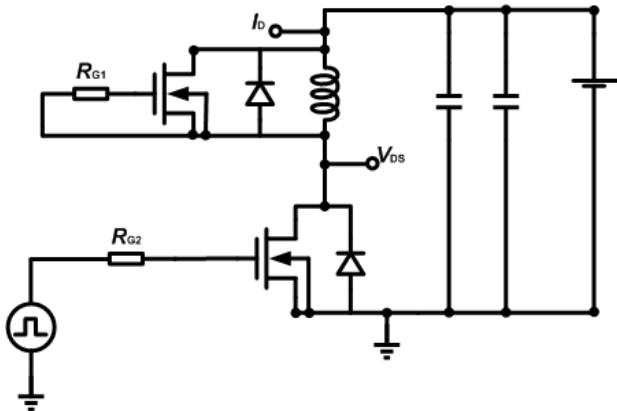


$E=f(R_G); V_{DD}=800V; V_{GS}=-5/+18V; I_D=15A$

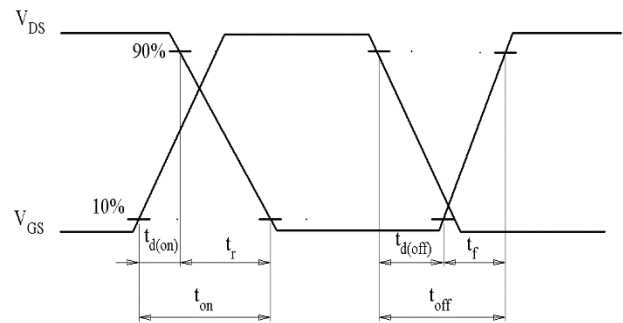
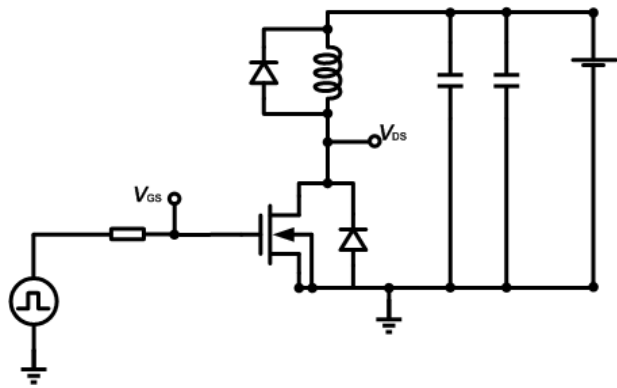


5. Test Circuits

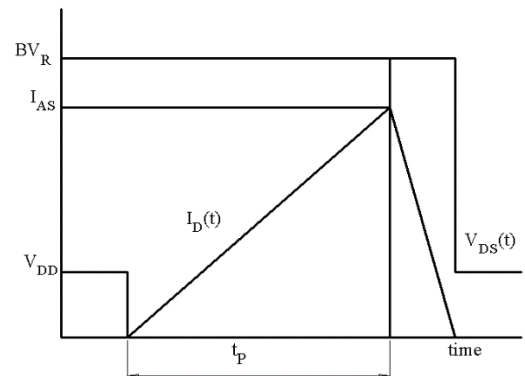
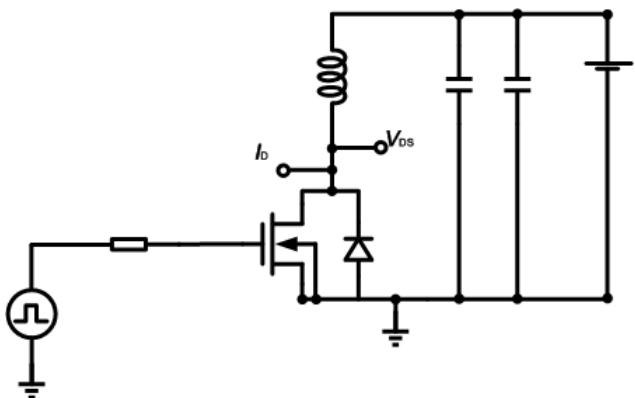
1) Test circuit and waveform for diode characteristics



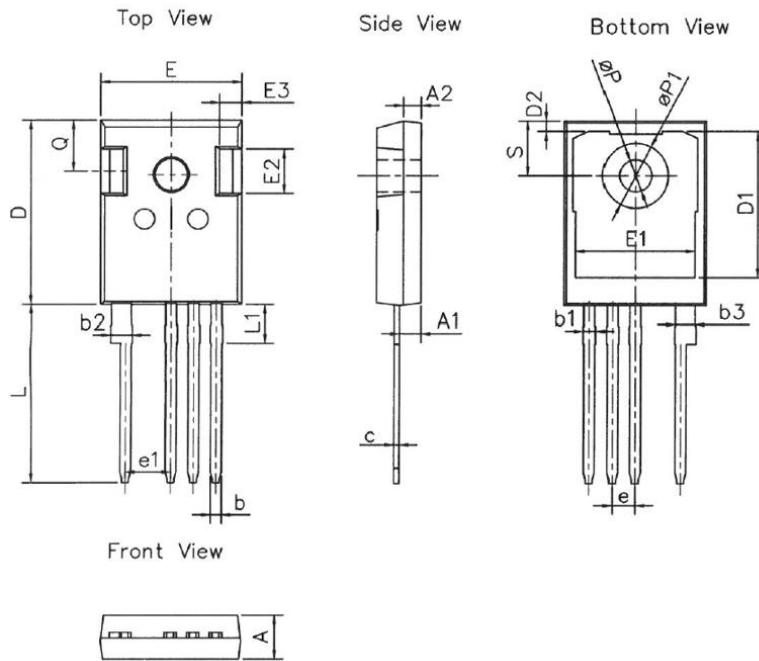
2) Switch time test circuit



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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