BCW120N21M1

N-Channel Silicon Carbide Power MOSFET

1200 V, 100 A, 21 mΩ

bestirpower

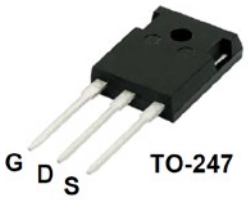
Features

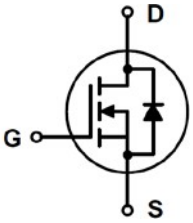
- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant

$BV_{DSS,Tc=25℃}$	$I_{D,Tc=25℃}$	$R_{DS(on),typ}$	$Q_{g,typ}$
1200 V	**100 A**	**21 mΩ**	**209 nC**

Benefits

- System efficiency improvement
- Higher frequency applicability
- Increased power density
- Reduced cooling effort





Applications

- Solar inverter
- EV charging station
- UPS
- Industrial power supply

RoHS compliant

HF

Absolute Maximum Ratings (T_C = 25℃ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		1200	V
V_{GS}	Gate to Source Voltage(DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		-5 / +18	V
I_D	Drain Current	Continuous (V_{GS}=18V, T_C = 25℃)	100	A
		Continuous (V_{GS}=18V, T_C = 100℃)	71	
I_{DM}	Drain Current	Pulsed (Note1)	267	A
P_D	Power Dissipation	(T_C = 25℃)	468	W
		Derate Above 25℃	3.1	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	℃
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds		260	℃

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.32	℃/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCW120N21M1	BCW120N21M1	TO247-3	Tube	30 units

Electrical Characteristics (TC = 25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 1200 V, V_{GS} = 0 V		1.7	100	μA
		V_{DS} = 1200 V, V_{GS} = 0 V, T_J = 175℃		2.4		
I_{GSS}	Gate-Source Leakage Current	V_{GS} = +22 V, V_{DS} = 0 V			+100	nA
		V_{GS} = -10 V, V_{DS} = 0 V			-100	
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 10 mA	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 18 V, I_D = 50 A		18.8		mΩ
		V_{GS} = 18 V, I_D = 50 A, T_J = 175℃		31.6		
		V_{GS} = 15 V, I_D = 50 A		24		
		V_{GS} = 15 V, I_D = 50 A, T_J = 150℃		28.4		
		V_{GS} = 15 V, I_D = 50 A, T_J = 175℃		34		
		V_{GS} = 18 V, I_D = 60A		19		
		V_{GS} = 18 V, I_D = 62A, T_J = 150℃		29		
		V_{GS} = 18 V, I_D = 62A, T_J = 175℃		32.2		
g_{fs}	Transconductance	V_{DS} = 20 V, I_D = 50 A		24.4		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 800 V, V_{GS} = 0V, f = 250 kHz		3683		pF
C_{oss}	Output Capacitance			225		
C_{rss}	Reverse Capacitance			26		
E_{oss}	Stored Energy in Output Capacitance	V_{DS} = 0 V to 800 V, V_{GS} = 0 V		47		μJ
$C_{o(er)}$	Energy Related Output Capacitance			146		pF
$C_{o(tr)}$	Time Related Output Capacitance			446		
$Q_{g(tot)}$	Total Gate Charge	V_{DS} = 800 V, I_D = 50 A, V_{GS} = -5 V / 18 V		209		nC
Q_{gs}	Gate to Source Charge			52		
Q_{gd}	Gate to Drain “Miller” Charge			80		
R_G	Internal Gate Resistance	f = 1MHz, V_{AC}=25mV		2.7		Ω

Electrical Characteristics (T_C = 25℃ unless otherwisenoted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DS} = 800 V, I_D = 50 A, V_{GS} = -5 V / 18 V, R_G = 2.5 Ω , FWD : BCH120S020D1, Inductive load		46		ns
t_r	Turn-On Rise Time			19		
$t_{d(off)}$	Turn-Off Delay Time			55		
t_f	Turn-Off Fall Time			12		
E_{on}	Turn-on Switching Energy			1230		µJ
E_{off}	Turn-off Switching Energy			302		
E_{tot}	Total Switching Energy			1532		
Source-Drain Diode Characteristics						
I_S	Maximum Continuous Diode Forward Current				100	A
I_{SM}	Maximum Pulsed Diode Forward Current				250	
V_{SD}	Diode Forward Voltage	V_{GS} = -5 V, I_{SD} = 50 A		4		V
t_{rr}	Reverse Recovery Time	V_{DD} = 800 V, I_{SD} = 50 A, dI_F/dt = 1000 A/µs		60		ns
Q_{rr}	Reverse Recovery Charge			404		nC

Typical Performance Characteristics

Figure 1. On-Region Characteristics T_J = -40℃

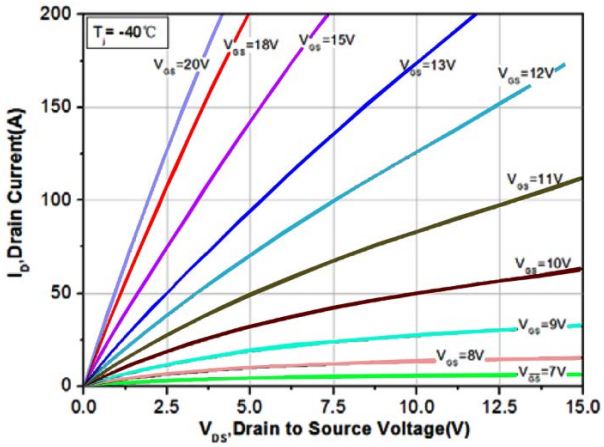


Figure 2. On-Region Characteristics T_J = 25℃

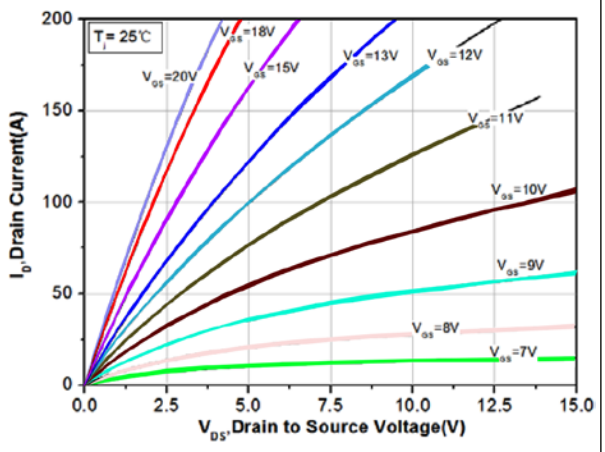


Figure 3. On-Region Characteristics T_J = 175℃

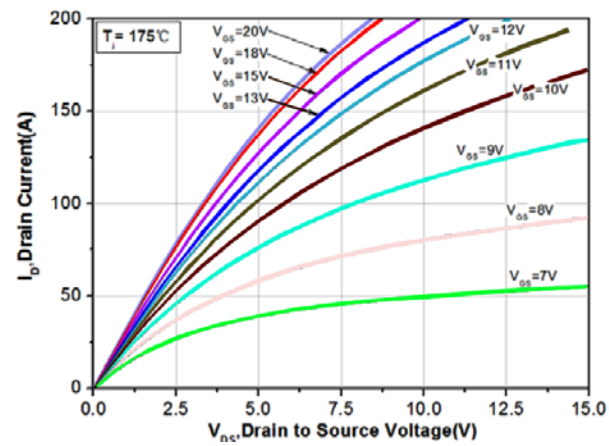


Figure 4. Normalized On-Resistance Characteristics vs. Temperature

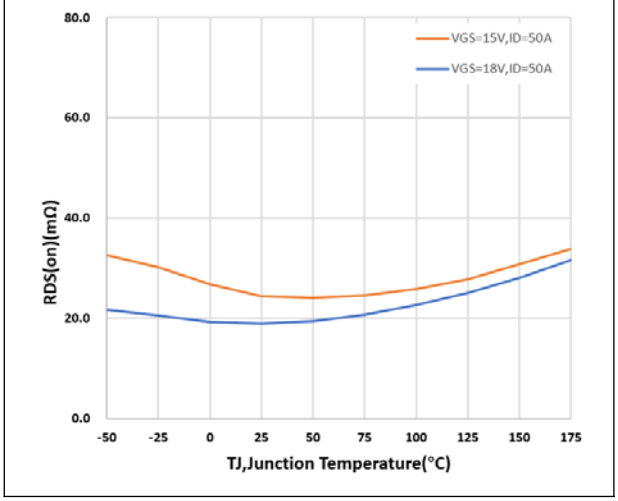


Figure 5. Transfer Characteristics

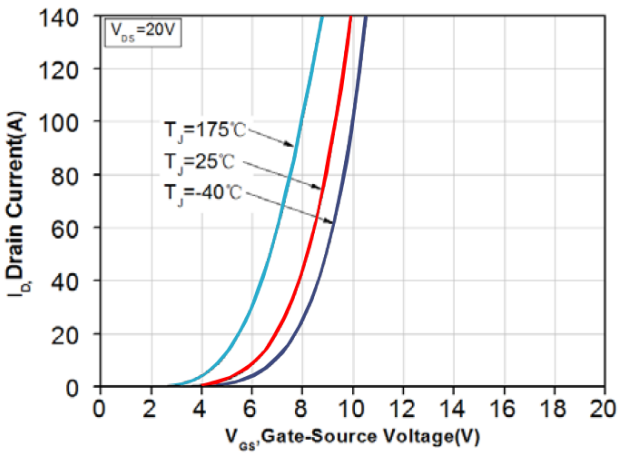
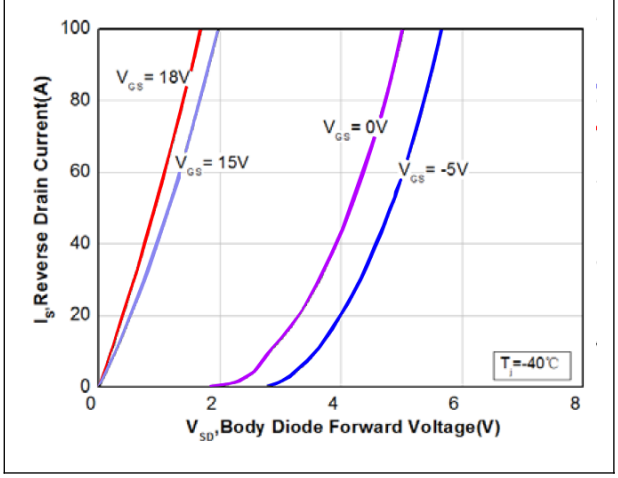


Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = -40℃



Typical Performance Characteristics

Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 25℃

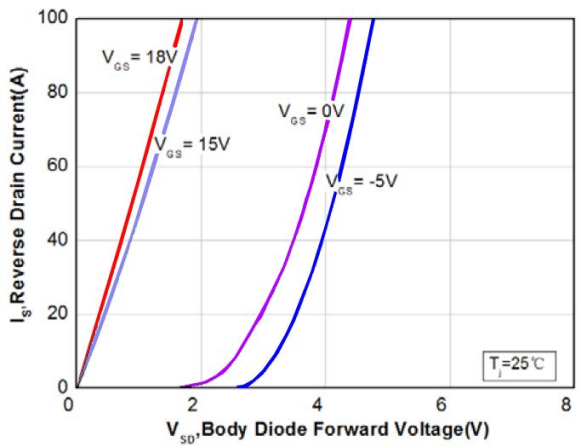


Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current T_J = 175℃

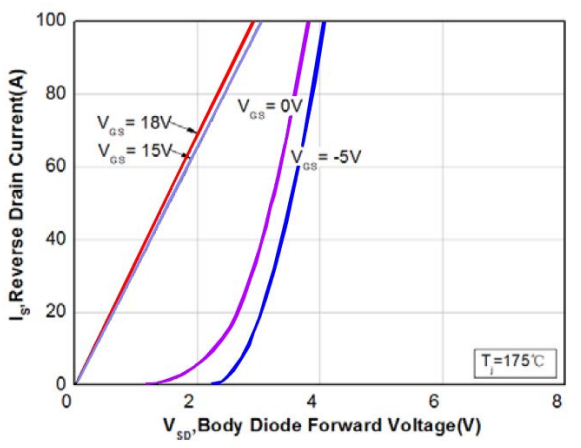


Figure 9. Threshold Voltage vs. Temperature

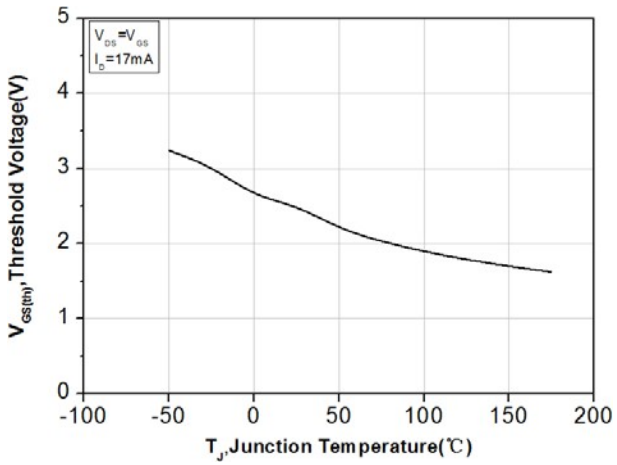


Figure 10. Gate Charge Characteristics

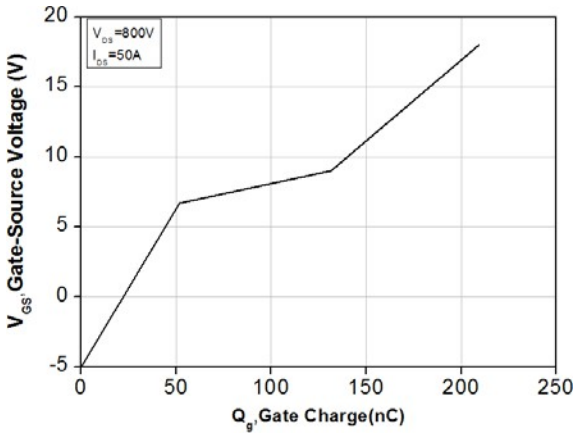


Figure 11. Stored Energy in Output Capacitance (0~1200V)

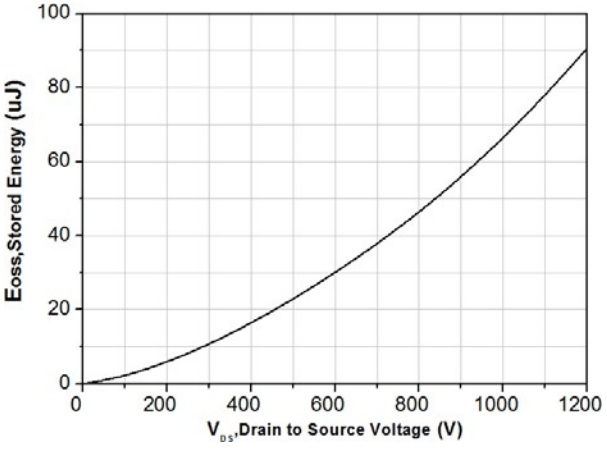
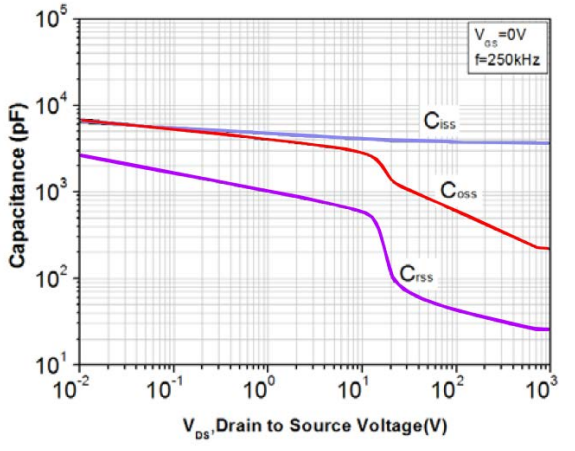


Figure 12. Capacitance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

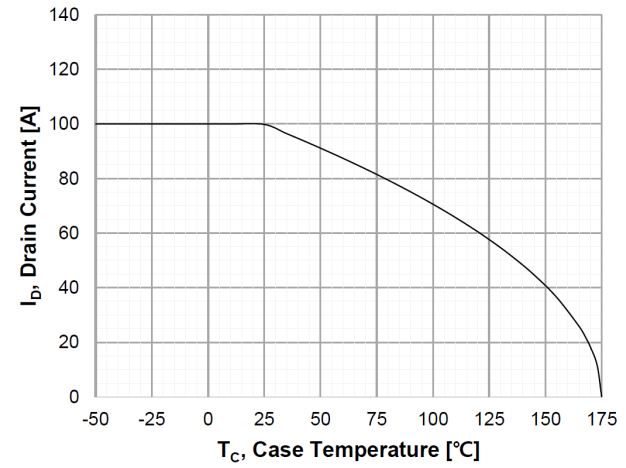


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

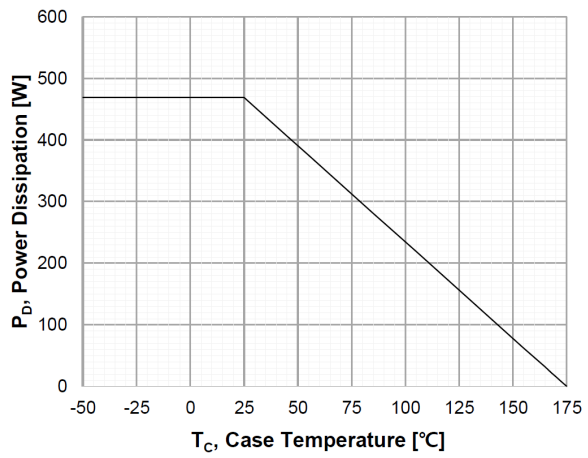


Figure 15. Typ. Switching losses vs. Drain current (VGS=-5V/15V)

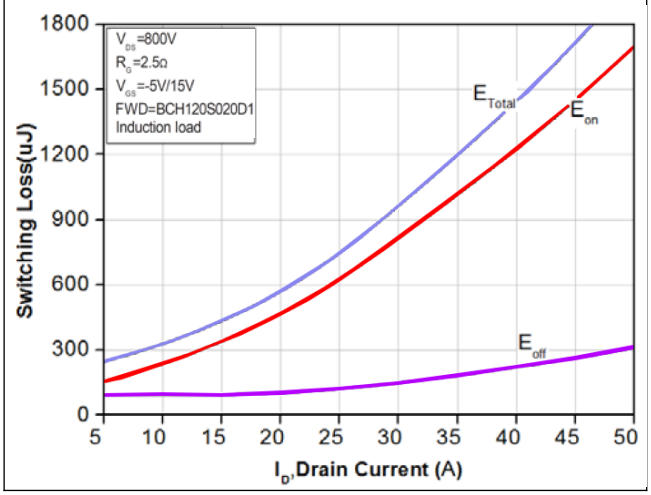


Figure 16. Typ. Switching losses vs. Drain current (VGS=-5V/18V)

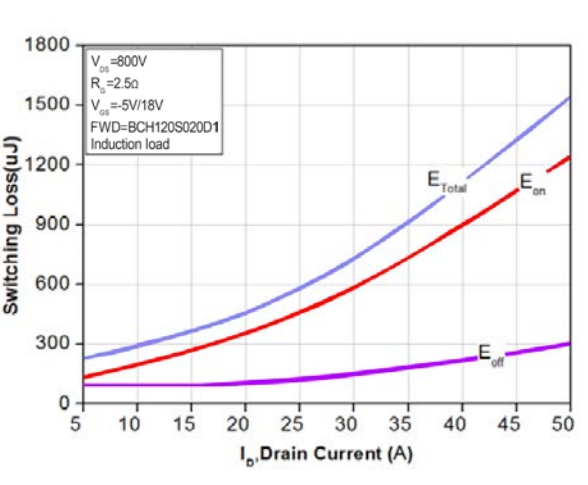


Figure 17. Typ. Switching losses vs. Drain current (VGS=-5V/15V)

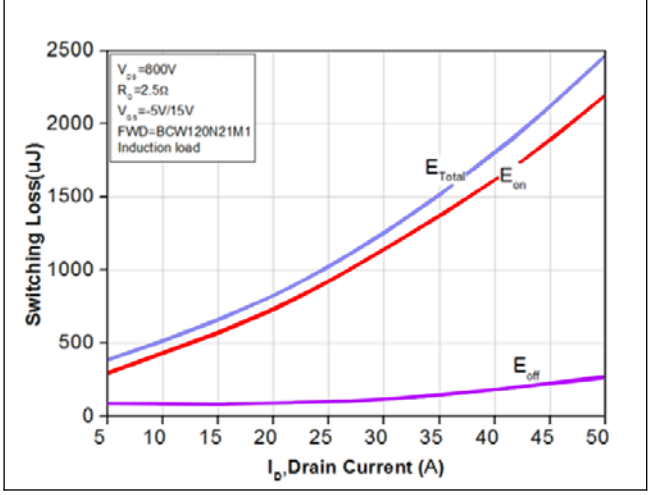
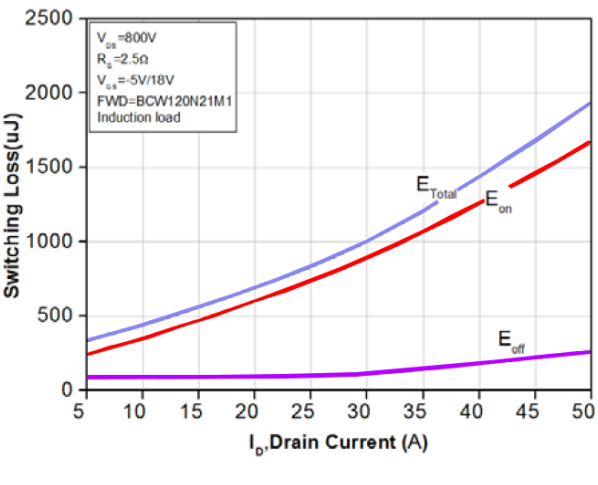


Figure 18. Typ. Switching losses vs. Drain current (VGS=-5V/18V)



Typical Performance Characteristics

Figure 19. Typ. Switching losses vs. Gate resistance (VGS=-5V/15V)

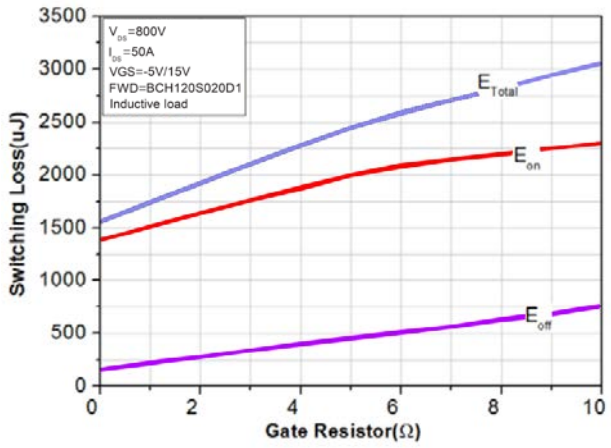


Figure 20. Typ. Switching losses vs. Gate resistance (VGS=-5V/18V)

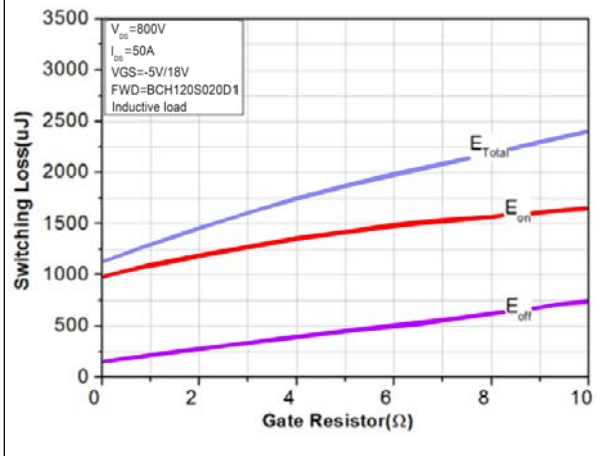


Figure 21. Typ. Switching losses vs. Gate resistance (VGS=-5V/15V)

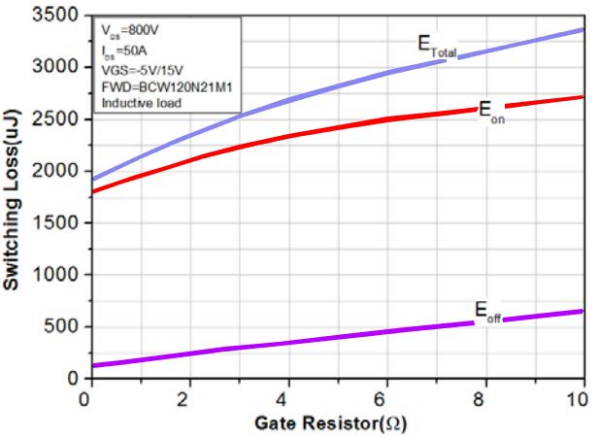


Figure 22. Typ. Switching losses vs. Gate resistance (VGS=-5V/18V)

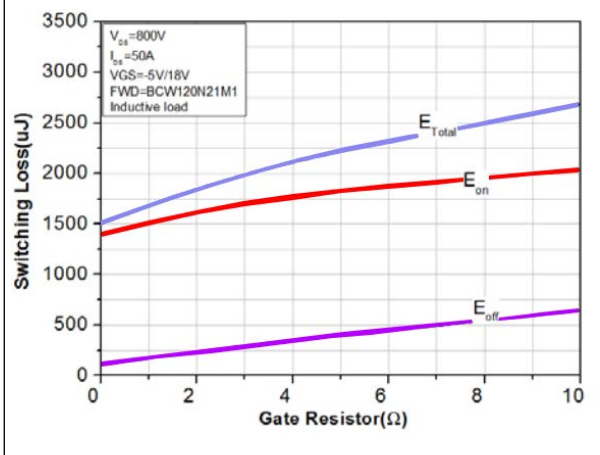


Figure 23. Maximum Safe Operating Area

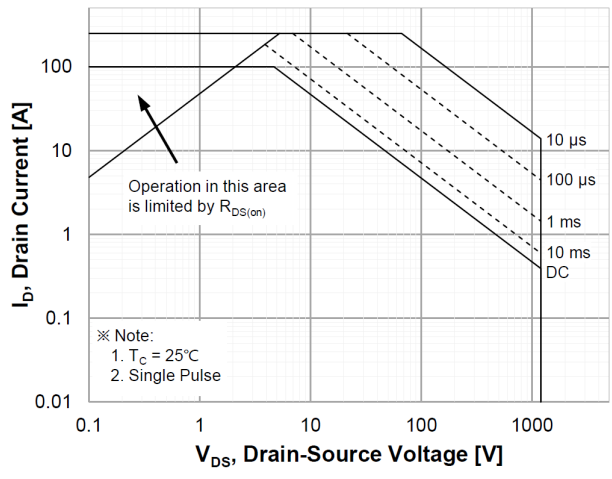
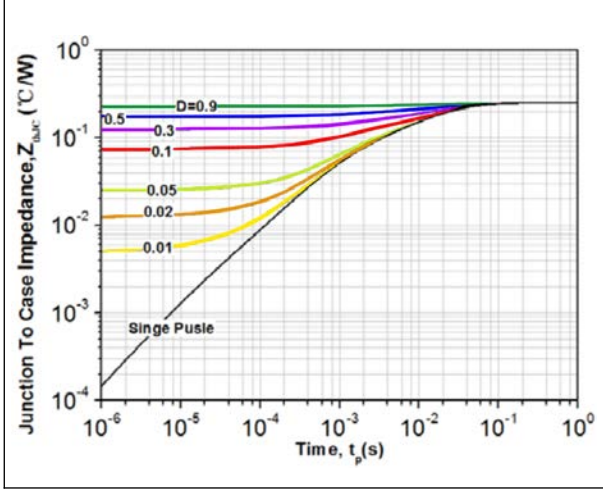


Figure 24. Transient Thermal Response Curve



Typical Performance Characteristics

Figure 25. On-Resistance vs. Drain Current For Various Temperature(VGS=15V)

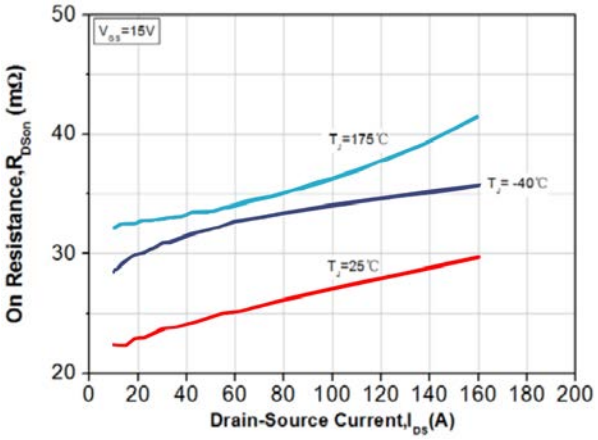


Figure 26. On-Resistance vs. Drain Current For Various Temperature(VGS=18V)

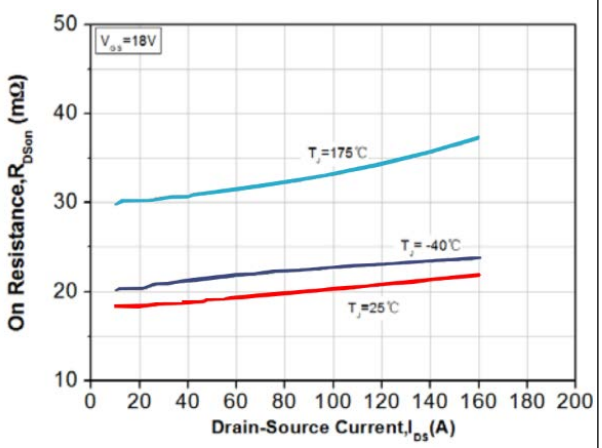


Figure 27. On-Resistance vs. Temperature For Various Gate Voltage

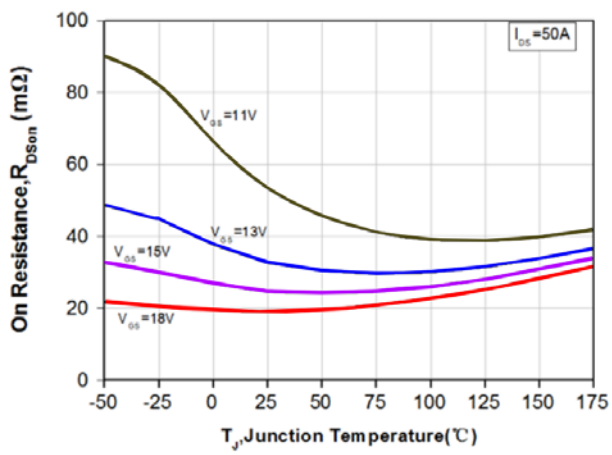


Figure 28. 3rd Quadrant Characteristic at -40℃

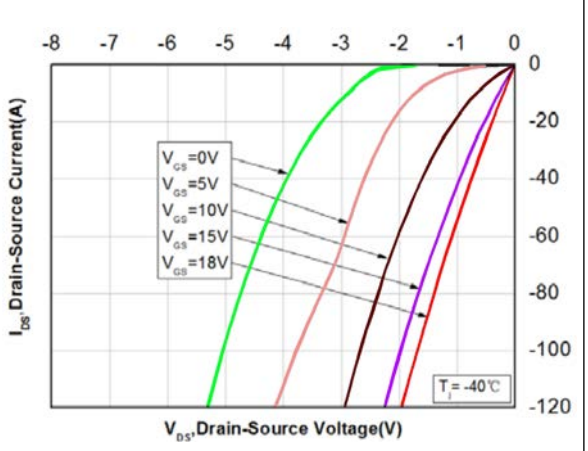


Figure 29. 3rd Quadrant Characteristic at 25℃

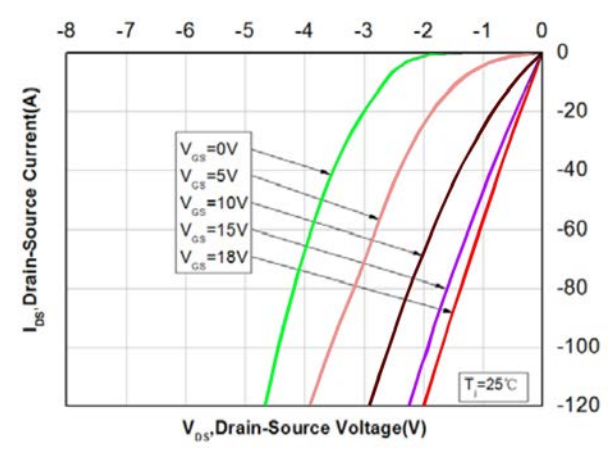
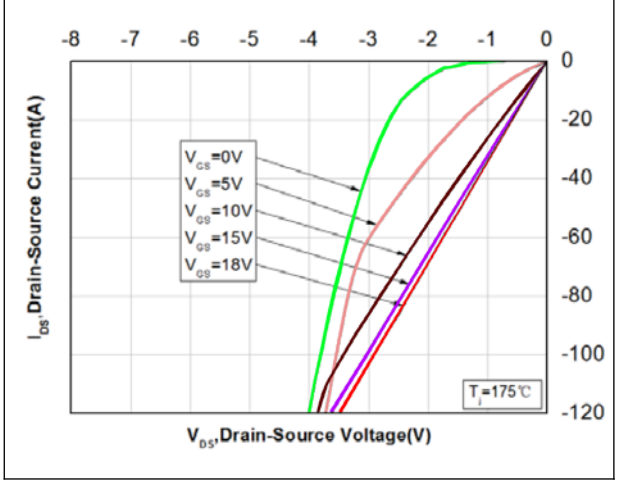


Figure 30. 3rd Quadrant Characteristic at 175℃



Typical Performance Characteristics

Figure 31. Capacitance vs. Drain-Source Voltage (0~200V)

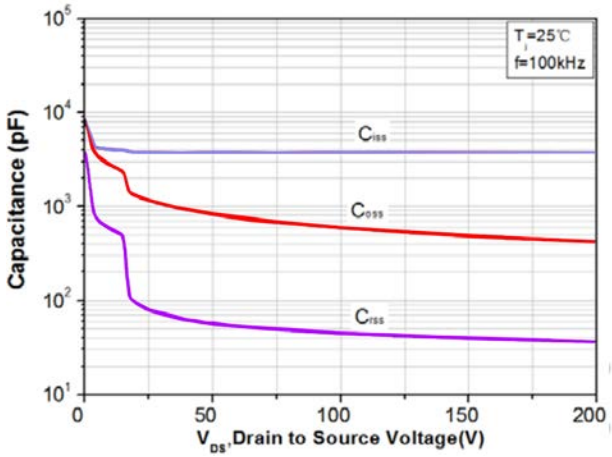


Figure 32. Capacitance vs. Drain-Source Voltage (0~1200V)

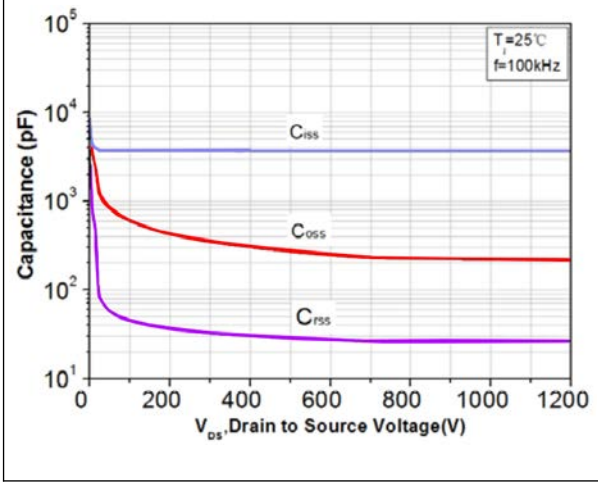


Figure 33. Clamped Inductive Switching Energy vs. Temperature

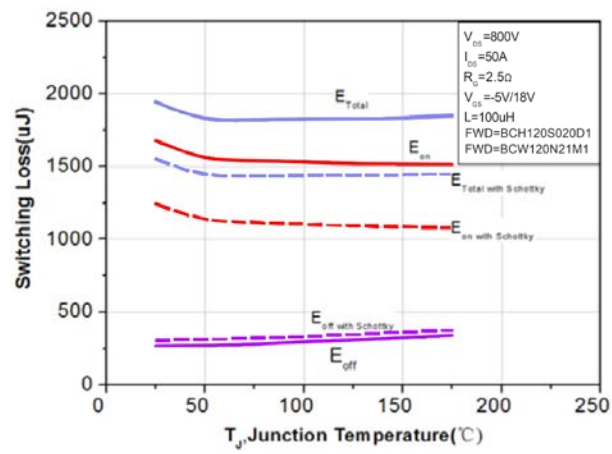


Figure 34. Switching Times vs. $R_{G(ext)}$

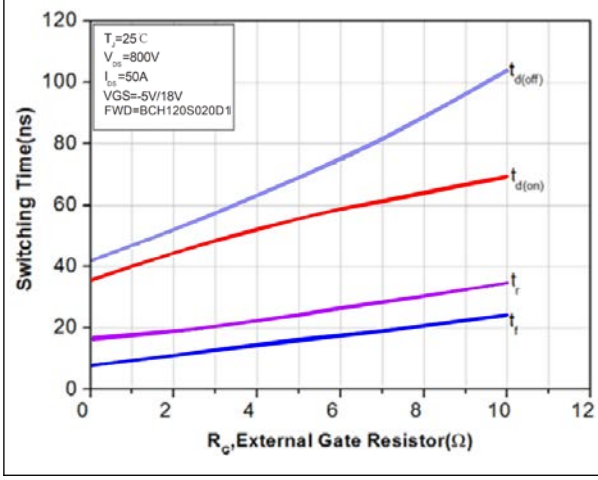
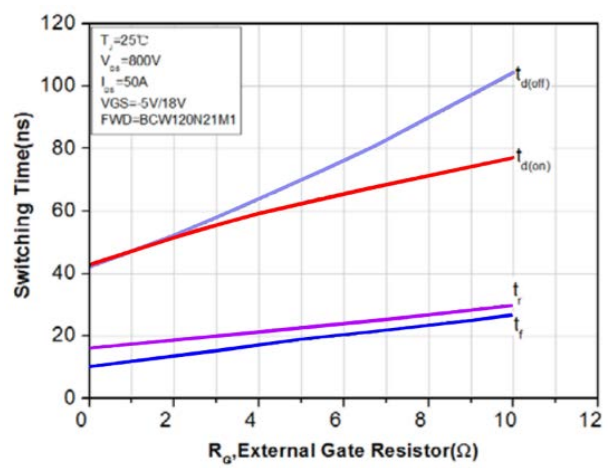


Figure 35. Switching Times vs. $R_{G(ext)}$



Typical Performance Characteristics

Figure 36. Inductive Load Switching Test Circuit and Waveforms

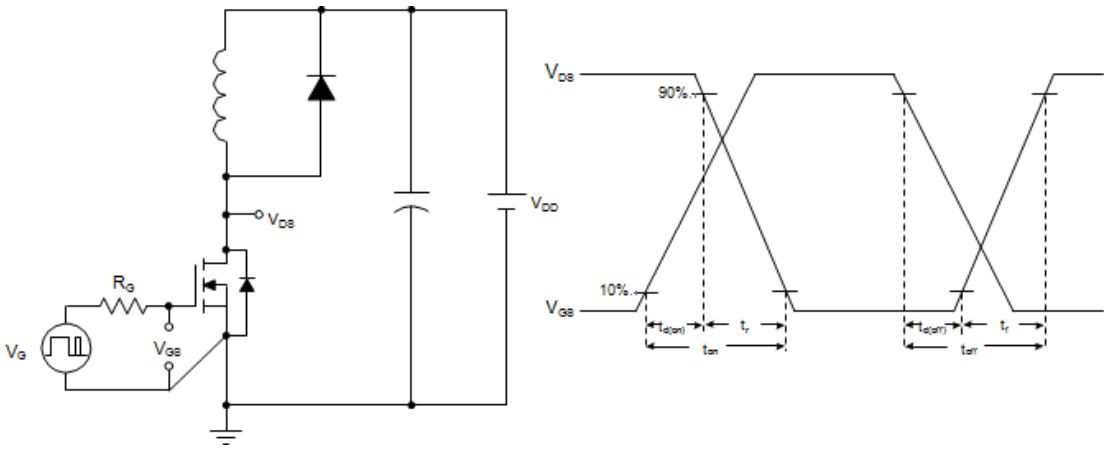
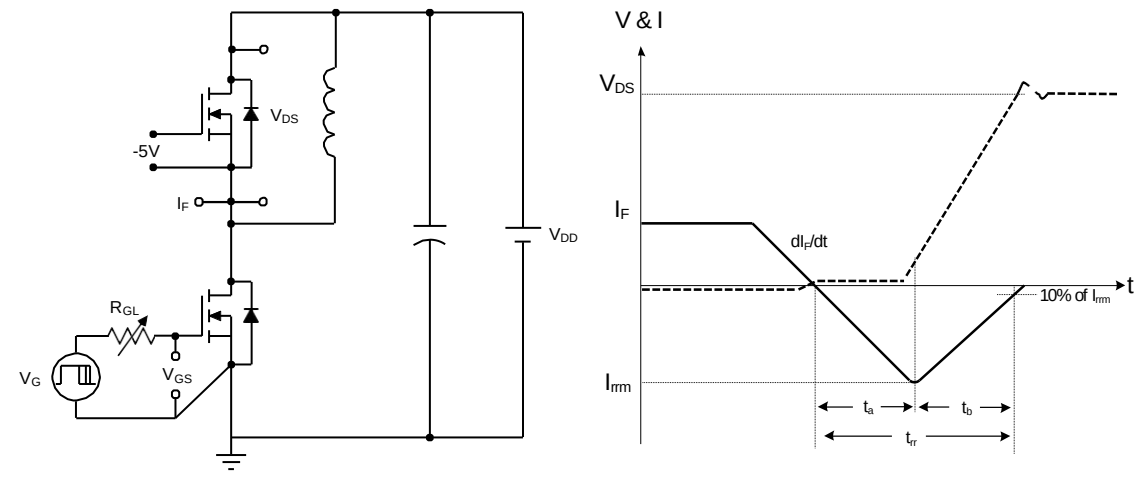
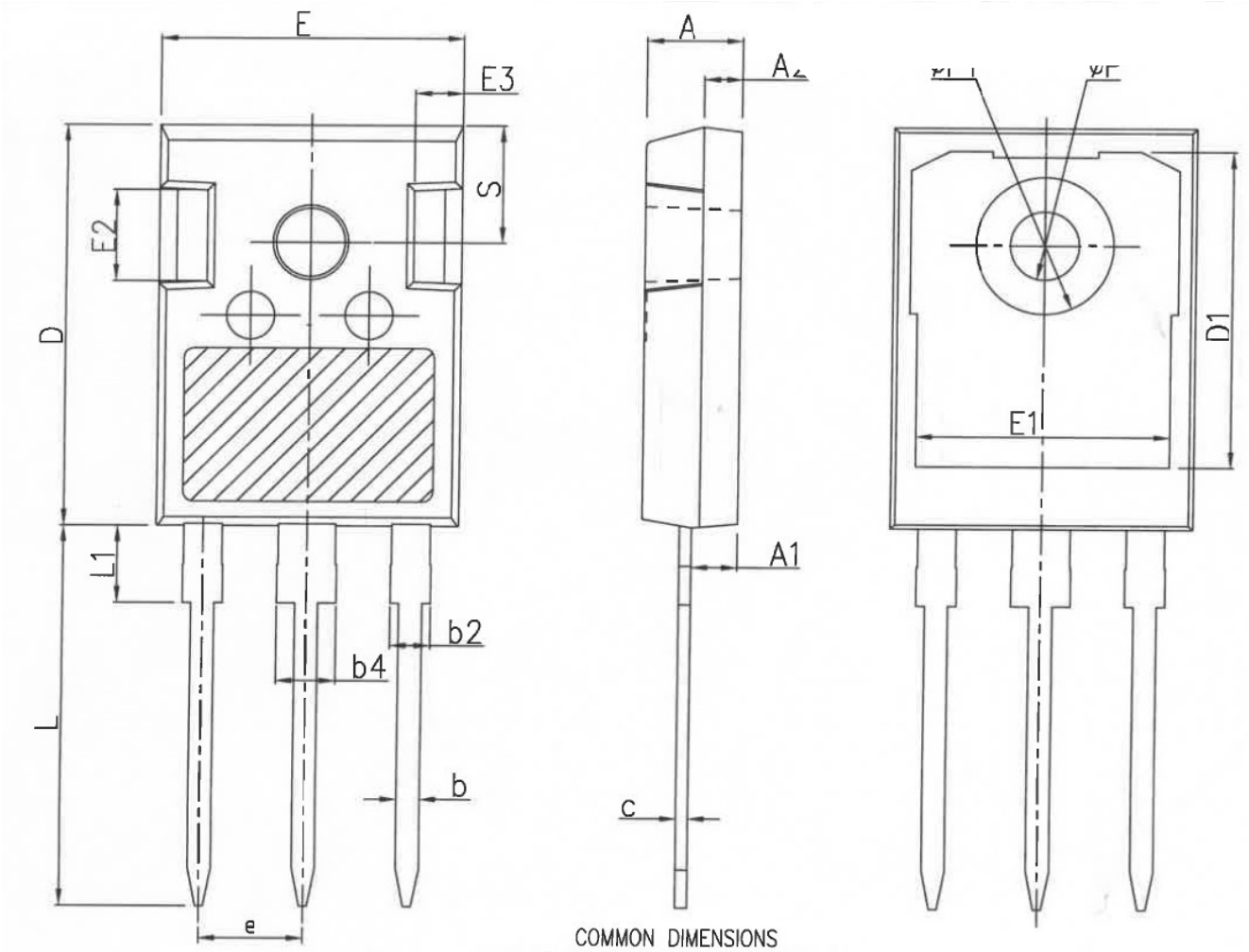


Figure 37. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO247-3



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85
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	5.44BSC		
L	19.62	19.92	20.22
L1	–	–	4.30
ΦP	3.40	3.60	3.80
ΦP1	–	–	7.30
S	6.15BSC		

*Dimensions in millimeters

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