

BCD65N180P1

N-Channel Silicon Carbide Power MOSFET

650 V, 19 A, 180 mΩ



bestirpower

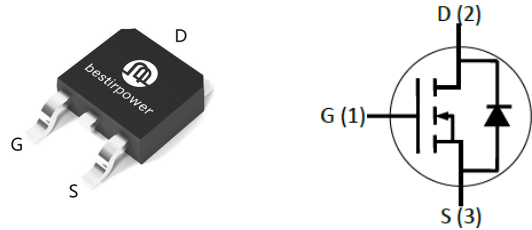
Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Fast Intrinsic Diode With Low Reverse Recovery
- Low Switching Losses

BV_{DSS}	$I_D, T_C=25^\circ\text{C}$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	19 A	180 mΩ	15.3 nC

Applications

- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Uninterruptable Power Supplies
- EV Battery Chargers
- Solar/Wind Inverters



Absolute Maximum Ratings ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Unit	
V_{DSS}	Drain to Source Voltage	650	V	
V_{GS}	Gate to Source Voltage (DC)	-10 / +22	V	
V_{GSop}	Recommended Operation Value	0/15	V	
I_D	Drain Current	$V_{GS} = 15\text{ V}, (T_C = 25^\circ\text{C})$	19	A
		$V_{GS} = 15\text{ V}, (T_C = 100^\circ\text{C})$	13.5	
I_{DM}	Drain Current	Pulsed	33	A
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	76	W
E_{AS}	Single Pulse Avalanche Energy	$V_{DD}=50\text{V}, V_{GS}=15\text{V}, L=0.5\text{mH}, I_{AS}=11.5\text{A}$	33.4	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 175	°C	

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.98	°C/W
T_{sold}	Soldering temperature, wave soldering only allowed at leads	260	°C

Electrical Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	650	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	-	0.1	20	μA
I_{GSS}	Gate-Source Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = +22\text{ V}$	-	-	+250	nA
I_{GSS}	Source-Gate Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ V}$	-250	-	-	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{DS} = 10\text{ mA}, T_J = 25^\circ\text{C}$	-	3.9	-	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 15\text{ V}, I_D = 7\text{ A}$	-	187	215	mΩ
		$V_{GS} = 15\text{ V}, I_D = 7\text{ A}, T_J = 175^\circ\text{C}$	-	175	-	

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}, f = 1\text{ MHz}$	-	431	-	pF
C_{oss}	Output Capacitance		-	30	-	
C_{riss}	Reverse Capacitance		-	3	-	
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 7\text{ A}, V_{GS} = 0\text{ V} / 15\text{ V}$	-	15.3	-	nC
Q_{gs}	Gate to Source Charge		-	5.5	-	
Q_{gd}	Gate to Drain "Miller" Charge		-	2.6	-	
R_G	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	-	36	-	Ω




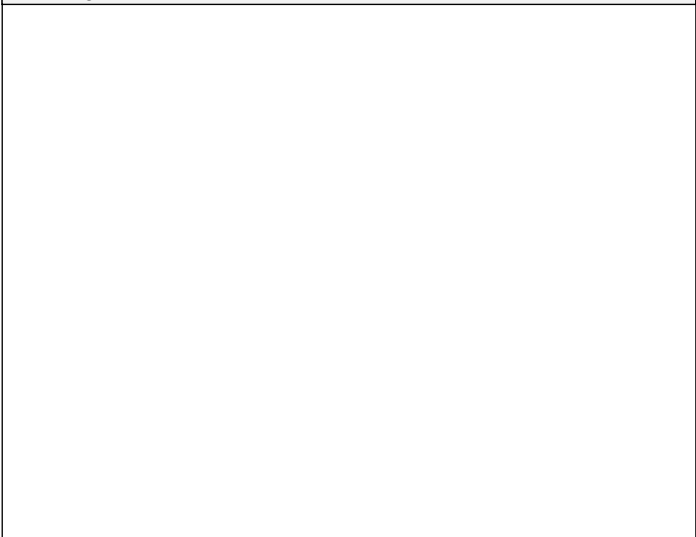
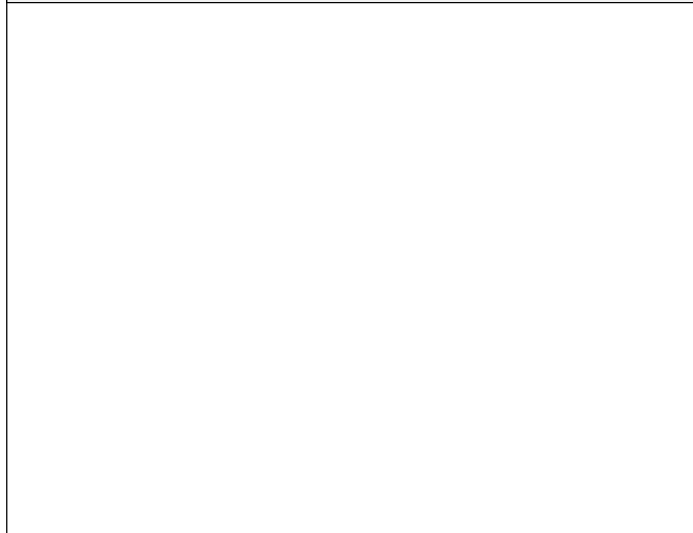
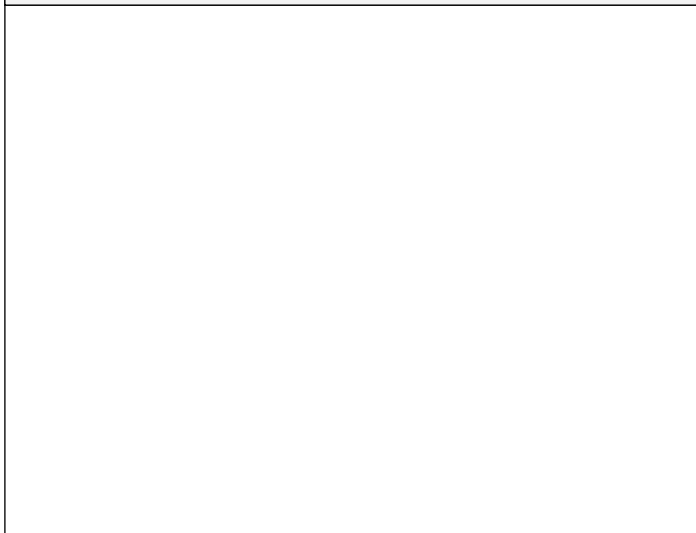
Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 0/15\text{ V}, L = 600\ \mu\text{H}, V_{DS} = 400\text{ V}, I_D = 7\text{ A}, R_{G(on)} = 2.2\ \Omega, R_{G(off)} = 2.2\ \Omega$	-	27.6	-	ns
t_r	Turn-On Rise Time		-	10.8	-	
$t_{d(off)}$	Turn-Off Delay Time		-	43.1	-	
t_f	Turn-Off Fall Time		-	13.3	-	μJ
E_{on}	Turn-On Switching Energy		-	67.5	-	
E_{off}	Turn-Off Switching Energy		-	10.5	-	

Source-Drain Diode Characteristics

I_S	Continuous Diode Forward Current	$T_C = 25^\circ\text{C}$	-	13.5	-	A
		$T_C = 100^\circ\text{C}$	-	7.7	-	
V_{SD}	Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 3.5\text{ A}$	-	3.3	-	V
t_{rr}	Reverse Recovery Time	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, I_{SD} = 7\text{ A}, di/dt = 2000\text{ A}/\mu\text{s}$	-	26	-	ns
Q_{rr}	Reverse Recovery Charge		-	68	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	5.8	-	A

Typical Performance Characteristics

<p>Figure 1: Safe Operating Area ($R_{thjc}=2.37\text{ }^{\circ}\text{C/W}$, Single Pulse, $T_{vj}=25\text{ }^{\circ}\text{C}$)</p> 	<p>Figure 2: Power Dissipation as a Function of Case Temperature Limited by Bond Wire</p> 
<p>Figure 3 Typical Output Characteristic, VGS as Parameter $T_v=-55\text{ }^{\circ}\text{C}$</p> 	<p>Figure 4 Typical Output Characteristic, VGS as Parameter $T_v=25\text{ }^{\circ}\text{C}$</p> 
<p>Figure 5 Typical Output Characteristic, VGS as Parameter $T_v=175\text{ }^{\circ}\text{C}$</p> 	<p>Figure 6: Typical on-state Resistance as a Function of Drain Current (VGS=15V)</p> 

Typical Performance Characteristics

Figure 7: Typical on-state Resistance as a Function of Temperature (IDS=7A)

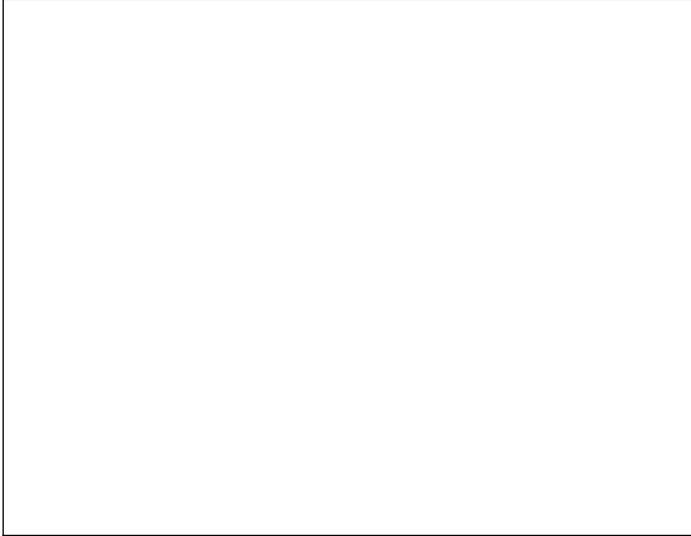


Figure 8: Typical on-state Resistance as a Function of VGS (IDS=7A)



Figure 9: Typical Transfer Characteristic (VDS=20V)

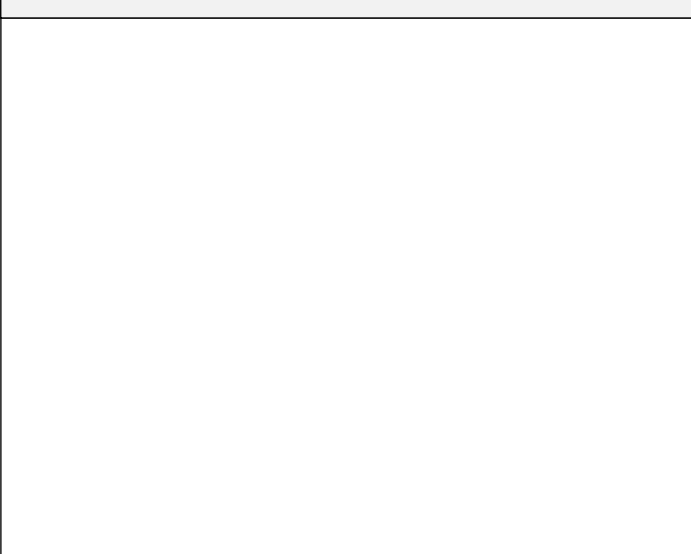


Figure 10: Threshold Voltage vs Temperature (IDS=10mA)

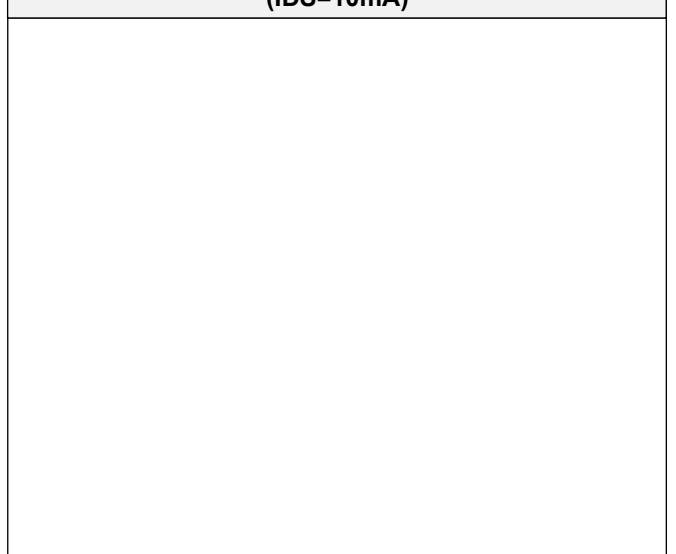
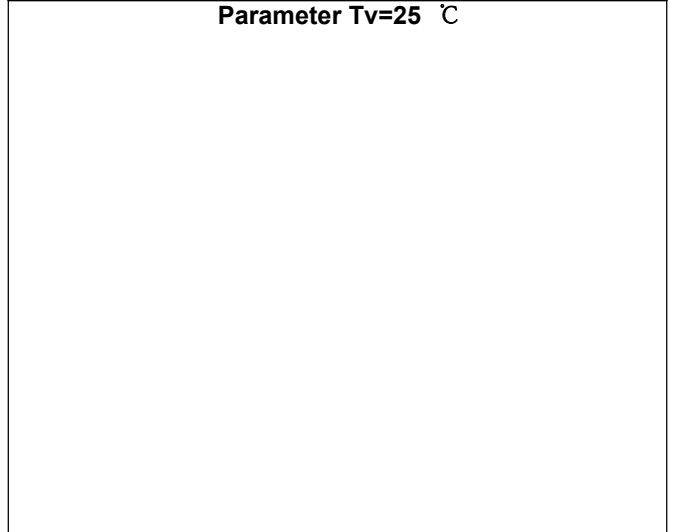


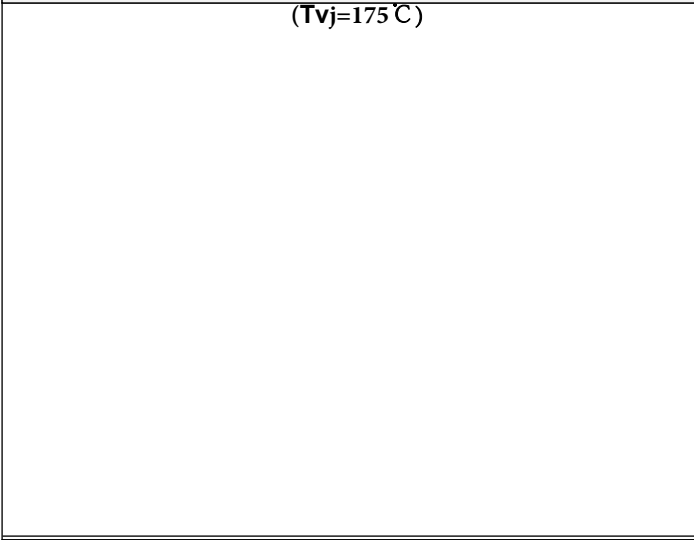
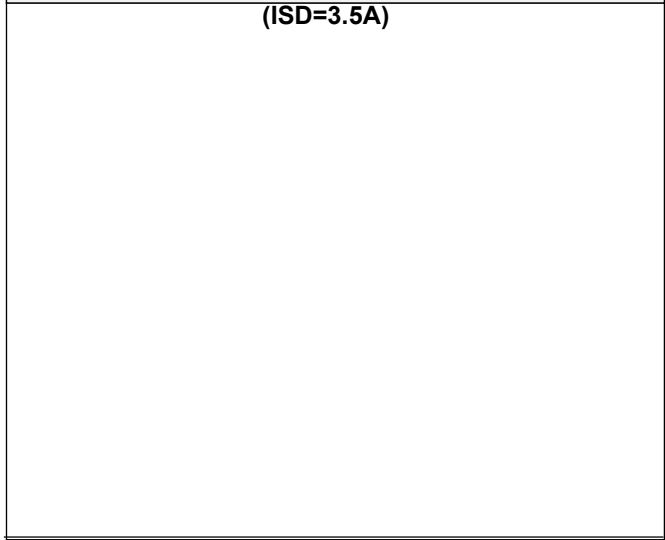

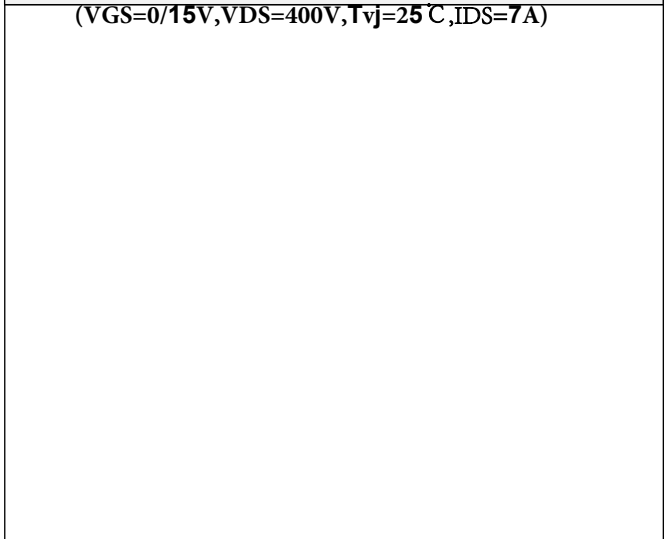
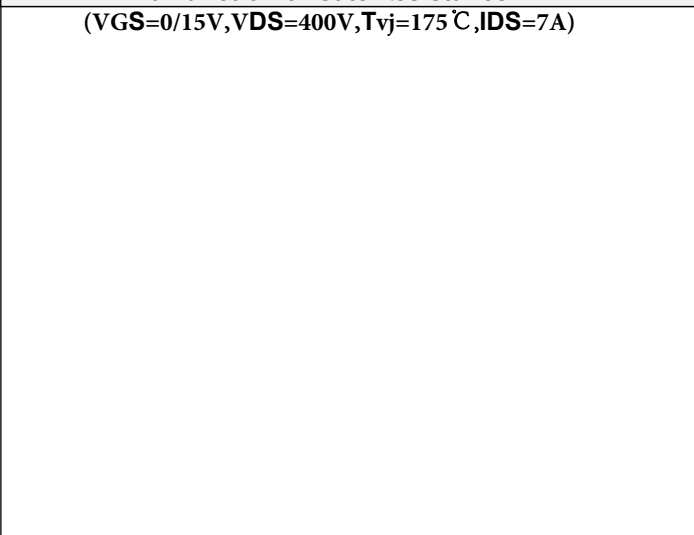

Figure 11 Typical Reverse Drain Current as Function of Reverse Drain Voltage, VGS as Parameter Tv=-55 °C



Figure 12 Typical Reverse Drain Current as Function of Reverse Drain Voltage, VGS as Parameter Tv=25 °C



Typical Performance Characteristics

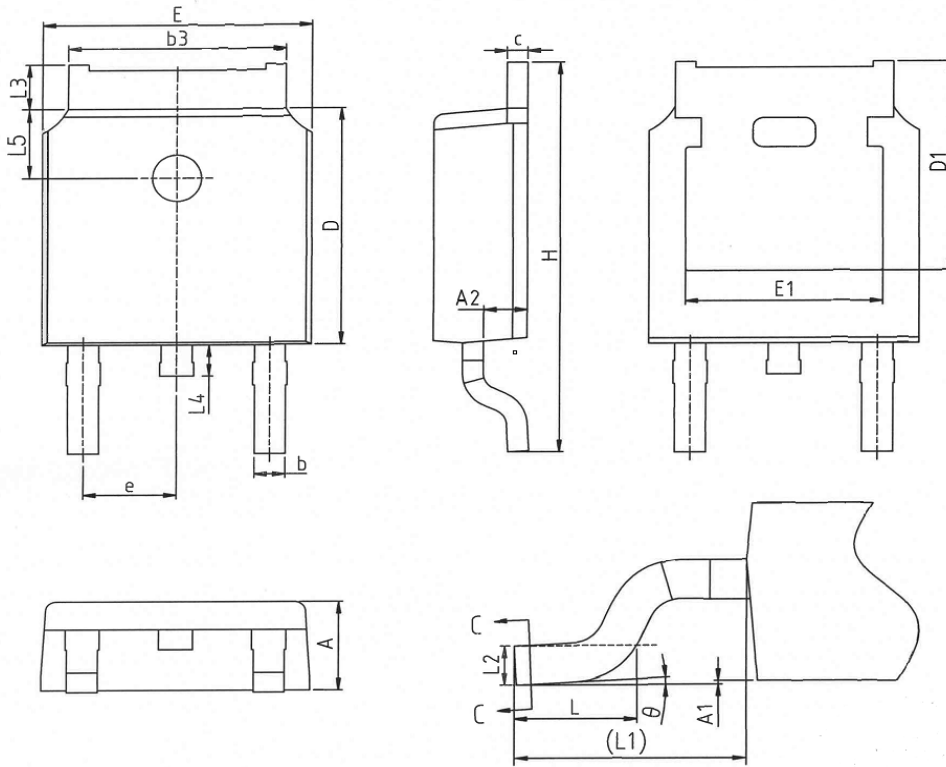
<p>Figure 13: Typical Reverse Drain Current as Function of Reverse Drain Voltage, VGS as Parameter ($T_{vj}=175^{\circ}\text{C}$)</p> 	<p>Figure 14: Typical Reverse Drain Voltage as Function of Junction Temperature ($I_{SD}=3.5\text{A}$)</p> 
<p>Figure 15: Typical Switching Energy as a Function of Junction Temperature ($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, R_{G(\text{ext})}=2.2\Omega, I_{DS}=7\text{A}$)</p> 	<p>Figure 16: Typical Switching Energy as a Function of Junction Temperature ($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, T_{vj}=25^{\circ}\text{C}, I_{DS}=7\text{A}$)</p> 
<p>Figure 17: Typical Switching Energy Losses as a Function of Gate Resistance ($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, T_{vj}=175^{\circ}\text{C}, I_{DS}=7\text{A}$)</p> 	<p>Figure 18: Typical Switching Energy Losses as a Function of IDS ($V_{GS}=0/15\text{V}, V_{DS}=400\text{V}, R_{G(\text{ext})}=2.2\Omega, T_{vj}=25^{\circ}\text{C}$)</p> 

Typical Performance Characteristics

<p>Figure 19: Typical Switching Energy Losses as a Function of I_{DS} ($V_{GS}=0/15V, V_{DS}=400V, T_{vj}=175\text{ }^{\circ}\text{C}, R_{G(ext)}=2.2\Omega$)</p>	<p>Figure 20: Typical switching energy losses as a function of V_{DS} ($V_{GS}=0/15V, T_{vj}=25\text{ }^{\circ}\text{C}, R_{G(ext)}=2.2\Omega, I_{DS}=7A$)</p>
<p>Figure 21: Typical Switching Energy Losses as a Function of V_{DS} ($V_{GS}=0/15V, T_{vj}=175\text{ }^{\circ}\text{C}, R_{G(ext)}=2.2\Omega, I_{DS}=7A$)</p>	<p>Figure 22: Typical Gate Charge ($V_{DS}=400V, I_{DS}=7A$)</p>
<p>Figure 23: Typical Capacitance as a Function of Drain-Source Voltage ($V_{GS}=0V, f=1\text{MHz}$)</p>	<p>Figure 24: Transient thermal resistance (MOSFET)</p>

Package Outlines

D-Pak



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0.00	-	0.12
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.46
c	0.43	0.53	0.61
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.73
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90REF		
L2	0.51BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCD65N180P1	BCD65N180P1	DPAK	Tape & Reel	2500 units

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