

BCF80N180M2

N-Channel Silicon Carbide Power MOSFET

800 V, 16.2 A, 180 mΩ

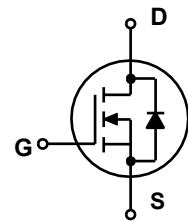
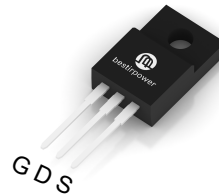
Features

- Revolutionary semiconductor material Silicon Carbide
- High blocking voltage with low on-resistance
- High-speed switching with very low switching losses
- High-speed and high robust intrinsic bodydiode

$BV_{DSS, T_c=25^{\circ}\text{C}}$	$I_D, T_c=25^{\circ}\text{C}$	$R_{DS(on), typ}$	$Q_{g, typ}$
800 V	16.2 A	180 mΩ	20.7nC

Applications

- LED driver
- PD charger
- PC adapter
- Air-conditioning
- E-bike charger



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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		800	V
V_{GS}	Gate to Source Voltage (DC)		-10/22	V
V_{GSop}	Recommended Operation Value		0/15	V
I_D	Drain Current	$V_{GS} = 15\text{ V}, (T_C = 25^{\circ}\text{C})$	16.2	A
		$V_{GS} = 15\text{ V}, (T_C = 100^{\circ}\text{C})$	11.4	
I_{DM}	Drain Current	Pulsed、	34	A
P_D	Power Dissipation	$(T_C = 25^{\circ}\text{C})$	78.5	W
		Derate Above 25°C	0.51	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	°C

Thermal Characteristics

Symbol	Parameter	Value	Unit
R_{thj-c}	MOSFET/Body Diode Junction-Case Thermal Resistance	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	$I_D = 100\mu\text{A}$	800	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}$	-	0.7	20	μA
I_{GSS}	Gate-Source Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = +22\text{ V}$	-	13.5	+250	nA
I_{SGS}	Source-Gate Leakage Current	$V_{DS} = 0\text{ V}, V_{GS} = -10\text{ V}$	-250	-6.95	-	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 10\text{ mA}, T_J = 25^\circ\text{C}$	-	3.07	-	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 12\text{ V}, I_D = 7\text{ A}, T_J = 25^\circ\text{C}$	-	226	-	mΩ
		$V_{GS} = 12\text{ V}, I_D = 7\text{ A}, T_J = 175^\circ\text{C}$	-	201	-	
		$V_{GS} = 15\text{ V}, I_D = 7\text{ A}, T_J = 25^\circ\text{C}$	-	179	-	
		$V_{GS} = 15\text{ V}, I_D = 7\text{ A}, T_J = 175^\circ\text{C}$	-	167	-	

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}, f = 1\text{ MHz}$	-	659	-	pF
C_{oss}	Output Capacitance		-	59	-	
C_{rss}	Reverse Capacitance		-	2.54	-	
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 600\text{ V}, I_D = 5\text{ A},$ $V_{GS} = 0\text{ V} / 15\text{ V}$	-	20.7	-	nC
Q_{gs}	Gate to Source Charge		-	7.26	-	
Q_{gd}	Gate to Drain "Miller" Charge		-	15.6	-	
R_G	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 25\text{ mV}$	-	12.1	-	Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{GS} = 0/15\text{ V}, L = 600\mu\text{H}$ $V_{DS} = 600\text{ V}, I_D = 5\text{ A},$ $R_{G(on)} = 2.2\Omega, R_{G(off)} = 2.2\Omega$	-	9.44	-	ns
t_r	Turn-On Rise Time		-	13.6	-	
$t_{d(off)}$	Turn-Off Delay Time		-	12.5	-	
t_f	Turn-Off Fall Time		-	29	-	
E_{on}	Turn-On Switching Energy		-	94	-	μJ
E_{off}	Turn-Off Switching Energy		-	6.1	-	

Source-Drain Diode Characteristics

V_{SD}	Body Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_{SD} = 3.5\text{ A}, T_C = 25^\circ\text{C}$	-	2.36	-	V
		$V_{GS} = 0\text{ V}, I_{SD} = 3.5\text{ A}, T_C = 175^\circ\text{C}$	-	2.21	-	V
t_{rr}	Reverse Recovery Time	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}, I_{SD} = 5\text{ A},$ $di/dt = 1.2\text{ kA}/\mu\text{s}$	-	9.5	-	ns
Q_{rr}	Reverse Recovery Charge		-	47.8	-	nC
I_{rrm}	Peak Reverse Recovery Current		-	9	-	A

Typical Performance Characteristics

Figure 1. Safe operating area (SOA)

Single Pulse, $T_{vj} = 25^{\circ}\text{C}$

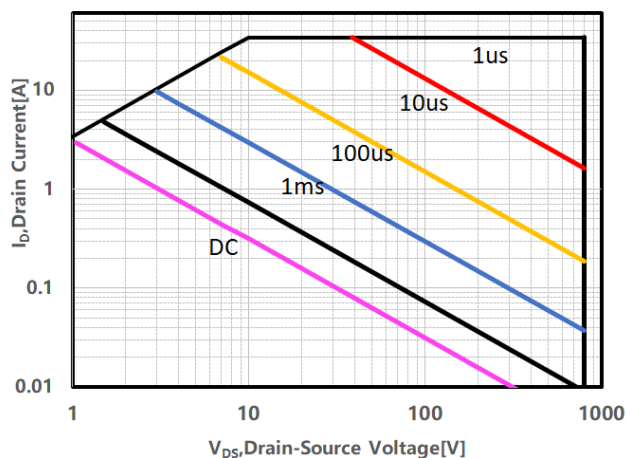


Figure 2. Power dissipation as a function of case temperature limited by bond wire

$P_D = f(T_C)$

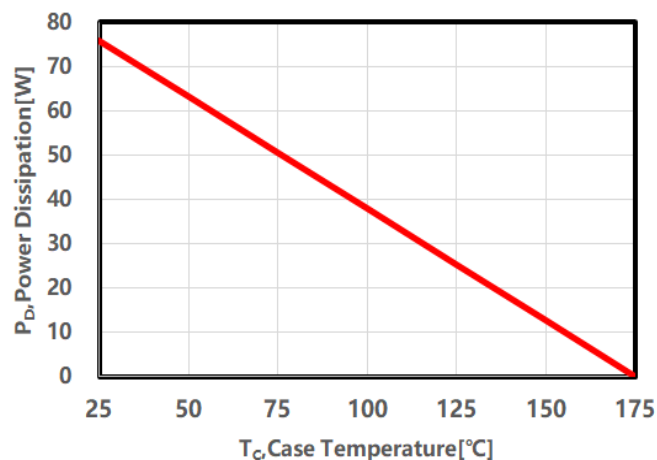


Figure 3. Typical output characteristic, VGS as parameter

$I_{DS} = f(V_{DS})$ $T_{vj} = -55^{\circ}\text{C}$

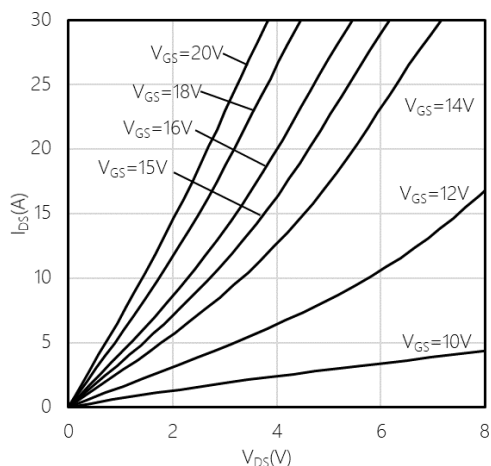


Figure 4. Typical output characteristic, VGS as parameter

$I_{DS} = f(V_{DS})$ $T_{vj} = 25^{\circ}\text{C}$

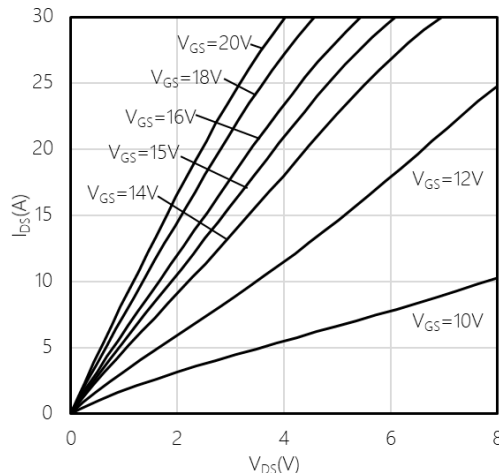


Figure 5. Typical output characteristic, VGS as parameter

$I_{DS} = f(V_{DS})$ $T_{vj} = 175^{\circ}\text{C}$

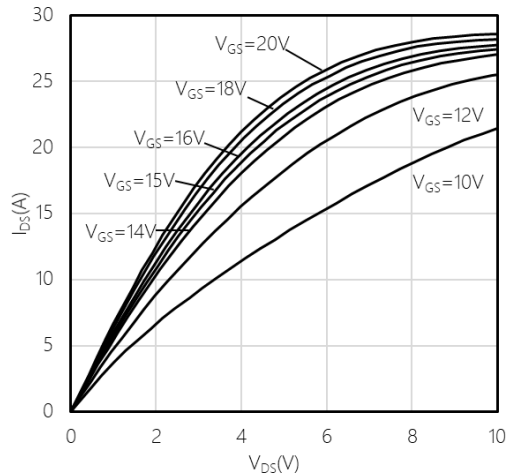
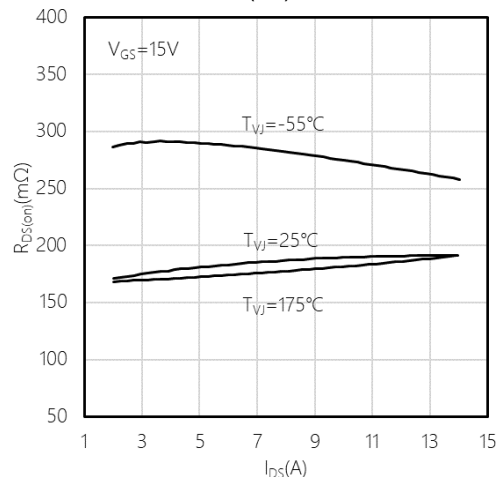


Figure 6. Typical on-state resistance as a function of drain current

$R_{DS(on)} = f(I_{DS})$, $V_{GS} = 15\text{V}$



Typical Performance Characteristics

Figure 7. Typical on-state resistance as a function of temperature

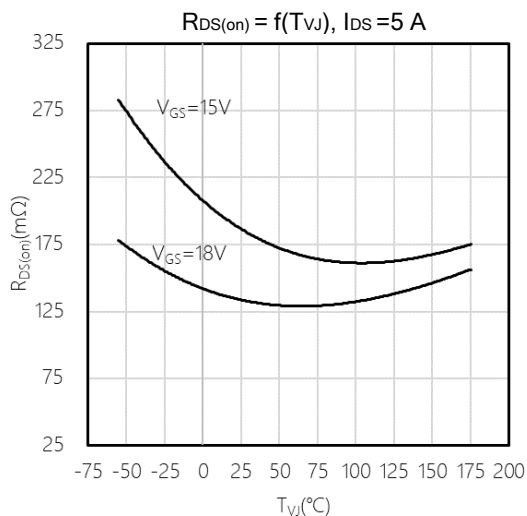


Figure 8. Typical on-state resistance as a function of V_{GS}

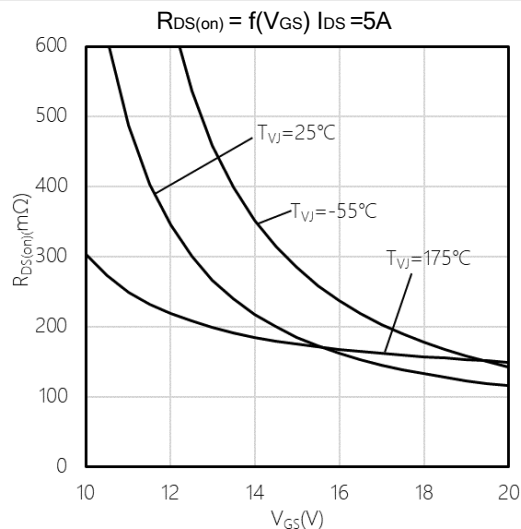


Figure 9. Typical transfer characteristic

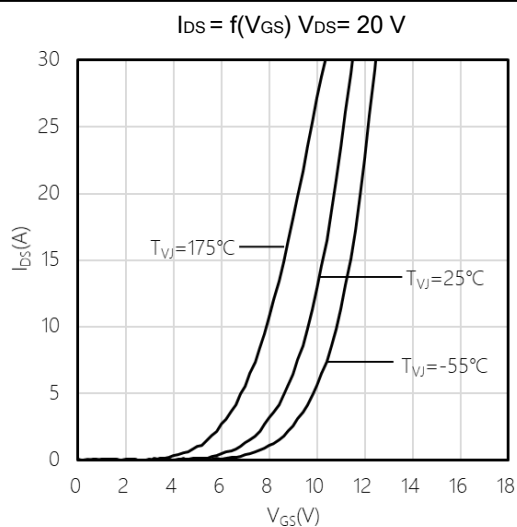


Figure 10. Typical gate-source threshold voltage as a function of junction temperature

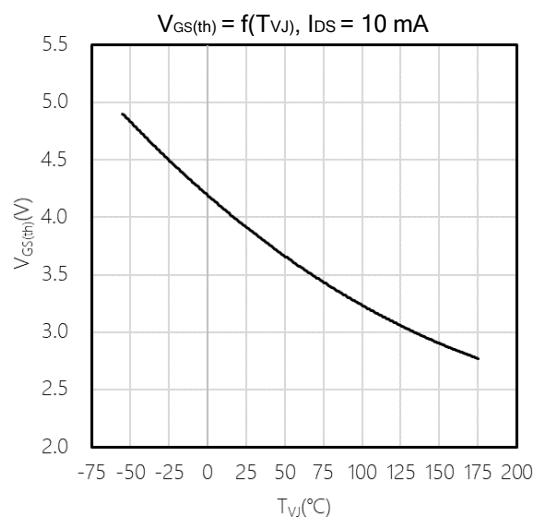


Figure 11. Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

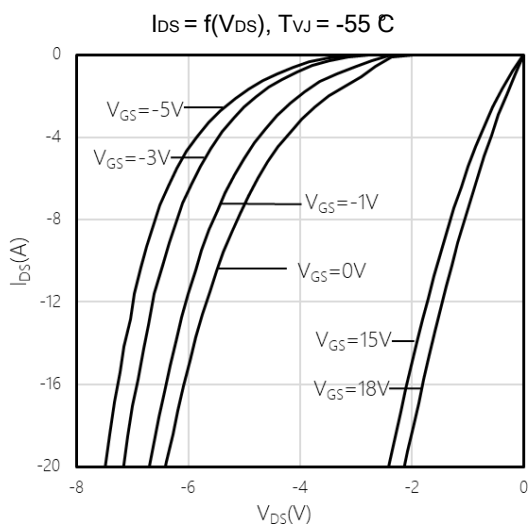
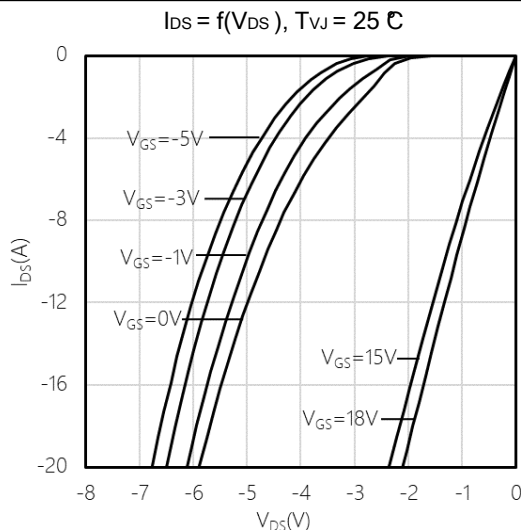


Figure 12. Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter



Typical Performance Characteristics

Figure 13. Typical reverse drain current as function of reverse drain voltage, V_{GS} as parameter

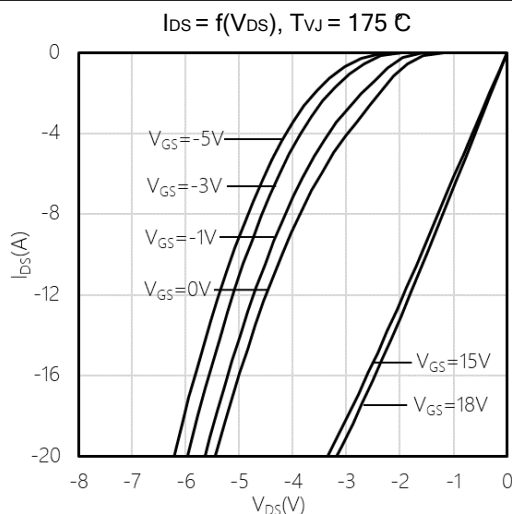


Figure 14. Typical reverse drain voltage as function of junction temperature

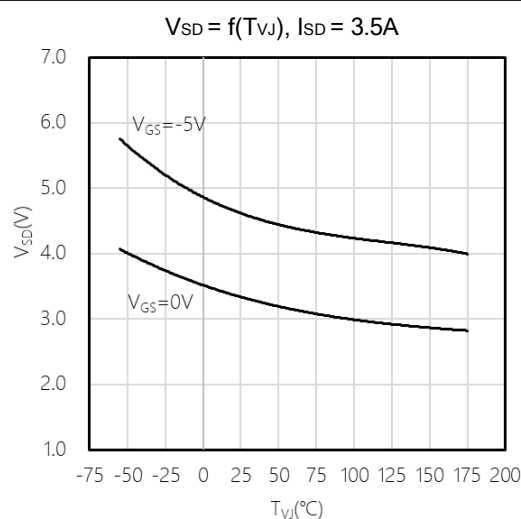


Figure 15. Typical switching energy as a function of junction temperature

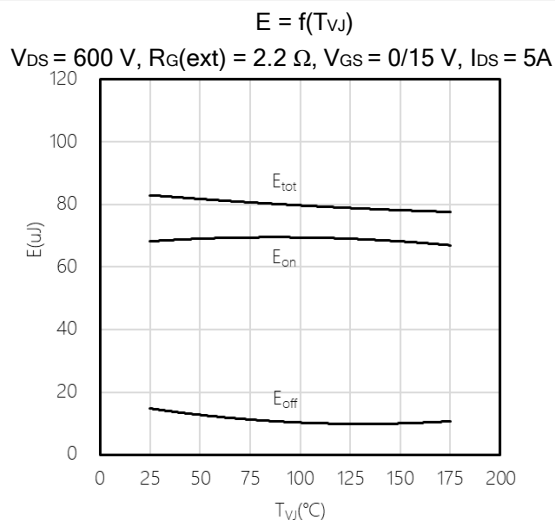


Figure 16. Typical switching energy losses as a function of gate resistance

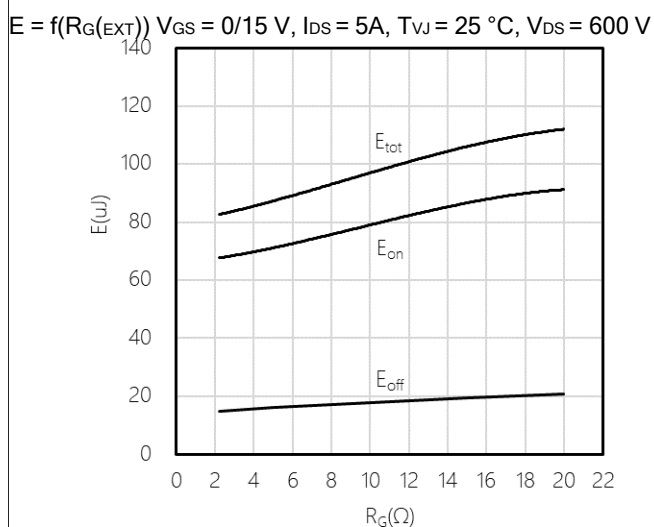


Figure 17. Typical switching energy losses as a function of gate resistance

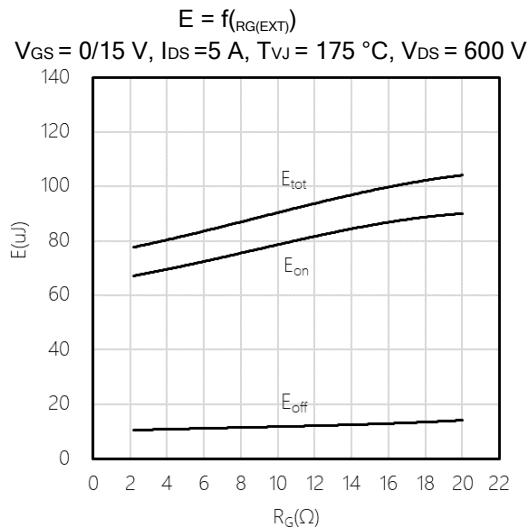
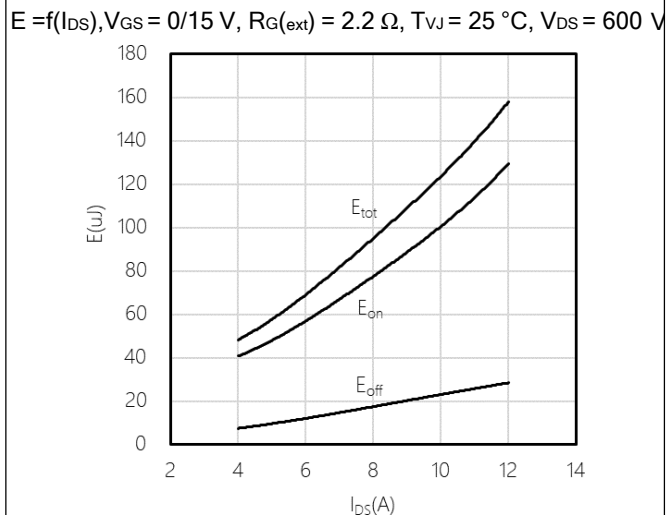


Figure 18. Typical switching energy losses as a function of I_{DS}



Typical Performance Characteristics

Figure 19. Typical switching energy losses as a function of I_{DS}

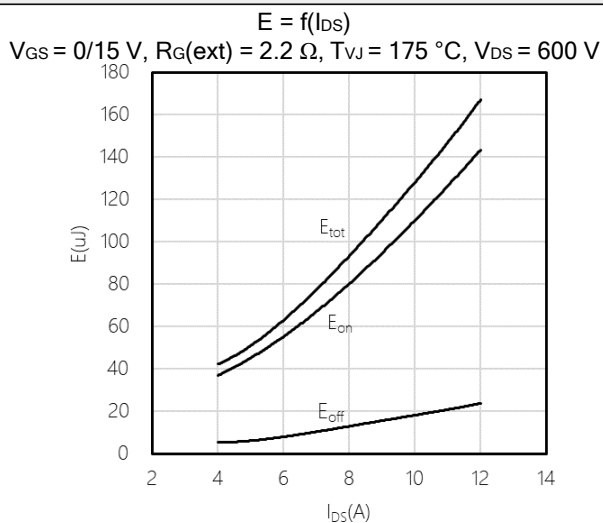


Figure 20. Typical switching energy losses as a function of V_{DS}

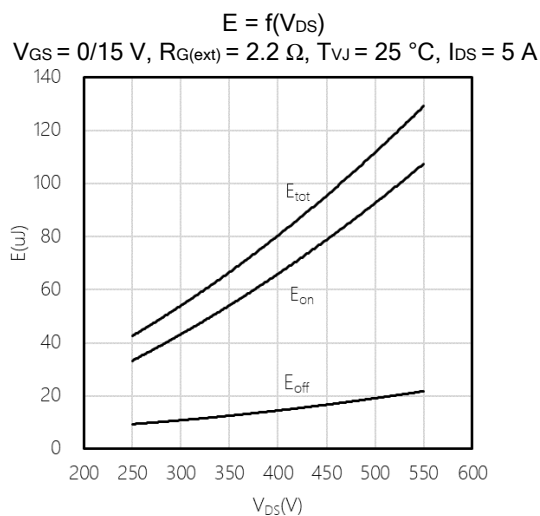


Figure 21. Typical switching energy losses as a function of V_{DS}

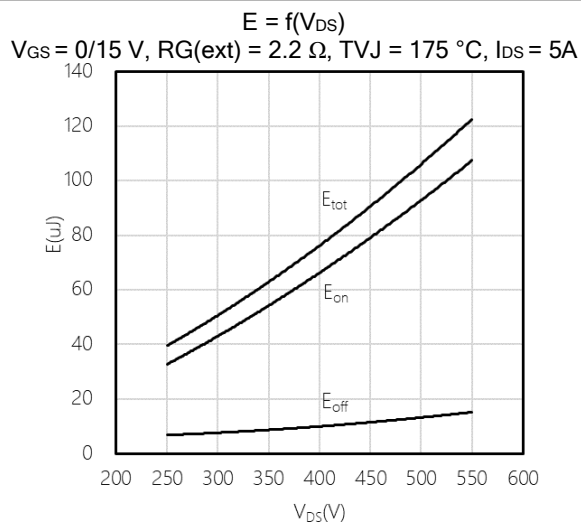


Figure 22. Typical gate charge

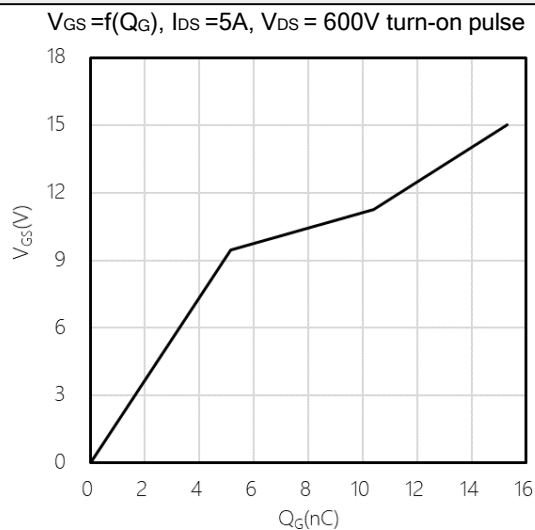


Figure 23. Typical capacitance as a function of drain-source voltage

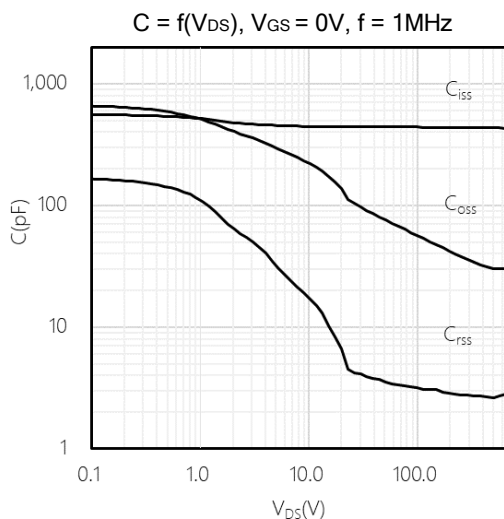
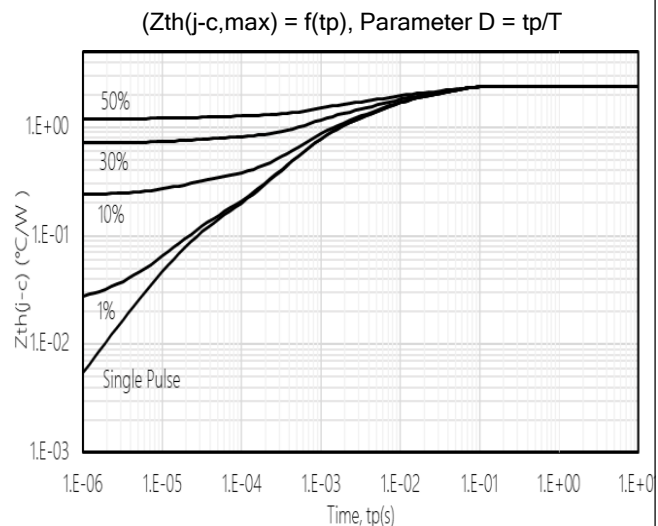
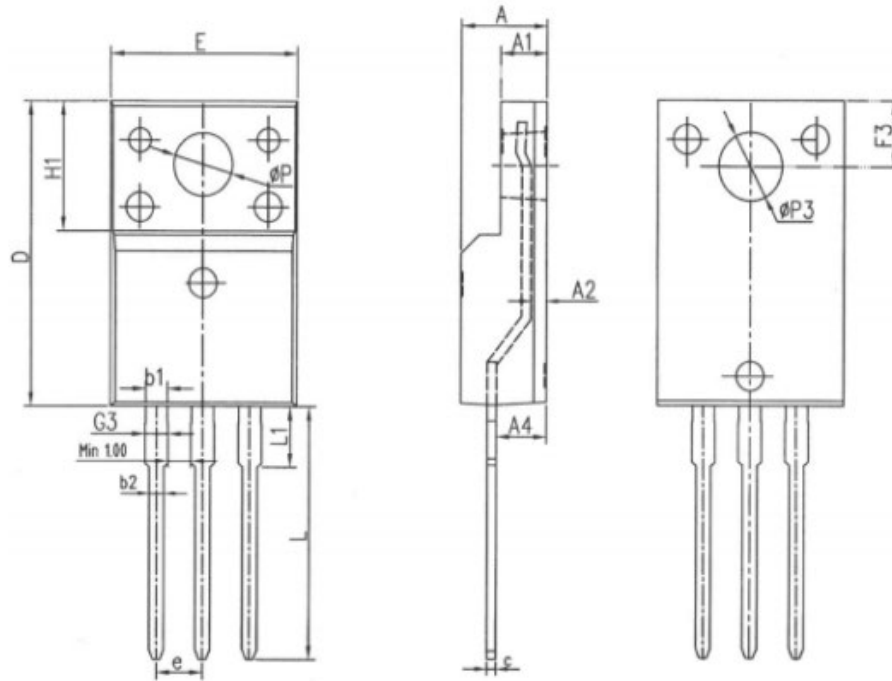


Figure 24. Transient thermal resistance (MOSFET)



Package Outlines

TO-220F



COMMON DIMENSIONS

SYMBOL	MM		
	MIN	NOM	MAX
E	10.00	10.20	10.40
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.65	0.85	1.30
A4	2.55	2.75	2.95
c	0.40	0.50	0.65
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
ΦP	3.183REF		
L	12.68	12.98	13.28
L1	3.25	3.45	3.65
ΦP3	3.45REF		
F3	3.10	3.30	3.50
G3	1.10	1.30	1.50
b1	1.05	1.20	1.35
b2	0.70	0.80	0.92

* Dimensions in millimeters

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
BCF80N180M2	BCF80N180M2	TO220F	Tape & Reel	50 units

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