

**Product Summary**

$V_{DS}$	1200 V
$I_D (T_c=25^\circ\text{C})$	69 A
$R_{DS(on),typ}$	40 m $\Omega$ @ $V_{GS}=18\text{V}$

**Features**

- Low On-Resistance with High Blocking Voltage
- Low Capacitance
- Avalanche Ruggedness
- Halogen Free, Rohs Compliant

**Benefits**

- High Frequency Operation
- Enabling Higher Switching Frequency
- Increased Power Density
- Reduction of Heat Sink Requirements

**Applications**

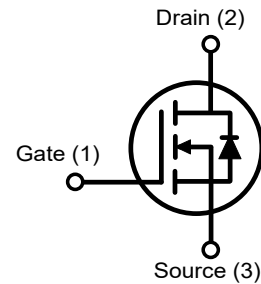
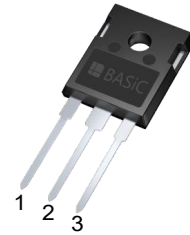
- Switch Mode Power Supplies (SMPS)
- Power Inverter & Solar Inverter
- Motor Drivers & EV Charging Station
- DC/DC Converter

**Package Pin Definitions**

- Pin1 - Gate
- Pin2 - Drain
- Pin3 - Source

**Package Parameters**

Part Number	Marking	Package
B2M040120H	B2M040120H	TO-247-3

**Package: TO-247-3**


**Maximum Ratings**

Symbol	Parameter	Test conditions	Value	Unit
$V_{DSmax}$	Drain-Source Voltage	$V_{GS}=0V, I_D=100\mu A$	1200	V
$V_{GSmax}^{1)}$	Gate-Source Voltage		-8/22	V
$V_{GSop}$	Recommend Gate-Source Voltage		-4/18	V
$I_D$	Continuous Drain Current	$V_{GS}=18V, T_C=25^\circ C$	69	A
		$V_{GS}=18V, T_C=100^\circ C$	48	A
$I_{D,pulse}$	Pulsed Drain Current	Pulse with $t_p$ limited by $T_{jmax}$	123	A
$P_{tot}$	Power Dissipation	$T_C=25^\circ C, T_j=175^\circ C$	333	W
$T_j$	Operating Junction Temperature		-55~175	$^\circ C$
$T_{stg}$	Storage Temperature		-55~175	$^\circ C$
$M_d$	TO-247 mounting torque	M3 Screw	0.7	N·m

1) Note: When using MOSFET Body Diode  $V_{GSmax} = -4/22V$

**Electrical Characteristics (Defined at  $T_j=25^\circ C$  unless otherwise specified)**
**Static Characteristics**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=100\mu A$	1200			V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=10mA$	2.3	2.7	3.5	V
		$V_{GS}=V_{DS}, I_D=10mA, T_j=175^\circ C$		1.9		
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=18V, V_{DS}=0V$			100	nA
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=1200V, V_{GS}=0V$		1	50	$\mu A$
		$V_{DS}=1200V, V_{GS}=0V, T_j=175^\circ C$		10	200	
$R_{DS(on)}$	Drain-Source On-State Resistance	$V_{GS}=18V, I_D=40A$		40	55	m $\Omega$
		$V_{GS}=18V, I_D=40A, T_j=175^\circ C$		70		
$g_{fs}$	Transconductance	$V_{DS}=10V, I_D=40A$		16		S

**Thermal Characteristics**

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$R_{th(jc)}$	Thermal Resistance from Junction to Case		0.45		K/W

**AC Characteristics**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=800V$ $f=100kHz, V_{AC}=25mV$		2100		pF
$C_{oss}$	Output Capacitance			115		pF
$C_{rss}$	Reverse Transfer Capacitance			6		pF
$R_{G(int)}$	Internal Gate Resistance	$f=1MHz, V_{AC}=25mV$		1.6		$\Omega$

**Gate Charge Characteristics**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$Q_{GS}$	Gate to Source Charge	$V_{DS}=800V$ $I_D=40A$ $V_{GS}=-4/+18V$		30		nC
$Q_{GD}$	Gate to Drain Charge			42		nC
$Q_G$	Total Gate Charge			90		nC

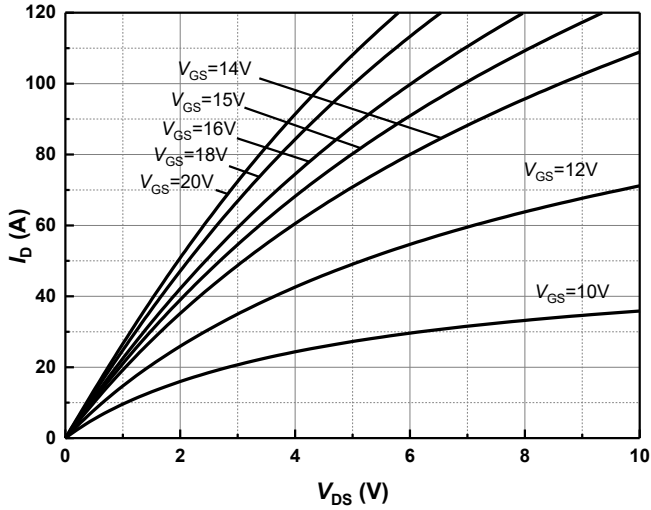
**Switching Characteristics**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$t_{d(on)}$	Turn-On Delay Time			58		ns
$t_r$	Rise Time	$V_{DC}=800V, V_{GS}=-4/18V$		24		ns
$t_{d(off)}$	Turn-Off Delay Time	$I_D=40A, R_{G(ext)}=8.2\Omega$		28		ns
$t_f$	Fall Time	$L_\sigma=70nH, T_j=25^\circ C$		16		ns
$E_{on}$	Turn-On Energy	diode: body diode at $V_{GS}=-4V$		1400		uJ
$E_{off}$	Turn-Off Energy	Inductive Load		340		uJ
$t_{d(on)}$	Turn-On Delay Time	Eon includes diode reverse recovery		55		ns
$t_r$	Rise Time	$V_{DC}=800V, V_{GS}=-4/18V$		30		ns
$t_{d(off)}$	Turn-Off Delay Time	$I_D=40A, R_{G(ext)}=8.2\Omega$		34		ns
$t_f$	Fall Time	$L_\sigma=70nH, T_j=175^\circ C$		16		ns
$E_{on}$	Turn-On Energy	diode: body diode at $V_{GS}=-4V$		1910		uJ
$E_{off}$	Turn-Off Energy	Inductive Load		370		uJ
		Eon includes diode reverse recovery				

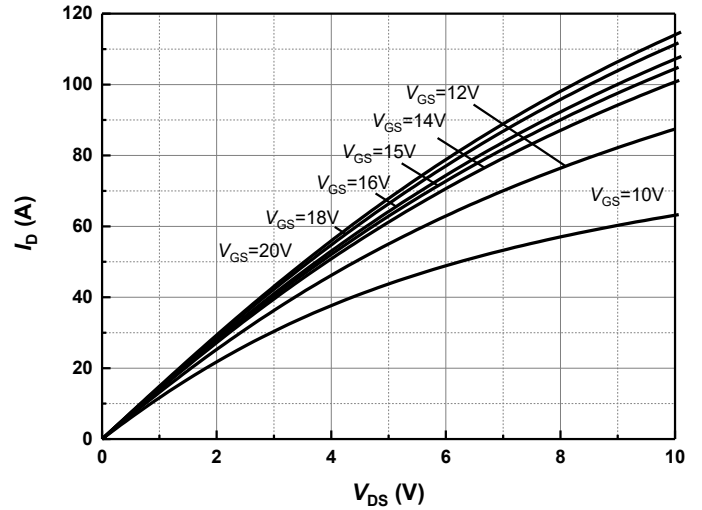
**Reverse Diode Characteristics**

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{SD}$	Diode Forward Voltage	$V_{GS}=-4V, I_{SD}=20A, T_j=25^\circ C$		4.6		V
		$V_{GS}=-4V, I_{SD}=20A, T_j=175^\circ C$		4.0		
$I_{SD}$	Continuous Diode Forward Current	$V_{GS}=-4V, T_C=25^\circ C$			56	A
$I_{SD,pulse}$	Pulse Diode Current	$V_{GS}=-4V, \text{pulse width } t_p \text{ limited by } T_{jmax}$		129		A
$t_{rr}$	Reverse Recovery Time	$V_{DC}=800V, I_{SD}=40A$		34		ns
$Q_{rr}$	Reverse Recovery Charge	$-di_F/dt=1200A/\mu s$		112		nC
$I_{rrm}$	Peak Reverse Recovery Current	$T_j=25^\circ C$		7		A
$t_{rr}$	Reverse Recovery Time	$V_{DC}=800V, I_{SD}=40A$		50		ns
$Q_{rr}$	Reverse Recovery Charge	$-di_F/dt=1400A/\mu s$		725		nC
$I_{rrm}$	Peak Reverse Recovery Current	$T_j=175^\circ C$		25		A

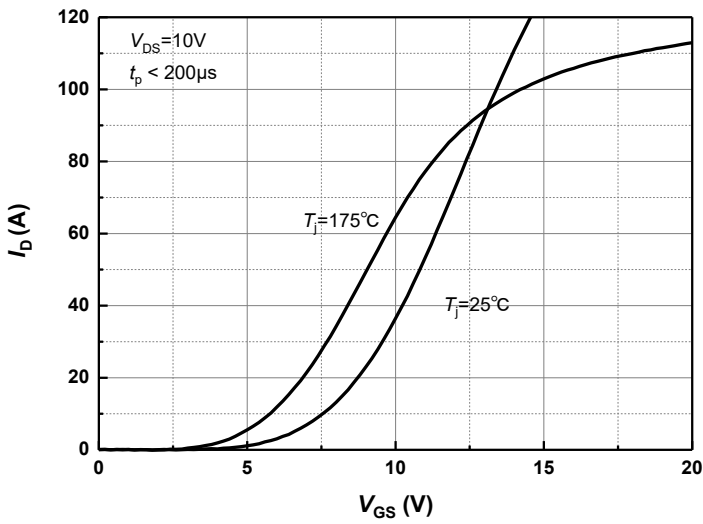
**Typical Performance**



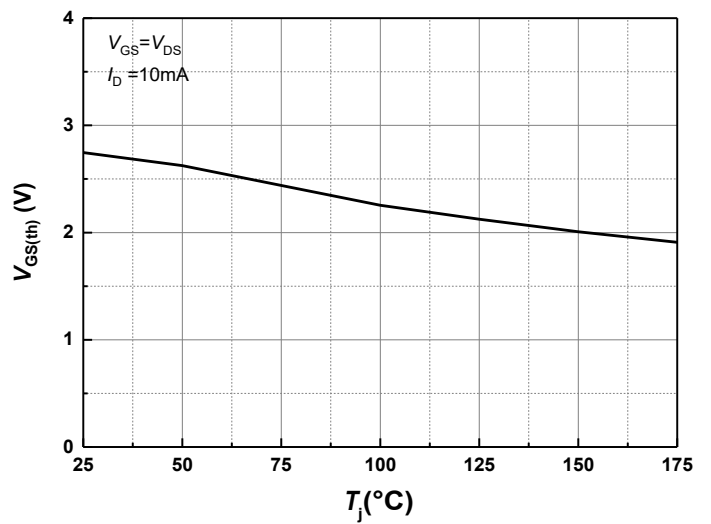
**Figure 1** Typical Forward Output Characteristics at  $T_j = 25^\circ\text{C}$



**Figure 2** Typical Forward Output Characteristics at  $T_j = 175^\circ\text{C}$

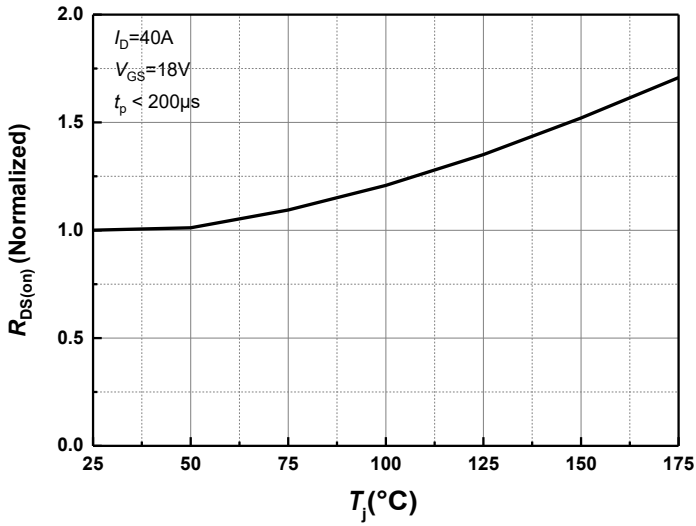


**Figure 3** Transfer Characteristics for Various Temperature

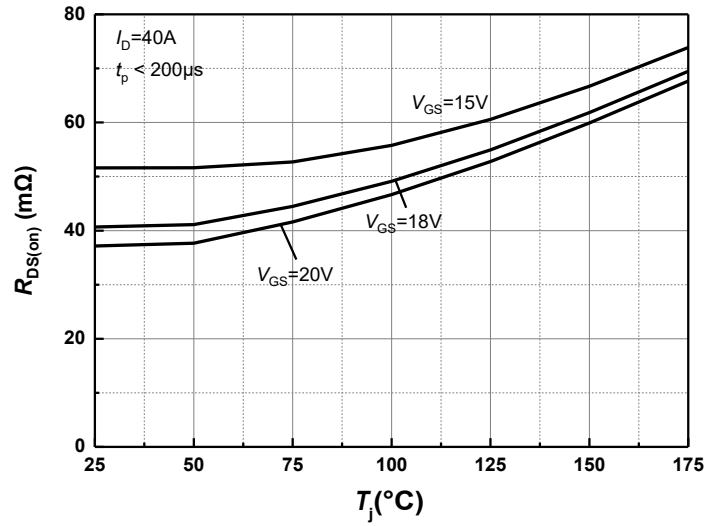


**Figure 4** Threshold Voltage for Various Temperature

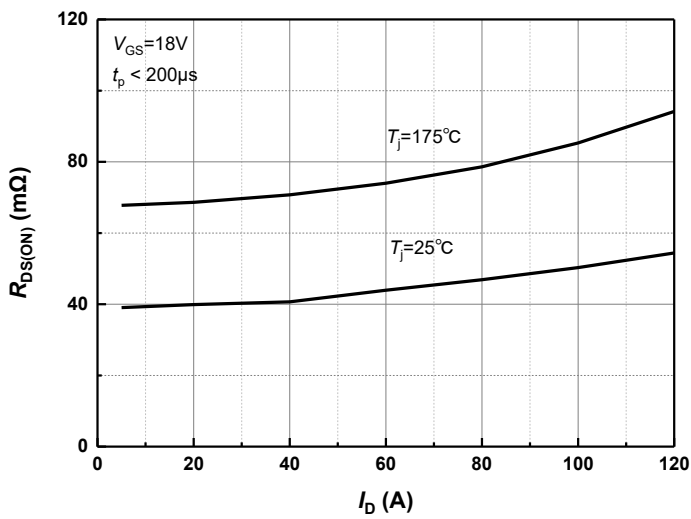
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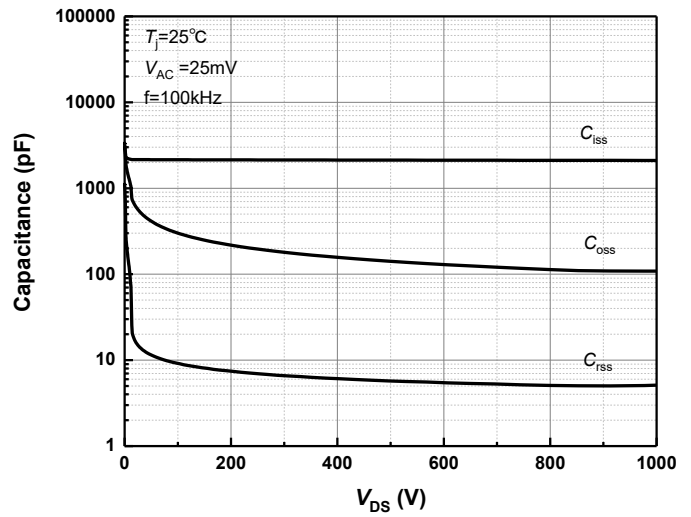
**Figure 5 Normalized On-Resistance for Various Temperature**



**Figure 6 On-Resistance vs. Temperature for Various Gate-Source Voltage**

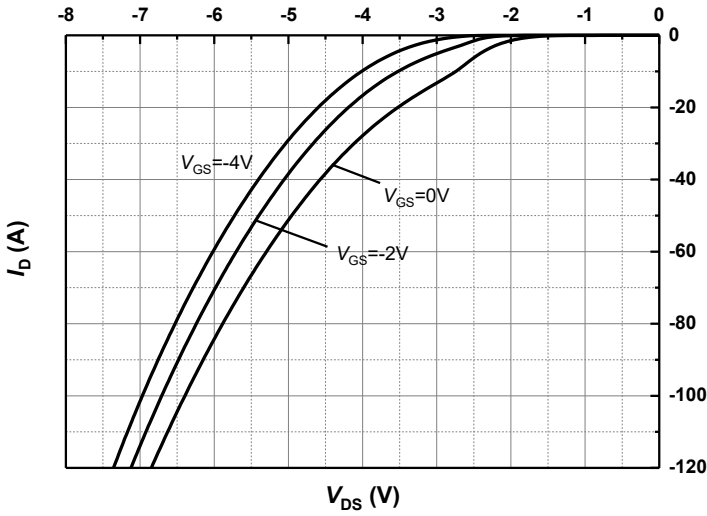


**Figure 7 On-Resistance vs. Drain Current for Various Temperature**

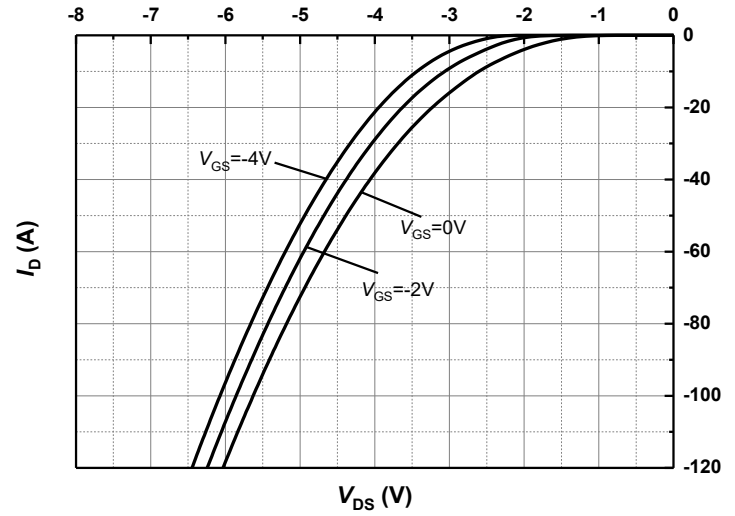


**Figure 8 Capacitance vs. Drain-Source Voltage (0 - 1000V)**

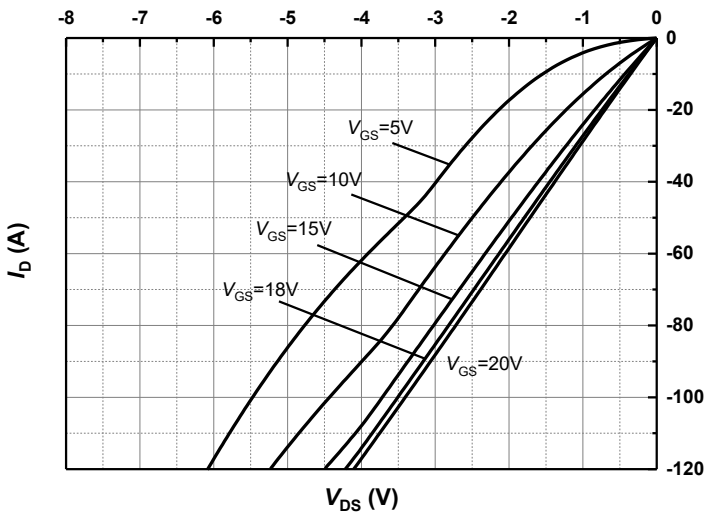
**Typical Performance**



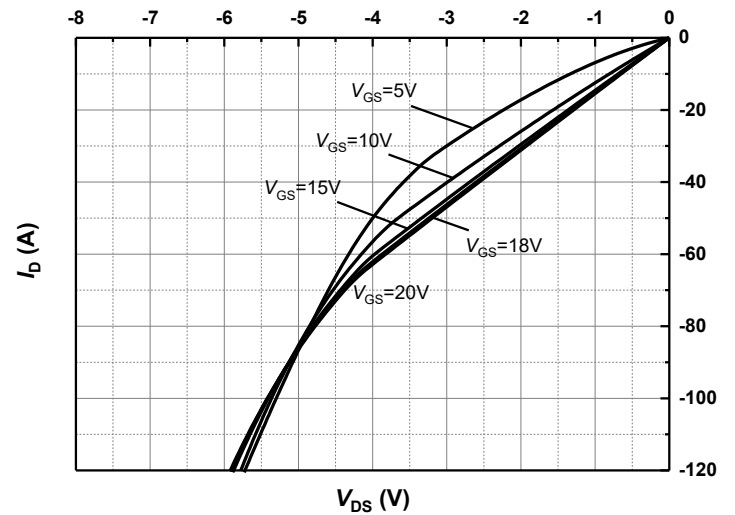
**Figure 9** Body Diode Characteristics at  $T_j=25^\circ\text{C}$



**Figure 10** Body Diode Characteristics at  $T_j=175^\circ\text{C}$

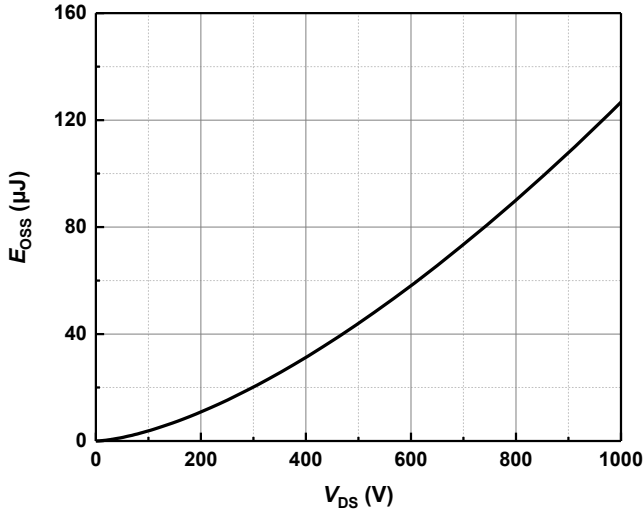


**Figure 11** 3rd Quadrant Characteristics at  $T_j=25^\circ\text{C}$

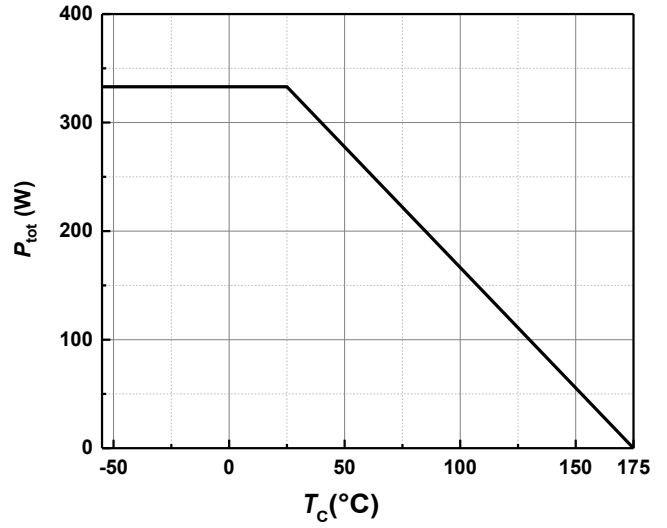


**Figure 12** 3rd Quadrant Characteristics at  $T_j=175^\circ\text{C}$

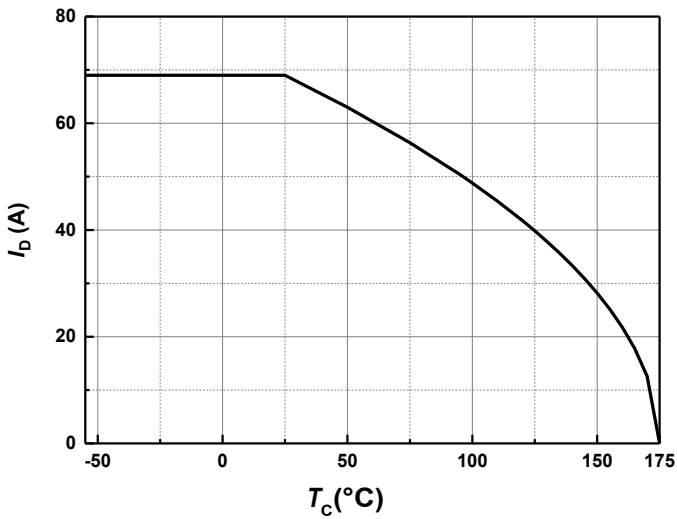
**Typical Performance**



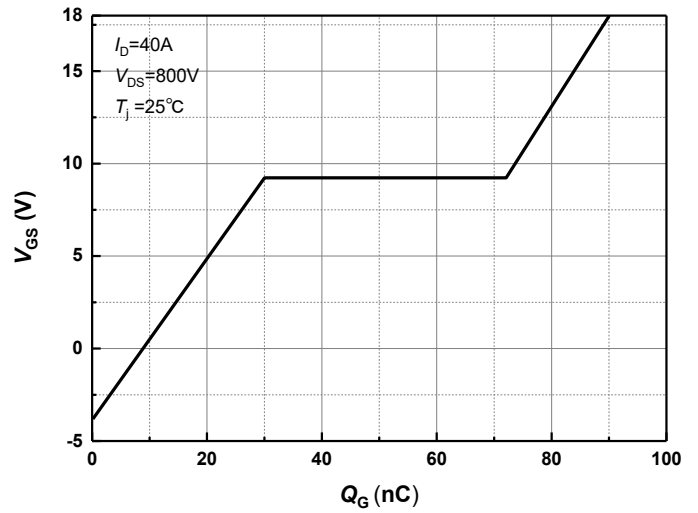
**Figure 13 Output Capacitor stored Energy**



**Figure 14 Maximum Power Dissipation Derating vs. Case Temperature**



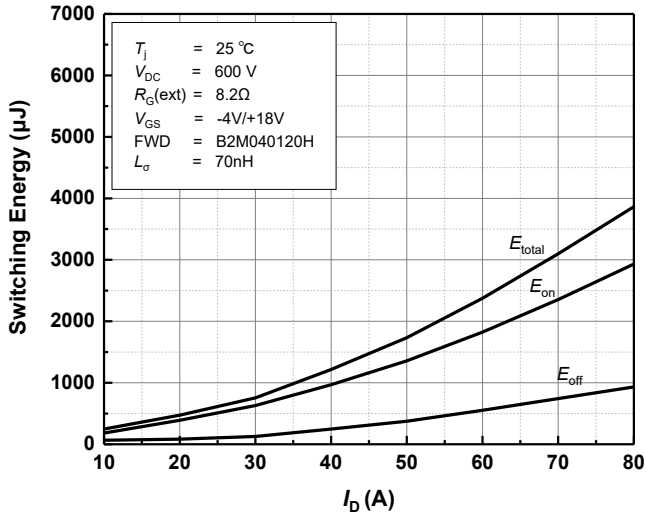
**Figure 15 Continuous Drain Current Derating vs. Case Temperature**



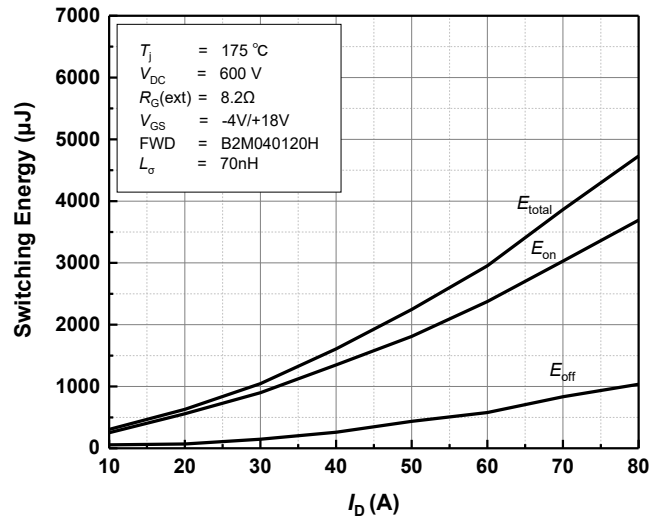
**Figure 16 Gate Charge Characteristics**



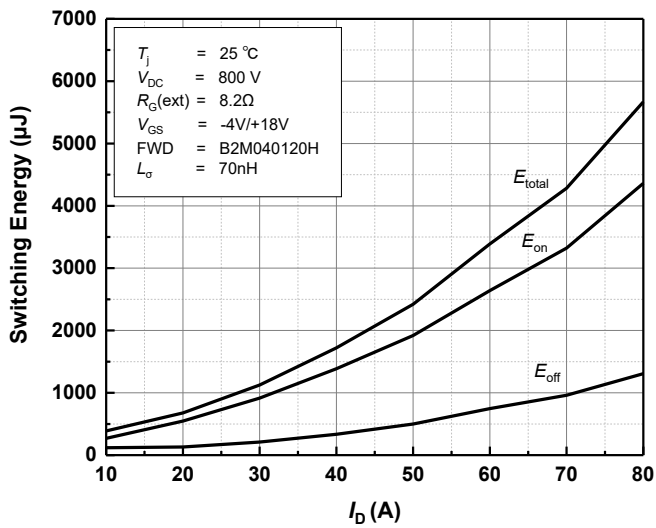
**Typical Performance**



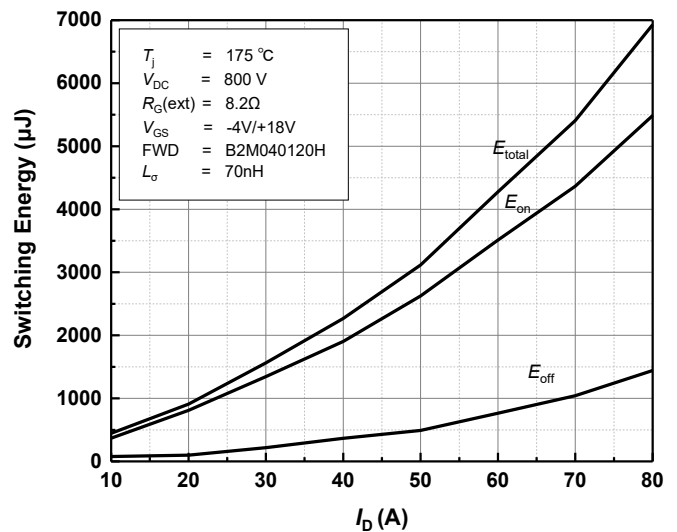
**Figure 17** Clamped Inductive Switching Energy vs. Drain Current ( $V_{\text{DC}} = 600\text{V}$ ) at  $T_j = 25^\circ\text{C}$



**Figure 18** Clamped Inductive Switching Energy vs. Drain Current ( $V_{\text{DC}} = 600\text{V}$ ) at  $T_j = 175^\circ\text{C}$

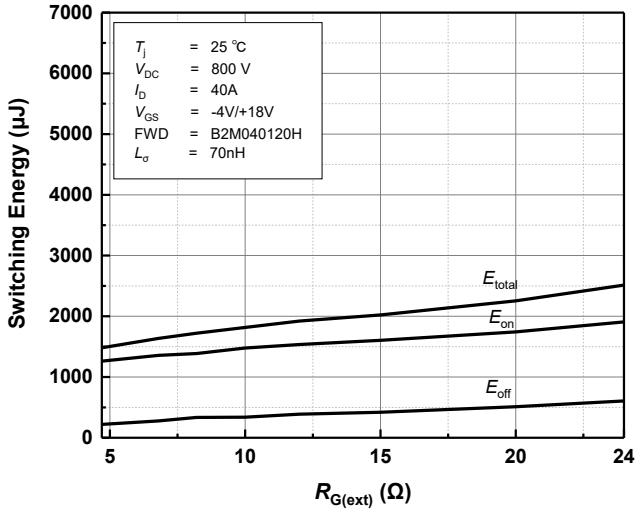


**Figure 19** Clamped Inductive Switching Energy vs. Drain Current ( $V_{\text{DC}} = 800\text{V}$ ) at  $T_j = 25^\circ\text{C}$

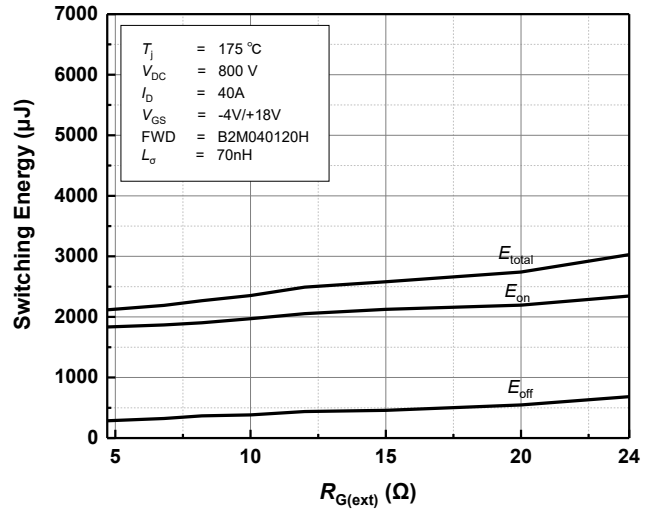


**Figure 20** Clamped Inductive Switching Energy vs. Drain Current ( $V_{\text{DC}} = 800\text{V}$ ) at  $T_j = 175^\circ\text{C}$

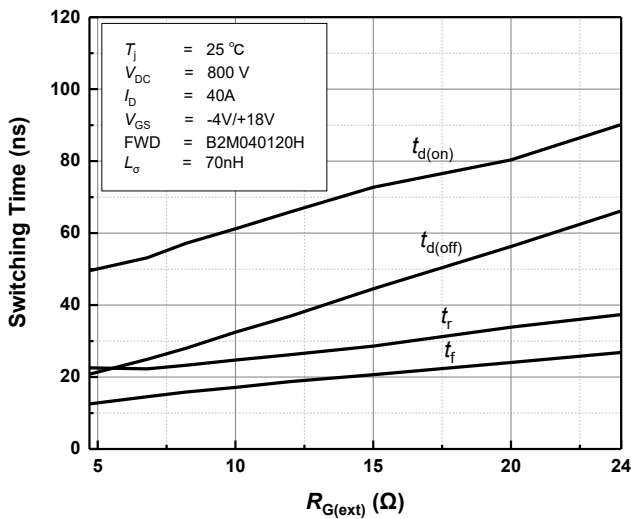
**Typical Performance**



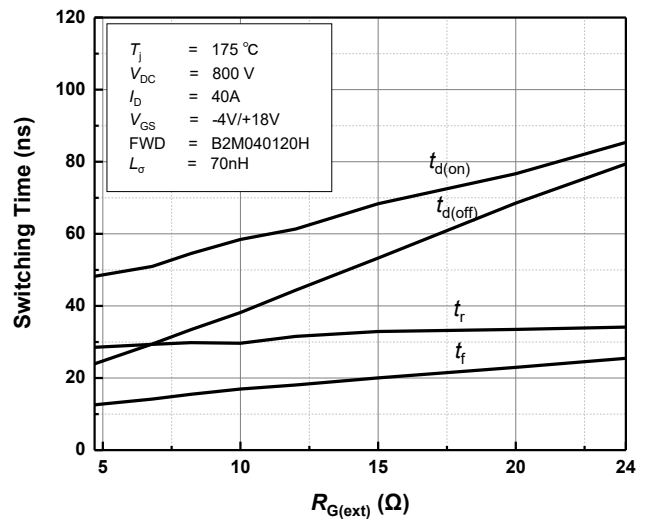
**Figure 21 Clamped Inductive Switching Energy vs. External Gate Resistance at  $T_j=25^\circ C$**



**Figure 22 Clamped Inductive Switching Energy vs. External Gate Resistance at  $T_j=175^\circ C$**



**Figure 23 Clamped Inductive Switching Time vs. External Gate Resistance at  $T_j=25^\circ C$**



**Figure 24 Clamped Inductive Switching Time vs. External Gate Resistance at  $T_j=175^\circ C$**

Typical Performance

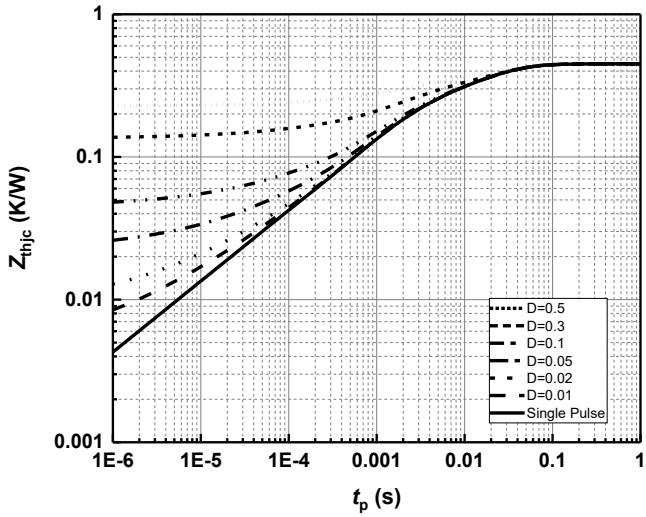


Figure 25 Transient Thermal Impedance (Junction - Case)

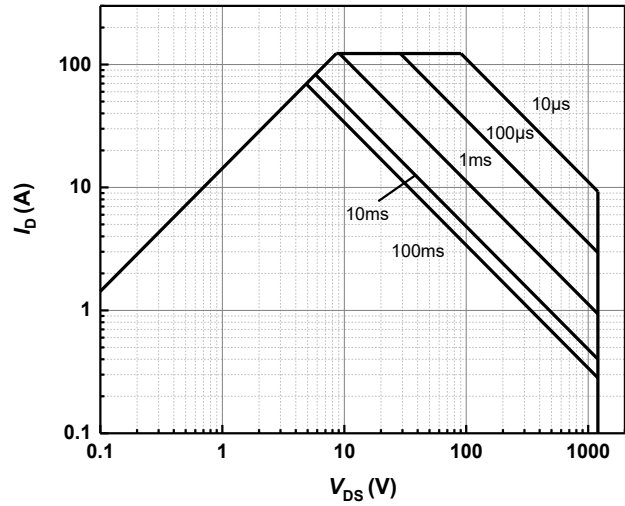
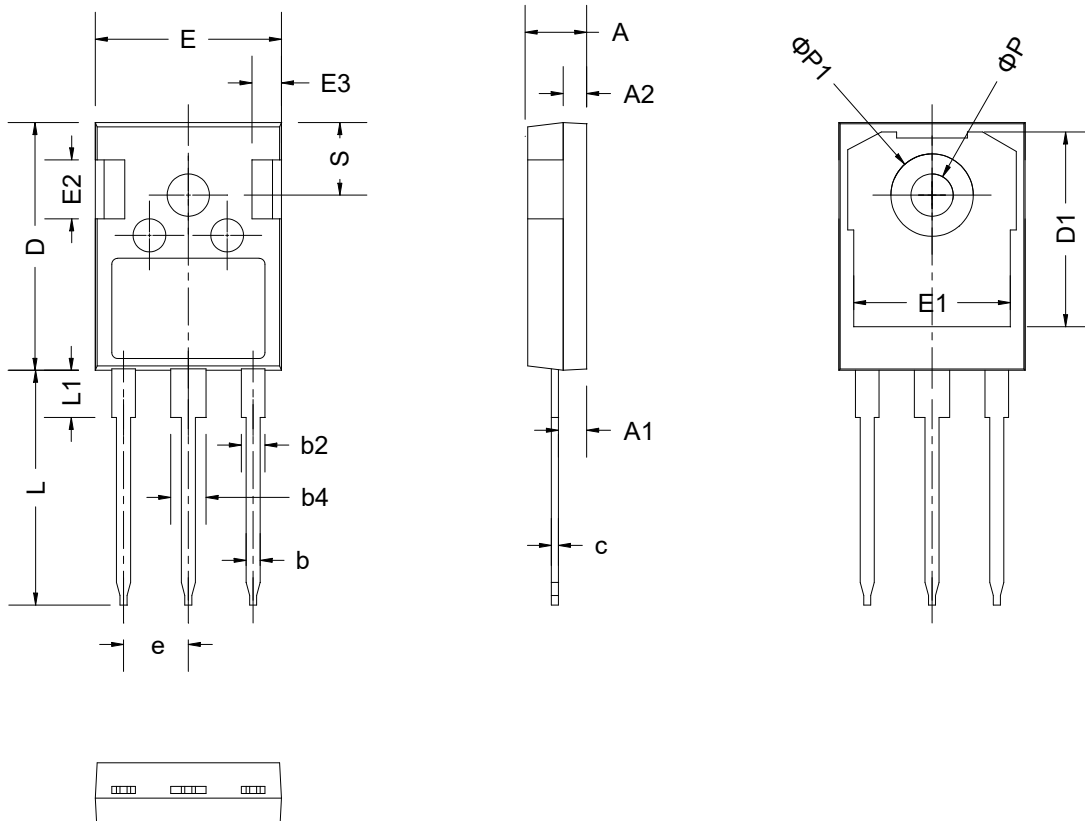


Figure 26 Forward Biased Safe Operating Area

**Package 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	20.80	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	5.44 BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
φ P	3.40	3.60	3.80
φ P1	-	-	7.30
S	6.16 BSC		

**Revision History**

<b>Document Version</b>	<b>Date of Release</b>	<b>Description of Changes</b>
Rev. 0.0	2023-07-18	Draft datasheet created.
Rev. 0.1	2023-07-27	Characteristics update.

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