MM40N120BK

TO247-4

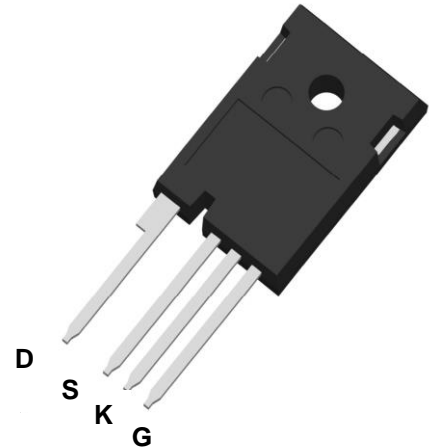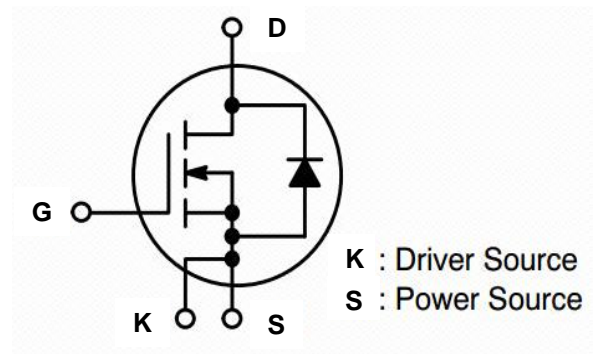| August 2024 | Preliminary | RoHS Compliant |

PRODUCT FEATURES

☐ Very fast and robust intrinsic body diode

☐ Very low $R_{DS(on)}$ over the entire temperature range

☐ High speed switching performances

☐ Very high operating junction temperature capability

☐ Source sensing pin for increased efficiency

APPLICATIONS

☐ General purpose drives (GPD)

☐ EV-Charging

☐ Online UPS/Industrial UPS

☐ String inverter

☐ Solar power optimizer

K : Driver Source
S : Power Source

Maximum Ratings(T_C=25°C unless otherwise specified)

Symbol	Parameter/Test Conditions		Values	Unit
V_{DS}	Drain-source Voltage	V_{GS}=0 V, I_D=100µA	1200	V
$V_{GS,max}$	Gate-source Voltage （Dynamic）	AC (f >1 Hz)	-10/+23	V
$V_{GS,op}$	Gate-source Voltage （Static）	Static	-4/+18	V
I_D	Continuous Drain Current	V_{GS}=18V,T_C=25℃,T_{vjmax}=175℃	70	A
		V_{GS}=18V,T_C=100℃,T_{vjmax}=175℃	50	A
$I_{D,pulse}$	Pulsed Drain Current	tp limited by T_{vjmax}	100	A
P_D	Power Dissipation	Tc=25°C,limited by T_{vjmax}	300	W
T_{vj}, T_{stg}	Operating Junction and Storage Temperature		-55~175	℃
Weight			8	g

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Electrical Characteristic *(T$_C$=25°C unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V$_{BR(DSS)}$	Drain-Source Breakdown Voltage	V$_{GS}$ = 0 V,I$_D$=100 μA	1200			V
V$_{GS(th)}$	Gate Threshold Voltage	V$_{DS}$=V$_{GS}$,I$_C$=10mA,T$_{vj}$=25℃	2.3	2.8	4.0	V
		V$_{DS}$=V$_{GS}$,I$_C$=10mA,T$_{vj}$=175℃		2.2		V
I$_{DSS}$	Reverse Bias Drain Current	V$_{DS}$=1200V, V$_{GS}$=0V, Tvj=25℃		1.0	20	μA
I$_{GSS}$	Gate-source Leakage Current	V$_{DS}$=0V,V$_{GS}$=18V, Tvj=25℃		10	100	nA
		V$_{DS}$=0V,V$_{GS}$=-4V, Tvj=25℃	-100	-10		nA
R$_{DS(on)}$	Static Drain-source On-state Resistance	I$_D$=33.3A, V$_{GS}$=15V, T$_{vj}$=25℃		40	50	mΩ
		I$_D$=33.3A, V$_{GS}$=15V, T$_{vj}$=125℃		49		
		I$_D$=33.3A, V$_{GS}$=15V, T$_{vj}$=150℃		53.5		
		I$_D$=33.3A, V$_{GS}$=15V, T$_{vj}$=175℃		61		
		I$_D$=33.3A, V$_{GS}$=18V, T$_{vj}$=25℃		32	40	mΩ
		I$_D$=33.3A, V$_{GS}$=18V, T$_{vj}$=125℃		46		
		I$_D$=33.3A, V$_{GS}$=18V, T$_{vj}$=150℃		50		
		I$_D$=33.3A, V$_{GS}$=18V, T$_{vj}$=175℃		58		
g$_{fs}$	Transconductance	V$_{DS}$=20V, I$_D$=33.3A, Tvj=25℃		24		S
		V$_{DS}$=20V, I$_D$=33.3A, Tvj=175℃		32		
C$_{iss}$	Input Capacitance	V$_{DS}$=1000V,V$_{GS}$=0V,f =100kHz		3000		pF
C$_{oss}$	Output Capacitance			122		pF
C$_{rss}$	Reverse Transfer Capacitance			4.4		pF
Q$_{oss}$	Output Charge	Calculated by C$_{oss}$(f)V$_{DS}$@100kHz		240		nC

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Electrical Characteristic *(T$_C$=25℃ unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
t$_{d(on)}$	Turn on Delay Time	V$_{DS}$=800V I$_D$=33.3A R$_{Gon}$ =2.5Ω,R$_{Goff}$ =2.5Ω V$_{GS}$=-4/18V T$_{vj}$=175℃		17		ns
t$_r$	Rise Time			20		
t$_{d(off)}$	Turn off Delay Time			44		
t$_f$	Fall Time			9		
E$_{on}$	Turn on Energy			0.25		mJ
E$_{off}$	Turn off Energy			0.2		
R$_{G(int)}$	Internal Gate Resistance	f =1MHz		1.6		Ω
Q$_{GS}$	Gate to Source Charge	V$_{DS}$=800V,I$_D$=33.3A,V$_{GS}$=-4/18V		44		nC
Q$_{GD}$	Gate to Drain Charge			25.8		nC
Q$_G$	Total Gate Charge			120		nC
R$_{thJC}$	Junction to Case Thermal Resistance			0.486		K /W

Body Diode

Electrical Characteristic *(T$_C$=25℃ unless otherwise specified)*

Symbol	Parameter/Test Conditions		Min.	Typ.	Max.	Unit
V$_{SD}$	Diode Forward Voltage	I$_{SD}$=20A,V$_{GS}$=-4V,T$_{vj}$ =25℃		4		V
		I$_{SD}$=20A,V$_{GS}$=-4V,T$_{vj}$=175℃		3.6		
I$_S$	Continuous Diode Forward Current	V$_{GS}$=-4V,T$_C$=25℃,T$_{vjmax}$=175℃			65	A
I$_{S,pulse}$	Pulsed Drain Current	V$_{GS}$=-4V,tp limited by T$_{vjmax}$			100	A
t$_{rr}$	Reverse Recovery Time	V$_{GS}$=-4V , I$_S$=33.3A,V$_R$=800V dI$_F$/dt=-5000A/μs,T$_{vj}$=175℃		17.5		ns
I$_{RRM}$	Max. Reverse Recovery Current			44		A
Q$_{RR}$	Reverse Recovery Charge			430		nC

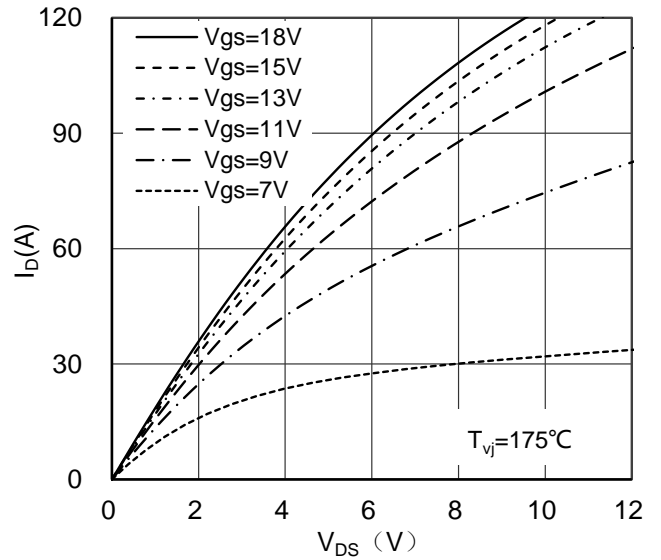Figure 1. Typical Output Characteristics
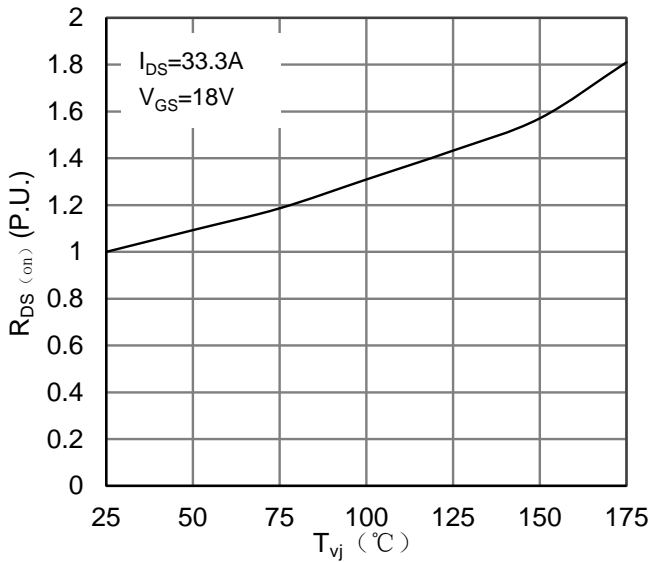

Figure 2. Typical Output Characteristics
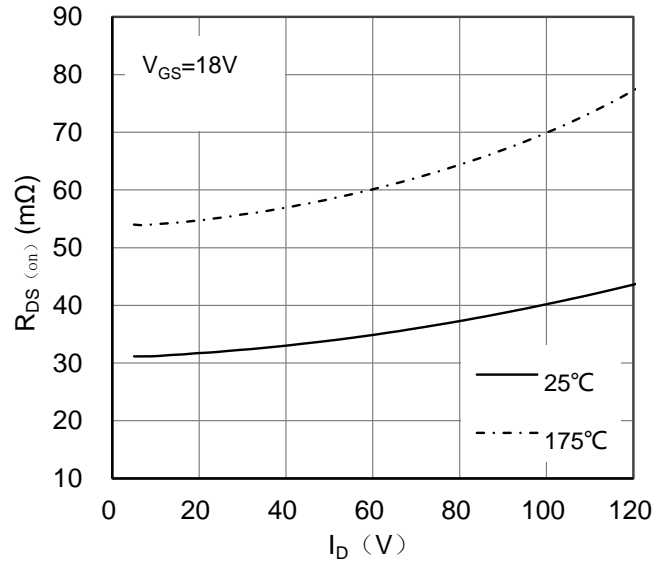

Figure 3. Typical Drain Source On-resistance

Figure 4. Typical Drain Source On-resistance
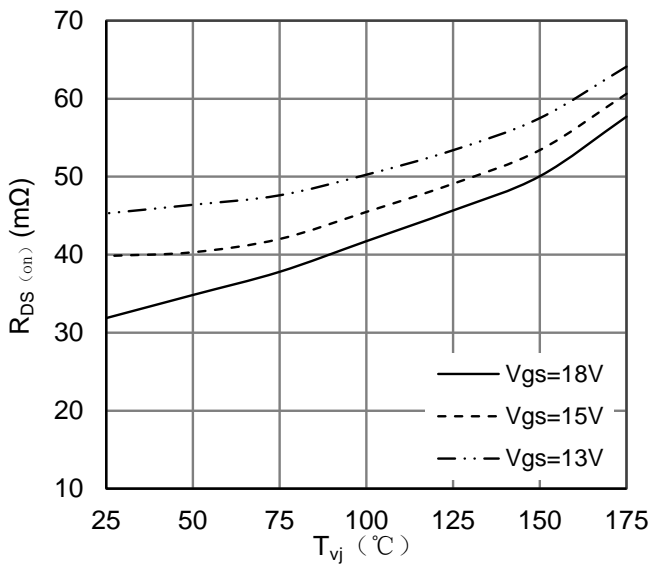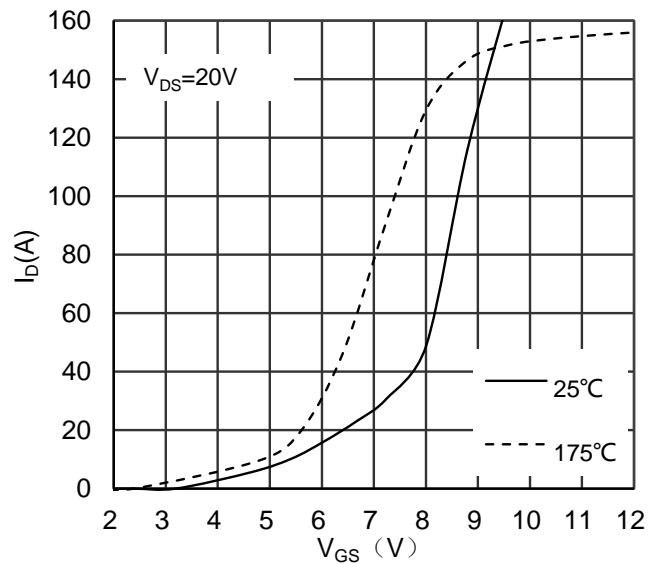

Figure 5. Typical Drain Source On-resistance

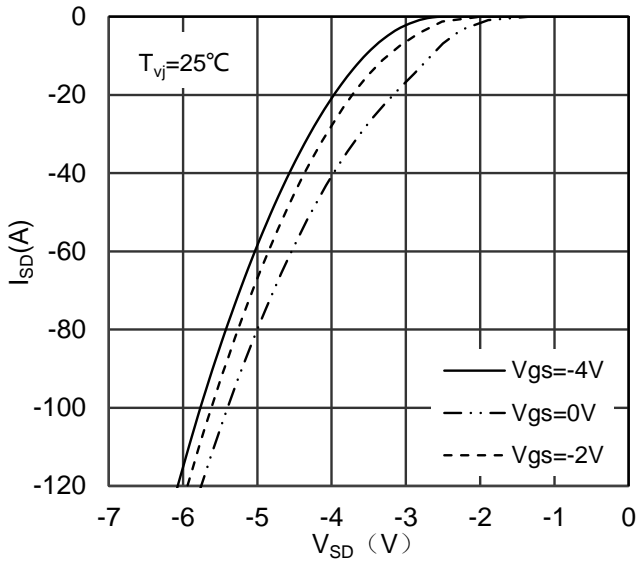Figure 6. Typical Transfer Characteristics
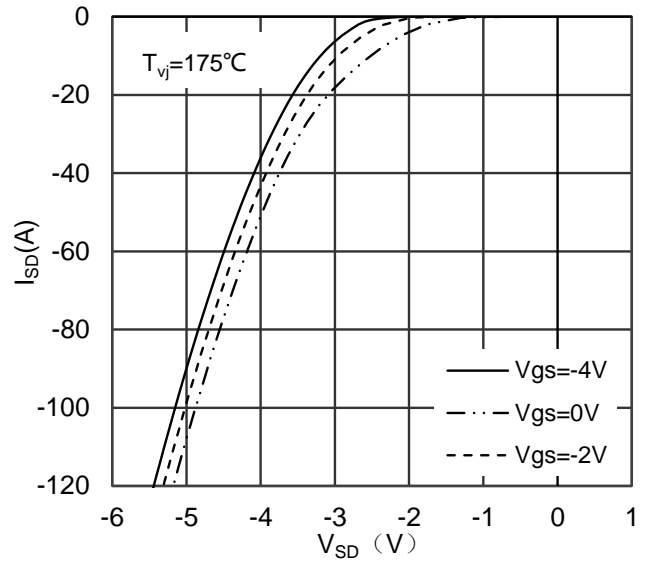
Figure 7. Typical Body Diode Forward Characteristics

Figure 8. Typical Body Diode Forward Characteristics

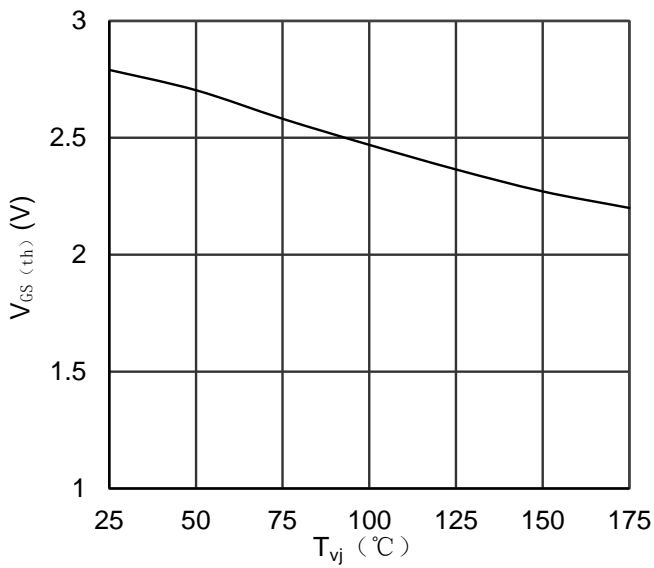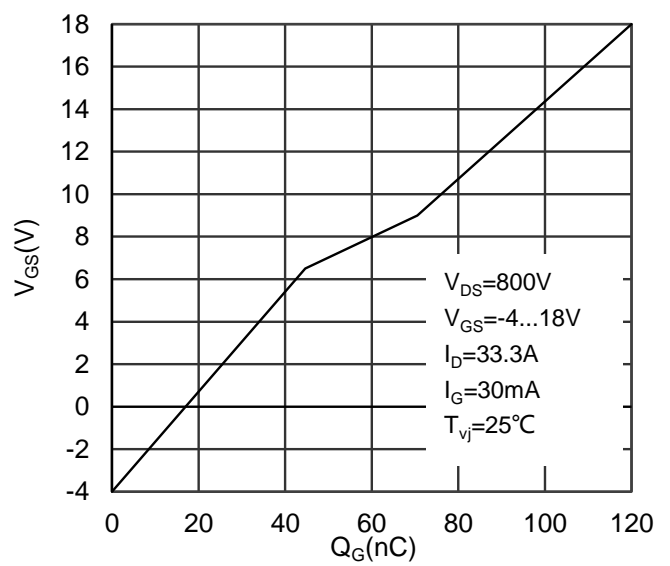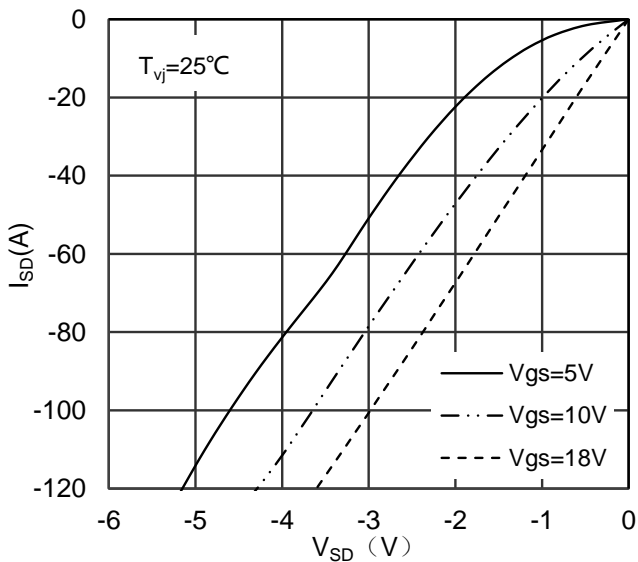Figure 9. Typical Gate-source Threshold Voltage

Figure 10. Typical Gate Charge

Figure 11. Typical Body Diode Forward Characteristics

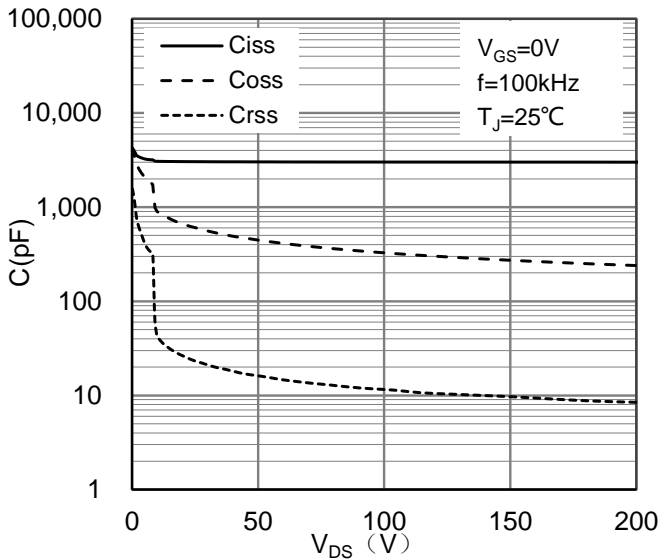Figure 12. Typical Body Diode Forward Characteristics
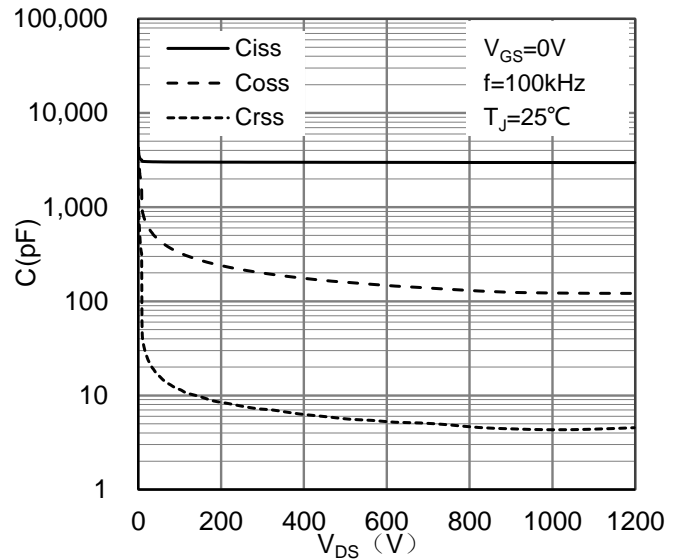
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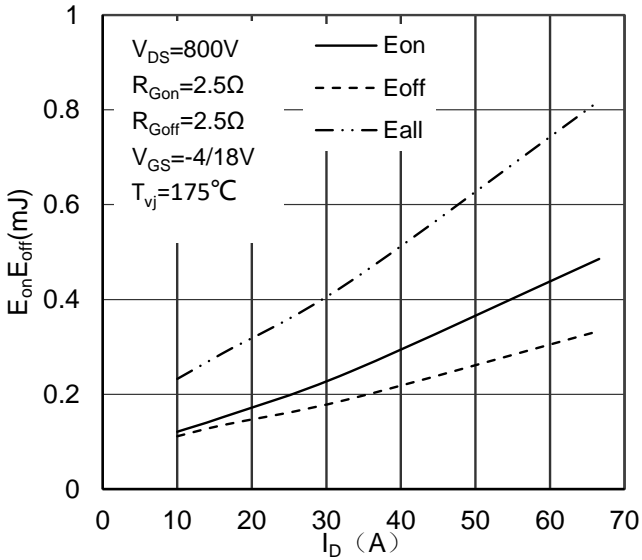Figure 13. Typical Capacitance

Figure 14. Typical Capacitance

Figure 15. Typical Switching Energy

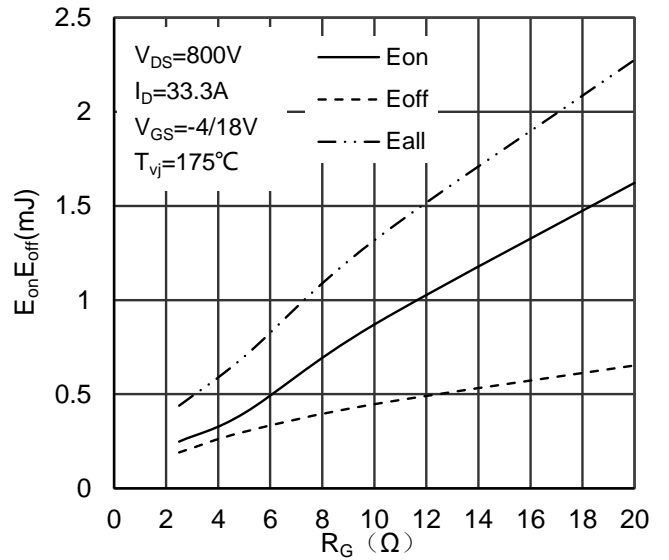

Figure 16. Typical Switching Energy
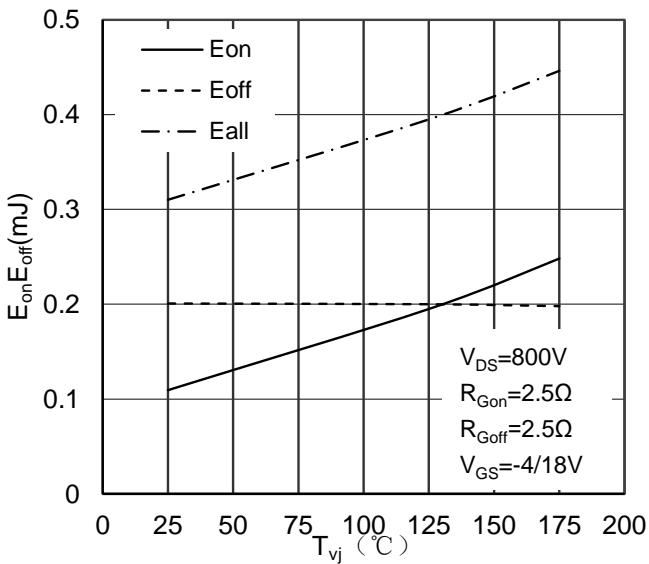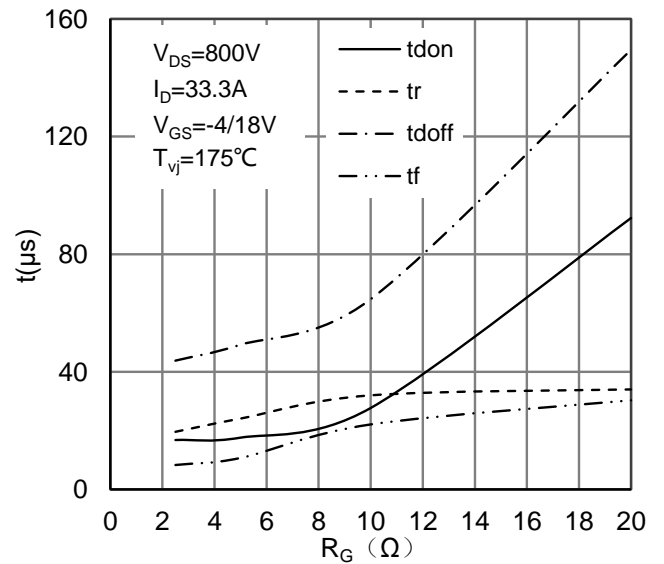

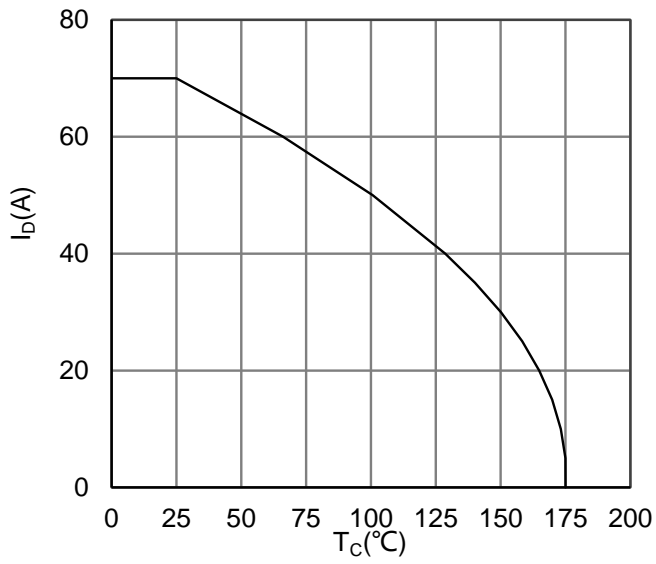Figure 17. Typical Switching Energy

Figure 18. Typical Switching Times

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Figure 19. Continuous Drain Current vs Case Temperature

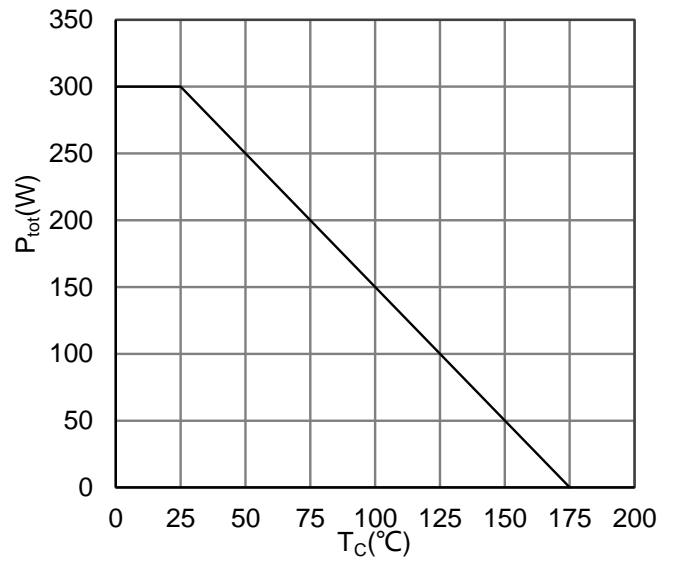Figure 20. Power Dissipation vs Case Temperature

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Symbol	Min	Nom	Max
A	4.83	5.02	5.21
A1	2.29	2.42	2.54
A2	1.91	2.04	2.16
b	1.07	1.34	1.60
b1	2.39	2.67	2.94
c	0.55	0.62	0.68
e		2.54BSC	
e1		5.08BSC	
E	15.75	15.94	16.13
E1	12.38	12.91	13.43
E2	3.68	4.39	5.10
E3	1.00	1.14	1.90
D	23.30	23.45	23.60
D1	16.25	17.10	17.65
L	17.31	17.57	17.82
L1	3.97	4.17	4.37
L2	2.35	2.50	2.65
ΦP	3.51	3.58	3.65
ΦP1	-	-	7.18
S	6.04	6.17	6.30

UNIT: mm

Dimensions in (mm)
Figure 21. Package Outline