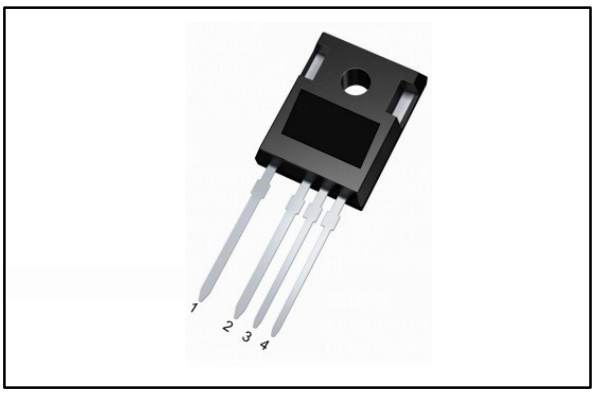
Type	HMM165N120T4
Package	TO247-4L
V_{DS}	1200V
I_{DS} (T_c=25℃,$R_{th(j-c,max)}$)	150A
$R_{DS(ON),typ}$ (V_{GS}=18V,I_D=100A,T_j=25℃)	13mΩ
$T_{j,max}$	175℃

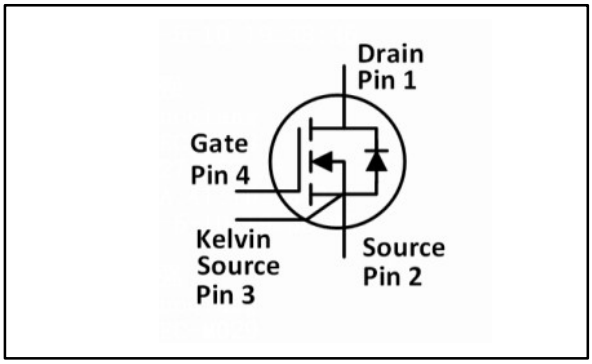
Outline



Features

- High-Speed Switching
- Low switching losses
- High blocking voltage with low on-resistance
- Temperature-Independent Switching Behavior

Inner Circuit



Applications

- PV string inverters
- Solar power optimizer
- Switch mode power supplies
- Online UPS/Industrial UPS
- High Voltage DC/DC Converters

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

Symbol	Parameter	Conditions	Value	Unit	Note
$V_{DS,max}$	Drain Source Voltage	V_{GS}=0V,I_D=100μA	1200	V	
$V_{GS,max}$	Gate Source Voltage	Absolute Maximum Values	-8/+22	V	
V_{GSop}	Gate Source Voltage	Recommended Operational Values	-4/+18	V	
I_D	Continuous Drain Current	V_{GS}=18V,T_C=25℃	150	A	Fig.19
		V_{GS}=18V,T_C=100℃	106		
$I_{D(pulse)}$	Pulsed Drain Current	Pulse width t_p limited by T_j,max	316	A	Fig.22
P_D	Power Dissipation	T_C=25℃,T_j=175℃	535	W	Fig.20
T_j,T_{stg}	Operating Junction and Storage Temperature		-55 to 175	℃	
T_L	Soldering Temperature	1.6mm (0.063″) from case for 10s	260	℃	

Static Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
$V_{(BR)DSS}$	Drain Source Breakdown Voltage	V_{GS}=0V,I_D=100uA	1200	-	-	V	
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=28mA	2.0	2.6	4	V	Fig.11
		V_{DS}=V_{GS},I_D=28mA,T_j=175℃	-	2.0	-	V	
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=1200V,V_{GS}=0V		0.2	100	μA	
I_{GSS}	Gate Source Leakage Current	V_{GS}=18V,V_{DS}=0V	-	-	100	nA	
$R_{DS(on)}$	Current Drain-Source On-State Resistance	V_{GS}=15V,I_D=100A	-	17	23	mΩ	Fig.4,5,6
		V_{GS}=15V,I_D=100A,T_j=175℃	-	24	-		
		V_{GS}=18V,I_D=100A	-	13	20		
		V_{GS}=18V,I_D=100A,T_j=175℃	-	23	-		
g_{fs}	Transconductance	V_{DS}=20V,I_D=100A	-	58	-	S	Fig.7
		V_{DS}=20V,I_D=100A,T_j=175℃	-	55	-		
$R_{g,int}$	Internal Gate Resistance	V_{AC}=25mV,f=1MHz	-	9.0	-	Ω	
V_{SD}	Diode Forward Voltage	V_{GS}= -4V,I_{SD}=50A	-	3.4	-	V	Fig.8,9,10
		V_{GS}= -4V,I_{SD}=50A,T_j=175℃	-	3.0	-		

Dynamic Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
C_{iss}	Input Capacitance	V_{DS}=1000V,V_{GS}=0V,T_j=25℃,V_{AC}=25mV,f=100KHz	-	6522	-	pF	Fig.17, 18
C_{oss}	Output Capacitance		-	300	-		
C_{rss}	Reverse Capacitance		-	17.7	-		
E_{oss}	Coss Stored Energy		-	175	-	μJ	Fig.16
Q_{gs}	Gate Source Charge	V_{DS}=800V,V_{GS}=-4/18V,I_D=100A	-	89	-	nC	Fig.12
Q_{gd}	Gate Drain Charge		-	74	-		
Q_g	Gate Charge		-	250	-		

Switching Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
E_{on}	Turn on Switching Energy	V_{DS}=800V,V_{GS}=-4/+18V,I_D=100A, R_g=2.4Ω,L=120μH	-	2869	-	μJ	Fig.26
E_{off}	Turn off Switching Energy		-	1959	-		
$t_{d(on)}$	Turn on Delay Time		-	56	-	nS	Fig.27, 28
t_r	Rise Time		-	83	-		
$t_{d(off)}$	Turn off Delay Time		-	95	-		
t_f	Fall Time		-	23	-		

Body Diode Characteristics (Tc=25℃ unless otherwise noted)

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
V_{SD}	Diode Forward Voltage	V_{GS}= -4V,I_{SD}=50A	-	3.4	-	V	Fig.8,9,10
		V_{GS}= -4V,I_{SD}=50A,T_j=175℃	-	3.0	-		
I_S	Continuous Diode Forward Current	V_{GS}= -4V,T_c=25℃	-	102	-	A	
t_{rr}	Reverse Recovery Time	VR=800V,V_{GS}= -4V,I_D=100A, di/dt=3000A/μS,T_j=175℃	-	52	-	nS	
Q_{rr}	Reverse Recovery Charge		-	2211	-	nC	
I_{rm}	Peak Reverse Recovery Current		-	69	-	A	

Thermal Characteristics

Symbol	Parameter	Conditions	Value	Unit	Note
$R_{th(j-c)}$	Thermal Resistance from Junction to Case		0.28	℃/W	Fig.21
$R_{th(j-a)}$	Thermal Resistance from Junction to Ambient		26.8		

Electrical Characteristic Curves

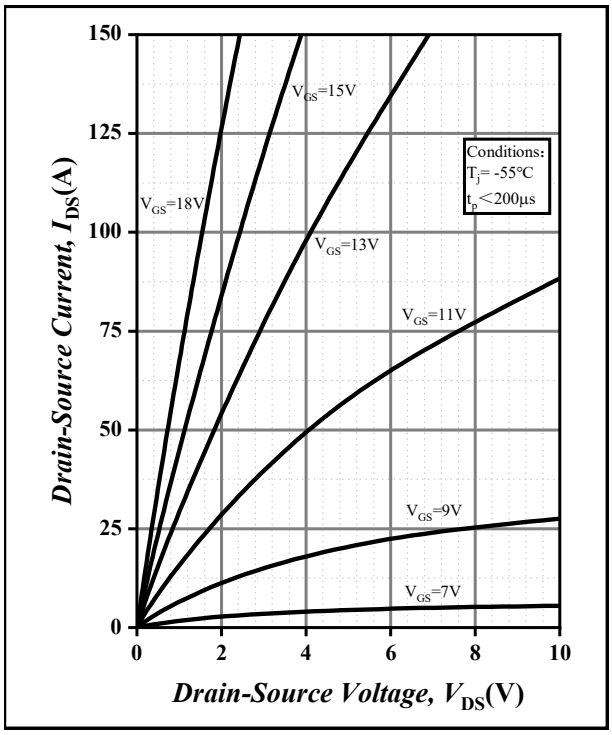


Figure 1. Output Characteristic T_j= -55℃

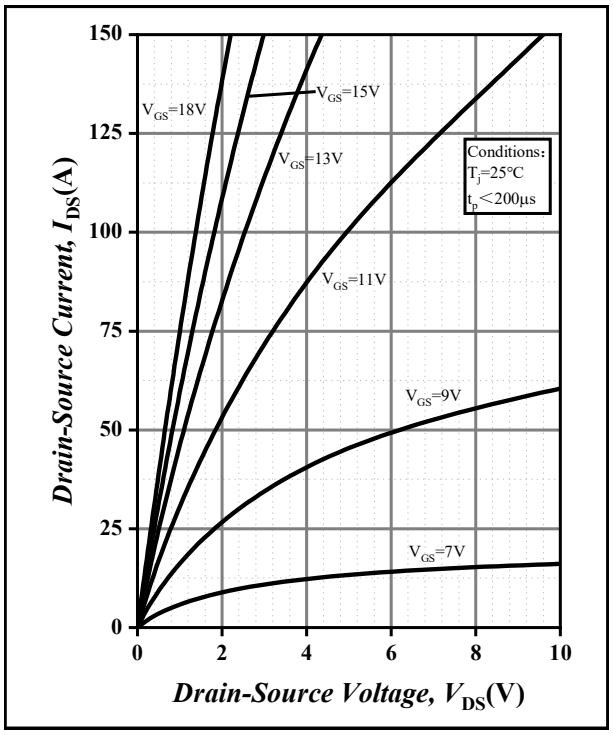


Figure 2. Output Characteristic T_j= 25℃

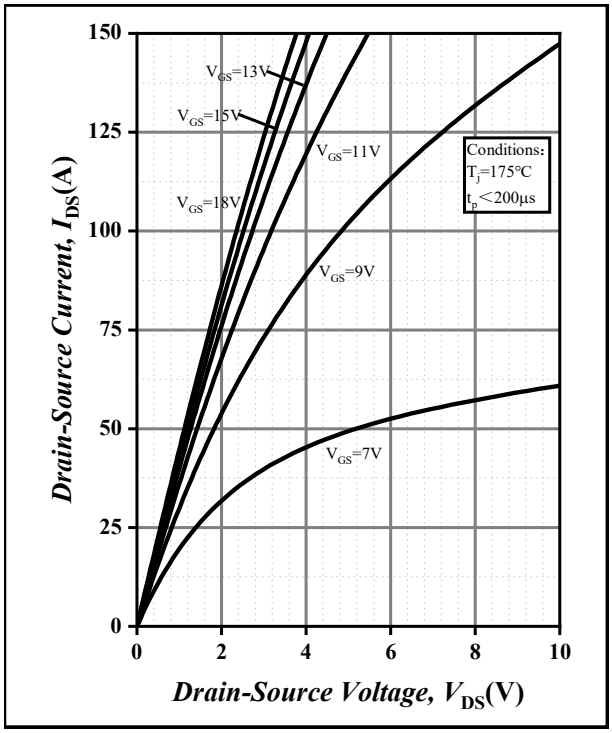


Figure 3. Output Characteristic T_j= 175℃

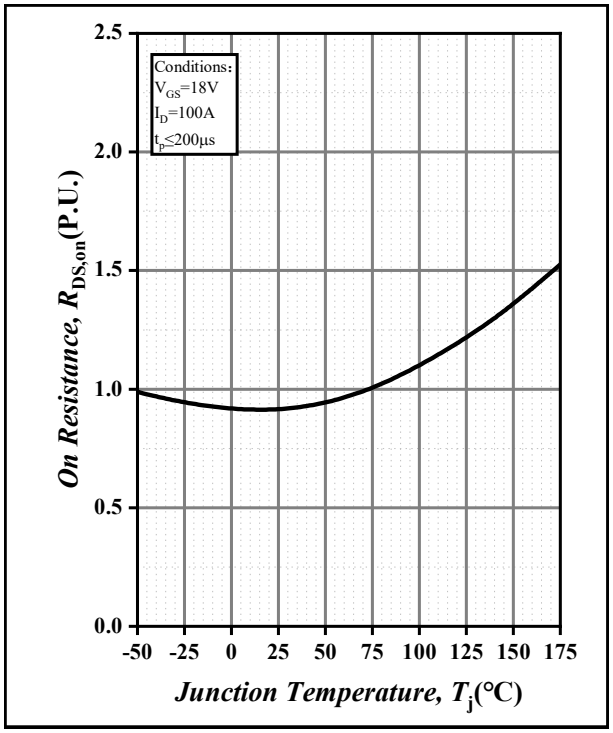


Figure 4. Normalized On-Resistance vs. Temperature

Electrical Characteristic Curves

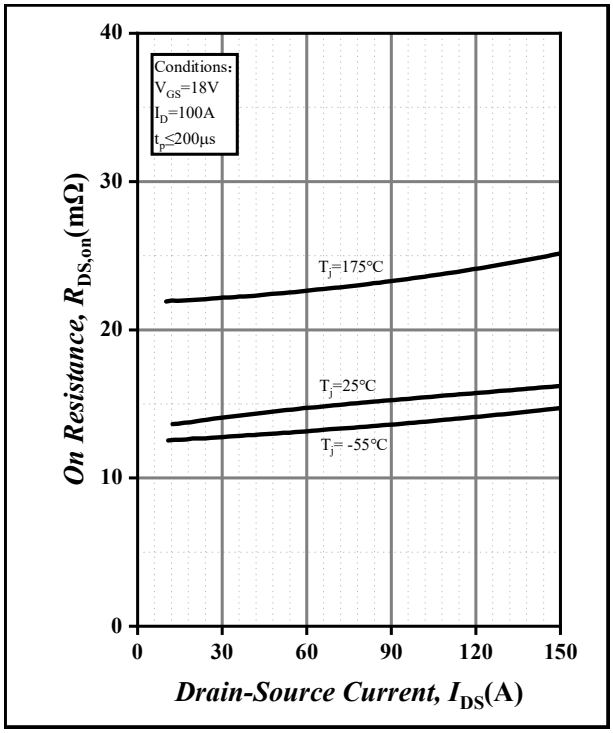


Figure 5. On-Resistance vs. Drain Current for Various Temperature

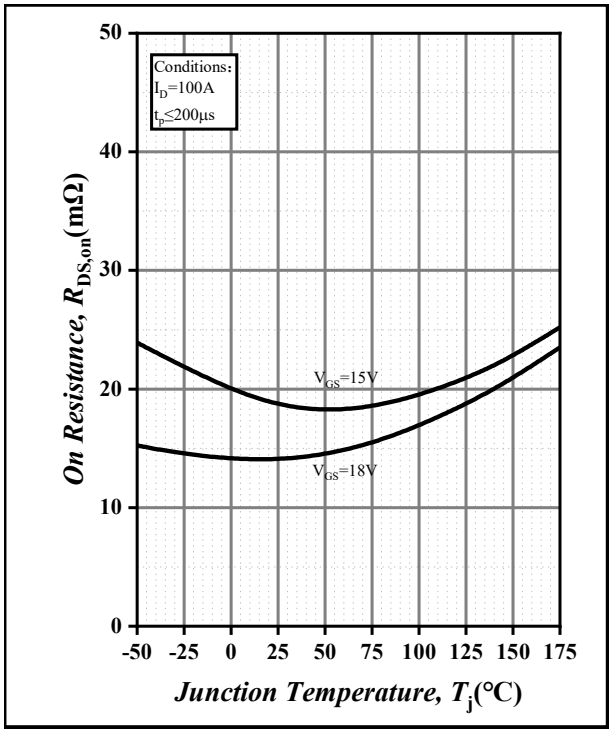


Figure 6. On-Resistance vs. Temperature for Various Gate Voltage

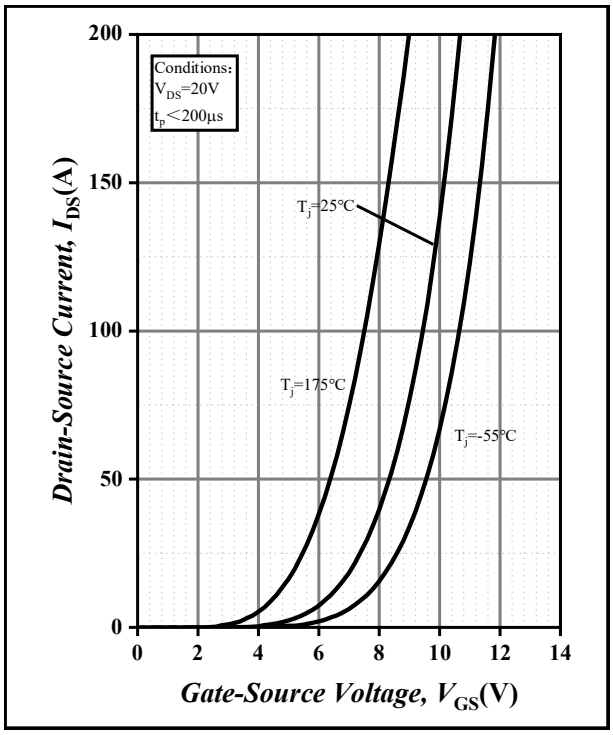


Figure 7. Transfer Characteristic for Various Junction Temperature

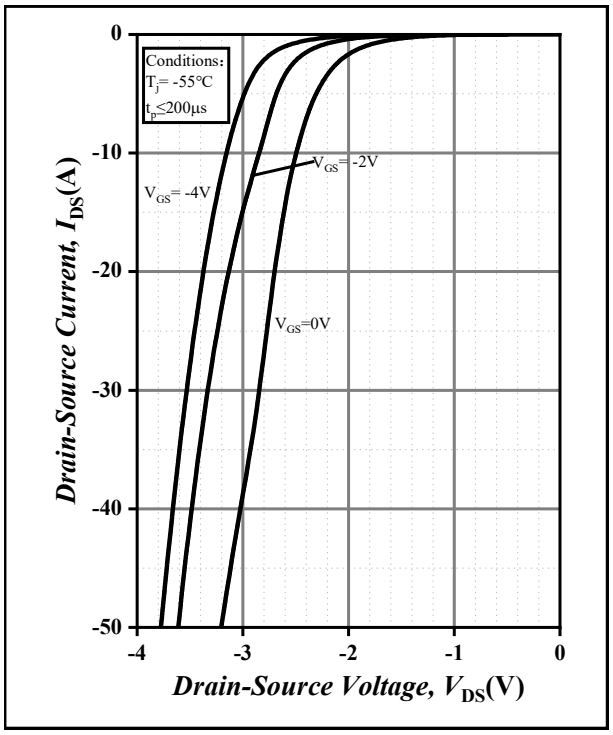


Figure 8. Body Diode Characteristic T_j= -55℃

Electrical Characteristic Curves

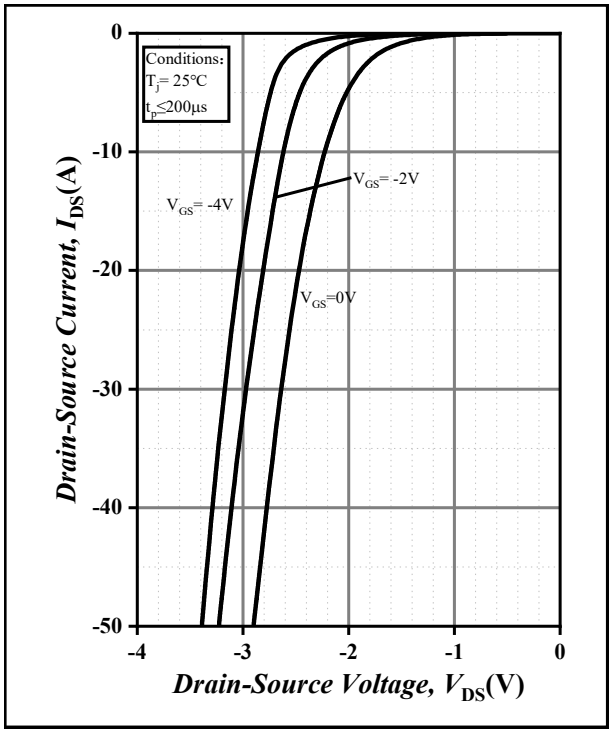


Figure 9. Body Diode Characteristic T_j= 25℃

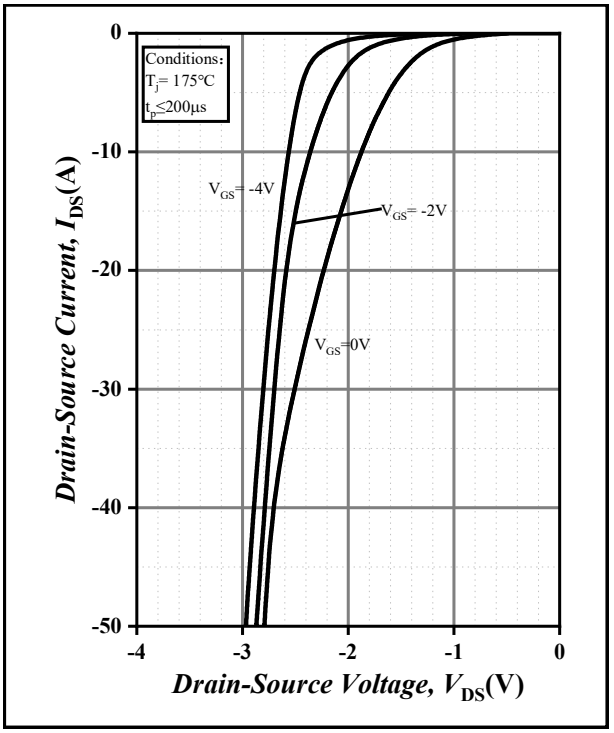


Figure 10. Body Diode Characteristic T_j= 175℃

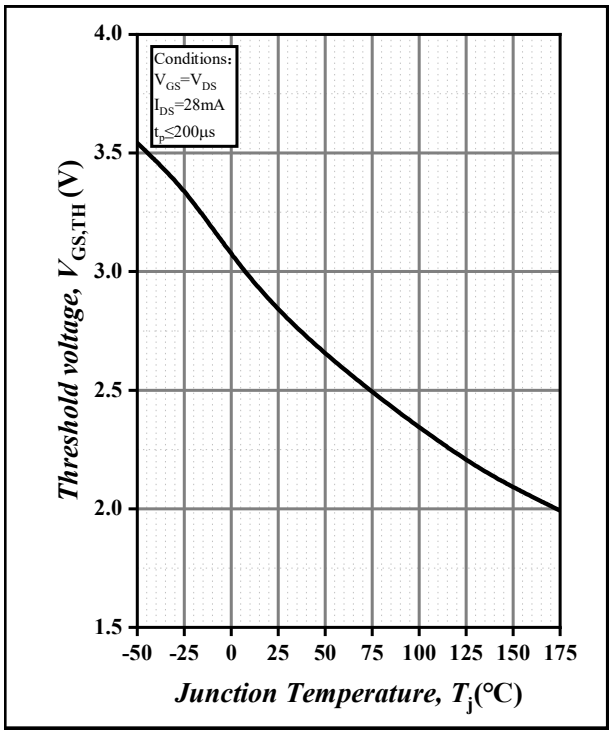


Figure 11. Threshold Voltage vs. Temperature

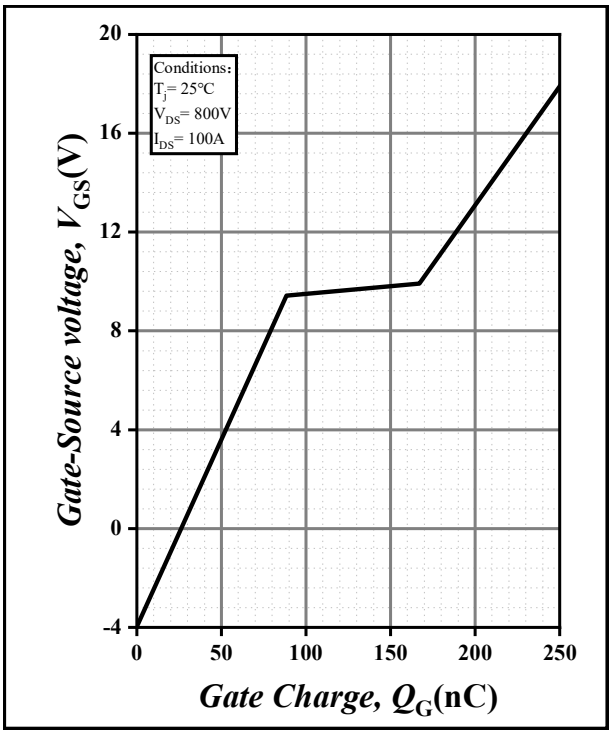


Figure 12. Gate Charge Characteristic

Electrical Characteristic Curves

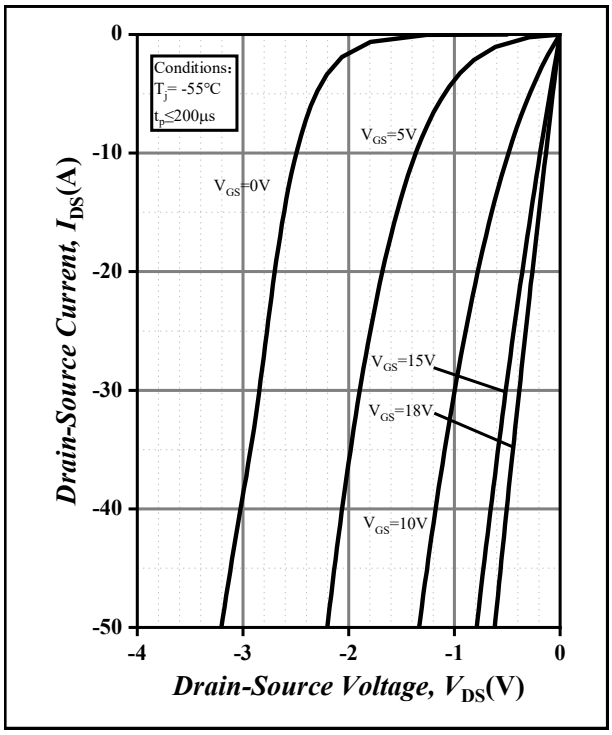


Figure 13. 3rd Quadrant Characteristic T_j= -55℃

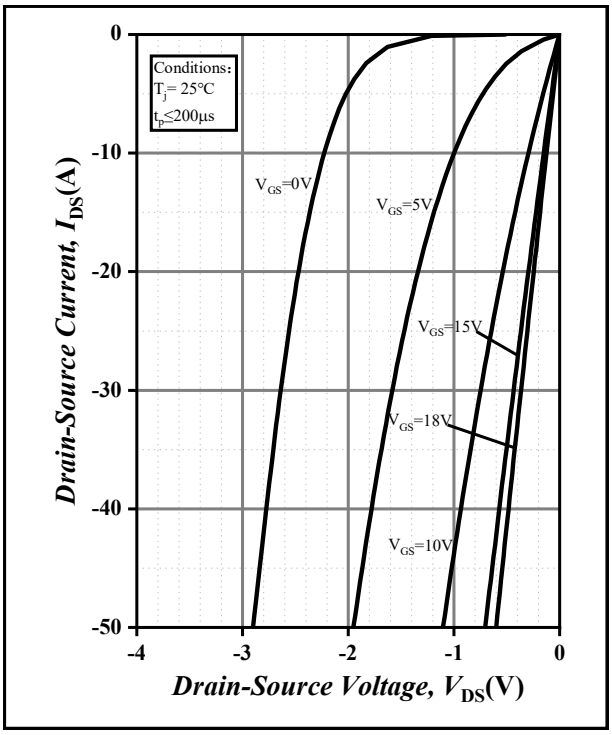


Figure 14. 3rd Quadrant Characteristic T_j= 25℃

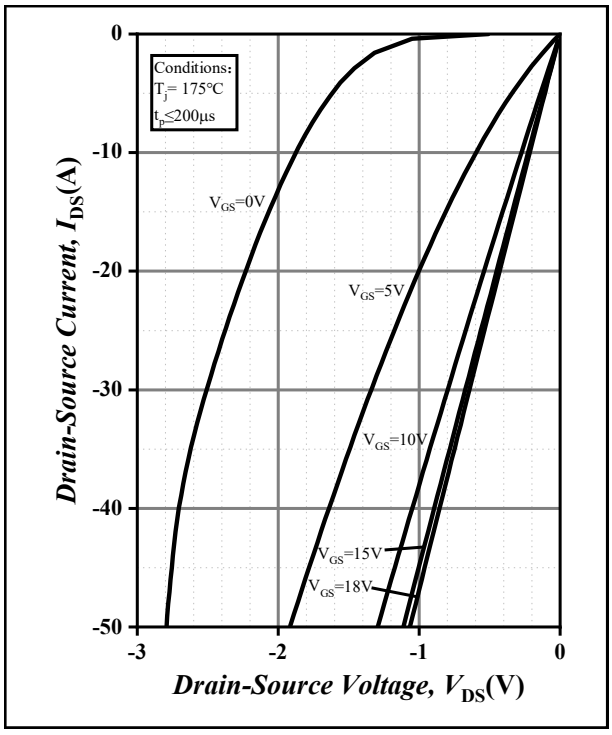


Figure 15. 3rd Quadrant Characteristic T_j= 175℃

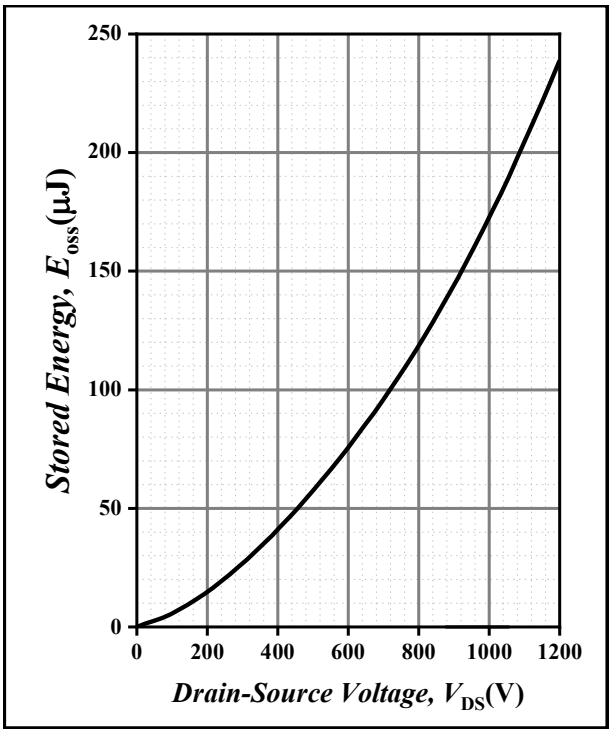


Figure 16. Output Capacitor Stored Energy

Electrical Characteristic Curves

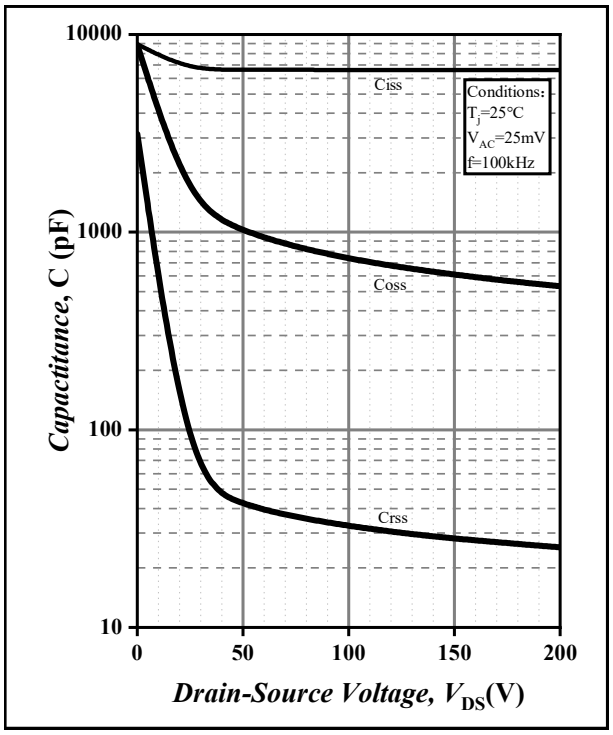


Figure 17. Capacitance vs. Drain-Source Voltage(0 - 200V)

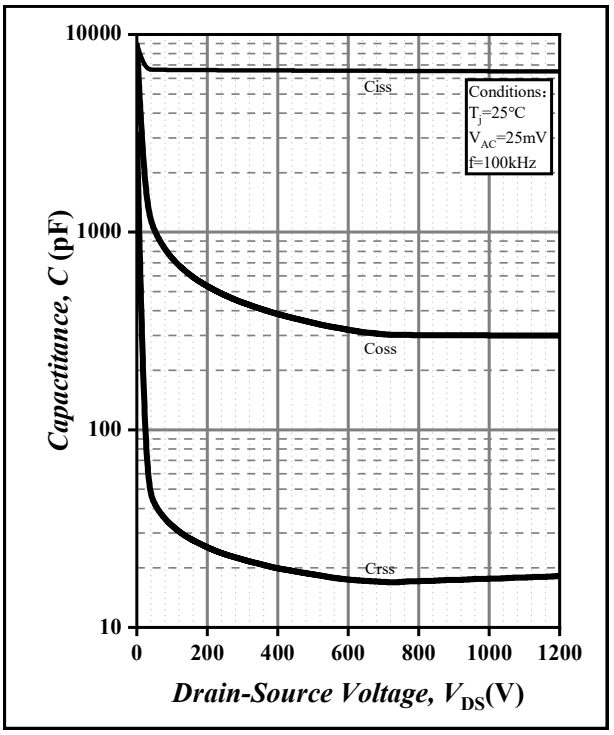


Figure 18. Capacitance vs. Drain-Source Voltage(0 - 1200V)

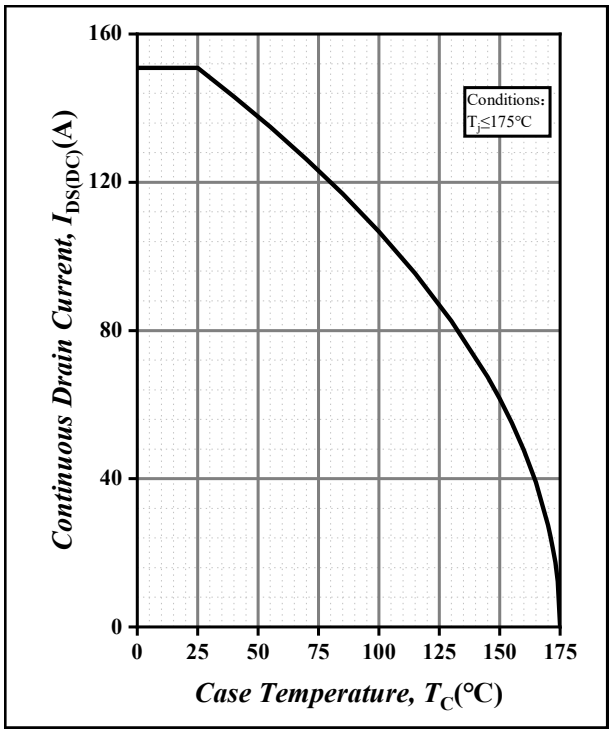


Figure 19. Continuous Drain Current Derating vs. Case Temperature

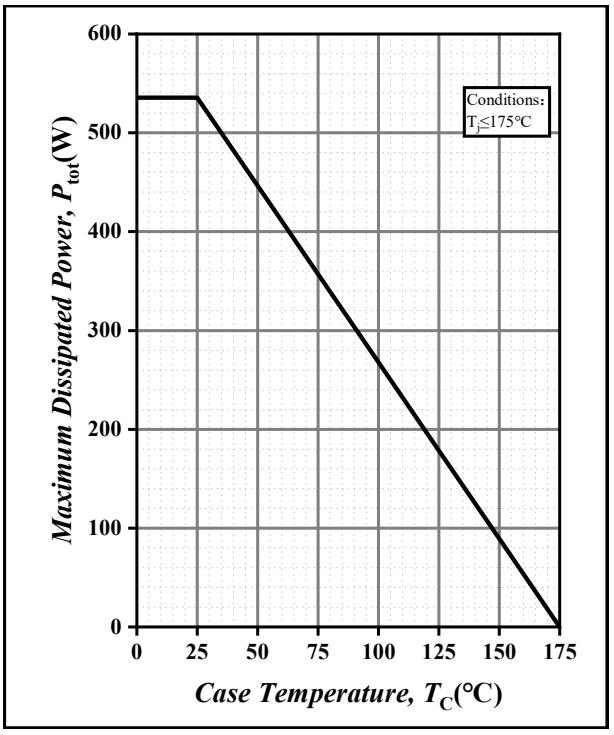


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

Electrical Characteristic Curves

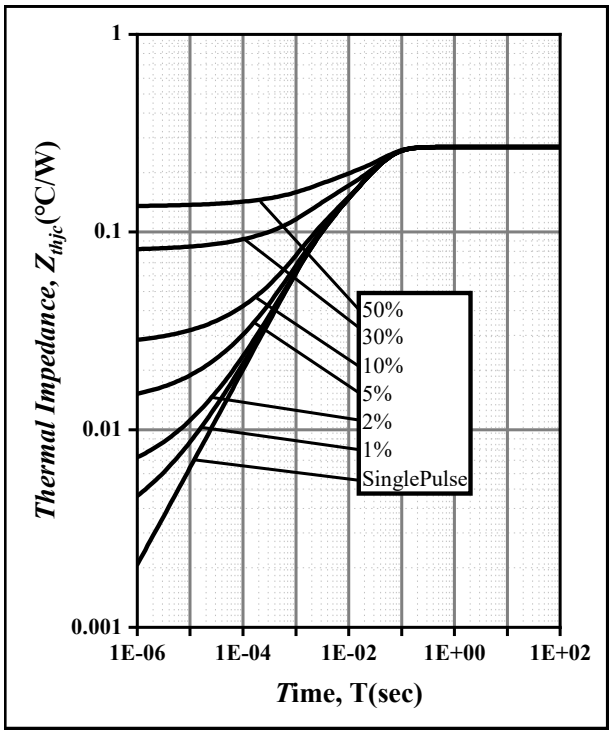


Figure 21. Transient Thermal Impedance (Junction - Case)

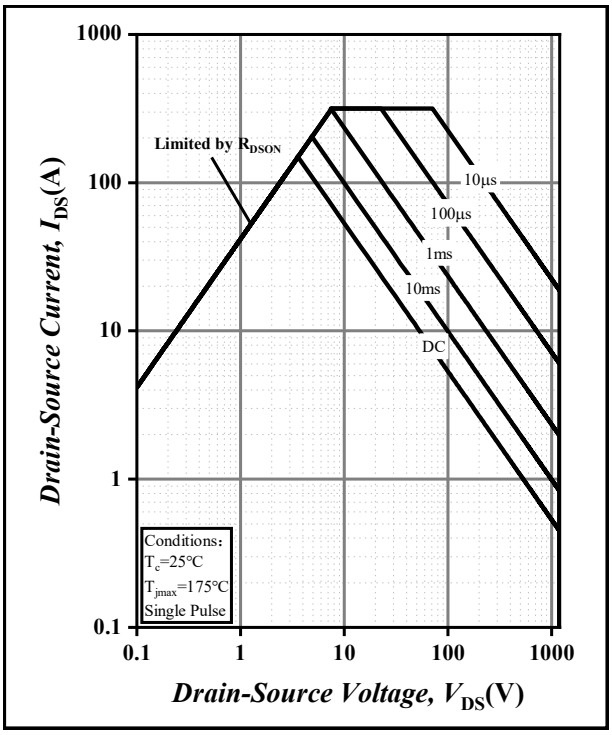


Figure 22. Safe Operation Area

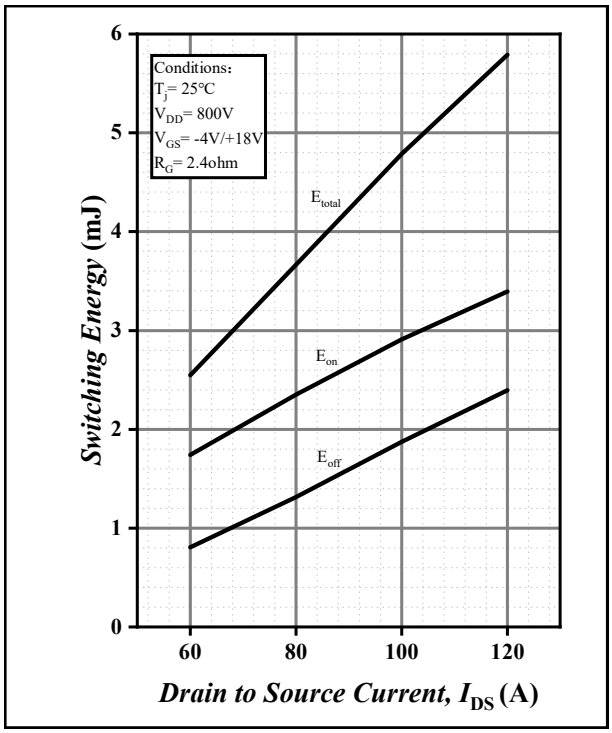


Figure 23. Clamped Inductive Switching Energy vs. Drain Current(V_{DD}=800V)

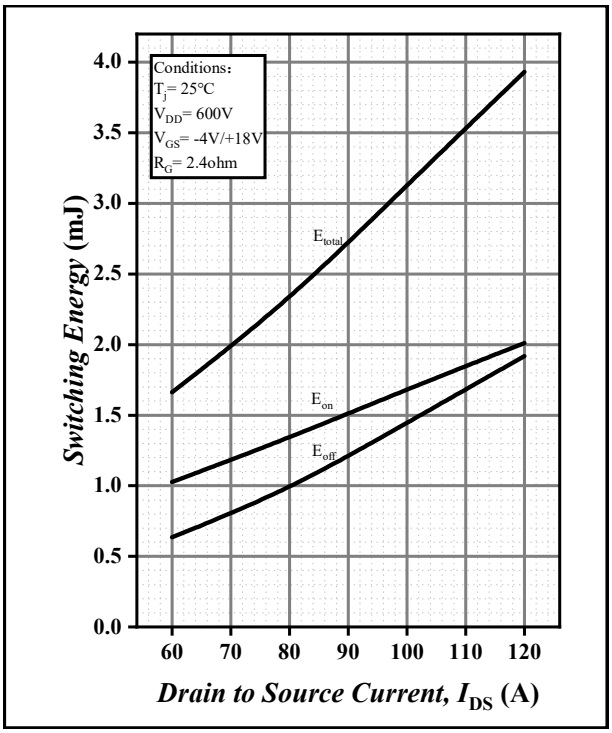


Figure 24. Clamped Inductive Switching Energy vs. Drain Current(V_{DD}=600V)

Electrical Characteristic Curves

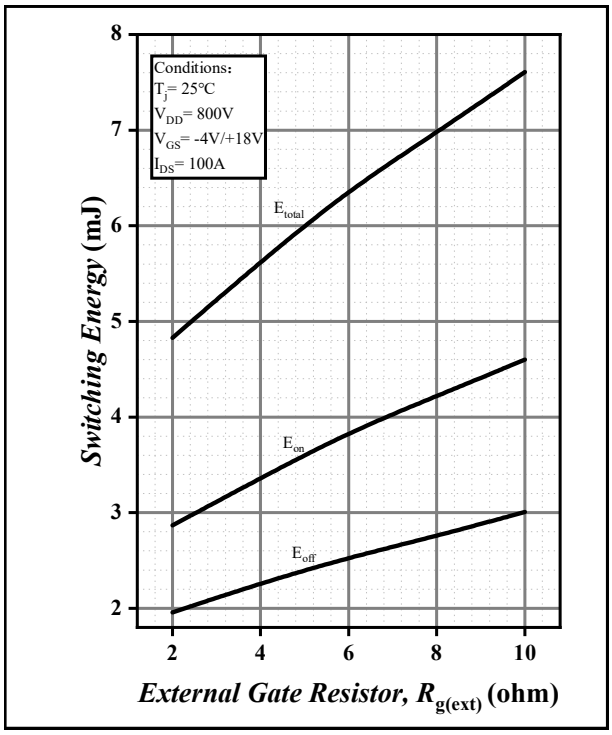


Figure 25. Clamped Inductive Switching Energy vs. $R_{g(ext)}$

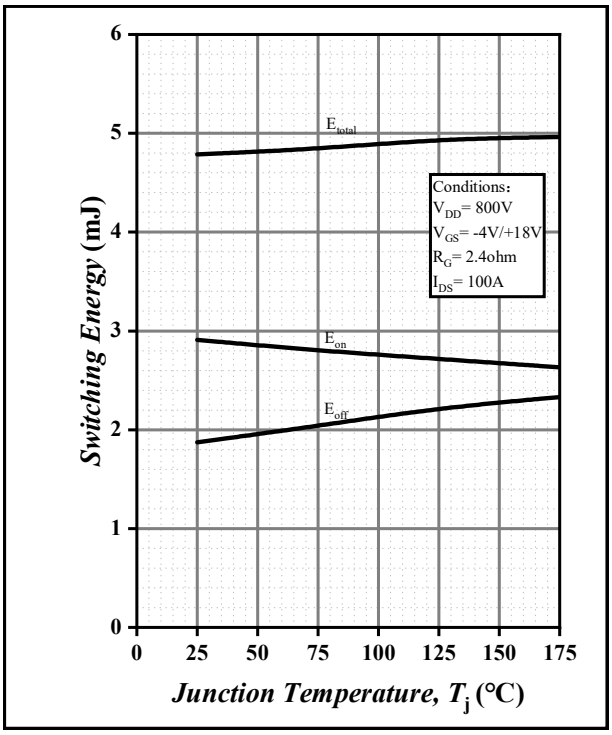


Figure 26. Clamped Inductive Switching Energy vs. Temperature

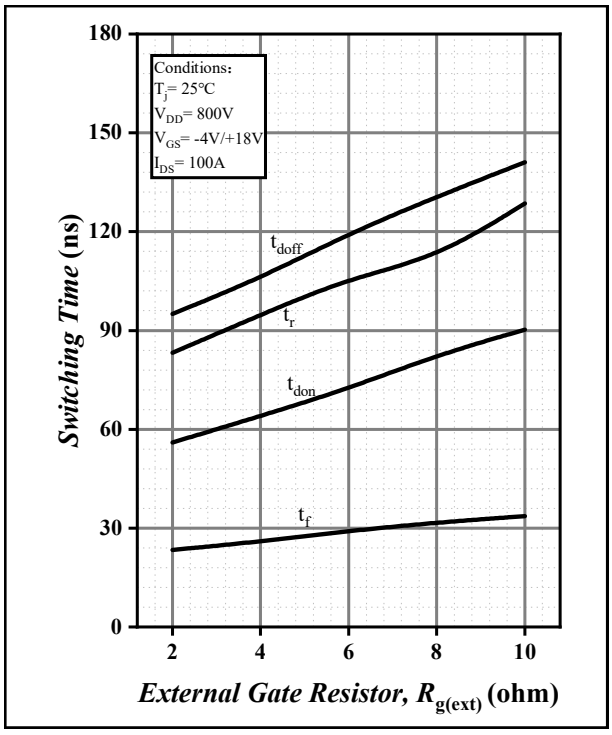
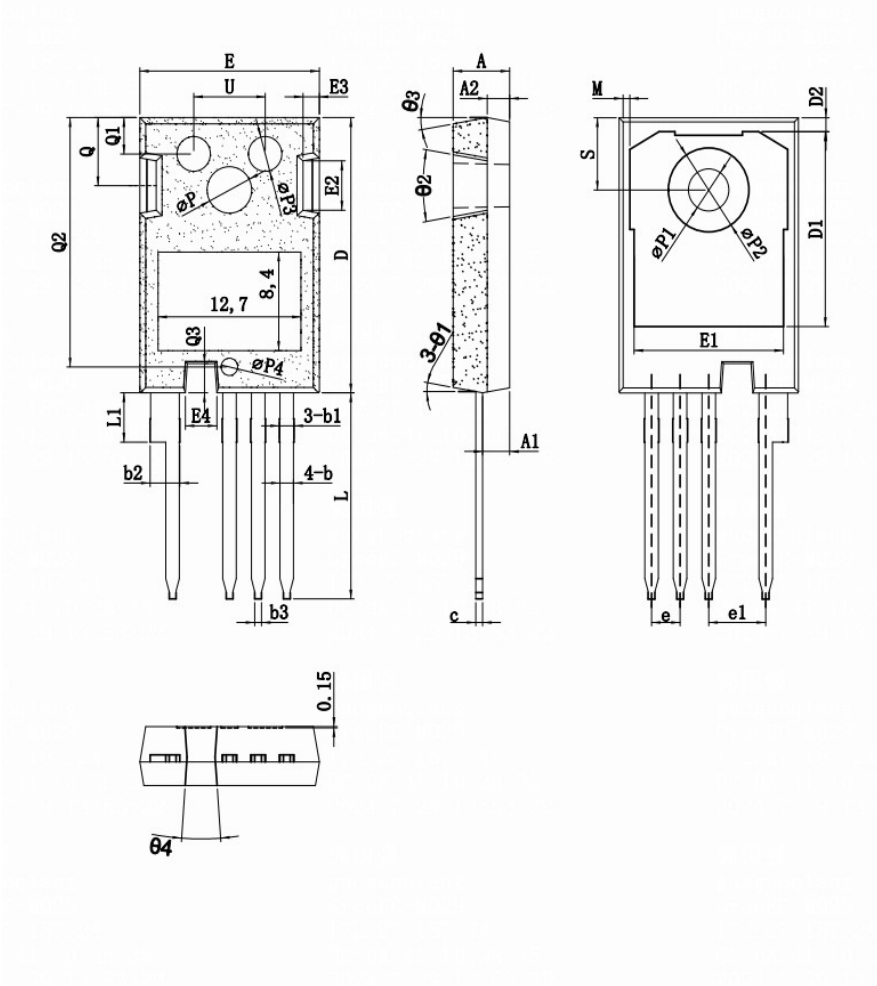


Figure 27. Switching Times vs. $R_{g(ext)}$

Package Outline



Common Dimensions

SYMBOL	mm		
	MIN	NOM	MAX
✻A	4.83	5.02	5.21
✻A1	2.29	2.42	2.54
A2	1.91	2.00	2.16
✻b	1.07	1.20	1.33
✻b1	1.15	1.30	1.45
✻b2	2.39	2.67	2.94
b3	0.45	0.60	0.75
✻c	0.55	0.60	0.68
✻D	23.30	23.45	23.60
D1	16.35	16.65	16.95
D2	0.95	1.19	1.25
✻E	15.75	15.94	16.13
E1	13.10	13.25	13.40
E2	4.00	4.40	4.80
E3	1.00	1.45	1.90
E4	2.40	2.80	3.20
✻e	2.50	2.54	2.58
✻e1	5.03	5.08	5.13
✻L	17.31	17.57	17.82
✻L1	–	–	4.37
M	0.40	0.60	0.80
✻ ΦP	3.90	4.00	4.10
✻ ΦP1	3.51	3.61	3.71
ΦP2	7.03	7.18	7.33
ΦP3	2.80	3.00	3.20
ΦP4	1.30	1.50	1.70
Q	5.49	5.79	6.00
Q1	2.80	3.10	3.40
Q2	19.95	21.25	21.55
Q3	2.35	2.50	2.65
S	6.04	6.17	6.30
U	6.05	6.35	6.55
θ1	6°	10°	13°
θ2	16°	20°	24°
θ3	6°	10°	13°
θ4	5°	8°	11°