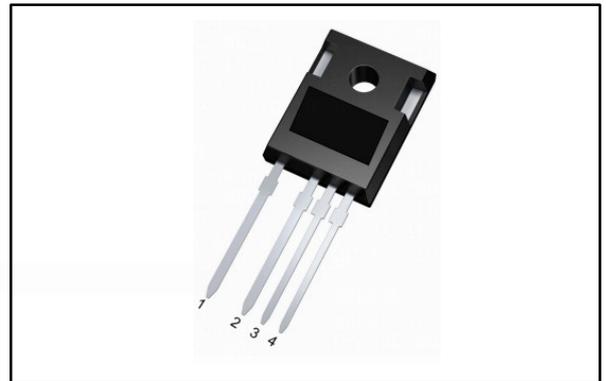


Type	HMM165N120T4
Package	TO247-4L
V <sub>DS</sub>	1200V
I <sub>DS</sub> (T <sub>c</sub> =25°C, R <sub>th(j-c,max)</sub> )	150A
R <sub>DS(ON),typ</sub> (V <sub>GS</sub> =18V, I <sub>D</sub> =100A, T <sub>j</sub> =25°C)	13mΩ
T <sub>j,max</sub>	175°C

● Outline



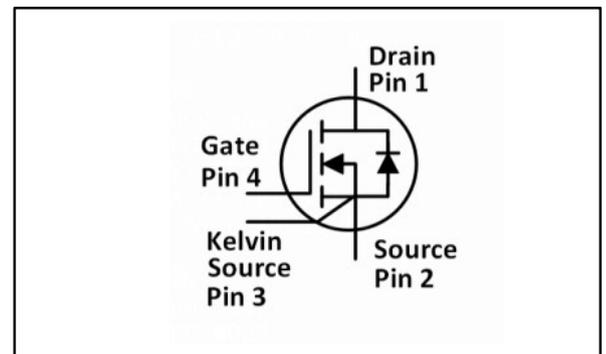
Features

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

Applications

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

● Inner Circuit



Absolute Maximum Ratings (T<sub>c</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Value	Unit	Note
V <sub>DS,max</sub>	Drain Source Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =100μA	1200	V	
V <sub>GS,max</sub>	Gate Source Voltage	Absolute Maximum Values	-8/+22	V	
V <sub>GSop</sub>	Gate Source Voltage	Recommended Operational Values	-4/+18	V	
I <sub>D</sub>	Continuous Drain Current	V <sub>GS</sub> =18V, T <sub>c</sub> =25°C	150	A	Fig.19
		V <sub>GS</sub> =18V, T <sub>c</sub> =100°C	106		
I <sub>D(pulse)</sub>	Pulsed Drain Current	Pulse width t <sub>p</sub> limited by T <sub>j,max</sub>	316	A	Fig.22
P <sub>D</sub>	Power Dissipation	T <sub>c</sub> =25°C, T <sub>j</sub> =175°C	535	W	Fig.20
T <sub>j</sub> , T <sub>stg</sub>	Operating Junction and Storage Temperature		-55 to 175	°C	
T <sub>L</sub>	Soldering Temperature	1.6mm (0.063" ) from case for 10s	260	°C	

**Static Characteristics (Tc=25°C unless otherwise noted)**

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

**Dynamic Characteristics (Tc=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =1000V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C, V <sub>AC</sub> =25mV, f=100KHz	-	6522	-	pF	Fig.17, 18
C <sub>oss</sub>	Output Capacitance		-	300	-		
C <sub>rss</sub>	Reverse Capacitance		-	17.7	-		
E <sub>oss</sub>	Coss Stored Energy		-	175	-	μJ	Fig.16
Q <sub>gs</sub>	Gate Source Charge	V <sub>DS</sub> =800V, V <sub>GS</sub> =-4/18V, I <sub>D</sub> =100A	-	89	-	nC	Fig.12
Q <sub>gd</sub>	Gate Drain Charge		-	74	-		
Q <sub>g</sub>	Gate Charge		-	250	-		

**Switching Characteristics (Tc=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
E <sub>on</sub>	Turn on Switching Energy	V <sub>DS</sub> =800V, V <sub>GS</sub> =-4/+18V, I <sub>D</sub> =100A, R <sub>g</sub> =2.4Ω, L=120μH	-	2869	-	μJ	Fig.26
E <sub>off</sub>	Turn off Switching Energy		-	1959	-		
t <sub>d(on)</sub>	Turn on Delay Time		-	56	-	nS	Fig.27, 28
t <sub>r</sub>	Rise Time		-	83	-		
t <sub>d(off)</sub>	Turn off Delay Time		-	95	-		
t <sub>f</sub>	Fall Time		-	23	-		

**Body Diode Characteristics (Tc=25°C unless otherwise noted)**

Symbol	Parameter	Conditions	Value			Unit	Note
			Min	Typ	Max		
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> = -4V, I <sub>SD</sub> =50A	-	3.4	-	V	Fig.8,9,10
		V <sub>GS</sub> = -4V, I <sub>SD</sub> =50A, T <sub>j</sub> =175°C	-	3.0	-		
I <sub>S</sub>	Continuous Diode Forward Current	V <sub>GS</sub> = -4V, T <sub>c</sub> =25°C	-	102	-	A	
t <sub>rr</sub>	Reverse Recovery Time	VR=800V, V <sub>GS</sub> = -4V, I <sub>D</sub> =100A, di/dt=3000A/μS, T <sub>j</sub> =175°C	-	52	-	nS	
Q <sub>rr</sub>	Reverse Recovery Charge		-	2211	-	nC	
I <sub>rm</sub>	Peak Reverse Recovery Current		-	69	-	A	

**Thermal Characteristics**

Symbol	Parameter	Conditions	Value	Unit	Note
R <sub>th(j-c)</sub>	Thermal Resistance from Junction to Case		0.28	°C/W	Fig.21
R <sub>th(j-a)</sub>	Thermal Resistance from Junction to Ambient		26.8		

Electrical Characteristic Curves

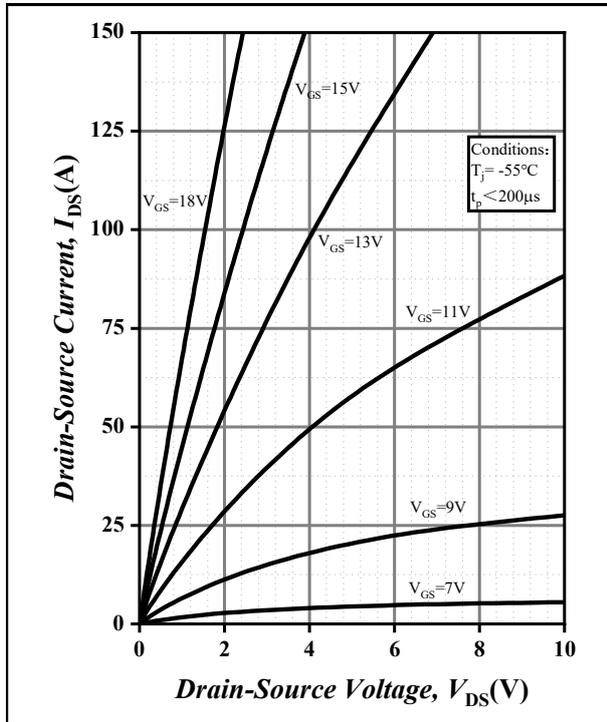


Figure 1. Output Characteristic  $T_j = -55^\circ\text{C}$

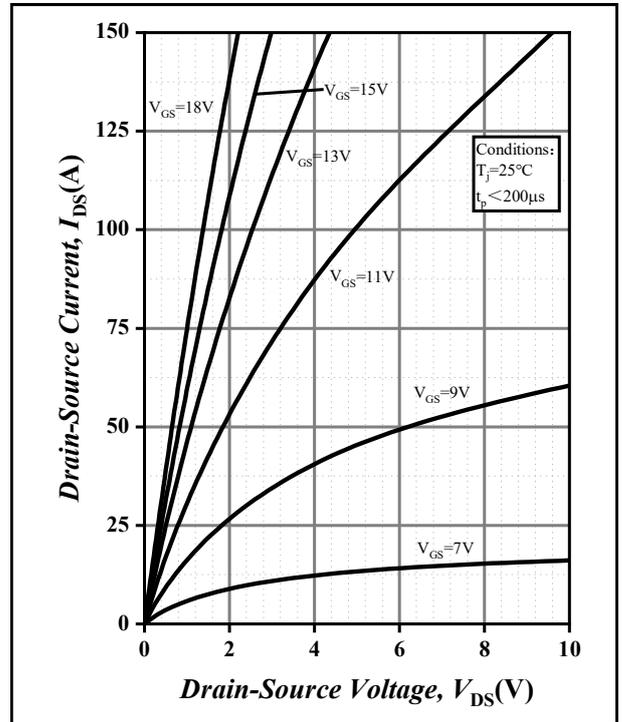


Figure 2. Output Characteristic  $T_j = 25^\circ\text{C}$

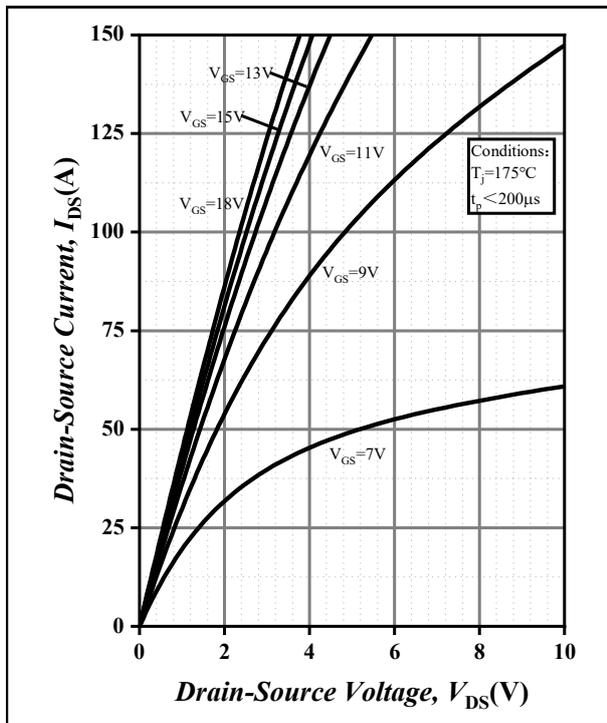


Figure 3. Output Characteristic  $T_j = 175^\circ\text{C}$

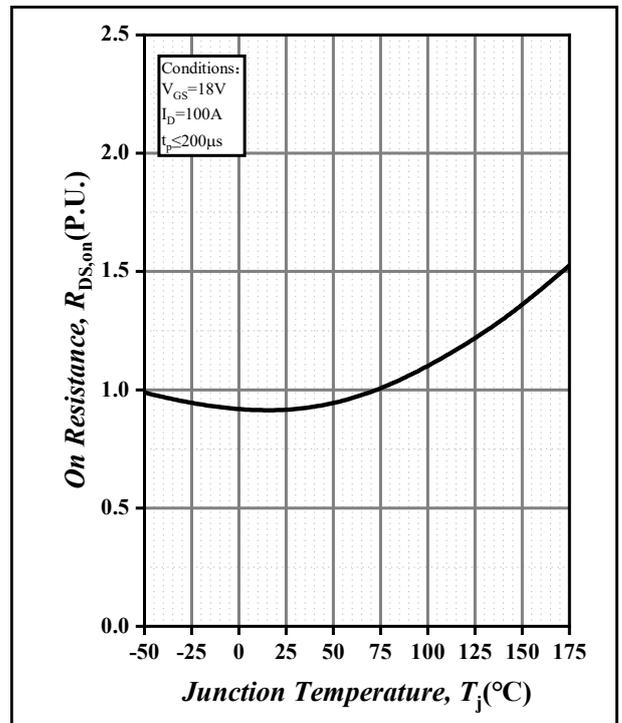


Figure 4. Normalized On-Resistance vs. Temperature

Electrical Characteristic Curves

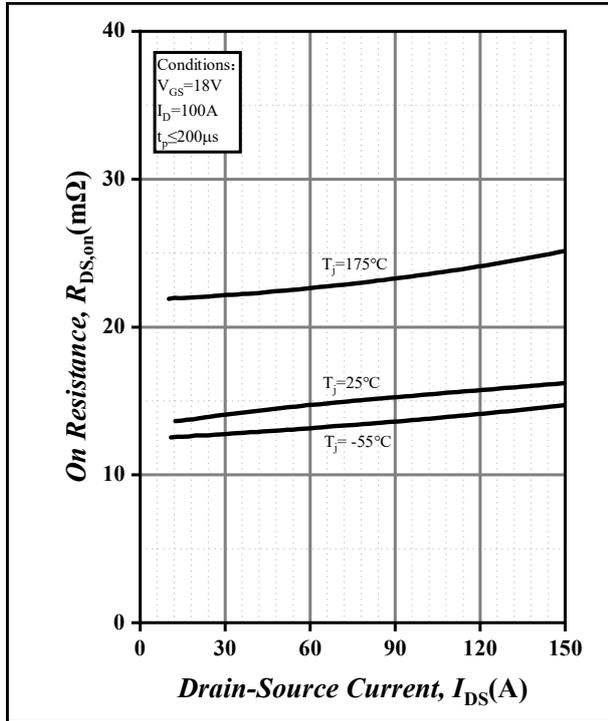


Figure 5. On-Resistance vs. Drain Current for Various Temperature

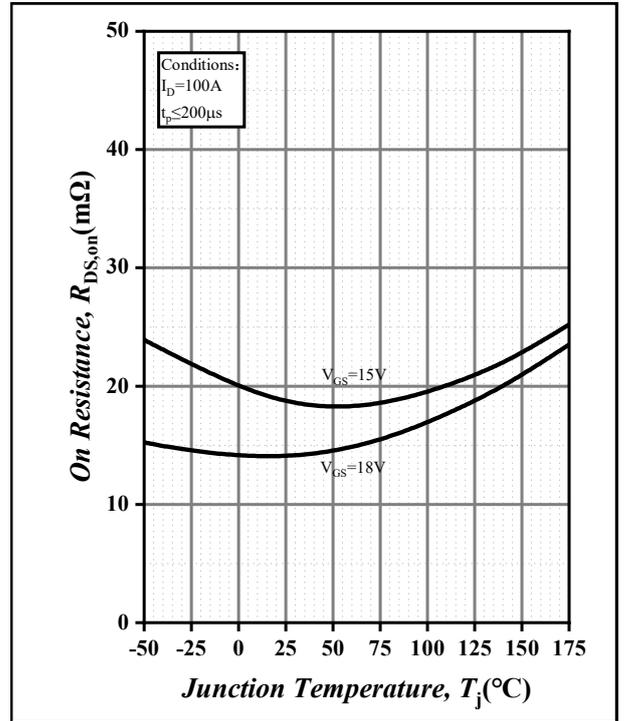


Figure 6. On-Resistance vs. Temperature for Various Gate Voltage

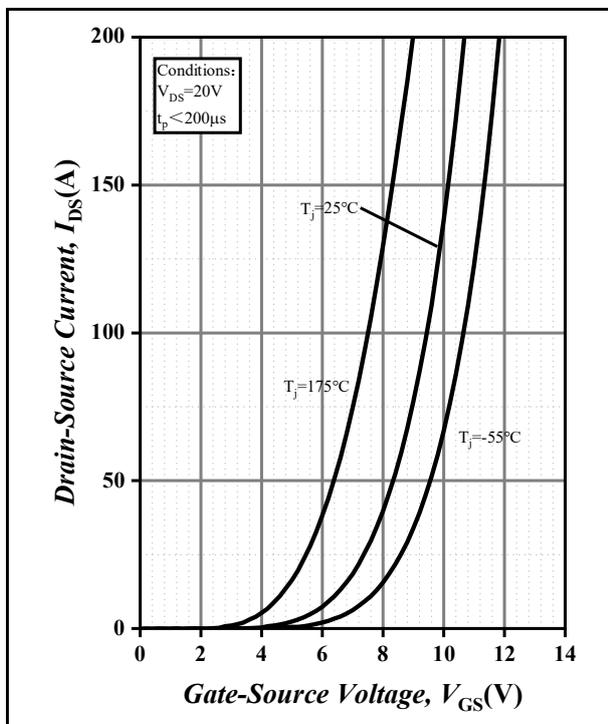


Figure 7. Transfer Characteristic for Various Junction Temperature

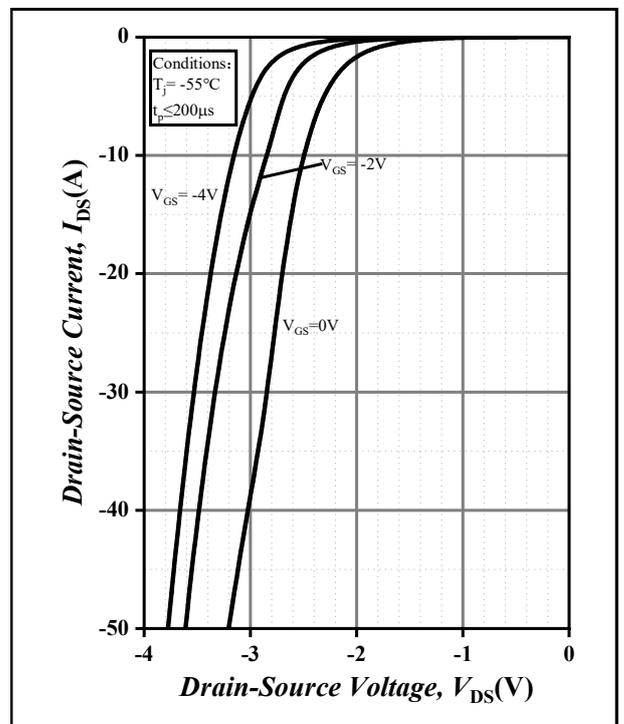


Figure 8. Body Diode Characteristic  $T_j = -55^\circ\text{C}$

Electrical Characteristic Curves

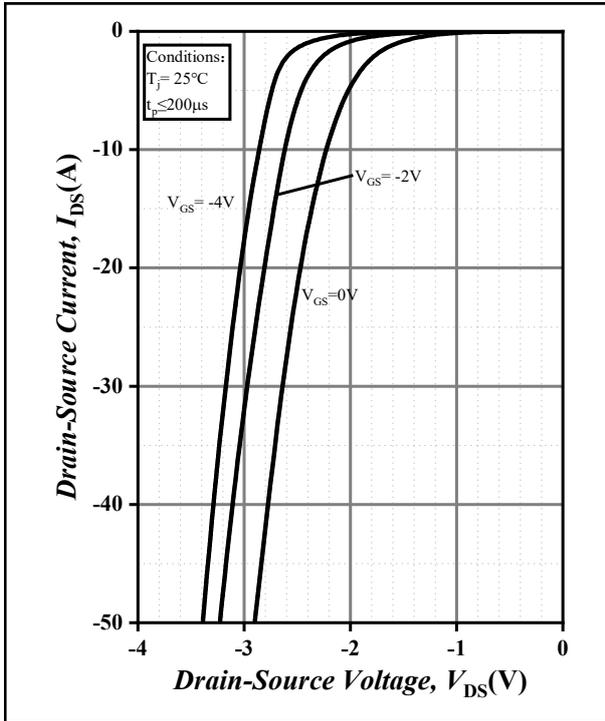


Figure 9. Body Diode Characteristic  $T_j = 25^\circ\text{C}$

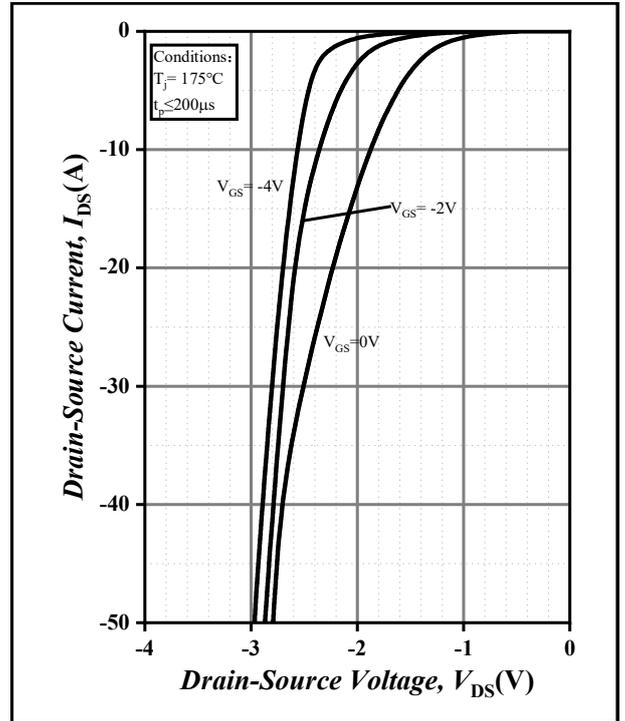


Figure 10. Body Diode Characteristic  $T_j = 175^\circ\text{C}$

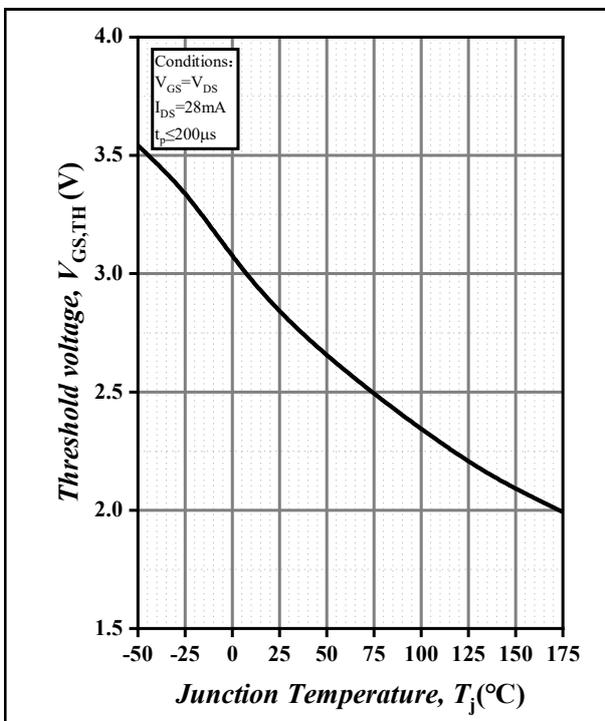


Figure 11. Threshold Voltage vs. Temperature

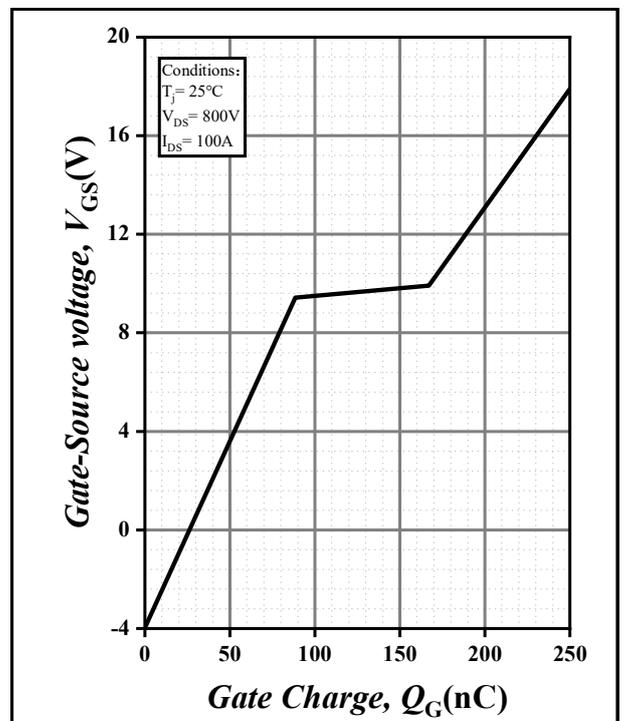


Figure 12. Gate Charge Characteristic

Electrical Characteristic Curves

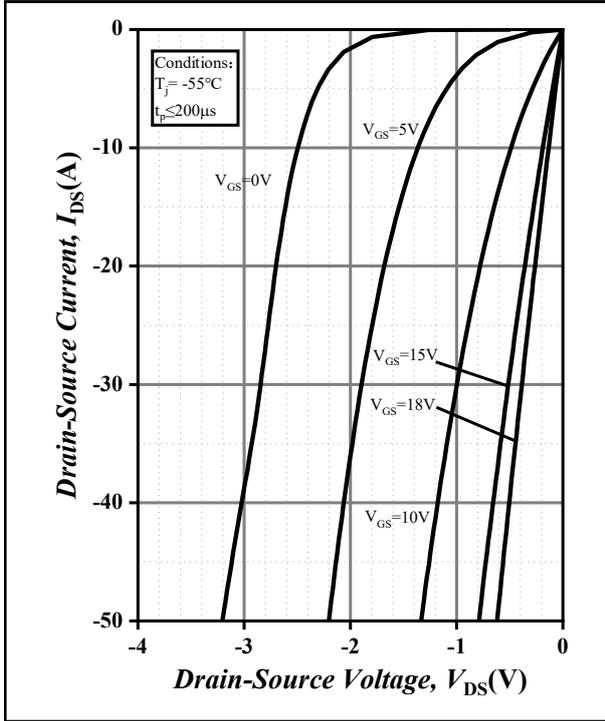


Figure 13. 3rd Quadrant Characteristic  $T_j = -55^\circ\text{C}$

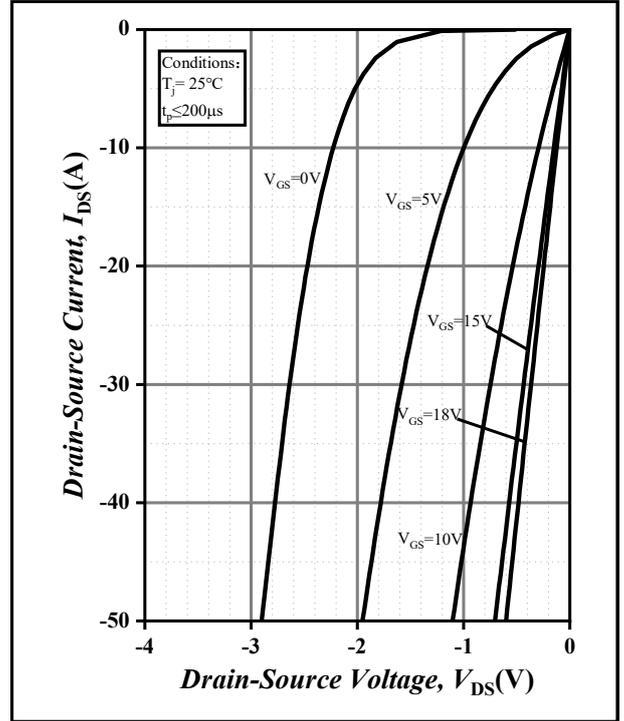


Figure 14. 3rd Quadrant Characteristic  $T_j = 25^\circ\text{C}$

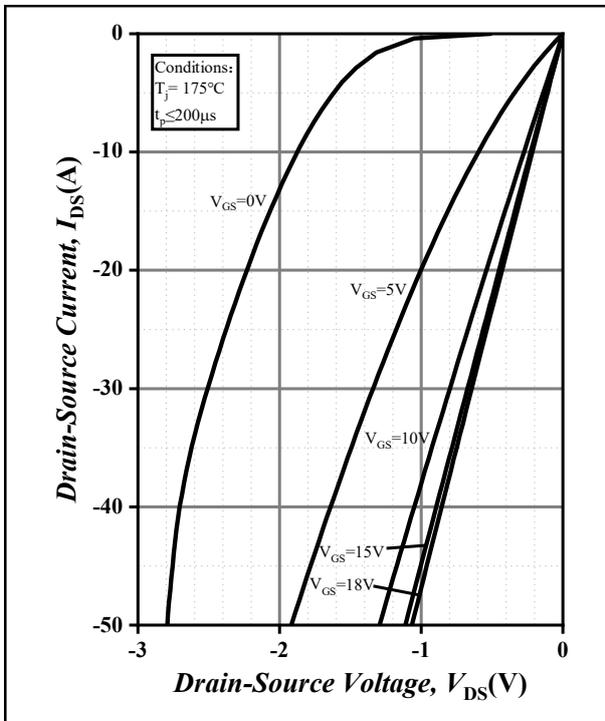


Figure 15. 3rd Quadrant Characteristic  $T_j = 175^\circ\text{C}$

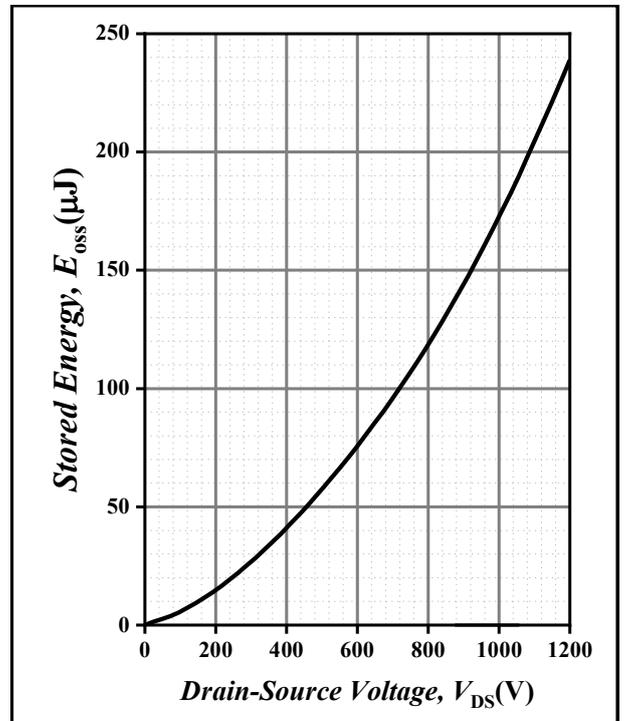


Figure 16. Output Capacitor Stored Energy

Electrical Characteristic Curves

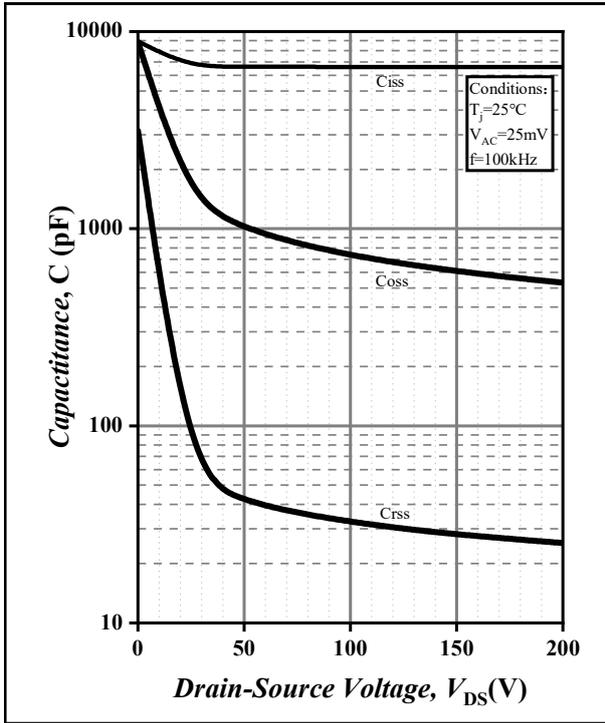


Figure 17. Capacitance vs. Drain-Source Voltage(0 - 200V)

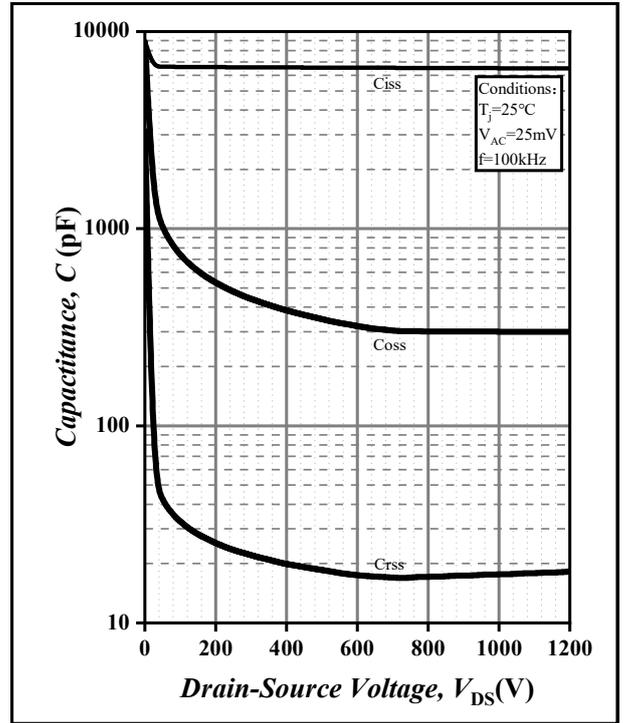


Figure 18. Capacitance vs. Drain-Source Voltage(0 - 1200V)

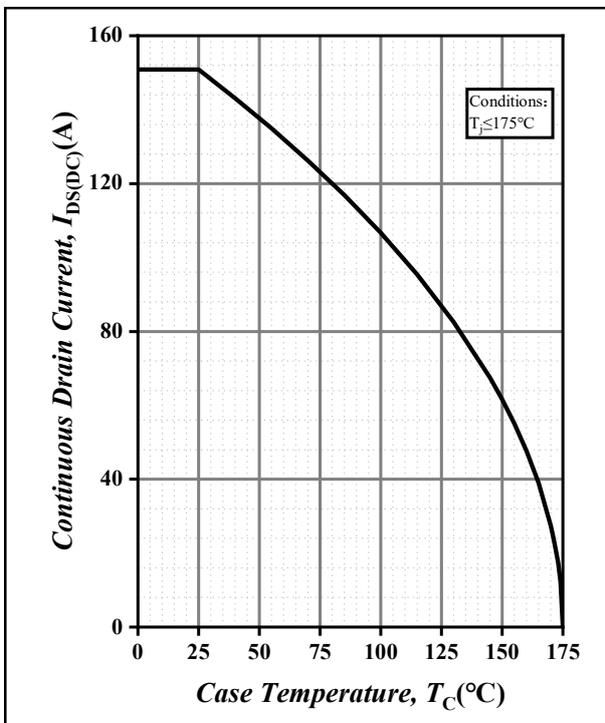


Figure 19. Continuous Drain Current Derating vs. Case Temperature

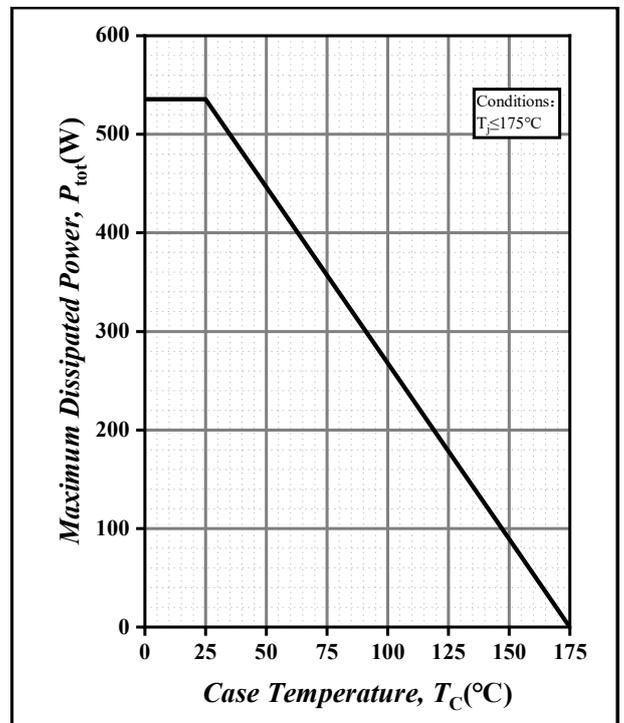


Figure 20. Maximum Power Dissipation Derating vs. Case Temperature

Electrical Characteristic Curves

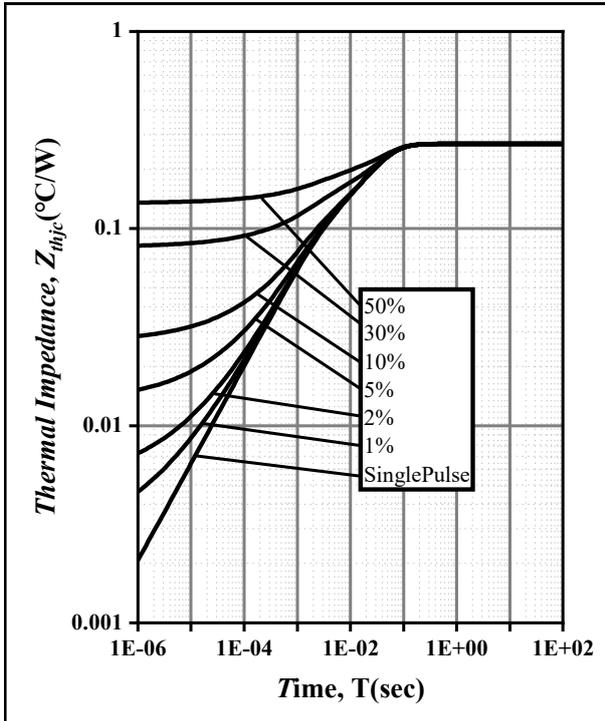


Figure 21. Transient Thermal Impedance (Junction - Case)

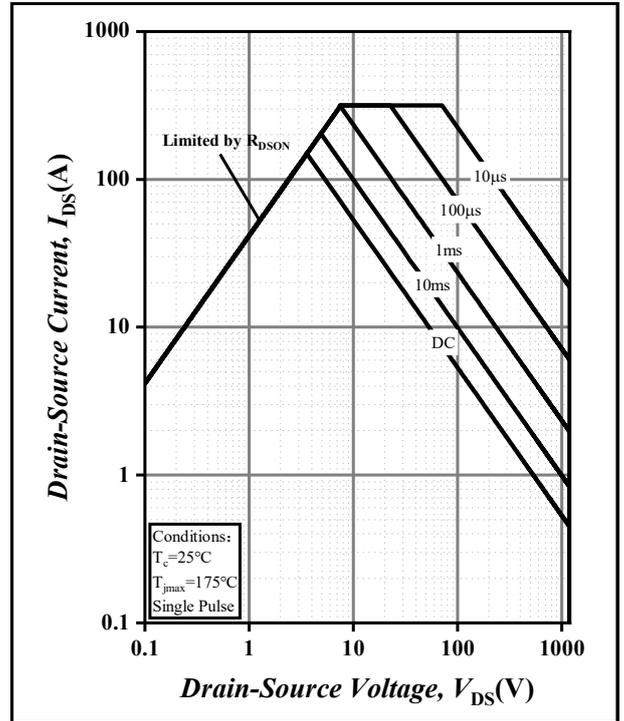


Figure 22. Safe Operation Area

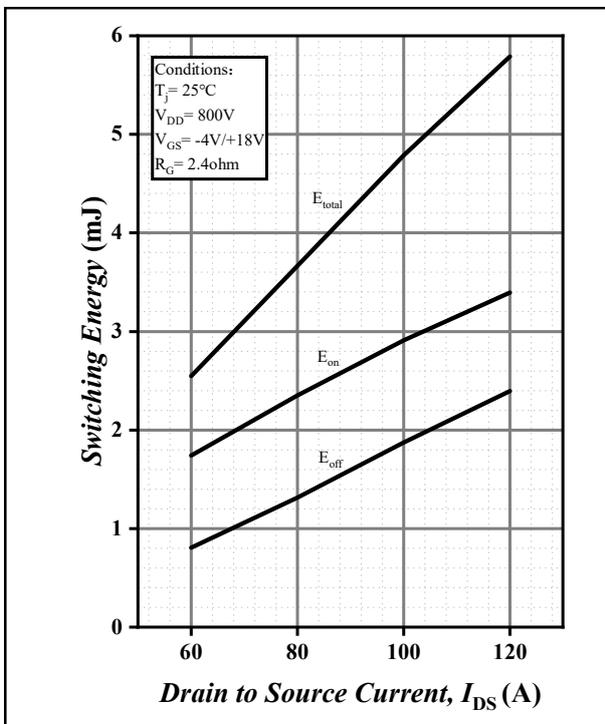


Figure 23. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD}=800V$ )

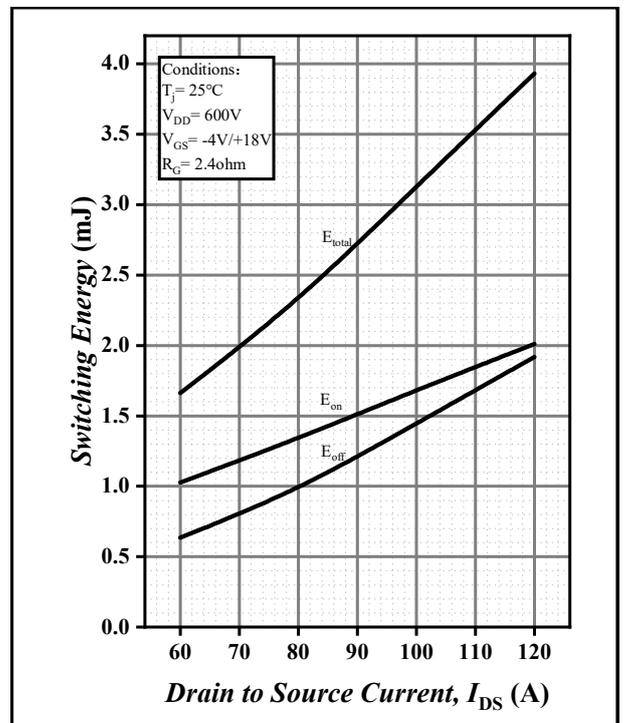


Figure 24. Clamped Inductive Switching Energy vs. Drain Current( $V_{DD}=600V$ )

Electrical Characteristic Curves

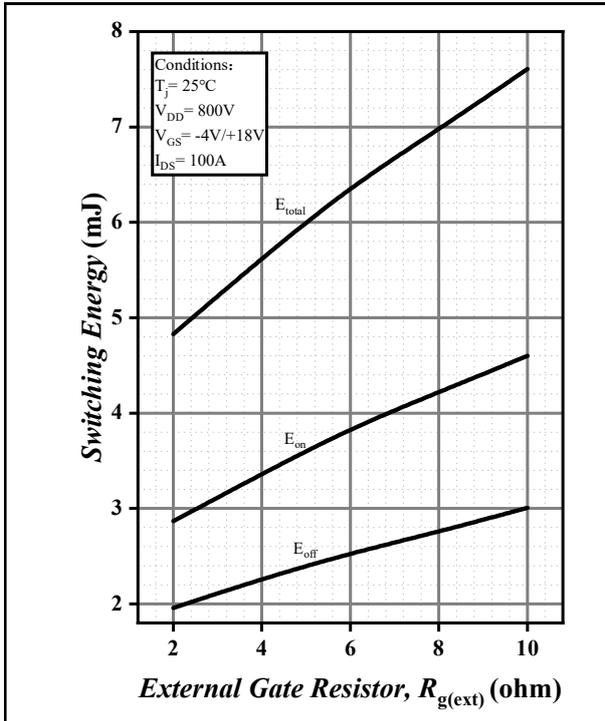


Figure 25. Clamped Inductive Switching Energy vs.  $R_{g(ext)}$

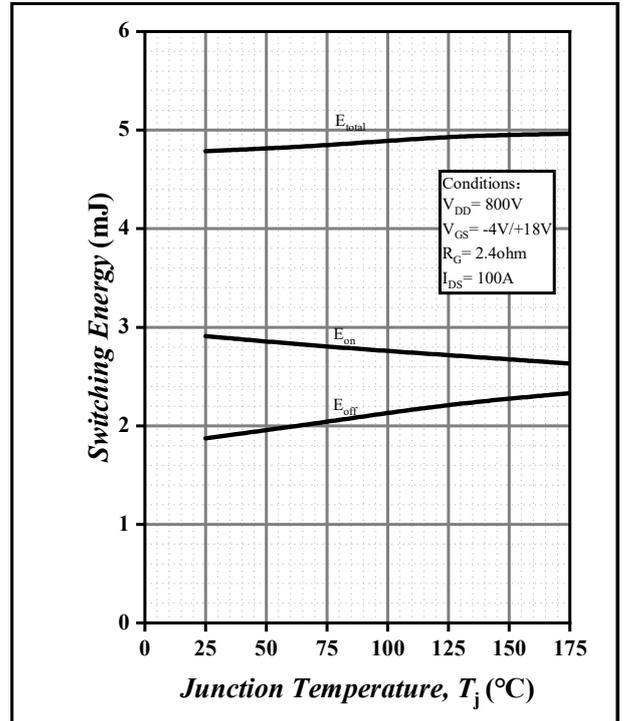


Figure 26. Clamped Inductive Switching Energy vs. Temperature

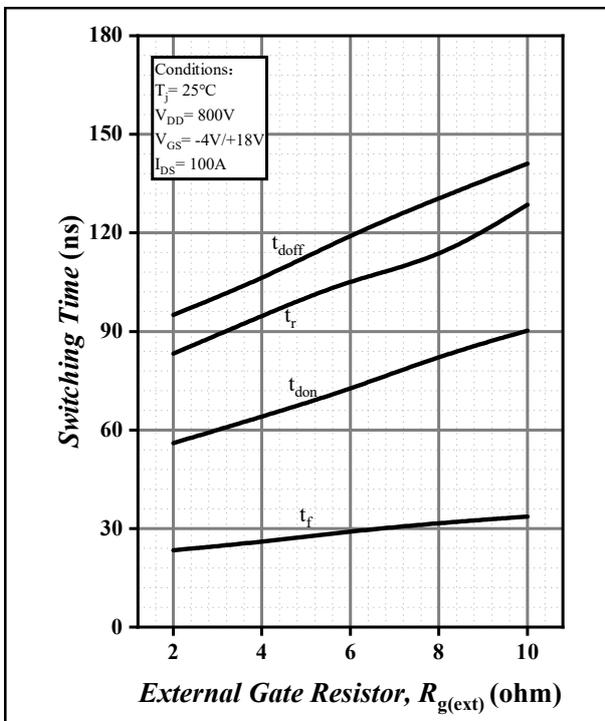
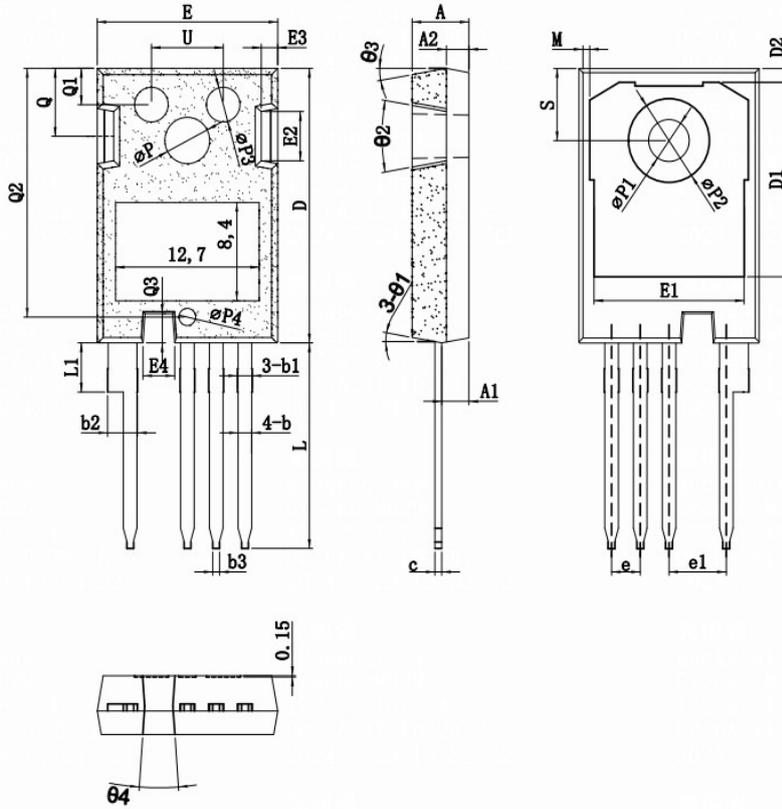


Figure 27. Switching Times vs.  $R_{g(ext)}$

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
* $\Phi P$	3.90	4.00	4.10
* $\Phi P1$	3.51	3.61	3.71
$\Phi P2$	7.03	7.18	7.33
$\Phi P3$	2.80	3.00	3.20
$\Phi P4$	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
$\theta 1$	6°	10°	13°
$\theta 2$	16°	20°	24°
$\theta 3$	6°	10°	13°
$\theta 4$	5°	8°	11°