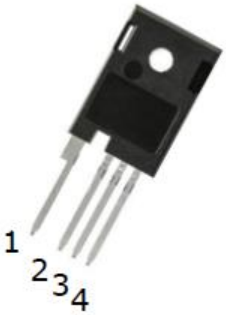
Hua | 芯華睿 Semiconductor

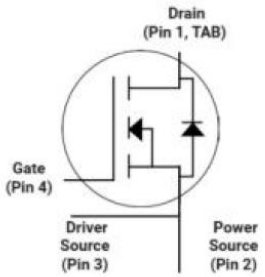
HAFZ044N120P1X750

Silicon Carbide Power MOSFET

Product Summary

V_{DS} = 1200 V
I_D@25ºC = 44A
$R_{DS(ON)}$ = 75mΩ
AEC-Q101 and PPAP capable





TO-247-4

Features

- High speed switching
- Very low switching losses
- IGBT-compatible driving voltage
- Fully controllable dv/dt
- High blocking voltage with low on-resistance
- Fast intrinsic diode with low reverse recovery (Qrr)
- Temperature independent turn-off switching losses
- Halogen free, RoHS compliant

Benefits

- Cooling effort reduction
- Efficiency improvement
- Reduced cooling requirements
- Increased power density
- Increased system switching frequency

Applications

- On-board charger/PFC
- EV battery chargers
- Booster/DC-DC converter
- Switch mode power supplies

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

Symbol	Parameter		Value	Unit
V_{DSmax}	Drain - Source Voltage		1200	V
V_{GSmax}	Gate - Source Voltage (dynamic), T_{surge} <100ns		-8 / +22	V
V_{GSop}	Gate - Source Voltage (static)		-4 / +18	V
I_D	Continuous Drain Current	V_{GS} = 15V, T_C=25°C V_{GS} = 15V, T_C=100°C	44 31	A
$I_{D(pulse)}$	Pulsed Drain Current at T_C=25°C		88	A
P_D	Total power dissipation	T_C=25°C, T_J=175°C	224	W
T_J	Operating Junction Temperature		-40 to 175	°C
T_{STG}	Storage Temperature		-40 to 175	°C
T_L	Soldering temperature		260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

Electrical Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Test conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 100μA	1200			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 5mA	2.3	2.8	3.6	V
		V_{DS} = V_{GS}, I_D = 5mA, T_J = 175°C		2.1		
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 1200V, V_{GS} = 0V	0	1	10	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS} = 15V, V_{DS} = 0V	0		100	nA
Drain-Source On-State Resistance	$R_{DS(on)}$	V_{GS} = 15V, I_D = 20 A		75	90	mΩ
		V_{GS} = 15V, I_D = 20 A, T_J = 175°C		110		
		V_{GS} = 18V, I_D = 20 A		60	74	
		V_{GS} = 18V, I_D = 20 A, T_J = 175°C		109		
Transconductance	g_{fs}	V_{DS} = 20V, I_D = 20 A,		9.7		S
		V_{DS} = 20V, I_D = 20 A, T_J = 175°C		9.9		
Input capacitance	C_{iss}	V_{DS} = 1000V, V_{GS} = 0V f = 1MHz		1037		pF
Output capacitance	C_{oss}			65		
Reverse transfer capacitance	C_{rss}			3.8		
C_{oss} Stored Energy	E_{oss}			40		μJ
Total gate charge	Q_g	V_{DS} = 800V, V_{GS} = -4V / 15V I_D = 20 A,		40		nC
Gate-source charge	Q_{gs}			8.9		
Gate-drain charge	Q_{gd}			25		
Internal gate input resistance	$R_{g(int)}$	f = 1MHz, VAC = 25mV		1.5		Ω
Turn-On Switching Energy	E_{ON}	V_{DS} = 800 V, V_{GS} = -4V/15V, I_D = 20A, $R_{G(ext)}$ =0Ω, L=120μH		112		μJ
Turn-Off Switching Energy	E_{OFF}			25		
Turn-On Delay Time	$t_{d(on)}$			8.8		ns
Rise Time	t_r			10.5		
Turn-Off Delay Time	$t_{d(off)}$			15		
Fall Time	t_f			8.4		

Reverse Diode Characteristics (T_C=25°C unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Diode Forward Voltage	V_{SD}	V_{GS} = -4V, I_{SD} = 20A,		3.8		V
		V_{GS} = -4V, I_{SD} = 20A, T_J = 175°C		3.5		
Continuous Diode Forward Current	I_S	V_{GS} = -4V		44		A
Reverse Recovery time	t_{rr}	V_{GS} = -4V, I_{SD} = 20A, V_R= 800V, dif/dt = 2436 A/μs T_J = 155°C		39		ns
Reverse Recovery Charge	Q_{rr}			321		nC
Peak Reverse Recovery Current	I_{rrm}			16.5		A

Thermal Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$R_{th(j-c)}$	Thermal resistance from junction to case		0.7		^{0}C/W
$R_{th(j-a)}$	Thermal resistance from junction to ambient		35		^{0}C/W

Electrical characteristic diagrams

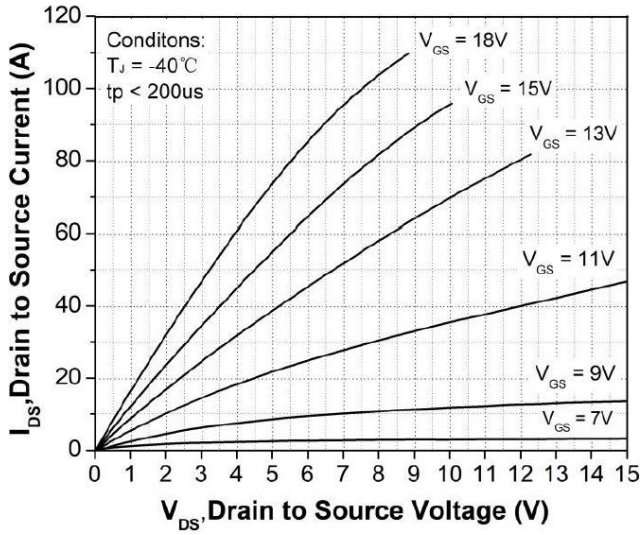


Figure 1. Output characteristics T_J = -40 °C

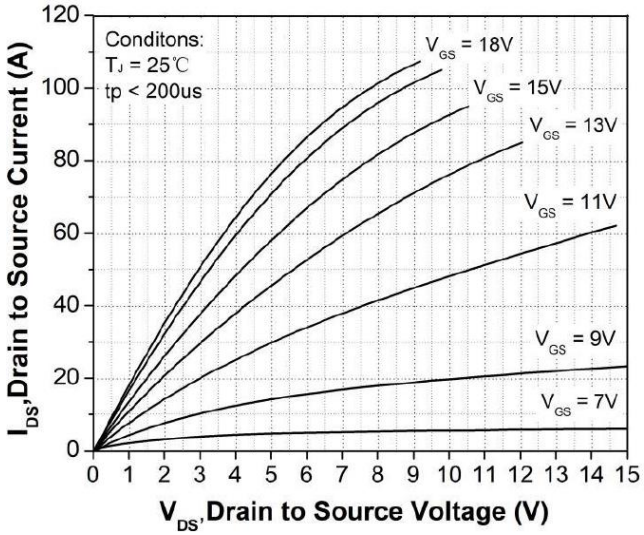


Figure 2. Output characteristics T_J = 25 °C

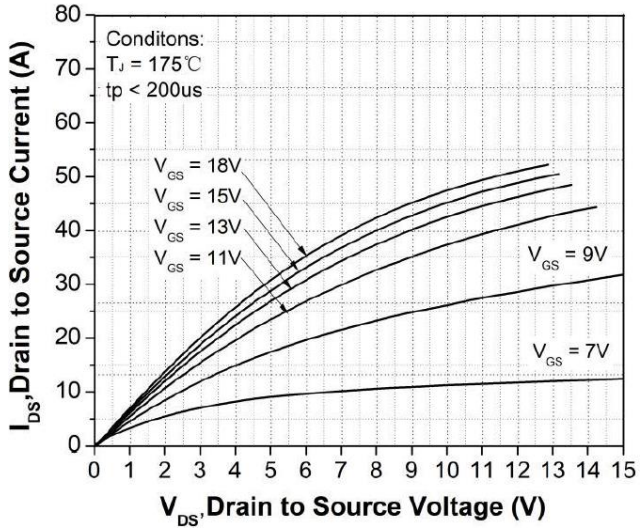


Figure 3. Output characteristics T_J = 175 °C

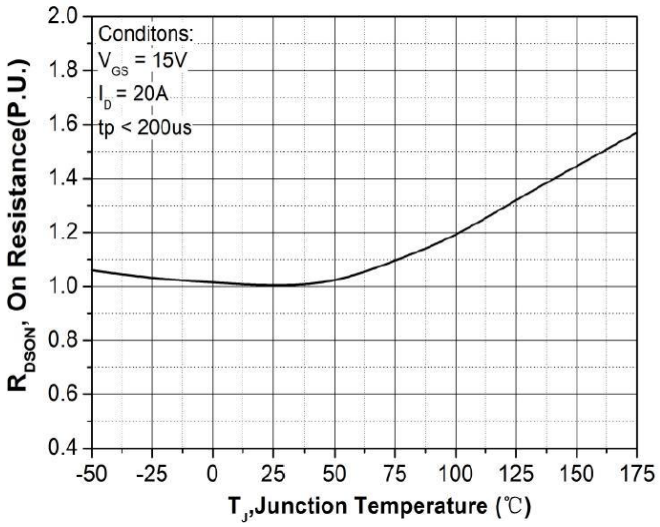


Figure 4. Normalized on-resistance vs. temperature

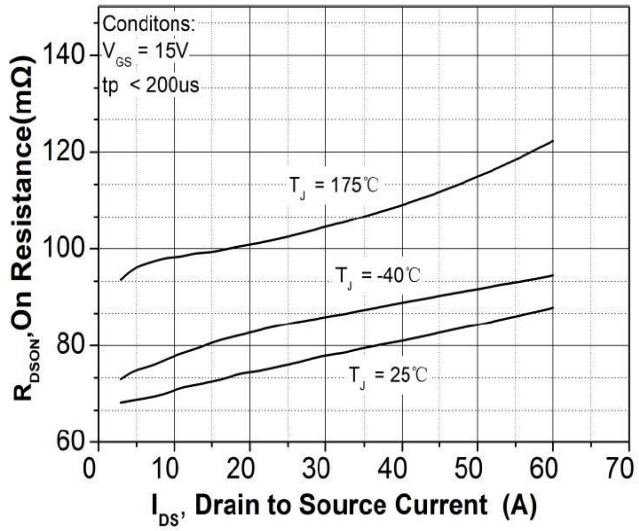


Figure 5. On-resistance vs. drain current

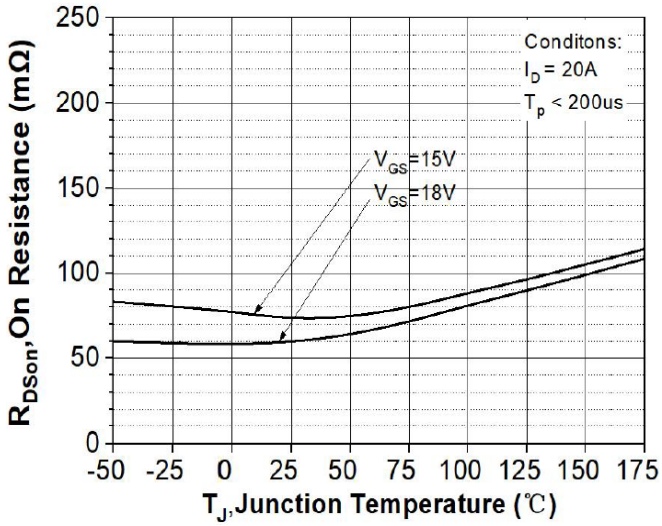


Figure 6. On-resistance vs. temperature

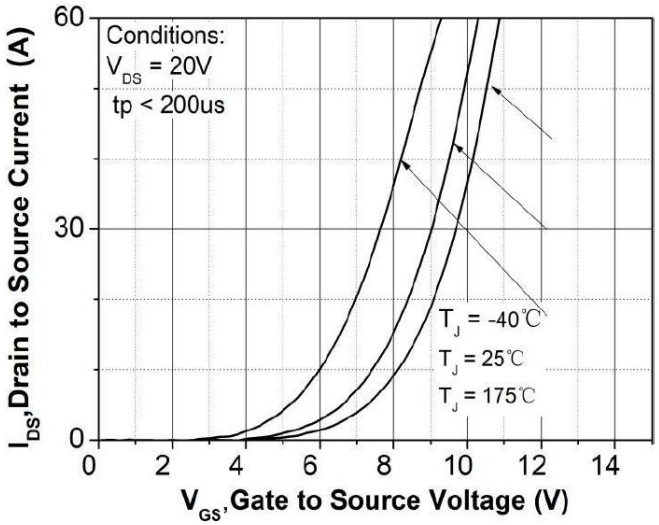


Figure 7. Transfer characteristic

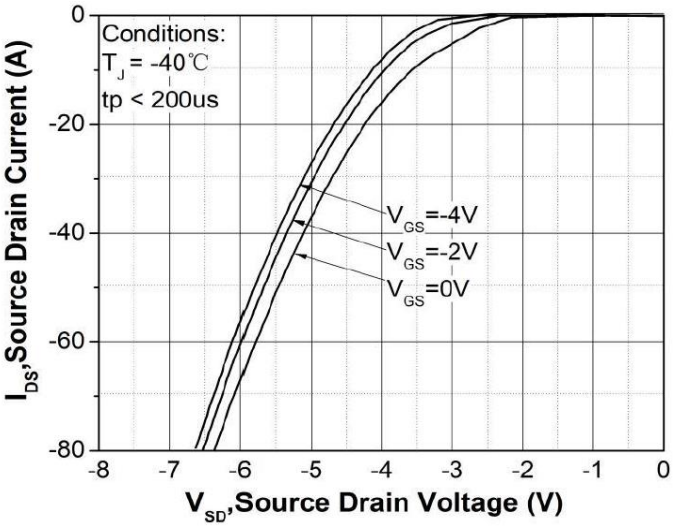


Figure 8. Body diode characteristic at T_J = -40 °C

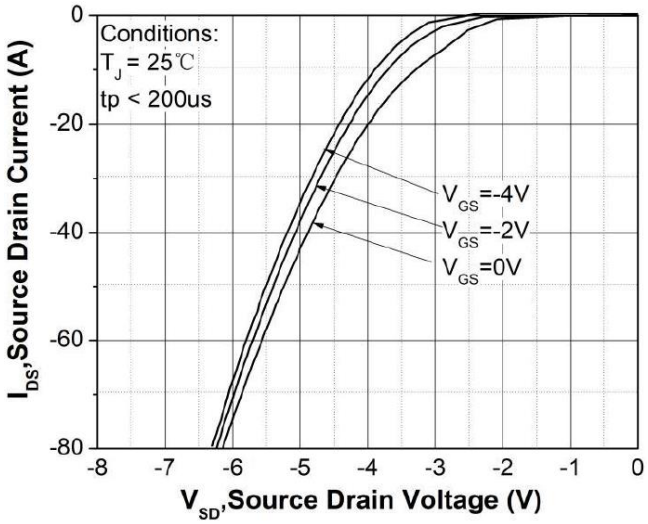


Figure 9. Body diode characteristic at T_J = 25 °C

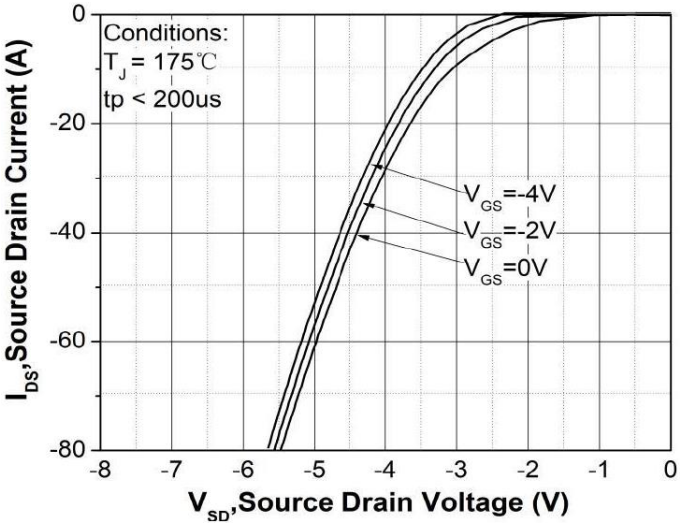


Figure 10. Body diode characteristic at T_J = 175°C

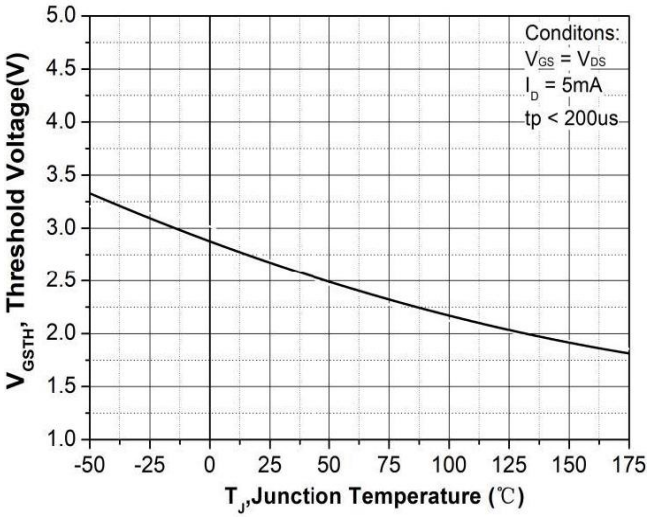


Figure 11. Threshold voltage vs. temperature

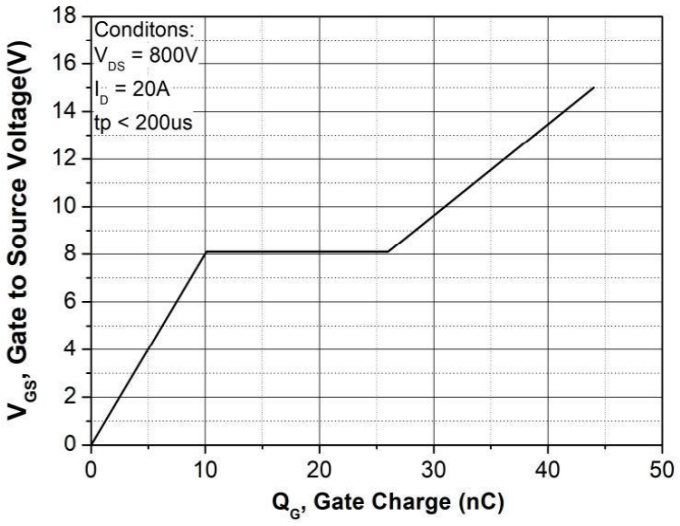


Figure 12. Gate charge characteristic

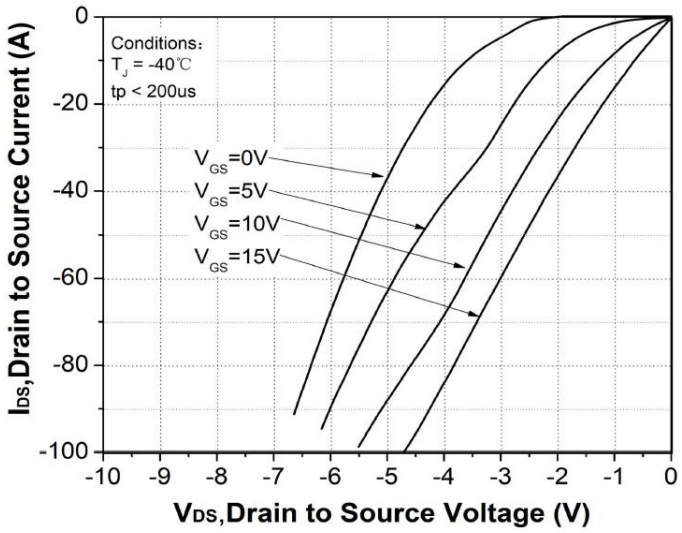


Figure 13. 3rd quadrant characteristic at T_J = -40 °C

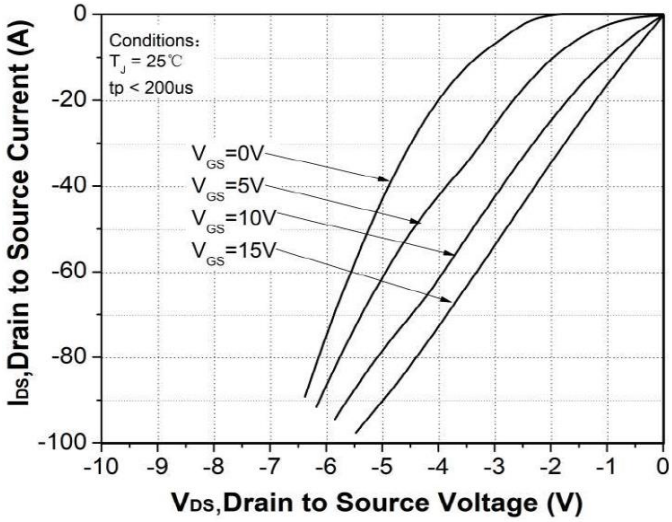


Figure 14. 3rd quadrant characteristic at T_J = 25 °C

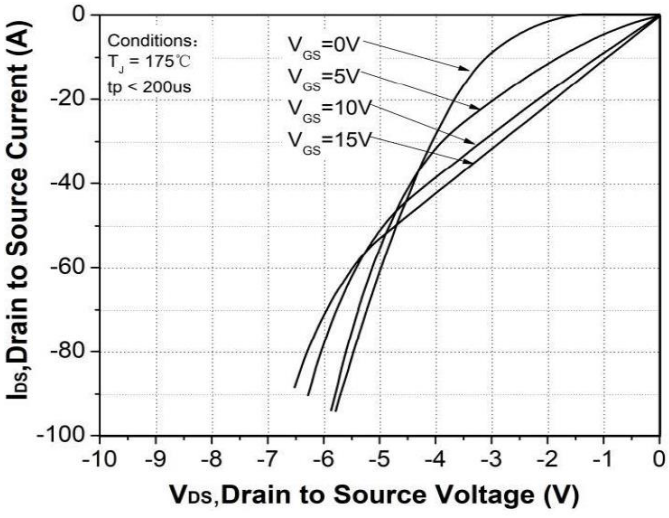


Figure 15. 3rd quadrant characteristic at T_J = 175 °C

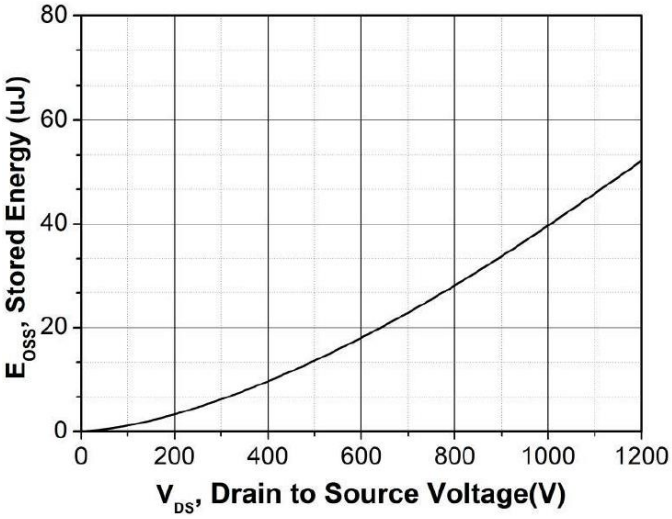


Figure 16. Output capacitor stored energy

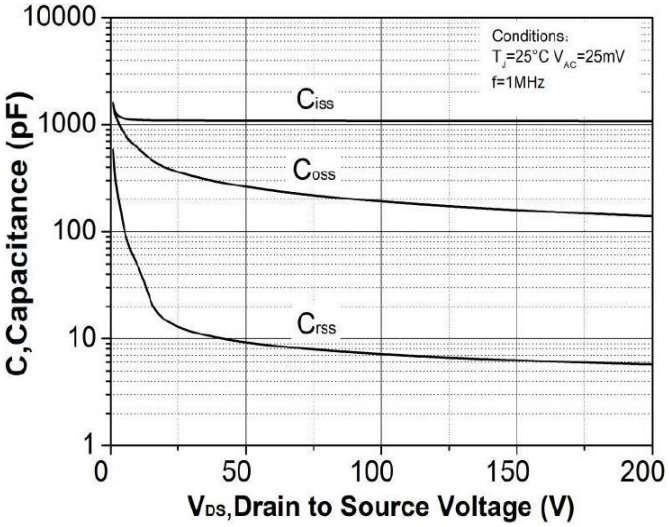


Figure 17. Capacitances vs. drain-source voltage (0 - 200V)

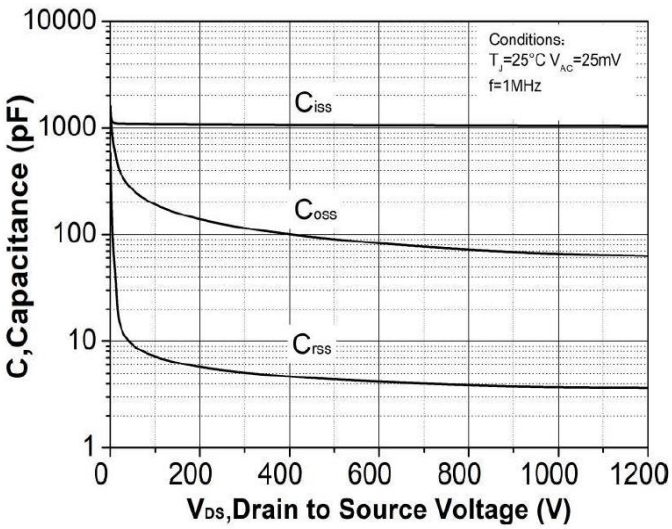


Figure 18. Capacitances vs. drain-source voltage (0 - 1200V)

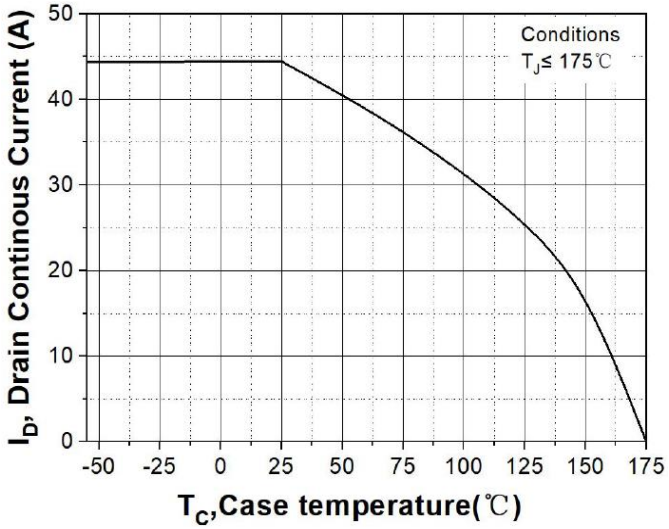


Figure 19. Continuous drain current vs. case temperature

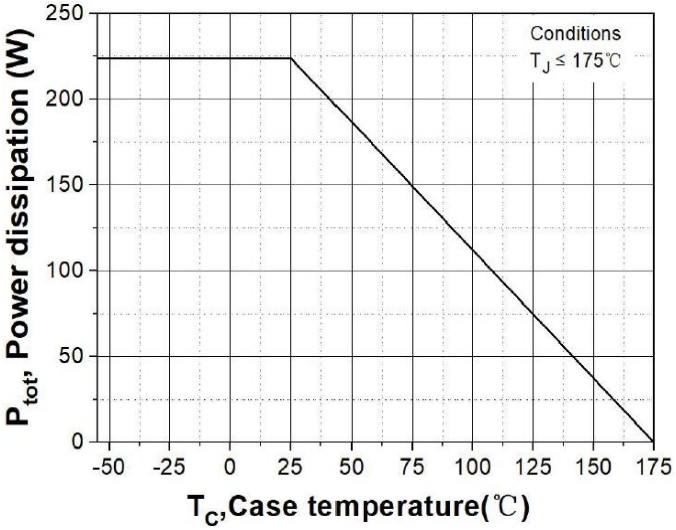


Figure 20. power dissipation vs. case temperature

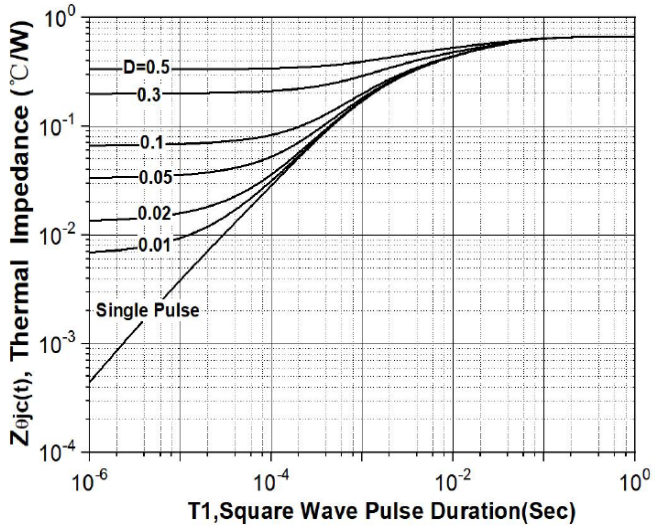


Figure 21. Transient thermal impedance (junction - case)

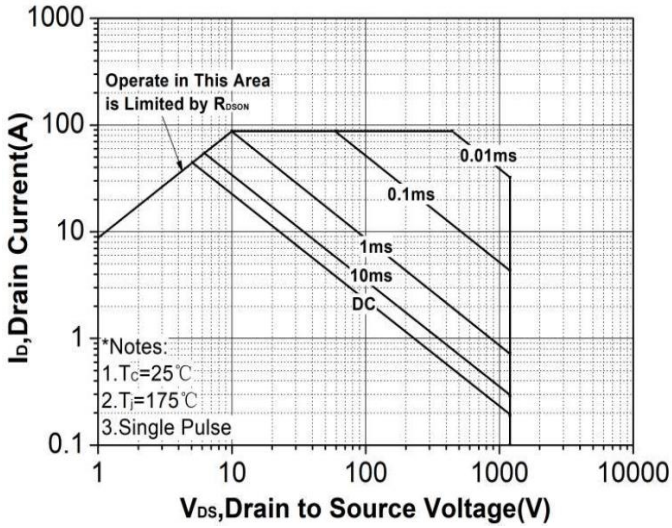


Figure 22. Safe operating area

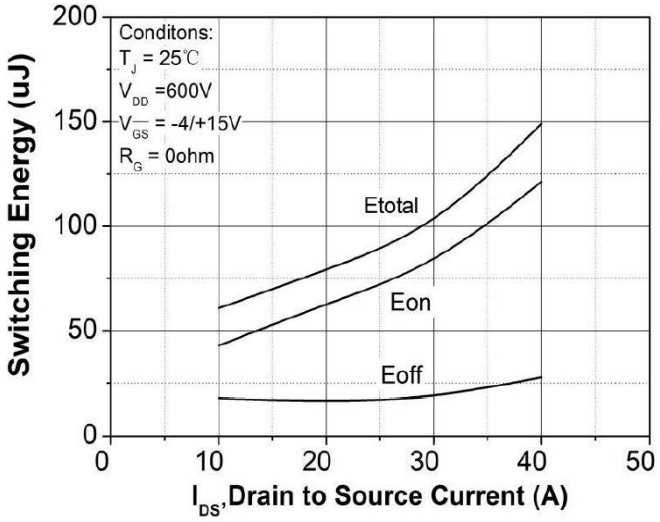


Figure 23. switching energy vs. drain current (V_{DD} = 600V)

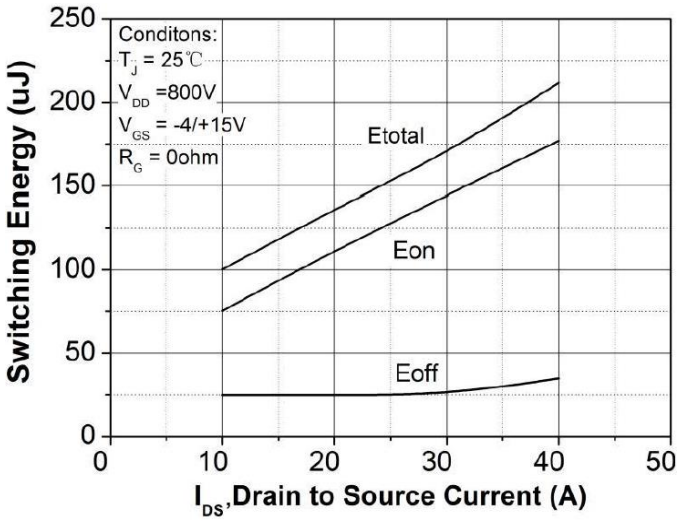


Figure 24. switching energy vs. drain current (V_{DD} = 800V)

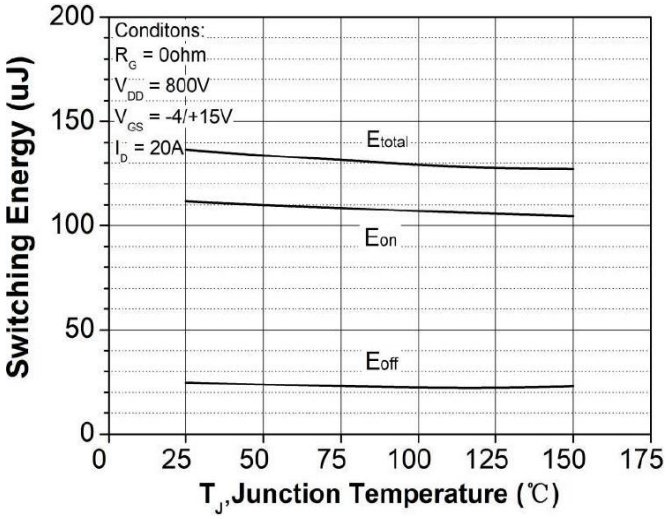


Figure 25. Clamped inductive switching energy vs. RG(ext)

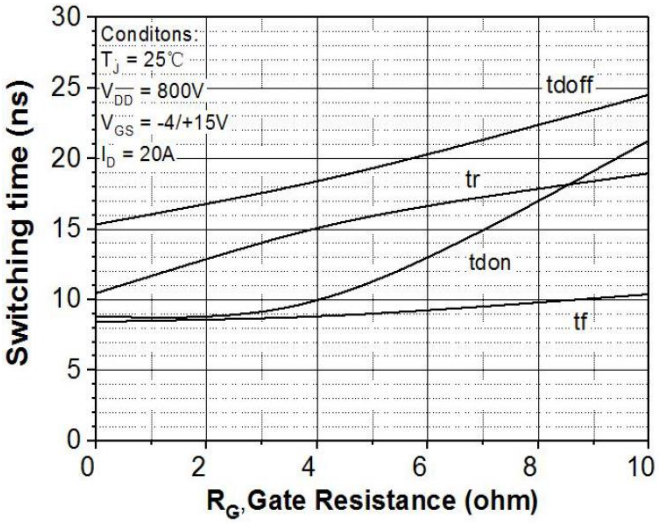
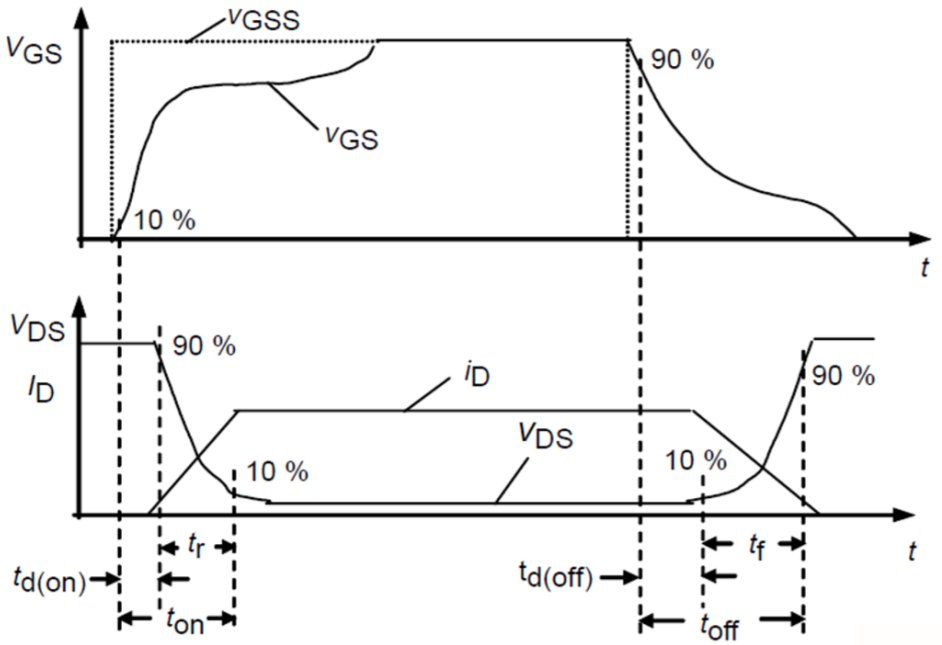
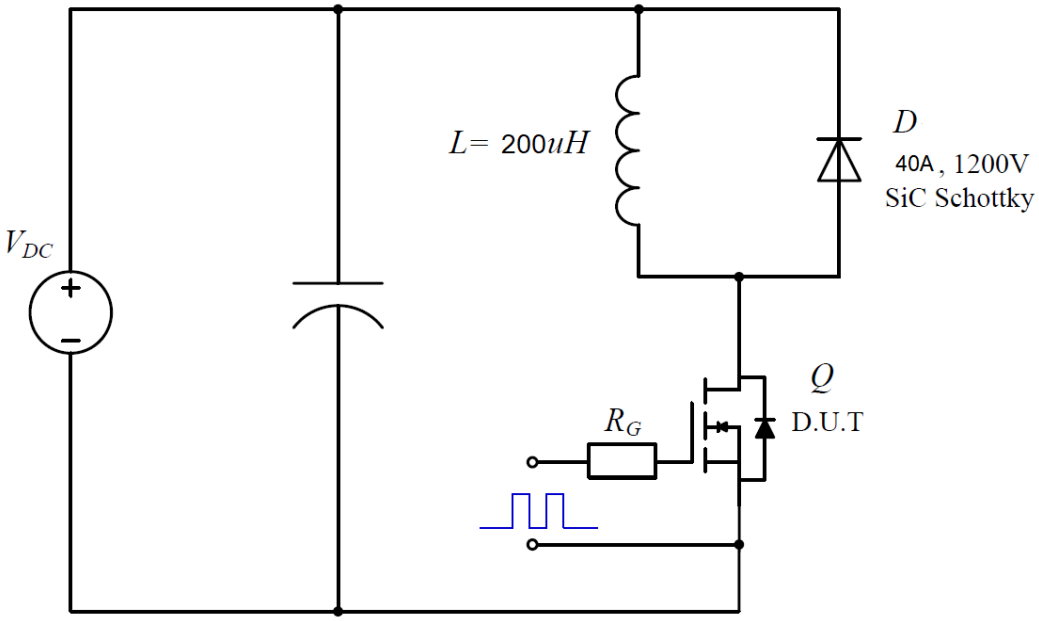


Figure 26. Switching times vs. RG(ext)

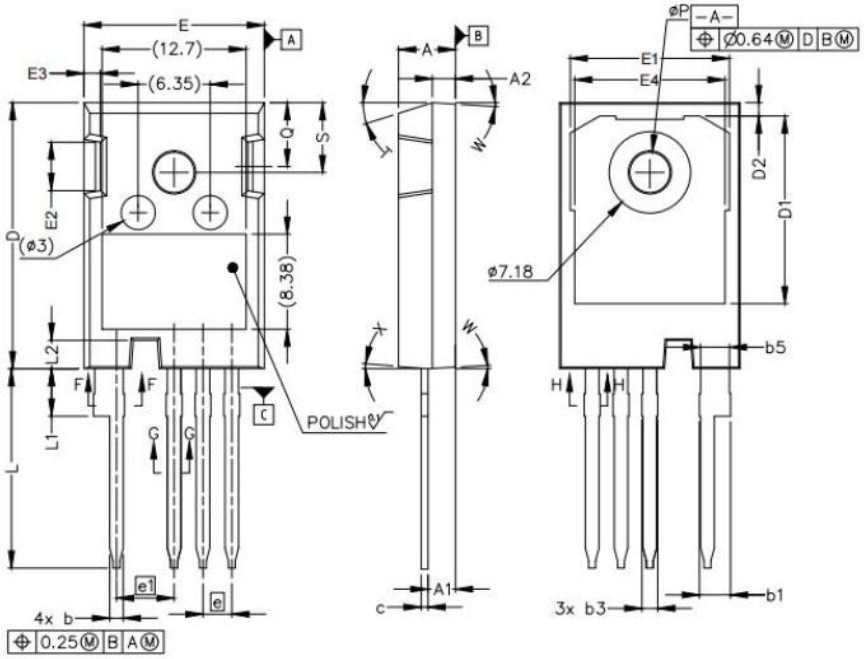
Switching Times Definition and Test Circuit

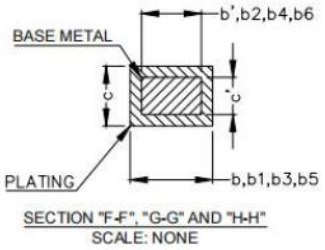




Package Dimensions

(TO-247-4 Package)





SECTION "F-F", "G-G" AND "H-H"
SCALE: NONE

SYMBOL	MILLIMETERS	
	MIN	MAX
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b'	1.07	1.28
b	1.07	1.33
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c'	0.55	0.65
c	0.55	0.68
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
N	4	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
øP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF.	
W	3.5 ° REF.	
X	4° REF.	