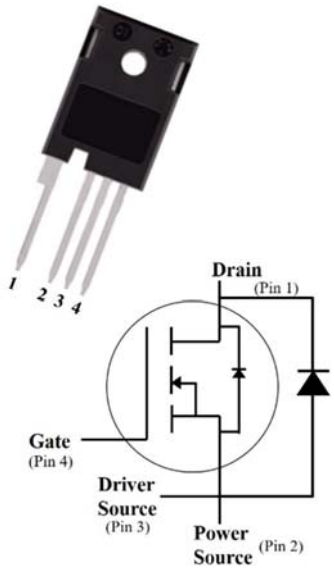
Silicon Carbide Power MOSFET （N-Channel Enhancement）

V_{DS}	1200V
$I_{D\ (25°C)}$	69A
$R_{DS(on)}$	32mΩ



Features

- High speed switching
- Essentially no switching losses
- Reduction of heat sink requirements
- Maximum working temperature at 175 °C
- High blocking voltage
- Fast Intrinsic diode with low recovery current
- High-frequency operation
- Halogen free, RoHS compliant

Typical Applications

Typical applications are in power factor correction (PFC), solar inverter, uninterruptible power supply, motor drives, photovoltaic inverter, electric car and charger.

Mechanical Data

- **Package**: TO-247-4L
- **Terminals**: Tin plated leads
- **Polarity**: As marked

■Maximum Ratings (Tc=25℃ unless otherwise specified)

PARAMETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code			DH12040NCFYG3		
Drain source voltage @ T_j=25°C	$V_{DS,max}$	V	1200	V_{GS}=0V, I_D=100uA	
Gate source voltage @ T_j=25°C	$V_{GS,max}$	V	-8/+22	Absolute maximum values (AC f >1Hz, duty cycle < 1%)	
Gate source voltage @ T_j=25°C	$V_{GS,op}$	V	-5/+18	Recommended operational values	
Continuous drain current @ T_c=25°C	I_D	A	69	V_{GS}=18V, Tc=25℃	Fig.17
Continuous drain current @ T_c=100°C			47	V_{GS}=18V, Tc=100℃	
Pulsed drain current	$I_{D(pulsed)}$	A	168	Pulse width t_p limited by $T_{j,max}$	Fig.22
Power Dissipation	P_{TOT}	W	333	Tc=25°C , Tj = 175℃	Fig.16
Power Dissipation			88	Tc=100°C, Tj = 175℃	
Operating junction and Storage temperature range	Tj ,Tstg	°C	-55 to +175		
Soldering temperature	T_L	°C	260	1.6mm (0.063'') from case for 10s	
Mounting torque	T_M	Nm	0.6	M3 screw Maximum of mounting process: 3	

■Static Electrical Characteristics (Tc=25℃ unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Gate threshold voltage	$V_{GS(th)}$	V	2.2	2.8	3.6	V_{DS}=V_{GS}, I_D= 12mA	Fig.4, 11
				2.2		V_{DS}=V_{GS}, I_D= 12mA, Tj=175℃	
Drain source breakdown voltage	$V_{(BR)DSS}$	V	1200			V_{GS}=0V, I_D=100uA	
Drain source leakage current	I_{DSS}	uA		3	10	V_{DS}=1200V, V_{GS}= 0V	
Gate source leakage current	I_{GSS}	nA		10	100	V_{GS}= 18V, V_{DS}=0V	
Current drain source on-state resistance	$R_{DS\ ON}$	mΩ		38		V_{GS}=15V, I_D=30A	Fig.5, 6, 7
				32	60	V_{GS}=18V, I_D=30A	
				63		V_{GS}=15V, I_D=30A,Tj=175℃	
				60		V_{GS}=18V, I_D=30A,Tj=175℃	
Transconductance	g_f	S		20		V_{DS}=(20)V,I_D=30A	Fig.4
				18		V_{DS}=20V,I_D=30A,Tj=175℃	

■Dynamic Electrical Characteristics (Tc=25℃ unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	Ciss	pF		3447		V_{DS}=1000V, V_{GS}=0V, Tj=25℃, f=400kHz, V_{AC} = 25mV	Fig.13, 14
Output capacitance	Coss			211			
Reverse capacitance	Crss			3.6			
Coss stored energy	Eoss	uJ		104			Fig.15
Gate source charge	Qgs	nC		30		V_{DS}=1000V, V_{GS}=-5/+18V, I_D=30A	Fig.12
Gate drain charge	Qgd			67			
Gate charge	Qg			117			
Internal gate resistance	Rg	Ω		1.6		f=1MHz, V_{AC} = 25mV	

■Switching Characteristics (Tc=25℃ unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on delay time	$t_{d(on)}$	ns		13.7		V_{DD}=1000V, V_{GS}=-5/+18V, I_D=30A, Rg=2.4Ω, L=100uH	Fig.21
Rise time	t_r			19.6			
Turn off delay time	$t_{d(off)}$	ns		27.2			
Fall time	t_f			17.9			
Turn on switching energy	E_{on}	uJ		533		V_{DD}=1000V, V_{GS}=-5/+18V, I_D=30A, Rg=2.4Ω, L=100uH	Fig.19, 20
Turn off switching energy	E_{off}			172			

■Body diode characteristics (Tc=25℃ unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		1.38		V_{GS}=0V,I_{SD}=15A	Fig.8
				1.6		V_{GS}=0V, I_{SD}=15A, Tj=175℃	
Continuous diode forward current	I_S	A		69		V_{GS}=-5V,Tc=25℃	
Reverse recovery time	trr	nS		19.5		V_R=800V, V_{GS}=-5V, I_D=30A, di/dt=2000A/uS	
Reverse recovery charge	Qrr	nC		200			
Peak reverse recovery current	Irrm	A		16.8			

■Thermal Characteristics (Ta=25℃ unless otherwise specified)

SYMBOL	PARAMETER	UNIT	Typ.
$R_{\theta J-C}$	Thermal Resistance from Junction to Case(SiC MOSFET)	°C /W	0.45
$R_{\theta J-C}$	Thermal Resistance from Junction to Case(Silicon JBS)		0.65

■Typical Characteristics

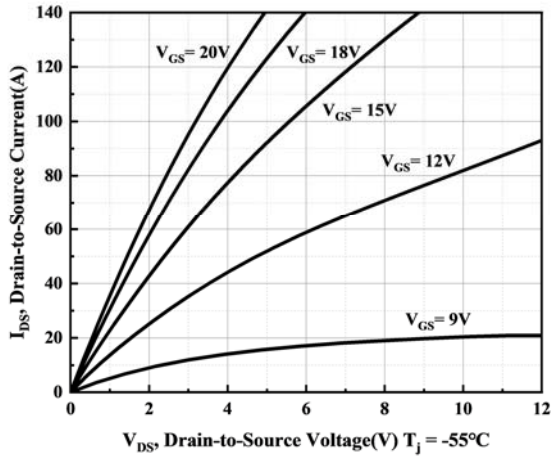


Figure 1. Output Characteristics T_j = -55℃

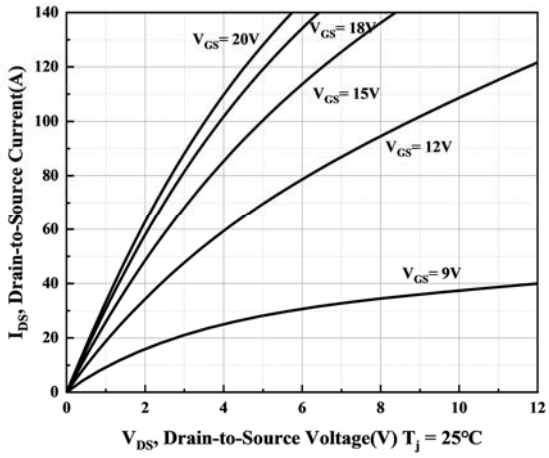


Figure2. Output Characteristics T_j = 25℃

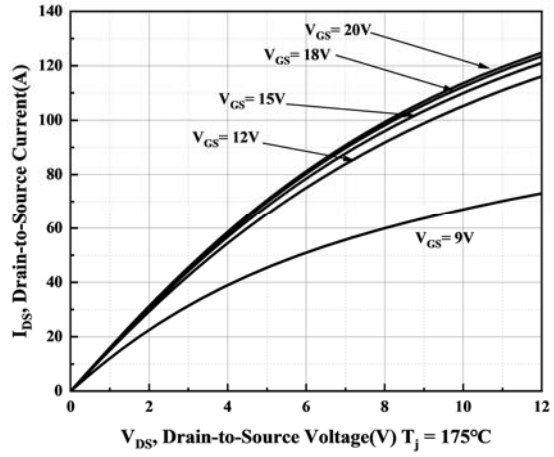


Figure 3. Output Characteristics T_j = 175℃

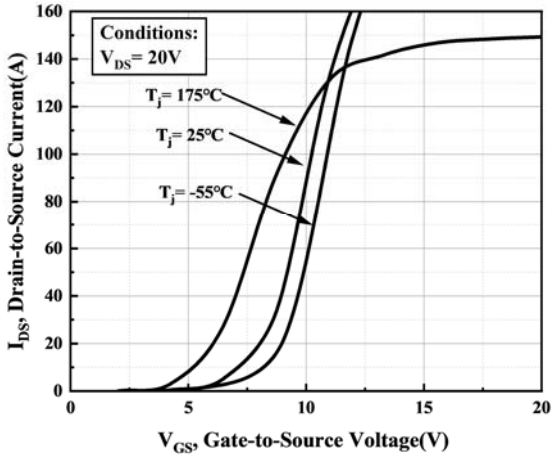


Figure 4. Transfer Characteristics for Various Junction Temperature

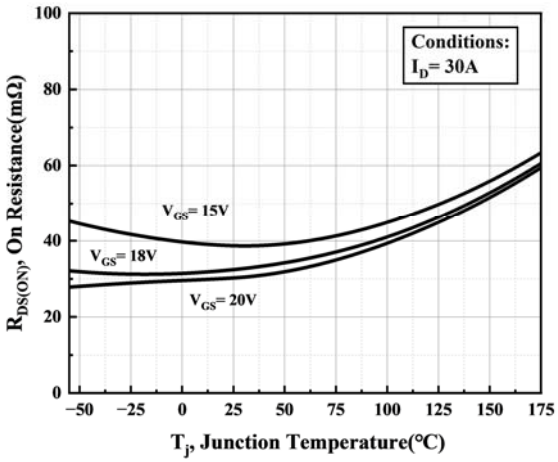


Figure 5. On-resistance vs. Temperature for Various Gate Voltage

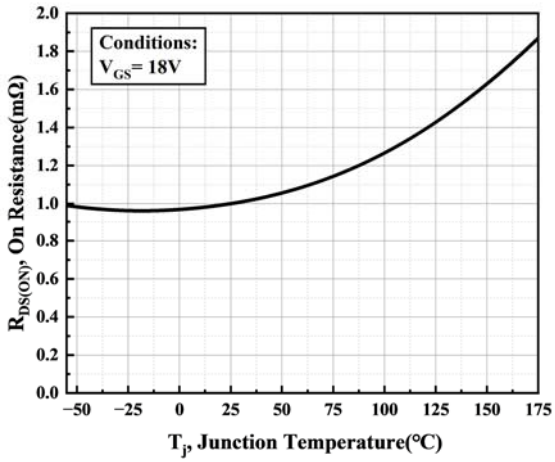


Figure 6. Normalized on-resistance vs. Temperature

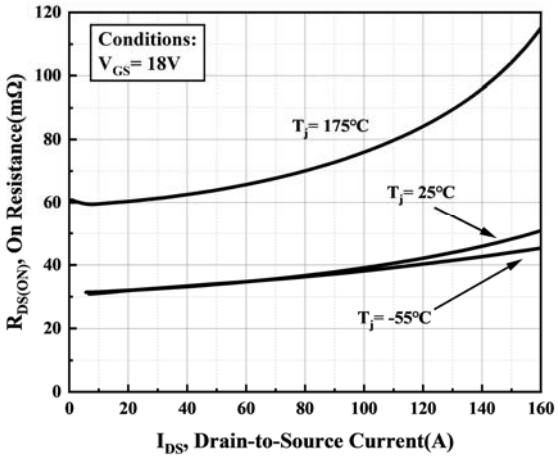


Figure 7. On-resistance vs. Drain Current

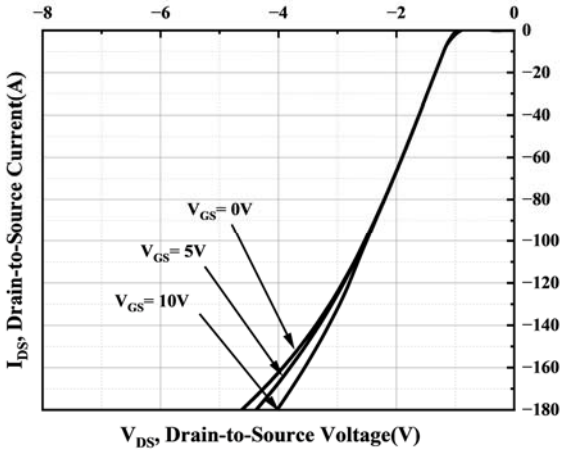


Figure 8. Body Diode Characteristic at T_j= -55 ℃

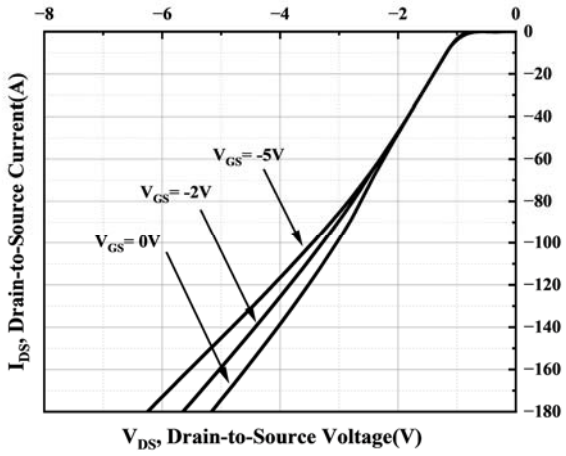


Figure 9. Body Diode Characteristic at T_j= 25 ℃

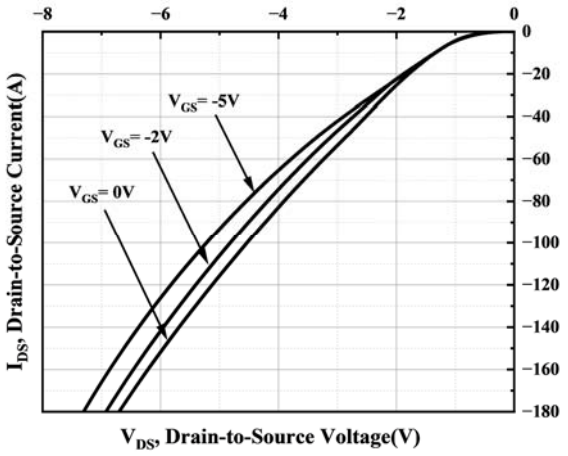


Figure 10. Body Diode Characteristic at T_j= 175 ℃

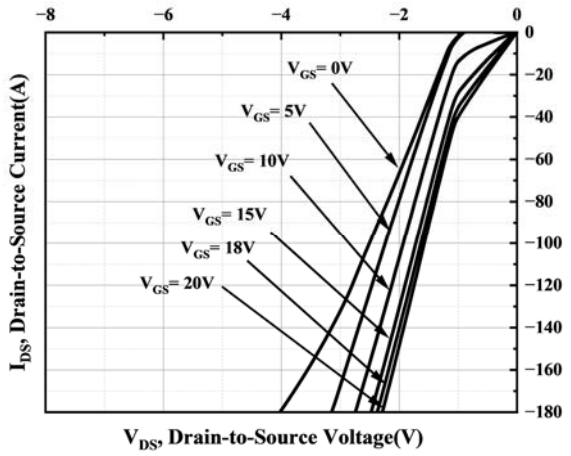


Figure 11. 3rd quadrant Characteristic at T_j= -55 ℃

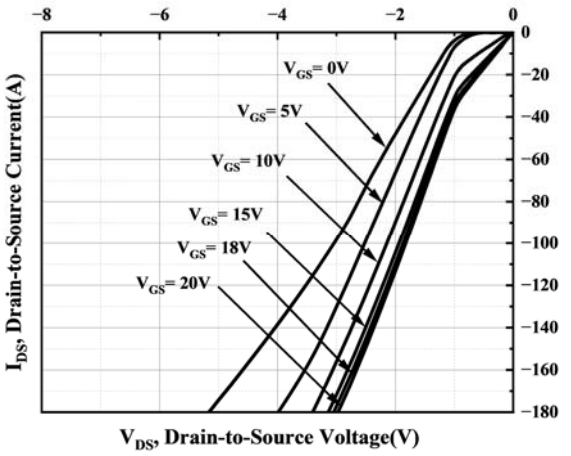


Figure 12. 3rd quadrant Characteristic at T_j= 25 ℃

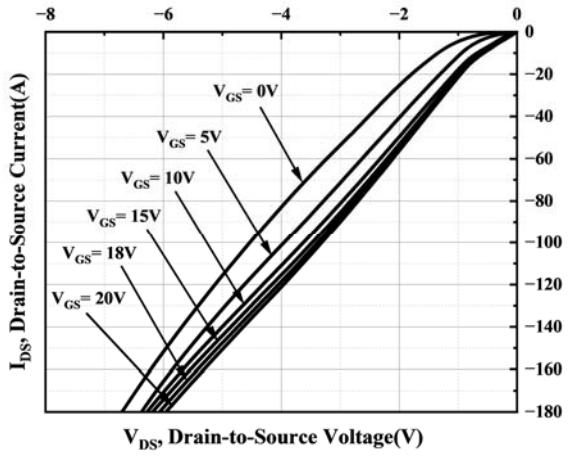


Figure 13. 3rd quadrant Characteristic at T_j= 175 ℃

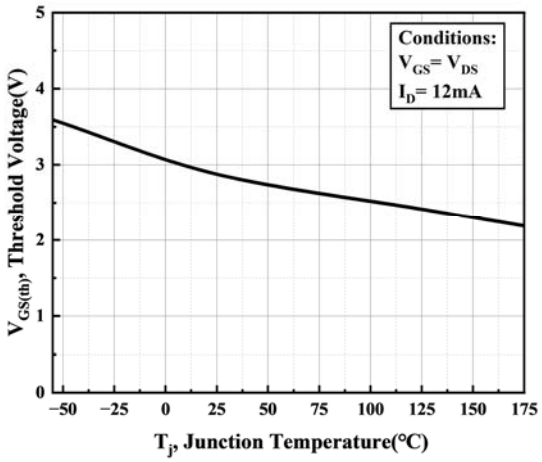


Figure 14. Threshold Voltage vs. Temperature

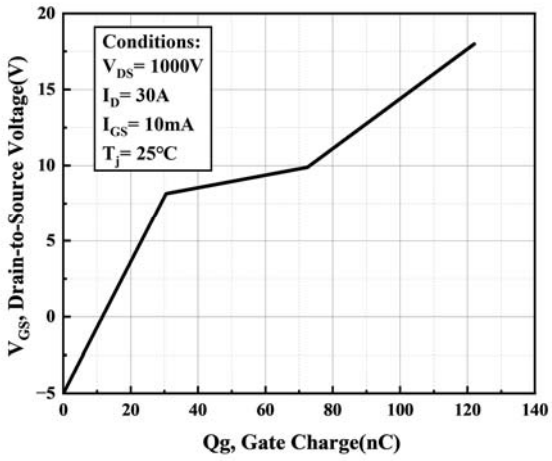


Figure 15. Gate Charge Characteristic Figure

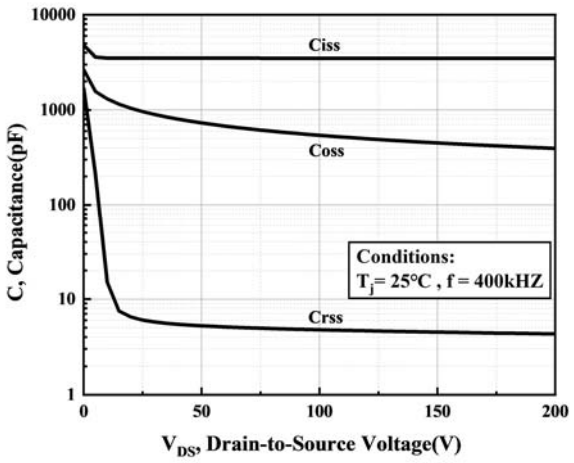


Figure 16. Capacitances vs. Drain Source Voltage (0-200V)

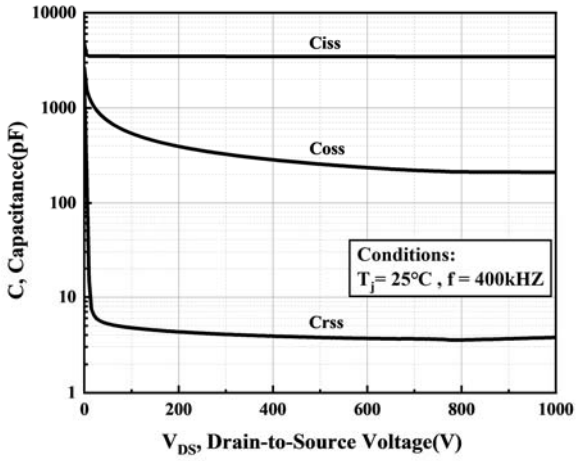


Figure 17. Capacitances vs. Drain Source Voltage (0-1000V)

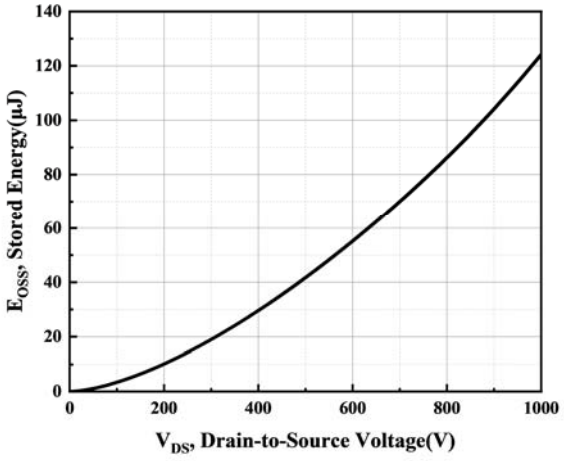


Figure 18. Output Capacitor Stored Energy

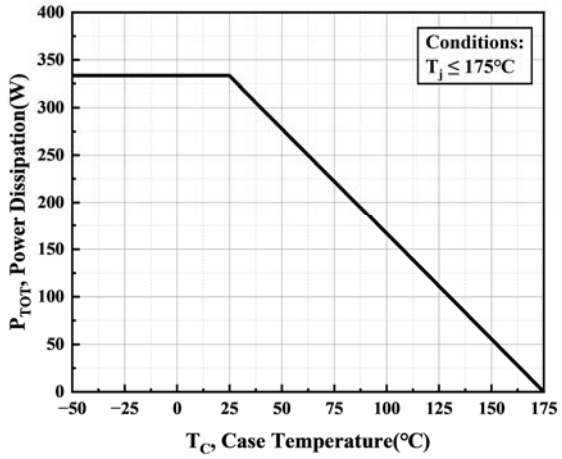


Figure 19. Maximum Power Dissipation Derating vs. Case Temperature

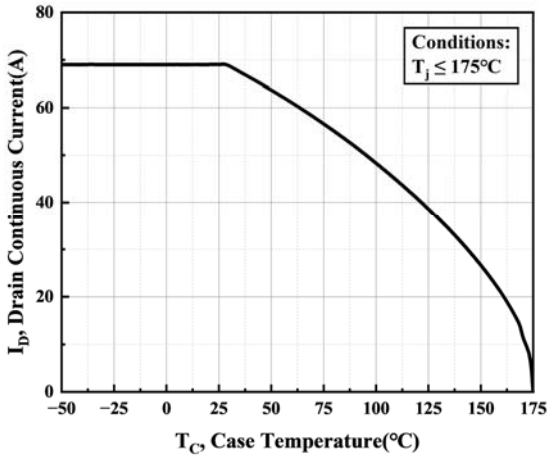


Figure 20. Coutinuous Drain Current Derating vs. Case Temperature

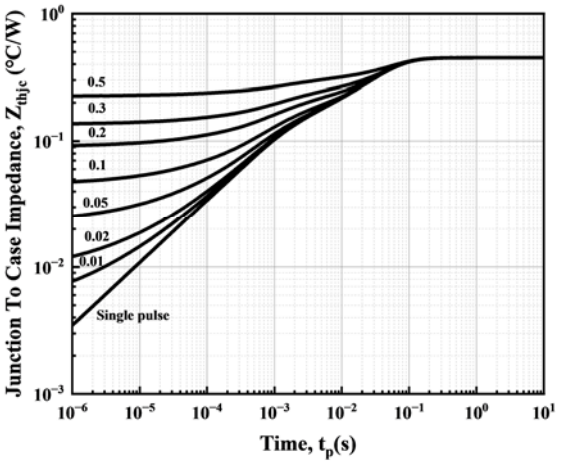


Figure21. Transient Thermal Impedance (Junction - Case)

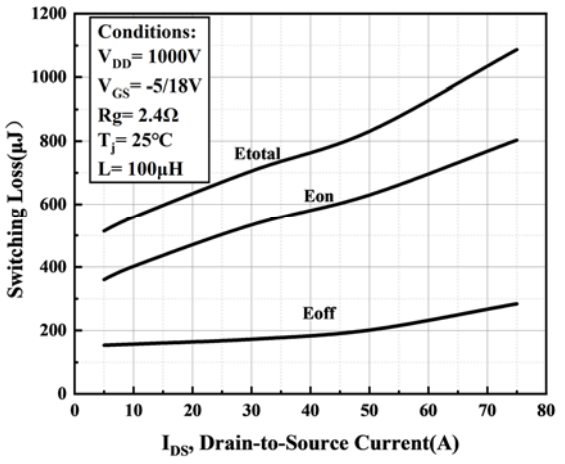


Figure 22. Clamped Inductive Switching Energy vs. Darin Current

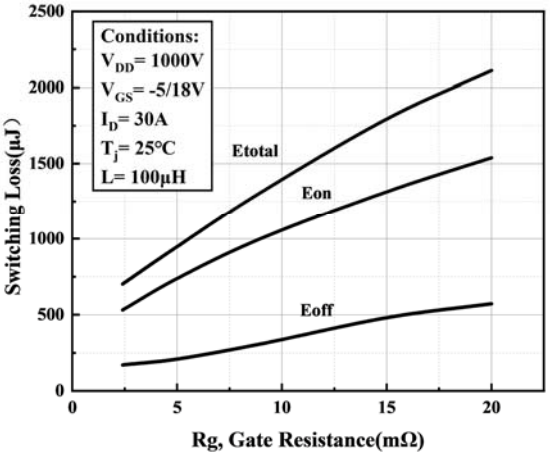


Figure 23. Clamped Inductive Switching Energy vs. Rg

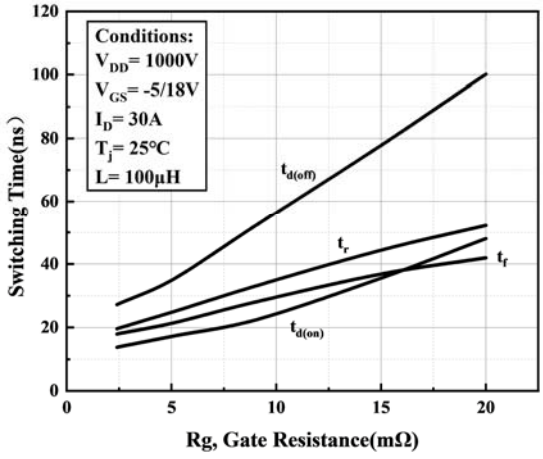


Figure 24. Switching Times vs. Rg

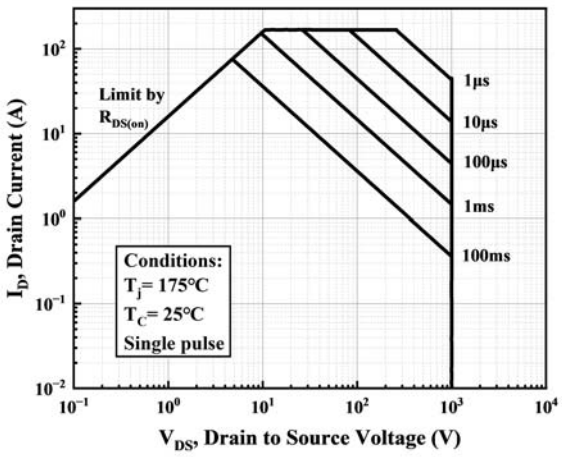


Figure 25. Safe Operating Area

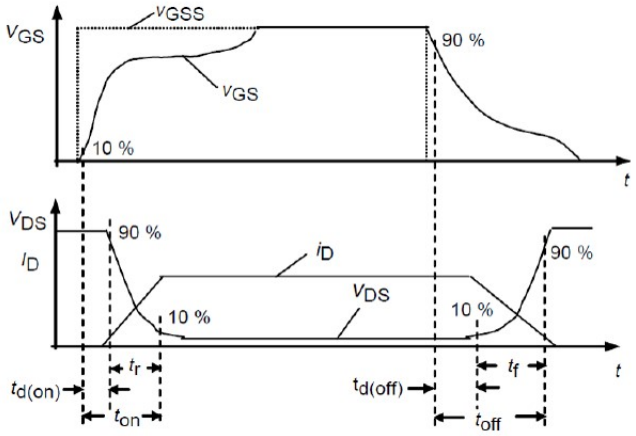


Figure 26. Switching Times Definition

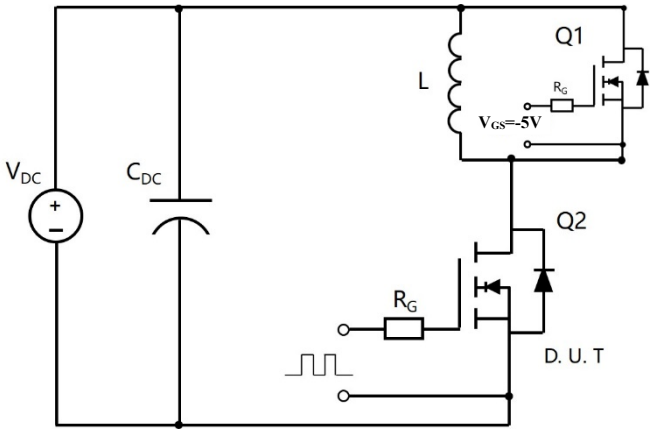
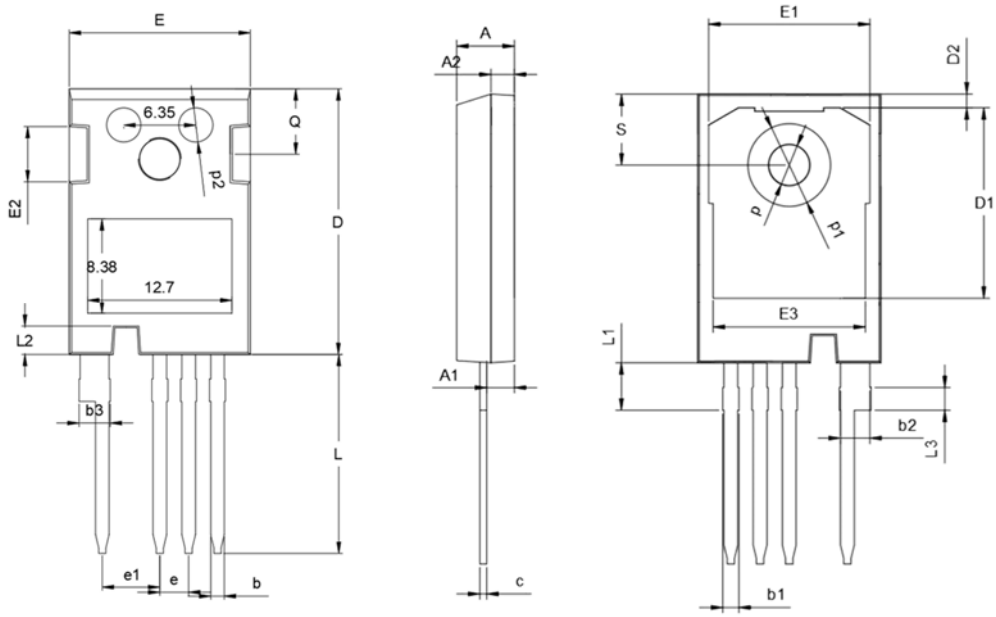


Figure 27. Clamped Inductive Switching Waveform Test Circuit

■Outline Dimensions



TO247-4L			
Dim	Min	Norm	Max
A	4.80	5.00	5.20
A1	2.30	2.40	2.50
A2	1.88	1.98	2.08
b	1.10	1.20	1.30
b1	1.20	/	1.50
b2	2.35	2.55	2.75
b3	2.45	/	2.85
c	0.55	0.60	0.65
D	23.3	23.45	23.6
D1	16.25	16.55	16.85
D2	1.00	/	1.30
e	TYP2.54		
e1	TYP5.06		
E	15.75	15.90	16.05
E1	13.80	/	14.20
E2	4.40	4.75	5.10
E3	13.00	/	13.45
L	17.34	17.49	17.64
L1	4.00	/	4.30
L2	2.35	/	2.65
L3	TYP1.98		
Q	5.60	5.80	6.00
S	6.05	/	6.30
p	TYP3.58		
p1	TYP7.18		
p2	TYP3.00		

Disclaimer

The information presented in this document is for reference only. Yangzhou Yangjie Electronic Technology Co., Ltd. reserves the right to make changes without notice for the specification of the products displayed herein to improve reliability, function or design or otherwise.

The product listed herein is designed to be used with ordinary electronic equipment or devices, and not designed to be used with equipment or devices which require high level of reliability and the malfunction of with would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), Yangjie or anyone on its behalf, assumes no responsibility or liability for any damages resulting from such improper use of sale.

This publication supersedes & replaces all information previously supplied. For additional information, please visit our website http:// www.21yangjie.com , or consult your nearest Yangjie's sales office for further assistance.