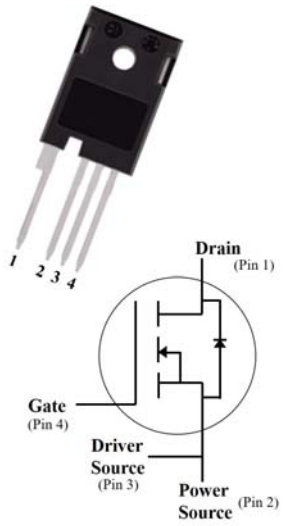
Silicon Carbide Power MOSFET （N-Channel Enhancement）

V_{DS}	1200V
$I_{D\ (25°C)}$	65A
$R_{DS\ (on)}$	36mΩ



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			D212040NCFYG3M		
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	65	V_{GS}=18V, Tc=25℃	Fig.16
Continuous drain current @ T_c=100°C			32	V_{GS}=18V, Tc=100℃	
Pulsed drain current	$I_{D(pulsed)}$	A	138	Pulse width t_p limited by $T_{j,max}$（1）	Fig.21
Power Dissipation	P_{TOT}	W	288	Tc=25°C , Tj = 175℃	Fig.15
Power Dissipation			76	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	

Note:（1）Typical Reference Conditions: VGS = VGS_on PW < 10 μs, Duty cycle < 1%.

■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	3	4	V_{DS}=V_{GS}, I_D= 7.4mA	Fig.4, 10
				2.4		V_{DS}=V_{GS}, I_D= 7.4mA, 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		45		V_{GS}=15V, I_D=19A	Fig.5, 6, 7
				36	52	V_{GS}=18V, I_D=19A	
				68		V_{GS}=15V, I_D=19A, Tj=175℃	
				59		V_{GS}=18V, I_D=19A, Tj=175℃	
Transconductance	g_f	S		18		V_{DS}=20V,I_D=19A	Fig.4
				17		V_{DS}=20V,I_D=19A,Tj=175℃	

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	Ciss	pF		1981		V_{DS}=1000V, V_{GS}=0V, Tj=25℃, f=100kHz, V_{AC} = 25mV	Fig.13, 14
Output capacitance	Coss			85			
Reverse capacitance	Crss			3.2			
Coss stored energy	Eoss	uJ		51			Fig.15
Gate source charge	Qgs	nC		25.5		V_{DS}=1000V, V_{GS}=-5/+18V, I_D=19A	Fig.12
Gate drain charge	Qgd			34.4			
Gate charge	Qg			90			
Internal gate resistance	Rg	Ω		2.3		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		9.9		V_{DD}=1000V, V_{GS}=-5/+18V, I_D=19A, Rg=2.4Ω, L=100uH	Fig.21
Rise time	t_r			11.8			
Turn off delay time	$t_{d(off)}$	ns		24			
Fall time	t_f			13.7			

Turn on switching energy	E_{on}	uJ		404		V_{DD}=1000V, V_{GS}=-5/+18V, I_D=19A, Rg=2.4Ω, L=100uH	Fig.19, 20
Turn off switching energy	E_{off}			67			

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		4		V_{GS}=-5V,I_{SD}=9.5A	Fig.8
				3		V_{GS}=-5V, I_{SD}=9.5A, Tj=175℃	
Continuous diode forward current	I_S	A		46		V_{GS}=-5V,Tc=25℃	
Reverse recovery time	trr	nS		15		V_R=800V, V_{GS}=-5V, I_D=19A, di/dt=2000A/uS	
Reverse recovery charge	Qrr	nC		152			
Peak reverse recovery current	Irrm	A		17			

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

SYMBOL	PARAMETER	UNIT	Typ.
$R_{\theta J-C}$	Thermal Resistance from Junction to Case	°C /W	0.52

■Typical Characteristics

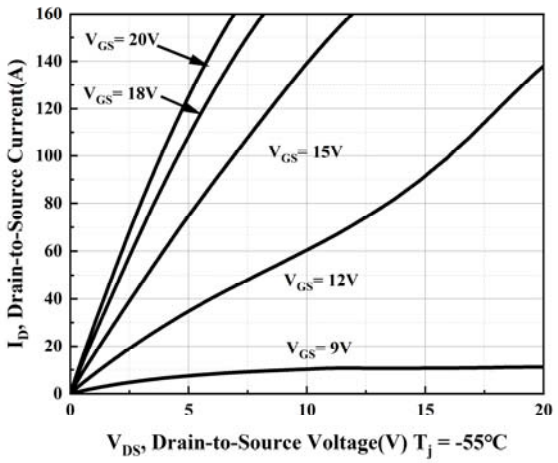


Figure 1. Output Characteristics T_j = -55℃

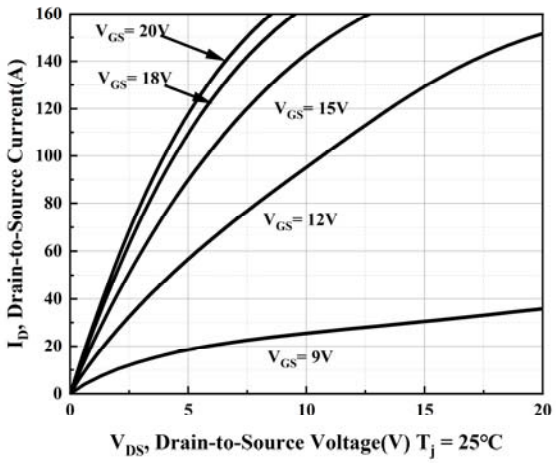


Figure2. Output Characteristics T_j = 25℃

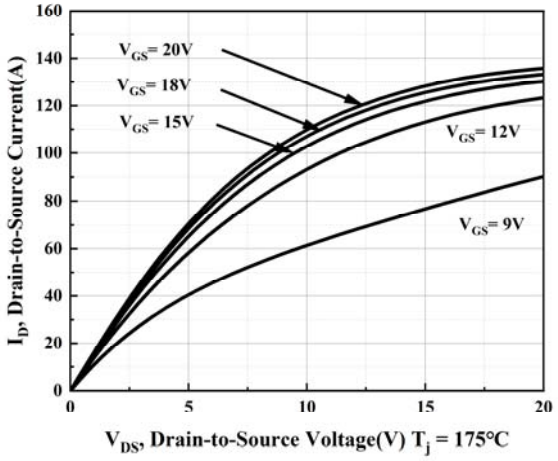


Figure 3. Output Characteristics T_j = 175℃

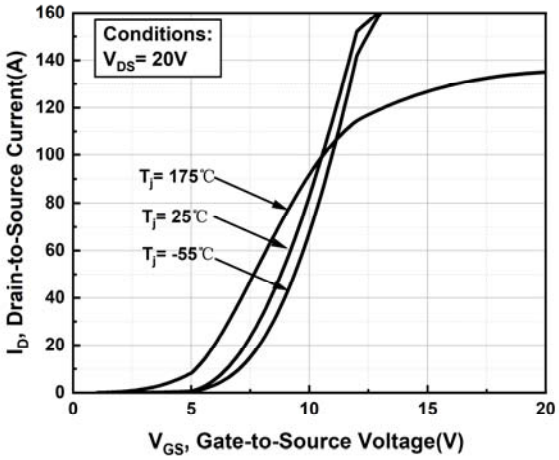


Figure 4. Transfer Characteristics for Various Junction Temperature

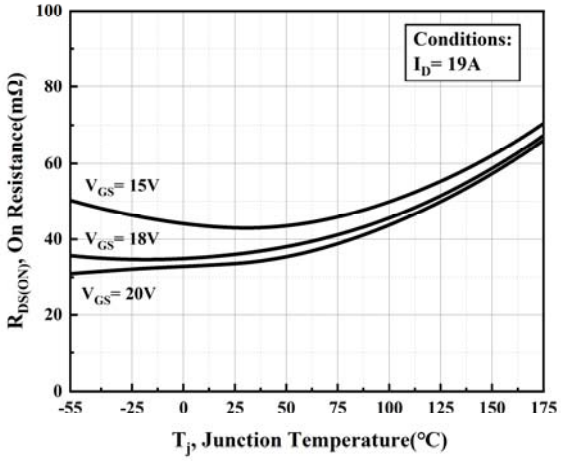


Figure 5. On-resistance vs. Temperature for Various Gate Voltage

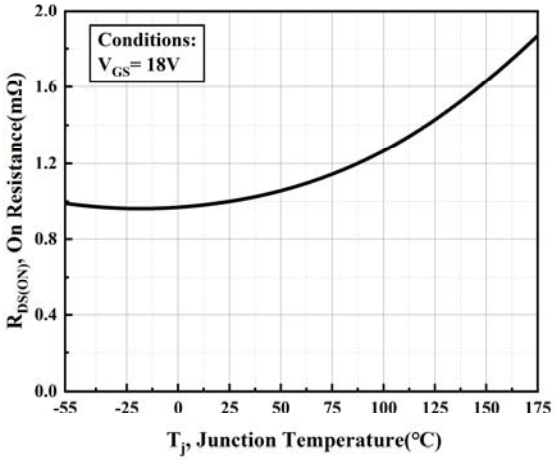


Figure 6. Normalized on-resistance vs. Temperature

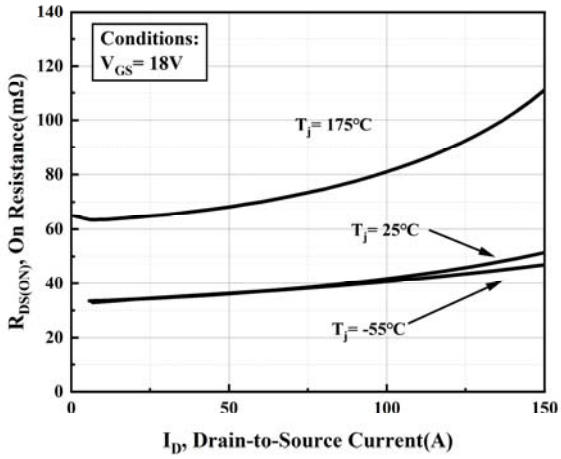


Figure 7. On-resistance vs. Drain Current

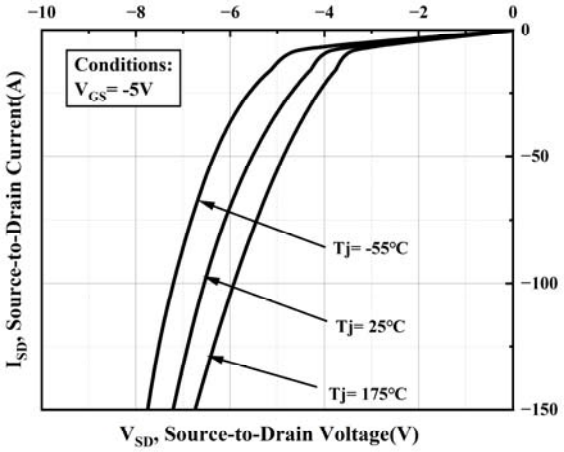


Figure 8. Body Diode Characteristic

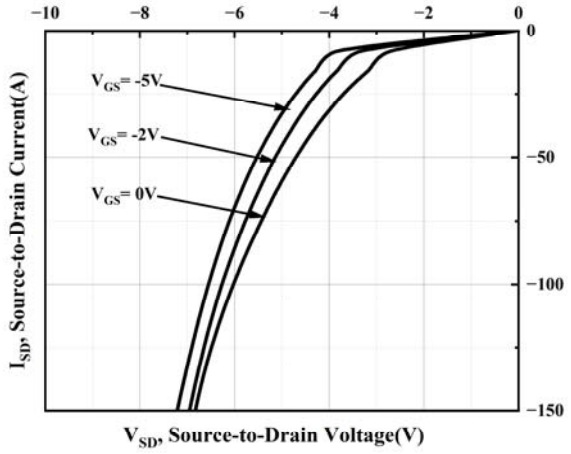


Figure 9. Body Diode Characteristic at Tj= 25 ℃

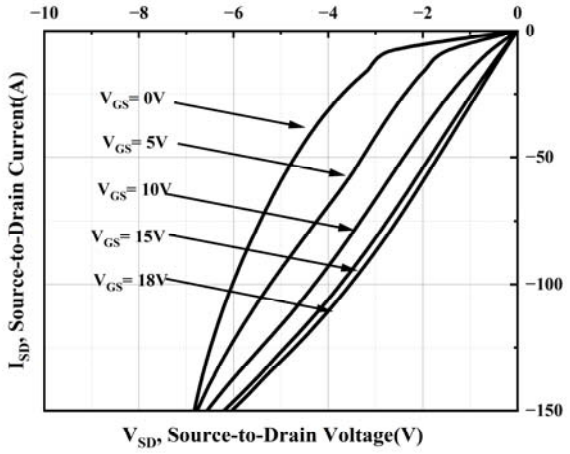


Figure 10. 3rd quadrant Characteristic at T_j= 25 ℃

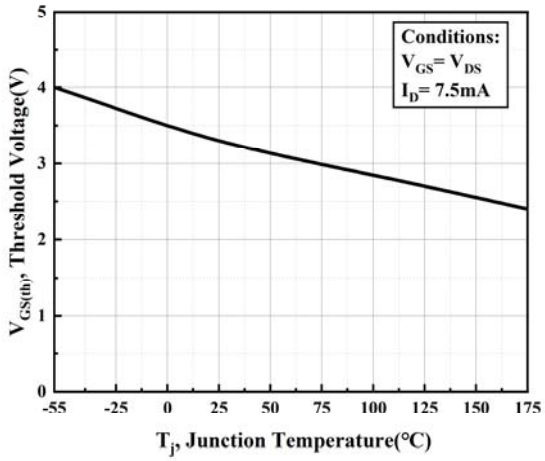


Figure 11. Threshold Voltage vs. Temperature

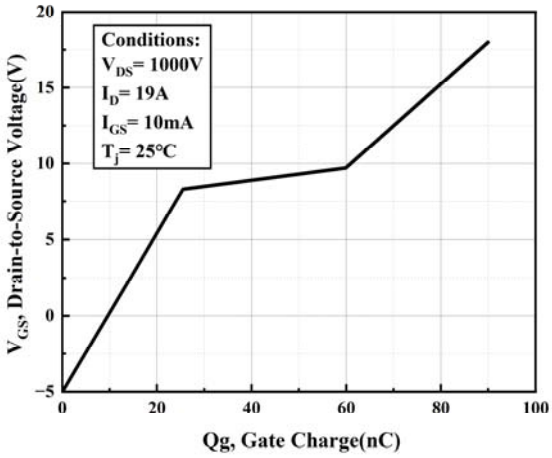


Figure 12. Gate Charge Characteristic Figure

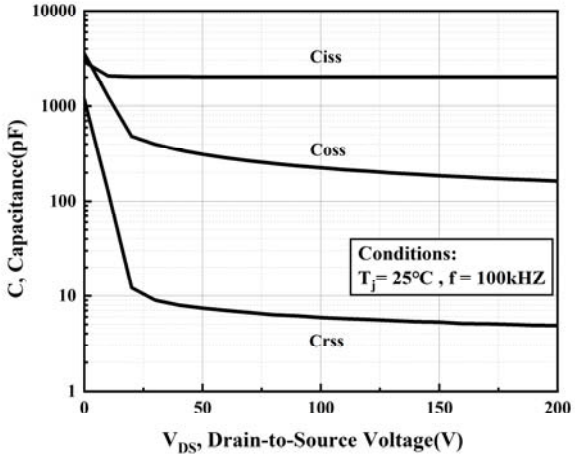


Figure 13. Capacitances vs. Drain Source Voltage (0-200V)

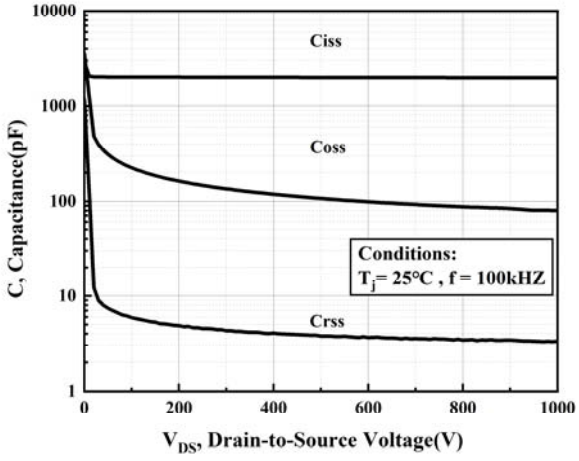


Figure 14. Capacitances vs. Drain Source Voltage (0-1000V)

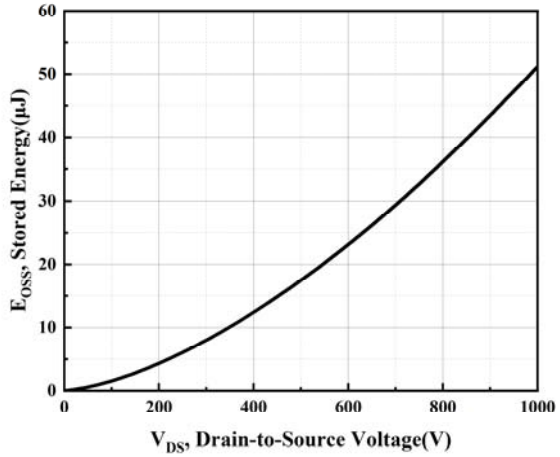


Figure 15. Output Capacitor Stored Energy

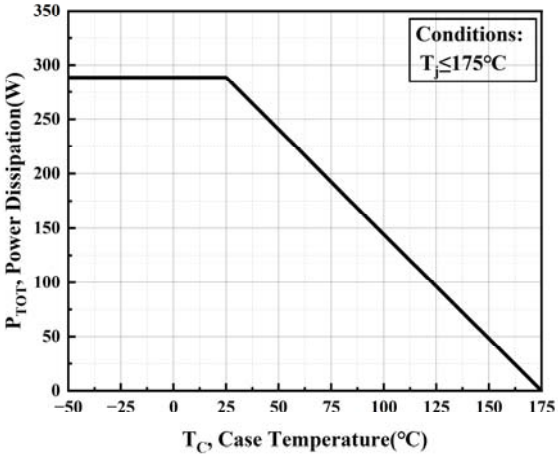


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

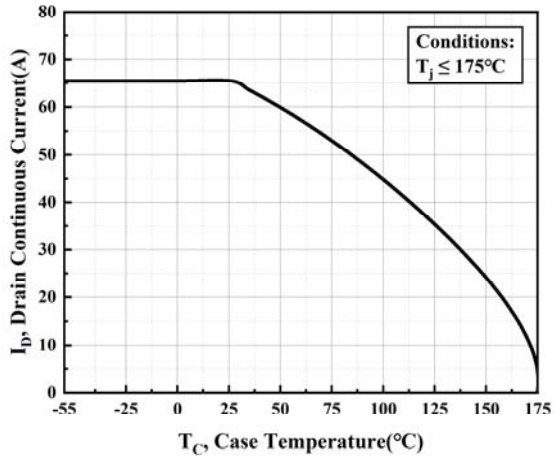


Figure 17. Coutinuous Drain Current Derating vs. Case Temperature

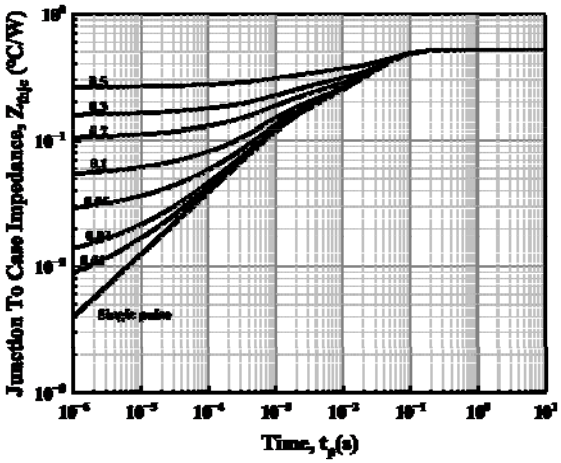


Figure18. Transient Thermal Impedance (Junction - Case)

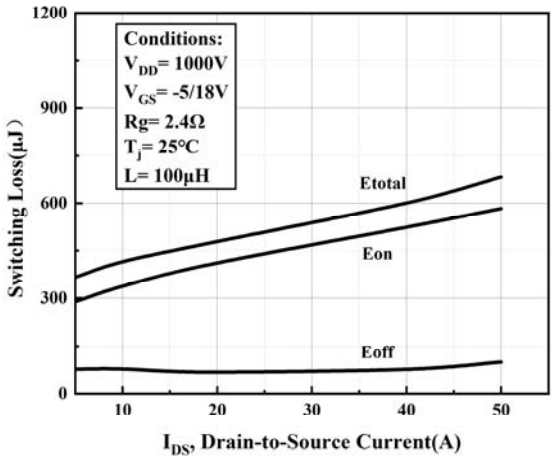


Figure 19. Clamped Inductive Switching Energy vs. Darin Current

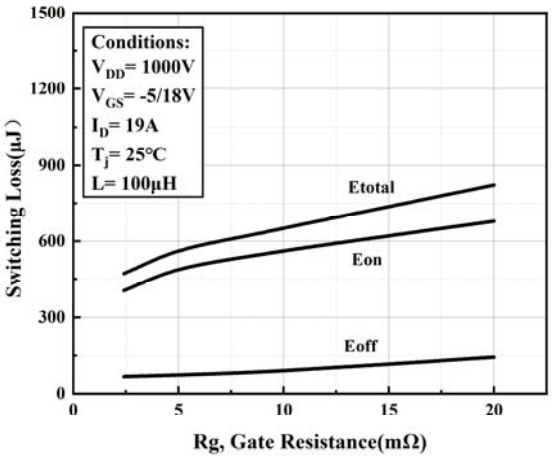


Figure 20. Clamped Inductive Switching Energy vs. Rg

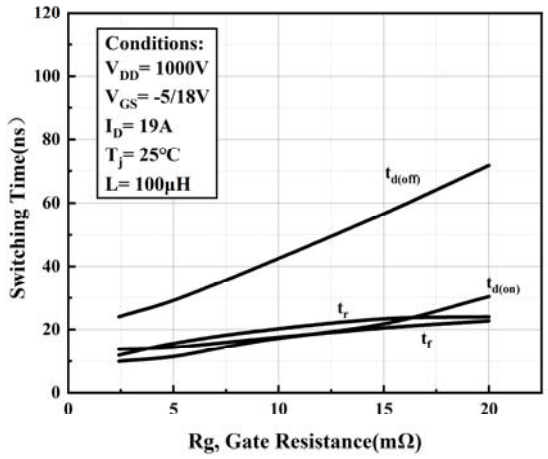


Figure 21. Switching Times vs. Rg

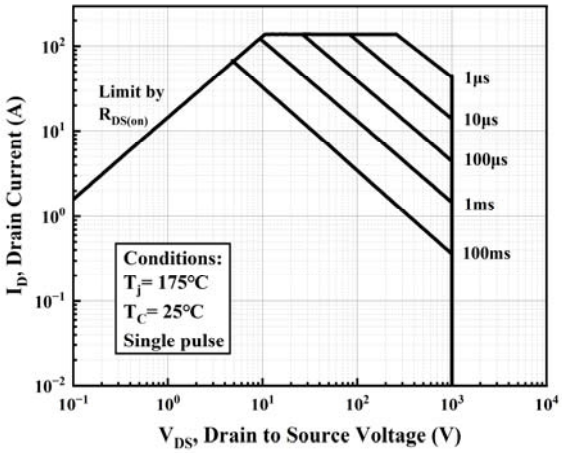


Figure 22. Safe Operating Area

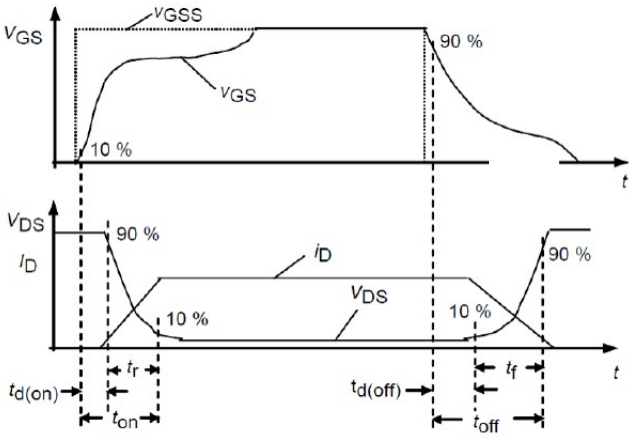


Figure 23. Switching Times Definition

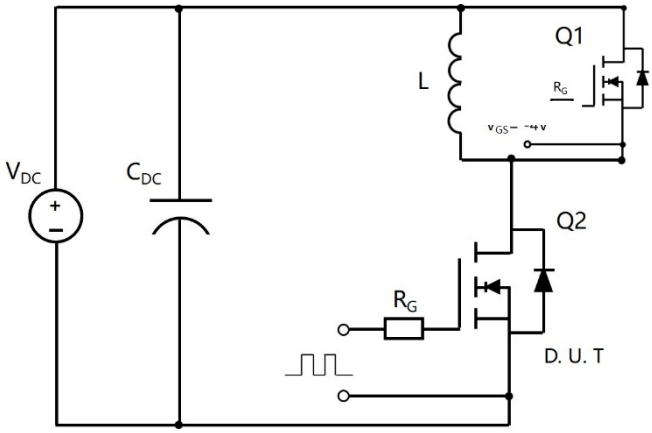
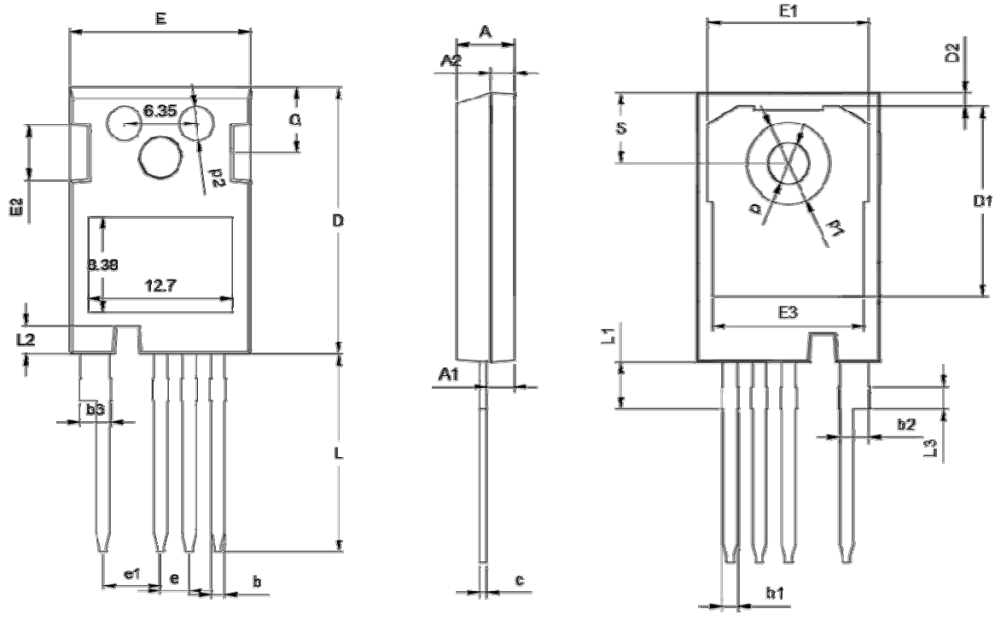


Figure 24. Clamped Inductive Switching Waveform Test Circuit

■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		

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