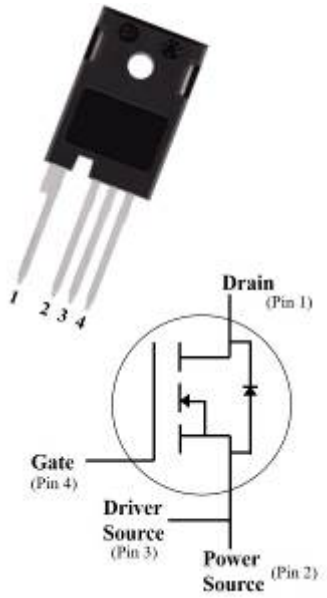
Silicon Carbide Power MOSFET （N-Channel Enhancement）

V_{DS}	650V
$I_{D\ (25°C)}$	33A
$R_{DS(on)}$	50mΩ



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**: TO247-4L
- **Terminals**: Tin plated leads
- **Polarity**: As marked

■Maximum Ratings (T_C=25℃ Unless otherwise specified）

PARAMTETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code			D206550NCFGG2		
Drain source voltage @ T_j=25°C	$V_{DS,max}$	V	650	V_{GS}=0 V, I_D=100uA	
Gate source voltage @ T_j=25°C	$V_{GS,max}$	V	-8/+22	Absolute maximum values	
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	33	V_{GS}=18V, Tc=25℃	Fig.17
Continuous drain current @ T_c=100°C			25	V_{GS}=18V, Tc=100℃	
Pulsed drain current	$I_{D(pulsed)}$	A	90	Pulse width t_p limited by $T_{j,max}$	Fig.22
Power Dissipation	P_{TOT}	W	131	T_c=25°C , Tj = 175℃	Fig.16
Power Dissipation			65	T_c=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 ）

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Gate threshold voltage	$V_{GS(th)}$	V	2.0	3.2	4.0	V_{DS}=V_{GS}, I_D= 5mA, Tj=25℃	Fig.4, 11
				2.3		V_{DS}=V_{GS}, I_D= 5mA, Tj=175℃	
Drain source breakdown voltage	$V_{(BR)DSS}$	V	650			V_{GS}=0V, I_D=100uA	
Gate source leakage current	I_{GSS}	nA		50	200	V_{GS}=18V, V_{DS}=0V	
Current drain source on-state resistance	$R_{DS\ ON}$	mΩ		50	55	V_{GS}=18V, I_D=20A,Tj=25℃	Fig.5, 6, 7
				75		V_{GS}=18V, I_D=20A,Tj=175℃	
Internal gate resistance	Rg	Ω		6.0		f=1MHz,V_{AC}=25mV	
Transconductance	g_{fs}	S		20		V_{DS}=20V,I_D=20A,Tj=25℃	Fig.4
				17		V_{DS}=20V,I_D=20A,Tj=175℃	

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

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	Ciss	pF		1600		V_{DS}=400V, V_{GS}=0V, Tj=25℃, f=1MHz, V_{AC}= 25mV	Fig.13, 14
Output capacitance	Coss			70			
Reverse capacitance	Crss			12			
Coss stored energy	Eoss	uJ		21			Fig.15
Gate source charge	Qgs	nC		21		V_{DD}=400V, V_{GS}=-5/18V, I_D=20A	Fig.12
Gate drain charge	Qgd			32			
Gate charge	Qg			82			

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

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on switching energy	E_{on}	uJ		110		V_{DS}=400V, V_{GS}=-5/+18V, I_D=20A, Rg=5Ω, L=200uH	Fig. 19, 20
Turn off switching energy	E_{off}			32			
Turn on delay time	$t_{d(on)}$	ns		22		V_{DD}=400V, V_{GS}=-5/+18V, I_D=20A, Rg=5Ω, L=200uH	Fig.21
Rise time	t_r			12			
Turn off delay time	$t_{d(off)}$			28			
Fall time	t_f			11			

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

PARAMTETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		3.4		V_{GS}=-5V,I_{SD}=10A, Tj=25℃	Fig.8
				3.2		V_{GS}=0V, I_{SD}=10A, Tj=175℃	Fig.9
Continuous diode forward current	I_S	A		60		Tc=25℃	
Reverse recovery time	trr	nS		20		V_R=400V, V_{GS}=-5V, I_{SD}=20A, di/dt=1200A/us	
Reverse recovery charge	Qrr	nC		65			
Peak reverse recovery current	Irrm	A		8			

■Thermal Characteristics （T_a=25℃ Unless otherwise specified）

PARAMETER	SYMBOL	UNIT	Typ.
Thermal resistance	$R_{\theta J-C}$	°C /W	1.14

■Typical Characteristics

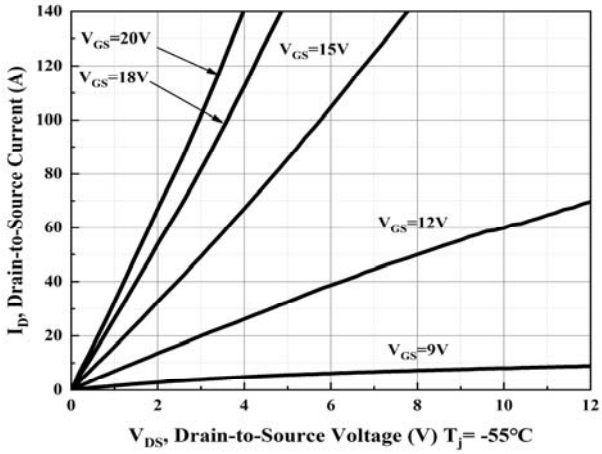


Figure 1. Output Characteristics Tj = -55℃

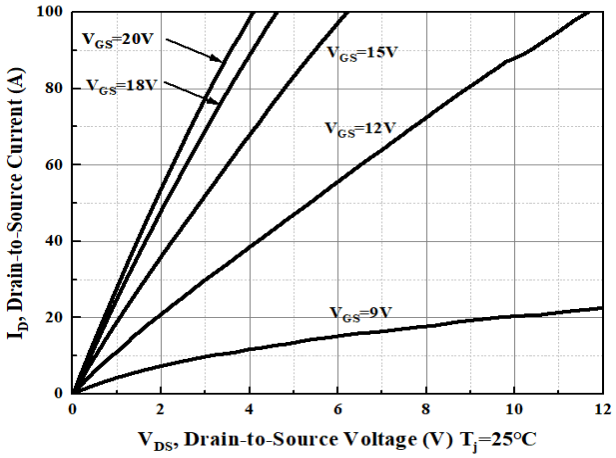


Figure2. Output Characteristics Tj = 25℃

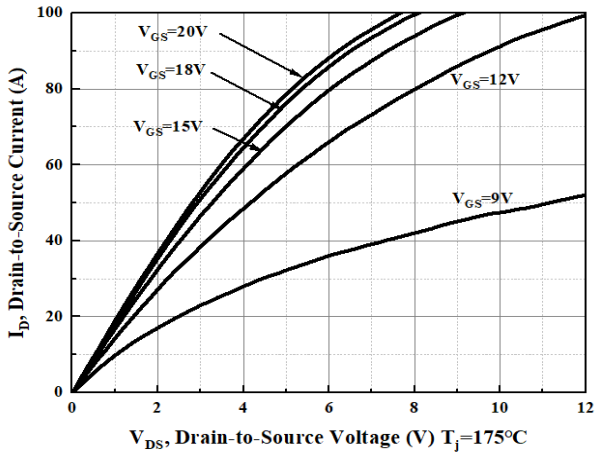


Figure 3. Output Characteristics Tj = 175℃

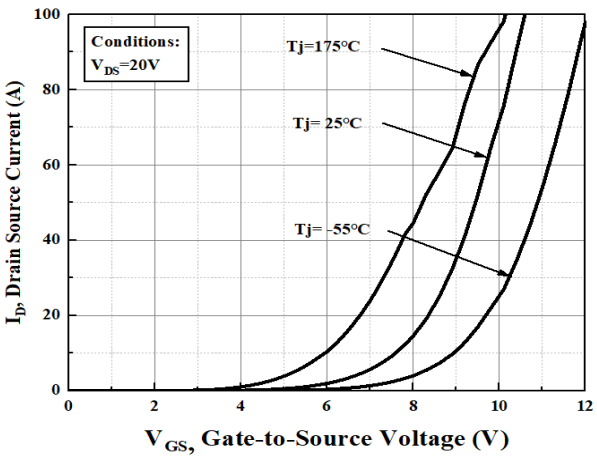


Figure 4. Transfer Characteristics for Various Junction Temperature

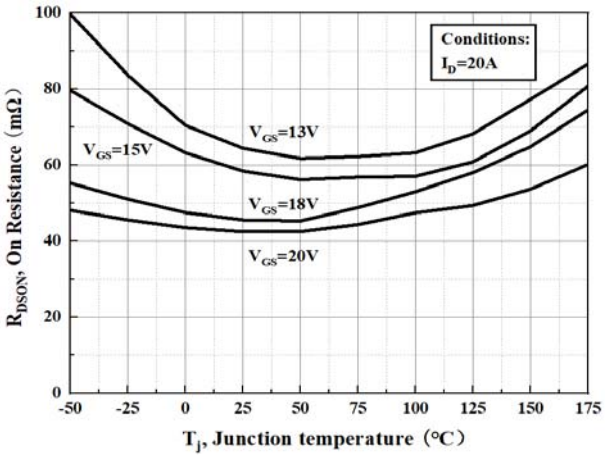


Figure 5. On-resistance vs. Temperature for Various Gate Voltage

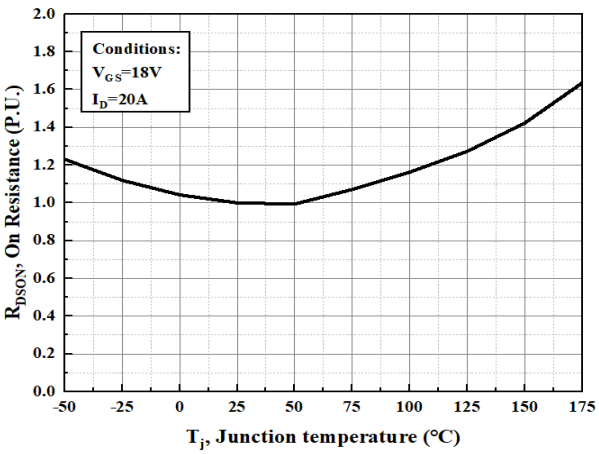


Figure 6. Normalized on-resistance vs. Temperature

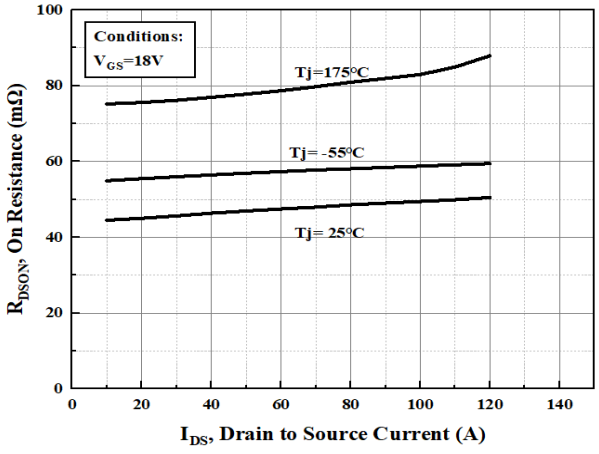


Figure 7. On-resistance vs. Drain Current

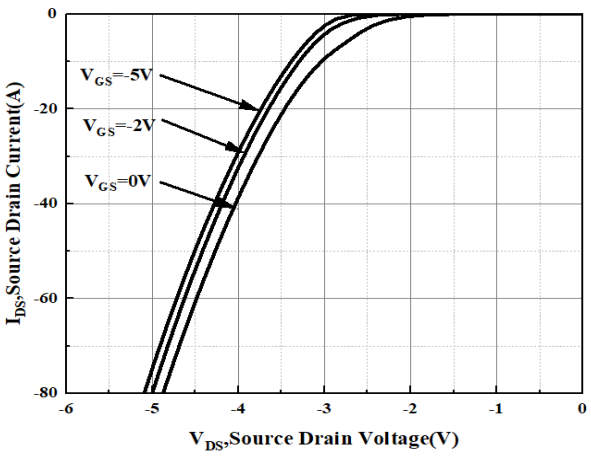


Figure 8. Body Diode Characteristic at Tj= 25 ℃

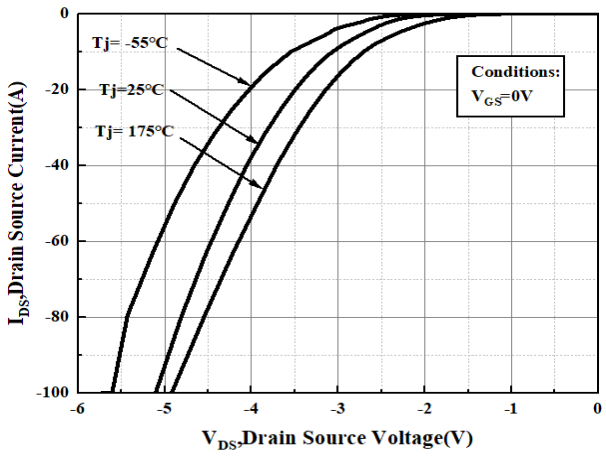


Figure 9. Body Diode Characteristic

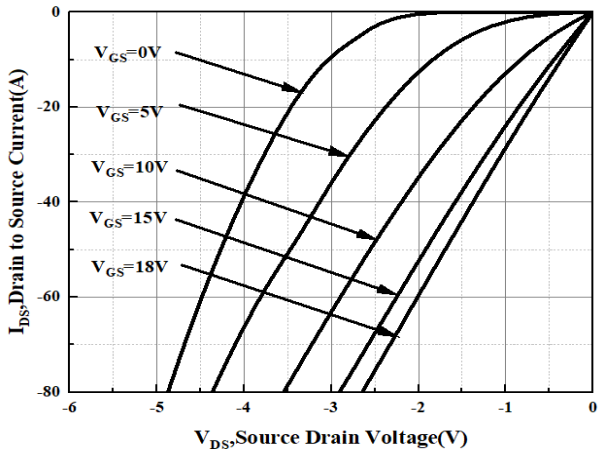


Figure 10. 3rd quadrant Characteristic at Tj= 25 ℃

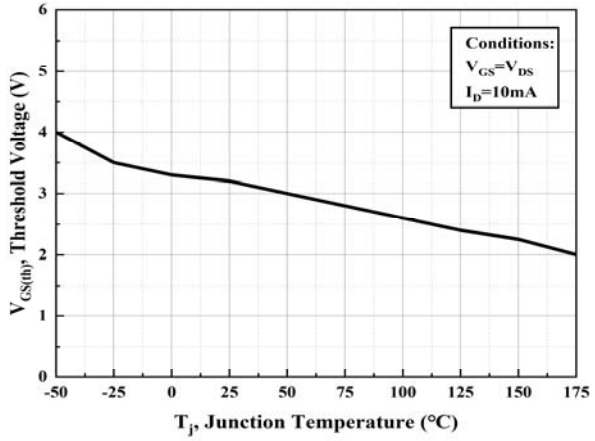


Figure 11. Threshold Voltage vs. Temperature

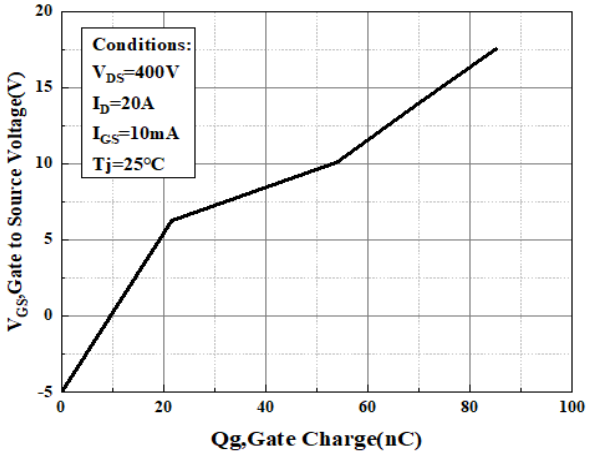


Figure 12. Gate Charge Characteristic

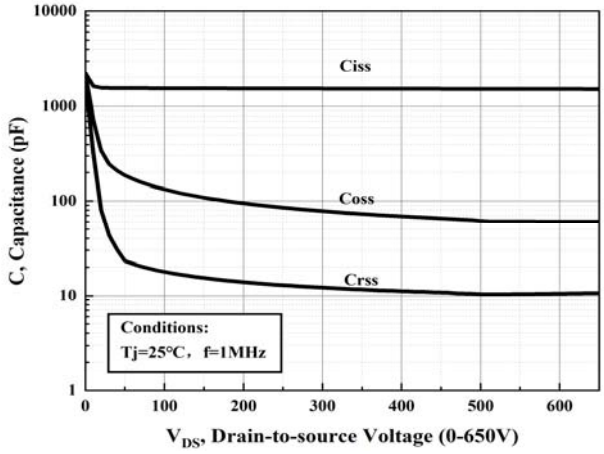


Figure 13. Capacitances vs. Drain Source Voltage (0-650V)

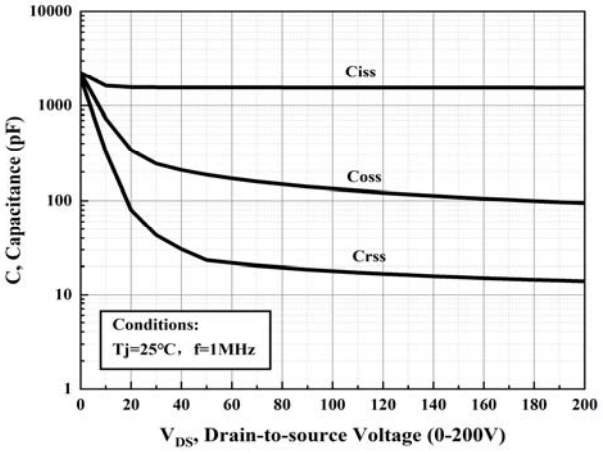


Figure 14. Capacitances vs. Drain Source Voltage (0-200V)

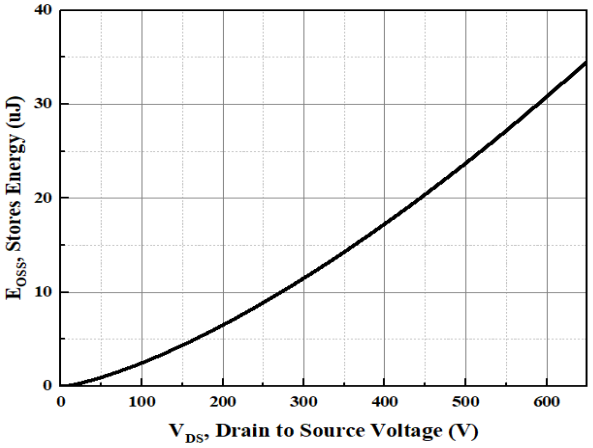


Figure 15. Output Capacitor Stored Energy

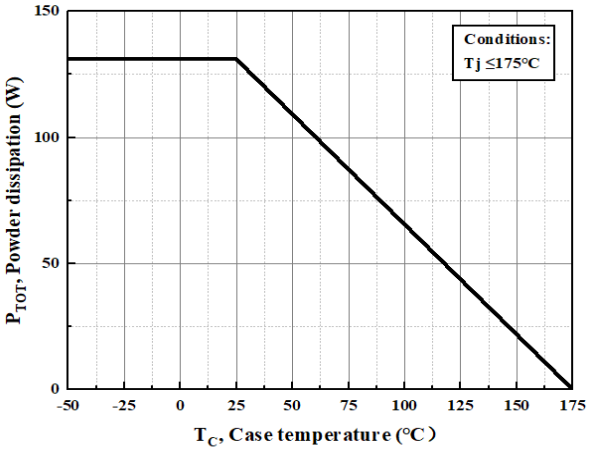


Figure 16. Maximun Power Dissipation Derating vs. Case Temperature

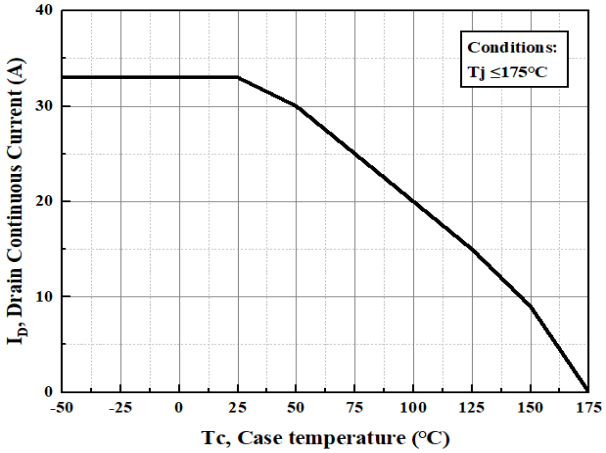


Figure17. Coutinuous Drain Current Derating vs Case Temperature

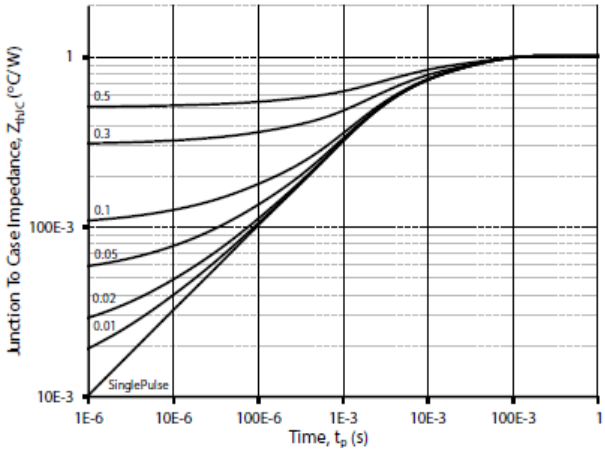


Figure18. Transient Thermal Impedance (Junction - Case)

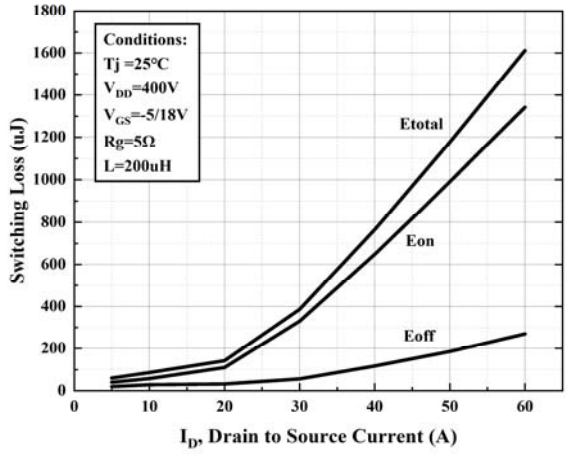


Figure 19. Clamped Inductive Switching Energy vs. Darin Current

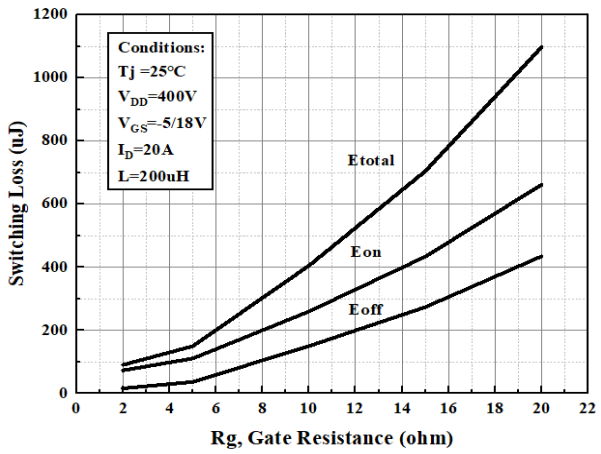


Figure 20. Clamped Inductive Switching Energy vs. Rg

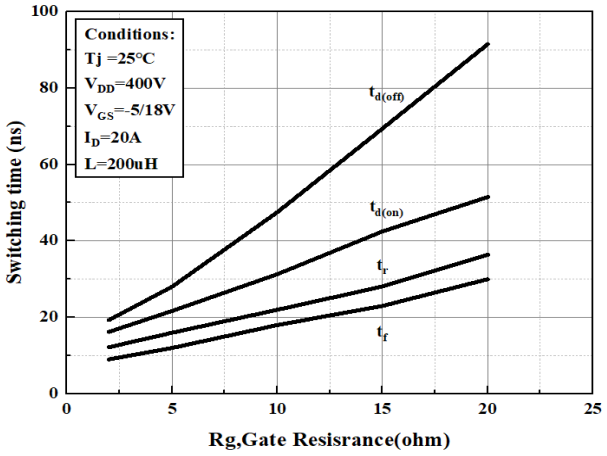


Figure 21. Switching Times vs. Rg

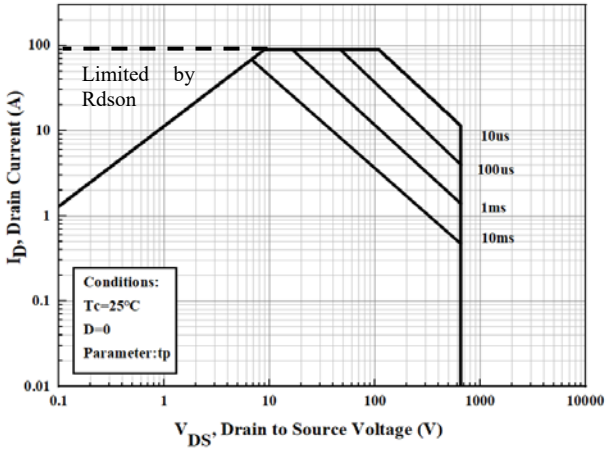


Figure 22. Safe Operating Area

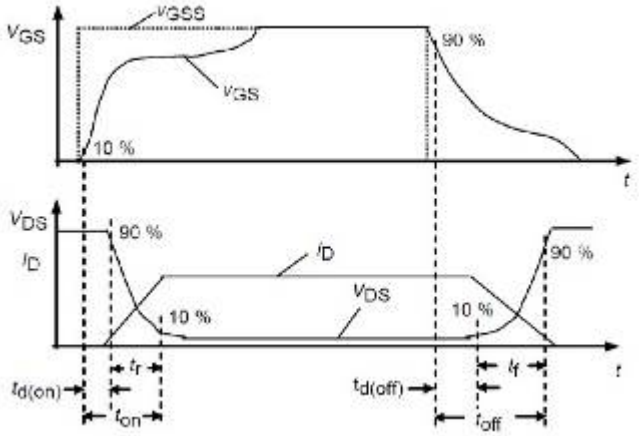


Figure 23. Switching Times Definition

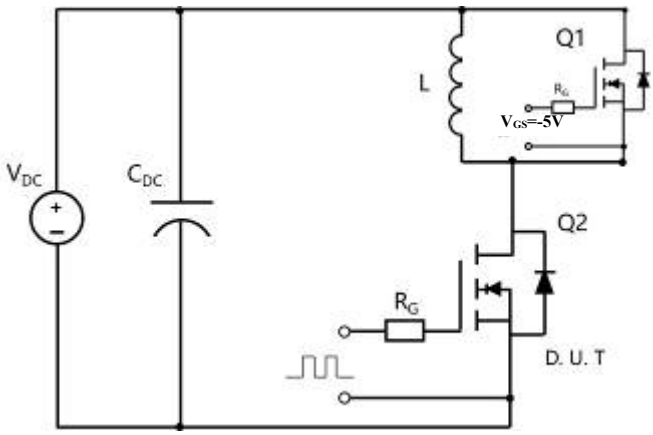
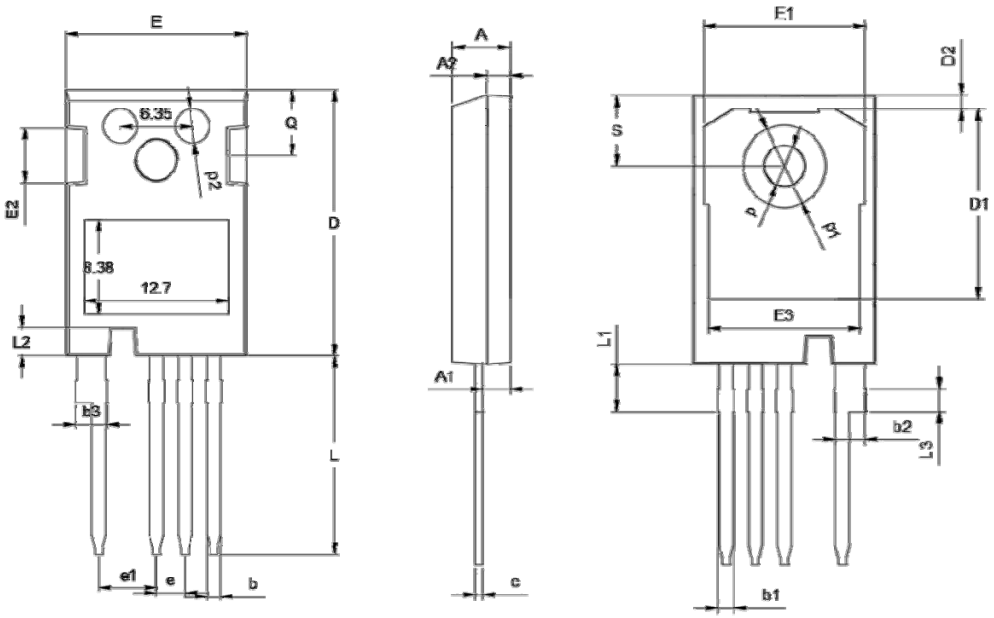


Figure 24. Clamped Inductive Switching Waveform Test Circuit

■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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