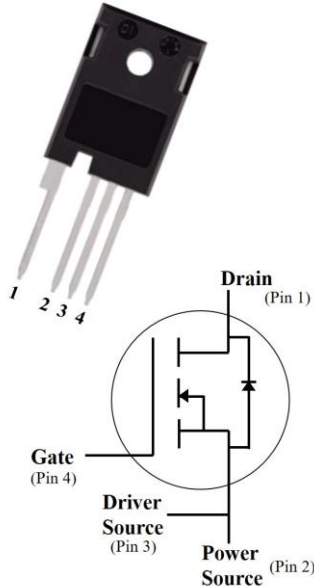


Silicon Carbide Power MOSFET (N-Channel Enhancement)

V_{DS}	1200V
I_D (25°C)	137A
$R_{DS(on)}$	12mΩ



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 (T_C=25°C Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	VALUE	TEST CONDITIONS	NOTE
Device marking code			D212013NCFYG3M		
Drain source voltage @ T _J =25°C	$V_{DS,max}$	V	1200	$V_{GS}=0V$, $I_D=100\mu A$	
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	137	$V_{GS}=18V$, T _C =25°C	Fig.17
Continuous drain current @ T _C =100°C			101	$V_{GS}=18V$, T _C =100°C	
Pulsed drain current	$I_{D(pulsed)}$	A	410	Pulse width t _p limited by T _{J,max}	Fig.22
Avalanche energy, Single pulse	E_{AS}	mJ	1845	$V_{DD}=75V$, L=10mH	
Power Dissipation	P_{TOT}	W	500	T _C =25°C, T _J = 175°C	Fig.16
Power Dissipation			250	T _C =100°C, T _J = 175°C	
Operating junction and Storage temperature range	T _J , T _{stg}	°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	



YJD212013NCFYG3M

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Gate threshold voltage	$V_{GS(th)}$	V	2.0	2.8	4.0	$V_{DS}=V_{GS}, I_D=22mA$	Fig.4, 11
				2.1		$V_{DS}=V_{GS}, I_D=22mA, T_J=175^{\circ}C$	
Drain source breakdown voltage	$V_{(BR)DSS}$	V	1200			$V_{GS}=0V, I_D=100\mu A$	
Drain source leakage current	I_{DSS}	μA		10	100	$V_{DS}=1200V, V_{GS}=0V$	
Gate source leakage current	I_{GSS}	nA		10	100	$V_{GS}=18V, V_{DS}=0V$	
Current drain source on-state resistance	$R_{DS(on)}$	m Ω		15		$V_{GS}=15V, I_D=60A$	Fig.5, 6, 7
				12		$V_{GS}=18V, I_D=60A$	
				25		$V_{GS}=15V, I_D=60A, T_J=175^{\circ}C$	
				23		$V_{GS}=18V, I_D=60A, T_J=175^{\circ}C$	
Transconductance	g_f	S		60		$V_{DS}=20V, I_D=60A$	Fig.4
				48		$V_{DS}=20V, I_D=60A, T_J=175^{\circ}C$	

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	C_{iss}	pF		5862		$V_{DS}=800V, V_{GS}=0V, T_J=25^{\circ}C, f=100kHz, V_{AC}=25mV$	Fig.13, 14
Output capacitance	C_{oss}			244			
Reverse capacitance	C_{rss}			11			
Coss stored energy	E_{oss}	μJ		93			Fig.15
Gate source charge	Q_{gs}	nC		82.7		$V_{DS}=800V, V_{GS}=-5/+18V, I_D=60A$	Fig.12
Gate drain charge	Q_{gd}			78.3			
Gate charge	Q_g			246			
Internal gate resistance	R_g	Ω		6.3		$f=1MHz$	



YJD212013NCFYG3M

■Switching Characteristics (Tc=25°C unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Turn on delay time	$t_{d(on)}$	ns		34.2		$V_{DD}=800V$, $V_{GS}=-5/+18V$, $I_D=60A$, $R_g=2.4\Omega$, $L=100\mu H$	Fig.21
Rise time	t_r			37.7			
Turn off delay time	$t_{d(off)}$	ns		88.6			
Fall time	t_f			19.2			
Turn on switching energy	E_{on}	μJ		1473		$V_{DD}=800V$, $V_{GS}=-5/+18V$, $I_D=60A$, $R_g=2.4\Omega$, $L=100\mu H$	Fig.19, 20
Turn off switching energy	E_{off}			505			

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		4.8		$V_{GS}=-5V$, $I_{SD}=30A$	Fig.8
				3.6		$V_{GS}=-5V$, $I_{SD}=30A$, $T_j=175^\circ C$	Fig.9
Continuous diode forward current	I_S	A		91		$V_{GS}=-5V$, $T_c=25^\circ C$	
Reverse recovery time	t_{rr}	nS		22		$V_R=800V$, $V_{GS}=-5V$, $I_D=60A$, $di/dt=2000A/\mu S$	
Reverse recovery charge	Q_{rr}	nC		352			
Peak reverse recovery current	I_{rrm}	A		27			

■Thermal Characteristics (Ta=25°C Unless otherwise specified)

PARAMETER	SYMBOL	UNIT	Typ.
Thermal resistance	$R_{\theta J-C}$	$^\circ C/W$	0.3

■Typical Characteristics

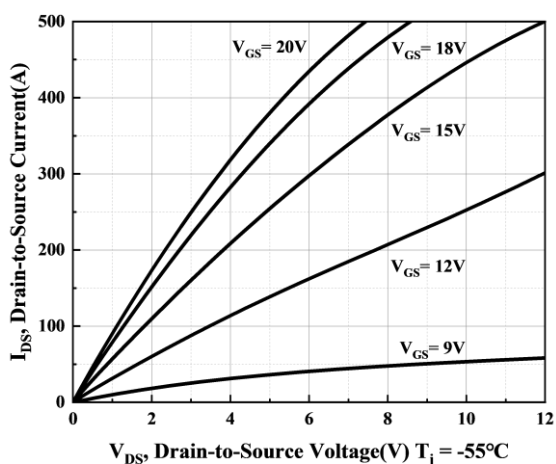


Figure 1. Output Characteristics Tj = -55°C

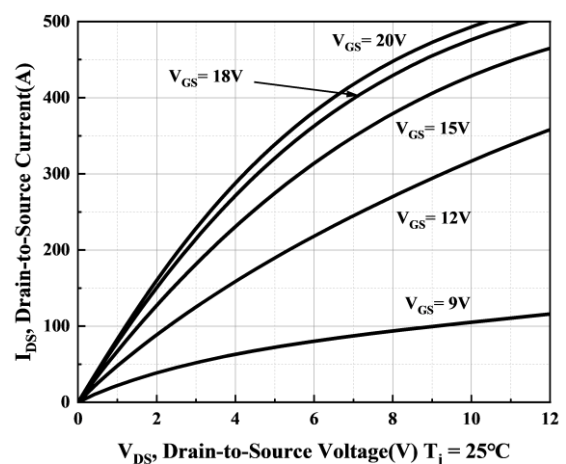


Figure2. Output Characteristics Tj = 25°C

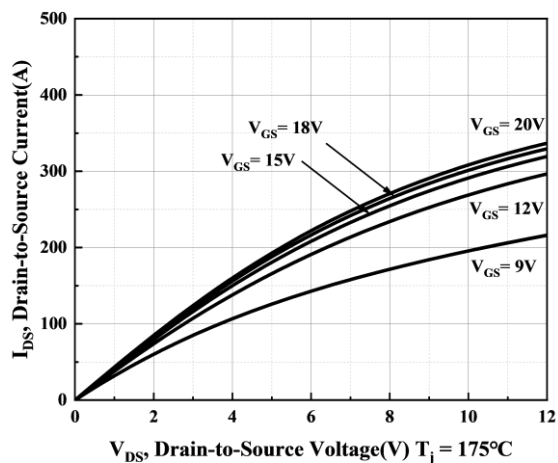


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

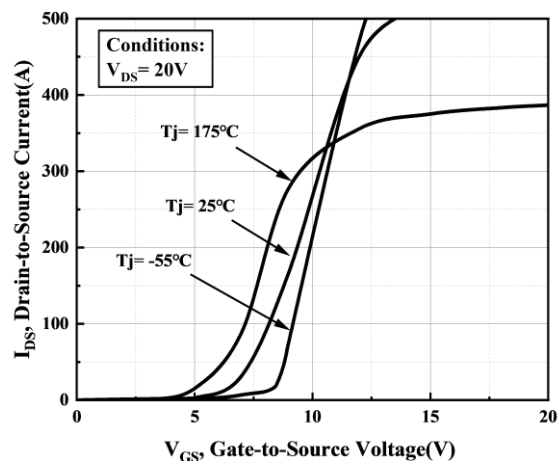


Figure 4. Transfer Characteristics for Various Junction Temperature

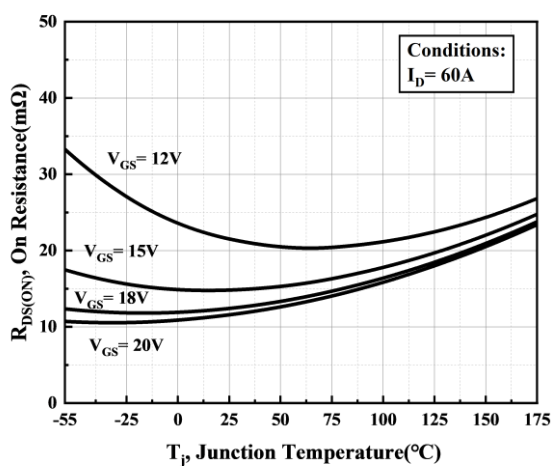


Figure 5. On-resistance vs. Temperature for Various Gate Voltage

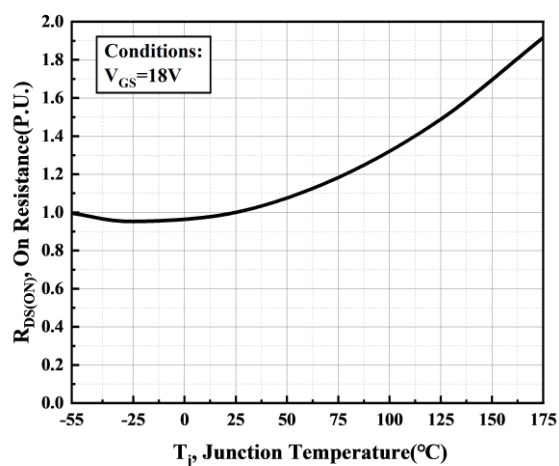


Figure 6. Normalized on-resistance vs. Temperature

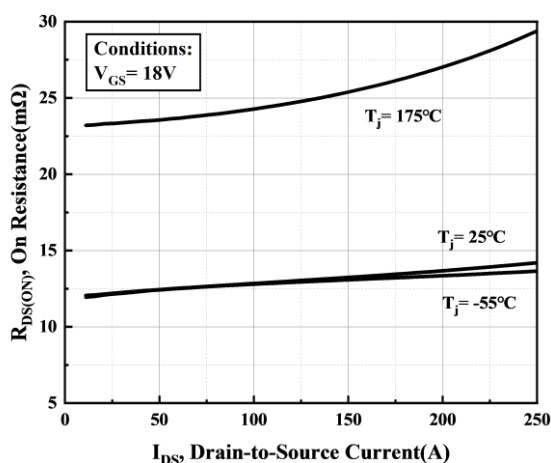


Figure 7. On-resistance vs. Drain Current

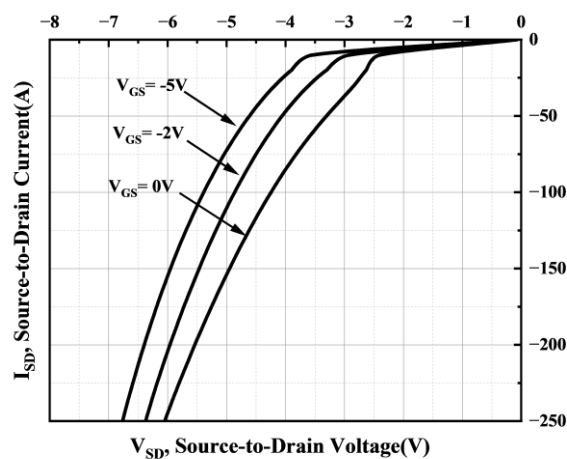


Figure 8. Body Diode Characteristic at $T_j = 25^\circ\text{C}$

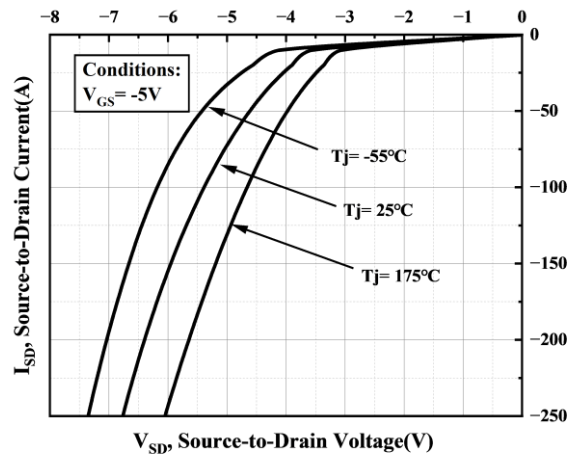


Figure 9. Body Diode Characteristic

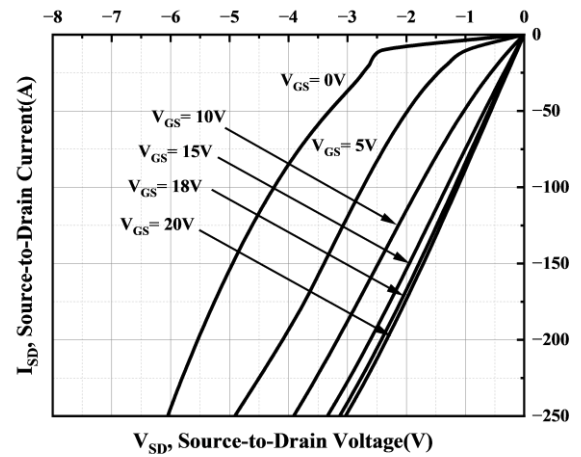


Figure 10. 3rd quadrant Characteristic at Tj= 25 °C

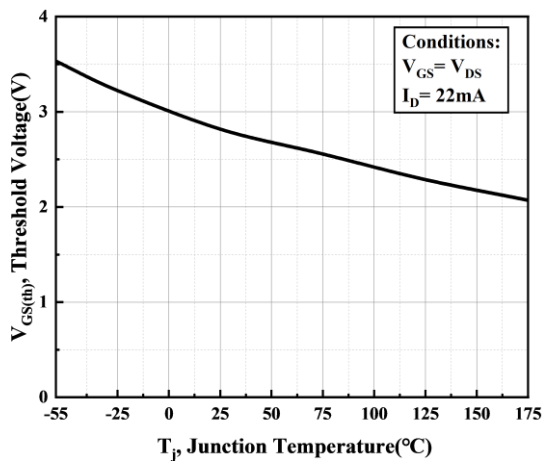


Figure 11. Threshold Voltage vs. Temperature

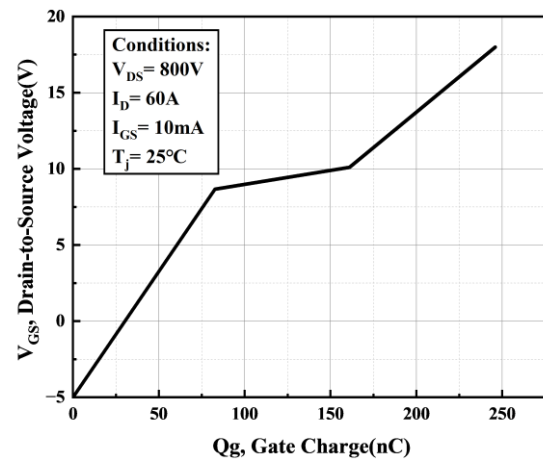


Figure 12. Gate Charge Characteristic

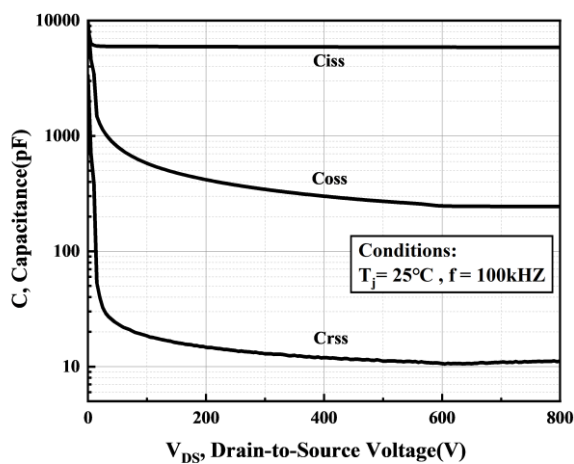


Figure 13. Capacitances vs. Drain Source Voltage (0-800V)

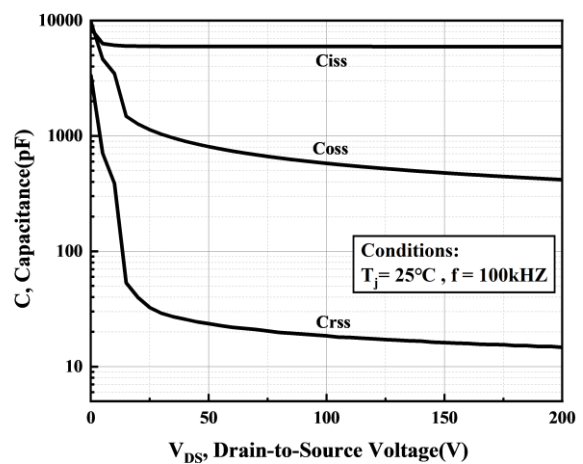


Figure 14. Capacitances vs. Drain Source Voltage (0-200V)

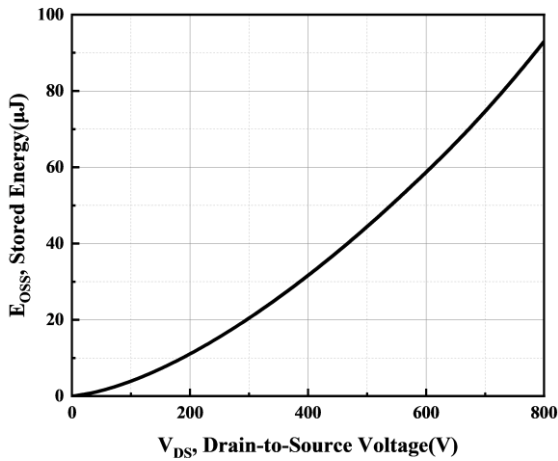


Figure 15. Output Capacitor Stored Energy

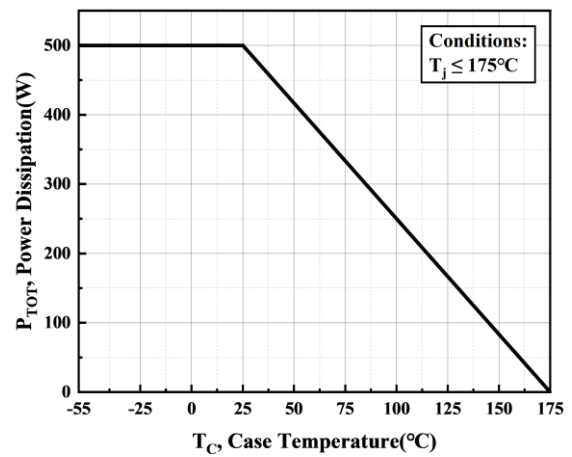


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

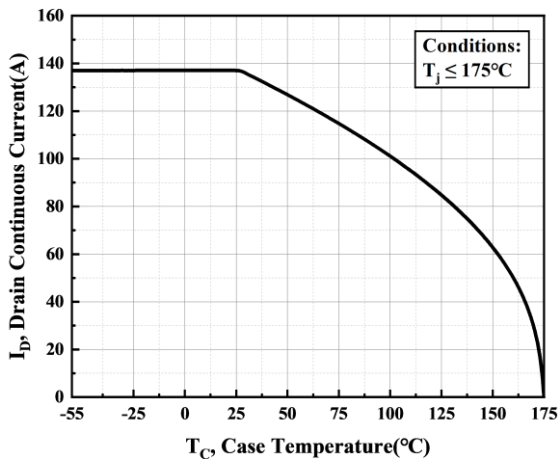


Figure 17. Continuous Drain Current Derating vs. Case Temperature

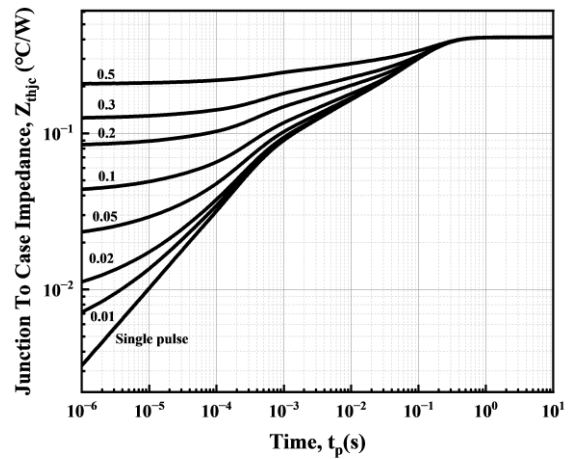


Figure 18. Transient Thermal Impedance (Junction - Case)

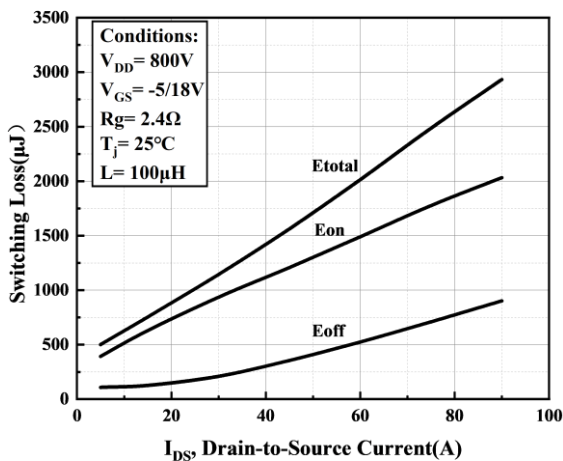


Figure 19. Clamped Inductive Switching Energy vs. Drain Current

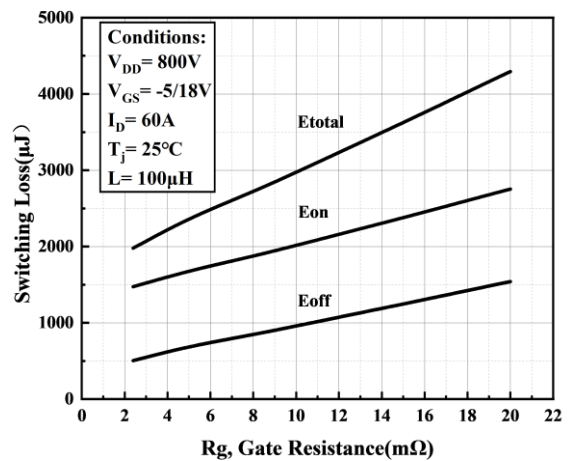


Figure 20. Clamped Inductive Switching Energy vs. R_g

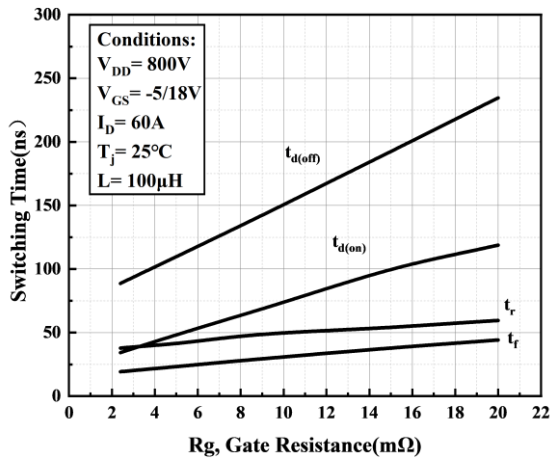


Figure 21. Switching Times vs. R_g

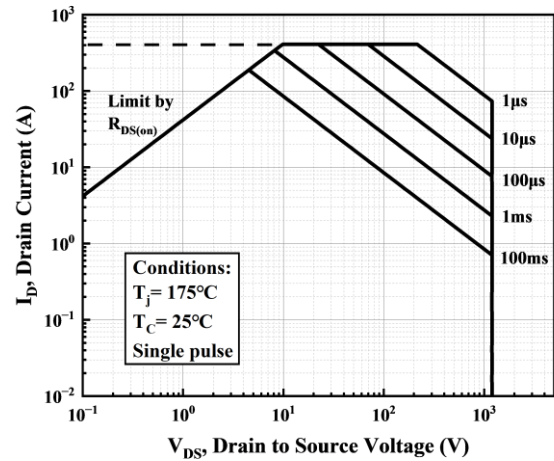


Figure 22. Safe Operating Area

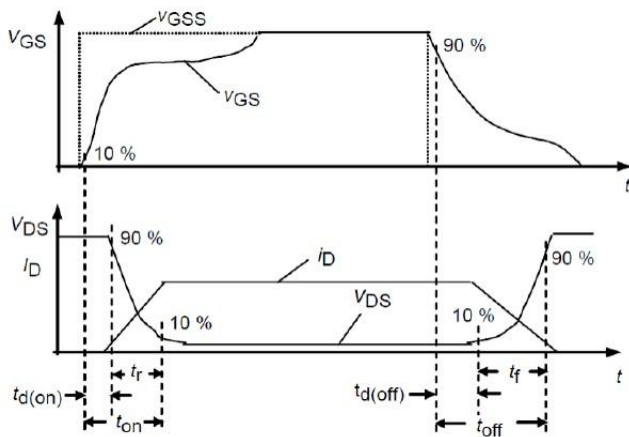


Figure 23. Switching Times Definition

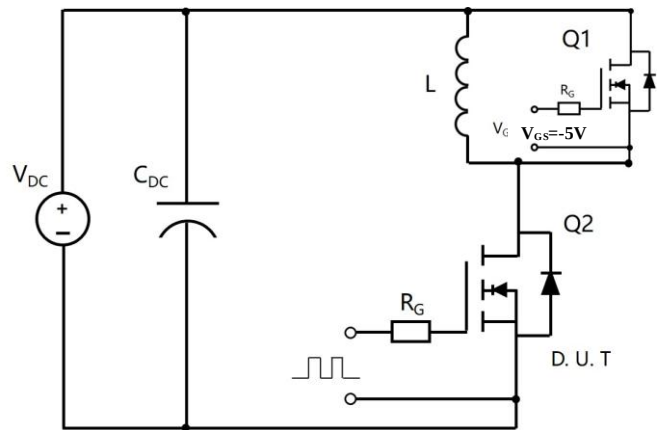
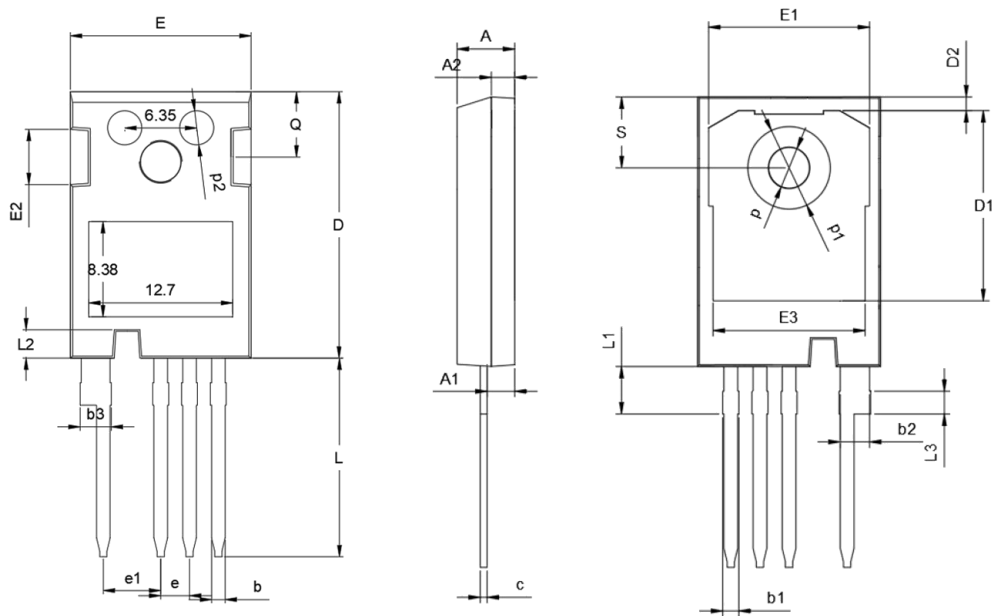


Figure 24. Clamped Inductive Switching Waveform Test Circuit



YJD212013NCFYG3M

■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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