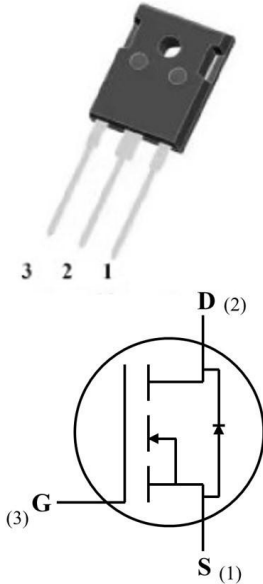


Silicon Carbide Power MOSFET (N-Channel Enhancement)

V_{DS}	1200V
I_D (25°C)	12A
$R_{DS(on)}$	290mΩ



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-247AB
- **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			D2120320NCTYG3		
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	12	$V_{GS}=18V$, T _c =25°C	Fig.17
Continuous drain current @ T _c =100°C			8.3	$V_{GS}=18V$, T _c =100°C	
Pulsed drain current	$I_{D(pulsed)}$	A	17	Pulse width t _p limited by T _{j,max}	Fig.22
Avalanche energy,Single pulse	E_{AS}	mJ	90	$V_{DD}=75V$, L=10mH	
Power Dissipation	P_{TOT}	W	92.6	T _c =25°C, T _j = 175°C	Fig.16
Power Dissipation			46	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	



YJD2120320NCTYG3

■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	3.0	4.0	$V_{DS}=V_{GS}$, $I_D=1.2mA$	Fig.4, 11
				2.2		$V_{DS}=V_{GS}$, $I_D=1.2mA$, $T_J=175^\circ C$	
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		375		$V_{GS}=15V$, $I_D=3.5A$	Fig.5, 6, 7
				290	377	$V_{GS}=18V$, $I_D=3.5A$	
				495		$V_{GS}=15V$, $I_D=3.5A$, $T_J=175^\circ C$	
				460		$V_{GS}=18V$, $I_D=3.5A$, $T_J=175^\circ C$	
Transconductance	g_f	S		2.4		$V_{DS}=20V$, $I_D=3.5A$	Fig.4
				2.3		$V_{DS}=20V$, $I_D=3.5A$, $T_J=175^\circ C$	

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Input capacitance	C_{iss}	pF		470		$V_{DS}=1000V$, $V_{GS}=0V$, $T_J=25^\circ C$, $f=1MHz$, $V_{AC}=25mV$	Fig.13, 14
Output capacitance	C_{oss}			25.6			
Reverse capacitance	C_{rss}			1.9			
Coss stored energy	E_{oss}	μJ		27.4			Fig.15
Gate source charge	Q_{gs}	nC		3.8		$V_{DS}=1000V$, $V_{GS}=-5/+18V$, $I_D=3.5A$	Fig.12
Gate drain charge	Q_{gd}			14			
Gate charge	Q_g			19.8			
Internal gate resistance	R_g	Ω		4		$f=1MHz$	

■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		8.2		$V_{DD}=1000V$, $V_{GS}=-5/+18V$, $I_D=3.5A$, $R_g=2.4\Omega$, $L=100\mu H$	Fig.21
Rise time	t_r			16.2			
Turn off delay time	$t_{d(off)}$	ns		13.5			
Fall time	t_f			20.5			



YJD2120320NCTYG3

Turn on switching energy	E_{on}	μJ		81.8		$V_{DD}=1000V, V_{GS}=-5/+18V,$ $I_D=3.5A, R_g=2.4\Omega, L=100\mu H$	Fig.19, 20
Turn off switching energy	E_{off}			20.2			

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

PARAMETER	SYMBOL	UNIT	Min.	Typ.	Max.	Test Conditions	Note
Diode forward voltage	V_{SD}	V		5.1		$V_{GS}=-5V, I_{SD}=1.8A$	Fig.8
				3.6		$V_{GS}=0V, I_{SD}=1.8A, T_J=175^\circ C$	Fig.9
Continuous diode forward current	I_S	A		12.3		$V_{GS}=-5V, T_c=25^\circ C$	
Reverse recovery time	t_{rr}	nS		55.7		$V_R=1000V, V_{GS}=-5V, I_D=3.5A,$ $di/dt=1000A/\mu S$	
Reverse recovery charge	Q_{rr}	nC		86			
Peak reverse recovery current	I_{rrm}	A		2.5			

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

PARAMETER	SYMBOL	UNIT	Typ.
Thermal resistance	$R_{\theta J-C}$	$^\circ C/W$	1.62

■Typical Characteristics

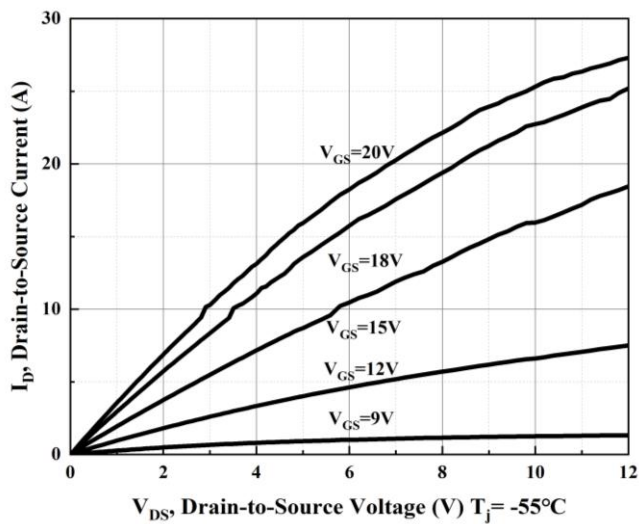


Figure 1. Output Characteristics T_j = -55°C

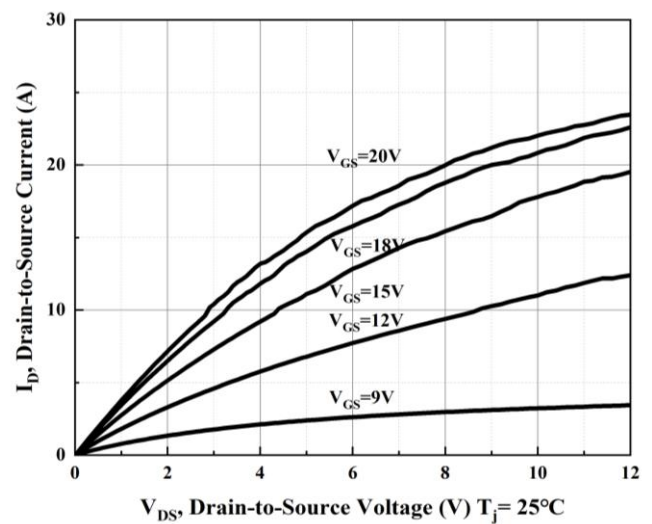


Figure2. Output Characteristics T_j = 25°C

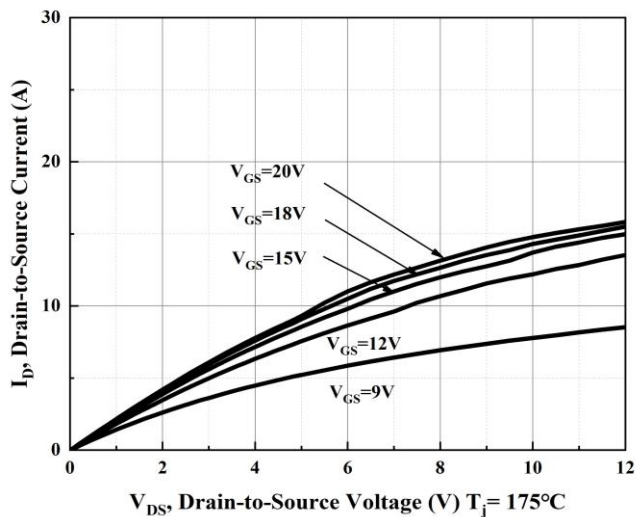


Figure 3. Output Characteristics $T_j = 175^\circ\text{C}$

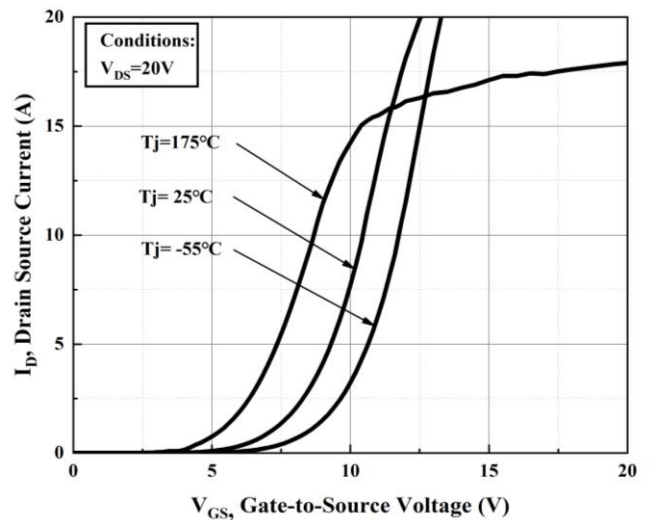


Figure 4. Transfer Characteristics for Various Junction Temperature

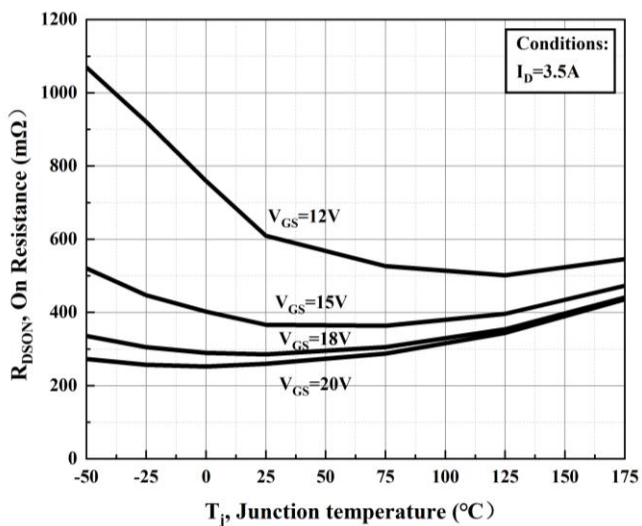


Figure 5. On-resistance vs. Temperature for Various Gate Voltage

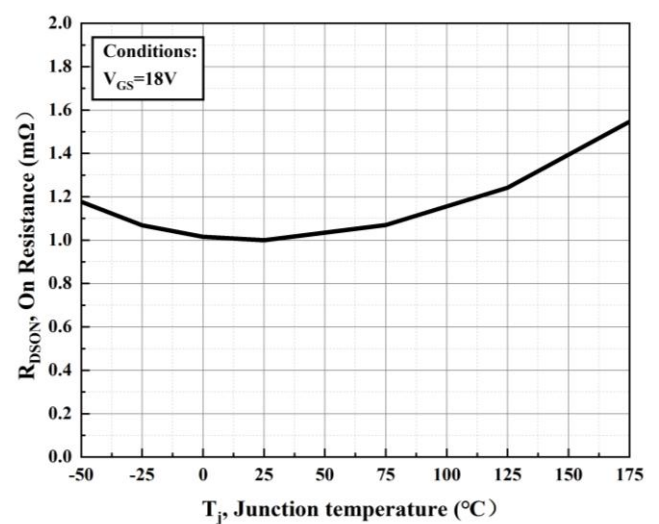


Figure 6. Normalized on-resistance vs. Temperature

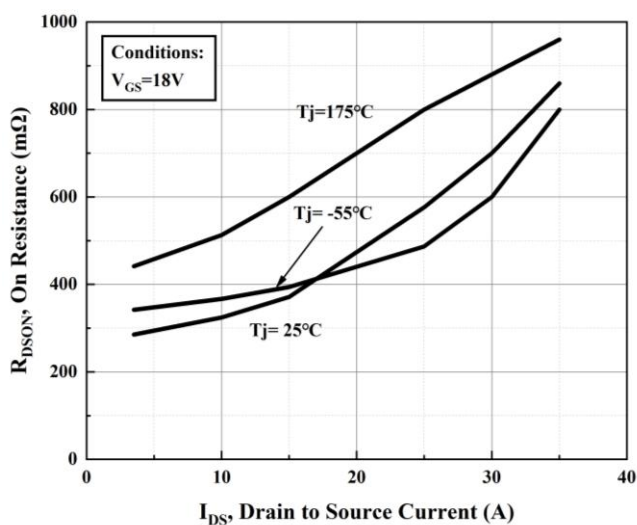


Figure 7. On-resistance vs. Drain Current

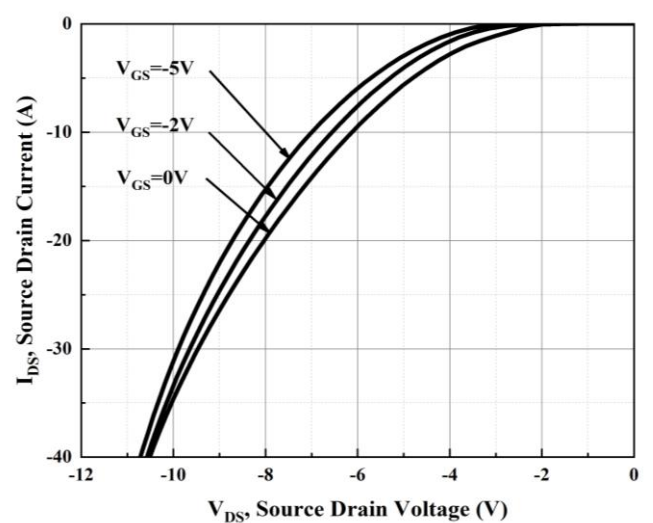


Figure 8. Body Diode Characteristic at $T_j = 25^\circ\text{C}$



YJD2120320NCTYG3

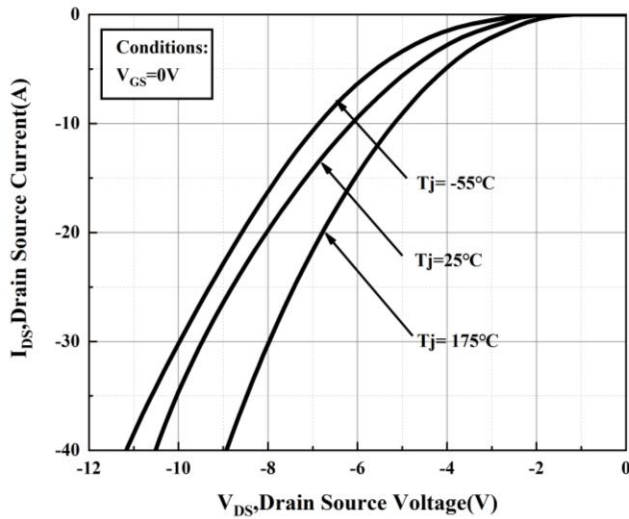


Figure 9. Body Diode Characteristic

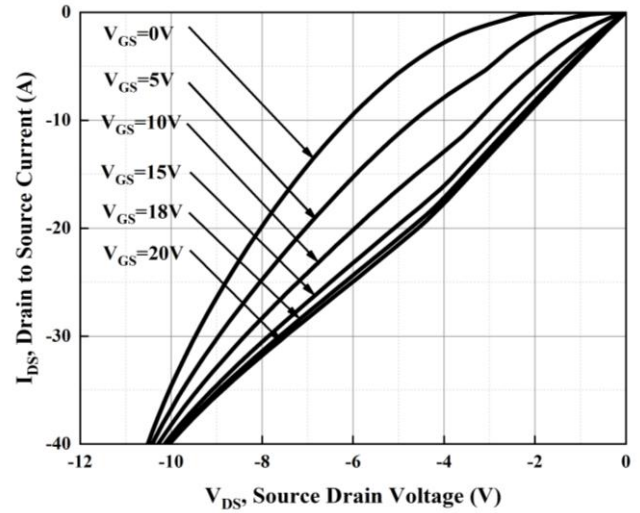


Figure 10. 3rd quadrant Characteristic at Tj= 25 °C

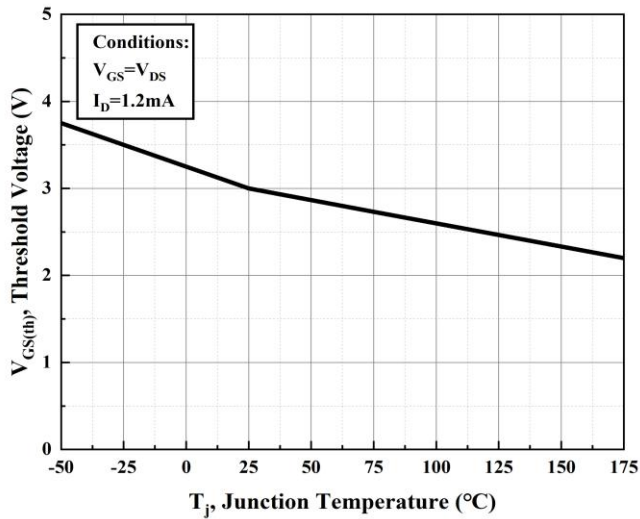


Figure 11. Threshold Voltage vs. Temperature

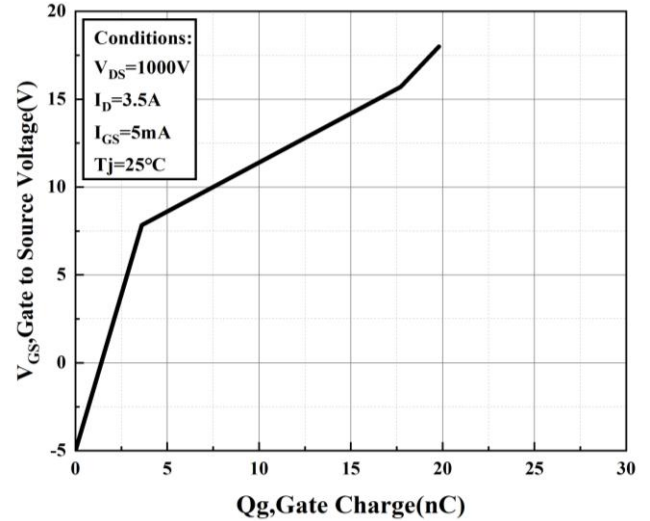


Figure 12. Gate Charge Characteristic

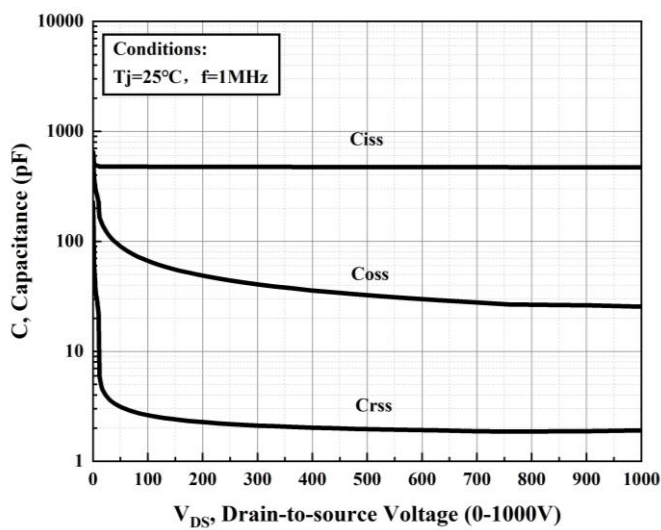


Figure 13. Capacitances vs. Drain Source Voltage (0-1000V)

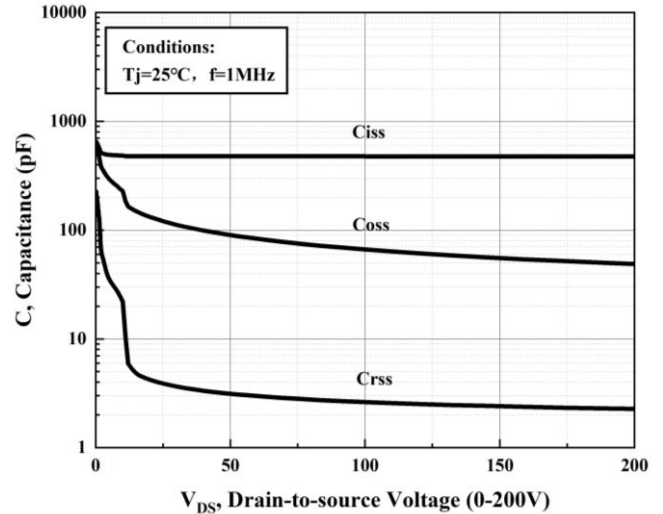


Figure 14. Capacitances vs. Drain Source Voltage (0-200V)

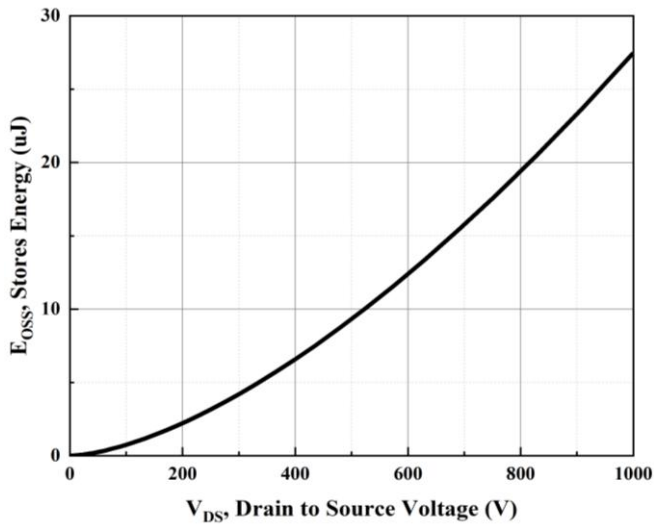


Figure 15. Output Capacitor Stored Energy

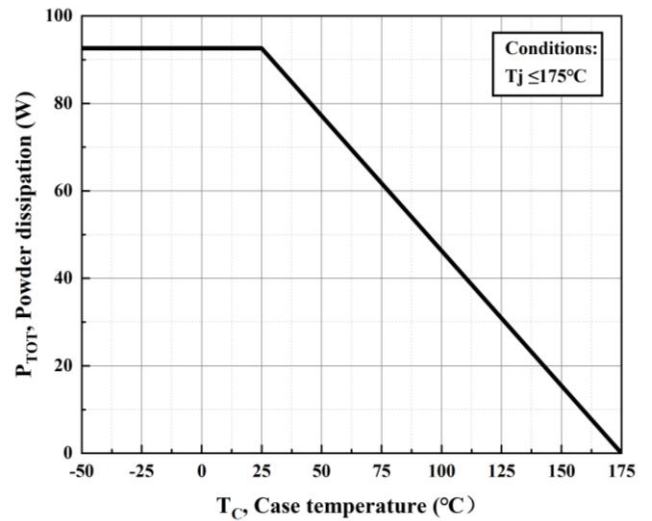


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

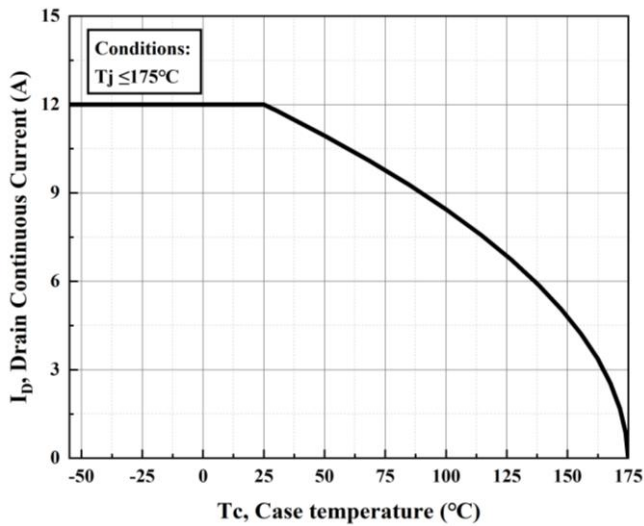


Figure 17. Continuous Drain Current Derating vs. Case Temperature

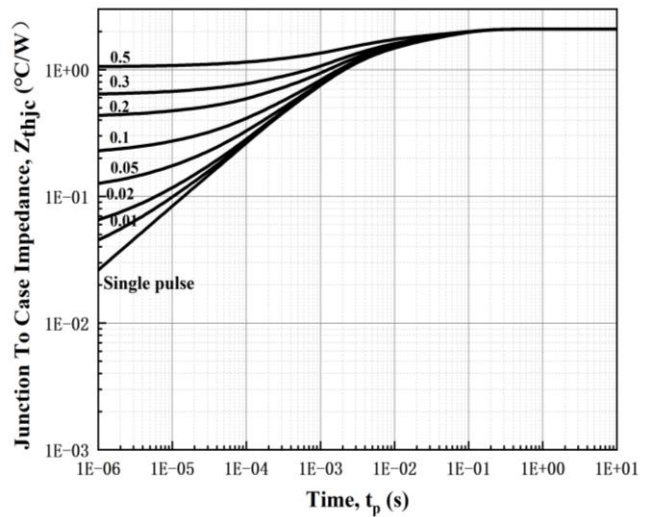


Figure18 Transient Thermal Impedance (Junction - Case)

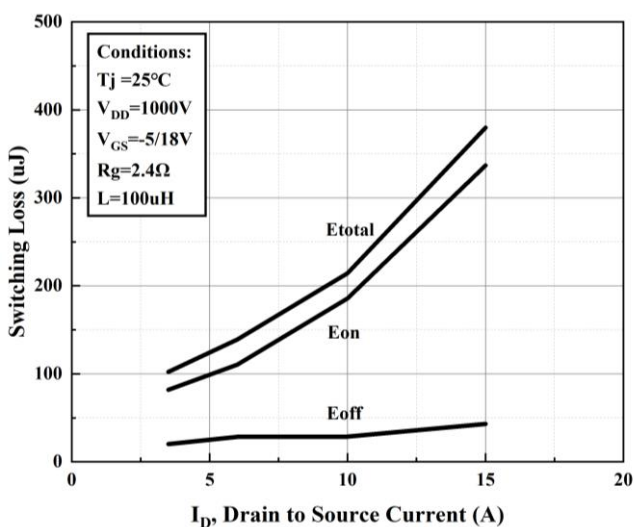


Figure 19. Clamped Inductive Switching Energy vs. Drain Current

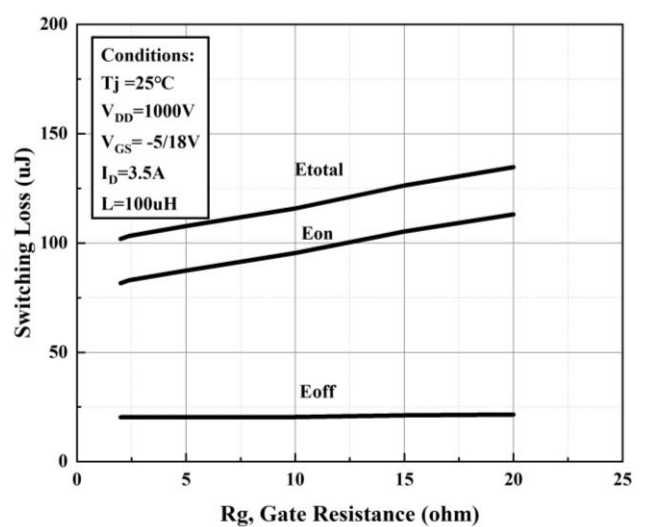


Figure 20. Clamped Inductive Switching Energy vs. R_g

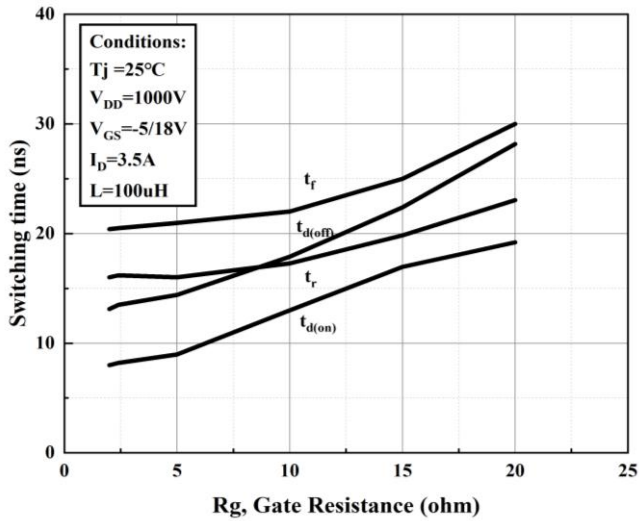


Figure 21. Switching Times vs. R_g

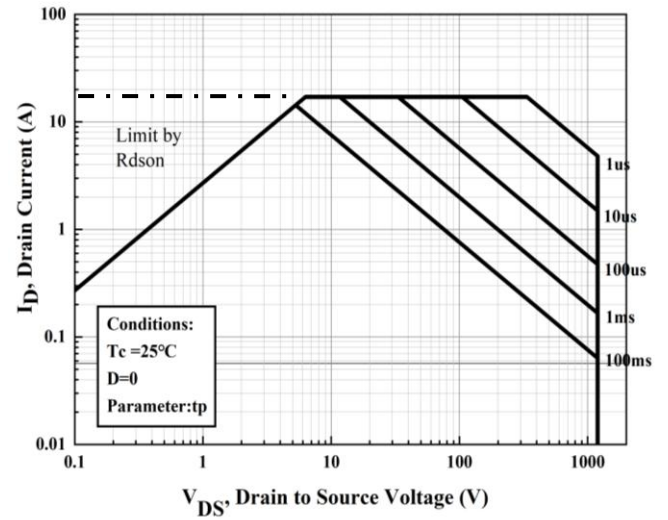


Figure 22. Safe Operating Area

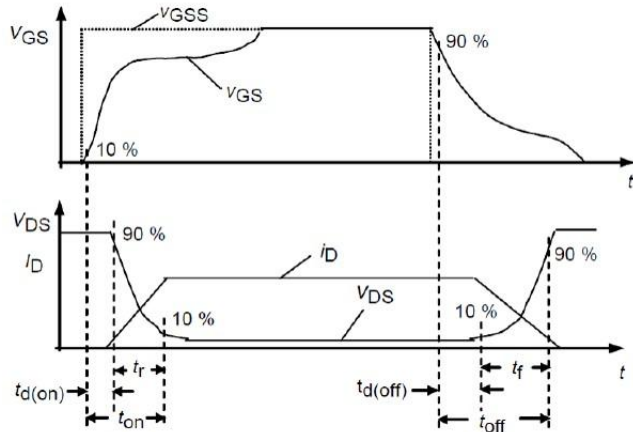


Figure 23. Switching Times Definition

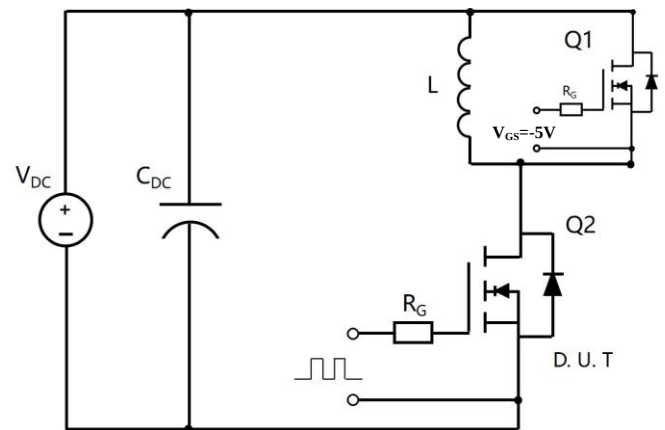


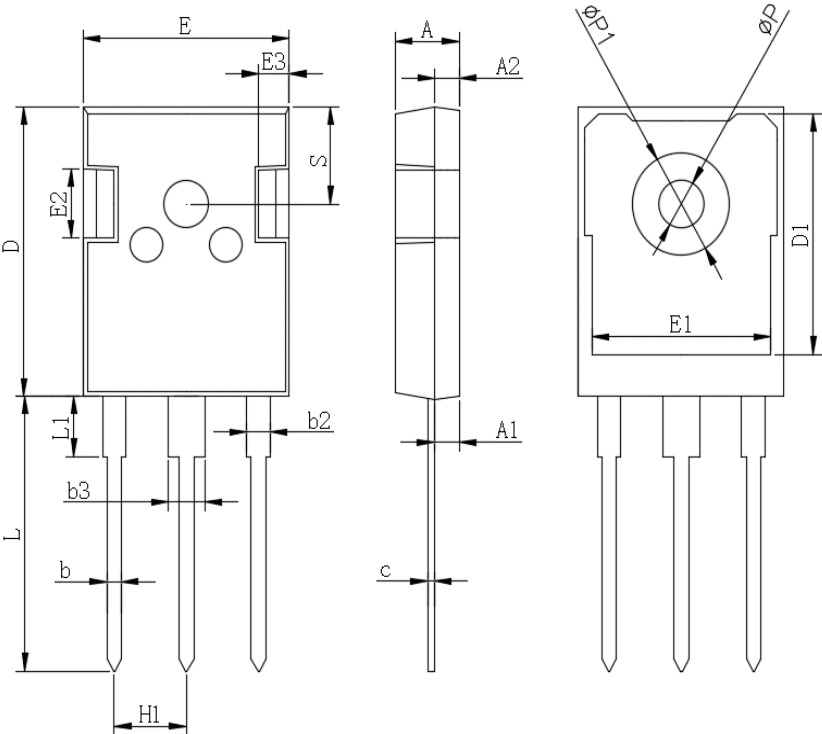
Figure 24. Clamped Inductive Switching Waveform Test Circuit



YJD2120320NCTYG3

■Outline Dimensions

TO-247AB



TO-247AB		
Dim	Min	Max
A	4.80	5.20
A1	2.21	2.61
A2	1.85	2.15
b	1.0	1.4
b2	1.91	2.21
C	0.5	0.7
D	20.70	21.30
D1	16.25	16.85
E	15.50	16.10
E1	13.0	13.6
E2	4.80	5.20
E3	2.30	2.70
L	19.62	20.22
L1	-	4.30
ΦP	3.40	3.80
ΦP1	-	7.30
S	6.15TYP	
H1	5.44TYP	
b3	2.80	3.20



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