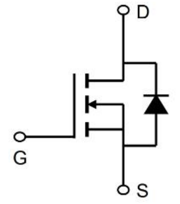
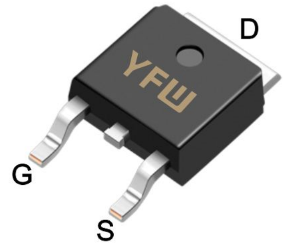
650V N-Channel SiC Silicon Carbide Power MOSFET

MAIN CHARACTERISTICS

I_D	7A
V_{DS}	650V
R_{DSON}-typ (@V_{GS}=18V T_C=25℃)	<637mΩ(Typ:490mΩ)





TO-252

FEATURES

- High Speed Switching
- Highblockigotagwit $R_{DS(on)}$
- Easy to Parallel
- Simple to Drive
- RoHS Compliant

BENEFITS

- Increased Power Density
- Faster Operating Frequency
- Reduction of Heat Sink Requirements
- Higher Efficiency
- Reduced EMI

APPLICATIONS

- Power Factor Correction Modules
- Switch Mode Power Supplies
- DC-AC Inverters
- High Voltage DC/DC Converters

Maximum Ratings at Tc=25°C unless otherwise specified

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	-8/+22	V
Recommended Operation Value	V_{GSop}	-4/+18	V
Continue Drain Current T_C=25℃	I_D	7	A
Continue Drain Current T_C=100℃		5	A
Pulsed Drain Current (Note1)	I_{DM}	13	A
Power Dissipation T_C=25℃	P_D	35	W
Power Dissipation T_C=100℃		17	W
Operating Temperature Range	T_J	-40 to +175	°C
Storage Temperature Range	T_{STG}	-40 to +150	°C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	4.3	°C/W
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	°C/W

Note1:Pulse test: 300 μs pulse width, 2 % duty cycle

Electrical Characteristics at Tc=25°C unless otherwise specified

Parameter	Test Condition	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100μA	BV_{DSS}	650	-	-	V
Drain-Source Leakage Current	V_{DS} = 650 V, V_{GS} = 0 V	I_{DSS}	-	1	10	μA
Gate Leakage Current	V_{GS} = 18 V, V_{DS} = 0 V	I_{GSS}	-	-	250	nA
Gate-Source Threshold Voltage	V_{DS}=V_{GS} , I_D=1mA T_J=25℃	$V_{GS(th)}$	2	2.9	4	V
	V_{DS}=V_{GS} , I_D=1mA T_J=175℃		-	2.1	-	V
Drain-Source On-State Resistance	V_{GS} = 15 V, I_D = 3.3 A	$R_{DS(on)}$	-	640	864	mΩ
	V_{GS} = 15 V, I_D =3.3 A,T_J = 175℃		-	670	-	
	V_{GS} = 18 V, I_D = 3.3 A		-	490	637	
	V_{GS} = 18 V, I_D =3.3 A,T_J = 175℃		-	610	-	
Forward Transconductance	V_{DS}=20V, I_D=3.3A	gfs		2.1		S
Input Capacitance	V_{GS} = 0 V V_{DS} = 600 V f = 1MHz	C_{iss}	-	116	-	pF
Output Capacitance		C_{oss}	-	18	-	
Reverse Transfer Capacitance		C_{rss}	-	2.8	-	
Coss Stored Energ		Eoss	-	2.4	-	μJ
Internal Gate Resistance	f=1MHz	RG(int)	-	36	-	Ω
Total Gate Charge(Note2)	I_D = 3.3 A V_{DD} = 400 V V_{GS} =-4/18V	Q_G		7		nC
Gate to Source Charge(Note2)		Q_{GS}		1.3		
Gate to Drain Charge(Note2)		Q_{GD}		4.2		
Turn-on Delay Time(Note2)	V_{DS} = 400 V, I_D = 3.3A, V_{GS} = -4/18 V, RG = 2.5Ω, L=200μH, Tc=25°C	$t_{d(ON)}$	-	3	-	ns
Rise Time(Note2)		t_r	-	12	-	
Turn-Off Delay Time(Note2)		$t_{d(OFF)}$	-	9	-	
Fall Time(Note2)		t_f	-	18	-	
Turn-On Energy		Eon	-	24	-	μJ
Turn-Off Energy		Eoff	-	4	-	μJ
Turn-on Delay Time(Note2)	V_{DS} = 400 V I_D = 3.3A, V_{GS} = -4/18 V RG = 2.5Ω L=200μH Tc=175°C	$t_{d(ON)}$	-	3	-	ns
Rise Time(Note2)		t_r	-	11	-	
Turn-Off Delay Time(Note2)		$t_{d(OFF)}$	-	10	-	
Fall Time(Note2)		t_f	-	19	-	
Turn-On Energy		Eon	-	22	-	μJ
Turn-Off Energy		Eoff	-	4	-	μJ
Maximun Body-Diode Continuous Current	Tc=25°C	I_S	-	7	-	A
Maximun Body-Diode Continuous Current	Tc=175°C		-	3	-	A
Maximun Body-Diode Pulsed Current(Note2)		I_{SM}	-	-	13	A
Drain-Source Diode Forward Voltage	V_{GS}=-4V, I_{SD}=1.7A Tc=25°C	V_{SD}	-	4.8	-	V
Drain-Source Diode Forward Voltage	V_{GS}=-4V, I_{SD}=1.7A Tc=175°C		-	4.3	-	V
Reverse Recovery Time(Note2)	V_{GS}=-4V, I_{SD}=1.7A, VR=400V, di/dt=1990A/μs, Tj=25°C	trr	-	45	-	ns
Reverse Recovery Charge(Note2)		Qrr	-	54	-	nC
Peak Reverse Recovery Current		Irrm	-	2	-	A
Reverse Recovery Time(Note2)	V_{GS}=-4V, I_{SD}=1.7A, VR=400V, di/dt=1990A/μs, Tj=175°C	trr	-	48	-	ns
Reverse Recovery Charge(Note2)		Qrr	-	52	-	nC
Peak Reverse Recovery Current		Irrm	-	2.3	-	A

Note2:Pulse test: 300 μs pulse width, 2 % duty cycle

RATINGS AND CHARACTERISTIC CURVES

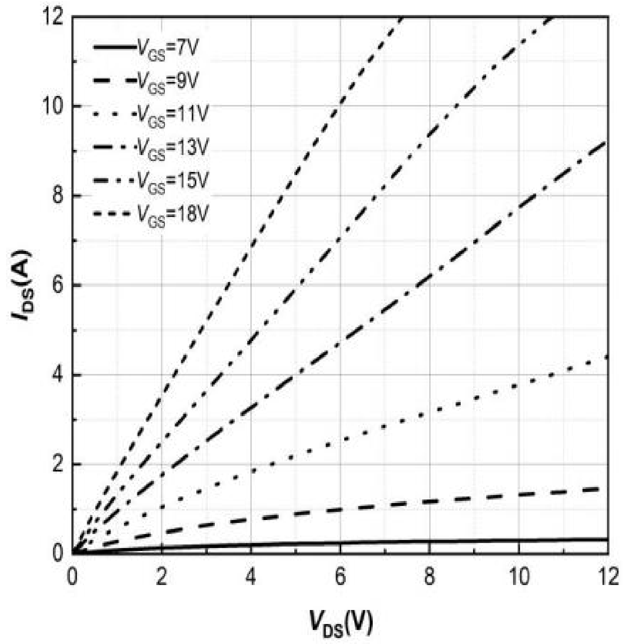


Figure 1. **Output Characteristics**
T_j=-40°C

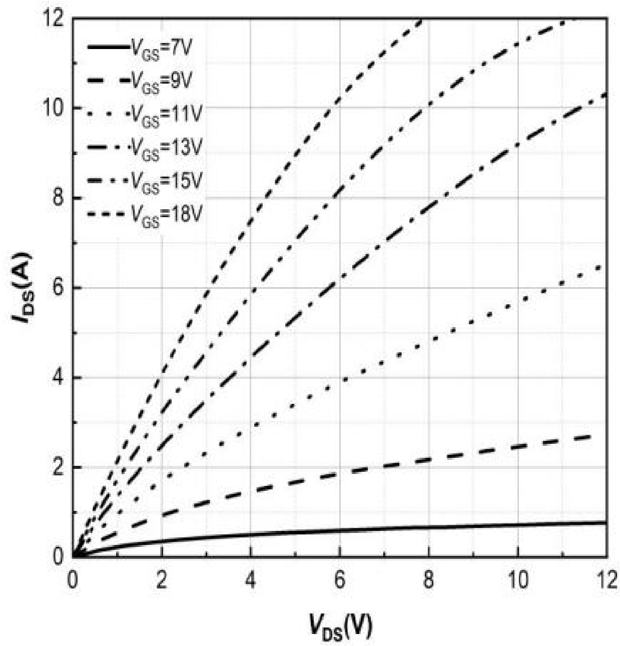


Figure 2. **Output Characteristics**
T_j=25°C

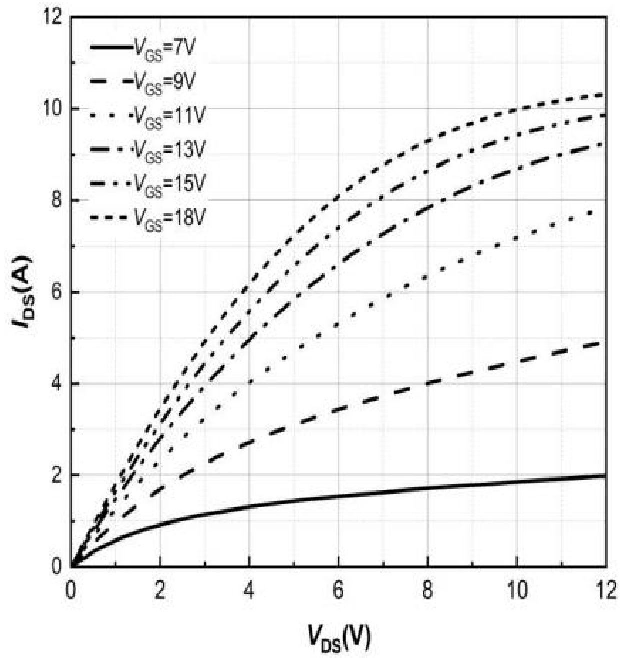


Figure 3. **Output Characteristics**
T_j=175°C

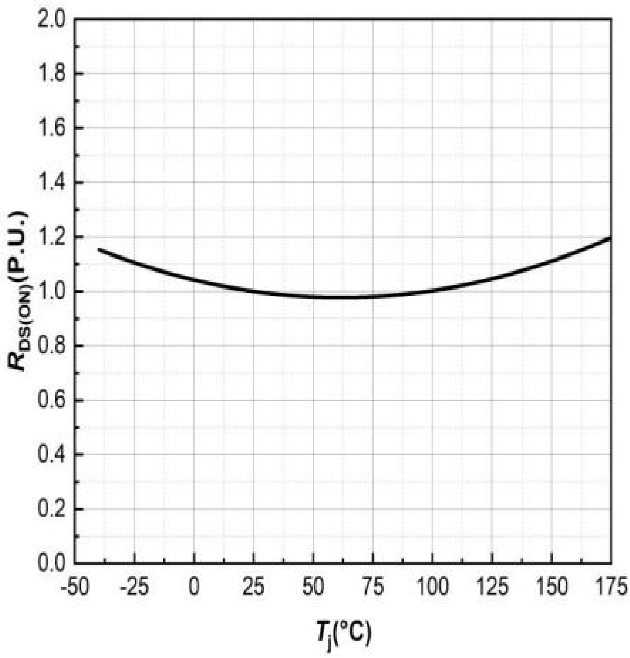


Figure 4. **Normalized On-Resistance vs. Temperature**

RATINGS AND CHARACTERISTIC CURVES

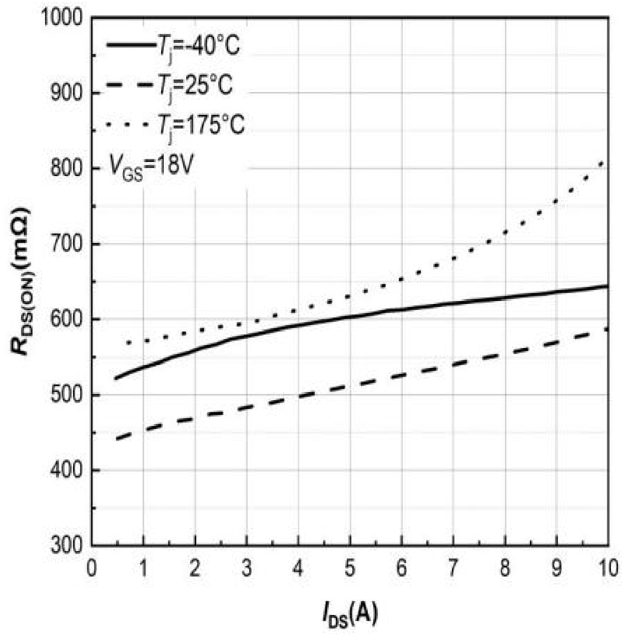


Figure 5. **On-Resistance vs. Drain Current For Various Temperatures**

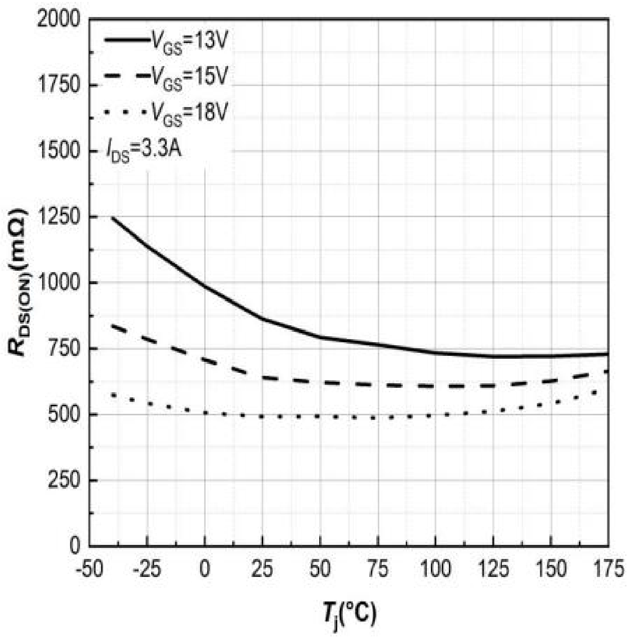


Figure 6. **On-Resistance vs. Temperature For Various Gate Voltage**

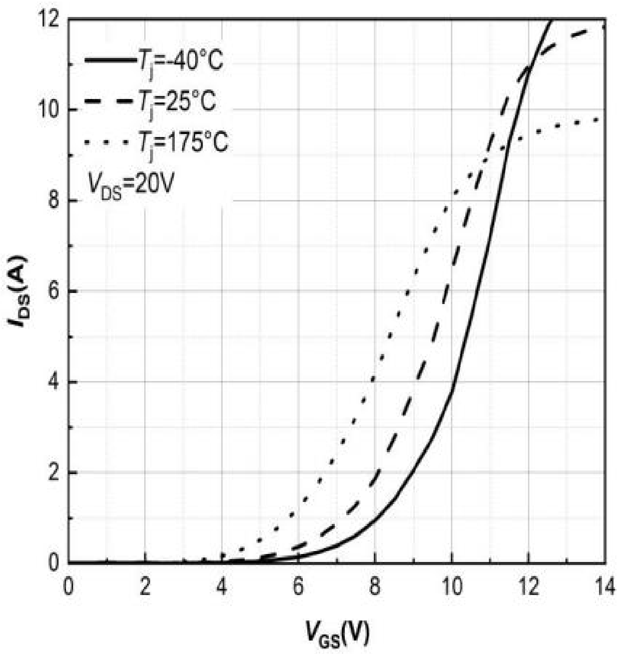


Figure 7. **Transfer Characteristic for Various Junction Temperatures**

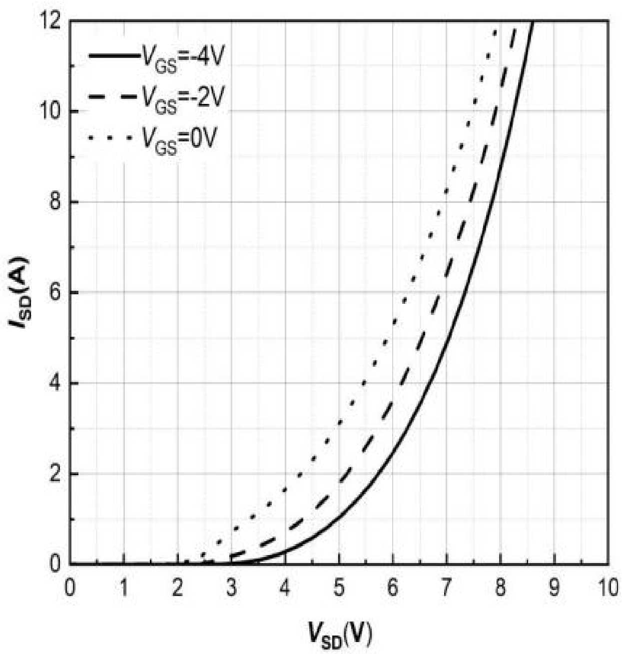


Figure 8. **Body Diode Characteristic T_j=-40°C**

RATINGS AND CHARACTERISTIC CURVES

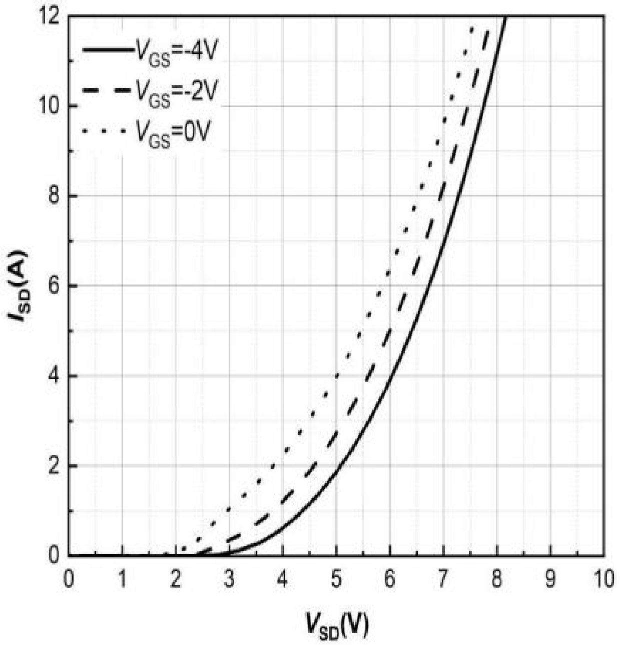


Figure 9. **Body Diode Characteristic**
T_j=25°C

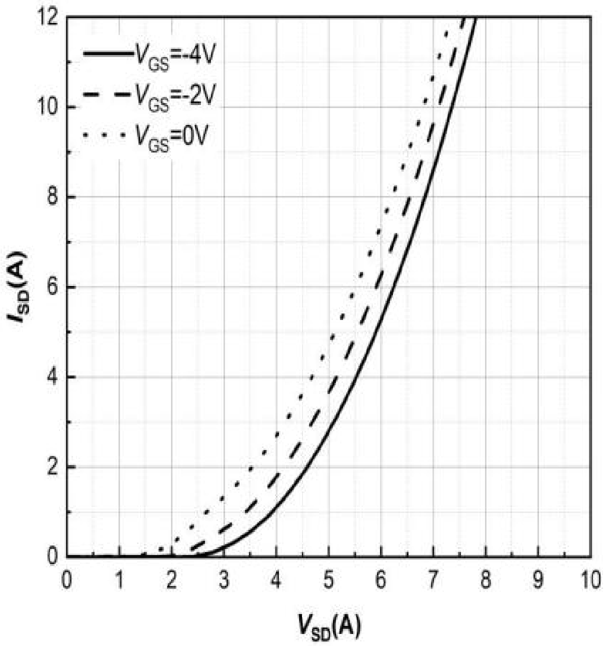


Figure 10. **Body Diode Characteristic**
T_j=175°C

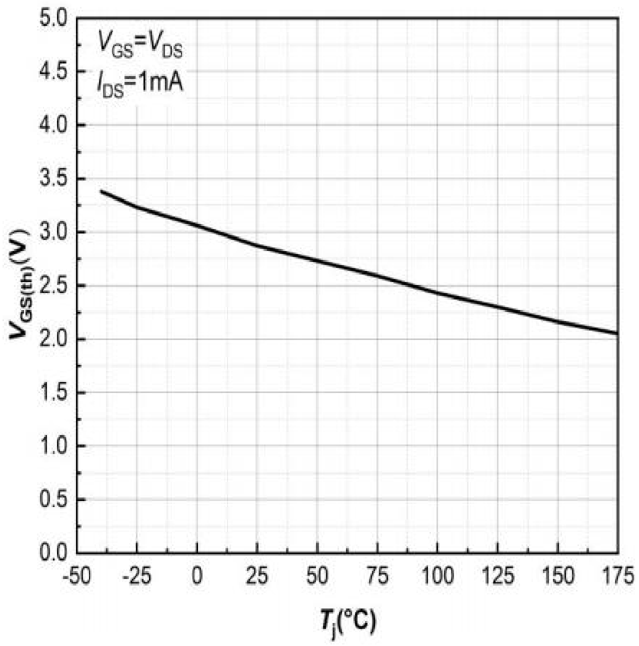


Figure 11. **Threshold Voltage vs. Temperature**

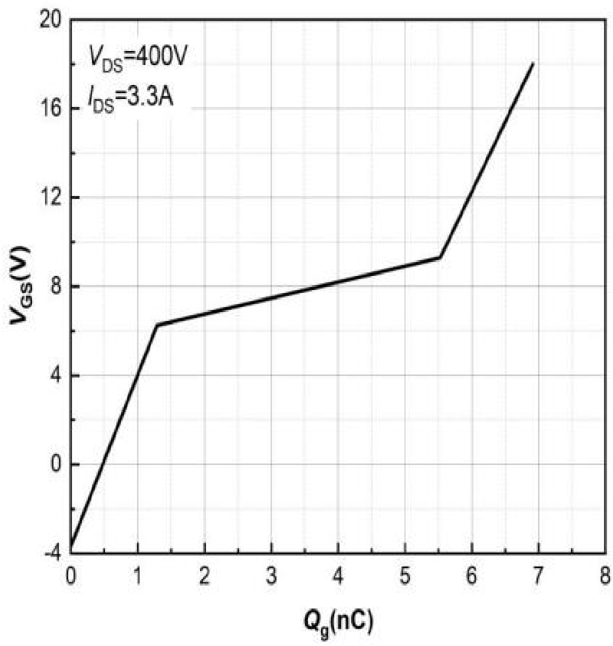


Figure 12. **Gate Charge Characteristics**

RATINGS AND CHARACTERISTIC CURVES

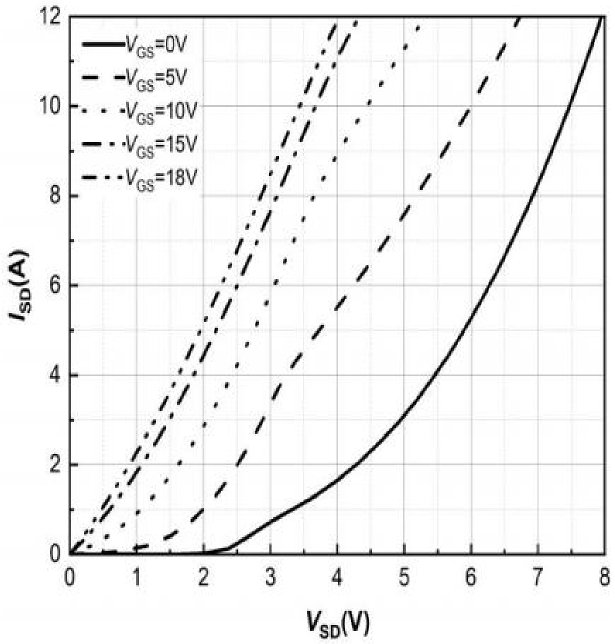


Figure 13. **3rd Quadrant Characteristic**
T_j=-40°C

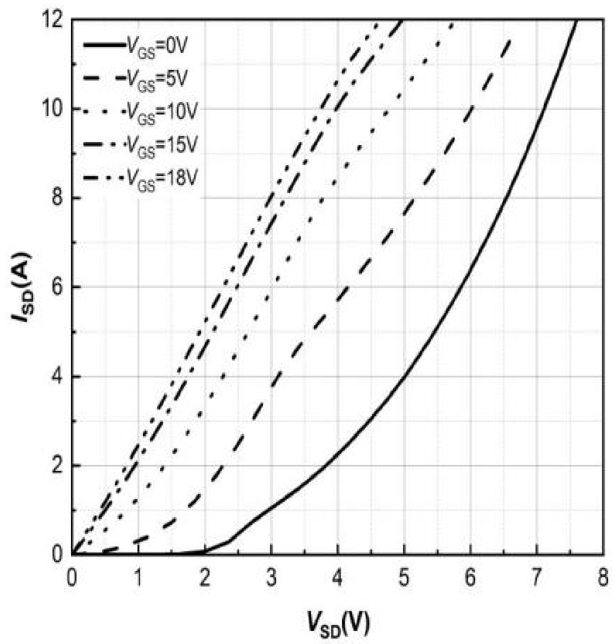


Figure 14. **3rd Quadrant Characteristic**
T_j=25°C

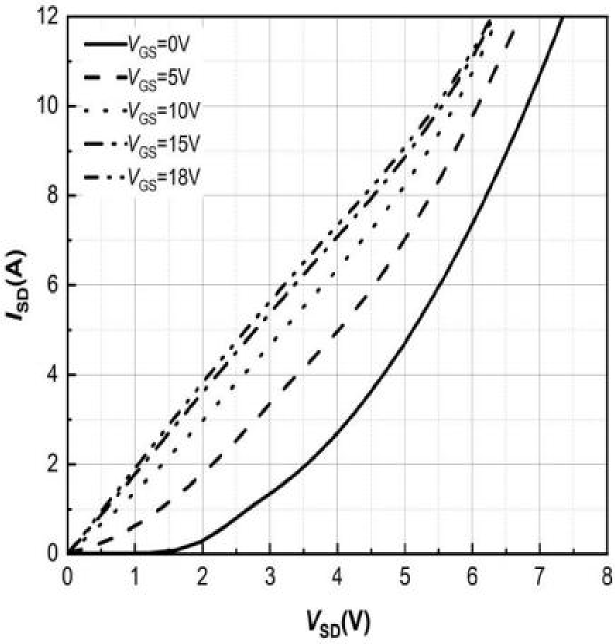


Figure 15. **3rd Quadrant Characteristic**
T_j=175°C

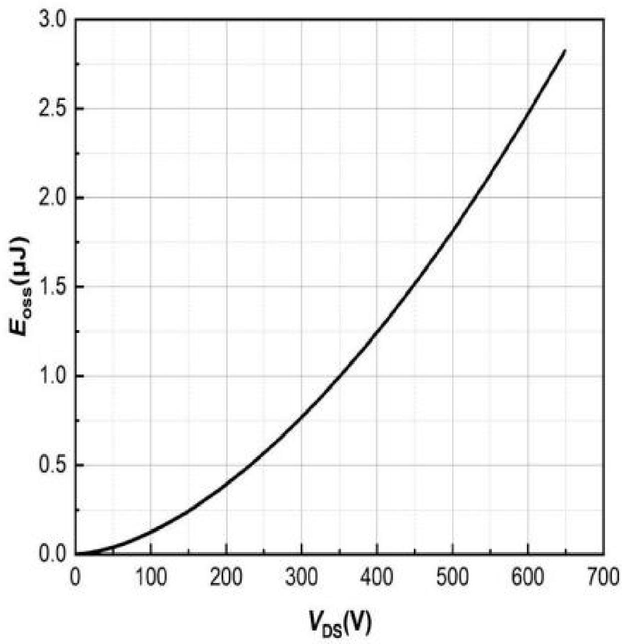


Figure 16. **Output Capacitor Stored Energy**

RATINGS AND CHARACTERISTIC CURVES

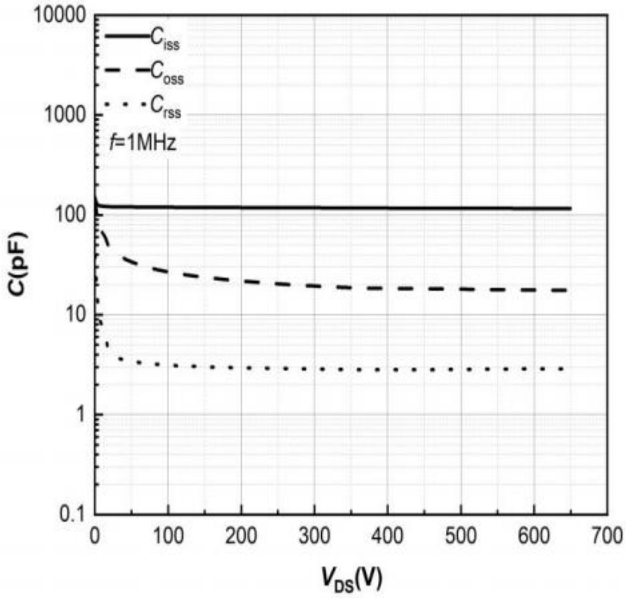


Figure 17. **Capacitances vs. Drain-Source**

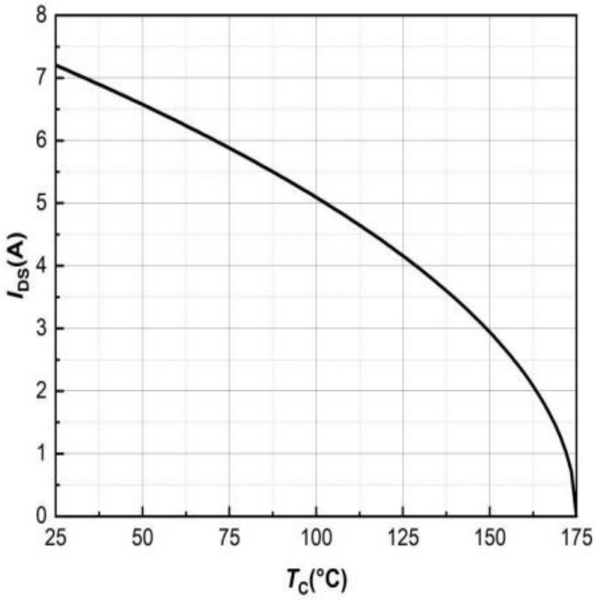


Figure 18. **Continuous Drain Current Derating vs. Case Temperature**

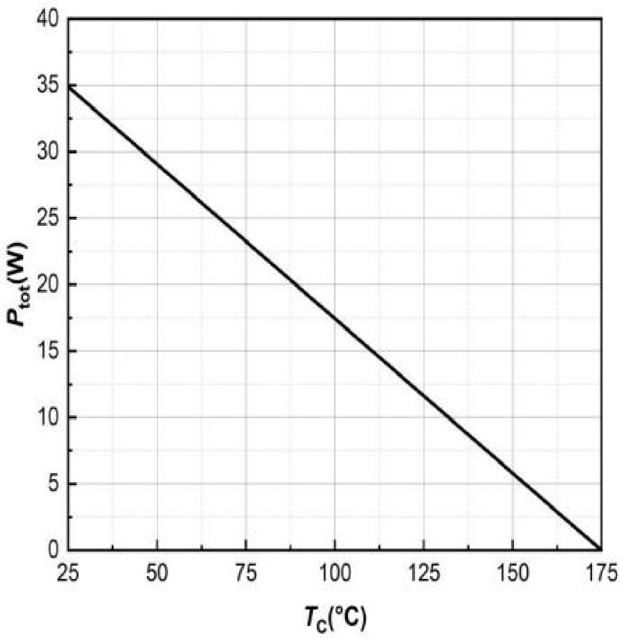


Figure 19. **Maximum Power Dissipation Derating vs. Case Temperature**

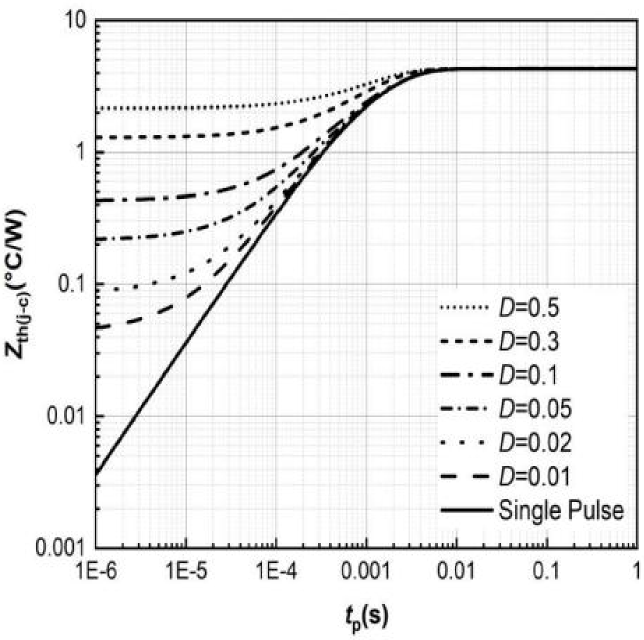


Figure 20. **Transient Thermal Impedance**

RATINGS AND CHARACTERISTIC CURVES

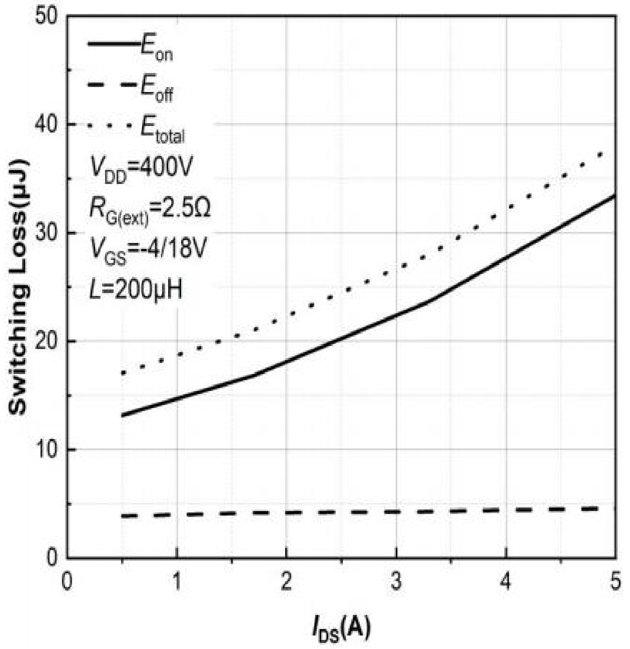


Figure 21. **Clamped Inductive Switching Energy vs. Drain Current T_j=25°C**

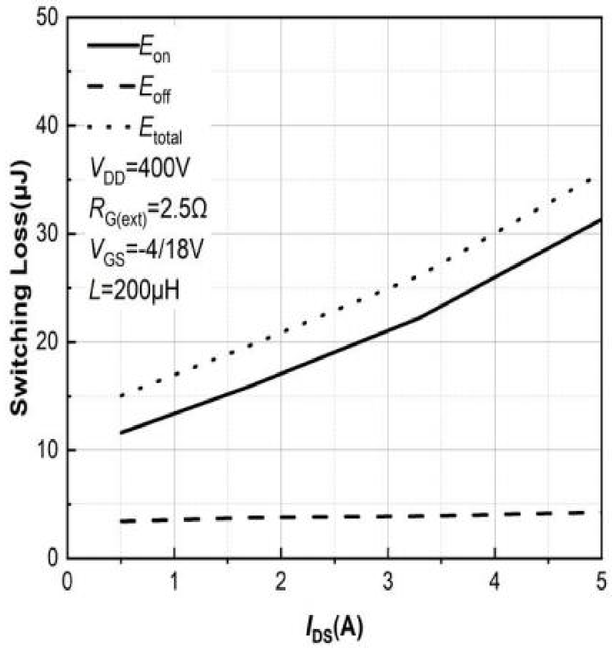


Figure 22. **Clamped Inductive Switching Energy vs. Drain Current T_j=175°C**

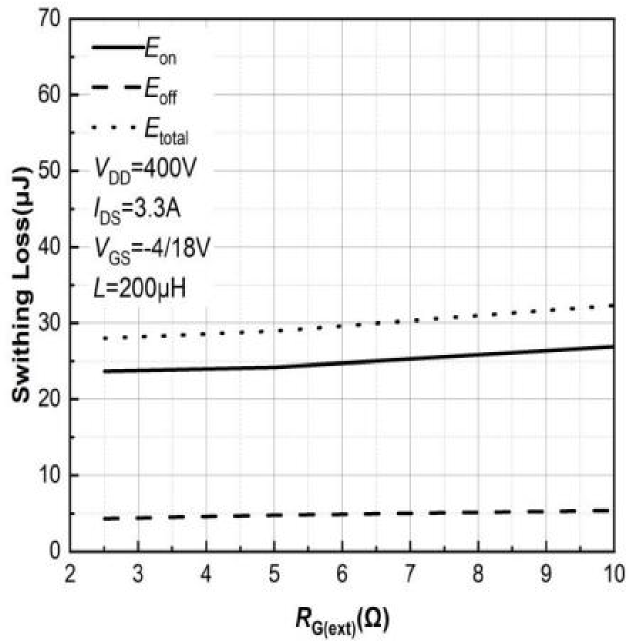


Figure 23. **Clamped Inductive Switching Energy vs. $R_{G(ext)}$ T_j=25°C**

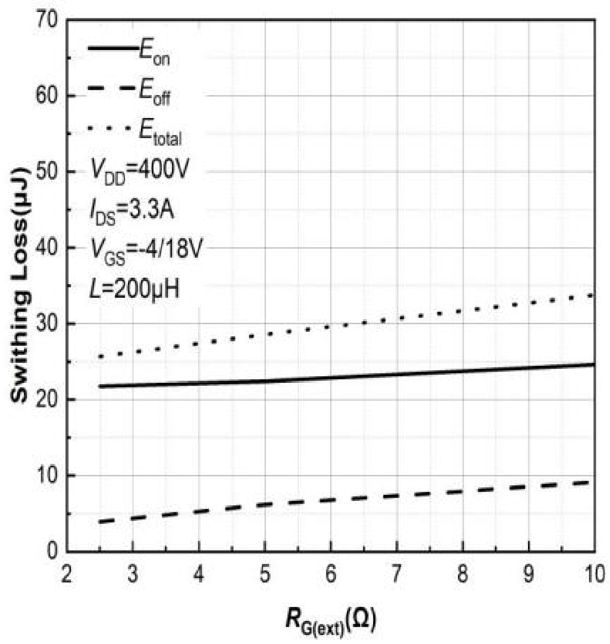


Figure 24. **Clamped Inductive Switching Energy vs. $R_{G(ext)}$ T_j=175°C**

RATINGS AND CHARACTERISTIC CURVES

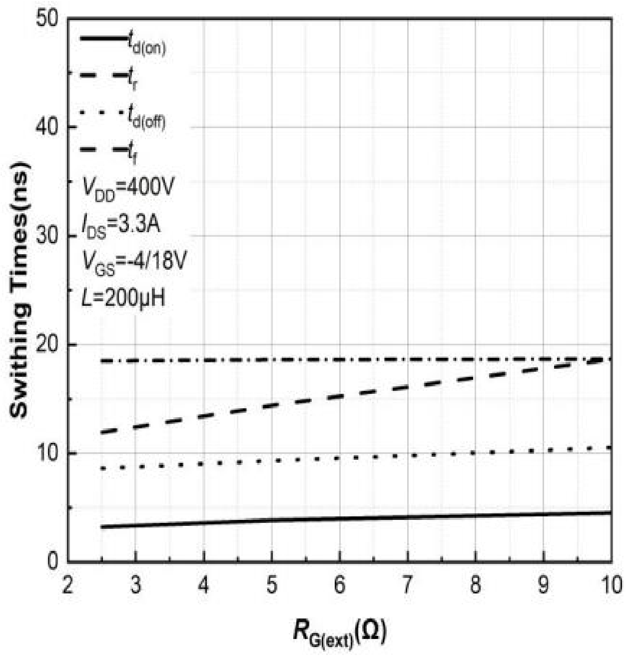


Figure 25. **Switching Times vs. $R_{G(ext)}$**
T_j=25°C

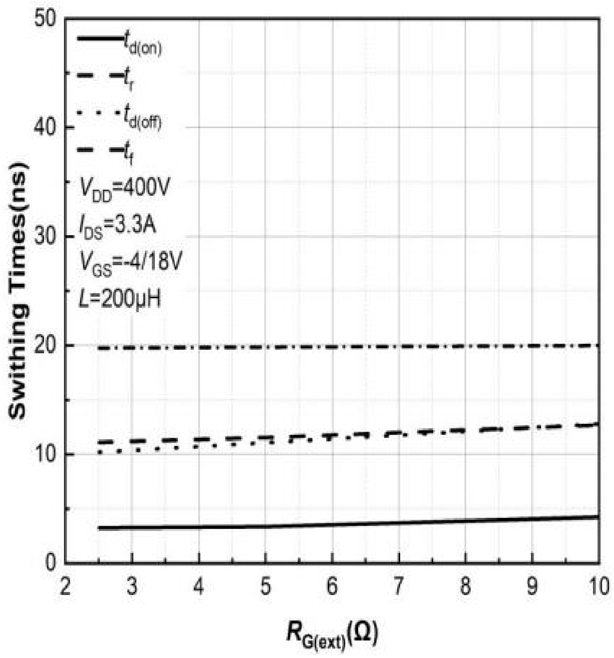


Figure 26. **Switching Times vs. $R_{G(ext)}$**
T_j=175°C

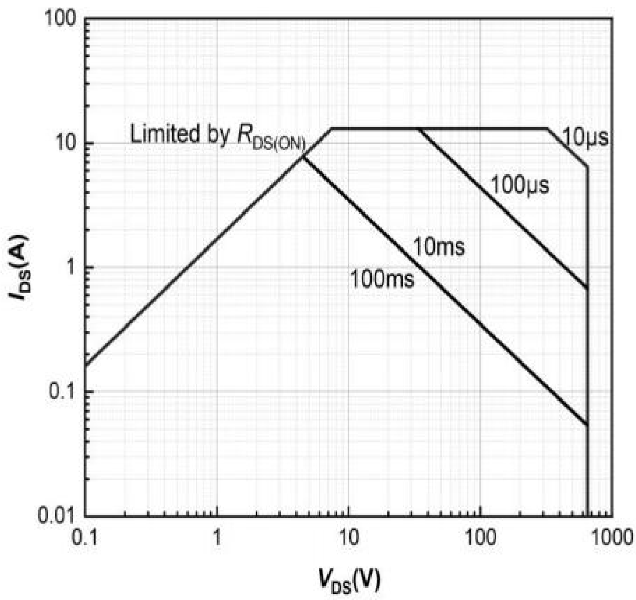
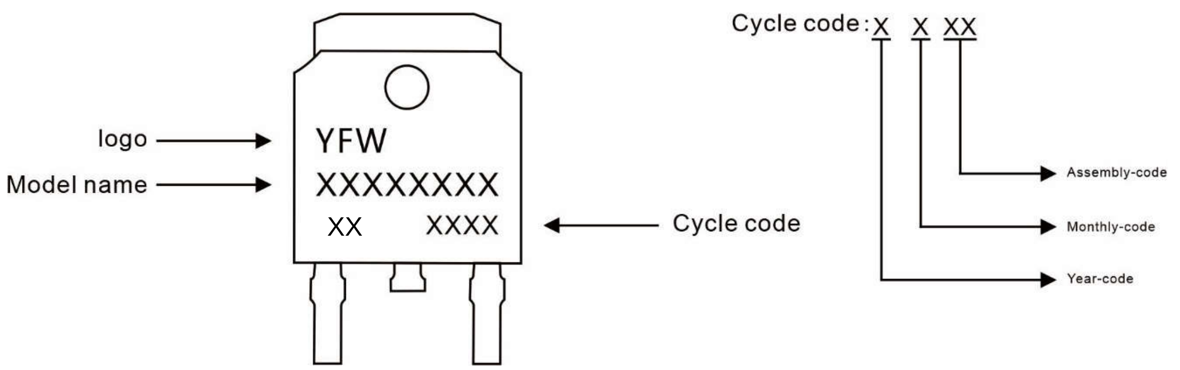


Figure 27. **Safe Operating Area**

Marking Diagram

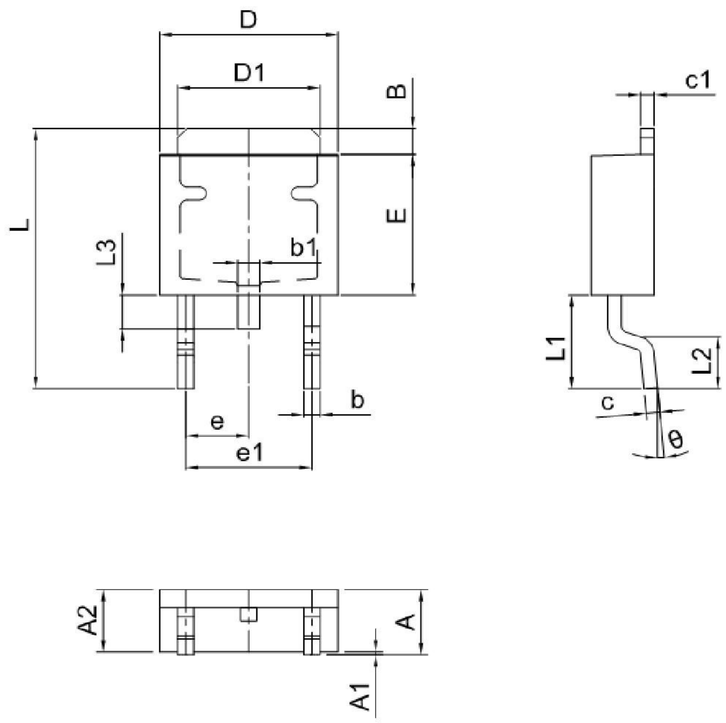


Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWM350065ADG3	TO-252	0.011oz(0.32g)	2500pcs/reel	5000pcs/box 25000pcs/Carton

Package Dimensions

TO-252



Dim	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	2.20	2.50	0.087	0.098
A1	0.00	0.12	0.000	0.005
A2	2.20	2.40	0.087	0.094
B	1.20	1.60	0.047	0.063
b	0.50	0.70	0.020	0.028
b1	0.70	0.90	0.028	0.035
c	0.40	0.60	0.016	0.024
c1	0.40	0.60	0.016	0.024
D	6.35	6.65	0.250	0.262
D1	5.20	5.40	0.205	0.213
E	5.40	5.70	0.213	0.224
e	2.20	2.40	0.087	0.094
e1	4.40	4.80	0.173	0.189
L	10.00	11.00	0.393	0.433
L1	2.70	3.10	0.106	0.122
L2	1.40	1.80	0.055	0.071
L3	0.90	1.50	0.035	0.059

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