

650V N-Channel SiC Silicon Carbide Power MOSFET

MAIN CHARACTERISTICS

I_D	15A
V_{DS}	650V
R_{DS(on)-typ} (@V _{GS} =18V T _C =25°C)	<208mΩ(Typ:154mΩ)

FEATURES

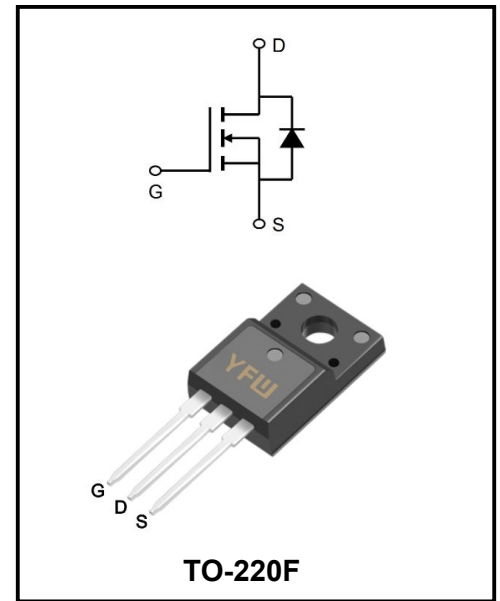
- ◆High Speed Switching
- ◆Highblockigotagwit R_{DS(on)}
- ◆Easy to Parallel
- ◆Simple to Drive
- ◆RoHS Compliant

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 T_C=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°C	I _D	15	A
Continue Drain Current T _C =100°C		11	A
Pulsed Drain Current (Note1)	I _{DM}	30	A
Power Dissipation	P _D	48	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 _{θJC}	3.14	°C/W
Thermal Resistance, Junction to Ambient	R _{θJA}	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	$V_{GS} = 0\text{ V}, I_D = 100\mu\text{A}$	BV_{DSS}	650	-	-	V
Drain-Source Leakage Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	I_{DSS}	-	1	10	μA
Gate Leakage Current	$V_{GS} = 18\text{ V}, V_{DS} = 0\text{ V}$	I_{GSS}	-	-	250	nA
Gate-Source Threshold Voltage	$V_{DS} = V_{GS}, I_D = 2.5\text{ mA}$	$V_{GS(th)}$	2	2.8	4	V
Drain-Source On-State Resistance	$V_{GS} = 15\text{ V}, I_D = 10\text{ A}$	$R_{DS(on)}$	-	200	290	m Ω
	$V_{GS} = 15\text{ V}, I_D = 10\text{ A}, T_J = 175^\circ\text{C}$		-	208	-	
	$V_{GS} = 18\text{ V}, I_D = 10\text{ A}$		-	154	208	
	$V_{GS} = 18\text{ V}, I_D = 10\text{ A}, T_J = 175^\circ\text{C}$		-	188	-	
Input Capacitance	$V_{GS} = 0\text{ V}$ $V_{DS} = 600\text{ V}$ $f = 1\text{ MHz}$	C_{iss}	-	308	-	pF
Output Capacitance		C_{oss}	-	32	-	pF
Reverse Transfer Capacitance		C_{rss}	-	4.2	-	pF
Coss Stored Energy		E_{oss}	-	5.3	-	pF
Total Gate Charge(Note2)	$I_D = 10\text{ A}$ $V_{DD} = 400\text{ V}$ $V_{GS} = -4/18\text{ V}$	Q_G	-	14	-	nC
Gate to Source Charge(Note2)		Q_{GS}	-	2.8	-	nC
Gate to Drain Charge(Note2)		Q_{GD}	-	6.4	-	nC
Turn-on Delay Time(Note2)	$V_{DS} = 400\text{ V},$ $I_D = 10\text{ A},$ $V_{GS} = -4/+18\text{ V},$ $R_G = 2.5\text{ }\Omega$ $L = 200\mu\text{H}$	$t_{d(ON)}$	-	6	-	ns
Rise Time(Note2)		t_r	-	9	-	ns
Turn-Off Delay Time(Note2)		$t_{d(OFF)}$	-	8	-	ns
Fall Time(Note2)		t_f	-	11	-	ns
Turn-on Switching Energy		E_{on}	-	27	-	μJ
Turn-off Switching Energy		E_{off}	-	6	-	μJ
Maximun Body-Diode Continuous Current	$V_{GS} = -4\text{ V}$ $T_c = 25^\circ\text{C}$	I_S	-	15	-	A
	$V_{GS} = -4\text{ V}$ $T_c = 100^\circ\text{C}$		-	8	-	A
Maximun Body-Diode Pulsed Current(Note2)		I_{SM}	-	-	30	A
Drain-Source Diode Forward Voltage	$V_{GS} = -4\text{ V}, I_{SD} = 5\text{ A}, T_J = 25^\circ\text{C}$	V_{SD}	-	4	-	V
	$V_{GS} = -4\text{ V}, I_{SD} = 5\text{ A}, T_J = 175^\circ\text{C}$		-	3.7	-	V
Reverse Recovery Time(Note2)	$V_{GS} = -4\text{ V}, I_{SD} = 5\text{ A},$ $V_R = 400\text{ V},$ $di/dt = 1400\text{ A}/\mu\text{s}, T_J = 25^\circ\text{C}$	t_{rr}	-	12	-	ns
Reverse Recovery Charge(Note2)		Q_{rr}	-	62	-	nC
Peak Reverse Recovery Current		I_{rrm}	-	5	-	A

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

RATINGS AND CHARACTERISTIC CURVES

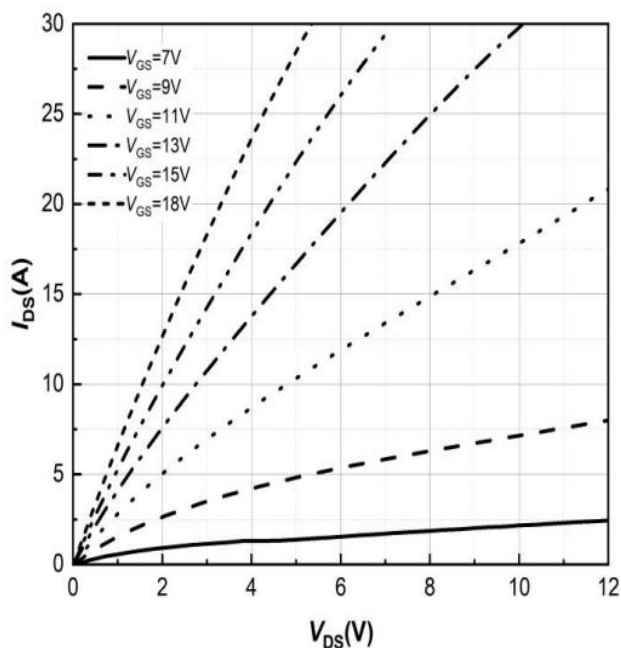


Figure 1. Output Characteristics
 $T_j = 25^\circ\text{C}$

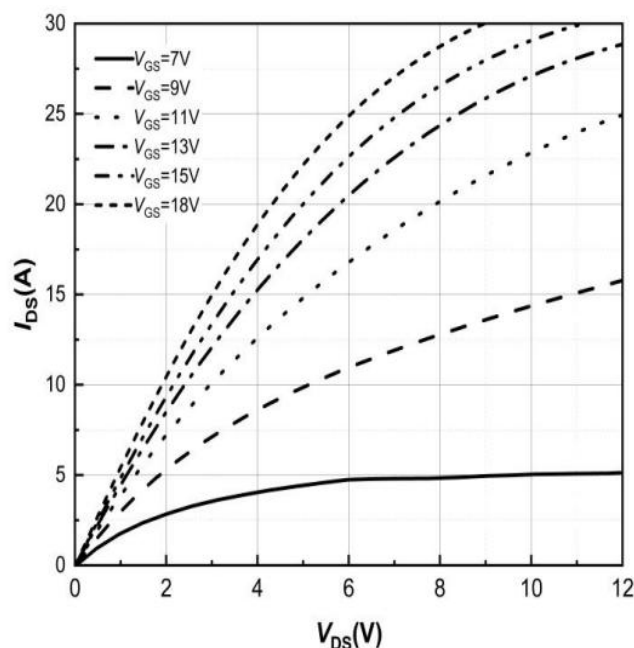


Figure 2. Output Characteristics
 $T_j = 175^\circ\text{C}$

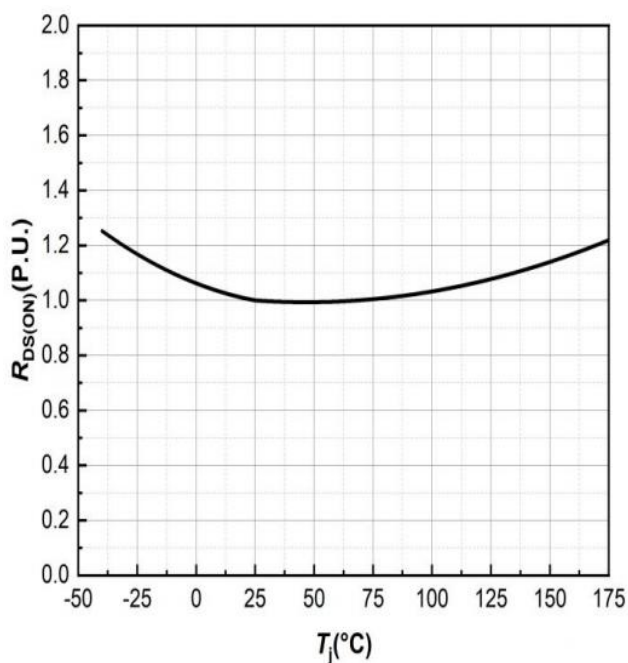


Figure 3. Normalized On-Resistance vs. Temperature

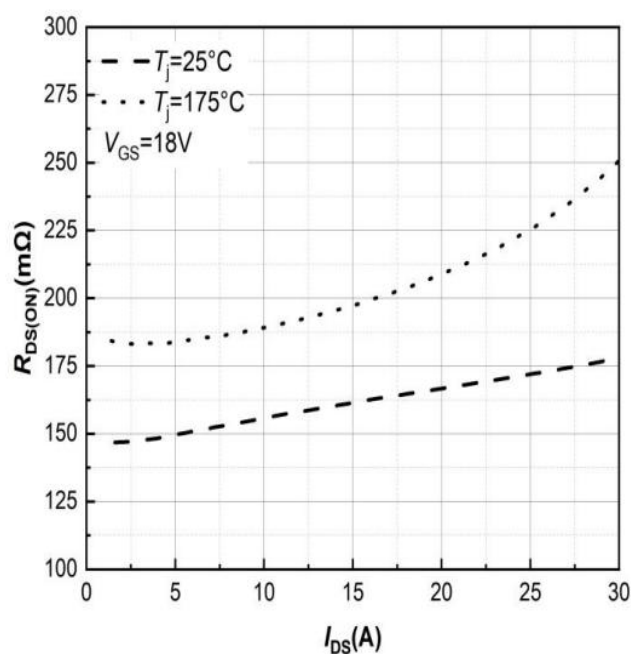


Figure 4. On-Resistance vs. Drain Current For Various Temperatures

RATINGS AND CHARACTERISTIC CURVES

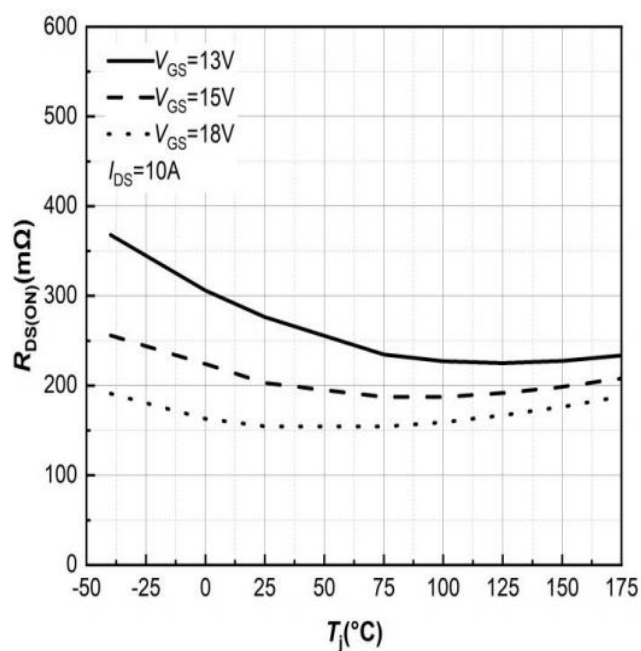


Figure 5. On-Resistance vs. Temperature For Various Gate Voltage

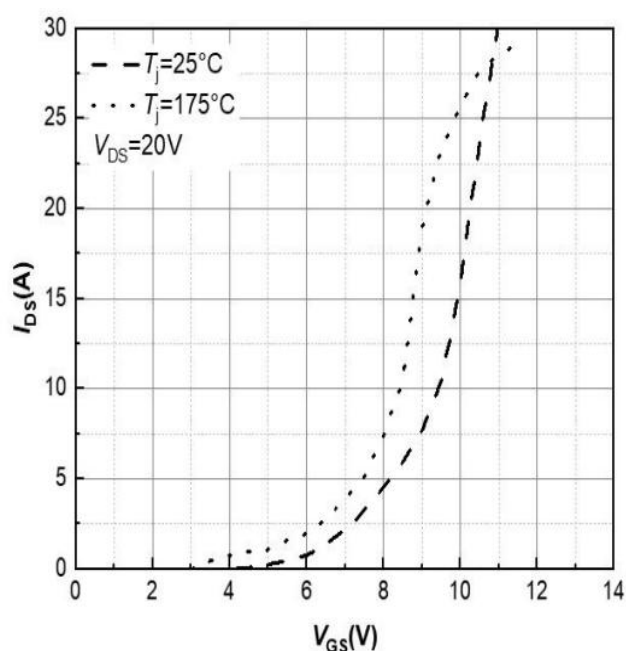


Figure 6. Transfer Characteristic for Various Junction Temperatures

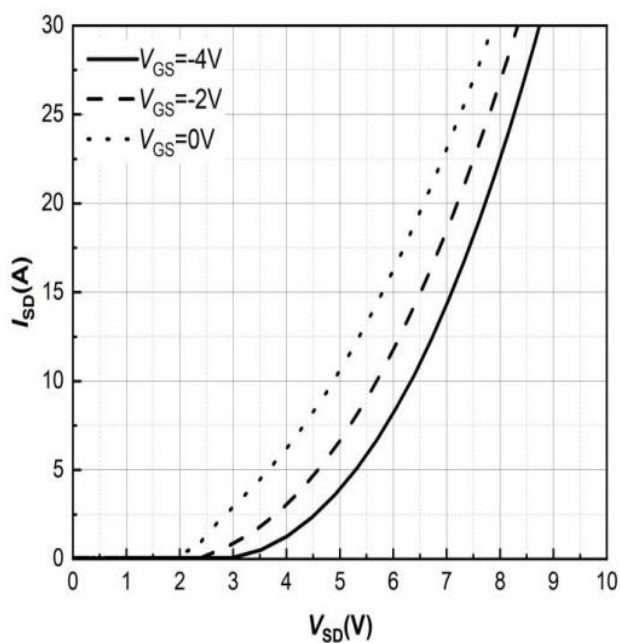


Figure 7. Body Diode Characteristic $T_J=25^{\circ}\text{C}$

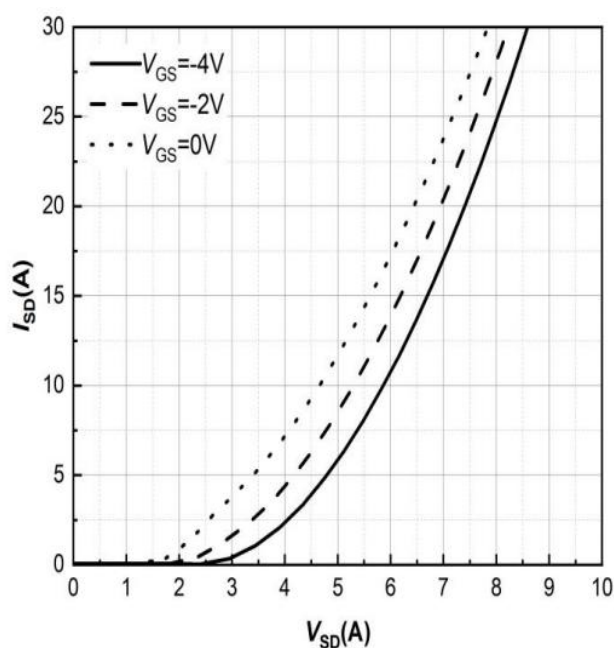


Figure 8. Body Diode Characteristic $T_J=175^{\circ}\text{C}$

RATINGS AND CHARACTERISTIC CURVES

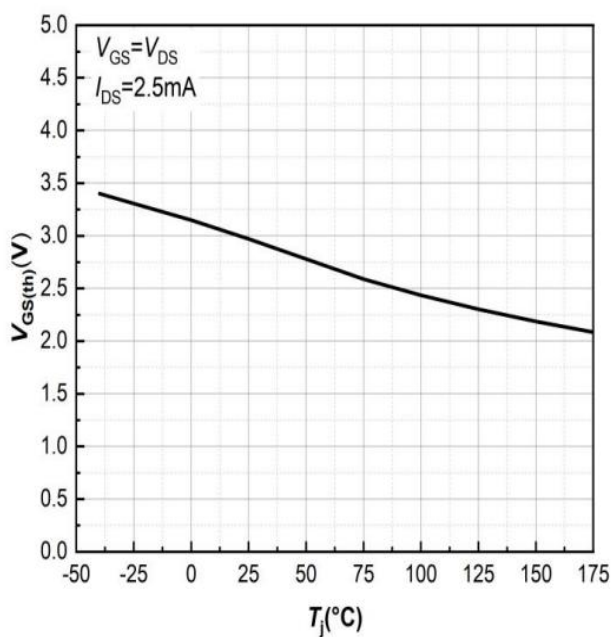


Figure 9. Threshold Voltage vs. Temperature

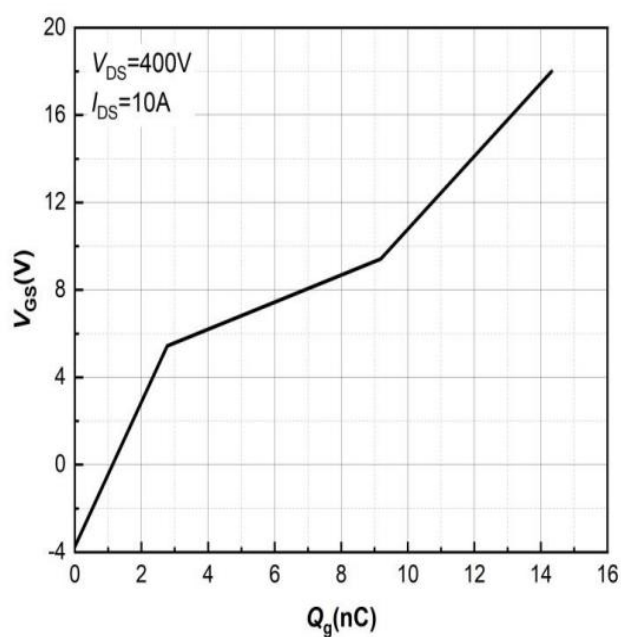


Figure 10. Gate Charge Characteristics

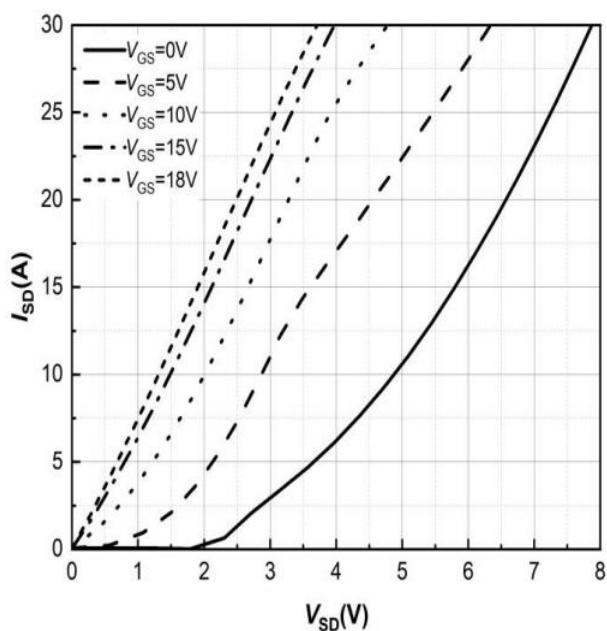


Figure 11. 3rd Quadrant Characteristic
 $T_J=25^{\circ}\text{C}$

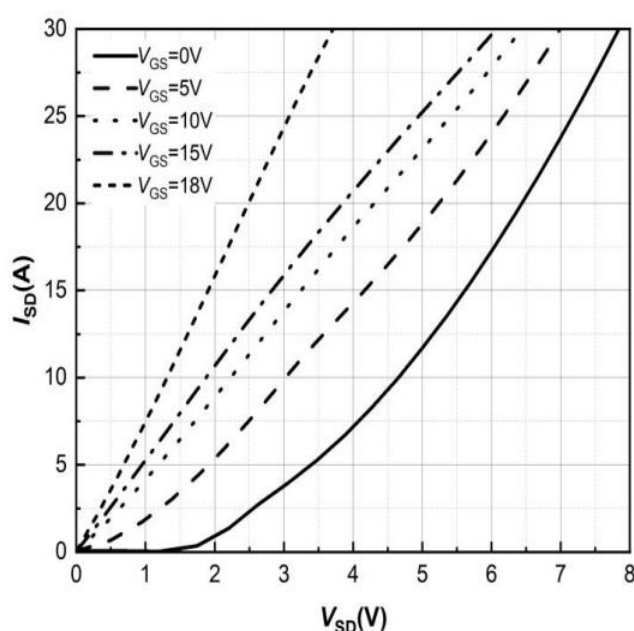


Figure 12. 3rd Quadrant Characteristic
 $T_J=175^{\circ}\text{C}$

RATINGS AND CHARACTERISTIC CURVES

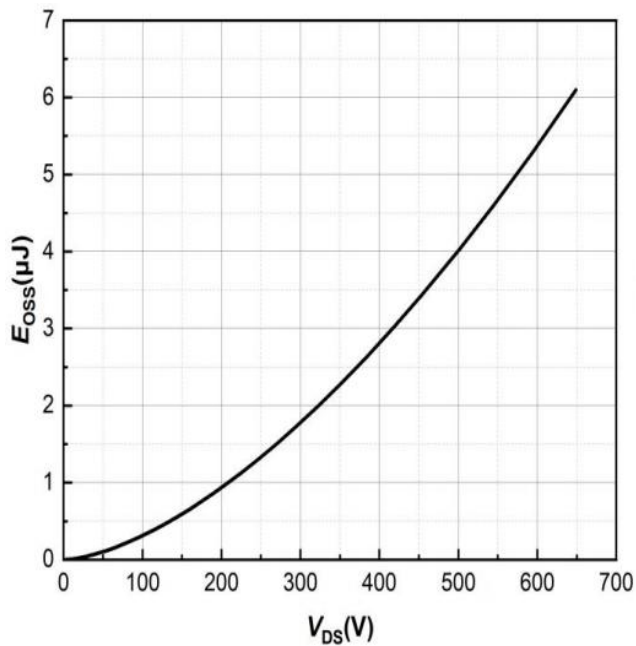


Figure 13. Output Capacitor Stored Energy

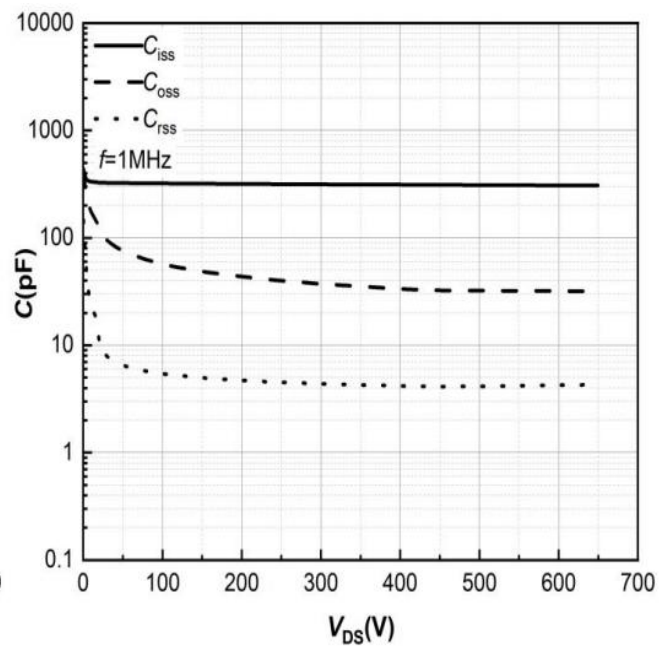


Figure 14. Capacitances vs. Drain-Source

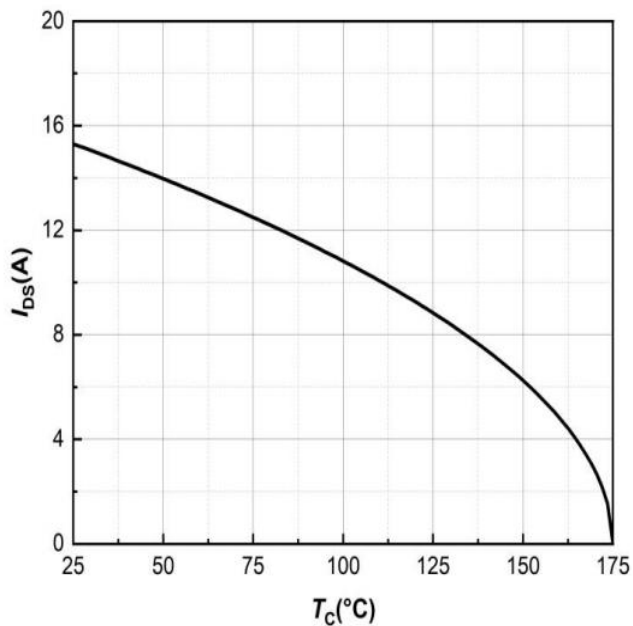


Figure 15. Continuous Drain Current Derating vs. Case Temperature

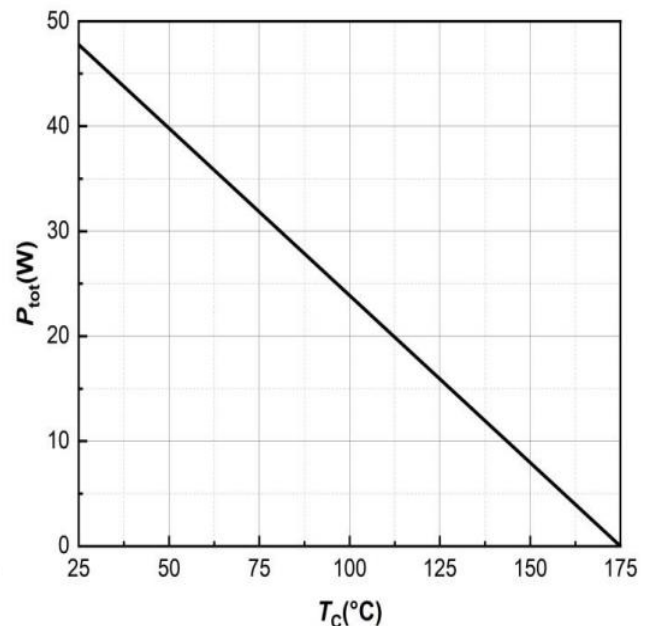


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

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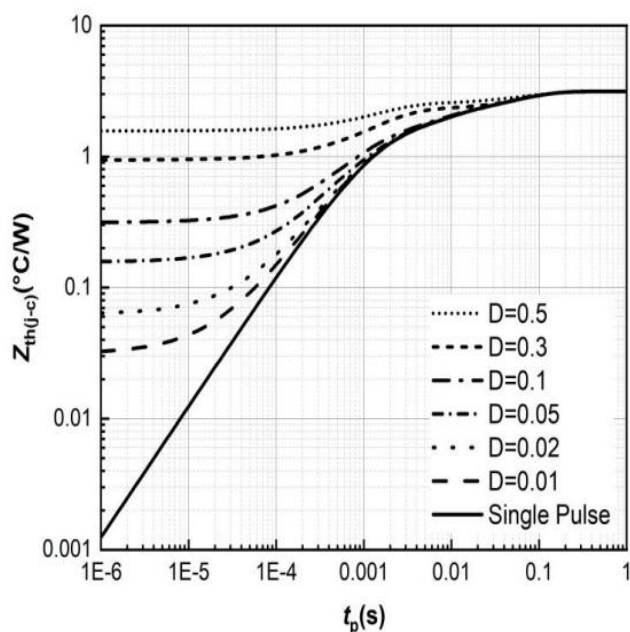


Figure 17. Transient Thermal Impedance

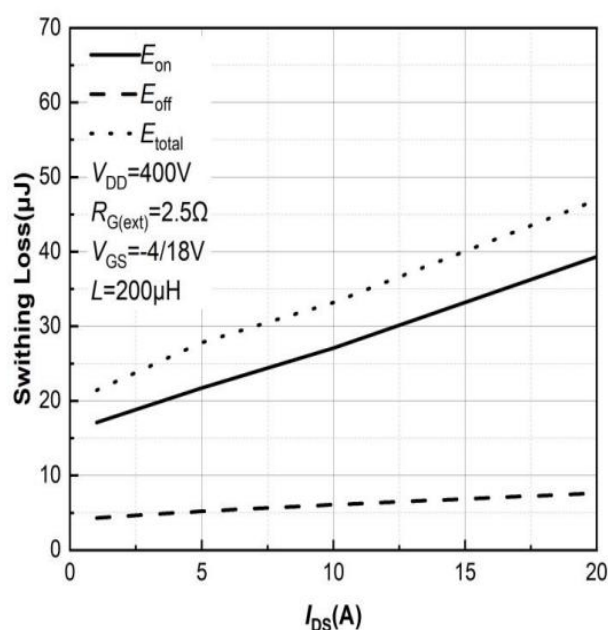


Figure 18. Clamped Inductive Switching Energy vs. Drain Current
 $T_J = 25^\circ\text{C}$

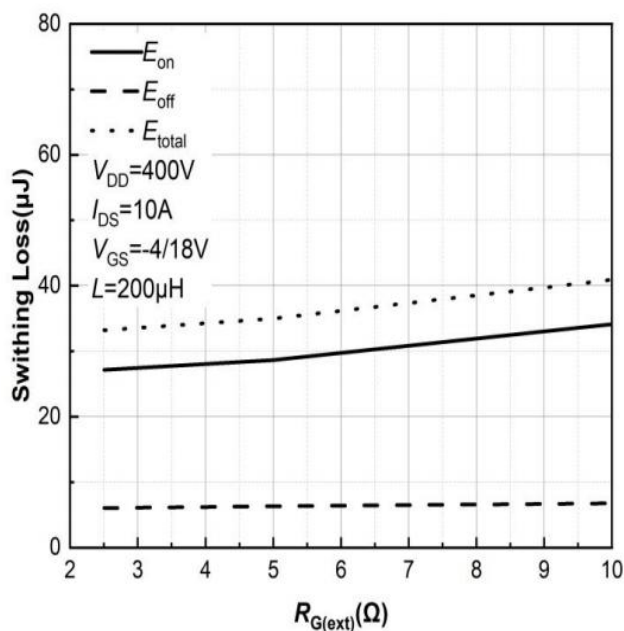


Figure 19. Clamped Inductive Switching Energy vs. $R_{G(\text{ext})}$
 $T_J = 25^\circ\text{C}$

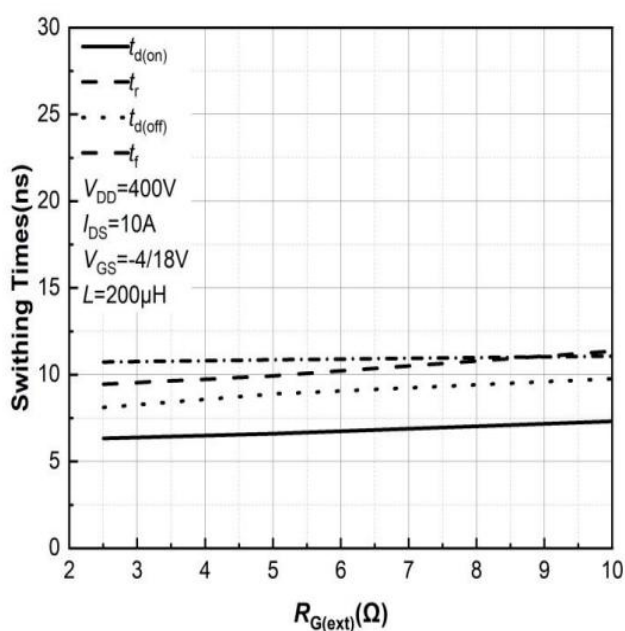


Figure 20. Switching Times vs. $R_{G(\text{ext})}$
 $T_J = 25^\circ\text{C}$

RATINGS AND CHARACTERISTIC CURVES

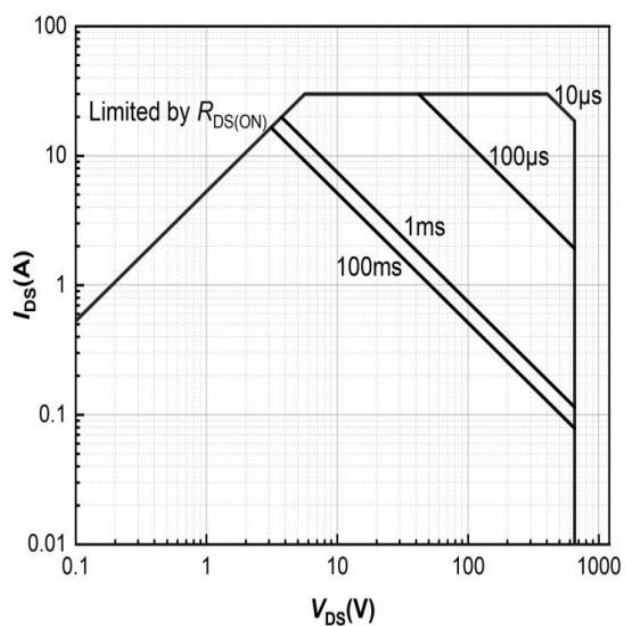
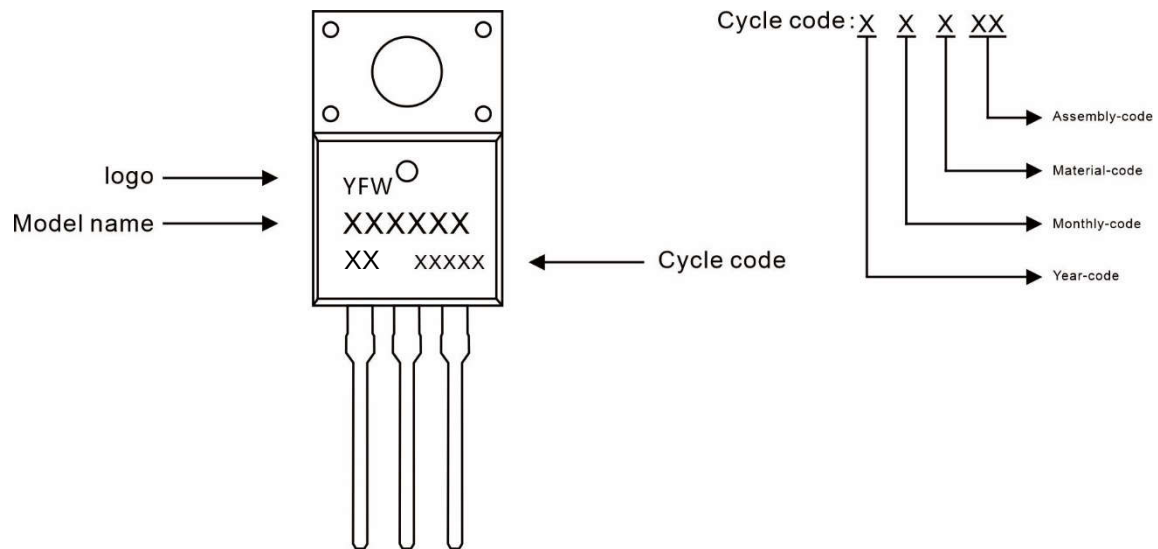


Figure 21. **Safe Operating Area**

Marking Diagram



Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWM318065AFG3	TO-220F	0.06oz(1.74g)	50pcs/tube	1000PCS/Box 5000PCS/Carton

Package Dimensions

TO-220F

Symbol	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.50	4.90	0.177	0.193
A1	2.34	2.74	0.092	0.108
A2	2.66	2.86	0.105	0.113
b	0.75	0.85	0.030	0.033
b1	1.24	1.44	0.049	0.057
c	0.40	0.60	0.016	0.024
D	10.00	10.32	0.394	0.406
E	15.75	16.05	0.620	0.632
e	2.44	2.64	0.096	0.104
e1	4.88	5.28	0.192	0.208
F	3.10	3.5	0.122	0.138
L	13.50	13.90	0.531	0.547
L1	2.90	3.30	0.114	0.130
Φ	3.10	3.30	0.122	0.130

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