

650V Silicon Carbide (SiC) MOSFET

MAIN CHARACTERISTICS

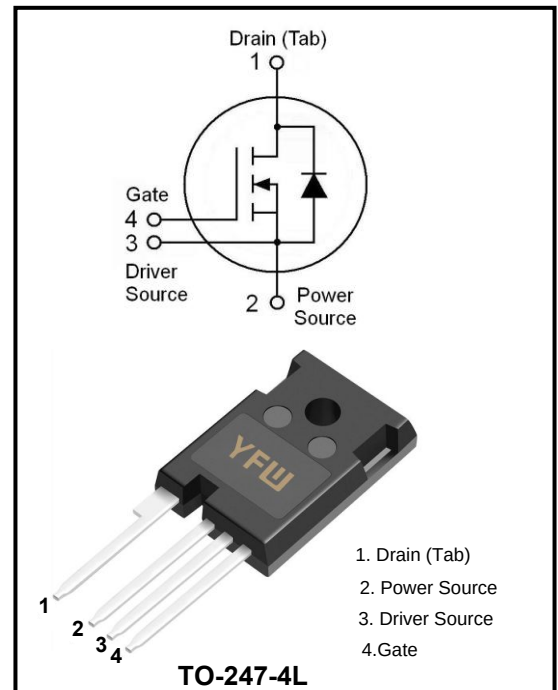
I_D	70A
V_{DSS}	650V
$R_{DS(on)-typ}(@V_{GS}=15V)$	$<41m\Omega$ (Typ: $30m\Omega$)

FEATURES

- ◆ 3rd generation SiC MOSFET technology
- ◆ Optimized package with separate driver source pin
- ◆ 8mm of creepage distance between drain and source
- ◆ High blocking voltage with low on-resistance
- ◆ High-speed switching with low capacitances
- ◆ Fast intrinsic diode with low reverse recovery (Q_{rr})

APPLICATIONS

- ◆ Motor Drives
- ◆ EV Charging Station
- ◆ High Voltage DC/DC Converters



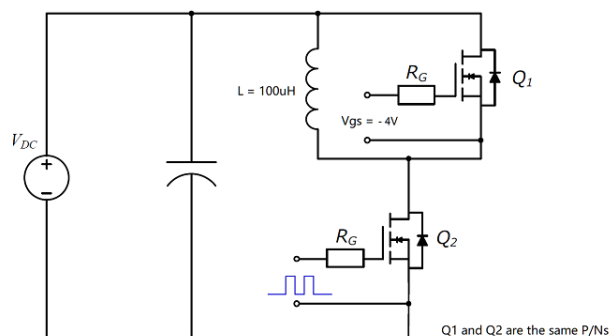
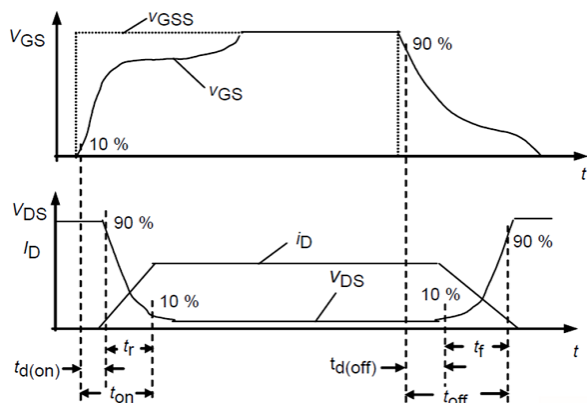
Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$, unless otherwise specified)

Characteristics	Symbols	Value	Units
Drain-Source Voltage	V_{DS}	650	V
Gate-source Voltage (dynamic) AC ($f > 1\text{Hz}$) Max	V_{GS}	-8 / +19	V
Gate source voltage (static)	V_{GSop}	-4 / +15	V
Continue Drain Current $V_{GS}=0, T_C=25^\circ\text{C}$ $V_{GS}=15V, T_C=100^\circ\text{C}$	I_D	70 49	A
Gate source voltage (static) pulse	I_D	217	A
Avalanche Capability $V_{DD}=100V, V_{GS}=15V, L=1\text{mH}$	E_{AS}	450	mJ
Avalanche Peak Current $V_{DD}=100V, V_{GS}=15V, L=1\text{mH}$	I_{AV}	30	A
Power Dissipation $T_C=25^\circ\text{C}$	P_D	246	W
Operating Temperature Range	T_J	175	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-40 to +175	$^\circ\text{C}$
Solder Temperature 1.6mm from case for 10s	T_L	260	$^\circ\text{C}$
Mounting Torque (M3 or 6-32 screw)	M_d	1 8.8	Nm Lbf-in
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.61	$^\circ\text{C/W}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	40	$^\circ\text{C/W}$

Note: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.
Absolute maximum ratings are stress ratings only and functional device operation is not implied.

Electrical Characteristics at Tc=25°C unless otherwise specified

Characteristics	Test Condition	Symbols	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=100\mu A$	BV_{DSS}	650	-	-	V
Drain-Source Leakage Current	$V_{DS}=650V, V_{GS}=0V$	I_{DSS}	-	1	50	μA
Gate Source Leakage current	$V_{GS}=15V, V_{DS}=0V$	I_{GSS}		1	200	nA
	$V_{GS}=-4V, V_{DS}=0V$	I_{GSS}		-1	-200	nA
Gate-Source Threshold Voltage	$V_{DS}=V_{GS}, I_D=10mA$	$T_J = 25^\circ C$	1.8	-	3.6	V
		$T_J = 150^\circ C$	-	2.0	-	
		$T_J = 175^\circ C$	-	1.9	-	
Drain-source on-state resistance	$V_{GS}=15V, I_D=30A$	$T_J = 25^\circ C$	-	30	41	m Ω
		$T_J = 150^\circ C$	-	37	-	m Ω
		$T_J = 175^\circ C$	-	41	-	m Ω
Forward Transconductance	$V_{DS}=20V, I_D=30A$	gfs	-	23	-	S
Input Capacitance	$V_{DS}=400V, V_{GS}=0V, f=1MHz$	C_{iss}	-	2550	-	pF
Output Capacitance		C_{oss}	-	215	-	
Reverse Transfer Capacitance		C_{rss}	-	6	-	
Coss stored energy		E_{oss}	-	21	-	μJ
Turn-on switching energy	$V_{DS}=400V, I_D=30A, V_{GS}=-4V/15V, R_{G(ext)}=2\Omega, L=200\mu H$	E_{on}	-	110	-	μJ
Turn off switching energy		E_{off}	-	15	-	μJ
Turn-on Delay Time		$t_{d(on)}$	-	14	-	ns
Rise Time		T_r	-	17	-	
Turn-Off Delay Time		$t_{d(OFF)}$	-	27	-	
Fall Time		t_f	-	7	-	
Total Gate Charge	$V_{DS}=400V, I_D=30A, V_{GS}=-4V/15V$	Q_g	-	111	-	nC
Gate to Source Charge		Q_{gs}	-	32	-	
Gate to Source Charge		Q_{gd}	-	41	-	
Diode forward voltage	$V_{GS}=-4V, I_{SD}=15A, T_J=25^\circ C$	V_{SD}	-	4.5	-	V
	$V_{GS}=-4V, I_{SD}=30A, T_J=150^\circ C$		-	4.7	-	
Diode forward current	$V_{GS}=-4V$	I_S	-	-	41	A
Reverse recovery time	$V_{GS}=-4V, I_{SD}=30A, V_R=400V, di/dt=3300A/\mu s$	trr	-	15	-	nS
Reverse recovery charge		Q_{rr}	-	198	-	μC
Peak reverse recovery current		I_{rrm}	-	23	-	A

Switching Times Definition and Test Circuit


Typical Characteristics

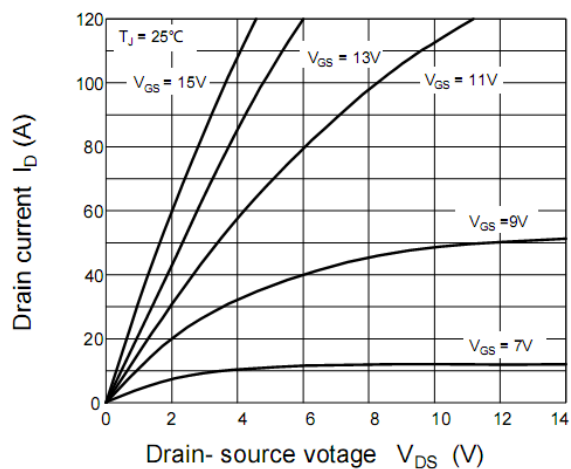


Figure 1. On Region Characteristics

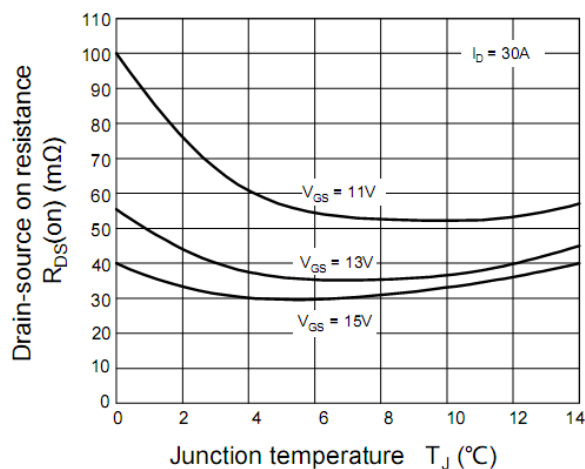


Figure 2. On-Resistance vs. Temperature

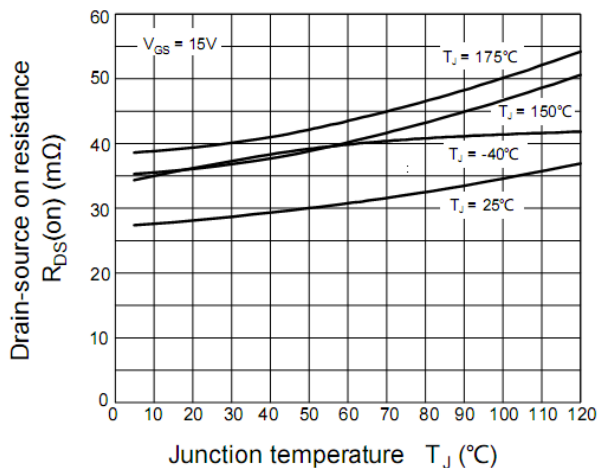


Figure 3. On-Resistance vs. Drain Current For Various Temperature

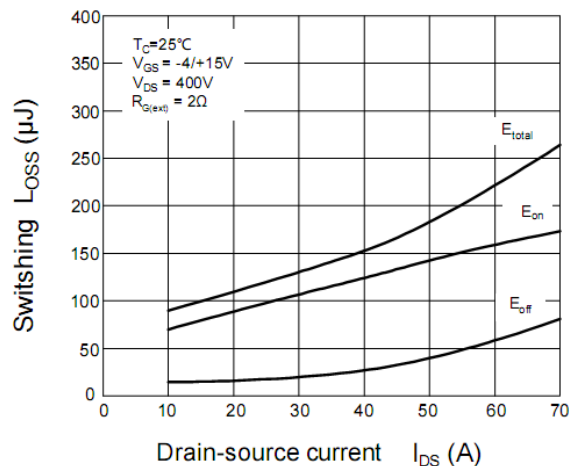


Figure 4. Switching energy vs Drain current

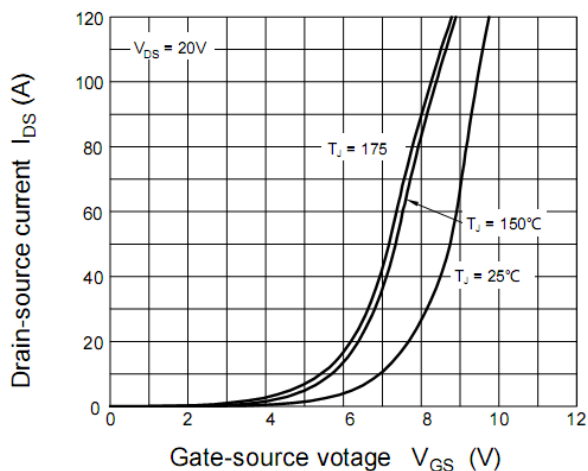


Figure 5. Transfer Characteristic

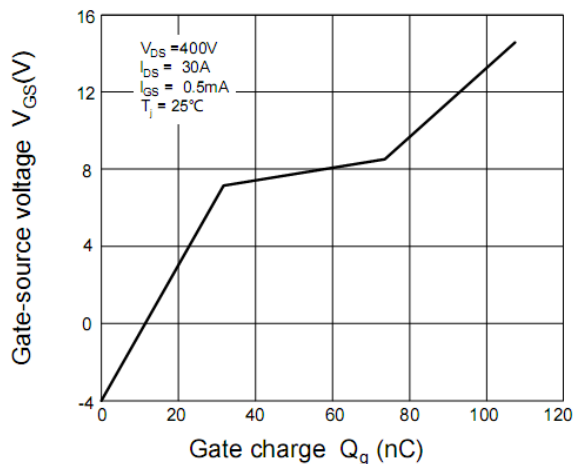


Figure 6. Gate Charge Characteristics

Typical Characteristics

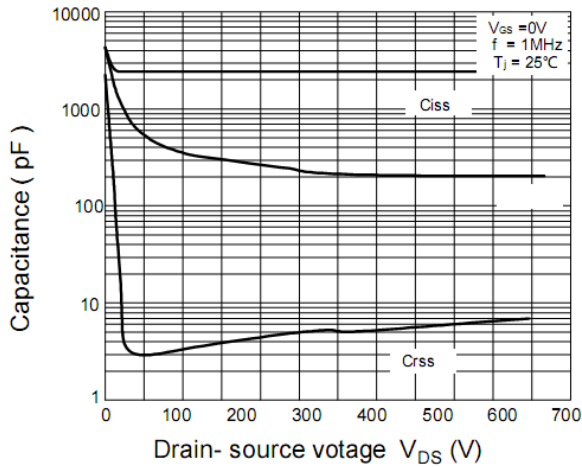


Figure 7. Capacitance vs Drain to Source Voltage

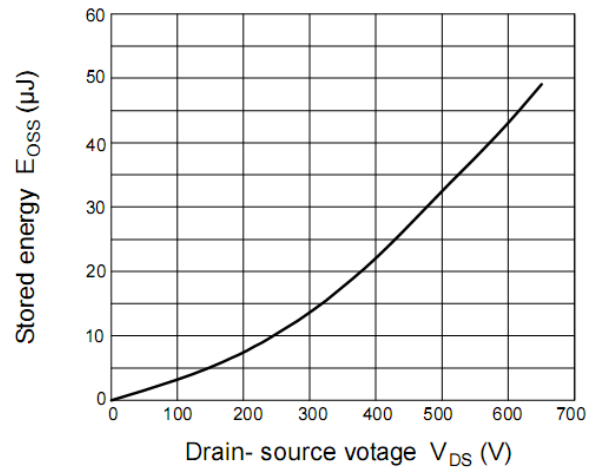


Figure 8. Output Capacitor Stored Energy

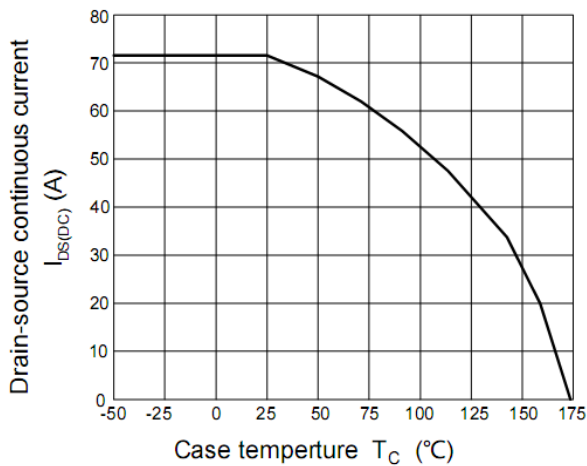


Figure 9. Continuous Drain Current vs Case Temperature

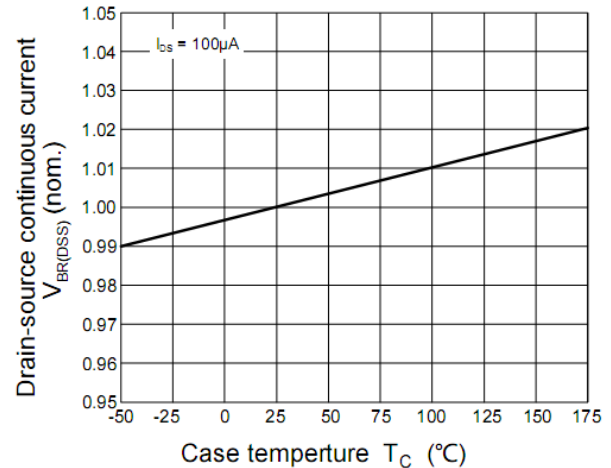


Figure 10. Normalized breakdown voltage vs Temperature

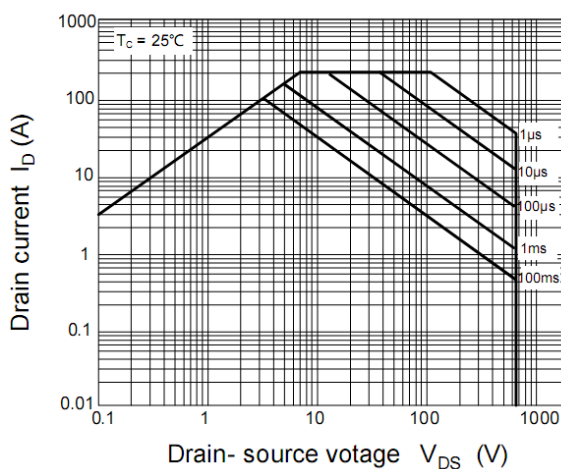


Figure 11. Safe Operating Area

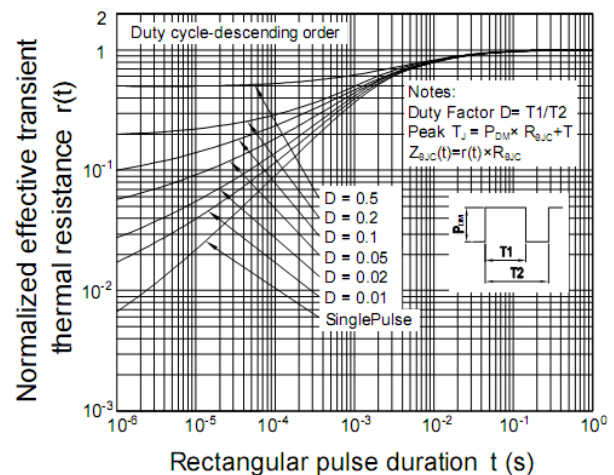
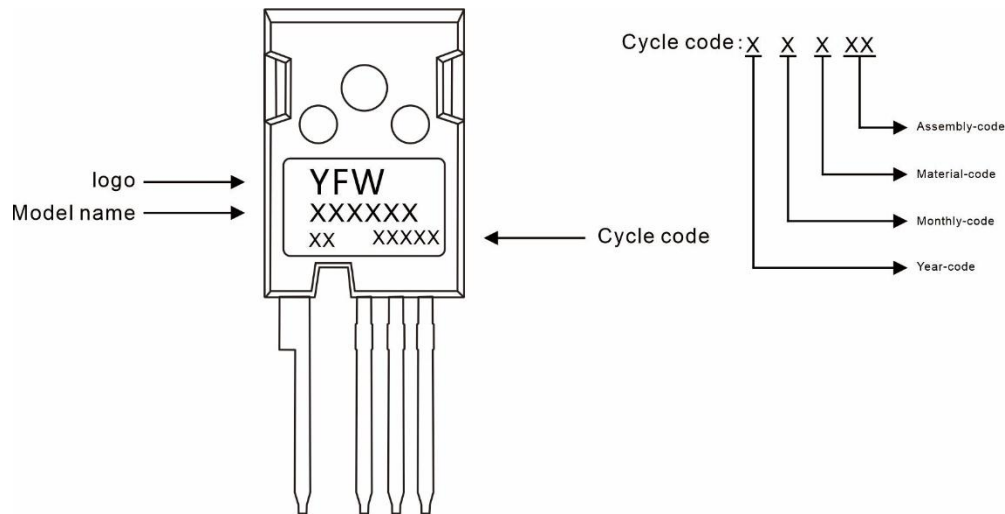


Figure 10. Junction- case Transient Thermal Response Curve

Marking Diagram



Ordering information

Model name	Package	Unit Weight	Base Quantity	Packing Quantity
YFWM303065APG3	TO-247-4L	0.242oz(6.85g)	30pcs/tube	600PCS/Box 2400PCS/Carton

Package Dimensions

TO-247-4L

Symbol	Dimensions in mm		Dimensions in Inch	
	Min.	Max.	Min.	Max.
A	4.90	5.10	0.193	0.201
A1	1.90	2.10	0.075	0.083
A2	2.29	2.54	0.090	0.100
b	1.07	1.33	0.042	0.052
b1	1.20	1.50	0.047	0.059
B2	2.40	2.80	0.094	0.110
B3	2.40	2.69	0.094	0.106
c	0.55	0.68	0.022	0.027
D	15.77	16.03	0.621	0.631
D1	11.60	12.00	0.457	0.472
D2	2.40	2.70	0.094	0.106
E	23.30	23.70	0.917	0.933
e	2.54(BSC)		0.100(BSC)	
e1	5.08(BSC)		0.200(BSC)	
F	6.05	6.25	0.238	0.246
F1	5.50	5.90	0.217	0.232
F2	9.30	9.70	0.366	0.382
L	17.20	17.60	0.677	0.693
L1	4.05	4.35	0.159	0.171
L2	2.35	2.65	0.093	0.104
Φ	3.50	3.70	0.138	0.146

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