

Silicon Carbide Power MOSFET 650V N-Channel MOS

■ Applications

- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications

■ Features

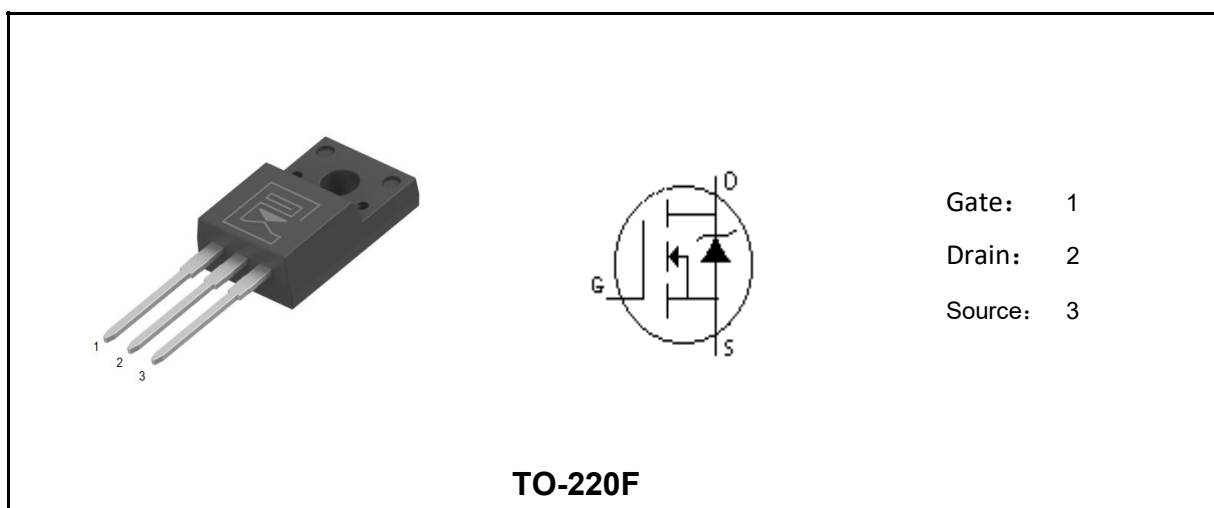
- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

■ Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

■ Product Summary

V_{DS}	650	V
I_D	11	A
$R_{DS(ON)}$, Typ@18V	140	mΩ
Q_g	29	nC



Marking	Package	Packaging	Min. package quantity
MF3C180R065	TO-220F	Tube	1000



**■ Absolute Maximum Ratings (Tc=25°C unless otherwise noted)**

Parameter	Symbol	Ratings	Unit
Drain-Source Voltage	V_{DS}	650	V
Gate-Source Voltage	V_{GS}	- 10/+22	V
Recommended operational values	V_{GSop}	0/+18	V
Continuous Drain Current Tc=25°C V_{GS} =18V (Note 1)	I_D	11	A
Continuous Drain Current Tc=100°C V_{GS} =18V (Note 1)		8	A
Drain Current-Pulsed (Note 1)	I_{DM}	22	A
Total Dissipation	P_D	25	W
Junction Temperature	T_j	175	°C
Storage Temperature	T_{stg}	- 55~175	°C

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

■ Thermal Characteristics

Parameter	Symbol	Max	Unit
Maximum Junction-to-Case	$R_{\theta JC}$	6	°C/W
Maximum Junction-to-Ambient	$R_{\theta JA}$	80	°C/W

Note 1: Ensure that the channel temperature does not exceed 175°C.

Note: This transistor is sensitive to electrostatic discharge and should be handled with care.





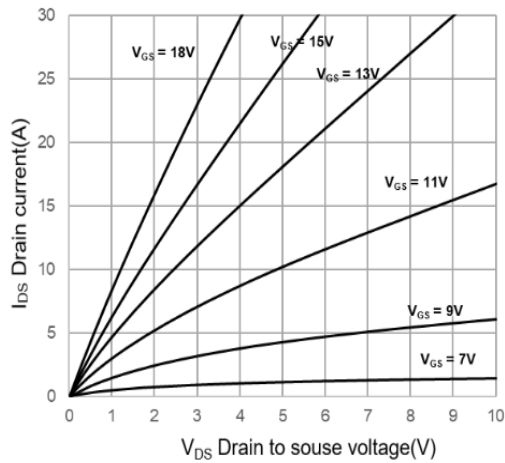
■ Electrical Characteristics (Tc=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Static Parameters						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =500uA	650	-	-	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	-	-	1	uA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =18V, V _{DS} =0V	-	-	100	nA
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} = V _{DS} , I _{DS} =5mA	3.0	3.8	5.0	V
Drain-Source On Resistance	R _{DS(ON)}	V _{GS} =15V, I _D =10A	-	200	240	mR
		Tj=175℃	-	180	-	
		V _{GS} =18V, I _D =10A	-	140	180	
		Tj=175℃	-	160	-	
Transconductance	g _{fs}	V _{GS} =20V, I _D =10A	-	1.6		S
Dynamic Characteristics						
Input Capacitance	C _{iss}	V _{DS} =25V, V _{GS} =0V, f=1.0MHz	-	503	-	pF
Output Capacitance	C _{oss}		-	141	-	pF
Reverse Transfer Capacitance	C _{rss}		-	10	-	pF
Gate Resistance	R _g	V _{DS} =0V, V _{GS} =0V, f=1.0MHz	-	2.9	-	Ω
Switching Paramters						
Turn-On Delay Time	t _{d(on)}	V _{DD} =500V, V _{GS} =0/15 V I _D = 8.5A, R _{G(ext)} =10Ω	-	15	-	ns
Turn-On Rise Time	t _r		-	55	-	ns
Turn-Off Delay Time	t _{d(off)}		-	32	-	ns
Turn-Off Fall Time	t _f		-	70	-	ns
Turn-On Switching Energy	E _{ON}		-	57	-	uJ
Turn-Off Switching Energy	E _{OFF}		-	7.3	-	
Total Gate Charge	Q _g	V _{DD} =500V, V _{GS} =0/15 V I _D =8.5A	-	29	-	nC
Gate-Source Charge	Q _{gs}		-	8.2	-	nC
Gate-Drain Charge	Q _{gd}		-	14.1	-	nC
Source-Drain Characteristics						
Diode Forward Voltage	V _{sd}	V _{GS} =0V, I _{SD} =5 A,	-	3.4	-	V
Continuous Diode Forward Current	I _S	T _C =25℃	-	12	-	A
Reverse Recovery Time	t _{rr}	VR=400V, IF=20A, di/dt=100A/us	-	26	-	ns
Reverse Recovery Charge	Q _{rr}		-	19.5	-	nC
Peak Reverse Recovey Current	I _{mm}		-	1.5	-	A

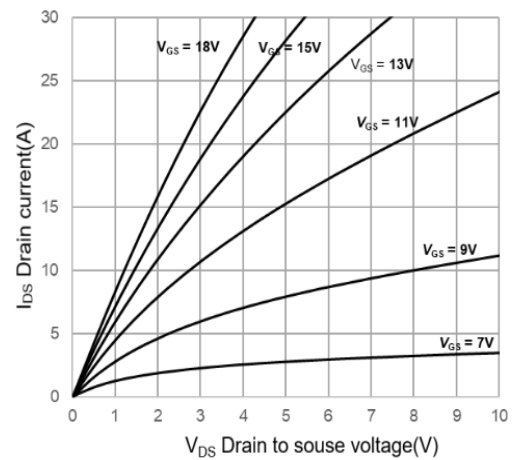




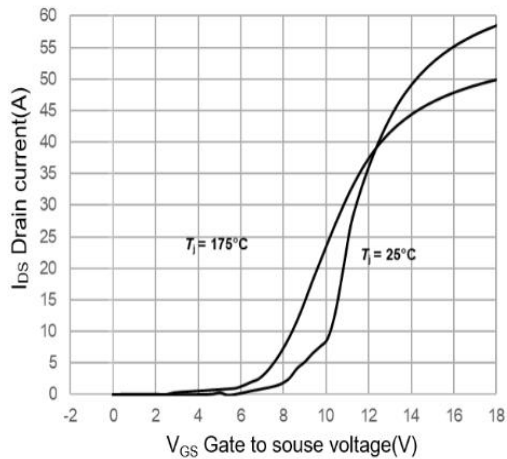
■ Characteristics Curves



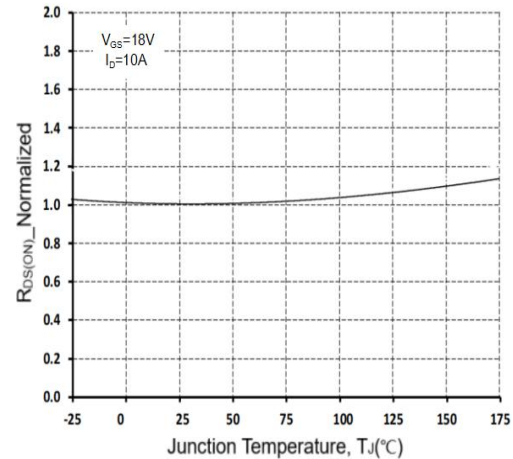
Output Characteristics $T_J = 25^\circ\text{C}$



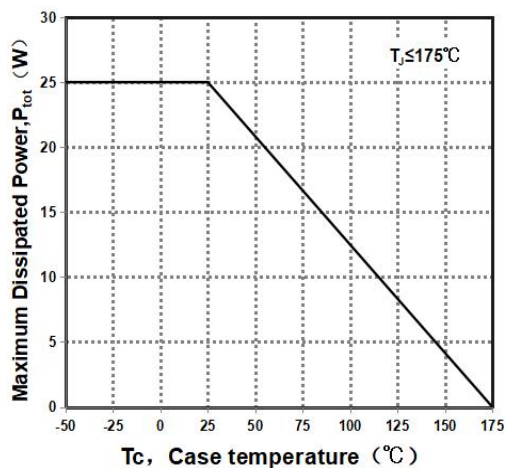
Output Characteristics $T_J = 175^\circ\text{C}$



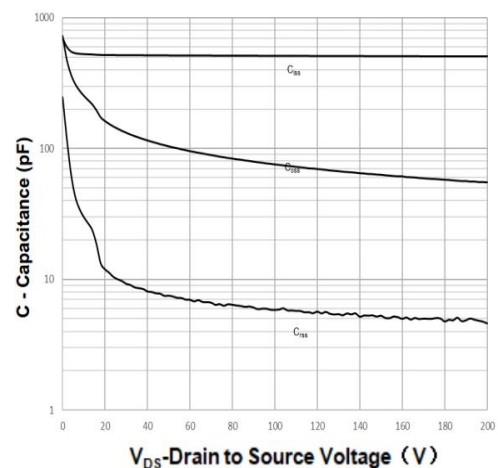
Transfer Characteristics



Normalized On-Resistance vs. Temperature

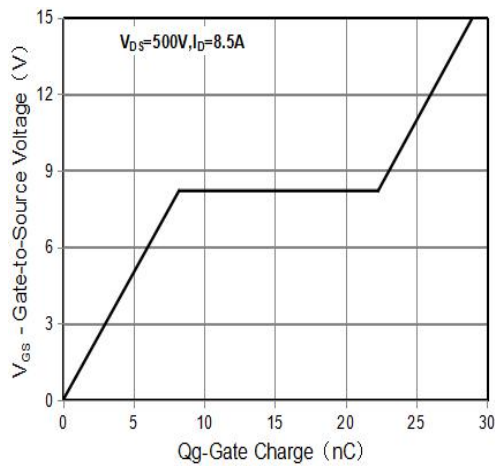


Power Dissipation Derating

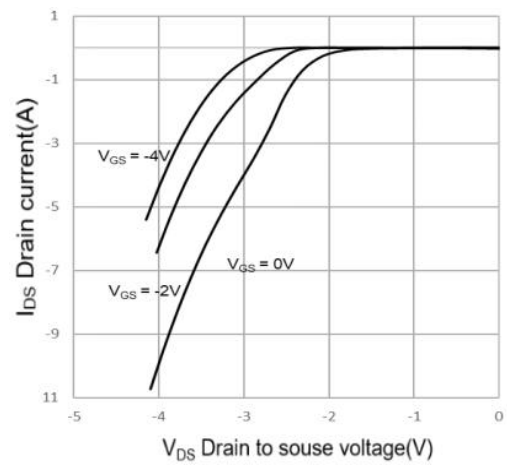


Capacitance

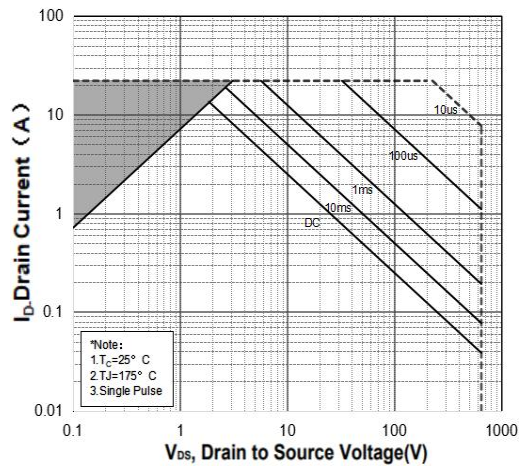




Gate Charge Waveform



Source-Drain Diode Characteristics, $T_J = 25^\circ C$



Safe Operating Area

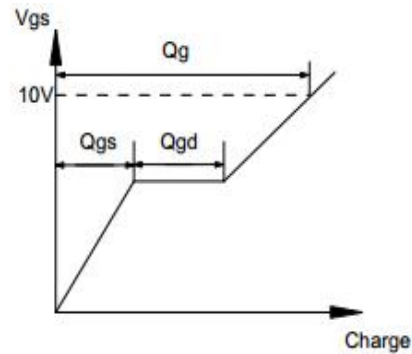
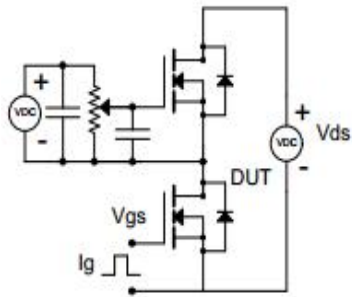
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



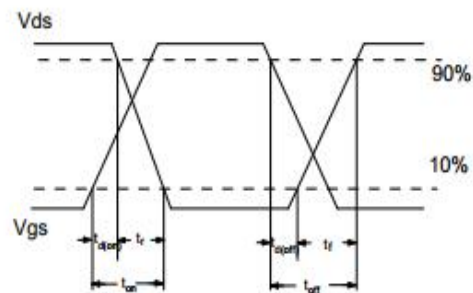
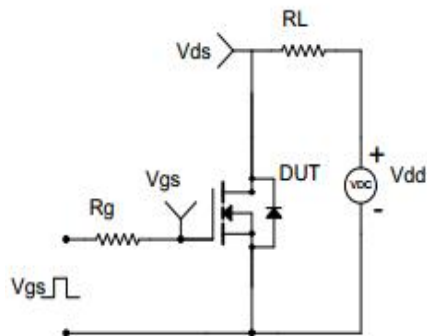


■ Test Circuit & Waveform

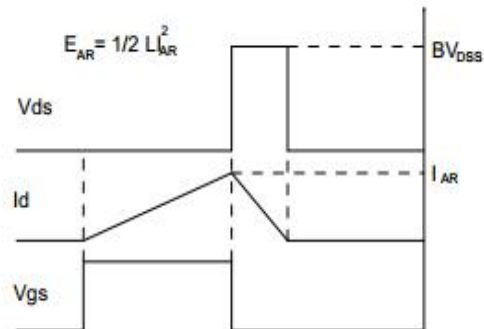
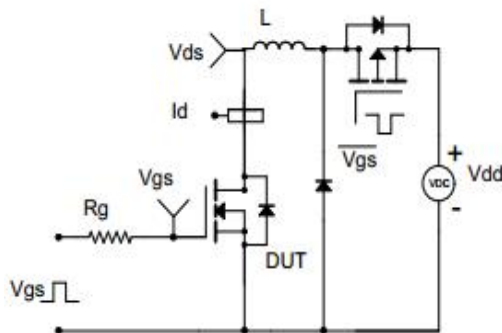
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching (UIS) Test Circuit & Waveform



**■ TO-220F Package Dimensions**

Unit: mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.5		4.9	e	2.44	2.54	2.64
A1	2.3		2.9	L	12.5		14.3
b	0.65		0.9	L1	9.45		10.05
b1	1.2		1.4	L2	15		16
c	0.35		0.65	L3	3.2		4.4
D	14.5		16.5	L4	0.7		0.9
D1	6.1		6.9	ΦP	3		3.3
E	9.6		10.3	Q	2.5		2.9
E1	6.5	7	7.5				

