9N20
N-Channel Enhancement Mode MOSFET

V_{DSS}	200V
I_D	9 A
$R_{DS(ON)}$	216mΩ

FEATURES

V_{DS} = 200V I_D =9A

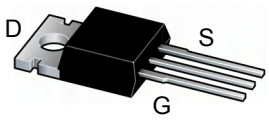
$R_{DS(ON)}$ < 270mΩ @ V_{GS}=10V

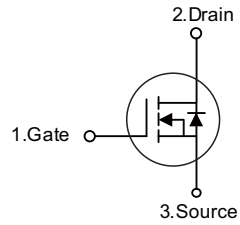
APPLICATION

Battery protection

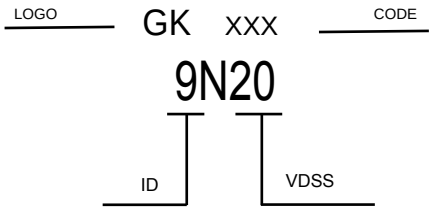
Load switch

Uninterruptible power supply









MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

Maximum ratings (T_a=25℃ unless otherwise noted)

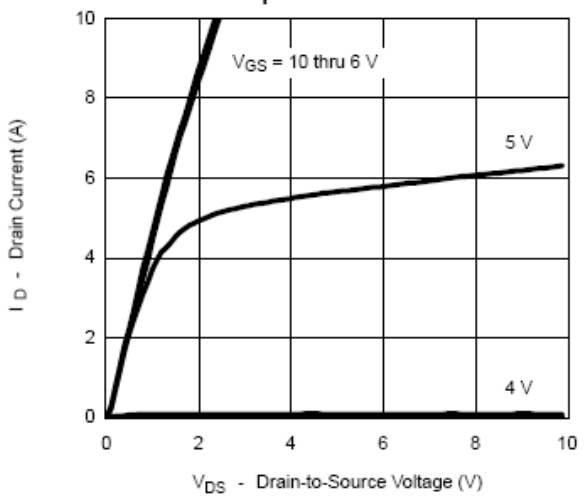
Symbol	Parameter	Rating	Units
V_{DS}	Drain-Source Voltage	200	V
V_{GS}	Gate-Source Voltage	±20	V
I_D@T_C=25℃	Continuous Drain Current, V_{GS} @ 10V[1]	9	A
I_D@T_C=100℃	Continuous Drain Current, V_{GS} @ 10V[1]	5.2	A
I_{DM}	Pulsed Drain Current[2]	10	A
EAS	Single Pulse Avalanche Energy[3]	2.45	mJ
I_{AS}	Avalanche Current	7	A
P_D@T_C=25℃	Total Power Dissipation[4]	60	W
T_{STG}	Storage Temperature Range	-55 to 150	℃
T_J	Operating Junction Temperature Range	-55 to 150	℃
$R_{\theta JA}$	Thermal Resistance Junction-ambient (Steady State)[1]	40	℃/W
$R_{\theta JC}$	Thermal Resistance Junction-Case[1]	2.5	℃/W

Electrical characteristics (T_J=25℃ unless otherwise noted)

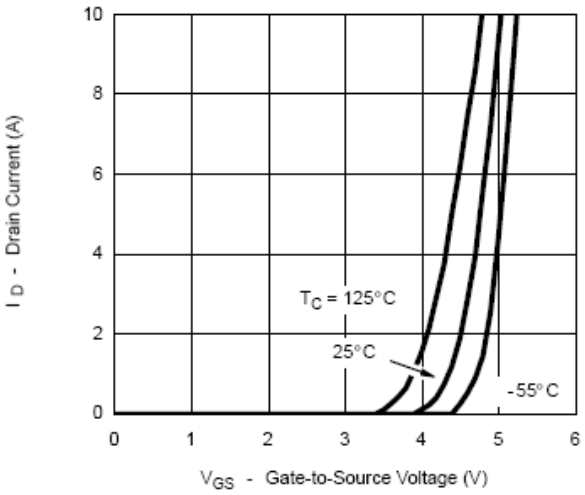
Parameter	Symbol	Test conditions	MIN	TYP	MAX	UNIT
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{DS}=0V,I_D=250μA	200	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=160V, V_{GS}=0V	-	-	1	μA
		V_{DS}=160V,V_{GS}=0V,T_J=125℃			50	
		V_{DS}=160V,V_{GS}=0V,T_J=175℃			250	
Gate-body Leakage	I_{GSS}	V_{DS}=0V, V_{GS}=±20V	-	-	±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	2	-	4	V
On-State Drain Currenta	$I_{D(on)}$	VDS ≥5 V, VGS =10 V	10	-	-	A
Static drain-Source On-resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=5A	-	0.216	0.270	Ω
		V_{GS}=10V,I_D=5A,T_J=125℃	-	-	0.54	
		V_{GS}=10V,I_D=5A,T_J=175℃	-	-	0.71	
		V_{GS}=6V,I_D=5A	-	0.24	0.3	
Forward Transconductance	g_{fs}	V_{DS}=15V,I_D=5A	-	15	-	S
Input Capacitance	C_{ISS}	V_{DS}=25V,V_{GS}=0V,f=1MHz	-	580	-	pF
Output Capacitance	C_{OSS}		-	75	-	
Reverse Transfer Capacitance	C_{RSS}		-	30	-	
Turn-On Delay Time	$t_{D(ON)}$	V_{DD} = 100V, I_D=10A R_L= 10ΩR_G= 2.5Ω,V_{GEN}=10V	-	10	15	ns
Rise Time	t_R		-	35	55	
Turn-Off Delay Time	$t_{D(OFF)}$		-	25	40	
Fall Time	t_F		-	40	60	
Total Gate Charge	Q_g	V_{DS}=100V,V_{GS}=10V I_D=10A	-	11	70	nC
Gate-source Charge	Q_{gs}		-	2.7	-	nC
Gate-drain Charge	Q_{gd}		-	4	-	nC
Reverse Recovery Time	Trr	I_F=10A dIF/dt=100A/μs	-	100	150	ns
Reverse Recovery Charge	Qrr		-	0.25	0.6	μC
Reverse Recovery Current	I_{RM}		-	5	8	A
Continuous Current	I_S		-	-	9	A
Pulsed Current	I_{SM}				10	A
Forward Voltagea	V_{SD}	I_F = 10 A, V_{GS} = 0 V		0.9	1.5	V

RATING AND CHARACTERISTIC CURVES

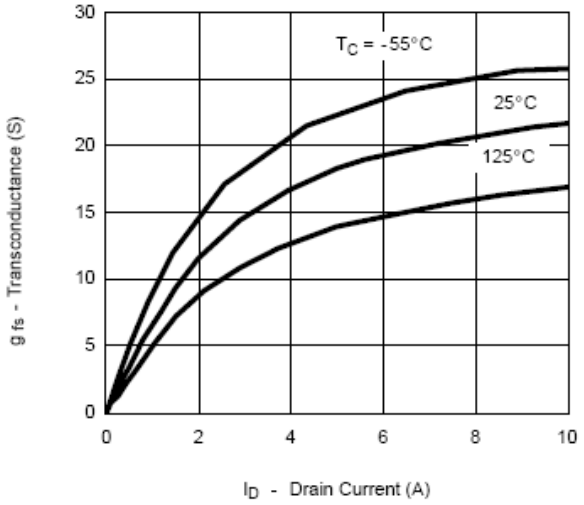
Output Characteristics



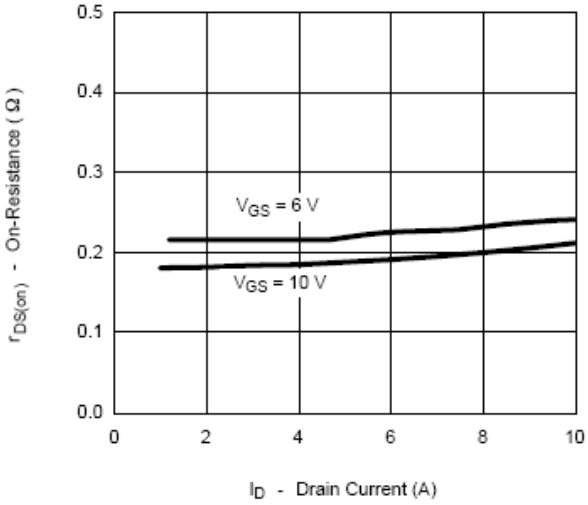
Transfer Characteristics



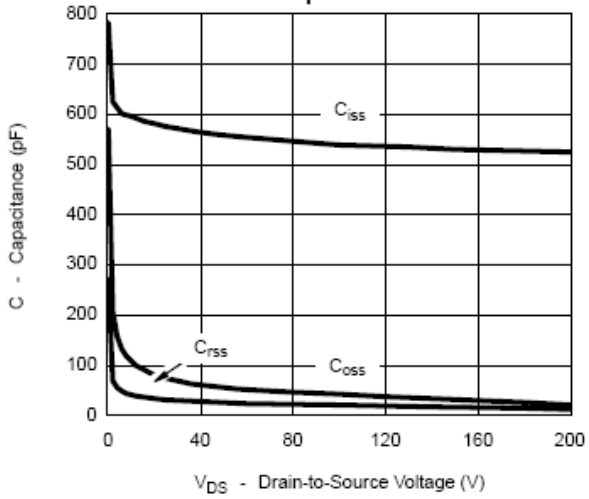
Transconductance



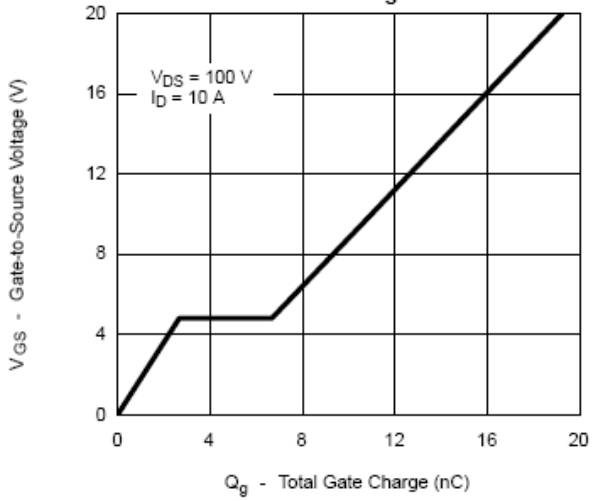
On-Resistance vs. Drain Current



Capacitance

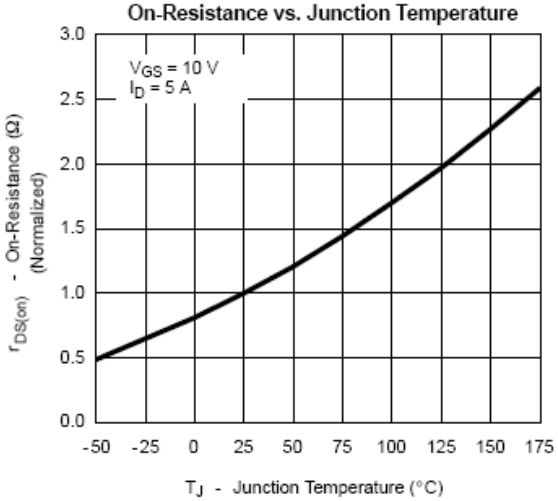


Gate Charge

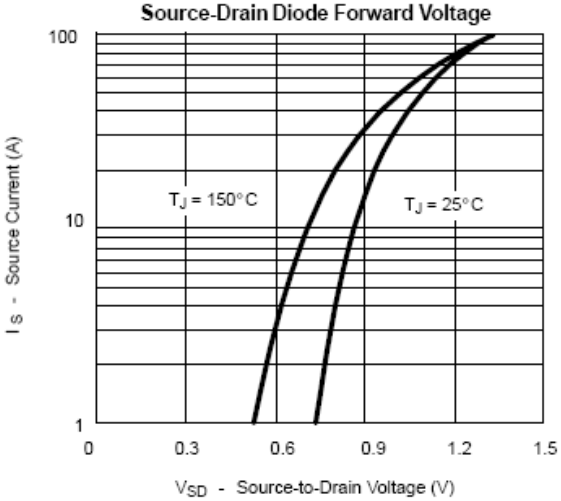


RATING AND CHARACTERISTIC CURVES

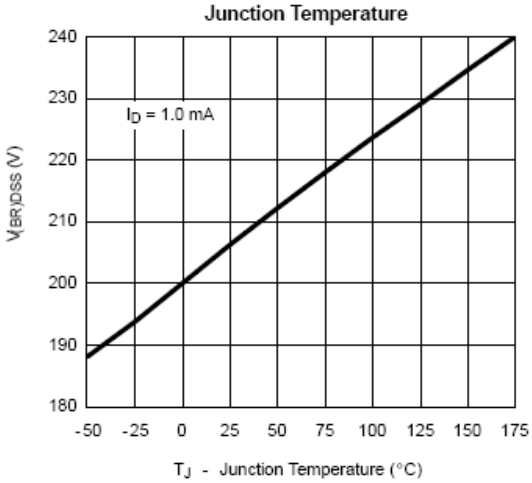
On-Resistance vs. Junction Temperature



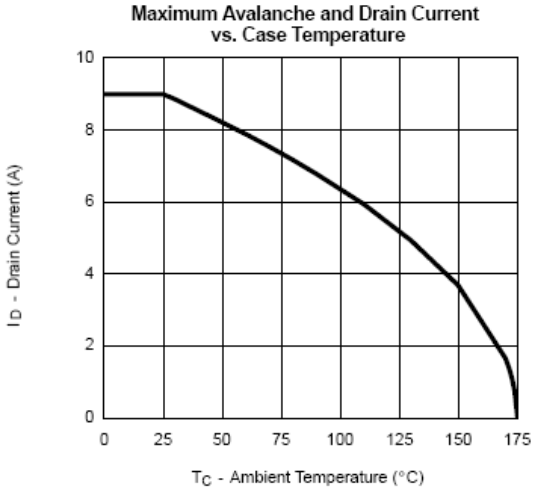
Source-Drain Diode Forward Voltage

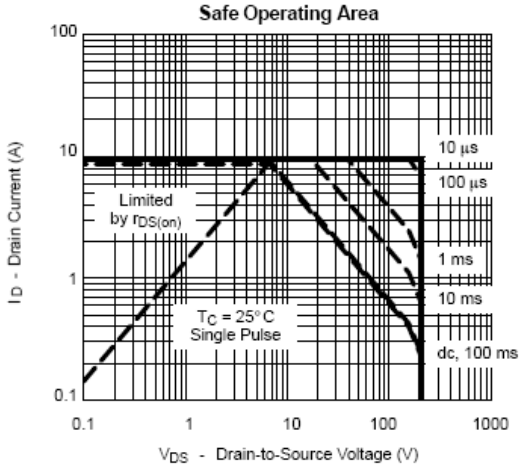


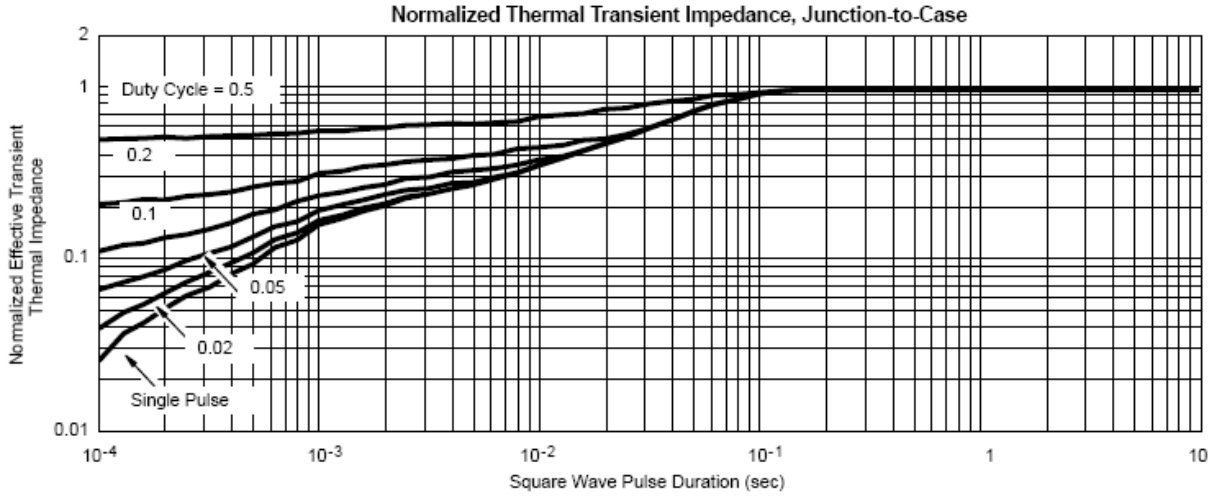
Drain Source Breakdown vs. Junction Temperature



RATING AND CHARACTERISTIC CURVES



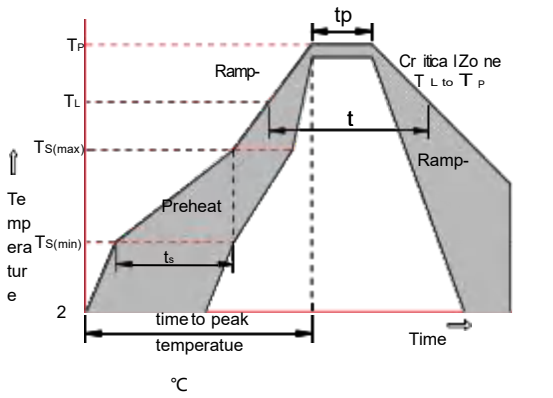




Soldering parameters

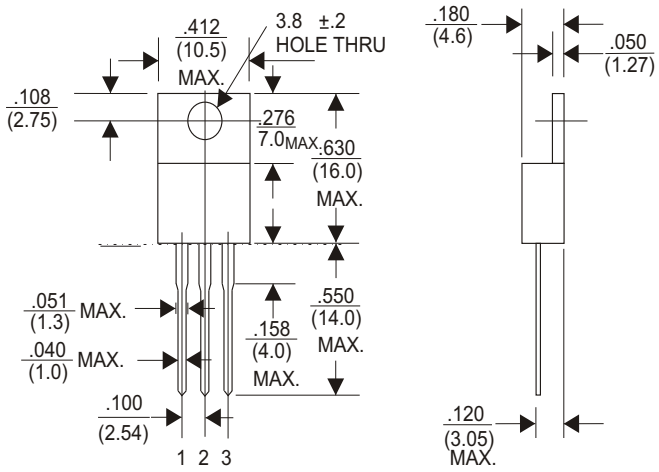
Reflow Condition		Pb-Free assembly (see as bellow)
Pre Heat	-Temperature Min ($T_{s(min)}$)	+150℃
	-Temperature Max($T_{s(max)}$)	+200℃
	-Time (Min to Max) (ts)	60-180 secs.
Average ramp up rate (Liquid us Temp (T_L) to peak)		3℃/sec. Max
$T_{s(max)}$ to T_L - Ramp-up Rate		3℃/sec. Max
Reflow	-Temperature(T_L)(Liquid us)	+217℃
	-Temperature(t_L)	60-150 secs.
Peak Temp (T_p)		+260(+0/-5)℃
Time within 5℃ of actual Peak Temp (t_p)		30 secs. Max
Ramp-down Rate		6℃/sec. Max
Time 25℃ to Peak Temp (T_P)		8 min. Max
Do not exceed		+260℃

FIG5: Reflow condition



Package Dimensions & Suggested Pad Layout

TO-220



Dimensions in inches and (millimeters)

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