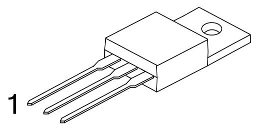
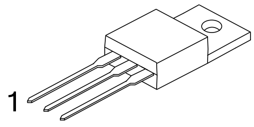
22A, 200V N-CHANNEL POWER MOSFET



TO-220



TO-220F

■ DESCRIPTION

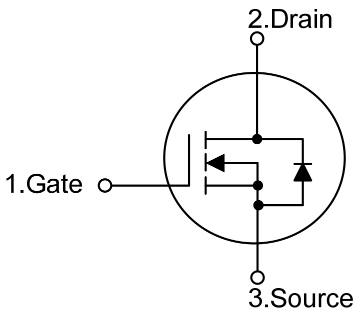
The UTC **22N20** is an N-channel enhancement mode power MOSFET using UTC's advanced technology to provide customers with planar stripe and DMOS technology. This technology is specialized in allowing a minimum on-state resistance and superior switching performance. It also can withstand high energy pulse in the avalanche and commutation mode.

The UTC **22N20** is universally applied in low voltage such as automotive, high efficiency switching for DC/DC converters and DC motor control.

■ FEATURES

* Fast switching
* $R_{DS(on)}$ < 0.14Ω @ V_{GS} = 10 V, I_D=11A
* Typically 20nC low gate charge
* 100% avalanche tested
* Typically 25pF Low C_{RSS}
* Improved dv/dt capability

■ SYMBOL



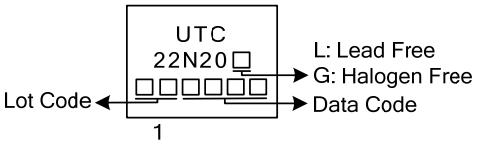
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
22N20L-TA3-T	22N20G-TA3-T	TO-220	G	D	S	Tube
22N20L-TF3-T	22N20G-TF3-T	TO-220F	G	D	S	Tube

Note: Pin Assignment: G: Gate D: Drain S: Source

22N20L-TA3-T	
(1)Packing Type	(1) R: Tape Reel
(2)Package Type	(2) TA3: TO-220, TF3: TO-220F
(3)Green Package	(3) L: Lead Free, G: Halogen Free and Lead Free

■ MARKING



■ ABSOLUTE MAXIMUM RATINGS (T_C=25°C, unless otherwise specified)

PARAMETER			SYMBOL	RATINGS	UNIT
Drain-Source Voltage			V_{DSS}	200	V
Gate-Source Voltage			V_{GSS}	±30	V
Drain Current	Continuous (T_C=25°C)		I_D	22	A
	Pulsed (Note 2)		I_{DM}	88	A
Avalanche Energy	Single Pulsed (Note 3)		E_{AS}	250	mJ
Power Dissipation (T_C=25°C)		TO-220	P_D	156	W
		TO-220F		50	
Derate above 25°C		TO-220		1.25	W/°C
		TO-220F		0.4	
Junction Temperature			T_J	+150	°C
Storage Temperature			T_{STG}	-55 ~ +150	°C

Notes: 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.
2. Repetitive Rating: Pulse width limited by maximum junction temperature.
3. L = 0.85mH, I_{AS} = 21A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		θ_{JA}	62.5	°C/W
Junction to Case	TO-220	θ_{JC}	0.8	°C/W
	TO-220F		2.5	

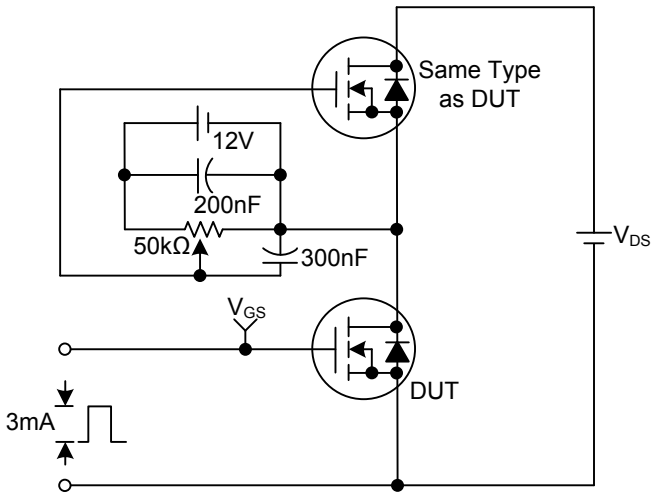
■ ELECTRICAL CHARACTERISTICS (T_C=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V	200			V
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	Reference to 25°C, I_D=250μA		0.25		V/°C
Drain-Source Leakage Current		I_{DSS}	V_{DS}=200V, V_{GS}=0V			1	μA
			V_{DS}=160V, T_C=125°C			10	
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=+30V, V_{DS}=0V			+100	nA
	Reverse		V_{GS}=-30V, V_{DS}=0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=11A		0.12	0.14	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		1700	2200	pF
Output Capacitance		C_{OSS}			220	290	pF
Reverse Transfer Capacitance		C_{RSS}			30	40	pF
SWITCHING PARAMETERS							
Total Gate Charge		Q_G	V_{GS}=10V, V_{DS}=160V, I_D=22A (Note 1, 2)		27	35	nC
Gate to Source Charge		Q_{GS}			5.8		nC
Gate to Drain Charge		Q_{GD}			11.2		nC
Turn-ON Delay Time		$t_{D(ON)}$	V_{DD}=100V, I_D=22A, R_G=25Ω (Note 1, 2)		35	80	ns
Rise Time		t_R			300	610	ns
Turn-OFF Delay Time		$t_{D(OFF)}$			130	270	ns
Fall-Time		t_F			180	370	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				22	A
Maximum Body-Diode Pulsed Current		I_{SM}				88	A
Drain-Source Diode Forward Voltage		V_{SD}	I_S=22A, V_{GS}=0V			1.5	V

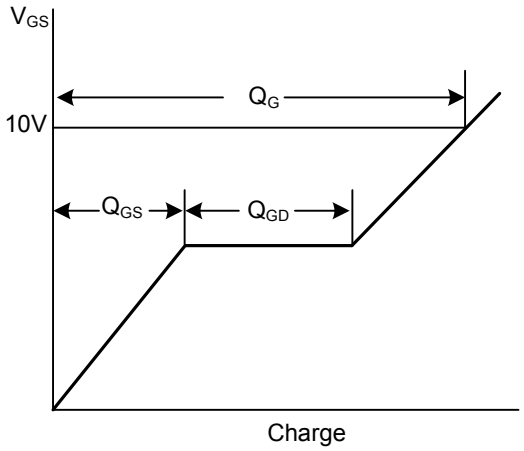
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

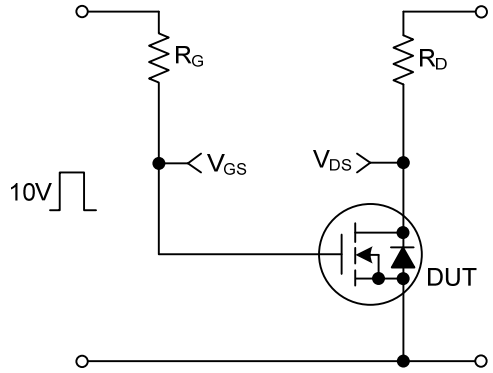
Gate Charge Test Circuit



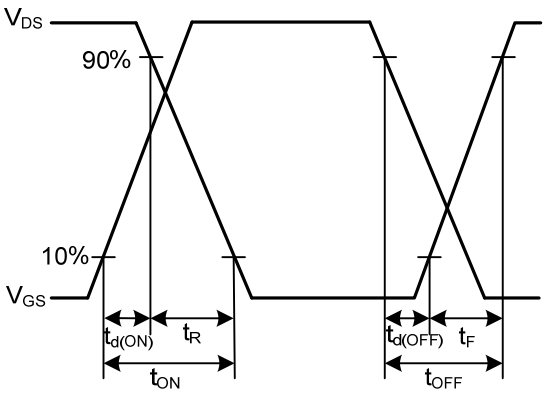
Gate Charge Waveforms



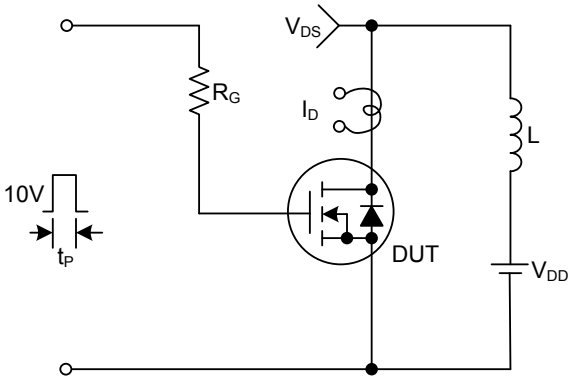
Resistive Switching Test Circuit



Resistive Switching Waveforms

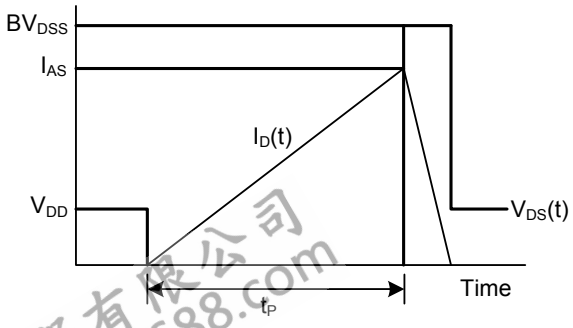


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

$$E_{AS}=\frac{1}{2}LI_{AS}^{2}\frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$



■ TEST CIRCUITS AND WAVEFORMS (Cont.)

Peak Diode Recovery dv/dt Test Circuit & Waveforms