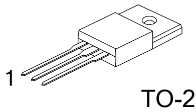
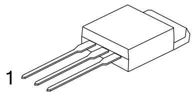
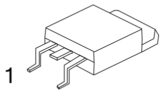
500V N-CHANNEL POWER MOSFET



TO-220F



TO-262



TO-252

■ DESCRIPTION

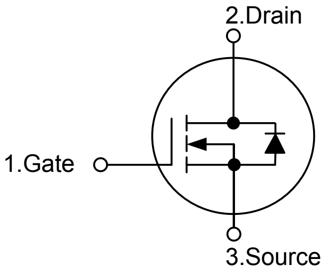
The UTC **5N50** is an N-channel MOSFET adopting UTC's advanced technology to provide customers with DMOS, planar stripe technology. This technology is designed to meet the requirements of the minimum on-state resistance and perfect switching performance. It also can withstand high energy pulse in the avalanche and communication mode.

The UTC **5N50** can be used in applications, such as active power factor correction, high efficiency switched mode power supplies, electronic lamp ballasts based on half bridge topology.

■ FEATURES

* 5A, 500V, $R_{DS(on)}$ = 1.4Ω @V_{GS} = 10 V
* 100% avalanche tested
* High switching speed

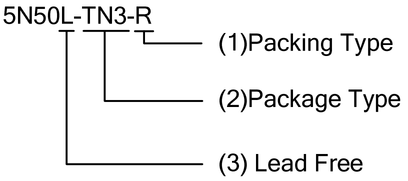
■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5N50L-TF3-T	5N50G-TF3-T	TO-220F	G	D	S	Tube
5N50L-TN3-R	5N50G-TN3-R	TO-252	G	D	S	Tape Reel
5N50L-T2Q-T	5N50G-T2Q-T	TO-262	G	D	S	Tube

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



(1) R: Tape Reel, T: Tube

(2) TF3: TO-220F, TN3: TO-252, T2Q: TO-262

(3) G: Halogen Free, L: Lead Free

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	500	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current	Continuous	I_D	5	A
	Pulsed (Note 1)	I_{DM}	20	A
Avalanche Current (Note 1)		I_{AR}	5	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	300	mJ
	Repetitive (Note 1)	E_{AR}	7.3	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation	TO-220F	P_D	38	W
	TO-252		54	W
	TO-262		125	W
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-55~+150	°C

Note : 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.

■ THERMAL CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F	θ_{JA}	62.5	°C/W
	TO-252		110	°C/W
	TO-262		62.5	°C/W
Junction to Case	TO-220F	θ_{JC}	3.25	°C/W
	TO-252		2.13	°C/W
	TO-262		1	°C/W

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

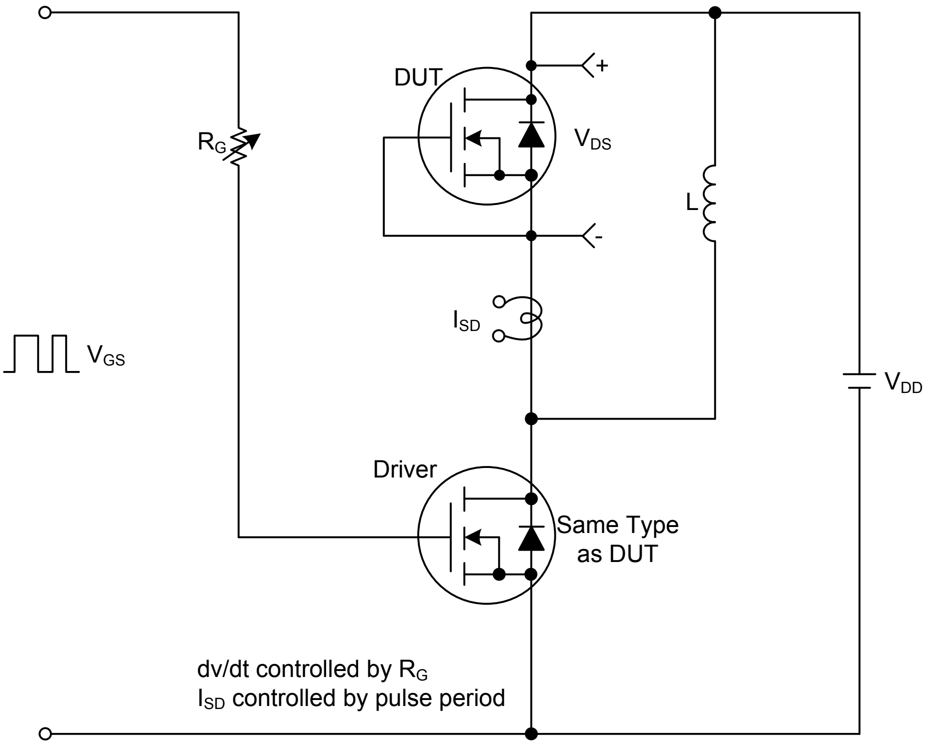
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	I_D=250μA, V_{GS}=0V	500			V
Breakdown Voltage Temperature Coefficient	$\triangle BV_{DSS}/\triangle T_J$	Reference to 25°C, I_D=250μA		0.5		V/°C
Drain-Source Leakage Current	I_{DSS}	V_{DS}=500V, V_{GS}=0V			1	μA
		V_{DS}=400V, 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=2.5A		1.14	1.4	Ω
Forward Transconductance (Note 4)	g_{FS}	V_{DS}=40V, I_D=2.5A		5.2		S
DYNAMIC PARAMETERS						
Input Capacitance	C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		480	625	pF
Output Capacitance	C_{OSS}			80	105	pF
Reverse Transfer Capacitance	C_{RSS}			15	20	pF
SWITCHING PARAMETERS						
Total Gate Charge (Note 4,5)	Q_G	V_{GS}=10V, V_{DS}=400V, I_D=5A		18	24	nC
Gate to Source Charge (Note 4,5)	Q_{GS}			2.2		nC
Gate to Drain Charge (Note 4,5)	Q_{GD}			9.7		nC
Turn-ON Delay Time (Note 4,5)	$t_{D(ON)}$	V_{DD}=250V, I_D=5A, R_G=25Ω		12	35	ns
Rise Time (Note 4,5)	t_R			46	100	ns
Turn-OFF Delay Time (Note 4,5)	$t_{D(OFF)}$			50	110	ns
Fall-Time (Note 4,5)	t_F			48	105	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Continuous Drain-Source Diode Forward Current	I_S				5	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				20	A
Drain-Source Diode Forward Voltage	V_{SD}	I_S=5A, V_{GS}=0V			1.4	V
Reverse Recovery Time (Note 4)	t_{RR}	I_S=5A, V_{GS}=0V, dI_F/dt=100A/μs		263		ns
Reverse Recovery Charge (Note 4)	Q_{RR}			1.9		μC

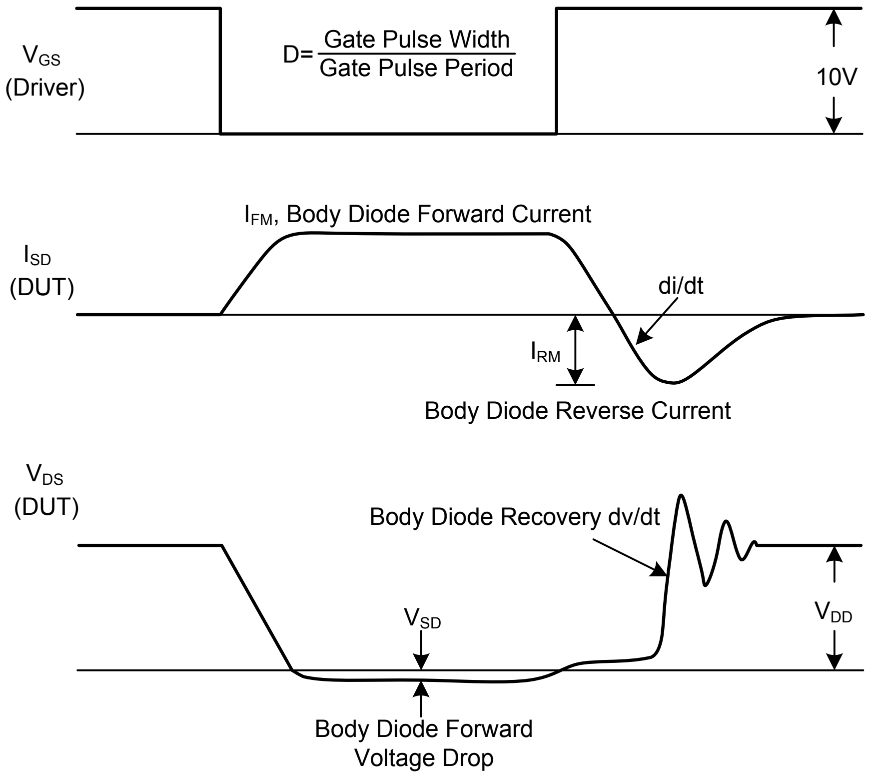
Note: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. L = 21.5mH, I_{AS} = 5A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤5A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

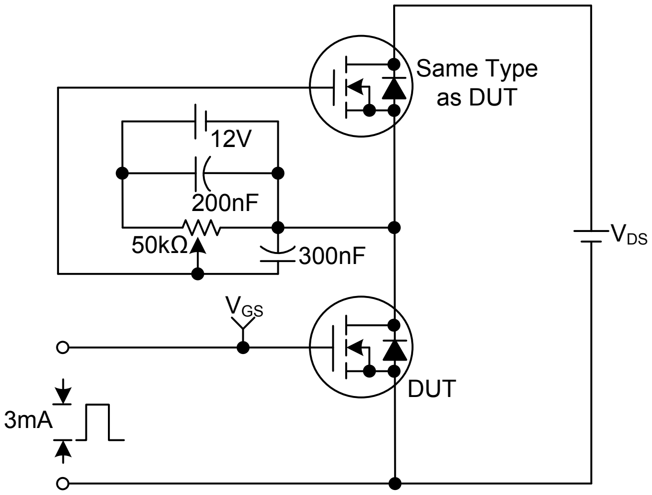
Peak Diode Recovery dv/dt Test Circuit & Waveforms



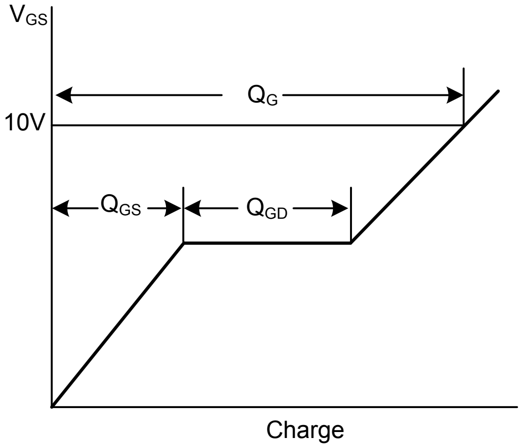


■ TEST CIRCUITS AND WAVEFORMS(Cont.)

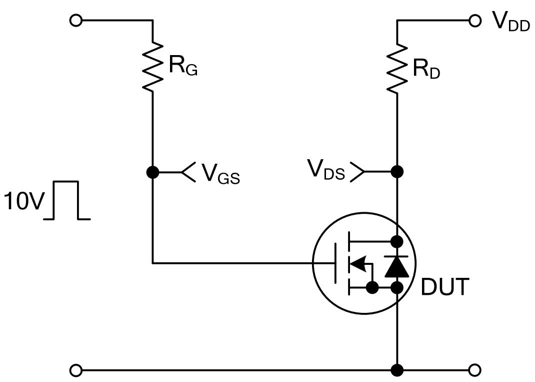
Gate Charge Test Circuit



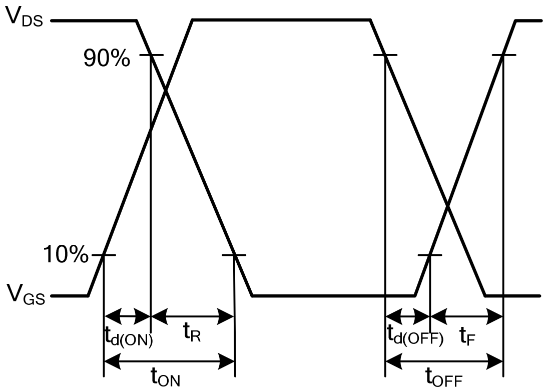
Gate Charge Waveforms



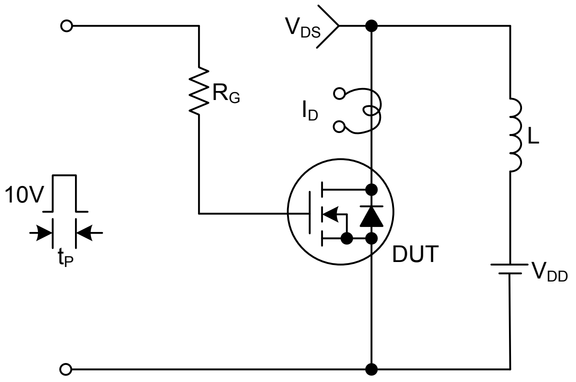
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms