



5NM50A

Preliminary

Power MOSFET

5.0A, 500V N-CHANNEL SUPER-JUNCTION MOSFET

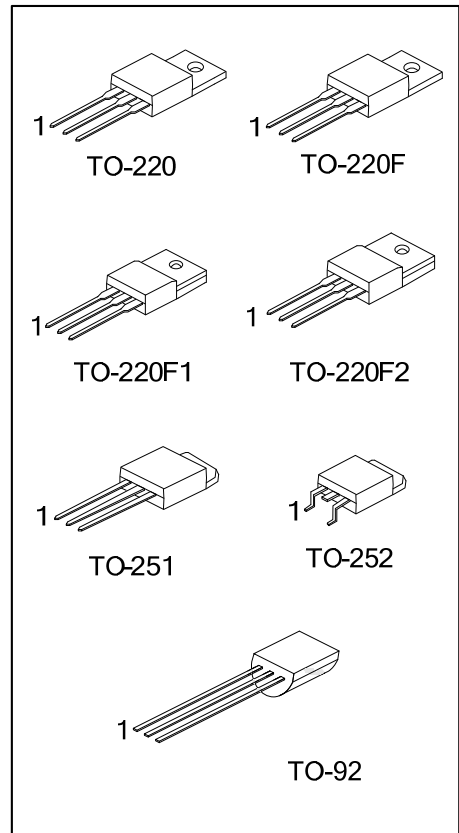
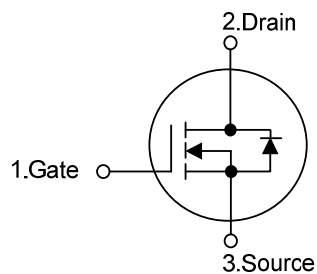
DESCRIPTION

The **UTC 5NM50A** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at DC-DC, AC-DC converters for power applications.

FEATURES

- * $R_{DS(ON)} < 1.08\Omega$ @ $V_{GS} = 10V$, $I_D = 2.5A$
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness

SYMBOL



ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5NM50AL-TA3-T	5NM50AG-TA3-T	TO-220	G	D	S	Tube
5NM50AL-TF1-T	5NM50AG-TF1-T	TO-220F1	G	D	S	Tube
5NM50AL-TF2-T	5NM50AG-TF2-T	TO-220F2	G	D	S	Tube
5NM50AL-TF3-T	5NM50AG-TF3-T	TO-220F	G	D	S	Tube
5NM50AL-TM3-T	5NM50AG-TM3-T	TO-251	G	D	S	Tube
5NM50AL-TN3-R	5NM50AG-TN3-R	TO-252	G	D	S	Tape Reel
5NM50AL-T92-B	5NM50AG-T92-B	TO-92	G	D	S	Tape Box
5NM50AL-T92-K	5NM50AG-T92-K	TO-92	G	D	S	Bulk

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

<p>5NM50AG-TA3-T</p> <p>(1) Packing Type</p> <p>(2) Package Type</p> <p>(3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel</p> <p>(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252, T92: TO-92</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING

TO-220F / TO-220F / TO-220F1 TO-220F2 / TO-251 / TO-252	TO-92
<p>UTC 5NM50A</p> <p>Lot Code → L: Lead Free G: Halogen Free</p> <p>Data Code → Data Code</p> <p>1</p>	<p>UTC 5NM50A</p> <p>Lot Code → L: Lead Free G: Halogen Free</p> <p>Data Code → Data Code</p> <p>1</p>

■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DS}	500	V
Gate-Source Voltage		V_{GS}	± 30	V
Drain Current	Continuous	I_D	5	A
	Pulsed (Note 2)	I_{DM}	20	A
Avalanche Current (Note 2)		I_{AR}	1.55	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	97.3	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.0	V/ns
Power Dissipation	TO-220	P_D	78	W
	TO-220F/TO-220F1		36	W
	TO-220F2		29	W
	TO-251/TO-252		54	W
	TO-92		1.78	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

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. $L = 81\text{mH}$, $I_{AS} = 1.55\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 5.0\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-220F1/TO-220F2			
	TO-251/TO-252		110	$^\circ\text{C}/\text{W}$
	TO-92		160	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220	θ_{JC}	1.6	$^\circ\text{C}/\text{W}$
	TO-220F/TO-220F1		3.47	$^\circ\text{C}/\text{W}$
	TO-220F2		4.3	$^\circ\text{C}/\text{W}$
	TO-251/TO-252		2.3	$^\circ\text{C}/\text{W}$
	TO-92		70	$^\circ\text{C}/\text{W}$

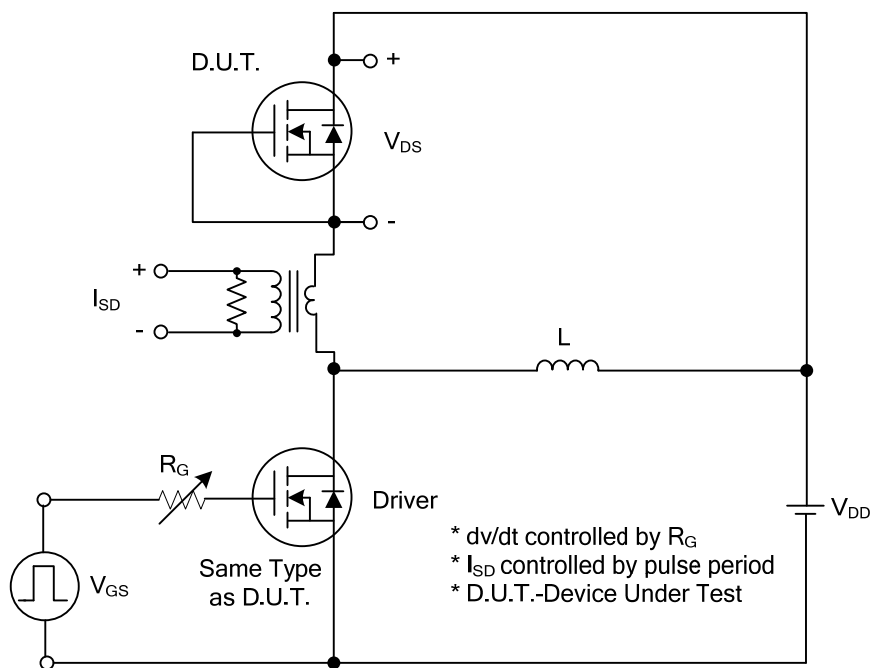
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} = 0 V, I _D = 250 μA	500			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} = 500 V, V _{GS} = 0 V			10	μA
Gate-Source Leakage Current	Forward	I _{GSS}	V _{GS} = 30 V, V _{DS} = 0 V			100	nA
	Reverse		V _{GS} = -30 V, V _{DS} = 0 V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} = V _{GS} , I _D = 250 μA	2.5		4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} = 10 V, I _D = 2.5 A			1.08	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1MHz		300		pF
Output Capacitance		C _{OSS}			175		pF
Reverse Transfer Capacitance		C _{RSS}			25		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =50V, V _{GS} =10V, I _D =1.3A, I _D =100μA (Note 1, 2)		30		nC
Gate to Source Charge		Q _{GS}			4		nC
Gate to Drain Charge		Q _{GD}			11		nC
Turn-ON Delay Time (Note 1)		t _{D(ON)}	V _{DS} =30V, V _{GS} =10V, I _D =0.5A, R _G =25Ω (Note 1, 2)		40		ns
Rise Time		t _R			72		ns
Turn-OFF Delay Time		t _{D(OFF)}			107		ns
Fall-Time		t _F			46		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I _S				5	A
Maximum Body-Diode Pulsed Current		I _{SM}				20	A
Drain-Source Diode Forward Voltage (Note 1)		V _{SD}	I _S =5.0A , V _{GS} =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t _{rr}	I _S =5.0A , V _{GS} =0V		230		ns
Body Diode Reverse Recovery Charge		Q _{rr}	dl _F /dt=100A/μs		1.9		μC

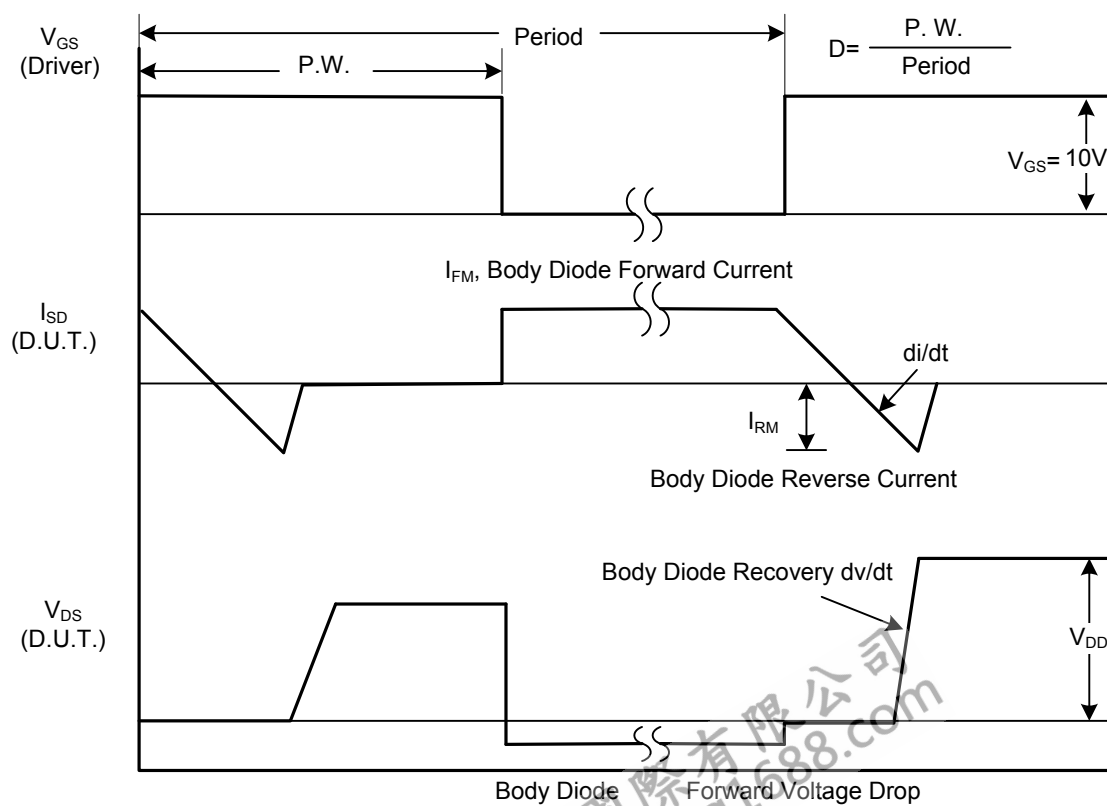
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

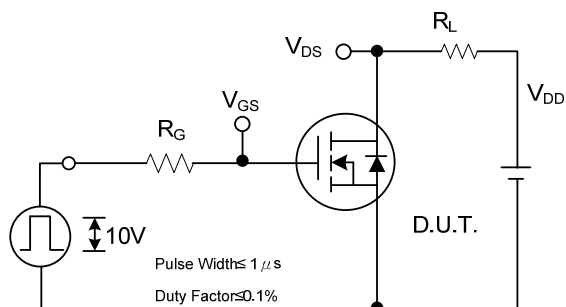


Peak Diode Recovery dv/dt Test Circuit

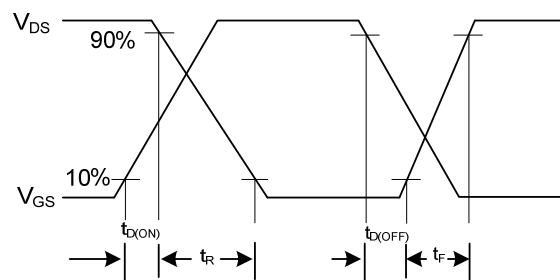


Peak Diode Recovery dv/dt Waveforms

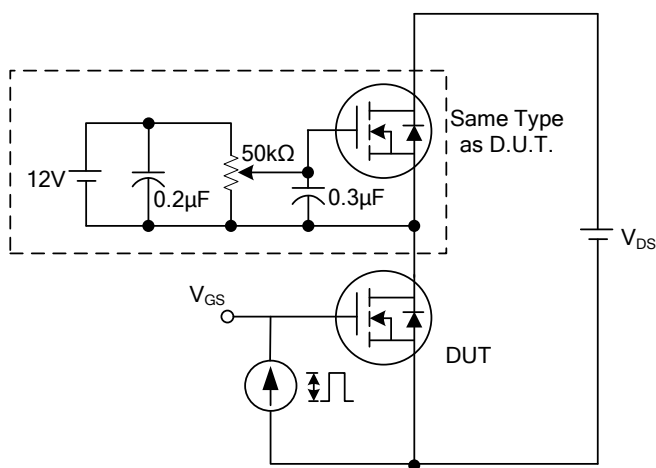
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



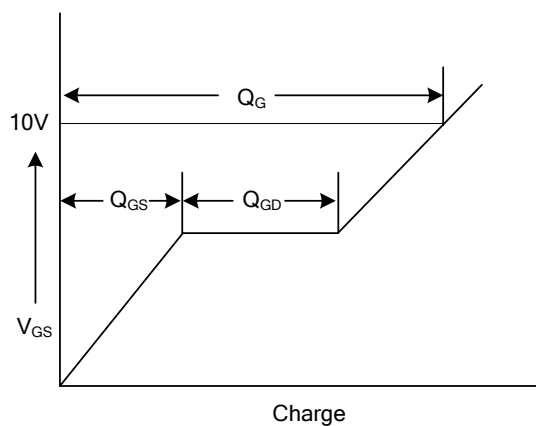
Switching Test Circuit



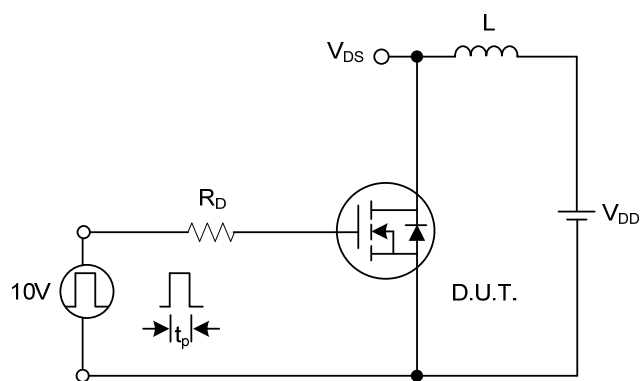
Switching Waveforms



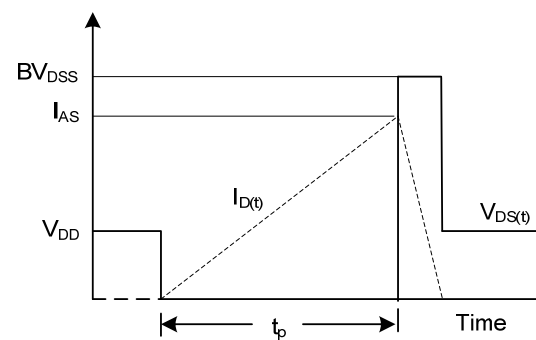
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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