



5NM60A-U2

Preliminary

Power MOSFET

5.0A, 600V N-CHANNEL SUPER-JUNCTION MOSFET

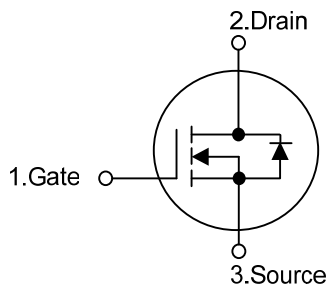
DESCRIPTION

The UTC **5NM60A-U2** 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 high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications at power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} < 1.25\Omega$ @ $V_{GS} = 10V$, $I_D = 2.5A$
- * Fast Switching Capability
- * Improved dv/dt Capability, High Ruggedness

SYMBOL

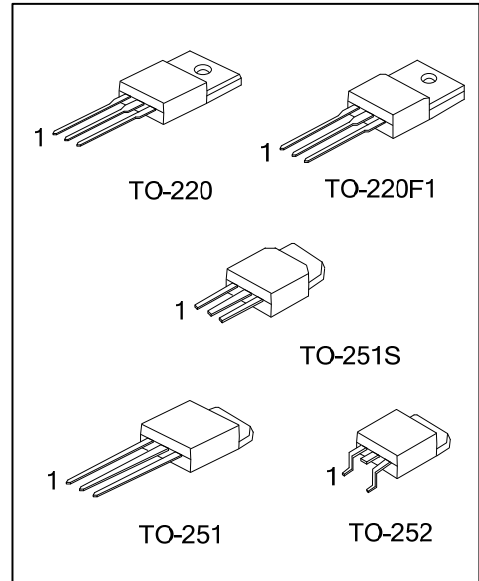


ORDERING INFORMATION

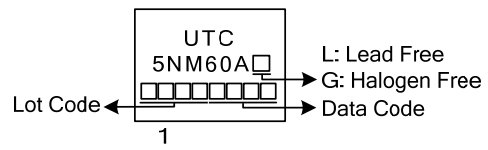
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
5NM60AL-TA3-T	5NM60AG-TA3-T	TO-220	G	D	S	Tube
5NM60AL-TF1-T	5NM60AG-TF1-T	TO-220F1	G	D	S	Tube
5NM60AL-TMS-T	5NM60AG-TMS-T	TO-251S	G	D	S	Tube
5NM60AL-TM3-T	5NM60AG-TM3-T	TO-251	G	D	S	Tube
5NM60AL-TN3-R	5NM60AG-TN3-R	TO-252	G	D	S	Tape Reel

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

<div>5NM60AL-TA3-T</div> <div>(1)Packing Type</div> <div>(2)Package Type</div> <div>(3)Green Package</div>	<div>(1) T: Tube, R: Tape Reel</div> <div>(2) TA3: TO-220, TF1: TO-220F1, TM3: TO-251, TMS: TO-251S, TN3: TO-252</div> <div>(3) L: Lead Free, G: Halogen Free and Lead Free</div>
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■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	± 30	V
Drain Current	Continuous	I_D	5.0	A
	Pulsed (Note 2)	I_{DM}	20	A
Avalanche Current (Note 2)		I_{AR}	1.2	A
Avalanche Energy		E_{AS}	104	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	5.0	V/ns
Power Dissipation	TO-220	P_D	110	W
	TO-220F1		36	W
	TO-251S/TO-251		54	W
	TO-252			
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. $L = 144\text{mH}$, $I_{AS} = 1.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, 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 CHARACTERISTICS

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F1	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-251S/TO-251		110	$^\circ\text{C}/\text{W}$
	TO-252			
Junction to Case	TO-220	θ_{JC}	1.25	$^\circ\text{C}/\text{W}$
	TO-220F1		2.6	$^\circ\text{C}/\text{W}$
	TO-251S/TO-251		2.08	$^\circ\text{C}/\text{W}$
	TO-252			

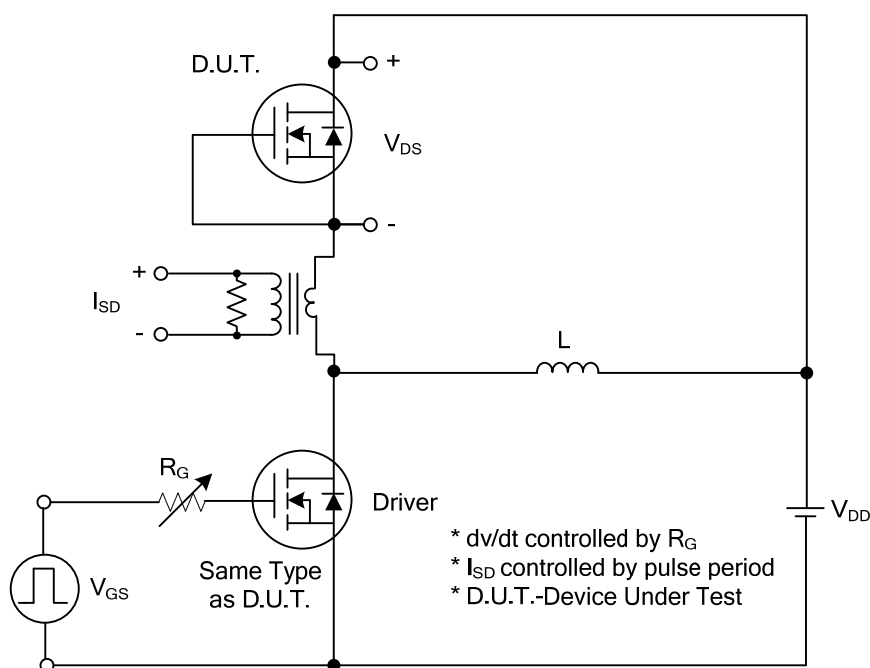
■ ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	I _D =250μA, V _{GS} =0V	600			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =600V, V _{GS} =0V			10	μA
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	2.5		4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =10V, I _D =2.5A			1.25	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =25V, f=1.0MHz		230		pF
Output Capacitance		C _{OSS}			179		pF
Reverse Transfer Capacitance		C _{RSS}			16		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q _G	V _{DS} =50V, V _{GS} =10V, I _D =1.3A, I _D =100μA (Note 1, 2)		37.5		nC
Gate to Source Charge		Q _{GS}			3.5		nC
Gate to Drain Charge		Q _{GD}			9.0		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)		43		ns
Rise Time		t _R			60		ns
Turn-off Delay Time		t _{D(OFF)}			118		ns
Fall-Time		t _F			43		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
Reverse Recovery Time (Note 1)		t _{rr}	I _S =5.0A, V _{GS} =0V,		210		nS
Reverse Recovery Charge		Q _{rr}	dI _F /dt=100A/μs		1.66		μC

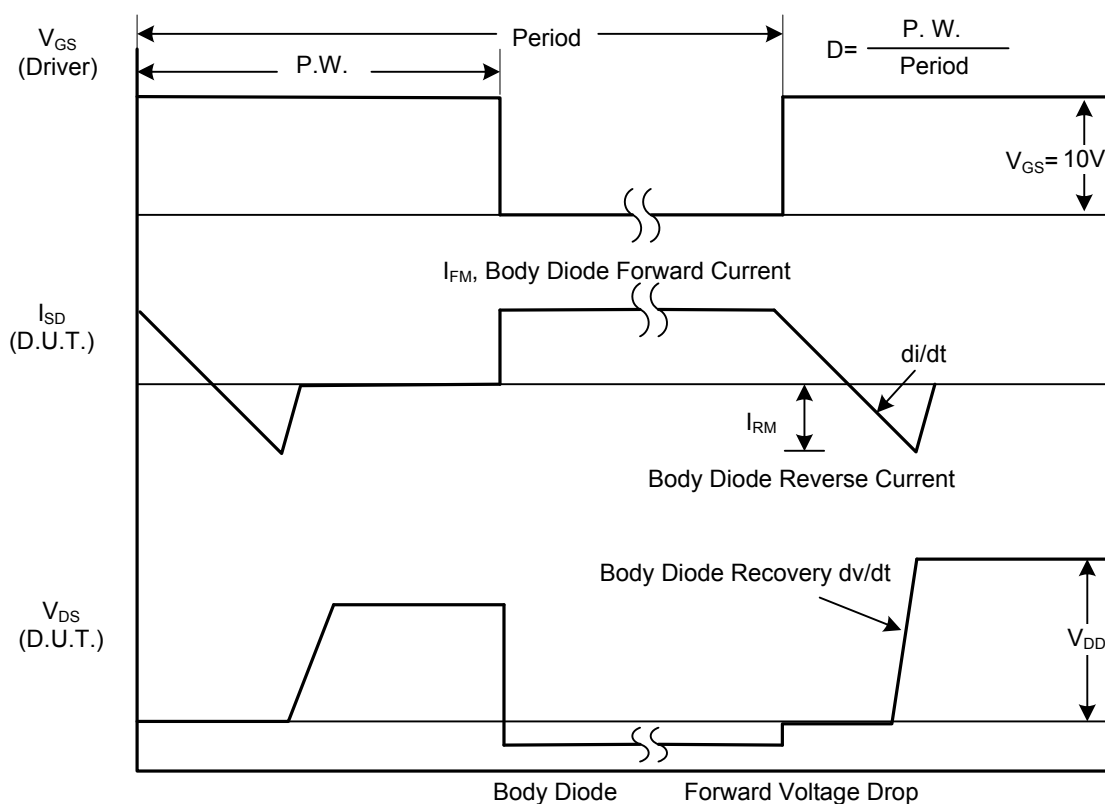
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

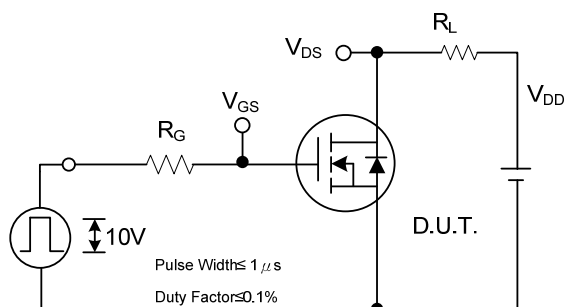


Peak Diode Recovery dv/dt Test Circuit

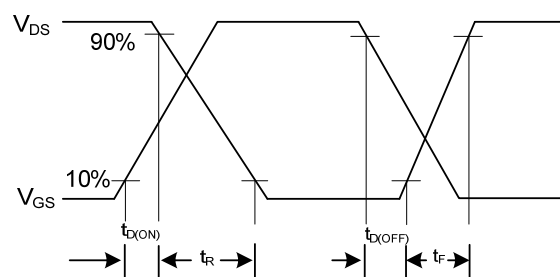


Peak Diode Recovery dv/dt Waveforms

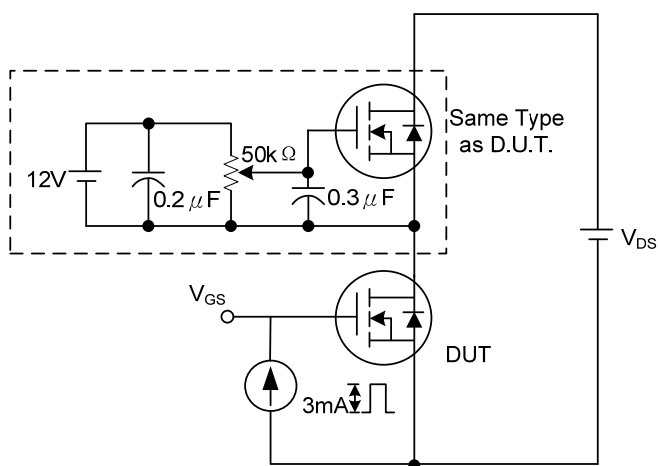
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



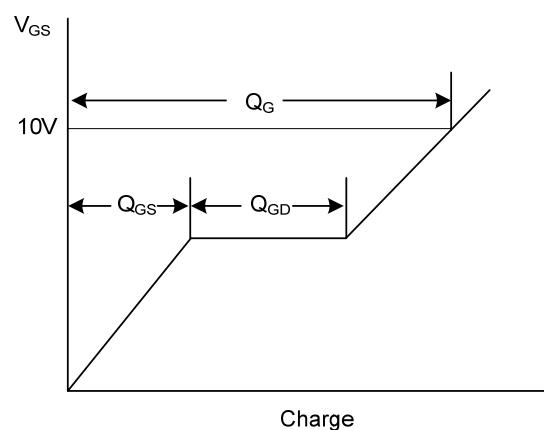
Switching Test Circuit



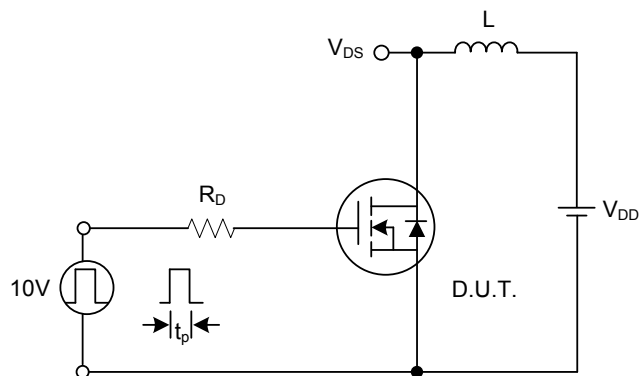
Switching Waveforms



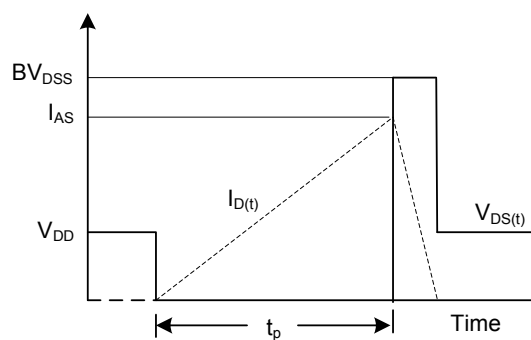
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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