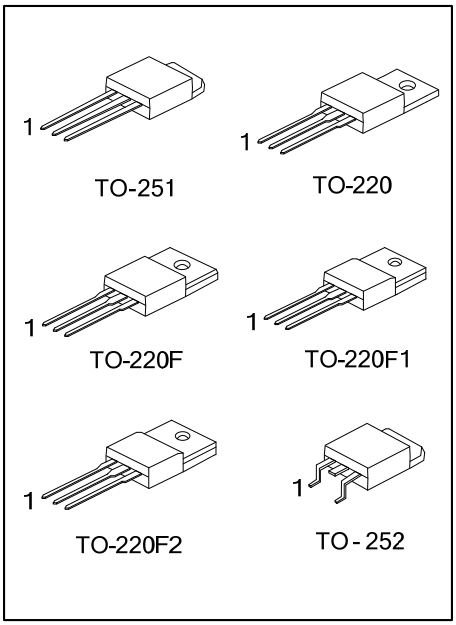
6.0A, 600V N-CHANNEL SUPER-JUNCTION MOSFET



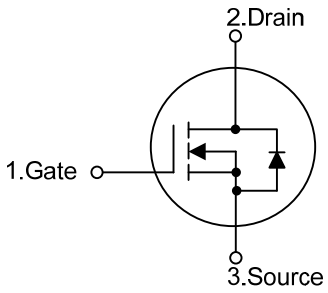
■ DESCRIPTION

The **UTC 6NM60-Q** 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

* $R_{DS(on)}$ < 1.08Ω @ V_{GS}=10V, I_D=3.0A
* Improved dv/dt capability
* Fast switching
* 100% avalanche tested

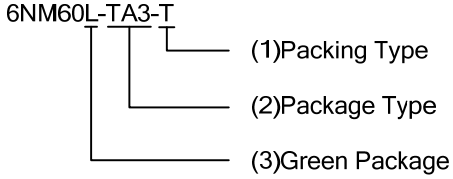
■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
6NM60L-TA3-T	6NM60G-TA3-T	TO-220	G	D	S	Tube
6NM60L-TF1-T	6NM60G-TF1-T	TO-220F1	G	D	S	Tube
6NM60L-TF2-T	6NM60G-TF2-T	TO-220F2	G	D	S	Tube
6NM60L-TF3-T	6NM60G-TF3-T	TO-220F	G	D	S	Tube
6NM60L-TM3-T	6NM60G-TM3-T	TO-251	G	D	S	Tube
6NM60L-TN3-R	6NM60G-TN3-R	TO-252	G	D	S	Tape Reel

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

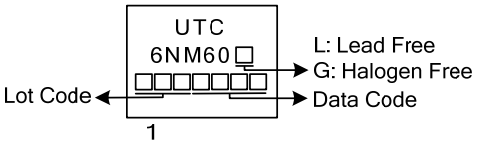


(1) T: Tube, R: Tape Reel

(2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TM3: TO-251, TN3: TO-252

(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}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current		I_D	6.0	A
Pulsed Drain Current (Note 2)		I_{DM}	24	A
Avalanche Current (Note 2)		I_{AR}	1.1	A
Single Pulsed Avalanche Energy (Note 3)		E_{AS}	87	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.7	V/ns
Power Dissipation	TO-220	P_D	125	W
	TO-220F/TO-220F1 TO-220F2		40	W
	TO-251/TO-252		55	W
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 = 144 mH, I_{AS} = 1.1A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ 6.0A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

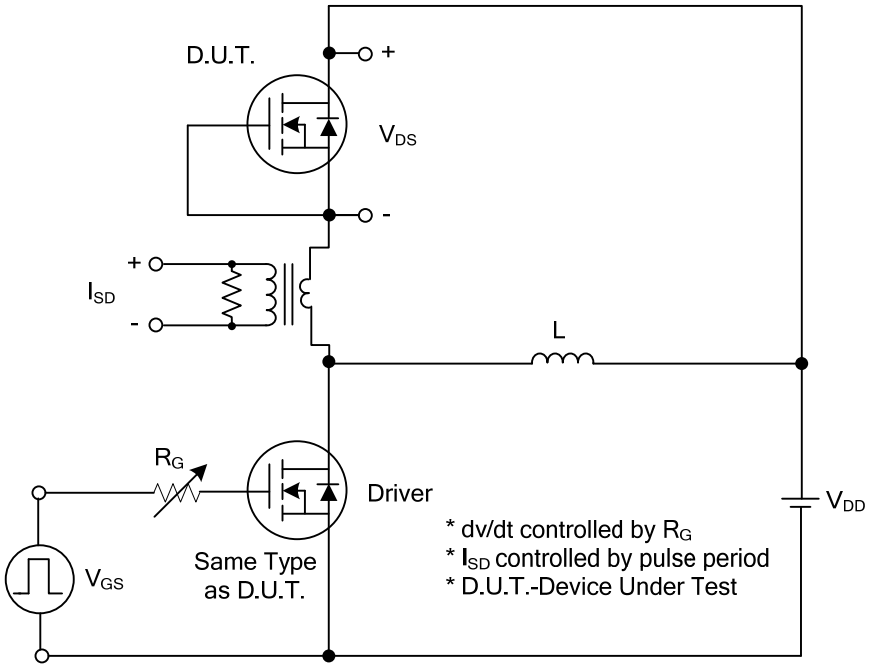
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2	θ_{JA}	62.5	°C/W
	TO-251/TO-252		110	
Junction to Case	TO-220	θ_{JC}	1.0	°C/W
	TO-220F/TO-220F1 TO-220F2		3.13	
	TO-251/TO-252		2.27	

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

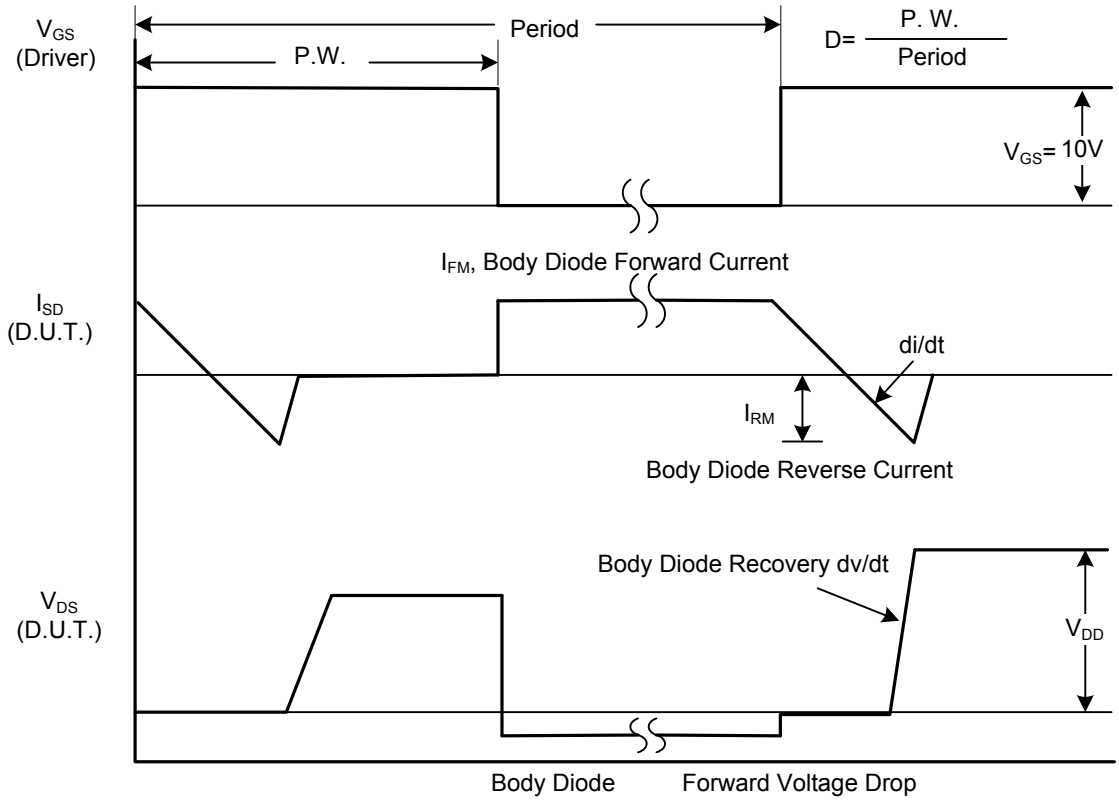
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} = 0V, I_D = 250μA	600			V
Drain-Source Leakage Current	I_{DSS}	V_{DS} = 600V, V_{GS} = 0V			10	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	nA
		V_{GS} = -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 = 3.0A			1.08	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		330		pF
Output Capacitance	C_{OSS}			165		pF
Reverse Transfer Capacitance	C_{RSS}			20		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q_G	V_{DS}=50V, I_D=1.3A, V_{GS}=10V I_G=100μA (Note 1,2)		42		nC
Gate-Source Charge	Q_{GS}			4.0		nC
Gate-Drain Charge	Q_{GD}			12		nC
Turn-On Delay Time (Note 1)	$t_{D(ON)}$	V_{DD}=30V, I_D=0.5A, R_G=25Ω (Note 1,2)		40		nS
Turn-On Rise Time	t_R			70		nS
Turn-Off Delay Time	$t_{D(OFF)}$			140		nS
Turn-Off Fall Time	t_F			38		nS
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS						
Maximum Body-Diode Continuous Current	I_S				6	A
Maximum Body-Diode Pulsed Current	I_{SM}				24	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	I_S=6.0A, V_{GS}=0V			1.4	V
Reverse Recovery Time (Note 1)	t_{rr}	I_S=6.0A, V_{GS}=0V, dI_F/dt=100A/μs		430		nS
Reverse Recovery Charge	Q_{rr}			3.91		μC

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

■ TEST CIRCUITS AND WAVEFORMS

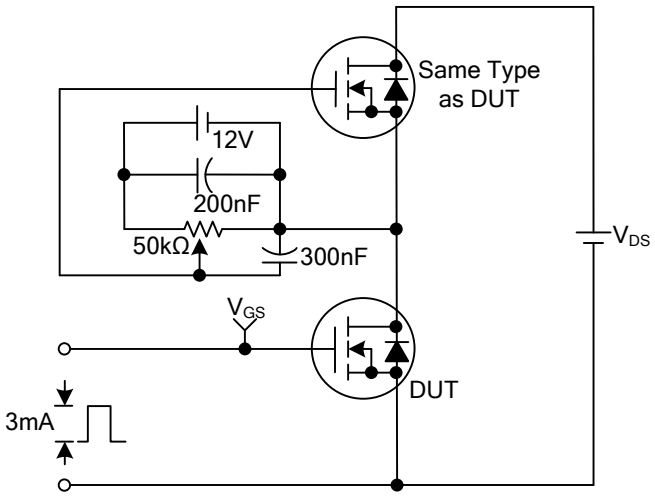


Peak Diode Recovery dv/dt Test Circuit

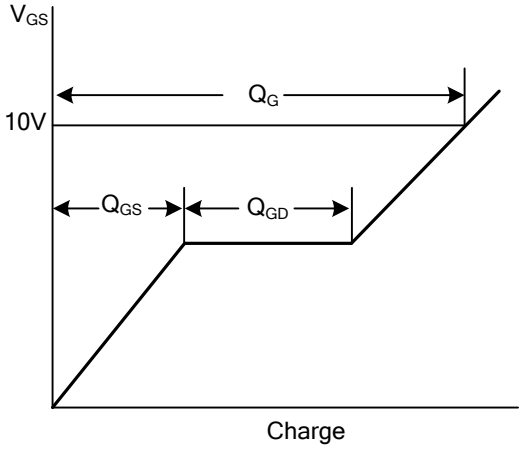


Peak Diode Recovery dv/dt Waveforms

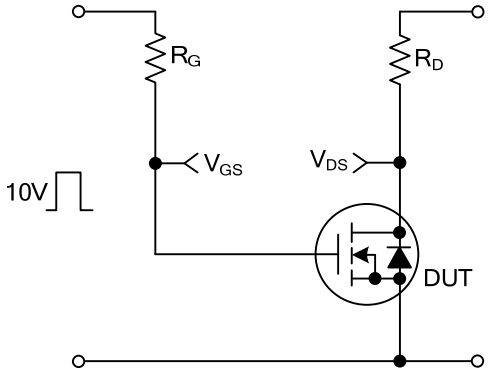
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



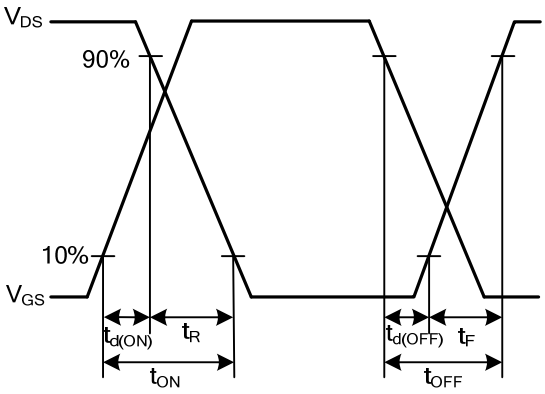
Gate Charge Test Circuit



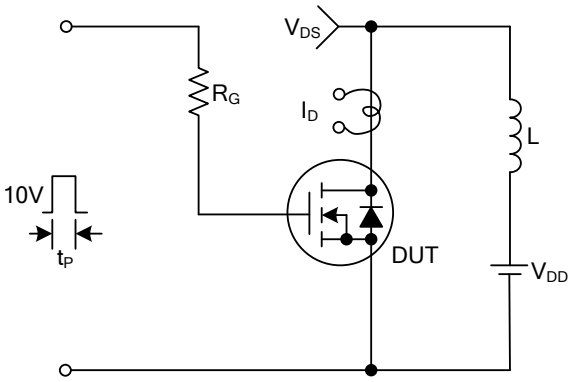
Gate Charge Waveforms



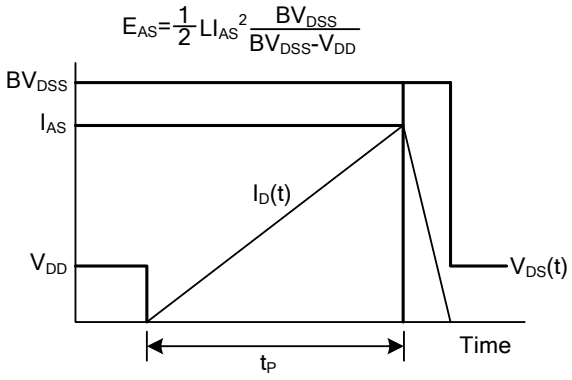
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms