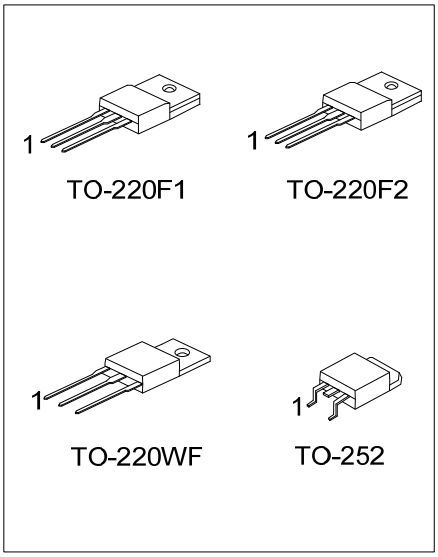
11NM60Z

Preliminary | ***Power MOSFET***

11A, 600V N-CHANNEL SUPER-JUNCTION MOSFET



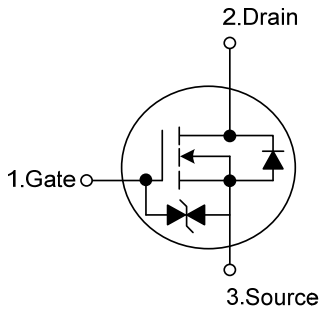
■ DESCRIPTION

The UTC **11NM60Z** 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 AC-DC converters for power applications.

■ FEATURES

* $R_{DS(ON)} \leq 0.32\ \Omega$ @ V_{GS}=10V, I_D=5.5A
* High Switching Speed

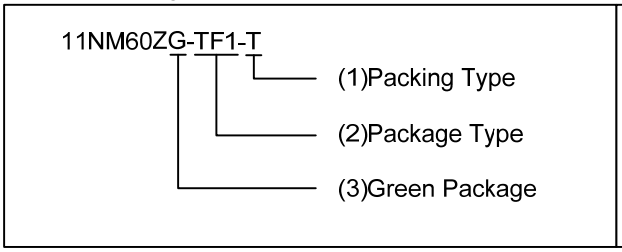
■ SYMBOL



■ ORDERING INFORMATION

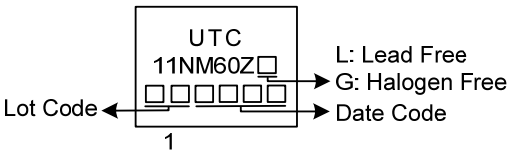
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
11NM60ZL-TF1-T	11NM60ZG-TF1-T	TO-220F1	G	D	S	Tube
11NM60ZL-TF2-T	11NM60ZG-TF2-T	TO-220F2	G	D	S	Tube
11NM60ZL-TW1-T	11NM60ZG-TW1-T	TO-220WF	G	D	S	Tube
11NM60ZL-TN3-R	11NM60ZG-TN3-R	TO-252	G	D	S	Tape Reel

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



(1) T: Tube, R: Tape Reel
(2) TF1: TO-220F1, TF2: TO-220F2, TW1: TO-220WF
TN3: TO-252
(3) G: Halogen Free and Lead Free, L: 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}	±20	V
Drain Current	Continuous	I_D	11	A
	Pulsed (Note 2)	I_{DM}	33	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	288	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.8	V/ns
Power Dissipation	TO-220F1/TO-220F2 TO-220WF	P_D	29	W
	TO-252		59	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 = 100mH, I_{AS} = 2.4A, V_{DD} = 50V, R_G = 25 Ω Starting T_J = 25°C
4. I_{SD} ≤ 11A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220F1/TO-220F2 TO-220WF	θ_{JA}	62.5	°C/W
	TO-252		110	°C/W
Junction to Case	TO-220F1/TO-220F2 TO-220WF	θ_{JC}	4.3	°C/W
	TO-252		2.1 (Note)	°C/W

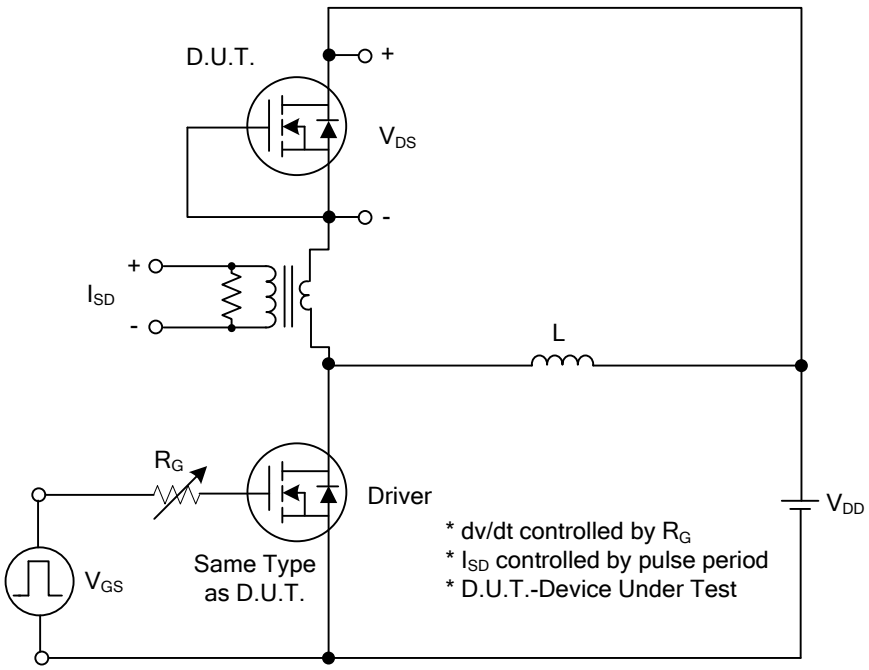
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

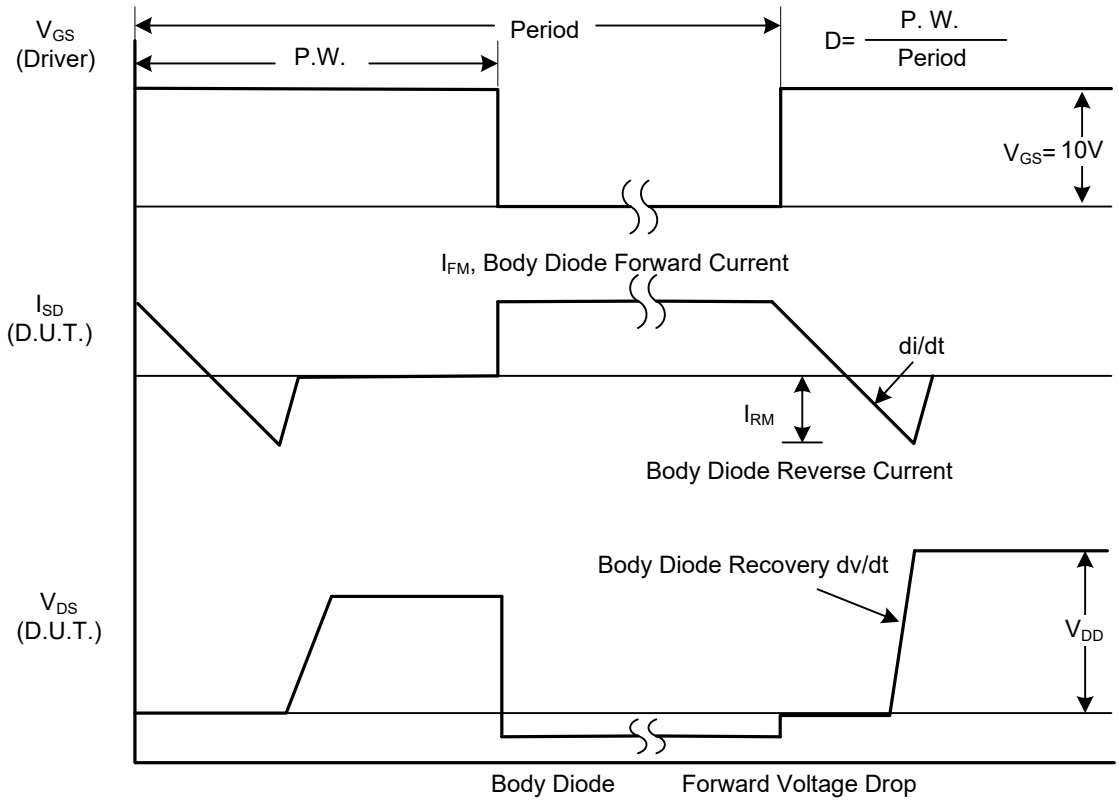
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D= 250μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS}=20V, V_{DS}=0V			10	μA
	Reverse		V_{GS}=-20V, V_{DS}=0V			-10	μA
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=5.5A			0.32	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=50V, f=1.0 MHz		742		pF
Output Capacitance		C_{OSS}			94		pF
Reverse Transfer Capacitance		C_{RSS}			6		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=480V, V_{GS}=10V, I_D=11A (Note 1, 2)		29		nC
Gateource Charge		Q_{GS}			5.2		nC
Gate-Drain Charge		Q_{GD}			10		nC
Turn-on Delay Time (Note 1)		$t_{D(ON)}$	V_{DS}=100V, V_{GS}=10V, I_D=11A, R_G=25Ω (Note 1, 2)		10		ns
Rise Time		t_R			24		ns
Turn-off Delay Time		$t_{D(OFF)}$			120		ns
Fall-Time		t_F			70		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				11	A
Maximum Body-Diode Pulsed Current		I_{SM}				33	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=11A, V_{GS}=0V			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	I_S=11A, V_{GS}=0V dI$_F$/dt=100A/μs (Note1)		328		ns
Reverse Recovery Charge		Q_{rr}			3.8		μC

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

■ TEST CIRCUITS AND WAVEFORMS

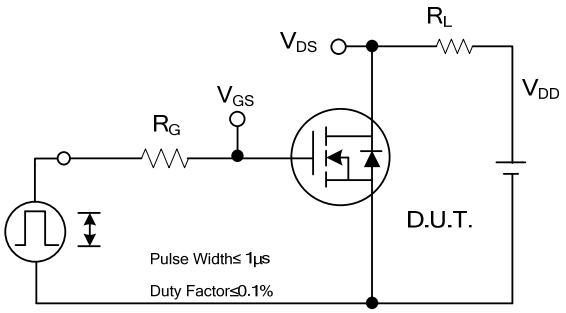


Peak Diode Recovery dv/dt Test Circuit

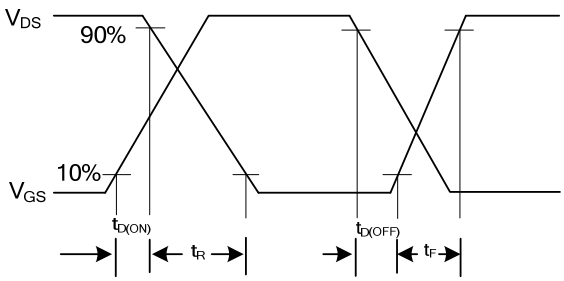


Peak Diode Recovery dv/dt Waveforms

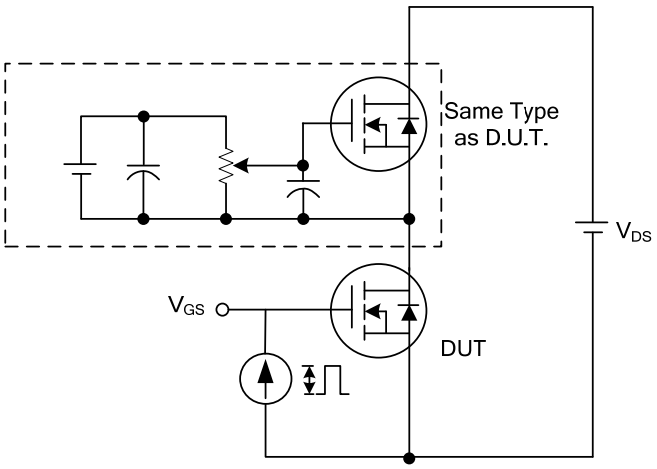
■ TEST CIRCUITS AND WAVEFORMS



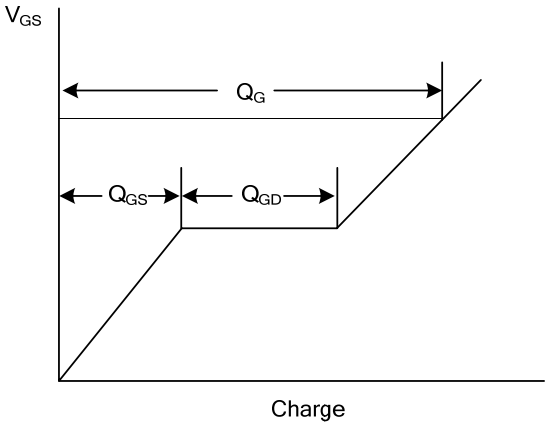
Switching Test Circuit



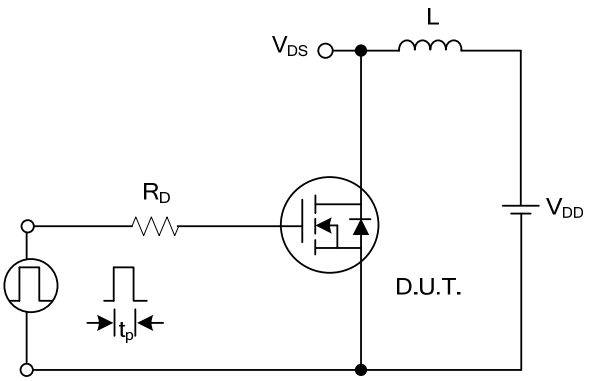
Switching Waveforms



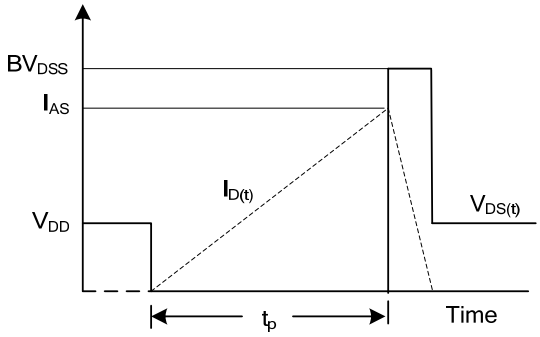
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms