



20NM95Z

Preliminary

POWER MOSFET

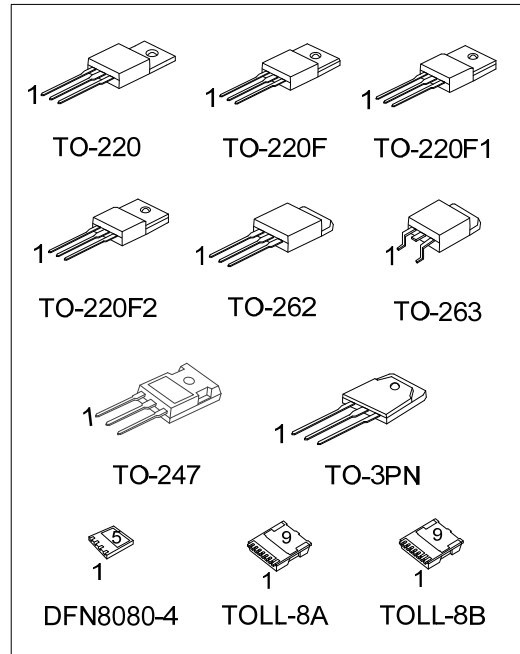
20A, 950V N-CHANNEL SUPER-JUNCTION MOSFET

DESCRIPTION

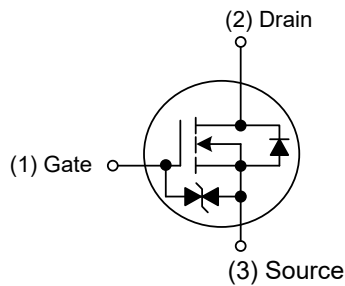
The UTC **20NM95Z** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

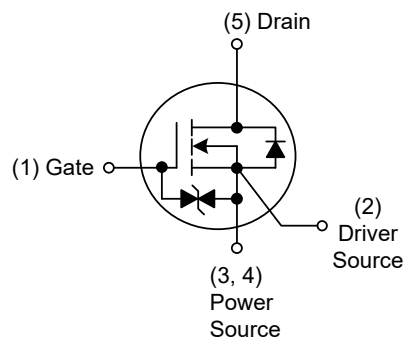
- * $R_{DS(ON)} \leq 0.33 \Omega$ @ $V_{GS}=10V$, $I_D=10A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness
- * With ESD protection



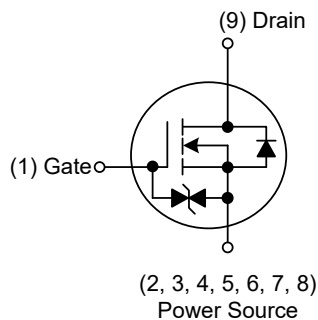
SYMBOL



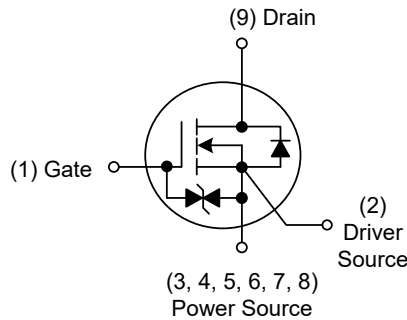
TO-220 / TO-220F1 / TO-220F2
TO-3PN / TO-247 / TO-262 / TO-263



DFN8080-4



TOLL-8A



TOLL-8B

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
20NM95ZL-TA3-T	20NM95ZG-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-TF1-T	20NM95ZG-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-TF2-T	20NM95ZG-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-TF3-T	20NM95ZG-TF3-T	TO-220F	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-T2Q-T	20NM95ZG-T2Q-T	TO-262	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-TQ2-T	20NM95ZG-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-TQ2-R	20NM95ZG-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel
20NM95ZL-T47-T	20NM95ZG-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-T3N-T	20NM95ZG-T3N-T	TO-3PN	G	D	S	-	-	-	-	-	-	Tube
20NM95ZL-K04-8080-R	20NM95ZG-K04-8080-R	DFN8080-4	G	S	S	S	D	-	-	-	-	Tape Reel
20NM95ZL-T8A-R	20NM95ZG-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
20NM95ZL-T8B-R	20NM95ZG-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

20NM95ZG-TA3-T	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, T2Q: TO-262, TQ2: TO-263, T3N: TO-3PN, T47: TO-247, T8A: TOLL-8A, T8B: TOLL-8B, K04-8080: DFN8080-4 (3) G: Halogen Free and Lead Free L: Lead Free
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■ MARKING

TO-220 / TO-220F / TO-220F1 / TO-220F2 TO-247 / TO-3PN / TO-262 / TO-263	DFN8080-4
TOLL-8A / TOLL-8B	-

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DS}	950	V
Gate-Source Voltage		V_{GS}	± 20	V
Drain Current	DC	I_D	20	A
	Pulsed (Note 2)	I_{DM}	60	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	98	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	0.9	V/ns
Power Dissipation	TO-220/TO-262 TO-263	P_D	125	W
	TO-220F/TO-220F1 TO-220F2		36	W
	TO-3PN		170	W
	TO-247		160	W
	DFN8080-4		68	W
	TOLL-8A/TOLL-8A		190	W
Junction Temperature		T_J	+150	$^{\circ}\text{C}$
Storage Temperature Range		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. $L=100\text{mH}$, $I_{AS} = 1.4\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$.

4. $I_{SD} \leq 20\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J=25^{\circ}\text{C}$.

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-262/TO-263	θ_{JA}	62.5	$^{\circ}\text{C}/\text{W}$
	TO-3PN		30	$^{\circ}\text{C}/\text{W}$
	TO-247		40	$^{\circ}\text{C}/\text{W}$
	DFN8080-4/ TOLL-8A/TOLL-8A		35	$^{\circ}\text{C}/\text{W}$
Junction to Case	TO-220/TO-262 TO-263	θ_{JC}	1	$^{\circ}\text{C}/\text{W}$
	TO-220F/TO-220F1 TO-220F2		3.47	$^{\circ}\text{C}/\text{W}$
	TO-3PN		0.73	$^{\circ}\text{C}/\text{W}$
	TO-247		0.78	$^{\circ}\text{C}/\text{W}$
	DFN8080-4		1.83 (Note)	$^{\circ}\text{C}/\text{W}$
	TOLL-8A/TOLL-8A		0.65 (Note)	$^{\circ}\text{C}/\text{W}$

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

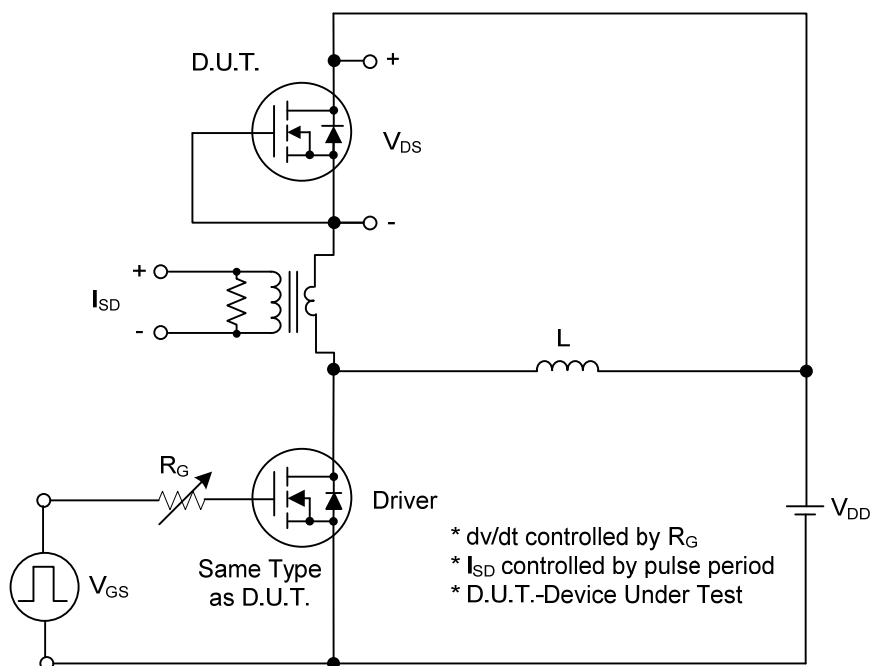
■ **ELECTRICAL CHARACTERISTICS** ($T_A=25^\circ\text{C}$ unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	950			V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =950V, 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 =10A			0.33	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1.0MHz		1680		pF
Output Capacitance		C _{OSS}			115		pF
Reverse Transfer Capacitance		C _{RSS}			9		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q _G	V _{DS} =760V, V _{GS} =10V, I _D =20A (Note 1, 2)		94		nC
Gate to Source Charge		Q _{GS}			19		nC
Gate to Drain Charge		Q _{GD}			41		nC
Turn-ON Delay Time		t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =20A, R _G =25Ω (Note 1, 2)		21		ns
Rise Time		t _R			34		ns
Turn-OFF Delay Time		t _{D(OFF)}			220		ns
Fall-Time		t _F			92		ns
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I _S				20	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				60	A
Diode Forward Voltage		V _{SD}	I _F =20A, V _{GS} =0V			1.4	V
Reverse Recovery Time		t _{rr}	I _S =20A, V _{GS} =0V,		600		ns
Reverse Recovery Charge (Note 1)		Q _{rr}	dl _F /dt = 100 A/μs		13		uC

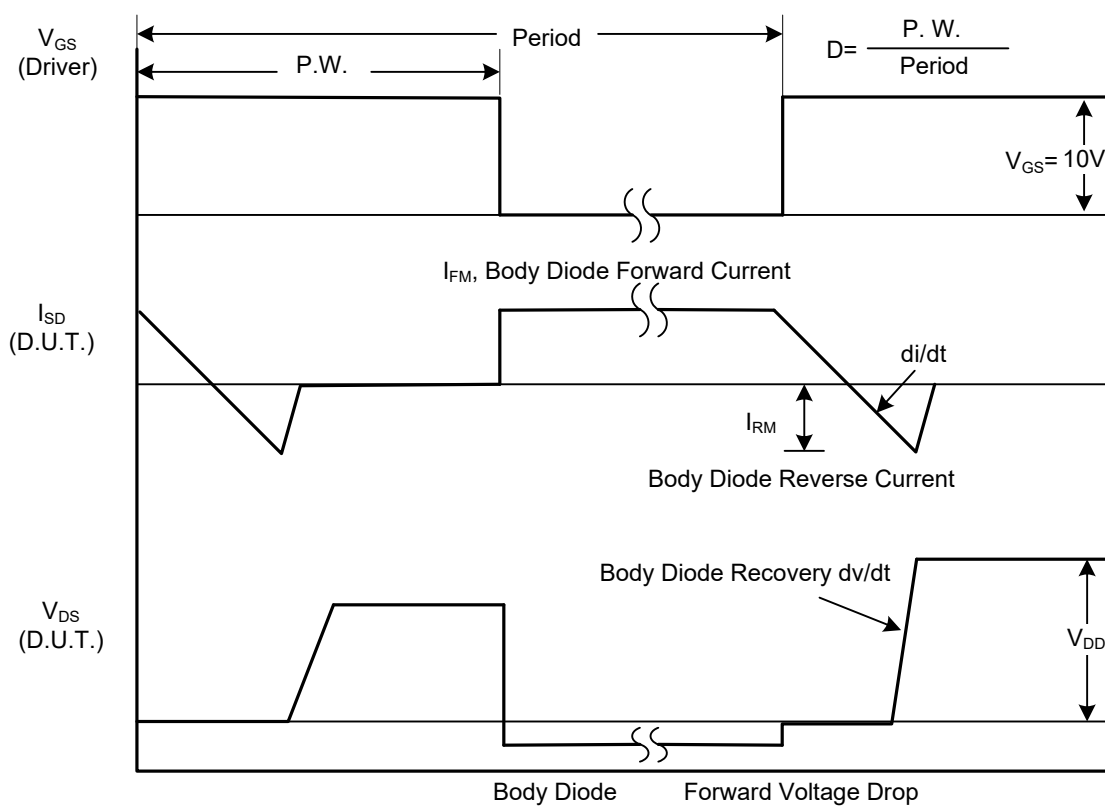
Notes: 1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

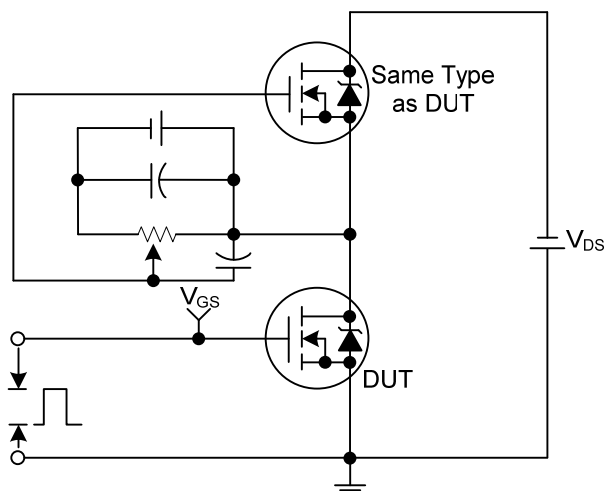


Peak Diode Recovery dv/dt Test Circuit

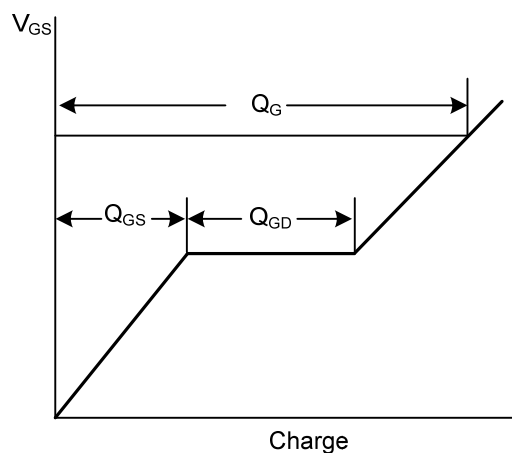


Peak Diode Recovery dv/dt Waveforms

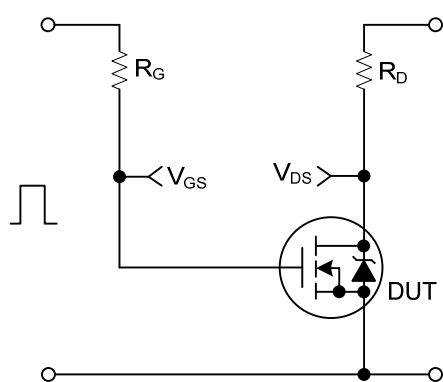
■ TEST CIRCUITS AND WAVEFORMS



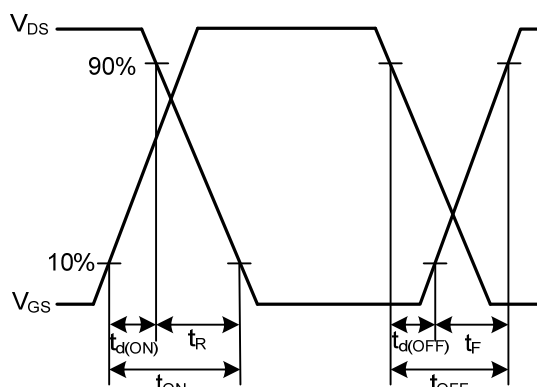
Gate Charge Test Circuit



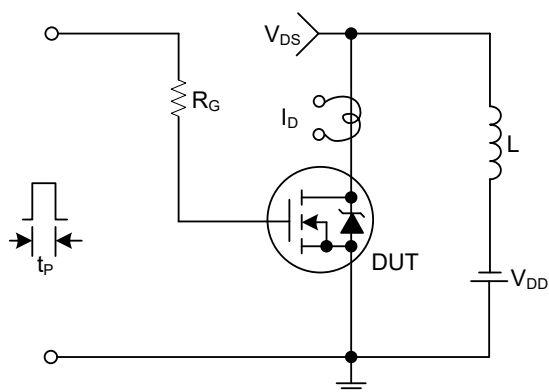
Gate Charge Waveforms



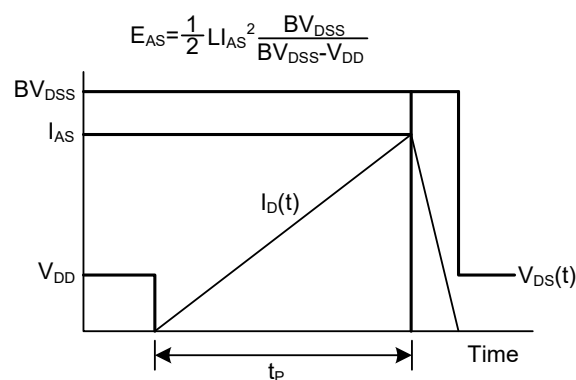
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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