

**28NM95Z**

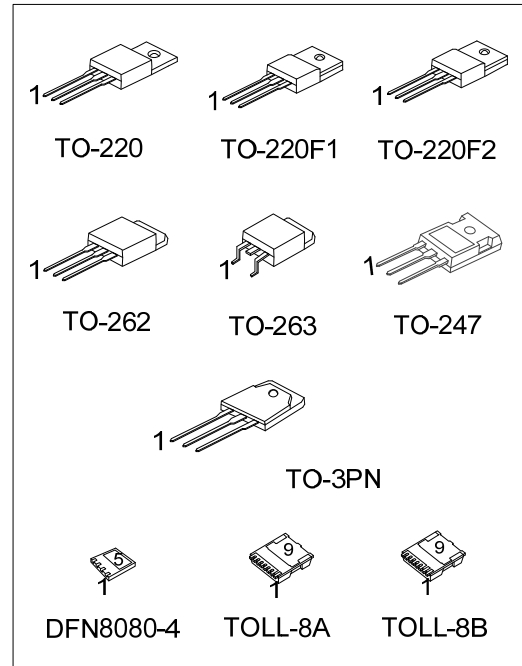
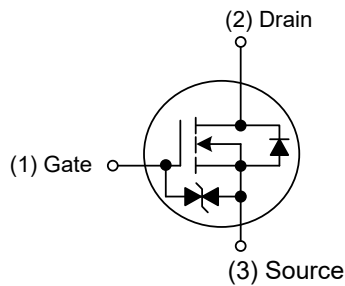
Preliminary

POWER MOSFET**28A, 950V N-CHANNEL
SUPER-JUNCTION MOSFET****DESCRIPTION**

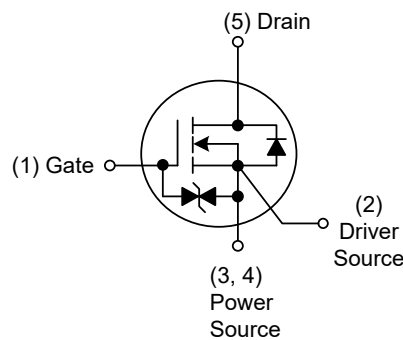
The UTC **28NM95Z** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

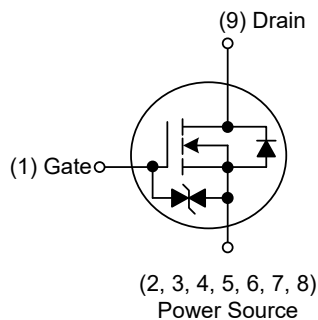
- * $R_{DS(ON)} \leq 0.22 \Omega$ @ $V_{GS}=10V$, $I_D=14A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness
- * With ESD protection

**SYMBOL**

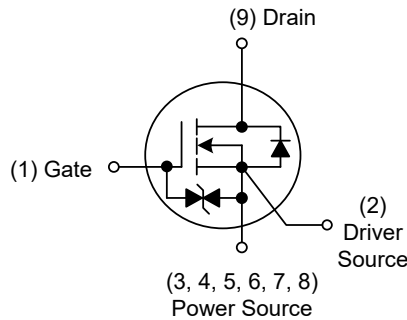
TO-220 / TO-220F1 / TO-220F2
TO-3PN / TO-247 / TO-262 / TO-263



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	
28NM95ZL-TA3-T	28NM95ZG-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-TF1-T	28NM95ZG-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-TF2-T	28NM95ZG-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-T2Q-T	28NM95ZG-T2Q-T	TO-262	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-TQ2-T	28NM95ZG-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-TQ2-R	28NM95ZG-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel
28NM95ZL-T47-T	28NM95ZG-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-T3N-T	28NM95ZG-T3N-T	TO-3PN	G	D	S	-	-	-	-	-	-	Tube
28NM95ZL-K04-8080-R	28NM95ZG-K04-8080-R	DFN8080-4	G	S	S	S	D	-	-	-	-	Tape Reel
28NM95ZL-T8A-R	28NM95ZG-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
28NM95ZL-T8B-R	28NM95ZG-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

28NM95ZG-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, 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-220F1 / TO-220F2 TO-3PN / TO-247 / TO-262 / TO-263 UTC 28NM95Z Lot Code L: Lead Free G: Halogen Free Date Code 1	DFN8080-4 UTC 28NM95Z Lot Code Date Code
TOLL-8A / TOLL-8B UTC 28NM95Z Lot Code L: Lead Free G: Halogen Free Date Code 1	-

■ **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	28	A
	Pulsed (Note 2)	I_{DM}	84	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	220	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.05	V/ns
Power Dissipation	TO-220/TO-262/TO-263	P_D	150	W
	TO-220F1/TO-220F2		40	W
	TO-3PN		220	W
	TO-247		210	W
	DFN8080-4		80	W
	TOLL-8A /TOLL-8A		240	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. $L=100\text{mH}$, $I_{AS} = 2.1\text{A}$, $V_{DD}=50\text{V}$, $R_G=25\Omega$, Starting $T_J=25^{\circ}\text{C}$.

4. $I_{SD} \leq 28\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J=25^{\circ}\text{C}$.

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F1 TO-220F2/TO-262 TO-263	θ_{JA}	62.5	$^{\circ}\text{C/W}$
	TO-3PN		30	$^{\circ}\text{C/W}$
	TO-247		40	$^{\circ}\text{C/W}$
	DFN8080-4/ TOLL-8A /TOLL-8A		35	$^{\circ}\text{C/W}$
Junction to Case	TO-220/TO-262/TO-263	θ_{JC}	0.83	$^{\circ}\text{C/W}$
	TO-220F1/TO-220F2		3.12	$^{\circ}\text{C/W}$
	TO-3PN		0.56	$^{\circ}\text{C/W}$
	TO-247		0.59	$^{\circ}\text{C/W}$
	DFN8080-4		1.56 (Note)	$^{\circ}\text{C/W}$
	TOLL-8A /TOLL-8A		0.52 (Note)	$^{\circ}\text{C/W}$

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

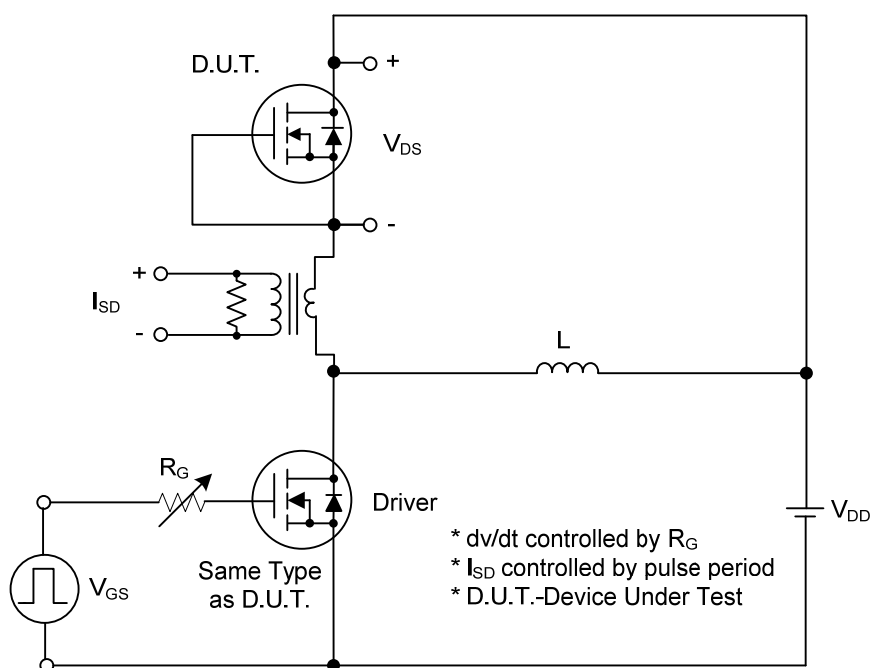
■ ELECTRICAL CHARACTERISTICS (T_A=25°C unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V, I _D =250μA	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 =14A			0.22	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C _{ISS}	V _{GS} =0V, V _{DS} =50V, f=1.0MHz		2450		pF
Output Capacitance		C _{OSS}			140		pF
Reverse Transfer Capacitance		C _{RSS}			9.3		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q _G	V _{DS} =760V, V _{GS} =10V, I _D =28A (Note 1, 2)		138		nC
Gate to Source Charge		Q _{GS}			26		nC
Gate to Drain Charge		Q _{GD}			58		nC
Turn-ON Delay Time		t _{D(ON)}	V _{DD} =100V, V _{GS} =10V, I _D =28A, R _G =25Ω (Note 1, 2)		32		ns
Rise Time		t _R			40		ns
Turn-OFF Delay Time		t _{D(OFF)}			320		ns
Fall-Time		t _F			97		ns
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I _S				28	A
Maximum Pulsed Drain-Source Diode Forward Current		I _{SM}				84	A
Diode Forward Voltage		V _{SD}	I _F =28A, V _{GS} =0V			1.4	V
Reverse Recovery Time		t _{rr}	I _S =28A, V _{GS} =0V,		735		ns
Reverse Recovery Charge (Note 1)		Q _{rr}	dl _F /dt = 100 A/μs		17.5		uC

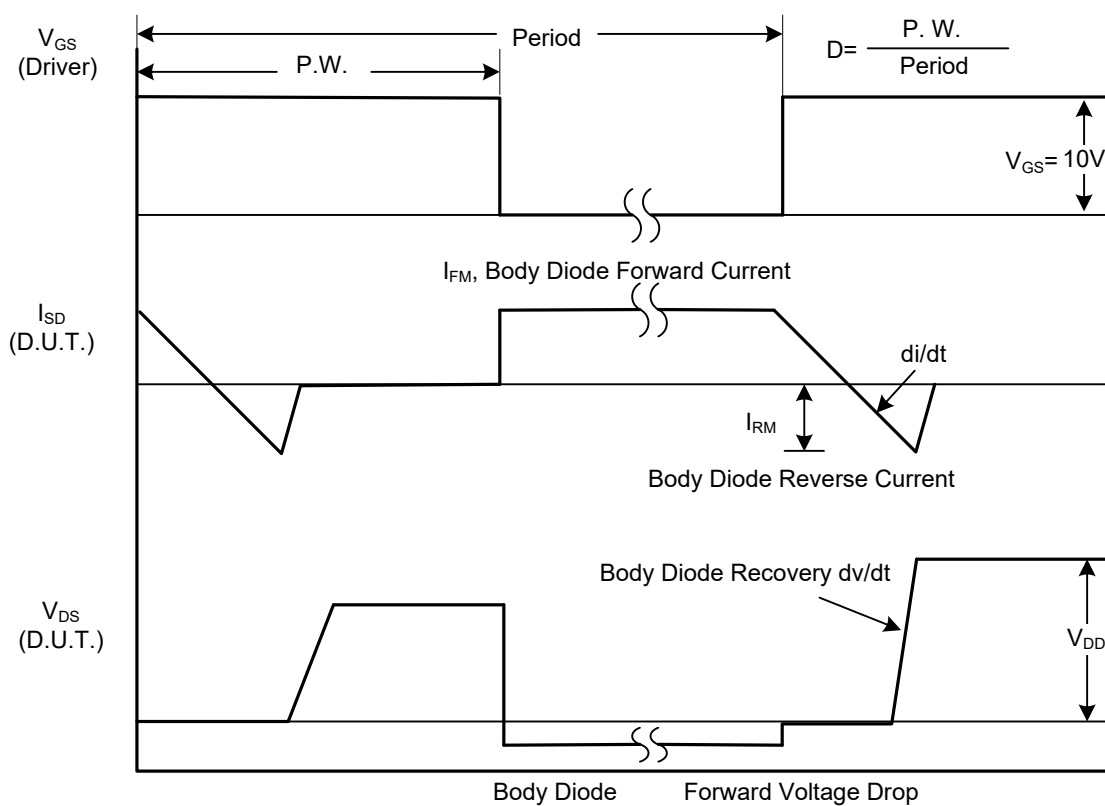
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

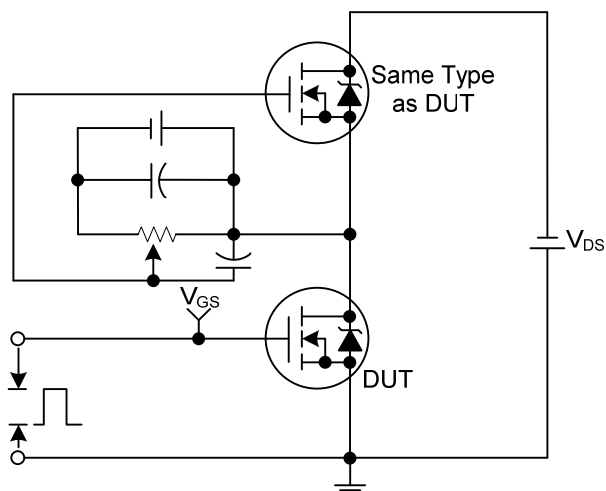


Peak Diode Recovery dv/dt Test Circuit

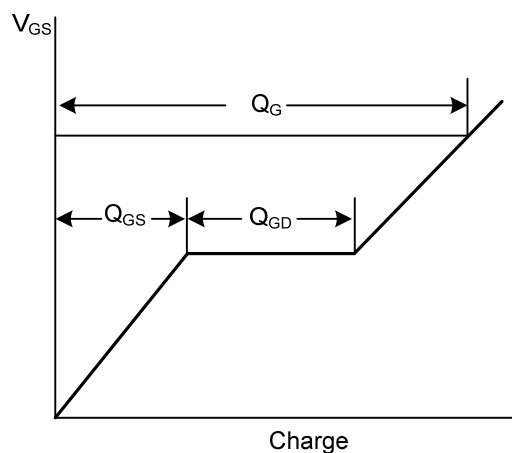


Peak Diode Recovery dv/dt Waveforms

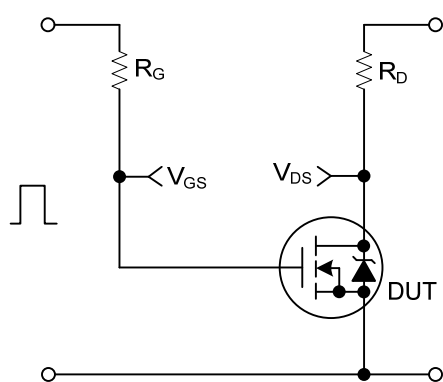
■ TEST CIRCUITS AND WAVEFORMS



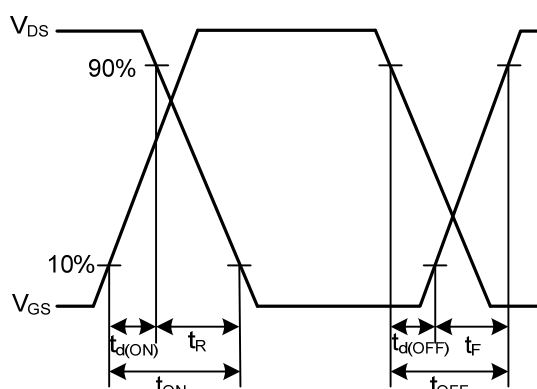
Gate Charge Test Circuit



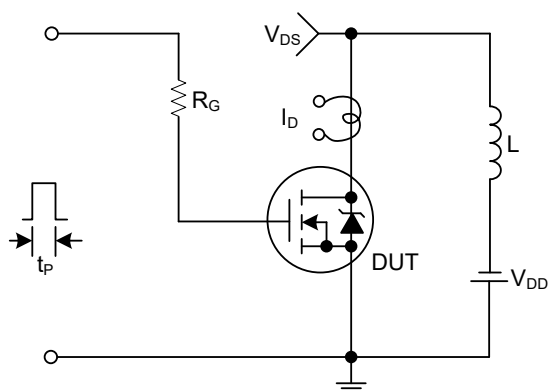
Gate Charge Waveforms



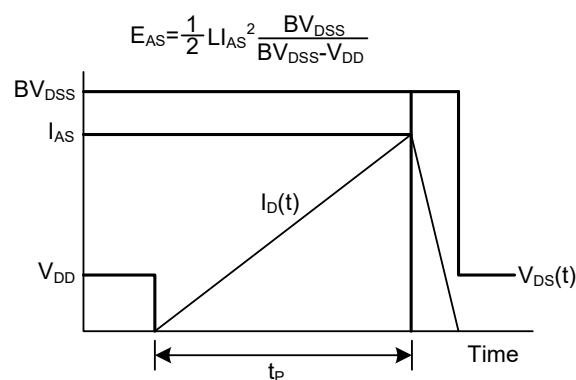
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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