

13NM90

Power MOSFET

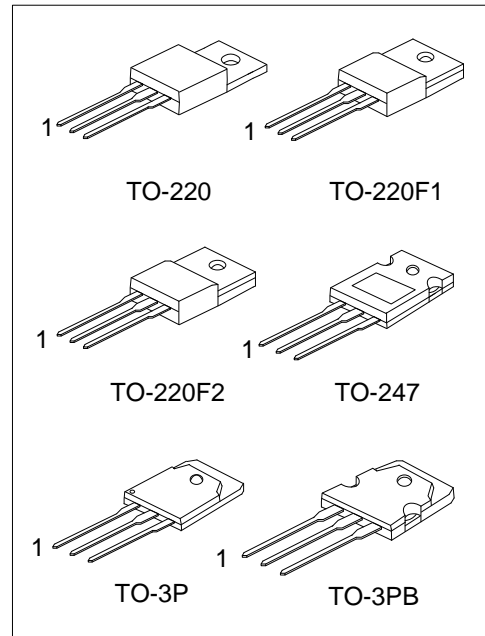
13A, 900V N-CHANNEL SUPER-JUNCTION MOSFET

DESCRIPTION

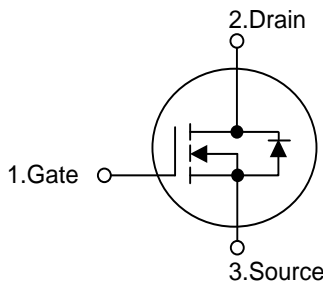
The UTC 13NM90 is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

FEATURES

- * $R_{DS(ON)} \leq 0.5 \Omega @ V_{GS}=10V, I_D=6.5A$
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness



SYMBOL



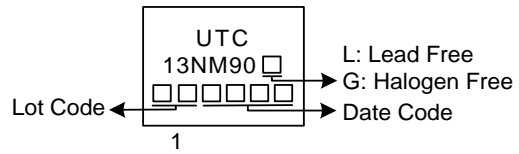
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13NM90L-TA3-T	13NM90G-TA3-T	TO-220	G	D	S	Tube
13NM90L-TF1-T	13NM90G-TF1-T	TO-220F1	G	D	S	Tube
13NM90L-TF2-T	13NM90G-TF2-T	TO-220F2	G	D	S	Tube
13NM90L-T3B-T	13NM90G-T3B-T	TO-3PB	G	D	S	Tube
13NM90L-T3P-T	13NM90G-T3P-T	TO-3P	G	D	S	Tube
13NM90L-T47-T	13NM90G-T47-T	TO-247	G	D	S	Tube

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

<p>13NM90G-TA3-T</p>	<p>(1) T: Tube (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2 T3B: TO-3PB, T3P: TO-3P, T47: TO-247 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	900	V
Gate-Source Voltage		V_{GSS}	± 30	V
Continuous Drain Current	Continuous	I_D	13	A
Pulsed Drain Current	Pulsed (Note 2)	I_{DM}	52	A
Avalanche Current (Note 2)		I_{AR}	3.0	A
Single Pulsed Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	180	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.68	V/ns
Power Dissipation	TO-220	P_D	101	W
	TO-220F1/TO-220F2		32	W
	TO-3P/TO-3PB		405	W
	TO-247		370	W
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. $L = 10\text{mH}$, $I_{AS} = 4.2\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$.

4. $I_{SD} \leq 13\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$.

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F1 TO-220F2	θ_{JA}	62.5	$^\circ\text{C}/\text{W}$
	TO-3P/TO-3PB		30	$^\circ\text{C}/\text{W}$
	TO-247		40	$^\circ\text{C}/\text{W}$
	TO-220		1.24	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220F1/TO-220F2	θ_{JC}	3.91	$^\circ\text{C}/\text{W}$
	TO-3P/TO-3PB		0.31	$^\circ\text{C}/\text{W}$
	TO-247		0.34	$^\circ\text{C}/\text{W}$
	TO-220		0.34	$^\circ\text{C}/\text{W}$

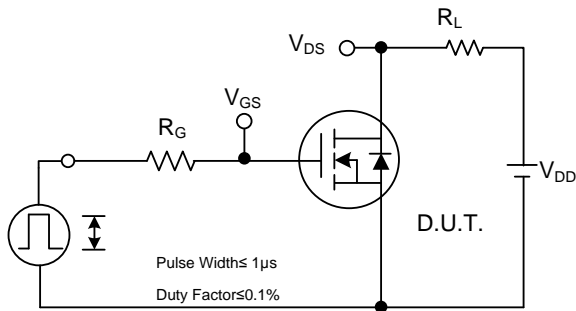
■ **ELECTRICAL CHARACTERISTICS** ($T_J = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS} = 0V, I_D = 250\mu A$	900			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS} = 900V, V_{GS} = 0V$			10	μA
Gate-Source Leakage Current	Forward	$V_{GS} = 30V, V_{DS} = 0V$			100	nA
	Reverse		$V_{GS} = -30V, V_{DS} = 0V$		-100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5		4.5	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10V, I_D = 6.5A$			0.5	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$		1650		pF
Output Capacitance	C_{OSS}			390		pF
Reverse Transfer Capacitance	C_{RSS}			0.3		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge (Note 1)	Q_G	$V_{DS}=100V, I_D=13A, I_G=1mA$ $V_{GS}=10V$ (Note 1,2)		60		nC
Gate to Source Charge	Q_{GS}			11		nC
Gate to Drain Charge	Q_{GD}			22		nC
Turn-ON Delay Time (Note 1)	$t_{D(ON)}$	$V_{DD} = 100V, I_D = 13A, R_G = 25\Omega,$ $V_{GS}=10V$ (Note 1,2)		25		nS
Rise Time	t_R			24		nS
Turn-OFF Delay Time	$t_{D(OFF)}$			190		nS
Fall-Time	t_F			37		nS
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I_S				13	A
Maximum Body-Diode Pulsed Current	I_{SM}				52	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	$I_S=13A, V_{GS}=0V$			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t_{rr}	$I_S=13A, V_{GS}=0V,$ $dI_F/dt=100A/\mu s$		640		nS
Body Diode Reverse Recovery Charge	Q_{rr}			12.7		μC

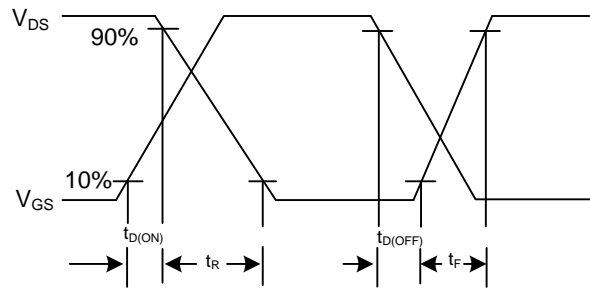
Notes: 1. Pulse Test : Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating ambient temperature.

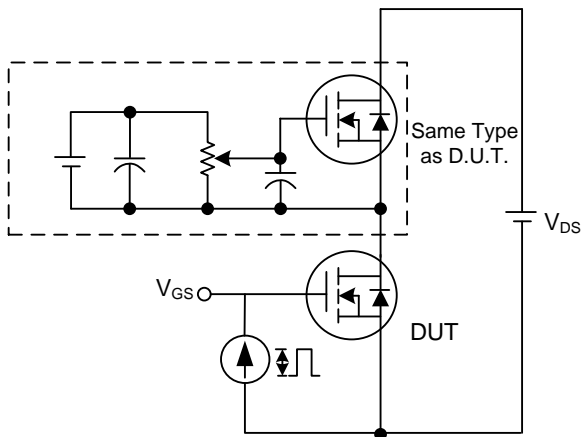
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



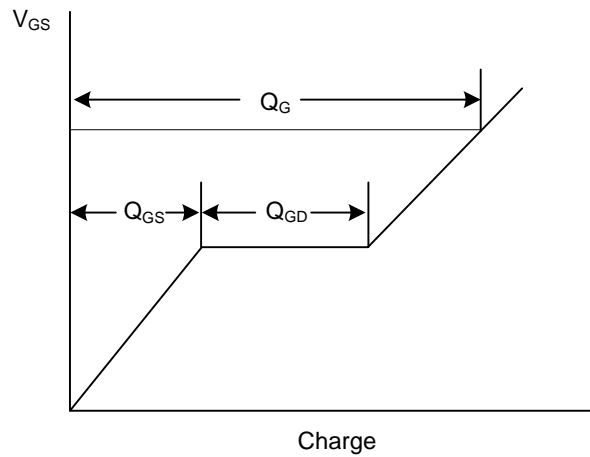
Switching Test Circuit



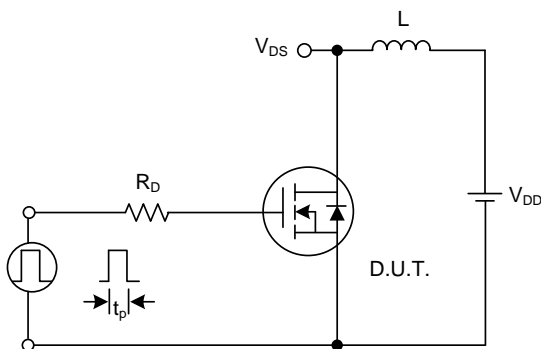
Switching Waveforms



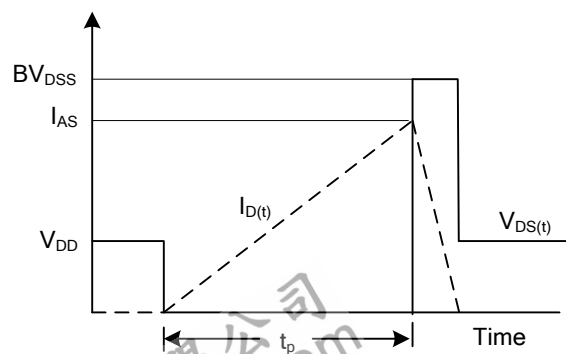
Gate Charge Test Circuit



Gate Charge Waveform

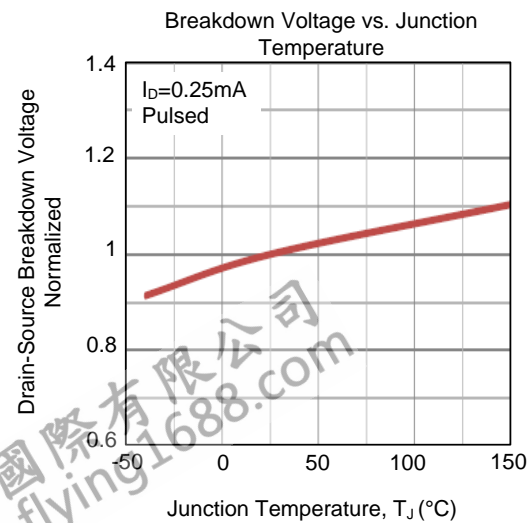
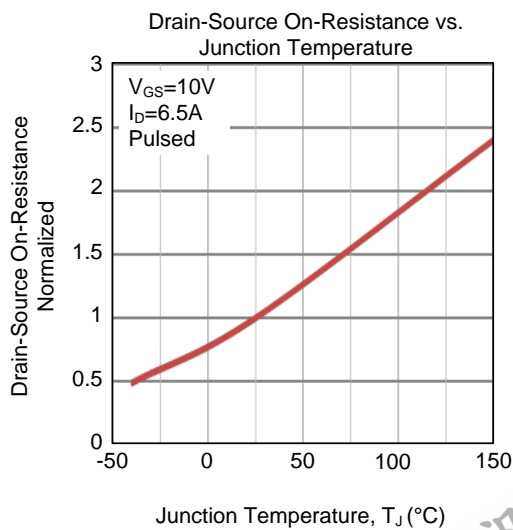
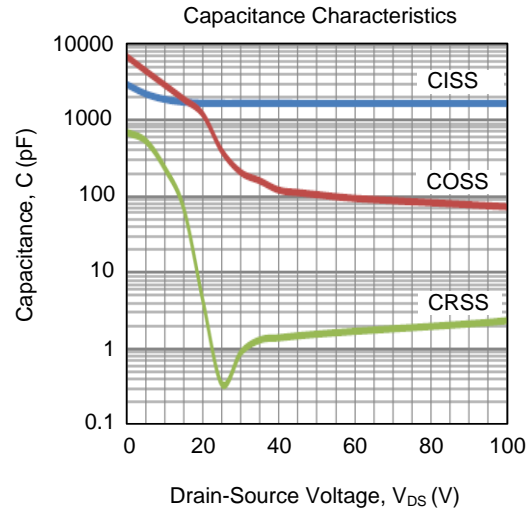
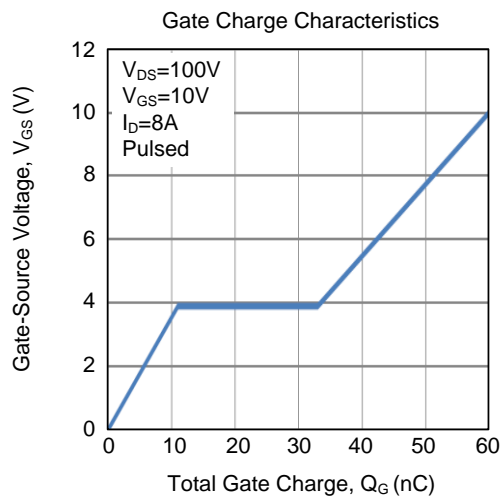
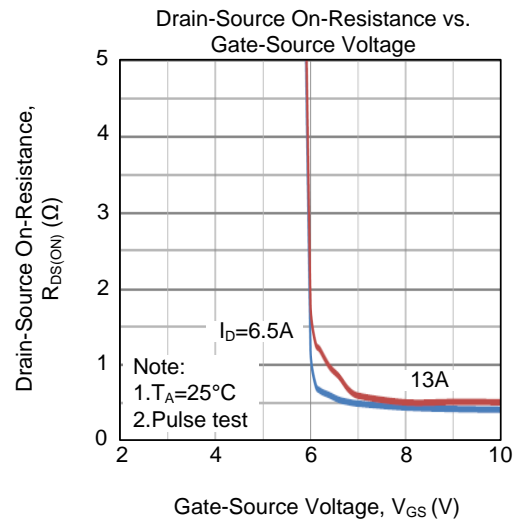
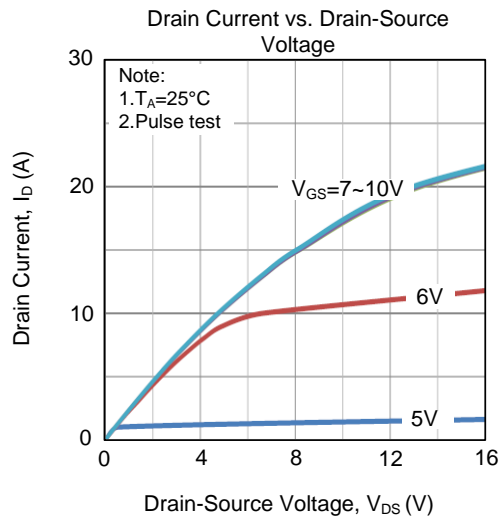


Unclamped Inductive Switching Test Circuit

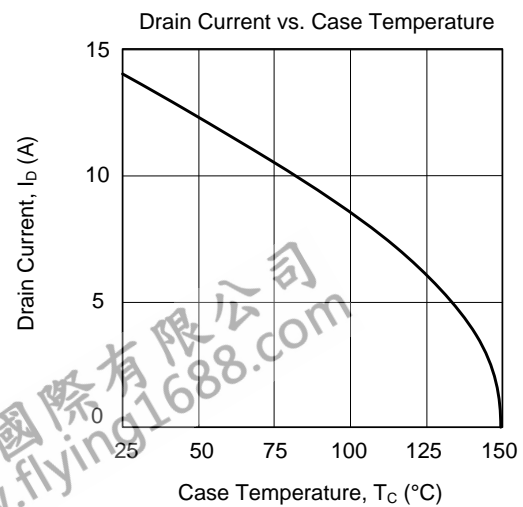
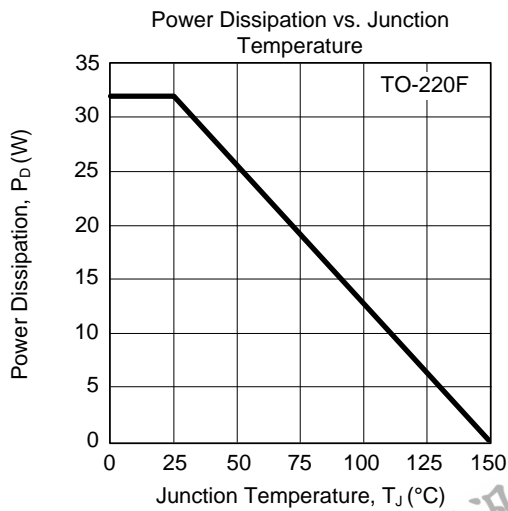
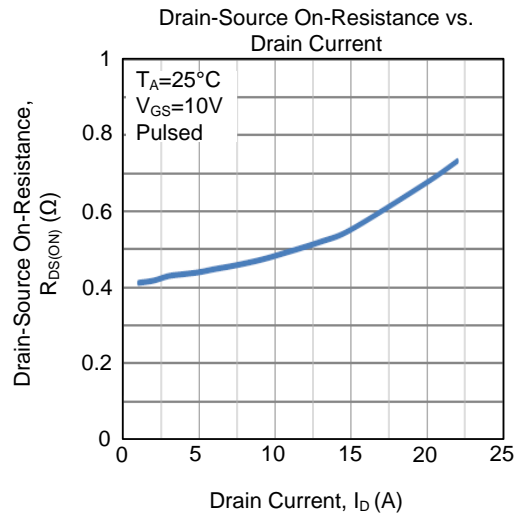
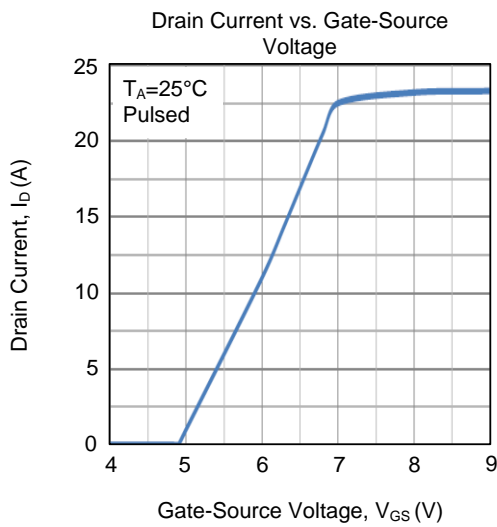
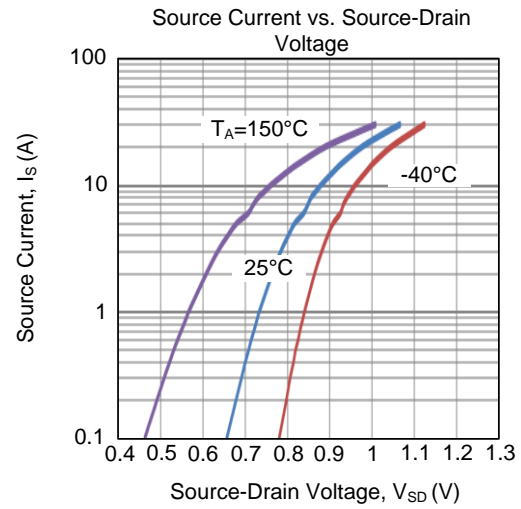
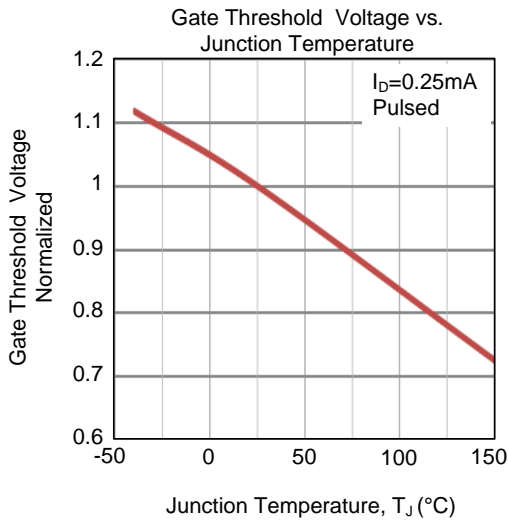


Unclamped Inductive Switching Waveforms

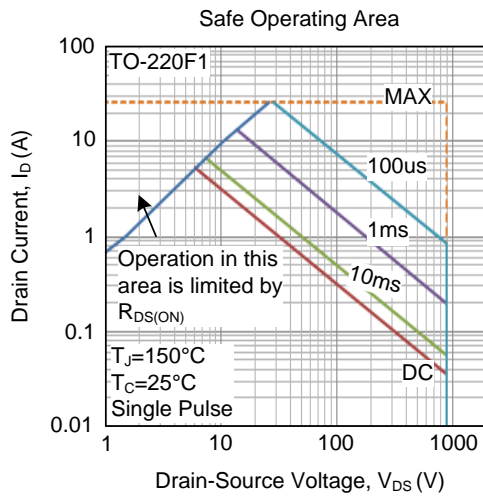
TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



■ TYPICAL CHARACTERISTICS (Cont.)



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