



20V DUAL MIDDLE POWER MOSFET (N-CHANNEL/P-CHANNEL)

■ DESCRIPTION

The UTC **UT9NP02** is a 20V N-Channel & P-Channel middle Power MOSFET, it uses UTC's advanced technology to provide the customers with a minimum on state resistance, etc.

The UTC **UT9NP02** is suitable for switching.

■ FEATURES

* N-CHANNEL

$R_{DS(ON)} \leq 16 \text{ m}\Omega$ @ $V_{GS}=4.5\text{V}$, $I_D=9.0\text{A}$

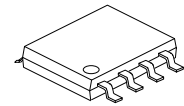
$R_{DS(ON)} \leq 23 \text{ m}\Omega$ @ $V_{GS}=2.5\text{V}$, $I_D=6.0\text{A}$

* P-CHANNEL

$R_{DS(ON)} \leq 40 \text{ m}\Omega$ @ $V_{GS}=-4.5\text{V}$, $I_D=-6.0\text{A}$

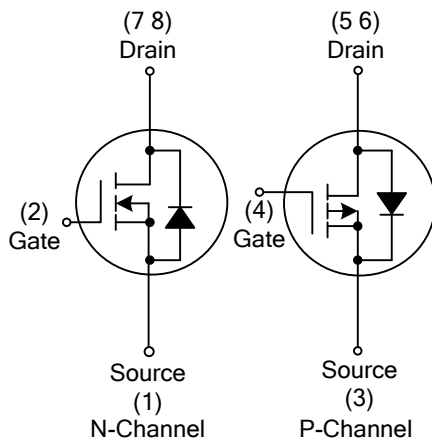
$R_{DS(ON)} \leq 54 \text{ m}\Omega$ @ $V_{GS}=-2.5\text{V}$, $I_D=-4.0\text{A}$

* Low on-resistance



SOP-8

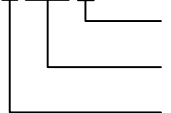
■ SYMBOL



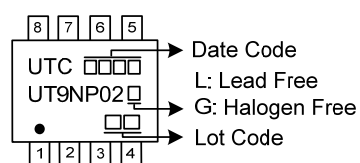
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
UT9NP02L-S08-R	UT9NP02G-S08-R	SOP-8	S1	G1	S2	G2	D2	D2	D1	D1	Tape Reel

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

UT9NP02G-S08-R  (1) Packing Type (2) Package Type (3) Green Package	(1) R: Tape Reel (2) S08: SOP-8 (3) G: Halogen Free and Lead Free, L: Lead Free
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■ MARKING



■ ABSOLUTE MAXIMUM RATING (T_C=25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS		UNIT
			N-CHANNEL	P-CHANNEL	
Drain-Source Voltage		V _{DSS}	20	-20	V
Gate-Source Voltage		V _{GSS}	±12	±12	V
Drain Current	Continuous	I _D	9	-9	A
	Pulsed (Note 2)	I _{DM}	36	-36	A
Avalanche Energy	Single Pulsed (Note 3)	E _{AS}	11	12	mJ
Power Dissipation		P _D	1.3		W
Junction Temperature		T _J	+150		°C
Storage Temperature Range		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 operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. N-CHANNEL: L = 0.1mH, I_{AS} = 14.5A, V_{DD} = 10V, R_G = 25Ω, Starting T_J = 25°C.

P-CHANNEL: L = 0.1mH, I_{AS} = -16A, V_{DD} = -10V, R_G = 25Ω, Starting T_J = 25°C.

■ THERMAL DATA

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ _{JA}	125	°C/W
Junction to Case	θ _{JC}	96	°C/W

Note: The data tested by surface mounted on a 1 inch² FR-4 board with 2OZ copper.

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

N-CHANNEL

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	I _D =250μA, V _{GS} =0V	20			V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =20V, V _{GS} =0V			1	μA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =±12V, V _{DS} =0V			±100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _D =250μA	0.5		1.2	V
Static Drain-Source On-State Resistance (Pulsed)	R _{DS(ON)}	V _{GS} =4.5V, I _D =9.0A			16	mΩ
		V _{GS} =2.5V, I _D =6.0A			23	mΩ
DYNAMIC PARAMETERS						
Input Capacitance	C _{ISS}	V _{DS} =15V, V _{GS} =0V, f=1.0MHz		733		pF
Output Capacitance	C _{OSS}			170		pF
Reverse Transfer Capacitance	C _{RSS}			155		pF
SWITCHING PARAMETERS						
Total Gate Charge (Pulsed)	Q _G	V _{DS} =16V, V _{GS} =4.5V, I _D =9.0A, (Note 1, 2)		21		nC
Gate to Source Charge (Pulsed)	Q _{GS}			2.6		nC
Gate to Drain Charge (Pulsed)	Q _{GD}			8		nC
Turn-ON Delay Time (Pulsed)	t _{D(ON)}	V _{DD} =10V, V _{GS} =10V, I _D =9.0A, R _G =3Ω (Note 1, 2)		5		ns
Rise Time (Pulsed)	t _R			17		ns
Turn-OFF Delay Time (Pulsed)	t _{D(OFF)}			28		ns
Fall-Time (Pulsed)	t _F			22		ns
SOURCE TO DRAIN DIODE SPECIFICATIONS						
Maximum Body-Diode Continuous Current	I _S				9	A
Maximum Body-Diode Pulsed Current	I _{SM}				36	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =1.0A, V _{GS} =0V			1	V

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

2. Essentially independent of operating temperature.

■ ELECTRICAL CHARACTERISTICS (Cont.)

P-CHANNEL

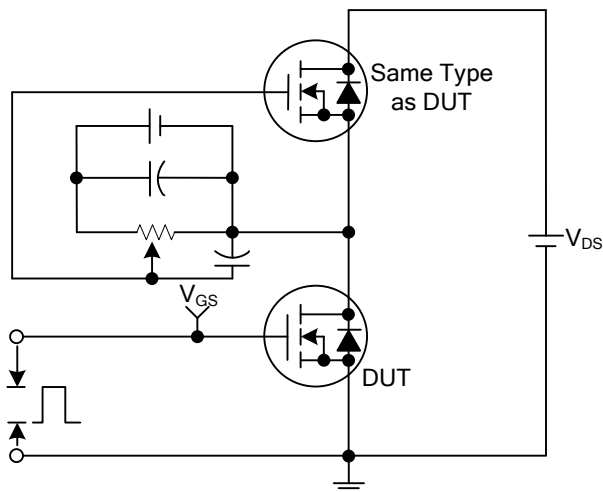
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV _{DSS}	I _D =-250μA, V _{GS} =0V	-20			V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-20V, V _{GS} =0V			-1	μA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =±12V, V _{DS} =0V			±100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _D =-250μA	-0.5		-1.2	V
Static Drain-Source On-State Resistance (Pulsed)	R _{DS(ON)}	V _{GS} =-4.5V, I _D =-6.0A			40	mΩ
		V _{GS} =-2.5V, I _D =-4.0A			54	mΩ
DYNAMIC PARAMETERS						
Input Capacitance	C _{ISS}	V _{DS} =-15V, V _{GS} =0V, f=1.0MHz		1000		pF
Output Capacitance	C _{OSS}			165		pF
Reverse Transfer Capacitance	C _{RSS}			148		pF
SWITCHING PARAMETERS						
Total Gate Charge (Pulsed)	Q _G	V _{DD} =-16V, V _{GS} =-10V, I _D =-9.0A (Note 1, 2)		13		nC
Gate to Source Charge (Pulsed)	Q _{GS}			1.5		nC
Gate to Drain Charge (Pulsed)	Q _{GD}			4.2		nC
Turn-ON Delay Time (Pulsed)	t _{D(ON)}	V _{DD} =-10V, V _{GS} =-10V, I _D =-9.0A, R _G =3.3Ω (Note 1, 2)		4		ns
Rise Time (Pulsed)	t _R			17		ns
Turn-OFF Delay Time (Pulsed)	t _{D(OFF)}			53		ns
Fall-Time (Pulsed)	t _F			32		ns
SOURCE TO DRAIN DIODE SPECIFICATIONS						
Maximum Body-Diode Continuous Current	I _S				-9	A
Maximum Body-Diode Pulsed Current	I _{SM}				-36	A
Drain-Source Diode Forward Voltage (Note 1)	V _{SD}	I _S =-1.0A, V _{GS} =0V			-1	V

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

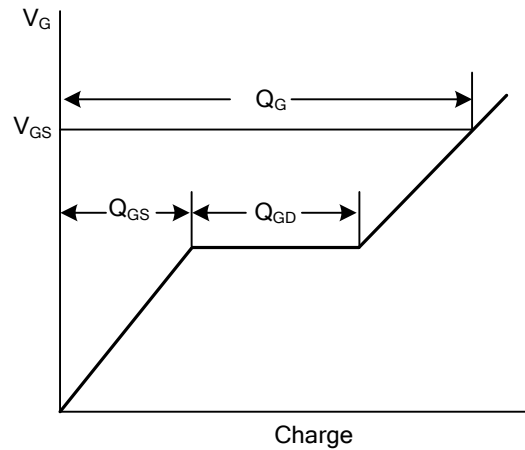
2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

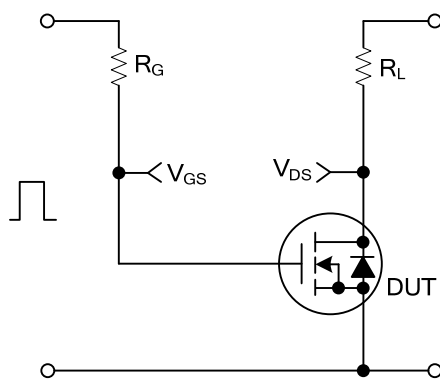
N-CHANNEL



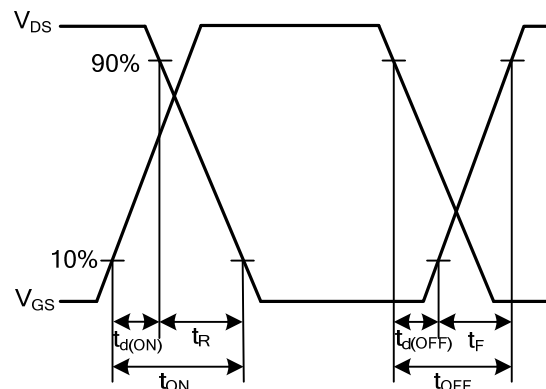
Gate Charge Test Circuit



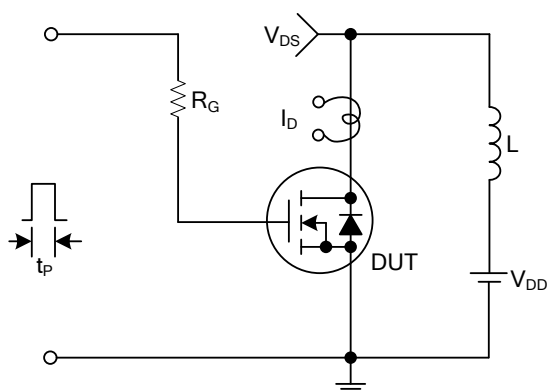
Gate Charge Waveforms



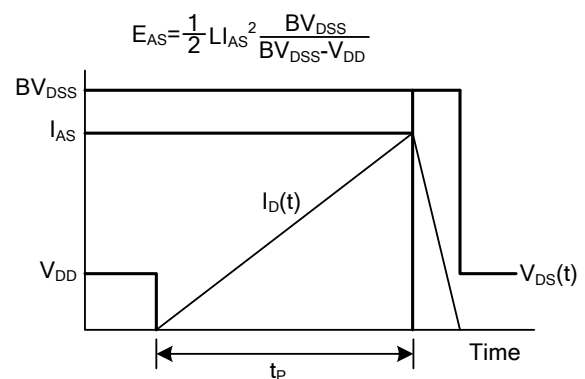
Resistive Switching Test Circuit



Resistive Switching Waveforms



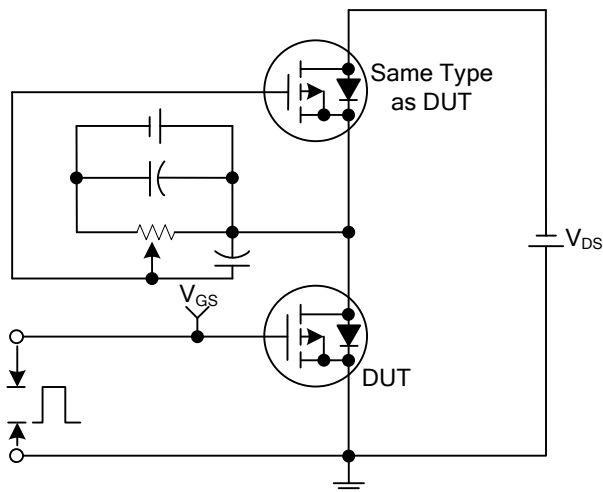
Unclamped Inductive Switching Test Circuit



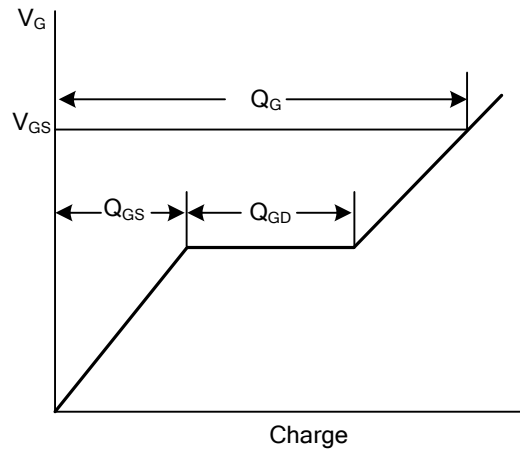
Unclamped Inductive Switching Waveforms

■ TEST CIRCUITS AND WAVEFORMS

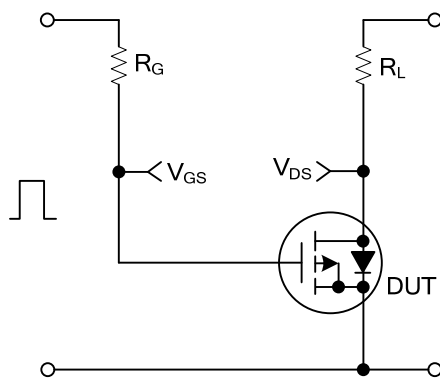
P-CHANNEL



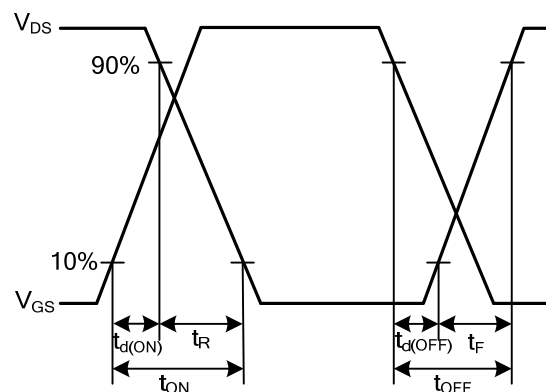
Gate Charge Test Circuit



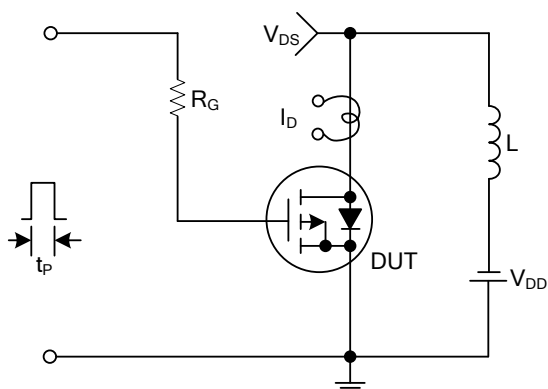
Gate Charge Waveforms



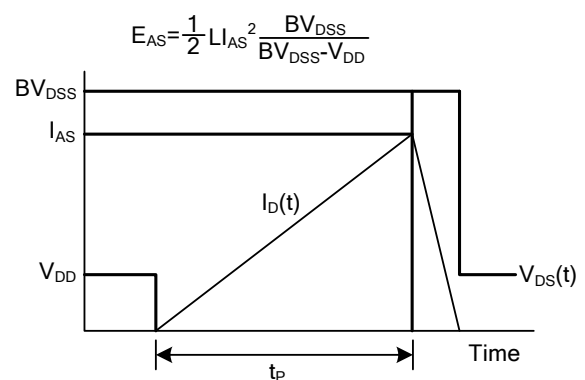
Resistive Switching Test Circuit



Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

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