

**TS4N65**

**4.0Amps, 650V N-Channel Power Mosfet**

DRAWING

**Features**

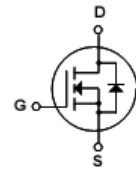
- ◆ 4.0A,650V, $R_{DS(ON)}=2.3\Omega@V_{GS}=10V$
- ◆ Low gate charge
- ◆ Fast switching capability
- ◆ Avalanche energy specified
- ◆ Improved dv/dt capability

**General Description**

- ◆ Package: ITO-220AB
- ◆ The TS4N65 N-Channel enhancement mode silicon gate power MOSFET is designed for high voltage, high speed power switching applications such as switching regulators, switching converters, solenoid, motor drivers, relay drivers.



G D S



**Absolute Maximum Ratings**

Symbol	Parameter	Spec	Units
$V_{DSS}$	Drain-Source Voltage	650	V
$I_D$	Drain Current -Continuous( $T_c=25^\circ C$ )	4.0	A
	Drain Current -Continuous( $T_c=100^\circ C$ )	2.5	
$I_{DM}$	Drain Current -Pulsed (Note 2)	16	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$P_D$	Power Dissipation( $T_c=25^\circ C$ )	36	W
$E_{AS}$	Single Pulsed Avalanche Energy	260	mJ
$I_{AR}$	Avalanche Current	4	A
$E_{AR}$	Repetitive Avalanche Energy	10.6	mJ
dv/dt	Peak Diode Recovery dv/dt	5.5	V/ns
$T_j$	Junction Temperature	+150	$^\circ C$
$T_{opr}$	Operating Temperature Range	-55 to +150	$^\circ C$
$T_{stg}$	Storage Temperature	-55 to +150	$^\circ C$

Note: 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. Pulse width limited by  $T_{J(MAX)}$
3.  $L = 16.8mH, I_{AS} = 5A, V_{DD} = 50V, R_G = 25 \Omega, \text{Starting } T_J = 25^\circ C$
4.  $I_{SD} \leq 4.5A, di/dt \leq 200A/\mu s, V_{DD} \leq BV_{DSS}, \text{Starting } T_J = 25^\circ C$

**Thermal Characteristics**

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	-	3.47	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	-	62.5	$^\circ C/W$

**Electrical Characteristics**(Tc=25°C unless otherwise noted)

**Off Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =250uA	650	—	—	V
BV <sub>DSS/TJ</sub>	Breakdown Voltage Temperature Coefficient	ID=250uA, Referenced to 25°C	—	0.6	—	V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	—	—	10	uA
I <sub>GSSF</sub>	Gate-Body Leakage Current Forward	V <sub>gs</sub> =30V, V <sub>ds</sub> =0V	—	—	100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current Reverse	V <sub>gs</sub> =-30V, V <sub>ds</sub> =0V	—	—	-100	nA

**On Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V <sub>GSTH</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	2.0	—	4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =2.2A	—	2.3	2.6	Ω

**Dynamic Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0MHz	—	520	670	pF
C <sub>oss</sub>	Output Capacitance		—	70	90	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		—	8	11	pF

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
t <sub>don</sub>	Turn-On Delay Time	V <sub>DD</sub> =325V I <sub>D</sub> =4.0A R <sub>G</sub> =25Ω (Note 1.2)	—	13	35	ns
t <sub>r</sub>	Turn-On Rise Time		—	45	100	ns
t <sub>doff</sub>	Turn-Off Delay Time		—	35	60	ns
t <sub>f</sub>	Turn-Off Fall Time		—	25	—	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =520V	—	15	20	nc
Q <sub>gs</sub>	Gate-Source Charge	I <sub>D</sub> =4.0A	—	3.4	—	nc
Q <sub>gd</sub>	Gate-Drain Charge	V <sub>GS</sub> =10V	—	7.1	—	nc

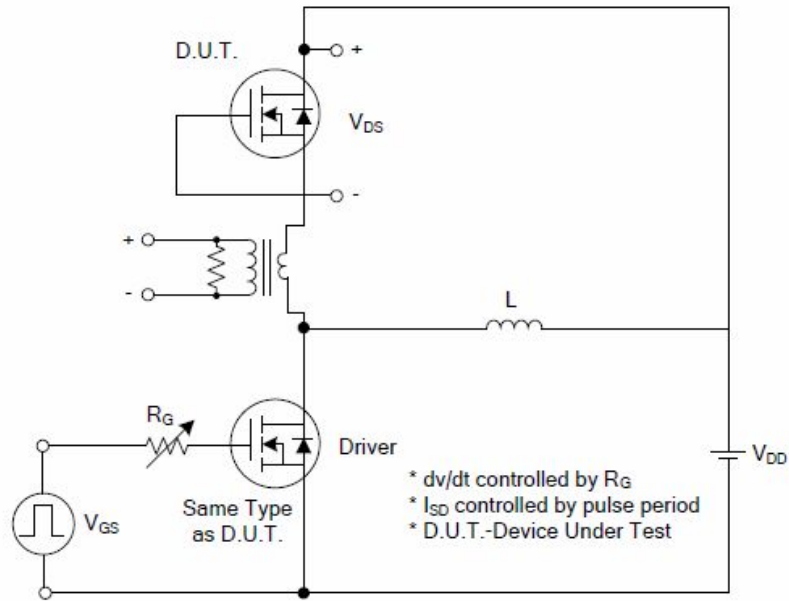
**Drain-Source Diode Characteristics and Maximum Ratings**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I <sub>s</sub>	Maximum Continuous Drain-source diode forward current		—	—	4.4	A
I <sub>sm</sub>	Maximum pulsed drain-source diode forward current		—	—	17.6	A
V <sub>sd</sub>	Drain-source diode forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =4A	—	—	1.4	V
T <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> =0V, I <sub>S</sub> =4A	—	250	—	ns
Q <sub>rr</sub>	Reverse Recovery charge	dif/dt=100A/us (Note 1)	—	1.5	—	uc

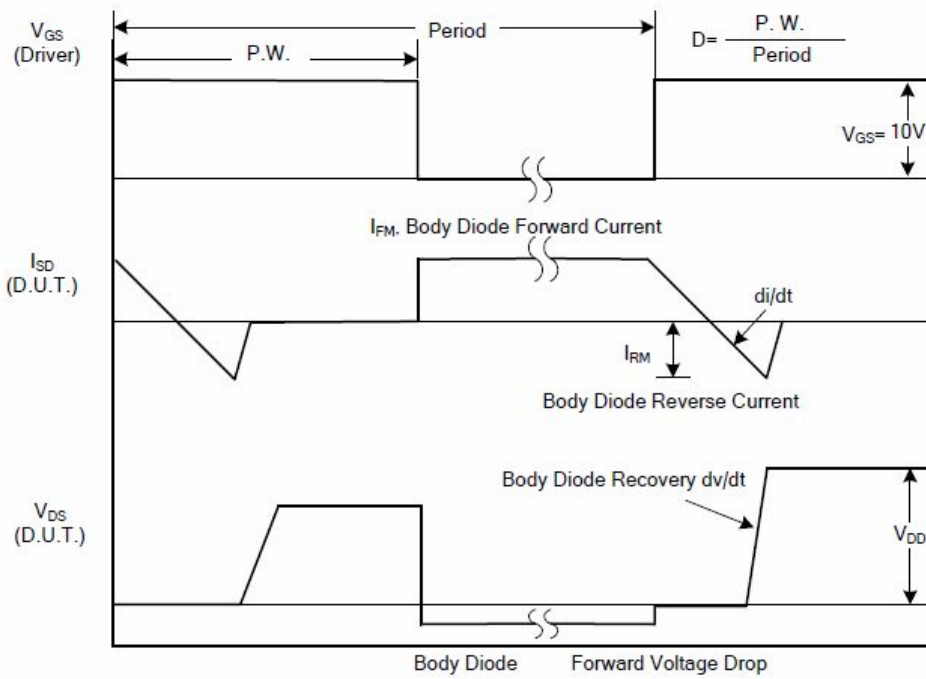
Notes : a. pulse test pulse width 300 us, duty cycle 2% ,Guaranteed by design, not subject to production testing.

b. HOMSEMI reserves the right to improve product design functions and reliability without notice.

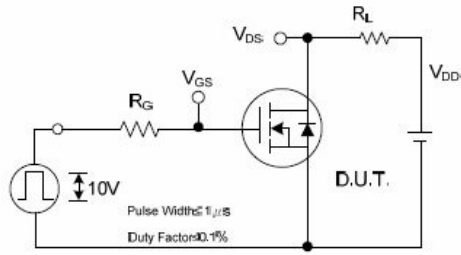
Test circuits and waveforms



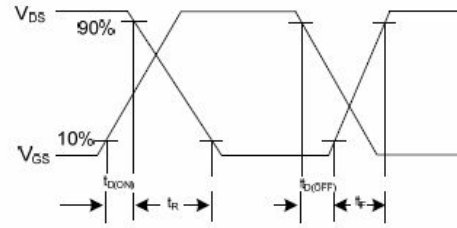
Peak Diode Recovery  $dv/dt$  Test Circuit



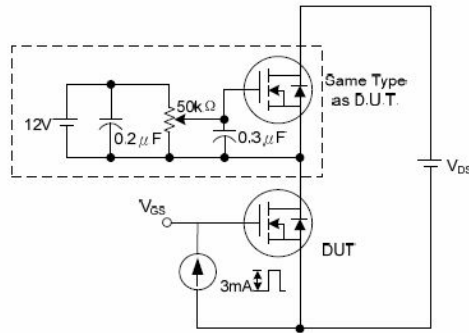
Peak Diode Recovery  $dv/dt$  Waveforms



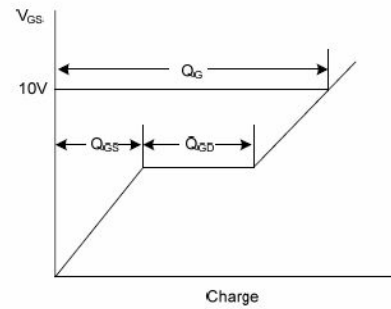
Switching Test Circuit



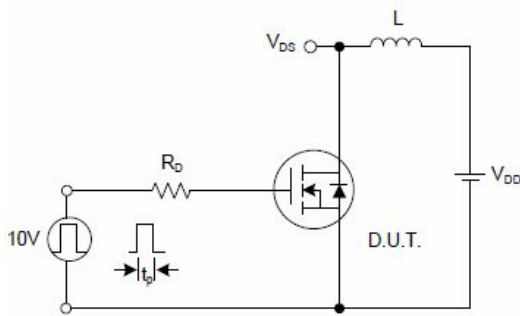
Switching Waveforms



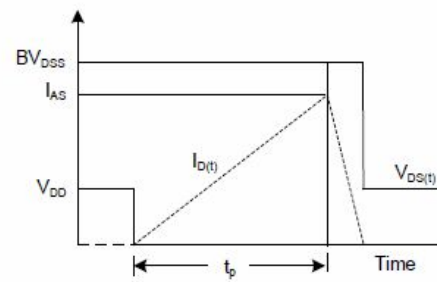
Gate Charge Test Circuit



Gate Charge Waveform

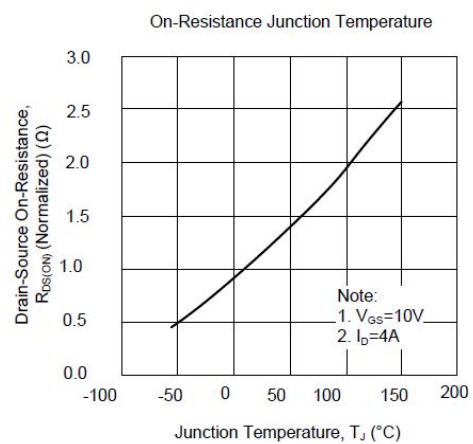
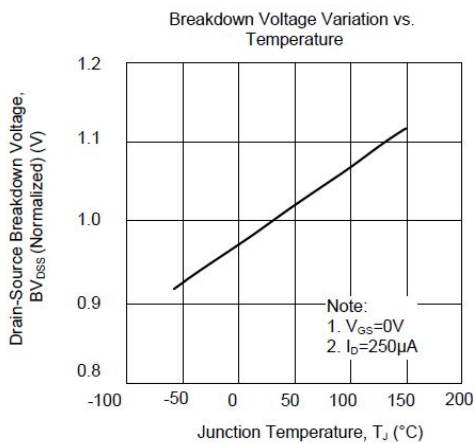


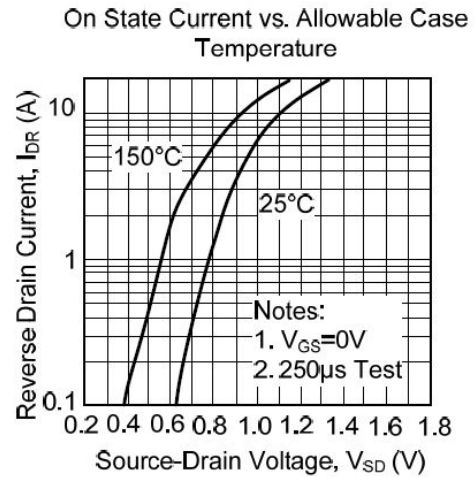
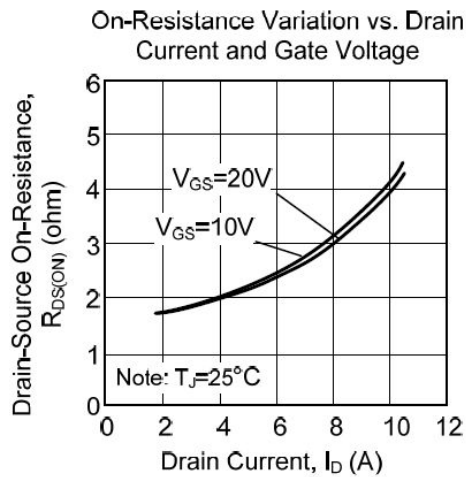
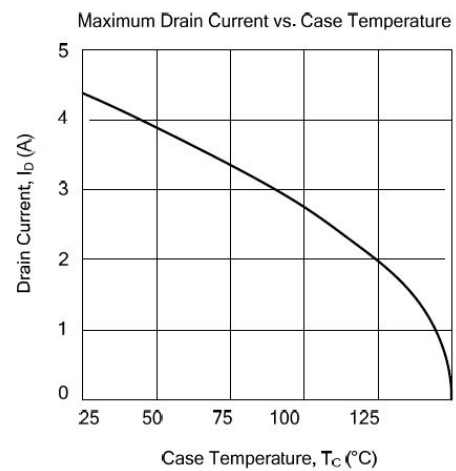
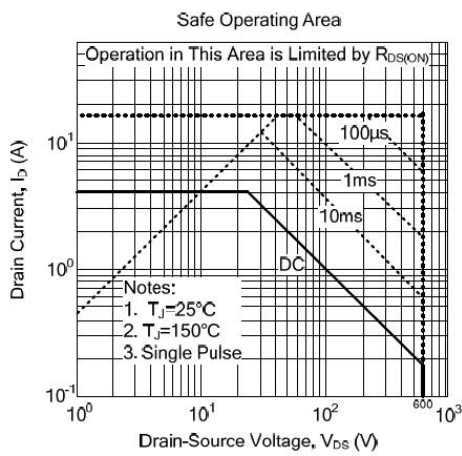
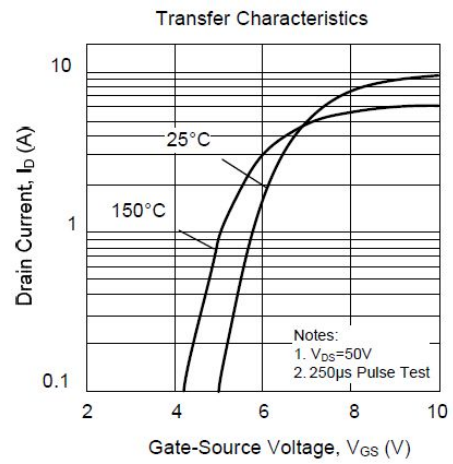
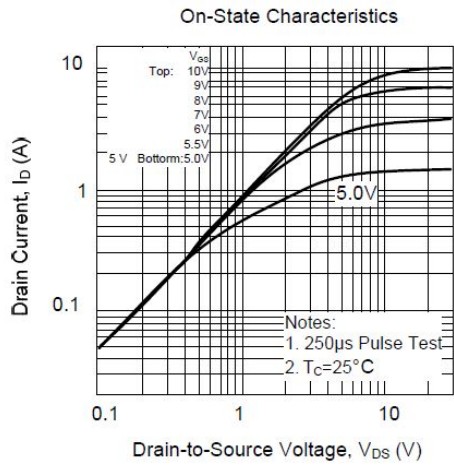
Unclamped Inductive Switching Test Circuit



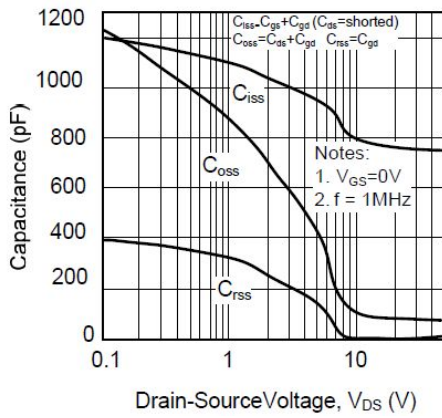
Unclamped Inductive Switching Waveforms

Typical Characteristics

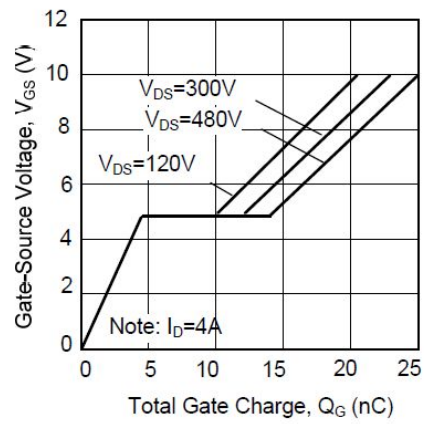




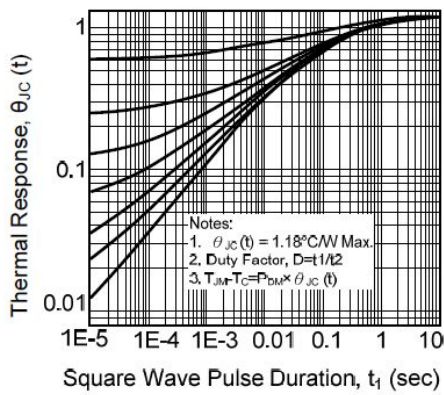
Capacitance Characteristics (Non-Repetitive)



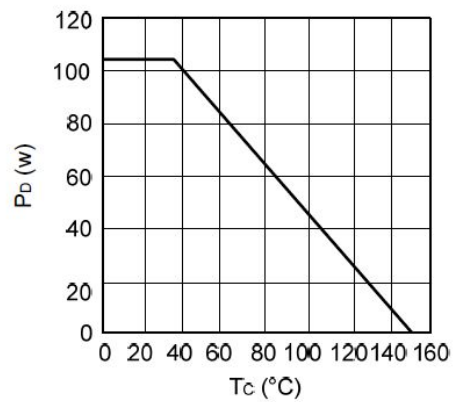
Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation



Mechanical Dimensions

