

**TS12N65**

**12Amps, 650V N-Channel Mosfet**

DRAWING

**features**

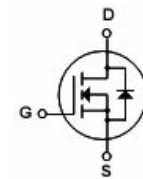
- ◆ 12A,650V, $R_{DS(ON)}=0.8\Omega@V_{GS}=10V,I_D=6A$
- ◆ Low gate charge(typical 21nc)
- ◆ Low Crss (typical 32pF)
- ◆ 100%avalanche tested

**General Description**

- ◆ Package:ITO-220AB DG
- ◆ This N-Channel enhancement mode power MOSFET is produced using proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.



G D S



**Absolute Maximum Ratings**

Symbol	Parameter	Spec	Units
$V_{DSS}$	Drain-Source Voltage	650	V
$I_D$	Drain Current -Continuous( $T_c=25^\circ C$ )	12*	A
	-Continuous( $T_c=100^\circ C$ )	7*	A
$I_{DM}$	Drain Current -Pulsed (note 1)	48*	A
$I_{AR}$	Avalanche Current (note 1)	7.0	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (note 2)	446	mJ
$E_{AR}$	Repetitive Avalanche Energy (note 1)	43	mJ
dv/dt	Peak Diode Recovery dv/dt (note 3)	4.0	V/ns
$P_D$	Power Dissipation ( $T_c=25^\circ C$ )	65	W
	-Derate above $25^\circ C$	0.52	W/ $^\circ C$
$T_j, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum lead temperature for soldering purpose 1/8" from case for 5 seconds	300	$^\circ C$

\* Drain current is limited by junction temperature.

**Thermal Characteristics**

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	-	1.92	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	-	62.5	$^\circ C/W$

**Electrical Characteristics**( $T_c=25^{\circ}\text{C}$  unless otherwise noted)

**Off Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	650	—	—	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D=250\mu A$ , Referenced to $25^{\circ}\text{C}$	—	0.55	—	$V/^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=650V, V_{GS}=0V$	—	—	1	$\mu A$
		$V_{DS}=520V, T_c=125^{\circ}\text{C}$	—	—	50	$\mu A$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS}=30V, V_{DS}=0V$	—	—	100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS}=-30V, V_{DS}=0V$	—	—	-100	nA

**On Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{Gsth}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	—	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS}=10V, I_D=6A$	—	0.7	0.8	$\Omega$
$G_{fs}$	Forward Transconductance	$V_{DS}=40V, I_D=6A$	5	—	—	S

**Dynamic Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$C_{iss}$	Input Capacitance	$V_{DS}=25V, V_{GS}=0V, f=1.0\text{MHz}$	—	1950	2530	pF
$C_{oss}$	Output Capacitance		—	156	205	pF
$C_{rss}$	Reverse Transfer Capacitance		—	32	42	pF

**Switching Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{don}$	Turn-On Delay Time	$V_{DD}=325V$ $I_D=12A$ $R_G=25\Omega$ (note 4,5)	—	22	60	ns
$t_r$	Turn-On Rise Time		—	43	100	ns
$t_{doff}$	Turn-Off Delay Time		—	169	250	ns
$t_f$	Turn-Off Fall Time		—	60	150	ns
$Q_g$	Total Gate Charge	$V_{DS}=520V$	—	53	80	nc
$Q_{gs}$	Gate-Source Charge	$I_D=12A$	—	9	—	nc
$Q_{gd}$	Gate-Drain Charge	$V_{GS}=10V$ (note 4,5)	—	21	—	nc

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$I_s$	Continuous source current	Integral reverse p-n Junction diode in the MOSFET	—	—	12	A
$I_{sm}$	Pulsed source current		—	—	48	A
$V_{sd}$	Drain-source diode forward Voltage	$V_{GS}=0V, I_s=12A$	—	—	1.5	V
$T_{rr}$	Reverse Recovery Time	$V_{GS}=0V, I_s=12A$ $di/dt=100A/\mu s$	—	425	—	ns
$Q_{rr}$	Reverse Recovery charge		—	6.3	—	$\mu C$

**Notes:**

1. Repetitive rating : pulse width limited by junction temperature.
2.  $L = 6.2\text{mH}$ ,  $I_{AS} = 12A$ ,  $V_{DD} = 50V$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^{\circ}\text{C}$ .
3.  $I_{SD} \leq 12A$ ,  $di/dt = 100A/\mu s$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^{\circ}\text{C}$ .
4. Pulse Test : Pulse Width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature.

Typical Characteristics

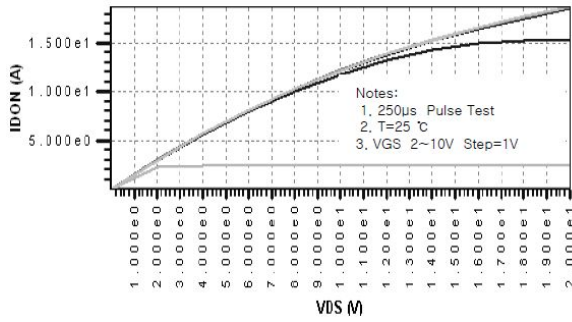


Figure 1. On-state characteristics

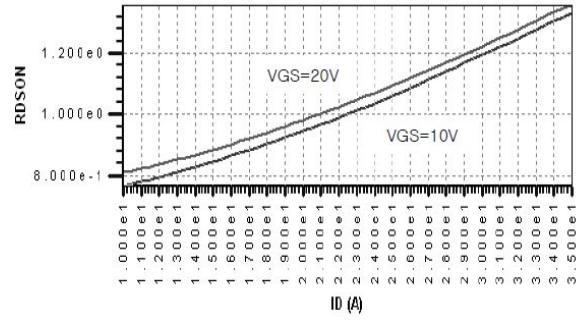


Figure 2. On-resistance variation vs. drain current and gate voltage

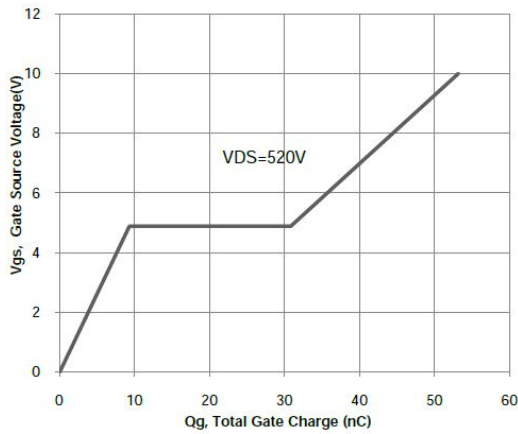


Figure 3. Gate charge characteristics

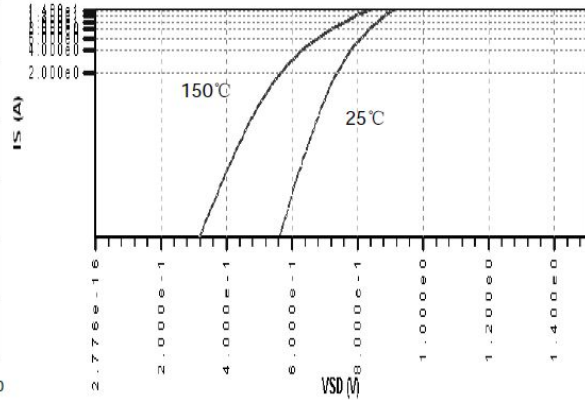


Figure 4. On state current vs. diode forward voltage

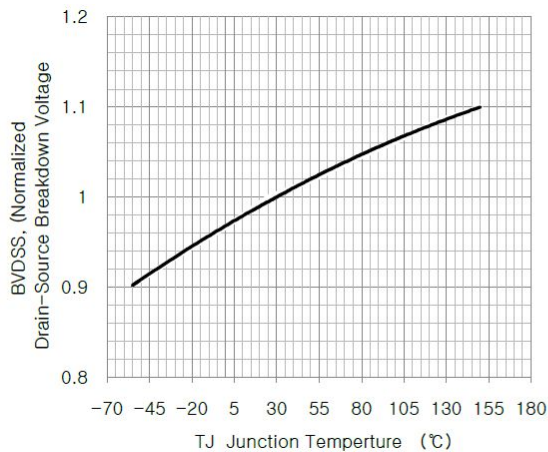


Figure 5. Breakdown Voltage Variation Vs. Junction Temperature

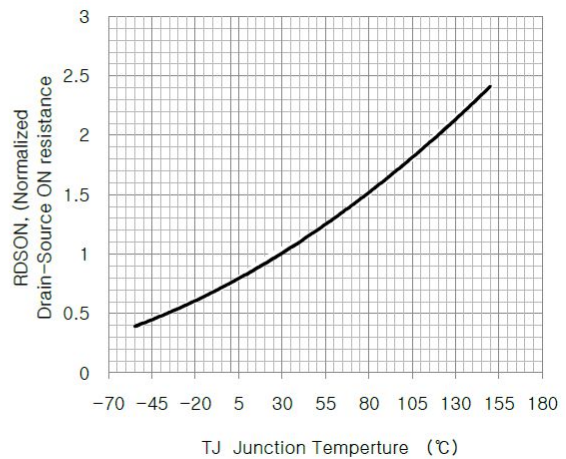


Figure 6. On-Resistance Variation vs. Junction Temperature

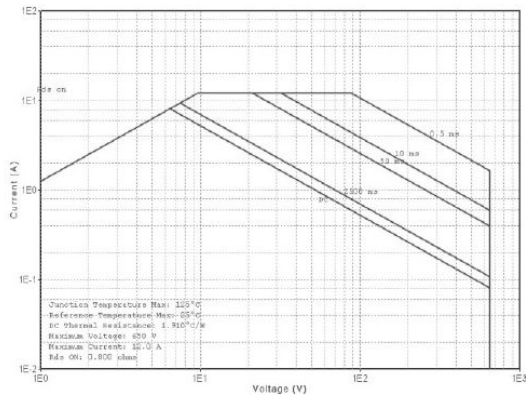


Figure 7. Maximum Safe Operating Area

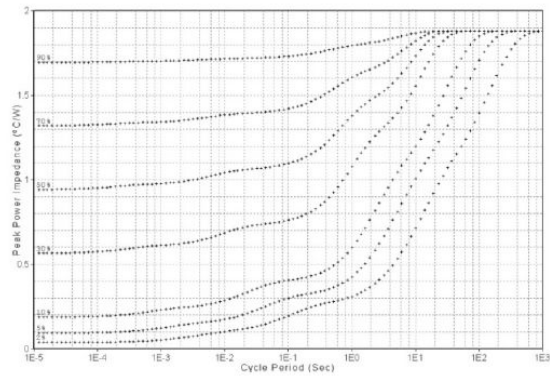
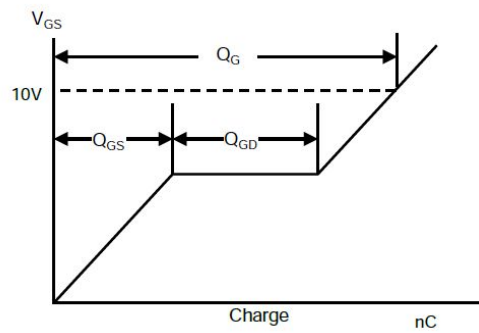
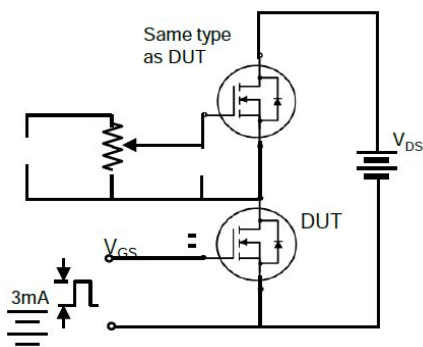


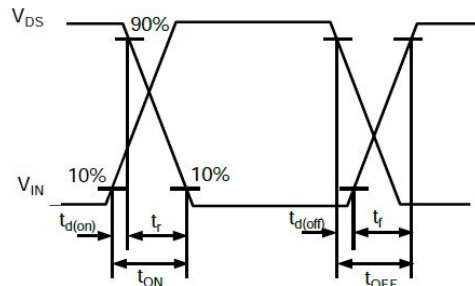
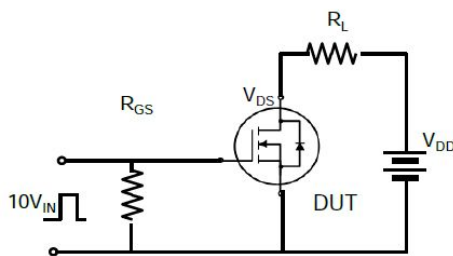
Figure 8. Transient thermal response curve

Test circuits and waveforms

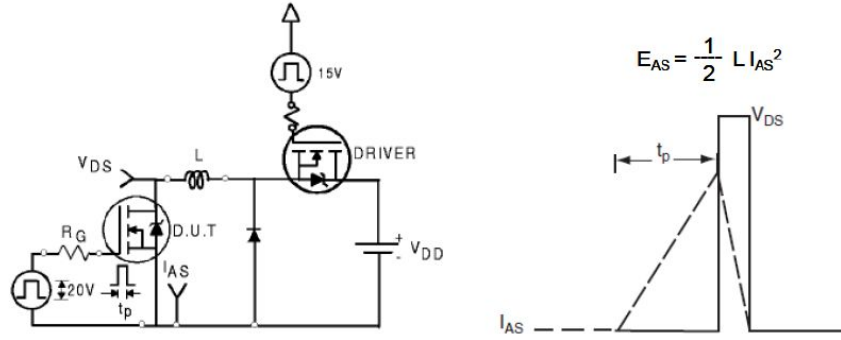
Gate Charge Test Circuit & Waveform



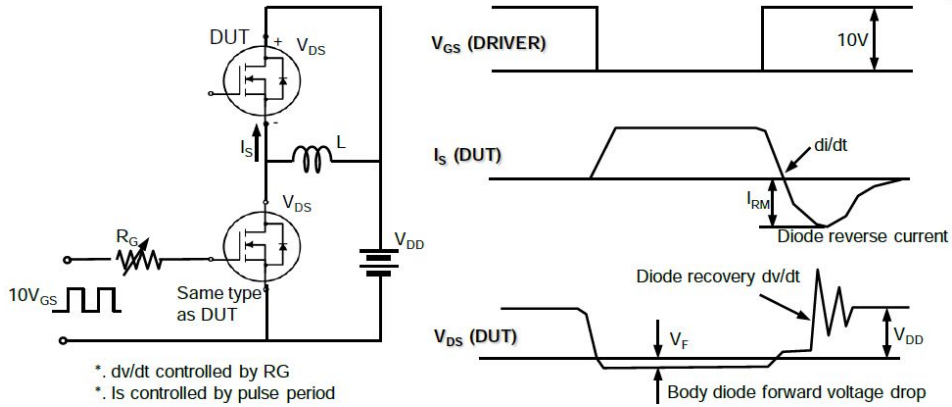
Switching Time Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Circuit & Waveforms



Mechanical Dimensions

