Dec2015

SemiHow
Know-How for Semiconductor

HRLP125N06K
60V N-Channel Trench MOSFET

$BV_{DSS} = 60$ V

$R_{DS(on)\ typ} = 10$ mΩ

$I_D = 70$ A

TO-220

1.Gate 2. Drain 3. Source

FEATURES

❑ Originative New Design
❑ Superior Avalanche Rugged Technology
❑ Excellent Switching Characteristics
❑ Unrivalled Gate Charge : 50 nC (Typ.)
❑ Extended Safe Operating Area
❑ Lower $R_{DS(ON)}$: 10 mΩ (Typ.) @V_{GS}=10V
❑ Lower $R_{DS(ON)}$: 12 mΩ (Typ.) @V_{GS}=4.5V
❑ 100% Avalanche Tested

Absolute Maximum Ratings T_C=25℃ unless otherwise specified

Symbol	Parameter	Value	Units
V_{DSS}	Drain-Source Voltage	60	V
I_D	Drain Current – Continuous ($T_C = 25$℃)	70	A
	Drain Current – Continuous ($T_C = 100$℃)	49	A
I_{DM}	Drain Current – Pulsed (Note 1)	245	A
V_{GS}	Gate-Source Voltage	±25	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	145	mJ
E_{AR}	Repetitive Avalanche Energy (Note 1)	11.5	mJ
P_D	Power Dissipation ($T_C = 25$℃)	115	W
	- Derate above 25℃	0.77	W/℃
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	℃
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	℃

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	1.3	℃/W
$R_{\theta CS}$	Case-to-Sink	0.5	--	
$R_{\theta JA}$	Junction-to-Ambient	--	62.5	

Electrical Characteristics T_J=25 °C unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
On Characteristics						
V_{GS}	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250\ \mu A$	1.0	--	2.4	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10$ V, $I_D = 15$ A	--	10	12.5	mΩ
		$V_{GS} = 4.5$ V, $I_D = 10$ A	--	12	15	mΩ
g_{FS}	Forward Transconductance	$V_{DS} = 5$, $I_D = 15$ A	--	30	--	S
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 250\ \mu A$	60	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48$ V, $V_{GS} = 0$ V	--	--	1	μA
		$V_{DS} = 48$ V, $T_J = 125\ ℃$	--	--	100	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS} = \pm 20$ V, $V_{DS} = 0$ V	--	--	± 100	nA
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, $f = 1.0$ MHz	--	2700	--	pF
C_{oss}	Output Capacitance		--	230	--	pF
C_{rss}	Reverse Transfer Capacitance		--	180	--	pF
R_g	Gate Resistance	$V_{GS} = 0$ V, $V_{DS} = 0$ V, $f = 1$MHz	--	1.2	--	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 30$ V, $I_D = 15$ A, $R_G = 6\ \Omega$	--	20	--	ns
t_r	Turn-On Rise Time		--	50	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	120	--	ns
t_f	Turn-Off Fall Time		--	40	--	ns
Q_g	Total Gate Charge	$V_{DS} = 48$ V, $I_D = 15$ A, $V_{GS} = 10$ V	--	50	--	nC
Q_{gs}	Gate-Source Charge		--	7	--	nC
Q_{gd}	Gate-Drain Charge		--	13	--	nC
Source-Drain Diode Maximum Ratings and Characteristics						
I_S	Continuous Source-Drain Diode Forward Current		--	--	70	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	245	
V_{SD}	Source-Drain Diode Forward Voltage	$I_S = 15$ A, $V_{GS} = 0$ V	--	--	1.3	V
trr	Reverse Recovery Time	$I_S = 15$ A, $V_{GS} = 0$ V, $di_F/dt = 100$ A/μs	--	40	--	ns
Qrr	Reverse Recovery Charge		--	40	--	nC
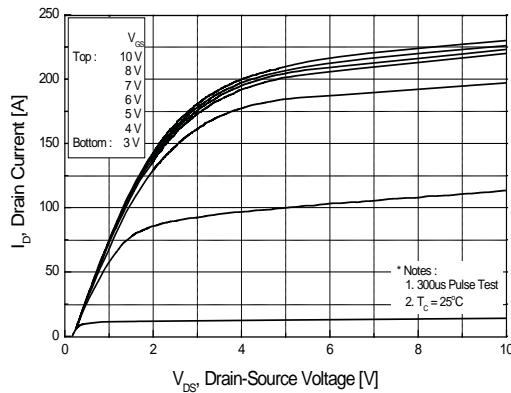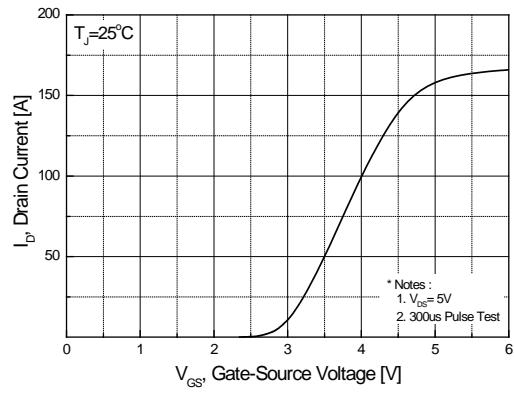
Notes :

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L=1mH, I_{AS}=13A, V_{DD}=25V, R_G=25Ω, Starting T_J=25°C
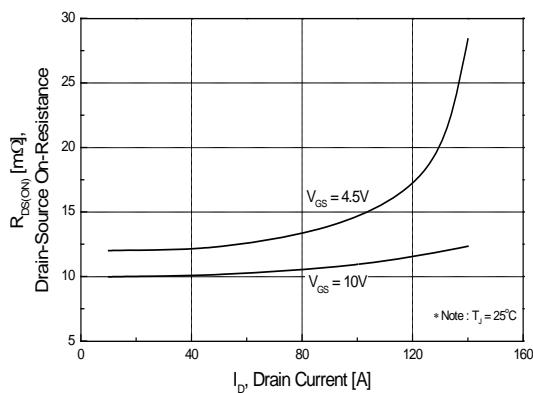
Typical Characteristics
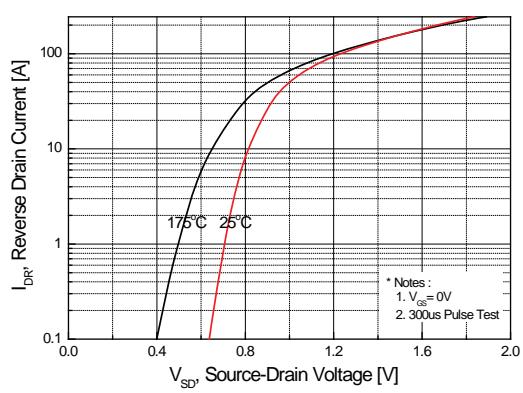
Figure 1. On Region Characteristics
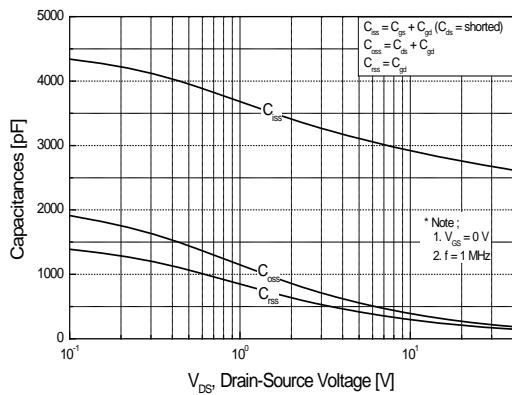
Figure 2. Transfer Characteristics
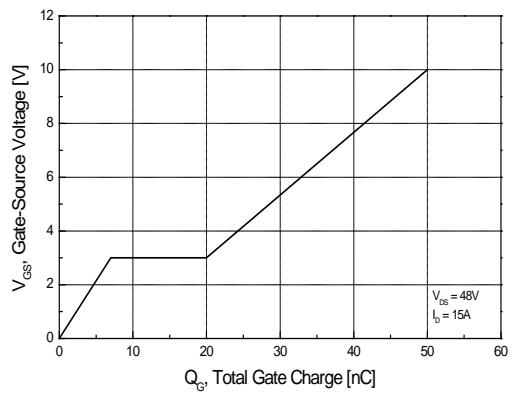
Figure 3. On Resistance Variation vs
Drain Current and Gate Voltage

Figure 4. Body Diode Forward Voltage
Variation with Source Current
and Temperature
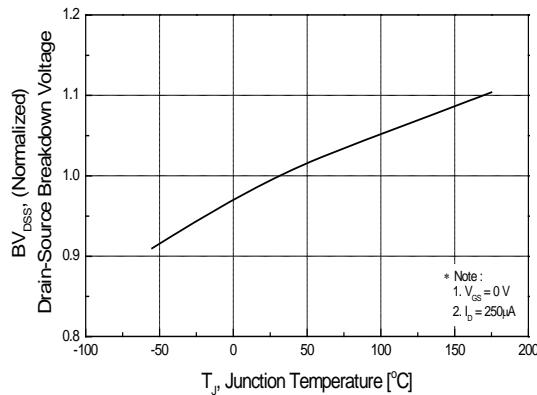


Figure 5. Capacitance Characteristics
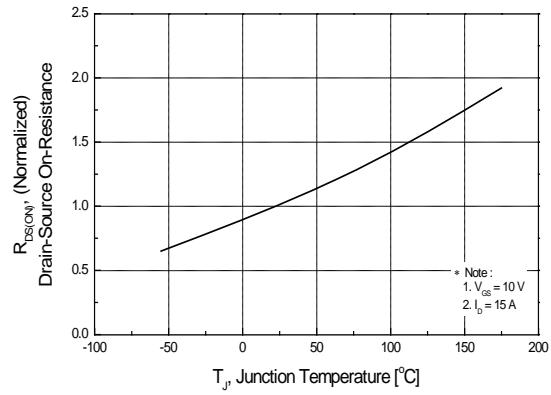
Figure 6. Gate Charge Characteristics
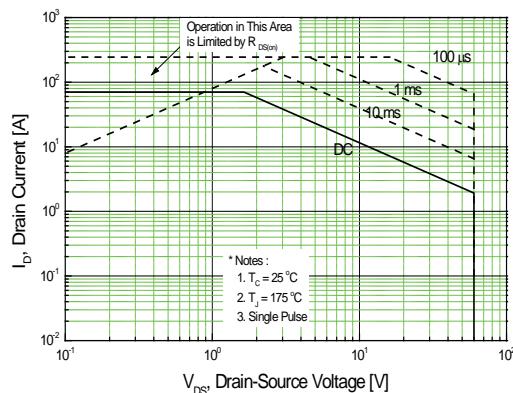
Typical Characteristics (continued)
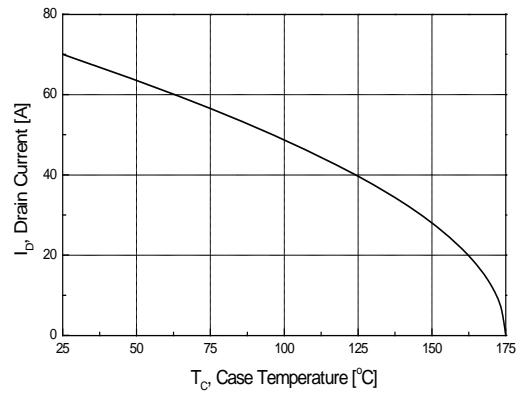
Figure 7. Breakdown Voltage Variation
vs Temperature
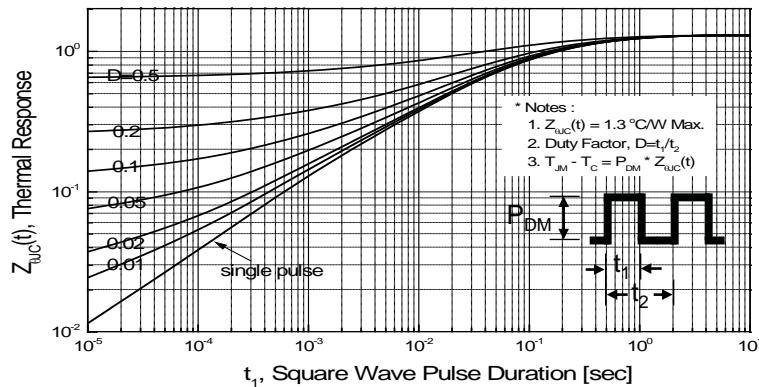
Figure 8. On-Resistance Variation
vs Temperature

Figure 9. Maximum Safe Operating Area
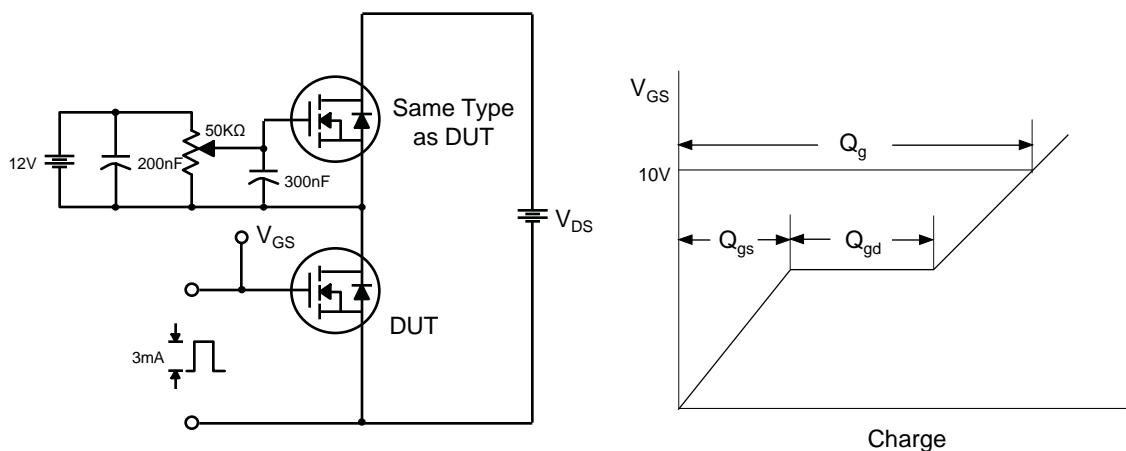
Figure 10. Maximum Drain Current
vs Case Temperature
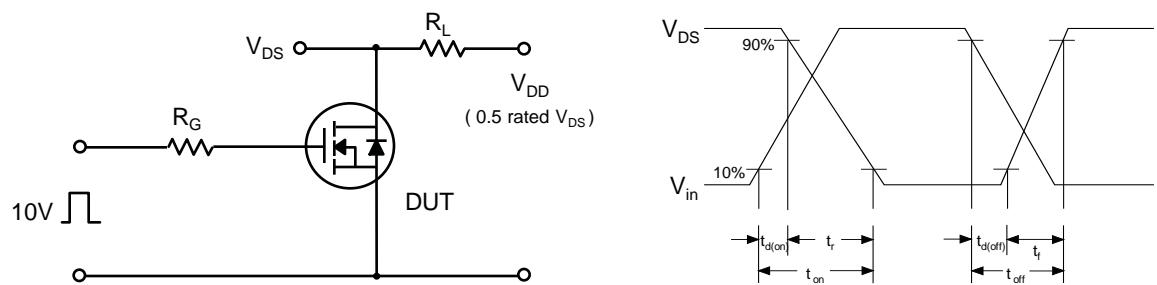
Figure 11. Transient Thermal Response Curve
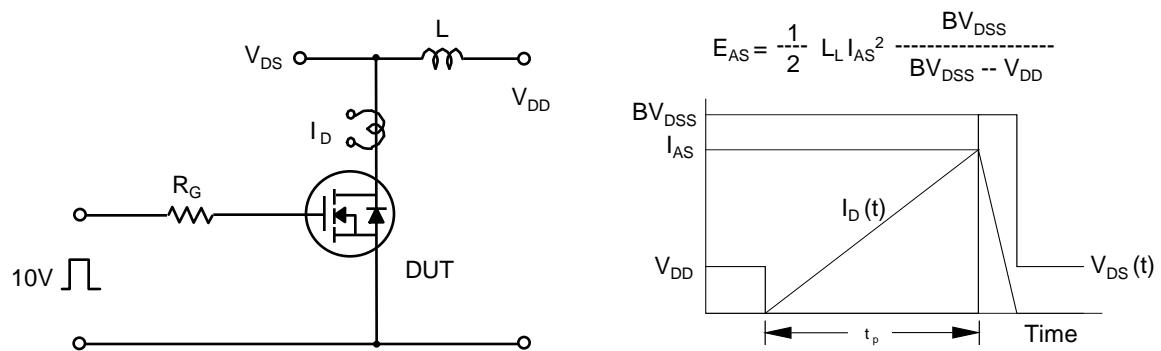
Fig 12. Gate Charge Test Circuit & Waveform

Fig 13. Resistive Switching Test Circuit & Waveforms
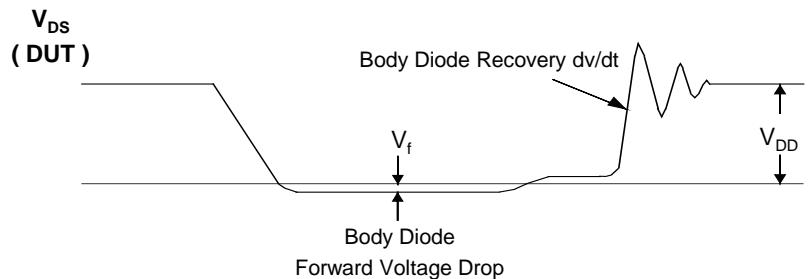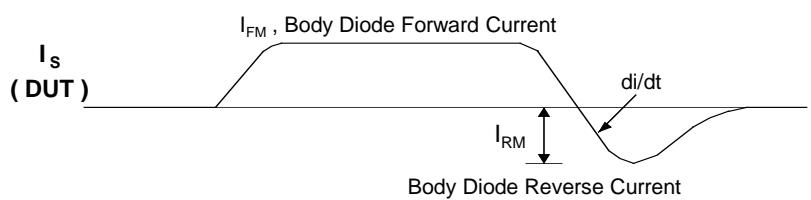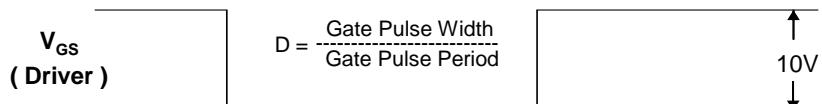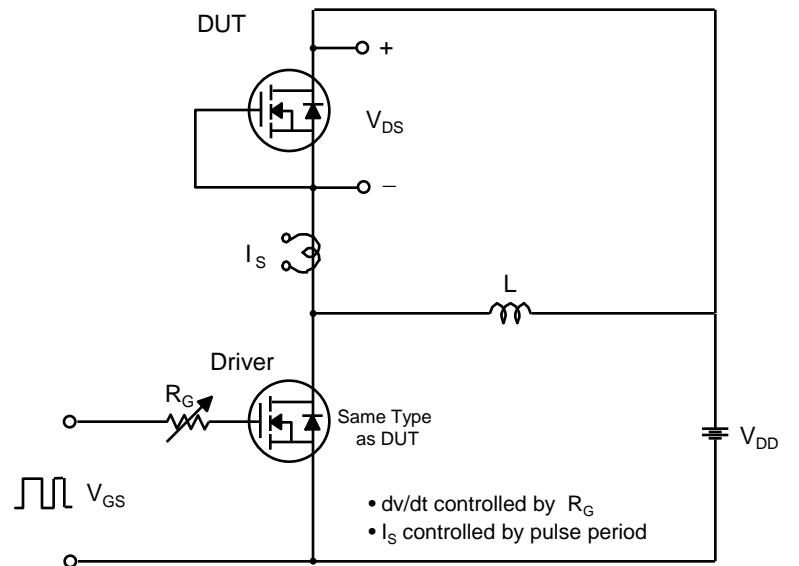
Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \, L_L \, I_{AS}^2 \; \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

+

−

I_S

L

Driver

R_G

Same Type
as DUT

V_{GS}

V_{DD}

• dv/dt controlled by R_G
• I_S controlled by pulse period

V_{GS}
(Driver)

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$

10V

I_S
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_f

V_{DD}

Body Diode
Forward Voltage Drop

Package Dimension

TO-220

9.90±0.20

φ3.60±0.20

15.70±0.20

2.80±0.20

6.50±0.20

9.19±0.20

13.08±0.20

1.27±0.20

1.52±0.20

3.02±0.20

0.80±0.20

2.54typ

2.54typ

4.50±0.20

1.30±0.20

2.40±0.20

0.50±0.20