SemiHow
Know-How for Semiconductor

Jan 2016

HRLO125N06K
60V N-Channel Trench MOSFET

Features

❑ High Dense Cell Design

❑ Reliable and Rugged

❑ Advanced Trench Process Technology

Key Parameters

Parameter	Value	Unit
BV_{DSS}	60	V
I_D	10	A
$R_{DS(on), typ}$ @10V	12.5	mΩ
$R_{DS(on), typ}$ @4.5V	14.0	mΩ

Application

❑ Power Management in Inverter System

❑ Synchronous Rectification

Package & Internal Circuit

SOP-8
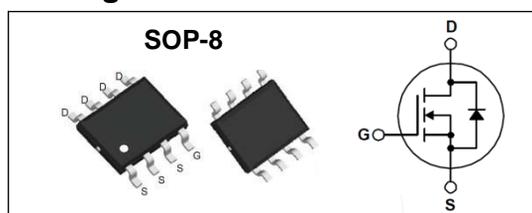
Absolute Maximum Ratings T_A=25℃ unless otherwise specified

Symbol	Parameter		Value	Units
V_{DSS}	Drain-Source Voltage		60	V
V_{GS}	Gate-Source Voltage		±20	V
I_D	Drain Current	$T_A = 25℃$	10	A
		$T_A = 70℃$	8	A
I_{DM}	Pulsed Drain Current (Note 1)		40	A
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		123	mJ
P_D	Power Dissipation	$T_A = 25℃$	3.1	W
		$T_A = 70℃$	2.0	W
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to +150	℃

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{θJL}$	Junction-to-Lead	--	24	℃/W
$R_{θJA}$	Junction-to-Ambient (t≤10s)	--	40	℃/W
	Junction-to-Ambient (steady state)	--	75	℃/W

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, $I_D = 10$ A	--	12.5	15.6	mΩ
		$V_{GS} = 4.5$ V, $I_D = 9$ A	--	14.0	17.5	mΩ
g_{FS}	Forward Transconductance	$V_{DS} = 5$, $I_D = 10$ A	--	24	--	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 = 1MHz	--	1.2	--	Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 30$ V, $I_D = 10$ A, $R_G = 6$ Ω	--	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, $I_D = 10$ 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		--	--	10	A
I_{SM}	Pulsed Source-Drain Diode Forward Current		--	--	40	
V_{SD}	Source-Drain Diode Forward Voltage	$I_S = 10$ A, $V_{GS} = 0$ V	--	--	1.3	V
trr	Reverse Recovery Time	$I_S = 10$ 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}=12A, V_{DD}=25V, R_G=25Ω, Starting T_J=25°C

Typical Characteristics
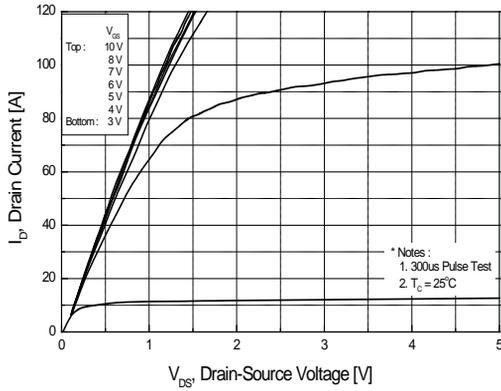

Figure 1. On Region Characteristics
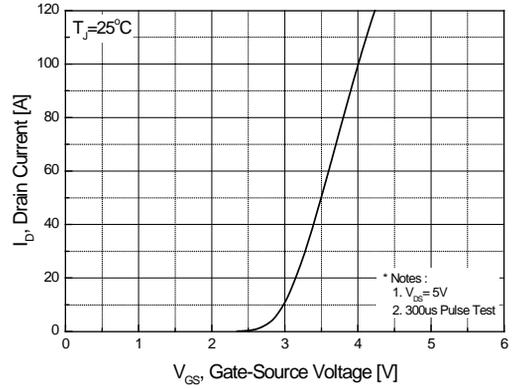
Figure 2. Transfer Characteristics
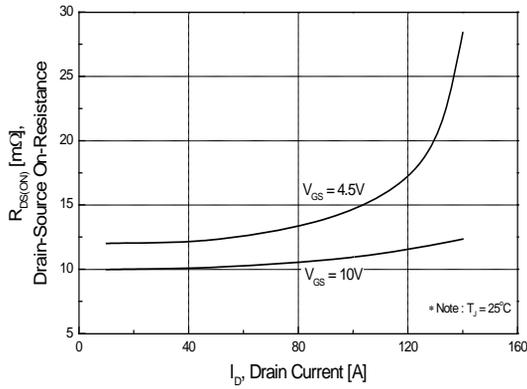
Figure 3. On Resistance Variation vs Drain Current and Gate Voltage
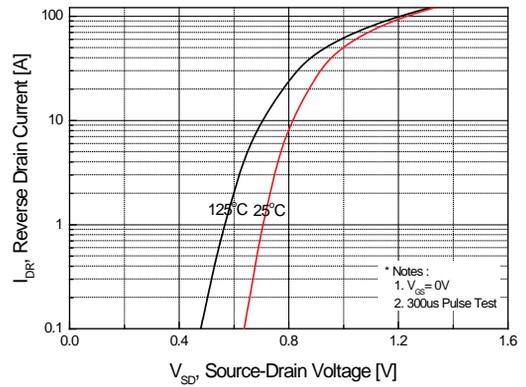
Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature
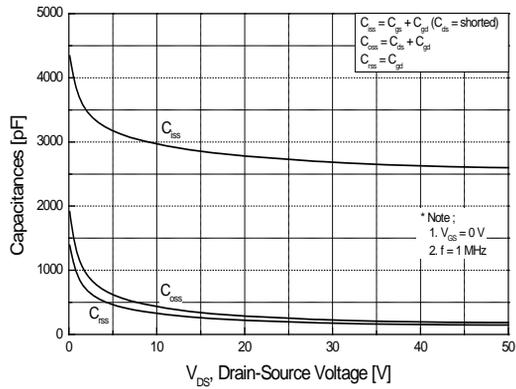

Figure 5. Capacitance Characteristics
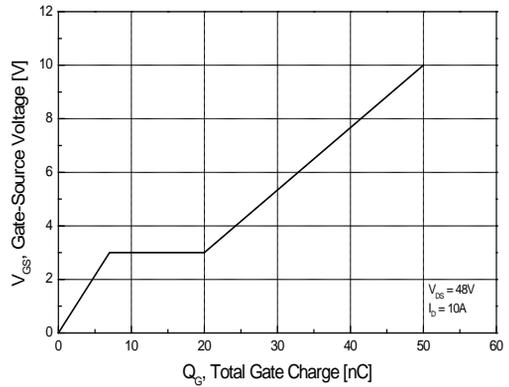
Figure 6. Gate Charge Characteristics

# Typical Characteristics   (continued)
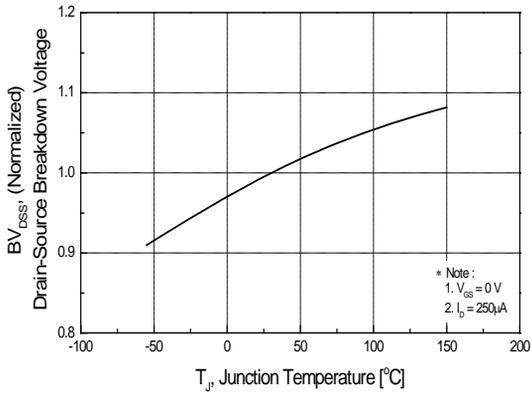
Figure 7. Breakdown Voltage Variation
vs Temperature
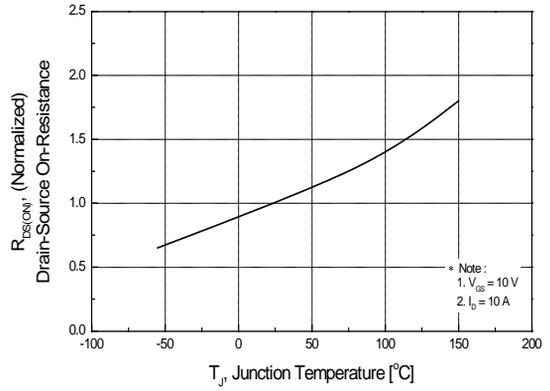
Figure 8. On-Resistance Variation
vs Temperature
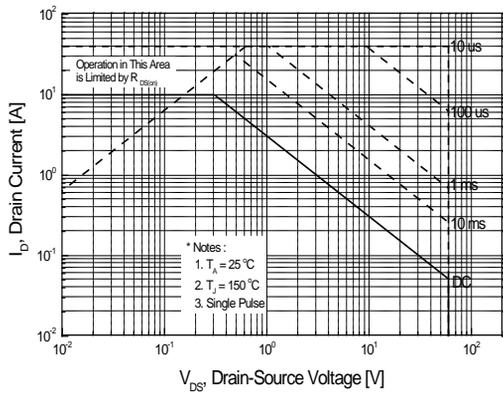
Figure 9. Maximum Safe Operating Area
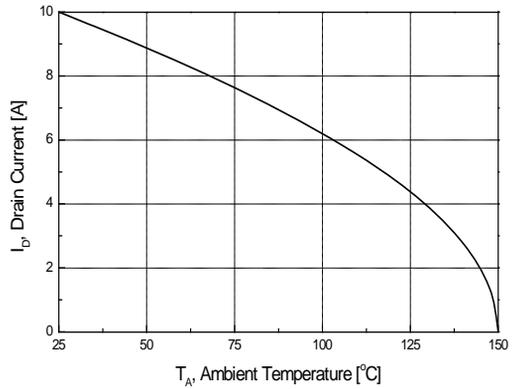

Figure 10. Maximum Drain Current
vs Case Temperature
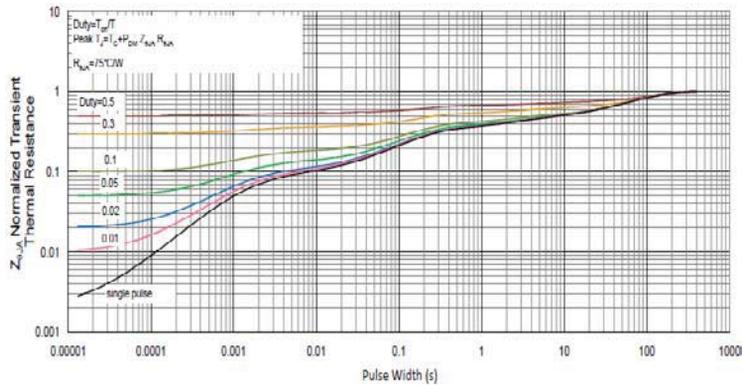

Figure 11. Transient Thermal Response Curve

Fig 12. Gate Charge Test Circuit & Waveform


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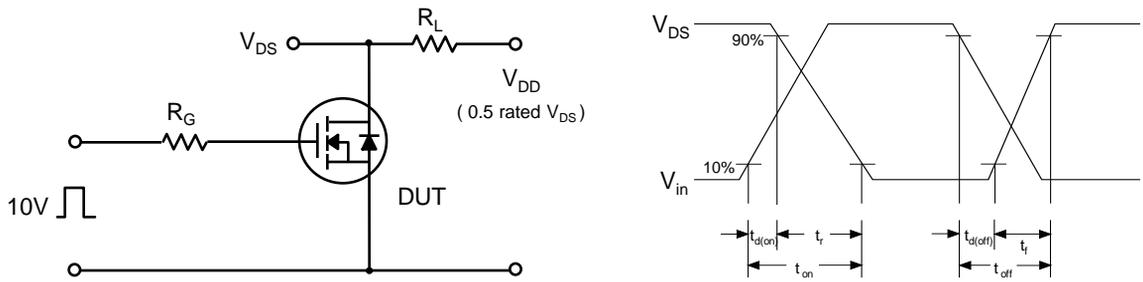
Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} \ L_L \ I_{AS}^2 \ \frac{BV_{DSS}}{BV_{DSS} -- V_{DD}}$$
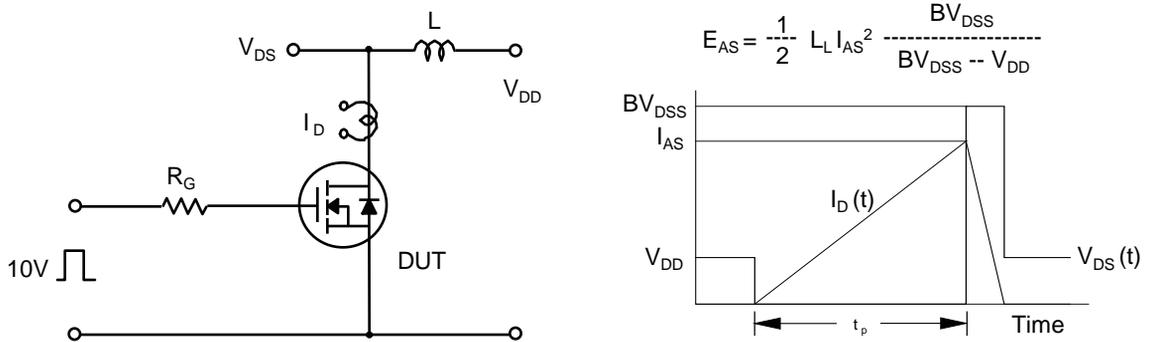
Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

I_S

L

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

• 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
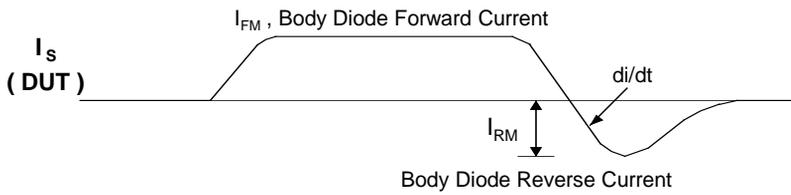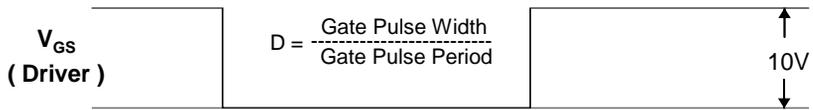
Package Dimension

SOP-8

Land Pattern
(Only for Reference)
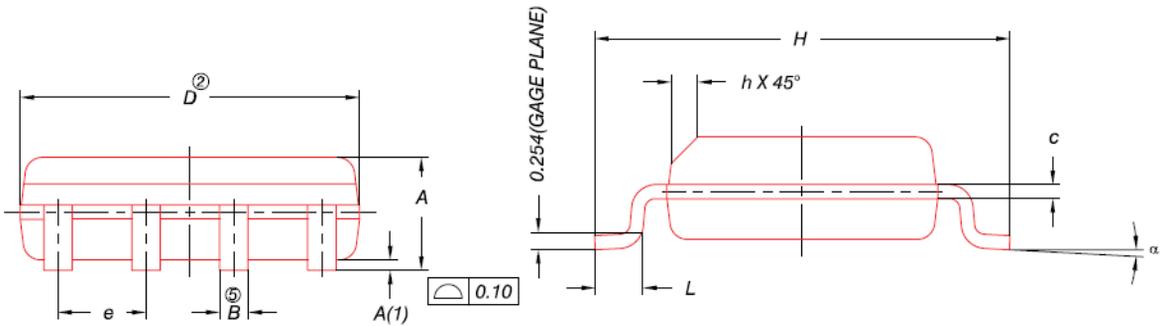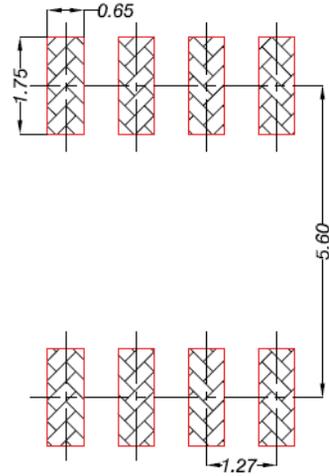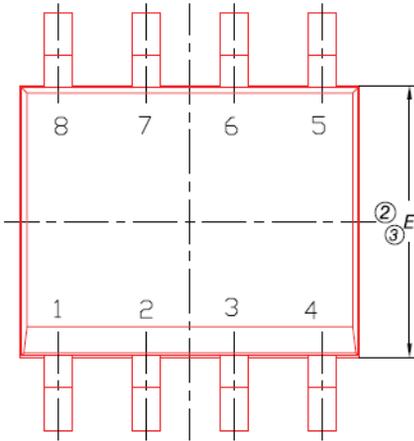
DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	1.35	1.55	1.75
A(1)	0.10	0.18	0.25
B	0.38	0.45	0.51
C	0.19	0.22	0.25
D	4.80	4.90	5.00
E	3.80	3.90	4.00
e	1.27 BSC		
H	5.80	6.00	6.20
L	0.50	0.72	0.93
α	0°	4°	8°
h	0.25	0.38	0.50