

# HRO400N10K

## 100V N-Channel Trench MOSFET

### Features

- High Dense Cell Design
- Reliable and Rugged
- Advanced Trench Process Technology

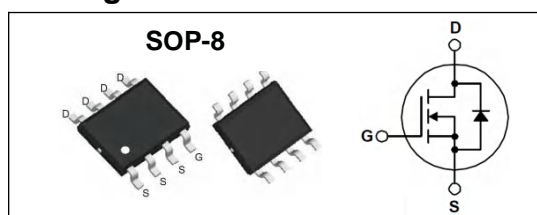
### Application

- Power Management in Inverter System
- Synchronous Rectification

### Key Parameters

Parameter	Value	Unit
$BV_{DSS}$	100	V
$I_D$	6.3	A
$R_{DS(on)}$ , typ @10V	33	m $\Omega$
$R_{DS(on)}$ , typ @4.5V	36	m $\Omega$

### Package & Internal Circuit



### Absolute Maximum Ratings $T_A=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	100	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Drain Current	$T_A = 25^\circ\text{C}$	6.3 A
		$T_A = 70^\circ\text{C}$	5.0 A
$I_{DM}$	Pulsed Drain Current (Note 1)	25	A
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	60	mJ
$P_D$	Power Dissipation	$T_A = 25^\circ\text{C}$	3.1 W
		$T_A = 70^\circ\text{C}$	2.0 W
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JL}$	Junction-to-Lead	--	24	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient ( $t \leq 10\text{s}$ )	--	40	$^\circ\text{C}/\text{W}$
	Junction-to-Ambient (steady state)	--	75	$^\circ\text{C}/\text{W}$

**Electrical Characteristics**  $T_J=25\text{ }^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>On Characteristics</b>						
$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1.0	--	2.4	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\ \text{V}, I_D = 6.3\ \text{A}$	--	33	40	m $\Omega$
		$V_{GS} = 4.5\ \text{V}, I_D = 5\ \text{A}$	--	36	45	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 5\ \text{V}, I_D = 6.3\ \text{A}$	--	16	--	S
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\ \text{V}, I_D = 250\ \mu\text{A}$	100	--	--	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\ \text{V}, V_{GS} = 0\ \text{V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 80\ \text{V}, T_J = 125\text{ }^\circ\text{C}$	--	--	100	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 20\ \text{V}, V_{DS} = 0\ \text{V}$	--	--	$\pm 100$	nA
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = 50\ \text{V}, V_{GS} = 0\ \text{V}, f = 1.0\ \text{MHz}$	--	2400	--	pF
$C_{oss}$	Output Capacitance		--	100	--	pF
$C_{riss}$	Reverse Transfer Capacitance		--	75	--	pF
$R_g$	Gate Resistance	$V_{GS} = 0\ \text{V}, V_{DS} = 0\ \text{V}, f = 1\ \text{MHz}$	--	1.4	--	$\Omega$
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 50\ \text{V}, I_D = 6.3\ \text{A}, R_G = 6\ \Omega$	--	24	--	ns
$t_r$	Turn-On Rise Time		--	20	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	135	--	ns
$t_f$	Turn-Off Fall Time		--	25	--	ns
$Q_{g(10V)}$	Total Gate Charge	$V_{DS} = 80\ \text{V}, I_D = 6.3\ \text{A}, V_{GS} = 10\ \text{V}$	--	53	--	nC
$Q_{g(4.5V)}$	Total Gate Charge		--	27	--	nC
$Q_{gs}$	Gate-Source Charge		--	7	--	nC
$Q_{gd}$	Gate-Drain Charge		--	13	--	nC
<b>Source-Drain Diode Maximum Ratings and Characteristics</b>						
$I_S$	Continuous Source-Drain Diode Forward Current		--	--	6.3	A
$I_{SM}$	Pulsed Source-Drain Diode Forward Current		--	--	25	
$V_{SD}$	Source-Drain Diode Forward Voltage	$I_S = 6.3\ \text{A}, V_{GS} = 0\ \text{V}$	--	--	1.3	V
$t_{rr}$	Reverse Recovery Time	$I_S = 6.3\ \text{A}, V_{GS} = 0\ \text{V}, di_F/dt = 100\ \text{A}/\mu\text{s}$	--	50	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	70	--	nC

**Notes :**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L=1\ \text{mH}, I_{AS}=9.5\ \text{A}, V_{DD}=25\ \text{V}, R_G=25\ \Omega$ , Starting  $T_J=25\text{ }^\circ\text{C}$

# Typical Characteristics

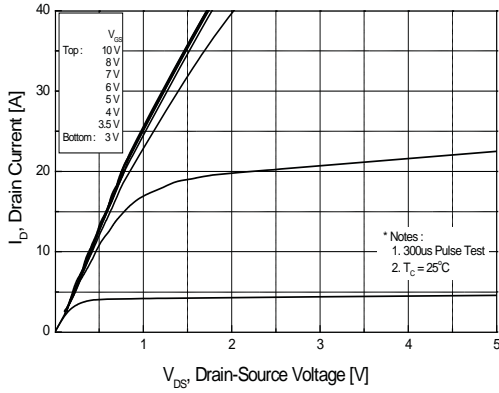


Figure 1. On Region Characteristics

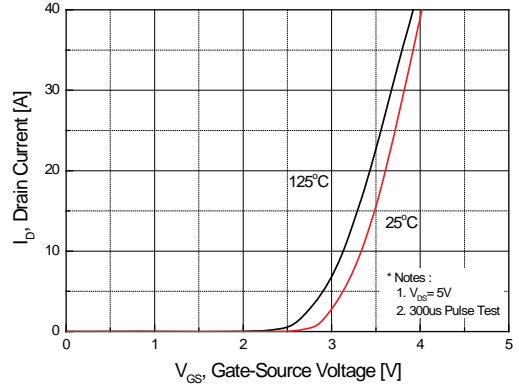


Figure 2. Transfer Characteristics

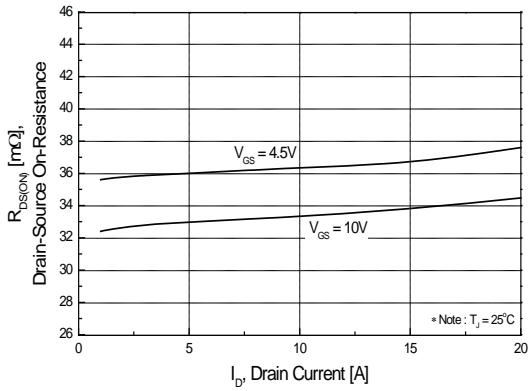


Figure 3. On Resistance Variation vs Drain Current and Gate Voltage

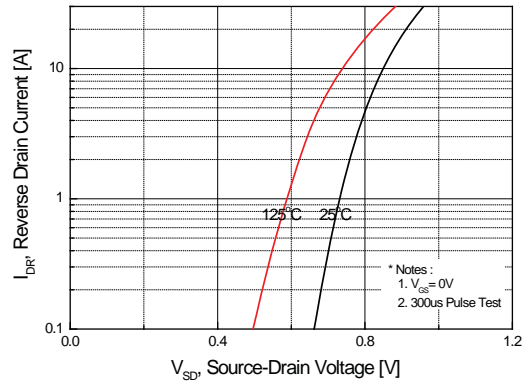


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

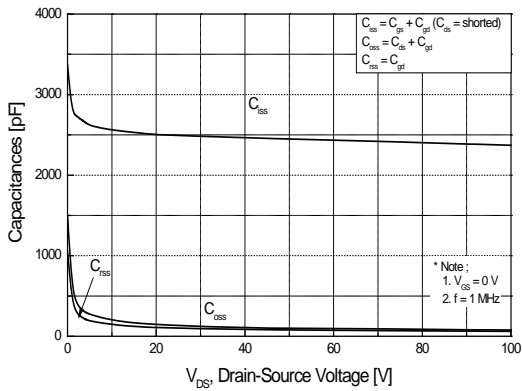


Figure 5. Capacitance Characteristics

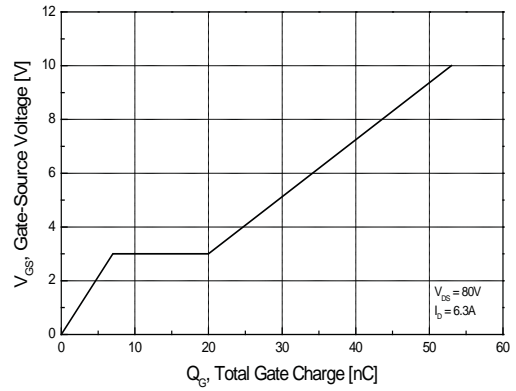


Figure 6. Gate Charge Characteristics

Typical Characteristics (continued)

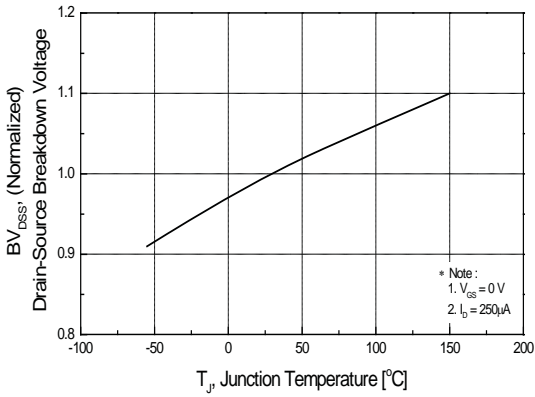


Figure 7. Breakdown Voltage Variation vs Temperature

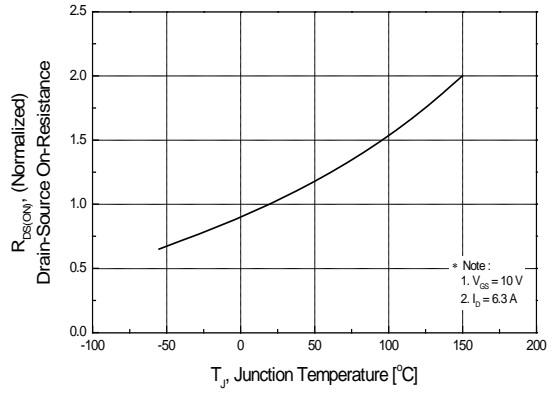


Figure 8. On-Resistance Variation vs Temperature

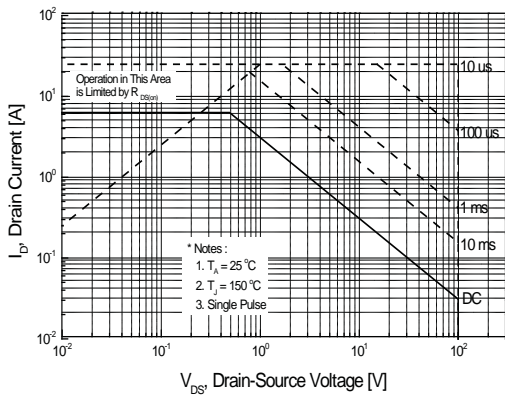


Figure 9. Maximum Safe Operating Area

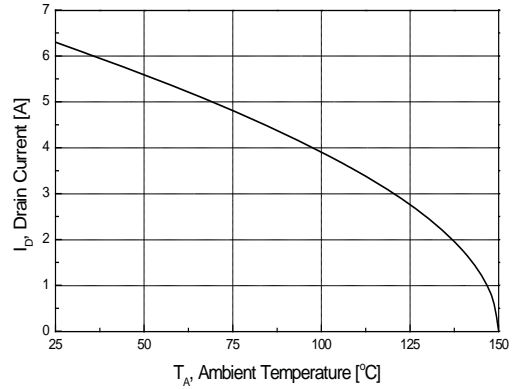


Figure 10. Maximum Drain Current vs Case Temperature

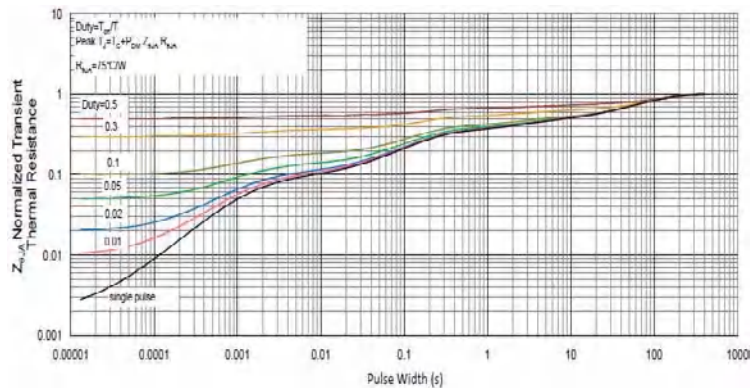


Figure 11. Transient Thermal Response Curve

**Fig 12. Gate Charge Test Circuit & Waveform**



**Fig 13. Resistive Switching Test Circuit & Waveforms**



**Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms**



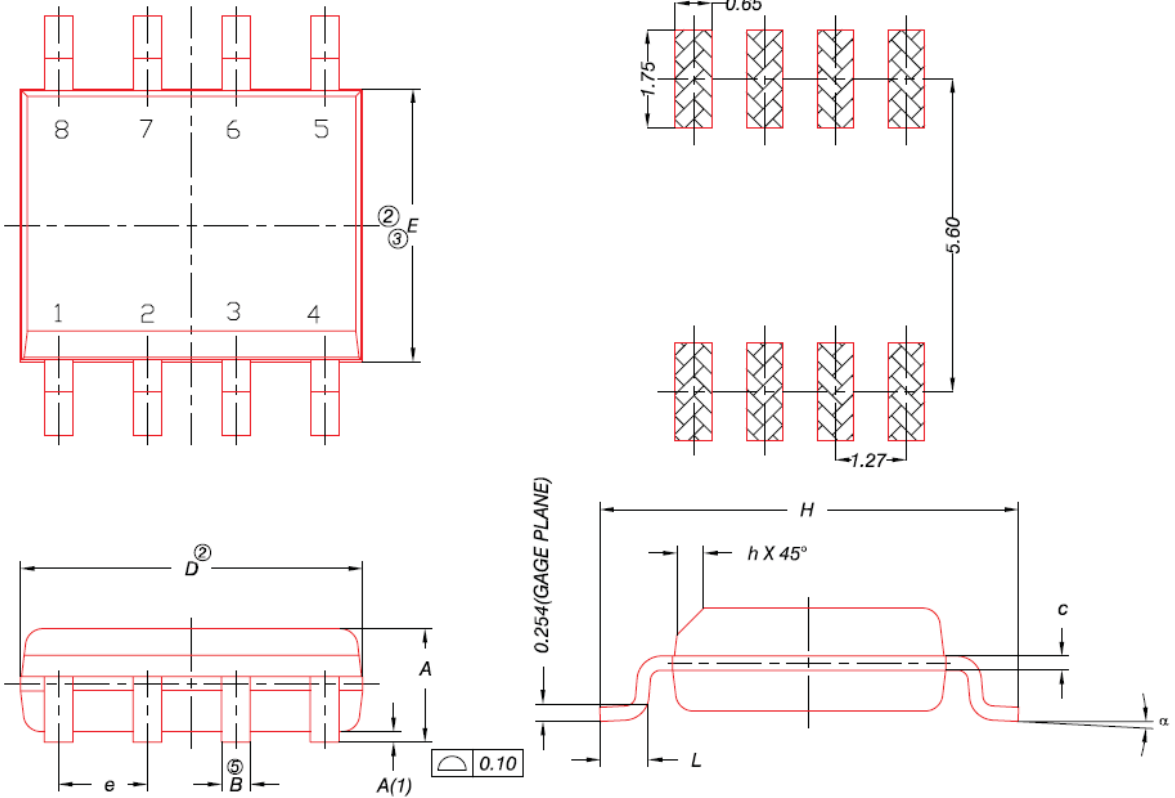
Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



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
$\alpha$	0°	4°	8°
h	0.25	0.38	0.50