

## Silicon N-Channel Power MOSFET

### General Description:

HMT40N50, the silicon N-channel Enhanced VDMOSFET, is obtained by the self-aligned planar Technology which reduce the conduction loss, improve switching performance and enhance the avalanche energy. The transistor can be used in various power switching circuit for system miniaturization and higher efficiency. The package form is TO-3P(N), which accords with the RoHS standard.

### Features:

- Fast Switching
- ESD Improved Capability
- Low Gate Charge (Typical Data: 140nC)
- Low Reverse transfer capacitances(Typical: 80pF)
- 100% Single Pulse avalanche energy Test

### Applications:

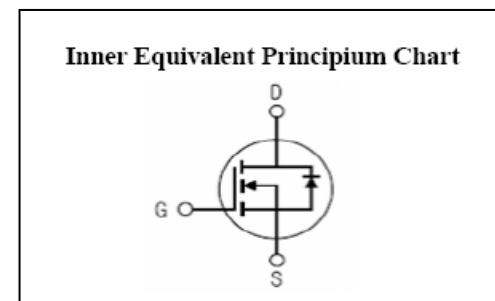
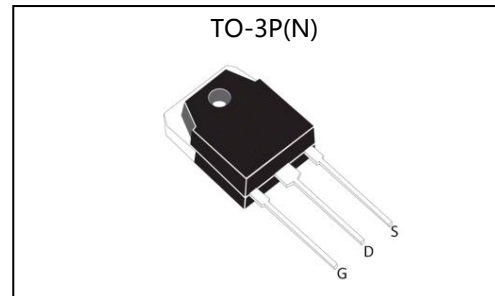
- Power switch circuit of PC POWER

### Absolute (Tc=25°C unless otherwise specified):

Symbol	Parameter	Rating	Units
V <sub>DSS</sub>	Drain-to-Source Voltage	500	V
I <sub>D</sub>	Continuous Drain Current	40	A
	Continuous Drain Current T <sub>C</sub> =100 °C	20	A
I <sub>DM</sub> <sup>a1</sup>	Pulsed Drain Current	120	A
V <sub>GS</sub>	Gate-to-Source Voltage	±30	V
E <sub>AS</sub>	Single Pulse Avalanche Energy	3500	mJ
E <sub>AR</sub> <sup>a1</sup>	Avalanche Energy ,Repetitive	400	mJ
I <sub>AR</sub> <sup>a1</sup>	Avalanche Current	8.9	A
dv/dt <sup>a2</sup>	Peak Diode Recovery dv/dt	5.0	V/ns
P <sub>D</sub>	Power Dissipation	250	W
	Derating Factor above 25°C	2	W/°C
T <sub>J</sub> , T <sub>stg</sub>	Operating Junction and Storage Temperature Range	150, -55 to 150	°C
T <sub>L</sub>	Maximum Temperature for Soldering	300	°C

Caution Stresses greater than those in the "Absolute Maximum Ratings" may cause permanent damage to the device

V <sub>DSS</sub> (T <sub>C</sub> =150°C)	500	V
I <sub>D</sub>	40	A
P <sub>D</sub> (T <sub>C</sub> =25°C)	250	W
R <sub>DS(ON)</sub>	0.082	Ω



**Thermal Characteristics**

Symbol	Parameter	Rating	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	0.5	°C/ W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	40	°C/ W

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

<b>OFF Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{DSS}$	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	500	--	--	V
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS}=500V, V_{GS}=0V, T_a=25^\circ\text{C}$	--	--	1.0	$\mu A$
		$V_{DS}=400V, V_{GS}=0V, T_a=125^\circ\text{C}$	--	--	100	
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+20V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-20V$	--	--	-100	nA

<b>ON Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=15A$	--	0.082	0.1	$\Omega$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	--	4.0	V
$g_{fs}$	Forward Trans conductance	$V_{DS}=30V, I_D=15A$	--	20	--	S

Pulse width < 380 $\mu$ s; duty cycle < 2%.

<b>Dynamic Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$	--	8260	--	$\text{pF}$
$C_{oss}$	Output Capacitance		--	730	--	
$C_{rss}$	Reverse Transfer Capacitance		--	80	--	

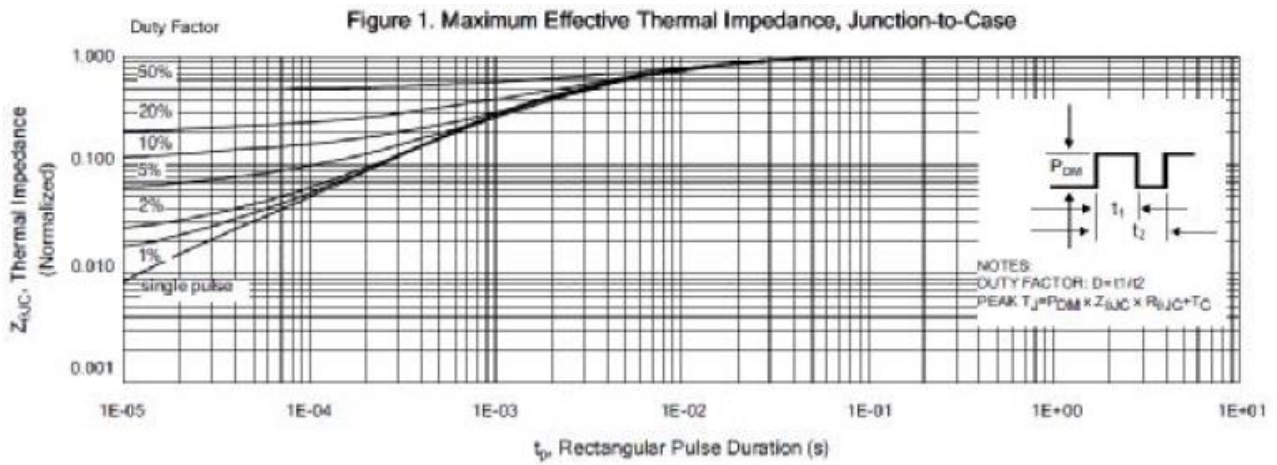
<b>Resistive Switching Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=30A, V_{DD}=250V$ $V_{GS}=10V, R_g=25\Omega$	--	68	--	ns
$t_r$	Rise Time		--	120	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	485	--	
$t_f$	Fall Time		--	145	--	
$Q_g$	Total Gate Charge	$I_D=30A, V_{DD}=250V$ $V_{GS}=10V$	--	140	--	nC
$Q_{gs}$	Gate to Source Charge		--	22	--	
$Q_{gd}$	Gate to Drain ( "Miller" ) Charge		--	48	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$I_{SD}$	Continuous Source Current (Body Diode)		--	--	30	A
$I_{SM}$	Maximum Pulsed Current (Body Diode)		--	--	120	A
$V_{SD}$	Diode Forward Voltage	$I_S=40A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S=40A, T_j=25^\circ C$	--	485	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt=100A/\mu s, V_{GS}=0V$	--	4.8	--	uC

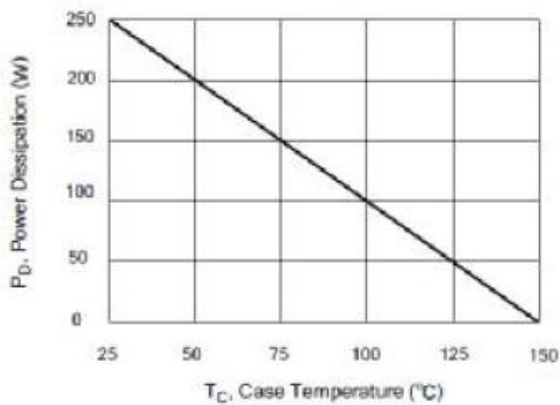
a1: Repetitive rating; pulse width limited by maximum junction temperature

a2:  $I_{SD}=30A, di/dt \leq 100A/\mu s, V_{DD} \leq BV_{DS}$ , Start  $T_j=25^\circ C$

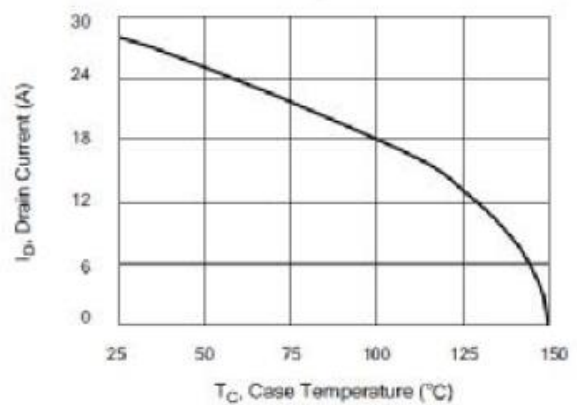
## Characteristics Curve:



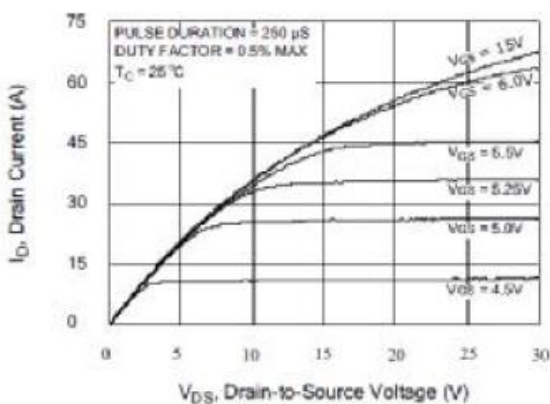
**Figure 2. Maximum Power Dissipation vs Case Temperature**



**Figure 3. Maximum Continuous Drain Current vs Case Temperature**



**Figure 4. Typical Output Characteristics**



**Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current**

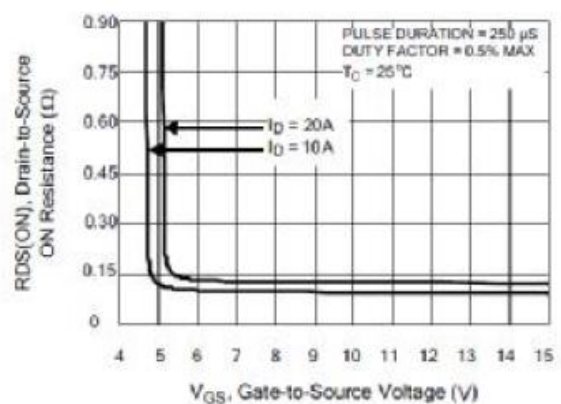


Figure 6. Maximum Peak Current Capability

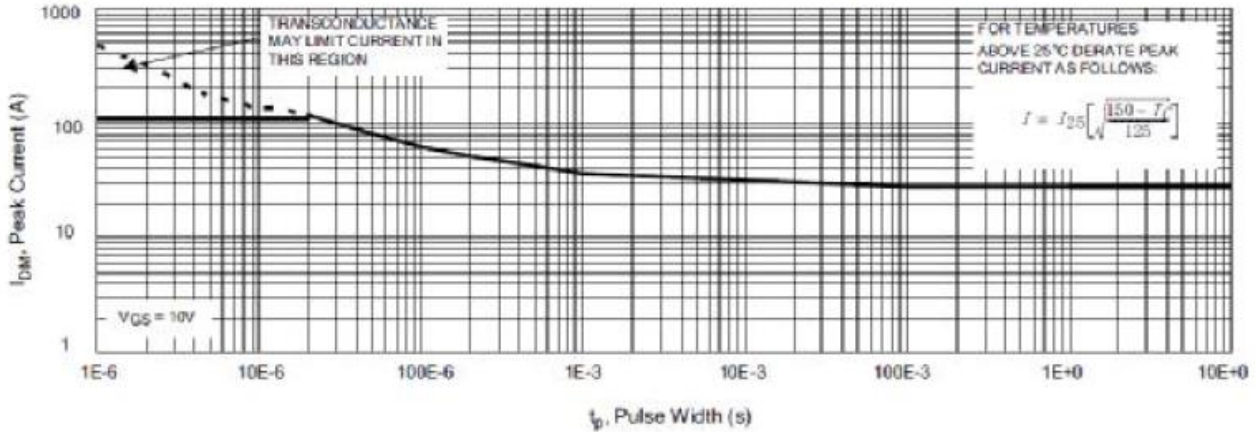


Figure 7. Typical Transfer Characteristics

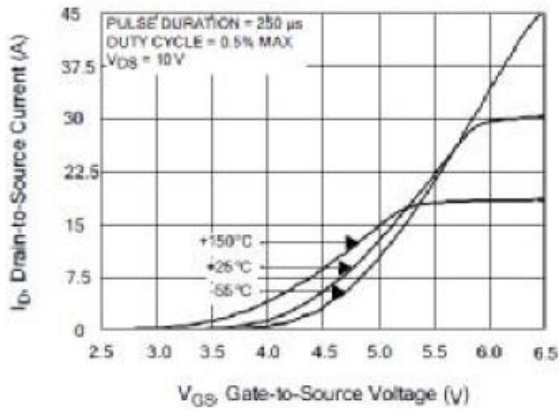


Figure 8. Unclamped Inductive Switching Capability

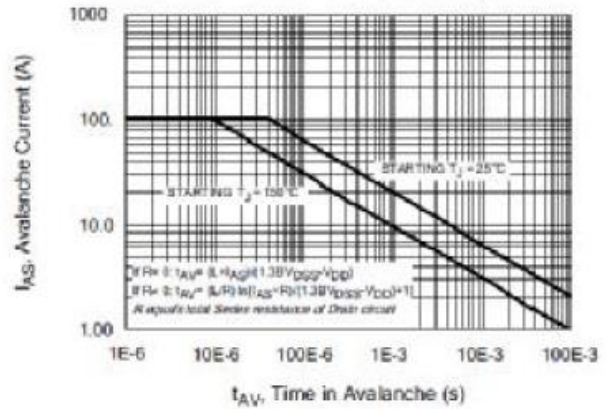


Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current

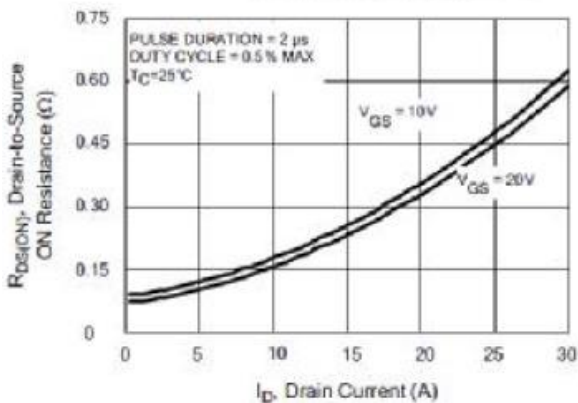


Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature

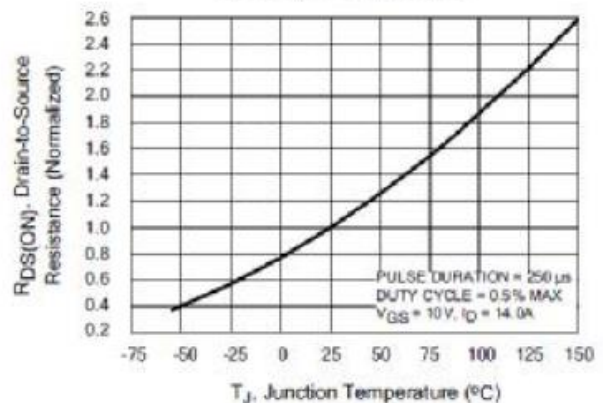


Figure 11. Typical Breakdown Voltage vs Junction Temperature

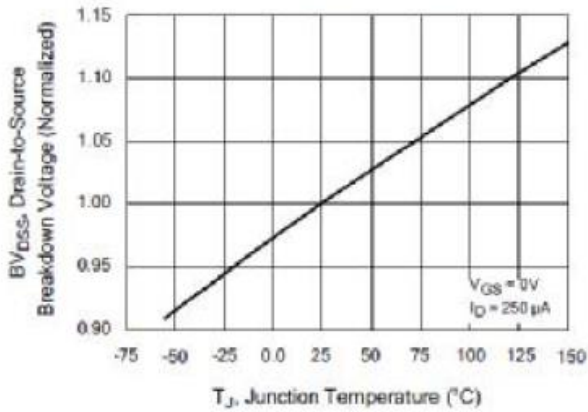


Figure 12. Typical Threshold Voltage vs Junction Temperature

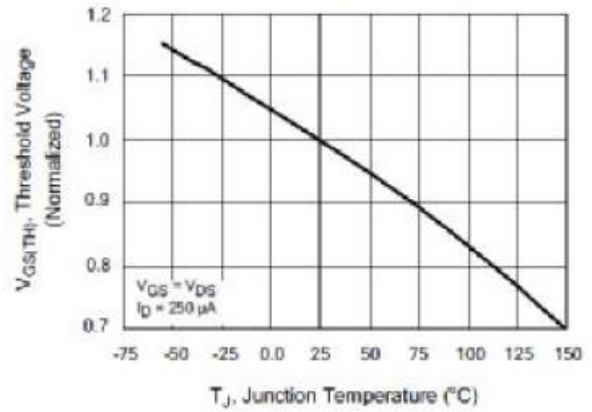


Figure 13. Maximum Forward Bias Safe Operating Area

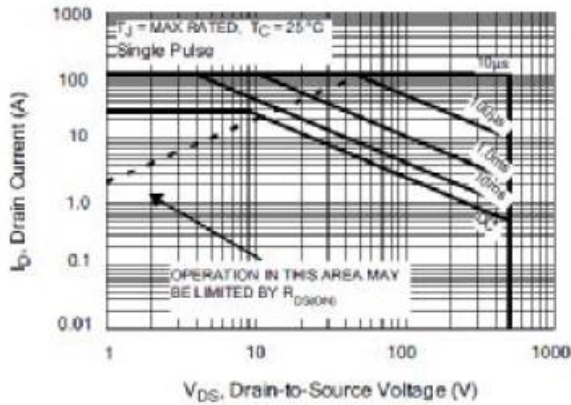


Figure 14. Typical Capacitance vs

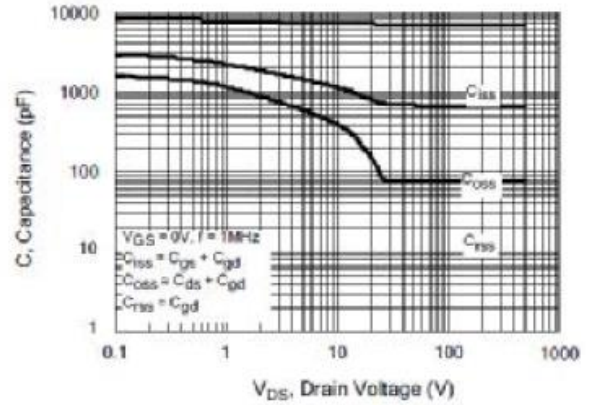


Figure 15. Typical Gate Charge vs Gate-to-Source Voltage

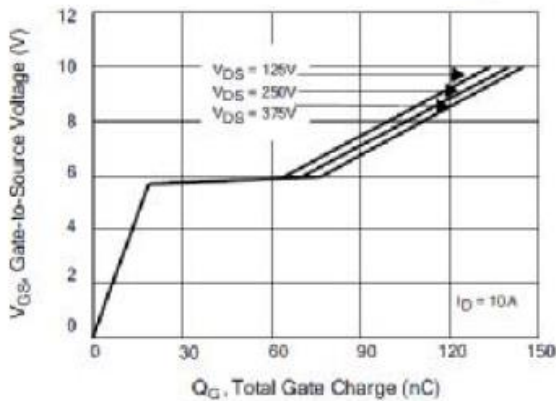


Figure 16. Typical Body Diode Transfer Characteristics

