

## Silicon N-Channel Power MOSFET

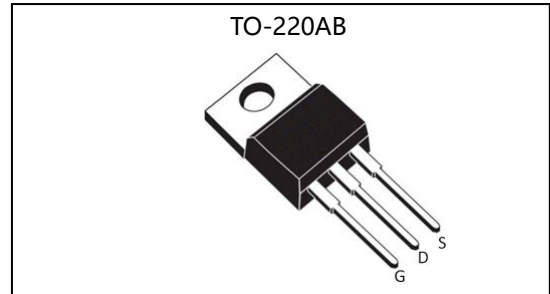
### General Description :

HMB10N60, 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-220AB, which accords with the RoHS standard.

$V_{DSS}$	600	V
$I_D$	10	A
$P_D(T_C=25^\circ C)$	125	W
$R_{DS(ON),TYP.}$	0.6	$\Omega$

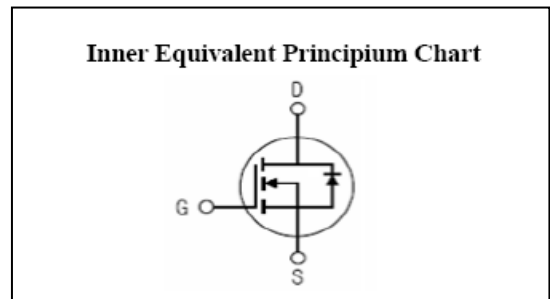
### Features :

- Fast Switching
- Low ON Resistance ( $R_{dson} \leq 0.75\Omega$ )
- Low Gate Charge (Typical Data: 39nC)
- Low Reverse transfer capacitances (Typical: 16pF)
- 100% Single Pulse avalanche energy Test



### Applications:

- Power switch circuit of adaptor and charger



### Absolute ( $T_C=25^\circ C$ unless otherwise specified ) :

Symbol	Parameter	Rating	Units
$V_{DSS}$	Drain-to-Source Voltage	600	V
$I_D$	Continuous Drain Current	10	A
	Continuous Drain Current $T_C=100^\circ C$	8	A
$I_{DM}^{a1}$	Pulsed Drain Current	40	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}^{a2}$	Single Pulse Avalanche Energy	800	mJ
$E_{AR}^{a1}$	Avalanche Energy ,Repetitive	80	mJ
$I_{AR}^{a1}$	Avalanche Current	4.0	A
$dv/dt^{a3}$	Peak Diode Recovery $dv/dt$	5.0	V/ns
$P_D$	Power Dissipation	125	W
	Derating Factor above $25^\circ C$	1.0	W/ $^\circ C$
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	150 , $-55$ to $150$	$^\circ C$
$T_L$	Maximum Temperature for Soldering	300	$^\circ C$

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

**Thermal Characteristics**

Symbol	Parameter	Rating	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.0	°C/ W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	°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	$V_{GS}=0V, I_D=250\mu A$	600	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	$I_D=250\mu A, \text{Reference } 25^\circ\text{C}$	--	0.74	--	V/°C
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS}=600V, V_{GS}=0V, T_a=25^\circ\text{C}$	--	--	1.0	$\mu A$
		$V_{DS}=480V, V_{GS}=0V, T_a=125^\circ\text{C}$	--	--	100	
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS}=+30V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS}=-30V$	--	--	-100	nA

<b>ON Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS}=10V, I_D=5A$	--	0.6	0.75	$\Omega$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0	--	4.0	V
$g_{fs}$	Forward Trans conductance	$V_{DS}=15V, I_D=5A$	--	9	--	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	$V_{GS}=0V, V_{DS}=25V$ $f=1.0\text{MHz}$	--	1556	--	pF
$C_{oss}$	Output Capacitance		--	158	--	
$C_{rss}$	Reverse Transfer Capacitance		--	16	--	

<b>Resistive Switching Characteristics</b>						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D=10A, V_{DD}=300V$ $V_{GS}=10V, R_g=4.7\Omega$	--	12	--	ns
$t_r$	Rise Time		--	16	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	39	--	
$t_f$	Fall Time		--	17	--	
$Q_g$	Total Gate Charge	$I_D=10A, V_{DD}=300V$ $V_{GS}=10V$	--	39	--	nC
$Q_{gs}$	Gate to Source Charge		--	7.4	--	
$Q_{gd}$	Gate to Drain ( "Miller" ) Charge		--	16	--	

Source-Drain Diode Characteristics						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$I_{SD}$	Continuous Source Current (Body Diode)		--	--	10	A
$I_{SM}$	Maximum Pulsed Current (Body Diode)		--	--	40	A
$V_{SD}$	Diode Forward Voltage	$I_S=10A, V_{GS}=0V$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$I_S=10A, T_J=25^\circ C$	--	262	--	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt=100A/\mu s, V_{GS}=0V$	--	1727	--	$\mu C$

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

a2 :  $L=10mH, I_D=12.6A, \text{Start } T_J=25^\circ C$

a3 :  $I_{SD}=10A, di/dt \leq 100A/\mu s, V_{DD} \leq BV_{DS}, \text{Start } T_J=25^\circ C$

## Characteristics Curve :

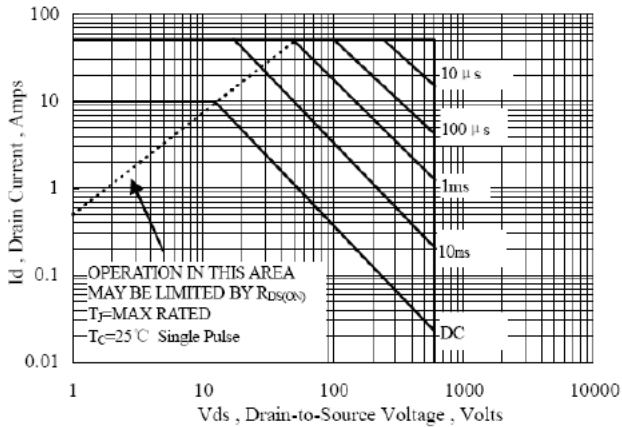


Figure 1 Maximum Forward Bias Safe Operating Area

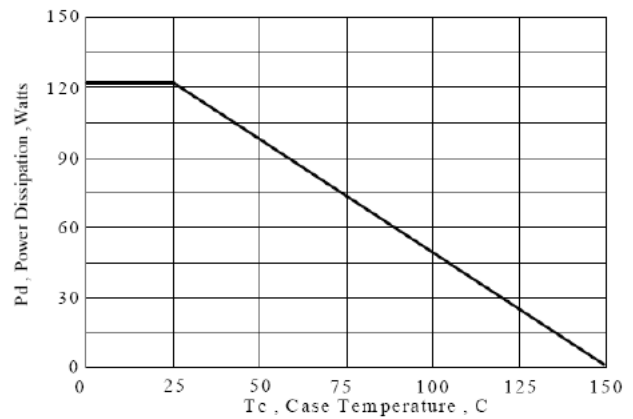


Figure 2 Maximum Power Dissipation vs Case Temperature

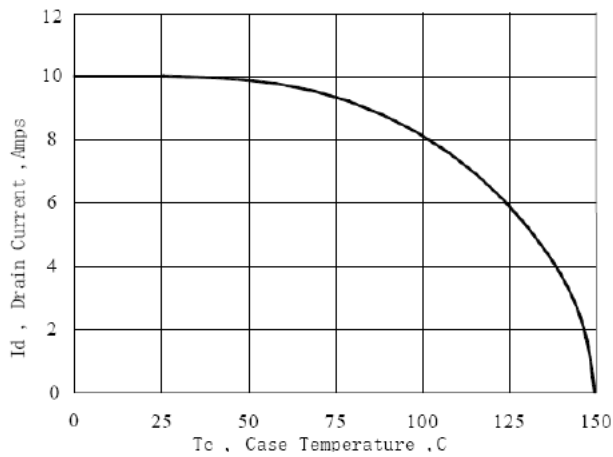


Figure 3 Maximum Continuous Drain Current vs Case Temperature

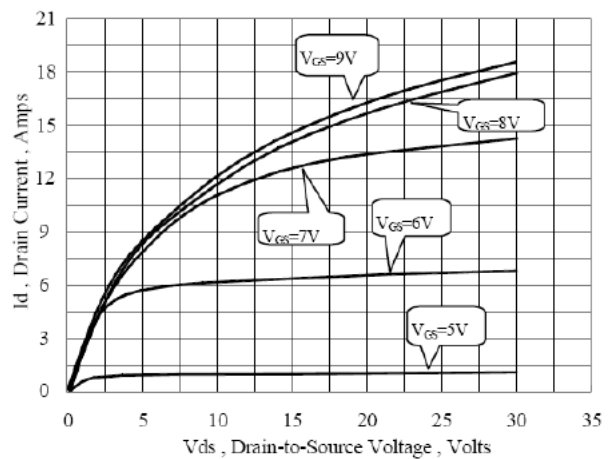


Figure 4 Typical Output Characteristics

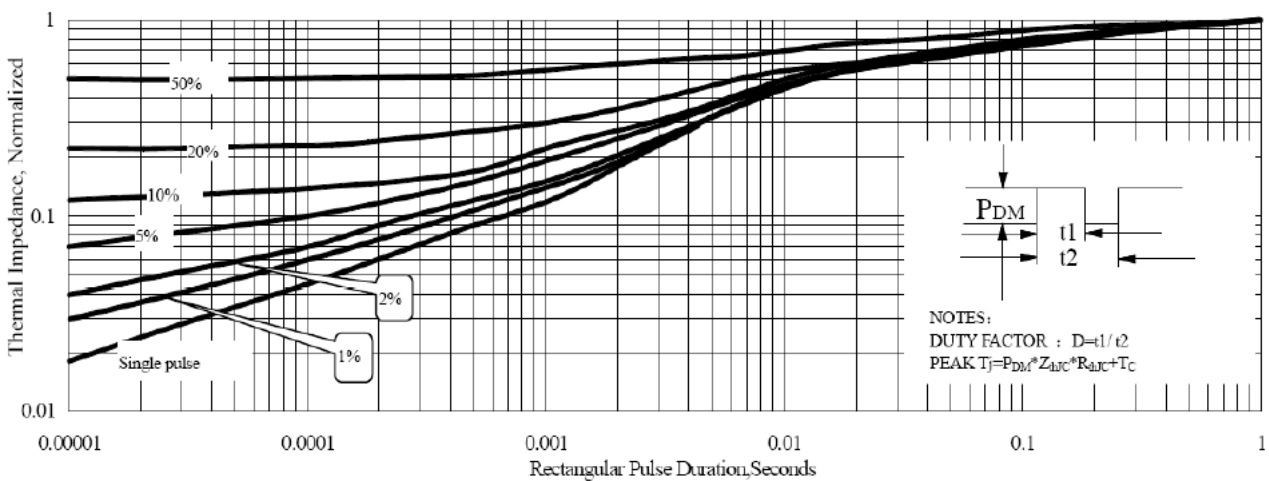


Figure 5 Maximum Effective Thermal Impedance, Junction to Case

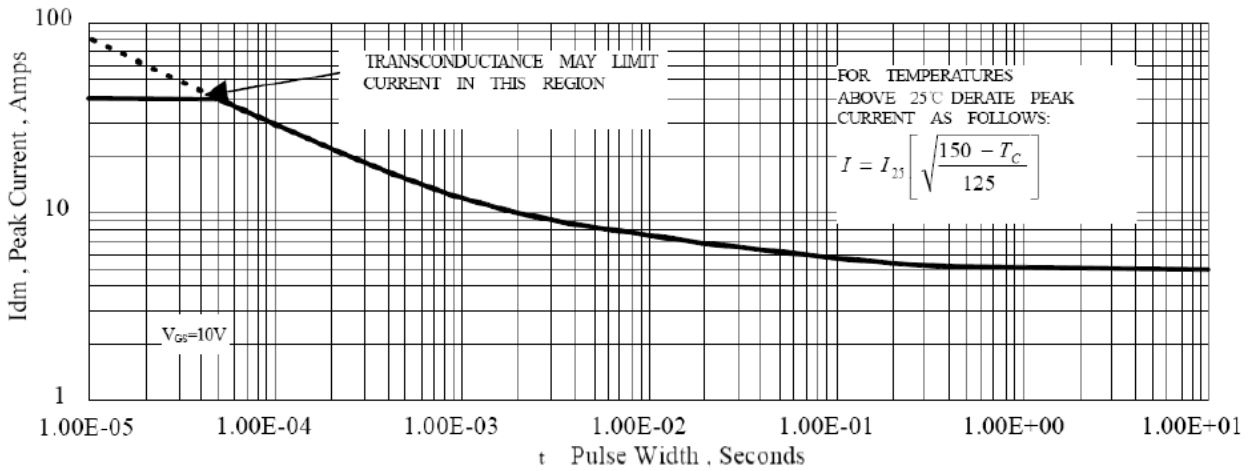


Figure 6 Maximum Peak Current Capability

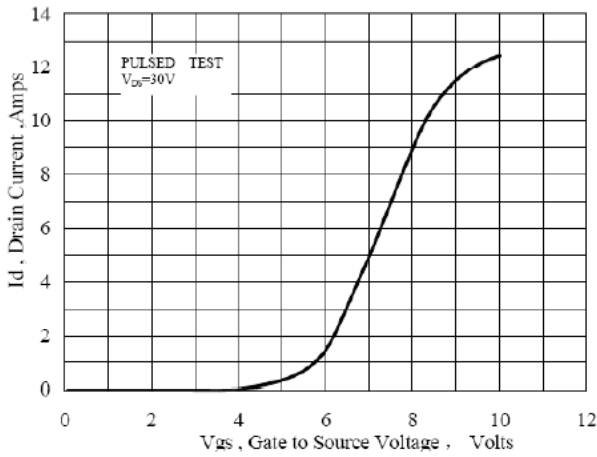


Figure 7 Typical Transfer Characteristics

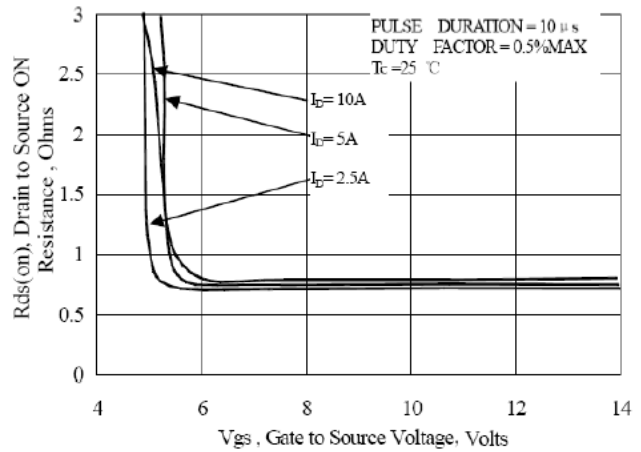


Figure 8 Typical Drain to Source ON Resistance vs Gate Voltage and Drain Current

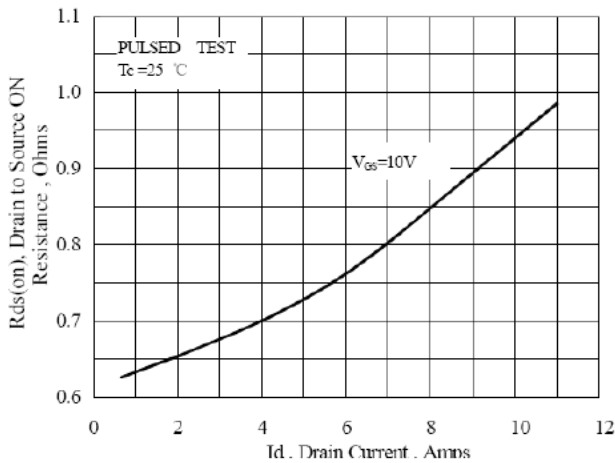


Figure 9 Typical Drain to Source ON Resistance vs Drain Current

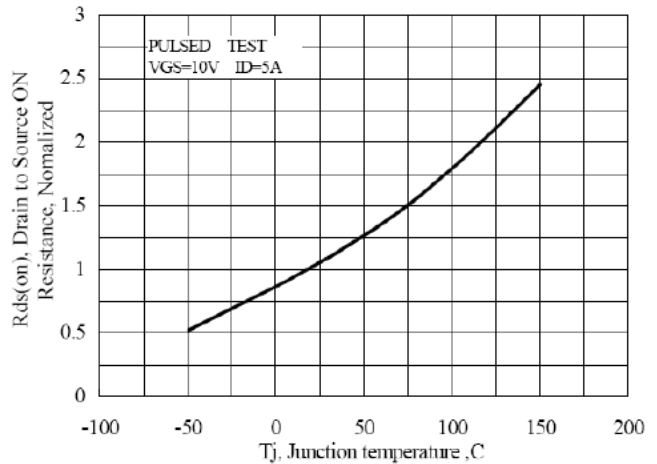


Figure 10 Typical Drain to Source on Resistance vs Junction Temperature

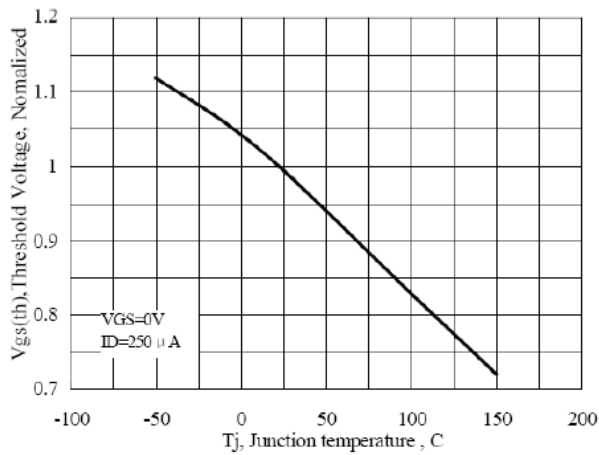


Figure 11 Typical Threshold Voltage vs Junction Temperature

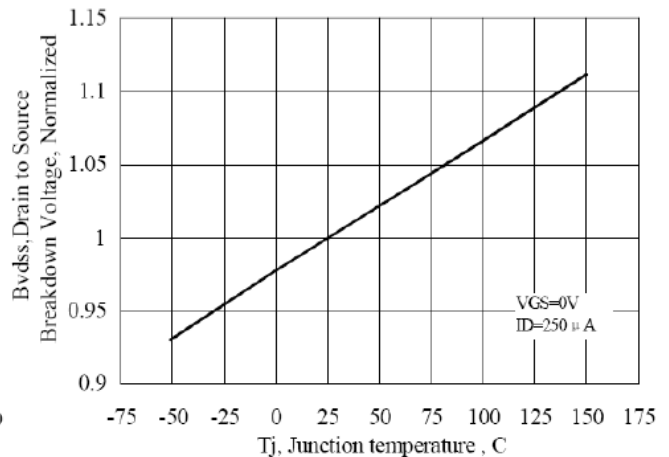


Figure 12 Typical Breakdown Voltage vs Junction Temperature

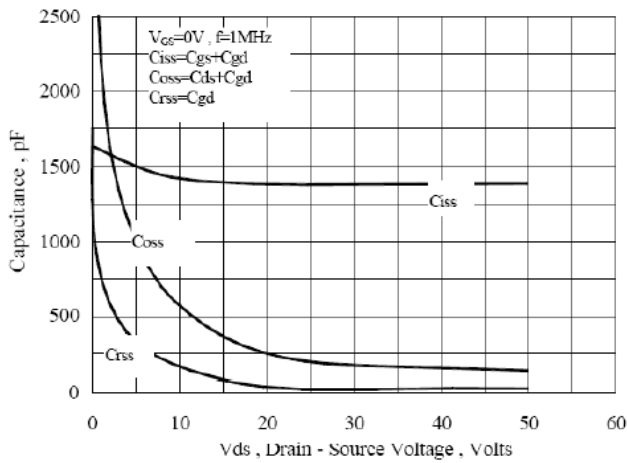


Figure 13 Typical Capacitance vs Drain to Source Voltage

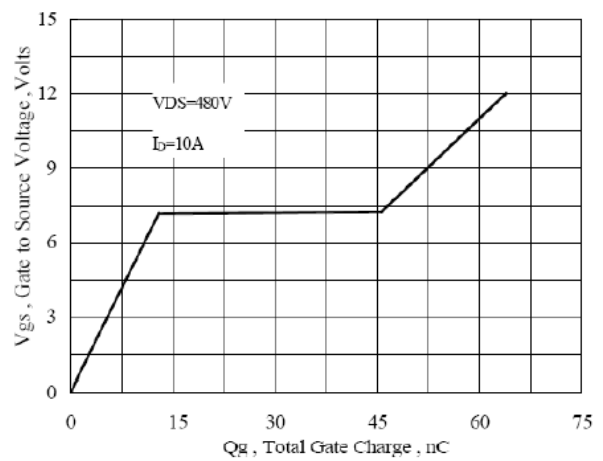


Figure 14 Typical Gate Charge vs Gate to Source Voltage

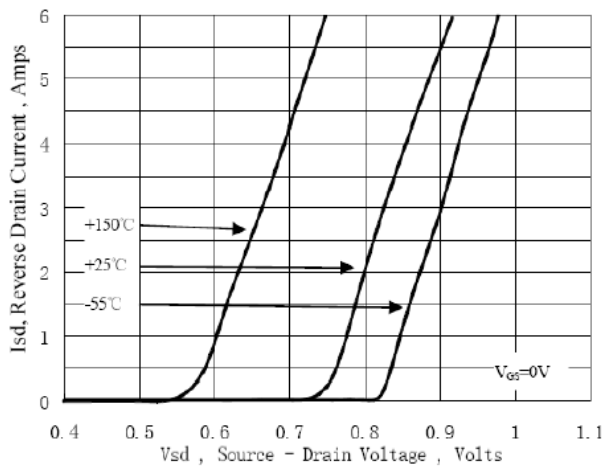


Figure 15 Typical Body Diode Transfer Characteristics

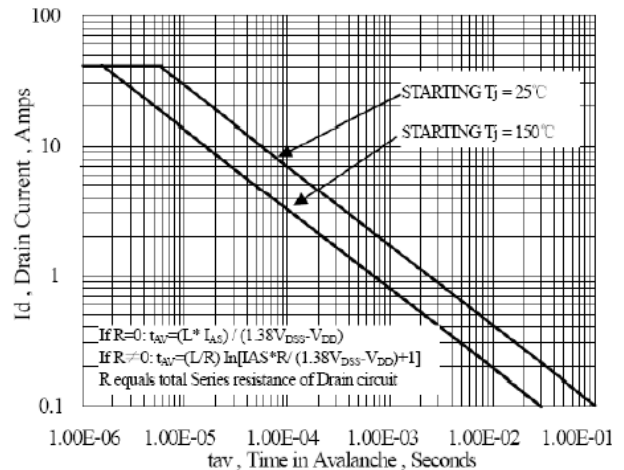


Figure 16 Unclamped Inductive Switching Capability