

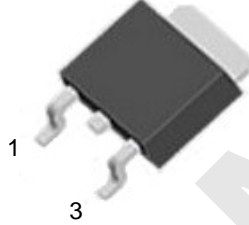
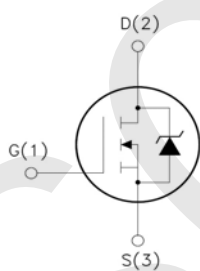
### SM20N06

60V N-Channel MOSFET

**Features:**

- Low Intrinsic Capacitances.
- Excellent Switching Characteristics.
- Extended Safe Operating Area.
- Unrivalled Gate Charge : $Q_g = 25.3nC$  (Typ.).
- $BVDSS = 60V, I_D = 20A$
- $R_{DS(on)} : 0.035\Omega$  (Max) @  $V_G = 10V$
- 100% Avalanche Tested

TO-252

1.Gate (G)  
2.Drain (D)  
3.Source (S)

### Absolute Maximum Ratings (Ta=25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-Source Voltage	60	V
$I_D$	Drain Current	$T_C = 25^\circ C$	20
		$T_C = 100^\circ C$	14
$V_{GS(TH)}$	Gate Threshold Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy (note1)	72	mJ
$I_{AR}$	Avalanche Current (note2)	20	A
$P_D$	Power Dissipation (Ta=25°C)	40	W
$T_j$	Junction Temperature(Max)	150	°C
$T_{stg}$	Storage Temperature	-55~+150	
$T_L$	Maximum lead temperature for soldering purpose, 1/8" from case for 5 seconds	300	

### Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	-	3.2	°C/W

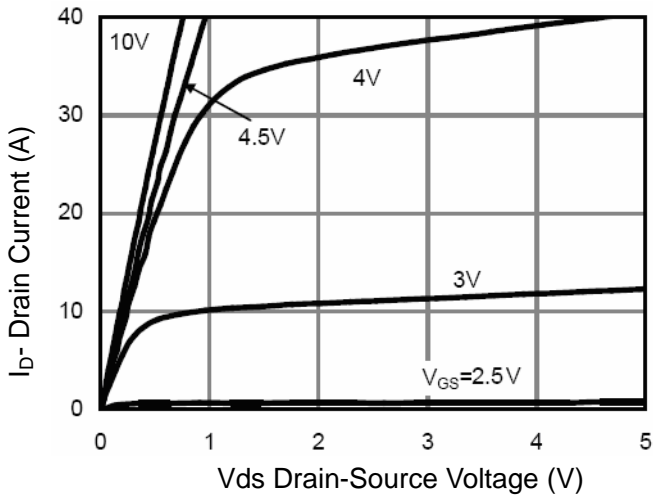
Electrical Characteristics ( $T_C=25^\circ\text{C}$  unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	60	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.2	1.6	2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$	-	24	35	m $\Omega$
		$V_{GS}=4.5V, I_D=20A$	-	30	40	
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=5A$	11	-	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V,$ $F=1.0MHz$	-	590	-	PF
Output Capacitance	$C_{oss}$		-	70	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	64	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=2A,$ $V_{GS}=10V, R_G=3\Omega$	-	6	-	nS
Turn-on Rise Time	$t_r$		-	6.1	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	17	-	nS
Turn-Off Fall Time	$t_f$		-	3	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=30V, I_D=10A,$ $V_{GS}=10V$	-	25.3	-	nC
Gate-Source Charge	$Q_{gs}$		-	4.7	-	nC
Gate-Drain Charge	$Q_{gd}$		-	6.1	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=20A$	-	-	1.2	V
Diode Forward Current	$I_S$		-	-	20	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^\circ\text{C}, I_F = 20A$ $di/dt = 100A/\mu s$ (Note 3)	-	29.5	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	50	-	nC
Forward Turn-On Time	$t_{on}$	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

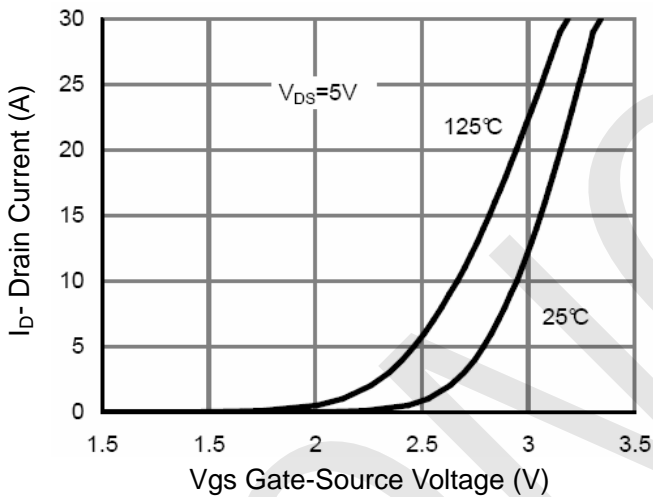
## Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production
5.  $E_{AS}$  condition:  $T_J=25^\circ\text{C}, V_{DD}=30V, V_G=10V, L=0.5mH, R_g=25\Omega$

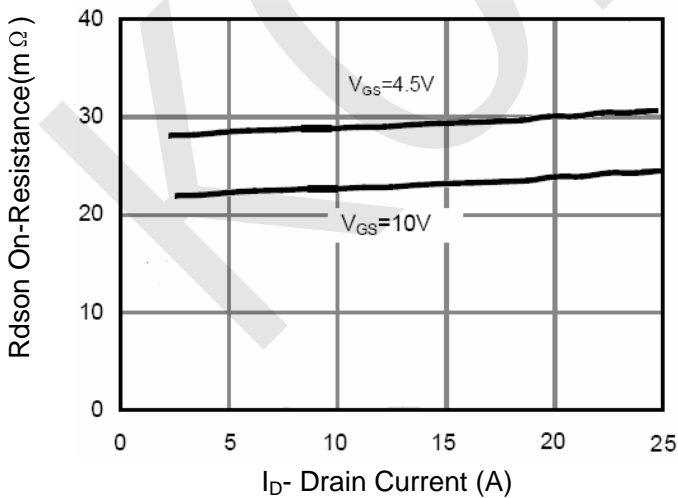
### Typical Characteristics



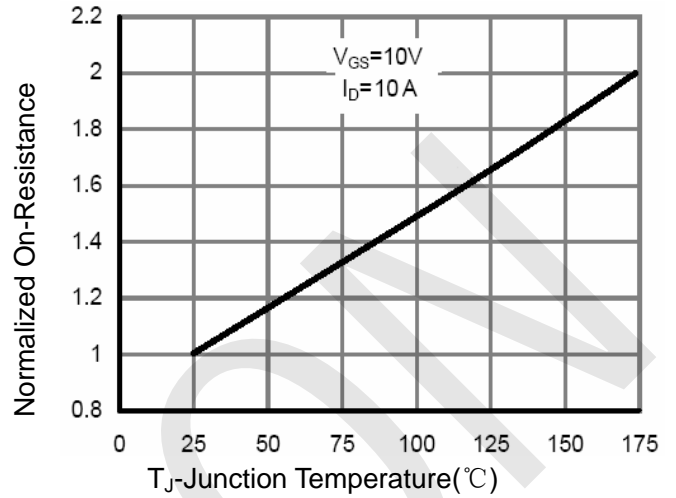
**Figure 1 Output Characteristics**



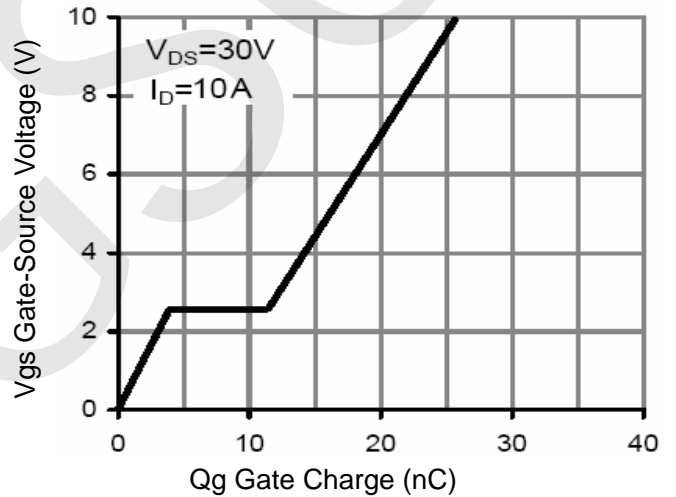
**Figure 2 Transfer Characteristics**



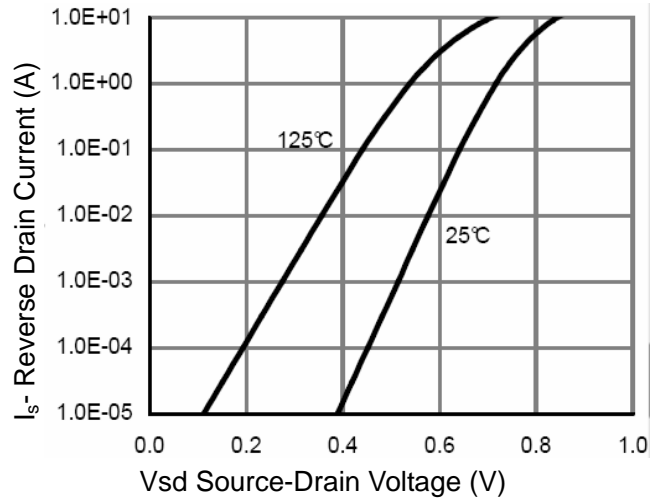
**Figure 3  $R_{DS(on)}$ - Drain Current**



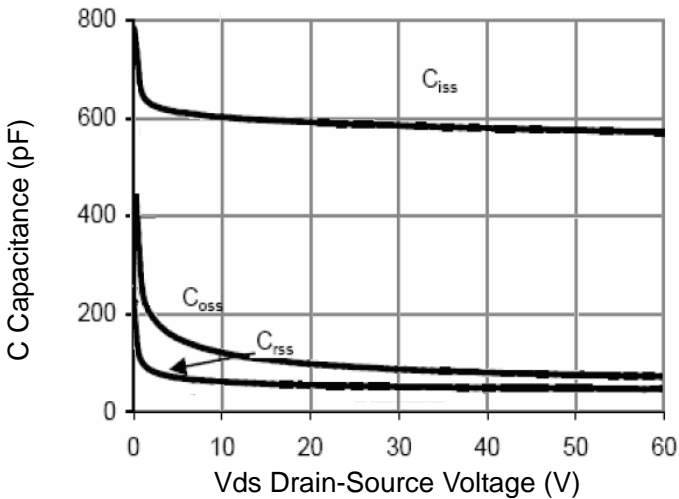
**Figure 4  $R_{DS(on)}$ -Junction Temperature**



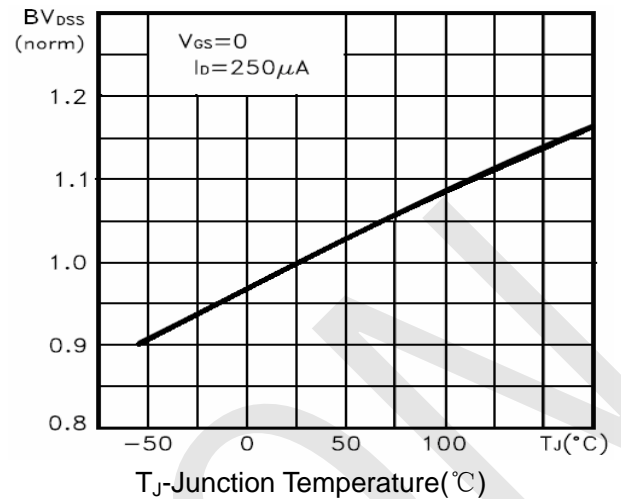
**Figure 5 Gate Charge**



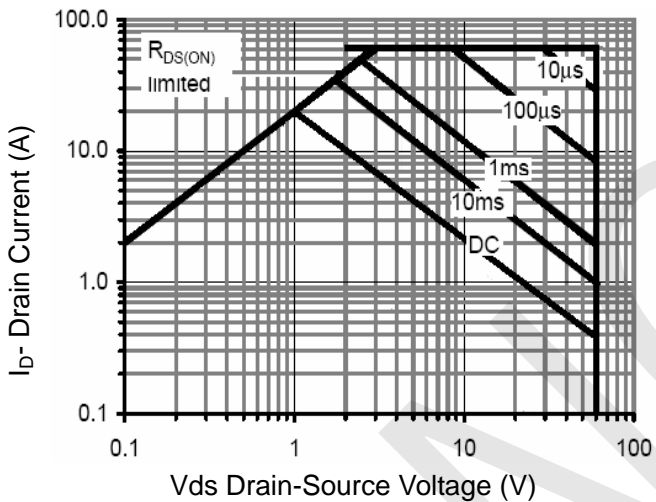
**Figure 6 Source- Drain Diode Forward**



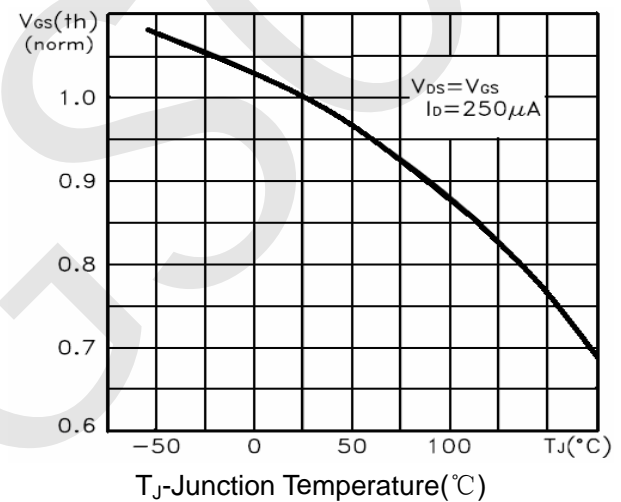
**Figure 7 Capacitance vs Vds**



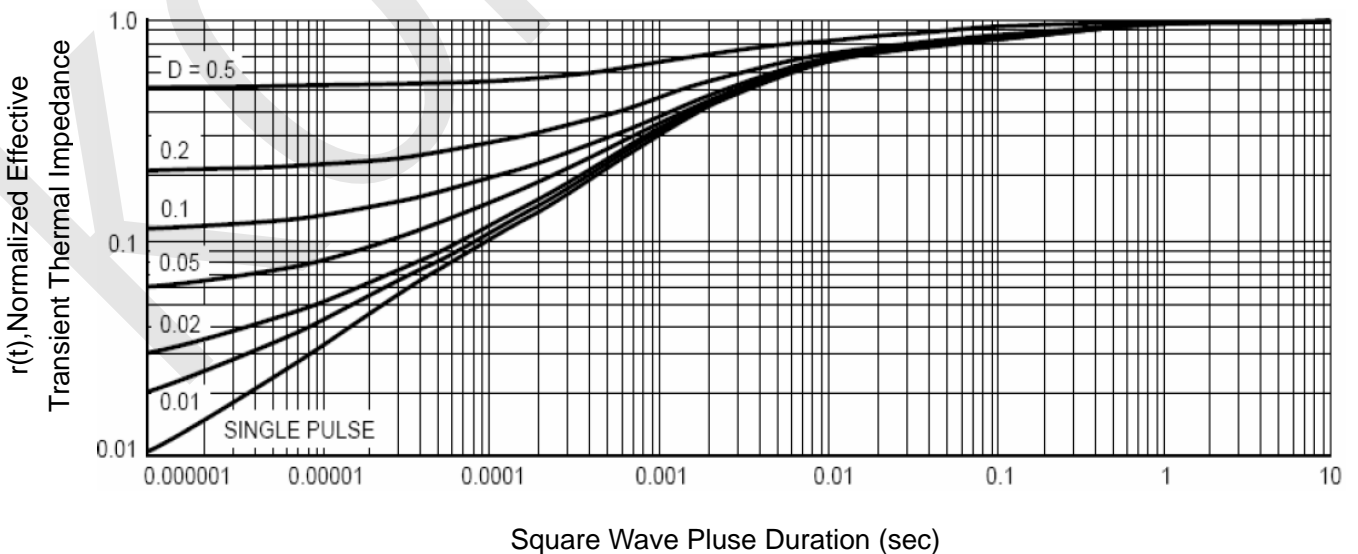
**Figure 9  $BV_{DSS}$  vs Junction Temperature**



**Figure 8 Safe Operation Area**



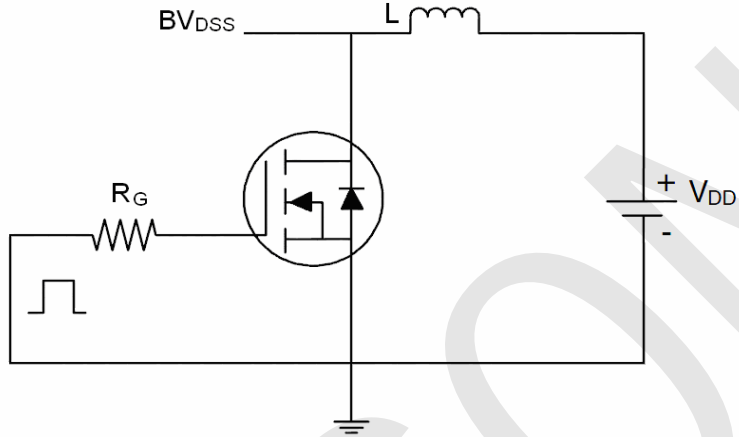
**Figure 10  $V_{GS(th)}$  vs Junction Temperature**



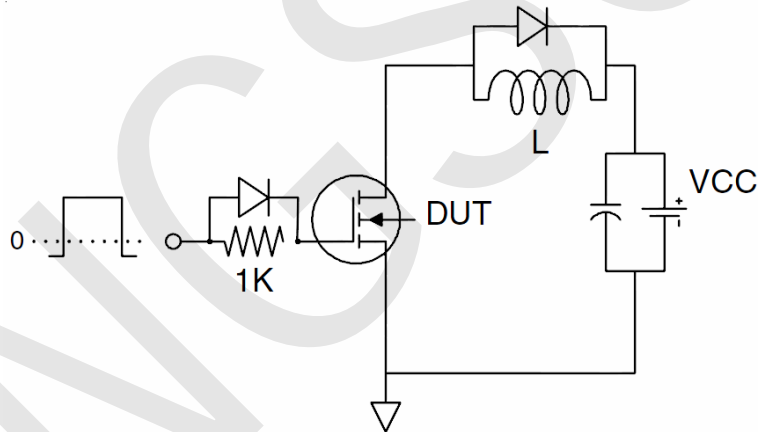
**Figure 11 Normalized Maximum Transient Thermal Impedance**

### Test Circuit

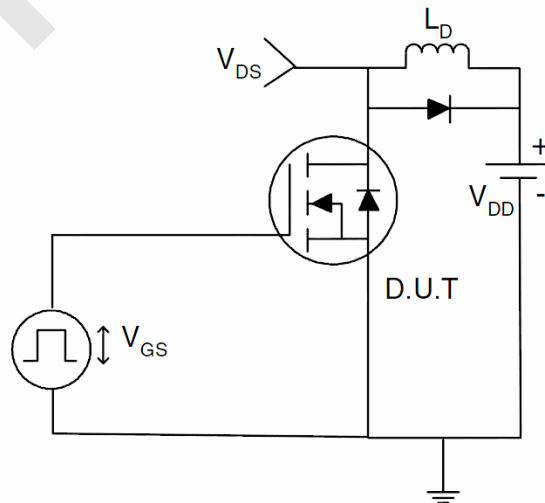
#### 1) $E_{AS}$ test Circuit



#### 2) Gate charge test Circuit



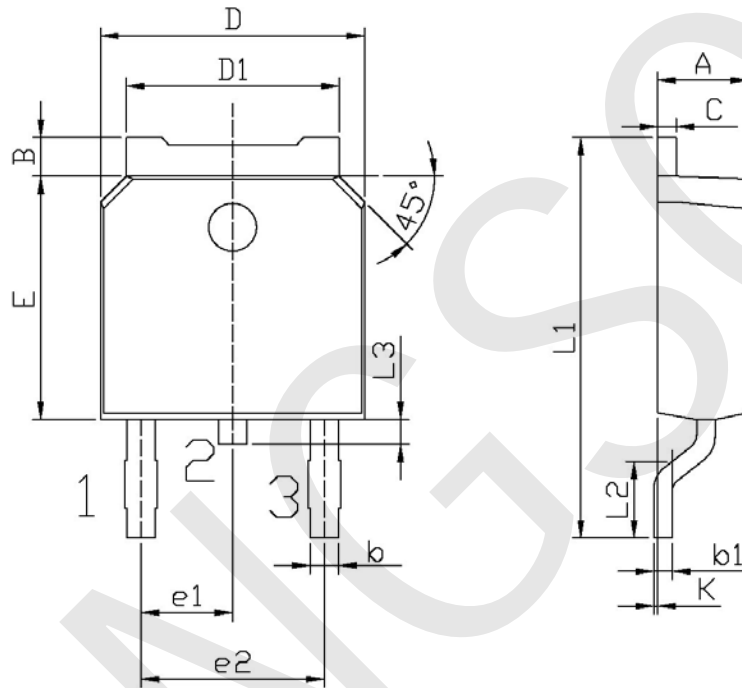
#### 3) Switch Time Test Circuit



### Package Dimension

TO-252

Unit:mm



Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
A	2.20	2.40	E	5.95	6.25
B	0.95	1.25	e1	2.24	2.34
b	0.70	0.90	e2	4.43	4.73
b1	0.45	0.55	L1	9.85	10.35
C	0.45	0.55	L2	1.25	1.75
D	6.45	6.75	L3	0.60	0.90
D1	5.20	5.40	K	0.00	0.10