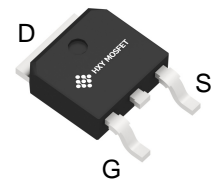




## Description

The 60N02 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



TO-252-2L

## General Features

$V_{DS} = 20V$   $I_D = 60A$

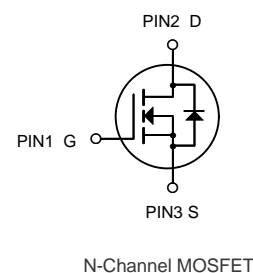
$R_{DS(ON)} < 6m\Omega$  @  $V_{GS}=4.5V$

## Application

Battery protection

Load switch

Uninterruptible power supply



N-Channel MOSFET

## Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
60N02	TO-252-2L	60N02D XXX YYYY	2500

## Absolute Maximum Ratings ( $T_c=25^{\circ}C$ unless otherwise noted)

Symbol	Parameter	Limit	Unit
$V_{DS}$	Drain-Source Voltage	20	V
$V_{GS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Drain Current-Continuous	60	A
$I_D(100^{\circ}C)$	Drain Current-Continuous( $T_c=100^{\circ}C$ )	42	A
$I_{DM}$	Pulsed Drain Current	210	A
$P_D$	Maximum Power Dissipation	60	W
	Derating factor	0.48	W/ $^{\circ}C$
$E_{AS}$	Single pulse avalanche energy (Note 5)	200	mJ
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 150	$^{\circ}C$
$R_{\theta JC}$	Thermal Resistance,Junction-to-Case(Note 2)	2.1	$^{\circ}C/W$



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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=20V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.5	0.75	1.0	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=20A$	-	4.5	6	m $\Omega$
		$V_{GS}=2.5V, I_D=15A$		5.3	8.2	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=20A$	15	-	-	S
Input Capacitance	$C_{iss}$	$V_{DS}=10V, V_{GS}=0V,$ $F=1.0MHz$	-	2000	-	PF
Output Capacitance	$C_{oss}$		-	500	-	PF
Reverse Transfer Capacitance	$C_{rss}$		-	200	-	PF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=10V, I_D=2A, R_L=1\Omega$ $V_{GS}=4.5V, R_G=3\Omega$	-	6.4	-	nS
Turn-on Rise Time	$t_r$		-	17.2	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	29.6	-	nS
Turn-Off Fall Time	$t_f$		-	16.8	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=10V, I_D=20A,$ $V_{GS}=10V$	-	27		nC
Gate-Source Charge	$Q_{gs}$		-	6.5		nC
Gate-Drain Charge	$Q_{gd}$		-	6.4		nC
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=10A$	-		1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	60	A
Reverse Recovery Time	$t_{rr}$	$T_J = 25^{\circ}\text{C}, I_F = 20A$ $di/dt = 100A/\mu s^{(Note3)}$	-	25	-	nS
Reverse Recovery Charge	$Q_{rr}$		-	24	-	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 :  $T_J=25^{\circ}\text{C}, V_{DD}=10V, V_G=10V, L=0.5mH, R_g=25\Omega,$



Typical Electrical and Thermal Characteristics (Curves)

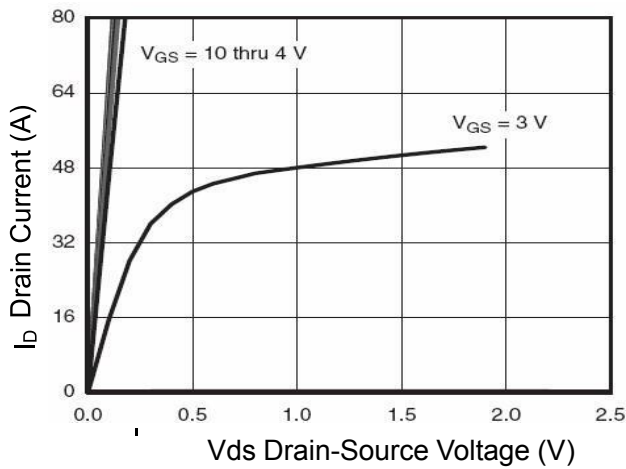


Figure 1 Output Characteristics

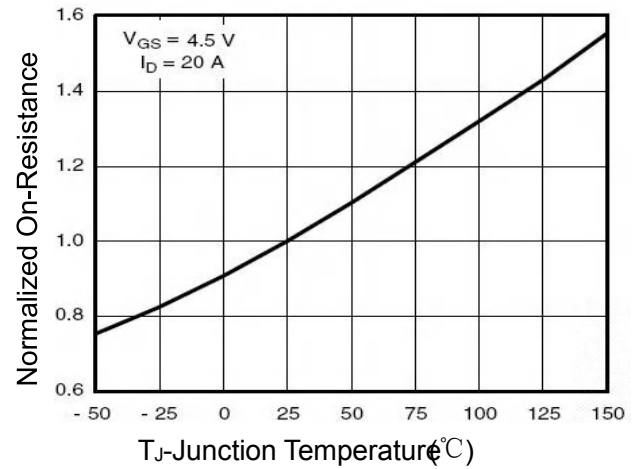


Figure 4  $R_{DS(on)}$ -Junction Temperature

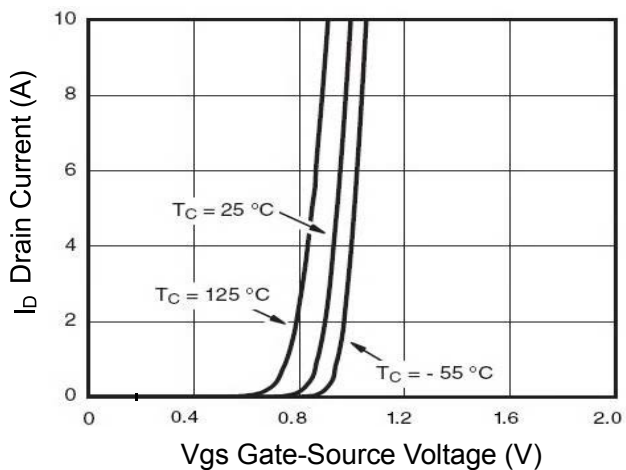


Figure 2 Transfer Characteristics

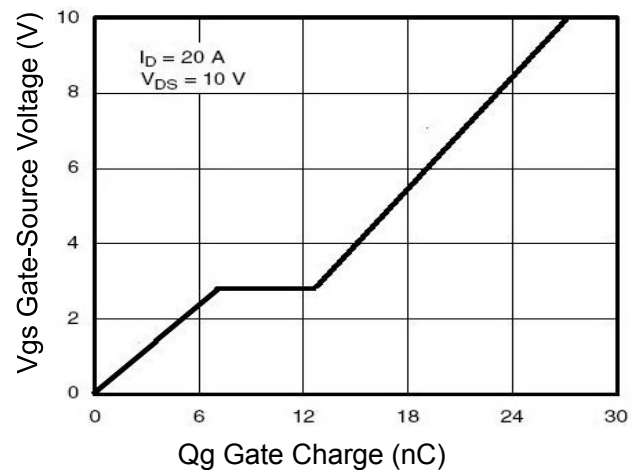


Figure 5 Gate Charge

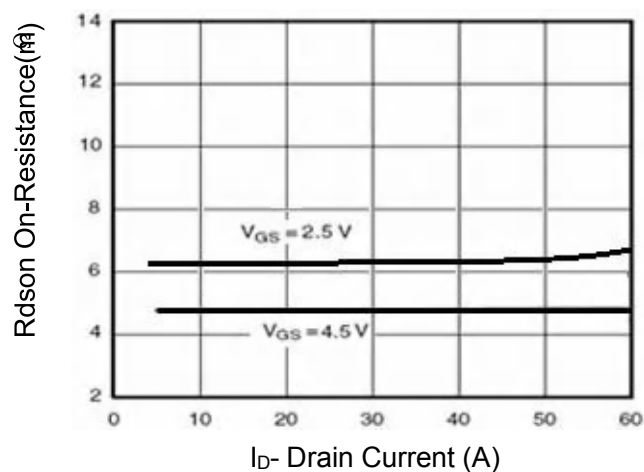


Figure 3  $R_{DS(on)}$ - Drain Current

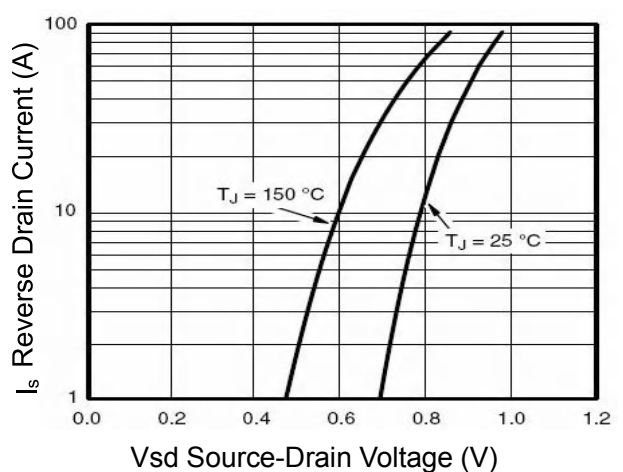


Figure 6 Source- Drain Diode Forward

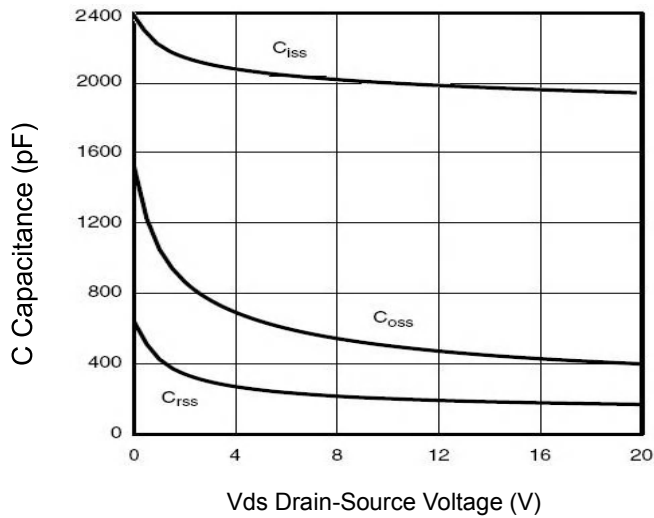


Figure 7 Capacitance vs Vds

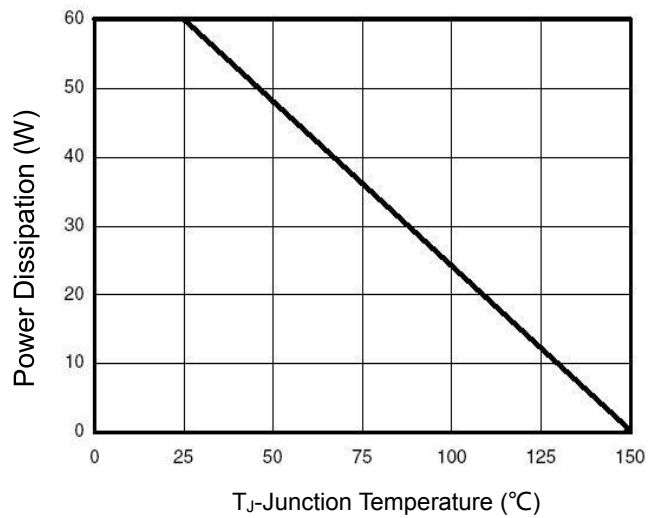


Figure 9 Power De-rating

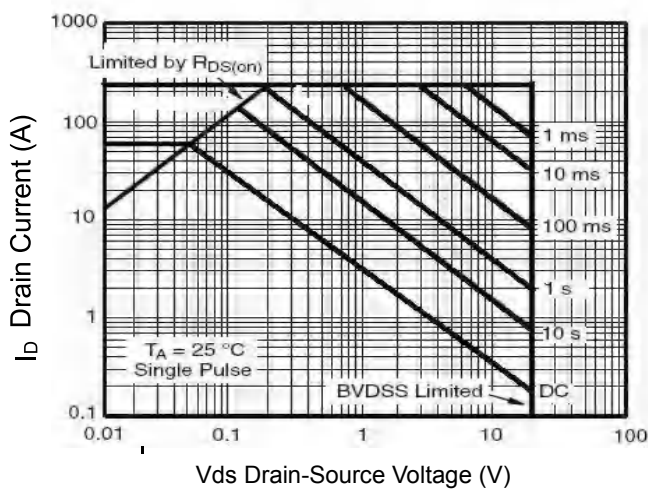


Figure 8 Safe Operation Area

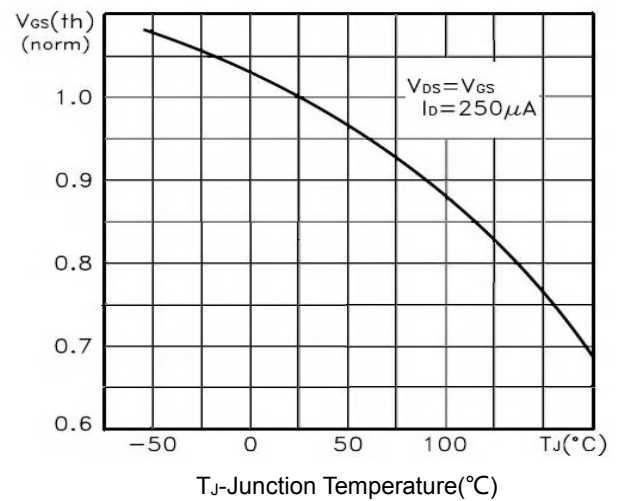


Figure 10 VGS(th) vs TJ

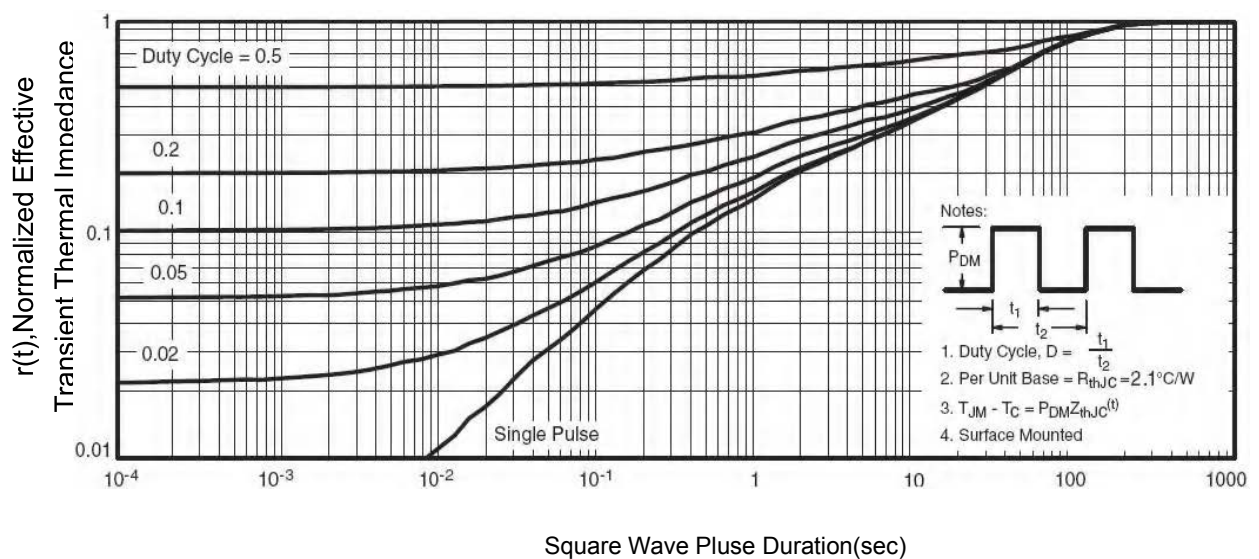


Figure 11 Normalized Maximum Transient Thermal Impedance



## N-Channel Enhancement Mode MOSFET

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	0.483 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	



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