
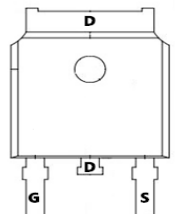
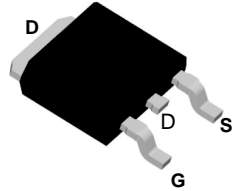
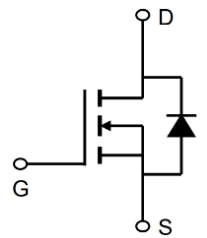


TM60N04D

N-Channel Enhancement Mosfet

<p>General Description</p> <ul style="list-style-type: none"> • Low $R_{DS(ON)}$ • RoHS and Halogen-Free Compliant <p>Applications</p> <ul style="list-style-type: none"> • Load switch • PWM 	<p>General Features</p> <p>$V_{DS} = 40V$ $I_D = 60A$</p> <p>$R_{DS(ON)} = 7.7m\Omega$ (Typ.) @ $V_{GS} = 10V$</p> <p>100% UIS Tested 100% R_g Tested</p> 
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D:TO-252-3L

Marking: 60N04

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

Symbol	Parameter	Rating	Unit	
Common Ratings ($T_A = 25^\circ C$ Unless Otherwise Noted)				
V_{DSS}	Drain-Source Voltage	40	V	
V_{GSS}	Gate-Source Voltage	± 20		
T_J	Maximum Junction Temperature	175	$^\circ C$	
T_{STG}	Storage Temperature Range	-55 to 175	$^\circ C$	
I_S	Diode Continuous Forward Current	60	A	
I_{DM}	300 μs Pulse Drain Current Tested	180	A	
I_D	Continuous Drain Current	$T_C = 25^\circ C$	60	A
		$T_C = 100^\circ C$	48	
P_D	Maximum Power Dissipation	$T_C = 25^\circ C$	60	W
		$T_C = 100^\circ C$	30	
$R_{\theta JC}$	Thermal Resistance-Junction to Case	2.5	$^\circ C/W$	
$R_{\theta JA}$	Thermal Resistance-Junction to Ambient	50	$^\circ C/W$	
E_{AS}^{**}	Drain-Source Avalanche Energy	$L = 0.5mH$	100	mJ

Notes : * Avalanche single pulse test and avalanche period time $t_{av} \leq 100 \mu s$, duty < 1% .
 ** Avalanche test condition: $T_J = 25^\circ C$, $L = 0.5mH$, $I_{AS} = 20A$, $V_{DD} = 30V$, and $V_{GS} = 10V$.
 *** Current limited by bond wire.

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

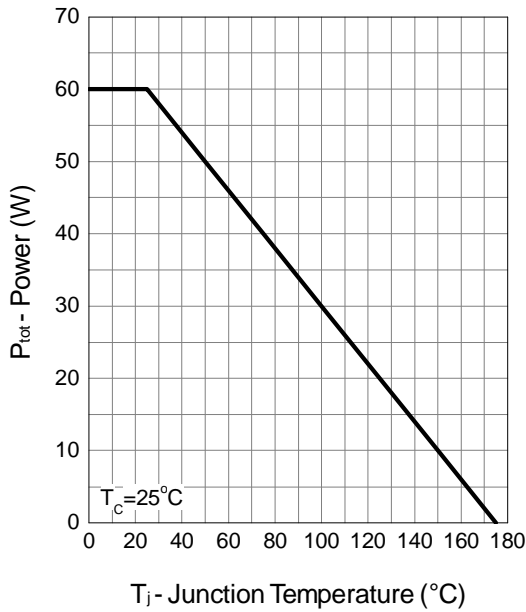
Symbol	Parameter	Test Conditions				Unit
			Min.	Typ.	Max.	
Static Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_{DS}=250\mu A$	40	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS}=32V, V_{GS}=0V$ $T_J=85^{\circ}\text{C}$	-	-	1	μA
			-	-	30	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_{DS}=250\mu A$	1.0	1.5	2	V
I_{GSS}	Gate Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
$R_{DS(ON)}^a$	Drain-Source On-state Resistance	$V_{GS}=10V, I_{DS}=20A$	-	7.7	9	m Ω
		$V_{GS}=4.5V, I_{DS}=10A$	-	10	18	
Diode Characteristics						
V_{SD}^a	Diode Forward Voltage	$I_{SD}=20A, V_{GS}=0V$	-	0.8	1.1	V
t_{rr}	Reverse Recovery Time	$I_{DS}=40A,$ $di_{SD}/dt=100A/\mu s$	-	28	-	ns
Q_{rr}	Reverse Recovery Charge		-	24	-	nC
Dynamic Characteristics ^b						
R_G	Gate Resistance	$V_{GS}=0V, V_{DS}=0V, F=1\text{MHz}$	-	1.4	-	Ω
C_{iss}	Input Capacitance	$V_{GS}=0V,$ $V_{DS}=20V,$ Frequency=1.0MHz	-	1260	-	pF
C_{oss}	Output Capacitance		-	180	-	
C_{riss}	Reverse Transfer Capacitance		-	146	-	
$t_{d(ON)}$	Turn-on Delay Time	$V_{DD}=20V, R_L=20\Omega,$ $I_{DS}=1A, V_{GEN}=10V,$ $R_G=6\Omega$	-	11	21	ns
t_r	Turn-on Rise Time		-	13	24	
$t_{d(OFF)}$	Turn-off Delay Time		-	37	67	
t_f	Turn-off Fall Time		-	11	21	
Gate Charge Characteristics ^b						
Q_g	Total Gate Charge	$V_{DS}=20V, V_{GS}=10V,$ $I_{DS}=40A$	-	31.2	44	nC
Q_{gs}	Gate-Source Charge		-	3.8	-	
Q_{gd}	Gate-Drain Charge		-	9	-	

Note a : Pulse test ; pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.

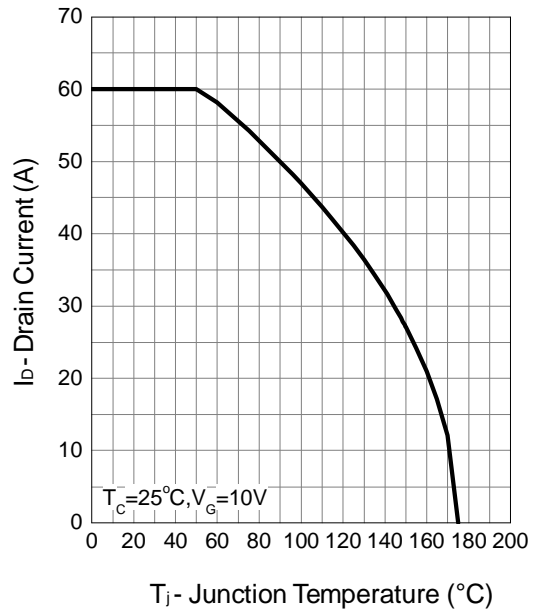
Note b : Guaranteed by design, not subject to production testing.

Typical Performance Characteristics

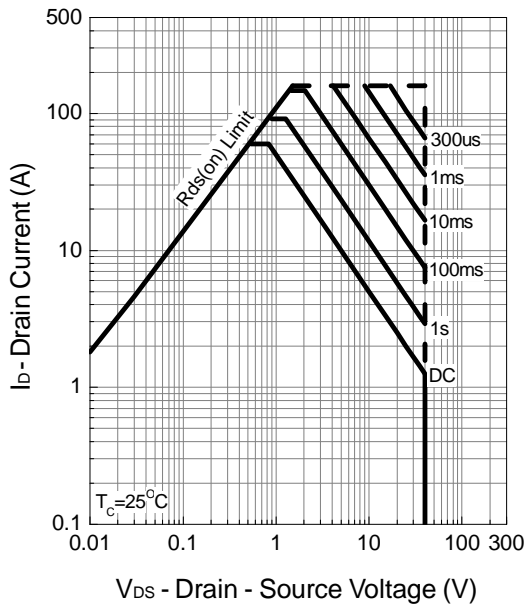
Power Dissipation



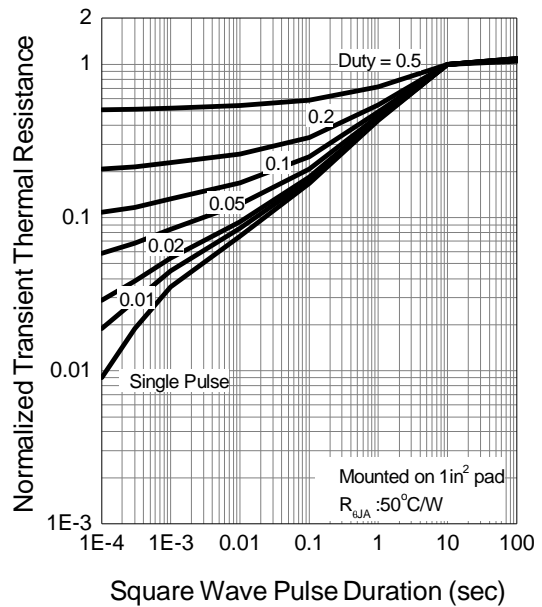
Drain Current



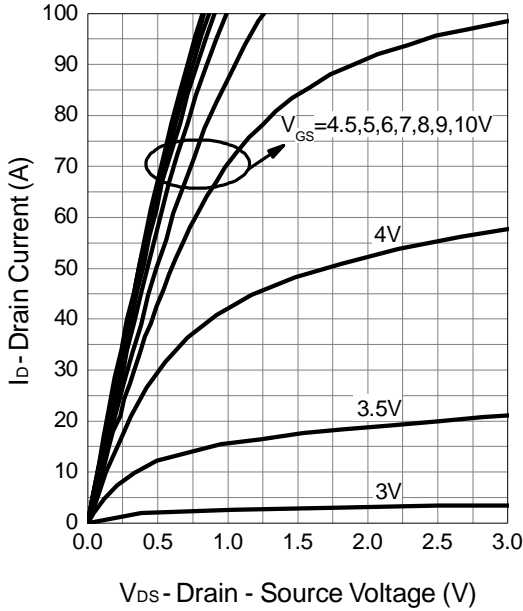
Safe Operation Area



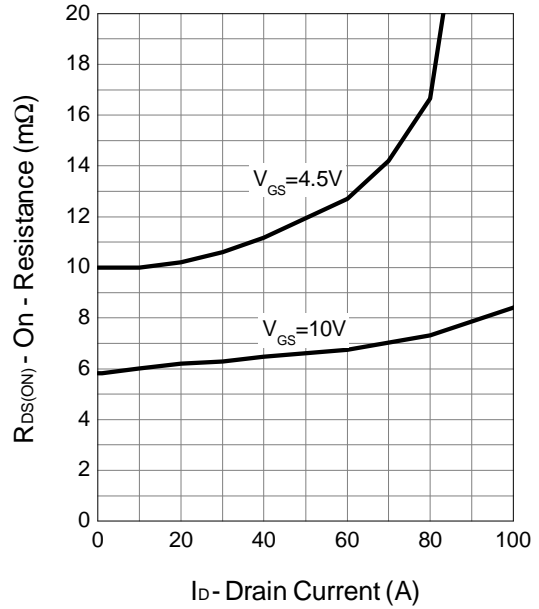
Thermal Transient Impedance



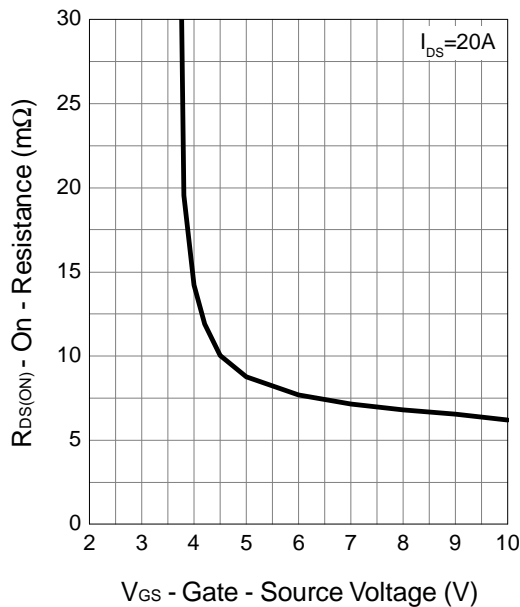
Output Characteristics



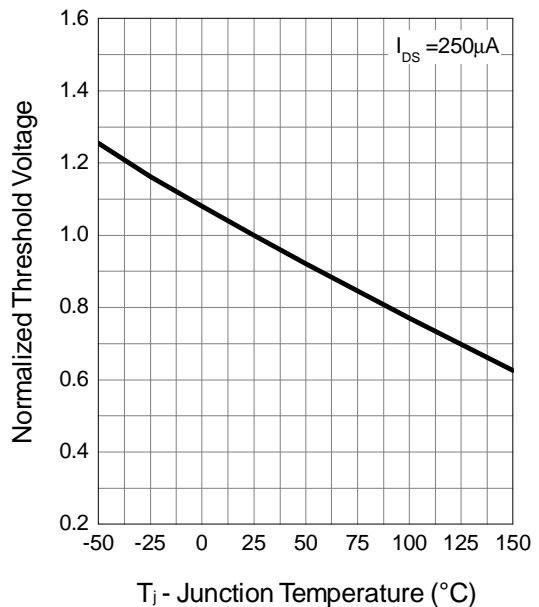
Drain-Source On Resistance



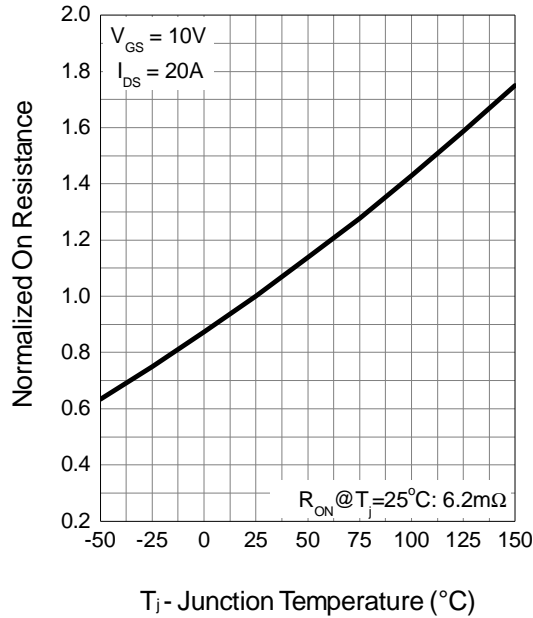
Gate-Source On Resistance



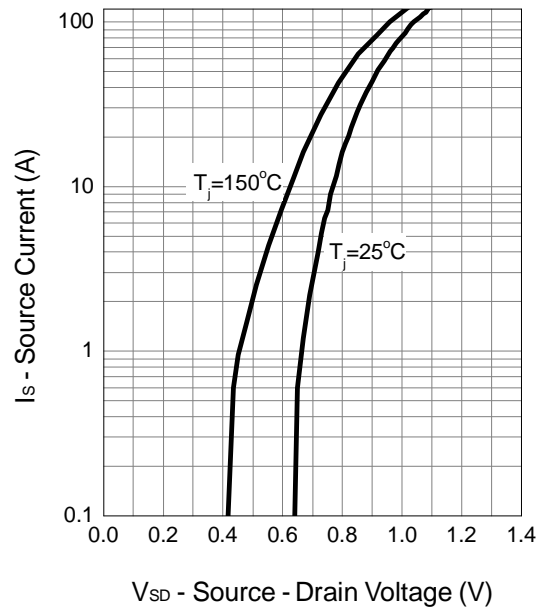
Gate Threshold Voltage



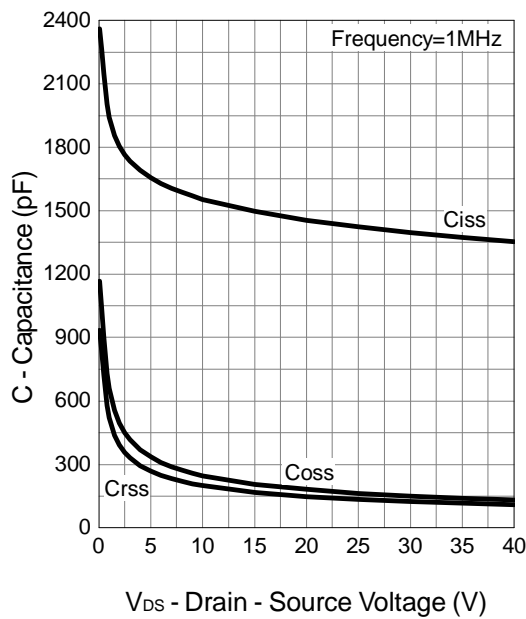
Drain-Source On Resistance



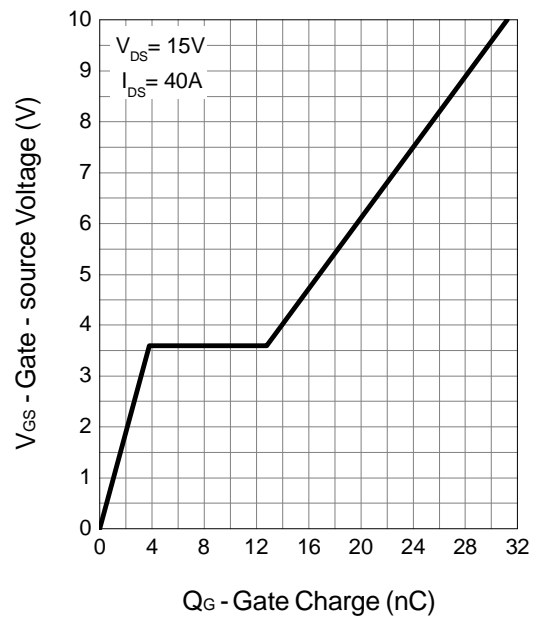
Source-Drain Diode Forward



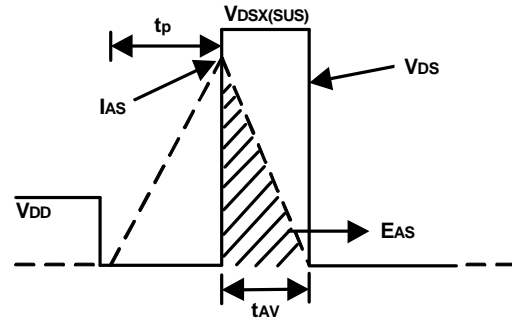
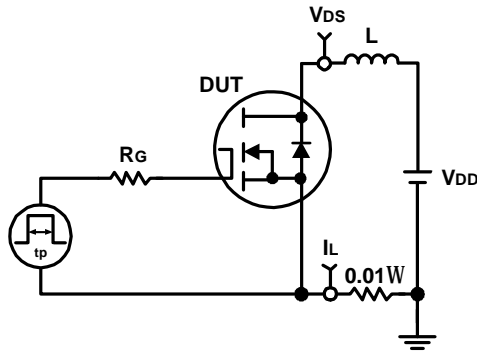
Capacitance



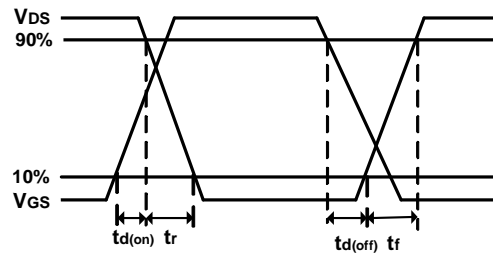
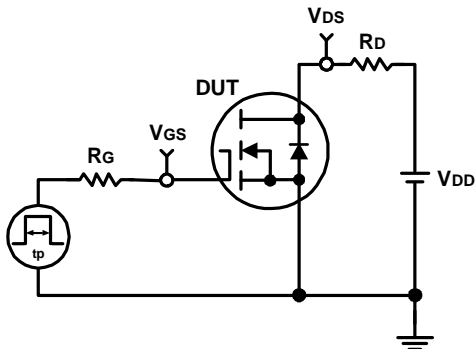
Gate Charge



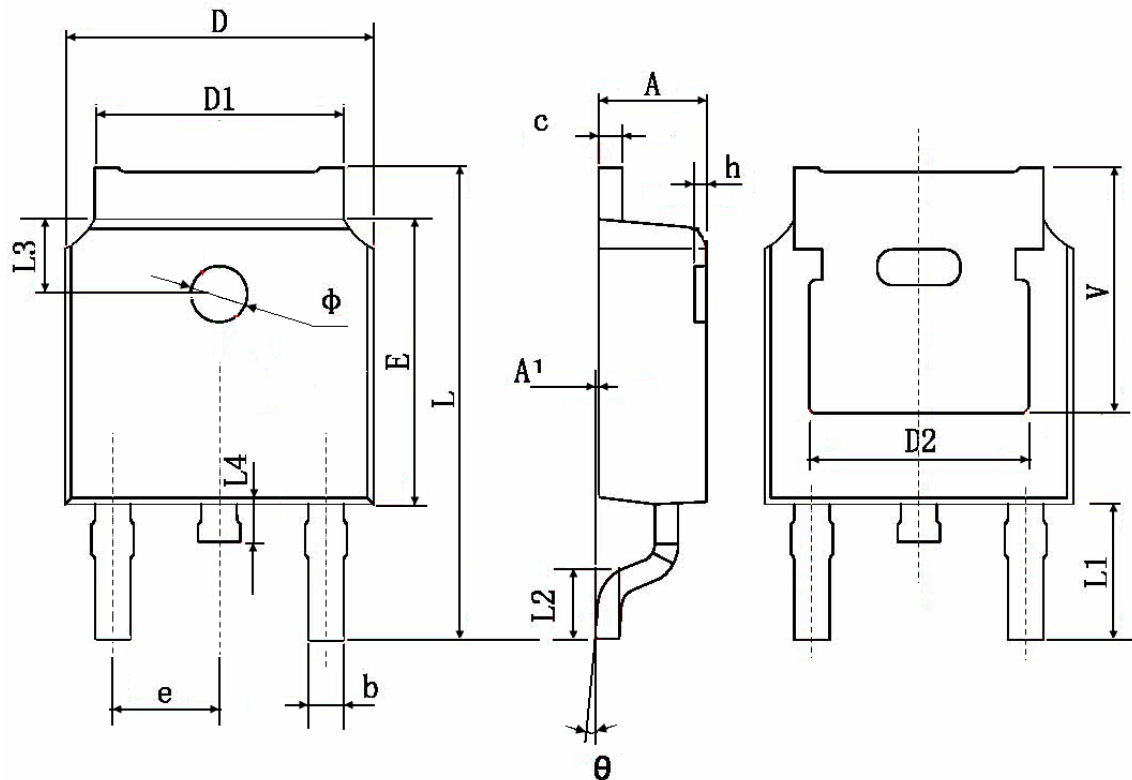
Avalanche Test Circuit and Waveforms



Switching Time Test Circuit and Waveforms



Package Information: TO-252-3L



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	4.830 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.	