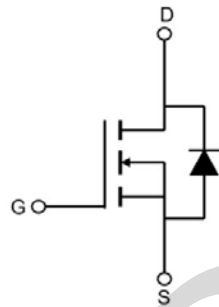


Trench N-channel Power MOSFET

TO-220
MSR012N13CT



To-220 Top View



Schematic Diagram

V_{DS}	130	V
$R_{DS(on),TYP@ V_{GS}=10V}$	8.5	mΩ
I_D	104	A

Features

- $V_{DS}=130V$; $I_D=104A@ V_{GS}=10V$;
 $R_{DS(ON)}<12.0m\Omega @ V_{GS}=10V$
- Special Designed for E-Bike Controller Application
- Ultra Low On-Resistance
- High UIS and UIS 100% Test
- 96V E-Bike controller applications
- Hard Switched and High Frequency Circuits
- Uninterruptible Power Supply

Maximum ratings, at $T_A = 25^\circ C$, unless otherwise specified

Symbol	Parameter		Rating	Unit
V(BR)DSS	Drain-Source breakdown voltage		130	V
VGS	Gate-Source voltage		±25	V
dv/dt	Peak Diode Recovery Voltage		7	V/ns
ID	Continuous drain current @VGS=10V	Tc =25°C	104	A
		Tc =100°C	73	A
IDM	Drain Current-Continuous@ Current-Pulsed (Note 1)	Tc =25°C	416	A
EAS	Single Pulse Avalanche Energy(Note 2)		1600	mJ
PD	Maximum power dissipation	Tc =25°C	348	W
TSTG,TJ	Storage and Junction Temperature Range		-55 to 175	°C

Notes1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. EAS condition: $T_J=25, V_{DD}=50V, V_{G}=10V, R_G=25\Omega$

Thermal Characteristics

Symbol	Parameter	Value	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	---	0.43	$^{\circ}\text{C/W}$

Electrical Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
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Static Electrical Characteristics @ $T_j=25^{\circ}\text{C}$ (unless otherwise stated)

$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	130	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current($T_c=25$)	$V_{DS}=130V, V_{GS}=0V$	--	--	1	μA
I_{DSS}	Zero Gate Voltage Drain Current($T_c=125$)	$V_{DS}=130V, V_{GS}=0V$	--	--	10	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	--	--	± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu A$	3	--	5	V
$R_{DS(on)}$	Drain-Source On-State Resistance ④	$V_{GS}=10V, I_D=40A$	--	8.5	12	m Ω

Dynamic Electrical Characteristics@ $T_j = 25^{\circ}\text{C}$ (unless otherwise stated)

C_{iss}	Input Capacitance	$V_{DS}=25V, V_{GS}=0V$ $f=1\text{MHz}$	--	9152	--	pF
C_{oss}	Output Capacitance		--	799	--	pF
C_{rss}	Reverse Transfer Capacitance		--	406	--	pF
g_{fs}	Forward Transconductance	$V_{DS} = 10V,$ $I_D = 15A$	20	--	--	S
$Q_g(10V)$	Total Gate Charge	$V_{DS}=50V, I_D=40A$ $V_{GS}=10V$	--	274	--	nC
Q_{gs}	Gate-Source Charge		--	56	--	nC
Q_{gd}	Gate-Drain Charge		--	113	--	nC

Switching Characteristics

Td(on)	Turn-on Delay Time	V _{DD} =65V, I _D =40A, R _L =15Ω, V _{GS} =10V, R _G =2.5Ω	--	40	--	ns
Tr	Turn-on Rise Time		--	72	--	ns
Td(off)	Turn-Off Delay Time		--	103	--	ns
Tf	Turn-Off Fall Time		--	35	--	ns

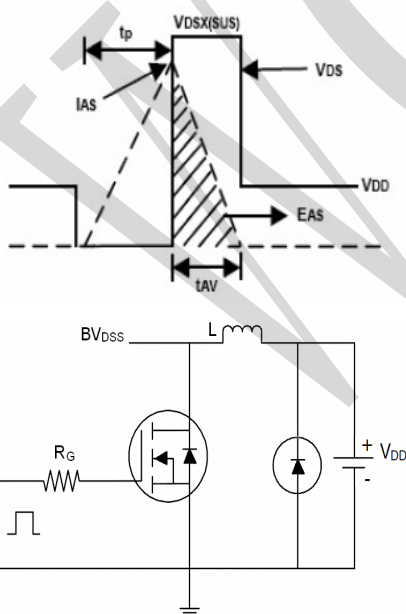
Source -Drain Diode Characteristics @T_j = 25°C (unless otherwise stated)

VSD	Forward on voltage	I _{SD} =40A, V _{GS} =0V	--	0.85	0.99	V
Trr	Reverse Recovery Time (Note1)	T _J =25, I _F =40A di/dt=100A/μs	--	80	--	ns
Qrr	Reverse Recovery Charge (Note1)		--	200	--	nC
I _{SD}	Source-Drain Current(Body Diode)			104		A
I _{SDM}	Pulsed Source-Drain Current(Body Diode)			416		A
t _{on}	Forward Turn-on Time	Intrinsic turn-on time is negligible(turn-on is dominated by LS+LD)				

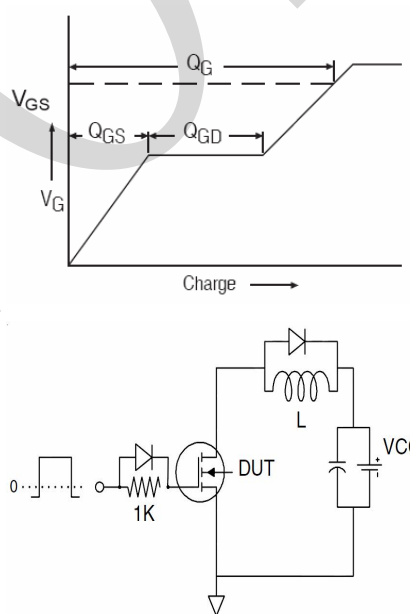
Notes1.Pulse Test: Pulse Width 300μs, Duty Cycle 1.5%, R_G=25Ω, Starting T_J=25

Test Circuit

1) EASTest Circuits



2) Gate Charge Test Circuit:



3) SwitchTime Test Circuit :

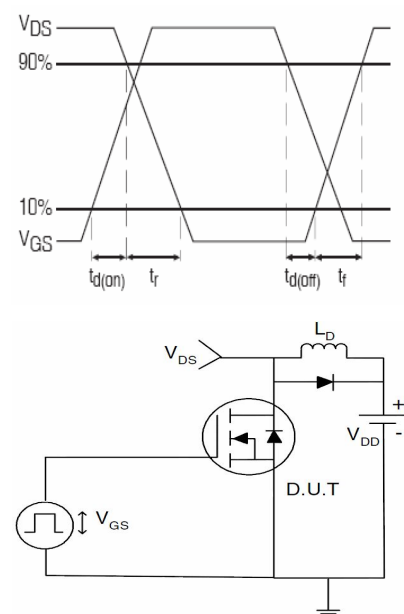


Figure1. Output Characteristics

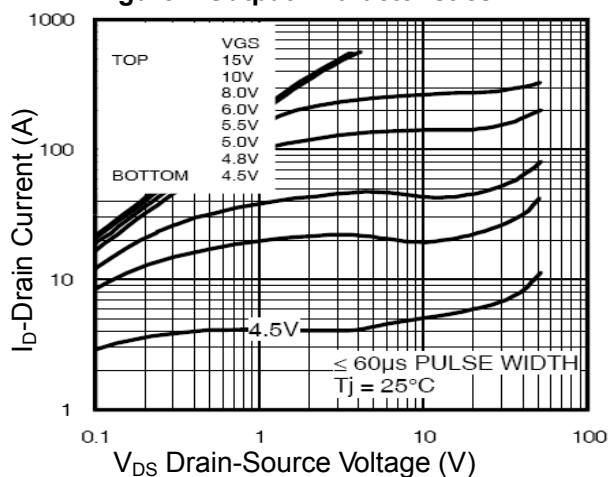


Figure2. Transfer Characteristics

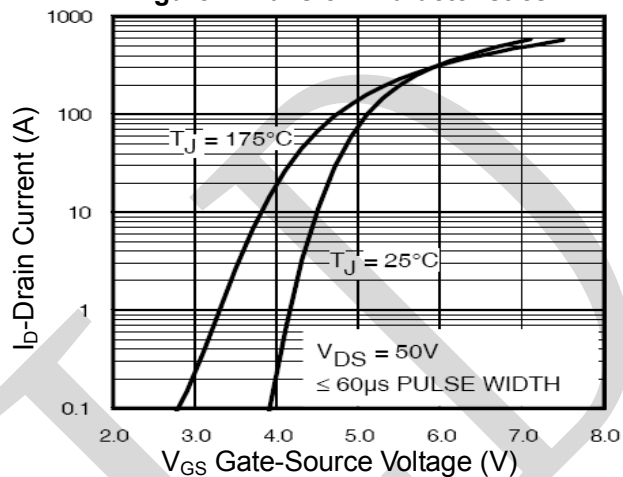


Figure3. BVDSS vs Junction

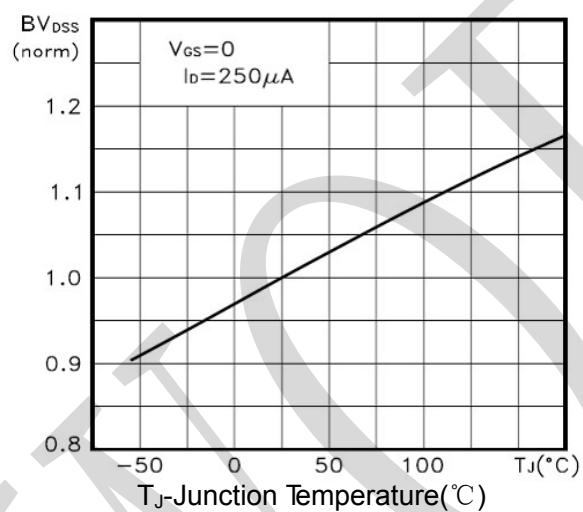


Figure4. ID vs Junction Temperature

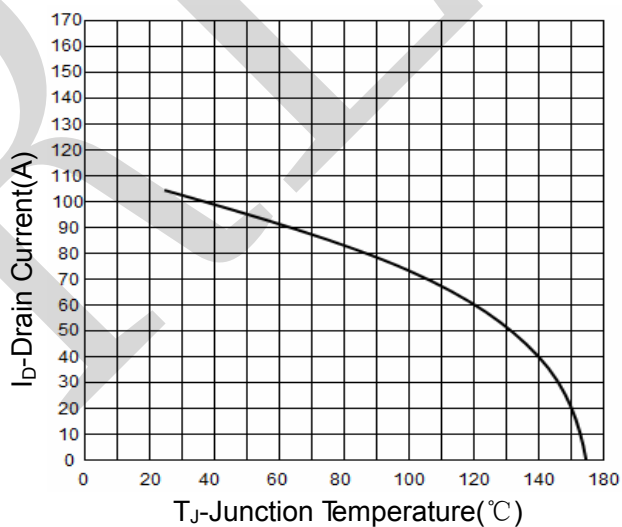


Figure5. VGS(th) vs Junction Temperature

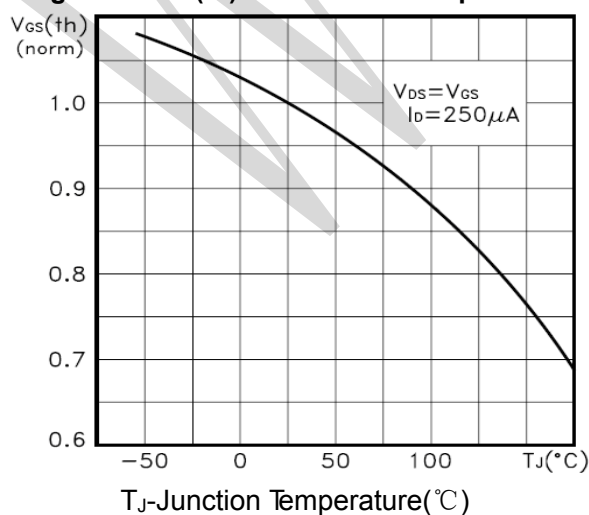


Figure6. Rds(on) Vs Junction Temperature

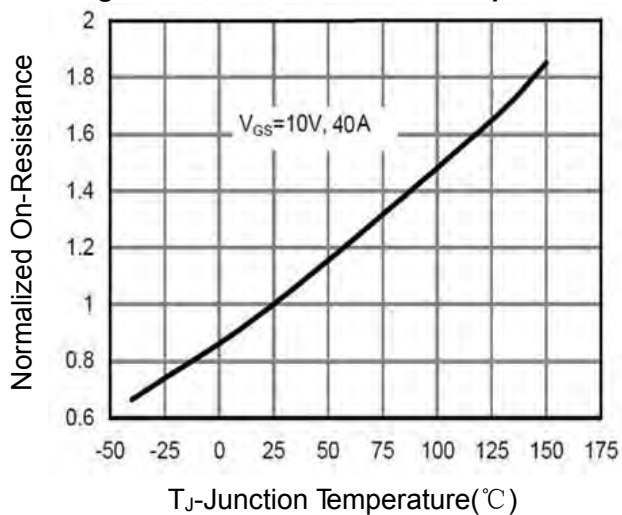


Figure7. Gate Charge

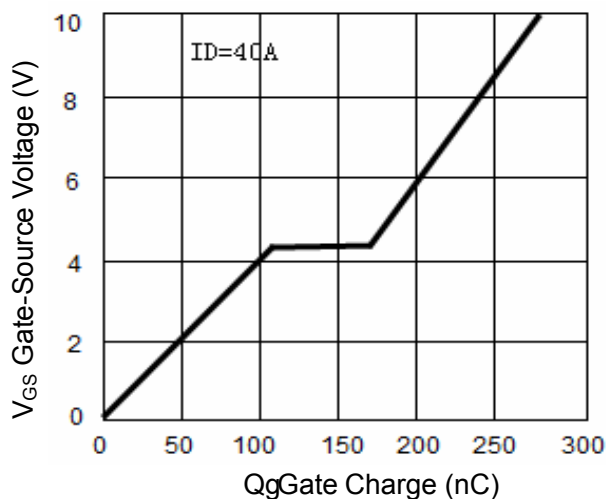


Figure8. Capacitance vs V_{DS}

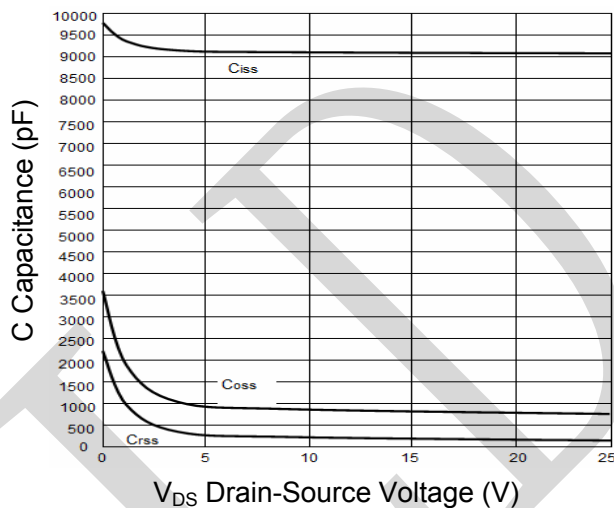


Figure9. Source- Drain Diode Forward

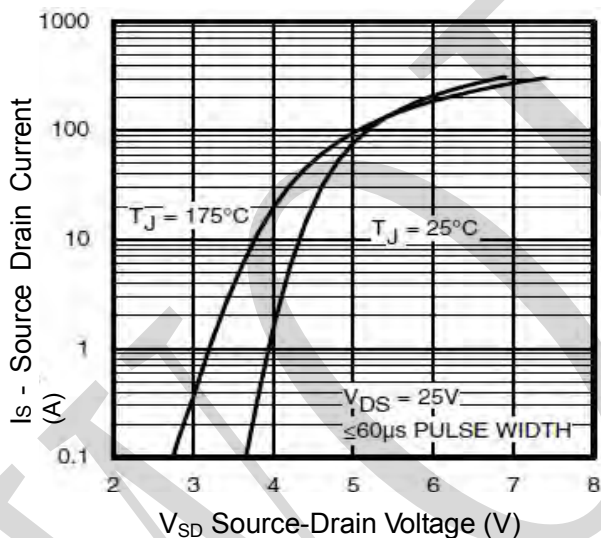


Figure10. Safe Operation Area

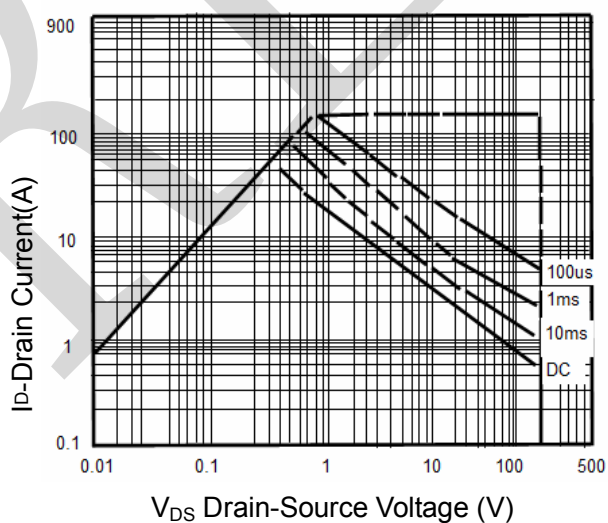
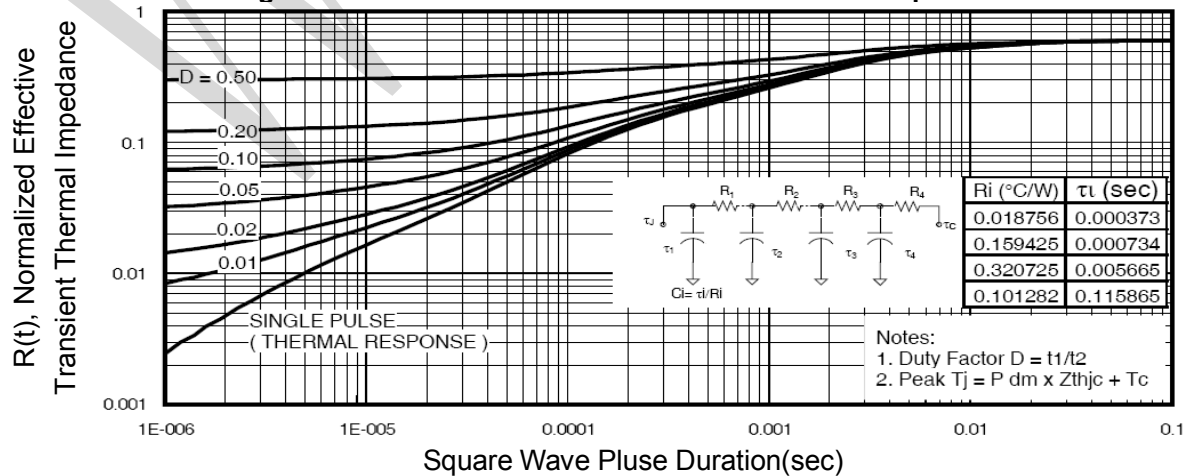
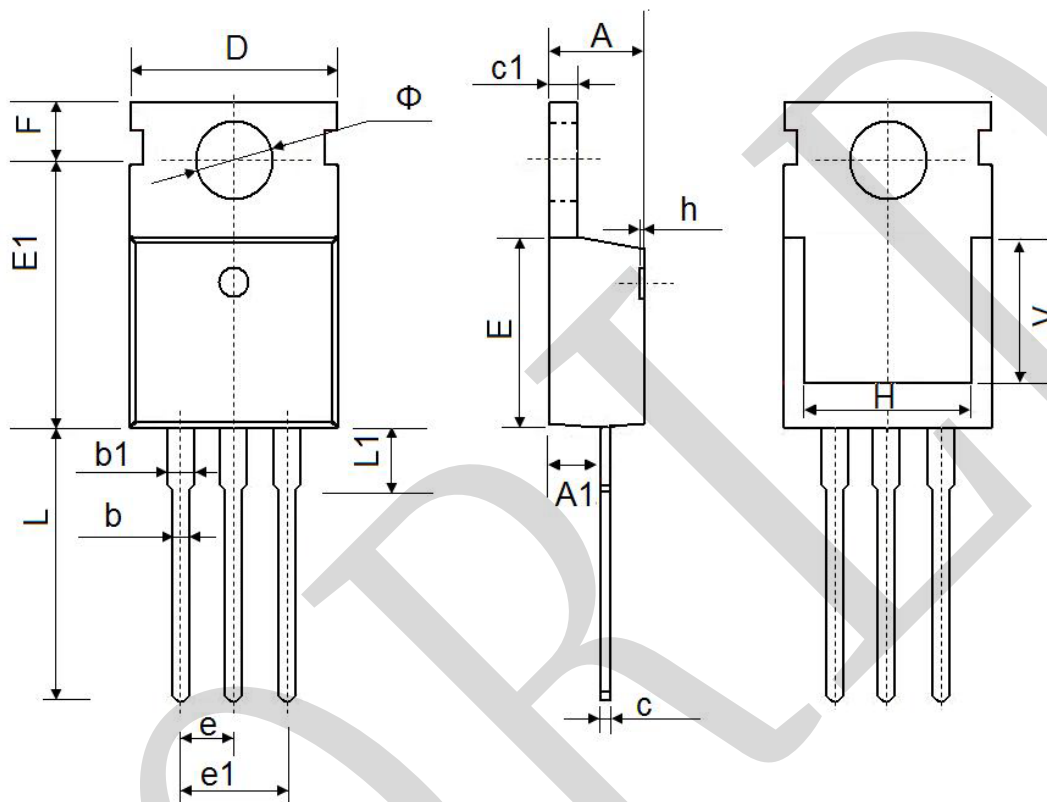


Figure11. Normalized Maximum Transient Thermal Impedance



TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.300	4.700	0.169	0.185
A1	2.200	2.600	0.087	0.102
b	0.700	0.950	0.028	0.037
b1	1.170	1.410	0.046	0.056
c	0.450	0.650	0.018	0.026
c1	1.200	1.400	0.047	0.055
D	9.600	10.400	0.378	0.409
E	8.8500	9.750	0.348	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.500	7.700	0.295	0.303
h	0.000	0.300	0.000	0.012
L	12.750	14.300	0.502	0.563
L1	2.850	3.950	0.112	0.156
V	6.80 REF.		0.267 REF.	
Φ	3.400	4.000	0.134	0.157