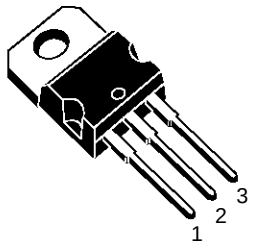
STP40N03L-20

N - CHANNEL ENHANCEMENT MODE "ULTRA HIGH DENSITY" POWER MOS TRANSISTOR

PRELIMINARY DATA

TYPE	V_{DSS}	$R_{DS(on)}$	I_D
STP40N03L-20	30 V	< 0.02 Ω	40 A

- TYPICAL $R_{DS(on)}$ = 0.016 Ω
- AVALANCHE RUGGED TECHNOLOGY
- 100% AVALANCHE TESTED
- HIGH CURRENT CAPABILITY
- 175°C OPERATING TEMPERATURE
- HIGH dV/dt CAPABILITY
- APPLICATION ORIENTED CHARACTERIZATION

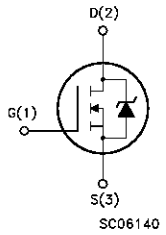


TO-220

APPLICATIONS

- HIGH CURRENT, HIGH SPEED SWITCHING
- POWER MOTOR CONTROL
- DC-DC & DC-AC CONVERTERS
- SYNCRONOUS RECTIFICATION

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage (V_{GS} = 0)	30	V
V_{DGR}	Drain- gate Voltage (R_{GS} = 20 kΩ)	30	V
V_{GS}	Gate-source Voltage	± 15	V
I_D	Drain Current (continuous) at T_c = 25 °C	40	A
I_D	Drain Current (continuous) at T_c = 100 °C	28	A
I_{DM}(•)	Drain Current (pulsed)	160	A
P_{tot}	Total Dissipation at T_c = 25 °C	90	W
	Derating Factor	0.6	W/°C
dV/dt(1)	Peak Diode Recovery voltage slope	6	V/ns
T_{stg}	Storage Temperature	-65 to 175	°C
T_j	Max. Operating Junction Temperature	175	°C

(•) Pulse width limited by safe operating area

THERMAL DATA

$R_{thj-case}$	Thermal Resistance Junction-case	Max	1.66	$^oC/W$
$R_{thj-amb}$	Thermal Resistance Junction-ambient	Max	62.5	$^oC/W$
$R_{thc-sink}$	Thermal Resistance Case-sink	Typ	0.5	$^oC/W$
T_l	Maximum Lead Temperature For Soldering Purpose		300	^oC

AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max, $\delta < 1\%$)	40	A
E_{AS}	Single Pulse Avalanche Energy (starting $T_j = 25\ ^oC$, $I_D = I_{AR}$, $V_{DD} = 25$ V)	300	mJ
E_{AR}	Repetitive Avalanche Energy (pulse width limited by T_j max, $\delta < 1\%$)	75	mJ
I_{AR}	Avalanche Current, Repetitive or Not-Repetitive ($T_c = 100\ ^oC$, pulse width limited by T_j max, $\delta < 1\%$)	28	A

ELECTRICAL CHARACTERISTICS ($T_{case} = 25\ ^oC$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250\ \mu A$ $V_{GS} = 0$	30			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	V_{DS} = Max Rating V_{DS} = Max Rating x 0.8 $T_c = 125\ ^oC$			250 1000	µA µA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 15$ V			$\pm$ 100	nA

ON (*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ $I_D = 250\ \mu A$	1	1.6	2	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V$ $I_D = 20$ A $V_{GS} = 10V$ $I_D = 20$ A $T_c = 100^oC$ $V_{GS} = 5V$ $I_D = 20$ A		0.016 0.019	0.02 0.04 0.023	Ω Ω Ω
$I_{D(on)}$	On State Drain Current	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $V_{GS} = 10$ V	40			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (*)	Forward Transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max}$ $I_D = 20$ A	15	22		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25$ V f = 1 MHz $V_{GS} = 0$		1800 450 180	2300 580 230	pF pF pF

ELECTRICAL CHARACTERISTICS (continued)

SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Time Rise Time	V_{DD} = 15 V I_D = 10 A R_G = 4.7 Ω V_{GS} = 5 V (see test circuit, figure 3)		20 80	30 100	ns ns
$(di/dt)_{on}$	Turn-on Current Slope	V_{DD} = 24 V I_D = 20 A R_G = 50 Ω V_{GS} = 5 V (see test circuit, figure 5)		200		A/µs
Q_g Q_{gs} Q_{gd}	Total Gate Charge Gate-Source Charge Gate-Drain Charge	V_{DD} = 24 V I_D = 20 A V_{GS} = 5 V		40 10 20	60	nC nC nC

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(Voff)}$ t_f t_c	Off-voltage Rise Time Fall Time Cross-over Time	V_{DD} = 24 V I_D = 20 A R_G = 4.7 Ω V_{GS} = 5 V (see test circuit, figure 5)		42 45 76	55 60 100	ns ns ns

SOURCE DRAIN DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(•)	Source-drain Current Source-drain Current (pulsed)				40 160	A A
V_{SD} (∗)	Forward On Voltage	I_{SD} = 40 A V_{GS} = 0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 20 A di/dt = 100 A/µs V_{DD} = 24 V T_j = 150 °C (see test circuit, figure 5)		65 0.12 4		ns µC A

(∗) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(•) Pulse width limited by safe operating area

(1) $I_{SD} \leq 40$ A, di/dt ≤ 300 A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$

PSPICE PARAMETERS

SUBCIRCUIT COMPONENTS

Symbol	Parameter	Value	Unit
S1	(V14_16<0) (See Power Mosfet Model Subcircuit)	ON	
S2	(V16_11<0) (See Power Mosfet Model Subcircuit)	ON	
LD	Drain Inductance	8	nH
LG	Gate Inductance	10	nH
LS	Source Inductance	10	nH
RDRAIN	Drain Resistance	$1.9E^{-2}$	Ω
RGATE	Gate Resistance	1	Ω
CGD	Gate Drain Capacitance	3.92	nF
CGS	Gate Source Capacitance	1.9	nF
ALFA	Drift Coeficient	$1E^{-3}$	V^{-1}
RGN	Negative Bias Resistance	10	KΩ

DIODE DRAIN GATE (Depletion Capacitance)

Symbol	Parameter	Value	Unit
CJO	Zero Bias p-n Capacitance	2.7	nF
VJ	p-n Potential	0.35	V
M	p-n Grading Coefficient	0.55	

DIODE DRAIN SOURCE

Symbol	Parameter	Value	Unit
CJO	Zero Bias p-n Capacitance	10	nF
VJ	p-n Potential	0.35	V
M	p-n Grading Coefficient	0.55	
TT	Transit Time	20	nsec

N MOSFET

Symbol	Parameter	Value	Unit
L	Channel Length	1	µMeter
W	Channel Width	1	µMeter
LEVEL	Model Index	3	
TOX	Oxide Thickness	1	Meter
VTO	Zero Bias Threshold Voltage	3.25	V
U0	Surface Mobility	600	cm^2/VS
THETA	Mobility Modulation	0.005	V^{-1}
Vmax	Maximum Drift Velocity	0	Meter/sec
KP	Trans Conductance Coefficient	15	Amp/V^2

For Transient Simulation Applicate U.I.C. (Use Initial Condition) Option