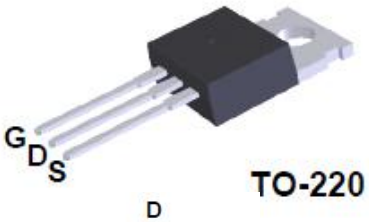
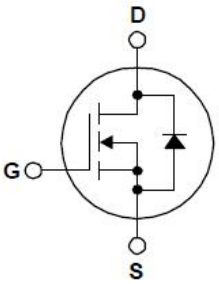
400V N-Channel MOSFET

Features

- V_{DSS}=400V / I_D=12A
  $R_{DS(On)}$=0.35Ω(Typ.)@V_{GS}=10V
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

PIN DESCRIPTION





Applications

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)

Part Number	Package	Marking	ROHS Status	Packing
SI12N40B	TO-220	SI12N40B	Pb-Free	Tube&Box

Absolute Maximum Ratings (T_A=25℃ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain-Source Voltage		400	V
V_{GSS}	Gate-Source Voltage		±30	V
I_D	Drain Current-Continuous		12	A
I_{DM}	Drain Current-Pulsed NOTE 1		48	A
E_{AS}	Single Pulse Avalanche Energy		230	mJ
I_{AS}	Avalanche Current		6.8	A
E_{AR}	Repetitive Avalanche Energy		138	mJ
P_D	Maximum Power Dissipation	T_C=25°C	107	W
T_J	Operating Junction Temperature		-55 to 150	°C
T_{STG}	Storage Temperature Range		-55 to 150	°C

Thermal Resistance Ratings

Symbol	Parameter	Value	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	60	℃/W
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.17	℃/W

Electrical Characteristics (T_J=25℃ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	TYP	Max	Unit
Static Characteristics						
BV_{DSS}	Drain-source breakdown voltage	V_{GS}=0V, I_{DS}=250uA	400	-	-	V
$V_{GS(TH)}$	Gate threshold voltage	V_{DS}=V_{GS},I_{DS}=250uA	3	-	4	V
I_{DSS}	Zero gate voltage drain current	V_{DS}=400V,V_{GS}=0V	-	-	1	uA
I_{GSS}	Gate-source leakage current	V_{GS}=±30V	-	-	±100	nA
$R_{DS(on)}$	Drain-source on-state resistance	V_{GS}=10V, I_{DS}=6A	-	0.35	0.43	Ω
Dynamic Characteristic						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=25V, f=1MHz	-	983	-	pF
C_{oss}	Output Capacitance		-	148	-	pF
C_{rss}	Reverse Transfer Capacitance		-	22	-	PF
Switching Characteristics						
Q_g	Total Gate Charge at 4.5V	V_{GS}=10V, V_{DD}=320V, I_D=12A	-	33	-	nC
Q_{gs}	Gate-Source charge		-	4.8	-	nC
Q_{gd}	Gate-Drain charge		-	18	-	nC
$T_{d(on)}$	Turn-on delay time	V_{DS}=200V,R_G=25Ω I_D=12A	-	40	-	ns
t_r	Rise time		-	32	-	ns
$T_{d(off)}$	Turn-off delay time		-	149	-	ns
t_f	Fall time		-	46	-	ns
Diode Characteristic						
Is	Continuous Body Diode Current	Tc=25°C	-	-	12	A
I_{SM}	Pulsed Diode Forward Current		-	-	48	A
V_{SD}	Body Diode Voltage	V_{GS}=0V,I_{SD}=6A	-	-	1.4	V
t_{rr}	Reverse Recovery Time	I_S=12A,T_J=25°C dI/dt=100A/μs	-	273	-	nS
Q_{rr}	Reverse Recovery Charge		-	2	-	nC

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 10mH, VDD = 50V, RG = 25 Ω, Starting TJ = 25 ºC
3. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 1%

Typical Characteristics (TJ = 25ºC, unless otherwise noted)

Figure 1. Output Characteristics (T_J = 25°C)

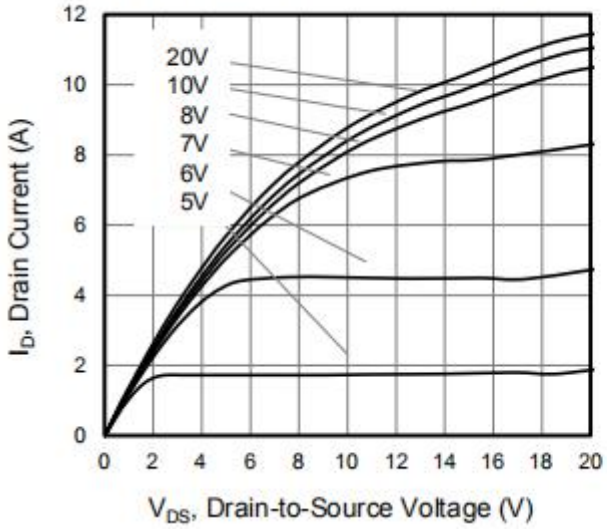


Figure 2. Body Diode Forward Voltage

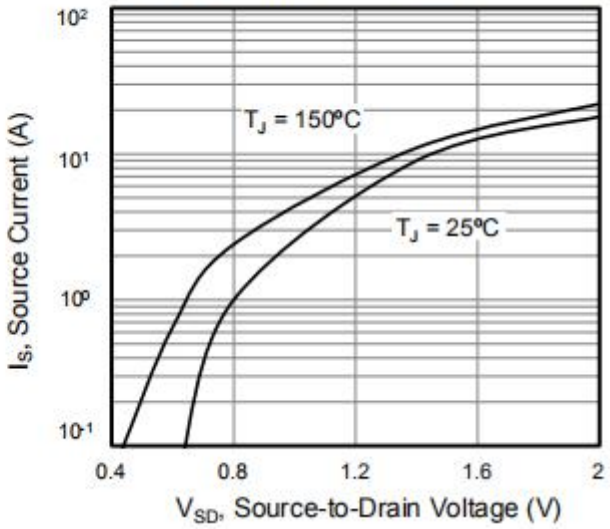


Figure 3. Drain Current vs. Temperature

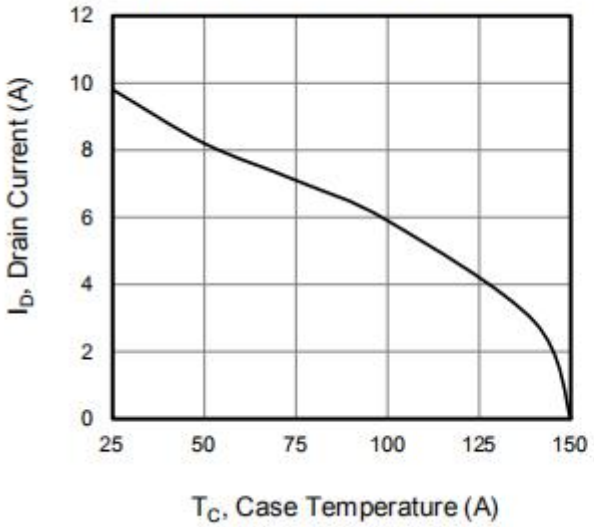


Figure 4. BV_{DSS} Variation vs. Temperature

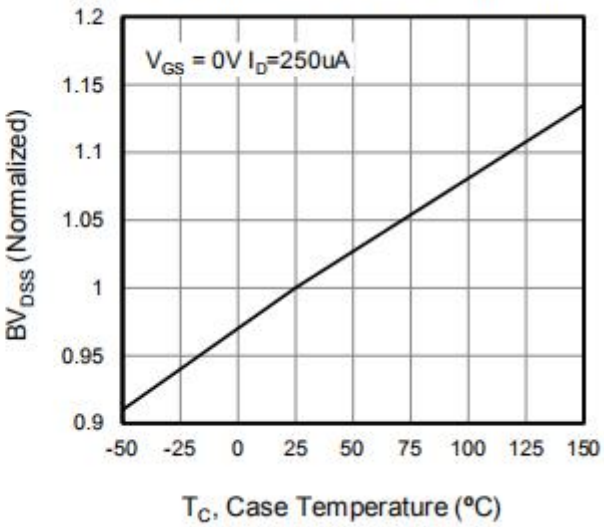


Figure 5. Transfer Characteristics

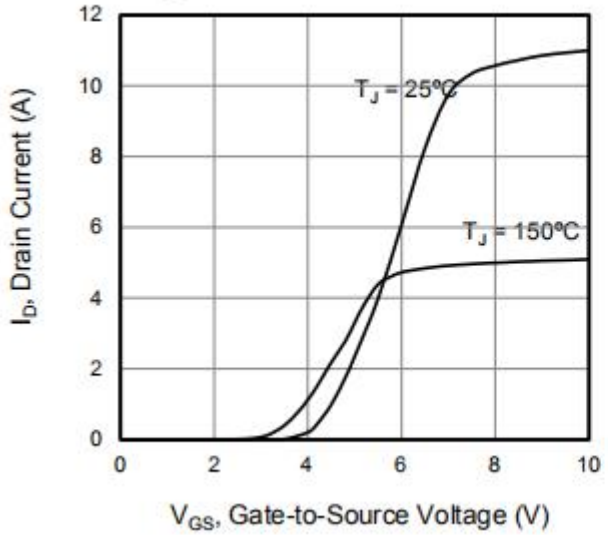
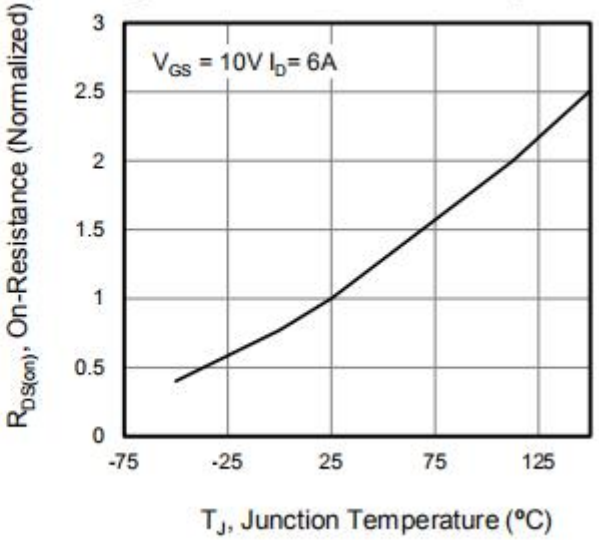


Figure 6. On-Resistance vs. Temperature



Typical Characteristics (Cont.)

Figure A: Gate Charge Test Circuit and Waveform

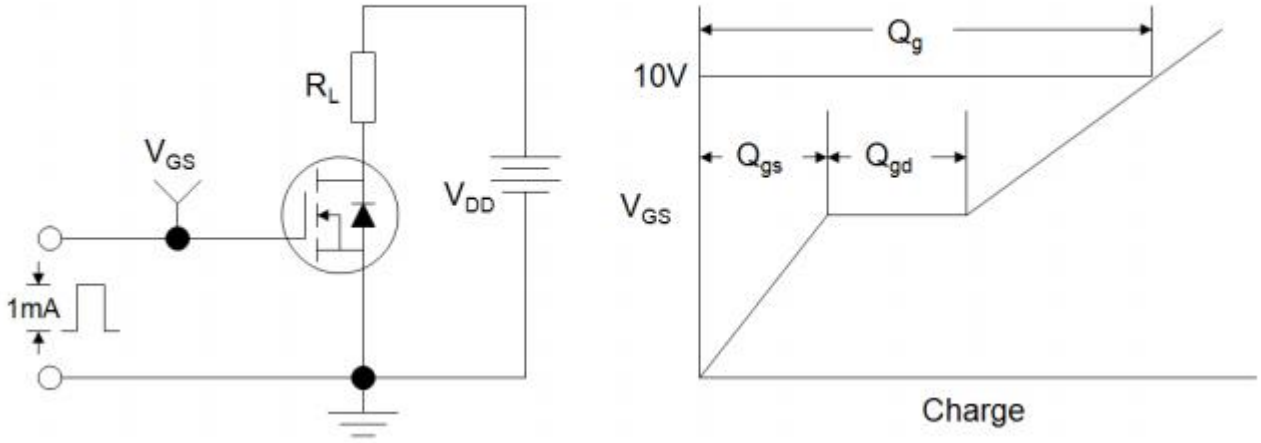


Figure B: Resistive Switching Test Circuit and Waveform

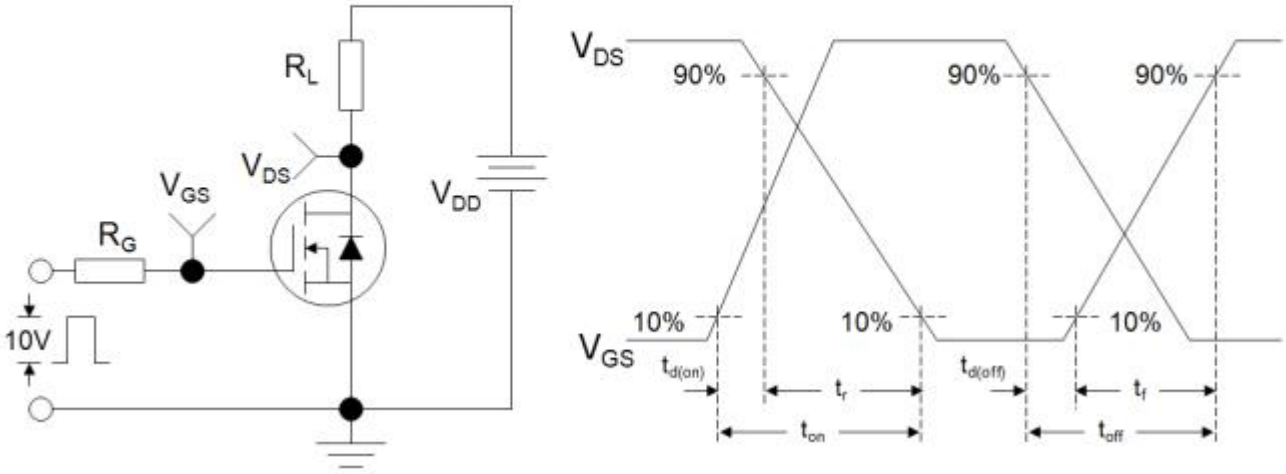
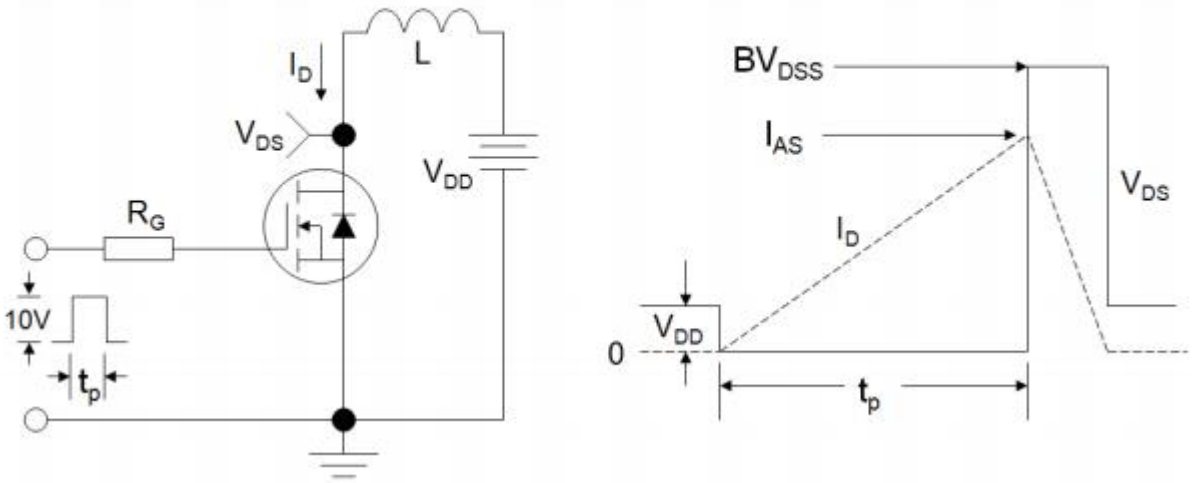


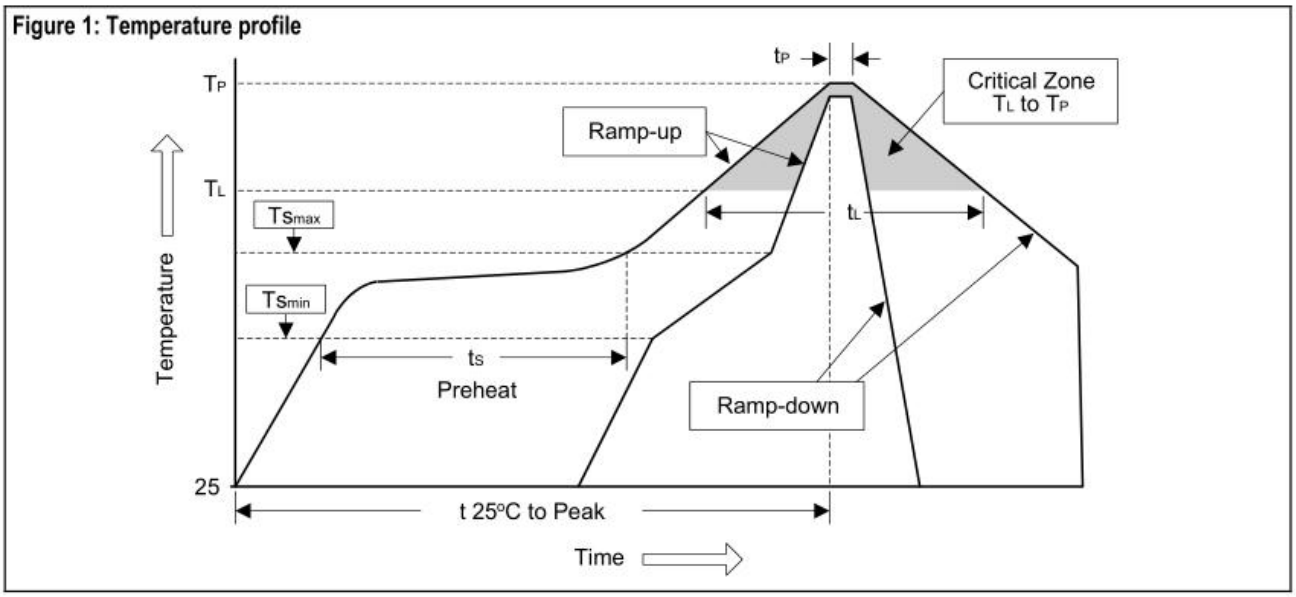
Figure C: Unclamped Inductive Switching Test Circuit and Waveform



Soldering Methods for Products

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp -up rate(TL to TP)	<3℃/sec	<3℃/sec
Preheat -Temperature Min(Ts min) -Temperature Max(Ts max) -Time(min to max)(ts)	- 100℃ 150℃ 60 to 120 sec	- 150℃ 200℃ 60 to 180 sec
Ts max to TL - ramp-up rate	<3℃/sec	<3℃/sec
Time maintained above: -Temperature(TL) -Time(TL)	183℃ 60 to 150 sec	217℃ 60 to 150 sec
Peak Temperature(TP)	240℃+0/-5℃	260℃+0/-5℃
Time within 5℃ of actual Peak Temperature	10 to 30 sec	20 to 40 sec
Ramp-down Rate	<6℃/sec	<6℃/sec
Time 25 ℃ to Peak Temperature	<6 minutes	<8 minutes

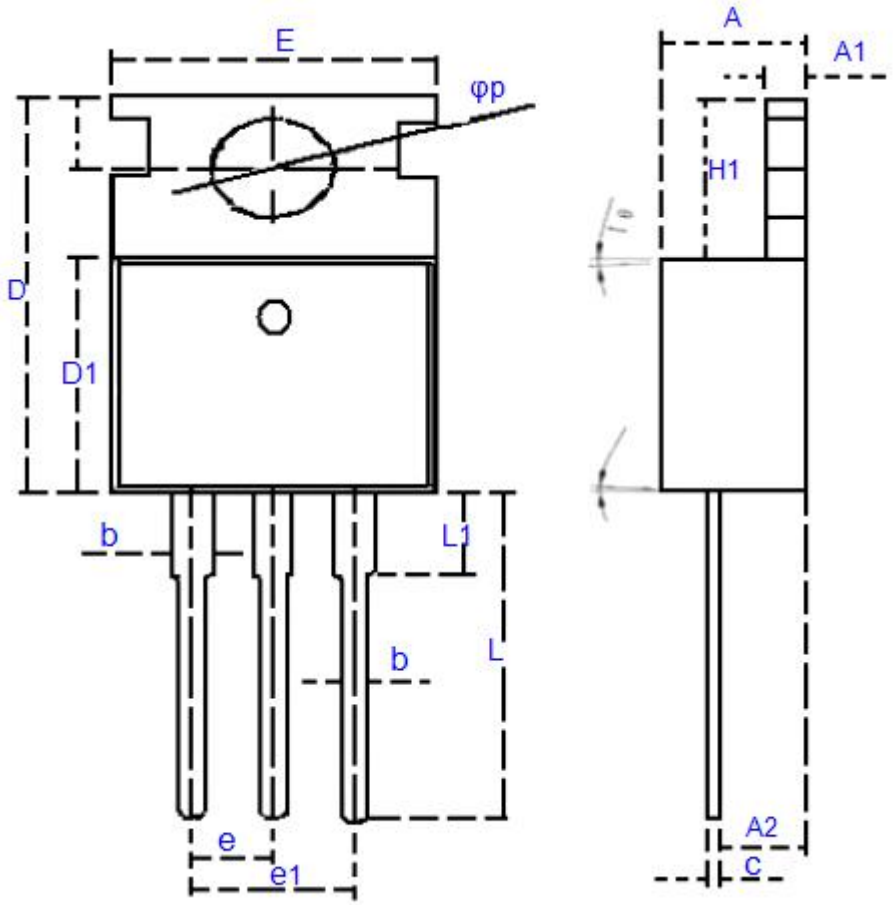
Figure 1: Temperature profile



Note : 1.Storage environment: Temperature=10℃ to 35@Humidity=45%±15%
2.Reflow soldering of surface-mount devices
3.Flow(wave) soldering(solder dipping)

Products	Peak Temperature	Dipping Time
Pb devices	245℃±5℃	5sec±1sec
Pb-free devices	260℃+0/-5℃	5sec±1sec

Package Outline



Millimeters					
Symbol	Min	Max	Symbol	Min	Max
A	4.2	4.8	E	9.6	10.5
A1	1.28	1.34	e	2.54 Typ.	
A2	2.2	2.6	e1	5.08	5.18
b	0.69	0.91	H1	6.1	7.0
b1	1.17	1.37	L	12.9	13.5
c	0.42	0.51	L1	2.9	3.7
D	15.1	16.3	ΦP	3.4	3.8
D1	9.0	9.5	θ1（°）	1	5

Important Notice

Si-Trend reserves the right to change all product、product specifications and data without prior notice；Our customer Please confirm to place an order confirmation before make the integrity of information complete and up-to-date。

Any semiconductor under specific conditions are possible to certain failure or malfunction rate； Customers are responsible in the use of Si-Trend products to system design and manufacturing in compliance with safety standards and adopting safety measures，To avoid the potential risk of failure may cause the personal safety and property loss。

Si-Trend Always refine on to provide more excellent products

Modify record

Date	Version	Description	Pagination
20160914	A.0	original	7