



# SPN125T06

## N-Channel Enhancement Mode MOSFET

### DESCRIPTION

The SPN125T06 is the N-Channel logic enhancement mode power field effect transistor which is produced using super high cell density DMOS trench technology. This high density process is especially tailored to minimize on-state resistance. These devices are particularly suitable for synchronous rectifier application, Motor control power management and other Power Tool circuits. It has been optimized for low gate charge, low RDS(ON) and fast switching speed.

### APPLICATIONS

- AC/DC Synchronous Rectifier
- Load Switch
- UPS
- Motor Control
- Power Tool

### FEATURES

- ◆ 60V/20A, RDS(ON)=4.3mΩ@VGS=10V  
60V/20A, RDS(ON)=5.6mΩ@VGS=4.5V
- ◆ Super high density cell design for extremely low RDS (ON)
- ◆ Exceptional on-resistance and maximum DC current capability
- ◆ TO-220/TO-220F/TO-251/TO-252/PPAK5x6 /TO-263 package design

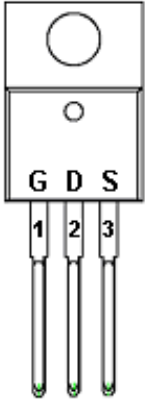


# SPN125T06

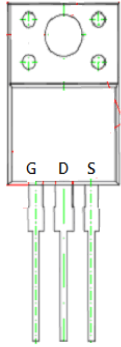
## N-Channel Enhancement Mode MOSFET

### PIN CONFIGURATION

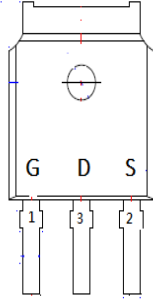
TO-220



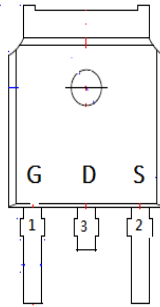
TO-220F



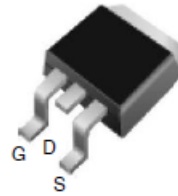
TO-251S-3L



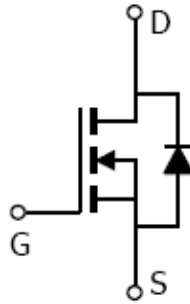
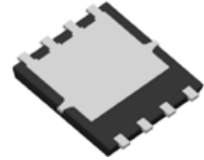
TO-252-2L



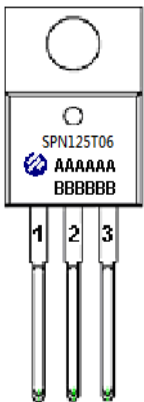
TO-263-2L



PPAK5x6



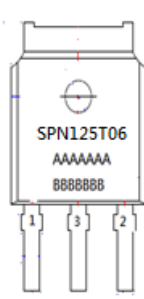
### PART MARKING



A : Lot Code  
B : Date Code  
(YY/MM/DD)



A : Lot Code  
B : Date Code  
(YYMMDD)



A : Lot Code  
B : Date Code



A : Lot Code  
B : Date Code



AAAAA : Wafer lot no  
BBBBBB : date code



A : Lot Code  
B : Date Code  
(YY/MM/DD)



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## N-Channel Enhancement Mode MOSFET

### TO-220/TO-220F/TO-263 PIN DESCRIPTION

Pin	Symbol	Description
1	G	Gate
2	D	Drain
3	S	Source

### TO-251/TO-252 PIN DESCRIPTION

Pin	Symbol	Description
1	G	Gate
2	S	Source
3	D	Drain

### PPAK5x6 PIN DESCRIPTION

Pin	Symbol	Description
1	S	Source
2	S	Source
3	S	Source
4	G	Gate
5	D	Drain
6	D	Drain
7	D	Drain
8	D	Drain

### ORDERING INFORMATION

Part Number	Package	Part Marking
SPN125T06T220TGB	TO-220-3L	SPN125T06
SPN125T06T220FTGB	TO-220F-3L	SPN125T06
SPN125T06ST251TGB	TO-251S-3L	SPN125T06
SPN125T06T252RGB	TO-252-2L	SPN125T06
SPN125T06T262RGB	TO-263-2L	SPN125T06
SPN125T06DN8RGB	PPAK5x6	SPN125T06

- ※ SPN125T06T220TGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN125T06T220FTGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN125T06ST251TGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN125T06T252TGB : Tape&Reel ; Pb – Free ; Halogen – Free
- ※ SPN125T06T262RGB : Tape&Reel ; Pb – Free ; Halogen – Free
- ※ SPN125T06DN8RGB : Tape&Reel ; Pb – Free ; Halogen - Free



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### ABSOLUTE MAXIMUM RATINGS

(TA=25°C Unless otherwise noted)

Parameter	Symbol	Typical	Unit	
Drain-Source Voltage	V <sub>DSS</sub>	60	V	
Gate –Source Voltage	V <sub>GSS</sub>	±20	V	
Continuous Drain Current(T <sub>J</sub> =150°C) (TO-220/TO-220F/TO-251/TO-252)	I <sub>D</sub>	T <sub>c</sub> =25°C	180	A
		T <sub>c</sub> =70°C	135	
Continuous Drain Current(T <sub>J</sub> =150°C) (PPAK5x6)	I <sub>D</sub>	T <sub>c</sub> =25°C	125	A
		T <sub>c</sub> =100°C	88	
Pulsed Drain Current (TO-220/TO-220F/TO-251/TO-252)	I <sub>DM</sub>	450	A	
Pulsed Drain Current (PPAK5x6)	I <sub>DM</sub>	410		
Power Dissipation@ T <sub>c</sub> =25°C	P <sub>D</sub>	TO-220/TO-220F/TO-263	166	W
Power Dissipation@ T <sub>c</sub> =25°C		TO-251/TO-252	83	
Power Dissipation@ T <sub>c</sub> =25°C		PPAK5x6	72	
Avalanche Energy with Single Pulse (T <sub>c</sub> =25°C, L = 0.1mH.) (TO-220/TO-220F/TO-251/TO-252/TO-263)	EAS		180	mJ
Avalanche Energy with Single Pulse ( T <sub>c</sub> =25°C, L = 0.1mH.) (PPAK5x6)			211	
Operating Junction Temperature	T <sub>J</sub>	-55/150	°C	
Storage Temperature Range	T <sub>STG</sub>	-55/150	°C	
Thermal Resistance-Junction to Case (TO-220/TO-220F/TO-263)	R <sub>θJC</sub>	1.2	°C/W	
Thermal Resistance-Junction to Case (TO-251/TO-252)	R <sub>θJC</sub>	1.35	°C/W	
Thermal Resistance-Junction to Case (PPAK5x6)	R <sub>θJC</sub>	1.5	°C/W	



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### ELECTRICAL CHARACTERISTICS

(TA=25°C Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	60			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0		2.0	V
Gate Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$ $T_J = 25^\circ C$			1	uA
		$V_{DS}=60V, V_{GS}=0V$ $T_J = 100^\circ C$			100	
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$		3.6	4.3	mΩ
		$V_{GS}=4.5V, I_D=20A$		4.5	5.6	
Forward Transconductance	$g_{fs}$	$V_{DS}=5V, I_D=20A$		75		S
Gate Resistance	$R_G$	$V_{GS}=0V, V_{DS}=\text{Open},$ $f=1\text{MHz}$		1.5		Ω
Diode Forward Voltage	$V_{SD}$	$I_S=20A, V_{GS}=0V$			1.2	V
<b>Dynamic</b>						
Total Gate Charge (10V)	$Q_g$	$V_{DS}=30V, V_{GS}=10V$ $I_D = 20A$		54		nC
Total Gate Charge (4.5V)	$Q_g$			27		
Gate-Source Charge	$Q_{gs}$			14		
Gate-Drain Charge	$Q_{gd}$			6		
Input Capacitance	$C_{iss}$	$V_{DS}=30V, V_{GS}=0V$ $f=1\text{MHz}$		3800		pF
Output Capacitance	$C_{oss}$			520		
Reverse Transfer Capacitance	$C_{rss}$			50		
Turn-On Time	$t_{d(on)}$	$V_{DD}=30V, I_D=20A$ $V_{GEN}=10V, R_G=10\Omega$		16		nS
	$t_r$			36		
Turn-Off Time	$t_{d(off)}$			55		
	$t_f$			35		



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## TYPICAL CHARACTERISTICS

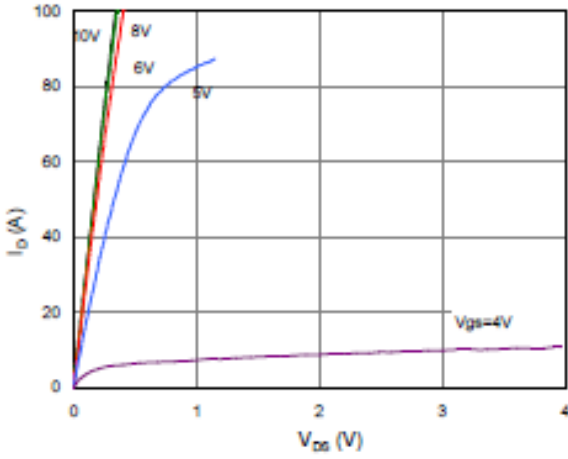


Fig. 1 Output Characteristics

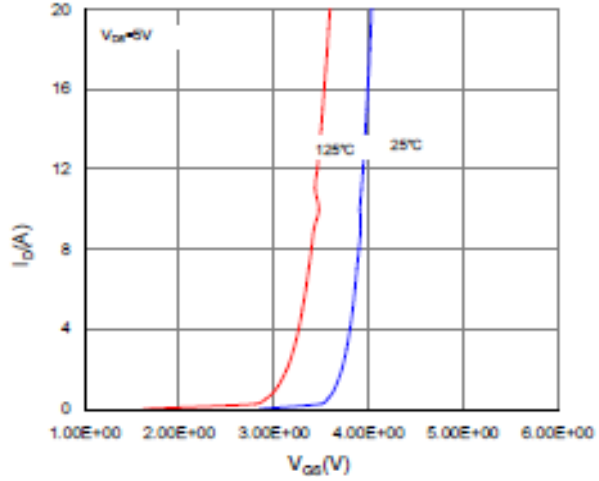


Fig. 2 Transfer Characteristics

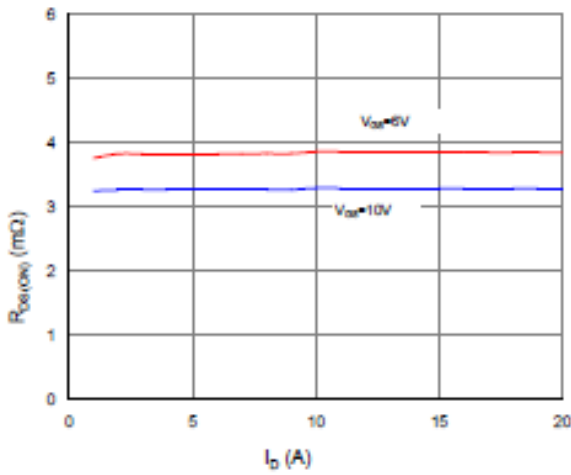


Fig. 3 On Resistances vs Drain Current

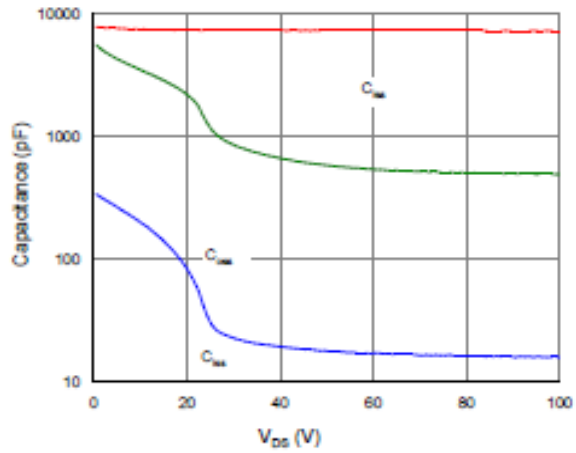


Fig. 4 Capacitance

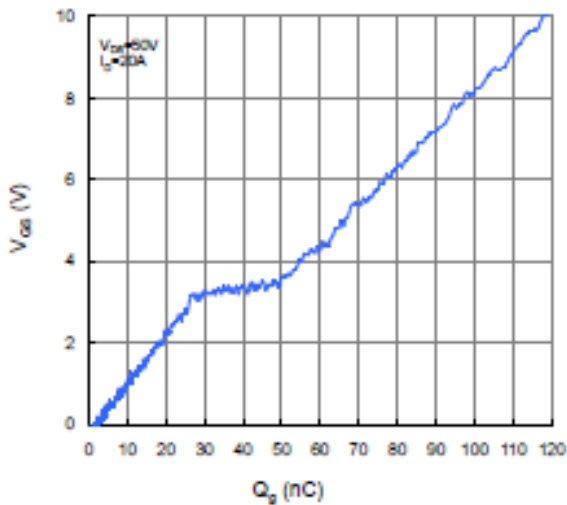


Fig. 5 Gate Charge

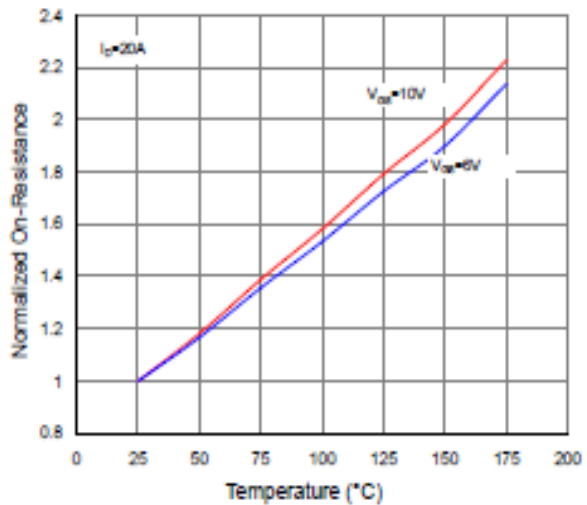


Fig. 6 On-Resistance vs Junction Temperature



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### TYPICAL CHARACTERISTICS

Figure 7. Typical Gate-Charge vs. Gate-to-Source Voltage

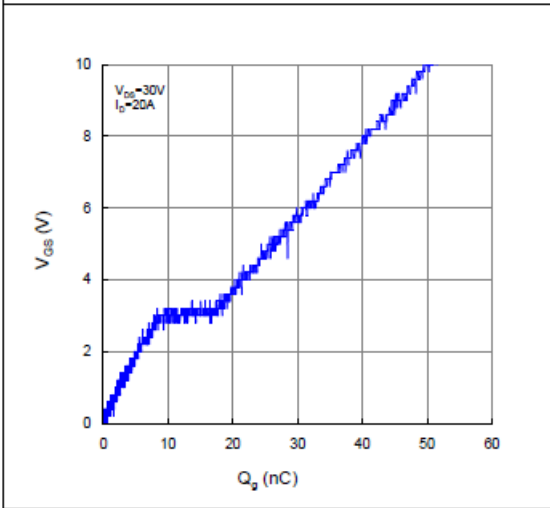


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

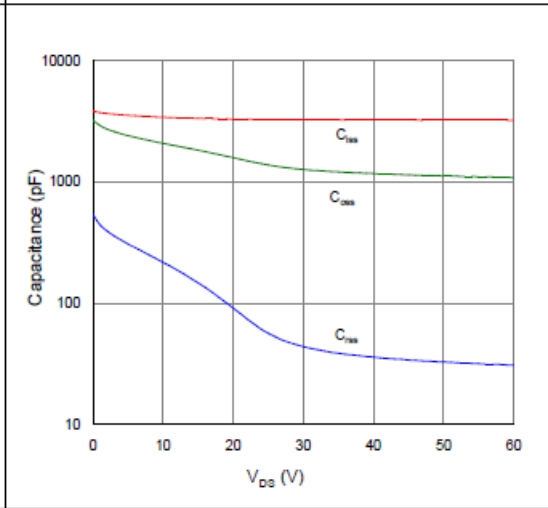


Figure 9. Maximum Safe Operating Area

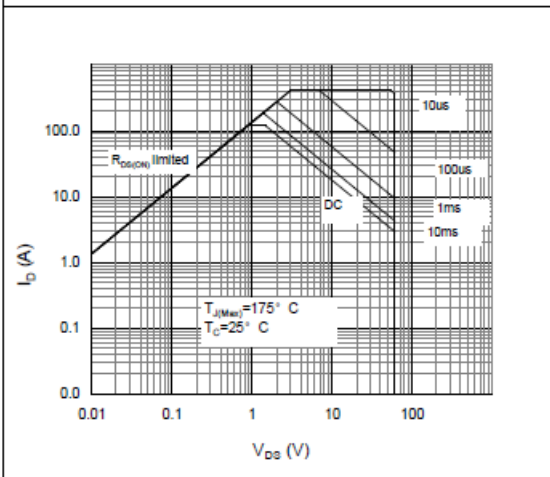


Figure 10. Maximum Drain Current vs. Case Temperature

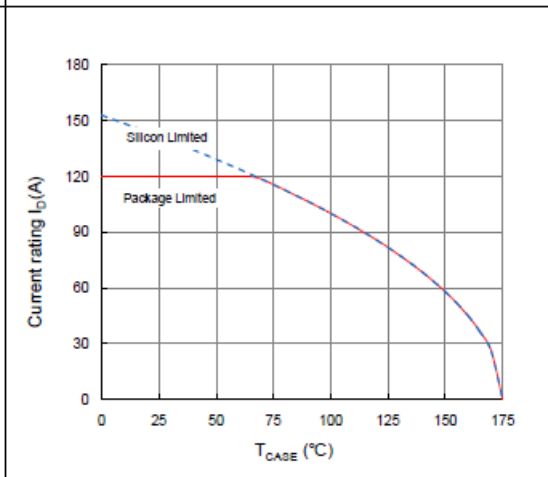
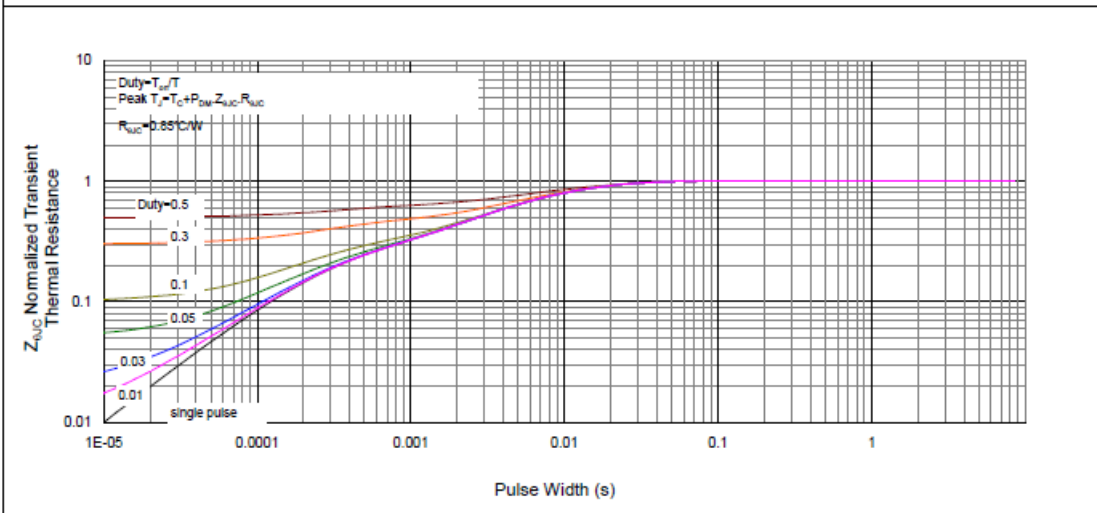


Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case

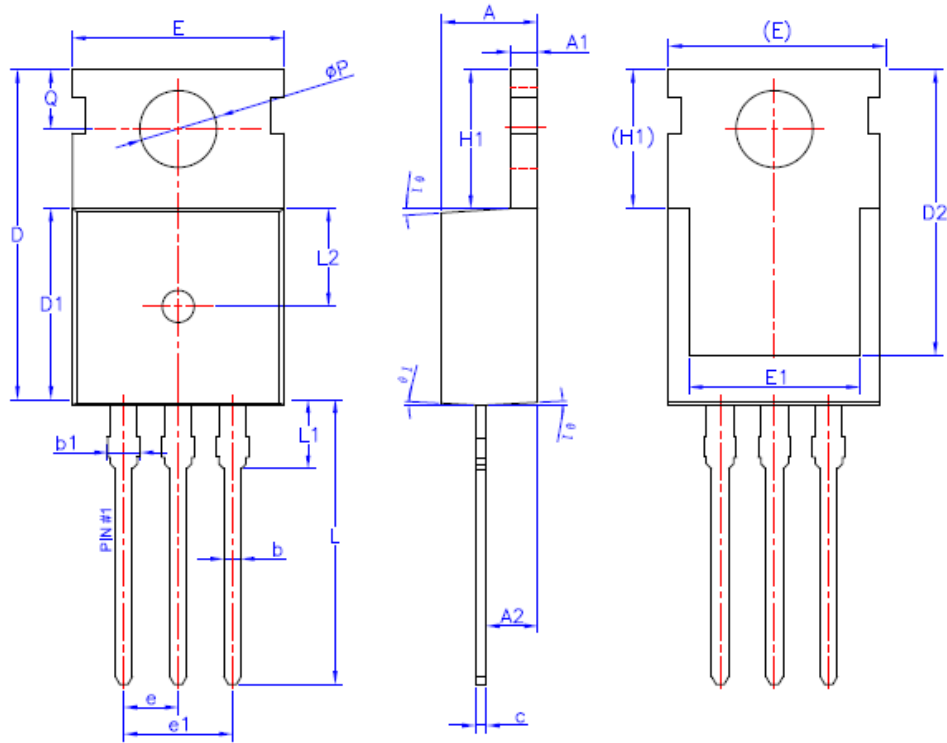




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## N-Channel Enhancement Mode MOSFET

### TO-220-3L PACKAGE OUTLINE



SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	—	0.90
b1	1.42	—	1.57
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	—	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.54BSC		
e1	5.08BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	—	—	3.50
L2	4.60REF		
øP	3.55	3.60	3.65
Q	2.73	—	2.87
φ1	1°	3°	5°

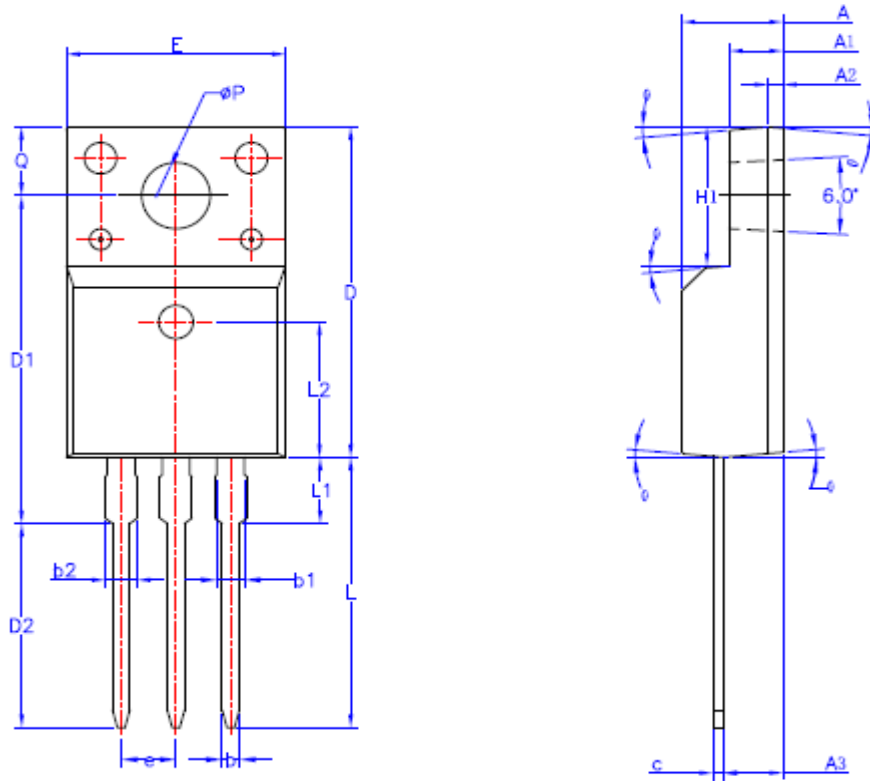




# SPN125T06

## N-Channel Enhancement Mode MOSFET

### TO-220F-3L PACKAGE OUTLINE



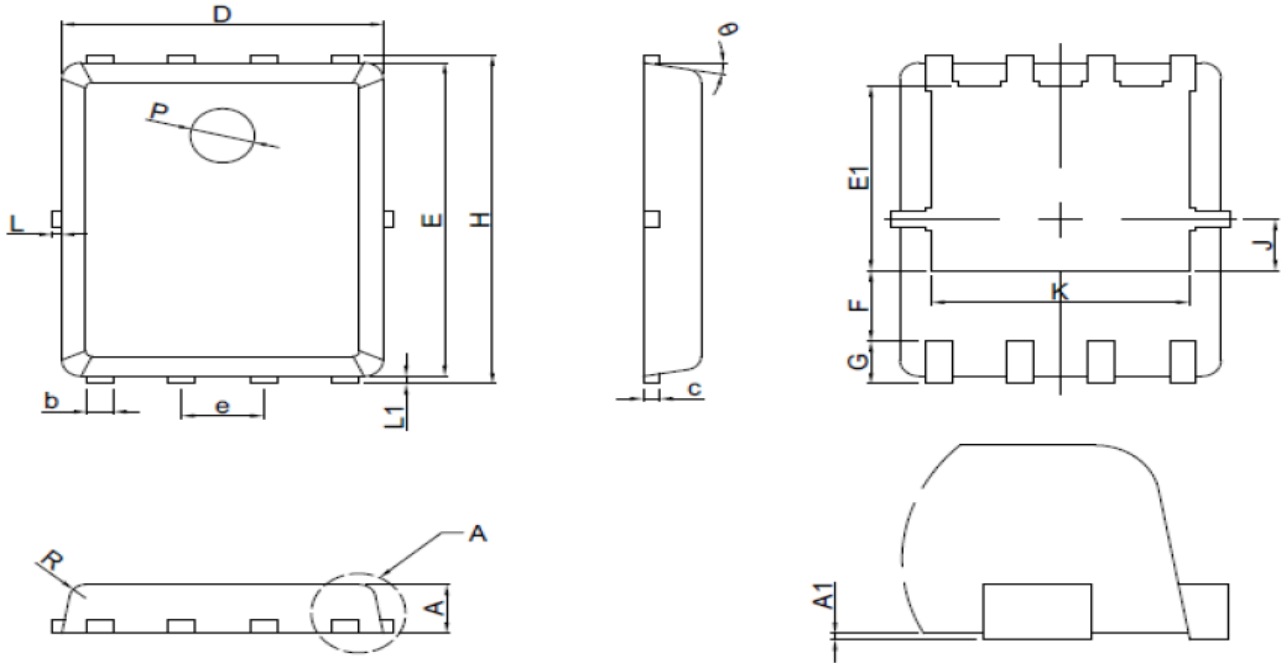
SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	—	0.90
b1	1.18	—	1.38
b2	—	—	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.0
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	—	—	3.50
L2	6.50REF		
$\phi P$	3.08	3.18	3.28
Q	3.20	—	3.40
$\theta 1$	1°	3°	5°



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### PPAK5X6 PACKAGE OUTLINE



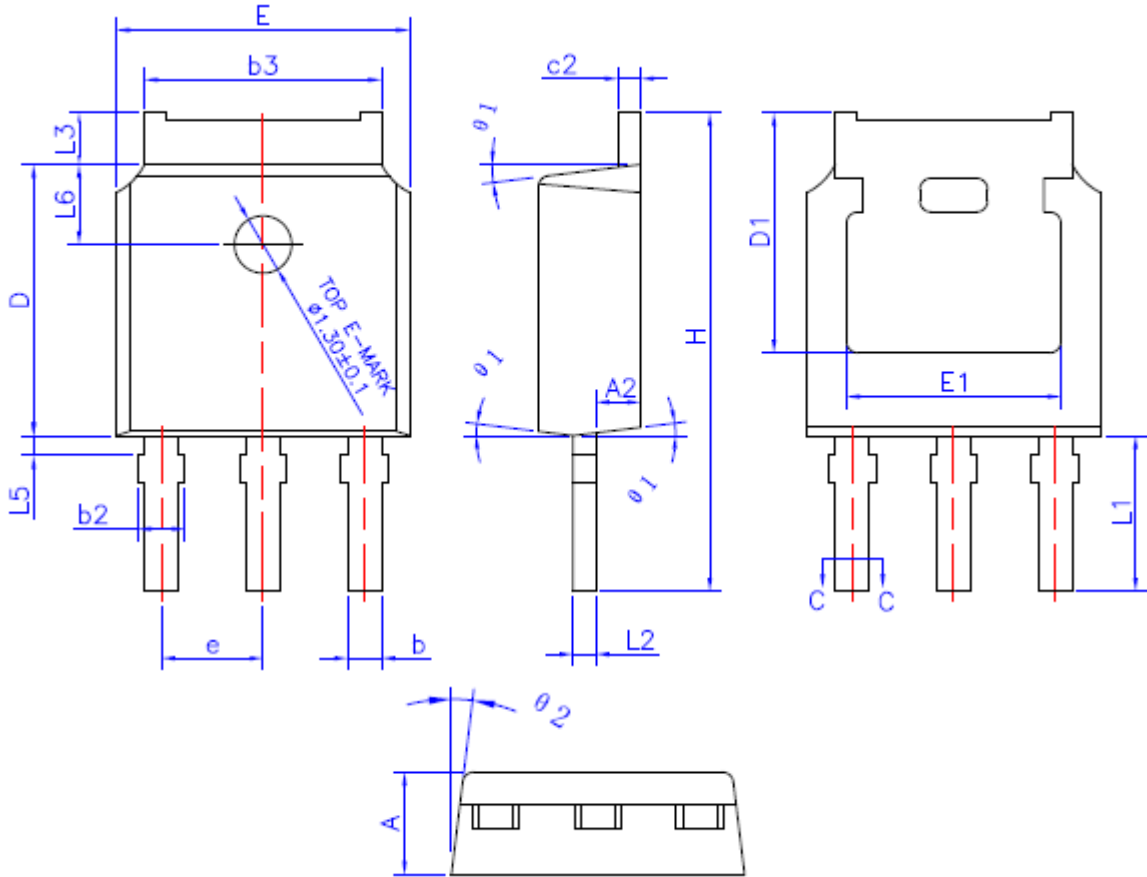
SYMBOL	MILLIMETERS		
	MIN	NOM	MAX
A	0.8	0.95	1.1
A1	0.00	0.03	0.05
b	0.33	0.41	0.51
c	0.254 REF		
D	4.80	4.95	5.10
F	1.40 REF		
E	5.70	5.80	5.90
e	1.27 BSC		
H	5.90	6.05	6.20
L1	0.06	0.13	0.20
G	0.60 REF		
J	0.95 BSC		
K	4.00 REF		
L	---	----	0.20
P	1.00 REF		
E1	3.40REF		
E2	0.95 REF		
$\theta$	6°	10°	14°
R	0.25REF		



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### TO-251S-3L PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)

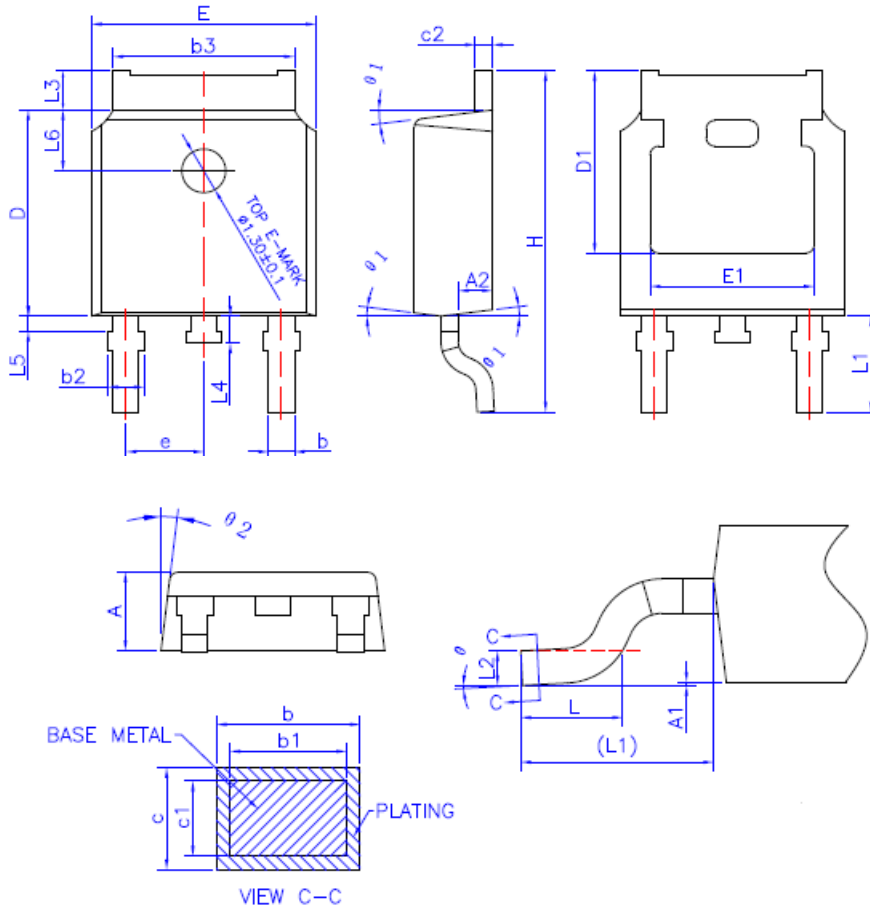
SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A2	0.90	1.01	1.10
b	0.72	—	0.85
b1	0.71	0.76	0.81
b2	0.72	—	0.90
b3	5.13	5.33	5.46
c	0.47	—	0.60
c1	0.46	0.51	0.56
c2	0.47	—	0.60
D	6.00	6.10	6.20
D1	5.25	—	—
E	6.50	6.60	6.70
E1	4.70	—	—
e	2.186	2.286	2.386
H	10.40	10.70	11.00
L1	3.50 REF		
L2	0.508 BSC		
L3	0.90	—	1.25
L5	0.15	—	0.75
L6	1.80 REF		
$\theta_1$	5°	7°	9°
$\theta_2$	5°	7°	9°



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## N-Channel Enhancement Mode MOSFET

### TO-252-2L PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.38
A1	0	—	0.10
A2	0.90	1.01	1.10
b	0.72	—	0.85
b1	0.71	0.76	0.81
b2	0.72	—	0.90
b3	5.13	5.33	5.46
c	0.47	—	0.60
c1	0.46	0.51	0.56
c2	0.47	—	0.60
D	6.00	6.10	6.20
D1	5.25	—	—
E	6.50	6.60	6.70
E1	4.70	—	—
e	2.186	2.286	2.386
H	9.80	10.10	10.40
L	1.40	1.50	1.70
L1	2.90 REF		
L2	0.508 BSC		
L3	0.90	—	1.25
L4	0.60	0.80	1.00
L5	0.15	—	0.75
L6	1.80 REF		
$\theta$	0°	—	8°
$\theta_1$	5°	7°	9°
$\theta_2$	5°	7°	9°

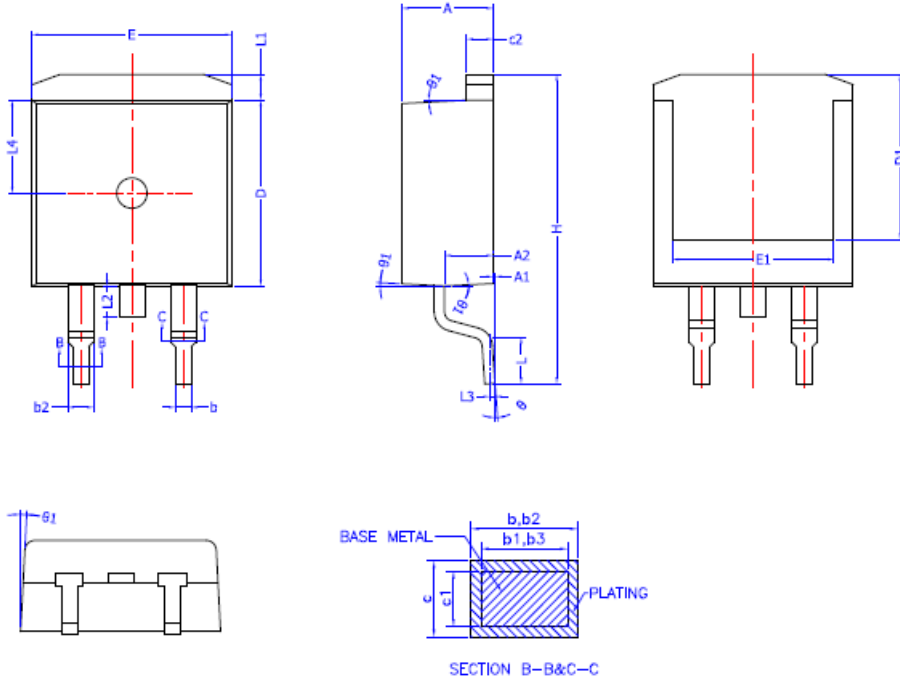
NOTES:  
ALL DIMENSIONS REFER TO JEDEC STANDARD  
TO-252 AA DO NOT INCLUDE MOLD FLASH OR  
PROTRUSIONS



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## N-Channel Enhancement Mode MOSFET

### TO-263-2L PACKAGE OUTLINE



COMMON DIMENSIONS  
(UNITS OF MEASURE =MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4,40	4,50	4,60
A1	0	0,10	0,25
A2	2,20	2,40	2,60
b	0,76	—	0,89
b1	0,75	0,80	0,85
b2	1,23	—	1,37
b3	1,22	1,27	1,32
c	0,47	—	0,60
c1	0,46	0,51	0,56
c2	1,25	1,30	1,35
D	9,10	9,20	9,30
D1	8,00	—	—
E	9,80	9,90	10,00
E1	7,80	—	—
e	2,54 BSC		
H	14,90	15,30	15,70
L	2,00	2,30	2,60
L1	1,17	1,27	1,40
L2	—	—	1,75
L3	0,25BSC		
L4	4,60 REF		
θ	0°	—	8°
θ1	1°	3°	5°



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