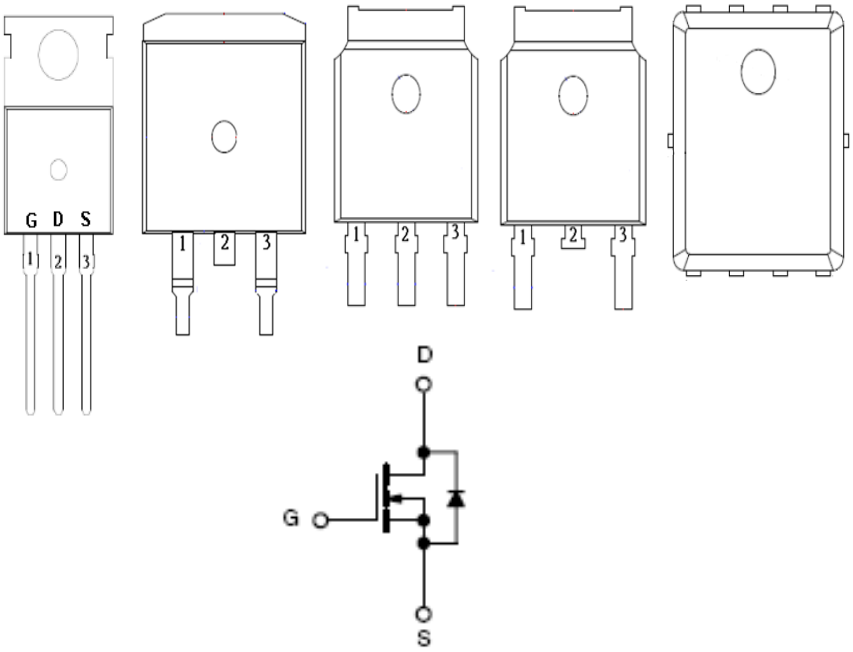
SPN166T04
N-Channel Enhancement Mode MOSFET

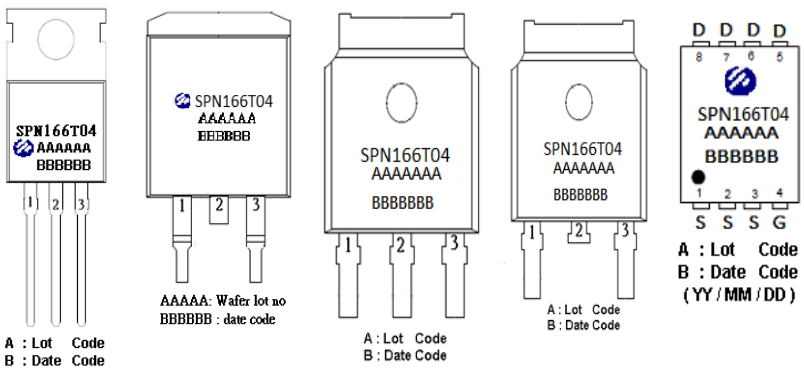
DESCRIPTION
The SPN166T04 is the N-Channel logic enhancement mode power field effect transistor which is produced using super high cell density DMOS trench technology. This high density process is especially tailored to minimize on-state resistance. These devices are particularly suitable for synchronous rectifier application, Motor control power management and other Power Tool circuits. It has been optimized for low gate charge, low $R_{DS(ON)}$ and fast switching speed.

APPLICATIONS
- DC/DC Converter
- Load Switch
- SMPS Secondary Side Synchronous Rectifier
- Motor Control
- Power Tool

FEATURES
- 45V/166A, $R_{DS(ON)}$=2.9mΩ@V_{GS}=10V
  $R_{DS(ON)}$=4.5mΩ@V_{GS}=4.5V
- Super high density cell design for extremely low $R_{DS(ON)}$
- Exceptional on-resistance and maximum DC current capability
- TO-220-3L/TO-251S-3L/TO-252-2L/ PPAK5x6-8L/TO-263-2L package desig

PIN CONFIGURATION
TO-220 TO-263 TO-251 TO-252 PPAK 5x6



PART MARKING


SPN166T04
N-Channel Enhancement Mode MOSFET

PIN DESCRIPTION

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

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
SPN166T04T220TGB	TO-220-3L	SPN166T04
SPN166T04ST251TGB	TO-251S-3L	SPN166T04
SPN166T04T252RGB	TO-252-2L	SPN166T04
SPN166T04T262RGB	TO-263-2L	SPN166T04
SPN166T04DN8RGB	PPAK5x6-8L	SPN166T04

※ SPN166T04T220TGB : Tube ; Pb – Free ; Halogen – Free
※ SPN166T04ST251TGB : Tube ; Pb – Free ; Halogen – Free
※ SPN166T04T252RGB : Tape& Reel ; Pb – Free ; Halogen – Free
※ SPN166T04DN8RGB : Tape&Reel ; Pb – Free ; Halogen - Free
※ SPN166T04T262RGB : Tape& Reel ; Pb – Free ; Halogen – Free

SPN166T04
N-Channel Enhancement Mode MOSFET

ABSOULTE MAXIMUM RATINGS

(T_A=25℃ Unless otherwise noted)

Parameter		Symbol	Typical	Unit
Drain-Source Voltage		V_{DSS}	45	V
Gate –Source Voltage		V_{GSS}	±20	V
Continuous Drain Current (Silicon Limited) (TO-220/TO-263/TO-251/TO-252)	Tc=25℃	I_D	166	A
	Tc=70℃		118	
Continuous Drain Current (Silicon Limited) (PPAK5x6)	Tc=25℃	I_D	140	A
	Tc=70℃		89	
Pulsed Drain Current		I_{DM}	450	A
Power Dissipation @ Tc=25℃	TO-220/TO-263	P_D	104	W
Power Dissipation @ Tc=25℃	TO251/TO-252		93	
Power Dissipation @ Tc=25℃	PPAK5x6		83	
Avalanche Energy with Single Pulse (T_C=25℃, L = 0.1mH.)		E_{AS}	42	mJ
Operating Junction Temperature		T_J	-55/150	℃
Storage Temperature Range		T_{STG}	-55/150	℃
Thermal Resistance-Junction to Case (TO-220/TO-263)		$R_{\theta JC}$	1.2	℃/W
Thermal Resistance-Junction to Case (TO-251/TO-252)		$R_{\theta JC}$	1.35	℃/W
Thermal Resistance-Junction to Case (PPAK5x6)		$R_{\theta JC}$	1.5	℃/W

Note :

The maximum current rating is package limited at 70A for TO-251S-3L and TO-252-2L

The maximum current rating is package limited at 80A for PPAK5x6-8L

ELECTRICAL CHARACTERISTICS

(T_A=25℃ Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ	Max.	Unit
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS}=0V,I_D=250uA	45			V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250uA	1.0		2.2	
Gate Leakage Current	I_{GSS}	V_{DS}=0V,V_{GS}=±20V			±100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=36V, V_{GS}=0V T_J = 25 ℃			1	uA
		V_{DS}=36V, V_{GS}=0V T_J = 100 ℃			100	
Drain-Source On-Resistance	$R_{DS(on)}$	V_{GS}=10V,I_D=20A		2.5	2.9	mΩ
		V_{GS}=4.5V,I_D=20A		3.7	4.5	
Forward Transconductance	gfs	V_{DS}=5V,I_D=20A		65		S
Gate Resistance	R_G	V_{GS}=0V,V_{DS} open, f=1MHz		1.6		Ω
Diode Forward Voltage	V_{SD}	I_S=20A ,V_{GS} =0V		0.9	1.2	V
Dynamic						
Total Gate Charge (10V)	Q_g	V_{DS}=20V, V_{GS}=10V I_D = 20A		50		nC
Total Gate Charge (4.5V)	Q_g			25		
Gate-Source Charge	Q_{gs}			8		
Gate-Drain Charge	Q_{gd}			10		
Input Capacitance	C_{iss}	V_{DS}=20V, V_{GS}=0V f=1MHz		3322		pF
Output Capacitance	C_{oss}			1367		
Reverse Transfer Capacitance	C_{rss}			96		
Turn-On Time	td(on)	V_{DD}=20V, ID=20A V_{GEN}=10V, R_G=10Ω		14		nS
	tr			12		
Turn-Off Time	td(off)			57		
	tf			18		

TYPICAL CHARACTERISTICS

Fig 1. Typical Output Characteristics

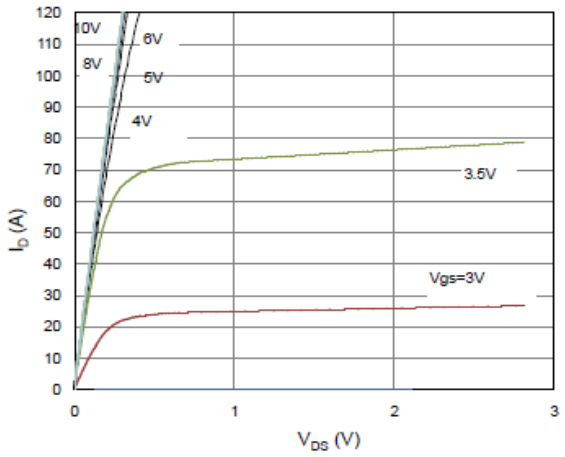


Figure 2. On-Resistance vs. Gate-Source Voltage

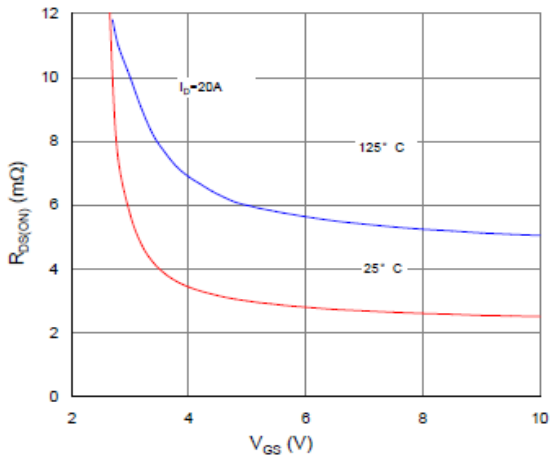


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

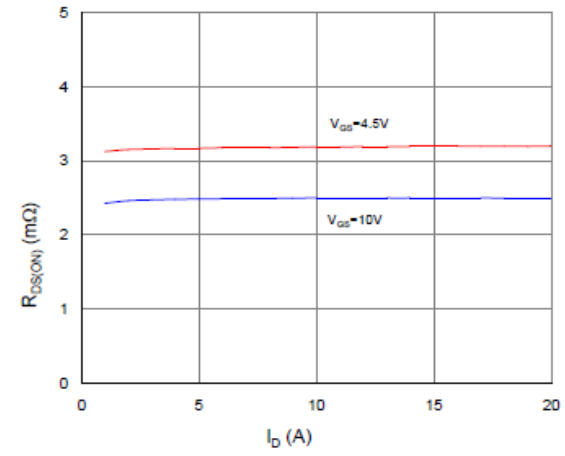


Figure 4. Normalized On-Resistance vs. Junction Temperature

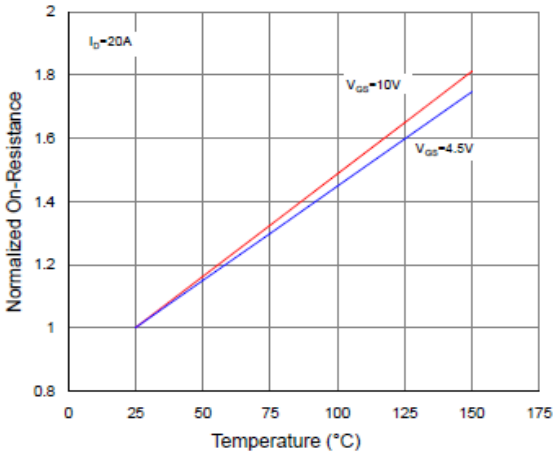


Figure 5. Typical Transfer Characteristics

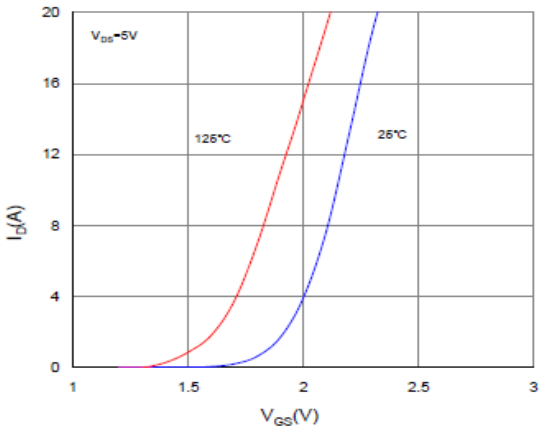
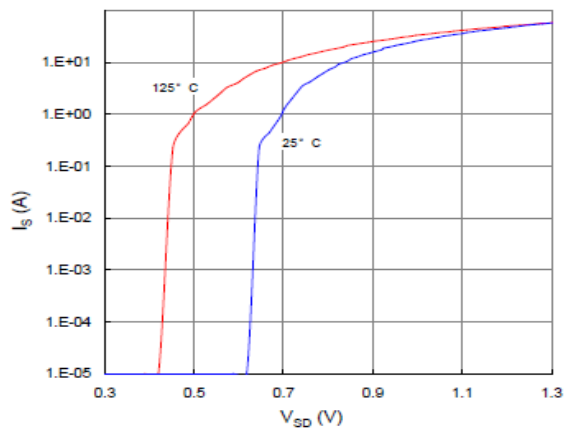


Figure 6. Typical Source-Drain Diode Forward Voltage



TYPICAL CHARACTERISTICS

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

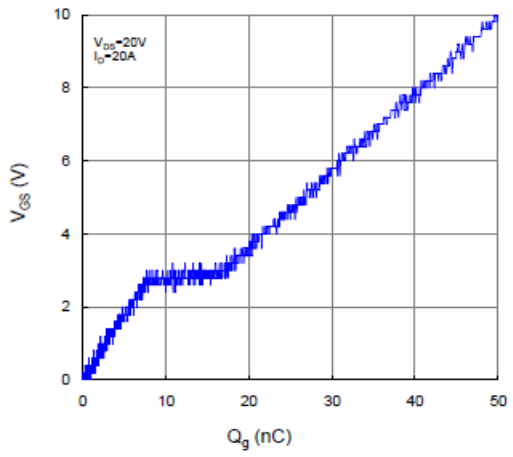


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

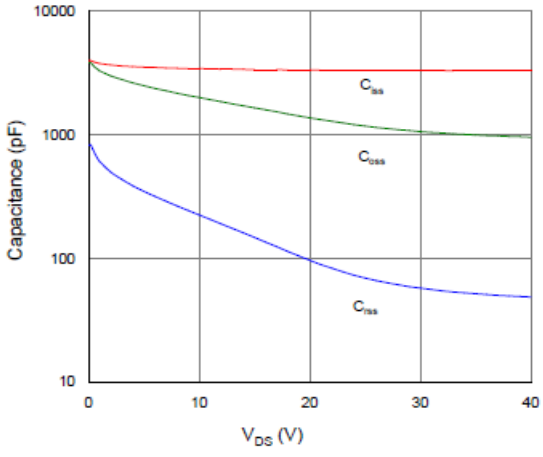


Figure 9. Maximum Safe Operating Area

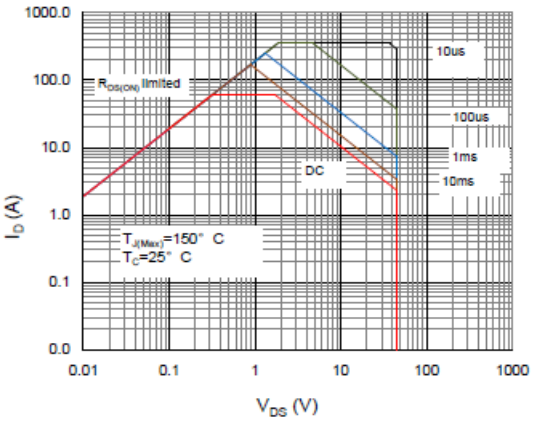


Figure 10. Maximun Drain Current vs. Case Temperature

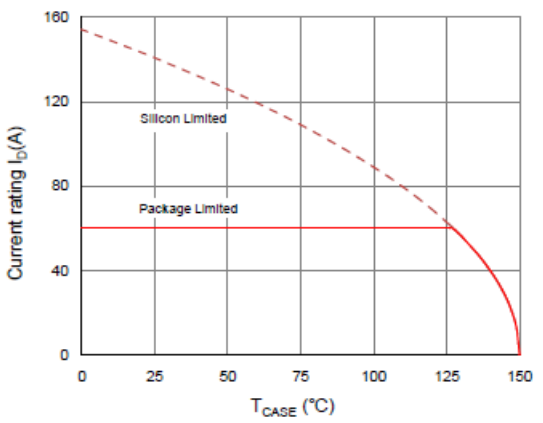
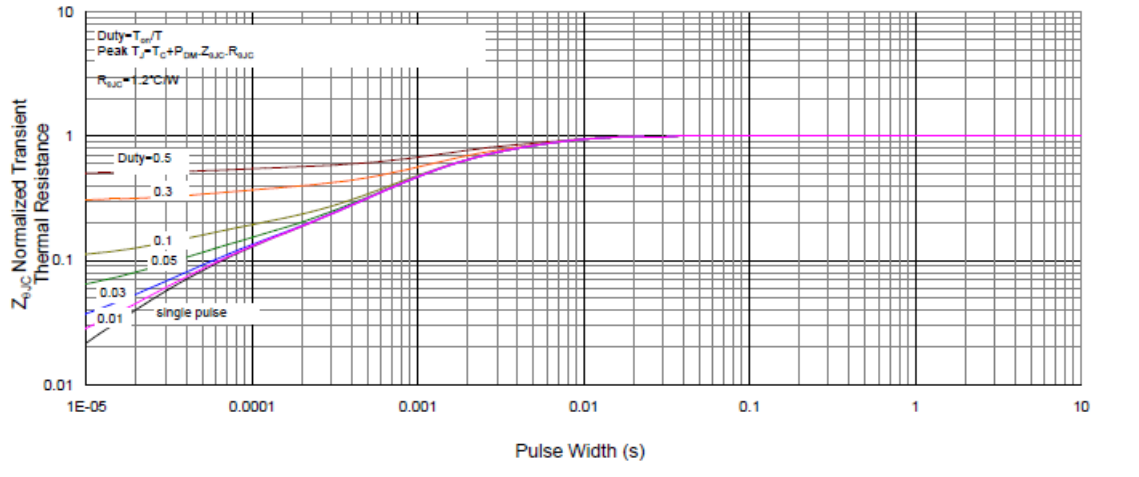
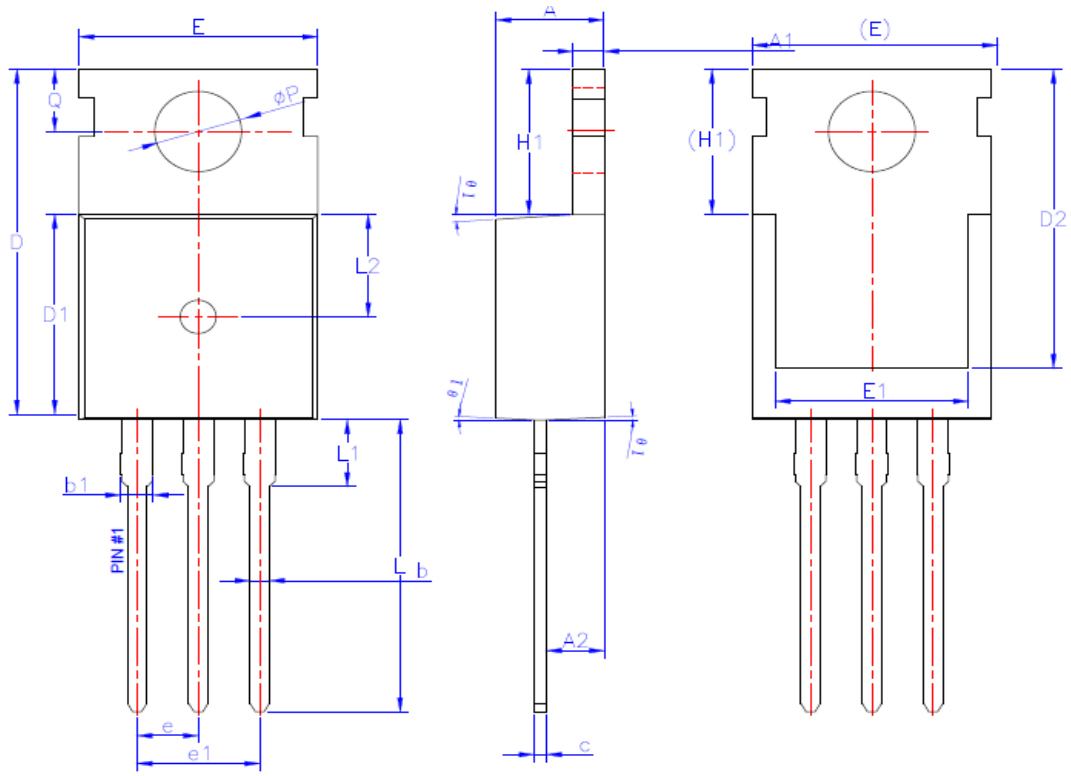


Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case

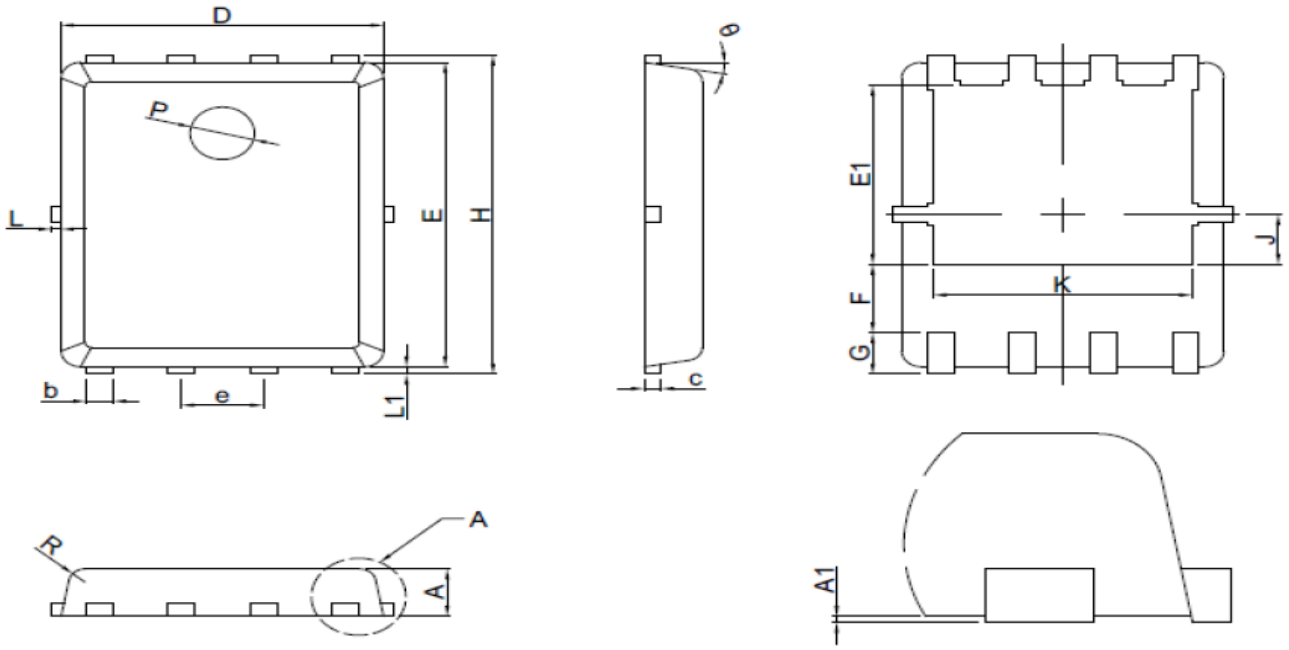


TO-220-3L PACKAGE OUTLINE



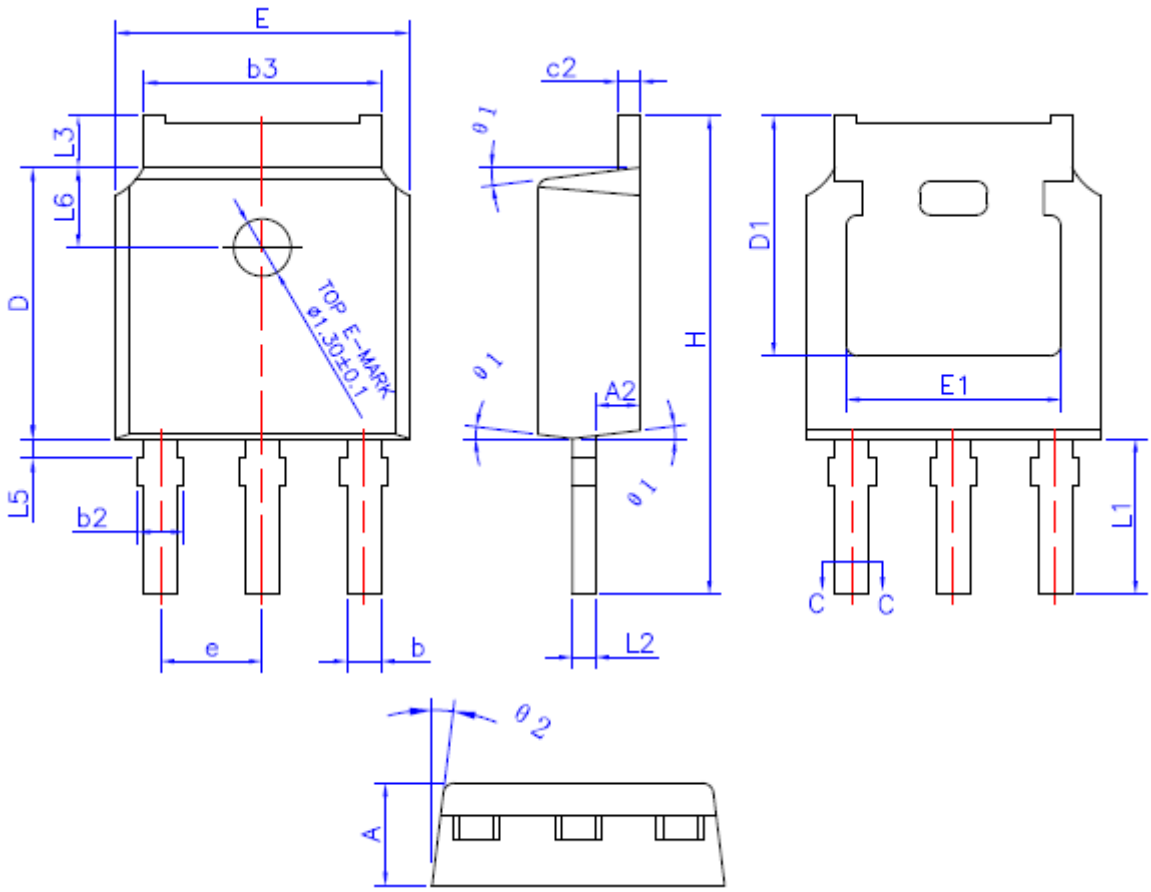
SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	0.60	0.90
b1	-	-	1.40
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	-	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.54BSC		
e1	5.08BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	-	-	3.50
L2	4.6REF		
φ P	3.55	3.60	3.65
Q	2.73	-	2.87
θ 1	1°	3°	5°

PPAK5x6-8L PACKAGE OUTLINE



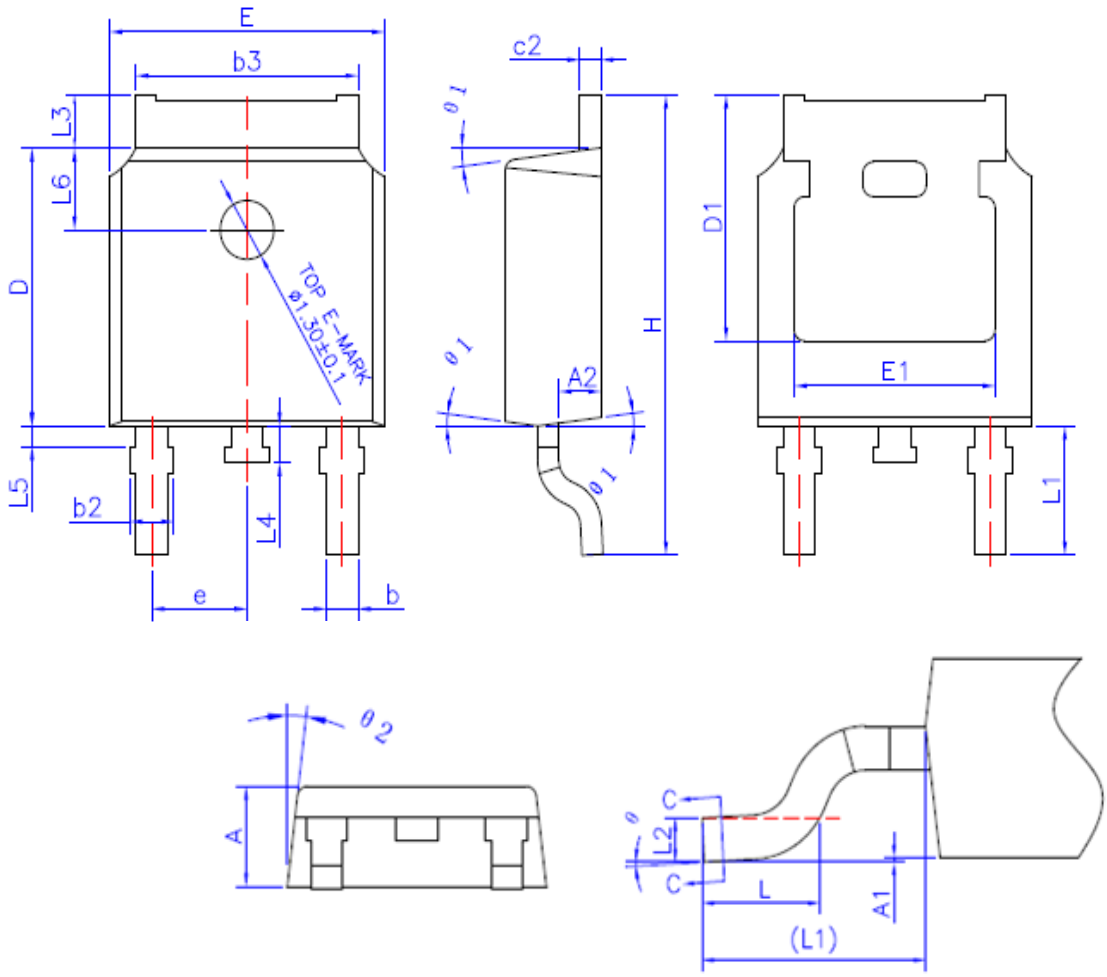
SYMBOL	MILLIMETERS		
	MIN	NOM	MAX
A	0.8	0.95	1.1
A1	0.00	0.03	0.05
b	0.33	0.41	0.51
c		0.254 REF	
D	4.80	4.95	5.10
F		1.40 REF	
E	5.70	5.80	5.90
e		1.27 BSC	
H	5.90	6.05	6.20
L1	0.06	0.13	0.20
G		0.60 REF	
J		0.95 BSC	
K		4.00 REF	
L	---	----	0.20
P		1.00 REF	
E1		3.40REF	
E2		0.95 REF	
θ	6°	10°	14°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

TO-251S-3L PACKAGE OUTLINE



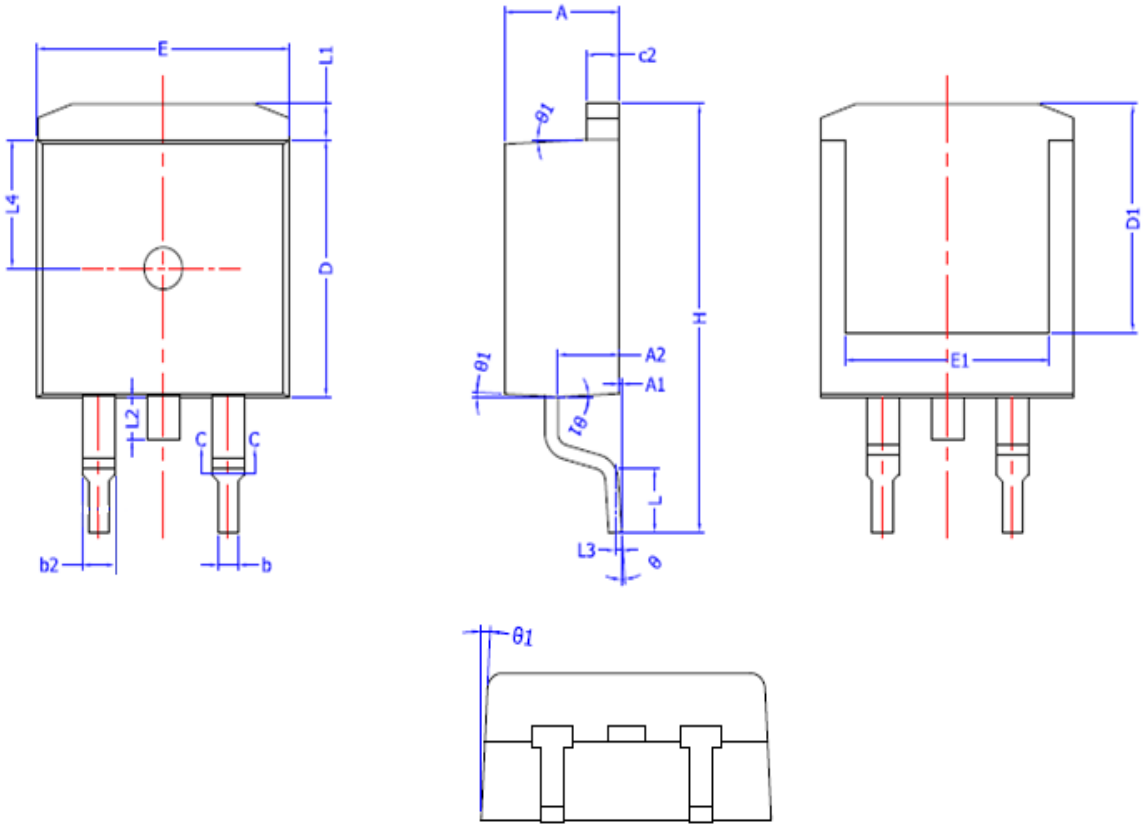
SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A2	0.86	1.01	1.16
b	0.66	-	0.86
b2	0.66	--	0.96
b3	5.10	5.28	5.46
c	0.46	--	0.60
c2	0.47	--	0.60
D	6.00	6.10	6.20
D1		5.35REF	
E	6.40	6.60	6.80
E1		4.83REF	
e		2.3REF	
H	9.80	10.40	11.00
L1		3.50REF	
L2		0.508BSC	
L3	0.90	--	1.25
L5	0.15	--	0.75
L6		1.80REF	
θ 1	5°	7°	9°
θ 2	5°	7°	9°

TO-252-2L PACKAGE OUTLINE



SYMBOL	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	--	0.15
A2	0.90	1.01	1.10
b	0.72	-	0.85
b2	0.72	--	0.90
b3	5.13	5.33	5.46
c	0.47	--	0.60
c2	0.47	--	0.60
D	6.00	6.10	6.20
D1	5.25	--	--
E	6.40	6.60	6.80
E1	4.70	--	--
e	2.3REF		
H	9.80	10.10	10.40
L	1.40	1.60	1.80
L1	2.90REF		
L2	0.508BSC		
L3	0.90	--	1.25
L4	0.60	0.80	1.00
L5	0.15	--	0.75
L6	1.80REF		
θ	0°	3°	8°
θ 1	5°	7°	9°
θ 2	5°	7°	9°

TO-263-2L PACKAGE OUTLINE



SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	0.00	0.10	0.25
A2	2.20	2.40	2.60
b	0.71	-	0.91
b2	1.17	--	1.37
c	0.47	--	0.60
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	2.54BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.60
L1	1.12	1.27	1.42
L2	--	--	1.75
L3	0.25BSC		
L4	4.60 REF		
θ	0°	--	8°
θ 1	1°	3°	5°

SYNC Power Corporation
7F-2, No.3-1, Park Street
NanKang District (NKSP), Taipei, Taiwan 115
Phone: 886-2-2655-8178
Fax: 886-2-2655-8468
© http://www.syncpower.com