



# SPN125T04

## N-Channel Enhancement Mode MOSFET

### DESCRIPTION

The SPN125T04 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.

### FEATURES

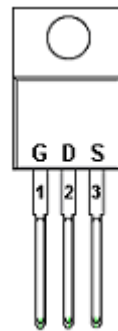
- ◆ 45V/125A,  $R_{DS(ON)} = 4.5m\Omega @ V_{GS} = 10V$
- ◆ 45V/125A,  $R_{DS(ON)} = 7.0m\Omega @ V_{GS} = 4.5V$
- ◆ Super high density cell design for extremely low  $R_{DS(ON)}$
- ◆ Exceptional on-resistance and maximum DC current capability
- ◆ TO-220-3L/TO-251/PPAK5x6 package design

### APPLICATIONS

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

### PIN CONFIGURATION

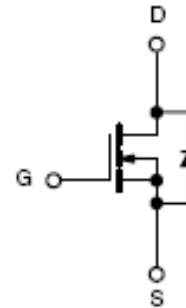
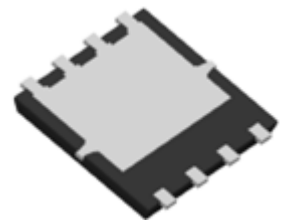
TO-220



TO-251



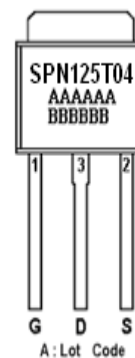
PPAK 5x6



### PART MARKING



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



A : Lot Code  
B : Date Code



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



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## N-Channel Enhancement Mode MOSFET

### TO-220/TO-251 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
SPN125T04T220TGB	TO-220-3L	SPN125T04
SPN125T04T251TGB	TO-251	SPN125T04
SPN125T04DN8RGB	PPAK5x6	SPN125T04

- ※ SPN125T04T220TGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN125T04T251TGB : Tube ; Pb – Free ; Halogen – Free
- ※ SPN125T04DN8RGB : Tape&Reel ; Pb – Free ; Halogen - Free



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### ABSOLUTE MAXIMUM RATINGS

(T<sub>A</sub>=25°C Unless otherwise noted)

Parameter	Symbol	Typical	Unit	
Drain-Source Voltage	V <sub>DSS</sub>	45	V	
Gate –Source Voltage	V <sub>GSS</sub>	±20	V	
Continuous Drain Current(T <sub>J</sub> =150°C) (TO-220/TO-251)	I <sub>D</sub>	T <sub>C</sub> =25°C	125	A
		T <sub>C</sub> =100°C	88	
Continuous Drain Current(T <sub>J</sub> =150°C) (PPAK5X6)	I <sub>D</sub>	T <sub>C</sub> =25°C	101	A
		T <sub>C</sub> =100°C	64	
Pulsed Drain Current (TO-220/TO-251)	I <sub>DM</sub>	350	A	
Pulsed Drain Current (PPAK5X6)	I <sub>DM</sub>	220	A	
Power Dissipation @ T <sub>C</sub> =25°C	P <sub>D</sub>	TO-220	125	W
		TO251/PPAK5X6	83	
Avalanche Energy with Single Pulse ( T <sub>C</sub> =25°C, L = 0.3mH. )	E <sub>AS</sub>	60	mJ	
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)	R <sub>θJC</sub>	1.2	°C/W	
Thermal Resistance-Junction to Case (TO-251)	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	$V_{(BR)DSS}$	$V_{GS}=0V, I_D=250\mu A$	45			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.8	2.2	
Gate Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=45V, V_{GS}=0V$ $T_J = 25\text{ }^\circ\text{C}$			1	uA
		$V_{DS}=45V, V_{GS}=0V$ $T_J = 100\text{ }^\circ\text{C}$			100	
Drain-Source On-Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=20A$		3.5	4.5	mΩ
		$V_{GS}=4.5V, I_D=20A$		4.6	7.0	
Forward Transconductance	$g_{fs}$	$V_{DS}=5V, I_D=20A$		40		S
Diode Forward Voltage	$V_{SD}$	$I_F=20A, V_{GS}=0V$		0.9	1.2	V
<b>Dynamic</b>						
Total Gate Charge (10V)	$Q_g$	$V_{DS}=20V, V_{GS}=10V$ $I_D = 20A$		42		nC
Total Gate Charge (4.5V)	$Q_g$			22		
Gate-Source Charge	$Q_{gs}$			4		
Gate-Drain Charge	$Q_{gd}$			10		
Input Capacitance	$C_{iss}$	$V_{DS}=20V, V_{GS}=0V$ $f=1\text{MHz}$		2159		pF
Output Capacitance	$C_{oss}$			756		
Reverse Transfer Capacitance	$C_{rss}$			118		
Turn-On Time	$t_{d(on)}$	$V_{DD}=20V, I_D=20A$ $V_{GEN}=10V, R_G=10\Omega$		12		nS
	$t_r$			10		
Turn-Off Time	$t_{d(off)}$			41		
	$t_f$			16		



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### TYPICAL CHARACTERISTICS

Fig 1. Typical Output Characteristics

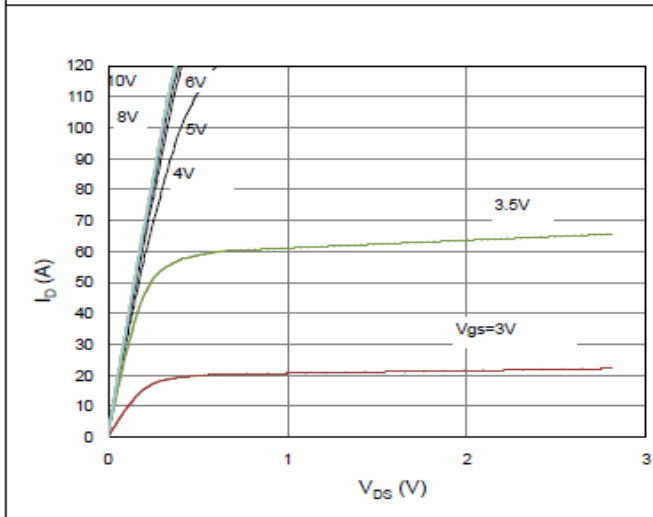


Figure 2. On-Resistance vs. Gate-Source Voltage

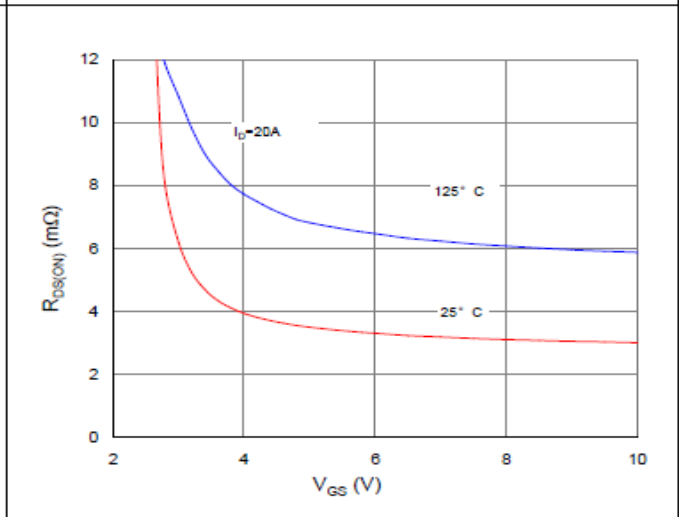


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

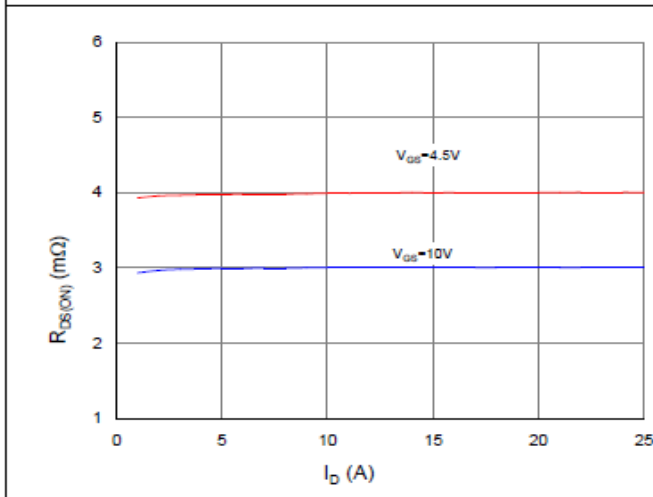


Figure 4. Normalized On-Resistance vs. Junction Temperature

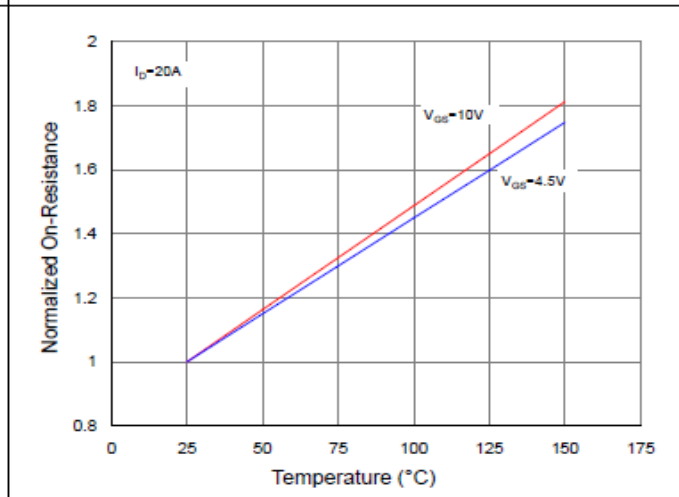


Figure 5. Typical Transfer Characteristics

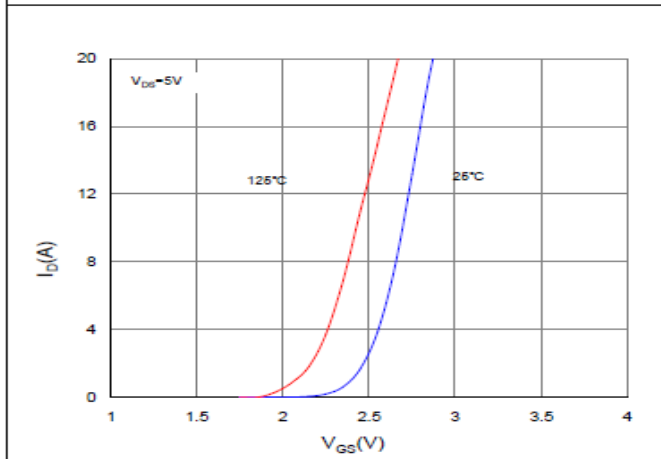
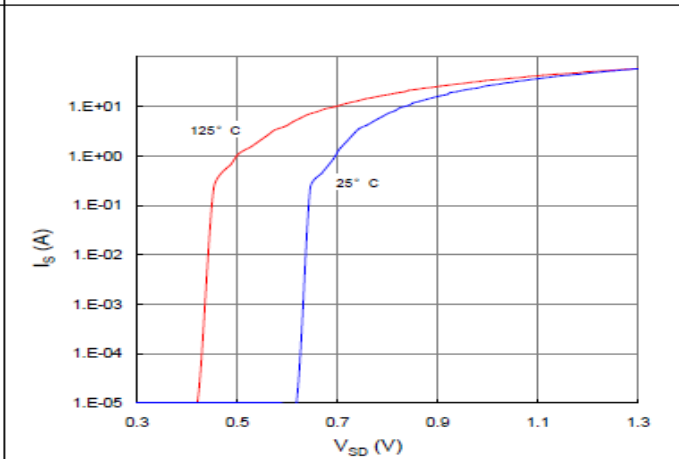


Figure 6. Typical Source-Drain Diode Forward Voltage





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### TYPICAL CHARACTERISTICS

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

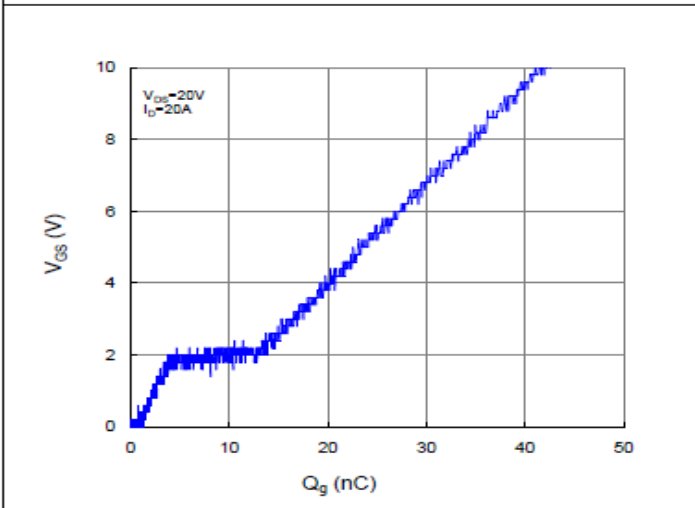


Figure 8. Typical Capacitance vs. Drain-to-Source Voltage

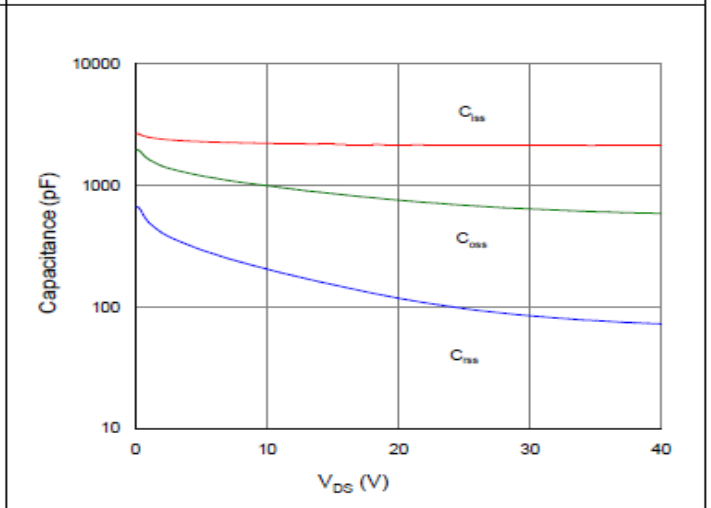


Figure 9. Maximum Safe Operating Area

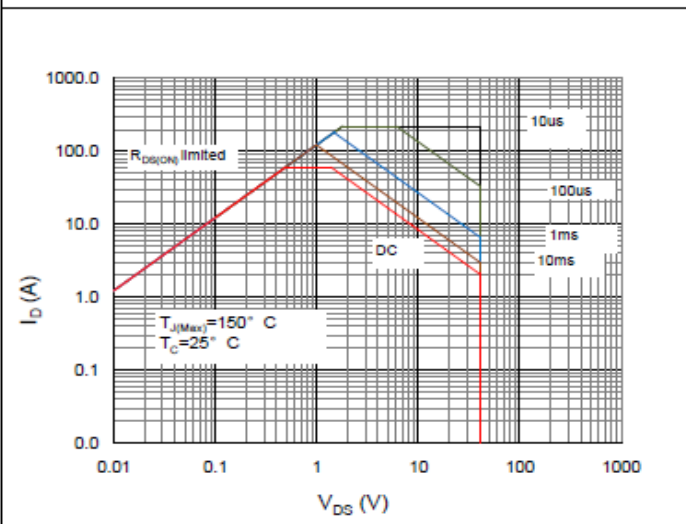


Figure 10. Maximum Drain Current vs. Case Temperature

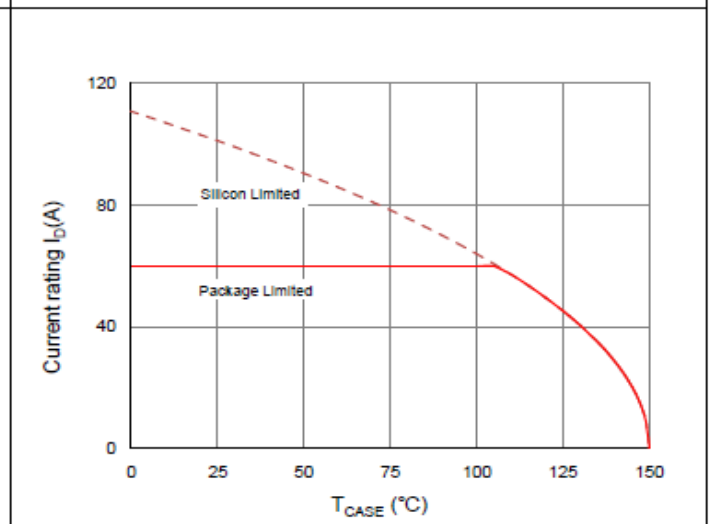
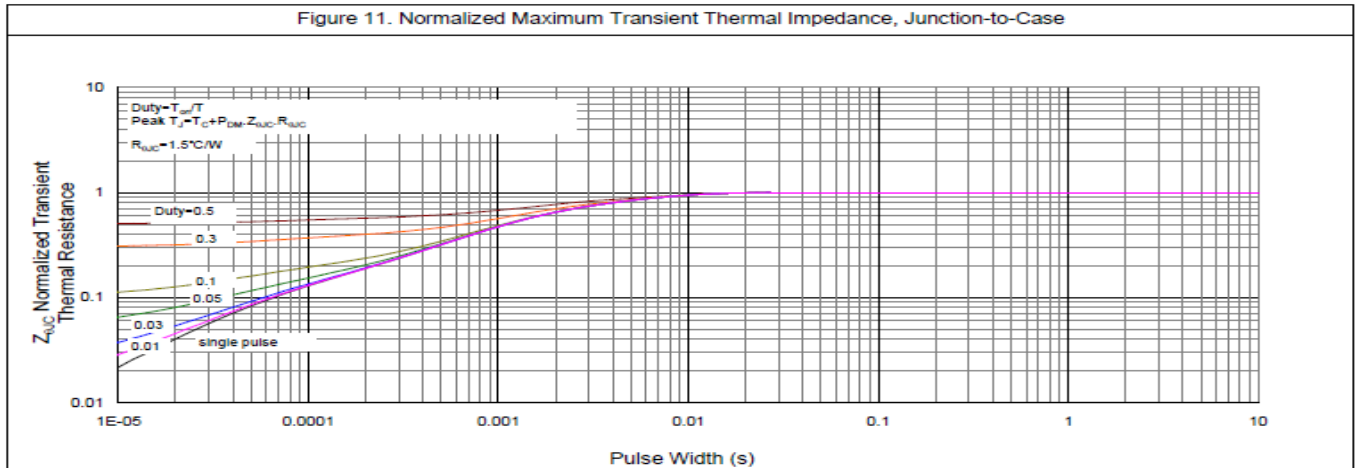


Figure 11. Normalized Maximum Transient Thermal Impedance, Junction-to-Case

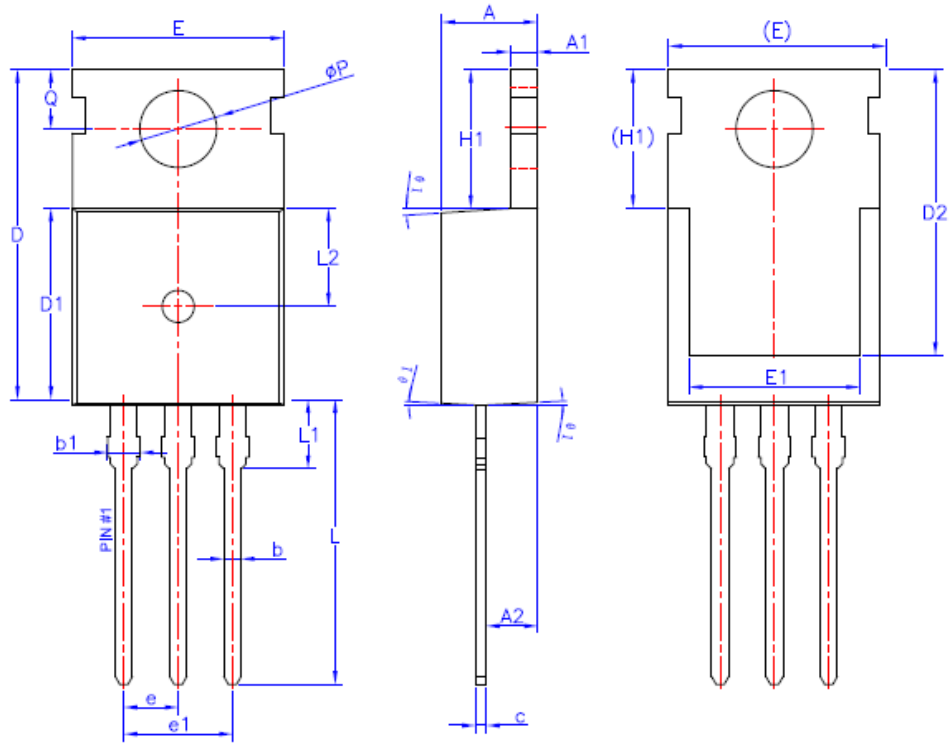




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## N-Channel Enhancement Mode MOSFET

### TO-220 PACKAGE OUTLINE



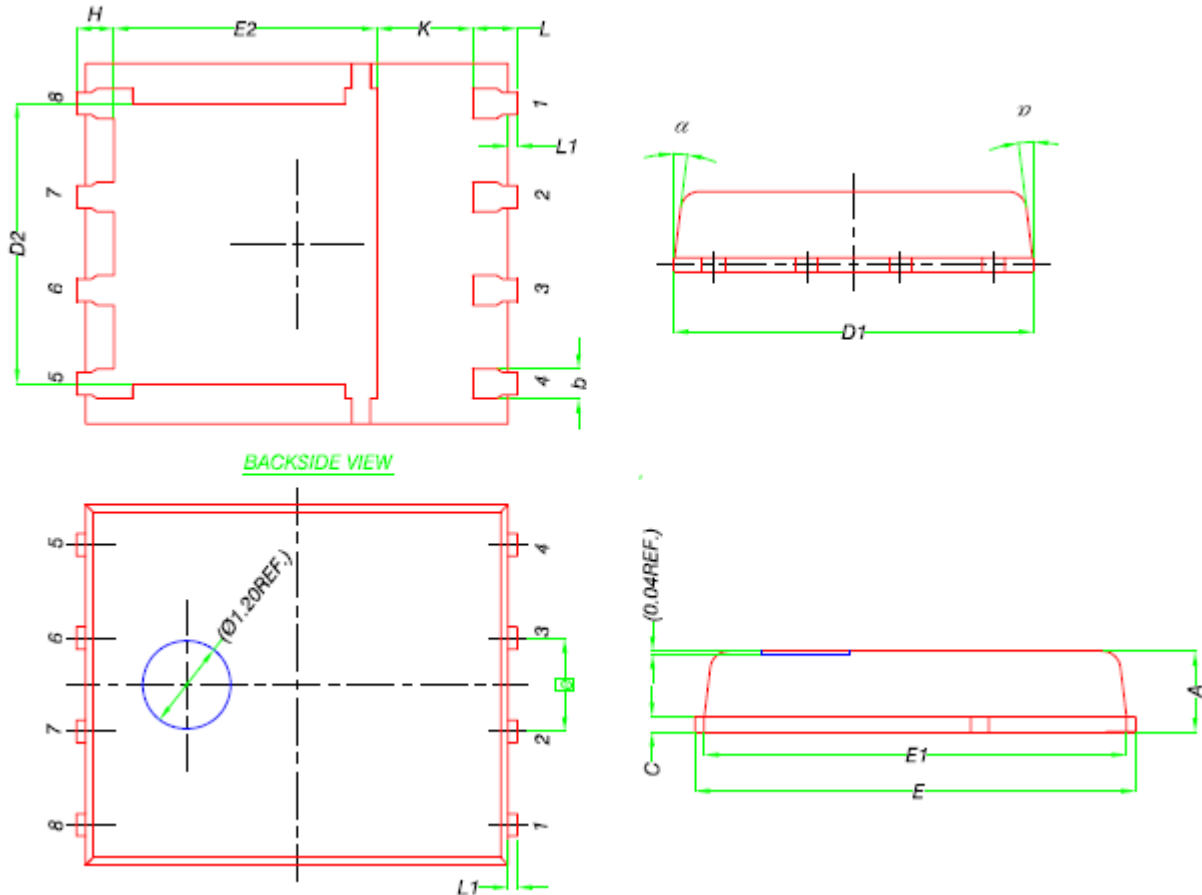
SYMBOL	MIN	NOM	MAX
A	4.40	4.50	4.60
A1	1.27	1.30	1.33
A2	2.30	2.40	2.50
b	0.70	—	0.90
b1	1.42	—	1.57
c	0.45	0.50	0.60
D	15.30	15.70	16.10
D1	9.10	9.20	9.30
D2	13.10	—	13.70
E	9.70	9.90	10.20
E1	7.80	8.00	8.20
e	2.54BSC		
e1	5.08BSC		
H1	6.30	6.50	6.70
L	12.78	13.08	13.38
L1	—	—	3.50
L2	4.60REF		
øP	3.55	3.60	3.65
Q	2.73	—	2.87
ø1	1°	3°	5°



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### PPAK5X6 PACKAGE OUTLINE



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
$\square e$	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
$\alpha$	0°	-	12°

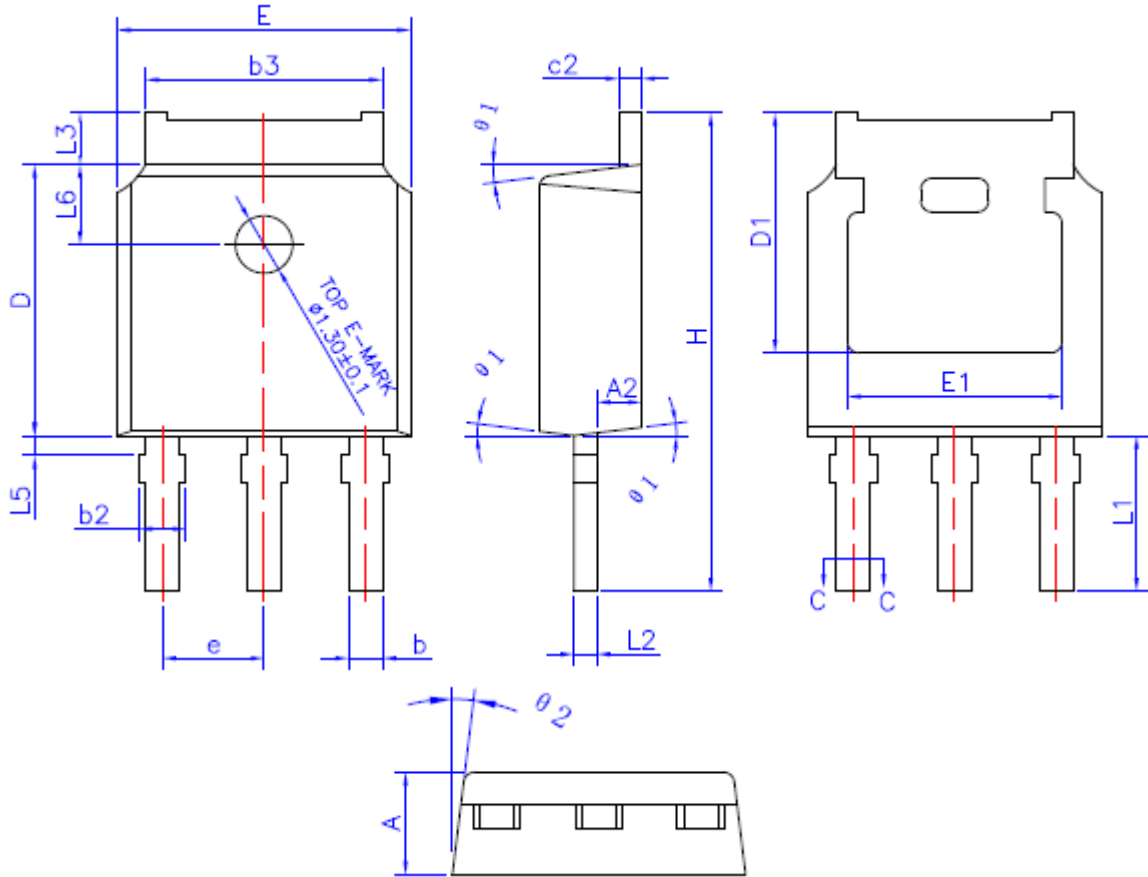




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## N-Channel Enhancement Mode MOSFET

### TO-251 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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