

SE4N60

**N-Channel Enhancement-Mode MOSFET**

Revision: A

**General Description**

This series is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics

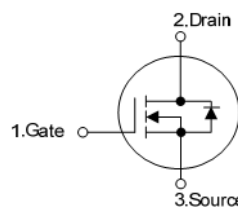
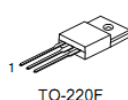
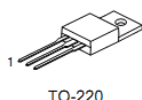
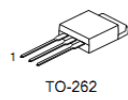
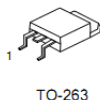
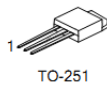
**Features**

For a single MOSFET

- $V_{DS} = 600V$
- $R_{DS(ON)} = 2.1\Omega @ V_{GS}=10V$

**Pin configurations**

See Diagram below



**Absolute Maximum Ratings**

Parameter		Symbol	Rating	Units
Drain-Source Voltage		$V_{DS}$	600	V
Gate-Source Voltage		$V_{GS}$	$\pm 30$	V
Avalanche Current <sup>2</sup>		$I_{AR}$	4.4	A
Drain Current	Continuous	$I_D$	4.0	A
	Pulsed		16	
Avalanche Energy Single Pulsed <sup>3</sup>		$E_{AS}$	260	mJ
Peak Diode Recovery dv/dt <sup>4</sup>		Dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262/TO-263	$P_D$	106	W
	TO-220F		36	
	TO-251/TO-252		50	
Operating Junction Temperature Range		$T_J$	-55 to 150	$^{\circ}C$

Note 1: Absolute maximum ratings are those values beyond which the device could be permanently damaged

Note 2: Repetitive Rating: Pulse width limited by maximum junction temperature

Note 3:  $L=30mH, I_{AS}=4A, V_{DD}=50V, R_G=25\Omega$ , starting  $T_J=25^{\circ}C$

Note 4:  $I_{SD}\leq 4.4A, di/dt\leq 200A/\mu s, V_{DD}\leq BV_{DSS}$ , starting  $T_J=25^{\circ}C$

**Thermal Resistance**

Symbol	Parameter	TO-220 series	TO-262/3	TO-251/2	Units
$R_{\theta JA}$	Junction to Ambient ( $t \leq 10s$ )	62.5		83	$^{\circ}C/W$

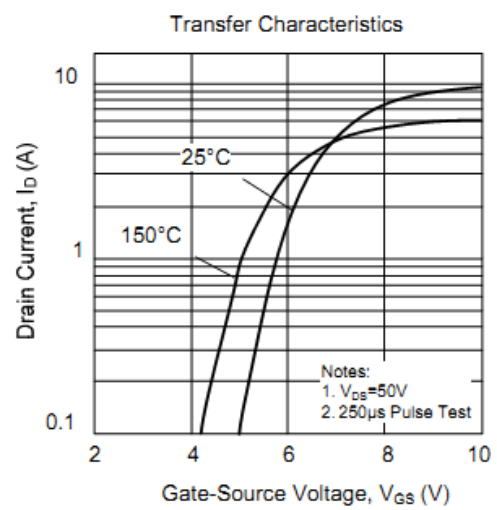
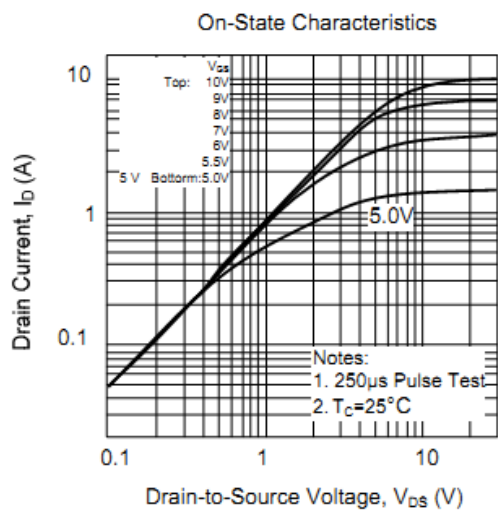
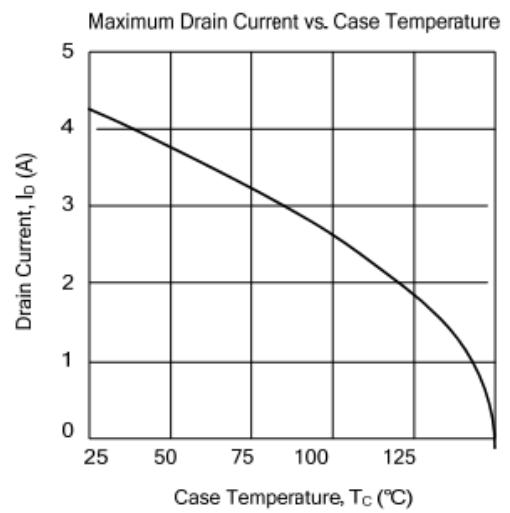
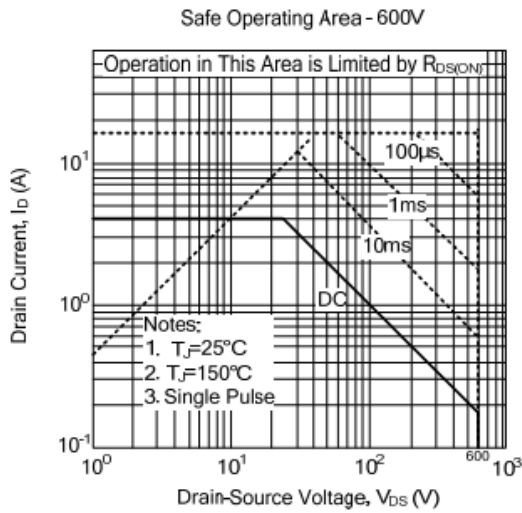
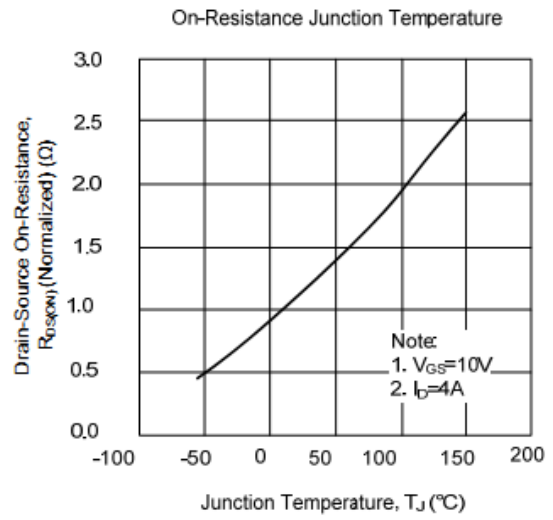
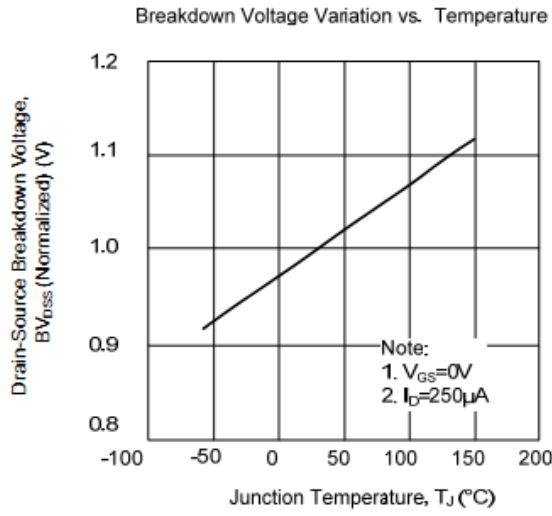
# SE4N60

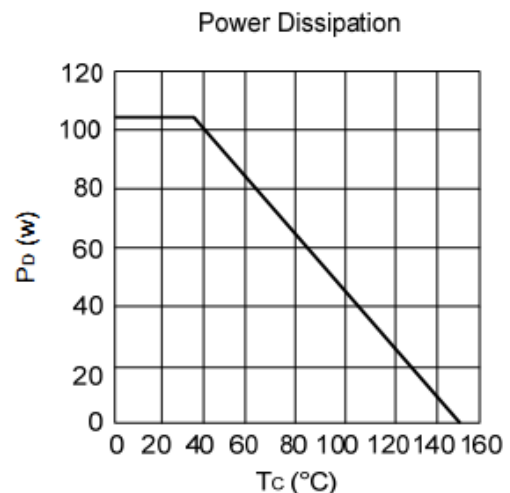
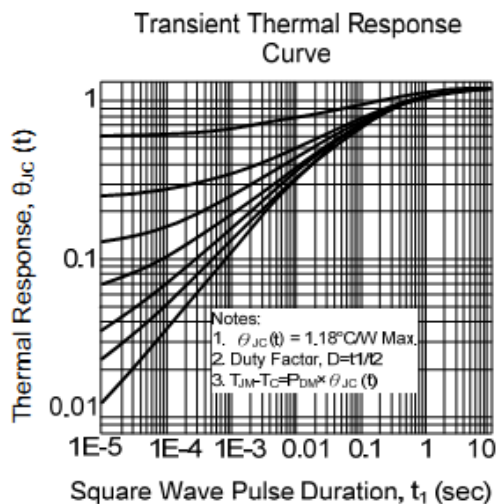
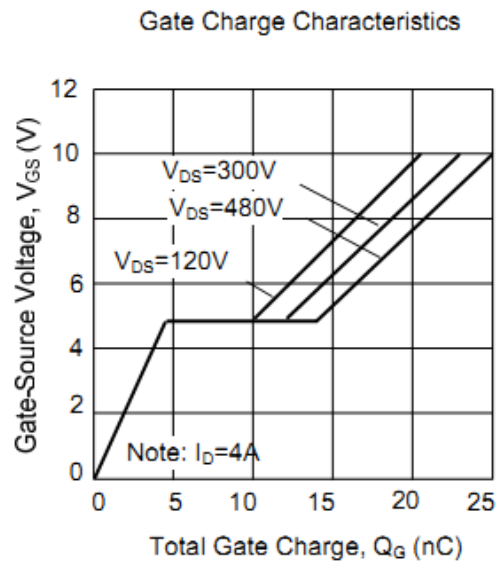
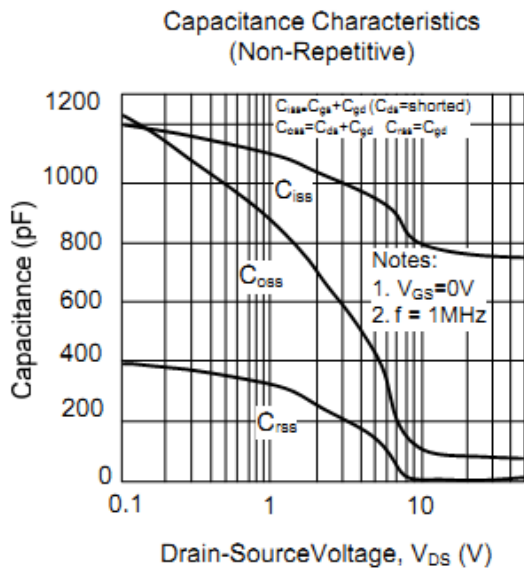
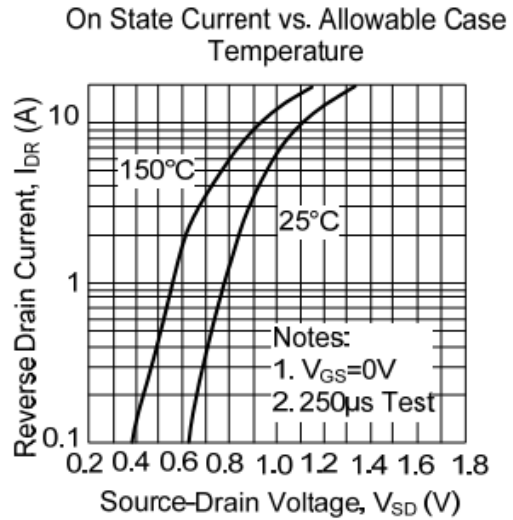
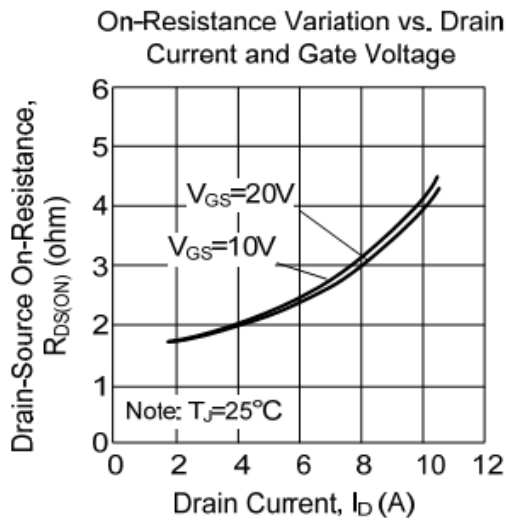
Electrical Characteristics (T <sub>J</sub> =25°C unless otherwise noted)						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS (Note 2)</b>						
B <sub>V</sub> DSS	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0 V, I <sub>D</sub> =250μA,	600			V
I <sub>DSS</sub>	Drain to Source Leakage Current	V <sub>DS</sub> = 600V, V <sub>GS</sub> =0V			10	μA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> =30 V			100	nA
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA	2.0		4.0	V
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =10V, I <sub>D</sub> =2.2A		2.1	2.5	Ω
<b>DYNAMIC PARAMETERS</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz		520	670	pF
C <sub>oss</sub>	Output Capacitance			70	90	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			8	11	pF
<b>SWITCHING PARAMETERS</b>						
Q <sub>g</sub>	Total Gate Charge <sup>2</sup>	V <sub>GS</sub> =10V, V <sub>DS</sub> =480V, I <sub>D</sub> =4.0A <sup>1,2</sup>		15	20	nC
Q <sub>gs</sub>	Gate Source Charge			3.4		nC
Q <sub>gd</sub>	Gate Drain Charge			7.1		nC
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DS</sub> =300V, R <sub>GEN</sub> =25Ω I <sub>D</sub> =4.0A <sup>1,2</sup>		13	35	ns
t <sub>d(off)</sub>	Turn-Off Delay Time			25	60	ns
t <sub>d(r)</sub>	Turn-On Rise Time			45	100	ns
t <sub>d(f)</sub>	Turn-Off Fall Time			35		ns
<b>Source-Drain Diode Characteristics</b>						
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =4.4A			1.4	V
I <sub>S</sub>	Max Drain-Source Diode Current				4.4	A
I <sub>SM</sub>	Max Pulse Drain-Source Current				17.6	A
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> =0V, I <sub>S</sub> =4.4A		250		ns
Q <sub>RR</sub>	Reverse Recovery Charge	di <sub>F</sub> /dt=100A/μs <sup>1</sup>		1.5		μC

Note 1: Pulse width≤300μs, Duty cycles≤2%

Note 1: Essentially independent of operating temperature

Typical Characteristics

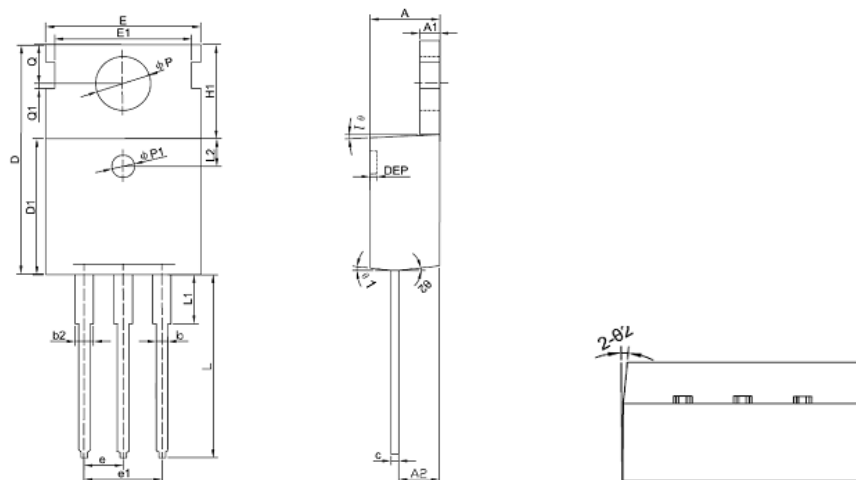




# SE4N60

## Package Outline Dimension

### TO-220

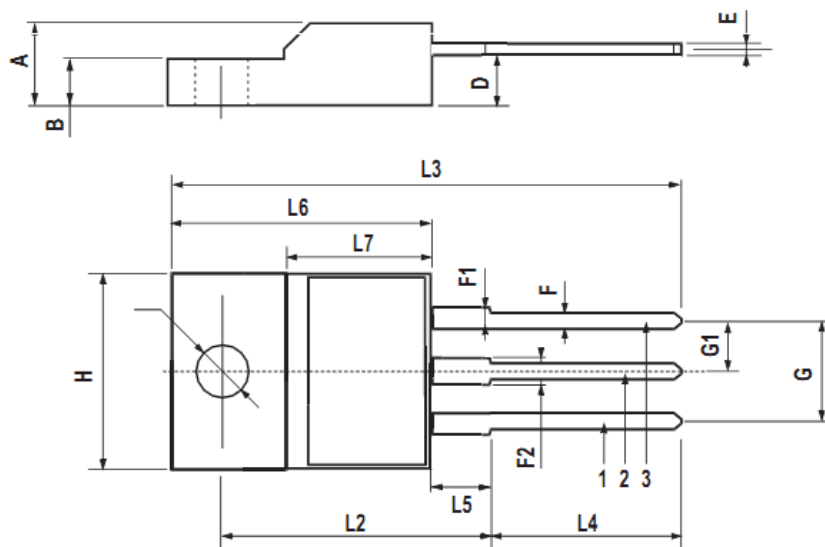


Symbol	Dimension In Millimeters			Dimension In Inches		
	Min	Nom	Max	Min	Nom	Max
A	4.400	4.550	4.700	0.173	0.179	0.185
A1	1.270	1.300	1.330	0.050	0.051	0.052
A2	2.590	2.690	2.790	0.102	0.106	0.110
b	0.770	-	0.900	0.030	-	0.035
b2	1.230	-	1.360	0.048	-	0.054
c	0.480	0.500	0.520	0.019	0.020	0.020
D	15.100	15.400	15.700	-	0.606	-
D1	9.000	9.100	9.200	0.354	0.358	0.362
DEP	0.050	0.285	0.520	0.002	0.011	0.020
E	10.060	10.160	10.260	0.396	0.400	0.404
E1	-	8.700	-	-	0.343	-
ΦP1	1.400	1.500	1.600	0.055	0.059	0.063
e	2.54BSC			0.1BSC		
e1	5.08BSC			0.2BSC		
H1	6.100	6.300	6.500	0.240	0.248	0.256
L	12.750	12.960	13.170	0.502	0.510	0.519
L1	-	-	3.950	-	-	0.156
L2	1.85REF			0.073REF		
ΦP	3.570	3.600	3.630	0.141	0.142	0.143
Q	2.730	2.800	2.870	0.107	0.110	0.113
Q1	-	0.200	-	-	0.008	-
θ1	5°	7°	9°	5°	7°	9°
θ2	1°	3°	5°	1°	3°	5°

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## Package Outline Dimension

### TO-220F

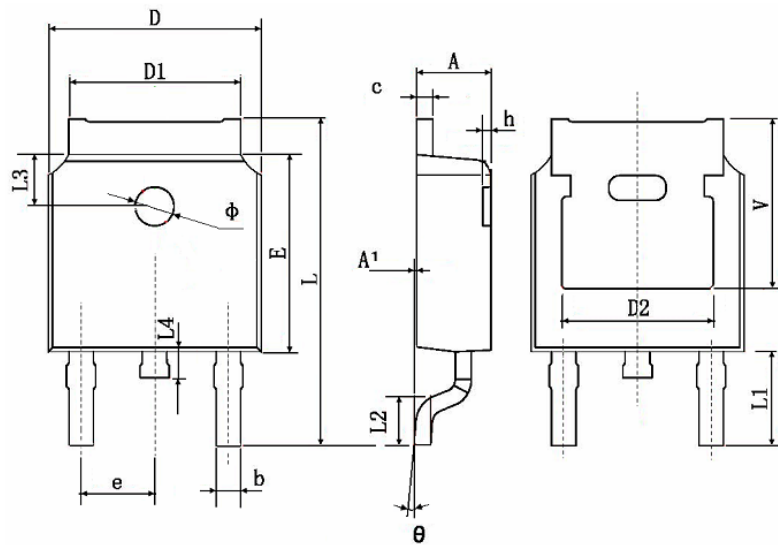


DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.5	0.045		0.067
F2	1.15		1.5	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126

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## Package Outline Dimension

### TO-252

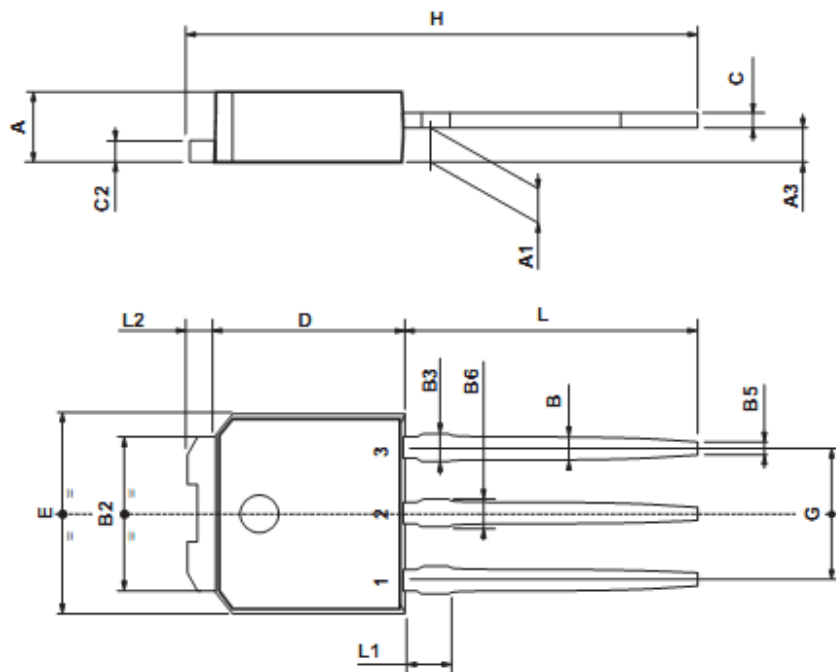


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	0.483 TYP.		0.190 TYP.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 TYP.		0.114 TYP.	
L2	1.400	1.700	0.055	0.067
L3	1.600 TYP.		0.063 TYP.	
L4	0.600	1.000	0.024	0.039
φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 TYP.		0.211 TYP.	

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## Package Outline Dimension

### TO-251



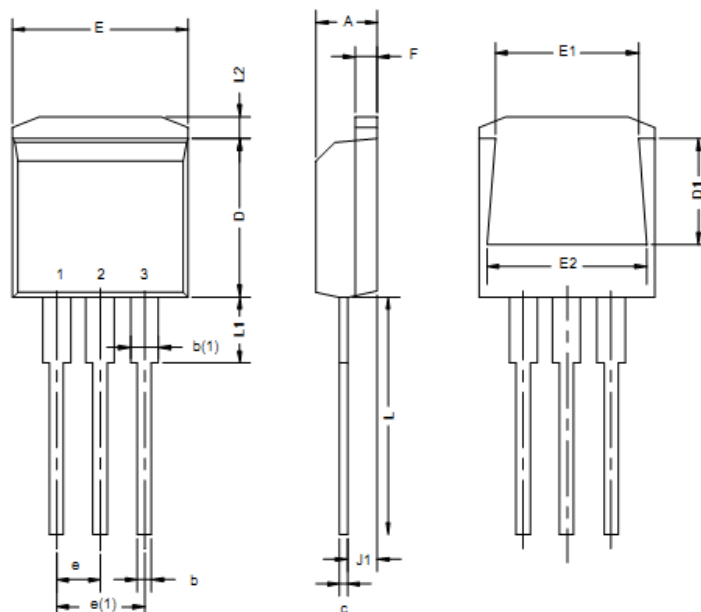
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039



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## Package Outline Dimension

### TO-262



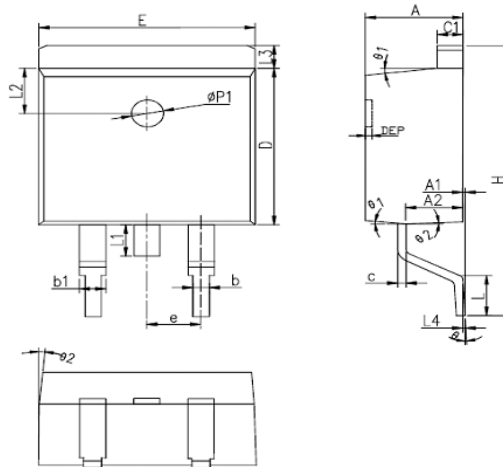
Dim	MILLIMETERS*		INCHES	
	Min	Max	Min	Max
A	4.32	4.70	0.170	0.185
b	0.64	1.00	0.025	0.039
b(1)	1.14	1.40	0.045	0.055
c	0.36	0.50	0.014	0.020
D	8.64	9.65	0.340	0.380
D1	5.59	6.10	0.220	0.240
e	2.41	2.67	0.095	0.105
e(1)	4.95	5.33	0.195	0.210
E	10.03	10.41	0.395	0.410
E1	7.87	8.64	0.310	0.340
E2	9.02	9.53	0.355	0.375
F	1.14	1.40	0.045	0.055
J1	2.41	2.79	0.095	0.110
L	13.08	14.22	0.515	0.560
L1	-	3.81	-	0.150
L2	1.02	1.40	0.040	0.055

ECN: T-02234—Rev. C, 14-Oct-02  
DWG: 5855

# SE4N60

## Package Outline Dimension

### TO-263



SYMBOL	MM			INCH			SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX		MIN	NOM	MAX	MIN	NOM	MAX
A	4.40	4.57	4.70	0.173	0.180	0.185	L	2.00	2.30	2.60	0.079	0.090	0.102
A1	0	0.10	0.25	0	0.004	0.010	L3	1.17	1.27	1.40	0.046	0.050	0.055
A2	2.59	2.69	2.79	0.102	0.106	0.110	L1	-	-	1.70	-	-	0.067
b	0.77	-	0.90	0.030	-	0.035	L4	0.25BSC			0.01BSC		
b1	1.23	-	1.36	0.048	-	0.052	L2	2.50REF.			0.098REF.		
c	0.34	-	0.47	0.013	-	0.019	Ø	0°	-	8°	0°	-	8°
C1	1.22	-	1.32	0.048	-	0.052	Ø 1	5°	7°	9°	5°	7°	9°
D	8.60	8.70	8.80	0.338	0.343	0.346	Ø 2	1°	3°	5°	1°	3°	5°
E	10.00	10.16	10.26	0.394	0.4	0.404	DEP	0.05	0.10	0.20	0.002	0.004	0.008
e	2.54BSC			0.1BSC			Øp1	1.40	1.50	1.60	0.055	0.059	0.063
H	14.70	15.10	15.50	0.579	0.594	0.610							

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