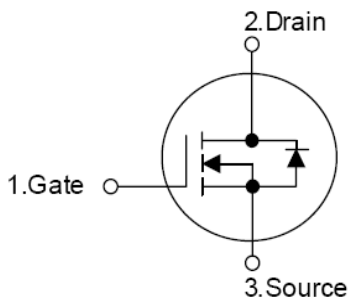


**600V, 4A, N-Channel Power MOSFET**
 $V_{DSS}=600V$ 
 $I_{DS}=4A$ 
 $R_{DS(ON)}=2.5\ \Omega$ 
**◆ Features**

- $R_{DS(ON)}$  = (Max.  $2.5\ \Omega$ )@ $V_{GS}=10V$ .
- Gate Charge (Typical 15nC).
- Improved dv/dt Capability, High Ruggedness.
- 100% Avalanche Tested.
- Maximum Junction Temperature Range( $150^{\circ}C$ ).

**◆ Symbol**

**◆ Applications**

- Switching Application
- Adaptor
- LED Lighting

**◆ Pin Description**

**◆ Ordering Information**

Part Number	Package	Pin Assignment			Packing
		1	2	3	
ET4N60-220-T	TO-220	G	D	S	Tube
ET4N60-220F-T	TO-220F	G	D	S	Tube
ET4N60-252-T	TO-252	G	D	S	Tube
ET4N60-252-R	TO-252	G	D	S	Tape Reel

### ◆ Absolute Maximum Ratings

Symbol	Parameter	Value	Units	
$V_{DSS}$	Drain to Source Voltage	600	V	
$I_D$	Continuous Drain Current(@ $T_C = 25\text{ }^\circ\text{C}$ )	4.0	A	
	Continuous Drain Current(@ $T_C = 100\text{ }^\circ\text{C}$ )	2.5	A	
$I_{DM}$	Drain Current Pulsed	16	A	
$V_{GS}$	Gate to Source Voltage	$\pm 30$	V	
$E_{AS}$	Single Pulsed Avalanche Energy	240	mJ	
$E_{AR}$	Repetitive Avalanche Energy	10	mJ	
dv/dt	Peak Diode Recovery dv/dt	4.5	V/ns	
$P_D$	Total Power Dissipation (@ $T_C = 25\text{ }^\circ\text{C}$ )	TO-220	105	W
		TO-220F	33	
		TO-252	50	
$T_{STG}, T_J$	Storage Temperature, Junction Temperature	-55~150	$^\circ\text{C}$	

Notes:

- (1)· Repeativity rating : pulse width limited by junction temperature  
 (2)·  $L = 27.5\text{mH}$ ,  $I_{AS} = 4.0\text{ A}$ ,  $V_{DD} = 50\text{ V}$ ,  $R_G = 25\text{ }\Omega$ , Starting  $T_J = 25\text{ }^\circ\text{C}$   
 (3)·  $I_{SD} \leq 4.0\text{ A}$ ,  $di/dt \leq 200\text{ A/us}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25\text{ }^\circ\text{C}$

### ◆ Thermal Characteristics

Symbol	Parameter	Value			Units	
		Min.	Typ.	Max.		
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	TO-220	-	-	1.18	$^\circ\text{C/W}$
		TO-220F	-	-	3.79	
		TO-252	-	-	2.5	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	TO-220	-	-	62.5	
		TO-220F			62.5	
		TO-252			83	

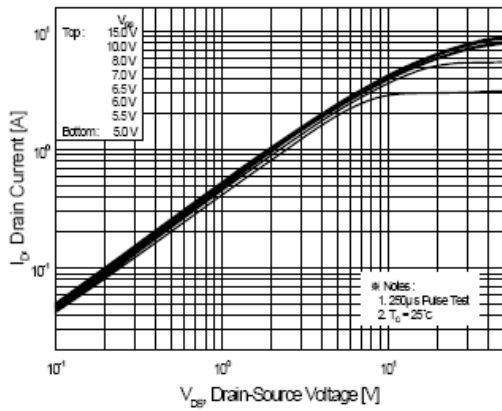
### ◆ Source-Drain Diode Characteristics and Maximum Ratings

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$I_S$	Maximum Continuous Source-Drain Diode Forward Current		-	-	4.0	A
$I_{SM}$	Maximum Pulsed Source-Drain Diode Forward Current		-	-	16	
$V_{SD}$	Diode Forward Voltage	$I_S = 4.0\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-	1.4	V
$t_{rr}$	Reverse Recovery Time	$I_S = 4.0\text{ A}$ , $V_{GS} = 0\text{ V}$ ,	-	300	-	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F/dt = 100\text{ A/us}$	-	2.2	-	$\mu\text{C}$

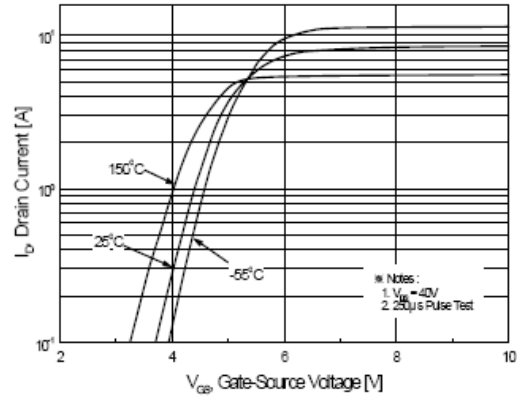
**◆ Electrical Characteristics** ( $T_C=25\text{ }^\circ\text{C}$  unless otherwise noted )

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V},$ $I_D = 250\text{ }\mu\text{A}$	600	-	-	V
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature coefficient	$I_D = 250\text{ }\mu\text{A},$ Referenced to 25 °C	-	0.6	-	V/°C
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS} = 600\text{ V},$ $V_{GS} = 0\text{ V}$	-	-	10	$\mu\text{A}$
		$V_{DS} = 480\text{ V},$ $T_C = 125\text{ }^\circ\text{C}$	-	-	100	$\mu\text{A}$
$I_{GSS}$	Gate-Source Leakage, Forward	$V_{GS} = 30\text{ V},$ $V_{DS} = 0\text{ V}$	-	-	100	nA
	Gate-source Leakage, Reverse	$V_{GS} = -30\text{ V},$ $V_{DS} = 0\text{ V}$	-	-	-100	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS},$ $I_D = 250\text{ }\mu\text{A}$	2.0	-	4.0	V
$R_{DS(on)}$	Static Drain-Source On-state Resistance	$V_{GS} = 10\text{ V},$ $I_D = 2.0\text{ A}$	-	2.0	2.5	$\Omega$
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{ V},$ $V_{DS} = 25\text{ V},$ $f = 1\text{ MHz}$	-	545	710	pF
$C_{oss}$	Output Capacitance		-	60	80	
$C_{rss}$	Reverse Transfer Capacitance		-	8	11	
<b>Dynamic Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 300\text{ V},$ $I_D = 4.0\text{ A},$ $R_G = 25\text{ }\Omega$ Pulse Width $\leq 300\mu\text{s},$	-	10	30	ns
$t_r$	Rise Time		-	35	80	
$t_{d(off)}$	Turn-off Delay Time		-	45	100	
$t_f$	Fall Time		-	40	90	
$Q_g$	Total Gate Charge	$V_{DS} = 480\text{ V},$	-	15	20	nC
$Q_{gs}$	Gate-Source Charge	$V_{GS} = 10\text{ V},$	-	2.8	-	
$Q_{gd}$	Gate-Drain Charge(Miller Charge)	$I_D = 4.0\text{ A}$	-	6.2	-	

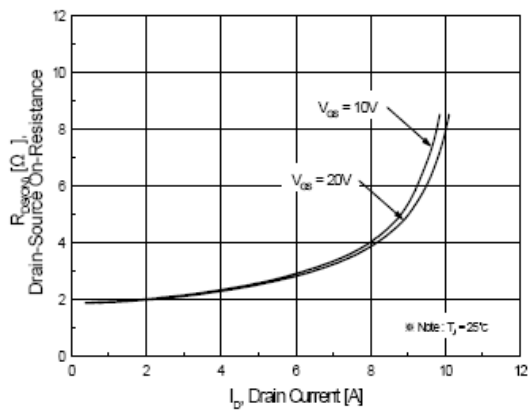
### ◆ Typical Characteristics



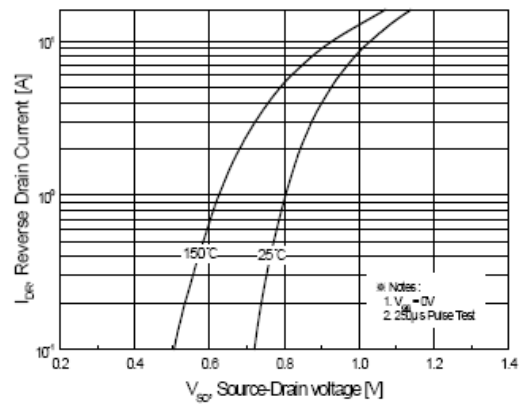
**Figure 1. On-Region Characteristics**



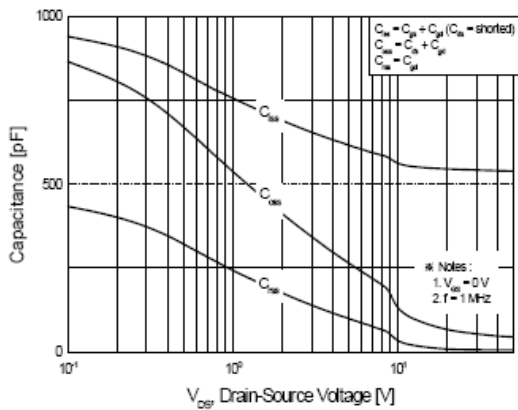
**Figure 2. Transfer Characteristics**



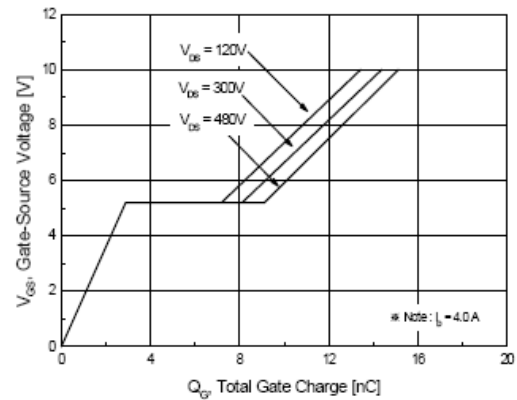
**Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage**



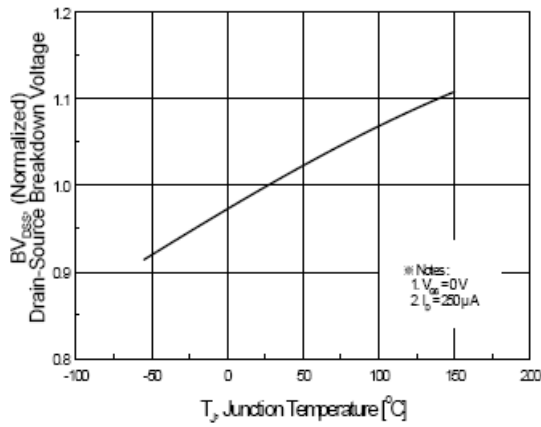
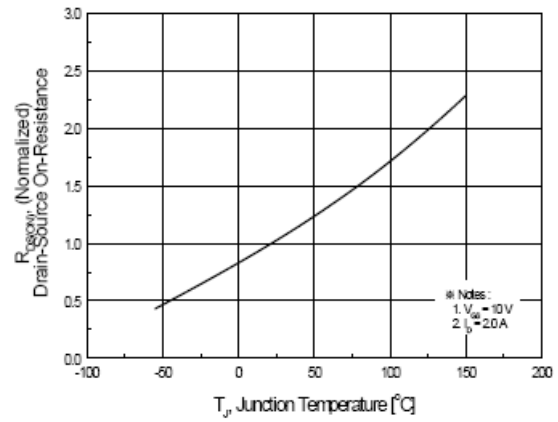
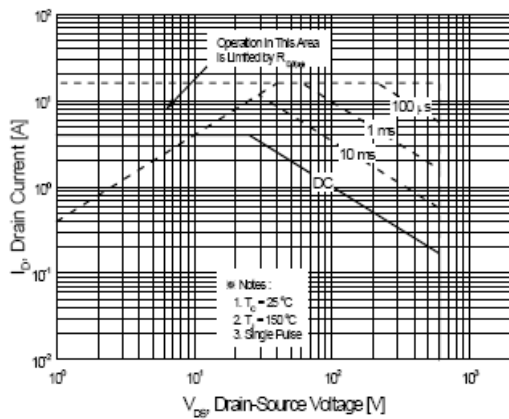
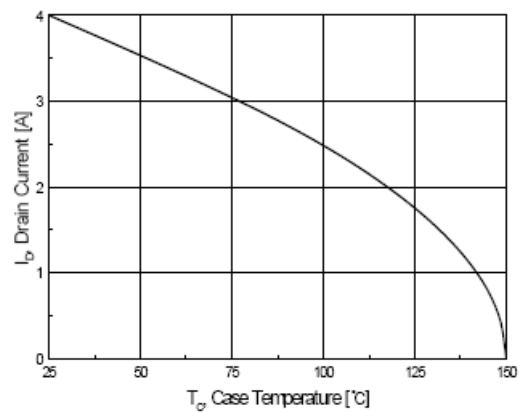
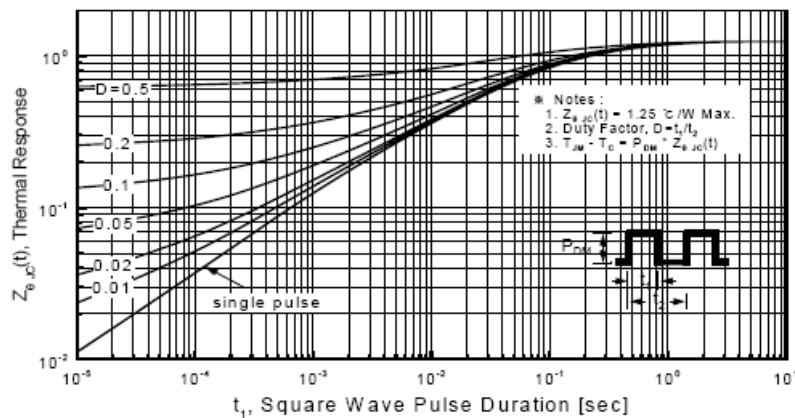
**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**



**Figure 5. Capacitance Characteristics**

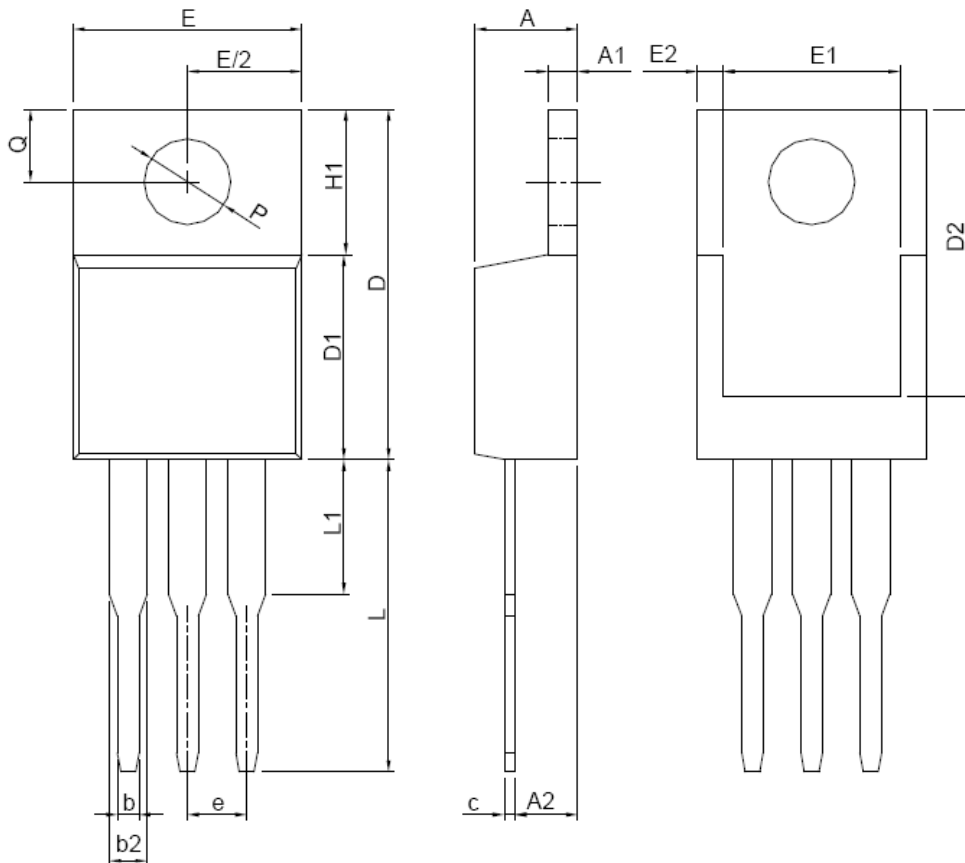



**Figure 6. Gate Charge Characteristics**

**◆ Typical Characteristics (Continued)**

**Figure 7. Breakdown Voltage Variation vs Temperature**

**Figure 8. On-Resistance Variation vs Temperature**

**Figure 9. Maximum Safe Operating Area**

**Figure 10. Maximum Drain Current vs Case Temperature**

**Figure 11. Transient Thermal Response Curve**

**◆ Package Information**

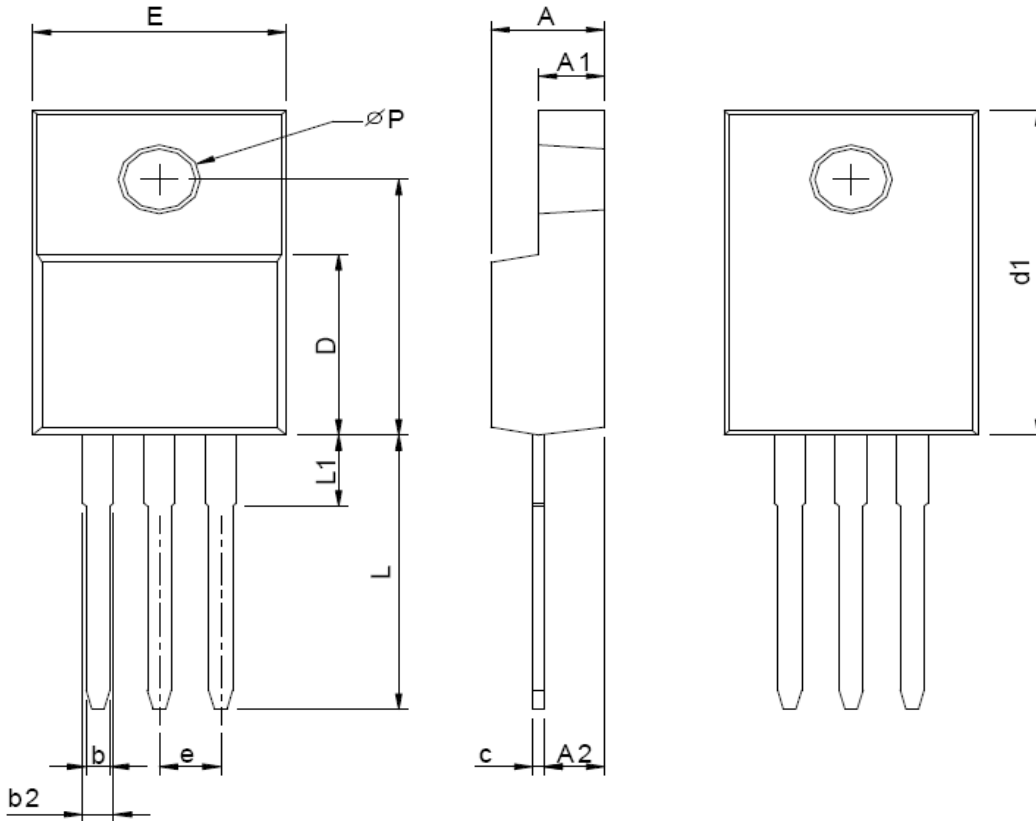
TO-220



	TO-220			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	3.56	4.83	0.140	0.190
A1	0.51	1.40	0.020	0.055
A2	2.03	2.92	0.080	0.115
b	0.38	1.02	0.015	0.040
b2	1.14	1.78	0.045	0.070
c	0.36	0.61	0.014	0.024
D	14.22	16.51	0.560	0.650
D1	8.38	9.02	0.330	0.355
D2	12.19	12.88	0.480	0.507
E	9.65	10.67	0.380	0.420
E1	6.86	8.89	0.270	0.350
E2		0.76		0.030
e	2.54 BSC		0.100 BSC	
H1	5.84	6.86	0.230	0.270
L	12.70	14.73	0.500	0.580
L1		6.35		0.250
P	3.53	4.09	0.139	0.161
Q	2.54	3.43	0.100	0.135

**◆ Package Information**

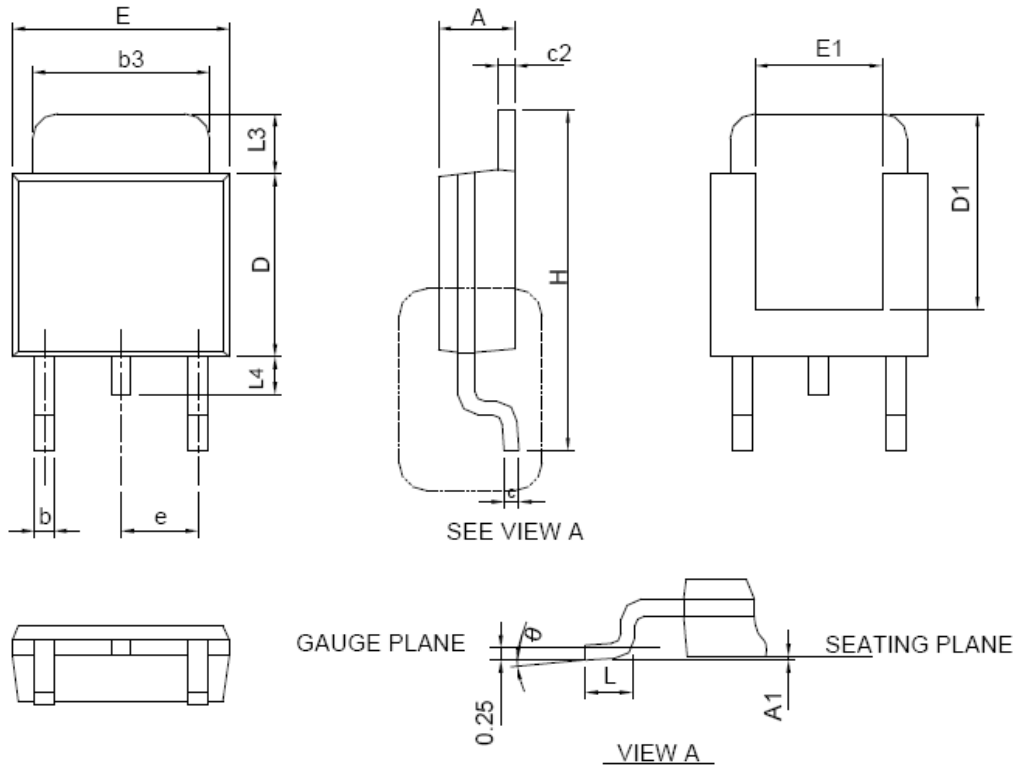
TO-220FP



SYMBOL	TO-220FP			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.20	4.80	0.165	0.189
A1	2.60	3.20	0.102	0.126
A2	2.10	2.90	0.083	0.114
b	0.50	1.00	0.020	0.039
b2	0.90	1.90	0.035	0.075
c	0.30	0.80	0.012	0.031
D	8.10	9.10	0.319	0.358
d1	14.50	16.50	0.571	0.650
d2	12.10	12.90	0.476	0.508
E	9.70	10.70	0.382	0.421
e	2.54 BSC		0.100 BSC	
L	13.00	14.50	0.512	0.570
L1	1.60	4.00	0.063	0.157
P	3.00	3.60	0.118	0.142

**◆ Package Information**

TO-252



SYMBOL	TO-252			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	2.18	2.39	0.086	0.094
A1		0.13		0.005
b	0.50	0.89	0.020	0.035
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c2	0.46	0.89	0.018	0.035
D	5.33	6.22	0.210	0.245
D1	4.57	6.00	0.180	0.236
E	6.35	6.73	0.250	0.265
E1	3.81	6.00	0.150	0.236
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	0.90	1.78	0.035	0.070
L3	0.89	2.03	0.035	0.080
L4		1.02		0.040
θ	0°	8°	0°	8°