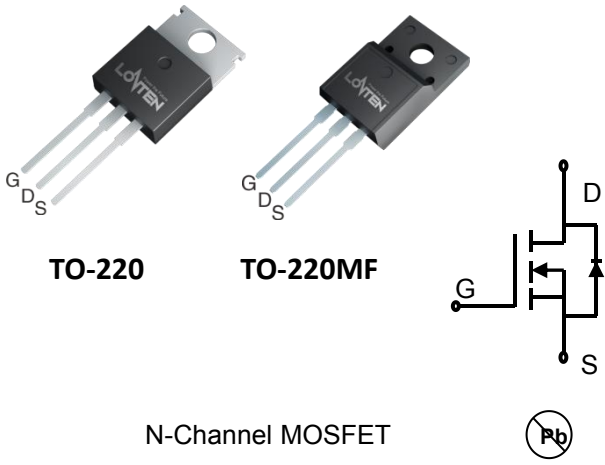


## Lonten N-channel 40V, 120A, 3.5mΩ Power MOSFET

<p><b>Description</b></p> <p>These N-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and with stand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>◆ 40V,120A,<math>R_{DS(on),max}=3.5m\Omega@V_{GS} = 10V</math></li> <li>◆ Improved dv/dt capability</li> <li>◆ Fast switching</li> <li>◆ 100% EAS Guaranteed</li> <li>◆ Green device available</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>◆ Motor Drives</li> <li>◆ UPS</li> <li>◆ DC-DC Converter</li> </ul>	<p><b>Product Summary</b></p> <table style="width: 100%; border: none;"> <tr> <td style="padding: 2px;"><math>V_{DSS}</math></td> <td style="padding: 2px;">40V</td> </tr> <tr> <td style="padding: 2px;"><math>R_{DS(on),max}@V_{GS}=10V</math></td> <td style="padding: 2px;">3.5mΩ</td> </tr> <tr> <td style="padding: 2px;"><math>I_D</math></td> <td style="padding: 2px;">120A</td> </tr> </table> <p><b>Pin Configuration</b></p> <div style="text-align: center;">  <p style="margin: 0;">TO-220      TO-220MF</p> <p style="margin: 0;">N-Channel MOSFET</p> </div>	$V_{DSS}$	40V	$R_{DS(on),max}@V_{GS}=10V$	3.5mΩ	$I_D$	120A
$V_{DSS}$	40V						
$R_{DS(on),max}@V_{GS}=10V$	3.5mΩ						
$I_D$	120A						

### Absolute Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	40	V
Continuous drain current ( $T_C = 25^\circ C$ ) <sup>1)</sup>	$I_D$	120	A
Continuous drain current ( $T_C = 100^\circ C$ ) <sup>1)</sup>		82	A
Pulsed drain current <sup>2)</sup>	$I_{DM}$	480	A
Gate-Source voltage	$V_{GSS}$	$\pm 20$	V
Avalanche energy <sup>3)</sup>	$E_{AS}$	1040	mJ
Power Dissipation ( $T_C = 25^\circ C$ ) TO-220	$P_D$	150	W
Power Dissipation ( $T_C = 25^\circ C$ ) TO-220MF		48	W
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ C$
Operating Junction Temperature Range	$T_J$	-55 to +150	$^\circ C$

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case TO-220	$R_{\theta JC}$	0.83	$^\circ C/W$
Thermal Resistance, Junction-to-Case TO-220MF		2.6	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient TO-220	$R_{\theta JA}$	62	$^\circ C/W$
Thermal Resistance, Junction-to-Ambient TO-220MF		80	$^\circ C/W$

**Package Marking and Ordering Information**

Device	Device Package	Marking
LNC04R035B	TO-220	LNC04R035B
LND04R035B	TO-220MF	LND04R035B

**Electrical Characteristics**
 $T_J = 25^\circ\text{C}$  unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=250\mu\text{A}$	40	---	---	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.3	---	2.5	V
Drain-source leakage current	$I_{DSS}$	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_J = 25^\circ\text{C}$	---	---	1	$\mu\text{A}$
		$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_J = 125^\circ\text{C}$	---	---	5	$\mu\text{A}$
Gate leakage current, Forward	$I_{GSSF}$	$V_{GS}=20\text{ V}, V_{DS}=0\text{ V}$	---	---	100	nA
Gate leakage current, Reverse	$I_{GSSR}$	$V_{GS}=-20\text{ V}, V_{DS}=0\text{ V}$	---	---	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=20\text{ A}$	---	2.7	3.5	$\text{m}\Omega$
		$V_{GS}=4.5\text{ V}, I_D=10\text{ A}$	---	3.8	6.0	$\text{m}\Omega$
Forward transconductance	$g_{fs}$	$V_{DS}=5\text{ V}, I_D=50\text{ A}$	26	---	---	S
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V},$ $F = 1\text{MHz}$	---	7810	---	pF
Output capacitance	$C_{oss}$		---	677	---	
Reverse transfer capacitance	$C_{riss}$		---	370	---	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 20\text{V}, V_{GS}=10\text{V}, I_D = 20\text{ A}$	---	15	---	ns
Rise time	$t_r$		---	17	---	
Turn-off delay time	$t_{d(off)}$		---	52	---	
Fall time	$t_f$		---	23	---	
Gate resistance	$R_g$	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, F=1\text{MHz}$	---	2.12	---	$\Omega$
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DS}=20\text{ V}, I_D=100\text{A},$ $V_{GS}= 10\text{ V}$	---	36.4	---	nC
Gate to drain charge	$Q_{gd}$		---	37.3	---	
Gate charge total	$Q_g$		---	139	---	
<b>Drain-Source diode characteristics and Maximum Ratings</b>						
Continuous Source Current	$I_S$		---	---	120	A
Pulsed Source Current <sup>4)</sup>	$I_{SM}$		---	---	480	A
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0\text{V}, I_S=50\text{A}, T_J=25^\circ\text{C}$	---	---	1.2	V
Reverse Recovery Time	$t_{rr}$	$I_S=100\text{A}, di/dt=100\text{A}/\mu\text{s},$ $T_J=25^\circ\text{C}$	---	42	---	ns
Reverse Recovery Charge	$Q_{rr}$		---	120	---	nC

**Notes:**

- 1: The maximum junction current rating is package limited.
- 2: Repetitive Rating: Pulse width limited by maximum junction temperature.
- 3:  $V_{DD}=20\text{V}, V_{GS}=10\text{V}, L=1\text{mH}, I_{AS}=45.6\text{A}, R_G=25\Omega,$  Starting  $T_J=25^\circ\text{C}$ .
- 4: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s},$  Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics Diagrams**

Figure 1. Typ. Output Characteristics

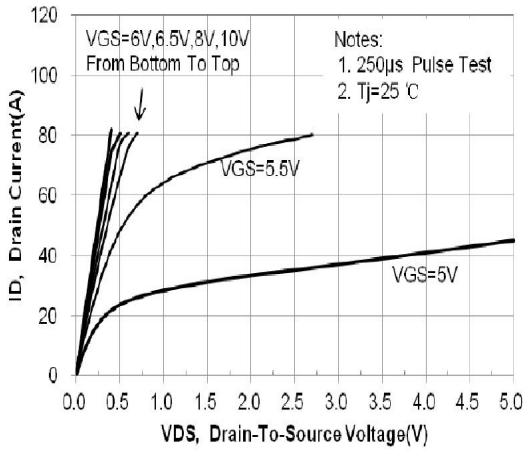


Figure 2. Transfer Characteristics

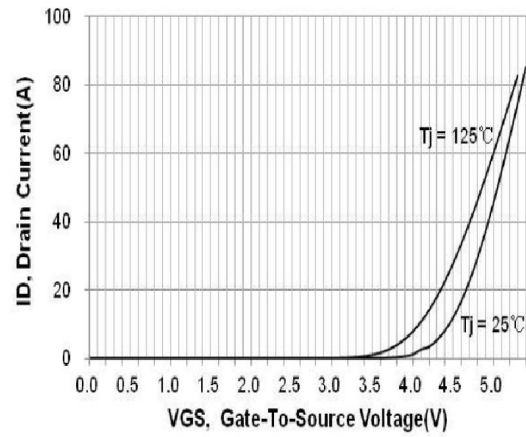


Figure 3. Capacitance Characteristics

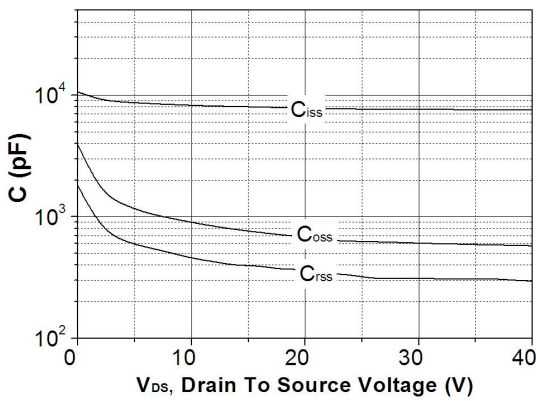


Figure 4. Gate Charge Waveform

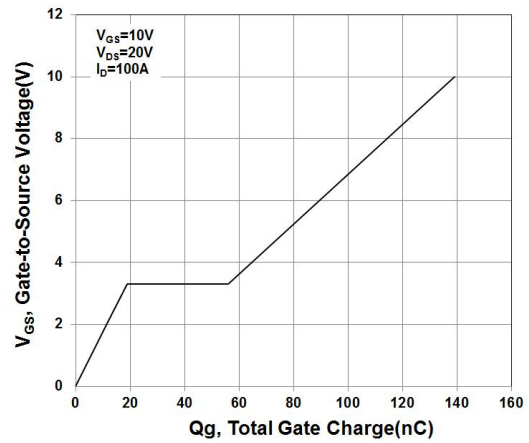


Figure 5. Body-Diode Characteristics

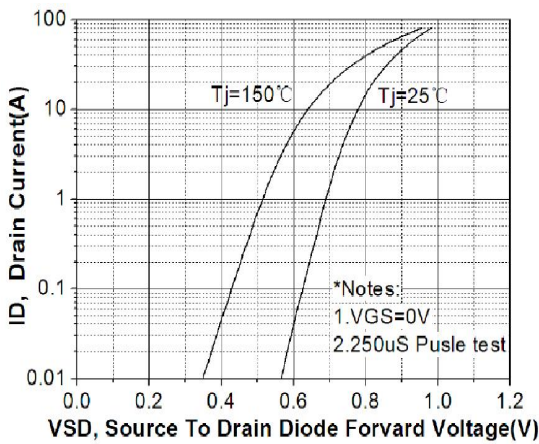


Figure 6. Normalized Maximum Transient Thermal Impedance (RthJC)

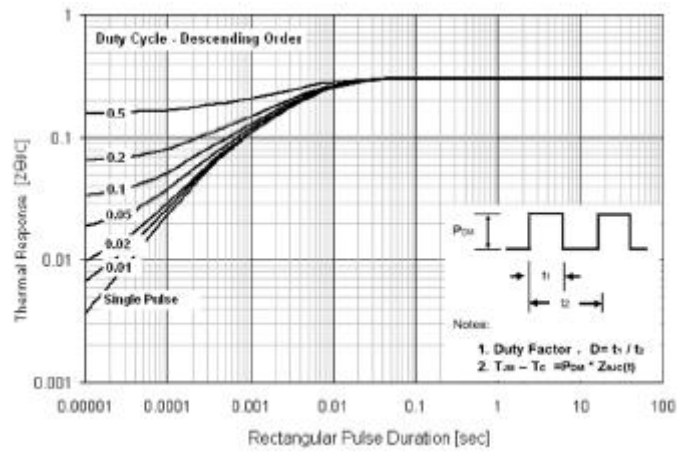
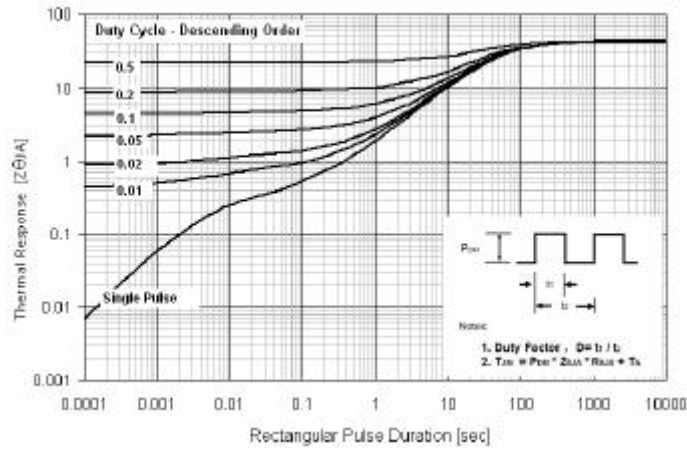


Figure 7. Normalized Maximum Transient Thermal Impedance (RthJA)



**Test Circuit & Waveform**

Figure 8. Gate Charge Test Circuit & Waveform

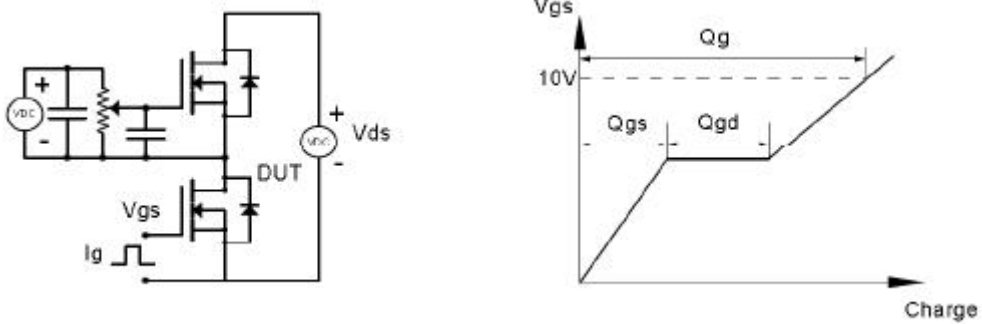


Figure 9. Resistive Switching Test Circuit & Waveforms

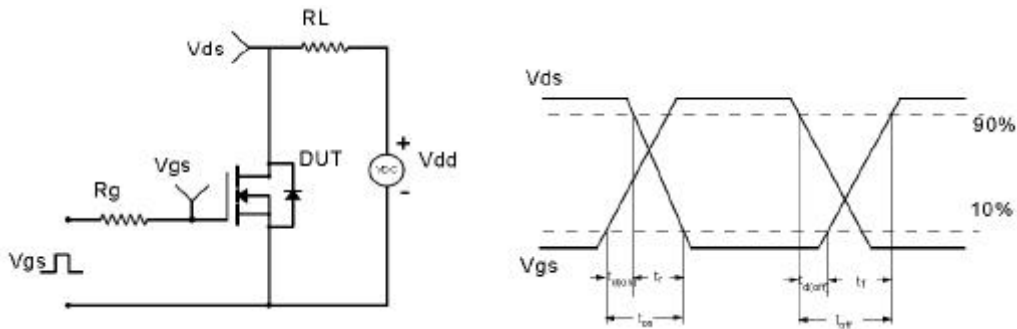


Figure 10. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

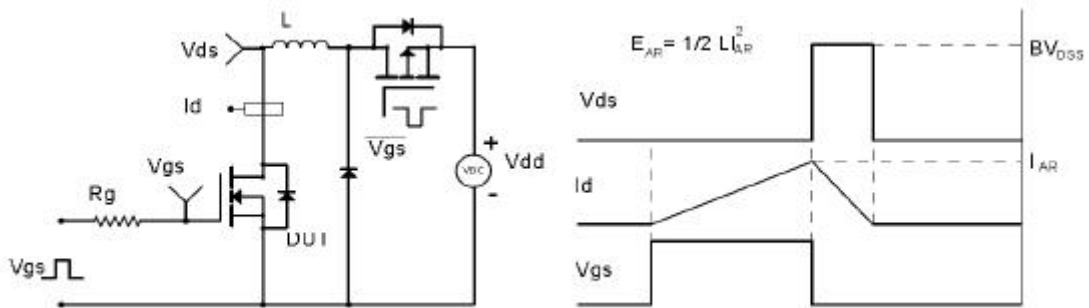
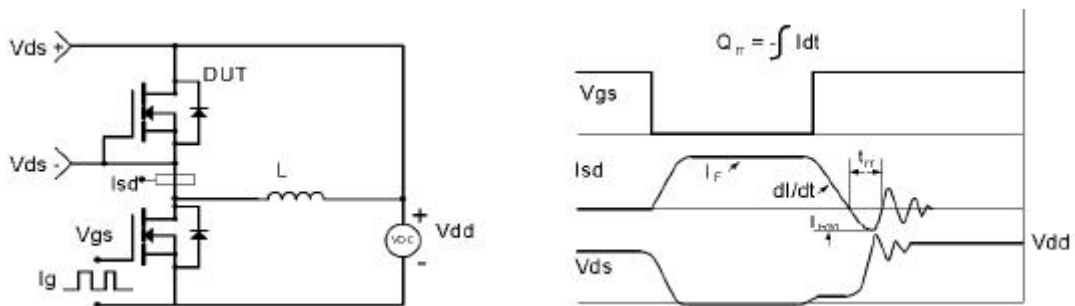
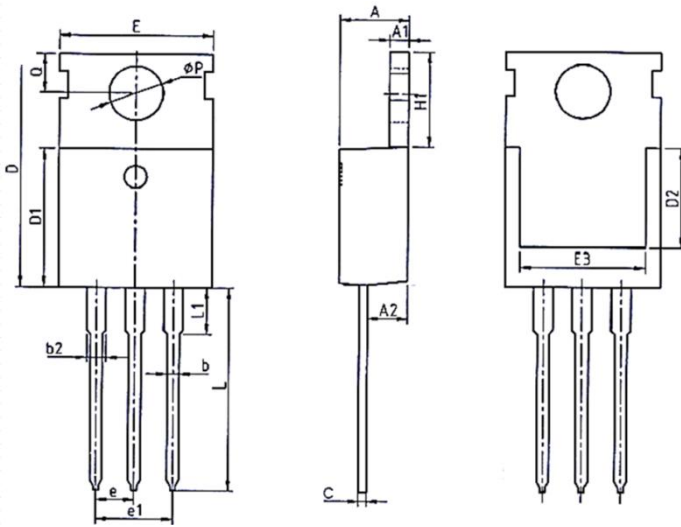


Figure 11. Diode Recovery Circuit & Waveform

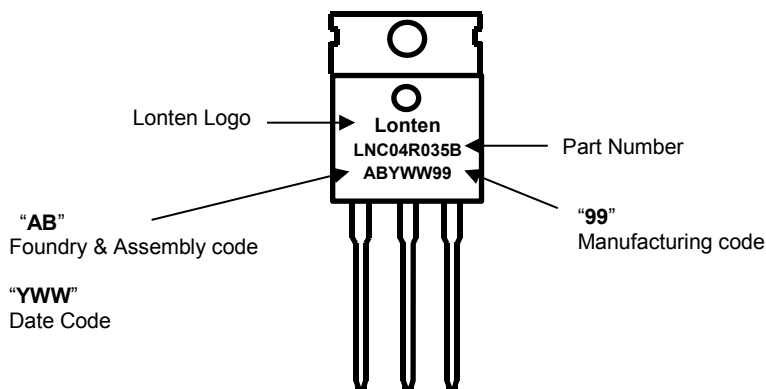


**Mechanical Dimensions for TO-220**

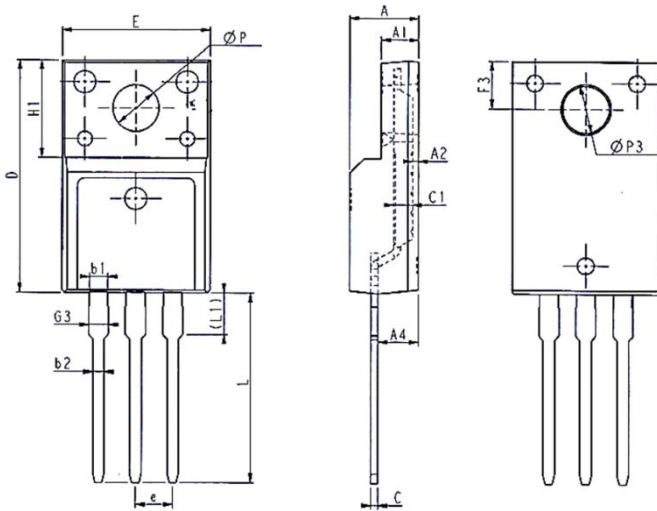


COMMON DIMENSIONS						
SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.37	4.57	4.70	0.172	0.180	0.185
A1	1.25	1.30	1.40	0.049	0.051	0.055
A2	2.20	2.40	2.60	0.087	0.094	0.102
b	0.70	0.80	0.95	0.028	0.031	0.037
b2	1.17	1.27	1.47	0.046	0.050	0.058
c	0.45	0.50	0.60	0.018	0.020	0.024
D	15.10	15.60	16.10	0.594	0.614	0.634
D1	8.80	9.10	9.40	0.346	0.358	0.370
D2	5.50	-	-	0.217	-	-
E	9.70	10.00	10.30	0.382	0.394	0.406
E3	7.00	-	-	0.276	-	-
e	2.54BCS			0.1BSC		
e1	5.08BCS			0.2REF		
H1	6.25	6.50	6.85	0.246	0.256	0.270
L	12.75	13.50	13.80	0.502	0.531	0.543
L1	-	3.10	3.40	-	0.122	0.134
ØP	3.40	3.60	3.80	0.134	0.142	0.150
Q	2.60	2.80	3.00	0.102	0.110	0.118

**TO-220 Part Marking Information**

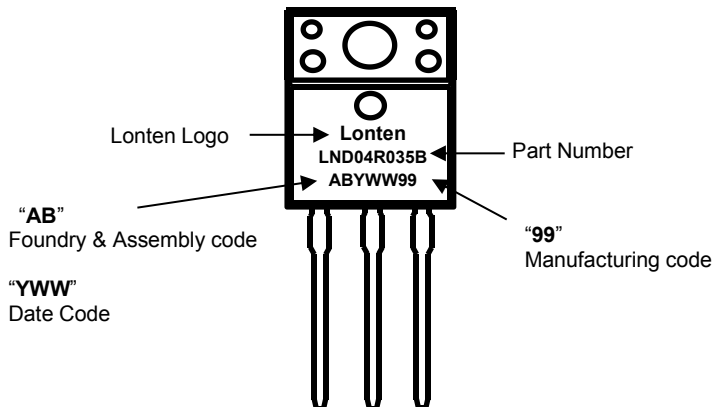


**Mechanical Dimensions for TO-220MF**



COMMON DIMENSIONS						
SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
E	9.96	10.16	10.36	0.392	0.400	0.408
A	4.50	4.70	4.90	0.177	0.185	0.193
A1	2.34	2.54	2.74	0.092	0.100	0.108
A2	0.30	0.45	0.60	0.012	0.018	0.024
A4	2.56	2.76	2.96	0.101	0.109	0.117
c	0.40	0.50	0.65	0.016	0.020	0.026
c1	1.20	1.30	1.35	0.047	0.051	0.053
D	15.57	15.87	16.17	0.613	0.625	0.637
H1	6.70REF			0.264REF		
e	2.54BSC			0.1BSC		
L	12.68	12.98	13.28	0.499	0.511	0.523
L1	2.88	3.03	3.18	0.113	0.119	0.125
ØP	3.03	3.18	3.38	0.119	0.125	0.133
ØP3	3.15	3.45	3.65	0.124	0.136	0.144
F3	3.15	3.30	3.45	0.124	0.130	0.136
G3	1.25	1.35	1.55	0.049	0.053	0.061
b1	1.18	1.28	1.43	0.046	0.050	0.056
b2	0.70	0.80	0.95	0.028	0.031	0.037

**TO-220MF Part Marking Information**



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