

## Lonten N-channel 60V, 60A, 11mΩ 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>◆ 60V,60A,<math>R_{DS(ON),max}=11m\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;">60V</td> </tr> <tr> <td style="padding: 2px;"><math>R_{DS(on),max}@V_{GS}=10V</math></td> <td style="padding: 2px;">11mΩ</td> </tr> <tr> <td style="padding: 2px;"><math>I_D</math></td> <td style="padding: 2px;">60A</td> </tr> </table> <p><b>Pin Configuration</b></p> <div style="text-align: center;"> </div> <p style="text-align: center;">N-Channel MOSFET</p>	$V_{DSS}$	60V	$R_{DS(on),max}@V_{GS}=10V$	11mΩ	$I_D$	60A
$V_{DSS}$	60V						
$R_{DS(on),max}@V_{GS}=10V$	11mΩ						
$I_D$	60A						

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	60	V
Continuous drain current ( $T_C = 25^\circ C$ )	$I_D$	60	A
Continuous drain current ( $T_C = 100^\circ C$ )		39	A
Pulsed drain current <sup>1)</sup>	$I_{DM}$	240	A
Gate-Source voltage	$V_{GSS}$	$\pm 20$	V
Avalanche energy <sup>2)</sup>	$E_{AS}$	132	mJ
Power Dissipation ( $T_C = 25^\circ C$ )	$P_D$	83	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	$R_{\theta JC}$	1.5	$^\circ C/W$

**Package Marking and Ordering Information**

Device	Device Package	Marking
LNC06R110	TO-220	LNC06R110
LNE06R110	TO-263	LNE06R110

**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	$BV_{DSS}$	$V_{GS}=0\text{ V}, I_D=250\mu\text{A}$	60	---	---	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1	1.6	2.5	V
Drain-source leakage current	$I_{DSS}$	$V_{DS}=60\text{V}, V_{GS}=0\text{V}, T_J = 25^\circ\text{C}$	---	---	1	$\mu\text{A}$
		$V_{DS}=48\text{V}, V_{GS}=0\text{V}, T_J = 125^\circ\text{C}$	---	---	30	$\mu\text{A}$
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	$R_{DS(on)}$	$V_{GS}=10\text{V}, I_D=20\text{A}$	---	8	11	m $\Omega$
		$V_{GS}=4.5\text{V}, I_D=10\text{A}$	---	11	14	m $\Omega$
Forward transconductance	$g_{fs}$	$V_{DS} = 5\text{V}, I_D=20\text{A}$	---	38	---	S
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V},$ $F = 1\text{MHz}$	---	2767	---	pF
Output capacitance	$C_{oss}$		---	209	---	
Reverse transfer capacitance	$C_{rss}$		---	162	---	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 30\text{V}, V_{GS}=10\text{V}, I_D = 25\text{A}$	---	17	---	ns
Rise time	$t_r$		---	167.5	---	
Turn-off delay time	$t_{d(off)}$		---	315	---	
Fall time	$t_f$		---	73.5	---	
Gate resistance	$R_g$	$V_{GS}=0\text{V}, V_{DS}=0\text{V}, F=1\text{MHz}$	---	1.7	---	$\Omega$
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DS}=48\text{V}, I_D=25\text{A},$ $V_{GS}= 10\text{V}$	---	11.2	---	nC
Gate to drain charge	$Q_{gd}$		---	12.6	---	
Gate charge total	$Q_g$		---	55	---	
<b>Drain-Source diode characteristics and Maximum Ratings</b>						
Continuous Source Current	$I_S$		---	---	60	A
Pulsed Source Current <sup>3)</sup>	$I_{SM}$		---	---	240	A
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0\text{V}, I_S=20\text{A}, T_J=25^\circ\text{C}$	---	---	1.2	V
Reverse Recovery Time	$t_{rr}$	$I_S=25\text{A}, di/dt=100\text{A}/\mu\text{s}, T_J=25^\circ\text{C}$	---	29.6	---	ns
Reverse Recovery Charge	$Q_{rr}$		---	40.5	---	nC

**Notes:**

1: Repetitive Rating: Pulse width limited by maximum junction temperature.

 2:  $V_{DD}=25\text{V}, V_{GS}=10\text{V}, L=0.5\text{mH}, I_{AS}=23\text{A}, R_G=25\Omega, \text{Starting } T_J=25^\circ\text{C}.$ 

 3: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics Diagrams**

Figure 1. Typ. Output Characteristics

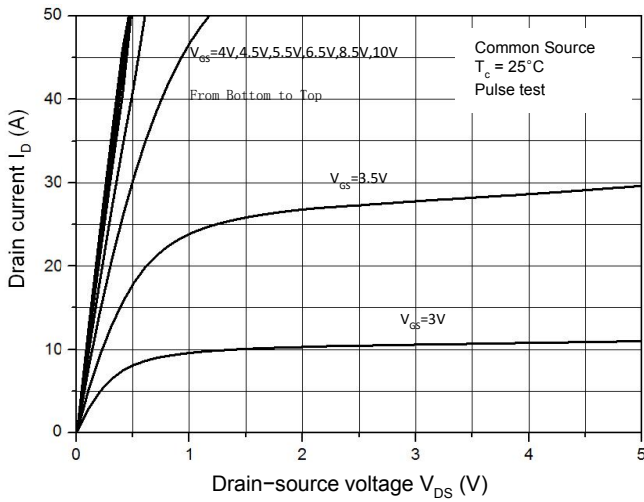


Figure 2. Transfer Characteristics

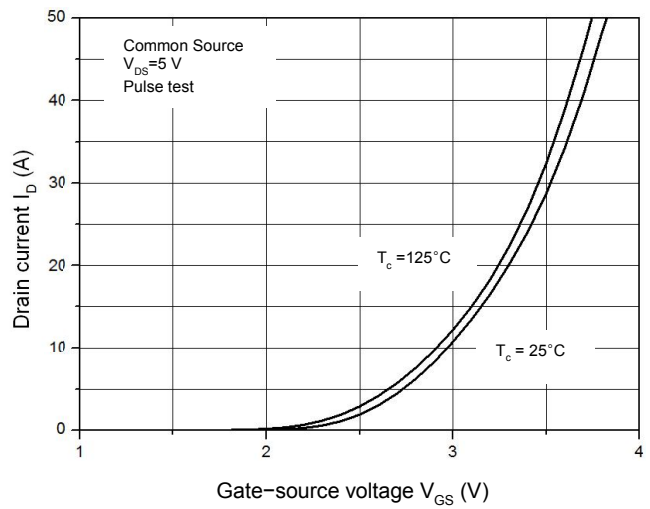


Figure 3. Capacitance Characteristics

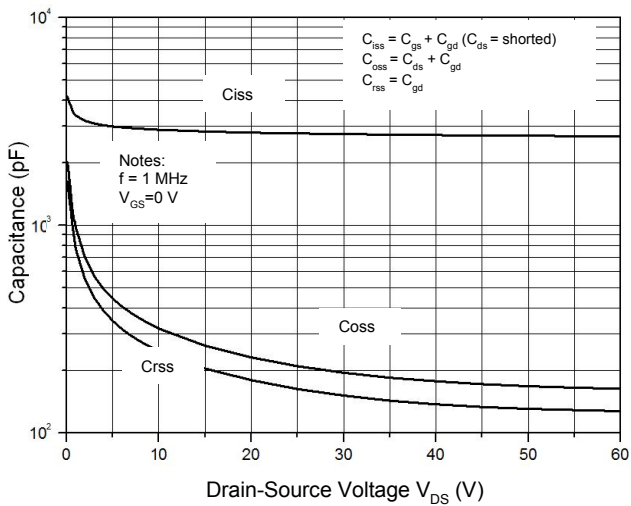


Figure 4. Gate Charge Waveform

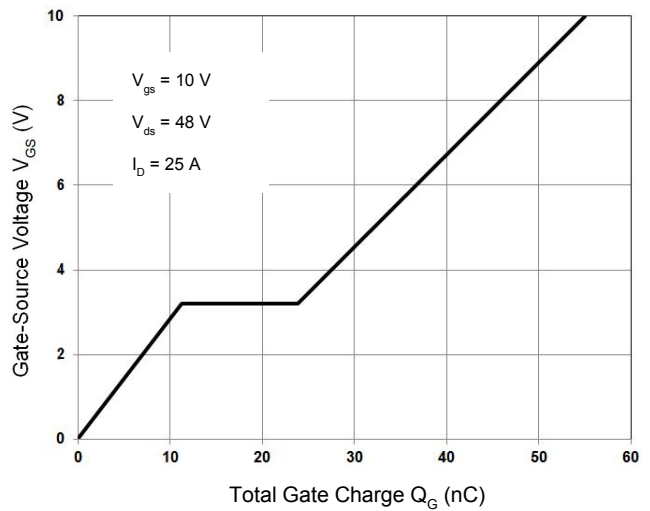


Figure 5. Body-Diode Characteristics

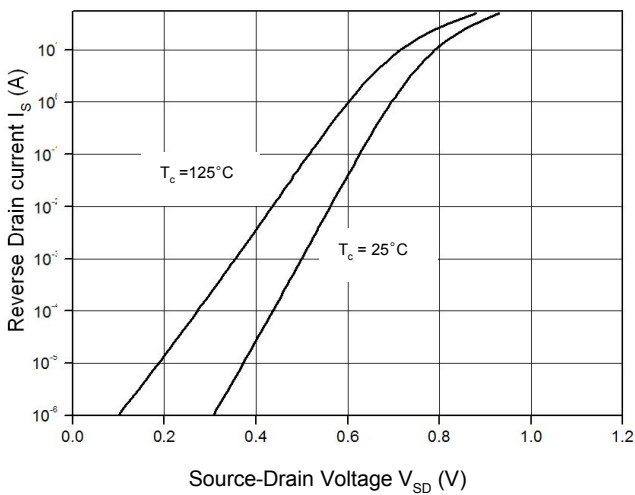


Figure 6. Rds(on)-Drain Current

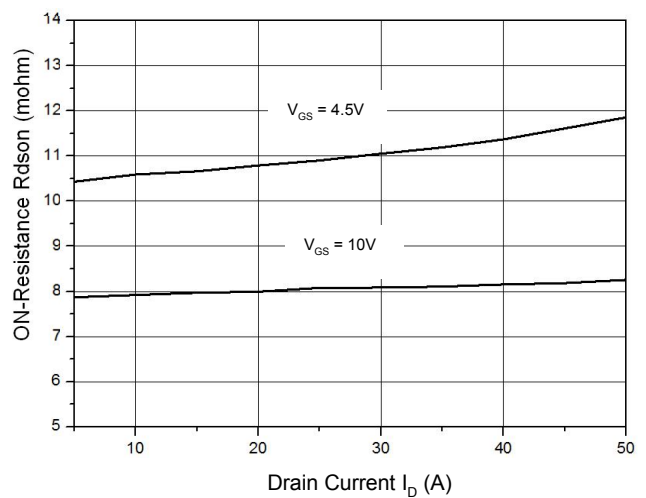


Figure 7. Rdson-Junction Temperature(°C)

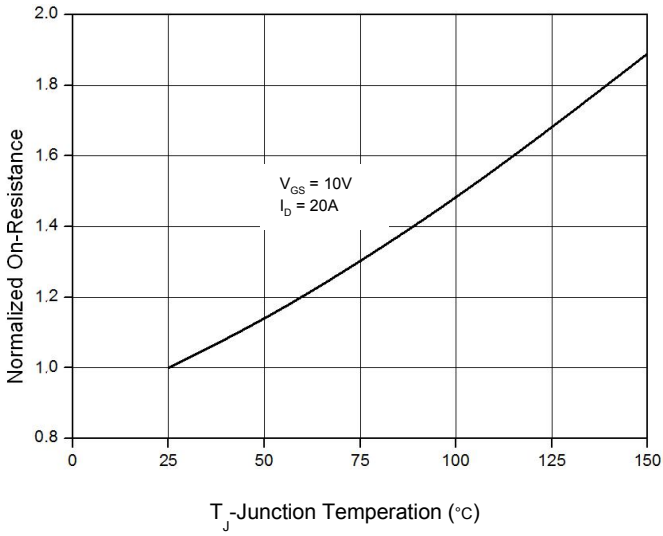


Figure 8. Maximum Safe Operating Area

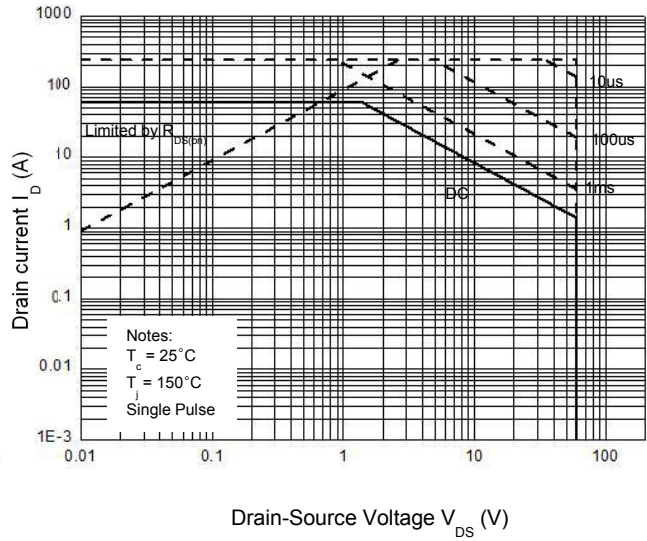
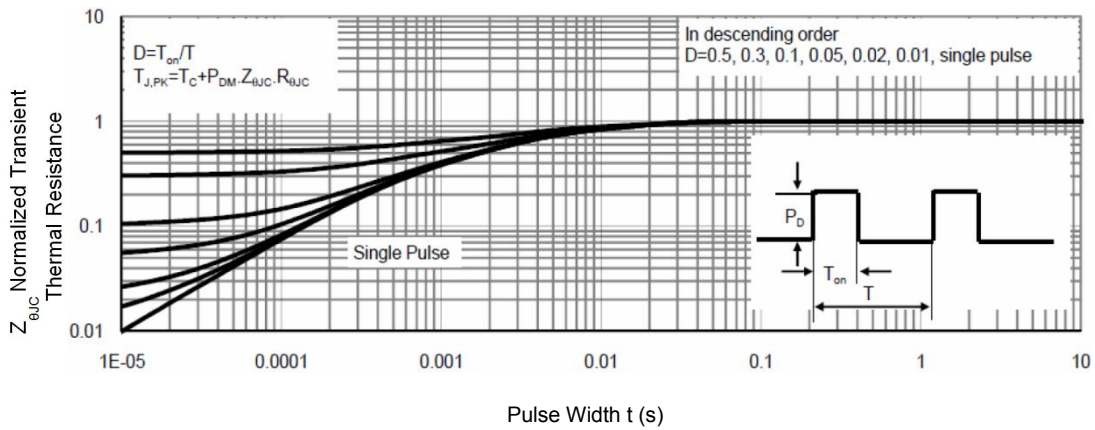


Figure 6. Normalized Maximum Transient Thermal Impedance (RthJC)



**Test Circuit & Waveform**

Figure 8. Gate Charge Test Circuit & Waveform

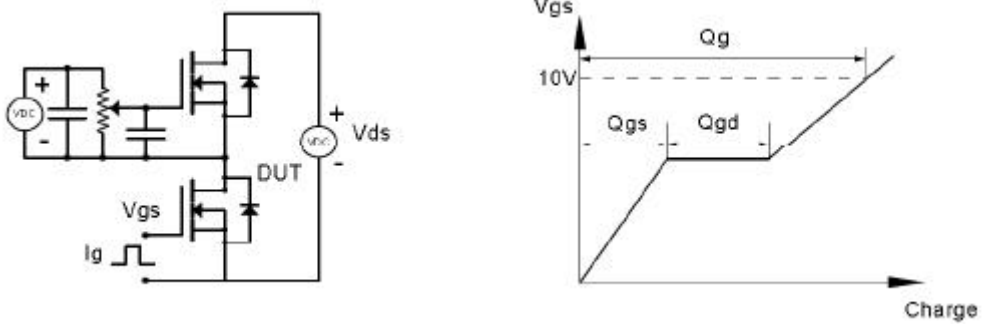


Figure 9. Resistive Switching Test Circuit & Waveforms

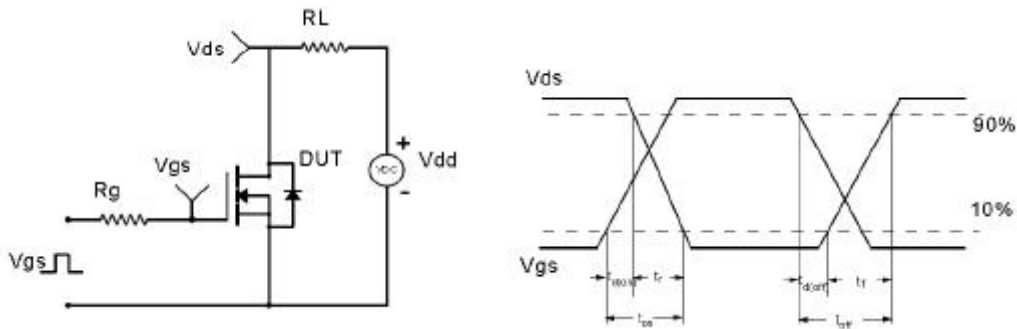


Figure 10. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

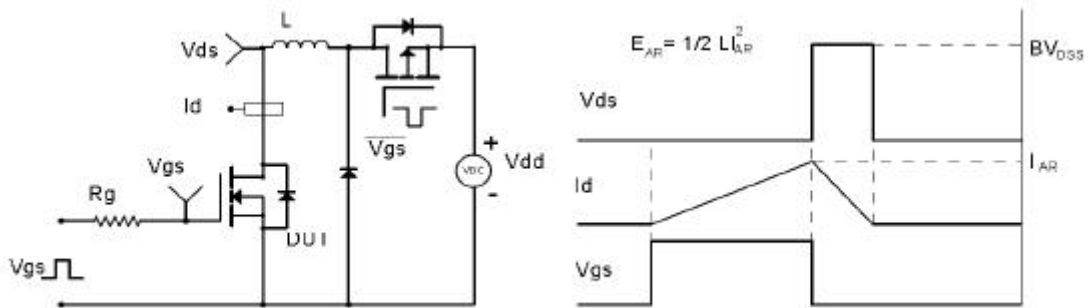
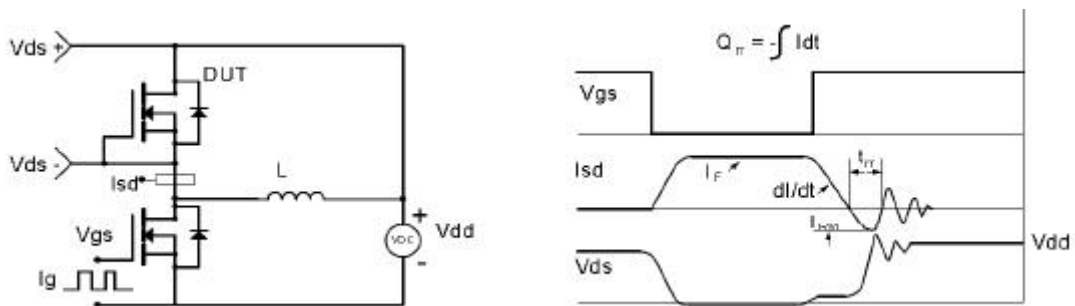
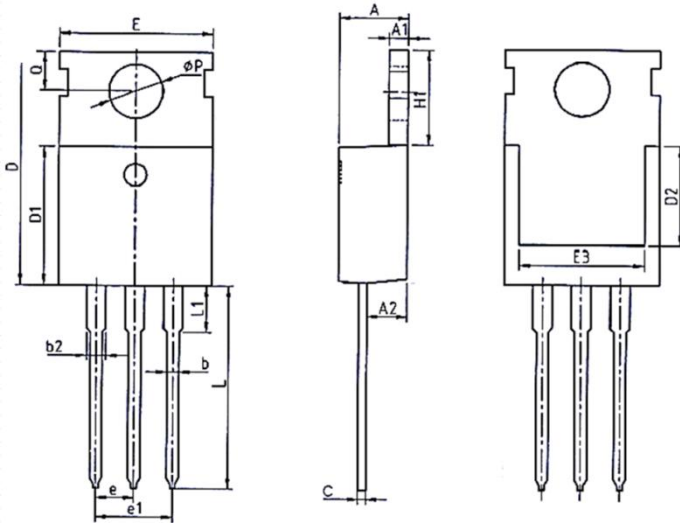


Figure 11. Diode Recovery Circuit & Waveform

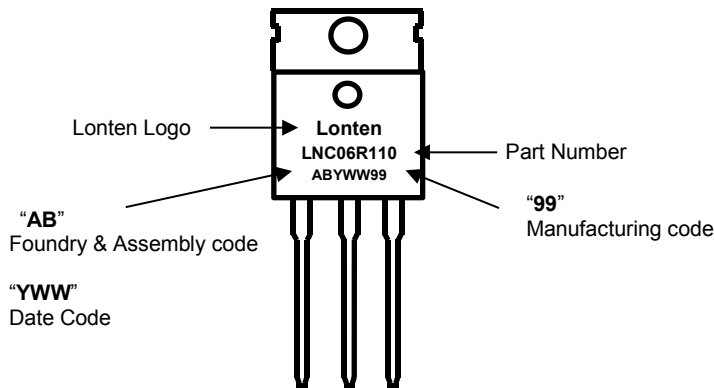


**TO-220 PACKAGE INFORMATION**

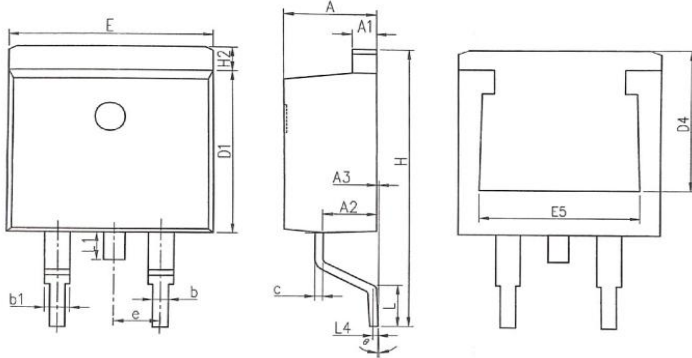


COMMON DIMENSIONS						
SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.37	4.57	4.70	0.172	0.180	0.185
A1	1.25	1.30	1.40	0.049	0.051	0.055
A2	2.20	2.40	2.60	0.087	0.094	0.102
b	0.70	0.80	0.95	0.028	0.031	0.037
b2	1.17	1.27	1.47	0.046	0.050	0.058
c	0.45	0.50	0.60	0.018	0.020	0.024
D	15.10	15.60	16.10	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**

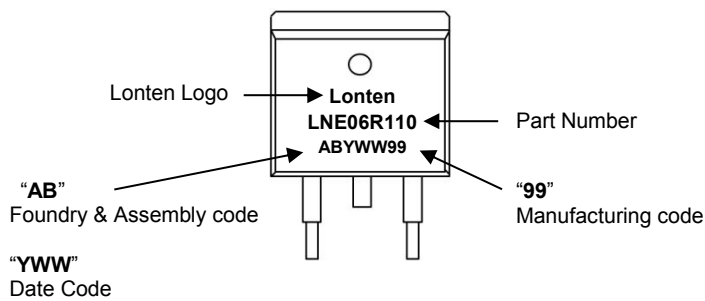


**TO-263 PACKAGE INFORMATION**



COMMON DIMENSIONS						
SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.37	4.57	4.77	0.172	0.180	0.188
A1	1.22	1.27	1.42	0.048	0.050	0.056
A2	2.49	2.69	2.89	0.098	0.106	0.114
A3	0.00	0.13	0.25	0.000	0.005	0.010
b	0.70	0.81	0.96	0.028	0.032	0.038
b1	1.17	1.27	1.47	0.046	0.050	0.058
c	0.30	0.38	0.53	0.012	0.015	0.021
D1	8.50	8.70	8.90	0.335	0.343	0.350
D4	6.60	—	—	0.260	—	—
E	9.86	10.16	10.36	0.388	0.400	0.408
E5	7.06	—	—	0.278	—	—
e	2.54 BSC			0.100 BSC		
H	14.70	15.10	15.50	0.579	0.594	0.610
H2	1.07	1.27	1.47	0.042	0.050	0.058
L	2.00	2.30	2.60	0.079	0.091	0.102
L1	1.40	1.55	1.70	0.055	0.061	0.067
L4	0.25 BSC			0.010 BSC		
θ	0°	5°	9°	0°	5°	9°

**TO-263 Part Marking Information**



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