
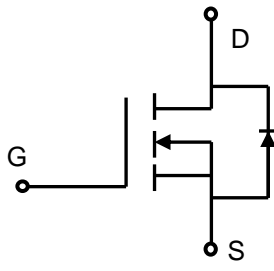



## Lonten N-channel 600V, 20A, 0.17Ω LonFET™ Power MOSFET

<p><b>Description</b> LonFET™ Power MOSFET is fabricated using advanced super junction technology. The resulting device has extremely low on resistance, making it especially suitable for applications which require superior power density and outstanding efficiency.</p> <p><b>Features</b></p> <ul style="list-style-type: none"> <li>◆ Ultra low <math>R_{DS(on)}</math></li> <li>◆ Ultra low gate charge (typ. <math>Q_g = 39\text{nC}</math>)</li> <li>◆ 100% UIS tested</li> <li>◆ RoHS compliant</li> </ul> <p><b>Applications</b></p> <ul style="list-style-type: none"> <li>◆ Power factor correction (PFC).</li> <li>◆ Switched mode power supplies (SMPS).</li> <li>◆ Uninterruptible power supply (UPS).</li> </ul>	<p><b>Product Summary</b></p> <p><math>V_{DS} @ T_{j,max}</math>      650V</p> <p><math>R_{DS(on),max}</math>      0.17Ω</p> <p><math>I_{DM}</math>                      60A</p> <p><math>Q_{g,typ}</math>                    39nC</p> <div style="text-align: center;">  <p>TO-247      TO-220MF</p> </div> <div style="text-align: center;">  <p>N-Channel MOSFET</p> </div> <div style="text-align: right;">  </div>
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### Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	600	V
Continuous drain current ( $T_C = 25^\circ\text{C}$ )	$I_D$	20	A
( $T_C = 100^\circ\text{C}$ )		13	A
Pulsed drain current <sup>1)</sup>	$I_{DM}$	60	A
Gate-Source voltage	$V_{GSS}$	$\pm 30$	V
Avalanche energy, single pulse <sup>2)</sup>	$E_{AS}$	600	mJ
Avalanche energy, repetitive <sup>3)</sup>	$E_{AR}$	0.4	mJ
Avalanche current, repetitive <sup>3)</sup>	$I_{AR}$	20	A
Power Dissipation TO-247 ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	$P_D$	205	W
		1.64	W/ $^\circ\text{C}$
Power Dissipation TO-220MF ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$		34	W
		0.28	W/ $^\circ\text{C}$
Mounting torque To-220MF ( M2.5 screws )		50	Ncm
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$
Continuous diode forward current	$I_S$	20	A
Diode pulse current	$I_{S,pulse}$	60	A

### Thermal Characteristics TO-247

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.61	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	60	$^{\circ}C/W$
Soldering temperature, wavesoldering only allowed at leads. (1.6mm from case for 10s)	$T_{sold}$	260	$^{\circ}C$

### Thermal Characteristics TO-220MF

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	3.6	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	80	$^{\circ}C/W$
Soldering temperature, wavesoldering only allowed at leads. (1.6mm from case for 10s)	$T_{sold}$	260	$^{\circ}C$

### Package Marking and Ordering Information

Device	Device Package	Marking	Units/Tube	Units/Real
LSB60R170GF	TO-247	LSB60R170GF	30	
LSD60R170GF	TO-220MF	LSD60R170GF	50	

### Electrical Characteristics $T_c = 25^{\circ}C$ unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static characteristics</b>						
Drain-source breakdown voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=0.25mA$	600	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=0.25mA$	2	3.5	5	V
Drain cut-off current	$I_{DSS}$	$V_{DS}=600V, V_{GS}=0V,$ $T_j = 25^{\circ}C$ $T_j = 125^{\circ}C$	-	-	1	$\mu A$
Gate leakage current, Forward	$I_{GSSF}$	$V_{GS}=30V, V_{DS}=0V$	-	-	100	nA
Gate leakage current, Reverse	$I_{GSSR}$	$V_{GS}=-30V, V_{DS}=0V$	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=10A$ $T_j = 25^{\circ}C$ $T_j = 150^{\circ}C$	-	0.14	0.17	$\Omega$
Gate resistance	$R_G$	$f=1MHz, \text{open drain}$	-	4.4	-	$\Omega$
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS} = 25V, V_{GS} = 0V,$ $f = 1MHz$	-	2637	-	pF
Output capacitance	$C_{oss}$		-	1250	-	
Reverse transfer capacitance	$C_{rss}$		-	17	-	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 380V, I_D = 10A$ $R_G = 4.7\Omega, V_{GS}=10V$	-	25	-	ns
Rise time	$t_r$		-	35	-	
Turn-off delay time	$t_{d(off)}$		-	97	-	
Fall time	$t_f$		-	12	-	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DD}=480V, I_D=10A,$ $V_{GS}=0 \text{ to } 10V$	-	10.3	-	nC
Gate to drain charge	$Q_{gd}$		-	13.7	-	

Gate charge total	$Q_g$		-	39	-	
Gate plateau voltage	$V_{\text{plateau}}$		-	5.5	-	V
<b>Reverse diode characteristics</b>						
Diode forward voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_F=10\text{ A}$	-	-	1.2	V
Reverse recovery time	$t_{rr}$	$V_R=50\text{ V}, I_F=20\text{ A},$ $dI_F/dt=100\text{ A}/\mu\text{s}$	-	170	-	ns
Reverse recovery charge	$Q_{rr}$		-	20	-	$\mu\text{C}$
Peak reverse recovery current	$I_{rrm}$		-	16	-	A

**Notes:**

1. Limited by maximum junction temperature, maximum duty cycle is 0.75.
2.  $I_{AS} = 5\text{ A}$ ,  $V_{DD} = 60\text{ V}$ , Starting  $T_j = 25^\circ\text{C}$ .
3. Repetitive Rating: Pulse width limited by maximum junction temperature.

## Electrical Characteristics Diagrams

Figure 1. On-Region Characteristics

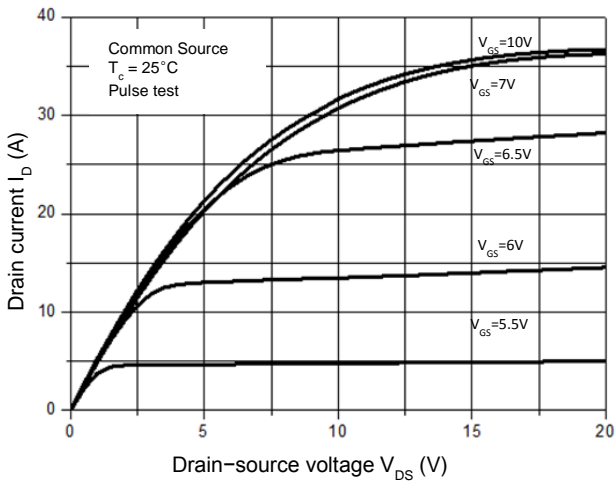


Figure 2. Transfer Characteristics

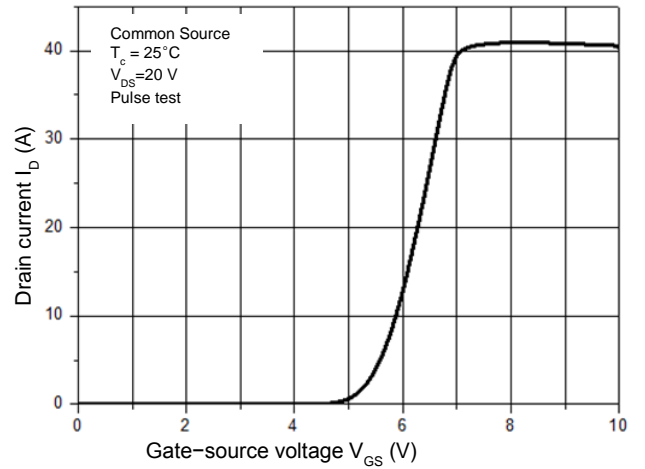


Figure 3. On-Resistance Variation vs. Drain Current

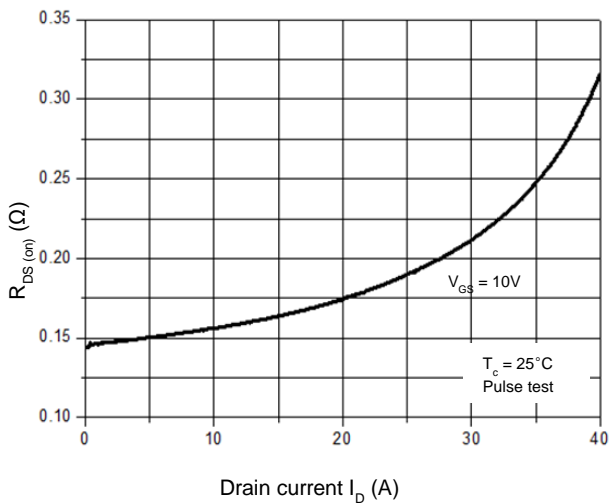


Figure 4. Threshold Voltage vs. Temperature

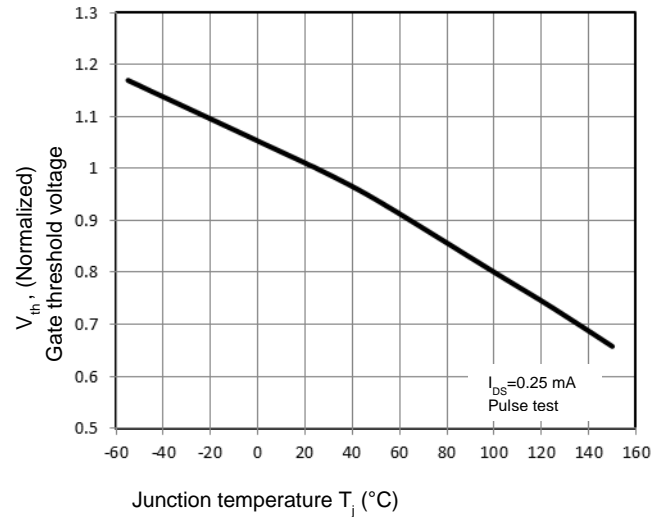


Figure 5. Breakdown Voltage vs. Temperature

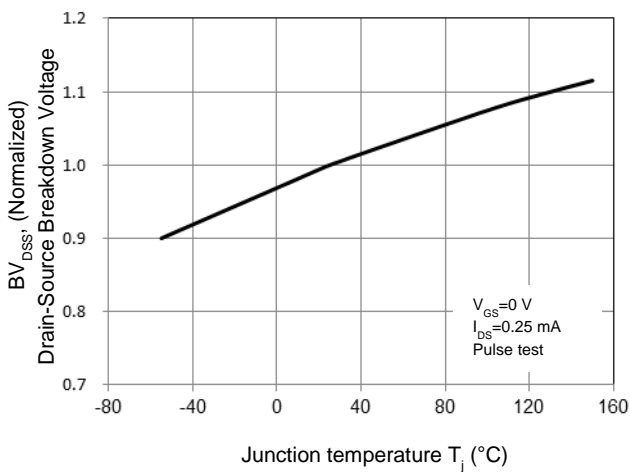


Figure 6. On-Resistance vs. Temperature

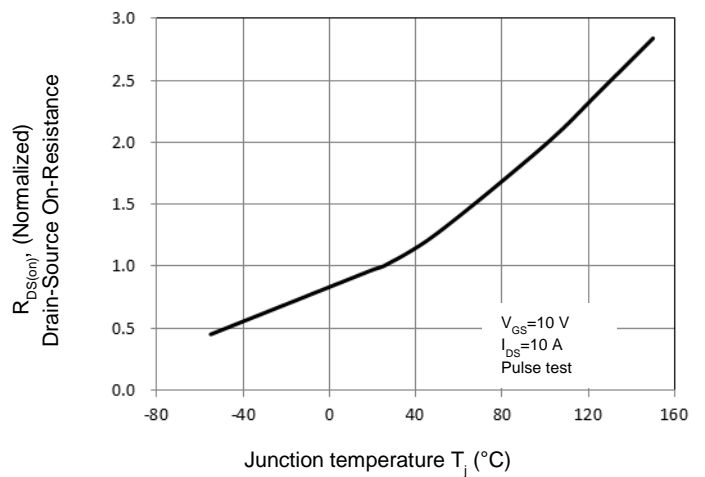


Figure 7. Capacitance Characteristics

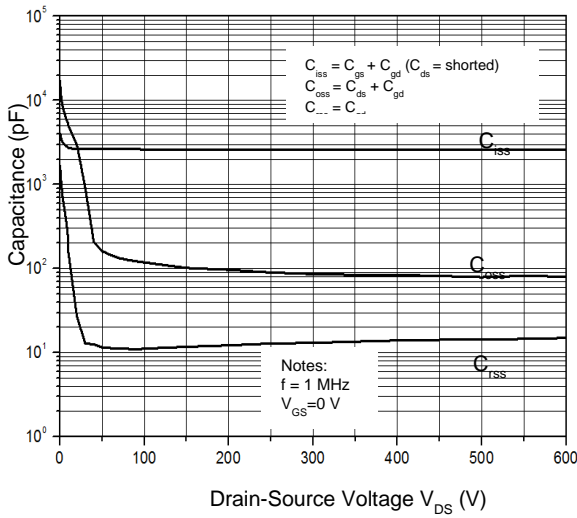


Figure 8. Gate Charge Characterist

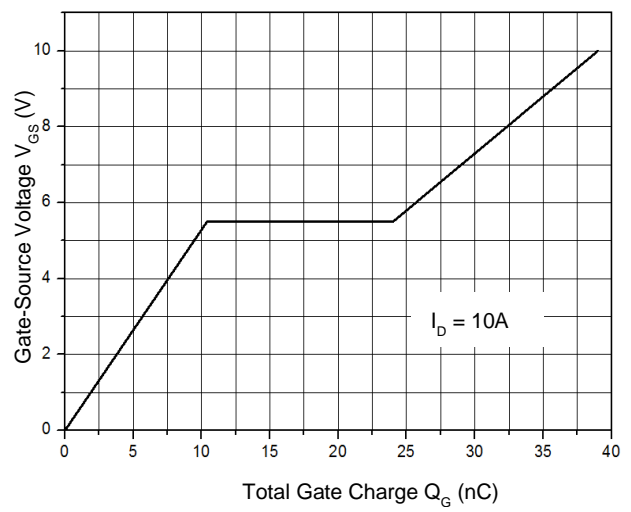


Figure 9.1 Maximum Safe Operating Area

TO-247

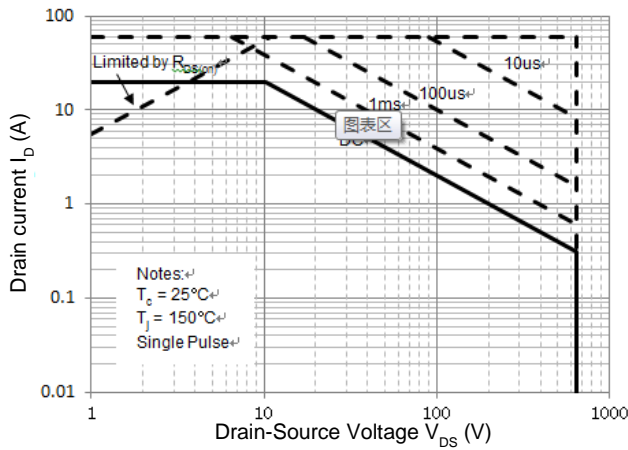


Figure 9.2 Maximum Safe Operating Area

TO-220MF

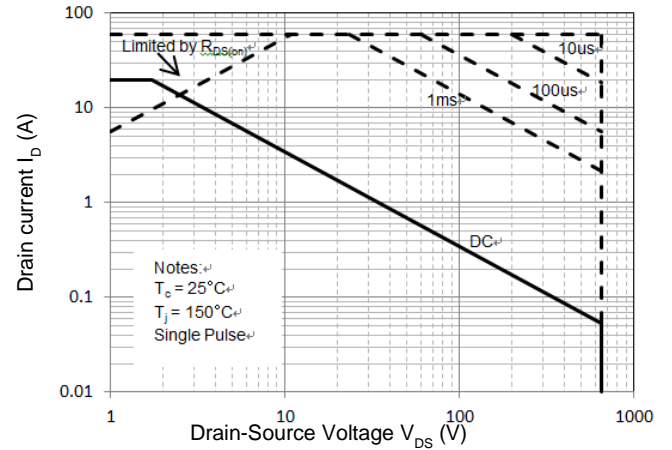


Figure 10.1 Power Dissipation vs. Temperature

TO-247

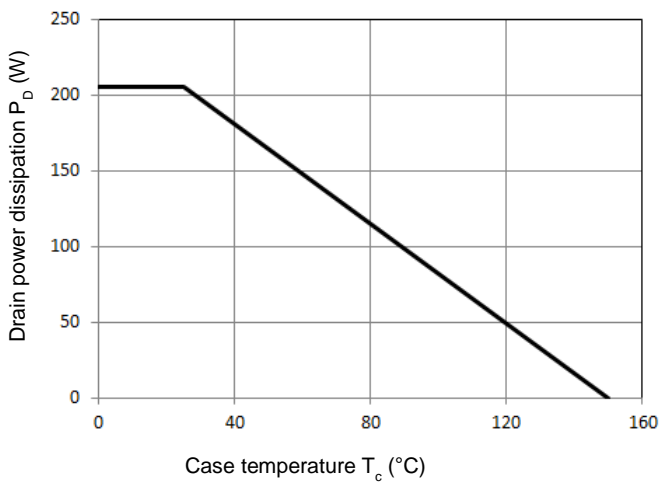


Figure 10.2 Power Dissipation vs. Temperature

TO-220MF

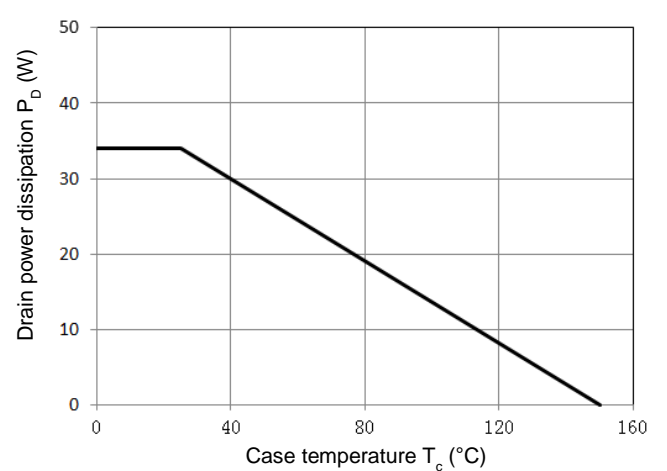


Figure 11.1 Transient Thermal Response Curve  
 TO-247

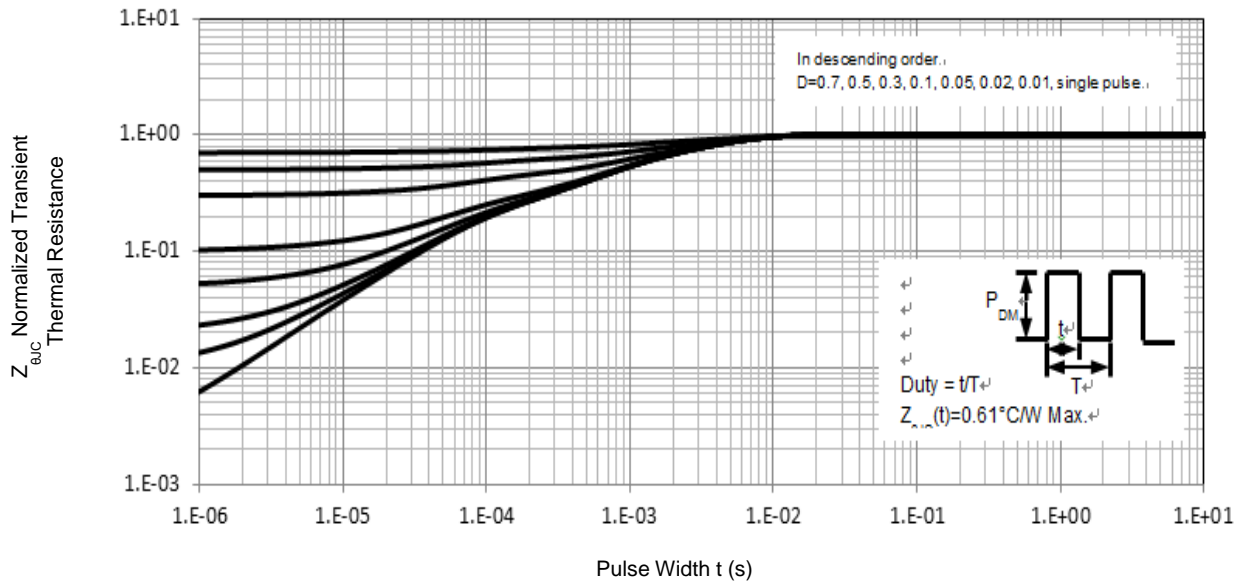
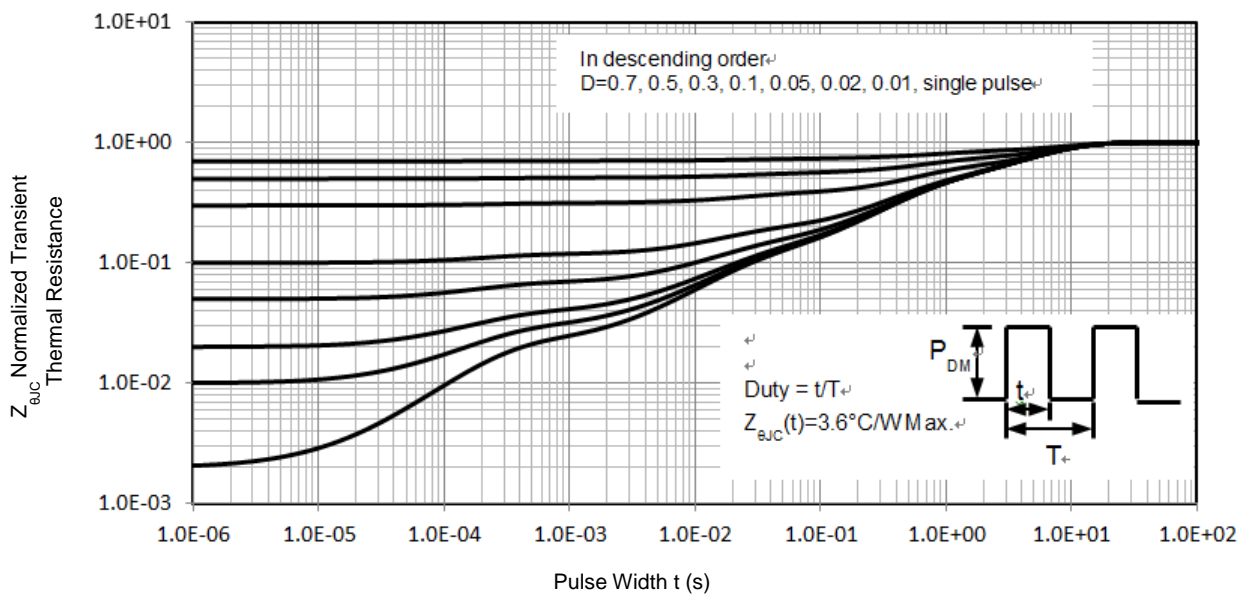
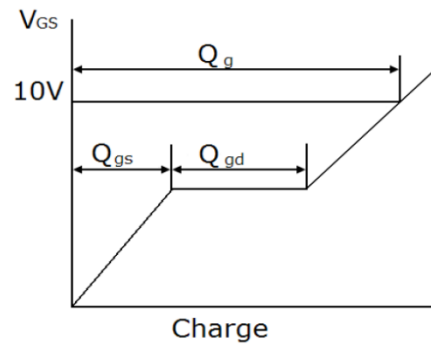
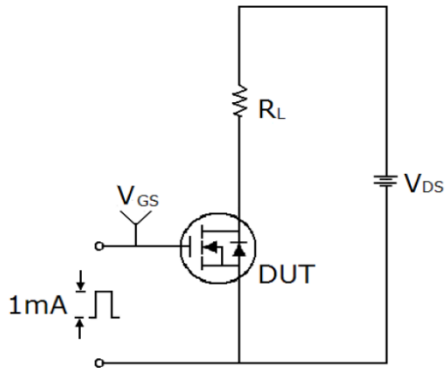


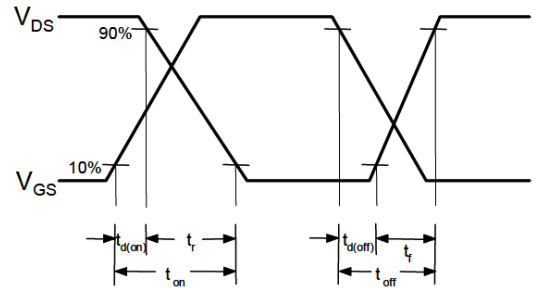
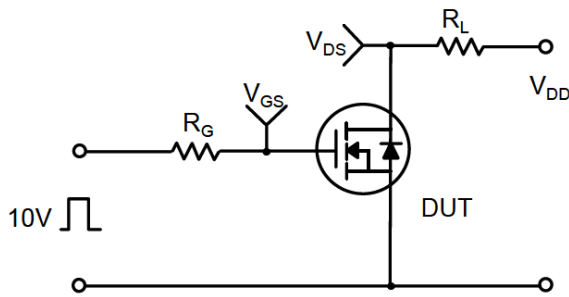
Figure 11.2 Transient Thermal Response Curve  
 TO-220MF



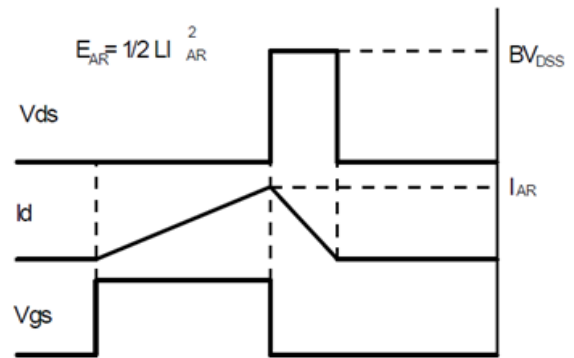
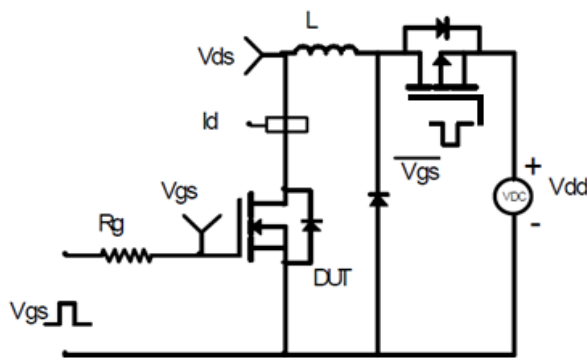
**Gate Charge Test Circuit & Waveform**



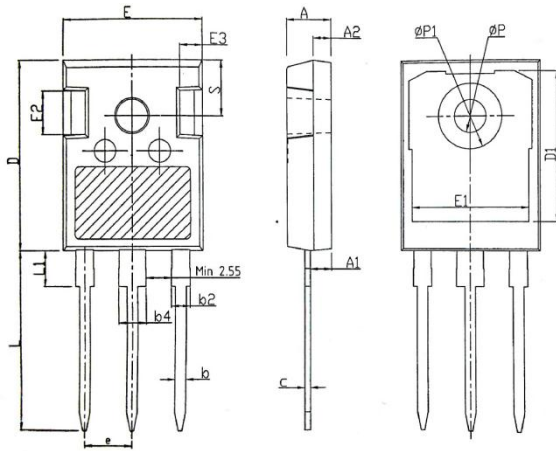
**Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**

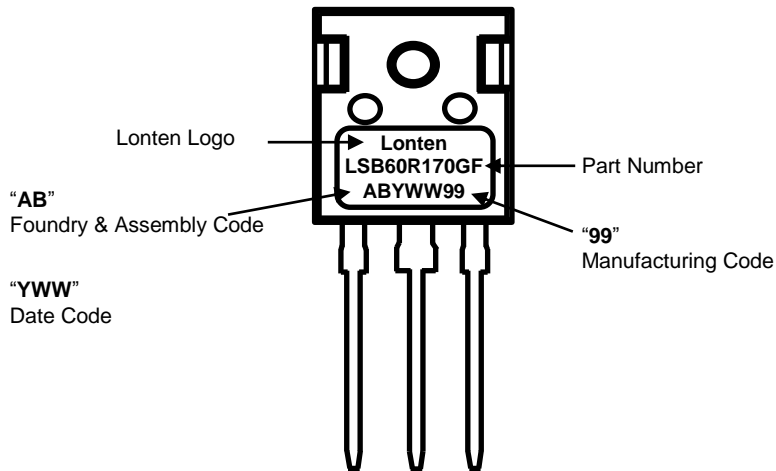


**Mechanical Dimensions for TO-247**



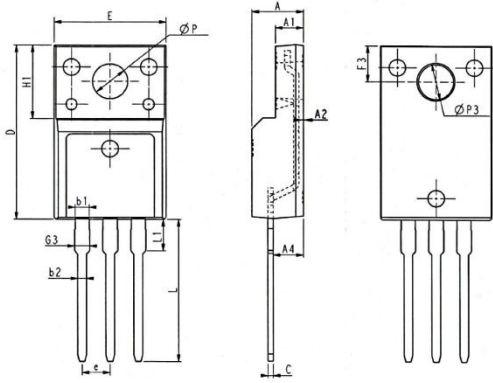
SYMBOL	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.21	2.41	2.59
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.80	21.00	21.30
D1	16.25	16.55	16.85
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.82	19.92	20.22
L1	—	—	4.30
ØP	3.40	3.60	3.80
ØP1	—	—	7.30
S	6.15BSC		

**TO-247 Part Marking Information**



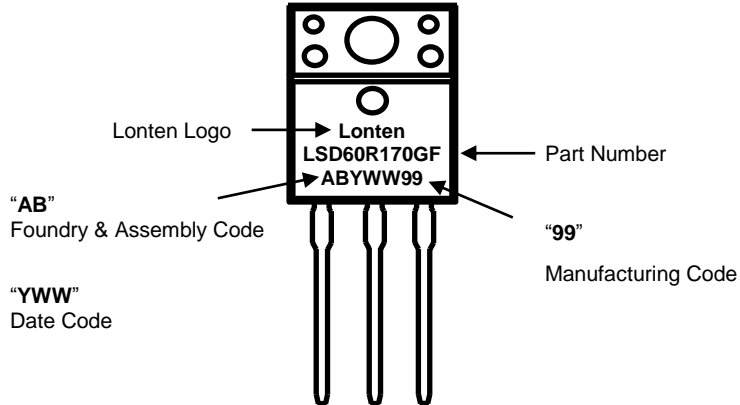


**Mechanical Dimensions for TO-220MF**



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	0.020	0.024
A4	2.65	2.76	2.96	0.104	0.109	0.117
C	0.40	0.50	0.65	0.016	0.020	0.026
D	15.57	15.87	16.17	0.613	0.625	0.637
H1	6.70REF			0.264REF		
e	2.54BSC			0.1BSC		
ØP	3.03	3.18	3.38	0.119	0.125	0.133
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
ØP3	3.15REF			0.124REF		
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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