

## Lonten N-channel 40V, 120A, 2.5mΩ Power MOSFET

<p><b>Description</b>                  These N-Channel enhancement mode power field effect transistors are using split gate 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} = 2.5m\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;">2.5mΩ</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="display: flex; justify-content: space-around; margin-top: 5px;"> <span>TO-220</span> <span>PPAK5 × 6</span> </p> </div> <div style="text-align: right; margin-top: 20px;"> <p style="margin-top: 5px;">N-Channel MOSFET</p> </div>	$V_{DSS}$	40V	$R_{DS(on),max} @ V_{GS}=10V$	2.5mΩ	$I_D$	120A
$V_{DSS}$	40V						
$R_{DS(on),max} @ V_{GS}=10V$	2.5mΩ						
$I_D$	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 ( $T_C = 100^\circ C$ )		81	A
Pulsed drain current <sup>2)</sup>	$I_{DM}$	360	A
Gate-Source voltage	$V_{GSS}$	±18	V
Avalanche energy <sup>3)</sup>	$E_{AS}$	225	mJ
Power Dissipation ( $T_C = 25^\circ C$ )	$P_D$	57.6	W
Storage Temperature Range	$T_{STG}$	-55 to +150	°C
Operating Junction Temperature Range	$T_J$	-55 to +150	°C

### Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.67	°C/W

**Package Marking and Ordering Information**

Device	Device Package	Marking
LSGN04R025	PPAK5X6	LSGN04R025
LSGC04R025	TO-220	LSGC04R025

**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	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1.0	---	2.2	V
Drain-source leakage current	$I_{DSS}$	$V_{DS}=40\text{ V}, V_{GS}=0\text{ V}, T_J=25^\circ\text{C}$	---	---	1	$\mu\text{A}$
Gate leakage current, Forward	$I_{GSSF}$	$V_{GS}=18\text{ V}, V_{DS}=0\text{ V}$	---	---	100	nA
Gate leakage current, Reverse	$I_{GSSR}$	$V_{GS}=-18\text{ V}, V_{DS}=0\text{ V}$	---	---	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	$V_{GS}=10\text{ V}, I_D=50\text{ A}$	---	---	2.5	m $\Omega$
		$V_{GS}=4.5\text{ V}, I_D=20\text{ A}$	---	---	5	m $\Omega$
Forward transconductance	$g_{fs}$	$V_{DS}=10\text{ V}, I_D=20\text{ A}$	---	131	---	S
<b>Dynamic characteristics</b>						
Input capacitance	$C_{iss}$	$V_{DS}=15\text{ V}, V_{GS}=0\text{ V},$ $F=1\text{ MHz}$	---	3210	---	pF
Output capacitance	$C_{oss}$		---	2130	---	
Reverse transfer capacitance	$C_{rss}$		---	343	---	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=15\text{ V}, V_{GS}=10\text{ V}, I_D=20\text{ A}$ $R_G=1.6\Omega$	---	9	---	ns
Rise time	$t_r$		---	4	---	
Turn-off delay time	$t_{d(off)}$		---	45	---	
Fall time	$t_f$		---	7	---	
<b>Gate charge characteristics</b>						
Gate to source charge	$Q_{gs}$	$V_{DS}=15\text{ V}, I_D=15\text{ A},$ $V_{GS}=10\text{ V}$	---	7	---	nC
Gate to drain charge	$Q_{gd}$		---	17.5	---	
Gate charge total	$Q_g$		---	67	---	
<b>Drain-Source diode characteristics and Maximum Ratings</b>						
Continuous Source Current	$I_S$		---	---	120	A
Pulsed Source Current <sup>4)</sup>	$I_{SM}$		---	---	360	A
Diode Forward Voltage	$V_{SD}$	$V_{GS}=0\text{ V}, I_S=40\text{ A}, T_J=25^\circ\text{C}$	---	0.85	1.2	V
Reverse Recovery Time	$t_{rr}$	$I_S=I_F, di/dt=100\text{ A}/\mu\text{s}, T_J=25^\circ\text{C}$ <sup>5)</sup>	---	---	26	ns
Reverse Recovery Charge	$Q_{rr}$		---	---	95	nC

**Notes:**

- 1: The maximum junction current rating is package limited.
- 2: Repetitive Rating: Pulse width limited by maximum junction temperature.
- 3:  $V_{DD}=23\text{ V}, V_{GS}=10\text{ V}, L=0.5\text{ mH}, I_{AS}=30\text{ A}, R_G=25\Omega$ , Starting  $T_J=25^\circ\text{C}$ .
- 4: Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$ .
- 5: Guaranteed by design, not subject to production.

**Electrical Characteristics Diagrams**

Fig 1: Output Characteristics

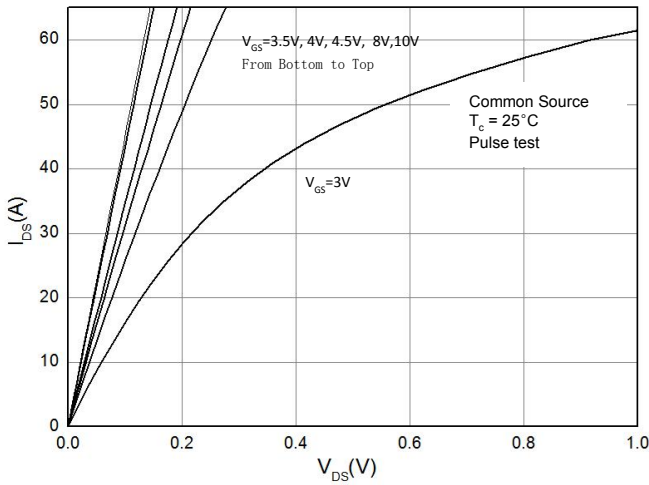


Fig 2: Transfer Characteristics

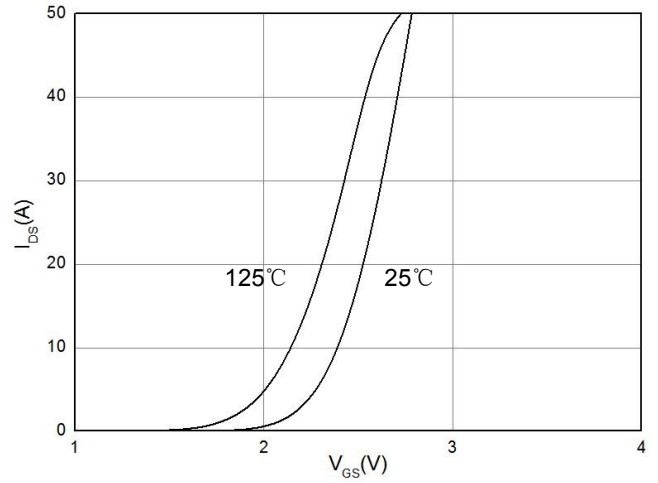


Figure 3. Capacitance Characteristics

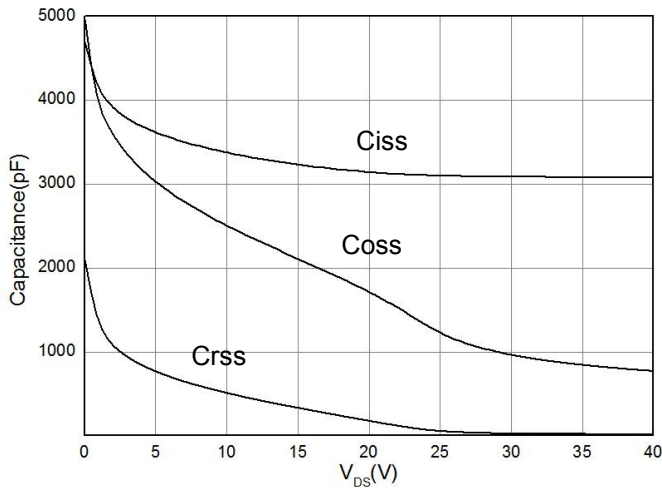


Figure 4. Gate Charge Waveform

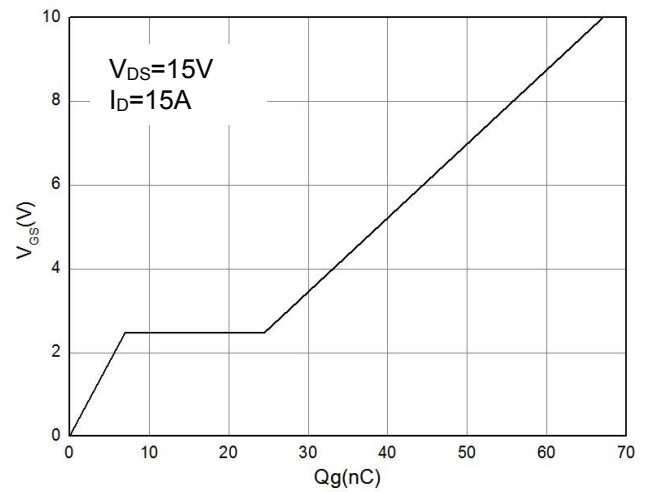


Figure 5. Body-Diode Characteristics

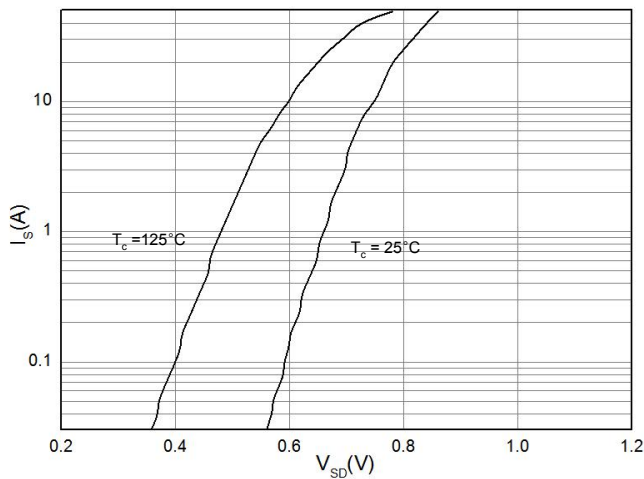


Figure 6. Rdson-Drain Current

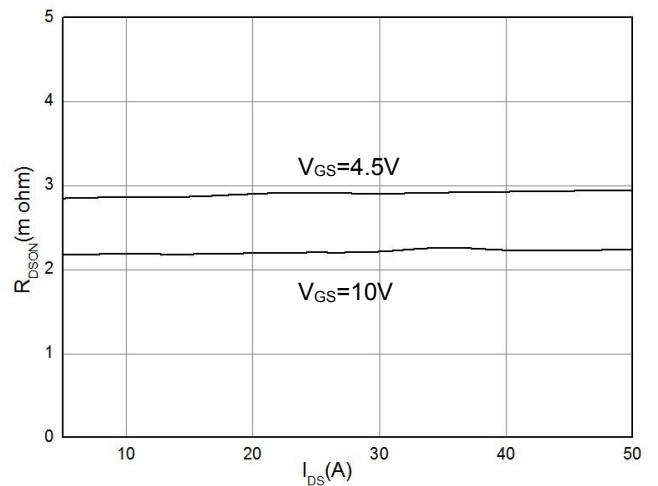


Fig 7: Rds(on) vs Gate Voltage

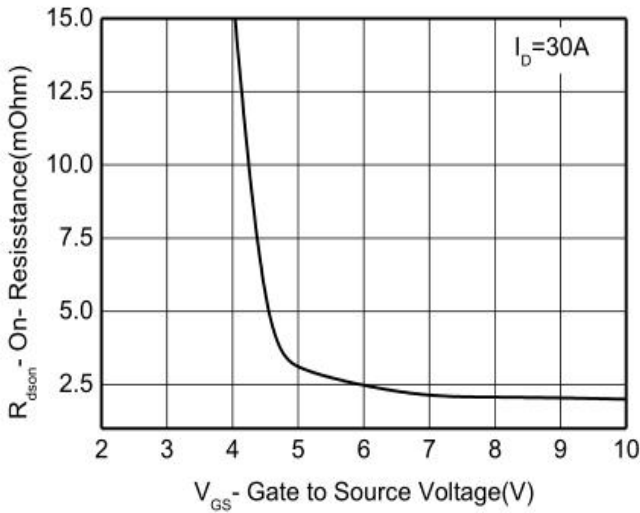


Fig 8: Rds(on)-Junction Temperature(°C)

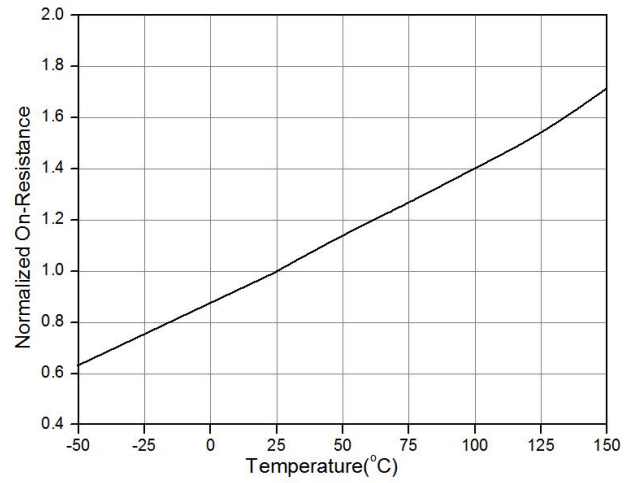


Figure 9. BVdss vs. Junction temperature

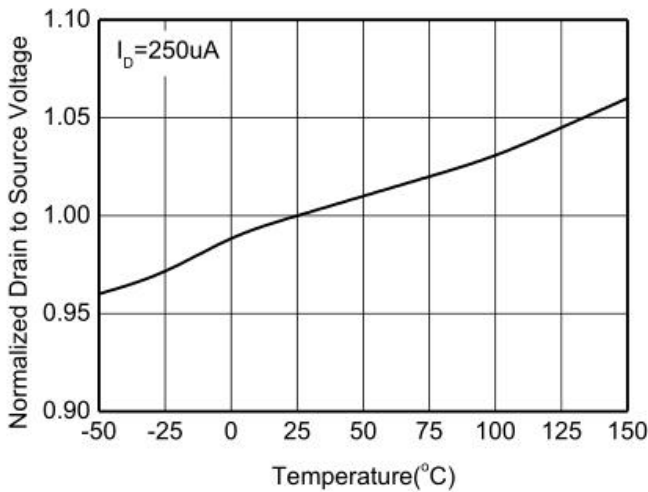


Figure 10. Maximum Safe Operating Area

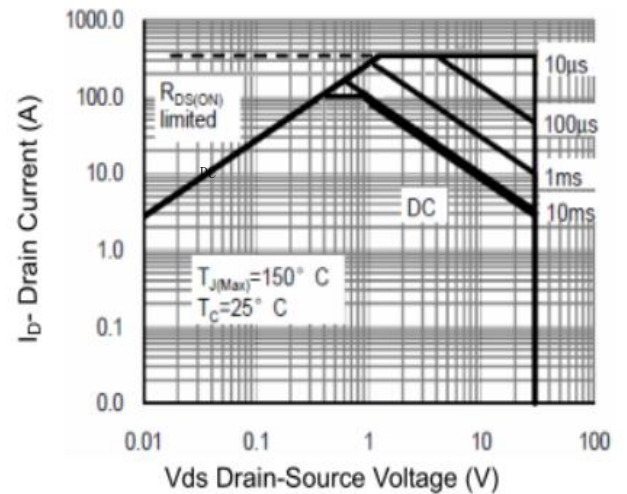
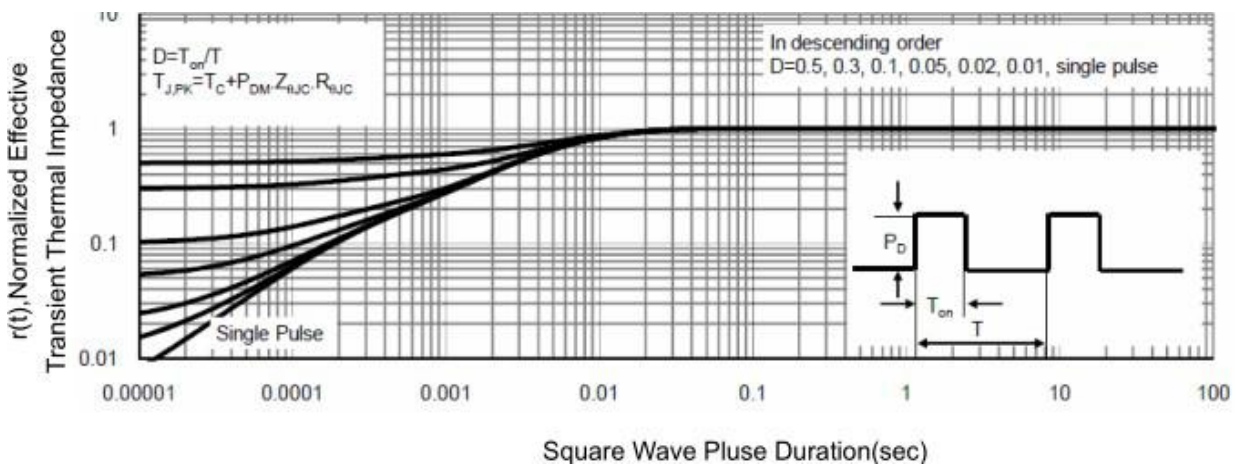


Figure 11. Normalized Maximum Transient Thermal Impedance (RthJC)



## Test Circuit & Waveform

Figure 12. Gate Charge Test Circuit & Waveform

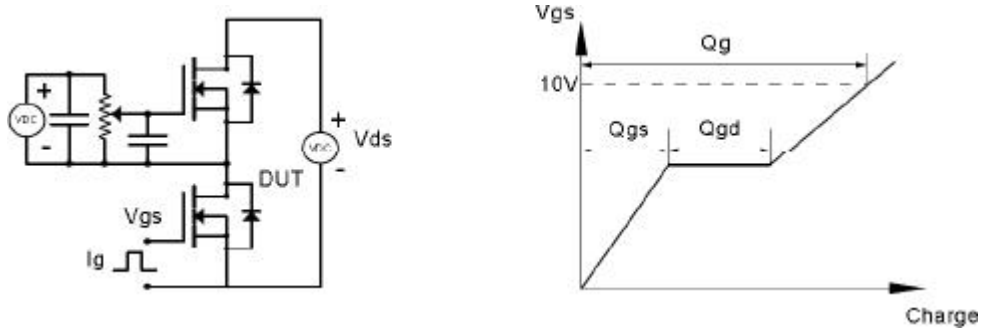


Figure 13. Resistive Switching Test Circuit & Waveforms

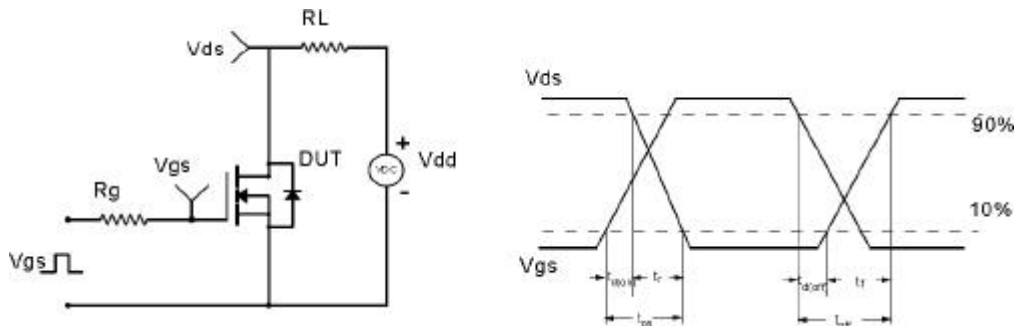


Figure 14. Unclamped Inductive Switching (UIS) Test Circuit & Waveform

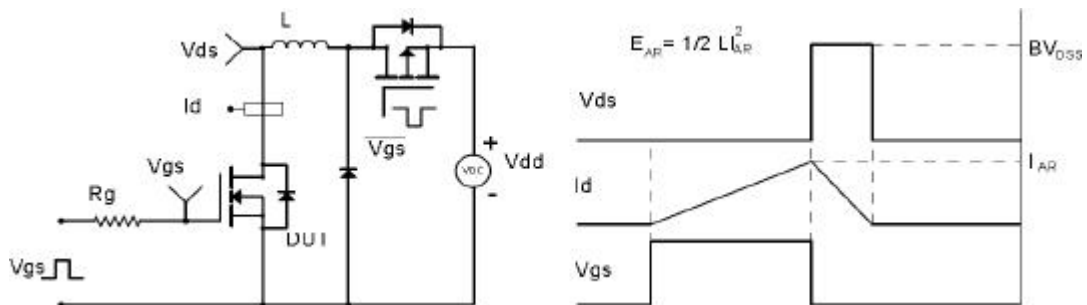
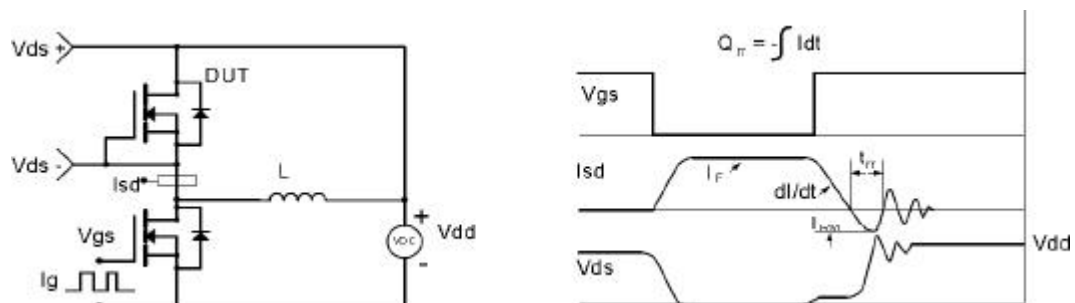
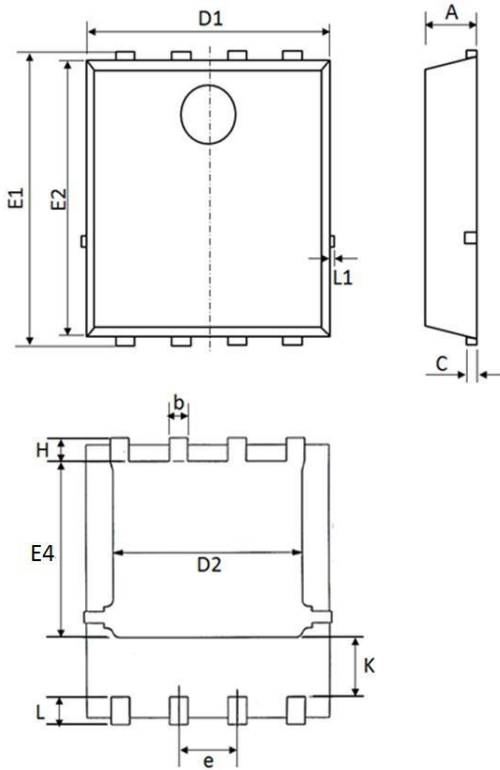


Figure 15. Diode Recovery Circuit & Waveform

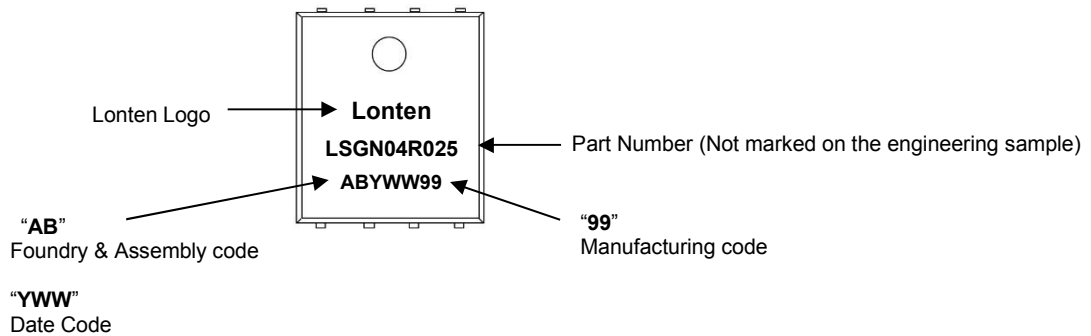


**Mechanical Dimensions for PPAK5×6**



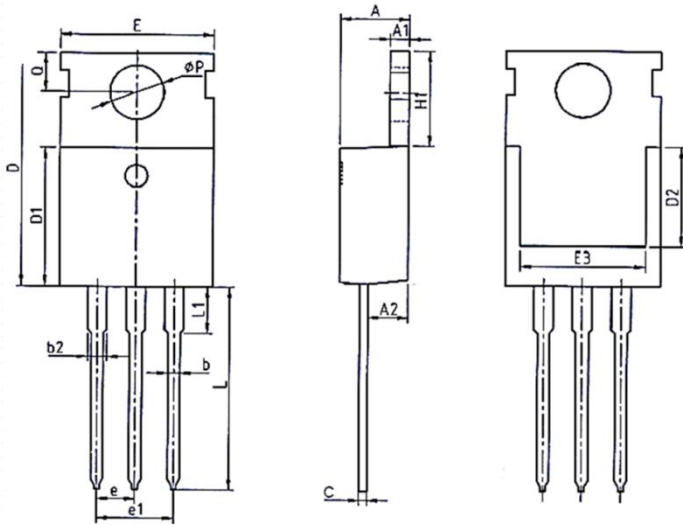
COMMON DIMENSIONS						
SYMBOL	MILLIMETERS			INCHS		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1	1.1	1.2	0.039	0.043	0.047
b	0.3	0.4	0.5	0.012	0.016	0.020
C	0.154	0.254	0.354	0.006	0.010	0.014
D1	5	5.2	5.4	0.197	0.205	0.213
D2	3.8	4.1	4.25	0.150	0.161	0.167
E1	5.95	6.15	6.35	0.234	0.242	0.250
E2	5.66	5.86	6.06	0.223	0.231	0.239
E4	3.52	3.72	3.92	0.139	0.146	0.154
e	1.27 BSC			0.050 BSC		
H	0.4	0.5	0.6	0.016	0.020	0.024
L	0.5	0.6	0.7	0.020	0.024	0.028
L1	-	-	0.12	-	-	0.005
K	1.14	1.29	1.44	0.045	0.051	0.057

**PPAK5×6 Part Marking Information**



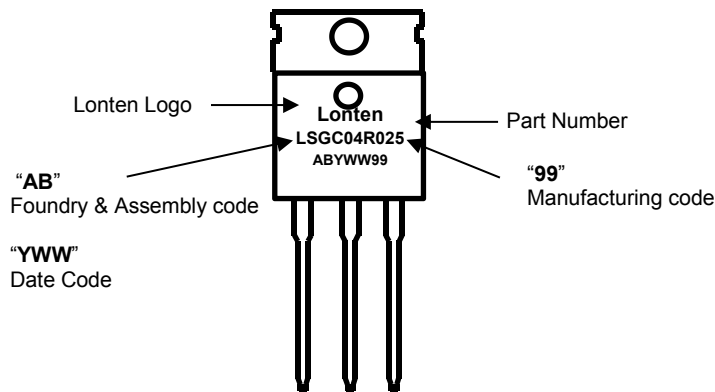
Calendar Year	Year Code	Calendar Week	Week Code
2018	G	Workweek 01	01
2019	H	Workweek 02	02
2020	I	Workweek 03	03
2021	J	Workweek 04	04
2022	K	Workweek 05	05
2023	L	Workweek 06	06
2024	M	.....	.....

**TO-220 PACKAGE INFORMATION**



SYMBOL	COMMON DIMENSIONS					
	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**



Calendar Year	Year Code	Calendar Week	Week Code
2018	G	Workweek 01	01
2019	H	Workweek 02	02
2020	I	Workweek 03	03
2021	J	Workweek 04	04
2022	K	Workweek 05	05
2023	L	Workweek 06	06
2024	M	.....	.....

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