

**650V N-CANNEL SUPER JUNCTION POWER MOSFET**

**GENERAL DESCRIPTION**

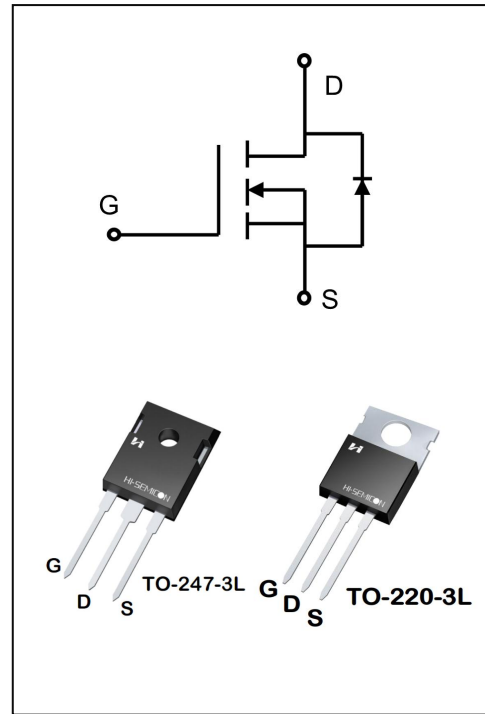
The Power MOSFET is fabricated using advanced super junction technology. The resulting device has extremely low on resistance, making it especially suitable for applications which require superior power density and outstanding efficiency.

**Features**

- ◆  $V_{DS}=650V, I_D=35A$
- ◆  $R_{DS(ON)}(TO-247-3L)$   
 TYP:81mΩ@ $V_{GS}=10V$   
 MAX:90mΩ
- ◆  $R_{DS(ON)}(TO-220-3L)$   
 TYP:89.2mΩ@ $V_{GS}=10V$   
 MAX:99mΩ

**Applications**

- ◆ Power facion correction (PFC)
- ◆ Switched mode power supplies (SMPS)
- ◆ Uninterruptible power supply (UPS)
- ◆ LED lighting power



**ORDERING INFORMATION**

Part No.	Package	Marking	Material	Packing
SCW65R090CF	TO-247-3L	SCW65R090CF	Pb free	Tube
SCP65R090CF	TO-220-3L	SCP65R090CF	Pb free	Tube

## ABSOLUTE MAXIMUM RATINGS (T<sub>J</sub>=25°C unless otherwise noted)

Characteristics		Symbol	Ratings	Unit
Drain-Source Voltage		V <sub>DS</sub>	650	V
Gate-Source Voltage		V <sub>GS</sub>	±30	V
Drain Current	T <sub>C</sub> = 25°C	I <sub>D</sub>	35	A
	T <sub>C</sub> = 100°C		22	
Drain Current Pulsed(Note 1)		I <sub>DM</sub>	140	A
Power Dissipation(T <sub>C</sub> =25°C) -Derate above 25°C		P <sub>D</sub>	298	W
			2.4	W/°C
Single Pulsed Avalanche Energy (Note 2)		E <sub>AS</sub>	1131	mJ
Operation Junction Temperature Range		T <sub>J</sub>	-55~+150	°C
Storage Temperature Range		T <sub>stg</sub>	-55~+150	°C
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		TL	260	°C

## THERMAL CHARACTERISTICS

Characteristics	Symbol	MAX	Unit
Thermal Resistance, Junction-to-Case	R <sub>θJC</sub>	0.42	°C/W
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	50	°C/W

## ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit	
Off Characteristics							
Drain -Source Breakdown Voltage	B <sub>VDS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650	--	--	V	
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	--	--	6.0	uA	
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =30V, V <sub>DS</sub> =0V	--	--	100	nA	
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V	--	--	-100		
On Characteristics							
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> =1mA	2.5	3.5	4.5	V	
Static Drain- Source On State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =20A	TO-247-3L	--	81	90	mΩ
			TO-220-3L	--	89.2	99	
Dynamic Characteristics							
Gate Rresistance	R <sub>g</sub>	V <sub>GS</sub> =0V; f=1.0MHZ	1	1.1	10	Ω	
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =100V V <sub>GS</sub> =0V f=1MHZ	--	2925	--	pF	
Output Capacitance	C <sub>oss</sub>		--	108	--		
Reverse Transfer Capacitance	C <sub>rss</sub>		--	21	--		
Switching Characteristics							
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =325V, V <sub>GS</sub> =10V R <sub>G</sub> =1.6Ω, I <sub>D</sub> =35A (Note 2.3)	--	138	--	ns	
Turn-on Rise Time	t <sub>r</sub>		--	22	--		
Turn-off Delay Time	t <sub>d(off)</sub>		--	91	--		
Turn-off Fall Time	t <sub>f</sub>		--	7.5	--		

Total Gate Charge	$Q_g$	$V_{DS}=520V, I_D=35A$ $V_{GS}=10V$ (Note 2.3)	--	139	--	nC
Gate-Source Charge	$Q_{gs}$		--	22	--	
Gate-Drain Charge	$Q_{gd}$		--	91	--	

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	$I_S$	Integral Reverse P-N Junction Diode in the MOSFET	--	--	35	A
Pulsed Source Current	$I_{SM}$		--	--	140	
Diode Forward Voltage	$V_{SD}$	$I_S=35A, V_{GS}=0V$	--	1.05	1.4	V
Reverse Recovery Time	$T_{rr}$	$I=35A, V_{GS}=0V,$ $dI/dt=100A/\mu S$ (Note 3)	--	125	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	0.6	--	$\mu C$

### NOTE:

1. Pulse width limited by maximum junction temperature
2.  $L=79mH, V_{DD}=100V, V_G=10V, R_G=25\Omega,$  starting  $T_J=25^\circ C$
3. Pulse Test: Pulse width  $\leq 300\mu s,$  Duty cycle  $\leq 2\%$
4. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

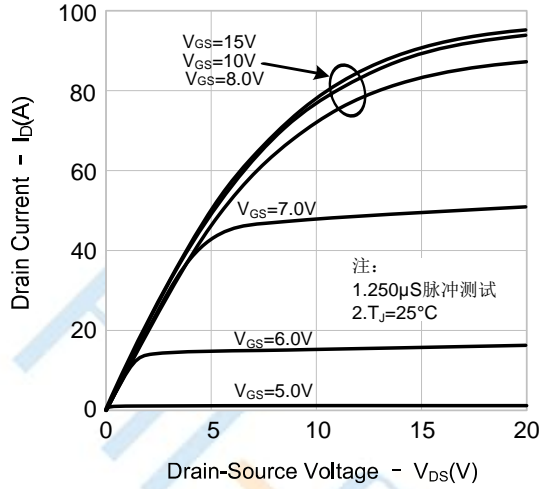


Figure 2. Transfer Characteristics

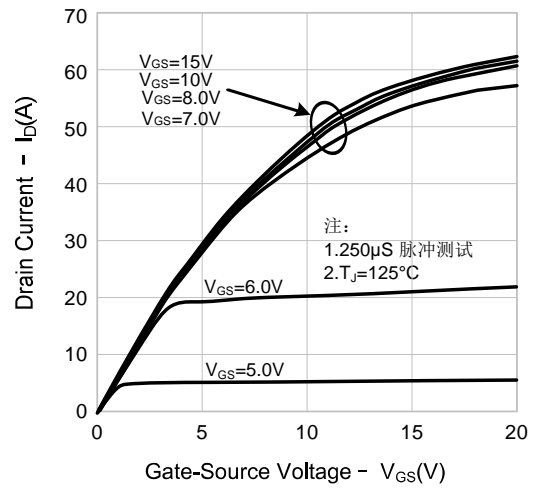


Figure 3. On-Resistance Variation vs. Drain Current

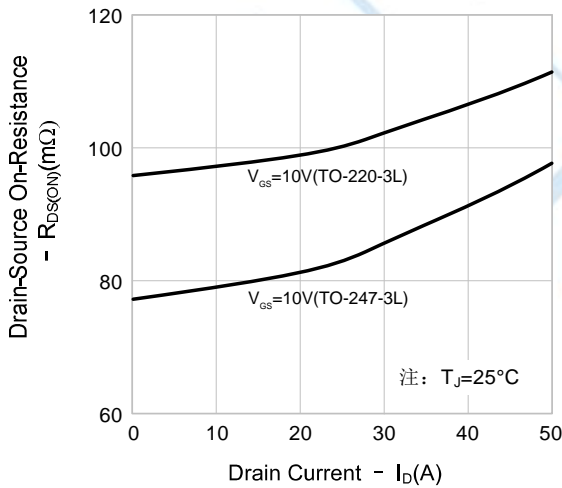


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

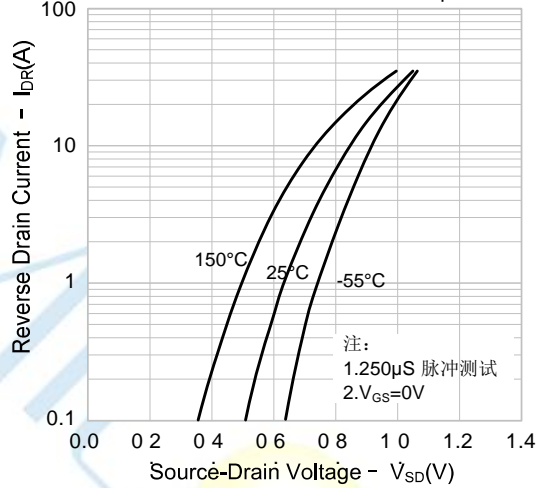


Figure 5. Capacitance Characteristics

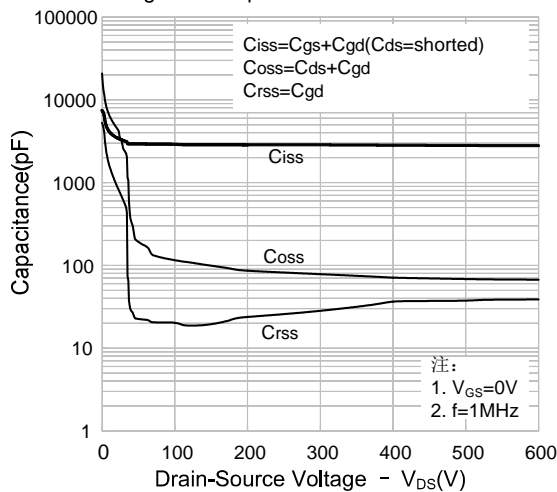
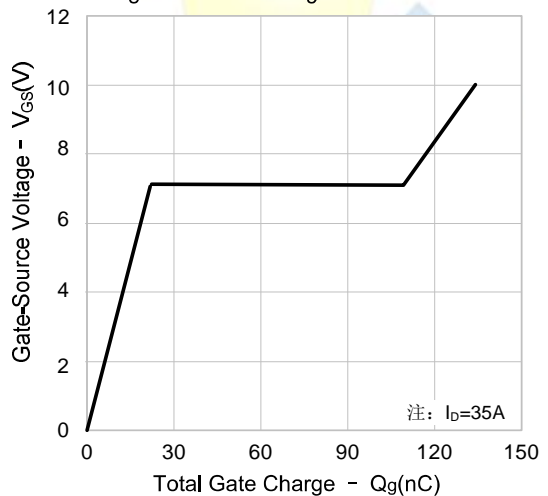


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Variation vs Temperature

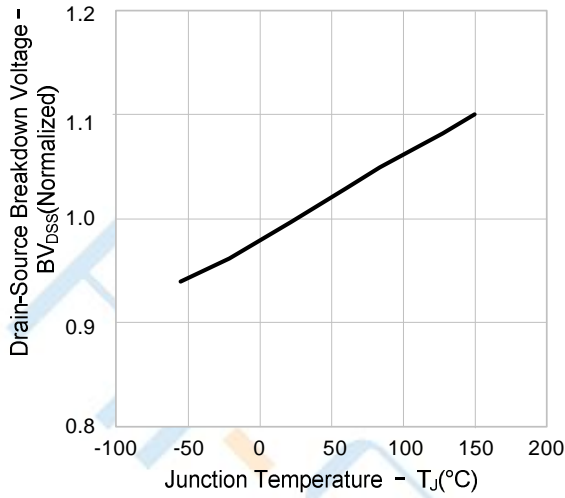


Figure 8. On-resistance Variation vs. Temperature

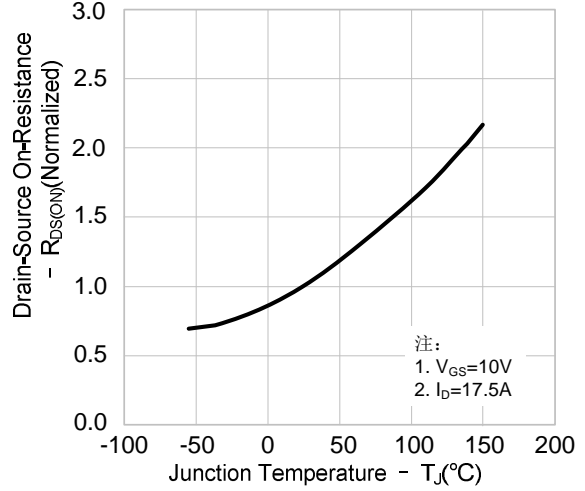
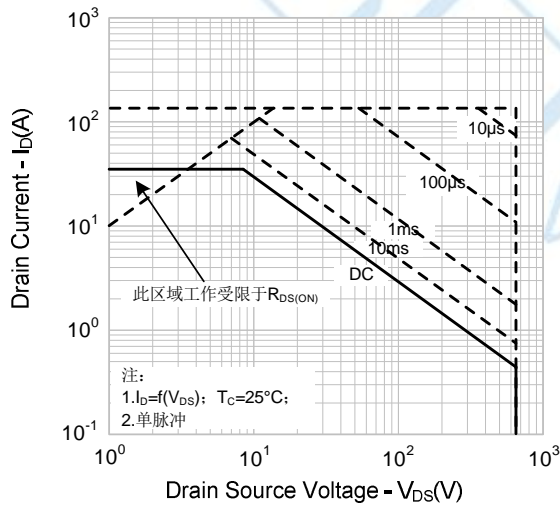
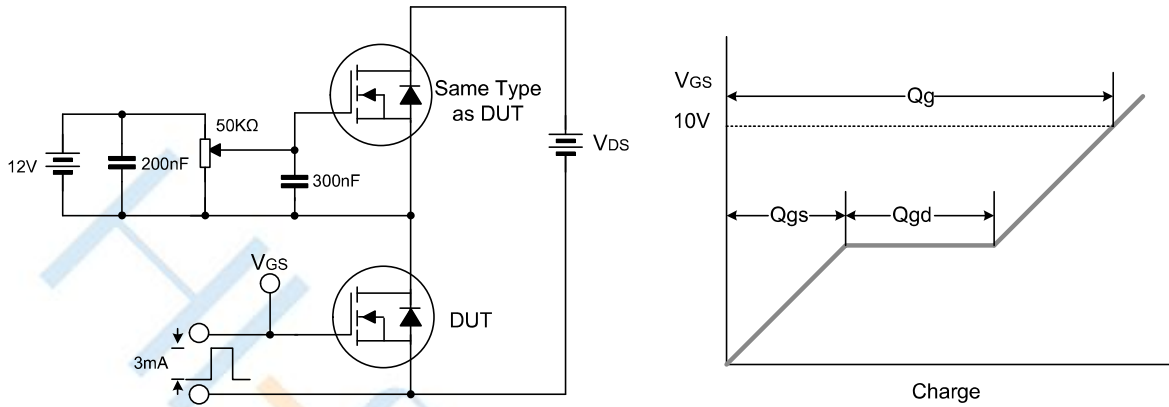


Figure 9. Max. Safe Operating Area

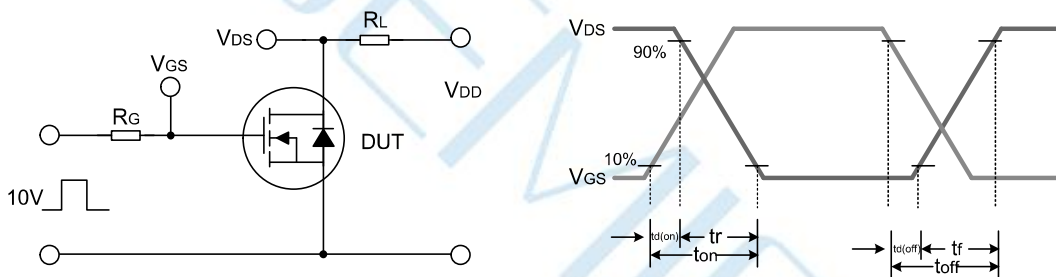


Test Circuit

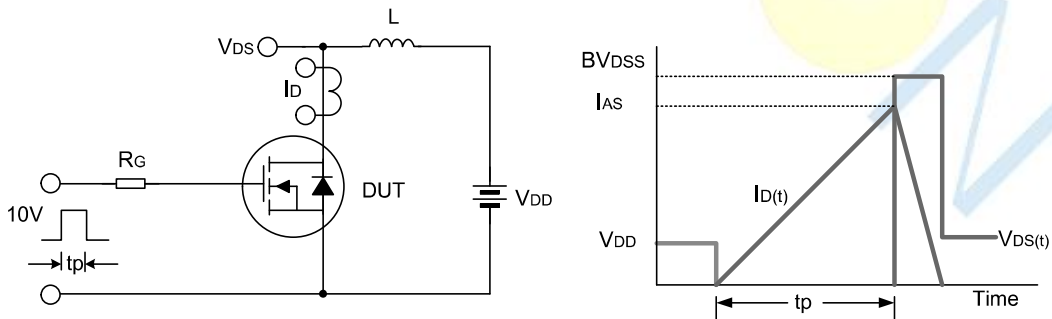
Gate Charge Test Circuit & Waveform



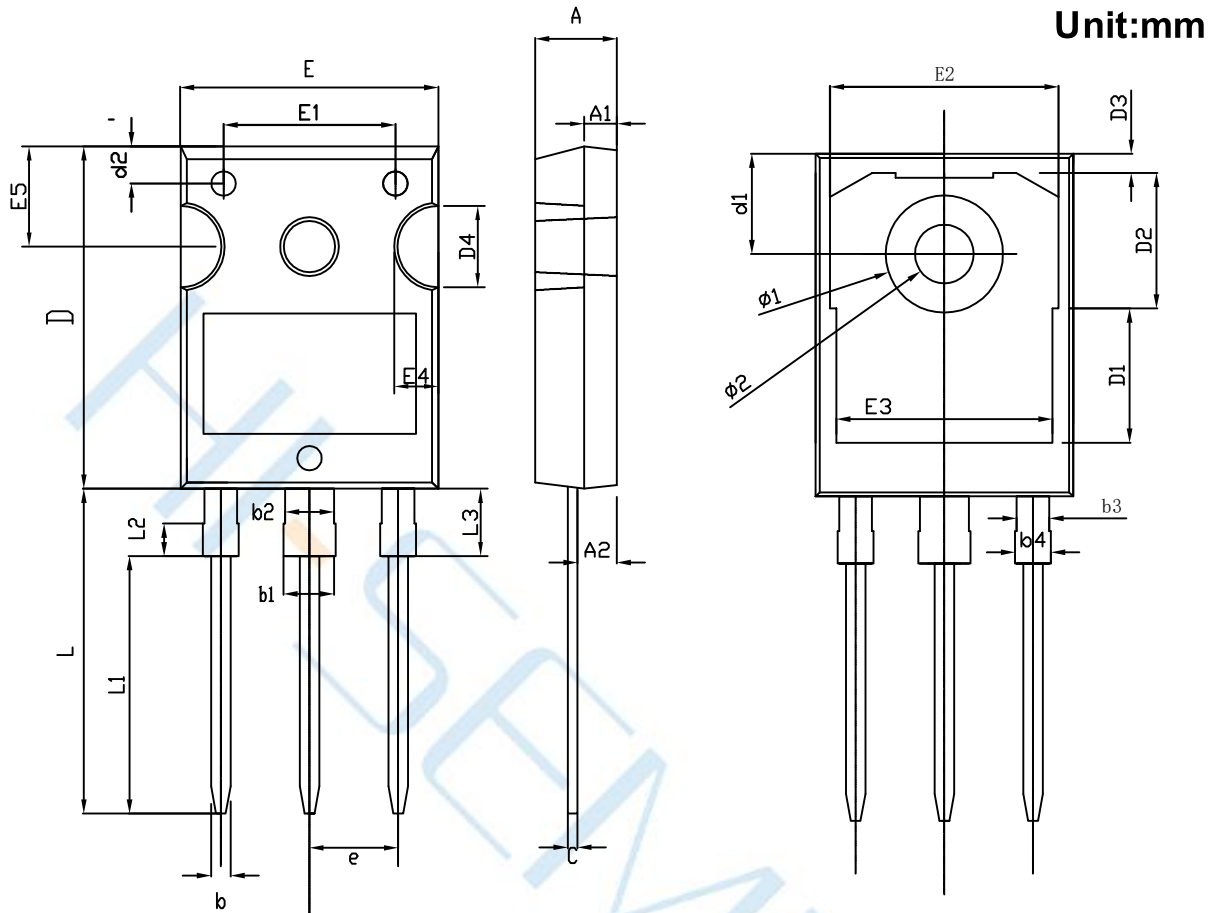
Resistive Switching Test Circuit & Waveform



Undamped Inductive Switching Test Circuit & Waveform



Package Dimensions of TO-247-3L

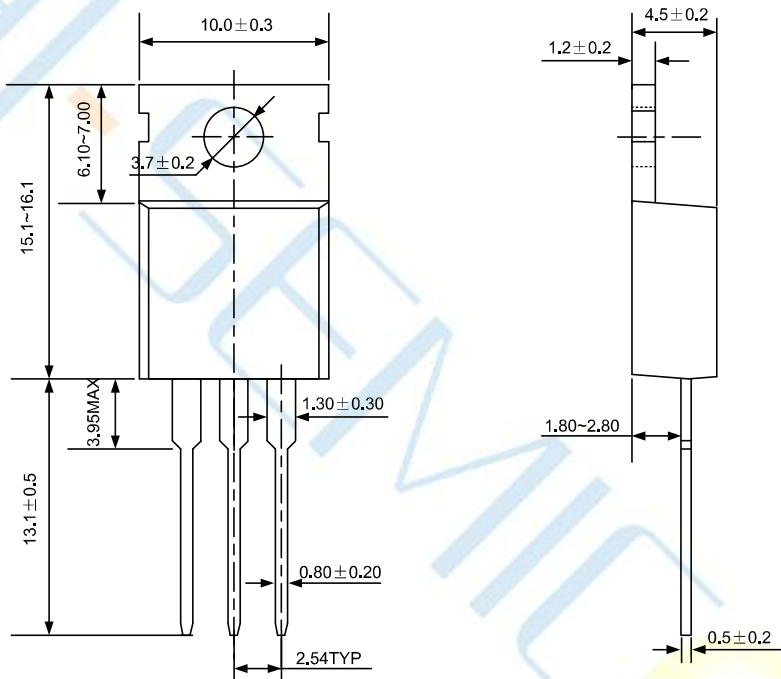


Unit:mm

	MIN	NOM	MAX
A	4.60	4.80	5.00
A1	1.90	2.00	2.10
A2	2.27	2.41	2.54
b	1.10	1.20	1.30
b1	2.90	-	3.20
b2	2.90	3.00	3.10
b3	1.90	2.00	2.10
b4	2.00	-	2.20
c	0.55	0.60	0.68
D	20.80	21.00	21.10
D1		8.23	
D2		8.32	
D3		1.17	
D4	3.68	4.90	5.10
d1	6.04	6.15	6.30
d2	2.20	2.30	2.40
E	15.70	15.80	16.00
E1		10.50	
E2		14.02	
E3		13.50	
E4	2.20	2.40	2.60
E5	5.49	5.80	6.00
e	5.34	5.44	5.54
L	19.72	19.92	20.12
L1		15.79	
L2		1.98	
L3	4.00	4.10	4.47
phi1	7.10	7.19	7.30
phi2	3.50	3.60	3.70

Package Dimensions of TO-220-3L

Unit:mm



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