

**650V N-CHANNEL 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.

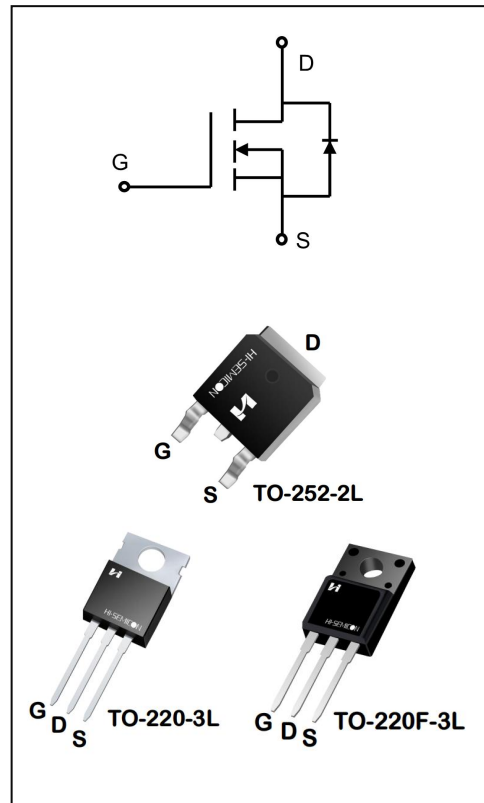
**Features**

- ◆  $V_{DS}=650V, I_D=8A$
- ◆  $V_{DS,min}@T_j(max)=700V$
- ◆  $R_{DS(ON)}$

TYP:  $520m\Omega@V_{GS}=10V, I_D=4A$

**Applications**

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



**ORDERING INFORMATION**

Part No.	Package	Marking	Material	Packing
SCF65R540T	TO-220F-3L	SCF65R540T	Pb free	Tube
SCP65R540T	TO-220-3L	SCP65R540T	Pb free	Tube
SCD65R540T	TO-252-2L	SCD65R540T	Pb free	Reel

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

Characteristics	Symbol	Ratings			Unit
		SCF65R540T	SCD65R540T	SCP65R540T	
Drain-Source Voltage	V <sub>DS</sub>	650			V
Gate-Source Voltage	V <sub>GS</sub>	±30			V
Drain Current	I <sub>D</sub>	T <sub>C</sub> = 25°C			A
		T <sub>C</sub> = 100°C			
Drain Current Pulsed(Note 1)	I <sub>DM</sub>	30			A
Power Dissipation(T <sub>C</sub> =25°C) -Derate above 25°C	P <sub>D</sub>	35	48	85	W
		0.28	0.38	1.2	W/°C
Single Pulsed Avalanche Energy (Note 2)	E <sub>AS</sub>	89			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	300			°C

## THERMAL CHARACTERISTICS

Characteristics	Symbol	MAX			Unit
		SCF65R540T	SCD65R540T	SCP65R540T	
Thermal Resistance, Junction-to-Case	R <sub>θJC</sub>	3.57	2.6	2.1	°C/W
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	62.5	62.0	65.0	°C/W

## ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
<b>Off Characteristics</b>						
Drain -Source Breakdown Voltage	B <sub>VDS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	650	700	--	V
		V <sub>GS</sub> =0V, I <sub>D</sub> =250μA, T <sub>J</sub> =150	700	--	--	
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	--	--	1	μA
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	
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> =250μA	2	3.1	4.0	V
Static Drain- Source On State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =4A	--	520	580	mΩ
<b>Dynamic Characteristics</b>						
Gate Rresistance	R <sub>g</sub>	V <sub>GS</sub> =0V; f=1.0MHZ	1	3.1	10	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =100V V <sub>GS</sub> =0V f=1.0MHZ	--	479	--	pF
Output Capacitance	C <sub>oss</sub>		--	20.6	--	
Reverse Transfer Capacitance	C <sub>rss</sub>		--	2.5	--	

Switching Characteristics						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=325V; V_{GS}=10V$ $R_G=25\Omega; I_D=8A$ (Note 3.4)	--	11.5	--	ns
Turn-on Rise Time	$t_r$		--	32.6	--	
Turn-off Delay Time	$t_{d(off)}$		--	52.1	--	
Turn-off Fall Time	$t_f$		--	26.5	--	
Total Gate Charge	$Q_g$	$V_{DS}=520V, I_D=8A$ $V_{GS}=10V$ (Note 3.4)	--	18	--	nC
Gate-Source Charge	$Q_{gs}$		--	4.2	--	
Gate-Drain Charge	$Q_{gd}$		--	9.2	--	

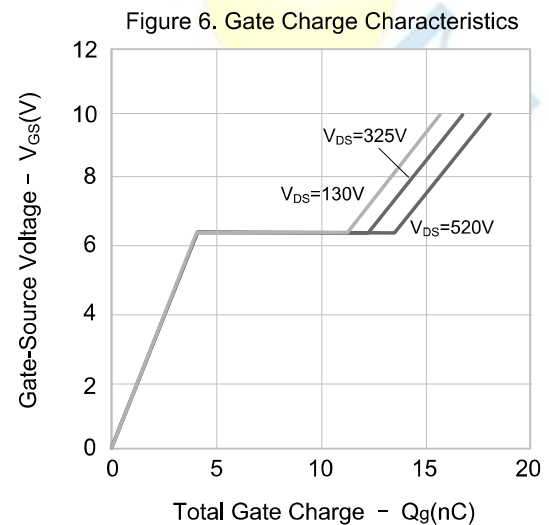
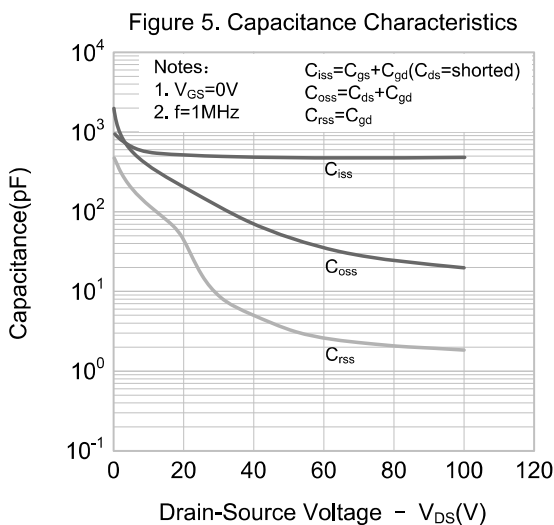
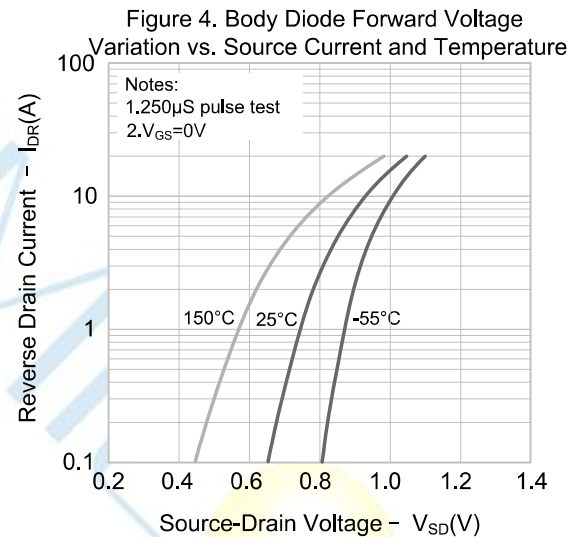
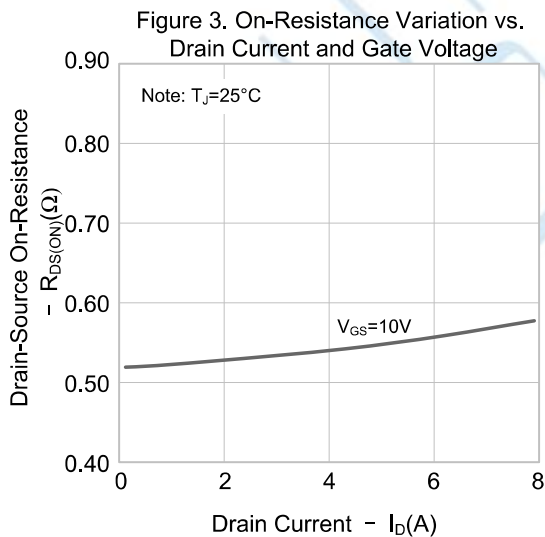
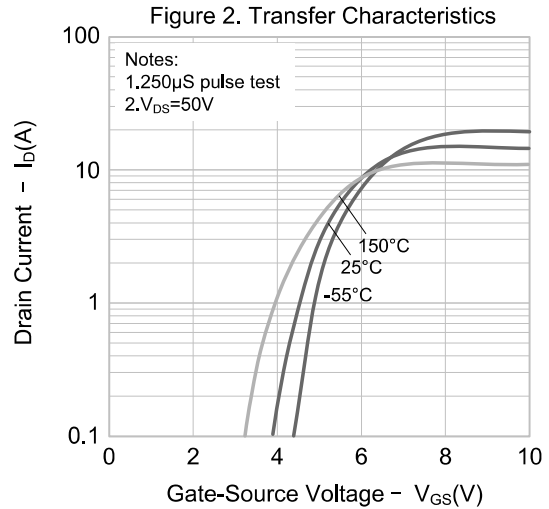
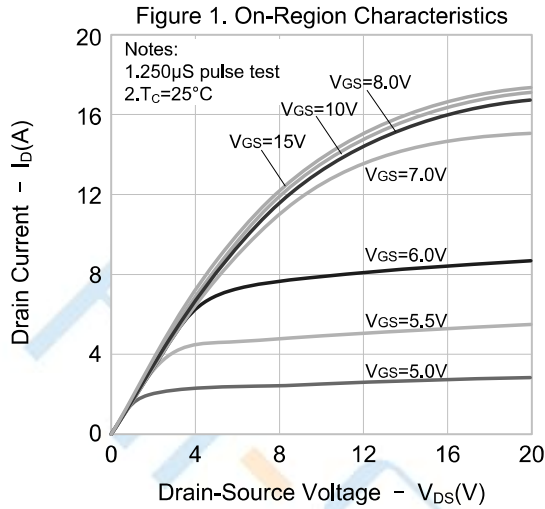
## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	$I_S$	Integral Reverse P-N Junction Diode in the MOSFET	--	--	8	A
Pulsed Source Current	$I_{SM}$		--	--	32	
Diode Forward Voltage	$V_{SD}$	$I_S=8A, V_{GS}=0V$	--	0.9	1.4	V
Reverse Recovery Time	$T_{rr}$	$I=8A, V_{GS}=0V,$ $dI/dt=100A/\mu S$ (Note 3)	--	411	--	ns
Reverse Recovery Charge	$Q_{rr}$		--	12	--	nC

### 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



Typical Performance Characteristics

Figure 7. Breakdown Voltage Variation vs. Temperature

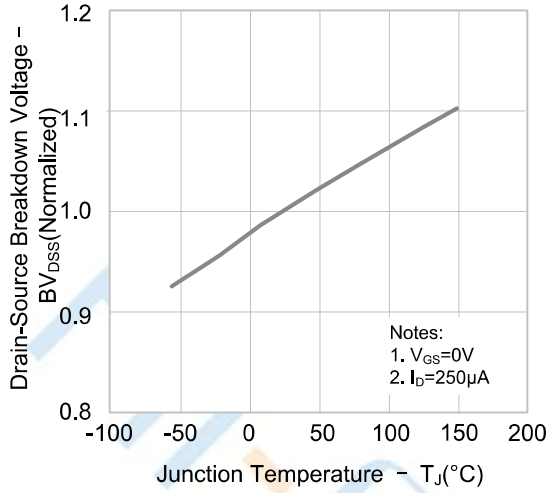


Figure 8. On-resistance Variation vs. Temperature

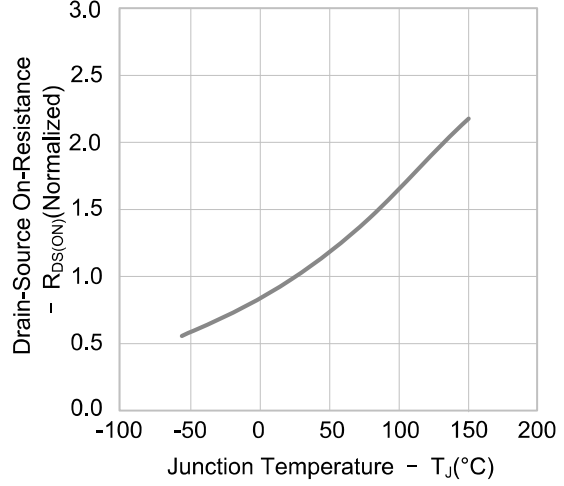
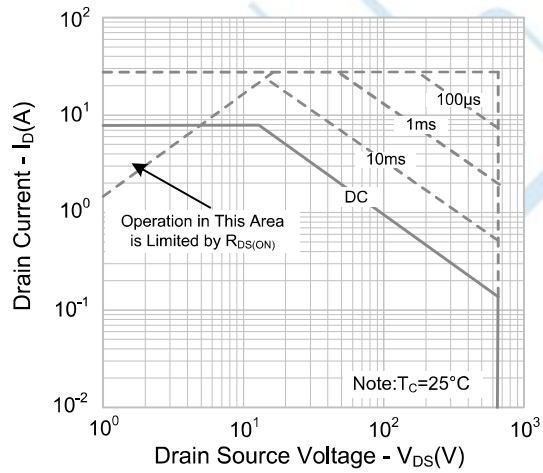
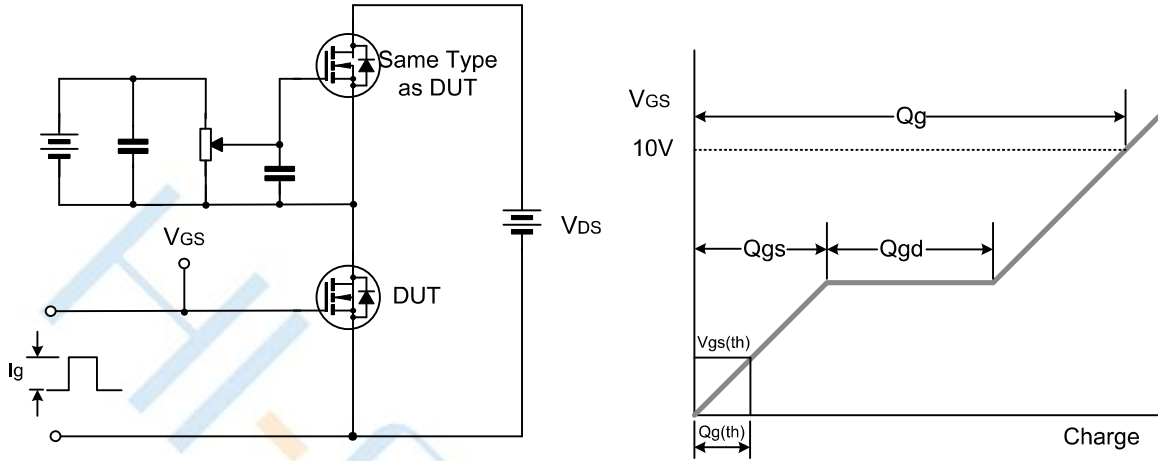


Figure 9-1. Max. Safe Operating Area

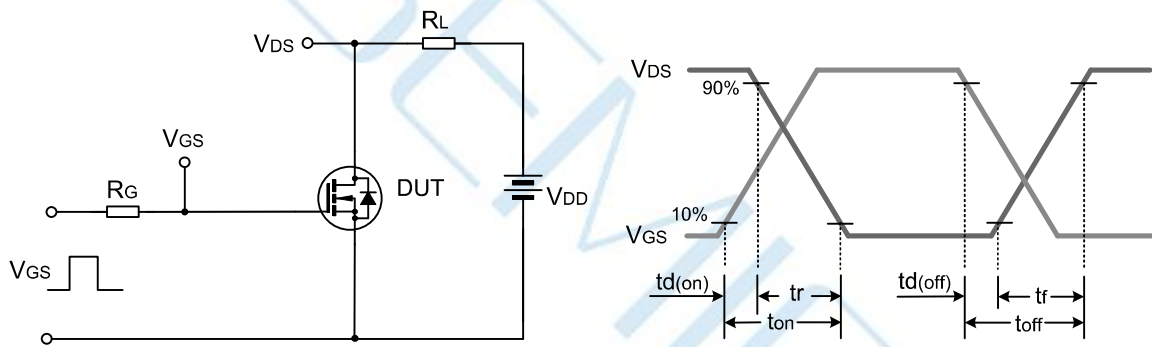


Test Circuit

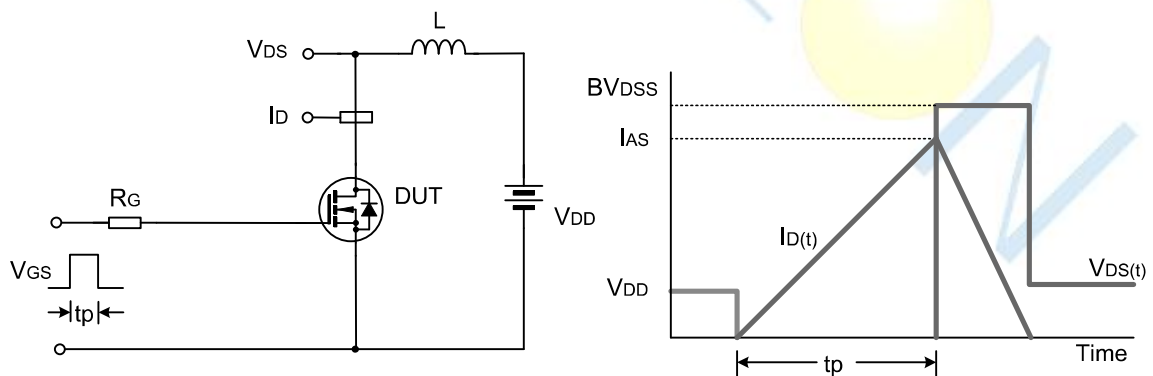
Gate Charge Test Circuit & Waveform



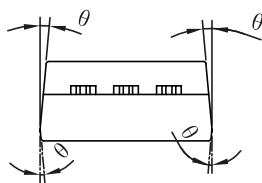
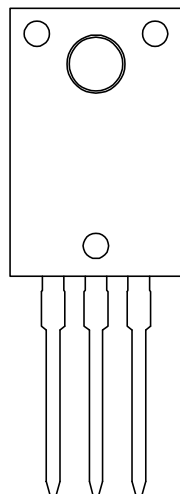
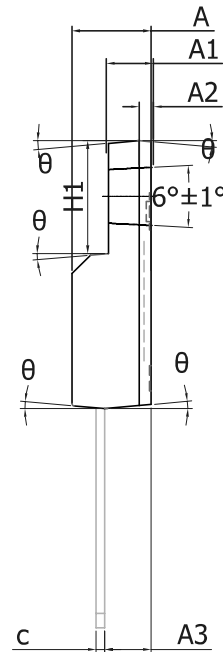
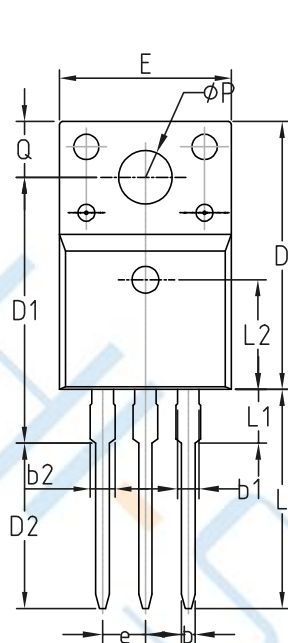
Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Package Dimensions of TO-220F-3L

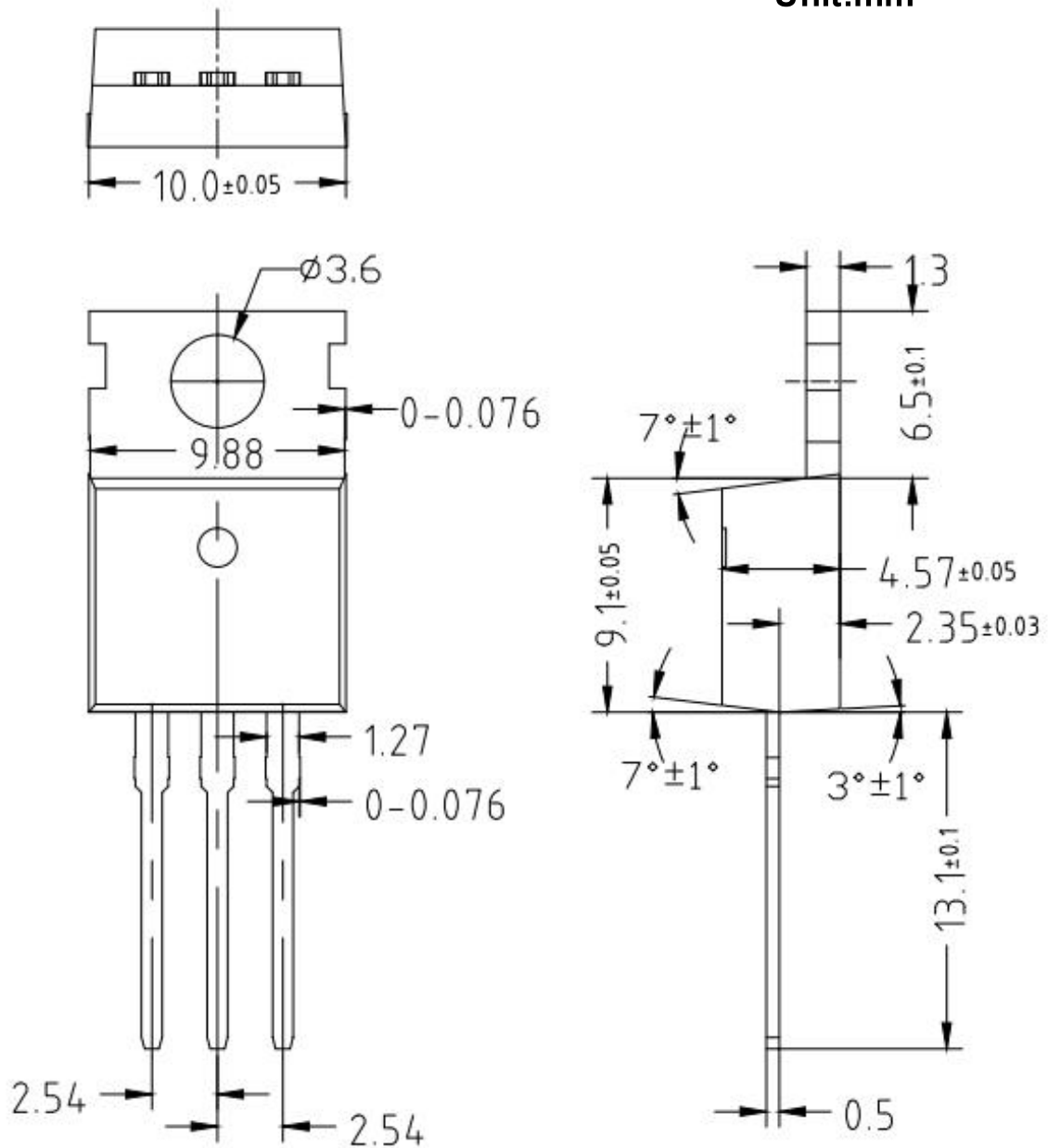


COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.96
b	0.70	0.80	0.90
b1	1.17	1.2	1.25
b2	1.17	1.2	1.25
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	10.0	10.2	10.4
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2	6.50REF		
$\phi P$	3.08	3.18	3.28
Q	3.20	3.30	3.40
$\theta$ 1	1°	3°	5°
A4	0.53	0.56	0.59

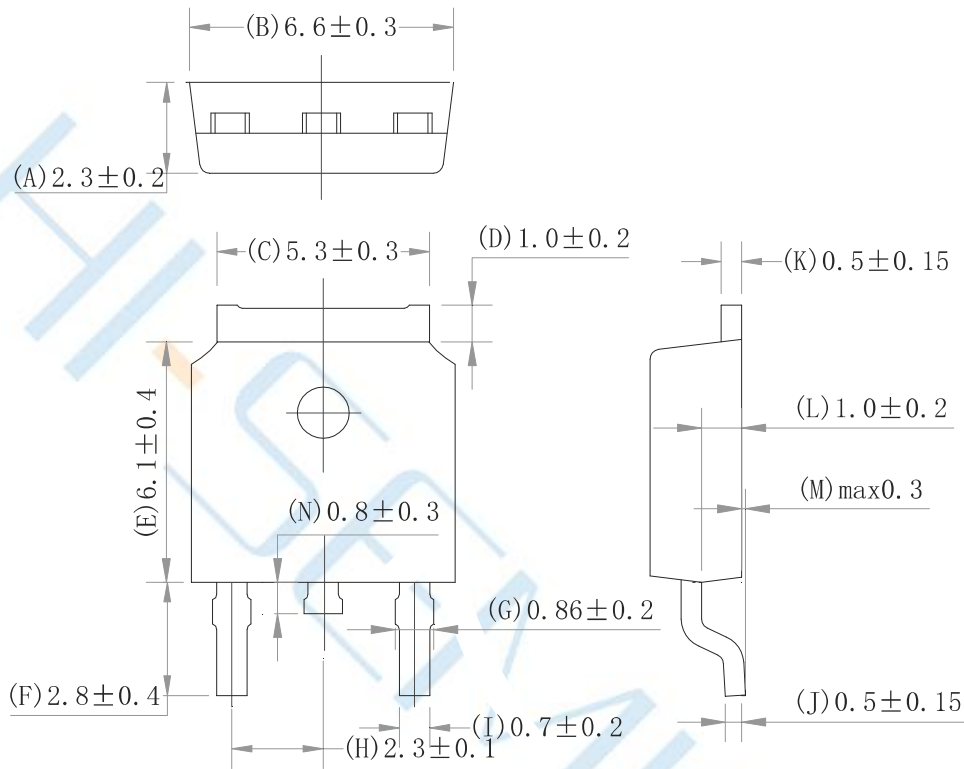
Package Dimensions of TO-220-3L

Unit:mm





Package Dimensions of TO-252-2L



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