

### Description

The GC11N 65 uses advanced super junction technology and design to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with low gate voltages. This device is suitable for industry's AC-DC SMPS requirement for PFC, AC/DC power conversion, and industrial power application.

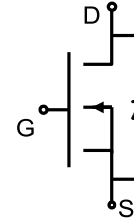
### General Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small Package
- Ultra Low Gate Charge cause lower driving requirement
- 100% Avalanche Tested
- RoHS Compliant

### Application

- Power Factor Correction (PFC)
- Switched Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)

$V_{DS}$	$R_{DS(ON)}$ @ 10V (Max)	$I_D$
650V	360mΩ	11A



Schematic Diagram



Marking and Pin Assignment

### Ordering Information

Part Number	Marking	Case	Packaging
GC11N65T	GC11N65	TO-220	50pcs/Tube
GC11N65F	GC11N65	TO-220F	50pcs/Tube
GC11N65K	GC11N65	TO-252	2500pcs/Reel

### Absolute Maximum Ratings ( $T_C=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Value		Unit
		TO-252 TO-220	TO-220F	
Drain-Source Voltage	$V_{DS}$	650		V
Gate-Source Voltage	$V_{GS}$	±30		V
Drain Current-Continuous	$I_D$	11		A
Drain Current-Pulsed (Note 1)	$I_{DM}$	33		A
Single Pulse Avalanche Energy (Note 2)	$E_{AS}$	211		mJ
Avalanche Current (Note 1)	$I_{AR}$	1.6		A
Repetitive Avalanche Energy (Note 1)	$E_{AR}$	0.32		mJ
Maximum Power Dissipation	$P_D$	78	31.3	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150		°C

### Thermal Characteristic

Parameter	Symbol	Value		Unit
		TO-252 TO-220	TO-220F	
Thermal Resistance, Junction-to-Case	$R_{thJC}$	1.6	4	°C/W
Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{thJA}$	62	80	°C/W

## Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>On/ Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	650	-	-	V
Zero Gate Voltage Drain Current ( T <sub>J</sub> =25°C )	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	-	-	1	μA
Zero Gate Voltage Drain Current ( T <sub>J</sub> =150°C )	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V	-	-	100	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.5	-	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =5.5A	-	-	360	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =5.5A	-	-	-	S
<b>Dynamic Characteristics (Note4)</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHZ	-	901	-	PF
Output Capacitance	C <sub>oss</sub>		-	50	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	5.5	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =400V, I <sub>D</sub> =11A V <sub>GS</sub> =10V, R <sub>GEN</sub> =25Ω	-	42	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	20	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	123	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	6.4	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DD</sub> =520V, I <sub>D</sub> =11A, V <sub>GS</sub> =10V	-	21	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	4.5	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	7	-	nC
<b>Drain-Source Diode Characteristics</b>						
Continuous Body Diode Current (Note 2)	I <sub>s</sub>	T <sub>C</sub> =25°C	-	-	11	A
Pulsed Diode Forward Current	I <sub>SM</sub>	T <sub>C</sub> =25°C	-	-	33	A
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	T <sub>J</sub> =25°C, I <sub>SD</sub> =11A, V <sub>GS</sub> =0V	-	-	1.4	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>R</sub> =520V, I <sub>F</sub> =I <sub>s</sub> , di <sub>F</sub> /dt = 100A/ μ s	-	280	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	2.8	-	μC
Peak Reverse Recovery Current	I <sub>rrm</sub>		-	17	-	A

### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. I<sub>AS</sub> = 1.6A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25Ω, Starting T<sub>J</sub> = 25°C
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 1%.
4. Guaranteed by design, not subject to production

Typical Electrical And Thermal Characteristics

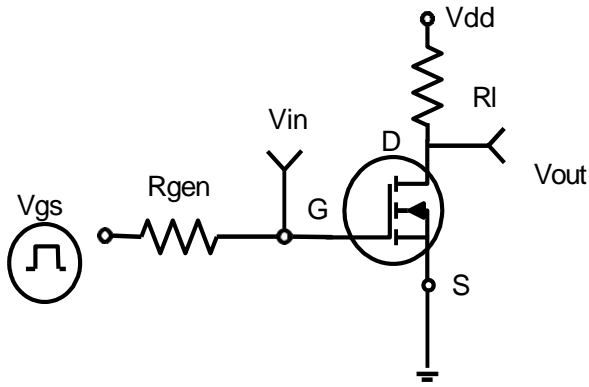


Figure 1. Switching Test Circuit

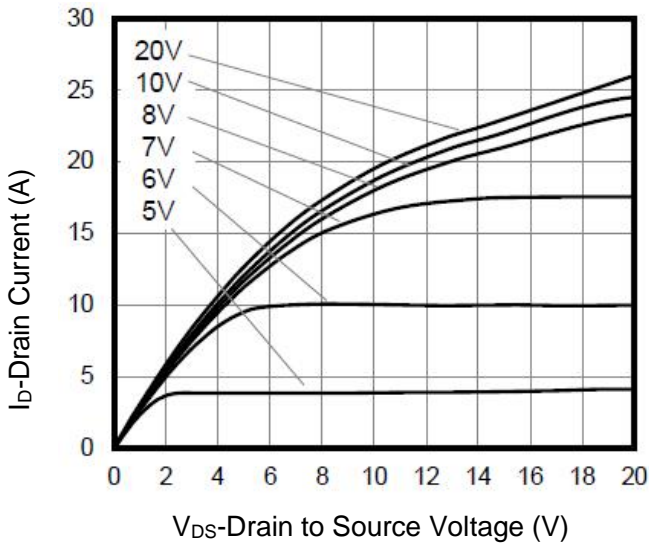


Figure 3. Output Characteristics

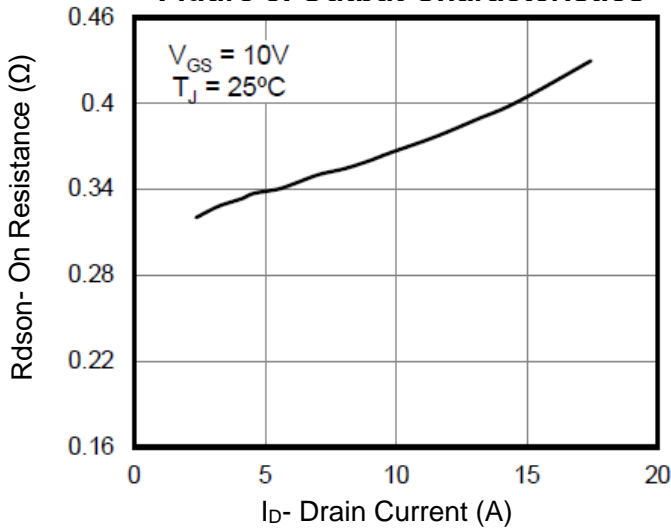


Figure 5. On Resistance vs. Drain Current

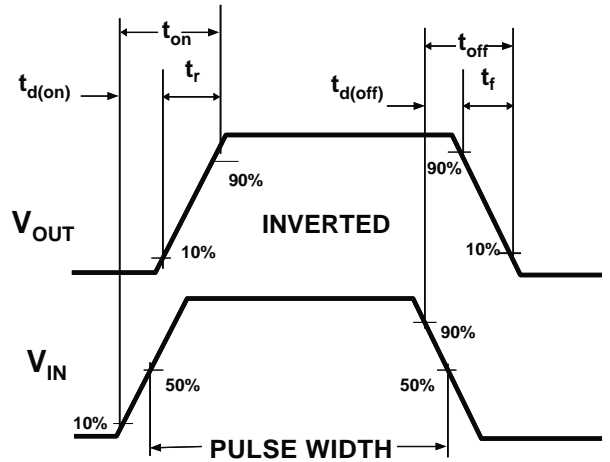


Figure 2. Switching Waveforms

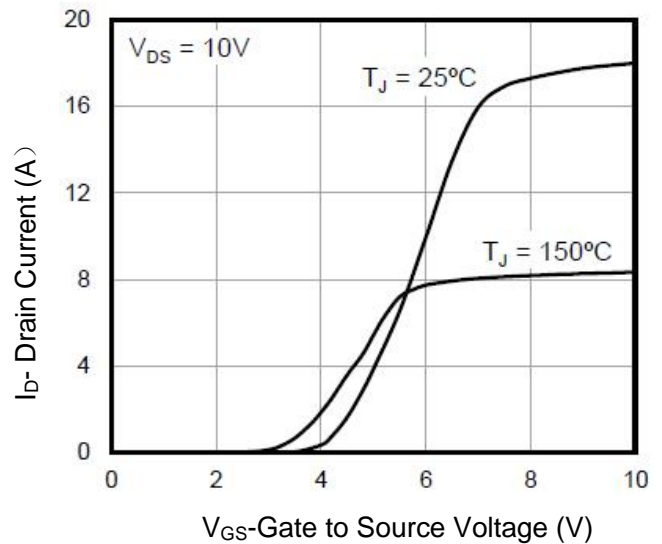


Figure 4. Transfer Characteristics

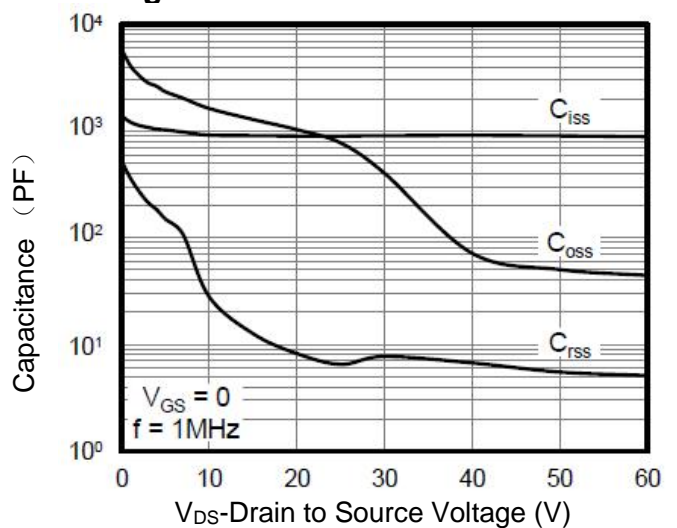


Figure 6. Capacitance

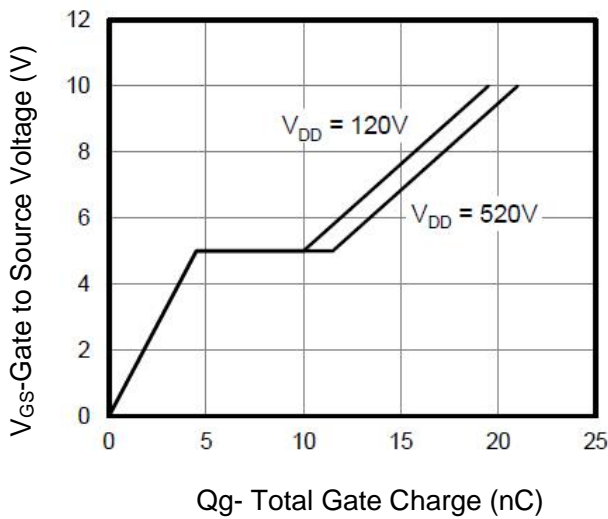


Figure 7. Gate Charge

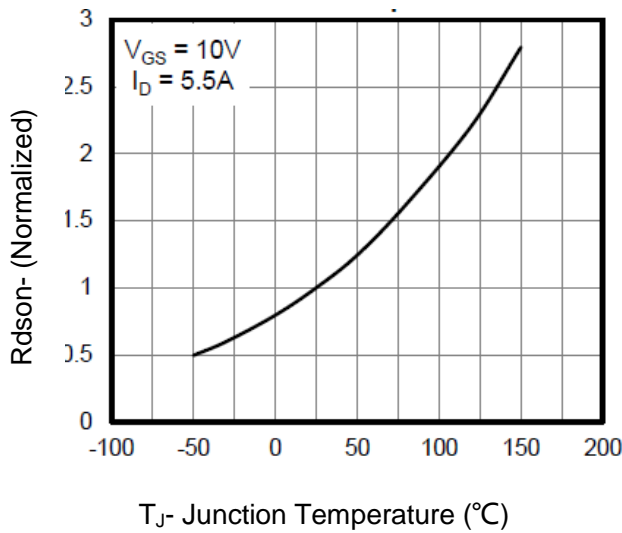


Figure 9. Rdson vs T<sub>J</sub>

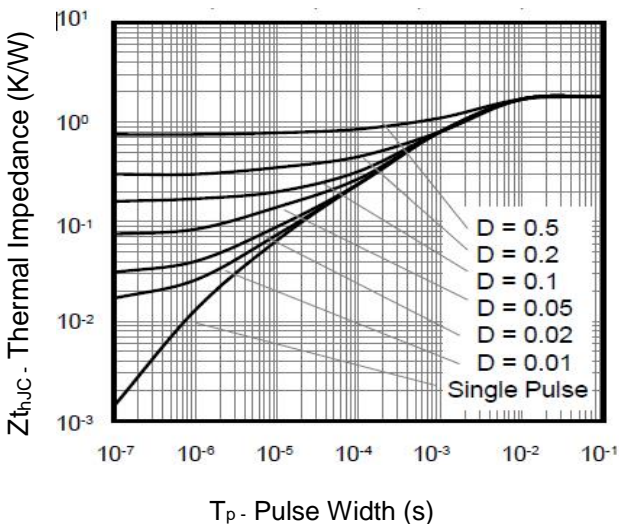


Figure 11. Transient Thermal Impedance (TO-252, TO-220)

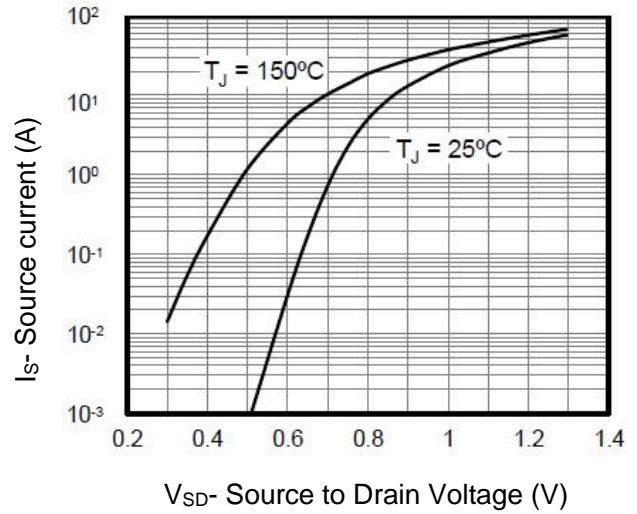


Figure 8. Body Diode Forward Voltage

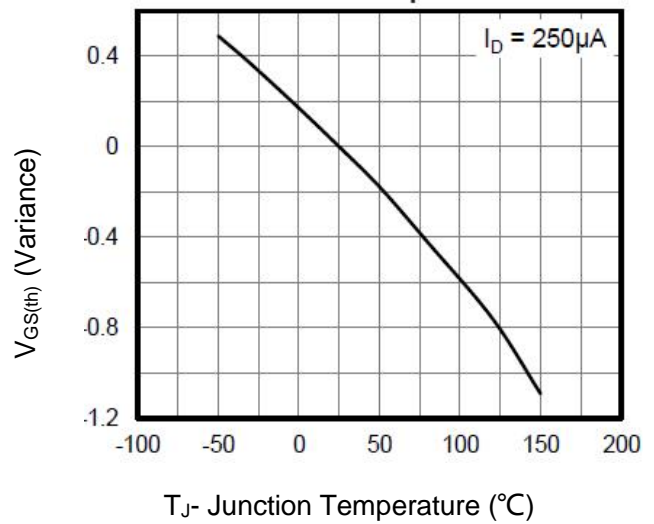


Figure 10. V<sub>th</sub> vs T<sub>J</sub>

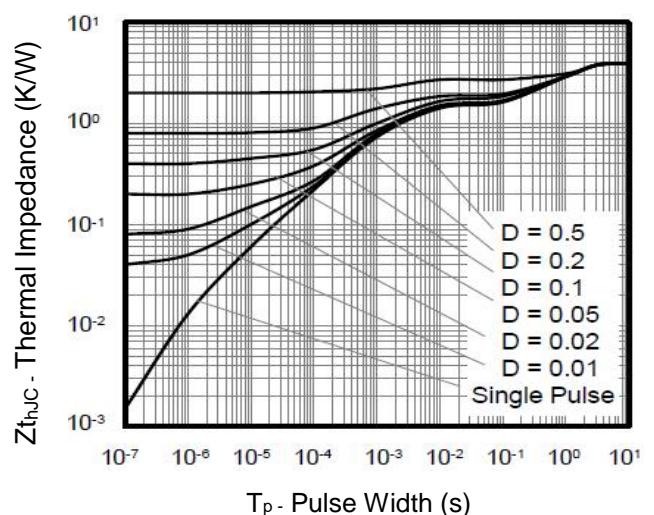
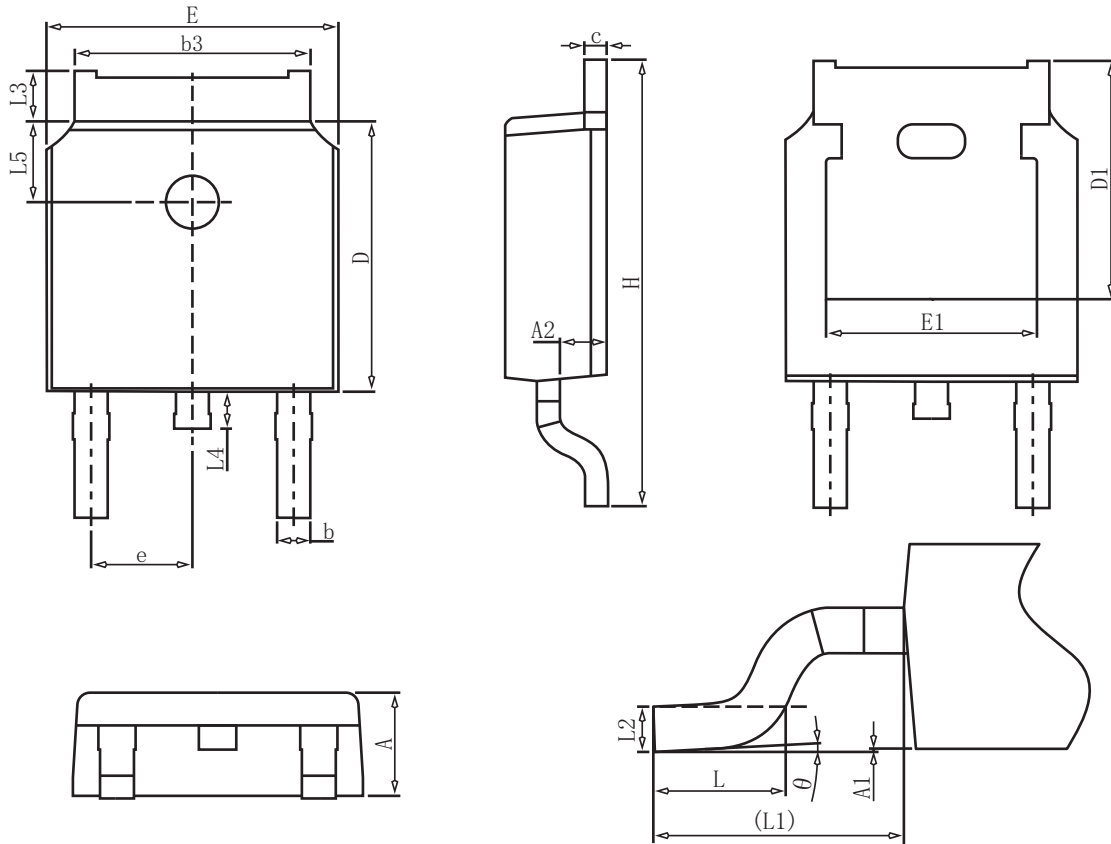


Figure 12. Transient Thermal Impedance (TO-220F)

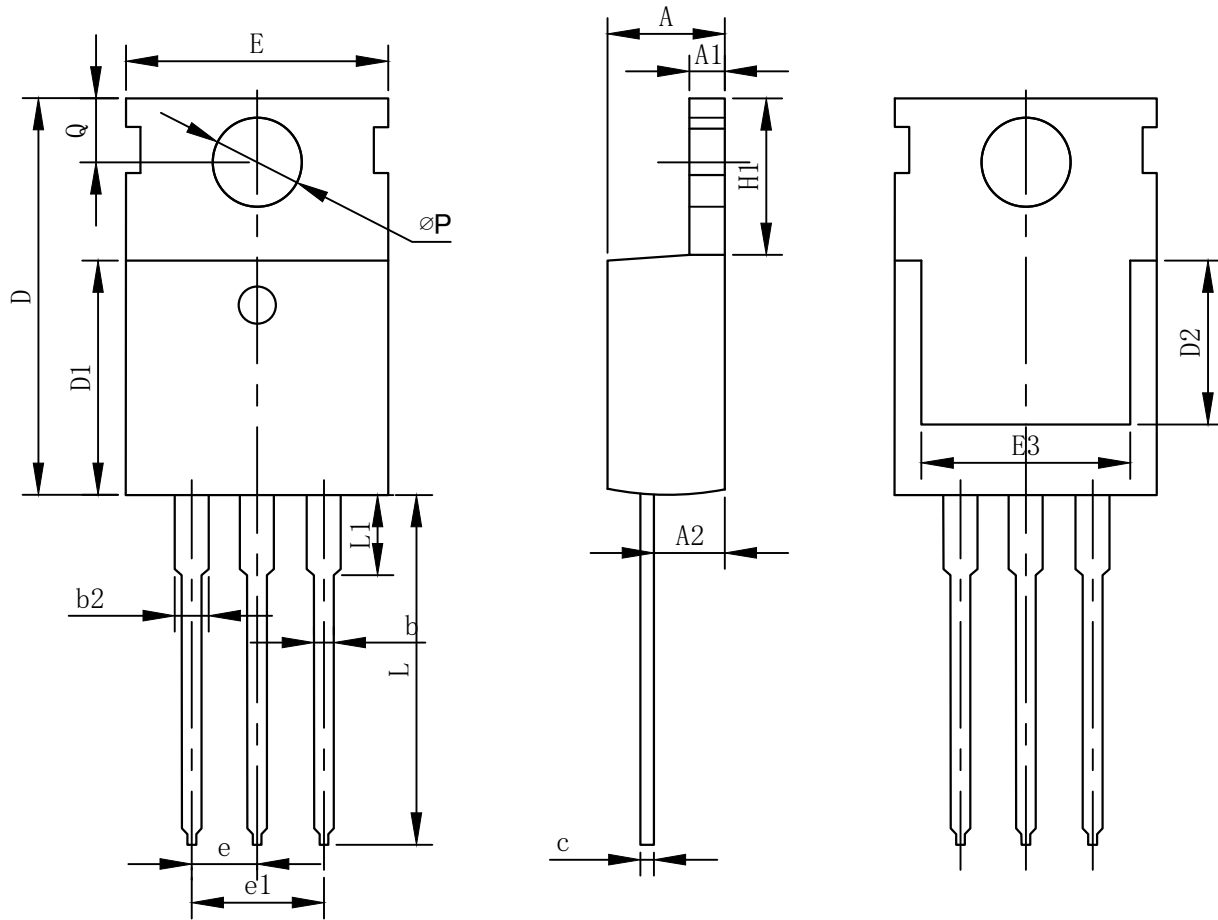
**TO-252 Package Information**



**COMMON DIMENSIONS**

SYMBOL	mm		
	MIN	NOM	MAX
A	2.20	2.30	2.40
A1	0.00	-	0.20
A2	0.97	1.07	1.17
b	0.68	0.78	0.90
b3	5.20	5.33	5.50
c	0.43	0.53	0.63
D	5.98	6.10	6.22
D1	5.30REF		
E	6.40	6.60	6.80
E1	4.63	-	-
e	2.286BSC		
H	9.40	10.10	10.50
L	1.38	1.50	1.75
L1	2.90REF		
L2	0.51BSC		
L3	0.88	-	1.28
L4	0.50	-	1.00
L5	1.65	1.80	1.95
θ	0°	-	8°

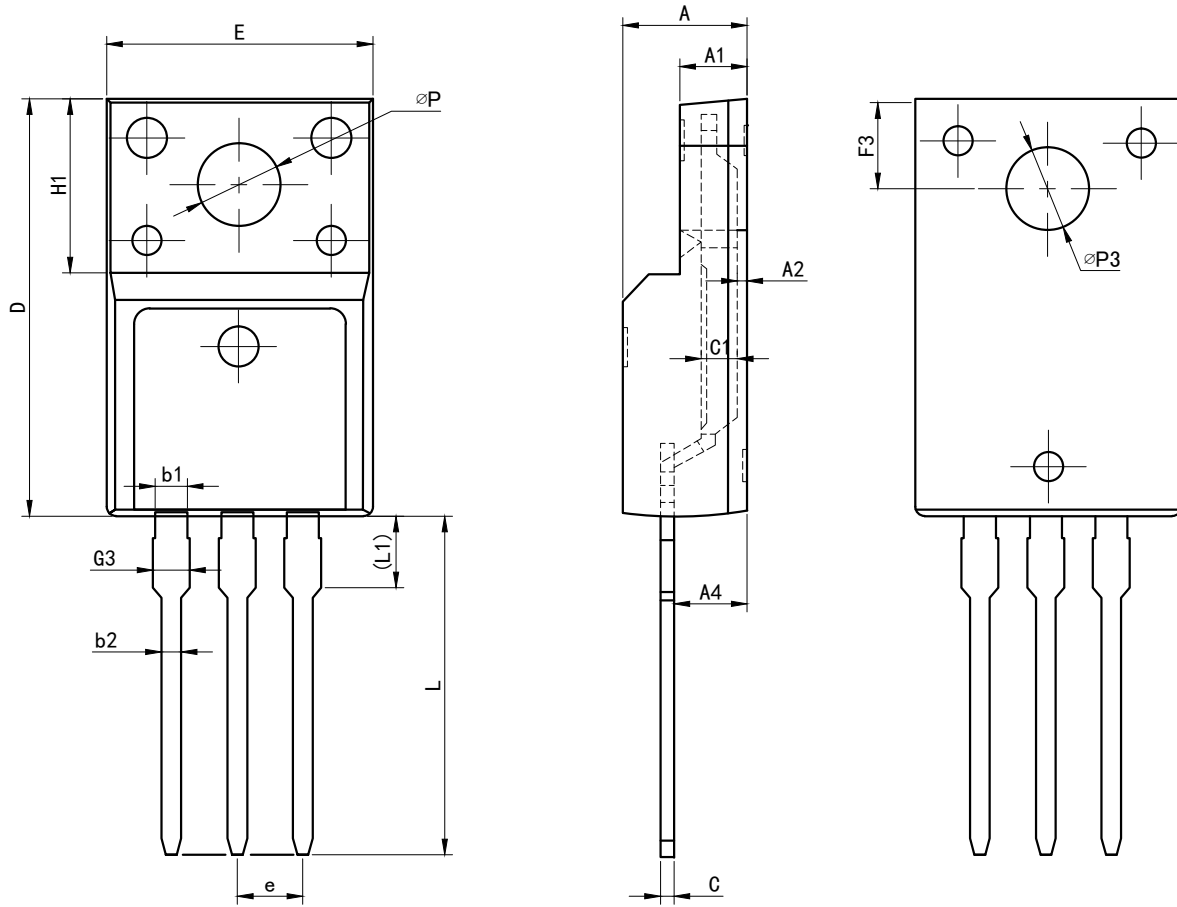
**TO-220 Package information**



COMMON DIMENSIONS

SYMBOL	mm		
	MIN	NOM	MAX
A	4.37	4.57	4.70
A1	1.25	1.30	1.40
A2	2.20	2.40	2.60
b	0.70	0.80	0.95
b2	1.70	1.27	1.47
c	0.45	0.50	0.60
D	15.10	15.60	16.10
D1	8.80	9.10	9.40
D2	5.50	-	-
E	9.70	10.00	10.30
E3	7.00	-	-
e	2.54BSC		
e1	5.08BSC		
H1	6.25	6.50	6.85
L	12.75	13.50	13.80
L1	-	3.10	3.40
$\phi P$	3.40	3.60	3.80
Q	2.60	2.80	3.00

**TO-220F Package information**



**COMMON DIMENSIONS**

SYMBOL	mm		
	MIN	NOM	MAX
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.30	0.45	0.60
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
c1	1.20	1.30	1.35
D	15.57	15.87	16.17
H1	6.70REF		
e	2.54BSC		
L	12.68	12.98	13.28
L1	2.93	3.03	3.13
ØP	3.03	3.18	3.38
ØP3	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

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