

N-Channel Enhancement Mode Power MOSFET

Description

SMIRF12N65 is an N-channel enhancement mode power MOS field effect transistor. The improved planar stripe cell and the improved guard ring terminal have been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode.

These devices are widely used in AC-DC power suppliers, DCDC converters and H-bridge PWM motor drivers.

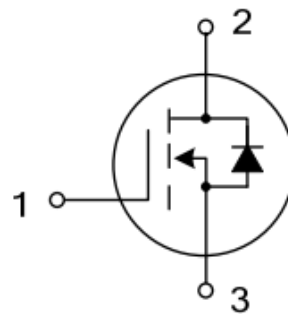
General Features

- 16A,650V, $R_{DS(on)(typ.)} = 0.48\Omega @ V_{GS}=10V$
- Low Gate charge
- Low Crss
- Fast Switching
- Improved dv/dt Capability

Application

- Power switching application
- Hard switched and high frequency circuits
- Uninterruptible power supply

I_D	16A
V_{DSS}	650V
$R_{dson (max)}$	$0.6\Omega (V_{GS}=10V, I_D=8A)$
Q_g	54nC



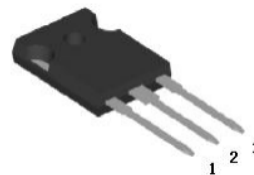
1.Gate 2.Drain 3.Source



TO-220



TO-220F



TO-247

**Order Information**

Order Information	Marking ID	Package	Packing Type Supplied As
SMIRF16N65T2TL	IRF16N65	TO220F-3L	1000 units on Box, 5000 units on Carton
SMIRF16N65T1TL	IRF16N65	TO220-3L	1000 units on Box, 5000 units on Carton
SMIRF16N65T8TL	IRF16N65	TO247-3L	450 units on Box, 2250 units on Carton

Absolute Maximum Ratings Ta=25 °C unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-source Voltage	V_{DS}	650	V
Gate-source Voltage	V_{GS}	±30	V
Continuous Drain Current(Ta=25°C)	I_D	16	A
Drain Current-Pulsed	I_{DM}	64	A
Total Dissipation(Ta=25°C)	TO247	250	W
	TO220	223	
	TO220F	56	
Junction Temperature	T_J	150	°C
Storage Temperature	T_{STG}	-55 to 150	°C
Single Pulse Avalanche Energy	E_{AS}	850	mJ
ESD HBM(Human Body Mode)		≥2000	V
ESD MM(Machine Mode)		≥200	V

Electrical Characteristics Ta = 25°C

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Drain-source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650			V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	2.0	3.0	4.0	V
Drain-source Leakage Current	I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			1	uA
Gate-body Leakage Current ($V_{DS} = 0$)	I_{GSS}	$V_{GS}=\pm 30V$			±100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=8A$		0.48	0.6	Ω

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant in temperature etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum rating

Thermal Characteristics Ta=25°C

PARAMETER		Symbol	TYP	MAX	UNIT
Maximum Junction-to-case	TO247	R _{QJC}		0.83	°C/W
	TO220F, TO220			2.4	
Maximum Junction-to-Ambient	TO247	R _{QJA}		60	
	TO220F, TO220			62.5	

Note1: Ensure that the channel temperature does not exceed 150°C

Note2: V_{DD}=50V, T_{ch}=25 °C(initial), I_{AS}=16A, R_g=25Ω

Note3: This transistor is sensitive to electrostatic and should be handled with care

Dynamic Characteristics Ta = 25 °C

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Input Capacitance	C _{iss}	V _{DS} =25V, V _{GS} =0V, f=1.0MHZ		2640		pF
output Capacitance	C _{oss}			230		pF
Reverse Transfer Capacitance	C _{rss}			15		pF
Gate Resistance	R _g	V _{DS} =0V, V _{GS} =0V, f=1.0MHZ		1.5		Ω

Switching Characteristics Ta=25 °C

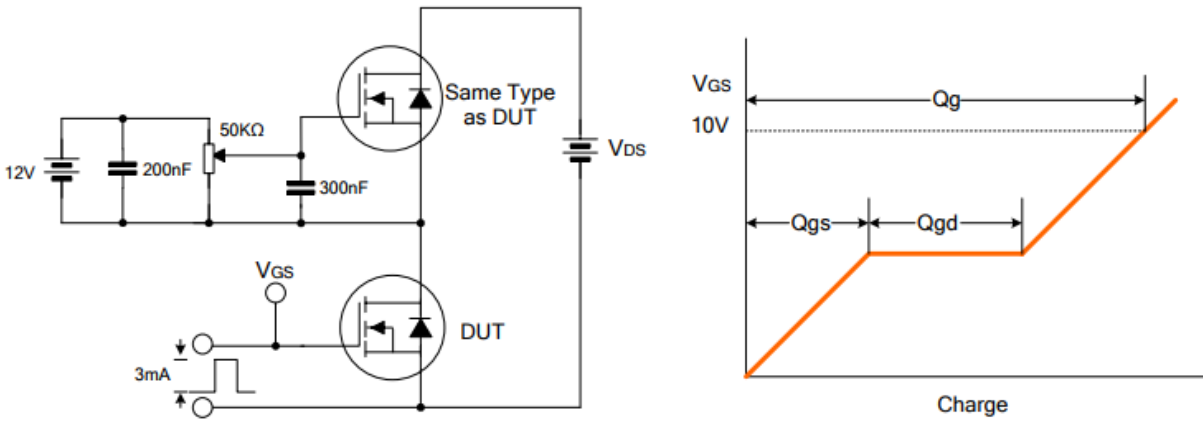
PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Turn-On Delay Time	T _{d(on)}	V _{DS} =325V, I _D =16A, V _{GS} =10V, R _G =25Ω		16		nS
Turn-On Rise Time	T _r			40		nS
Turn-Off Delay Time	T _{d(off)}			85		nS
Turn-Off Rise Time	T _f			18.5		nS
Total Gate Charge	Q _g	V _{DS} =520V, I _D =16A, V _{GS} =10V		54		nC
Gate-Source Charge	Q _{gs}			13.5		nC
Gate-Drain Charge	Q _{gd}			19		nC

Drain-Source Diode Maximum Ratings and Characteristics Ta=25 °C

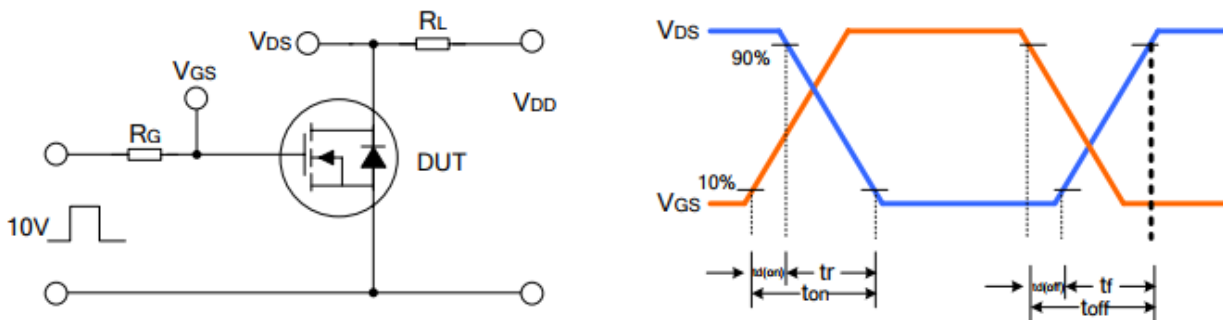
PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Max. Diode Forward Current	I _s	Integral Reverse P-N Junction Diode in the MOSFET			16	A
Pulsed Source Current	I _{sm}				64	A
Diode Forward Voltage	V _{SD}	V _{GS} =0V, I _s =16A		0.93	1.5	V
Reverse Recovery Time	t _{rr}	V _{GS} =0V, I _s =16A,		450		nS
Reverse Recovery Charge	Q _{rr}	dI _F /dt=100A/μs		5.5		μC

Test Circuit

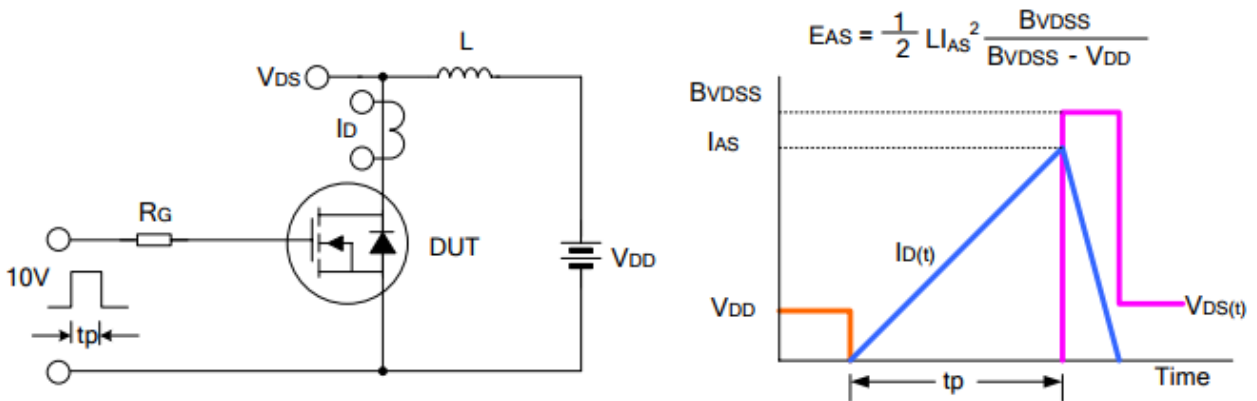
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



Typical Characteristics Curves

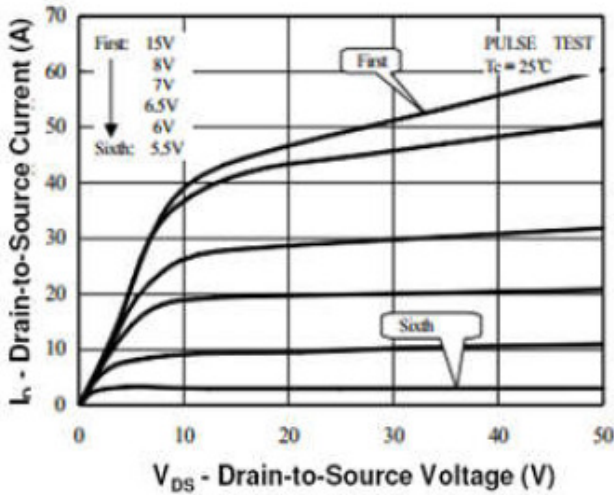


Figure 1: Output Characteristics

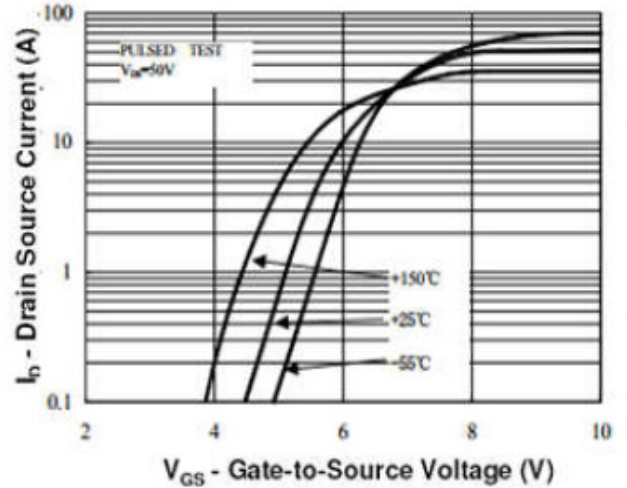


Figure 2: Transfer Characteristics

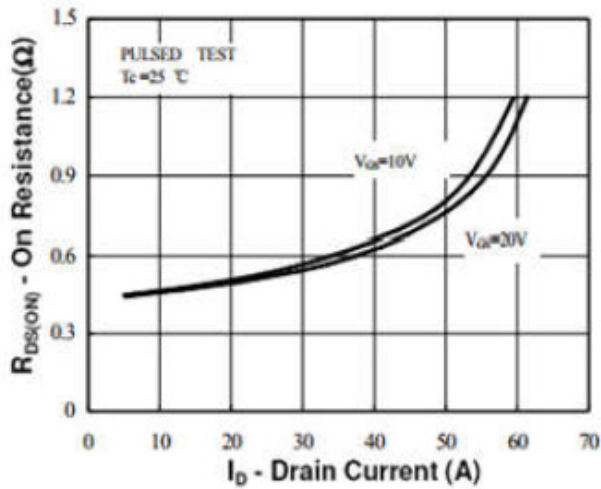


Figure 3: On Resistance Vs Drain Current

Gate Source Voltage

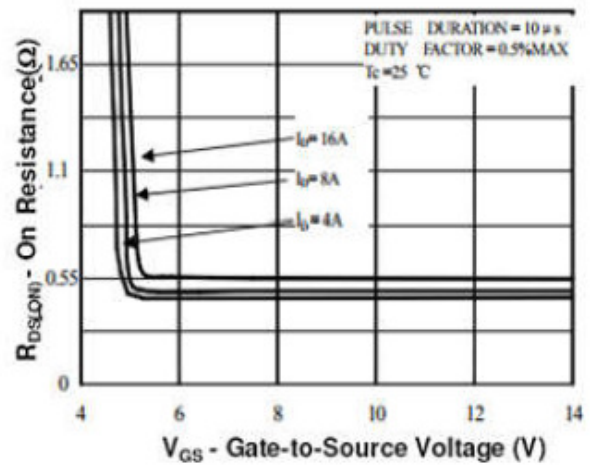


Figure 4: On Resistance Vs

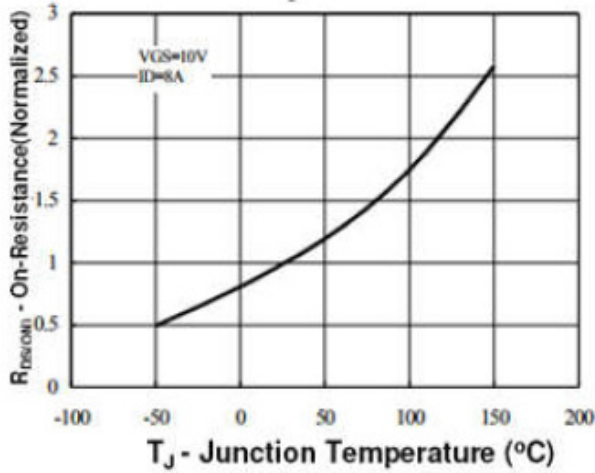


Figure5: On Resistance Vs Junction Temperature

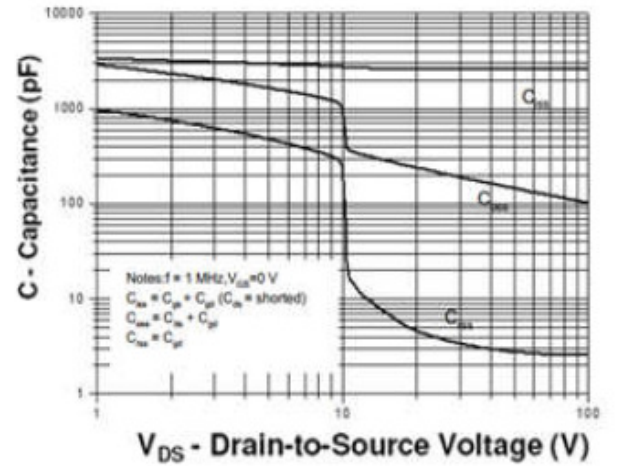


Figure6:

Capacitance Characteristics

Typical Characteristics Curves

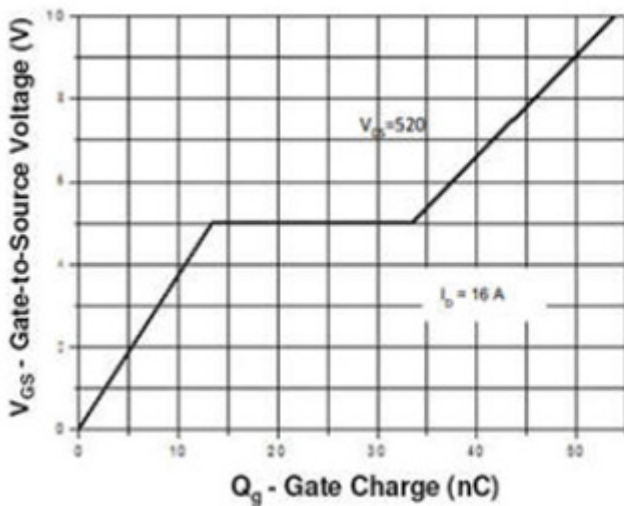


Figure7: Gate Charge Waveform

Source-Drain Diode Forward Voltage

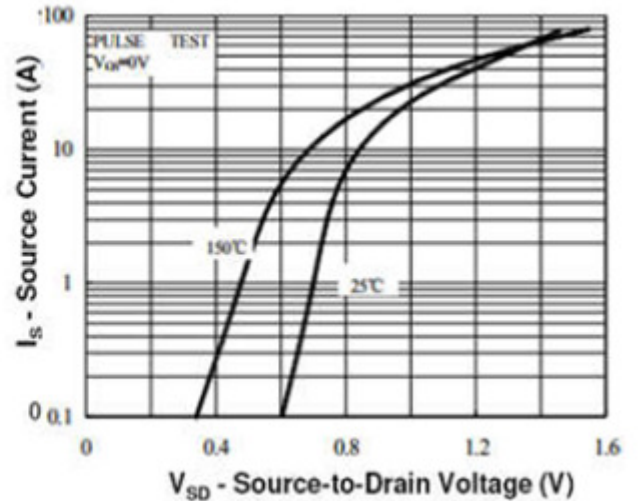
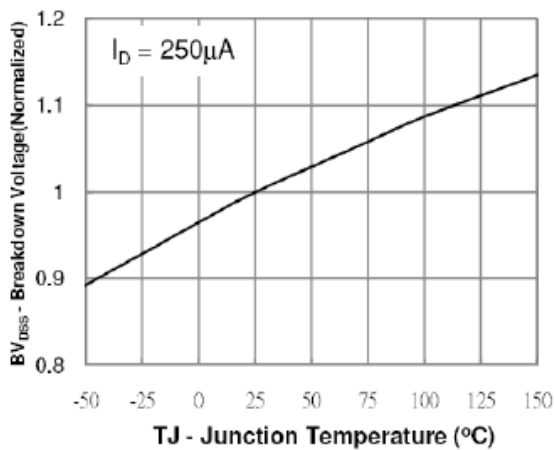
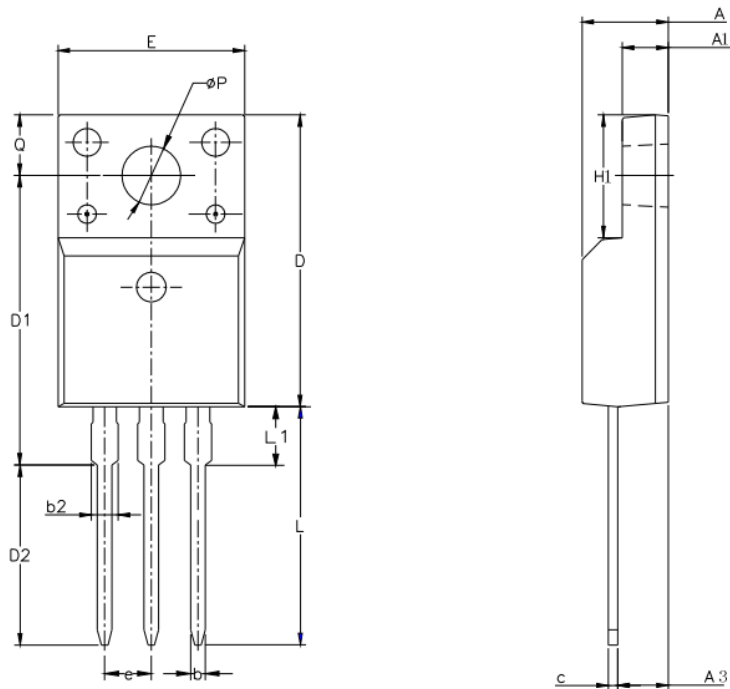


Figure8:

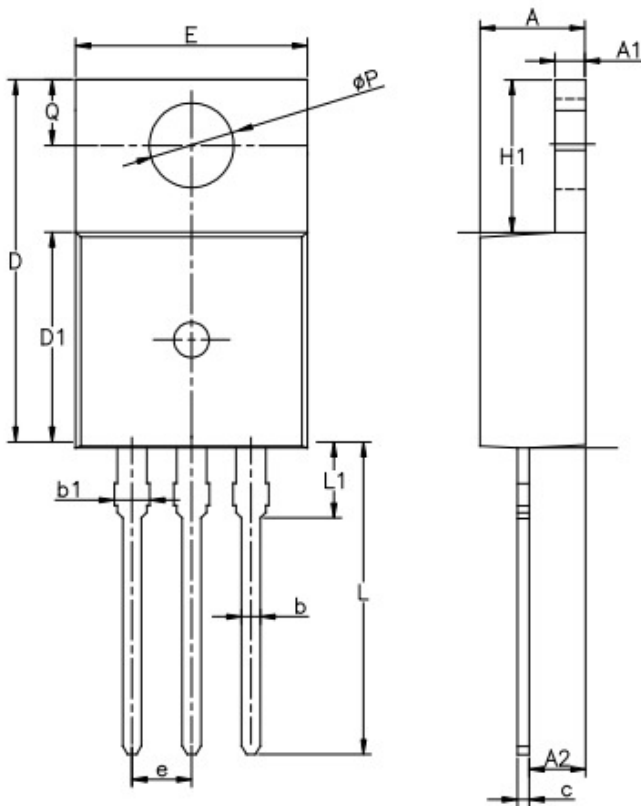


Outline Information (TO220F-3L) Unit:mm



SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	—	—	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55

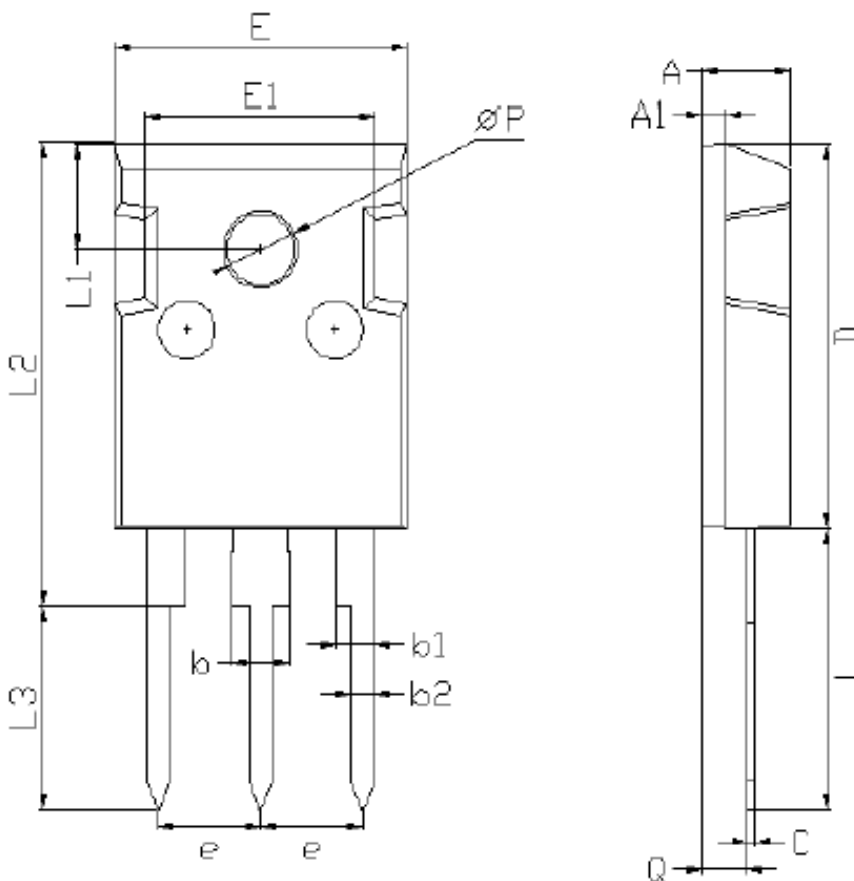
Outline Information (TO220-3L) Unit:mm



SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e	2.54BSC		
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ϕP	3.40	3.70	3.90
Q	2.60	—	3.20

Outline Information (TO247-3L) Unit:mm

Symbol	Min	Nom	Max	Symbol	Min	Nom	Max
A	4.60		5.15	A1	1.30		1.60
b	2.88		3.28	b1	1.88		2.28
b2		1.20		C		0.50	
D	19.00		21.00	E	15.45		15.75
E1	12.00		13.08	e		5.45	
L	14.00		14.60	L1	5.20		5.88
L2	24.00		24.40	L3	10.00		10.60
ΦP		3.50		Q	2.30		2.70



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