N-Channel Enhancement Mode Power MOSFET

Description

SMIRF5N65 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, DC/DC converters and H-bridge PWM motor drivers.

General Features

● 5A,650V,R_{DS}(on)(typ.)= 1.9ohm@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	5A
V_{DSS}	650V
$R_{dson\ (max)}$	2.3Ω(V_{GS}=10V, I_D=2.5A)
Q_g	15nC

1.Gate 2.Drain 3.Source
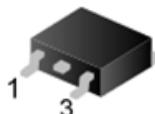
TO-220   TO-220F

TO-252   TO-251

Order Information

Order Information	Marking ID	Package	Packing Type Supplied As
SMIRF5N65TBRL	IRF5N65	TO251-3L	2400 Units on Box
SMIRF5N65T9RL	IRF5N65	TO252-2L	3000 Units on Reel
SMIRF5N65T2TL	IRF5N65	TO220F-3L	1000 units on Box、5000 units on Carton
SMIRF5N65T1TL	IRF5N65	TO220-3L	1000 units on Box、5000 units on Carton

Absolute Maximum Ratings Ta=25 ºC 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℃)		I_D	5	A
Drain Current-Pulsed		I_{DM}	20	A
Total Dissipation (Ta=25℃)	TO251	P_D	55	W
	TO252		50	
	TO220		30	
	TO220F		30	
Junction Temperature		T_J	150	ºC
Storage Temperature		T_{STG}	-65 to 150	ºC
Single Pulse Avalanche Energy		E_{AS}	210	mJ
ESD HBM(Human Body Mode)			≥2000	V
ESD MM(Machine Mode)			≥200	V

Electrical Characteristics Ta = 25ºC

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Drain-source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250µA	650			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS}=V_{DS} ,I_D=250µA	2.0		4.0	V
Drain-source Leakage Current	I_{DSS}	V_{DS}=650V,V_{GS}=0V			25	uA
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V，I_S=5A			1.4	V
Gate-body Leakage Current (V_{DS} = 0)	I_{GSS}	V_{GS}=±30V			±100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=10V,I_D=2.5A		1.9	2.3	Ω

Thermal Characteristics Ta=25℃

PARAMETER		Symbol	TYP	MAX	UNIT
Maximum Junction-to-case (note1)	TO251,TO252	R_{QJC}		2.5	℃/W
	TO220F,TO220			3	℃/W
Maximum Junction-to-Ambient	TO251,TO252	R_{QJA}		63	℃/W
	TO220F,TO220			80	

Note1: Surface Mounted on FR4 Board, t ≤ 10 sec

Dynamic Characteristics Ta = 25 ℃

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Input Capacitance	C_{iss}	V_{DS}=25V,V_{GS}=0V, f=1.0MHZ		560	600	pF
output Capacitance	C_{oss}			70	78	pF
Reverse Transfer Capacitance	C_{rss}			8	10	pF

Switching Characteristics Ta=25 ℃

PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Turn-On Delay Time	Td(on)	V_{DS}=300V,I_D=5A,R_G=25Ω		13	26	nS
Turn-On Rise Time	Tr			45	8	nS
Turn-Off Delay Time	Td(off)			38	120	nS
Turn-Off Rise Time	Tf			35	85	nS
Total Gate Charge	Qg	V_{DS}=480V，I_D=5A,V_{GS}=10V		15		nC
Gate-Source Charge	Qgs			2.5		nC
Gate-Drain Charge	Qgd			6.6		nC

Drain-Source Diode Maximum Ratings and Characteristics Ta=25 ℃

| PARAMETER	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Max. Diode Forward Current	Is	Integral Reverse P-N Junction Diode in the MOSFET			5	A
Pulsed Source Current	Ism				20	
Diode Forward Voltage	V_{SD}	V_{GS}=0V,I_s=5A			1.5	V
Reverse Recovery Time	Trr	V_{GS}=0V,I_s=5A, dIF/dt=100A/µs		270		nS
Reverse Recovery Charge	Qrr			1.9		µC

Test Circuit

Gate Charge Test Circuit & Waveform
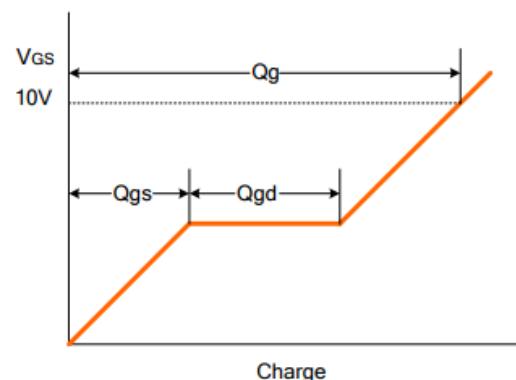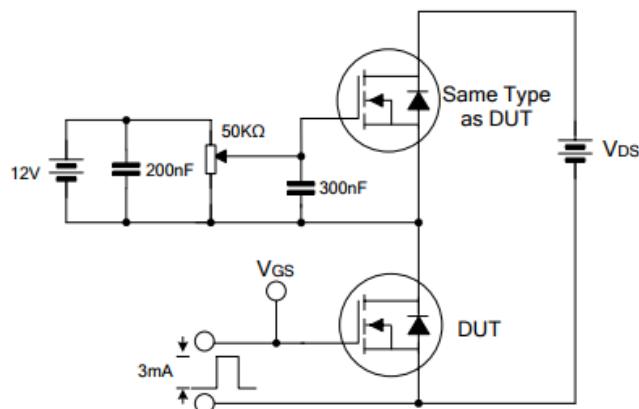
Resistive Switching Test Circuit & Waveform
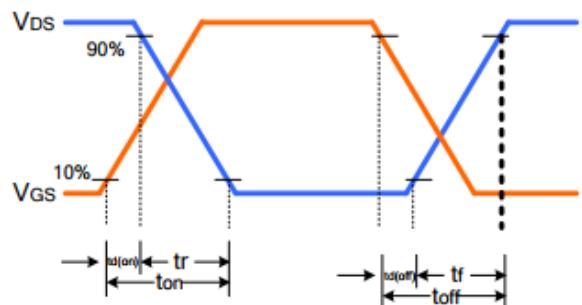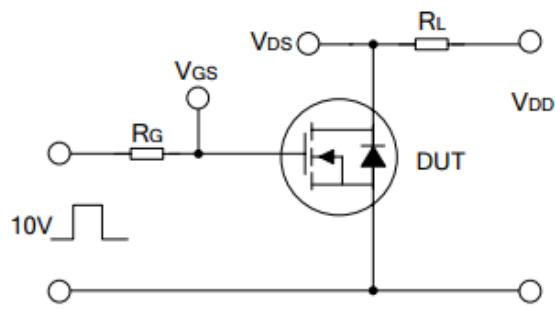
Unclamped Inductive Switching Test Circuit & Waveform

$$EAS = \frac{1}{2} LI_{AS}^2 \frac{B_{VDSS}}{B_{VDSS} - V_{DD}}$$
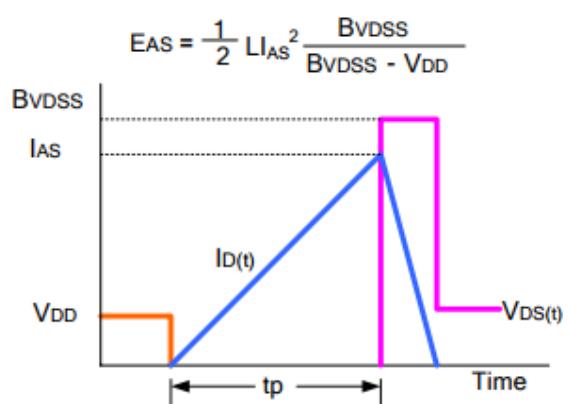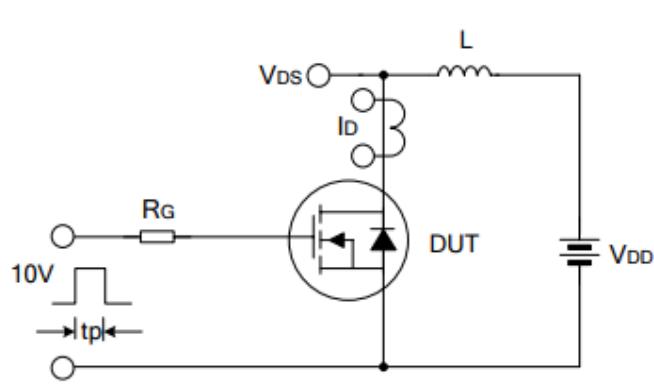
## Typical Electrical   And Thermal Characteristics
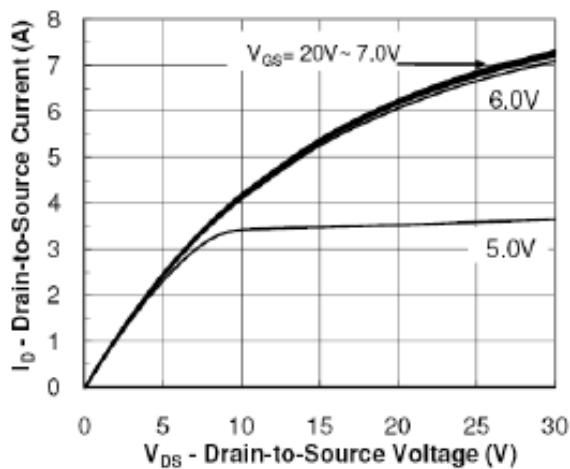
Figure 1: Output Characteristics
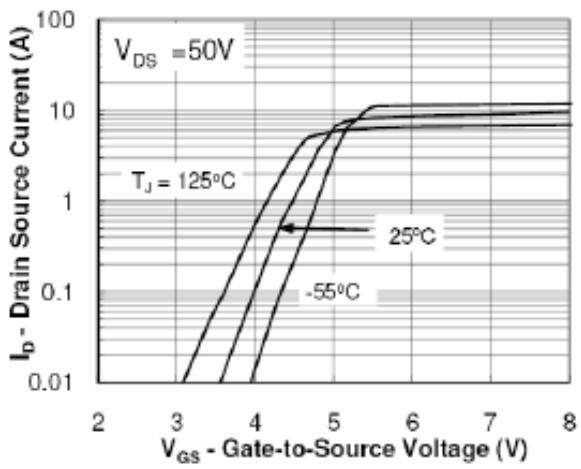
Figure 2: Transfer Characteristics
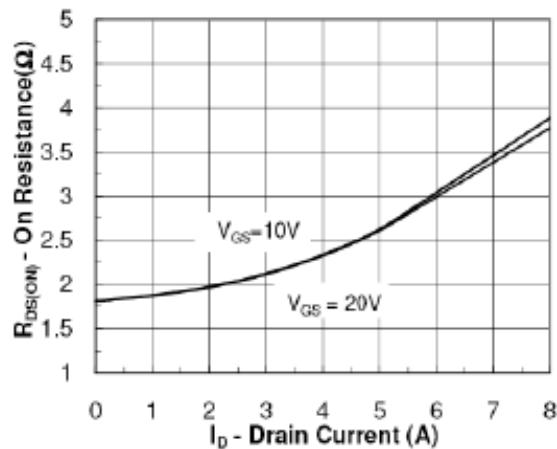
Figure 3: On Resistance Vs Drain Current
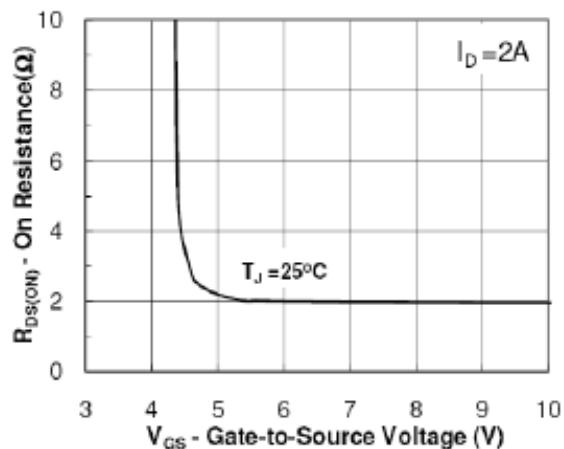
Figure 4: On Resistance Vs Gate Source Voltage
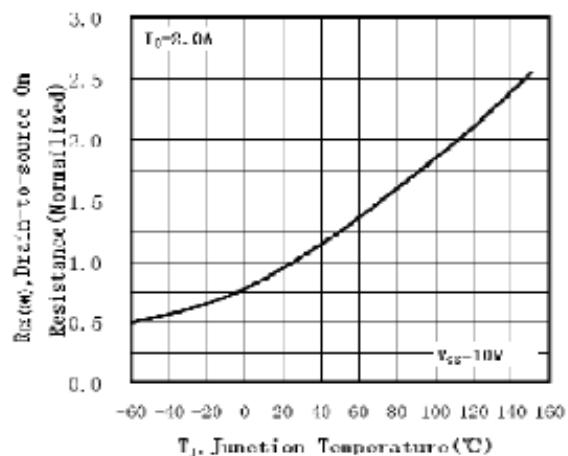
Figure5:   On Resistance Vs Junction Temperature

Figure6: Capacitance Characteristics

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Characteristics Curve
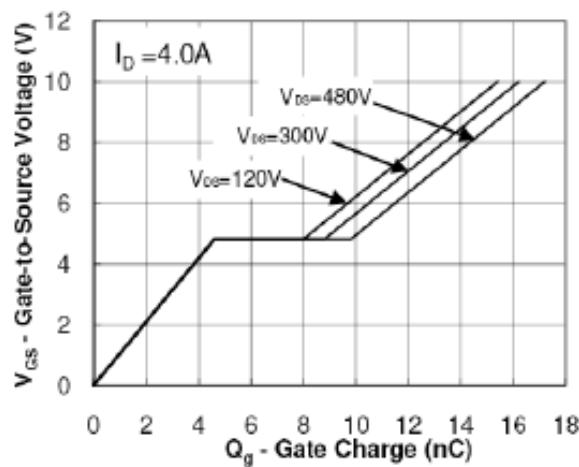
Figure7: Gate Charge Waveform
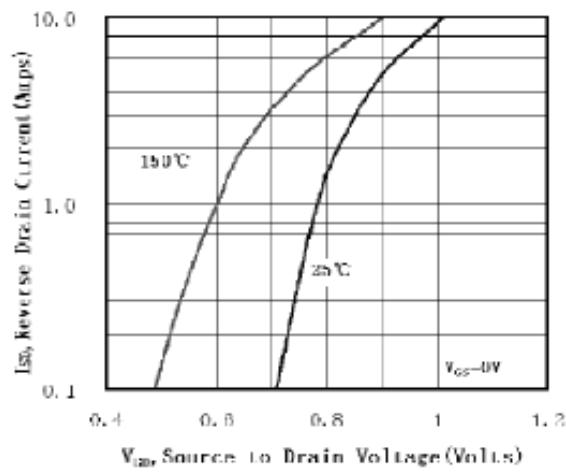
Figure8: Source-Drain Diode
Forward Voltage
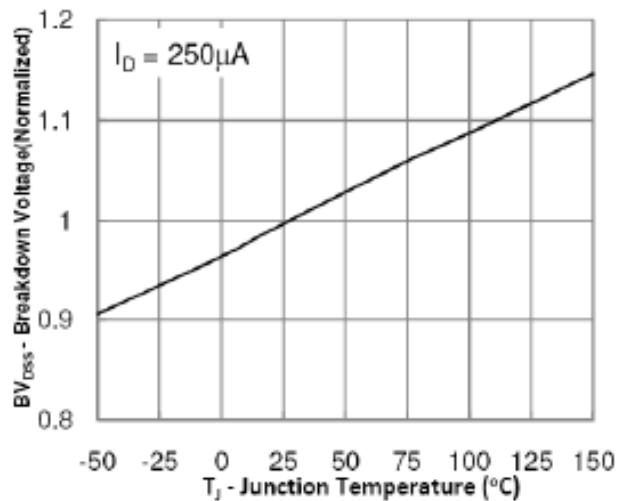
Figure9:   Breakdown Voltage Vs Junction Temperature

Outline Information (TO251-3L)
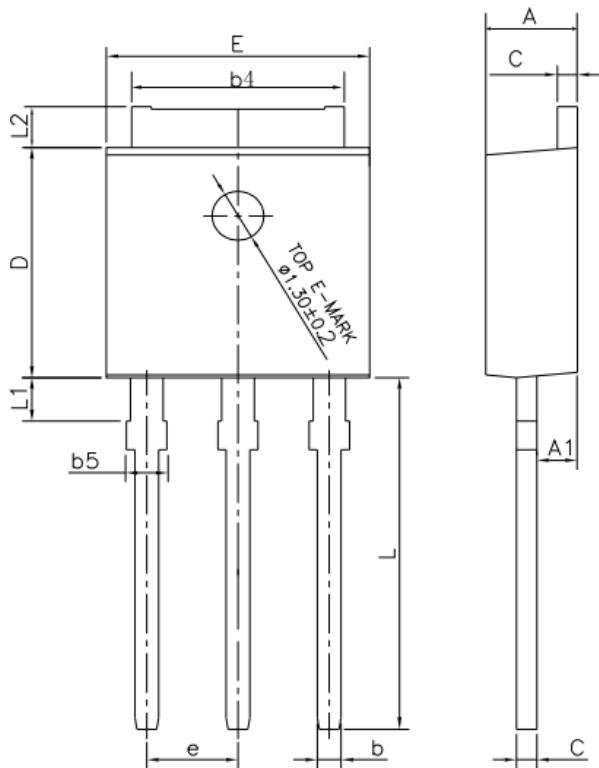
SYMBOL	MIN	NOM	MAX
A	2.18	2.30	2.39
A1	0.89	1.00	1.14
b	0.56	---	0.89
b4	4.95	5.33	5.46
b5	---	---	1.05
c	0.46	---	0.61
D	5.97	6.10	6.27
E	6.35	6.60	6.73
e	2.29 BCS		
L	8.89	9.30	9.65
L1	0.95	---	1.50
L2	0.89	---	1.27

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Outline Information (TO252-2L)
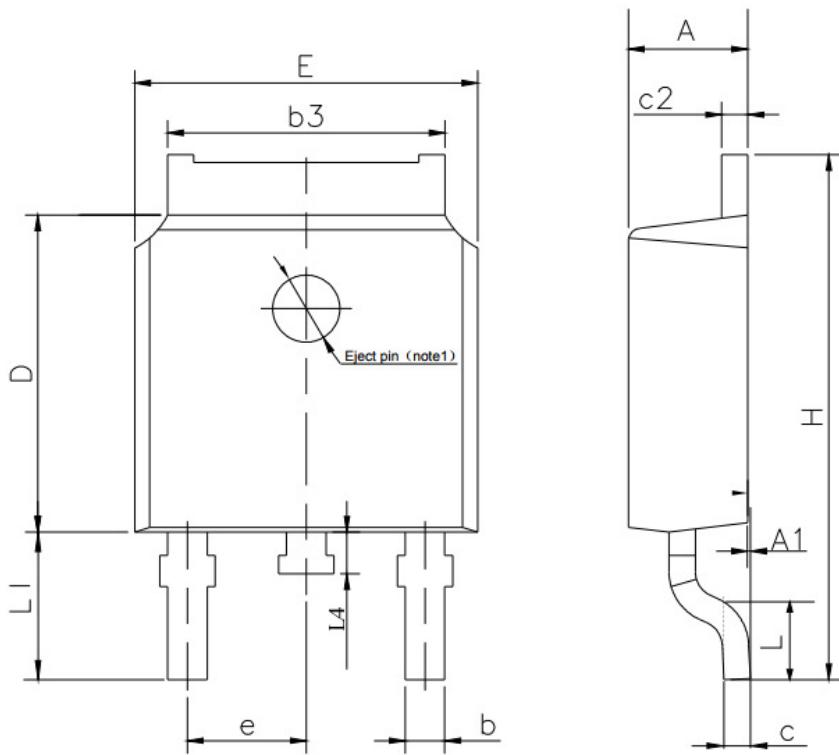
SYMBOL	MIN	NOM	MAX
A	2.10	2.30	2.50
A1	0	----	0.127
b	0.66	0.76	0.89
b3	5.10	5.33	5.46
c	0.45	----	0.65
c2	0.45	----	0.65
D	5.80	6.10	6.40
E	6.30	6.60	6.90
e		2.30TYP	
H	9.60	10.10	10.60
L	1.40	1.50	1.70
L1		2.90REF	
L4	0.60	0.80	1.00

Outline Information (TO220F-3L)
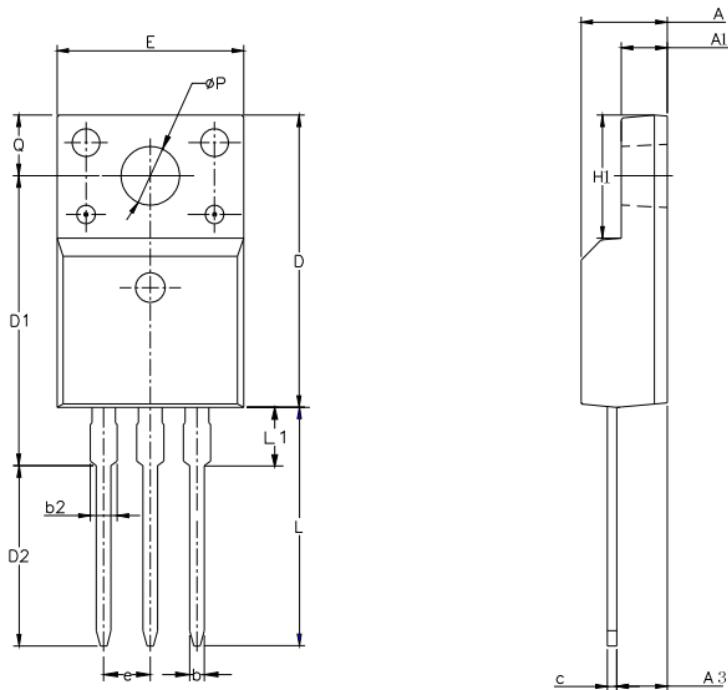
SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.70	0.80	0.90
b2	–	–	1.47
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	15.30	15.75	16.30
D2	9.30	9.80	10.30
E	9.73	10.16	10.36
e		2.54BCS	
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	/	/	3.50
ØP	3.00	3.18	3.40
Q	3.05	3.30	3.55

Outline Information (TO220-3L)
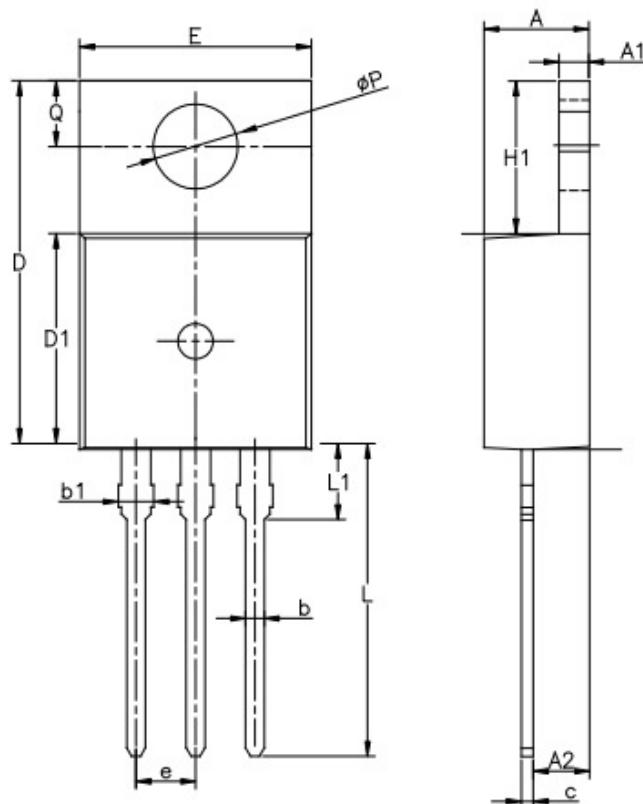
SYMBOL	MIN	NOM	MAX
A	4.30	4.50	4.70
A1	1.00	1.30	1.50
A2	1.80	2.40	2.80
b	0.60	0.80	1.00
b1	1.00	—	1.60
c	0.30	—	0.70
D	15.10	15.70	16.10
D1	8.10	9.20	10.00
E	9.60	9.90	10.40
e		2.54BSC	
H1	6.10	6.50	7.00
L	12.60	13.08	13.60
L1	—	—	3.95
ΦP	3.40	3.70	3.90
Q	2.60	—	3.20

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