N-Channel Super Junction Power MOSFET Ⅲ

General Description

The series of devices use advanced trench gate super junction technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

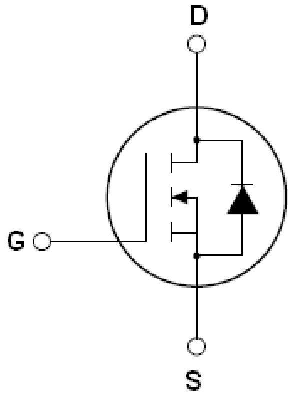
V_{DS}	900	V
$R_{DS(ON)TYP}$	1.5	Ω
I_D	5	A

Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

Application

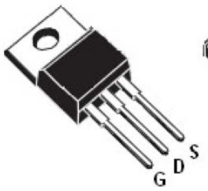
- Power factor correction（PFC）
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）



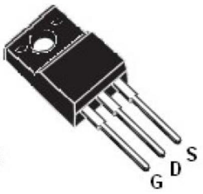
Schematic diagram

Package Marking And Ordering Information

Device	Device Package	Marking
HMS5N90	TO-220	HMS5N90
HMS5N90F	TO-220F	HMS5N90F



TO-220



TO-220F

Table 1. Absolute Maximum Ratings (T_C=25℃)

Parameter	Symbol	Value	Unit
Drain-Source Voltage (V_{GS}=0V）	V_{DS}	900	V
Gate-Source Voltage (V_{DS}=0V) ,AC (f>1 Hz)	V_{GS}	±30	V
Continuous Drain Current at Tc=25°C	$I_{D\ (DC)}$	5	A
Continuous Drain Current at Tc=100°C	$I_{D\ (DC)}$	3	A
Pulsed drain current **(Note 1)**	$I_{DM\ (pluse)}$	20	A
Maximum Power Dissipation(Tc=25℃)	P_D	46	W
Derate above 25°C		0.37	W/°C
Single pulse avalanche energy **(Note2)**	E_{AS}	52	mJ
Avalanche current**(Note 1)**	I_{AR}	0.9	A
Repetitive Avalanche energy ， t_{AR} limited by T_{jmax} **(Note 1)**	E_{AR}	0.14	mJ
Parameter	**Symbol**	**Value**	**Unit**

Drain Source voltage slope, V_{DS} ≤480 V,	dv/dt	50	V/ns
Reverse diode dv/dt，V_{DS} ≤480 V,I_{SD}<I_D	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	T_J,T_{STG}	-55...+150	°C

Table 2. Thermal Characteristic

Parameter	Symbol	Value	Unit
Thermal Resistance，Junction-to-Case（Maximum）	R_{thJC}	2.72	°C /W
Thermal Resistance，Junction-to-Ambient （Maximum）	R_{thJA}	75	°C /W

Table 3. Electrical Characteristics (TA=25℃unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V I_D=250μA	900			V
Zero Gate Voltage Drain Current(Tc=25℃)	I_{DSS}	V_{DS}=900V,V_{GS}=0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I_{DSS}	V_{DS}=900V,V_{GS}=0V			50	μA
Gate-Body Leakage Current	I_{GSS}	V_{GS}=±20V,V_{DS}=0V			±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS},I_D=250μA	2.6		4.4	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=2.5A	1.48		1.5	Ω
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{DS}=50V,V_{GS}=0V, F=1.0MHz		370		pF
Output Capacitance	C_{oss}			25		pF
Reverse Transfer Capacitance	C_{rss}			0.5		pF
Total Gate Charge	Q_g	V_{DS}=480V,I_D=5A, V_{GS}=10V		10.5	15	nC
Gate-Source Charge	Q_{gs}			2.6		nC
Gate-Drain Charge	Q_{gd}			5.3		nC
Switching times						
Turn-on Delay Time	$t_{d(on)}$	V_{DD}=420V,I_D=3A, R_G=5Ω,V_{GS}=10V		8		nS
Turn-on Rise Time	t_r			4		nS
Turn-Off Delay Time	$t_{d(off)}$			55		nS
Turn-Off Fall Time	t_f			11		nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I_{SD}	T_C=25°C			5	A
Pulsed Source-drain current(Body Diode)	I_{SDM}				20	A
Forward on voltage	V_{SD}	Tj=25°C,I_{SD}=5A,V_{GS}=0V		0.9	1.2	V
Reverse Recovery Time	t_{rr}	Tj=25°C,I_F=2.5A,di/dt=100A/μs		210		nS
Reverse Recovery Charge	Q_{rr}			0.66		uC
Peak reverse recovery current	I_{rrm}			6.5		A

Notes: 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2. Tj=25℃,VDD=50V,VG=10V, R_G=25Ω

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

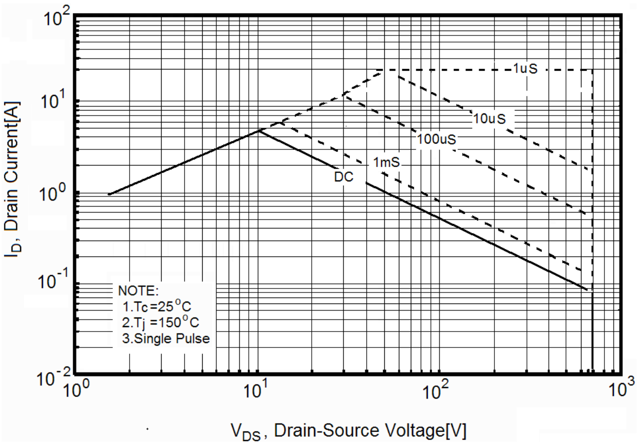


Figure2. Source-Drain Diode Forward Voltage

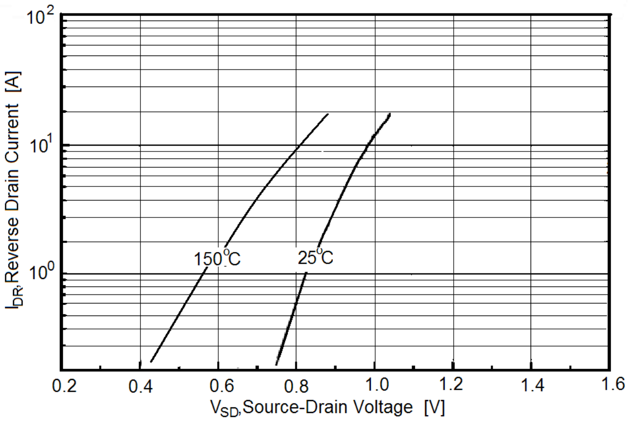


Figure3. Output characteristics

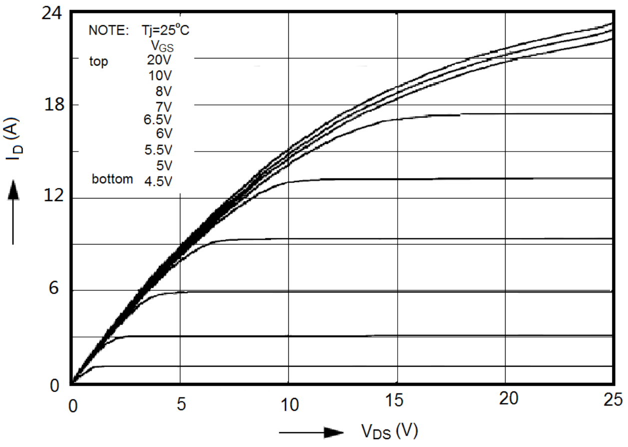


Figure4. Transfer characteristics

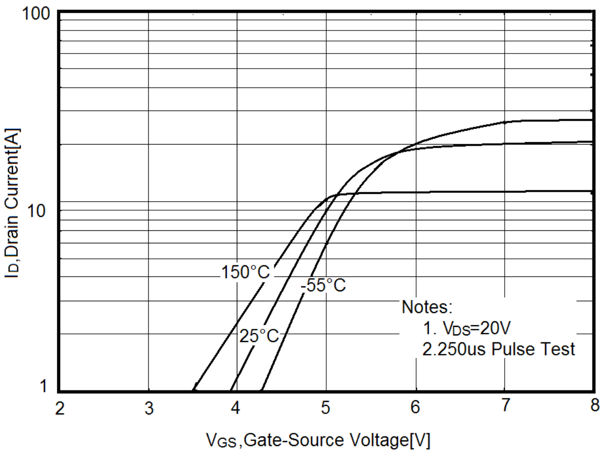


Figure5. Static drain-source on resistance

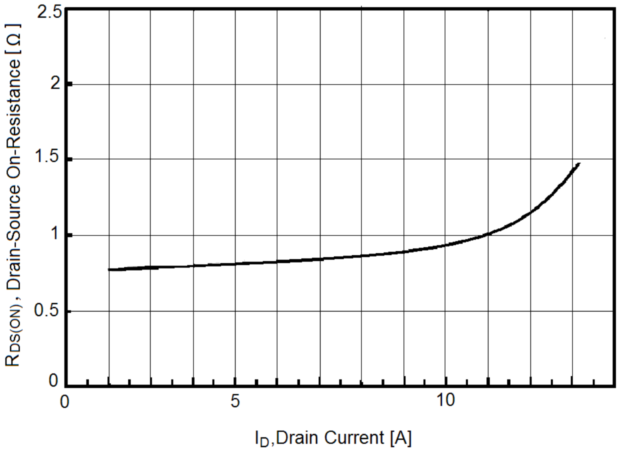


Figure6. $R_{DS(ON)}$ vs Junction Temperature

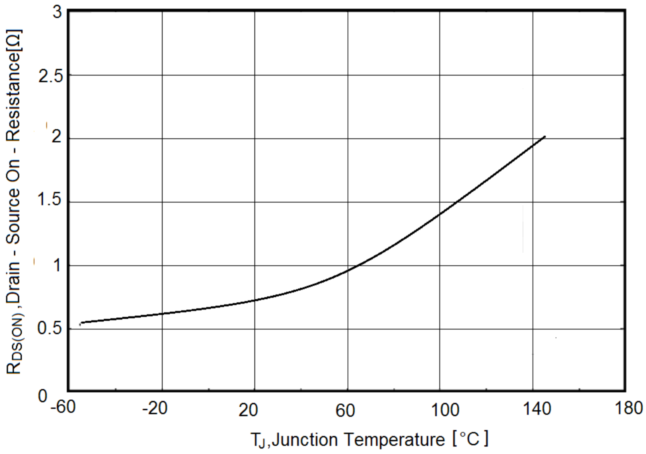


Figure7. BV_{DSS} vs Junction Temperature

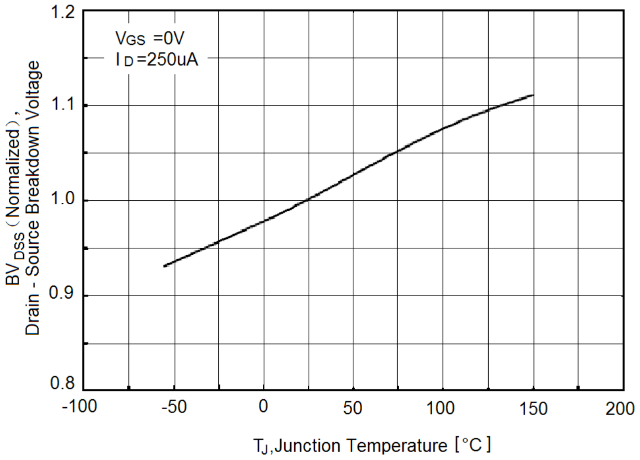


Figure8. Maximum I_D vs Junction Temperature

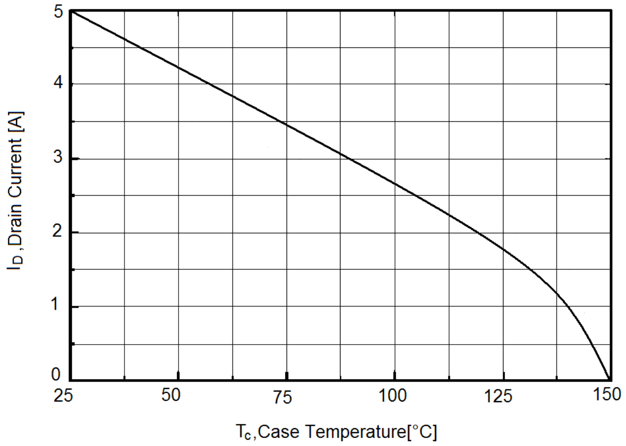


Figure9. Gate charge waveforms

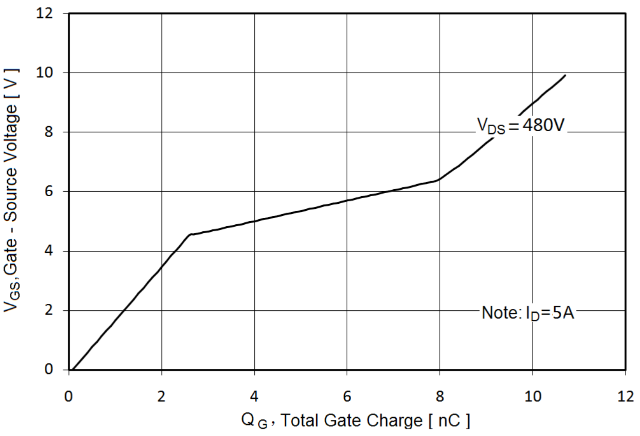


Figure10. Capacitance

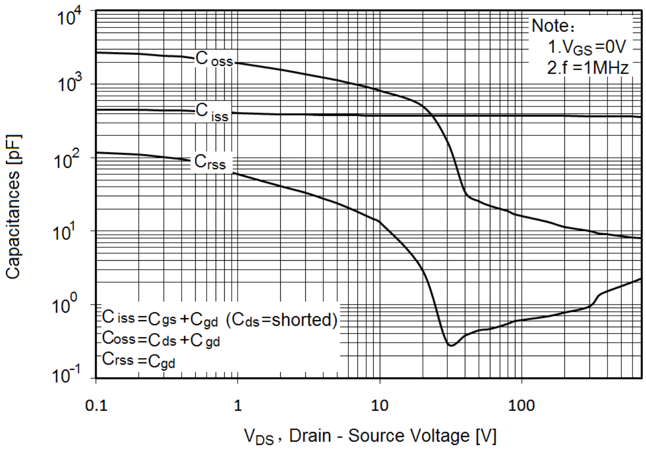
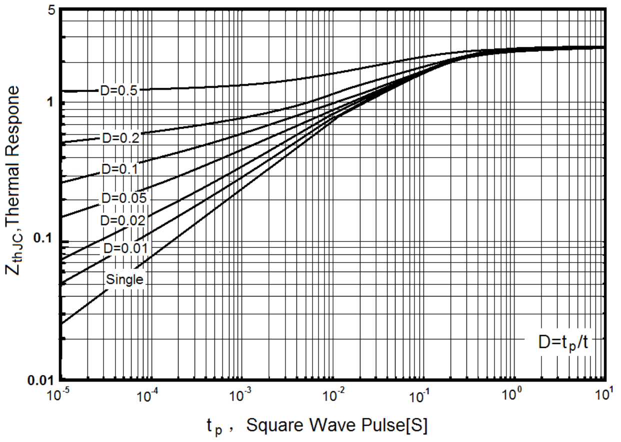
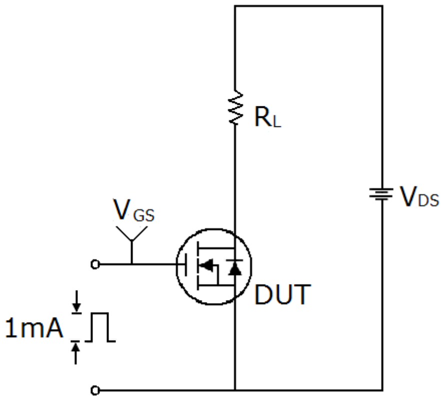


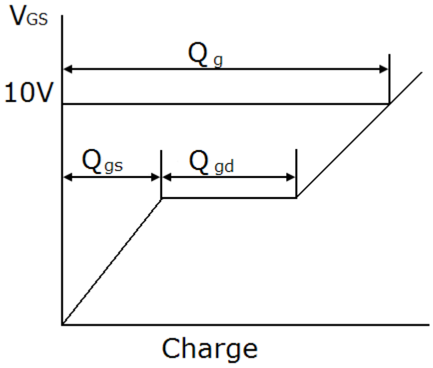
Figure11. Transient Thermal Impedance



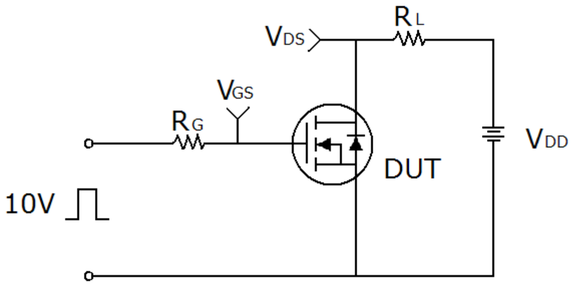
Test circuit

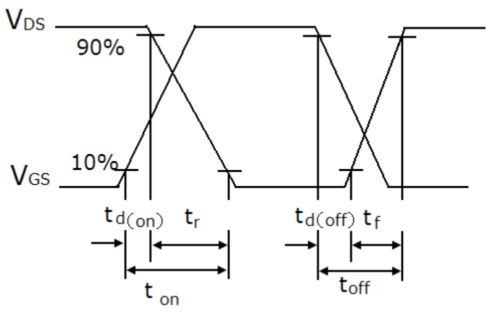
1）Gate charge test circuit & Waveform



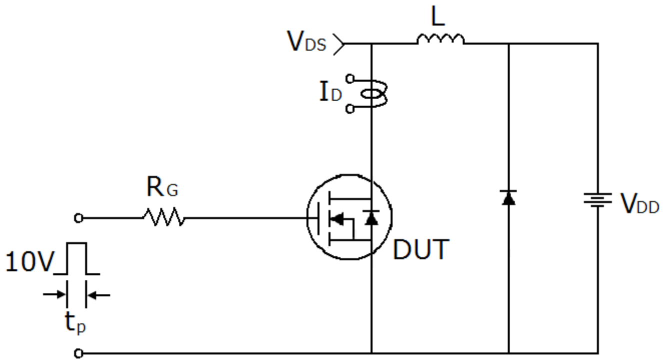


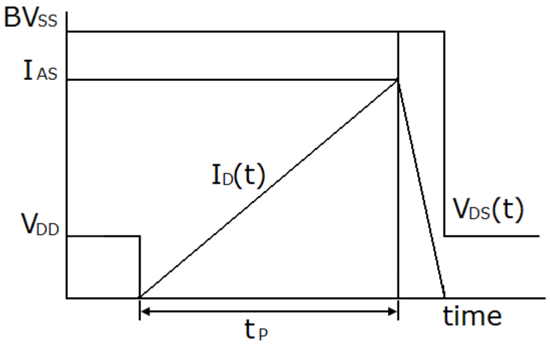
2）Switch Time Test Circuit:



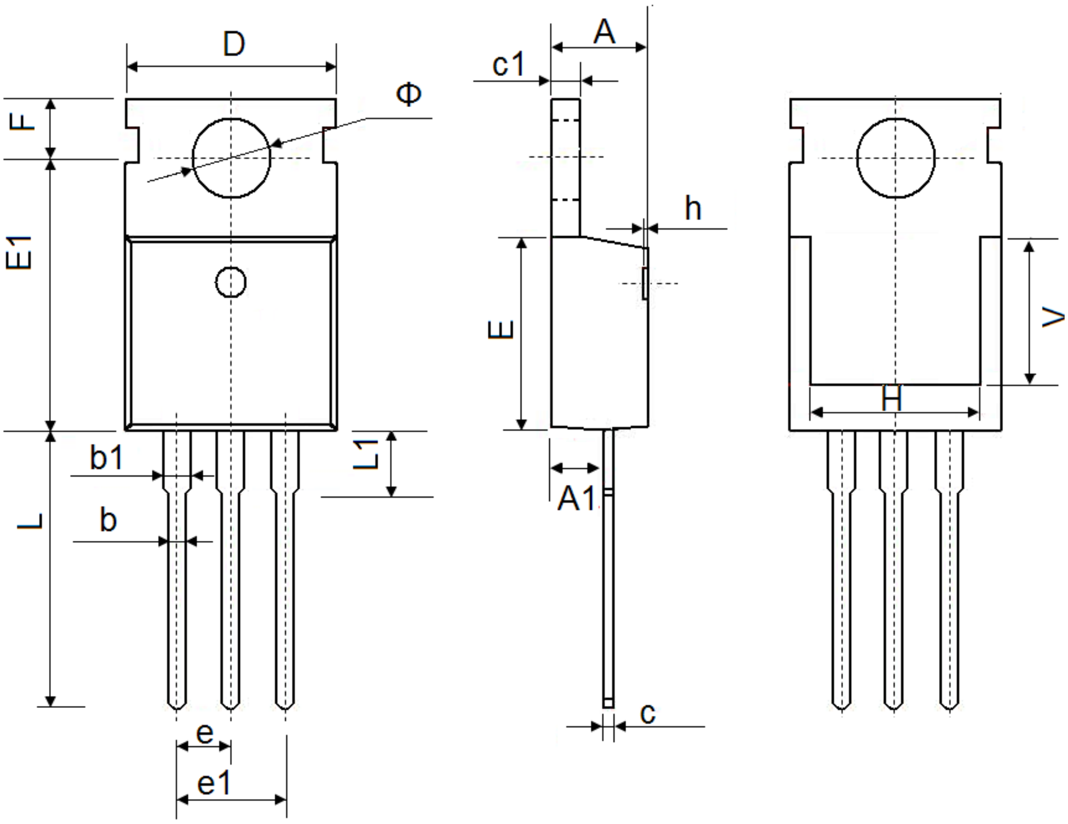


3）Unclamped Inductive Switching Test Circuit & Waveforms



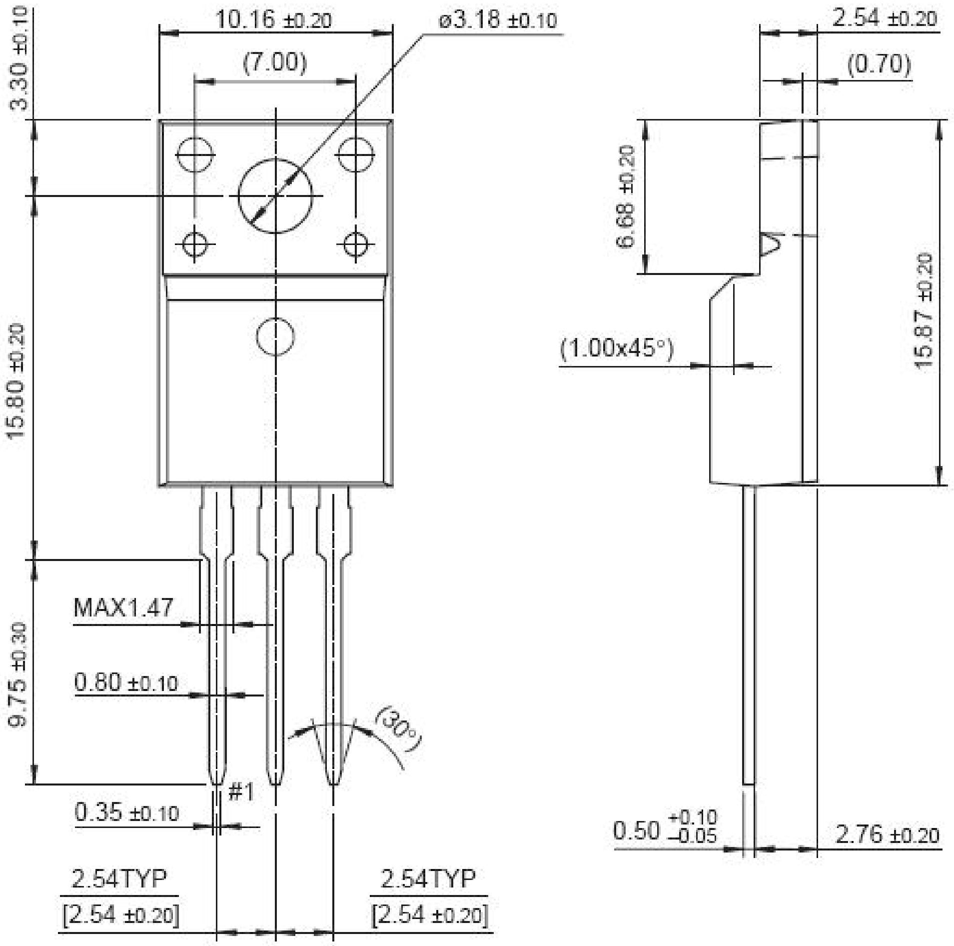


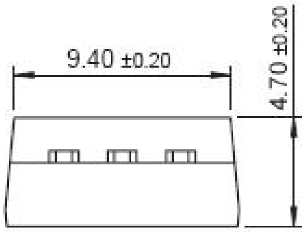
TO-220 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.400	4.600	0.173	0.181
A1	2.250	2.550	0.089	0.100
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.330	0.650	0.013	0.026
c1	1.200	1.400	0.047	0.055
D	9.910	10.250	0.390	0.404
E	8.9500	9.750	0.352	0.384
E1	12.650	12.950	0.498	0.510
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
F	2.650	2.950	0.104	0.116
H	7.900	8.100	0.311	0.319
h	0.000	0.300	0.000	0.012
L	12.900	13.400	0.508	0.528
L1	2.850	3.250	0.112	0.128
V	7.500 REF.		0.295 REF.	
Φ	3.400	3.800	0.134	0.150

TO-220F Package Information





Dimensions in Millimeters