

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.

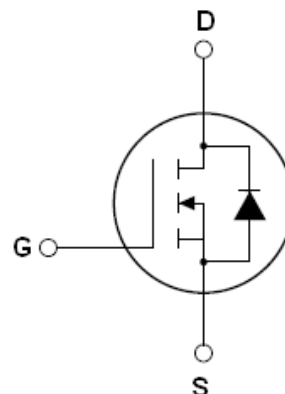
Features

- 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)

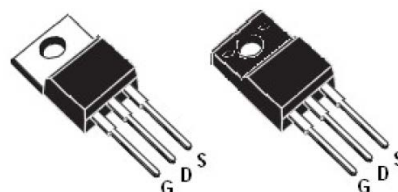
V_{DS}	900	V
$R_{DS(ON)TYP}$	1.5	Ω
I_D	5	A



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 ($T_c=25^\circ\text{C}$)

Parameter	Symbol	Value	Unit
Drain-Source Voltage ($V_{GS}=0V$)	V_{DS}	900	V
Gate-Source Voltage ($V_{DS}=0V$), AC ($f>1\text{ Hz}$)	V_{GS}	± 30	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	5	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	3	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	20	A
Maximum Power Dissipation($T_c=25^\circ\text{C}$)	P_D	46	W
Derate above 25°C		0.37	W/ $^\circ\text{C}$
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, $V_{DS} \leq 480V$,	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$	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°C 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℃			5	A
Pulsed Source-drain current(Body Diode)	I _{SDM}				20	A
Forward on voltage	V _{SD}	T _j =25℃, I _{SD} =5A, V _{GS} =0V		0.9	1.2	V
Reverse Recovery Time	t _{rr}	T _j =25℃, 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. $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

Figure1. Safe operating area

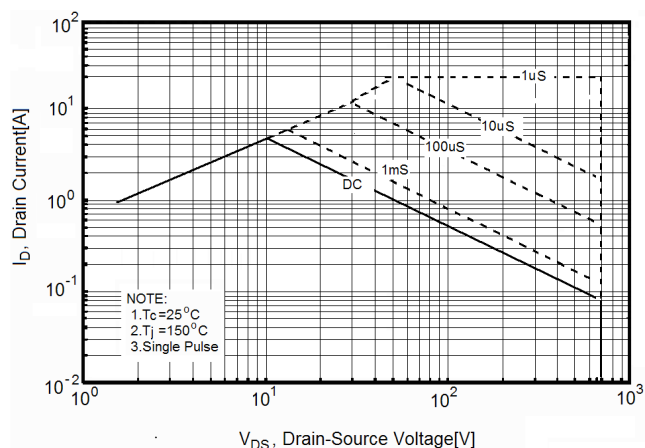


Figure2. Source-Drain Diode Forward Voltage

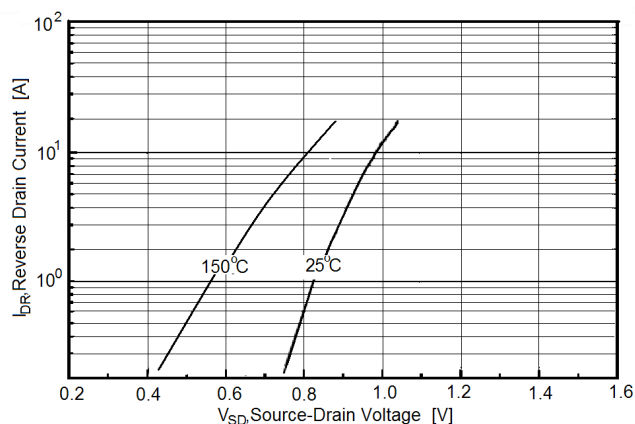


Figure3. Output characteristics

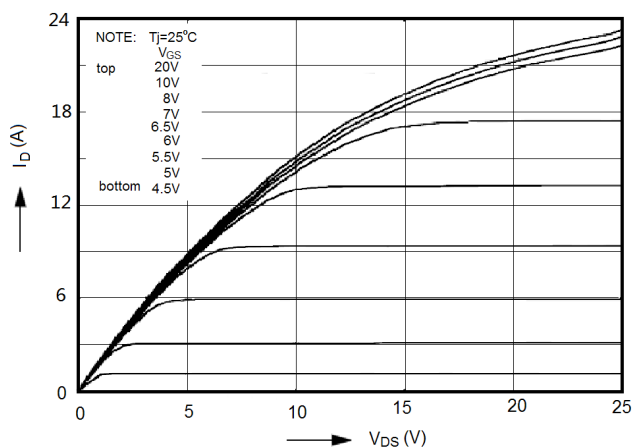


Figure4. Transfer characteristics

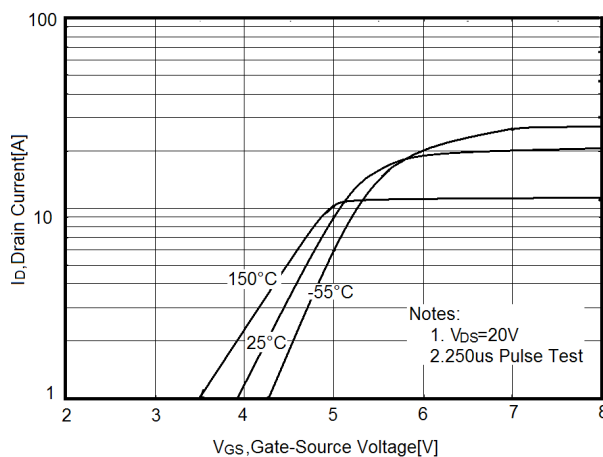


Figure5. Static drain-source on resistance

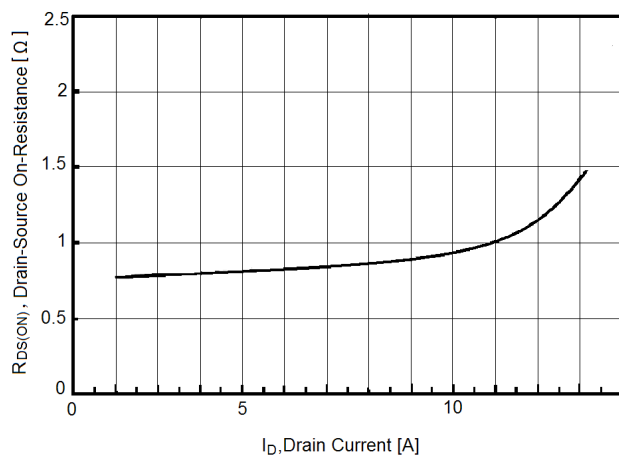


Figure6. $R_{DS(ON)}$ vs Junction Temperature

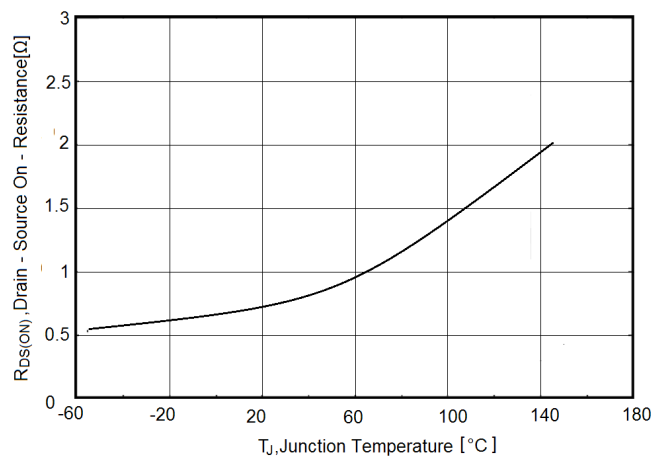


Figure7. BV_{DSS} vs Junction Temperature

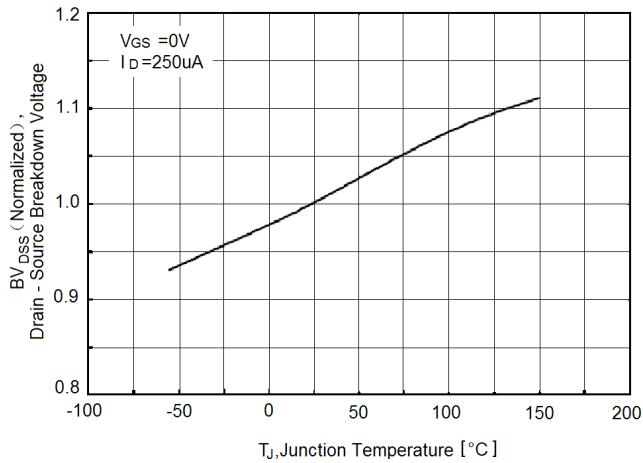


Figure8. Maximum I_D vs Junction Temperature

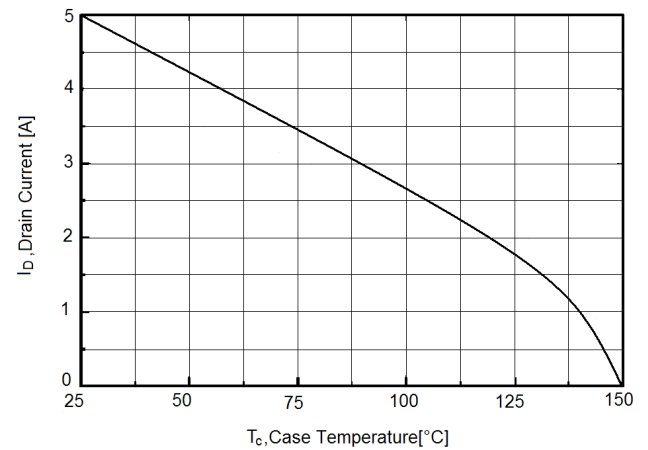


Figure9. Gate charge waveforms

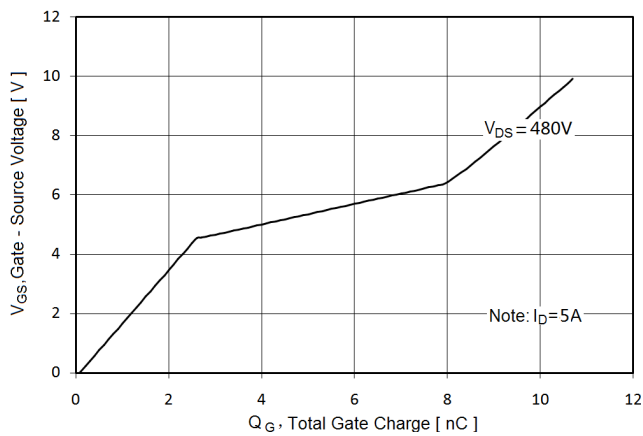


Figure10. Capacitance

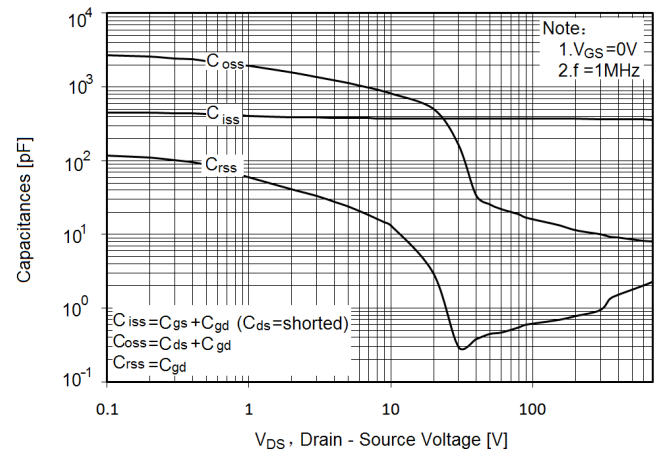
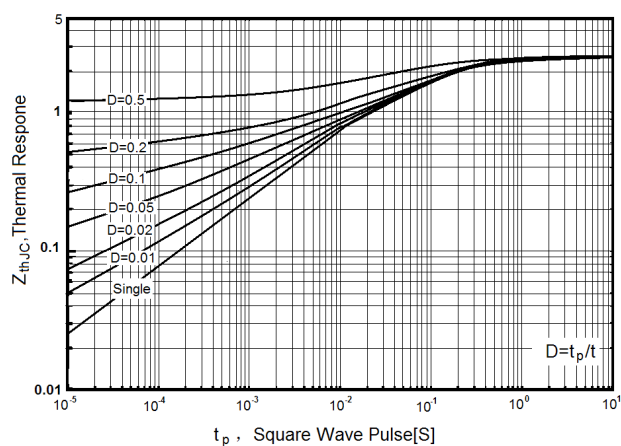
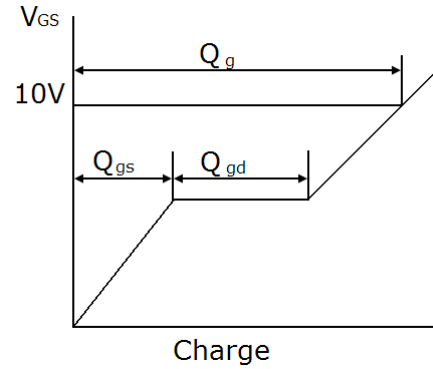
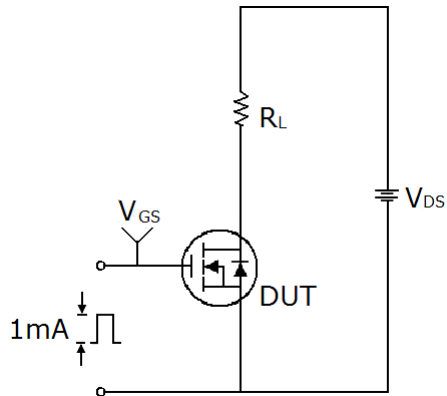


Figure11. Transient Thermal Impedance

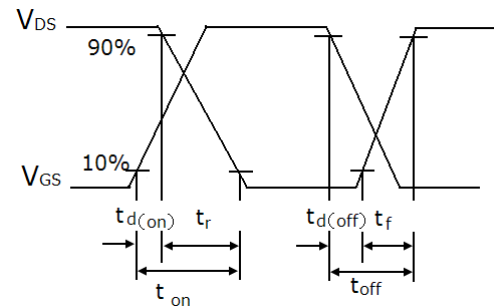
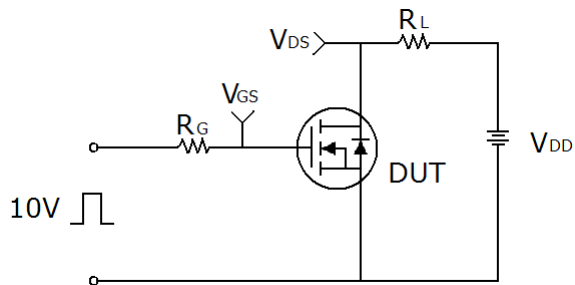


Test circuit

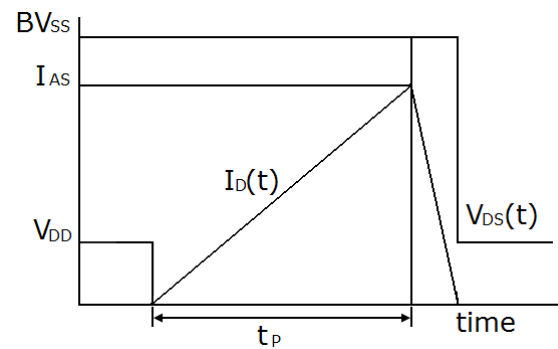
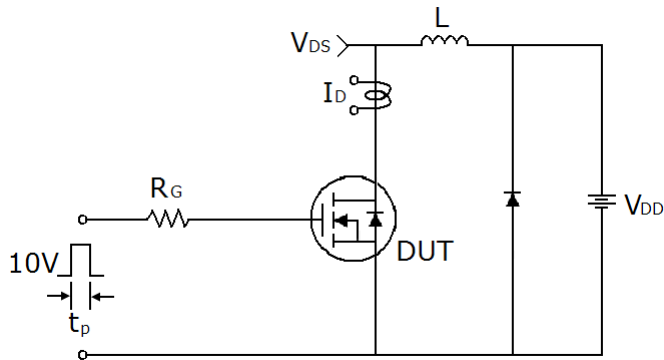
1) Gate charge test circuit & Waveform



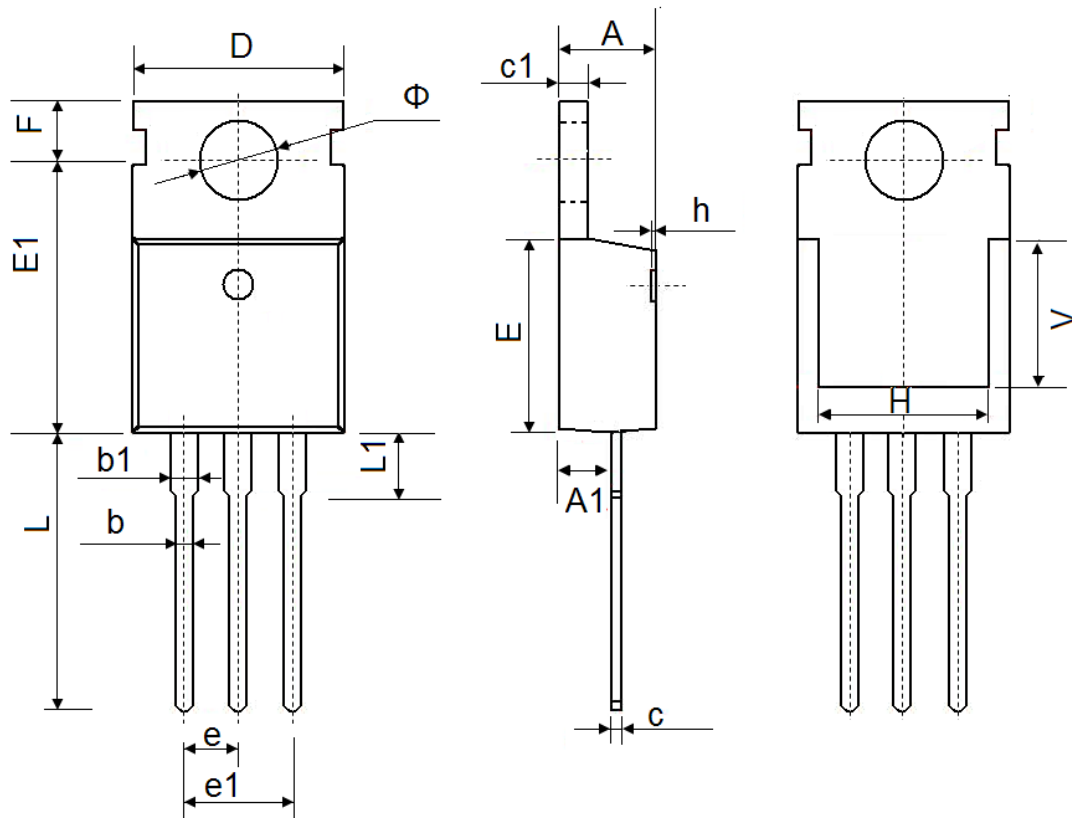
2) Switch Time Test Circuit:



3) Unclamped Inductive Switching Test Circuit & Waveforms

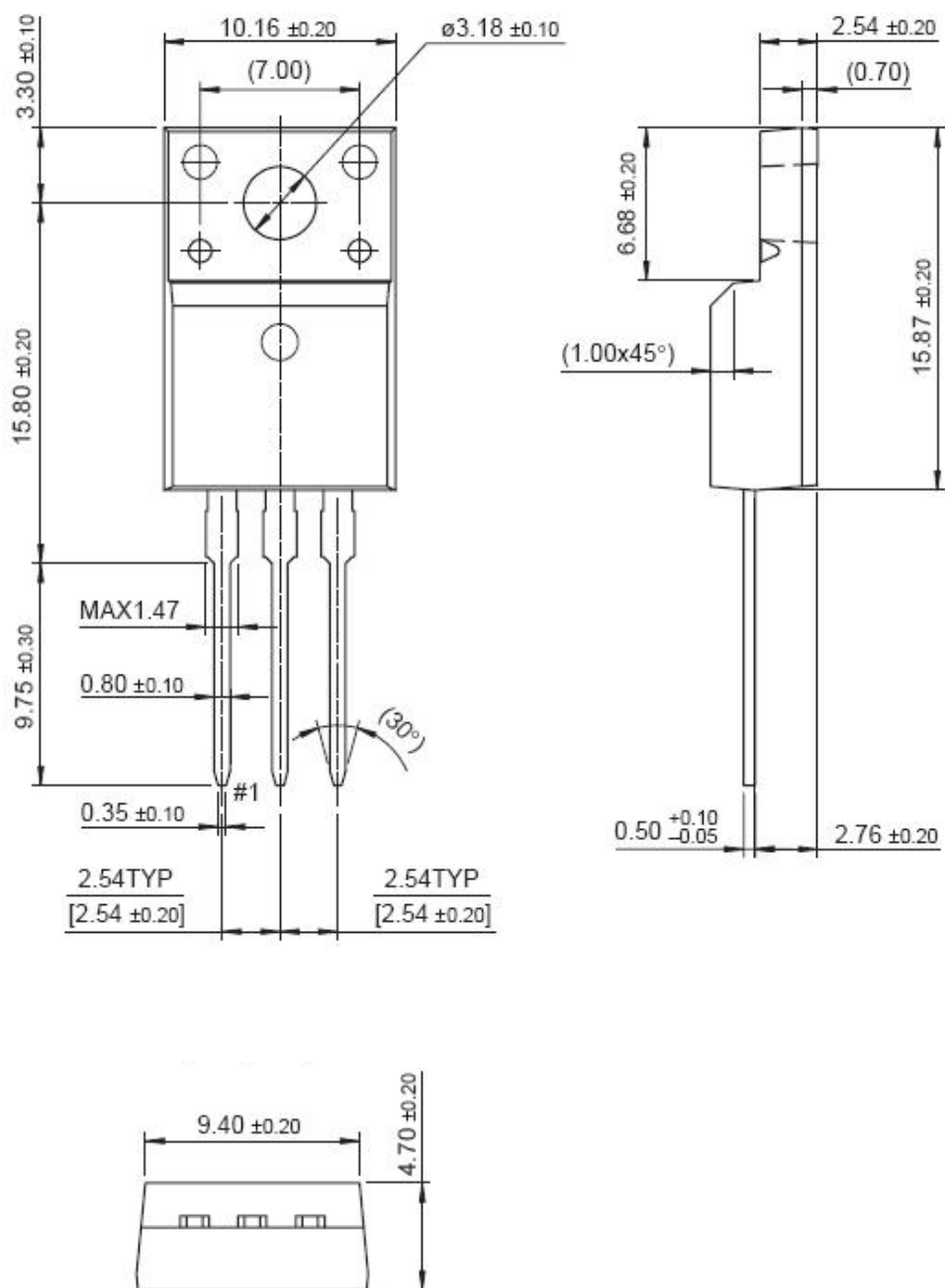


TO-220' Package Information



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

ATTENTION:

- Any and all H&M SEMI products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your H&M SEMI representative nearest you before using any H&M SEMI products described or contained herein in such applications.
- H&M SEMI assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all H&M SEMI products described or contained herein.
- Specifications of any and all H&M SEMI products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- H&M Semiconductor CO.,LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all H&M SEMI products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of H&M Semiconductor CO.,LTD.
- Information (including circuit diagrams and circuit parameters) herein is for example only ; it is not guaranteed for volume production. H&M SEMI believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the H&M SEMI product that you intend to use.
- This catalog provides information as of Sep.2010. Specifications and information herein are subject to change without notice.