

20A, 650V N-CHANNEL POWER MOSFET

GENERAL DESCRIPTION

These N-Channel enhancement mode power field effect transistors are produced using Hi-semicon's proprietary, planar stripe, DMOS technology.

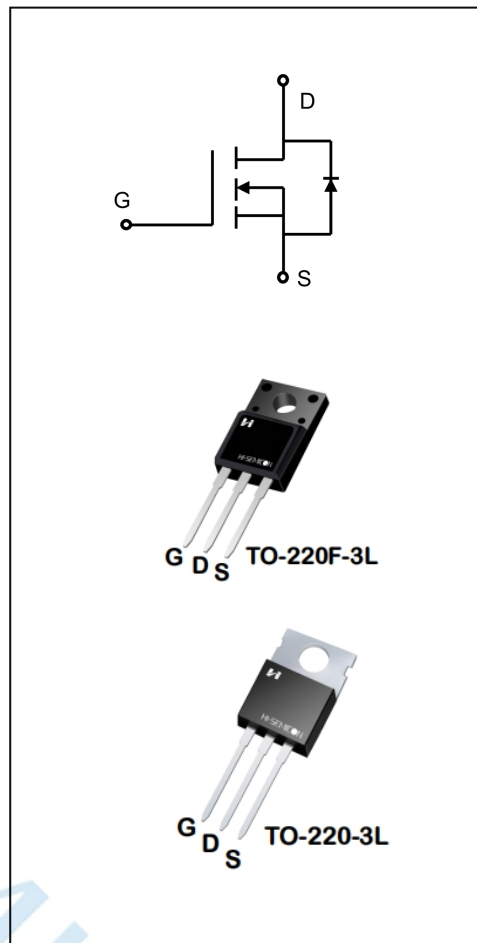
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

Features

- ◆ $V_{DS}(V)=650V, I_D=20A$
- ◆ $R_{DS(ON)}$
 TYP: $0.37\Omega @ V_{GS}=10V, I_D=10A$
 MAX: 0.5Ω

Applications

- ◆ Power faction correction (PFC)
- ◆ Switched mode power supplies (SMPS)
- ◆ Uninterruptible power supply (UPS)
- ◆ LED lighting power



ORDERING INFORMATION

Part No.	Package	Marking	Material	Packing
SFF20N65	TO-220F-3L	SFF20N65	Pb free	Tube
SFP20N65	TO-220-3L	SFP20N65	Pb free	Tube

ABSOLUTE MAXIMUM RATINGS (T_J=25°C unless otherwise noted)

Characteristics	Symbol	Ratings		Unit
		SFF20N65	SFP20N65	
Drain-Source Voltage	V _{DS}	650		V
Gate-Source Voltage	V _{GS}	±30		V
Drain Current	I _D	T _C = 25°C		A
		T _C = 100°C		
Drain Current Pulsed (Note 1)	I _{DM}	80		A
Power Dissipation(T _C =25°C) -Derate above 25°C	P _D	65	237	W
		0.36	1.98	W/°C
Single Pulsed Avalanche Energy (Note 2)	E _{AS}	638.2		mJ
Operation Junction Temperature Range	T _J	-55~+150		°C
Storage Temperature Range	T _{stg}	-55~+150		°C
Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	TL	300		°C

THERMAL CHARACTERISTICS

Characteristics	Symbol	MAX		Unit
		SFF20N65	SFP20N65	
Thermal Resistance, Junction-to-Case	R _{θJC}	2.33	0.51	°C/W
Thermal Resistance, Junction-to-Ambient	R _{θJA}	62.5	39	°C/W

ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
Drain -Source Breakdown Voltage	B _{VDS}	V _{GS} =0V, I _D =250μA	650	705	--	V
Drain-Source Leakage Current	I _{DSS}	V _{DS} =650V, V _{GS} =0V	--	3.8	100	nA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =30V, V _{DS} =0V	--	--	100	nA
Gate-Source Leakage Current	I _{GSS}	V _{GS} =-30V, V _{DS} =0V	--	---	-100	nA
On Characteristics						
Gate Threshold Voltage	V _{GS(th)}	V _{GS} = V _{DS} , I _D =250μA	2	3.3	4.0	V
Static Drain- Source On State Resistance	R _{DS(on)}	V _{GS} =10V, I _D =10A	--	0.37	0.5	Ω
Dynamic Characteristics						
Gate Resistance	R _g	V _{GS} =0V; f=1.0MHZ	1	2.8	10	Ω
Input Capacitance	C _{iss}	V _{DS} =25V V _{GS} =0V f=1.0MHZ	--	3400	--	pF
Output Capacitance	C _{oss}		--	238.8	--	
Reverse Transfer Capacitance	C _{rss}		--	5.1	--	
Switching Characteristics						
Turn-on Delay Time	t _{d(on)}	V _{DD} =325V; V _{GS} =10V	--	25.1	--	ns
Turn-on Rise Time	t _r	R _G =25Ω; I _D =20A (Note 3.4)	--	37.4	--	

Turn-off Delay Time	$t_{d(off)}$	$V_{DD}=325V; V_{GS}=10V$ $R_G=25\Omega; I_D=20A$ (Note 3.4)	--	77.2	--	ns
Turn-off Fall Time	t_f		--	47.5	--	
Total Gate Charge	Q_g	$V_{DS}=480V, I_D=20A$ $V_{GS}=10V$ (Note 3.4)	--	49.73	--	nc
Gate-Source Charge	Q_{gs}		--	13.4	--	
Gate-Drain Charge	Q_{gd}		--	12.9	--	

SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

Characteristics	Symbol	Test conditions	Min.	Typ.	Max.	Unit
Continuous Source Current	I_S	Integral Reverse P-N Junction Diode in the MOSFET	--	--	20	A
Pulsed Source Current	I_{SM}		--	--	80	
Diode Forward Voltage	V_{SD}	$I_S=20A, V_{GS}=0V$	--	0.81	1.2	V
Reverse Recovery Time	T_{rr}	$I_F=20A, V_R=520V,$ $dI_F/dt=100A/\mu S$	--	601	--	ns
Reverse Recovery Charge	Q_{rr}		--	8.2	--	μC

1. Pulse width limited by maximum junction temperature
2. $L=10mH, I_{AS}=8A, V_{DD}=100V, V_G=10V, R_G=25\Omega$, starting $T_J=25^\circ C$
3. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$
4. Essentially independent of operating temperature

Typical Performance Characteristics

Figure 1. On-Region Characteristics

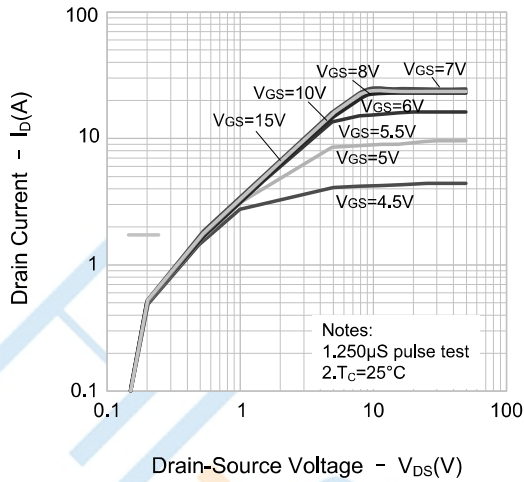


Figure 2. Transfer Characteristics

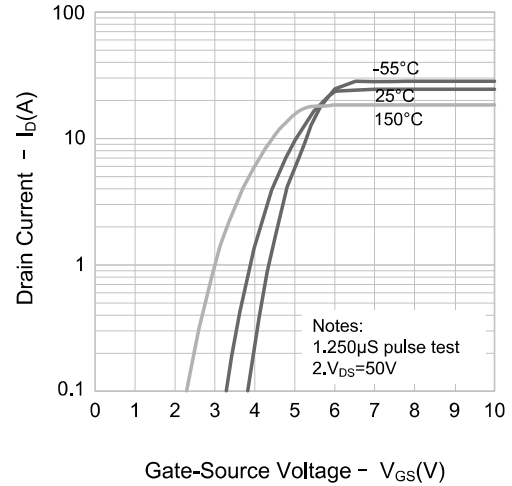


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

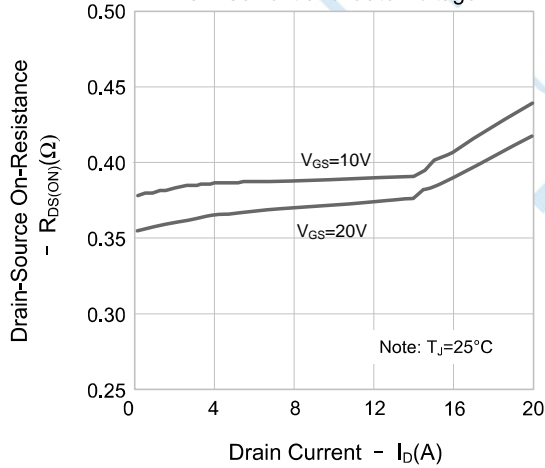


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

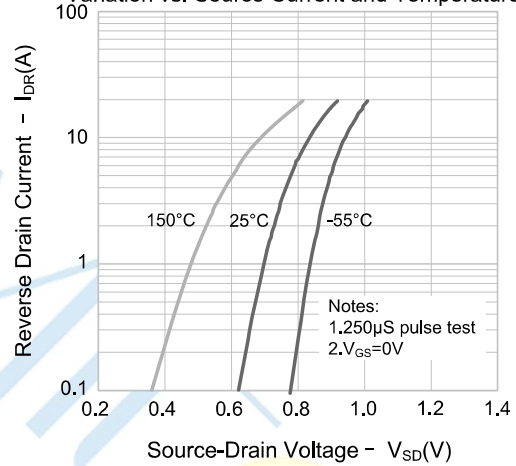


Figure 5. Capacitance Characteristics

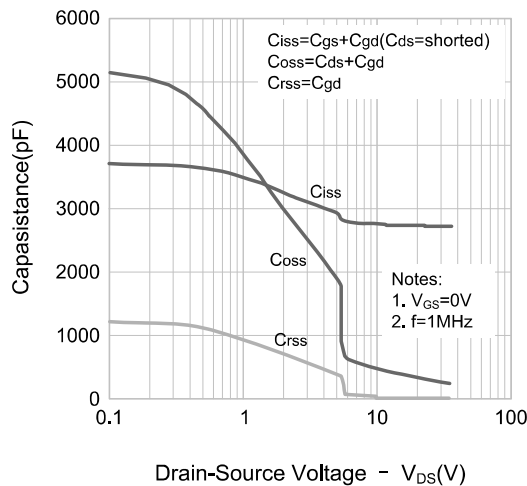
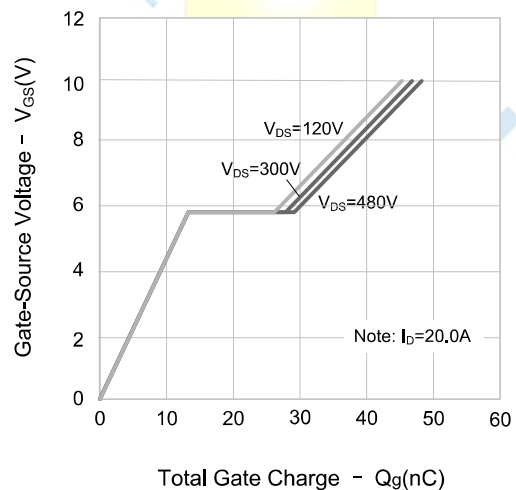


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Variation vs. Temperature

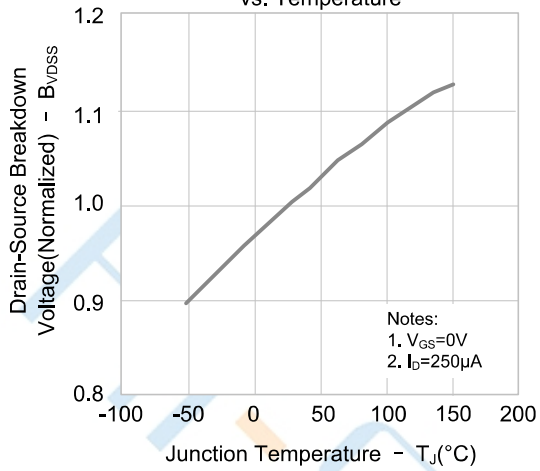


Figure 8. On-resistance Variation vs. Temperature

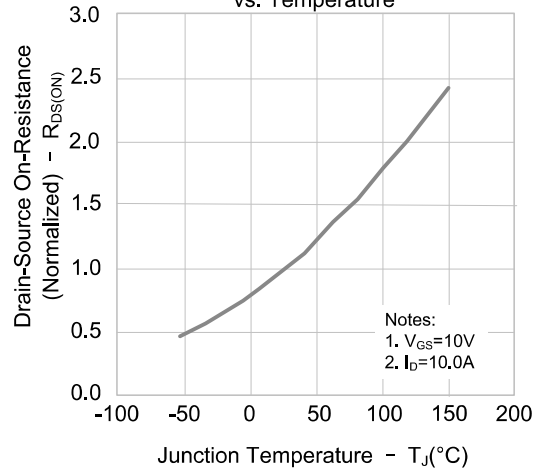


Figure 9. Max. Safe Operating Area

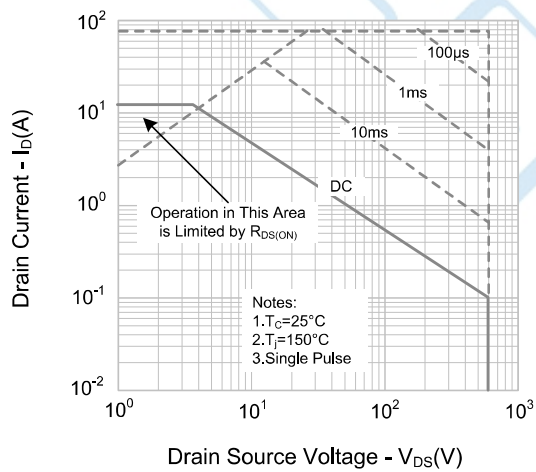
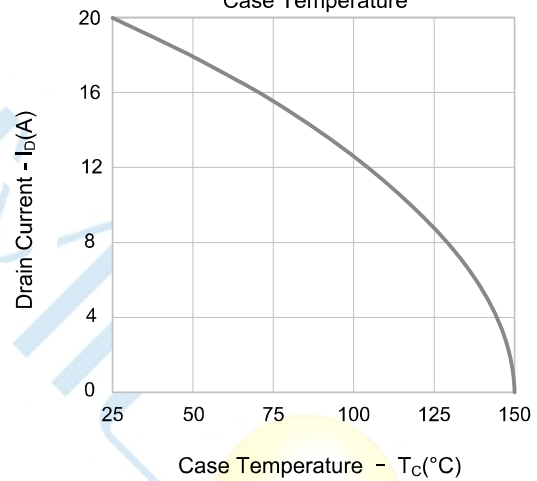
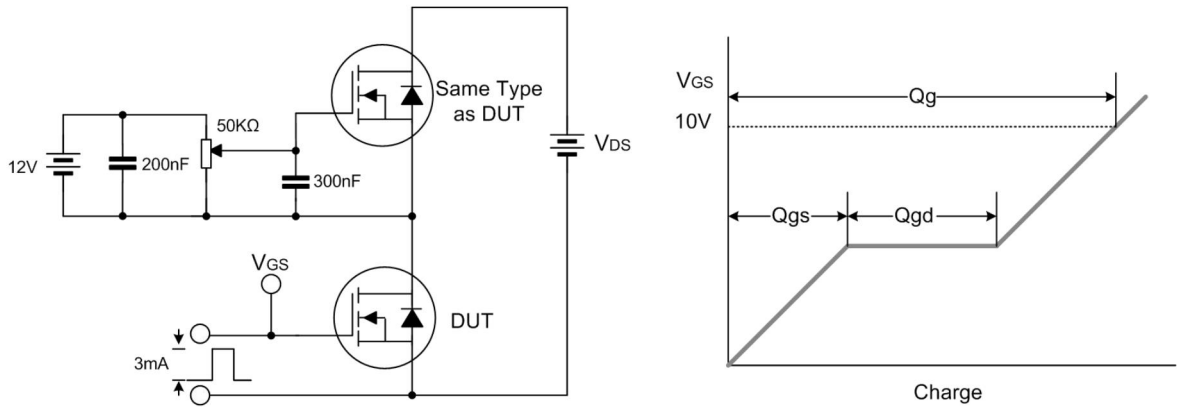


Figure 10. Maximum Drain Current vs. Case Temperature

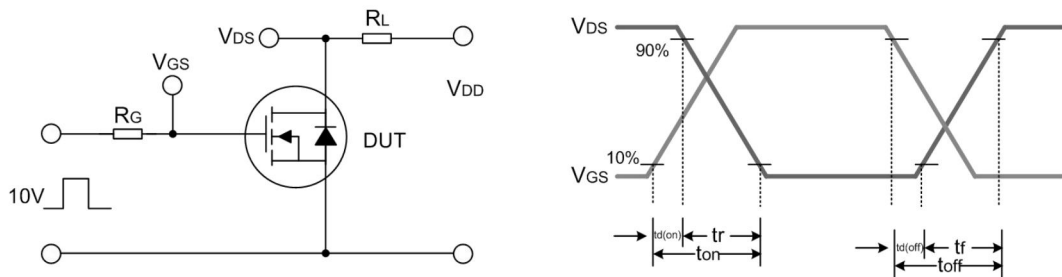


Test Circuit

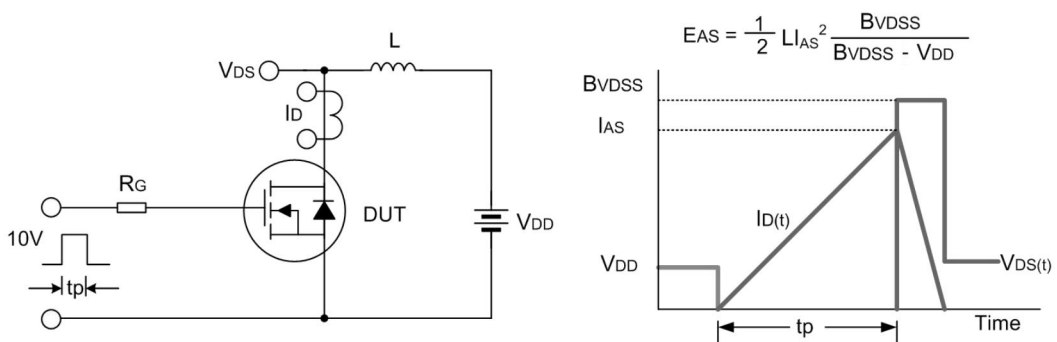
Gate Charge Test Circuit & Waveform



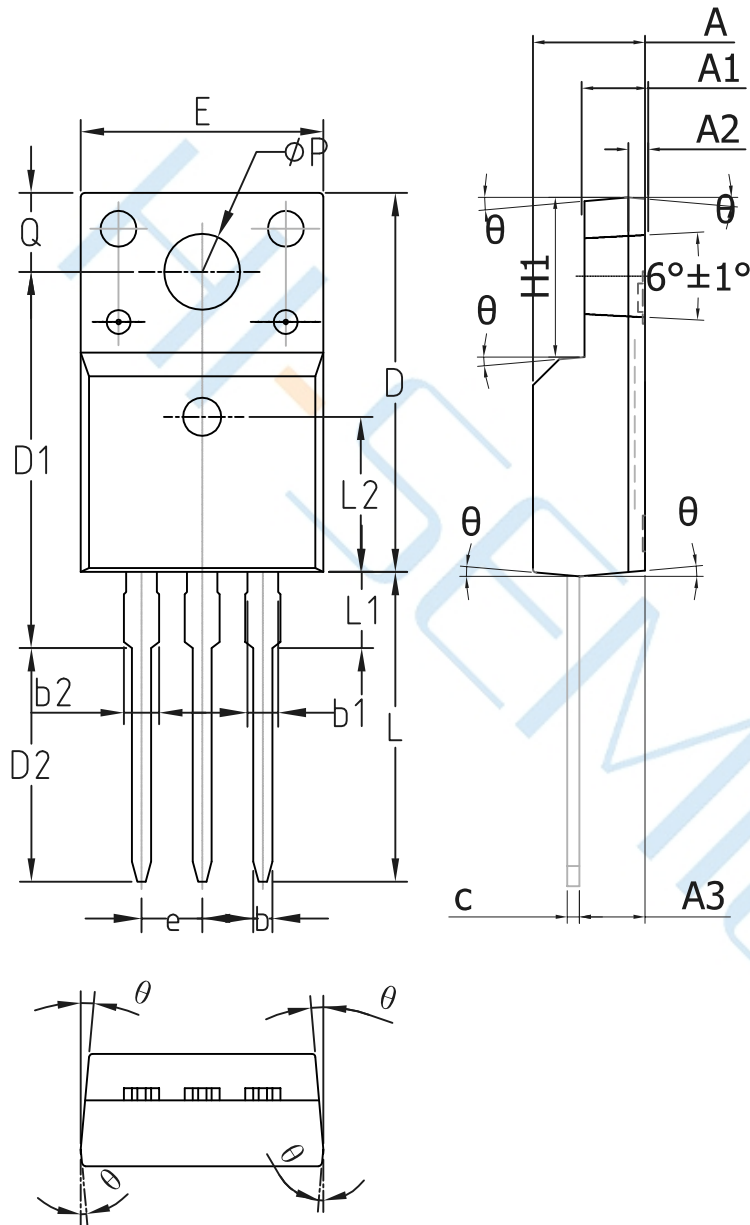
Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching Test Circuit & Waveform



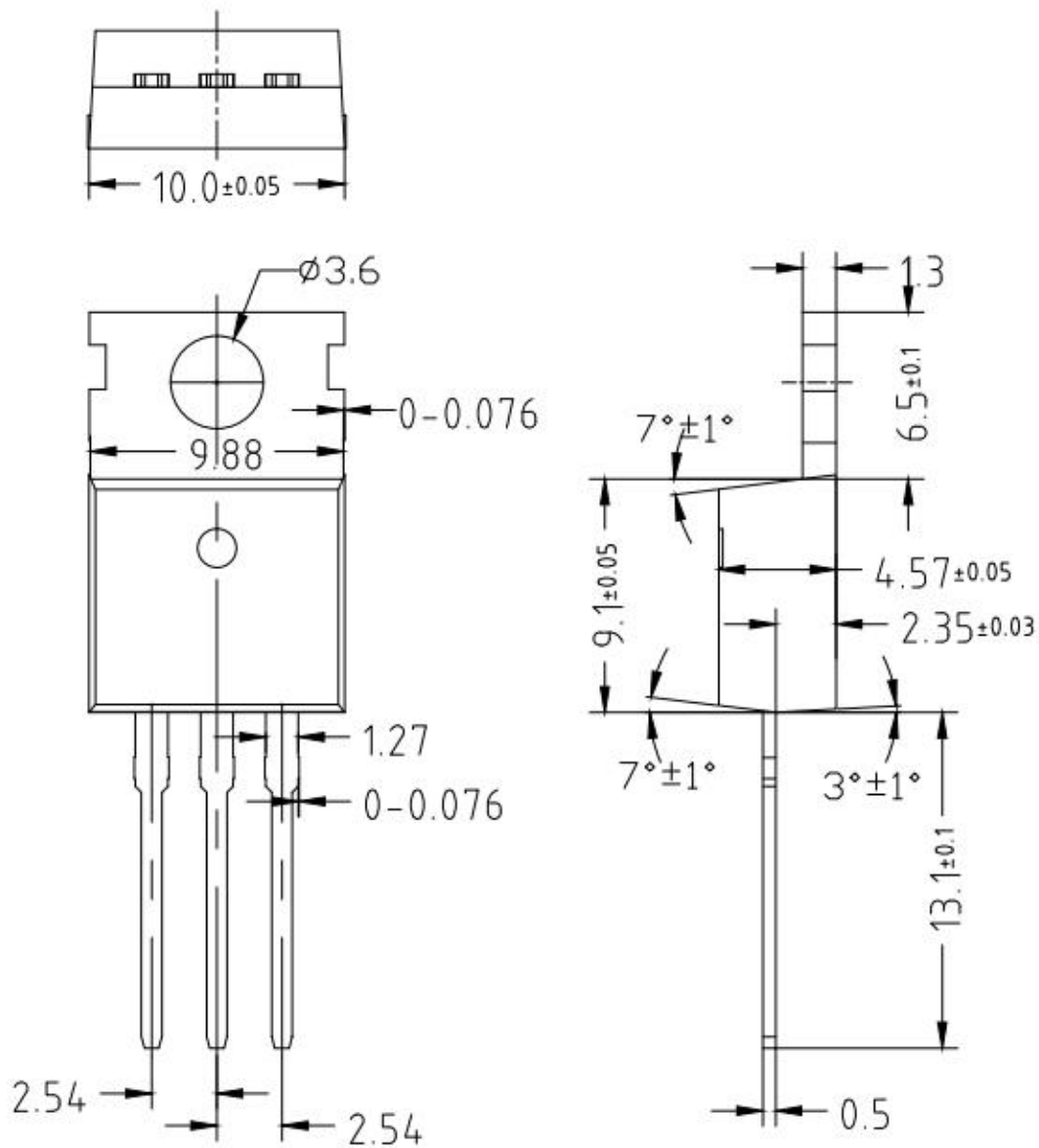
Package Dimensions of TO-220F-3L



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.96
b	0.70	0.80	0.90
b1	1.17	1.2	1.25
b2	1.17	1.2	1.25
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	10.0	10.2	10.4
E	9.96	10.16	10.36
e	2.54BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2	6.50REF		
phi P	3.08	3.18	3.28
Q	3.20	3.30	3.40
theta 1	1°	3°	5°
A4	0.53	0.56	0.59

Package Dimensions of TO-220-3L



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