

# Advanced Power MOSFET

# SSF10N60A

## FEATURES

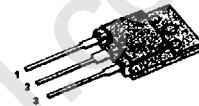
- Avalanche Rugged Technology
- Rugged Gate Oxide Technology
- Lower Input Capacitance
- Improved Gate Charge
- Extended Safe Operating Area
- Lower Leakage Current : 25  $\mu$ A (Max.) @  $V_{DS} = 600V$
- Low  $R_{DS(ON)}$  : 0.646  $\Omega$  (Typ.)

$$BV_{DSS} = 600 V$$

$$R_{DS(on)} = 0.8 \Omega$$

$$I_D = 6.9 A$$

TO-3PF



1.Gate 2. Drain 3. Source

## Absolute Maximum Ratings

Symbol	Characteristic	Value	Units
$V_{DSS}$	Drain-to-Source Voltage	600	V
$I_D$	Continuous Drain Current ( $T_c=25^\circ C$ )	6.9	A
	Continuous Drain Current ( $T_c=100^\circ C$ )	4.3	
$I_{DM}$	Drain Current-Pulsed ①	40	A
$V_{GS}$	Gate-to-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy ②	519	mJ
$I_{AR}$	Avalanche Current ①	6.9	A
$E_{AR}$	Repetitive Avalanche Energy ①	9	mJ
dv/dt	Peak Diode Recovery dv/dt ③	3.0	V/ns
$P_D$	Total Power Dissipation ( $T_c=25^\circ C$ )	90	W
	Linear Derating Factor	0.72	
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ C$
$T_L$	Maximum Lead Temp. for Soldering Purposes, 1/8" from case for 5-seconds	300	

## Thermal Resistance

Symbol	Characteristic	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	--	1.38	$^\circ C/W$
$R_{\theta JA}$	Junction-to-Ambient	--	40	



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## N-CHANNEL POWER MOSFET

### Electrical Characteristics (T<sub>C</sub>=25°C unless otherwise specified)

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	600	--	--	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA
ΔBV/ΔT <sub>J</sub>	Breakdown Voltage Temp. Coeff.	--	0.66	--	V/°C	I <sub>D</sub> =250μA <i>See Fig 7</i>
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	--	4.0	V	V <sub>DS</sub> =5V, I <sub>D</sub> =250μA
I <sub>GSS</sub>	Gate-Source Leakage, Forward	--	--	100	nA	V <sub>GS</sub> =30V
	Gate-Source Leakage, Reverse	--	--	-100		V <sub>GS</sub> =-30V
I <sub>DSS</sub>	Drain-to-Source Leakage Current	--	--	25	μA	V <sub>DS</sub> =600V
		--	--	250		V <sub>DS</sub> =480V, T <sub>C</sub> =125 °C
R <sub>DS(on)</sub>	Static Drain-Source On-State Resistance	--	--	0.8	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =3.45A ④
g <sub>fs</sub>	Forward Transconductance	--	7.35	--	Ω	V <sub>DS</sub> =50V, I <sub>D</sub> =3.45A ④
C <sub>iss</sub>	Input Capacitance	--	1750	2270	pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz <i>See Fig 5</i>
C <sub>oss</sub>	Output Capacitance	--	190	220		
C <sub>rss</sub>	Reverse Transfer Capacitance	--	78	90		
t <sub>d(on)</sub>	Turn-On Delay Time	--	20	50	ns	V <sub>DD</sub> =300V, I <sub>D</sub> =10A, R <sub>G</sub> =6.2 Ω <i>See Fig 13</i> ④ ⑤
t <sub>r</sub>	Rise Time	--	23	55		
t <sub>d(off)</sub>	Turn-Off Delay Time	--	85	180		
t <sub>f</sub>	Fall Time	--	30	70		
Q <sub>g</sub>	Total Gate Charge	--	74	95	nC	V <sub>DS</sub> =480V, V <sub>GS</sub> =10V, I <sub>D</sub> =10A <i>See Fig 6 &amp; Fig 12</i> ④ ⑤
Q <sub>gs</sub>	Gate-Source Charge	--	12	--		
Q <sub>gd</sub>	Gate-Drain( "Miller" ) Charge	--	35.4	--		

### Source-Drain Diode Ratings and Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Units	Test Condition
I <sub>S</sub>	Continuous Source Current	--	--	6.9	A	Integral reverse pn-diode in the MOSFET
I <sub>SM</sub>	Pulsed-Source Current ①	--	--	40		
V <sub>SD</sub>	Diode Forward Voltage ④	--	--	1.4	V	T <sub>J</sub> =25°C, I <sub>S</sub> =6.9A, V <sub>GS</sub> =0V
t <sub>rr</sub>	Reverse Recovery Time	--	440	--	ns	T <sub>J</sub> =25°C, I <sub>F</sub> =10A
Q <sub>rr</sub>	Reverse Recovery Charge	--	4.7	--	μC	di <sub>F</sub> /dt=100A/μs ④

#### Notes ;

- ① Repetitive Rating : Pulse Width Limited by Maximum Junction Temperature
- ② L=20mH, I<sub>AS</sub>=6.9A, V<sub>DD</sub>=50V, R<sub>G</sub>=2Ω, Starting T<sub>J</sub>=25 °C
- ③ I<sub>SD</sub> ≤ 10A, di/dt ≤ 150A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub>=25 °C
- ④ Pulse Test : Pulse Width = 250μs, Duty Cycle ≤ 2%
- ⑤ Essentially Independent of Operating Temperature

Fig 1. Output Characteristics

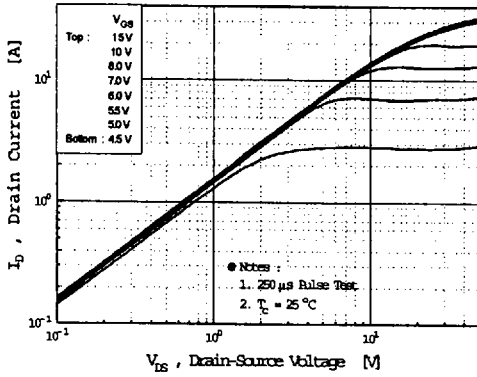


Fig 2. Transfer Characteristics

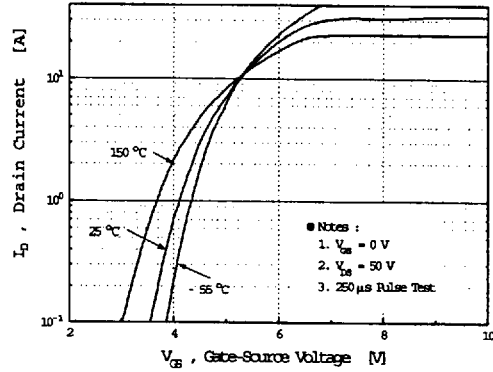


Fig 3. On-Resistance vs. Drain Current

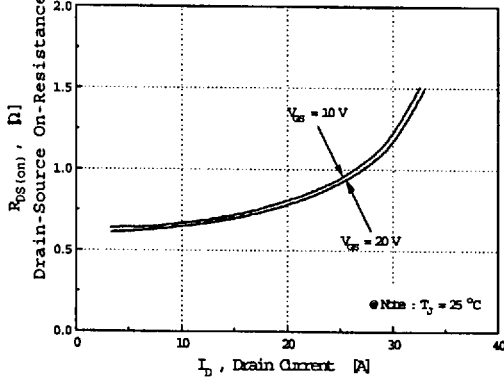


Fig 4. Source-Drain Diode Forward Voltage

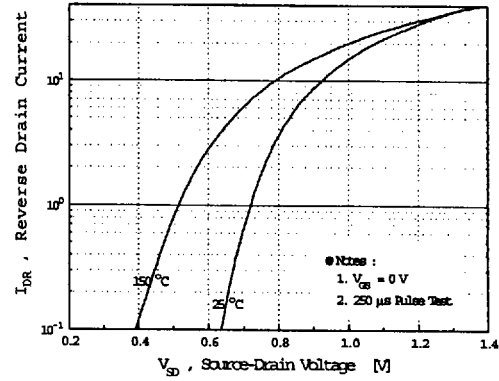


Fig 5. Capacitance vs. Drain-Source Voltage

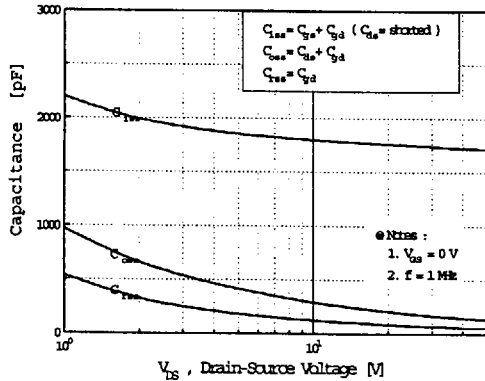
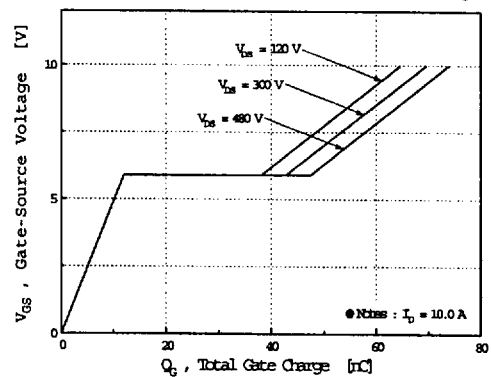


Fig 6. Gate Charge vs. Gate-Source Voltage



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## N-CHANNEL POWER MOSFET

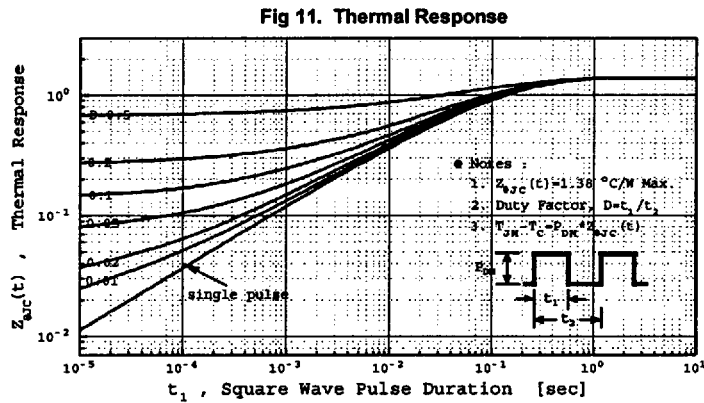
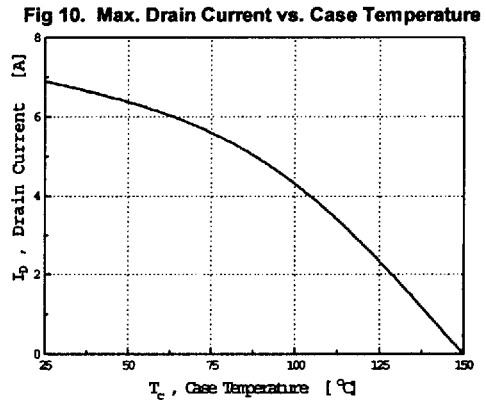
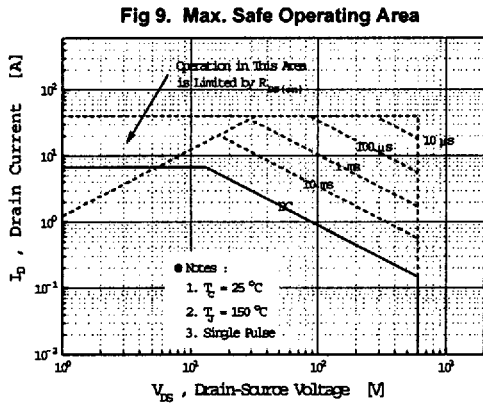
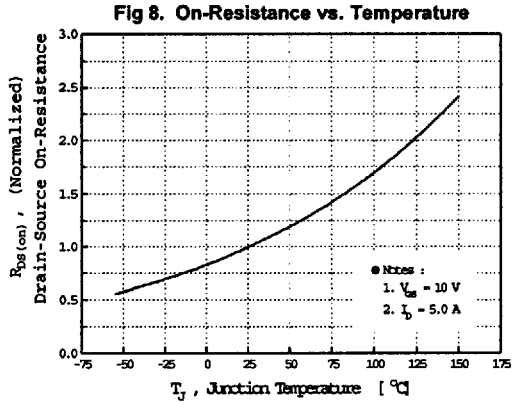
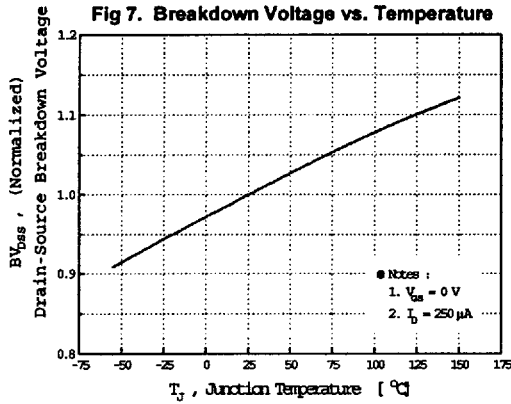


Fig 12. Gate Charge Test Circuit & Waveform

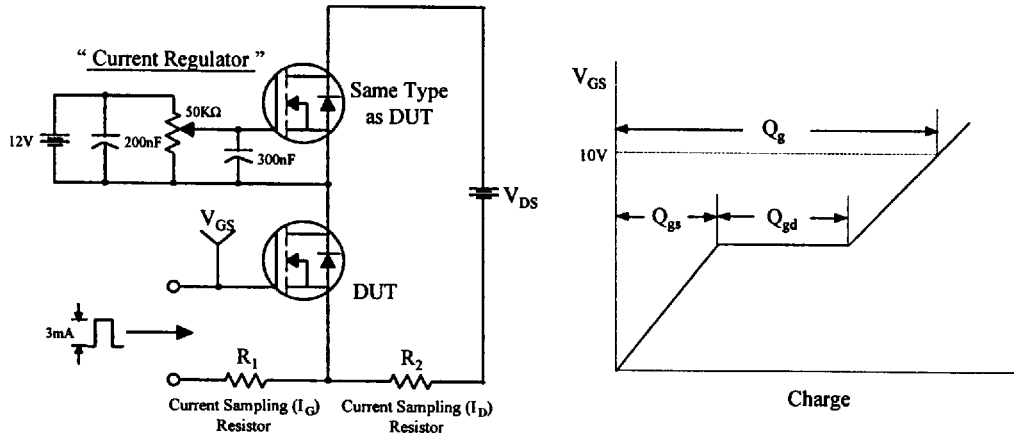


Fig 13. Resistive Switching Test Circuit & Waveforms

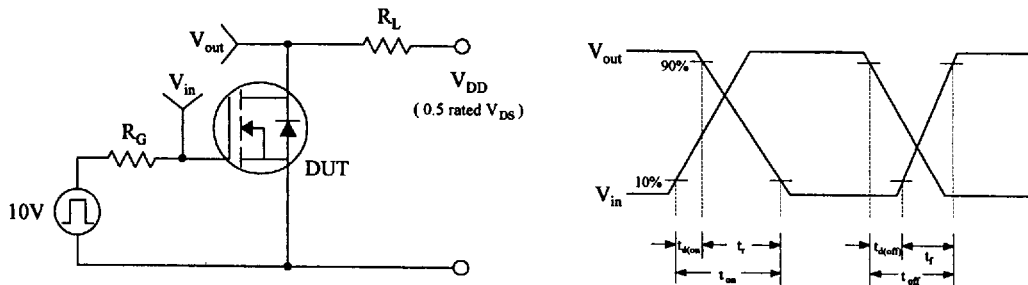
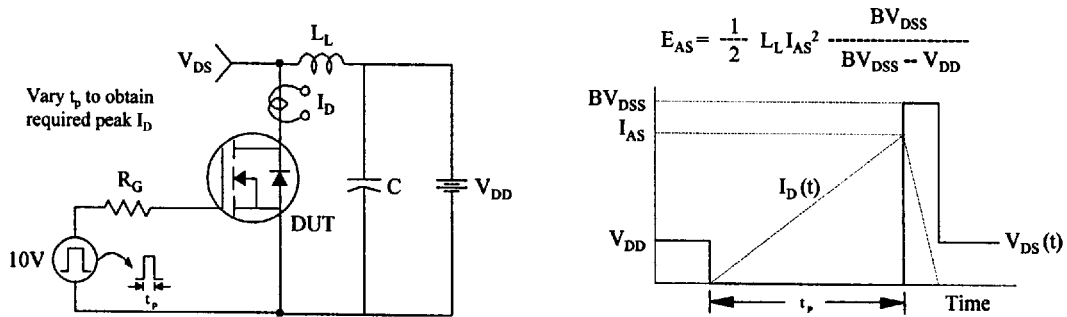


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms



$$E_{AS} = \frac{1}{2} L_L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

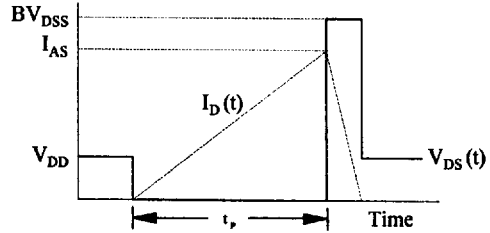
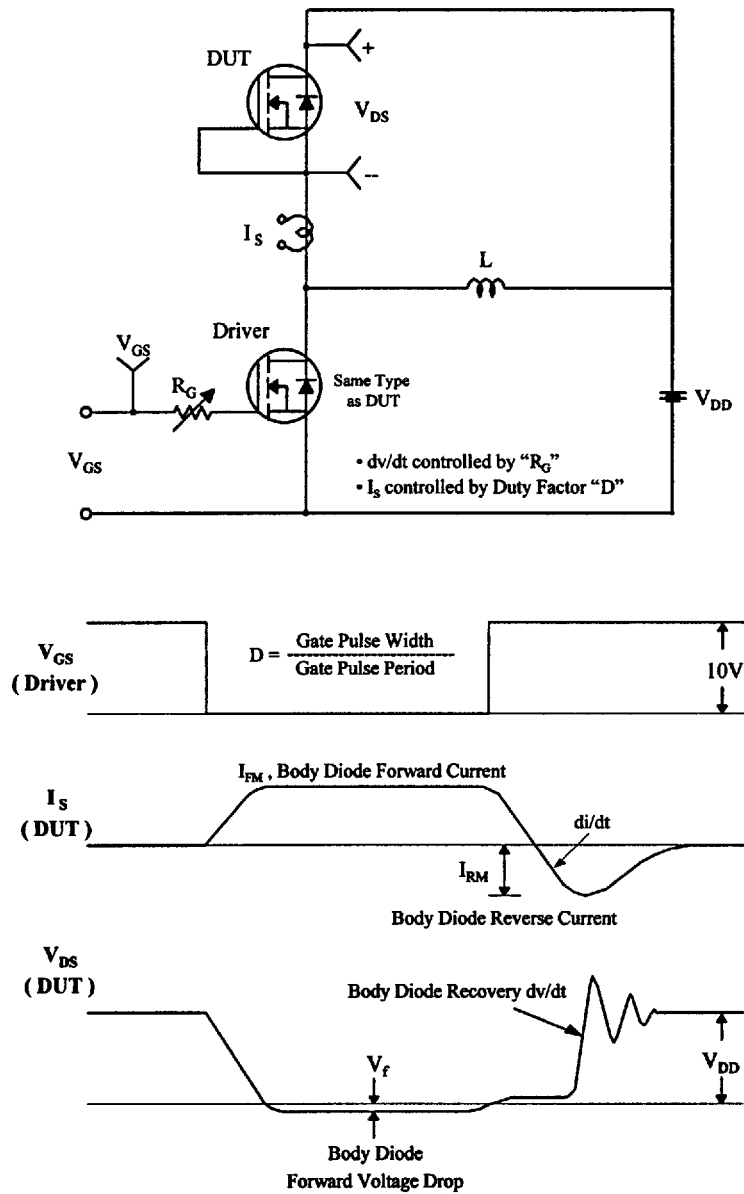
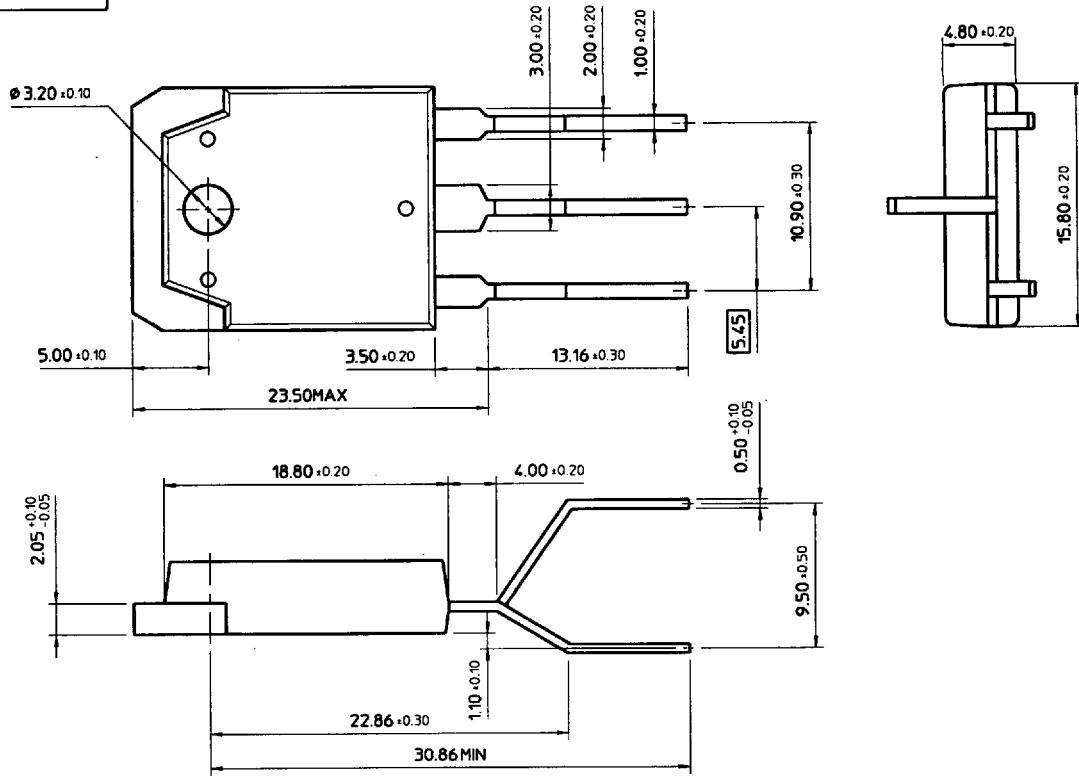


Fig 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

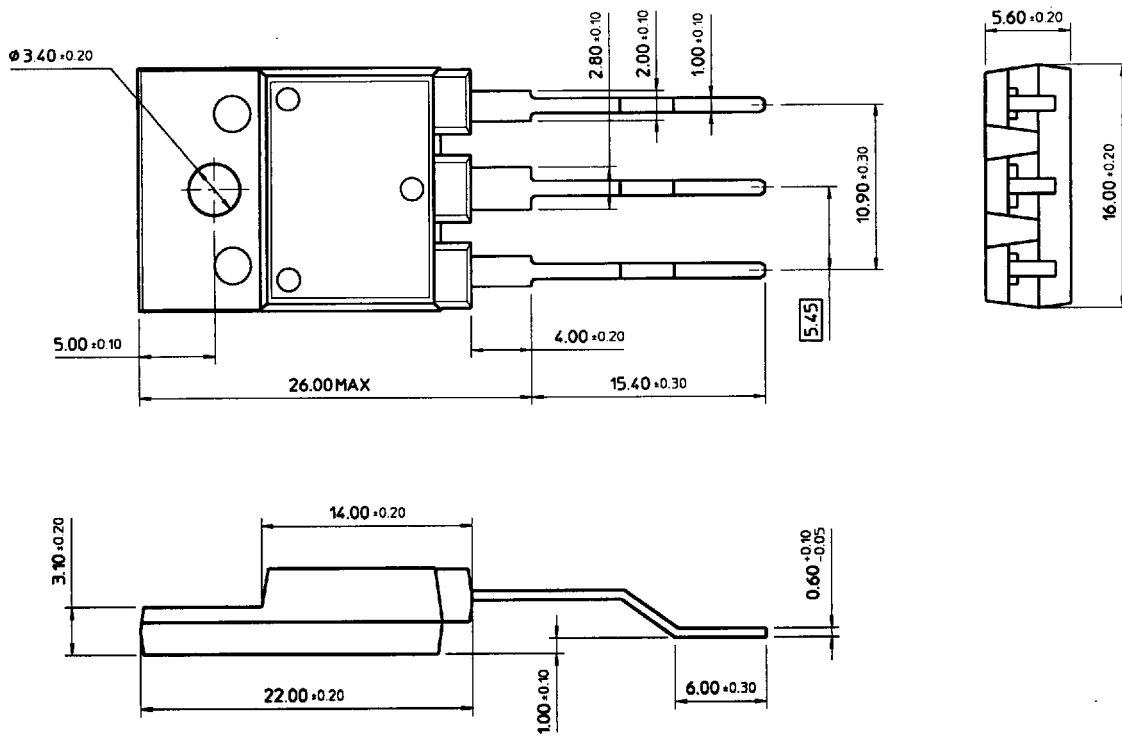


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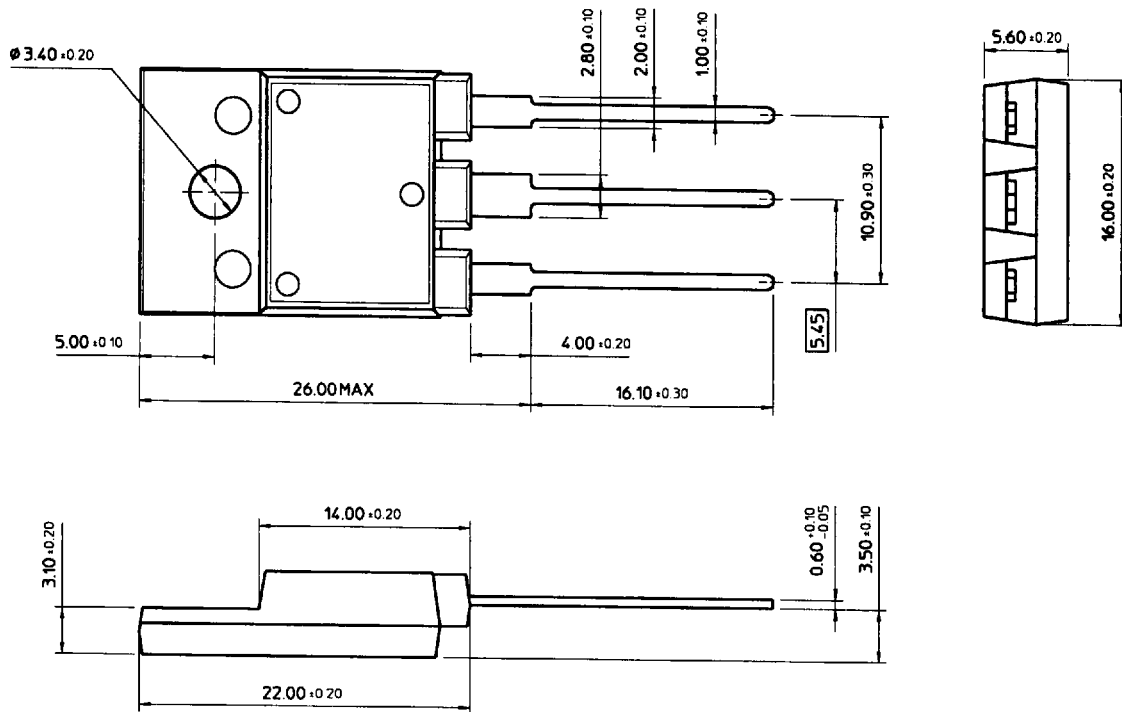
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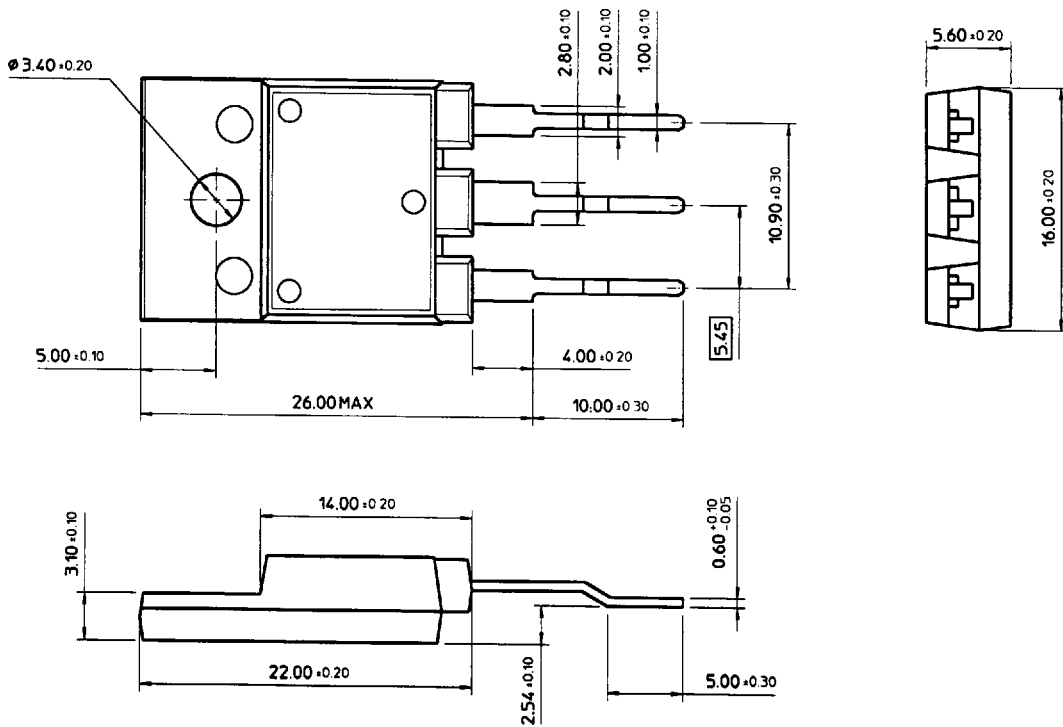
T0-3PF (1)



TO-3PF (2)

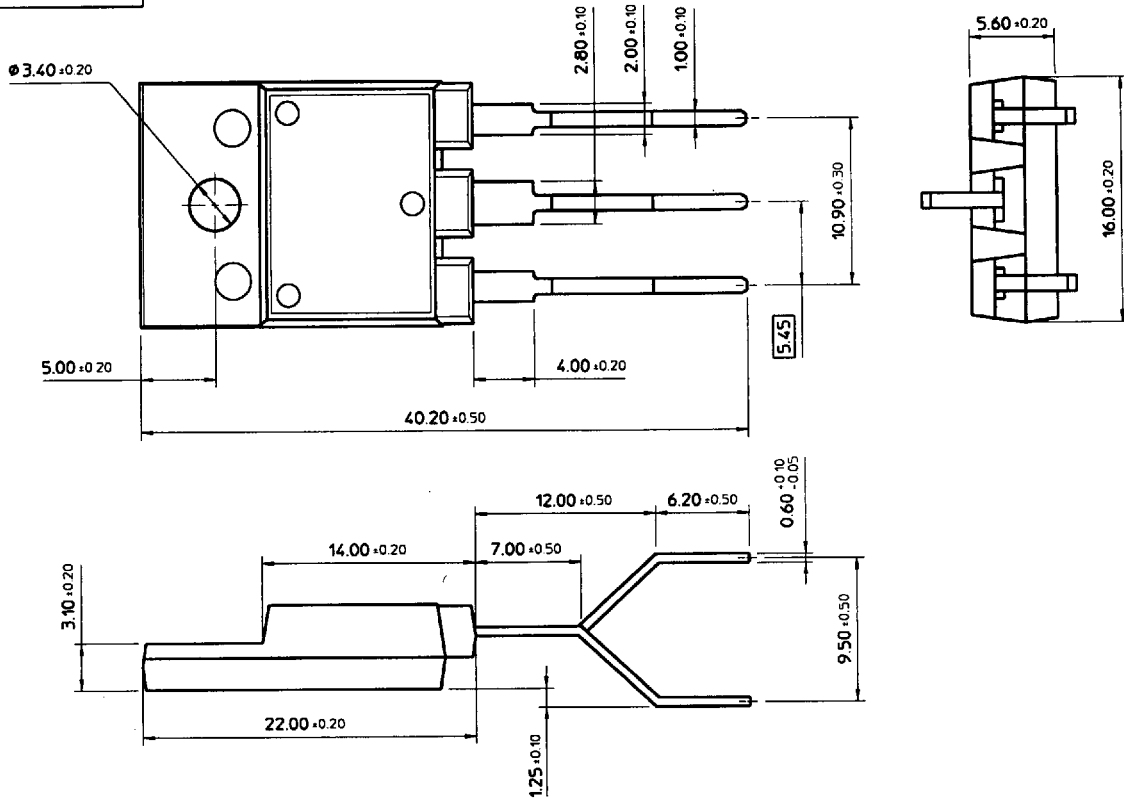


TO-3PF (3)

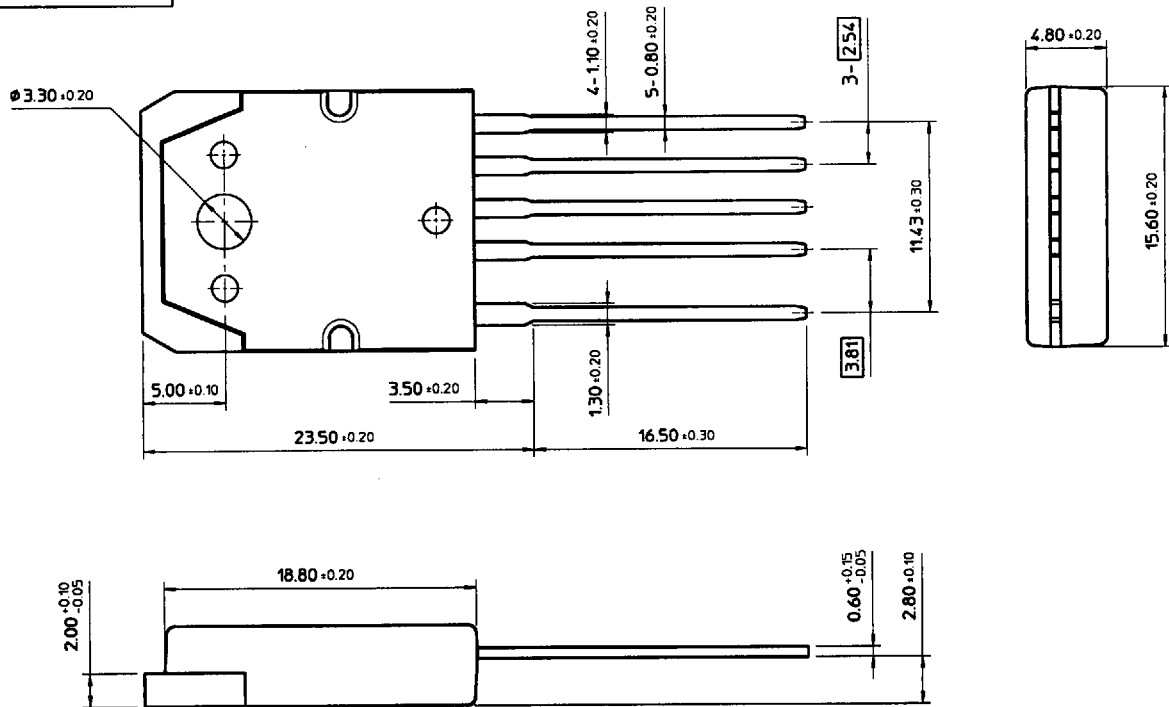




TO-3PF (4)



TO-3P-5L



Under Development