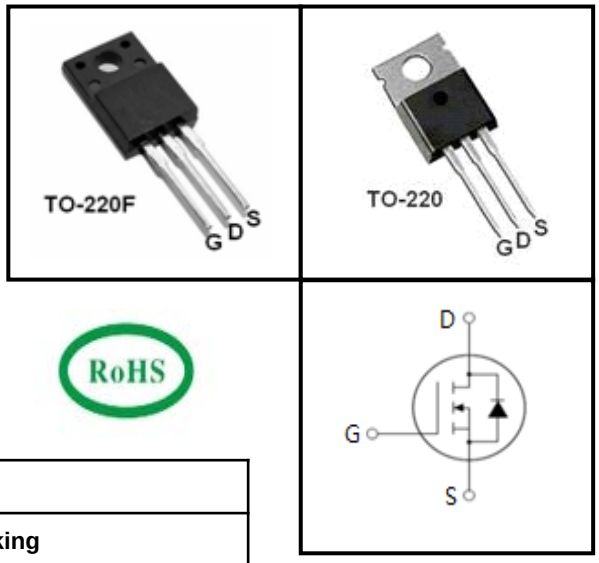
650V N-Channel MOSFET

FEATURES

- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



RoHS

Device Marking and Package Information

Device	Package	Marking
TMA12N65H	TO-220F	A12N65H
TMP12N65H	TO-220	P12N65H

Absolute Maximum Ratings T_C = 25ºC, unless otherwise noted

Parameter		Symbol	Value		Unit
			TO-220F	TO-220	
Drain-Source Voltage (V_{GS} = 0V)		V_{DSS}	650		V
Continuous Drain Current		I_D	12		A
Pulsed Drain Current	(note1)	I_{DM}	48		A
Gate-Source Voltage		V_{GSS}	±30		V
Single Pulse Avalanche Energy	(note2)	E_{AS}	810		mJ
Avalanche Current	(note1)	I_{AR}	9		A
Repetitive Avalanche Energy	(note1)	E_{AR}	54		mJ
Power Dissipation (T_C = 25ºC)		P_D	70	223	W
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150		ºC

Thermal Resistance

Parameter	Symbol	Value		Unit
		TO-220F	TO-220	
Thermal Resistance, Junction-to-Case	R_{thJC}	1.78	0.56	ºC/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62.5	60	

Specifications T_J = 25ºC, unless otherwise noted

Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0V, I_D = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 650V, V_{GS} = 0V, T_J = 25ºC	--	--	1	μA
		V_{DS} = 520V, V_{GS} = 0V, T_J = 125ºC	--	--	50	
Gate-Source Leakage	I_{GSS}	V_{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250μA	3	--	4	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	V_{GS} = 10V, I_D = 6A	--	0.55	0.65	Ω
Dynamic						
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz	--	1540	--	pF
Output Capacitance	C_{oss}		--	175	--	
Reverse Transfer Capacitance	C_{rss}		--	21	--	
Total Gate Charge	Q_g	V_{DD} = 520V, I_D = 12A, V_{GS} = 10V	--	44	--	nC
Gate-Source Charge	Q_{gs}		--	8.6	--	
Gate-Drain Charge	Q_{gd}		--	21	--	
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 325V, I_D = 12A, R_G = 25Ω	--	30	--	ns
Turn-on Rise Time	t_r		--	12	--	
Turn-off Delay Time	$t_{d(off)}$		--	95	--	
Turn-off Fall Time	t_f		--	22	--	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	T_C = 25ºC	--	--	12	A
Pulsed Diode Forward Current	I_{SM}		--	--	48	
Body Diode Voltage	V_{SD}	T_J = 25ºC, I_{SD} = 12A, V_{GS} = 0V	--	--	1.4	V
Reverse Recovery Time	t_{rr}	V_{GS} = 0V, I_F = 12A, di_F/dt = 100A/μs	--	380	--	ns
Reverse Recovery Charge	Q_{rr}		--	4.5	--	μC

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS} = 9A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 1%

Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 1. Output Characteristics (T_J = 25ºC)

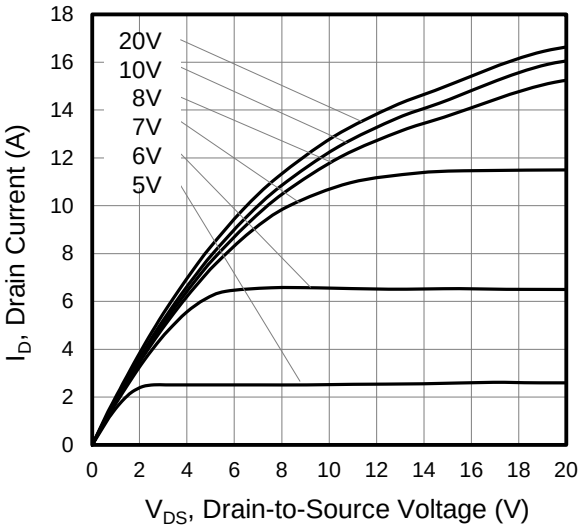


Figure 2. On-Resistance vs. Drain Current

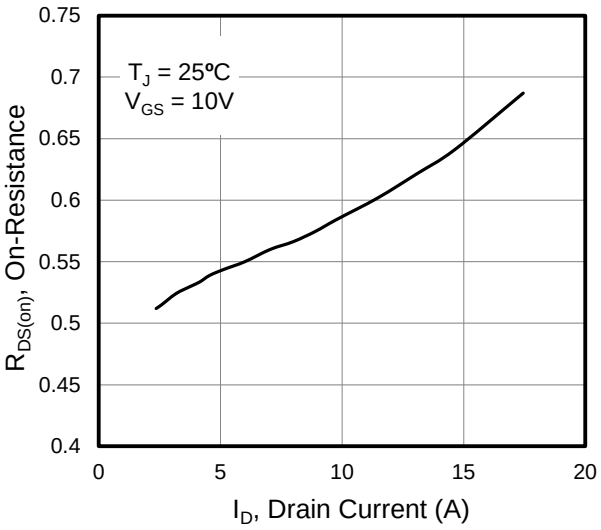


Figure 3. BV_{DSS} vs. Temperature

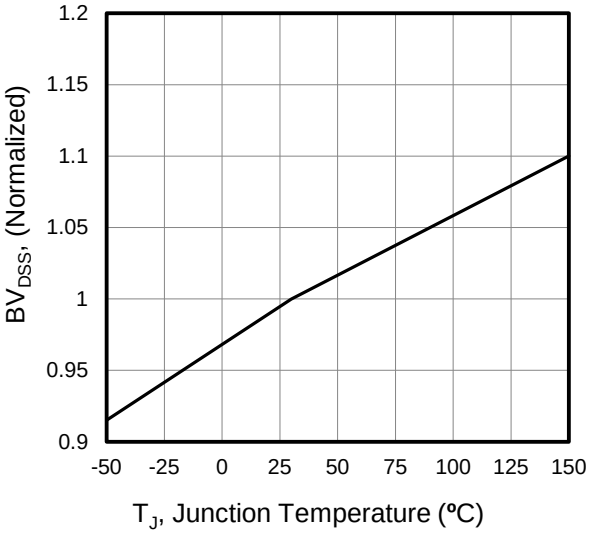


Figure 4. On-Resistance vs. Temperature

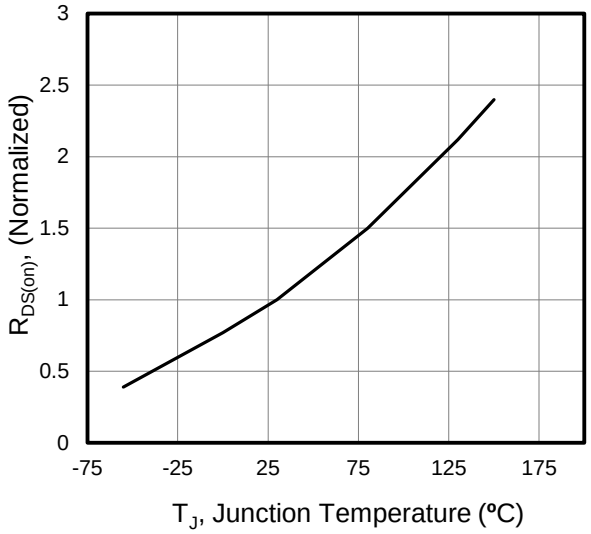


Figure 5. Gate Charge

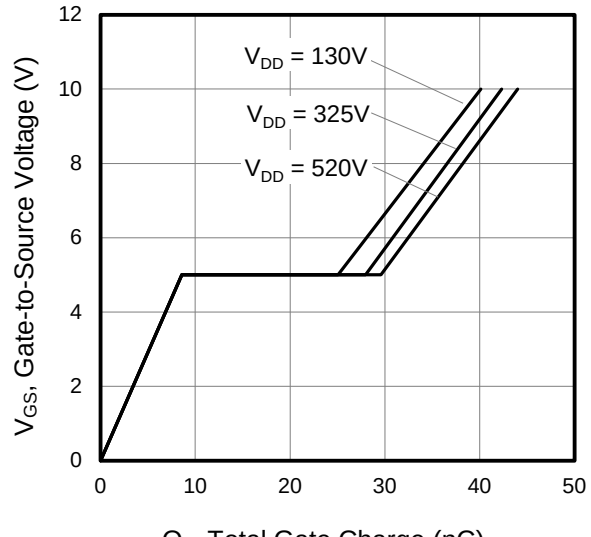
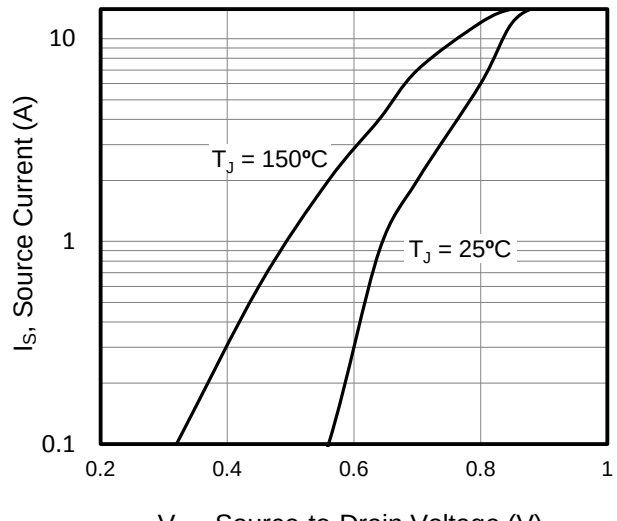


Figure 6. Body Diode Forward Voltage



Typical Characteristics T_J = 25ºC, unless otherwise noted

Figure 7. Transient Thermal Impedance

TO-220F

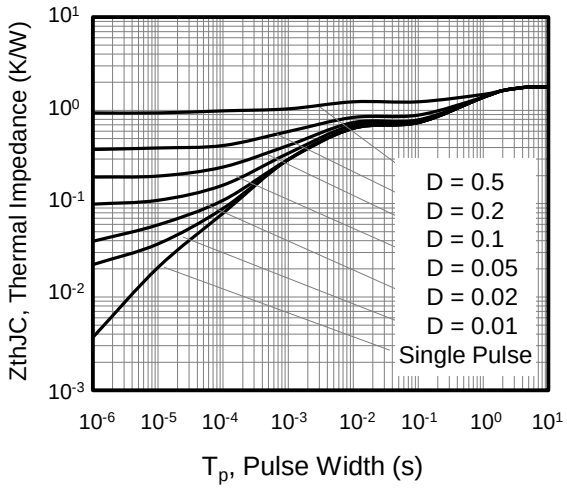


Figure 8. Transient Thermal Impedance

TO-220

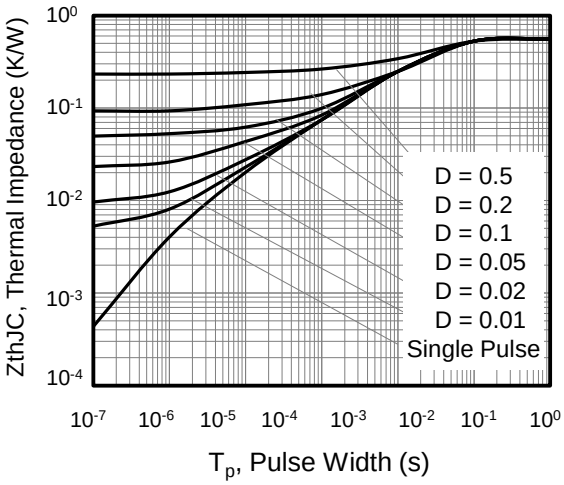


Figure A：Gate Charge Test Circuit and Waveform

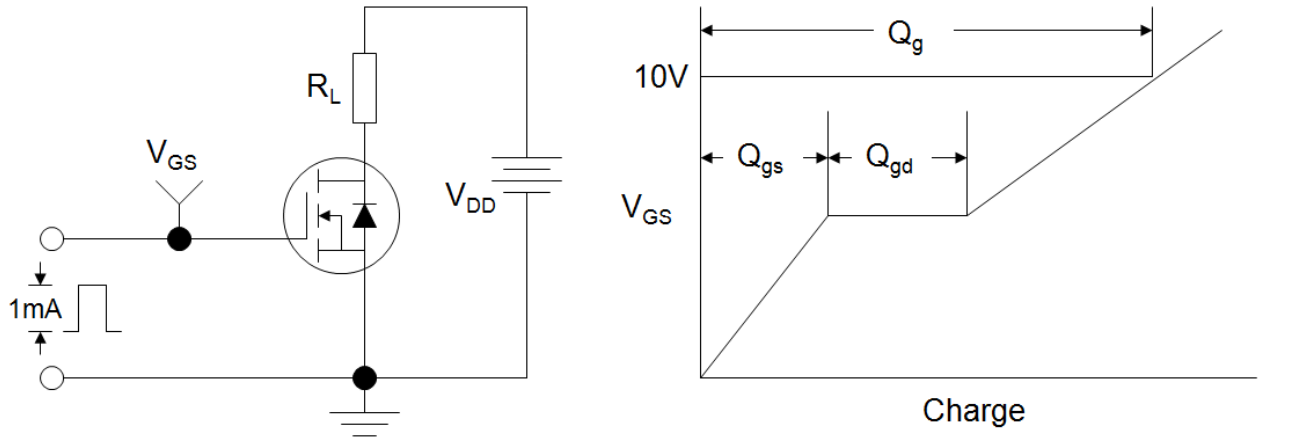


Figure B：Resistive Switching Test Circuit and Waveform

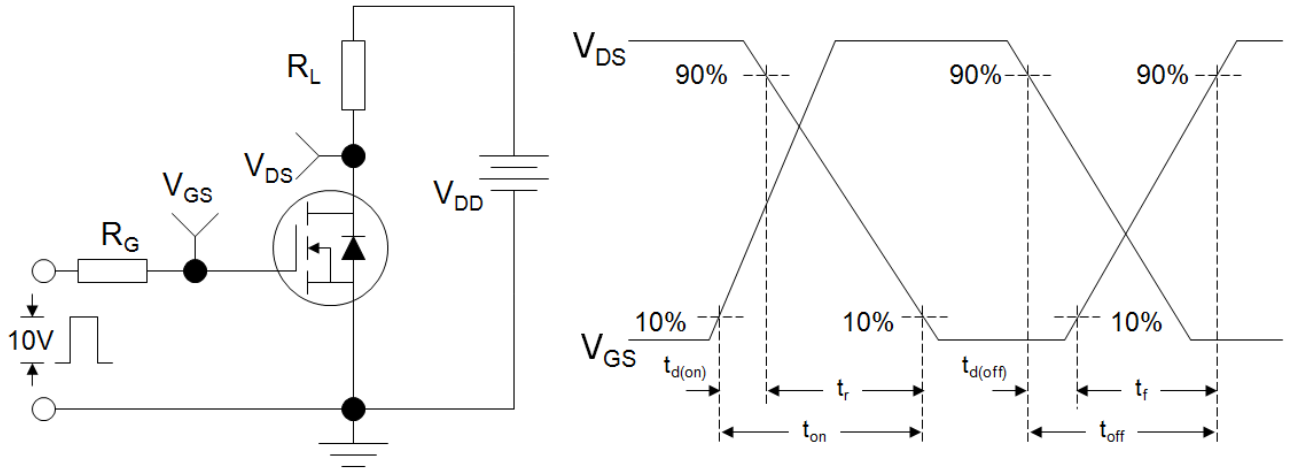
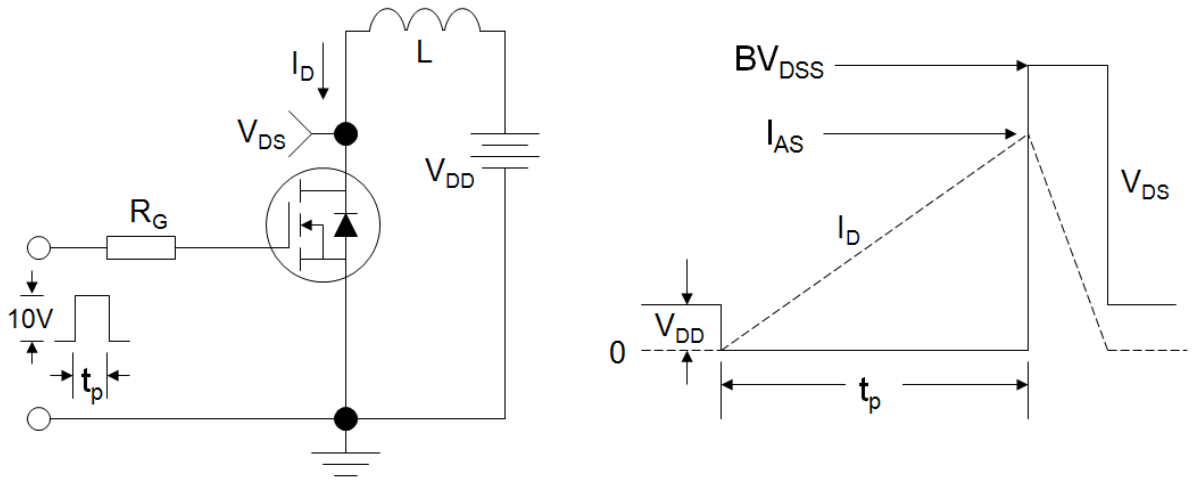
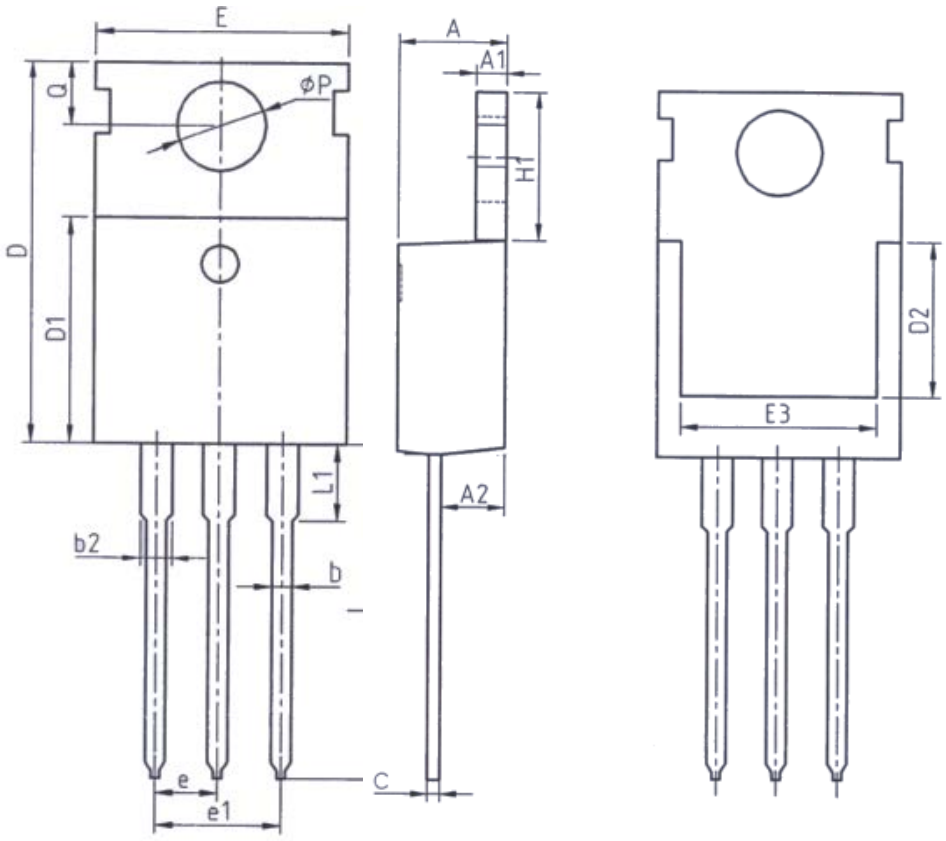


Figure C：Unclamped Inductive Switching Test Circuit and Waveform



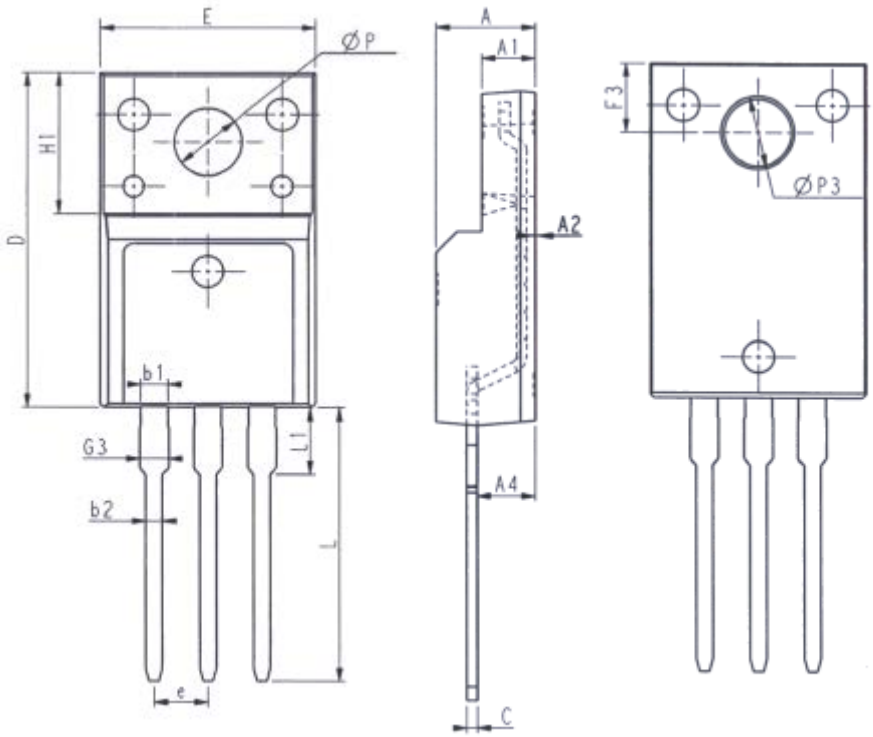
TO-220



Unit: mm		
Symbol	Min.	Max.
A	4.37	4.77
A1	1.25	1.45
A2	2.20	2.60
b	0.70	0.95
b2	1.17	1.47
c	0.40	0.65
D	15.10	16.10
D1	8.80	9.40
D2	5.50	–

Unit: mm		
Symbol	Min.	Max.
E	9.70	10.30
E3	7.00	–
e	2.54BSC	
e1	5.08BSC	
H1	6.25	6.85
L	12.75	13.80
L1	–	3.40
P	3.40	3.80
Q	2.60	3.00

TO-220F



Unit: mm		
Symbol	Min.	Max.
E	9.96	10.36
A	4.50	4.90
A1	2.34	2.74
A2	0.30	0.60
A4	2.56	2.96
c	0.40	0.65
D	15.57	16.17
H1	6.70REF	
e	2.54BSC	

Unit: mm		
Symbol	Min.	Max.
L	12.68	13.28
L1	2.93	3.13
P	3.03	3.38
P3	3.15	3.65
F3	3.15	3.45
G3	1.25	1.55
b1	1.18	1.43
b2	0.70	0.95

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