

**12A, 650V N-CHANNEL
POWER MOSFET**

TO-220F-3L

DESCRIPTION

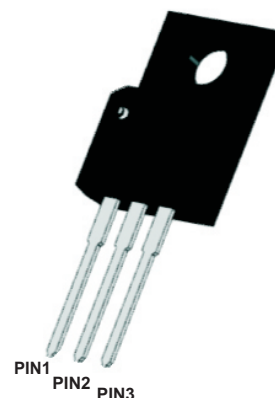
The F12N65L is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in switching power supplies and adaptors.

Features

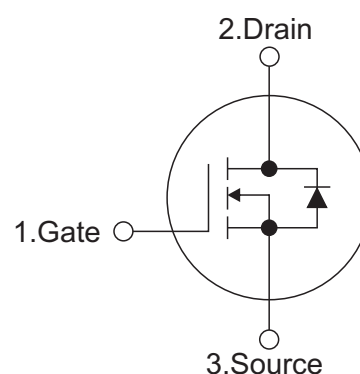
- $R_{DS(ON)} \leq 0.85 \Omega @ V_{GS}=10V, I_D=12A$
- Fast switching capability
- Avalanche energy tested
- Improved dv/dt capability, high ruggedness

Mechanical data

- Case: TO-220F-3L
- Approx. Weight: 2.1g (0.07oz)
- Lead free finish, RoHS compliant
- Case Material: "Green" molding compound, UL flammability classification 94V-0, "Halogen-free".



SYMBOL



ABSOLUTE MAXIMUM RATINGS (TA=25°C, unless otherwise specified)

PARAMETER	Symbols	RATINGS	Units
Drain-Source Voltage	V_{DSS}	650	V
Gate-Source Voltage	V_{GSS}	± 30	V
Continuous Drain Current	I_D	$T_c=25^\circ C$	12
		$T_c=100^\circ C$	7.8
Pulsed Drain Current (Note 2)	I_{DM}	48	A
Avalanche Energy Single Pulsed (Note 3)	E_{AS}	790	mJ
Peak Diode Recovery dv/dt (Note 4)	dv/dt	50	V/ns
Power Dissipation	P_D	51	W
Operation Junction Temperature and Storage Temperature	T_j, T_{stg}	-55 ~ +150	$^\circ C$

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. $L = 30mH, I_{AS} = 7.3A, V_{DD} = 50V, R_G = 25 \Omega, \text{Starting } T_J = 25^\circ C$

4. $ISD \leq 12A, di/dt \leq 200A/\mu s, V_{DD} \leq BVDSS, \text{Starting } T_J = 25^\circ C$

THERMAL DATA

PARAMETER	Symbols	RATINGS	Units
Junction to Ambient	R_{thJA}	62.5	$^\circ C/W$
Junction to Case	R_{thJC}	2.44	$^\circ C/W$



ELECTRICAL CHARACTERISTICS (TA=25°C, unless otherwise specified)

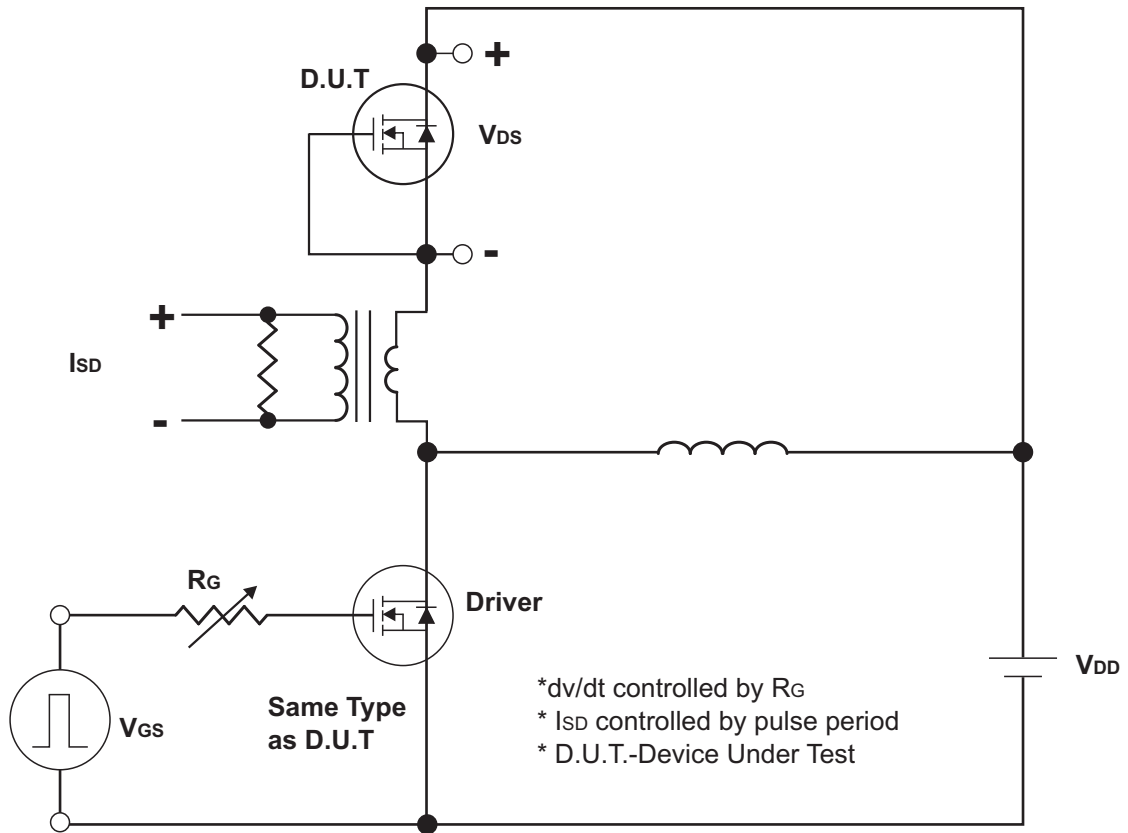
PARAMETER		Symbols	TEST CONDITIONS	Min	Typ	Max	Units	
OFF CHARACTERISTICS								
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS}=0V, I_D=250\mu A$	650			V	
Drain-Source Leakage Current		I_{DSS}	$V_{DS}=650V, V_{GS}=0V$			1	μA	
Gate- Source Leakage Current	Forward	I_{GSS}	$V_{GS}=30V, V_{DS}=0V$			100	nA	
	Reverse		$V_{GS}=-30V, V_{DS}=0V$			-100		
ON CHARACTERISTICS								
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	2.0		4.0	V	
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS}=10V, I_D=6.0A$		0.62	0.85	Ω	
DYNAMIC CHARACTERISTICS								
Input Capacitance		C_{ISS}	$V_{DS}=25V,$ $V_{GS}=0V,$ $f=1.0MHz$		2000		pF	
Output Capacitance		C_{OSS}				160		pF
Reverse Transfer Capacitance		C_{RSS}				5		pF
SWITCHING CHARACTERISTICS								
Total Gate Charge (Note 1)		Q_G	$V_{DS}=520V, V_{GS}=10V,$ $I_D=12A, I_G=1mA$ (NOTE1,2)		36		nC	
Gate-Source Charge		Q_{GS}				8.6		nC
Gate-Drain Charge		Q_{GD}				10		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	$V_{DS}=325V, V_{GS}=10V,$ $I_D=12A, R_G=25\Omega$ (NOTE1,2)		22		ns	
Turn-On Rise Time		t_R				23		ns
Turn-Off Delay Time		$t_{D(OFF)}$				115		ns
Turn-Off Fall Time		t_F				32		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS								
Maximum Body-Diode Continuous Current		I_S				12	A	
Maximum Body-Diode Pulsed Current		I_{SM}				48	A	
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	$I_S=12A, V_{GS}=0V$			1.4	V	
Reverse Recovery Time (Note 1)		t_{rr}	$I_S=12A, V_{GS}=0V,$			470	ns	
Reverse Recovery Charge		Q_{rr}	$di/dt=100A/\mu s$			12		μC

Notes:

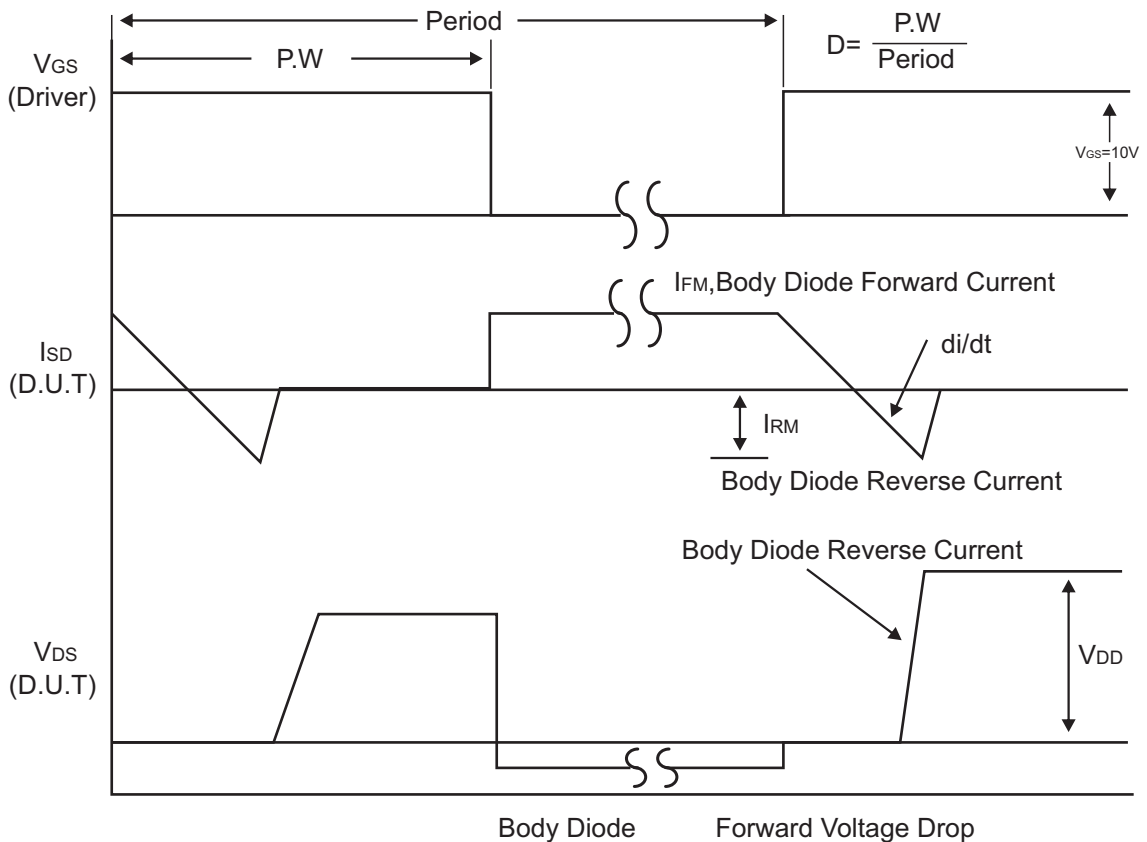
1. Pulse Test: Pulse width $\leq 300\mu s$, Duty cycle $\leq 2\%$.
2. Essentially independent of operating temperature.



Test Circuits and waveforms



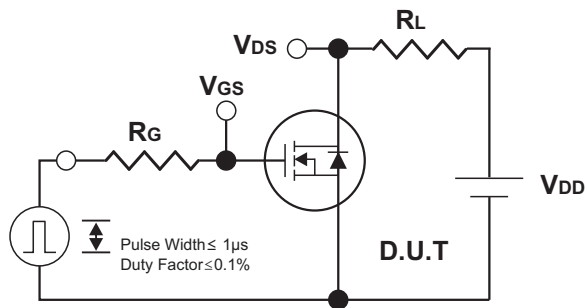
Peak Diode Recovery dv/dt Test Circuit



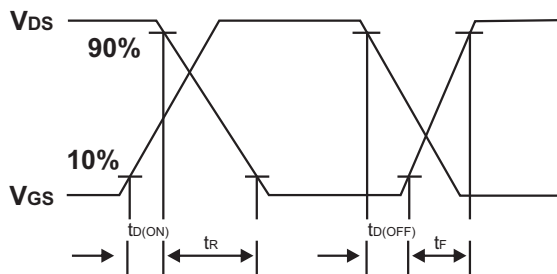
Peak Diode Recovery dv/dt Waveforms



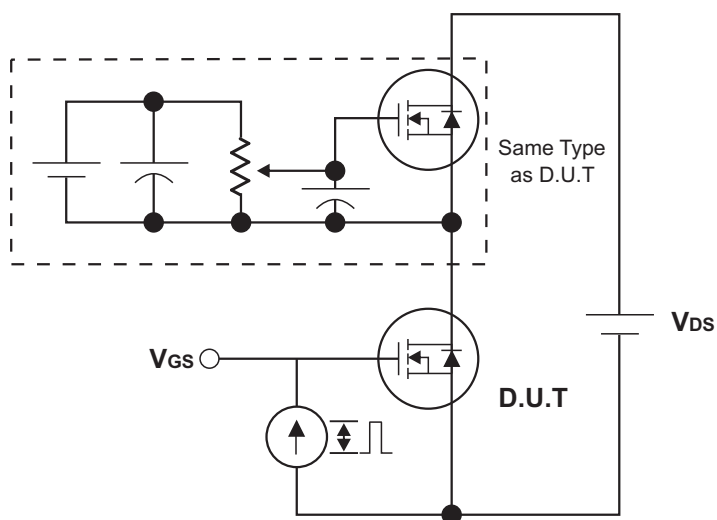
Test Circuits and waveforms



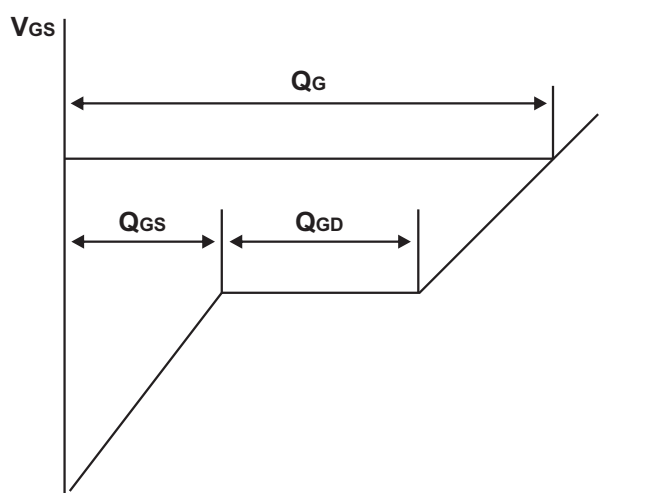
Switching Test Circuit



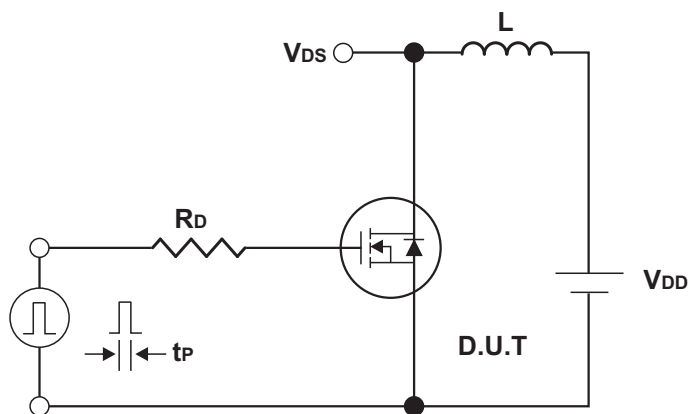
Switching Waveforms



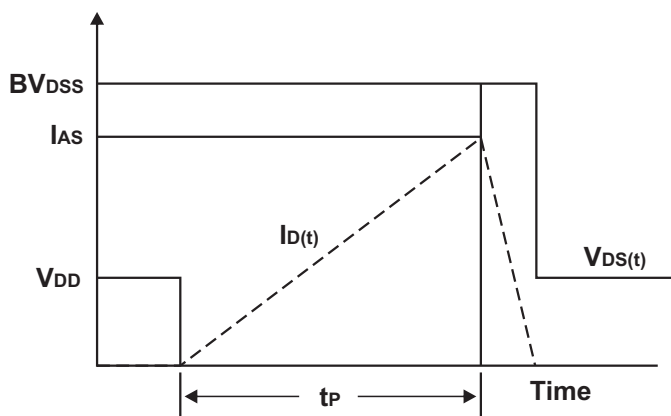
Gate Charge Test Circuit



Charge
Gate Charge Waveform



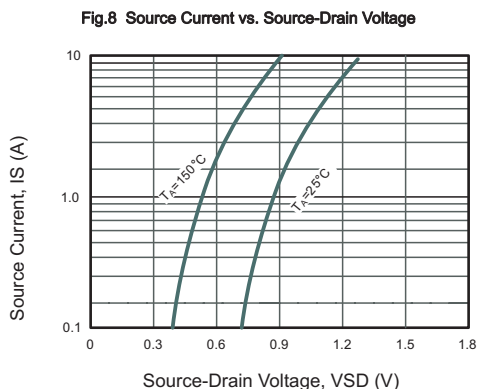
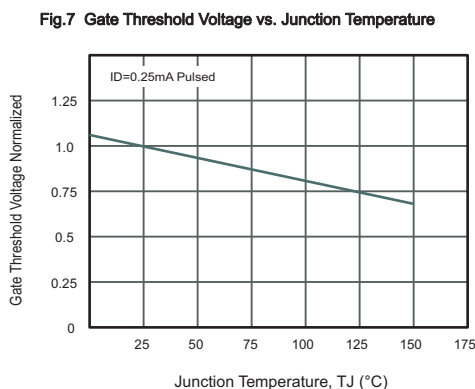
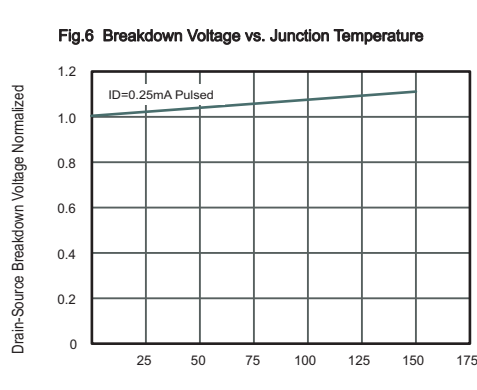
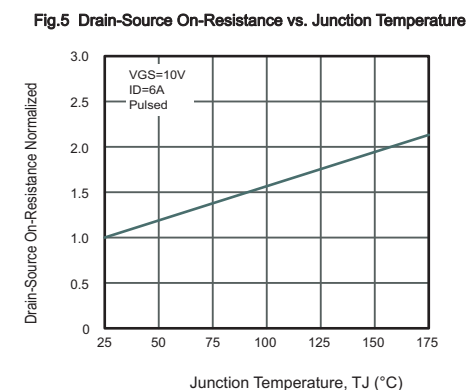
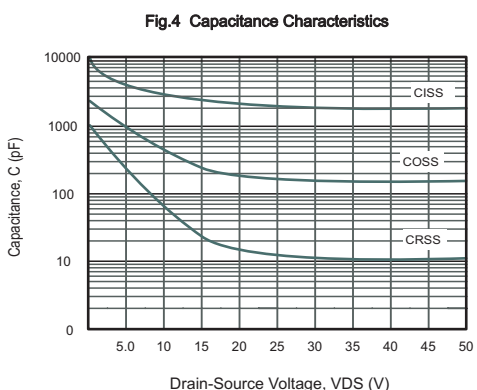
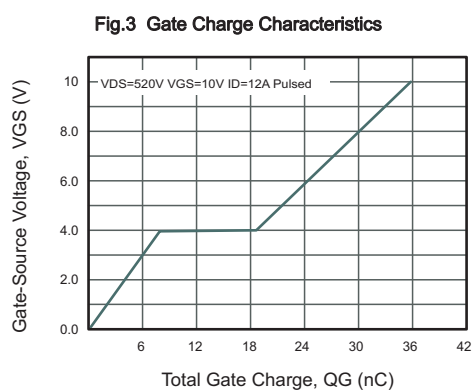
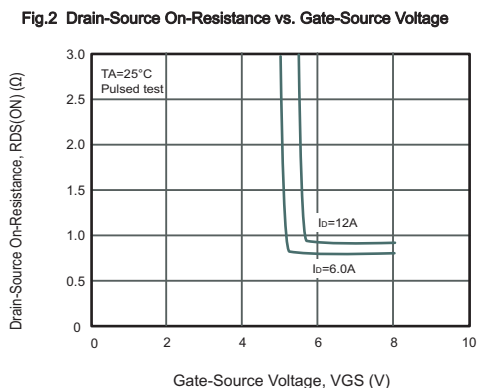
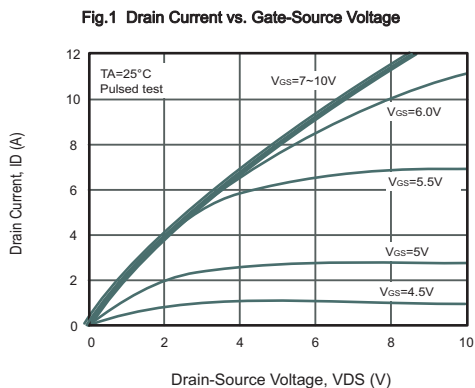
Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms



Typical Characteristics





Typical Characteristics

Fig.9 Drain Current vs. Gate-Source Voltage

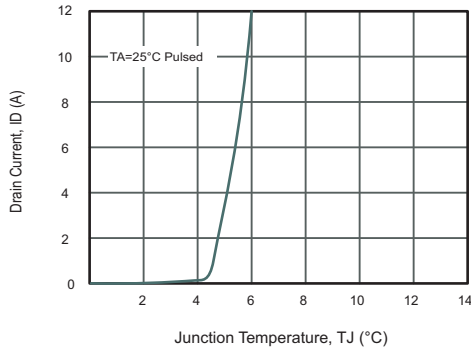


Fig.10 Drain-Source On-Resistance vs. Drain Current

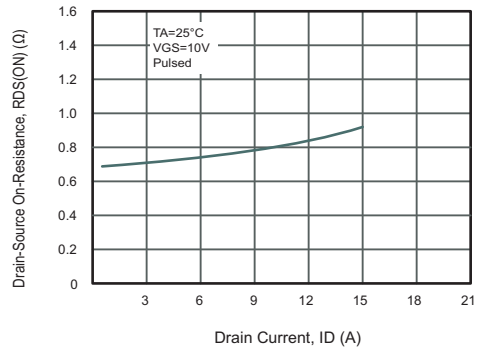


Fig.11 Power Dissipation vs. Junction Temperature

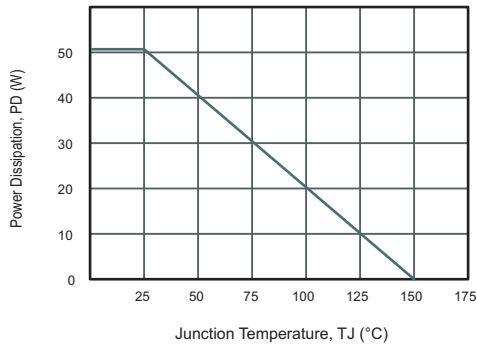


Fig.12 Drain Current vs. Junction Temperature

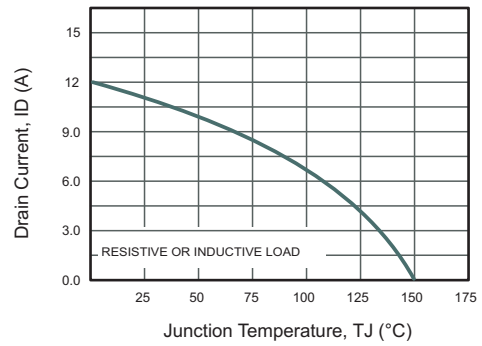
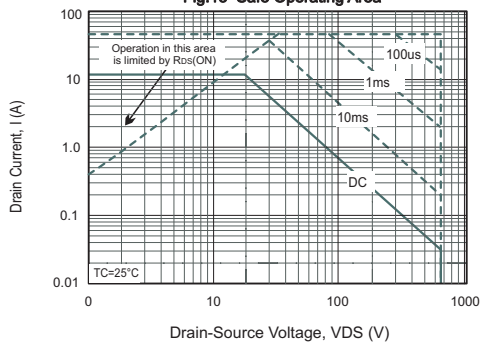


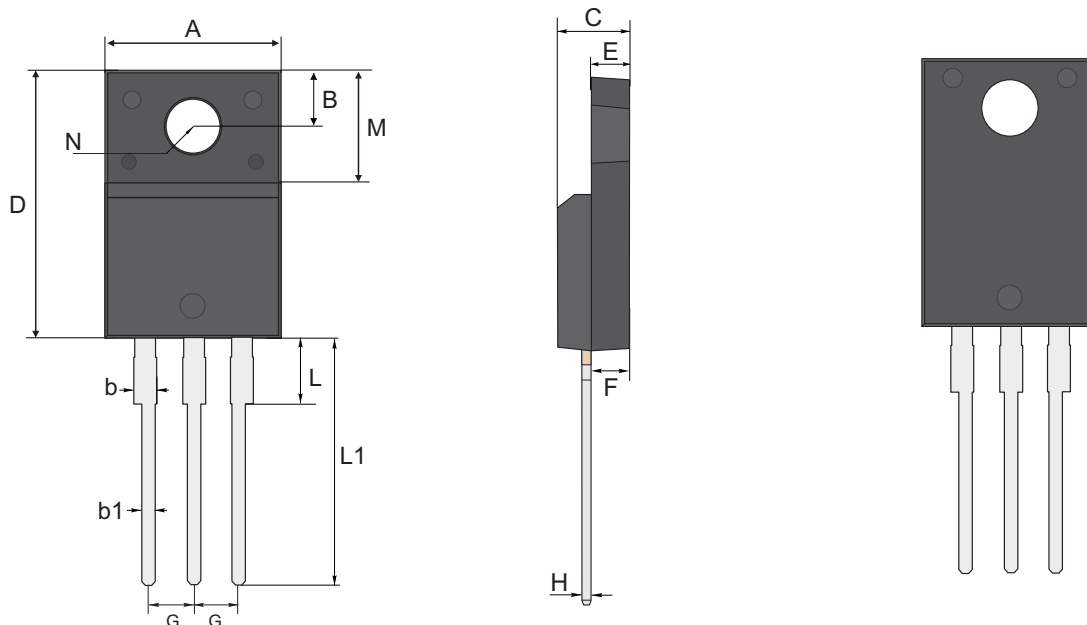
Fig.13 Safe Operating Area





PACKAGE OUTLINE
Plastic Through hole package; 3 leads

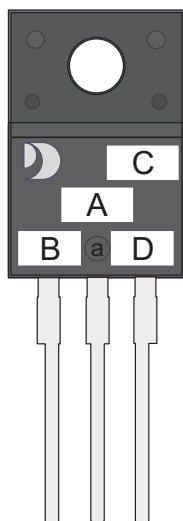
TO-220F-3L



TO-220F-3L mechanical data

UNIT		A	B	b	b1	C	D	E	F	G	H	L	L1	M	N
mm	max	10.28	3.37	1.34	0.9	4.9	16.07	2.74	2.74	2.64	0.60	2.85	13.7	6.88	3.18 TYPICAL
	typ	10.18	3.27	1.24	0.8	4.7	15.87	2.54	2.54	2.54	0.50	2.65	13.5	6.68	
	min	10.08	3.17	1.14	0.7	4.5	15.67	2.34	2.34	2.44	0.40	2.45	13.3	6.48	
mil	max	405	133	53	35	193	630	108	108	104	27	112	539	271	125 TYPICAL
	typ	401	129	49	31	185	590	100	100	100	20	104	531	267	
	min	397	125	45	28	177	580	92	92	96	16	96	524	255	

MARKING DIAGRAM



- Unmarkable Surfacea
- Marking Composition Field
- a:Ejector Pin Mark
- A:Marking Area
- B: Lot Code
- C: Additional Information
- D:Date Code (YWW)
- Y:Years(0~9)
- WW:Week



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