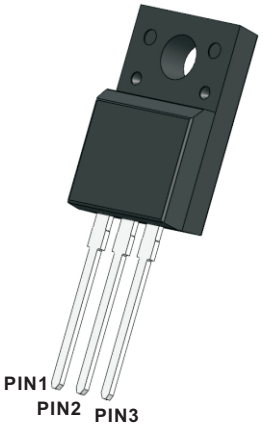
4A, 650V N-CHANNEL POWER MOSFET

TO-220F-3L(*Prefix :F)



RoHS COMPLIANT

Description

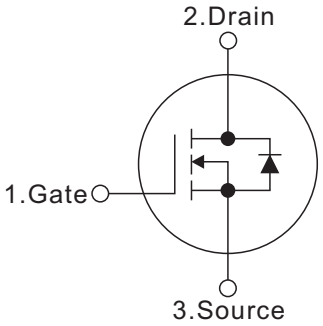
The F4N65L is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in switching power supplies and adaptors.

Features

- $R_{DS(ON)}$ < 2.6 Ω @ V_{GS}=10V, I_D=2.0A
- Fast switching capability
- 100% Avalanche tested
- 100% △V_{DS} tested

Mechanical data

- Case: TO-220F-3L
- pprox. Weight: 1.77g (0.062oz)
- Lead free finish, RoHS compliant
- Case Material: “Green” molding compound, UL flammability classification 94V-0,“Halogen-free”.



Packing Marking And Ordering Information

Device Package	Device	Marking	Packing Type	QTY Per Tube	Inner box	Per Carton
TO-220F-3L	F4N65L	F4N65L	Tube	50 Pcs	2,500 Pcs	5,000 Pcs

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	Tc=25°C Tc=100°C	I_D	4.0 2.5	A
Pulsed Drain Current (Note 2)		I_{DM}	16	A
Avalanche Energy Single Pulsed (Note 3)		E_{AS}	173	mJ
Power Dissipation (Tc = 25°C)		P_D	50	W
Operating junction and storage temperature		T_J,T_{STG}	-55 ~+150	°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 = 100mH, I_{AS} = 4.1A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C

Thermal Resistance

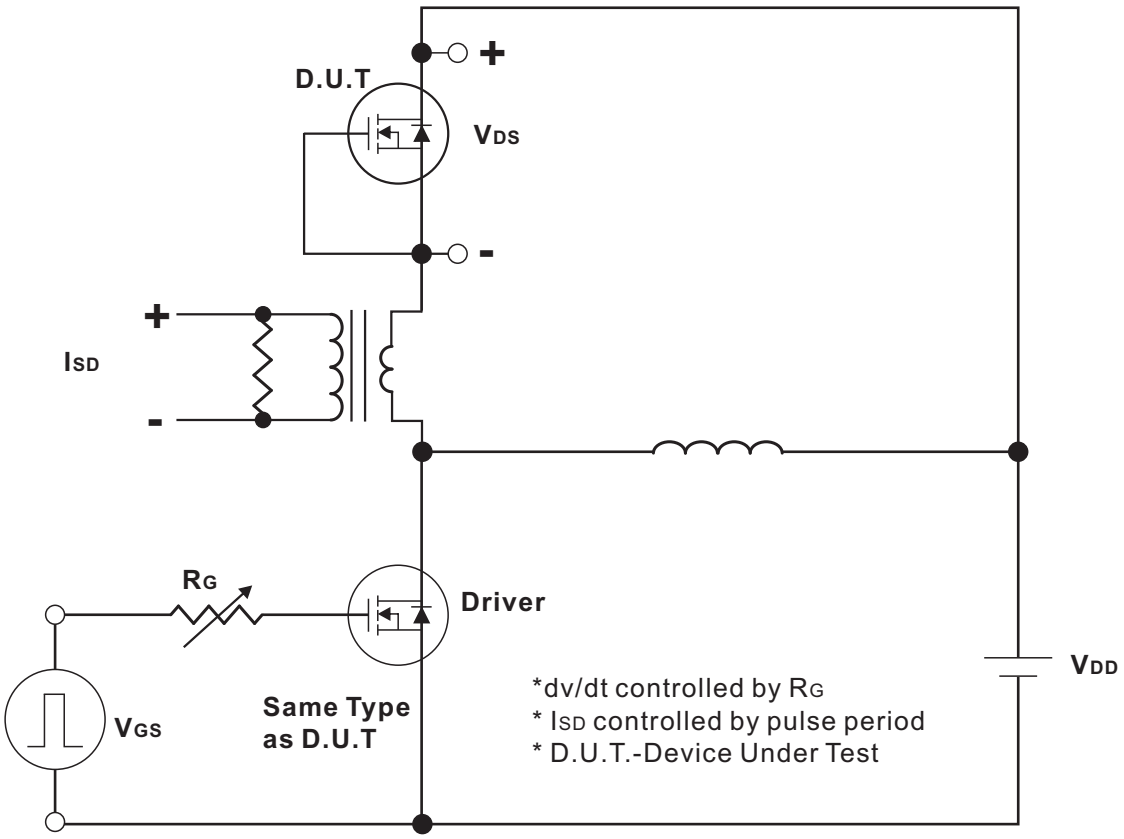
Parameter	Symbols	Ratings	Units
Thermal resistance, junction – case.	R_{thJC}	4	°C/W
Thermal resistance, junction – ambient(min. footprint)	R_{thJA}	63	°C/W

Electrical Characteristics (ta=25°c, Unless Otherwise Specified)

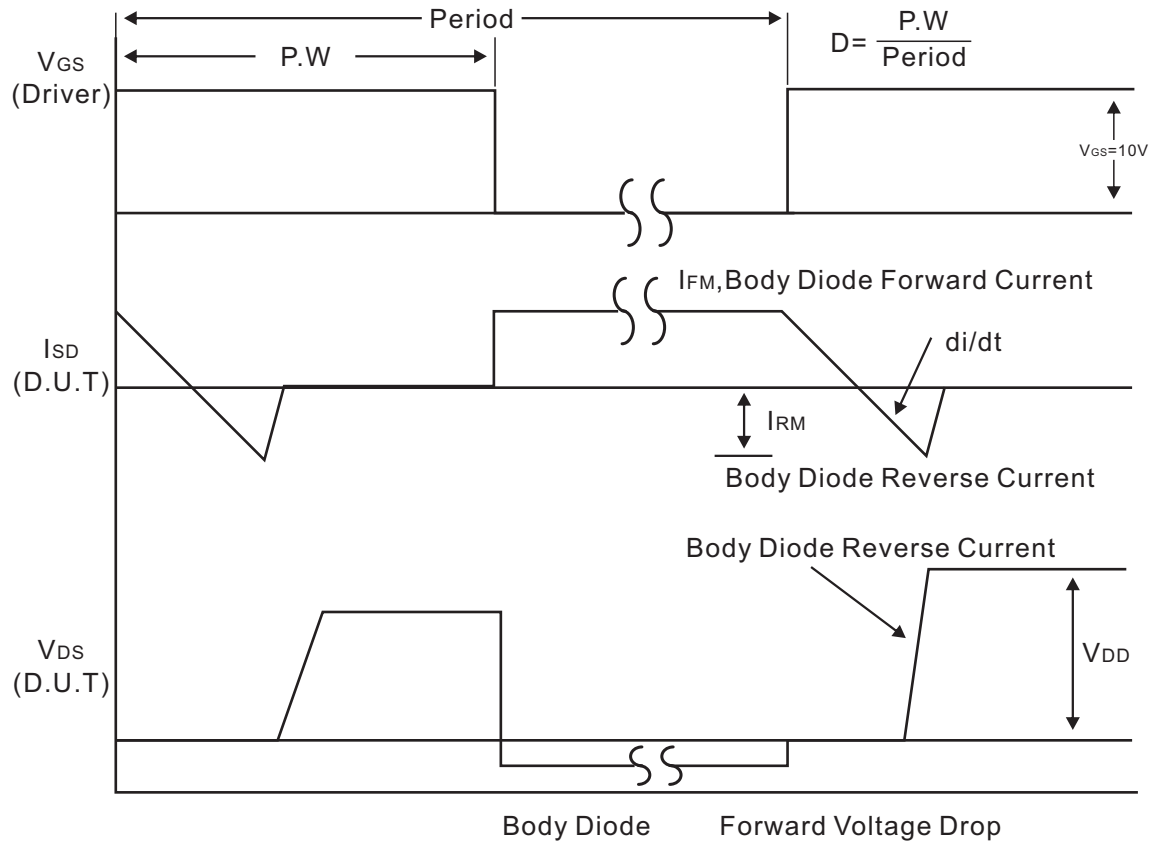
Parameter		Symbols	Test Conditions	Min	Typ	Max	Units
Off Characteristics							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V,I_D=250uA	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=650V,V_{GS}=0V			1.0	uA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=30V,V_{DS}=0V			100	nA
	Reverse		V_{GS}=-30V,V_{DS}=0V			-100	
On Characteristics							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS},I_D=250uA	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V,I_D=2.0A		2.4	2.6	Ω
Transconductance		g_{fs}	V_{DS}=15V,I_D=2A		2.7		S
Dynamic Characteristics							
Input Capacitance		C_{ISS}	V_{DS}=25V,		581		pF
Output Capacitance		C_{OSS}	V_{GS}=0V,		63		pF
Reverse Transfer Capacitance		C_{RSS}	f=1.0MHz		11		pF
Gate resistance		R_G			1.9		Ω
Switching Characteristics							
Total Gate Charge (Note 1)		Q_G	V_{DS}=480V,V_{GS}=10V,		25		nC
Gate-Source Charge		Q_{GS}	I_D=4A		17		nC
Gate-Drain Charge		Q_{GD}	(NOTE1,2)		20		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	V_{DS}=325V,I_D=4A		45		ns
Turn-On Rise Time		t_R	R_G=2.5Ω		100		ns
Turn-Off Delay Time		$t_{D(OFF)}$	(NOTE1,2)		200		ns
Turn-Off Fall Time		t_F			130		ns
Drain-Source Diode Characteristics And Maximum Ratings							
Maximum Body-Diode Continuous Current		I_S				4	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_{SD}=4A,V_{GS}=0V			1.3	V
Reverse Recovery Time (Note 1)		trr	I_F=4A		48		ns
Reverse Recovery Charge		Qrr	di/dt=100A/us		370		nC

Notes:
1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating temperature.

Test Circuits and waveforms

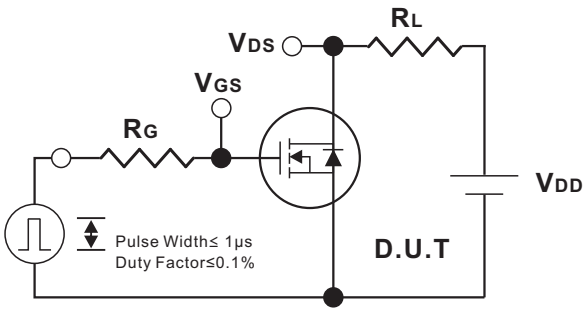


Peak Diode Recovery dv/dt Test Circuit

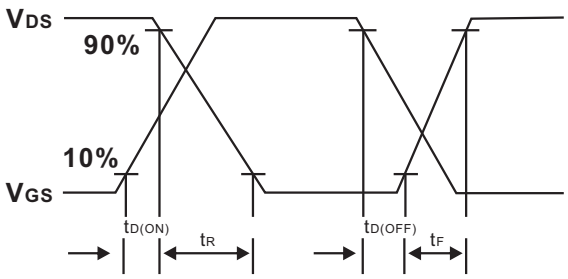


Peak Diode Recovery dv/dt Waveforms

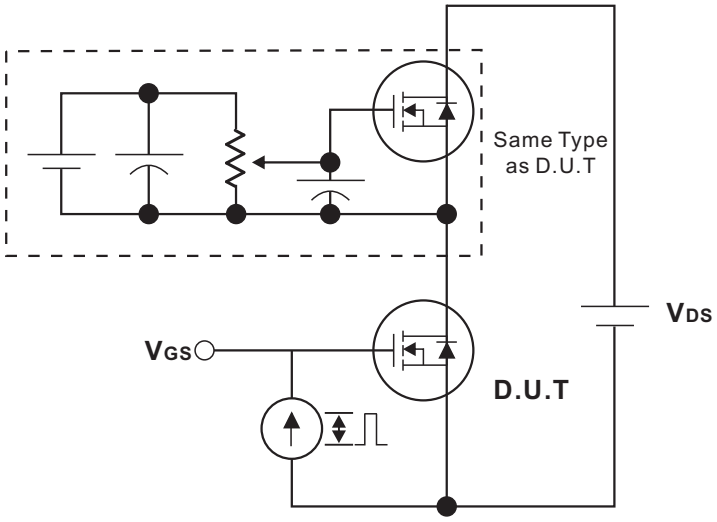
Test Circuits and waveforms



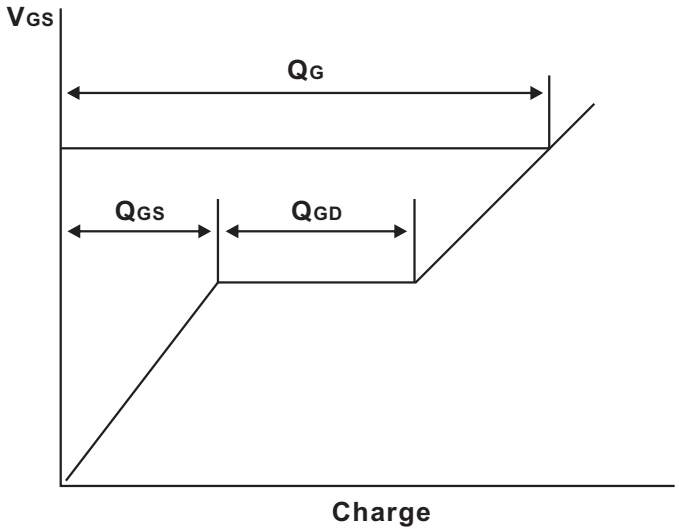
Switching Test Circuit



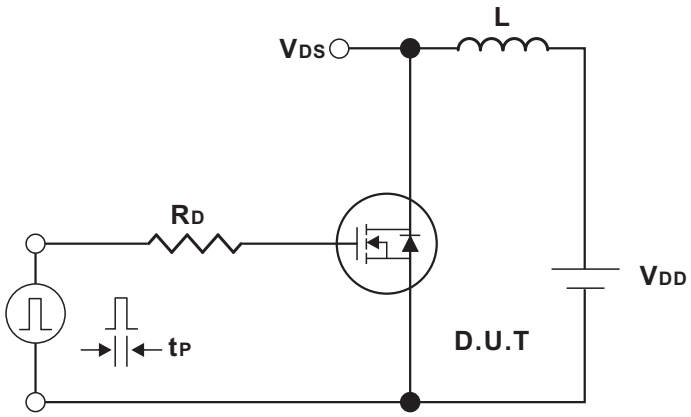
Switching Waveforms



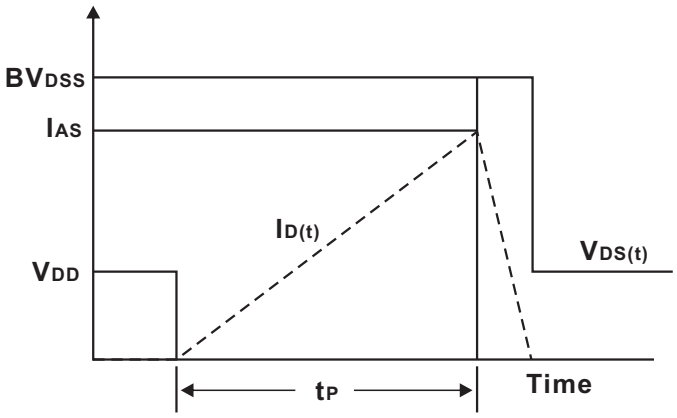
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

Typical Characteristics

Fig.1 Output characteristics

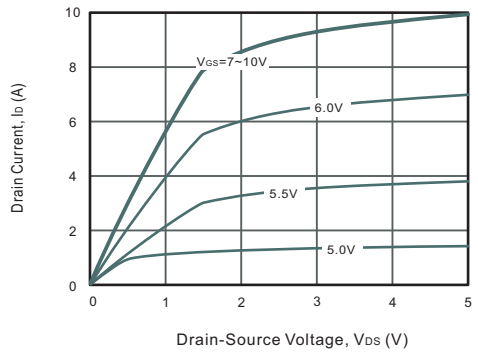


Fig.2 Power Dissipation

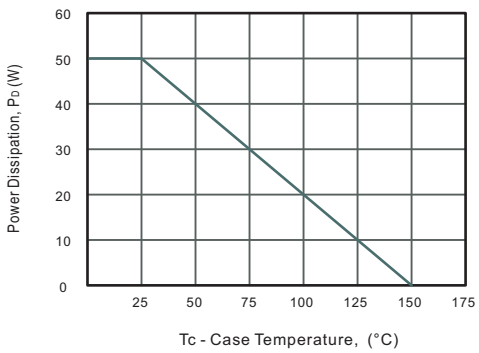


Fig.3 Drain Current Derating

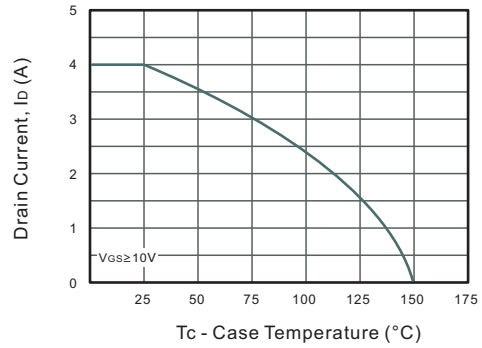


Fig.4 Drain-Source On-Resistance vs. Drain Current

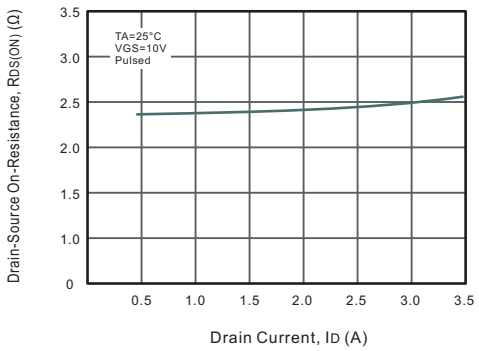


Fig.5 Gate Threshold Voltage vs. Junction Temperature

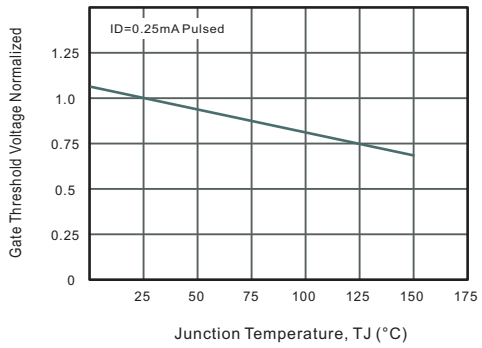


Fig.6 Body-diode Forward Characteristics

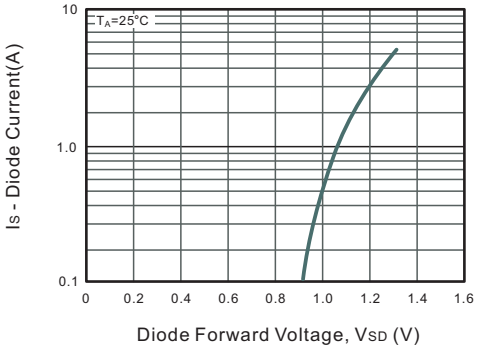


Fig.7 Drain-Source On-Resistance vs. Junction Temperature

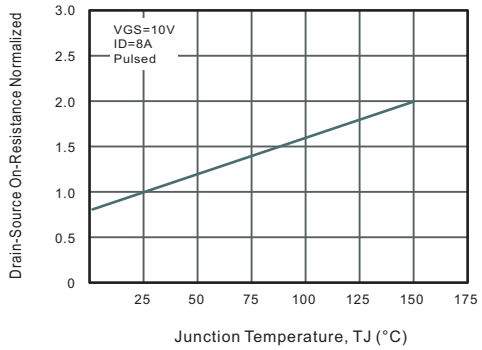
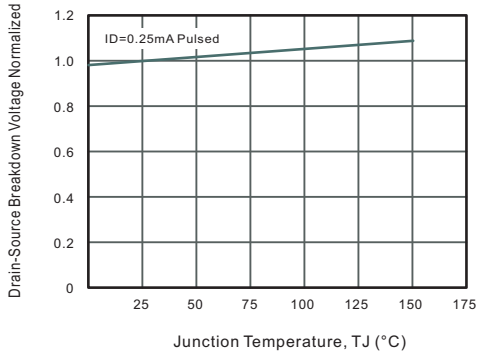


Fig.8 Breakdown Voltage vs. Junction Temperature



Typical Characteristics

Fig.9 Capacitance Characteristics

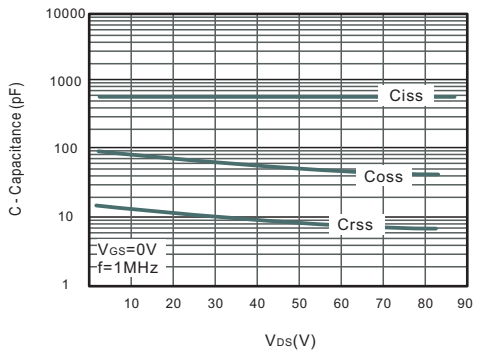


Fig.10 Gate Charge Characteristics

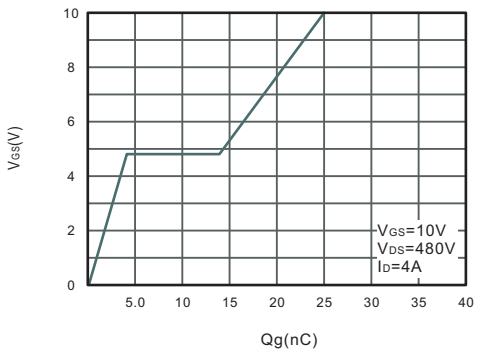


Fig.11 Safe Operating Area

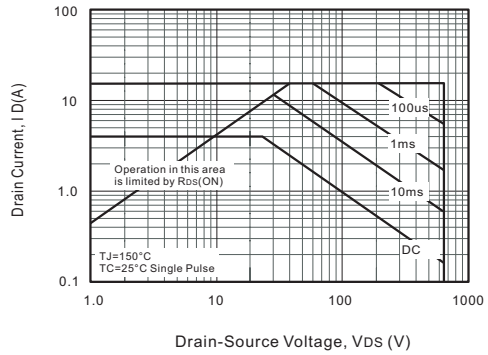
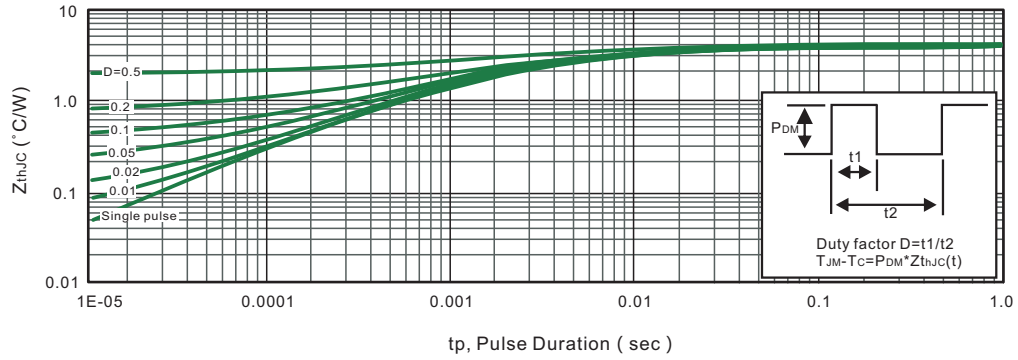
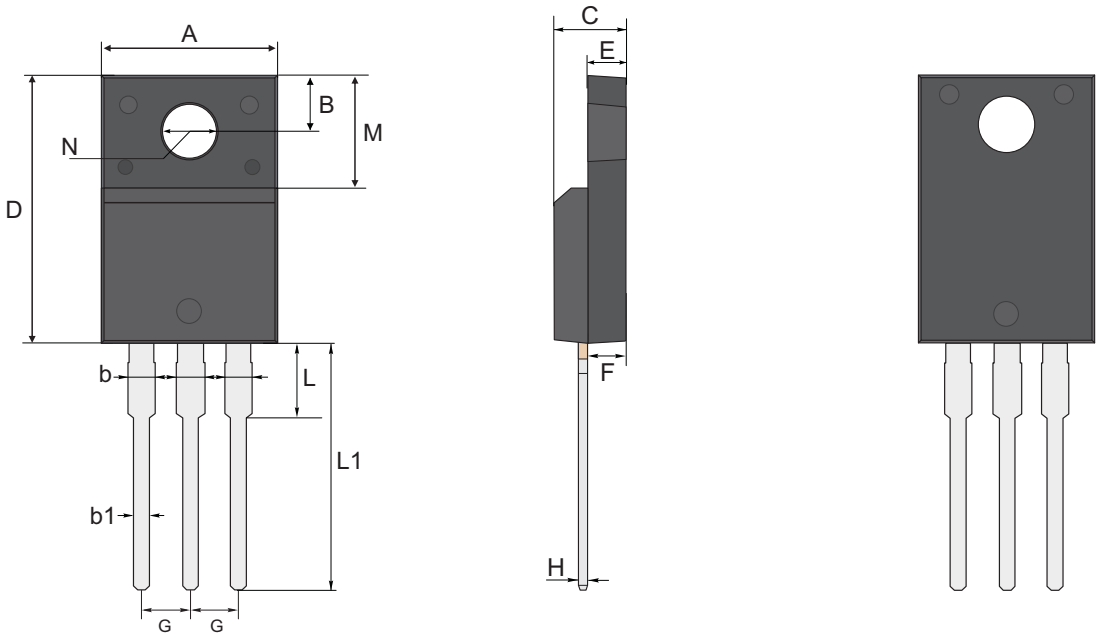


Fig.12 Max. Transient Thermal Impedance



Package Outline
Through Hole Package ; 3 leads

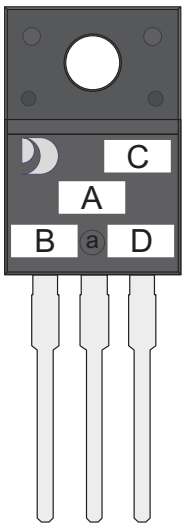
TO-220F-3L



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	1.44	0.9	4.9	16.07	2.74	2.74	2.64	0.6	3.38	13.7	6.98	3.18 typ.
	typ	10.18	3.27	1.34	0.8	4.7	15.87	2.54	2.54	2.54	0.5	3.18	13.5	6.68	
	min	10.08	3.17	1.24	0.7	4.5	15.67	2.34	2.34	2.44	0.4	2.98	13.3	6.38	
mil	max	405	133	57	35	193	633	108	108	104	24	133	539	275	125 typ.
	typ	401	129	53	31	185	625	100	100	100	20	125	531	263	
	min	397	125	49	28	177	617	92	92	96	16	117	524	251	

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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