NPS12N65F

650V N-Channel Enhancement Mode Power MOSFET

VOLTAGE:	650 Volts	CURRENT:	12.0 Amperes	TO-220F

FEATURES

- Low RDS(ON)
- Ultra Low Gate Charge
- RoHS Compliant
- 100% UIS and RG Tested

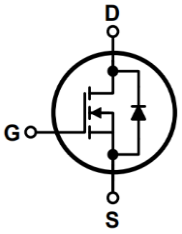
TYPICAL APPLICATIONS

- Adapter,PC,PD,Charger,LED Driver
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply（UPS）

PRODUCT SUMMARY

VDS@T_JMAX.	650	V
ID	12.0	A
RDS(ON) ,Typ.@10V	0.62	Ω

Marking and Polarity



Remark:

①. NH=niuhang trademark;

②. FF=Product line code,According to actual changes

YWW=Data code,According to actual changes

LLWWF=Inernal code,According to actual changes

③. NPS12N65F=Modle.

Absolute Maximum Ratings (Ratings at 25℃ ambient temperature unless otherwise specified)

Parameter	Test Conditions	Symbol	Ratings	Unit
Drain-Source Voltage		V_{DS}	650	V
Gate-Source Voltage		V_{GS}	±30	V
Continuous Drain Current (Note 1)	Ta= 25 ℃ Ta= 100 ℃	I_D	12 7.7	A
Drain Current-Pulsed (Note 1)	T_J< 150 ℃	I_{DM}	48	A
Maximum Power Dissipation Power Dissipation Derating Factor above 25℃	Ta= 25 ℃ Ta= 100 ℃	P_D	55 22	W
Derating Factor		D_F	0.44	W/℃
Junction Temperature		T_J	-55 to 150	℃
Storage temperature range		T_{STD}	-55 to 150	℃
Avalanche Current,Single pulse	L= 10 mH	I_{AS}	11.8	A
Single Pulse Avalanche Energy	L= 10 mH,VDD=50V IAS= 11.8 A,RG=25Ω Starting TJ =25℃	E_{AS}	696	mJ

Thermal Characteristcs (Ratings at 25℃ ambient temperature unless otherwise specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Thermal Resistance Junction to Ambient(Note 2)	1.still air environment with TA =25° C.	$R_{\theta JA}$	100.0	℃/W
Thermal Resistance Junction-Case(Note 2)	2.device mounted on 1 in^2 FR-4 board with 2oz	$R_{\theta JC}$	2.27	

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in2 FR-4 board with 2oz. Copper, in a still air environment with TA =25° C. The value in any given application depends on the user's specific board design.This transistor is sensitive to electrostatic discharge and should be handled with care.

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Electrical Characteristcs (Ratings at 25℃ ambient temperature unless otherwise specified)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Static off Characteristics						
Drain-Source Breakdown Voltage	VGS=0V,ID=250uA	BV_{DSS}	650	-	-	V
Bvdss Temperature Coefficient	ID=250uA,Reference25℃	$\Delta BV_{DSS}/\Delta T_J$	-	0.74	-	V/℃
Drain-Source Leakage Current	VDS= 650 V,VGS=0V	I_{DSS}	-	-	1	uA
Gate-Body Leakage Current	VGS= ±30 V,VDS=0V	I_{GSS}	-	-	±100	nA
Static on Characteristics						
Gate Threshold Voltage	VGS= VDS ID=250uA	$V_{GS(TH)}$	2.0	3.0	4.0	V
Drain-Source On Resistance	ID= 6 A,VGS=10V	$R_{DS(ON)}$	-	0.62	0.7	Ω
Dynamic Characteristics						
Input Capacitance	VDS= 25 V	C_{iss}	-	2060	-	pF
Output Capacitance	VGS= 0 V	C_{oss}	-	184	-	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	-	16.0	-	pF
Switching Paramters						
Turn-On Delay Time	VDS= 325 V	$t_{d(on)}$	-	15	-	ns
Turn-On Rise Time	ID= 12 A	t_r	-	18	-	ns
Turn-Off Delay Time	VGS= 10 V	$t_{d(off)}$	-	44	-	ns
Turn-Off Rise Time	RG= 4.7 Ω	t_f	-	22	-	ns
Total Gate Charge	VDS= 325 V	Q_g	-	44	-	nC
Gate-Source Charge	ID= 12 A	Q_{gs}	-	7	-	nC
Gate-Drain Charge	VGS= 10 V	Q_{gd}	-	18	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
Max. Diode Forward Cuurent		I_S	-	-	12	A
Max. Pulsed Forward Cuurent		I_{SM}	-	-	48	A
Diode Forward Voltage	ID= 6 A,VGS=0V	V_{SD}	-	0.86	1.4	V
Reverse Recovery Time	ID= 12 A,VGS=0V	t_{rr}	-	345	-	ns
Reverse Recovery Charge	di/dt= 100 A/us	Q_{rr}	-	2680	-	nC

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Typical Characteristics Curves

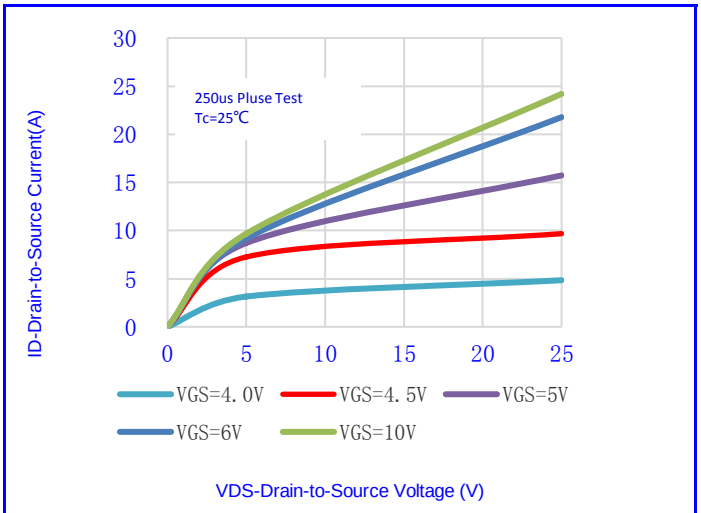

Fig.1-Output Characteritsics

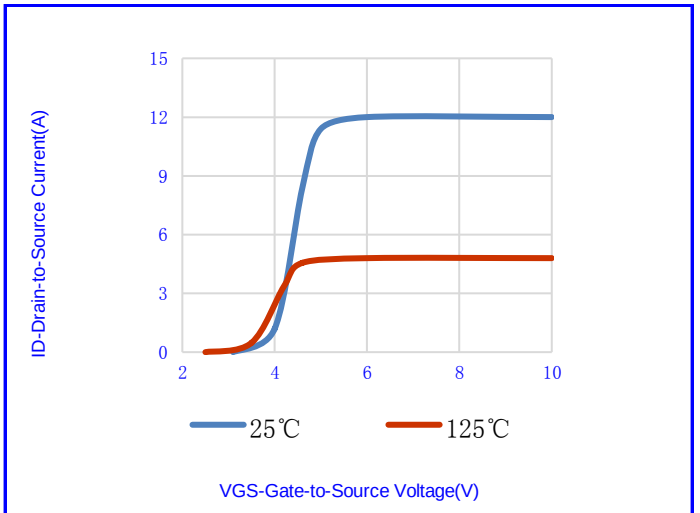

Fig.2- Transfer Characteritsics

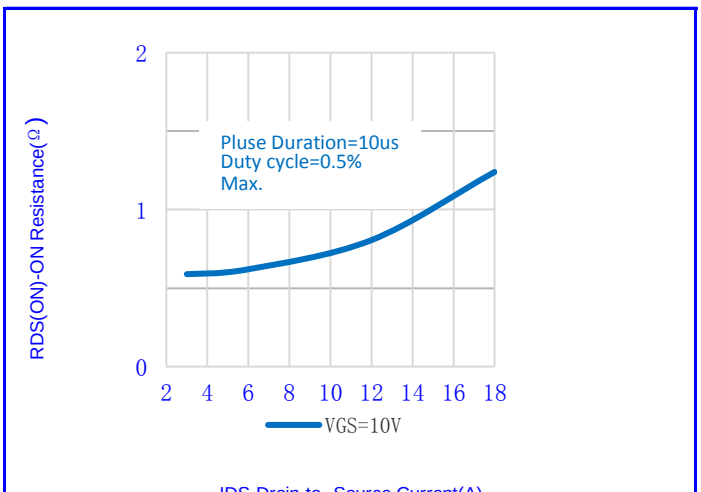

Fig.3- On Resistance vs. Drain Current

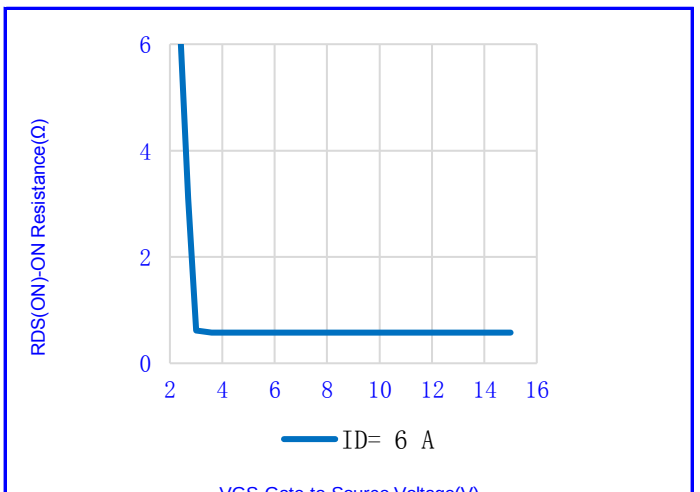

Fig.4- On Resistance vs. Gate Source Voltage

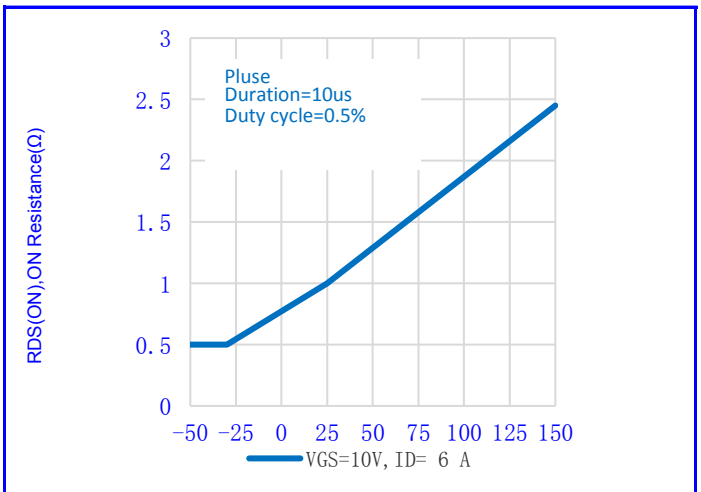

Fig.5-On Resistance vs. Junction Temperature

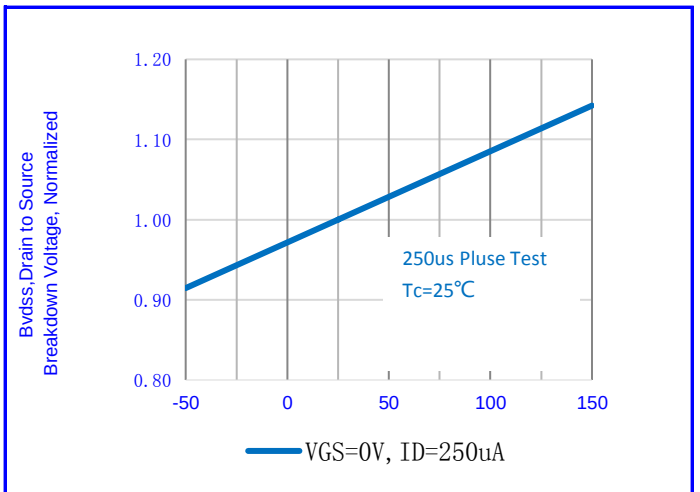

Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

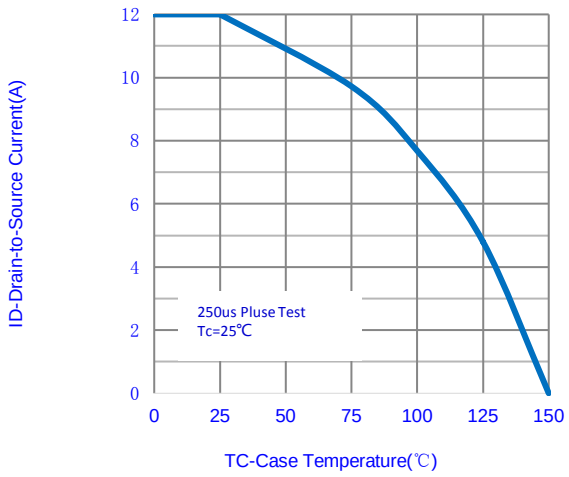

Fig.7-Maximum Continuous Drain Current vs. Case Temperature

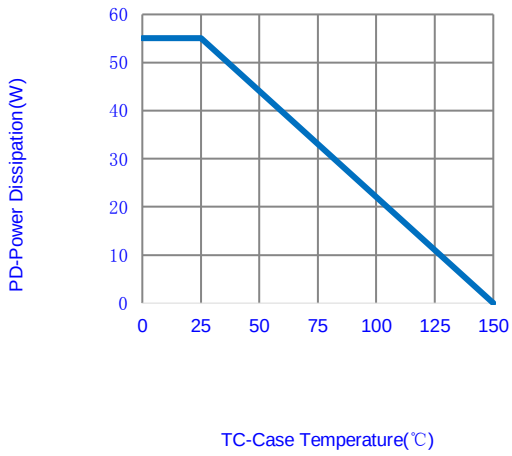

Fig.8-Maximum Power Dissipation vs. Case Temperature

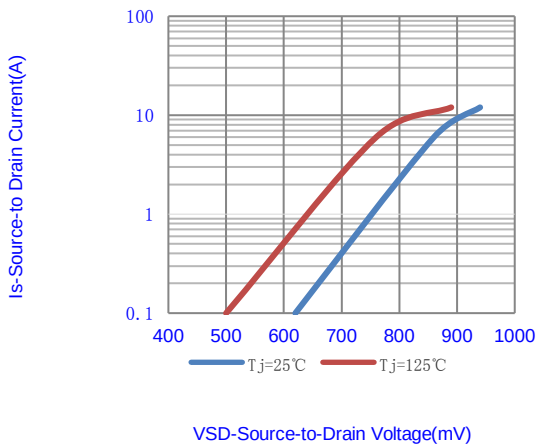

Fig.9- Source-Drain Diode Forward Voltage

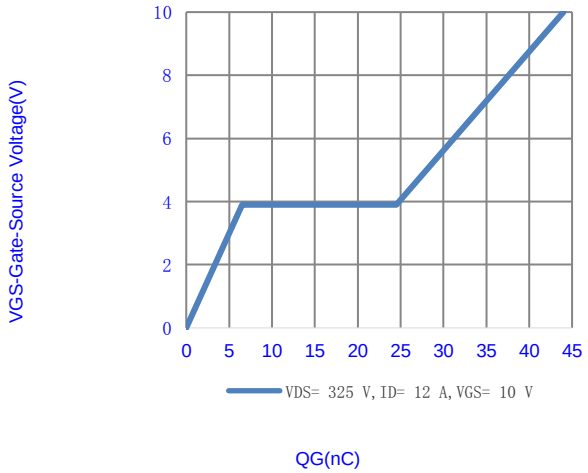

Fig.10-Gate Charge Waveform

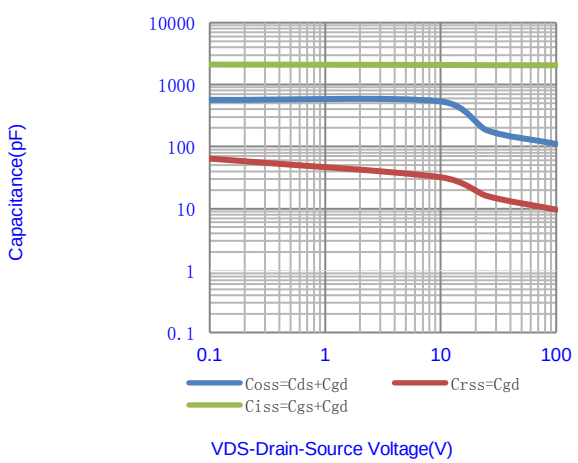

Fig.11- Gate-Source Voltage-VGS(V)

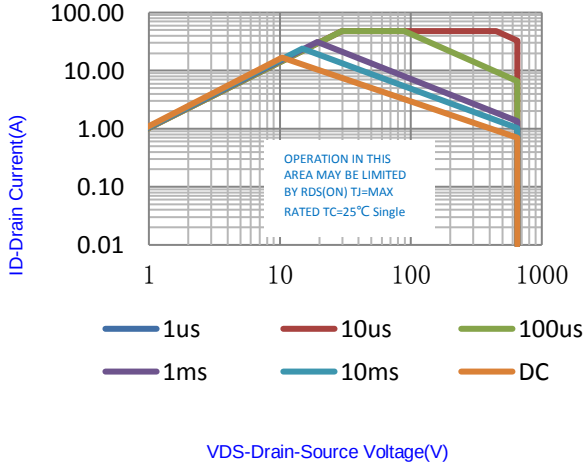

Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

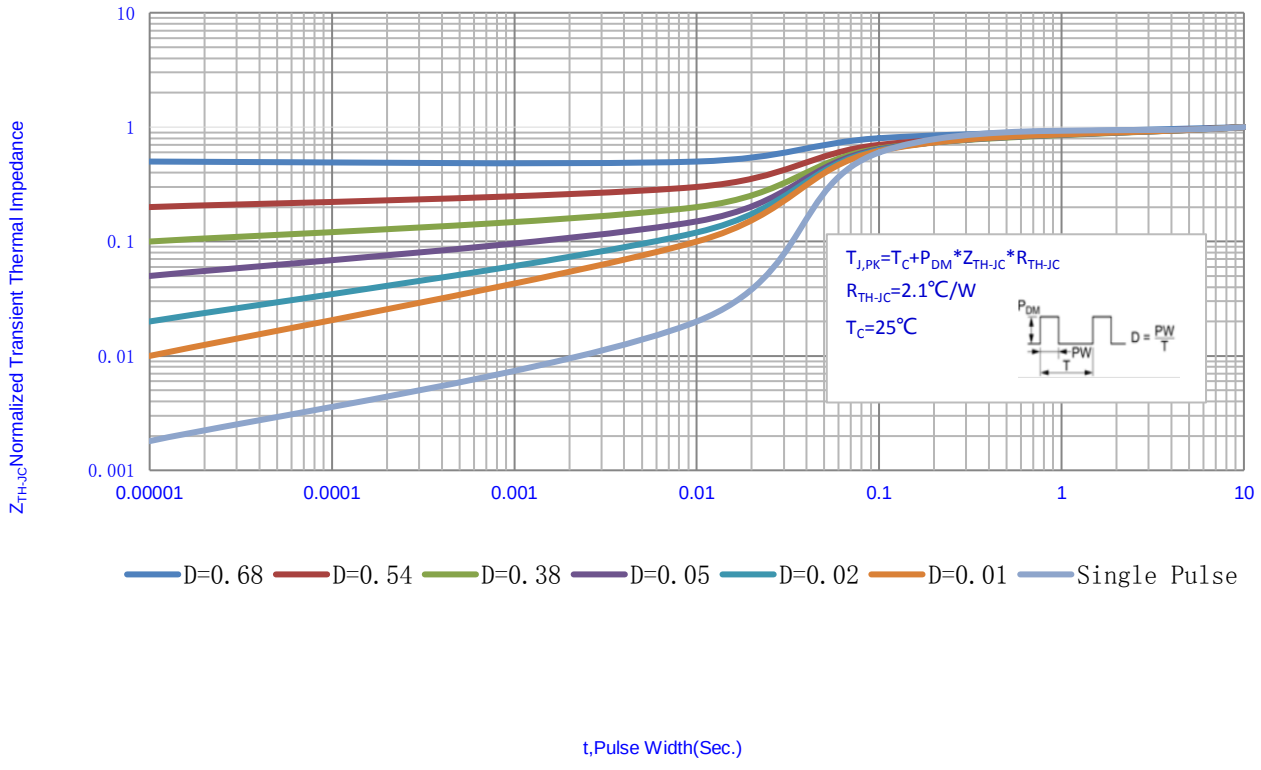

Fig.13- Normalized Transient Thermal Impedance vs.Pulse Width

Test Circuit & Waveform

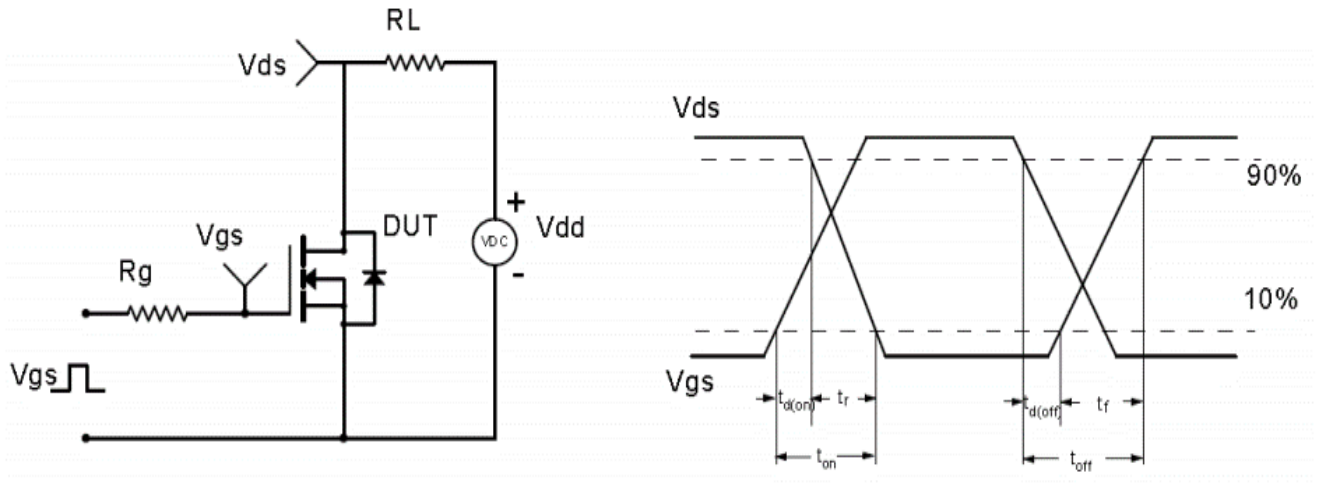

Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

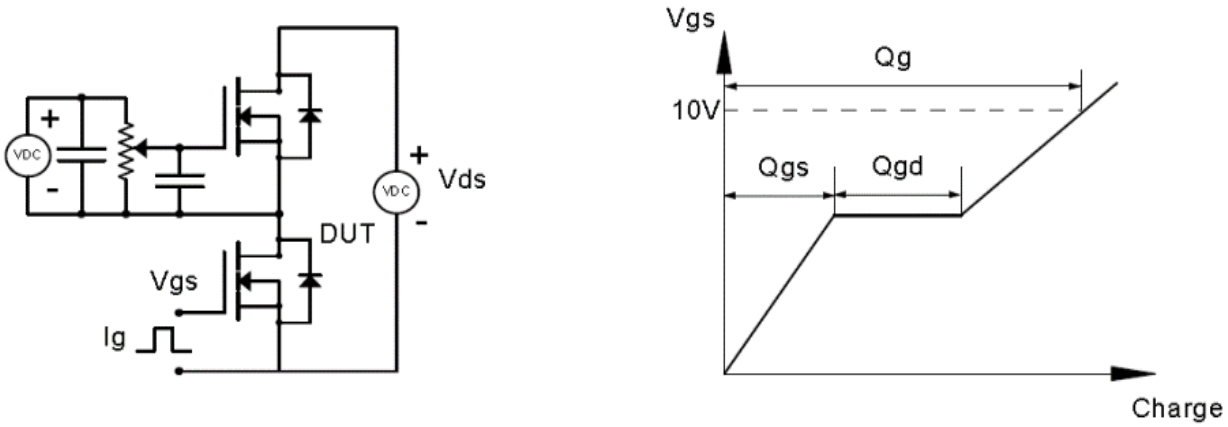

Fig.15-Gate Charge Test Circuit & Waveform

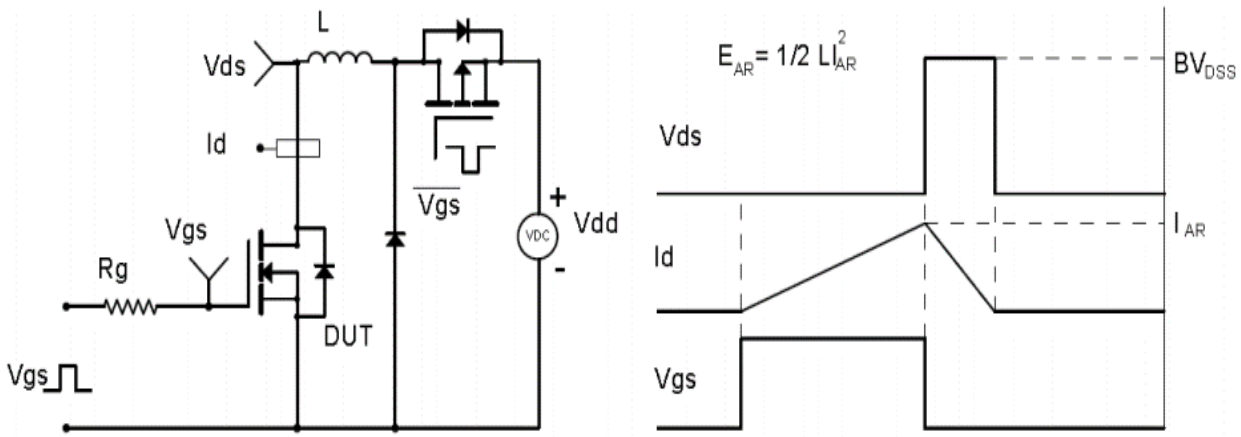

Fig.16- EAS Test Circuit & Waveform

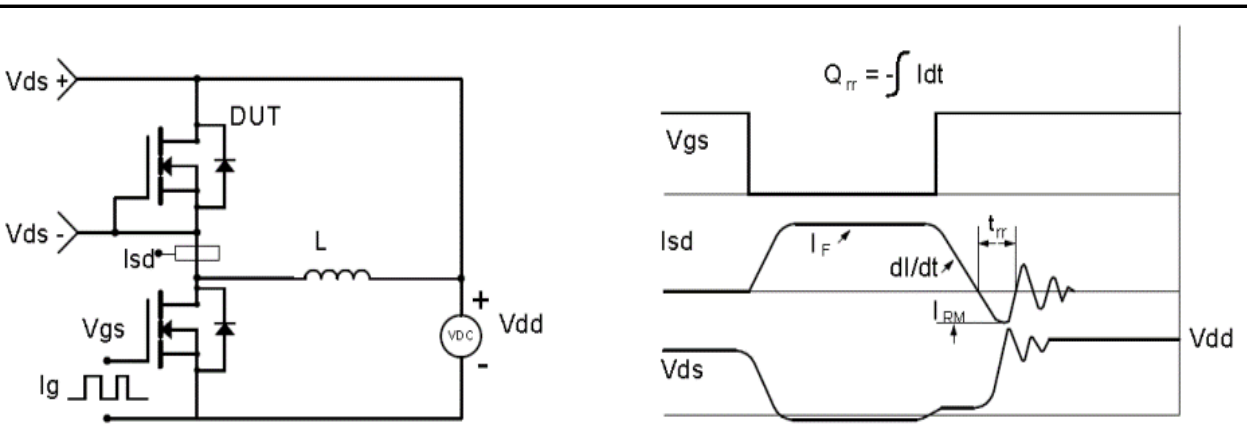

Fig.16- Diode Recovery Test Circuit & Waveform

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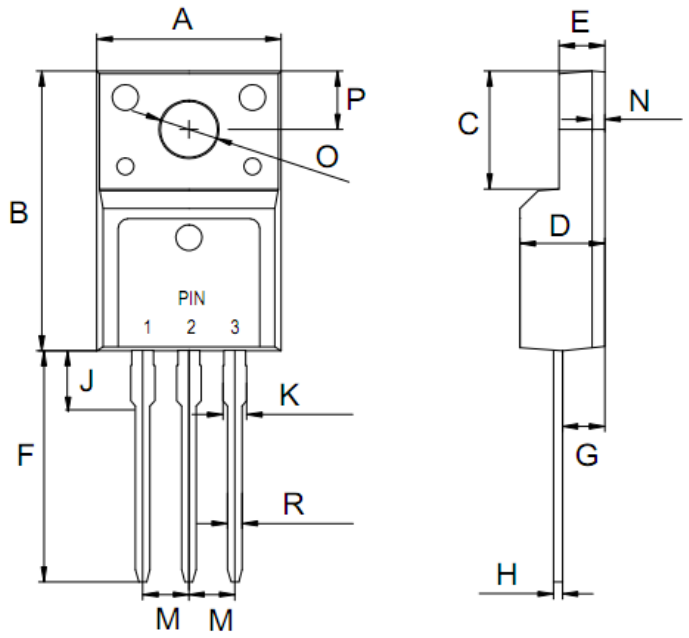
OUTLINE DRAWINGS — TO-220F



OUTLINE DIMENSIONS						
Dim.	Milimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	10.00	-	10.50	0.39	-	0.41
B	15.40	-	16.20	0.61	-	0.64
C	6.48	-	6.88	0.26	-	0.27
D	4.50	-	4.90	0.18	-	0.19
E	2.35	-	2.75	0.09	-	0.11
F	12.50	-	-	0.49	-	-
G	2.40	-	3.00	0.09	-	0.12
H	0.40	-	0.60	0.02	-	0.02
J	2.20	-	4.20	0.09	-	0.17
M	2.40	-	2.70	0.09	-	0.11
N	0.80	-	1.10	0.03	-	0.04
K	1.20	-	1.50	0.05	-	0.06
R	0.60	-	1.00	0.02	-	0.04
O	3.10	-	3.70	0.12	-	0.15
P	3.00	-	4.00	0.12	-	0.16

PACKING INFORMATION — TO-220F

Package Method	Inner Box Size L×W×H(mm)	Quantity (pcs/box)	Carton Size L×W×H(mm)	Quantity (box/carton)
Box Package	570×153×47	1000	580×250×180	5000

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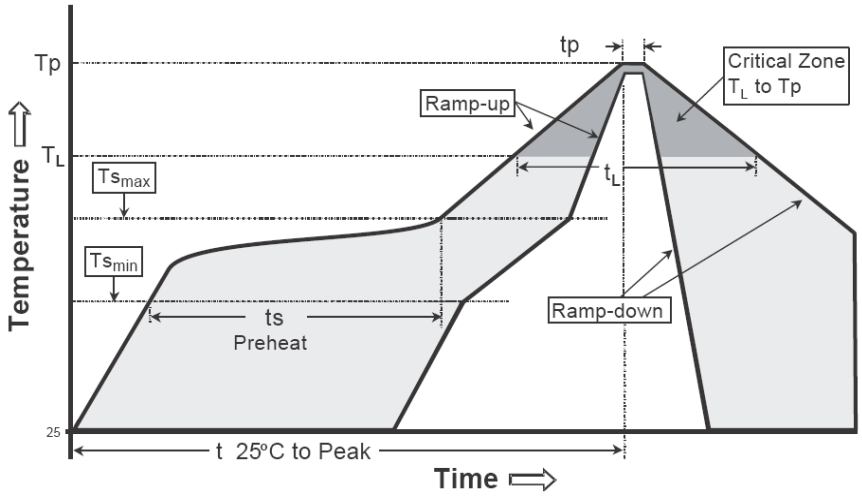
Recommended wave soldering condition

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat −Temperature Min(TS min) −Temperature Max(TS max) −Time(ts min to ts max)	 100°C 150°C 60-120 seconds	 150°C 200°C 60-180 seconds
Time maintained above: −Temperature (TL) − Time (tL)	 183°C 60-150 seconds	 217°C 60-150 seconds
Peak Temperature(TP)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.

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