

NPS16N65F

N-Channel Enhancement Mode Power MOSFET



VOLTAGE: 650 Volts

CURRENT: 16 Amperes

Package: TO-220F

Marking And Polarity

FEATURES

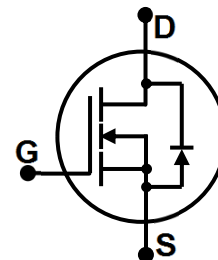
- Low $R_{DS(ON)}$ For High Efficiency
- Low Gate Charge For High Speed Switching
- High EAS For High Reliability
- 100% UIS And RG Tested

TYPICAL APPLICATIONS

- AC/DC converter
- Adaptor and Charger
- LED Drives
- High-Frequency Circuits and Switching Power Supply
- **Weight: App. 2.048 Grams (0.07224 Ounce)**

PRODUCT SUMMARY

VDS Min.@T _j	650	V
I _D Min.@Ta	16	A
RDS(ON) Type@10V	480.00	mΩ



Remark:

- ①. NH=Nihang Trademark
- ②. FF=Product Line Code,According To Actual Changes
YWW=Date Code,According To Actual Changes
LLWWF=Inernal Code,According To Actual Changes
- ③. NPS16N65F=Model

Absolute Maximum Ratings (Ta=25°C 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 °C	I_D	16	A
	Ta= 100 °C		10	
Drain Current-Pulsed (Note 1)	T _j < 150 °C	I_{DM}	64	A
Maximum Power Dissipation Power	Ta= 25 °C	P_D	34	W
Dissipation Derating Factor Above 25°C	Ta= 100 °C		14	
Derating Factor		D_F	0.27	W/°C
Junction Temperature		T_J	-55 to 150	°C
Storage Temperature Range		T_{STD}	-55 to 150	°C
Avalanche Current,Single Pulse (Note 1)	L= 0.5 mH	I_{AS}	58.2	A
Single Pulse Avalanche Energy (Note 1) Test Circuit & Waveform See Fig.16	L= 0.5 mH,VDD= 325 V IAS= 58.15 A,RG= 10 Ω Starting T _j =25 °C,VG = 10 V	E_{AS}	845	mJ

Thermal Characteristics (Ta=25°C Unless Otherwise Specified)

Parameter	Test Conditions	Symbol	Typ.	Unit
Thermal Resistance Junction To Ambient	Still Air Environment With Ta =25°C	$R_{θJA}$	52.0	°C/W
Thermal Resistance Junction-Case	Device Mounted On 1 in ² FR-4 Board With 2oz	$R_{θJC}$	3.70	

Notes: 1. Pulse Width Limited By Max. Junction Temperature. (See Fig. 13).

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Electrical Characteristics (Ta=25°C 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℃	$\Delta BV_{DSS}/\Delta T_J$	--	0.772	--	V/℃
Drain-Source Leakage Current	VDS= 650 V,VGS=0V	I_{DSS}	--	--	1.0	uA
Gate-Body Leakage Current	VGS= ±30 V,VDS=0V	I_{GSS}	--	--	±100	nA
Forward Transconductance	ID= 8 A,VDS= 15 V	g_{fs}	--	15	--	S
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= 8 A,VGS= 10 V	$R_{DS(ON)}$	--	480.00	620.00	mΩ
	ID= 8 A,VGS= 4.5 V		--	552.00	830.80	
Dynamic Characteristics						
Gate Resistance	VGS=0V,VDS=0V, Freq.=1MHz	R_g	--	2.50	--	Ω
Input Capacitance	VDS= 25 V	C_{iss}	--	2750.0	--	pF
Output Capacitance	VGS= 0 V	C_{oss}	--	225.0	--	pF
Reverse Transfer Capacitance	F= 1 MHZ	C_{rss}	--	28.0	--	pF
Switching Paramters (Test Circuit & Waveform See Fig.14)						
Turn-On Delay Time	VDS= 325 V	$t_{d(on)}$	--	40.0	--	ns
Turn-On Rise Time	VGS= 10 V	t_r	--	50.0	--	ns
Turn-Off Delay Time	RL= 1.2 Ω	$t_{d(off)}$	--	175.0	--	ns
Turn-Off Rise Time	RG= 10 Ω	t_f	--	69.0	--	ns
Gate Charge Paramters (Test Circuit & Waveform See Fig.15)						
Total Gate Charge	VDS= 325 V	Q_g	--	60.0	--	nC
Gate-Source Charge	VGS= 10 V	Q_{gs}	--	15.0	--	nC
Gate-Drain Charge	ID= 8 A	Q_{gd}	--	25.0	--	nC
Drain-Source Diode Characteristics And Maximum Ratings (Test Circuit & Waveform See Fig.17)						
Max. Diode Forward Cuurent		I_s	--	--	16	A
Max. Pulsed Forward Cuurent		I_{SM}	--	--	56	A
Diode Forward Voltage	ID= 8 A,VGS=0V	V_{SD}	--	0.87	1.2	V
Reverse Recovery Time	ID= 8 A,di/dt= 100 A/us	t_{rr}	--	475	--	ns
Reverse Recovery Charge	VGS= 10 V,VDS= 325 V	Q_{rr}	--	7.0	--	uC

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Typical Characteristics Curves

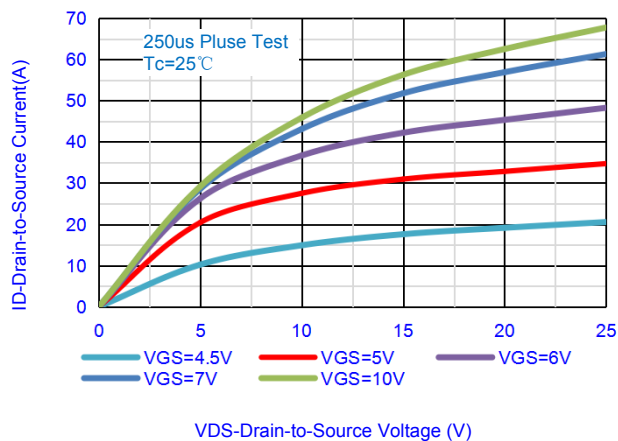


Fig.1-Output Characteristics

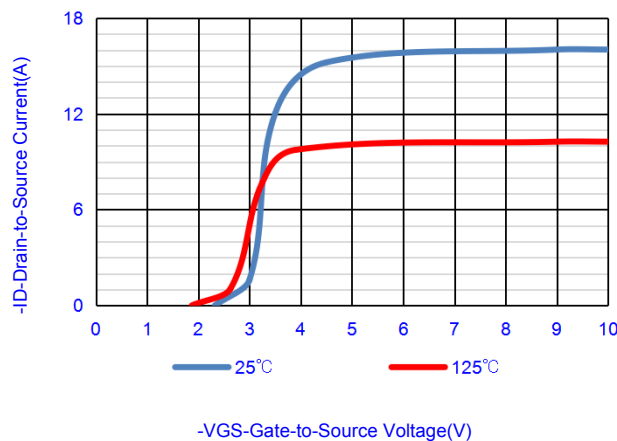


Fig.2- Transfer Characteristics

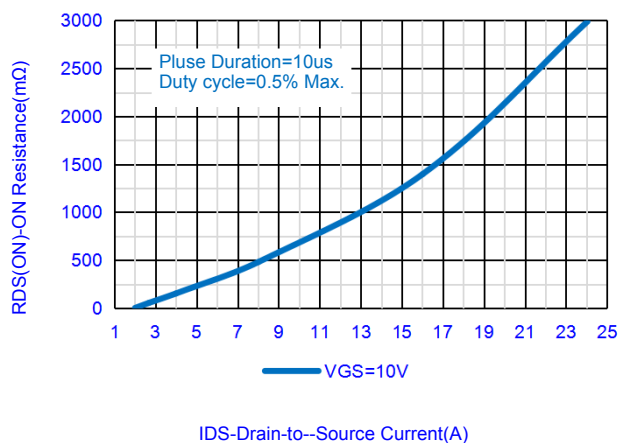


Fig.3- On Resistance vs. Drain Current

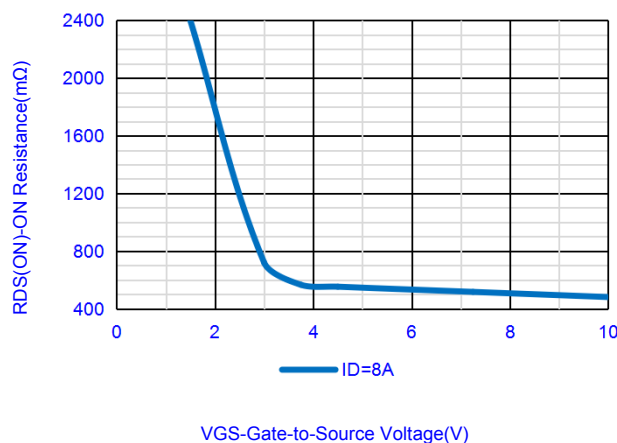


Fig.4- On Resistance vs. Gate Source Voltage

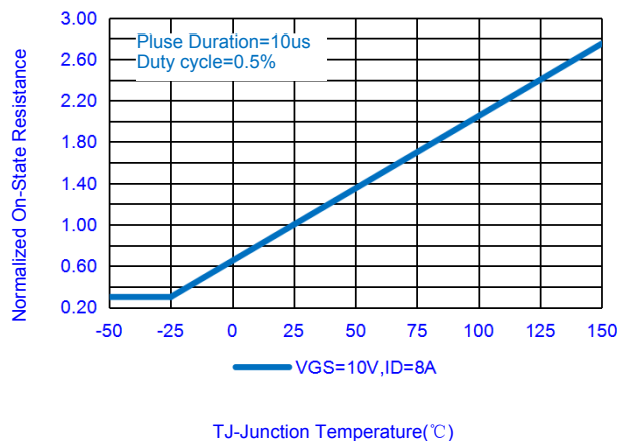


Fig.5- On Resistance vs. Junction Temperature

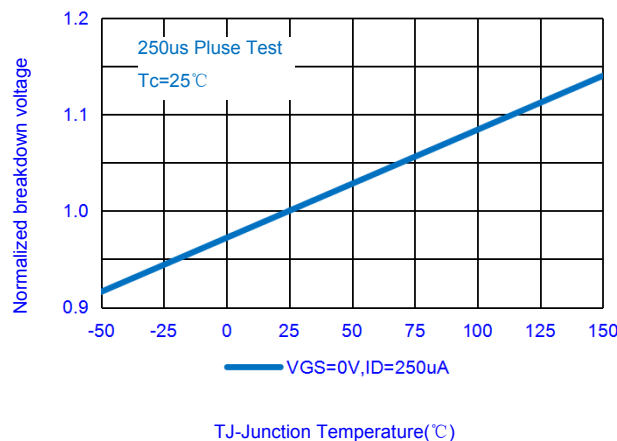


Fig.6- Breakdown Voltage vs. Junction Temperature

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Typical Characteristics Curves

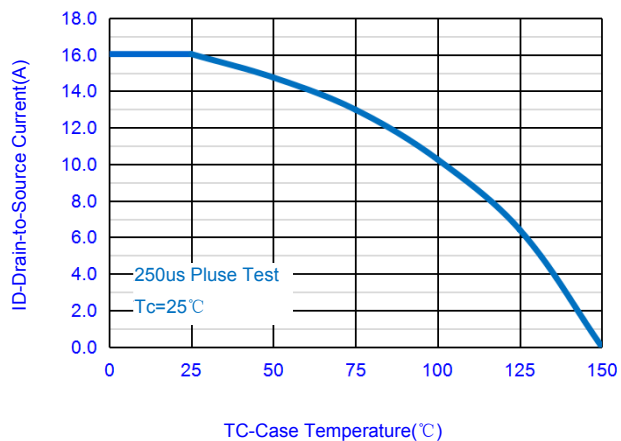


Fig.7-Maximum Continuous Drain Current vs. Case Temperature

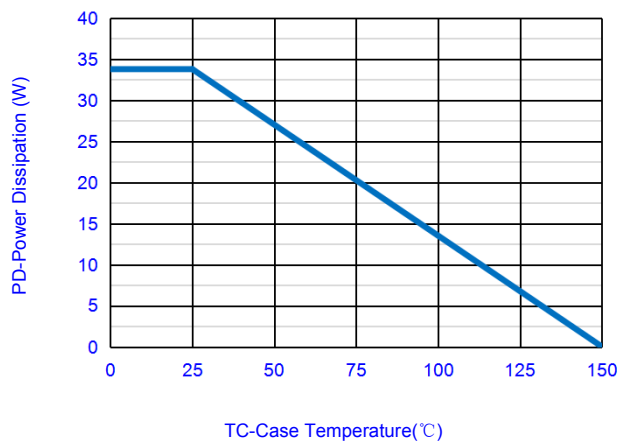


Fig.8-Maximum Power Dissipation vs. Case Temperature

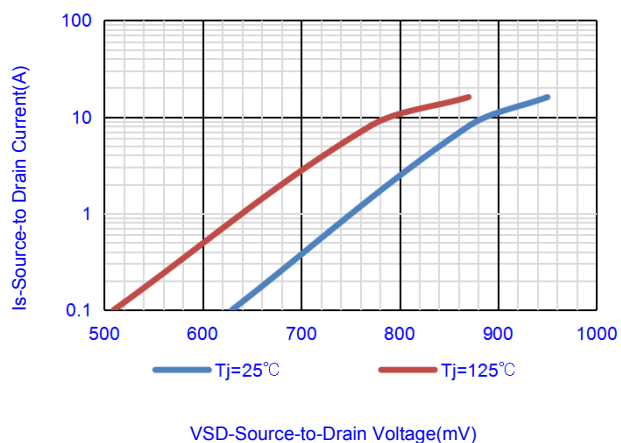


Fig.9- Source-Drain Diode Forward Voltage

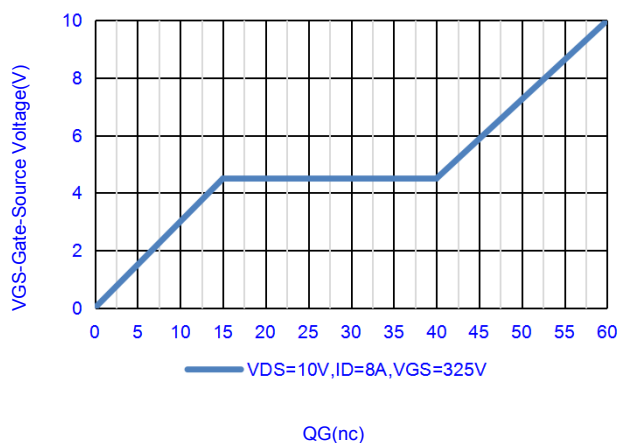


Fig.10-Gate Charge Waveform

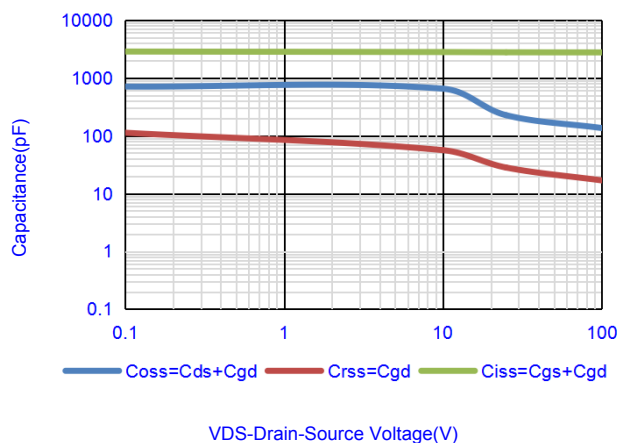


Fig.11- Gate-Source Voltage-VGS(V)

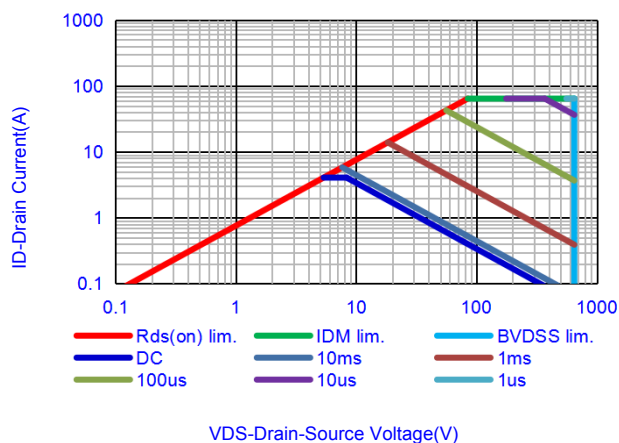


Fig.12-Maximum Safe Operating Area(SOA)

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Typical Characteristics Curves

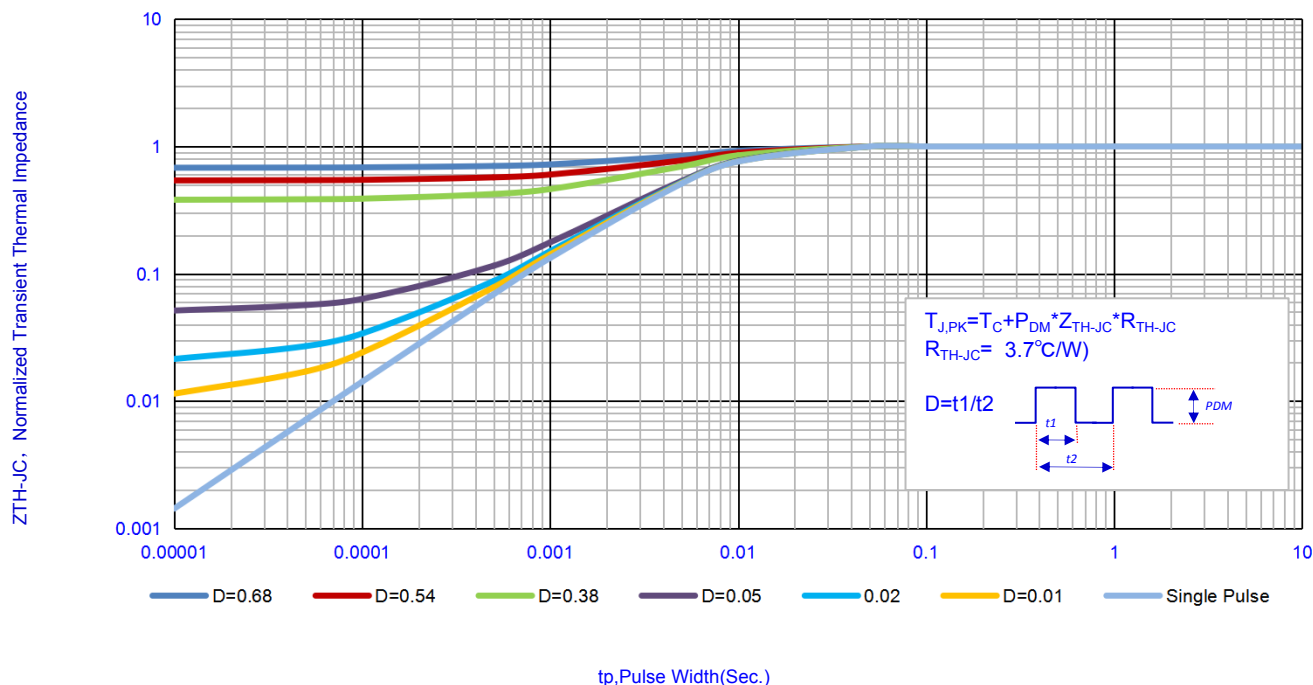


Fig.13- Normalized Maximum Transient Thermal Impedance vs. Pulse Width

Test Circuit & Waveform

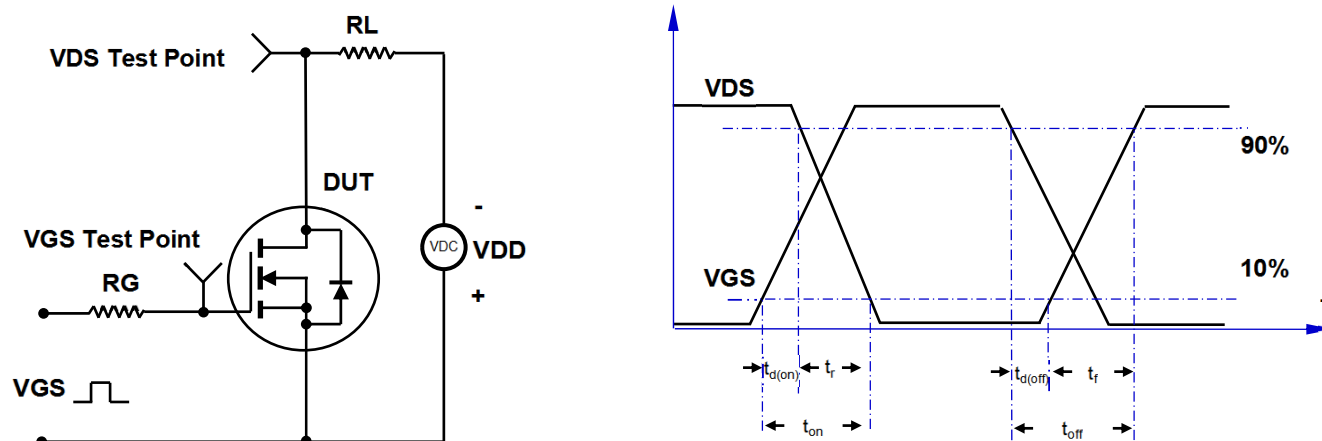


Fig.14- Resistive Switching Test Circuit & Waveform

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Test Circuit & Waveform

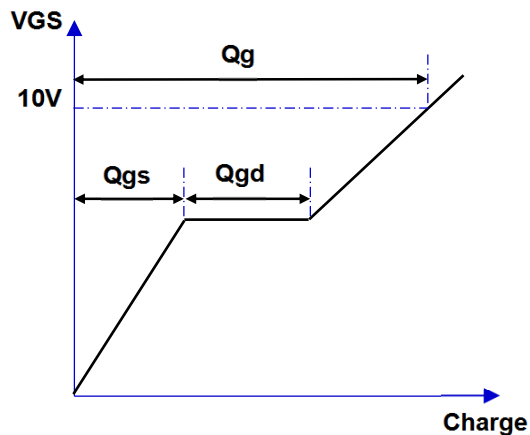
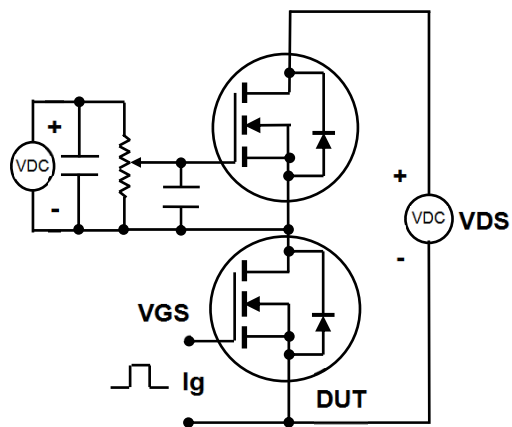


Fig.15- Gate Charge Test Circuit & Waveform

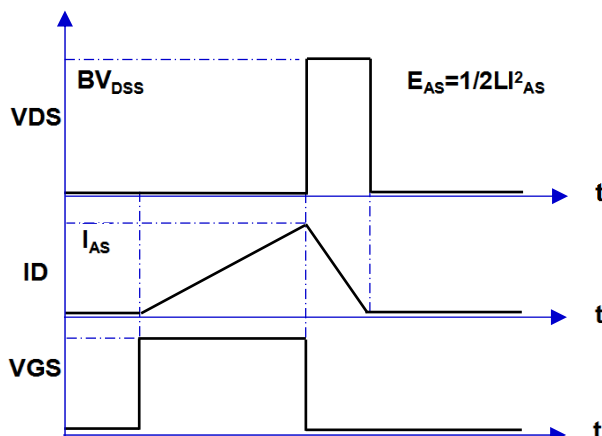
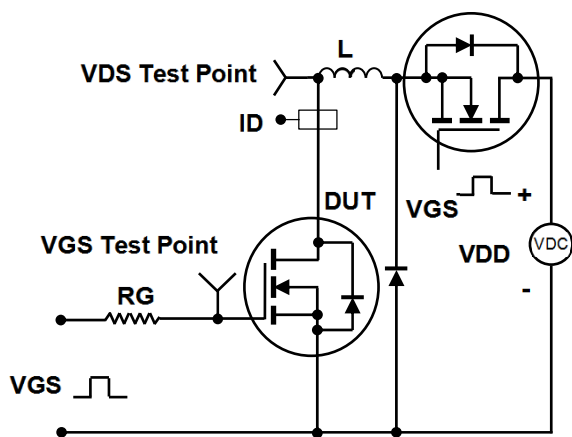


Fig.16- EAS Test Circuit & Waveform

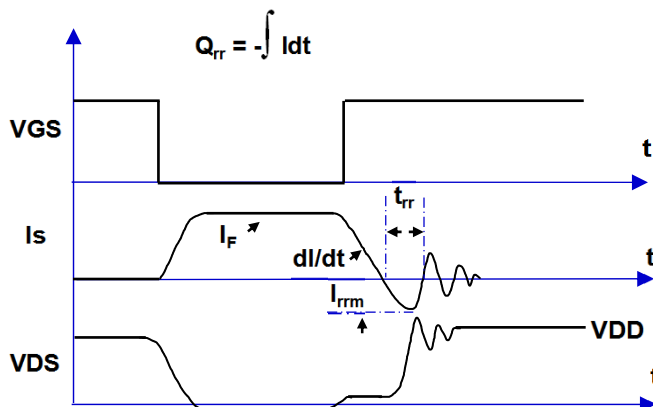
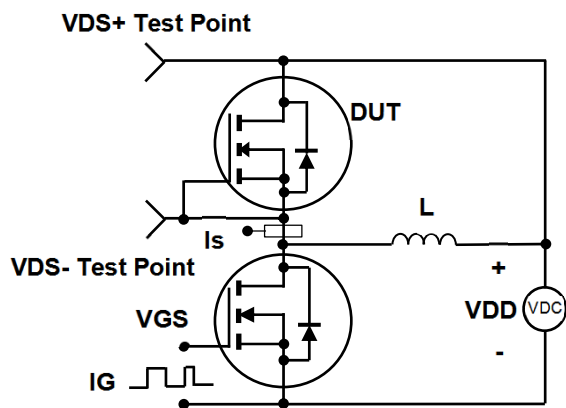


Fig.17- Diode Recovery Test Circuit & Waveform

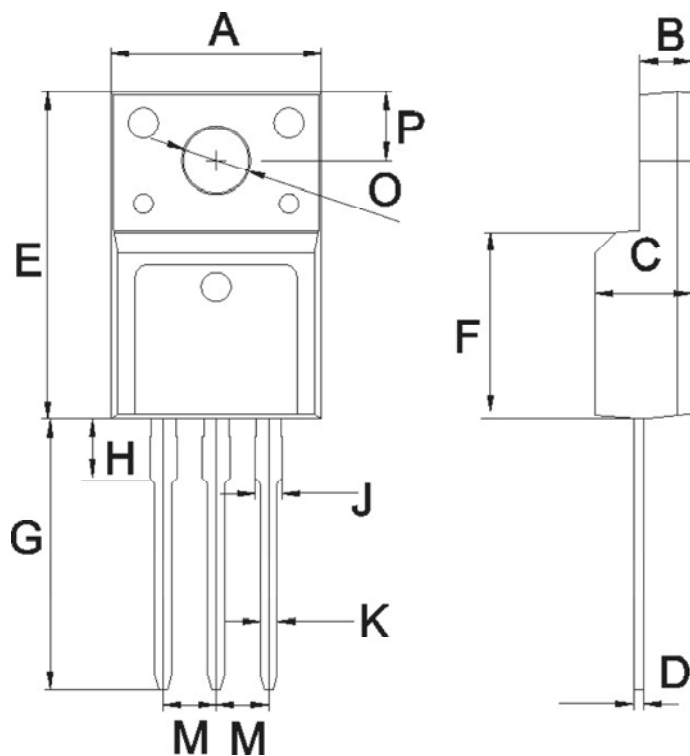
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OUTLINE DRAWINGS

TO-220F



OUTLINE DIMENSIONS

Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	9.25	-	10.75	0.36	-	0.42
B	2.30	-	2.90	0.09	-	0.11
C	4.20	-	5.20	0.17	-	0.20
D	0.35	-	0.75	0.01	-	0.03
E	14.80	-	16.80	0.58	-	0.66
F	8.25	-	9.75	0.32	-	0.38
G	12.15	-	14.15	0.48	-	0.56
H	2.40	-	3.00	0.09	-	0.12
J	1.10	-	1.50	0.04	-	0.06
K	0.60	-	1.00	0.02	-	0.04
M	2.20	-	3.00	0.09	-	0.12
O	2.70	-	3.50	0.11	-	0.14
P	2.25	-	2.85	0.09	-	0.11

PACKING INFORMATION

Package Code	Package Method	Inner Box Size L×W×H(mm)	Quantity (Pcs/Inner Box)	Outer Carton Size L×W×H(mm)	Quantity (Pcs/Carton)
TO-220F	Tube Packaging	560x155x55	1000	570×284×185	5000

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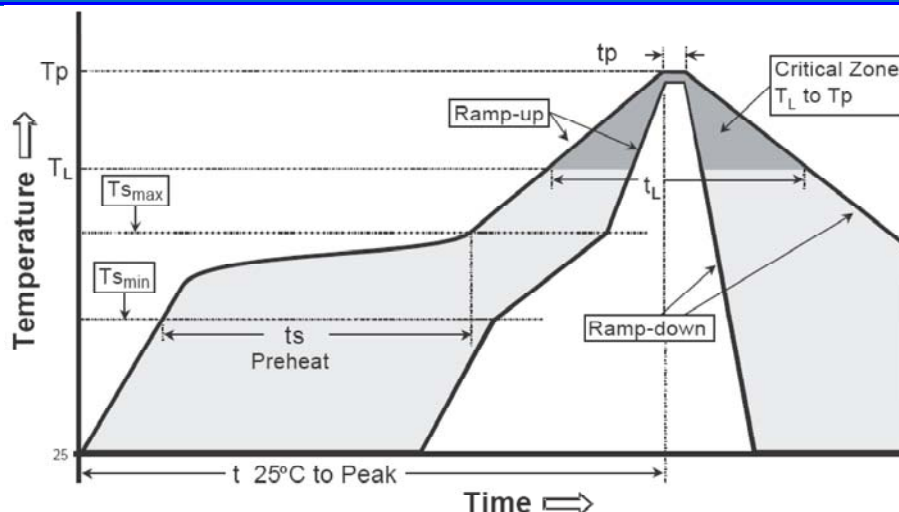
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Recommended wave soldering condition

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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