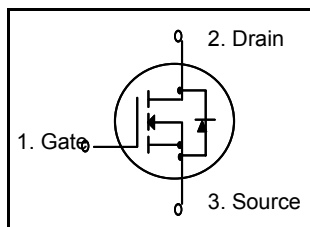


## N-Channel MOSFET

### Features

- **High ruggedness**
- $R_{DS(on)}$  (Max 5.5  $\Omega$ ) @  $V_{GS}=10V$
- Gate Charge (Typical 15nC)
- Improved dv/dt Capability
- 100% Avalanche Tested



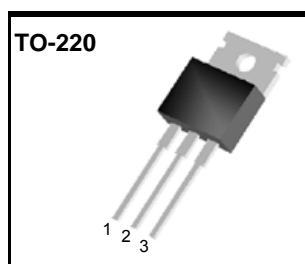
$$BV_{DSS} = 600V$$

$$R_{DS(on)} = 5.5 \text{ ohm}$$

$$I_D = 2.4A$$

### General Description

This N-channel enhancement mode field-effect power transistor using DI semiconductor's advanced planar stripe, DMOS technology intended for off-line switch mode power supply. Also, especially designed to minimize  $r_{ds(on)}$  and high rugged avalanche characteristics. The TO-220F PAK pkg is well suited for charger SMPS and small power inverter application.



### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$V_{DSS}$	Drain to Source Voltage	600	V
$I_D$	Continuous Drain Current(@ $T_C = 25^\circ C$ )	2.4	A
	Continuous Drain Current(@ $T_C = 100^\circ C$ )	1.5	A
$I_{DM}$	Drain Current Pulsed (Note 1)	9.6	A
$V_{GS}$	Gate to Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	150	mJ
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	6.4	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
$P_D$	Total Power Dissipation(@ $T_C = 25^\circ C$ )	64	W
	Derating Factor above 25 $^\circ C$	0.50	W/ $^\circ C$
$T_{STG}, T_J$	Operating Junction Temperature & Storage Temperature	- 55 ~ 150	$^\circ C$
$T_L$	Maximum Lead Temperature for soldering purpose, 1/8 from Case for 5 seconds.	300	$^\circ C$

### Thermal Characteristics

Symbol	Parameter	Value			Units
		Min.	Typ.	Max.	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	-	-	1.95	$^\circ C/W$
$R_{\theta CS}$	Thermal Resistance, Case to Sink	0.5	-	-	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	-	-	62.5	$^\circ C/W$

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## Electrical Characteristics (T<sub>C</sub> = 25 °C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250uA	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature coefficient	I <sub>D</sub> = 250uA, referenced to 25 °C	-	0.4	-	V/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> = 600V, V <sub>GS</sub> = 0V	-	-	10	uA
		V <sub>DS</sub> = 480V, T <sub>C</sub> = 125 °C	-	-	100	uA
I <sub>GSS</sub>	Gate-Source Leakage, Forward	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V	-	-	100	nA
	Gate-source Leakage, Reverse	V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V	-	-	-100	nA
<b>On Characteristics</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250uA	2.0	-	4.0	V
R <sub>DS(ON)</sub>	Static Drain-Source On-state Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.0A	-	4.5	5.5	Ω
<b>Dynamic Characteristics</b>						
C <sub>iss</sub>	Input Capacitance	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 25V, f = 1MHz	-	570	720	pF
C <sub>oss</sub>	Output Capacitance		-	150	215	
C <sub>rss</sub>	Reverse Transfer Capacitance		-	310	450	
<b>Dynamic Characteristics</b>						
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>DD</sub> = 300V, I <sub>D</sub> = 2.4A, R <sub>G</sub> = 25Ω * see fig. 13. (Note 4, 5)	-	15	35	ns
t <sub>r</sub>	Rise Time		-	75	140	
t <sub>d(off)</sub>	Turn-off Delay Time		-	30	60	
t <sub>f</sub>	Fall Time		-	35	60	
Q <sub>g</sub>	Total Gate Charge		V <sub>DS</sub> = 480V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.4A	-	15	
Q <sub>gs</sub>	Gate-Source Charge	-		1.6	-	
Q <sub>gd</sub>	Gate-Drain Charge(Miller Charge)	* see fig. 12. (Note 4, 5)		-	6	-

## Source-Drain Diode Ratings and Characteristics

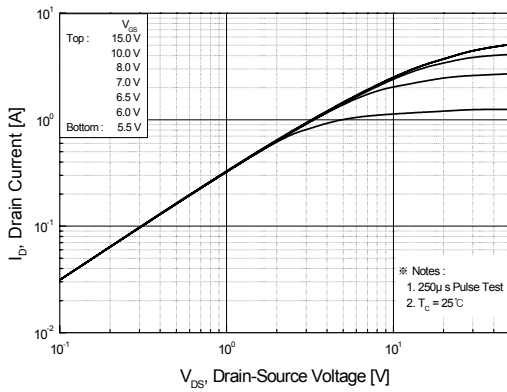
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit.
I <sub>S</sub>	Continuous Source Current	Integral Reverse p-n Junction Diode in the MOSFET	-	-	2.0	A
I <sub>SM</sub>	Pulsed Source Current		-	-	8.0	
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> = 2.4A, V <sub>GS</sub> = 0V	-	-	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	I <sub>S</sub> = 2.4A, V <sub>GS</sub> = 0V, di/dt = 100A/us	-	820	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge		-	0.82	-	uC

### \* NOTES

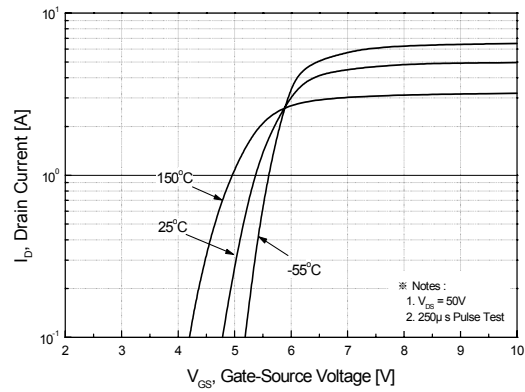
1. Repeativity rating : pulse width limited by junction temperature
2. L = 47mH, I<sub>AS</sub> = 2.4A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 50Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 2.4, di/dt ≤ 300A/us, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test : Pulse Width ≤ 300us, Duty Cycle ≤ 2%
5. Essentially independent of operating temperature.

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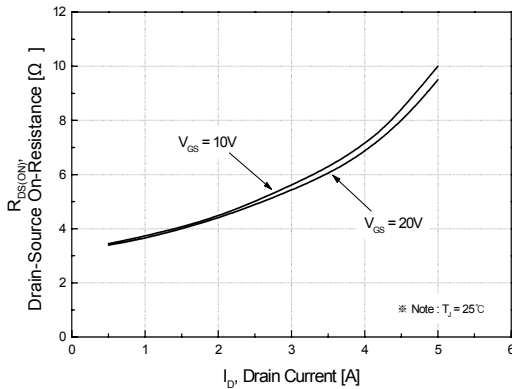
**Fig 1. On-State Characteristics**



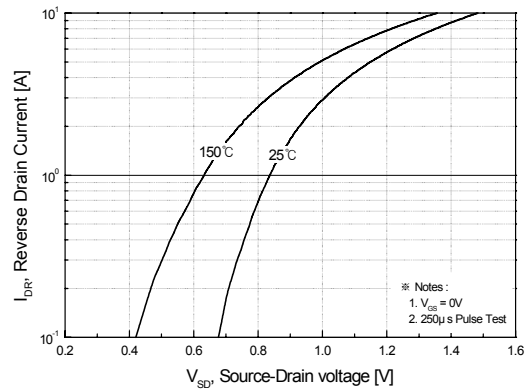
**Fig 2. Transfer Characteristics**



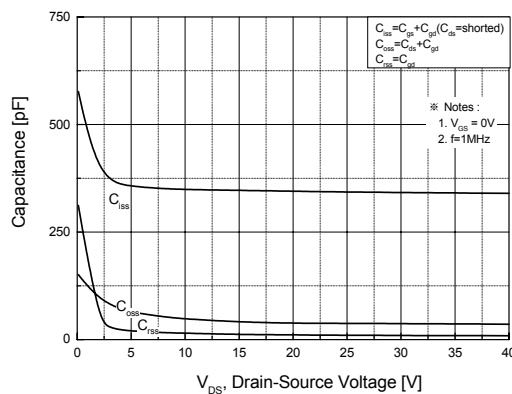
**Fig 3. On Resistance Variation vs. Drain Current and Gate Voltage**



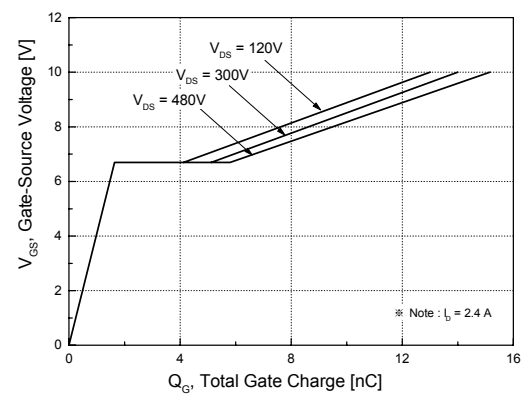
**Fig 4. On State Current vs. Allowable Case Temperature**



**Fig 5. Capacitance Characteristics ( Non-Repetitive )**

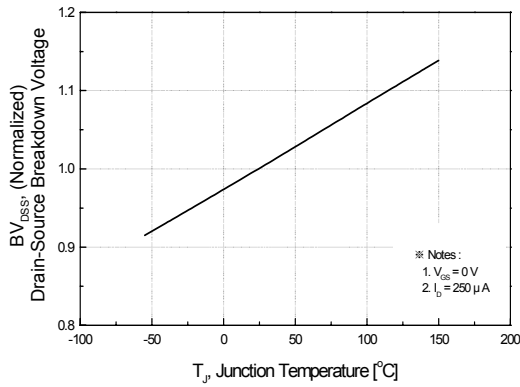


**Fig 6. Gate Charge Characteristics**

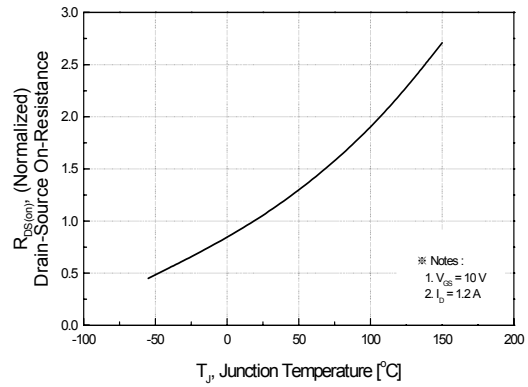


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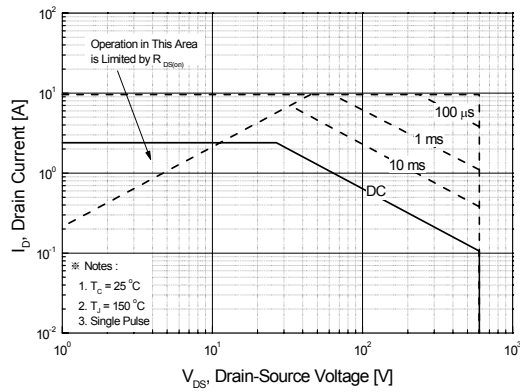
**Fig 7. Breakdown Voltage Variation vs. Junction Temperature**



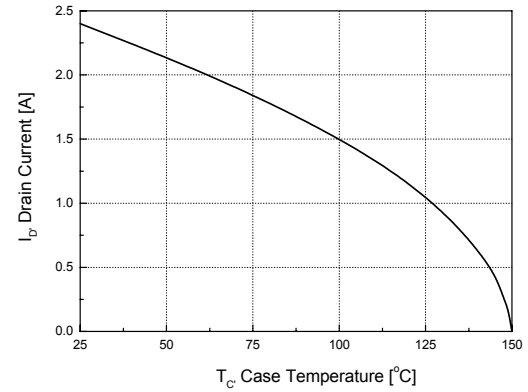
**Fig 8. On-Resistance Variation vs. Junction Temperature**



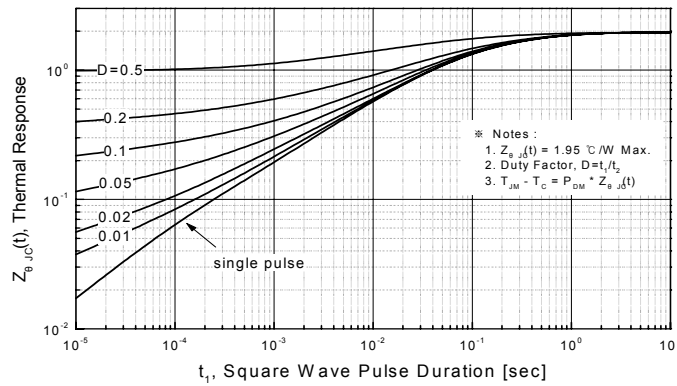
**Fig 9. Maximum Safe Operating Area**



**Fig 10. Maximum Drain Current vs. Case Temperature**



**Fig 11. Transient Thermal Response Curve**



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Fig. 12. Gate Charge Test Circuit & Waveforms

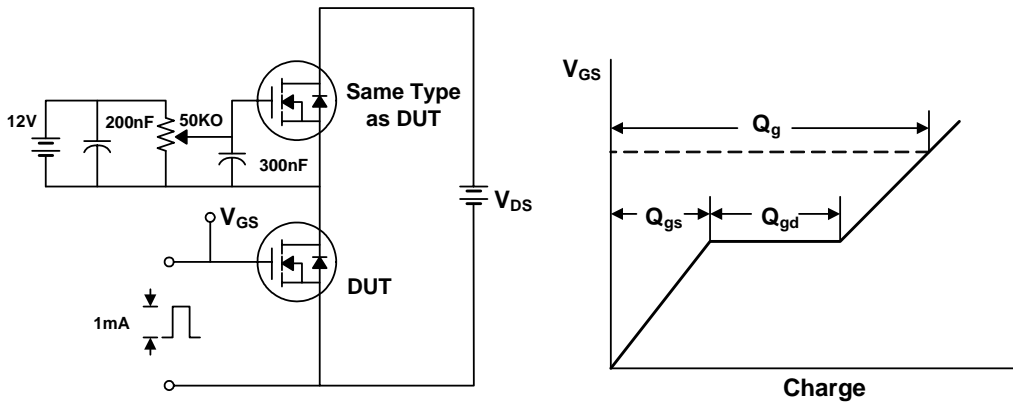


Fig 13. Switching Time Test Circuit & Waveforms

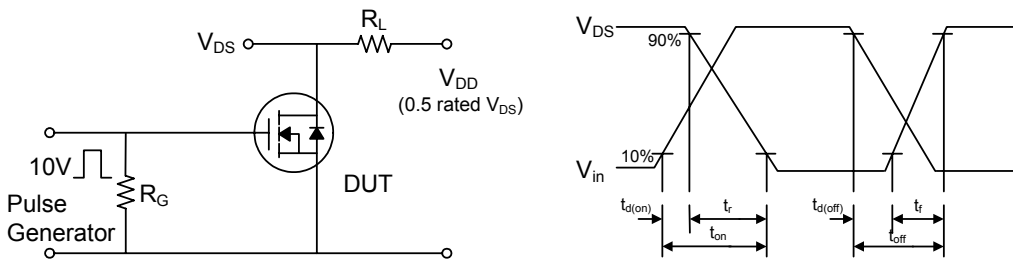
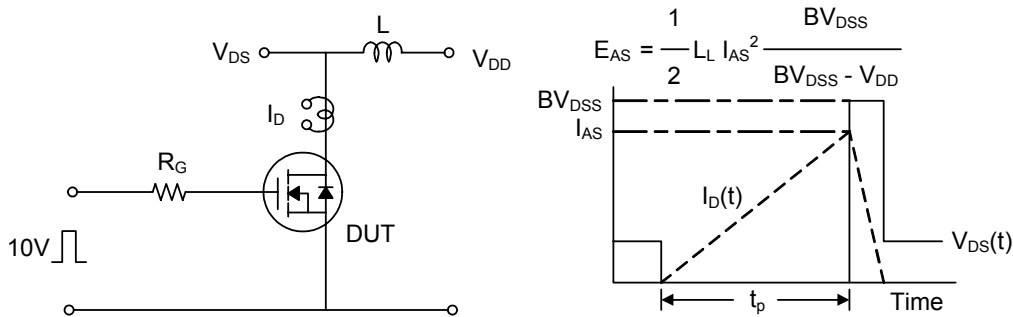
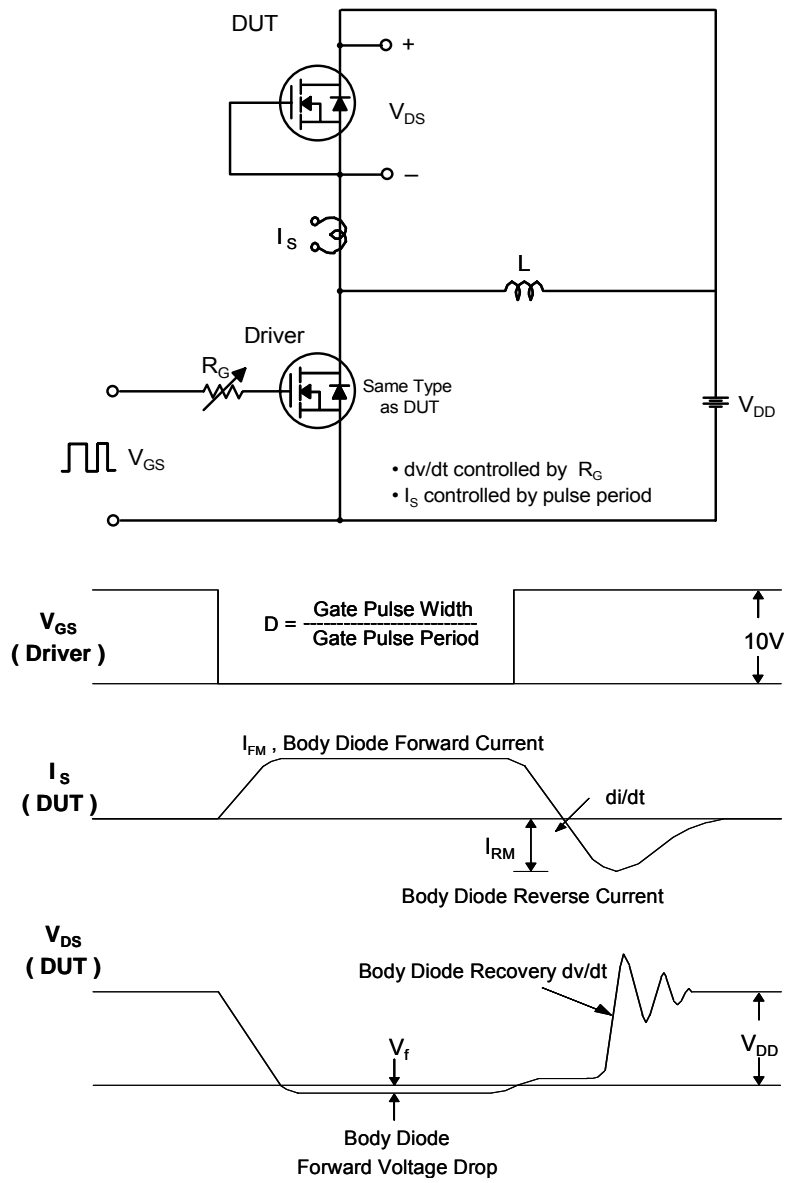


Fig 14. Unclamped Inductive Switching Test Circuit & Waveforms



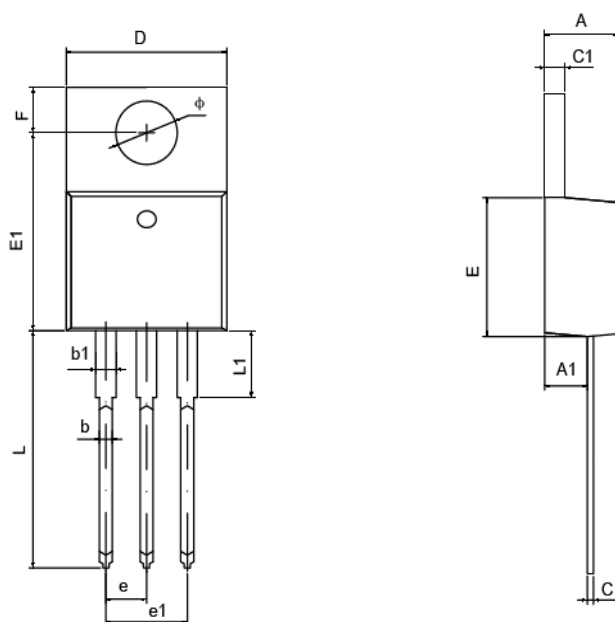
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Fig. 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



## DFP2N60

## TO-220 Package Dimension



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	4.420	4.720	1.174	0.186
A1	2.520	2.820	0.099	0.111
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.360	0.460	0.014	0.018
c1	1.170	1.370	0.046	0.054
D	9.950	10.250	0.392	0.404
E	8.990	9.290	0.354	0.366
E1	12.550	12.850	0.494	0.506
e	2.540TYP		0.100TYP	
e1	4.980	5.180	0.196	0.204
F	2.590	2.890	0.102	0.114
L	13.080	13.480	0.515	0.531
L1	2.470	2.870	0.097	0.113
φ	3.790	3.890	0.149	0.153