

**600V N-Channel MOSFET**

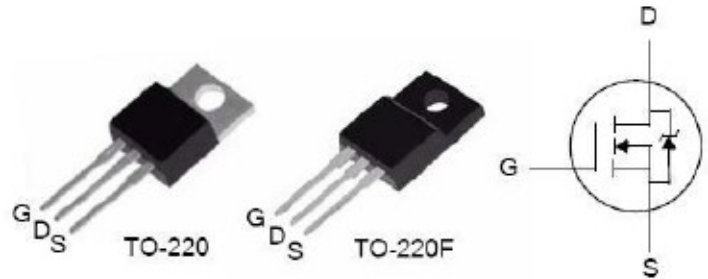
**General Features**

- Low ON Resistance
- Low Gate Charge (typical 8.9nC)
- Fast Switching
- 100% Avalanche Tested
- RoHS Compliant
- Halogen-free available

**Applications**

- High Efficiency SMPS
- Adaptor/Charger
- Active PFC
- LCD Panel Power

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> (Max.)	I <sub>D</sub>
600V	4.4Ω	2.2A



**Ordering Information**

Part Number	Package	MDSing	RemDS
FTP02N60A	TO-220	FTP02N60A	RoHS
FTP02N60AG	TO-220	FTP02N60AG	Halogen-free
FTA02N60A	TO-220F	FTA02N60A	RoHS
FTA02N60AG	TO-220F	FTA02N60AG	Halogen-free

**Absolute Maximum Ratings**

T<sub>c</sub>=25°C unless otherwise specified

Symbol	Parameter	FTP02N60A	FTA02N60A	Unit
V <sub>DSS</sub>	Drain-to-Source Voltage <sup>[1]</sup>	600		V
I <sub>D</sub>	Continuous Drain Current	2.2	2.2*	A
I <sub>D@100°C</sub>	Continuous Drain Current	Figure 3		
I <sub>DM</sub>	Pulsed Drain Current, V <sub>GS@10V</sub> <sup>[2]</sup>	Figure 6		
P <sub>D</sub>	Power Dissipation	54	21	W
	Derating Factor above 25°C	0.43	0.17	W/°C
V <sub>GS</sub>	Gate-to-Source Voltage	±30		V
E <sub>AS</sub>	Single Pulse Avalanche Energy L=50mH, I <sub>D</sub> =2.2A	120		mJ
dv/dt	Peak Diode Recovery dv/dt <sup>[3]</sup>	4.5		V/ns
T <sub>L</sub>	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300		°C
T <sub>J</sub> and T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to 150		

\*Drain Current limited by Maximum Junction Temperature.

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

# FTP02N60A/FTA02N60A

## Thermal Characteristics

Symbol	Parameter	FTP02N60A	FTA02N60A	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	2.3	6.0	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	65	65	

## Electrical Characteristics

### OFF Characteristics

$T_c=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	600	--	--	V	$V_{GS}=0V, I_D=250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temperature Coefficient	--	0.6	--	V/°C	Reference to 25°C, $I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current	--	--	20	$\mu A$	$V_{DS}=600V, V_{GS}=0V$
		--	--	100		$V_{DS}=480V, V_{GS}=0V,$ $T_c=125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Leakage Current	--	--	100	nA	$V_{GS}=+30V$
		--	--	-100		$V_{GS}=-30V$

### ON Characteristics

$T_c=25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	3.8	4.4	$\Omega$	$V_{GS}=10V, I_D=1.1A_{[4]}$
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS}=V_{GS}, I_D=250\mu A$
gfs	Forward Transconductance	--	1.7	--	S	$V_{DS}=15V, I_D=2.2A_{[4]}$

### Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$C_{ISS}$	Input Capacitance	--	301	--	pF	$V_{GS}=0V$ $V_{DS}=25V$ $f=1.0MHz$ Figure 14
$C_{OSS}$	Output Capacitance	--	23.6	--		
$C_{RSS}$	Reverse Transfer Capacitance	--	4.6	--		
$Q_G$	Total Gate Charge	--	8.9	--	nC	$V_{DD}=300V$ $I_D=2.2A$ Figure 15
$Q_{GS}$	Gate-to-Source Charge	--	1.3	--		
$Q_{GD}$	Gate-to-Drain (Miller) Charge	--	4.2	--		

### Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(ON)}$	Turn-on Delay Time	--	8	--	ns	$V_{DD}=300V$ $I_D=2.2A$ $V_{GS}=10V$ $R_G=20\Omega$
$t_{rise}$	Rise Time	--	25	--		
$t_{d(OFF)}$	Turn-off Delay Time	--	22	--		
$t_{fall}$	Fall Time	--	28	--		

## FTP02N60A/FTA02N60A

### Source-Drain Diode Characteristics

$T_c=25^{\circ}\text{C}$  unless otherwise specified

Symbol	Parameter	Min	Typ.	Max.	Units	Test Conditions
$I_{SD}$	Continuous Source Current (Body Diode)	--	--	2.2	A	Integral P-N diode in MOSFET
$I_{SM}$	Maximum Pulsed Current (Body Diode)	--	--	8.8	A	
$V_{SD}$	Diode Forward Voltage	--	--	1.2	V	$I_S=2.2\text{A}$ , $V_{GS}=0\text{V}$
$t_{rr}$	Reverse Recovery Time	--	208	--	ns	$V_{GS}=0\text{V}$ $I_F=2.2\text{A}$ , $di/dt=100\text{A}/\mu\text{s}$
$Q_{rr}$	Reverse Recovery Charge	--	730	--	nC	

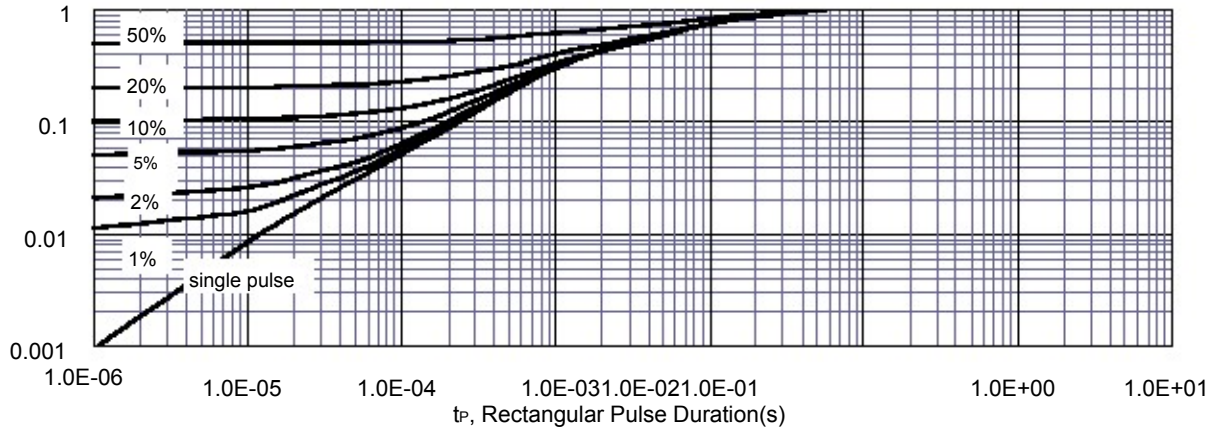
#### NOTE:

- [1]  $T_J=+25^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
[2] Repetitive rating, pulse width limited by maximum junction temperature.  
[3]  $I_{SD}=2.2\text{A}$ ,  $di/dt \leq 100\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BVDSS$ ,  $T_J=+150^{\circ}\text{C}$   
[4] Pulse width  $\leq 380\mu\text{s}$ ; duty cycle  $\leq 2\%$ .

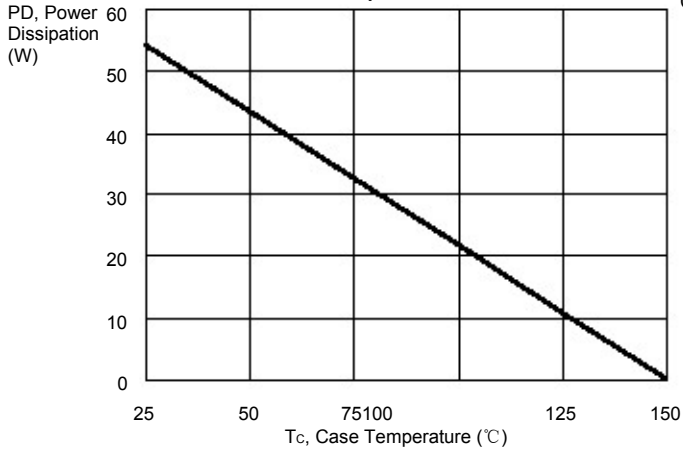
# FTP02N60A/FTA02N60A

Z $\theta$ JC, Thermal Impedance(Normalized)

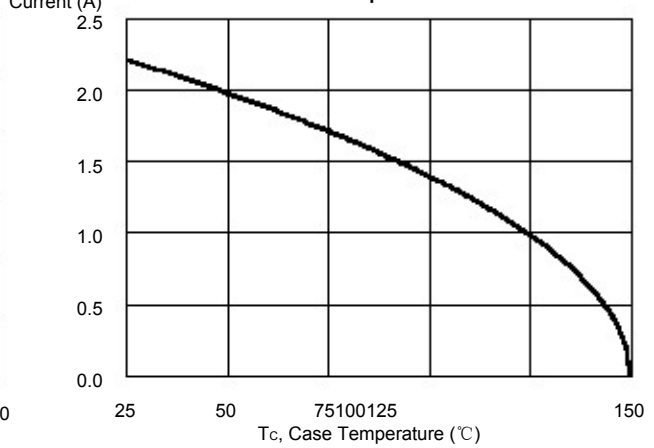
**Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case**



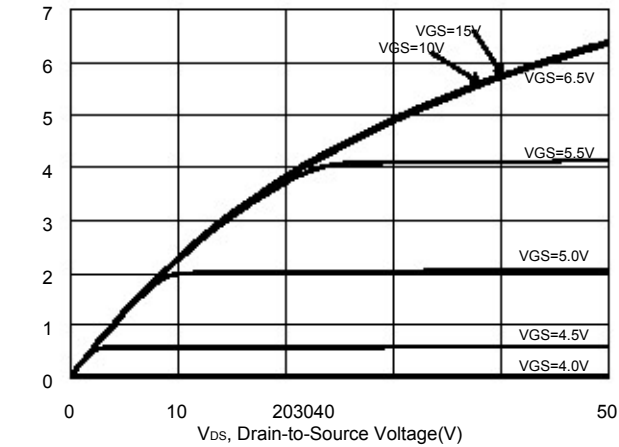
**Figure 2. Maximum Power Dissipation vs. Case Temperature**



**Figure 3. Maximum Continuous Drain Current vs Case Temperature**

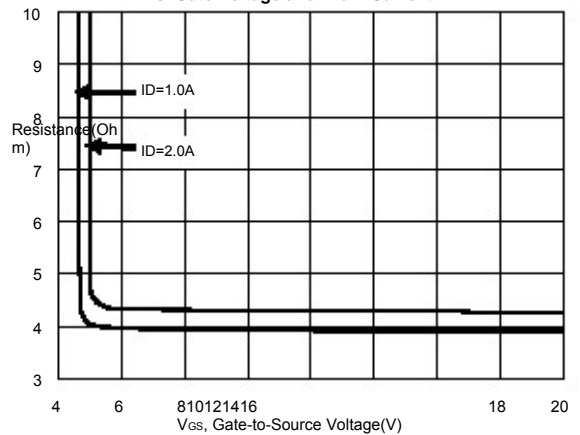


**Figure 4. Typical Output Characteristics**



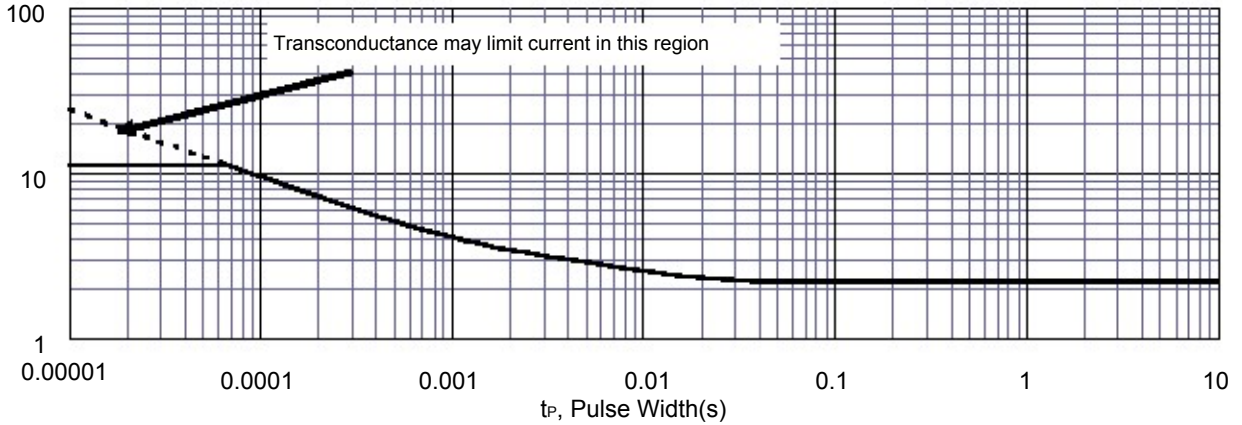
RDS(ON), Drain-to-Source ON

**Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage and Drain Current**



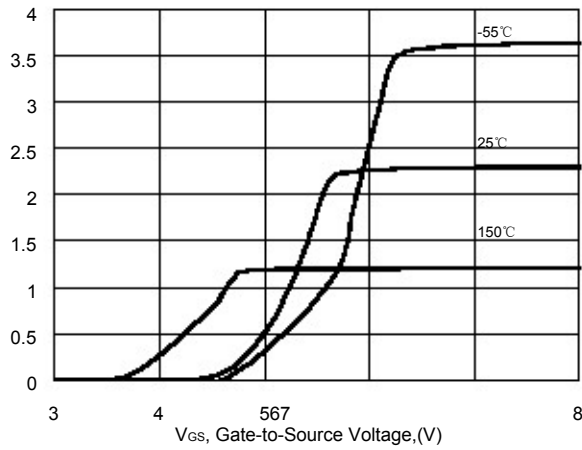
IDM, Peak Current(A)

Figure 6. Maximum Peak Current Capability



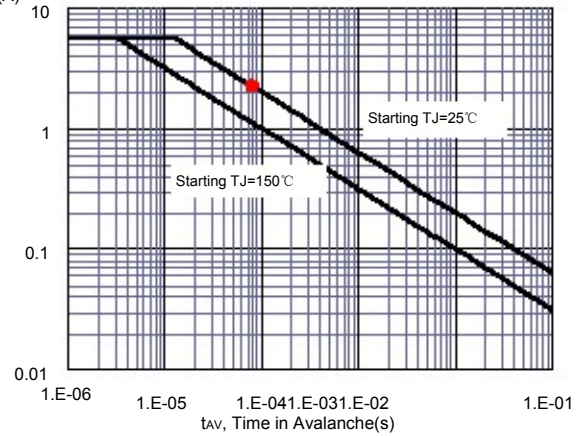
ID, Drain-to-Source Current (A)

Figure 7. Typical Transfer Characteristics



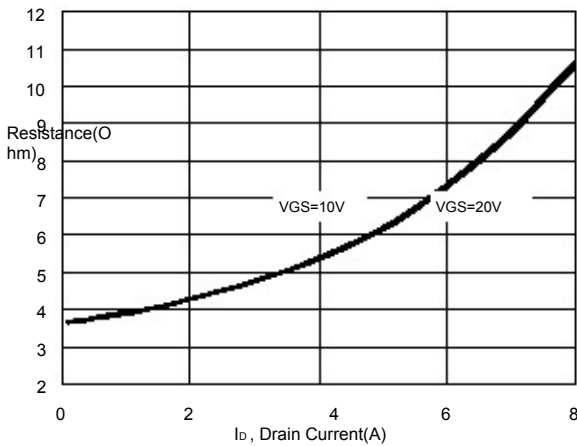
IAS, Avalanche Current(A)

Figure 8. Unclamped Inductive Switching Capability



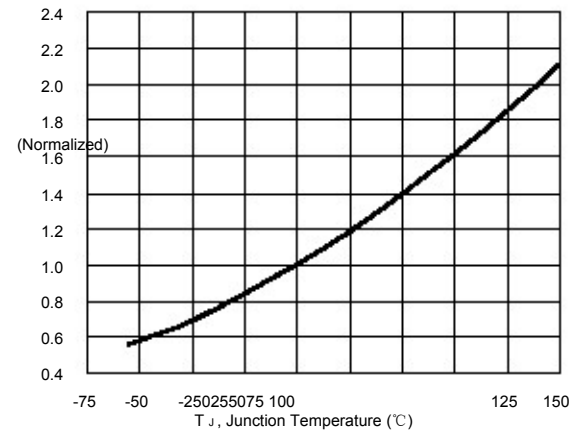
RDS(ON), Drain-to-Source ON Resistance

Figure 9. Typical Drain-to-Source ON Resistance



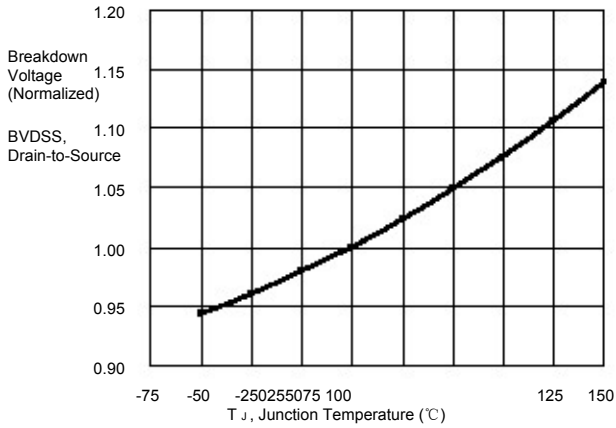
RDS(ON), Drain-to-Source Resistance

Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature



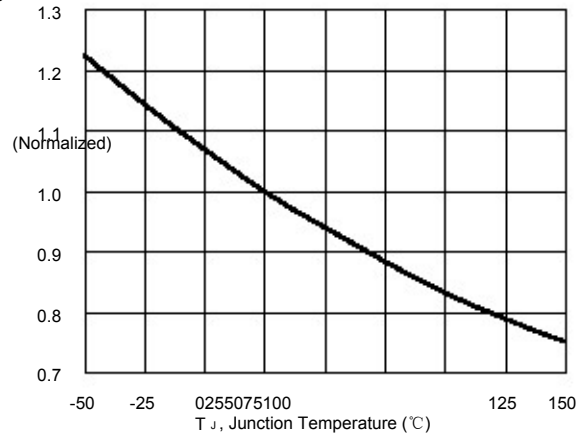
# FTP02N60A/FTA02N60A

**Figure 11. Typical Breakdown Voltage vs. Junction Temperature**

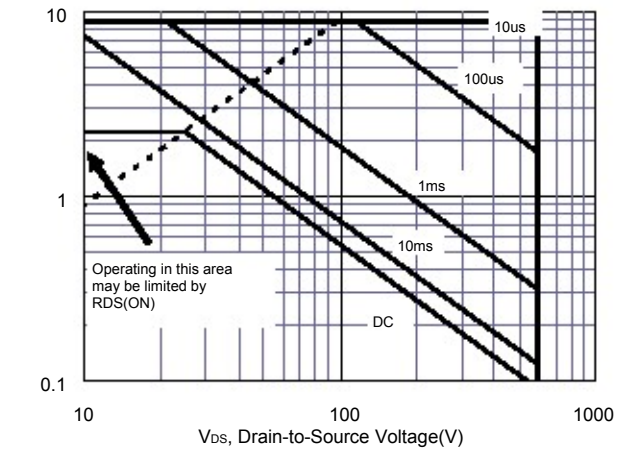


**VGS(TH) Threshold Voltage**

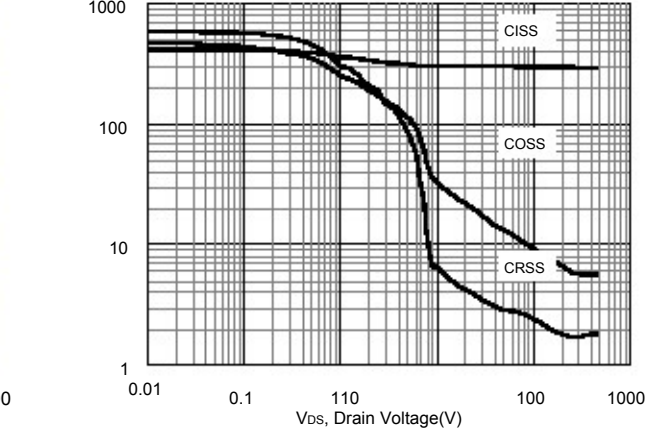
**Figure 12. Typical Threshold Voltage vs. Junction Temperature**



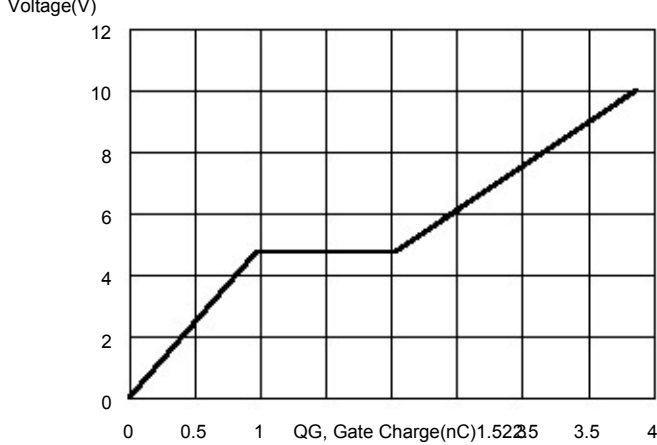
**Figure 13. Maximum Forward Safe Operation Area**



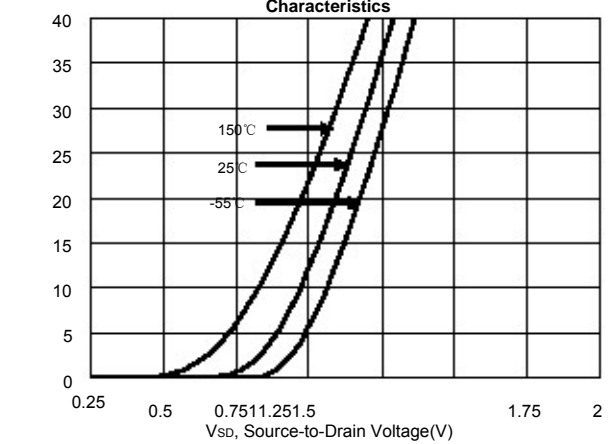
**Figure 14. Typical Capacitance vs. Drain-to-Source Voltage**



**Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage**



**Figure 16. Typical Body Diode Transfer Characteristics**



Test Circuit

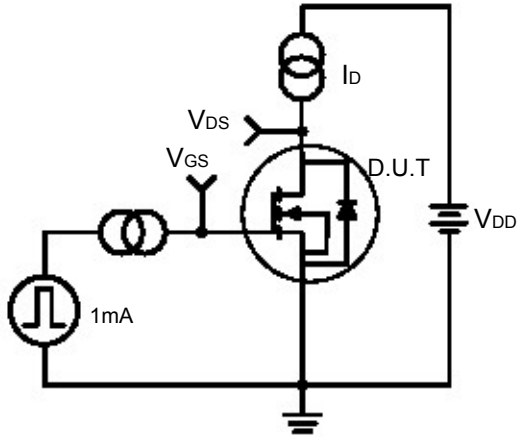


Figure 17. Gate Charge Test Circuit

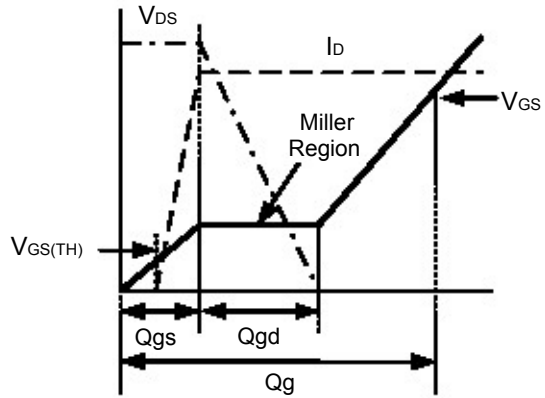


Figure 18. Gate Charge Waveform

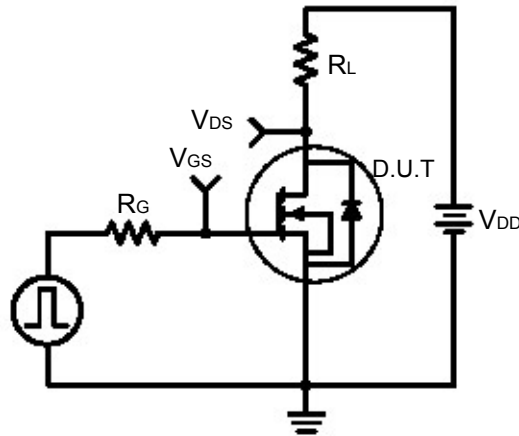


Figure 19. Resistive Switching Test Circuit

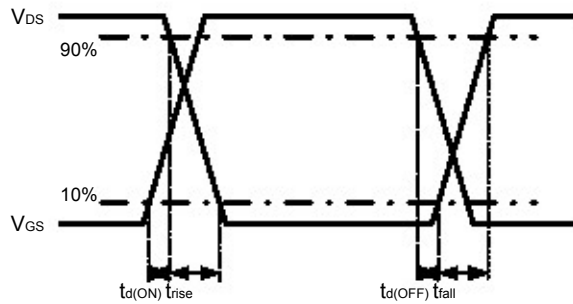


Figure 20. Resistive Switching Waveforms

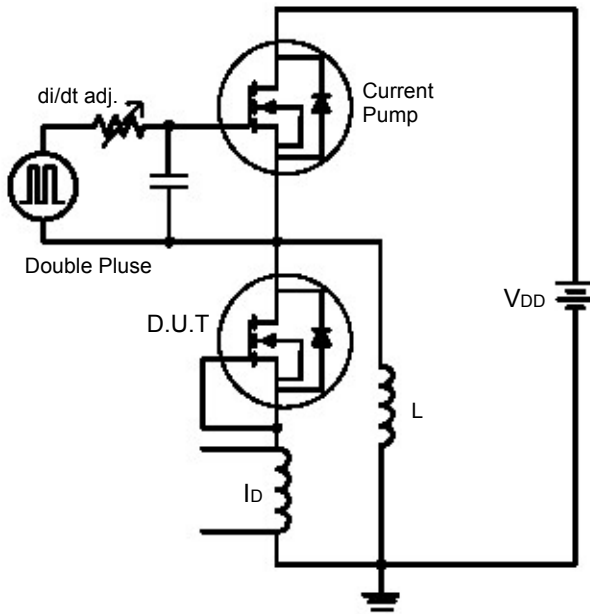


Figure 21. Diode Reverse Recovery Test Circuit

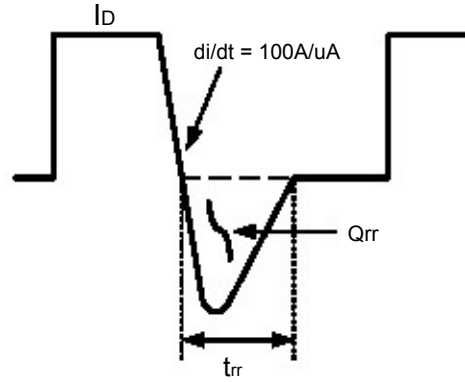


Figure 22. Diode Reverse Recovery Waveform

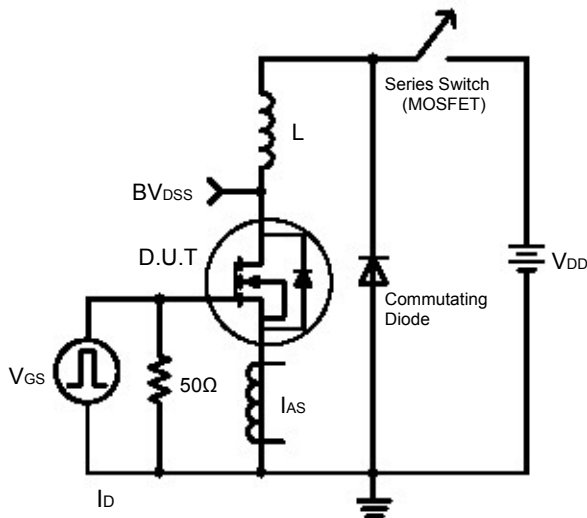


Figure 23. Unclamped Inductive Switching Test Circuit

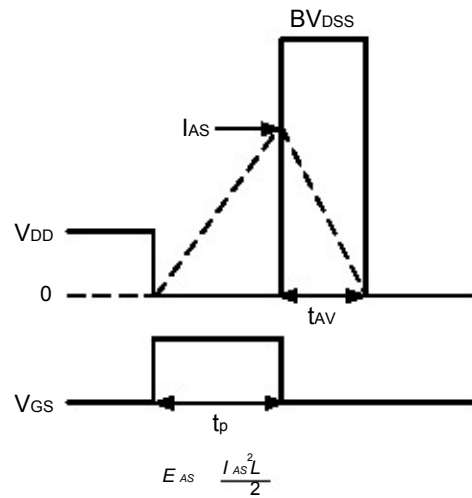
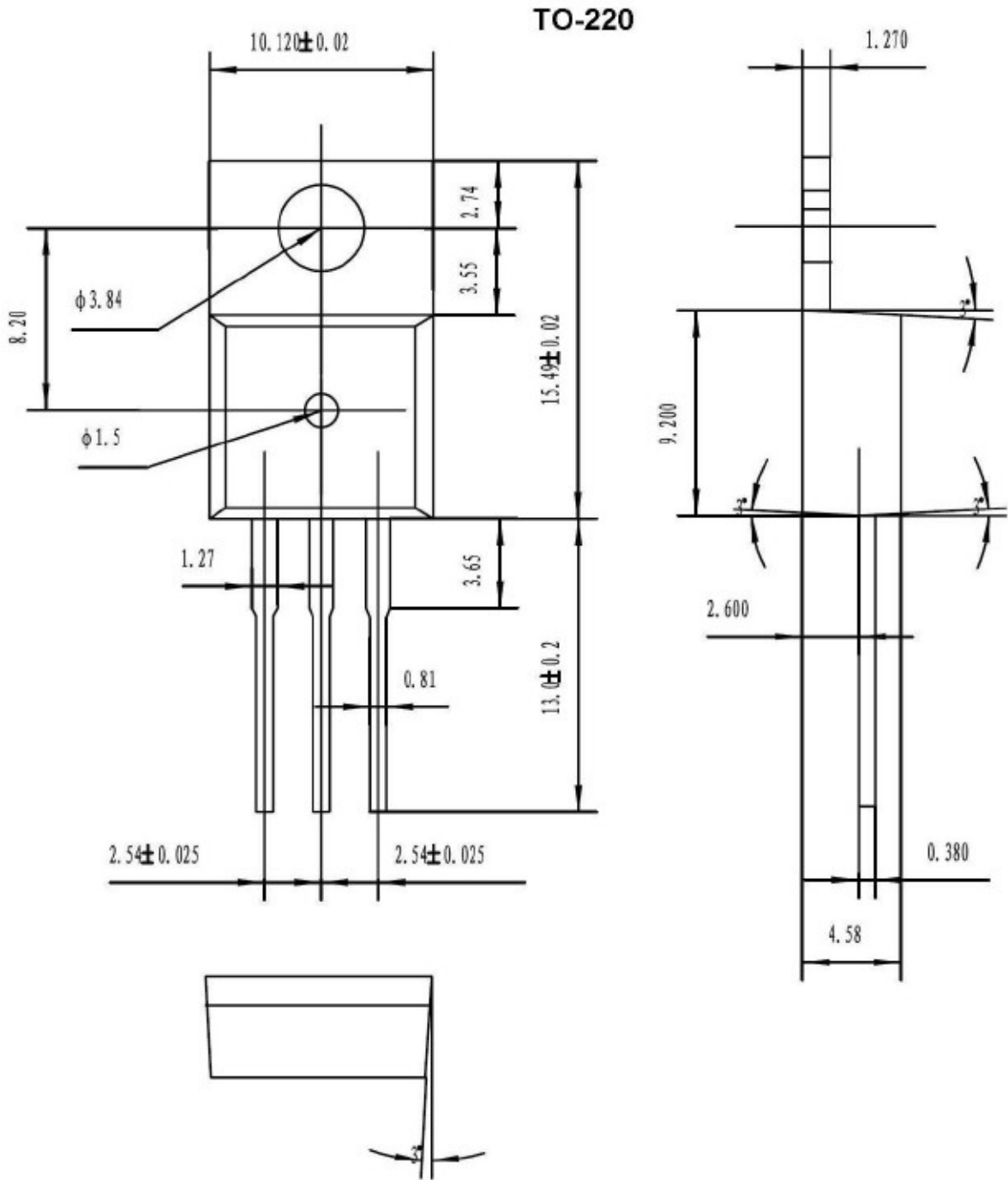


Figure 24. Unclamped Inductive Switching Waveforms



# FTP02N60A/FTA02N60A

## Package Dimensions





## Published by

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