

# N-Channel Enhancement Mode Power MOSFET

## MTN10N60E3

**$BV_{DSS} : 650V @ T_j=150^{\circ}C$**   
 **$R_{DS(ON)} : 0.75 \Omega$**   
 **$I_D : 10A$**

### Description

The MTN10N60E3 is a N-channel enhancement-mode MOSFET, providing the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost effectiveness. The TO-220 package is universally preferred for all commercial-industrial applications

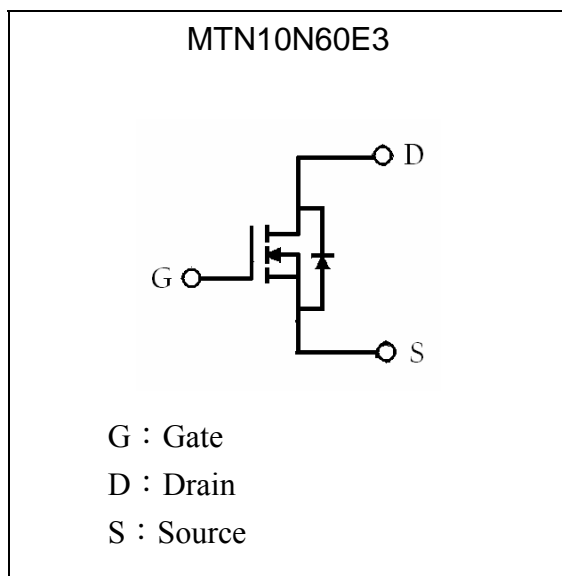
### Features

- $BV_{DSS}=650V$  typically @  $T_j=150^{\circ}C$
- Low On Resistance
- Simple Drive Requirement
- Low Gate Charge
- Fast Switching Characteristic
- RoHS compliant package

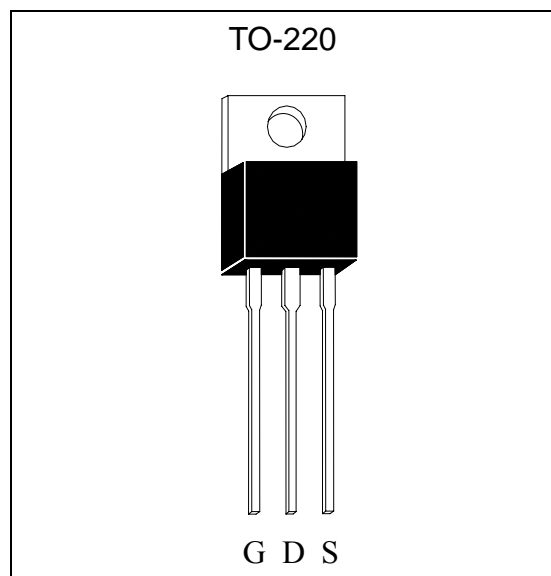
### Applications

- Adaptor
- LCD Panel Power
- TV Main Power
- SMPS Standby Power

### Symbol



### Outline



**Absolute Maximum Ratings** ( $T_c=25^\circ\text{C}$ )

Parameter	Symbol	Limits	Unit
Drain-Source Voltage (Note 1)	$V_{DS}$	600	V
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V
Continuous Drain Current	$I_D$	10	A
Continuous Drain Current @ $T_c=100^\circ\text{C}$	$I_D$	6	A
Pulsed Drain Current @ $V_{GS}=10\text{V}$ (Note 2)	$I_{DM}$	40	A
Single Pulse Avalanche Energy @ $L=10\text{mH}$ , $I_D=10\text{Amps}$ , $V_{DD}=50\text{V}$	$E_{AS}$	484	mJ
Repetitive Avalanche Energy	$E_{AR}$	21.6	
Peak Diode Recovery $dv/dt$ (Note 3)	$dv/dt$	3.0	V/ns
Maximum Temperature for Soldering @ Lead at 0.063 in(1.6mm) from case for 10 seconds	$T_L$	300	$^\circ\text{C}$
Maximum Temperature for Soldering @ Package Body for 10 seconds	$T_{PKG}$	260	$^\circ\text{C}$
Total Power Dissipation ( $T_c=25^\circ\text{C}$ )	$P_d$	216	W
Linear Derating Factor		1.72	W/ $^\circ\text{C}$
Operating Junction and Storage Temperature	$T_j, T_{stg}$	-55~+150	$^\circ\text{C}$

Note : \*1.  $T_J=+25^\circ\text{C}$  to  $+150^\circ\text{C}$ .

\*2. Repetitive rating; pulse width limited by maximum junction temperature.

\*3.  $ISD=10\text{A}$ ,  $dI/dt<100\text{A}/\mu\text{s}$ ,  $V_{DD}<BV_{DSS}$ ,  $T_J=+150^\circ\text{C}$ .**Thermal Data**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-case, max	$R_{th,j-c}$	0.58	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-ambient, max	$R_{th,j-a}$	62	$^\circ\text{C}/\text{W}$



**Characteristics (Tj=25°C, unless otherwise specified)**

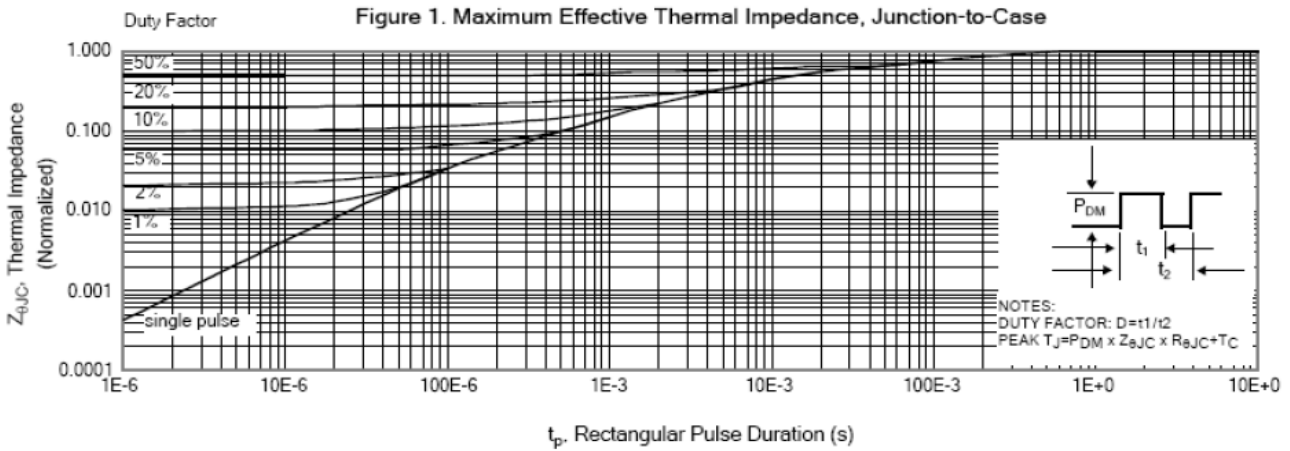
Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV <sub>DSS</sub>	600	-	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =250μA
BV <sub>DSS</sub>	-	650	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =250μA, Tj=150°C
ΔBV <sub>DSS</sub> /ΔTj	-	0.631	-	V/°C	Reference to 25°C, I <sub>D</sub> =250μA
BV <sub>DS</sub>	-	700	-	V	V <sub>GS</sub> =0, I <sub>D</sub> =10A
V <sub>GS(th)</sub>	2.0	-	4.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA
*G <sub>FS</sub>	-	6.8	-	S	V <sub>DS</sub> =15V, I <sub>D</sub> =10A
I <sub>GSS</sub>	-	-	±100	nA	V <sub>GS</sub> =±30
I <sub>DSS</sub>	-	-	25	μA	V <sub>DS</sub> =600V, V <sub>GS</sub> =0
I <sub>DSS</sub>	-	-	250	μA	V <sub>DS</sub> =480V, V <sub>GS</sub> =0, Tj=125°C
*R <sub>DS(ON)</sub>	-	0.65	0.75	Ω	V <sub>GS</sub> =10V, I <sub>D</sub> =6A
<b>Dynamic</b>					
*Q <sub>g</sub>	-	39	-	nC	I <sub>D</sub> =10A, V <sub>DD</sub> =300V, V <sub>GS</sub> =10V
*Q <sub>gs</sub>	-	9.5	-		
*Q <sub>gd</sub>	-	17.6	-		
*t <sub>d(ON)</sub>	-	19	-	ns	V <sub>DD</sub> =300V, I <sub>D</sub> =10A, V <sub>GS</sub> =10V, R <sub>G</sub> =9.1 Ω
*t <sub>r</sub>	-	16	-		
*t <sub>d(OFF)</sub>	-	49	-		
*t <sub>f</sub>	-	16	-		
C <sub>iss</sub>	-	1882	-	pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1MHz
C <sub>oss</sub>	-	170	-		
C <sub>rss</sub>	-	20	-		
<b>Source-Drain Diode</b>					
*V <sub>SD</sub>	-	-	1.5	V	I <sub>S</sub> =10A, V <sub>GS</sub> =0V
*I <sub>S</sub>	-	-	10	A	V <sub>D</sub> =V <sub>G</sub> =0, V <sub>S</sub> =1.3V
*I <sub>SM</sub>	-	-	40		
*t <sub>rr</sub>	-	352	528	ns	V <sub>GS</sub> =0, I <sub>F</sub> =10A, dI/dt=100A/μs
*Q <sub>rr</sub>	-	2.9	4.35	μC	

\*Pulse Test : Pulse Width ≤300μs, Duty Cycle ≤2%

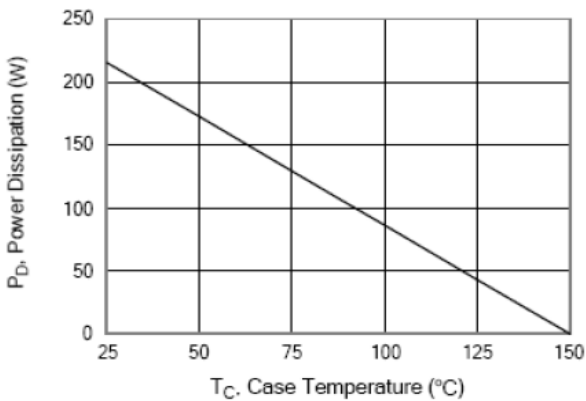
**Ordering Information**

Device	Package	Shipping	Marking
MTN10N60E3	TO-220 (RoHS compliant)	50 pcs/tube, 20 tubes/box, 4 boxes / carton	10N60

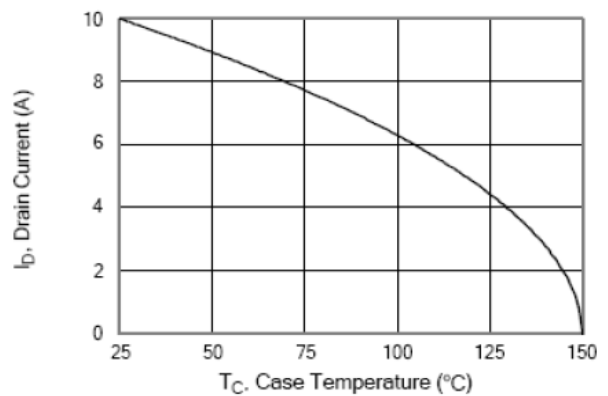
**Characteristic Curves**



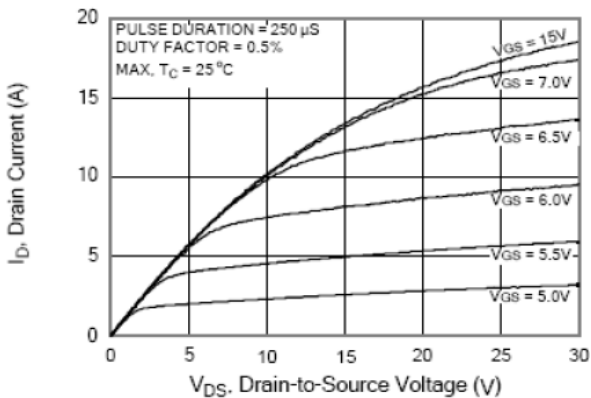
**Figure 2. Maximum Power Dissipation vs Case Temperature**



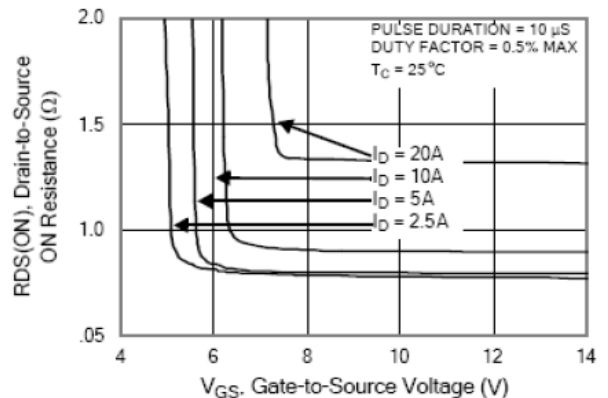
**Figure 3. Maximum Continuous Drain Current vs Case Temperature**



**Figure 4. Typical Output Characteristics**

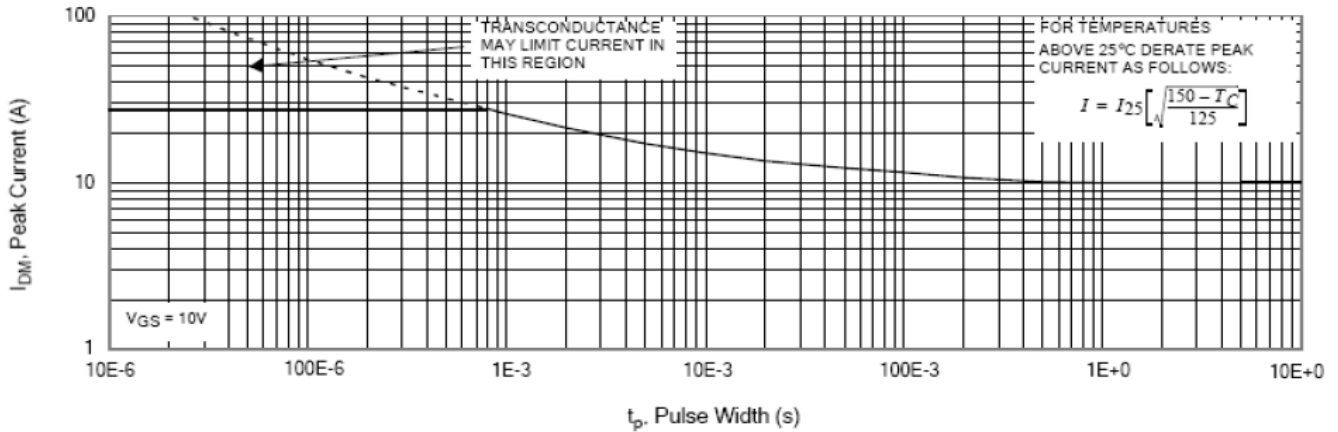


**Figure 5. Typical Drain-to-Source ON Resistance vs Gate Voltage and Drain Current**

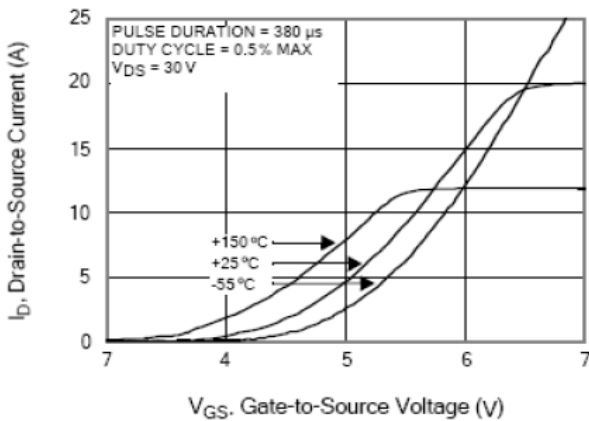


**Characteristic Curves(Cont.)**

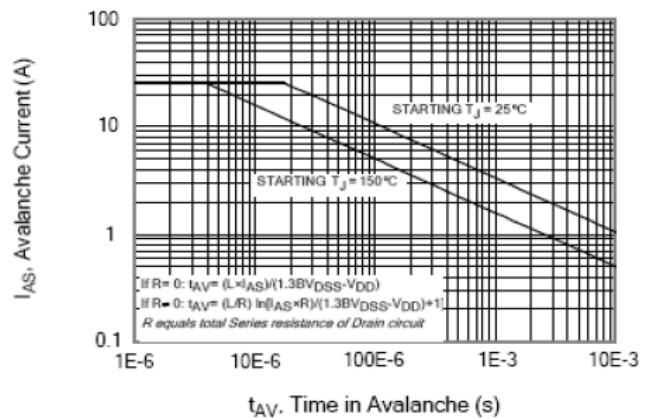
**Figure 6. Maximum Peak Current Capability**



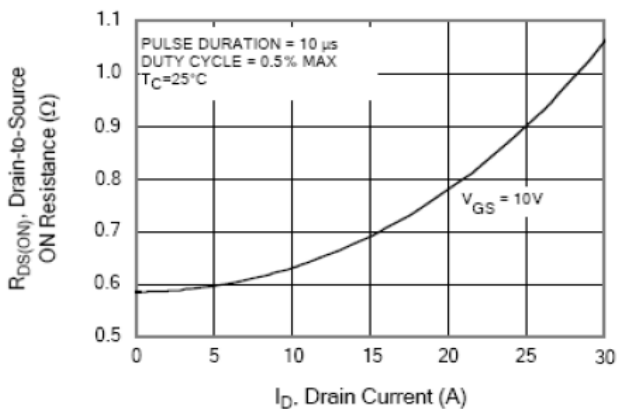
**Figure 7. Typical Transfer Characteristics**



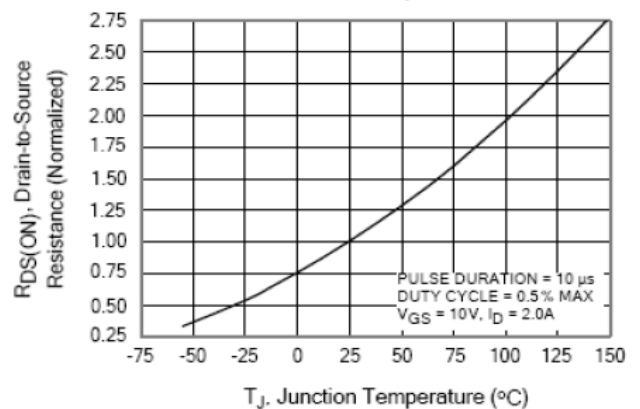
**Figure 8. Unclamped Inductive Switching Capability**



**Figure 9. Typical Drain-to-Source ON Resistance vs Drain Current**

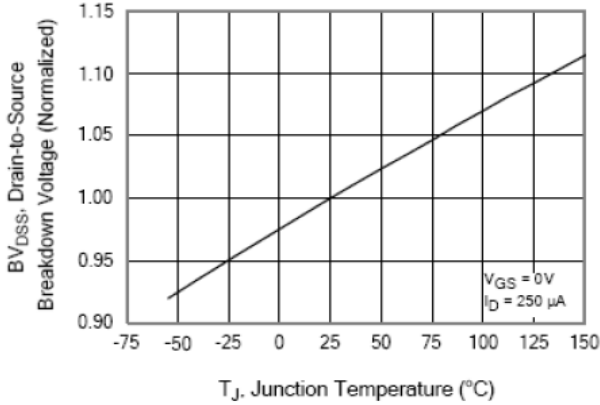


**Figure 10. Typical Drain-to-Source ON Resistance vs Junction Temperature**

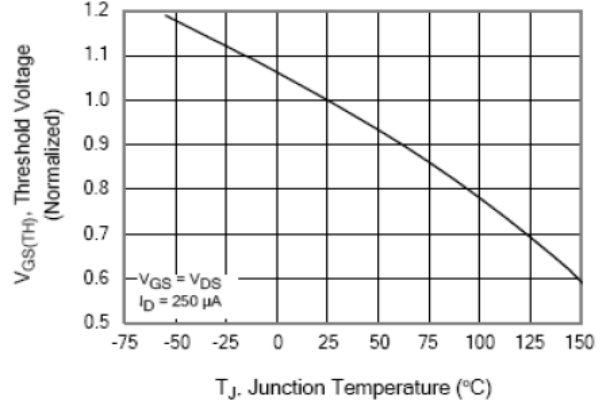


**Characteristic Curves(Cont.)**

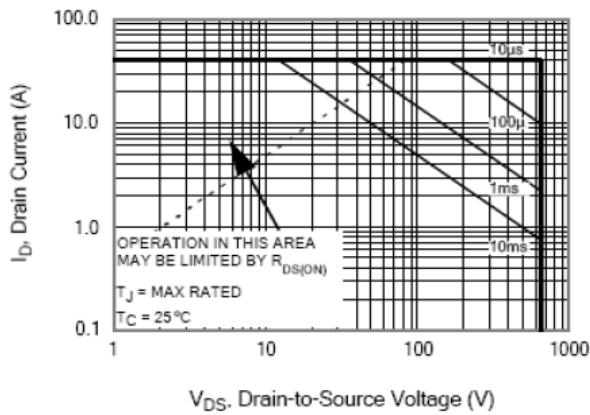
**Figure 11. Typical Breakdown Voltage vs Junction Temperature**



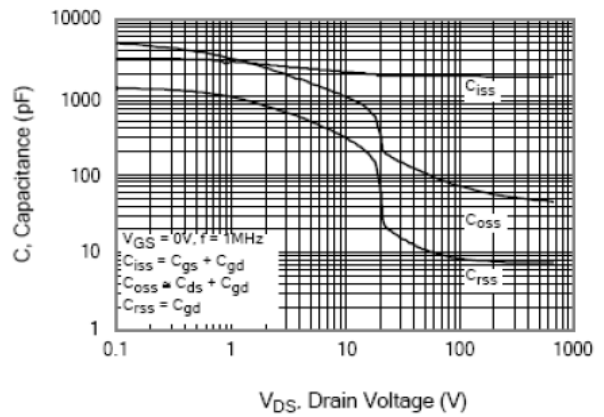
**Figure 12. Typical Threshold Voltage vs Junction Temperature**



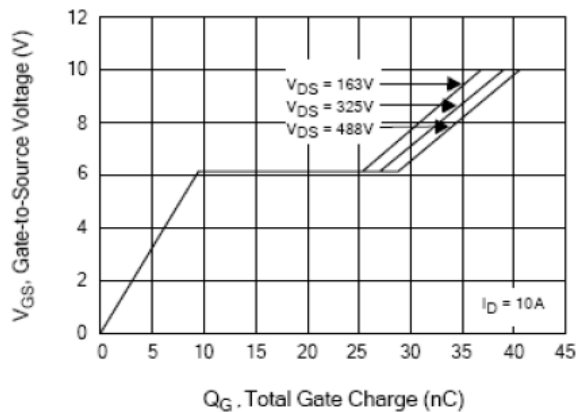
**Figure 13. Maximum Forward Bias Safe Operating Area**



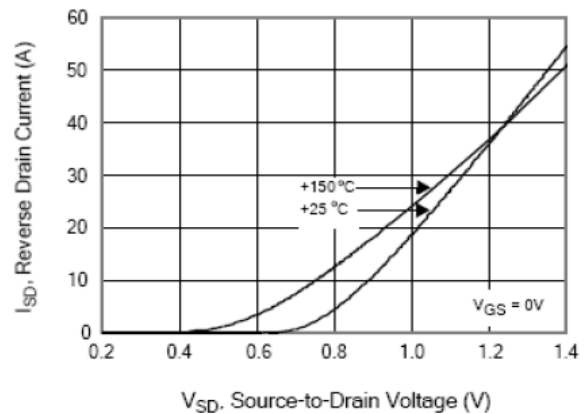
**Figure 14. Typical Capacitance vs Drain-to-Source Voltage**



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



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



**Test Circuit and Waveforms**

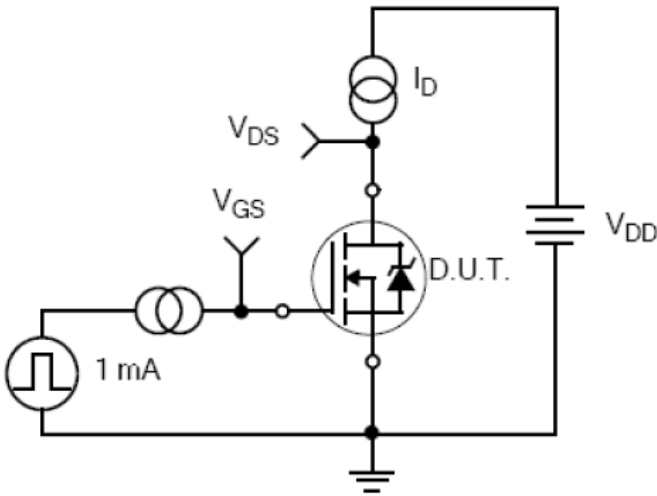


Figure 17. Gate Charge Test Circuit

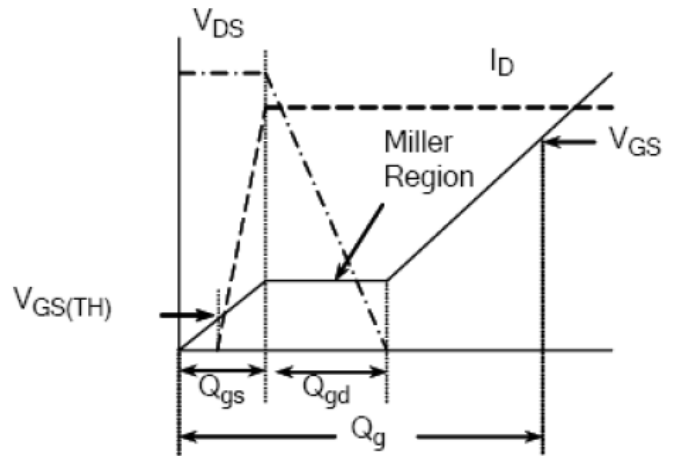


Figure 18. Gate Charge Waveform

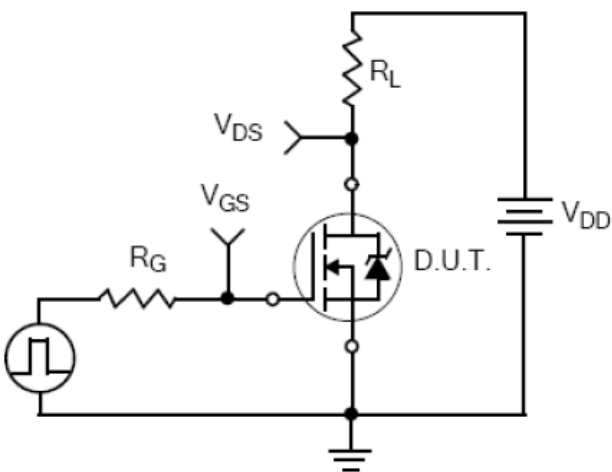


Figure 19. Resistive Switching Test Circuit

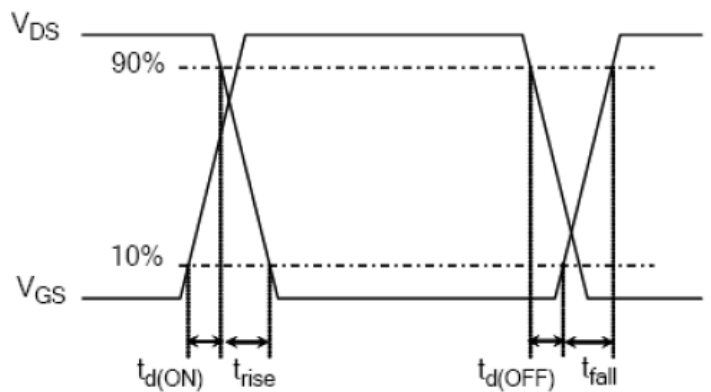


Figure 20. Resistive Switching Waveforms

**Test Circuit and Waveforms(Cont.)**

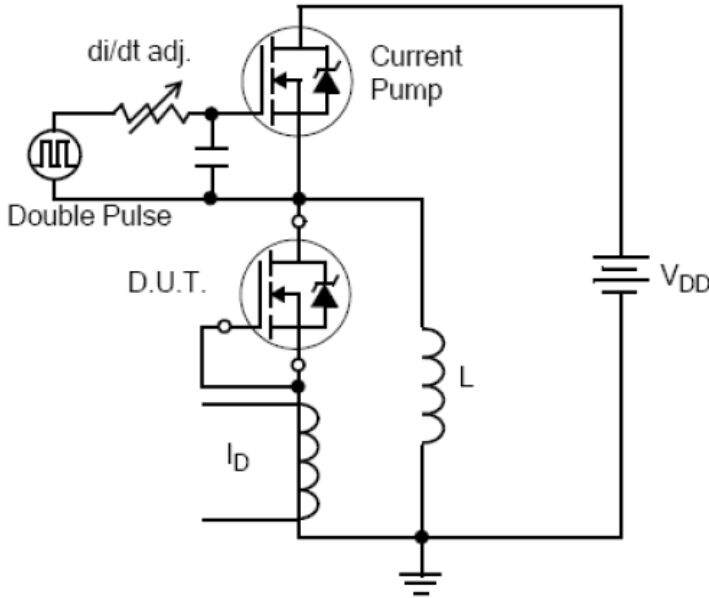


Figure 21. Diode Reverse Recovery Test Circuit

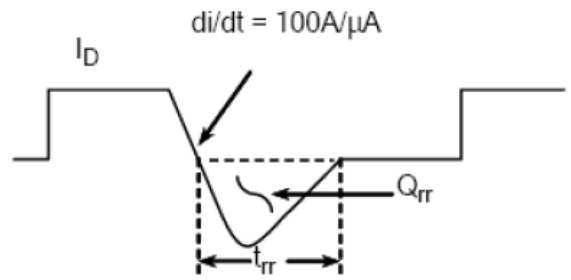


Figure 22. Diode Reverse Recovery Waveform

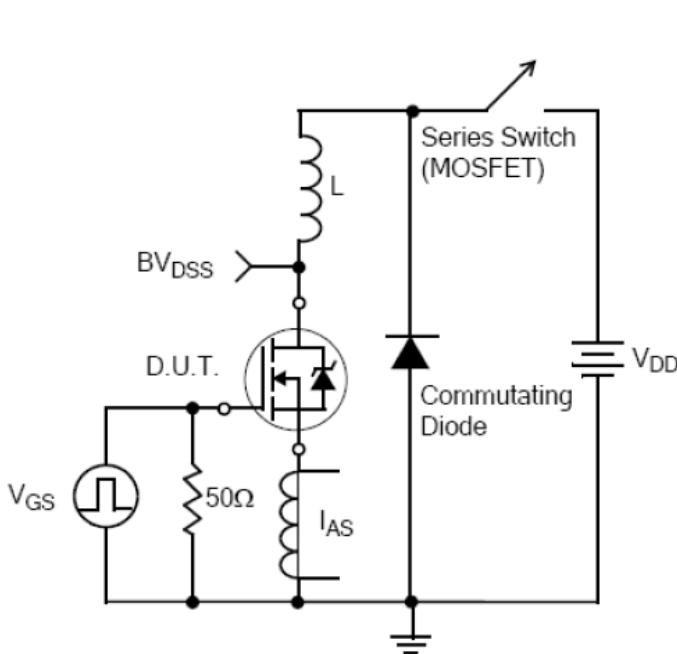


Figure 23. Unclamped Inductive Switching Test Circuit

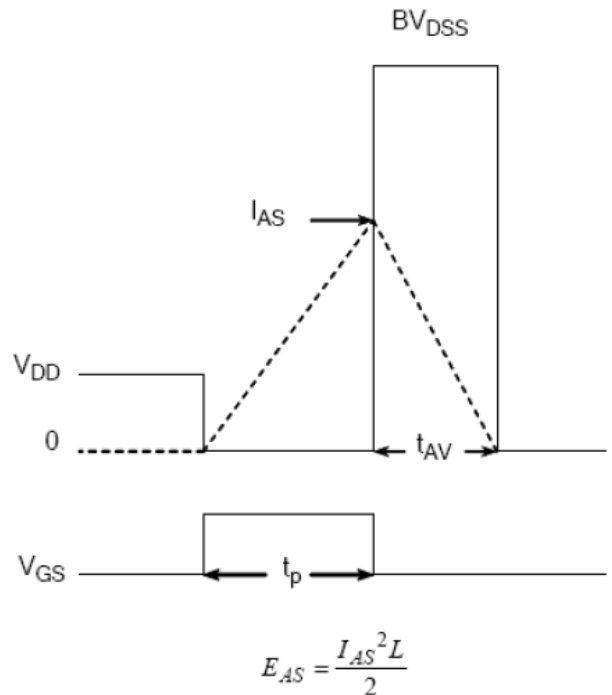
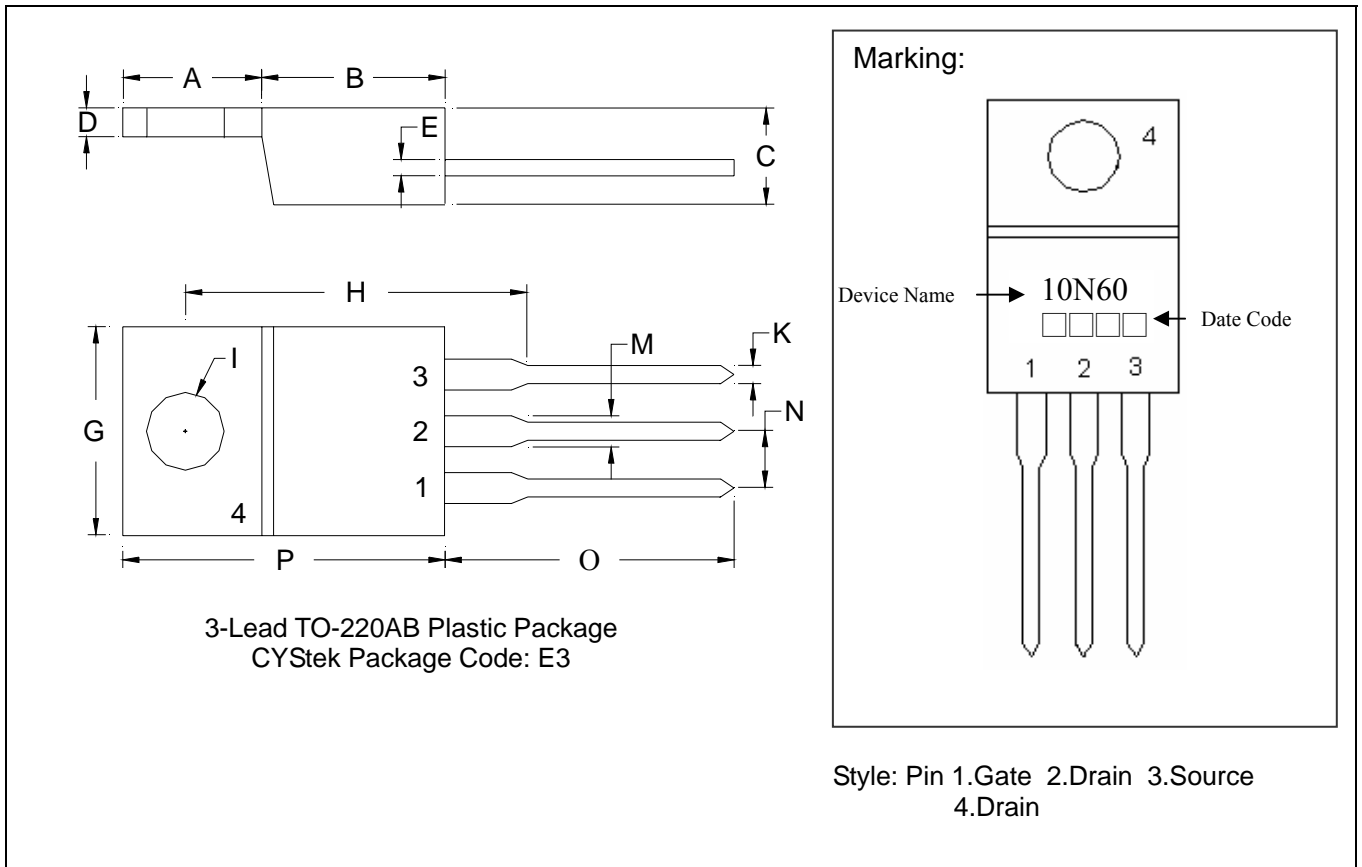


Figure 24. Unclamped Inductive Switching Waveforms



**TO-220AB Dimension**



\*: Typical

DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.2441	0.2598	6.20	6.60	I	-	*0.1508	-	*3.83
B	0.3386	0.3543	8.60	9.00	K	0.0299	0.0394	0.76	1.00
C	0.1732	0.1890	4.40	4.80	M	0.0461	0.0579	1.17	1.47
D	0.0492	0.0571	1.25	1.45	N	-	*0.1000	-	*2.54
E	0.0142	0.0197	0.36	0.50	O	0.5217	0.5610	13.25	14.25
G	0.3858	0.4094	9.80	10.40	P	0.5787	0.6024	14.70	15.30
H	-	*0.6398	-	*16.25					

Notes: 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: KFC ; pure tin plated
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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