

# FCA36N60NF

## N-Channel SupreMOS® FRFET® MOSFET

600 V, 34.9 A, 95 mΩ

### Features

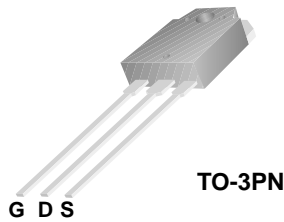
- $R_{DS(on)} = 80 \text{ m}\Omega$  (Typ.) @  $V_{GS} = 10 \text{ V}$ ,  $I_D = 18 \text{ A}$
- Ultra Low Gate Charge (Typ.  $Q_g = 86 \text{ nC}$ )
- Low Effective Output Capacitance (Typ.  $C_{oss,eff} = 338 \text{ pF}$ )
- 100% Avalanche Tested
- RoHS Compliant

### Applications

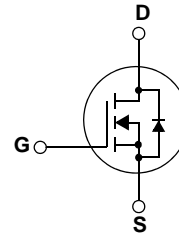
- Solar Inverter
- AC-DC Power Supply

### Description

The SupreMOS® MOSFET is Fairchild Semiconductor®'s next-generation of high voltage super-junction (SJ) technology employing a deep trench filling process that differentiate it from the conventional MOSFETs. This advanced technology and precise process control provide lowest  $R_{sp}$  on-resistance, superior switching performance and ruggedness. SupreMOS MOSFET is suitable for high frequency switching power converter applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SupreMOS FRFET® MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.



TO-3PN



### MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted\*

Symbol	Parameter	FCA36N60NF	Unit
$V_{DSS}$	Drain to Source Voltage	600	V
$V_{GSS}$	Gate to Source Voltage	$\pm 30$	V
$I_D$	Drain Current	Continuous ( $T_C = 25^\circ\text{C}$ )	34.9
		Continuous ( $T_C = 100^\circ\text{C}$ )	22
$I_{DM}$	Drain Current	Pulsed (Note 1)	104.7
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	1800
$I_{AR}$	Avalanche Current		12
$E_{AR}$	Repetitive Avalanche Energy		3.12
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	50
	MOSFET dv/dt Ruggedness		100
$P_D$	Power Dissipation	( $T_C = 25^\circ\text{C}$ )	312
		Derate above $25^\circ\text{C}$	2.6
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

\*Drain current limited by maximum junction temperature

### Thermal Characteristics

Symbol	Parameter	FCA36N60NF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	0.40	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case to Heat Sink (Typical)	0.24	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	40	

**Package Marking and Ordering Information**  $T_C = 25^\circ\text{C}$  unless otherwise noted

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FCA36N60NF	FCA36N60NF	TO-3PN	-	-	30

**Electrical Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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**Off Characteristics**

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 1 \text{ mA}, V_{GS} = 0 \text{ V}, T_J = 25^\circ\text{C}$	600	-	-	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 1 \text{ mA}, \text{Referenced to } 25^\circ\text{C}$	-	0.60	-	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 480 \text{ V}, V_{GS} = 0 \text{ V}$ $T_J = 125^\circ\text{C}$	-	-	10 100	$\mu\text{A}$
$I_{GSS}$	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	$\pm 100$	nA

**On Characteristics**

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	3.0	3.7	5.0	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 18 \text{ A}$	-	80	95	m $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 20 \text{ V}, I_D = 18 \text{ A}$	-	39	-	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V}$ $f = 1 \text{ MHz}$	-	3191	4245	pF
$C_{oss}$	Output Capacitance		-	145	195	pF
$C_{rss}$	Reverse Transfer Capacitance		-	5	8	pF
$C_{oss}$	Output Capacitance	$V_{DS} = 380 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$	-	81	-	pF
$C_{oss\text{eff}}$	Effective Output Capacitance	$V_{DS} = 0 \text{ V to } 480 \text{ V}, V_{GS} = 0 \text{ V}$	-	338	-	pF
$Q_{g(tot)}$	Total Gate Charge at 10V	$V_{DS} = 380 \text{ V}, I_D = 18 \text{ A},$ $V_{GS} = 10 \text{ V}$ (Note 4)	-	86	112	nC
$Q_{gs}$	Gate to Source Gate Charge		-	16	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		-	36	-	nC
ESR	Equivalent Series Resistance (G-S)	Drain Open, $f = 1 \text{ MHz}$	-	1.2	-	$\Omega$

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 380 \text{ V}, I_D = 18 \text{ A}$ $R_G = 4.7 \Omega$ (Note 4)	-	27	64	ns
$t_r$	Turn-On Rise Time		-	17	44	ns
$t_{d(off)}$	Turn-Off Delay Time		-	92	194	ns
$t_f$	Turn-Off Fall Time		-	4	18	ns

**Drain-Source Diode Characteristics**

$I_S$	Maximum Continuous Drain to Source Diode Forward Current	-	-	36	A	
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current	-	-	108	A	
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{SD} = 18 \text{ A}$	-	-	1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{SD} = 18 \text{ A}$	-	166	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di_F/dt = 100 \text{ A}/\mu\text{s}$	-	1.3	-	$\mu\text{C}$

**Notes:**

- Repetitive Rating: Pulse width limited by maximum junction temperature
- $I_{AS} = 12 \text{ A}, R_G = 25 \Omega, \text{Starting } T_J = 25^\circ\text{C}$
- $I_{SD} \leq 36 \text{ A}, di/dt \leq 1200 \text{ A}/\mu\text{s}, V_{DD} \leq 380 \text{ V}, \text{Starting } T_J = 25^\circ\text{C}$
- Essentially Independent of Operating Temperature Typical Characteristics

## Typical Performance Characteristics

Figure 1. On-Region Characteristics

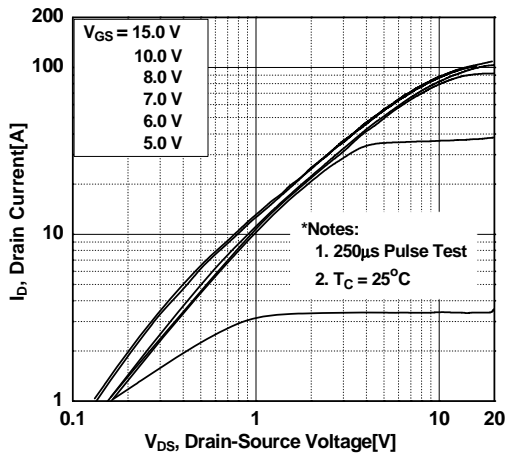


Figure 2. Transfer Characteristics

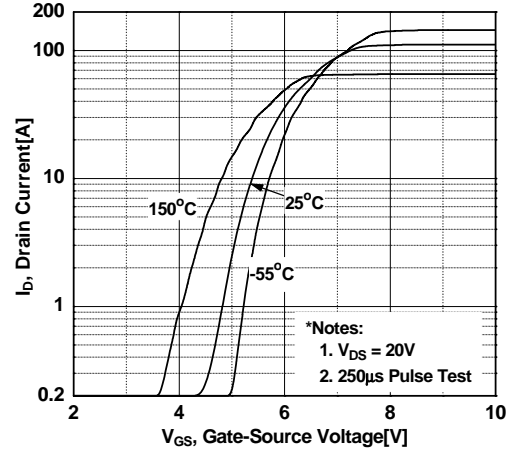


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

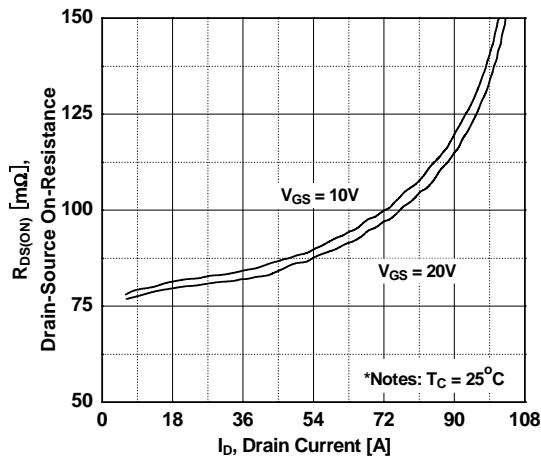


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

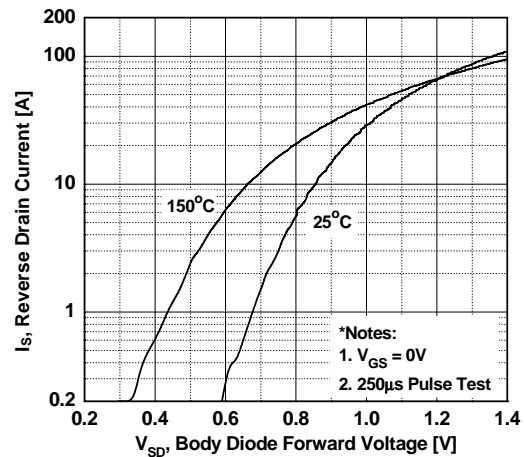


Figure 5. Capacitance Characteristics

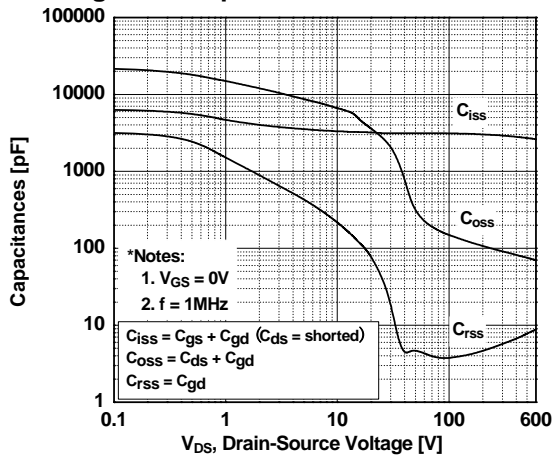
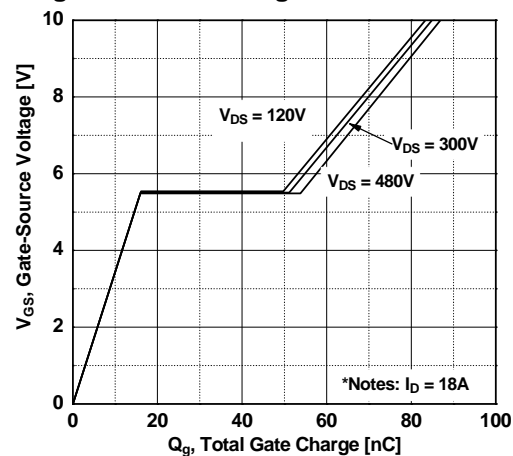


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

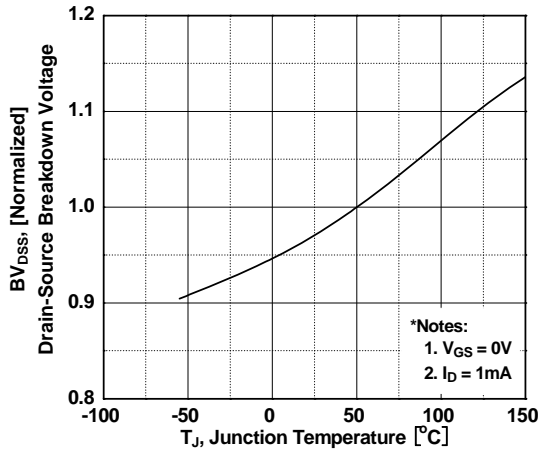


Figure 8. On-Resistance Variation vs. Temperature

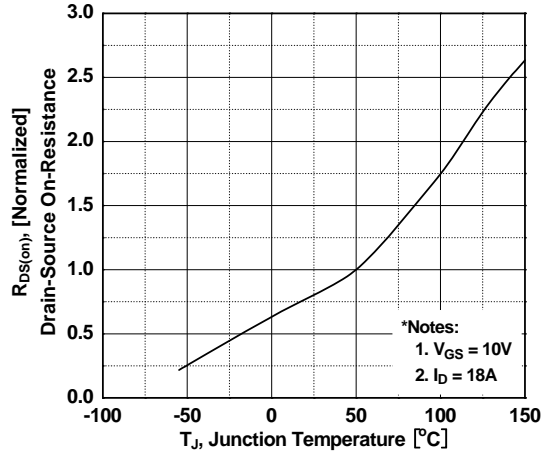


Figure 9. Maximum Safe Operating Area

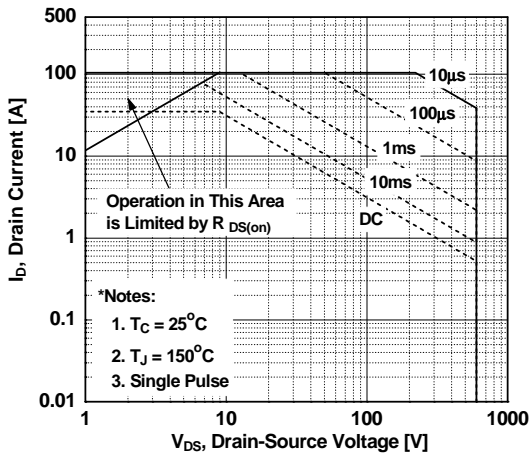


Figure 10. Maximum Drain Current vs. Case Temperature

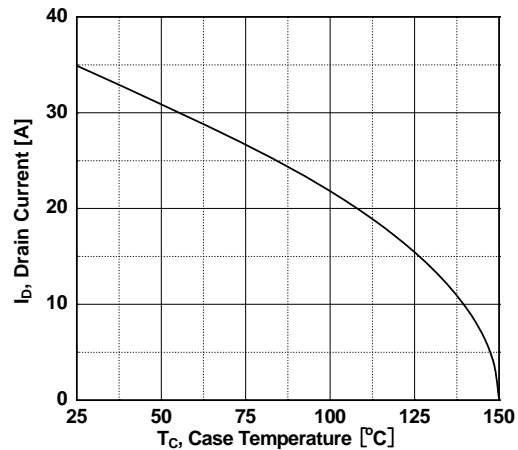
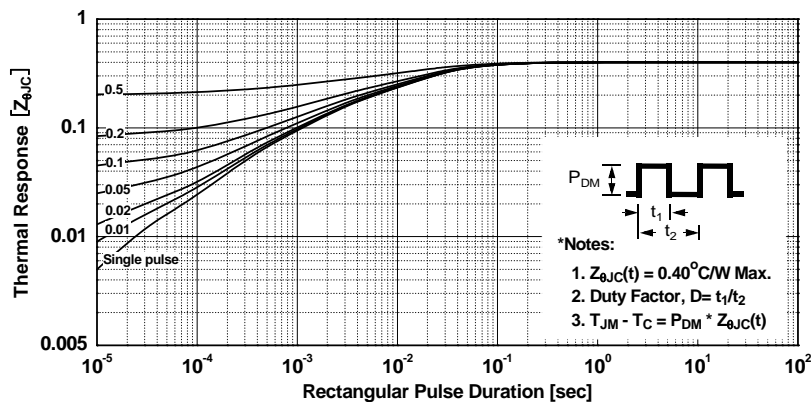
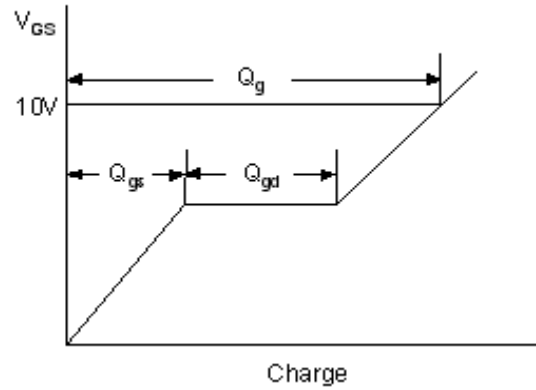
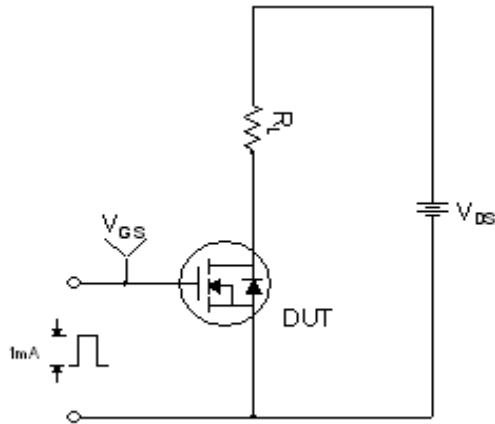


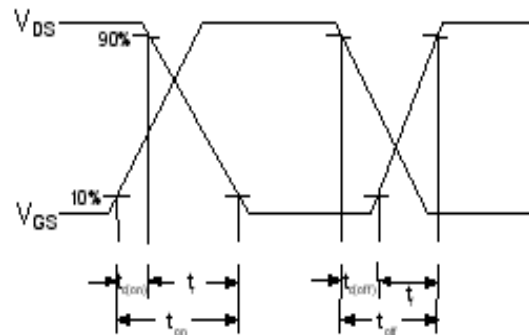
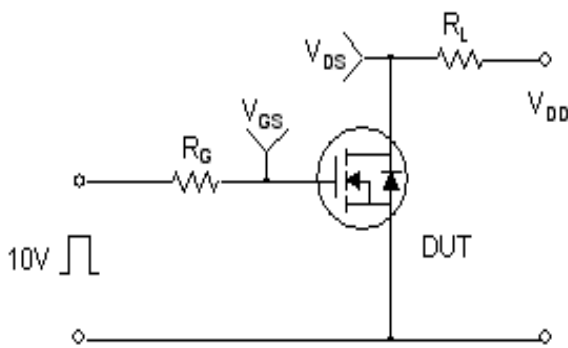
Figure 11. Transient Thermal Response Curve



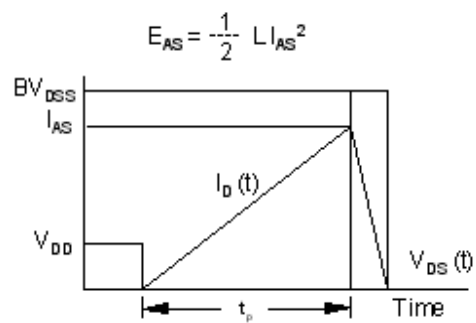
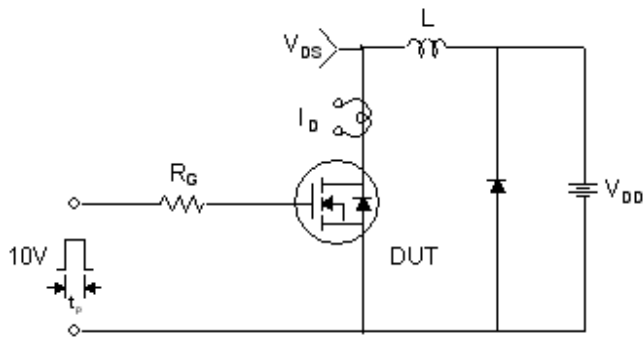
Gate Charge Test Circuit & Waveform



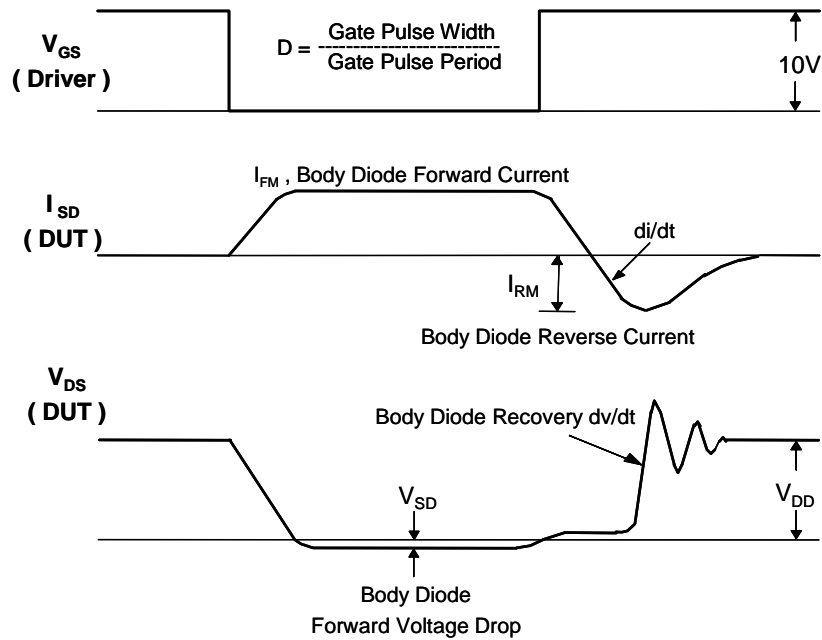
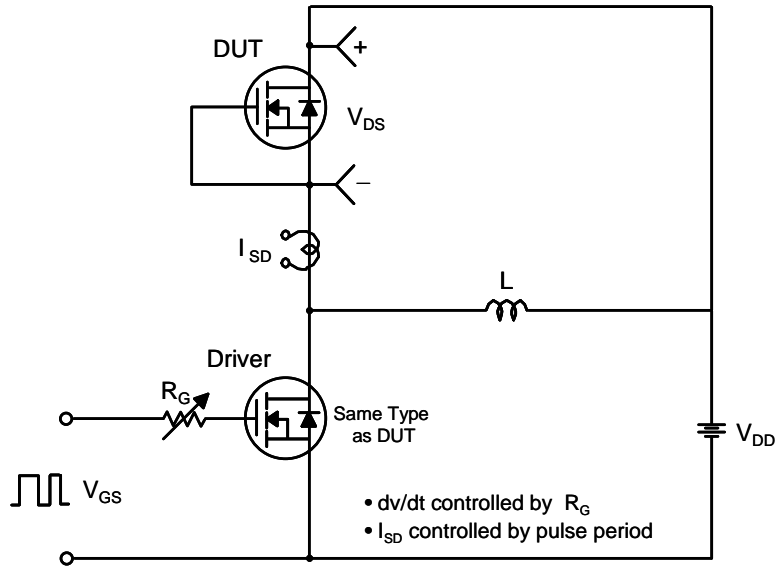
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

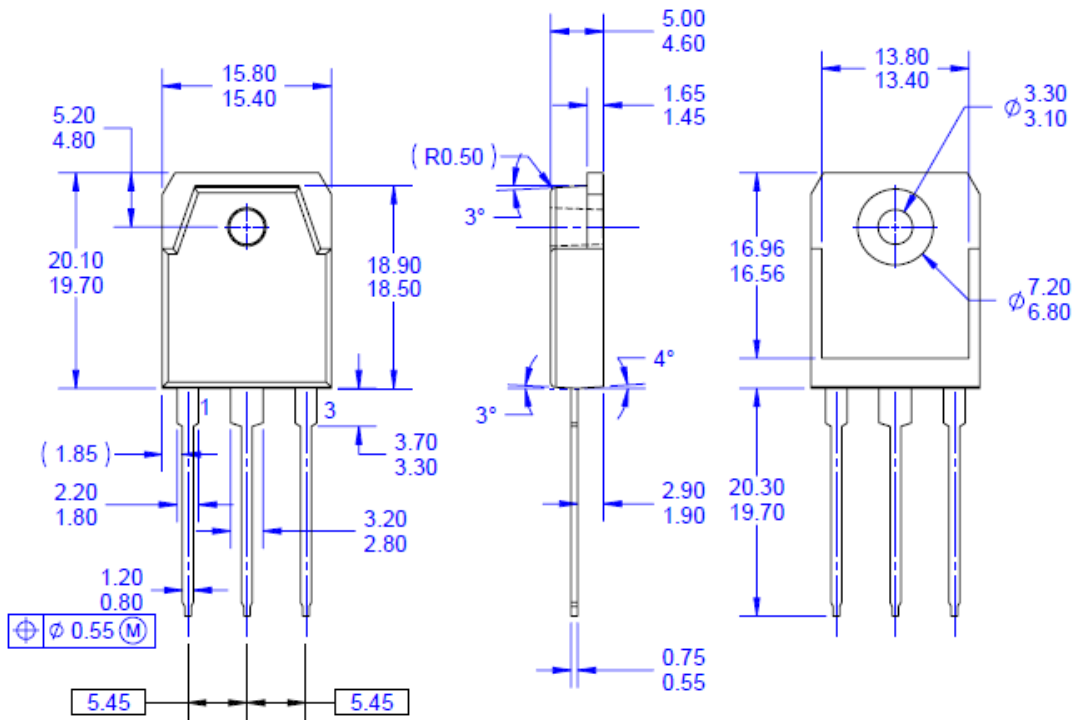


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

TO-3PN







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