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May 2014

FDA70N20

N-Channel UniFET™ MOSFET

200 V, 70 A, 35 mΩ

Features

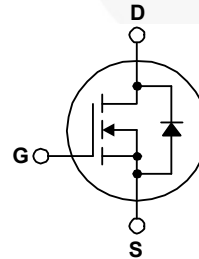
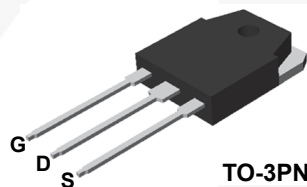
- $R_{DS(on)} = 35 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 35 \text{ A}$
- Low Gate Charge (Typ. 66 nC)
- Low C_{rss} (Typ. 89 pF)
- 100% Avalanche Tested

Applications

- Uninterruptible Power Supply
- AC-DC Power Supply

Description

UniFET™ MOSFET is Fairchild Semiconductor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to reduce on-state resistance, and to provide better switching performance and higher avalanche energy strength. This device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

Symbol	Parameter	FDA70N20	Unit
V_{DSS}	Drain-Source Voltage	200	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	70 45	A A
I_{DM}	Drain Current - Pulsed (Note 1)	280	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	1742	mJ
I_{AR}	Avalanche Current (Note 1)	70	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	41.7	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate Above 25°C	417 3.3	W W/ $^\circ\text{C}$
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	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FDA70N20	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.3	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.24	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	40	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDA70N20	FDA70N20	TO-3PN	Tube	N/A	N/A	30 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA	200	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25°C	--	0.2	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 200V, V _{GS} = 0V V _{DS} = 160V, T _C = 125°C	-- --	-- --	1 10	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 35A	--	0.029	0.035	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40V, I _D = 35A	--	47	--	S
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0 MHz	--	3050	3970	pF
C _{oss}	Output Capacitance		--	750	980	pF
C _{rss}	Reverse Transfer Capacitance		--	89	130	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 100V, I _D = 70A R _G = 25Ω (Note 4)	--	71	150	ns
t _r	Turn-On Rise Time		--	235	480	ns
t _{d(off)}	Turn-Off Delay Time		--	65	140	ns
t _f	Turn-Off Fall Time		--	39	88	ns
Q _g	Total Gate Charge	V _{DS} = 160V, I _D = 70A V _{GS} = 10V (Note 4)	--	66	86	nC
Q _{gs}	Gate-Source Charge		--	19	--	nC
Q _{gd}	Gate-Drain Charge		--	26	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	70	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	280	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _S = 70A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _S = 70A dI _F /dt = 100A/μs	--	175	--	ns
Q _{rr}	Reverse Recovery Charge		--	4.1	--	μC

NOTES:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 0.533 mH, I_{AS} = 70 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 70 A, di/dt ≤ 200 A/μs, V_{DD} ≤ BV_{DSS}, starting T_J = 25°C.
4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

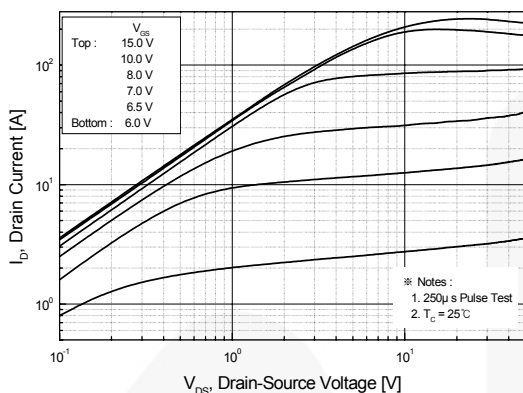


Figure 2. Transfer Characteristics

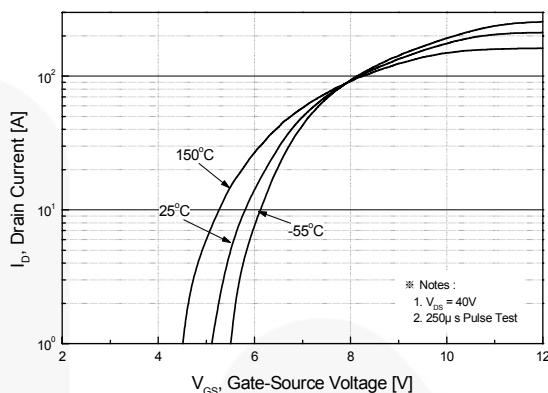


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

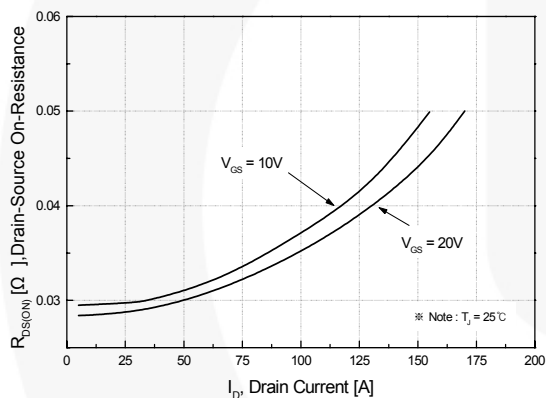


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

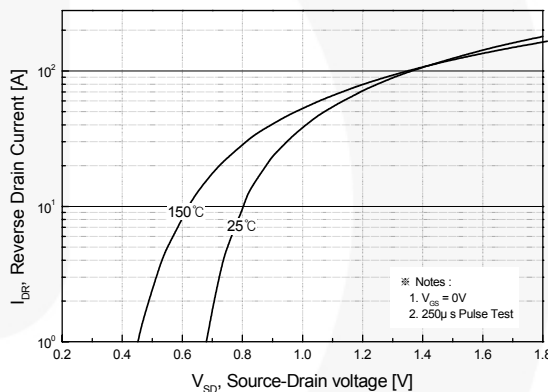


Figure 5. Capacitance Characteristics

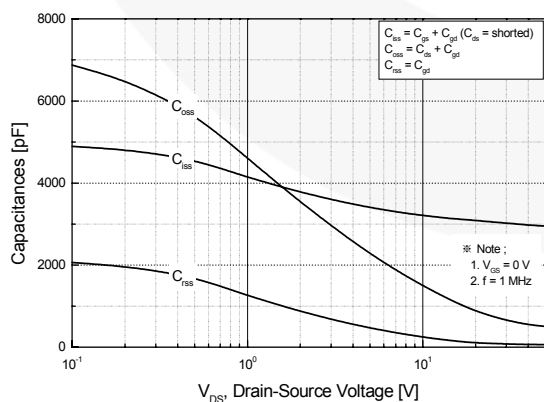
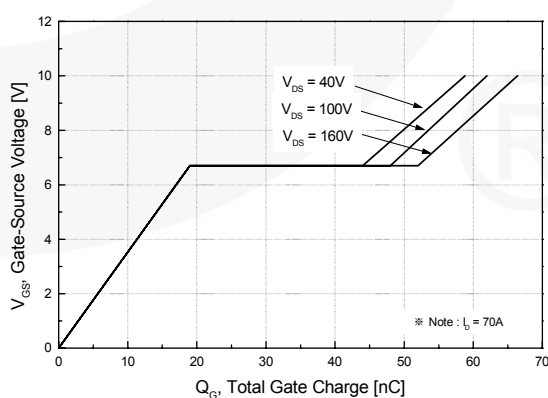


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

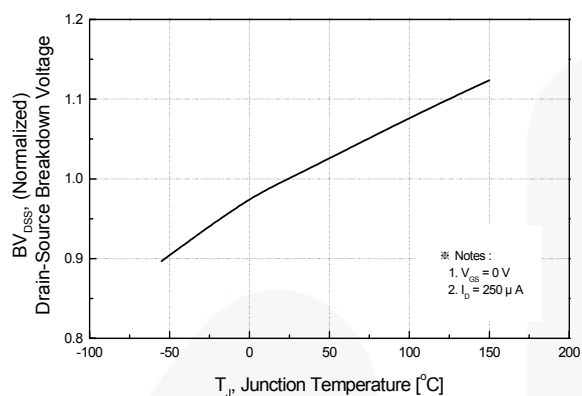


Figure 8. On-Resistance Variation vs. Temperature

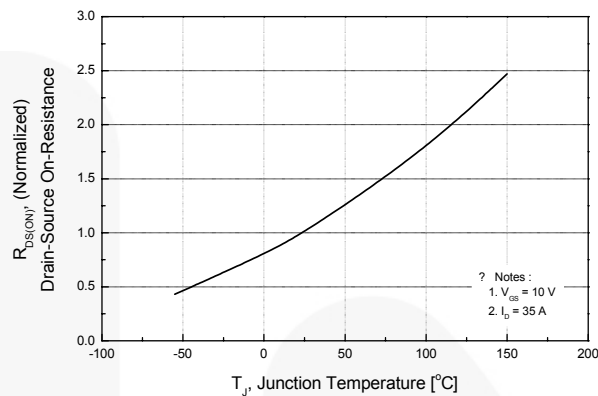


Figure 9. Safe Operating Area

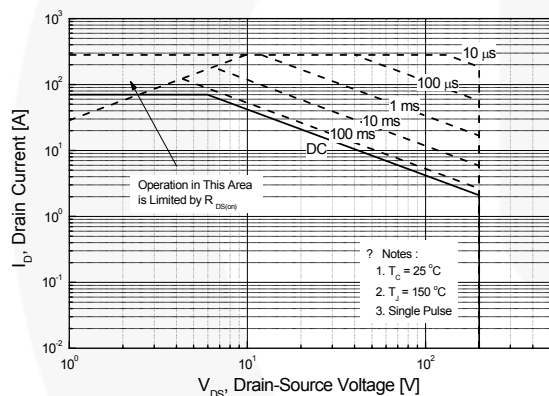


Figure 10. Maximum Drain Current vs. Case Temperature

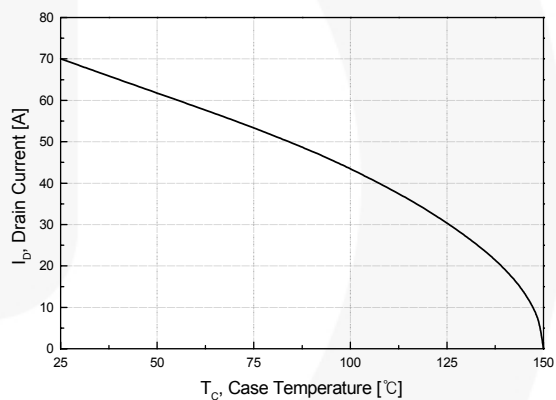
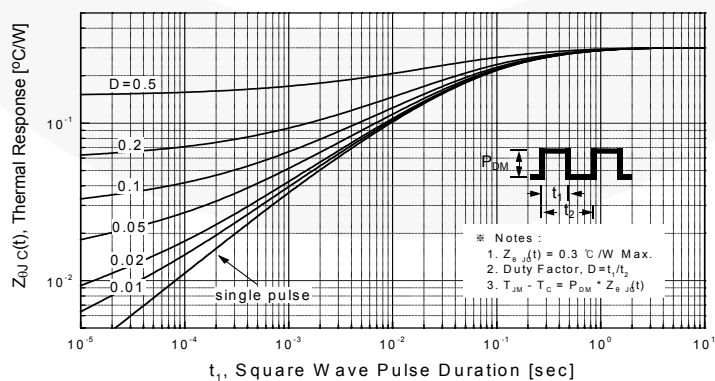


Figure 11. Transient Thermal Response Curve



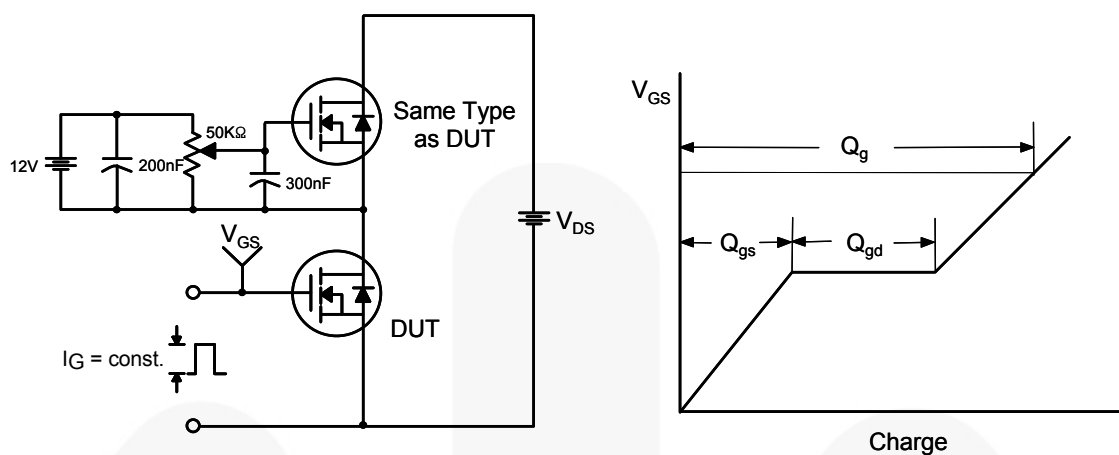


Figure 12. Gate Charge Test Circuit & Waveform

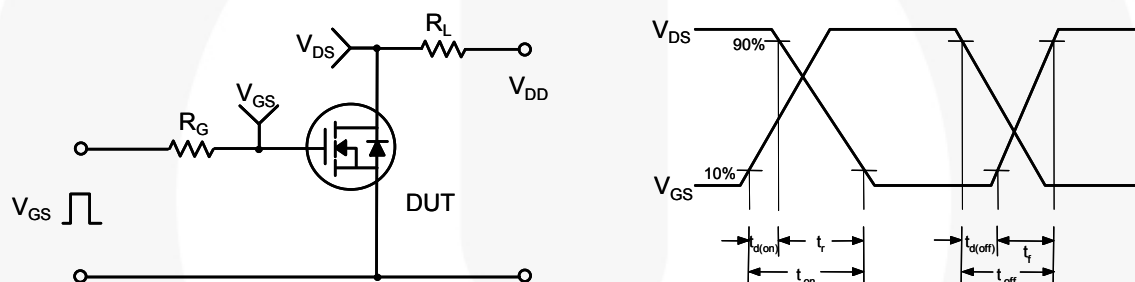


Figure 13. Resistive Switching Test Circuit & Waveforms

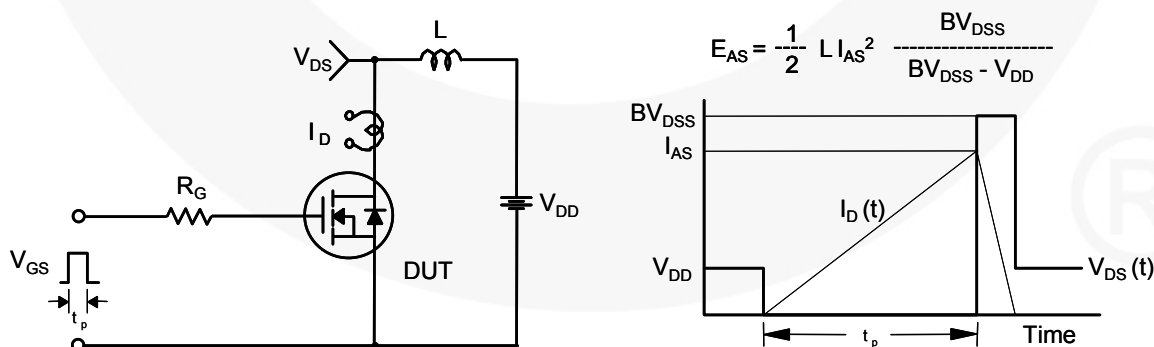


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

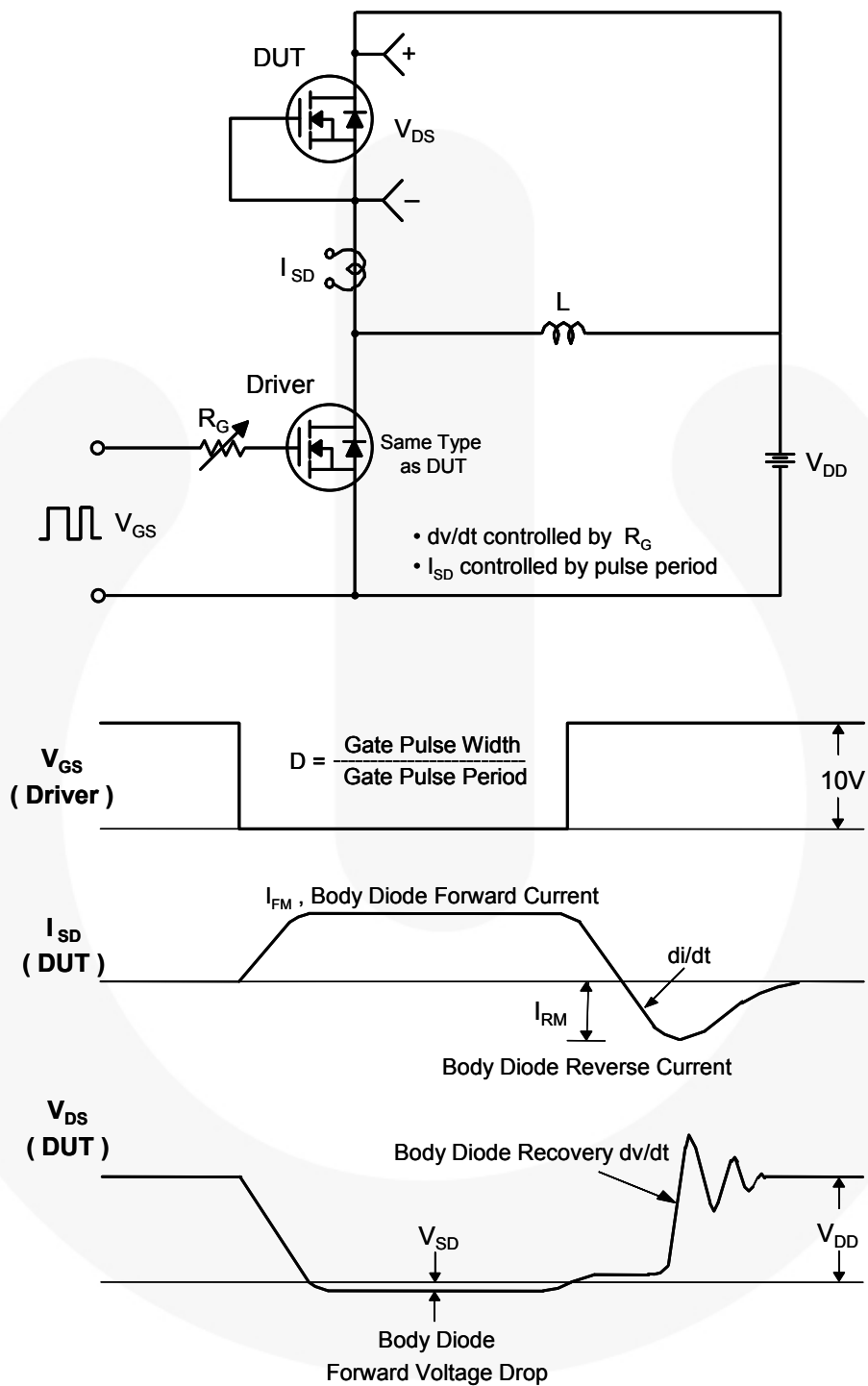
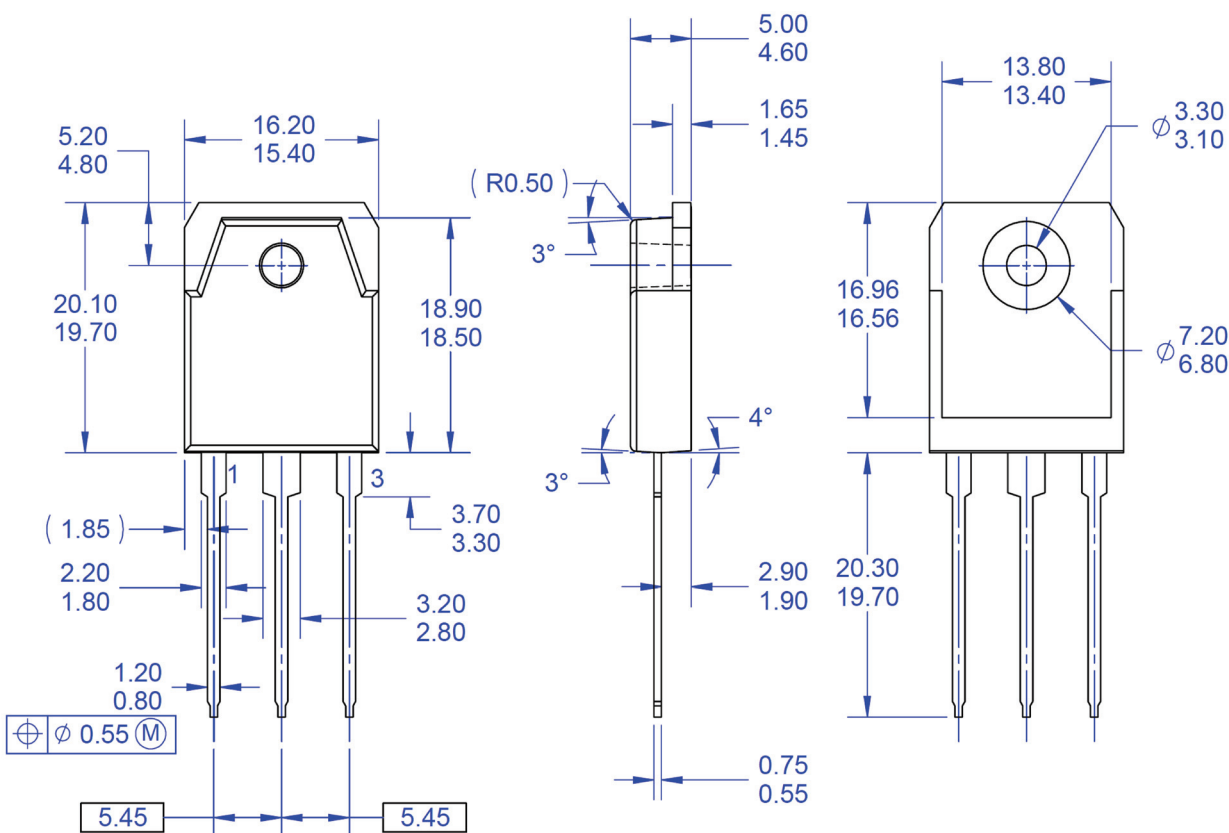


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

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- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSION AND TOLERANCING PER ASME14.5-2009.
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Figure 16. TO3PN, 3-Lead, Plastic, EIAJ SC-65

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