

HCS70R1K6

700V N-Channel Super Junction MOSFET

Features

- Very Low FOM ($R_{DS(on)} \times Qg$)
- Extremely low switching loss
- Excellent stability and uniformity
- 100% Avalanche Tested
- Built-in ESD Diode

Application

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)
- TV Power & LED Lighting Power

Key Parameters

Parameter	Value	Unit
$BV_{DSS} @ T_{j,max}$	750	V
I_D	5	A
$R_{DS(on), max}$	1.6	Ω
Qg, Typ	5.5	nC

Package & Internal Circuit

TO-220F	SYMBOL
	

Absolute Maximum Ratings $T_J=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	700	V
V_{GS}	Gate-Source Voltage	± 20	V
$I_D^{1)}$	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	5.0 *	A
	Drain Current - Continuous ($T_C = 100^\circ\text{C}$)	3.2 *	A
$I_{DM}^{2)}$	Drain Current - Pulsed	8.4 *	A
$E_{AS}^{3)}$	Single Pulsed Avalanche Energy	43	mJ
I_{AR}	Avalanche Current	1	A
dv/dt	MOSFET dv/dt ruggedness, $V_{DS}=0\dots 560\text{V}$	50	V/ns
dv/dt	Reverse diode dv/dt, $V_{DS}=0\dots 560\text{V}$, $I_{DS} \leq I_D$	15	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	20	W
$V_{ESD(G-S)}$	Gate source ESD(HBM-C=100pF, R=1.5K Ω)	2500	V
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$

* Drain current limited by maximum junction temperature

Thermal Resistance Characteristics

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Junction-to-Case	-	6.3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Junction-to-Ambient	-	62.5	$^\circ\text{C}/\text{W}$

Electrical Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
On Characteristics						
V_{GS}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 60 \mu\text{A}$	2.5	-	3.5	V
$R_{DS(ON)}$	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 1.1 \text{ A}$	-	1.35	1.6	Ω
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	700	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 700 \text{ V}, V_{GS} = 0 \text{ V}, T_C = 25^\circ\text{C}$	-	-	1	μA
		$V_{DS} = 700 \text{ V}, V_{GS} = 0 \text{ V}, T_C = 150^\circ\text{C}$	-	-	100	μA
I_{GSS}	Gate-Body Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	± 1	μA
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 100 \text{ V}, V_{GS} = 0 \text{ V},$ $f = 1.0 \text{ MHz}$	-	245	-	pF
C_{oss}	Output Capacitance		-	13	-	pF
C_{rss}	Reverse Transfer Capacitance		-	1.7	-	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Time	$V_{DS} = 350 \text{ V}, I_D = 1.5 \text{ A},$ $R_G = 25 \Omega$ (Note 4,5)	-	20	-	ns
t_r	Turn-On Rise Time		-	18	-	ns
$t_{d(off)}$	Turn-Off Delay Time		-	50	-	ns
t_f	Turn-Off Fall Time		-	20	-	ns
Q_g	Total Gate Charge		$V_{DS} = 560 \text{ V}, I_D = 1.5 \text{ A},$ $V_{GS} = 10 \text{ V}$ (Note 4,5)	-	5.5	-
Q_{gs}	Gate-Source Charge	-		1.1	-	nC
Q_{gd}	Gate-Drain Charge	-		2.2	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		-	-	5.0	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		-	-	8.4	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 5.0 \text{ A}$	-	-	1.3	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_S = 1.5 \text{ A}$ $di_F/dt = 100 \text{ A}/\mu\text{s}$	-	135	-	ns
Q_{rr}	Reverse Recovery Charge		-	0.6	-	μC

Notes :

- Limited by T_J max. Maximum duty cycle $D=0.50$
- Repetitive Rating : Pulse width limited by maximum junction temperature
- $I_{AS}=1\text{A}, V_{DD}=50\text{V}, R_G=25\Omega$, Starting $T_J=25^\circ\text{C}$
- Pulse Test : Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
- Essentially Independent of Operating Temperature

Typical Characteristics

Figure 1. On Region Characteristics

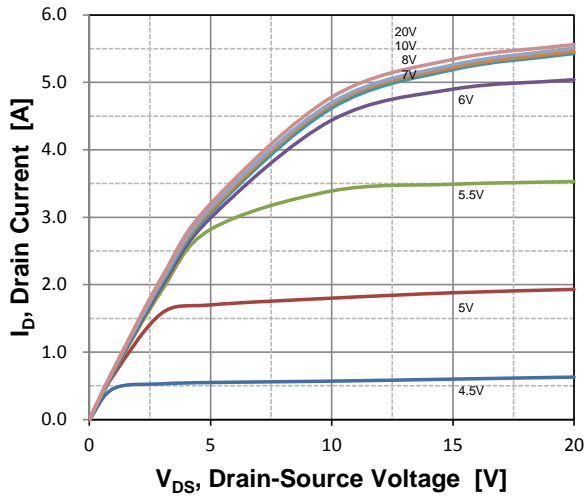


Figure 2. Transfer Characteristics

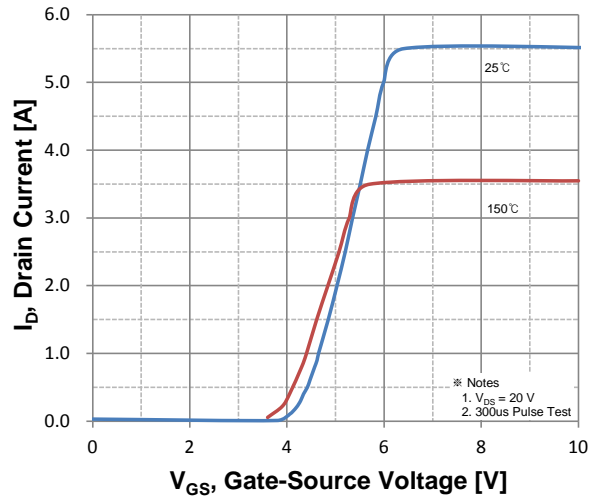


Figure 3. On Resistance Variation vs. Drain Current and Gate Voltage

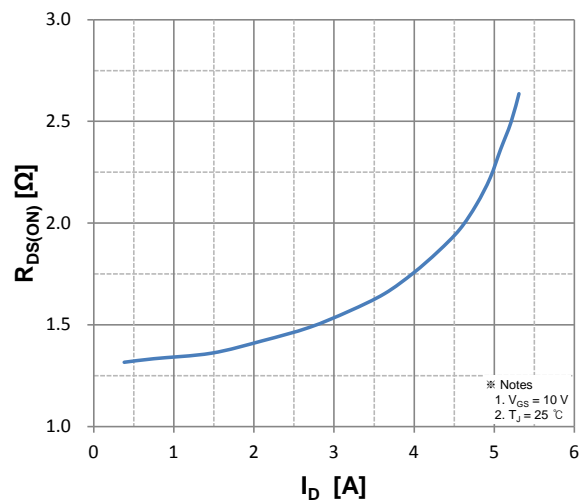


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

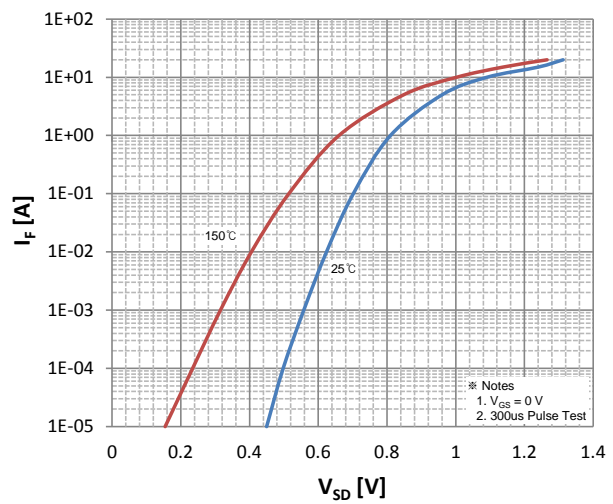


Figure 4. Capacitance Characteristics

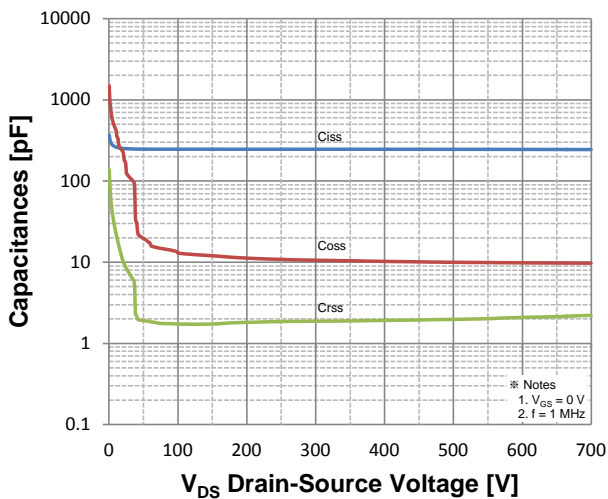
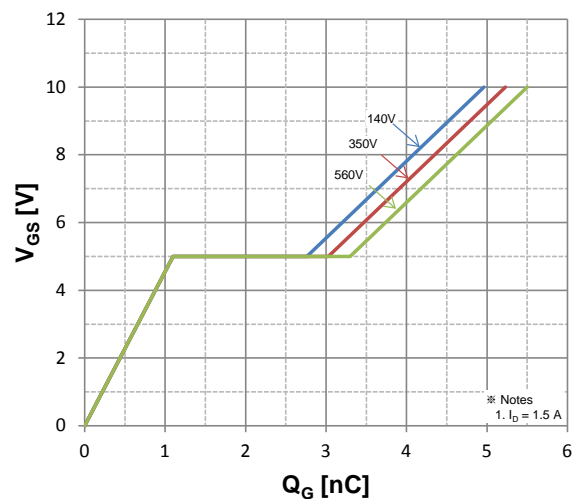


Figure 5. Gate Charge Characteristics



Typical Characteristics

Figure 7. Breakdown Voltage Variation vs. Temperature

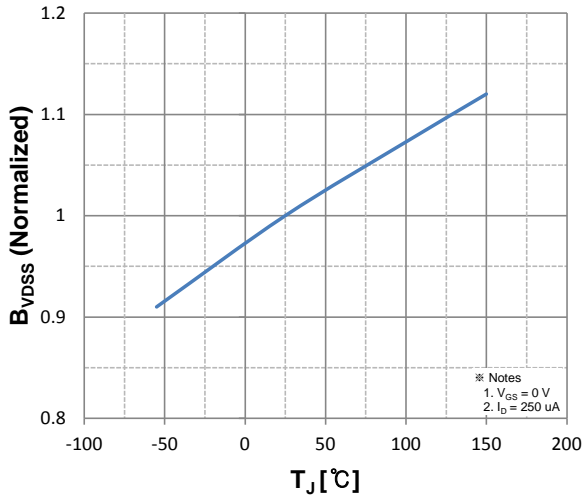


Figure 8. On-Resistance Variation vs. Temperature

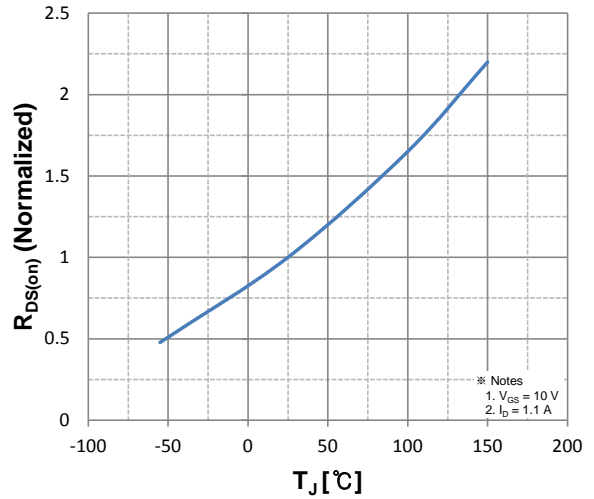


Figure 9. Maximum Safe Operating Area

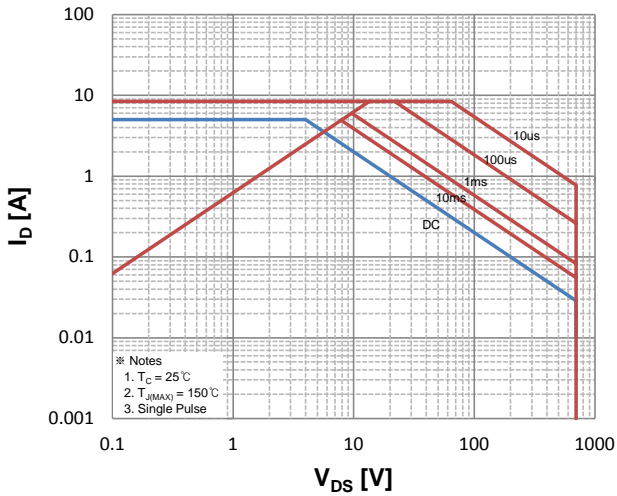


Figure 10. Maximum Drain Current vs. Temperature

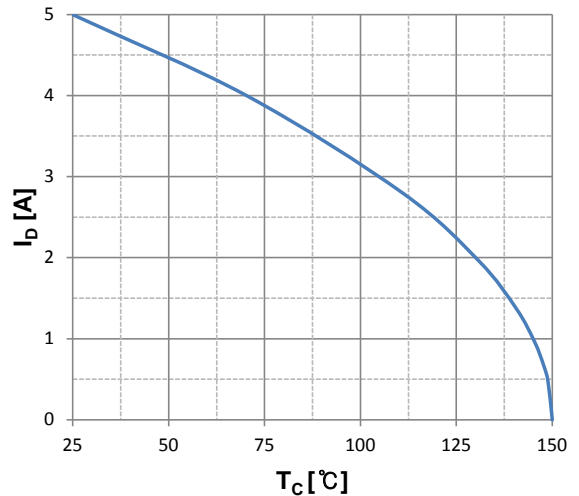


Figure 10. Transient Thermal Response Curve

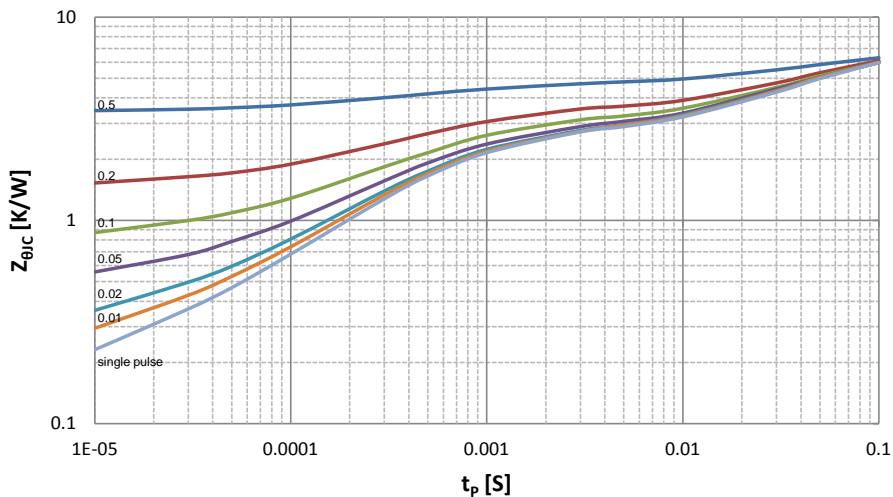


Figure 12. Gate Charge Test Circuit & Waveform

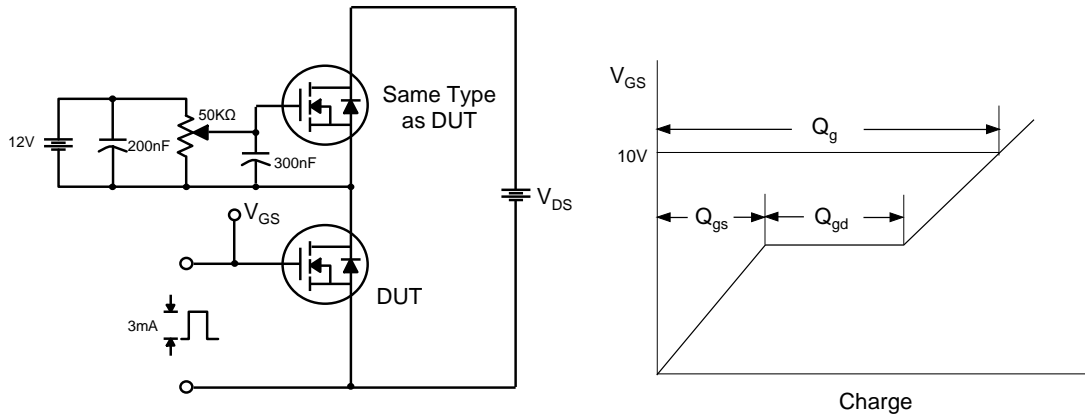


Figure 13. Resistive Switching Test Circuit & Waveforms

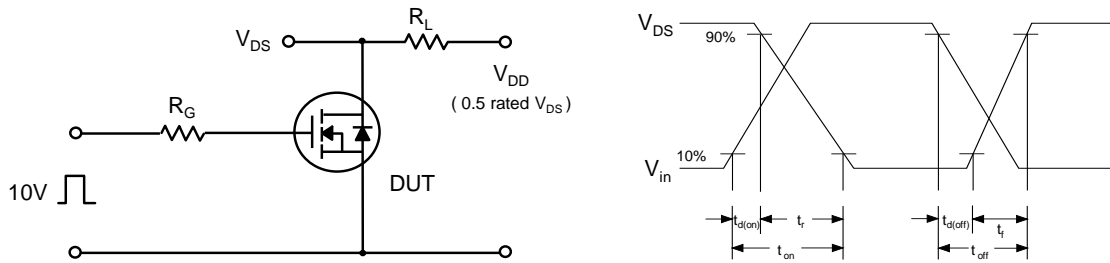


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

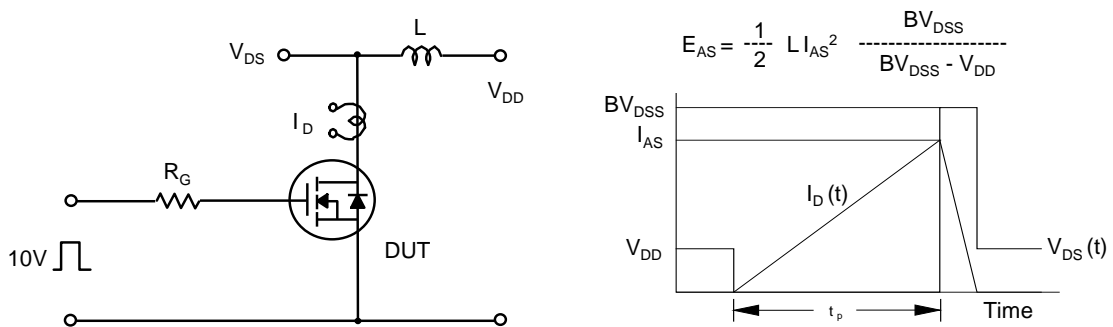
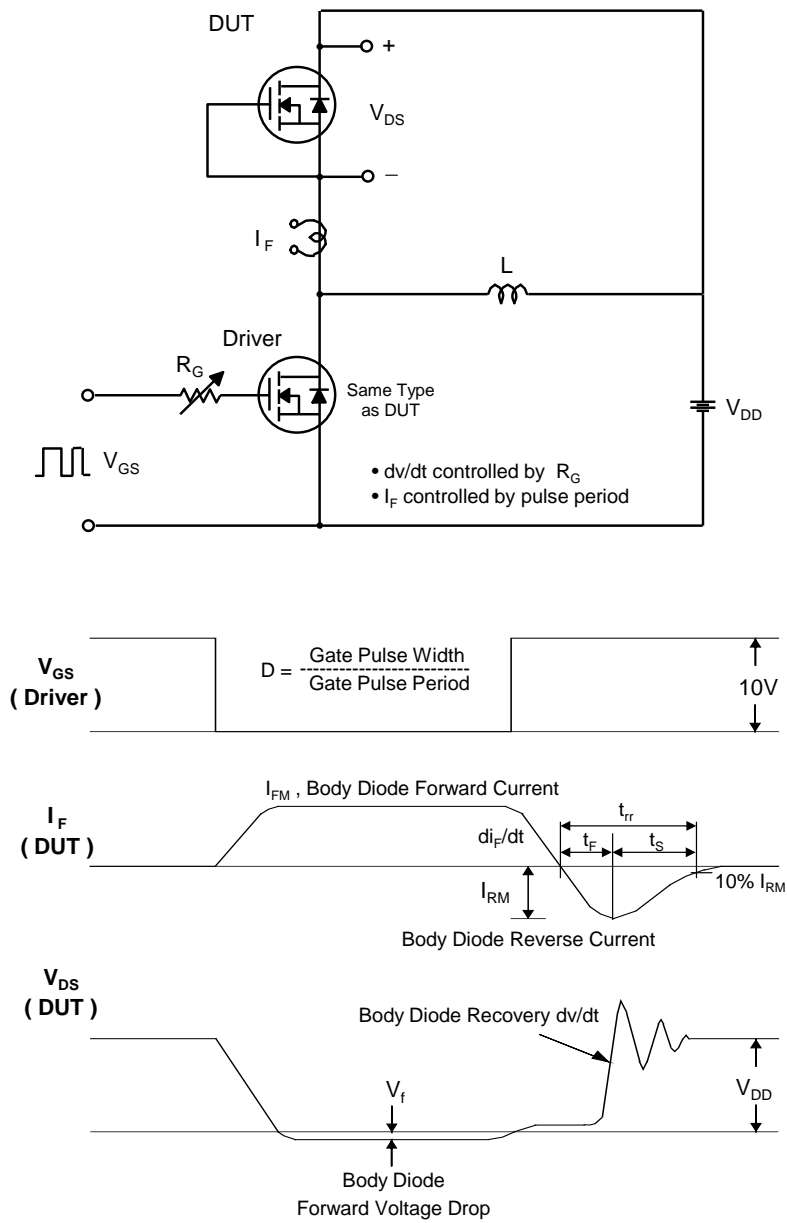
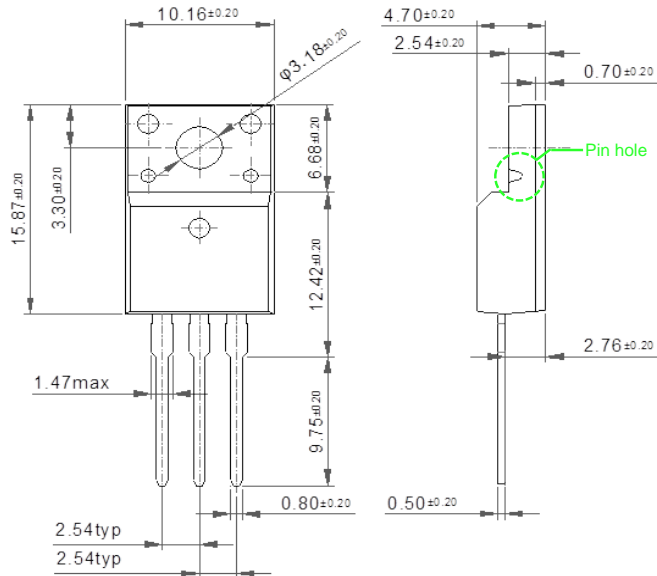


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimension □

TO-220F



TO-220F-FM(Full Mold)

