

600 V, 18.2 A, 193 mΩ

Description

The 600V FRD series has ultra-fast body diode performance, low on-resistance and reduced gate charge.

It combines the benefits of a fast switching performance with ease of usage and robustness. Additionally, we offer low reverse recovery time (trr) and reverse recovery charge (Qrr) for the bridge structure topology, especially for resonant converters (LLC, PSFB, etc.).

Features

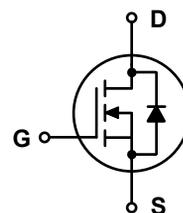
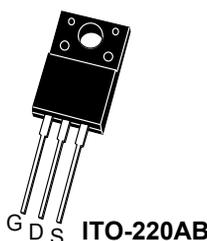
$BV_{DSS} @ T_{J,max}$	I_D	$R_{DS(on),max}$	$Q_{g,typ}$
650 V	18.2 A	193 mΩ	31.9 nC

- Reduced Switching & Conduction Losses
- Fast Recovery Body-Diode
- Lower Gate Resistance
- 100% Avalanche Tested
- Pb-free and RoHS Compliant
- Compliance with EU REACH



Applications

- Soft Switching Topologies
- Telecom and Server Power Supplies
- EV Charger and Industrial Power Supplies



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

Symbol	Parameter	Value	Unit
V_{DSS}	Drain to Source Voltage	600	V
V_{GSS}	Gate to Source Voltage	± 30	V
I_D	Drain Current	Continuous ($T_C = 25^\circ\text{C}$)	18.2*
		Continuous ($T_C = 100^\circ\text{C}$)	11.5*
I_{DM}	Drain Current	Pulsed (Note1)	54.6*
E_{AS}	Single Pulsed Avalanche Energy	(Note2)	102
I_{AS}	Avalanche Current	(Note2)	4
E_{AR}	Repetitive Avalanche Energy	(Note1)	1.6
dv/dt	MOSFET dv/dt	100	V/ns
	Peak Diode Recovery dv/dt	(Note3)	
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	36
		Derate Above 25°C	0.29
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds	260	$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	3.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	



Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
HXMH60M193F	H60M193F	ITO-220AB	Tube	50 units

Electrical Characteristics (T_C = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
--------	-----------	-----------------	-----	-----	-----	------

Off Characteristics

BV _{DSS}	Drain to Source Breakdown Voltage	V _{GS} = 0 V, I _D = 1 mA	600			V
		V _{GS} = 0 V, I _D = 1 mA, T _J = 150°C	650			
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V			10	μA
		V _{DS} = 480 V, V _{GS} = 0 V, T _J = 125°C		16		
I _{GSS}	Gate-Source Leakage Current	V _{GS} = ±30 V, V _{DS} = 0 V			±100	nA

On Characteristics

V _{GS(th)}	Gate Threshold Voltage	V _{GS} = V _{DS} , I _D = 1.7 mA	3.0		5.0	V
R _{DS(on)}	Static Drain to Source On Resistance	V _{GS} = 10 V, I _D = 8.5 A		160	193	mΩ

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{DS} = 400 V, V _{GS} = 0V, f = 250 kHz		1220		pF
C _{oss}	Output Capacitance			35		pF
C _{o(tr)}	Time Related Output Capacitance	V _{DS} = 0 V to 400 V, V _{GS} = 0 V		354		pF
C _{o(er)}	Energy Related Output Capacitance			57		pF
Q _{g(tot)}	Total Gate Charge at 10 V	V _{DS} = 400 V, I _D = 8.5 A, V _{GS} = 10 V		31.9		nC
Q _{gs}	Gate to Source Charge			8.2		nC
Q _{gd}	Gate to Drain "Miller" Charge			16.3		nC
R _G	Gate Resistance	f = 1 MHz		1.3		Ω

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DS} = 400 V, I _D = 8.5 A, V _{GS} = 10 V, R _G = 10 Ω See Figure 13		14.2		ns
t _r	Turn-On Rise Time			12		ns
t _{d(off)}	Turn-Off Delay Time			43.9		ns
t _f	Turn-Off Fall Time			8.5		ns

Source-Drain Diode Characteristics

I _S	Maximum Continuous Diode Forward Current			18.2		A
I _{SM}	Maximum Pulsed Diode Forward Current			54.6		A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V, I _{SD} = 8.5 A			1.2	V
t _{rr}	Reverse Recovery Time	V _{DD} = 400 V, I _{SD} = 8.5 A, di _F /dt = 100 A/μs		93		ns
Q _{rr}	Reverse Recovery Charge			0.42		μC

※Notes:

1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. I_{AS} = 4 A, R_G = 25 Ω, starting T_J = 25°C.
3. I_{SD} ≤ 8.5 A, di/dt ≤ 100 A/μs, V_{DD} ≤ 400 V, starting T_J = 25°C.



Typical Performance Characteristics

Figure 1. On-Region Characteristics

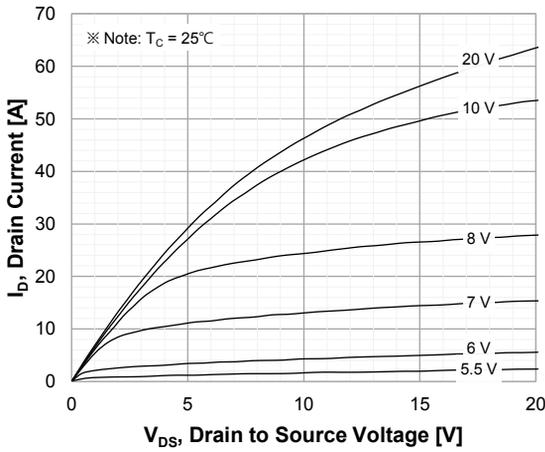


Figure 2. Transfer Characteristics

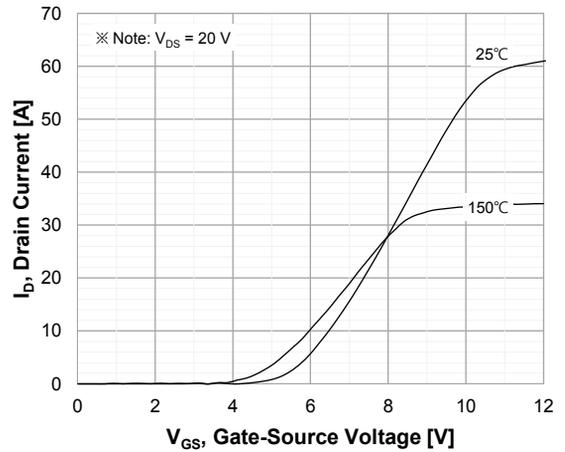


Figure 3. On-Resistance Characteristics vs. Drain Current and Gate Voltage

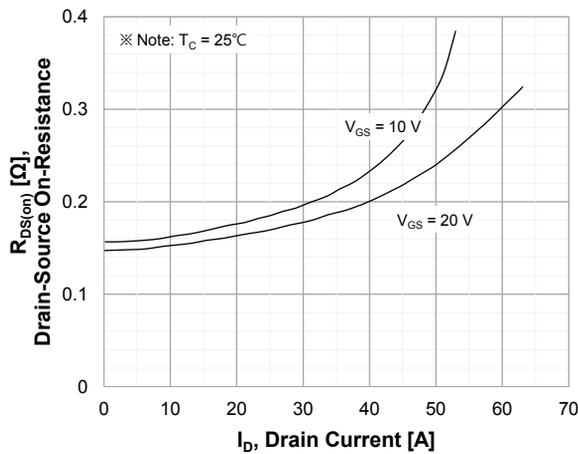


Figure 4. Diode Forward Voltage Characteristics vs. Source-Drain Current and Temperature

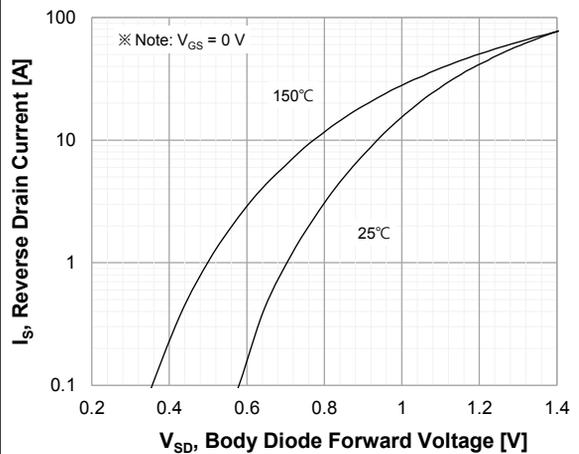


Figure 5. Capacitance Characteristics

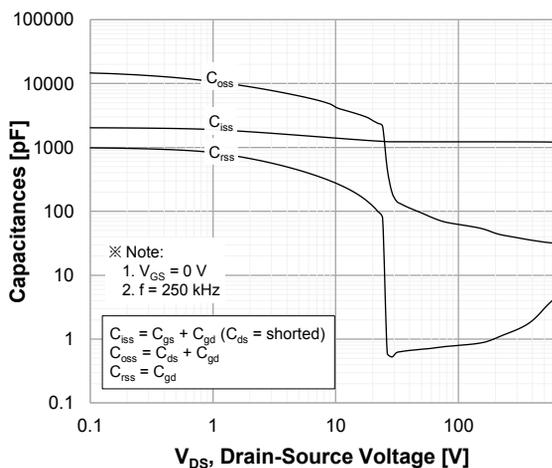
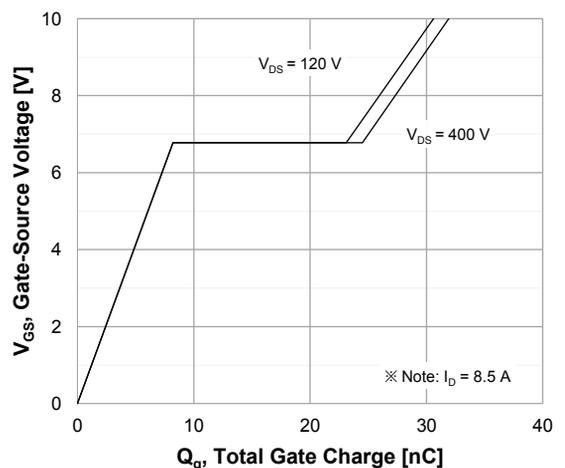


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics

Figure 7. Breakdown Voltage Characteristics vs. Temperature

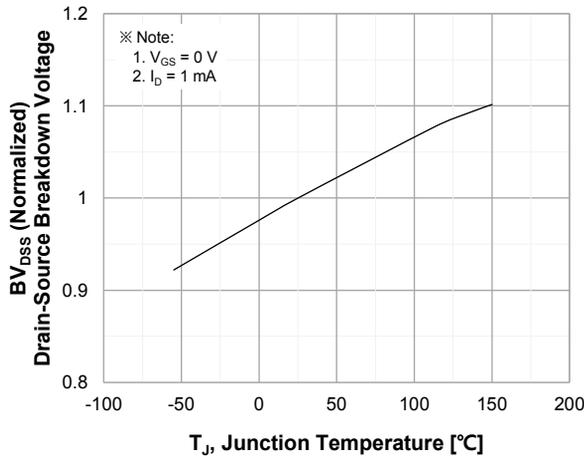


Figure 8. On-Resistance Characteristics vs. Temperature

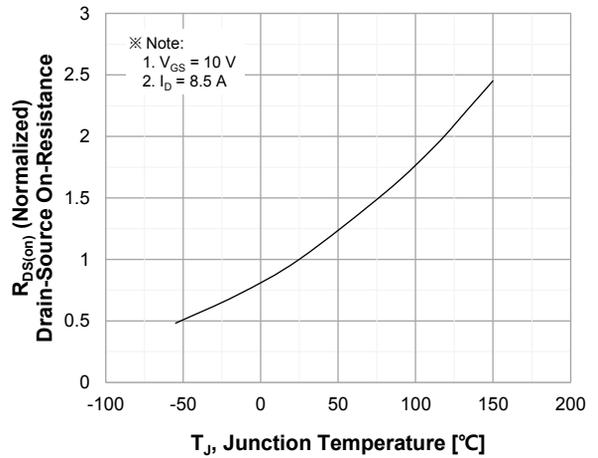


Figure 9. Maximum Safe Operating Area

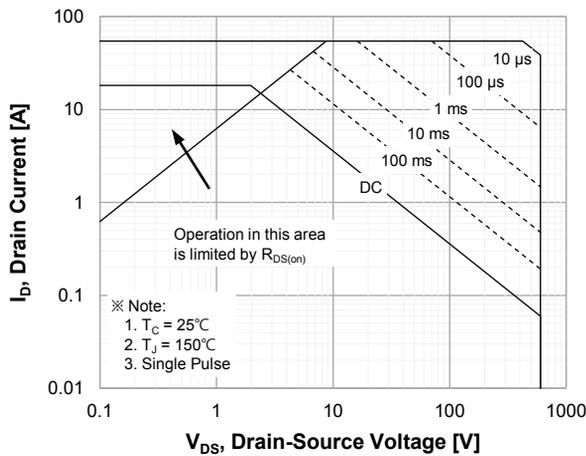


Figure 10. Maximum Drain Current vs. Case Temperature

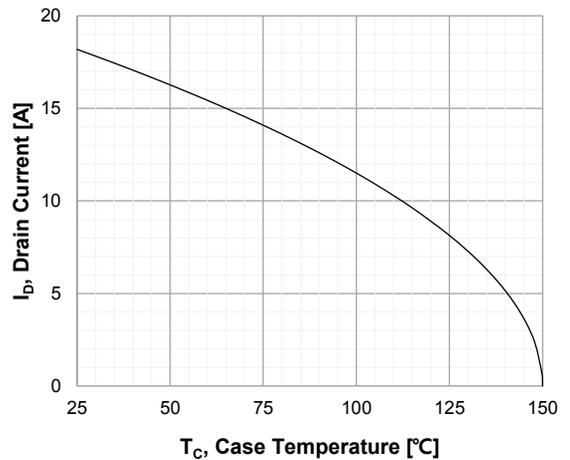


Figure 11. E_oss vs. Drain to Source Voltage

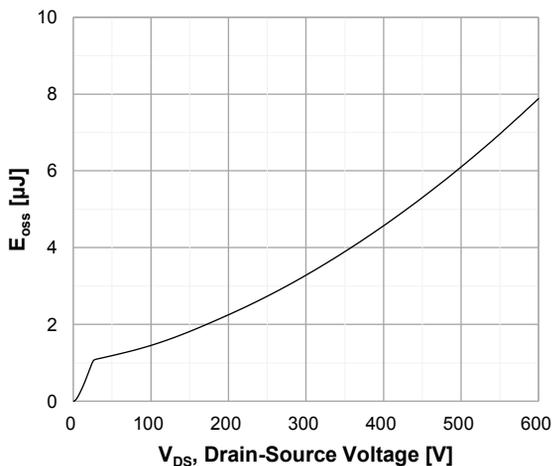
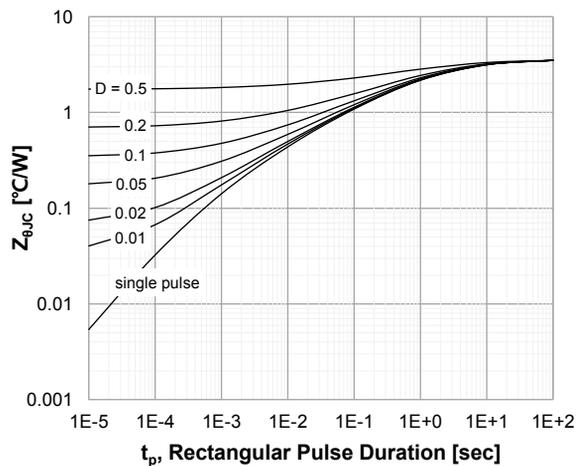


Figure 12. Transient Thermal Response Curve



Test Circuits

Figure 13. Inductive Load Switching Test Circuit and Waveforms

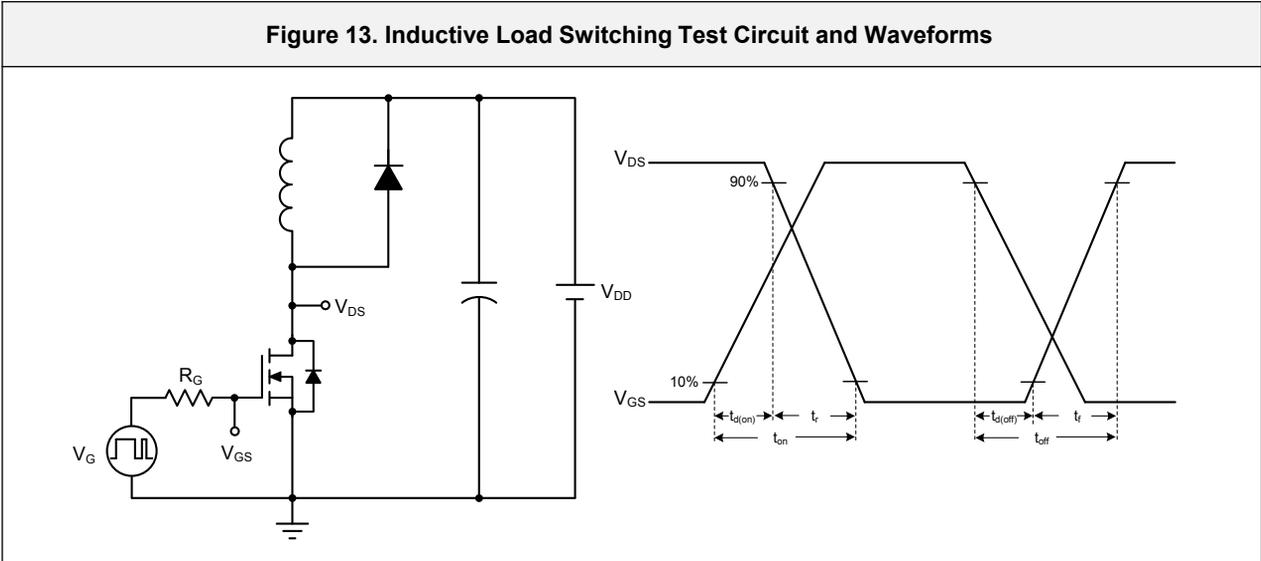


Figure 14. Unclamped Inductive Switching Test Circuit and Waveforms

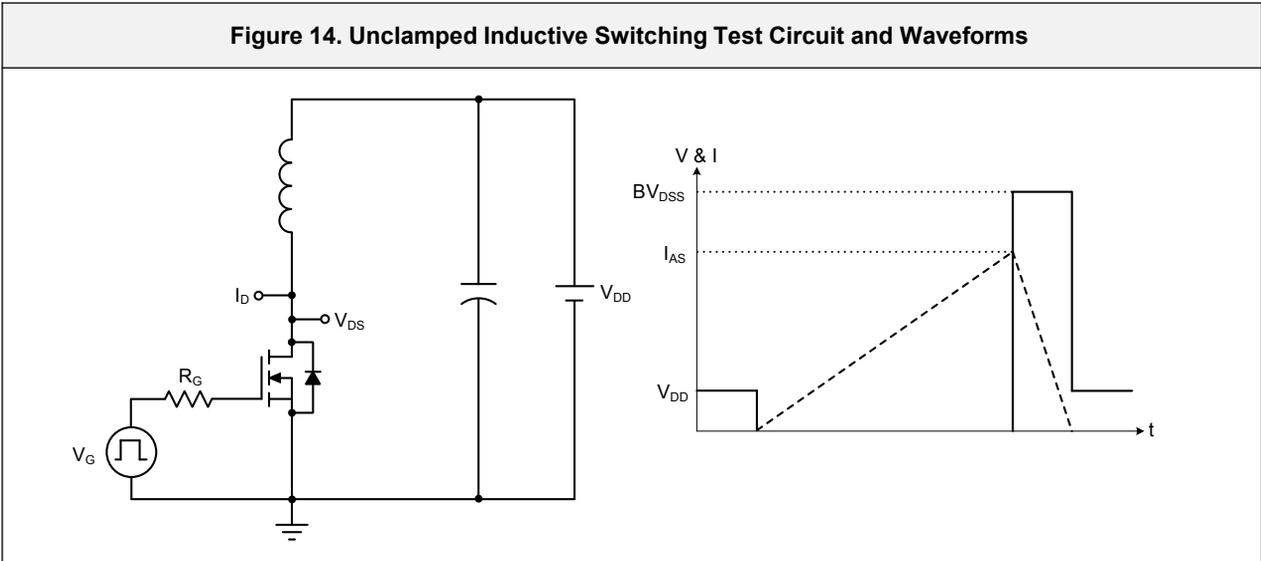
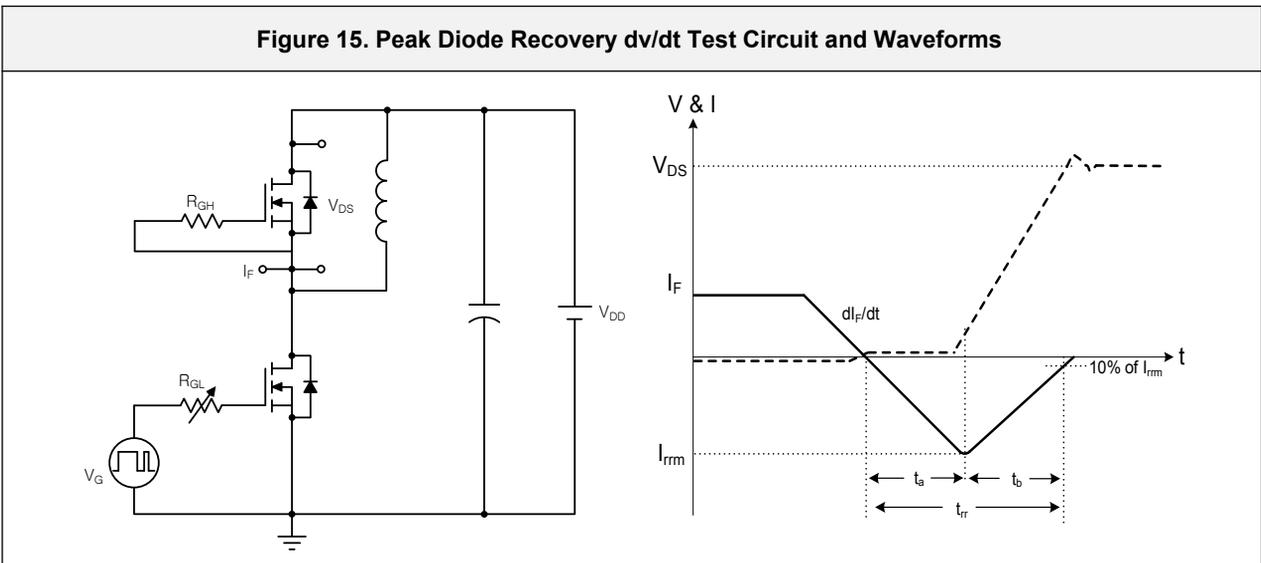
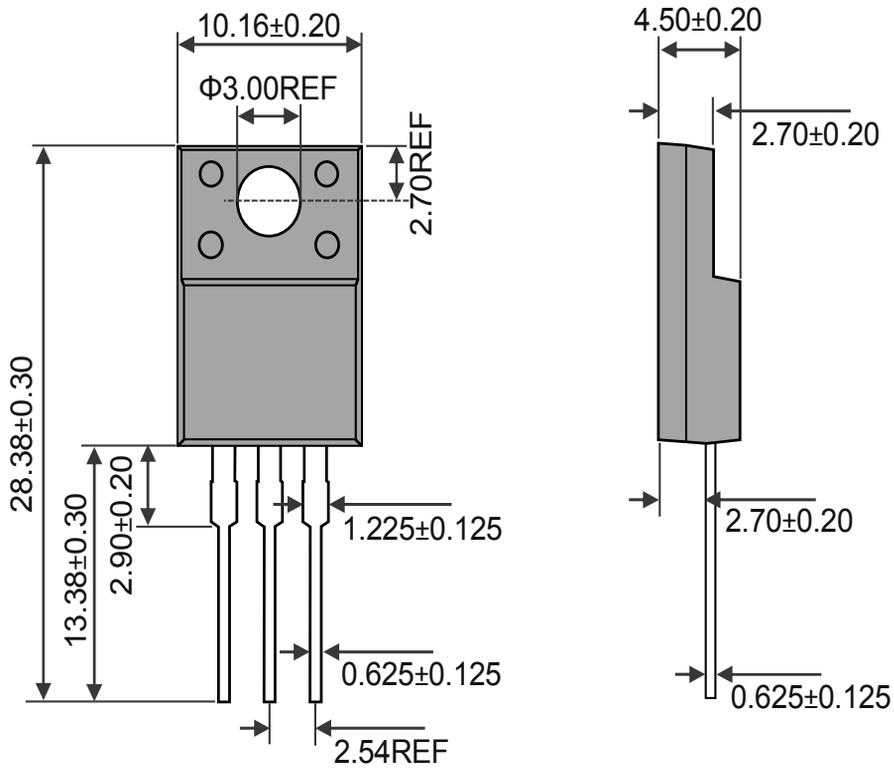


Figure 15. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

ITO-220AB



ITO-220AB
Unit:mm



DISCLAIMER

1. Above specification may be changed without notice. MHCHXM will reserve authority on material change for above specification.
2. The graphs shown in this datasheet are representing typical data only and do not show guaranteed values.
3. When using this product, please observe the absolute maximum ratings and the instructions for use outlined in these specification sheets. MHCHXM assumes no responsibility for any damage resulting from use of the product which does not comply with the absolute maximum ratings and the instructions included in these specification sheets.
4. These specification sheets include materials protected under copyright of MHCHXM. Reproduction in any form is prohibited without the specific consent of MHCHXM.
5. This product is not intended to be used for military, aircraft, automotive, medical, life sustaining or life saving applications or any other application which can result in human injury or death. Please contact authorized MHCHXM sales agent for special application request.
6. Statements regarding the suitability of products for certain types of applications are based on MHCHXM's knowledge of typical requirements that are often placed on MHCHXM products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify MHCHXM's terms and conditions of purchase, including but not limited to the warranty expressed therein.
7. This publication supersedes & replaces all information previously supplied. For additional application information, please visit our website <http://www.jshxm.com> , or consult your nearest MHCHXM's sales office for further assistance.

