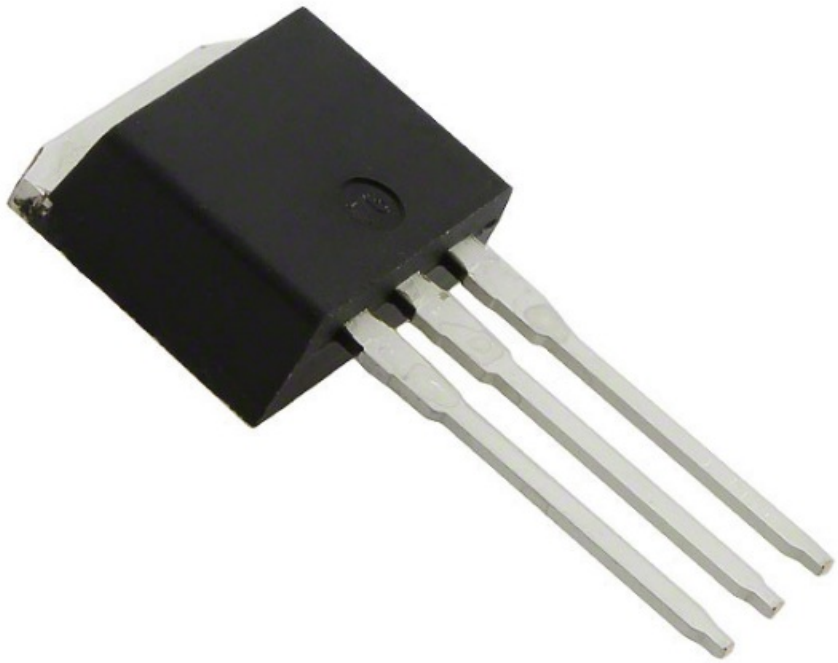
IRFBC40 Vishay Siliconix Discrete Owner's Manual

Contents

IRFBC40 Vishay Siliconix Discrete



Specifications

- **Brand**: Vishay Siliconix
- **Model**: IRFBC40
- **Type**: Power MOSFET
- **Package Type**: TO-220AB
- **Channel Type:** N-Channel
- **Drain-Source Voltage (VDS)**: 600V
- **On-Resistance (RDS(on)):** 1.2Ω
- **Total Gate Charge (Qg max.):** 60nC
- **Gate-Source Charge (Qgs):** 8.3nC
- **Gate-Drain Charge (Qgd)**: 30nC

Description
Third-generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance, and cost-effectiveness. The TO-220AB package is widely used in commercial-industrial applications due to its low thermal resistance and cost.

Ordering Information

- **Lead (Pb)-free:** IRFBC40PbF
- **Lead (Pb)-free and halogen-free:** IRFBC40PbF-BE3

Thermal Resistance Ratings

- Maximum Junction-to-Ambient: 62°C/W
- Case-to-sink, flat, greased surface: 1.0°C/W
- Maximum Junction-to-Case (Drain): 0.50°C/W

Product Usage Instructions

1. **Mounting:** Use a 6-32 or M3 screw for mounting the device with the specified torque.
2. **Operating Temperature:** Ensure the operating temperature range is between -55°C to +150°C.
3. **Soldering:** Follow the soldering recommendations with a peak temperature not exceeding the specified value for 10 seconds.

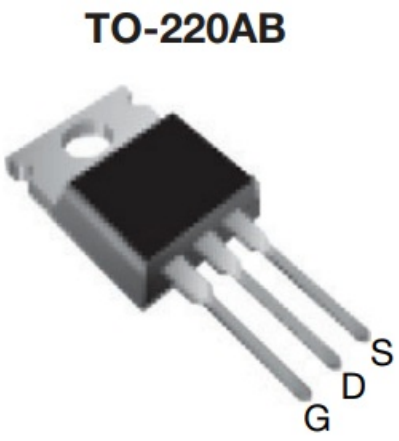
FEATURES

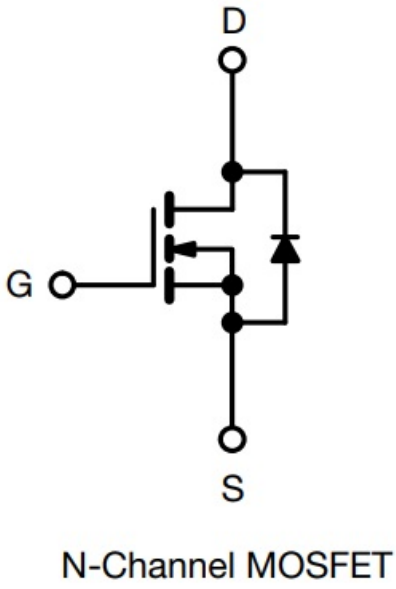
- Dynamic dV/dt rating
- Repetitive avalanche rated
- Fast switching
- Ease of paralleling
- Simple drive requirements
- Material categorization: for definitions of compliance please see **www.vishay.com/doc?99912**

Note
This datasheet provides information about parts that are RoHS-compliant and / or parts that are non-RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information/tables in this datasheet for details

DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.The TO-220AB package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 W. The low thermal resistance and low package cost of the TO-220AB contribute to its wide acceptance throughout the industry.





N-Channel MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	600	
RDS(on) (W)	V_{GS} = 10 V	1.2
Q_g max. (nC)	60	
Q_{gs} (nC)	8.3	
Q_{gd} (nC)	30	
Configuration	Single	

ORDERING INFORMATION	
Package	TO-220AB
Lead (Pb)-free	IRFBC40PbF
Lead (Pb)-free and halogen-free	IRFBC40PbF-BE3

	ORDERING INFORMATION		
	Package	TO-220AB	
	Lead (Pb)-free	IRFBC40PbF	
	Lead (Pb)-free and halogen-free	IRFBC40PbF-BE3	

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)

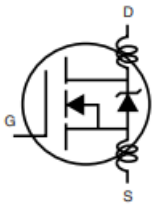
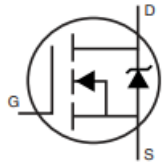
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-source voltage			VDS	600	V
Gate-source voltage			VGS	± 20	
Continuous drain current	V_{GS} at 10 V	T_C = 25 °C	I_D	6.2	A
		T_C = 100 °C		3.9	
Pulsed drain current a			IDM	25	
Linear derating factor				1.0	W/°C
Single pulse avalanche energy b			EAS	570	mJ
Repetitive avalanche current a			IAR	6.2	A
Repetitive avalanche energy a			EAR	13	mJ
Maximum power dissipation	T_C = 25 °C		P_D	125	W
Peak diode recovery dV/dt c			dV/dt	3.0	V/ns
Operating junction and storage temperature range			TJ, Tstg	-55 to +150	°C
Soldering recommendations (peak temperature) d	For 10 s			300	
Mounting torque	6-32 or M3 screw			10	lbf · in
				1.1	N · m

Notes

1. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
2. VDD = 50 V, starting TJ = 25 °C, L = 27 mH, Rg = 25 Ω, IAS = 6.2 A (see fig. 12)
3. ISD ≤ 6.2 A, dI/dt ≤ 80 A/μs, VDD ≤ VDS, TJ ≤ 150 °C
4. 1.6 mm from the case

THERMAL RESISTANCE RATINGS				
PARAMETER	**SYMBOL**	**TYP.**	**MAX.**	**UNIT**
Maximum junction-to-ambient	RthJA	–	62	°C/W
Case-to-sink, flat, greased surface	RthCS	0.50	–	
Maximum junction-to-case (drain)	RthJC	–	1.0	

SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static							
Drain-source breakdown voltage	VDS	V_{GS} = 0 V, I_D = 250 µA		600	–	–	V
V_{DS} temperature coefficient	DV_{DS}/T_J	Reference to 25 °C, I_D = 1 mA		–	0.7	–	V/°C
Gate-source threshold voltage	VGS(th)	V_{DS} = V_{GS}, I_D = 250 µA		2.0	–	4.0	V
Gate-source leakage	IGSS	V_{GS} = ± 20 V		–	–	± 100	nA
Zero gate voltage drain current	IDSS	V_{DS} = 600 V, V_{GS} = 0 V		–	–	100	µA
		V_{DS} = 480 V, V_{GS} = 0 V, T_J = 125 °C		–	–	500	
Drain-source on-state resistance	RDS(on)	V_{GS} = 10 V	I_D = 3.7A b	–	–	1.2	W
Forward transconductance	gfs	V_{DS} = 100 V, I_D = 3.7 A b		4.7	–	–	S
Dynamic							
Input capacitance	Ciss	V_{GS} = 0 V, V_{DS} = 25 V, f = 1.0 MHz, see fig. 5		–	1300	–	pF
Output capacitance	Coss			–	160	–	
Reverse transfer capacitance	Crss			–	30	–	
Total gate charge	Q_g	V_{GS} = 10 V	I_D = 6.2 A, V_{DS} = 360 V, see fig. 6 and 13 b	–	–	60	nC
Gate-source charge	Qgs			–	–	8.3	
Gate-drain charge	Qgd			–	–	30	
Turn-on delay time	td(on)	V_{DD} = 300 V, I_D = 6.2 A, R_g = 9.1 W, R_D = 47 W, see fig. 10 b		–	13	–	ns
Rise time	t_r			–	18	–	
Turn-off delay time	td(off)			–	55	–	
Fall time	t_f			–	20	–	
Gate input resistance	R_g	f = 1 MHz, open drain		0.3	–	3.9	W

Internal drain inductance	L_D	Between lead, D 6 mm (0.25″) from package and center of G die contact 	–	4.5	–	nH
Internal source inductance	L_S		–	7.5	–	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	MOSFET symbol D showing the integral reverse G p – n junction diode 	–	–	6.2	A
Pulsed diode forward current a	ISM		–	–	25	
Body diode voltage	VSD	T_J = 25 °C, I_S = 6.2 A, V_{GS} = 0 V b	–	–	1.5	V
Body diode reverse recovery time	trr	T_J = 25 °C, I_F = 6.2 A, dI/dt = 100 A/µs b	–	450	940	ns
Body diode reverse recovery charge	Qrr		–	3.8	7.9	µC
Forward turn-on time	ton	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)				

Notes

1. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
2. Pulse width ≤ 300 µs; duty cycle ≤ 2 %

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

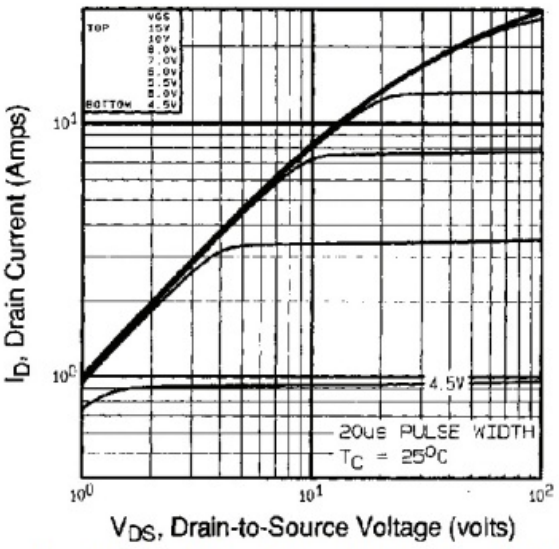


Fig. 1 - Typical Output Characteristics, T_C = 25 °C

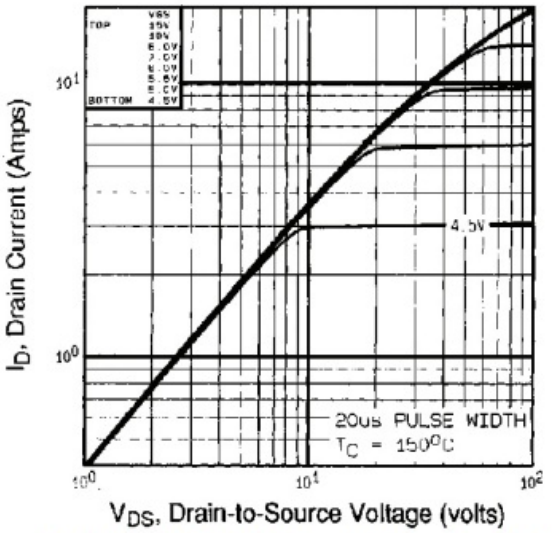


Fig. 2 - Typical Output Characteristics, T_C = 150 °C

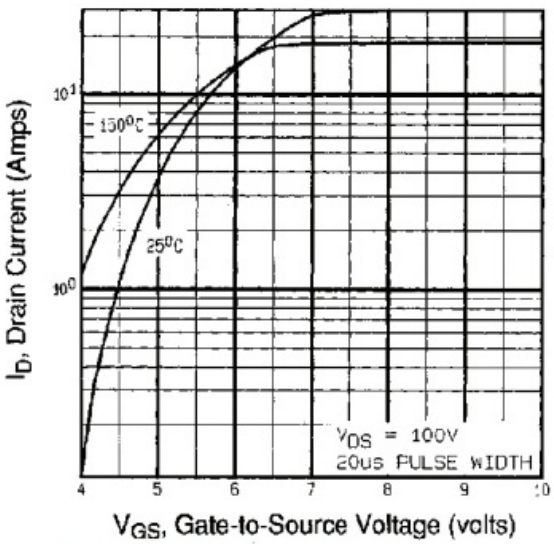


Fig. 3 - Typical Transfer Characteristics

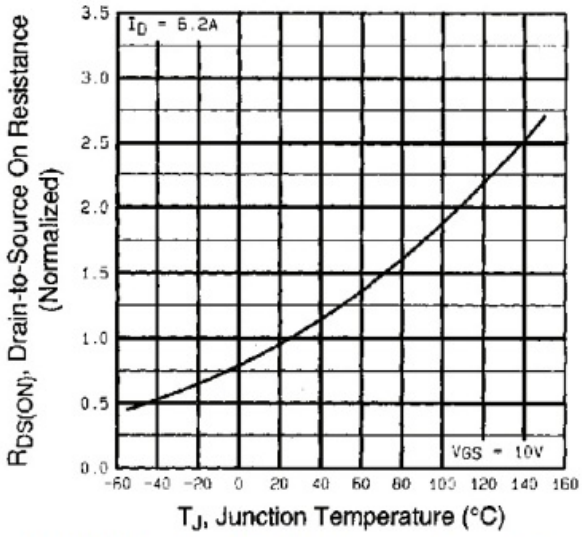


Fig. 4 - Normalized On-Resistance vs. Temperature

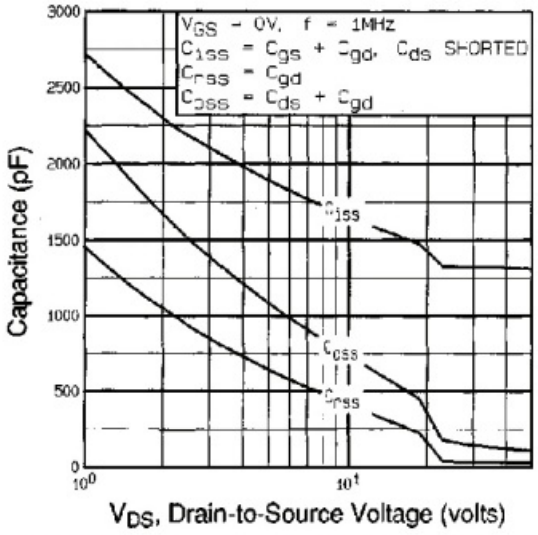


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

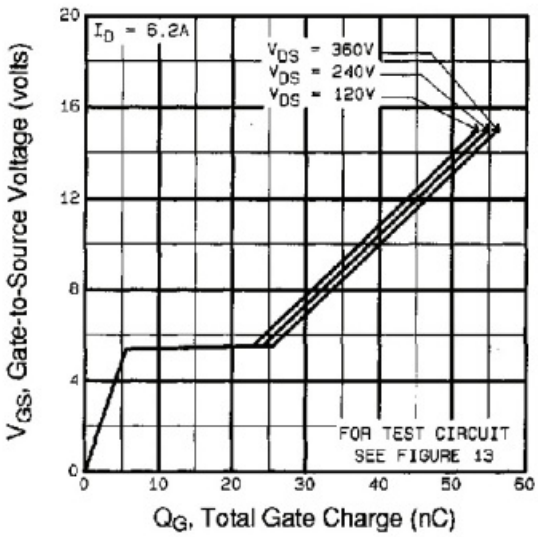


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

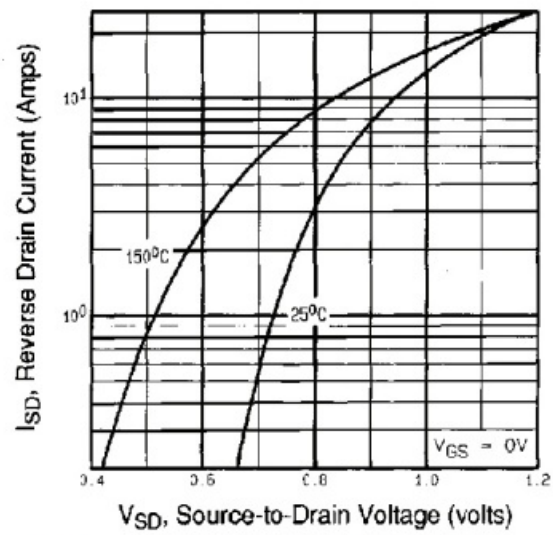


Fig. 7 - Typical Source-Drain Diode Forward Voltage

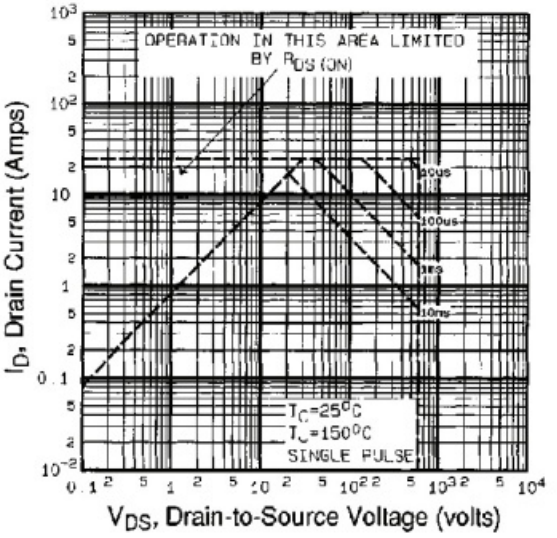


Fig. 8 - Maximum Safe Operating Area

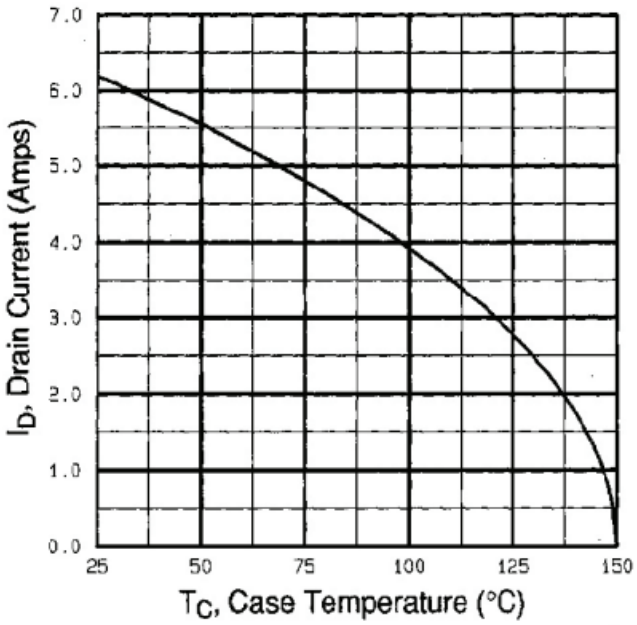


Fig. 9 - Maximum Drain Current vs. Case Temperature

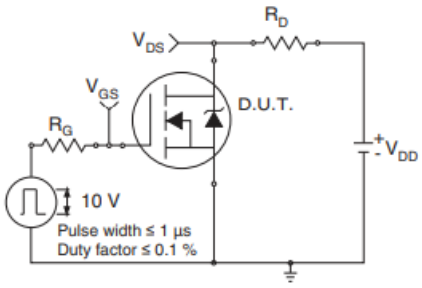


Fig. 10a - Switching Time Test Circuit

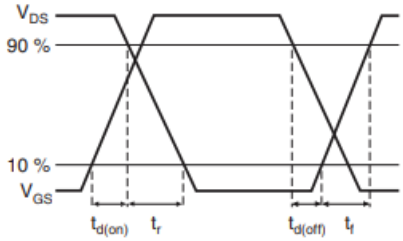


Fig. 10b - Switching Time Waveforms

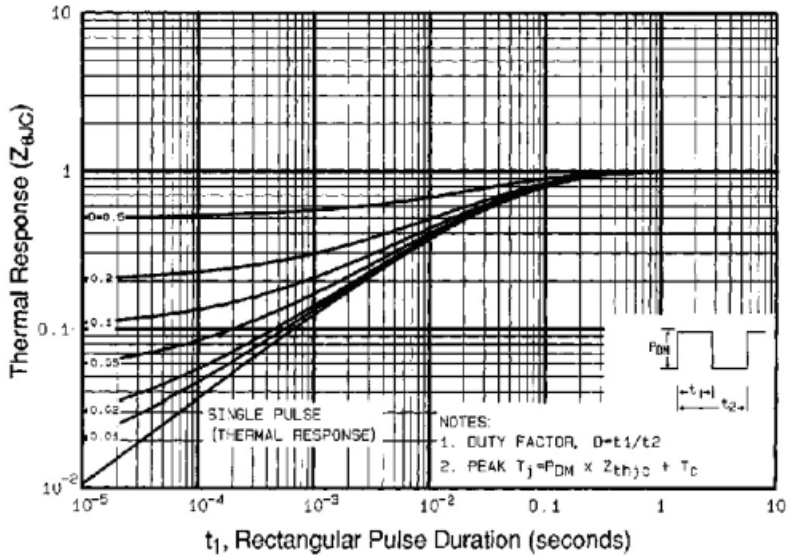


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Case

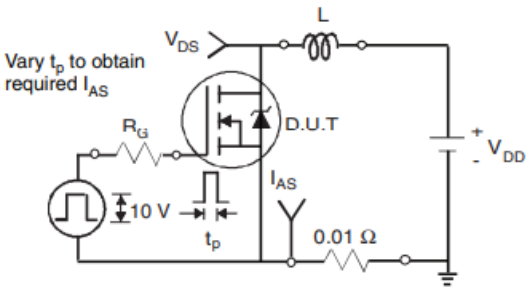


Fig. 12a - Unclamped Inductive Test Circuit

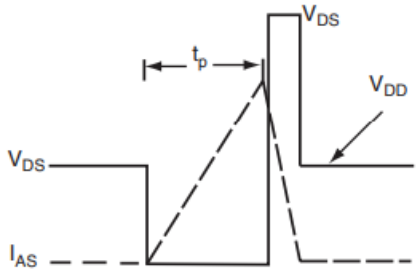


Fig. 12b - Unclamped Inductive Waveforms

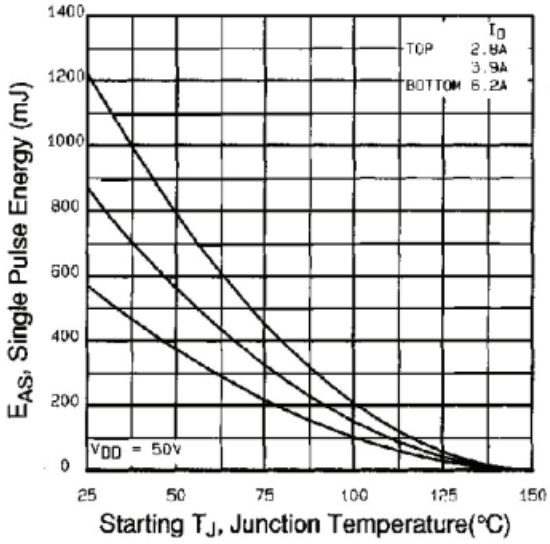


Fig. 12c - Maximum Avalanche Energy vs. Drain Current

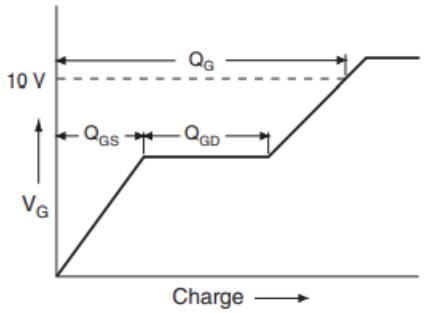


Fig. 13a - Basic Gate Charge Waveform

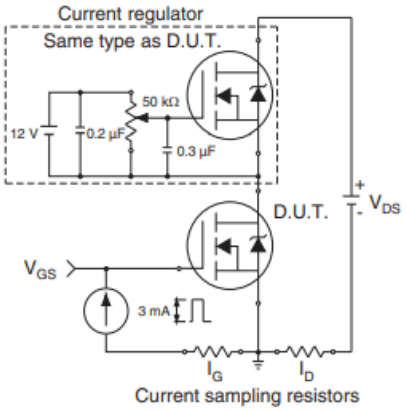


Fig. 13b - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit

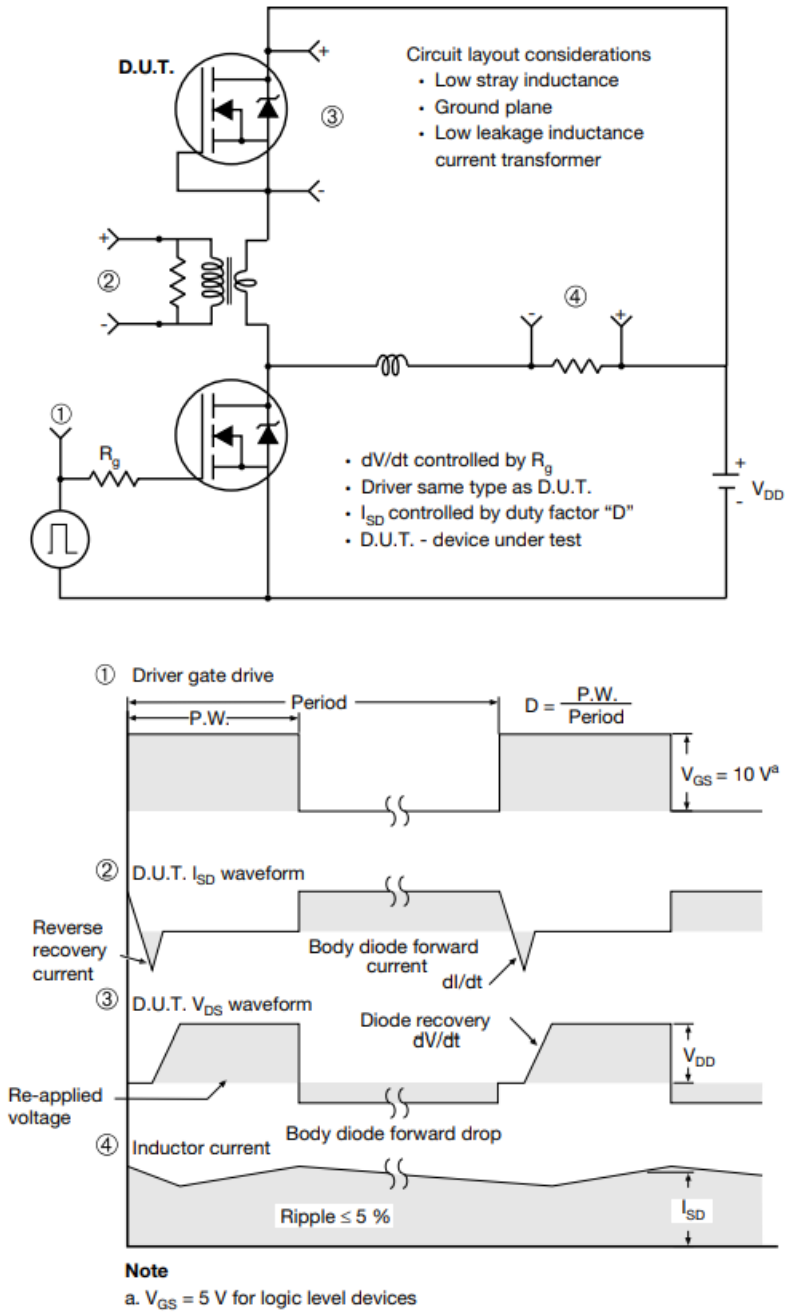


Fig. 14 - For N-Channel

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon

Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?91115.

- **To the maximum extent permitted by applicable law, Vishay disclaims**
    1. any and all liability arising out of the application or use of any product,
    2. any and all liability, including without limitation special, consequential or incidental damages, and
    3. any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.
- Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay 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 Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.
- Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

For technical questions, contact:
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT **www.vishay.com/doc?91000**

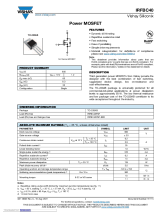
FAQ

Is this product RoHS-compliant?
This datasheet provides information on RoHS-compliant and non-RoHS-compliant parts. Please refer to the datasheet for specific details.

What is the maximum drain-source voltage?
The maximum drain-source voltage is 600V.

What is the package type of this MOSFET?
The package type is TO-220AB.

Documents / Resources

	VISHAY IRFBC40 Vishay Siliconix Discrete [pdf] Owner's Manual IRFBC40, IRFBC40PbF, IRFBC40PbF-BE3, IRFBC40 Vishay Siliconix Discrete, IRFBC40, Vishay Siliconix Discrete, Siliconix, Discrete

References

- Vishay Intertechnology: Passives & Discrete Semiconductors
- User Manual