

# 2SK3140

Silicon N Channel MOS FET  
High Speed Power Switching

# HITACHI

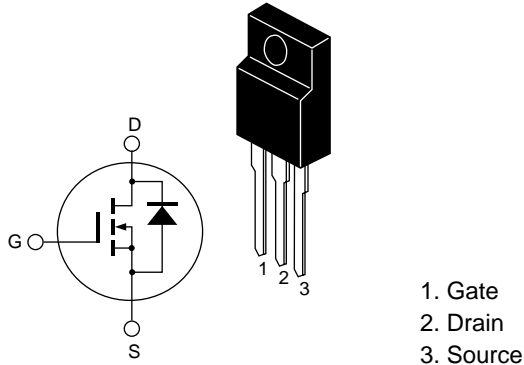
ADE-208-767C (Z)  
4th. Edition  
February 1999

## Features

- Low on-resistance  
 $R_{DS(on)} = 6 \text{ m}\Omega$  typ.
- Low drive current
- 4 V gate drive device can be driven from 5 V source

## Outline

TO-220CFM



**Absolute Maximum Ratings** ( $T_a = 25^\circ\text{C}$ )

<b>Item</b>	<b>Symbol</b>	<b>Ratings</b>	<b>Unit</b>
Drain to source voltage	$V_{DSS}$	60	V
Gate to source voltage	$V_{GSS}$	$\pm 20$	V
Drain current	$I_D$	60	A
Drain peak current	$I_{D(\text{pulse})}$ <sup>Note 1</sup>	240	A
Body-drain diode reverse drain current	$I_{DR}$	60	A
Avalanche current	$I_{AP}$ <sup>Note 3</sup>	50	A
Avalanche energy	$E_{AR}$ <sup>Note 3</sup>	214	mJ
Channel dissipation	$P_{ch}$ <sup>Note 2</sup>	35	W
Channel temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

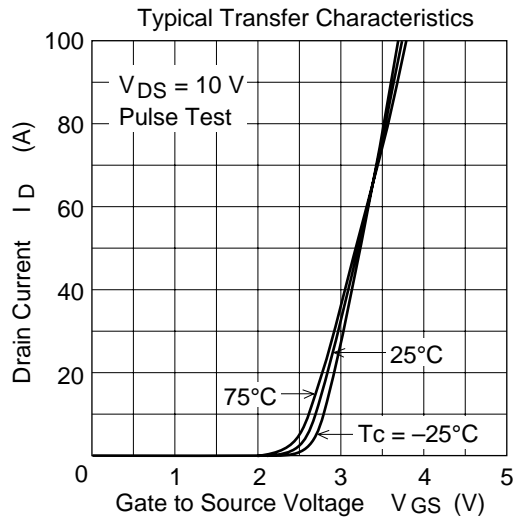
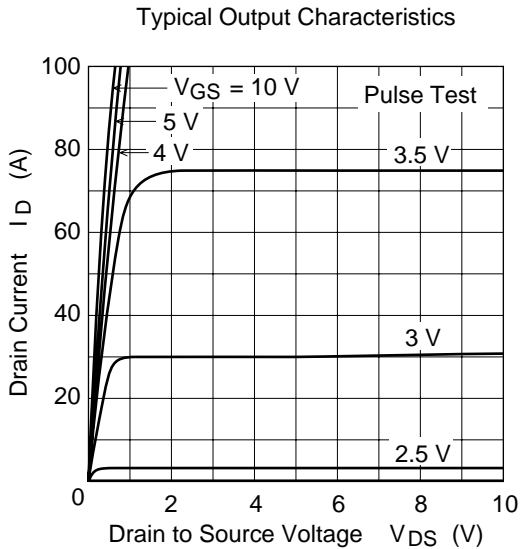
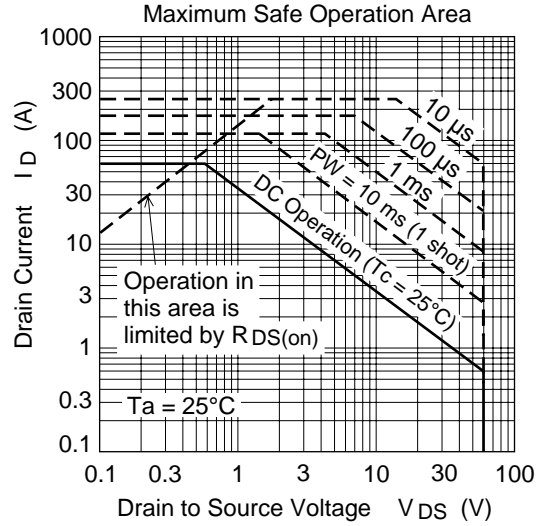
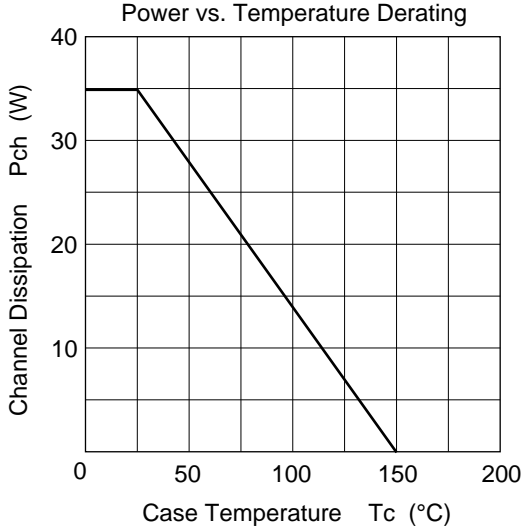
- Note: 1.  $PW \leq 10 \mu\text{s}$ , duty cycle  $\leq 1\%$   
2. Value at  $T_c = 25^\circ\text{C}$   
3. Value at  $T_{ch} = 25^\circ\text{C}$ ,  $R_g \geq 50 \Omega$

## Electrical Characteristics (Ta = 25°C)

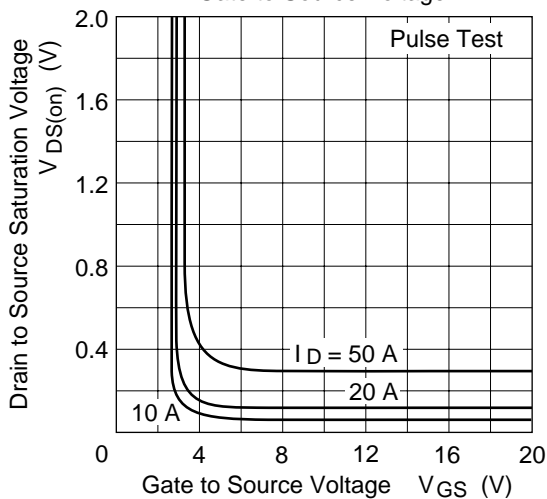
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	$I_D = 10 \text{ mA}$ , $V_{GS} = 0$
Gate to source leak current	$I_{GSS}$	—	—	$\pm 0.1$	$\mu\text{A}$	$V_{GS} = \pm 20 \text{ V}$ , $V_{DS} = 0$
Zero gate voltage drain current	$I_{DSS}$	—	—	10	$\mu\text{A}$	$V_{DS} = 60 \text{ V}$ , $V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.5	V	$I_D = 1 \text{ mA}$ , $V_{DS} = 10 \text{ V}$ <sup>Note 1</sup>
Static drain to source on state resistance	$R_{DS(on)}$	—	6.0	7.5	$\text{m}\Omega$	$I_D = 30 \text{ A}$ , $V_{GS} = 10 \text{ V}$ <sup>Note 1</sup>
		—	8.0	12	$\text{m}\Omega$	$I_D = 30 \text{ A}$ , $V_{GS} = 4 \text{ V}$ <sup>Note 1</sup>
Forward transfer admittance	$ y_{fs} $	45	75	—	S	$I_D = 30 \text{ A}$ , $V_{DS} = 10 \text{ V}$ <sup>Note 1</sup>
Input capacitance	$C_{iss}$	—	7100	—	pF	$V_{DS} = 10 \text{ V}$
Output capacitance	$C_{oss}$	—	1000	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	$C_{rss}$	—	280	—	pF	$f = 1 \text{ MHz}$
Total gate charge	$Q_g$	—	125	—	nc	$V_{DD} = 25 \text{ V}$
Gate to source charge	$Q_{gs}$	—	25	—	nc	$V_{GS} = 10 \text{ V}$
Gate to drain charge	$Q_{gd}$	—	25	—	nc	$I_D = 60 \text{ A}$
Turn-on delay time	$t_{d(on)}$	—	60	—	ns	$V_{GS} = 10 \text{ V}$ , $I_D = 30 \text{ A}$
Rise time	$t_r$	—	250	—	ns	$R_L = 1 \Omega$
Turn-off delay time	$t_{d(off)}$	—	540	—	ns	
Fall time	$t_f$	—	320	—	ns	
Body-drain diode forward voltage	$V_{DF}$	—	1.0	—	V	$I_F = 60 \text{ A}$ , $V_{GS} = 0$
Body-drain diode reverse recovery time	$t_{rr}$	—	80	—	ns	$I_F = 60 \text{ A}$ , $V_{GS} = 0$ $diF/dt = 50 \text{ A}/\mu\text{s}$

Note: 1. Pulse test

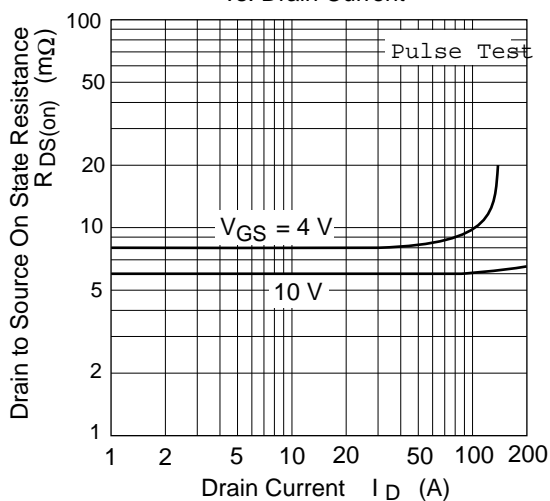
Main Characteristics



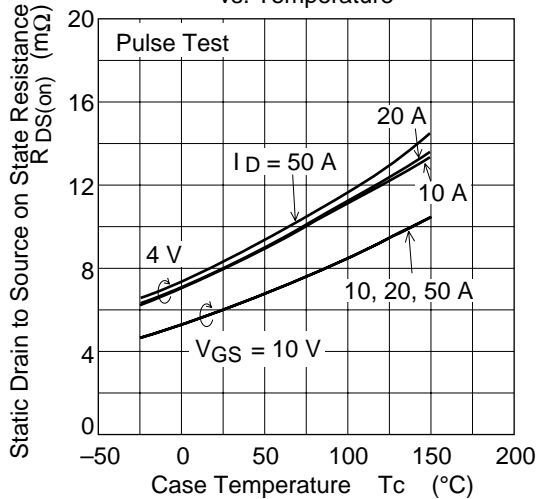
Drain to Source Saturation Voltage vs. Gate to Source Voltage



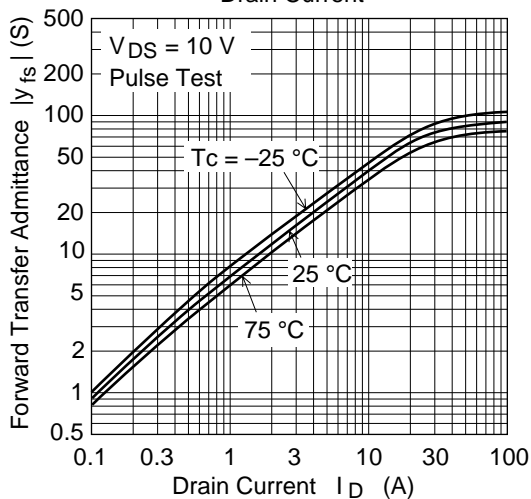
Static Drain to Source on State Resistance vs. Drain Current



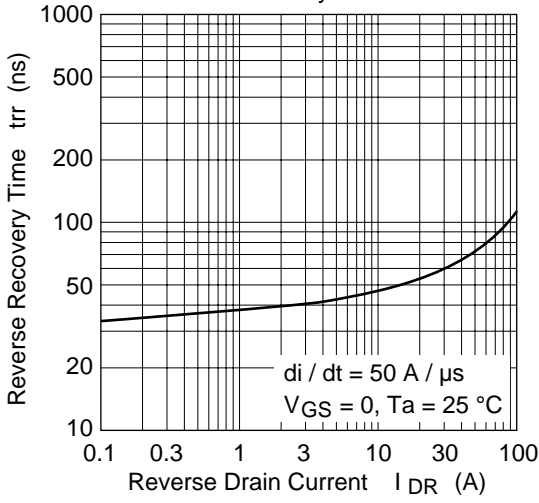
Static Drain to Source on State Resistance vs. Temperature



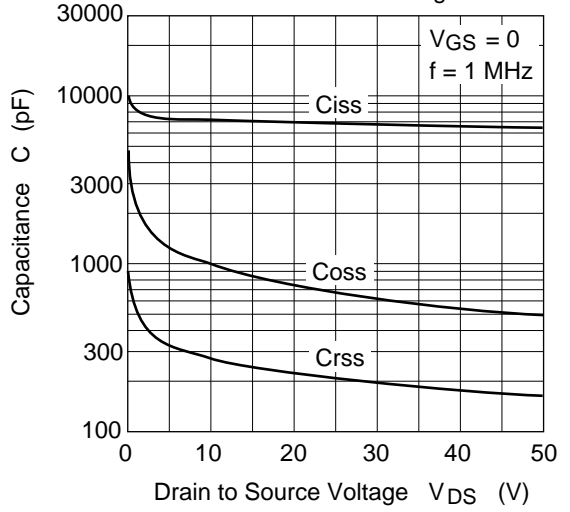
Forward Transfer Admittance vs. Drain Current



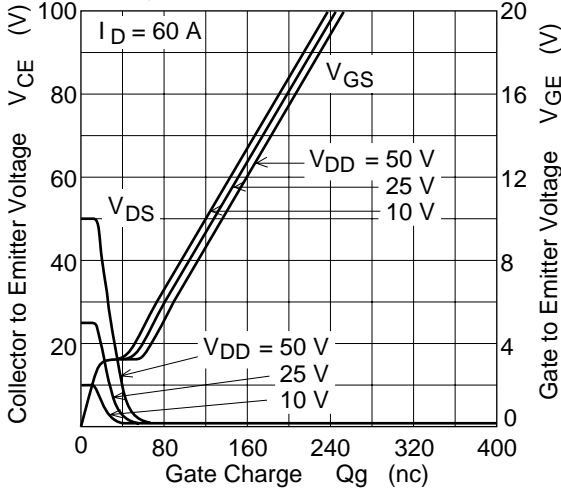
Body-Drain Diode Reverse Recovery Time



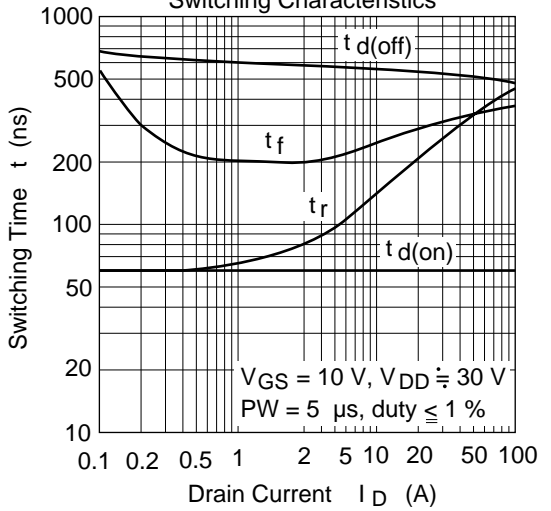
Typical Capacitance vs. Drain to Source Voltage

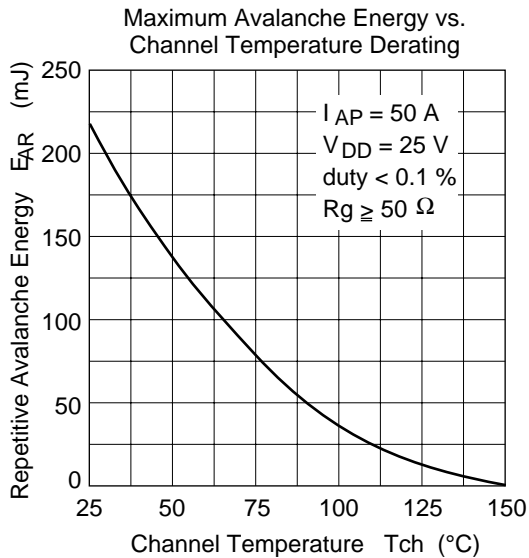
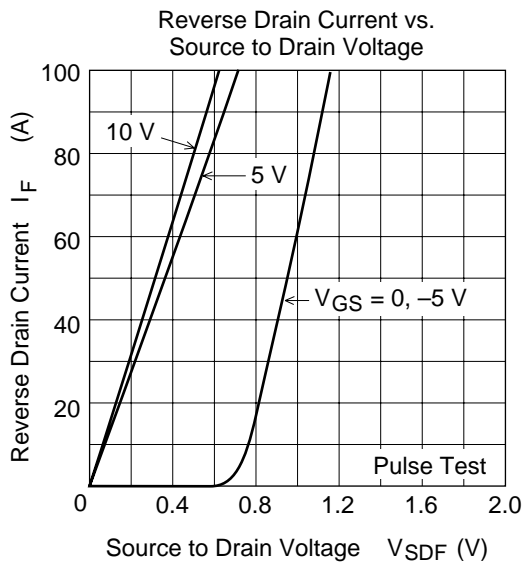


Dynamic Input Characteristics

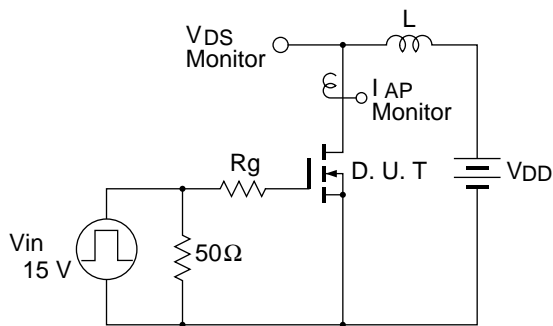


Switching Characteristics



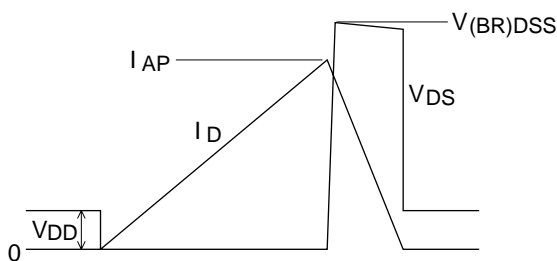


Avalanche Test Circuit

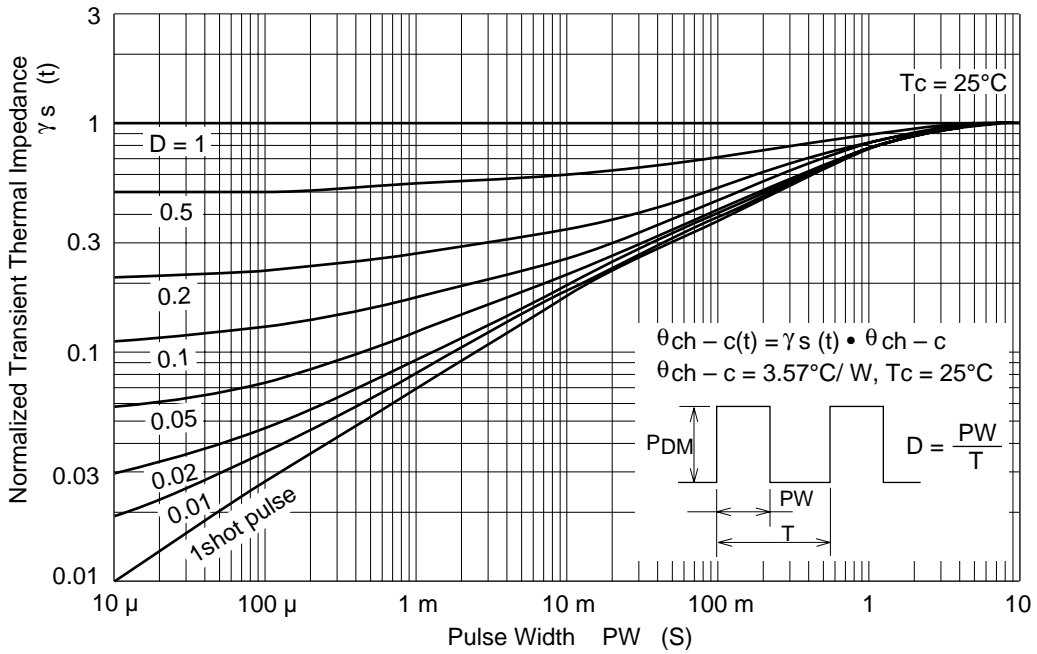


Avalanche Waveform

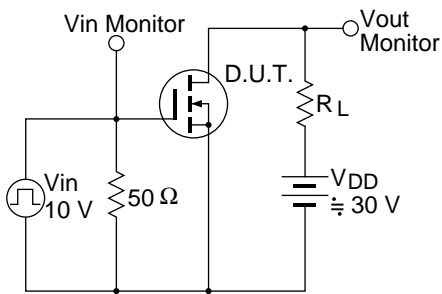
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP}^2 \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



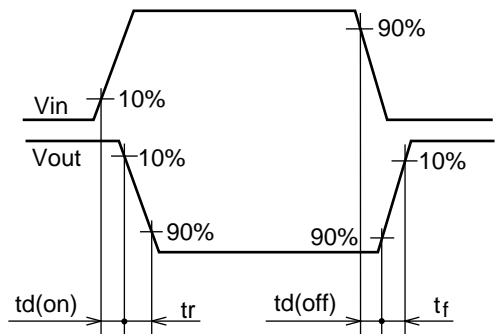
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit



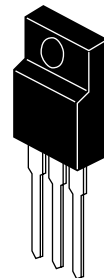
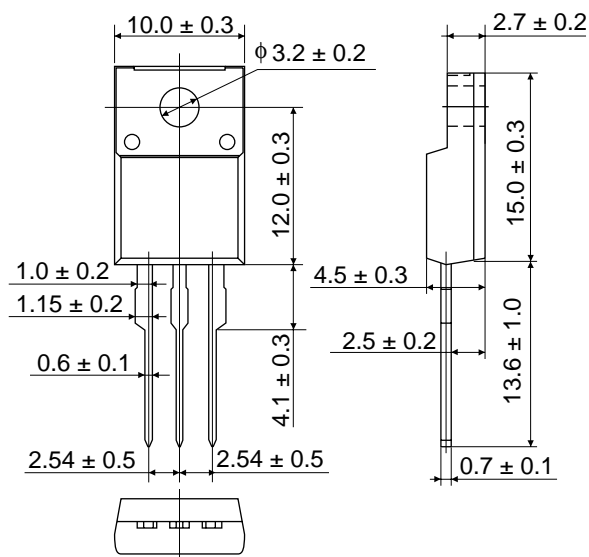
Waveform





## Package Dimensions

Unit: mm



Hitachi Code	TO-220CFM
EIAJ	—
JEDEC	—

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