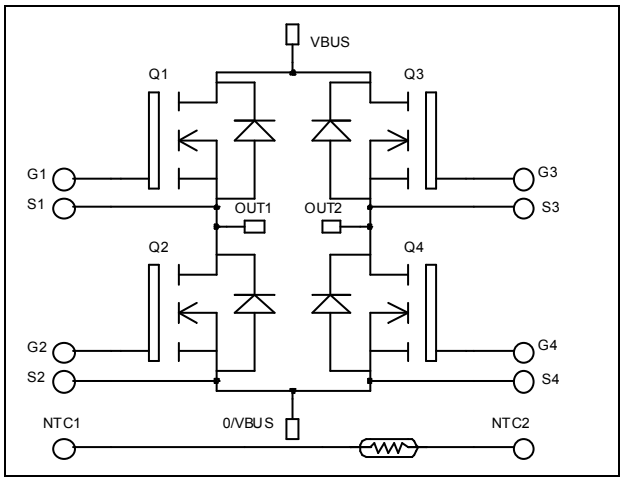
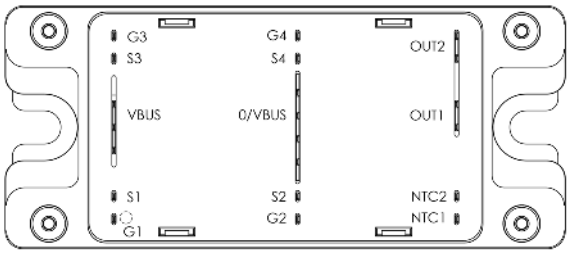
APTM20HM20FTG

Full - Bridge MOSFET Power Module

V_{DSS} = 200V
R_{DSon} = 20mΩ typ @ Tj = 25°C
I_D = 89A @ Tc = 25°C





Application

- Welding converters
- Switched Mode Power Supplies
- Uninterruptible Power Supplies

Features

- Power MOS 7® FREDFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic reverse diode
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
- Lead frames for power connections
- Internal thermistor for temperature monitoring
- High level of integration

Benefits

- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Solderable terminals both for power and signal for easy PCB mounting
- Low profile
- RoHS Compliant

Absolute maximum ratings

Symbol	*Parameter*		*Max ratings*	*Unit*
V_{DSS}	Drain - Source Voltage		200	V
I_D	Continuous Drain Current	T_c = 25°C	89	A
		T_c = 80°C	66	
I_{DM}	Pulsed Drain current		356	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		24	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	357	W
I_{AR}	Avalanche current (repetitive and non repetitive)		89	A
E_{AR}	Repetitive Avalanche Energy		50	mJ
E_{AS}	Single Pulse Avalanche Energy		2500	

CAUTION: These Devices are sensitive to Electrostatic Discharge. Proper Handling Procedures Should Be Followed. See application note APT0502 on www.microsemi.com

All ratings @ T_j = 25°C unless otherwise specified

Electrical Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
BV_{DSS}	Drain - Source Breakdown Voltage	V_{GS} = 0V, I_D = 250µA		200			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{GS} = 0V, V_{DS} = 200V	T_j = 25°C			250	µA
		V_{GS} = 0V, V_{DS} = 160V	T_j = 125°C			1000	
$R_{DS(on)}$	Drain – Source on Resistance	V_{GS} = 10V, I_D = 44.5A			20	24	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 2.5mA		3		5	V
I_{GSS}	Gate – Source Leakage Current	V_{GS} = ±30 V, V_{DS} = 0V				±100	nA

Dynamic Characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
C_{iss}	Input Capacitance	V_{GS} = 0V V_{DS} = 25V f = 1MHz			6850		pF
C_{oss}	Output Capacitance				2180		
C_{rss}	Reverse Transfer Capacitance				97		
Q_g	Total gate Charge	V_{GS} = 10V V_{Bus} = 100V I_D = 75A			112		nC
Q_{gs}	Gate – Source Charge				43		
Q_{gd}	Gate – Drain Charge				47		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** V_{GS} = 15V V_{Bus} = 133V I_D = 75A R_G = 5Ω			28		ns
T_r	Rise Time				56		
$T_{d(off)}$	Turn-off Delay Time				81		
T_f	Fall Time				99		
E_{off}	Turn-off Switching Energy	V_{GS} = 15V V_{Bus} = 133V I_D = 75A R_G = 5Ω	T_j = 25°C		455		µJ
E_{off}	Turn-off Switching Energy		T_j = 125°C		531		µJ

Source - Drain diode ratings and characteristics

Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			89	A
			Tc = 80°C			66	
V_{SD}	Diode Forward Voltage	V_{GS} = 0V, I_S = - 75A				1.3	V
dv/dt	Peak Diode Recovery ❶					8	V/ns
t_{rr}	Reverse Recovery Time	I_S = - 75A V_R = 133V di_S/dt = 100A/µs	T_j = 25°C			220	ns
			T_j = 125°C			420	
Q_{rr}	Reverse Recovery Charge		T_j = 25°C		1.07		µC
			T_j = 125°C		2.9		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \le$ - 75A di/dt ≤ 700A/µs $V_R \le V_{DSS}$ $T_j \le$ 150°C

Thermal and package characteristics

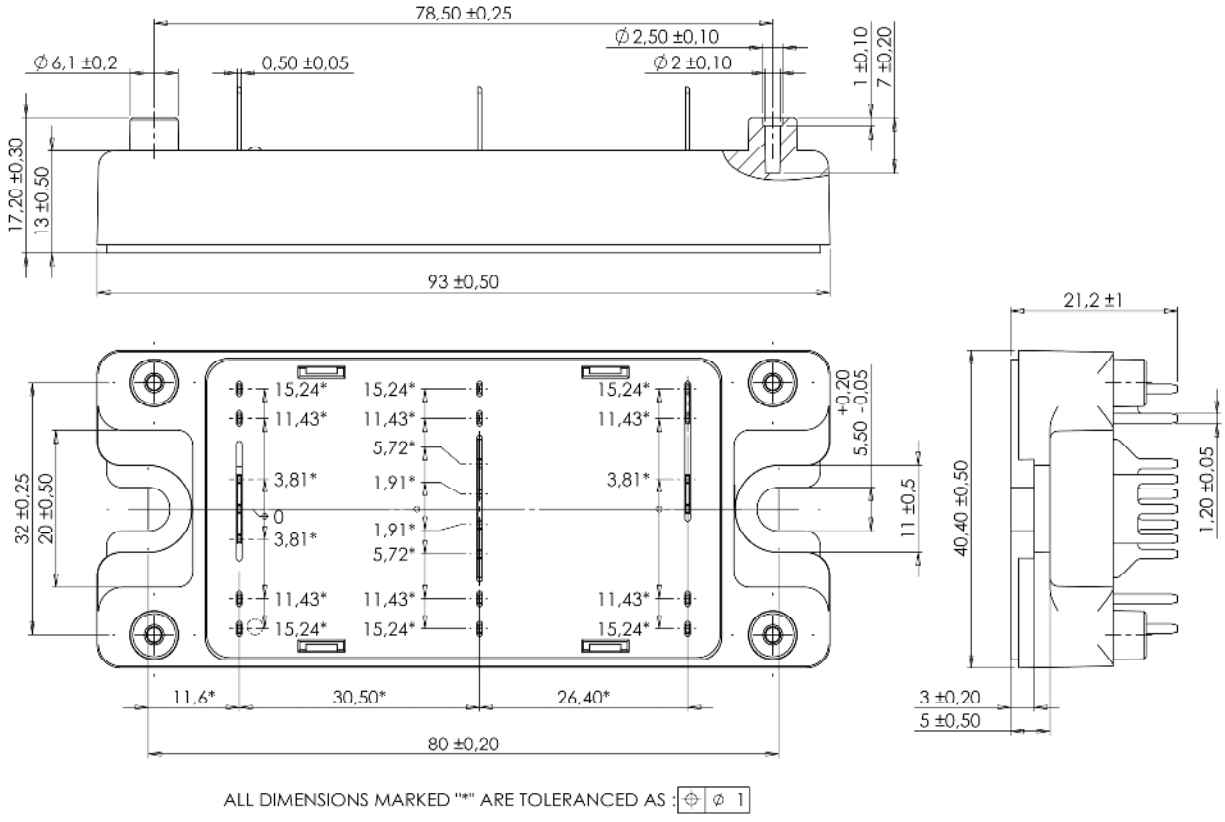
Symbol	Characteristic			Min	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance				0.35	°C/W
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, 50/60Hz			4000		V
T_J	Operating junction temperature range			-40	150	°C
T_{JOP}	Recommended junction temperature under switching conditions			-40	$T_J$max -25	
T_{STG}	Storage Temperature Range			-40	125	
T_C	Operating Case Temperature			-40	100	
Torque	Mounting torque	To Heatsink	M5	2.5	4.7	N.m
Wt	Package Weight				160	g

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance @ 25°C			50		kΩ
$\Delta R_{25}/R_{25}$				5		%
$B_{25/85}$	T_{25} = 298.15 K			3952		K
$\Delta B/B$		T_C=100°C		4		%

$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

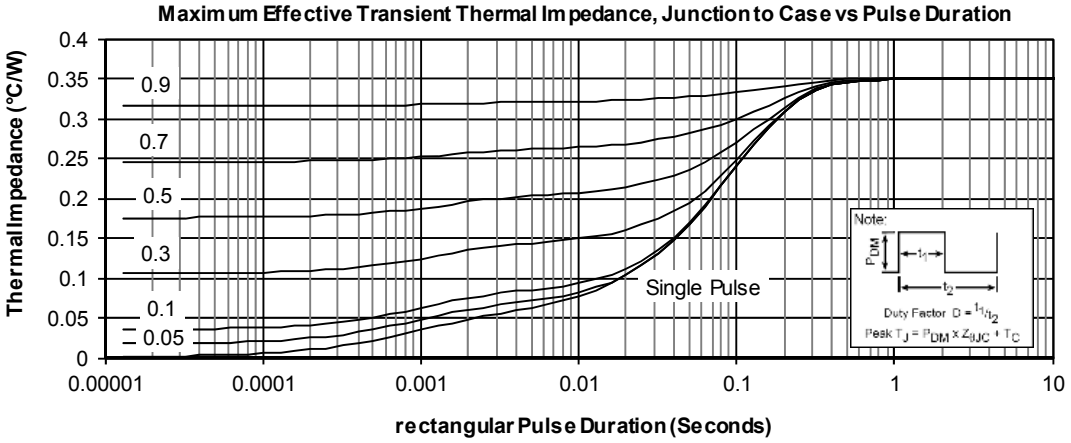
T: Thermistor temperature
R_T: Thermistor value at T

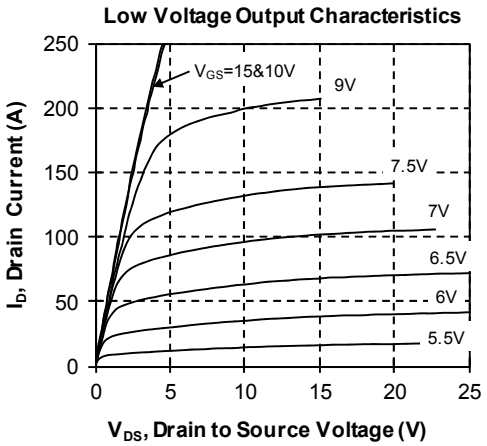
SP4 Package outline (dimensions in mm)

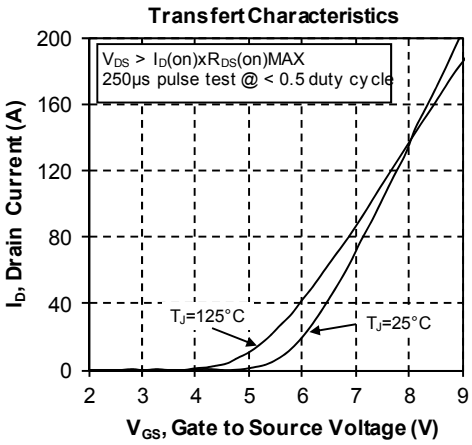


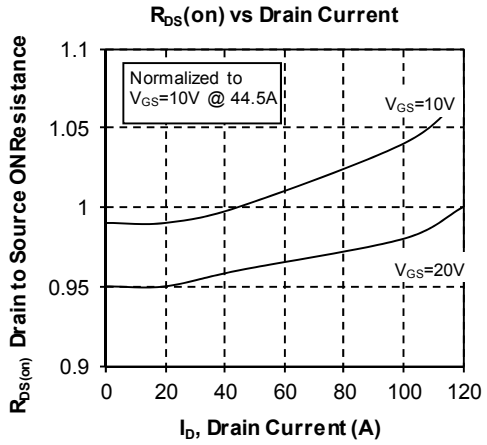
See application note APT0501 - Mounting Instructions for SP4 Power Modules on www.microsemi.com

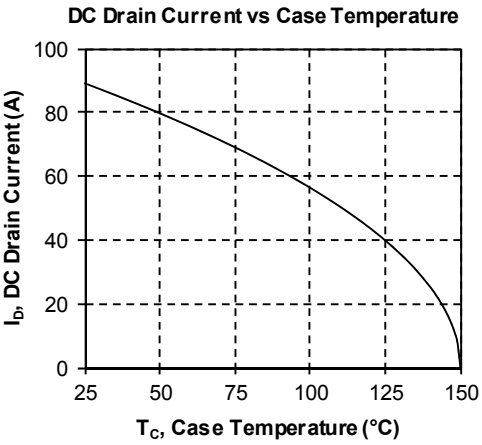
Typical Performance Curve

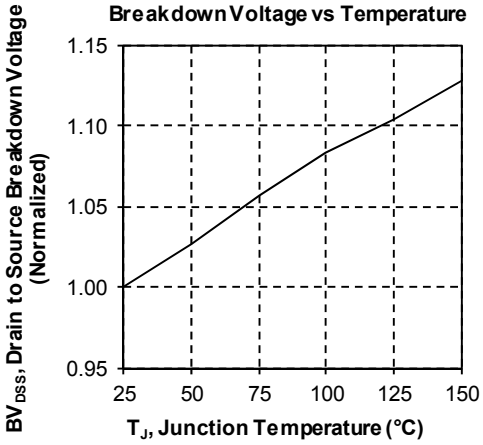


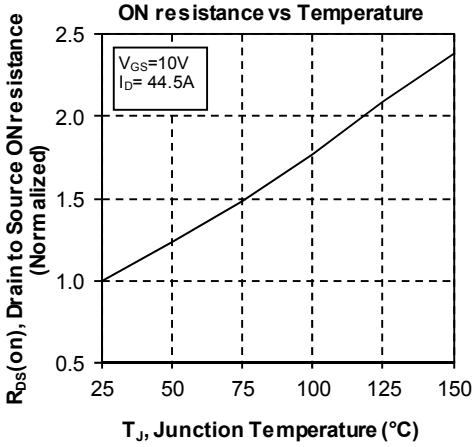


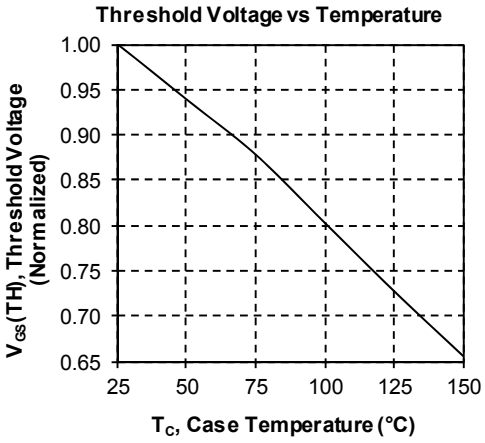


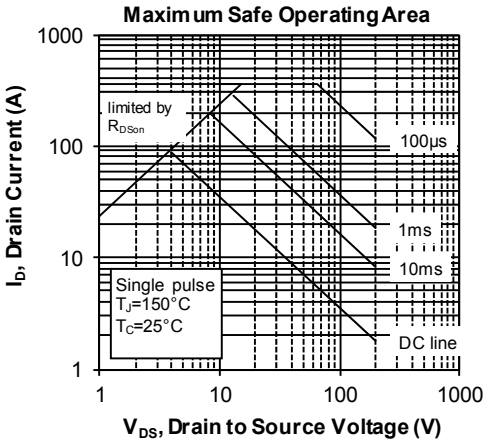


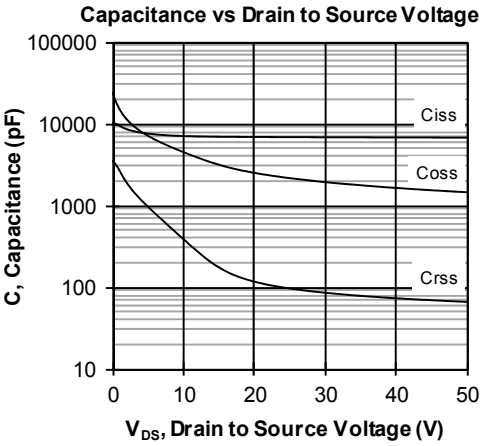


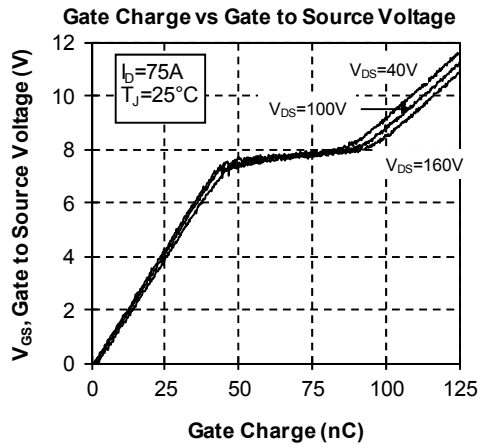

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
25
50
75
100
125
150
TJ, Junction Temperature (°C)


ON resistance vs Temperature
RDS(on), Drain to Source ONresistance (Normalized)
VGS=10V
ID= 44.5A
2.5
2.0
1.5
1.0
0.5
25
50
75
100
125
150
TJ, Junction Temperature (°C)

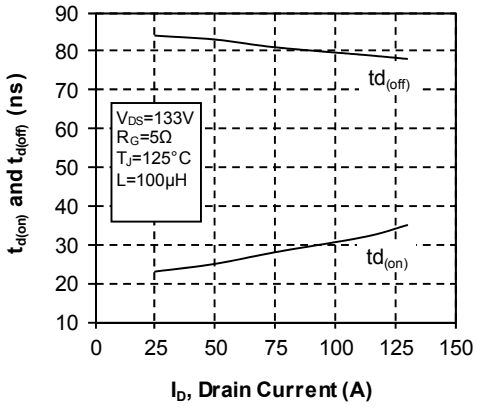

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
25
50
75
100
125
150
TC, Case Temperature (°C)


Maximum Safe Operating Area
ID, Drain Current (A)
1000
100
10
1
limited by RDSon
100µs
1ms
10ms
DC line
Single pulse
TJ=150°C
TC=25°C
1
10
100
1000
VDS, Drain to Source Voltage (V)

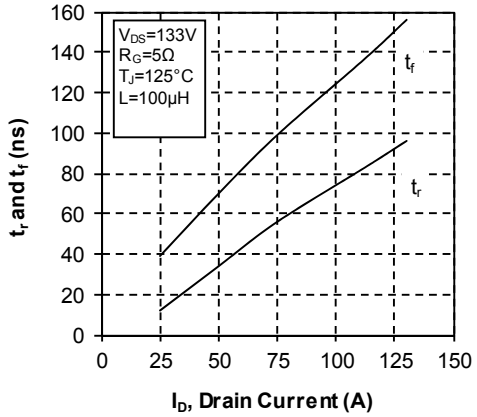

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
100000
10000
1000
100
10
Ciss
Coss
Crss
0
10
20
30
40
50
VDS, Drain to Source Voltage (V)


Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
12
10
8
6
4
2
0
ID=75A
TJ=25°C
VDS=40V
VDS=100V
VDS=160V
0
25
50
75
100
125
Gate Charge (nC)

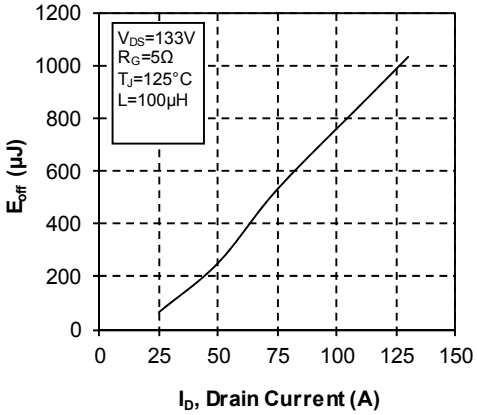
Delay Times vs Current



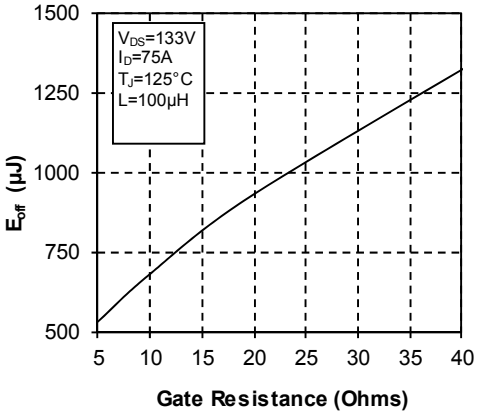
Rise and Fall times vs Current



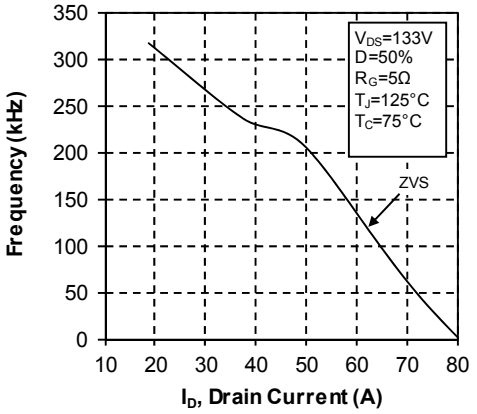
Switching Energy vs Current



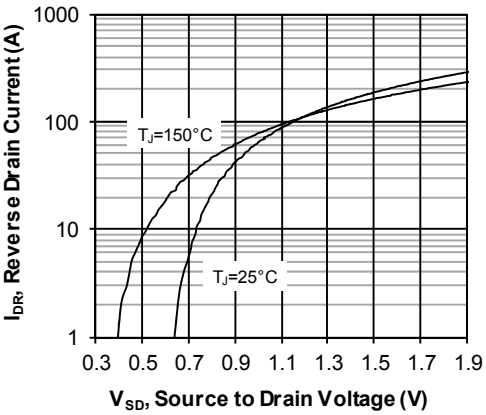
Switching Energy vs Gate Resistance



Operating Frequency vs Drain Current



Source to Drain Diode Forward Voltage



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