![Microsemi POWER PRODUCTS GROUP logo]

APTM20DHM20T3G

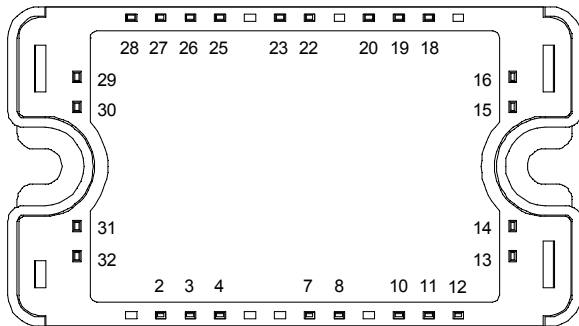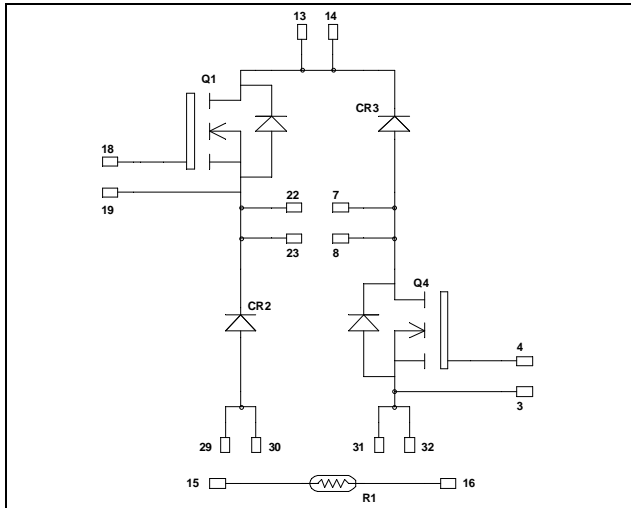## *Asymmetrical - Bridge MOSFET Power Module*

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

All multiple inputs and outputs must be shorted together
Example: 13/14 ; 29/30 ; 22/23 …

Application
- Welding converters
- Switched Mode Power Supplies
- Switched Reluctance Motor Drives

Features
- Power MOS 7® MOSFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
- 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 Breakdown 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
I_{DSS}	Zero Gate Voltage Drain Current	$V_{GS} = 0V, V_{DS} = 200V$	$T_j = 25°C$			100	μA
		$V_{GS} = 0V, V_{DS} = 160V$	$T_j = 125°C$			500	
$R_{DS(on)}$	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	$V_{GS} = 0V$		6850		pF
C_{oss}	Output Capacitance	$V_{DS} = 25V$		2180		
C_{rss}	Reverse Transfer Capacitance	$f = 1MHz$		97		
Q_g	Total gate Charge	$V_{GS} = 10V$		112		nC
Q_{gs}	Gate – Source Charge	$V_{Bus} = 100V$		43		
Q_{gd}	Gate – Drain Charge	$I_D = 75A$		47		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C**		28		ns
T_r	Rise Time	$V_{GS} = 15V$		56		
$T_{d(off)}$	Turn-off Delay Time	$V_{Bus} = 133V$ $I_D = 75A$		81		
T_f	Fall Time	$R_G = 5Ω$		99		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** $V_{GS} = 15V, V_{Bus} = 133V$		463		μJ
E_{off}	Turn-off Switching Energy	$I_D = 75A, R_G = 5Ω$		455		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** $V_{GS} = 15V, V_{Bus} = 133V$		608		μJ
E_{off}	Turn-off Switching Energy	$I_D = 75A, R_G = 5Ω$		531		

Diode ratings and characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
V_{RRM}	Maximum Peak Repetitive Reverse Voltage			200			V
I_{RM}	Maximum Reverse Leakage Current	$V_R = 200V$	$T_j = 25°C$			250	μA
			$T_j = 125°C$			500	
I_F	DC Forward Current		$Tc = 80°C$		100		A
V_F	Diode Forward Voltage	$I_F = 100A$			1		V
		$I_F = 200A$			1.4		
		$I_F = 100A$	$T_j = 125°C$		0.9		
t_{rr}	Reverse Recovery Time	$I_F = 100A$ $V_R = 133V$ di/dt $= 200A/μs$	$T_j = 25°C$		60		ns
			$T_j = 125°C$		110		
Q_{rr}	Reverse Recovery Charge		$T_j = 25°C$		200		nC
			$T_j = 125°C$		840		

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance	MOSFET				0.35	°C/W
		diode				0.55	
V_{ISOL}	RMS Isolation Voltage, any terminal to case t =1 min, I isol<1mA, 50/60Hz			4000			V
T_J	Operating junction temperature range			-40		150	
T_{STG}	Storage Temperature Range			-40		125	°C
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M4	2.5		4.7	N.m
Wt	Package Weight					110	g

Temperature sensor NTC (see application note APT0406 on www.microsemi.com for more information).

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		%

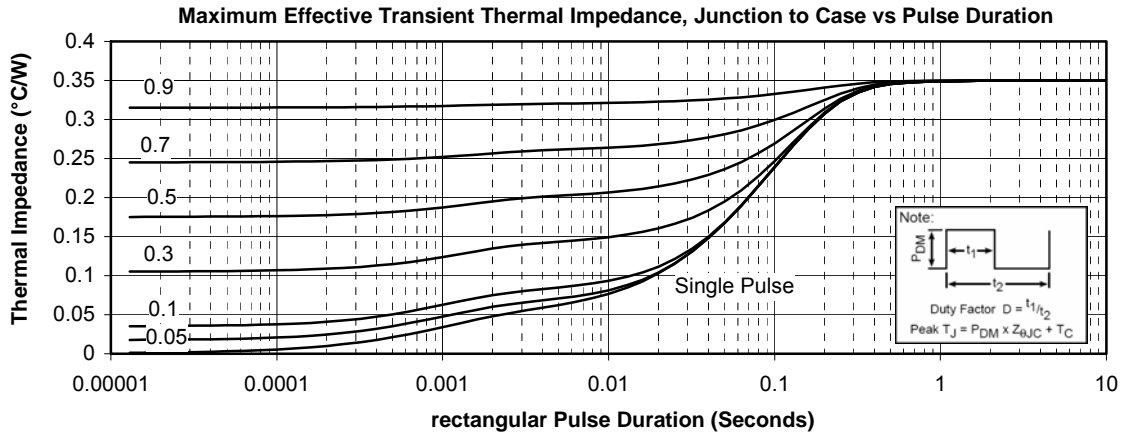$$R_T = \frac{R_{25}}{\exp\left[B_{25/85}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$
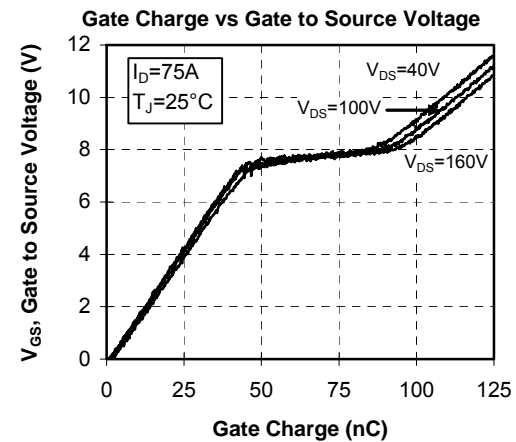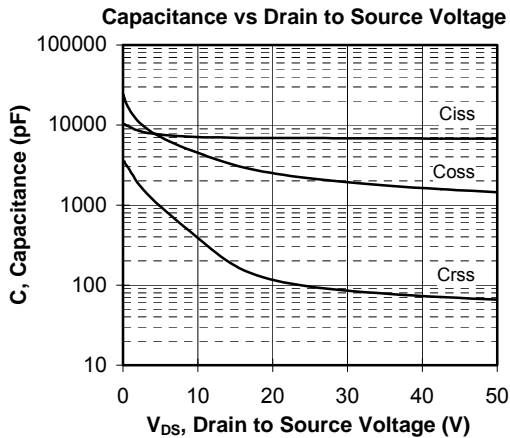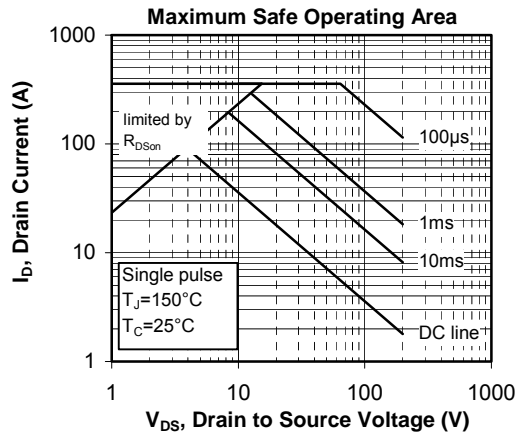
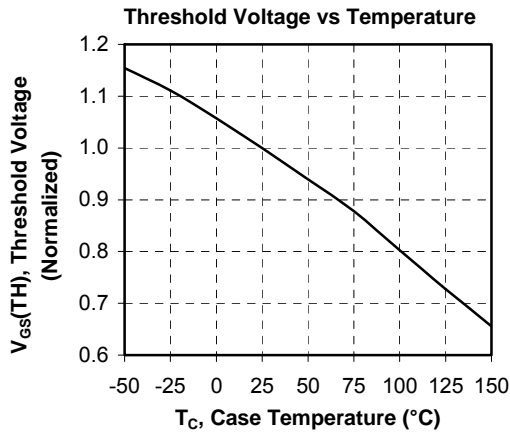T: Thermistor temperature
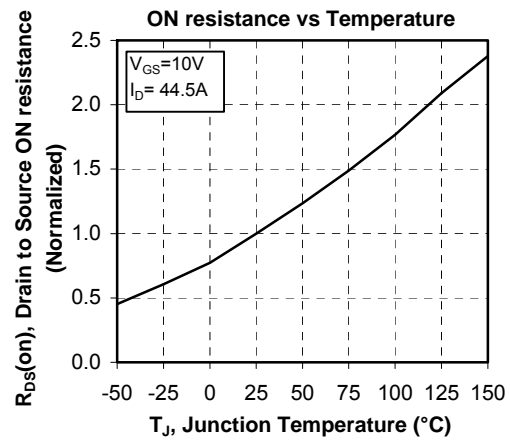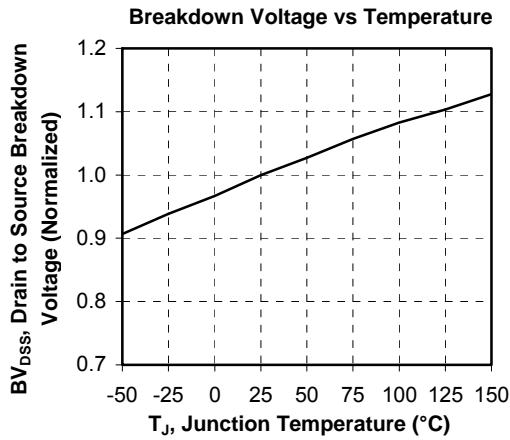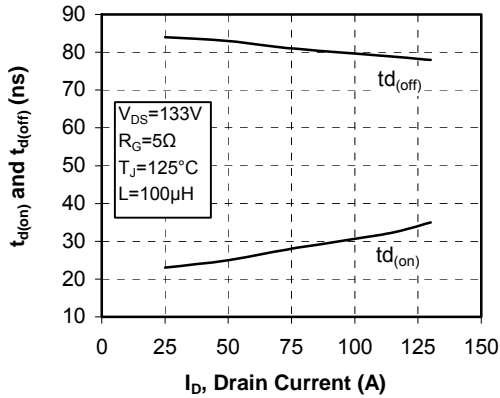R_T: Thermistor value at T

SP3 Package outline (dimensions in mm)
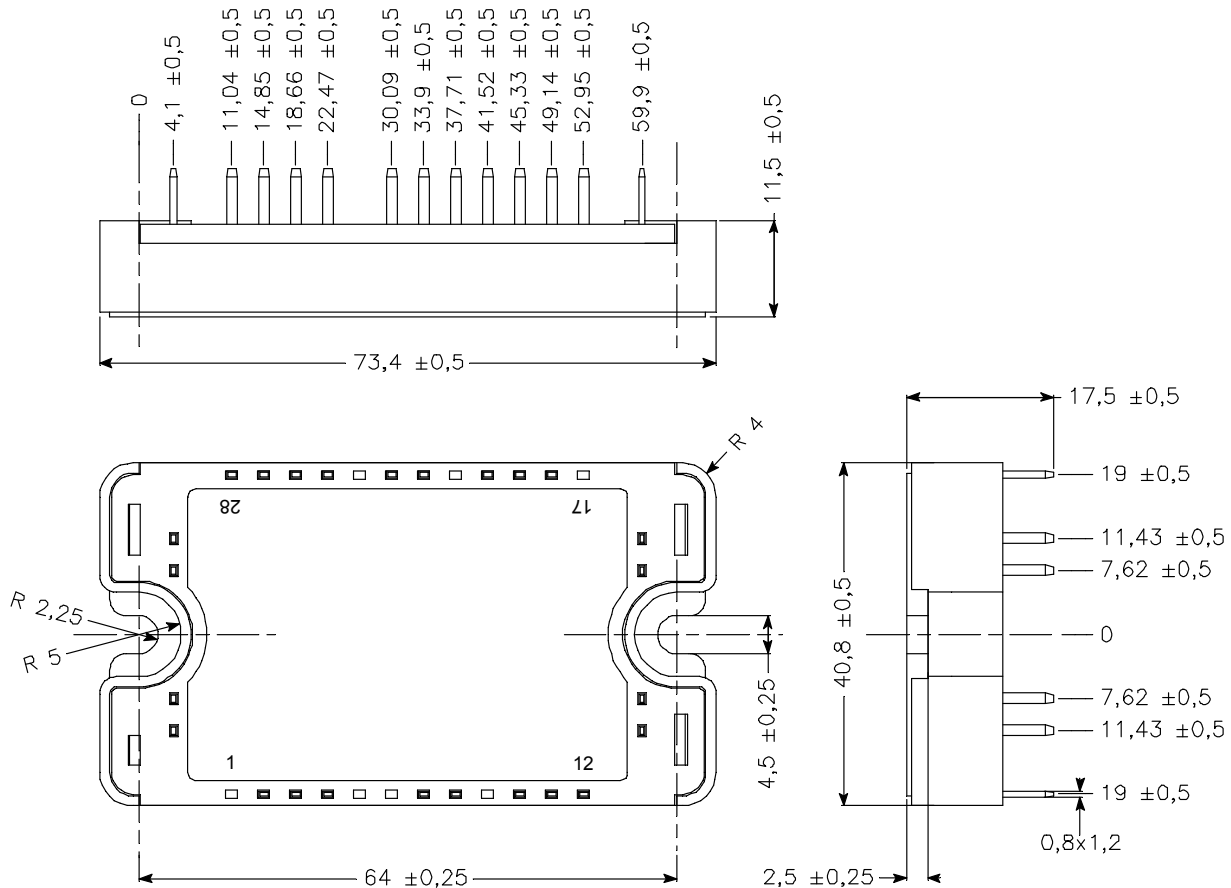
See application note 1901 - Mounting Instructions for SP3 Power Modules on www.microsemi.com
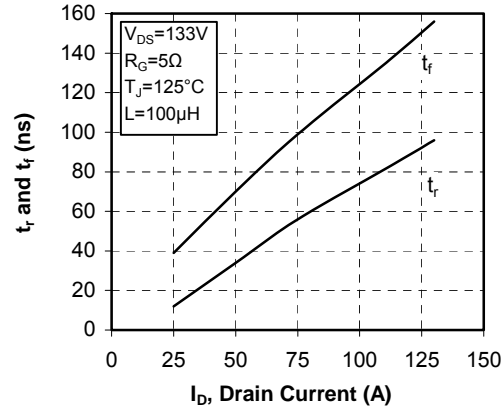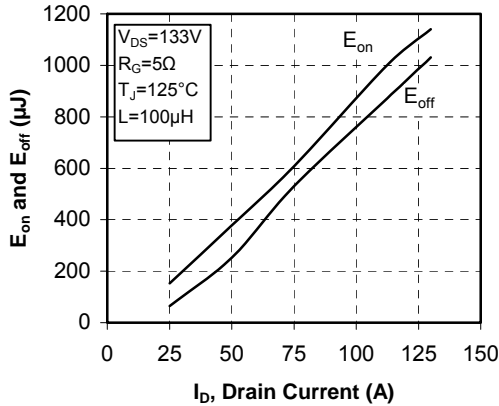
Typical MOSFET Performance Curve

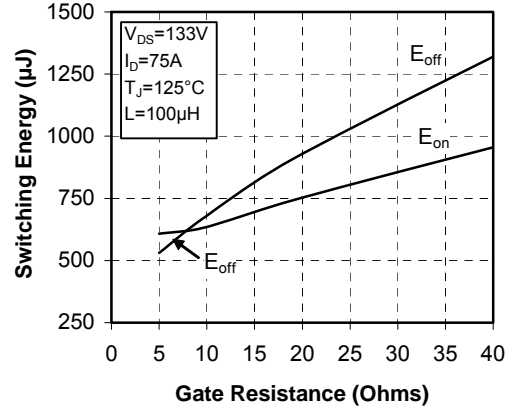**Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration**

Low Voltage Output Characteristics

Transfert Characteristics

R$_{DS}$(on) vs Drain Current

DC Drain Current vs Case Temperature

Breakdown Voltage vs Temperature

ON resistance vs Temperature

V_{GS}=10V
I_D= 44.5A

Threshold Voltage vs Temperature

Maximum Safe Operating Area

limited by R_{DSon}

100µs

1ms

10ms

Single pulse
T_J=150°C
T_C=25°C

DC line

Capacitance vs Drain to Source Voltage

Ciss

Coss

Crss

Gate Charge vs Gate to Source Voltage

I_D=75A
T_J=25°C

V_{DS}=40V
V_{DS}=100V
V_{DS}=160V

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Delay Times vs Current

t_{d(on)} and t_{d(off)} (ns)

$V_{DS}=133V$
$R_G=5\Omega$
$T_J=125°C$
$L=100\mu H$

td_{(off)}

td_{(on)}

I_D, Drain Current (A)

Rise and Fall times vs Current

t_r and t_f (ns)

$V_{DS}=133V$
$R_G=5\Omega$
$T_J=125°C$
$L=100\mu H$

t_f

t_r

I_D, Drain Current (A)

Switching Energy vs Current

E_{on} and E_{off} (μJ)

$V_{DS}=133V$
$R_G=5\Omega$
$T_J=125°C$
$L=100\mu H$

E_on

E_off

I_D, Drain Current (A)

Switching Energy vs Gate Resistance

Switching Energy (μJ)

$V_{DS}=133V$
$I_D=75A$
$T_J=125°C$
$L=100\mu H$

E_off

E_on

E_off

Gate Resistance (Ohms)

Operating Frequency vs Drain Current

Frequency (kHz)

$V_{DS}=133V$
D=50%
$R_G=5\Omega$
$T_J=125°C$
$T_C=75°C$

ZVS

ZCS

Hard switching

I_D, Drain Current (A)
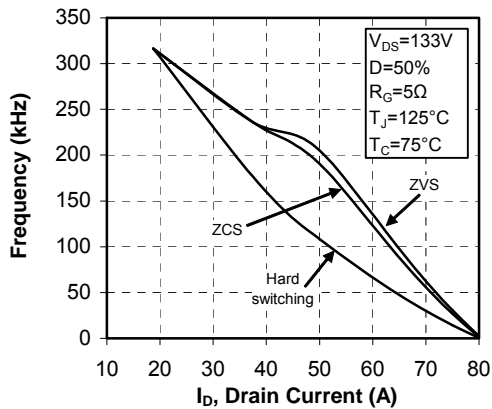
Source to Drain Diode Forward Voltage

I_{DR}, Reverse Drain Current (A)

$T_J=150°C$

$T_J=25°C$

V_{SD}, Source to Drain Voltage (V)
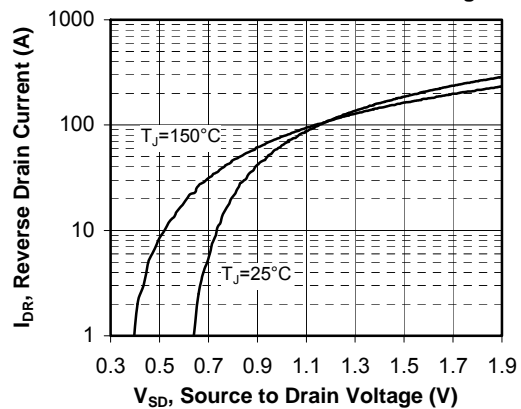
Typical Diode Performance Curve

Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration

Forward Current vs Forward Voltage

Trr vs. Current Rate of Charge

Q_RR vs. Current Rate Charge

I_RRM vs. Current Rate of Charge

Capacitance vs. Reverse Voltage

Max. Average Forward Current vs. Case Temp.
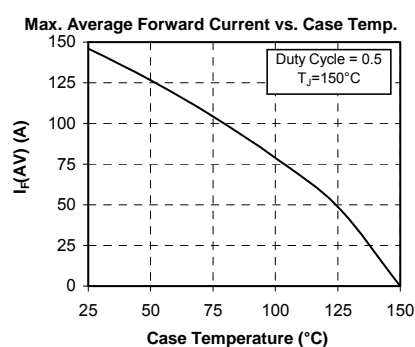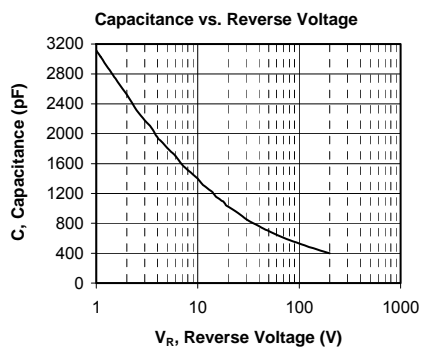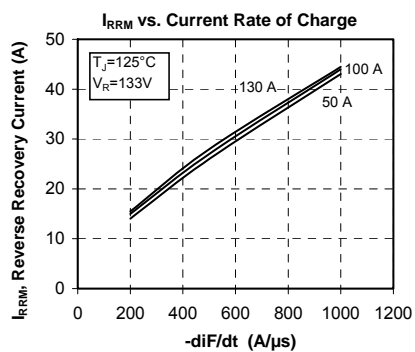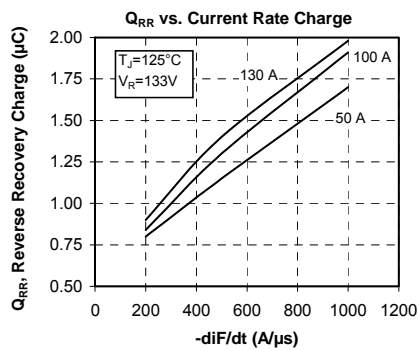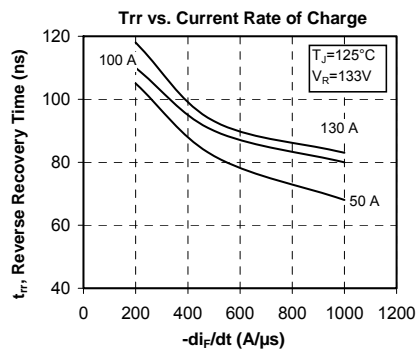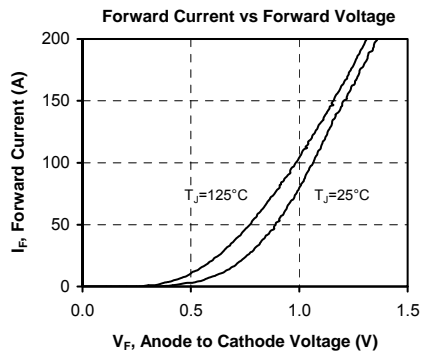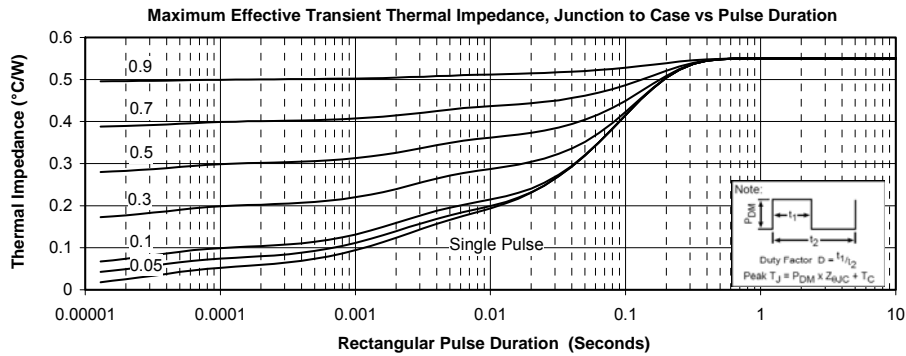
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