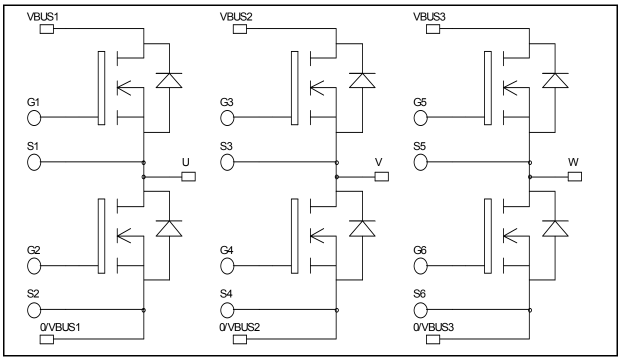
APTM10TAM19FPG

Triple phase leg MOSFET Power Module

V_{DSS} = 100V
R_{DSon} = 19mΩ typ @ Tj = 25°C
I_D = 70A @ Tc = 25°C

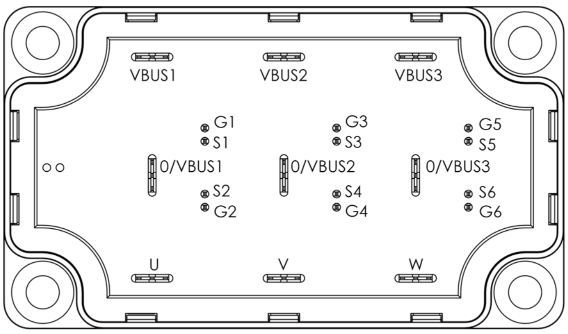


Application

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

Features

- Power MOS V® FREDFETs
  - Low R_{DSon}
  - Low input and Miller capacitance
  - Low gate charge
  - Fast intrinsic diode
  - Avalanche energy rated
  - Very rugged
- Kelvin source for easy drive
- Very low stray inductance
  - Symmetrical design
  - Lead frames for power connections
- 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
- Very low (12mm) profile
- Each leg can be easily paralleled to achieve a phase leg of three times the current capability
- Module can be configured as a three phase bridge
- Module can be configured as a boost followed by a full bridge
- RoHS Compliant

Absolute maximum ratings

Symbol	Parameter		Max ratings	Unit
V_{DSS}	Drain - Source Breakdown Voltage		100	V
I_D	Continuous Drain Current	T_c = 25°C	70	A
		T_c = 80°C	50	
I_{DM}	Pulsed Drain current		300	
V_{GS}	Gate - Source Voltage		±30	V
R_{DSon}	Drain - Source ON Resistance		21	mΩ
P_D	Maximum Power Dissipation	T_c = 25°C	208	W
I_{AR}	Avalanche current (repetitive and non repetitive)		75	A
E_{AR}	Repetitive Avalanche Energy		30	mJ
E_{AS}	Single Pulse Avalanche Energy		1500	

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	$V_{GS} = 0V, V_{DS} = 100V$	$T_j = 25°C$			250	µA
		$V_{GS} = 0V, V_{DS} = 80V$	$T_j = 125°C$			1000	
$R_{DS(on)}$	Drain – Source on Resistance	$V_{GS} = 10V, I_D = 35A$			19	21	mΩ
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1mA$		2		4	V
I_{GSS}	Gate – Source Leakage Current	$V_{GS} = \pm 30$ 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		5100		pF
C_{oss}	Output Capacitance			1900		
C_{rss}	Reverse Transfer Capacitance			800		
Q_g	Total gate Charge	$V_{GS} = 10V$ $V_{Bus} = 100V$ $I_D = 70A$		200		nC
Q_{gs}	Gate – Source Charge			40		
Q_{gd}	Gate – Drain Charge			92		
$T_{d(on)}$	Turn-on Delay Time	**Inductive switching @ 125°C** $V_{GS} = 15V$ $V_{Bus} = 66V$ $I_D = 70A$ $R_G = 5\Omega$		35		ns
T_r	Rise Time			70		
$T_{d(off)}$	Turn-off Delay Time			95		
T_f	Fall Time			125		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 25°C** $V_{GS} = 15V$, $V_{Bus} = 66V$ $I_D = 70A$, $R_G = 5\Omega$		276		µJ
E_{off}	Turn-off Switching Energy			302		
E_{on}	Turn-on Switching Energy	**Inductive switching @ 125°C** $V_{GS} = 15V$, $V_{Bus} = 66V$ $I_D = 70A$, $R_G = 5\Omega$		304		µJ
E_{off}	Turn-off Switching Energy			320		

Source - Drain diode ratings and characteristics

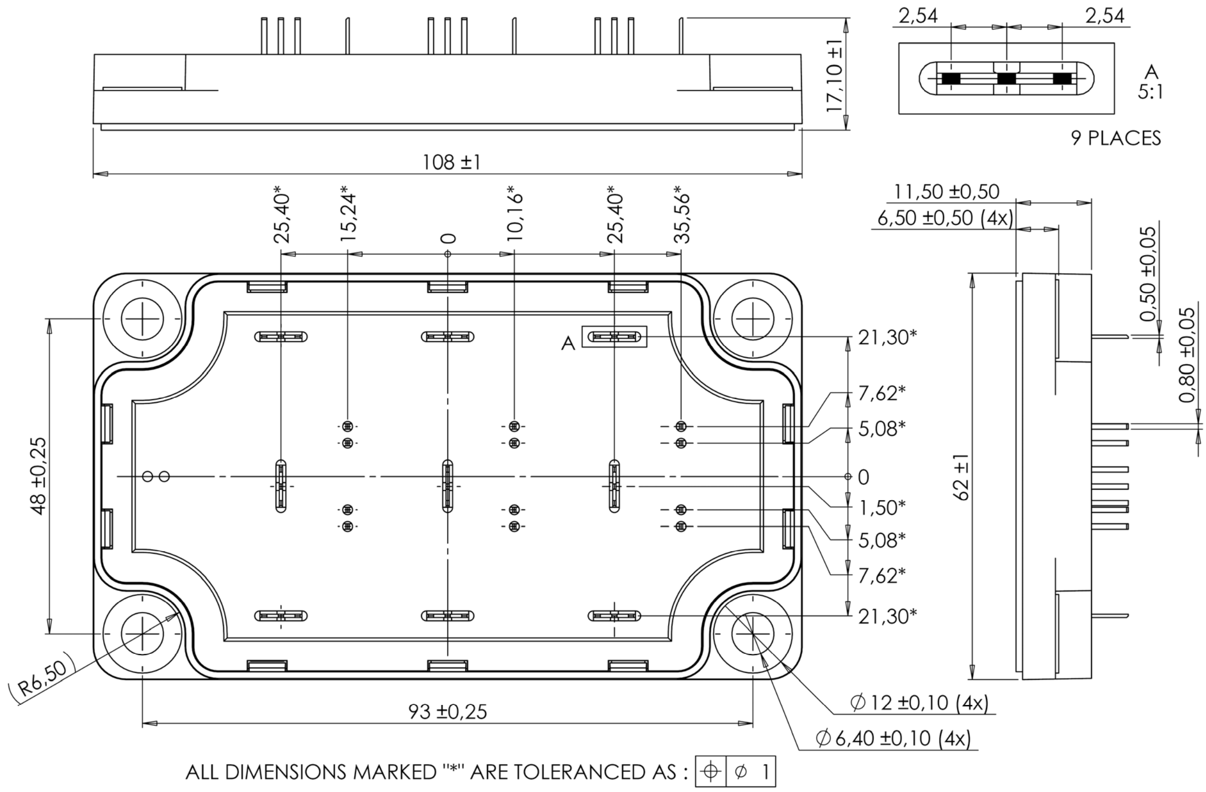
Symbol	*Characteristic*	*Test Conditions*		*Min*	*Typ*	*Max*	*Unit*
I_S	Continuous Source current (Body diode)		Tc = 25°C			70	A
			Tc = 80°C			50	
V_{SD}	Diode Forward Voltage	$V_{GS} = 0V, I_S = -70A$				1.3	V
dv/dt	Peak Diode Recovery ❶					5	V/ns
t_{rr}	Reverse Recovery Time	$I_S = -70A$ $V_{Bus} = 66V$ $di_S/dt = 100A/\mu s$	$T_j = 25°C$			200	ns
			$T_j = 125°C$			350	
Q_{rr}	Reverse Recovery Charge		$T_j = 25°C$		0.5		µC
			$T_j = 125°C$		1		

❶ dv/dt numbers reflect the limitations of the circuit rather than the device itself.
$I_S \leq -70A$ $di/dt \leq 700A/\mu s$ $V_R \leq V_{DSS}$ $T_j \leq 150°C$

Thermal and package characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
R_{thJC}	Junction to Case Thermal Resistance					0.6	°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_{STG}	Storage Temperature Range			-40		125	
T_C	Operating Case Temperature			-40		100	
Torque	Mounting torque	To heatsink	M6	3		5	N.m
Wt	Package Weight					250	g

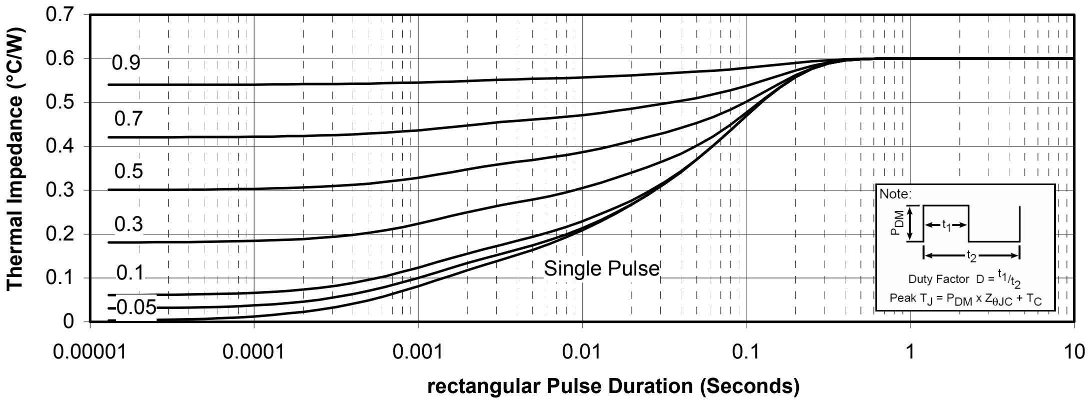
SP6-P Package outline (dimensions in mm)



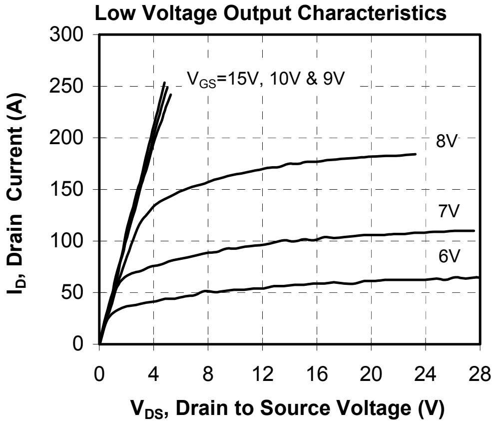
See application note 1902 - Mounting Instructions for SP6-P (12mm) Power Modules on www.microsemi.com

Typical Performance Curve

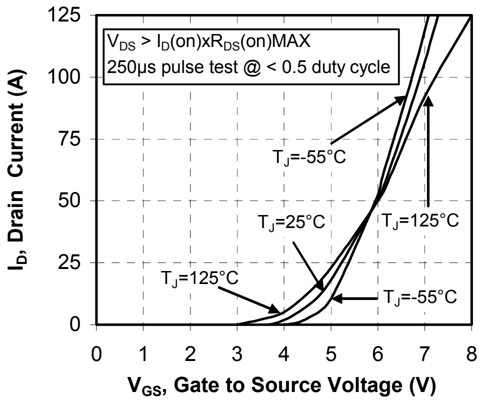
Maximum Effective Transient Thermal Impedance, Junction to Case vs Pulse Duration



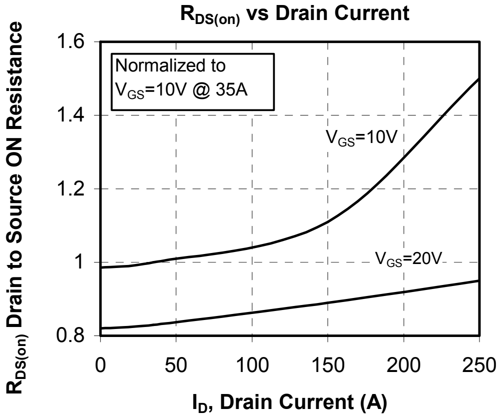
Low Voltage Output Characteristics



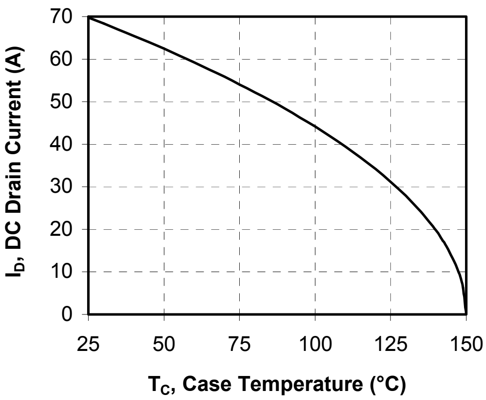
Transfert Characteristics

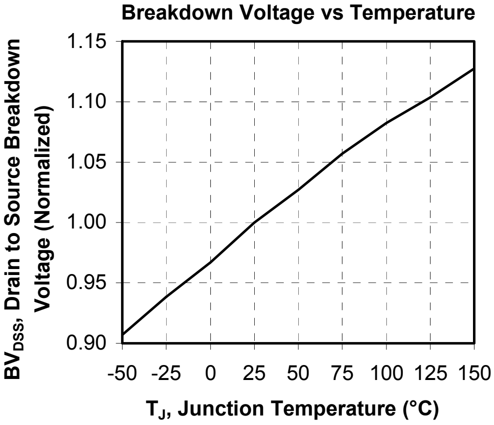


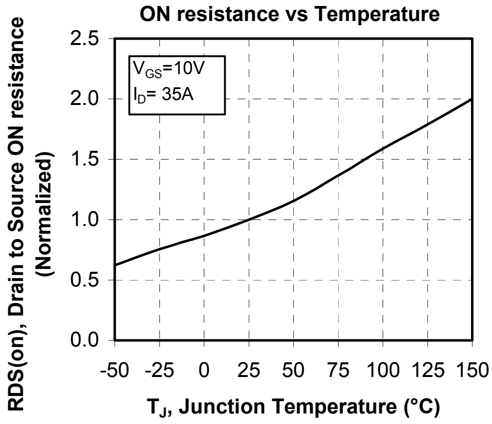
$R_{DS(on)}$ vs Drain Current

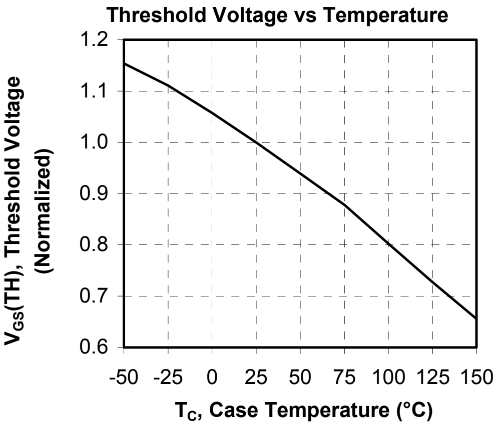


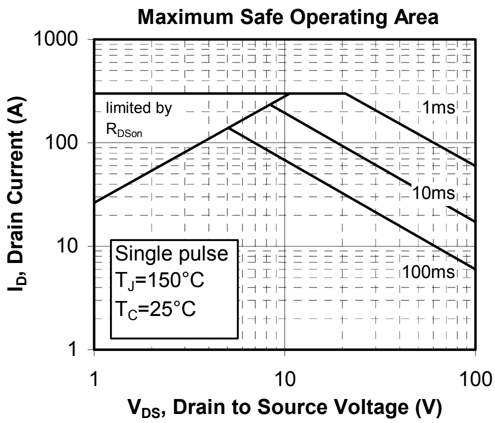
DC Drain Current vs Case Temperature

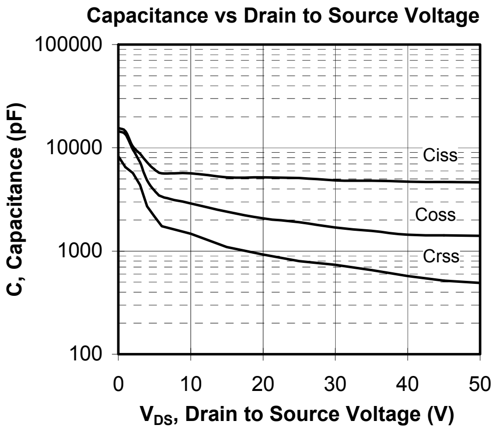


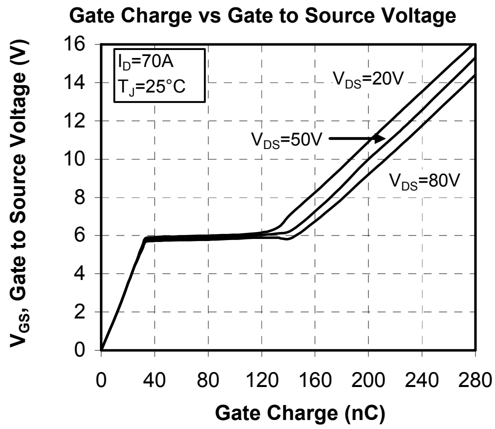

Breakdown Voltage vs Temperature
BVDSS, Drain to Source Breakdown Voltage (Normalized)
1.15
1.10
1.05
1.00
0.95
0.90
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

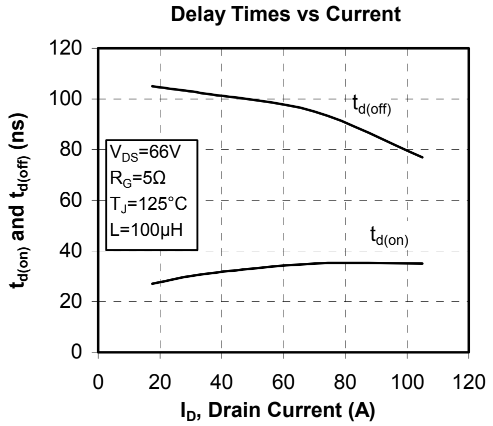

ON resistance vs Temperature
RDS(on), Drain to Source ON resistance (Normalized)
VGS=10V
ID= 35A
2.5
2.0
1.5
1.0
0.5
0.0
-50 -25 0 25 50 75 100 125 150
TJ, Junction Temperature (°C)

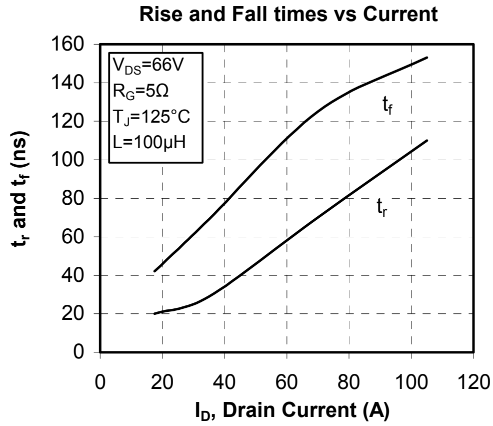

Threshold Voltage vs Temperature
VGS(TH), Threshold Voltage (Normalized)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
-50 -25 0 25 50 75 100 125 150
TC, Case Temperature (°C)

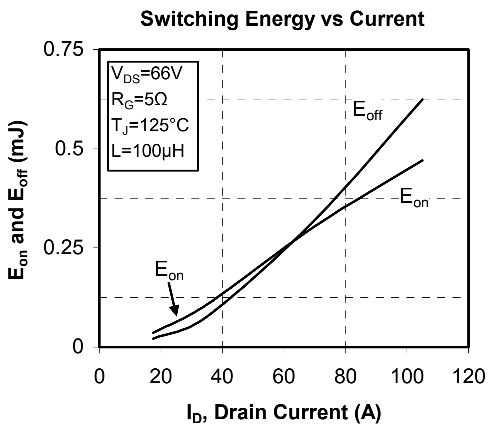

Maximum Safe Operating Area
ID, Drain Current (A)
limited by RDSon
1ms
10ms
100ms
Single pulse
TJ=150°C
TC=25°C
1000
100
10
1
1
10
100
VDS, Drain to Source Voltage (V)

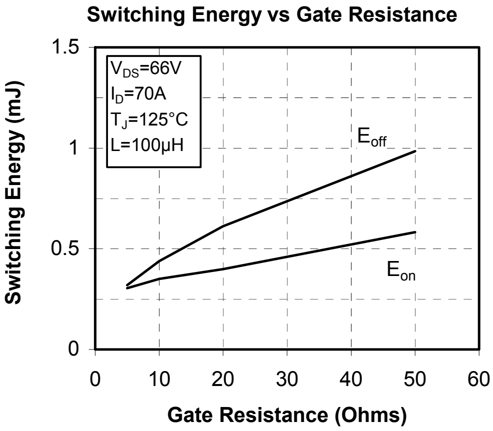

Capacitance vs Drain to Source Voltage
C, Capacitance (pF)
Ciss
Coss
Crss
100000
10000
1000
100
0 10 20 30 40 50
VDS, Drain to Source Voltage (V)

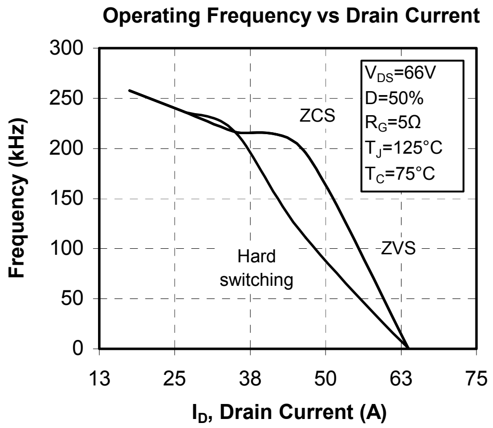

Gate Charge vs Gate to Source Voltage
VGS, Gate to Source Voltage (V)
ID=70A
TJ=25°C
VDS=20V
VDS=50V
VDS=80V
16
14
12
10
8
6
4
2
0
0 40 80 120 160 200 240 280
Gate Charge (nC)

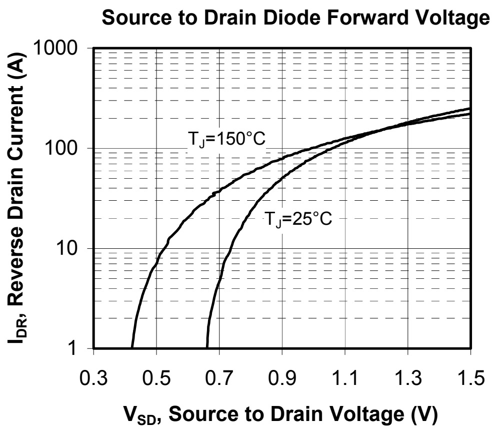

Delay Times vs Current
VDS=66V
RG=5Ω
TJ=125°C
L=100µH
td(off)
td(on)
td(on) and td(off) (ns)
ID, Drain Current (A)


Rise and Fall times vs Current
VDS=66V
RG=5Ω
TJ=125°C
L=100µH
tf
tr
tr and tf (ns)
ID, Drain Current (A)


Switching Energy vs Current
VDS=66V
RG=5Ω
TJ=125°C
L=100µH
Eoff
Eon
Eon
Eon and Eoff (mJ)
ID, Drain Current (A)


Switching Energy vs Gate Resistance
VDS=66V
ID=70A
TJ=125°C
L=100µH
Eoff
Eon
Switching Energy (mJ)
Gate Resistance (Ohms)


Operating Frequency vs Drain Current
VDS=66V
D=50%
RG=5Ω
TJ=125°C
TC=75°C
ZCS
ZVS
Hard
switching
Frequency (kHz)
ID, Drain Current (A)


Source to Drain Diode Forward Voltage
TJ=150°C
TJ=25°C
IDR, Reverse Drain Current (A)
VSD, Source to Drain Voltage (V)

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