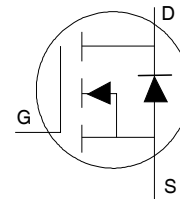## Applications

- Brushed Motor drive applications
- BLDC Motor drive applications
- Battery powered circuits
- Half-bridge and full-bridge topologies
- Synchronous rectifier applications
- Resonant mode power supplies
- OR-ing and redundant power switches
- DC/DC and AC/DC converters
- DC/AC Inverters

Benefits

- $V_{DS}(V) = 40V$
- $I_D = 100A$ ($V_{GS} = 10V$)
- $R_{DS(ON)} < 2.0m\Omega$ ($V_{GS} = 10V$)

Static @ T_J = 25°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	40			V	$V_{GS} = 0V$, $I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient		0.029		V/°C	Reference to 25°C, $I_D = 1mA$②
$R_{DS(on)}$	Static Drain-to-Source On-Resistance		1.5	2.0	mΩ	$V_{GS} = 10V$, $I_D = 100A$
			1.8			$V_{GS} = 6.0V$, $I_D = 50A$
$V_{GS(th)}$	Gate Threshold Voltage	2.2	3.0	3.9	V	$V_{DS} = V_{GS}$, $I_D = 150\mu A$
I_{DSS}	Drain-to-Source Leakage Current			1.0	μA	$V_{DS} = 40V$, $V_{GS} = 0V$
				150		$V_{DS} = 40V$, $V_{GS} = 0V$, $T_J = 125°C$
I_{GSS}	Gate-to-Source Forward Leakage			100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage			-100		$V_{GS} = -20V$
R_G	Internal Gate Resistance		2.2		Ω	

Absolute Maximum Ratings

Symbol	Parameter	Max.		Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	250①		A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 10V (Silicon Limited)	180		
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 10V (Wire Bond Limited)	195		
I_{DM}	Pulsed Drain Current ②	1000		
P_D @T_C = 25°C	Maximum Power Dissipation	230		W
	Linear Derating Factor	1.5		W/°C
V_{GS}	Gate-to-Source Voltage	± 20		V
T_J	Operating Junction and	-55 to + 175		°C
T_{STG}	Storage Temperature Range			
	Soldering Temperature, for 10 seconds (1.6mm from case)	300		
	Mounting torque, 6-32 or M3 screw	10lbf· in (1.1N· m)		
$E_{AS\ (Thermally\ limited)}$	Single Pulse Avalanche Energy ③	350		mJ
$E_{AS\ (Thermally\ limited)}$	Single Pulse Avalanche Energy ⑨	802		
I_{AR}	Avalanche Current ②	See Fig. 14, 15, 22a, 22b		A
E_{AR}	Repetitive Avalanche Energy ②			mJ
$R_{θJC}$	Junction-to-Case ⑧		0.65	°C/W
$R_{θCS}$	Case-to-Sink, Flat Greased Surface	0.50		
$R_{θJA}$	Junction-to-Ambient ⑧		62	

Notes:

① Calculated continuous current based on maximum allowable junction temperature. Bond wire current limit is 195A. Note that current limitations arising from heating of the device leads may occur with some lead mounting arrangements.

② Repetitive rating; pulse width limited by max. junction temperature.

③ Limited by T_{Jmax}, starting T_J = 25°C, L = 0.069mH R_G = 50Ω, I_{AS} = 100A, V_{GS} =10V.

④ $I_{SD} \leq$ 100A, di/dt $\leq$ 1166A/µs, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq$ 175°C.

⑤ Pulse width $\leq$ 400µs; duty cycle $\leq$ 2%.

⑥ C_{oss} eff. (TR) is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

⑦ C_{oss} eff. (ER) is a fixed capacitance that gives the same energy as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS}.

⑧ $R_θ$ is measured at T_J approximately 90°C.

⑨ Limited by T_{Jmax} starting T_J = 25°C, L= 1mH, R_G = 50Ω, I_{AS} = 40A, V_{GS} =10V.

Dynamic @ T_J = 25°C (unless otherwise specified)

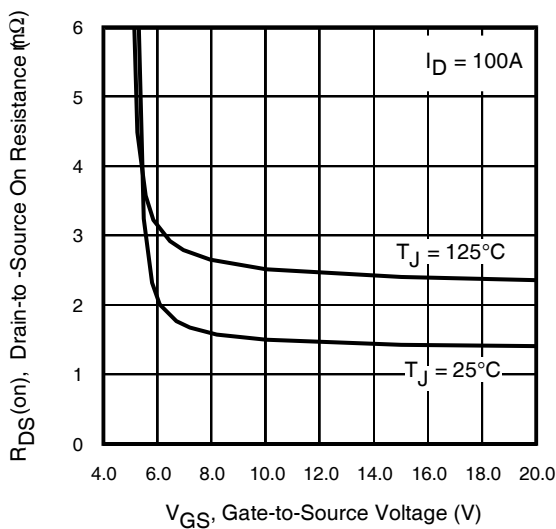| Symbol	Parameter	Min.	Typ.	Max.	Units	Conditions
gfs	Forward Transconductance	160			S	V_{DS} = 10V, I_D = 100A
Q_g	Total Gate Charge		150	225	nC	I_D = 100A
Q_{gs}	Gate-to-Source Charge		41			V_{DS} =20V
Q_{gd}	Gate-to-Drain ("Miller") Charge		51			V_{GS} = 10V ⑤
Q_{sync}	Total Gate Charge Sync. (Q_g - Q_{gd})		99			I_D = 100A, V_{DS} =20V, V_{GS} = 10V
$t_{d(on)}$	Turn-On Delay Time		19		ns	V_{DD} = 20V
t_r	Rise Time		70			I_D = 30A
$t_{d(off)}$	Turn-Off Delay Time		78			R_G = 2.7Ω
t_f	Fall Time		53			V_{GS} = 10V ⑤
C_{iss}	Input Capacitance		7330		pF	V_{GS} = 0V
C_{oss}	Output Capacitance		1095			V_{DS} = 25V
C_{rss}	Reverse Transfer Capacitance		745			f = 1.0 MHz, See Fig. 5
C_{oss} eff. (ER)	Effective Output Capacitance (Energy Related) ⑦		1310			V_{GS} = 0V, V_{DS} = 0V to 32V ⑦, See Fig. 11
C_{oss} eff. (TR)	Effective Output Capacitance (Time Related)⑥		1735			V_{GS} = 0V, V_{DS} = 0V to 32V ⑥
I_S	Continuous Source Current (Body Diode)			250①	A	MOSFET symbol showing the
I_{SM}	Pulsed Source Current (Body Diode) ②			1000	A	integral reverse p-n junction diode.
V_{SD}	Diode Forward Voltage		1.0	1.3	V	T_J = 25°C, I_S = 100A, V_{GS} = 0V ⑤
dv/dt	Peak Diode Recovery ④		3.1		V/ns	T_J = 175°C, I_S = 100A, V_{DS} = 40V ⑤
t_{rr}	Reverse Recovery Time		30		ns	T_J = 25°C V_R = 34V,
			30			T_J = 125°C I_F = 100A
Q_{rr}	Reverse Recovery Charge		24		nC	T_J = 25°C di/dt = 100A/µs ⑤
			25			T_J = 125°C
I_{RRM}	Reverse Recovery Current		1.3		A	T_J = 25°C

Fig 1. Typical On-Resistance vs. Gate Voltage
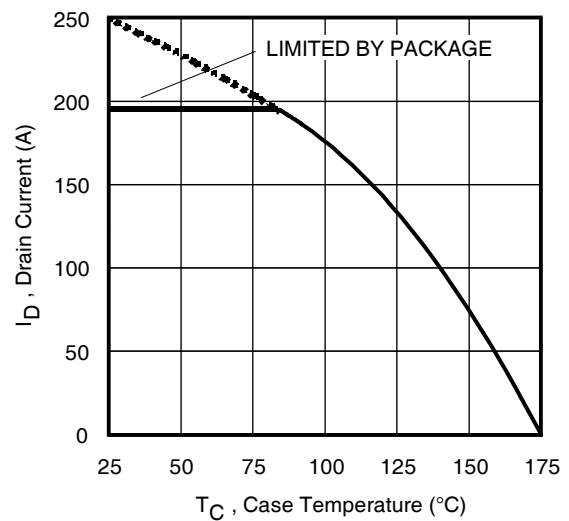

Fig 2. Maximum Drain Current vs. Case Temperature
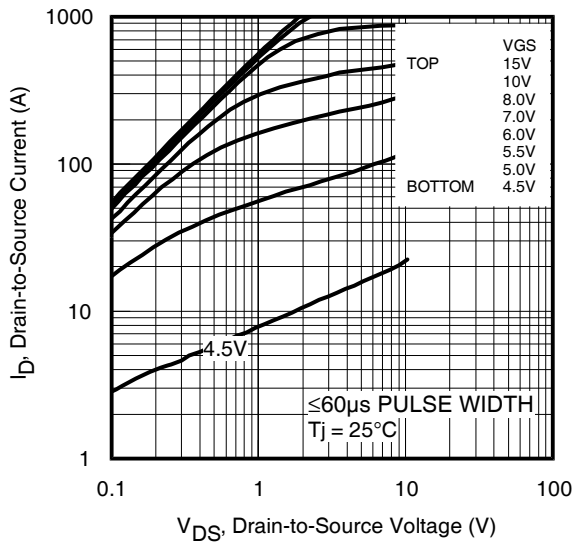
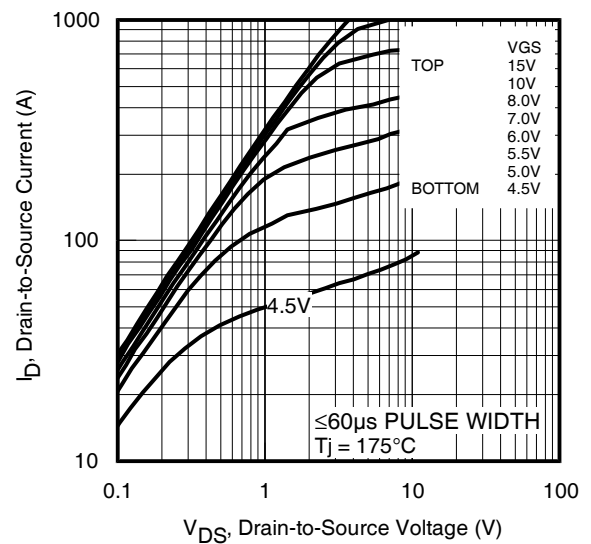**Fig 3.** Typical Output Characteristics

Fig 4. Typical Output Characteristics
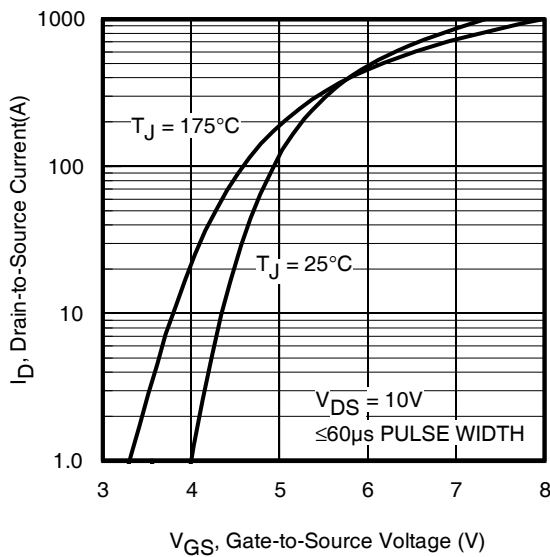

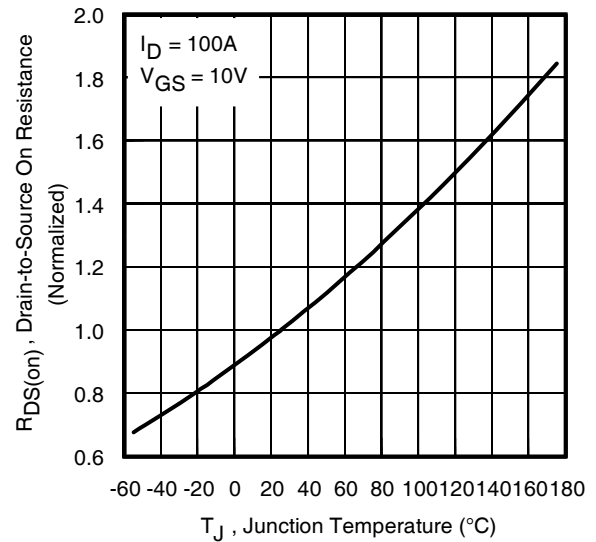**Fig 5.** Typical Transfer Characteristics

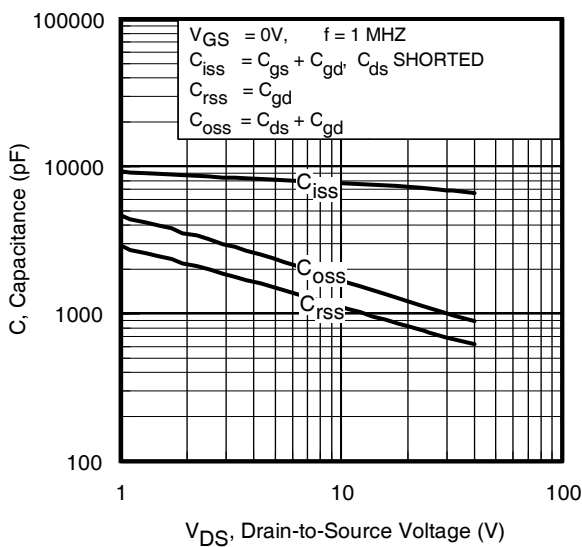**Fig 6.** Normalized On-Resistance vs. Temperature

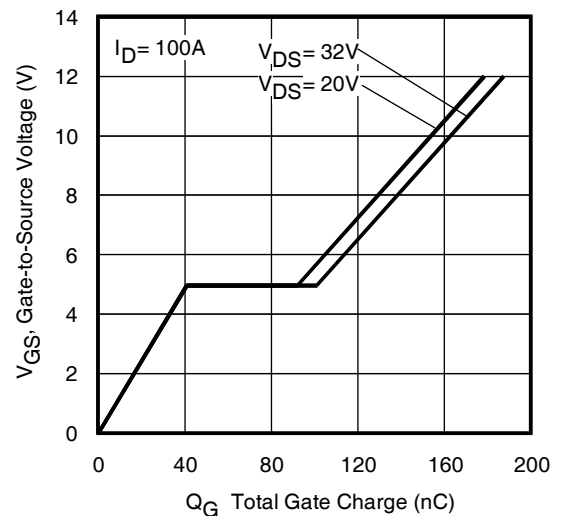**Fig 7.** Typical Capacitance vs. Drain-to-Source Voltage
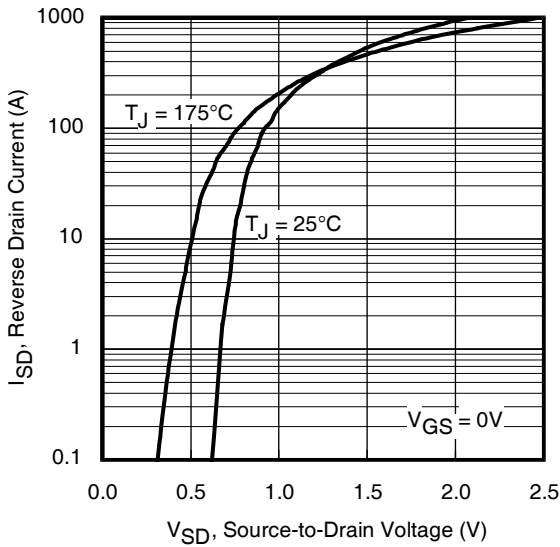

Fig 8. Typical Gate Charge vs. Gate-to-Source Voltage
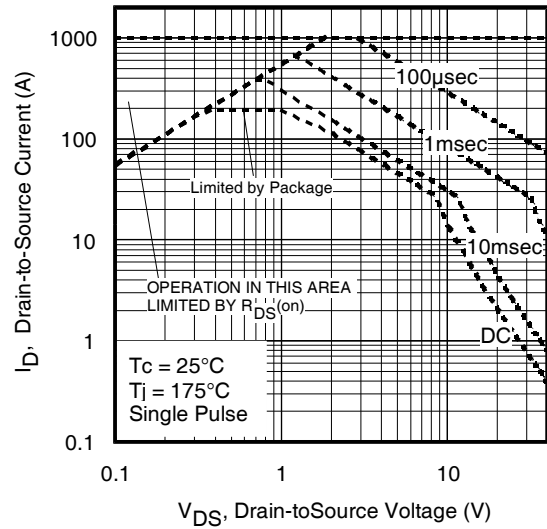
Fig 9. Typical Source-Drain Diode Forward Voltage
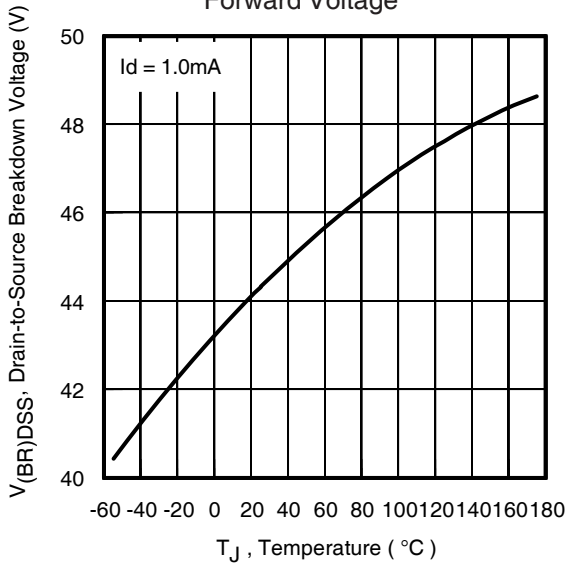

Fig 10. Maximum Safe Operating Area

Fig 11. Drain-to-Source Breakdown Voltage
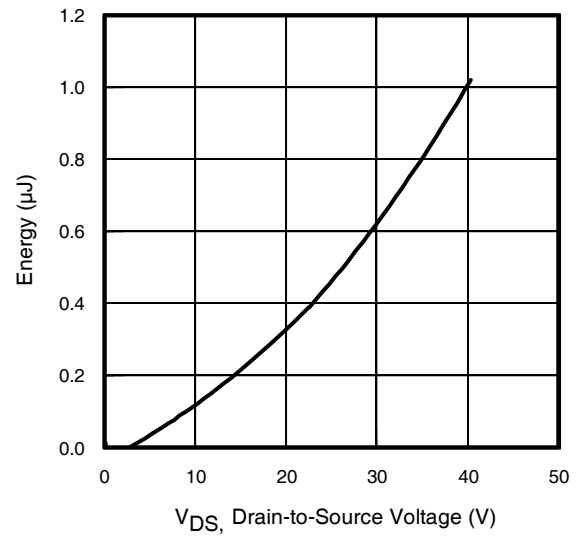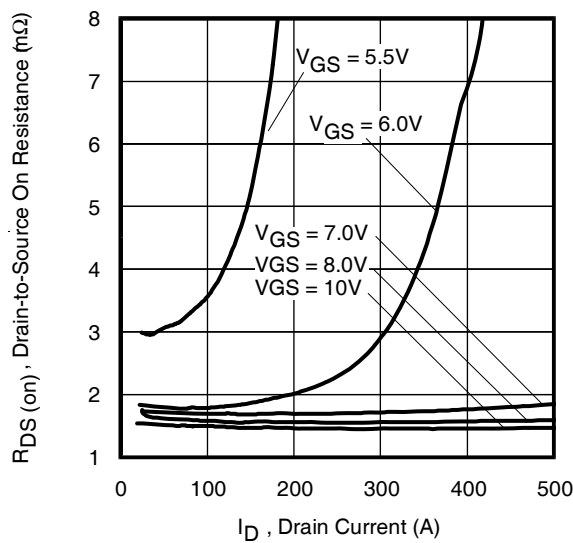

Fig 12. Typical C_{OSS} Stored Energy

Fig 13. Typical On-Resistance vs. Drain Current
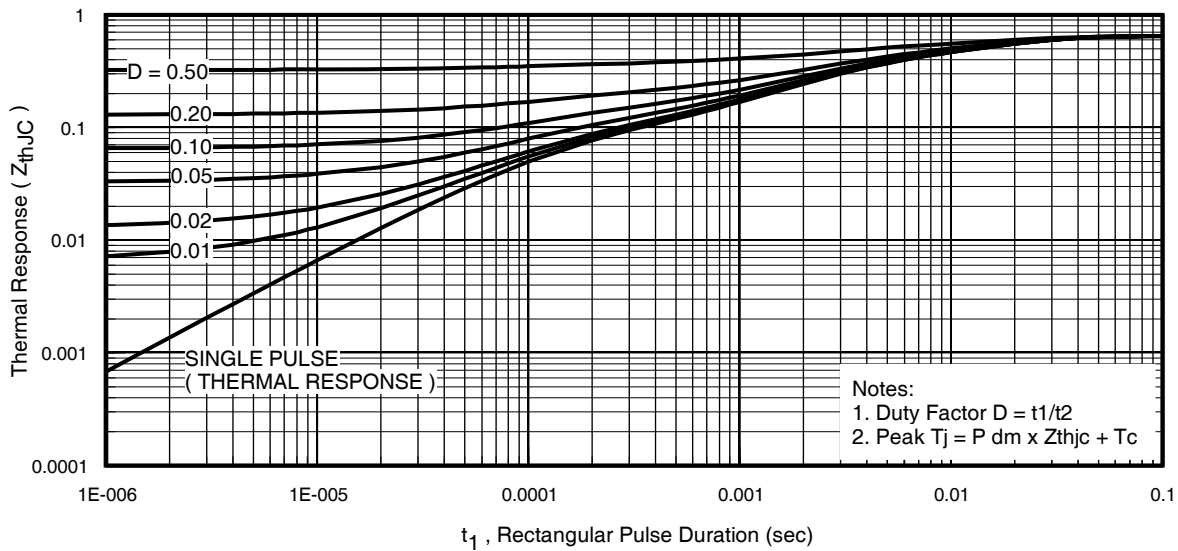
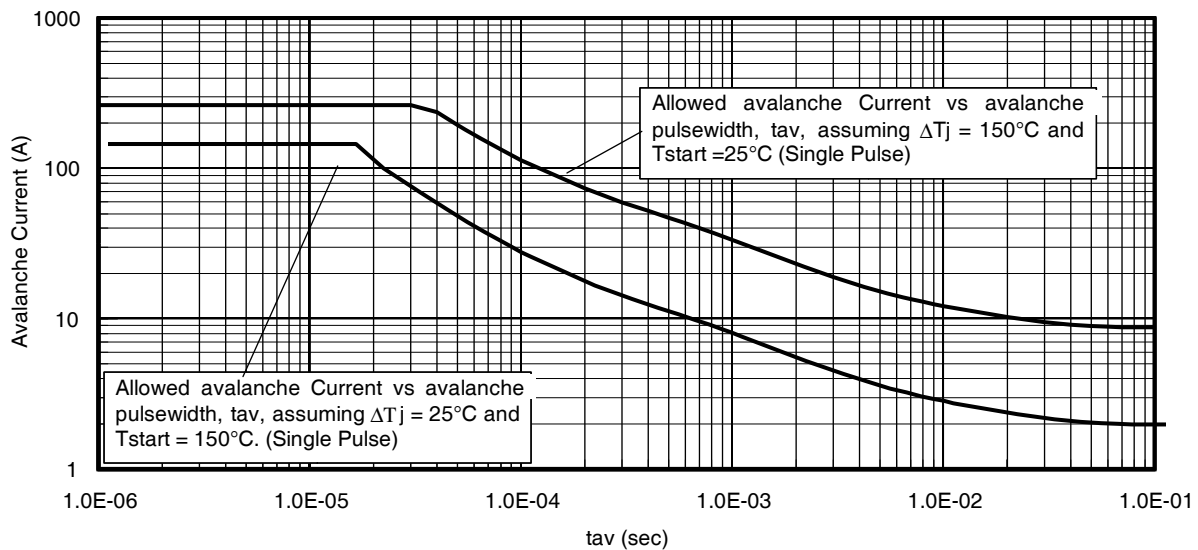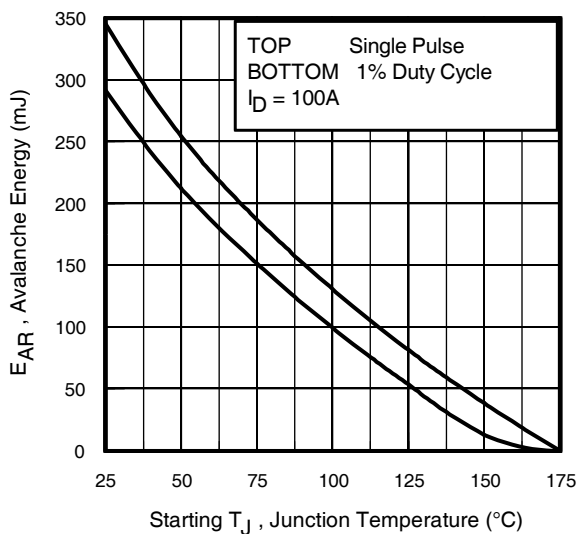**Fig 14.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

Notes:
1. Duty Factor D = t1/t2
2. Peak Tj = P dm x Zthjc + Tc

Allowed avalanche Current vs avalanche pulsewidth, tav, assuming $\Delta T_j = 150°C$ and Tstart =25°C (Single Pulse)

Allowed avalanche Current vs avalanche pulsewidth, tav, assuming $\Delta T_j = 25°C$ and Tstart = 150°C. (Single Pulse)

Fig 15. Typical Avalanche Current vs.Pulsewidth

TOP   Single Pulse
BOTTOM   1% Duty Cycle
I_D = 100A

Fig 16. Maximum Avalanche Energy vs. Temperature

Notes on Repetitive Avalanche Curves , Figures 14, 15:

1. Avalanche failures assumption:
   Purely a thermal phenomenon and failure occurs at a temperature far in excess of T_{jmax}. This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as T_{jmax} is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 22a, 22b.
4. $P_{D\ (ave)}$ = Average power dissipation per single avalanche pulse.
5. BV = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6. I_{av} = Allowable avalanche current.
7. ΔT = Allowable rise in junction temperature, not to exceed T_{jmax} (assumed as 25°C in Figure 14, 15).
   t_{av} = Average time in avalanche.
   D = Duty cycle in avalanche = $t_{av} \cdot f$
   $Z_{thJC}(D, t_{av})$ = Transient thermal resistance

$$P_{D\ (ave)} = 1/2\ (\ 1.3 \cdot BV \cdot I_{av}) = \Delta T/\ Z_{thJC}$$
$$I_{av} = 2\Delta T/\ [1.3 \cdot BV \cdot Z_{th}]$$
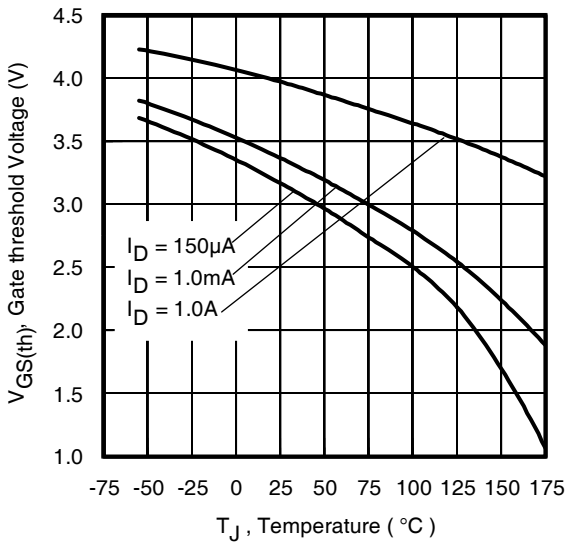$$E_{AS\ (AR)} = P_{D\ (ave)} \cdot t_{av}$$

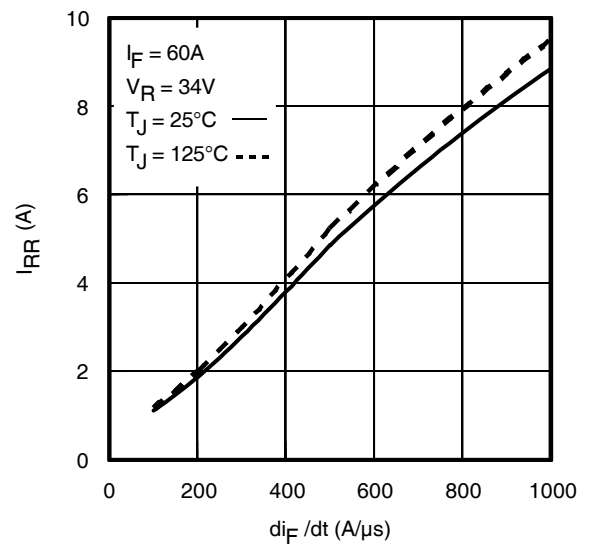**Fig 17.** Threshold Voltage vs. Temperature

Fig 18. - Typical Recovery Current vs. di_F/dt
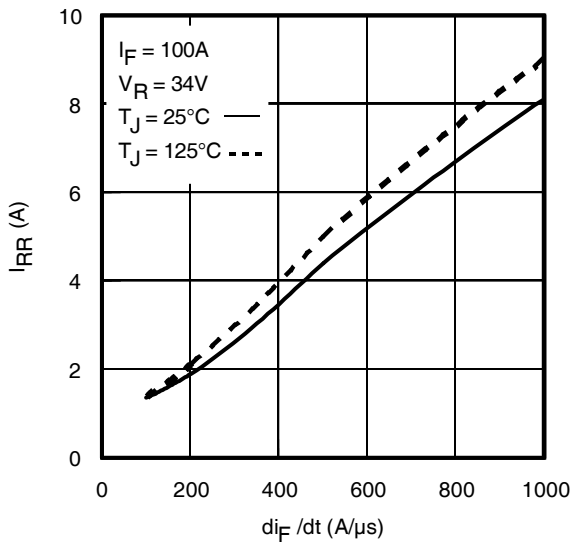

Fig 19. - Typical Recovery Current vs. di_f/dt
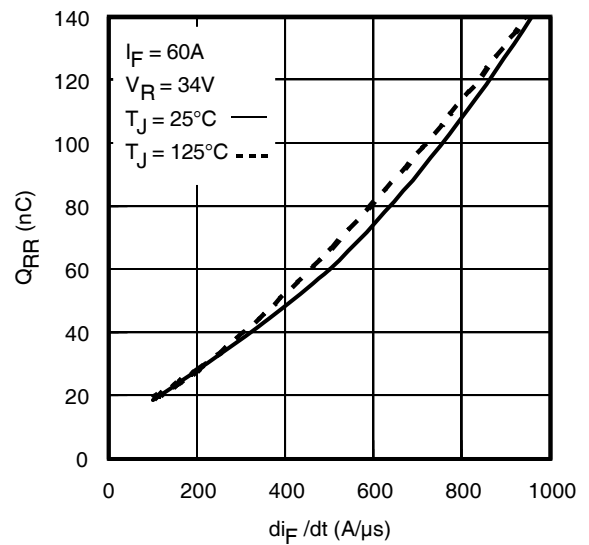

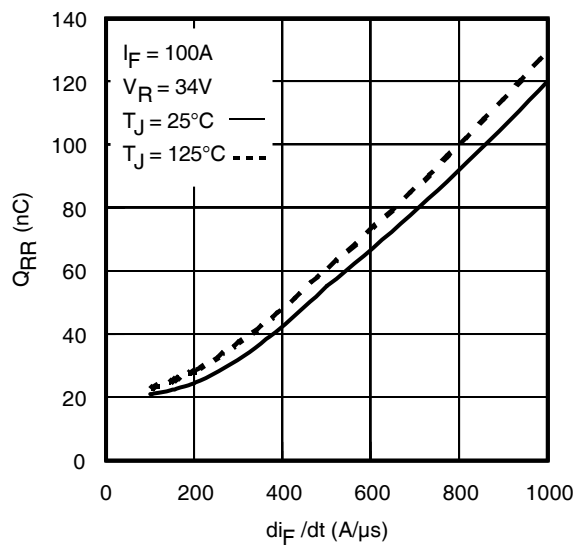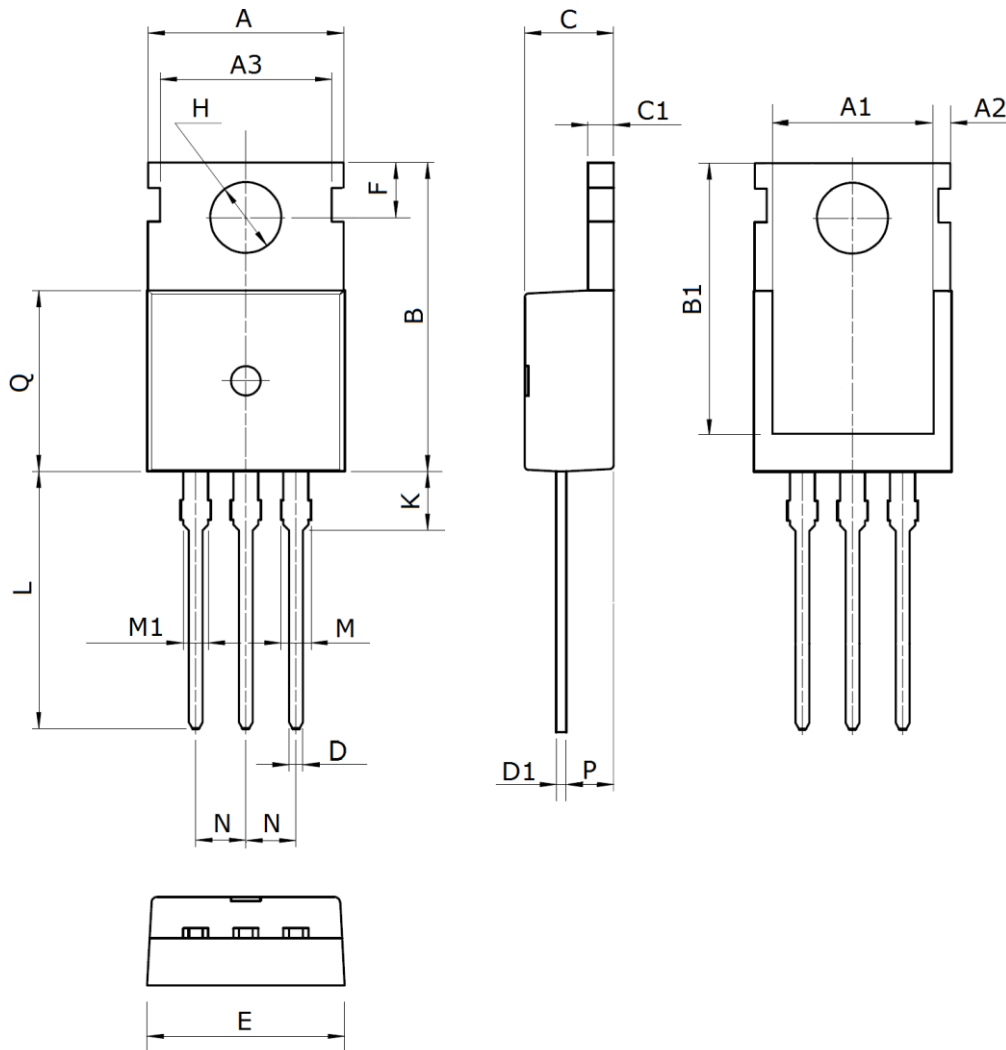**Fig 20.** - Typical Stored Charge vs. di_f/dt

Fig 21. - Typical Stored Charge vs. di_f/dt

Package Demensions

TO 220

Symbol	Dimensions（mm）	Symbol	Dimensions (mm)	Symbol	Dimensions (mm)
A	10.0±0.3	C1	1.3±0.2	L	13.2±0.4
A1	8.0±0.2	D	0.8±0.2	M	1.38±0.1
A2	0.94±0.1	D1	0.5±0.1	M1	1.28±0.1
A3	8.7±0.1	E	10.0±0.3	N	2.54(typ)
B	15.6±0.4	F	**2.8±0.1**	P	2.4±0.3
B1	**13.2±0.2**	H	3.6±0.1	Q	**9.15±0.25**
C	**4.5±0.2**	K	3.1±0.2		

Marking

```
┌─────────────┐
│  FB7437     │
│     ○       │
│  UMW XXXX   │
└─────────────┘
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Ordering information

Order code	Package	Baseqty	Deliverymode
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DMN61D9UWQ-13 US6M2GTR DMN31D5UDJ-7 DMP22D4UFO-7B IPS60R3K4CEAKMA1 DMN1006UCA6-7 DMN16M9UCA6-7
STF5N65M6 IRF40H233XTMA1 STU5N65M6 DMN6022SSD-13 DMN13M9UCA6-7 DMTH10H4M6SPS-13 IPS60R360PFD7SAKMA1
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